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What the National Energy Strategy Means for the Nuclear Power Industry

**Remarks of
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before the

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It is a great pleasure to be here to take part in this conference. Thank you for inviting me.

My aim today is to talk about the national energy strategy and its implications for the nuclear power industry and for nuclear safety. However, recent events have brought a particular focus on questions of physical security. So let me say just a few words about a topic that has dominated our attention in recent weeks -- the defense of nuclear facilities from a terrorist assault. Those of you who live and work in New York City no doubt have a particular interest in the NRC's response to the cruel attacks of September 11.

I. Physical Security at Nuclear Power Plants

In the aftermath of the attacks, many immediately asked about the consequences if a large airliner, fully loaded with jet fuel, had crashed into a nuclear power plant. We had to say candidly that we were not sure. We know that reactor containments are extremely robust, that nuclear plants benefit from redundant safety equipment, that operators are trained to respond to unusual events, and that carefully designed emergency plans are in place. Nuclear power plants are certainly far more capable to respond to an aircraft attack than other civilian infrastructure. But the NRC had never previously had reasons to perform a detailed engineering analysis of the consequences of a deliberate attack by a large airliner. We are performing those analyses today. Certainly the various steps to improve air security

generally should serve to reduce any current risk.

Since long before September 11th, the NRC has required the operators of nuclear power plants to have in place a strong defense to other types of possible terrorist attacks. Although the details are understandably classified, this typically involves a fenced perimeter, intrusion detection devices, access barriers, heavily armed and carefully trained guard forces, and a comprehensive defensive strategy. This program is subject to comprehensive NRC regulatory requirements and detailed inspection, including periodic force-on-force exercises. Nuclear power plants have long had defensive capabilities that far exceed those of other civilian infrastructure.

Immediately after the airliner attacks, we immediately advised our licensees to go to the highest level of security. This meant increased patrols, augmented security forces and capabilities, heightened coordination with law enforcement and military authorities, and limitations on access to nuclear sites. Although we are not aware at this time of a specific credible threat directed at nuclear power plants, our licensees have remained at the highest security level. And the NRC has continued to undertake audits of power plant defenses and to provide guidance and information so as to enable our licensees to strengthen their defensive capacities.

To improve our preparedness, the NRC has also worked closely with the new Office of Homeland Security, the Federal Bureau of Investigation, the Federal Emergency Management Agency, the military, the Department of Energy, and nuclear regulators in Mexico and Canada. A notice to airmen has been issued by the Federal Aviation Administration that has advised pilots to avoid flying over or in the vicinity of the nuclear plants. And I have written the governors of 40 states so as to assure that any state defensive assets (National Guard or state police) are properly integrated into our licensees' defensive strategies.

The attack of September 11 has served as a wakeup call in our country of the seriousness of the terrorism threat and of the need to develop policies to address it. As a result, I have directed the NRC staff to commence a top-to-bottom review of our safeguards and security requirements and policies. This will include not only the regulations and guidance directed at licensees, but also an examination of the NRC's processes, communications capabilities, coordination with other agencies, and security. In short, the NRC and its licensees recognize the need for vigilance and care in the protection of nuclear facilities and we are pursuing this obligation aggressively.

II. The Role of Nuclear Power in Energy Supply

Let me now turn to the main subject of my talk -- the role of nuclear power now and in the future.

The question of where and how the United States will obtain the energy it needs, now and in decades to come, should be of concern not only to the investor community, but to every American. In the past, these issues have rarely received the attention they deserve, either from the public or the media, unless some crisis has brought them to the fore. In the news business, energy has all too often been regarded as a "MEGO" -- an acronym standing for "my eyes glaze over." In part this is understandable, as the subject does not lend itself to short sound bites or colorful visual displays.

Yet energy will play a crucial role in determining the quality of life for Americans, now and in the future. Not only is energy supply a central factor in how our economy performs, and thus how our citizens live, it also has major foreign policy implications, as we saw, for example, during the Gulf War

ten years ago.

