



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

INDIANA AND MICHIGAN ELECTRIC COMPANY

DOCKET NO. 50-315

DONALD C. COOK NUCLEAR PLANT UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 61
License No. DPR-58

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The applications for amendment by Indiana and Michigan Electric Company (the licensee) dated April 7, 1982 and July 12, 1982, comply with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's rules and regulations set forth in 10 CFR Chapter I;
 - B. The facility will operate in conformity with the applications, the provisions of the Act, and the rules and regulations of the Commission;
 - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
 - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and security of the public; and
 - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

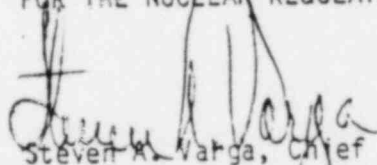
2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. DPR-58 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 61, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION


Steven A. Wurga, Chief
Operating Reactors Branch #1
Division of Licensing

Attachment:
Changes to the Technical
Specifications

Date of Issuance: September 15, 1982

ATTACHMENT TO LICENSE AMENDMENT

AMENDMENT NO. 61 TO FACILITY OPERATING LICENSE NO. DPR-58

DOCKET NO. 50-315

Revise Appendix A as follows:

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3.4.2 POWER DISTRIBUTION LIMITS

AXIAL FLUX DIFFERENCE (AFD)

LIMITING CONDITION FOR OPERATION

3.2.1 The indicated AXIAL FLUX DIFFERENCE (AFD) shall be maintained within the target band ($\pm 5\%$ or $\pm 3\%$ flux difference units) about a target flux difference.

APPLICABILITY: MODE 1 above 50% RATED THERMAL POWER*

ACTION:

- a. With the indicated AXIAL FLUX DIFFERENCE outside of the target band about the target flux difference and with THERMAL POWER:
 1. Above 90% or $0.9 \times \text{APL}^{**}$ (whichever is less) of RATED THERMAL POWER, within 15 minutes:
 - a) Either restore the indicated AFD to within the target band limits, or
 - b) Reduce THERMAL POWER to less than 90% or $0.9 \times \text{APL}$ (whichever is less) of RATED THERMAL POWER.
 2. Between 50% and 90% or $0.9 \times \text{APL}$ (whichever is less) of RATED THERMAL POWER:
 - a) POWER OPERATION may continue provided:
 - 1) The indicated AFD has not been outside of the target band for more than 1 hour penalty deviation cumulative during the previous 24 hours, and
 - 2) The indicated AFD is within the limits shown on Figure 3.2-1. Otherwise, reduce THERMAL POWER to less than 50% of RATED THERMAL POWER within 30 minutes and reduce the Power Range Neutron Flux-High Trip Setpoints to $< 55\%$ of RATED THERMAL POWER within the next 4 hours.
 - b) Surveillance testing of the Power Range Neutron Flux Channels may be performed pursuant to Specification 4.3.1.1.1 provided the indicated AFD is maintained within the limits of Figure 3.2-1. A total of 16 hours operation may be accumulated with the AFD outside of the target band during this testing without penalty deviation.

* See Special Test Exception 3.10.2

** APL is the Allowable Power Level defined in Specification 3.2.6.

POWER DISTRIBUTION LIMITS

LIMITING CONDITION FOR OPERATION (Continued)

- c) Surveillance testing of the APDMS may be performed pursuant to Specification 4.3.3.6.1 provided the indicated AFD is maintained within the limits of Figure 3.2-1. A total of 6 hours of operation may be accumulated with the AFD outside of the target band during this testing without penalty deviation.
- b. THERMAL POWER shall not be increased above 90% or $0.9 \times \text{APL}$ (whichever is less) of RATED THERMAL POWER unless the indicated AFD is within the target band and ACTION 2.a) 1), above has been satisfied.
- c. THERMAL POWER shall not be increased above 50% of RATED THERMAL POWER unless the indicated AFD has not been outside of the target band for more than 1 hour penalty deviation cumulative during the previous 24 hours.
- d. During power reductions using control rods, the reporting requirements of Specification 6.9.1.9 shall not apply provided the action items above are satisfied.

SURVEILLANCE REQUIREMENTS

4.2.1.1 The indicated AXIAL FLUX DIFFERENCE shall be determined to be within its limits during POWER OPERATION above 15% of RATED THERMAL POWER by:

- a. Monitoring the indicated AFD for each OPERABLE excore channel:
 - 1. At least once per 7 days when the AFD Monitor Alarm is OPERABLE, and
 - 2. At least once per hour for the first 24 hours after restoring the AFD Monitor Alarm to OPERABLE status.
- b. Monitoring and logging the indicated AXIAL FLUX DIFFERENCE for each OPERABLE excore channel at least once per hour for the first 24 hours and at least once per 30 minutes thereafter, when the AXIAL FLUX DIFFERENCE Monitor Alarm is inoperable. The logged values of the indicated AXIAL FLUX DIFFERENCE shall be assumed to exist during the interval preceding each logging.

POWER DISTRIBUTION LIMITS

SURVEILLANCE REQUIREMENTS (Continued)

4.2.1.2 The indicated AFD shall be considered outside of its target band when at least 2 of 4 or 2 of 3 OPERABLE excore channels are indicating the AFD to be outside the target band. Penalty deviation outside of the target band shall be accumulated on a time basis of:

- a. A penalty deviation of one minute for each one minute of POWER OPERATION outside of the target band at THERMAL POWER levels equal to or above 50% of RATED THERMAL POWER, and
- b. A penalty deviation of one-half minute for each one minute of POWER OPERATION outside of the target band at THERMAL POWER levels between 15% and 50% of RATED THERMAL POWER.

4.2.1.3 The target axial flux difference of each OPERABLE excore channel shall be determined in conjunction with the measurement of F_Q^M (Z) as defined in Specification 4.2.2.2.c. The provisions of Specification 4.0.4 are not applicable.

4.2.1.4 The axial flux difference target band about the target axial flux difference shall be determined in conjunction with the measurement of F_Q^M (Z) as defined in Specification 4.2.2.2.c. The allowable values of the target band are $\pm 5\%$ or $\pm 3\%$. Redefinition of the target band from $\pm 3\%$ to $\pm 5\%$ between determinations of the target axial flux difference is allowed when appropriate redefinitions of APL are made. Redefinition of the target band from $\pm 5\%$ to $\pm 3\%$ is allowed only in conjunction with the determination of a new target axial flux difference. The provisions of Specification 4.0.4 are not applicable.

