UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

May 16, 1994

Docket Nos. 50-352
and 50-353

LICENSEE: Philadelphia Electric Company

FACILITY: Limerick Generating Station, Units 1 and 2

SUBJECT: SUMMARY OF APRIL 15, 1994 MEETING REGARDING THE SPENT FUEL POOLS RERACKING AT LIMERICK GENERATING STATION, UNITS 1 AND 2

On April 15, 1994, representatives from Philadelphia Electric Company (PECO) and Holtec International (HI) met with the staff to discuss PECO's submittal of January 14, 1994, requesting approval for the proposed modification to install new high density spent fuel racks in each of the spent fuel pools at the Limerick Generating Station, Units 1 and 2. Meeting attendees are listed in Enclosure 1.

The proposed modification would increase the spent fuel storage capacity in each spent fuel pool from 2040 fuel assemblies to 4117 assemblies. The licensee has proposed to perform the reracking of each fuel pool after removing all of the stored contents, and possibly after draining and decontaminating each fuel pool. PECO plans to finalize its plan on the choice of wet or dry reracking within a week. However, in order to accomplish the proposed reracking, PECO would need approval by the middle of June 1994, and complete the Unit 2 reracking before its upcoming refueling outage scheduled for February 1995. In addition to discussing the technical merits of the proposal, the staff and the licensee explored possible ways to attain the licensee's goals.

The licensee presented the layout of the refueling floor, which indicated the common floor location and interconnection between the two spent fuel pools, and the layouts of each spent fuel pool that indicate: the current configuration, the current analyzed capacity, the current licensed capacity, the configuration during the construction modification, the configuration after completion of Unit 2 modification, and the final configuration. (Enclosure 2)

The staff review is expected to go beyond PECO's requested date. During the meeting, the staff identified initial information in the area of plant systems, structural engineering, and radiation protection (Enclosure 3), that the licensee agreed to address. The questions identified in Enclosure 3 are considered as a formal request for additional information (RAI). This requirement affects one respondent and, therefore, is not subject to Office of Management and Budget review under P.L. 96-511.

Currently, the spent fuel storage capacity does not warrant the urgent rerack of the fuel pools. However, the licensee has indicated that performing the reracking of the two spent fuel pools at this time, without any spent fuel in the pools, would be very economical and would maintain the personnel exposure As Low As Reasonably Achievable (ALARA). This is the only time when this situation would occur at this site.

DF01

The licensee and the staff discussed the potential for approval of the transfer of the spent fuel from the Unit 2 spent fuel pool to the Unit 1 spent fuel pool. The staff indicated that the submittal should be done in the next few weeks and it should be complete, in order to obtain approval by the end of June 1994. The licensee indicated that the initial evaluation had considered a design storage capacity of 2862 per spent fuel pool. Also, the licensee stated that the staff's safety evaluation had confirmed this capacity for the criticality and structural engineering aspects, and a capacity of 2484 for the thermal hydraulics evaluation.

Based on the discussions, the licensee indicated that they would provide a request for an increase in the capacity for the Unit 1 spent fuel pool, and requested that the staff continue with the review of their current request for the new high density reracking of the spent fuel pools.

/S/
Frank Rinaldi, Project Manager
Project Directorate I-2
Division of Reactor Projects
Office of Nuclear Reactor Regulation

Enclosures:
1. Meeting Attendees
2. Layouts of Spent Fuel Pools
3. Staff's RAI

cc w/enclosures:
See next page

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*PREVIOUS CONCURRENCE

OFFICE	PDI-2/LA	PDI-2/PM	*SPLB/BC	*ECGB	*PRPB	PDI-2/D
NAME	MO'Brien	FRinaldi:rb	CMcCracken	GBagchi	LCunningham	CMiller
DATE	5/10/94	5/10/94	05/05/94	05/05/94	05/06/94	5/16/94

