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Subject: Revision to Design and Licensing Report for the License Amendment Application to Allow Use of Expanded Spent Fuel Storage Capability
(License Amendment Request No. 98-0007; TAC No. MA5477)

Ladies and Gentlemen:

On May 21, 1999, the FirstEnergy Nuclear Operating Company (FENOC) submitted an application for an amendment to the Davis-Besse Nuclear Power Station (DBNPS), Unit Number 1, Operating License Number NPF-3, Appendix A Technical Specifications, regarding the use of expanded spent fuel storage capability. The proposed amendment (DBNPS Serial Number 2550) would expand the present spent fuel storage capability by up to 289 storage locations by allowing the use of spent fuel racks in the cask pit area adjacent to the spent fuel pool (SFP). As noted in the May 21 license amendment application, the Cask Pit storage racks are needed, in part, to support a complete re-rack of the SFP, which will be proposed in a future license amendment request. During a review of analyses being performed in support this future license amendment, the need was identified to revise a portion of the Design and Licensing Report, which is an attachment to the License Amendment Request (LAR) 98-0007. The portion for revision is contained in the Holtec International Design and Licensing Report (HI-981933, Revision 2), Section 7, "Fuel Handling and Mechanical Accidents," which discusses the postulated drop of a fuel assembly on the top of a spent fuel storage rack.

Specifically, the second shallow drop accident scenario discussed in Section 7.2.1 of the report implies that the Cask Pit fuel storage rack will only be considered acceptable if less than 50 percent of a storage cell is blocked, as a result of a dropped fuel assembly. However, it has been determined that up to 90 percent of a storage cell can be blocked without adversely affecting the local temperature analyses. Therefore, Section 7.2.1 is being revised to reflect this information. The results of the second shallow drop scenario, found in the last paragraph of Section 7.4.1, discuss that the damage resulting from the dropped fuel assembly remains local to the impacted cell. However, Figure 7.4.3 shows that the fuel storage cell adjacent to the impacted cell is also damaged. Accordingly, the discussion in Section 7.4.1 is being revised to also address the results of damage to the adjacent cell.

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Enclosed are two revised pages to Section 7 of the Holtec International Design and Licensing Report and a detailed explanation of the revisions. These revisions were reviewed and approved under the Holtec International Quality Assurance program. The enclosed pages are for both the proprietary and non-proprietary versions of the Holtec Design and Licensing Report. The LAR 98-0007 submittal concluded that the proposed changes have no adverse effect on nuclear safety, that the proposed changes do not involve a significant hazards consideration, and that the proposed changes do not constitute an unreviewed safety question. The revisions described above have no effect on these conclusions.

Should you have any questions or require additional information, please contact Mr. James L. Freels, Manager - Regulatory Affairs, at (419) 321-8466.

Very truly yours,

DLM

Enclosures

cc: J. E. Dyer, Regional Administrator, NRC Region III
D. V. Pickett, NRC/NRR Senior Project Manager
J. R. Williams, Executive Director, Ohio Emergency Management Agency, State of Ohio (NRC Liaison)
K. S. Zellers, NRC Region III, DB-1 Senior Resident Inspector
Utility Radiological Safety Board

ENCLOSURE 1

Revised pages to the Holtec International
Design and Licensing Report
(HI-981933, Revision 2)

Page 7-3
Page 7-6

sectional area. In order to maximize the penetration into the top of the rack by the falling assembly, the rack is considered empty, with the exception of the impacted corner cell, where an irradiated fuel assembly is stored.

The second shallow drop accident scenario considers a fuel assembly striking the top of an empty rack cell to maximize cell wall deformation. This drop scenario is performed to maximize cell blockage. As discussed in Section 5.6, the thermal hydraulic evaluations, performed to support the additional Cask Pit storage racks, considered 50 percent cell blockage. However, the local temperature evaluation results are not particularly sensitive to this assumption, primarily because of the much more predominant flow resistance of the flow holes at the base of the storage cell. It has been determined that 90 percent blockage can occur without adversely affecting the local temperature results. Therefore, a conservative acceptance criteria of less than, or equal to, 80 percent blockage is appropriate. (Section 5.6 describes conservatisms in the local temperature analysis methodology). In this scenario, all other elements of the impacting fuel assembly and the impacted rack assembly are identical to those used in the first shallow drop scenario. Since the rack is considered empty in this scenario, criticality consequences need not be considered.

