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RE-EKR-90-028

November 15, 1990

U. S. Nuclear Regulatory Commission
ATTN: Mr. George H. Bidinger, Section Leader
Uranium Fuel Section
Fuel Cycle Safety Branch
Division of Industrial and Medical Nuclear Safety, NMSS
Washington, DC 20555

Gentlemen:

This letter is to provide supplementary information to our amendment application dated July 2, 1990, requesting a change to the authorized criticality safety limit in the license for the fuel assembly wash tanks at our facility. This expanded identification and discussion of controls for the full range of credible abnormal conditions which could defeat the safety margin is based on our zero-based re-assessment of the request -- arising from our discussions with your Mr. Scott Pennington when he visited our facility last month, on your November 8 letter to us, on our telephone conversation with your Messers. Scott Pennington and Robert Wilson this morning, and on your November 7 progress report memorandum (faxed to us following this morning's telecon).

A clarification Enclosure and expanded Attachment 2; "Events/Controls"; to supplement our original July 2, 1990 application, are included with this submittal. In addition to the control identified, we have thoroughly researched the feasibility of engineered safety features in the form of fixed neutron poisons, and this option was found to be unattractive for the following reasons:

- The reduced clearance between the fuel assembly and the fixed poison could result in contact and possible fuel assembly damage.
- The fixed poison would adversely affect the amount of energy received by the fuel assembly from the ultrasonic cleaner.
- Tank water flow would be impacted.
- The presence of a fixed poison would interfere with tank cleaning.

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- The future of the wash tank operation is uncertain. We have identified a development initiative to evaluate whether or not there is a continued need to wash fuel assemblies. This evaluation should be completed by the end of the third quarter of 1991.

We have also reviewed our decision not to take credit for integral fuel poisons (i.e., IFBA boron) in the Keff calculations, and have again determined that this option should remain an unclaimed conservative safety margin -- unless no other alternative is available.

We are confident that this additional information reinforces our technically substantiated belief that increasing the Keff limit for this limited application involving a rigorously defined system will not compromise the safety of Plant operations; and, that it will also meet with your approval. Your prompt consideration of this application is respectfully requested, since our production schedule currently calls for washing of subject fuel assemblies on or about December 15, 1990.

Sincerely,

WESTINGHOUSE ELECTRIC CORPORATION

Edward Reid

E. K. Reitler, Manager
Regulatory Engineering

ENCLOSURE TO LETTER RE-EKR-90-026

SUPPLEMENT TO REQUEST FOR AMENDMENT TO LICENSE SNM-1107 DOCKET 70-1151

Westinghouse provides supplementary information pertaining to the request to change currently licensed nuclear criticality safety control criteria to enable use of a K_{eff} limit of 0.98, including bias and uncertainty at the 95% confidence level, with an apparent safety margin of 0.02, for the fuel assembly wash tank station located in the final assembly fabrication area of the Columbia facility. The following information is submitted:

1. Attachment 1, providing a discussion of additional credible abnormal conditions that could defeat the proposed 0.02 safety margin.

2. Attachment 2, a revision of Attachment 2 to the original submittal, providing a description of current administrative and engineered controls for the wash tanks, in conjunction with postulated events.

Westinghouse readily understands the risk involved in reducing the criticality safety margin from 0.05 to 0.02, a sixty percent (60%) change, and, as a result, has conducted what we believe is a comprehensive study of the possible **credible** abnormal conditions that would compromise that safety margin.

Westinghouse is confident that this additional information satisfactorily addresses any questions or concerns that were raised during recent exchanges with NRC concerning this matter, and adequately supports a conclusion that increasing the K_{eff} limit from 0.95 to 0.98 for this particular application will not compromise the safety of operations involving the wash tanks.