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See next page

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ENCLOSURE 1

LIST OF ATTENDEES

MEETING WITH PECO ON SPENT FUEL POOLS RERACKING

LIMERICK GENERATING STATION, UNITS 1 AND 2

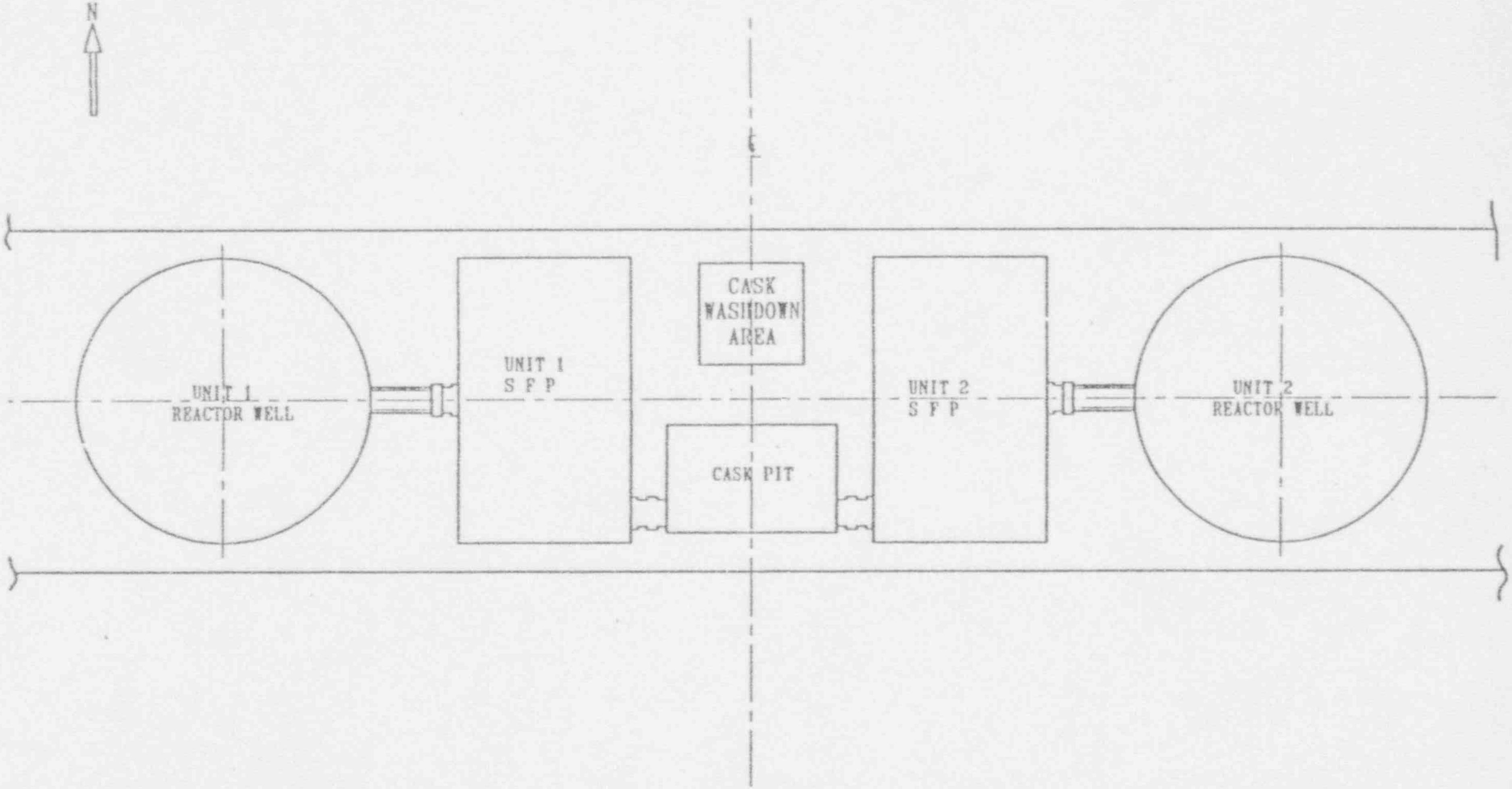
APRIL 15, 1994

NAME	ORGANIZATION
F. Rinaldi	NRC/NRR
H. Ashar	NRC/NRR
T. Cerovski	NRC/NRR
S. Kim	NRC/NRR
S. Klementowicz	NRC/NRR
L. Kopp	NRC/NRR
G. Hubbard	NRC/NRR
C. Miller	NRC/NRR
N. Perry	NRC/RGN-I
D. Fiorello	PECO
G. Hunger	PECO
J. Goff	PECO
M. Kowalski	PECO
B. Dickinson	PECO
A. Soler	Holtec

