Progress Energy

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MAR 1 2 2004

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TSC-2003-07

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: Brunswick Steam Electric Plant, Unit No. 1
Docket No. 50-325/License No. DPR-71
Response to Request for Additional Information
Technical Specification 2.1.1.2, Reactor Core Minimum Critical Power Ratio Safety Limit and Revision to References in Technical Specification 5.6.5, Core Operating Limits Report (COLR)
(NRC TAC No. MC1249)

References:

1. Letter from John S. Keenan to U.S. Nuclear Regulatory Commission (Serial: BSEP 03-0148), "Request for License Amendment - Technical Specification 2.1.1.2, Reactor Core Minimum Critical Power Ratio Safety Limit and Revision to References in Technical Specification 5.6.5, Core Operating Limits Report (COLR)," dated October 31, 2003

2. Letter from William G. Noll to U.S. Nuclear Regulatory Commission (Serial: BSEP 04-0035), "Response to Request for Additional Information, Technical Specification 2.1.1.2, Reactor Core Minimum Critical Power Ratio Safety Limit and Revision to References in Technical Specification 5.6.5, Core Operating Limits Report (COLR)," dated March 4, 2004

Ladies and Gentlemen:

On October 31, 2003, Carolina Power & Light Company, now doing business as Progress Energy Carolinas, Inc. (PEC) requested a license amendment for the Brunswick Steam Electric Plant (BSEP), Unit No. 1. The proposed license amendment would: (1) revise the Technical Specification (TS) 2.1.1.2 minimum critical power ratio (MCPR) safety limit value for both two and single recirculation loop operation and (2) add topical report NEDE-32906P-A, "TRACG Application for Anticipated Operational Occurrences (AOO) Transient Analyses," to the TS 5.6.5 list of approved methodologies used to determine the core operating limits.

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On February 10, 2004, the NRC provided an electronic request for additional information (RAI) concerning this request. The electronic RAI was subsequently discussed and revised during telephone calls held on February 18, February 24, and February 26, 2004. The RAI consists of six questions. On March 4, 2004 (i.e., Reference 2), PEC provided responses RAI Questions 1 through 5.

Enclosure 1 provides the response to RAI Question 6. RAI Question 6 pertains to the Cycle 15 operating strategy and the applicability of analytic methods used for evaluating the operating cycle.

Enclosure 1 contains information that Global Nuclear Fuel - Americas, LLC (GNF-A) considers to be proprietary as defined by 10 CFR 2.390. GNF-A, as the owner of the proprietary information, has executed the affidavit provided in Enclosure 2, which identifies that the enclosed proprietary information has been handled and classified as proprietary, is customarily held in confidence, and has been withheld from public disclosure. GNF-A requests that the enclosed proprietary information be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390 and 9.17. A non-proprietary (i.e., redacted) version of the response is provided in Enclosure 3.

PEC is providing the State of North Carolina a copy of this letter.

Please refer any questions regarding this submittal to Mr. Edward T. O'Neil, Manager - Support Services, at (910) 457-3512.

Sincerely,

FOR

Cornelius J. Gannon

WRM/wrm

Enclosures:

1. Response to Request for Additional Information **(Proprietary Information)**
2. Global Nuclear Fuel - Americas, LLC Affidavit of Proprietary Information
3. Response to Request for Additional Information **(Non-proprietary Version)**

William G. Noll, having been first duly sworn, did depose and say that the information contained herein is true and correct to the best of his information, knowledge and belief; and the sources of his information are officers, employees, and agents of Carolina Power & Light Company.

