

POWER DISTRIBUTION LIMITS

SURVEILLANCE REQUIREMENTS (Continued)

- c. Verifying that the AXIAL SHAPE INDEX is maintained within the allowable limits of Figure 3.2-2, where 100% of maximum allowable power represents the maximum THERMAL POWER allowed by the following expression:

$$M \times N$$

where:

1. M is the maximum allowable THERMAL POWER level for the existing Reactor Coolant Pump combination.
2. N is the maximum allowable fraction of RATED THERMAL POWER as determined by the  $F_{xy}^T$  curve of Figure 3.2-3.

4.2.1.4 Incore Detector Monitoring System<sup>#</sup> - The incore detector monitoring system may be used for monitoring the core power distribution by verifying that the incore detector Local Power Density alarms:

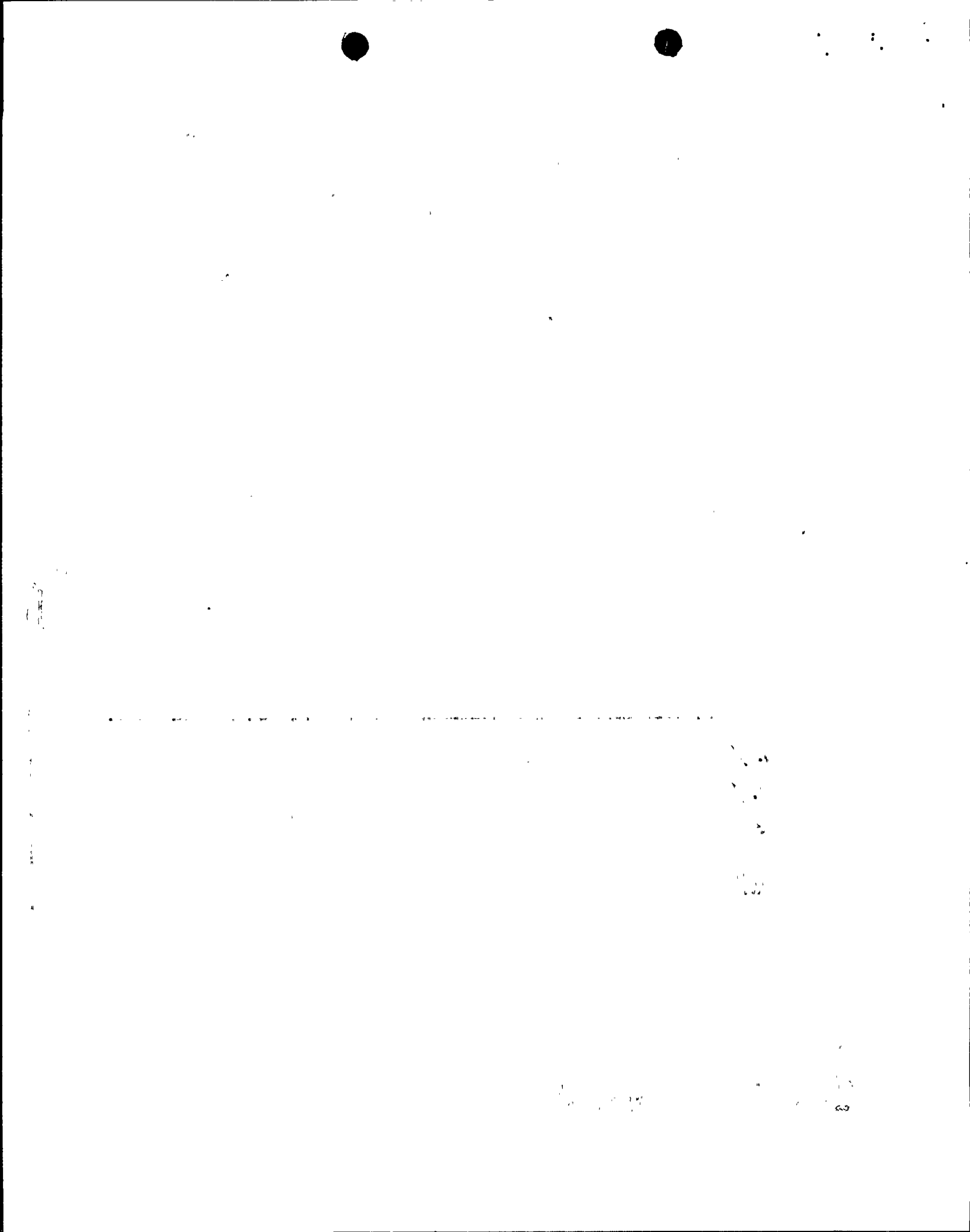
- a. Are adjusted to satisfy the requirements of the core power distribution map which shall be updated at least once per 31 days of accumulated operation in MODE 1.
- b. Have their alarm setpoint adjusted to less than or equal to the limits shown on Figure 3.2-1 when the following factors are appropriately included in the setting of these alarms:

