NATIONAL ENERGY POLICY: NUCLEAR ENERGY

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY AND AIR QUALITY

OF THE

COMMITTEE ON ENERGY AND COMMERCE

HOUSE OF REPRESENTATIVES

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TUESDAY, MARCH 27, 2001

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ENERGY AND COMMERCE,
SUBCOMMITTEE ON ENERGY AND AIR QUALITY,
Washington, DC.

The subcommittee met, pursuant to notice, at 1 p.m., in room 2123, Rayburn House Office Building, Hon. Joe Barton (chairman) presiding.

Members present: Representatives Barton, Cox, Largent, Burr, Whitfield, Ganske, Norwood, Shimkus, Wilson, Shadegg, Pickering, Bryant, Walden, Tauzin (ex officio), Boucher, Markey, Strickland, Barrett, and Luther.

Staff present: Dwight Cates, professional staff; Yong Choe, legislative clerk; and Rick Kessler, minority counsel.

Mr. BARTON. The subcommittee will come to order.

Today the Energy and Air Quality Subcommittee of the Energy and Commerce Committee will have another in its continuing series of hearings on our energy policy options for the United States. Today we are going to focus on nuclear energy, which currently provides one-fifth of our electricity and is our second-largest fuel source.

We all know how few nuclear plants have been built recently, i.e. none. But that may soon change. Natural gas prices are expected to remain high for the foreseeable future, especially with the current difficulties in gaining access to new resources and building infrastructure to market natural gas.

As this happens, other generation becomes more cost competitive. Our current generation of nuclear plants have shown increases in efficiency and safety, along with decreases in cost, as some of our witnesses will explain later.

Today witnesses will discuss several different parts in the nuclear industry with a focus on the future. I want to commend Chairman Meserve of the Nuclear Regulatory Commission for all of his leadership efforts. Unfortunately, he cannot be here today. I have heard good things about his leadership and continue to work with him and the Commission and believe his interaction with this subcommittee has been very, very cooperative.

I do want to thank Dr. Travers, who is here today for the NRC, and I also want to thank our friends from the Department of Energy and the Energy Information Agency for being here.

Commercial witnesses on our second panel include Entergy, a utility that has decided to make nuclear energy a part of its strat-

egy for the future. Another witness can talk about one of the next generation technologies that might make up future nuclear plant orders—the Pebble Bed Modular Reactor.

It is important to note that there are other competing technologies, some of which have already been approved by the NRC. In general, future plants will be easier to permit because of the uniformity, less expensive because of their next generation technology, and more efficient as a power generator.

Later in this Congress, this subcommittee will begin to explore the vitally important issue of the nuclear fuel cycle concerning our Nation's mining, conversion, and enrichment capability. I welcome any statements for the record that those entities might offer.

Mr. John Longenecker is here today to speak on those issues as a whole as the focus today is somewhat more on the regulatory side.

Finally, the incredibly important issue of nuclear waste policy will be dealt with by this subcommittee later in this Congress. We all await news of the scientific work that is being currently done at Yucca Mountain and the site recommendation that is due to the Secretary of Energy later this year.

This subcommittee, on a bi-partisan basis, reported legislation last year dealing with the budget issue, environmental standards, interim storage, transportation, and on the waste storage issue. We will discuss this same issue again later this year and hopefully successfully resolve it, put a bill on the President's desk that he can sign.

A problem with spent fuel cited at more than 100 sites throughout our nation is getting worse, not better. The Federal Government must live up to its obligations to take that waste out of its distributed locations and get it safely in one proper repository. If a Federal solution is not found soon, some plants will be forced to close, not because of problems with the plants but because of laws dealing with the waste that they generate.

That would mean that our electric reliability would be threatened. We have seen first-hand in California the effect on the economy and livelihood of consumers what happens when dysfunction occurs in the electricity markets. In the first half of this year, we will hold a hearing specifically on nuclear waste, Yucca Mountain, and the Federal Government's progress toward that decision deadline.

We will also look at the hearing record to draft a comprehensive national energy policy that almost certainly will include a revitalization and nuclear option. We should identify changes in laws and regulations that promote retention of the nuclear option and even its expansion.

The Price-Anderson Act is up for reauthorization during this Congress, and we must address liability and disaster preparedness issues to send the signal that new next generation nuclear plants are welcome in this country. Nuclear will and must be a part of a balanced policy.

For those who want a reliable electricity source from plants with growing efficiency in a fuel source of domestic supply, I say, "Look at nuclear." For those who don't like dams or natural gas pipelines, I say, "Look at nuclear." And for those concerned about emissions

from coal plants, I say, "Look at nuclear." You kind of get the message in this.

In my opinion, after all of the hearings in this and previous Congresses, one cannot possibly discuss a balanced energy portfolio without taking a fresh and unbiased look at nuclear power. I look forward to the testimony of the witnesses today and the questions that the subcommittee is going to ask.

I would now like to recognize the ranking minority member, a distinguished gentleman from Virginia, Congressman Boucher.

Mr. BOUCHER. Thank you very much, Mr. Chairman. Today we will learn about the current contribution of nuclear power to our national energy portfolio, its future potential, and what steps, if any, we might take in order to ensure that nuclear energy has a place in a balanced energy portfolio for the future.

In that light, I am very pleased to note that our subcommittee will hear testimony later this afternoon from the Senator from New Mexico, Mr. Domenici. As chairman of both the Senate Budget Committee and also the Energy and Water Appropriations Subcommittee, Senator Domenici is uniquely well-positioned to comment on energy policy, and I look forward very much to his testimony and to having the benefit of his insights.

After coal, nuclear plants are our Nation's second-largest source of electricity and generate approximately 20 percent of our total electricity output. But there is increasing uncertainty about the future role that nuclear energy will play in our Nation's energy mix.

Although the Energy Information Administration identifies a total of 259 nuclear units that were ordered since the 1950's, all of those orders occurred before 1978. No new orders for commercial nuclear power plants were placed during all of the Reagan, Bush, or Clinton Administrations.

Similarly, no new construction permits have been issued since the end of the Carter Administration. Furthermore, the total number of cancellations by utilities of ordered units stands at 124. The uncertainty surrounding the role of nuclear energy may be due, in part, to the fact that nuclear power production has proven to be highly capital-intensive.

Siting is also a problem for nuclear power plants. Despite a commendable safety record during the course of the past decade, the public's negative perception of nuclear power has not changed significantly during the past 20 years.

Another matter of concern is the current state and uncertain future of our Nation's domestic nuclear fuel production capability, in view of the privatization of the U.S. Uranium Enrichment Corporation. The problems attending its privatization were clearly delineated by a recent decision of the United States District Court for the District of Columbia, and its ongoing problems have been the source of numerous inquiries by this subcommittee and its individual members, particularly Mr. Strickland and Mr. Whitfield.

Finally, there is the question of nuclear waste disposal. Chairman Barton, the ranking member on the full committee, Mr. Dingell, and other members of this committee have demonstrated a bipartisan and serious commitment to ensuring that waste from our Nation's nuclear power plants will be disposed of permanently in an environmentally safe and scientifically sound manner.

But that goal may be slipping away from us because of the diversion of ratepayer money from the nuclear waste fund for other purposes—an event that is threatening to derail the repository program which is paid for through the nuclear waste fund. And that fund was created under the 1992 Act to pay for the DOE repository program.

While more than $15 billion has been paid into the fund, only about $6 billion has been appropriated for the repository program. Data provided to the subcommittee by the DOE in recent years indicates that unless the balance in the waste fund is restored, the repository program will face significant funding shortfalls beginning in 2003, which in turn could jeopardize prospects for opening the repository by 2010.

Moreover, if damages from utility lawsuits are determined to be awarded from the waste fund, and not from some other governmental source, the funding shortage will be significantly exacerbated. The only way that we can truly remedy this situation is to restore the nuclear waste fund to its off-budget status, as this committee voted to do by a margin of 40 to six during the last Congress.

Surely, in a time of great surplus, we can afford to take this simple but essential step. And I look forward to working with my colleagues here, as well as in the other body, to accomplish this goal.

Mr. Chairman, despite these challenges, I note that during our testimony today we will have witnesses from two electric utilities who are optimistic about the prospects for nuclear energy in the future. And I think that is a positive development.

In order to assure access to affordable, safe, and reliable energy, we must develop a balanced energy portfolio and, in my view, nuclear power should be part of that mix. The Federal Government already helps the nuclear industry by limiting its liability under the Price-Anderson Act.

And among the items which should be on the agenda of this subcommittee is the reauthorization of the Price-Anderson legislation during the course of this Congress. And we should ensure that a permanent nuclear waste repository will open by the end of this decade.

These efforts, taken together, may or may not prove sufficient. Some utilities and their shareholders foresee a future for nuclear industry. Their advice concerning the steps this committee should take to address the several problems that confront the industry will be most welcome, and I want to commend you, Mr. Chairman, for assembling this afternoon an excellent conversation on this subject with knowledgeable witnesses who I am sure will provide outstanding guidance.

Mr. BARTON. I thank the gentleman from Virginia.

We now welcome the gentleman from Kentucky, Mr. Whitfield, for an opening statement.

Mr. WHITFIELD. Thank you, Mr. Chairman. As many people know, the Paducah Gaseous Diffusion Plant will soon become the only uranium enrichment facility in operation in the United States. We also have one remaining converter of natural uranium in this country, and that conversion plant is located in Metropolis, Illinois.

Just last week, the Nuclear Regulatory Commission approved the high assay upgrade license at the Paducah plant to allow the plant to enrich uranium to the 4 or 5 percent level needed to power nuclear reactors. As has been stated, nuclear power supplies about 22 percent of our Nation's electricity, but nuclear power plants obviously cannot operate without enriched uranium.

As I stated earlier, there will soon be only one enrichment facility in this country, and over half of our domestic supply of uranium comes from Russia. But the Russian supply has been interrupted five times in 5 years, and many people fear it will soon become too costly to produce enriched uranium in the U.S. because it is cheaper to import from foreign sources.

The electricity crisis in California has taught us many lessons, and one is that it reminds us, once again, we can ill afford to rely on only one form of power generation in America, and particularly as demand continues to exceed supply. Nuclear energy is a key component to providing for our power needs now and in the future as the existing plants obtain relicensure to operate for another 20 years, and hopefully we will have new power plants coming online.

As we go through this hearing, there are a number of issues we must focus on, but I want all of us to remember the importance of protecting our domestic capability to enrich uranium in the U.S., and I look forward to the testimony of our panels. And I yield back the balance of my time.

Mr. BARTON. We thank the gentleman from Kentucky.

We now recognize the gentleman from Massachusetts for an opening statement.

Mr. MARKEY. Thank you, Mr. Chairman, very much. And I thank you for calling today's hearing. It is very, very timely.

Tomorrow is the 22nd anniversary of the Three Mile Island nuclear accident, and April 26 will mark the 15th anniversary of the Chernobyl nuclear accident. Now these two events—Three Mile Island and Chernobyl—stand as a stark warning to us about the enormous risks and dangers inherent in nuclear reactor operations.

The nuclear industry supporters like to say that more people have died from other forms of electricity generation than from nuclear power. But when there is an accident in a coal mine, they don't give warnings to pregnant women and children to evacuate all of Central Pennsylvania. When there is an explosion of a natural gas pipeline, they don't force 100,000 people to flee the area and to throw away all fresh vegetables and fruit across Europe.

While offsite exposures at Three Mile Island were low, we now know that we came close, very close, to a catastrophe. At Chernobyl, at already know that at least 31 people have died, 140 people suffered severe radiation sickness and impairment, and hundreds of thousands more were exposed to significant levels of radiation.

Of course, the full human cost of the Chernobyl disaster is still unknown, as those who have been exposed face the dread prospect of thyroid cancers and other radiation-induced illnesses.

And what of nuclear waste? When are we ever going to solve that issue? If the nuclear industry is so clean, why is the nuclear utility industry trying to weaken groundwater protection standards—weaken—for the Yucca Mountain waste repository? If it is so clean,

why is the nuclear industry trying to take away the EPA's power to establish these standards and give it to the NRC?

If it is so safe, why is the nuclear industry seeking to retain taxpayer-subsidized Price-Anderson insurance? If it is so safe, why is the industry so insistent on retaining the provisions of Price-Anderson that indemnify the DOE contractors transporting spent fuel from any liability in the case of an accident? The Mobil-Chernobyl provision.

And if nuclear power is so economically viable, why is the industry seeking taxpayer financed Federal subsidies in the form of special tax breaks, special R&D subsidies, and even a Federal subsidy to help defray future licensing costs? If it is so economic, why do we provide government subsidized irradiation services for years, a subsidy that we will revive if we were to bail out the U.S. Enrichment Corporation as some now desire?

If it is so economic, why do the utilities come in for bailouts of their so-called stranded nuclear investments? Just over the last 5 years, bailouts that disguise the true costs of nuclear power by shifting acquisition and construction costs from nuclear utility shareholders to captive utility consumers.

I look forward to obtaining the answers to these questions in the course of the day, so that I can really find out whether or not this is a technology which is economical, is safe, and is clean.

I thank you, Mr. Chairman.

Mr. BARTON. I thank the gentleman.

The gentlelady from New Mexico, Congressman Wilson, is recognized for an opening statement.

Ms. WILSON. Thank you, Mr. Chairman. I appreciate your holding this hearing because nuclear energy has to be part of any comprehensive national energy policy. We have 104 nuclear generating plants in the United States providing some 20 percent of the power that we rely on for electricity.

And over the last decade, power produced by nuclear plants has increased by 30 percent, roughly the equivalent of building 23 new nuclear power plants, while by every measure safety has improved markedly during the same period. The cost to produce nuclear power is less than 2 cents per kilowatt hour, which compares with coal at over 2 cents and natural gas at about 3.5 cents per kilowatt hour.

Yet, with the demand for electricity growing every year, no nuclear power plants are projected to come online by 2020, and nuclear power is projected to decline to only 11 percent of the Nation's electricity generation by 2020. I am here to say today that things are changing.

Since the incident at Three Mile Island, expanding reliance on nuclear power has been a non-starter in America. It has been in the "too hard" column. In the context of rolling blackouts in California, high prices, growing demand for power, and continued environmental protection and global warming concerns, America is taking a second look at nuclear power. And we should.

On this committee we are often charged with assessing risks and benefits, balancing competing interests—in this case, the need to protect the environment and public health with the need to make sure that America's energy needs are met.

We are trying to craft an energy policy for America that will reduce the dependence on foreign oil, make sure adequate power is available at a reasonable price, protect the public health, promote conservation, and minimize impact on the environment. Every source of energy has risks and benefits. Where there are risks we should seek to mitigate those risks, whether by investing in research and clean coal technology or improving the safety designs of nuclear reactors. But we cannot take one energy source off the table as we have in the last 20 years.

One of the barriers to increasing nuclear power capacity is the capital cost of plants, and there is new and emerging power designs, some of them being tested in South Africa, that promise the possibility of making the capital cost competitive with other kinds of technologies.

We have challenges to address—opening Yucca Mountain, reauthorizing Price-Anderson, regulatory streamlining. It is time to take on those challenges and take nuclear power out of the "too hard" category.

Thank you, Mr. Chairman.

Mr. BARTON. We thank the gentlelady.

We recognize Congressman Strickland for an opening statement.

Mr. STRICKLAND. Thank you, Mr. Chairman. I am pleased that we are holding this hearing today because I believe, as I have stated at previous subcommittee meetings, that we face an urgent problem in this country; that is, the demise of a reliable domestic nuclear fuel supply.

Last year, on June 20, the United States Enrichment Corporation announced it would cease production at the Portsmouth, Ohio, gaseous diffusion plant in my district. This decision by USEC leaves one gaseous diffusion plant in this country located in my friend Mr. Whitfield's district in Paducah, Kentucky.

This decision is alarming, Mr. Chairman, because the Portsmouth facility is the only plant with the capability of enriching uranium to the desired commercial assay. I understand this past Saturday the Paducah plant was able to enrich a little over 4 percent assay. I think that is good news. But it is important to note that reactors presently use nearly 5 percent assay, and the trend is toward higher assay fuel.

Portsmouth is the only plant licensed to enrich up to 10 percent assay. As you know, over 20 percent of electricity in this country comes from nuclear generation. Currently, the U.S. depends on imports from Russia for over 50 percent of its nuclear fuel, and we understand that USEC is proposing to import even more fuel from Russia's commercial vendors, which would place U.S. nuclear power plants in an OPEC-like dependency on Russia.

Given this existing dependency on Russian material, it seems absolutely reasonable to request that the Portsmouth plant is placed in a warm standby mode until we know for sure that the Paducah plant is capable of enriching uranium to commercial-grade over a reasonable period of time.

Mr. Chairman, I have reviewed a number of reports which have been released by GAO, the NRC, and DOE in the last few months, and a particular report by the NRC predicts that the Paducah plant may cease to be economically viable after the year 2003. If

the NRC is correct, and Paducah is not viable after 2003, do we want to become dependent upon Russia for nearly 80 percent of our nuclear fuel supply?

I say again, we have an urgent problem on our hands, one that must be addressed within the next few weeks or the next few months. Certainly, we don't have years. And I hope today's hearing will shed some light on what it is that we can do as a Congress, or what the administration and the Congress can do together, to make sure that our Nation's energy supply is secure.

Thank you, and I look forward to our witnesses.

Mr. BARTON. We thank the gentleman from Ohio.

The distinguished full committee chairman, Mr. Tauzin, is recognized for an opening statement.

Chairman TAUZIN. Thank you, Mr. Chairman. Mr. Barton, thank you for holding the hearing today for examining the critical role that the Nation's energy infrastructure plays in the life of our country, and the fact that nuclear now supplies as much as 20 percent of the Nation's electricity cannot be forgotten.

Interestingly enough, over the past decade, the same nuclear reactors that provide our country with 20 percent of our electricity have increased their output and efficiency by 30 percent, and that's pretty remarkable considering that we haven't licensed a new nuclear plant for many years.

Recently I have noticed, however, initial stages of resurgence in nuclear power and the interest of building new nuclear plants. The current energy crisis we are in requires us to understand that natural gas and coal should not be the only fuel sources for developing our future electric generation capacity.

Likewise, nuclear reactors have become a hot item in restructured markets. Six reactors have changed hands in the last 24 months. Several electric utilities have outlined aggressive plans to invest and to extend the life of existing plants because they are still reliable and provide a competitive stream of electricity.

Witnesses today will reveal that some utilities are contemplating the construction of new nuclear plants, and that is good news for maintaining the diversity of fuels that our country requires.

I want to make it clear, however, that it is not Congress or the administration which will determine how many nuclear reactors should be in operation. Ultimately, the fate of nuclear power will be determined by the private sector, and energy markets will determine whether new and existing nuclear plants are an economical source of generating capacity.

But the actions we take here in Congress can directly affect the future outlook for maintaining a mix of fuels that obviously should include nuclear energy.

Here are the few issues that I think we need to consider, Mr. Chairman. First, the compensation liability provisions of the Price-Anderson Act are set to expire in the year 2002. It is important that Congress reauthorize Price-Anderson, because without it there will be no real opportunity to construct or to operate new nuclear facilities.

Second, the NRC must regulate reactors to ensure they are safe. The NRC must administer its authority in a consistent and even-

handed manner that does not discourage companies from future investments in nuclear power.

Third, the NRC must be prepared to renew as many as 30 reactor licenses that are set to expire in a few years. They recently renewed licenses to extend the life of five reactors in the states of Maryland and South Carolina, but, obviously, with 30 requiring action the NRC must be prepared to manage dozens of renewal requests in the near future.

Fourth, it has been 20 years since they issued a new license to construct a nuclear reactor, and we should all be concerned that the NRC may be a little rusty in responding to any future requests.

Fifth, Congress and the administration must work harder to sell the long-term disposal of spent nuclear fuel, and this is not just a problem for the nuclear industry but also a big problem for the Department of Energy. In the long run, it is not safe to store spent nuclear fuel in dozens of locations around the country at facilities designed only for short-term storage. Continued uncertainty here will only discourage future development of nuclear power.

The nuclear industry, the administration, and Congress must focus our attention on the future viability of our domestic fuel industry as the gentleman just spoke to. We must make sure that the country can produce nuclear fuel to feed our future energy needs and to maintain our national security interest.

That is just a short list, Mr. Chairman, and I am sure this hearing and other hearings will develop more. But I want to thank you for identifying these issues and making this inquiry a major part of the fuel and energy review that your committee is undertaking in advance of producing with the administration a new energy policy for this country.

Nuclear is, and will be, a major component of that policy. This hearing is, therefore, critically important.

I thank you and yield back the balance of my time.

Mr. BARTON. We thank the distinguished full committee chairman.

The gentleman from Georgia, Mr. Norwood, is recognized for an opening statement.

Mr. NORWOOD. Thank you, Mr. Chairman. I am sorry I was a minute late. I was trying to time it so I could follow Mr. Markey, and, doggone it, I missed it by one. I particularly thought he would enjoy my opening statement.

I thank you very much for conducting this hearing today on nuclear energy and its role in the national energy policy of our country. I am glad to be here today discussing this subject, because I believe that everyone's goal of enacting coherent, comprehensive energy policy is contingent upon developing and maintaining a sound nuclear energy policy.

Nuclear power plants generate approximately one-fifth of the electricity consumed in the United States, second only to that of coal. Given the relatively stable price of nuclear fuel, nuclear power is the lowest cost power in the nation, averaging below 2 cents per kilowatt hour, well below the 3 to 4 cents per kilowatt hour cost of natural gas.

Nuclear power generation enjoys significant environmental advantages encompassing the largest source of emission-free genera-

tion of electricity in the United States. Nuclear power doesn't hurt the ozone or cause smog. Electricity generated from the 103 U.S. nuclear plants account for roughly two-thirds of the emission-free electricity, far exceeding hydropower's contribution of approximately 29 percent.

Innovation with the research and development of sound science has proved that disposal and storage of spent nuclear fuel can be done in a safe and an environmental-friendly manner. We are now very close to selecting Yucca Mountain as a permanent repository for spent nuclear fuel. However, many, many years have passed since the last permit was issued to construct a nuclear plant in this country. Given the evidence in support of nuclear power generation, I fail to understand why.

I have said it before, but I would like to say it again here today, Mr. Chairman. Electricity is the lifeline of our economy and is of paramount importance to the entire public interest. Electricity disruption and unreliability on a national scale in my view would be catastrophic. If you don't believe me, just ask our friends out in California.

The United States cannot afford to allow politics to continue to dictate something contrary to good science and good public policy.

Thanks to our competent chairman and his leadership, this subcommittee has now held three hearings on the current crisis in California. Although a number of factors have contributed to the problems there, at the end of the day it is still a problem of supply and demand. Demand for electricity in the United States is projected to continue rapid and expansive growth.

Nuclear energy is reliable, competitively priced, and emission-free. No other generation source of electricity can provide significant amounts of low-cost and reliable power while enhancing air quality.

Mr. Chairman, I appreciate the substance of these hearings, but, more importantly, the open and methodical process in which they have been held. It is a pleasure to work with this subcommittee as we seek to craft what will be a real and comprehensive energy policy.

Mr. BARTON. I thank the gentleman from Georgia, and let me say I look forward to working with him on health policy when I have a chance to get to the Health Subcommittee.

Mr. NORWOOD. I will take care of it for you. Don't worry.

Mr. BARTON. I know you will take care of it.

The gentleman from Oregon, Mr. Walden, is recognized for an opening statement.

Mr. WALDEN. Thank you, Mr. Chairman. I will forego an opening statement at this time.

Mr. BARTON. Seeing no other members present, the Chair would ask unanimous consent that all members of the subcommittee not present have the requisite number of days to put their statement in the opening record at the appropriate point. Hearing no objection, so ordered.

[Additional statements submitted for the record follow:]

PREPARED STATEMENT OF HON. GREG GANSKE, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF IOWA

Mr. Chairman: I welcome Senator Domenici to the committee today and look forward to his thoughts on the future of nuclear energy. I am aware that nationwide nuclear power plants produce approximately twenty percent of the electricity consumed in the United States. However, my state of Iowa has only one nuclear facility in operation, the Duane Arnold nuclear power plant in Palo. Even with only one facility in my state, I am acutely aware of the need to establish a permanent repository for spent fuel. The Nuclear Waste Policy Act of 1982 required that a site be established no later than January 31, 1998. Of course we all know that this has not taken place.

This has caused local facilities to build more on-site storage facilities, which is not the best public policy option. The current goal of the Department of Energy for opening of the permanent site is now 2010 . . . twelve years past the original deadline.

Mr. Chairman I am very aware that this committee has not been a part of the problem, and has indeed been a part of the attempted solution. However, I hope that this is the year that we can finally give some certainty to the future on this issue and get legislation completely through the process and adopted into law to address this matter.

I am among those Members who are concerned about the level of carbon dioxide emissions worldwide and the impact that those emissions are having on the earth's temperature. Based only on emissions factors, obviously nuclear power presents a more favorable alternative. However, I feel we must resolve the questions regarding long term waste disposal before we consider expansion in the industry. Our cumulative experience in attempting to create a national permanent waste repository over the last two decades . . . has not been very encouraging. Thank you Mr. Chairman and I yield back my remaining time.

PREPARED STATEMENT OF HON. JOHN SHIMKUS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ILLINOIS

Good afternoon, Mr. Chairman and to all whom have shown up this afternoon. I am looking forward to this hearing today.

I would very much like to thank the Chairman for holding this hearing today. As many of you here today know, I am from Illinois, which is home to more nuclear power plants than anywhere else in the country. So my opinion maybe a little biased.

As we will hear from most of the witnesses today, nuclear is making a comeback. Only a few short years ago, the general public perception was that nuclear energy was at death's door. To paraphrase Mark Twain, the reports of nuclear's death have been greatly exaggerated. Not only have they been exaggerated, but nuclear energy is close to becoming our energy leader for the future.

Nuclear is cheap and nuclear is emission-free. Over the last ten years nuclear energy has also become safer and more efficient. The 103 plants that currently operate today produce more power than 110 plants did just 6 years ago.

When talking about nuclear energy in a national energy policy, one thing is clear. If a cleaner environment and more affordable and reliable energy is the goal of a national energy policy, then nuclear energy must play a more pronounced role.

A couple of weeks ago, many here heard me talk about all the positives of coal, another fuel that is plentiful in Illinois. I believe that coal, and nuclear and natural gas and hydro and all the other fuels need to part of a balanced national energy policy. Like any good retirement portfolio, we need to have a national energy policy that is diversified and uses all of our resources.

The only real downside to nuclear energy is figuring out what to do with the waste. Yesterday, I visited Yucca Mountain with my colleague from Illinois, Mark Kirk. What I saw and heard there has solidified my belief that Yucca Mountain is a suitable place for a permanent repository. The only thing that is holding it back is politics, because the science is there. I would encourage my fellow members, whether you are for or against Yucca Mountain, to visit there and hear what the scientist have to say. I'm sure you find it as educational as I did.

In closing Mr. Chairman, I would like to give you one statistic. Currently, France generates 80% of their energy from nuclear power. If the US did that, we would be 10% below the emission levels outlined in the Kyoto Protocol.

Thank you.

PREPARED STATEMENT OF HON. ED BRYANT, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TENNESSEE

Mr. Chairman, thank you for holding today's hearing on nuclear energy. For too long, nuclear energy has had an image problem, despite its many advantages. When many Americans think about nuclear energy, they envision the bumbling Homer Simpson asleep at the control panel while the Springfield Nuclear Power Plant is on the verge of a meltdown. While the antics of Homer Simpson make for great comedy, the misrepresentation of nuclear power is no laughing matter.

It's not often that I would find anything to compliment the French on, but France, by generating 80 percent of its electricity with nuclear power, has reduced its air pollution by a factor of five. However, nuclear power's future in the U.S. remains questionable because of the negative images of Three-Mile Island and Chernobyl, despite its advantages as a source of electricity free of harmful emissions.

In reality nuclear energy is quite safe. Comprehensive and highly reliable automated safety procedures at nuclear plants operating in the U.S. keep the communities they are located in safe. The public stigma surrounding nuclear plants is one of several obstacles the nuclear power industry must overcome.

Other obstacles include high initial construction costs, operating and maintenance expenses, long lead times, and regulatory uncertainty for new plants, which restricts the utilization of this generation option.

We must streamline the regulatory process for nuclear power plants in the U.S.

In addition, we must address unanswered questions about how to dispose of low-level nuclear waste and spent fuel from nuclear power plants. Currently, spent fuel is being stored on-site at nuclear power plants across the nation.

Our nation's 103 nuclear power plants are valuable assets to the companies that own and operate them, as well as to the consumers that buy the electricity they produce. Nuclear power represents a vital hedge between the volatility of the natural gas market because of their predictable and stable operating costs. Unlike coal-fired plants, nuclear plants do not have to deal with constantly escalating environmental requirements and clean air standards that drive up production costs.

From the rolling blackouts in California to our nation's dependence on foreign oil, the recent convergence of energy disasters is a wake-up call to this Congress to develop a National Energy Policy.

In terms of environmental benefits, cost, and efficiency, nuclear energy should be a major part of a comprehensive National Energy Policy.

I look forward to hearing the testimony of the experts on today's panel, and once again I thank the Chairman for addressing this issue.

PREPARED STATEMENT OF HON. BILL LUTHER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MINNESOTA

Thank you Mr. Chairman for holding today's hearing on nuclear energy. I am particularly pleased that you have included a public interest advocate to discuss some of the very real problems of long lasting radioactive wastes for which there currently is no safe viable solution. I am also hopeful that as we continue this series of hearings on domestic energy markets, we begin to focus more on renewable and alternative energy sources. Any national energy policy not weighed heavily toward developing new technologies will not result in long term solutions to today's growing energy crisis. Thank you and I yield back the balance of my time.

Mr. BARTON. We would now like to welcome our first panel today. We have, representing the Nuclear Regulatory Commission, Dr. William Travers, who is the Executive Director for Operations for the NRC. We have Mr. William Magwood, who is the Director of the Office of Nuclear Energy, Science and Technology, from the Department of Energy. And we have Ms. Mary Hutzler, who we had last week I believe, who is the Director for the Office of Integrated Analysis and Forecasting from the Energy Information Administration.

We will start with Dr. Travers, and go to Mr. Magwood, and then Ms. Hutzler.

At approximately 2 p.m., we expect that Senator Domenici is going to be here to testify on a nuclear reform bill that he has just

put into play in the Senate. So we may have to break to let him testify when he arrives.

Your statement is in the record in its entirety. We would recognize you for 7 minutes, Dr. Travers, to elaborate on it.

STATEMENTS OF WILLIAM D. TRAVERS, EXECUTIVE DIRECTOR FOR OPERATIONS, U.S. NUCLEAR REGULATORY COMMISSION; WILLIAM D. MAGWOOD, DIRECTOR, OFFICE OF NUCLEAR ENERGY, SCIENCE AND TECHNOLOGY, U.S. DEPARTMENT OF ENERGY; AND MARY J. HUTZLER, DIRECTOR, OFFICE OF INTEGRATED ANALYSIS AND FORECASTING, ENERGY INFORMATION ADMINISTRATION

Mr. TRAVERS. Thank you, Mr. Chairman, members of the subcommittee. I am pleased to testify today on behalf of the Nuclear Regulatory Commission regarding the NRC's perspective on how nuclear energy fits into the national energy policy.

As the subcommittee knows, the Commission's statutory mandate is to ensure the adequate protection of public health and safety, the common defense and security, and the environment, in the application of nuclear technology for civilian use.

Although the Commission's primary focus is on safety, it nonetheless recognizes that the quality, predictability, and timeliness of its regulatory actions bear on licensee decisions related to construction and operation of nuclear power plants. The Commission also recognizes that its decisions and actions as a regulator influence the public's perception of the NRC and ultimately the public's perception of the safety of nuclear technology.

Currently, there are 104 nuclear power plants licensed by the Commission to operate in 31 different states. As a group, they are operating at high levels of safety and reliability. These plants have produced approximately 20 percent of our Nation's electricity over the past several years, and in 2000 they produced a record 755,000 gigawatt hours of electricity.

The Nation's nuclear generators have worked over the past 10 years to improve nuclear power plant performance, reliability, and efficiency, while ensuring operational safety. The improved performance they have achieved is equivalent to placing 23 new large plants online. The Commission has focused on ensuring that safety has not been compromised as a result of these industry efforts.

The nuclear industry has undergone a period of remarkable change. As electricity restructuring proceeds, the Commission is witnessing the start of the consolidation of nuclear generating capacity among a smaller group of operating companies and the development of a market for nuclear power plants as capital assets. As a result, the Commission has seen a significant increase in the number of requests for approval of license transfers. These requests increased from a historical average of about 2 to 3 per year to 20 to 25 in the past 2 years. The NRC has completed a number of improvements to its license transfer review process, and in calendar 2000 we reviewed and approved transfers in periods ranging from about 4 to about 8 months. The Commission intends to strive to continue to perform at this level of proficiency even in the face of continued high demand.

Another result of the new economic conditions is an increasing interest in license renewals beyond the original 40-year term. That term, which was established by the Atomic Energy Act, did not reflect an engineering or a scientific limitation, but rather was based on financial and antitrust concerns. The Commission now has the technical bases and the experience on which to base judgments about the potential useful life and safe operation of facilities.

The Commission has already reviewed the licenses of five units at two sites for an additional 20 years, and I am happy to report that the reviews of these licenses were completed on or ahead of schedule. Applications from an additional five units at three sites are currently under review, and many more are anticipated in the coming years.

In recent years, the Commission has approved numerous license amendments that permit its licensees to make small power uprates. Collectively, these uprates supply the electricity equivalent to that of two large power plants. The Commission has received applications for several more substantial uprates and anticipates others within the near term.

The Commission has responded to numerous requests to approve spent fuel cask designs for onsite dry storage. These actions, which are expected to increase as other nuclear power plants require additional fuel storage, are providing an interim approach pending implementation of a program for the long-term disposition of spent fuel.

Certain matters also need to be resolved in order to make progress on a geologic repository. The Energy Policy Act of 1992 requires the EPA to promulgate general standards while the Commission has the obligation to implement those standards. As you know, the Commission has concerns about certain aspects of EPA's proposed approach and is currently working with EPA to resolve these issues.

The Commission also is in a period of dynamic change as the agency moves toward a more risk-informed and performance-based regulatory paradigm. Perhaps the most visible aspect of this effort is the new reactor oversight process. The new process was developed to focus inspection effort on those areas involving greatest risk while simultaneously providing a more objective and transparent process. The Commission continues to work with its stakeholders to assess the effectiveness of this new process, and to date the feedback received from both the industry and the public, in general, is favorable.

In this period of increasing demand for electricity, serious industry interest in new construction of nuclear power plants in the United States has recently emerged. As you know, the Commission has already certified three advanced reactor designs. In addition to these, there are new nuclear power plant technologies such as the Pebble Bed Modular Reactor which some believe can provide enhanced benefits. The Commission recently directed the staff to assess its capabilities—the capabilities that would be necessary to review an application for a new reactor.

In order to confirm the safety of new reactor technologies, the Commission believes that a strong nuclear research program should be maintained. A comprehensive evaluation of the Commis-

sion's research program is underway with assistance from outside experts. With the benefit of these insights, the Commission expects to undertake steps to strengthen our research program over the coming months.

Linked to these technical and regulatory assessments, the Commission is reviewing its human capital to assure the appropriate professional staff is available for the Commission to fulfill its safety mission. In some offices, nearly 25 percent of the staff are eligible to retire today. In fact, the Commission has six times as many staff over the age of 60 as it has staff under the age of 30. While the numbers of individuals with technical skills critical to the achievement of the Commission's safety mission is rapidly declining, the educational system is not replacing them. The Commission staff has taken steps to address this situation. However, the maintenance of a technically competent staff will require substantial effort for an extended period.

Finally, Mr. Chairman, the Commission will continue to be active in concentrating its staff's efforts on its statutory responsibilities. Those statutory mandates notwithstanding, the Commission is mindful of the need to reduce unnecessary burden, so as not to inappropriately inhibit any renewed interest in nuclear power, to maintain open communications with all of its stakeholders, and to continue to encourage its highly qualified staff to strive for increased efficiency and effectiveness.

Mr. Chairman, that completes my oral statement, and, of course, I will be happy to answer questions.

[The prepared statement of William D. Travers follows:]

PREPARED STATEMENT OF WILLIAM D. TRAVERS, EXECUTIVE DIRECTOR FOR OPERATIONS

INTRODUCTION

Mr. Chairman, members of the Subcommittee, I am pleased to submit this testimony on behalf of the U.S. Nuclear Regulatory Commission (NRC) regarding the NRC's perspective on how nuclear energy fits into the U.S. National Energy Policy. As the Subcommittee knows, the Commission's mission is to ensure the adequate protection of public health and safety, the common defense and security, and the environment in the application of nuclear technology for civilian use. The Commission does not have a promotional role—the agency's role is to ensure the safe application of nuclear technology if society elects to pursue the nuclear energy option. The Commission recognizes, however, that its regulatory system should not establish inappropriate impediments to the application of nuclear technology. Many of the Commission's initiatives over the past several years have sought to maintain or enhance safety while simultaneously improving the efficiency and effectiveness of our regulatory system. The Commission also recognizes that its decisions and actions as a regulator influence the public's perception of the NRC and ultimately the public's perception of the safety of nuclear technology. For this reason, the Commission's primary performance goals also include increasing public confidence.

The Commission's primary focus is on safety. The Commission nonetheless recognizes that the quality, predictability, and timeliness of its regulatory actions bear on licensee decisions related to construction and operation of nuclear power plants.Background

Currently there are 104 nuclear power plants licensed by the Commission to operate in the United States in 31 different states. As a group, they are operating at high levels of safety and reliability.

These plants have produced approximately 20% of our nation's electricity for the past several years and are operated by about 40 different companies. In 2000, these nuclear power plants produced a record 755-thousand gigawatt-hours of electricity.

Improved Licensee Efficiencies (Increased Capacity Factors)

The nation's nuclear electricity generators have worked over the past 10 years to improve nuclear power plant performance, reliability, and efficiency. According to the Nuclear Energy Institute, the improved performance of the U.S. nuclear power plants since 1990 is equivalent to placing 23 new 1000-MWe power plants on line. The average capacity factor[1] for U.S. light water reactors was 86 percent in 1999, up from 63 percent just 10 years ago. The Commission has focused on ensuring that safety has not been compromised as a result of these industry efforts. The Commission will continue to carry out its regulatory responsibilities in an effective and efficient manner so as not to impede industry initiatives inappropriately.

U.S. Commercial Nuclear Power Reactor Average Capacity Factor and Net Generation

Year	Number of Reactors Licensed to Operate	Average Annual Capacity Factor (Percent)	Net Generation of Electricity	
			Thousands of Gigawatthours	Percent of Total U.S.
1989	109	63	528	19.0
1990	111	68	576	20.5
1991	111	71	613	21.7
1992	110	71	620	22.2
1993	109	73	611	21.2
1994	109	75	640	22.1
1995	109	79	674	22.5
1996	110	77	670	21.9
1997	104	74	628	20.1
1998	104	78	673	22.6
1999	104	86	727	19.8

Electric Industry Restructuring

As the Subcommittee is aware, the nuclear industry has undergone a period of remarkable change. The industry is in a period of transition in several dimensions, probably experiencing more rapid change than in any other period in the history of civilian nuclear power. As deregulation of electricity generation proceeds, the Commission is seeing significant restructuring among the licensees and the start of the consolidation of nuclear generating capacity among a smaller group of operating companies. In part, this change is due to an industry that has achieved gains in both economic and safety performance over the past decade and thus has been able to take advantage of the opportunities presented by industry restructuring. The Commission has established a regulatory system that is technically sound, that is fair, predictable, and reaches decisions with reasonable dispatch.

INITIATIVES IN THE AREA OF CURRENT REACTOR REGULATION

License Transfers

One of the more immediate results of the economic deregulation of the electric power industry has been the development of a market for nuclear power plants as capital assets themselves. As a result, the Commission has seen a significant increase in the number of requests for approval of license transfers. These requests increased from a historical average of about two or three per year, to 20-25 in the past two years.

The Commission has assured that our reviews of license transfer applications, which focus on adequate protection of public health and safety, are conducted efficiently. These reviews sometimes require a significant expenditure of talent and energy by our staff to ensure a high quality and timely result. Our legislative proposal to eliminate foreign ownership review could help to further streamline the process. To date, the Commission believes that it has been timely in these transfers. For example, in CY 2000, the staff has reviewed and approved transfers in periods ranging from four to eight months, depending on the complexity of the applications. The Commission will strive to continue to perform at this level of proficiency even in the face of continued demand.

[1] Capacity factor is the ratio of electricity generated, for the period of time considered, to the amount of energy that could have been generated at continuous full-power operation during the same period.

License Renewals

Another result of the new economic conditions is an increasing interest in license renewal that would allow plants to operate beyond the original 40-year term. That term, which was established in the Atomic Energy Act (AEA), did not reflect a limitation that was determined by engineering or scientific considerations, but rather was based on financial and antitrust concerns. The Commission now has the technical bases and experience on which to base judgments about the potential useful life and safe operation of facilities and is addressing the question of extensions beyond the original 40-year term.

The focus of the Commission's review of applications is on maintaining plant safety, with the primary concern directed at the effects of aging on important systems, structures, and components. Applicants must demonstrate that they have identified and can manage the effects of aging so as to maintain an acceptable level of safety during the period of extended operation.

The Commission has now renewed the licenses of plants at two sites for an additional 20 years: Calvert Cliffs in Maryland, and Oconee in South Carolina, comprising a total of five units. The thorough reviews of these applications were completed ahead of schedule, which is indicative of the care exercised by licensees in the preparation of the applications and the planning and dedication of the Commission staff. Applications for units from three additional sites—Hatch in Georgia, ANO-1 in Arkansas, and Turkey Point in Florida—are currently under review. As indicated by our licensees, many more applications for renewal are anticipated in the coming years.

Although the Commission has met the projected schedules for the first reviews, it would like the renewal process to become as effective and efficient as possible. The extent to which the Commission is able to sustain or improve on our performance depends on the rate at which applications are actually received, the quality of the applications, and the ability to staff the review effort. The Commission recognizes the importance of license renewal and is committed to providing high-priority attention to this effort. As you know, the Commission encourages early notification by licensees, in advance of their intentions to seek renewals, in order to allow adequate planning so as not to create unmanageable demands on staff resources.

Reactor Plant Power Uprates

In recent years, the Commission has approved numerous license amendments that permit its licensees to make relatively small power uprates (approximately 2-7 percent increases in the output of a facility). Collectively, these uprates supplied the electricity equivalent to that from two large power plants (approximately 2,000 MWe). The Commission has received applications for several substantial uprates, and anticipates more within the near term. In addition, some nuclear generators have requested Commission safety review of increasing fuel burnup, thereby extending the operating cycle between refueling outages and thus increasing nuclear plant capacity factors. Such approvals are granted only after a thorough evaluation by Commission staff to ensure that safe operation and shutdown can be achieved at the higher power and increased fuel burnup.

High Level Waste Storage/Disposal (Spent Fuel Storage)

In the past several years, the Commission has responded to numerous requests to approve spent fuel cask designs and independent spent fuel storage installations for onsite dry storage of spent fuel. These actions have provided an interim approach pending implementation of a program for the long-term disposition of spent fuel. The ability of the Commission to review and approve these requests has provided the needed additional onsite storage of spent nuclear fuel, thereby avoiding plant shutdowns as spent fuel pools reach their capacity. The Commission anticipates that the current lack of a final disposal site will result in a large increase in on-site dry storage capacity during this decade.

The Commission is currently reviewing an application for an Independent Spent Fuel Storage Installation on the reservation of the Skull Valley Band of Goshute Indians in Utah.

Certain matters also need to be resolved in order to make progress on a deep geologic repository for disposal of spent nuclear fuel. The Energy Policy Act of 1992 requires the Environmental Protection Agency (EPA) to promulgate general standards to govern the site, while the Commission has the obligation to implement those standards through its licensing and regulatory process. The Commission has concerns about certain aspects of EPA's proposed approach and is working with EPA to resolve these issues.

Risk-Informing the Commission's Regulatory Framework

The Commission also is in a period of dynamic change as the Agency moves from a prescriptive, deterministic approach towards a more risk-informed and performance-based regulatory paradigm. Improved probabilistic risk assessment techniques combined with over four decades of accumulated experience with operating nuclear power reactors have led the Commission to recognize that some regulations may not serve their intended safety purpose and may not be necessary to provide adequate protection of public health and safety. Where that is the case, the Commission has determined it should revise or eliminate the requirements. On the other hand, the Commission is prepared to strengthen our regulatory system where risk considerations reveal the need.

Perhaps the most visible aspect of the Commission's efforts to risk-inform its regulatory framework is the new reactor oversight process. The process was initiated on a pilot basis in 1999 and fully implemented in April 2000. The new process was developed to focus inspection effort on those areas involving greater risk to the plant and thus to workers and the public, while simultaneously providing a more objective and transparent process. While the Commission continues to work with its stakeholders to assess the effectiveness of the revised oversight process, the feedback received from industry and the public is favorable.

FUTURE ACTIVITIES

Scheduling and Organizational Assumptions Associated with New Reactor Designs

While improved performance of operating nuclear power plants has resulted in significant increases in electrical output, significant increased demands for electricity will need to be addressed by construction of new generating capacity of some type. Serious industry interest in new construction of nuclear power plants in the U.S. has only recently emerged. As you know, the Commission has already certified three new reactor designs pursuant to 10 CFR Part 52. These designs include General Electric's advanced boiling water reactor, Westinghouse's AP-600 and Combustion Engineering's System 80+. Because the Commission has certified these designs, a new plant order may include one of these approved designs. However, the staff is also conducting a preliminary review associated with other new designs.

In addition to the three already certified advanced reactor designs, there are new nuclear power plant technologies, such as the Pebble Bed Modular Reactor, which some believe can provide enhanced safety, improved efficiency, lower costs, as well as other benefits. To ensure that the Commission staff is prepared to evaluate any applications to introduce these advanced nuclear reactors, the Commission recently directed the staff to assess the technical, licensing, and inspection capabilities that would be necessary to review an application for an early site permit, a license application, or construction permit for a new reactor unit. This will include the capability to review the designs for generation III+ or generation IV light water reactors including the Westinghouse AP-1000, the Pebble Bed Modular Reactor, and the International Reactor Innovative and Secure (IRIS) designs. In addition to assessing its capability to review the new designs, the Commission will also examine its regulations relating to license applications, such as 10 CFR Parts 50 and 52, in order to identify whether any enhancements are necessary.

In order to confirm the safety of new reactor designs and technology, the Commission believes that a strong nuclear research program should be maintained. A comprehensive evaluation of the Commission's research program is underway with assistance from a group of outside experts and from the Advisory Committee on Reactor Safeguards. With the benefit of these insights, the Commission expects to undertake measures to strengthen our research program over the coming months.

Human Capital

Linked to these technical and regulatory assessments, the Commission is reviewing its human capital to assure that the appropriate professional staff is available for the Commission to fulfill its traditional safety mission, as well as any new regulatory responsibilities in the area of licensing new reactor designs.