Dean S Mason
Notary (Seal)

My commission expires: August 29, 2004

cc (with all enclosures):

U. S. Nuclear Regulatory Commission, Region II
ATTN: Mr. Luis A. Reyes, Regional Administrator
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW, Suite 23T85
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U. S. Nuclear Regulatory Commission
ATTN: Mr. Eugene M. DiPaolo, NRC Senior Resident Inspector
8470 River Road
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U. S. Nuclear Regulatory Commission **(Electronic Copy Only)**
ATTN: Ms. Brenda L. Mozafari (Mail Stop OWFN 8G9)
11555 Rockville Pike
Rockville, MD 20852-2738

cc (with Enclosures 2 and 3 only):

Ms. Jo A. Sanford
Chair - North Carolina Utilities Commission
P.O. Box 29510
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Ms. Beverly O. Hall, Section Chief
Radiation Protection Section, Division of Environmental Health
North Carolina Department of Environment and Natural Resources
3825 Barrett Drive
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Global Nuclear Fuel - Americas, LLC
Affidavit of Proprietary Information

Affidavit

I, Margaret E. Harding, state as follows:

(1) I am Manager, Fuel Engineering Services, Global Nuclear Fuel – Americas, L.L.C. ("GNF-A") and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in the attachment, "Response to Request for Additional Information Relating to Proposed Amendment to License No. DPR-71 Progress Energy Brunswick Unit No. 1 Docket No. 50-325" dated March 11, 2004. GNF proprietary information is indicated by enclosing it in double brackets. In each case, the superscript notation [3] refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GNF-A relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4) and 2.390(a)(4) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential" (Exemption 4). The material for which exemption from disclosure is here sought is all "confidential commercial information," and some portions also qualify under the narrower definition of "trade secret," within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, <u>Critical Mass Energy Project v. Nuclear Regulatory Commission</u>, 975F2d871 (DC Cir. 1992), and <u>Public Citizen Health Research Group v. FDA</u>, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GNF-A's competitors without license from GNF-A constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals cost or price information, production capacities, budget levels, or commercial strategies of GNF-A, its customers, or its suppliers;

d. Information which reveals aspects of past, present, or future GNF-A customer–funded development plans and programs, of potential commercial value to GNF-A;

e. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b., above.

(5) To address the 10 CFR 2.390 (b) (4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GNF-A, and is in fact so held. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in (6) and (7) following. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GNF-A, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or subject to the terms under which it was licensed to GNF-A. Access to such documents within GNF-A is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GNF-A are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2) is classified as proprietary because it contains details of GNF-A's fuel design and licensing methodology.

The development of the methods used in these analyses, along with the testing, development and approval of the supporting methodology was achieved at a significant cost, on the order of several million dollars, to GNF-A or its licensor.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GNF-A's competitive position and foreclose or reduce the availability of profit–making opportunities. The fuel design and licensing methodology is part of GNF-A's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC–approved methods.

The research, development, engineering, analytical, and NRC review costs comprise a substantial investment of time and money by GNF-A or its licensor.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GNF-A's competitive advantage will be lost if its competitors are able to use the results of the GNF-A experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GNF-A would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GNF-A of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed at Wilmington, North Carolina, this 11th day of March, 2004.

Margaret E. Harding

Margaret E. Harding
Global Nuclear Fuel – Americas, LLC

Response to Request for Additional Information
(Non-Proprietary Version)

RESPONSE to REQUEST FOR ADDITIONAL INFORMATION RELATING TO PROPOSED AMENDMENT TO LICENSE NO. DPR-71 PROGRESS ENERGY BRUNSWICK UNIT NO. 1 DOCKET NO. 50-325

NRC Question 6

For the Brunswick Cycle 15 core design, if the hot bundle exit void fractions at rated EPU conditions are greater than 90%, based on the most limiting exposure and control rod patterns, demonstrate that the NRC-approved SLMCPR calculation methods, including the uncertainty treatments, remain applicable. For example, Section 3.1.1, "Model Uncertainty," of NEDC 32601P covers the accuracy of the TGBLA model by comparing the calculated peaking factor distributions with Monte Carlo benchmarks results based on the MCNP program. Table 3.1, "Summary of TGBLA/MCNP Pin Power Comparisons," provides the RMS differences in rod power for different fuel types based on 0%, 40%, and 70% void conditions. Demonstrate why model uncertainty derived from this assessment would be applicable for void fraction greater than 90%. Specifically justify why these benchmark comparisons would be applicable for Brunswick Cycle 15 fuel and core designs. In addition, state if the fuel dependent model uncertainty was developed for the GE14 lattice design. Similarly, please review the applicability of the NRC-approved SLMCPR licensing and analytical methods, including NEDC 32601P to the Cycle 15 fuel/core design and operating conditions.