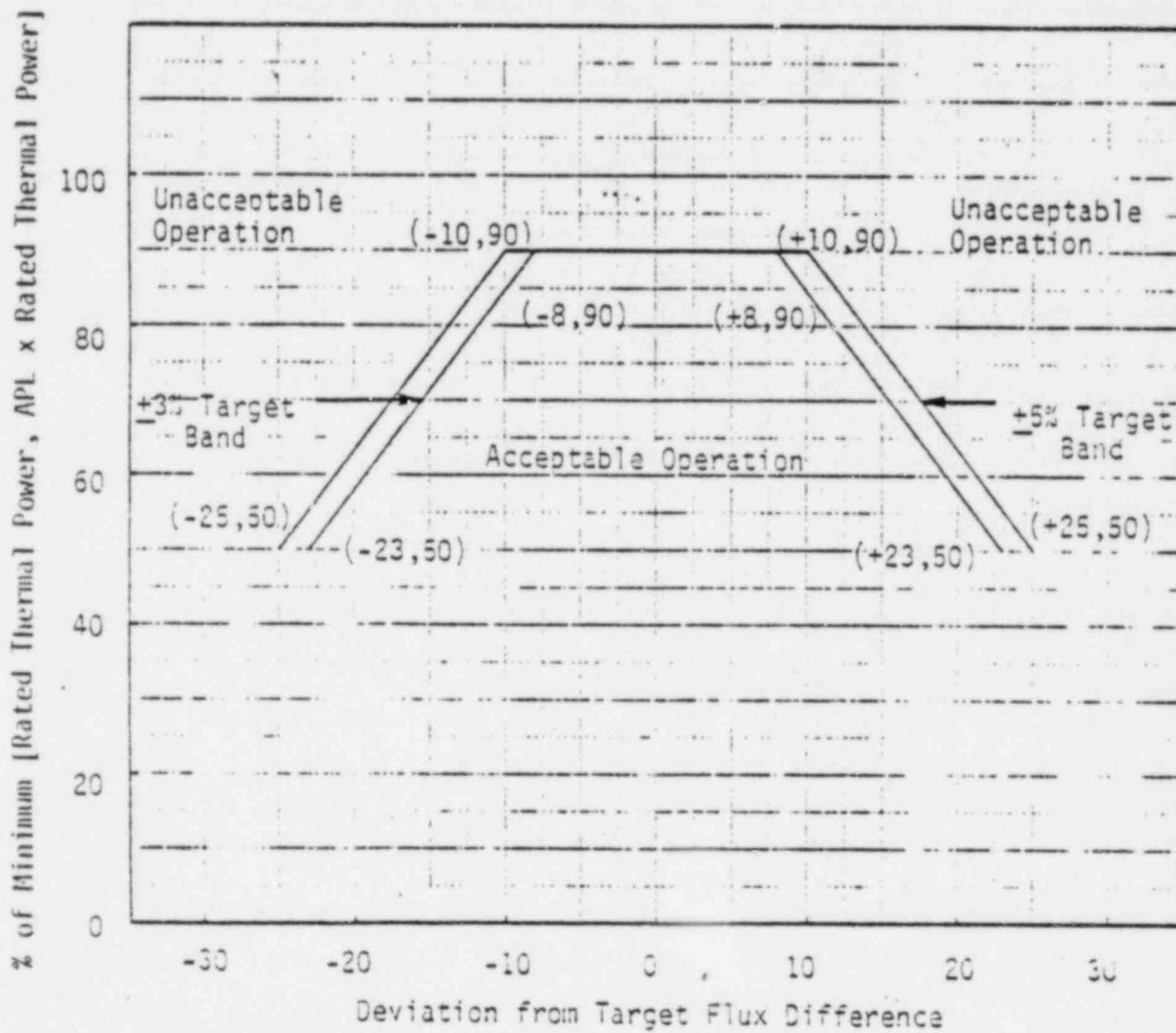


Figure 3.2-1 Allowable Deviation from Target Flux Difference

POWER DISTRIBUTION LIMITS

SURVEILLANCE REQUIREMENTS

4.2.2.1 The provisions of Specification 4.0.4 are not applicable.

4.2.2.2 $F_Q(Z, z)$ shall be determined to be within its limit by:

- a. Using the movable incore detectors to obtain a power distribution map at any THERMAL POWER greater than 5% of RATED THERMAL POWER.
- b. Increasing the measured $F_Q(Z, z)$ component of the power distribution map by 3% to account for manufacturing tolerances and further increasing the value by 5% to account for measurement uncertainties. This product defined is $F_Q^M(Z)$.
- c. Satisfying the following relationship at the time of the target flux determination.

$$F_Q^M(Z) \leq \frac{F_Q^L(Z)}{P \times E_P(Z)} [K(Z)] / [V(Z)] \quad \text{for } P > .5$$

$$F_Q^M(Z) \leq \frac{2F_Q^L(Z)}{E_P(Z)} [K(Z)] / [V(Z)] \quad \text{for } P \leq .5$$

where: $F_Q^M(Z) = F_Q(Z, z)$ at z for which

$$\frac{F_Q(Z, z)}{T(E_z)} \text{ is a maximum}$$

$F_Q^L(Z) = F_Q^L(E_z)$ at z for which

$$\frac{F_Q(Z, z)}{T(E_z)} \text{ is a maximum}$$

$F_Q^M(Z)$ and $F_Q^L(Z)$ are functions of core height, Z , and correspond at each Z to the rod z for which $\frac{F_Q(Z, z)}{T(E_z)}$ is a maximum at that Z .

$V(Z)$ is the function defined in Figure 3.2-3 which corresponds to the target band, $K(Z)$ is defined in Figure 3.2-2, $T(E_z)$ is defined in Figures 3.2-3a and 3.2-3b, P is the fraction of RATED THERMAL POWER. $E_P(Z)$ is an uncertainty factor to account for the reduction in the $F_Q^L(E_z)$ curve due to an accumulation of exposure prior to the next flux map.

$$E_P(Z) = 1.0 \quad 0 \leq E_z \leq 17.62$$

$$E_P(Z) = 1.0 + \left[.0040 \times F_Q^M(Z) \right] \quad 17.62 \leq E_z \leq 34.5$$

$$E_P(Z) = 1.0 + \left[.0093 \times F_Q^M(Z) \right] \quad 34.5 \leq E_z \leq 42.2$$

- d. Measuring $F_Q(Z, z)$ in conjunction with a target flux difference and target band determination, according to the following schedule:

POWER DISTRIBUTION LIMITS

SURVEILLANCE REQUIREMENTS

1. Upon achieving equilibrium conditions after exceeding by 10% or more of RATED THERMAL POWER, the THERMAL POWER at which $F_Q(Z)$ was last determined*, or
2. At least once per 31 effective full power days, whichever occurs first.

*During power escalation at the beginning of each cycle, the design target may be used until a power level for extended operation has been achieved.

- e. With successive measurements indicating an increase in peak pin power, $F_{\Delta H}$, with exposure, either of the following additional actions shall be taken.

1. $F_Q^M(Z)$ shall be increased by 2% over that specified in 4.2.2.2.c, or
2. $F_Q^M(Z)$ shall be measured and a target axial flux difference reestablished at least once per 7 effective full power days until 2 successive maps indicate that the peak pin power, $F_{\Delta H}$, is not increasing.

- f. With the relationship specified in 4.2.2.2.c not being satisfied either of the following actions shall be taken:

1. Place the core in an equilibrium condition where the limit in 4.2.2.2.c is satisfied and remeasure the target axial flux difference.
2. Comply with the requirements of Specification 3.2.2 for $F_Q(Z, z)$ exceeding its limit by the percent calculated with the following expression with $V(Z)$ corresponding to the target band.

$$\left[\left[\max. \text{ over } Z \text{ of } \frac{F_Q^M(Z) \times V(Z) \times Ep(Z)}{\frac{F_Q^L(E_z)}{p} \times [K(Z)]} - 1 \right] \times 100 \right] \geq .5$$

- g. The limits specified in 4.2.2.2.c and 4.2.2.2.f above are not applicable in the following core plane regions:

1. Lower core region 0 to 10% inclusive.
2. Upper core region 90% to 100% inclusive.

- 4.2.2.3 When $F_Q(Z, z)$ is measured for reasons other than meeting the requirements of Specification 4.2.2.2, an overall measured $F_Q(Z, z)$ shall be obtained from a power distribution map and increased by 3% to account for manufacturing tolerances and further increased by 5% to account for measurement uncertainty.