In some important offices within the Commission, nearly 25 percent of the staff are eligible to retire today. In fact, the Commission has six times as many staff over the age of 60 as it has staff under 30.

And, as with many Federal agencies, it is becoming increasingly difficult for the Commission to hire personnel with the knowledge, skills, and abilities to conduct the safety reviews, licensing, research, and oversight actions that are essential to our safety mission. Moreover, the number of individuals with the technical skills critical to the achievement of the Commission's safety mission is rapidly declining in the Nation and the educational system is not replacing them. The Commission's

staff has taken steps to address this situation, and as a result, is now seeking systematically to identify future staffing needs and to develop strategies to address the gaps. It is apparent, however, that the maintenance of a technically competent staff will require substantial effort for an extended time.

As the Commission is currently challenged to meet its existing workload with available resources, additional resources would be necessary to respond to increased workload which could result from some of the initiatives discussed in this testimony.

IMPLICATIONS OF A NATIONAL ENERGY POLICY

The Commission has a stake in a national energy policy and has identified areas where new legislation would be helpful to eliminate artificial restrictions and to reduce the uncertainty in the licensing process. These changes would maintain safety while increasing flexibility in decision-making. Although those changes would have little or no immediate impact on electrical supply, they would help establish the context for consideration of nuclear power by the private sector without any compromise of public health and safety or protection of the environment.

Legislation will be needed to extend the Price-Anderson Act. The Act, which expires on August 1, 2002, establishes a framework that provides assurance that adequate funds are available in the event of a nuclear accident and sets out the process for consideration of nuclear claims. Without the framework provided by the Act, private-sector participation in nuclear power would be discouraged by the risk of large liabilities.

Several other legislative changes would be helpful. For example, Reorganization Plan No. 3 of 1970 could be revised to provide the Commission with the sole responsibility to establish all generally applicable standards related to Atomic Energy Act (AEA) materials, thereby avoiding dual regulation of such matters by other agencies. Along these same lines, the Nuclear Waste Policy Act of 1982 could be amended to provide the Commission with the sole authority to establish standards for high-level radioactive waste disposal. These changes would serve to provide full protection of public health and safety, provide consistency, and avoid needless and duplicative regulatory burden.

Commission antitrust reviews could also be eliminated. As a result of the growth of Federal antitrust law since the passage of the AEA, the Commission's antitrust reviews are redundant of the reviews of other agencies. The requirement for Commission review of such matters, which are distant from the Commission's central expertise, should be eliminated.

Elimination of the ban on foreign ownership of U.S. nuclear plants would be an enhancement since many of the entities that are involved in electrical generation have foreign participants, thereby making the ban on foreign ownership increasingly anachronistic. The Commission has authority to deny a license that would be inimical to the common defense and security, and thus an outright ban on all foreign ownership is unnecessary.

With the strong Congressional interest in examining energy policy, the Commission is optimistic that there will be a legislative vehicle for making these changes and thereby for updating the AEA.

SUMMARY

The Commission has long been, and will continue to be, active in concentrating its staffs' efforts on ensuring the adequate protection of public health and safety, the common defense and security, and the environment in the application of nuclear technology for civilian use. Those statutory mandates notwithstanding, the Commission is mindful of the need to: 1) reduce unnecessary burdens, so as not to inappropriately inhibit any renewed interest in nuclear power; (2) maintain open communications with all its stakeholders, in order to seek to ensure the full, fair, and timely consideration of issues that are brought to our attention; and (3) continue to encourage its highly qualified staff to strive for increased efficiency and effectiveness, both in our dealings with all the Commission's stakeholders and internally within the agency.

I look forward to working with the Committee, and I welcome your comments and questions.

Mr. NORWOOD [presiding]. Thank you very much, Dr. Travers.

Mr. Magwood, we would be pleased to hear from you now.

STATEMENT OF WILLIAM D. MAGWOOD

Mr. MAGWOOD. Thank you, Mr. Chairman. My name is Bill Magwood. I am the Director of DOE's Office of Nuclear Energy, Science and Technology. It is a great pleasure to appear before you today.

As you know, for the last several years DOE has been working to coordinate with NRC, the industry, and others to try to understand what the issues facing nuclear power will be in the near term and also in the longer term, and to find ways, both in terms of research and institutionally, to remediate those problems. We have made some progress, but, clearly, there is a lot that we need still to do.

Over the last year or so, it has been very clear and very public that there are some utilities in this country that are looking very seriously to nuclear option for the first time in many years. We have been very pleased to see that level of interest, and you are going to hear from some of those utilities today.

Probably more important than any other single factor to make industry more comfortable with the idea of building new nuclear power plants in this country has been the tremendous progress the NRC has made, and I give great credit to NRC, in proving itself to be a reliable and consistent regulator. Without that, utilities wouldn't be here today talking to you.

In fact, I know from conversations with many utility executives that NRC's performance in license renewal is the single most important factor they point to when asked why they believe nuclear has a future in the United States—because the NRC has done such a good job.

That said, the industry itself deserves a great deal of credit. If you go back to just 1990, just a little over 10 years ago, nuclear power plants in this country were operating at only about 70 percent availability, which was a pretty miserable record when compared to other energy sources and compared to other nuclear power plants in the world.

Today, U.S. nuclear power plants are among the best in the world. We are operating our plants at an average of about 90 percent availability. That is an astonishing improvement in performance. A great deal of that credit is due to the management of the utility companies who, during the 1990's, understood that great management is the way to get to high levels of safety and also high levels of economy and performance. I think that they have done a great job in moving toward that objective.

At the same time, the business structure of the nuclear industry has been changing over the last several years, and I believe this will probably prove to be more important than any other single factor in making a future for nuclear energy. The utility industry itself has been consolidating over the last 2 or 3 years, and as has been well reported in the papers, there have been a number of mergers, as well as acquisitions of nuclear power plants.

What this has done is that it has served to centralize more nuclear power plants under the management of some of the best managed utilities in the country. I think this will lead to even more economy and more effectiveness in the future, and an even greater benefit to the Nation.

In the longer-term, the consolidation of the nuclear industry will result in formation of large electric utilities with a long-term interest in nuclear power, which will be a very important factor in utility considerations about the future of nuclear power.

DOE also has been very active in this area. We have been supporting research for the last several years to make sure that existing nuclear power plants operate reliably and effectively as they operate for the long term. We have been supporting advanced research and development, looking at new types of nuclear power plants. Our Nuclear Energy Research Initiative has been very successful in that regard.

We are also coordinating with other countries. Just last year, we launched an initiative known as "Generation IV" to look at ways of reforming nuclear power and—aimed at addressing barriers to long-term use of nuclear energy—making it more effective than it is today through the use of advanced technologies. Not to wait for the long term, we are also been working with industry to find ways to make deployment of new nuclear power plant technology occur as quickly as possible.

We are working in all of these areas. Our statement covers all of this in more detail, and I look forward to talking with the committee about that over the course of the hearing.

Thank you.

[The prepared statement of William D. Magwood follows:]

PREPARED STATEMENT OF WILLIAM D. MAGWOOD, IV, DIRECTOR, OFFICE OF NUCLEAR ENERGY, SCIENCE AND TECHNOLOGY, U.S. DEPARTMENT OF ENERGY

Mr. Chairman and Members of the Subcommittee, I am William D. Magwood, IV, Director of the Department of Energy's Office of Nuclear Energy, Science and Technology. My office is charged to apply the science, engineering, and art of nuclear technology to address a wide range of civilian requirements. We support research and provide radioisotopes to find new treatments for cancer. We provide the advanced power systems without which the United States cannot explore the solar system. We develop new, advanced technologies to deal with spent nuclear fuel. But our core and most important mission especially in these days of energy supply concern is the development of advanced nuclear energy technologies to satisfy the energy needs of the United States in a clean, safe, and cost-effective manner.

Our program has undergone a dramatic transformation in the last three years. With the completion of the advanced light water reactor program in fiscal year 1998, we saw our nuclear energy research budget essentially fall to zero. With a great deal of planning and hard work; advice from our independent advisory committee, the Nuclear Energy Research Advisory Committee (NERAC) and its many subcommittees and task forces; and effective and focused support from the Congress, we have turned the program around. Our office is now focused on three key missions:

- Supporting R&D that enhances nuclear powers viability as part of the U.S. energy portfolio.
- The support for irreplaceable U.S. nuclear R&D infrastructure, both in the Government and in U.S. universities; and
- Support for students and programs to develop the human capital required to preserve a viable future for nuclear technology in the United States.

While I will touch on all of these key missions in my statement today, I will primarily focus on the first one to provide you with information regarding our technology activities and how they impact the future of nuclear energy in the United States.

RECENT DEVELOPMENTS: A PATH TO A VIABLE FUTURE FOR U.S. NUCLEAR ENERGY

First, however, I would like to provide you with some context for our efforts. Just a few years ago, many analysts were predicting the end of nuclear energy in the United States. Many predicted that in the face of electric industry competition large

numbers of nuclear power plants would be shut down before the end of their 40-year licenses and the amount of energy generated by U.S. plants would slowly erode. Many believed that nuclear couldn't compete that U.S. utilities would turn away from their plants, largely forego license renewals, and invest in alternative sources of electric generation.

Reality has proven these forecasts to be incorrect. For the most part, it was always clear that the picture would be brighter than the worse predictions foresaw. But few, even those of us who watch nuclear industry developments closest, would have predicted the turn-around that is occurring today. This reversal of nuclear fortunes has reinforced the Departments re-energized nuclear R&D activities. We perceive three key reasons for this change in the United States:

1) *Performance of nuclear utilities.* Little more than a decade ago, U.S. nuclear power plants were generating electricity only about 70% of the time. Today, the average is approaching 90%. U.S. nuclear plants rank high when compared with the nuclear plants of other countries and compare very favorably with other sources of generation in the United States. In fact, the average nuclear plant in the U.S. produces electricity at only about two cents per kilowatt-hour—far below the average U.S. market price and about the same as the most efficient natural gas-fired power plants. Moreover, our colleagues at the Energy Information Administration (EIA) have just reported that U.S. nuclear power plants broke another record, producing more electricity in the year 2000 than ever before—despite the closure of eight less efficient units over the last decade.

2) *Consolidation of the nuclear utility industry.* Because of the performance of U.S. plants, they have become attractive targets for acquisition. We are now seeing the formation of large nuclear utilities in the United States that more closely resemble the large nuclear-focused power companies in countries like Japan. Instead of many utilities owning one or two plants, we expect that there will soon be far fewer nuclear utilities, with each owning a dozen or more plants. The highly successful Exelon Corporation is a prototype of what appears to be taking shape in this country. This development not only provides for considerable efficiencies of scale in parts, training, and other aspects of operation, but it has two other benefits of possibly greater import. First, consolidation exploits a realization that swept through the industry less than a decade ago: that the safest plants were the most cost-competitive plants and that good management was the key to both. As the best operators of nuclear plants acquire more plants, the performance of nuclear plants is likely to increase. Second, as in other countries which plan to build new plants, large utilities with majority nuclear generation have a long-term interest in nuclear power well beyond that of utilities that operate one plant as part of a larger system.

3) *Successful management at the Nuclear Regulatory Commission.* Not long ago, many utility executives cited the unpredictability of regulation in the U.S. as a primary barrier to the construction of new plants in the U.S. and an obstacle to utilities seeking license renewals to operate their nuclear power plants for an additional 20 years. NRC has since that time shown itself to be a fair and effective regulator of the nuclear industry. Its process to approve the renewal of the operating license for the Calvert Cliffs plant and later for the three-unit Oconee plant was a tremendous success for both the Commission and the industry. Completed years earlier and millions less expensively than most analysts predicted, these first license renewals proved that the industry could rely on the NRC for fair, stable, effective, and predictable regulation. Thirty-three nuclear power plants are entering the renewal process now and informal contacts with utility executives now indicate that the overwhelming majority if not all of U.S. nuclear power plant owners are planning to apply for license renewals for their nuclear units.

Maintaining a strong option to build new nuclear power plants to meet near and long-term energy needs is not an end unto itself for the United States. Nuclear power plants provide important benefits that are not found with other energy options. Nuclear plants do not emit pollutants such as nitrogen oxides, sulfur oxides, mercury, or particulates that affect human health. Nor do nuclear plants emit carbon dioxide. These plants have proven to be highly reliable in all weather conditions, cost-effective in operation, and act as crucial anchors to the national electric grid.

That said, like all sources of energy, nuclear power has issues with which we must deal. Utilities must be certain that the high costs for construction that characterize many plants completed in the late 1980s and early 1990s are not repeated. The United States must successfully resolve the nuclear waste issue. And any remaining public concern over the safety of nuclear plants must be fully addressed. As I conclude my remarks, I will discuss the challenges ahead including some of the barriers that must still be overcome to enable the United States to maintain a strong nuclear energy option for the future.

With this backdrop, I would like to highlight what the Department is doing in the nuclear energy arena. We are active in three areas that affect the future of nuclear energy:

- We are supporting cooperative research with the utility industry to develop advanced technologies to enable existing nuclear power plants to operate reliably and cost-effectively into the long-term;
- We are pursuing technology and institutional activities to clear the way for near-term deployment of nuclear power plants in the United States; and
- We are leading a world-wide effort to develop standard, next-generation nuclear energy technologies that could enable nuclear power to fully meet the promise our predecessors saw in the 1950s and 1960s.

TECHNOLOGY FOR CURRENT PLANTS: BUILDING ON SUCCESS

To discuss the prospects for new nuclear power plants in the United States, it is essential that existing U.S. plants be successful both in terms of safety performance and in terms of economic competitiveness. The industry has made impressive strides to meet this condition, particularly over the last decade. The Department assisted in making some of this performance possible through its past programs to develop high-burnup nuclear fuel (which has enabled utilities to reduce their fuel costs by half, saving some $200 million each year) and to reduce occupational radiation exposures by 67% since 1985.

Now we enter a new phase. As U.S. plants receive license renewals, they must be prepared to operate for an additional 20 years—a total of 60 years—far longer than nuclear plants have been operated to date. While NRCs license renewals confirm that safety will not be impacted as these plants operate for the long term, it is less clear what long-term operation means for reliability and cost-effectiveness. The application of advanced technologies can also continue the process of enhancing safety.

The Departments Nuclear Energy Plant Optimization (NEPO) program plays a vital role in ensuring that current nuclear plants can continue to deliver reliable and economic energy supplies up to and beyond their initial 40-year license period by resolving open issues related to plant aging, and by applying new technologies to improve plant economics, reliability, and availability. The NEPO program is cost-shared with industry through the Electric Power Research Institute (EPRI) and is conducted in close cooperation with the Nuclear Regulatory Commission. The research conducted under the NEPO program is identified, prioritized, and selected with broad input from utilities, national laboratories, the Departments Nuclear Energy Research Advisory Committee (NERAC), and other stakeholders. With dozens of projects underway, this program demonstrates the Departments ability to lead without massive funding: about 60 percent of NEPO funding is provided by industry and the suite of projects focuses on areas that industry would not have pursued on its own projects that look at the long-term and focus on the need for a stable, reliable, non-polluting electricity source for the United States.

NEAR-TERM DEPLOYMENT: ADVANCED STATE-OF-THE-ART NUCLEAR ENERGY TECHNOLOGY FOR THIS DECADE

Third generation nuclear power plants have been very successful in several countries. Advanced plants based on U.S. technology have been and are being constructed in Japan, South Korea, and Taiwan and are expected to be selected by other countries in the coming years. We believe that small but important enhancements to these plants (which have been referred to as "Gen III+" designs) could help make them state-of-the-art and deployable in the United States by 2010. As part of its Nuclear Energy Technologies activities, the Office of Nuclear Energy, Science and Technology is working cooperatively with both the U.S. Nuclear Regulatory Commission and the domestic commercial nuclear industry in several activities focused on supporting the potential near-term deployment of new nuclear generating capacity in the U.S. in the next five to ten years.

Working with both the public and private sectors, we are reviewing the current regulatory requirements associated with designing, licensing, siting and constructing new nuclear-based electricity generating facilities to identify areas where changes in the regulatory requirements could be beneficial to both public and private sectors. Working with the Nuclear Regulatory Commission, we are developing a new regulatory framework for advanced gas reactor technologies that recognizes the inherent differences between the light water technology-based regulations that currently govern the regulatory requirements. Working with the nuclear utility industry, we will be developing a demonstration program for early site permitting of

potential new generation facilities whether it be new plants on new sites or, more likely, at sites upon which current nuclear plants are operating.

This latter activity holds particular interest for us. We believe that many of the difficult issues associated with siting new facilities of any kind can be avoided in the case of new nuclear plants in the United States. Many operating U.S. nuclear plant sites were designed with four or six reactors in mind and currently host far fewer. This provides a tremendous opportunity for expansion in this country and we, working with industry, will examine the issues closely.

Finally, through NERAC, we are working with industry to develop a report identifying technical, regulatory, and institutional issues which must be addressed and a delineation of those the actions necessary to successfully deploy new nuclear reactor facilities in the U.S. by 2010. The report on near-term deployment opportunities will be available in September 2001.

NERI AND I-NERI: A PEER-REVIEWED PATH TO ADVANCED NUCLEAR R&D

The Departments Nuclear Energy Research Initiative (NERI), a competitive, peer-reviewed research and development selection process to fund researcher-initiated R&D proposals from universities, national laboratories, and industry, has reinvigorated the Nations nuclear energy R&D organizations. Focused on research to address the potential long-term barriers to expanded use of nuclear power—economics, safety, proliferation resistance, and waste minimization—the NERI program is yielding innovative scientific and engineering R&D in nuclear fission and reactor technology. Initiated in FY 1999, there are currently 55 projects underway with an additional 15 projects expected to be selected for award in FY 2001. This program signaled the return of the United States to nuclear R&D, but a return that reflected important lessons learned and a new appreciation for harnessing outside expertise to focus the research. NERI has, despite its limited funding, gone a long way to reinvigorate nuclear R&D in this country.

In FY 2001, the Department is launching the International Nuclear Energy Research Initiative, or I-NERI, to sponsor innovative scientific and engineering research and development conducted by joint teams of U.S. and foreign researchers. Established as a cost-shared R&D program, the primary program objectives of the I-NERI are to:

- Develop advanced concepts and scientific breakthroughs in nuclear fission and reactor technology to address and overcome the principal technical and scientific obstacles to the expanded use of nuclear energy worldwide;
- Promote bilateral and multilateral collaboration with international agencies and research organizations to improve the development of nuclear energy; and
- Promote and maintain the U.S. nuclear science and engineering infrastructure to meet future technical challenges.

We are in the final stages of signing I-NERI agreements with France and South Korea. We are negotiating agreements with Japan and South Africa, which we hope to conclude this year. We also expect to conclude I-NERI agreements with the Nuclear Energy Agency of the Organization for Economic Cooperation and Development and with Euratom. When implemented, these agreements will magnify modest U.S. investments in R&D many times over with great benefit to both the United States and our research partners.

GENERATION IV: REALIZING THE ORIGINAL PROMISE OF NUCLEAR ENERGY

The Department initiated the Generation IV Nuclear Energy Systems Project (or more simply, the "Gen IV Project") in January 2000, by convening a meeting of senior policy officials from interested countries. Representatives of nine countries participated in this initial discussion and considered the long-term interest of the countries in the application of nuclear energy, the international interest in advanced nuclear technologies, the barriers that might prevent the future expansion of nuclear energy, and the interest of the representatives in exploring potential multilateral research projects to explore and develop new technologies. These representatives agreed to a Joint Statement regarding the importance of the nuclear energy option to the future and to a process to explore further cooperative activities.

As a result of this meeting, and subsequent meetings, the participants are currently exploring the formal creation of a Generation IV International Forum (GIF) to pursue multilateral coordination and cooperation with the goal of identifying and developing Gen IV technologies that could address the factors impacting the expansion of nuclear energy internationally: economic competitiveness of building and operating nuclear energy systems; remaining concerns regarding nuclear safety and proliferation; and the challenge of minimizing and dealing successfully with nuclear wastes.

The Technology Roadmap

A specially chartered subcommittee of the U.S. Governments Nuclear Energy Research Advisory Committee (NERAC) is providing guidance to the Department of Energy's (DOE) efforts to create a Generation IV Technology Roadmap—a document which will identify and set research and development paths for the most promising technologies. Professor Neil Todreas of MIT and Dr. Sol Levy, a world-respected pioneer in commercial nuclear power who is a retired manager from General Electric, co-chair this ambitious effort and have brought together a highly experienced team to oversee the Roadmap effort.

We believe that to be successful, future nuclear energy technologies must be broadly acceptable—that is, meet the needs of many nations and not only those of the United States. As a result, consistent with the requirements of the United States, the Department is pursuing the Gen IV Project as an international effort through the GIF. Together, approximately 150 senior, experienced engineers and scientists from at least 10 countries will work together to create the Gen IV Technology Roadmap. We have found that U.S. leadership has been essential to this process and that without the Departments initiative, this type of effort would not have been possible. This Roadmap is scheduled to be completed by the end of FY 2002 and will:

- Draw upon a wide range of experts from government, national laboratories, industry, and academia;
- Set ambitious technology goals for next-generation systems;
- Identify the most promising concepts for advanced nuclear energy systems to meet future energy needs; and
- Identify the R&D activities needed to develop these concepts and make them ready for commercial deployment.

What are Generation IV Nuclear Energy Systems?

The international community has deployed over 400 nuclear reactors to produce power, with new projects underway in several countries. Most operating plants are based on the experience gained from the first generation of nuclear plants that were built and operated in the late 1950's and early 1960's. These demonstrations of the practicality of nuclear power enabled second generation plants to be built all over the world, including over 100 in the United States. The lessons learned from the second generation plants led directly to the development and deployment of third generation (*i.e.,* advanced light water) nuclear plants beginning in the 1990's.

The next generation, Generation IV nuclear energy systems, would take the next step in the evolution of nuclear power plant design. Finding new approaches—some of which have been postulated in NERI projects—to make nuclear power more cost-effective while further enhancing safety and proliferation-resistance will enable nuclear energy to fulfill the role envisioned in the early days of the development of atomic fission.

To develop these new technologies, ambitious but achievable technology goals are required against which technology concepts can compete and toward which research activities can strive. NERAC developed initial draft technology goals for Gen IV systems earlier this year and while they continue to be refined, they have been largely accepted by the international research community. The Gen IV goals reflect the need for future nuclear energy systems to build upon the worlds experience with nuclear technology and develop systems that can be fully competitive with any other form of energy production. These goals represent new thinking in the nuclear community, a recognition that nuclear energy must fully support all our economic, environmental, and societal ambitions. We expect that these goals will be finalized before the end of this Spring and become a standing testament to the determination of the world nuclear technology energy community that nuclear energy must continue its development and meet its initial promise as a widely used source of energy, providing benefit to all the worlds peoples.

CHALLENGES AHEAD: MUCH WORK REMAINS

Despite the United States long experience with nuclear power and the promising outlook for near-term deployment of new nuclear power facilities, there remain important challenges to expanding the successful application of nuclear technology. These, in addition to the activities discussed above, are the focus of the Departments efforts.

Foremost, we must continue the hard but essential work of dealing with disposal of spent nuclear fuel. In this connection, the Departments Office of Civilian Radioactive Waste Management continues the scientific work and step-wise process for

a Secretarial decision on whether or not the Yucca Mountain site should be recommended to the President. Congressional support for this process is essential.

Next, we must recognize and deal with the nuclear energy research facility infrastructure within both the Departments national laboratories and the Nations university nuclear engineering programs. Over the last eight years, the Department lost four irreplaceable research reactors and terminated a major project to build a replacement facility. Working with the NERAC, we completed a Nuclear Science and Technology Infrastructure Roadmap last year which raised a large number of questions for the Department to address in determining the future course of DOE facilities and their ability to support expanded needs for research.

Without such capacity, enhancing our nuclear R&D activities will become increasingly difficult. As a result, we and our colleagues at the Nuclear Regulatory Commission are looking overseas to countries such as Russia to request access to research facilities. As Congress requested last year, we are completing a program plan on Advanced Accelerator Applications, exploring the potential of a new type of research facility to meet U.S. needs in the 21st Century. We will soon issue a report to Congress on the analysis we have completed to date.

Finally, we are very concerned about the state of the Nations nuclear technology education infrastructure. Through our University Fuel Assistance and Support program, the Department provides direct financial support to the Nations 28 remaining university nuclear engineering programs and associated university research reactors. This assistance has shown positive effects in recent years the decline in students appears to be moderating. But funding is very limited and many important university-based research facilities are in financial trouble. Worse, the number of U.S. students earning degrees in nuclear-related fields is far lower than the annual need.

We look forward to working with Congress to consider these issues. We support the Vice Presidents interagency task force which is developing a much-needed, comprehensive strategy to the Nations energy needs. Together, Congress and the Bush Administration will work to plan for our country's energy future and together we will address the issues that face us.

Mr. BARTON. Thank you, Mr. Magwood.

We will now hear from Ms. Hutzler for 7 minutes.

STATEMENT OF MARY J. HUTZLER

Ms. HUTZLER. Mr. Chairman, members of the subcommittee, I appreciate the opportunity to appear before you today to discuss the current and future use of nuclear power in the United States.

The Energy Information Administration is an autonomous statistical and analytical agency within the Department of Energy. We are charged with providing objective, timely, and relevant data, analysis, and projections for the use of the Department of Energy, other government agencies, the U.S. Congress, and the public.

The projections in my testimony are from the Annual Energy Outlook 2001, which provides projections and analysis of domestic energy consumption, supply, and prices. Our projections are used by government agencies, the private sector, and academia for their energy analyses. Our projections are not meant to be exact predictions of the future. They represent a likely energy future, given technological and demographic trends, current laws and regulations, and consumer behavior.

Today, nuclear power is the second largest supplier of U.S. electricity generation accounting for 20 percent of total generation. The United States currently has 104 operable nuclear units, totaling 97.5 gigawatts of capacity. Electricity generation from nuclear power increased in 2000 to 754 billion kilowatt hours, 30 percent higher than 10 years ago.

The average capacity factor for U.S. nuclear power plants in 2000 was the highest in history at 89 percent, 35 percent higher than just 10 years ago.

Increased performance has been achieved through improved operations resulting in shorter and fewer outages. Nearly all nuclear plants now operate for 18 months between refuelings, 6 months longer than the average refueling cycle during the 1970's and 1980's.

In 1999, production costs—the costs of fuel and operations and maintenance—for nuclear plants average 1.9 cents per kilowatt hour, about the same as coal plants and about two-thirds that of natural gas steam plants. Safety improvements initiated during the late 1980's and in the 1990's had caused nuclear costs to increase and had lowered its output.

Generation from nuclear power plants is expected to rise slightly over the next several years, due to increased production at existing reactors. It is expected that recent trends and improved performance will be maintained, resulting in average capacity factors for operating plants of 90 percent.

However, the long-term projection is for a decline in total generation from nuclear power as some existing nuclear reactors are retired and replaced by other mainly gas-fired generating units. Our projections indicate that nuclear power will provide 11 percent of the electricity generation in 2020, less than coal or natural gas.

Within the forecast, nuclear units are projected to retire when their operation is no longer economic relative to replacement capacity. Due to the uncertainty surrounding future aging-related costs, several cases were developed to analyze the effects on electricity supply due to differing assumptions about the costs of maintaining nuclear reactors which are depicted in this chart.

In the Reference Case, 33 units are projected to retire, while 27 units are projected to operate beyond their initial 40-year license period. Currently, five units have received approval from the NRC to extend their licenses for an additional 20 years. Another five units have submitted applications, and 28 units have scheduled future submissions through 2004.

In our low nuclear case where it is assumed that aging-related costs would begin earlier and at slightly higher costs than the Reference Case, a total of 18 additional units are projected to be retired through 2020 relative to the Reference Case.

In the high nuclear case where aging-related costs are assumed to be 25 percent lower than the Reference Case, 11 units are projected to retire through 2020. That is about 9 percent of current capacity.

Since no new orders for nuclear capacity have been made in the United States since 1978, projections of the cost of building nuclear capacity are highly uncertain. In the Reference Case, the cost of a new nuclear unit is based on the advanced passive reactor design, the AP600, which has been approved by the NRC as part of its standardized design certification.

The initial overnight capital cost, in 1999 dollars, of the AP600, is assumed to be about $1,700 per kilowatt, compared to about $1,000 to $1,200 per kilowatt for a coal-fired unit, and $400 to $500 per kilowatt for a gas-fired combined cycle unit.

Contingency factors are applied for delays during construction due to unforseen problems such as weather or labor issues and for the tendency to underestimate costs for new technologies. As new

capacity is built and experience is gained, capital costs decline. The average generating cost of nuclear is higher than coal or natural gas, which results in no new nuclear construction coming online by 2020 in our Reference Case.

However, if capital costs of nuclear were to fall to around $1,000 per kilowatt, nuclear could become a viable economic choice, particularly if natural gas prices were to remain at their current high levels.

In summary, the nuclear industry has made significant strides in improving the performance and lowering the operating costs of our existing nuclear plants. As a result, nuclear power today provides roughly one-fifth of our Nation's electricity generation. Operating performance achievements at individual nuclear units is expected to remain high. The total output from nuclear plants is expected to decline by about 20 percent between now and 2020, as some units are expected to be retired.

The ability to relicense existing nuclear plants will extend the operating lives of many of our current reactors. However, achieving new orders for nuclear plants, based solely on economics, is unlikely due to the higher construction costs of the currently demonstrated technology relative to its fossil counterparts, as well as uncertainties related to costs, safety, and waste.

Thank you, Mr. Chairman, and members of the subcommittee. I will be happy to answer any questions you may have.

[The prepared statement of Mary J. Hutzler follows:]

PREPARED STATEMENT OF MARY J. HUTZLER, ENERGY INFORMATION ADMINISTRATION, DEPARTMENT OF ENERGY

Mr. Chairman and Members of the Committee: I appreciate the opportunity to appear before you today to discuss current and future prospects for nuclear power in the United States.

The Energy Information Administration (EIA) is an autonomous statistical and analytical agency within the Department of Energy. We are charged with providing objective, timely, and relevant data, analysis, and projections for the use of the Department of Energy, other Government agencies, the U.S. Congress, and the public. We do not take positions on policy issues, but we do produce data and analysis reports that are meant to help policy makers determine energy policy. Because we have an element of statutory independence with respect to the analyses that we publish, our views are strictly those of EIA. We do not speak for the Department, nor for any particular point of view with respect to energy policy, and our views should not be construed as representing those of the Department or the Administration. However, EIA's baseline projections on energy trends are widely used by Government agencies, the private sector, and academia for their own energy analyses.

The Committee has requested information about current and future utilization of nuclear power for electricity generation, statutory and regulatory provisions that impact the use of nuclear power, the prospects for using nuclear power to meet future generation needs, and the role of nuclear power in a comprehensive national energy policy. EIA collects and interprets data on the current energy situation, and produces both short-term and long-term energy projections. The projections in this testimony are from our *Annual Energy Outlook 2001,* released late last year. The *Annual Energy Outlook* provides projections and analysis of domestic energy consumption, supply, and prices through 2020. These projections are not meant to be exact predictions of the future, but represent a likely energy future, given technological and demographic trends, current laws and regulations, and consumer behavior as derived from known data. EIA recognizes that projections of energy markets are highly uncertain and subject to many random events that cannot be foreseen, such as weather, political disruptions, strikes, and technological breakthroughs. In addition, long-term trends in technology development, demographics, economic growth, and energy resources may evolve along a different path than assumed in the *Annual Energy Outlook.* Many of these uncertainties are explored through alternative cases.

THE CURRENT SITUATION

Supply, Demand and Prices

The United States currently has 104 operable nuclear units, totaling 97.5 gigawatts of capacity. Electricity generation from nuclear power increased in 2000 to 754 billion kilowatthours, and the average capacity factor for U.S. nuclear power plants in 2000 was the highest in history at 89% (Figure 1). Through 1990, the average annual capacity factor was less than 70%. Increased performance has been achieved through improved operations resulting in shorter and fewer outages. During 1999, the average time required to refuel a nuclear reactor was 42 days, and nearly all nuclear plants operate for 18 months between refuelings. During the 1970's and 80's the average refueling cycle was more typically 12 months, resulting in more frequent outages. The industry's median unplanned capacity loss factor was just two percent in 1999.

In 1999, the production costs (expenditures for fuel and operations and maintenance) at nuclear power plants averaged 1.9 cents per kilowatthour (kwh), roughly the same as the operating costs of coal-fired power plants, and about two-thirds the operating costs of oil and natural gas-fired steam plants.

Fuel costs are a small part of the operating costs of a nuclear power plant. In 1999, U.S. utilities purchased a total of 47.9 million pounds of U3O8e (equivalent) at an average price of $11.63 per pound U3O8e. Foreign sources supplied 76 percent of the deliveries, mainly from Canada, Australia and Russia. Nuclear operators tend to purchase uranium on long-term contracts and the prices are not particularly volatile. Utilities loaded fuel assemblies containing 58.8 million pounds U3O8e into reactors during 1999, and had inventories of 58.2 million pounds at year-end. U.S. suppliers had 68.8 million tons of uranium inventories at year-end 1999. EIA estimates of U.S. uranium reserves total 1,182 million pounds, although the estimated costs of mining and milling the uranium are higher than current market prices. During 1999, a total of 4.5 million pounds U3O8e of uranium were produced by mining, and there were nine commercially operating uranium mines in the United States. Once the uranium is purchased, it must then be enriched (increasing the concentration of the fissionable isotope) before it can be used as nuclear fuel. U.S. facilities provided 46 percent of U.S. utilities enrichment services in 1999, and foreign enrichment plants the remaining 54 percent. Enrichment services are also primarily obtained through long-term service contracts.

Legislative and Regulatory Challenges

The Nuclear Regulatory Commission (NRC) oversees the licensing and operation of nuclear power plants. The typical operating license for a nuclear plant was issued for 40 years. With the first wave of current plants brought online in the 1970s, many of these units could be facing retirement in the near future. However, the NRC has provided a process for nuclear plant owners to apply for renewal of their operating licenses, adding another 20 years to the licensed lifetime. In March of 2000, Baltimore Gas and Electric's two Calvert Cliffs units were the first nuclear reactors to receive license renewal, extending their license expiration dates to 2034 and 2036, respectively. Also in 2000, three units at Oconee received license renewal approval, and five other units have applications submitted. Future submittals have been scheduled for roughly 40 percent of current plants through 2004. The NRC has created a streamlined process to review applications, and the total time from application submitted to approval has been just under two years. The cost to the owner of pursuing a license renewal has been estimated at between $10 million and $20 million per reactor, and requires detailed descriptions of expected aging effects and how they will be addressed to maintain safe operation. The renewal approval does not require the company to undertake potential capital expenditures to keep the plant running the additional time, which could be substantially more than the cost of obtaining the license. So the eventual retirement date of any plant will likely be based on the economics of its operation rather than the actual date on the license. To date, the longest a commercial nuclear plant in the United States has operated is 33 years.

Nuclear waste disposal is a challenge that is faced primarily when the plant is shut down and waiting to be decommissioned. Low level waste (LLW) disposal is the responsibility of the states where the waste is generated. Interstate compacts have been created to jointly develop sites for disposal; however, no new sites have been opened even though the Low Level Radioactive Waste Policy Act stated that disposal facilities could refuse to accept waste from outside their compacts beginning in 1992. Currently, only three low-level waste sites exist: one in Hanford, Washington, which only accepts waste from states in the Northwest Compact in which it resides, and the neighboring Rocky Mountain Compact; one in Clive, Utah, which

is only licensed to accept the lowest level—Class A—waste, and one in South Carolina, which is still accepting all classes of LLW from all states except North Carolina. States that do not have access to disposal facilities are likely to require the waste generators to store their waste on-site until new disposal sites are available. South Carolina has recently joined a compact with Connecticut and New Jersey, and has enacted a state law to phase out acceptance of non-compact waste by 2008. The site in Utah, operated by Envirocare, has applied for a license to accept the higher classes of waste, and has no plans to limit acceptance of the waste. Low-level waste disposal issues are important because they affect the cost and timing of decommissioning nuclear power plants.

The Department of Energy is working on siting a repository for spent nuclear fuel and high-level waste. The proposed waste site at Yucca Mountain, NV is still undergoing site characterization, to determine if the site is suitable and should be recommended for development. The soonest this proposed facility could begin accepting the waste is 2010. The initial storage of the spent fuel assemblies, once removed from a reactor, is in steel lined pools at the reactor site. However, these are quickly being filled to capacity at most reactors. For temporary storage, dry cask containers have been developed and licensed by the NRC to store the used fuel assemblies. Some of these storage containers should be suitable for transporting the waste once the final repository is sited. The lack of a final repository is not likely to force any operating nuclear reactors to shut down early, but will require the owners to purchase, and receive approval to install, the temporary storage containers on-site.

Finally, the Price-Anderson Act expires in 2002 and could create barriers to new construction if it is not extended in its current form. The Price-Anderson Act was enacted into law in 1957, as part of the Atomic Energy Act, to meet two objectives: to remove any deterrents to private sector participation in nuclear energy due to the threat of large liability claims in the event of a catastrophic nuclear accident, and to ensure that adequate funds are available to the public if such an accident were to occur. The Act limits liability to third parties in the event of a nuclear accident to $9.43 billion. It also provides for a series of retroactive assessments paid by all nuclear utilities if the total liability exceeds the amount of primary coverage. If the Act is not extended, coverage for existing units would continue as provided by the Act, but any new nuclear units would not be covered. The Price-Anderson Act has been extended three times since 1957, and current legislation has been proposed in the Senate that includes the extension of the Act through 2012.

THE OUTLOOK

The Annual Energy Outlook 2001 (AEO2001) reference case projects U.S. energy supply, demand and prices through 2020. It assumes a continuation of current laws and regulations, and provides alternative scenarios to deal with uncertainty in the assumptions. It is expected that recent trends in improved performance will be maintained, resulting in average capacity factors for operating plants of 90 percent by the last years of the forecast. The long-term projection, however, is for a decline in total generation from nuclear power as some existing nuclear reactors are retired and replaced by other, mainly gas-fired, generating units (Figure 2).

Electricity demand is projected to grow at an annual average rate of 1.8 percent between now and 2020. To meet this demand, and to replace retirements of older generating units, EIA projects 413 gigawatts of new generating capacity will be needed (including cogeneration capacity). Of this new capacity, 92 percent is projected to be combined-cycle or combustion turbine technology fueled by natural gas. About five percent of the new capacity is expected to be coal-fired, and the remaining three percent renewable technologies. The projected operating cost of a new nuclear reactor (including capital recovery) is about 6 cents per kilowatthour, higher than that for coal or combined-cycle capacity which are roughly 4 cents per kilowatthour (Figure 3). Gas-fired units are favored particularly in restructured electricity markets due to their lower capital costs, higher efficiencies, shorter construction times, and better load following characteristics.

Within the EIA forecast, nuclear units are forecast to retire when their operation is no longer economic relative to replacement capacity. The forecast incorporates future aging-related costs that could be incurred as plants consider operating beyond 40 years. In the reference case, nuclear plants are assumed to incur additional capital costs of $14 per kilowatt (kw) per year after 40 years, and increase to $25/kw per year after 50 years. These costs are reduced significantly for individual units if they have already incurred major capital investments related to plant upgrades. The aging related costs are similar in magnitude to annual capital additions assumed for existing fossil plants ($4-5/kw for gas plants, $10/kw for oil/gas steam units and $16/kw for coal plants, on average). In the reference case, 27 percent of

current capacity is forecast to retire by 2020, mainly after 2010. Of this retiring capacity, one nuclear plant is projected to retire before the end of its 40 year life, 30 units are forecast to retire at the end of their current license expiration and 2 units are projected to retire ten years after their current license expiration (implying a license renewal was received). Another 25 units have original licenses that expire by 2020, but are forecast to receive license renewal and extend their operation beyond 2020.

Because the U.S. nuclear industry has no experience operating reactors beyond 40 years (the oldest operating reactor today is just over 30 years old), future operating costs and capital investments required are unknown. Due to the uncertainties surrounding future aging-related costs, several cases were developed to further analyze the effects on electricity supply due to differing assumptions regarding the costs of future operation (Figure 4). These results provide a range of possible futures for existing nuclear power. In the low nuclear case it was assumed that aging related costs would begin earlier, with capital additions of $5/kw per year starting at age 30. A total of 18 additional units were projected to be retired through 2020 relative to the reference case. Additional fossil-fired capacity was projected to be built to replace the retiring nuclear capacity, and the carbon emissions from electric generators increased by two percent (16 million metric tons carbon equivalent) above the reference case in 2020. In the high nuclear case, aging related costs were assumed to be lower by 25 percent, resulting in more plants projected to operate beyond their initial license life. In the high nuclear case only 11 units were projected to retire through 2020 (9 percent of current capacity). About 14 gigawatts of fossil-fired capacity (roughly 47 units at 300 megawatts each) would no longer be required, relative to the reference case, and carbon emissions from electric generators would be reduced by two percent (16 million metric tons carbon equivalent) by 2020.

There are additional uncertainties affecting other generating industries that could change the competitiveness of nuclear power. Current natural gas prices are much higher than normal in response to low levels of gas storage, unusually cold weather and supply issues. The AEO2001 forecasts that this situation will reverse over the next few years, as increased drilling and production occurs, and that gas prices will return to more typical levels by 2004. Therefore, forecasts of the cost of new gas-fired capacity later in the forecast are based on gas prices below the current levels. More existing nuclear power plants would be economic if current gas prices remained throughout the forecast period, resulting in fewer retirements. However, it is expected that this tight supply situation for natural gas will dissipate before 2010, when the retirement decisions for nuclear units start being made.

The electric generation sector may also face restrictions on the emissions of various pollutants in the future. Since the AEO2001 forecast incorporates current laws and regulations, it requires the electric sector to meet sulfur dioxide and nitrogen oxide restrictions as specified in the Clean Air Act. The summer season cap on nitrogen oxide (for 22 states) will be imposed in 2004 by the Environmental Protection Agency (EPA). Because these reductions are being met by existing fossil plants by adding the necessary control equipment, their operation and costs are not greatly affected. If additional emissions were targeted in the future for reduction, such as carbon dioxide, a large number of coal plants would be retired and replaced mainly by gas-fired technology, leading to higher natural gas prices. This situation would provide an economic incentive to continue operating more of the existing nuclear power plants.

For example, the EIA recently performed an analysis of strategies for reducing multiple emissions at power plants, at the request of then-Representative David M. McIntosh, Chairman of the Subcommittee on National Economic Growth, Natural Resources, and Regulatory Affairs of the House Government Reform Committee. In this report, EIA was asked to provide an analysis of proposals to reduce sulfur dioxide (SO_2) and nitrogen oxide (NO_X) by 75 percent from 1997 levels, and carbon dioxide (CO_2) to either 1990 levels or 7 percent below 1990 levels, similar to the general requirements of the Kyoto protocol, but restricted to emissions by electric generators. In order to comply with the CO_2 cap, the industry was projected to dramatically shift away from coal to natural gas, and to a lesser extent, renewables. This analysis also showed fewer nuclear retirements (9 percent of current capacity) by 2020, as the higher natural gas prices (as much as 63 percent higher than the reference case in 2010) and CO_2 allowance prices made it economical to continue operating more of the existing capacity. This scenario assumed the AEO2001 reference case aging-related costs for nuclear plants, however, the nuclear capacity forecast was similar to the high nuclear case due to the emissions targets and higher natural gas prices. At the request of the Subcommittee, this analysis assumed that no new nuclear power plants would be built throughout the forecast period.

Projections of the cost of building new nuclear capacity is difficult, due to the length of time since a new unit has been ordered in the United States, and the lack of experience in building new designs. The AEO2001 reference case bases the cost of a new nuclear unit on the advanced passive reactor design (AP600), which has been approved by the NRC as part of its standardized design certification. This design has evolved from the current operating designs, but also includes passive safety features and is based on a smaller size (600 megawatts). The initial overnight capital cost (in 1999 dollars) of the AP600 is assumed to be $1730 per kilowatt, compared to $1020 to $1220/kw for a coal-fired unit and $420 to $530/kw for a gas-fired combined cycle unit. Contingency factors are applied to the costs of all new capacity, and are made up of two components—a project contingency factor, which is applied throughout the forecast to account for delays during construction due to unforseen problems such as weather or labor issues, and a technological optimism factor, which is only applied to the first four units built of a new design to account for the tendency to underestimate costs for new technologies. Capital costs decline over time as new capacity is built and experience is gained. However, because the initial cost for the advanced nuclear technology is much higher than other available technologies, it is not economic to build nuclear units in the reference case.

The Department of Energy's Office of Nuclear Energy has developed long-term cost goals for these evolutionary designs that are lower than current estimates. An alternative nuclear cost case was developed assuming the cost of the new nuclear technology was $1500/kw initially, falling to $1200/kw by 2015, with a ten percent project contingency factor applied to these costs. In addition, cases were considered assuming both 3 and 4 year construction times. In these cases the nuclear technology was closer to being competitive with coal and gas-fired capacity (Figure 5); one new unit was projected to be built in the last years of the forecast under the assumption of a 3 year lead time. (Nuclear units were not economic under a four year lead time assumption.)

Worldwide, work has been developing on a more revolutionary new commercial nuclear power technology, known as the pebble bed modular reactor. South Africa's state-owned utility has been working on the technology since 1993, but it has recently gained the interest of foreign energy policymakers as well as potential investors. One U.S. based company, PECO Energy, has joined with British Nuclear Fuels Corporation in making financial commitments to the venture. PECO's parent company, Exelon Corporation, has begun discussions with the NRC about building PBMRs in the United States. The economics are expected to improve for this technology because of the plant's small, modular design (110 megawatts each). The design incorporates passive safety features and would have higher thermal efficiency than existing nuclear plants, requiring less fuel and producing less waste. The estimates of construction costs ($1000/kw) would be very competitive with new coal-fired technologies available in the United States, if they could be attained. The construction costs would still be almost double that of a new gas combined-cycle unit ($530/kw). Ultimately, this design is still untested, and its future will be determined in large part by the success or failure of the South African demonstration project, scheduled for completion in 2005.

CONCLUSION

While nuclear power today provides roughly one-fifth of the nation's electricity generation, that share is expected to drop over the next two decades as some existing units are retired and replaced by other generating technologies. Coal will remain a large supplier of electricity, and natural gas is expected to greatly increase its proportion of electricity generation. While operating performance at individual nuclear units is expected to remain high, total output from nuclear plants is expected to decline by about twenty percent between now and 2020, as units are removed from service.

The ability to relicense existing nuclear plants for an additional twenty years of operation could extend the operating lives of current reactors, and delay retirements. However, achieving new orders for nuclear plants based solely on economics is unlikely at this time due to the high construction costs of the technology, as well as uncertainties related to costs, safety and waste. The challenge of waste disposal is faced by existing nuclear power plants as they continue to store high level waste on-site, waiting for site approval and construction of the permanent waste repository required by the Nuclear Waste Policy Act.

Thank you, Mr. Chairman and members of the Subcommittee. I will be happy to answer any questions you may have.