~~1. Flux peaking augmentation factors as shown in Figure 4.2-1,~~

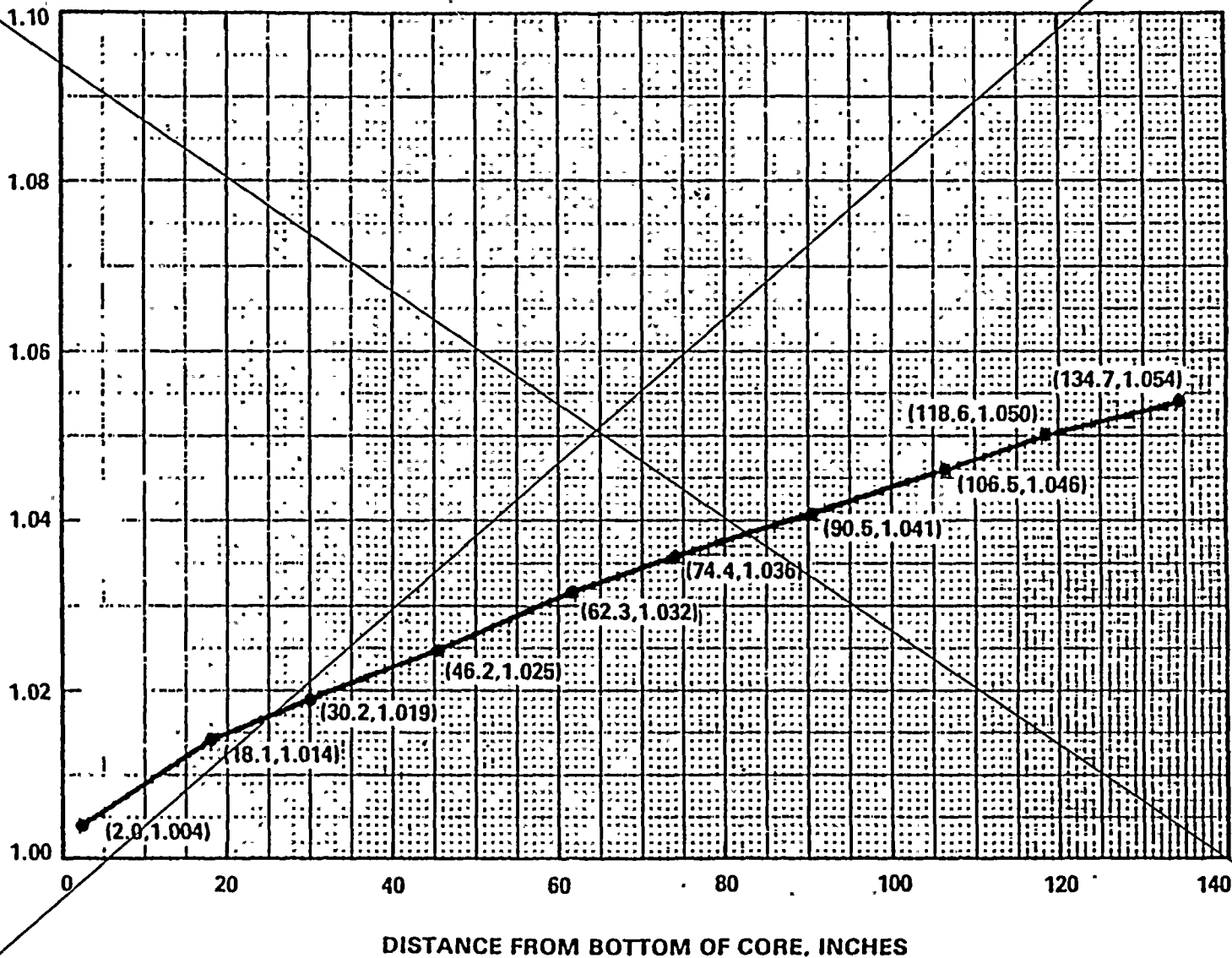
1.  $\checkmark$ . A measurement-calculational uncertainty factor of 1.062,
2.  $\checkmark$ . An engineering uncertainty factor of 1.03,
3.  $\checkmark$ . A linear heat rate uncertainty factor of 1.01 due to axial fuel densification and thermal expansion, and
4.  $\checkmark$ . A THERMAL POWER measurement uncertainty factor of 1.02.