Response to NRC Question 6

Brunswick Cycle 15 core design has been developed using the GE14 fuel product line. The confirmation that the uncertainties in NEDC-32601P-A and NEDC-32694P-A are directly applicable to GE14 fuel is contained in the following references that formally satisfy the conditions for the SER for these topical reports:

Letter, G A. Watford (GNF) to R. Pulsifer (NRC), "Request for Additional Information - GE14 Review - Power Distribution Uncertainties and GEXL Correlation Development Procedure," FLN-2001-004, March 27, 2001.

Letter, Glen A. Watford (GNF-A) to U. S. Nuclear Regulatory Commission Document Control Desk with attention to R. Pulsifer (NRC), "Confirmation of 10x10 Fuel Design Applicability to Improved SLMCPR, Power Distribution and R-Factor Methodologies", FLN-2001-016, September 14, 2001.

Letter, Glen A. Watford (GNF-A) to U. S. Nuclear Regulatory Commission Document Control Desk with attention to J. Donoghue (NRC), "Confirmation of the Applicability of the GEXL14 Correlation and Associated R-Factor Methodology for Calculating SLMCPR Values in Cores Containing GE14 Fuel", FLN-2001-017, October 1, 2001.

As stated, Table 3.1 on page 3-2 of NEDC-32601P-A contains the results of pin power comparisons between TGBLA and MCNP for various lattice design, PLR zone, and lattice average void content. Examining modern 10x10 fuel designs, the uncontrolled pin power uncertainties at 90% void is approximately [[{3}]] as indicated in Figure 1-28 of eDRF 0000-0001-3039. In the same figure, the values at 70% and 90% voids are comparable and these values are comparable to the uncertainties at 70% shown in Table 3.1 on page 3-2 of NEDC-32601P-A . These uncertainty values are all less than the

2.6% uncertainty assumed for this component in GETAB as documented on page IV-4 of NEDO-10958-A. The uncertainty is not exposure dependent and is only one component of the overall R-factor uncertainty utilized in the SLMCPR process. Furthermore, the calculated SLMCPR values are relatively insensitive to the R-factor uncertainty that is used in the calculations. Therefore, these overall uncertainties remain applicable to Brunswick in the power uprate condition.

Additional Discussion and Details

The discussion that follows is focused on showing that the NRC-approved methodology for calculating cycle-specific SLMCPR values is applicable for purposes of calculating the SLMCPR for Brunswick 1, Cycle 15. The applicability of the uncertainties has been addressed in previous paragraphs. The cycle-specific elements for Brunswick 1, Cycle 15 that influence the calculated SLMCPR will be addressed here to demonstrate that the SLMCPR methodology is appropriate for calculating the SLMCPR for the conditions expected for Brunswick 1, Cycle 15.

The SLMCPR process is monitored by GNF-A by sampling from the calculations that have been performed. The sample size presented here contains [[{3}]] calculations which constitutes a representative sample of the total number of verified SLMCPR calculations of all fuel types since 1999 and includes most of the verified SLMCPR calculations since 2001 where the reload batch was GE14 fuel. (The actual experience base is much larger but only this sample could be expeditiously assembled.) As shown in Figure 1, the calculated SLMCPR values are correlated to [[

{3}]] The values for Brunswick-1 Cycle 14 are shown as red squares and the values for Brunswick-1 Cycle 15 are shown as red circles in Figure 1. The Brunswick-1 values for both Cycle 14 and 15 were calculated using the more conservative GETAB power distribution uncertainties.

