



# NRC NEWS

## U.S. NUCLEAR REGULATORY COMMISSION

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### THE FUTURE OF NUCLEAR ENERGY IN THE U.S.

**Prepared Remarks by  
Chairman Dale Klein**

**at the  
Goizueta Leadership Center  
Atlanta, GA**

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Good afternoon. I was introduced as the new Chairman of the Nuclear Regulatory Commission, and I am new – just completing my second month. However, I have spent just about my entire career in the nuclear field, beginning with my academic training as a nuclear engineer at the University of Missouri and then at The University of Texas at Austin.

My academic training and work experience have prepared me well for my present position, but I think my Missouri roots are also a valuable qualification.

More than a century ago, an educator and politician named Willard Duncan Vandiver coined the saying that has defined my home state of Missouri for all time, a saying that I often like to quote.

Speaking to an audience in blue-blooded Philadelphia, he said, "I came from a state that raises corn and cotton and cockleburs and Democrats, and frothy eloquence neither convinces nor satisfies me. I am from Missouri. You have got to show me."

We've grown a bit in Missouri since then – we have some Republicans, and we even have a nuclear plant. But concepts don't change.

Today we hear predictions that nuclear power can make a pivotal contribution to the world in the 21<sup>st</sup> century. But when I hear it said we're going to build 50 nuclear plants in the next 20 years, I say, show me – show me the designs, and then show me the hardware and the construction, and then show me you have the people and procedures in place to run those plants in a way that protects public health and safety. And as importantly, show me that you are maintaining the capability of running the current fleet of plants at the same high level.

I think that a questioning, “show me” attitude is an absolute necessity for a regulator in this time of rebirth for the nuclear industry. Both the NRC and the industry have enormous and complex challenges facing us for the foreseeable future. Vision is a fine thing, but it will take a lot of hard work to realize the vision. The U.S. nuclear sector must recreate a nuclear design and construction industry that essentially has been dormant for the past 20 years.

I have a vision for the NRC, as well – true to my roots. First and foremost, NRC needs to be a strong regulator. We will hold our licensees accountable, will articulate our requirements clearly, we will be demanding and we will be responsive to their legitimate needs and concerns. In other words, the industry needs to show the NRC the attention to detail and the focus on quality necessary to protect the public health and safety. And in turn, the NRC needs to show the industry, the financial community – and above all, the public – regulatory stability as we all play our roles in this massive new venture.

The nuclear industry itself has more than 40 years of operating experience that are serving it well in its current operations. All of the measures of productivity and safety in nuclear plants reached impressively high levels starting in the mid-1990s, and have been maintained there since then. Operation and Maintenance electricity production costs from nuclear plants are now less expensive than from coal plants, and far less expensive than natural gas. The improved economics over an extended period, coupled with the fact that nuclear plants emit no greenhouse gases, have led to a new and intensifying interest in building new plants. Promising new technologies and a streamlined NRC licensing process are contributing to the new economic viability of nuclear energy.

You have heard something from Commissioner Merrifield about the NRC and our plans for handling this enormous influx of expected work. So I’m not going to dwell on the coming organizational and procedural changes at NRC. I am instead going to speak a bit about what the NRC will expect from the nuclear industry over the next few years . . . what they must show me and my colleagues to translate the great promise of nuclear power, and the vision of the industry’s leaders, into reality. And in return, the NRC should show the industry predictability and stability.

Nuclear plants are tremendously complex industrial facilities. Their construction must be robust enough not only to contain radiation, but to control steam temperatures in excess of 500 degrees and to channel the high-voltage electricity on its way to consumers. The vast majority of the technology to accomplish those difficult tasks was developed in the United States after World War 2.

The planning, design and construction of the first generation of nuclear facilities, was an effort that occupied industrial giants such as Westinghouse and GE for decades, at a total cost well up in the hundreds of billions in today’s dollars.

In the three decades since the last nuclear plant order, and the two decades since the bulk of the nuclear plant construction was completed in the U.S., the nuclear design, manufacturing, and construction industry in the U.S. has withered on the vine.

The leading U.S. firms have either ceased operation, consolidated or become subsidiaries of non-U.S. parent companies. The companies that remain have survived on retrofits and maintenance of existing U.S. plants, and plant construction outside the U.S., where new nuclear construction has continued to flourish.

If the U.S. is going to build new nuclear plants, the architect-engineers, construction and component supply industries must re-establish themselves. NRC's primary charge as a regulator is to protect public health and safety, and those planning to build these new plants must come to us with quality designs and hardware, and workable construction and operational plans to meet our rigorous regulatory standards.

It will not be feasible to manufacture all of the major plant components, such as the massive reactor vessels themselves, in the U.S. But in terms of the logistics of quality control and safety inspections, it would be desirable to have as much of the contents originate in the U.S. as possible.

Restoring the U.S. supplier network needed to provide components – from the steam generators and vessel heads to the thousands of valves, pumps, heat exchangers and other parts used in a nuclear plant – would have advantages. There are now 442 nuclear plants in operation worldwide, and 27 more under construction. The most ambitious construction projects are in China, India and Russia – all of whom have announced plans for further expansions in their nuclear power production capabilities. There will be competition for materials, and a home-grown manufacturing industry should benefit those building U.S. plants.

