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SUBJECT: Forwards response to NRC 980811 RAI re application to amend TS 5.5, "Storage of Unirradiated & SF."

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September 25, 1998
NMP1L 1363

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

RE: Nine Mile Point Unit 1
Docket No. 50-220
DPR-63

Subject: *Request for Additional Information Regarding Increased Spent Fuel Pool Storage Capacity at Nine Mile Point Nuclear Station Unit 1 (TAC No. MA1945)*

Gentlemen:

By letter dated May 15, 1998, Niagara Mohawk Power Corporation submitted an application to amend Nine Mile Point Unit 1 (NMP1) Technical Specification 5.5, Storage of Unirradiated and Spent Fuel. The changes reflect proposed modifications to increase the storage capacity of the NMP1 spent fuel pool from 2776 to 4086 fuel assemblies. The NRC's letter dated August 11, 1998 requested additional information regarding our application. The Attachment to this letter provides this information.

Sincerely,

Richard B. Abbott

Richard B.Abbott
Vice President Nuclear Engineering

RBA/JMT/kap

xc: Mr. H. J. Miller, NRC Regional Administrator Region I
Mr. S. S. Bajwa, Director, Project Directorate, I-1, NRR
Mr. B. S. Norris, Senior Resident Inspector
Mr. D. S. Hood, Senior Project Manager, NRR
Records Management

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ATTACHMENT

REQUEST FOR ADDITIONAL INFORMATION

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION UNIT 1

REACTOR SYSTEMS

Question 1:

The proposed changes to Technical Specifications (TS) 5.5 contain requirements for both the current spent fuel pool storage racks (flux trap and Boraflex) and the new Boral racks to be installed in 2 campaigns. Presumably, this is to allow intermediate configurations during reracking. Discuss the applicability of the TS following each campaign, including the final rerack configuration. When will the reference to the current non-poison flux trap racks be eliminated from the TS?

Response:

In an effort to preclude multiple Technical Specification (TS) revisions, proposed TS 5.5 was worded anticipating the various rack configurations that would be present in the NMPC spent fuel pool (SFP) prior to and following NRC approval of the subject TS Amendment Application. To address the SFP configuration prior to the initial rerack, proposed Section 5.5, second paragraph, first two sentences, describes the limitations on the number of spent fuel assemblies that can be stored in the existing SFP with the non-poison flux trap racks (north half) and Boraflex racks (south half). Because the proposed wording is consistent with the existing SFP configuration, the amendment can be implemented upon receiving NRC approval (i.e., prior to the initial rerack campaign).

The proposed wording also allows the first campaign (north half) to be completed while being consistent with TSs. Proposed Section 5.5 states 1066 assemblies can be stored in non-poison flux trap racks in the north half (not that they are) while also stating the north half is analyzed to store 1840 assemblies with Boral racks. The SFP is analyzed to store assemblies in either non-poison flux trap or Boral racks in the north half with Boraflex racks in the south half. Therefore, the proposed wording remains accurate following the initial rerack campaign.

Following the second campaign, the proposed TSs are accurate in stating that the north and south halves are analyzed to store 1840 and 2246 fuel assemblies when provided with racks made of Boral, as well as stating 1710 assemblies can be stored in the south half in racks made of Boraflex. (The SFP is analyzed to store fuel assemblies in the north and south halves with Boral racks or with Boral racks in the north half and Boraflex in the south half.) Since the flux trap racks are scheduled to be removed in the first campaign, the SFP was not analyzed to have the non-poison flux trap racks in the north with Boral racks in the south. Consequently,

this configuration is not anticipated, and a TS amendment to eliminate the reference to the flux trap racks is unnecessary.

Question 2:

How does the reactivity with the assumption of a maximum lattice-average enrichment compare to that using the actual enrichment distribution?

Response:

Fuel assemblies used in Boiling Water Reactors (BWR) utilize fuel rods of varying enrichments as a means of controlling power peaking during in-core operation. For rack calculations involving BWR assemblies, the use of a uniform (lattice-average) enrichment, as opposed to the distributed enrichments normally used in the fuel, produces conservative results. This has been well established over many years. Nevertheless, specific criticality calculations for the design basis 8x8 fuel assembly (in the storage rack geometry) with (1) 3.19 wt% lattice-average enrichment and (2) the corresponding distributed fuel pin enrichments were performed to confirm the conservatism inherent in using lattice-average enrichments. The use of the lattice-average enrichment results in a higher k-inf value. The difference between the two calculated k-inf values is 0.0096 Δk, thus confirming the conservatism in the criticality analyses. Uniformly enriched assemblies yield a reactivity that is about 0.01 Δk higher (more conservative) than fuel assemblies with distributed enrichments.

Question 3:

Since initially only the non-poisoned racks in the north half of the pool will be replaced with Boral racks, why have you not analyzed the misloading of fuel with the maximum allowed enrichment in the Boral racks (4.6 w/o and k-inf no greater than 1.31) into the south half Boraflex racks?

Response:

The storage criteria for the existing Boraflex racks exceeds that of the new high-density Holtec Boral racks, and thus, the misloading of fuel that meets the storage criteria for the Holtec Boral racks into the existing Boraflex racks is of no concern.

