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THE NRC AND NUCLEAR POWER PLANT SAFETY IN 2010

A Brighter Spotlight Needed



EXECUTIVE SUMMARY

MARCH 2011

This report is the first in an annual series on the safety-related performance of the owners of U.S. nuclear power plants and the Nuclear Regulatory Commission (NRC), which regulates the plants. The NRC's mission is to protect the public from the inherent hazards of nuclear power.

In 2010, the NRC reported on 14 special inspections it launched in response to troubling events, safety equipment problems, and security shortcomings at nuclear power plants. This report provides an overview of each of these significant events, or "near-misses."

This overview shows that many of these significant events occurred because reactor owners, and often the NRC, tolerated known safety problems. For example, the owner of the Calvert Cliffs plant in Maryland ended a program to routinely replace safety components before launching a new program to monitor degradation of those components. As a result, an electrical device that had been in use for longer than its service lifetime failed, disabling critical safety components.

In another example, after declaring an emergency at its Brunswick nuclear plant in North Carolina, the owner failed to staff its emergency response teams within the required amount of time. That lapse occurred because workers did not know how to activate the automated system that summons emergency workers to the site.

OUTSTANDING CATCHES BY THE NRC

This report also provides three examples where onsite NRC inspectors made outstanding catches of safety problems at the Oconee, Browns Ferry, and Kewaunee nuclear plants—before these impairments could lead to events requiring special inspections, or to major accidents.

At the Oconee plant in South Carolina, the owner fixed a problem with a vital safety system on Unit 1 that had failed during a periodic test. However, the owner decided that identical components on Units 2 and 3 could not possibly have the same problem. NRC inspectors persistently challenged lame excuse after lame excuse until the company finally agreed to test the other two units. When it did so, their systems failed, and NRC inspectors ensured that the company corrected the problems.

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Calvert Cliffs, Annapolis, MD

Many of the significant events described here occurred because reactor owners, and often the NRC, tolerated known safety problems.

POOR NRC OVERSIGHT

However, the NRC did not always serve the public well in 2010. This report analyzes serious safety problems at Peach Bottom, Indian Point, and Vermont Yankee that the NRC overlooked or dismissed. At Indian Point, for example, the NRC discovered that the liner of a refueling cavity at Unit 2 has been leaking since at least 1993. By allowing this reactor to continue operating with equipment that cannot perform its only safety function, the NRC is putting people living around Indian Point at elevated and undue risk.

The NRC audits only about 5 percent of activities at nuclear plants each year. Because its spotlight is more like a strobe light—providing brief, narrow glimpses into plant conditions—the NRC must focus on the most important problem areas. Lessons from the 14 near-misses reveal how the NRC should apply its limited resources to reap the greatest returns to public safety.

© NRC



Davis-Besse, Toledo, OH

The NRC can be an effective regulator, but it still has work to do to become the regulator that the public deserves.

Because we have not reviewed all NRC actions, the three positive and three negative examples do not represent the agency's best and worst performances in 2010. Instead, the examples highlight patterns of NRC behavior that contributed to these outcomes. The positive examples clearly show that the NRC can be an effective regulator. The negative examples attest that the agency still has work to do to become the regulator of nuclear power that the public deserves.

FINDINGS

Overall, our analysis of NRC oversight of safety-related events and practices at U.S. nuclear power plants in 2010 suggests these conclusions:

- Nuclear power plants continue to experience problems with safety-related equipment and worker errors that increase the risk of damage to the reactor core—and thus harm to employees and the public.
- Recognized but misdiagnosed or unresolved safety problems often cause significant events at nuclear power plants, or increase their severity.
- When onsite NRC inspectors discover a broken device, an erroneous test result, or a maintenance activity that does not reflect procedure, they too often focus just on that problem. Every such finding should trigger an evaluation of why an owner failed to fix a problem before NRC inspectors found it.