Figure 1. Nuclear Power Plant Capacity Factors, 1973-2000 (percent)

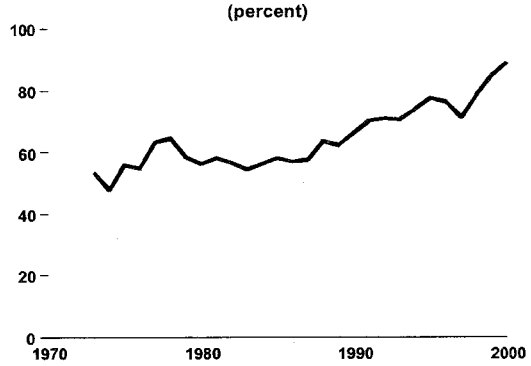


Figure 2. Projected Electricity Generation by Fuel, 1999 and 2020 (billion kilowatthours)

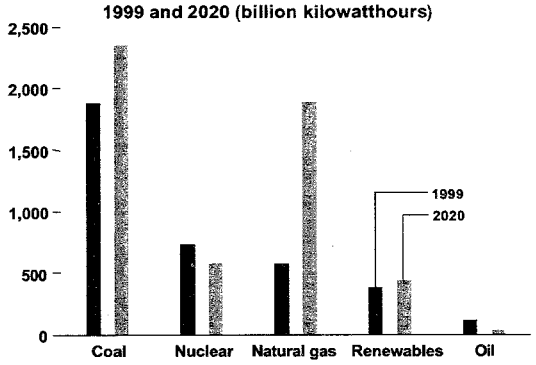


Figure 3. Projected Electricity Generation Costs, 2005 and 2020 (1999 mills per kilowatthour)

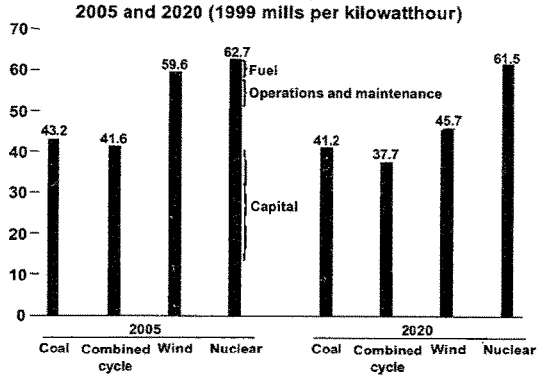


Figure 4. Projected Operable Nuclear Capacity in Three Cases, 1995-2020 (gigawatts)

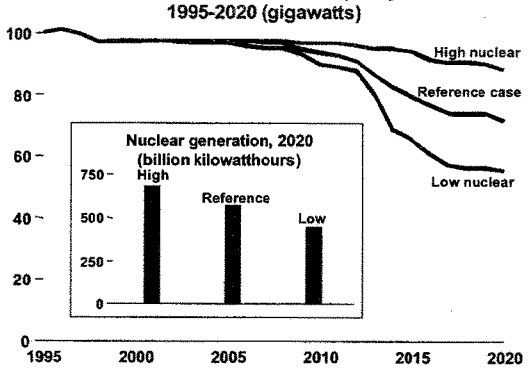
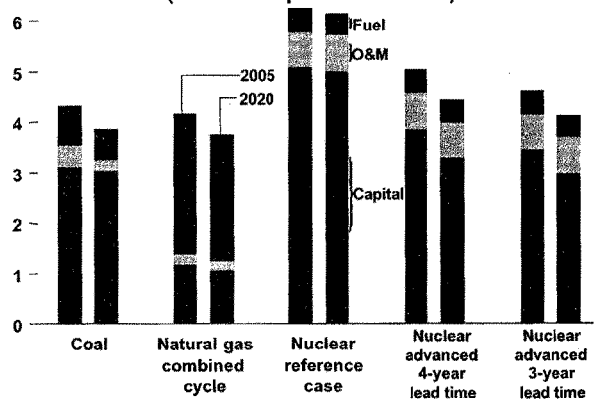


Figure 5. Projected Electricity Generation Costs by Fuel Type in Two Advanced Nuclear Cost Cases, 2005 and 2020 (1999 cents per kilowatthour)



Mr. BARTON. Thank you.

The Chair would—is Mr. Tauzin in the room? We will recognize him first if he is here. Okay.

The Chair would recognize himself, then, for 5 minutes to start the questioning period. Dr. Travers or Mr. Magwood, can either of you gentlemen tell me how many billions of dollars have been paid into the nuclear waste fund since its creation in the 1980's?

Mr. MAGWOOD. I don't think I know the up-to-date number, but I think it is in the order of $12 billion.

Mr. BARTON. Okay. Ms. Hutzler, can you tell me?

Ms. HUTZLER. No, I don't have that number.

Mr. BARTON. You don't have it either?

Ms. HUTZLER. No.

Mr. BARTON. Well, I want to know how many dollars have been paid in, how many dollars have been paid out, where the money has gone to, and how many dollars are officially still in the fund. That would seem to be a baseline piece of information that we would need. So do you think you all can handle that? Mr. Magwood?

Mr. MAGWOOD. I was looking through my notes. I do have a calculation provided by the Office of Civilian Reactor Waste Management. I can give you the numbers they have. They indicate that there is total cumulative fees of about $10.6 billion, with a total income, which includes defense fees, of $15.5 billion.

The disbursements to the program for expenditures have been totaling about $5.6 billion, and the balance in the fund currently is $9.976 billion.

[The following was received for the record:]

In response to your question, I would like to provide the following information supplied by the Department's Office of Civilian Radioactive Waste Management, which manages the Nuclear Waste Fund. The Nuclear Waste Fund is a special account established in the U.S. Treasury by the Nuclear Waste Policy Act.

As of December 31, 2000, the balance of the Nuclear Waste Fund was $9.976 billion. Receipts of the Fund, derived primarily from fees paid by the owners and generators of civilian spent nuclear fuel, totaled $10.673 billion. Receipts resulting from return on Treasury security investments totaled $4.9 billion. Therefore, cumulative receipts of the Fund totaled $15.573 billion.

Since enactment of the Nuclear Waste Policy Act, disbursements from the Fund totaled $5.597 billion. These disbursements cover the costs for numerous expenditures. Over half has been spent on the characterization of Yucca Mountain, Nevada. These expenditures have covered extensive scientific and technical work required to gather the information needed to support a decision on whether Yucca Mountain is suitable for use as a repository. Aside from expenditures related to the characterization of the Yucca Mountain site, additional funds have been spent on statutorily mandated activities to identify other candidate repository sites, to support work toward siting a second repository, and to develop a monitored retrievable storage facility. All of these activities were later terminated. Also, funds have been expended to pay for regulatory and scientific oversight, financial and technical assistance, and payments-equal-to-taxes.

All expenditures from the Fund are limited to funds appropriated by Congress.

Mr. BARTON. Okay. Well, doublecheck that. And especially on the disbursements we would like to know where the money has gone, because one of the key elements in a nuclear waste bill later this year is going to be paying to construct the site.

And last year the committee passed a funding resolution in the House bill that actually used the nuclear waste fund for what it was supposed to be used for, and my intention is to move a bill

that does that this year also. But in order to do that, I want to know what the numbers are.

Okay. I would like to ask Dr. Travers—and, again, perhaps Mr. Magwood—later in the hearing today we are going to hear from a private industry representative who is going to talk about the Pebble Bed Modular Reactor, which is a much smaller reactor.

Now, my understanding of the projections that the EIA has made, you all are basing those projections on the new lightwater reactor, which is a much larger reactor. In my conversations with industry representatives, I have not seen much interest in purchasing the new large lightwater reactor, but I have seen a lot of interest in purchasing the smaller reactor if it is certified by the NRC.

So what steps is DOE and the NRC taking to look at this different technology, this smaller, more passive safety of Pebble Bed Reactor?

Mr. TRAVERS. Mr. Chairman, thank you. The NRC, for its part, is engaged in a dialog with Exelon, and I think you are going to hear from representatives of that company a little bit later.

We are, in the most technical sense, involved in a pre-application review of specific key issues related to that design. Exelon, of course, is reviewing whether or not to go forward with development of a detailed technical design for this facility, and whether or not to submit an application to the Nuclear Regulatory Commission.

We currently have a planning wedge in our budget for carrying out a review of a combined operating license for a PBMR beginning in either fiscal 2002 or fiscal 2003. But the activities that are currently being undertaken are those that are directed at identifying key issues for this rather new technology, a technology that has not been one that has been licensed, at least for large-scale production, in the United States.

We are involved and engaged with Exelon in identifying the key issues that would put us in the best position to move out quickly should we receive an application from that company to license this technology. And there are some unique elements to that.

The Commission has actually directed the NRC staff to begin a reexamination of its capabilities for things such as construction inspection program for licensing the reactor technologies, and we have undertaken, specific to your request, an examination of our current regulations that would allow for licensing of new and innovative technologies.

We believe we fundamentally have the infrastructure in place and the requirements in place that will provide our basis for moving forward. But there are unique elements to this design that, as I mentioned earlier, heretofore have not been examined by the NRC.

So there are some specific technical issues that are on somewhat of a cutting edge, and certainly the experience in the NRC staff is somewhat limited in these areas. But there is quite a lot.

Mr. BARTON. Do you see any statutory restriction in reviewing the new technology?

Mr. TRAVERS. No, sir.

Mr. BARTON. Okay. So there is no need for new statutes to review different types of nuclear reactor technology?

Mr. TRAVERS. No, sir.

Mr. BARTON. Okay. Ms. Hutzler, this will be my last question. The EIA 2000 analysis and 2001 analysis shows that about 27 percent of the existing nuclear power plants are going to shut down. Given the increased operating efficiencies and fuel cycle efficiencies, why is that built into your assumption?

Ms. HUTZLER. It is based on economics. What we do is we look at aging-related costs to keep these units operating. We do that for fossil units as well. My written testimony indicated the costs that we have for these units. For the fossil units, we assume that the costs are added on in each year. The nuclear units are added on later in the time horizon.

But for each unit, we take a look at the costs and whether it is economic to continue operating or whether a replacement unit should be built.

Mr. BARTON. Well, were any of those closures a result of an operating permit expiring? Is your analysis based on the theoretical economics of continuing to operate the plant?

Ms. HUTZLER. It is the latter.

Mr. BARTON. The latter.

Ms. HUTZLER. Continued economics.

Mr. BARTON. Okay. My time has expired.

The gentleman from Virginia is recognized for 5 minutes.

Mr. BOUCHER. Thank you, Mr. Chairman.

Dr. Travers, I notice that the NRC is proposing that the authority of the EPA to have oversight and enforcement capabilities with regard to the cleanup of decommissioned nuclear plants be repealed. Can you give us some rationale for that? What is the thinking of the NRC with regard to how the public policy is better served if EPA does not have this enforcement and review authority?

Mr. TRAVERS. Thank you for the question. The Commission has been generally interested in issues where dual regulation or concurrent jurisdiction are at issue. And, of course, when you enter into this sort of situation, the issues that arise from it are the predictability of government actions necessary, in this case, for decommissioning facilities.

The NRC has promulgated what we have called a license termination rule, which establishes a single all-pathway standard for judging whether or not a nuclear facility—nuclear power, fuel facility, what have you—can be released after a decommissioning and decontamination period.

We have run into a parallel jurisdictional issue with EPA wherein very often, or at least on occasion when the NRC has completed its assessment of the adequacy of the decommissioning efforts, the Environmental Protection Agency, under its authorities I think in CERCLA, have raised issues that we feel technically in the main are not justified.

So what we have urged in terms of legislative initiatives is a situation where the Congress reexamines whether or not the NRC should be looked to as the principal establishment—principal organization responsible for establishing those sorts of standards, and thereby increasing the predictability of the Federal process associated with the release and decommissioning of nuclear facilities.

Mr. BOUCHER. Let us suppose Congress approves your recommendation. What effect would that have on the liability under Superfund of the owners of nuclear power plants?

Mr. TRAVERS. I am really not sure. I would have to answer that one for the record.

[The following was received for the record:]

The Commission has established, by regulation, radiological criteria for the termination of licenses that fall under the Commission's regulatory authority. These regulations provide a clear and consistent basis for determining the adequacy of remediation of residual radioactivity resulting from the possession of Atomic Energy Act material. The NRC legislative proposal would establish that NRC's cleanup standards are adequately protective for purposes of the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund), and that those NRC standards govern the cleanup of sites and material licensed by the Commission, or by an Agreement State. In order for NRC licensees to remediate their sites, NRC regulations require that funds be set aside during the license term to ensure that sufficient money is available for the cleanup of residual atomic energy act materials.

To provide some background on this matter, the NRC has the statutory responsibility for the protection of public health and safety related to the possession and use of source, byproduct, and special nuclear material under the Atomic Energy Act of 1954, as amended, and must ensure safeand timely decommissioning of the nuclear facilities that it licenses. The EPA has responsibilities under CERCLA with respect to cleanup activities at contaminated sites containing hazardous substances, which can include sites subject to NRC regulation. Since September 8, 1983, EPA has generally deferred listing on the CERCLA National Priorities List (NPL) those sites that are subject to NRC's licensing authority, in recognition that NRC's actions are believed to be consistent with the CERCLA requirement to protect human health and the environment. However, as EPA indicated in the Federal Register notice announcing the policy of CERCLA deferral to NRC, if EPA "determines that sites which it has not listed as a matter of policy are not being properly responded to, the Agency will consider listing those sites on the NPL" (see 48 FR 40658).

Since the initiation of the 1983 deferral policy, EPA has taken action at very few formerly or currently licensed NRC sites. These EPA response actions at NRC licensed sites were conducted in joint cooperation, to address contamination that is not within NRC's regulatory authority, including non-radiological chemical contamination or contamination outside the facility boundary.

In the rare cases where the regulatory efforts of the NRC or an Agreement State would not accomplish results that are satisfactory to the NRC or an Agreement State, the Commission or, where applicable, the Agreement State, could request the application of Superfund to effect adequate cleanups. Superfund would apply only in this situation. That is, Superfund would not apply to NRC or Agreement State licensees unless NRC or an Agreement State asks for its application.

The Commission's proposal would end uncertainties facing former NRC licensees regarding the future views of EPA with respect to acceptability of cleanup efforts that the NRC has found to be adequate, and would resolve an outstanding issue that has not been resolved regarding dual regulation.

Mr. BOUCHER. Well, I would invite you to do that, because if we are going to consider seriously your recommendation, I think that is a key consideration for us.

Mr. TRAVERS. Sure.

Mr. BOUCHER. I notice also that you are recommending that Congress amend the Atomic Energy Act and eliminate the restrictions that exist in current law on the ability of foreign entities to own nuclear power plants in the U.S. What is your rationale for that?

Mr. TRAVERS. Our rationale, sir, is that when these restrictions were—at least we believe when these restrictions were first put into the Act, nuclear technology was in its incipient stage. And it was not a technology that, in large measure, was known and being implemented around the world. Of course, today that situation has largely changed.

And so that, combined with the fact that many of the organizational restructuring efforts that we see involve foreign entities, and the fact that the Commission has with its capability the ability and responsibility to determine if there is an inimicable problem with a particular entity—for example, a country like Iraq, if you will—we could still exercise our authority under the Act, we believe, even without this prohibitive sort of exclusionary language that currently exists in the Atomic Energy Act.

Mr. BOUCHER. Well, would you be making the determination with regard to whether there was some kind of national security risk with a particular foreign entity having ownership of a facility in the U.S.?

Mr. TRAVERS. The answer, I believe, is that the NRC could in fact do that with consultation among Federal agencies that would provide——

Mr. BOUCHER. Is that consultative requirement built into your statutory proposal?

Mr. TRAVERS. I would have to answer that one for the record, sir. I am not sure.

[The following was received for the record:]

The NRC's legislative proposal does not include an express requirement for the Commission to consult among Federal agencies before implementing the requirement that a license may not be issued to any person if, in the Commission's opinion, such issuance would be inimical to the common defense and security or to the health and safety of the public (the latter requirement is contained in the last sentence of both sections 103 d. and 104 d. of the Atomic Energy Act, and it remains unchanged). However, there are informal mechanisms through which the NRC may obtain the views of the Executive Branch. In practice, the Commission has obtained the views of other Federal agencies on issues of mutual concern, including those related to the protection of the common defense and security. These informal mechanisms would be available for use in making a determination implementing the restriction against issuance of a license to a new owner, as to whether issuance would be inimical to the common defense and security.

Mr. BOUCHER. I would ask you to do that.

Mr. TRAVERS. Sure.

Mr. BOUCHER. Last year, largely at your request, Congress changed the method by which you collect user fees, but there was a provision adopted simultaneously that says that the utilities do not have to pay for certain kinds of programs that are carried out by the NRC—your international programs, for example.

Mr. TRAVERS. Yes.

Mr. BOUCHER. What effect is that provision having in terms of the overall level of fee collection? Is it diminishing the level of fee collection? And if it is diminishing the level of fee collection, are you finding that you have adequate revenues with which to carry forward your essential programs?

Mr. TRAVERS. Yes. In fact, it is, and——

Mr. BOUCHER. It is what?

Mr. TRAVERS. It is reducing the collections.

Mr. BOUCHER. Okay.

Mr. TRAVERS. Because as I understand the stipulation, 2 percent going forward additive for the next 5 years, equating to 10 percent ultimately, of fees that are currently obtained from our licensees would be money that would be collected from the general fund instead.

And as you indicated, activities such as international activities that we feel are sort of a generic benefit to our licensees but not a direct one, are the sorts of activities that we had in mind in proposing this.

And in the main, the answer as far as, do we have enough monies to support our fundamental mission objectives, the answer is that, generally—I mean, the answer is yes, and we are moving forward in the development of our budget to support and determine, really, what sorts of resources would be required should projects currently not anticipated, like advanced reactors, come before the Commission.

The expectation is that if many of these projects did come before the Commission in the near term, we would need to budget additional resources for that, because what we have today is very much in play in activities such as license renewal and other activities.

Mr. BOUCHER. All right. Thank you, Dr. Travers. That is a complete answer.

Mr. BARTON. The gentleman's time has expired.

The gentleman from Kentucky, Mr. Whitfield, is recognized for 5 minutes.

Mr. WHITFIELD. Thank you, Mr. Chairman.

Mr. Magwood, I know that your Office of Nuclear Energy does not have responsibility anymore for the DUF-6 conversion project, but I also know you are quite knowledgeable about it. And I think you all have received five bids on March 1, and supposedly the Department of Energy will award a contract sometime in August to build a facility at Paducah and at Portsmouth.

And I was curious, do you have any idea or thoughts on what the appropriation level should be for fiscal year 2002 to keep that project on track?

Mr. MAGWOOD. As you pointed out with the transfer of this program to DOE's Office of Environmental Management, my office is no longer responsible for the program, so it would be difficult to give you a very precise answer. Let me say that I do know that industry has begun to express its interest in this project more formally and has asked for additional time to formulate bid packages. My understanding is that the schedule for the program is being reset based on the request made by industry.

As you know, this is a complex technological task that we have asked industry to take on. Until the project schedule is redefined, it is very difficult to know what the appropriation for next year should be.

I do know that a number has been established by the Office of Environmental Management, working with the Office of Management and Budget, and that will be in the President's budget request. However, I think that that number may have been affected by the fact that industry has asked for more time to prepare its bids.

Mr. WHITFIELD. Okay. Now, let me ask you, this is a hypothetical question. But Mr. Strickland and others talk frequently, as I do, about the necessity for the capability to produce enriched uranium domestically.

And, hypothetically, let us say that, as you know, USEC has in negotiations with TENEX tried to amend their suspension agree-

ment to bring in commercial grade SWU from Russia. Obviously, one of the reasons they want to do that is it would help them financially. And let us say that they do not receive approval to do that.

And then, second of all, they are the exclusive agent for the Russian agreement on highly enriched uranium, and there are other utilities that have expressed an interest in also becoming an executive agent, so that USEC would not be the sole exclusive agent. And let us say that that was approved and that USEC was no longer the exclusive agent.

Then, let us suppose, USEC had real financial difficulty and maybe would not be able to operate their plant. And as I said, all of this is hypothetical. But if that happened and we would not have any ability to enrich uranium domestically, what would you recommend we do?

Mr. MAGWOOD. That is an interesting hypothetical. I think that the way that we are going to address this over the next several weeks and into the future—that is, the issue of what to do with the enrichment business in the United States, which is very important as I think several opening statements reflected—is to recognize that it has both an energy aspect to it and also a national security aspect to it.

That said, the administration is examining these issues in the context of both the Vice President's energy review, which is underway, and also under the various national security reviews that are being pursued.

And until those reviews are complete, it is very difficult to know or to answer your question. There is simply a great deal of analysis, and policy review that needs to be completed, but I can promise you that it is something that is very, very high on the Secretary's list of issues.

He has, in fact, formed a new senior-level task force within the Department that brings together all of the components of the Department, including the National Nuclear Security Administration—to try to deal with this adequately. So as I say, I can't really answer your hypothetical at this point, but I do know that policy is being established and hopefully very soon we will be able to address that.

Mr. WHITFIELD. Thank you.

Mr. BARTON. The gentleman's time has expired.

Seeing no other members on the minority side, we are going to let Mr. Strickland ask questions for 10 minutes, so that we will only have one round of questions for this panel, and he had expressed an interest in a second round. So we are going to recognize him for 10 minutes.

Mr. STRICKLAND. Thank you, Mr. Chairman.

Mr. Whitfield, thank you for that question. It is a question that absolutely needs to be answered.

Mr. Travers, if the research on the Pebble Bed Reactor progresses to the point of it becoming viable, and it needs an 8-percent assay in order to operate, and we are shutting down Portsmouth, which is currently licensed to enrich to 10 percent, where will we get the fuel that we may need at some future time for such a reactor?

Mr. TRAVERS. Well, Congressman, as you know, in relationship to the remaining enrichment facility that will be operating shortly in the U.S., that capacity has been recently increased from 2.75 to 5.5 percent. It is my understanding that for PBMR the enrichments are on the order of 8 percent or so.

Exactly where that will come from I can't say, but I think the expectation——

Mr. STRICKLAND. Thank you.

Mr. TRAVERS. [continuing] is that it could come from abroad, or potentially even from the reactivation of Portsmouth or the licensing of a new facility.

Mr. STRICKLAND. I think the truth is that once Portsmouth is put on cold standby, we are talking about at least 1½ to 2 years and multiple millions of dollars to bring it back on stream. This is a fuel we may need in the future, and we are proceeding to close this facility. It just does not make sense.

Mr. Magwood, could you explain why DOE is proposing to maintain Portsmouth on cold standby? As a part of your answer, could you tell me, did DOE expect to find itself facing these circumstances? And what are the consequences if we do not place Portsmouth on cold standby?

Mr. MAGWOOD. To answer your second question first, it is very clear we did not expect to be in this position.

Mr. STRICKLAND. That you did not expect.

Mr. MAGWOOD. Did not expect it. The government as a whole, not just the Department, had a very clear understanding that the Portsmouth and Paducah plants would operate until at least 2004. Because of the financial issues that USEC has encountered, USEC has decided to cease enrichment operation at Portsmouth considerably earlier.

As a result, the government was unprepared, quite frankly, for the decision that was made, and had to react very, very quickly.

Mr. STRICKLAND. If I could just interrupt. I could say the government was not prepared because the government did not listen to very clear warnings about what was likely to happen. What are the consequences if we do not place Portsmouth on cold standby?

Mr. MAGWOOD. The consequences of not placing Portsmouth on cold standby are that the plant would be placed in I guess what has been called a cold iron mode, which is to say that you would allow the plant to be shut down in a way that would not make it likely ever to be brought back into operation, or you would go immediately to D&D, decontamination and decommission mode.

Mr. STRICKLAND. Can you tell me what the one-time costs are for—annual costs for placing Portsmouth on cold standby? How long will it take to restart the Portsmouth plant in the event that it is necessary for our national needs in the future?

Mr. MAGWOOD. The annual cost projected for cold standby, including the cost of removing any uranium deposits in the plant systems, is about $65 million a year. If that condition is maintained adequately, and it can be maintained that way for probably about 5 to 6 years without significant degradation of the plant, we would be able to bring the plant back up in about 1½ to 2 years.

Mr. STRICKLAND. How much would it cost to bring the plant back into operation, if necessary?

Mr. MAGWOOD. I don't know that off hand. I would have to answer that for the record.

Mr. STRICKLAND. As you know, Secretary Abraham announced his plan for cold standby in Columbus, Ohio, on March 1. How does the administration plan to fund that initiative? Will this committee be required to review a reprogramming request? When can we expect to receive such a request?

Mr. MAGWOOD. The Department has been working very closely with the Office of Management and Budget to formulate a plan to meet the financial requirements of the cold standby approach. We have not presented that as yet. It is currently under review by the administration.

It is my belief that it will be forthcoming very soon. In fact, I am hopeful that it will be forthcoming within the next couple of weeks. But it is a very complicated matter. It is a very expensive issue to be dealing with at this point in the fiscal year. So finding the resources has not been an easy matter, but we are trying to do that now.

The Office of Environmental Management has the lead role to work with the Department to try to find those resources, and they are doing that now.

Mr. STRICKLAND. So are you telling me that we could expect perhaps within 2 weeks to have such a reprogramming request before the Congress?

Mr. MAGWOOD. I am certainly hopeful of that. I think that if all of the approvals are completed, it can show up in that timeframe.

Mr. STRICKLAND. As you know, Mr. Magwood, USEC has received approval from the NRC to produce enriched uranium at 5.5 at Paducah. However, recent reports in the press indicate that USEC's maximum economic output at the Paducah plant is only about 4.5 million SWU per year when compared with the requirement of 10 million SWU to fulfill their contracts, both to the domestic and the foreign utilities.

Aside from safety, for which the NRC has already conducted a review, are you confident that the Paducah plant will be able to reliably and economically enrich uranium up to 8 million SWU per year at the 5.5 level assay?

Mr. MAGWOOD. I can't personally give you that guarantee. I don't know that the Department is in a position to give that guarantee. While we are very concerned about the energy security issues, it is clearly a commercial matter for which USEC is responsible. If NRC approves that upgrade from a safety perspective, we would certainly have to defer to USEC as to whether it is economic to do that.

Mr. STRICKLAND. So DOE does not have an answer as to whether or not this country is going to be supplied with a reliable economic domestic supply of enriched uranium to meet our Nation's needs? Is that what you are saying?

Mr. MAGWOOD. I am saying that DOE doesn't have a role in making the economic decisions for USEC. But we are concerned about potential long-term and the near-term energy security issues facing this country. As I have stated, the Vice President is conducting a very thorough review that includes this issue.

Mr. STRICKLAND. Mr. Travers, the NRC staff came to my office a few days ago, and they provided me with this document, and it laid out the timetable for closing the Portsmouth facility and for their hope that the Paducah would achieve a certain level of enrichment.

I was somewhat stunned, and I will tell you why I was stunned. We have got a facility that is currently finishing a fuel for our nuclear utilities. Paducah has been given permission to upgrade to 5 percent. We are in the process of closing our facility, making it inoperable for at least any reasonable expectation of coming back into production.

And yet we have not yet seen whether or not the Paducah facility can do what I believe you and the NRC is required to determine under the law, and that is that they are a reliable, economic, domestic supplier of fuel.

The document that was brought to my office indicates that USEC will begin to generate at 4 percent product during late March and early April, and then USEC will generate near 5 percent product for a few days in mid-April at Paducah. And then USEC will ramp down power and assay to near 1 percent in early May.

Isn't it reasonable to assume that something that is so critical to the energy security of this nation would require more than a few days' demonstration on the part of the Paducah facility? We are closing the plant that can provide the fuel before we know for sure.

Can you sit here today and tell me that you are absolutely sure that the Paducah facility will be able to meet our domestic needs in a reliable and an economic fashion after the Portsmouth facility is closed?

Mr. TRAVERS. Well, Congressman, I think, as you know, Chairman Meserve and the NRC have given these concerns that have been expressed by you and other stakeholders some very serious consideration. And, in fact, the reliable and economic responsibilities that you relate to, as contained in Section 193(F)(2)(b), we believe, after consultation with the general counsel of the NRC, is principally directed at the possibility of foreign——

Mr. STRICKLAND. Can I interrupt just a moment, sir? And I am sorry. But you say "is principally." Does that——

Mr. TRAVERS. It is, we believe, focused on this element, the potential for domestic—or, I am sorry, foreign entities becoming—gaining control and undermining the U.S. enrichment capability, as opposed to and separate from an obligation that we, frankly, would find difficult to exercise given our public health and safety responsibilities.

We think, rather, the objectives of the reliable and economic capacity of the country—rather than being an NRC responsibility fundamentally should be exercised in the Congress and in other organizations of government, the Enrichment Oversight Committee. And as I think Mr. Magwood pointed out, these discussions are taking place.

Our role, as we have evaluated it, is a rather focused one in the arena of assuring that the operations associated with the enrichment facilities, or facility in this case, are conducted in a manner that is safe. And so while we have looked at this, and while we have looked at the possibility of exercising your suggestion that we

limit our authorization at Paducah based on some linkage to the Portsmouth facility, we really have found that to be separate and a matter that should be considered separate. And so we——

Mr. BARTON. Okay. The gentleman's time has expired, actually, and that answer took about 4 minutes, that one answer. So if you have additional questions, put them in writing, and we will certainly get them expeditiously. I know how important this is.

Mr. STRICKLAND. Mr. Chairman, I want to thank you for your terrific patience, and I want to thank you for this hearing. And I will follow your suggestion.

Mr. BARTON. You know, it brings back memories of my efforts on a project down in Texas in my district called the Super Collidor Project. It is a different level of intensity when it is in your district, and you are to be commended for being well informed and on point on the questions. But, unfortunately, we have got about 7 or 8 other members that need to ask questions.

The gentlelady from New Mexico is recognized for 5 minutes.

Ms. WILSON. Thank you, Mr. Chairman.

Mr. Travers, in your testimony, or at least in the summary of it, you said that serious industry interest in new construction of nuclear power plants in the U.S. has only recently emerged. Could you expand on that statement and who you think is out there toying with the idea of—what is going to happen here?

Mr. TRAVERS. One reason for stating that is if you look historically at orders for new nuclear power plants we haven't, at the NRC, received an application for a new order for a commercial generating station since before Three Mile Island. Some might find that surprising. But before March 1979 was the last instance where the NRC received an application for a new nuclear power generation plant.

That having been said, we have over the last few years received applications that imply an interest in the development of new nuclear technology. In that regard, I am referring to design certifications which have been forwarded to the Commission, and, in fact, approved. These design certifications for three different plants——

Ms. WILSON. Thank you.

Mr. TRAVERS. [continuing] the advanced boiling water reactor, and others—are available to be referenced without further regulatory or without substantial further regulatory review.

Ms. WILSON. Thank you.

Mr. TRAVERS. So they are available.

Ms. WILSON. I wondered whether it was those design certifications or whether you were aware of any potential applications that——

Mr. TRAVERS. And I am.

Ms. WILSON. [continuing] you haven't received but that might be coming.

Mr. TRAVERS. And I am. And so I will finish very briefly by saying that what we are now experiencing is some more direct interest in the possibility of actually building a new nuclear power plant or at least licensing a site. And three instances come to mind—the Pebble Bed Modular Reactor that we have some ongoing discussion in a preapplication sense with Exelon; the advanced passive 1,000 reactor, which is a Westinghouse design, which has—which there

is an expressed interest for at least certification of the design if not for building a plant; and, third, for the possibility of licensing a site.

Again, this is an early site permit potential. What we are looking at here is an NRC review that would allow a utility to have all of the environmental review and approvals associated with the siting requirements for a new nuclear plant, completed and available for reference for——

Ms. WILSON. Okay.

Mr. TRAVERS. [continuing] between 10 and 20 years.

Ms. WILSON. Thank you.

Mr. Magwood, in your testimony, you talked about your work on advanced U.S. nuclear plant designs similar to those that have been constructed in Japan, South Korea, and Taiwan. In your opinion, where is the most promising technology for reducing the capital cost of nuclear plants?

Mr. MAGWOOD. That is a very good question. I think that there are many different paths we can pursue. We have talked about the potential for the Pebble Bed Reactor to present a new option. The Department has also been investigating gas turbine modular heating reactors, which is a technology using some similar aspects but a little different twist.

Also, with respect to the advanced light water reactors, there is huge potential that we have discussed with utilities and with the vendors to find smarter ways of building those technologies using advanced information system technology, for example, to reduce the cost of actually putting the plant together at a site, and also using smart equipment, which can reduce the operating cost, which is another component.

So there is different pathways, and I think that they are all going to have to be explored over the next several years to see what should be pursued, if not everything at the same time. It depends on what the utilities see as the economic model for building new nuclear power plants.

Ms. WILSON. Do you have within the Department an R&D road map for critical technologies to reduce the cost and improve the safety of nuclear plants? Or, I mean, maybe another way of putting that is, what do you need in your office, which I think is critical to this whole question, what do you need to accelerate the development of the fourth generation of nuclear power?

Mr. MAGWOOD. Yes. We have started—due largely to the leadership that came from Congress—the Generation IV technology road map, working not just with entities in the U.S. but with many other countries as well.

There are now—and this may be a surprise to some people—about 150 engineers and scientists all over the world working on the Generation IV technology road map with a goal to finish the road map next fall. This roadmap will provide a sense of what high priority technology research should be pursued by the U.S. and other countries and what the R&D plans should be to pursue those technologies.

And once that is completed, we will need to decide whether the Department should take an active role in developing those technologies using our national laboratories and other resources. That

is something we are pursuing right now very aggressively, and hopefully about a year from now we will know a lot more.

Mr. LARGENT [presiding]. The gentlelady's time has expired.

The gentleman from Georgia is recognized for 5 minutes.

Mr. NORWOOD. Thank you, Mr. Chairman. I have a couple of questions that I will submit in writing and expect detailed answers, and would point out that if I were having problems in my district with Plant Vogtle there wouldn't be enough hours in the day for me to ask questions. So with that in mind, I will yield the balance of my time to Mr. Strickland.

Mr. STRICKLAND. Thank you, my friend. I want you to know when I was meeting with the dentist earlier today I was saying really good things about you. So——

Mr. NORWOOD. Why do you think I yielded my time?

Mr. STRICKLAND. Mr. Travers, I am going to try to be terribly unemotional, and I want to read a part of Section 3116 to you, and it says this. I am quoting, "No license or certificate of compliance may be issued to the United States Enrichment Corporation or its successors under this section or Sections 53, 63, or 1701, if the Commission determines that the issuance of such a license or certificate of compliance would be inimical to, a) the common defense and security of the United States, or"—not and, but or "the maintenance of a reliable and economic domestic source of enrichment services."

Now, you are telling me and the NRC apparently has made the termination that they are going to either ignore that or assume that it is not relevant to your responsibilities. The NRC general counsel apparently has concluded that the requirement to make the determination regarding reliable and economic domestic supply is, "principally directed to the possibility of foreign entities being in control and undermining domestic enrichment capabilities in the privatized USEC."

Your general counsel has apparently advised the NRC that it may change its previous policies and interpretations of the Privatization Act so that the NRC will not have to render a determination on whether USEC's certificate amendment will result in USEC being a reliable and economic supplier of enrichment services.

Now, my question: can you please explain to me what new facts or laws justify the agency making this stark change?

Mr. TRAVERS. Not being a lawyer, I am a little bit at a disadvantage, Congressman, but I think—and perhaps we have, and if we haven't we should—provide you with the legal analysis that has been done in this matter.

I am relying on that, frankly, and the Commission has relied upon it, and it really is the basis for Chairman Meserve's letter to you and Congressman Dingell that indicates that a very serious look has been done to examine the Commission's responsibilities under the Act. And that as you have indicated, that a determination is that it is principally related to this possibility of——

Mr. STRICKLAND. Well, what about the part that is not "principally"? I mean, it seems clear to me that you have got an obligation to make a determination regarding reliable and economic domestic source of enrichment industries.

I will tell you what really bothers me here, sir. You received a 1997 memo and a 2000 memo. They both reference the same law, but they draw remarkably different conclusions about NRC's legal obligations. Is that true or not?

Mr. TRAVERS. I am not sure, but I guess I would point out there is a practical problem that I think we face.

Mr. STRICKLAND. There is a practical problem that we face.

Mr. TRAVERS. Yes, sir. And it is simply that given our principal focus on public health and safety, once we have looked at facilities and whether they are operating safely, the principal regulatory tools that we have at our disposal—issuances of orders, for example, to shut facilities down, or to have utilities take specific actions——

Mr. STRICKLAND. Yes, sir. Can I interrupt just a moment?

Mr. TRAVERS. Yes, sir.

Mr. STRICKLAND. Is it possible that this Congress gave you additional statutory responsibilities other than those that you have historically been responsible for?

Mr. TRAVERS. Again, I am relying upon the general counsel's analysis of what the responsibilities of the agency are, and I believe the Commission has relied upon that as well.

Mr. STRICKLAND. This is what concerns me. Many months ago, we started raising some of these issues about NRC's responsibility. We talked about it with NRC staff here in this committee. I had them in my office.

And I think we raised some very legitimate issues regarding your responsibility as an agency, and it seems to me that this second memo is an attempt to cutoff our questions, attempt to reinterpret your responsibilities in the light of the issues that I and others were raising with your agency, and that is terribly troubling to me.

Was public notice or comment made available prior to the NRC's change of policy in this regard?

Mr. TRAVERS. As far as I know, there was no public notice given prior to the general counsel's legal analysis being provided to the Commission.

Mr. STRICKLAND. And your general counsel apparently says that this change could, in fact, lead to litigation.

Mr. LARGENT. The gentleman's time has expired. Thank you.

Mr. STRICKLAND. I thank the Chair, and I thank my friend from Georgia.

Mr. LARGENT. The gentleman from Wisconsin, Mr. Barrett, is recognized for questions.

Mr. BARRETT. Thank you, Mr. Chairman. And given that Mr. Strickland has obviously got serious concerns here, I would be more than happy to yield my time to Mr. Strickland.

Mr. STRICKLAND. I thank my friend. You know, I don't want to be unfair to others and dominate this. We will submit questions. But I would just like to point out to the Chair that we have an agency of the Federal Government charged with a huge responsibility to protect the energy security of this nation, and I believe they are being negligent and wilfully so, and I would hope that this committee would take that very, very seriously.

Mr. LARGENT. I thank the gentleman.

The Chair recognizes himself for 5 minutes. I think I am next in order here.

And we are—just to give you a heads up, we are expecting Senator Domenici to be here at any time. When he comes, we will complete the questions, let him testify, and then move forward.

Mr. Magwood, I had a question for you. In light of the concerns that have been expressed in testimony before this committee today about the scarcity of fuel in the future, why doesn't the United States reprocess spent nuclear fuel?

Mr. MAGWOOD. I think the most obvious answer to that question is that it isn't economic to do so. We have worked very closely with other countries and discussing this issue over the years—Japan, France, others. They have had to make very large investments in plant and in people and in technology to begin reprocessing spent fuel.

And I think that the primary reason U.S. industry hasn't pursued this aggressively is because it is just not economic. That is not to say it won't be economic at some point in the long-term future, but right now it certainly isn't.

The former administration had a very aggressive policy regarding the proliferation aspects of reprocessing. The current administration hasn't spoken to the issue but it may be something they look at in the context of the Vice President's energy review. But the issue really hasn't been raised at this point.

Mr. LARGENT. So you believe that if or when it becomes economically feasible that this country would begin reprocessing spent fuel?

Mr. MAGWOOD. I believe——

Mr. LARGENT. That is the only impediment?

Mr. MAGWOOD. I believe that if it becomes economic, then the industry will make a case to the government to begin looking at it, and then it will be up to the government at that time to respond to it from a policy perspective.

Mr. LARGENT. Okay. Dr. Travers, I had a question for you. We have conflicting testimony. Senator Domenici is here, and we will recognize him in just a moment. But in his testimony I was reading with interest, in the fourth paragraph it says, "Safety has been a vital focus of the NRC, as evidenced by a constant decrease in the number of emergency shutdowns or scrams in our domestic plants. In 1985, there were 2.4 scrams per reactor. Last year there were just .03."

But in contrast to that testimony, testimony submitted by Anna Aurilio with the Public Interest Research Group in the next panel, she says, "There is a consistent pattern and history of lax NRC enforcement and oversight ranging from fire prevention to worker fatigue. The agency has focused on increasing the industry's profitability, not protecting humans and the environment."

Would you like to respond to that testimony?

Mr. TRAVERS. Thank you, Mr. Chairman. I think we have a serious disagreement on views on this subject. The NRC has been, and continues to be, an effective regulator with a bent and a passion, really, for the assurance of safety in all of the civilian use of radioactive materials. And I think that has been borne out over time.

It is somewhat difficult sometimes to differentiate where the NRC plays a role in the assurance of safety or the good record in

performance of the nuclear industry and where it is attributable in the main to the industry. We like to think, based on the activities that we have in place, that we have been a factor in the increasing level of performance, and, in fact, the increasing level of safety over time that the nuclear power industry has exhibited.

The Commission, for its part, has laid out policies that include expectations that for the next generations of advanced reactors, for example, they expect those designs to provide a higher level of safety than the current ones do today. We believe those are acceptable, but, nevertheless, the Commission has put in place an expectation that as we move forward potentially to develop new power reactor designs and projects that they ought to be safer than the current generation of nuclear power plants.

Mr. LARGENT. So you would say that workers are safer today, that neighbors to nuclear facilities are safer today than they ever have been?

Mr. TRAVERS. I would say that that is a fair statement.

Mr. LARGENT. Okay. With that, I would like to recognize Congresswoman Wilson from New Mexico to introduce our esteemed colleague from the Senate, Mr. Domenici.

Ms. WILSON. Thank you, Mr. Chairman.

I am very fortunate, as a New Mexican in the House, to have a senior Senator who is not only one of the most powerful members of the Senate but one of the most capable as well, and who has taught a young Member of Congress in the House how to be a better legislator.

And since I wasn't much on committees and being a legislator before I showed up here, I needed a lot of work, and I wanted to publicly thank him for his stewardship, but also to share with the members of this committee and with the members of the audience that while most of us know him as the chairman of the Budget Committee, he knows more about the budget than just about anybody in this town.

He has been one of the most stalwart advocates of a comprehensive energy policy for a long, long time, and when it wasn't popular to do so was encouraging people from all different parts of the political spectrum to reconsider nuclear energy. He has introduced the nuclear energy supply bill in the Senate, and he is a self-acknowledged sucker for big science projects.

Ladies and gentlemen, it is my pleasure to introduce Senator Pete Domenici.

Mr. DOMENICI. Thank you.

Mr. LARGENT. Senator, you are recognized for 5 minutes, and we look forward to your testimony. Thank you for visiting us.

STATEMENT OF HON. PETE V. DOMENICI, A UNITED STATES SENATOR FROM THE STATE OF NEW MEXICO

Mr. DOMENICI. Thank you very much. First, I apologize for being late. I should have been earlier on the agenda, but I could not help that. We couldn't complete our luncheon where we were discussing the budget today.

In any event, members of the Committee, and Mr. Chairman in particular, I came mostly to tell you that I have come to the conclu-

sion that every now and then a crisis is good. It is not great, but good.

And what I see now is that the energy crisis that is before us is good, because it is going to make America evaluate our energy supplies and the conservation practices that we are going to undertake in order to assure the American people that they are going to have sufficient energy in the future to turn the lights on in their houses, to turn the power on in their plants, to let streetlights in the city light up, and offices across this land have sufficient electricity to make sure everybody can see and do their work.

In a nutshell, my hope is we come out of this crisis in much better shape with reference to our future. I, for one, have known, and it didn't take me very long to understand that energy and the availability of it at a reasonable price, or as reasonable a price as possible, is America's life blood. Without it, we have no future, no future whatsoever with reference to prosperity, with reference to growth, with reference to jobs.

I have been for at least 4 years strongly advocating a return by the United States of America to prowess in the area of nuclear power at every level, build it back into our universities as a major area and field of study, build it back into our energy department. A department that, believe it or not, existed, Mr. Chairman, for more than 1 decade without wanting to claim that nuclear power was part of the energy department of the greatest Nation on earth—a rather incredible phenomenon that existed for quite some time.

I am proud to tell you that I have had a little bit to do with putting nuclear energy back into the energy department. This gentleman was hired to head up, after a dearth of years, that part of the Department that does nuclear power research.

It is a budding part of the Department, but it is moving out and causing universities to start rekindling nuclear activities on their campuses with their bright students, and the world is leaving us sort of behind. In Japan, in the next few months, there will be two new starts of two brand-new nuclear reactors because they are bound and determined to have a diversity of energy supply.

Now the United States comes to a period when we are extremely short of energy for the future—in particular, electricity. And, obviously, we will continue to need crude oil more and more unless something happens in the automobile area that isn't on the horizon today.

But the truth of the matter is that we are also bumping up against something else, that the world wants to prosper and America wants the world to prosper. We want rich countries to be made out of the poor countries of the world. The only way to do that is an abundant supply of energy, and so what we are coming right stark up to is, what do we do about air quality? And what do we do about the pollution? And what do we do about the Greenhouse effect?

And, Mr. Chairman, I am here to tell you that for a great nation to turn its face away from nuclear power, in light of this kind of a world situation, I don't know the word, but I am going to say it is borderline lunacy, because a few people have us frightened to death about what we are going to do with the waste.

We are about—now we are not going to—but we were about to abandon this perfectly clean fuel that is probably on average safer than any other way to generate electricity, contrary to what we are told. And we have one little problem left, and that is, what do we do with the waste? There are some who would like you all to believe it is not a small problem, that it is sufficient that you should abandon the option.

Well, I don't know whether any of you have gone to France and asked them to take you to the place wherein their nuclear waste from reactors lies. But if you are going to do that, tell them in advance, "Don't tell us when we arrive there. Just arrive there and let us guess." Because you will walk into a couple of buildings that look like school buildings, like big gymnasiums.

And you walk out about 100 feet and they will punch you and say, "Look down." And when you look down, the former fuel rods from their nuclear power are underneath you. They are in a solid compound with glass, with concrete on top of it, so there is no radiation in that building. You can walk anywhere. You can serve food there.

And they will have that for up to 50 years while they figure out what to do with it permanently. But they are not worried because they will figure out what to do with it permanently. And here we sit pondering what in the world are we going to do about this kind of energy supply for the future.

Now, in the U.S. Senate, I introduced a bill. I won't ask anybody to introduce it here, but I ask that if you are seriously considering the diversity required in the American energy mix in the future that you might take a look at it. As a matter of fact, it has one very exciting section that they are working on in the Department that is called "Transmutation of Waste."

Now, if you keep it open for those who are totally anti-nuclear, they will line up to tell you that is a bad thing. But I am here to tell you, if it works it is a good thing. Transmutation is a science, currently proved on a model size that takes high level waste and converts it into a much lower level waste that you can deal with very easily, and the other byproducts are not such that we can't handle them. It is an expensive one, but we put it in the mix for the future.

Now, there are other things to speak of, but I won't do that now. I will be glad to answer questions. And I just came over because I knew this committee, led by this subcommittee, are going to do some really important things in the next few months to establish where we are going with an American energy crisis that may be our most severe crisis.

And I wanted to urge you in my own way not to be frightened away by those who focus on one little piece of the nuclear energy cycle, but, rather, to look at the whole picture and the risks that you avoid when you look at the whole picture versus the risks you take.