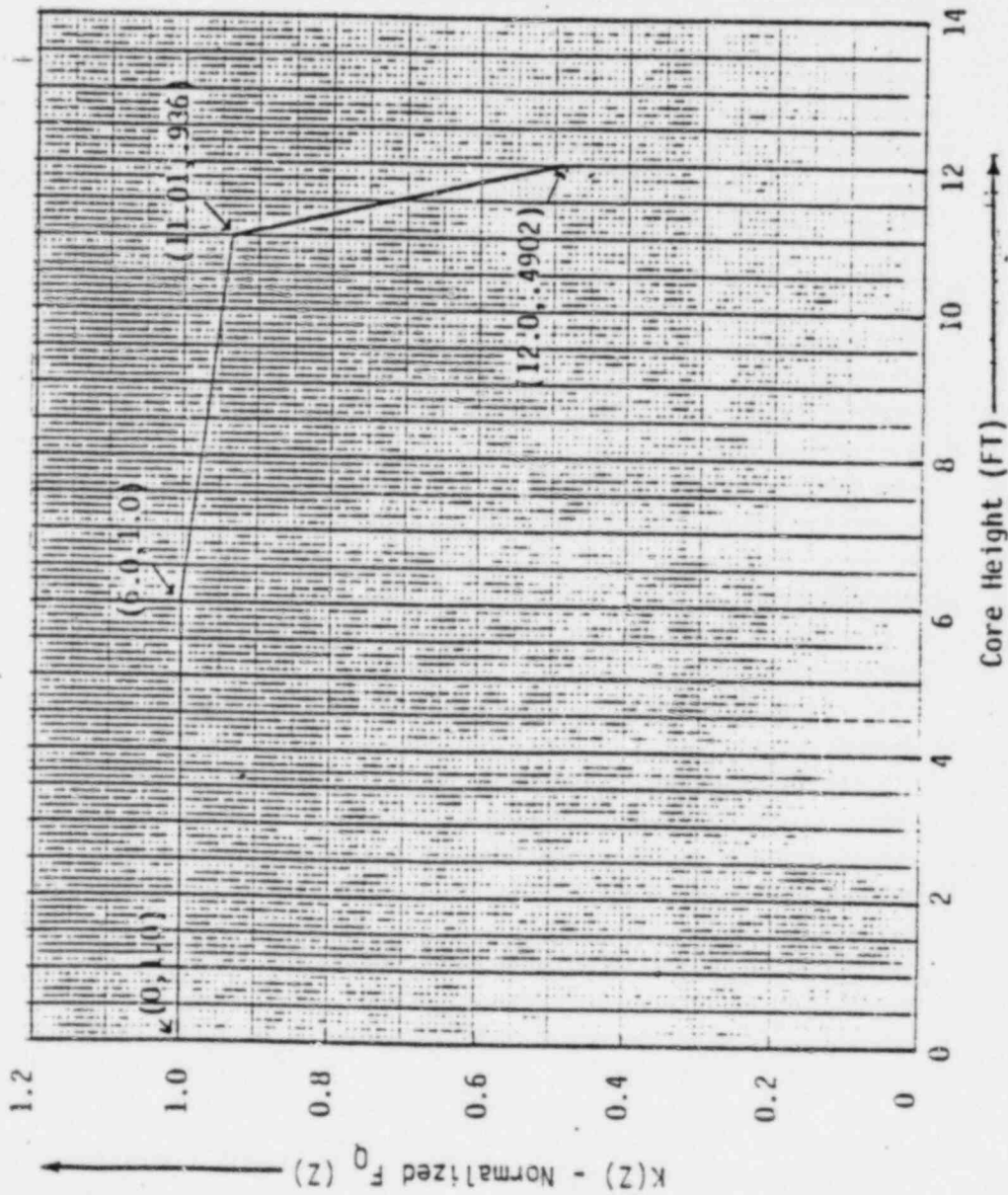


Figure 3-2-2 K(Z) - Normalized $F_0(Z)$ As A Function of Core Height

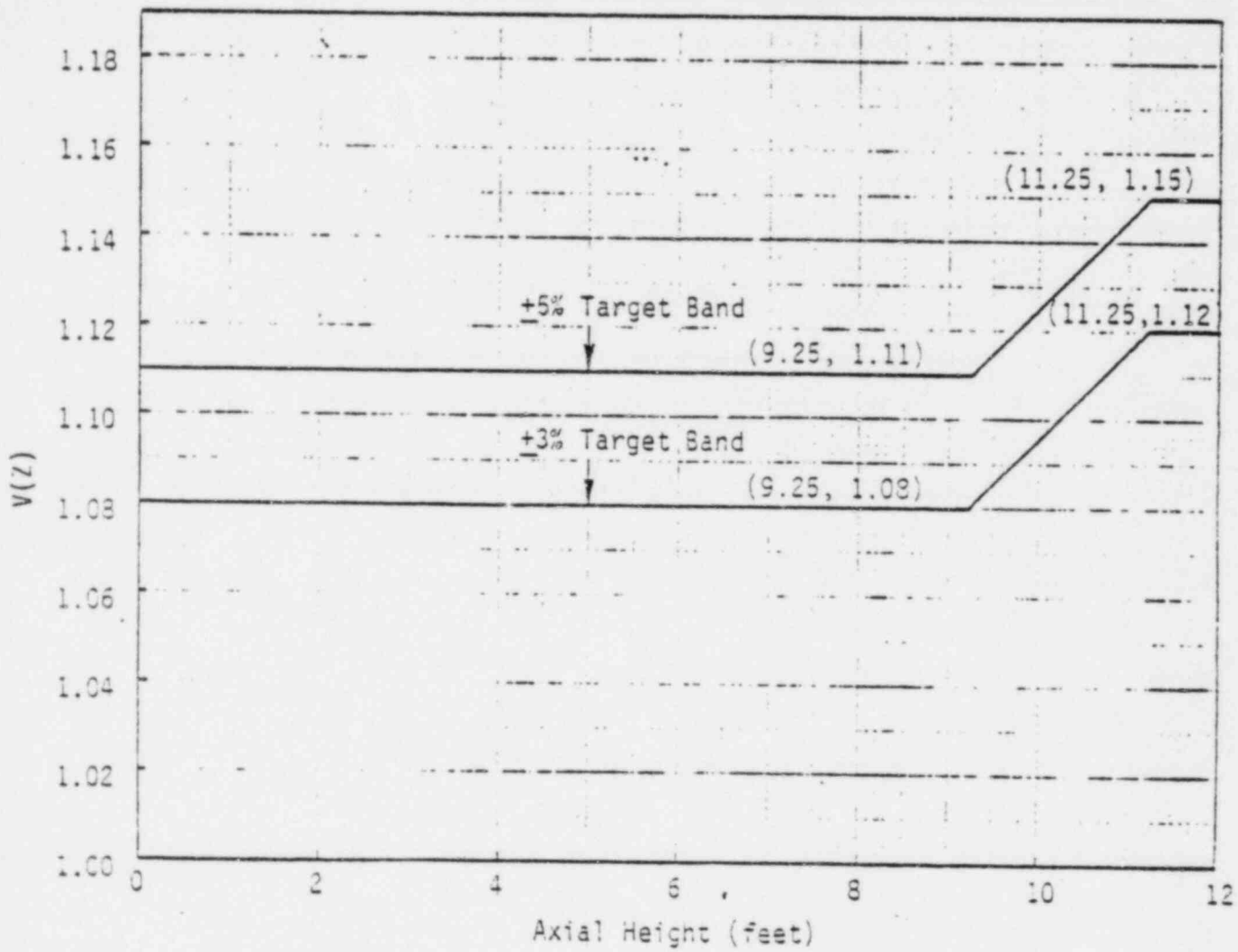


Figure 3.2-3 $V(Z)$ As A Function of Core Height

POWER DISTRIBUTION LIMITS

AXIAL POWER DISTRIBUTION

LIMITING CONDITION FOR OPERATION

3.2.6 The axial power distribution shall be limited by the following relationship:

$$[F_j(Z)]_S = \frac{[2.04] [K(Z)]}{(\bar{R}_j)(P_L)(1.03)(1 + \sigma_j)(1.07) F_p}$$

