ATTACHMENT 4 TO AEP:NRC:1182

CONTROL ROD
MISALIGNMENT ANALYSIS

DONALD C. COOK NUCLEAR PLANT

CONTROL ROD MISALIGNMENT ANALYSIS

SEPTEMBER 1993

AMERICAN ELECTRIC POWER SERVICE CORPORATION

COLUMBUS, OHIO

TABLE OF CONTENTS

1. INTRODUCTION AND DEFINITION OF TERMS

1.1 Introduction

The Donald C. Cook Nuclear Plant constructed and operated by the American Electric Power Company is located along the eastern shore of Lake Michigan in Bridgman, Berrien County, Michigan. The reactor is a closed-cycle, pressurized, light water moderated and cooled system, and uses slightly enriched uranium oxide fuel. The Unit 1 reactor is designed to produce 3250 $MW_{thermal}$ and Unit 2 is designed to produced 3411 $MW_{thermal}$. This report describes the result of the analyses performed to modify the rod position indication system technical specifications.

1.2 Definition of Terms

The following list of symbols, terms and abbreviations will be used consistently throughout this report:

BOL	:	Beginning of Life
MOL	:	Middle of Life
EOL	:	End of Life
MWD/MTU	:	Megawatt days per metric tonne of uranium metal (represents burnup of fuel)
RCCA	:	Rod Cluster Control Assemblies (type of control rods used)
ARPI	:	Analog Rod Position Indication (type of system used to determine the axial position of individual control rods)
T/S	:	Technical Specification
RTP	:	Rated Thermal Power
PDIL	:	Power Dependent Insertion Limit (represents insertion limits for control banks)

APL	:	Allowable Power Level (Monthly surveillance determines this power level. This power level assures that limits on heat flux hot channel factors are protected.)
ARO	:	All Rods Out
$\Delta\rho$:	:	Change in reactivity ($\Delta\rho = \ln k_1/k_2$ where k_1 and k_2 are eigenvalues obtained from two calculations)
pcm	:	Percent mille (a reactivity change of 1 pcm equals a reactivity change of 10^{-5})
step	:	A unit of control rod travel equal to 0.625 inch
ppm	:	Parts per million by weight (specifies chemical shim boron concentration)
F_Q	:	Heat flux hot channel factor (maximum rod power at any axial level divided by average rod power at that axial level)
$F_{\Delta H}$	:	Enthalpy rise hot channel factor (maximum rod power divided by average rod power)
k(Z)	:	F_Q normalized to the maximum value allowed at any core height
HFP	:	Hot Full Power
HZP	:	Hot Zero Power
CAOC	:	Constant Axial Offset Control (power distribution control procedure)

2. ARPI TECHNICAL SPECIFICATION

2.1 Problem Description

The current Technical Specifications (T/Ss) allow an individual Rod Cluster Control Assembly (RCCA) to be misaligned from the bank demand position if the misalignment is less than 12 steps. As stated in the NRC letter dated October 28, 1979 (Reference 1 -- letter from A. Schwencer, NRC to J. Dolan, AEP), Westinghouse performed safety analyses for control rod misalignment up to 24 steps at the time of the development of the Standard Technical Specifications. The letter also noted that the Analog Rod Position Indication (ARPI) system is designed to an accuracy of 12 steps. Thus, in order to guarantee a rod misalignment of less than 24 steps, the indicated ARPI readings must be no larger than 12 steps. Experience with the ARPI system has shown that the indicated misalignment could be greater than 12 steps. It should be noted that there was no evidence of actual misalignment in the majority of cases. Procedures are in place to deal with actual rod misalignment when it occurs.

In order to reduce the action items imposed due to the current T/S limits, it is necessary to change the T/S to allow 18 step misalignment. Therefore, analyses must be performed for 30 step (18 step indicated + 12 step uncertainty) misalignment.

2.2 Problem Solution

The T/Ss allow reactor operation with the control rods at Power Dependent Insertion Limit (PDIL). The T/Ss also provide limits for peaking factors F_Q and $F_{\Delta H}$. As the power level is lowered, the limits for F_Q and $F_{\Delta H}$ increase according to:

a. F_Q^{Limit}/P

b. $F_{\Delta H}^{Limit}$ [1 + 0.2(1-P)] or $F_{\Delta H}^{Limit}$ [1 + 0.3(1-P)]

where P is the fraction of Rated Thermal Power.

These increases in the limit for F_Q and $F_{\Delta H}$ can be used for accommodating increased RCCA misalignment at a lower power level. That is, at 85% RTP, the limit for peaking factor, F_Q, increases by 15%. Analyses must show that the increase in peaking factor due to a 30-step misalignment (18 step indicated + 12 step uncertainty) is lower than 15%. If it is, then a T/S requirement of 18 steps is possible up to a power level of 85% RTP.

At 100% RTP, the current level of misalignment of 24 steps (12 step indicated + 12 step uncertainty) is maintained. If the measured F_Q and $F_{\Delta H}$ at 100% RTP are smaller than the corresponding limits at 100% RTP, then these margins can be used for accommodating larger than 12-step (indicated) misalignments. This can be determined on a monthly basis in conjunction with incore flux mapping.

The advantage of this procedure is that the initial conditions for transients are unaffected.

3. ROD MISALIGNMENT CONCERNS

3.1 Reactivity Control

It is necessary at all times to maintain enough reactivity out of the core to safely cover the power defect with a suitable margin allowed for accidents. In order to maintain this required shutdown margin, a rod bank Power Dependent Insertion Limit (PDIL) is set. The amount of reactivity associated with this insertion limit is called the rod insertion allowance. RCCAs which are misaligned inward from their bank demand position will add to the rod insertion allowance. The reactivity of a misaligned group (misaligned by 30 steps) was calculated to be less than 120 pcm (Table 3.1-1). This is substantially less than the excess shutdown margin generally available. Tables 3.1-2 and 3.1-3 show excess shutdown margin for past cycles in both units. The Unit 1 PDIL will be changed to match the Unit 2 PDIL at the beginning of cycle 14. Figures 3.1-1 and 3.1-2 show the Unit 1 and Unit 2 PDILs respectively. By making the PDIL similar for both units, the Unit 2 analyses detailed in this report can also be applied for Unit 1.

3.2 Control Rod Misoperation

The worst case control rod misoperation accident has been previously analyzed (Reference 2, 3) and found that applicable acceptance criteria are met.

A misoperation of control rods is detected by:

a. change in power level as seen by the nuclear instrumentation system

b. asymmetric power distributions as seen by the nuclear instrumentation system or core exit thermocouples

c. rod bottom light

d. rod deviation alarm

Reactor protection for control rod and control bank drop event is provided by the power range neutron flux high negative rate trip. This protection is augmented by the following alarms: low level and low-low level rod insertion limit.

A dropped RCCA bank results in a reactivity insertion greater than 500 pcm which will be detected by the power range neutron flux negative rate trip circuitry.

For a dropped RCCA event in automatic rod control mode, the rod control system detects a drop in power level and initiates bank withdrawal. Power overshoot may occur due to this after which the control system will insert the bank to restore nominal power. Power overshoot is not impacted since the existing analysis assumed RCCA drop from ARO position. The impact due to power distribution is minimal since the additional misalignment of six steps is allowed only if there is sufficient margin in F_Q and $F_{\Delta H}$ at full power. Power distribution calculations were performed and are detailed in Section 4.

In the case of statically misaligned RCCA, an analysis was performed by the vendor to show that the DNBR does not fall

below the limit value. The most severe misalignment with respect to DNBR at significant power levels arise from cases in which one RCCA is fully inserted, or where control bank D is fully inserted with one RCCA fully withdrawn. Multiple independent alarms, including a bank insertion limit alarm, alert the operator well before the postulated conditions are approached. The analysis was performed with control bank D deeply inserted as the criteria on DNBR and peaking factor will allow. To be conservative, the PDIL for Unit 1 will be moved up by seven steps to accommodate the possible six-step misalignment [See Figure 3.1-2. Allowed insertion of 182 steps at HFP was changed to 189 steps at HFP.]

3.3 Rod Ejection

A control rod which is misaligned from its bank at PDIL can slightly increase the available ejected rod worth. Calculations were performed at HZP and HFP conditions. An HZP misalignment is not a concern since the calculation is performed for rod ejection from a fully inserted position. At full power conditions, an increase in worth of less than 30 pcm (119 pcm ÷ 4 = 29.75 pcm) in rod worth was calculated. Since adequate margin exists between the calculated pellet energy deposition and the acceptance criteria, the misalignment presents no concern in this area. A re-analysis of the EOL HZP rod ejection event was performed to account for effects of operation down to 50% power for extended periods of time (Reference 10). Specifically, the re-analysis addressed increases in the ejected rod worth and hot channel factor. The results showed average fuel pellet enthalpy and fuel center temperature to be below limits.

3.4 Power Operation with a Misaligned Rod

The NSSS vendor has performed safety analyses for control rod misalignments up to 24 steps from the bank demand position to show that the misalignment will not cause power distributions worse than the limits. Operation with an RCCA significantly misaligned from its bank demand position would normally be detected and promptly realigned.

In the unlikely event that operation with a control rod misalignment of greater than 24 steps would occur, the impact on power distribution would be of concern. The increase in peaking factors due to single RCCA misalignment may be small but misalignment of one group of RCCAs may contribute to increases in peaking factors. Power distributions with control rod misalignment of 30 steps were therefore evaluated in detail, and the results are presented in Section 4 of this report.

4. POWER DISTRIBUTION ANALYSES

Neutronic analyses were performed to evaluate the impact of RCCA misalignment on steady state power distributions and normal operational transients such as load-follow operations. Calculations were done for both inward and outward misalignments from the demand counter position.

Current technical specifications require that the reactor operation be restricted to a ±5% axial offset band about a target axial offset (CAOC operation). This restriction controls the axial power distribution and minimizes transient xenon effects on the axial power distribution. The reactor is operated below an Allowable Power Level (APL) which assures that the power distributions arising from operation under this strategy will meet the limit on heat flux hot channel factor.

The technical specification on quadrant power tilt ratio assures that the radial power distribution does not deviate substantially from the measured steady state power distribution between flux maps.

Therefore, limits on axial offset and quadrant power tilt ratio are vital to maintaining satisfactory power distribution and assure that most of the RCCA misalignments are detected and corrected in a timely manner.

4.1 Analysis Method

The principal tool used in these calculations is the Westinghouse ANC code (Reference 6) exercised in a three-dimensional mode. Full core and quarter core models were used for the analyses. In this model, each fuel assembly is described by four nodes in the XY plane and 26 axial nodes. The macroscopic cross-sections for ANC were generated by PHOENIX-P (Reference 7). The calculations were performed by Westinghouse using approved methodology.

ANC also has the capability of calculating discrete pin power and pin burnup from the nodal information. The F_Q^{pin} and $F_{\Delta H}^{pin}$ thus obtained is shown in Tables 4.2-1 through 4.2-14. It should be noted that as far as this analysis is concerned, we are interested in changes in F_Q rather than absolute values of F_Q.

The Unit 2, Cycle 9 ANC model was used for the RPI analysis since Unit 2 core has axial blankets and therefore more conservative calculation from a peaking factor standpoint. Also, the F_Q and $F_{\Delta H}$ T/S limits are slightly more restrictive for the remaining ANF fuel in unit 2.

In order to show that the calculational tools used in the analysis are reasonable, the Unit 2, Cycle 9 ANC model was depleted and results of the power distribution and boron letdown calculations were compared to the measured values. This is shown in Appendix A.

The loading pattern and control rod locations for Unit 2, Cycle 9 are shown in Figures 4.1-1 and 4.1-2. The loading pattern and control rod locations for Unit 1, Cycle 13 are

shown in Figures 4.1-3 and 4.1-4.

4.2 Misalignment Calculations

The first step was to determine a power level at which the peaking factor increase due to RCCA misalignment of 30 steps (18 step indicated + 12 step uncertainty) could be accommodated. Therefore, misalignment calculations from PDIL were performed. The question of multiple RCCA misalignment was addressed by analyzing misalignments of groups of RCCAs in the control bank (Groups 1 and 2 in Control Bank D). Group misalignment was considered since it is more realistic to assume that the RCCAs in one group would mis-step rather than different RCCAs from different groups would mis-step. However, some single RCCA misalignment calculations were also performed. Especially, misalignment of RCCA H-8 was investigated since it is in the middle of the core and will be difficult to detect through monitoring excore detector quadrant tilt.

First, the change in peaking factors due to operation at lower power levels without RCCA misalignments was investigated. As seen in Table 4.2-1, peaking factors F_Q and $F_{\Delta H}$ do not change substantially with power change as long as the reactor operation is on CAOC. Misalignment calculations were then performed at 85% RTP. The misalignment effect of a single RCCA H-8 and the misalignment effect of group 1 and 2 were investigated. From Table 4.2-2, it can be seen that the maximum increase in F_Q is 4.7% and maximum increase in $F_{\Delta H}$ is 2.1%. Similar calculations at MOL gave a maximum increase of 6.6% in F_Q and 0.7% in $F_{\Delta H}$ (Table 4.2-3). EOL calculations yielded an increase of 7.4% in F_Q and 0.9% in $F_{\Delta H}$ (Table 4.2-4).

As noted in previous section, the equations governing the limits (ANF fuel) for F_Q and $F_{\Delta H}$ are as follows:

$$F_Q^{Limit} = \frac{2.1}{P} \times k(z)$$

$$F_{\Delta H}^{Limit} = 1.49[1 + 0.2(1-P)]$$

Therefore, the limits at 85% RTP will be:

$$F_Q^{Limit @ 85\% RTP} = 2.47$$

$$F_{\Delta H}^{Limit @ 85\% RTP} = 1.53$$

It is evident that the limit for F_Q increased by 17.6% and the limit for $F_{\Delta H}$ increased by 2.6% at 85% RTP. Therefore, a ±18 steps misalignment is acceptable up to a power level of 85% RTP.

Other sensitivity runs were also made for similar RCCA misalignments from different D-bank positions other than PDIL. Results of misalignment calculations from D-bank position of 215 steps is shown in Table 4.2-5. Table 4.2-6 shows the results of calculations at 50% RTP with control bank at PDIL (i.e., D at 94.5 steps and C at 222.5 steps). The maximum increase in F_Q in these calculations was found to be 7.3% and maximum increase in $F_{\Delta H}$ was found to be 2.7%.

Full core analysis for investigating single RCCA misalignment was performed. RCCAs H-12 and D-12 were misaligned 30 steps from ARO and PDIL and increases in F_Q and $F_{\Delta H}$ noted.

From Tables 4.2-7, it can be seen that F_Q increased by 1.7% and $F_{\Delta H}$ increased by 0.9%. This is accommodated by the increases in limits at 85% RTP. It should also be noted that the impact of RCCA H-8 misalignment on peaking factor is small. Therefore, it can be concluded that a 18-step misalignment up to 85% RTP can be tolerated.

The next step was to perform sensitivity calculations to determine the additional misalignment (above 12 steps indicated) allowed at power levels between 85% RTP and 100% RTP. For this, misalignment calculations were performed for 24 steps (12 step indicated + 12 step uncertainty), 27 steps (15 step indicated + 12 step uncertainty), and 30 steps (18 step indicated + 12 step uncertainty). These calculations at 100% RTP were performed for the following RCCAs in control bank D: H-8, RCCAs in Group 1 and RCCAs in Group 2. Results from these calculations are shown in Tables 4.2-8 through 4.2-10.

Sensitivity runs were made for a similar misalignment case from a D-bank position of 215 steps rather than from PDIL. Results are shown in Tables 4.2-11 and 4.2-12. Review of these results shows that the change in F_Q is 2.2% and $F_{\Delta H}$ is 0.4%. These changes are similar to the change in peaking factors due to misalignment from PDIL. The effect of a single RCCA misalignment (D-12,K-14,H-12 and K-8) on peaking factors is shown in Table 4.2-13; as seen before, the impact is small.

The increase in F_Q due to an additional misalignment of three steps over the existing 12 step (indicated) misalign-

ment was found to be 0.9%. The increase due to an additional misalignment of six steps was found to be 1.6%. Additional load-follow calculations indicate an increase of 3.4%. Since the analysis was performed for a typical cycle, the F_Q margin necessary is increased to 6% for conservatism. This means that if a margin of 6% in F_Q exists, then an additional misalignment of six steps (i.e., total of 18 steps -- indicated) is allowed at 100% RTP.

As far as peaking factor $F_{\Delta H}$ is concerned, a 0.5% increase over the 12-step misalignment case is noted. Load-follow calculations indicate that a 0.8% margin is required. This was the increase calculated for the 18-step case over the 12 step case.

In conclusion, it can be mentioned that if the requirements given in T/S 3.1.3.1 are satisfied, T/S limits on F_Q and $F_{\Delta H}$ will not be violated even with an 18-step (indicated) misalignment. Since the T/S limiting conditions for operations are not violated, the initial conditions assumed in accident analyses are not violated.

4.3 Load-Follow Transient with RCCA Misalignment

Effect of load-follow maneuver and misalignment on peaking factors was investigated. Axial power distribution which could be obtained during a load-follow operation was obtained by skewing the EOL xenon distribution to the bottom. This is a conservative assumption since typical load-follow under CAOC rules will not give a skewed xenon distribution as this. An option in the ANC code was used to get the skewed xenon distribution.