And, frankly, I would assume that if that were the case and you were unburdened by anything else, you would say, "Let us move ahead to further perfect nuclear power because it is the right thing to do for the future."

My last observation is, I heard the Nuclear Regulatory Commission man saying that we were doing better at safety, and yet producing at a higher capacity. That is true.

Since 1990, the capacity has been going up, and the safety records have improved because the Nuclear Regulatory Commission has started to really regulate instead of playing games. They don't play games with the power plants anymore and having them do a bunch of things that are irrelevant just to waste their time.

And as a consequence, they have produced the equivalent of 20 new 1,000-megawatt power plants in the generating capacity of existing American nuclear power plants just by getting the capacity up from the 1970's to the 1990's per plant. No new plants, nothing new, just doing it better.

I would hope that this day would go down that I am testifying here that an event is occurring in our land wherein a nuclear power plant is being bought commercially, as a commercial transaction, one utility company buying it from another and making it part of a new inventory of the company that bought it which wants diversity and assurance. They are going to pay for it, just like you would pay for buying a natural gas power plant, and as a matter of fact they will lower their rates by doing it. That is very exciting.

Thank you very much.

[The prepared statement of Hon. Pete V. Domenici follows:]

PREPARED STATEMENT OF HON. PETE V. DOMENICI, A U.S. SENATOR FROM THE STATE OF NEW MEXICO

Mr. Chairman, thank you for the invitation to testify before your Subcommittee on Energy and Air Quality. I compliment you on the choice of subject for this hearing, the role of nuclear energy in national energy policy—this issue is of critical importance to our nation's energy and economic security.

Nuclear energy now provides about 22 percent of our electricity from 103 nuclear reactors. The operating costs of nuclear energy are among the lowest of any source. The Utility Data Institute recently reported production costs for nuclear at 1.83 cents per kilowatt-hour, with coal at 2.08 cents per kilowatt-hour.

Through careful optimization of operating efficiencies, the output of nuclear plants has risen dramatically since the 1980's; nuclear plants operated with an amazing 87 percent capacity factor in 2000. Since 1990, with no new nuclear plants, the output of our plants has still increased by over 20 percent. That's equivalent to gaining the output of about 20 new nuclear plants without building any.

Safety has been a vital focus, as evidenced by a constant decrease in the number of emergency shutdowns, or "scrams," in our domestic plants. In 1985, there were 2.4 scrams per reactor, last year there were just 0.03. While some use the Three Mile Island accident to highlight their concerns with nuclear energy, the fact remains that our safety systems worked at Three Mile Island and no members of the public were endangered.

Another example of the exemplary safety of nuclear reactors, when properly designed and managed, lies with our nuclear navy. They now operate about 90 nuclear powered ships, and over the years, they've operated about 250 reactors in all. In that time, they've accumulated 5,400 reactor-years of operation, over twice the number of reactor-years in our civilian sector. In all that time, they have never had a significant incident with their reactors. They are welcomed into over 150 major foreign ports in over 50 countries.

Nuclear energy and coal are our major producers of our electricity—those two sources provide over 70 percent. In both cases, their use presents significant risks. Together, they illustrate a fundamental point, that absolutely every source of energy presents both benefits and risks. It's our responsibility to ensure that citizens are presented with accurate information on benefits and risks, information that is free from any political biases. And where risk areas are noted, it's our responsibility to devise programs that mitigate or avoid the risks. Solutions, through careful research, for clean coal and for nuclear waste storage address key risk areas for these two electricity sources.

Interest in our nuclear plants is increasing along with dramatically increased confidence in their ability to contribute to our energy needs. Interest in re-licensing plants, to extend their lifetime beyond the originally planned 40 years, has greatly expanded. The NRC has now approved re-licensing for 5 reactors, and over 30 other reactors have begun the renewal process. Industry experts now expect virtually all operating plants to apply for license extension.

Nuclear energy is essentially emission free. We avoided the emission of 167 million tons of carbon last year or more than 2 billion tons since the 1970's. In 1999, nuclear power plants provided about half of the total carbon reductions achieved by U.S. industry under the federal voluntary reporting program. The inescapable fact is that nuclear energy is making an immense contribution to the environmental health of our nation.

But unfortunately, when it comes to nuclear energy, we're living on our past global leadership. Most of the technologies that drive the world's nuclear energy systems originated here. Much of our early leadership derived from our requirements for a nuclear navy; that work enabled many of the civilian aspects of nuclear power.

Our reactor designs are found around the world. The reprocessing technology used in some countries originated here. The fuel designs in use around the world largely were developed here. This nation provided the global leadership to start the age of nuclear energy.

Now, our leadership is seriously at risk. No nuclear plant has been ordered in the United States in over 20 years. To some extent, this was driven by decreases in energy demand following the early oil price shocks and from public fears about Three Mile Island and Chernobyl. But we also have allowed complex environmental reviews and regulatory stalemates to extend approval and construction times and to seriously undercut prospects for any additional plants.

As a nation, we cannot afford to lose the nuclear energy option until we are ready to specify with confidence how we are going to replace 22 percent of our electricity with some other source offering comparable safety, reliability, low cost, and environmental attributes. We risk our nation's future prosperity if we lose the nuclear option through inaction. Instead, we need concrete action to secure the nuclear option for future generations. We must not subject the nation to the risk of inadequate energy supplies.

In closing, Mr. Chairman, There is no single "silver bullet" that will address our nation's thirst for clean, reliable, reasonably priced, energy sources. Energy is far too important to our economic and military strength to rely on any small subset of the available options. In my view, it is critically important to our nation that nuclear energy be treated as a strong, viable option for our nation's electricity needs now and into the distant future. This would ensure that future generations continue to enjoy clean, safe, reliable electricity and the many benefits that this energy source provides.

Mr. LARGENT. Thank you, Senator.

I will recognize the gentleman from Massachusetts, Mr. Markey, for 5 minutes.

Mr. MARKEY. Thank you.

Senator, if you were looking at the nuclear power industry and obstacles which existed to the construction of a plant, let us say in New Mexico, what would you say would be the largest obstacle to a utility in New Mexico just ordering a nuclear power plant right now, and constructing one over the next 5 or 6 years?

Mr. DOMENICI. Well, I want to say to my good friend, Representative Markey, 5 years ago I would have told you the obstacles were so many and so numerous that I couldn't answer the question. I would say impossible.

I think it is still highly improbable as of this particular moment that you will do it, but I think we are getting very, very close. And the obstacles that are going to remain are public opinion. Thus, I guess that the next power plants will be built close to the existing power plants, so you couldn't pick New Mexico, but I don't mind you picking it. We just don't have one.

But if we had one, my guess would be that if somebody wanted to build one they would build it close to that, and that would be

one of the things you would look at in the country, I would think. Doesn't have to be the case.

Second, we have to have a new way of licensing. I think that has evolved, so there is a bit of modularness to the licensing. Then you would have a standard accepted design. If you chose to build that design, you wouldn't have to spend an inordinate amount of time going through that licensing process. But you would still have seismic and other considerations with each site.

And last would be whether you could finance it, and it would appear to me that—5 years ago I would have said it is impossible. Today I think the company that just bought one, and that is the fourth one bought and sold recently, they got it financed.

Mr. MARKEY. There has been a bit of a change in the way in which the industry itself used nuclear power. Back 2, 3, 4 years ago, they were calling it "stranded investment." All of these nuclear power plants were called "stranded investment." And they wanted to be compensated by the ratepayers in the states as a condition of moving to a deregulated marketplace.

And now, as you are pointing out, there are companies that are purchasing these nuclear power plants, really at bargain basement rates, and they are generating nuclear power at 90 percent efficiency. And so the industry itself—in other words, I guess my question is, do you believe that the industry itself had a misperception heading into the late—really into the mid and late 1990's in terms of how efficient and affordable nuclear power was?

Because we have already changed the laws here. The nuclear licensing laws have been changed by the Congress in the past decade that streamlines that process. So do you think that—in other words, is it more of a private sector issue now, where they are going to have to just engage this in the states, take on public opinion, make the decision they are going to go to the markets and just try to build, or is there something else here that you think that Congress should do as a matter of public policy?

Mr. DOMENICI. Well, Representative Markey, I have a bill that contains about 25 provisions, so I think there are some things we ought to do as a nation.

But I am not suggesting that the industry—if this bill never happened, and we continue in a crisis mode—I am not suggesting that industry might not find a solution as you are suggesting. But I don't think they were wrong 5 years ago. The market would not have provided for the buying and selling of nuclear plants 5, 7, 10 years ago, because we weren't in a crisis situation on energy, plus there has become a much broader base of acceptance, believe it or not.

Until you get the antis focusing in on one facility, the general public in the United States accepts nuclear power today. So, you know, that hasn't been the case all of the time.

Mr. MARKEY. Can I just say ,in conclusion, Mr. Chairman, that I want to agree with Congresswoman Wilson that you are a great Senator and a great American.

Mr. DOMENICI. Thank you.

Mr. MARKEY. And we thank you for coming over here.

Mr. DOMENICI. Thank you very much.

Mr. LARGENT. I thank the gentleman. The gentleman yields back.

I recognize the gentleman from Illinois, Mr. Shimkus, for 5 minutes of questions.

Mr. SHIMKUS. Thank you, Mr. Chairman.

Senator, and other people on the panel, welcome. Senator, a quick question, and it really kind of ties to a question that we had to the panelists earlier about the nuclear waste fund and the money that has been put in by industry, the amount that has been used for Yucca Mountain, and the balance, the unused portion.

Budgetarily, that is—you know, has it with Treasury—the Treasury Department is the steward of that, and it is not really dollars. It has been spent. And there is—very similar, like Social Security trust fund, where it has just been, you know, paperwork shuffled. Senator, can you speak to the nuclear waste fund and the budgeting aspect of that?

Mr. DOMENICI. Well, I would be glad to. I don't remember the numbers. I do know that the trust fund has been sitting there, like many trust funds. If the question has to do with why do we use it in the totality of a budget, then I would just say to you that my recollection is there are about 140 trust funds within the budget of the United States—some little tiny ones, some very big ones.

And if we chose to take them all off budget and say we are going to just run them on their own without relationship to a macro budget of the country, then we would have very little left in the budget. So we have left it in, and its reserves have been accounted for in the totality of the budget, thus making it easier to balance budgets and the like.

Of late, it doesn't seem to matter very much, Mr. Chairman. The surplus has grown so fast that they have left all of that subject to reconsideration.

Mr. SHIMKUS. Thank you.

And I have a question for Mr. Travers. And there is really a dispute, and I know that times have changed also based upon the environment, that the Energy Information Administration forecast 27 percent increase—actually, forecast that 20 percent of the existing nuclear generating capacity will retire by the year 2020 and be replaced by gas-fired generation.

Now, that may be prior to the gas spikes. I don't know when that report was filed, but that may have been past the doubling of the natural gas prices that we have had over the last couple of months.

But the Nuclear Energy Institute forecasts that most of the existing nuclear reactor operators will seek to renew their licenses, continue in operations for 20 years, long after 2020. There seems to be some degree of disagreement between EIA and NEI's forecast on the future of nuclear energy. What is the NRC's forecast for license renewals and future generating capacity of the existing nuclear fleet?

Mr. TRAVERS. Thank you. We have formal indications from about 40 percent of the operating units that they will, in fact, seek renewed period of licensed operation. And we really have to rely on the industry beyond that. The expectation, as you have indicated, from organizations like NEI is that 80 percent or more may seek license renewal.

Given that we rely on utilities to give us an indication of what their planning is, that is really our best source of information. I am

not familiar with the assumptions that may underlie the EIA's projections, but our current sort of budgeting assumptions are that 80 percent or more of the currently operating facilities will, in fact, seek renewal. And I recognize that recently NEI has suggested that most, perhaps more than—many more than 80 percent will.

Mr. SHIMKUS. You don't see anything that would prohibit right now industry from requesting renewals of the current facilities?

Mr. TRAVERS. I certainly don't see anything that would limit it in terms of our regulatory review process. It is one that we think has been efficient thus far. It is one that we are seeking to improve and factor in the experience of the initial application reviews as we move forward, with a focus on safety and the plant aging issues that dominate as you allow these plants to operate in a period of continued operation beyond 40 years.

Mr. SHIMKUS. And, Senator, just to finish, I was at Yucca Mountain yesterday.

Mr. DOMENICI. Oh, you were?

Mr. SHIMKUS. And so if in France you can walk over the spent nuclear waste, do you think we can safely put it inside a big mountain?

Mr. DOMENICI. Well, you see, the difference between the two philosophies is very, very big, in that we somehow are thinking that we are going to put high-level waste from our reactors in the ground, and then close it up and leave it there forever.

When I walked on top of the spent fuel rods in France, they never intended to leave them there forever. They intended to leave them there temporarily, so that they are completely different. Their product will be treated differently in terms of how it is encapsulated, incarcerated, and everything else, in that gymnasium in France versus putting it in the ground forever.

But I think you were really asking me whether I thought Yucca Mountain would ever work, would we ever do it. And I don't know, because I think so long as you have two differing opinions as widespread as the Nuclear Regulatory Commission on what are adequate safety guidelines versus the Environmental Protection Agency's guidelines, and they are so far apart, I don't believe you can build a facility under the environmental protection guidelines. I don't think it can be built.

So that is the hangup right now, as I understand it, in the country.

Mr. LARGENT. The gentleman's time has expired.

Mr. SHIMKUS. Thank you, Mr. Chairman.

Mr. LARGENT. Senator Domenici, I just wanted you to know that our committee staff has done a review, an initial review of your bill, and it has several positive ideas in the bill that I think would help develop our nuclear energy.

However, there were a few concerns, including nine new reports to Congress, two new Assistant Secretaries at DOE, two new named officers within the DOE, increased funding for nine research grant and cooperative agreement programs, and two new expert panels. And my concern is that we are going to need a new nuclear reactor just to turn on the lights of all of those new positions created.

And the question that I had for you was, do all those positions have to be in New Mexico?

Mr. DOMENICI. No.

Mr. LARGENT. I want to recognize the gentleman from Arizona, Mr. Shadegg, for 5 minutes of questions.

Mr. DOMENICI. We want them there very badly, but——

Mr. SHADEGG. Senator, let me ask you, last week we received testimony here in this committee, both on Tuesday and Thursday, on the California energy crisis, which is severe. And one of the witnesses explained that until—that current California law provides that no nuclear plant can be constructed in California until the issue of nuclear waste storage is resolved.

Mr. DOMENICI. Yes.

Mr. SHADEGG. I appreciate the analysis that you just gave my colleague, Mr. Shimkus, about the dichotomy. I guess I am looking, since I view you as a leader in this issue, for your guidance on how we resolve the dichotomy between those two and where we can go in this nation because I completely agree with you that we need a mix of energy sources.

I think to continue to rely solely, as far as we can see into the future, on natural gas is a—is not a wise policy. The Arizona—my home state, as you know, has a fairly large nuclear power plant which is operating well, and we are pleased with it.

I tend to agree with your statement about the acceptance of nuclear power by the American public. But I do think they want some resolution of this issue of waste. And if you could give us guidance on that I would appreciate it.

Mr. DOMENICI. Frankly, I want to tell you about your state. I went to the Palo Verde plant, and, you know, that was much questioned for a long time. It isn't being questioned now. If anybody wants to find out what piece of geography in the U.S. is yielding more megawatts of electricity per unit of ground, just go to the Palo Verde plant.

There are three power plants there, 1,000 megawatts each I think, which is a huge thing. If you want to see an example of American construction and engineering prowess, if you are like me when you see something that is put together with that kind of talent, you are just very proud to be there and see it. That is the way I felt.

And then, to see all of these workers well paid, none of them, from what I could tell, the least bit worried about their workplace, they felt probably as safe or safer than they would in your natural gas fields or mine producing natural gas out there at the well head. Probably they felt safer in this place.

But I don't have an answer. If California is going to insist that we close the nuclear energy cycle before you build one in California, then I think they are going to have to wait a long time—and maybe that is how they would like it—because I think we have a political problem with the State of Nevada that is serious with reference to the state fighting the Federal Government.

And you see if transportation is an issue, then what we should do is have a temporary facility as close as possible to the permanent facility, so you don't move everything twice. That is why it was pretty smart to say, if you are going to put it in the ground,

wherever, in Nevada, why don't you put the temporary facility for 30, 40, 50 years, close to it?

We can get neither of those approved, so we are going to look to another policy. And I don't think we are without options. I think there are some that will be worked on, but I don't know when that will occur.

Mr. SHADEGG. Let me ask you a different question, then. The Generation IV technology appears to at least to a certain degree address this waste issue by the—I guess the encapsulating of the fuel and glass, and the question of moisture no longer being able to reach the fuel.

Do you see that as a long-term solution? And are there things that your bill does to specifically promote Generation VI capability?

Mr. DOMENICI. Well, Generation IV also is a passively safe plant, so that for those who envision meltdowns, you can't have a meltdown with a Generation IV nuclear generator. Just by definition, it is built so that can't happen.

I have just been recently told by companies that own American nuclear power production, none of which are Generation IV, that they are not giving up on next generation of lightwater reactors. They are not certain you have to go all the way to Generation IV. There are a couple of new models by big American companies that would improve the lightwater reactors so dramatically that rather than waiting around for Generation IV to be ready, if they were looking to build now, they would build one of the improved lightwater reactors.

On the other hand, one of the most exciting things happening about energy is the Generation IV, and one of those is going to be built in South Africa. They are modular. They are small. That is a very exciting idea. I don't remember. Are they going to be 100 megawatts each? That is, you know, one-tenth the size of what we have licensed for nuclear power. And then you just build more of them under an expanding permit with the exact same replica.

And it has all of the other exciting features that you have described with reference to waste, so I think the world needs to move with as much rapidity as possible in that direction. If we are worried about Greenhouse gases and the ambient air qualities, we clearly should be helping with that. And I think our Nuclear Regulatory Commission is going to be helpful, Mr. Chairman, with the Generation IV that is being built in South Africa.

Mr. SHADEGG. My time has expired.

Mr. LARGENT. The gentleman's time has expired.

Mr. SHADEGG. I thank the gentleman for his testimony.

Mr. LARGENT. There is a sadistic side of me that wants to unleash my friend, Mr. Strickland, for 5 more minutes, but I am going to resist that temptation and excuse our panel. Thank you, Dr. Travers, Mr. Magwood, Ms. Hutzler, and Senator Domenici, for shedding some light and your experiences with us. Thank you. Thank you very much.

We will call the next panel forward.

Mr. NORWOOD [presiding]. We welcome our panel this afternoon. Thank you for taking your time to come and be with us. The first person we would like to hear from is Mr. Randy Hutchinson. He

is Senior Vice President, Business Development, for Entergy Nuclear in Jackson, Mississippi.

Mr. Hutchinson, we are pleased you are here, and we would like to hear from you for 5 minutes, please.

STATEMENTS OF C. RANDY HUTCHINSON, SENIOR VICE PRESIDENT, BUSINESS DEVELOPMENT, ENTERGY NUCLEAR; ALFRED C. TOLLISON, JR., EXECUTIVE VICE PRESIDENT, INSTITUTE OF NUCLEAR POWER OPERATIONS; EDWARD F. SPROAT III, VICE PRESIDENT OF INTERNATIONAL PROGRAMS, EXELON CORPORATION; JOHN R. LONGENECKER, LONGENECKER & ASSOCIATES, INC., MANAGEMENT CONSULTANTS; AND ANNA AURILIO, LEGISLATIVE DIRECTOR, U.S. PIRG

Mr. HUTCHINSON. Thank you. Thank you, Mr. Norwood, Chairman Barton, Ranking Member Boucher, and other distinguished members of the Energy and Air Quality Subcommittee. It is a pleasure to appear before you today.

I am here on behalf of the Entergy Corporation and the Nuclear Energy Institute. Entergy is a large nuclear utility with more than 2.5 million customers. We operate in Arkansas, Mississippi, Louisiana, and Texas, with more than 30,000 megawatts in generating capacity.

We are also a large national nuclear operator. We have extensive nuclear operations in the mid-south and in the northeast, primarily in the Massachusetts and New York areas. I want to speak to the resurgence or renewed interest or renaissance that we are seeing in our industry today with nuclear power.

I think that is primarily for three reasons. First, the performance of the Nation's nuclear plants has improved dramatically. You have heard discussion about the improvement in safety performance, capacity factors, or the availability factors of the plants in the industry have improved from around 65 percent in the 1980's to about 90 percent today.

And as you heard previously, that is the equivalent of adding about 23 1,000-megawatt generating plants to the grid. That is enough to meet about 30 percent of the growth in demand that has occurred during that time period.

Also, I think another factor that relates to increased performance from the reactors is we have seen a consolidation in the industry resulting in fewer but larger nuclear operators in this country today. They bring far greater management expertise and focus to nuclear operations.

Five years ago, there were 46 operators operating the Nation's 103—or 104 we have heard today—nuclear plants. Today, 34 operators operate the same number, and I think we will continue to see that consolidation in our industry. It is kind of like we—we view it as kind of like buying a mutual fund. You can benefit from highly focused nuclear management expertise, and the sharing of nuclear talent and expertise across your fleet.

The second reason I think is that we are seeing that renaissance relates to the—that nuclear power is not cost-competitive driven by two factors; one, to improve performance, that has helped reduce

nuclear production costs, but also the rise we have seen in natural gas prices recently.

Today, nuclear production costs are lower than any other source of generation that we have in the country, lower than coal, gas, oil. And nuclear power provides a hedge against large price swings that we see in the market in the gas and oil industry.

And then, the third reason I think we have seen renaissance in the nuclear area is that the environmental benefits of nuclear energy are being recognized. Nuclear does not produce any Greenhouse gases or any combustion pollutants. I think the bottom line is, in our view, that the Nation's 103 nuclear plants today are producing about 22 percent of the electric power that is being consumed in this country in a safe, low-cost, and in an environmental-friendly manner.

What is the future for nuclear power? Well, I think we are likely to see this volatility in the oil and gas market in the future. Since nuclear is now providing about 20 percent of the electricity consumed in this country today, we are likely to see nuclear power around for a long time. I think that should be the case. And there are some things in place to help ensure this.

The Nuclear Regulatory Commission has established a license renewal process to provide a mechanism for extending the life of an operating nuclear power plant today for an additional 20 years beyond its 40-year licensed life. Several plants have either already done this or are in the process of doing it. We are doing this with our plants. We have one that is nearing the completion of a license renewal process.

And the owners of at least two-thirds and perhaps more of the operating plants in the country have indicated, some formally and some informally to the Nuclear Regulatory Commission, that they intend to apply for a life extension for their plants.

So this is an area where I think you can help. It is critically important, in our view, that the Nuclear Regulatory process remained in place, adequately funded, and it continues to function in the effective and timely manner that it has so far to act on these license renewal applications as they come along in the future.

To the question of, "Will new plants be built?" we think so eventually. I think several factors are giving us some optimism in this area. One is that there are standard lightwater reactor designs that have already been approved and—reviewed and approved by the Nuclear Regulatory Commission and are on the shelf so to speak.

You have heard some discussion on the advanced reactor technologies here that is being looked at and considered by some utilities in our industry. And the NRC has also developed and has in place a new licensing process, a streamlined process for licensing new plants. That process is yet untested in that nobody has used it, but it is there.

And then, finally, an industry task force is in place that has been formed, and it is working to identify and try to address issues that are—have to be resolved. Some of these issues are likely to be industry needs confidence that the regulatory process is going to be timely, effective, dependable.

I think the industry—we are going to have to get comfortable and have some confidence and certainty in the fact that a new plant can be built in—with a time to market in 36- to 42-month timeframe and at a cost of something on the order of $1,000 a kilowatt hour that will compete with $3 and $4 gas.

And, finally, we also all look forward to the Department of Energy's recommendation of the Yucca Mountain fuel repository and the President's approval hopefully later this year.

Thank you.

[The prepared statement of C. Randy Hutchinson follows:]

PREPARED STATEMENT OF C. RANDY HUTCHINSON, SENIOR VICE PRESIDENT, BUSINESS DEVELOPMENT, ENTERGY NUCLEAR, INC.

Chairman Barton, Ranking Member Boucher and distinguished members of the Energy and Air Quality Subcommittee, my name is Randy Hutchinson. I am the Senior Vice President for Nuclear Business Development for Entergy Nuclear. My staff buys nuclear power plants.

Entergy's customers—2.5 million in Arkansas, Mississippi, Louisiana and Texas—have long benefited from a diverse electric generating portfolio. Our company has more than 30,000 megawatts of power using a range of fuels—29% from natural gas, 26% from nuclear, 17% from coal, 3% from oil and 26% from purchased power—an almost ideal balanced mix of fuels. As a result, Entergy's electric customers are not as subject to the volatility of foreign oil and gas prices. And Entergy will maintain this balanced fuel mix as the company grows.

Entergy Nuclear is headquartered in Jackson, Miss. Entergy Nuclear Southwest has operated five reactors at four locations in Arkansas, Mississippi and Louisiana going back about two decades.

Entergy Nuclear Northeast in White Plains, N.Y., is our new regional headquarters for that region. We own and operate the Pilgrim Nuclear Power Station in Plymouth, Mass., the Indian Point 3 plant in Westchester County, N.Y. and the James A. Fitzpatrick plant in Oswego County, N. Y. We have agreed to purchase the Indian Point 1 and 2 plants from Con Edison and expect to close that transaction in mid-2001. Indian Point 1 has been in safe storage for 20 years, waiting for decommissioning of the other two operating units.

Entergy Nuclear, the fastest growing nuclear operator in the nation, is now the second largest with nine operating units. And we are aggressively competing for additional nuclear units wherever they are for sale. Nuclear power is a principal growth strategy of our corporation. Indeed nuclear energy is our core competency.

Entergy has built its success on the foundation of a *strong safety culture.* When you have invested billions of dollars in nuclear assets as Entergy has, believe me, you are serious about safety at all times and at all levels. We know a reliable, top performing plant is also a safe plant. Our operating experience of 25 years shows they go together.

In our view, we are seeing a *renaissance* of nuclear power for three principal reasons:

- Operators of nuclear power plants have made significant improvements in the performance of their plants. Capacity factors were around 65% in the 1980s, meaning nuclear plants were producing about 65% of the power they could produce in a year. Last year, the industry average capacity factor hit 89 percent. Our plants in Entergy were in the low to mid 90 percent range. Safety performance has also improved as shown by INPO's performance indicators.
- Secondly, nuclear power is now the lowest cost power in the nation. Production costs at a nuclear plant are below 2 cents a kilowatt-hour, compared to 3-4 cents at a natural gas-fired plant
- Thirdly, nuclear does not emit the global warming gases and other pollutants that other energy sources do.

Why is nuclear seeing this renaissance now?

We are seeing a confluence of forces. Natural gas prices have risen dramatically. Historically gas has been available for prices in the $2-3 per million BTUs range but those prices in the past year have risen to the $4-6 range nationally and even hit $50 and more in California recently.

At the same time, the nation's economy has continued to grow, increasing the demand for electric power across the nation. Higher fossil fuel prices and growing demand has been a powerful combination of forces.

It is also becoming much clearer to many that nuclear power is the lowest cost power in the nation. The cost of nuclear fuel has long been relatively stable, not subject to oil and gas price increases. Nuclear is also being recognized for its environmental advantages. Nuclear plants do not emit the global warming gases and other pollutants that power plants running on other types of fuel do.

California today is seeing the perfect storm. Three colliding fronts. There is too little supply and transmission capacity. No new power plants have been built in California in a decade. State deregulation law forced utilities to sell their plants and buy only in the day ahead market. Long-term power supply contracts were prohibited, a prescription for disaster. Then natural gas prices rose from $2-4 per million BTUs to $50 and up. California could really use the Rancho Seco nuclear plant, shut down a decade ago amid much controversy.

Deregulation is allowing and accelerating the consolidation of nuclear power industry that was already occurring and probably would have occurred anyway. Utilities with only one or two nuclear power plants have been realizing that it would be increasingly difficult to remain competitive without the resources and capabilities of larger operators.

We at Entergy Nuclear recognized the advantages of operating a fleet of nuclear plants three or four years ago and decided to pursue a nuclear growth strategy. We have now become the nation's fastest growing nuclear operator, and truly a national operator with two fleets of plants—in the South and in the Northeast.

Consolidation in the nuclear industry is bringing several advantages.

You can bring a very focused management to plant operations. Economics of scale through purchasing can be achieved. You can spread financial risk over several plants, much like spreading risk when you buy a mutual fund. You can pool talent and expertise in financial, technical and management areas.

You can respond quickly to a problem at one plant with highly qualified expertise. You can bring the best practices from all plants to each plant. And you grow to understand better what the regulatory authorities want and require.

You can easily see why consolidation is occurring. It is rapidly providing our country with higher levels of safety and reliable performance at lower costs.

Entergy Nuclear bought the first nuclear plant sold by a utility when we purchased the Pilgrim Nuclear Station from Boston Edison in July 1999. There have been 13 acquisitions of nuclear plants since then, less than two years. Entergy has been the fastest growing, having almost doubled our five-reactor fleet in the South with four plants bought or under contract in the Northeast.

Five years ago, 46 operators were running the nation's 103 nuclear plants. Today 24 operators are. Eventually there probably will be 5-8 principal nuclear operators.

The average nuclear plant operating today is only about 18 years old, far from the expiration of its original 40-year operating license period. But as some of the earliest plants approach their license periods, we in the industry have realized their useful lives are actually much longer. As computer systems, instrumentation and other technology has advanced, these whole systems have been replaced in today's nuclear plants. In many ways, today's operating plants are virtually new. Many were originally designed with a 60-year life in mind, but were licensed for 40 years to provide an extra margin of safety.

As a result, we are convinced the useful operating life of today's plants can safely be extended through a rigorous license renewal process for up to an additional 20 years. Several plants are in the relicensing process at present, including one of ours, Arkansas Nuclear One unit 1.

To further demonstrate our commitment to nuclear power, Entergy Nuclear last fall purchased a decommissioning services firm, TLG Services in Bridgewater, Conn., to get world-class technical and scientific engineering expertise in the planning and cost estimating of decommissioning. And we are now offering complete nuclear life cycle management services to the U. S. industry.

Will new nuclear plants be built? Yes, we think so. But only if and when we can bring some certainty to the industry. And you, as our nation's policymakers, can help to establish that certainty. New nuclear capacity can and will be built when it makes sense to take the financial risk. The industry must see:

- Certainty in the costs of a new plant
- Certainty in the regulatory permitting process, and
- Certainty in the time required to build.

Much work has already been done to design and obtain regulatory approval of new advanced reactor designs that are simpler than today's operating plants. Simpler generally means safer. It also means more competitive in both construction and operating costs.

Much has also been accomplished by the industry and the NRC in developing a streamlined license process. So that you can depend on actually operating the plant

once built. A new licensing process must be thorough, and result in the issuance of both a construction permit and an operating license. When today's operating plants were built, a construction permit was issued after much review and another review was required before an operating license could be issued, often resulting in years of additional delay and accumulating costs. As a result, as much as 20 percent of the total cost of today's plants was actually interest costs that had grown while the plant was waiting to go into operation.

With advanced, simpler reactor designs, an improved construction and operating license process, the time and resulting cost of a new nuclear plant would be better known. That would translate to less financial risk, an imperative in today's deregulated power marketplace. It can be done and is well on the way to reality. Your support as policymakers is critical.

In our view, a new nuclear plant will be built when one can reasonably depend on the cost of that capacity will be in the $1,000 per kilowatt range. And that cost will be determined by the above circumstances.

We at Entergy and others in the industry have been working together with the NRC to find solutions and bring certainty. We expect several nuclear operators will announce early site locations later this year to begin the process of keeping the nuclear option open in this country.

The used nuclear fuel problem is, in our view, a political problem, not a technical one. A decade of science has brought us very close to the selection of a permanent storage facility at Yucca Mountain. The nation's electric consumers have been paying one mill per kilowatt-hour produced at all nuclear plants into a Nuclear Waste Fund that now totals $16 billion. The used fuel solution has been paid for. We are confident the Department of Energy will complete its study and recommend moving forward with the Yucca Mountain facility and the President will agree later this year.

Entergy is committed to nuclear energy. We firmly believe nuclear will continue to be a safe, reliable and lower cost source of power for our country. Nationally, nuclear energy is the second-largest source of U.S. electricity, producing one-fifth of all electricity at record levels of safety and efficiency and at production costs lower than coal and natural gas plants.

No other source of electricity can provide large amounts of power reliably and reasonable costs while enhancing our air quality.

Nuclear energy will continue to help meet our nation's public policy goals for energy security, economic growth and environmental protection. You and your colleagues can make it happen. I assure you, nuclear will respond **with safe, reliable and low cost** energy. Today, and in the future.

With your help, nuclear power can continue to be a critical part of our nation's energy supply.

I hope you find this information helpful. Thank you for inviting me today.

GENERAL DISCUSSION OF ENERGY POLICY AND NUCLEAR ENERGY

Nationally, nuclear energy is the second-largest source of U.S. electricity, producing one-fifth of all electricity at record levels of safety and efficiency and at production costs lower than coal and natural gas plants.

I would like to thank Chairman Barton and this subcommittee for focusing on the importance of national energy policy and the value of America's nuclear power plants to our nation's energy supply and environmental protection.

From an energy policy perspective—the nation is at a crossroad. The greatest source and constant driver of growth in the United States for the past century has been electricity. Without vast and steadily increasing supplies of power, this nation could not have become the economic marvel that it is. Many of the country's most significant advances—technological and societal—would not have been possible without a constant flow of reliable, affordable electricity.

The Nation Needs a Comprehensive National Energy Policy

As the "new" economy converges with traditional economic infrastructure needs, electricity will continue to be the driver of our economic engine, whether to power the Internet or the nation's assembly lines. As its cornerstone, any national energy policy must increase domestic electricity supply in order to meet this new demand, expected to increase at least 42 percent by 2020.[1]

To meet future electricity demand and maintain U.S. energy security, a comprehensive national energy policy must:

- Encourage investment in new power plant construction.

[1] EIA, Annual Energy Outlook 2001

- Continue regulatory modernization, including regulatory stability for operating nuclear plants and licensing of new plants.
- Ensure sufficient funding for research, development and swift application of new nuclear energy technologies is consistent with nuclear energy's future role in meeting U.S. energy needs.
- Eliminate discrimination and ensure nuclear energy receives the same treatment as other electricity generating technologies in the marketplace.
- Educate the nation about the excellent safety record of nuclear energy and inject sound science and intellectual honesty into the national energy debate so consumers may make informed energy choices.
- Maintain U.S. leadership and infrastructure to train the next generation of scientists, engineers and technicians required to design, build and operate nuclear power plants.

Our nation cannot meet the demands of our growing population and economy without increased power generation through the construction of new power plants. We need to maintain the proportion of non-emitting baseload capacity through the construction of new emission-free plants. This will maintain a diverse energy portfolio for the nation and continue the price stability nuclear energy offers.

Nuclear Energy: Significant Role in the Nation's Electricity Portfolio

To achieve these short and long-term objectives requires an energy policy that supports and encourages a continuing significant role for nuclear power. More than ever, the nation relies on nuclear energy to meet the country's soaring demand for power. There is no longer any question that nuclear energy currently plays—and will continue to play—a critical role in providing electricity to the nation. Today, the nation's 103 nuclear plants produce about 20 percent of our electricity.

More importantly, as plants have increased in efficiency over the last decade, nuclear power's role in meeting consumer demand has grown by nearly 20 percent. Clearly, nuclear energy is absolutely essential to the integrity of the U.S. electricity grid and to our clean air goals.

Nuclear electricity is generated without producing greenhouse gases or other air pollutants, thus providing Americans with tremendous environmental benefits. Without nuclear energy, the United States could not meet air quality standards established by the Clean Air Act or international commitments to reduce greenhouse gases, including carbon dioxide. The reduction of air pollutants or the avoidance of emissions imparts significant health benefits to people across the nation, by reducing respiratory illness, for example.

Nuclear power plants are the nation's greatest emission-free source of electricity—producing nearly two-thirds of all emission-free power. And, as public demand for clean air and a healthy environment increases in the future, nuclear energy is going to become even more important.

The Emerging Energy Crisis

In analyzing recent events in California, as well as looking at increased consumer heating and electricity bills elsewhere, the nation appears to be in the midst of an emerging energy crisis. There may be debate about the exact variables at the root of problems in California, but there is no debate that rolling blackouts in one of the nation's fastest growing states—the world's sixth largest economy—represent a serious problem.

There is also no doubt that soaring heating and cooling bills for lower income families—including retirees—pose a serious threat to the health and safety of a large number of Americans. And, with population growth and economic expansion expected to increase the need for new electricity generation capacity by more than 393,000 megawatts by 2020,[2] events in California may only be the beginning of a widespread energy shortage.

A few words from Silicon Valley—one of American's great economic success stories—may illuminate not just the crisis, but what two of the world's most forward-thinking executives see as one potential solution.

Nuclear Energy: A Time-Tested Solution

That nuclear energy is again figuring prominently on policymakers' and business leaders' agendas is no coincidence. Indeed, this is not the first time the nation has looked to nuclear energy as a solution to its energy woes. Looking back at recent history to the last energy crisis in the United States, nuclear energy provided the most significant and lasting response.

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[2] EIA, Annual Energy Outlook 2001

At the time of the first oil embargo in 1973, about 20 percent of U.S. electricity supply came from power plants that used oil for fuel. In some parts of the nation—the Northeast, for example—the percentage of oil-fired electric generation was considerably higher. Just five percent of U.S. electricity was produced at nuclear power plants.

In the subsequent decades, 89 new nuclear reactors began operating, effectively replacing oil as a fuel source for electricity, and making nuclear energy one of the most successful energy security programs. Today, nuclear power reactors continue to provide a reliable hedge against volatile fuel prices and energy supply disruptions, protecting American businesses and homes from wildly fluctuating energy costs and providing a reliable supply of electricity. Nuclear energy answered the call then, and the industry is answering that call now.

It must be remembered that nuclear's role in avoiding emissions also has significant implications for domestic economic development. If a state is not complying with Clean Air Act regulations, it will be constrained when it comes to building new conventional power plants as well as other industrial and manufacturing facilities.

Without nuclear energy, there will be difficult choices on the horizon as we try to balance economic development, electricity needs and environmental goals. New power plants will not come on line in the future without serious consideration of their environmental impact. Again, California's woes clearly show that energy, the environment and economic development are inextricably linked. Nuclear energy is the only expandable form of electricity generation that meets all three criteria.

Status of U.S. Nuclear Energy: Power for Today and Tomorrow

The United States has the largest commercial nuclear power industry in the world. The 103 nuclear power reactors generate enough electricity to serve 67 million Americans, or the equivalent of the nuclear electricity needs of France and Japan combined. The industry's safety record is unparalleled among the world's energy providers, and nuclear power plant efficiency and production have improved steadily during the last decade and today are at record levels. In 2000, nuclear power plants in 31 states produced a record amount of electricity—754 billion kilowatt-hours.

The industry's safety record has laid the foundation for this strong operational performance. Safety and excellence are at the very core of the industry, and safety is essential to its continued success in the competitive electricity market. As the industry moves forward, safety and low-cost power will continue to go hand-in-hand.

The increase in electricity generation at U.S. nuclear power plants during the 1990s was equivalent to adding twenty-three 1,000-megawatt power plants to our nation's electricity grid. That's enough to meet 30% of all new electricity demand during that time. This dramatic increase in electricity production by nuclear power plants is one the most successful energy efficiency programs of the last decade. Safe, outstanding performance at nuclear power plants, especially during the transition to competitive electricity markets, is one reason why a growing number of policymakers, financial analysts and the public are rediscovering the benefits of nuclear energy.

Outstanding operational performance is also a major reason why Entergy and other energy companies are extending the operating licenses at existing reactors for an additional 20 years. In 1997, some energy forecasters were predicting that dozens of nuclear power plants would shut down prematurely and that many more would shut down at the end of their 40-year licenses, issued by the Nuclear Regulatory Commission. However, many of those same analysts today have reassessed the situation and now predict only a handful of plants may close prior to the expiration of their licenses. They now recognize that the vast majority of plants will extend their operating licenses beyond the initial 40-year period.

And, it is also why the industry is looking at innovative partnerships for building advanced reactor designs that will be necessary to meet the future demands of a power-hungry digital economy and improve our air quality. The Energy Information Administration, in its 2001 annual energy outlook, forecasts higher nuclear power production.

> "In 2020, nuclear generation is projected to be 34 percent higher than forecast last year, due to lower estimated costs for extending the life of current reactors and higher projected natural gas prices."
>
> ENERGY INFORMATION ADMINISTRATION
> *Energy Outlook, 2001*

Even with this two-fold production and environmental advantage, nuclear power plants are the lowest cost electricity generators. In 2000, the average production cost of electricity generated by nuclear power plants was 1.83 cents per kilowatt-hour, making nuclear power the most affordable electricity in the United States.

Nuclear Energy's Long History of Protecting our Air Quality

The environmental value of nuclear energy was recognized early by policy makers. In Shippingport, Pa., over 50 years ago, nuclear energy's clean air value tipped the scales in favor of construction of the first demonstration nuclear power plant.

Beginning in the 1940s, Pittsburgh began instituting strict smoke control programs as part of urban redevelopment plans—well ahead of the rest of the nation. At the time, Duquesne Light Company was petitioning to build a coal-fired plant on the Allegheny River. They were encountering a great deal of resistance from the area's citizens, who were fearful of air pollution from the plant. The main reason that Duquesne chose to bid on the nuclear project was because it offered power without pollution.

That benefit is being rediscovered today, and promises to be of prime importance in the future. Energy and the environment are increasingly being linked both locally and globally. Yet, nuclear energy's clean air benefits—its ability to avoid the emission of harmful air pollutants while producing vast amounts of electricity—is still undervalued.

In the process of generating electricity, nuclear plants produce no carbon dioxide, sulfur oxide or nitrogen oxides. Between 1970 and 1990, the increased use of nuclear energy alone eliminated more nitrogen oxide emissions than direct industry action taken to comply with the Clean Air Act. Nuclear energy, by avoiding additional emissions as electricity output grows, acts as a vital partner in Clean Air Act compliance.

To meet more stringent Clean Air Act requirements and effectively manage carbon risk in the future, the United States must increase its percentage of non-emitting sources of electricity—such as nuclear energy, solar, hydro and wind—above the current baseline of 30 percent. Of these electricity production technologies, nuclear energy generates two-thirds of all emission-free electricity today, and is the only expandable, large-scale electricity source that avoids emissions and can meet the baseload energy demands of a growing, modern economy.

Industry Planning is Already Underway for New Nuclear Energy Plants

Although the average age of U.S. nuclear plants is only 18 years, we must begin planning now to enhance these services through increases in production capacity, improved efficiency, and license renewal. That's why the industry is working now to set the stage for construction of new advanced-designed nuclear plants that will have more automatic safety systems and will be even more reliable and economical.

The industry is working together to lay the groundwork for new plants.Three advanced designs have already achieved certification by the NRC, having gone through extensive, multi-year safety reviews. Of the three designs, two have been built and are setting world-class performance records in Japan, while others are being built in Korea and Taiwan.

Additionally, two more advanced designs are undergoing NRC review. One involves a review of changes to an existing approved design, uprating it from 600 to 1,000 megawatts. The other is a new reactor—known as the Pebble Bed Modular Reactor—now in preliminary review by the NRC.

The NRC's licensing process for new nuclear plants will ensure that safety, design and site-related issues are resolved before large capital investments are made. A new licensing process will allow the NRC to issue a single license to construct and operate a new nuclear plant.

Industry executives have come together—contributing personnel, funding and guidance—to develop a plan that will mark out a clear path for new nuclear plant orders. This plan for the future considers safety standards and objectives; NRC licensing requirements; policy and legislative implications; capital investment needs and changing business conditions.

Nuclear Energy: Balancing the Nation's Energy Needs

Our nation cannot meet the demands of our growing population and economy without increased power generation through the construction of new power plants. We need to increase the proportion of non-emitting baseload capacity through the construction of new emission-free plants. This will maintain both a diverse energy portfolio for the nation, and the price stability that nuclear energy offers. In order to do this, comprehensive national energy policy must

- Encourage investment in new power plant construction.
- Continue regulatory modernization, including regulatory stability for operating nuclear plants and licensing of new plants.
- Ensure sufficient funding for research, development and swift application of new nuclear energy technologies is consistent with nuclear energy's future role in meeting U.S. energy needs.

- Eliminate discrimination and ensure nuclear energy receives the same treatment as other electricity generating technologies in the marketplace.
- Educate the nation about the excellent safety record of nuclear energy and inject sound science and intellectual honesty into the national energy debate so that consumers may make informed energy choices.
- Maintain U.S. leadership and infrastructure to train the next generation of scientists, engineers and technicians required to design, build and operate nuclear power plants.

In a competitive marketplace, the nuclear energy industry has the primary responsibility for ensuring the viability of nuclear technology. However, the industry values the important role that can be played by the federal government in preparing the way for new nuclear power plants.

Protecting our air quality and our environment, as well as improving our energy security, are among the reasons why two-thirds of Americans favor nuclear energy as one way to generate electricity.

One reason for the steady support for nuclear energy is that the public views nuclear energy as a fuel of the future and believes it is important for future generations. Americans consider solar and nuclear energy as primary sources of energy for the future. In addition, there is broad support for the continued operation of nuclear power plants (76 percent) as well as for maintaining the option to build more nuclear power plants in the future (73 percent).[3]

And, a January survey by Bisconti Research Inc., shows an increase in those who favor building more nuclear power plants. Fifty-one percent of those polled said that the United States should "definitely" build more nuclear power plants in the future—compared with 42 percent in October 1999.

The increase in favorability for building new nuclear plants was largest in the West, where those in favor increased from 33 percent in October 1999 to 52 percent in the January survey. Clearly, the California crisis is impressing upon the public the need for new electricity supplies.

Used Nuclear Fuel: Sound Science Supports Yucca Mountain

Federal legislation mandates a centralized geologic repository. The Nuclear Waste Policy Act of 1982 and its 1987 amendments require or authorize the U.S. Department of Energy to locate, build and operate a deep, mined geologic repository for used nuclear fuel. To pay for the permanent repository, the Nuclear Waste Policy Act established the Nuclear Waste Fund. Since 1982, electricity consumers have paid into the fund which now totals more than $16 billion.

Based on scientific information gathered from several sites, Congress in 1987 selected Yucca Mountain as the location for further study to determine if the desert ridge is a suitable location for the federally operated underground repository. And, the industry fully expects that the Energy Department will forward a science-based decision on Yucca Mountain to the President later this year.

A decade of science has been completed and will lead to a draft report this spring. A decision document is expected to be finalized in the fall, following hearings that will take place in Nevada. It is important that DOE and the Administration move ahead on schedule with the site recommendation process, leading to a decision by the President on site suitability late this year. This decision allows DOE to prepare documents to submit to the NRC to license a disposal facility.

Most used fuel is stored in steel-lined, water-filled vaults at nuclear power plants. However, Entergy Nuclear and other nuclear power plant owners are absorbing the cost of on-site storage of spent nuclear fuel, despite the fact that they have already paid the government to perform this service. Other electric companies must build additional storage facilities for used nuclear fuel at nuclear power plant sites until a federal repository is operating.