Where:

- a. $F_j(Z)$ is the normalized axial power distribution from thimble j at core elevation Z .
- b. P_L is the fraction of RATED THERMAL POWER.
- c. $K(Z)$ is the function obtained from Figure 3.2-2 for a given core height location.
- d. \bar{R}_j , for thimble j , is determined from at least $n=6$ in-core flux maps covering the full configuration of permissible rod patterns at 100% or APL (whichever is less) of RATED THERMAL POWER in accordance with:

$$\bar{R}_j = \frac{1}{n} \sum_{i=1}^n R_{ij}$$

Where:

$$R_{ij} = \frac{F_{Qiz}^{Meas} / T(Ez)}{[F_{ij}(Z)]_{Max}}$$

- e. F_{Qiz}^{Meas} is the limiting total peaking factor in flux map i . The limiting total peaking factor is that factor with least margin to the $F_Q^L(Ez)$ curve defined in Figure 3.2-3a for Exxon Nuclear Company fuel and in Figure 3.2-3b for Westinghouse fuel.

POWER DISTRIBUTION LIMITS

LIMITING CONDITION FOR OPERATION (Continued)

$T(E_2)$ is the ratio of the exposure dependent $F_Q^L(E)$ to 2.04 and is defined in Figure 3.2-3a for fuel supplied by Exxon Nuclear Company and in Figure 3.2-3b for fuel supplied by Westinghouse Electric Corporation.

- f. $[F_{ij}(Z)]_{Max}$ is the maximum value of the normalized axial distribution at elevation Z from thimble j in map i which had a limiting total measured peaking factor without uncertainties or densification allowance of F_{Qiz}^{Meas} .

σ_j is the standard deviation associated with thimble j , expressed as a fraction or percentage of \bar{R}_j , and is derived from n flux maps from the relationship below; or 0.02, (2%) whichever is greater.

$$\sigma_j = \frac{\left[\frac{1}{n-1} \sum_{i=1}^n (\bar{R}_j - R_{ij})^2 \right]^{1/2}}{\bar{R}_j}$$

The factor 1.07 is comprised of 1.02 and 1.05 to account for the axial power distribution instrumentation accuracy and the measurement uncertainty associated with F_Q using the movable detector system respectively.

The factor 1.03 is the engineering uncertainty factor.

- g. F_p is an uncertainty factor for Exxon fuel to account for the reduction in the $F_Q^L(E)$ curve due to an accumulation of exposure prior to the next flux map. The following F_p factor shall apply:

$F_p = 1.0$	$0 \leq E_2 \leq 17.12$
$F_p = 1.0 + [0.0015 \times W]$	$17.62 < E_2 \leq 34.5$
$F_p = 1.0 + [0.0033 \times W]$	$34.5 < E_2 \leq 42.2$

where W is the number of effective full power weeks (rounded up to the next highest integer) since the last full core flux map.

POWER DISTRIBUTION LIMITS

LIMITING CONDITION FOR OPERATION (Continued)

APPLICABILITY: Mode 1 above the percent of RATED THERMAL POWER indicated by the relationship.#

$$\text{APL} = \min \text{ over } Z \text{ of } \frac{F_0^L(E_2)K(Z)}{F_0(Z,2) \times V(Z) \times E_p(Z)} \times 100\%$$

where $F_0(Z,2)$ is the measured $F_0(Z,2)$, including a 3% manufacturing tolerance uncertainty and a 5% measurement uncertainty, at the time of target flux determination from a power distribution map using the movable incore detectors. $V(Z)$ is the function defined in Figure 3.2-3 which corresponds to the target band. The above limit is not applicable in the following core plane region.

- 1) Lower core region 0% to 10% inclusive.
- 2) Upper core region 90% to 100% inclusive.

ACTION:

- a. With a $F_j(Z)$ factor exceeding $[F_j(Z)]_S$ by ≤ 4 percent, reduce THERMAL POWER 1 percent for every percent by which the $F_j(Z)$ factor exceeds its limit within 15 minutes and within the next 2 hours either reduce the $F_j(Z)$ factor to within its limit or reduce THERMAL POWER to APL or less of RATED THERMAL POWER.
- b. With a $F_j(Z)$ factor exceeding $[F_j(Z)]_S$ by > 4 percent, reduce THERMAL POWER to APL or less of RATED THERMAL POWER within 15 minutes.

The APCMS may be out of service: 1) when incore maps are being taken as part of the Augmented Startup Test Program or 2) when surveillance for determining power distribution maps is being performed.

