BLUE RIBBON COMMISSION ON AMERICA'S NUCLEAR FUTURE

+ + + + +

MEETING

+ + + + +

TUESDAY,

SEPTEMBER 21, 2010

+ + + + +

The Commission convened at 8:30 a.m. in Ballrooms A, B and C of the Washington Marriott at 1221 22nd Street, Northwest, Washington, DC, Lee Hamilton and Brent Scowcroft, Co-Chairs, presiding.

MEMBERS PRESENT:

LEE HAMILTON, Chair
BRENT SCOWCROFT, Chair
MARK H. AYERS
VICKY A. BAILEY
ALBERT CARNESALE

PETE V. DOMENICI
SUSAN EISENHOWER
ALLISON MacFARLANE
ERNIE MONIZ
JOHN ROWE
PHIL SHARP

ALSO PRESENT:

TIM FRAZIER, Designated Federal Official

ANDREW KADAK, MIT

CHARLES FORSBERG, MIT

VIC REIS, US DOE

CHARLES McCOMBIE, Arius Association

JIM TIMBIE, US Department of State

FRANK von HIPPEL, Princeton University

STEVEN MILLER, Harvard University

BOB O'CONNOR, National Science Foundation

WES CRAGG, York University

TOM COTTON, Consultant to the Commission, for Alvaro Rodriguez Beceiro, ENRESA

CLAUDIO PESCATORE, OECD Nuclear Energy Agency

CHUCK POWERS, Vanderbilt University and the Consortium for Risk Evaluation with Stakeholder Participation

DAVID LEROY, former US Nuclear Waste Negotiator

C-O-N-T-E-N-T-S

C-O-N-T-E-N-T-S (Cont'd)

C-O-N-T-E-N-T-S (Cont'd)

C-O-N-T-E-N-T-S (Cont'd)

P-R-O-C-E-E-D-I-N-G-S

8:31 a.m.

MR. FRAZIER: Okay, we're going to go ahead and get started.

First of all, I'd like to welcome you all to the open full Commission meeting of the Blue Ribbon Commission on America's Nuclear Future. My name is Tim Frazier. I am the designated federal officer for the Commission. And with that, as soon as -- are you ready, Congressman?

CHAIR HAMILTON: Yes.

MR. FRAZIER: I turn it over to Congressman Hamilton.

CHAIR HAMILTON: Thank you, Tim. Good morning. Thank you all for coming.

The purpose of this meeting of the Blue Ribbon Commission on America's Nuclear Future is to explore four broad areas. First, nuclear waste program governance; second, international perspectives on and the implications of U.S. decisions regarding the back end of the nuclear fuel cycle; third, the ethical and societal foundations for nuclear waste management; and fourth, perspectives on the facility-siting process, including public and community engagement. You'll hear today and tomorrow from an impressive collection of experts who can help us work through these issues.

As always, we recognize there are others who care deeply about the issues we will hear about these next two days. We encourage anyone with an interest in our work to submit written input to the Commission now or at any point in the process. Your comments will be posted on the Commission website and will be made available to the full Commission.

We remind our invited speakers this morning and this afternoon that they are to keep their formal presentations to 15 minutes or less. We appreciate the time and effort the speakers have put into their presentations. We do look forward to hearing what they have to say.

After tomorrow's discussion of waste program governance, we will discuss the Commission's planned meeting schedule for the next four months and open the floor to matters the Commissioners wish to discuss.

At the end of tomorrow's session, we will hear from any member of the audience who wishes to speak. We've allowed for an extended public comment period at the end of tomorrow's meeting in light of the significant number of people who've commented at past meetings of the full Commission.

A sign-up sheet for the public comment period will be available tomorrow morning starting at 8:00 a.m., closing at 11:00 a.m. Of course, the amount of time allotted to each speaker will depend on the number of people who wish to speak.

With that, I want to give the Commissioners any opportunity for any statement or comment they wish to make before we hear from our first speaker.

Are there any comments from the Commissioners?

(No response.)

CHAIR HAMILTON: If not, we will proceed.

Before we hear from our invited speakers, and in an effort to both inform the Commission and ensure transparency, we've asked Commissioner Moniz to give the Commission an overview of the recently released MIT report on the future of the nuclear fuel cycle.

He is joined by his colleagues, Dr. Charles Forsberg and Andy Kadak. Commissioners Sharp, Lash, Meserve, and Rowe served on the Advisory Committee for the report, so they are undoubtedly familiar with the results. However, as the report makes clear, the Advisory Committee members provided advice and perspective to the MIT study group but were not asked to endorse the report, findings or recommendations.

We take this opportunity for the rest of the Commission and for those observing our work to better understand the MIT study's methodology, assumptions and conclusions. We appreciate the willingness of Drs. Moniz, Forsberg, and Kadak to join us today. We look forward to their comments.

Dr. Moniz, you may begin.

MEMBER MONIZ: Thank you, Mr. Chairman. We're pleased to have this opportunity, and I will reinforce your message that the Advisory Group does not endorse the recommendations, at least as a group. Hopefully, as individuals, many of them endorse many of the recommendations. I would just say that, as well, that, that pertains to the sponsors who almost more assuredly do not endorse all of the findings and recommendations as a group.

(Laughter.)

MEMBER MONIZ: Is there a clicker?

Oh, here we are.

Just to give you an idea, this is the study group. The only point I will make here is that, without going through it, is that we've put together a multidisciplinary group, certainly people in the nuclear engineering business, but scientists, economists, political science, and this is the characteristic of all of our future-of studies, which this is the fourth in the series in the series, covering nuclear power, coal -- natural gas previously -- and solar energy and the grid in the next couple of years.

In all cases, what we are doing is trying to provide technically grounded analysis and recommendations for how these particular energy sources may be marketplace-competitive, looking forward particularly in the context of a carbon-constrained world. As I already said, we have a distinguished advisory group. I should say this advisory group was formed two and a half years ago or so, well before this Commission, at least, was assembled.

Next, as I said, we have a set of sponsors. EPRI was the lead sponsor with contributions from, as you can see, Idaho, NEI and others.

So, why did we revisit nuclear following our initial 2003 report? Basically, a lot has changed. Certainly, nuclear power is seeing accelerated deployment globally -- not the United States, at least not yet. On the other hand, there have also been major changes in the United States, certainly the whole Yucca Mountain issue, issues of recycle. We thought it was timely three years ago to revisit this question with a stronger focus on fuel cycle issues compared to our earlier report.

What we will do very briefly is run through this, so there's some time for questions, as I will give a very high-level run-through kind of narrative of overarching points, and then my colleagues will reinforce and go a bit deeper into three of the critical issues that underpin this set of conclusions; namely, the question of uranium resources, issues around long-term storage and then some issues around fuel cycle choices and waste management. So, four high-level messages:

First, for the next several decades in the United States, the once-through fuel cycle using light water reactors is and remains the preferred economic option. Underpinning this are several issues, but this includes, as you will hear, what we believe is a completely adequate uranium resource base for a long time, and the fact that the science underpinning geological isolation remains sound.

Resource extension and waste management benefits of limited recycle, like the MOX processes pursued today, are minimal and we also have a context that, even if one preferred a different fuel cycle, it takes a long time in this business to make a transition. LWRs will be a workhorse for a long time and things like total transuranic inventories or uranium needs in a growth scenario are not materially different in this century for any of the fuel, core fuel cycle choices.

Second, we believe planning for long-term managed storage, or interim storage with a planning horizon of a century should be integral for fuel cycle design. Design is italicized because we mean design of the fuel cycle has to incorporate long-term storage as integral to that process.

Among other things, this preserves, and we should preserve, options for future choices in disposal, reprocessing and/or recycle. A reason for that is that today there are major uncertainties that we cannot resolve that will influence informed choices in the future.

Some of these are, if you like, societal, such as we don't know the future trajectory of nuclear power, let's say in the United States, which would have a profound influence on the optimum choice of a fuel cycle, nonproliferation norms, but also technical issues, as we will go into more detail. The technology pathway even, let's say, for closed fuel cycles, is not clear. We would argue that we do not know today whether an optimum choice will treat spent nuclear fuel as a resource or a waste.

We do feel that moving spent nuclear fuel from shutdown reactors is something that should commence as soon as possible, as this Commission has heard already in many ways, and not for reasons of economics or safety but for reasons of how one puts together a fuel cycle with built-in, very long-term managed storage. We feel that moving to centralized managed storage is preferable.

A key technical point which underpins policy in an important way -- it's really an amplification of comments already made -- is that, the idea that has been kind of floating around for a long time that we need high conversion ratio, an idea really in many ways driven way back when by the idea that uranium resources were constrained. High conversion ratio is not, at least not obviously, the choice. Indeed, we find that lower conversion ratios, like one or one plus epsilon, are sustainable and, in fact, attractive.

The key point that this opens up in the policy sphere is that with relaxing that conversion ratio requirement gives you many, many more technology pathways, including, for example, starting up fast reactors with LEU, which bears directly on this question: is spent nuclear fuel a waste or a resource.

Finally, in terms of these first

four messages, in terms of waste management and geological disposal, well, geological disposal, first of all, is simply needed for any choice and we should get on with developing the geological disposal options with a transparent and public process.

A point that we emphasize is that we need to go to a new level of integrating waste management with fuel cycle design. It's not good enough just to ask what goes back into a reactor in the closed fuel cycle; it's what goes into the waste streams. In fact, the waste streams in many ways dominate the costs of going forward, not to mention determine the possibility of various pathways. In that context, we need a new waste management kind of classification system, one that is not, for example, based upon a source of the waste but on its content and the risks posed by different waste streams.

In this context, we developed a set of criteria, the last five sub-bullets there, in terms of what one would like to see in an effective waste management organization. Our observation is that these are, none of them, zero of them are recognizable in the US program to date, and that leads us to recommend a quasi-government waste management organization. If and only if it, in fact, is imbued with these authorities -- it will make no sense to create a quasi-government waste organization that has no more authorities than our program has had up to date.

Finally, in this overview, let me just make a couple of points on nonproliferation, which is clearly a very important issue, principally an institutional question with some influence, of course, from technologies. We believe that some version of fuel leasing, and we'll go into this more in the full report, for a fixed term is the right approach. But the real message we want to leave here is that, until we resolve a waste management strategy, we are constrained in our national security options because, frankly, we can't get into fuel leasing without a waste management plan.

Finally, on R&D or RD&D, we believe that the DOE 2010 Roadmap that we heard about in one of our meetings is a good start. It's a positive shift of the priorities in the program, for example, in having a strong program around improvements of LWR technology. It kind of makes sense. LWRs are going to be a workhorse; why don't we do some research on improving them?

I will say, and we have an interest in this, in the sense that also a few months ago we became partners, not the lead but partners, in the innovation hub created at Oak Ridge for advanced simulation for light water reactor improvements. That's an example, I think, bringing new tools to a high-priority problem.

When all is said and done, we recommend about a billion dollars a year, but recognizing that about a third of that, we would argue, is needed to make a significant dent, at least, over a decade in rebuilding -- or one might say building -- an adequate research infrastructure to pursue these issues. In time, not immediately, additional funds would be required for appropriate demonstrations, but we believe right now, it's more a focus on exploring alternatives and establishing the infrastructure needed to do the research.

So that's a very high level run-through and, Mr. Chairman, I'd suggest that maybe we can go on to discuss and drill down on three of these key issues and then come back to questions if that's acceptable.

Thank you.

Andy?

DR. KADAK: Good morning. I hope the next slide comes up on spent fuel storage.

Oh, I'm sorry. I click it? Same presentation, yes. Thank you.

My role is going to be to discuss the role of spent fuel storage. Clearly, in looking at our options, this is obviously not a choice; it's the reality for the future of spent fuel at light water reactors.

One of the findings that we had was that the time of storage helps in the repository largely because of lower heat loads. As many of you know, the design constraint of Yucca Mountain is, in fact, heat, and the longer we store, the easier it becomes to site such a facility. There is a long transition time, as Ernie has already mentioned, and this interim storage period allows us the time to decide on what is the appropriate fuel cycle for the future.

So we're looking at planning for at least, as Ernie said, a hundred years or so. It should be part of the integral waste management design. And this chart basically identifies one of the reasons for making this finding a recommendation, which is the decay heat of the spent fuel helps us in design of a repository.

In fact, if you look at the Yucca Mountain history, they took about 30 years to store. They had aging pads outside to allow the spent fuel to decay even further. After even closure or filling up the repository, there was a period of 50, perhaps a hundred, years of ventilation. So as we can see, interim storage is a good thing from that perspective.

Ernie also mentioned that there was a transition time of about 40 to 50 years, and this chart basically shows that if we assume fast reactors start on the red line at around 2040 or so, it will take quite a while before it makes a dent in terms of replacing the light water capacity or adding to the light water capacity. And you'll see from this chart, even we assume, at a 2-1/2 percent growth rate, a substantial increase in LWRs in the future with a fast reactor program, aggressive fast reactor program.

Now there's much discussed about how important spent fuel from light water reactors is as an energy resource, and it, in fact, does become a Strategic Petroleum Reserve-equivalent if we want to utilize it. And Ernie's point was we need to understand what the real value of that utilization is, and we now have some years to figure out whether it's worth going through an intermediate step of reprocessing for MOX recycle or even using the plutonium in the spent fuel for fast reactor startups.

As you also heard him say, it's probably better to start fast reactors earlier with enriched uranium instead of plutonium from light water reactors. In fact, one of the issues was that, what is the cheapest alternative moving forward. As you know, plutonium recycling is not inexpensive, and it adds additional burdens of the waste streams.

So a finding that we have is that

the burden for spent fuel storage is, is relatively small at operating plants. The marginal cost of at-reactor storage is quite small but it does increase considerably when you have a decommissioned plant. Having been president of Yankee Atomic, I can say that that is a real number every year.

So, for decommissioning sites, we would highly recommend moving this spent fuel from the decommissioned sites to some interim storage facility if only to demonstrate that we can do this and to begin the path forward of getting fuel moving in the country.

So we're looking to a recommendation that says we should go to more centralized storage starting with decommissioning sites because I think starting a first movement of spent fuel is going to be a tricky and, let's say, controversial process.

Now, this recommendation comes with the assumption that you can, in fact, site an interim storage facility without an exit strategy, the exit strategy being a repository or some other facility to take it. As we've seen in this country, there have been many attempts at that, and tomorrow you'll hear from David Leroy about unsuccessful efforts in this regard. So, my sense is it's easy to say and probably hard to do.

Now, in terms of storage options, obviously we have several, and storage in a repository is technically sound. One of the recommendations that we looked at, and I will address it later on this afternoon, is using the repository as a storage site, underground storage site, and if, in fact, we decide not to go to a recycle strategy using LWRs, it becomes a disposal site. So you would design for disposal, license for storage, with fully retrievable systems.

So the last recommendation or, and another recommendation, is even though we have confidence that we can store spent fuel at reactor sites or interim storage facilities for a hundred years, that does not fully answer the question about what happens when you have to move this spent fuel. There are degradation mechanisms at work, even though the spent fuel is stored in helium, inert environments, degradation mechanisms continue. No one has yet integrated the storage with transportation for, for the safety of the transport and ultimate handling, once you get it either to a reprocessing plant or the final repository or storage facility.

So, we're recommending an R&D program to validate the assumption that you can store and then transport for long periods of time.

So that would be my presentation. So thank you. Charles?

DR. FORSBERG: I'm going to continue with addressing -- drill down to two particular areas. That is the uranium and systems analysis models that we conducted.

Our finding is there's no shortage of uranium that might constrain nuclear commitments for most of this century, but this is so central to our recommendations that we encourage additional -- develop R&D to confirm that conclusion. We have strong confidence in it, but it's central on this and thus, appropriate effort should be made to confirm that.

A couple of observations on uranium cost assessments. Uranium is about two to four percent of the cost of nuclear electricity. We evaluated the cost of uranium mining versus cumulative worldwide production looking at uranium resources versus ore grades, economics of scale and technology, learning over time. Our best estimate is that a 50% increase in uranium cost; that is, a one- to two-percent increase in electricity cost would occur if -- there are two conditions -- nuclear power grows by a factor of 10 worldwide and we assume each of those plants operates for a full century; in other words, small cost impacts for a very large nuclear power growth.

I'm going to show one particular slide that I think is indicative of where we're coming from. This happens to be a slide of the prices of 25 metals over the last century -- copper, nickel, zinc, cobalt and so forth. Over that period of time, the demand for these various metals went up by a factor of 10 to 1,000, and what you observe on an inflation-adjusted basis is that the price of these various metals did not change in a century. Thus, the question is, if all the other metals have this trend, why should uranium be different.

I'd like to turn to the second subject. We did a dynamic simulation of the nuclear energy system, and the objective was to examine the implications of reasonable ranges of nuclear energy assumptions and growth rates in the US on various nuclear fuel cycle options. It's an advanced tool, where you put in different assumptions and you see what the results are.

Key item -- we modeled multiple fuel cycles. We looked at different growth rates, one, 2.5%, and 4%, and we looked at a variety of fuel cycle options. We looked at a light water reactor with a once-through fuel cycle, a light water reactor with the recycle of the LWR spent fuel into the light water reactor, and a light water reactor -- spent-fuel transuranic materials, mostly plutonium, to fast reactors.

Then we looked at a fast reactors with a conversion ratio of 0.75. That is, actinide-burning of the plutonium. We looked at the conversion ratio of 1, where we make fuel as fast as we consume it, and we looked at a conversion ratio of 1.23, the traditional fuel cycle option where you make fuel faster than you consume it in a fast reactor.

Now, I'm not going to, I'm going to show you a couple of slides that follow this, but what is noteworthy is we looked at a whole variety of options, and the results sort of came out independent of the fuel cycle. That's the surprising thing that most people are not aware of.

This one shows the installed capacity for all of those five fuel cycles with a 2.5% growth rate. In all the options, you end up with a lot of light water reactors. This shows the total transuranics in these five systems -- very different assumptions -- and what you find out is there's a 30-, 40% difference in the amount of transuranics in the system whether you have a once-through fuel cycle or a fast-reactor fuel cycle -- relatively insensitive to the amount of the fissile -- insensitive to the assumptions on the fuel cycle.

We looked at the total transuranics in one of these systems, an LWR spent nuclear fuel fast reactor system. What you find out in these fast reactor scenarios is the total plutonium or the total fissile material is about the same as with other fuel cycles; it's just, the location varies. You have more of the plutonium in the reactor core, less in the repository.

We looked at the cumulative demand of uranium for the medium case, a whole bunch of fuel cycles. Total uranium demand? Well, gee, for 2050, there's almost no difference in all these different scenarios. And even by 2100 for the middle growth scenario, you see there's like a 30% difference in uranium demand. In other words, you could have lots of different fuel cycles, and some of the main measurements stay very similar, which is in some sense rather surprising.

This brought us to the question after we looked at all this, looked and realized there wasn't much difference between these various cases, we said maybe we should rethink the fuel cycle assumptions and ask what our options are because it turns out many of the results are independent of the option. We asked the key question of, what if we started fast reactors with enriched uranium, low enriched uranium, less than 20%, rather than plutonium.

Now, historically, fast reactors have been started on high enriched uranium, but recent work at MIT and elsewhere indicates that we should be able to start them on low enriched uranium. Now, if you start fast reactors on low enriched uranium, what it means is that your fast reactor long-term fuel cycle is totally decoupled from the light water reactor spent fuel and the light water reactor fuel cycle. You have two cycles and they're independent of each other. There's no connection, and LWR spent fuel becomes a waste.

We took a look at things like uranium requirements. This happens to show the once-through fuel cycle. This shows various fuel cycles where we start with low enriched uranium and fast reactors, and the funny thing is, is the total uranium consumption for the whole system goes down. The report goes into the complicated details of why but the more you look at this idea of starting up on low enriched uranium, the more potentially attractive it is.

But it has a couple of other implications, and of course, a couple of implications from all these. First is the transition times are very long. Second, any of the scenarios, the LWRs are dominant. Third, recycle has a surprisingly small impact on actual uranium. Fourth, recycle does not lead to applicable large reductions in transuranic waste. Fifth, from a technical perspective, there is little difference in the outcomes of a fast reactor with a conversion ratio of 1 versus 1.23.

Well, why is that relevant? The historical assumption is we need a high conversion ratio. That's why we chose a sodium-cooled fast reactor. If you take that assumption away and you say a conversion ratio 1 is fine, instead of having one reactor option, you have many reactor options for a sustainable long-term fuel cycle. The bottom line is one doesn't know which one of these options is the preferred option. Important in that context of course is that some of these new options may have superior characteristics compared to the traditional options.

So, the results of our analysis: lots of fuel cycles, but the outcomes in terms of transuranic are about the same, but by slight changes in some of the assumptions, we open up a much wider options space that we think needs to be investigated before you go forward on long-term sustainable reactors.

That leads for our recommendation. Integrated system studies and experiments with innovative reactor and fuel cycle options should be undertaken in the next several years to determine the viable technical options, define time lines when decisions need to be made and select a limited set of options for the path forward.

Thank you very much.

MEMBER MONIZ: So, Mr. Chairman, I'd like to say that we kind of raced through this perhaps, but we did want to leave enough time for questions.

CHAIR HAMILTON: Okay, we thank you for your presentations.

We'll open it up to the Commissioners for questions.

Pete, go ahead. Are there questions? Allison.

MEMBER McFARLANE: Great. Thanks very much, you guys. I appreciated that. I did see a preview the other day.

So, a couple of questions. So first, that one of your first conclusions, Ernie, was that you said that we should be planning our fuel designs, fuel cycle designs, for, sort of on the century scale. What's the historical basis for that? Has anything been designed thinking this century out and then actually there's really been a follow-through that's been measurable?

MEMBER MONIZ: Well, Gothic cathedrals took many centuries to build. Of course, the flaw in that argument is that you've got a place in heaven no matter which piece you did, which is not the case with waste management, I'm afraid.

But, look, obviously, anything we do that requires a commitment for a long time line, we understand is difficult. That doesn't change the fact that we need to get launched in this direction. We want to emphasize that what we said is that the planning horizon should be for a century. That fits the time scales needed.

As Andy noted, it's not that different from the implicit time scale we had anyway for, let's say, Yucca Mountain. It is not different materially from the planning horizons in other international spent fuel programs in terms of the need for storage, whether it's through ventilation or some other approach. But we do emphasize it's a planning horizon, and clearly, if at some point in that period one decides that one should proceed with disposal or one should proceed with partitioning the fuel for any purpose -- resource extension, waste management, both -- the option is there.

In fact, I would turn the question around and say that, from the beginning in this business, the value of maintaining options has been strangely discounted in contrast to any other business that I know of that assigns great financial value to being able to maintain options at a low cost, which, which is the case here. So I think all of these things come into our feeling that that's kind of the right time scale.

We also, on the other side by the way, pressing your point maybe even harder, as

Andy noted, we feel that -- I'll add a word that Andy didn't say that was on his slide -- is that we argue that the RD&D program around long-term storage is not only for validation but for potential extension even longer time periods in terms of maintaining the options.

MEMBER McFARLANE: Okay.

So can I ask a few more questions?

CHAIR HAMILTON: Sure. Go right ahead.

MEMBER McFARLANE: All right. One has to do about this billion-dollar-per-year RD&D program, and how much of that do you imagine going to actual understanding disposal relative to demonstration facilities, et cetera? Well, that's one question. Go ahead.

MEMBER MONIZ: Well, first of all, there's -- maybe, Charles, if you want to answer this as well -- there is a table on page 16 of the summary report that gives a rough breakout of what we anticipate.

Let me first say that, along the

lines of what we said earlier, that, of the $650-ish million that we recommend for RD&D -- it's really R&D because major large-scale demonstrations, we are arguing, is something that we should not be entertaining at the moment -- those will be defined through the program over the next years. But we say about $150 million should be around LWR improvements -- I want to make sure that we're still aligned with those, with those important priorities -- and then another $100 million around spent nuclear fuel and high-level waste management.

Part of that is that dry cask research but other disposal concepts, other enhanced waste and engineered barrier forms, are all areas where we have had, shall we say, an extremely limited program.

MEMBER McFARLANE: Yes, that's true.

MEMBER MONIZ: And we need to make it a strong program.

MEMBER McFARLANE: Yes, okay.

Finally, I know when you guys talked on Thursday at CSIS, Mujid Kazimi talked about his systems analysis and he said that when you guys did your analysis, you assumed that uranium would be recycled along with plutonium. I wondered why and I wondered how that affected the outcome of your analysis because nobody really does that. It's not very cost-effective and it implies a whole extra infrastructure.

DR. FORSBERG: It reduces uranium demand by about 10 percent. But you're right; economically, it's not currently a competitive option, although it's done on a small scale, mostly a demo scale, in Europe at the time.

MEMBER MONIZ: Also in Japan, they have, they have used the uranium from the French --

MEMBER McFARLANE: Yes, but this is all very, very small scale, and nobody wants to dirty their centrifuges. You know, send it somewhere else, blah, blah, blah.

MEMBER MONIZ: Yes, but I think, Allison, I think the real point is that that's not the big driver. The big drivers are choices around plutonium and minor actinides, and again, not only what goes into the reactor but what goes into waste streams, which is, I think, a really important point that needs emphasis.

Also, maybe it's worth just emphasizing that the issue of the LWR role and the long transition times, in the standard, plutonium-initiated fast reactor economy, of course, comes because LWRs are a really inefficient generator of plutonium. Basically, in the growth scenario, you've got to keep building LWRs fast enough to keep feeding the fast reactors --

MEMBER McFARLANE: Beast.

MEMBER MONIZ: Beast; is that what you said? Yes.

Secondly, your huge uranium

commitment comes because once you build the LWR to feed the fast reactor, you'd better operate it for 60 years to get your investment back and you've got to keep feeding it uranium all the time. So that is a major part of the dynamics in that cycle.

Now, the irony is -- and Andy said a little bit about this. Was it Andy or Charles? I forget which; it was Charles, excuse me -- is that if you do go to this, if you relax the conversion ratio, you go to the uranium feeding, on the one hand, you use less uranium because you're not requiring all those LWRs. You decouple from the constraints on building fast reactors, ironically, so you could transition faster from light water reactors.

But then, and it's an issue that, actually, Tom Cochran is here, raised last week is that, of course, the attractiveness of that will depend upon whether or not you can get fast reactors to be cheap enough.

MEMBER McFARLANE: Well, that's, that's what --

MEMBER MONIZ: And so, it's --

MEMBER McFARLANE: That's really the fundamental question, the economics of any of this.

MEMBER MONIZ: Absolutely. So there's lots of open questions, which then goes back and reinforces -- well, since we're going to the in this once-through light water reactor fuel cycle for a while, why don't we start using the time strategically and begin to answer these questions?

CHAIR HAMILTON: All right, I have four, three others, John and then Al and then Vicky.

MEMBER ROWE: Two questions, Mr. Chairman, the first to Dr. Moniz.

You talked about the importance of a quasi-government special-purpose organization to manage this process and suggested that, unless it had very comprehensive authorities, it wouldn't make much difference.

As I understood your chart, what you were saying is you think such a federal corporation, for lack of a better phrase, should manage everything from coordinating a new scientific review process to controlling the use of the waste disposal funds and ultimately operating an interim storage facility and the ultimate repository.

Were you, in fact, suggesting something that comprehensive?

MEMBER MONIZ: Well, I'll ask Charles to supplement the answer, or Andy. But, first of all, we are -- the task would be managing spent fuel and high-level waste, not everything about the back end of the fuel cycle but managing spent nuclear fuel through high-level waste, to do so effectively, however, having the ability to be involved in a broader set of decisions.

For example, we don't think it's

very sensible for some combination of, let's say, government and private sector to be making fundamental decisions about fuel cycles and what waste streams are created without having the person responsible for managing the waste streams in that argument. We would argue today that there's really kind of a decoupling.

So, it's about managing spent nuclear fuel, high-level waste, storage, disposal. To do so, you need continuity. You need to have control of the funds, need to be able to talk about what gets shipped when for storage and/or disposal, et cetera. So we listed the characteristics, as we said, none of which seem to have been imbued in organizations up to this time.

MEMBER ROWE: But you would include the coordination of the basic review process for deciding the standards and characteristics of an ultimate repository within that organization's authority?

MEMBER MONIZ: It could not -- I mean, it would not determine various regulation specifications, which are the government role between NRC and EPA, but would and should be deeply engaged in those discussions.

MEMBER ROWE: My second question goes to the issue on the economics of reprocessing. Your point is very clear on the economics and the uranium-supply issue. But some of us have thought that the importance of reprocessing came ultimately from minimizing the amount of waste that requires permanent storage.

As I listened to your charts, Charles, you -- it kind of suggests that reprocessing doesn't have a big effect on that amount in the next century either.

DR. FORSBERG: Reprocessing doesn't have a major affect. Also, one needs to recognize that volume in particular has no implications on repository design. Heat load can have, but not volume. So whether you have high volumes or low volumes is irrelevant to the discussion of reprocessing and repositories.

MEMBER MONIZ: Could I, could I just add a few comments to that, Chairman? The -- clearly, as we showed, in this growth scenario, total transuranic inventories, as Charles showed, are not very different. Now, clearly, as he said, they are in very different places and if you carry on to infinity, then there can be a very large difference in your waste-management challenge.

On the other hand, a 2-1/2% growth rate to infinity is not a logical scenario as this would violate a law of physics eventually and eventually is measured in, perhaps in a century kind of a timescale. So, for example -- but if the trajectory kind of levels off; nuclear power stops. It's replaced by solar. Then you still have to handle all of that as waste.

So, once again, things like the nuclear power trajectory, et cetera -- great unknowns down the road -- will completely alter the decision space and the policy space that one has.

We also point out in the full report that, while issues like volume are not exactly a compelling criterion for a geological repository, one could imagine different strategies. Maybe one partitions light water reactor spent fuel for the purposes of waste management by extracting a very, very small package of minor actinides, and as I described last week, and given MIT's fetish with deep boreholes, one decides that --

(Laughter.)

MEMBER MONIZ: -- that is a very appropriate place to put very small packages, et cetera.

So it's, again, I just think we have been so blindered in our option decisions, ironically, with no logical pressure -- technically speaking; I don't mean politically but technically -- that we need to have a whole different strategic mindset in terms of how we, how we go forward.

CHAIR HAMILTON: I want to remind Commissioners, this phase of our program concludes at 9:30. We have four seeking to ask questions in this order: Al, Vicky, Susan, and Pete.

Al?

MEMBER CARNESALE: I, too, have two questions. Let me put them both out there, and you can decide.

One, I'd like a follow up on the recycle question. Clearly, the result you have is consistent with the result that some others have had; namely, not an appreciable change in uranium demand and not an appreciable changing transuranic waste, but it differs widely from some others' claims.

I'd like to know what you

attribute the difference to? What is it they were assuming or not assuming, or whatever it might be, that's different than the calculations that leads them to a different -- because they, too, have done an analysis. It's not simply them. What is it that's different?

My other question relates to the notion that nonproliferation is an institutional problem. Perhaps, maybe, you meant in the context of the nuclear fuel cycle, I presume.

But anyway, if you could expand upon, you could expand upon those two things.

DR. FORSBERG: Well, I, I can't speak to what other people's analyses are, but the central observation that I make is people have not really looked at the fuel cycles for about 30 years. So, when we came back over the last three years and looked at these with some very new tools that did not exist in the past, we came to these conclusions.

But the emphasis I would, again -- again -- is that because technology has changed and because we have tools that we did not have a decade ago, we now have an understanding of all these very complicated system dynamics that you can't do on a simple spreadsheet, and that's what's leading to these different, different conclusions than people have seen in the past.

A lot of things have changed in 30 years, and that's what this reflects.

DR. KADAK: Let me add to why people come to different conclusions. I think in listening to people advocate, say, reprocessing is a MOX fuel cycle, there's a belief that there's, this energy stored in the fuel needs to be harnessed regardless of the economics. Okay? People haven't really -- and the arguments they make about using reprocessing as a waste management strategy, it's a different philosophy.

In our study, we didn't kind of

focus on reprocessing as a waste -- or MOX -- as a waste management strategy. We basically said, well, let's, why go through this effort, short-term MOX recycle, and why not jump to what you really want to be at, which is a fast reactor fuel cycle? Because that is the long-term sustainable nuclear future.

So I, I think it's where you come from and what your expectations are, relative to what the fuel cycle alternatives are, that drives the differences.

MR. FRAZIER: Okay, Vicky -- excuse me. I didn't want to cut anyone off in response.

Vicky.

DR. KADAK: There, there was a second question.

MEMBER CARNESALE: I asked the second question about nonproliferation.

MEMBER MONIZ: Just one correction there is it's as close to recycle, as we emphasize, could be on a thermal reactor, not necessarily a fast reactor.

On the proliferation, Al, yes, let me first -- you're absolutely right. We should have made it very clear, we are talking about proliferation as it could be driven by the civilian nuclear fuel cycle. Okay, so we're not talking about proliferation in the broadest sense, North Korea or other, other issues.

In that context, our view is that, again, instead of, well, technology could have some influence, our view is that the overarching mechanisms are, in the end, institutional. As an example of a technology influence would be the option of, if you're going to a closed fuel cycle of starting with low enriched uranium for the initial core, would lower your enrichment requirements. But, A, 70 years into the future, and B, it's like everything else, a 20- or 30-percent effect and not a material effect.

Going to the uranium, fed, as

another example of that particular choice is that -- which may be more material -- is it would eliminate the need for a reprocessing infrastructure for light water reactor fuel. You might have a more distributed pyroprocessing approach, for example, as we saw Idaho. Okay?

