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Home

Who We Are

What We Do

Nuclear
Reactors

Nuclear
Materials

Radioactive
Waste

Public
Involvement

Re

Home > [Electronic Reading Room](#) > [Document Collections](#) > [Commission Documents](#) > [Commission Speeches](#) > [2001](#) > S-01-024

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Radiological Protection, Nuclear Energy and the Environment in the 21st Century

**Resurgence of Nuclear Power by The Honorable Greta Joy Dicus
Commissioner
U.S. Nuclear Regulatory Commission**

**National Congress of Professional Societies
Mexican Nuclear Society
Mexican Health Physics Society**

**Zacatecas, Mexico
October 8, 2001**

Buenos Dias. Let me try some more Spanish. **Es un gran placer estar aquí.** This is a lovely setting to participate in the Annual Conference of the Nuclear Mexican Society and the Annual Reunion of the Mexican Society of Radiological Protection.

Before I begin my presentation, let me say a few words about the September 11, 2001, terrorist attacks in New York, Pennsylvania, and Washington, D.C. Latin America and the rest of the world have expressed their sympathy. We appreciate our friend's words of support and sympathy. These are difficult times for us but we will recover. Concerning nuclear plants, since September 11, the United States Regulatory Commission (NRC) has been working with our licensees (around the clock) to ensure adequate protection of nuclear power plants and nuclear fuel facilities. The NRC is prepared to make any adjustments as may be deemed necessary to continue to protect the public health and safety.

When Mr. Raul Ortiz invited me to speak, I welcomed the opportunity to come and tell you how nuclear power is regulated in the United States. As you may be aware, the number one responsibility of the United States NRC is to ensure public safety in the operations of our licensees. The NRC does not promote the nuclear industry. It is from the regulatory viewpoint that we are involved with the nuclear power industry. This is a very important point that needs to be underscored. I mention this because the structure in other countries may differ from the United States and because this responsibility will continue as new nuclear power plants are built.

There has been a tremendous amount of nuclear power developments in the past twelve months. Never since the beginning of nuclear power have such monumental movements occurred in the United States. These are movements that may eventually lead to building new nuclear power plants. Specifically, I would like to discuss three very important current issues in the resurgence of nuclear power that cut across international borders. The first topic is the new **Regulatory and Industry Activities** - if the resurgence is to take place, the various industry efforts need to be consistent and supportive of a new regulatory framework and infrastructure. The first topic leads to the second topic, the realization that we have a **Human Capital Crisis** - we are finding that there are not enough nuclear professionals to meet the demand. The third topic is the **High-Level Waste Repository** - spent fuel was never meant to be stored permanently at the plant site. I will say more about topic one than the other two topics but believe that for completeness the other two topics need some discussion.

Regulatory and Industry Activities

There are many factors that have led to the potential nuclear power resurgence in the United States. In many ways, the NRC planned for the future over a decade ago by establishing the regulatory framework (i.e., Part 52 and Part 54).

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accommodate the nuclear power resurgence. But that is not to say that we had a crystal ball that predicted precisely what has happened or is happening. In fact, the rules that were promulgated for the new framework may need to be revised now that some of those rules are being exercised. In addition to the regulatory framework, the regulatory infrastructure needs to be established. Some of the other factors deal with timing and external factors, such as, the California power crisis and the deregulation of the electrical industry. Let me discuss some of these factors, some may be very obvious and some may not be so obvious.

Part 52 and New Reactor Designs

The current fleet of 103 operating nuclear power plants was licensed many years ago under 10 CFR Part 50. Part 50 served its purpose well for that time but the processes were eventually criticized for being slow. The NRC started to lay the foundation for a new way of licensing reactors in the late 1980s. While new nuclear plant applications were not filed until the 1980s, the move to improve the effectiveness and efficiency of the processes in Part 50 prompted the development of CFR Part 52. Part 52 was promulgated to provide an alternate process for licensing that differs from Part 50. Part 52 is for the certification of standardized designs and the early approval of sites for reactor construction, either or both may be referenced in an application for a combined construction permit and operating license.

By the late 1990s Part 52 had been exercised when the NRC certified three new reactor designs - Combustion Engineering's System 80+, General Electric's Advanced Boiling Water Reactor, and Westinghouse's AP600. The industry is currently working with the Nuclear Energy Institute to develop plans for the applications of early site permits, advanced reactor certifications, and combined operator licenses.

The potential nuclear power resurgence has also brought new ideas in design. Due to the economics, some of the new designs are modular facilities where multi-units can be combined to supply the amount of power needed. Each module by itself produces only a fraction of today's operating nuclear plants. Two of the modular designs of interest are the Small Modular Reactor and the Gas Turbine Modular Helium Reactor. Two other designs receiving attention are the modified version of the certified AP600, and the International Reactor Inherently Safe Design, normally called IRID.