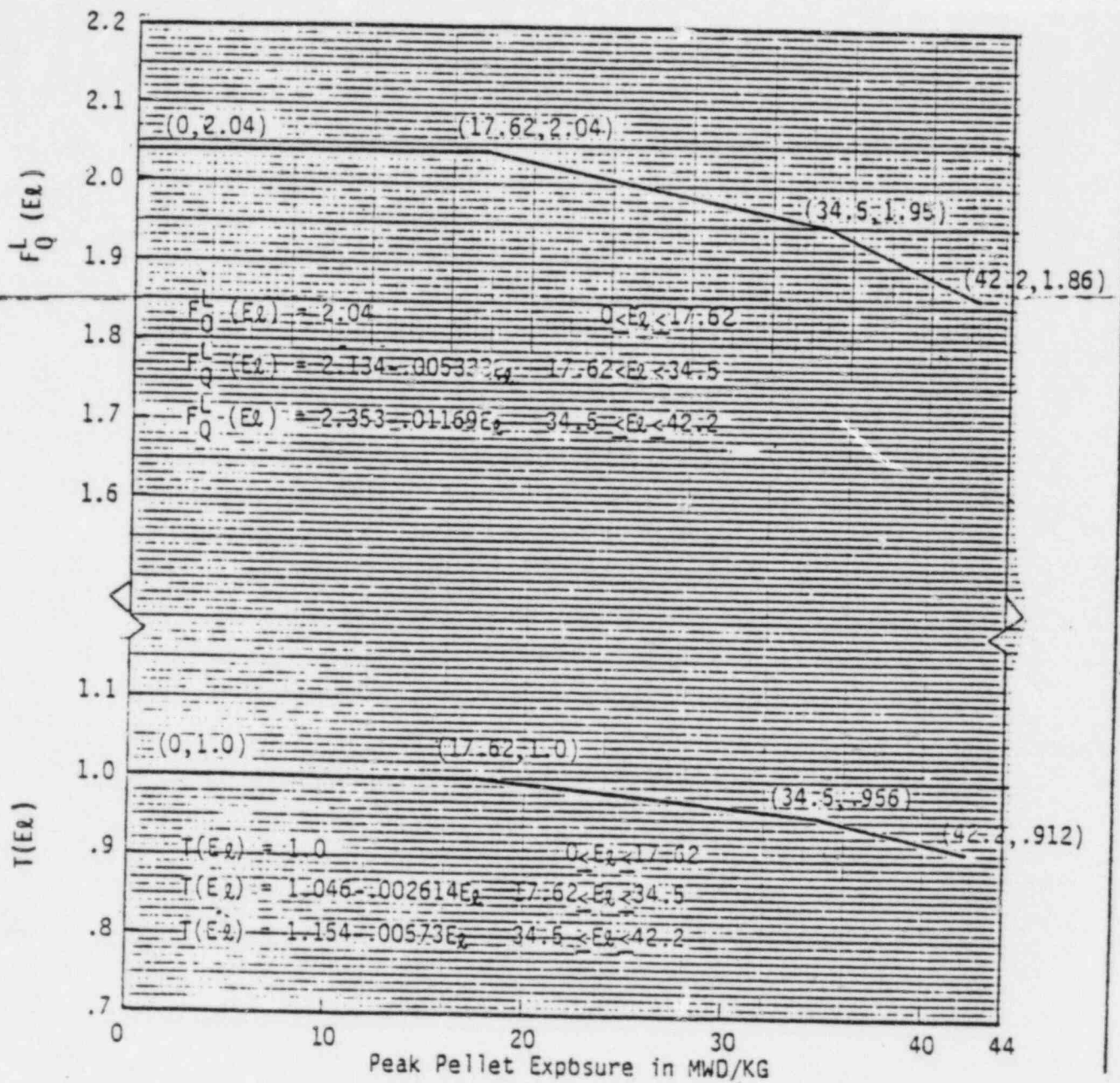


Figure 3.2.3a

Exposure Dependent F_Q Limit, $F_Q^L(E_2)$, and Normalized Limit $T(E_2)$ as a Function of Peak Pellet Burnup for Exxon Nuclear Company Fuel

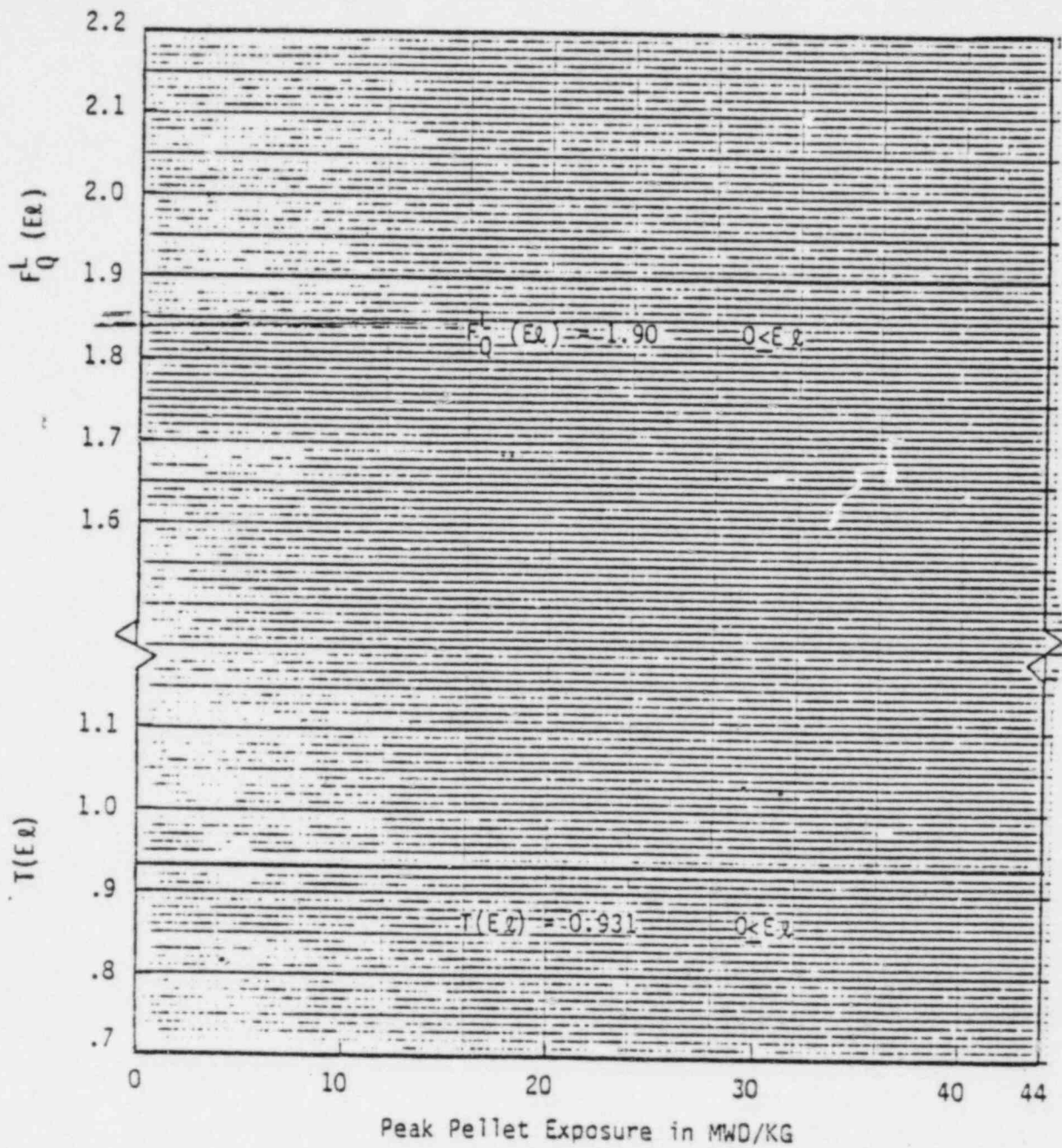


Figure 3-2-3b

F_Q Limit, $F_Q^L (E_2)$, and Normalized Limit $T(E_2)$ as a
Function of Peak Pellet Burnup for Westinghouse Fuel

POWER DISTRIBUTION LIMITS

BASES

Although it is intended that the plant will be operated with the AXIAL FLUX DIFFERENCE within the target band about the target flux difference, during rapid plant THERMAL POWER reductions, control rod motion will cause the AFD to deviate outside of the target band at reduced THERMAL POWER levels. This deviation will not affect the xenon redistribution sufficiently to change the envelope of peaking factors which may be reached on a subsequent return to RATED THERMAL POWER (with the AFD within the target band) provided the time duration of the deviation is limited. Accordingly, a 1 hour penalty deviation limit cumulative during the previous 24 hours is provided for operation outside of the target band but within the limits of Figure 3.2-1 while at THERMAL POWER levels above 50% of RATED THERMAL POWER. For THERMAL POWER levels below 50% of RATED THERMAL POWER, deviations the AFD outside of the target band are less significant. The penalty of 2 hours actual time reflects this reduced significance.

Provisions for monitoring the AFD on an automatic basis are derived from the plant process computer through the AFD Monitor Alarm. The computer determines the one minute average of each of the OPERABLE excore detector outputs and provides an alarm message if the AFD for at least 2 of 4 or 2 of 3 OPERABLE excore channels are outside the target band and the THERMAL POWER is greater than 90% or 0.9 x APL of RATED THERMAL POWER (whichever is less). During operation at THERMAL POWER levels between 15% and 90% or 0.9 x APL of RATED THERMAL POWER (whichever is less), the computer outputs an alarm message when the penalty deviation accumulates beyond the limits of 1 hour and 2 hours, respectively.