Although the official Monte Carlo calculated values for Brunswick-1 Cycles 14 and 15 are within the scatter of the correlation as seen in Figure 1, they are nominally higher than anticipated from the correlation (which is in the direction of increased conservatism). For Cycle 15, this is due to the fact that the [[{3}]] in calculated SLMCPRs attributed to the revised methodology is somewhat less than anticipated. For Cycle 14, the 1.1200 SLMCPR value at BOC (indicated by the rightmost red square in Figure 1) is somewhat of an outlier in the direction that suggests it is even more conservative than is necessary; however, this is of no consequence in setting the SLMCPR Technical Specification value for Cycle 14 because the calculated 1.1161 value at EOC (uppermost red square in Figure 1) is also nominally equal to 1.12. For Brunswick-1 Cycle 15, the point that sets the 1.11 SLMCPR value in the proposed Technical Specification is indicated by the rightmost red circle in Figure 1. Notice that this point at BOC [[

{3}]]. The main point from Figure 1 is that the Brunswick-1 Cycle 15 SLMCPR calculations are within the experience base sample.

The requested 1.11 Technical Specification value of SLMCPR for Brunswick-1 Cycle 15 is set by the calculated SLMCPR value at BOC. Table 1 provides the details. As exposure increases during Cycle 15, the requested 1.11 Technical Specification value for the SLMCPR will provide at least 0.02 conservatism relative to the calculated values at peak hot excess (PHE) reactivity and end of cycle (EOC). Because all calculated values are equally well correlated to their respective values of [[{3}]] as shown in Figure 1, it is appropriate to focus attention on the BOC value. For Brunswick-1 Cycle 15, a very flat MCPR distribution at BOC was used to perform the SLMCPR evaluation as indicated by [[{3}]]. Figure 2 illustrates this fact in comparison to other cores and exposure points that are included in the sample. The abnormally high value of [[{3}]] for the BOC exposure for Brunswick-1 Cycle 15 illustrates dramatically the use of limiting rod patterns to increase the conservatism in the SLMCPR calculation. This is the NRC approved process which in this application leads to a calculated SLMCPR value that is perhaps overly conservative. Note that as exposure increases for Brunswick-1 Cycle 15 that [[{3}]] move back to be well within the experience base sample.

The value of [[{3}]] at BOC for Cycle 15 is **not** higher because the Cycle 15 core design produces a much flatter MCPR distribution in Cycle 15 than Cycle 14. If that were the case, the Cycle 15 [[{3}]] for PHE and EOC also would be abnormally high which is demonstrated in Figure 2 not to be the case. To remove the effect of the control blade positions, the inherent flatness of the core loading is best obtained by looking at the distribution of MCPR (minimum CPR for each bundle) when all control blades are removed (ARO: all rods out). Figure 3 shows a comparison between Cycles 14 and 15 MCPR histograms for the EOC ARO condition. This measure of the natural flatness for the Cycle 14 and Cycle 15 cores indicates that Cycle 14 is substantially flatter at the EOC ARO condition [[{3}]]. This explains why the SLMCPR at EOC for Cycle 14 is larger than the calculated SLMCPR at EOC for Cycle 15. To emphasize the point: (1) the inherent flatness of Cycle 14 allows for more bundles near the operating limit MCPR (OLMCPR) at EOC than does Cycle 15 at EOC (2) the Cycle 15 core design, on the other hand, allows a limiting control blade pattern that can place more bundles near the OLMCPR at BOC than afforded by the Cycle 14 core design. The second point is discussed in more detail a few paragraphs further along.

