Critical Nuclear Reactor Parts Fail at Indian Point 2

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By Roger Witherspoon

A special inspection of the Indian Point 2 nuclear reactor found that more than a quarter of the stainless steel bolts needed to channel cooling water through active nuclear fuel rods were broken, distorted or "missing", a finding that calls into question the effectiveness of the long term management of this and other ageing power plants.

The inspection, which began March 7, concerned the 832 "baffle-former assembly bolts" which hold special metal plates around the 100-tons of uranium fuel within the reactor and channel cooling water to the bottom of the reactor and then up through center of the bundled 12-foot fuel rods to keep them from overheating. Entergy, which owns the twin Indian Point plants, stated in a March 29 report to the three judge panel of the Atomic Safety and Licensing Board (http://1.usa.gov/1Y1oqVO) that 227 of the baffle-former bolts were degraded, broken, or "missing." That is an extraordinarily high failure rate of 27.2%.

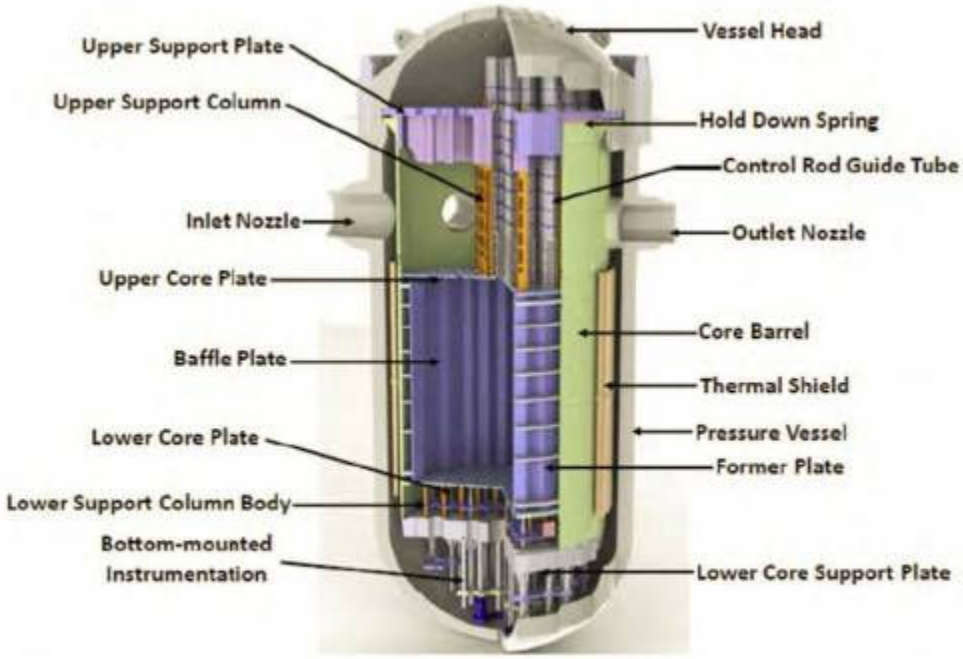

Figure 1 – Overview of Typical Westinghouse-design Reactor Vessel Internals (reproduced from update Westinghouse Figures Presented at Public Meeting on MRP-227, Rev. 1, March 31, 2015, ADAMS Accession No. ML15091A136 Ex. NRC000211)

In its public statement, Entergy sought to minimize the problem by stating they inspected some 2000 bolts and 11% of these were degraded. But their legal filing was more specific. It was only the 832 bolts holding the baffles that had the greatest exposure and suffered the most damage. All 227 of the deteriorated bolts were in this category. Entergy spokesmen at Indian Point and at their corporate office declined to discuss the issue.

The fact that entire bolts or parts of them could not be initially located is considered a serious safety threat. That was the cause of the partial meltdown of the Fermi power reactor outside Detroit in August, 1966 (http://bit.ly/H1WNrx) . In that case, bits of metal blocked the flow of coolant through two bundles of active fuel rods, and they overheated and melted.

