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"Material Issues"
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Thank you for this opportunity to offer some informed public perceptions on the theme of "Pro-active Management of Material Degradation"

A clearly articulated theme recurs through the NRC Office of the Inspector General and Government Accountability Office reports on the agency's mishandling of the Davis-Besse vessel head corrosion degradation.

The agency cannot effectively manage materials degradation issues in the absence of demonstrating an effective enforcement program.

NRC Office of Inspector General, December 30, 2002
"Staff considered the financial impact to the licensee of an unscheduled plant shutdown."

"NRC appears to have informally established an unreasonably high burden of requiring absolute proof of a safety problem, versus lack of reasonable assurance of maintaining public health and safety, before it will act to shut down a power plant."

U.S. Government Accountability Office, May 2004
"NRC did not have specific guidance for deciding on plant shutdowns."

How has NRC addressed or not addressed key Davis-Besse findings on its regulatory interface with material degradation in other reactor systems, structures and components than the reactor pressure boundary with an lessons learned program?

One area of continuing concern with respect to these findings which we will focus our comments today on is fuel cladding materials performance and its significant role in the agency's philosophy and practice of defense-in-depth.

Fuel cladding represents the first and primary protective barrier from the release of fission products. There are a variety of cladding materials. Everyone in this room will agree that from an operational standpoint, fuel rods must remain intact to provide the overall structural integrity of the fuel assemblies. The fuel design bases ensure that *"the fuel is not damaged as a result of normal operation and anticipated operational occurrences."* (NUREG-0800, Standard Review Plan, Section 4.2. Fuel System Design) The phrase "not damaged" as used by both NRC and industry, means that the fuel rods are not damaged to the point that they would fail. The public reads this to mean that the fuel design bases include the explicit requirement that fuel cladding remains intact during normal operation.

Historically this has not been the case, however.

In 1983, Surry Unit 1 damaged fuel rods were discovered due to metal chips that had been left in the reactor coolant system.

In 1986, the owner of Point Beach Nuclear Plant reported "The fuel cladding was failed to the extent that fuel pellets could be seen through the hole in the cladding. However, no pellets escaped from the rod." The cladding failure was detected when radioactivity levels in the coolant rose to a level that was "10 percent of that allowed by Point Beach Operating license." (Wisconsin Power Co. LER 85—002-01, May 19, 1986) In other words, the station's operating license would have allowed it to remain critical with up to nine other similarly failed fuel rods. The Union of Concerned Scientists has stated that this event suggests that the restrictions on reactor water radioactivity levels are too high to prevent operation with gaping holes in fuel rod cladding.

In 1989, Connecticut Yankee had 480 fuel rods damaged by metal chips present in the coolant even though during the 16 month operating cycle, coolant activity indicated only minor fuel damage was occurring. During this same time frame, 54% of U.S. reactors were operating with defective fuel.

In 1993, Palisades nuclear generating station discovered three portions of a broken fuel rod in different parts of the reactor. One 5 ½ feet long segment was missing about one-third of its fuel pellets. A second segment, 4 ½ feet long, and a third segment, 1 ½ feet long, appeared to contain all their fuel pellets. (NRC Information Notice 93-82, October 12, 1993).

Trending continues to show significant instability in fuel performance due to material failures caused by personnel performance including inattentiveness to control debris in the coolant and water chemistry, Pellet Cladding Interaction, and still undetermined mechanisms.

Today, at a one given time, 25% to 33% of U.S. power reactors are still operating with defective fuel.

Even industry recently pointed out that the past several years as unacceptable trending years.

On February 24, 2005, the Vice President of Nuclear Fuels for Exelon Generating Company stated to the Commission that at one point during 2003 eleven of its units were operating with failed fuel including the LaSalle and Quad Cities units. The senior manager is quoted as saying “This is the epitome of an unacceptable number of fuel failures.”