<sup>#</sup>If incore system becomes inoperable, reduce power to M x N within 4 hours and monitor linear heat rate in accordance with Specification 4.2.1.3.

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PDR ADOCK 05000389  
P PDR

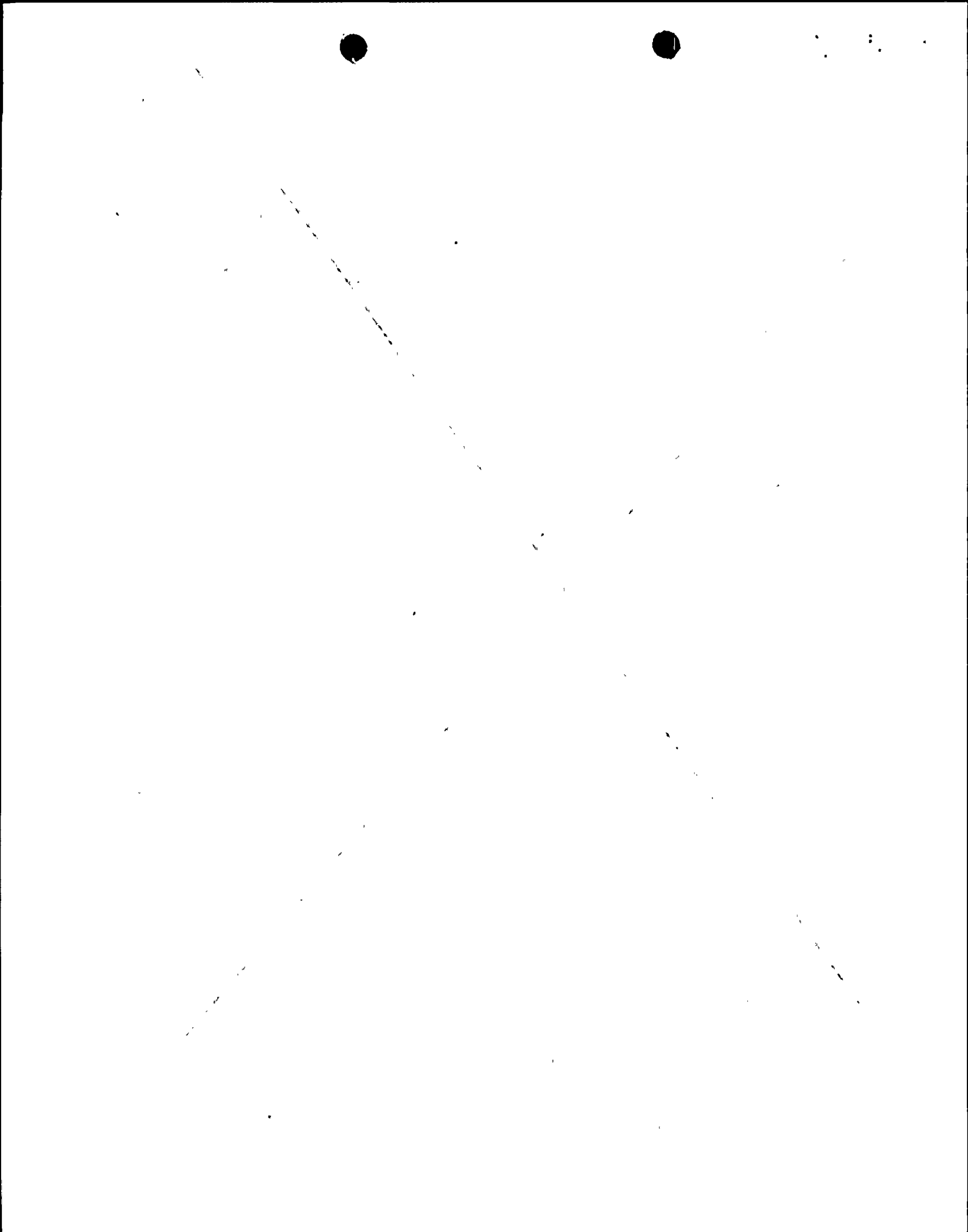


AUGMENTATION FACTOR



Delete

Figure 4.2-1  
Augmentation factors vs distance from bottom of core



## 3/4.2 POWER DISTRIBUTION LIMITS

### BASES

#### 3/4.2.1 LINEAR HEAT RATE

The limitation on linear heat rate ensures that in the event of a LOCA, the peak temperature of the fuel cladding will not exceed 2200°F.

Either of the two core power distribution monitoring systems, the Excore Detector Monitoring System and the Incore Detector Monitoring System, provides adequate monitoring of the core power distribution and are capable of verifying that the linear heat rate does not exceed its limits. The Excore Detector Monitoring System performs this function by continuously monitoring the AXIAL SHAPE INDEX with the OPERABLE quadrant symmetric excore neutron flux detectors and verifying that the AXIAL SHAPE INDEX is maintained within the allowable limits of Figure 3.2-2. In conjunction with the use of the excore monitoring system and in establishing the AXIAL SHAPE INDEX limits, the following assumptions are made: (1) the CEA insertion limits of Specifications 3.1.3.5 and 3.1.3.6 are satisfied, (2) ~~the flux peaking augmentation factors are as shown in Figure 4.2-1,~~ (3) the AZIMUTHAL POWER TILT restrictions of Specification 3.2.4 are satisfied, and (4) the TOTAL PLANAR RADIAL PEAKING FACTOR does not exceed the limits of Specification 3.2.2.

The Incore Detector Monitoring System continuously provides a direct measure of the peaking factors and the alarms which have been established for the individual incore detector segments ensure that the peak linear heat rates will be maintained within the allowable limits of Figure 3.2-1. The setpoints for these alarms include allowances, set in the conservative directions, for (1) ~~flux