The current TSs for the existing Boraflex racks in the south half of the spent fuel pool allow for the storage of fuel assemblies with maximum enrichment of 3.75 wt% without any credit for burnup or burnable poisons (gadolinium) in the fuel. In comparison, the TSs for the Holtec Boral racks to be installed in the north half of the spent fuel pool, allow for the storage of fuel assemblies with maximum enrichment of 4.6 wt% with a corresponding maximum k-inf in the standard cold core geometry, at the maximum over burnup of 1.31. The criteria for acceptable storage in the Holtec racks implicitly takes credit for the burnable absorber (gadolinium) in the fuel. Without any credit for burnup or burnable poison in the fuel, the

Holtec racks are capable of storing fuel assemblies with a maximum enrichment of 3.1 wt%. In summary, without credit for the burnable poison in the fuel, the existing Boraflex racks can store fuel with maximum enrichment of 3.75 wt% while the Holtec Boral racks can store fuel with a maximum enrichment of 3.1 wt%. Therefore, the existing Boraflex racks are capable of storing more reactive fuel than the new high-density Holtec Boral racks, and thus, the misloading of fuel (that meets the criteria for storage in the Holtec racks) into the Boraflex racks is of no concern.

Actual fuel assemblies with enrichments greater than approximately 2.3 wt% contain burnable poison (gadolinium) incorporated into a finite number of the fuel rods, with the weight percent of the gadolinium and the number of rods that contain gadolinium increasing with enrichment. All fuel assemblies with 3.75 wt% enrichment contain gadolinium, and thus, the storage criteria for the Boraflex racks is quite conservative. In fact, a review of the actual fuel at Nine Mile Point Unit 1 (NMP1) reveals that all fuel, with the exception of the initial core (which was 2.11 wt% enrichment) contains gadolinium. Further, the maximum k-inf in the standard cold core geometry for the various bundles that are currently in storage or in the core is 1.24, which is well below the limit for the Holtec Boral racks. Because fuel of 3.75 wt% will necessarily contain a great deal of burnable absorber, the misloading of fuel that meets the criteria for storage in the existing Boraflex racks into the Boral racks is also of no concern.

__Question 4__:

Describe how zirconium flow channel bulging is modeled in the criticality calculations and explain why a positive reactivity effect is obtained.

__Response__:

CASMO-3 was used to investigate the reactivity effect of bulging of the zirconium fuel channel in the design basis 8x8 fuel assembly (@ 3.1 wt% 235U enrichment). CASMO-3 calculations were performed with the as-manufactured zirconium channel and with the zirconium channel very conservatively assumed to be bulged out such that the center of the channel is touching the inside surface of the box wall. In this condition, the corners would be consequently pulled inward, and the box would have a curved shape. The bulged channel was simulated by assuming a square channel located at half the distance between the normal channel O.D. and the box I.D., preserving the box area. The reactivity effect of the channel bulging is considered to be the difference between the two calculations.

The results of the calculations demonstrate a positive (increased) reactivity effect associated with the zirconium fuel channel bulging, consistent with observations for numerous other rack designs that have been previously licensed. The B-10 isotope in the Boral panels has a large neutron absorption cross section, which makes it particularly useful for reactivity control. However, the B-10 absorption cross-section dramatically increases with decreasing energy, and thus, is largest in the thermal energy range. In other words, the Boral panels are most effective in conjunction with a thermalizing material such as water. By moving the zirconium channel outward toward the Boral panel (to simulate the bulging), the thermalization material

(water) is being replaced by zirconium, which does not thermalize neutrons. Removal of thermalization material (water) near the Boral reduces the thermalization of the neutrons, and thus, slightly reduces the effectiveness of the Boral. Therefore, a small positive reactivity effect is obtained.

MATERIALS AND CHEMICAL ENGINEERING

Question 5:

Although the Boral neutron absorbers are expected to exhibit significant corrosion resistance in the spent fuel pool environment, some corrosion may still occur. While this corrosion should not cause significant degradation of neutron absorption capability of Boral panels, the resulting hydrogen generated by corrosion reaction, if not vented, may produce pressures within the Boral enclosing sheathing which may cause distortion of the fuel cells. This could be especially significant in the early stages when Boral panels have not yet developed protective oxide films. Does the design of the Nine Mile Point Unit 1 (NMP1) spent fuel racks include a hydrogen venting feature?

Response:

Yes, the Boral panels in the NMP1 spent fuel racks allow for venting. The Boral panels are held in place by a stainless steel sheathing that is spot-welded to the cell walls. The sheathing is not seal-welded, and thus, gas released from the Boral panel may escape from the sheathing. Therefore, it is not possible for pressure to build up in the sheathing.

Question 6:

Use of Boral in many nuclear plants has indicated that the material exhibits a high degree of stability to radiation. However, it is not known if, under certain circumstances, some degree of degradation will not occur. A verification is needed, therefore, for determining that Boral will perform its neutron absorbing function throughout the life of the spent fuel racks. Describe the measures you will take to ensure satisfactory performance of Boral in the NMP1 spent fuel racks. Discuss the extent to which Niagara Mohawk Power Corporation will implement the Boral integrity surveillance program described in the Holtec report enclosed with your submittal.

Response:

Niagara Mohawk Power Corporation will fully implement the Boral integrity surveillance program described in Chapter 10 of the license amendment application. This surveillance program will verify that the Boral will perform its neutron absorbing function throughout the life of the spent fuel racks. Test irradiations and experience in many facilities (up to 30 years exposure) confirm the absence of radiation-induced degradation.