

No: S-14-005

March 12, 2014

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“The Seven Pillars of the Nuclear Safety Future”

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U.S. Nuclear Regulatory Commission

March 12, 2014

It has been another eventful year at the NRC. Since RIC 2013, the Commission has instructed staff to develop a new rule to consider vent filtering strategies and assure contaminate integrity during severe accidents and agreed on a draft rule to risk-inform low-level waste disposal. We have launched an enhanced policy statement regarding our relationships with tribal governments and responded comprehensively to court decisions related to high-level waste.

In the past year, I have walked on the basemat rebar for the first new nuclear power plant to be built in the United States in a generation. I have also borne witness in a control room as the first U.S. nuclear power plant to be closed for purely financial reasons was powered down for the last time.

In the past year, I have addressed members of Japan’s Diet, the Premier of Taiwan, and Ministers in Indonesia to espouse the principles of safety culture and regulatory independence. I have met with scores if not hundreds of young engineers to highlight the awesome personal responsibility each and every one of them has as a member of the nuclear community.

It has been another busy year for all of us at the NRC - but it is only one of many since the Energy Reorganization Act was enacted 40 years ago this coming October. But as varied as our activities have been over the 12 months, they all converge upon a single, clear concept—that the NRC exists to assure nuclear safety.

Nuclear safety is why the NRC was created. Out of the great accomplishments and great controversies of our predecessor agency, the Atomic Energy Commission, the NRC was formed to provide a clarity of voice, a singularity of purpose, and an existential focus on nuclear safety—or, to be more precise, to assure that “the utilization or production of special nuclear material will be in accord with the common defense and security and will provide adequate protection to the health and safety of the public.”

This phrase appears in section 182 of the Atomic Energy Act of 1954, the legislation that provides the core of our authorities. The Atomic Energy Act, as far-reaching and comprehensive as it is, is a haiku in comparison to the enormous bills manufactured by Congress today. While a creature

from the depths of the Cold War, the provisions of the AEA remain the subject of active discussion and—despite many amendments over the decades—its foundational principles remain in effect.

But how we interpret and apply those principles has evolved considerably since the Act became effective 60 years ago this coming August. How the broad authorities bestowed by the AEA in the era of Eisenhower and the “Say Hey Kid” are made manifest in the age of Obama and “Sid the Kid” reflects many other laws passed by Congress, many court decisions, and decades of regulatory experience and precedent.

The NRC is built upon thousands of experiences reflected in guidance and procedure. This is reflected in the inculcated culture of the organization, the evolving work practice of generations of staff, and the decisions made by the thirty-three people who have served as NRC Commissioners. The result is not simply a regulatory framework, but a collected wisdom.

In the *Book of Proverbs*, it is written that “Wisdom hath built her house; she hath hewn out her seven pillars.” Our house is based upon pillars of wisdom that reflect what we have learned and what we continue to learn. Our regulatory framework rests on the pillars hewn out over decades. But this wisdom is not static and it has never been. Our understanding evolves with experience and the ongoing commerce in ideas. Thus, while we must apply our current foundations to prepare for the future, our greatest challenge is to allow those pillars to shift without bringing the entire regulatory edifice to the ground.

Among the pillars that support the NRC’s overall framework, is the understanding that narrow purpose has its own power. Part of the reason that NRC was created was to address public concerns about the scope and power of the Atomic Energy Commission. While the NRC’s role and powers are bounded by walls and barriers established over decades, the resulting framework, though it serves us very well, is complex even to those of us who live with it every day. For the public, it can be opaque and downright confusing.

For example, when the average person learns that a radioactive material called “tritium” is leaking from a nuclear plant into the groundwater, it is likely she would expect the NRC to take quick action to stop it and punish those responsible. Instead, she learns at a public meeting that NRC is a safety regulator, not an environmental regulator. Further, the NRC says the leak is not an indication of a problem with the plant’s safety systems and scientific analyses shows that it poses no hazard to public health. Therefore, NRC has no basis for action.

In other cases, members of the public ask NRC to weigh-in regarding one technology or the other—fuel cycle technologies, storage systems, and some question whether NRC should allow a utility to build a nuclear power plant at all if, for example, wind power is a viable option. In such interactions, the bright line we at NRC see between our role as a safety regulator and decisions related to national energy policy can appear murky and inexplicable to people outside the agency.

These limitations sometimes appear frustrating—even to many people inside the agency—but they serve an important principle. Vince Lombardi once said that “success demands singleness of purpose.” We take action only when it is relevant to our imperative to protect human health. We leave to Congress the decision whether to restrict or encourage a particular technology—as it has done, for example, with regard to the use of HEU for medical isotope production. Our singleness of purpose focuses our regulatory scope and it separates regulatory decisions from policy decisions.

Ironically, the most intense consternation is sometimes found in the attribute for which NRC is perhaps most widely admired around the world—our rigorous, disciplined process for making regulatory decisions.

When a proposal is made to change our requirements, we first consider whether that change is needed to ensure the adequate protection of public health and safety or to assure accord with the common defense and security. This has occurred in the past, such as when NRC responded to the terrorist attacks of September 11, 2001.