peaking augmentation factors as shown in Figure 4.2-1,~~ (2) a measurement-calculational uncertainty factor of 1.062, (3) an engineering uncertainty factor of 1.03, (4) an allowance of 1.01 for axial fuel densification and thermal expansion, and (5) a THERMAL POWER measurement uncertainty factor of 1.02.

#### 3/4.2.2, 3/4.2.3 and 3/4.2.4 TOTAL PLANAR AND INTEGRATED RADIAL PEAKING

FACTORS -  $F_{xy}^T$  AND  $F_r^T$  AND AXIMUTHAL POWER TILT -  $T_q$

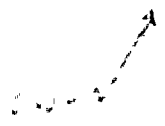
The limitations on  $F_{xy}^T$  and  $T_q$  are provided to ensure that the assumptions used in the analysis for establishing the Linear Heat Rate and Local Power Density - High LCOs and LSSS setpoints remain valid during operation at the various allowable CEA group insertion limits. The limitations on  $F_r^T$  and  $T_q$  are provided to ensure that the assumptions used in the analysis establishing the DNB Margin LCO, the Thermal Margin/Low Pressure LSSS setpoints remain valid during operation at the various allowable CEA group insertion limits. If  $F_{xy}^T$ ,  $F_r^T$  or  $T_q$  exceed their basic limitations, operation may continue under the additional restrictions imposed by the ACTION statements since these additional restrictions provide adequate provisions to assure that the

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## ATTACHMENT 2

### SAFETY EVALUATION

#### Introduction

The proposed change to the St. Lucie Unit 2 Technical Specifications is to discontinue the use of Nuclear Flux Peaking Augmentation Factors. Augmentation factors are used at present in establishing setpoints for the peak linear heat generation rate alarm. The changes, which are detailed in Attachment 1, modify part 4.2.1.4 of the Linear Heat Rate Technical Specification and the associated Technical Specification Bases. Figure 4.2.1, which specifies the value of the augmentation factor versus height in the core, is also presented in Attachment 1 and is proposed for deletion by this Technical Specification change.

