ATTACHMENT I TO JPN-91-XXX

SUPPLEMENT A
HOLTEC REPORT HI-89399

(JPTS-89-035)

New York Power Authority

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
Docket No. 50-333

SUPPLEMENT A
HOLTEC REPORT HI-89399

1.0 PURPOSE

This modification to NYPA's application for storage capacity expansion of the J.A. FitzPatrick pool is required to incorporate the dimensional changes in the module layout submitted with the original licensing application.

2.0 BACKGROUND

A dimensional survey of the pool indicated that the rack-to-wall gap at certain locations, and the gap between the existing racks and the new rack array, are slightly reduced. Figure 2.1 in the original licensing application is herein modified to reflect the new dimensions and is relabelled as Figure 1. A review of NYPA's licensing submittal document indicated that thermal/hydraulic (Section 5) and structural considerations (Section 6) required reassessment and re-evaluation. This submittal documents results of the reanalysis, and provides results in conformance with the actual spent fuel pool dimensions and rack spacing.

3.0 THERMAL-HYDRAULIC CONSIDERATIONS

3.1 Introduction

Section 5 of the licensing report documents the results of the thermal-hydraulic analyses. The thermal-hydraulic safety assessment presented in Section 5 can be sub-divided into two broad areas, namely (i) bulk pool water temperature evaluation and (ii) local pool water and fuel cladding temperature evaluation.

3.2 Bulk Pool Water Temperature

The bulk pool water temperature profile is a function of the gross heat generation and removal rates, and is therefore unaffected by the slight dimensional changes in the relative positioning of the rack modules.

3.3 Local Pool Water and Fuel Cladding Temperature

The local pool water temperature is affected by the module-to-wall gap. To determine the effect of the dimensional change, the local water and fuel cladding temperatures were re-evaluated using computer code THERPOOL following the methodology described in Section 5 of the Licensing Report.

3.4 Results and Conclusions

Tables 1 and 2 provide a comparison of the previous values (extracted from Section 5 of the Licensing Report) and the recalculated values. It is noted that, while the local water and peak fuel cladding temperatures have increased, the maximum values are well within the limits and preclude localized nucleate boiling or a state of overstress in the fuel cladding.

Table 1

Maximum Local Water and Fuel Cladding Temperature (°F)

Case	LOCAL WATER TEMPERATURE		MAXIMUM CLADDING TEMPERATURE	
	Previous Gap Configuration (Table 5.7.3)	Revised Configuration	Previous Gap Configuration (Table 5.7.3)	Revised Configuration
Normal discharge	210.9	218.6	246.5	250.6
Full core offload	192.8	199.7	223.3	227.1

Table 2

Maximum Local Water and Fuel Cladding Temperature
with 50% Assumed Blockage Condition (°F)

Case	LOCAL WATER TEMPERATURE		MAXIMUM CLADDING TEMPERATURE	
	Previous Gap Configuration (Table 5.7.3)	Revised Configuration	Previous Gap Configuration (Table 5.7.3)	Revised Configuration
Normal discharge	226.0	235.7	257.5	263.1
Full core offload	205.9	215.9	232.9	238.9

4.0 SEISMIC/STRUCTURAL CONSIDERATIONS

4.1 Introduction

The reduction in the reference gap between the existing racks and the new racks (scheduled to be installed along the east wall) requires a re-evaluation of the potential for impact between the new and old racks during an SSE (Safe Shutdown Earthquake) event. To make this evaluation, rack modules proximate to the new modules were analyzed using the computer code DYNARACK. The modeling procedure and analysis methodology for analyzing new fuel racks is described in detail in Section 6 of the licensing report, and is therefore not repeated here. For the existing high density racks, the simulations are limited to a study of bounding notions. Therefore, it is only necessary to compute the overall mass and inertial properties of the racks. For the purpose of estimating maximum rack movement, the important stiffness that should be modeled is the vertical stiffness of the pedestals, including the effects of local rack cellular structure. The drawings of the existing racks are utilized to obtain the appropriate stiffness; Section 2.2 of the Licensing Report also describes the existing racks. Referring to Figure 2, the existing racks are almost square. The 11x10 modules have the maximum inertial mass and will therefore most likely define the limiting case for kinematic evaluation; however, some runs evaluating the existing 8x10 have been added. In order to establish an upper bound on the module displacement, various conditions of fuel loading, full as well as partly full, were studied. Similarly, additional dynamic analyses on limiting new module geometries were also performed with the objective to establishing their maximum displacements. For this purpose, the module with the maximum aspect ratio (6x14 module), and the one with maximum inertia (12x11 module) were selected. The coefficient of friction between the rack pedestal and pool liner interface was also set at its extremal values (0.2 and 0.8) to bracket the effect of variation in the friction coefficient. In all, the following cases were analyzed. Table 3 lists all of the single rack analyses performed.

