Entergy Nuclear Issue Brief
March 21, 2011

Safety Redundancies at Indian Point
Defense in Depth

We understand that you would have questions and concerns based on what is happening in Japan. We would like to briefly summarize why we, as well as the NRC, continue to believe that our facilities are safe and do not pose a risk to the public. We will of course continue to closely monitor the situation at the Fukushima Daiichi station, and apply any lessons learned to our operations.

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1. We obviously don't know the full story from Japan as yet, but the information available to us suggests that the loss of electrical power at the station has been largely responsible for the escalating set of problems.

    a) Containment structures at all reactors appear to have been intact after the earthquake and the tsunamis.
    b) The reactors shut down automatically as they were supposed to, with control rods moving into place to stop the fission. There was no out-of-control fission at Fukushima, as occurred at Chernobyl.
    c) But the combination of the quake and the tsunami resulted in a loss of power supply from the grid to the Fukushima station, and also to the loss of the on-site emergency diesel generators.
    d) Power is critical at Fukushima, as at any nuclear generating plant, to the operation of the pumps and systems that are necessary to transition the reactor to a cold and stable status after the fission reaction is shut down; and to maintain the cooling systems for the spent fuel storage pools.

2. At IPEC, we have multiple layers of backups to deal with the loss of power from the grid, commonly referred to as "defense in depth." Loss of grid power is a scenario for which we have well developed procedures and for which we train and drill regularly.

3. At a high level, we have four separate defense in depth systems in place to provide reactor cooling using the steam generators after a loss of power to the site from the grid:

    a) The first line of defense is the on-site emergency diesel generators (EDGs), as at Fukushima. The emergency diesels at Fukushima were installed below grade, and were flooded in the tsunami, and thus rendered unusable. But, at IPEC we have three emergency diesels per unit (only two per unit are required to run the pumps and cooling systems), and they are in separate above ground structures for both units. The stations license requires an on site fuel supply of 7 days but typically the supply is greater than 14 days on site. A normal transition to a cold shut down status takes 24 hours.

b) The second layer of defense, if the EDGs are not operable, is an additional redundant and independent diesel generator (the Station Black Out, or SBO diesels) at each unit, each of which is installed at a different location and electrically isolated from the primary EDGs for each unit. In addition, both SBO diesels are cross connected so that each can power the pumps and cooling systems at either Unit.

c) Thus, there are a total of 8 diesel generators on the site in 4 different locations, and each location is electrically independent of the other 3 locations.

d) The third layer of defense, if the diesels are not operable, is that each unit has a steam powered pump (using steam produced by the steam generators from the reactor heat) that can be used to cope with a complete loss of AC power from any source. In the unlikely event of a complete loss of all electrical power, a steam driven auxiliary feedwater pump can supply cooling water to the steam generators and hence cool the reactor. This pump has valves that are provided with a back-up nitrogen supply system and can also be operated manually (without air or nitrogen), and has a dedicated water tank. In addition, the steam pumps' suction is piped to the city water system and its 1.5 million gallon storage tank which would provide approximately 4 more days of water supply.

e) The fourth layer of defense, if none of the other measures are available, is a diesel driven contingency pump. This pump can be used to supply water to the steam generators and cool the reactor.

f) All of these steam generator cooling methods are designed to avoid loss of reactor coolant; in the extremely unlikely possibility of hydrogen formation due to exposure of fuel rods, both Indian Point units are equipped with two redundant hydrogen recombination systems to ensure that hydrogen concentrations would remain well below the level that could give rise to an explosion. If power was not available and neither recombiner system was available at a unit, Entergy would have a number of options for preventing the containment environment from reaching explosive levels of hydrogen, including external venting of hydrogen from the containment.

g) There are additional mechanisms for cooling the reactor including flooding the reactor cavity directly with river water using portable pumps. However, to get to that stage, since Indian Point is a different reactor design, there would have to be an even more extreme set of circumstances than what happened at Fukushima.

4. The spent fuel pool is normally cooled by its dedicated cooling system. If all the normal cooling capabilities are lost, back-up methods are available. The inventory of the pool can be replenished using internal water sources. The pools can be filled via various systems such as primary water make-up, city water make-up and the fire water system. In addition, an independent diesel powered contingency pump and strategy is available to spray over the pools to replenish the water inventory.

5. These multiple layers of backup are a result of a vigorous regulatory and safety structure in the United States. The NRC required all licensees to perform a systematic examination to identify vulnerabilities to severe accidents and to implement severe accident mitigations plans in the late 80's and early 90's. Following the tragic events of September 11th, the NRC required licensees to take additional actions to maintain or restore spent fuel pool and core cooling capabilities due to events caused by explosions or fires. In response to these requirements, we have put in place procedures outlining our mitigation actions/plans and hold required training to ensure these plans can be implemented.

6. In the wake of Fukushima, we will of course be reviewing all of our equipment and procedures. Questions we will be addressing – both at our own company and as an industry through INPO – include:

    a) Are the loss of power contingency scenarios that we currently plan for sufficiently robust, or are there additional scenarios for which we should be preparing?
    b) Do we have adequate equipment redundancy to deal with these scenarios taking account of possible common failure modes? For instance, we are considering pre-positioning off-site emergency generators that could be brought to the site quickly by truck or helicopter and made operational should the on-site emergency generators be disabled.
    c) Is our training and drilling for these loss of power scenarios adequate?

In sum, at IPEC we have numerous redundant safety systems for dealing with the loss of off-site power experienced in Japan. But, we are committed to fully understanding the events at Fukushima, and applying those lessons to further improve the safety of our facilities.