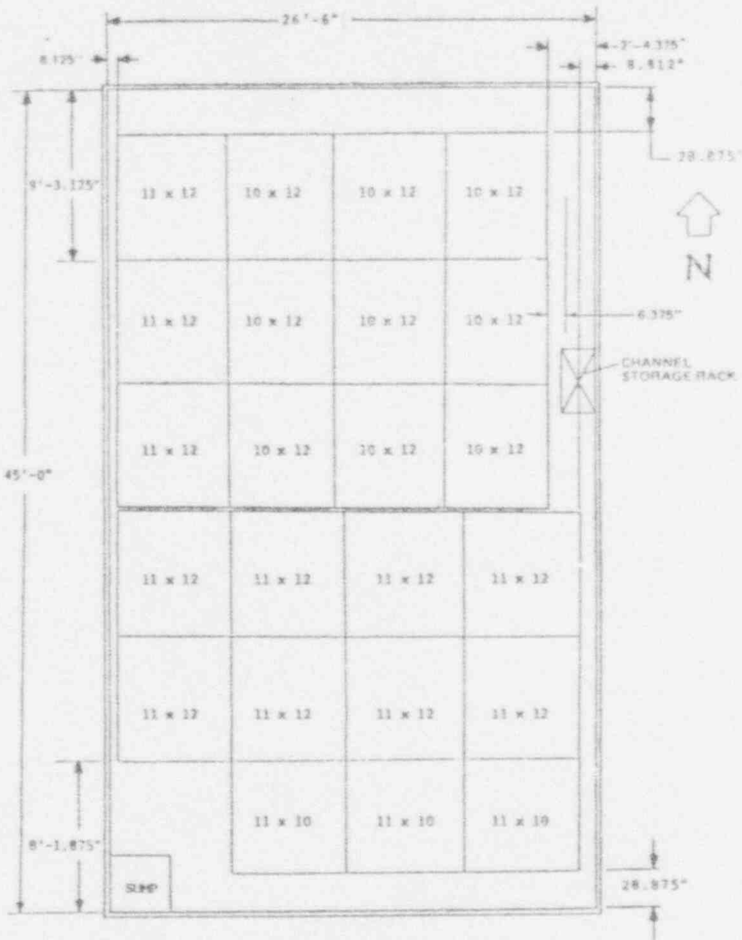
LIMERICK GENERATING STATION

Spent Fuel Pool Rerack

ENCLOSURE 2

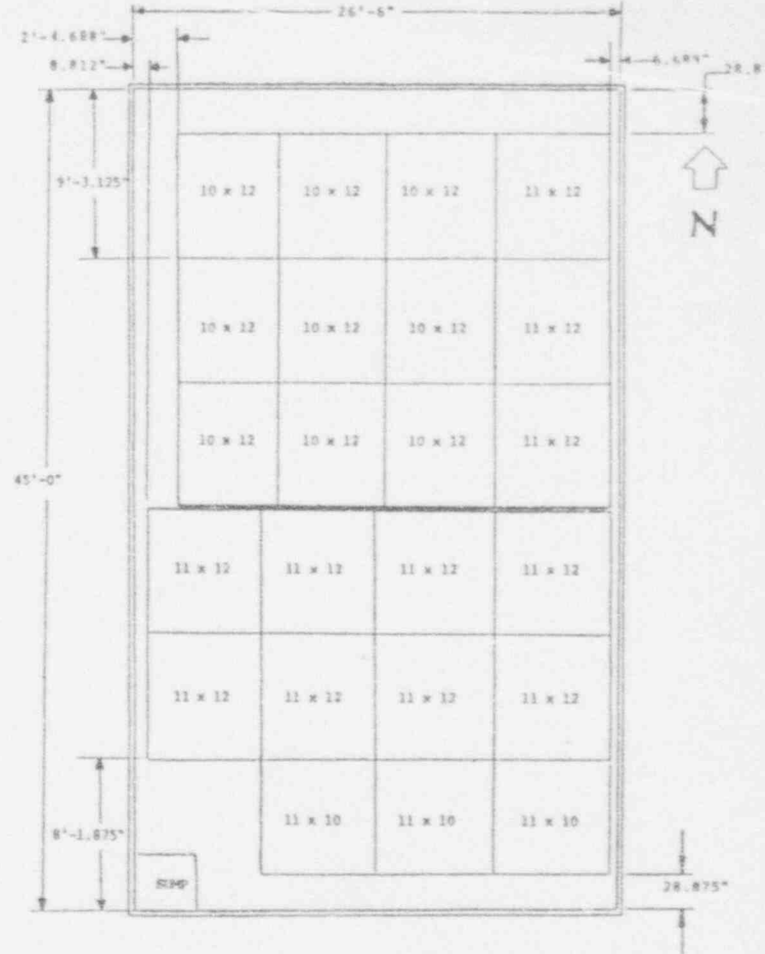


Limerick Generating Station Refuel Floor



2862 cells

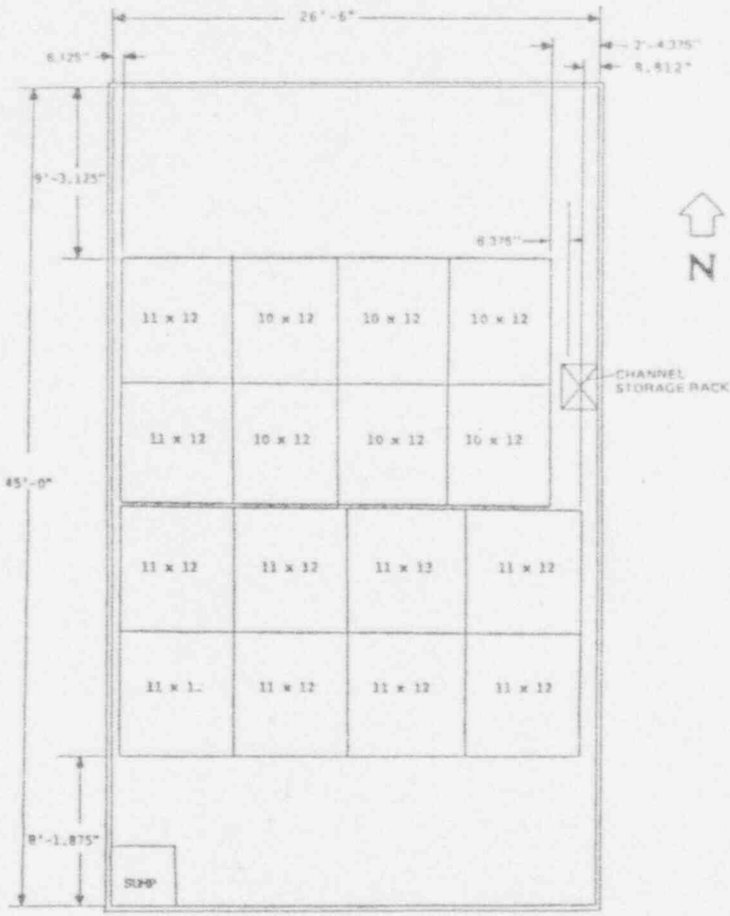
Unit 1



2862 cells

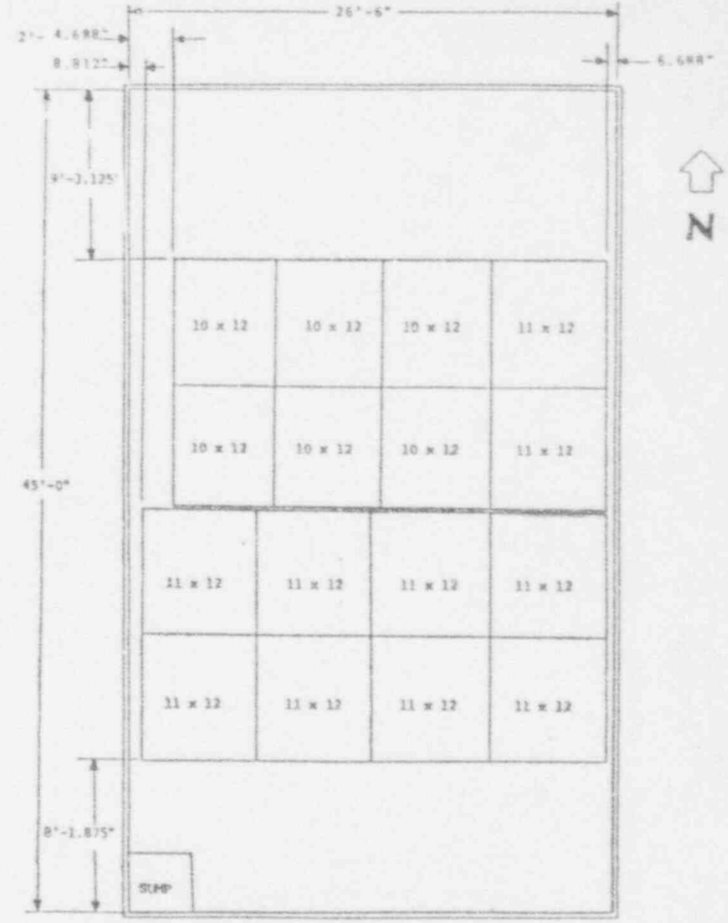
Unit 2

Current Analyzed Capacity



2040 cells

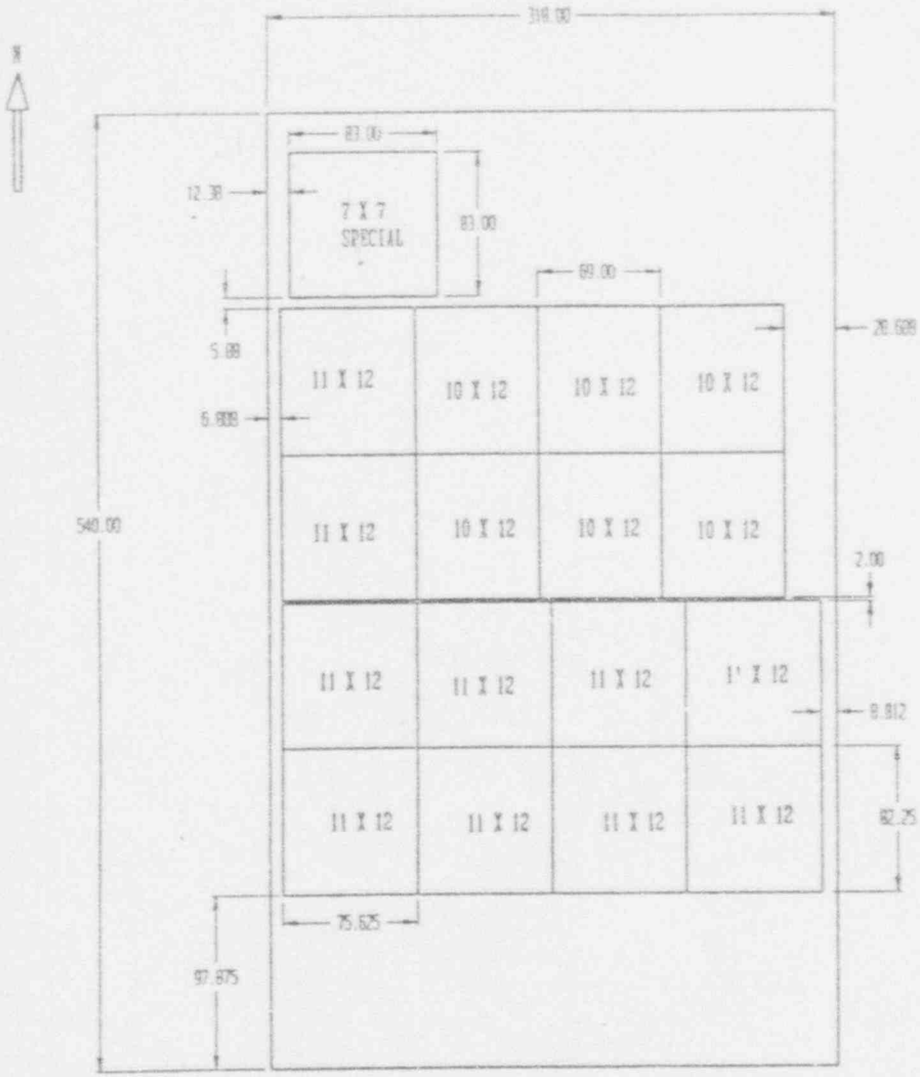
Unit 1



2040 cells

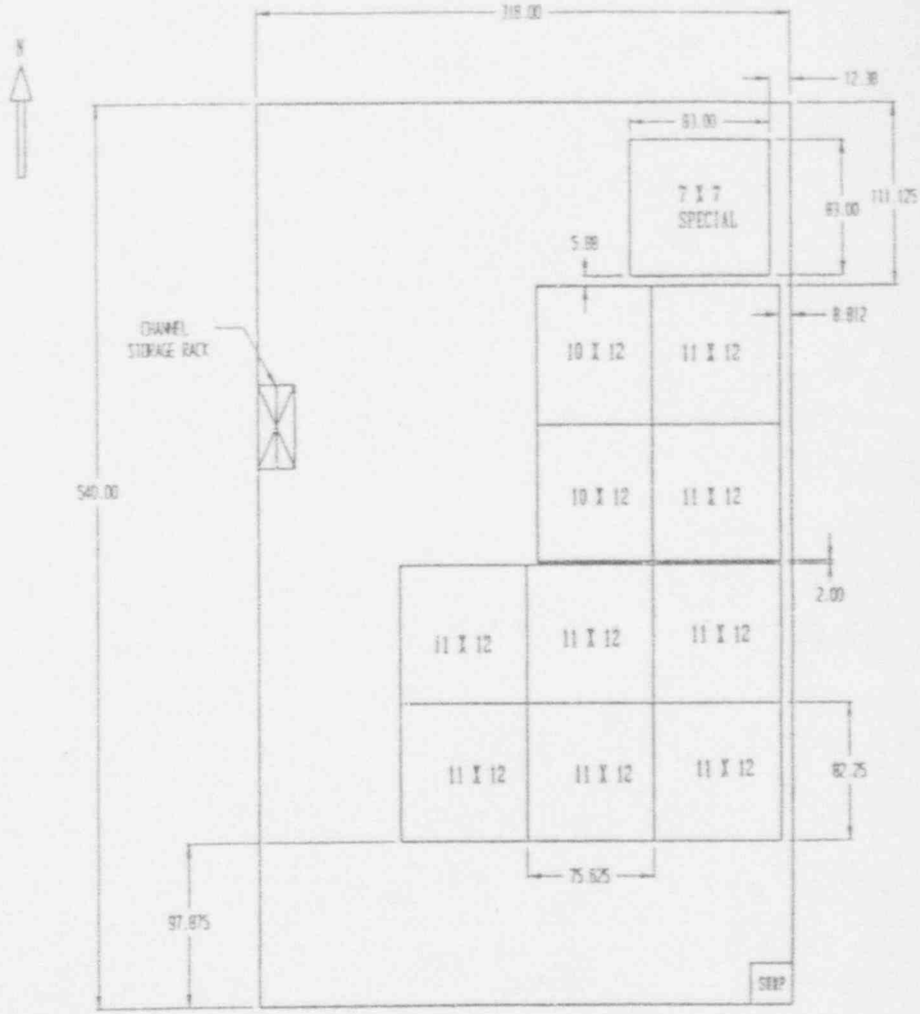
Unit 2

Current Licensed Capacity



2040 cells + CRB rack

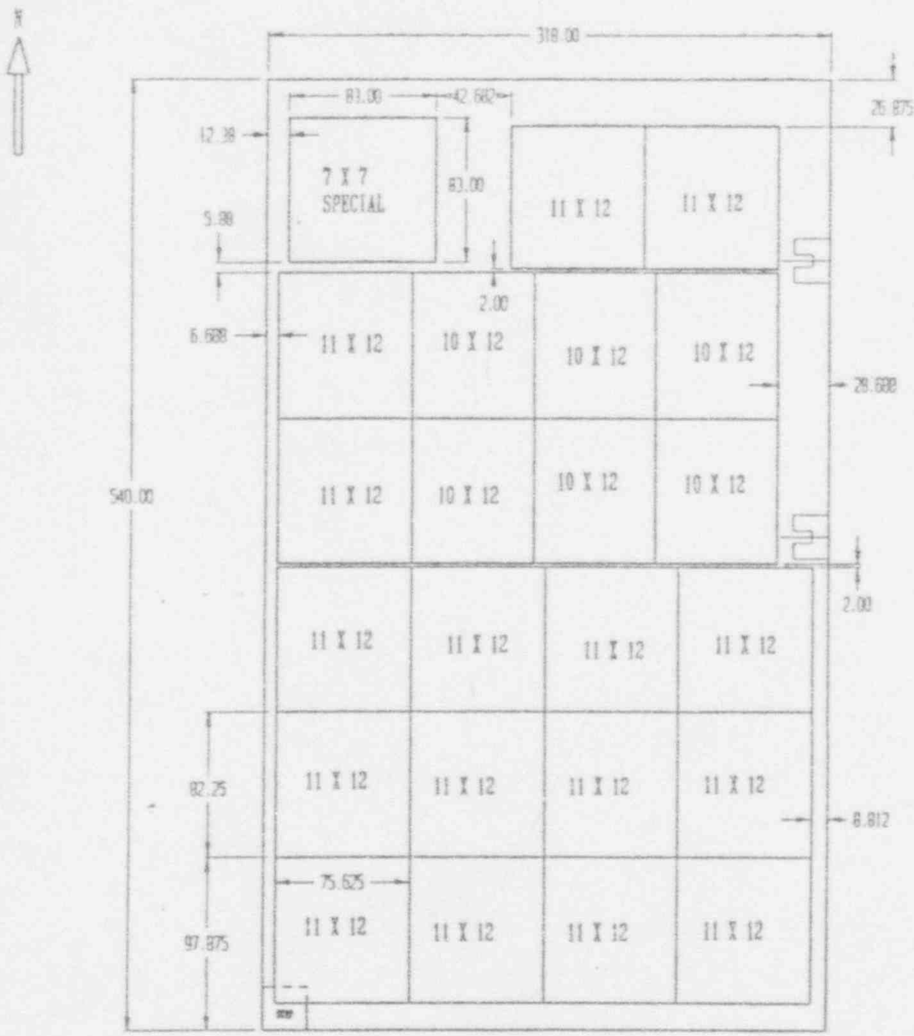
Unit 1



1296 cells + CRB rack

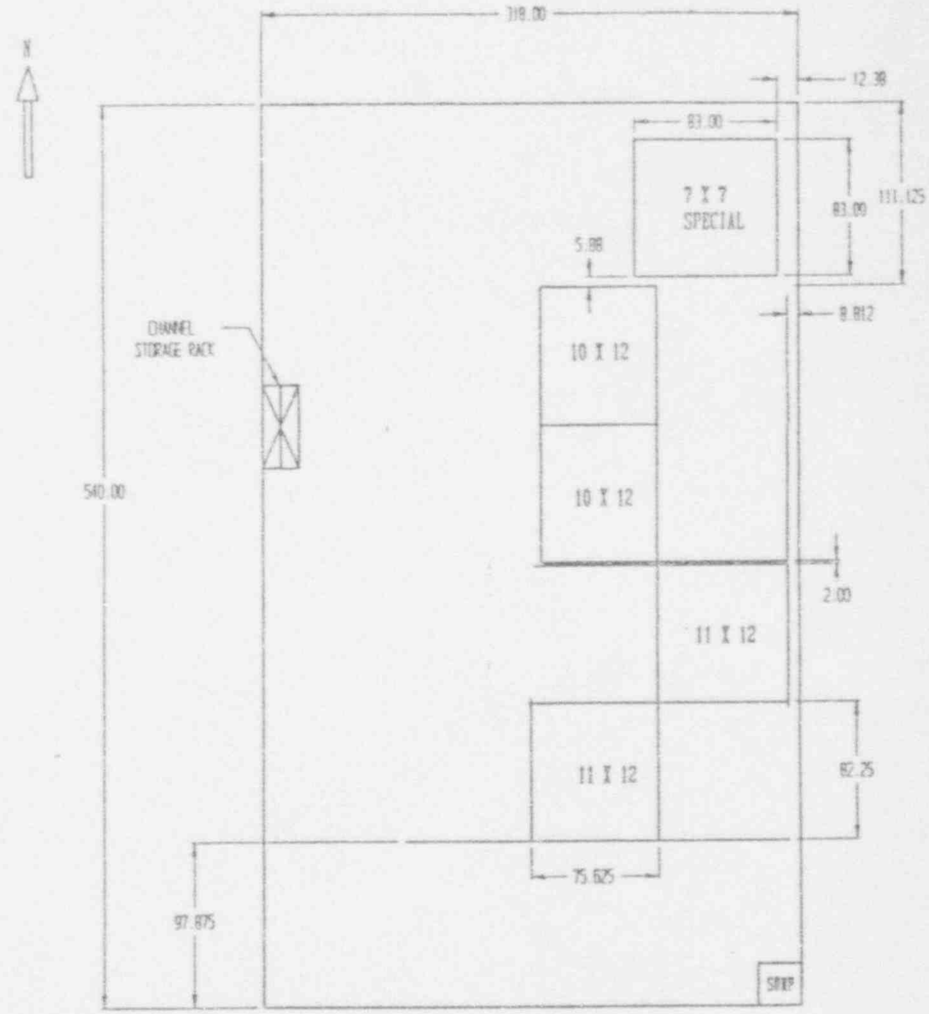
Unit 2

Current Configuration



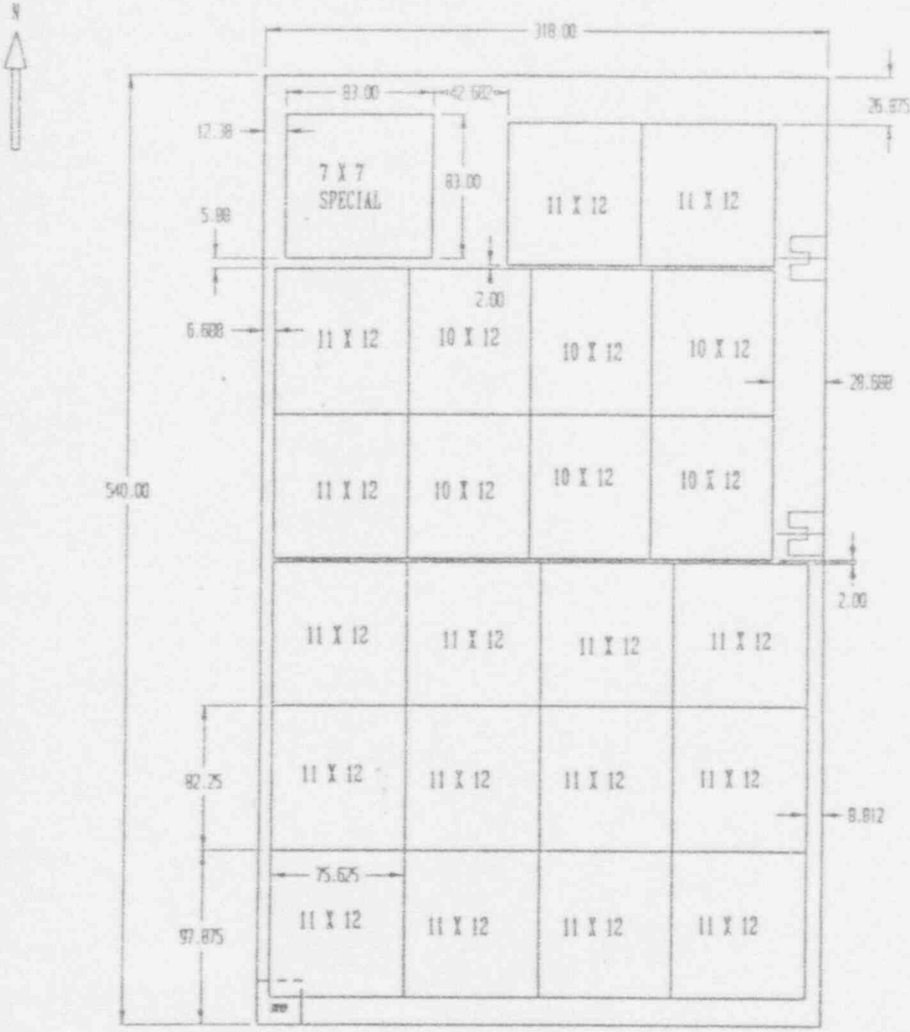
2832 cells + CRB rack

Unit 1



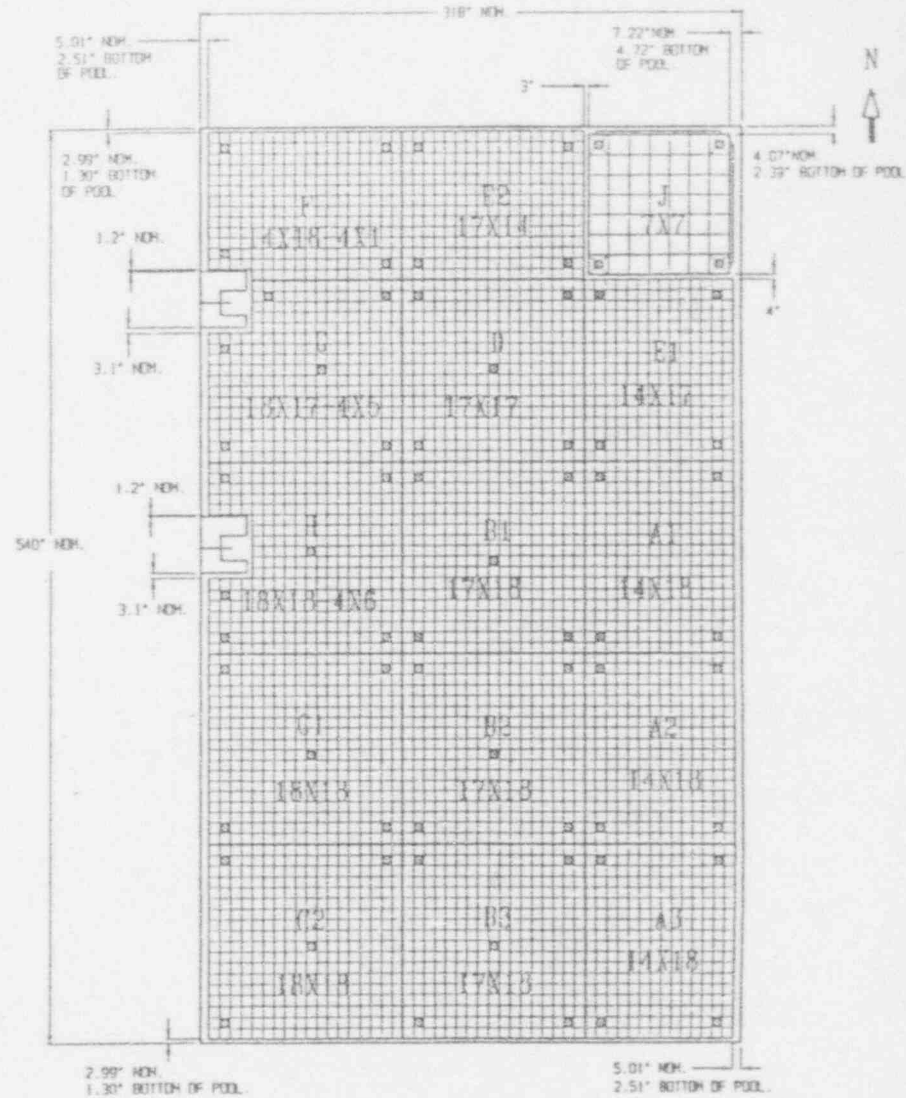
Unit 2

Configuration During Construction



2832 cells + CRB rack

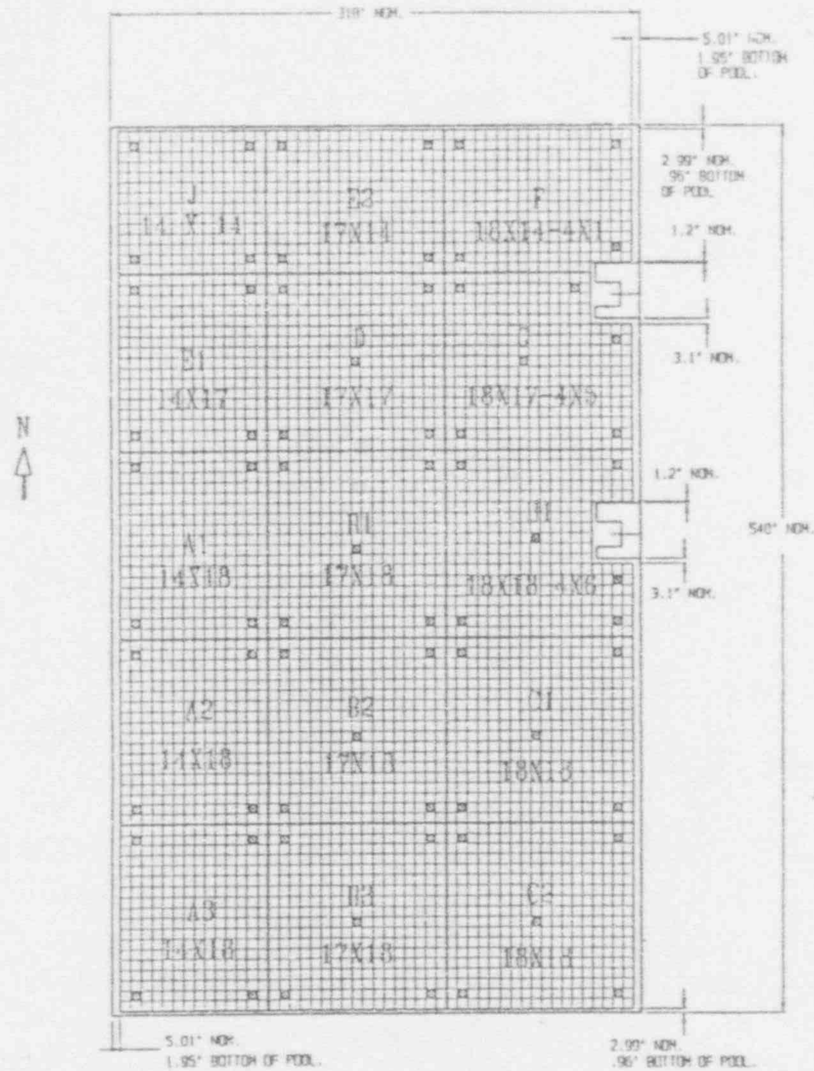
Unit 1



3970 cells + CRB rack

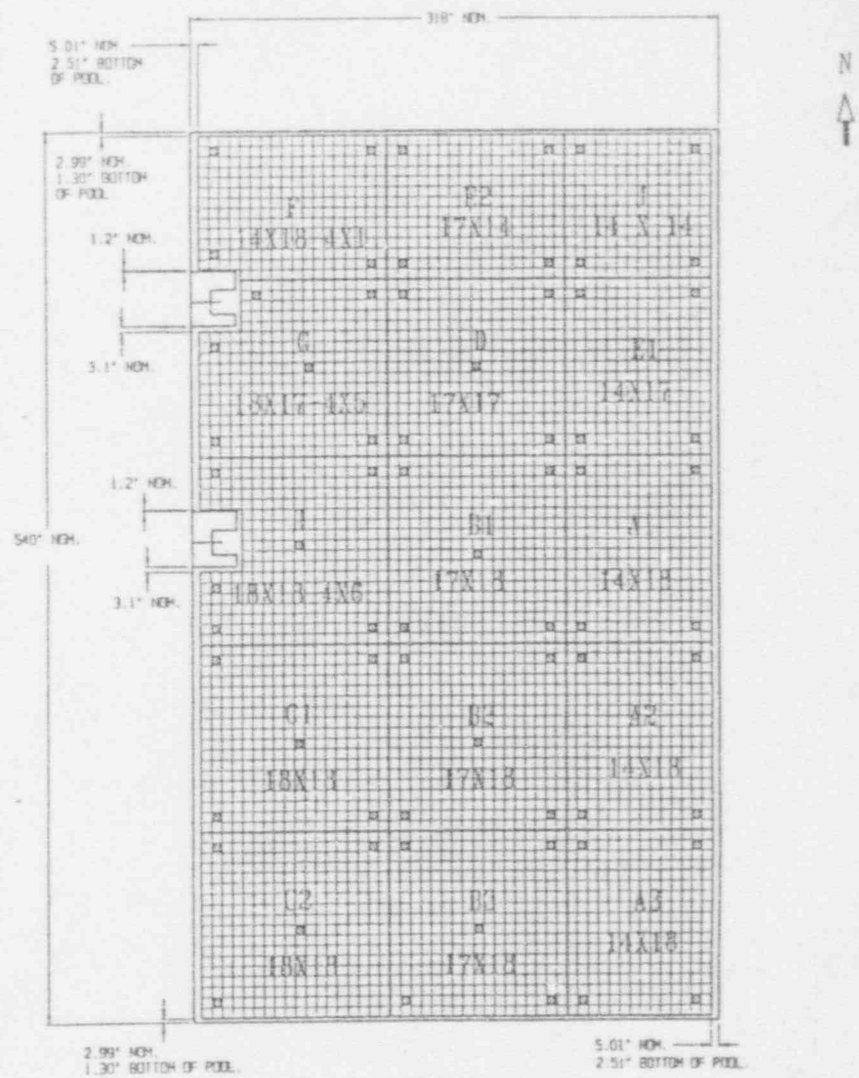
Unit 2

Configuration After Mod Completion



4117 cells

Unit 1



4117 cells

Unit 2

Ultimate Analyzed Configuration

ENCLOSURE 3

REQUEST FOR ADDITIONAL INFORMATION

TECHNICAL SPECIFICATIONS CHANGE TO INCREASE THE

SPENT FUEL POOL STORAGE CAPACITY

LIMERICK GENERATING STATION, UNITS 1 AND 2

PLANT SYSTEMS

1. As indicated in Attachment 2 of the January 14, 1994 submittal, the spent fuel pools (SFP) cooling system, with two out of three cooling trains operating, has sufficient cooling to maintain the SFP bulk water temperature at or below 143°F, and the net normal heat load corresponding to