NIRS has identified that between 2002 and 2003 LaSalle released 37,000 curies of radiation to the environment due to operation with failed fuel, more than double the total released radioactivity from the site between the years of 1982 -1994.

Quad Cities 1 operated from May 20, 2002 with failed fuel until May 2003 when Exelon replaced 233 defective fuel assemblies <u>after</u> becoming the industry leader in radiation exposures to its workforce.

It is the public's perception that a company that can delay its regard towards rising numbers of fuel failures over eleven facilities with increasing exposures to its workforce is also highly suspect to disregard radiation exposures to the downwind public.

However, a review of the Quad Cities Reactor Coolant System Activity performance indicator submitted by Exelon for this period appeared "acceptable" without even a comment referencing conditions warranting the replacement of 233 defective fuel assemblies.

<u>It is</u> also our understanding that current regulations allow NRC to permit nuclear reactors to operate with defective fuel cladding, <u>but</u> only when operators establish acceptable boundaries based on the analysis of both normal operating and accident conditions.

Federal regulations do not permit nuclear power stations to operate in unanalyzed conditions and the safety analyses for each and every nuclear power station assume that <u>all</u> three barriers are intact prior to an accident.

What might happen if a reactor with failed fuel had an accident? Say the accident involves a large pipe break connected to the reactor where water and steam rushing out creates a dynamic cross-flow that pushes fuel rods to the side rather than towards the top. Weak cladding could fail causing the fuel rods to shift out of their vertical alignment possibly preventing control rod insertion. The safety analysis assumes that the control rods can insert. Pre-existing cladding failures have not been considered in the safety analysis for this accident or any other accident. Yet units like Quad Cities are allowed to operate with hundreds of defective fuel rods.

We are therefore left with a number of questions including whether this same level of admittedly “unacceptable” performance is acceptable or unacceptable under the NRC oversight process?

With regard to the oversight of the overall fuel performance cycle (including reactor operations, fuel handling, interim storage, transport and repository storage) at what point in the Significance Determination Process is fuel cladding failure indicated as a RED finding under the “Unacceptable Performance Band”?

Is the Reactor Coolant System Activity Performance Indicator an effective metric if it has failed to track failed fuel conditions deemed “unacceptable” by industry?

How has “Staff considered the financial impact to the licensee of an unscheduled plant shutdown” with regard to allowing continued reactor operations with such significant and “unacceptable” fuel cladding failures?

To what extent has NRC once again “informally established an unreasonably high burden of requiring absolute proof of a safety problem, versus lack of reasonable assurance of maintaining public health and safety, before it will act to shut down a power plant” specifically in regard to unanalyzed conditions involving significant number of fuel cladding failures evidenced.

What is NRC’s “specific guidance for deciding on plant shutdowns” that are experiencing a significant degree of fuel cladding failure resulting in an unanalyzed core condition?

Moreover, while industry and fuel vendors are involved in collaborated efforts toward addressing ongoing fuel performance issues to what extent is the further withholding of information from the public less a proprietary issue and more an issue of the lack of regulatory transparency?

Conclusion

The public, the industry or the NRC cannot afford to wait for an operational event to determine that widespread fuel cladding failures were not adequately analyzed under accident conditions or for that matter all operational conditions and that NRC failed to take timely, effective corrective enforcement action.

While both industry and regulator have claimed that the material degradation resulting in failed and leaking fuel is not a safety issue, in our view as public health and safety advocates the function of the fuel rod cladding not only has an operational role but clear and undisputable safety functions to include providing the first and primary barrier for the retention of fission products and providing structural integrity to ensure effective cooling of the reactor core geometry. But beyond the reactor core, fuel cladding integrity has a critical health and safety role in interim storage in both fuel ponds and dry casks, during transportation and whatever long term storage mode is ultimately adopted. To say that there are no health and safety issues is to ignore or obfuscate the significance of this fuel materials issue and allow NRC to further postpone coming to grips with its appropriate regulatory interface and enforcement responsibilities.