So there are technology influences, but we don't find them to be, in any case, magic solutions.

CHAIR HAMILTON: Okay, Vicky.

MEMBER BAILEY: Actually, my question has been asked several times, but I would just make a comment.

Ernie, in your slides, and -- you know, you said that the once-through fuel cycle is the preferred option, and I thought "preferred" was an interesting choice of words. I'm always interested in, when I get studies like this, what possibly has been left on the cutting room floor.

You obviously had members of

industry and others in your participants and in your advisory group, so I thought was interesting -- you know, this is an MIT study. Obviously, it carries a lot of weight, so I expect to have cutting-edge recommendations, and we're looking at the future here.

So I was just interested in your choice of words. Obviously, Commissioner Rowe may not go to his commission and recommend a fast reactor. He's not going to recommend anything, according to him.

(Laughter.)

MEMBER BAILEY: But obviously, there are economic issues there.

But I'd just like to know, maybe, some of the other various opinion that might, might have been talked about amongst the other members.

DR. KADAK: The word "preferred" was debated hotly. Why do we "prefer" as opposed to "think" the LWRs were going to be the future? My view is there are other technologies that are out there, but the time period is the real issue.

It's pretty clear that in the -- I'm a fast, I'm a thermal reactor guy, but I think gas reactors might be, have a role in the future. So when he said "preferred", I said, well, are you sure you want to use that word?

So, I think by saying "preferred", we avoid or at least kind of neglect other options that are on the table that could provide energy for us, and some of them were already listed -- molten salt-cooled, for example, and some of these new small modular reactors that people are proposing now to address the huge capital cost for LWRs.

So, yes, that was the discussion, but everybody sort of concurred, let's use "preferred" for now.

MEMBER MONIZ: Also, I think the important point, Vicky, is that the word "preferred" is attached to several things.

First of all, "next several decades," it doesn't say "for the next several centuries". Number two, it was first to once-through, for example, using -- I mean, a gas reactor is still going to be a once-through fuel cycle.

There are realities of the time to licensing any new reactor, let alone any more complicated fuel cycles. I think the most important part of that, in my view and I think the group's view as a whole, is that certainly for the next several decades, once-through fuel cycle in the context of a planning horizon for long-term managed storage is the preferred option.

Another part of third of sub bullet, which -- I'm sure everyone remembers the exact order of the slides --

(Laughter.)

MEMBER MONIZ: Was that, the benefits of doing something different.

Certainly, in the United States, with no sunk costs, let's say, in going to the

MOX fuel cycle, we just don't see them. So the preferred option becomes fairly clear.

I'm going to say I get a little more inside -- and I think my colleagues can comment on that. When the group started, I do not believe that there was a consensus that there was a starting position on everybody's part, that that was the place we would end up. So I think it was, it was a real conclusion of our discussions.

CHAIR HAMILTON: Susan?

MEMBER EISENHOWER: Thank you very much for an interesting presentation. I think my question may or may not have been answered; I'm not sure. But I'd like to make a larger observation, then to sort of bring it back to this presentation.

I'm generally concerned that the testimony we're hearing is sort of operating at cross purposes because I'm not clear on what problem we're trying to solve. Are we trying to solve this issue of economics, and if so, under what market assumptions, whether climate change is part of that assumption? Or are we trying to solve the problem of waste management reduction? Or are we trying to solve a nonproliferation question? Or are we trying to solve the question of energy maximization? Obviously, we're trying to solve all these problems in some way, but we've got to have a hierarchy for this because, otherwise, all the presentations come in with a different set of assumptions.

So I would ask you, what was the principal problem you were trying to solve when you undertook this study? Was it to provide more energy for the future, to manage the national security issues, waste reduction, or finding an economic system for nuclear energy going forward?

DR. FORSBERG: It, it was to create, have a viable option to address things like climate change, which implies nuclear energy on a very, very large scale, starting at hundreds of reactors and going up to thousands. So --

MEMBER EISENHOWER: Okay. So, in other words, climate change was, was the principal --

DR. FORSBERG: Yes.

MEMBER EISENHOWER: -- problem you were trying to solve.

DR. FORSBERG: Yes, to have a credible option to make a significant difference.

MEMBER EISENHOWER: Yes. Thank you.

MEMBER MONIZ: Let me add to that, Susan, that our entire set of studies, the future-of series, have a fundamental question behind it, not the only question. But a fundamental question is, in the end, based upon a technical, technically grounded analysis, what are the steps recommended for the relatively near term that would enable technology X to be competitive in a future carbon-constrained marketplace? That's in some sense how we choose the topics -- nuclear now twice; coal, of course with carbon capturing and sequestration; we're doing solar; we just did natural gas as carbon light, et cetera.

But it's not the only question we are looking at. But in this case, the question is, ultimately, what steps do we recommend in the near term to enable nuclear, in this case, fuel cycle development for potential -- not predicted and not necessarily wished -- but for a potential growth of nuclear power on a scale material for addressing climate change?

Now, of course, at the same time, it's also for supply of energy, et cetera, but that is kind of, that's the mind set that we are coming from. So, in that context, statements about what we should do for waste management organization in the near term, statements about building in the planning horizon on storage --

MEMBER EISENHOWER: Right.

MEMBER MONIZ: Statements about focusing on LWRs -- that's the game in town for the next several decades; statements about the need to develop waste management in order to have flexibility in the national security nonproliferation arena, statements about how to structure an R&D program -- in the end, these are all about decisions to take now but with the enabling of that bigger, bigger picture.

MEMBER EISENHOWER: May I just say that I really, really appreciate the answer to that question. I think we should almost require everybody who's making a presentation to tell us principally what their findings, which problem, which of these many problems, their presentations are trying to solve because I suspect that we're mixing apples and oranges, and at the end of the day, this Commission's going to have to decide what principal problem we're trying to solve when we issue our recommendation.

Thank you very much, Dr. Moniz.

CHAIR HAMILTON: Thank you, Susan.

We have time for only one more questioner. Pete?

MEMBER MONIZ: Uh-oh, it's going to be like a Senate hearing again.

(Laughter.)

MEMBER DOMENICI: I'm not too with it today, so I beg your pardon.

First, I know I have only one question, but it's just an observation. It is correct, is it not, that you have recommended that the government explore ways and means to reduce the time and cost of licensing new technologies using a risk-based technology neutral licensing framework?

I read that, but I want to leave that, set aside for the moment, an answer, if you, if you tell me. This seems to apply to new technology. What about the existing ones?

Is the process too slow or not, or is that not something that you've concerned yourself about, the process of licensing?

So my basic question is, with the time lines that you've developed and the uranium resources that you've put into perspective, do you see a scenario where some volume of spent fuel from light water reactors will be directly disposed of in a repository while, even while some volumes might be reserved for potential future reuse by us?

What I'm seeing is, and I wonder if we have the evidence, that this Commission could conclude that we already know enough to say that there is more than plenty of purse time through waste, that humankind doesn't need it all, even reprocessing or not, and some significant portion of it could be destined for a repository, a permanent repository, that we might recommend be done.

If we did that and cared for making sure that we reserved some -- it didn't all go that way, but we reserved a quantity -- that we know it's adequate for further use. Could you discuss that? That seems to me to be something that stood out to me as I talked to people. Certainly, I came to this Commission not thinking of that, and I should have.

But to me, this is the basic simplicity of this, that we're now finding that quantities justify some decisions, and we don't have to wait forever for those quantities to, to develop. We're going to have plenty, if not more than we could ever use, of spent fuel of nuclear energy. So some of that is going to be put away, and we can, we could say that right up front, that America will have a repository, and start that part.

Can you talk about that?

DR. KADAK: Let me, let me address the technology-neutral framework idea. I think it's a very useful approach to license new technologies that are not traditional in the LWR sphere. The NRC is moving to apply technology-neutral licensing. It's slow, but it's moving. As we now observe in the LWR industry, NRC is moving more to a risk-informed licensing strategy, so that's all good news.

Let me just, let me just introduce the second answer, the answer to your second question. I think I mentioned that one of the options we looked at was, for repository design, make it fully retrievable; meaning, it becomes an underground storage facility. So, if it is found to be useful as a resource, spent fuel, it can be easily removed. The Yucca Mountain design was not done that way. It was pretty much a repository, and even though they say it was retrievable, it really was very difficult to do.

So if you design an underground repository as a storage facility able to be reused as needed, that is, in my view at least, the optimum solution.

MEMBER DOMENICI: Let me, let me just say, before you leave the mic, Professor, salt and similar, similar things that are out there that we can use lend themselves to a permanent, permanent repository, not necessarily one that you can remove the substance from. I'm not suggesting that we leave waste in salt, where it is not retrievable. We have plenty of information as to how much access we have. Why do we have to make it retrievable?

DR. KADAK: Well, I guess, to keep the options open.

MEMBER DOMENICI: Well, you could keep the option open by saying, we shall never let the reserve of once-through fuel get below a certain level and go ahead and use the rest for a permanent repository; couldn't you?

DR. KADAK: Yes.

MEMBER DOMENICI: That, to me -- I wanted to make sure we got that on the record because that seems very practical to me, and it satisfies another group of people, mainly those that might have to have the interim repository in their neighborhood because you can then tell them, here's living proof that everything is not going to come to your area and stay there forever; we're also going to do a permanent repository and start putting once-through fuel in there as long as we have enough left over. I just want to make sure I understood that.

DR. KADAK: I would just add to that, Senator, that, first of all, we certainly agree that we should be aggressively developing a geological repository or repositories options.

MEMBER DOMENICI: Yes, sir.

DR. KADAK: That's very important.

Secondly, exercising the repository early on makes a lot of sense. I would add, however, that it's not only the civilian waste. We also have the defense waste. The production complex waste in particular is finite and not growing, and I think we should be getting a little fire under that program to start getting the waste ready for geological disposal. The submarine fleet waste will keep growing, but again, these are modest amounts. We're talking there thousands of times, ultimately, of defense waste. I think that would be a very interesting priority to be moving that into a geological repository.

As far as the civilian waste goes, we certainly -- there are many options, including the one that you say. The only caution is that, because we do not know what a possible nuclear-power growth scenario is and we don't know if we are going to use that light water reactor fuel as a resource, if we do, in the traditional fuel cycle, as we saw, we need a lot of, we would need a lot of plutonium to feed those reactors.

So, in the end, I think the important point is moving aggressively on a geological repository and exercising it as early as we can.

DR. FORSBERG: Two technical observations. One --

CHAIR HAMILTON: We can conclude with your observations.

DR. FORSBERG: Yes, two technical observations. One, there have been designs of salt repositories with suitability of spent fuel back in the '70s.

Second, if economics is a criterion in recycle of spent fuel, I would suspect in the long term that much of the spent fuel will be reprocessed but other spent fuel will be considered uneconomic because of particular technical characteristics. It's just like uranium ore grades: We mine the high ore grades; we don't mine the low ore grades. Spent fuel is in the same context as a resource.

CHAIR HAMILTON: Well, our thanks MIT and Drs. Moniz and Forsberg and Kadak for a very, very good opening discussion. We're grateful to you.

CHAIR HAMILTON: We'll move now to the next topic for the morning, International Perspectives on and International Implications of U.S. Decisions at the Back End of the Fuel Cycle

We'll hear from each speaker for 15 minutes and then engage in a panel discussion with all five of the speakers, so we ask the Commissioners to only ask clarifying questions during the presentations, save their other questions for the panel discussion.

Our first invited speaker is Dr. Vic Reis, Senior Advisor to the Office of Science within the US Department of Energy.

Dr. Reis, you may proceed. Thank you very much for coming.

DR. REIS: Thank you. My first thing, well, I was going to tell you I'm not to talk about the subject you asked me. I will talk about what I believe, the total problem that the Commission is looking at. So, I'll give you my advisory thoughts on what that ought to be, and we can discuss the international stuff as part of the panel.

I've been in this business -- let's see -- for quite some time, starting with stockpile stewardship, the global nuclear energy process, and I'm doing this right now. Dan Ponemon asked me to look about, involve how the high-performance computing could be done here. So I didn't -- let me take, let me take Ms. Eisenhower's advice, starting out with -- first of all, let me say what my assumptions are. Let me make some postulates in terms of what they are, I believe the valid end, then tell you what I think the answer ought to be.

First of all, the availability and effective use of electricity is extraordinarily important, both for the US and the rest of the world. Climate change due to carbon dioxide is real. But it's also time-critical. This time-critical part is essential to what I'm, I'll be suggesting. Nuclear power is a primary replacement for coal-burning baseload electricity. Electricity generation in the US will mostly remain in the private sector. The US government's responsibility is for environment safety, national security, and well-being. Those are, if you will, my going-in assumptions.

Putting that together, I say the US government will require a rapid growth of affordable, safe, secure nuclear power. Why? That's because we want to reduce those emissions a lot, and as soon as possible. So it's this rate problem, I think, which drives much of what we're doing.

At the same time, if we're going to do that, we've got resolved the spent fuel management, and we have to, at least the US, should be a global leader in dealing with nonproliferation. I would recommend -- I'm sure that Jim Timbie will discuss that in some detail.

So what can the government actually do about it? Well, of course, the -- not necessarily as part of nuclear, but of course, but as I'm sure everybody is aware, is that the cost of carbon emissions has got to be a major play. But within the large nuclear reactors, I'm suggesting that, of course, loan guarantees is probably the only tool the government has available to it.

For small light water modular reactors, I'm suggesting the government can help with the design certification, combined operating licenses, and also be a first user of this technology.

It could provide sites for dry-cask interim storage and take back used fuel. It could generate a salt repository for commercial waste. We're going to hear more, of course, as we discuss the whole idea of international fuel banks both for supply and take-back, and then of course it can do advanced R&D.

So those are the roles that I think the government specifically can do, and what I'll try to show is how you put those things together into an integrated, basically an integrated strategy.

So this is the light water reactor, LEU fuel -- both of those things are important, that they're light. They're for small modular reactors. I believe the Commission has seen some of this, so I can go it through very quickly. There are two, potentially at least two, credible designs that are getting ready to be, through, going through the license process.

But I think was important for them is, the industrial base to support this, I believe, is for the most part available and can be built up. It builds upon an industrial base which we've done for the US Navy in terms of submarines. I believe that's important. Because they're LEU and because they're light water reactors, then we can move rapidly, I believe, to get them licensed and onboard.

The role of the first user is something that I believe that the DOE sites themselves, and then the DOD can in fact be used. The DOD is required by the presidential Executive Order 13514 to reduce their emissions by almost 30 percent by the year 2020. If you look across the board, that is a significant, difficult problem, but small modular reactors very possibly could play a serious role in this, and people have looked at that, and the numbers begin to be sensible.

There's about a gigawatt of electricity that's used by these systems. Most of the sites are large accelerators, large computers, which use a lot of electricity, and they get their electricity off the grid, which tends to be carbon- or coal-dominated.

Okay, so this is, what you do you now do about spent fuel management? Well, of course, the error here is interim storage with dry casks. I point out a very good -- well, it doesn't quite make it onto the screen, but there was a very good study that was done back in 2001 -- some of your commissioners participated in it -- where they said interim storage is a key element of the fuel cycle, regardless of whether they're planned permanent option and for reprocessing and direct disposal. I believe that's correct, but of course, they also say, like we know, that's not enough; it has to be permanent storage.

Well, here's one. You know, this is the Waste Isolation Pilot Plant, which has actually been demonstrated at the National Academy way back in 1957. I think that's when I graduated from college -- said salt was preferred, was the preferred option for permanent storage, I think probably the analysis will still show it's the preferred option, and in fact, indeed, we've now demonstrated it.

It's got, had -- the WIPP, the Waste Isolation Pilot Plant, has been operating now for 11 years. It primarily uses low, low radiation defense wastes, but nonetheless, it can be used for high. The analysis indicates it can be used for high, highly radioactive waste, and some highly radioactive waste actually goes down there. It's been EPA-certified. It's been analysis to show it's been there for 250 million years, which is a pretty reasonably long time. But in addition, it has strong local support, and we know the cost. I've just indicated that one of your members, Senator Domenici, actually has been there and can describe it, I'm sure, in some detail.

What about nonproliferation? Well, of course, assured nuclear fuel services is really the key. There are some very good -

- we've been talking about that for some time -- a paper by Carter, Perry, Kramer, Scowcroft; another very good paper by Deutch, Kantor, Ernie Moniz, and Dan Poneman. Of course, more recently in his Prague speech, President Obama has said this whole idea of the international fuel bank is kind of the way to go.

Somehow how do I put all these, these things together? Well, you start off by light water reactors, both large and small. Interim storage and salt repository is kind of the key, I think, of making this happen. Again, you go into interim storage. Do we have to deal with, what are the oversea reactors? They're primarily low light water reactors with LEU as well. Of course, you set up a fuel bank and then do the take-back where the take-back goes into the interim storage facility.

The other important point, and we'll be talking about that in front in the panel, is that while that's a diplomatic heavy lift, it's also an enormous diplomatic opportunity for getting, if you will, the nations of the world to agree on how that happens. Then, interim storage can eventually either be put into the permanent repository -- we're suggesting salt -- or future fast-recycle systems, and of course, what Dr. Moniz and the MIT folks have said. There are a number of options there. I've indicated fast, but in fact, what we're saying is that it could be others as well.

Now, I just want to leave with one thing. Of course, what you're dealing with here is not really just where to put this stuff in the ground and whether John Rowe make some more money with Exelon or not. These are really transcendental problems that go back to the beginning of the Cold War.

This is Eisenhower's "Atoms for Peace" talk, where he first embeds nuclear power, then describes this situation. I would argue that President Obama has made a very equivalent statement in his Prague speech back in April of 2009.

CHAIR HAMILTON: Thank you very much, Dr. Reis.

DR. REIS: I almost got you back on time.

CHAIR SCOWCROFT: Thank you very much, Vic.

I think the advantages of the Small Modular Reactor are obvious, but one of the problems that's apparent that we have to deal with is the "not in my backyard" syndrome. If you proliferate these small reactors around the country, won't you magnify the problems and the objections to nuclear power in general?

DR. REIS: Well, that's certainly an issue. The suggestion generally starts off by adding these two nuclear reactor sites that are already available, and as time goes on, I think the obvious place to put them for is the replacement of coal. You know, large coal plants, even moderate coal plants, also have a "not in my backyard" situation. That's one of the reasons, by the way, I'm also suggesting that the Department of Energy and the Department of Defense and the others can act, if you will, as the first mover both in terms of moving that industry along and also providing, also providing sites.

I think the data that I've seen said once a nuclear reactor is in an area, the populace becomes big supporters. There's no, there's no pollution, there's no -- we don't have to go through all that now. So I think that certainly is an issue, but I think there's a pathway, there's a pathway to making that happen, and I believe that's where the Department of Energy can play a significant role in making that, in making that happen.

CHAIR HAMILTON: Dr. Reis, thank you very much. We'll have you back on a panel here in a few minutes while we go ahead with the other speakers.

DR. REIS: All right. Thanks.

CHAIR HAMILTON: John, did you have a question?

MEMBER ROWE: Yes, just one.

Vic, you assume or postulate salt is the preferred medium for, the ultimate repository for waste. Do you think there is a body of research that says that salt is clearly superior in the United States to the other geologic options?

DR. REIS: Yes, I do. Yes. I think starting with the National Academy study back in 1957, people have reviewed that said, you know, that still holds true. That doesn't mean there aren't other options as well, but I do believe salt is certainly the preferred. Most importantly, we've been doing it, so we understand what, the costs.

In addition to that, there's a very enthusiastic and technically qualified population around that area, so they are anxious to have that, anxious to have that happen.

Of course, the radioactive isotopes -- I don't know really whether they came from a defense use or a reactor.

So I'm convinced that that's the preferred solution.

CHAIR HAMILTON: Dr. Reis, thank you very much.

DR. REIS: Okay, sure.

CHAIR HAMILTON: We'll look for to seeing you on the panel in a few minutes.

The next speaker is Dr. Charles McCombie, Arius Association in Switzerland. He's come a long way to be with us today.

We appreciate that much, and you may proceed, sir.

DR. McCOMBIE: Thank you very much, Commissioners. Well, I really appreciate the opportunity to put to you my views on how programs, fuel cycle programs and waste management programs in the USA can affect developments in the rest of the world. This is especially important, of course, nowadays when we are expecting a large increase in global nuclear power, and it will probably expand very strongly, as you see indicated here.

If it does, it's in the interests in all of us to see that any expansion like this -- and this is the purpose of my talk, as the Commissioner Eisenhower said -- is that it must happen safely, securely, and without social unrest. It's the last part that I'm going to come to a couple of times in my talks to you today.

So, these goals can only be achieved if the back end is done in a responsible way everywhere in the world. How it's done in other parts of the world is affected, some things positively and sometimes negatively, by how it's done here in the USA. So what I was going to do is look at two issues very quickly, given the time we've got, reprocessing geological disposal -- what's the status today; what's the impact of U.S. policies in my opinion -- and is there a way forward?

Reprocessing is big technology, as you know. In Europe, these were the biggest building sites there ever were in Europe as they were being built, so commercial reprocessing's not a small job.

If you look at the history of reprocessing without going through it in detail, it's necessary to look at the checkered history of reprocessing in the States. You invented it, and then you decided, or your president at that time, it was not a good idea, and you tried to persuade the rest of the world it was not a good idea with little success; yes?

You persuaded people it was not a good idea for economic reasons and other nonproliferation reasons. That persuaded some people. Money talks; yes? Then suddenly out of the blue, of course, you came back, and then we had all of this, and suddenly, it was on the table again. I don't know if you realize how that impacts on people outside the USA. Suddenly the coin's turned, and reprocessing is not just "in", but desirable.

So what is the status with reprocessing? First of all, it works well. It works well in some countries. There's nothing wrong with reprocessing, at least in France. In my second home country, the UK, it's got more problems. Of course, we could improve today's reprocessing, the separation efficiency, emissions, the plutonium separation has been mentioned, and economics are currently unfavorable. You can argue whether that's because reprocessing is too expensive and/or uranium is too cheap. We rip stuff out of the ground at pretty cheap rates all over the world today, and I'd like to come back to that in the ethics discussion this afternoon.

Of course, the other issues of re-effect, reprocessing, are the resource conservation -- Andy Kadak mentioned that -- environmental impacts, which have led to lots of discussion in many countries where reprocessing has been introduced, proliferation concerns, transport concerns, which weren't mentioned. If you ship around, of course, it's a big thing, and back again to the economics.

Using my time, I'm going to jump right to what I think, in the reprocessing area, might happen. What should happen? Well, this is actually in line -- these slides were prepared before your MIT report -- reprocessing. Concentrate it, and a few countries are going to have full recycle facilities. Build new facilities; don't build nonsensical copies of French facilities now. There's no need for them. Build them when there is a need, and that means when fast reactors are around today, when recycling --

I should say, there are a lot of fast reactors -- looks to be a certainty. Then is the time to close the fuel cycle.

Of course, you should develop more proliferation-resistant technologies. I agree that it's not the total answer, but it'll certainly help in the answer there. And then you should enhance incentives for other countries to desist from reprocessing. Up until now, it has been done with security of supply -- big talk about this. Security of supply has never been a problem. There's a market there. People are fighting to give you fuel.

But where there is a problem is with the back end. It's with the geological disposal, where it possibly costs a billion, to $4 billion, the cheapest one around. Maybe helping with geologic disposal could be the carrot that would be more likely to persuade countries to desist from reprocessing.

Unfortunately, in this area, the

US is not showing a good example, and that's the set of slides I'm going to rush through now. In the geological area, the first thing to know is this in the middle here. Every country needs geological disposal. I'm really pleased the MIT study says that, and we believe that. The problem is we don't tell enough people that this is true, and it's not universally accepted. It's accepted in our circles, in the insiders? Well, I'd like to emphasize that point.

If you want to solve this waste problem and overcome the resistance to it, there's this nice quotation here, the definition of insanity. I lived through this. In the '70s, it's exactly what we did. In the '70s, we said we can do all this without having a back-end solution. We ignored waste disposal issued. We were confident; we had waste confidence then, without knowing the word would be invented 30, 40 years later. "A repository will be available when we need it."

I'm really astonished that people can say that now because it wasn't available when we said we would need it, so why should we believe this the second time around?

So, what can we do to make that better? Well, I think we could work on this to get the consensus that geological disposal is feasible and it's safe if it's done the right way at the right place, and we have to change our way of siting these repositories. The whole issue of geologic disposal, of course, you invented that as well back in 1957. We've already seen. It was invented not because it's a cheap and nasty "out of sight, out of mind" solution. It was invented because that's the only place that it's known to be safe.

I get fed up hearing people saying, we can't tell what people will be doing a thousand years from now, or two. It doesn't matter what they're doing up there a thousand years from now if I'm 500 meters down here, where it's been -- somebody said, 250 million years. We don't bring that point through enough.

In the geological disposal area, what the US has done well, of course, is lots of the technology, lots of the technology. It's all been positive. But there's been more negative than positive signals. First of all, the government's program is totally non-transparent, I suspect, from inside the country, never mind from outside the country. The siting process is driven, at least in its final stages -- not up until then; it was good -- the final stage when it was pretty clearly political rather than scientific.

The staging study that was mentioned, One Step at a Time, which I chaired and where Tom Isaacs did most of the real work, was actually a very good way forward. The DOE sponsored it and then ignored it, and Canada actually took it on board and has had big success with it.

The overly expansive and expensive -- it just, it puts fear and terror -- I headed up a small waste program, and when I saw the budgets being done at Yucca Mountain, it struck terror into my soul the whole time, and into the souls of my Finnish friends, my Swedish friends, my French friends even. It's hugely expensive.

Other things like engineered barriers, pop-ups -- in the beginning, a paper bag would have done, think, almost a quart. Then suddenly, out of the blue comes in $8 billion titanium drip shield. You know, people are falling over. It's losing credibility for, not just for your program, it's losing credibility for waste disposal in general, which is my real point.

The last point, of course, is this dropping the Yucca Mountain without letting the NRC judgment come through is such a very clear mixture of policy and science, of not keeping them separate, that it's sent a bad signal outside the USA as well. So, if you didn't want to hear unpleasant things, you shouldn't have invited me.

So how can we go forward? Well, first thing I think is really important: Make clear that Yucca Mountain is a policy choice. That's okay; you can make policy choices like that. In Switzerland, we had a site that everybody thought was good, even the regulator did pronounce it was good. The locals thought it was good and so on. We dropped it because it didn't get public acceptance, and it was a policy decision. We wrote off $500 million, which for us is a lot of money. But it was a policy decision, and nobody tried to mix the justifications. That seems to me to be one of the most important points here.

The second point is that service storage, we all know that it's good and it can last for a long time, but it's a final solution. That's said in the MIT report as well. It's not said strongly enough. You have to keep saying it. It's not a final solution. You won't get your centralized storage unless you have the -- what did somebody say? -- an exit strategy, I think it was described as.

Unless we bring that through, then you're endangering the whole of waste management, and through that, the whole of nuclear power, not just in USA, but in all of the countries around the world. So what one should do is they start up this model, adaptively staged, to use "one step at a time" thing, taking into account all of the societal issues.

Then lastly, and this is little bit in my own area, of course, support multinational or regional geological disposal and fuel leasing. There, you need take-back from that, of course. Take-back came into the GNEP program, and I've often made the comment when I saw GNEP being presented in the States or outside of the States -- I always thought it was due to a different format of paper. You know, our paper's longer. So the last bullet, which said, "take-back of fuel could come on," when I saw it in the States it never came on.

(Laughter.)

DR. McCOMBIE: So that's as much as I like to say now.

Thank you.

CHAIR HAMILTON: Dr. McCombie, thank you very, very much.

That concludes the first session this morning. We'll have questions directed to the panel soon after we return. When we return, we will hear from Dr. Timbie. We'll have a 15-minute break.

(Whereupon, the above-entitled matter went off the record at 10:05 a.m. and resumed at 10:22 a.m.)

MR. FRAZIER: Okay, we're going to resume.

Congressman Hamilton?

CHAIR HAMILTON: Thank you, Tim.

Our next speaker is James Timbie, Senior Advisor to the Under Secretary for Arms Control, United States Department of State.

Mr. Timbie, thank you for joining us, and you may proceed.

MR. TIMBIE: Okay, thank you for this opportunity to appear before you today. You have an important and a difficult task, and we're happy to help in any way that we can. You should all have a page with bullets on it so that you can follow along.

To us, the question is how domestic fuel cycle decisions could affect the worldwide effort to discourage enrichment and reprocessing. You asked the speakers to be explicit in what problem we are addressing, and to us, the problem is the potential spread of enrichment reprocessing, and the question is, how could domestic fuel cycle decisions help?

As nuclear energy expands, if

enrichment and reprocessing scales up, that would be a major nonproliferation setback. There would be concern about states acquiring the capability to produce nuclear materials for nuclear weapons, and there would be concern about terrorists having access to fissile materials. So the spread of enrichment reprocessing is not going to be constrained by a new international agreement.

There's not going to be a treaty, there's not going to be a legal instrument, prohibiting countries that don't now have enrichment reprocessing from gaining that capability. We know from our experience, including our experience in the Nuclear Suppliers Group, that if we drafted such an agreement, probably not a single country would sign up. There is no interest in establishing another division between haves and have-nots based on enrichment and reprocessing.

So the way forward is to develop incentives, incentives for countries considering nuclear energy to rely on international markets for nuclear fuel services and not to engage in indigenous enrichment and reprocessing. Our goal is to help shape the options available to for countries, to provide incentives to cooperate, and to influence decisions that they make.

We want countries to choose not to enrich, to choose not to reprocess, even though they have a right to do so. So let me first outline what we are, steps that we are now taking to discourage enrichment reprocessing. Then at the end, I'll suggest some ways that U.S. domestic fuel cycle decisions can, can facilitate that activity.

On enrichment, the main argument for relying on the international market for nuclear fuel rather than producing it indigenously is that existing international suppliers are far more reliable and far more economical than any indigenous effort could hope to be. But at the margin, one can add fuel banks and other fuel supply assurances to help tip the balance in favor of relying on international suppliers.

As a country makes the decision whether to adopt nuclear energy, they also make fuel cycle decisions, and we're attempting to add another argument against enrichment and reprocessing through these fuel supply assurances. We have actively supported the establishment of an enriched uranium reserve at Angarsk in Russia.

The United States is producing its own reserve of low-enriched uranium derived from the diluted HEU for the purpose of supporting fuel supply assurances. The United States is leading the effort in Vienna to establish an international fuel bank using $150 million supplied by NTI, the United States, the EU, and several other donors.

These reserves of enriched uranium are designed to support the argument that countries considering nuclear energy don't need indigenous fuel cycle facilities. They can rely on the international market, and if something goes wrong, they have recourses. They can go to the IAEA. They can have access to international supplies of enriched uranium.

Now on reprocessing, the main argument against reprocessing is that it's not been economical and it has not significantly reduced waste burden wherever it has been practiced. The separated plutonium piling up around the world because of the imbalance between production and use of plutonium is a major nonproliferation concern.

Now if we can add to that argument, that basically economic argument, against reprocessing by helping other countries, particularly newcomers, in spent fuel management, that could be another major incentive to forgo enrichment and reprocessing. I've listed on the handout a variety of ways where we could potentially provide useful assistance in spent fuel management.

In the first instance, we and others can assist spent fuel storage for period of time at the reactor sites. As has been mentioned here several times, dry cask storage is something we know how to do, and we could assist, we can assist other countries.

Another, a second way we can be helpful on the back end of the fuel cycle is interim retrievable storage for 50 to a hundred years either at reactor sites or at a central facility. These would preserve future options to extract more energy value. It would buy a considerable amount of time -- 50, a hundred years -- and it would be cheaper than a decision now to reprocess with existing technology. Again, this is something we know how to do. This is a way that we could assist others.

Moving to things that don't now exist, international storage does not, does not now exist, but the potential benefits would be very high. The problems are formidable. Where would you locate it? Who would be responsible for the material? Who would pay for the costs? What happens after 50 to a hundred years? But the potential value of international storage, we believe, is very high because that is one route to allowing or to establishing a fuel leasing scheme where a country could receive fresh fuel, and the supplier could take it back and put it in an international facility. So even though it's not an easy thing to do, we definitely think it's worth pursuing.

There's several -- well, spent fuel take-back, just sort of progressing from things we know how to do to things that we don't know how to do, spent fuel take-back also has potentially high value and fermentable problems. Only Russia now takes back spent fuel, and only from Russian-supplied reactors. Now we understand that importing other countries' spent fuel and taking responsibility for it will be difficult, but if suppliers of fresh fuel were in a position to take back spent fuel, that, too, would open up the form of leasing. So we think that, too, is worth pursuing, an idea worth pursuing, even though it's obviously very complex.

As several people have mentioned, fuel leasing -- the provision of fresh fuel; taking responsibility for the spent fuel -- that would be a very attractive alternative to indigenous, indigenous fuel cycle activities. We think that implementation of fuel leasing -- well, implementation of fuel leasing, attractive as it is, would require some sort of international storage or some sort of take-back arrangement. So those are sort of the prerequisites to establishing a fuel leasing opportunity.

Finally, the final way that we can help other countries is that decisions not to pursue reprocessing with existing technology but to store spent fuel for a considerable period of time would be facilitated by the prospect that if there are going to be better options in the future, better choices down the road.

So that's the menu of incentives that we are aiming to develop as an attractive alternative to enrichment and reprocessing. The question before us today is how U.S. fuel cycle decisions could help, and we have five suggestions.