Whatever this country does, it is clear that nuclear power is growing elsewhere in the world. The nation would be well served if our own energy needs serve as a springboard to rebuild U.S. technology and manufacturing capabilities to something approaching the leadership the nation once enjoyed, contributing to foreign markets as well as supporting our own.

Not only does the U.S. industry need additional infrastructures to supply the components for future nuclear plants, it also needs to ensure the skilled workforce needed to manufacture them. The lack of a skilled workforce is a problem that goes far beyond the manufacturing and construction segments. The nuclear industry must answer a fundamental question regarding new plants: who will run them? What are their educational qualifications? What is their training? As a regulator, the NRC has the responsibility of asking these questions, and of determining the adequacy of the answers.

To some degree, the knowledge amassed by the industry in 40 years of operation is institutional, and is transferable to future operations. But to a large extent, the knowledge is in the minds of older workers. A nuclear industry survey shows that nearly half of current nuclear industry workers are more than 47 years old, and that nuclear energy companies could lose as many as 23,000 workers over the next five years – about 40 percent of the total jobs in the sector. That is a tremendous brain drain. How do we transfer the knowledge to their replacements – who may form the cadre of workers as the next generation of plants starts up?

At the same time, the key suppliers to the industry – the architect/engineering firms, fuel suppliers and reactor manufacturers, anticipate that 32 percent of their workers will be eligible to retire within the next three years. They clearly must be replaced and their numbers augmented if the nation is to restore its manufacturing capability.

I might add that the government also will be competing for the same nuclear-related skills. The NRC alone will increase staff by a net of 200 professionals per year through 2008 to handle the increased workload of new plant applications and other business. The U.S. Department of Energy, national laboratories, NNSA and other government agencies also have personnel needs.

The Nuclear Energy Institute estimates that 90,000 entry-level workers will be needed to support existing industry operations through 2011. The nuclear industry is working on many fronts to address this critical need – it has launched major programs to provide scholarships, training programs and recruitment drives, and so on. But I have the sense that it's just nibbling around the edges of an enormous challenge.

My background is in academia, running a university nuclear engineering program, and during my time in the University of Texas program I fought constantly against budget erosion and declining interest both by students and school administration.

Many of my nuclear colleagues at other universities fought the same fight – and some lost. The number of four-year nuclear engineering programs now stands at about 25, nationwide – down from 38 in the 1970s. That is a matter of extreme concern at a time when we need to increase the numbers of academic training grounds to meet sharply increasing needs. And the potential for increased student interest has not influenced all remaining schools. Recently the University of Cincinnati announced that it would close its nuclear engineering study. Many concerned industry and government officials, myself included, are hoping that they remain open.

The potential student interest is clearly there. A Department of Energy survey shows that undergraduate enrollment at 23 reporting institutions in nuclear engineering, health physics, radiological and related fields nationwide has increased from 668 in 2001 to 1,520 last year. Graduate enrollment has risen above 1,000.

The Navy nuclear program is not as large as it was in the past and will not supply the workforce in the same percentage.

I would suggest to you that a major industry effort is necessary, and that it must address every level of education in this country, starting with a commitment to fostering the interest in science and engineering of elementary and middle school children. We also must concentrate our efforts on women and minority students, who now represent the majority of potential candidates, but less than a quarter of the students currently enrolled in nuclear-related undergraduate programs. When I arrived at the NRC, I was pleased to note the diversity of the professional workforce. That is a trend I intend to continue and encourage.

Scholarships, training centers and recruitment efforts are commendable ways to steer the technically-inclined toward careers in the nuclear industry. So are beefed-up internship programs with meaningful work. And once they're on board, mentoring programs will help to augment training as we engage in generational knowledge transfer.

Every segment of the nuclear industry needs to work to increase the talent pool, though, so that we are not competing for a small number of candidates. If we all spend the next 20 years waving money and benefits at the same people, there will be winners and losers. And if the industry wins and the NRC loses, or the industry wins and the manufacturers lose, we all lose. This is an issue that should

be addressed, urgently, at the CEO level at every company with any involvement in the nuclear industry.

I hope that I don't sound unduly alarmist or negative. Our glass is half full and not half empty. As I said, I have spent my career in the nuclear field, and I am personally excited by the possibilities ahead of us. I think the Nuclear Regulatory Commission has a very important and very positive role to play. We are gearing up for a vastly increased workload, and I am convinced that the NRC can discharge our obligation to provide rigorous regulatory scrutiny of the new reactor applications and associated duties without unnecessary delays. In fact, I believe that we will be able to reduce the lead times for regulatory approvals from their current duration while ensuring public health and safety.

I assure you that the NRC will do the hard work of creating the needed framework of regulatory stability. We, in turn, must be assured that the manufacturers, builders, owners and operators of the coming plants are prepared to meet their obligations to the public. You should show us good applications and we should show you a timely response.

- First, in my brief time at the NRC, I have been very impressed by both the competence and the dedication of the staff. I have been pleased with the quality of the work I have seen. They come early, stay late and focus on the job to be done.
- That said, the NRC itself places too much emphasis on process. I would like to see us concentrate more on progress, with no compromise on safety.
- We need to develop more milestones and deliverables, and articulate them clearly to those we regulate.
- I also would like to see the NRC focus more on real risk and less on risk that is simply perceptual. The tritium issue is an example of the latter.

Thank you. I will be pleased to answer your questions.