The purpose for which the Nuclear Flux Peaking Augmentation Factor was originally developed was to provide margin for increased flux peaks which could result from the formation of interpellet gaps in the fuel pellet column and the subsequent local creepdown of the fuel cladding. The augmentation factor is defined as the ratio of the local flux with increased peaks due to interpellet gaps to the local flux in the absence of interpellet gaps. Analysis of fuel performance data such as that in Reference 1 is the basis for determining appropriate sizes and spatial distributions of the gaps used in the calculation of these fluxes.

The proposed change is based on the performance of fuel rods of modern design as compared to the performance of fuel rods of older design for which the flux peaking augmentation factors were originally developed.

As noted in References 2 and 3, Baltimore Gas and Electric Company has received NRC approval to modify the linear heat rate technical specifications for their Calvert Cliffs Units 1 and 2 based on considerations similar to those noted in this evaluation.

#### Discussion

The purpose of using augmentation factors has been to provide margin for flux peaks which would result from the formation of gaps between fuel pellets and subsequent cladding collapse. Uranium fuel is a strong neutron absorber and a gap in the fuel column will cause a localized flux peak. This peak causes an increase in the reaction rate for the neighboring fuel pellets. If the gaps are larger than about 0.5", then clad collapse can occur over the voided region. Cladding collapse will increase the flux peak in the voided region because it increases the moderator present in the area of the peak. The mechanisms leading to the formation of these gaps and cladding collapse which were present in old fuel designs have been eliminated in modern fuel designs.

CHALMERS YLÉN

1911

1. The first part of the report deals with the general situation of the country and the position of the Church. It is a very interesting and important document, which gives a clear and concise picture of the state of affairs at the time. The author's analysis is very thorough and his conclusions are well founded. The report is a valuable contribution to the history of the Church in Sweden.

2. The second part of the report deals with the work of the Church in the different parts of the country. It is a very detailed and comprehensive account of the activities of the Church, and shows how the Church has worked to improve the spiritual and moral life of the people. The author's observations are very acute and his descriptions are very vivid. The report is a very valuable document for the study of the history of the Church in Sweden.

3. The third part of the report deals with the future of the Church. It is a very thoughtful and far-sighted analysis of the problems which the Church will face in the future. The author's proposals are very practical and his conclusions are very sound. The report is a very valuable contribution to the study of the future of the Church in Sweden.

4. The fourth part of the report deals with the work of the Church in the different parts of the country. It is a very detailed and comprehensive account of the activities of the Church, and shows how the Church has worked to improve the spiritual and moral life of the people. The author's observations are very acute and his descriptions are very vivid. The report is a very valuable document for the study of the history of the Church in Sweden.



## Attachment 2 (con't)

Due to the material properties of  $UO_2$ , fuel pellets suffer from irradiation-induced densification. This densification is caused by the reduction of porosity and subsequent shrinkage of  $UO_2$ . This is most important in the low-density (< 92% theoretical density)  $UO_2$  used in old fuel designs. Modern fuel designs utilize  $UO_2$  that is closer to the maximum theoretical density. This material has less porosity and is incapable of significant shrinkage. Fuel pellets used in old designs would densify by as much as 3% of the theoretical density. Industry-wide, increased pellet sintering temperatures and sintering time have led to a significant decrease in densification. Modern fuel pellets are considered non-densifying (they densify less than 0.5% T.D.). The main impact of fuel pellet shrinkage is the associated reduction in the fuel column height.

In old fuel designs, the fuel rods were not prepressurized. These rods were subjected to greater pressure differences across the cladding which caused cladding ovality and creepdown to begin at relatively low exposure. As the deformation of the cladding continued, the cladding would begin to make contact with the fuel pellets. This resulted in the immobilization of fuel pellets. Because this was occurring before the fuel densification and shrinkage were complete, axial gaps would form below the immobilized pellets as the remainder of the column continued to settle.