This past year has been an exception to the general rule that energy issues receive little news coverage. This is only in part attributable to California's energy crisis early in the year. Principal credit, I believe, belongs to the development of a National Energy Policy by the Administration. As is well known, this plan has detractors as well as supporters. But even its strongest critics should be willing to acknowledge that the Administration has done the Nation a service by reminding Americans that national energy policy should be made deliberately, by conscious decision, rather than through inaction, indecision, and drift.

This year, energy is no longer a back-burner issue, and the American people and their representatives in Congress are rightly being asked to look at the problem holistically. That entails the consideration of a range of energy options, evaluating and comparing their pros and cons, rather than looking narrowly at each one in isolation from the others. This is, I believe, an extremely positive development.

Today I would like to offer you my thoughts on the implications of the National Energy Strategy for the future of nuclear power in this country. Let me preface my remarks by making clear that the Nuclear Regulatory Commission has a limited role in this debate. The Commission has the duty under the law to refrain from promoting nuclear power or any other energy option. Indeed, the whole point of the 1974 law that created the NRC was to separate nuclear regulation from nuclear promotion. That law abolished the Atomic Energy Commission, which had both promotional and regulatory responsibilities, and divided its duties between two new agencies -- ultimately, the NRC and the Department of Energy. The NRC was established to be a regulator and nothing else.

Thus it is not for the NRC to advise utilities whether to build and operate nuclear power plants. Nor is it for us to counsel utilities which currently operate nuclear plants on whether they should apply to renew their licenses. It is the NRC's responsibility to allow a nuclear power plant to be constructed and operated only if we are assured that there is adequate protection of the public health and safety. At the risk of oversimplification, our role is analogous to a highway department, which does not advise people *whether* to drive cars, but *does* makes sure that anyone who chooses to drive can do so without imposing undue risk.

The NRC does have an obligation, however, of fulfilling its regulatory responsibility without imposing *needless* burdens. Thus, in overseeing operating plants, we need to be intrusive, but only as required to achieve our statutory goals. We have to avoid the pitfalls both of under-regulation and over-regulation. Unduly lax regulation could put the public at risk (and incidentally, bring economic disaster to the utility, if not to the industry as a whole.) Unduly stringent regulation, on the other hand, would create unwarranted economic burdens without any corresponding benefit. As in most things in life, the goal is to find the appropriate balance.

With this understanding of the NRC's role as a backdrop, let me turn to a brief of where the nuclear option stands today, in the era of electrical deregulation.

III. Nuclear Power and Energy Supplies: Economic and Market Changes

Historians will probably describe the deregulation of the electric power industry as one of the great experiments in American economic history. Some would call it a calculated gamble; others might

describe it as a leap in the dark. Perhaps it is some of both. To those who believe on principle that market forces should be allowed free rein, deregulation has great appeal, and it also seems to promise lower electricity rates for consumers. What the effects will be in practice, however, no one is quite sure. Even today, not all the returns are in.

The nuclear power industry was launched, of course, in the era before deregulation, when electricity was considered a “natural monopoly,” and pricing depended on rate bases and rates of return on capital established by State public service commissions. The positive side of that approach was that utilities could plan for the long term, and make large capital investments (as for example in nuclear plants) with the assurance that they would be able to recover their costs. The downside was that utilities, with their rate of return essentially guaranteed, were not always rigorous in keeping costs under control. Indeed, part of the drive toward deregulation came from consumers’ resentment of having to pay in their electric bills for cost overruns in the construction of nuclear power plants.

When deregulation was first being discussed, there were many who assumed that nuclear power was destined to be a casualty of the new economic realities. Not only did nuclear plants have high capital costs, but they were also seen as unreliable, in the sense of having comparatively low capacity factors -- only about 70 percent on average, in the early 1990s. (A capacity factor is a measure of the actual production by a plant compared to the power it could produce if operated at full power 100 percent of the time.) The outlook seemed grim enough that many observers feared, and others hoped, that a substantial fraction of the current generation of nuclear plants would be shut down and retired even before the end of their 40-year license terms.

