Nuclear Reactors and Hurricanes

When faced with a hurricane or other foreseeable severe weather event, nuclear reactors are required to manually shut down as a safety precaution when certain conditions exist.
The South Texas nuclear power station in Bay City, Texas and the Waterford nuclear power station near Baton Rouge, LA are required to shut down when hurricane force winds speeds reach 73 and 74 miles per hour, respectively. Nuclear reactor operators will also shut down the reactor in advance of the arrival of hurricane force winds. In some cases, where utilities do not have a sufficient amount of non-nuclear back-up power, this will cause a loss of electrical power before the storm even arrives.

While most nuclear reactors built in potential hurricane zones are designed to structurally withstand high winds and modest flooding, they are vulnerable to other effects of severe storms.

The most significant event is the loss of offsite power, a problem that can lead to a "station blackout."

During operation, all atomic reactors rely upon alternating current (AC) electricity generated and transmitted from offsite sources to provide the power needed to operate the reactor's vital safety systems. Without these systems in operation, even when the reactor is shut down, the thermally hot and radioactive fuel inside the reactor would quickly overheat and cause a nuclear meltdown.

According to U.S. Nuclear Regulatory Commission findings documented in NUREG-1150 "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants," station blackout is the number one contributor of risk to the public, with risk defined as a combination of probability and serious consequences.

When offsite AC power is lost due to electrical grid failure, reactors are designed to automatically switch over to required backup emergency diesel generators. These are locomotive-size, fuel-guzzling generators that provide enough power to operate a narrower but basic set of reactor safety systems. Each reactor unit is required to have at least two emergency diesel generators onsite. Should these backup generators fail due to overheating, mechanical failure or the fouling of the diesel fuel, etc. a smaller subset of vital reactor cooling instrumentation and control systems would rely upon power from large on-site battery banks. The failure of both onsite and offsite AC power supplies result in the condition known as station blackout. According to the NRC safety study, a station blackout leads to battery depletion after approximately 4 hours and sets in motion a time table where "approximately 3 hours beyond battery depletion was allowed for the restoration of AC power before core uncovery would occur." Uncovering of the reactor core of cooling water would lead to a meltdown of the extremely hot and radioactive nuclear fuel.

However, the history of emergency diesel generators compliance with operability requirements is checkered. As recent as August 09, 2005, all four of a South Carolina nuclear power station's

emergency diesel generators were discovered to be inoperable due to a common mode failure. Actual natural disasters have led to close calls for public safety. Following the June 24, 1998 tornado at Ohio's Davis-Besse reactor, all three off-site power lines were knocked out to reactor safety systems along with the station's fiber optic communication lines. Two independent emergency diesel generators energized when reactor safety systems lost all offsite power. However, one generator had to be manually started after bad switch contacts in the control room prevented its remote start-up. After 23 hours on emergency power, Davis-Besse recovered off-site power just as the other emergency diesel generator was declared inoperable due to overheating.

During two major hurricanes, emergency diesel generators fortunately passed their most critical tests. Following a direct hit by the Category 4 Hurricane Andrew on August 24, 1992, the reactor safety systems for the two-unit Turkey Point nuclear complex ran for six days on diesel generators alone.

After Category 4 Hurricane Katrina hit the Gulf Coast on August 29, 2005, the Waterford reactor, which is 20 miles west of New Orleans, was relatively unscathed by the hurricane itself, but was forced to operate on diesel generators for four days because of instability in the offsite electrical grid.

Given the risks associated with station blackout due to the failure brittle electric grid infrastructure and emergency diesel generators performance issues in the past, we can hope that this string of good luck will continue.

For additional information on Nuclear Power and Natural Disasters visit our website at http://www.nirs.org/factsheets/naturaldisaster&nuclearpower.pdf

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