Because modern fuel rods are prepressurized, the pressure differential across the cladding is reduced. This delays the onset of cladding deformation so that pellet-to-cladding contact does not immobilize fuel pellets until after most of the fuel column shrinkage is completed. Since the total amount of column shrinkage is significantly reduced in modern fuel, and because most of the shrinkage occurs before cladding deformation causes pellet immobilization, the possibility of forming large axial gaps in the fuel is eliminated. The absence of any large axial gaps also prevents clad collapse and the associated flux peaks.

Combustion Engineering (CE) has evaluated the factors that cause the formation of gaps and cladding collapse and has concluded that, for fuel designed by CE, significant gaps and cladding collapse will not occur. CE examined fuel supplied to several utilities to verify these conclusions. Because of these results, no flux peaking augmentation factors are required for fuel designed by CE. The justification for this position is presented in Reference 1. No new data has been developed which would require changes to the conclusions presented in Reference 1.

The fuel used at St. Lucie Unit 2 is provided by CE. The manufacturing process for the fuel rods used in Unit 2 is the same as that which was used in the fuel rods for which CE demonstrated the formation of no interpellet gaps.

The safety analyses for St. Lucie Unit 2 have been performed in a manner to support the elimination of the augmentation factor. The calculations were either run without the augmentation factors or, if the augmentation factors were used, they were included in a way that would enhance the conservatism of analytical results. The removal of the augmentation criteria will not cause the results of any analysis to exceed design acceptance criteria.

The first part of the document discusses the importance of maintaining accurate records. It emphasizes that proper record-keeping is essential for the effective management of any organization. The text highlights the various benefits of a well-maintained record system, including improved communication, better decision-making, and enhanced accountability. It also notes that records provide a historical perspective on the organization's activities, which can be invaluable for future planning and analysis.

In addition, the document outlines the key components of a successful record-keeping system. These include the selection of appropriate record-keeping methods, the establishment of clear policies and procedures, and the implementation of regular review and maintenance schedules. The text stresses that a record-keeping system should be designed to be user-friendly and accessible to all relevant personnel. Furthermore, it underscores the importance of ensuring the security and confidentiality of records, particularly in light of the increasing reliance on digital information.

The document also addresses the challenges associated with record-keeping, such as the volume of data generated, the complexity of record structures, and the need for ongoing training and support. It suggests that organizations should adopt a proactive approach to record management, involving all employees in the process. By doing so, organizations can ensure that their records are accurate, complete, and readily available when needed. The text concludes by reiterating the significance of records as a critical asset for any organization.

Finally, the document provides a summary of the key points discussed. It reiterates that a well-maintained record system is essential for organizational success. It encourages organizations to take the time to evaluate their current record-keeping practices and to implement the necessary changes to ensure that their records are accurate, complete, and accessible. The text also emphasizes the importance of ongoing training and support for all personnel involved in record management. By following the guidelines outlined in this document, organizations can ensure that their records are a valuable asset for the future.

In conclusion, the document provides a comprehensive overview of the importance of record-keeping and the key components of a successful record-keeping system. It highlights the various benefits of a well-maintained record system and outlines the challenges associated with record-keeping. The text suggests that organizations should adopt a proactive approach to record management, involving all employees in the process. By doing so, organizations can ensure that their records are accurate, complete, and readily available when needed. The document concludes by reiterating the significance of records as a critical asset for any organization.

Attachment 2 (con't)

References

1. EPRI NP-3966-CCM, "CEPAN Method of Analyzing Creep Collapse of Oval Cladding Volume 5: Evaluation of Interpellet Gap Formation and Clad Collapse in Modern PWR Fuel Rods", April 1985
2. Letter, A. E. Lundvall, Jr. to J. R. Miller (Chief Operating Reactors Branch #3), "Calvert Cliffs Nuclear Power Plant Unit Nos. 1 & 2, Docket Nos. 50-317 & 50-318, Request for Amendment, " December 31, 1984.
3. "Safety Evaluation By the Office of Nuclear Reactor Regulation Related to Amendment No. 104 to Facility Operating License No. DPR-53, Baltimore Gas & Electric Company Calvert Cliffs Nuclear Power Plant Unit No. 1 Docket No. 50-317."