Today, however, it is apparent that deregulation has not meant the death knell for nuclear power. Indeed, quite the contrary. The “unbundling” of electrical generation, transmission, and distribution services has created a new type of business: an unregulated electric generating company, in which economic success depends on efficiency and the bottom line. That in turn means that the preferred generating technologies are those with low production costs and high reliability, a description that applies increasingly to nuclear power.

In part because of the spur of competition, nuclear generating companies have become “leaner and meaner”: more efficiently run, with fewer outages and greater reliability. In less than a decade, the average capacity factor has jumped from the 70 percent figure I just quoted to nearly 90 percent in the year 2000. To give you an idea of how this increased reliability translates into electrical generation, there are 103 nuclear plants operating today, seven fewer than in 1990, but total electrical generation from nuclear power has *increased* by some 35 percent in that time. That’s the rough equivalent of building 23 new nuclear plants. As a result, nuclear power has maintained about a 20 percent share of total electrical generation in a growing market without new construction.

As the electrical production of the average plant has increased, the cost per kilowatt hour of electricity generated has declined accordingly. The current average cost of nuclear-generated electricity, including all costs other than capital amortization, is about 1.7 cents per kilowatt hour. That is less than the cost of power from coal-fired plants, and, owing to increases in the price of natural gas, less expensive than power from gas-fired plants.

As a result, existing nuclear plants are perceived as good investments, and not just because of improved reliability. Many plants have largely amortized their initial capital costs, and their operating and maintenance costs tend to be reasonably low compared to other technologies. Fuel costs continue to be a small fraction of overall operating costs, and these costs have not shown the volatility often seen

in the price of fossil fuels. Moreover, nuclear power is not subject to increasingly stringent emission controls, including the possibility of controls on greenhouse gas emissions.

By all objective measures, the safety performance of nuclear plants has improved in parallel with economic performance. One such measure is the number of automatic “scrams.” A “scram” refers to the activation of the systems that shut down the reactor, usually because of equipment failure or operator error. The number of scrams have declined 70 percent since 1988 which means that safety systems are being challenged far less often. So too is the number of what the NRC calls “significant events” -- safety system failures, unanticipated plant responses, degradation of key systems or components, and operator errors. In the last 15 years, we have seen a decrease of some 99 percent in these events. The radiation dose received by nuclear plant workers is also decreasing, a sign of better, more careful operating procedures.

On reflection, it is not surprising that improved safety performance and improved economic performance should be linked to each other. Both are furthered by more attention to preventive maintenance, better training of operators, and, overall, a greater focus on fostering a safety culture, by which I mean an attitude that anticipates problems and prevents them, rather than waiting for problems to occur and then intervening. The safer the plant, of course, the less likely it is that the NRC will need to step in and shut it down. Our licensees have learned that improvements in safety and improvements in economics go hand-in-hand.

In short, we are seeing a nuclear industry that is doing its job significantly better than a decade or two ago. In part, that is the result of greater experience. In part, it is no doubt because the new competitive environment has created incentives to be progressively more competent and more efficient from one year to the next. And, in part, I hope it is because the NRC is reinforcing the industry’s self-interest in ensuring careful attention to the matters that underlie both safety and economic performance.

IV. Recent Changes in the Climate for Nuclear Power

It was against a backdrop of highly favorable indicators for nuclear power that Vice President Cheney unveiled the proposals of the National Energy Policy Development Group in May of this year. The plan includes a general recommendation that the President support the expansion of nuclear energy. Some 12,000 more megawatts of generating capacity can be obtained, the report suggests, by power uprates, using new technologies to increase output without compromising safety. The group also comments that advanced reactor technology promises to improve nuclear safety through inherent safety features.

The report’s specific recommendations include encouraging the NRC to do the following:

- relicense existing plants that meet or exceed safety standards;
- expand generation by uprating existing reactors; and
- prepare to evaluate and expedite applications for licensing new advanced technology reactors.