ATTACHMENT 1

IDENTIFICATION OF AND CONTROLS FOR ADDITIONAL CREDIBLE ABNORMAL CONDITIONS

INTRODUCTION

Westinghouse agrees with the NRC that, in preparation for increasing the K_{eff} license limit from 0.95 to 0.98 for the wash tank operation, all **credible** abnormal conditions should be evaluated. In the original submittal, we evaluated the following possible scenarios:

1. Inappropriately trained personnel performing and reviewing criticality calculations.

2. Inappropriately validated computer codes.

3. Inappropriately modeled calculations.

4. Inappropriately used results.

5. Inappropriately released materials for fuel assembly fabrication.

6. Assemblies fabricated with higher reactivity than that which was modeled.

7. More than one assembly loaded into a single wash tank.

8. Equipment failures resulting in more than one assembly loaded into a single wash tank.

9. Equipment failures resulting in a more reactive assembly.

In response to NRC concerns, and after further consideration by Westinghouse Regulatory Affairs engineers and management, we have expanded our study to include the following **credible** abnormal scenarios:

1. A fuel assembly dropping into a wash tank, and possibly changing lattice pitch

2. A fuel assembly dropping into a wash tank, and possibly breaching fuel rod integrity.

3. Moderating material other than water being introduced into a wash tank (e.g., oil, cleaning detergent).

4. A re-evaluation of the possibility that more than one fuel assembly would be loaded into a wash tank.

The results of these evaluations are presented below, including a discussion of engineered and administrative controls that are in effect or will be enforced to prevent such an occurrence.

I. FUEL ASSEMBLY DROPPING INTO A WASH TANK, CHANGING LATTICE PITCH

This scenario would be possible should an overhead crane fail, dropping the fuel assembly into the wash tank. This event was studied to determine the possibility that the fuel assembly lattice pitch would be altered enough to cause an increase in reactivity.

Theoretical 15 foot drop tests of one fuel assembly directly onto another show that lattice pitch of the dropped assembly would be unchanged and reactivity would not increase. Actual drop tests involving fuel assemblies inside a shipping container dropped 30 feet onto an unyielding surface and three feet onto a pin resulted in fuel rod and grid compression, which reduced the assembly reactivity.

Scenario (1) concerns a fuel assembly dropping at most 20 feet into a tank of water. Because the water and the sides of the wash tank would cushion the fall considerably, it is reasonable to conclude that the scenario (1) fuel assembly would suffer less damage than either the theoretical or actual drop test assemblies. Therefore, such an occurrence would neither alter lattice pitch nor increase reactivity.

II. FUEL ASSEMBLY DROPPING INTO A WASH TANK, BREACHING FUEL ROD INTEGRITY

This event was studied to determine the possibility that the fuel assembly falling onto the lip of a wash tank would result in a fuel rod integrity breach, allowing pellets to fall to the bottom of the tank.

Previous actual drop tests involving a similar fuel assembly, horizontally and vertically oriented and dropped onto a steel pin, showed that fuel rod integrity was completely maintained. In these tests, the fuel rods were bent and crimped, but not ruptured. In fact, all of the rods remained pressurized.

Scenario (2) assumes that, as it falls, the fuel assembly hits against the lip of the wash tank and ruptures one or more fuel rods, resulting in loose pellets collecting at the bottom of the tank.

Again, it is reasonable to conclude that a fuel assembly falling against the lip of a wash tank would suffer less damage than the assembly subjected any of the tests mentioned. Therefore, the conclusion is that fuel rod integrity would not be compromised in a scenario (2) fall.

III. MODERATING MATERIAL OTHER THAN WATER IN THE WASH TANK

Moderation control practices are enforced in the wash tank area through procedures in order to minimize the presence of moderators or combustibles in the area. Only that material necessary to the wash tank operation is permitted. This event was studied to determine the possibility that

(1) hydraulic fluid from the overhead crane could flood the wash tank, or

(2) cleaning detergent used in wash tank #1 could flood a wash tank.

It is conceivable that hydraulic fluid could leak from the overhead crane system into a wash tank which holds a fuel assembly. Two engineered controls preclude an increase in reactivity were this to occur.

First, the hydrogen content of the hydraulic fluid in the crane system is less than the hydrogen content of the water already in the tank. Therefore, were the oil to completely displace the water, neutron moderation would decrease, and so would reactivity.

Second, each overhead crane unit holds approximately one quart of hydraulic fluid. Therefore, since there is not enough hydraulic fluid in the crane system to fill a wash tank completely, this is not a credible nuclear criticality concern.

