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May 3, 1985
NRC/TMI-85-030

Docket No. 50-320

Mr. F. R. Standerfer
Vice President/Director
Three Mile Island Unit 2
GPU Nuclear Corporation
P.O. Box 480
Middletown, PA 17057

Dear Mr. Standerfer:

Subject: Fuel Canister Storage Racks

Reference: Letter 4410-85-L-0036, F. Standerfer to B. Snyder, Fuel Canister Storage Racks Technical Evaluation Report, dated February 27, 1985

This letter is in response to the above referenced letter which forwarded your technical evaluation for the proposed fuel canister storage racks that will be installed in the fuel transfer canal and the "A" spent fuel pool. The Technical Evaluation Report (TER) addressed the general design and layout of the storage racks, structural and seismic load considerations, load drops over the racks, and anticipated occupational radiation exposure associated with rack installation. Additional information was provided in discussions between members of our technical staffs. Criticality considerations for an array of loaded fuel canisters stored in the fuel racks was not addressed in this TER. Our evaluation of your criticality analysis is currently being performed in conjunction with the NRC review of your fuel canister TER which was submitted by your letter 4410-85-L-0067, dated April 9, 1985. This letter transmits our safety evaluation and our approval of the proposed design and installation of the fuel canister storage racks. Use of the racks for storage of loaded fuel canisters will be contingent upon our approval of the fuel canister TER, your defueling safety evaluation, and the related procedures subject to our approval per Technical Specification 6.8.2.

Sincerely,

ORIGINAL SIGNED BY:
William D. Travers

William D. Travers
Deputy Program Director
TMI Program Office

Enclosure: As stated

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NRC STAFF EVALUATION OF FUEL CANISTER STORAGE RACKS

Description of the Storage Racks:

The storage racks in the fuel transfer canal (FTC) will provide 11 storage locations for fuel canisters. The racks consist of cells with a 14.4 inch square inside cross section. Each cell has an overall length of 173 inches (including the base plate) and an internal height of 150 inches to accommodate a 150 inch long fuel canister. The cells are fabricated of 304L stainless steel sheets about 1/8 inch thick. Nine cells are arranged on an east-west axis on an 18.5 inch center-to-center spacing along the south wall of the deep end of the FTC. At each end of the east-west array, an additional cell is placed on an 18 inch center-to-center spacing on an axis going north to give a C-shaped array. The cells are connected together by vertical tie plates welded intermittently along their length. The array consists of three separately installed modules. One module includes three cells and weighs about 1500 lbs. The other two modules include four cells and weigh about 2100 lbs. each. The array is anchored to resist lateral movement by brackets on top of the south wall of the FTC. The rack includes a base plate with swiveling adjustable pads that rest on the FTC floor (elevation 308').

The storage racks in the "A" spent fuel pool (SFP) will provide 252 storage locations for fuel canisters. They will consist of four free standing modules with storage cells arranged in a 9x7 array. Each cell has an internal height of 150 inches and a cross section of 18 inches square. Each cell is fabricated of 304L stainless steel sheets about 0.09 inches thick. Each module consists of 63 cells connected together by tie angles to form a rigid rectangular free standing honeycomb structure weighing about 16000 lbs. The cells are welded to a base plate that has swiveling adjustable pads that rest on the SFP floor. Each cell has an upper and lower guide collar that provides lateral support to the fuel canisters. The racks will support loaded fuel canisters and constrain them to a minimum center-to-center spacing of 18 inches.

The weight of the racks and loaded fuel canisters falls within the design floor loading of the 'A' SFP and the FTC when flooded to the proposed operating elevation of 327'-8". We are aware of proposed contingency plans to flood to an elevation of 346'-4" if necessary. Prior to approval of such contingency plans, the floor loading will require further evaluation. This should be addressed in the defueling SER.

Both sets of fuel canister storage racks are classified as nuclear safety related.

Structural and Seismic Considerations:

The licensee performed a structural and seismic analysis of the fuel canister storage racks and determined that the rack design is adequate to withstand the stresses encountered during handling, normal operation and a safe shutdown earthquake (SSE). The stresses used in the analysis, and the limits applied to the load combinations analyzed were in accordance with ASME Code Section III, Subsection NF, and ASME Code Section III, Appendix XVII. The analysis considered the stresses due to normal dead loads, live loads, thermal effects resulting from maximum pool differential temperatures, loads caused by a SSE,

and effects of wave action caused by water sloshing in the pool during an SSE. A stability analysis was performed to demonstrate that the maximum cell displacement during a SSE would not result in impacts between adjacent rack modules or between rack modules and the pool wall.

The loads analyzed in the licensee's analysis and the methods of considering load combinations meet the guidelines of NRC Standard Review Plan (NUREG-0800) Section 3.8.4. The staff concurs with the licensee's analysis which demonstrates that the fuel canister storage racks will not fail during a design basis seismic event.

Load Drops

Load handling analyses were evaluated for three cases: load drops associated with fuel rack installation activities, dropping of loads over the installed fuel racks prior to use for storage of loaded fuel canisters, and load handling over the racks with loaded fuel canisters present.

