NRC NEWS

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"Looking to the Future"

The Honorable Gregory B. Jaczko
Chairman
U.S. Nuclear Regulatory Commission
at
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Good morning, everyone, and thank you for that very kind introduction.

I was looking over the program, and it's a tremendously distinguished panel here this morning as well as throughout the conference. I think you will have some very interesting discussions in what is really, I think, a very interesting time.

I thought I would talk a little bit today about some of the questions that I see that are out there in the nuclear industry. And I won't claim to have answers for most of those questions. I will give you some thoughts on what I think about some of those questions, but I hope that as this two-day conference goes on, perhaps some of those questions will have answers more fully fleshed out.

Today is a very unique day and a very unique time for the nuclear industry. It was only within the last several weeks that the Blue Ribbon Commission on America's Nuclear Future – which was looking at spent nuclear fuel and geological repositories -- issued their report, which perhaps provides an answer to a long-standing quest in this country to come up with a feasible way to develop a geological repository.

I think as was mentioned, today the Commission will be meeting to make a final decision on the mandatory hearing for the Vogtle COL application. Had I been speaking to you about 1:00 p.m., I would probably give you a very different talk than I am going to give you this morning. So I can't really say much more about that than what I said already.

Our staff at the NRC are continuing to meet to tackle what we refer to as the Tier 1 Fukushima recommendations. Those are a series of eight recommendations that have been

established by the Commission as really the top category of activities that need to be moved forward in the near term. And the Commission is expecting to get a proposal from the staff on specific ways to address a subset of those recommendations in about two weeks.

So that is some of the landscape of the work and the activity that we have in front of us, running the gamut from spent fuel storage to new reactor licensing to Fukushima response. But at the same time, of course, we have a fleet of 104 operating reactors that continue to be the primary day-to-day focus of the agency.

And of course at this time we find ourselves in a somewhat unique situation from recent experience. We have one plant in column 4 of our action matrix, so that is a plant that is getting more significant oversight from the NRC. And we also have another plant which is a Manual Chapter 0350 plant, which is getting a little bit more exposure and oversight and there are some additional conditions for potentially restarting that facility.

So, again, we have some new situations, but things that are not historically too far out of the norm, but certainly present some challenges and issues for us I think as we go forward.

So as I said, perhaps we will have more in the way of questions that I will leave you with today than answers for some of these.

As I was thinking about preparing these remarks, one of the things that I believe we often don't do a good enough job on, is trying to look out into the future to see where we will be and where we want to be in nuclear safety, and where you want to be as a nuclear power And I will share with you an experience. I went to visit another country as part of my responsibilities as Chairman, and I had a long discussion with the regulators, with people in the industry in that country, about their future and what they intended to do for nuclear power.

They had a very ambitious program for nuclear power development that would take them out 30, 40, 50 years. And they were making decisions today to prepare themselves for decisions that they were going to need to make in 20 or 30 years.

So one of the things that I was thinking about is: what are the decisions that we need to be making today to ensure that we are at the right place 20 years from now? And the question I would ask is, what is the future of nuclear safety?

Twenty years from now, what kind of a future do we see for nuclear regulation? Well, of course, hovering over all of this are the past occurrences. There have probably been three really seminal accidents or incidents at nuclear power plants, commercial nuclear facilities.

Of course there was Three Mile Island here in the United States. It was an accident. There were no significant releases of radiation, but it created a tremendous amount of activity and work for the U.S. Nuclear Regulatory Commission and very much changed how we did our job. It changed the very nature and structure of the NRC itself.

Following that, several years later, was the Chernobyl accident. And of course that had profound impacts on the way nuclear safety was conducted. Chernobyl was the impetus for a number of enhanced international agreements and international efforts to better share information about nuclear safety, to ensure that there were better ways to communicate and share information and ensure consistency and increase the regulatory competence in as many countries as possible.

