

March 10, 2004

Mr. J. W. Moyer, Vice President
Carolina Power & Light Company
H. B. Robinson Steam Electric Plant
Unit No. 2
3581 West Entrance Road
Hartsville, South Carolina 29550

SUBJECT: H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2 - ISSUANCE OF AN
AMENDMENT RE: DELETION OF ADDITIONAL CONDITION RELATED TO
CYCLE LENGTH (TAC NO. MC1461)

Dear Mr. Moyer:

The Nuclear Regulatory Commission has issued the enclosed Amendment No. 200 to Facility Operating License No. DPR-23 for the H. B. Robinson Steam Electric Plant, Unit No. 2 (HBRSEP2). This amendment changes the HBRSEP2 Appendix B, "Additional Conditions," to the Facility Operating License in response to your request dated December 3, 2003, as supplemented by letters dated January 14 and February 6, 2004.

The amendment eliminates a license condition that limits HBRSEP2 operation to 504 effective full-power days. This license condition had been added by License Amendment No. 196 issued on November 5, 2002.

A copy of the related Safety Evaluation is enclosed. Notice of Issuance will be included in the Commission's bi-weekly Federal Register notice.

Sincerely,

/RA/

Chandu P. Patel, Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-261

Enclosures:

1. Amendment No. 200 to DPR-23
2. Safety Evaluation

cc w/enclosures:
See next page

AMENDMENT NO. 200 TO FACILITY OPERATING LICENSE NO. DPR-23 - H. B. ROBINSON
STEAM ELECTRIC PLANT, UNIT NO. 2

Dated: March 20, 1004

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CAROLINA POWER & LIGHT COMPANY

DOCKET NO. 50-261

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 200
License No. DPR-23

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Carolina Power & Light Company (the licensee), dated December 3, 2003, as supplemented by letters dated January 14 and February 6, 2004, complies 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 application, 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 safety 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 the deletion of the additional condition in Appendix B, "Additional Conditions," that had been added by License Amendment No. 196 issued on November 5, 2002, that limited operation to 504 effective full-power days.

3. This license amendment is effective as of the date of its issuance and shall be implemented within 30 days.

FOR THE NUCLEAR REGULATORY COMMISSION

William Burton, Acting Chief, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment:
Appendix B to Facility Operating
License No. DPR-23

Date of Issuance: March 10, 2004

ATTACHMENT TO LICENSE AMENDMENT NO. 200

FACILITY OPERATING LICENSE NO. DPR-23

DOCKET NO. 50-261

Replace Appendix B with the following Appendix B. The revised page is identified by amendment number and contains a marginal line indicating the area of change.

Remove Page

Insert Page

Appendix B

Appendix B

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 200 TO FACILITY OPERATING LICENSE NO. DPR-23
CAROLINA POWER & LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261

1.0 INTRODUCTION

By letter dated December 3, 2003, as supplemented by letters dated January 14 and February 6, 2004, the Carolina Power & Light Company (licensee) submitted a request for a change to the H. B. Robinson Steam Electric Plant, Unit No. 2 (HBRSEP2), Appendix B, "Additional Conditions," to the Facility Operating License. The requested change would eliminate a license condition that limits HBRSEP2 operation to 504 effective full-power days (EFPD) during the fuel cycle. This license condition was added by License Amendment No. 196, issued on November 5, 2002. Upon approval of this amendment request, the license condition will be eliminated, allowing HBRSEP2 to operate beyond 504 days subject to existing technical specifications and provisions of the core operating limits report (COLR).

The February 6, 2004, letter provided clarifying information only and did not change the initial proposed no significant hazards consideration determination or expand the scope of the initial application.