The consequences of load drops during installation activities include the effects of impacts on the floor slabs and other safety related systems and components not directly associated with the fuel canister storage racks. The consequences of such load drops in the fuel handling building are bounded by the analysis performed in the NRC approved safety evaluation for fuel pool "A" refurbishment submitted by the licensee's letter 4410-83-L-0156 dated July 29, 1983. The consequences of load handling accidents during rack installation in the reactor building are bounded by the analysis performed in the NRC approved safety evaluation for reactor building heavy loads submitted by the licensee's letter 4410-84-L-111A dated November 1, 1984. Installation activities will be procedurally controlled to assure that the weight of loads handled, load lift heights, and load travel pathways are constrained to stay within the bounds of these previously approved safety evaluations.

Load drops over the racks after installation but prior to their use for fuel storage present no significant hazards as a result of rack assembly failure since there will be no material present that could produce a release of radioactive material. In addition, damage to rack modules in this event could be repaired without undue risk to plant workers. Load handling in these situations will be controlled in such a manner that postulated load drop consequences relating to other systems or components will be bounded by the currently approved load drop analyses referred to above.

The structural design of the racks is sufficient to withstand the effects of a postulated drop of a filled fuel canister (3355 lbs.) without gross failure of the rack. Damage would be limited to the area of impact and would not result in a reduction of the 18 inch center to center spacing of adjacent fuel canisters. However, the effects of such a drop on the fuel canisters in storage has not been fully evaluated. It will be evaluated in the licensee's fuel canister TER.

The staff concluded that heavy load handling necessary to support fuel canister storage rack installation and load handling over the racks prior to their use for storage of fuel can be carried out without undue safety consequences when controlled in such a manner that the loads handled, lift heights, and load travel pathways are within the bounds of the previously

approved safety evaluations. Load handling over the fuel racks when filled fuel canisters are present has not been fully analyzed and will be addressed in subsequent safety evaluations.

Criticality:

The fuel canister storage racks are designed to maintain the loaded fuel canisters in a geometrically safe subcritical array. The specifics of the canister criticality analysis are not included in this evaluation but will be evaluated during review of the fuel canister TER. For the purposes of this evaluation, the staff assumed that maintaining a minimum center-to-center spacing of 18 inches between loaded fuel canisters is adequate to assure a subcritical array. This assumption will be reevaluated in the staff's review of the fuel canister TER.

As previously stated, the canister storage racks are designed such that during normal operations the minimum center-to-center spacing of adjacent fuel canisters is 18 inches. The racks are designed structurally so that a postulated SSE or postulated load drop on the rack will not cause damage that reduces the 18 inch spacing. The design also prevents inadvertent insertion of a fuel canister into any location not intended as a storage location. If a canister was dropped from the canister transfer system such that it fell vertically alongside the rack modules and leaned against the side of a storage cell, the center-to-center spacing between the dropped canister and an adjacent stored canister would always be greater than 18 inches. However, the center module of three cells in the FTC is designed such that the 18 inch spacing for a dropped canister can be assured only if the reactor plenum is in place on the plenum storage stand in the deep end of the FTC. If for some unforeseen reason, the plenum is not placed on the storage stand, the staff will require additional controls to ensure the required minimum spacing.

Radiation Exposure:

The only potential radiation exposure resulting from the fuel canister storage racks is the plant worker dose attributable to rack installation and subsequent removal. Procedural controls during installation and removal will assure that personnel exposure is maintained ALARA. The licensee projected a maximum exposure of 8.5 person-rem for this task. The staff review of this estimate concluded that it is based on a reasonable estimate of the manhours needed for the task and conservative radiation dose rates determined by review of current survey and exposure data from tasks already performed in the same working areas. The projected occupational exposure is within the scope of considerations made in the Programmatic Environmental Impact Statement.

Conclusion:

Based on our safety review, the fuel canister storage racks do not pose a significant risk to the occupational work force or the public. They do not present the possibility of any accident not previously analyzed nor do they change the consequences of, or likelihood of any previously analyzed accident. Margins of safety as previously analyzed are not reduced. We conclude that the proposed fuel canister storage racks do not constitute an unreviewed safety question and can be installed as designed in the fuel transfer canal and the 'A' spent fuel pool.

Use of the racks for storage of loaded fuel canisters poses no significant risk to the work force or public and has no significant potential environmental impact, provided that the design geometry of the racks is adequate to assure a subcritical array of fuel containers, and the racks and stored fuel canisters can withstand the affects of postulated load drops. We have not completed our review of the fuel canister criticality and load drop analysis. We therefore approve the installation of the fuel canister storage racks in the fuel transfer canal and the 'A' spent fuel pool but not the storage of fuel material. Approval of the use of the racks for storage of fuel canisters loaded with fuel material is contingent upon our approval of our criticality and load drop analysis. Such approval will be forwarded to you upon satisfactory completion of our review of your fuel canister TER.

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