7.2.2 Deep Drop Events

The second category of fuel assembly drop events postulate that the 2482 lb. impactor falls through an empty storage cell and impacts the rack base-plate. The origin of the dropping trajectory is again chosen as the highest elevation that the load can be lifted by the Fuel Storage Handling Bridge, which is 98.13 inches above the upper elevation of the fuel storage rack. This so-called deep drop scenario evaluates the structural integrity of the rack baseplate. If the baseplate is pierced or deforms sufficiently, then the fuel assembly or base-plate might damage the pool liner and/or create an abnormal condition of the enriched zone of fuel assembly outside the poisoned space of the fuel rack. To preclude damage to the pool liner, and to avoid the potential of an abnormal fuel storage configuration in the aftermath of a deep drop event, it is required that the base-plate remain unpierced. It is also required that the maximum lowering of the fuel assembly support surface is less than the distance from the bottom of the rack base-plate to the liner.

stress in the cell wall, recorded at maximum displacement time, is 38.39 ksi and the maximum plastic strain is 0.106. Approximately 10% of the cell opening in the impacted cell is blocked. The maximum gross deformation is limited to 3 inches, which is below the acceptance criteria of 4.75 inches. Therefore, the penetration is determined to be acceptable from a criticality perspective and the racks will remain subcritical.

The study of residual plastic strain for the second shallow drop analysis shows that damage remains local to the upper portion of the rack near the impact site, but is significantly more extensive than the first scenario. Figure 7.4.3 shows an isometric view of the post-impact geometry of the rack for this scenario, as well as a plot of the Von-Mises stresses. Deformation of the impacted cell extends 18 inches downward from the top of the undeformed cells. The maximum Von-Mises stress in the cell wall is 40.96 ksi and the maximum plastic strain is .264. The effective damaged area of the impacted cell measures 12 inches deep and blocks approximately 50 percent of the cell. The adjacent cell has an effective damage of less than 12 inches deep with blockage of approximately 75 percent of the cell. Thus, the acceptance criterion of a maximum of 80 percent is met. Since the percentage of cell blockage was determined based on a completely empty rack, it is concluded that the blockage sustained by an adjacent loaded cell would be substantially less.

7.4.2 Deep Drop Event Results

The first deep drop scenario considers the impacted area to be over a pedestal that is resting on the ¼ inch thick liner and located near the convergence of two leak chases. Figure 7.4.4 shows an isometric view of the finite element model for the impactor, pedestal, bearing pad, liner and underlying concrete. As shown in Figure 7.4.5, a Von-Mises stress of 106 ksi is observed in the pedestal cylinder at the contact surface with the bearing pad, which is below the failure stress of 140 ksi for the pedestal material. The bearing pad registers a Von-Mises stress of approximately 30 ksi, as shown in Figure 7.4.6.

The numerical analysis of this event shows that the liner is not pierced during the collision, since the maximum Von-Mises liner stress, as shown in Figure 7.4.7, is 27 ksi, which is less than the failure stress of 71 ksi. Therefore, the acceptance criteria is satisfied. The concrete stratum

Explanation for Revised Pages

The second shallow drop accident scenario, discussed in Holtec Report HI-981933, Section 7.2.1, fourth paragraph (page 7-3), implies that the rack will only be considered acceptable if the damage incurred results in less than 50 percent blockage of the storage cell. This implication is embedded in the sentence that states, "Therefore, the rack will be considered acceptable under this drop scenario if 50 percent or more storage cell area remains open for cooling flow subsequent to the event." This statement was based on the fact that the thermal-hydraulic analysis for local cell temperature evaluation was performed by *assuming* that the top of the cell was 50 percent blocked subsequent to the drop accident, as stated in Report HI-981933, Section 5.6, page 5-12, 4th bullet.