Table 3

RUN I.D.	RACK	COF.	LOADING
220	Existing 10x11	Cof. = .8	full fuel load
225	Existing 10x11	Cof. = .8	1/2 load positive x-half
227	Existing 10x11	Cof. = .8	1/2 diagonal load (positive x, y quadrant)
325	Existing 10x11	Cof. = .2	6 cells loaded
BH1	New 11x12	Cof. = .8	1/2 load positive x
BH2	Same as BH1	Cof. = .2	
BH3	New 11x12	Cof. = .8	1/2 diagonal load (positive x,y quadrants)
BH4	Same as BH3	Cof. = .2	
CH1	New 6x14	Cof. = .8	1/2 load in positive x
CH2	Same as CH1	Cof. = .2	
CH3	New 6 x 14	Cof. = .8	1/2 load in positive y
CH4	Same as CH3	Cof. = .2	
CH5	New 6x14	Cof. = .8	1/2 load diagonally located (positive x,y quadrants)
CH6	Same as CH5	Cof. = .2	
C22	New 6x14	Cof. = .8	full (same as C02 in Licensing report except takes account of new gap dimensions).
C23	New 6x14	Cof. = .8	full (heavier fuel) (same as C01 in Licensing report, except with new gaps.
500	Existing 8x10	Cof. = .8	full fuel load
501	Existing 8x10	Cof. = .8	6 cells loaded

* All runs carried out for the SSE seismic event.

The coordinate system notation used in the foregoing is illustrated in Figure 3. Cof. indicates the "coefficient of friction" between the rack pedestal/liner interface.

4.2 Results of Simulations

Tables 4 and 5 summarize the additional simulations carried out and are continuations of Tables 6.5 and 6.6 of the licensing report, respectively. The following additional remarks are appropriate.

1. For the existing racks, rack-to-rack hydrodynamics was neglected so as to maximize rack movements, and stress factors were not computed since the focus of this analysis is to determine the potential for rack-to-rack impact with the new racks.

2. Rack-to-rack hydrodynamics was included in the analyses for the different load cases involving the new racks, and the stress factors were computed and reported. This is consistent with original analyses in the licensing document for the new racks.

We see from the tables that predicted displacements from all runs indicate that no rack-to-rack impacts will occur even with reduced spacing. The stress factors for the additional new rack simulations are all less than 1.0, the OBE limit. All analyses were performed for the SSE event, since the kinematic displacements for SSE will be a bound for those for OBE.

5.0 CONCLUSIONS

The results of the analyses presented in the foregoing demonstrate that criteria of safety applicable to spent fuel storage racks, as enunciated in the USNRC OT Position Paper and NUREG-0800, continue to be satisfied by the maximum density racks.

- The analysis of critical racks using the changed gap geometry shows that no impacts will occur between existing and new racks.
- The small increase in bulk pool temperature does not affect pool cooling.
- All conclusions presented in NYPA's safety evaluation remain valid.

Table 4

STRESS FACTORS* (continuation of Table 6.5 of the Licensing Report)

RUN	R_1	R_2	R_3	R_4	R_5	R_6	R_7
CH1	.011	.006	.050	.040	.078	.090	.007
	.091	.013	.089	.087	.141	.152	.013
CH2	.011	.006	.051	.039	.078	.090	.007
	.103	.012	.101	.086	.183	.198	.015
CH3	.011	.006	.052	.039	.061	.070	.007
	.089	.014	.139	.091	.202	.223	.021
CH4	.011	.006	.052	.039	.061	.070	.007
	.089	.013	.164	.096	.224	.249	.024
CH5	.011	.006	.051	.043	.078	.090	.007
	.099	.014	.089	.101	.150	.161	.013
CH6	.011	.005	.051	.042	.078	.091	.007
	.100	.011	.130	.080	.200	.219	.019

* For each run, upper values are for baseplate gross section; lower values are for pedestal upper section (including gussets).