But these developments are, thankfully, quite rare and unusual. It is far more common that proposed changes do not address matters that challenge our “adequate protection” threshold. Instead, it is far more common that such changes provide more incremental benefits. If a proposed change is not in response to an issue of adequate protection or does not raise unaddressed concerns of common defense and security, NRC then engages in a “backfit” analysis to determine whether the resources required to implement the change can be justified by the safety benefits it provides. We do this as quantitatively as practical, but there is considerable judgment and debate involved in this process as well. We saw this very recently as the Commission considered a staff proposal regarding the filtering of containment vents.

Clearly, there are many observers who feel quite strongly that matters like these should not be decided by a cost-benefit analysis. Few other countries apply such an approach, and it has been argued that backfit analyses place the financial interests of industry over the safety of the public. In my view, this is an uninformed opinion.

The organizational and legal traditions in the United States are very different from those of our friends overseas. In many countries, for example, nuclear power plants are directly or indirectly owned or otherwise controlled by national governments. U.S. nuclear power plants are almost entirely the privately-held assets of commercial companies. In our legal tradition, private companies have rights that are in many cases similar to those of individuals. Commercial companies have an expectation that requirements will not be imposed upon them without good cause and due process. Our disciplined approach supports this tradition.

But more to the point, a disciplined approach allows us to focus both NRC and licensee resources on the issues of safety significance. When everything is significant, nothing is significant. Management attention, engineering talent, and, yes, financial resources can be spread too thin and too ineffectually. When this occurs, safety is not enhanced, it is weakened. Our quantitative, disciplined approach reflects this understanding.

I am not sympathetic to the concern I’ve heard from some people that the Backfit Rule makes it too hard to put new requirements in place. It should be hard. It forces us to question ourselves about what is truly needed for safety and avoid taking steps just because they may be popular or politic. At the end of the day, if there is a matter that appears to be needed for safety but doesn’t survive a cost-benefit analysis, the Commission has the authority to use its judgment to impose any requirements it finds necessary. The order issued in 2012 to enhance the instrumentation in spent fuel pools serves as a good and recent example.

The Commission structure itself is a vital pillar of our safety infrastructure. I’m sure some people hate it—five people not under the direct thrall of the usual Executive Branch structure.

Independent at inconvenient times. Sometimes a bit deliberate. Occasionally in disagreement with the staff. Occasionally in disagreement with itself.

But as I've noted in the past, the Commission structure, which involves intensive, informed debates among five individuals with very different backgrounds—for example university professors, nuclear submarine commanders, Congressional staff, the occasional sage—provides an excellent mechanism to reflect society's evolving view as to what constitutes adequate protection. After four years in the center of this process, I think it is a far better approach to making important, complex decisions than leaving these matters to a single political appointee.

Nevertheless, I'm sure there are many who think we get it wrong. Since I've been on the Commission, we have had vigorous debates about worker dose standards, containment vent filtering, and most recently spent fuel pool safety. It is rare that everyone is satisfied with judgments on such contentious issues. But the process we apply is a disciplined one that assures consideration and evaluation of all the relevant information available to us. And, I should say, it is my opinion that in every case, we have reached an appropriate result that is protective of public safety and security.

All that said, we are not perfect. Humility is, even for sages, a core attribute of a good nuclear safety culture. As such, we must be able to change and revise our most fundamental pillars should experience, knowledge, or the availability of new methods, tools, or technologies compel us to do so. Ignoring the call for fundamental change is as bad as leaping to change for the sake of change or the vicissitudes of fashion.

As a regulatory organization, we value stability. And our licensees value stability and predictability. Yet one the most important pillars of NRC's success to date has been our ability to evolve. SALP gave way to the ROP. Part 50 yielded to Part 52. It is my belief that the next major step in our evolution is the adoption of a strategy based upon risk-informed, site-specific regulation.

If we've learned nothing else over the years, it is that each nuclear power plant is a unique creature. In the United States, in particular, most plants are unique in design. They have wide variances in operating history and in the modifications incorporated over the years. As my colleague, Commissioner Apostolakis stated earlier, "risk contributors are plant specific, even for sister units."

Moreover, American manifest destiny has bestowed upon us a country with swamps and deserts, plains and mountains, forests and tropics,

and we have nuclear power plants in most of these environments. Each site has unique characteristics and hazards that must be understood and addressed by plant design and operation.

The NRC staff does a good job of recognizing the different issues and features of each plant as it seeks to implement our regulations. But the fact exists that the agency issues and prioritizes regulatory actions on an industry-wide basis. It is not quite "one size fits all," but it is a close relative. We have taken diminutive steps toward site-specific prioritization, for example in implementing seismic and flooding reassessments. Staff has prioritized plants in groups to be reviewed over the come months. This approach allows the NRC to prioritize the plants facing the most challenging seismic and flooding issues and enables us to apply our resources in a logical and effective fashion.