The consolidation of the nuclear industry has resulted in licensees like Exelon that owns several nuclear power plants in the forefront of building new power plants with new reactor designs. Exelon along with other parties in South Africa is in the process of designing and building a pebble bed modular reactor. Depending upon on-going feasibility assessments, Exelon will decide by the end of the year to either proceed or drop its plan to build a new reactor in the United States. If it decides to proceed, Exelon could potentially apply for a combined license for the pebble bed modular reactor as early as 2010.

California Power Crisis

The California electrical power crisis influenced the plans to build new power plants including nuclear ones. The decision of the electrical industry began its final stage of implementation in California this year. This fact, the business factors associated with deregulation, and California's resistance to build new power plants due to plant air emissions, could have created a power crisis in late winter 2000 and spring of this year. Among the many issues identified, the California utility pointed out the shortage of generation capacity in California and, in general, the western United States. In many ways, it was not the cost of electricity that escalated to extreme level that was the problem but that excess power was just not available in the western United States to sell to California. The nuclear industry noted that new nuclear plants could meet the electrical demand and satisfy the strict requirements of air emissions. As it turned out, the crisis of the lack of power did not materialize this summer when it was believed that California would experience many blackouts. Fortunately, conditions in California and a mild summer averted the power crisis.

National Energy Policy

In the Spring of this year when the shortage of electrical power in California was being experienced, a special group was commissioned by President Bush was in the process of assessing the federal energy supply for its report - the National Energy Policy. The report was submitted to President Bush in mid-May. The National Energy Policy was designed to bring together business, government, local communities and citizens to promote dependable, affordable and environmentally sound energy for the future. The report envisions a comprehensive long-term strategy that uses leading edge technologies to produce an integrated energy, environmental and economic policy. The report states that to achieve a 21st century energy life, the United States must modernize conservation, modernize infrastructure, and increase energy supplies. In a major way, hydro, coal, and oil, the report specifically recommends that the President support the expansion of nuclear energy as a major component of our national energy policy.

While the report was a well-thought out assessment of the energy situation and carries a lot of influence, there are still powerful opponents to nuclear power in the United States. This points out that the nuclear industry still has to overcome resistance if the nuclear power resurgence is to occur. Nevertheless, we have seen increased interest in Congress to pass laws that would facilitate the nuclear energy resurgence.

License Renewal (Part 54)

It is not necessary to build new nuclear plants to generate more electricity. The United States nuclear industry generates more electricity by being more effective and efficient in their operations. In addition, in recent years the NRC has approved power uprates. These approved power uprates have increased the power output by a few percentage points, and interest in the industry to increase the power up to 20%. Nevertheless, the biggest factor for the industry to produce electricity has been to extend the years of the existing operating licenses. The Atomic Energy Act (AEA) limits the license term for operation to 40 years. This term limitation was not established by technical considerations, but rather driven by antitrust and financial factors. However, AEA did allow for license renewal, and the Commission has established regulations to implement this option.

In the 1990s, the NRC promulgated 10 CFR Part 54, Renewal of Operating License. Part 54 has provided the option for licensees to renew their license for an additional twenty years. A few years ago, it was believed that this option would be used by many of the licensees. The first application for license renewal was received in 1998, long before the potential nuclear power resurgence. Since that time, the NRC has approved operating license extensions for three plants and has five more pending applications. The NRC expects to receive twenty more applications for license renewal in the next few years. Furthermore today, it is believed that most current licensees, if not all, will ultimately seek to extend their licenses.

NRR and RES New Design Organizations

In March of this year, the Office of Nuclear Reactor Regulation (NRR) established the Future Licensing Organization. This organization was staffed by temporary assignments. In August of this year, the temporary organization was replaced with a permanent office called the New Reactor Licensing Project Office (NRLPO). The permanent staffing for this new office is currently on-going. NRLPO has responsibility for coordination of all NRR activities with new reactor licensing, including design certification, early site permits, and combined license applications. NRLPO will also be responsible for reactor regulation, infrastructure development, and will coordinate all its activities with other NRC headquarters and regional offices.

In July of this year, the Office of Nuclear Regulatory Research (RES) also established the Advanced Reactor Group (ARG). ARG will serve as a focal point for RES advanced reactor activities. Responsibilities for ARG include managing, in cooperation with NRR and the Office of Nuclear Material Safety and Safeguards, non LWR advanced reactor pre-application activities supporting NRR in activities related to advanced LWR's. Current activities include a pre-application review of the Experimental Breeder Modular Reactor and interface with the United States Department of Energy on the Generation IV reactor program. ARG will use a matrix approach to capitalize on the technical expertise across RES, such as thermal hydraulic analysis, accident analysis, and high temperature performance of materials, components, and systems.