the maximum water temperature is 18.05×10^6 Btu/hr. However, the design heat removal rate for each cooling train is 4.0×10^6 Btu/hr and, it is not clear how two SFP cooling trains with a combined design heat removal rate (8.0×10^6 Btu/hr), which is less than the heat generation rate (18.05×10^6 Btu/hr) in the SFP, will be able to maintain the pool temperature to or below 143°F. Provide detailed information (e.g., detailed computation of the minimum free pool water volume, heat transfer from the walls of the pool, etc.) to demonstrate how the above pool temperature of 143°F is determined.

2. In Attachment 1 of the January 14, 1994 submittal, you stated that the time to boil of 13.5 hours, currently specified in the Updated Final Safety Analysis Report (UFSAR), bounds the time to boil of 9.15 hours presented in the supporting Safety Analysis Report. The 13.5 hours applies for 21 days after reactor shutdown and the 9.15 hours applies for 7.25 days after reactor shutdown. Because the calculated time of 13.5 hours for the SFP to boil is less conservative than that of 9.15 hours, it is not clear what the above statement means. Provide clarification for the above statement.

3. With regard to the calculation for the maximum amount of thermal energy to be removed by the SFP cooling system, the Standard Review Plan (SRP), Section 9.1.3, "Spent Fuel Pool Cooling and Cleanup System," provides, in part, the following guidance:

   a) The normal maximum spent fuel heat load is set at one refueling load at equilibrium conditions after 150 hours (not 7.25 days) decay and one refueling load to equilibrium conditions after 1 year decay.