Less than six percent of commercial reactor fuel is stored in additional "dry" storage facilities today, but by 2010, approximately 30 percent of used fuel will be stored in these costly storage containers. Steps must be taken now to avoid a forced shutdown of any nuclear power plant due to a lack of used fuel storage,

Universal Application of Nuclear Technology Saves and Protects Lives

For five decades, the United States has been the global leader in the use of nuclear technology to benefit society. America's high-tech digital economy and high standard of living simply would not be possible without the use of nuclear energy. In addition, nuclear technology is used in scores of consumer products—both necessities and conveniences that enhance our daily lives.

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[3] Nuclear Energy 2000: Public Support Remains Strong, Ann Stouffer Bisconti, Ph.D., *Perspectives on Public Opinion,* April 2000.

Among the necessities is nuclear energy, which provides one-fifth of our nation's electricity and is our largest supply of emission-free electricity, and nuclear medicine, which is used in one of every three medical diagnoses and treatments. Ten million Americans are diagnosed and treated every year using nuclear medicine. Radioactive isotopes also are essential to the biomedical research that seeks causes and cures for diseases such as AIDS, cancer and Alzheimer's disease.

Nuclear technology also is used agricultural applications, industrial manufacturing and environmental protection. The use of nuclear technologies in the field of agriculture improves crop varieties, controls pests and preserves food. The use of irradiation in food safety continues to grow in the United States and has been used for decades in Europe. In fact, food irradiation has been approved to control food loss and to improve sanitation for more than 100 kinds of food in 41 countries. These uses of nuclear technology make significant contributions to our quality of life.

The associated economic benefit of the use of nuclear technology and nuclear materials on the economy is significant, accounting for more than $400 billion in revenues (6 percent of the gross domestic product) and 4.4 million jobs.

Conclusion: Nuclear Energy Powers America's Future

One of the most prominent environmental protection programs in the industrial sector during the last three decades has been America's increased reliance on nuclear energy to power economic growth. No other source of electricity can provide large amounts of power while enhancing our air quality.

Policymakers should maximize nuclear energy's potential to improve our air quality while providing low-cost electricity to fuel our economy. Continued research and development funding, streamlined business regulation, implementation of a federal waste management program, and equal access to business incentives will ensure that nuclear energy will continue to help meet our nation's public policy goals for energy security, economic growth and environmental protection.

Mr. NORWOOD. Thank you very much, Mr. Hutchinson. We appreciate your time and testimony.

I would like to introduce to the committee now Mr. A.C. Tollison, Jr., the Executive Vice President, Institute of Nuclear Power Operations, from Atlanta, Georgia.

Welcome, Mr. Tollison, and please take 5 minutes.

STATEMENT OF ALFRED C. TOLLISON, JR.

Mr. TOLLISON. Thank you, Mr. Chairman, and good afternoon.

My name is Fred Tollison, Executive Vice President of the Institute of Nuclear Power Operations, INPO, in Atlanta. I have been with INPO for 13 years and have worked in the nuclear power industry for 30 years. I was plant manager of the Brunswick station in North Carolina for 5 years.

I am here to discuss safety and reliability in the nuclear power industry. In fact, last year, U.S. nuclear power plants performed at record levels of safety and reliability. I will begin with INPO's activities and INPO's role in the nuclear industry.

The Institute's mission is to promote the highest levels of safety and reliability to promote excellence in the operation of nuclear power plants. INPO was formed in 1979 as a non-profit, independent, technical organization. Each of the 34 companies that operate nuclear plants in this country is a member of INPO.

Our key technical programs are, first, periodic, in-depth inspections of each nuclear plant. Second, training programs at each plant are accredited by the independent National Nuclear Accrediting Board. Third, INPO analyses plant operating experience and passes along lessons learned to the industry. And, fourth, INPO provides industry assistance, including plant visits, seminars, and workshops.

Significant process has been achieved by the U.S. nuclear industry, in part through participation in these programs. Indicators that measure the performance of nuclear plants best demonstrated this progress. Since the mid-'80's, INPO has tracked a series of 10 performance indicators. Aggressive goals were established at 5-year intervals, and the year 2000 marks the end of the third such period.

The basic principal of performance indicators is that nuclear plants with good performance, as measured by these indicators, are generally recognized as well-managed plants. Such plants are more reliable and typically have higher margins of safety.

Let me show you now the industry's progress using a few selected indicators to your right. Unit capability factor is a measure of the plant's ability to stay online and produce electricity. In 2000, the median was 91.1 percent, the best performance ever for this indicator, and for the second year in a row it exceeded the year 2000 goal.

Unplanned automatic scrams show the number of automatic reactor shutdowns per year. A low number indicates care and operations, good maintenance, and good training. The 2000 median value was zero for the third straight year, continuing to exceed the year 2000 goal.

Safety assistance performance monitors the availability of standby or redundant safety systems to provide backup electricity and cooling water to the reactor if needed. The 2000 performance of 96 percent represents a high state of readiness for these systems. 2000 was a very successful year for the U.S. nuclear industry, the best ever in terms of safety and reliability. The industry met or exceeded the year 2000 goals in all 10 performance indicators.

So what does this say about the future of the industry? U.S. nuclear plants are performing at record levels of safety and reliability. Nuclear plant owners are vigorously pursuing license renewal, and the industry is consolidating rapidly to improve efficiency. These actions indicate that nuclear power is being recognized as a valuable, reliable source of energy today and for the future.

Without question, the industry will face new challenges as it makes the transition to the competitive marketplace. INPO is helping the industry focus on the issues that will be important in the near future to maintain and improve on safety and reliability.

In conclusion, nuclear energy is an essential domestic resource, and proper management is important for today and for future generations. It is not an overstatement to say that a foundation is being put in place for a renaissance in nuclear power. But this foundation requires absolutely that we remain accident-free. This requires vigilance and commitment not just to the higher standards we have today but to continuous improvement.

With vigilance and with commitment to safety by the industry, supported by INPO, and with oversight by a strong and fair regulator—the Nuclear Regulatory Commission—nuclear power has a bright future in helping fulfill our Nation's energy needs.

Thank you.

[The prepared statement of Alfred C. Tollison, Jr. follows:]

PREPARED STATEMENT OF ALFRED C. TOLLISON, JR., EXECUTIVE VICE PRESIDENT, INSTITUTE OF NUCLEAR POWER OPERATIONS

Good afternoon. My name is Alfred C. Tollison, Jr., executive vice president of the Institute of Nuclear Power Operations in Atlanta, Georgia. I have been asked to discuss the safety and performance of the commercial nuclear power industry today and the trends we see for the future. I will begin my remarks with a brief explanation of INPO's structure and activities and what INPO's role is in the nuclear industry.

THE INSTITUTE OF NUCLEAR POWER OPERATIONS

The Institute was formed by the U.S. nuclear utility industry in late 1979 in response to the accident at Three Mile Island Nuclear Station. INPO's mission is to promote the highest levels of safety and reliability—to promote excellence—in the operation of nuclear electric generating plants, including applying the lessons learned from the President's Commission on the Accident at Three Mile Island (the Kemeny Commission). The nuclear utility industry leaders established INPO as an independent organization—independent from governmental agencies and independent from any individual member.

INPO is a nonprofit, independent technical organization with a staff of about 350 and a 2001 budget of $59 million. The bulk of this budget is dedicated to travel and employee compensation. Each of the 34 utilities in the United States with operational nuclear plants is a member of the Institute. To augment its professional staff, INPO utilizes the expertise of loaned employees from members and participants. This program is designed to provide a continuing source of personnel with recent nuclear plant experience to supplement the INPO staff. It also provides loaned personnel with an opportunity to gain broader experience in the industry.

The Institute's organization is similar in many ways to a typical U.S. corporation. A Board of Directors, elected by INPO's members, oversees the operations and activities of the Institute.The president and chief executive officer of the Institute is elected by and reports to the Board of Directors. The current president and CEO is Dr. James T. Rhodes. He also serves as Chairman of the Board.

In addition to the Board of Directors, an Advisory Council of professionals from outside the industry reviews Institute activities and provides advice on broad objectives and methods to the Board of Directors. The Advisory Council is composed of distinguished professionals including prominent educators, scientists, industrialists and health specialists.

To ensure that INPO programs benefit from the best technical advice the industry has to offer, an Executive Review Group reviews INPO programs and products in the various technical areas on a continuing basis. The members of the Executive Review Group are experienced executives—typically the chief nuclear officers—who are currently active in nuclear plant operations or management. An Academy Council provides advice in the areas of training and accreditation, and an Industry Communications Council provides advice on effective communication of INPO programs and activities.

Non-U.S. nuclear utility organizations from 13 countries participate in the Institute's International Program. Ten nuclear steam system suppliers and architect-engineering and construction firms worldwide involved in nuclear work also participate in INPO through the Supplier Program.

The key technical activities of the Institute can be divided into four cornerstone programs, which I will address in more detail later. They are:

1. Evaluations—Periodic evaluations are conducted of each operating nuclear electric plant in this country.
2. Training and Accreditation—Training programs for key personnel at each plant are accredited by the independent National Nuclear Accrediting Board.
3. Events Analysis and Information Exchange—INPO analyzes operating experience and feeds back lessons learned to the industry.
4. Assistance—This includes plant visits, courses, seminars, and workshops.

In addition, there is a detailed infrastructure to carry out each of these cornerstone programs. The *Institutional Plan for the Institute of Nuclear Power Operations,* updated last year, and our *2000 Annual Report* provide additional details about the Institute's programs and are attached to this testimony (attachments A and B).

All interactions between INPO and its members are held strictly confidential. This is vital to the success of INPO's mission. Utilities are voluntary members of INPO and are under no regulatory obligation to provide information to INPO—or to be members. Experience shows that utilities are more willing to set challenging goals and to strive for excellence if they know they will not be criticized publicly if they

fall somewhat short of these challenging goals. Over the years, U.S. courts and administrative agencies have consistently upheld this position.

INPO CORNERSTONE PROGRAMS

We believe the Institute's cornerstone programs have directly contributed to the industry's progress.

Evaluations

The evaluation program cornerstone is a direct response to a recommendation of the Kemeny Commission that—"the industry must—set and police its own standards of excellence to ensure the effective management and safe operation of nuclear electric generating plants."

A comprehensive program has been established for conducting, on a periodic basis, independent evaluations of the operating nuclear plants and supporting corporate organizations of all U.S. nuclear utilities. These evaluations are performance-based and are designed to ensure that each utility is striving to meet the industry's high standards in key areas.

Teams of qualified and experienced personnel conduct these evaluations, focusing on plant safety and reliability. The evaluation teams are augmented by senior reactor operators, other peer evaluators from operating units similar to those at the station being evaluated, and host utility peer evaluators. The scope of the evaluation includes traditional functional categories such as operations, maintenance, and engineering that generally correspond to the nuclear station organization. The areas evaluated include organizational effectiveness, operations, maintenance, engineering, radiological protection, chemistry, and training.

In addition, the teams evaluate cross-functional performance areas—processes and behaviors that cross organizational boundaries and that address organizational integration and interfaces. The cross-functional evaluation includes areas such as safety culture, self-assessment and corrective action (learning organization), operating experience, human performance, and training.

The performance of operations and training personnel during simulator exercises is included as part of each evaluation. Also included, where practicable, are observations of plant startups, shutdowns, and major planned evolutions. Evaluations of each operating nuclear station are conducted at an average interval of 21 months.

Results from more than 875 plant evaluations INPO has conducted to date show substantial improvements in the conduct of plant operations, enhanced maintenance practices and improvements in equipment and human performance.

Training and Accreditation

Another excellent example of the industry's response to the Kemeny Commission is in its commitment to improved training through INPO. This commitment has resulted in considerable improvements in both the safety and reliability of the nation's nuclear power plants.

Under the training and accreditation cornerstone, the Institute assists its member utilities in developing, implementing and maintaining high quality, comprehensive training in a wide range of areas. INPO also evaluates the results of utility training programs through the ongoing operating plant evaluation program and analyzes industry events to identify needed training improvements.

INPO manages an industrywide accreditation program for utility training programs through the National Academy for Nuclear Training. Established in 1985, the National Academy for Nuclear Training provides a framework for the following three essential elements in the industry's program to strengthen nuclear utility training:

- training activities, resources and facilities at nuclear utilities
- the National Nuclear Accrediting Board
- INPO's training-related activities

The National Nuclear Accrediting Board is an independent body established to ensure that nuclear utility training programs meet the standards of the National Academy for Nuclear Training. The Board is composed of eminent American scholars and executives from the following four groups:

- industrial training experts from fields outside the nuclear industry
- members of the postsecondary education community
- individuals nominated by the NRC
- senior utility executives

As an example of the National Nuclear Accrediting Board's independence, the Board's charter requires that the majority of each panel be from outside the utility industry when considering each accreditation action.

The need for the work INPO is doing in training was recognized by the Kemeny Commission when it recommended the establishment of "agency-accredited training institutions" for nuclear plant operators. As a condition of membership, each of INPO's 34 member utilities has committed to achieve and maintain accreditation for 12 key positions involved in nuclear power operations. These positions include shift managers; licensed and nonlicensed operators; maintenance supervisors, craftsmen, and technicians; chemistry and radiological protection technicians; and engineers.

By the end of 1990, all U.S. nuclear power stations had achieved initial accreditation of all applicable training programs. Accreditation is maintained on an ongoing basis and is formally renewed for each training program every four years.

INPO conducts courses and seminars in support of the National Academy for Nuclear Training. These courses and seminars help personnel better manage nuclear technology, more effectively address leadership challenges, and improve their personal performance. Examples of courses conducted include the Chief Executive Officer Seminar, Reactor Technology Course for Utility Executives, Senior Nuclear Plant Management Course, Control Room Teamwork Development Course, and professional development seminars for shift managers, maintenance supervisors, engineering supervisors, radiation protection and chemistry supervisors, and training supervisors.

Events Analysis and Information Exchange

The exchange of industry operating experience is another direct result of a Kemeny Commission recommendation which called for a "systematic gathering, review and analysis of operating experience at all nuclear power plants." Through this cornerstone program, each nuclear station provides data on events to the Institute's technical staff. At INPO, these industry events are reviewed for significance. Following this analysis, the Institute disseminates applicable lessons learned throughout the industry. As a follow-up, INPO evaluation teams check to see that nuclear stations have implemented all the applicable recommendations.

The Institute has reviewed more than 100,000 events since its inception and provided 482 recommendations to member utilities and international participants through 85 Significant Operating Experience Reports. More than 99 percent of the 482 recommendations (lessons learned) issued to date have been implemented industrywide.

Nuclear Network® is an Internet-based electronic communications system available to all U.S. members and international participants. The system allows rapid transmittal, storage and retrieval of nuclear plant information, and it provides a means for questioning other members and participants about their experiences in solving nuclear operations problems.

The Institute collects and analyzes data and information related to nuclear plant performance. Members provide data on quantitative performance indicators on a quarterly basis. This plant data is then consolidated for trending and analysis purposes. Industrywide data, plus trends developed from the data, is provided to member and participant utilities for a number of key operating plant performance indicators. These include the performance indicators used by the World Association of Nuclear Operators (WANO) for worldwide nuclear plant performance comparisons. Members use this data in setting specific performance goals and in monitoring and assessing performance of their nuclear plants. INPO uses performance goals from individual utilities to help establish industrywide performance goals for plants in the United States.

Assistance

The assistance cornerstone has also contributed to the industry's improvements by fostering comparison and the exchange of performance information and successful methods. Visits to member utilities by INPO personnel in response to requests by the utilities are one of the most important modes of assistance. To date, INPO has conducted more than 3,500 assistance visits.

Several categories of documents (such as guidelines and good practices) are designed and developed to assist member utilities in their efforts to achieve excellence in operation, maintenance, training, and support of nuclear plants. These documents are now in widespread use at every U.S. nuclear station and at many utilities worldwide.

Another element of the assistance cornerstone is workshops. INPO sponsors workshops that afford the Institute, international participants and U.S. member utilities an opportunity for face-to-face information exchange. Typically, all U.S. nuclear utilities are represented at these workshops that routinely address topics such as operations, operating experience and maintenance. International speakers are featured at most INPO workshops to promote the worldwide sharing of information. INPO

has sponsored 178 workshops with a cumulative attendance of more than 20,000 personnel. In addition, INPO has sponsored more than 330 working meetings and seminars with a cumulative attendance of more than 5,300 personnel.

INPO'S INTERNATIONAL PROGRAM, WANO-AC

As INPO developed and expanded its activities, an International Participant Program was formed in 1981 to promote the widespread application of INPO standards of excellence and ensure that INPO programs benefit from good practices and lessons learned worldwide. To accomplish this, the International Participant Program, which is observing its twentieth anniversary this year, facilitates the exchange of operating experience and technical information with participating international nuclear utilities and utility organizations in other countries.

There are currently 13 countries participating in the program. These include Belgium, Brazil, Canada, France, Germany, Japan, Korea, Mexico, Slovenia, South Africa, Spain, Taiwan and the United Kingdom.

It is important to note that following the Chernobyl accident, the International Participant Program was instrumental in the formation of WANO. The mission of WANO is to maximize the safety and reliability of the operation of nuclear power plants by exchanging information and encouraging communication, comparison, and emulation among its members.

WANO is organized through regional centers and includes every operating nuclear electric plant in the world. INPO represents all U.S. utilities as a member of the WANO-Atlanta Center.

INPO'S RELATIONSHIP WITH U.S. GOVERNMENT AGENCIES

INPO coordinates its activities with federal government agencies as appropriate. The Institute maintains a formal Memorandum of Agreement with the Nuclear Regulatory Commission (NRC) and with the Department of Energy (DOE). These agreements reflect the desire of both organizations for a continuing, cooperative relationship in the exchange of experience, information and data related to the safety of nuclear power plants.

Although nuclear plant safety and protection of the public are fundamental goals of both INPO and the NRC, their roles, while complementary, are different. INPO was not created to supplant the regulatory role of the NRC, but to provide the means whereby the industry itself could, acting collectively, make its nuclear operations safer. It was recognized that in establishing and meeting its goals and objectives, INPO would have to work closely with the NRC, while at the same time not becoming or appearing to become an extension of or an advisor to the NRC or an advocacy agent for the utilities.

INPO provides assistance to DOE to support improvement of operational safety at DOE nuclear facilities. INPO conducts a limited number of assistance visits to DOE nuclear facilities, provides DOE with copies of selected INPO documents and domestic operating experience reports, and allows DOE personnel to attend industrywide workshops and conferences. A limited number of DOE personnel are given access to Nuclear Network and selected information available on INPO's member Web site.

Additionally, certain aspects of INPO's international program are coordinated with the Department of State.

PERFORMANCE IMPROVEMENTS

In part through participation in INPO's cornerstone programs, a great deal of progress has been achieved by the U.S. nuclear industry. This progress may be best exemplified by a set of performance indicators that reflect the considerable progress in the areas of operations, training and maintenance.

In the mid-1980s, INPO began an initiative to develop additional methods for measuring and comparing the performance of nuclear plants. A series of 10 nuclear plant performance indicators was selected, and utilities have been reporting their performance. These indicators have been adopted by WANO and are now used worldwide. Aggressive goals are established at five-year intervals. The year 2000 marks the end of the third five-year period.

The basic principle inherent in the performance indicator program is that nuclear plants with good performance, as measured by the overall set of performance indicators, are generally recognized as well-managed plants. Such plants are generally more reliable and can be expected to have higher margins of safety.

Year 2000 was successful overall for the U.S. nuclear industry—the best ever in terms of safety and reliability. For the first time, the industry met or exceeded the five-year goals in all categories. Additionally, performance in every indicator was as

good as or better than the previous year's performance. The 2000 results continue the remarkable record of progress that was started in 1980.

I won't discuss each performance indicator in detail today. Instead, I will illustrate the industry's progress using a few selected indicators, which are included in the *INPO 2000 Annual Report* I mentioned earlier.

Unit Capability Factor is a measure of the plant's ability to stay on line and produce electricity. A high unit capability factor indicates effective plant programs and practices to minimize unplanned outages and to optimize planned outages. In 1980, the industry median was 62.7 percent. In 2000, the median was 91.1 percent. This represents the best performance ever for this indicator; and for the second year in a row, it exceeds the 2000 goal.

Unplanned Automatic Scrams shows the number of automatic shutdowns for approximately one year of operation. A low number indicates care in operations, good maintenance, and good training. The median number has been reduced from 7.3 percent in 1980 to zero in 2000. In fact, the median value has been zero for three straight years and continues to exceed the 2000 goal.

Safety System Performance monitors the availability of three important standby redundant safety systems to mitigate off-normal events. The industry's goal is to encourage a high state of readiness, with at least 85 percent of these systems meeting specific 2000 goals for availability in excess of 97 percent. The 85 percent target allows for normal year-to-year variations in individual system performance. The 2000 performance of 96 percent is an increase over 1999 and continues to exceed the 2000 goal.

Collective Radiation Exposure examines the effectiveness of personnel radiation exposure controls for boiling water reactors and pressurized water reactors. Low exposure indicates strong management attention to radiological protection. Worker exposure has been reduced significantly over the past 20 years. The 2000 median value of 150 man-rem per unit for boiling water reactors is the best performance ever and exceeds the 2000 goal for the fourth straight year. This is a striking improvement over the 1980 figure of 859 man-rem per unit. Likewise, the pressurized water reactor value of 82 man-rem per unit exceeds the 2000 goal for the third straight year, also a significant improvement over the 1980 figure of 417 man-rem.

Not shown in the material provided, the INPO Performance Indicator Index is an excellent illustration of the industry's overall progress since 1985. This Index is a weighted composite of the individual indicators on a scale of 0-100. In 1985, the aggregate Index value for the industry was 43. In 2000, the value was 94—an all-time high.

TRENDS IN THE INDUSTRY

In short, the industry has made excellent overall progress in safety and reliability since 1980 and is committed to seeing these improvements continue.

U.S. nuclear plants are performing at historically high levels from a safety and reliability standpoint. Owners are vigorously pursuing license renewal. Also, with the advent of deregulation, the industry is consolidating rapidly to further improve efficiency. All this indicates that nuclear power is being recognized as a valuable, reliable source of energy for the future. The business community is now recognizing what the nuclear industry has spent 20 years demonstrating: These plants can be operated safely and efficiently; and, if properly maintained, there is no reason they can't continue this performance well beyond their original 40-year licenses.

Unquestionably, the industry will face—and is already facing—new challenges as it deals with deregulation and life extension issues. Long-term industry success will require vigilance and commitment, not just to the higher standards we have today, but to continuous improvement. INPO is helping the industry focus on the key issues that will be important in the near future—issues like human performance, equipment performance, and self-assessment and corrective action. New training needs will also emerge as we prepare a new generation of nuclear professionals to operate and maintain our nuclear fleet.

The U.S. industry will continue to set challenging goals for itself. Already, new 2005 goals have been established for the performance indicator program. Taking into account the dramatic improvement of the industry as a whole during the past two decades, these new goals focus more on plants that are performing below the industry median. In concert with these changes, INPO is also adapting its programs to further help these outlier plants improve their performance.

CONCLUSION

In conclusion, nuclear energy is a God-given resource; and its proper management is vitally important, not only today, but for future generations. I don't believe it's an overstatement to say that a foundation is being put in place for a renaissance in nuclear power.

But this foundation requires absolutely that we remain accident-free. This requires vigilance and commitment, not just to the higher standards we have today, but to continuous improvement. With vigilance and with commitment to safety by the industry, supported by INPO, and with oversight by a strong and fair regulator, I believe nuclear power has a bright future in helping fulfill our nation's energy needs.

At the 1989 INPO CEO Conference, on the observance of INPO's tenth anniversary, then-U.S. Secretary of Energy Admiral James D. Watkins said, and I quote:

In the past 10 years, INPO has done an outstanding job in helping the nuclear industry improve its performance. Ten years from now, on the twentieth anniversary of INPO, I sincerely hope that we can all celebrate the absence, during the 1990s, of a single significant incident at a nuclear reactor. If we do, we will be well on our way to reestablishing nuclear power as a safe and viable source of energy, not only for America, but for the world.

Thanks to the nuclear industry's continued pursuit of excellence in plant safety and reliability, I believe we are seeing the realization of Admiral Watkins' vision just as he predicted.

Thank you for the opportunity to share INPO's perspective. Subject to your questions, this concludes my testimony.

Mr. NORWOOD. Thank you, Mr. Tollison.

And for the committee, I would like to introduce to you Mr. Ward Sproat, Vice President of International Programs, Exelon Corporation, Kennett Square, Pennsylvania.

Welcome, Mr. Sproat.

STATEMENT OF EDWARD F. SPROAT III

Mr. SPROAT. Mr. Chairman, thank you. And thank you, members of the committee.

For those of you who are not familiar with Exelon, we are the largest nuclear generator in the U.S. with approximately 20 percent of the nuclear generating capacity under our operation and control. We have approximately 37,000 megawatts of electric generating capacity in the U.S. of diversified fuel sources, and we have another 8,500 megawatts under either construction or development.

There have been some references made to the Pebble Bed Modular Reactor here today, and I would like to give you a brief overview of that project and explain why Exelon is involved with that project, and what our decisionmaking process is regarding that technology moving forward.

Right now, we have committed up to $7.5 million of our own money to be involved with the preliminary design of the Pebble Bed Modular Reactor technology in South Africa. The other parties that are partners in that venture at this point in time are British Nuclear Fuels Limited, BNFL, of the UK; SCOM, which is the national electric utility of the Republic of South Africa; and the Industrial Development Corporation of South Africa.

The four partners are funding the preliminary design of that technology which will be completed—the preliminary design will be completed sometime in the next 2 to 3 months. At the end of June, there will be produced a detailed feasibility study of the technology which will be the basis for the decision by the partners to move forward with the project or not.

If we make a decision to move forward with the project, the plan is to build, with the appropriate approvals from the government of South Africa, a full-size demonstration plant in South Africa, probably starting in late 2002, and that construction period would probably take approximately 3 years with another year of startup testing.

Let me make it very clear that Exelon's involvement in this project is not because we want to be a nuclear reactor supplier. We want to be a nuclear power producer using this technology here in the U.S. And let me just talk about why we are interested in this technology and why we believe it is a good fit in the future.

Our company was formed of the merger of Commonwealth Edison in Illinois and Philadelphia Electric in Pennsylvania. Both of those states are at the forefront of the electric market deregulation in this country, and as a result we have gotten a pretty unique perspective on what the unregulated or the deregulated wholesale marketplace looks like in this country.

And we believe that this small modular reactor technology has got some unique aspects to it that very well fit the unique dynamics of a regional wholesale power marketplace, and we don't believe, based on our current evaluations, that the currently available other nuclear alternatives can compete successfully in that deregulated marketplace.

Let me just talk briefly about what some of those unique aspects of that deregulated marketplace are. No. 1 is the technology needs to be brought online quickly—a 36- to 48-month lead time at max—because if a demand—supply/demand gap develops in a regional marketplace, your competitors will beat you to market with combined cycle gas turbine technology. And if you can't bring a nuclear plant on in a relatively quick period of time, you are going to lose your opportunity.

Obviously, the economics have to be able to compete with gas-fired combined-cycle gas turbines at about 3 to 3.5 cents a kilowatt hour for your all-in costs. Also, adding a large 1,100- or 1,200-megawatt electric power plant to a deregulated marketplace will probably throw off the supply/demand to the point where the marginal—while the prices in that market will be depressed to the marginal costs of the lowest cost producer.

And, finally, the PBMR, we believe, is a very environmentally sound alternative in terms of not emitting any air pollutants and Greenhouse gases. So we intend to find out whether the PBMR can, in fact, compete and meet those criteria that we believe are necessary to compete in the deregulated marketplace in the future.

The PBMR itself is a high-temperature gas-cooled reactor, has a helium gas turbine directly connected to the reactor, has an overall thermal efficiency of about 40 to 42 percent, and provides, as was mentioned to earlier by one of the members, provides—the fuel is a very unique design, which is in a ceramic form which does not—is not soluble in water, which is one of the concerns of a deep geological repository for spent fuel.

We do expect some regulatory hurdles, though, with trying to get this technology licensed of a non-technical nature. Specifically, we don't know how long the licensing process is going to take. We do

believe that in an ideal situation we should be able to get this technology licensed in about 26 to 28 months.

However, given the uniqueness of the technology itself, given the fact that the 10 CFR 50, Part 52 licensing process, which is the expedited licensing process, has never been tested before by anybody in this country, that there is going to be a steep learning curve for both ourselves and the Nuclear Regulatory Commission in utilizing that licensing process for the first time.

So we do believe that that licensing process will—is somewhat indeterminant in terms of the amount of time it is going to take.

Also, because of the small modular nature of these reactors, there are some unique regulatory impediments that we are going to have to overcome. Essentially, some of the requirements for financial protection, in terms of $80 million retroactive premium per reactor that is currently required. That means an 1,100-megawatt reactor would have the same premium as a 100-megawatt reactor for the PBMR, and we think that is going to be a significant problem for us. And there are several others as outlined in my testimony.

Mr. NORWOOD. Of course, your testimony, Mr. Sproat, will be in the record. And we are very grateful for the time that you have been able to come and share with us.

Mr. SPROAT. Thank you, Mr. Chairman.

[The prepared statement of Edward F. Sproat III follows:]

PREPARED STATEMENT OF EDWARD F. SPROAT III, VICE PRESIDENT—INTERNATIONAL PROJECTS, EXELON GENERATION COMPANY

Mr. Chairman and Members of the Subcommittee: I appreciate the invitation to appear before the Subcommittee to discuss the views of Exelon Generation Company regarding our interests in building new nuclear power plants in the United States and the potential barriers we currently face in our efforts to do so. My name is Edward F. Sproat and I am the Vice President of International Projects for Exelon Generation Company. Exelon Generation is a wholly owned subsidiary of Exelon Corporation, which was formed last year by the merger of Unicom Corporation of Chicago and PECO Energy Company of Philadelphia. Exelon Generation currently owns and operates approximately 37,000 megawatts of diversified electrical generation with another 8,500 megawatts under construction or development. We are the largest nuclear generation operator in the country with approximately 20% of the nation's nuclear generation capacity. Both Unicom and PECO Energy were pioneers in the commercialization of civilian nuclear power with each company building its first nuclear plant in the early 1960's. As a result, our new company has both a deep respect for and a keen understanding of nuclear power and we have been able to make it the foundation of our successful generation business.

Exelon's Involvement in the Pebble Bed Modular Reactor Project

You may have recently heard or read about the Pebble Bed Modular Reactor, or PBMR, that is currently being developed in the Republic of South Africa. Exelon is investing approximately $7.5 million in this project to complete the preliminary design so that a feasibility study of the technology and its economics can be completed. Our other partners in this venture are ESKOM, the national electric utility of the Republic of South Africa; the Industrial Development Corporation of South Africa; and British Nuclear Fuels Limited (BNFL) of the United Kingdom. The study is due to be completed early this summer. If the technology is deemed ready for commercialization, and if the economics prove to be competitive against other forms of generation, the partners with the appropriate approvals of the South African government will proceed to build a demonstration plant in South Africa near Cape Town. Construction of that plant will take approximately thirty-six months, followed by a twelve month testing period.

If Exelon's review of the feasibility study is favorable, we do not intend to wait for the completion of the demonstration plant in South Africa to begin the licensing process to build a number of PBMR's in this country. We would intend to submit

a license application for early site permitting in 2002, followed by an application for a combined construction and operating license in 2003 after the detailed design is completed in South Africa. We believe that the licensing process, under the best of circumstances, could be completed in twenty-six months; but in reality, the time required is unknown as there are a number of technical and legal issues that will need to be resolved. I will come back to the legal issues in a moment.

Reasons for Exelon's Interest in the PBMR

Both Illinois and Pennsylvania are at the forefront of the deregulation of the electric utility industry. As a result, Exelon has been able to learn about the market dynamics of the deregulated marketplace very quickly. To be able to compete in the deregulated wholesale power markets, which have distinctly unique regional characteristics, new generation sources must be able to meet several criteria. Specifically, new plants must be able to be permitted and brought on-line quickly, in thirty-six to forty-eight months at the most, and they must be able to compete with gas-fired combined cycle power plants on a total cost basis in the 3 to 3.5 cents per kilowatt-hour range. They must be small enough so that as their capacity is added to the market, an oversupply situation is not created in the region that drives prices down below the producers' marginal costs. They must also meet the environmental constraints of the region. We don't believe that the currently available designs of light water reactor nuclear power plants can meet all of these criteria. We believe that the PBMR is the only reactor currently under development that may be able to meet the needs of this deregulated marketplace in the next five years. We intend to find out if it can.

Description of the PBMR

The PBMR is a small nuclear power plant that would produce approximately 125 megawatts of electricity per module with four of these modules being able to fit on a football field. Each module has a high temperature gas-cooled reactor that heats helium under pressure to approximately 900 degrees Celsius, which turns a gas turbine connected to a generator. The helium then returns to the reactor. This direct cycle allows higher efficiencies than existing nuclear plants and also significantly reduces the amount of water required for plant cooling over other power plants. The coupling of a gas turbine directly to the helium reactor has only recently been made possible through advances in gas turbine technology

The reactor core is comprised of about three hundred thousand fuel spheres that are approximately the size of billiard balls. Each sphere contain approximately 14,000 coated particles of 9% enriched Uranium 235, each 0.5 millimeters in diameter. The coating on each particle is designed to contain the radioactive gases produced by nuclear fission and can withstand extremely high temperatures. As a result of the reactor and fuel designs, the fuel cannot melt under any conditions, a significant safety improvement over existing reactor technology. The reactor and fuel designs have been demonstrated through years of testing in Germany where the Pebble Bed Reactor was invented in the early 1970's. The South Africans are utilizing the German fuel and reactor technology for the PBMR and would be the suppliers of the fuel to be used in our reactors. The ceramic nature of this fuel also make it insoluble in water which is significant in that it can't leach into ground water when stored underground in a spent fuel repository.

Regulatory Hurdles

As I mentioned before, the expected length of the process that we will face to license the first set of PBMR's is difficult to determine. While the technical issues will be complex, there are legal hurdles that appear to be more difficult to resolve. Specifically, there are a number of regulations that were promulgated when it was anticipated that only regulated electric utilities would build nuclear plants. These regulations never foresaw the dawn of a deregulated power generation market and are now obsolete. If Exelon proceeds with building PBMR's, they will be merchant nuclear power plants that will not be in a regulated utility rate structure. The financial risk of the plant will rest on the shareholder, not the ratepayer.

The financial burden imposed on small, modular plants by these inappropriate regulations clearly has the potential to make the economics untenable. Some of the key regulations which need to be addressed include the financial protection requirements of 10 CFR Part 140, the decommissioning funding requirements of 10 CFR Part 50.75, the antitrust review requirements of 10CFR Part 50.33a, the annual fees on a per reactor basis in 10 CFR Part 171, and the large emergency planning zone requirements in 10 CFR Part 50.54(m).

In addition to the above regulations, the licensing process which we would follow under 10 CFR Part 52 to obtain a combined construction and operating license for these plants has never been utilized. As a result, we expect that there will be a

steep learning curve for both the U.S. Nuclear Regulatory Commission staff and ourselves on how to execute this process with resultant high costs and delays. We will also need to work with the NRC staff to develop the technical licensing framework for the PBMR as the existing regulations are written for light water reactors. Regulations will need to be developed for gas reactors, also at additional costs and potential delay.

Potential Role for Public Funding

Exelon believes strongly that the development of the design and the cost to commercialize and build the PBMR should be borne by the PBMR partners. It is anticipated that the partners will invest upwards of $600 million of their own money to make the PBMR commercially viable with Exelon investing a significant additional amount to license and build the first PBMR's. There are, however, a number of first of a kind costs that Exelon will bear as the first licensee for this new technology that will flow directly to government agencies such as the NRC in the form of licensing fees and the national laboratories as consultants to the NRC. As stated earlier, we expect that the costs of licensing this technology will be higher than normal because of the unproven nature of the 10CFR Part 52 licensing process and the need to create a gas reactor licensing framework. The technical expertise needed to review the PBMR application does not currently exist either in the NRC or in the national labs and will need to be developed. We believe it is appropriate for some level of government funding to be provided to fund the work of government agencies in these areas.

Summary

In conclusion, as the shortage of electricity supplies in several areas of the country looms large with the approach of summer, we must find ways to cut through the morass of archaic legal and procedural impediments to building new environmentally benign sources of electricity. This is an issue of urgent national priority.

Nuclear power has earned the right to be counted among this country's most viable options as a future power source. It has achieved an outstanding safety record and serves as a stable and abundant domestic source of electricity which emits no air pollutants or greenhouse gases. If we're able to make the PBMR commercially viable and cost competitive, we will have at least one potential solution to our future energy needs.

Mr. NORWOOD. Is it Longenecker?

Mr. LONGENECKER. It is Longenecker.

Mr. NORWOOD. I would like to introduce John R. Longenecker to the committee, Longenecker & Associates, Management Consultants from Del Mar, California. Thank you for taking your time to be here, and please take 5 minutes.

STATEMENT OF JOHN R. LONGENECKER

Mr. LONGENECKER. Mr. Chairman, thank you.

I want to thank you for the opportunity to address the subcommittee on the issues involved with the——

Mr. NORWOOD. Pull the mike just a little closer.

Mr. LONGENECKER. [continuing] on the issues involved with the U.S. nuclear fuel cycle. Living in California, I understand very well the importance of secure energy supplies, and the reliable, economic supply of nuclear fuel is certainly essential to the future energy security of the United States.

Today, however, that supply is endangered. U.S. nuclear fuel cycle companies are being challenged by a range of factors that include excess capacity because there were fewer reactors built than the fuel cycle companies planned originally. Also, the sale of Russian highly enriched uranium, U.S. HEU blending, and sale of inventories including those of USECs challenge these industries.

With respect to uranium enrichment, Mr. Chairman, a very severe situation exists in the United States, where USEC is operating uneconomic, 50-year old plants, has no proven technology to

replace them, and relies on Russian HEU blending and resale to meet more than half of all of its commercial customer needs.

Constructing new, cost-competitive, enrichment capacity in the United States as soon as possible is critical to the future of all parts of the U.S. nuclear fuel cycle and must be a top priority. There is a very strong linkage between a healthy uranium enrichment business and the health of the uranium conversion and fuel fabrication industries in this country.

Now, the Russian highly enriched uranium agreement is certainly a key market factor. We all realize that maintaining political and financial stability for the Russian HEU agreement is essential for the fulfillment of our international policy objectives.

However, the U.S. Government should carefully consider several aspects of that agreement, including the assignment of the role of the executive agent of the Federal Government on behalf of the—to the United States Enrichment Corporation as its sole agent. Second, how the billion dollar trading profits that have already accrued and will continue to accrue from that agreement should be allocated. And, third, whether it is in the best interest of the United States to allow USEC to broker additional supplies of enriched uranium from Russian commercial enrichment plants.

Now, it is my firm belief that government subsidies for non-competitive companies and trade sanctions against foreign competitors will not build a sustainable basis for the continued use of nuclear power in the United States. It is particularly alarming that the anti-dumping action brought by USEC against its European competitors who have deployed low-cost technology over the past few decades could increase fuel cost to U.S. ratepayers by $650 million to $1.2 billion per year.

This suit has also created uncertainty about the assurance of supply under existing import contracts to many U.S. utilities.

Mr. Chairman, I strongly believe that the United States must define a comprehensive strategy to maintain viable, competitive, nuclear fuel supplies for this country for the decades ahead. The roles in implementing a long-term strategy to keep the U.S. nuclear industry competitive must be clear and must include substantial participation by both the government and private sector with the private sector taking the lead. Once the private sector has proposed its solution the government can then determine whether and how to support it.

Now, thus far, Mr. Chairman, I have spoken only to the front end of the fuel cycle. As part of its overall nuclear fuel cycle strategy, I believe the government must place top priority on assuring that a permanent disposal mechanism for used fuel is implemented as soon as possible. Later this year, the Department of Energy will issue its site recommendation for the Yucca Mountain project, and this recommendation must be acted on promptly and a path forward defined and funded as soon as possible.

Mr. Chairman, in summary, if the government and private sector evaluate the nuclear fuel supply situation in the United States and decide that reliance on non-U.S. sources is acceptable due to the high costs and risks involved in developing or maintaining our own domestic industry, that is okay.

However, an immediate public policy debate is warranted on how best to assure that that doesn't happen by sheer neglect. We need a competitively priced nuclear fuel supply source in the United States or abroad to provide reliable low-cost electricity to our nations.

I thank you, and I would be pleased to respond to your questions.

[The prepared statement of John R. Longenecker follows:]

PREPARED STATEMENT OF JOHN R. LONGENECKER, LONGENECKER & ASSOCIATES, INC., MANAGEMENT CONSULTANTS

Mr. Chairman, thank you for this opportunity to address the Subcommittee on Energy and Air Quality on the issues involved with the US nuclear fuel cycle. I have been involved with nuclear energy and nuclear fuel cycle issues for more than 28 years, and previously managed DOE's uranium enrichment business as Deputy Assistant Secretary of DOE, and later as the first Transition Manager of USEC.

Today, parts of the nation, including my home state of California, are experiencing electricity shortages, with rolling blackouts that disrupt business and productivity in some of the nation's key high-tech industrial regions. Nuclear power currently represents about 20% of electrical power consumed in the US, and any uncertainty regarding the reliable and economic supply of fuel to US nuclear power plants could pose a serious threat to our nation.

My key conclusions regarding the US nuclear fuel cycle industry are as follows:

1. A reliable, economic supply of nuclear fuel is essential to the future energy security of the United States. That supply in endangered.
2. US nuclear fuel cycle companies are being challenged by a range of factors including the sale of Russian HEU, US HEU, and USEC's inventories of natural and enriched uranium.
3. A very severe situation exists in the uranium enrichment business, where the US is operating 50-year-old plants, has no proven technology to replace them, and relies on Russian HEU blending to meet more than half of all customer deliveries. Constructing new, cost competitive enrichment capacity in the United States as soon as possible is critical to the future of all parts of the US nuclear fuel cycle industry.
4. Maintaining political and financial stability for the Russian HEU Agreement is essential for the fulfillment of international policy objectives.

   However, the US government should carefully consider (a) the assignment of the role of Executive Agent on behalf of the US government, (b) how the billion dollar trading profits from brokering Russian enriched uranium should be allocated, and (c) whether it is in the best interests of the United States to allow USEC to broker additional supplies of enriched uranium from Russian commercial enrichment plants.
5. Government subsidies for non-competitive companies and trade sanctions against foreign competitors do not build a sustainable basis for the continued use of nuclear power in the United States. It is particularly alarming that the anti-dumping action brought by USEC against its European competitors could increase fuel costs to US ratepayers by $650 million to $1.2 billion per year, and has created uncertainty about assurance of supply under existing import contracts.
6. The United States must define a comprehensive strategy to maintain viable, competitive nuclear fuel supplies for this country for the decades ahead. The roles in implementing a long-term strategy to keep the US nuclear industry competitive must be clear, and must include substantial participation by both the government and private sector, with the private sector taking the lead.

BACKGROUND

The nuclear fuel cycle market is restructuring and consolidating. This restructuring has had some painful effects, exacerbated by the sale of Russian Highly Enriched Uranium, US HEU, and USEC's inventories of natural and enriched uranium.

Maintaining political and financial stability for the Russian HEU Agreement is essential for the fulfillment of international policy objectives. The US government's goal must be to assure that the Agreement's supply contract stabilizes delivery arrangements for the next 15 years.

The viability of the Agreement must not be jeopardized if newly negotiated pricing terms or conditions in the contract fail to assure the continuity of deliveries.

However, the Russian HEU contract is only one part of the equation. The United States must have an overarching objective to define a comprehensive strategy to maintain viable, competitive nuclear fuel supplies for this country for the decades ahead. Short term fixes and band-aid approaches must be avoided.

Today's highly competitive market is no surprise to anyone who has followed the nuclear fuel markets over the past 20 years. We have known for more than a decade that due to the construction of fewer nuclear power plants than originally projected and HEU blending, nuclear fuel supply exceeds demand in every sector. We have also known for more than 25 years that US gaseous diffusion uranium enrichment technology would become economically obsolete and would need to be replaced. However, today the US lacks any plan to address the key nuclear fuel cycle issues both in the near term and in the long term.

In the context of assuring reasonable nuclear fuel supply at competitive prices, I believe that the US must assure that it is not totally reliant on non-US sources for its fuel. However, in order to survive, US fuel supply companies themselves must be competitive. Government subsidies for non-competitive companies and trade sanctions against foreign competitors do not build a sustainable basis for the continued use of nuclear power in the United States.

For example, the antidumping action brought by USEC against its European competitors in late 2000, has created significant market uncertainties, and could increase fuel costs to US ratepayers by $650 million to $1.2 billion per year.

In the final analysis, US citizens end up paying the bill for such actions, either though higher taxes or higher electricity rates. The US nuclear fuel businesses must be able to compete head-to-head in the world nuclear fuel market.

To develop a comprehensive nuclear fuel cycle strategy will require collaboration among the Congress, the Administration, industry, labor, state governments, and other constituencies. The ultimate goal must be to have a competitive, stable, viable nuclear fuel supply for this country. Reliability of supply and price are crucial elements in this plan. More specifically, we must assure that nuclear fuel prices do not suffer a shock similar to that experienced with natural gas prices recently. Fuel prices must be stable and predictable if the nation is to rely on nuclear power as part of its supply mix for the future.

The roles in implementing a long-term strategy to keep the US nuclear industry competitive must be clear, and must include substantial participation by both the government and private sector. The nuclear power industry must not and will not rely on the government to implement a solution. The private sector should take the lead. However, the government also has a key role to play. This role should be defined after the private sector plan is defined.

A key policy debate revolves around the Russian HEU Agreement. At present the Russian HEU contract is under re-negotiation and will expire on December 31, 2001. The contract has already generated substantial profits for the exclusive US Executive Agent, USEC. Under USEC's proposed "market based" revision to the supply contract with Tenex, the Russian Executive Agent, trading profits are estimated to be $1 billion or more over the next 10 years. USEC has also sought Administration approval to import and resell an additional one million SWU per year from Russian commercial enrichment facilities.

Since this is a government-to-government agreement, and the Executive Agent is selected by the US government, there needs to be an open dialogue regarding whether and how profits generated by this government created franchise are allocated to promote the long-term viability of the nuclear fuel cycle industry.

More specifically, should this billion-dollar benefit accrue solely to USEC, for use at its discretion, or should the US government have some say in how the trading profits from this government-to-government agreement are utilized?

As part of this dialogue, consideration should be given to establishing a second Executive Agent that would purchase a portion of the low enriched uranium derived from HEU now being blended in Russia. Such action could increase the assurance of continuity of the Russian HEU Agreement, allow USEC to take advantage of its low marginal costs by increasing production at Paducah and thereby enhance its near term profits and viability by lowering its average GDP production costs.