First is, if the United States decisions, the decisions that you make, validate the safety, reliability and economics of storage of spent fuel for a considerable period of time, initially where the fuel was irradiated, perhaps eventually at a central facility, that could be very useful. That would support the view that there's no rush for countries to make decisions on spent fuel disposition, including unhelpful decisions like reprocessing with existing technology.

Second is, if the United States fuel cycle decisions validate a policy of deferring decisions on spent fuel disposition and keeping option open with retrievable storage, that would support our advocacy of similar approaches in other countries. We could lead by example.

Third, exports of nuclear fuel and exports of enriched uranium, they strengthen international markets, and that's a positive benefit as we are encouraging countries to rely on international markets. But in addition, they provide the United States with consent rights on further processing. So we think exports of, enriched uranium exports of fuel are something to be encouraged.

Imports of fuel and enrichment also have the benefit that they show that the United States is prepared to rely on international markets for a significant fraction of its nuclear fuel. So a situation where we export a portion, a considerable portion, of the enriched uranium in the fuel that we produce and import a portion, a major portion, of the enriched uranium and fuel that we use has benefits both ways.

Okay, fourth -- and again, we understand this is difficult -- but establishing a path forward on domestic spent fuel is clearly a prerequisite for consideration of the question of take-back of spent fuel into the United States. So we look forward to the establishment of the domestic framework for spent fuel management that would allow consideration of the question of take-back of foreign spent fuel.

Finally, a strong research and development program would support the argument that countries should forgo reprocessing and store spent fuel for a period of time until more attractive options become available.

So, we think U.S. spent fuel policy could make a significant contribution to nonproliferation. We could establish a path forward on spent fuel management that not only resolved that question for ourselves and established a good example for others but would put us in a position to help others in the back end of the fuel cycle.

So that's the way we look at this question, and thanks for the opportunity to share with you.

CHAIR HAMILTON: Thank you very much, Mr. Timbie. We appreciate your anticipation.

Any immediate questions for him?

(No response.)

CHAIR HAMILTON: If not, we'll look forward seeing you on the panel in a few minutes.

Our next speaker will be Dr. Frank von Hippel, Co-Director of the Program on Science and Global Security at Princeton University.

Dr. von Hippel, we're very pleased to have you, and you may proceed, sir.

DR. von HIPPEL: Thank you very much, Chairman. I, I submitted a prepared statement that I hope you all have. It goes a little bit further than what I'll have time to talk about, and it also provides a lot of references, especially to material that has been produced on the subject by the International Panel on Fissile Materials, which I co-chair.

I should note, also, that we are, the next annual publication of the International Panel on Fissile Material, the Global Fissile Material Report, will focus on spent fuel management internationally, and you know, I'd be, I'd welcome an opportunity to come back to talk to you about that in the spring.

Okay, I'm going to talk about the history of US spent fuel reprocessing policy. We started by promoting reprocessing and promoting plutonium breeder reactors. In fact, during the 1960s, Glenn Seaborg, who was the Chairman of the Atomic Energy Commission, promoted what he called the "plutonium economy of the future". That came to a screeching halt after 1974 when India, one of the countries that we encouraged to reprocess, used the first plutonium, and it separated for what it called a peaceful nuclear explosion.

The Ford administration reconsidered it, the idea of encouraging reprocessing, and in fact, when, at that time, France had contracts with South Korea and Pakistan, and Germany with Brazil, for exporting reprocessing plants, and Henry Kissinger and others worked very hard to get those contracts canceled, and ultimately they were. We learned later that all those countries at the time had nuclear weapons programs.

In 1977, President Carter canceled the licensing of a US reprocessing plant which had been largely constructed in South Carolina, stating that, from our own experience, we have concluded that a viable and economic nuclear power program can be sustained without reprocessing and recycling. I think you heard that again from the MIT study this morning.

In 1981, President Reagan lifted that ban on domestic reprocessing, but at that point, the US utilities preferred the option of giving their spent fuel over to the government for mil per kilowatt-hour, having learned that reprocessing was much more expensive than they had been originally led to believe. Then the US breeder program was ultimately, breeder demonstration program, was ultimately killed by Congress in 1983 after there had been a 500-percent cost increase before, really, construction began.

So this shows the history in the OECD countries of the budgets for developing the fast neutron plutonium breeder reactors, which were the core of the R&D development efforts by the OECD countries from the 1960s to the 1980s.

You can see that -- well, overall, including India, Russia in pre-1960, and also France, which didn't report its R&D, a very large R&D program, as breeder R&D, it was about a $100 billion spent. So my one reservation on the MIT study's recommendations is, having spent $100 billion on these reactors, I'd really like to know what we would be doing with additional R&D funds before I committed those.

The legacy of the breeder reactor development program is small in terms of reactors. There, there is one operating demonstration breeder reactor in Russia. There's, there's a couple under construction, one in Russia and one in India. There's a large legacy of plutonium, which was separated in the expectation that breeder reactors would need start-up plutonium for their fuel.

As the MIT study pointed out, you don't need start-up, even if someday these reactors were to materialize. You wouldn't need to prepare for that by separating huge amounts of plutonium. We do have 250 tons of separated plutonium, as much separated plutonium as was separated during the Cold War by the Soviet Union and the United States have accumulated. In some cases, for example, the UK, they haven't figured out what to do with it, you know, now that there are no fast reactors.

Now, the history of reprocessing is -- well, where we are with regard to reprocessing -- now this is all the 30 countries that have operating reactors today. Some of them have never reprocessed, including the US. The majority of that capacity is the US capacity.

Some of them -- all, a number of weapons states plus Japan reprocess, on that side.

One country in that column, the Netherlands, sends the fuel from its small reactor, single reactor, to France to be reprocessed.

In the middle, we have countries which were customers of France, UK and Russia for reprocessing services. But they haven't renewed the contracts. The reason is that there was an advantage. I mean, most countries have problems with spent fuel, political problems with spent fuel management. So there was an advantage to send spent fuel out of the country to get it reprocessed. But the contracts with France and the UK specified that the high-level waste from reprocessing, the fission products, transuranics solidified in glass, would come back to the customer country.

So, after this sort of brief period of respite, the customer countries were faced by the same problem as they had originally. They now had to figure out where to put this high-level waste. They also -- it was costing about 10 times as much to get it reprocessed abroad as it would cost to have interim storage domestically. So all but Japan decided to go for interim storage.

Japan decided to go for a domestic reprocessing plant. They couldn't solve their interim storage problem without committing a huge amount of money to the second poorest prefecture in Japan, more than $10 billion and a $20 billion reprocessing plant and then $2 billion a year operating cost for 40 years.

MEMBER DOMENICI: Mr. Chair, can I ask him a clarifying question?

CHAIR HAMILTON: Certainly. Pete?

MEMBER DOMENICI: I want to ask you --

DR. von HIPPEL: Yeah?

MEMBER DOMENICI: -- just a simple question. When you use the word "reprocessing", what do you mean?

DR. von HIPPEL: I mean dissolving spent fuel and separating the plutonium or the plutonium and mixture of transuranics from the long-lived fission products.

MEMBER DOMENICI: Is it synonymous with breeder reactors?

DR. von HIPPEL: It was originally justified for breeder reactors. It's, today, it's in the absence of breeder reactors. In France, and as planned in Japan or just starting in Japan, it's being, the plutonium is being recycled in the reactors from which it came.

MEMBER DOMENICI: When you say France has reprocessing --

DR. von HIPPEL: Yes.

MEMBER DOMENICI: -- do they?

DR. von HIPPEL: Yes. Yes, they do. They reprocess.

MEMBER DOMENICI: What, what percent are they getting out of the one-time through as they, as they reprocess it? What are they leaving and what are they getting out?

DR. von HIPPEL: They're getting

out maybe 99 percent of the plutonium and recycling it, and they also are beginning to recycle the reprocessed uranium.

MEMBER DOMENICI: Thank you.

DR. von HIPPEL: Sure.

So things are not working out so well in Japan, however. Their reprocessing plant is 13 years behind, and they have, they are starting de facto to have to deal with their spent fuel problems with interim storage, which, which originally they thought they couldn't do.

So why did the US nonproliferation policy succeed? I think Jim Timbie basically encapsulated what has been most of the time US policy. We don't reprocess; you don't need to either. That has been effective. It's -- yes? Pardon?

MR. FRAZIER: Turn your mic on, Ernie.

DR. von HIPPEL: Yeah? Say it again; I'm sorry.

MEMBER MONIZ: Just to clarify, did you mean "not succeed" in the top?

DR. von HIPPEL: "Why did US" -- no, it did succeed.

MEMBER MONIZ: It did succeed, okay.

DR. von HIPPEL: It did succeed, yes. It's sometimes described as a failure because some countries still reprocess. But in fact, no new countries have reprocessed since we, since our policy was initiated. A number of countries which were reprocessing, had reprocessing pilot plants, abandoned reprocessing, and countries which were trying to acquire reprocessing plants didn't.

Now, if you divide up, look at these 30 states which have nuclear power plants, this was facilitated by the fact that a large fraction of them were aligned with either the Soviet Union or with the US. Very few were sort of more loosely coupled to the nonproliferation regime that the US and the

Soviet Union were cooperating on. Those three, Argentina, Brazil, and South Africa, all developed, all launched nuclear weapons programs. Only South Africa's went to the end.

But if you look forward, the stars aren't necessarily aligned so well with us. You see, this is the Nuclear Energy Agency's choice of the next 25, including one weapon state, so 24 non-weapons states which would, which are expected to acquire nuclear power plants. They are not so coupled, tightly coupled with reinforcing arrangements to the nonproliferation regime. So I would, I would answer my question, we shouldn't risk ending our opposition to national reprocessing plants.

So, in summary, I think the US has done rather well by not reprocessing. Our nuclear utilities have been able to save about $100 billion that they would have otherwise spent. The influence of our example has helped limit the spread of reprocessing, reinforced by these fortuitous, the fortuitous fact of who was acquiring nuclear power. Only one non-weapons state reprocesses today.

Finally, I'd just observe that reprocessing has been advocated in the last decade or so as a way to facilitate, make repositories more acceptable. But if you look at the success of countries who have been trying to site repositories, you find that the countries which are furthest along, Sweden and Finland, do not reprocess, while countries which do reprocess and have been trying to site repositories have not been so successful, even though the plutonium has been, has been separated out of the waste that they would propose to bury.

So that's my statement. Thank you.

CHAIR HAMILTON: Dr. von Hippel, thank you very much. We look forward to seeing you on the panel, unless there are clarifying questions for him.

(No response.)

CHAIR HAMILTON: -- I gather not. We will see you shortly.

The final speaker in this portion of the program will be Dr. Steven Miller. He's the Director of the International Security Program at Harvard's Belfer Center.

Doctor Miller, thank you for coming, and you may proceed, sir.

DR. MILLER: Thank you very much. It's an honor to have an opportunity to share some thoughts with this Commission. I was asked to make some comments putting the domestic issues that you have under consideration in a wider international context. Coming at the end of a string of very accomplished and knowledgeable speakers, much of which I thought I might say has been said, and I'll try to refrain from repeating the detailed suggestions they've already gotten.

I thought, as I was listening to Frank von Hippel and Jim Timbie, that I might be able to structure my remarks as a framework for thinking about why it is so important to pursue the kinds of angles that they were advocating.

For Commissioner Eisenhower, I come at this from a nonproliferation point of view, and so the issue I'm trying to come at in a roundabout way is, what are the late implications of our domestic nuclear policy choices for the global nonproliferation regime and effort?

So what is the global nuclear context for America's domestic nuclear decision making? In the current environment, there are two notable developments, both of which have been alluded to earlier. One is that we're seeing in some places a substantial expansion of nuclear power, that is the growth, rapid growth, in places that already have nuclear power.

A large fraction of this globally is accounted by four countries: China, India, Russia, and South Korea. Interestingly, all four of these either reprocess or have a strong interest in reprocessing. About half of the growth is, in fact, found in China, which presently has 23 reactors under construction. So that's one piece of the puzzle, and so we're going to end up in a world where there's quite a few more nuclear reactors, at least until older ones start being phased out, because in some countries there has been a very significant choice to accelerate the growth of nuclear power.

But there's a second factor, which again has been touched on by some of my predecessors, which has to do with the spread of nuclear power. Charles McCombie, in one of his slides, used the number 61 as the number of states that you can find in the Power Reactor Information System database of the IAEA, states that have approached the IAEA and expressed an interest in exploring the nuclear power option for themselves.

I think it was implicit in some of what Frank von Hippel was saying, that on average, these 61 states are less stable, less democratic, more corrupt, less blessed with bureaucratic and regulatory experience and capacity, often reside in much more dangerous neighborhoods. So the idea that we're going to have nuclear technology spreading much more widely across the planet and much more significantly outside what you might call the OECD zone means that the kinds of risks and worries that we try to contain as we seek to harvest the benefits of nuclear power, they press themselves upon us even more urgently.

I've been fortunate to be a part of a project at the American Academy of Arts and Sciences called the Global Nuclear Future, which is an effort to look at the perceptions and implications of this expansion and spread of nuclear power. One of the things to point out and perhaps highlight is that among these five dozen or so states that have an interest in nuclear power, some are perfectly content to be compliant with established norms and to be deferential to our preferences for the kind of nuclear world that we'd like to live in.

However, there are a significant number of exceptions, of states that do not fully share our views of the NPT, do not fully share our views of the preferred nuclear order, and under the NPT system, they have the right to pursue options that will make us nervous. Those are the kinds of options that I think Jim Timbie's incentives are designed to woo them away from.

I just flagged for your attention the fact that not only are we seeing changes on the demand side for nuclear power, but also we're seeing some changes on the supply side as well. The illustration here that I think is quite vivid is the most recent large nuclear export deal in which the Korean

Electric Power Company succeeded in winning a $40 billion, 20-year contract with Abu Dhabi.

So, if we think that the nuclear past largely consisted of the French exporting to the Finns, the nuclear future may look much more like the Koreans exporting to Abu Dhabi, the Chinese exporting to Pakistan. If you follow the nuclear trade magazines, you'll have noticed that the Koreans have followed up their Abu Dhabi deal with discussions with Sri Lanka, with Jordan, with Bangladesh, where it appears they're losing out to the Russians.

But it isn't going to be the same limited circle of customers and the same tiny band of suppliers as in the past, and this means that we may have more competition, less American ability to impose some discipline on this market, and all of those, I think, have implications for how we manage the nonproliferation system going forward.

So just to conclude this portion of my remarks, what I would say is that we're edging into a different nuclear world, one in which there are more players and more technology spread more widely around the planet.

Now this is not going to happen rapidly and some of this isn't going to happen at all and some of these 60-plus states that have an interest in nuclear power will never achieve nuclear power and many of them are decades away from having any meaningful operational nuclear capability. So why does this matter now, and why should it matter to our decision making now? I would say there are two answers to this.

One is that a number of important states out there in the developing world -- Saudi Arabia, Malaysia, Indonesia -- are in the process right now of exploring their options, defining the frame for their future nuclear policies and making choices for the future. So, even though the manifestations of their choices may not hit us in an operational sense until 20 or 30 years down the road, the perceptions and choices they make today can heavily influence what world it is that we live in.

The second point is that some states are beyond just framing options. Some states are making decisions today that are going to shape the nuclear world that we live in 20 or 30 years from now. Abu Dhabi has made a decision to have four nuclear reactors. Abu Dhabi has already completed its vendor selection process. Abu Dhabi has in place its regulatory framework. Abu Dhabi has already hired a general contractor for its nuclear power plant. Abu Dhabi already has a fixed and firm construction time table. With the Jordanians, they have made a decision to have a nuclear reactor. The Egyptians have made a decision to have four nuclear reactors. And so on. So decisions are being made out there that will very strongly shape the future nuclear order that we live in.

Well, why does this for American domestic nuclear decision making? I would offer three quick points in my waning two or three minutes here. First, what we choose to do -- and I think this is very much in the spirit of Jim Timbie's point about incentives -- what we choose to do affects how others perceive their choices, what they perceive to be desirable, acceptable, legitimate, economically viable, and tolerable within the existing rules of the game.

Secondly, there is a kind of, what I would call a double standard problem. Not everywhere but in many significant places among these aspiring nuclear states, what one finds is a considerable degree of frustration and resistance with what I would call the "do as I say, not as I do" approach to nonproliferation. If we do it, others are likely to do it; it's as simple as that. Our ability to be persuasive in asking others to avoid certain choices is, I think, very much undercut if we don't factor in that our behavior casts a big shadow on how they think about things.

Then the third point is there exists within the NPT regime -- and I think you saw some of this in May at the NPT Review Conference -- there exists what I call a coalition of the disaffected, people who are not with the drill as we see it, who react skeptically and often with hostility to our preferred normative interpretations of the NPT regime.

So what one finds is that there are key opinion-leader states within the developing world, the Egypts, the Indonesias, the Mexicos and so on, who, each has their varying national positions. But on average, what you can find is significant, articulate, and hard-working groups of souls out there who oppose the establishment of the additional protocol as a condition of supply;

Who resist the idea of

international fuel banks as a compromise on their sovereign rights; who look skeptically on export controls and view the strengthening of them as contrary to our Article 4;

Who argue that the Nuclear Suppliers Group was never in view when they signed up to the NPT, and constitutes a violation of what they see as the deal;

Who resist the strengthening of Article 10 so there's not such an easy exit route for potential cheaters; and

Who resist or reject restraints on the spread of international nuclear fuel cycle capabilities.

Not every state feels equally passionately about these issues and some care a lot more than others and some are much more active than others, but every one of the positions that I just described was contained in the working paper that the Non-Aligned Movement submitted to the 2010 NPT review conference. This is 118 states and 18 observers. That is to say, roughly two-thirds of the members of the NPT system, signatories on the NPT, have lined up with positions that are exactly contrary to our preferences. These are the kinds of political ties that I think we have to work against in building incentives that will shape the nuclear order in the way that we hope for it to be shaped.

So let me conclude by drawing attention to some old work that I think has very current relevance. Thirty five years ago, the legendary nuclear strategist Albert Wohlstetter ran a big project which was called "Life in the Nuclear-Armed Crowd", and the punch line is, I think, betrayed by the title. They, they had the thought that life in the nuclear-armed crowd probably won't be all that appealing.

As part of that project, he wrote a quite influential article called "Spreading the Bomb Without Quite Breaking the Rules" because everything we're talking about is permitted by the NPT system, so we can spread a lot of implicit nuclear weapons capability while staying within the rules on the inside of the boundary of permissible.

Wohlstetter argued in this famous piece that the international implications of our domestic political decisions, our domestic nuclear policy decisions, were those that posed the highest costs to our national interests properly understood. He argued quite stridently that this reality was not properly taken into account in our policymaking at that moment. What he ended up doing was arguing that it's not enough to advocate the world that we want to live in; we have to illustrate it. The way we illustrate it is with the behavior we display in our own country, the choices that we make.

So I would conclude by saying that if you think nuclear proliferation represents a first-order threat to the long-term security interests of the United States, then this consideration has to play a very large role in all of our calculations about the choices we make here at home.

Thank you very much.

CHAIR HAMILTON: Thank you very much, Dr. Miller.

I think we'll ask all of the five preceding presenters to come to the table here, and we'll begin the panel discussions.

We'll open it up now for questions from commissioners. I want to say to the members of the panel that we've had a very thought-provoking series of presentations. We're deeply grateful to each one of you, and we will proceed with questions.

Are there questions from commissioners? Brent?

CHAIR SCOWCROFT: Yes, I'd like to ask the panel, following all of your presentations here, which were fascinating, it seems to me that one of the ways that we can rectify the situation we're in now is to try to, in a way, internationalize the fuel cycle as much as possible, and that is, to make enriched uranium, low-enriched uranium for reactors available at prices that nobody can match by doing it nationally; to guarantee a supply as long as the IAEA certifies it so we can't deny it based on our national preferences for countries; and to take back the spent fuel after it's over.

It seems to me that would minimize incentives for others and for the 108 non-aligned countries, whatever you call them, to do it. What are your thoughts on that?

DR. REIS: Yeah, I would agree with that.

DR. von HIPPEL: I guess the key part of that is the take-back --

CHAIR SCOWCROFT: Right.

DR. von HIPPEL: -- of the spent fuel and, because that is a big issue. But of course, it's a big issue; it would be a big issue here. If the Blue Ribbon Commission can figure out how to achieve that, it certainly would have lived up to its name.

DR. McCOMBIE: Yeah, I'd just like to reinforce that. Take-back is the big issue.

If I can add something that's a little bit in my own area, there is one alternative to take-back that can help, and that is if small countries are helped to do it together so that it doesn't have to go back to the producer. But if small countries are helped to do it together, then they also have an exit strategy, to use the words that we used earlier.

One important thing -- I work in this area a lot, so I know -- is that large countries, not the US but large countries in Europe, have actively at some stages worked against that. They've actively pushed a pseudo-ethic that every country has to take care of its own waste by disposing of it in its own territory. I call that a pseudo-ethic because it doesn't apply across the board elsewhere.

Some more positive support from the US and the other large nuclear countries to help that particular option, which we call a shared option, as opposed to a take-back option could also be valuable.

MR. TIMBIE: Yeah, I, I would say that what you just described is an excellent long-term aspiration. I would also point out that many countries are going to be making decisions on a time scale, short compared to the realization of your aspiration. Therefore, we ought to spend a lot of time and put a lot of our effort into strengthening existing international markets as we move toward the longer-term aspiration.

DR. MILLER: I think yours is a very coherent approach, and I would just add in addition to points that have already been made, that there is some resistance to buy into internationalization schemes for the front end of the fuel cycle on the part of the hard cases that probably matter most because they view the nuclear marketplace as very heavily politicized.

There's always a fear that if you get yourself crosswise with Washington, it doesn't matter if the IAEA has this stuff because Washington really pulls the strings. Iran certainly feels that way, but also many in the Egyptian nuclear league and so on. There are lots of folks out there who look at the way the system currently works and say it's very difficult to imagine how you're going to provide fuel assurances that have sufficient guarantees that the people who are really on the other side of the divide in terms of friendliness with the United States will be confident in putting their fuel future in the hands of that system.

CHAIR HAMILTON: The Chair has three Commissioners who want to ask questions: Allison, then Pete, then Ernie -- and then

Susan's four, and then Al -- we have five.

Allison?

MEMBER McFARLANE: Okay, great. Thanks, I really appreciate all your great presentations, and I just want to go further with this discussion about take-back.

I think the issue on the front end you're all, as many of you pointed out, the fuel bank issue which the US really seems to be pushing, it's not, according to Charles, it's not much of a problem, fuel supply. But the take-back issue is the real key here, and so I want to explore a little bit more about whether this is at all possible, or whether we're just going to be really wasting our time with a solution that really isn't workable.

So, I want to understand how to, how you guys think it could work in the US, some concrete suggestions. Is this being discussed elsewhere? And what are the options? If it is being discussed elsewhere, how is it being implemented?

DR. von HIPPEL: I guess we'll go down the line.

(Laughter.)

CHAIR HAMILTON: Let's not be too polite here.

(Laughter.)

MEMBER McFARLANE: Is it that hard a question? Maybe we shouldn't even deal with it.

MR. TIMBIE: Of course, it is a hard question. You sort of posit take-back as the only medium-term solution. As I pointed out, long-term storage and international storage is also a feasible way to implement a fuel leasing scheme, which we think provides the maximum incentive to forgo enrichment reprocessing.

So I wouldn't say that take-back is the only solution --

MEMBER McFARLANE: Yeah, but --

MR. TIMBIE: -- but it is -- I mean, many people talked about leading by example. You know, if, as a result of your decisions or your recommendations, policies are formulated where we have a well-defined path forward for disposition of US spent fuel, that then opens up the question, first of all, if this path could be replicated by others, but also whether the path that's designed for the United States could also be used for foreign spent fuel.

We take back, now, the --

MEMBER McFARLANE: Um-hmm.

MR. TIMBIE: -- spent HEU from research reactors. That's on a very small scale and so forth, but it does show that it can be done once one has a means for dealing with one's own problem. So then use that, or at least consider using that, to deal with spent fuel of others.

MEMBER McFARLANE: No, I agree that, I think take-back is very attractive and the idea of international long-term storage is great. But I think it, it basically reflects the fact that the US has no solution itself, and it's just sort of a mirror reflection of what our own policy is, or lack thereof.

So, I'd like to think about what our policies could or should be, so I want to explore, I want to understand more about what some of the details could be with a take-back option.

DR. McCOMBIE: Yeah, well, I think we all agree, it's a really difficult option. For those that don't know, of course, it was mentioned that Russia does it for its own fuel. One of the drivers that might lead to it happening, of course, is purely commercial. If Russia sells enough reactors, then the French are going to start thinking about it then more strongly, especially if France does implement its own national repository in 2025, which it would like to. So there could be commercial drivers, in fact, that would lead in that direction.

The other aspect, of course, is a

level of trust. Russia did take back in the past. I think Frank mentioned it. The Finnish fuel went to Russia. But it didn't have a long-term guarantee, the same as the UK, so they all got their fingers burned. They, they introduced nuclear power on the expectation they wouldn't have to deal with spent nuclear fuel, and then suddenly the take-back became conditional at very high prices. So that's when the Finns, for example, decided, we can't do this; it's not predictable.

So I think somebody mentioned take-back with a 10-year time horizon or something. It's too short. You know, you want to have confidence if there's take-back that it's going to last a longer time.

DR. von HIPPEL: To add that -- I know you've had many discussions before, but I just wanted to say that I think the US debate over spent fuels is highly irrational and that if you have, in my view, a rational hierarchy of concerns about nuclear power, about the external effects of nuclear power would be nuclear proliferation, a nuclear weapons connection, nuclear safety, and then at the bottom of the list would be radioactive waste, the hazard from radioactive waste.

But the "not in my backyard" concerns about spent fuel have really imperiled, I think, the nonproliferation objective. So I think hopefully one of your tasks is to try to make the process more rational, I mean reflecting a real objective set of dangers that we're facing.

CHAIR HAMILTON: Okay. Pete --

MEMBER DOMENICI: Could I ask him to clarify something?

CHAIR HAMILTON: -- Pete, you're next.

MEMBER DOMENICI: The last speaker -- would you clarify, what was your last -- the end of your statement, what was it at the end?

DR. von HIPPEL: That, that the -- objectively spent fuel 500 meters underground, or even kilometers underground, does not represent a hazard on the scale of the spread of nuclear weapons.

MEMBER DOMENICI: Oh.

I wanted to ask you all a question. One of you said that the old-fashioned saying that people would like to, for us to do what we say instead of saying and not doing -- I don't know which one said that, but I'm going to borrow the phrase for minute and say to you, the United States, pursuant to your suggestions, would be out there pounding on its chest talking about wanting to do things for other countries when we don't know how to do it for ourselves, and we haven't decided how to do it.

It would appear to me, and you'd, I'd like you to answer this, that the best way for us to get involved in a meaningful way in the nonproliferation aspects of international markets would be for us to have our own policy with reference to the disposition of the waste and the nonproliferation activities that we would be part of. Am I correct in that thinking or not?

I don't see how any other countries are going to buy into us, and you described between you this whole new group of countries that are getting active, and they're apt to all go elsewhere if the United States of America continues what we're doing. We're all talk and do nothing. Would you address that? If you don't want to, I'll leave my statement stand. I wanted to make it anyway.

DR. REIS: Senator Domenici, let, let me respond to that by suggesting that the tools for doing something is really with us. We really understand about interim storage, I think most using dry casks. We understand what that is. I think everybody on the panel, certainly everybody here, would agree to that. As the people from MIT suggested -- and I guess the panel would agree on that -- if we move ahead aggressively with low-enriched uranium or the once-through fuel cycle interim storage, the issue then becomes, it's just interim; where does the US put it?

Again, I would suggest that where to put it, we've already demonstrated that at the Waste Isolation Pilot Plant. In other words, the National Academy has some years ago and continues to suggest that's the preferred technical option. There are political obstacles. I would suggest that those political obstacles can indeed be overcome. We understand because we've done it. We haven't just talked about it; we've actually done it --

MEMBER DOMENICI: That, that kind of medium could be the permanent one too.

DR. REIS: Indeed. I would suggest that is -- again, the technical response is that is indeed the permanent one, so, if you take a combination of interim storage and salt, put them together, recognizing that we are taking back, admittedly at a low level, the HEU.

So we've done -- the pieces of everything you have suggested are already being done. They don't happen to be in the right, if you will, political bins necessarily, but technically, we haven't just talked about it. We've actually done all the things to put together a system to make that, to make that happen.

CHAIR HAMILTON: Dr. Miller, did you -- your light was on a moment ago.

DR. MILLER: Well, I was the one who I think used the phrase in question. But in the famous Wohlstetter article that I alluded to in my remarks, he opens that essay by saying that the incoherence of American nuclear policy has been damaging to our nonproliferation objectives, and I think that's sort of consistent with the point you were trying to make. It's certainly true that if we have failures in our nuclear policies in important areas that cause other states to choose paths we don't like, that again is sort of consistent with the spirit of your question.

But I think that you've gotten some specific substantive answers from my colleague.

CHAIR HAMILTON: Dr. McCombie?

DR. McCOMBIE: I was going to disagree with Vic because it's always good if people disagree on panels, but in fact, he saved himself at the end by pointing out that the interim storage has to be tied to a final solution. It doesn't work unless it is.

MEMBER DOMENICI: That's true.

DR. McCOMBIE: We shouldn't mince words. We shouldn't deliberately mix everybody, including ourselves, up with that. Unless you have some kind of exit strategy --

MEMBER DOMENICI: That's right. Absolutely right.

DR. McCOMBIE: -- then you can't do the rest, and you can't do it in the US and you can do it anywhere else.

In Switzerland, my second home country, we have a centralized interim storage facility, but the locals who agreed to it have a signed contract that after 25 years, if they don't want it anymore, then the utilities have 10 years to get out of there to somewhere. But that can only work if there's enough trust in the system, and I think that level of trust might be harder to get here.

CHAIR HAMILTON: Okay, we have --

MEMBER DOMENICI: Thank you, Mr. Chairman.

CHAIR HAMILTON: -- Ernie and then Susan and then Al. Ernie?

MEMBER MONIZ: Actually, a few comments, then a question. First of all, Vic just mentioned the interim storage, and I just wanted to reinforce a point that we made, that while we feel very confident about a century and maybe even longer, the technical basis, factually speaking, is rather thin, and I think that's an important contribution for us to make by carrying out the program to do that RD&D.

Charles, you mentioned -- in terms of observations again, you mentioned multibillion-dollar titanium drip shields and the general Rube-Goldberg construction just to say that that reinforces this idea. If you don't do an integrated look at the whole business, you get into terrible problems.

I do have a question for you, and that is, why in your list of reprocessing technology issues don't you include things like safety and health? You know, on the scale of large civilian activities, we don't have a whole lot of reprocessing experience. What we do have -- sure, La Hague is on one side; very positive -- but we have lots and lots of other issues that have occurred historically that I think deserve attention.

DR. McCOMBIE: Well, I think earlier, early reprocessing was not clean. It was a military operation to start with. It's cleaned up, even in the UK very much so, and it's doable. It's, we'll talk later about ethical issues, but that's an intergenerational issue.

It's a lot -- if we're really worried about the nuclear fuel cycle, my idea is we should be looking at the mining and milling part of it and not even at the reprocessing if you look farther down the line. Nothing we do is going to get us away from the mining and milling parts.

But these are technologically solvable problems, it seems to me, even in the future.

MEMBER MONIZ: Again, I don't disagree with the statements. The fact remains that there are issues, and certainly issues of short-term versus long-term exposures, worker exposures versus public exposures. So I just think we make a mistake in not having this on the table as a major issue, as well, to address.

DR. von HIPPEL: Mr. Chairman, could I just make a comment on that? I think you're right. In practice, the way reprocessing has been executed in France and the UK is, actually creates a major danger. Instead of solidifying the high-level waste immediately, they actually accumulate years' worth of liquid high-level waste in tanks, you know, the inventory's about a hundred Chernobyls' worth of cesium 137.

Those tanks have to be constantly actively cooled so that they don't boil. They're potential targets of terrorists. In fact, right after 9/11 the French put anti-aircraft missiles around La Hague, the reprocessing plant, because, maybe because of this concern.

Now the Japanese are hung up, but in part, because they have refused to go this easy route when they have problems solidifying the high-level waste, of just letting it accumulate in tanks. So, I mean, some people can, they may laugh at the misfortunes of the Japanese, but in fact, part of their problem is, in fact, being responsible in this regard.

MEMBER MONIZ: There are also, of course, alternative reprocessing approaches that have very, very different sets of technological solutions, et cetera.

Mr. Chairman, I had a set of questions for Mr. Timbie as well, but do you want me to defer those until later, or --

MEMBER McFARLANE: My question has been answered.

CHAIR HAMILTON: Your question's been answered?

MEMBER McFARLANE: Yes.

CHAIR HAMILTON: Well, let's go to Al, and then we can come back.

MEMBER MONIZ: Great. Al?

MEMBER CARNESALE: Thank you, Mr.

Chairman.

I have two questions. One relates to this dilemma that we hear to some extent, especially when we take into account the MIT study and what you said. First, we see the reaction in this country to the withdrawal of the application for Yucca Mountain, which shows that all those places that have ostensibly interim storage are suddenly very upset that there is not a solution for long-term storage. Whether there really was one or not is irrelevant; right? They are very upset about that, which I think reinforces the point that some of you are making that it's essential that you have some sort of plan for the long term. I want to put that in juxtaposition to, what's most important is keep your options open, which means don't have a firm plan for the long-term.

So my question on that one is, help me.