The results of the analysis is shown in Tables 4.3-1 through 4.3-3. The effect of single RCCA H-8 misalignment is small as before. The change in F_Q due to group misalignment was found to be 3.4%.

4.4 Unit 1 Applicability

The analyses in previous sections were performed for Unit 2 (3411 MWt) which consists of 17 x 17 fuel assemblies. The Unit 1 core (3250 MWt) consists of 15 x 15 fuel assemblies. Both units have 12 feet cores consisting of 193 assemblies. The difference in the fuel type is not considered to be significant for this type of analysis. Moreover, the Unit 1 PDIL has been moved up to match the revised Unit 2 insertion limit shown in Figure 3.1-1. Since the T/Ss allow a 12-step misalignment for both units currently, regardless of the fuel type or power level, and since the PDIL will be the same for both units, the analyses performed for Unit 2 is applicable for Unit 1.

A sensitivity study using the PHOENIX/ANC model for Unit 1, Cycle 13 shows that the response due to rod misalignment is almost the same as that in Unit 2. As shown in Table 4.4-1, BOL calculations for Unit 1 yielded a change of 6.2% and 1.1% for F_Q and $F_{\Delta H}$, respectively. Although the change in F_Q is slightly higher in Unit 1 compared to Unit 2, such differences are expected and are accounted for in the F_Q margin necessary to achieve 18 step misalignment at full power.

5. TECHNICAL SPECIFICATION CHANGES AND IMPLEMENTATION

5.1 Technical Specification Changes

From the analyses detailed in Section 4.0, it can be seen that the increase in peaking factor F_Q due to an RCCA misalignment of 30 steps (18 step indicated + 12 step uncertainty) is less than 8% and the increase in $F_{\Delta H}$ is less than 3%. These increases in peaking factors can be accommodated at a power level of 85% RTP. Therefore, the revised T/Ss allow RCCA misalignments of ±18 steps (indicated) up to a power level of 85% RTP. [The current T/Ss allow rod misalignment of ±12 steps (indicated) up to 100% RTP.]

Analysis detailed in Section 4 also shows that a 3.4% margin in F_Q is necessary to accommodate a misalignment of 30 steps (18 steps indicated + 12 step uncertainty) at full power. That is, F_Q increases by 3.4% for an 18-step (indicated) misalignment compared to a 12-step (indicated) misalignment. For conservatism, this is increased to require a margin of 6% in F_Q.

The current T/S basis references a 4% $F_{\Delta H}$ margin for uncertainties arising from abnormal perturbations in radial power shape. This analysis shows that a 0.8% margin in $F_{\Delta H}$ is required to take into account an 18-step (indicated) misalignment. Therefore, the conservative requirement of 4% margin is retained and is adhered to in a strict manner by specifying this requirement in T/S figure 3.1-4 (Appendix B).

It should be noted that the margin in F_Q is that available beyond the expected transient F_Q and is computed in the following way:

F_Q (measured-steady state) $= F_Q^M$

F_Q (penalized) $= F_Q^M \times 1.03 \times 1.05$

F_Q (transient) $= F_Q^M \times 1.03 \times 1.05 \times V(Z)$

F_Q (limit) $= F_Q^L \times k(Z)$

$$\text{margin} = \frac{F_Q^L \times k(Z)}{F_Q^M \times 1.03 \times 1.05 \times V(Z)}$$

Compared with the definition of APL in T/S 3.2.6, the margin defined above is essentially the APL. Note that the margin calculated is with respect to the limit at 100% RTP.

In a similar manner the margin in $F_{\Delta H}$ (defined as R) is calculated in the following way:

$F_{\Delta H}$ (measured-steady state) $= F_{\Delta H}^N$

$F_{\Delta H}$ (limit) $= F_{\Delta H}^{Limit\ @\ 100\%RTP}$

$$\text{margin R} = \frac{F_{\Delta H}^{Limit@100\%RTP}}{F_{\Delta H}^N}$$

Therefore, if the APL given in the monthly incore flux map is 106% and if the value of R (margin in $F_{\Delta H}$) is 1.04, then an additional six-step misalignment is allowed above 85% RTP. If the APL is lower, then a lower amount of misalignment is allowed. This is graphically shown in T/S

Figure 3.1-4.

Since a new rod insertion limit was used in the analysis, the unit 1 PDIL will be changed to reflect the limit used in the analysis at the begining of cycle 14.

The updated T/S pages for both units are given in Appendix B.

5.2 Technical Specification Implementation

As seen in Section 5.1, the updated T/Ss allow a rod misalignment of ±18 steps for power levels less than or equal to 85% RTP. Above 85% RTP, the level of misalignment allowed is based on the peaking factors obtained from the monthly incore flux map taken. For this, the plant procedure, "Surveillance of core power distribution limit," (**1EHP 4030 STP.330 and **2EHP 4030 STP.330) will be revised to provide the allowed rod misalignment on a monthly basis. The incore flux map gives the values for APL and $F_{\Delta H}$ and from T/S Figure 3.1-4, the additional rod misalignment is obtained.

For example, if an incore flux map taken at 98% RTP gives the following:

$F_{\Delta H}^{measured}$ = 1.40

APL = 103%

Therefore,

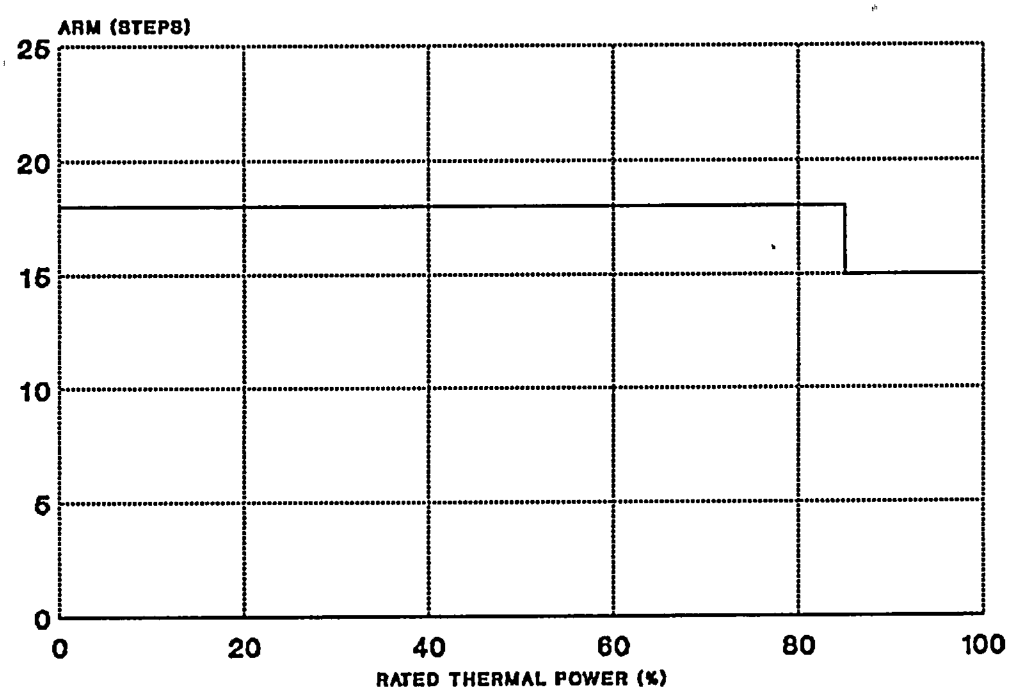
$$R = \frac{F_{\Delta H}^{Limit@100\%}}{F_{\Delta H}^{Measured}}$$

$$= \frac{1.49}{1.40}$$

$$= 1.064$$

Since the value of R obtained is greater than 1.04, from T/S Figure 3.1-4, for an APL of 103%, a misalignment of 15 steps is obtained for power levels greater than 85% RTP. In order to assist the reactor operator in determining the allowed rod misalignment, a plot as shown below may be provided.

ALLOWED ROD MISALIGNMENT



6. SUMMARY

RCCA misalignments up to 30 steps (18 steps indicated + 12 steps uncertainty) were evaluated for impact on peaking factors and reactivity worths. A review of the results of the transient analyses showed that adequate conservatism exists in the analyses to absorb the penalties associated with increased rod misalignment. As a conservative measure, the power dependent insertion limit (PDIL) will be moved slightly upwards.

Power distributions were evaluated under steady state and load-follow conditions with rod misalignment of 30 steps (18 steps indicated + 12 steps uncertainty) showed that the increase in peaking factors could be accommodated at or below 85% RTP. Calculations also showed that above 85% RTP, a misalignment of 30 steps (18 steps indicated + 12 steps uncertainty) could be accommodated if the APL is at least 106% and the margin in $F_{\Delta H}$ is at least 4%.

It should be noted that typical plant operation is with control rods essentially withdrawn from the core and under constant axial offset control. Also, the quadrant tilt is monitored. This, coupled with the fact that actual control rod misalignments are rare, shows that this analysis is conservative. An actual control rod misalignment would be promptly realigned upon verification of its position.

Based on this, the technical specification changes given in this report do not increase the probability of an accident or decrease safety margins previously established.

TABLE 3.1-1

ROD WORTH CALCULATION

Bank/Group	Rod worth (pcm)	Delta pcm
Control Bank D @189	248.3	0
Control Bank D @189, Group 2 @ 159	367.7	119.4
Control Bank D @189, Group 1 @ 159	349.6	101.3

TABLE 3.1-2

UNIT 1 SHUTDOWN MARGIN

Parameter	Cycle												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Net Rod Worth [(ARI-1)*0.9]	6620	6399	6170	5913	5807	5837	5764	5870	5479	5743	5733	5736	5768
HFP Requirement	3380	3500	3500	2970	2956	2968	2970	3390	2904	2274	2293	2319	2461
Required Shutdown Margin	1600	1750	1750	1750	1750	1750	1750	1600	1600	1600	1600	1600	1600
Excess Shutdown Margin	1640	1149	920	1193	1101	1119	1044	880	975	1869	1840	1817	1707

Note: All reactivity values in pcm

TABLE 3.1-3

UNIT 2 SHUTDOWN MARGIN

Parameter	Cycle								
	1	2	3	4	5	6	7	8	9
Net Rod Worth [(ARI-1)*0.9]	5660	5130	5210	5484	5471	5409	5908	5626	4779
HFP Requirement	3280	3230	3360	3150	3150	3150	2740	3129	2324
Required Shutdown Margin	1600	1600	1600	1600	1600	1600	2000	1600	1600
Excess Shutdown Margin	780	300	250	734	721	659	1168	897	855

Note: All reactivity values in pcm

TABLE 4.2-1
UNIT 2, CYCLE 9
EOL, D IN TO HOLD TARGET AO

Description	F_Q^{pin}	$F_{\Delta H}^{pin}$
100% RTP, ARO	1.696	1.423
75% RTP, D in for target AO	1.644	1.409
50% RTP, D in for target AO	1.603	1.444
25% RTP, D in for target AO	1.654	1.483

TABLE 4.2-2

UNIT 2, CYCLE 9
BOL, 85% RTP, +30 STEPS FROM PDIL (18 + 12)

Rod Position	F_Q^{pin}	$F_{\Delta H}^{pin}$
ARO	1.832	1.475
D @ PDIL (160.7)	2.039	1.465
D @ PDIL, H-8 @190.7	2.027	1.493
D @ PDIL, H-8 @130.7	2.044	1.449
D @ PDIL, GP2 @190.7	1.954	1.490
D @ PDIL, GP2 @130.7	2.134	1.456
D @ PDIL, GP1 @190.7	1.970	1.440
D @ PDIL, GP1 @130.7	2.117	1.496
Delta F_Q	4.7%	
Delta $F_{\Delta H}$		2.1%

Note:
1) Control Bank D Locations
Group 1 : D4, D12, M12, M4
Group 2 : H4, D8, H12, M8, H8

2) Delta F_Q & Delta $F_{\Delta H}$ is the percent difference between highest value and value for the case with D-bank at PDIL

TABLE 4.2-3

UNIT 2, CYCLE 9
MOL, 85% RTP, +30 STEPS FROM PDIL (18 + 12)

Rod Position	F_Q^{pin}	$F_{\Delta H}^{pin}$
ARO	1.740	1.474
D @ PDIL (160.7)	2.182	1.474
D @ PDIL, H-8 @190.7	2.158	1.473
D @ PDIL, H-8 @130.7	2.206	1.475
D @ PDIL, GP2 @190.7	2.026	1.470
D @ PDIL, GP2 @130.7	2.326	1.483
D @ PDIL, GP1 @190.7	2.050	1.484
D @ PDIL, GP1 @130.7	2.306	1.475
Delta F_Q	6.6%	
Delta $F_{\Delta H}$		0.7%

TABLE 4.2-4

UNIT 2, CYCLE 9
EOL, 85% RTP, +30 STEPS FROM PDIL (18 + 12)

Rod Position	F_Q^{pin}	$F_{\Delta H}^{pin}$
ARO	1.697	1.409
D @ PDIL (160.7)	2.225	1.412
D @ PDIL, H-8 @190.7	2.191	1.424
D @ PDIL, H-8 @130.7	2.253	1.417
D @ PDIL, GP2 @190.7	2.036	1.415
D @ PDIL, GP2 @130.7	2.389	1.419
D @ PDIL, GP1 @190.7	2.061	1.410
D @ PDIL, GP1 @130.7	2.368	1.415
Delta F_Q	7.4%	
Delta $F_{\Delta H}$		0.9%

TABLE 4.2-5

UNIT 2, CYCLE 9
EOL, 85% RTP, +30 STEPS FROM 215 STEPS (18 + 12)

Rod Position	F_Q^{pin}	$F_{\Delta H}^{pin}$
ARO	1.697	1.409
D @ 215 STEPS	1.640	1.404
D @ 215, H-8 @231	1.664	1.414
D @ 215, H-8 @185	1.607	1.396
D @ 215, GP2 @231	1.688	1.413
D @ 215, GP2 @185	1.759	1.403
D @ 215, GP1 @231	1.654	1.400
D @ 215, GP1 @185	1.727	1.442
Delta F_Q	7.3%	
Delta $F_{\Delta H}$		2.7%

TABLE 4.2-6

UNIT 2, CYCLE 9

BOL, 50% RTP, +30 STEPS FROM PDIL (18 + 12)

Rod Position	F_Q^{pin}	$F_{\Delta H}^{pin}$
D @ 50% PDIL (94.5) C @ 50% PDIL(222.5)	2.597	1.489
D&C @ 50%P PDIL D GP2 @ 64.5	2.615	1.511
D&C @ 50%P PDIL D GP2 @ 124.5	2.479	1.476
D&C @ 50%P PDIL C GP2 @ 192.5	2.702	1.495
Delta F_Q	4.0%	
Delta $F_{\Delta H}$		1.5%

TABLE 4.2-7

UNIT 2, CYCLE 9
EOL, 85% RTP, +30 STEPS FROM PDIL (18 + 12)

Rod Position	F_Q^{pin}	$F_{\Delta H}^{pin}$
ARO	1.697	1.409
D @ PDIL (160.7)	2.225	1.412
D @ PDIL,D-12 @130.7	2.262	1.425
D @ PDIL,K-14 @195.0	2.245	1.418
D @ PDIL,H-12 @130.7	2.257	1.423
D @ PDIL,K-8 @195.0	2.239	1.416
Delta F_Q	1.7%	
Delta $F_{\Delta H}$		0.9%

TABLE 4.2-8

UNIT 2, CYCLE 9
EOL, 100% RTP, +24 STEPS FROM PDIL (12 + 12)

Rod Position	F_Q^{pin}	$F_{\Delta H}^{pin}$
ARO	1.696	1.423
D @ PDIL (189.0)	2.069	1.396
D @ PDIL, H-8 @213	2.040	1.448
D @ PDIL, H-8 @165	2.099	1.391
D @ PDIL, GP2 @213	1.906	1.442
D @ PDIL, GP2 @165	2.220	1.392
D @ PDIL, GP1 @213	1.934	1.385
D @ PDIL, GP1 @165	2.198	1.421
Delta F_Q	7.3%	
Delta $F_{\Delta H}$		3.7%

TABLE 4.2-9

UNIT 2, CYCLE 9
EOL, 100% RTP, +27 STEPS FROM PDIL (15 + 12)

Rod Position	F_Q^{pin}	$F_{\Delta H}^{pin}$
ARO	1.696	1.423
D @ PDIL (189)	2.069	1.396
D @ PDIL, H-8 @216	2.035	1.453
D @ PDIL, H-8 @162	2.103	1.392
D @ PDIL, GP2 @216	1.891	1.447
D @ PDIL, GP2 @162	2.238	1.393
D @ PDIL, GP1 @216	1.921	1.387
D @ PDIL, GP1 @162	2.216	1.424
Delta F_Q	8.2%	
Delta $F_{\Delta H}$		4.1%

TABLE 4.2-10

UNIT 2, CYCLE 9
EOL, 100% RTP, +30 STEPS FROM PDIL (18 + 12)