Another notable point from Figure 3 is that Cycle 15 operates at EOC ARO with a minimum value of MCPR for the core that is 0.013 higher than the value obtained for Cycle 14. In other words, the limiting GE14 bundle for the entire core at EOC has more margin to its critical power in Cycle 15 than does the limiting GE14 bundle at EOC in Cycle 14. This is an important point because the pressurization event that typically provides the largest change in CPR during a transient tends to be most severe for the ARO condition at EOC. The fact that Cycle 15 has more margin to the critical power at this condition (even at the uprated power) is the result of having designed the core so that the increased power is spread over more fuel bundles. Such a design implies a flatter MCRP distribution overall but does not necessarily produce a MCPR distribution that [[{3}]] since bundles nearer the lead bundle in MCPR are [[{3}]] more probable to have rods that are susceptible to boiling transition than those bundles that have MCPRs that are further away. This fact is accounted for in the definition of [[{3}]] and is illustrated in Figure 4.3 on page 4-6 of NEDC-32601P-A. Figure 4 shows how this principle applies to the EOC ARO cases for Brunswick-1 Cycles 14 and 15.

The answer for why [[{3}]] at BOC for Cycle 15 is high is found in looking at the histograms for the limiting rod patterns compared to the nominal rod patterns. As stated above, the core design for Cycle 15 makes it easier to find limiting control blade patterns (however unrealistic) that will maximize the number of bundles with MCPRs at the OLMCPR and thus making the calculated SLMCPR more conservative. The trend for the Cycle 15 [[{3}]] (see Table 1) corresponds to how many bundles are near the OLMCPR in the limiting rod patterns at BOC (Figure 5), PHE (Figure 6) and EOC (Figure 7). The nominal rod patterns for these exposures are also shown in these figures. There is so much CPR margin designed into Cycle 15 that the histograms for the nominal conditions are mainly off scale to the right in these figures. Notwithstanding, the CPR margins observed for Brunswick-1 Cycle 15 are within the experience base established as early as 1996 and presented to the NRC. (See column 13 of Table III.5-1 starting on page A-27 of NEDC-32601P-A). In fact, this original experience basis (to which many other calculations have been added) is what was used to establish the use of [[{3}]] for setting limiting rod patterns.

The main point of Figure 5, Figure 6 and Figure 7 is to show that the limiting rod patterns used to calculate the SLMPCR are more than "*reasonably bounding*" as required by the NRC-approved process. The fact that the [[{3}]] for Brunswick-1 Cycle 15 is atypically high at BOC confirms that the approved process was outstandingly successful in achieving its stated objective of maximizing the number of bundles with MCPR values near the OLMCPR and thus leading to a conservative SLMCPR value. The nominal MCPR distributions for Brunswick-1 Cycle 15 that would cause this process to be more or less difficult are well within the established experience base. The use of the approved TRACG AOO methodology has resulted in significantly lower OLMCPRs for the SLMCPR calculation in Cycle 15 when compared to the OLCMPR values used in the Cycle 14 SLMCPR calculations. Nevertheless, the OLMCPR values used for the Cycle 15 SLMCPR calculation are still well within the experience base established as early as 1996. (See column 11 of Table III.5-1 starting on page A-27 of NEDC-32601P-A).

[[

{3}]] GNF-A has already agreed to perform SLMCPR calculations at reduced flow to support this point. These results will be reported in response to other NRC RAIs related to implementation of MELLLA+ operations.

There are only a few more points to make. The number of fuel rods that potentially are susceptible to boiling transition is what defines the SLMCPR. The SLMCPR is correlated as shown previously in Figure 1 [[{3}]]. The values of [[{3}]] for Brunswick-1, Cycle 15 are compared to the experience base sample in Figure 8. The main point of Figure 8 is that the limiting point for Brunswick-1, Cycle 15 is well within the experience base sample.

The flatness of the bundle R-factor distribution is characterized by the value of [[{3}]]. The comparison provided in Figure 9 relative to the experience base sample shows that Brunswick-1, Cycle 15 bundles that contribute to the determination of the SLMCPR are typical of those evaluated in other calculations. Again, the point of Figure 9 is that the bundle R-factor distributions for Brunswick-1, Cycle 15 are well within the experience base sample.