But this barely scratches the surface of the benefits that can be obtained by designing the regulatory agenda on a plant-by-plant basis based, to the extent practical, upon a quantitative understanding of risk. Adopting such an approach would allow the resources at each plant to be focused on the safety issues of highest significance for that plant and get them done more quickly and more efficiently.

Clearly, making this change will be difficult. It will require enhanced PRA tools and models and it will require research to develop the facts and data to support those models. It will require a shift in mindset in both the industry and NRC that embraces more fully probabilistic approaches. It will also require a willingness to make the up-front investments in order to realize long-term benefits.

However, it is vital that we never lose the perspective that plant operators are responsible for safety—not the NRC. There is no legislation that states it, but operators must take the principal responsibility for the safety of their plants. This understanding informs all we do as the regulator and the regulated.

A licensed operator recently asked me an interesting question: “Would nuclear power plants be operated safely if NRC did not exist?”

This is the question we should all ask. The answer should be ‘yes’ but I doubt that anyone here today would give this reply without hesitation. Just as the plants differ, so do the companies that own and operate them. Some are, quite frankly, stronger than others. If this were not the case, we would not have and need an INPO.

That is not to suggest that any operator would, left to its own devices, run a plant in an irresponsible manner. But without a regulator, what additional pressure would plant managers feel from boards and financial staffs? Would maintenance cycles be stretched? Would training be cut back? What would be the “safety goal” for each plant? How much risk would be acceptable?

The reality is, quite clearly, that industry needs the NRC. Where would public confidence be without a strong regulator? NRC provides a common expectation for safety across the country that all operators understand they must meet. This provides a coherent standard by which decisions regarding plant operations and investment can be measured.

But this yardstick should not become a shepherd’s crook and plant managers should not be pushed into the role of sheep led about by the NRC staff. We must not create an environment in which plant decisions are made—or not made—with solely compliance in mind rather than plant safety. When owners refuse make safety-beneficial investments in a plant unless NRC requires them, we have all failed. When plant managers forego the installation of equipment that they believe would increase the safety of their plants because the NRC staff gives little or no credit for the installation, we all need to take a long look in the mirror. Are these the outcomes we expect and want? For my part, I don’t think that they are.

Think about the practices that have evolved over the decades and the cultures we have established—both good and bad. For many of the people who regulate and operate plants today, the current balance between regulator and licensee is viewed in the context of the 35 years since the Three Mile Island accident. They have the perspective born of experience to know how to draw the lines and how they have shifted over time.

With a new generation gaining prominence in both the industry and the NRC, the experience of the past is fragmenting into snippets of history and legend. I am very proud of the important role the Federal government in general and the NRC in particular have played in supporting nuclear technology education in the United States. What we have accomplished has helped prepare us for the changing of the guard and assured that the most important pillar of our nuclear safety infrastructure—highly trained people—will remain strong for many years to come. That is a success story.

But this new generation of engineers and scientists, as quick and bright as they are, lack the experience of the days when dozens of new plants came on line and plant transients were all too common. The experience of those who managed NRC and the industry through those times is fading from the scene, never to be replaced. Even with NRC's excellent training programs, this is a reality that cannot be evaded.

However, these young people will also bring new ideas, new energy, and new approaches as they grow into positions of increasing responsibility. Even now, in plants across the country and in the halls of the NRC, this new generation pushes us into the future. I imagine they are sometimes frustrated by the structures and practices of the ruling generation. As T.E. Lawrence wrote in his memoir *Seven Pillars of Wisdom: A Triumph*, "Youth could win, but had not learned to keep, and was pitifully weak against age." But I say to them, be patient. Your time is coming soon and the responsibility for nuclear safety will pass to you all too quickly. Your challenge is to be ready to accept the responsibility when that time comes.

One of the greatest aspects of the RIC is the participation of so many of our friends and colleagues from around the world. Welcome to all of you and thank you for attending this year's conference. Your presence today is no longer a luxury or a convenience. It is a vital necessity.

I've often reflected on that moment, during the signing of the Declaration of Independence when Benjamin Franklin famously remarked "We must all hang together, or assuredly we shall all hang separately." This comment applies to many things in life, but even Franklin could never have forecast how well it applies to a group like the 3100 people in this hall today.

Nuclear power is a global undertaking and we are in this together. We are married to each other. We are held hostage by each other. We are each other's best friends and worst enemies. We are at once buyers and suppliers. We are teachers one day and students the next. The relationships and cooperation we share are part of the modern foundation of nuclear safety in all of our countries. We must seek to expand and extend them.

Thus with the engagement with our colleagues across the globe; our focused mission and disciplined processes; our Commission structure; and our ability to change when change is required, we will go forward. By reinforcing the understanding that operators—not regulators—are responsible for safety and by continuing our investment in the next generation, the pillars are in place to assure that the Nuclear Regulatory Commission will continue its impressive success and be prepared for the unknown challenges that the future will bring.

When the Atomic Energy Act became law 60 years ago, no one could have imagined the breadth and diversity of nuclear power and nuclear regulation as it exists across the world today. Our challenge is to find a way to make that diversity a strength from which to build a brighter, safer future for the publics we all serve.