Then, of course, the most recent incident was the Fukushima Daiichi accident. And if you look at these three incidents together, one of the things that struck me as I was looking at this, is there is definitely a progression. And it's an interesting progression, because generally what we want to see as we learn more and we have a better understanding of nuclear safety, is that the accidents decrease in their magnitude and severity.

But to some extent, we haven't really seen that. The first accident -- Three Mile Island -- did not have a significant release. It did not lead to significant offsite consequences. But that of course was not what happened at Chernobyl. It was not what happened at Fukushima.

I think there are a lot of reasons for that. One is that I think we have done a very good in the safety world of addressing and tackling the more likely, smaller types of accidents. In many ways, we have done a lot to really prevent the Three Mile Island type of accidents.

But I think what this tells us, and what it may show us, is that we have not done enough to prevent the more significant severe accidents. Now, that may not be something that is possible. And that is a question that I want to explore a little bit more -- what that would mean, and can we really get to a place in which we can prevent severe accidents?

Now, I think if you look at the countries that are involved in these accidents, in looking at the United States, the former Soviet Union, and Japan, we are looking at countries that are considered to have very mature nuclear programs.

So as we look at the future of nuclear safety, clearly in those countries that have mature nuclear programs there are still things that we need to focus on and need to consider. One of the most important, and will always be the most important, is ensuring a trusted and credible and reliable regulator.

I think in many ways the U.S. NRC is a world leader as a regulator today, because of what happened at Three Mile Island. It caused us to change how we do our work, change our practices, and change the way we go about nuclear safety. But we have had the benefit of 30-some years since that accident to refine and develop what is now I believe a very mature and very stable regulatory program.

But it is certainly one in which we can learn and we can do better. If we look to the future in 20 years, there will certainly be continuing challenges with those mature nuclear regulators. But in 20 years, we may also be introducing new entrants.

The IAEA has forecast that there are 60-some entrants or countries that are interested in getting into the commercial nuclear business. So as we look 20 years from now, one of the most

important things I think for us as a regulatory community, and for those of you in the industry, is to ensure that those new entrants don't go through the same kind of learning curve that the mature regulators have gone through.

That means we don't want to see an accident in one of these countries that forces a rethinking and a reevaluation of the regulatory infrastructure, changes to the regulator that are made because of the response to a significant incident.

As we look at these new entrant countries, we really have to understand what it is that led these mature countries down the path in which their regulatory systems or their industry did not properly do something which then led to a severe accident or some type of accident.

And I think one of the things that in this country has made us very unique is the role that INPO plays. It's a very unique model. It provides a tremendous opportunity for licensees and utilities in this country to improve and refine their performance and to fill a gap that the regulator never can fill.

As we look 20 years out, I think one of the most important areas in which we need to ensure improvement is on some type of INPO organization for other countries. Ensuring that this type of structure exists to complement the work that the regulator does is, I think, crucial. I believe it is one of the key reasons for the tremendous improvement in the capacity factors in this country and the performance of utilities in this country. Of course, I think a large measure of credit goes to the work of the NRC as well, but I believe INPO plays a very, very important role.

So what type of organization can fill that void in other countries? Clearly, right now the most reasonable candidate is WANO. And as we look 20 years from now, one of the things that we need to think about today is, what do we want WANO to look like in the future? And how can WANO develop and grow today, so that 20 years from now it can play the kind of strong role that INPO plays in the United States today?

It is one of those areas where I think investment today will pay tremendous dividends into the future, and, in particular, to help those new entrant countries as they begin to embark on nuclear programs. And hopefully we will be able to prevent them from having to go through the learning curve that so many of us in the mature countries have gone through.

Now, I want to touch on another subject, again thinking about where we will be 20 years from now. As the nuclear industry in this country has developed, and as nuclear safety in this country has developed, one of the areas we have begun to explore more and utilize more is the area of risk analysis and what we call risk-informed regulation.