These two NRR and RES organizations are needed to support the industry activities. As I have previously mentioned, industry representatives are developing plans to submit applications for early site permits, advanced reactor design certifications, and combined licenses. In addition, the industry is assessing the potential to restart suspended construction projects over the next one to two years. Stakeholders have also expressed an interest in working with the NRC to address regulatory issues affecting possible new reactor licenses, and to make improvements to increase the efficiency and effectiveness of regulatory processes. The NRC has also begun efforts to reactivate the construction inspection program in anticipation of these potential projects. While there is still considerable uncertainty regarding what activities the NRC will be called upon to support, and when this support would be required, it is essential that the NRC continue the efforts underway to prepare for future applications so that the NRC can fulfill its safety mission.

Human Capital Crisis

For the past decade, the number of college graduates in nuclear engineering, health physics, and in general, engineering sciences has been declining in the United States. When the number of operating nuclear power plants was decreasing, this fact was not as troublesome as it is today with the potential nuclear power resurgence. That is not to say that we did not worry a few years ago, we did. The private industry and the government were competitors then and now in attracting graduates. This competition for engineers will continue but with more urgency. The human capital crisis is exacerbating as we consider that many of the nuclear professionals are near retirement age.

To say the least, the NRC has been affected by the diminishing supply of new engineering graduates. As we found, this has been a problem not only for us but all of the federal technical agencies. There have been recent reports that the number of science and engineering graduates has stabilized. But even if the downward trend is stopped, it will take years to reverse the declining trend. I say this not because it involves only students but institutions who continue to shut down their reactors. Not only are these reactors important in training the graduates but additionally providing the opportunity for further reactor research. Today, we believe that the supply of nuclear engineering graduates at most only meets the demand.

If this deficient supply of graduates was not enough of a problem, the industry and the NRC are now facing an age force. The large number of near retirements will aggravate the problem. I have recent data that demonstrates some concerns specifically for the NRC. As of May 2001, the average age of the NRC professional staff was 48.5. In September 2000, the NRC had six times as many staff over the age of 60 as it had staff under the age of 30. Today, because of effort to aggressively recruit, the ratio has been reduced to five times as many staff over the age of 60 as for the age of 30. I do not have the exact comparable data for our licensees but the numbers would closely resemble figures.

The supply outlook for health physics professionals is no better than for engineering professionals. In August of this year, the Health Physics Society (HPS) published a position statement on this topic. In this position, the HPS recommends financial support by the US Congress and federal agencies for health physics programs in academic institutions. This would assist faculty, students, and research associated with these programs and thus ensure an adequate supply of radiation safety professionals.

The HPS position paper goes on to point out a critical shortage exists in the supply of qualified radiation safety professionals throughout a broad spectrum of activities including medical practice and research, regulatory oversight, academic environmental protection, occupational safety, and the research and application of nuclear technologies. A recent survey conducted by HPS indicates that present supply of radiation safety professionals is approximately 77% of the demand. Supply during the next five years will only be 63% of the demand. One again, the retirement of the radiation safety professionals is the big factor in meeting less of the demand in the next five years.

As I have stated, this human capital crisis is across the industry and the government. In testimony before Congress, I have also asked for help from the federal government and we have pointed out specific remedies - for instance, all NRC to fund fellowships and scholarships, and supporting specific colleges that provide the training in skills needed by the NRC. The whole federal issue of the human capital problem is being addressed by the United States Office of Personnel Management .

High-Level Waste Repository

With respect to the progressions that are before us in a path toward new reactor designs, license renewals, and perhaps new reactor applications, we should pursue these progressions methodically and with the end-in-mind. Along this path there is one essential element that remains to be resolved. That element being a national policy decision on how spent fuel and other high-level waste will be emplaced for final disposal.

We are all well aware of the Department of Energy's efforts regarding siting and characterization activities at the Yucca Mountain site, as mandated by law. Along these lines, both the Environmental Protection Agency and the NRC recently finalized our environmental protection standards and implementing regulations. With the site characterized and its sufficiency aspects drawing to closure, the United States government is rapidly approaching a policy decision, that will forever impact future decisions of the commercial nuclear industry. This decision will yield impacts well beyond borders. After two decades of data compilation and spending more than \$6 billion dollars, I believe that a final decision on whether to move forward with Yucca Mountain or not, is needed, so that energy generators and suppliers can plan and determine their future. With more than 100 commercial nuclear reactors now in operation in the United States and projections of more to come, we are faced with two very fundamental issues.

The first being, do we conduct final waste disposal operations at one location or do we plan for continued storage at individual locations; and the second being, when does continued storage become in-place disposal. Whatever decision is made, they will unquestionably have lasting global implications.

Although the technical and safety aspects of any major policy decision are inherently critical, spent fuel and other waste disposal will always remain a political decision. It is time to make that decision.

Conclusion

In summary, the nuclear industry has many on-going activities that could lead to a new nuclear power resurgence. The industry has begun to establish the framework and infrastructure to accommodate the potential nuclear power resurgence. There are many challenges ahead including the shortage of nuclear professionals and the long term storage of the high-level