Rod Position	F_Q^{pin}	$F_{\Delta H}^{pin}$
ARO	1.696	1.423
D @ PDIL (189)	2.069	1.396
D @ PDIL, H-8 @219	2.033	1.455
D @ PDIL, H-8 @159	2.106	1.392
D @ PDIL, GP2 @219	1.884	1.449
D @ PDIL, GP2 @159	2.254	1.354
D @ PDIL, GP1 @219	1.917	1.388
D @ PDIL, GP1 @159	2.230	1.426
Delta F_Q	8.9%	
Delta $F_{\Delta H}$		4.2%

TABLE 4.2-11

UNIT 2, CYCLE 9
EOL, 100% RTP, +24 STEPS FROM 215 STEPS (12 + 12)

Rod Position	F_Q^{pin}	$F_{\Delta H}^{pin}$
ARO	1.696	1.423
D @ 215 STEPS	1.737	1.419
D @ 215, H-8 @231	1.732	1.428
D @ 215, H-8 @191	1.769	1.381
D @ 215, GP2 @231	1.713	1.427
D @ 215, GP2 @191	1.907	1.386
D @ 215, GP1 @231	1.720	1.416
D @ 215, GP1 @191	1.876	1.446
Delta F_Q	9.8%	
Delta $F_{\Delta H}$		1.9%

TABLE 4.2-12

UNIT 2, CYCLE 9
EOL, 100% RTP, +30 STEPS FROM 215 STEPS (18 + 12)

Rod Position	F_Q^{pin}	$F_{\Delta H}^{pin}$
ARO	1.696	1.423
D @ 215 STEPS	1.737	1.419
D @ 215, H-8 @231	1.732	1.428
D @ 215, H-8 @185	1.777	1.382
D @ 215, GP2 @231	1.713	1.427
D @ 215, GP2 @185	1.945	1.389
D @ 215, GP1 @231	1.720	1.416
D @ 215, GP1 @185	1.911	1.452
Delta F_Q	12.0%	
Delta $F_{\Delta H}$		2.3%

TABLE 4.2-13

UNIT 2, CYCLE 9
EOL, 100% RTP, +30 STEPS FROM PDIL (18 + 12)

Rod Position	F_Q^{pin}	$F_{\Delta H}^{pin}$
ARO	1.696	1.423
D @ PDIL (189.0)	2.069	1.396
D @ PDIL,D-12 @159.0	2.109	1.405
D @ PDIL,K-14 @195.0	2.091	1.401
D @ PDIL,H-12 @159.0	2.107	1.400
D @ PDIL,K-8 @195.0	2.088	1.394
Delta F_Q	1.9%	
Delta $F_{\Delta H}$		0.7%

TABLE 4.3-1

UNIT 2, CYCLE 9
EOL, 100% RTP, +24 STEPS FROM PDIL (12 + 12)
LOAD-FOLLOW MODE

Rod Position	F_Q^{pin}	$F_{\Delta H}^{pin}$
ARO	2.108	1.409
D @ PDIL (189)	1.685	1.400
D @ PDIL, H-8 @213	1.743	1.442
D @ PDIL, H-8 @165	1.649	1.406
D @ PDIL, GP2 @213	1.904	1.434
D @ PDIL, GP2 @165	1.637	1.408
D @ PDIL, GP1 @213	1.812	1.396
D @ PDIL, GP1 @165	1.673	1.404
Delta F_Q	13.0%	
Delta $F_{\Delta H}$		3.0%

TABLE 4.3-2

UNIT 2, CYCLE 9
EOL, 100% RTP, +30 STEPS FROM PDIL (18 + 12)
LOAD-FOLLOW MODE

Rod Position	F_Q^{pin}	$F_{\Delta H}^{pin}$
ARO	2.108	1.409
D @ PDIL (189)	1.685	1.400
D @ PDIL, H-8 @219	1.764	1.453
D @ PDIL, H-8 @159	1.648	1.407
D @ PDIL, GP2 @219	1.962	1.445
D @ PDIL, GP2 @159	1.676	1.410
D @ PDIL, GP1 @219	1.844	1.400
D @ PDIL, GP1 @159	1.673	1.408
Delta F_Q	16.4%	
Delta $F_{\Delta H}$		3.8%

TABLE 4.3-3

UNIT 2, CYCLE 9
EOL, 100% RTP, +30 STEPS FROM 215 STEPS (18 + 12)
LOAD-FOLLOW MODE

Rod Position	F_Q^{pin}	$F_{\Delta H}^{pin}$
ARO	2.108	1.409
D @ 215 STEPS	2.044	1.403
D @ 215, H-8 @185	1.984	1.391
D @ 215, H-8 @231	2.073	1.415
D @ 215, GP2 @185	1.819	1.402
D @ 215, GP2 @231	2.099	1.413
D @ 215, GP1 @185	1.936	1.447
D @ 215, GP1 @231	2.055	1.398
Delta F_Q	2.7%	
Delta $F_{\Delta H}$		3.1%

TABLE 4.4-1

UNIT 1 CYCLE 13
BOL, 85% RTP, +30 STEPS FROM PDIL (18+12 STEPS)

Rod Position	F_Q^{pin}	$F_{\Delta H}^{pin}$
ARO	1.556	1.381
D @ PDIL (160.7)	1.781	1.426
D @ PDIL, H-8 @190.7	1.756	1.430
D @ PDIL, H-8 @130.7	1.804	1.422
D @ PDIL, GP2 @190.7	1.671	1.419
D @ PDIL, GP2 @130.7	1.892	1.438
D @ PDIL, GP1 @190.7	1.697	1.415
D @ PDIL, GP1 @130.7	1.868	1.442
D @ PDIL, B10 @190.7	1.759	1.441
D @ PDIL, B10 @130.7	1.802	1.440
Delta F_Q	6.2%	
Delta $F_{\Delta H}$		1.1%

Note: Control Bank D Locations:
Group 1 : F2, B10, K14, P6
Group 2 : B6, F14, P10, K2, H8

ROD GROUP INSERTION LIMITS vs. POWER
UNIT - 2

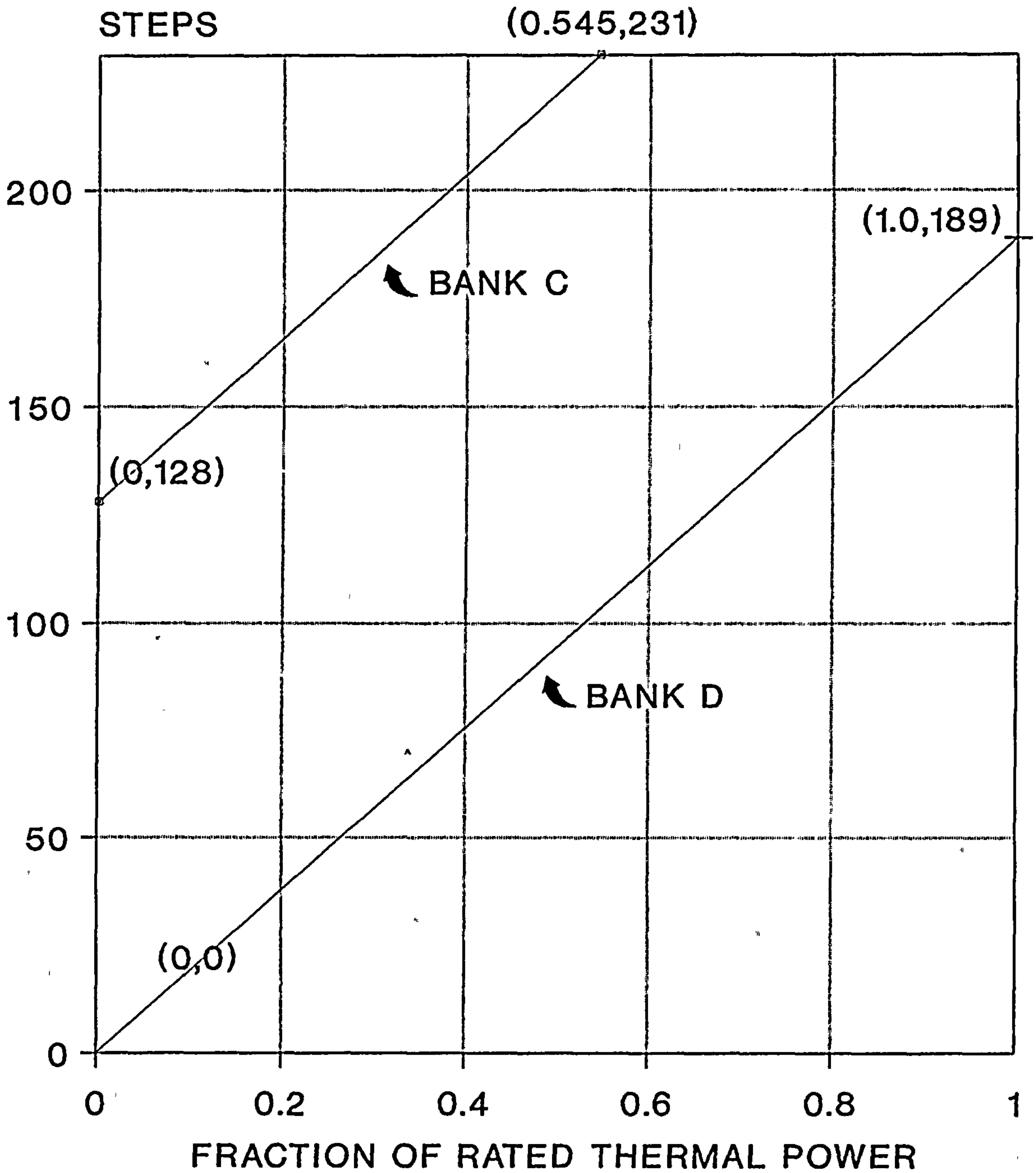
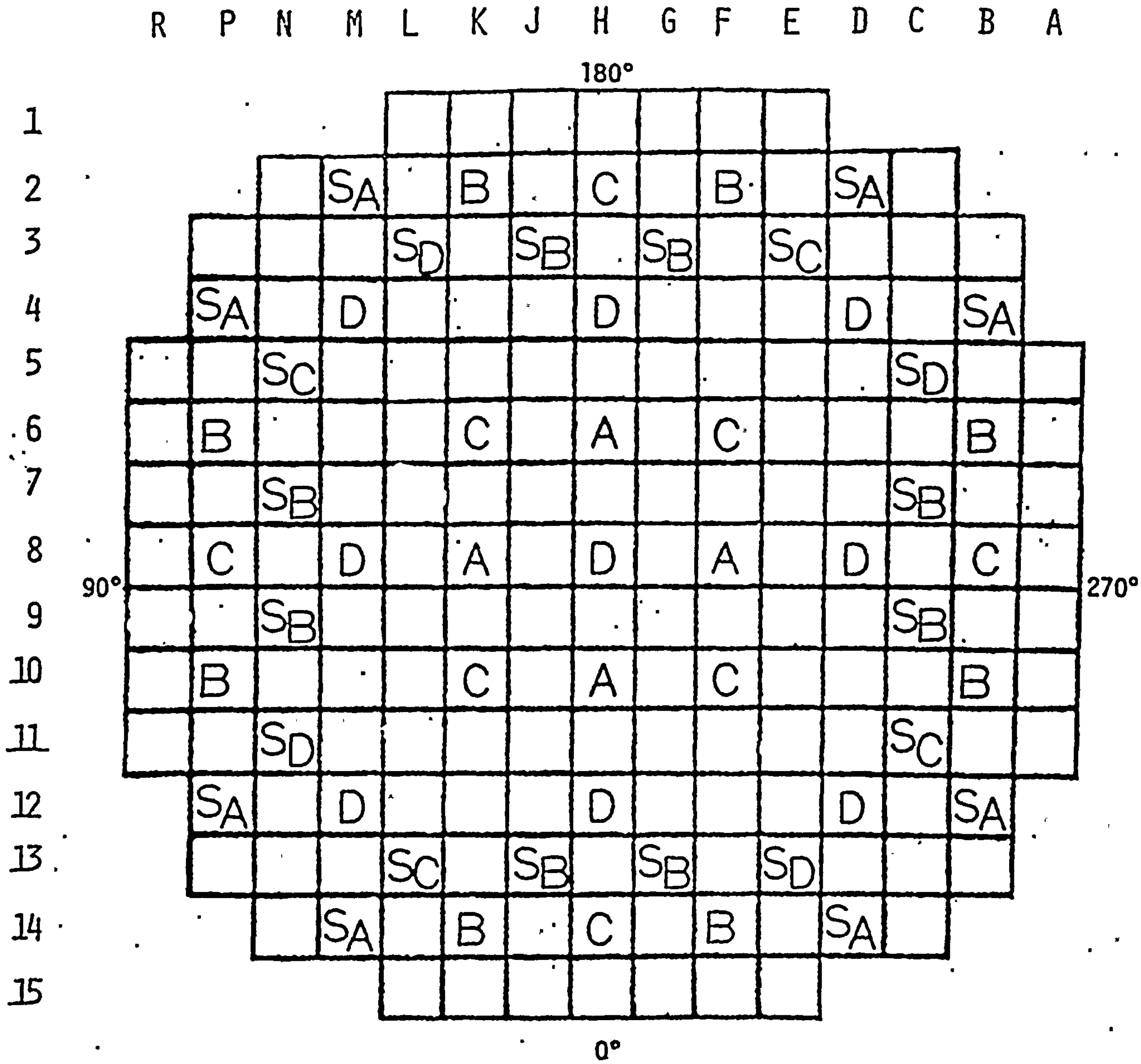


Figure 3.1-1

Figure 4.1-2

CONTROL AND SHUTDOWN ROD LOCATIONS



BANK	NUMBER OF ROD CLUSTERS
S_A	8
S_B	8
S_C & S_D	4 & 4
A	4
B	8
C	8
D	9

FIGURE 4.1-1

COOK NUCLEAR PLANT UNIT 2 CYCLE 9

CORE LOADING PATTERN

	R	P	N	M	L	K	J	H	G	F	E	D	C	B	A
1					9	10B	9	9	9	10B	9				
2			9	11B	11B	11B	11B	11B	11B	11B	11B	11B	9		
3		9	9	11B	10A	10B	10B	9	10B	10B	10A	11B	9	9	
4		11B	11B	10A	11A	10A	11A	10A	11A	10A	11A	10A	11B	11B	
5	9	11B	10A	11A	10B	11A	10B	11A	10B	11A	10B	11A	10A	11B	9
6	10B	11B	10B	10A	11A	9	10A	10A	10A	9	11A	10A	10B	11B	9
7	9	11B	10B	11A	10B	10A	10B	11B	10B	10A	10B	11A	10B	11B	9
8 (90°)	9	11B	9	10A	11A	10A	11B	10C	11B	10A	11A	10A	9	11B	9
9	9	11B	10B	11A	10B	10A	10B	11B	10B	10A	10B	11A	10B	11B	9
10	10B	11B	10B	10A	11A	9	10A	10A	10A	9	11A	10A	10B	11B	10B
11	9	11B	10A	11A	10B	11A	10B	11A	10B	11A	10B	11A	10A	11B	9
12		11B	11B	10A	11A	10A	11A	10A	11A	10A	11A	10A	11B	11B	
13		9	9	11B	10A	10B	10B	9	10B	10B	10A	11B	9	9	
14			9	11B	11B	11B	11B	11B	11B	11B	11B	11B	9		
15					9	9	9	9	9	10B	9				

0°

LEGEND :