(Laughter.)

DR. REIS: Have a plan. I mean, options really do have value, but if they're not -- I think we've been talking about these options that have been going on for 50 years. Okay, at some time, people want to say enough talking, enough workshops, enough CSIS, you know, Brookings, et cetera, et cetera. John Rowe's got an issue he's got a deal with; okay?

I think the -- so I think it's very important to have a plan. I think we have the elements of a plan. I would certainly concur almost entirely with what my MIT colleagues say. I think that if we get along to, you know, what we're talking about here, I think the elements of that are already there, that the part that is missing is the final, if you will, is the final disposition.

Is there a plan? Again, I keep coming back to this because I say we've actually demonstrated that we know how to do that. It may not fit our legal construct, and we still have to do with NIMBY and all those other things, but the pieces of that, the technical perspective, is there. We have a plan, or we have the technical perspective of genuinely getting a plan.

I think the options, Al, would be just exactly what Ernie and MIT folks have said. It's, okay, the options are at the end of the century. Now it does make a difference to start doing that. That's why you do a research program. That's why a vigorous research program is necessary.

But I think it's really important to move ahead and move ahead rapidly, and I think the reason for that has to do with carbon; okay? If you're, if you don't believe there's a carbon problem, if you don't believe that, then we can wait. But if you really believe -- if you, you know, you can just put the numbers down, and you get a metric ton of, you know, of carbon dioxide for every megawatt year of carbon. That's a lot of carbon you're putting out from a coal plant. If you don't believe that's important, you know, then this is an academic exercise. But if you believe that's important, it's important to move ahead, and options don't help you with moving ahead rapidly.

That's my answer.

DR. von HIPPEL: I'm glad that you brought this up because I don't really understand which options would be foreclosed by putting spent fuel into a repository. I mean, you could, of course, do that and have it retrievable, fuel retrievable. But even if it weren't retrievable, the amount of energy, the energy potential in that spent fuel is minuscule compared to the energy potential if we do have a large future nuclear energy system in the future spent fuel.

So, I think we could, in fact, demonstrate that we know what to do with the existing spent fuel and have all of our options open. You know, two centuries from now, if we decide the world's a different place, we want to have a closed fuel cycle, that option will still be open.

DR. McCOMBIE: Yeah, I'm a little bit confused by the question, as well. If I live at a site where I'm collecting spent fuel, that's my whole problem. Nobody's giving me another option. The only other -- you've just proven that the other option that was supposed to be out there hasn't worked, namely Yucca Mountain. The only people who are saying there is an option there are the dyed-in-the-wool technical people like we are, or the NRC commissioners, apparently. But that's the whole, that's why people object to having it there, because they think there is no other option.

So, following Frank's thing, you've got to show that there is another option. You don't have to build a full-scale repository or something like that, but you have to get a large enough consensus that you can do that, and you know where it's going to go, and then you have an option. But right now, that's exactly what's bothering people at the local sites, that they don't see that there is another option.

CHAIR HAMILTON: Okay, we have three Commissioners who have questions. Mark has not asked a question, so we'll go to him next, and he'll be followed by Ernie and Susan.

MEMBER AYERS: Thank you very much. I don't know if I have question as much as I do a statement.

You know, we're spending a lot of time. One of the gentlemen here said that we have a plan. It's pretty clear to me that the science and technology is sound. There may be some differences, but it does appear to be sound from my perspective, and the discussions are centered on spent fuel, taking it back, repositories, interim storage. It seems as though the policy is in place in the United

States for a seemingly nuclear renaissance.

The only thing that is not in place are loan guarantees for these first starters. We can, with all the solutions, and I'm very respectful of all the great testimony and professors that we have here, but the real question is, are we going to be sitting here for the next 10 years letting OMB be the ones that stopped any renaissance in this country? That's really troubling to me. That's been an issue for quite some time now, and it's going to continue to be, and it's what's going to interfere with moving forward in the United States with any nuclear renaissance.

CHAIR HAMILTON: Okay, thank you, Mark. I don't see too many lights on up there on the panel on this question, but it's really not a question for them, I think, probably. It's a statement. Thank you very much, Mark.

Turn to Ernie, then Allison, then Pete.

MEMBER MONIZ: Actually following

on Mark's point, I just wanted to say that in my first slide, the first bullet, was accelerated implementation of the First Mover Program, and goes back to Vic's point. That is, in the climate context, that is actually being still reinforced. That's the number one issue.

Another observation I would make is that in our 2003 -- this goes to the whole take-back issue -- I just want to emphasize a point that we, in 2003 we did a construction of a scenario as to what a terawatt by mid-century might look like in terms of a global distribution. Now, you know, there was judgement involved in there.

The only point I want to make in this context is that it was very difficult to find a scenario where you possibly have more than 15 to 20 percent of spent fuel as candidates for this kind of take-back option. So one might say that no matter which pathway one follows, at least for 50 years, we're not talking about a complete -- you know, turning the whole waste management system in the world on its head. It's actually a pretty small increment, and our view was, every country engaged should just do with whatever they do with their own spent fuel with this small increment.

But now, to Jim and a couple of questions. One is, your presentation was all about carrots, and have you thought about sticks? Secondly, we've heard various issues of policy incoherence. I need only mention India, UAE, Jordan, Brazil, Japan, to get to the drift of, shall we say, a boutique strategy for each and every country, which I suppose could be viewed by some as an advantage, but it's not viewed by me that way, at least. How are we going to get coherence and any kind of uniformity that would provide us an opportunity for leadership in this field?

MR. TIMBIE: Okay, as far as

sticks are concerned, I guess the answer to your question is, no, maybe we should think more about sticks. Our entire focus is, as I mentioned in my remarks, looking at incentives, to ways to influence, ways to cooperate and therefore influence decisions to establish options, and as several mentioned, lead by example. So I would say sticks would be an area that might require more attention.

As far as coherence is concerned, I mean, we do have a worldwide policy to discourage enrichment and reprocessing. It is implemented on a case-by-case, country-by-country, one-by-one approach. I guess I don't see that as a disadvantage. Countries are different. They're in different situations. They have different resources. They come to this decision from different perspectives. As Frank pointed out, some countries are embedded in a good security situation; others are not.

So I guess I don't see it as a disadvantage that, although we do have a worldwide policy of discouraging enrichment, indigenous enrichment, indigenous reprocessing, we do approach each country, sort of, one by one as to what strategy, what set of incentives, what set of cooperation opportunities would best lead to the sorts of decisions that we would like to see.

MEMBER MONIZ: Steve used the words -- many of your words keep being revived here -- crosswise with the United States, and I think it would be very hard argued that there is not an impression created that we have very, very different approaches to friends and others, and I don't know if Steve wants to comment on that.

CHAIR HAMILTON: Okay, any further comment from the panel?

(No response.)

CHAIR HAMILTON: If not, we got to Allison, then Pete, and then Al.

MEMBER McFARLANE: Okay, great. So I want to start again with Steve's words.

You made such an impression on us, Steve.

Your last words, if nuclear proliferation represents a threat to the US, then, to the effect, the US, you know, we should be thinking carefully about our own domestic policy decisions. So, in that vein, could or how could the US explicitly support reprocessing or recycling without an international impact?

Then let me broaden that out a bit and ask some of the others to jump in, and ask, are there types of, in your view are there types of reprocessing technologies, like pyroprocessing, for instance, that offer the advantages or the cover or whatever that would allow the US to do such a thing?

DR. MILLER: First, I'd just say in partial response with Dr. Moniz that on the question of sticks, many of the behaviors we would like to discourage or encourage are either permitted by the NPT or not required by the NPT, and so it's very difficult to create international political traction for punishing somebody who's doing something acceptable under the NPT. We might not like it, but that's different from saying they have no right to do it. That's where the incentives, again, come into play.

I've spent much of the last several years traveling around to places like Saudi Arabia and Egypt and Singapore and so on talking to nuclear elites in these other countries, and there's a very wide perception that the nuclear marketplace is heavily politicized. If you're on good terms of Uncle Sam, you get carveouts and exceptions, and if you're crosswise of Uncle Sam, you not permitted even to pursue your inalienable rights under Article IV. Some of those perceptions are probably exaggerated, some of them are perhaps unfounded, but they are a political reality that we have to deal with. Then they ripple through our ability to arrive at various international solutions because the trust that's necessary to build a system is, in fact, lacking.

The principle that at least a group of us up in Cambridge has been advocating is, no further national fissile material production capabilities, period, as an operating principle. In order to get to that, you might need to de-nationalize the existing national fissile material production capabilities sooner or later. That, then, gets you into, under what circumstances can you imagine people buying into and relying on, you know, an internationally managed and run, operated reprocessing facility if the global choice is that we need additional commercialization of plutonium?

But that's, that's the one circumstance under which you can imagine that you could have, you could go down the reprocessing order, the additional enrichment route, and not eventually run into additional nonproliferation worries.

But the Jordanians have refused to accept the Abu Dhabi pledge that they will neither enrich nor --

MEMBER McFARLANE: Same with Saudi.

DR. MILLER: Saudis, the Egyptians, and so on. Some of this is just a declaration of principle, that they don't have any intent to do it but they don't want to establish the precedent that they're prepared to sacrifice their rights.

In the case of Jordan, they have domestic uranium, and they think that they can make money through the value additive of enrichment. So they see it as a commercial opportunity, and why should they give that up. Other people do it; why not them? They're permitted under the Treaty.

So that's exactly the dilemma that we're hoping to avoid, that 20 or 30 years from now, we wake up in a world where many more states and very different sorts of states are engaged in this process that gives them de facto weapons-making capability.

DR. von HIPPEL: I'd like to pick up on that and also pick up on something Steve said. On the question of proliferation resistance, I mean, we had great debates on about five years ago about whether pyroprocessing was more proliferation-resistant than PUREX, which is the one that the US developed to separate plutonium for weapons. So, certainly, you can't argue it's proliferation-resistant.

There was recently, in 2009, there was an internal lab study which I think finally brought some closure to this debate, which basically concluded, yes, there is a difference, some differences between these different technologies with regard to subnational diversion of materials, but there was essentially very little proliferation resistance against national diversion of materials. I think you could understand that.

The big trick with regard to reprocessing is you have to do this remotely, behind very thick shielding. Once you have that remote management capability or once you even separate most efficient products, which all the, you know, pyroreprocessing does, then it's quite easy to, you know -- even if you don't have pure plutonium, you could -- to separate out pure plutonium.

Now the other thing with regard to the question of no new national fissile material production capabilities is I'd just like to say that, of course, I'm against reprocessing, period, but we still have the problem of enrichment, and that's the struggle we're having with Iran right now. I think the US has an opportunity to, to show that one can do enrichment under multinational auspices.

In fact, de facto, the industry has been moving that way. URENCO is building one of the new U.S. enrichment plans. AREVA, the French conglomerate, is building an enrichment plant in the US The, if the laser enrichment gets built, it's a US-Japanese-Canadian consortium. There's only one enrichment plant that may or may not be built that's purely national.

But we haven't made a virtue out of the, out of what's happening. I mean, it's also happening elsewhere. The, you know, France is building an enrichment plant with URENCO centrifuges, the Chinese enrichment plants are based on Russian centrifuges, so that there, it's really possible, I think, to take advantage of these industrial trends and actually to say, well, what would we like a multinational enrichment regime to look like?

CHAIR HAMILTON: Al?

MEMBER CARNESALE: First, a statement, a reminder -- that while we have this broad title of the Blue Ribbon Commission on America's Nuclear Future, our charge is not promoting nuclear power in the United States. Rather, it is focused on the back end of the nuclear fuel cycle and decisions that relate to that.

Secondly, it is not to solve the proliferation problem. Proliferation is an important, perhaps the most important, factor in considering choices that we make about the back end. The difficulty of arguing that example matters in proliferation is our example is that we have more than 5,000 nuclear weapons and talk about the need for possibly some new ones. So we got a problem to begin with when we talk about proliferation: Follow our example.

We're already quite limited here. We're talking about examples as they relate to the nuclear fuel cycle. But in that context, for countries of concern, just on the front and for a moment, I think it's perfectly legitimate to worry about assurance of fuel supply. Yes, there's a market, but if you want to make political hay in the United States, you don't talk about climate change, you talk about energy independence; right? We would depend on anybody else for energy, but others should somehow depend on this arrangement.

It might work. I mean, if we can pull it off, I'm all for it.

But it's useful to be somewhat realistic here. We've seen, if you're another country, you've seen oil embargoes, UN sanctions, national sanctions, you've seen people manipulate natural gas supplies for political ends, so let's not kid ourselves. But it helps.

On the back end, the principal thing that came out of the Ford and then the Carter administration was not the argument that we weren't going to reprocess. It was that we weren't going to reprocess because it made no economic sense. It wasn't, look at us; were giving up something good. It was, look at us; we have learned that this makes no sense. What we hear now looking at the problem 35 years later is it makes no sense, not economically, not from a resource point of view.

So it's not so much that people will follow our example or not. I gather it's more that if we proceed, it provides others with some cover. They can say, well, gee, you reprocess; there must be some reason why you're doing it. We should not fool -- those will be the real countries of concern that will use it as cover. But there, countries that would have liked to have done it anyway.

So, while we're all in favor of minimizing the spread of these facilities, we should keep in mind that most of their choices are not going to be based on whether or not we do it. If we think that's what's important, we'd better look at our arsenal before we worry -- which, by the way, I'm not in favor of disarmament. I'm just saying we shouldn't kid ourselves as to what we can accomplish or can't accomplish with these choices.

So again, my question is, so what do you think of that?

DR. REIS: You're all wet, Al.

CHAIR HAMILTON: Let's see. Dr. Reis, and then Dr. McCombie.

DR. REIS: No, I think you, you know, I think in large measure the discussions of reprocessing and which one, and what won't, I think is a red herring. We're not going to do reprocessing in this country; we're not. Economically, politically, you name it, we're not going to do that, and I think everybody on this panel, one way or another, would -- you know, I'm not making a policy. I'm just telling you that we're just not going to do it. So the real question is, what should we be doing? Which, of course, is what your panel is supposedly going to do.

What comes out of the discussion is really, what are we going to do for a repository? Right? I mean, that's really where the rubber meets the road because, if you can have a repository, then you can do interim storage. If you can do interim storage, then you can you take-back. Now there are political problems all along the way, but it all gets back to thing, do you have a repository?

My statement -- I hate to sound like a one-trick pony on this -- is that we demonstrated in this country that you can have a repository that can be licensed, that the local community, at least, represents, you know, an enthusiastic support -- I mean, some of the -- you know, that we really do understand the environment, that we really have worked out that problem to a fare thee well, that we've got the National Academy saying that this is the best, you know, ultimately this is the best solution.

Now there is still obviously, some work, basically some work to be done. But if we do that, if you people can recommend that as moving ahead, I would argue that the other pieces, all the carrots, are technically feasible, and spending your time whether it's worried about whether it's by pyroprocessing or PUREX is a waste of time because we're simply not going to do that.

You should be thinking about, okay, how can we make salt or even something else, you know, the viable option? The administration, I would argue, is waiting. You know, they're taking you very seriously, and the sooner you come up with a solution, the more, the quicker we'll be able to move ahead.

CHAIR HAMILTON: Dr. McCombie, then Dr. Miller, in response to the question from Al, and then we'll go to Susan.

DR. McCOMBIE: I'd just like the back up that independent of reprocessing or not, spent nuclear fuel is nasty stuff, and it will be nasty stuff for a long time into the future, whatever you do with it. At 50 years, it will kill anybody who's close to it still.

Now do we want to have spent nuclear fuel in 61 countries or however many come for the next hundred years?

It's great to say that in the US they say, we'll keep it for a hundred years or 200 years or 300 years. If you've seen pictures of the country which has problems, social or economic problems, if you've seen pictures of naval nuclear fuel in Russia falling to the bottom of ponds and rusting there in a big rich country like Russia, do we really want to have spent nuclear fuel and 68 countries around the world for the next several decades? Or do we want to show them that there's another way to do it, there's a better way to do it? That's where the US could show a lead, show that there is something you can do with it.

It's nasty stuff, and even if you don't reprocess it, you do not want, anywhere in today's world, any of the substate actors to get their hands on these very, very nasty materials. So that's an issue there that's important.

CHAIR HAMILTON: Dr. Miller, and then Mr. Timbie, I guess, wants to comment.

Dr. Miller?

DR. MILLER: I think Al makes a number of good points about the limits of the power of our example, but I would sort of refine how I was thinking about it by saying that the aspiring nuclear newcomers are making big decisions, and often with fierce debates inside. So there's a question of what arguments are available for deployment, what kind of perceptions do they bring to these debates, and so on.

You know, if international organization is such a great idea at both the front end and the back end of the fuel cycle, why haven't we done it? We, the United States has been in the nuclear business for 70 years. We've had decades to do it. We haven't done it. So why is it a good idea for Egypt?

Al's point about reprocessing and why we didn't do it, which is, we came to the sensible conclusion that, for the current context, it doesn't make economic sense, this is a very powerful message. If others learn it, that's good.

I mean, I spent an afternoon in Tehran sitting through their energy briefing, and they make about their nuclear, civil nuclear power program every optimistic assumption in the book, many of which they borrow actually from the Japanese. It's very much like sitting through briefing in Tokyo about the likely costs of things, about the eventual cost of nuclear electricity, and so on. Those, then, ripple through the decisions that they make.

So, that's kind of the context in which I think we need to think about our own behavior, is that it affects their perceptions of what's desirable, what's feasible, what's acceptable, and if we didn't think it was good enough to do it, then why should it be a good solution for them? That question comes up all the time.

CHAIR HAMILTON: Mr. Timbie, you'll have the last word on this question.

MR. TIMBIE: Al's comment focused on the value of leading by example, and I have advocated that; the others have also advocated that. And it's also certainly easier to make your argument if what we're doing, actually doing, supports that.

But I'll also just point out that in addition to setting a good example, there's also the question of putting ourselves in a position to do helpful things. I mean, Russia provides fresh fuel to Iran and takes back the spent fuel, and that has a major nonproliferation benefit. And if other countries were in a position to do that and that became the norm rather than the exception, we'd be better off.

CHAIR HAMILTON: Okay. We have

two more commissioners with questions, Susan and then Pete, and that will have to conclude the morning.

Susan?

MEMBER EISENHOWER: Well, first of all, I want to thank the panel for terrific presentations. It was very provocative because I must say that by the time I got done listening to these presentations, you know, I'm impressed by the array of countries that are moving towards nuclear energy who are not anchored, you might say, in the West who are certainly are not American allies.

But we've got -- at the same time, I think it only added to the urgency, I think, of General Scowcroft's original idea that we need to find some kind of comprehensive system here. It's hard for me to imagine that the United States alone could shoulder the burden of take-back or anything else.

So my question to the panel is: Is there a short list of other countries we could engage on an immediate and urgent basis to create some kind of, you know, the first steps towards an international system that might also, for international security reasons, take back some of this nuclear fuel? I think it was in Frank's paper that he very articulately said that in certain, even Western, countries, having spent fuel sitting around is not acceptable.

So, what would a short list of other countries look like that might also help the United States with taking back spent fuel from various places or even taking spent fuel off the hands of countries who don't have populations that will find it acceptable to house that material?

So the question is, first of all, would the United States agree to a short list? It's hard for me to imagine, with the domestic circumstances as they are without our own solution in place, that we're going to be able to take back a lot of this stuff. So, if you agree with any of those assumptions, what would a short list look like? Would they have to be all U.S. allies or U.S. allies plus weapon states? Or, what would that look like?

DR. McCOMBIE: Well, actually I've worked on an international project for the back end and we did pull up sets of criteria for such things. It didn't include being a U.S. ally. It didn't include being internationally well founded, though. Internationally, not U.S.

If you go to another country and say that we, we, the US, thinks this is a great idea, I think it could be counterproductive if the United Nations goes and says that we think this is really good for the international community. It could be different, and we experienced that in very direct. It's documented.

We had an international project which was based in Australia. From a technical angle and many other angles, Australia would be an ideal country. It's a big uranium producer and a good incentive there. There are people that are interested and so on. Of course, it's a non-nuclear nation, which makes it very difficult. But at that time, I think we did get the direct help from some U.S. government figures and so on, but it did not turn out to be very positive to look as though the US was asking them to do it rather than in a wider setting.

So, to answer or try to answer a little bit of your question more directly, however, the kind of obvious states that you can involve the weapon states, very clearly, or maybe the big uranium producer states with the take-back kind of thing. It's been discussed at different levels in most of the big uranium production states and certainly in Australia and Canada and Kazakhstan and so on, or maybe in some state that actually could use the business. And certainly if there was a kind of international guarantee that the thing would be done state-of-the-art and fair to all concerned, you might have a chance of doing in some of these other states.

CHAIR HAMILTON: Dr. von Hippel, and then Dr. Miller, and then we'll go to Pete.

DR. von HIPPEL: The country that's been mentioned is, of course, Russia, and Russia did take back spent fuel from Eastern Europe, Finland, Armenia. The Soviet-supplied reactors -- it was the Soviet Union that was taking back the spent fuel. As I mentioned, that has pretty much stopped, and I think both -- it was mentioned that the price went up.

Also, think on the European countries, the EU developed -- which, you know, a number of the countries moved into the EU, the customer countries, and the EU sort of felt that that wasn't responsible to export their spent fuel, and that left Ukraine and Armenia basically.

Ukraine recently actually did, after the election, start to send spent fuel back. As far as I know, they're the only country. It's not for reprocessing. It's for storage.

MEMBER EISENHOWER: I'm sorry. Which country?

DR. von HIPPEL: Ukraine, which has a big nuclear sector.

But there was also a great debate in Russia. I mean, there was really a push on the, when Russia felt, really when the nuclear sector felt very poor, to try to make this a business taking other countries' spent fuel back. There was a large public opposition. In fact, they had to change the constitution, I think, to make it impossible to petition against this and for a referendum. And so, Sergei Kirienko, who's the head of Rosatom, announced a policy that Russia would not take back spent fuel as a whole, although there's exceptions, and it's not quite clear how will actually work out.

Certainly, Iran in Ukraine seems to be an exception. But certainly, the only country which has done this is Russia and it's an obvious partner.

CHAIR HAMILTON: Dr. Miller?

MEMBER EISENHOWER: Could you -- oh, I'm sorry.

CHAIR HAMILTON: Excuse me. Excuse me, Susan.

MEMBER EISENHOWER: Just as a quick follow-up to Frank, though, okay, there's Russia. What about the short list of what would be acceptable for the US, in your opinion, the US national security community?

DR. von HIPPEL: I think it's, I mean, it probably is a pretty long list, and the question is whether it's acceptable, of interest in those countries. I mean, it was mentioned, Australia was mentioned, where -- which is obvious; physically, a great place; you know, lots of desert. China is another, you know, has lots of desert, and in fact, it's thinking of siting it's -- well, of course, we've tried to site our repository in a desert.

So there are, you know, candidate countries out there, which I think would be acceptable from many points of view.

CHAIR HAMILTON: Dr. Miller.

DR. MILLER: I just wanted to pick up for a moment on where you started your interjection, which was with the notion that we need a comprehensive system, and I draw attention to some ideas in which, actually, Charles and Tom Isaacson have played the role about linking the front end and the back end of the fuel cycle.

Spent nuclear fuel is an unavoidable but problem for everybody, and if you could find a way of solving it internationally -- granted, a big if -- this would be very attractive to countries that wish to have nuclear power. If you could link that to some sort of buy-in to an international fuel provision scheme, that would then give countries an incentive to overcome some of the impediments that Al described so precisely, about why states are reluctant to internationalize their fuel supply.

So, there is some thinking out there about trying to create a comprehensive approach to international management of the whole fuel cycle. There are plenty of barriers on both sides, so maybe this is compounding, this is problem squared rather than fixing anything, but it's an interesting idea that builds on the Timbie notion of incentives.

CHAIR HAMILTON: Final question to the panel. Pete?

MEMBER DOMENICI: Well, Mr. Chairman, let me say to the panel I think there's been something said about, what would you think about all these countries around the world, small and large, et cetera, having to dispose of their own waste and keep it and take care of it.

I think one of the panelists said that was not an acceptable situation. I assume, then, if that's not acceptable, you would have in mind that some country like America would, would offer to take waste from other countries, and if that's part of what you're suggesting, I like you to say it in the record. I myself think that's very difficult while we're writing this report to put on top of everything else we're saying, but I think you're implying such.

My second question is international also. When you speak of the adequacy of supply of uranium -- and we don't have to worry for a long, long time, if ever, about getting the fuel out of the spent fuel rods because we have plenty of enriched uranium that can come from uranium -- is that true for the world or for America or how does that international situation match up in those two? Does anybody know that?

Will you answer the first one first? I mean, are you all expecting that the United States will be the repository for foreign spent fuel from small countries and others? Is that the recommendation?

DR. McCOMBIE: No, not directly. It would be very good if the US could do it. the US has bigger hurdles than many other countries to do it now. It would be good if one of two things happened. Either a large country -- it does not have to be the US; in fact, it would be better if it was more than one country for very obvious reasons -- if a large country would accept this small increment, it would be very good for the global nuclear system.

The other option, at that point I very briefly, is that small countries get together, but even to do that, they would need help from the international community, and they could make their own multinational, international, whatever you want to call it, repository.

MEMBER DOMENICI: Thank you very much. Anybody going to talk about the world adequacy of uranium and the adequacy of energy coming from the spent fuel rods, that we don't need to worry about it, we can put those away? Does that mean worldwide also?

DR. von HIPPEL: Yes, I think the picture that the MIT study drew about the availability of uranium is correct. I mean, it is a global picture but I also agree with them that it's important to nail that down. It's sort of -- the, actually, if you look at their paper, it sort of goes back to a 1970s, an article or a study done in the 1970s in Princeton actually, by some geologists about the geological abundance of uranium. I think it would be good to put some money into that.

But you know, there's also the issue of how much uranium from sea water would cost. There's a huge amount of uranium in the oceans. It's very dilute. People are claiming that it could be extracted maybe at twice the current price of uranium. And if that could be firmed up, that would really provide us a sort of definitive sort of, something you could nail this question to the floor with.

MEMBER DOMENICI: Thank you very much, Mr. Chairman. I would just put on the record here, for our staff as much is anything, that Senator Sam Nunn is Chairman of the National Threat Initiative nonprofit corporation. They deal exclusively, of late, in the issue of trying to solve the problem of getting back uranium -- goes out is used, and it, and there's a system to get it back and have it. I think they run a lot of problems, it's cost a lot of money, but they've had some successes, and it would be good for us to know what that's about.

I thank you.

CHAIR HAMILTON: Thank you very much, Pete. Our thanks to the panelists, Reis, von Hippel, McCombie, Timbie, and Miller. It was an extraordinarily informative panel, and we thank you very much for your contributions. You've brought a lot of expertise to the attention to the Committee.

We stand now in recess for lunch. We will reassemble at one o'clock.

(Whereupon, the above-entitled matter went off the record at 12:09 p.m. and resumed at 12:51 p.m.)

CHAIR SCOWCROFT: We'll start now this afternoon by exploring the ethical and societal foundations for nuclear waste management. The Commission has heard many references to the need for fairness and equity in nuclear waste management both within and across generations, and we would like to spend some time focusing on that topic.

As in the morning session, we will hear from each speaker for a maximum of 15 minutes and then engage in a panel discussion. So we would ask the Commissioners only to ask clarifying questions during the presentation.

The first speaker is Mr. Bob O'Connor, Director of the Social and economic Sciences Program at the National Science Foundation. Thank you for joining us, Dr. O'Connor.

DR. O'CONNOR: Thank you very much, General Scowcroft. I also should thank you for the promotion. I really, I run a program called Decision Risk and Management Sciences at NSA.

I am not the entire Social and Economic Sciences --

CHAIR SCOWCROFT: You just got promoted.

DR. O'CONNOR: -- Division, but thank you very much. It's the highlight of the day.

But I really appreciate and am honored to have the opportunity to address this truly blue-ribbon commission. A couple of background things though. First is the disclaimer: I'm not speaking for the National Science Foundation, which the Foundation has a charter which prohibits us from taking positions on any issues. So, second, why am I here then? Well, I'm speaking as an expert on public opinion on long-term, on certain risks. I began studying opinions about radioactive waste and spent fuel -- and by the way, in my presentation, I'm going to refer to it as radioactive waste, although I mean the whole plethora of spent fuel and actinides, et cetera.

Okay, I began in 1984 when DOE hired me to prepare a seminar for DOE officials on public opinion and the history of intergovernmental relations regarding radioactive waste storage and disposal. Last evening I read my report in 1984, and I must report that when it comes to public attitudes in the salience of the issues, the fundamentals haven't changed much. The level of support is almost very similar. The amount of opposition has been reduced a little bit. Many people are kind of in between. But you know, the fundamentals haven't changed.

Anyway, since '84, I've done some work for, I've done research on this off and on, intermittently, research funded by DOE, EPA, NSF and other sources in my previous life as a political science professor. I've had the honor of working with scholars such as Carol Silva, Hank Jenkins-Smith, and Gib Bassett. And this presentation is really a revision and some new thinking about a paper given, I presented at a waste management conference three years ago. I will mention that I have not shared this presentation was anyone, so they, you cannot blame them for my mistakes and interpretations.

Okay. What I'm talking about, my focus, is public opinion about radioactive waste disposal facilities. Where do people get their ideas to favor or oppose citing, and nuclear power? What are the challenges to acceptance? And what policies would build support and reduce opposition to reasonable policies to address the problem of radioactive waste and spent fuel storage and disposal?

Okay, why focus on human considerations? Let me propose an after-lunch thought experiment. If all that matters is technical acceptability, the federal government could demonstrate that the waste is harmless by building a repository in the Washington, DC area. Technically, this idea is not far-fetched. Engineers tell us that high-level waste disposal is a trivial engineering problem, that transportation also is nothing to worry about -- after all, we have DOE running trains into the canister and the canister not being broken -- you know, so long as the geology of the place is appropriate.

Well, under the Nuclear Waste

Policy Act, in the 1980s, DOE began to do exploratory work on a second repository, presumably, in the east. Well, one potential site identified is a stable granite formation in Northern Virginia, including Rosslyn, a neighborhood in Arlington one Metro stop from here, across the Potomac from Georgetown. Well, the amendments of 1987 terminated granite research but not for technical reasons.

I notice you are smirking or laughing because the idea of putting the repository in Rosslyn doesn't seem to have -- you're thinking, what did this guy, ingest during lunch? But my point is that successful management must take into account technical feasibilities of cost. This is a technical problem, but the more difficult constraints involved the humans, what the humans are willing to accept.

Okay, returning to reality, I want to talk about five sources of public perceptions that constrain policy options for radioactive waste management. Some of these five we can do something about fairly easily; others we really can't. Let me just go through the five.

The first is the inherent nature of the risk. This is the psychometric research by Paul Slovic, Baruch Fischoff. What they found, that there are some risks because of their inherent nature, have characteristics that make the risk associated with threats that people see as unacceptable. Other types of risks which scientists tell us may be more dangerous to health and safety, people find acceptable or even seek out. In skydiving, people will do that because they want to. Americans are not necessarily risk-averse, but there are certain kinds of risks that our research shows people find scary and unacceptable, and it makes them angry.

So what are the characteristics of

this, from this psychometric literature? Well, first off, is there a catastrophic potential? One worries a lot more about terrorist attacks, a catastrophe caused by some kind of attack than we worry about people dying because of obesity. It has to be imaginable, if you can envision it.

One reason people aren't terribly frightened about radon is, you know, it's not a scary image. Something blowing up, however, is a scary image, and nuclear has the famous mushroom cloud. Now you are thinking why is this guy saying this? Everybody knows that he radioactive waste facility cannot blow up. You in this room know that, but a lot of other folks don't, and when you mentioned radioactive waste repository -- a.k.a. nuke dump -- the image of the thing blowing up, you know, is salient to people.

Another psychometric is the level of personal control. If you can control it or think you can, like driving, it's much less riskier than living near a waste facility where you're not even allowed into the facility. You don't have any personal control.

Another psychometric is the origin. If the humans have caused it, it's much more likely to be acceptable than if nature has. I mean, people find asbestos from a manufacturing plant waste much more dangerous than the same amount of asbestos occurring naturally in the ground.

Victim status -- if the, is the risk imposed by others or self-selected? That's why we worry less about minors, who presumably have self-selected to take that risk, than we do about a neighborhood of innocent homeowners being faced with a threat that explodes something. The recent California gas explosion, that will make people really angry.

And finally on these psychometrics, the level of societal benefit really matters. People find radioactive waste from medical devices much more acceptable and less dangerous than the same level in the same exact radioactive waste from non-medical devices. If it's useful, it's less dangerous. That's how people think.

Okay, so there's the psychometric. In conclusion, radioactive waste facilities fall on the unpleasant side of all of these psychometric factors that tend to define risk acceptance.

Another reason people believe the way they do is their beliefs about fairness. Most people share an understanding which we were taught in kindergarten, that if you make a mess, you should clean it up yourself; you don't ship it off to somebody else. If you benefit from something, you should clean up the mess you've made. If you asked me, Bob, design a program that would make people think it's really unfair. I think, okay, here's what you do: You have one repository, you put it in one state, and you pick a state that has almost no nuclear power; that'll raise all kinds of fairness issues.

I'm not saying this is right or wrong. I'm not accusing anybody of being unfair. I'm talking about perceptions, and when it comes to citing a facility or people finding different policies acceptable, perceptions matter, especially as a difference between moderate opposition and outrage.