The call for a reevaluation of America’s energy choices could not have come at a more opportune time from the standpoint both of economics and the environment. The energy crisis in California earlier this year was a striking illustration of the dangers of being too much the grasshopper, too little the ant, in planning for energy needs. That State had assumed, unwisely as it turned out, that

the supply of cheap power would continue uninterrupted, and it found itself having to buy power at astronomical rates when its supplies ran low. At the same time, there was renewed concern, not only among those who would describe themselves as environmentalists, over the effects of burning fossil fuels: on human health, on air pollution, and on the global environment, as a result of the buildup of greenhouse gases.

From many standpoints, then, the time was ripe for a reexamination of the pros and cons of nuclear power -- not in isolation, I would emphasize, but in comparison with other alternatives.

V. NRC Initiatives: Adjusting to Change, Anticipating Demand

I would like now to describe what we at the NRC have been doing in the specific areas discussed by the Energy Plan. Let me begin with the recommendation to extend the license terms of currently operating plants.

The question for the nation's nuclear generators is this: Given the current performance level of the nation's nuclear plants, and given what is known about alternative energy sources and their costs, should they shutdown their existing plants or instead seek to exploit them further? Not surprisingly, the answer is that, far from abandoning those plants, the generators, virtually without exception, should seek to extend the original 40-year license terms. Several have already obtained 20-year license extensions; others are in the process of doing so; and applications from many other generators, possibly all of them, are expected.

Some in the public are apprehensive at the idea of license extensions, on the mistaken assumption that 40 years represents the useful life of a nuclear plant, and that any extension beyond that must be risky. In reality, the 40-year term was written into law almost half a century ago based on anti-trust and financial considerations, not plant safety. In fact, as a result of licensees' maintenance obligations, much of the active equipment in nuclear plants (for example, pumps, motors, and valves) has been replaced or refurbished many times since the start of operations. What we have done in the renewal process, beginning in the early 1990s, is to focus attention on the passive structures, systems, and components of the plants that are subject to the effects of aging. Here again, our purpose is ensuring safety. **Incidentally, the NRC set an ambitious 30-month schedule for the review of license renewal applications, and in each case, we have been able to meet or beat that timetable without sacrificing quality.**

In the area of power uprates, we have already received and approved several applications to increase the level of power generated by existing plants. From the standpoint of maximizing energy supply, this is an extremely attractive option, so long as safety margins are maintained. Licensees can justify such uprates by introducing improved instrumentation, such as more accurate flow meters, or applying more realistic analytical techniques that allow the relaxation of overly conservative assumptions used in defining operational constraints. We recently approved an application for a 15 percent uprate, and we expect others.

Perhaps the greatest challenge is the preparation for possible new construction -- in particular, for the construction of reactors of advanced designs. The current generation of nuclear plants was, almost without exception, "custom built." These facilities were licensed by a two-step process, with a mandatory hearing prior to construction, and a second hearing, on request, prior to operation. With the passage of time, it became apparent that a series of one-of-a-kind designs was inefficient and impractical both for the industry and the regulators. Moreover, the two-step licensing process, whatever

its justification might have been when nuclear power was in its infancy, had largely outlived its usefulness.

Beginning in the 1980s, the NRC began to reform this process, promoting the standardization of plants and the application of more streamlined procedures. These NRC initiatives were later written into law by Congress. Under this approach, a proposed standardized design can be approved by rule, and once approved, it can be used by any utility in an application for a combined construction permit and operating license. Three such standardized designs have already been approved.

At least one company is considering whether to construct the prototype of a kind of plant that is completely different from existing nuclear facilities -- the so-called pebble bed modular reactor. Instead of a reactor core made up of fuel rods, the core of this design would consist of several hundred thousand graphite-encapsulated spheres, each the size of a tennis ball (hence "pebbles.") Cooling would be provided by pressurized helium, which passes directly through a turbine to generate electricity. The NRC is conducting a preliminary study of the design, primarily to identify the kinds of regulatory issues that it would present. Other designs for advanced reactors are similarly being examined.

In short, in each of the three areas singled out in the Energy Plan, the NRC has initiatives in progress. I believe that we are on the right track on all of them.