Table 4 (continued)

STRESS FACTORS*

RUN	R_1	R_2	R_3	R_4	R_5	R_6	R_7
220	NOT APPLICABLE						
225	NOT APPLICABLE						
227	NOT APPLICABLE						
325	NOT APPLICABLE						
500	NOT APPLICABLE						
501	NOT APPLICABLE						
BH1	$\frac{.012}{.124}$	$\frac{.008}{.023}$	$\frac{.044}{.186}$	$\frac{.033}{.162}$	$\frac{.046}{.269}$	$\frac{.053}{.299}$	$\frac{.008}{.026}$
BH2	$\frac{.012}{.133}$	$\frac{.007}{.018}$	$\frac{.047}{.139}$	$\frac{.034}{.132}$	$\frac{.057}{.225}$	$\frac{.065}{.246}$	$\frac{.006}{.020}$
BH3	$\frac{.012}{.127}$	$\frac{.008}{.026}$	$\frac{.033}{.155}$	$\frac{.033}{.182}$	$\frac{.043}{.259}$	$\frac{.049}{.285}$	.00[illegible] / .022
BH4	$\frac{.012}{.128}$	$\frac{.007}{.016}$	$\frac{.033}{.122}$	$\frac{.033}{.115}$	$\frac{.045}{.220}$	$\frac{.052}{.240}$	$\frac{.006}{.018}$

Table 4 (continued)

STRESS FACTORS*

RUN	R_1	R_2	R_3	R_4	R_5	R_6	R_7
C22	.016	.023	.078	.041	.088	.102	.012
	.122	.029	.110	.200	.267	.297	.016
C23	.024	.031	.113	.060	.131	.153	.019
	.197	.044	.170	.300	.414	.458	.025

* For each run, upper values are for baseplate gross section; lower values are for pedestal upper section (including gussets).

Table 5

RACK DISPLACEMENTS AND SUPPORT LOADS

(continuation of Table 6.6 of the Licensing Report)

Run	Remarks	Maximum Vertical Load on Slab (4 pedestals) (lb)	Maximum Vertical Load on Slab (single pedestal) (lb)	Maximum Shear Load (single pedestal) (lb)	Maximum Displacements (in.) DX	DY
CH1	6x14 1/2 x, cof. = .8	$.4009 \times 10^5$	1.982×10^4	1959.	.1211 .0007	.0271 .0004
CH2	6x14 1/2 x, cof. = .2	$.4011 \times 10^5$	2.250×10^4	2273	.1125 .0009	.0281 .0005
CH3	6x14 1/2 y, cof. = .8	$.4011 \times 10^5$	1.944×10^4	3025	.1279 .0008	.0339 .0006
CH4	1/2 y, cof. = .2	$.4010 \times 10^5$	1.942×10^4	3583	.1188 .0008	.0322 .0007
CH5	1/2 diagonal cof. = .8	$.4001 \times 10^5$	2.154×10^4	2161.	.0943 .0008	.0285 .0006
CH6	1/2 diagonal cof. = .2	$.4008 \times 10^5$	2.178×10^4	2876.	.0969 .0008	.0285 .0006
C22	Rerun of C02 6x14, Full, Cof. = .8 (new gaps)	$.716 \times 10^5$	2.653×10^4	4282.	.1494 .0009	.0460 .0005
C23	Rerun of C03 6x14, Full, heavier fuel Cof. = .8 (new gaps)	1.279×10^5	4.289×10^4	6501	.2099 .0015	.0690 .0007

* First line indicates values at top corner, second line indicates values at baseplate.

Table 5 (continued)