   b) The spent fuel pool cooling system should have the capacity to remove the decay heat from one full core at equilibrium conditions after 150 hours decay and one refueling load at equilibrium conditions after 36 days decay.

   Therefore, revise the decay heat and SFP heat-up calculations (e.g., normal decay heat load, maximum anticipated decay heat load, pool temperatures, pool time-to-boil, etc.), as presented in various sections in the January 14, 1994, submittal and in the UFSAR, to reflect the above SRP guidance.

4. The activity release analysis presented in the UFSAR assumes 40,600 ft^3 of water in each SFP. The pool heat-up and time to boil analysis presented in the January 14, 1994 submittal, assumes 46,000 ft^3 of water in each SFP. Provide clarification for the above discrepancy. In addition, the installation of the new spent fuel storage racks will increase the spent fuel storage capacity in each of the SFPs. However, it will also decrease the minimum free water volumes in these SFPs. Therefore, the minimum free volume of water assumed in the pool heat-up and time to boil analysis should be revised to reflect this decrease in free pool water volume. Please address this staff concern.

STRUCTURAL ENGINEERING

5. Describe the method of leak detection and monitoring in the spent fuel pool. Also, state if you are aware of any existing leakage.

6. Describe the relation between the Skimmer Surge Tank and the SFP level.