The upper bound limit (90% or 0.9 x APL of RATED THERMAL POWER (whichever is less)) on AXIAL FLUX DIFFERENCE assures that the $F_0(Z,2)$ envelope of 2.04 times $K(Z) \times T(E_2)$ is not exceeded during either normal operation or in the event of xenon redistribution following power changes. The lower bound limit (50% of RATED THERMAL POWER) is based on the fact that at THERMAL POWER levels below 50% of RATED THERMAL POWER, the average linear heat generation rate is half of its nominal operating value and below that value, perturbations in localized flux distributions cannot affect the results of ECCS or DNBR analyses in a manner which would adversely affect the health and safety of the public.

Figure B 3/4 2-1 shows a typical monthly target band near the beginning of core life.

The bases and methodology for establishing these limits is presented in topical report XN-NF-77-57. "Exxon Nuclear Power Distribution Control for PWR's - Phase II" and Supplements 1 and 2 to that report.



UNITED STATES
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WASHINGTON, D. C. 20555

INDIANA AND MICHIGAN ELECTRIC COMPANY

DOCKET NO. 50-316

DONALD C. COOK NUCLEAR PLANT UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 44
License No. DPR-74

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The applications for amendment by Indiana and Michigan Electric Company (the licensee) dated April 7, 1982 and July 12, 1982, comply with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's rules and regulations set forth in 10 CFR Chapter I;
 - B. The facility will operate in conformity with the applications, the provisions of the Act, and the rules and regulations of the Commission;
 - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
 - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and security of the public; and
 - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

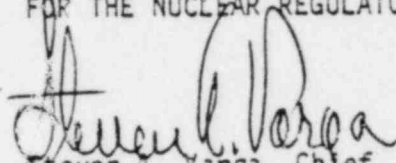
2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. DPR-74 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 44, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION


Steven A. Varga, Chief
Operating Reactors Branch #1
Division of Licensing

Attachment:
Changes to the Technical
Specifications

Date of Issuance: September 15, 1982

ATTACHMENT TO LICENSE AMENDMENT

AMENDMENT NO. 44 TO FACILITY OPERATING LICENSE NO. DPR-74

DOCKET NO. 50-316

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3/4.2 POWER DISTRIBUTION LIMITS

AXIAL FLUX DIFFERENCE (AFD)

LIMITING CONDITION FOR OPERATION

3.2.1 The indicated AXIAL FLUX DIFFERENCE (AFD) shall be maintained within the target band ($\pm 5\%$ or $\pm 3\%$ flux difference units) about a target flux difference. |

APPLICABILITY: MODE 1 above 50% RATED THERMAL POWER*

ACTION:

- a. With the indicated AXIAL FLUX DIFFERENCE outside of the target band about the target flux difference and with THERMAL POWER:
 1. Above 90% or $0.9 \times \text{APL}^{**}$ (whichever is less) of RATED THERMAL POWER, within 15 minutes:
 - a) Either restore the indicated AFD to within the target band limits, or
 - b) Reduce THERMAL POWER to less than 90% or $0.9 \times \text{APL}$ (whichever is less) of RATED THERMAL POWER.
 2. Between 50% and 90% or $0.9 \times \text{APL}$ (whichever is less) of RATED THERMAL POWER:
 - a) POWER OPERATION may continue provided:
 - 1) The indicated AFD has not been outside of the target band for more than 1 hour penalty deviation cumulative during the previous 24 hours, and
 - 2) The indicated AFD is within the limits shown on Figure 3.2-1. Otherwise, reduce THERMAL POWER to less than 50% of RATED THERMAL POWER within 30 minutes and reduce the Power Range Neutron Flux-High Trip Setpoints to $< 55\%$ of RATED THERMAL POWER within the next 4 hours.
 - b) Surveillance testing of the Power Range Neutron Flux Channels may be performed pursuant to Specification 4.3.1.1.1 provided the indicated AFD is maintained within the limit of Figure 3.2-1. A total of 16 hours operation may be accumulated with the AFD outside of the target band during this testing without penalty deviation.

* See Special Test Exception 3.10.2

** APL is the Allowable Power Level defined in Specification 3.2.6

POWER DISTRIBUTION LIMITS

ACTION: (Continued)

- c) Surveillance testing of the APDMS may be performed pursuant to Specification 4.3.3.7.1 provided the indicated AFD is maintained within the limits of Figure 3.2-1. A total of 6 hours of operation may be accumulated with the AFD outside of the target band during this testing without penalty deviation.
- b. THERMAL POWER shall not be increased above 90% or $0.9 \times \text{APL}$ (whichever is less) of RATED THERMAL POWER unless the indicated AFD is within the target band and ACTION 2.a) 1), above has been satisfied. . . .
- c. THERMAL POWER shall not be increased above 50% of RATED THERMAL POWER unless the indicated AFD has not been outside of the target band for more than 1 hour penalty deviation cumulative during the previous 24 hours.
- d. During power reductions using control rods, the reporting requirements of Specification 6.9.1.9 shall not apply provided the action items above are satisfied.

SURVEILLANCE REQUIREMENTS

4.2.1.1 The indicated AXIAL FLUX DIFFERENCE shall be determined to be within its limits during POWER OPERATION above 15% of RATED THERMAL POWER by:

- a. Monitoring the indicated AFD for each OPERABLE excore channel:
 1. At least once per 7 days when the AFD Monitor Alarm is OPERABLE, and
 2. At least once per hour for the first 24 hours after restoring the AFD Monitor Alarm to OPERABLE status.
- b. Monitoring and logging the indicated AXIAL FLUX DIFFERENCE for each OPERABLE excore channel at least once per hour for the first 24 hours and at least once per 30 minutes thereafter, when the AXIAL FLUX DIFFERENCE Monitor Alarm is inoperable. The logged values of the indicated AXIAL FLUX DIFFERENCE shall be assumed to exist during the interval preceding each logging.

POWER DISTRIBUTION LIMITS

SURVEILLANCE REQUIREMENTS (continued)

4.2.1.2 The indicated AFD shall be considered outside of its target band when at least 2 of 4 or 2 of 3 OPERABLE excore channels are indicating the AFD to be outside the target band. Penalty deviation outside of the target band shall be accumulated on a time basis of:

- a. A penalty deviation of one minute for each one minute of POWER OPERATION outside of the target band at THERMAL POWER levels equal to or above 50% of RATED THERMAL POWER, and
- b. A penalty deviation of one half minute for each one minute of POWER OPERATION outside of the target band at THERMAL POWER levels between 15% and 50% of RATED THERMAL POWER.

4.2.1.3 The target axial flux difference of each OPERABLE excore channel shall be determined in conjunction with the measurement of $F_Q^M(z)$ as defined in Specification 4.2.2.2.c. The provisions of Specification 4.0.4 are not applicable.

4.2.1.4 The axial flux difference target band about the target axial flux difference shall be determined in conjunction with the measurement of $F_Q^M(z)$ as defined in Specification 4.2.2.2.c. The allowable values of the target band are $\pm 5\%$ or $\pm 3\%$. Redefinition of the target band from $\pm 3\%$ to $\pm 5\%$ between determinations of the target axial flux difference is allowed when appropriate redefinitions of APL are made. Redefinition of the target band from $\pm 5\%$ to $\pm 3\%$ is allowed only in conjunction with the determination of a new target axial flux difference. The provisions of Specification 4.0.4 are not applicable.