2.0 BACKGROUND

By letter dated May 10, 2002, the licensee submitted a license amendment request regarding a full implementation of an alternative source term (AST).¹ This request involved a reanalysis of the dose consequences of design-basis accidents (DBAs) to reflect operation at a reactor core power level of 2346 megawatts thermal (MWt). The inputs to these reanalyses included a reactor core fission product inventory that updated the inventory documented in the updated final safety analysis report (UFSAR). By letter dated May 16, 2002, the licensee submitted a license amendment request proposing to increase the authorized reactor power from 2300 MWt to 2339 MWt, an increase of about 1.7 percent. During the original facility licensing, the analyses of record (AOR) for plant transients and accidents were performed assuming 102 percent of the allowed reactor power to account for a measurement uncertainty of 2 percent. In its amendment request, licensee proposed replacing the existing feedwater flow instrumentation with equipment rated at 0.3 percent uncertainty. The reduction in the level of uncertainty provides margin to increase the authorized reactor power by 1.7 percent to 2339 MWt.

¹ By letter dated March 13, 2002, the licensee submitted a license amendment request for a selective implementation of the AST based upon a reanalysis of a fuel handling accident (FHA) that assumed a reactor power level of 2346 MWt. This application was approved in Amendment 195 dated October 4, 2002. That amendment and the FHA analysis are not impacted by the present amendment request and will not be discussed further in this Safety Evaluation.

During the review of the power uprate application, the NRC staff informed the licensee that the power uprate amendment could not be approved on the schedule requested by the licensee due to the review effort needed on the AST amendment. By letter dated August 12, 2002, the licensee submitted a revised evaluation that did not rely on approval of the AST amendment. That evaluation determined that the radiological consequences of DBAs would be bounded by AOR-estimated consequences for approximately 95 percent of Cycle 22, or approximately 504 EFPD. By letter dated October 15, 2002, licensee proposed a license amendment that would add a license condition limiting the HBRSEP2 operation to 504 EFPD. The NRC issued Amendment 196 on November 5, 2002, authorizing operation at 2339 MWt for up to 504 EFPD.

The 504 EFPD limitation, an expedient measure to allow the power uprate to proceed, was based on a simplistic and conservative methodology. At the time of the licensee's August 12, 2002, submittal, there was an expectation that the AST amendment would be approved before the 504 EFPD limitation was reached. However, the NRC staff and the licensee identified deficiencies in the analyses supporting the AST amendment. These deficiencies are still being addressed by the licensee.

By letter dated December 3, 2003, as supplemented by letters dated January 14, 2004, and February 6, 2004, the licensee submitted the present license amendment to remove the 504 EFPD limitation. To support this request, licensee performed a more detailed analysis of the impact of the uprated power and extended fuel burnup on the radiological analyses for the loss-of-coolant accident (LOCA). This analysis, which does not involve the AST, showed that the thyroid doses estimated by the AOR continued to be bounding. The whole body dose increased slightly over that estimated by the AOR, but continues to meet the current licensing basis acceptance criteria.

3.0 REGULATORY EVALUATION

This Safety Evaluation (SE) addresses the impact of continued operation beyond the current 504 EFPD license condition limitation that the licensee has proposed to eliminate. The impacts considered in this SE are those on previously analyzed DBA radiological consequences and the acceptability of the revised analysis results. The regulatory requirements for which the NRC staff based its acceptance are the accident dose guidelines in 10 CFR 100.11, as supplemented by accident-specific criteria in Section 15 of the Standard Review Plan (SRP) and 10 CFR Part 50 Appendix A, General Design Criterion 19 (GDC-19), "Control Room," as supplemented by Section 6.4 of the SRP. Except where the licensee proposed a suitable alternative, the NRC staff utilized the regulatory guidance provided in the following documents in performing this review.

- Safety Guide 1.4, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss-of-Coolant Accident for Pressurized-Water Reactors"
- SRP Section 15.6.5, "Loss-of-Coolant Accidents Resulting from Spectrum of Postulated Piping Breaks Within the Reactor Coolant Pressure Boundary," Appendix A and Appendix B

The NRC staff also considered relevant information in the HBRSEP2 UFSAR, and technical specifications. Issues related to the AST analyses submitted by the licensee were not

considered since those analyses are not part of the HBRSEP2 current licensing basis.