Okay, a third is questions of managerial competence and trust. Now this is probably very unfair to DOE because, if you look at the history in the last 40 years of radioactive waste management and say, well, you know, how many people has DOE killed or maimed by the way they've managed this waste, I believe the number zero. So, you know, there's much to be proud of.

But having said that, so what? Trust in government is not high these days. You have Katrina. You have dead sheep from --

you know, there's a history there that people don't look back, either actively or not, and say, well, of course we can trust the good government. By the way, there's a number of folks who say, yes, I believe you when you tell me that technology is fine and that the waste can be managed responsibly without risking anyone's health and safety, but who says it will? Remember the time blah, blah, blah.

Okay. A fifth, or maybe fourth, factor is the framework for radioactive waste citing of a repository is what some have called dump it and leave. This is the Nuclear Waste Policy Act framework. Okay, you're asking federal government to do this: To come into a state -- Oregon, you pick the state; it doesn't matter, Indiana -- and say, hi, I'm from the federal government; I want to bring extremely hazardous substances in your state that's hazardous for like, oh, 500,000 years, maybe a million, we can argue about it, but a very long time.

Now here's the plan: I'm going to stick it in the ground or into the side of a mountain, then I'm going to backfill it, I'm going to put a sign on top saying "please don't dig here," and then I'm going to leave. That's the plan in the Nuclear Waste Policy Act. Well, you know, that's not reassuring to many Americans. They may be misguided, but that framework does not build trust and faith and say, go ahead, bring it in. You know, we want to help out.

And finally, this probabilistic risk assessment methodology for 500,000 years is a little problematic. It's difficult to make a case for safety for almost forever, and unlike what my economist friends would tell us, people do care about what their land will look like 500,000 years from now. We may tell them they're misguided, but a lot of folks really do care about future generations long after they are dead. So that's the background factors for why people believe what they do believe. I have five steps that could be taken toward acceptance of a solid, acceptance of policies that would solve this radioactive waste problem.

One is, plan on continuous monitoring forever. Drop the dump and leave framework. Pass legislation or whatever that says, look, we reevaluate every 50 years or 60 -- a lifetime; it doesn't matter. If we compare technological developments from 50 years ago or 100 years ago to now, the change is amazing. A lot of scientists say that different forms of this waste may become a resource rather than a burden. So plan on continuous monitoring.

Second, monitor in conjunction with local and state officials and other stakeholders. Instead of asking for trust, provide verification. In other words, you're saying, look, you can look at the dials. Come in once a week; we'll work it out. Is this adequate? What do you want to do? We will monitor this with you. So you're not saying, hey, trust the federal government; you're saying, let's do this together and verify.

Third, I would avoid assigning specific probabilities to extremely rare events over long time frames. I would use Bayesian and related methods for shorter periods, and I would view all decisions as reversible. We're using the vast risk methodologies we have now; this is where we stand; but we will revisit.

Okay, fourth, site high-technology research centers at repository sites. There is, as I think Hank Jenkins-Smith mentioned to you, this group, right now all we have is benefits -- I have one more -- not risks, all we have is cost and not benefits. Framing this to bring some benefits -- and by the way, don't just give them a lot of money because that looks like a bribe, and that makes it even more unacceptable. But a high test facility is different.

And finally, we need to increase efforts to educate the public on the benefits of nuclear power. Americans want to decrease our dependence on foreign oil, mitigate climate change and improve air quality. Nuclear power is a renewable energy source for all intents and purposes. Solving the radioactive waste problem should be framed as an environmental success because of its stimulating effect on nuclear power, which every true environmentalist should support.

Thank you.

CHAIR HAMILTON: Thank you very much, Dr. O'Connor. We appreciate it. We'll get back to questions a little later.

Next, we will hear from Dr. Wes Cragg, Senior Scholar and Professor Emeritus of Business Ethics at York University in Canada.

Dr. Cragg, thank you for coming down.

DR. CRAGG: Well, thank you for the opportunity to talk to you.

What I'm going to suggest is that the most important issue that you have to address is, what is the issue that you have to address? What's the problem here that you're facing? And there are a common or conventional approach which you will be quite familiar with, and one which I'm going to suggest, which is an alternative approach.

The common approach is to think of the waste disposal issue as a knowledge issue, in which case you focus on research, you focus on technology, and you focus on education. And you've heard a lot of that this morning, and no doubt in the work of your Commission. But what if it's not a knowledge issue? What if that's not the fundamental issue that you face as a society, as a political organism? What if it's an ethical issue that you face? Then how do you approach the task that you have in front of you with respect to nuclear waste disposal? I'm going to suggest that it's an ethical issue, not a knowledge issue, and I'm going to suggest that that's the approach that, in fact, the Canadian Nuclear Waste Management Organization followed, and that's the approach that they're attempting to follow.

Well, if you began with the idea that it's an ethical issue, not a knowledge issue or a management issue, as is traditionally responded or thought of, then here's where you're going to start. You're going to ensure that all research, all activities, all decisions, all recommendations are framed by explicitly articulated ethical values from the beginning and at every stage of the problem resolution process. So that's where you start, which is, I think, not a common approach in management and in many of the other issues that we're taking.

What, then, does that require? Well, it requires that the first and most important management task is to articulate the ethical values that will frame all aspects of the nuclear waste disposal process. All of them. That's, then, the first management process or the first management task, and that's a challenging task because managers aren't trained to do this. This is not what happens in management schools. This is not thought to be a fundamental responsibility of managers for the most part, and neither is it thought to be a fundamental responsibility of scientists or technologists or people who are generating technology. So you have yourself, then, a very, very significant challenge in front of you.

Well, why? I'm going to suggest the fundamental waste disposal challenge is building, winning, earning justified trust. That's the issue that we face when we're dealing with the disposal issue, and that's the stopper. That's the showstopper, is the lack of trust in our society for the people and the recommendations that are being made by the scientists and by the people who are developing the technology and by the groups that are generating the recommendations that people have to evaluate and accept.

Trust is an important phenomenon. What people frequently forget is that trust is grounded on ethics. That's to say, trust is grounded on the belief that those asking for one's trust will be guided in all relevant aspects of the relationship by shared ethical or moral values. That's where trust conference. It's always grounded on ethics. We can try to create other bases for it in our society; we do in marketing, for example. But if you're going to generate justified trust, then you have to identify the values on which it's based, and you have to identify commitment to those values.

Well, what that means, then, is that the relevant aspects of the relationship, that's to say the relationship of those who are trying to resolve the problems of nuclear waste disposal, has two dimensions. First, it focuses on all the decisions that are going to be made, and that's relatively easy to identify, and maybe we're not all too uncomfortable with that because we know what decisions are.

But the real challenge is that it also has to be involved with all knowledge creation, generation and assembly, and that's where the real challenge comes because typically we don't think that ethical values are very much to do with the generation of knowledge, with scientific research. Indeed, one of the fundamental aspects of our intellectual culture is to separate values and science, to see science is non value-laden or non value-based.

So, the approach that I'm suggesting requires that we move away some, from some very deeply held paradigms and understand that those people who are involved in the knowledge generation and those people who are proposing technological solutions also have to be thinking within an ethical framework, and they have to be evaluating their work from an ethical perspective. What this requires, then, is that the pursuit of all scientifically grounded solutions to the disposal issue should be guided by explicitly articulated ethical values. All of them from the ground up, from the very beginning.

Now, what I'm going to suggest to you is that this is the path followed by Canada's Nuclear Waste Management Organization, so we're not talking just theory. We're talking about an organization which has approached the issue of waste disposal from this explicit perspective. I'm not going to suggest that they did it understanding that this is what they were going to do from the beginning -- in fact, I think they didn't know what they were going to do from the beginning -- but they were guided by a leadership that understood intuitively that this was, in fact, a fundamental issue, and the way in which the process was organized followed this model that I'm suggesting.

So, the first thing that they did -- well, they did a number of things, and of course, I'm summarizing here -- it created, the Nuclear Waste Management Organization created an ethics roundtable. They did it in 2003, right at the very beginning of the process, which was involved in coming up with a plan for disposal of nuclear waste in Canada, which by the way had been extraordinarily controversial issue over a very extended period of time. Canada tried at least twice prior to this particular effort to find a management system or an approach which would work.

And the ethical roundtable or the ethics roundtable was charged with the responsibility of identifying the ethical standards that should guide all aspects of the operations of the Nuclear Waste Management Organization. I mean that seriously. It was to guide all aspects of it, the scientific aspects, that technology, and all of the human relations aspects of the work, and then to organize those standards into a coherent ethical and social framework, which is what they did. But it wasn't to be an exercise focused just on the work of experts, if that's what we were.

Rather, the Nuclear Waste Management Organization then undertook extensive public consultation and engagement with a view to doing, again, two things, identifying the values that the public believed should guide the disposal of nuclear waste -- so, you find out what the public thinks -- and organizing those values into a set of objectives that the public would recognize as reflecting what was heard in the consultation process. So feeding back a framework to the public that the public could see was there framework and not the framework of a group of experts working independently of that, of them and their values. And these two systems of values were then integrated into the proposal or the approach that the Nuclear Waste Management Organization came up with.

So the result was an ethical framework constructed around a series of questions, and I'll talk about those in a moment, focused on both procedural and substantive values. The framework did not tell people how they ought to think, ethically speaking. It proposed that they ought to think ethically and identified the values that they would need to resolve, thinking ethically. That is to say, it proposed that ethical reflection needed to be a part of the entire process at each stage. And so the ethical framework was organized around questions, not around imperatives.

And the second element of it was a set of eight objectives to guide all aspects of the decision-making process. And these, then, were the values that had been identified by the consultative process: fairness, which you've heard about already, public health and safety, worker health and safety, security, economic viability, community well-being, environmental integrity, and adaptability. Those were presented then as reflecting a Canadian consensus on the fundamental values that ought to guide the process, which would result in the long-term solution of the disposal problem.

The examples of values relevant to, or the question framework -- I'll just give you some examples, and these are truncated to get them onto the overhead slides. But this will just give you an example of where it was that we were going.

Is the Nuclear Waste Management Organization conducting its activities -- these are procedural questions -- in a way appropriate to making public policy in a free pluralistic and democratic society. That's a pretty challenging question to put to people who are involved in this kind of process. This is not an upper-level question. This is a question that's to be integrated into all aspects of the operations of this organization.

Are those making decisions impartial? So, this is a question that those making the decisions have to think about as they make their decisions.

Are they, have they established, are they impartial in the work that they're doing?

Are groups wishing to make their views known being provided with the forms of assistance they require to present their case effectively? This is a question that needed to be continuously asked as the public was engaged in the process.

Is the Nuclear Waste Management Organization committed to basing its deliberations and decisions on the best science, the best aboriginal knowledge, and the best ethics? Again, a question that needed to be asked continuously as the process continued because this would be one of the questions that the public would continuously ask of the process as it developed.

Example of substantive values -- do the nuclear waste management organizations reflect respect for life? That's a fundamental question, and not an easy one.

If implemented, would nuclear waste management decisions be fair?

Question 11 -- so again, these are just selected -- do the recommended provisions protect the liberty of future generations to pursue their lives as they choose, not constrained by unresolved problems caused by our nuclear activities? A fascinating question, but fundamental, and again, to the integrated into the management process.

These are questions that managers

are to wrestle with as they proceed to resolve the problems that they are proceeding to resolve.

And then, specific issues that were identified by the ethics roundtable -- monitoring, remediation, and if needed, reversal; risk reduction versus access; permanent or interim storage; lessons to be learned. And this was a really important issue that came out of the ethics roundtable. What lessons are we learning about the use of nuclear energy as we proceed through this process? What can we tell ourselves and what instruction can we acquire with respect to the appropriate use of nuclear energy based on the problems that were facing in trying to resolve disposal issues?

So, the characterization of the management model, and this is my characterization, a values-based management model -- a process of continuous ongoing moral reflection is what the model requires, and the management challenge is to build this approach into a vastly expanding and diverse organizational system and culture. It's not clear, to me at any rate, with the Nuclear Waste Management Organization has succeeded or is succeeding, but that, at any rate, is the trust, the challenge.

And then, a final trust-building principal which was discussed by the ethics roundtable, and in my view, perhaps the most important principle, that processes of the sort that we're talking about here also applies to issues like mining, for example, have to make, and that is Nuclear Waste Management committed itself to a no-go principal, what I call a no-go principal.

That's to say, it said that if a potential receiving community said no, the decision would be respected. That meant that the decision to receive the waste would be a voluntary decision on the part of the community that it would involve. A facility would not be placed in or near a community that did not want it.

Now, that's a trust-building decision that the Nuclear Waste Management Organization made and perhaps the most difficult decision that could have been made because, essentially, it does two things. Essentially, it says, we trust the community to do a serious job trying to understand whether or not this disposal should be placed in their territory. But the second thing it does is it creates trust by saying to a community, you can talk to us without being conscripted. You're not going to be co-opted by the process. You can engage in serious dialogue with us and then step away, and we won't stop you. And that means you could engage, or the communities could engage in conversation with the Nuclear Waste Management Organization without the fear that they will be trapped.

This is the approach that was

identified. I've sketched it out very, very briefly. If you want the whole story, there it is. And of course, it's an ongoing story because the Nuclear Waste Management Organization recommendations were accepted by the Canadian government and are now going forward. They've gone through a process of first evaluating a siting process with the Canadian public, and now they're engaged in a siting process. And I understand there are three communities already that have identified a willingness to talk to the Nuclear Waste Management Organization about the potential of their community as a site for the long-term disposal of nuclear waste.

Thank you.

CHAIR SCOWCROFT: Thank you very much, Dr. Cragg, for a very interesting presentation.

For our next speaker, we welcome Dr. Andy Kadak back to the podium. Dr. Kadak of MIT, the floor is yours, sir.

DR. KADAK: Thank you again. First, I'd like to just say that I'm very gratified that this Commission is looking at this question. When, we first started the MIT fuel cycle study, this question wasn't really on the top of their list, but luckily, we did get it included.

I'm going to talk about two studies that I participated in. The first is a National Academy of Public Administration study done, I think, in the mid-1990s, I think finally published in 1997, on intergenerational risk decision making, which I think is something that is really important. And that also factors in the intragenerational decisions that have to be made as part of the intergenerational equity question.

I do have to control the slides; yes?

This study basically had about 35 or 40 people from various backgrounds -- artists, Native American tribes, industry people, union people, engineers, regulators. There was a very diverse group of people. And what I'm going to report to you is the outcome, the findings, of this study, which had consensus from this diverse group of people, about how to deal with intergenerational equity issues.

So, as you can see here, this is the overarching principle that we tried to follow, and I think it's pretty much consistent with what's been previously said; namely, no generation should be needlessly -- the words are very important -- needlessly, now and in the future, deprive its successors the opportunity to enjoy a quality equivalent, quality-of-life equivalent to its own -- sure?

MEMBER CARNESALE: I thought in the material, we got reading ahead. This was an issue in the final -- this came up in the workshop.

DR. KADAK: This was -- yes.

MEMBER CARNESALE: And the final

report did not include the word "needlessly".

DR. KADAK: I thought it did, but I cannot say that it -- it looked like "needlessly". I thought it was "needlessly".

MEMBER CARNESALE: I'll check.

DR. KADAK: Okay, you can check.

MEMBER CARNESALE: But I think --

DR. KADAK: You're not on the mic.

MEMBER CARNESALE: But I thought it had been discussed, and the word -- I might be wrong.

DR. KADAK: Okay.

MEMBER CARNESALE: I'll check.

DR. KADAK: That's the last thing I saw, was "needlessly".

Now, part of that was some supporting principles, and these supporting principles were trusteeship, sustainability, chain of obligation, and precaution. Let me just quickly go over what those, in fact, are. The trusteeship, obviously, is pretty clear. You have an obligation to be the trustee for your future generations.

Sustainability -- again, dealing with, not depriving future generations of the opportunity. And the question of resource stocks, clearly we're going to be consuming oil, coal, and natural gas, which, depending upon how far you look into the future, will not be there. So we have an obligation to replace those resources with equivalent types of functional utilizations.

The chain of obligation principle is also quite important, and it talks about providing the needs for the living -- living -- and succeeding generations, depending upon how far you go out. And it says, "Near-term concrete hazards have a priority over long-term hypothetical hazards," a la one-million-year standards. So this society has an obligation to protect the interests of its own, such that there is a future generation.

And the last is precautionary, which I think everybody understands. It's, don't pursue courses of action that have the threat, a realistic threat, of irreversible harm and catastrophic consequences, again, unless there is compelling or countervailing need to benefit either current or near future generations. So this set of principles basically gave us some very key guidelines for how to make a decision.

And the other thing, the other bullet that came out of the study was no decisions can be so-called final, but decisions need to be made. I was a little concerned about the MIT fuel cycle study in the sense that it may be perceived as we don't need to do anything for a long, long time, a hundred years or more, but that's clearly not what we're saying, and I think the earlier discussion pointed that out.

A lot of things are linked. The repository is linked with the ability to site an interim storage facility, credibly. I mean, how -- I mean, the previous speaker said it's, it's highly unlikely that a community or a state will accept an interim storage facilities without some next step. So we looked at this "no decisions can be final, but decisions can be made" as part of the requirement for intergenerational equity.

And the last bullet basically is the so-called rolling futures approach, with credible intragenerational standards. Now why, what is a rolling future in the sense of how we meant it? What we meant is societies change, technology changes. Right now, if you look at the Yucca Mountain standard, it basically says you need to know everything now for a million years, and therefore, we will grant you a license to construct and operate this facility. That just doesn't make sense, even in a intergenerational, from an intergenerational perspective.

So, if I took these principles and I applied them to the Yucca Mountain approach, this is what we would come up with as an example. And I mentioned this earlier this morning. Design the repository to meet long-term disposal to defensible standards. License the repository as an underground storage facility, completely retrievable, completely retrievable. Do all the monitoring, all the performance validation tests you need to do, to satisfy yourself that you understand enough to either close it or keep it open. And monitor it for a longer period of time.

If you follow the MIT approach, that basically is you need, at some point, to decide whether spent fuel is a waste or a resource prior to closure if that's your intent, but you do have time to make this decision. And it is quite consistent with the rolling futures approach. And then, if you have to, and if you decide, well, we want to close this thing, we're done with it, you then can license it based on a lot of monitored data performance, which gives you high confidence that this, in fact, can be safe.

If this isn't acceptable, namely the repository is not acceptable or you want to keep it open, you at least have a safe underground storage facility until an alternative disposal solution is found or other uses are decided.

So, if you take the, apply it to the Yucca Mountain and take all this criteria, you can see trustee -- manage the waste -- sustainability, use of nuclear to preserve energy options for the future, particularly fossil fuels.

Chain of obligation -- you break it into periods, an engineered barrier period of 1000 years where you can, in fact, show complete containment, technically. The geological period you use, as they've done in the PRA or total system performance assessment, to design it to reasonable standards for the long term.

The precautionary principle as

applied is, when you load the repository, assure real retrievability for the entire repository inventory, and then monitoring for as long as you need to keep it open.

And then the rolling future basically says, okay, we can develop new technologies for disposal, new technologies for the use of the fuel, spent fuel. But there is no perfect million-year solution, which is why said my statement that I submitted to the Committee that the licensing process is fatally flawed, especially from an intergenerational basis.

And you look at the costs and benefits, and this NAPA study also looked at, or at least my paper looked at, you know, what could we spend the extra $10 billion for that we spent for Yucca Mountain? Cancer? You know, food for needies? This is a societal question that has intergenerational aspects. We just can't look at these issues in isolation.

The next study that I worked on was in support of the fuel cycle study, and it was largely done by now Dr. Benham Taebi from Delft University. He came over the summer as a result of this NAPA paper, was intrigued, and asked if he could work with me for a summer on looking at specific fuel cycle choices and, as they affect the intricate generational effect for fuel cycles.

So we came up with a set of moral values. You know, why is it we call it a moral value? Basically, they're built around the principle of sustainability. That's the moral value, sustainability. And we listed several criteria -- resource durability, which in a sense means how much of the resource we have and whether we will preserve it for the future; economic viability -- how expensive it is and what burdens it places in terms of cost; technological applicability basically means are we ready to deploy and what kinds of things are available perhaps in the future;

environmental friendliness is quite clear; public safety deals with the risks associated with dealing with the transportation, storage and operation of nuclear facilities; and security is essentially the terrorist question, people who want to do harm.

So, in looking at this criteria, we basically set forth a description of the fuel cycle. Now this is very, very busy. I'm not going to go through the detail. But what it attempts to do, if you look at it, you can see Generation 1, Generation 2, and Generation N. And for each of the criteria, we identify certain activities that are impactful, and the light shaded area is sort of the burdens, and the dark shaded areas are the benefits.

So, as we looked at -- we set this out -- now this is for the current once-through fuel cycle. You can see that there -- and it identifies which generational that is burdened. So as we look at this, you see a lot of gray in terms of burdens, and you see the real benefit, basically, is that associated with the production of energy, which is the resource durability one. But, lots of burdens. And you can see for final disposal of spent fuel and other waste, let's just say it's out to the million-year standard.

Now we looked at the number of fuel cycle options to basically make a comparison, and the second one we looked at was the one that I just described. Namely, it was underground storage then if works for disposal. And the arrows, if you look at it, basically say increasing burden and up, the up arrow, is increasing the burden, and the down arrow is decreasing burden. So as you can see, for this cycle, the Generation 2 burden, basically, or the Generation 1 burden on transport of recycled fuel goes up because you have to ship it somewhere.

The reduction in terms of spent fuel storage goes down, the burden goes down, because in fact you're now getting rid of it in a sort of a geological foundation. And the time dependency, if you will, of the storage hasn't changed, but the burden of spent fuel storage goes down. Nothing is changed on the production end as a benefit, and the retrievability is still a benefit that you can still have in this particular scenario.

If you go into the next scenario, you'll see, now this is the transmutation scenario, light water reactor fuel going into a fast reactor, and you try to say, well, we're going to minimize the waste streams or waste management. And this has, obviously, some benefits because you have reduced mining; you've recycled some of the energy. Transport goes up substantially because you're doing a lot of moving of fuel. Reactor operations and the decommissioning period, another set of new reactors being proposed. And the final disposal, that burden goes down because you're disposing of less material if you will.

So, if you work your way through it, essentially, the benefits are essentially limited, but you do have additional new burdens that come up, and those are the red arrows -- I mean, sorry, the red circles. And if you do this systematically, you can be able to see which generation benefits and which generation takes the burden in each incremental step of the fuel cycle.

I'm going to do two more and then I'll sort of end with this. The breeder makes it more complicated, but you can see the big difference in the breeder is that energy production for thousands of years. That's a real benefit. The burdens are, in fact, going to be placed on this generation and the next one to deal with the opportunity to create energy for future generations. That's the trade-off is being made.

And sorry about this one. What this chart is intended to do, and if you read the report and the paper, it looks at, the red is sort of bad unless it's resource-dependent, green is good, but it breaks out each of these impacts on, as the current practice once-through fuel cycle and alternatives as we talked about them. What this basically shows is a, perhaps a misleading picture relative to burdens. You can see, the last breeder cycle, there's lots of impacts but tremendous benefits for future generations. So what I'm trying to summarize here is a systematic approach to look at intergenerational equity on a step-by-step basis for each generation that we're talking about because there are risks and there are benefits.

My conclusion after having gone through all of this is we, as a nation, are willing to undertake the burden of dealing with nuclear waste for the benefit of a future generation, not that, because we're generating wastes; we are burdening future generations. It changed that whole dynamic around.

Okay, well, thank you very much.

CHAIR SCOWCROFT: Thank you very much, Dr. Kadak.

Our final speaker for this panel will be another repeat performer, Dr. Charles McCombie.

Welcome back.

DR. McCOMBIE: Thank you.

Okay then, I hope I can complement some of the points just made by Andrew Kadak. The first one to be made is that it's not new to talk about ethical issues in waste management. I've been in this for many years, and for decades, people have talked about it, but they talked about it to one another and not to the people they should be talking to. And the Canadian program, of course, is an excellent example of taking that outside, into the circles that it should be discussed in. So it's nothing new. There's been lots of talk about it.

There's a whole set of principles that have been discussed. The two that I'm going to talk to are the intergenerational equity, which again, the fairness word -- fairness to future generations, and intra-generation equity, fairness to current generations. The other principles that are bulleted, I won't have time to talk about, and luckily, on the intergenerational, Andrew Kadak has already said much of the things that have to be said there.

Well, let's look at intragenerational. I think this gets neglected very often. It's not just -- I'll come to the real point of it -- the "inter" afterwards but the intragenerational equity. There are really serious issues there.

The risk levels relative to other activities, these social economic impacts -- we really spend lots and lots of money on this. I've often made the statement that one of the worst things that happened with nuclear power is that it's so efficient that you can afford to do things you shouldn't be doing and other industries don't do. So you have many intragenerational issues associated with that.

You have a special distribution. One of the earlier speaker was mentioned it. You know, it's, it looks pretty unfortunate from the outside that the repository comes where the reactors aren't, and so the answer, that's a fairness issue that gets picked up. I think Wes mentioned that.

This issue of compensation, which has never really come on the table in the US but is very important in other countries, the compensation of the people or states or communities that are willing to host as communities.

And then last, and certainly not least, is public involvement is very important here, a dialogue. We never, ever in the nuclear industry, got around to having real dialogue until recently, and the Canadian example, again, I use as a special example there.

On the intergenerational equity issues, there are these three main points, and I'll skip the first two in a minute because I'll come to them afterwards. The ones that came up afterwards, this "maximize choice" actually came up very late in the discussion. It came originally from Sweden, from an advisory group there. We certainly put this -- the preventing burdens to future generations was set on the same level as providing choice, flexibility for new generations. That was a new thing that led to an increased discussion about surface versus disposal, surface storage versus disposal, and also led to a huge increase in the interest in retrievability, which of course keeps options open.

All of these issues came at the current practice. I won't go into this slide. It's just a reminder that even in legislation in most countries, there are ethical principles involved in the intragenerational side. These are things for doing radiation work.

More to the point is the future exposures. These are also fixed, and these are fixed in high-level documents that most countries, including the US, have bought into and signed even, the Joint Convention of the IAEA, and the principles that it's based on. And the two principles here, of course, are the protection of future generations. In fact, the assertion there is that they should not be exposed to greater exposures than we would accept today. That's a debatable issue maybe you discount for in the future.

And the other one is that they should not have burdens, undue burdens, as it was used here, and not unnecessary. These are the exact wordings in the documents which have been worked out at the international level.

So the first part of my message, then, this has been discussed at great detail, in the inside circles at least, and what has it led to? I'll try to skip ahead. If I were to word my conclusions here in respect to the general programs and the US program, the first point's we've got to realize, again, enforce it, this deep geological disposal can be safe if you do it right, and there is no other way to do it. We keep ignoring that.

Sometimes physicists are -- I used to be a physicist, so I can criticize them -- are one of the worst of people there. It's toys for the boys. Let's have something new to play with. Let's pretend that it will do away with the disposal issue. It won't do away with the disposal issue, and that's been said often enough but not as often still as it should be.

Of course, for technical reasons, this is all going to take decades anyway. We've seen that very well illustrated today. Safe storage is feasible for all that time, but it's not a final solution to the issue here.

Then comes the point I want to

make most strongly. Every responsible program should have a credible geological program. Now I want to try and say what I think is a credible program. It doesn't mean to have a repository working. It means to have a feasible technical design, one that's accepted as being a design that can be safe. And you can argue whether that's the case or not when nobody's judged the US designs.

It needs a funding mechanism that really is assured for the future. That's really important. Again, you can debate about how assured the US funding mechanism has been up until now. And then very importantly, it needs a site, or sites, which have been investigated at the level where people say, yes, that would do; that would do; that site's okay.

And then the fourth point, it's no good if we all believe that unless you have a sufficient societal consensus that these components have all been filled, these four components. Remember that because I'm going to come back to that. In fact, the US almost took a leading step here, this "One Step at a Time" report, which was mentioned before, where Tom and I worked on it and actually went through and tried to use many of the principles which have been talked about today. It used the wording "adaptive staging".

These were some of the key aspects of adaptive staging. Again, I'm not going to go through them all, but if you just look at the first two or three even, you can see that the deliberate decision making of a process to transparently make decisions between stages wasn't done here, wasn't done in many programs, and again, I could give you an example. So, without going through the whole list, you can see that most of them were not done in the US here.

Focus on program progress rather than prearranged milestones. This predilection for putting dates into laws that nobody, everybody knows at the beginning you can't, you cannot simply keep has lapped over from this side of the Atlantic to the other side. A European commission did exactly the same thing quite recently and tried to make laws with dates in them that were so transparently non-achievable that all they did was lose credibility for everybody inside the system.

So these are some of the keys. The report, the adaptive staging report actually made specific recommendations that the DOE should adopt this, that they should work toward pilot and test facilities and possibly demonstration facilities, that they should have an independent scientific oversight group, which didn't really happen at that level that we were talking at, scientific. So all of these were put up, and most of them were not done.

The DOE, I think, inferred that this was more or less how the program was run, but we didn't interpret it quite that way, and it was too far into the system anyway. So it wasn't done, and these messages were picked up much more strongly in the Canadian program that you heard about.

Jumping now to, what does that mean for the future? What should any program do to be ethically prepared for the future? Now, as you will have realized by my, twice in speaking to you today, that the repository the center. You know, it's like the Clinton era; it the economy, stupid. I think, it's the repository, stupid, is the mantra that we should be having here. We have to have some plausible thing there.

And that does not mean -- that could be different variations. You can't have a first-stage repository. And I think somebody mentioned, I think it was Ernie Moniz, that you could do it with defense wastes, for example. But a real demonstration that works, even if it's with a small part of your inventory, that would be much more convincing. You could, of course, build a full geological repository -- that's also been mentioned -- with retrievability, or even, you can stop short of implementation.

If everybody's happy to sit back and say, we've satisfied the four criteria that I put up, at that stage, you can then say, okay, next generations, it's up to you. The money's there, the technology's there, even the site or sites are there. Do it or don't do it. Keep your options open then. But there, you have established your exit strategy. So I think that, for any program, would be a sensible way to go forward.

For the US program -- I repeat again because, as you will have again interpreted, I'm really worried about the message that's coming out to the rest of the world from Yucca Mountain -- Yucca Mountain is a policy decision that has, up until now, nothing to do with the scientific and technical merits of the site.

The middle bullet is the really important one. To really increase the credibility and the ethical framework of the US program, don't just sit back for your hundred years or 200 years and do what is mentioned in the MIT report. But I would like it to be much more bold print. Start up a new adaptively staged siting program that's geographically and geologically and broad based in the beginning, and again, related to Wes Cragg's thing, include specifically at the beginning that this will not be done unless the host community is willing. Experience has shown in the world now that that is a, is not a stumbling block to a program, but it's a potential help.

That's what happened in Finland. That's what happened in Sweden. That's what happened in France. That's what is happening in the USA -- in the UK, sorry. So all of these programs have found that making it clear that it will not be thrust upon you, you have a veto right, has turned out to be a positive, and that could be part of the US strategy.

And of course, they acknowledge in the last bullet, this does not in any way prevent or stop the idea that you should be working on advanced technologies because the nature, the volumes, the kind of the wastes, will change as you go down the line over all these decades, and we should be prepared for that at all times.

Thank you.

CHAIR SCOWCROFT: Thank you very much, Dr. McCombie.

If the panel would now take its place, we'll have questions from the Commission.

Susan, you had the first question.

MEMBER EISENHOWER: Well, I thank all of our panelists for terrific presentations, and you covered much of the same territory but in different ways, so that was very welcome.

My question is for Dr. Kadak, though others may wish to chime in here. I'm, I'm sorry to sound like a bit of a broken record on this, but I'm sort of curious to know the assumptions going into doing, you know, the, these very useful charts. There's nothing like a good illustration.

Before you answer that question, let me just say that it strikes me that some of it is probably inevitably subjective because burdens can be defined in all kinds of ways. For instance, you kept mentioning the transportation burden. Well, it turns out that we've never had an accident, a nuclear -- we've never had an accident involving nuclear materials in transportation. I mean, no one's been killed. There haven't been any -- so it's interesting that you classify that as a burden when in fact, you know, so far this is the success story. Now, I think I know what you mean. It's an implied risk.

But the other thing I wanted to ask you to comment on is the word "burden" -- implies that this is a siloed study because, in fact, if the alternative is worse, then it's not a burden. In other words, if we're back to trying to solve the climate change problem, then having a severe case of climate change that may affect the coastal areas of the world, et cetera, is a far greater burden for future generations than the burden of bearing something in a permanent repository.

So maybe you could just comment on the, the going-in assumptions and the subjective nature of the study, if you would. And if anyone else has any comments, I'd appreciate that too.

Thank you.

DR. KADAK: On the MIT fuel cycle study, intergenerational equities, it was an attempt to describe a process. How would you go about making decisions, looking at the various aspects, whether they be burdens or benefits? It clearly was subjective. The way we, the way we figured, you know, a burden was, using the transportation example, there's a big effort required for transportation of all this stuff from where it is to some other place. There's a big effort in designing reactors, fast reactors and thermal reactors. So that's how we classified burdens.

Benefits are mostly, obviously, in the resource area. Declining or increasing benefits or burdens, how much of this stuff is eliminated from the process, or how much gain can you get in the resource? So it's clearly subjective. But to look at this as a way to deal with the question, not a clear analysis of which of these approaches is best. Okay?

MEMBER EISENHOWER: If I could just follow up by saying, at least in the, in the stimulus world, putting a big effort into a new technology is regarded as a plus, not a minus.

DR. KADAK: Yes.

