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“The Possession of Know-How, Technology, and Skill”

Remarks of Chairman Nils J. Diaz
United States Nuclear Regulatory Commission

before the

American Nuclear Society’s National Meeting

San Diego, CA
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Good morning. It is indeed my pleasure to address this distinguished group of nuclear engineering scientists and technologists, gathering one more time for the pursuit and dissemination of knowledge. You also gather and labor year-round to make a difference for your communities, and to improve and increase the global use of safe and beneficial nuclear technologies. I thank you and join you in these tasks, made even more important by these troubled times. At the outset, I want you to know that I am expressing my individual views, unless I state otherwise.

Today, our great nation needs to have assurance of supply of many commodities, and one of the most important is energy supply. In this respect, I would like to start my discourse with a quote:

“In our time, in particular, there exists another form of ownership which is becoming more important than land: the possession of know-how, technology, and skill. The wealth of a nation is based much more on this kind of ownership than on natural resources.”

I am sure you would not be surprised if I were to attribute this far-reaching statement to a 2003 philosopher, economist or entrepreneur. The statement is a lot older. It is a quote from the Encyclic Rerum Novarum, published in 1891. As pertinent as it was then, it is more pertinent

now, when a microchip can be worth much more than gold, and when services are more important than the production of goods for the U.S. economy; when disease is being conquered by mapping the human genome, and when virtual reality is no longer a dream, but a useful tool.

The impressive scientific and technological achievements of the last century were not visualized in 1891, yet they have irrefutably confirmed the far reaching conclusion of that visionary document. There is no doubt that the world has been shaped by the socio-political revolutions of the last three hundred years, the American, French, the Bolshevik revolutions, and in our recent socio-political world, by the “Reagan Revolution”. But it has also been shaped by the scientific and technological revolutions that spanned the 20th century, among great wars and massive economical developments.

As extraordinary as all these 20th century developments were, all is not well. I will quote first and then use a few thoughts from a wonderful article by George Gilder, who poignantly wrote regarding the early 20th century:

“It was the survival of unprecedented multitudes of human beings at ever increasing standards of living, together with a new intolerance toward the persistence of conditions of poverty that had previously been accepted as inevitable.”

I believe that Gilder stated what is a key and real crisis of the 20th and 21st centuries. In many ways, this succinct yet poignant statement expresses a fundamental social, political and economical issue confronting mankind, because it is a root cause of many of today’s great problems, and it has to be addressed with urgency and with solutions.

It is obvious to me that real solutions to this global problem can be found in democratic systems of government, where the pursuit of happiness and free enterprise are rights and not gifts. Indeed, I believe that solutions are found in the exercise of the Rerum Novarum postulate: “the possession of know-how, technology and skill.” In other words, education and technology in action, working synergistically to improve the survival and the standard of living of unprecedented multitudes, are enabling solutions, when anchored in democracy and free enterprise.

The possession of know-how, technology and skill and its use is the theme of this talk.

Nine years after Rerum Novarum, a transcendent discovery happened that changed the dimensions of human life: quantum mechanics. Our understanding of the nature of matter, and its associated view of the world, fundamentally changed. The universally-shared assumptions, based on sensory models and deterministic logic about materials, were forever altered. Our view of the physical world went from solid matter interacting through forces at a distance, to quarks and leptons interacting through intermediate vector bosons. Again, Gilder’s paper concludes that Max Planck, in 1900, “took the certainty out of matter, made the deterministic incomplete, inconclusive, and, yes, obsolete, when compared with the world of old, when quanta transport became far more important than movement with or against gravity; when the electron cannot be

defined in a particular space and time”, and yet, this new understanding -- the quantum mechanics world view -- is usable. Many other quintessential discoveries joined in -- from relativity to making uncertainty predictable. The world has changed rapidly, and those changes accelerated and did so for the better, to where know-how and technology are abundant and are becoming even more valuable.

The impact of quantum mechanics and the accompanying scientific and technological breakthroughs cannot be overstated. They have a continuing and accelerating influence in mankind’s progress, and specifically so in the increasing worth of know-how. Wealth, as measured by physical resources, is declining while the value of technological capabilities and innovation is increasing. For many nations, technological know-how and pressing societal needs ameliorated the many “crises” we have encountered, like the population crisis, the energy crisis, the nuclear winter crisis, the environmental pollution crisis, etc. From a modest, in present terms, industrial revolution, the more developed nations accelerated into the automobile era, the airplane age, the nuclear age, the space age, the era of information technology and now the biogenetics era. In so many ways, quantum mechanics, and the other key scientific discoveries are essential components of this yet-to-be-appropriately- named period of mankind, a fact that somehow is being lost when it should not. It is the better understanding and use of the physical world and associated applications that has made possible or leads to the understanding and progress in other sciences, and therefore, is a major contributor to mankind’s progress. For example, once, evolution was a very controversial theory; it is now a tool, a process to improve our world, to fight disease, to grow crops, and feed people. And so on, and so on.

Quantum mechanics enables so much: computation mapping, communicating, measuring, changing, improving, etc. -- it makes possible what is needed to achieve productivity and improve the quality of life in many areas. But it would not succeed without usable energy, and especially electricity.