Because of that risk Entergy, after discussions with officials at the Nuclear Regulatory Commission, is considering whether or not to shut Indian Point 3 and conduct a similar inspection now, rather than wait until a scheduled refueling outage in 2017. That would be a difficult fiscal pill for Entergy to swallow. The twin plants currently provide only 5% of the electricity used in New York City and neighboring Westchester County, primarily through its 560 megawatt contract with ConEd, the regional transmission company. The New York Power Authority, which provides power to the subways, airports, and municipal buildings, dropped Indian Point two years ago because there are cheaper alternatives (http://bit.ly/ZvIi41).

NRC spokesman Neil Sheehan said “Entergy will have to assess the implications for Indian Point Unit 3. There is no ETA at this point.”

For its part, the NRC is weighing whether or not other plants should be required to conduct similar special inspections of their reactor linings and, if so, how soon. It is not clear at this point how many other plants might have the same type of condition. But, said Sheehan, “we always look for possible generic implications and will do so in this case.”

David Lochbaum, nuclear safety specialist with the Union of Concerned Scientists, said “the NRC is struggling with the question ‘Do we shut down Indian Point 3 and see if there is a problem, or do we look further?’ If it were just those two reactors it would be an easier decision.

“But if they shut down Unit 3 based on probable cause, then why not shut down the other plants that may have this issue? This problem has surfaced before at D. C Cook in Michigan and R.E. Ginna in upstate New York. Why assume those are the only ones?”

Critics of Indian Point urged the NRC to force Entergy to inspect both reactors. “Since IP3 is virtually identical in design as IP2,” said Gary Shaw of the Indian Point Safe Energy Coalition, “IP3 should be shut down immediately to examine the integrity of the reactor core liner. Aging management is a predicate of relicensing and the last year of problems and near misses has already shown that the plant should not be relicensed and decommissioning should be initiated as soon as possible.”

Forced by NY Attorney General

Eric Schneiderman

The special inspection that discovered the disintegration of the bolts was undertaken by Entergy to put an end to a series of challenges by the Environmental Unit of New York Attorney General Eric Schneiderman's office dating to November, 2007. The Environmental Unit has filed more than 35 "contentions," or legal challenges before the three-judge Atomic Safety and Licensing Board, the judicial arm of the NRC. Their decisions can be appealed to the full NRC board, whose commissioners can uphold, modify, or reverse their conclusions.

Three of the New York challenges involve "embrittlement" of key components within the reactor, including the bolts holding the baffles. These serve a critical function in a pressurized system where temperatures approach 900 degrees Fahrenheit and it is difficult to even out the temperature fluctuations within the huge reactor core. Each of the fuel bundles has a temperature gauge at the end called a thermocouple, so the reactor operators can track the temperature o variations within the reactor. The danger of a breakdown of the zirconium cladding around the uranium fuel does not begin until the temperatures hit around 1,800 degrees Fahrenheit, so there is a lot of room for variation before temperatures hit a dangerous level.

At Fermi, operators saw the temperatures climb inside two of the fuel bundles, but assumed they were getting readings from faulty thermocouples since the other bundles were fine. But a metal plate which had fallen to the bottom of the reactor because of degraded bolts was blocking the flow of coolant through the inside of the two fuel bundles, and these heated up past the melting point.

The Environmental Unit asserted that Entergy's ageing management program was inadequate and did not take into account the embrittlement of metal as a result of years of intense bombardment by high levels of radiation within the reactor.

In fact, the State's attorneys found six cases – including Fermi, Cook, and plants in France that were younger than Indian Point – where metal pieces had become brittle, broken off, and blocked critical valves, control rods, or cooling water flow within the reactor. Despite those experiences, inspection of the baffle-former bolts is not required by the NRC and was not originally part of Entergy's long-term maintenance plan, according to their court filings.