7. The licensing report indicates that the pedestals of the existing racks have an aluminum threaded component. State if you have detected any indications of corrosion of the SFP mat due to the dissimilar metals (steel/aluminum) in the borated water environment.

8. The licensing report indicates that the increased capacity in the proposed reracking results more from the utilization of the floor space rather than by the change in cell-pitch. Provide an expanded discussion of this noted condition.

9. Describe the function and construction of the proposed overhead platforms. State and discuss their load capacity, and indicate if they will be removed and replaced after the placing of the assemblies and how this condition is factored in the rack analysis.

10. Describe the method used to develop spectra at the SFP floor level.

11. In the Final Safety Analysis Report (FSAR), you stated that four artificial time histories were generated from the design response spectra and that four response spectra were developed using the four artificial time histories. Also, you stated that an average response spectrum of the four response spectra enveloped the licensing basis design response spectra. However, your submittal indicates that you used a single time history for the actual structural dynamic analyses, rather than using the multiple (four) time histories. Provide your response to the following:

    a) State whether or not you used the multiple time histories for structural dynamic analyses.

b) If a single time history was used, state if the time history used in the analysis is the most conservative time history among the four generated artificial time histories.

c) The Standard Review Plan (SRP) Section 3.7.1 clearly states, if a single time history is used, demonstration of the adequacy of an artificial time history, including a determination of the extent of conformance to a target power spectral density (PSD) function of the artificial time history, should be provided. Demonstrate the adequacy of the single artificial time history used in a safe shutdown earthquake (SSE) analysis in accordance with guidance provided in SRP Section 3.7.1.

d) Provide the four response spectra developed from the four artificial time histories and compare them with the design response spectrum of the FSAR.

e) Discuss the basis for selecting Time History No. 2 over the Time History No. 3 in the SSE analysis. Provide justification that Time History No. 2 is more conservative than the No. 3.

f) Provide the digitized artificial time histories representing the input motions at the spent fuel pool floor, which correspond to the SSE and operating basis earthquake (OBE), in a 3.5-inch diskette for use by the staff in performing an independent analysis.

12. The staff is aware that you have generated two additional sets of artificial time histories for Safety-Relief-Valve (SRV) and Loss-of-Cooling-Accident (LOCA) analyses. Yet, a single time history was used for the analyses. Justify the use of the single time history, and indicate whether the single time history used is the most conservative time history among the artificial time histories generated.