The statement should be revised to the following, "However, the local temperature evaluation results are not particularly sensitive to this assumption, primarily because of the much more predominant flow resistance of the flow holes at the base of the storage cell. It has been determined that 90 percent blockage can occur without adversely affecting the local temperature results. Therefore, a conservative acceptance criteria of less than, or equal to, 80 percent blockage is appropriate. (Section 5.6 describes conservatisms in the local temperature analysis methodology.)"

Section 7.4.1, third paragraph, (page 7-6), states, "The study of residual plastic strain for the second shallow drop analysis shows that damage remains local to the impacted cell, but is significantly more extensive than the first scenario." This statement should be revised to read, "The study of residual plastic strain for the second shallow drop analysis shows that damage remains local to the upper portion of the rack near the impact site, but is significantly more extensive than the first scenario."

The cell blockage predicted from the second shallow drop scenario exceeds 50 percent, but does not exceed 80 percent. Section 7.4.1, third paragraph (page 7-6) states, "The effective damaged area measures 12 inches and can obstruct approximately 50 percent of the cross section of the cell. Thus, the acceptance criterion for blockage is met. Since the percentage of obstruction recorded is for an empty cell, it is concluded that this analysis would bound the damage sustained by a loaded cell. Therefore, the partial blockage assumption of 50 percent is shown to be acceptable." These statements should be revised as follows, "The effective damaged area of the impacted cell measures 12 inches deep and blocks approximately 50 percent of the cell. The adjacent cell has an effective damage of less than 12 inches deep with blockage of approximately 75 percent of the cell. Thus, the acceptance criterion of a maximum of 80 percent is met. Since the percentage of cell blockage was determined based on a completely empty rack, it is concluded that the blockage sustained by an adjacent loaded cell would be substantially less."

The revised statements are justified by the following arguments:

The assumption of 50 percent blockage at the top of the storage rack cell is common practice for performing thermal-hydraulic local temperature analyses and is chosen as an input to establish the hydraulic resistance of the storage cell. The 50 percent blockage is normally a conservative assumption, since this blockage usually bounds the damage predicted by the accident analyses. However, the local temperature evaluation results are not particularly sensitive to this assumption, primarily because of the much more predominant effect from the flow restriction at the base of the storage cell.

The local temperature analysis considers only cells located over rack pedestals, which do not contain the usual 5" diameter flow hole in the base-plate. The cells over pedestals contain four 1" diameter holes located in the base of the cell walls. These flow openings total less than 3.2 in^2 of flow area, which represents less than 4 percent of the nominal cell opening area of 81 in^2. By observation, the hydraulic resistance of the storage cell model is predominantly controlled by this small flow area.

Additional conservatism is included in the hydraulic resistance by increasing the inertial resistance by 25 percent. This conservatism alone more than offsets a reduction in the upper flow opening from 50 percent to 20 percent.

The second shallow drop scenario was performed in order to predict the maximum damage that may occur from a dropped assembly striking the top of an empty storage rack. The intent of this scenario was to perform an evaluation that would conservatively predict damage for a loaded rack and then apply appropriate blockage acceptance criteria for damage to cells that contained fuel. The B&W fuel design used at Davis-Besse protrudes above the storage rack. Therefore, significant blockage of the upper portion of storage cells containing a fuel assembly would require that the upper portion of the fuel assembly be damaged sufficiently to allow the cell wall to protrude into the storage cell opening. By observation, the strength and rigidity of the upper portion of a fuel assembly would be sufficient to withstand deformation of the 0.075" thick cell wall during any impacts at adjacent cell locations. Thus, the upper portion of cells containing fuel will not be significantly blocked, because the presence of the stored fuel assembly precludes significant displacement of the cell wall into the open cell area.

COMMITMENT LIST

The following list identifies those actions committed to by the Davis-Besse Nuclear Power Station in this document. Any other actions discussed in the submittal represent intended or planned actions by Davis-Besse. They are described only as information and are not regulatory commitments. Please notify the Manager - Regulatory Affairs (419-321-8466) at Davis-Besse of any questions regarding this document or associated regulatory commitments.

COMMITMENTS	DUE DATE
None	N/A