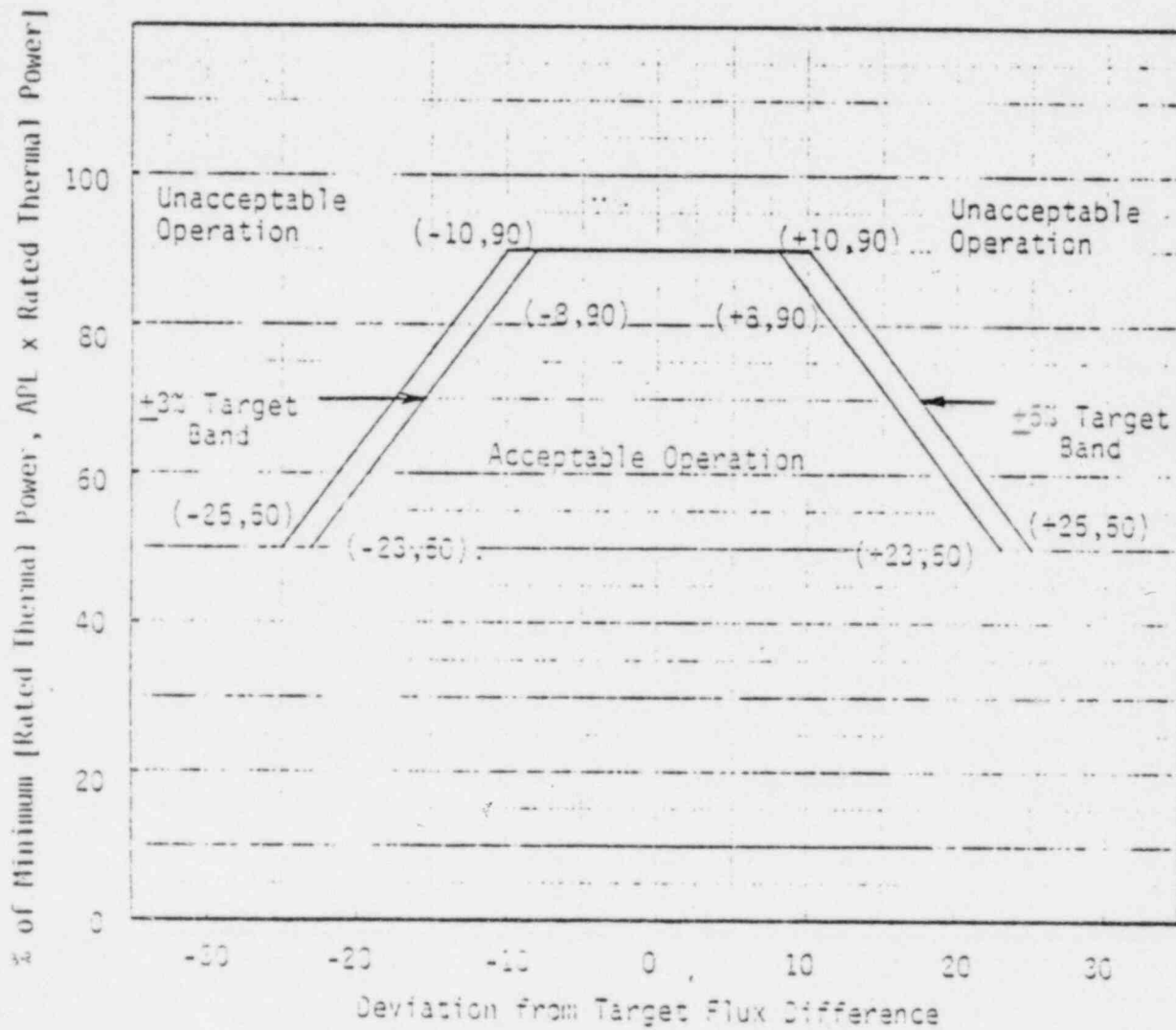


Figure 3.2-1 Allowable Deviation from Target Flux Difference

POWER DISTRIBUTION LIMITS

SURVEILLANCE REQUIREMENTS

- 4.2.2.1 The provisions of Specification 4.0.4 are not applicable.
- 4.2.2.2 $F_Q(Z)$ shall be determined to be within its limit by:
- Using the movable incore detectors to obtain a power distribution map at any THERMAL POWER greater than 5% of RATED THERMAL POWER.
 - Increasing the measured $F_Q(Z)$ component of the power distribution map by 3% to account for manufacturing tolerances and further increasing the value by 5% to account for measurement uncertainties. This product defined is $F_Q^M(Z)$.
 - Satisfying the following relationship at the time of the target flux determination.

$$F_Q^M(Z) \leq \frac{1.99}{P} [K(Z)] / [V(Z)] \quad \text{for } P > .5$$

$$F_Q^M(Z) \leq 3.98 [K(Z)] / [V(Z)] \quad \text{for } P \leq .5$$

where

$F_Q^M(Z)$ is the measured total peaking as a function of core height.

$V(Z)$ is the function defined in Figure 3.2-3 which corresponds to the target band, $K(Z)$ is defined in Figure 3.2-2, P is the fraction of RATED THERMAL POWER.

- Measuring $F_Q(Z)$ in conjunction with the target flux difference and target band determination, according to the following schedule:
 - Upon achieving equilibrium conditions after exceeding by 10% or more of RATED THERMAL POWER, the THERMAL POWER at which $F_Q(Z)$ was last determined*, or
 - At least once per 31 effective full power days, whichever occurs first.

*During power escalation at the beginning of each cycle, the design target may be used until a power level for extended operation has been achieved.

POWER DISTRIBUTION LIMITS

SURVEILLANCE REQUIREMENTS

- e. With successive measurements indicating an increase in peak pin power, $F_{\Delta H}$, with exposure, either of the following additional actions shall be taken.
1. $F_Q^M(Z)$ shall be increased by 2% over that specified in 4.2.2.2.c, or
 2. $F_Q^M(Z)$ shall be measured and a target axial flux difference reestablished at least once per 7 effective full power days until 2 successive maps indicate that the peak pin power, $F_{\Delta H}$, is not increasing.
- f. With the relationship specified in 4.2.2.2.c not being satisfied either of the following actions shall be taken.
1. Place the core in an equilibrium condition where the limit in 4.2.2.2.c is satisfied and remeasure the target axial flux difference.
 2. Comply with the requirements of Specification 3.2.2 for $F_Q(Z)$ exceeding its limit by the percent calculated with the following expression with $V(Z)$ corresponding to the target band:

$$\left[\left[\text{max. over } Z \text{ of } \frac{F_Q^M(Z) \times V(Z)}{\frac{1.99}{P} \times [K(Z)]} \right] - 1 \right] \times 100 \quad P \geq .5$$

- g. The limits specified in 4.2.2.2.c and 4.2.2.2.f above are not applicable in the following core plane regions:
1. Lower core region 0 to 10% inclusive.
 2. Upper core region 90% to 100% inclusive.
- 4.2.2.3 When $F_Q(Z)$ is measured for reasons other than meeting the requirements of Specification 4.2.2.2, an overall measured $F_Q(Z)$ shall be obtained from a power distribution map and increased by 3% to account for manufacturing tolerances and further increased by 5% to account for measurement uncertainty.