VI. Public Acceptance of Nuclear Power in a Time of Change

I would like to conclude these remarks by briefly discussing what may be the single most critical factor in the future of nuclear power: public acceptance. The willingness of the public to accept the risks and benefits of nuclear energy is difficult to measure and to predict, and it is affected by external events. Nuclear power is not alone in that respect; one need only think of the impact of the events of September 11 on the airline industry.

The more than 20-year hiatus in the applications for new nuclear power plants was in part the result of an abrupt change in public attitudes toward the technology. The 1979 accident at Three Mile Island was a surprise and a shock to the NRC, the industry, and especially the public, which had been led to think that such accidents were all but impossible. The entire industry paid a heavy price for human error and carelessness, and for a quarter-century of downplaying the risks inherent in the technology. The loss of trust in the industry and its regulators, coupled with cost overruns in a number of nuclear plants under construction, had a devastating effect on public perceptions of nuclear power.

In the 22 years since Three Mile Island, the nuclear industry has matured, and so too, I believe, have the attitudes of the American people with regard to energy choices. There is a greater appreciation that each energy option has its pluses and minuses, and, as is often the case, economics help to shape public opinion. In California earlier this year, for example, the newspapers quoted the representative of a group that spent years fighting the licensing of the Diablo Canyon nuclear plant as calling the plant a "necessary part of the energy mix to keep the lights on." Economics, like politics, makes strange bedfellows.

Does this mean that our society will proceed to a new flowering of the nuclear option? The answer is not clear.

We probably should distinguish the utilization of existing plants more fully, through license extensions and power uprates, from the construction of new plants. From the standpoint of public

acceptance, I doubt that there will be serious resistance to the former, provided that a convincing case is made for the safety of such plans. Building new facilities, on the other hand, may be more problematic. It seems likely that whatever generating company is first to apply for new construction will face a barrage of opposition from those who see it as the nose of the nuclear camel under the tent, and wish to frighten other utilities away from making a similar choice. Nonetheless, there is clear interest in the generating companies in new plants, particularly if the capital cost for new construction can be kept acceptably low. The question is one of who will make the first move and bear the risk and cost of applying for new construction. There are two additional considerations -- one old, one new -- that could affect public attitudes. First, there is public concern over the problem of nuclear waste disposal, and not just among nuclear skeptics. Many who are generally positive toward nuclear power are troubled by too many years in which permanent waste storage has been an elusive goal. It is not my intention to discuss the waste problem at length today; I would only make the point that until a path to resolution of the waste problem is apparent, public acceptance of nuclear power may remain at least partially a question mark.

Second, there is the issue of terrorism. As I mentioned at the outset, security at nuclear plants is tight and we have toughened it further in response to the al Qaeda attacks. In the aftermath of the September 11, however, there have been calls for shutting down some or all nuclear plants, on the theory that they are too attractive a target for terrorism to be allowed to operate. In general these suggestions come from people whose opposition to nuclear plants has long predated September 11. I think that most Americans appreciate that the way to deal with terrorism is not to try to deny targets to terrorists by putting skyscrapers, bridges, tunnels, chemical facilities or nuclear power plants out of action, but to go after the terrorists and to put *them* out of action.

Thus, while we are seeing calls for improved security at nuclear plants and broader emergency planning, I am not aware of any broad groundswell of opposition to nuclear power *per se*. Nonetheless, we are clearly seeing nuclear opponents use the prospect of a terrorist attack on a nuclear power plant as a means for questioning nuclear power. It remains to be seen whether these arguments will gain traction in the public mind. So this too must remain an area of uncertainty.

Conclusion

In conclusion, I would emphasize that while the NRC is an independent regulator with a focus on safety, we are by no means indifferent or unresponsive to the developments taking place elsewhere in the Government and in our society. We have used the long lull in the growth of nuclear power to good advantage, improving our processes and refitting the agency to accommodate the technological and economic developments of the present and the foreseeable future. I feel confident that if the application of the nuclear option were to expand, the NRC will be well prepared to perform its regulatory role.

Thank you.