



## UNLEARNED LESSONS OF YEAR-PLUS REACTOR OUTAGES: Q&A

Since the first U.S. commercial nuclear power industry began operating in 1957, severe problems have caused U.S. nuclear reactors to shut down 51 times for a year or longer. More than 70 percent of those outages were caused by programmatic breakdowns that led to cumulative, systemic degradation of reactor components. Basically, the owner's failure to find and fix problems caused safety margins to deteriorate to levels so low that reactor operations could not continue.

The fact that no U.S. nuclear power reactor has experienced significant core damage since the partial meltdown at Pennsylvania's Three Mile Island (TMI) in 1979 suggests nuclear power is safer today. Unfortunately, arguing that it is safe today is as fallacious as arguing that the levees protecting New Orleans were fully adequate prior to Hurricane Katrina by pointing to the absence of similar disasters between 1980 and 2004. Yes, reactors have been shut down before they experienced a major accident, but we cannot and should not assume our luck will continue.

Q. How many year-plus reactor outages have occurred?

A. UCS identified fifty-one (51) year-plus reactor outages, which occurred at 41 different reactors.

Q. What caused the majority of the year-plus reactor outages?

A. More than 70 percent of the year-plus outages were caused by cumulative, systemic degradation of reactor components and erosion of safety margins in the plant. These resulted from extensive violations of safety regulations within the plant, coupled with a failure by the Nuclear Regulatory Commission (NRC) to flag these violations. Federal regulations require nuclear plant owners to have quality assurance (QA) programs that find and fix problems in a timely manner. Ineffective QA programs, which resulted in these widespread problems at the plants, caused 36 of the 51 year-plus reactor outages. The NRC was either unaware of the inadequacy of the QA programs or unable to compel them to be improved. In each case, it took at least a year and untold millions of dollars to undo the damage caused by years of combined neglect.

Q. What is it about year-plus reactor outages that prompted UCS to study them?

A. Nuclear power reactors were built for one reason – to generate electricity. Their owners are extremely anxious to return idle reactors to service. Shutting down a reactor for a year or longer is therefore significant. The vast majority of these outages were caused not by the failure of a major component, but by widespread problems throughout the plant. That it takes these highly motivated owners longer than a year to fix enough of the reactors' problems to allow restart suggests how far safety levels had fallen. The fact that year-plus reactor outages happened so often suggests to UCS there is a long-standing behavior pattern that needs to be understood and corrected.

Q. Doesn't the fact that there have been 51 year-plus outages instead of 51 meltdowns demonstrate that the regulator has indeed been very effective?

A. 51 year-plus reactor outages are undoubtedly better than 51 reactor meltdowns. But for both safety and economic reasons it would be far better if the NRC monitored safety levels closely enough so that it intervened *before* safety levels had eroded so badly that it took longer than a year and tens to hundreds of millions of dollars to restore them to acceptable levels.

Q. When was the first year-plus reactor outage?

A. On October 5, 1966, the Unit 1 reactor at the Fermi Atomic Power Station outside Detroit, Michigan was shut down when unexpectedly high radiation levels were detected along with

anomalous behavior of the reactor core. Subsequent investigation revealed that a metal sheet had broken loose within the reactor vessel and blocked coolant flow to some of the fuel in the reactor core, causing damage to that fuel from overheating.

Q. When was the most recent year-plus reactor outage?

A. The Davis-Besse nuclear plant in Ohio restarted in March 2004 following its two-year-plus outage. However, more outages are on the horizon: the safety problems recently identified at the Salem and Hope Creek nuclear plants in New Jersey match or exceed those that caused both Salem reactors to be shut down for year-plus outages in the mid-1990s. But so far the NRC has opted not to apply the same cure to this recurring disease. These problems have occurred so often in the past (i.e., 36 year-plus reactor outages) that it's unreasonable to believe they will magically heal themselves without some fundamental change. Absent the NRC undergoing that fundamental change, it's only a matter of time before the names of additional reactors suffering through year-plus outages will be appended to our list – or worse, the safety erosion triggers a nuclear accident.

Q. Which reactor had the most year-plus outages?

A. Ten reactors share top dishonor with two year-plus outages each: Browns Ferry Units 1, 2, and 3 (AL); Davis-Besse (OH); Indian Point Unit 3 (NY); Nine Mile Point Unit 1 (NY); Peach Bottom Unit 2 (PA); Pilgrim (MA); Sequoyah Unit 1 (TN); and Surry Unit 2 (VA).

Q. Can the primary cause of year-plus reactor outages be remedied?

A. The primary cause of year-plus outages is operating plants in a way that allows cumulative, systemic degradation of reactor components and erosion of safety margins. There's no question it can be fixed. The question is whether it will be fixed. NRC attention to the secondary and tertiary causes of year-plus reactor outages successfully eliminated them – there hasn't been a year-plus outage from these causes in over a decade. NRC attention to the primary cause of year-plus outages should be equally successful in ending their recurrence. If, that is, the NRC will pay proper attention to that leading cause.

Q. How can NRC remedy the primary cause of year-plus reactor outages?

A. The NRC must change how it evaluates the adequacy of QA programs. A federal regulation, specifically Appendix B to 10 CFR Part 50, requires plant owners to have QA programs that effectively find and fix problems in a timely manner. More than 70 percent of the year-plus reactor outages were caused by inadequate QA programs that failed to find and fix safety problems. A contributing factor to the outages was the inability of the NRC to notice that the federal regulation was being violated and safety problems were accumulating.

The way NRC evaluates corrective action programs today is baffling. When an NRC inspector identifies a problem at a plant, that information is entered into the plant's QA program. But an NRC inspector can identify a problem if and only if plant workers failed to find it, or plant workers had already found it but failed to fix it. Since the only purpose for the QA program is to find and fix problems, each problem identified by an NRC inspector is an irrefutable sign that the QA program failed. Every problem identified by an NRC inspector should trigger an explicit evaluation into why the QA program failed so that holes can be plugged before more safety problems fall through it. Currently, that is not being done.

Q. How can we assure that the NRC remedies the primary cause of year-plus outage?

A. The NRC has much on its plate (e.g., security issues after 09/11, license renewals, potential new reactor licenses, etc.). It is critical that Congress provide active oversight of the important work being done by the NRC. Such oversight will be improved when Congress requires the NRC to provide updates on its efforts to prevent extended reactor outages in the NRC's monthly report to Congress.