4.0 TECHNICAL EVALUATION

The NRC staff reviewed the regulatory and technical analyses, as related to the radiological consequences of DBAs, performed by the licensee in support of its proposed license amendment. Information regarding these analyses was provided in the original submittal and in the supplementary letters dated January 14 and February 6, 2004.

The licensee stated that there had been no plant modifications made in conjunction with the power uprate implemented by Amendment 196 that would have invalidated assumptions or inputs used in any AOR that was used in the comparative evaluations that support the present amendment request.

The findings in this SE are based on the descriptions of the licensee's analyses and other supporting information docketed by the licensee. In addition, the NRC staff reviewed the assumptions, inputs, and methods used by the licensee to assess the impact of the proposed amendment.

4.1 Basis of the 504 EFPD Limitation

In order to fully understand the basis for the proposed change, the NRC staff reviewed the record of decision that led to the 504 EFPD limitation. In support of the power uprate, the licensee reanalyzed the radiological dose consequences resulting from several DBAs, including the LOCA, main steam line break (MSLB), locked rotor accident (LRA), steam generator tube rupture (SGTR), a single rod cluster control assembly (RCCA) withdrawal, and a waste gas system release, using an AST and an updated core fission product inventory. The power uprate and the AST reanalyses were submitted as separate license amendment requests; however, the power uprate amendment was made contingent on approval of the AST amendment. In discussions with the NRC staff, the licensee determined that the review and approval of the power uprate amendment would be facilitated by removing the reliance on the AST license amendment. On August 12, 2002, the licensee submitted a supplement to the power uprate amendment request providing a revised evaluation based upon the AORs and current licensing basis source term, rather than the proposed AST-based analyses. This evaluation considered the impact of the power uprate on the radiological consequences of the various DBAs. This evaluation determined that the AORs would remain bounding for about 95 percent of Cycle 22, approximately 504 EFPD.

The AORs were assessed using a core fission product inventory based on a reactor power of 2346 MWt, a core loading of 66.492 metric tonnes of uranium (MTU), and a projected core average burnup of 35,000 MWD/MTU. The core inventory used for Cycle 22 (developed for Cycle 20 to bound future cycles) was based on a reactor power of 2346 MWt and a fuel loading of 66.759 MTU. Because of this difference in loading, the licensee determined that AORs might not be bounding. To address this situation, the licensee conservatively assumed the fission product inventory of the core to be directly proportional to the fuel loading and multiplied the 35,000 MWD/MTU burnup by the ratio of the core loadings. The licensee predicted that the resulting core average burnup of 34,860 MWD/MTU would be reached when the fresh fuel

loaded for Cycle 22 reached a burnup of about 17,670 MWD/MTU, which corresponds to 504.33 EFPD. The NRC staff accepted this evaluation and issued Amendment 196 on November 5, 2002.

4.2 Present Analyses

As discussed above, the licensee evaluated the impact of the power uprate on the previously analyzed radiological consequences of DBA, including the FHA, LOCA, MSLB, SGTR, LRA, RCCA withdrawal, and a waste gas system release. The evaluation determined that the radiological consequences of an MSLB, an SGTR, and a waste gas system release were independent of the rated thermal power and would not be impacted by the proposed power uprate. A re-analysis of the FHA, based on an AST and the revised core fission product inventory, was approved as Amendment 195 issued on November 4, 2002. The current licensing basis RCCA withdrawal and locked rotor accident AORs involve a qualitative assessment and the conclusion that the dose consequences of these events are bounded by the consequences of the LOCA. As such, only the LOCA analysis is at issue for the present amendment request.