1952

1953

The following information was obtained from the records of the  
 Department of the Interior, Bureau of Land Management, on  
 the subject of the above-captioned tract of land.  
 The tract of land described in the above caption is  
 situated in the County of [County Name], State of [State Name].  
 The tract of land is bounded on the north by [Description],  
 on the south by [Description], on the east by [Description],  
 and on the west by [Description]. The total area of the  
 tract is [Area] acres. The tract is owned by [Owner Name].  
 The tract is subject to a [Type of Encumbrance] in favor of  
 [Beneficiary Name]. The [Type of Encumbrance] was created by  
 [Date] and is recorded in [Volume and Page] of the  
 [County Name] records. The [Type of Encumbrance] is a  
 [Type of Encumbrance] and is enforceable against the  
 tract of land. The [Type of Encumbrance] is a [Type of Encumbrance]  
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 and is enforceable against the tract of land.

### ATTACHMENT 3

#### DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

The standards used to arrive at a determination that a request for amendment involves no significant hazards consideration are included in the Commission's regulations, 10 CFR 50.92, which states that no significant hazards considerations are involved if the operation of the facility in accordance with the proposed amendment would not (1) involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety. Each standard is discussed as follows:

- (1) Operation of the facility in accordance with the proposed amendment would not involve a significant increase in the probability or consequences of an accident previously evaluated.

The change incorporates a model refinement reflecting present fuel designs and does not adversely affect accident initiating events or consequences. The consequences of removing the augmentation factors have already been evaluated because current safety analyses do take credit for the reduction in linear heat rate imposed by augmentation factors. Removal of the augmentation factors will not cause the results of any analysis to exceed design acceptance criteria.

- (2) Use of the modified specification would not create the possibility of a new or different kind of accident from any accident previously evaluated.

No new accident initiators are created by the incorporation of the model refinements. This change will not result in any change in the operating mode of the plant. The deficiencies in fuel design which necessitated the original implementation of augmentation factors have been corrected so that these factors are no longer necessary to ensure adequate fuel performance.

- (3) Use of the modified specification would not involve a significant reduction in a margin of safety.

The margin of safety is the difference between the peak linear heat generation rate Limiting Condition for Operation (LCO) and the Specified Acceptable Fuel Design Limit (SAFDL). Augmentation factors were included in the determination of the peak linear heat generation rate LCO and SAFDL in a conservative manner. Since these limits are conservative, neither the LCO nor the SAFDL will be changed by this modification to the Technical Specifications. Elimination of augmentation factors will not reduce the margin of safety between the peak linear heat generation rate LCO and SAFDL.

THE HISTORY OF THE UNITED STATES OF AMERICA

The first part of the book is devoted to the early history of the United States, from the discovery of the continent by Christopher Columbus in 1492 to the establishment of the first permanent settlements. This period is characterized by the struggle of the European powers for control of the continent, and the gradual development of a distinct American identity.

The second part of the book covers the period from the American Revolution to the Civil War. This is a period of great political and social change, marked by the struggle for independence, the formation of the federal government, and the eventual resolution of the slavery issue.

The third part of the book deals with the Reconstruction period and the Gilded Age. This era is characterized by the struggle to rebuild the South after the Civil War, the rise of industrial capitalism, and the emergence of a new political order.

The fourth part of the book covers the Progressive Era and the early 20th century. This period is marked by the rise of the Progressive movement, the emergence of a new political leadership, and the United States' entry into World War I.

The fifth part of the book deals with the interwar period and the New Deal. This era is characterized by the economic challenges of the Great Depression, the rise of Franklin D. Roosevelt, and the United States' entry into World War II.

The sixth part of the book covers the post-World War II period and the Cold War. This era is marked by the United States' emergence as a superpower, the Korean War, and the Vietnam War.

The seventh part of the book deals with the late 20th century and the present. This period is characterized by the end of the Cold War, the rise of the Internet, and the challenges of globalization and terrorism.

Attachment 3 (con't)

Based on the above, we have determined that the amendment request does not (1) involve a significant increase in the probability or consequences of an accident previously evaluated, (2) create the probability of a new or different kind of accident from any accident previously evaluated, or (3) involve a significant reduction in a margin of safety; and therefore does not involve a significant hazards consideration.

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