PACK DISPLACEMENTS AND SUPPORT LOADS

Run	Remarks	Maximum Vertical Load on Slab (4 pedestals) (lb)	Maximum Vertical Load on Slab (single pedestal) (lb)	Maximum Shear Load (single pedestal) (lb)	Maximum Displacements (in.) DX	DY
220	Existing Rack 10x11 Full, Cof. = .8	$1.166x10^5$	$7.424x10^4$	17848.	.0748 .0028	.0913 .0042
225	Existing Rack 10x11 1/2 x positive-x Cof. = .8	$.7161x10^5$	$5.124x10^4$	14568.	.0739 .0038	.0742 .0044
227	Existing Rack 10x11 1/2 diagonal, Cof. = .8	$.7240x10^5$	$5.189x10^4$	14218	.0687 .0056	.0771 .0043
325	Existing rack 10x11 6 cells, Cof. = .2	$.2915x10^5$	$1.5672x10^4$	3134	.0409 .0289	.0349 .0243
BH1	New Rack 11x12 (1/2x) SSE, Cof. = .8	$.6344x10^5$	$2.699x10^4$	4196	.0332 .0005	.0714 .0005
BH2	New Rack 11x12 (1/2x) SSE Cof. = .2	$.6339x10^5$	$2.899x10^4$	2956	.0338 .0005	.0701 .0006
BH3	New Rack 11x12 (1/2 diagonal) SSE, Cof. = .8	$.6341x10^5$	$2.784x10^4$	3944	.0296 .0004	.0577 .0007
BH4	New Rack 11x12 (1/2 diagonal) SSE, Cof. = .2	$.6342x10^5$	$2.784x10^4$	2919	.0296 .0004	.0601 .0007
500	Existing rack 8x10, Full Cof. = .8	$.7825x10^5$	$4.03x10^4$	11602	.0195 .0007	.0506 .0023
501	Existing Rack 8x10 6 cells loaded Cof. = .8	$.1661x10^5$	$.9417x10^4$	2062	.0064 .0003	.0152 .0008

* First line indicates values at top corner, second line indicates values at baseplate.