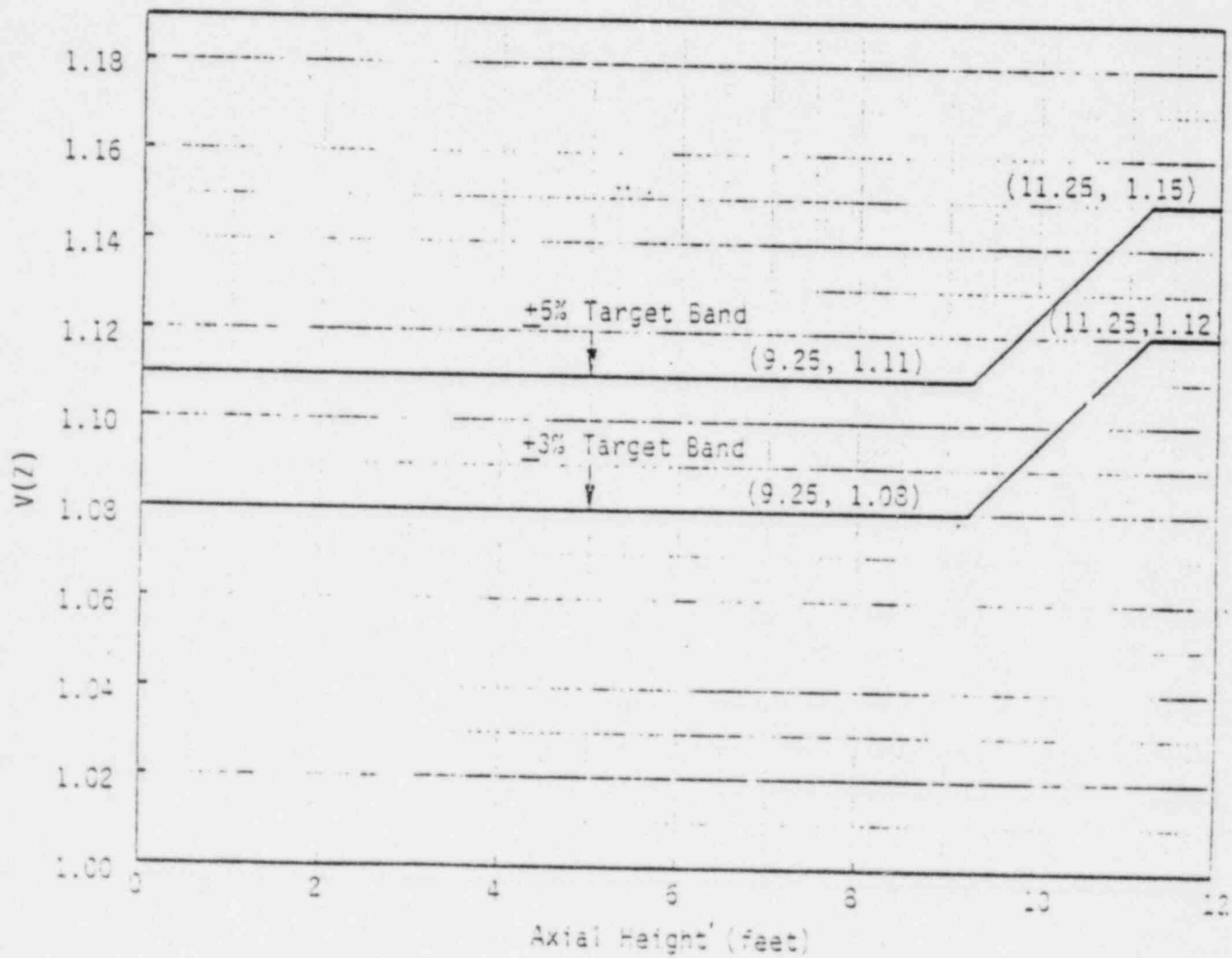


Figure 3.7-3 V(Z) As A Function of Core Depth

POWER DISTRIBUTION LIMITS

LIMITING CONDITIONS FOR OPERATION (Continued)

σ_j is the standard deviation associated with thimble j , expressed as a fraction or percentage of \bar{R}_j , and is derived from n flux maps from the relationship below, or 0.02, (2%) whichever is greater.

$$\sigma_j = \frac{\left[\frac{1}{n-1} \sum_{i=1}^n (\bar{R}_j - R_{ij})^2 \right]^{1/2}}{\bar{R}_j}$$

The factor 1.07 is comprised of 1.02 and 1.05 to account for the axial power distribution instrumentation accuracy and the measurement uncertainty associated with F_Q using the movable detector system respectively.

The factor 1.03 is the engineering uncertainty factor.

APPLICABILITY: Mode 1 above the percent of RATED THERMAL POWER indicated by the relationship. #

$$APL = \min \text{ over } Z \text{ of } \frac{1.99 K(Z)}{F_Q(Z) \times V(Z)} \times 100\%$$

where $F_Q(Z)$ is the measured $F_Q(Z)$, including a 3% manufacturing tolerance uncertainty and a 5% measurement uncertainty, at the time of target flux determination from a power distribution map using the movable incore detectors. $V(Z)$ is the function defined in Figure 3.2-3 which corresponds to the target band. The above limit is not applicable in the following core plane regions.

- 1) Lower core region 0% to 10% inclusive.
- 2) Upper core region 90% to 100% inclusive.

ACTION:

- a. With a $F_j(Z)$ factor exceeding $[F_j(Z)]_S$ by ≤ 4 percent, reduce THERMAL POWER one percent for every percent by which the $F_j(Z)$ factor exceeds its limit within 15 minutes and within the next two hours either reduce the $F_j(Z)$ factor to within its limit or reduce THERMAL POWER to APL or less of RATED THERMAL POWER.
- b. With a $F_j(Z)$ factor exceeding $[F_j(Z)]_S$ by > 4 percent, reduce THERMAL POWER to APL or less of RATED THERMAL POWER within 15 minutes.

The APDMS may be out of service when surveillance for determining power distribution maps is being performed.

POWER DISTRIBUTION LIMITS

BASES

Although it is intended that the plant will be operated with the AXIAL FLUX DIFFERENCE within the target band about the target flux difference, during rapid plant THERMAL POWER reductions, control rod motion will cause the AFD to deviate outside of the target band at reduced THERMAL POWER levels. This deviation will not affect the xenon redistribution sufficiently to change the envelope of peaking factors which may be reached on a subsequent return to RATED THERMAL POWER (with the AFD within the target band) provided the time duration of the deviation is limited. Accordingly, a 1-hour penalty deviation limit cumulative during the previous 24 hours is provided for operation outside of the target band but within the limits of Figure 3.2-1 while at THERMAL POWER levels above 50% of RATED THERMAL POWER. For THERMAL POWER levels between 15% and 50% of RATED THERMAL POWER, deviations of the AFD outside of the target band are less significant. The penalty of 2 hours actual time reflects this reduced significance.

Provisions for monitoring the AFD on an automatic basis are derived from the plant process computer through the AFD Monitor Alarm. The computer determines the one minute average of each of the OPERABLE excore detector outputs and provides an alarm message if the AFD for at least 2 of 4 or 2 of 3 OPERABLE excore channels are outside the target band and the THERMAL POWER is greater than 90% or 0.9 x APL of RATED THERMAL POWER (whichever is less). During operation at THERMAL POWER levels between 50% and 90% or 0.9 x APL of RATED THERMAL POWER (whichever is less) and between 15% and 50% RATED THERMAL POWER, the computer outputs an alarm message when the penalty deviation accumulates beyond the limits of 1 hour and 2 hours, respectively.

Figure B 3/4 2-1 shows a typical monthly target band.

The bases and methodology for establishing these limits is presented in topical report XN-NF-77-57, "Exxon Nuclear Power Distribution Control for PWR's-Phase II" and Supplements 1 and 2 to that report.