MEMBER EISENHOWER: And so, I don't know. Maybe the problem I've got is with the word "burden" as opposed to benefit. Maybe there's some other -- because, you know, what is one man's burden is another man's, I don't know, opportunity or something.

DR. KADAK: But you also need to go back to the NAPA study because both should be used together about what is the best thing to do. And in the NAPA study, we really didn't focus that much on intragenerational benefit. But in my paper, I did. And that basically gets to your second problem about, you know, is nuclear really a benefit? Relative to what? Relative to what is rising water levels. So it's a much broader scope paper than either of the NAPA studies nor the fuel cycle study.

MEMBER EISENHOWER: Thank you very much.

CHAIR SCOWCROFT: Senator?

MEMBER DOMENICI: Mr. Chairman,

fellow Commissioners, I, I just wanted to make an observation and make it for you all. I'm wondering why you experts had not sought out how the community of the City of Carlsbad, New Mexico, County of Eddy -- it's amazing to me that you didn't go find out how they determined the ethical and other feasibility matters pertaining to an existing underground permanent repository. There is one. It is established. It's done. It's been solved.

And if you're talking around, if you're telling how things occur, it would seem to me that, as experts, somebody would have interviewed those who were part of this decision. It's 10 years old. It's been open for 10 years. The transportation -- in 10 years, no accidents; one scratched fender. Why is that not something that adds to your theoretical discussion and talks practically about how a permanent repository was established?

From my standpoint, most of what

you're talking about, I would hope this Commission would go find answers to by interviewing and spending some considerable time with the local, state, and national leaders who, over a period of six years, brought into that community an underground disposal facility. They are filling it up at a super high rate of truckloads. It will run out of space in eight or 10 years, and it has plenty more of it on -- the legislative space, I mean. That state and city turned the population around such that you could learn from it.

Instead of telling us theoretically, you could say that the population of a medium-sized community can apparently be educated sufficiently on this subject to where they, they go on the truth instead of on fairy tales. That's what happened to that community. They didn't believe the fairytalers who talked of blowups and the rest. They went to meetings and found it didn't blow up. And what did it add to the community? Instead of adding burdens, it added tremendous plusses.

Now, I think that's all, Mr. Chairman, more relevant, to be honest with you, than their testimony. I believe that you can find out what was conceived as ethical and fair to those people, how you got the subject across, and contrary to the rest of the country -- I tell you, I was there. Did you see my picture by accident on one of those slides? That was because I was in that place.

We had been dragging people, having meetings, and at the end, there was such an excitement that they were going to get an enterprise that would employ a thousand highly educated, skilled people, and there would be no risk, and their disciples or apostles -- whichever is a higher rate of somebody that'll go out and give a message, their apostles or disciples -- that you can have a repository, it can involve nuclear waste, it is not dangerous, and it adds to the community.

Now, I will tell you -- I want to leave one other comment. I think there are now, in the United States, regions, regions, that have already have experienced the entire episode that we're talking about. Down in the Carolinas where we have all the radioactive work that's being done by the federal government --

SPEAKER: Savannah River.

MEMBER DOMENICI: -- yes, Savannah River, up there in the salt of New Mexico and a couple other places, communities are already fully aware of all the things that have been talked about here today, and they're just willing to talk about, what are you going to do in our community to make sure you're not going to leave something that has no jobs and no benefits? And if that's answered, they're already ready to accept it, in my humble opinion.

And I think we are going to go there -- I hope; you've said that -- and probably have a meeting before we close our episode. Is that not right, Chairman? I think we're going to go down there. But thank you.

I just want you all to comment. Do you know about the waste isolation project, either or any of you?

DR. O'CONNOR: Yes, real quickly. Yes, it, it has been extensively studied by social scientists who've asked, and your points are certainly well taken. There are other reasons also.

Frankly, it's a poor area with heavy unemployment, although probably less poor since the WIPP. The other -- you had an institutional review board from the state, you know, verifying, looking over, et cetera. But I think the point is well taken that -- you know, I spoke in general about public opinion. Well, there's no such thing as public opinion.

There's publics' opinion. There are different publics by all different types of criteria, including geographic.

And so, anyway, WIPP was also -- it was, the Waste Isolation Pilot Plant is the name. It's not the nation's high-level radioactive waste repository.

MEMBER DOMENICI: I know that.

DR. O'CONNOR: -- for all the waste -- anyway.

MEMBER DOMENICI: I've never said that, and I --

DR. O'CONNOR: I realize, sir.

MEMBER DOMENICI: -- and I'm not even saying that they would want to be. It is radioactive. It is long-lived radioactive, radioactive material.

Anybody else -- and incidentally, you could also learn from what he just said, that in order to convince the public of much of the things you've said up there, you could have said, in one community where there is a repository, an independent review board was set up, paid for by the government, and that added to the credibility. That should be something you would be telling this panel, it seems to me.

I'm telling the panel that's something we ought to put in there, that they can have an independent review board and we'll pay for it, and at least there won't be any argument in the future as to whether you can have it or not.

Any of the rest of you have any comments?

DR. McCOMBIE: Well, in a vital sense, it's a very good point that we should not assume that hosting a geological repository is a burden. In the best example of that, I think, in the world today, in fact, is in Sweden again, where two, two communities competed to host the facility, and at the end, one had to be chosen because they just needed one facility. And there was a pot of benefits, financial benefits, to be distributed, and the larger part of the pot went to the ones who lost the repository, which sets a really nice signal that the repository is then suddenly switched from the burden side to the benefits side.

DR. KADAK: Just to -- Senator, I've been into Yucca -- WIPP -- so I know, and I have a very good feeling for what is there. But I think there are a couple of distinguishing differences.

If you look at how WIPP was licensed, it was licensed by the EPA under a very different process than the NRC uses, and there was state support eventually for the project, which obviously doesn't exist in Nevada.

I'd like to contrast that with the private fuel storage facility, an interim storage facility already licensed ready to go. But my recollection was there was some congressional interference and --

MEMBER DOMENICI: Which one?

DR. KADAK: This is the private fuel storage facility in Utah. There was congressional and administrative interference on actually allowing the project to proceed because the state opposed it. The local community loved it.

So there's, we need to find a balance between what the local community likes and what the state will accept, and that's always been the problem.

MEMBER DOMENICI: The point, the point I'm making is the one in New Mexico offers an example as to how you can go about getting all the things necessary to establish and build one. In that case, the state went along because we had strong leadership pulling them. The national representatives believed the truth instead of the fairy tales and thought, these are engineering problems that are not terribly unsurmountable problems. Engineers and smart people with good communications can solve the problems. And that's what I think can be learned from that.

We're not supposed to be relying upon one set of licensing and permitting. We're going to recommend how it is. So what New Mexico used might be considered, that it be EPA instead of -- I wouldn't vote for that, but that might be that this group might think that the EPA ought to be in the licensing process.

Anyway, thank you very much for listening.

Thank you, Mr. Chairman.

CHAIR SCOWCROFT: I have a question that follows directly on this, all the criteria that you all laid out. This is according to whom? What sample of the citizens? Are you talking about the country at large, or are you talking about the local community? And what do you do when there's a sharp difference, as we've already seen in a number of perspectives? In answering these, they may be honest answers, depending on what group of citizenry you choose, and how do you decide among all those?

DR. O'CONNOR: Well, I guess I'm the survey research guy. I have very little trust when I see a single survey at one point in time. It can be influenced by some event that has made the issue more salient. There's all kinds of factors.

In terms of nuclear power and waste facilities, there are, you know, over a thousand surveys with different question wording over time, so when -- for example, this psychometric stuff, which just doesn't apply to the radioactive waste but to all kinds of substances, that's been replicated by many, many scholars in different places. So there, there is much more faith.

I agree thoroughly, by the way, that you don't get everyone saying the same thing in every point in time in every place. Overall, the positive note from now, from 1984 when I did that initial work, is that the amount of opposition of people who were just strongly opposed to even talking about a facility, and really are strongly opposed to nuclear power, is substantially down. Something like 19 percent, where it was much, much higher. People favorable -- there is, that hasn't changed very much, depending upon, of course, on how you ask the question.

But you know, there is a lot of nuance, but the survey results are consistently consistent.

DR. CRAGG: Perhaps I can make a comment. I'm not familiar with the details of the American search or the American process, but it seems to me that one of the problems here is thinking you have to find the answers to these questions before you actually go out into the community or you start the decision-making process. I mean, that's a question that the community needs to be asked, how do you know?

In the case of the Canadian experience, for example, the Nuclear Waste Management Organization has determined that the community is going to have to agree to the siting before the decision is going to be made. There, there has to be agreement. But what they haven't done is to say how they're going to determine whether there's going to be agreement.

Now, for some people that would be judged to be incompetence or ridiculous. But in fact, what the Nuclear Waste Management Organization has in fact said -- they haven't said it deliberately, but in fact, this is implied by their position -- is that they're going to have to find out what the answer to that question is, and it's not going to be their answer.

They're going to have to engage the communities that are involved, and the public because the public is going to be involved in passing judgment on the decisions that are made in this particular process. They're going to have to engage in a dialogue whose purpose it is to find what the appropriate answers are.

One of the difficulties I think we face in this area and many other areas is a belief that that's a process that can't lead to a realizable conclusion, when in fact, if you engage in these discussions, I think you can find that it can generate answers that people, even if they disagree with them, are perfectly prepared to respect.

So the issue here is not coming to an absolute consensus where everybody says this is the right decision. Rather, it's a process of coming to a decision that everybody can respect whether they agree with it or not.

DR. KADAK: Just to amplify a little bit, in my role as a waste board member, we had the opportunity to go visit the United Kingdom and the Sellafield site. We met with the local community people, and they were one of the quote-unquote "volunteers" for a repository.

And in pushing the question, I said, well, why did you volunteer? And I think the same might be applied to the Swedish case. It's because Sellafield is there; it's a mess. We have to do -- if we don't do anything, we're stuck with it, no matter what. So why not be part of the process to clean it up or to fix it rather than sit on the sidelines? So their volunteer process is really one in which it's almost, they have to participate, they have to volunteer. Otherwise -- the alternative is worse.

And I think the same is true in the Finland and Sweden case where, even though they had a volunteer competition, the sites that were ultimately competing were sites where there were nuclear power plants. Same answer -- we've got the power plant. It's going be stored on-site, so why not find a better place to put it, like underground in our community or near our community? And there was consensus. There was national consensus that this was okay.

Senator Domenici said "leadership". That's what is needed to get this thing done.

CHAIR SCOWCROFT: Thank you.

Phil Sharp, you're next.

MEMBER SHARP: My line of questions is following up our practical problem of how do we do implement the general principles. You've articulated several very similar sets of principles, and I must say, Dr. Cragg, I'm very impressed with your presentation and the effort made in the Canadian politics. As folks here south of the border, we actually do admire many of the things Canada achieves and their ability to get a social consensus when we seem to be incapable of it in many cases in the United States.

But what I wanted to follow up on

a little bit more was whether there's any more -- you talked about how you determine whether there's a go principle or no-go principle, that that's not yet established. I was going to ask that, but to step back one more, and that is, who has to give approval? I mean, is it the community that's within two miles, 10 miles, 250 miles? Is it the provincial government? Is it the neighboring provincial government because they have a lot of transportation coming through? How far do we have to expand in order to get consensus? Because, of course, this is, the example is already articulated in the United States. Where we've run into trouble actually has not always been at the local level. It has actually been at the state level or something else.

And the follow-on question to that is, is there any -- do we have to take the assumption that the decision is always up for grabs again? At the next election the city council turns over, the county commission turns over, the state legislature turns over, somebody has decided to make their political career out of undoing the previous decision. In other words, do we have a contract?

Do you have any insights into those?

DR. CRAGG: Well, one of the interesting things about the question is that there isn't an answer yet. I mean, and this has very much to do with the trust-building process. And if you provided an answer before you started, you would almost certainly generate very intense controversy, and the community would divide. There would be, there would be a debate. But the process that's been selected for this, for resolving these questions, is to engage in dialogue and talk to the various publics that will be impacted by the decisions.

First of all, you engage the public in a discussion of whether or not the way in which you're going to proceed with the siting process is acceptable, which is what the Nuclear Waste Management Organization did. Many people would regardless this as terribly inefficient, a very time-consuming process. I think, in fact, it's the essence of efficiency because it means you have agreement as you go along.

So first up was to say, this is how we intend to proceed, these are the kinds of discussions that we intend to engage in with the communities, this is the kind of support we are going to offer, financial support, to communities to hire the researchers that they think that they need to answer the questions that they have with respect to these kinds of questions. This is the kind of dialogue.

So, effectively, it was, the decisions all had to do with the nature of the dialogue. And we will listen to all comers, essentially, and we believe that we can come to a conclusion which is agreeable to the various parties that are going to engage in the discussion. But we don't have an answer. We don't know what the answer to that question is. We don't know how we're going to determine or how the community or how the public is going to determine whether or not there's consensus at this point in time.

And we don't know which communities are going to be involved. Will it be the communities that the waste travels through as it goes to the central site? We've decided that there's going to be a central site. That's a part of the process. Now we have to engage in a discussion, which I think the Nuclear Waste Management Organization has indicated will take at least 10 years to resolve these kinds of questions. But the answers are going to be discovered on the basis of a process of dialogue guided by ethical principles that have been agreed on as the discussion proceeds.

MEMBER SHARP: Mr. Chairman, I have one other question, if I might.

I'm not on the other subcommittee that's already had extensive hearings on the ultimate disposal project and how to begin establishing a process by which to make that decision, so I'm speaking with even greater ignorance than normal, but let me ask you this: if the Commission were to decide on a process, start from scratch, look for a new, one or more deep geologic disposal sites, what can you say ought to be -- should anything be said or need anything be said about Yucca Mountain?

In other words, could the local county there simply apply and say, we already have $8 billion worth of investment here, we are ready to go with these new arrangements, we'd be happy to entertain that process?

DR. CRAGG: Who are you directing that to?

MEMBER SHARP: Any of you, but

several of you mentioned Yucca Mountain and how mistakes were made in the process of doing that, and I was just curious if that --

DR. McCOMBIE: I'll give you a cross-comparison rather than an opinion on the US situation. In two cases, three cases at least, in the UK, where a repository site was refused, in Switzerland where a repository site was refused by -- legally turned down, and in Germany where the Gorleben site was stopped by the government.

In all these three cases, they afterwards introduced a more modern or more societally acceptable process, and in each of these three cases, it was decided there was no good reason to keep the original proposal off the table; it should be on the table with other ones. In these three cases, that's what happened.

DR. KADAK: My sense is that if we're looking for a good site or a site that will work for geological disposal, that should also be concluded. It should not be off the table, as they say.

DR. O'CONNOR: Yeah, I think maybe one of the points here is that siting is a very geographic-specific activity, and you almost have to go place by place. One reason for the opposition in Nevada is that the gaming industry opposes the siting, fearing that southern Nevada would be stigmatized and people would be unlikely to want to go there to gamble. I personally think that's not accurate, that these are not risk-averse people --

(Laughter.)

DR. O'CONNOR: -- but it is believed, and that matters.

MEMBER SHARP: The point I'm trying to get at is whether or not the process ought to allow for a change in the social contract under the original Nuclear Waste Policy Act. Obviously, you would probably start with a new process altogether. But, thank you.

MEMBER ROWE: I would like to make an observation. I thought of trying to torture it into a question and failed.

(Laughter.)

MEMBER ROWE: But it concerns a conundrum between what I think is the very powerful weight of what this group has been saying to us and some of the issues the folks in my industry face. I have, for some time, advised my board and the larger public that I would not recommend that my company start a new nuclear plant, on a new site at least, until there is a meaningful and tangible and believable solution to the waste problem so that you can go to your neighbors when you try to build the plant and tell them where the waste will go. That's part of trust in my world. Also part of economics. I'm very risk-averse.

Now I listen to this panel, and we describe a process that seems to have at its root consent from a number of layers of local entities, and I think the case for that is very powerful. It may even support such a principle at the end. But I don't see how anyone rationally starts building a new nuclear plant while that goes on.

There are those who disagree with me and who will proceed. They may be the wise ones and I the fool. But, you know, we may have a blessing right now in that cheap natural gas pretty well removes the need for new nuclear plants, as an economic matter, for a decade; perhaps two.

But you know, we're dealing with very difficult questions, not just of trust at the siting level, of trust at a business level and trust with those with whom businesses deal every day -- my customers, for example -- and it's very difficult to see how this Commission can recommend so much consensus on solving problems that we already have and still think we're creating a trustworthy ground for business or government investments going forward.

And I hope that doesn't sound shrill. I don't mean it to be shrill because I think there's a great deal to be said that the only efficient processes are those that have a great deal of consent behind them. But it does suggest that a very long-term solution to one set of problems involves stalemate in what some people consider to be solutions to other sets of problems. I know that's been a concern to Senator Domenici, and one I share.

Excuse me for the monologue.

CHAIR SCOWCROFT: Vicky, are you next?

MEMBER BAILEY: Okay. I was getting lost in what Commissioner Rowe was saying. I think he presents the conundrum very well. And I don't necessarily have a question either, but we've been very fascinated by the Canadian experience. We had a presentation by, I believe it was Liz -- was her last name Downwoody?

PARTICIPANT: Dowdeswell.

MEMBER BAILEY: Yes, we had, we had a presentation by her, and I was just following up on some of the things that Commissioner Sharp was asking as it relates to the applicability to the US. I mean, obviously, your procedures and your substantive values and things you list here in your comments and in your presentation, I was just, you know, can they be overlaid as is to the US? Do you think that's a possibility or realistic as we search for this issue of public involvement in trying to build trust and confidence in what we're trying to do as we go forward? I mean, it's going to be a big part of our decision-making on this Commission.

And I address that really to Dr. Cragg.

DR. CRAGG: Well, I don't really think I can answer the question as a Canadian.

I guess if I were to answer it, I would say I think it's doubtful that you could take the process that was developed in Canada and just lay it on, if you like, in the United States. I don't think that's how this sort of process works.

I think what might be learned from the Canadian experience is the importance of identifying the ethical dimensions of what it is that you're doing and the principles by reference to which they're going to be resolved, and to understand that it's not a scientific issue, it's an ethical issue, how it is you go about resolving this particular problem, and trying to drive out in a way which generates respect -- not necessarily consensus, but respect -- the values that are going to guide the process.

And to go back to the comments made by your colleague just before you, see, I think this, too, is an ethical issue. There's the practical issue, why should someone or group of people who have a substantial sum of money that wish they wish to invest, perhaps, in a nuclear project, why should they proceed if the issue of disposal hasn't been resolved, or should they proceed? I mean, that's a practical problem that they have to resolve.

But behind it is an ethical issue. Should, in fact, nuclear development proceed if, in fact, one of the fundamental issues that a society faces -- namely, how the waste material will be disposed of -- hasn't been resolved? It seems to me that that needs to be addressed as well. And that, in fact, putting those kinds of issues on the table is itself a trust-building exercise.

That's how you build trust, by acknowledging the issues that need to be addressed from an ethical perspective are going to be addressed, and it takes an enormous amount of faith in your community when you say, we think the community, the society, can do it.

So one of the really fundamental issues, I think, that are around these goes well below what it is we're talking about. It has to do with the faith that a community has -- and I'm thinking here of the American community -- a political community has in its capacity to address these kinds of issues in a way that will generate respect, which is essentially an ethical way. And I think that what you have to do is to find a process that will generate respect for a political process that will lead to outcomes that are beneficial for your community.

But it's a matter of faith. Does the community have within it the values that allow the kind of discussion that will address the fundamental issues with positive outcomes? And there's no way you can do a cost-benefit analysis on that one.

CHAIR SCOWCROFT: Yes?

DR. KADAK: Just to compound John

Rowe's conundrum question, I think when the Nuclear Waste Policy Act was passed in 1982, amended in 1987, the nuclear industry felt, aha, our hands are clean; the solution is the government's responsibility. And so we kind of sat back for many, many years leaving it to the government to deal with this question. Unfortunately, it didn't work.

And as a business, how do you take the durability of the political process in business decisions where you have a law that says, you will do this by such a date, and the law wasn't met? So his conundrum really is, can I even trust the law to enforce or at least implement certain things? And as you start looking at the history of the nuclear waste issue, you will find many instances where we thought we were making progress, and Congress intervened saying, I'm sorry. As you'll hear from David Leroy, that is his examples.

The problem is we need to find a

way, and I think your committee needs to try to figure out a way, and maybe the MIT fuel cycle study suggestion of a quasi-government, independent agency, hopefully free of political interference, could be organized to implement this work. Now, I know you're smiling and I think we discussed this at one of our advisory committees, and they looked at me like I'm some kind of a planet Pluto person, but this is something that you ought to strive to do. The political interference is the problem, not the technology, as has been mentioned thousands of times.

DR. McCOMBIE: Well, the question was whether you should have nuclear power if you don't have a solution, and I'd like to go on record as saying, no, you shouldn't. You should have a solution, but what does a solution mean? Again, using my international experience, it doesn't necessarily mean having a repository.

Again, starting with the examples,

in Sweden, they passed a law, the Stipulation Act, back in the '80s, and it said you cannot run your nuclear power stations unless you can convince us that you have a solution. And the convincing didn't include building a repository. It included doing a lot of scientific work, doing a very solid project and having it reviewed by independent experts, and then being pronounced at the government level.

In Switzerland, exactly the same thing happened in `97 to `98, with a new atomic law, and it said you cannot run your existing stations -- never mind new ones -- unless you have a solution that we believe in. Again, it went through a long process, a multi-year process, and at the end, government at the level of the cabinet agreed that they'd been there. But that only works in countries where there is sufficient trust at that level.

If I compare that with the USA, what's happened here? What was the solution?

Well, many times -- I remember one previous director of OCRWM, of DOE, who is not in the room I should say, who went around many times saying that if Yucca Mountain dies, nuclear power in the United States is dead. That was what the statement said over and over again, yes? And suddenly, Yucca Mountain is not there, but -- it's not. So what do we have instead? We have a waste confidence statement that says, we believe there will be a solution.

You know, somehow, you've got to find something that is sufficiently consensual that there is an agreement that a solution can be found. And consensus is not enough just between us specialists. It's got to be wider, and that's what it seems to me has been lacking, and you can't wait until you have a repository. We've seen it takes too long if you want to expand nuclear power.

So you definitely need some kind of agreed mechanism. An agreed mechanism, maybe the Canadian example, is you should get agreement on the mechanism before you go out and pronounce what the mechanism is. But you need to have some level of societal agreement. Without some sufficient level of societal agreement that the waste issue can be solved, then I think you should not be having nuclear power.

DR. O'CONNOR: Just a quick comment. I think you really need to take a look at alternative institutional arrangements for reaching this goal because what's there now is not working.

CHAIR HAMILTON: Allison.

MEMBER McFARLANE: Okay, great. Thank you. One quick observation or question, and then a longer question. The first one is for you, Andy.

In this paper that you talked about where you did these different scenarios, it seems like it was inconsistent with the MIT report because you seem to assume, you know, things like the importance of volume and in these different -- is there, are there inconsistencies?

DR. KADAK: Yes --

MEMBER McFARLANE: There seem like there are.

DR. KADAK: This study was --

MEMBER McFARLANE: I just don't want everybody to be confused.

DR. KADAK: No, no. This study was done to develop a methodology, okay, a process by which one can maybe judge intergenerational --

MEMBER McFARLANE: Right, but it seems to assume things that the MIT report does not.

DR. KADAK: Now, the volume question really gets to the -- shipping issues, I think, is the section where volumes were addressed, and of course, as you noted, breeder reactors were not one of the preferred choices. So we just have to make a selection about scenarios that we'd study. So its relationship to the MIT study is -- from that standpoint, not necessarily, does not need to be consistent.

MEMBER McFARLANE: So, a larger question then, especially for Dr. Cragg.

I'm wondering -- you said in the Canadian process, you know, it's something that you're just dealing with in the communities, but it seems like there is an important scientific or technological aspect. I mean, if you decide, a community decides that it would like the site, and it is, from a technological or scientific point of view, inappropriate, what do you do? And where -- and so I'm interested in where the science comes into your process, first of all.

And then secondly, you know, listening to all of you speak, it seems to me it's really important to try to keep politics out of the process as much as possible, and that seems next to impossible in this country.

Look where we're sitting; we should be outside the Beltway, at least. So, any suggestions as to how to do that would be helpful.

DR. CRAGG: Well, the short answer is that if it's not an appropriate site, the answer's no. I mean, it's a dialogue; it's not a one-way decision process.

MEMBER McFARLANE: Right, but where do the scientists come into this?

DR. CRAGG: Well, the scientists are, the responsibility of the Nuclear Waste Management Organization to the Canadian public is to determine that in fact a site is an appropriate site before the dialogue gets really serious. So one of the first steps in the discussion is, is this an appropriate site? And so the scientists are involved in the discussion all the way.

But if the community is concerned about the quality of the science or about the quality of the decisions that are being made, they can enter into the dialogue. I mean, they can, in fact, hire their own science, if you want to put it that way. They can set up research whose purpose it is to verify, validate the conclusions that the Nuclear Waste Management Organization has come to, so that the community is in the position of dialogue.

This is a dialogical process here where nobody holds all the cards. It's not just a community decision. It's an issue that the Canadian public has to make. So, I mean, that's one of the first decisions. The Nuclear Waste Management Organization has to work out with the community that this is an appropriate site, and if it's not, then it doesn't go there. Just, it wouldn't be there.

And just, just one comment before the others launch in on the issue of politics. I mean, one of the really crystal questions, I think, and golly, this is something that -- I mean, one of the most important issues that we face as societies in Canada and the United

States is whether we're going to keep politics in or keep out. And I think one of the reasons that -- for discouragement is the idea that in order to arrive at a sensible position, you have to keep politics out.

I mean, it's a political decision. I mean, we're talking about a political community. We're talking about democracy. We're talking about fundamental values about how we're going to relate each other as human beings and as, in particular, societies. And you can't keep politics out. It is a political decision, but that's nothing fundamentally wrong with politics if you're democrat -- and I don't mean an American Democrat --

(Laughter.)

DR. CRAGG: I'm in trouble now for sure. I'm not involved in your political debates.

(Laughter.)

DR. CRAGG: -- if you believe in

democratic principles, which are fundamental to your Constitution, then you have to find a way to build a political dialogue that leads to sensible conclusions, and that means you have to have faith in your community to engage in sensible political dialogue. But that's an act of faith.

DR. O'CONNOR: Can I follow up quickly? Just that, you know, there's, in America, we have tend to have this view, we've got a problem; now if we could just get politics out of it and get, in this case, even values out of it, and go to the technical solution that the experts can tell us is the way to go, that'll solve our problems and we'll all be happy. That is so na‹ve. I'm not -- I'm sorry. I don't mean to sound insulting. I wish it were true, but the humans, humans have different values and have different tolerances and different cultures in this great nation of ours.

So, to me, you know, we, to try to

insulate this process from politics -- I think the Canadian example, as you said, is intensely political. Now, "political" does not necessarily mean "partisan", and as a political scientist, I don't use politics as an epithet, but --

MEMBER McFARLANE: Yes, I don't mean politics writ large.

DR. O'CONNOR: Okay.

MEMBER McFARLANE: I mean special political interests that have a lot of power, in part because they have a lot of money behind them. So that, the -- your average member of the public, their voice is gone. How do you get it, you know, how do you make sure it doesn't get captured, this whole process doesn't get captured by certain political interests?

DR. O'CONNOR: That is looked at institutionally. I think stakeholders are stakeholders. The ones we don't like we call "special interests". The ones we do like we call our favorite, you know --

MEMBER McFARLANE: Even the term "stakeholders" is a bit laden, I'd have to argue.

DR. O'CONNOR: Okay. But, you know, my thing is that this is, this is your task, and it's not simple and easy how to create institutional forms appropriate for our culture that will give rise to authentic participation.

CHAIR SCOWCROFT: Very quickly, because we have to move on. I know. I've got, I've got three more questions.

DR. McCOMBIE: Very quickly then, to Allison's question about, what happens if a site's not suitable? Of course the answer is, you don't accept it. A real practical case is, I've worked very closely with the Japanese program on their volunteer program, which hasn't worked, and also with the UK program. But in both cases, this is made very clear up front, there will be a set of criteria quickly applied, and if it doesn't pass it here, it won't go on. Of course, that depends on the local community having trust in the people who apply the criteria, and that's where, again, it falls down on it.

DR. KADAK: And very briefly, I was the one that sort of suggested that we insulate it from politics, recognizing that you can't quite do it.

I think what you can do is create an organization, an independent organization, that is politically insulated -- let's argue that Nuclear Regulatory Commission is apolitical, they have Republicans and Democrats, and they operate independently. If this institution had money and the mission, you could get this thing done, but what I was concerned about -- and set up in a trustworthy manner.

Establish all the criteria for transparency, openness, but clear rules of people need to follow in terms of knowing what the success criteria are. And then, hopefully, giving them the money and authority to implement this job, it insulates them a little bit. But having it ethical, if you want to use the generic term, but I also understand that politics will always play a role, but you need to do something to keep happening, keep from happening what has been happening to this waste program.

CHAIR SCOWCROFT: Okay, we have two more questions. Al Carnesale, then Pete Domenici.

MEMBER CARNESALE: Well, this time I might not even pretend there are questions.

(Laughter.)

MEMBER CARNESALE: Let me do two. First, a clarification. Radioactive waste is a burden. This is unambiguous. We should not fool ourselves. It's a burden the same way an incinerator is a burden, a landfill is a burden, a refinery is a burden. However, there may be benefits that outweigh the burden, but the radioactive waste is unambiguously a burden. If you're having radioactive waste problem in your vicinity and having a repository there will make it better, that's not saying radioactive waste in your backyard is a good thing. If it brings jobs to a poor area -- and where new refineries wind up? Where do landfills wind up? They wind up where poor, powerless people are. It is likely that that's where this will wind up, and it will be the equivalent of a negative auction, right? Who will take it for the lowest price? But we want to do better than that if we can.

Second is on the ethical question, is why would one proceed with nuclear power before the radioactive waste problem is solved? We heard the ethical answer: global warming and climate change. And that's the trade-off between these two. Now, different people can differ in their views about which wins, but there certainly is an argument to be made for urgency. On the Canadian plan as you apply it to the United States, or even as you apply it to Canada, number one, certainly no guarantee of convergence; secondly, 10 years to find out if it will converge.

If we think that in the United States, our need is to have some strategy that clearly will converge as opposed to an interesting experiment in morality, that clearly will converge, then we need more than that. The two can go in parallel, but we need some default option that says if that doesn't converge, here's what we're going to do because we have all kinds of information that indicates that nuclear power isn't going anywhere unless we have a strategy for disposal, which we all agree is not the same as saying, we have to have the geological repository open and running.

So, I think there are things to be learned from the Canadian experience, but it simply does not apply directly to our current problem. And that took me less time than if I would have tried to pretend they were questions.

(Laughter.)

MEMBER DOMENICI: Well, a few things have been said that cause me to ask to be heard for couple of minutes.

First of all, I think somebody made the point that Yucca Mountain, that it was a policy decision. Apparently, there's more concern about Yucca in Europe than there is here. Yucca Mountain was not a policy decision. It began with a "P" all right, but it was a political decision, and no question about it. I lived it. They're not denying it. The senator from Nevada is powerful enough to stop it; he stopped it. That's it. And it won't come off. It won't go anywhere else, because by the time this president is out of office if he did not have a second term, it will already be divested enough that it's gone.

So, it was a close call that it might be gone by regulatory action, but it was canceled because the senator from Nevada asked the president to do it, and he did. Now, if anybody doesn't think that, I was there, so you know, he's one of my best friends, the senator from Nevada. And that's how happened.

So now, to go to the next question that you all have raised, I don't understand the use of the word "values" and the like in this discussion, so forgive me. This process is much simpler, in my opinion, than you all are talking about. First of all, what we have learned is you don't try to go to a community that doesn't want you. So we've got to start with that. You just forget about it unless it's a last resort for your country, nothing else works, and we're choking on waste and we have to dictate it to a city. If that's not the case, then you don't choose that area. Who is it that says they're for you?

The best you can do is the elected

officials that are credible, and you ought to have enough antennae to know that, whether you're dealing with scoundrels or not. Don't deal with scoundrel politicians; just put them in the "no" column and go to another community. Get decent politicians in the community to say, we want you.

The third proposition is the sponsors should be truthful. Whatever they tell the politicians they're going to give the community and what burdens they must assume should never be violated because you will lose it as soon as you get down there with the public, and if it's different than you were told, you're a dead duck.

If we want to say you have to have local concurrence or local veto -- whichever we say -- that's going to be part of our writing of recommendations and/or the state's going to be in it. You can decide how much authority they have, Mr. Chairman, or whether it's just yes or no, and then the local community runs it from that point on. You can have different versions. But it's the community that wants it and then local leaders that want it. Supply plenty of money and resources for the community to do its own investigating. Whatever they want to do, set up committees, because this whole process must start on the proposition that is much different than we've been talking about. We must have concluded as a group that what we are recommending can be done in the United States is, engineering and construction-wise, a safe production.

In other words, if it's an underground repository, we're saying it is safe. If it's aboveboard, we are saying it is safe. And we start with that proposition, and we don't have any ethics involved because we're not selling anything that's not safe. It is safe, or we're not peddling it, and this Commission ought to say that, that if it's not safe and whatever you want say is safe, we don't try to sell it. If it is, you proceed with it, and that's what you're telling a community, this is safe.