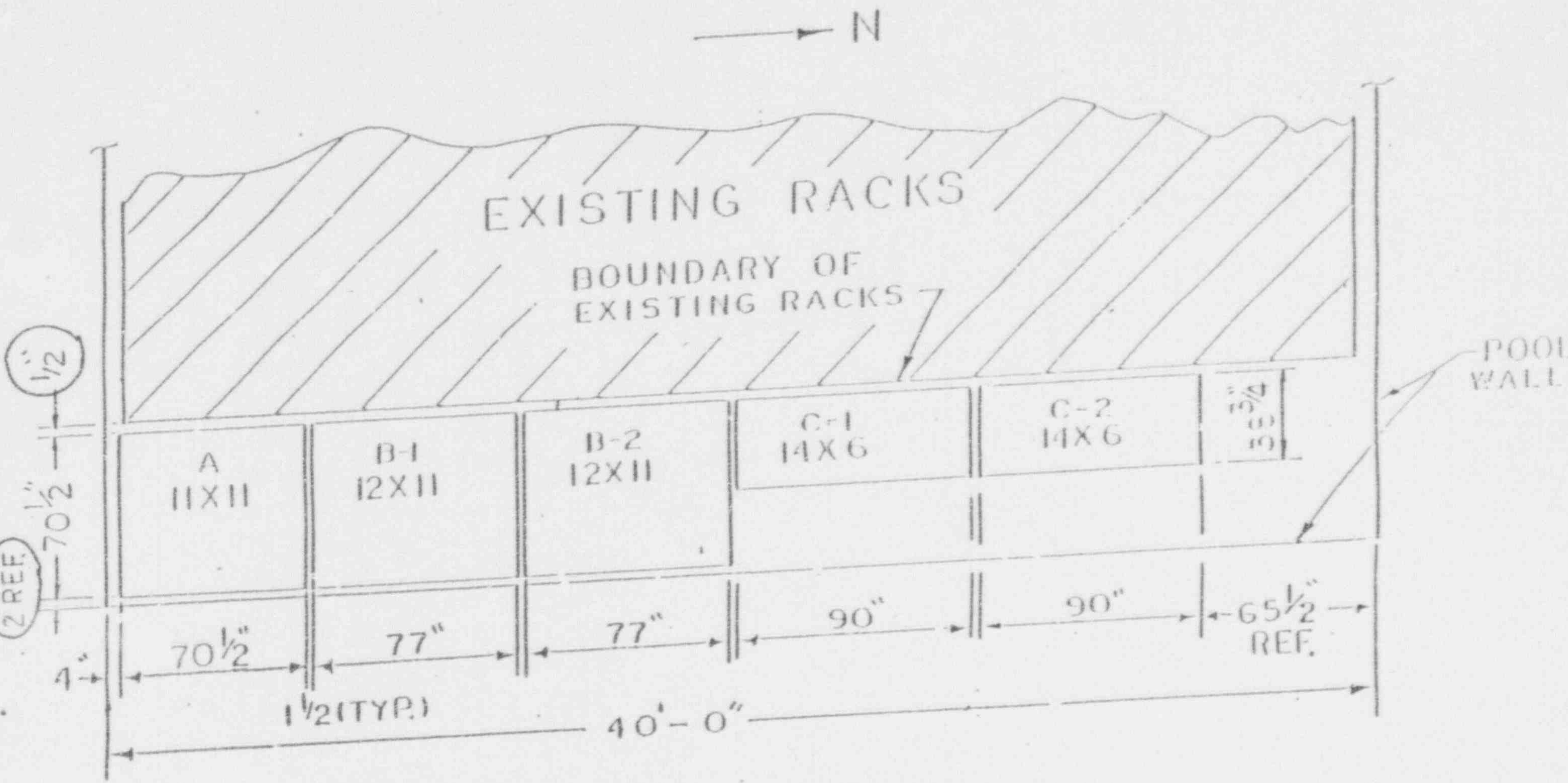

FIGURE 1 MODULE LAYOUT

(Replaces Figure 2.1 of Licensing Report)

(Dimensional Changes Circled)