R : REGION IDENTIFIER

ROD GROUP INSERTION LIMITS vs. POWER
UNIT - 1

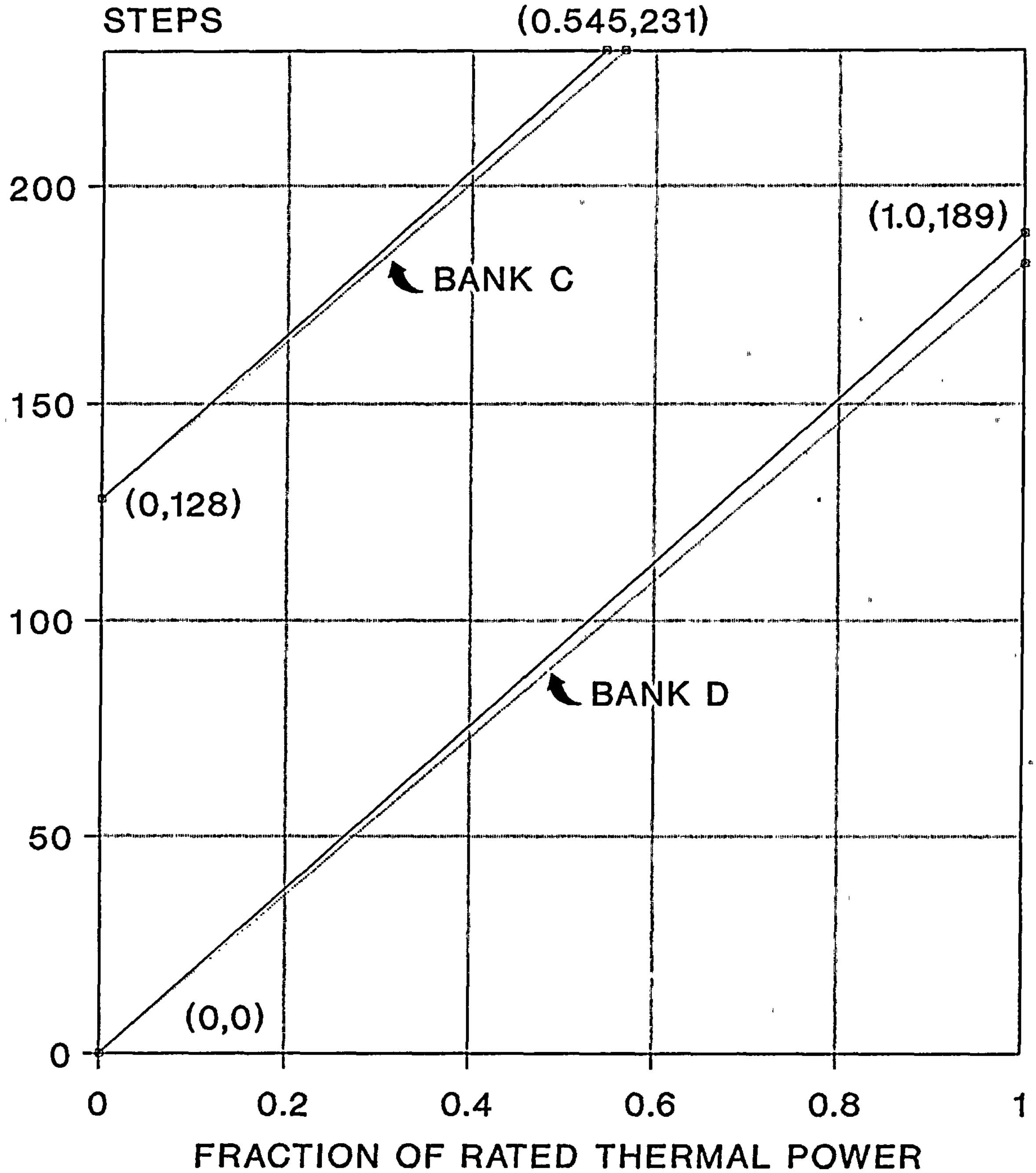


Figure 3.1-2

FIGURE 4.1-3

D. C. COOK UNIT 1 CYCLE 13

CORE LOADING PATTERN

	R	P	N	M	L	K	J	H	G	F	E	D	C	B	A
1					13B	14A	14B	14A	14B	14A	13B				
2			13B	15A	15B	15B	15A	15B	15A	15B	15B	15A	13B		
3		13B	14A	15B	14B	14B	14A	14A	14A	14B	14B	15B	14A	13B	
4		15A	15B	14A	15A	13B	15A	14B	15A	13B	15A	14A	15B	15A	
5	13B	15B	14B	15A	14A	15A	14A	14B	14A	15A	14A	15A	14B	15B	13B
6	14A	15B	14B	13B	15A	13A	15A	14A	15A	13A	15A	13B	14B	15B	14A
7	14B	15A	14A	15A	14A	15A	13A	15B	13A	15A	14A	15A	14A	15A	14B
8 (90°)	14A	15B	14A	14B	14B	14A	15B	13B	15B	14A	14B	14B	14A	15B	14A
9	14B	15A	14A	15A	14A	15A	13A	15B	13A	15A	14A	15A	14A	15A	14B
10	14A	15B	14B	13B	15A	13A	15A	14A	15A	13A	15A	13B	14B	15B	14A
11	13B	15B	14B	15A	14A	15A	14A	14B	14A	15A	14A	15A	14B	15B	13B
12		15A	15B	14A	15A	13B	15A	14B	15A	13B	15A	14A	15B	15A	
13		13B	14A	15B	14B	14B	14A	14A	14A	14B	14B	15B	14A	13B	
14			13B	15A	15B	15B	15A	15B	15A	15B	15B	15A	13B		
15					13B	14A	14B	14A	14B	14A	13B				

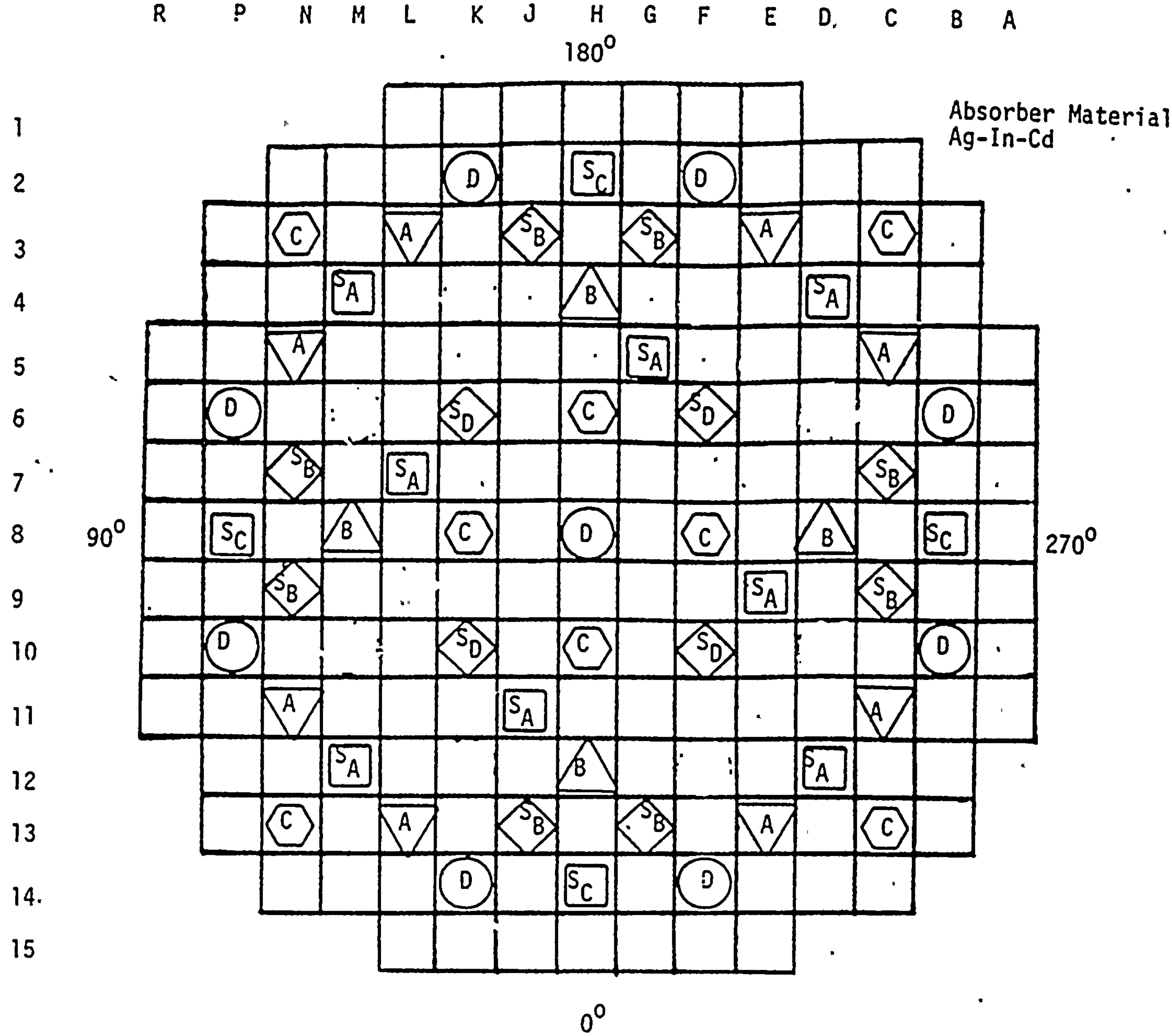
0°

LEGEND :

R : REGION IDENTIFIER

Figure 4.1-4

Control Rod Pattern for Donald C. Cook 1



BANK	SYMBOL	NUMBER OF ROD CLUSTERS
S_A	□	8
S_B	◇	8
S_C	□	4
S_D	◇	4
A	▽	8
B	△	4
C	⬡	8
D	○	9

7. APPENDICES

Appendix A: Unit 2, Cycle 9 ANC Model

Appendix B: Technical Specification Pages

APPENDIX A

UNIT 2, CYCLE 9 ANC MODEL

Results of the Unit 2, Cycle 9 core design using Westinghouse code system PHOENIX-P/ANC and methodology are compared to measured data. The results from the Zero Power Physics Testing are given in Tables A-1, A-2, and A-3. HFP critical boron obtained from ANC was compared to the measured critical boron and is shown in Figure A-1. It should be noted that the small deviation from the design data is due to the boron-10 depletion phenomena. The BOL and MOL radial assembly power distributions are given in Figure A-2 and A-3. Review of these data indicate that the ANC model is adequate for power distribution analyses.

TABLE A-1

HZP MODERATOR TEMPERATURE COEFFICIENT

Temperature	$MTC^{Meas}-MTC^{Design}$
547°F	0.14 pcm/°F

TABLE A-2

HZP ROD WORTH MEASUREMENT

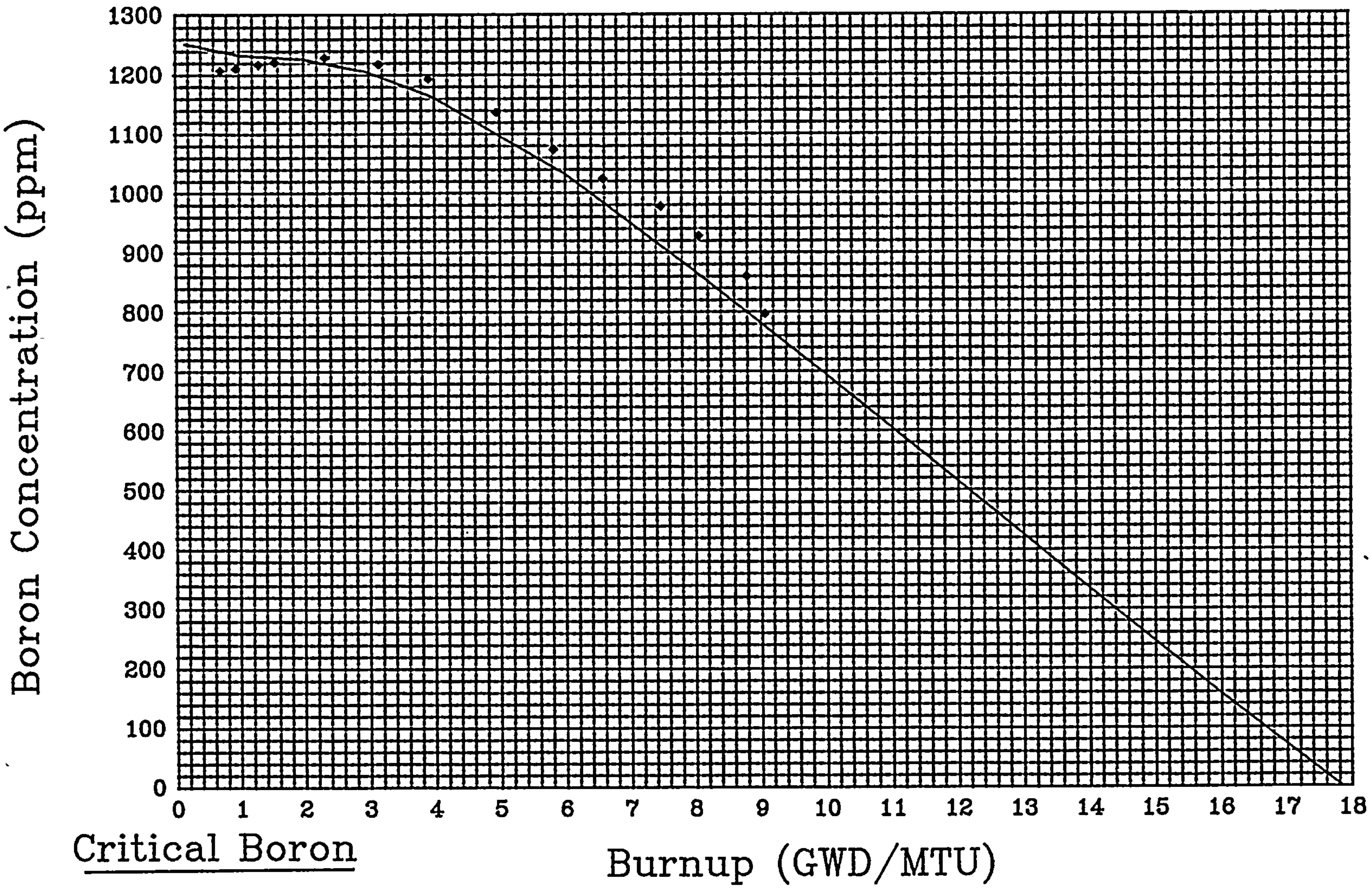
Bank	% Error
CBD	0.19
CBC	-3.02
CBB	-7.06
CBA	-4.79
SBD	-6.03
SBC	-4.92
SBB	-1.62
SBA	-10.14
TOTAL	-3.86

TABLE A-3

HZP BORON ENDPOINT MEASUREMENT

Bank	$C_B^{Meas}-C_B^{Design}$
ARO	6.9 ppm
CBD In	8.7 ppm

Unit 2 Cycle 9
Boron Letdown Curve



Critical Boron

— Design Curve
◆ Measured Data

FIGURE A-1

FIGURE A-2

D.C. COOK UNIT 2 CYCLE 9 BOC HFP POWER DISTRIBUTION

	H	G	F	E	D	C
8	0.813 0.806 0.007					
9	1.394 1.382 0.012	1.254 1.219 0.035				
10	1.111 1.120 -0.009	1.219 1.168 0.051	1.014 1.032 -0.018			
11	1.335 1.322 0.013	1.194 1.198 -0.004	1.243 1.233 0.010	1.148 1.159 -0.011		
12	1.125 1.081 0.044	1.305 1.293 0.012	1.132 1.084 0.048	1.253 1.249 0.004	1.003 1.004 -0.001	
13	0.974 0.980 -0.006	1.133 1.139 -0.006	1.184 1.178 0.006	1.023 1.031 -0.008	1.072 1.102 -0.030	0.500 0.517 -0.017
14	1.210 1.207 0.003	1.189 1.190 -0.001	1.191 1.197 -0.006	1.147 1.147 0.000	0.920 0.924 -0.004	0.256 0.267 -0.011
15	0.412 0.426 -0.014	0.411 0.419 -0.008	0.488 0.507 -0.019	0.326 0.336 -0.010		

STANDARD DEVIATION = 0.020

POWER LEVEL = 100 %

CYCLE BURNUP = 489 MWD/MT

1.101	MAP 209-10
1.098	ANC
0.003	DIFFERENCE

FIGURE A-3

D.C. COOK UNIT 2 CYCLE 9 MOC 90%RTP POWER DISTRIBUTION

	H	G	F	E	D	C
8	0.771 0.776 -0.005					
9	1.336 1.325 0.011	1.038 1.055 -0.017				
10	0.968 0.973 -0.005	1.022 1.018 0.004	0.946 0.947 -0.001			
11	1.330 1.319 0.011	1.096 1.105 -0.009	1.373 1.353 0.020	1.157 1.165 -0.008		
12	1.017 1.031 -0.014	1.359 1.339 0.020	1.069 1.079 -0.010	1.362 1.372 -0.010	1.027 1.035 -0.008	
13	0.905 0.925 -0.020	1.076 1.075 0.001	1.122 1.116 0.006	1.010 1.013 -0.003	1.253 1.242 0.011	0.576 0.583 -0.007
14	1.252 1.236 0.016	1.267 1.260 0.007	1.270 1.266 0.004	1.167 1.177 -0.010	0.928 0.926 0.002	0.292 0.303 -0.011
15	0.449 0.464 -0.015	0.454 0.463 -0.009	0.545 0.556 -0.011	0.355 0.366 -0.011		

STANDARD DEVIATION = 0.011

POWER LEVEL = 90 %

CYCLE BURNUP = 9247 MWD/MT

1.101	MAP-209-28
1.098	ANC
0.003	DIFFERENCE

APPRNDIX B

TECHNICAL SPECIFICATION PAGES

3/4.1.3 MOVABLE CONTROL ASSEMBLIES

GROUP HEIGHT

LIMITING CONDITION FOR OPERATION

3.1.3.1 All full length (shutdown and control) rods shall be OPERABLE with all individual indicated rod positions within the allowed rod misalignment of their group step counter demand position as follows:

- o for THERMAL POWER less than or equal to 85% of RATED THERMAL POWER, the allowed rod misalignment is ±18 steps, and
- o for THERMAL POWER greater than 85% of RATED THERMAL POWER, the allowed rod misalignment is ±12 steps or as determined from Figure 3.1-4. Figure 3.1-4 permits for an allowed rod misalignment from ±13 steps (for APL equal to 101%) to ±18 steps (for APL greater or equal to 106%) provided the value of R (defined in Figure 3.1-4) is greater than or equal to 1.04.