Now if a local group can convince the constituency that it is not safe and you don't want it, then obviously you've done something wrong. Either your original stuff is wrong or you're not answering the questions right, and you lose. But if you have truth following you right along, then you don't have to be so worried about these issues of value, these issues of ethics, because the ethics is, what you're sending down there, if built right, will be safe.

Now, am I right in that? I don't think anybody wants to build a temporary repository that is not engineering and scientifically safe. You said it in your report. It is going to be. If it's a repository underground, it's going to be safe. So the promoter starts with all ethics on his side. It's a safe thing, or we never brought to you. And if you can't do it that way, then you'll have no chance of winning and you shouldn't win.

The third point, if it's going to be a freestanding, above-ground temporary repository for a hundred years, you'd better put something in that says you're going to give the community something besides the repository because nobody's going to want this thing when you finish building it, it just sits there. It's got to have some benefits to the community. Now if you're doing something like WIPP and you offer a thousand jobs by the time it's finished, that's self-evident, but it's bad too because it's going to close pretty soon. So, you know, that's the other, the flip side of the coin because they're going to have it full.

MEMBER SHARP: Would the Senator yield?

MEMBER DOMENICI: I'm about finished. I just wanted to go sit up there in the middle of those four, and I couldn't, and go up there and say I would just like to talk about the reality of ethics and the reality of values; here's what it is when we lived with it. Not because you are not the right people for the job, but just we don't need you. We already have the best case in New Mexico. We don't need your, what you're talking about, theoretically.

New Mexico and its experts and its citizenry can tell you what ought to happen, and they'll, it'll be more right than a theoretical case study that will be made here and given to us.

That's all I'll say.

MEMBER SHARP: Would the Senator yield?

MEMBER DOMENICI: Yes, indeed.

MEMBER SHARP: I appreciate it because what you've gotten at is something I think is going to be a continually troubling problem, and that is, what lessons do we take from our experience so far? And Dr. O'Connor expressed one that I've said, others have said: well, we messed it up under the Waste Policy Act, so we ought to try to get some other institutional framework to do it and get it off the government books somehow, out of the politics, whatever. The statements have been made.

But the reality is, the most successful one, the only one operating, was precisely done under current institutions, significant political interference, if you want to use that term, as well as local approval and local engagement. So, it's a little hard to come to an instantaneous conclusion as to, as if there's some new magic box out here.

Now, I personally am quite open to looking at other institutional ways to organize this, but we'd better be a little careful about the conclusions that are getting drawn because we don't like the outcome of the

Nuclear Waste Policy Act. One, there are plenty of criticisms of that, and I was involved in some of those decisions, and we were wrong, and I confess, you know --

MEMBER DOMENICI: Now, we don't want to get involved in a congressional debate, but what I want to tell you is I did not intend by my statements to indicate that the existing law is great, hunky-dory, shouldn't be changed. It's very tough.

MEMBER SHARP: Right.

MEMBER DOMENICI: And we've got to make it easier. But essentially, what I said will be pervasive under a new law which would be much, much more fluid, much easier to operate and much more certain, a lot more certitude in it. The one we've got is pretty vague on these issues. We should have learned a lesson that we want to say whether the local community says yes or no; no implications. Put it in the law. How much power does the state have? We've got to put it in the law.

The federal government controls such and such, we ought to put it in the law. It's not in now. And so, this one is a written, free-standing statute written by a couple of people and me and some others, and we introduced it and then it got amended a hundred times, and so it's statutorily created. We don't want to do that to the future of our country and nuclear power.

CHAIR SCOWCROFT: I'm assuming these last two interventions are statements, not questions.

(Laughter.)

CHAIR SCOWCROFT: I want to thank the panel very much for what was obviously a stimulating discussion.

We'll take a break now and be back at three o'clock.

(Whereupon, the above-entitled matter went off the record at 2:51 p.m. and resumed at 3:03 p.m.)

MR. FRAZIER: Okay, we'd like to

get started again if the Commissioners can take their seats.

We're ready when you are, sir.

CHAIR SCOWCROFT: Okay, can we get started now? The final topic we will explore to the is the consideration in siting nuclear waste management facilities, including public and community engagement.

We're going to start off by hearing from Dr. Tom Cotton, who is a senior consultant to our Commission staff. Dr. Cotton will deliver a presentation which was intended to be delivered by Mr. Alvaro Rodriguez Beceiro of ENRESA in Spain. The Spanish government is currently in the midst of the storage site identification process, and Mr. Beceiro had to attend to that important business.

Dr. Cotton has been following the Spanish program closely and will now provide us a brief overview.

Thank you.

DR. COTTON: Thank you very much. Mr. Beceiro sends his apologies for not being here. I know he wanted to be here very much, and he appreciated the opportunity to explain the siting process that Spain is engaged in at the moment. But as of last Thursday, the Spanish government took what I think is the penultimate step in their process, and things have gotten very, very busy and active back there, and he has to remain there while they take the next steps.

So, I think this is a very important process that they're engaged in. This is a real-time volunteer siting process for a spent fuel storage facility in a very diverse country politically, with a level of government between the local government and the national government. So it's important to watch and to see how this works.

ENRESA is the state-owned limited liability corporation that handles all radioactive waste in Spain. It's owned primarily by the research organization under the Ministry of Science, but it reports in a policy sense through the Ministry of Industry and the activity associated with energy policy. It is controlled through a general radioactive waste management plan, which ENRESA prepares every four years. It is responsible for all the radioactive waste in Spain, not just high-level. They handle, in addition, the decommissioning of reactors, they do the R&D on waste management activities, and they handle all of the funding which comes from radioactive waste producers.

The nuclear facilities in Spain are primarily 10 reactors when they started -- or their maximum was 10 reactors. They have eight operating reactors now supplying about 20 percent of Spain's nuclear electricity, which is similar to our own level. They also have a low-level waste disposal site operating here and a number of fuel cycle, fuel production facilities.

The amount of waste that they're handling is -- typically, most of the waste is low-level waste, a very small amount of spent fuel and high-level waste, approximately 6,700 tons of spent fuel will be what they're handling. They have a very small amount of glass high-level waste, which I'll talk about in a minute. It happens to be one of the drivers in their waste program. What they're doing now with respect to low-level waste is disposal at the facility in southern Spain. They're in the process of decommissioning and dismantling two reactors.

The real policy activity is here at the spent fuel high-level waste management area. What they've been doing with respect to temporary storage is reracking all of the pools in their reactors. They've done that very effectively. One reactor has run out of space, so they've built one dry storage installation, the Trillo reactor. One of the pressures for going to a centralized storage facility is to avoid having to do that at the other reactors. We have built them now pretty much at every reactor, but in their case, they've got pools everywhere except one.

With respect to final disposal, they are in a wait-and-see mode. They're planning a central storage facility with about a 60-year storage period. What they're doing is generic work on repositories, and they're also doing work separately -- but ENRESA's not doing it -- on transmutation, or separations and transmutation. This is just a picture of that low-level waste site in Southern Spain, which has been working extremely well for quite a number of years.

The waste that will go to their storage facility, again, I said, is primarily the 6,700 tons of spent fuel from the reactors but also an amount of waste from their dismantling the power plants. And this very small amount, 13 cubic meters, of high-level waste coming back from France that was a result of reprocessing fuel from one reactor, Vandellos, which had graphite fuel, and they pretty much had to reprocess it. They otherwise stopped their reprocessing plans back in the mid '80s.

But they have this waste that, under the contracts with COGEMA, has to come back and has to start back here in, back to Spain at the end of this year. And if it doesn't start coming back by the end of this year, ENRESA has to pay COGEMA penalties, quite a high penalty of, I think it's, what I've read is þ50,000 a day, which comes to about $20-some-odd million a year. So that's the other driver for a centralized storage facility. They don't have any place right now to put it, so that's what the other purpose is for that.

This is just another picture. This is where the reactors are and where all the spent fuel is stored. The one that has a dry storage installation is Trillo, and here's all that reprocessing waste just sitting up here on the French border waiting to come in at the end of this year.

So what happened? The -- in 2004 at the end of December, there was a resolution passed by the Congress of Deputies calling on the government to set up a process for coming up with a centralized storage site. At that point, ENRESA got on with designing a facility and got approval from the safety authority. In parallel, they updated their general waste management plan, got it approved, and the government set up an interministerial commission to implement the process for finding the site. Bear in mind, this is a governmental siting process. Even though ENRESA is responsible for doing the management, it is an interministerial commission that was responsible for setting up the process.

They got a process going, providing information out here, but from what

I can tell from the press, there was some decisions that, because of the timing of local elections and the subsequent national elections, they deferred opening up the actual call for volunteers until late last year.

But the key points that he wanted to make about this process, and I think a very important one, there's a very high level of political commitment at the national level. The congressional resolution that called on the government to come up with the storage site was unanimously supported by all of the parties in the congress, and I would really like to know how they did that. But it was, that's been important in maintaining the support. They've gotten approval of their plan and they have established this interministerial commission to set up a siting process and carry it out.

The commission is made up of very high-level members from key ministries and from the presidential cabinet. Its functions were to define the conditions for the sites, and that's define the site selection criteria, establish an open and transparent public information process, and develop a procedure whereby municipalities could volunteer to be the host for this facility. And then based on that, the volunteer proposals that they got, they would come up with a proposal to the government for a site to use. What they have done in that process was to develop a number of basic support -- reports to support it. They started with the siting criteria. It had to be clearly defined.

The next one -- this is an important one -- a report justifying the need. This is very important when you're trying to site a facility that a lot of people may not want. You have to explain very clearly why you have to have it. They came up with an analysis of what other countries are doing, safety analysis, analysis of transportation of spent fuel. Then they set up a public information program, including a website with all of these reports on it. And the minutes of all of the commission meetings are available online.

And then finally, in December of last year, they issued what everybody knew was coming -- this was not a secret -- but they issued the call for voluntary proposals from the communities. And the process was for communities who were interested to submit their own proposal for why their site was good and why it should be selected. They would do an initial analysis of it against the screening criteria. They would have an iteration with more public information and inquiry, and then more detailed proposals would be evaluated by the commission. And then finally, they would come up with a report basically recommending which would be the preferred site. And finally, there would be a government decision picking it.

Now, what happened last week was

the results of this report were made public. That's the penultimate step, and we're waiting for the government decision.

So, this is my slide. I added this to bring in some information that I was aware of that seemed to be relevant to things that we've been talking about and you've heard here in this Commission having to do with, what are the benefits to the community for a facility like this? Well, there are cash benefits. It's on the order of $2 million a year -- þ2 million, excuse me -- þ25,000 per ton of spent fuel, and þ3,500 per cubic meter. And what I've read in the press is that the total of all of these payments could come to on the order of þ10 million a year.

In addition to the project investments themselves, they're on the order of half a billion euros. So this is a very significant investment. The employment is, what, 300 during construction and 110 during operation. Now, you bear in mind that many of these communities that are interested may be on the order of 500 people, so this is a very major employment opportunity.

Now this one, I think, is very important, and we've heard discussion about it today. Combined as an integral part of the facility is an advanced technology research Center for ENRESA. So it's not just a fuel storage dump, it is an advanced center for both research on all aspects of interim and final disposal of high-level waste, spent fuel and low-level waste, but also work on separations and transmutation, with the possibility of some sort of demonstration facility.

In fact, this focus was part of the congressional resolution calling on the government to establish something. So they're pursuing two paths with a high-tech research center. And there's also an industrial park there both to support the development and operation of the facility but also to help the local government and the local people with employment.

This is just a picture of the facility, artist's rendering. I want to point out what's missing here is, you notice that there is no big field with large storage casks. This is not a cask storage facility. It is a modular dry-vault storage system, which is similar to one that's also being used in the Netherlands and also to the storage facility that you saw up at Hanford, for the N-reactor fuel. It's a large building. And what happens is they're bringing in their spent fuel from the operating reactors. It goes in here, put into canisters, and then they're put into vertical cells, concrete cells that are below grade.

And this kind of facility turns out to be, I think, more cost-effective when you know that you have a substantial amount of storage to provide for a long period of time. It's modular in the sense that they can add another chunk on the side to add more capacity. Completely passive air-cooled; no moving parts.

So what happened with the process? Well, they got something, I think it was about 14 initial proposals from communities, so there was a lot of interest out there. They screened out, I think, six that did not meet the initial criteria and wound up with a set, suite of eight candidates.

Now, what's interesting, and this shouldn't be surprising after the discussion we've been having, is, whereas you had eight candidates in a number of these -- the large areas are what they call the autonomous communities, which are the equivalent of our states, and the political leadership of all of the autonomous communities in which a volunteer community was located have come out in opposition to it. This is not surprising to us.

So what happened last Thursday was

the report was made public that indicated this site, Zarra, in Valencia, was the preferred site. And immediately -- and I mean within a matter of hours -- the political leader, at least one, in the community, autonomous community of Valencia, said that they're going to appeal the decision. So the Spanish government then decided to defer the final approval, which is the last step, while they were having, I think, a legal analysis of the implications of an appeal by Valencia. I also heard that it's also, that it's equally likely that there will be appeals by the losing communities too. So they're -- you can see why he's busy right now. They're dealing with this.

So the summary of the experience was, at the political level -- this is interesting; I think we've run into this -- very high commitment at the national level, very good cooperation and participation at the municipal level, and opposition in the middle.

And this sounds, this sort of sandwich is a fairly familiar experience.

At the public level, it's interesting. Apparently, the attitude of the public at large is this was not a big deal. They're essentially neutral. They had some confrontations in some of the municipalities. I know that one mayor, who was a little premature and jumping the gun back in 2007, and stuck up his hand, was barricaded in his office for about a half a day by some unhappy residents. But that, I think, passed.

The media had been reasonable in their treatment of it, and that's been my impression of what I can gleam from the Spanish press.

The environmental organizations have been actively negative from the very beginning in the process. There was an anti-nuclear cemetery coalition that was formed, and they've been basically opposing the siting process everywhere. It's not so much opposition to particular details or particular sites but just general opposition.

And in general, the process took, in his view, too long. I would say that it's been only four years. This is the speed of light by our experience.

And I will end with two things that I found in the Spanish press, two pictures that I think capsulize the problems of siting. It's not just the Spanish problems but the ones that we've been talking about and probably will talk about some more.

This is a sign from the community of Zarra, and it says, "ATC" -- that's the facility -- "Equals Future Development", very positive.

The next one is a sign from, some signs put together by the neighbors. I don't know if you can see that, but this is a caravan of, very slow-moving on the highway from Valencia to Madrid with signs that are saying "No Nuclear Cemetery in Zarra" with your little mushroom cloud on it.

So that's the doughnut problem of local support and folks around it not being quite so supportive. And that's been resolved. I hope it will be successful, and I hope we'll know fairly soon.

Thank you.

CHAIR SCOWCROFT: Thank you very much, Tom.

Our next presenter is Doctor Claudio Pescatore, who leads the Forum on Stakeholder Confidence within the OECD Nuclear Energy Agency in Paris.

Dr. Pescatore, thank you for coming here to be with us.

DR. PESCATORE: Thank you, sir. I'm very happy to be here. Thank you for inviting me.

So, I will try to concentrate in 15 minutes to give some of the main messages of what we've been learning over the past 10 years -- it's been, in fact, 20 years for myself. In my presentation, first I will give some key messages if you like. Then I will give a feel for the amount of understanding which has been raising in the past 20 years, in fact, and then the way we've been formalizing what we've learned.

This is the leaflet of our workshop that just took place in Europe. I was struck by two words. It says, "Nuclear Energy in Europe: From Acceptance to Ownership". These are two important words -- acceptance can be passive, and in fact it can be resigned; ownership is something that you want, it's something that you want to, in fact, continue on, perhaps giving honors and heritage. This is a very important word and one I will use, in fact.

My first very important message is that the necessary goal of siting is not just to have siting per se, in fact. It implies, it's something that you have to create an ownership in the facility that will last many decades. So the concept of ownership is very important, and therefore you have to create conscious relationships, construct relationships, many type of them.

Of course, this concept of ownership rests on people who are comfortable about safety, so you have to talk about safety and what it is, safety. In fact, many times, it's really a sort of construct. It's not something very clear what it is. People have to also be accepting. They're not condemning a deviant practice, and somehow this has to do with the deviation of power. But point in fact, it is the broader interests of society. We learned before that if people feel responsible for the waste, perhaps they will move on to do something about it. And also, that the facility will contribute to the quality of life and the community across the generations. All the above is necessary, of course and it takes time, so it's necessary, perhaps not sufficient, and it takes time.

Basically, another thing which is important to know, and that social scientists have been telling us, in fact, is that radioactive waste repositories are part of a larger class of an unwanted type of facilities. A classical problem is the siting of hazardous facilities. What complicates, in fact, the siting of radioactive waste facilities also has to do with radioactivity, which is especially dreadful. It has to do also with debates about nuclear/no nuclear. And the debate also moves on quite quickly on how trustworthy the various actors are, et cetera. Therefore, you can say the siting cannot be seen in isolation from a host of other issues. That is really the problem of siting.

The problem also, that, over time, the stakeholders change, the boundary conditions change over time; therefore, what is there to be done? We have to construct a process of decision making that is robust over time. And robustness, the first thing for robustness is that this project must be seen as being fair, and we'll talk a little bit about it later.

So how is the evolution of the knowledge over time? What has been learned over time? This is a study that was done in 1992, in fact, by the equivalent of the NWKRD in Sweden. They realized that basically, the strong technical portion of work, basically, they saw it. They looked at experience in several countries -- Sweden, Canada, France, United Kingdom, Switzerland and USA -- and they end up saying systematic screening, technical screening, really doesn't work very well. The one which work most are those that are based on back-end involvement with a systematic political scheme in a reduced role.

Ranking sites for their technical suitability is a temptation but not a smart policy, because if you're telling people, well, these are the best sites, then if the communities do not accept them, then you've lost the ability to have any other sites. And also, ranking sites is already difficult in itself because the data is never really equivalent, for instance. Also, you can find some of the real bothersome scenarios, like human intrusion, they are really independent of sites. Then, if you add things like remoteness and other things, then it destroys the credibility of the process.

The other thing that was very clear is that local governments, and of course, regional governments, they have an effective veto power. So, in our democracy, governments will find the ways to block projects. The starting study itself affects the ability of the Commission in the counties who block the projects, so the way they are approached is important.

This is what they were saying, the people who were working in the hazardous waste management field in 1995, I think something which is still valuable today, also for our projects, is that for successful siting of hazardous waste facilities, there is no recipe. There are some ingredients, though, there. Certainly, a facility should not be sited if it's not needed, so one should establish the need for this facility. Is there really a need? If it is perceived as acceptably safe, so we have to say something about safety.

Then we need a process that is to be seen as transparency, but in fact, because the concept of fairness changes with publics, you have to come up with negotiating this process -- which is what is happening, in fact, in Canada.

Now, other examples. There are many, many studies over the past 20 years. This is, in fact, again, this is from the Canadians. The Canadians are trying to get learning experience from a siting experience, and here are some messages they found. The first one is very important, that there is not a universal definition of "willing host communities". They look at eight case studies, and they see that in none of them there was a successful definition of a "willing host community". People come in from all sides. They claim they have, or have not, an interest. So that is a very difficult thing.

So when we talk about community, we must be careful. We must have this in the back of our mind. There's not a single way to look at community acceptance -- referendum, not perhaps a great idea. There are, in fact, several perhaps stepwise processes by which you gauge how the community -- so you have to, again, negotiate in the community and what is community acceptance.

The siting process, of course, can be lengthy and the outcome can be uncertain. We have heard this before. In order to effectively -- the issue there is very much about also aboriginal knowledge, and to some extent, this is also true here in the United States, and basically, again, we have to build the time allowances for this to have culturally sensitive communication and research methods. It is very important to build capacity in these communities. They have to have their own funding to hire their own experts, for instance. It is important that this methodology -- there are agreements. This adds rigor to the process, and patterning could be an effective tool. Engage communities in transparency. I put in two websites where you can find, first of all, these findings and then also how they were going about developing a siting strategy in Canada. I think these are interesting reads.

In our case, for 10 years, we've been looking in a professional way very collaboratively with society at large. We've had seven workshops in seven countries. Understand the dialoging, in fact, with people. Overall, you can see at least 500, 600 people from all walks of life, not just specialists and practitioners. We have now a database that you could access online, which is probably the largest in this field.

And perhaps enough on these direct examples. I'll just go to formalizing the learning -- look at things from top down rather on bottom up. What we see is that decision making should be performed through interview processes, and utilizing, if possible, a stepwise approach. We should try to evolve, to try to have social learning, mutual learning, as much as possible and to involve the public is much as possible.

Now this has three principles. What are these three principles? To increase familiarity of control by all stakeholders, all the publics; familiarity and control there about safety; To enhance and maintain trust and confidence amongst the institutional actors and stakeholders. Now, I put it in red because this is something you don't hear very much, at least at these hearings.

Trust in the actors is very important. It is very low. To establish legitimacy in a system, we need to get to the decisions and also to promote, in the end, ownership. When I say that the authorities are not very much trusted, there is data from the Eurobarometer in Europe.

We can see that when people are asked, who should be involved in a decision regarding underground disposal, you can see 56 percent of the people say the concerned citizen; 22 percent, which is quite amazing, the NGOs; and only 15 percent say the authorities. The authorities are the ones who tell people what to do. They would not be very credible unless they are into a process by which they establish their credibility and their authenticity as well. Probably this can also be transferred to other countries and to other continents.

We find that basically, the national, the siting of facilities embedded, therefore, in a larger system of decision making. There are several rungs of decision making. One is about energy policy. We heard this morning about nuclear power. The other one is about really constructing the reactor waste management system and then going down to siting. So we have to have at least that kind of line before we go to any communities. And of course, you must keep implementing decisions, otherwise you lose altogether your ability, and this is what Senator Domenici was saying.

So, you're talking about different publics; national policy is not a matter of the local community. So we have to look at this at different levels. We have to try to think keep this different level sort of clear so that there is most ability for decisions.

The national energy policy, what people would like to know, then -- if there was a debate on energy, that we want, in fact, nuclear or we don't want nuclear but we have the waste. So this must be clear. It also must be clear that there are liabilities. There are ways to address who owns this waste in the long term, and especially for the long term, in fact, because, you know, you can sort of fizzle out; you can play out in a short time. But the long term is very unclear, in fact. What is closure of the facility for instance?

Then we have to have a regulatory system, which is not only the technical regulator. The regulatory system is involving -- in this case, for instance, in this country, you could end up with the DNC as the Congress, so the whole system that basically checks the authenticity and the trustfulness of this process.

Then other tools in which you made involve the right people -- clearly, people can accept decisions that they don't like if they think or if they find that the process was fair.

Again we have, the waste management system has to be fairly clear again. You must define the type of waste you're getting, how much you're getting, from where you're getting it, and how much of you're going to give to the communities, and will there be more waste come. In Finland, they had to make sure that they -- they had a decision for the waste to which the country was committed and separate it from any future nuclear power before the decision for the community would be positive.

You should establish broad safety principles, and then also suggest which way you want to go about a site. You go site first, technical method first, or a parallel way?

And never propose a turnkey package. I mean, everything -- we will learn those from Canada -- everything has to be, to some extent, negotiated, finalized at the proper time, in time. This way, you'll build this iterative, if you like, way of improving the project and bringing in new knowledge.

The ideal site selection process is a stepwise process which combines procedures for excluding sites that do not meet criteria with procedures for identifying ones where residents are willing to discuss concerns about safety. Now, "residents" is really just more than just the local ones. As we said, the ideal community is difficult to define. And we know that statewide, even in this case, in the country, is important, so when we say "residents", I mean, we should really be using the word in the larger meaning of the word.

It should be a voluntary process in which communities are allowed to withdraw if they wish under certain conditions. Ideally, there should be multiple communities, and eventually, they should be disconnected by safety. If safety is the same, then other communities may be invoked.

The nuclear communities has a special role because they do not have to build this big round of trust and removing the fear of radioactivity, and of course, those who have the ways, they want to be part of the solution as well.

You have to go to communities, also, with the project which is credible. It should be seen as a win-win, basically, solution, and there should be packages of community benefits. But these community benefits should also accompany oversight schemes. We already talked about this.

An example that seems to be going to sustainable solutions -- here are a few countries where there's spent fuel or low-level waste. Some of them -- the region is very important. All of them, they go through stepwise level decision making.

These are countries where the

future is a bit unclear for certain types of waste.

Basically, the final conclusion is that we are no longer in Kansas. We were in Kansas, also, 30 years ago in this country by the way. So I would like to say that the experience of siting exists within and beyond adaptive waste management. As well, there's a large body of analytical work beyond all sorts of reactor waste management.

There have been many years of trial and errors. Things have been learned. You can see on the right, at Osthammer, 80 percent saying yes. So there have been important changes in attitudes. Some countries are moving forward. I would say that for the motivated publics, three basically important things to keep in mind for us are safety, which is a social construct -- it's not only technical safety -- participation with real influence, which is also part of this concept of safety, and the durable improvement of the quality of life.

Thank you.

CHAIR SCOWCROFT: Thank you very much, Dr. Pescatore.

Our next presenter is Dr. Charles Powers of Vanderbilt University. Doctor Powers is a Co-Principal Investigator with the Consortium for Risk Evaluation with stakeholder participation.

Dr. Powers, welcome.

DR. POWERS: Hi, and thank you very much for asking me to come before you. It's a little bit daunting because if you actually spend much time, as I have recently, with your website, you've heard almost everything I can think of that someone might say about almost every one of these issues, and then you listen today and try to figure out how someone who was actually trained in ethics might somehow relate that to the siting experience, and you just spent a lot of time working on that. So I'm going to try to move through this presentation relatively quickly, picking out just a couple of things.

You could, I guess, I go this way.

You don't have to look at this for longer than to say that if you really take on what it is that, where we are on the full set of issues that one must resolve, about managing nuclear waste in all its forms, public and private, defense and civilian, and then try to relate that to all the different classifications as they currently exist, you realize that very little is resolved. You only see those very dark colors on the left-hand side where some things are okay for the last next 30 years, but nothing begins to match what it is that we need in terms of any kind of permanent resolution of these issues.

I want to suggest that a common theme really, but really not actually explicitly said enough, it seems to me, is something that actually Phil Sharp said late in the morning of your second day, which is that if you were going to actually do something as a commission, you're going to have to figure out how to integrate all the things that you have talked about. We all know that we need an integrated back-end strategy to move forward to break the impasse, and we know we need to acknowledge that we do not know yet where the technology will take us that may might make some ways they save resource, and we know that only phased-step processes can win the assent of the needed parties. I mean, everybody sort of knows that now.

The problem is that those two things run into each other. They are directly apposite. That is actually the task that you post have, to try to figure out how to put those two pieces together because they do not naturally they fit, because in order to come up with an integrated strategy, don't you have to tell people things you don't know on the basis of what's coming in from the other side?

But you've been given a job. You will make recommendations for a new plan. And that new plan, actually, if you start thinking about it, has all range of options about a whole range of different -- I could have put forth four or five or six things up there at the top, of components of what a fully integrated strategy would look like. But if you're going to do something other than come up with a list of options, you have to figure out exactly how the key pieces are going to fit together.

Anybody who thinks that you can do siting as anything independent of that, I don't think understands the problem that you have. What I'm going to talk about, in one sense as an abstraction from what it is that you have to do, is to try to figure out some characteristics of that siting process that must eventually fit with what you're going to say on timing, about institutional mechanisms, about who's going to run this thing. I'm going to give you an example of something that's really quite specific.

The objective of this presentation is actually to take you through a number of issues that place the challenge of nuclear waste facility siting in the context of what would create integrated nuclear waste management, including three guiding principles for a plan -- you've heard all this stuff in one sense but not quite this way -- safety, informed consent and equity.

To define the importance of a very early commission decision as to whether and, if so, how storage and disposal of defense of private nuclear waste should be governed by the same or separate policies and institutional processes. That is fundamental, and it is a problem that is not actually shared with many of the European counterparts that have not been in the defense business.

To explore briefly how the pre-suppositions that governed what went on in the late '70s and '80s helped lead to the current siting impasse and what concrete steps could be taken to make a new start successful, and to explore the structural ways to address perhaps the major impediment: the perception that on nuclear waste, the government does not keep its promises. That is huge. I think that's the root of the trust problem.

To propose a scenario -- threat and all the rest of it, I think are enormously important. I've got a doctoral student working solely on the question at the moment. But I don't think that that's where the major problem comes from. To propose a scenario where citing efforts would seek to elicit local and state proposals to serve as sites for regional interim storage and for developing fuel cycle options -- probably putting those two things together, as you've heard a couple of times.

While simultaneously, the waste streams, in an appropriate geological and geographical settings context, for geological disposition are defined on siting for them. You've heard a lot about that from MIT this morning. What I didn't hear enough about is the imperative to try to relate those things in a timeframe that you will be convincing if you put them forward.

To draw on the work on experience of the Consortium Group for Risk Evaluation's participation related to work to explore the relationship between credible technical work and public acceptance where nuclear waste decisions are at issue. I think the whole business of splitting those two pieces between credible technical work and public acceptance misses the boat.

And I'm going to try to suggest some experience and suggest we're better than that if we set the right context, and to suggest the basic outlines for the authorities, and key practices of a successor commission to this one that would have to operate for at least a decade to facilitate nuclear waste facility siting as a specific business. Specifically, what kind of authority and resources would be needed to allow it to address the local and state issues.

I want to point out that's what "safe" means is a lot more complex, when you really start thinking about it, across the full range of things than you have been hearing. It incorporates preemptive monitoring in place and provides for retrievability of nuclear materials for many generations. But don't forget that WIPP, our one success, has absolutely no retrievability whatsoever. So you need to figure out what it is that you're going to be putting into that kind of context.

"Provides for technically safe permanent disposal of the future generation" shows that option without placing unreasonable financial burdens on future generations.

That's the way in which I'm not handle it. I'm going to go quite quickly past intergenerational material because you heard so much of it.

"Allows no implementation of any facility or process whose implication in foreseeable adverse consequences for preventing proliferation have not been addressed." That's part of the safety envelope. These are built right into it. It was developed materially by stable and credible institutions to ensure management and resources consistent with these criteria over the full term of its operation. An arrangement to lock in those assurances, trust funds, irrevocable agreements, leases and escalating liability provisions would, in fact, make those things durable and overcome this problem of promise-keeping.

I'm not going to spend much time at all with the issues that we've talked about at great length today. I do think that the intragenerational problems are the ones we addressed most poorly in what we did in our own context here. We need to go from what it was that we started with in 1977 and on to the way in which the Canadian folks have been talking about these, at least as interpreted by Tom Isaacs, and then move on to the fact that we do know a lot about what the generations closest to us are about, and we ought try to figure out some way to protect number two while in fact recognizing what it is that we can't say because of the fact that we know so little about things 10 and 20 and 100 generations out the future.

"Informed consent" is, the host community is fully familiar with the nuclear energy or nuclear systems to be operating in form and knowledgeably agrees to the local siting and operation throughout the process of the facility development. It's really quite fundamental to any democracy that that's what goes on. We're going to have to come back to that in a minute. I'm not going to walk you through all these. You can actually read this in a paper that I gave to the Commission.

What I suggest is that where we started back in 1977 pushed us in the wrong directions on some fundamental issues that, if in fact you rethink those fundamental premises and presuppositions, you're probably moving toward what it is that will be a paradigm shift toward the kind of larger integrated systems you're going to be talking about.

Put simply, the Commission should commit to the following basic criteria to guide every aspect of the site selection process: stable, credible, transparent processes; state and local assent -- I'm going to come back to that because that's the hardest -- geographic equity; establishing appropriate geologic and geographic setting; and a comprehensive safety case established to address known, and provide mechanism to address evolving, issues. While these criteria seem self-evident, it's arguable that it's only four and possibly five. I don't think, really, the comprehensive safety case has been done in terms of what we've been doing.

I want to say very quickly that I think you need to sort out just exactly what you're going to do about the relationship between civilian and defense waste. There are really powerful reasons to go either way on those, but you can't think very far into the siting question and give much guidance to anybody about what you're going to do unless you're trying to figure out, you know, whether or not you're trying to do both defense and civilian waste, in some way, in the same context, particularly if you're heading for the same disposition facility, and the possibility of separating them.

You know, there is good reason to learn from what we did learn from legacy waste processing and all the problems we've created with it. We do have WIPP siting example, as Commissioner Sharp just said a little while ago. There are possible dual storage locations if you keep them together. On the other hand, does weapons legacy work tarnish the nuclear energy, and does current overlap limit institutional innovation on the private side? It confused resolution of the distinguishable high-level waste disposition questions, and they really are distinguishable. Every aspect of what the Commission decides about all key issues in the plan it has been charged with producing will flow from its decision on this defense/civilian issue.

And I just want to say something very quickly about the issue of, to propose a scenario where the siting effects would seek to elicit local and state proposals for sites on a regionalism storage basis. I want to say that, while it's true that the NRC just said last week that it's okay to leave things where they are for 60 years after a reactor closes, I think we need take concrete steps to normalize. Unless we get nuclear waste management somehow into the swing of things this country knows how to do, as people were talking about, the problem with the MIT study, I don't think we'll move forward.

WIPP is not some exception. Make sure that WIPP is not some exception but some model, modified as appropriate. We need to be doing what we need to do and be taking modest but sure steps to prove that we can proceed by continually adapting as pursuit of full plan, including a repository.

It seems to me that we need to understand, have the public understand, that nuclear waste management issues are large and hard, yet tiny comparison to what we expand, the risk we run, and the property we sequester to generate other forms of energy in this country. That's part of the larger task.