The cleaning detergent which is prescribed for use in the wash tank operation is Calgonite, whose principal chemical constituent is sodium metasilicate. The absorption and scattering cross sections of Calgonite ingredients are significantly less than those of water. Hence, significant amounts of detergent added to a wash tank (a very unlikely event), would lower the reactivity.

IV. RE-EVALUATION OF THE POSSIBILITY THAT MORE THAN ONE FUEL ASSEMBLY WOULD BE LOADED INTO A WASH TANK

Regulatory Engineering revisited this scenario and determined that there are engineered controls in place in the overhead crane system which prevent operators from inadvertently loading two fuel assemblies in the same tank.

There are two ways to unhook a fuel assembly from the crane. Both require slack in the suspense chain, implying that the assembly must be resting on something. The first way is to remove the crane hook, which requires two hands to lift the "mouse tail" and take off the hook.

The second way is to loosen the suspense top plate to which the crane hook is connected. This also requires two hands to loosen the tightening screws, rotate the plate 90° (requiring some effort), and lifting the plate.

For a fuel assembly weighing in excess of 1700 pounds, the above is unlikely to occur. The wash tanks are 20 feet deep. The longest fuel assembly is 14 feet long. If an operator were to lower the assembly to the bottom of the tank, he would be unable to reach the top of the assembly with both hands and separate the assembly from the crane.

These factors make reasonable the conclusion that adequate controls exist to preclude loading two fuel assemblies into the same wash tank.

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ATTACHMENT 2

EVENTS/CONTROLS

1.	Inappropriately trained personnel performing and reviewing criticality calculations.	1.1	Calculations are performed in accordance with written approved procedures.
		1.2	Calculations are performed by an individual with at least one year experience in reactivity calculations.
		1.3	Calculations are reviewed by an individual with at least five years of experience in reactivity calculations.
2.	Inappropriately validated codes.	2.1	Reactivities are calculated using the SCALE AMPEX MODULE CODES: NITAWL, XSDRNPM, and KENO-IV.
		2.2	Codes are validated through bench-marking approximately 80 varied criticality experiments consisting of heterogeneous and homogenous arrays.
3.	Inappropriately modeled calculations.	3.1	Reactivities of all assembly types are calculated using qualified codes and methodology.
		3.2	Wash tanks are modeled with assemblies of highest reactivity, using optimum moderation and credible reflection conditions.
		3.3	Assemblies are modeled infinite in length.
		3.4	Assemblies are essentially isolated from other assemblies when loaded into the wash tanks.

3.5 Situations, such as roof leaks, that might produce partial water densities do not yield higher reactivities among assemblies in the wash tanks--since they are isolated from each other as well as all other special nuclear material.

3.6 Situations introducing oil, such as leaks from the conveyor system, would produce lower assembly reactivities--since the hydrogen content relative to water is lower.

4. Moderators present in wash tank system that are more effective than water.

4.1 Fuel assembly areas are appropriately posted to identify them as moderation controlled areas.

4.2 Moderation control procedures are applied to the wash tank area, to enforce minimization of moderating and combustible materials.

4.3 Only those moderating materials essential to process operations are allowed in the fabrication area.

4.4 Moderating materials are specifically approved by the Criticality Safety component.

4.5 Situations introducing detergents [Calgonite (Na_2SiO_3 with P)] to the wash tank system would yield lower reactivities, due to lower absorption and scattering cross-sections than water.

		4.6	Situations introducing oil, such as leaks from the conveyor system, would produce lower assembly reactivities--since the hydrogen content relative to water is lower.
		4.7	Routine audits are performed to verify that moderation control criteria are properly applied.
5.	Reflectors present surrounding wash tank system that are more effective than water.	5.1	A fuel assembly immersed in a wash tank filled with water, surrounded by the stainless steel liner and air gap, and further reflected by concrete, is less reactive than the infinite water moderated and reflected fuel assembly modeled.
		5.2	A fuel assembly in a dry wash tank, surrounded by the stainless steel liner and air gap, and further reflected by concrete, is less reactive than the infinite water moderated and reflected fuel assembly modeled.
		5.3	A fuel assembly placed adjacent to the concrete liner, with no water moderation is less reactive than the infinite water moderated and reflected fuel assembly modeled.
6.	Inappropriately used results.	6.1	Methodology bias, and all uncertainties for a 95 percent confidence level, are added to calculated values.
		6.2	No calculations are excluded as a result of poor convergence.
7.	Inappropriately released materials for assembly fabrication.	7.1	Materials are procured in accordance with approved written procedures and specification drawings.

