Four Generator Failures Hit U.S. Nuclear Plants

RAY HENRY,Associated Press

ATLANTA (AP) — Four generators that power emergency systems at nuclear plants have failed when needed since April, an unusual cluster that has attracted the attention of federal inspectors and could prompt the industry to re-examine its maintenance plans.

None of these failures has threatened the public. But the diesel generators serve the crucial function of supplying electricity to cooling systems that prevent a nuclear plant's hot, radioactive fuel from overheating, melting and potentially releasing radiation into the environment. That worst-case scenario happened this year when the Fukushima Dai-ichi nuclear plant in Japan lost all backup power for its cooling systems after an earthquake and tsunami.

Three diesel generators failed after tornadoes ripped across Alabama and knocked out electric lines serving the Tennessee Valley Authority's Browns Ferry nuclear plant in April. Two failed because of mechanical problems and one was unavailable because of planned maintenance.

Another generator failed at the North Anna plant in Virginia following an August earthquake. Generators have not worked when needed in at least a dozen other instances since 1997 because of mechanical failures or because they were offline for maintenance, according to an Associated Press review of reports compiled by the U.S. Nuclear Regulatory Commission.

"To me it's not an alarming thing," said Michael Golay, a professor at the

Massachusetts Institute of Technology who studies risk at nuclear plants. "But if this trend were to continue, you'd certainly want to look into it."

At a minimum, the failures have prompted NRC inspectors to increase their scrutiny at plants where the problems happened. Beyond that, industry officials and academics say the incidents could lead the NRC to formally warn nuclear plant operators about the recent failures and prompt utilities to reevaluate what can disable a generator. Some think these experiences may factor into upcoming rules the NRC will issue in response to the crisis in Japan.

A single generator failure is not a calamity. All reactors have at least one backup generator and sometimes more. If the diesel generators fail, nuclear plants can run safety gear off batteries for hours or use steam-driven pumps to keep cooling water flowing.

But the loss of all emergency power — including the diesels — is a crisis. That happened on March 11 when an earthquake and tsunami disabled all the diesel generators at the Japanese plant. Three of its six reactors suffered meltdowns. The facility was rocked by explosions and released radiation requiring the evacuation of roughly 100,000 people.

In the U.S., an average of roughly one diesel generator has failed when needed each year since 1997. Government researchers who examined diesel generator failures in the U.S. from 1997 to 2003 calculated the average odds that a diesel generator would fail to work at some point during an eight-hour run were slightly greater than 2 or 3 percent, depending on which database was analyzed.

Even at low odds, a generator failure can turn serious when combined with other problems, notably human error.

A prominent example is the March 20, 1990, accident that cut off electricity for less than an hour at Plant Vogtle, roughly 25 miles southeast of Augusta, near the Georgia-South Carolina line. At the time, plant workers had just installed fresh nuclear fuel into the Unit 1 reactor. One of two lines supplying the reactor with power from the electrical grid was offline for maintenance. So was one of the reactor's two diesel generators.

A poorly supervised delivery truck driver backed his truck into a pole, knocking out the sole source of grid electricity to the Unit 1 reactor. The available diesel generator turned on, then quit. Plant workers restarted it, but it failed again. Workers finally bypassed parts of the diesel's electrical controls, forcing it to run. Temperatures inside the reactor rose from 90 degrees to 136 degrees until power was restored, but the accident did not become more serious. No radiation was released.

The recent failures in the Southeast came in a tight cluster.

Tornadoes tearing across the region on April 27 broke electric transmission lines, causing a loss of grid energy at Browns Ferry in Alabama. One of the eight diesel

generators serving the three reactors was undergoing maintenance. The remaining generators immediately started, supplying the plant with emergency power.

The following day, plant operators noticed a small hydraulic oil leak on one of those emergency generators, according to reports that the TVA filed with the NRC. The leak went from roughly a drop a minute to a steady spray. As the electricity from the generator fluctuated, plant staff shut it down. Two reactors briefly lost their cooling systems, although no damage occurred.

Another generator failed on May 2. TVA officials blame that malfunction on equipment that was not properly set.

NRC inspectors at the plant say they are waiting on more information before taking additional action.

A fourth failure happened when the largest earthquake to strike Virginia in 117 years rattled the North Anna Power Station. The reactor lost offsite power and its emergency diesel generators automatically started. Less than an hour later, plant operators shut down one generator because it was leaking coolant, said Gerald McCoy, an NRC branch chief who oversees federal inspectors at the plant.

"We are concerned with the fact that diesels are having issues, and that could very well be the subject of future inspections," McCoy said.

Dominion Virginia Power says the problem was caused by an incorrectly installed gasket that eventually created the coolant leak, utility spokesman Richard Zuercher said. The power company and NRC officials are still examining the incident.

Experts say no single factor appears to connect the four failures. Nathan Ives, a senior manager of advisory services at Ernst & Young, said the incidents could prompt the nuclear industry to re-examine the kinds of component failures that can disable a generator. Reports show that TVA officials had not previously considered that a component blamed for one failure at the Browns Ferry plant could disable the entire generator.

Ives, a licensed senior reactor operator who advises utilities on maintenance issues, said that while he did not think the clusters illustrated a larger problem, he believed they were worth scrutiny.

"Everyone, myself included, is always concerned about a diesel failure," he said.

John Lane, a senior reliability and risk engineer in the NRC's Office of Nuclear Regulatory Research, said he contacted other scientists for an off-the-cuff discussion about the failures. He said it remains unclear exactly how significant the numbers are.

He compared the situation to flipping a coin. While you would expect to get a head half the time if you made dozens of tries, it's possible there could be a surge in heads over a shorter span of tosses.

"If you flip a coin 10 times, you're liable to get 6 or 7 or 8 heads," Lane said. "And our feeling is that's essentially what it is. ... It doesn't mean it's not a fair coin."

Failure rates have decreased considering they once hovered above 10 percent in the early days of the nuclear power industry, according to NRC reports. Members of the Nuclear Energy Institute, an industry lobbying group, focused years ago on getting reliability rates up to 95 percent, said Alex Marion, NEI's vice president of nuclear operations.

Marion said that whenever diesel generators fail, plant officials assess the root problem and determine whether it's a one-time fluke or potentially a larger issue that could happen in other generators. The results are shared across the industry. Marion said the NRC's methods overstate the risk of generator failures because once a problem is identified and fixed, it's unlikely to recur.

"We are continuously learning and developing and evolving," he said.

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