I'm part of CRESP. This is an

organization that's been going now since 1995. It has been working almost entirely on issues associated with the legacy waste, and I want to say a few things about what we've been doing. We've been working through four different modes of operation -- strategic analysis, research, review, and research itself -- and at the full range of the DOE complex sites, more at some than at others, and we have enormous breadth of experience.

In that, we try to figure out how to get accepting publics, not cheating them, not promising things, but getting accepting public so we can persuade regulators and decision-makers to go ahead in a functioning relationship with an integrated DOE of technically sound basis. We have a cooperative agreement that's advisory to DOE, but the fundamental difference between what this organization is, is that as it has now built, the sense that what it will say is technically competent and is responsive to how we have spent time understanding what the public are thinking about the issues we're talking about at the same time we're trying to figure out what the technical resolution of them is, we get drawn in by states -- the state of Alaska, the state of South Carolina, by EPA in response to the issues along the Savannah River by SSABs, when the SSAB at SRS asked us to do a major epidemiological study of workers, on Native American groups and other regulators like the Defense Board.

The fact that we're asked into issues continually by the full range of groups is now known across the complex, and what I think you folks need to think about is whether or not some such process that would establish such a way of thinking about how technical issues are addressed might actually be helpful.

I've just spent eight years chairing something called the New York/New Jersey Harbor Consortium for the New York

Academy of Sciences, and we spent eight years building across 80 organizations in the region. Understanding of what the technical issues were associated with prevention of new toxins coming into the Harbor. We got consensus before we were through on hundreds of regulations because we had a process that people began to believe was one in which the definition of "what is" and the explanation of "what ought to be" did not stop where certain interests were but went through to the entire process. There are ways of doing that in this country that we have not yet explored effectively, and figure out how to do that I think may be a key to what you try to come up with.

What we also learned is that the general public knows very little about nuclear waste, even as to where it's currently located. There are some demographics-specific differences. The American mind appears to close when it hears the word "nuclear", but not well understood is the extent to which that is currently changing, and we need to keep track of that as there are emerging age-specific differences. As I said, I have a psychology student -- not a student -- a doctor, post-doc, who's emerging as a major researcher.

The federal advisory committees at DOE waste sites, the SSABs plays a major role in providing what appears to be the most effective way yet devised for promoting an effective mechanism of broader public understanding linked to the technical and public policy challenges nuclear waste managers face. Trying to figure out how you're going to build one of those into the process by which you're deciding seems to be a goal as you try to figure out what it is that you're going to be doing. The public that's nearest DOE and its nuclear facilities are generally more knowledgeable and receptive to additional nuclear facilities.

I want, very briefly, to say one of the things that we keep on saying is that this is not primarily a technical problem in almost all the fundamental search researcher goes on. It's not that CRESP doesn't know how to figure out, how to evaluate pulse jet mixers at the major vessel under which the waste will go at the WT facility. But it also knows that you're actually working at the same time on nuclear law and policy, and you're going to be missing a whole range of things unless you're working to try to figure out just exactly what's going on in the public.

This is the fourth iteration of a longitudinal study that's tracking the relationship between ways in which people think within the doughnut and the outer pieces of it as we try to understand what's going on with nuclear waste. What was fascinating is that most people have no idea where it is that we put our nuclear waste in this country, and only 10 percent of the people have some idea that it's actually at the power plants. That's a fascinating figure, and it runs pretty consistently that runs across the full range of people who are described there.

Well, these are the issues about what communities seem to want. I want to pick up the doughnut concept and say, but the states are the linchpins to the siting process, and United States' failure to achieve an active participation of the host state in the decision to site a nuclear waste site will simply not work. But the question is, how do you go to work on that?

States have not been persuaded that permitting one of the communities in their states; they appear to be -- there's scant evidence that, taken as a whole, there be an inequitable distribution of benefits. They're dubious that they can guarantee a long-term commitment from the federal government. Popular fears of transportation of waste of those facilities remain extremely high, and states see no evidence that the federal government has established law or practice in this case that will provide equity at the national level, and in fact, it's been working very hard to prove that's the opposite. And then, they have an enormous adverse experience with promise-keeping. I think focusing how you're going to address issues of the state in this context, the problem is not going to be getting, as I think Leroy will talk about, is not getting the communities to step forward in this process. How is it that you can address this set of issues with the states?

I want to talk about WIPP for a minute. Anybody who thinks that was a simple process, you know, that the state voluntarily came along and said, okay, let's have the first underground nuclear repository in the world, it was very strenuous. It remains a pilot project. The state demanded and received a major new road and $300 million of unrestricted federal dollars in the final negotiation. It's supported by a congressional jurisdictional fair factor. It was able to limit the waste received, the Defense waste. It controls the characteristics of the two it receives. It uses RCRA to help it do that, so it's a relationship along with EPA authority, and it exercises that authority, and fought hard to ensure that government guarantees regarding WIPP would be binding in the site-specific federal law.

That is not a process that simply says, oh, well, you got the states to go along with it, but you need to get the communities going. It is a very -- try to figure out, then, institutionally what you have to do to take the experience of the waste negotiator, which you're now going to hear about, and try to think that experience into something that allows you to say, on the issue about siting, no typical bureaucracy.

The same institutions who actually managing existing facilities, or those who regulate the facilities, to make any one of them primarily responsible for the issues of siting for this country is to great role confusion. Safety, informed consent, and equity are the triangle of principles the institution with implements them must do everything that it does and exhibit that it creates no confusion about what its mission is. I think the way to do that is actually to create a commission subsequent to yours that would actually have that task, again, integrating it with a whole range of other integrated waste management processes that you've come up with.

So, we'll go ahead. It seems to me, while I didn't talk much about this, I think you are be getting 90 years from removal of reactor as a way of sort of making sure that you begin to move toward figuring out how to look at the next generation of fuel cycles and establish a pilot repository. But I really urge you to think seriously about the impact of having multiple regional interim storage locations to get this program on the way and moving, provide geographically, include informed consent, show that in fact you know how to do compensation and opportunity development, with reverse auctions, et cetera, possibly existing federal facilities if you decide that's what you want to do.

It's actually the same advice I gave to EPRI in 1991. Many in this room agreed then, whether quietly or openly. It's my own personal hope that the Commission's plan can incorporate these principles and recommend these practices in the context of an integrated nuclear waste system that facilitates the new culture that's needed.

Thanks.

CHAIR SCOWCROFT: Thank you very much, Dr. Powers.

Our final presentation is by David Leroy, an attorney in private practice who's a former lieutenant governor of the state of Idaho and was the first head of the US Office of the Nuclear Waste Negotiator.

Welcome, Mr. Leroy.

MR. LEROY: Thank you, General, Mr. Co-Chairman, Members of the Commission.

Perhaps some of you have seen that national television beer commercial that's currently being broadcast, where a gentleman of modest stature and advanced years with gray hair and a grizzled beard is seated at a table with a trio of young ladies around him, and he's introduced as the "most interesting man in the world" to sell the product. Well, I've never been that fellow, but --

(Laughter.)

MR. LEROY: -- from 1990 until 1993 I must have been some kind of relation because I ran around the country giving speeches saying that I had the most interesting job in America. I was called by the national media and some international press by less formal names. I was characterized as the Most Unpopular Man in America by the New York Times. I was called the Monarch of Mock. I was called the Sultan of Swill.

(Laughter.)

MR. LEROY: And my official title was United States Nuclear Waste Negotiator. In 2006, I wrote a paper that was published in a professional journal, copies of which I've given to your secretariat, and perhaps he's distributed those to you. The title was "Political Life and Half-Life: The Future Formulation of Nuclear Waste Public Policy in the United States." I observed that government by popularly elected officials serving two, four and six year terms is ill-designed to create and implement public policy controlling highly unpopular and long-lived nuclear wastes. I commented upon NIMBY, "not in my backyard," and its corollary, NIMTOO, "not in my term of office."

I predicted that instead of the bold policy initiatives that we saw in the 1980s on siting questions, during the first decade of the 2000s, we were going to see, instead, small, practical, improvised, necessary waste management tools such as narrow necessary consensus amendments to existing laws, memoranda of understanding between regulatory agencies, the issuance of interpretive guidelines, licensing, perhaps, of nonthreatening facilities or expansions to existing facilities.

And I noted, of course, that public reaction to perceived waste threats, such as that continuing controversy at Yucca Mountain, were becoming hardened and constant, and there was even an occasional ballot measure where some constituency or another around the country took an anti-nuclear waste stand. It was my thesis that politicians had come to understand that the public is now empowered and that we can no longer simply decide, announce, and defend the siting of nuclear waste facilities in an unwilling population and expect success in that siting initiative.

The conclusion to my paper was as follows, relevant to the mission of this Commission:

"The next visionary policy concepts regarding United States will necessarily deal with the subject of interim storage of high-level waste at those commercial sites which can no longer expand on site. In the future, an anxious U.S. electorate will still demand that its public officials at all levels create and oversee a proper policy on nuclear waste. Predictably, the politicians will duck the controversial waste issues to the maximum extent possible. They will defer those decisions as far as practicable to successors or to future terms of office. Unlike members of Congress in the 1980s, they will think small. Few will stand tall, but with emerging less formal public policy tools and procedures which effectively deal with those waste issues, the United States will continue to enjoy the benefits of the nuclear age."

It's my thesis, Mr. Chairman, and one reason I was eager to accept your invitation, that this Commission actually does have a chance to stand tall and that you are empowered to think broadly, if not largely, about public siting and nuclear waste policy issues. It's my belief that your Disposal Subcommittee has framed before it precisely the right question when you ask, how can the United States go about establishing one or more disposal sites for high-level nuclear waste in a manner that is technically, politically, scientifically, and socially acceptable.

Mr. Chairman, from 1987 to July 1,

1995, the United States had an approach, a solution, which partially answered that question, in my opinion. Congressman Morris Udall from Arizona is typically given the credit for offering an amendment in the 1987 Nuclear Waste Policy Amendments Act which created something called the Office of the United States Nuclear Waste Negotiator.

You recall that the earlier Policy Act of 1982 had failed socially, politically and technically when it attempted to site two deep geological repositories for commercial spent fuel in the East and the West of our country from 20 candidate sites in a science-driven search. The public outcry, the political pressure arising from each and all of those candidate sites, in fact, enabled various locales at various times through various processes to drop off that candidate list. And the premise, within five years, of a nationwide politically balanced, scientifically driven siting process was destroyed. The policy was in shambles.

In 1987, with Congressman Udall in the wings in the House, the Congress revisited that policy and decided instead to characterize one site, Yucca Mountain, and created the Office of the Nuclear Waste Negotiator. The history of the Office was not uncheckered. It took them three years to find someone to fill the post. When the White House called me, they explained candidly that it had been offered under the Reagan Administration, now under the Bush administration, to others who had declined to take the job. It seemed to me that one could probably complete the mission by simply sending out a self-addressed, stamped postcard upon which one would ask governors, Indians chiefs, and territorial officers to mark one box: I would like, or I would not like, nuclear waste for my jurisdiction.

Nevertheless, I took the job because I decided it was not about an answer, or not even about waste, so much as it was the challenge of whether the United States of America, through its government, could develop an entirely new way of doing business with states, with sovereign Indian tribes, with territories on something so controversial as waste siting.

We were to find a repository site or what was then called a monitored retrievable storage site, a temporary above-ground commercial spent fuel storage location. We were to do so with a budget of approximately $1.5 million a year. We were to do so with a staff of 10. And I was confirmed in August of 1990 to begin that mission.

Our first communication went out in May 1991 to 623 jurisdictions, the 50 states, all of the then-federally recognized Indian tribes, and a certain number of territories listed in the Act. We were to be an independent agency, independent of the Department of Energy, reporting directly to the President and directly to the Congress. And with that banner, in October of 1991 we issued a formal invitation to dialogue and participation to the same jurisdictions, that went out with an information packet and this program.

If someone was interested in talking with the Office of the Negotiator upon this topic, they could apply for three different sets of grants -- a phase 1 grant in the amount of $100,000 to do their own feasibility assessment, to hire their own experts, to approach the issue in their own way. On a short form that application went to the Department of Energy.

If they wished to proceed further after that, they could file an application for a Phase 2A monetary benefit to conduct public outreach and begin discussions with the Negotiator's Office with a public emolument of $200,000 associated with that. And should they choose to go further, they could apply for a Phase 2B grant up to $2.8 million that would actually encompass their expenses during the process of negotiation and local characterization, as well as all the local processes necessary.

Within three days of the time that we issued that call for invitation and dialogue, we had our first application from the Mescalero Apache tribe in Senator Domenici's New Mexico, and it was back to us upon the following principles announced in that solicitation:

(1) the process must and will be truly voluntary;

(2) requests for information and preliminary dialogues will not be viewed as a commitment to proceed any further;

(3) any dialogue is terminable at the will of the prospective host;

(4) Indian tribes and states will be provided with the resources to obtain independent, credible information upon which

they can make their own decisions;

(5) all discussions should begin and end with the thoughtful evaluation of issues related to health, safety, and the protection of our environment;

(6) choices of technology and participation in oversight controls should be utilized with assure compliance;

(7) there are no irrelevant issues;

(8) a prospective host is entitled to achieve an equity for helping to solve a national problem, and the nature and means of achieving that equity should represent the individual needs, concerns, and desires of the host;

(9) the process should encourage broad public participation, seeking and credibly consider the views of all affected stakeholders; and finally

(10) process can only work with participation.

We did have, within 19 months, a total of 20 applicants for the initial dialogue. Discussions were conducted at the state, county, tribal council, and tribal leader levels. Interest was expressed from 16 sovereign tribes from four counties within four separate states, and directly from one state governor who discussed initial activities with us in private.

Various benefits of various natures were conceptualized by the volunteers themselves. Some wanted to talk about infrastructure improvements. Some, environmental improvements. Some, public school assistance programs; there were higher education programs discussed. Some were interested in healthcare benefits. Some proposed co-locations of this site with other federal projects. Some worried about general economic development programs. Some wanted to transfer ownership of federal properties. Others wanted direct financial assistance.

And some wanted public recreation improvement projects.

Three of those applicants had sufficient staying power to come to the application 2A phase level. There was one county that wished to do that, but consistent with our obligation, we believe, to the state governments, we allowed the governor to veto that initiative. In September 1992, we proposed even changing the grant program to make it more sympathetic and useful based on our experience.

And finally, in October of 1992, the original five-year term of the Office was extended for another two years to January 1995. As we progressed into that fall, there was, in November of 1992, a presidential election, in January 1993, a change of administration, and in July 1993, a change of negotiators began. We unfortunately, in that process of changing personnel, lost momentum, and my successor was not able to pick up where we had left off. In January 1995, the Office sunsetted, and it no longer exists in the federal Christmas tree.

At least two or three of the volunteer sites that were contacted by that initiative remained interested and so sufficiently interested that they continued, even without the promise of federal benefits, to pursue the siting of relevant facilities on their own initiative or in concert with utilities. Thus, as Canada has shown us today, as we experienced then, it's my belief that voluntary siting dialogues on high-level spent fuel can commence, will continue, and may work if nurtured.

Consistent with your mandate from the President and the Secretary of Energy, I recommend that you apply the following nutrition:

Number one, change terminology. Eliminate the words "waste." Eliminate the words "dump." I liked my friend Andy Kadak's suggestion today that we adopt a parallel from the field of fossil fuel oil. It would, in my opinion, aptly describe the material that you are working with if we called it the "strategic nuclear fuel reserve." In this day and age of 15-second sound bites, tweets and twitters, anything with so negative a connotation as "dump," "waste," or even "cemetery," is doomed to failure at the outset.

Secondly, commit to retrievability. You've heard, through the Disposal Subcommittee, Professor Hank Jenkins-Smith on September 1 indicated that there's a very direct correlation between public support and retrievability. This Commission needs to commit to retrievability.

Third, endorse centralized storage. Make it a clear message. It doesn't matter so much the range of technology, or even as we suggested this morning, the rationales utilized, whether you call it safety economy or just programmatic. But centralized storage needs to be a feature of this Commission's report.

Fourth, in so doing, please require volunteer siting. A new-generation nuclear waste negotiator or a commission, as Dr. Powers has suggested, can get new leads for this initiative if properly empowered.

Fifth, start immediately. I've been a part of a number of commissions that, when they produce a noble report at the end of a long process, see that report consigned library shelves all over America. It seems to me that while you have the President's mandate and his ear, you could and should work with the relevant Cabinet officials in the White House to, even now, begin to craft some legislation that could he perhaps introduced as contemporaneously as your early preliminary report next July.

Sixth, embrace risk-based, risk-informed regulation. For the National

Research Council of the National Academy of Science, I chaired, in 2003 to 2006, a study commission that wrote a report on improving the regulation and management of a low-activity radioactive wastes, which castigated this 60-year patchwork of statutes and regulations we have based on source-based management decisions. We need to move to risk-informed activity. You can help that.

Finally, Mr. Chairman, I hope this Commission will rise to the challenge and counsel the political leaders of our nation and our localities to commit to long-term action on this topic. You have in the name of your Commission both the word "America" and the word "Future," and we must somehow or another, hopefully starting with you, get beyond NIMTOO, that short-term focus that has so badly hamstrung our efforts to develop intelligent policy in this area.

If you will each spend some of your current political capital to urge elected leaders to do likewise, then perhaps, indeed, America will have an uncluttered nuclear future utilizing, protecting, and storing materials in a nuclear fuel reserve.

Mr. Chairman, I urge the Commission to pledge, to design and to implement voluntary siting for this reserve and to create appropriate spent fuel facilities for the United States on a voluntary basis, as we once did long ago when I was unpopular.

Thank you, Mr. Chairman.

CHAIR SCOWCROFT: Thank you very much, Mr. Leroy, for that challenge. We appreciate it.

MR. LEROY: You're welcome.

CHAIR SCOWCROFT: All right. Do we have comments, questions from the Commission?

Phil.

MEMBER SHARP: I have a question, first of all, for Chuck Powers.

You talk about informed consent,

and it seems to me there are two different versions of informed consent, one of which I think is imperative, which is you clearly provide opportunity for people who have to make a decision, a local community and their officials, to understand what's going on. But the second and harder version of that is, where you could actually go in and know that people have received the information and were, in fact, informed.

I don't know that that standard can be met, given a society which is so hard to get people's attention against all the other clutter and distractions and the tendency, from my political experience, to recognize that many people will step forward in a serious manner when that opportunity arises -- and there have to be multiple opportunities; you don't have just one meeting -- to learn. But many won't hear about it, won't become informed, until some other thing activates them one, two, three, four years later.

So I guess I'm asking if you're looking for that second standard because you made several allusions to the low level of technical knowledge among the population.

DR. POWERS: Actually, I think the second standard in the context of where we are with -- what is the proper term -- strategic nuclear fuel reserve --

(Laughter.)

DR. POWERS: I think it's required for any affected community because there's no question in my mind that a community is not going to participate in this process -- Carlsbad is a particularly good example of this -- without being pretty actively engaged in it. And so, trying to figure out how that group, that larger community, can at least have the opportunity of having people they trust translate to them, either their own local people or some sort of technical people who are helping them think in risk-informed terms that Leroy was just talking about, is going to happen anyhow, so I think you ought to plan that that is, in fact, what is going to happen.

It is surprising to me to see that around DOE facilities, only 11 percent of the people know that, in fact, the reactor material is actually sitting at current reactors. Don't forget, a number of those facilities never had reactors, so it's not that they don't know something is close to them. Yes, I think you want to get the public sufficiently engaged and, I think, working on that issue.

I guess my experience, Commissioner Sharp, is that when you do that and you've figured out some way of delivering that information by way of some form of institutional mechanism that has built some sort of credibility with the affected parties -- often that can be local university people, et cetera -- it's amazing what kind of agreement you can work out.

I'll never forget walking into the Idaho site, actually, and presenting two pieces of information that was thought to be contrary to what it was, that the folks that were from the Snake River Alliance, who were effectively were at that point leading the Citizens Advisory Board at Idaho, and walking them through a process, by which they came to understand what they were actually dealing with and what their actual options were and emerging from that meeting with a consensus among them that was quite different than what they entered with. I don't think that these things are impossible, and I think that you'd better take it on earlier rather than later because I think it's going to come up. I think, if you don't have it there, you're not going to get there now.

The states are a much more complicated business. How you keep the state, the governor or those folks from making the exact immediate response that David Leroy got when he tried to approach that governor, I think, is a really complicated issue, and that's why I don't think that a single office can do it. I think it takes a commission to start really working those questions so that what is actually brought to the state is something quite concrete and broad and meets those fundamental criteria that I was talking about.

Obviously, working with a state, there's going to be two groups -- those within the Governor's office and the environmental protection or whoever it is, who actually can comprehend it, and then all the political stuff around that. What you want to do is have built the understanding so that, in fact, any -- I don't think you're going to anything done. I think we've just proved that over the last 37 years; not that many quite, just 27 -- unless a state assents, you're not going to actually get there.

Incidentally, I don't necessarily assume you have to give up on Yucca at this point, at least for some possible role. But I don't think you'll ever get there by forcing it down their throat.

MEMBER SHARP: Well, I tend to agree with much of what you said. What I was trying to get at is, if we were to advocate the principle "informed consent," what do we mean by it? And certainly, I believe we have learned, and I think Mr. Leroy's impressive efforts just confirm, that you can provide assistance, do all kinds of things. You have to provide persistent institutional, both support and interaction, in order to get a community informed, and I believe you will get activists and you will get officials who will become informed. Indeed, on our trip to Hanford, it was clear to me, the incredible knowledge that individual citizens had who'd worked at this for decades in some cases.

My point, though, is I can't

imagine us suggesting that we have to wait until there's a certain level of testing that's done in the community that tells us, oh, now they're informed, so now they can agree to consent. I think the best you could hope to do is set up some very effective procedures, you finance their capacity to get knowledge, kind of proposition.

Indeed, one of the hopeful signs, I think, in all of this process is one we keep hearing about, and it was Mr. Leroy's experience again, that there are places to willingly consider these propositions --

DR. POWERS: Absolutely.

MEMBER SHARP: -- as long as we will nurture them. And second of all, my stunning impression of Hanford -- perhaps I misread the local politics; I was only there briefly -- was that compared to what I heard in the 1980s from members of the House, from the state of Washington, the state of South Carolina, and other places, the intense hostility they faced toward the Department of Energy and its relations with the local community appeared to me to be significantly less and that a whole series of techniques have been developed. I'm sure they don't all work perfectly every day, but it's a different kind and style of operation which we can build on.

DR. POWERS: Well, I agree with you. And you know, you heard interesting sort of variations among the tribal folks, for example, who -- I went over that set of testimony pretty carefully because I know that situation exceedingly well. I also know that some very interesting things have been done to try to much more effectively -- and again, that FACA is very important to making that happen out there.

However, I do not expect that you're going to get interim storage of spent nuclear fuel at Hanford.

MEMBER SHARP: I want to be clear,

I was not there for anything.

CHAIR SCOWCROFT: Allison.

MEMBER McFARLANE: Okay, I'm --

DR. PESCATORE: Perhaps, at the risk of being na‹ve also, you have to go and try to create this informed consent, it seems to me. That is, you have to do all efforts at the several levels I was talking about before.

It was ten years ago, and the government of Canada asked the industry, they said, show me that you have a method. And these guys went all over Canada. Of course, it was difficult to get people to come and talk, but in the end, you know, they could claim that they had spoken to enough, big enough section of Canada so that they got the kind of information they wanted about the waste management method.

When they go down to a community, these three communities for instance, that are there now, they been very careful with these communities, saying, okay, just establish your interest; let's understand that you have real interest; in fact, we'll pay you to understand your interest. And they want informed consent in a very, very important way. So I believe that the Canadians, the Canadian NWMO would not accept basically to continue in serious negotiations with a community where a majority of the people were not aware actively of what was going on.

MEMBER SHARP: Well, I should be very clear. I believe the government, in trying to get us to a decision, has to be very aggressive about trying to help people know what the possibilities are and allowing for and more than allowing for their participation; in fact, they can reject it, in my view.

My own political experience in running for office, however, suggests that if you think you're going to wait until you genuinely have a large populace well informed on the issues, I think that's a standard that you may not -- I think you'll decay the waste more rapidly than you will achieve that.

I don't mean to be flippant about this. It's just, we have to come to some realistic understanding that you aggressively allow for. Of course, communication today means that at any moment of the night or day, you can become informed if you want to the websites and things, even of this Commission.

So, I'm all for those possibilities, but I think it would be rather na‹ve for us to assume that after you make that aggressive effort, you indeed have everybody onboard.

I'd be interested in those communities you go into in Canada and just see -- I don't have any doubt that the majority knows something is happening on the issue. The question was going back to the presentation of what they know about is at a very low level, according one of Chuck's polling pieces of data there. You know, I would not say, so, we can't make a decision because enough people don't know. No, there has to be enough opportunity and a very aggressive effort at it, and you have to keep at it to do it, and you have to have allowed retrieval of some stuff in the issue too.

DR. PESCATORE: In fact, the study shows that it is very difficult to define what is community acceptance, which goes in your direction.

MEMBER McFARLANE: Okay, I'm going to do something a little different right now. One of our commissioners couldn't be here today, and he sends his apologies. That's Per Peterson. And he sent me a couple questions which I agreed to ask, and one was just asked.

So there are two more. You started getting into the second one, in which he asks, if local communities were to develop voluntary proposals to host a centralized interim storage or disposal facility, what type of state-level approval or ratification of the proposal should be sought, and when in the proposal development and initial site characterization process should such state-level approval or ratification be sought? So, that's the first question. Why don't you guys go for that, and then I'll --

MR. LEROY: Mr. Chairman, I can speak to our experience. Chuck can probably speak to the theory. When we took over this mission, there was no particular way of coordinating with states. It was not even clear that we did not have the authority to negotiate directly with a locality without considering the wishes of a state legislature or a governor.

I made the decision, once again because we were to find sovereigns with whom to have equal treaty negotiations, in effect, that we would give the governor voluntarily, at any stage in the proceedings when he or she wished to exercise it, a veto power over a county or a municipal subdivision of the state involved in that process. In some regards, although you don't get to the informed or consent part of the populace that's interested, if you have a governor exercise an opt-out very early, there is a utility in that.

Our approach was to try to find willing citizens, willing sovereigns, and we included giving the governor a veto as a part of what we voluntarily determined would be best in conserving limited resources.

MEMBER McFARLANE: Can I ask a clarifying follow-up for that? So, did you also give the governor a veto over the Indian tribes' decisions?

MR. LEROY: Mr. Chairman, Commissioner, we did not because we regarded, as does federal law, the Indian tribes as separate sovereigns. So, as in the case of the Skull Valley Goshutes in Utah who remain, 17 years later, very interested in just such a facility as they proposed talking to us about. There are transportation corridors and other issues that do involve the states, but in terms of consent, we allowed the states to express it early in terms of their own subdivisions.

In terms of tribes and tribal relations, we attempted to involve congressional delegations and governors in as much information about where the process was with those entities as possible, but we gave neither of those governmental groups a veto power over tribal initiatives.

MEMBER McFARLANE: In hindsight, was this the right thing to do?

MR. LEROY: Mr. Chairman, Commissioner, I believe so. As I hinted, and without giving details then, now or in my remarks, we actually had a governor who met with us to talk about state approval, and some of those things on that checklist of benefits came from that governor's initiative and were initially explored, although the state never got to the point during the limited time that we existed of filing an application. There was a possibility that that state would have done so.

But it seemed to me that, back to the informed consent observation of Mr. Sharp, in each of these jurisdictions, tribal or otherwise, you have to take their own judgment, have their own entities, and each citizen within those entities a measure of how much is enough to be informed and by what process do they consent. We tried to discourage very quick and early votes on anything, whether it be by county commission or by a plebiscite.

In the case of some Indian tribal organizations that may have had a tribal council at the front of the room but may have had a matriarchal society for the last 10,000 years, it wasn't anybody in the front room that was making the decision. It was the wonderful little grandmother of the Bear Clan in the back wrapped in a shawl that was going to actually make the decision. You have to take your volunteers you find them.

MEMBER McFARLANE: Great. So the second question is for is for Dr. Pescatore. Dr. Peterson writes, "In your written testimony, you recommend that 'successful disposal facility siting implies creating the conditions for continued ownership of the facility over time' What might be the best way to implement such ownership, for example, if a new nuclear fuel management corporation were created to construct and operate storage and disposal facilities? Would it be helpful to have the majority of corporation's board of directors appointed by governors from states hosting these facilities so these states would collectively have majority control over the Corporation? Are there other approaches?"

DR. PESCATORE: Do I understand correctly, you're asking what for a acceptable facility, the board of directors of this corporation is to be a represented --

MEMBER McFARLANE: I think it's more a question of what's the best kind of management agency, you know, in general. What would you recommend, based on your experience?

DR. PESCATORE: I see that the most successful -- experience shows up to now, the most successful has been agencies which are related to the industry that the nuclear industry has to set apart to build an agency. This is the case in Sweden, the case in Finland, the case in Canada, and also the case in Switzerland, by the way. And to some extent, you can see also in France it is sort of state owned, but it is -- okay, that's independent; that is not state owned. So you must have, perhaps, the industry themselves working towards the problem.

In some states, perhaps in this country, it may be even better for the industry to be seen rather than to be the government, the federal government. I believe that the industry can be more flexible, can be effective to have a leaner operation, and to have really an interest in solving the problem.

So, in industry-based, let's say, institutions, organization could be very effective. This is my feeling.

DR. POWERS: Let me suggest that -- I think what Dr. Pescatore was heading for with focusing on ownership really gets to something very important because if you actually get past the dread point, if somehow there's actually some sort of effective discussion about the possibility of actually doing it, then the next issue is, certainly a relationship to interim storage, is, will they ever leave? And you heard a lot of that at Hanford.

My guess is that the one way is you start looking for mechanisms that give people a sense that they have continuing control over something. So maybe the ownership, even if this whole operation is run by a quasi-public entity, the actual ownership of the site and rights associated with ownership might actually be a way to function, and you work out very long-term leasing agreements that are contemporaneous with whatever it is you have agreed to do about getting the material both there and off the site.

Trying to figure out what it is that is going to sound persuasive after the series of things that we have not done that we've said we were going to do is going to be a fundamental challenge to any effective siting process, and that's one of the reasons I think that the Commission has to put all these pieces together and come up with something that deals with it.

I think that exploring issues like ownership, very strong liability principles, clear commitments, unbreakable -- and maybe that's why it's possible that you actually have more capacity to do that with tribes than you do with communities that, in fact, because there are sovereign obligations that we've seen within the last year that the federal government sort of owned up to some treaty obligations that it had walked away from for very long periods of time -- that kind of creativity that is particular to the kind of waste being stored or disposed of, that relates to the specific nature of the relationship between the local government, the county, the state, and the possible other entities that have certain kinds of authority in these matters, that needs to be very, very imaginatively explored specifically within the context of this integrated strategy I'm talking about.

DR. PESCATORE: About ownership and imagination, I mean, you can really go very far. Of course, there are many empowerment measures. For instance, people can be also helping, the organizations, for instance, for helping monitor the facility. And there are ways to invest in the education, and education for the community creates opportunities so that they can create out of business on their own. So it can raise the knowledge level of the community.

But you can also be more imaginative. Some of the things we're thinking, for instance, is create a facility that is distinctive. This is, for instance, if a facility can begin a cultural value. Is the whole country 20 percent of the energy for, I don't know, for 30 or 40 years that is basically now represented there? So it can be given cultural value with that.

This facility need not to be ugly. You need not to separate, to fence off the land for 10,000 years. You can say, look, I mean, as soon as we are done with some part of the land, we can visit it; we can make a park; we can do a barbecue there. You could do this. You could do these things. It's not crazy. So you must think in terms of distinctiveness, understandability of amenities. There are things you can do from the point of view of creativity. I believe this is going to happen.

Next April we'll be going to have this national workshop that usually we have in Sweden. One of the activities, in fact, will be to talk to the town architect who is involved in this, and we have published, in fact, a report on this type of creativity. The idea is the added value, giving it additional value, and to continue this relationship for a long time. In the beginning, nobody wanted it. Now, everybody wants it and wants to maintain it. They want to keep the memory of it, and so on.

So there is enough interest, enough money, to do amazing things.

DR. POWER: Don't lose track of the fact that you're working in a somewhat different context than David Leroy was working.

Incidentally, I spent a little time trying to help his process, and what he described today, it was amazing that with this tiny staff, he was able to sort of put this whole thing together, and it's really a shame that the country couldn't figure out a way of continuing to support the Office and see whether or not some of what he had going would actually get going.

But I really suspect that we're sort of shortchanging the difference of the context of within which you're functioning. People do know now in ways that they did not before, or they're learning very quickly, that nuclear energy does not generate greenhouse gases. That is part of why it's important. They've learned the importance for national security and for all the things I'm not, you know, I decided not to talk about all because you know them all. But that creates a different context. And he was functioning beginning five years after Chernobyl. We're now way out there.

This post-doc I have working for me is actually, who's both doing focus studies but also doing a lot of sort of anecdotal epidemiology, thinks that there may really be a difference between what people under 25 are thinking about these issues than what it was that those of us that have the kind of gray hair that both David and I do.

I'm sorry, David.

CHAIR SCOWCROFT: Are there any other questions?

(No response.)

CHAIR SCOWCROFT: If not, I'd like to thank the panel for a very stimulating discussion. We appreciate it very much.

We will stand adjourned until 8:30 tomorrow morning.

Thank you very much.

(Whereupon, the Committee was adjourned at 4:45 p.m.)

E