		7.2	All UF_6 is sampled to verify enrichments do not exceed 5.0 wt% ^{235}U.
		7.3	Quality Assurance inspects all materials in accordance with specification drawings.
		7.4	Materials that are out of specification are appropriately identified, documented, and dispositioned.
		7.5	Mechanical Production Control delivers all materials to the Manufacturing Component for assembly fabrication.
8.	Assembly fabricated with attributes of more reactivity than that modeled.	8.1	Assemblies are fabricated in accordance with written approved procedures and specification drawings.
		8.2	Pellet diameters, cladding thicknesses and assembly lattice pitch meet very rigorous tolerances.
		8.3	All attributes are verified by Quality Assurance prior to assembly washing.
9.	More than one assembly loaded into single wash tank.	9.1	Written procedures limit one assembly per wash tank.
		9.2	The wash tanks are provided with physical constraints to limit each tank to one assembly. These physical constraints are designed to withstand the accidental impact of a single assembly.

	9.3 Assemblies are lowered into a wash tank using a conveyor transport system, and remain connected to this system while in the wash tanks.
	9.4 The transport system is designed to provide adequate separation distances between adjacent assemblies during transporting and washing.
	9.5 Fabrication inspection and transport documentation are required for each assembly. Documentation is placed within the rods of each assembly and is reviewed prior to each operation.
	9.6 Assembly wash control documentation for wash tank operations is maintained in a bin directly adjacent to the wash tanks.
	9.7 Each assembly in a wash tank is traceable to a specific file. Documentation is maintained with the fuel assembly once the fuel assembly is removed from the wash tank.
	9.8 Years of experience have been accrued without a single occurrence of an attempt to load two assemblies into a single wash tank (which would have produced a K_{eff} > 0.95, even under currently licensed operations).
10. Equipment failures resulting in more than one assembly loaded into a single wash tank.	10.1 The transport system maintains assemblies in a single file that restricts shuffling.

		10.2	Assemblies are lowered into a wash tank using a conveyor transport system and remain connected to this system while in the wash tanks; thus, assemblies or other heavy objects (such as crane test weights), can not be transported over other assemblies already in wash tanks.
		10.3	Assemblies at the back end of the washing process are removed prior to assembly movement at the front end.
		10.4	The assembly conveyor system receives routine preventive maintenance to assure that assemblies are not damaged during transport.
		10.5	The assembly conveyor system is designed to provide a minimum factor of safety of 5:1 for normal lifting.
		10.6	In the unlikely event of equipment failure, fuel assembly documentation would be maintained traceable to a specific assembly at a specific wash tank location.
		10.7	Discrepancies between documentation and wash tank conditions are considered resolved only after appropriate inspections are conducted of each tank.
11.	Equipment failures resulting in more reactive assembly.	11.1	Fuel assemblies are typically less than 20-feet from the wash tank floor during loading.

11.2 Evaluations of 10CFR71 30-foot, and 3-foot pin, drop tests of assemblies in RCC shipping containers have shown that the assembly reactivity would be decreased due to fuel rod and grid compression.

11.3 Analytically modeled 15-foot drop tests of a single assembly on top of another assembly have shown that the assembly lattice pitch is unchanged, thus resulting in a zero reactivity increase.

11.4 Equipment located above the wash tank area is limited to that which is essential to the tank operations (i.e., conveyor system and corrugated metal roof).

11.5 10CFR71 30-foot, and 3-foot pin, drop tests of assemblies in RCC shipping containers have shown that the fuel rod integrity is maintained to the extent that no pellet material is released.