"Entergy voluntarily agreed to have this inspection," said Lochbaum. "Without the State of New York, that would not have happened. When you look at the reasons that the State wanted them to do the inspections, it is not a surprise that when Entergy did the inspection they found the problem that the State was warning about.

“It had happened many, many times before. Since our reactors are older than the French reactors where this problem showed up, it seemed just a matter of time before it happened here.”

Attorney General Schneiderman said in a statement yesterday that “For years, my office has raised serious concerns about the aging of components of the Indian Point nuclear plants, including “baffle-former assembly” bolts…Our concerns have been repeatedly dismissed by Entergy and the NRC.

“After finally conducting inspections that my office had long called for, Entergy revealed that at Indian Point Unit 2, over one-quarter of these bolts were found either missing or degraded to a point they must be replaced. This significant finding – coupled with the spate of other recent problems revealed at Indian Point – underscores real and present safety issues related to continuing to operate this aging nuclear facility in close proximity to more than 17 million people.”

A Radioactive Underwater Problem

Installing a New Reactor at Watts Bar

It will take Entergy several weeks to fix this reactor problem. Because of the extremely high

levels of radiation, the cavity holding the reactor – which is approximately 14 feet in diameter and 45 feet long – is flooded with at least 20 feet of water above the top. The cavity is connected to a canal which connects with the spent fuel pool in an adjacent building. When the canal is flooded, the fuel is removed and taken, underwater, to the spent fuel pool for storage until work is completed.

The interior of the reactor, however, is extremely radioactive and too dangerous for workers. "At the Ginna plant," said Lochbaum, "workers could only replace five to six bolts a day. That's because they were working so far underwater, and the work wasn't done by divers.

"They had to have special equipment where screw drivers were attached to 40-foot long robotic arms and directed from a console connected to a camera. It takes a while to position the equipment that is used to do those tasks, and Entergy doesn't have those kinds of tools onsite.

"The equipment won't arrive until April 20, and these long-reach tools are challenging to use, especially with cameras and underwater lighting. They will be lucky if they can replace 10 bolts a day and they have to find all of the missing parts of bolts before they replace anything. And since we are dealing with decay, decisions will have to be made if some of the other bolts should be replaced now, or if they should schedule another inspection in the near future. Entergy is going to take an economic hit on this."

It is a hit the company can ill afford. Entergy closed its Vermont Yankee plant last year, and announced its Pilgrim Nuclear Power Station in Massachusetts would close in 2019. This year, Entergy announced it will close its James A. Fitzpatrick Nuclear Power Station in Scriba, NY, in 2017. The plants were all victims of the free market – their electricity is too expensive to compete with the growing amount of wind-powered electricity, the reduced demand due to the explosive growth of solar units, and the low cost of natural gas. Indeed, Fitzpatrick is considered a zombie plant – financially dead but still operating. At times, Entergy has had to pay the grid to take Fitzpatrick's electricity since it lost out in the competitive auctions run by the NY Independent System Operator, which operates the grid.

The increased competition and decreased demand has also hurt the profit margins of Indian Point, which is Entergy's only remaining successful nuclear plant in the northeast. And Wall Street has rated Entergy's corporate debt as just above junk bond status.

That is a severe comedown. When Entergy bought Indian Point in 2001 it was rated the worst run plant in the nation by the NRC, which considered shutting it (http://bit.ly/1SA7QLw). Entergy pumped some $500 million in repairs and new equipment into the plant and, within two years, it was rated one of the best run plants in the nation.

With that designation, oversight by the NRC was minimal.

But last month the NRC downgraded Indian Point 3 from a “green” rating, which is the top of the color-coded, four-part scale, to the second tier “white” rating. This was primarily due to the excessive number of unplanned shutdown due to equipment failures and other issues. The downgrade brought an increase in oversight by the NRC, which Entergy has to pay for.

The NRC has not made a decision as to whether or not the status of Indian Point 2 will change because of the discovery of the deteriorated reactor bolts.