APPLICABILITY: MODES 1* and 2*

ACTION:

a. With one or more full length rods inoperable due to being immovable as a result of excessive friction or mechanical interference or known to be untrippable, determine that the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is satisfied within 1 hour and be in HOT STANDBY within 6 hours.

b. With more than one full length rod inoperable or misaligned from the group step counter demand position by more than the allowed rod misalignment, be in HOT STANDBY within 6 hours.

c. With one full length rod inoperable due to causes other than addressed by ACTION a, above, or misaligned from its group step counter demand position by more than the allowed rod misalignment, POWER OPERATION may continue provided that within one hour either:

   1. The affected rod is restored to OPERABLE status within the above alignment requirements, or

   2. The affected rod is declared inoperable and the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is satisfied. POWER OPERATION may then continue provided that:

      a) A reevaluation of each accident analysis of Table 3.1-1 is performed within 5 days; this reevaluation shall confirm that the previously analyzed results of these accidents remain valid for the duration of operation under these conditions, and

*See Special Test Exceptions 3.10.2 and 3.10.4

LIMITING CONDITION FOR OPERATION (Continued)

b) The SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is determined at least once per 12 hours, and

c) A power distribution map is obtained from the movable incore detectors and $F_Q(Z)$ and $F^N_{\Delta H}$ are verified to be within their limits within 72 hours, and

d) Either the THERMAL POWER level is reduced to less than or equal to 75% of RATED THERMAL POWER within one hour and within the next 4 hours the high neutron flux trip setpoint is reduced to less than or equal to 85% of RATED THERMAL POWER, or

e) The remainder of the rods in the group with the inoperable rod are aligned to within the allowed rod misalignment of the inoperable rod within one hour while maintaining the rod sequence and insertion limits as specified in the COLR; the THERMAL POWER level shall be restricted pursuant to Specification 3.1.3.5 during subsequent operation.

SURVEILLANCE REQUIREMENTS

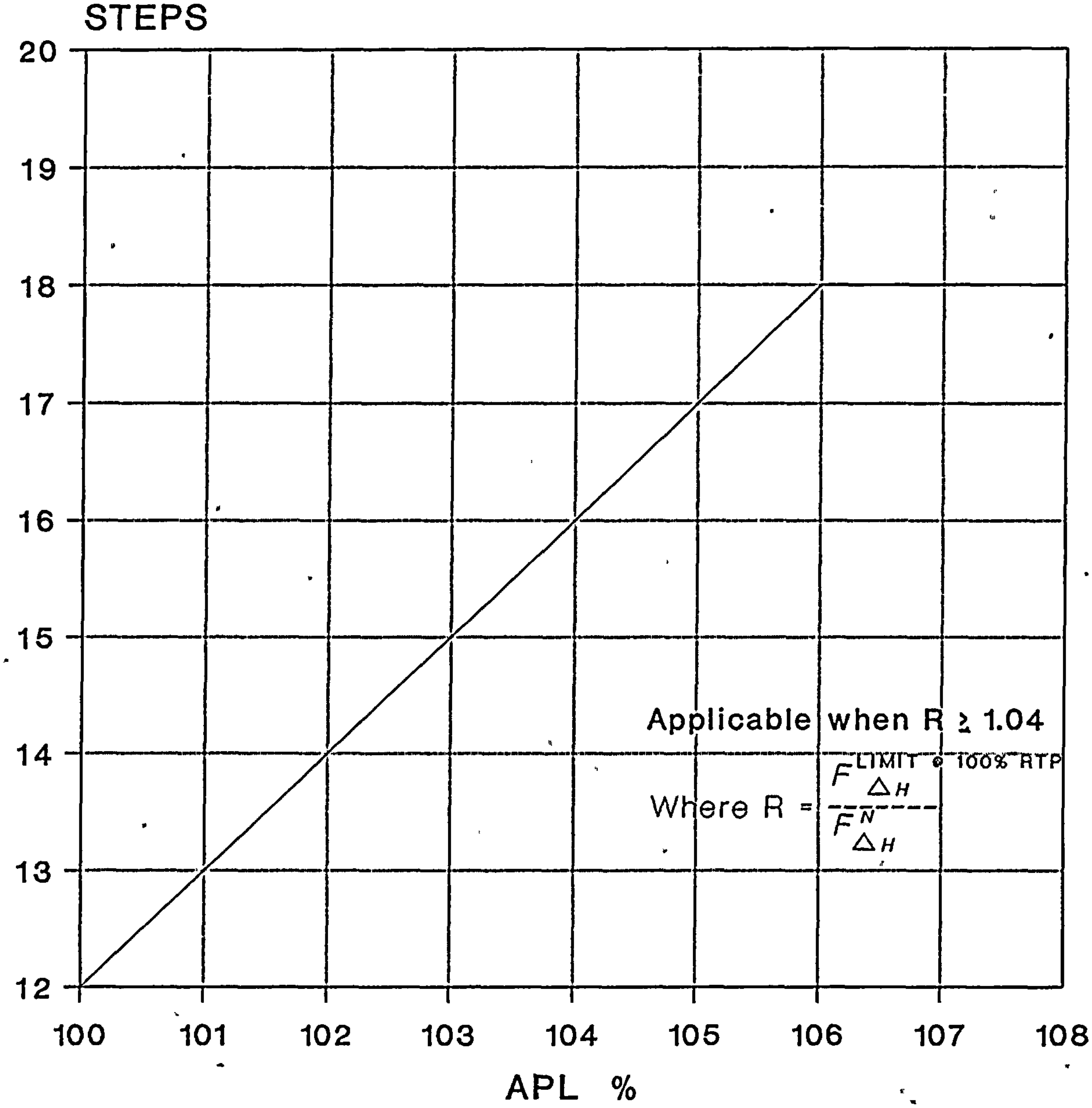
4.1.3.1.1 The position of each full length rod shall be determined to be within the group demand limit by verifying the individual rod positions at least once per 12 hours except during time intervals when the Rod Position Deviation Monitor is inoperable, then verify the group positions at least once per 4 hours.

4.1.3.1.2 Each full length rod not fully inserted in the core shall be determined to be OPERABLE by movement of at least 8 steps in any one direction at least once per 31 days.

4.1.3.1.3 The allowed rod misalignment for THERMAL POWER greater than 85% of RATED THERMAL POWER shall be determined in conjunction with the measurement of APL as defined in Specification 4.2.6.2.

ALLOWED ROD MISALIGNMENT ABOVE 85% RTP

FIGURE 3.1-4



POSITION INDICATOR CHANNELS

LIMITING CONDITION FOR OPERATION

3.1.3.2 All shutdown and control rod position indicator channels and the demand position indication system shall be OPERABLE and capable of determining the rod positions within the allowed rod misalignment specified in Specification 3.1.3.1.

APPLICABILITY: MODES 1 and 2.

ACTION:

a. With a maximum of one rod position indicator channel per group inoperable either:

   1. Determine the position of the non-indicating rod(s) indirectly by the movable incore detectors at least once per 8 hours and immediately after any motion of the non-indicating rod which exceeds 24 steps in one direction since the last determination of the rod's position, or

   2. Reduce THERMAL POWER to less than 50% of RATED THERMAL POWER within 8 hours.

b. With a maximum of one demand position indicator per bank inoperable either:

   1. Verify that all rod position indicators for the affected bank are OPERABLE and that the most withdrawn rod and the least withdrawn rod of the bank are within a maximum of the allowed rod misalignment of each other, at least once per 8 hours, or

   2. Reduce THERMAL POWER to less than 50% of RATED THERMAL POWER within 8 hours.

SURVEILLANCE REQUIREMENTS

4.1.3.2 Each rod position indicator channel shall be determined to be OPERABLE by verifying the demand position indication system and the rod position indicator channels agree within the allowed rod misalignment at least once per 12 hours except during time intervals when the Rod Position Deviation Monitor is inoperable, then compare the demand position indication system and the rod position indicator channels at least once per 4 hours.

3/4.2.2 and 3/4.2.3 HEAT FLUX HOT CHANNEL FACTOR, AND NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR

The limits on heat flux hot channel factor, and nuclear enthalpy rise hot channel factors ensure that 1) the design limits on peak local power density and minimum DNBR are not exceeded and 2) in the event of a LOCA the peak fuel clad temperature will not exceed the 2200°F ECCS acceptance criteria limit.

Each of these is measurable, but will normally only be determined periodically, as specified in Specifications 4.2.2.1, 4.2.2.2, 4.2.3, 4.2.6.1 and 4.2.6.2. This periodic surveillance is sufficient to ensure that the hot channel factor limits are maintained provided:

a. Control rods in a single group move together with no individual rod insertion differing by more than ± 18 steps from the group demand position (allowed rod misalignment) for power levels less than or equal to 85% of RATED THERMAL POWER. For power levels greater than 85% of RATED THERMAL POWER, the allowed rod misalignment is from ±12 to ±18 steps, which is dependent on the Allowable Power Level and the ratio of $F^N_{\Delta H}$ limit at 100% of RATED THERMAL POWER to maximum measured $F^N_{\Delta H}$ as indicated in Figure 3.1-4.

b. Control rod groups are sequenced with overlapping groups as described in Specification 3.1.3.5.

c. The control rod insertion limits of Specifications 3.1.3.4 and 3.1.3.5 are maintained.

d. The axial power distribution, expressed in terms of AXIAL FLUX DIFFERENCE, is maintained within the limits.

The relaxation in $F^N_{\Delta H}$ as a function of THERMAL POWER allows changes in the radial power shape for all permissible rod insertion limits. $F^N_{\Delta H}$ will be maintained within its limits as specified in the COLR, provided conditions (a) through (d) above are maintained.

When an F_Q measurement is taken, both experimental error and manufacturing tolerance must be allowed for. 5% is the appropriate allowance for a full core map taken with the incore detector flux mapping system, and 3% is the appropriate allowance for manufacturing tolerance.

When $F^N_{\Delta H}$ is measured, experimental error must be allowed for, and 4% is the appropriate allowance for a full core map taken with the incore detection system. This 4% measurement uncertainty has been included in the design DNBR limit value. The specified limit for $F^N_{\Delta H}$ also contains an additional 4% allowance for uncertainties. The total allowance is based on the following considerations:

REACTIVITY CONTROL SYSTEMS

3/4.1.3 MOVABLE CONTROL ASSEMBLIES

GROUP HEIGHT

LIMITING CONDITION FOR OPERATION

3.1.3.1 All full length (shutdown and control) rods shall be OPERABLE with all individual indicated rod positions within the allowed rod misalignment of their group step counter demand position as follows:

- o for THERMAL POWER less than or equal to 85% of RATED THERMAL POWER, the allowed rod misalignment is ±18 steps, and

- o for THERMAL POWER greater than 85% of RATED THERMAL POWER, the allowed rod misalignment is ±12 steps or as determined from Figure 3.1-4. Figure 3.1-4 permits for an allowed rod misalignment from ±13 steps (for APL equal to 101%) to ±18 steps (for APL greater or equal to 106%) provided the value of R (defined in Figure 3.1-4) is greater than or equal to 1.04.

APPLICABILITY: MODES 1* and 2*

ACTION:

a. With one or more full length rods inoperable due to being immovable as a result of excessive friction or mechanical interference or known to be untrippable, determine that the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is satisfied within 1 hour and be in HOT STANDBY within 6 hours.

b. With more than one full length rod inoperable or misaligned from the group step counter demand position by more than the allowed rod misalignment, be in HOT STANDBY within 6 hours.

c. With one full length rod inoperable due to causes other than addressed by ACTION a, above, or misaligned from its group step counter demand position by more than the allowed rod misalignment, POWER OPERATION may continue provided that within one hour either:

   1. The affected rod is restored to OPERABLE status within the above alignment requirements, or

   2. The affected rod is declared inoperable and the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is satisfied. POWER OPERATION may then continue provided that:

      a) A reevaluation of each accident analysis of Table 3.1-1 is performed within 5 days; this reevaluation shall confirm that the previously analyzed results of these accidents remain valid for the duration of operation under these conditions, and

*See Special Test Exceptions 3.10.2 and 3.10.3

LIMITING CONDITION FOR OPERATION (Continued)

b) The SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is determined at least once per 12 hours, and

c) A power distribution map is obtained from the movable incore detectors and $F_Q(Z)$ and $F^N_{\Delta H}$ are verified to be within their limits within 72 hours, and

d) Either the THERMAL POWER level is reduced to less than or equal to 75% of RATED THERMAL POWER within one hour and within the next 4 hours the high neutron flux trip setpoint is reduced to less than or equal to 85% of RATED THERMAL POWER, or

e) The remainder of the rods in the group with the inoperable rod are aligned to within the allowed rod misalignment of the inoperable rod within one hour while maintaining the rod sequence and insertion limits as specified in the COLR; the THERMAL POWER level shall be restricted pursuant to Specification 3.1.3.6 during subsequent operation.

SURVEILLANCE REQUIREMENTS

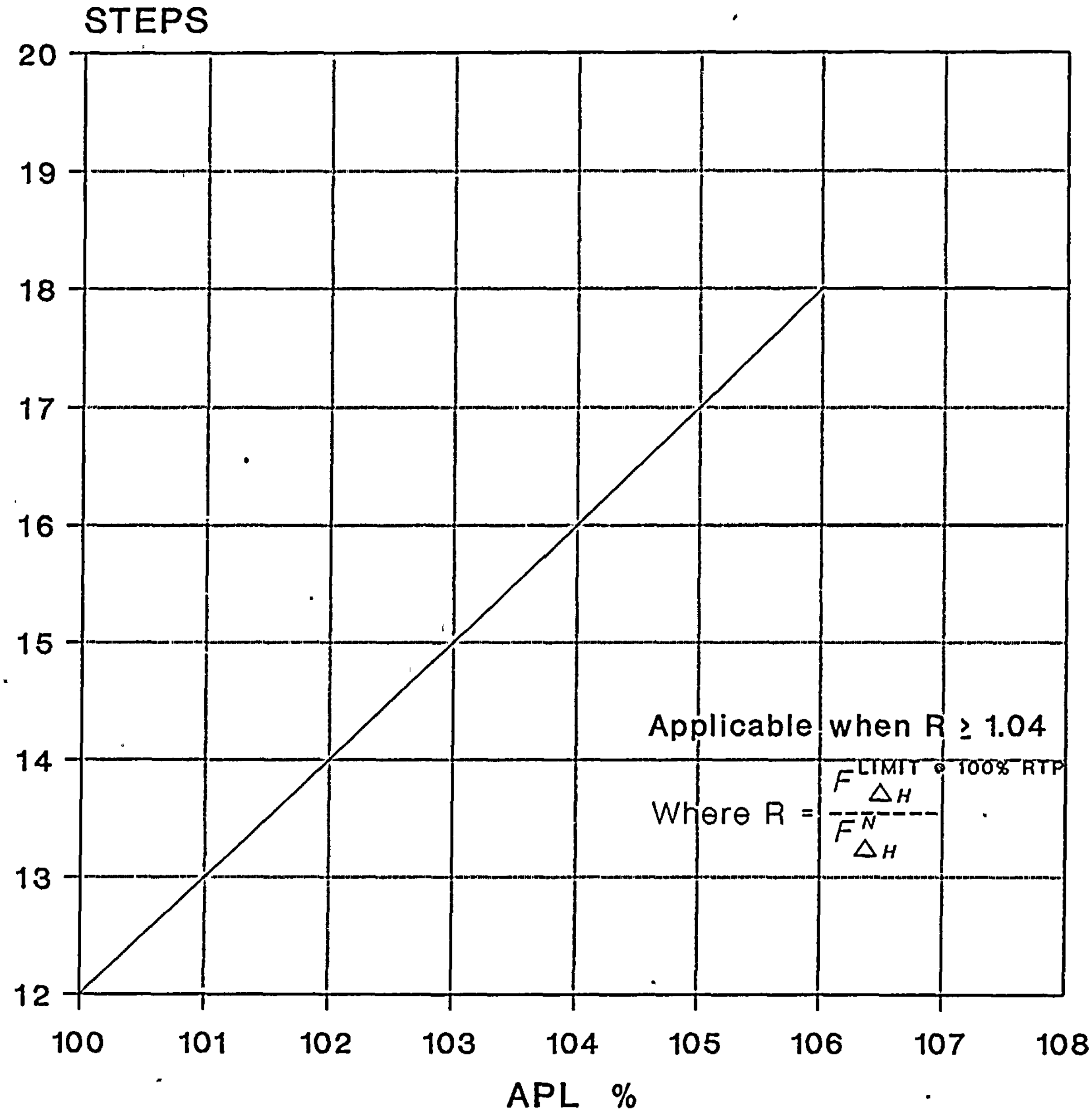
4.1.3.1.1 The position of each full length rod shall be determined to be within the group demand limit by verifying the individual rod positions at least once per 12 hours except during time intervals when the Rod Position Deviation Monitor is inoperable, then verify the group positions at least once per 4 hours.

4.1.3.1.2 Each full length rod not fully inserted in the core shall be determined to be OPERABLE by movement of at least 8 steps in any one direction at least once per 31 days.

4.1.3.1.3 The allowed rod misalignment for THERMAL POWER greater than 85% of RATED THERMAL POWER shall be determined in conjunction with the measurement of APL as defined in Specification 4.2.6.2.