It is a fact that without abundant, reliable, safe energy there would be little of what we enjoy today. We would be much poorer. Energy, well distributed and affordable, is one of the indispensable and enabling components of the know-how era. And, obscured by achievements and gadgets, we have the working atoms; the protons and neutrons, the electrons, and quantum mechanics in action. The energy from the nucleus, and uses of radiation, are integral and necessary components of this day and age. Unheralded, nuclear energy serves the needs of millions and millions of people worldwide, safely and reliably. From an overall energy and economical perspective, nuclear electricity supply can be a major stabilizing force in energy markets, and I believe especially so if coupled with hydrogen production.

How do we get there? Well, I have a “couple” of ideas in my areas of expertise.

First, we should realize that, unless the case is made by professionals in the field, governments and people will not have a full realization of how technology and energy got mankind to today’s standard of living, and the particular role of nuclear energy and related technologies. It is not as obvious as we think. There are many making the opposite case. Do they have a better case or are they just more dedicated to their cause? Nothing will change in this

respect unless you change it, and are as dedicated. The price is your time and it has to be paid if you want results. This is an indisputable role of the American Nuclear Society: the pursuit and dissemination of nuclear know-how.

Second, the productive and interesting world of the working nucleus, and of radiation, needs to be brought to the classrooms, where young people need to be presented with balanced facts. There might not be a more important class of people in this respect than science teachers.

Max Planck, in “The Philosophy of Physics,” said:

“A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die out, and a new generation grows up that is familiar with it.”

Well, that probably worked for quantum mechanics, but the opponents of nuclear power and radiation technologies remain, and the task is for the ANS and others to educate a new generation that will grow familiar with nuclear science and technology.

Third, directly connected to all of the above, is the pressing need to bring state-of-the-art know-how to nuclear radiation technology and energy production, and to develop even newer and better techniques and applications. There is a need for better, more functional, more realistic and safer processes. If time keeps passing, lesser technologies than nuclear will fill the voids, with difficult-to-achieve claims of efficiency and economics -- but they would be there. Who would have thought 25 years ago that nuclear power and radiation technologies could be called obsolete? I see what is out there, and I am certain you believe that nuclear sciences have a good and vibrant song for our times. The tune has to be attractive and the lyrics factual.

It is also important that value be given to public service. In the USA, the land of technological know-how, there are far fewer technical people in government than needed. The ANS has had a role in encouraging the entry into public service by many qualified individuals. It should continue and grow by making public service a more important part of the ANS agenda.

Many positive factors are converging to make possible a renaissance of nuclear power, based on the real and well communicated fact of its safety and reliability. It is on improving the safety and reliability of nuclear power plants, viewed from the perspective of a regulator and former nuclear technologist, that I want to focus my concluding comments for this special occasion.

The viability, and the probable growth, of nuclear power is inextricably linked to its regulation. I want to be crystal clear in addressing this issue. There is no way, presently and in the foreseeable future, to maintain and to advance the use of nuclear power without a strong, predictable and credible regulator. Therefore, it is essential that regulatory infrastructures be all that they can be: safety-focused, with state-of-the-art know-how in every important safety aspect. As regulators we should make independent decisions, listening to and respecting different views, but without undue interference. We at the NRC should be willing to risk criticism by

communicating both the good and the not-so-good safety performance, as well as assessing and explaining potential risks with realistically conservative analysis, based in our assurance of protection of public health and safety, the environment and the common defense and security. I believe that the present needs in the U.S. and many other countries demand the use of a safety construct that embodies the best regulatory practices, from licensing, to rules, to oversight. A safety construct that interacts with the best design, operation, and maintenance practices of the industry, and utilizes the law, is a two-edged sword: to enable and to correct according to well established and transparent principles.

I will over-extend my welcome if I don't quit soon, but allow me to try a preliminary definition of a safety construct for you:

A nuclear power plant safety construct is a hierarchical, techno-legal assembly of regulatory and operational safety systems ensuring the safe design, operation, and maintenance of nuclear power reactors for the benefit of the Nation.

The above definition is not complete, but is a good start for a much needed dialogue.

We have the know-how, the technology and the skill to improve nuclear technologies so they are even more useful to society and, definitely, to implement a safety construct that leaves little doubt about requirements and responsibilities, for regulators and regulated alike. A safety construct, although not a contract, is a working and dynamic instrument that will ensure predictable and credible safety performance, as well as being a vehicle to explain our actions. Its regulatory components will be bound by the rule of law, serving to assure safety, and to avoid the unnecessary intrusion into or disruption of licensed activities without a strong safety reason. It should have only the necessary prescriptive components, with probabilistic risk-insights and performance-based regulation, design, and operation replacing what has been made obsolete. It must result in safety being a driver, but also being an enabler. I firmly believe that these are compatible and beneficial to society. A safety construct, including the requisite regulatory components, is much more than a set of "don'ts": it should be a positive force, a roadmap, a pathway to helping the industry accomplish its proposed uses of nuclear technologies, tempered by the mission to achieve a better, safer and more secure existence for the American people.

As I said before, "[i]n our time, in particular, there exists another form of ownership which is becoming more important than land: the possession of know-how, technology and skill." You have them for nuclear and radiation technologies. In fact, many of the attributes and characteristics of a safety construct for the U.S.A. are well known, but not integrated. I have my own, but I do not want to spoil your fun: I challenge you to use your know-how, technology and skill and take safety to the next level, where safety is a dynamic instrument of change, and build a 21st Century safety construct.

I thank you for the opportunity to share my views with you.