In summary: (1) the established GETAB SLMCPR uncertainties as revised in NEDC-32601P-A are applicable to Brunswick-1, Cycle 15 (2) all aspects of the cycle-specific conditions anticipated for Brunswick-1, Cycle 15 are within the established experience basis for which the SLMCPR methodology has previously been reviewed and approved by the NRC; therefore, the applicability of the methodology to Brunswick-1, Cycle 15 has been demonstrated.

Table 1 Comparisons of Exposure Points, [[{3}]] and SLMCPR for Cycles 14 and 15

Quantity	Cycle	BOC	PHE	EOC
Cycle Exposure	14	181.4	9071.9	15512.8
(MWd/STU)	15	181.4	9072.0	16440.2
[[				
				{3}]]
SLMCPR (DLO)	14	1.1200	1.0917	1.1161
	15	1.1095	1.0711	1.0882

[[

Figure 1
{3}]]

[[

Figure 2

{3}]]

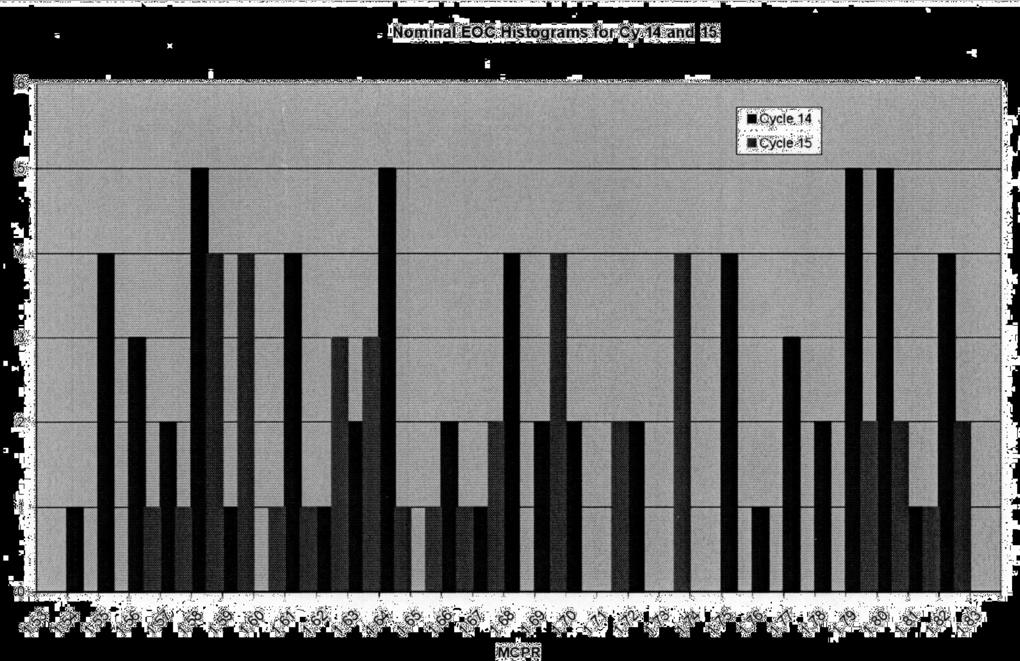

Figure 3 MCPR Histograms for EOC ARO for Cycles 14 and 15

[[

[redacted]

Figure 4 [redacted]

