NRC NEWS

U.S. NUCLEAR REGULATORY COMMISSION

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No. S-06-030

The Meaning and Proper Use of "Risk"

Prepared Remarks by
The Honorable Gregory B. Jaczko
Commissioner

at the Quadripartite Meeting
Washington, DC

October 19, 2006

Good morning. I would like to thank the Advisory Committee on Reactor Safeguards, specifically Graham Wallis and John Larkins, for the opportunity to be here today. This is an opportunity to speak to a diverse and distinguished group of U.S. and international nuclear advisory panels that Commissioners do not often have.

You may be wondering what exactly a Nuclear Regulatory Commission (NRC) Commissioner actually does on a daily basis. Well, we do a lot of things focused on developing the high-level policy of the agency. Sometimes we act as lawyers, and practice law without a license, but what concerns me more is when we practice risk analysis without a license.

An acceptable level of risk to the public is ultimately not a technical determination. Risk is simply a tool we use to make decisions. Too often at the Commission level we are not dealing with tangible risk information, but with the perceptions of risk. This idea lays the framework for what I want to speak about this morning.

The country and the world are at a crossroads on the potential deployment of new electrical power sources. Nuclear power contributes 20 percent of this nation's power supply. We would need scores of new plants by 2030 and 2050 just to maintain that 20 percent figure.

Should the markets and energy policy makers choose to maintain the nuclear option, which looks likely, regulators will have more sophisticated risk tools with which to assess the impact of these facilities on public health and safety. You will most likely be using these tools to advise the regulators in your respective countries on important safety issues.

I would like to take a few minutes to discuss one of those tools. Recently the staff decided to update the 1982 consequence analysis study, also known as NUREG/CR-2239, "Technical Guidance for Siting Criteria Development," which indicated quite severe consequences from low probability events. Many people look to this study to evaluate how accepting they are of nuclear power. It is often quoted in the press and by the public interest groups.

The 1982 study did not do a good job, however, of explaining the concept of risk. The document did convey consequences but did not put those consequences and the low probability of them occurring into the proper context. So, the conclusions of this study are often misunderstood.

Because of the lack of clarity provided by the 1982 study, and because of the advances that we have made in our understanding of the behavior of radioactive materials in the intervening decades, the agency is now undertaking an update. The agency is, however, attempting to move away from addressing higher consequence events by arguing they are of such low probability that they are no longer worthy of consideration. This staff proposal, which the Commission endorsed, involves only analyzing the consequences of events whose large early release frequency is 1x10E-6 or greater.

I argued unsuccessfully that this was not the proper approach to updating the consequence analysis study. All this proposal does is to define a certain narrower range of events and analyze the consequences of that predefined and somewhat arbitrary frequency of occurrence.

I believe that we should analyze the full spectrum of events that is physically reasonable to occur at a nuclear power plant. The only way to comprehensively address the consequences of accidents is to focus on those consequences regardless of the probability that they will occur. If we only focus on what is most likely to occur, we will always have doubts and gaps in our knowledge of events which *could* occur.

I believe that as the agency has learned to work with risk tools and become comfortable with them, we have developed a tendency to overly rely on them. I am concerned that the staff and the Commission have tended not to assess risk, but rather to use probability as a surrogate for risk. As we all know, Risk equals Probability times Consequences, but we seem to want to focus on the probability and not the consequences.

Safety is a policy decision. It involves many variables other than just risk. But we have developed an aversion to true and complete consequence analysis. Because we avoid thorough consideration of those events that have a low probability of occurring, we send the wrong message to the public.

One event that piqued my interest was the idea of a steam explosion or alpha-mode failure. I asked the staff to brief me on this event and the specific question I conveyed to them in preparation for the briefing was the following: Is this an event that is of low probability of occurrence or is it an event that is physically not possible to occur?

Back in the 1990s the research community revisited this event and the response I received from the staff after a very good briefing was that this event is of very low probability and is also not physically reasonable to occur.

After the staff briefed me on the alpha-mode failure concept, they provided me with NUREG-1524, which is a July 1996 manuscript on the reassessment of the alpha-mode failure. At the end of this document was what I would consider a dissenting opinion by Dr. Bal Raj Sehgal of the Royal Institute of Technology, Sweden. His paper's first section was titled, "What is the meaning of all those probability estimates?" He noted that he did not fully understand the 10E-6 and10E-5 values advanced at the meeting. What were they based on? What was the level of confidence in the numbers?

Dr. Sehgal argued that the best numerical estimate of alpha-mode containment failure probability that he could actually calculate with a high degree of confidence was 10E-2. In other words, he felt comfortable stating that he was 99.9% certain that the chance of an in-vessel steam explosion causing a PWR containment to fail given a core melt is less than one in 100. That was the most precise probability he could calculate with confidence given the information at his disposal.

He goes on to argue, however, that even though he cannot calculate this event is of a lower probability, he believes it is physically unrealistic to assume that such a failure will occur.

I believe this explanation does a lot to explain the distinction between our ability to calculate probability and a clear look at whether something is physically reasonable. Here we have a relatively high probability event that is not physically reasonable and therefore does not require much concern on the part of a regulator.

I use this example to caution against ignoring the consequences of the opposite of those types of events, events that have a low probability of occurring and high consequences, and are not physically unreasonable.

Why is this concept so relevant today? It goes to the heart of how we regulate.

We are in a new era. We not only have to assess the risk associated with random accidents, now we have to assess the risks of terrorism.

The Commission has done a great deal of work through the national labs to assess the impacts of large aircraft hitting a nuclear power plant. This research was expensive and supported the conclusion that in the unlikely event of a radiological release due to a terrorist attack, there would be time to implement the required offsite planning strategies already in place to protect public health and safety. That is about as far as I will delve into the matter today.

However, I believe the Commission should require that any new plants are designed to withstand an attack by aircraft. For the current fleet of plants, we have assessed the damage that may occur and required licensees to develop mitigating strategies to protect the core, containment, and spent fuel pool in the event of damage from large fires and explosions. I am comfortable with this approach with the current fleet of reactors.

We should not, however, miss this opportunity to design new facilities in a way that would not require such mitigating strategies. Significantly improved separation and protection of systems necessary to maintain core, containment, and spent fuel pool integrity must be a requirement for the next generation of nuclear power plants.

I will leave you with two thoughts:

1) Probability cannot be a surrogate for risk. We must get the consequences of low probability events out to the public in a properly conveyed context. If we do not, the public will always default to the 1982 study as the real consequences of an accident.

2) Risk is only one input. Safety is a policy judgement.

Thank you again for this opportunity and I look forward to answering any questions you may have.

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