NUCLEAR NEAR-MISSES IN 2010

| Reactor & Location | Owner | Highlights |
|---|-----------------------------|--|
| Arkansas Nuclear One Russellville, AR | Entergy | Security problems prompted the NRC to conduct a special inspection. Details of the problems, their causes, and their fixes are not publicly available. |
| Braidwood Joliet, IL | Exelon | The plant owner knew about several problems but did not correct them, leading to a near-miss. The problems included a poor design that led to repeated floods in buildings with safety equipment, a poor design that allowed vented steam to rip metal siding off containment walls, and undersized electrical fuses for vital safety equipment. |
| Brunswick Southport, NC | Progress Energy | Equipment failure prompted the plant owner to declare an emergency. Workers did not know how to operate the computer systems that automatically notified offsite workers to report immediately to emergency response facilities. Staffing and preparing these facilities took far longer than required. |
| Calvert Cliffs Annapolis, MD | Constellation Energy | A roof known for years to leak when it rained allowed rainwater to short out electrical equipment. One reactor automatically shut down. A worn-out protective device that workers had not replaced because of cost-cutting efforts allowed the electrical problem to trigger an automatic shutdown of a second reactor. |
| Catawba Rock Hill, SC | Duke Energy | Security problems prompted the NRC to conduct a special inspection. Details of the problems, their causes, and their fixes are not publicly available. |
| Crystal River 3 Crystal River, FL | Progress Energy | Workers severely damaged thick concrete reactor containment walls when they cut a hole to replace steam generators. The ensuing inquiry concluded that the workers had applied more pressure than the concrete could withstand—a mistake that cost more than \$500 million. |
| Davis-Besse Toledo, OH | FirstEnergy | Workers discovered through-wall cracks in metal nozzles for control rod drive mechanisms in a replacement reactor vessel head. These cracks leaked because workers did not properly account for peak temperatures inside the reactor vessel. |
| Diablo Canyon San Luis Obispo, CA | Pacific Gas & Electric | A misguided repair to valves that would not open fast enough prevented other key valves from opening. Tests after the valve repairs failed to detect the problem. The reactor operated for nearly 18 months with vital emergency systems disabled. |
| Farley Dothan, AL | Southern Nuclear | A replacement pump had a part with a manufacturing defect. Excessive vibration levels caused the pump to fail when workers did not ensure that it met key parameters specified in the purchase order. |
| Fort Calhoun Omaha, NE | Omaha Public Power District | Pumps in an emergency water makeup system failed repeatedly over several years. The plant owner never identified the true cause of the failures, and therefore did not take the right steps to prevent their recurrence. |
| HB Robinson Florence, SC | Progress Energy | On the 31st anniversary of Three Mile Island, this event revisited nearly all the problems that caused that meltdown: bad design, poor maintenance of problematic equipment, inadequate operator performance, and poor training. |
| HB Robinson Florence, SC | Progress Energy | The same problems (see above) caused this reactor's second near-miss in six months: bad design, nonconforming equipment, inadequate operator performance, and poor training. This baggage reflected years of programmatic failures. |
| Surry Newport News, VA | Dominion Generation | After an inadvertent shutdown of the Unit 1 reactor, a fire began in the control room due to an overheated electrical component. A similar component in the Unit 2 control room had overheated and started a fire six months earlier. The company did not take steps to protect Unit 1 from the problem identified in Unit 2. |
| Wolf Creek Burlington, KS | Wolf Creek Nuclear | Seven hours after the reactor shut down automatically because of a problem with the electrical grid, an NRC inspector found water leaking from the system that cools the emergency diesel generators and virtually all other emergency equipment. An internal study in 2007 had forecast such leakage, and a leak had actually occurred after a reactor shutdown in April 2008. However, the owner had taken few steps to correct this serious safety problem. |

- The NRC can better serve the U.S. public and plant owners by emulating the persistence shown by onsite inspectors who made good catches while eliminating the indefensible lapses that led to negative outcomes.
- Four of the 14 special inspections occurred at three plants owned by Progress Energy. While the company may simply have had an unlucky year, corporate-wide approaches to safety may have contributed to this poor performance. When conditions trigger special inspections at more than one plant with the same owner, the NRC should formally evaluate whether corporate policies and practices contributed to the shortcomings.

The chances of a disaster at a nuclear plant are low. When the NRC finds safety problems and ensures that owners address them—as happened last year at Oconee, Browns Ferry, and Kewaunee—it keeps the risk posed by nuclear

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power to workers and the public as low as practical. But when the NRC tolerates unresolved safety problems—as it did last year at Peach Bottom, Indian Point, and Vermont Yankee—this lax oversight allows that risk to rise. The more owners sweep safety problems under the rug and the longer safety problems remain uncorrected, the higher the risk climbs.

While none of the safety problems in 2010 caused harm to plant employees or the public, their frequency—more than one per month—is high for a mature industry. The severe accidents at Three Mile Island in 1979 and Chernobyl in 1986 occurred when a handful of known problems—aggravated by a few worker miscues—transformed fairly routine events into catastrophes. That plant owners could have avoided nearly all 14 near-misses in 2010 had they corrected known deficiencies in a timely manner suggests that our luck at nuclear roulette may someday run out.



Browns Ferry, AL

The full text of this report is available on the UCS website at www.ucsusa.org/nuclear_power.

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