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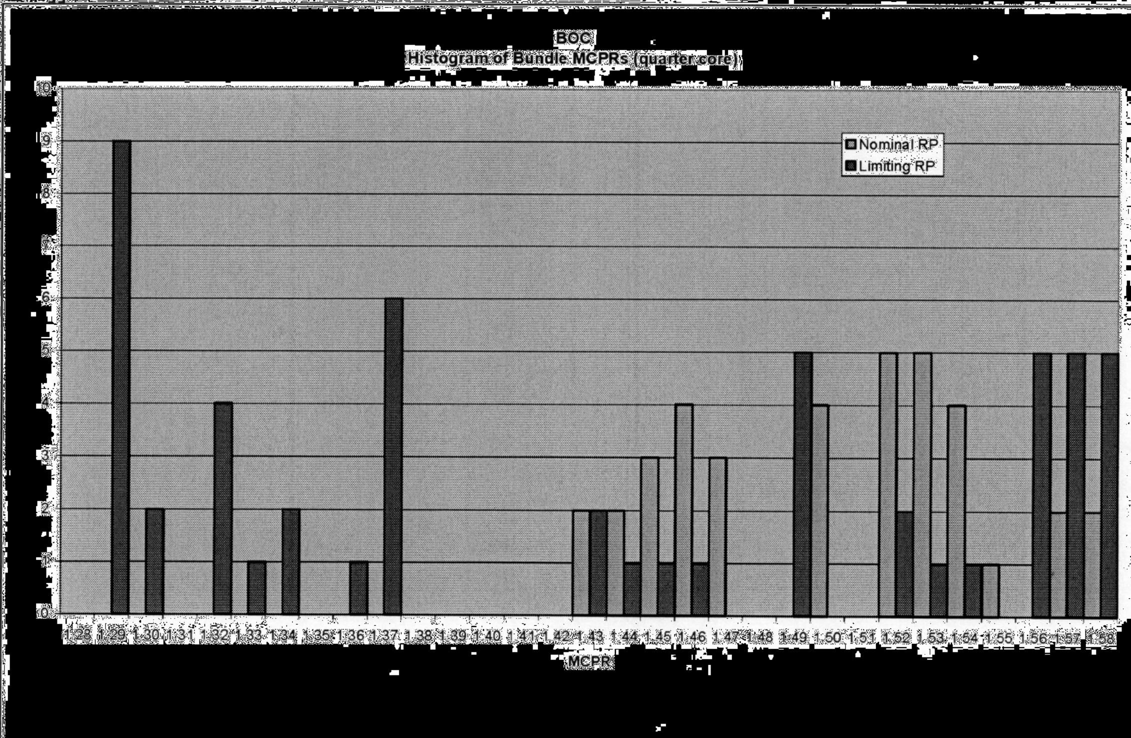

Figure 5 MCPR Histogram for Nominal and Limiting Rod Patterns at Cycle 15 BOC [redacted]