URANIUM ENRICHMENT

Today, USEC is the only North American supplier of uranium enrichment services, and the long-term future of this business is highly uncertain. USEC is the high cost supplier in the market, and enrichment operations at the GDPs in the future will operate at a loss. USEC utilized only about 29% of its nameplate GDP capacity in 2000 (see Table 1), and over the next year will supply a majority of its customers needs from Russian and US HEU blending. This situation led to the decision to

close the Portsmouth GDP in 2001, and at some point in the future will lead to the closure of the Paducah GDP. Trading profits from the Russian HEU agreement and sale of natural and enriched uranium inventories provide essentially all of USEC's cash ($150-200 million per year) that is used to pay for dividends, capital upgrades, R&D, and sales, general and administrative costs.

USEC is finding it more profitable to operate as a trader of blended HEU rather than as a primary producer. This approach appears to lead inevitably to USEC exiting the market as a primary producer. As a result, constructing replacement enrichment capacity in the US should be the key focus for the next few years.

Table 1—Worldwide capacity, sales and production of separative work

	Nominal Production Capacity (MSWU/year)	Estimated 2000 Sales (MSWU/year)	Percent of Total 2000 Sales	Estimated Capacity Utilization
USEC (2 GDPs)	18.5	11.0	32%	*29%
COGEMA	10.8	7.1	20%	66%
TENEX	14.0	8.5	24%	61%
URENCO	4.8	4.8	14%	100%
Other	3.4	3.4	10%	100%
Total	51.5	34.8	100%	56%

* 5.5 million SWU supplied by Russian HEU

A reality of the uranium enrichment industry is that prices have been declining since 1985. This decline was driven by the deployment and gradual improvement of centrifuge technology, primarily in Europe. The continuing decrease in prices should have been no surprise to anyone, since the Department of Energy (see Figure 1) Office of Uranium Enrichment, the predecessor to USEC, predicted this trend in 1984.

DOE committed to Congress and to its customers in 1985 to deploy AVLIS technology to meet this challenge. As shown in Figure 1, DOE was reasonably accurate in its price projections. Also as predicted by DOE, Urenco added new enrichment capacity to the market with production costs well below those of the US gaseous diffusion plants.

However, after an investment of about $1.5 billion, DOE did not deploy AVLIS, instead transferring all rights to the technology to USEC. In 1994, USEC announced plans to deploy AVLIS, and proceeded to price aggressively in the market, only to cancel those plans in 1999 when it faced financial problems. USEC's credit rating was downgraded to below investment grade (junk bond status) within 18 months of privatization.

USEC's continued reliance on GDP technology in 2001 is not driven by the competitiveness of GDP technology, but rather by its lack of a proven technology to replace the GDPs. The high costs of GDP operation have been recognized for years. In fact, the US Atomic Energy Commission announced in the mid-1970s that its three GDPs were soon to be economically obsolete. Thus, 25 years later we should not be surprised that the Portsmouth GDP is closing, and that the closure and replacement of the Paducah GDP is a reality that must be planned for.

What is surprising, and in fact astounding to many in the world, is that despite the expenditure of more than $7 billion dollars of US government funds on centrifuge and AVLIS technology development and deployment over the past 40 years, the United States today is still operating economically obsolete 50-year old gaseous diffusion plants. In 1994, USEC announced its plans to have an AVLIS plant operating by 2002. If USEC had succeeded in this plan, it would have very different future prospects than it has today.

The solution to the future competitiveness of the US uranium enrichment industry was and still is the deployment of new, cost competitive enrichment capacity. Low cost technologies have been developed and deployed by non-US enrichment companies over the past three decades, while the US has failed to follow through on past commitments to deploy new low cost enrichment technologies. It is ironic that the same companies who followed through with the investment in advanced technologies and new enrichment capacity over the past decades, now face trade sanctions in the US. In addition, US utilities face supply uncertainties due to these possible sanctions.

However, even with proven technologies, there are risks inherent in building any new enrichment capacity in the US. These include market risks, regulatory risks, and actions by governments such as trade restrictions. Assuming that these risks

can be managed, Urenco and Russian centrifuge technologies are the low cost proven production options, and absent trade restrictions, are poised to dominate the market for the foreseeable future. The question is whether the US will cede this business to foreign suppliers.

The US DOE has proposed a revival of its centrifuge technology program, but after being out of the centrifuge R&D arena for the last 15 years, the US has no proven advanced gas centrifuge (AGC) design, limited design infrastructure, and no production infrastructure. Although the US has a strong history in AGC development, the time, costs and risks involved with developing a competitive design, proving it, and deploying may be much less financially attractive than simply relying on proven designs and equipment.

One path forward could be a private sector initiative to construct an enrichment plant using proven technology, while the US government pursues advanced technologies for the long term, either centrifuge or laser, in an attempt to define an option that is substantially cheaper than today's centrifuge plants. However, if the government decides to pursue such an option, it must be soundly based to assure that the end result will be a substantial economic advantage. If there is not a high probability of such an advantage, government funds should not be spent.

The workers in the uranium enrichment industry have done a great job keeping the US competitive for decades. However, with 50 year-old GDP technology, they can only do so much. Furthermore, workers know that there is no long-term future in working at economically obsolete facilities. They need to know the path forward, or they will soon be forced to move to other industries with the obvious loss of technical expertise and skills.

Although it sometimes gets masked by rhetoric, the uranium enrichment business is all about producing SWUs cheaper than you sell them. If the US keeps this focus, it will have an economically viable production base at the end of the decade.

URANIUM

Natural uranium is a critical element of the nuclear fuel cycle. For the past several years, world production of uranium has been substantially less than world demand.

The difference between production and consumption was made up from HEU blending, enrichment of depleted uranium tails and inventory sales. The largest single inventory seller was USEC, who sold about $100 million worth of inventories that it obtained from DOE prior to privatization, in its fiscal year 2000 to raise cash for its operations.

The countries with rich ore deposits today dominate the world uranium market. Providing a measure of supply security to US utilities, Canada, with its vast low cost reserves, is the world's largest producer of uranium. As shown in Table 2, Australia was second, and former Soviet Union countries were the third largest producer of uranium in 1999.

US production was a small portion of world requirements, a situation that is unlikely to change substantially even as prices recover, due to relatively low uranium ore grades and high mining costs.

A summary of 1999 uranium production follows:

Table 2—1999 Uranium Production

Area of Production	Production % Of World Production
Canada	27
Australia	19
Former Soviet Union	18
Central Africa	10
Southern Africa	12
United States	6
Other	8

World uranium prices in the spot market hit an historic low in real terms in 2000, at about $7/lb before recovering to the current level of about $8.20/lb. Prices have been strongly impacted by Russian HEU blending and inventory sales. At present, about one third of world uranium requirements are met from inventory sales and HEU blending.

Although most uranium is delivered to utilities under long-term contracts at prices higher than spot market prices, inventory sales have lowered even long-term prices.

Shown below in Table 3 are the spot prices for uranium over the past decade. At present, spot uranium prices in the US market are about $8.20/lb, with long-term prices at about $9.75/lb. Outside the US market, which restricts the importation of Russian uranium, spot prices are substantially less at about $6.75/lb.

Overall, the uranium market is expected to be challenging over the next five years as USEC and other inventory sales and Russian HEU blending continues. As these inventories are depleted, primary producer sales will increase and prices should recover.

Table 3—Spot U_3O_8 Price Trends 1990-2000—In Restricted Market

Year	Price/lb U_3O_8 US $
1990	9.73
1991	8.73
1992	8.55
1993	10.10
1994	9.37
1995	11.36
1996	15.50
1997	12.09
1998	10.42
1999	10.20
2000	8.37

CONVERSION

The conversion of uranium concentrates into uranium hexafluoride (UF_6) for enrichment by GDP or centrifuge is commonly called conversion. Although conversion represents a small portion of total nuclear fuel cycle costs, it is an essential component. Worldwide consumption in 2000 was about 52 M kg/year, as compared to installed production of 63.2 M kg/year.

The principal suppliers of conversion services now include ConverDyn in the US, Cameco in Canada, BNFL in the UK, Cogema in France, and Minatom in Russia. Over the past decade, the worldwide conversion capacity decreased with the closing of the Sequoyah Fuels facility in Oklahoma, reducing the number of conversion suppliers in North America from three to two. In addition, BNFL announced recently that it would withdraw from the business in 2006, with Cameco assuming ownership of its operations. Capacities of these plants are shown below.

Table 5—Worldwide Uranium Conversion Capacity

Country	Owner/Operator	Plant Capacity MTU/year
United States	ConverDyn	14,000
Canada	Cameco	12,500
China	CNNC	1,000
France	Comurhex	14,350
Japan	PNC	50
South Africa	AEC	1,000
United Kingdom	British Nuclear Fuels, Ltd.	6,000
Russia	Minatom	14,000
India	DAE	295
Total		***63,195**

*(consumption 52,000)

Due to excess supplies and aggressive selling of inventories by entities including USEC, conversion prices decreased to about $5.75/kg in 1996, and to about $2.50/kg in 2000. However, recently conversion prices have recovered, and now stand at about $4/kg for spot sales and $4.50/kg for long-term contracts.

In the future, as inventories are depleted, the conversion industry should stabilize. However, even though US customers can take some comfort from having two North American suppliers, further industry consolidation is possible.

DISPOSAL OF USED FUEL

As part of its overall nuclear fuel cycle strategy, the government must place top priority on assuring that a permanent disposal mechanism for used fuel is implemented as soon as possible. Later this year, DOE will issue its site recommendation for the Yucca Mountain Project. This recommendation must be acted on promptly, and a path forward defined and funded as quickly as possible.

Without some certainty on the disposal mechanism for used fuel, no additional nuclear power plants will be built in the United States.

SUMMARY

In summary, now is the time for action to address the critical issues in the supply of nuclear fuel cycle to US power plants in a manner that is technically and financially sound. Due to a range of factors, the future of US nuclear fuel supply is in doubt. The situation is somewhat more secure for uranium and conversion services due to the existence of competitive supply sources in Canada, but the long-term prospects of USEC, the only North American supplier of enrichment services, are highly uncertain.

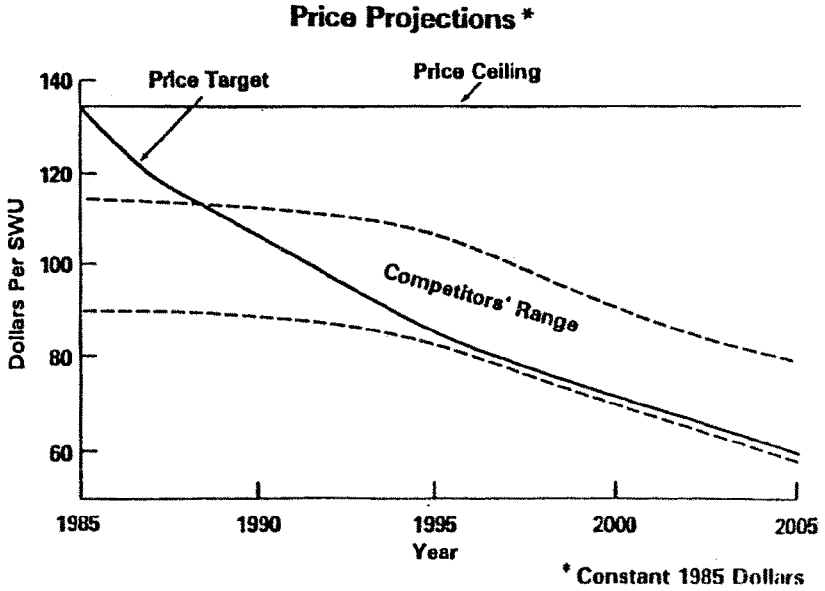
The current US situation results from market factors, resource limitations, and in some instances from management misjudgments. However, the reasons why we arrived at this dysfunctional state are not as important as where we go from here to address the problems.

If the government and private sector evaluate the nuclear fuel supply situation and decide that reliance on non-US sources is acceptable due to the high costs and risks involved in developing or maintaining a competitive US industry, that's okay.

However, an immediate public policy debate is warranted on how best to assure the flow of competitively priced nuclear fuel to provide reliable low cost electricity to our nation.

Thank you for your attention.

FIGURE 1



Mr. NORWOOD. Thank you, sir, for your time and generosity.

I would like to now introduce to the committee Ms. Anna Aurilio, Legislative Director for U.S. PIRG in Washington, DC.

Ms. Aurilio?

STATEMENT OF ANNA AURILIO

Ms. AURILIO. Thank you, Mr. Chairman. Thanks for the opportunity to speak this afternoon.

My name is Anna Aurilio. I am the Legislative Director for the state Public Interest Research Groups. We are non-profit, non-partisan, consumer and environmental advocacy groups active across the country.

We have a long history of working on—working to shift the country away from polluting energy sources such as fossil and nuclear and toward energy efficiency and clean renewable energy sources. Today I am going to focus primarily on our concerns with nuclear power.

We believe that nuclear power is unsafe, uneconomic, generates waste for which there are no sound solutions, and should not be promoted as a future energy source. First of all, nuclear power is unsafe. All aspects of the nuclear fuel cycle pose tremendous risk to human beings and the environment.

For example, uranium mining has caused illness and death in workers. There is a new type of uranium mining now being used in some areas called in situ leaching. I can't think of an easier way to contaminate precious and scarce groundwater supplies out in the west.

Nuclear fuel from reactors after it comes out of a reactor is perhaps the most lethal material that we have ever generated on this earth. Just a few seconds of exposure can cause death. Commercial nuclear power in this country has generated by radioactivity 95 percent of the waste that future generations will have to deal with.

Now, nuclear power plants are very complex. And, thus, the threat of an accident is certainly something that people should be concerned about. Obviously, two of the most tragic examples were the accident at the Chernobyl nuclear reactor and at Three Mile Island here in this country.

We are very concerned about the safety of the reactors operating in this country, and we are astonished that the industry and the Nuclear Regulatory Commission, instead of taking another look at aging issues because reactors are deteriorating with age more quickly than expected, particularly reactor pressure vessels and steam generator tubes are deteriorating more quickly than expected—and I have talked to some of the scientists that did some of the initial calculations.

We are astonished that the agency and the industry are pushing to relax safety standards instead of trying to figure out how best to protect the public.

Let me give you an example of something that happened in—last year as an example of why the Nuclear Regulatory Commission has standards and requirements that are just too lax. In the early 1990's, the Commission proposed standards for steam generator tubes. They were never implemented. Instead, the industry has voluntary self-regulation for the most part.

In February 2000, the Indian Point Nuclear Generating Station located just 24 miles from New York City had an accident where a steam generator tube blew and released radioactive steam. Now, the company was supposed to have replaced these tubes, which is quite expensive, in 1993 but never did thanks to NRC's lax oversight. Again, a reactor this close to such a large population on the Hudson River poses a severe threat. Regulations should be increased and enforced, not loosened.

The second issue I would like to cover is that even though capacity factors may be going up, nuclear power is still unreliable. I was very amused to see on the NEI website a press release saying that increased capacity could fuel California's energy shortage, and yet, on February 3 of this year, the San Onofre Nuclear Generating System had a breaker fire that has caused it to be down for the past several weeks.

In fact, it is loss of this generation that is in part, because it is unexpected, due to the rolling—causing the rolling blackouts that California has currently been experiencing.

Nuclear power is uneconomic. I was pleased to see that the Energy Information Administration has got some more realistic examples of nuclear generating costs. It is incredible to us that the industry seems to shamelessly revise history and pretend that it has transformed itself into a cost-effective energy source, and yet it continues to ask for taxpayer and ratepayer handouts.

Just a couple of things to raise the uneconomic nature of nuclear power. In 1986, DOE looked at initial estimates of costs for 75 reactors. It was $45 billion. The final cost to construct those reactors was $145 billion.

I guess I will conclude right now, because I am sure you will have questions.

[The prepared statement of Anna Aurilio follows:]

PREPARED STATEMENT OF ANNA AURILIO, LEGISLATIVE DIRECTOR, U.S. PUBLIC INTEREST RESEARCH GROUP

Good afternoon, my name is Anna Aurilio and I'm the Legislative Director of the U.S. Public Interest Research Group, or U.S. PIRG. U.S. PIRG is the national office for the State PIRGs, which are environmental, good government and consumer advocacy groups active around the country. Thank you for the opportunity to speak today.

The state PIRGs have a long history of working for a clean affordable energy future. Our goal is shift from polluting and dangerous sources of energy such as nuclear and fossil energy to increased energy efficiency and clean renewable energy sources.

Today I will be addressing nuclear energy issues. Nuclear power is unsafe, unreliable, uneconomic and generates long-lived radioactive wastes for which there is no safe solution. It should be phased out as soon as possible and should not be encouraged as a future energy source.

Since the late 1970's, the PIRGs have worked to protect the public from unsafe, expensive nuclear reactors. PIRGs successfully opposed the construction of several nuclear power plants because of cost, safety and nuclear waste concerns. For example, in 1982, litigation by MASSPIRG helped cancel the proposed Pilgrim 2 nuclear power plant. In 1983, NJPIRG helped cancel the proposed Hope Creek nuclear power plant. CoPIRG worked for the creation of the Office of Consumer Counsel (OCC) in 1984. The OCC was key in protecting ratepayers from being burdened with "stranded costs" in the St. Vrain nuclear power plant case.

During reauthorization of the Price-Anderson Act, the PIRGs successfully advocated for lower taxpayer liability in case of a nuclear accident. From 1993 through 1995, PIRG helped shift more than $500 million in nuclear and fossil R &D spending to efficiency and renewable programs. During that time, we helped convince

Congress to eliminate funding for two extremely expensive advanced reactor programs, the gas-cooled reactor and the Advanced Liquid Metal Reactor, saving taxpayers at least $5.6 billion.

NUCLEAR POWER IS UNSAFE.

Nuclear power poses an unacceptable threat to humans and the environment. All aspects of the nuclear fuel cycle pose a risk to humans and the environment. Uranium mining and enrichment has caused sickness and death in workers and has generated tons of mining and enrichment wastes, which continue to threaten nearby communities. Current uranium mining practices include "in-situ" leaching, which pollutes precious aquifers in the arid West. Irradiated fuel from nuclear reactors is perhaps the most toxic material generated by humans. Unshielded, it delivers a lethal dose of radiation within seconds. According to the Department of Energy, 95% of the radioactive waste (by radioactivity) in this country has been generated by commercial nuclear reactors.

Nuclear power plants are very complex and contain enormous amounts of potential energy in the fuel at the core of the reactor. The most tragic example of the dangers posed by this technology is the 1986 accident at the Chernobyl reactor in the Ukraine. The explosion and core meltdown at Chernobyl released radiation that generated a plume encompassing the entire Northern Hemisphere [1]. Here in the U.S., in addition to the partial core meltdown at Three Mile Island in 1979 which forced the evacuation of nearly one hundred fifty thousand people, there have been four other nuclear accidents in the U.S. involving at least partial core meltdown.[2]

The potential consequences of a serious accident are staggering. A 1982 study by the Sandia National Laboratories found that a serious accident at a U.S. nuclear reactor could cause hundreds to thousands of deaths in the near term.[3] In 1985, in response to a question posed by Representative Markey, an NRC commissioner responded that there was a 45% chance of a severe nuclear accident in the following twenty years.

We are therefore very concerned about the safety of nuclear reactors currently operating in this country. We are astonished that the industry and the regulatory agency have been lobbying for a relaxation of safety standards and oversight and limiting the public's access to these processes. We are concerned that utility deregulation and new ownership of reactors may increase risks of accidents because of increased pressure to run the plants closer to the margin. This risk is heightened by the fact that the 103 operating reactors around the country are deteriorating with age more quickly than expected. Even Vice President Cheney acknowledged the aging problem on the television show "Hardball" (March 21): "[T]oday nuclear power—produces 20 percent of our electricity, but that's going to go down over time—because some of these plants are wearing out."

CURRENT REGULATION IS INADEQUATE TO PROTECT PUBLIC HEALTH AND SAFETY.

For example, one aging-related problem is reactor embrittlement. Cracks in the reactor vessel caused by constant neutron bombardment could lead to a meltdown. When problems were found, the Nuclear Regulatory Commission (NRC) simply changed the safety margins and allowed the utilities to recalculate their compliance. Steam generators are also susceptible to premature degradation. The failure of as few as ten tubes can lead to a reactor meltdown, yet the NRC has inadequate steam generator tube standards. For example, the Indian Point 2 nuclear power plant is located 24 miles north of New York City, along the Hudson River. It had been scheduled for steam generator tube replacement in 1993, yet this never happened thanks to increasingly lax NRC requirements. On February 2, 2000, a tube ruptured, releasing radioactive steam.

There is a consistent pattern and history of lax NRC enforcement and oversight ranging from fire prevention to worker fatigue. The agency is focused on increasing the industry's profitability, not protecting humans and the environment. In fact a recent letter to this subcommittee from the NRC's Chairman Meserve reveals an agenda focused on, among other things: wresting control of certain radioactive materials regulation from the Environmental Protection Agency (EPA); limiting the scope of NEPA (National Environmental Policy Act) review for new power plants; and promoting new nuclear power plant siting. None of these changes will lead to increased

[1] OECD Nuclear Energy Agency report "*Chernobyl Ten Years On, Radiological and Health Impact*", November, 1995.

[2] Public Citizen website http://www.citizen.org/Press/pr-cmep84.htm

[3] Union of Concerned Scientists, Nuclear Plant Safety: Will the Luck Run Out? December 15, 1998

public health and safety. In fact, the NRC has been battling with the EPA for years over radiation standards. NRC's proposed standards are consistently less protective than the EPA's.

NUCLEAR POWER IS UNRELIABLE.

Complex and often mis-managed nuclear power plants are subject to frequent fires, leaks and other accidents. For example, the Nuclear Energy Institute's website boasts that "Increased Nuclear Output Would Satisfy California's Residential Demand."[4] It fails to mention a February 3 fire at the San Onofre Nuclear Generating Station that has shut the plant for weeks and is a key factor in current rolling blackouts in California.

NUCLEAR POWER IS UNECONOMIC.

Nuclear power would not exist in this country today if it weren't for enormous subsidies paid for by ratepayers and taxpayers. Originally touted as being "too cheap to meter", nuclear power plants are still too expensive for America. The nuclear industry has received the vast majority of energy research and development funding, a special taxpayer-backed insurance policy known as the Price Anderson Act, unjustified electric rates from state regulators, enormous and unwarranted bailouts in state deregulation plans, taxpayer-funded cleanup of uranium enrichment sites plus a giveaway of the Uranium Enrichment Corporation, and an ultimately taxpayer-funded nuclear waste dump. Many of the issues I raise here are described in more detail in the Green Scissors report (www.greenscissors.org) released by U.S. PIRG, Taxpayers for Common Sense and Friends of the Earth.

It is incredible that the nuclear industry shamelessly revises history to pretend that it has transformed itself into a cost effective energy source. Yet the industry continues to ask for more handouts.

TAXPAYER DOLLARS SHOULD NOT BE USED FOR MORE NUCLEAR RESEARCH AND DEVELOPMENT FUNDING.

According to the Congressional Research Service, nuclear research and development has gotten more than 60%, or $66 billion in energy research and development funding from 1948-1998. Led by Representative Markey and others, Congress wisely killed funding for the gas-cooled reactor and the breeder reactor, saving taxpayers at least $5.6 billion.

Now proposals to revive research programs to develop these uneconomic and dangerous reactors are creeping into the Department of Energy's budget. Supporters of the gas-cooled reactor proposed for South Africa may tout its cost. They do not highlight the fact that the design cuts costs by not building containment. The breeder reactor supporters ignore the dismal failure of France's breeder reactor program and the chance of a reactor explosion if the coolant (usually highly reactive sodium) leaks.

PHASE OUT THE PRICE ANDERSON ACT.

The industry is also lobbying for an extension of the Price Anderson Act, which is due to expire in 2002. This law, passed in 1957 and amended in 1988 provides a taxpayer funded insurance for the nuclear industry in the event of an accident. We believe that this insurance program is an unwarranted taxpayer subsidy to the nuclear industry that has no parallel in any other industry. During reauthorization of the Price Anderson Act, PIRG and others successfully fought for lower taxpayer liability in the event of an accident.

The American public is being barraged by misleading NEI ads touting the safety and positive economics of nuclear power. Yet the February 28 letter from NRC Commissioner Meserve to Chairman Barton states, "[W]ithout the framework provided by the Act, private-sector participation in nuclear power would be discouraged by the risk of large liabilities." The Federal Trade Commission has said that NEI's "advertising campaign touting nuclear power as environmentally clean was without substantiation." Several reactors are extending their operating licenses through a process which cuts out the public and essentially rubber-stamps the renewal application. If these plants are safe and economical enough to get a license extension, they shouldn't need a taxpayer-backed insurance plan.

[4] http://www.nei.org/doc.asp?docid=724

PROTECT CITIZENS FROM UNJUSTIFIED RATE INCREASES AND BAILOUTS AT THE STATE LEVEL.

We realize that this committee does not have jurisdiction over state deregulation and rate-making. However, in analyzing current electricity problems, it is important to recognize the magnitude of the ratepayer subsidies enjoyed by this industry and the role these subsidies have played in blocking competition and propping up economically marginal nuclear power plants.

In the 1980's, the PIRGs successfully blocked unjustified rate increases for nuclear power mismanagement. As states across the country restructured their electricity markets, the promise to consumers was that these changes would provide competition among electricity providers. Instead, utilities lobbied, and for the most part received, an unjustified ratepayer-funded bailout of their uneconomic investments, usually nuclear power plants. The PIRGs, free market, and other consumer and environmental groups in several states fought back against these requests for "stranded cost" recovery. We argued that these bailouts were unjustified and unfair to consumers and would hamper efforts to shift towards clean energy. According to a report released in 1998 with the Safe Energy Communication Council entitled "Ratepayer Robbery" we estimated these bailouts could total more than $112 billion for just eleven states. There is strong evidence that without these bailouts, almost half of the nuclear power plants would have shut down. Instead, aging plants have been given a new lease on life, are in some cases, still shielded from market forces. Some have been sold at rock-bottom prices to new owners who have every incentive to run them close to the margin.

CURB TAXPAYER COSTS FOR NUCLEAR WASTE AND INDEX THE FEE TO INFLATION.

The nuclear industry is the only industry that we are aware of which has a government program to guarantee disposal of lethal waste. We agree with the industry that the DOE has mismanaged the program. However, our solution is stop spending money on the program and insure that enough money is collected now to adequately cover future costs of a sound waste disposal program. A 1998 financial review commissioned by the State of Nevada concluded that the funding shortfall for the program would range from $12 to $17 billion in 1996 dollars. We urge that the Nuclear Waste Fund Fee be indexed to inflation so that there will be adequate funds to cover the ultimate cost of nuclear waste disposition.

THERE IS NO CURRENT SOUND SOLUTION FOR THE NUCLEAR WASTE PROBLEM.

Nuclear waste is one of the most dangerous substances created by humans. This waste remains dangerous for at least a quarter of a million years (based on the decay of Pu-239). One would expect that policies for dealing with this lethal material would be based on sound science and protecting public health. Instead nuclear waste policies in this country have been based on political expediency. The incredible problems faced by citizens living near former DOE weapons sites, such as Hanford, Washington should be a lesson to those who want to ignore science and public health.

We believe that the current project should be stopped, as the proposed dump site at Yucca Mountain cannot meet current standards for containing the waste. In 1998, PIRG and more than one hundred environmental, consumer and safe energy organizations petitioned then-Energy Secretary Richardson to disqualify Yucca Mountain because it would not meet current standards for containing the waste. Instead, DOE is in the process of weakening the current site guidelines, a clear case of changing the rules when science gives the answer that is not wanted.

We are pleased that President Clinton vetoed dangerous nuclear waste legislation last year. This legislation would have interfered with EPA's ability to set radiation standards and would have prematurely moved nuclear waste to Yucca Mountain, unnecessarily risking the lives of millions of Americans who live along the transport routes. We are concerned that there are ongoing efforts by both the Department of Energy and Nuclear Regulatory Commission to weaken radiation standards for the site. We are also concerned that EPA's ongoing review will lead to a standard that will not adequately protect Nevadans who live near the site.

We urge this committee to re-examine nuclear waste policy and develop a public, fair process based on sound science and protecting the public for deciding the ultimate fate of this extremely dangerous material. No country in the world has a permanent solution to this problem. The U.S. should reject its current mismanaged program that relies on changing the rules when the science isn't favorable to the industry's solution. Instead, we should show leadership by developing a solution focused on sound science and protecting the public.

CONCLUSION

Nuclear power is unsafe, uneconomic, unreliable and generates waste for which there is no sound solution. It is a failed technology of the past and would not exist were it not for enormous and unjustified government subsidies and policies. The U.S. should do everything it can to protect the health and safety of the public as well as our pocketbooks. Nuclear power should be phased out as quickly as possible and replaced by energy efficiency and clean renewable energy.

Mr. NORWOOD. Thank you, Ms. Aurilio. We appreciate your being here and your time.

Let me start the questions simply by maybe trying to set the record straight. I am sorry my friend, Mr. Markey, is not here, but he brought up the question of stranded cost in terms of deregulation of electricity.

And I think it is fair for the record to note that though the economics have gotten much better, not all power plants are the same, and the one we happen to have was built under Jimmy Carter's 21 percent interest rate. So it is a little different scenario when you had to spend that much, and were forced to build the plant, incidentally.

Mr. Hutchinson and others, let me follow up on a question Mr. Largent asked to the earlier panel, particularly the gentleman from DOE. And the question was, why don't we reprocess spent nuclear fuel in this country? And he gave a very short answer. He simply said, "Well, that is too expensive." Do you agree with that? Is that the correct answer to the question Mr. Largent posed to him?

Mr. HUTCHINSON. It is not economical in this country at this time. That doesn't mean it might not be at some time in the future. That is why I think——

Mr. NORWOOD. Is it economical in France?

Mr. HUTCHINSON. I don't know.

Mr. NORWOOD. I mean, I danced on those rods that Senator Domenici—well, is it economical in Britain?

Mr. HUTCHINSON. Well, I know there is discussion going on in Britain today as to whether they will continue to reprocess fuel due to economics. But, clearly, it is not economical in this country, but that doesn't mean it might not be at some time in the future, which is why I think, you know, R&D in this area is important, to preserve that option.

Mr. NORWOOD. Well, should we move forward with mixed oxide plants reprocessing in this country?

Mr. HUTCHINSON. I don't think we ought to eliminate any possible source of energy.

Mr. NORWOOD. Why I am confused is that I am told by the Brits 5 years ago that they did not use any of their tax dollars for their energy department in Britain, because they made so much money reprocessing fuel for Japan. Does anybody want to comment on that? Anybody want to say that is incorrect?

Mr. HUTCHINSON. I am not——

Mr. NORWOOD. If you know it is, I need to know. You know these British. They may have tricked me.

Mr. LONGENECKER. Mr. Chairman, could I try an answer to that, please?

Mr. NORWOOD. Yes, Mr. Longenecker.

Mr. LONGENECKER. Back in the early days when Mr. Barton and I first met about 20 years ago, in the Department of Energy, you

will recall at that time uranium prices were about $40 a pound and projected to go at this time to maybe $70 to $100 a pound. Reprocessing spent fuel and separating out the reusable uranium and plutonium at $70 a pound uranium would make economic sense.

At that time, the French and British were processing industries, were planned, and we began an industry here in the United States. Today uranium prices are about $8 a pound, and that is due to a number of finds of very rich reserves in Canada and Australia, and other factors.

Uranium is a finite resource, and so we have to think about the mined uranium and plutonium that is in that spent fuel. Mixed oxide makes sense in this country today because it is a good way of getting rid of the excess plutonium that we have around the country that is very expensive to store.

I think proceeding with mixed oxide technology now builds the technology base, and later we have the option, if uranium reserves are finite and the Nation and the world continues to rely on nuclear, to go get that and reprocess it. So I think that the question as to whether you permanently dispose of material in Yucca Mountain or whether you preserve the option to retrieve it later is a very important one.

Mr. NORWOOD. Ms. Aurilio, I only have a minute, and I do have a question I particularly wanted to ask you. If nuclear power, which, of course, does not emit any Greenhouse gases is phased out, with what would you propose we replace the 20 percent of the Nation's power supply that we would lose?

Ms. AURILIO. I believe that the future of this country is going to lie in becoming more energy efficient, and we have been perplexed as to why the Bush Administration seems to be ignoring energy efficiency, which can save consumers money, avoid pollution——

Mr. NORWOOD. So you think if we are all more efficient we can do away with the 20 percent of energy that nuclear power presents?

Ms. AURILIO. It is certainly conceivable. And then the other piece of it in terms——

Mr. NORWOOD. Now, you are going to be ready to prove that, aren't you?

Ms. AURILIO. In terms of new generating capacity, wind energy is actually quite economical, and I want to just draw a contrast. This week in Germany, farmers in Germany are blockading the streets because they don't want the reprocessed fuel to be driven through their farmlands and potentially contaminate their farmlands, while in Iowa farmers are getting $2,000 a year per wind turbine to put wind turbines on their farms. They still farm——

Mr. NORWOOD. Let me interrupt to ask you the last part of this question before the time runs out. If you believe that renewables could perhaps replace that 20 percent, I know you wouldn't sit here and tell me that unless you knew what the cost of that would be to the nation.

Don't count hydropower, hydroelectric power. Just what would it cost this Nation's economy to switch from nuclear to renewables to pick up that 20 percent? I don't know if conservation is going to get the job done. They are working on it in California.

Ms. AURILIO. Yes. I actually think that it has to be a mix of conservation and renewables.

Mr. NORWOOD. Tell me what the cost is.

Ms. AURILIO. Right now, wind energy plants are at about 4 to 6 cents a kilowatt hour, and some are as low as 3 cents per kilowatt hour. So I actually think that trying to revive the nuclear industry will bankrupt this country, whereas going toward energy efficiency, conservation, and renewable energy is the way of the future.

Mr. NORWOOD. So renewables, if we go that way, it will bankrupt this country.

Ms. AURILIO. No, that is not what I said at all, sir.

Mr. NORWOOD. Well, say it again, then.

Ms. AURILIO. I said wind energy right now is going at 4 to 6 cents a kilowatt hour.

Mr. NORWOOD. Yes.

Ms. AURILIO. The best wind sites are actually as low as 3 cents a kilowatt hour. I heard the person from Energy Information Administration actually say that the costs of new nuclear power plants were at least 6 cents a kilowatt hour, so I would say that wind is actually cheaper. And by her charts, it is cheaper than new nuclear energy.

Mr. NORWOOD. So you would think we would get out there and build some windmills right now.

Ms. AURILIO. In fact, in Iowa, as I said, they are building windmills. In Colorado, wind came in at less than the cost of a new gas-fired power plant, and the utility is building windmills.

Mr. NORWOOD. Well, the private investment, the magnitude of that, is gigantic. There is no question about it. And it has got to be questionable, in my mind, if we did away—let us just say tomorrow we closed all nuclear power plants which shuts off 20 percent of the electricity to this country and replaced it immediately with wind. Somebody better be very, very right when they make a statement like that. Otherwise, it is going to cause this country a great deal of trouble.

With that, I yield back the balance of my time. And, Mr. Strickland, you are up.

Mr. STRICKLAND. Thank you, Mr. Chairman.

Mr. Longenecker, I have a question regarding new technology. I think you indicated USEC has an aging expensive technology. Given USEC's financial condition, do you foresee USEC employing a new uranium enrichment technology in the next few years?

Mr. LONGENECKER. No.

Mr. STRICKLAND. That being the case, what alternatives are there for us as a government, and what do you think the likely outcome will be, using your best judgment?

Mr. LONGENECKER. Well, as I said, this is a good job for the private sector. There are a lot of good technologies out there. There are a lot of very highly qualified nuclear companies in the United States and in the world. And in my estimate, because that is our job is to follow this industry, we project that you could build in the United States a new uranium enrichment plant using proven European technology in about 5 years with NRC licensing.

Russian technology would take slightly longer, and, you know, there are some—within a decade, you might also be able to imple-

ment some other options that are currently being worked on in research and development. But I would say there are a number of options that can be implemented within a decade, and the company that does it needs to have a strong financial background and access to the technology, neither of which USEC has at this time.

Mr. STRICKLAND. What role do you think the government should most appropriately play in the development of a new technology, if any?

Mr. LONGENECKER. The difficulty that I have in defining that is I think you need to wait for the private sector solution to come forward. If someone wants to build a plant in the United States, they may do it with no government support whatsoever. And I think it behooves us to wait until that private sector solution has been developed.

If you think about it, in 10 years, if it is a government solution—what worries me about the government trying to do this was 10 years is five Congresses and three Presidential elections and 10 annual budgets. And as you well know, the United States in the 20 years that I have been involved in this industry has spent $7 billion, as I say in my testimony, on centrifuge and laser, and we have no new capacity to show for it.

So if this is a critical time, then I would put my money on the private sector this time around, and let them define what government support they need.

Mr. STRICKLAND. Mr. Sproat, I would like to ask you about your involvement or your company's involvement in the Pebble Bed technology. And the question I have, have you looked at the implications of the fuel that you are going to need, or I understand that you are going to need for this technology?

Is the fact that we perhaps will not have the enrichment capacity at a level that you would need a hindrance or a detriment in your decision to move forward and to invest in this technology?

Mr. SPROAT. I think, Mr. Strickland, the answer to that is we are clearly looking at that. With this technology, there are a number of unresolved issues, the economics being one of them, at this stage of the game. And it would certainly be a factor in our decision. However, as Mr. Longenecker said, that we believe there may be some private sector solutions to the enrichment issue.

I think as you pointed out earlier today, that we are going to require, if we proceed with the project, 8 to 9 percent enrichment in that fuel. And right now we have no currently available domestic sources for that. And that first fuel would probably come from South Africa with an enriched feed stock from Russia.

Mr. STRICKLAND. Isn't it true, though, that you could get that fuel from the current plant in Ohio, if necessary?

Mr. SPROAT. I believe so. It would need to be relicensed, I believe, for the higher enrichment levels. Let us put it this way, we would certainly prefer to have a domestic source of enriched feed stock for this plant.

Mr. STRICKLAND. Yes. And if I am not misled, I believe the Portsmouth plant is currently licensed to enrich up to 10 percent.

Mr. SPROAT. It may be. I am just not sure.

Mr. STRICKLAND. In terms of the utility industry or industries, is there concern—and if there is concern, how great is that concern—

that we are not paying sufficient attention to making sure that we have a domestic, economic, reliable source of enriched uranium?

Mr. SPROAT. There is a very large concern to that effect. The large nuclear generating utilities don't want to be in a position where they are held hostage to a single supplier, and where we don't have some alternatives. And we also want to make sure we have an economically competitive source of enriched feed stock for the fuel, so that is a major concern of ours right now.

Mr. STRICKLAND. Thank you.

Thank you, Mr. Chairman.

Mr. BARTON. Thank you, Congressman.

The Chair would recognize himself. My first question to the panelists that tend to be generally supportive of nuclear power—what action, if any, does this Congress and the Federal Government need to take in this session to make the nuclear option a real option?

Mr. HUTCHINSON. As I have said in my remarks, we look forward to the study being completed at Yucca Mountain. That recommendation will be made——

Mr. BARTON. So a high-level waste bill that the President signs.

Mr. HUTCHINSON. We would support and favor repeal of the PUCA Act. There are a handful of utilities that that impacts. My utility is one of those.

Mr. BARTON. That is kind of utility generic as opposed to nuclear power specific. Anything else?

Mr. HUTCHINSON. We certainly want to know that the regulatory processes going forward are dependable, timely, sort of thing, so we need to be sure that that is——

Mr. BARTON. So there are some things that the NRC, in terms of their process——

Mr. HUTCHINSON. Well, the NRC is looking at that process and is, you know, I think doing an admirable job at this point of identifying areas that they can improve in. The license renewal is an example of that. In our view, it has gone very well.

Mr. BARTON. Mr. Tollison or Mr. Sproat or Mr. Longenecker, other than a high-level waste bill, is there any other specific legislative action that is specific to the nuclear industry that you would recommend?

Mr. TOLLISON. Well, we do need renewal of the Price-Anderson Act. That is——

Mr. BARTON. Reauthorization of Price-Anderson.

Mr. TOLLISON. [continuing] very important. And the sooner and the better.

Mr. BARTON. Okay. Mr. Sproat or Mr. Longenecker?

Mr. SPROAT. Mr. Chairman, I would say that one of the issues that Dr. Travers referred to earlier regarding the loss of technical expertise within the NRC and the national labs I think is a very key issue in terms of making sure—particularly, say, if we bring in new advanced nuclear technologies, making sure that we have people in the Federal Government who have the capabilities to review those technologies and are qualified to review them I think is very key.

I also think that a couple of the issues are brought out in my testimony regarding the fact that a number—the regulatory frame-

work in this country was written in anticipation of a regulated utility industry building nuclear power plants, and we are clearly moving away from that into a deregulated marketplace where there will be merchant nuclear power plants. And some of the key top-level regulatory guidance or regulatory requirements need to be looked at and revised to recognize that changing marketplace.

Mr. BARTON. My next question, assuming a perfect world—you always hear in marketing a perfect world, and assume a perfect world; you never get it, but in all of the classes I took in business school the first assumption was perfect world and perfect knowledge.

Where would nuclear power be economical to consider as an option, again, if you take all of the political and environmental issues off the table? New nuclear power plants at 3 cents a kilowatt hour, 4 cents, 5, 6, at the generation, where is it a real economic option compared to coal or natural gas?

Mr. SPROAT. Well, if I could answer that, just to give you a benchmark. As we are evaluating the Pebble Bed Modular Reactor, we are evaluating against gas-fired combined-cycle gas turbine plants that assume long-term gas prices of about $3.50 per million BTU. And we think that if we can produce a power plant that has all-in costs at between 3 and 3.5 cents a kilowatt hour, we will not only be able to compete but we will be able to earn a significant return for our shareholders.

Mr. BARTON. "All-in" means construction and operations.

Mr. SPROAT. And operating and decommissioning funding and spent fuel disposal.

Mr. BARTON. Okay. Does everybody tend to agree with that? Mr. Longenecker?

Mr. LONGENECKER. Mr. Chairman, as you know, living in California where we are paying about 20 cents a kilowatt hour in San Diego, and finding it very difficult to——

Mr. BARTON. When you can get it.

Mr. LONGENECKER. [continuing] when we can get it, and finding it very difficult to find wholesale sources at 6 cents, a much higher threshold would apply.

Mr. BARTON. You know in California there is a state law. You couldn't build in a nuclear power plant in California, even if it was economical, until we get a solution to the waste issue.

Mr. LONGENECKER. Yes, sir. But I was addressing your question of if another plant could be——

Mr. BARTON. In a perfect world, perfect——

Mr. LONGENECKER. Yes. Let me also add on your legislative question, on December 31 of this year, Mr. Chairman, the Russian highly enriched uranium agreement expires.

And I think it does warrant, as I said in my overview remarks, some look by Congress on who the executive agent should be, whether that continues to remain with USEC or whether it should be allocated, some of that, to another executive agent, because the stability of that agreement, keeping that material off the market and putting it to use in nuclear power plants is a very, very important aspect of international policy for this country.

Mr. BARTON. Okay. Mr. Sproat, on the Pebble Bed Reactor, what is the main advantage to your company of considering that? Is it

the size of it, the modularity of it, the passive safety design of it? I mean, what is the—what is it that attracts your company to looking at that design as compared to some of the designs that the NRC—the next generation that they have already certified?

Mr. SPROAT. I think, Mr. Chairman, you summarized some of the key characteristics. It is—because of its small size, it can be built—once we have it—have the design certified by the NRC, we believe it can be built in approximately 24 months per unit as opposed to between 5 to 7 years per unit for a conventional size nuclear power plant.

Small capital investment required. Each unit would probably require between $110 to $125 million per unit as opposed to several billion dollars per unit. So the capital risk is much lower. And with that lower capital cost, we do believe it has the potential—and this is a key issue for us that we have not resolved yet—is that if we can bring it in in that 3 to 3.5 cents per kilowatt hour, the economics will make it——

Mr. BARTON. Of the next generation designs that the NRC has already certified, none of them are that size? They are all bigger?

Mr. SPROAT. All of them are larger. They would take longer to build. They require a larger capital investment. And the lowest price we believe we can get for an all-in cost out of that technology is somewhere in the neighborhood of about 6 to 7 cents a kilowatt hour.

Mr. BARTON. How do you answer the question about the enrichment of the fuel for the Pebble Bed Reactor? It is a lot higher enrichment——

Mr. SPROAT. Right.

Mr. BARTON. [continuing] required than what is commercially available right now, I am told, on the market.

Mr. SPROAT. That is correct.

Mr. BARTON. How do you answer that question?

Mr. SPROAT. Well, I think our—right now, as I said, we don't have a domestic source for that enrichment. We would like to get one, and we are exploring a couple of different options.

Mr. BARTON. I mean, is it technically feasible——

Mr. SPROAT. It is absolutely technically feasible.

Mr. BARTON. [continuing] and within all the various national security protocols?

Mr. SPROAT. Yes.

Mr. BARTON. To get that highly enriched——

Mr. SPROAT. It is technically feasible, as well as, you know, there—we haven't explored, but another possible option is downblending of military fuel into a lower——

Mr. BARTON. And who would actually—I am told you would actually have to build an enrichment plant to do that. Is that true or not true? And if it is true, who would build it? Would that be a private sector company, or would it be——

Mr. SPROAT. We are exploring some options that are primarily focused on the private sector.

Mr. BARTON. Okay.

Mr. SPROAT. But I am really not prepared to talk about that.

Mr. BARTON. My time has expired, but I want to ask Ms. Aurilio a question. I looked at your bio and it is pretty impressive. You

have got a physics degree from Amherst, and you have got an environmental engineering degree from MIT. So that is—that impresses me, since I am an engineer with an MBA and a registered professional engineer.

So I am going to assume that you are more than just another pretty face coming before this subcommittee, that you actually have a brain and you are very committed to what you believe in, and you have spoken very eloquently.

Now, in the answer to Congressman Norwood's question, you talked about Three Mile Island and Chernobyl. What was the containment structure at Chernobyl?

Ms. AURILIO. The containment structure at Chernobyl was inadequate to contain the accident and——

Mr. BARTON. Isn't it true that there was no containment structure?

Ms. AURILIO. And it was inadequate, and that is exactly what the problem with the PBMR is.

Mr. BARTON. The second question—wait a minute. They didn't have one. Do we have any reactor in the United States in the commercial power generation that doesn't have a containment structure?

Ms. AURILIO. No, we don't.

Mr. BARTON. Okay.

Ms. AURILIO. But the PBMR is saying that they are going to cut capital costs by not having a containment structure.

Mr. BARTON. Well, now, I didn't ask that. I am just—you are a physicist and you are an environmental engineer, and you put Chernobyl on the table. So you have an—at least I have an obligation, if we are going to have a record on Chernobyl, let us have a record. There was no containment structure at Chernobyl.

What was the design of the reactor at Chernobyl? Was it a lightwater reactor? Was it a high pressure reactor? Or was it a design that we have not even built since the research stage in this country, something called a hot graphite reactor?

Ms. AURILIO. It was a graphite moderated reactor, known as the RBMK.