ALLOWED ROD MISALIGNMENT ABOVE 85% RTP

FIGURE 3.1-4



REACTIVITY CONTROL SYSTEMS

POSITION INDICATOR CHANNELS

LIMITING CONDITION FOR OPERATION

3.1.3.2 All shutdown and control rod position indicator channels and the demand position indication system shall be OPERABLE and capable of determining the rod positions within the allowed rod misalignment specified in Specification 3.1.3.1.

APPLICABILITY: MODES 1 and 2.

ACTION:

a. With a maximum of one rod position indicator channel per group inoperable either:

   1. Determine the position of the non-indicating rod(s) indirectly by the movable incore detectors at least once per 8 hours and immediately after any motion of the non-indicating rod which exceeds 24 steps in one direction since the last determination of the rod's position, or

   2. Reduce THERMAL POWER to less than 50% of RATED THERMAL POWER within 8 hours.

b. With a maximum of one demand position indicator per bank inoperable either:

   1. Verify that all rod position indicators for the affected bank are OPERABLE and that the most withdrawn rod and the least withdrawn rod of the bank are within a maximum of the allowed rod misalignment of each other, at least once per 8 hours, or

   2. Reduce THERMAL POWER to less than 50% of RATED THERMAL POWER within 8 hours.

SURVEILLANCE REQUIREMENTS

4.1.3.2 Each rod position indicator channel shall be determined to be OPERABLE by verifying the demand position indication system and the rod position indicator channels agree within the allowed rod misalignment at least once per 12 hours except during time intervals when the Rod Position Deviation Monitor is inoperable, then compare the demand position indication system and the rod position indicator channels at least once per 4 hours.

BASES

3/4.2.2 and 3/4.2.3 HEAT FLUX HOT CHANNEL FACTOR, AND NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR

The limits on heat flux hot channel factor, and nuclear enthalpy rise hot channel factor ensure that 1) the design limits on peak local power density and minimum DNBR are not exceeded and 2) in the event of a LOCA the peak fuel clad temperature will not exceed the 2200°F ECCS acceptance criteria limit.

Each of these is measurable but will normally only be determined periodically as specified in Specifications 4.2.2.1, 4.2.2.2, 4.2.3, 4.2.6.1 and 4.2.6.2. This periodic surveillance is sufficient to ensure that the limits are maintained provided:

a. Control rods in a single group move together with no individual rod insertion differing by more than ±18 steps from the group demand position (allowed rod misalignment) for power levels less than or equal to 85% of RATED THERMAL POWER. For power levels greater than 85% of RATED THERMAL POWER, the allowed rod misalignment is from ±12 to ±18 steps, which is dependent on the Allowable Power Level and the ratio of $F^N_{\Delta H}$ limit at 100% of RATED THERMAL POWER to maximum measuered $F^N_{\Delta H}$ as indicated in Figure 3.1-4.

b. Control rod groups are sequenced with overlapping groups as described in Specification 3.1.3.6.

c. The control rod insertion limits of Specifications 3.1.3.5 and 3.1.3.6 are maintained.

d. The axial power distribution, expressed in terms of AXIAL FLUX DIFFERENCE, is maintained within the limits.

$F^N_{\Delta H}$ will be maintained within its limits as specified in the COLR provided conditions a. through d. above are maintained. The relaxation of $F^N_{\Delta H}$ as a function of THERMAL POWER allows changes in the radial power shape for all permissible rod insertion limits. The form of this relaxation for DNBR limits is discussed in Section 2.1.1 of this basis.

When an F_Q measurement is taken, both experimental error and manufacturing tolerance must be allowed for. 5% is the appropriate allowance on F_Q for a full core map taken with the incore detector flux mapping system and 3% if the appropriate allowance for manufacturing tolerance.

8.0 REFERENCES

1. U.S. Nuclear Regulatory Commission Letter, A. Schwencer (NRC) to J. Dolan (AEP), October 19, 1979.

2. "Reduced Temperature and Pressure Operation for Donald C. Cook Nuclear Plant, Unit 1 -- Licensing Report," WCAP-11902, October 1988.

3. "Vantage5 Reload Transition Safety Report for Donald C. Cook Nuclear Plant Unit 2 ", Revision 2, September 1990.

4. "Power Distribution Control and Load Following Procedures," WCAP-8385, September 1974.

5. "Exxon Nuclear Power Distribution Control for Pressurized Water Reactors -- Phase 2," XN-NF-77-57, January 1978.

6. "ANC -- A Westinghouse Advanced Nodal Computer Code", WCAP-10965-P-A, December 1985.

7. "Qualification of the PHOENIX-P / ANC Nuclear Design System for Pressurized Water Reactor Cores", WCAP-11596, December 1987.

8. "D. C. Cook Nuclear Plant Unit 2 Technical Specifications -- Appendix A to License No. DPR-74."

9. "D. C. Cook Nuclear Plant Unit 1 Technical Specifications -- Appendix A to License No. DPR-58."

10. "Donald C. Cook Nuclear Plant Unit 2 Cycle 9, Reload Safety Evaluation",Revision 1, October 1993

ATTACHMENT 1 TO AEP:NRC:0692CV

Response to Request for Additional Information Regarding Generic Letter 92-08, "Thermo-Lag 330-1 Fire Barriers," pursuant to 10 CFR 50.54 (f) - Donald C. Cook Nuclear Plant, Units 1 and 2

The numbered responses provided below correspond to the associated numbered reporting requirement in the generic letter.

"I. Thermo-Lag Fire Barrier Configurations and Amounts

B. Required Information

1. Describe the Thermo-Lag 330-1 barriers installed in the plant to

   a. meet 10 CFR 50.48 or Appendix R to 10 CFR Part 50,
   b. support an exemption from Appendix R,
   c. achieve physical independence of electrical systems,
   d. meet a condition of the plant operating license,
   e. satisfy licensing commitments.

2. For the total population of Thermo-Lag fire barriers described under Item I.B.1, submit an approximation of:

   a. For cable tray barriers: the total linear feet and square feet of 1-hour barriers and the total linear feet and square feet of 3-hour barriers.

   b. For conduit barriers: the total linear feet of 1-hour barriers and the total linear feet of 3-hour barriers.

   c. For all other fire barriers: the total square feet of 1-hour barriers and the total square feet of 3-hour barriers.

   d. For all other barriers and radiant energy heat shields: the total linear or square feet of 1-hour barriers and the total linear or square feet of 3-hour barriers, as appropriate for the barrier configuration or type."

RESPONSE

1. Thermo-Lag fire barriers are installed in order to comply with 10 CFR 50 Appendix R, Section III.G.2.a and c. Several of these 1-hour fire barriers are installed to enclose intervening combustibles.

Thermo-Lag panels are also used in the construction of a radiant energy barrier between 10kVA isolimiter trains (non Appendix R equipment located outside containment). A small amount of Thermo-Lag material is used on the structural support of Appendix R instrumentation located inside containment. Neither of these applications is intended as a rated fire barrier.

Thermo-Lag installations at Cook Nuclear Plant are typically installed using a combination of preformed panels, conduit preshapes, and trowel applications. Thermo-Lag materials are used to wrap conduit, cable tray, pull boxes, and junction boxes. Thermo-Lag panels are used in the construction of one free standing wall and to protect the hot shutdown panels in each control room.

Cook Nuclear Plant uses only 12-inch-wide cable trays which are six inches deep. In some locations, up to four trays are installed side by side and enclosed together within one boxed enclosure.

Conduits are wrapped with conduit preshapes in most cases. In some areas, several conduits are enclosed in a common boxed enclosure using preformed panels. Thermo-Lag panel joints and conduit preshape joints are prebuttered and covered with an additional layer of trowel grade material. Raceway interferences such as supports and non-Appendix R trays and conduits are wrapped 18 inches from the point of contact with the raceway.

Descriptions of each Thermo-Lag 330-1 barrier installed in Cook Nuclear Plant and its intended purpose are provided in Attachment 2.

2. The data provided below is an estimation of the total linear feet and square feet of Thermo-Lag fire barrier materials installed at Cook Nuclear Plant Units 1 and 2. The approximate square feet of cable tray and other fire barriers is based upon the outside barrier dimensions and includes only that portion of a fire barrier that could be exposed to a fire. For example, for a vertical cable tray mounted against a wall, the side of the tray adjacent to the wall is not included in the approximation of square feet for the associated fire barrier.

   a. Cable tray barriers:

      one hour barriers are 370 linear feet

      one hour barriers are 1850 square feet

      three hour barriers are 0 linear feet

      three hour barriers are 0 square feet

   b. Conduit barriers:

      one hour barriers are 930 linear feet

      three hour barriers are 100 linear feet

   c. Other fire barriers:

      one hour barriers are 120 square feet

      three hour barriers are 800 square feet

   d. Other barriers and radiant energy shields:
      (One non-Appendix R radiant energy shield located outside of containment)

      total square footage is 75

"II. Important Barrier Parameters

B. Required Information

1. State whether or not you have obtained and verified each of the aforementioned parameters for each Thermo-Lag barrier installed in the plant. If not, discuss the parameters you have not obtained or verified. Retain detailed information on site for NRC audit where the aforementioned parameters are known.

2. For any parameter that is not known or has not been verified, describe how you will evaluate the in-plant barrier for acceptability.

3. To evaluate NUMARC's application guidance, an understanding of the types and extent of the unknown parameters is needed. Describe the type and extent of the unknown parameters at your plant in this context."

RESPONSE

1. The list of 24 parameters of importance for utilities' use provided in the request for additional information is an excerpt from a July 1993 NUMARC letter. Since that time, Phase I testing has been completed and other parameters of importance identified. NUMARC provided a list of 27 parameters of importance in a January 14, 1994, letter to utilities. Planned NUMARC Phase 2 testing could identify further parameters of importance, or demonstrate that some of these preliminary parameters are not significant. When the final content of the NUMARC Application Guide is finalized and accepted by the NRC, we will determine if additional parameter identification efforts are necessary.

We have conducted walkdowns of each installation to obtain or confirm observable, physical data and developed as-built sketches where formal drawings did not exist. These sketches and drawings, together with installation procedures and specifications, address a majority of the 24 barrier parameters listed in part II.A. for each installation.

The following parameters have either not been obtained or have not been verified for some installations:

Parameter #8 Air drops

Some parameters internal to the fire barrier system have not been verified in all cases. For example, air drop designs are established by our design standards. However, it has not yet been verified that cable tray to conduit junctions were installed to these standards.

Parameter #9 Baseline fire barrier panel thickness

Panel thickness has not been verified for every installation. A check of material in stock and a limited check of some installed panels found thickness to be 0.625 inches.

Parameter #18 Butt joints or scored and grooved joints

The installation procedure allowed for the use of butt joints or scored joints for cable tray enclosures. However, discussions with the supervisor in charge of the Thermo-Lag installations revealed that virtually all boxed enclosures using Thermo-Lag panels were installed using prebuttered butt joints due to limited working spaces. Walkdowns have confirmed this installation technique where the joint was visible.

2. Parameters of importance that are not presently known or verified will be evaluated using one or more of the following options:

   a. assume limiting conditions, e.g., pre-buttered butt joints versus score and fold joints,

   b. reviews of contractor work practices and procedures through documentation or testimony,

c. review of receipt inspection and installation documentation,

d. destructive examination of barriers on a sample basis to obtain information on construction techniques or material thickness, or

e. visual observations where appropriate.

Your letter also provides an eight item listing of parameters of importance concerning cable protected by fire barriers. It is not clear that consideration of these parameters would be necessary for most barriers; therefore, significant efforts to obtain the listed parameters, or describe how barriers will be evaluated in absence of these parameters, may be unjustified. To the extent that fire test results are satisfactory on the basis of temperature, as provided for in the draft test and acceptance criteria, we believe researching, at this time, for the NRC listing of cable performance parameters to be evaluated should be limited to the percentage cable fill in cable trays (subset of item 4 of the NRC 8 item listing), which relates to enclosed thermal mass and barrier performance. Consideration of the remaining listed cable parameters (items 1, 2, 3, 5, 6, 7 and 8) will be deferred until the scope of cable functionality verification becomes clear.

We believe this interpretation of the reporting requirements of your letter is consistent with the guidance provided by the NRC via our telephone conversation with NRR Staff on January 12, 1994, on this topic.

If fire tests demonstrate temperature criteria exceedances, one optional approach to resolution, as provided in the NRC draft test and acceptance criteria, would be to evaluate cable functionality at the elevated temperatures. In this case, determination of cable performance at elevated temperature (item 8) would be necessary, using cable performance test data or information for specific installed cable types (items 1, 2, 3, and 7 of the NRC listing). However, NRC has yet to finalize requirements for cable

functionality evaluation, nor are test results yet available that would clearly indicate the scope of such evaluations. The degree and conservatism of cable functionality evaluation requirements implied by the NRC listing of cable parameters, and discussed in proposed Supplement 1 to Generic Letter 86-10, significantly exceed the original requirements of Generic Letter 86-10.

Items 4, 5, and 6 of the NRC listing address issues relative to potential cable/barrier contact for cable trays. This is an unresolved industry issue at this time, and barrier inspection in this regard would be difficult or impossible. Barrier contact would be most likely to occur in situations of large cable fills. However, the large cable fills also provide significant thermal mass that could improve barrier system performance and mitigate the effect of cables in contact with the barrier. NUMARC has agreed to provide additional thermocouples below the cable tray rungs in the Phase 2 cable tray tests to provide information to address NRC concerns relative to potential contact of cables with the cold side of the fire barriers. Further, note that a small piece of Sealtemp cloth (NRC item 6) was used only in NUMARC test Number 1-4 (24" steel cable tray with air drop, three hour test), and did not impact performance or useability of the test.

Potential cable/barrier contact is not expected for Cook Nuclear Plant cable trays due to the type of tray used. These trays have a continuous expanded metal bottom which would prevent any cable sagging. No significant sagging of the top portion of the fire barrier is likely since trays are only twelve inches wide.

3. See response to 1 and 2 above.

"III. Thermo-Lag Fire Barriers Outside the Scope of the NUMARC Program

B. Required Information

1. Describe the barriers discussed under Item I.B.1 that you have determined will not be bounded by the NUMARC test program.

2. Describe the plant-specific corrective action program or plan you expect to use to evaluate the fire barrier configurations particular to the plant. This description should include a discussion of the evaluations and tests being considered to resolve the fire barrier issues identified in GL 92-08 and to demonstrate the adequacy of existing in-plant barriers.

3. If a plant-specific fire endurance test program is anticipated, describe the following:

   a. Anticipated test specimens.

   b. Test methodology and acceptance criteria including cable functionality."

RESPONSE

1. Several Thermo-Lag configurations exist at Cook Nuclear Plant which are different from those currently included in the scope of the NUMARC test program. Some additional barriers may fall outside of the expanded NUMARC test program depending upon the configurations tested and the final content of the Application Guideline. Configurations currently believed to be outside the NUMARC program can be divided into cable raceway barriers and non cable raceway barriers. The following provides a description of each of these barriers.

Cable Raceway Barriers

a. In some cases, two or more 12 inch wide cable trays were installed side by side at Cook Nuclear Plant rather than using a 24 inch or 36 inch wide tray, as used in the NUMARC testing configurations. In several cases, four 12 inch wide trays

were installed in this manner and protected with a 48 inch wide boxed enclosure constructed of Thermo-Lag panels.

b. Several irregularly shaped boxed enclosures were installed at Cook Nuclear Plant as fire barriers for cable tray junctions. For these configurations, a metal pan was fabricated in the field to accommodate the junction of several cable trays. These pans were fabricated in various sizes such as 5 feet by 2 feet and 3.5 feet by 3.5 feet. The Thermo-Lag enclosures protecting these pans were constructed using techniques similar to those used for cable trays with the exception that bolts were used to connect the bottom Thermo-Lag panels to the pans to provide support for the panels.

c. Thermo-Lag panels were used to construct three-hour fire barriers around several pilasters in the diesel generator rooms (Fire Zones 15 and 19). The pilasters are of concrete construction and are physically a part of the diesel generator room walls. Each pilaster contains several conduits which have been embedded below approximately two inches of concrete. Two layers of approximately one half inch thick Thermo-Lag panels were attached to the outside of each pilaster.

<u>Non Cable Raceway Barriers</u>

d. A wall constructed to separate (i.e., provide a fire barrier between) the component cooling water (CCW) pumps consists of two 1/2 inch thick Thermo-lag panels separated by a 1/4 inch thick expanded metal stiffener. The wall is approximately 36 feet long and 78 inches high. The Thermo-Lag panels were overlapped to provide protection for the bolts attaching the panels to the metal studs.

e. The hot shutdown (HSD) panels were originally installed to comply with the requirements of 10 CFR 50, Appendix A General Design Criterion 19, and are used to provide shutdown capability from outside the control room for design basis considerations other than Appendix R fires. The Unit 1 HSD panel is in the Unit 2 control room and the Unit 2 HSD panel is in the Unit 1 control room. The HSD panels are steel enclosures approximately 12 feet 6 inches wide, 5 feet deep and 8 feet high. A 3-hour fire barrier was constructed around the HSD panels to ensure that fires external to the panels do not damage internal wiring and fires internal to the panel do not spread outside. The walls were constructed of concrete block and steel columns with a Thermo-Lag trowel grade coating on the steel members. The roof was constructed in a manner similar to the CCW pump room wall in that two approximately 1/2 inch thick Thermo-Lag panels, separated and stiffened by expanded metal, were mounted on steel beams anchored to the top of the block wall. Access to each panel is via a steel roll-up fire door across the front of the panel.