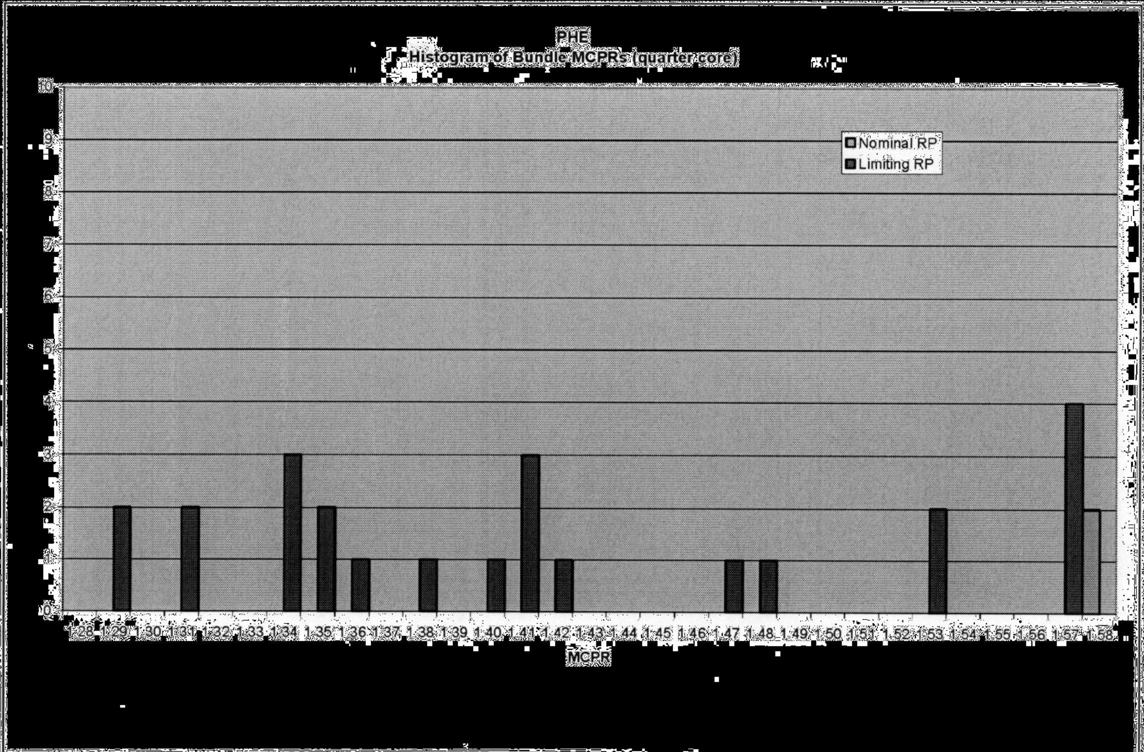

Figure 6 MCPR Histogram for Nominal and Limiting Rod Patterns at Cycle 15 PHE

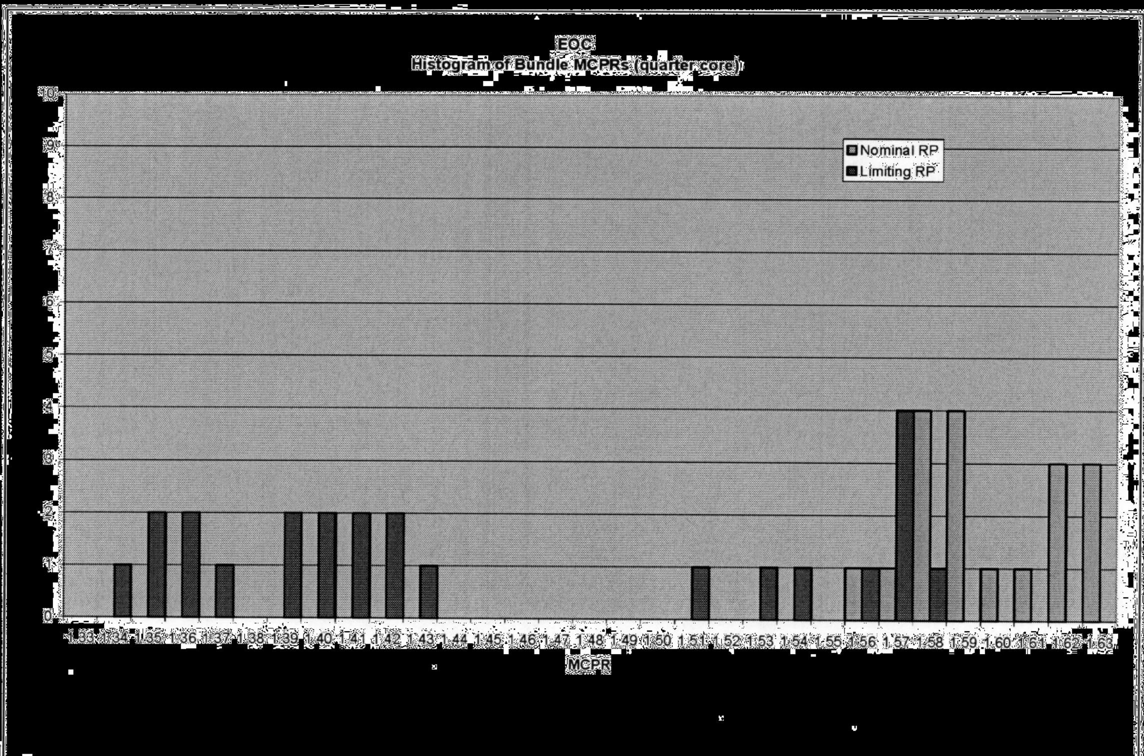

Figure 7 MCPR Histogram for Nominal and Limiting Rod Patterns at Cycle 15 EOC

[[

Figure 8

Figure 9

{3}]]