This is still very much a young activity in this country, but I would say that in the United States, and in the U.S. Nuclear Regulatory Commission, we are probably one of the more dominant users of risk information, and the U.S. nuclear industry is one of the more dominant users of risk information relative to other countries. But we are still at a very early stage in development of this kind of activity.

So as we look at the future, 20 years from now, one of the things that I believe is very important to think about is what role risk information will play in regulatory decisions, in economic decisions, in business decisions, in safety and operational decisions at nuclear power plants.

And I believe it is very important to put a lot of this in the context of Fukushima. I think it raises some very interesting questions for us today that we need to analyze and address if we want risk information to play a much more dominant role in the future.

The first and most important question may be: how do we properly model risk for nuclear power plants? And by that I don't mean how do we develop the computer codes, how do we do the analysis, but what kinds of things are we really interested in when it comes to accident consequences?

If you look back to the work that we have done, the metrics that we use are metrics based on exposures to radiation and the effects that those have on people. There are basically two types of these -- the prompt radiation health effects, and the latent radiation health effects.

So risk tells us things like that. We can develop models; we can develop the probabilities and likelihoods of certain individuals, in certain accident scenarios, being exposed to a certain amount of radiation that may have a potential either for a prompt health effect or latent health effect.

Now here is where things get a little bit difficult, as we look out to the future. While Fukushima was certainly a very significant event, it was not a very significant event from the risk metrics that we currently use in terms of those health effects.

So the question is: what does that tell us about the use of risk? Is it an effective metric? To some extent one could argue that based on the risk models, accidents like Fukushima will happen -- hopefully with a very unlikely or low frequency, but they will happen -- and they are acceptable. They are well within our risk metrics, primarily because we ultimately had a robust system that allowed people to be evacuated and allowed ultimately for people to be relocated from any exposure to radiation.

Now, I think if I were to talk to an average person on the street and say that, people would say no, that was a pretty significant event. And I personally think that's right. I think that this was a significant event, and it was an unacceptable event. But if we look at the risk models that we use today, it is not -- in our risk models -- an unacceptable event.

There were no prompt fatalities, the latent cancers are dramatically reduced, and eventually we will get better projections and better understandings of what those will be. But they will likely not be significantly different from whatever background cancer incidents would likely have occurred in those areas without Fukushima happening.

So if we look today at our risk models, the most fundamentally missing piece, I believe, is the right way to characterize what we believe as societies are the unacceptable things about nuclear power accidents. But it is a very different way to think about these things than we have done in the past.

And by that, I mean it is the real human consequences that we are dealing with -- evacuations of large populations, perhaps extended relocation of populations; significant effort to clean up, decommission and decontaminate perhaps significant areas of land; the redevelopment and the loss of significant energy infrastructure; and the societal consequences that entails.

These are much more complicated consequences to model and characterize in our models. Land contamination we can probably do. We can do pretty good estimates of what it takes -- what the material deposition would be, what generally it would take to remediate soil. We can put a cost on that right now and have a pretty good way to model what that land contamination will be.

But I don't think we have a good way right now to determine what is the effect of a relocation of a population for two months, three months, four months, five months, perhaps a population that can never return to a specific area. These are very, very difficult things to model.

And if we look to a risk-based approach or risk-informed approach, these are things we need to begin to understand today, so that we can better prepare for the kinds of actions that are likely to happen in the future. While I don't think we have the ability to prevent accidents, I do think we have dramatically reduced the likelihood that there will be accidents in which we see any type of prompt fatality and any type of significant impact from a latent health exposure from direct or indirect radiation exposure.

It is the intangible health effects of displacing a population from their homes, from their friends, their families, from the schools their children attend -- those are the kinds of intangibles that we don't account for right now in our understanding of consequences.

So as we look to the future, for a risk analysis framework, if we are going to be honest about talking about the consequences, we have to figure out a way to encapsulate these ideas into our risk models. That will be very, very difficult to do. I don't think it's impossible, but it will be a significant and difficult task as we go forward.