Mr. BARTON. Right. Now, isn't that inherently one of the least safe reactors? Do we have any of those types of designs even being thought about in this country?

Ms. AURILIO. We don't, but the PBMR——

Mr. BARTON. All right.

Ms. AURILIO. [continuing] would also be graphite moderated.

Mr. BARTON. So isn't it a little unfair—it is no requirement that people that testify be fair. I mean, just to be honest about it. The whole point of this is to develop a record, but it is at least somewhat disingenuous to say the word "Chernobyl" as if that would even be a possibility.

It is a different design, a very poor design. It was poorly manufactured. There was no containment. The operators weren't very well trained. Totally different than what we are talking about. Wouldn't you agree with that?

Now, you can still be against nuclear power. You are not unique in that. But somebody with your background, as smart as you are,

should try to be a little less disingenuous. Is that a fair statement, or is that an unfair statement on my part?

Ms. AURILIO. With all due respect, Mr. Chairman, I believe nuclear fission reactors are inherently unsafe.

Mr. BARTON. I understand that.

Ms. AURILIO. The Chernobyl reactor is a different design than U.S. reactors are, but we have played around with a lot of different designs in this country. And we have some grave safety concerns about the proposed PBMR reactor.

Mr. BARTON. No. Have you had a chance—you and your group—to look at this Pebble Bed? Because I am told that just the inherent design of it, it is much more passively safe, that it—you know, whereas the Chernobyl reactor was very passively unsafe.

So isn't what Mr. Sproat and his group doing at least moving in the right direction, if you assume that nuclear power—and you don't—but if you assume that nuclear power should be an option at some point, would you at least agree in your group that they are moving in the right direction in terms of safety?

Ms. AURILIO. I believe that the PBMR will not turn out to be a safe or economical reactor. We are still studying up on the reactor. We have grave concerns that as currently designed it, too, has no containment.

Mr. BARTON. But in concept——

Ms. AURILIO. But if you would let me finish, because what I have been seeing in the literature is that the containment would be the fuel itself. And we have grave concerns because right now the company, BNFL, which is one of the partners which would be involved also in making the fuel, we believe, they have been accused by both Germany and Japan of falsifying data for manufacturing fuel for reactors in Germany and Japan.

So we have very, very big concerns as to why you would want to build a reactor that lacks containment. And Commissioner Merrifield of the NRC did express some questions about that recently as well. And then why you would want to rely on manufacturing, which, as you know, it is never 100 percent perfect——

Mr. BARTON. I understand that. But at least it is a good idea——

Ms. AURILIO. [continuing] to contain radioactivity.

Mr. BARTON. [continuing] to build it. I mean, your group's position that we can get there with conservation and renewable, you know, the renewable exclusive of hydro is .2 of a quad, .2 of 1 percent of a quad. In other words, compared to the hundred quads that this country used, it is just orders of magnitude below what you would need to replace the existing power supply.

So if you are acting or attempting to act responsible, you know, nuclear power, if we can get these next generation technologies that are much safer and much more fail-safe, so that if things go wrong the system automatically shuts itself down, which is my understanding of this Pebble Bed Reactor—and I could be totally wrong on that—that is at least a step in the right direction. That is my only point.

I am not trying to convert you. You know, that would be stupid on my part. It would be unfair on my part. But give the industry credit and the private sector credit for at least attempting to listen to the concerns that we both share.

Ms. AURILIO. But if it is so safe, then why do they need Price-Anderson coverage for these reactors as well?

Mr. BARTON. That is a decision that was made before I was even born, quite frankly.

Ms. AURILIO. It doesn't cover these types of reactor designs. I mean, in reauthorization, if it is so safe and economical, perhaps the industry could pay for it itself, then, pay for insurance coverage——

Mr. BARTON. We may give you or your associates a chance to testify on that at the appropriate time. That is a valid question.

I am going to go to Mr.—let us see, we have already—Mr. Strickland has asked questions. We are going to go to Mr. Shimkus. Isn't that right? Yes.

Mr. SHIMKUS. Thank you. But, Mr. Strickland, you wanted to make a comment to the chairman on your plant, and I want to give you that opportunity.

Mr. STRICKLAND. Yes. And then I promise the chairman I will be finished for the day.

Mr. BARTON. No, it is okay.

Mr. STRICKLAND. Two things just for the record, Mr. Chairman. If the information that I have is accurate, and I believe it is, the answer to your question, where would we get the fuel with the higher assay, we currently have a plant that is licensed to enrich uranium up to 10 percent. And within the next 2½ months, we are going to be placing that facility in an inoperable condition. So we can do it now, but 2½ months from now we will not be able to do it.

And the second thing for the record, I have a report that was sent to the Congress from the Department of Energy entitled "Report to Congress on Maintenance of Viable Domestic Uranium Conversion and Enrichment Industries," and I was wondering if we could enter that into the record.

Mr. BARTON. Without objection, so ordered.

[The information referred to follows:]

United States Department of Energy

REPORT TO CONGRESS ON MAINTENANCE OF VIABLE DOMESTIC URANIUM, CONVERSION AND ENRICHMENT INDUSTRIES

December 2000

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EXECUTIVE SUMMARY

This report is prepared in response to the Fiscal Year 2001 Energy and Water Development Appropriations Conference Report, House Report 106-907, which asked the Secretary of Energy to undertake an evaluation and make specific recommendations on the various options to support a domestic uranium enrichment industry in the short and long-term. The Department also included the domestic conversion and mining industries -- themselves important components of the nation's nuclear fuel cycle -- within this evaluation.

Nuclear energy represents about 20 percent of the nation's electricity supply. Uranium, a basic raw material, is transformed into nuclear fuel through distinct processing steps -- mining and milling, conversion, enrichment, and fuel fabrication. Over the last several years, the nation has seen a significant decline in the U.S. nuclear fuel market, including the closure of nearly all of the remaining domestic mines, possible near-term closure of the only U.S. plant capable of converting uranium to an acceptable form for processing in enrichment plants, and the announcement by USEC, Inc. to stop the AVLIS enrichment technology program and its intention to cease enrichment operations next summer at one of two GDPs in the United States.

In 1996, Congress enacted the Privatization Act, which authorized the USEC Board of Directors, with the approval of the Secretary of the Treasury, to proceed to transfer the Government's interest in USEC to the private sector, in a manner that "provides for the continued operation by the Corporation of the Department of Energy's GDPs, provides for the protection of the public interest in maintaining a reliable and economical domestic source of uranium mining, enrichment and conversion services, ..." The Act, under Section 3112, required the Government to provide annual reports to Congress on the status of the industries and to take or propose to take steps to "mitigate any material adverse impact or any loss of employment at the GDPs."

When the Secretary of Treasury approved the initial public offering of USEC in July 1998, it was based on, among other things, a short and long-term strategy for maintaining reliable and economic domestic enrichment: operation of both GDPs through 2004 and deployment of an advanced technology, Atomic Vapor Laser Isotope Separation (AVLIS), by mid-decade. These conditions and the viability of domestic enrichment were jeopardized when USEC cancelled AVLIS in June 1999 and last summer, announced the closure of the Portsmouth GDP in Ohio in June 2001.

This report analyzes the market conditions, the impact of a one-GDP operation on domestic energy security, and the short and long-term options for restoring the status of domestic energy security that existed when the government concluded that the initial public offering proposal by USEC satisfied the objectives of the Privatization Act. The Government evaluated the cost, schedule, technical and policy considerations of placing the Portsmouth GDP in either warm or cold standby or continuing to operate the plant to produce 3 million SWU/year for a strategic reserve. Similarly, the Department evaluated the range of advanced enrichment technology options that would be available for future domestic enrichment. A key portion of the Secretary's October 6 plan is the demonstration of U.S. origin technology in order to satisfy national security objectives. As such, detailed analyses of cost, schedule, and technical maturity and risk associated with the AVLIS and gas centrifuge advanced enrichment technologies were performed. The results of these analyses are largely contained in *Options for Government Response to Energy Security Challenges Facing the Nuclear Fuel Cycle*, Revision 2, September 2000.

On October 6, 2000, Secretary Richardson announced steps that the Department would take to address domestic enrichment security: placing the Portsmouth GDP in standby to protect 3 million SWU/year of enrichment capacity while gas centrifuge technology is demonstrated at the Portsmouth site as commercially viable and deployable. The Department expects to complete these missions by mid-decade.

Finally, over the last several months, the Department has completed analyses of the conversion and uranium markets, the impact of privatization as well as other market-related impacts on these industries, the basis for government response as well as options that could be pursued with the goal of maintaining a viable and economic domestic nuclear fuel industry for the future. A wide range of options were evaluated, including further reducing supply entering the markets, conducting cooperative research and development on needed environmental remediation technologies, utilizing Government stockpiles of uranium and conversion to assist industry in meeting existing and future sales, as well as, financial assistance to maintain the industry infrastructure while the market recovers from its severe oversupply condition.

As a result of the conditions of the nuclear fuel cycle markets and to help maintain viable domestic industries, the Department recommends that legislative action be taken to delay, for a five year period, the introduction of the remaining Department-held 1995 and 1996 natural uranium component from deliveries under the HEU Agreement (9.8 million pounds of natural uranium) into the market as currently required by the Privatization Act. In addition, the Department recommends conducting cooperative research and development on needed environmental remediation technologies with the uranium industry.

The Department will also work closely with the Congress and industry to address the economic condition of the conversion industry. Consistent with the legislative objective to ensure reliable and competitive domestic mining, conversion and enrichment industries, the Department recommends prompt consideration of limited financial assistance to the only U.S. convertor, ConverDyn. This assistance, which would contain a ceiling on both quantity and length of time over which it is provided, will be calculated based on an assessment of actual costs versus prices received from existing and new contracted sales. This initiative will help ensure the maintenance of the only U.S. supplier of conversion services and provide an incentive for ConverDyn to proceed with new production and sales.

As part of the preparation of this report, the Department solicited input from industry. The Department received valuable insight from the domestic utility industry as well as the domestic and foreign conversion and mining industries. During the process, the Department met with representatives of the Nuclear Energy Institute and their member organizations. Although there were a number of disparate views and interests reflected in the range of comments received, there was broad consensus on the importance of the HEU Agreement to U.S. nonproliferation interests, the global nature of market conditions, and that U.S. energy security would be adversely affected by the loss of the domestic enrichment industry. In general, there was broad support for Departmental plans to demonstrate an advanced enrichment technology -- gas centrifuge-- for future deployment and for government action to protect against domestic supply disruption.

REPORT TO CONGRESS ON MAINTENANCE OF VIABLE DOMESTIC URANIUM MINING, CONVERSION AND ENRICHMENT INDUSTRIES

INTRODUCTION

The Conference Report on FY 2001 Energy and Water Development Appropriations expressed concern about the continued viability of the front end of the domestic nuclear fuel cycle.[1] The Conferees asked that the Department work with the President and other federal agencies to ensure that the privatization of USEC and the implementation of "The Agreement Between the Government of the United States of America and the Government of the Russian Federation Concerning the Disposition of Highly Enriched Uranium Extracted From Nuclear Weapons" (HEU Agreement) were being carried out in accordance with the various laws enacted regarding these efforts. This report is a result of the Department's continuing evaluation of the domestic uranium mining, conversion, and enrichment industries. Included are short- and long-term options that were considered to help sustain the domestic enrichment industry, as well as recommendations for other actions that could be or are being taken to further support these industries while at the same time ensuring that the HEU Agreement continues to be implemented in support of important national security and nonproliferation goals.

Nuclear energy continues to represent about 20 percent of this nation's electricity supply. Participants in the front end of the nuclear fuel cycle compete to supply reactor fuel to many countries. While the front end of the nuclear fuel cycle represents only 25–30 percent of all maintenance and operating costs for a nuclear reactor, it represents a much larger percentage of all variable costs. As reflected in the Figure 1–1 below, enrichment represents about 50 percent of all front end nuclear fuel cycle costs.

Since the privatization of USEC in July 1998, the makeup of the nation's nuclear fuel industry and the nuclear fuel market has changed substantially. For a variety of reasons, the nation has seen a significant decline in the financial condition of USEC; the collapse of the U.S. uranium market, including the closure of nearly all of the remaining domestic uranium mines; and the possible closure of the only U.S. plant capable of converting natural uranium or yellowcake (U_3O_8) to uranium hexafluoride (UF_6), the form needed for processing in uranium enrichment plants. Moreover, USEC's announcement that enrichment operations will cease in June 2001 at the Portsmouth (GDP) in Piketon, Ohio (more than three years ahead of the earliest closure date indicated in the Treasury Agreement[2]) has raised questions as to whether there is sufficient insurance against a disruption in the domestic supply of enriched uranium.

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[1] The nuclear fuel cycle is a term used to describe all of the functions related to the production of nuclear energy. For this report, nuclear fuel cycle refers to the "front-end" of the nuclear fuel cycle (i.e., mining, conversion, and enrichment). The back-end of the nuclear fuel cycle refers to the management and disposition of spent fuel.

[2] Agreement Between the United States of America and the United States Enrichment Corporation Regarding Post- Closing Conduct dated July 14, 1998.

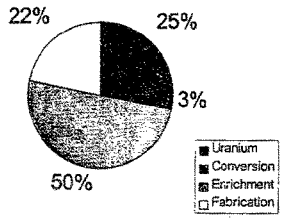

Figure 1-1. Breakdown of Nuclear Fuel Production Costs

This report focuses on issues related to the continued sustainability of the domestic uranium enrichment, conversion, and mining industries, and makes recommendations that may help these industries remain viable. The first section of the report addresses the domestic uranium enrichment industry, the status of the Portsmouth GDP, and actions that are being taken in the short- and long-term to support the continued viability of this industry, including options related to advanced enrichment technologies. Section 2 of the report discusses the state of the domestic mining industry and makes recommendations regarding its future economic viability. The third section of the report details the state of the domestic conversion industry and makes recommendations that could help to improve its sustainability. Section 4 discusses comments and suggestions received from industry and how they have affected the Department's consideration of these issues. Finally, Section 5 offers conclusions and recommendations for future activities that will help to ensure all of these industries remain viable.

1 STATE OF THE DOMESTIC URANIUM ENRICHMENT INDUSTRY

Closure of the Portsmouth GDP in June 2001 will increase our dependence on the performance of the remaining GDP at Paducah, Kentucky and increase the vulnerability of U.S. enrichment supply to disruptions in deliveries under the HEU Agreement. This section discusses (1) USEC's current contract commitments in the context of the world market; (2) energy security issues raised by relying on the Paducah GDP as the only domestic source of enrichment for the fulfillment of these commitments; (3) the role of commercial and government inventories in mitigating disruptions; (4) the relative impacts of disruption under various scenarios, including disruption of the HEU Agreement, on compliance with national energy security commitments; and (5) short- and long-term recommendations for improving the security and sustainability of the domestic enrichment industry.

1.1 USEC Commitments

Contract Commitments. USEC's current contract requirements are made up mainly of sales to U.S. utilities and to our allies in the Far East (i.e., Japan, Taiwan, and South Korea), as indicated in Table 1-1. The loss of ability to supply enrichment services to these customers would threaten our energy security and weaken U.S. nonproliferation commitments.

Table 1-1. USEC Contract Requirements

	USEC Sales (MSWU)	As % of USEC Sales	USEC Share of Regional Markets (%)
United States	6.8	62	69
Far East	3.3	30	52
Europe and Other	0.9	8	6

Covering Demand. The United States needs to be able to reliably meet the continuing demand for approximately 11 million separative work units per year. Today, there is sufficient capacity available to fill this demand if deliveries under the HEU Agreement are discontinued, as suggested in Table 1-2.

Table 1-2. Contract Commitments Under the HEU Agreement

Production Site	Demand Filled (MSWU)	Reserve Capacity (MSWU)
Paducah & Portsmouth GDPs	5.5	≅ 8.0
HEU Agreement	5.5	0*
Total	11.0	≅ 8.0

* Russia could supply more SWU only through government-to-government renegotiation of the HEU Agreement, taking into account Congressional and domestic concerns.

When enrichment activities at the Portsmouth GDP cease, as USEC plans in mid-2001, Paducah will be left as the lone operating U.S. GDP. This assumes that Paducah is licensed by the U.S. Nuclear Regulatory Commission (NRC) to perform enrichment up to 5 percent. Paducah has heretofore never produced commercial assay material, acting instead as a feeder plant to Portsmouth. USEC anticipates receiving the Paducah license in the spring of 2001 and has asserted an approximately 8 million SWU nameplate capacity at 5 percent enrichment. Certain technical issues, not yet fully understood, raise questions about Paducah's ability to achieve the full 8 million SWU at commercial assays.

World Market Context. With the closure of Portsmouth, the total world enrichment capacity will be approximately 40 million SWU; this includes both the 8 million SWU at Paducah and 5.5 million SWU equivalent from the HEU Agreement (see Table 1-3) Current world enrichment requirements are about 35 million SWU, with various estimates ranging between 34 and 37 million SWU. Thus, the closure of

Portsmouth significantly tightens the world SWU market and places additional importance on the uninterrupted delivery of material under the Russian HEU Agreement.

Table 1-3. Contributions of the Paducah GDP and HEU Agreement to SWU World Market

Production Site	Demand Filled (MSWU)	Reserve Capacity (MSWU)
Paducah GDP	5.5	≤ 2.5
HEU Agreement	5.5	0
Total	11.0	≤ 2.5

1.2 Energy Security Concerns Related To the Portsmouth Closure

USEC's decision to discontinue enrichment activities at the Portsmouth GDP in the summer of 2001 raises a number of concerns regarding the security of supply for enrichment. Among these are the following:

Advanced Technology Development, Demonstration and Deployment. When USEC was privatized in July 1998, the Atomic Vapor Laser Isotope Separation (AVLIS) technology was targeted for deployment by 2005 in order to provide a reliable, economical domestic enrichment capacity for the long term. When USEC discontinued the program in June 1999, citing technical and economic concerns, the United States was left without any advanced enrichment technology development program, public or private. Without an advanced enrichment technology development program, it will be impossible to sustain the domestic uranium enrichment industry in the long-term.

Increased Reliance on the HEU Agreement. There have been many difficulties associated with implementing the HEU Agreement. On five different occasions, deliveries under the HEU Agreement have been suspended for various periods of time. Subsequent agreements have helped to resolve these problems; however, issues continue to be raised that could lead Russia to withdraw from the HEU Agreement or prompt a prolonged delay in deliveries. The numerous political, national security, and commercial interests involved pose a continuous challenge to the long-term performance of the HEU Agreement. If circumstances were to cause Russia to suspend or cancel the HEU Agreement, the implications for enrichment supply disruptions in the United States could be serious. Deliveries of uranium from Russia, therefore, should not be considered as part of the long-term solution for maintaining a domestic source of enrichment services, however vital.

Paducah GDP Technical Concerns. Before the Paducah GDP can operate as a stand-alone enrichment source able to meet domestic requirements, it requires an NRC amendament of USEC's operating certificates to produce enrichment at 5.5% U-235. Issues have been raised about Paducah's ability to reach 8 million SWU at commercial assays. This issue, which is related to managing the content of lighter isotopes in order to meet commercial fuel specifications, is being examined. Also, Paducah is an old plant that could be prone to future

operating problems. However, it is important to note that the plant has been quite reliable to date and, therefore, this analysis assumes its continued successful operation in meeting USEC's needs.

Financial Viability. The cessation of enrichment activities at the Portsmouth GDP could theoretically, provide a near-term improvement in USEC's financial condition. However, a variety of analyses have pointed to significant challenges to USEC's long-term viability as a provider of enrichment services unless it has a clear plan for developing an advanced enrichment technology. In addition, expiration of the statutory restrictions on the ownership of USEC in 2001 could provide additional uncertainty about the company's future if its ownership changes substantially. The level of uncertainty, of course, is dependent upon the new ownership's business strategy.[3]

1.3 Role of Inventories and Alternative Enrichment Suppliers

As insurance against enrichment supply disruptions, USEC and some of its customers carry inventories of SWU that can be used as needed in an emergency. The following discusses the status of these inventories:

USEC Inventories. It is estimated that USEC currently maintains an inventory of approximately 5 million SWU, or enough SWU to cover about 1 year of production should either Paducah or the HEU Agreement experience delivery problems. USEC also has 3.3 million SWU in the form of 48 metric tons (t) of HEU that is being blended down at BWX Technologies, in Virginia, between now and 2006, and thus is not considered readily available for use in the short term.

Commercial Utility Inventories. Utilities are estimated to be carrying inventories of approximately 3 million SWU, but this level is considered insufficient to offer much in terms of insurance from supply disruptions. The utilities that carry these inventories are not expected to be interested in selling the material, especially in the event of a supply disruption. Over the past years, the inventory of SWU being carried by utilities has been reduced to avoid holding costs, and many utilities have transitioned to more of a just-in-time inventory system in an effort to reduce inventory costs.

Government Inventories. The U.S. Government also has inventories of about 56 metric tons of surplus HEU (roughly 6.2 million SWU) suitable for ultimate commercial disposition as low-enriched uranium (LEU); of that, 10 metric tons (1.8 million SWU) is in the form of HEU metal at Oak Ridge and would likely represent the earliest available source of inventory after downblending, although no near-term funds are budgeted for that purpose. Downblending the entire 56 metric tons would require approximately 4 years and cost roughly $50 million per 1 million SWU or a total of about $300 million.

Section 3111(b) of the Privatization Act limits "the beneficial ownership of securities" to less than 10 percent of the "total votes of all outstanding voting securities of the corporation" for a period of 3 years (i.e., until the summer of 2001).

Foreign Suppliers of Enrichment. There may be additional enrichment capacity available in Europe, but the ability to quickly increase European production to meet any shortfall is uncertain. At the present time, Eurodif (France's enrichment entity) and Urenco (jointly owned by Britain, Germany, and Holland) are operating close to their actual capacities. While the Eurodif plant is capable of operating at approximately 11 million SWU per year, it does not currently have access to the electricity needed to operate at that level. Urenco is operating at or very near its capacity, producing approximately 4.5 million SWU per year in three plants, with the capacity to produce only about 5 million SWU per year. Given the nature of Urenco's centrifuge plants, additional capacity could be added incrementally, but it would take an estimated 2–3 years. Urenco has not expressed any interest in building up its capacity to serve the U.S. market. Russia has a significant amount of estimated excess capacity available because it is only using approximately 8 million SWU per year of an estimated 15 million SWU per year capacity. However, should Russian deliveries to the United States under the HEU Agreement cause a disruption in domestic supply, deliveries of additional SWU from Russian enrichment plants would likely be jeopardized.

1.4 Legal and Policy Requirements

The Department is faced with a number of reasons for ensuring that the United States retains an adequate domestic enrichment capacity to address its national interests:

USEC Privatization Act. The USEC Privatization Act, Public Law No. 104-134, Title III, Section 3103 (1996), 110 Stat. 1321-336, 42 U.S.C. 2297h-1(a), authorized the privatization of USEC in a manner that provided: "for the protection of the public interest in maintaining a reliable and economical domestic source of uranium mining, enrichment and conversion services." In addition, the President is charged with making annual reports on the status of these industries and, if necessary, describing or proposing steps to "mitigate any material adverse impact or any loss of employment at the gaseous diffusion plants..." that may be caused by low-enriched uranium deliveries under the HEU Agreement (Public Law No. 104-134, Title III, Section 3112 (b)(10) (1996), 42 U.S.C. 2297h-10(b)(10)).

Section 3108(a) of the USEC Privatization Act, 42 U.S.C. 2297h-6(a), transferred all existing contracts, agreements and leases for enrichment services to USEC. Section 3108(c)(1) of the USEC Privatization Act, 42 U.S.C. 2297h-6(c), states that notwithstanding that transfer, the United States remains liable for the performance of those obligations, whether the government acts directly or through the private corporation.

Section 3108(c)(2)(A) of the USEC Privatization Act, 42 U.S.C. 2297h-6(c)(2)(A), allocates liability to USEC for any obligations arising after the date if extension or material amendment of any contract, agreement or lease that USEC terminates, extends or materially amends. Section 3108(c)(2)(B) of the USEC Privatization Act, 42 U.S.C. 2297h-6(c)(2)(B), allocates liability to the United States for any obligation arising before the date of termination, extension or material amendment of the date of extension or material amendment of any contract, agreement or lease by USEC.

Nuclear Non-Proliferation Act. The Nuclear Non-Proliferation Act of 1998, Public Law No. 95-242, Title I,

Section 101, 92 Stat. 121, 22 U.S.C. 3221, provides that:

> The United States, as a matter of national policy, shall take such actions and institute such measures as may be necessary and feasible to assure other nations and groups of nations that may seek to utilize the benefits of atomic energy for peaceful purposes that it will provide a reliable supply of nuclear fuel to those nations and groups of nations which adhere to policies designed to prevent proliferation.

Uranium enrichment involves the use of classified technology, and a reliable source of supply dampens the incentives for the spread of this technology, which can be used in fissile material production and weapons applications.

Energy Security Needs. Nuclear energy supplies one-fifth of the U.S. electricity requirements and is a significant source of electricity in Japan, South Korea, and Taiwan, all of which rely heavily on the United States for their enrichment requirements.

National Security and Foreign Policy. U.S. law, policy, and international agreements have enabled increasing imports of Russian enrichment and conversion services and uranium into the United States under the HEU Agreement in the interest of providing ongoing incentives for Russia to rid itself of HEU from nuclear weapons. At the same time, neither the United States nor the goals and objectives of the HEU Agreement would be well served if the United States were to become dependent on Russian enrichment industry in the process.

Nuclear Stockpile. It is necessary to sustain the U.S. enrichment capability (using U.S.-origin uranium and enrichment technology) in order to meet tritium requirements for maintaining the nuclear stockpile at levels set by the President through the Nuclear Weapons Council. The use of non-U.S.origin enrichment technology violates bilateral agreements with foreign countries that involve commitments not to use their uranium or enrichment services for weapons-related purposes.

1.5 Impacts of Supply Disruptions on Energy Security

If USEC were to permanently lose the SWU delivered under the HEU Agreement or lose the ability to deliver SWU from Paducah, the balance of USEC's contracts would have to be filled by available worldwide excess capacity after modest inventories were liquidated. The net effect would be a significant reduction in current worldwide enrichment capacity. This would likely place a strong upward pressure on SWU prices in the short-term until additional capacity was available to increase competition among the remaining enrichment suppliers. With only one enrichment plant operating, the security-of-supply risk would be greater for both domestic and non-U.S. customers under contract to USEC if there were a supply disruption stemming from the HEU Agreement or major problems (e.g., operations, economics, natural disaster) at the one remaining plant.

Obviously, once the Portsmouth GDP ceases enrichment activities, the implications of disruption in supply become more troublesome. For example, the domestic shortfall if Russian HEU deliveries were suspended, is summarized in Table 1-4. Should unanticipated operational problems at the Paducah GDP make it impossible to increase its production to 8 million SWU per year, any such shortfall would be significantly larger.

Table 1–4. Domestic HEU Shortfalls Attributable to Suspension of Russian Deliveries (in MSWU)

Effect of Russian Failure to Deliver SWU	Year				
	One	Two	Three	Four	Five
U.S. Supply Disruption	-5.5	-5.5	-5.5	-5.5	-5.5
Increased Paducah Production	≤2.5	≤2.5	≤2.5	≤2.5	≤2.5
USEC Inventories	3.0	2.0	0.0	0.0	0.0
USEC Shortfall	≤0.0	≤1.0	≤3.0	≤3.0	≤3.0

To address concerns associated with potential disruptions, the Department is moving to place the Portsmouth GDP in a standby condition with the capability to resume operations at approximately 3 million SWU per year within a period of 18 months to 2 years. For the longer term, the Department is restarting development of an advanced enrichment technology. The following section of this report discusses these activities.

1.6 Options for Improving the Sustainability of the Domestic Uranium Enrichment Industry

This section examines both short and long-term options for improving the sustainability of the domestic uranium enrichment industry. In the short term, options examined include continuing operation of the Portsmouth GDP for a limited period of time or placing it in standby, warm or cold. For the longer term, the Department considered options related to the development of an advanced enrichment technology. Some consideration was given to examining existing foreign technologies such as Russian or Urenco design centrifuges or the SILEX technology, but none would satisfy the Department's national security concerns relating to the ability to maintain a U.S.-origin source of tritium or national security material. Consequently, they were dropped from further consideration.

1.6.1 Short-Term Options

Each of these options were examined from the standpoint of their ability to ensure against a disruption in the supply of enriched uranium. Continued operation of the Portsmouth GDP would help to create a strategic reserve of enriched uranium equal to 6 million SWU, while standby would preserve the capacity to restart the plant should conditions warrant such an action. Each of these options is based on retaining the capability to produce 3 million SWU per year.

1.6.1.1 Operation of the Portsmouth GDP for 2 Years

Under this option, the Department would continue to operate the Portsmouth GDP for 2 years to build up an inventory of 6 million SWU that could be used to offset future supply disruptions. This would allow the

Department to build up an inventory that would cover approximately a 1-year supply disruption associated with the HEU Agreement or Paducah should either be unable to deliver SWU for a year. The advantage of this option is that it would allow the plant to continue to operate for 2 years, taking advantage of current staff experience to build up the SWU inventory. At the end of the 2-year operating period, the plant would be shut down permanently. The disadvantage of this option is the cost associated with continuing to operate the plant at a low level of production for the purpose of creating an SWU inventory that may never be needed. It was estimated that this option would cost the Department over $685 million over a 2-year period beginning in the summer of 2001.

1.6.1.2 Warm Standby

The warm standby option requires placing those portions of the Portsmouth GDP needed for 3-million SWU-per-year production capacity in a recycle mode at a 200-MW power load. Some cells would continue to operate while other cells required for production at a 850-MW power load (i.e., a 3 million SWU-per-year capacity) would be maintained in a fully buffered shut-down status ready to restart as needed. In the recycle operation, essentially no feed is needed nor is product withdrawn. In this state, the GDP could be ready, and would be currently authorized, to resume operations at a 3 million SWU-per-year capacity within approximately 2 months. Staffing of approximately 1,100 personnel would be needed to support a four-shift operation for this scenario. Thus, according to estimates, it would cost the Department about $100 million to place the facility in warm standby and about $120 million per year to keep it in that state.

1.6.1.3 Cold Standby

Cold standby requires placing those portions of the Portsmouth GDP needed for 3 million SWU-per-year production capacity in a shut down, nonoperational condition, and performing the surveillance and maintenance activities necessary to retain the ability to resume operations should it be required due a significant disruption in domestic enrichment supply. This was determined by the Department to be the most appropriate option for maintaining the Portsmouth GDP in a usable condition until a longer-term option was available to help sustain the country's uranium enrichment capability. This was also determined to be the most economical of the short-term options considered. According to estimates, the cold standby option would cost about $210 million (including costs for standby operations as well as ongoing and remaining GDP surveillance and maintenance).

It is estimated that it would take a maximum of 18–24 months to bring the plant back on-line under this option. Several activities would be required in order to shut down the cascade cells and retain them in a condition suitable for cold standby, including:

- Additional treatments to remove uranium deposits in certain portions of the cascades
- Buffering of process cells with dry air to prevent wet air inleakage
- Installation of buffer alarms on nonoperating cells to ensure that proper system integrity is maintained
- Revision of operating and maintenance procedures

In cold standby, the feed and withdrawal systems would also be in standby. In addition to the surveillance and maintenance staff needed to monitor the facilities, a single day shift of operations and maintenance personnel would be retained. These personnel will serve as a core cadre of cascade operators, utilities operators, and maintenance staff, forming the basis for future GDP restart, operations, and maintenance. Therefore, under this option the power load and staffing are significantly decreased. Cold standby would require only about 15 MW of additional electrical power over present DOE power needs. To support the cold standby option, the Department would also need to keep the cooling water systems in operating status to keep cooling towers wet, maintain Freon inventories, and support associated lube oil systems.

A decision to restart the GDP would require a significant level of effort in order to return the facility to operational status, including major updates to the Safety Authorization Basis; hiring and training of operations and maintenance personnel; recharging all coolant systems with Freon; returning auxiliary support systems to full operational status; operational readiness reviews; and ultimately authorization to restart and operate.

1.6.2 Long-Term Options

The Department considered two possible advanced technology options for further uranium enrichment development work: the AVLIS process and an advanced gas centrifuge technology. These technologies were part of prior research and development (R&D) programs operated by the Department. Demonstration of either technology presumes the use of the former gas centrifuge enrichment plant (GCEP) facilities at the Portsmouth site. Non-U.S. origin technologies, e.g., SILEX, were considered by the Department and dismissed due to national security concerns, as discussed briefly in the introduction to Section 1.6.

1.6.2.1 Atomic Vapor Laser Isotope Separation

The AVLIS process is an enrichment technology that was investigated by DOE and subsequently by USEC for potential use to enrich uranium. In June 1999, USEC announced that it was discontinuing its development of the AVLIS process. While USEC owns the AVLIS technology, the Department retains the right to utilize the intellectual property for government purposes.

When USEC terminated development of the AVLIS technology, it argued that the rates of return were not sufficient to outweigh the risks and ongoing capital expenditures necessary to develop and construct an AVLIS production plant. USEC had spent about $100 million in development of the technology since the corporation was privatized in July 1998.

Under this option, the AVLIS enrichment process would be demonstrated at Portsmouth as a means to complete the engineering development of the AVLIS process and demonstrate the commercial potential of this technology. Demonstration of this technology at Portsmouth would include construction of a separator reliability engineering test facility, as well as a 500,000 SWU per year demonstration plant representing a single line separator facility. The goal for the separator testing would be to extend separator life sufficiently above past test results to ensure adequate economic performance of the technology.

Demonstration of the technology would also involve dismantling remaining equipment at Lawrence Livermore National Laboratory (LLNL) and shipping it to Portsmouth for reactivation at that site. Consistent with the goal of successfully transferring the technology, Portsmouth personnel would assume the project lead providing key engineering and operations personnel. LLNL personnel would play a technology transfer and scientific support role.

It is estimated that it would take at least one year to reconstitute the technical expertise at Portsmouth and another 2.5 years before a separator reliability engineering test facility would be ready to operate. Separator reliability testing and development would be completed within
5.5 years. In addition, it would require 3.5 years to construct the demonstration plant. All together, this technology could be operational on a demonstration-scale at Portsmouth within 9 years.

The estimated cost to develop AVLIS is $659 million. In addition, the Portsmouth GDP would be kept in cold standby for at least 4 years longer than the gas centrifuge option at an estimated cost of about $47 million. As a result, and in light of concerns about the continued technical uncertainty surrounding the AVLIS process, development of the advanced gas centrifuge option for the long-term sustainability of the domestic uranium enrichment industry appeared to be the best option.

1.6.2.2 Advanced Gas Centrifuge

The gas centrifuge enrichment process was investigated by the United States over several decades until the mid-1980s and is currently used in a number of enrichment plants around the world. The Department and its predecessor agencies previously conducted R&D on gas centrifuge technology at Oak Ridge, Tennessee. Parts of this infrastructure and equipment, components, and expertise still exist there. Additionally, under the U.S. Gas Centrifuge Program, the government designed, constructed, and operated portions of a GCEP at Portsmouth. Although the GCEP was canceled in 1985 in favor of the AVLIS program, it was not canceled before portions of the GCEP had been successfully demonstrated. Much of the GCEP facilities, equipment, components, and expertise still exist at the Portsmouth site.

One factor in the decision to terminate development of the gas centrifuge was that the costs to enrich uranium were projected to be unfavorable when compared to projected costs for the AVLIS process. An element of the high cost of the gas centrifuge process was the cost of equipment and materials. Since 1985, there have been significant improvements in the properties of high-strength, light-weight materials, while the cost of these materials has dropped by about a factor of four. As a result there is the prospect that the use of these materials can dramatically improve the economics of gas centrifuge technology, making it attractive for commercial uranium enrichment. However, some design, development and verification testing is needed to demonstrate the projected performance and costs. The goal of the proposed gas centrifuge development activity would be to design an advanced gas centrifuge using new materials, to demonstrate the improvement in enrichment performance of the new design, and to collect and assess reliability and operability data to establish the potential economic performance of this technology on a commercial scale.

Under this option, a 70,000 SWU per year demonstration plant would be constructed. This represents the capacity needed to establish the commercial potential of the technology including all aspects of balance of plant design and operation given an aggressive one-year testing schedule. The pilot facility would be housed in the former GCEP facilities at the Portsmouth site. These facilities were built to house centrifuges of the scale that will be developed. To the extent possible existing GCEP equipment and components would be utilized. Engineering development of this technology would continue over 5 years using the specialized centrifuge test facilities available at the East Tennessee Technology Park in Oak Ridge. While most of the development work would be conducted by ORNL personnel, a significant number of Portsmouth personnel would be brought to Oak Ridge to allow the transfer of the technology and to support the manufacture and testing of the machines. Upon their return to Portsmouth they would lead and train others in the manufacture and operation of the pilot plant machines. Reliability operations would start at Portsmouth in mid-FY 2004, with the goal of attaining full capacity of the 70,000 SWU per year demonstration plant commensurate with start of operation. Operations would continue through March 2005.

The estimated cost to develop the gas centrifuge technology is about $255 million. Under this option, the Portsmouth GDP would be kept in cold standby for at least 5 years while the gas centrifuge demonstration plant is undergoing construction and testing.

1.7 Uranium Enrichment Options Summary

On October 6, 2000, the Secretary announced the Administration's plan to build an advanced centrifuge demonstration plant for uranium enrichment at the Portsmouth GDP. This will address some of the long-term concerns associated with the domestic uranium enrichment industry. This advanced centrifuge technology, which uses only a fraction of the electricity required for gaseous diffusion, will ultimately be made available to the industry for deployment in hopes of reviving the United States' leadership in the field of uranium enrichment. To facilitate the ultimate commercialization of the gas centrifuge technology, the Department will seek private participation. The Department will establish a Gas Centrifuge Technical Review Committee to perform independent reviews of the technology and the programmatic strategies for development, design and demonstration of gas centrifuges as a means to improve the probability of successful demonstration of the technology. The Committee will provide independent review comments on overall program risk, suitability and comprehensiveness of the program plan including cost and schedule objectives, technical issues and technical risk.

Central to the Administration's long-term plan is placing and maintaining the Portsmouth GDP in a cold standby condition pending the successful demonstration of the advanced technology, in about 5 years. This plan allows the plant to be available for restart, within 18 to 24 months, in the event of a disruption in the nation's supply of enriched uranium. Together, this strategy will ensure the retention of vital nuclear expertise and skills. Many of the highly trained and qualified workers at the Portsmouth GDP will be continued to be employed under this plan, either maintaining the facility in a standby condition or being trained in the operation of the advanced gas centrifuge demonstration plant.

These plans by the Administration, which conclude months of analysis by departmental officials, is regarded as essential to the long-term health and competitiveness of the domestic uranium enrichment industry, and to the security of the nation's long-term supply of electric power. The overall plan addresses the congressional objective to maintain a viable domestic enrichment industry.

Detailed plans for placing the Portsmouth GDP into cold standby and governing the development of the centrifuge are being prepared and are expected to be finalized in February 2001.

2 STATE OF THE DOMESTIC URANIUM MINING INDUSTRY

As a result of a significant decline in price over the past 5 years, U.S. uranium production is currently about 10 percent of peak historical production–4.6 million pounds U_3O_8 in 1999 versus 43.7 million pounds U_3O_8 in 1980.[4] For 1999, the quantity of U.S. production was equivalent to 8 percent of U.S. reactor requirements.[5] The three largest U.S. producers, each 100 percent foreign-owned, accounted for about 70 percent U.S. production in 1999.[6]

The decline in U.S. production has been offset principally by imports. In 1999, 76 percent of U.S. demand was met by imports.[7] The largest foreign suppliers of uranium delivered to U.S. utilities in 1999 were Canada, Australia, and Russia. That portion of U.S. reactor requirements not filled by domestic production or imports was filled by drawing down utility and supplier inventories.

Further cuts in U.S. uranium production are planned. Power Resources, Inc., announced in September 2000 that it would scale back production at its Highland in-situ leach mining project in Wyoming from 700,000 pounds U_3O_8 in 2001, to 300,000 pounds by 2003. The company also plans to suspend developing additional reserves at the project site.

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4 Source of U.S. production data in aggregate and status of mine and mills–EIA, *Uranium Industry Annual* 1999 and 1993.

5 U.S. reactor requirements for 1999 are equal to uranium in fuel assemblies loaded into U.S. commercial nuclear power reactors (EIA, *Uranium Industry Annual* 1999, Table 27).

6 Source of production data for individual facilities–*Cameco Corporation Annual Report 1999*, and *Rio Algom Corporation Annual Report 1999*.

7 EIA, *Uranium Industry Annual 1999*, Table 17.

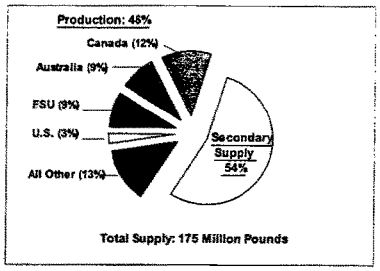

Figure 2-1. Uranium Supply to Meet World Requirements, 1999

2.1 Market Trends and Analysis

The U.S. uranium mining industry competes with production from the Australia, Canada, countries of the Former Soviet Union (FSU), and other countries, and with secondary supplies-stockpiles and inventories held by utilities; commercial suppliers, including USEC; and governments.

Because of relatively low cost of sales, secondary supplies have displaced a considerable amount of uranium production capacity since about 1980. For example, new mine production worldwide in 1999 was 81 million pounds out of world uranium requirements of 175 million pounds U_3O_8 (only 46 percent). The balance of 94 million pounds U_3O_8, or 54 percent of requirements, had been supplied from secondary sources (see Figure 2-1).[8]

Secondary supply includes the following sources:

Drawdown of U.S. Utility Inventories. Through sales and internal use, U.S. utilities have significantly decreased their uranium inventories, thereby displacing the demand for U.S. production.

Uranium Sales from the FSU. In the late 1980s, the FSU began selling uranium to Western countries. U.S. and other Western producers claimed that the FSU was selling uranium at prices that were far below fair market value. Beginning in 1991, the United States and the Europe took measures to mitigate the detrimental effects of

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[8] Based on uranium requirements of 175 million pounds U_3O_8 equivalent per EIA, International Nuclear Model PC Version, Reference Case 2000, April 2000 (http://www.eia.doe.gov/cneaf/nuclear/n_pwr_fc/data98/annura.html, December 6, 2000) and world uranium mine production of 81 million pounds U_3O_8 per Uranium Institute, (http://www.uilondon.org/coreissues/stats/uprod.html, December 6, 2000).

FSU sales on their domestic nuclear fuel cycle industries. In 1992, Department of Commerce signed initial agreements with Kazakhstan, Russia, and Uzbekistan placing quotas on imports from these countries. Although the suspension agreements have restricted deliveries of FSU-origin uranium to U.S. utilities, the sale of low-cost FSU uranium to Europe and Asia displaces the market share of other foreign suppliers. These producers could then utilize uncommitted capacity to compete in the U.S. market.

Drawdown of European Utility and Supplier Inventories. Inventories from Europe declined slightly in 1998 and 1999, after having been built up significantly in earlier years. Inventories were built up largely from imports from FSU countries. While the quantity of European uranium involved in the inventory drawdown is thought to be significant, no data on European inventories have been published.

Drawdown of Utility Inventories in Asia. For security of supply considerations, utilities in Asia typically hold a quantity of inventory to cover several years of future requirements. However, Asian utilities began to re-evaluate inventory policies during the latter half of the 1990s and subsequently reduced their uranium inventory reserve levels, resulting in less demand for uranium in the marketplace.

HEU Agreement. Pursuant to the HEU Agreement, the blending down of HEU contained in surplus Russian nuclear warheads to LEU would supply the world market with the equivalent of nearly 400 million pounds U_3O_8 through 2013. The HEU Agreement, to date, has not been a major contributing factor to the decline of the domestic uranium industry. However, due to the large quantities of uranium, conversion and enrichment, it is expected to be a major source of supply over the next 20 years. The impacts of these quantities of uranium entering the world and domestic markets are expected to be mitigated by the Privatization Act's quota provision that serves to restrict the amount of Russian HEU feed that can be delivered to U.S. end-users.

USEC Inventories. From 1993 through 1998, the DOE transferred about 172 million pounds of uranium in the form of natural UF_6 to the United States Enrichment Corporation in order to meet requirements under the Energy Policy Act of 1992 (EPACT) and the Privatization Act. Of the total 172 million pounds U_3O_8 equivalent transferred, approximately 99 million pounds U_3O_8 was uranium feed held by the Department, but owned by various enrichment utility customers . The remaining amount of approximately 73 million pounds U_3O_8 represents the Department's transfers of DOE-owned uranium to USEC. Forty-two million pounds U_3O_8 or about 57 percent of the 73 million pounds U_3O_8 of DOE-owned uranium is restricted by law or agreement in the manner in which it could be introduced into the uranium market. Lately USEC has, through public statements, recognized the perils of selling in a weak market. In reporting its earnings for the quarter ending September 30, 2000, USEC states "the short-term spot market for new natural uranium sales is soft, and the Company is focusing on longer-term sales where the prices are higher."[9]

DOE Inventories. DOE's surplus inventories consist of (1) natural uranium from DOE purchases of the 1995-1996 and 1997-1998 deliveries under the HEU Agreement (Russian HEU feed), and (2) natural uranium and

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[9]USEC Inc., "USEC Inc. Reports First Quarter Fiscal 2001 Earnings," press release, October 25, 2000.

HEU declared as surplus to U.S. defense purposes.[10] As part of a commitment to minimize the impact of inventory sales on the market, the Department has agreed not to begin selling 58 million pounds U_3O_8 for a 10-year period (1999 through 2008 as agreed to under the Feed Agreement between Russia and the United States signed in March 1999). The content of this stockpiled uranium is equally divided between the 1997-1998 Russian HEU feed and U.S. Government surplus natural uranium and HEU.

2.2 Why Is It Important for the United States to Maintain a Viable, Domestic Uranium Mining Industry?

A viable domestic uranium-mining industry is important for the following reasons:

- It offers diversification of supply for domestic and foreign utilities that rely on the U.S. for nuclear fuel.
- It provides domestic utilities with the confidence to reduce inventories that would have been held to ensure security of supply, thus improving their efficiency.
- The majority of current uranium requirements are met through secondary supply sources. As inventories are depleted, new production will be needed.
- Domestic in situ leach technology and production are competitive with foreign suppliers. A minimal investment is required to support a vital U.S. industry.
- A viable domestic mining industry ensures a fully integrated U.S. nuclear fuel cycle industry.

2.3 Proposed Assistance to Industry Reviewed by the Department[11]

The Department has vigorously pursued alternatives to help revitalize the uranium industry and allow it to be a competitive and reliable supplier to the world market. In this respect, the Department has reviewed proposals such as the following:

- Reducing the supply of uranium entering the market from U.S. Government inventories, including delaying the commercial sale of surplus inventories and the congressionally mandated sale of the natural uranium feed component from the HEU Agreement that was purchased by DOE pursuant to provisions of the Privatization Act (remaining amount is about 9.8 million pounds of natural UF_6).
- Using the Department's surplus UF_6 inventories to help the domestic industry meet existing and new sales of U.S. uranium.