13. Tables 6.7.3 and 6.7.9 show the results of two single-rack analyses. All conditions (rack dimension, friction, loading, etc.) for the two analyses are identical except for the assumption of the motion modes (out-of-phase and in-phase motions). Displacements at top corner (0.78 inch) and baseplate corner (0.07 inch) of the rack are predicted for the in-phase motion case (Table 6.7.9), but no rack-to-rack impact is predicted. However, rack-to-rack impact is predicted for the out-of-phase motion case (Table 6.7.3) even though smaller displacements at top corner (0.15 inch) and baseplate corner (0.02 inch) of the rack are predicted. Discuss the factors attributable to such phenomenon.

14. A whole pool multi-rack (WPMR) analysis (Table 6.8.1) shows a large displacement of 3.079 inches at rack top, but no rack-to-wall impact. However, a single rack analysis (Tables 6.7.2 and 6.7.52) shows a small displacement of 0.1628 inch, but rack-to-wall impact. Discuss the factors attributable to such phenomenon, and provide a rationale for concluding that these results are accurate and reasonable.

15. The results of a WPMR analysis (Table 6.8.1) indicate that larger displacements of the structure are due to the SSE loading, and not by the combined SSE+SRV+LOCA loading. Discuss the factors attributable to such phenomenon, and provide a rationale for concluding that these results are accurate.

16. Table 6.7.52 shows the results of the analysis for the computer run da3sslol.rf8 with a friction coefficient of 0.8. However, Table 6.7.1 shows that a friction coefficient of 0.2 was used for the same computer run. Similar discrepancies have been noted for Tables 6.7.54, 6.7.56 and 6.7.58. Clarify these discrepancies.

    Considering the facts that a coefficient of friction is one of the important parameters in numerical (DYNARACK) analysis, and similar discrepancies are found in the submittal (i.e., inconsistent magnitudes of coefficients of friction in Tables 6.7.1, 6.7.54, 6.7.56, and 6.7.58), we request that you check whether the coefficients of friction were accurately used in the analyses and proper results are presented in the tables and applicable figures.

17. With respect to the reinforced concrete spent fuel pool (SFP) structural analysis, we request that you submit for staff review the following:

    a) Provide the largest magnitude of the hydrodynamic pressure distribution along the height of the rack and pool wall during the fluid and rack interaction for each case of the 3-D single and WPMR analyses.

    b) Provide the magnitude of the hydrodynamic pressure used in the SFP concrete wall analysis. If you used a hydrodynamic pressure that is smaller than the peak (largest) hydrodynamic pressure of the DYNARACK analyses, justify the use of the smaller dynamic pressure as an acceptable conservative approach.

    c) State if an analysis that utilizes the peak dynamic pressure would not alter the calculated safety margin of 1.01 for the East Wall with respect to the shear strength evaluation (Table 8.3) and the safety margin of 1.09 for the West Wall with respect to the bending strength evaluation (Table 8.2). If they alter the margins, provide the revised margins. Also, discuss their implications.

    d) The staff anticipates that a smaller safety margin could be predicted if an analysis is carried out with the maximum dynamic pressure, different analytical methodologies, parameters (e.g., material properties), or assumptions (e.g., boundary conditions, load factor, etc.). Provide the input and output of the pool structural analyses (manual methods and ANSYS analyses) for the pool slab, the steel beam embedded in the pool slab, and the four walls. Also, provide the results for the upper, middle and lower sections of the walls for all four different critical loading conditions. Further, provide the physical dimensions, the reinforcement areas, and their locations for further staff review. Key technical assumptions considered should be discussed in details.

e) Provide the temperature profiles with magnitudes used for the pool's slab and walls analyses.

f) The submittal (pages 8-10) does not present any analysis of the post-tensioned girder when subjected to the SSE loading. Indicate whether or not the SSE loading was considered in the post-tensioned girder analysis. Provide the results of the girder analysis for the SSE loading case.

g) Describe the procedure(s) used to check and maintain adequate tension force in the tendons of the post-tensioned pool girders. Indicate whether tendon surveillance and test reports are available for staff audit.

h) The results of some of the rack analyses show that the SSE loading is more critical than the combined SSE+SRV+LOCA loading. Therefore, larger rack displacements and impact forces, and larger dynamic water pressure are induced due to the SSE loading rather than by the combined SSE+SRV+LOCA loading. Indicate whether or not you have observed a similar phenomenon from the SFP analyses. It appears that you used 0.61 g and 0.58 g as the SSE loading and the combined SSE+SRV+LOCA loading, respectively, for the SFP analyses (page 8-4 of the submittal). Indicate whether the calculated safety margin of 1.01 for the East Wall (shear strength evaluation Table 8.3) is based on the combined SSE+SRV+LOCA loading. If it is, then state the safety margin of the East Wall for the SSE loading. Further, provide and discuss the results of the SFP analysis for the SSE loading.

18. Describe how the structural responses (axial and shear stresses, moments and deflections) of three components (two horizontals and one vertical) of an earthquake motion are combined in the single and WPMR analyses.

19. Explain how the numerical analyses (single, multi-rack, and pool) account for the torsional effects when subjected to the SSE loading.

20. Discuss how the proposed platform was considered in the rack analysis. Also, discuss the effects of the inclusion of the platform in the rack modelling upon its controlling responses.

21. Commit to perform a post-OBE rack inspection and, as needed, to restore the rack gaps to their design configurations. Discuss the plan and the procedure for implementing this inspection.

RADIATION PROTECTION

22. Describe whether the rerack of the SFPs will be performed with water in the pools or with the pools dry.

23. Your letter dated March 22, 1994, indicates that you want to perform the rerack of Unit 2 pool after all fuel is moved to the Unit 1 pool and the Unit 2 pool is drained. Provide the procedure for this activity.

24. Describe how the old racks will be decontaminated (i.e., under water (hydrolysed) or after being removed from the pool). Also, describe the potential of creating airborne radioactive material (ARM) and methods/equipment to control ARM to keep worker/public doses ALARA.

25. If the reracking is to be performed in a full water pool, describe:

    a) If reracking activities will be performed using remote operations.

    b) If the licensee will use divers during any operations. If so, indicate commitment to the guidance provided in Appendix A to Regulatory Guide 8.38, "Control Access to High and Very High Radiation Areas in Nuclear Power Plants," for the protection of divers, or provide detailed equivalent procedures and controls.

26. If the reracking is to be performed with the pool dry, describe:

    a) What precautions will be taken to minimize worker doses from airborne radioactive material concentration during decontamination activities (e.g., close capture devices).

    b) Any fuel defect or hot particle problems that the licensee has experienced in the past, and their impact on the proposed activity.

    c) The process followed to perform required Total Effective Dose Equivalent (TEDE) ALARA evaluations, and to what extent personnel will be wearing respiratory protection.

    d) How the licensee will ensure that airborne effluent concentrations from potentially elevated airborne levels will be maintained ALARA, consistent with 10 CFR Part 50, Appendix I requirements.

    e) What controls or processes will be used to prevent particulates on the walls or pool floor from resuspending and becoming airborne (e.g., wall sprays.)