Now, I will just close with just a few points here. I think as we look at these issues it is very important to think about ultimately, what do we want accidents to be? Do we as an industry, do we as regulators, believe that severe accidents are acceptable or not? I would say today we believe that severe accidents -- while we work to reduce them -- are unavoidable, that it may be that severe accidents will happen.

I think pre-Fukushima more people would have said, "No, I don't think severe accidents are possible." I think today, certainly in my opinion, I think that they are.

That is an interesting policy question and a policy choice that we have to tackle as a society. Do we find that as an acceptable metric? And if not, what are the things we need to do today, to work towards achieving that? And, again, this is not to say that there will likely be accidents or severe accidents. They are still very, very unlikely events.

But I think all of us today would acknowledge that we can't with certainty say that they won't happen. That there is a very, very small probability or likelihood, but there is still a severe accident possibility.

So, again, as we look to the future, I think it's important that we begin to think about these things and understand what the nuclear safety paradigm will look like in the future. Is it one in which we will do risk modeling that accounts for the consequences of severe accidents in a very different way than we do today? Will we account for the more likely consequences that we will be experiencing and consequences which to society are probably unacceptable just as prompt fatalities, significantly enhanced latent health effects would be?

If I were to look to the future, instead of looking at things like large early release frequencies and core damage frequencies, to me the metric that we are really looking at, that I think would really describe a societally acceptable consequence, is that accidents can't lead to the need for evacuation.

That is a very different risk metric than anything we have used before, but it addresses all of the uncertainties in trying to figure out how you quantify the health effects on an individual from extended relocation. How you quantify the costs for cleanup of significant areas that may have been contaminated by a severe accident.

It's just a very different approach to our risk metrics and our risk calculations. And quite frankly, it would lead to a very significant rewrite of the Commission's safety objectives and safety goals.

So, again, I'm not saying I have the answers for any of these questions right now. But I pose these for you to think about, in where we want to be 20 years into the future. If I look 20 years into the future I think I can see two different scenarios for the nuclear industry, one perhaps more active than the other.

I think there is certainly one that for the industry is probably the most ideal, and that would be 20 years from now we see -- either in operation or under construction -- a large number of small module reactors; a smaller but increasing number of generation three reactors; perhaps a number of reactors operating in 60-plus years of operation, beyond their original 40-year life in their next 20 years of operation; a geologic repository under construction, fuel in interim storage facilities throughout the country, or in a few select locations throughout the country; and a continuous process of construction of new reactors, generally of Gen Three type, and small modular reactors.

That is one vision, and that is one that is certainly possible. But what you should think about is, what is it that needs to be done today for that vision to be realized? Because there are things that would need to be done for that to be realized. And none of those things that I laid out, while I'm sure there are many of you who would dream of that as the ideal future, I'm not sure that there is any of you that would say with certainty that is where we will be in 20 years.

I will give you another scenario, which perhaps is just as plausible. In 20 years, we can see ourselves with a few unsustainable Gen Three reactors in this country. And by "unsustainable," I mean plants that have been built today, or in the next few years, that are suffering from a dwindling

workforce, a lack of expertise in nuclear technology, a lack of interest in young people in going into the nuclear industry, no geologic repository, no geologic repository option in sight, and fuel sitting at decommissioned reactor sites.

And instead of a process of continuous construction of nuclear reactors, we are seeing the industry dominated by a process of continuous decommissioning, and embarking on a process and a long-term trend of continuous decommissioning.

Now, I don't think today either one of those scenarios is more or less likely than the other. But I think today there are a number of decisions about nuclear safety and actions related to nuclear safety that may move you on one of those paths versus the other path.

As I said, I perhaps am offering you more questions than there are answers. I wish I could spend more time to stay here and listen to the panels and hear the discussions that you are going to have, because I think in many ways a lot of these things are topics that you will be touching on. It looks like you have a tremendous schedule in front of you. I thank you for your attention.