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[10] Privatization Act (April 1996), Section 3112 (d).

[11] While the Department reviewed and considered these options, not all options are recommended for implementation. Please see section 5 for the Department's recommended options.

- Purchasing remaining USEC uranium inventories for storage by DOE for a 5-year period. The uranium would then be resold into the market in a reliable, low-volume manner (not greater than 4 million pounds per year), thus allowing market prices to recover.

3 STATE OF THE DOMESTIC CONVERSION SERVICES INDUSTRY

Uranium conversion services are required to change uranium oxide (U_3O_8) from mines and mills to uranium hexafluoride (UF_6). UF_6 can be enriched into the type of fuel used by light water reactors in the United States and other parts of the world. The only U.S. uranium conversion facility is operated by ConverDyn at Metropolis, Illinois. A second uranium conversion facility had been operated by Sequoyah Fuels, a subsidiary of the Kerr-McGee Corporation, at Gore, Oklahoma until 1992.

ConverDyn, a 50-50 joint venture between General Atomics, a privately held U.S. integrated nuclear fuel supply and services company, and General Electric, one of the largest publically traded U.S. companies. General Atomics also owns the Beverly mine, a uranium mine in Australia that began production in late 2000. In November 2000, General Electric acquired its share of ConverDyn. General Electric is also involved in nuclear fuel fabrication and nuclear reactor design and engineering businesses.

In 1999, ConverDyn utilized 9.3 million kilograms of uranium (kgU) capacity out of the licensed capacity at Metropolis of 12.7 million kgU. In addition to the overall downturn in the market described below, ConverDyn's less-than-full capacity utilization resulted from additonal factors such as:

1. The converter's location relative to its enrichment supplier. ConverDyn, the only U.S. converter, is highly dependent on USEC sales of enrichment services. According to ConverDyn, 99 percent of the Metropolis plant's output is enriched by USEC.[12]

2. Since USEC has lost market share in the enrichment market. As a result, ConverDyn has experienced corresponding loss of market share.

3. Another indirect but less-significant cause of ConverDyn's difficulty has been the continued strength of U.S. dollar relative to the competing currencies in Canada and Europe.

It is also important to note that Cameco Corporation, a Canadian company and ConverDyn competitor, is vertically integrated in uranium mining and conversion services. It operates some of the world's highest quality uranium mines. Cameco, along with Cogema and Nukem Inc., have a commercial contract with Russia for the marketing of Russian HEU feed including the conversion services component.

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[12] ConverDyn, Letter from James J. Graham, President and CEO of ConverDyn to Senator Mitch McConnell, dated November 20, 2000.

3.1 Market Trends and Analysis

The conversion services market, like the uranium market, has suffered downward pressure on price and severely depressed market conditions for the past several years. As seen in Figure 3–1, the price for conversion services has fluctuated considerably since the early 1980s. With the closure of the Sequoyah Fuels facility in 1992, the conversion services spot-market
price moved upward to a new high and maintained a level of close to $6.00 per kgU through 1997.[13] After 1997, the spot-market price began its quick decline to $2.30 per kgU by August 2000. However, the declining price trend may have been reversed–the price of conversion has gradually increased to about $3.50 per kgU at the end of December.

There were various causes for the downward pressure on price, including sales of existing UF_6 inventories, drawdown of utility inventories, and, to a lesser degree, the appearance of uranium feed supplies from the HEU Agreement. Although large quantities of conversion services from the HEU Agreement could be perceived to overhang the market, the actual quantities sold to date have been limited. The quantities sold pursuant to the HEU Agreement equate to an annual average of 4.7 percent of U.S. demand for conversion services.

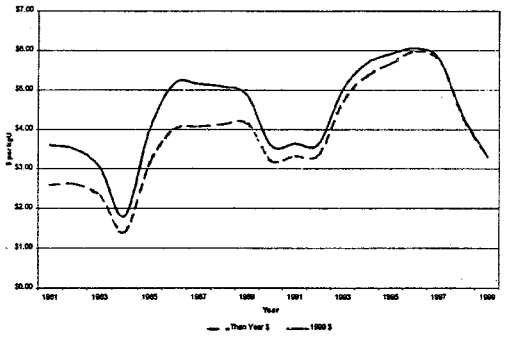

Figure 3–1. Average Annual Conversion Prices in the United States (1981-1999)

[13] Monthly uranium conversion spot-market prices from the Uranium Exchange Company.

During 2000, Western conversion capacity was at 81 percent, with ConverDyn only using approximately 73 percent of its capacity. Although current capacity is actually in balance with demand, due to the low spot-market price for conversion services and the plentiful inventories available, the remaining demand is being filled by inventories.

If the only U.S. converter were to fail, then the market price for conversion services would be expected to increase dramatically due to the initial loss of supply. This increased price, in combination with potential increases in transportation costs[14] for U.S. utilities, could impact U.S. energy security.

3.2 Why Is It Important for the United States to Maintain a Conversion Industry?

A viable domestic conversion industry:

- Provides an integrated domestic supply source to meet U.S. utility nuclear fuel requirements.
- Avoids over reliance on foreign sources of nuclear fuel supply, helps to maintain fair pricing by foreign suppliers, and increases assurance of supply.
- Provides a key element that facilitates the successful implementation of the HEU Agreement.
- Reduces fuel costs of U.S. nuclear utilities by facilitating exchanges of feed material that minimize transportation costs.
- Increases safety by reducing uranium cylinder handling.
- Helps provide assured operation of U.S. enrichment plants, as 60 percent of uranium feed delivered to USEC is from the domestic convertor. In the case of a foreign supply disruption, a domestic convertor can help maintain a secure source of supply to USEC.
- Provides positive earnings important to the U.S. balance of trade.
- Provides excellent U_3O_8 storage capacity.

3.3 Proposed Assistance to Industry Reviewed by the Department[15]

Over the past year, the Department has reviewed and considered many alternatives with the goal of maintaining a viable domestic uranium mining and conversion capability. Under any of these alternatives, Government

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[14] Other primary Western converters are located in Europe and Canada.

[15] While all options were analyzed and considered, not all options were recommended for implementation. Please see section 5 for the Department's recommended actions.

assistance is recommended to be provided only until the market conditions could sustain a viable convertor and reliable supply source. Proposals considered to date include:

- Reducing the supply of uranium and conversion services entering the market from the U.S. Government, including delaying the commercial sale of surplus inventories and the congressionally mandated sale of the natural uranium feed component from the HEU Agreement pursuant to provisions of the Privatization Act (remaining amount is about 9.8 million pounds of natural UF_6).

- Using the Department's surplus UF_6 inventories to help the domestic industry meet existing and new sales of U.S. uranium and conversion services.

- Government purchase of services from the domestic convertor to facilitate implementation of the HEU Agreement. This would ensure the domestic capability is there to separate the LEU into the enrichment and natural UF_6 components as required by the HEU Agreement.

- Government financial assistance to the domestic convertor for a short period to bridge the gap until market prices increase to the point of supporting a viable future U.S. conversion industry. This approach would be based upon cost versus sales price, and the duration of the assistance could be tailored to coincide with the completion of sales by USEC of surplus uranium inventories. The conversion industry is well positioned to remain a reliable and competitive supplier in the world market if oversupply conditions are relieved over the next couple of years. In this respect, the industry has already begun to see the market rebound favorably over the last several months as evidenced by the price for conversion rising from a low of $2.35 per kgU to its current price of $3.50 per kgU.

- Purchase by the Government of remaining USEC uranium inventories, including the conversion component since the uranium is in the form of UF_6, for storage by DOE for a five year period. The uranium and the conversion component would then be resold into the market in a reliable, low-volume manner, thus allowing market prices to recover in an orderly manner.

4 COMMENTS AND SUGGESTIONS FROM INDUSTRY

In the preparation of this report, the Department has received input from several sectors of the nuclear fuel cycle. The views expressed to the Department came from the domestic utility industry as well as domestic and foreign uranium mining and conversion industries and the Nuclear Energy Institute.

The views received from industry vary widely, as expected, depending upon their position within the nuclear fuel cycle market. However, there are some common beliefs that were evident from most or all of the input received from industry. These common beliefs include:

- While the HEU Agreement provides for large quantities of uranium, conversion and enrichment entering the marketplace (very little material has entered the market to date, but nearly 400 million pounds of uranium are involved over the twenty year period of the HEU Agreement), the HEU Agreement is necessary and vital to national security and meeting U.S. nonproliferation objectives. As such, every effort should be made to ensure successful implementation of the HEU Agreement.

- Actions taken by the U.S. Government to transfer large quantities of uranium to USEC and USEC's rate of liquidation of the uranium hexafluoride into the market have contributed to the depressed uranium and conversion markets.

- U.S. energy security would be affected by the loss of a domestic uranium enrichment supplier.

- Notwithstanding the successful HEU Agreement implementation, no further government action should be taken to place surplus uranium into the market place.

- The nuclear fuel market is global in nature. Therefore, any uranium, conversion or enrichment placed into the market, even the foreign market, will affect domestic suppliers of nuclear fuel services. Conversion levels at Converdyn were closely tied to USEC market share.

- Key issues that affect the U.S. mining industry include costs and the lead-time associated with permitting new in-situ leach projects and environmental restoration criteria.

5 CONCLUSIONS AND RECOMMENDATIONS RELATED TO SUSTAINING THE DOMESTIC URANIUM MINING, CONVERSION, AND ENRICHMENT INDUSTRIES

The domestic uranium mining, conversion, and enrichment services industries continue to experience downward pressure on prices and depressed market conditions. A number of parties have attributed this downturn to deliveries and sales resulting from the HEU Agreement, . However, these market declines cannot be solely attributed such deliveries and sales. To date, only a small quantity of the natural uranium and conversion services associated with this HEU Agreement have actually entered the market, and the enrichment services component has been introduced into the market on an orderly basis and in a manner that was widely anticipated by the market.

Although the HEU Agreement is partially responsible for reductions in employment at the GDPs and the decision on the part of USEC to shut down the Portsmouth GDP in June 2001, it is not the only factor. In fact, USEC was aware of the extent of the SWU delivery commitments when it was privatized in July 1998 and still believed that it would need to operate both GDPs through 2004. Other factors that contributed to the decision to shut down Portsmouth include a more competitive enrichment market than originally anticipated that has forced USEC to quickly reduce costs to improve efficiencies, as well as changing USEC management decisions. Moreover, the strength of the U.S. dollar has continued to provide foreign enrichment suppliers with a competitive edge, especially in the U.S. market, further pushing the market price downward.

On October 6, 2000, Energy Secretary Richardson announced the Administration's plans to address the long-term concerns associated with sustaining a viable uranium enrichment industry by building an advanced centrifuge demonstration plant at Portsmouth. In the short term, the Administration has announced plans to place the Portsmouth GDP on cold standby for a 5-year period. This will allow the GDP to be restarted in the event of a significant disruption in the nation's supply of enriched uranium. Both of these actions are considered essential to long-term U.S. energy security. They will preserve skills necessary to provide the United States with a new enrichment technology to compete competitively in the market well into the 21st century.

The Department continues to review proposals related to the long-term viability of the domestic uranium mining and conversion industries. We have worked with Congress and industry to analyze all options to help ensure the viability of these vital industries.

Resolution of the natural uranium feed issue associated with the HEU Agreement is expected to have a positive impact on the market. First, DOE's purchase of the natural uranium component from the 1995–1998 deliveries under the HEU Agreement and DOE's agreement to stockpile 58 million pounds of uranium for 10 years are expected to help the market.

Based upon the Department's review of the uranium and conversion industries as well as the input received from Congress and industry, the following recommendations are forwarded by the Department:

- Section 3112 of the USEC Privatizaion Act be amended to avoid the requirement for the near- term sale of the Department's remaining inventories associated with the 1995 and 1996 natural uranium component of the HEU Agreement deliveries. This action would eliminate the need to place approximately 9.8 million pounds of natural UF_6 into an already depressed market by April 2003. This action would be consistent with actions already taken by Congress and the Administration to remove 58 million pounds from the market over the next ten years.

- Consistent with the legislative objectives to ensure reliable and competitive domestic mining, conversion and enrichment industries, consider promptly limited financial assistance to ConverDyn. This assistance, which would be capped in annual amount and in length of time over which it is provided, would be derived through an assessment of actual costs versus prices received from existing and new contracted sales. The payment provisions of this initiative would help ensure the maintenance of the only U.S. supplier of conversion services and incentivize new production and sales.

- Establish a cooperative effort between DOE and the uranium industry to identify, test and develop low-cost environmental restoration technology for uranium mining and cleanup activities. Funding for this effort will be determined through congressional appropriations.

- Recognizing the vital importance of the nuclear fuel cycle to U.S. energy security, the Department establish the Office of Nuclear Fuel Cycle Security with the following goals and objectives:

  - Provide leadership and expertise on nuclear fuel cycle policy; including expert analysis and advice on uranium, conversion and enrichment markets; sales; asset management; and security of domestic supply.

  - Manage enrichment technology activities for commercial and government purposes, including those related to the advanced gas centrifuge demonstration program.

  - Manage activities required to place the Portsmouth GDP in a cold standby condition.

  - Continue to work with Congress and industry to reach conclusion on the ability to provide the near-term assistance required by the domestic uranium and conversion industries.

Mr. STRICKLAND. Thank you, Mr. Chairman.

And thank you, my colleague.

Mr. BARTON. Mr. Shimkus?

Mr. SHIMKUS. Thank you.

Let me—Mr. Sproat, and others may comment on it, you identified a concern of mine that refers to, in essence, a brain drain out of the NRC, especially with new technology that may come online, especially with, as I mentioned to the previous panel, the relicensing aspects of a lot of plants in the future. Can you just reiterate that? And then I will let any of the other panelists talk about that.

Mr. SPROAT. One of the things that we are—as we are looking at the various issues we will face with trying to license the Pebble Bed Modular Reactor—and just for the record we will have a containment. The design requirements may be different, but there would be a containment building.

It is very clear that the gas reactor expertise that existed in the national labs and the NRC back in the 1960's and 1970's and early 1980's has pretty much dissipated. And as a result, we are facing the possibility of coming into the government with an application for this technology, if we decide to do that, where they will be really technically deficient in being able to review that technology.

And the NRC management recognizes this. In our discussions with them, they believe they need to get their staffs educated. And one of the things we are discussing with both the Department of Energy and the NRC is to have an independent third-party such as MIT or some other university develop the appropriate courses to give to the various government employees to get them educated in the technology, so that they could learn more about it prior to the actual licensing effort starting.

Mr. SHIMKUS. Would anyone else want to add if they have a concern on the NRC? Mr. Tollison?

Mr. TOLLISON. The concern about the demographics of the NRC staff that Mr. Travers introduced is shared somewhat by the industry. In other words, the average age of the nuclear professionals in the industry is in the high forties, so over the next several years a lot of people will be—a lot of very qualified people will be coming into the retirement age zone.

And so there are several initiatives underway to revitalize the pipeline of new people coming into the industry to operate the existing fleet until the end of life, and that end of life, as you have heard today, in many plants will extend an additional 20 years. In fact, as we speak, there is a workshop going on in Florida right now that includes the universities and the utilities and the public relations people to discuss the best strategy and approaches for revitalizing the pipeline.

And the NRC, in part, will be the beneficiary of that, because that would create a supply of young graduates who are—who have an education that would support regulating and licensing current plants and future plants.

Mr. SHIMKUS. Thank you.

Let me go to Ms. Aurilio. On your submitted testimony, on page 5, you have a quotation attributed to the Federal Trade Commission that says, "NEI's advertising campaign touting nuclear power

as environmentally clean was without substantiation." Could you give me a source for that?

Ms. AURILIO. Yes. I will have to get it to you in writing.

Mr. SHIMKUS. Because as far as we understand, the Federal Trade Commission has made no such statement. So if you could substantiate that, we would appreciate it, just for clarification.

The other thing, in the testimony you—actually, in the submitted testimony, you mentioned specific standards that are not—that will not be met at Yucca Mountain. What are those standards?

Ms. AURILIO. What I talked about in my testimony, what you might be referring to, is that we are concerned that the Nuclear Regulatory Commission is trying to take control over setting the standards, which Congress gave EPA. Is that what you are referring to?

Mr. SHIMKUS. But you are not referring to any specific standards that are set right now that science makes determinations that you believe Yucca is not going to be able to make——

Ms. AURILIO. There are Department of Energy guidelines as to the suitability of Yucca Mountain. In 1998, PIRG and many other groups petitioned Department of Energy to withdraw Yucca Mountain as a nuclear waste dump site, because we felt it would not meet the current guidelines. But the most——

Mr. SHIMKUS. And what are the current guidelines?

Ms. AURILIO. The guideline of most concern—I don't have the cite off the top of my head, but the guideline of most concern would be that there would not be significant radioactive waste migration along the paths of most likely leakage from the mountain. And we felt that given the existing data that we had at that time that the mountain would not meet that criteria.

Mr. SHIMKUS. And I would respectfully submit that we don't know any of that right now. And the issue is, if you want to establish some standards which are going to require—or you want the DOE or the NRC or the EPA to meet, we ought to know what those standards are.

Ms. AURILIO. But DOE had some standards at the time, and their now revising it downward is the problem. And it said there should be no significant——

Mr. SHIMKUS. So you would accept the previous standards.

Ms. AURILIO. There is different stages of the——

Mr. SHIMKUS. What standards would you accept? I guess that is the question.

Ms. AURILIO. There is different stages of the process. What we said in 1998 was, given the science that currently existed—for example, there was new evidence to indicate that plutonium, which is relatively insoluble, could actually migrate pretty quickly offsite because it could attach itself to other particles. So that would be of concern.

There was enough information, given new scientific data, that there could be considerable migration off the site of radioactive waste. That did not meet DOE's current guidelines.

In terms of what we would want to see out of a final repository for nuclear waste—and, again, our premise is there is no sound solution yet that has been found. We would want the waste to be iso-

lated for human beings and the environment for the hazardous lifetime of the waste.

Mr. SHIMKUS. I think we will be very pleased with Yucca Mountain and its meeting not just NRC standards but whatever comes out as far as the EPA standards. Having visited there yesterday, I am very supportive.

And I would just ask a final question, Mr. Chairman, if I may.

Mr. BARTON. You have got as much time as you——

Mr. SHIMKUS. In the issue of doesn't Yucca Mountain—back to the industry folks. Doesn't Yucca Mountain also present a possible asset for us in the future? If we have high-level nuclear waste stored, and we don't have the ability, it is not economically feasible at this time to reprocess that.

But could you not make an argument that there is an asset there stored and buried that at times can be pulled out and reprocessed once the ability to reprocess becomes economically feasible?

Mr. SPROAT. If I could, I will try and answer that. Absolutely that is the case. I think one of the fallacies in the discussions on Yucca Mountain so far is the broad assumption that we are going to put it in the ground and it is gone forever. Clearly——

Mr. SHIMKUS. And Senator Domenici mentioned that, and I was surprised that he said just close it up. And I don't expect it to be closed——

Mr. SPROAT. Well, that is the current game plan that DOE is offering. However, I think the reality is is that nobody can say with certainly exactly how the repository will perform over 10,000 years.

But you can certainly start to put waste in that repository and leave it in a retrievable form and see how the repository operates over the next 50 years, 100 years, 150 years, and gain much greater certainty about what the long-term performance of the repository will be before you close off that option of making it—of closing off the repository and not making that fuel retrievable for whatever purpose; say, if the repository is not operating in the correct way, or you wanted to take that fuel out and start reprocessing it for economic reasons.

Mr. SHIMKUS. Thank you, Mr. Chairman. I will yield back my time.

Mr. BARTON. Thank you.

Mr. Strickland, did you have one final question or any comment?

Mr. STRICKLAND. No, thank you, Mr. Chairman.

Mr. BARTON. Okay. I have just a few wrap-up questions. Mr. Sproat, at what time do you expect the developer of the Pebble Bed Reactor to bring forward an application for certification to the NRC?

Mr. SPROAT. The current project schedule is that the partners will make their decision by the end of this year as to whether or not——

Mr. BARTON. "The partners" being?

Mr. SPROAT. Being Exelon, BNFL, SCOM in South Africa, and IDC in South Africa. We will make our decision about whether to proceed with the final design and the construction of the demonstration plant in South Africa. We will make that decision by the end of the year.

The government of South Africa also needs to make a decision about approving the construction of that demonstration reactor, and we expect that to occur first quarter of 2002. Once that decision is made, at that point in time, then, we would intend to begin the preparation of a combined construction operating license application for a set of PBMRs in this country—not one, but a string of several, number yet to be determined, and location yet to be determined.

And we would expect to submit that application for the combined construction operating license probably in the second half of 2003, and we would probably precede that with an early site permitting application for a site or several sites sometime in late 2002.

Mr. BARTON. And the site or several sites, would they likely be sites of existing nuclear power plants?

Mr. SPROAT. They would most likely be sites of existing nuclear power plants because the site—we already have a site characterized. The transmission capability to get the power out would already be there.

Mr. BARTON. Okay. Now, the other three witnesses that are supportive of the nuclear option, is it your general agreement that the next generation of nuclear reactors, if any, that are ordered are going to be of the smaller variety as opposed to the large, 500 or larger megawatt variety that are currently certified?

Mr. HUTCHINSON. I don't think I would necessarily agree with that.

Mr. BARTON. You wouldn't agree with that.

Mr. HUTCHINSON. No. I think you could see—there is a possibility you could see an existing design that is already approved on the shelf, built——

Mr. BARTON. And some of those are being built overseas.

Mr. HUTCHINSON. Right.

Mr. BARTON. And are in operation, so you would have some certainty in operation.

Mr. HUTCHINSON. Built in Japan—right, and in Korea, in some of those places. It will be driven by what the industry can finally get comfortable with it, the time to market question, and construction costs. And I think given that those have times and costs that compete with combined cycle gas turbines, whatever that turns out to be, that you—then, that is where you will see——

Mr. BARTON. Okay. Mr. Tollison?

Mr. TOLLISON. Our focus at INPO is on the safety and reliability of the existing fleet, and my only comment on your question would be I think the success of the demonstration reactor down in Cape Town would be a big factor in how we eventually go——

Mr. BARTON. Okay.

Mr. TOLLISON. [continuing] as an industry.

Mr. BARTON. Mr. Longenecker?

Mr. LONGENECKER. Mr. Chairman, I would say that the size of the reactor that is going to be ordered is highly dependent on the company that is building it, what their supply mix is. All of the arguments about small being, you know, modular, simple, cheap, and you can add to it, is true. When you build a large one, you do have the concern when it is out of service you have lost a large chunk of your capacity.

But for companies that have a very substantial generating capacity where this does not represent a significant portion of it, the large plants like the Japanese are looking at, economy of scale is still true. And I think probably you will see a mix of them depending, again, on the company that is ordering them and their specific needs and reliability concerns.

Mr. BARTON. Okay. My final question, I am going to go back to the gentlelady from PIRG. Let us assume that I totally agree with you, that I have just been blown away, I understand the logic, I have had a Damascus Road experience, and I am totally a true believer now, that you have so impressed me—and your group—that I just can't wait to help you. Okay? Now that is a big assumption, but let us assume that.

You said something to Mr. Shimkus that kind of set me back. You know, let us say that next week I put in a bill to close down all of the existing nuclear reactors. In a time-certain, we are going to pay off the stranded costs, we are going to figure out a way to build windmills and import power from Canada and take up the slack for the existing plants.

You still have all this high-level waste scattered out all over the country. And I come to your group and I say, "Solve that problem. I will guarantee you no future problem." I am a true believer now, you know, but help me solve the existing waste problem. What is your solution?

Ms. AURILIO. Well, I wish I had a solution, and I wish that the industry had had a solution before they built the reactors. In fact, some of the earlier scientists who developed nuclear energy, like Enrico Fermi and Robert Oppenheimer, even said, "Don't build these commercial plants until you have solve the waste problem."

Mr. BARTON. No, but that cat is out of the bag.

Ms. AURILIO. I agree. I agree.

Mr. BARTON. Cloning has occurred. Okay? We can't debate whether there should be cloning. It has occurred.

Ms. AURILIO. Yes.

Mr. BARTON. So what do we do to solve the——

Ms. AURILIO. And I think the scenario that you set up in terms of phasing out these plants as quickly as possible is something that gives the public a good starting point.

Mr. BARTON. You are still not answering my question. You are too smart. You know, I am going——

Ms. AURILIO. I am giving you a starting point.

Mr. BARTON. No, no. I want a—you don't have to give it to me today, obviously. But it is not valid to just say there is no solution. Okay?

Ms. AURILIO. I can tell you about a process that we could use to come to a solution.

Mr. BARTON. Man made the problem; man can solve the problem. Now you can have it spread out in 102 locations or 50 locations or one location or somewhere in between. You can put in an interim basis, a permanent basis, you can reprocess it, you can shoot it to the moon, you can put it under the ocean. But you can't just say there is no solution. That is not viable. This Congress can't just throw up its hands and say, "The PIRG says there is no solution. So we are not even going to worry about it."

Ms. AURILIO. So our solution is to minimize the amount of waste that ultimately has to be dealt with, which is your starting point, and then starting out with a fair and honest process, which I don't believe the history of nuclear waste policymaking in this country has been, and involving the public at every step of the way to make a decision, because this is some of the most dangerous material we have ever created.

I don't think any country in the world has a permanent solution to this problem, and the solutions that we have seen coming out of the industry rely on changing the goalposts every time the science shows us.

Mr. BARTON. Yes. You are a very good testifier. Okay? You are very good at not answering the question and getting your political commentary on the record. And, again, that is acceptable. But we can't be for no solution. Mr. Boucher and Mr. Waxman, Mr. Markey, right on down the road, on the Democrat side, can't be for no solution, nor can myself and Mr. Largent, Mr. Pickering, Mr. Burr, Mr. Norwood, all the way down to Mr. Radanovich and Ms. Bono. We can't be for no solution. Okay? We can't study it for another 20 years.

Ms. AURILIO. Why not?

Mr. BARTON. Because it is there.

Ms. AURILIO. It is there, and it is going to stay there, and they are going to generate more of it.

Mr. BARTON. We have the technology. So your solution is just to study it for 20 more years.

Ms. AURILIO. My solution is to make sure that we protect the public and the environment and future generations, and the things that I have seen coming out of the industry so far don't do that. They change the goalposts every time that science shows them it is not going to contain the waste.

Mr. BARTON. Well, you know, it is a funny thing but in a different era, a different issue, you know, when we find bad actors or we find something that is a potential problem, we don't leave it spread out. We put it together.

There is a jail in Ellis County, in Waksahatchee, all the bad guys and girls in Ellis County go to that jail. If they are really bad guys, they go to Huntsville. And if it is a Federal problem and they are really, really bad guys, they go to a Federal—we concentrate where we can control it, watch it, monitor it, do all of the good things that your group supports.

There is no other issue that I am aware of in this country where the solution is, a) not to do anything, or b) leave it spread out. I don't want a convicted felon in my backyard in a bird cage. I want it in Ellis County or Huntsville or the Federal penitentiary.

Now, you can be against Yucca Mountain. You can be against the process. That is totally acceptable. But at some point in time, to be responsible—and I am not just talking to you. I am talking to the whole group that you represent—needs to come forward with some solution.

And the likelihood is—I wasn't here for Senator Domenici. I didn't get to hear his testimony. But the likelihood is we are going to put a high-level nuclear waste bill on the President's desk some-

time in this calendar year. So if your group has got potential solutions, come forward.

And, you know, I think on a bipartisan basis we are going to be very open to all of the potential safeguards and transportation issues and local impact issues, and all of that. But just to say, "Don't do anything," you know, that dog won't hunt anymore. It is pretty well gone.

Ms. AURILIO. I don't think that is what I was saying. I was saying minimize the amount of the waste and then come up with a fair and public process, which so far has not existed, for making the decision.

Mr. BARTON. Okay. That is fair enough.

I want to thank the panel. The Chair would ask unanimous consent that the statement of the Uranium Producers of America on this issue be made a part of the official record. Is there objection? Hearing none, so ordered.

Gentlemen and lady, we want to thank you. We may have questions for the record. We would ask that you put them back in. We do plan to move legislation in the very—in this Congress on this issue.

This hearing is adjourned.

[Whereupon, at 4:28 p.m., the subcommittee was adjourned.]

[Additional material submitted for the record follows:]

RESPONSES FOR THE RECORD OF EDWARD F. SPROAT III, VICE PRESIDENT OF INTERNATIONAL PROGRAMS, EXELON CORPORATION

Question 1. Do you believe it is important for the nuclear utility industry to have a domestic source of uranium enrichment services? If not, why not? What about conversion services?

Response. One of the primary advantages of nuclear fuel has been the presence of a reliable and competitive nuclear fuel market. If nuclear power is to continue to be competitive with other electric generation technologies, nuclear fuel supply—both enrichment and conversion—must remain both reliable and competitive.

Clearly, a domestic source of enrichment services can furnish a high degree of reliability. At the same time, reliability is not merely dependent upon the geographic location of the enrichment service provider. Enrichment companies must also be financially viable and able to provide assurances of their long-term viability. Today, the market for enrichment services is truly global in nature, and many foreign suppliers of enrichment services have proven to be highly reliable.

It is equally important for the nuclear industry to have a fair and competitive source of supply for enrichment services. Effective risk management dictates that nuclear plant operators diversify their sources of fuel supplies, particularly in the face of increasing competition and consolidation. Regardless of the price, no company will want to rely on a single source to meet 100 percent of their fuel enrichment needs.

In our view, as long as the nuclear fuel markets are reliable and competitive, a domestic enrichment capability—while perhaps preferable—is not essential. As the nuclear industry seeks to compete in an increasingly deregulated and competitive electric industry, it is difficult to justify subsidizing enrichment service providers using inefficient and obsolete technology merely because they are located in the United States. We believe as a matter of policy that the interests of consumers would be better served if USEC were subject to the rigors of a competitive market for enrichment services rather than given continued protection as a monopoly service provider.

Question 2. In the past there has been a glut in nuclear fuel available to the US, but that appears to be changing rapidly, with US dependence on a single plant providing less than half of US requirements, and the remaining supply coming from Russia. Does the nuclear utility industry have any concerns about the reliability of nuclear fuel supplies in the future in view of the fact that there have been 5 interruptions in shipments of nuclear fuel from Russia in the past 5 years?

Response. We do have concerns about the wisdom of depending on a limited number of suppliers for an essential service. While the disruptions in Russian supply to date have had little actual impact, it is not clear what impact future disruptions might have following the closure of USEC's Portsmouth facility. If Cogema and Urenco were forced from the US market as a result of USEC's trade actions, the consequences of any disruption in either Russian or USEC supply would be magnified.

Question 3. What are your views on the anti-dumping case brought by USEC? How do you reconcile USEC efforts to raise SWU prices with the need to make the Paducah plant viable as a domestic source of enrichment services? Wouldn't a domestic enrichment plant be consistent with the view that we need a domestic supply?

Response. USEC has brought antidumping and countervailing duty actions against enrichment service providers in Europe, which now supply about 20 percent of the U.S. market. The purpose of the antidumping and countervailing duty laws is to counteract sales of dumped or subsidized goods, not services. Though enrichment suppliers such as USEC and the European enrichers contract with the utilities for the service of enriching uranium owned by the utilities, USEC is asking the Commerce Department and the International Trade Commission to treat the enrichment services contracts as contracts for the sale of low-enriched uranium (LEU). However, as described in a letter submitted to the Commerce Department by the Ad Hoc Utilities Group, the trade laws do not cover sales of services, such as uranium enrichment contracts. The imposition of punitive duties on sales of services would be both contrary to U. S. law and internationally unprecedented.

Contrary to USEC's recent claims, the imposition of duties has the potential to significantly impact ratepayers and the future competitiveness of nuclear power. USEC is seeking duties of 39 to 73 percent. Since the value of LEU used by utilities is $1.7 billion per year (on the basis of current market prices), the resulting increase in utility fuel costs ranges from $650 million to $1.2 billion annually.

USEC attempts to minimize the potential impact of its trade action by understating the relative cost of enrichment. With NEI's definition of production costs as a basis, fuel represents roughly one third of production costs and enrichment represents roughly one half of fuel cost, so enrichment actually represents roughly 17 percent of nuclear production costs---not 10 percent as claimed by USEC. But even this analysis understates the potential impact of USEC's trade action, because U.S. Customs assesses duties on the value of imported products—in this case LEU. Given that LEU represents roughly 80 percent of the total value of nuclear fuel, roughly 27 percent of nuclear production costs are subject to higher costs from duties.

Through its trade actions, USEC seeks to impose prohibitive duties on its only competition in the U.S. market. If USEC is successful, proven and reliable suppliers may be effectively excluded from participating in the U.S. market, thereby eliminating vital competition in the supply of this critical service, on which the nuclear generators depend.

USEC's efforts to raise SWU prices are necessary only from their own perspective. In Exelon's view, as long as the nuclear fuel markets are reliable and competitive, a domestic enrichment capability—while perhaps preferable—is not essential.

Question 4. While I know your industry benefits from low SWU prices in the short-term, has the industry reached a consensus on what you would do if we lose all domestic supply and Russian shipments were interrupted for a protracted period of time?

Response. Exelon cannot speak for the nuclear utility industry, but we are not aware of any such consensus. We believe that simultaneous loss of domestic supply and interruption of Russian shipments is an unlikely scenario. In this extremely unlikely case, it is probable that certain actions would be taken by the U. S. government to assure that there was an adequate supply of enrichment services beyond that available from other foreign suppliers. Many of the contracts currently held by USEC are backed by US government performance guarantees that were extended by the USEC privatization act. Government Actions could include allowing Russia to sell low enriched uranium directly into the U.S. market by modifying the Suspension Agreement currently in place, restarting the Portsmouth GDP under DOE control, or both.

Question 5. In a matter of a few months, the restrictions on the ownership of USEC stock will permit investors to hold more than 10% of its stock. There has been some concern that efforts to maximize share price could result in the liquidation of USEC's assets. Could you explain what provisions the nuclear utility industry has in place to assure deliveries of nuclear fuel in such a circumstance if the Paducah plant were also closed as part of such liquidation?

Response. Maximization of USEC's share price is not likely to lead to liquidation of the company. Liquidation is likely if the share price or market valuation is less than the value of USEC's inventories.

Exelon cannot speak for the nuclear utility industry. Although an entity in control of USEC could make the decision to cease operating the Paducah facility, there are still contracts with USEC that require fulfillment. If the contracts were not abided by, the new entity would face protracted legal actions from the customers.

In the event that the Paducah plant were closed and USEC ceased to function as an entity, it is possible that the U. S. government could take over operation of the facility until an alternative could be established to provide for enrichment demand no met by supplies available from foreign suppliers.

Question 6. Are utilities such as yours considering the deployment of advanced uranium enrichment technologies?

Response. Exelon is considering many alternatives with respect to its nuclear fuel supply.

DOE recently communicated to Congress that the United States needs an advanced enrichment technology development program to sustain its uranium enrichment industry in the long-term. While research on several domestic technology initiatives is ongoing, it is unlikely that these research initiatives will result in the commercialization of an advanced technology prior to the retirement of USEC's remaining gaseous diffusion plant. The best means of assuring an uninterrupted transition to a competitive domestic source of enrichment is through the construction of a new plant by the private sector using existing centrifuge technology. The United States should encourage private sector initiatives in this regard.

Question 7. Do utilities such as yourselves believe that USEC should remain as the exclusive executive agent for the brokering of the blended down highly enriched uranium from Russia. If not, what role to you see for nuclear power plant operators such as your company?

Response. No. Exelon does not believe that USEC should remain as the exclusive executive agent for brokering the blended down Russian HEU. Exelon believes that an alternate executive agent or agents would provide competition that would be beneficial to the U.S. market as well as Russia.

USEC has suggested that the appointment of additional executive agents for Russian HEU would cause USEC to shut down its remaining domestic production facility. However, we believe that the appointment of additional executive agents would forestall the retirement of USEC's remaining production facility, not accelerate it.

Given that USEC's sales have been relatively constant, use of the Russian HEU material has directly displaced domestic production. Effective risk management dictates that utilities diversify their sources of fuel supplies, particularly in the face of increasing competition and consolidation. For this reason alone, it is unrealistic for USEC to expect to maintain greater than 70 percent of the U.S. enrichment market. Given the increasing pressures on utilities to manage risks, USEC's continuation as the sole executive agent at a time when the volume of its sales may be dropping due to utility diversification can only have the effect of reducing domestic output. Additional executive agents would reduce USEC's access to Russian supplies and prompt USEC to increase its domestic output.

More importantly, the deeply discounted prices USEC is seeking in its recently proposed HEU Agreement amendment threaten to introduce greater revenue uncertainties for the Russians. The most critical element to the HEU Agreement's future stability is the revenue received by Russia. Russia must be paid fair prices, which can best be assured through the bidding of multiple executive agents. This would also ensure that an alternative exists in the event one agent is unable to perform for financial or other reasons. Given the importance of this supply to U.S. nuclear generators and their customers, it is essential that immediate steps be taken to ensure its future reliability.

Question 8. If the utilities served as an executive agent for the Russian HEU deal as a way to reduce their fuel costs by eliminating USEC as a middleman, would you be willing to direct those savings into maintaining operations at Paducah until new technology was deployed?

Response. As the nuclear generators seek to compete in an increasingly deregulated and competitive electric industry, it is difficult to justify subsidizing a particular enrichment service provider merely because it is located in the United States. It is also not clear to us that operations at Paducah require a subsidy.

Question 9. I know you disagree with the Energy Information Agency's view that construction of new nuclear power plants in the U.S. for the foreseeable future is unlikely. What would it cost to build a nuclear power plant using the best and proven technology available today?

Response. Current "extensions" of Light Water reactor plants (AP600, AP100, ABWR, etc.) are estimated to cost between 3.5 and 5.1 cents/kWh to build and operate. These estimates may be optimistic, as no one has licensed or built such a plant and we expect that the licensing and construction of these plants will take between six and eight years each.

For reasons outlined in my written testimony, Exelon believes that a small, modular reactor such as the Pebble Bed Modular Reactor (PBMR) is best suited for operation in a deregulated marketplace. Preliminary studies estimate that the PBMR could be built and operated for a total cost of 3.2 to 3.8 cents/kWh and constructed in less than 24 months once the design has been certified by the Nuclear Regulatory Commission.

RESPONSES FOR THE RECORD OF JOHN R. LONGENECKER, LONGENECKER & ASSOCIATES, INC., MANAGEMENT CONSULTANTS

Question 1. How much SWU does the US use each year, and how much of this is imported from Russia at present?

Response. In the year 2000, US nuclear power plants consumed 10.4 million SWU. Of this total demand, about 53% was supplied by Russian HEU blending.

Question 2. If we all agree that it is in our best interest to dismantle Russia's nuclear arsenal and bring in 5.5 million SWU per year from that source, do you believe the federal government should subsidize that arrangement in the interest of national security?

Response. No. I believe that the objectives of the US-Russian HEU agreement can be achieved without subsidy by the US government. Under the current Russian HEU contract, USEC realizes trading profits of about $100 million per year. As the agreement is renegotiated to provide for future deliveries, market-based arrangements with multiple executive agents could provide continuity of supply without subsidy. Since the HEU deal is a government-to-government agreement, I believe that the most significant US government role is to facilitate the smooth continuation of the contract to whatever extent that it can.

Question 3. In your opinion, how long can USEC operate the Paducah plant and still turn a profit based on their existing and anticipated contracts with the nuclear utilities?

Response. The answer to your question depends on the average price of SWU in the market. Today USEC is the high cost producer in the world market based on its failure to follow through on its earlier commitments to deploy new lower cost enrichment capacity. In the future, the production costs at Paducah are likely to exceed the cost of buying Russian SWU, and the costs of any of the other primary enrichment producers. Realizing this, USEC is attempting to increase prices to US customers by its trade action against European suppliers of enrichment services.

A better alternative is for the US to build new, cost competitive domestic enrichment capacity as soon as possible. The high costs of production from the Paducah GDP, and its economic obsolescence should stimulate a market response to build cost competitive capacity either in the US or abroad. I strongly support building new enrichment capacity in the US, but realize that regulatory and other conditions would have to be conducive for this to occur.

While new enrichment capacity is being constructed, I assume that the US will continue to need production from Paducah due to limits on Russian imports, and the limited supply capability in Europe.

Question 4. Since the Russians have interrupted SWU deliveries on five occasions in the last five years, can we consider the Russian SWU a reliable source?

Response. Reliability is certainly a major issue in nuclear fuel supply. Although there are concerns regarding future changes in Russian policy, infrastructure failures and the like, overall, I believe that the Russian supply of blended HEU will continue to be reliable. The US currently is dependent on Russian SWU, but the Russians also depend strongly on the funds provided by the US for those SWU.

However, future short-term disruptions are possible, and I believe that the key is for the US to factor potential problems into negotiations on the Russian HEU deal, and also to find a way to bridge any short-term disruptions.

Question 5. Do you agree with the DOE assessments that although the Russian HEU agreement is a very important proliferation agreement, it should not be considered a secure source of energy supply for our nation's nuclear power plants due to a number of unresolved issues in the Agreement's implementation? What contingencies should be in place to provide enrichment services domestically, and does the government have a role in paying for a portion of this energy security as part of

enabling the non-proliferation benefits of selling the imported uranium supplied under the HEU Agreement with Russia?

Response. Reliability of supply issues exist, and the first priority of the US government should be to stabilize the Russian HEU agreement. One way of doing so would be to name a second executive agent. This can be done at no cost to the government. Having multiple executive agents would offer greater assurance of continuity of deliveries by providing greater financial incentives to the Russians through competition.

The trading profits from selling Russian HEU to utilities are derived from an exclusive franchise granted by the US government. Congress should examine whether this exclusive franchise should continue to reside with USEC, and what benefit the country will derive from the billion dollars in trading profits that the executive agent is likely to realize over the next decade.

USEC appears to have enough inventories to bridge a supply disruption of at least 6 months. However, additional US government actions could also be taken, although they would require government funding. For example, DOE could make its surplus US HEU inventories available for blending in the event of a Russian supply disruption. Plans could be put in place that would allow the blending of HEU in US based facilities to begin with a short lead-time.

Another alternative, although quite expensive, is for DOE to create a strategic stockpile of enriched uranium. This could be done by accelerating the rate of Russian HEU blending, down blending US HEU, or by operating the Portsmouth GDP for some period of time after June 2001. If such a stockpile is created, DOE should agree to keep the material off the market, and only make it available in case of disruption.

Question 6. Do you believe is it important to have a domestic source of enrichment services?

Response. Yes, this is vitally important to our national energy security. The US government should act to assure that it facilitates and does not inhibit private sector efforts to construct new cost competitive enrichment capacity in the US as soon as possible. I believe that this can be done by the private sector in 5 to 6 years. The private sector should pick the technology to be deployed, and in the near term this likely would involve non-US technology.

Continued development of US technology by DOE, possibly for long-term deployment, may be justified. However, the near term priority must be on constructing new enrichment capacity to replace the economically obsolete US GDP capacity.

Question 7. The GAO in a December 2000 report questioned the benefits of proceeding forward with the proposal to import an additional 1 million SWU of enriched uranium from Russia that is produced in their commercial uranium enrichment plants. in addition to the 5.5 million SWU per year brought in under the non-proliferation agreement. What happens to the economics of the Paducah plant if Russian commercial SWU is brought into the US and production is cut, say from 5 to 4 million SWU/year?

Response. In round numbers, assuming the availability of low cost power for production at Paducah of 5 million SWU per year, unit costs of production, excluding R&D, administrative, dividends and interest costs, would be about $95/SWU. If production at Paducah were 4 million SWU per year, unit costs of production would increase to about $105/SWU. Allocating USEC's R&D, administrative, dividend and interest costs to arrive at a breakeven price adds roughly another $15 to these numbers. As I stated before, USEC's production costs are above those of any of the major primary enrichment suppliers, and this points out the need for new, low cost enrichment capacity in the US.

Since the US likely will require the operation of the Paducah plant to meet domestic fuel needs, absent a decision to lift restrictions on the commercial sale of Russian SWU in the US, our country needs new competitive enrichment capacity as soon as possible. This should be the main US priority.

Question 8. Do you believe that USEC has a viable business model to sustain it for the long run as a domestic nuclear fuel producer? If not, what should be done to assure that there will be a domestic uranium enrichment industry over the next 3-5 years? What steps should Congress take to encourage this, if any?

Response. In my opinion, USEC does not have a viable business strategy to sustain it for the long term. USEC is increasingly becoming a trader of blended Russian HEU. In fact, it realizes trading profits of approximately $100 million per year from this Executive Agency, and will meet about 75% of its 2001 deliveries to US utilities using Russian SWU.

Since USEC lacks a proven low cost enrichment technology, its future strategy appears to rely mainly on obtaining import restrictions on its European competitors to obtain an effective monopoly position in the US market, and on generating trad-

ing profits from the brokering of Russian HEU. To assure that there is a viable US industry in the future, I would suggest that Congress provide support, as needed to private sector plans as they evolve to build new uranium enrichment capacity in this country.

Question 9. Won't the trade action by USEC extend the life of the domestic industry for a few more years, if successful?

Response. The United States needs a reliable, diverse, economic supply of enrichment services to sustain a competitive nuclear power option and to ensure future energy security. USEC's initiatives including its antidumping action against European enrichment suppliers, work against these objectives and are creating significant uncertainties and unnecessary financial costs for nuclear operators and customers

Today, although USEC supplies almost 70% of the US market, it seeks import duties of up to 73% on its lower cost European competitors, price reductions for Russian supplied SWU from HEU, and increased Russian SWU imports as a means of survival.

If USEC won its trade case, it would effectively be granted a monopoly on the US enrichment market, and could raise prices by the maximum allowed by the duties imposed on European enrichers. It is clear that imposition of duties would increase the cost of enrichment services from European suppliers, possibly excluding them from the US market, and would allow USEC to increase its prices to US utilities accordingly.

Even if USEC acted as a "benevolent monopolist", and did not raise prices to the maximum extent possible, US utilities would still end up paying hundreds of millions of dollars per year in higher nuclear fuel costs. Clearly, the financial impacts of such action would be significant both to US electricity customers and to the US economy as a whole. Furthermore, these hundreds of millions of dollars would accrue solely to USEC and its shareholders, providing USEC a financial windfall from successful litigation rather than from efficient, competitive operations.

In addition, there is no certainty that USEC would use its windfall from the trade sanctions to construct new enrichment capacity in the US. Specifically, USEC has no proven advanced technology, and its credit rating has been downgraded to junk bond status, making it unlikely that it could obtain financing to deploy any new enrichment technology that it might acquire. The stark reality is that under USEC's plan, US utilities and electricity customers could pay USEC billions in increased fuel costs over the next decade and still have just one 60-year-old GDP operating in this country.

In summary, unfounded trade sanctions on foreign uranium enrichment services suppliers will not assure a sustainable uranium enrichment industry in the United States. Trade sanctions would be bad for our nation's economy, and may serve as a distraction from the critical task of building new competitive US enrichment capacity. Rather than pursuing trade actions, the US should be focusing on implementing a credible plan for building new, low cost enrichment capacity in the US so that we can compete in global markets.