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Dear Mr. Darl S. Hood:

The purpose of this letter is to provide you with my thoughts on the Nine Mile Point, Unit I core shroud cracking problem. These comments are based on my understanding of copies of IN 94-42, IN 93-79, IN 97-17, GL 94-03, the May 8, 1997 Nine Mile Point Core Shroud Letter you wrote, the Nine Mile Point Safety Evaluation by the NRR, and my personal notes of the April 14, 1997 Fulton meeting. (I do not have a copy of IN 94-42, Supplement 1.)

My background includes two U.S. Navy Construction Battalion officer assignments in what was then called South Vietnam, two Civil Engineering degrees, employment as a field engineer on fossil and nuclear power plants under construction, and an NRC issued SRO license on the Nine Mile I plant as an STA on an operating shift.

At the plant, I was a Drywell Coordinator when the reactor vessel to recirculation pipe safe ends and then the recirc piping was replaced. I was at the plant when the feedwater spargers were replaced and the nozzle IDs were inspected. I also spent a lot of time on the refuel floor during fuel moves since I was one of the refuel floor SROs. When I moved to a support group, I learned root cause analysis from Steve Garchow of INPO and from Robert Dischner of NMPC.

I have used computer programs to study plant system unavailability, (GO), root cause (K-T's TroubleShooter), risk assessment (RISKMAN and CAFTA), and thermal plant performance (PEPSE). My last assignment was on a pilot reliability centered maintenance study of the Unit I turbine control system.

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Additionally, I have worked at a large, out of state gas turbine power plant helping to install a new maintenance management computer program.

At this time, the NRC has made a decision to allow Niagara Mohawk to run Unit I for 14 months. I feel that the NRC has acted appropriately to handle its responsibility. I appreciate the action taken to move the public meeting to a location convenient to near by residents. The time taken to make the decision also appears reasonable to me. In short, I

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do not have "an axe to grind." These comments are offered to provide one additional point of view.

Comments on the reference material:

IN 93-79

No Comments

IN 94-42

No Comments

IN 97-17

No Comments

GL 94-03

"The accident scenarios of primary concern are the main steam line break, recirculation line break and seismic events." The logic here is "OR". However, at the public meeting in Fulton, I believe that I heard the required accident described as a pipe break AND an earthquake: this is not the same logic. I did not hear this statement challenged by any panel members.

Does a letter which addresses IGSCC, something that requires high neutron flux, apply to cracking cases where high flux areas are not the ones primarily effected? I don't think so. To me, this letter provides a shift in logic. In the beginning, the NRC is appropriately described as having "an overall concern with cracking of BWR internals." Next the reader is introduced to the idea that IGSCC causes cracking. Finally, it seems to me, the subtle conclusion is that if there is cracking, it must have been caused by IGSCC. And, at the Fulton meeting, I believe that I heard somebody say the cracking was not caused by operation. Yet, I didn't hear any evidence to support this conclusion except for a question if the plant lost feedwater heating in the last cycle. (The answer was no, it did not.)

Your May 8th Nine Mile Point Core Shroud Letter

Is 10,600 hours of hot operation cumulative, without regard to power level or number and types of reactor shutdowns?

Nine Mile Point Safety Evaluation by NRR

How can "The location of the cracking in the NMP1 shroud is consistent with IGSCC" be true if the worst cracking is not in the area of highest neutron flux? Isn't the worst cracking on the outside of the shroud?

I don't understand how "cracking in the cold-worked areas will also not grow very deep" unless the statement should say "cracking due to IGSCC in the cold-worked ...."

"Although irradiation increases the susceptibility of the material, it also relaxes the weld residual stresses, the driving force for crack growth." Is this statement pertinent to welds in the shroud? Don't actual shroud welds get any effective post weld heat treatment?

"Typically, the allowable crack sizes are large and approach or exceed the length of the weld itself." If I am reading this right, don't you feel a little uneasy when you are told you don't need any of the weld, in fact, you could use even less than none? I can't help but think of a flagpole. If it were constructed the same as the shroud, I wouldn't want to walk near it if every horizontal weld was failed, all the vertical welds were failed, and the support consisted of 4 tie rods to the top.

The Public Meeting

The drawing of the finite element mesh held up at the meeting appeared to be reversed. I expect, based on a finite element college course that I took, to see the finer mesh in the area of major concern. For the question I remember being asked, this was the bottom of the shroud, where it is supported from the reactor vessel. I remember the smaller finite elements being at the top of the drawing shown at the meeting.

General Comments

It is my opinion that thermal effects should have been considered as a possible cause of cracking on the outer surface of the shroud.

If you take a horizontal section through the reactor where it will also intersect the shroud and look down on it during operation, you will see hot water and some steam rising towards you in the area inside the shroud. Outside the shroud but inside the reactor vessel wall is the annulus. In this area, the flow of water is away from you. The average temperature here is lower than that inside the shroud because the steam is gone and colder feedwater is replacing it.

So, as I see it, a heated ring is cooled on the outside. Wouldn't you expect to see cracking where the metal is trying to shrink? But this is just a simplification. The actual shroud inside surface temperature may vary directly with an increase in elevation (from the core support plate) as the fuel heats the water.

Follow a drop of water up past the top of the inside of the shroud. Moving upwards, it enters a steam separator and exits heading down the top of the steam separator dome and out to the top of the annulus.

Here my memory is unclear on the relative position of the feedwater spargers, the edge of the steam separator dome, and the bottom edge of the steam separator skirt. I remember that the feedwater spargers are higher in elevation than the top of the core shroud: this allows them to be removed. Anyway, the steam separator skirt seems, to me, to allow the top outside surface of the shroud to be the same temperature as the top inside surface. (As I think about it now, some heated water from inside the shroud must exit over the top of the shroud and head downward inside the steam separator skirt. The driving force would be approximately that pressure drop that exists in the steam seperators.)

Somewhere below the bottom of the skirt, the return water from the steam seperators, cooled by the addition of the cooler feedwater may mix with the water exiting between the outer shroud surface and the steam separator skirt and actually contact the outer shroud surface. This is where I would expect to see the approximate top of thermal induced vertical cracking (either weld or plate, depending on which is more easily cracked.) And, I would expect it to continue downward somewhat until the outer surface temperature of the shroud is close to the inner temperature of the shroud.

One factor that might provide thermal cycling of this area, and thus movement in the location where the waters would first mix is change in feedwater flow. Thermal cycles may increase directly with feedwater flow control valve stem movement.

The description that I have given above would apply equally to any azimuth of the shroud. It is also my opinion that stagnant areas, if formed in the annulus, could provide local areas of temperature differences (not temperature cycling), that may be sufficient to promote shroud (outer) surface cracking. One way to cause this might be to valve out one (or more) of the 5 reactor recirculation pumps. Unequal feedwater flow to the feedwater spargers, or partly clogged or non-uniformly fabricated feedwater spargers might also cause some local temperature differences.

Conclusions & Final Comments

I have tried to show some potential causes that appear to better address the shroud problem area of the Nine Mile I reactor (the annulus). I do not need any response on the technical points, but would appreciate knowing that you received this letter.

Thank you,

Thomas Gurdziel

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