A supplemental response, which identifies cable raceway barriers outside the NUMARC program scope, will be provided to the NRC. This response will take into consideration the results of NUMARC's expanded generic test program if undertaken.

NUMARC is also initiating actions to facilitate shared testing of installations that cannot be practically considered under the generic program scope but may be common to several facilities. It is expected that a matrix of shared tests could be developed and provided to the industry. NUMARC is scheduled to provide additional information to utilities in this regard by April 1, 1994. Therefore, a supplemental response will also be provided for non cable raceway barriers which will take into consideration the potential for future plant specific or shared testing.

The supplemental response to Item III.B.1 will be provided to the NRC within 60 days following receipt of the NUMARC Application Guideline.

2&3. The plant-specific plan to be used for evaluation of the above configurations has not been established at this time. This plan will be largely dependent on whether or not the scope of the NUMARC test program will be expanded to cover some or all of the above configurations. NUMARC has stated that additional information will be provided to utilities in this regard by April 1, 1994, and the Application Guideline will be final by mid-April 1994. Our response to Items III.B.2 and III.B.3 will be provided to the NRC within 60 days following receipt of the Application Guideline. This will allow time to assess the final generic program scope, and the potential for shared testing, both of which could reduce or eliminate the need for plant specific corrective actions, particularly fire testing.

"IV. Ampacity Derating

B. Required Information

1. For the barriers described under Item I.B.1, describe those that you have determined will fall within the scope of the NUMARC program for ampacity derating, those that will not be bounded by the NUMARC program, and those for which ampacity derating does not apply.

2. For the barriers you have determined fall within the scope of the NUMARC program, describe what additional testing or evaluation you will need to perform to derive valid ampacity derating factors.

3. For the barrier configurations that you have determined will not be bounded by the NUMARC test program, describe your plan for evaluating whether or not the ampacity derating tests relied upon for the ampacity derating factors used for those electrical components protected by Thermo-Lag 330-1 (for protecting the safe-shutdown capability from fire or to achieve physical independence of

electrical systems) are correct and applicable to the plant design. Describe all corrective actions needed and submit the schedule for completing such actions.

4. In the event that the NUMARC fire barrier tests indicate the need to upgrade existing in-plant barriers or to replace existing Thermo-Lag barriers with another fire barrier system, describe the alternative actions you will take (and the schedule for performing those actions) to confirm that the ampacity derating factors were derived by valid tests and are applicable to the modified plant design."

RESPONSE

In the early 1980's, we expanded our ampacity derating program to consider Thermo-Lag installations at Cook Nuclear Plant. This program was applied to all wrapped cable raceways containing power cables.

A computer model was developed based on American Institute of Electrical Engineers (AIEE) transaction paper 57-660, by Neher, McGrath, and Buller to calculate the temperature rise in the conductor, heat generation per foot of raceway, and ampacity. The model considers that all cables in the raceway were energized with the maximum steady state current.

A test program was developed to validate the computer model. A series of test runs simulating representative as-built tray and conduit configurations were conducted at our Canton Test Lab. The results of the tests validated the analytical computer model. The testing was conducted under rigid laboratory controls, with test procedures, and with engineering supervision and review, however, it was not under the auspices of a 10 CFR 50 Appendix B quality assurance program.

The calculations using this computer model confirmed that the cable raceway design at Cook Nuclear Plant included sufficient margin to accommodate the temperature rise resulting from wrapping raceways with Thermo-Lag. We do not believe that any additional testing or evaluation is necessary to derive valid ampacity derating factors for these cable raceways installed at Cook Nuclear Plant.

We will review the NUMARC program for ampacity derating when it is made available. In the event that fire barrier tests indicate the need to upgrade existing in-plant barriers or to replace existing Thermo-Lag barriers with another fire barrier system, we will make a determination as to whether to use NUMARC's ampacity derating program or our own program. We will inform the NRC of the ampacity program to be used for fire barrier upgrades or replacements within 90 days following receipt of the NUMARC Ampacity Test Report.

"V. <u>Alternatives</u>

B. Required Information

Describe the specific alternatives available to you for achieving compliance with NRC fire protection requirements in plant areas that contain Thermo-Lag fire barriers. Examples of possible alternatives to Thermo-Lag based upgrades include the following.

1. Upgrade existing in-plant barriers using other materials.

2. Replace Thermo-Lag barriers with other fire barrier materials or systems.

3. Reroute cables or relocate other protected components.

4. Qualify 3-hour barriers as 1-hour barriers and install detection and suppression systems to satisfy NRC fire protection equipment."

RESPONSE

The selection of specific alternatives available for achieving compliance with NRC fire protection requirements in plant areas that contain Thermo-Lag fire barriers will depend on a number of factors. Three currently undefined factors must be considered in determining whether upgrades using additional Thermo-Lag materials are practical, and what alternatives would be most appropriate in case Thermo-Lag upgrades cannot be developed.

1. Test and acceptance criteria have not been finalized and issued by NRC. Proposed draft criteria contain new conservatism in fire test methods and acceptance criteria that could affect the scope and complexity of upgrades to installed barriers. The content of the final criteria, and the resulting impact on utility-specific action plans, is uncertain.

2. Complete Phase 2 tests results will not be known until the mid-March time frame. Results of baseline (as installed) and upgraded test configurations from Phase 2 must be considered to determine appropriate utility action plans to address specific configurations. Moreover, further generic testing may be undertaken following Phase 2, as noted previously.

3. The NUMARC Application Guideline, to be finalized by mid-April, will include a matrix of important performance parameters and bounding conditions. Discussion with NRC will be necessary to reach agreement on the selection of comparison parameters and bounding conditions. The results of these NRC interactions will define the final content and would directly impact the generic applicability of a given test to an installed configuration.

Your letter provides only a partial listing of resolution alternatives. Three additional alternatives are provided below. Other resolution alternatives may be possible. Further, it should be noted that implementation of alternative solutions may be considered even if upgrades have been successfully tested. Potential alternatives include the following.

1. Re-evaluation of engineering analyses used for determination of Appendix R safe shutdown pathways, equipment, and actions, could provide a basis for reduction in the scope of protected circuits and their associated fire barriers.

2. Exemption requests could be submitted based upon the use of fire modeling in conjunction with baseline (non-upgraded) test results to demonstrate adequate protection for the installed hazard. In conjunction with the above, probabilistic safety analysis (PSA) could be used as an exemption basis, by demonstrating insignificant core damage frequency impacts, assuming barrier inoperability.

3. Re-evaluation of licensing commitments that may exceed the requirements of pertinent regulations may be undertaken.

During our review of this issue, we noted that several conduits and cable trays which were wrapped with Thermo-Lag materials no longer require protection from fire. This conclusion was made possible by a combination of design changes and the removal of several components from the list of safe shutdown equipment. The need to retain existing fire barrier installations will continue to be evaluated as a part of our ongoing effort to revalidate our current safe shutdown analysis.

"VI. <u>Schedules</u>

B. Required Information

Submit an integrated schedule that addresses the overall corrective action schedule for the plant. At a minimum, the schedule should address the following aspects for the plant:

1. implementation and completion of corrective actions and fire barrier upgrades for fire barrier configurations within the scope of the NUMARC program,

2. implementation and completion of plant-specific analyses, testing, or alternative actions for fire barriers outside the scope of the NUMARC program."

RESPONSE

Because of the uncertainties noted in the above discussion of NRC Items III and V above, submittal of an integrated schedule that addresses the overall corrective action program for the plant is not possible at this time. While the scope of the NUMARC test program for Phase 1 and 2 is known, what will ultimately be "bounded" is a function of the outcome of the tests, and the final content of the Applications Guide. In addition, NUMARC is considering an expansion of the planned test program scope. Considerable information concerning the results of currently planned NUMARC tests, expansion of the NUMARC test program, and the content of the Applications Guide will become available in April. This information will directly impact the overall corrective action schedule for Cook Nuclear Plant. We will provide the required schedule information to the NRC within 60 days following receipt of the Application Guideline.

"VII. <u>Sources and Correctness of Information</u>

Describe the sources of the information provided in response to this request for information (for example, from plant drawings, quality assurance documentation, walkdowns or inspections) and how the accuracy and validity of the information was verified."

RESPONSE

Numerous different sources were employed to provide the response to this request for information. A majority of the information concerning fire barrier descriptions and parameters was contained in Thermo-Lag installation procedures and specifications and verified through field walkdowns. Other sources of information that were consulted include quality assurance documentation contained in design change packages under which the Thermo-Lag fire barriers were installed, design drawings of specific fire barriers, and discussions with contractor personnel responsible for Thermo-Lag installation. Our ampacity testing was conducted under rigid laboratory controls, with test procedures, and with engineering supervision and review; however, it was not under the auspices of a 10 CFR 50 Appendix B quality assurance program.

ATTACHMENT 2 TO AEP:NRC:0692CV

Response to Request for Additional Information Regarding Generic Letter 92-08, "Thermo-Lag 330-1 Fire Barriers," pursuant to 10 CFR 50.54 (f) - Donald C. Cook Nuclear Plant, Units 1 and 2

Descriptions of Thermo-Lag 330-1 Barriers Installed in Cook Nuclear Plant

Barrier No. 1A   Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8004 R-1	C	4

Barrier length (ft) 23   Area (sq.ft) NA

Description PREFABRICATED CONDUIT SECTIONS

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
X Discussed in Appendix R exemption request
___ Other reason, described below

****

Barrier No. 1B   Fire Rating 1HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8004 G-1	C	4

Barrier length (ft) 10   Area (sq.ft) NA

Description PREFABRICATED CONDUIT SECTIONS

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 1C   Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
9867 G-1	C	1½

Barrier length (ft) 45   Area (sq.ft) NA

Description PREFABRICATED CONDUIT SECTIONS

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
X Discussed in Appendix R exemption request
___ Other reason, described below

****

Barrier No. 1D   Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
PULL BOX PB-1		12x8x24
8626 G-1, 8627 G-1	C	2
8628 G-1, 8629 G-1	C	2
9867 G-1	C	1½

Barrier length (ft) 1   Area (sq.ft) 18

Description PULL BOX AND A SHORT SECTION OF EACH CONDUIT ARE ENCLOSED IN A COMMON BOXED ENCLOSURE

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
X Discussed in Appendix R exemption request
___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 1E   Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
PULL BOX PB-2		12x8x24
8618 R-1, 8619 R-1	C	2
8620 R-1, 8624 R-1	C	2
9967 R-1	C	2

Barrier length (ft) 1   Area (sq.ft) 18

Description PULL BOX AND A SHORT SECTION OF EACH CONDUIT ARE ENCLOSED WITHIN A COMMON BOXED ENCLOSURE

Purpose
X Physical independence of Appendix R safe shutdown systems
__ Enclosure of intervening combustibles for Appendix R
X Discussed in Appendix R exemption request
__ Other reason, described below

****

Barrier No. 1F   Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
PULL BOXES PB-3 PB-4		
8627 G-2, 8628G-2, 8629G-2	C	2
8977 G-2, 8979 R-2, 8644G-2	C	2
8618 R-2, 8620 R-2, 8619-R-2	C	2
8996 R-2	C	2

Barrier length (ft) 1   Area (sq.ft) 24

Description BOXED ENCLOSURE CONTAINS PB-3, PB-4 AND A SHORT SECTION OF EACH CONDUIT

Purpose
X Physical independence of Appendix R safe shutdown systems
__ Enclosure of intervening combustibles for Appendix R
X Discussed in Appendix R exemption request
__ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 1G Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8004 G-2	C	4

Barrier length (ft) 10 Area (sq.ft) NA

Description PREFABRICATED CONDUIT SECTIONS EXCEPT FOR ABOUT 2 FT WHICH IS PROTECTED BY A BOXED ENCLOSURE.

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
X Discussed in Appendix R exemption request
___ Other reason, described below

****

Barrier No. 1H Fire Rating 1-HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8004 R-2	C	4

Barrier length (ft) 23 Area (sq.ft) NA

Description PREFABRICATED CONDUIT SECTIONS

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
X Discussed in Appendix R exemption request
___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 2A Fire Rating 1HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
9747 R-1	C	1
9748 R-1	C	1
JUCTION BOX		

Barrier length (ft) 60 Area (sq.ft) 4.3

Description CONDUITS WRAPPED WITH CONDUIT PRESHAPES UP TO JUNCTION BOX. JUNCTION BOX ENCLOSED WITH TSI PANELS.

Purpose
- X Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

****

Barrier No. 2B Fire Rating 1-HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
9874 R-1	C	1½

Barrier length (ft) 12 Area (sq.ft) NA

Description CONDUIT PRESHAPES COVERED WITH TROWEL GRADE.

Purpose
- X Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 2C   Fire Rating 1-HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
PULL BOX		
9747 R-2	C	1
9748 R-2	C	1

Barrier length (ft) 80   Area (sq.ft) 4.5

Description CONDUITS WRAPPED WITH PRESHAPES EXCEPT FOR SHORT SECTION WHICH IS IN THE PB ENCLOSURE. PB WRAPPED WITH TSI PANELS.

Purpose
- X Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

****

Barrier No. 2D   Fire Rating 1-HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8788 R-2	C	1½

Barrier length (ft) 10   Area (sq.ft) NA

Description CONDUIT PRESHAPES

Purpose
- X Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 3A   Fire Rating 1-HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8744 R-2	C	3

Barrier length (ft) 160   Area (sq.ft) NA

Description CONDUIT PRESHAPES

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

****

Barrier No. 3B   Fire Rating 1-HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
2E-C9	T	12
2E-C10	T	12
2AZ-C55	T	12
2AZ-C99	T	12

Barrier length (ft) 17.5   Area (sq.ft) 102

Description TRAYS 2AZ-C55 & 2AZ-C99 ARE HORIZONTAL SIDE BY SIDE. TRAYS 2E-C9 & 2E-C10 ARE VERTICAL SIDE BY SIDE. PARALLEL TRAYS ARE ENCLOSED IN COMMON BOXED ENCLOSURE.

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 4A   Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8003 R-2	C	4
JUNCTION BOX		

Barrier length (ft) 7 (COND.)   Area (sq.ft) 8.5 (JB)

Description TSI PANELS USED FOR JUNCTION BOX CONDUIT PRESHAPES FOR CONDUIT

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

****

Barrier No. 4B   Fire Rating 1-HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8003R-2	C	4

Barrier length (ft) 11   Area (sq.ft) NA

Description CONDUIT PRESHAPES

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 5A　　Fire Rating 3 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8000G-2, 8002 G-2	C	4
8004 G-2 8001 G-2	C	4
80036-2 8007 G-2	C	4

Barrier length (ft) 15　　Area (sq.ft) NA

Description CONDUITS EMBEDDED UNDER 2" OF CONCRETE IN VERTICAL PILASTER. PILASTER COVERED WITH 2 ½" THICK TSI PANELS

Purpose
X Physical independence of Appendix R safe shutdown systems
____ Enclosure of intervening combustibles for Appendix R
____ Discussed in Appendix R exemption request
____ Other reason, described below

****

Barrier No. 5B　　Fire Rating 3 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8048 G-2	C	4
8545 G-2	C	4

Barrier length (ft) 16.4　　Area (sq.ft) ~~58.7~~ NA

Description CONDUITS EMBEDDED UNDER 2" OF CONCRETE IN VERTICAL PILASTER. PILASTER COVERED WITH 2 ½" THICK TSI PANELS.

Purpose
X Physical independence of Appendix R safe shutdown systems
____ Enclosure of intervening combustibles for Appendix R
____ Discussed in Appendix R exemption request
____ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 5C   Fire Rating 3 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
1254-2	C	4
8544-G2	C	4

Barrier length (ft) 16.5   Area (sq.ft) NA

Description CONDUITS EMBEDDED UNDER 2" OF CONCRETE IN A VERTICAL PILASTER. PILASTER COVERED WITH 2 ½" THICK TSI PANELS.

Purpose
- X Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

****

Barrier No. ______   Fire Rating ______

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)

Barrier length (ft) NOT USED   Area (sq.ft) ______

Description

Purpose
- ___ Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 6A　　　Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
1AZ-C20	T	12

Barrier length (ft) 13　　　Area (sq.ft) 50.4

Description 1AZ-C20 IS A 12" VERTICAL TRAY WHICH WAS INSTALLED NEXT TO 1AZ-C32, A NON-APP R TRAY. BOTH TRAYS ENCLOSED IN COMMON BOXED ENCLOSURE.