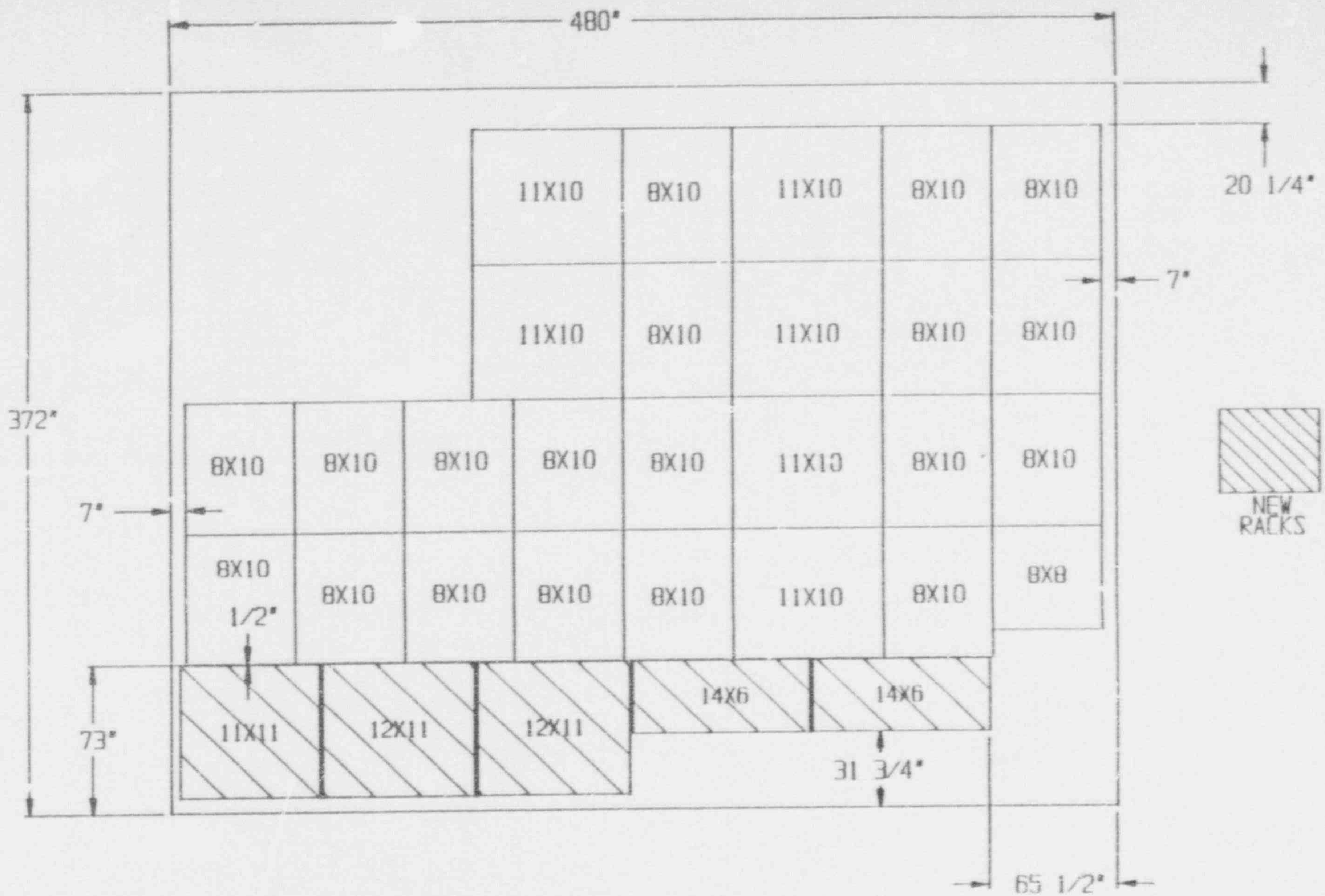

FIGURE 2: MODULE LAYOUT

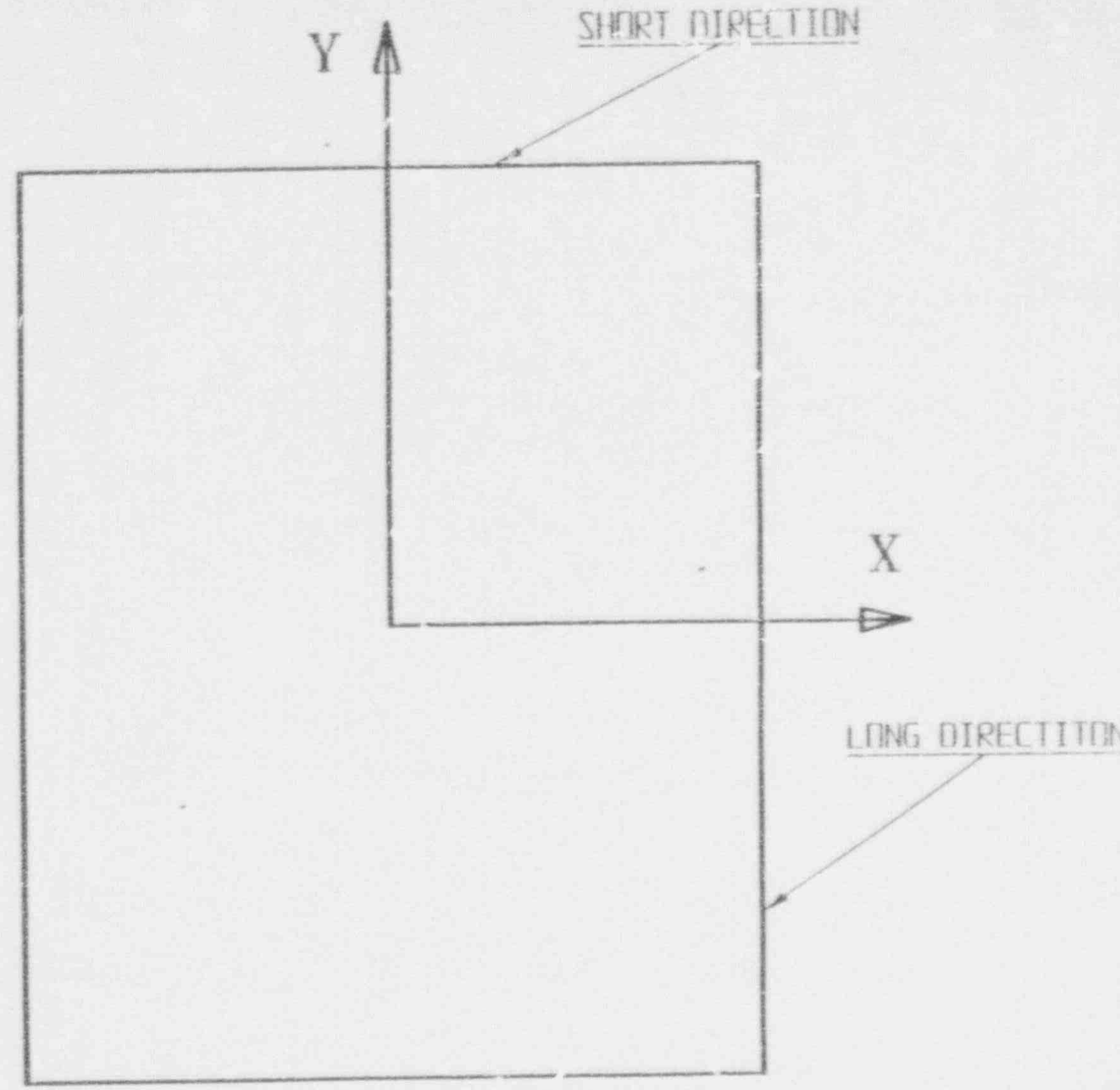

FIGURE 3:COORDINATE SYSTEM NOTATION