Purpose
- X Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

****

Barrier No. ______　　　Fire Rating ______

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)

NOT USED

Barrier length (ft) ______　　　Area (sq.ft) ______

Description

Purpose
- ___ Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 7A Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8003 R-1	C	4

Barrier length (ft) 11.3 Area (sq.ft) NA

Description CONDUIT PRESHAPES

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

****

Barrier No. 7B Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8003 R-1	C	4

Barrier length (ft) 6.5 Area (sq.ft) NA

Description RONDUIT PRESHAPES

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 7C   Fire Rating 1HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8003 R-1	C	4
JUNCTION BOX		

Barrier length (ft) NA   Area (sq.ft) 8

Description JUNCTION BOX ENCLOSED WITH TSI PANELS

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

****

Barrier No. ______   Fire Rating ______

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)

NOT USED

Barrier length (ft) ______   Area (sq.ft) ______

Description

Purpose
___ Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 8A Fire Rating 1HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
1AZ-C34	T	12

Barrier length (ft) 10 Area (sq.ft) 40

Description ENCLOSED WITH TSI PANELS

Purpose
X Physical independence of Appendix R safe shutdown systems
____ Enclosure of intervening combustibles for Appendix R
____ Discussed in Appendix R exemption request
____ Other reason, described below

****

Barrier No. 8B Fire Rating 3 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8504 R-1	C	4
8756 GH-1	C	4

Barrier length (ft) 16.5 Area (sq.ft) NA

Description CONDUITS EMBEDDED IN 2" OF CONCRETE PILASTER. PILASTER COVERED WITH 2 LAYERS OF 1/2" THICK TSI PANELS

Purpose
X Physical independence of Appendix R safe shutdown systems
____ Enclosure of intervening combustibles for Appendix R
____ Discussed in Appendix R exemption request
____ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 8C Fire Rating 3 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8048 R-1	C	4
8079 R-1	C	4
8503 R-1	C	4

Barrier length (ft) 16.5 Area (sq.ft) NA

Description CONDUITS EMBEDDED UNDER 2" OF CONCRETE IN PILASTER. PILASTER COVERED WITH TWO LAYERS OF ½" TSI PANELS.

Purpose
X Physical independence of Appendix R safe shutdown systems
____ Enclosure of intervening combustibles for Appendix R
____ Discussed in Appendix R exemption request
____ Other reason, described below

****

Barrier No. 8D Fire Rating 3HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8000 R-1 8001 R-1	C	4
8002 R-1 8003 R-1	C	4
8004 R-1 8005 R-1	C	4
8007 R-1	C	4

Barrier length (ft) 16.5 Area (sq.ft) NA

Description CONDUITS EMBEDDED UNDER 2" OF CONCRETE IN PILASTER. PILASTER COVERED WITH TWO LAYERS OF ½" TSI PANELS.

Purpose
X Physical independence of Appendix R safe shutdown systems
____ Enclosure of intervening combustibles for Appendix R
____ Discussed in Appendix R exemption request
____ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 9A Fire Rating 3 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
NA		

Barrier length (ft) NA Area (sq.ft) 623

Description 3 HR RATED FIRE WALL SEPARATING UNIT 1 AND UNIT 2 CCW PUMPS

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
X Discussed in Appendix R exemption request
___ Other reason, described below

****

~~Barrier No. ___ Fire Rating ___~~

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)

Barrier length (ft) ___ Area (sq.ft) ___

NOT USED

Description

Purpose
___ Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 10 A Fire Rating 3HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
HOT SHUTDOWN PANEL		

Barrier length (ft) NA Area (sq.ft) 87.8 EACH (2 PANELS)

Description ENCLOSURE CONSISTS OF CONCRETE BLOCK WALLS WITH CEILING MADE OF 2 ½" TSI PANELS SEPARATED BY ¼" THICK EXPANDED METAL STIFFENER.

Purpose

X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

****

Barrier No. ____ Fire Rating ____

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)

NOT USED

Barrier length (ft) ____ Area (sq.ft) ____

Description

Purpose

___ Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 11A Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8505 R-1	C	1
8154 G-2	C	1
PULL BOX	NA	NA

Barrier length (ft) 4 Area (sq.ft) 3

Description CONDUITS WRAPPED WITH PRESHAPES. PULL BOX WITH TSI PANELS.

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

****

Barrier No. 11 B Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8506 R-1	C	1
PULL BOX	NA	NA

Barrier length (ft) 8 Area (sq.ft) 3

Description CONDUIT WRAPPED WITH PRESHAPE. PULL BOX WITH TSI PANELS.

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 11 C   Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8155 G-2	C	1
PULL BOX	NA	NA

Barrier length (ft) 8   Area (sq.ft) 3

Description CONDUIT WRAPPED WITH PRESHAPE, PULL BOX WITH TSI PANELS

Purpose
- X Physical independence of Appendix R safe shutdown systems
- ____ Enclosure of intervening combustibles for Appendix R
- ____ Discussed in Appendix R exemption request
- ____ Other reason, described below

****

Barrier No. ________   Fire Rating ________

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)

Barrier length (ft) ________   Area (sq.ft) ________

NOT USED

Description

Purpose
- ____ Physical independence of Appendix R safe shutdown systems
- ____ Enclosure of intervening combustibles for Appendix R
- ____ Discussed in Appendix R exemption request
- ____ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 12 A   Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
2AZ- C90	T	12

Barrier length (ft) 22   Area (sq.ft) 26

Description HORIZONTAL BOXED ENCLOSURE

Purpose
___ Physical independence of Appendix R safe shutdown systems
_X_ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

****

Barrier No. ______   Fire Rating ______

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)

Barrier length (ft) ______   Area (sq.ft) ______

Description

NOT USED

Purpose
___ Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

D

Barrier No. 13 A Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
PULL THROUGH	NA	NA

Barrier length (ft) NA Area (sq.ft) 12

Description BOXED ENCLOSURE USING TSI PANELS

Purpose
X Physical independence of Appendix R safe shutdown systems
____ Enclosure of intervening combustibles for Appendix R
____ Discussed in Appendix R exemption request
____ Other reason, described below

****

D

NOT USED

Barrier No. ____ Fire Rating ____

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)

Barrier length (ft) ____ Area (sq.ft) ____

Description

Purpose
____ Physical independence of Appendix R safe shutdown systems
____ Enclosure of intervening combustibles for Appendix R
____ Discussed in Appendix R exemption request
____ Other reason, described below

r

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 14 A   Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
87·44 R-2	C	3

Barrier length (ft) 115   Area (sq.ft) NA

Description CONDUIT PRESHAPES USED

Purpose
X Physical independence of Appendix R safe shutdown systems
____ Enclosure of intervening combustibles for Appendix R
____ Discussed in Appendix R exemption request
____ Other reason, described below

****

Barrier No. 14 B   Fire Rating 1-HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8786 R-2	C	1½

Barrier length (ft) 50   Area (sq.ft) NA

Description CONDUIT PRESHAPES USED

Purpose
X Physical independence of Appendix R safe shutdown systems
____ Enclosure of intervening combustibles for Appendix R
____ Discussed in Appendix R exemption request
____ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 14 C   Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
80180 R-2	C	1½

Barrier length (ft) 30   Area (sq.ft) NA

Description CONDUIT PRESHAPES USED

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

****

Barrier No. 14 D   Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
9767 R2	C	1½"

Barrier length (ft) 35   Area (sq.ft) NA

Description CONDUIT PRESHAPES USED

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 14 E Fire Rating 1-HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
2AZ- CG2-H16	NA	NA

Barrier length (ft) 5.5 Area (sq.ft) 44.5

Description PAN ≈ 5½' × 2' × 1½' BOXED ENCLOSURE USING TSI PANELS

Purpose
- X Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

****

Barrier No. 14.F Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
9747 R-2	C	1
9748 R-2	C	1

Barrier length (ft) 50 Area (sq.ft) NA

Description CONDUIT PRESHAPES USED

Purpose
- X Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 15 A   Fire Rating 1-HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
PAN 2AZ-C59-H3	NA	NA
2A-C14, 2A-C15	T	12
2AZ-C60, 2AZ-C80	T	12

Barrier length (ft) 10   Area (sq.ft) 51.6

Description TWO TRAYS CONNECTED TO PAN IN A "T" CONFIGURATION, TRAY VERTICAL, PAN HORIZONTAL, TRAYS ARE SIDE BY SIDE ENCLOSED IN COMMON BOXED ENCLOSURE USING TSI PANELS

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

****

Barrier No. 15 B   Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
2AZ-C59	T	12

Barrier length (ft) 6   Area (sq.ft) 18

Description BOXED ENCLOSURE USING TSI PANELS

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 16 A   Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
1 AI - P4	T	12
1 AI - C9	T	12

Barrier length (ft) 25   Area (sq.ft) 125

Description TWO TRAYS SIDE BY SIDE IN COMMON BOXED ENCLOSURE USING TSI PANELS

Purpose
____ Physical independence of Appendix R safe shutdown systems
X Enclosure of intervening combustibles for Appendix R
____ Discussed in Appendix R exemption request
____ Other reason, described below

****

Barrier No. 16 B   Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
1 AI - P1	T	12
1 AI - C4	T	12

Barrier length (ft) 23   Area (sq.ft) 115

Description TWO HORIZONTAL TRAYS SIDE BY SIDE IN COMMON BOXED ENCLOSURE USING TSI PANELS

Purpose
____ Physical independence of Appendix R safe shutdown systems
X Enclosure of intervening combustibles for Appendix R
____ Discussed in Appendix R exemption request
____ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 17 A   Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
20094-2	C	1

Barrier length (ft) 45   Area (sq.ft) NA

Description CONDUIT PRESHAPES USED

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

****

Barrier No. ______   Fire Rating ______

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)

Barrier length (ft) ______   Area (sq.ft) ______

Description ______

Purpose
___ Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 18 A   Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
9152 R-2	C	1.5

Barrier length (ft) 70   Area (sq.ft) NA

Description CONDUIT PRESHAPES USED

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

****

Barrier No. 18 B   Fire Rating 1-HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
TERM. BOX B4	NA	NA
9152 R-2	C	1.5

Barrier length (ft) NA   Area (sq.ft) 5.25

Description TERM BOX SHORT SECTION OF CONDUIT ENCLOSED IN COMMON BOXED ENCLOSURE USING TSI PANELS.

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 18 C Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
PULL BOX	NA	12 x 12 x 18

Barrier length (ft) NA Area (sq.ft) 4

Description BOXED ENCLOSURE USING TSI PANELS

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

****

Barrier No. 18 D Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
2AZ-C58	T	12

Barrier length (ft) 14 Area (sq.ft) 84

Description 2AZ-C58 RUNS SIDE BY SIDE WITH A NON-APP R TRAY, VERTICAL AGAINST A CONCRETE WALL. BOTH TRAYS BOXED TOGETHER USING TSI PANELS.

Purpose
X Physical independence of Appendix R safe shutdown systems
___ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 18 E Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
2A-C3	T	12
2AI-C24	T	12

Barrier length (ft) 31 Area (sq.ft) 212

Description TRAY 2AC3 RUNS SIDE BY SIDE WITH 2 NON APP R TRAYS VERTICALLY AGAINST A WALL. TRAY 2AI-C24 RUNS HORIZONTAL SIDE BY SIDE WITH 2 NON APP. R TRAYS - CONNECTS WITH TOP END OF 2A-C3. ALL TRAYS BOXED WITH TSI PANELS.

Purpose
- X Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

****

Barrier No. ________ Fire Rating ________

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)

NOT USED

Barrier length (ft) ________ Area (sq.ft) ________

Description

Purpose
- ___ Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 19 A   Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
2AZ - C36	T	12
2AZ - C37	T	12

Barrier length (ft) 30   Area (sq.ft) 180

Description TRAYS ARE HORIZONTAL SIDE BY SIDE BOXED TOGETHER USING TSI PANELS

Purpose

___ Physical independence of Appendix R safe shutdown systems
_X_ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

****

Barrier No. 19 B   Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
2AZ - P3	T	12

Barrier length (ft) 30   Area (sq.ft) 105

Description HORIZONTAL TRAY BOXED USING TSI PANELS

Purpose

___ Physical independence of Appendix R safe shutdown systems
_X_ Enclosure of intervening combustibles for Appendix R
___ Discussed in Appendix R exemption request
___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 20 A Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
1AZ - C54	T	12
1AZ - P9	T	12

Barrier length (ft) 14 Area (sq.ft) 105

Description 1AZ-C54 & 1AZ-P9, EACH ARE 12" Horizontal TRAYS. THREE TRAYS 1AZ-C54 (outer) 1AZ-C53 (middle) a NON-Appendix TRAY and 1AZ-P9 (INNER). These TRAYS ARE ENCLOSED IN A COMMON BOX. ENCLOSURE IS 38.5 INCH WIDE.

Purpose
X Physical independence of Appendix R safe shutdown systems
__ Enclosure of intervening combustibles for Appendix R
__ Discussed in Appendix R exemption request
__ Other reason, described below

****

Barrier No. 20B Fire Rating 1HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
PAN 1AZ-C56-H21	NA	NA

Barrier length (ft) 4 Area (sq.ft) 22

Description BOXED ENCLOSURE USING TSI PANELS

Purpose
X Physical independence of Appendix R safe shutdown systems
__ Enclosure of intervening combustibles for Appendix R
__ Discussed in Appendix R exemption request
__ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 20C   Fire Rating 1HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
PILASTER 1A-C55	NA	NA
PILASTER 1A-P20	NA	NA

Barrier length (ft) 2   Area (sq.ft) 12

Description PILASTER 1A-P20 outer; PILASTER (No Name) IN MIDDLE and PILASTER 1A-C55 INNER, EACH 12" WIDE, 2.' ft LONG ARE BOXED IN AS ONE COMPOUND STRUCTURE USING TSI PANELS.

Purpose
- x Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

****

Barrier No. 20D   Fire Rating 1HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
1AZ-P8	T	12

Barrier length (ft) 34   Area (sq.ft) 120

Description This is A Standard 12" wide tray. Horizontal, Boxed ENCLOSURE USING TSI PANELS

Purpose
- x Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 20G Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
PAN 1AZ-P8-H4	NA	NA

Barrier length (ft) 4.75 Area (sq.ft) 26.125

Description PAN SUPPORTED HORIZONTALLY CONNECTED. TO CABLE TRAY 1AZ-C50 This PAN is 2 ft WIDE and 4 3/4 ft long. BOXED ENCLOSURE USING TSI PANELS.

Purpose
- X Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

****

Barrier No. ________ Fire Rating ________

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)

Barrier length (ft) ________ Area (sq.ft) ________

Description

NOT USED.

Purpose
- ___ Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

[illegible]

Barrier No. 20E Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
1AZ-C50	T	T
8026R-1	C	1/2

Barrier length (ft) 30 Area (sq.ft) 105

Description This is a standard 12" WIDE CABLE TRAY, HORIZONTALLY, BOXED IN. A 1/2" CONDUIT LEAVES This tray, 3 FEET LONG only Covered with PREFABRICATED TSI PANELS

Purpose

- x Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

****

Barrier No. 20F Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
1AZ-C46	T	12

Barrier length (ft) 2 Area (sq.ft) 7

Description STANDARD TRAY, HORIZONTALLY MOUNTED 12" WIDE, 2 FT LONG BOXED USING TSI PANELS

Purpose

- x Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 21 A　　Fire Rating 1 HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
8344 G-2	C	1
8333 G-2	C	1

Barrier length (ft) 41　　Area (sq.ft) NA

Description PREFABRICATED CONDUIT SECTIONS.

Purpose
- X Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

****

Barrier No. 21B　　Fire Rating 1HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
PULL BOX 1 3/4 x 3/4' x 1/2'	NA	NA

Barrier length (ft) 1 3/4　　Area (sq.ft) 4.375

Description PULL BOX 1.75' long 1/2 ft HIGH & 3/4 ft WIDE. BOXED IN WITH STANDARD PANEL.

Purpose
- X Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 22A   Fire Rating 1HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
1AI-C4	T	12
1AI-P1	T	12

Barrier length (ft) NA   Area (sq.ft) 129

Description CABLE TRAYS 1AI-C4 and 1AI-P1 EACH ARE 12 INCH WIDE AND BOXED IN A COMMON ENCLOSURE HORIZONTALLY. This wrapped RACEWAY IS 22 Ft. LONG.

Purpose
- X Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

****

Barrier No. 22B   Fire Rating 1HR

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
1AI-C8	T	12
1AI-P2	T	12

Barrier length (ft) NA   Area (sq.ft) 132

Description CABLE TRAYS 1AI-C8 AND 1AI-P2 EACH ARE 12 INCH WIDE AND BOXED IN A COMMON ENCLOSURE, MOUNTED HORIZONTALLY. This ENCLOSURE IS 22 Ft LONG.

Purpose
- X Physical independence of Appendix R safe shutdown systems
- X Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns

Barrier No. 23 Fire Rating NA

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)
BARRIER 6 1/2 X 2 3/4	NA	NA

Barrier length (ft) 6 1/2 Area (sq.ft) 35.75 EACH UNIT

Description RADIANT ENERGY BARRIER ONLY FOR UNIT 1 & 2. THIS BARRIER ARE IN BETWEEN ISOLIMITERS IN 4KV SWITCHGEARS.

Purpose
- ___ Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- X Other reason, described below

THIS BARRIER IS FOR PROTECTION AGAINST DIRECT FLAME IMPINGEMENT ONLY, AND NOT A ONE HOUR UL RATED BARRIER.

****

Barrier No. ______ Fire Rating ______

Enclosed raceway	Conduit(C)/Tray(T)	Size (inches)

Barrier length (ft) ______ Area (sq.ft) ______

Not Used

Description

Purpose
- ___ Physical independence of Appendix R safe shutdown systems
- ___ Enclosure of intervening combustibles for Appendix R
- ___ Discussed in Appendix R exemption request
- ___ Other reason, described below

Note: Dimensions provided are estimates based upon field walkdowns