In performing this evaluation, the licensee used the core fission product inventory documented in UFSAR Table 15.6.5-4 of the HBRSEP2 and that used for Cycle 22. The Cycle 22 inventory had been calculated in 1998 using the ORIGEN-S code and assuming a reactor power level of 2346 MWt, a core loading of 66.759 MWt, and fuel assembly burnups to 60,000 MWD/MTU. The licensee then compared the concentrations of each of the iodine, xenon, and krypton radionuclides in the two projected fission product inventories. The comparison showed that concentrations of some nuclides were higher and some were lower in the Cycle 22 inventory when compared to the inventory used in the AOR. In order to assess the impact of these differences on the previously calculated radiological consequences, the licensee calculated a dose-equivalent weighted sum of the total concentration by summing the product of the concentration for each radionuclide and its dose conversion factor. This process was repeated for the whole body dose due to noble gases, the whole body dose due to radioiodines, and the thyroid dose due to radioiodines. Since the mix of radionuclides changes as the accident progresses, the process was performed for multiple time steps during the accident progression. The licensee stated that the results of the comparisons indicated the following:

- For the thyroid dose, the dose-equivalent radioiodine concentrations for the Cycle 22 core inventory were less than those used in the AOR for all time steps. Thus, the use of the Cycle 22 fission product inventory would result in lesser thyroid doses than would the inventory used in the AOR.
- For the whole body dose due to radioiodines, the comparison results were mixed. For the time periods after 24 hours, the dose-equivalent radioiodine concentrations for Cycle 22 were less than those used in the AOR and would result in lesser whole body doses. However, for the time steps between 0 and 24 hours, the Cycle 22 concentrations were greater, which would result in a 3-percent greater whole body dose due to radioiodines than the dose estimated by the AOR.

- For the whole body dose due to noble gases, the comparison results were also mixed. For the first hour, the dose-equivalent noble gas concentrations for Cycle 22 were less than those used in the AOR and would result in lesser whole body doses. However, after the first hour, the Cycle 22 concentrations were greater, which would result in an 11-percent greater whole body dose due to noble gases than the dose estimated by the AOR.

Based on these results, it was conservatively assumed that the whole body doses could increase by 15 percent and the thyroid dose would be less if the HBRSEP2 operated beyond 504 EFPD. The resulting doses, in rem, are presented in Table 1.

| | Site Boundary | | Low Population Zone | | Control Room | |
|--------------|---------------|---------|---------------------|---------|--------------|---------|
| | W.Body | Thyroid | W.Body | Thyroid | W.Body | Thyroid |
| AOR | 2.8 | 235 | 0.5 | 50 | 1.0 | 29.3 |
| This Request | 3.22 | * | 0.58 | * | 1.15 | * |
| Criteria | 25 | 300 | 25 | 300 | 5 | 30 |

*Iodine concentrations decreased with core inventory used for Cycle 22. Thus, AOR thyroid results remain bounding.

4.3 Staff Assessment

The licensee's evaluation that established the 504 EFPD limitation was simplistic and conservative. Although the core loading increased by about 0.3 percent, it does not follow that the core inventory of radionuclides increased by 0.3 percent, nor does it follow that the radiological consequences of the release of these radionuclides to the environment would increase by 0.3 percent. Although the concentrations of radionuclides will generally increase with increasing burnup, many of the radionuclides (e.g., I-131) that are significant contributors to the radiological consequences of DBAs reach peak equilibrium concentrations early in the first cycle and decrease with increasing burnup. Although the concentrations of other significant dose contributors may continue to increase with increasing burnup, the rate of increase in concentration is relatively small.¹ Although licensee's approach was expedient under the circumstances, the radiological consequences of the DBAs would have met the applicable dose criteria without resorting to the 504 EFPD limitation, as shown in the present amendment request.

The NRC staff reviewed the description of the core fission product inventory used for Cycle 22. The licensee performed a detailed analysis intended to provide a core inventory that would bound future cycles. The licensee modeled the core as nine assembly classes, one containing

¹ A significant exception is the long-lived Cs-137, which continues to increase in concentration over the three cycles that the fuel is irradiated. Consistent with Regulatory Guide 1.4, Cs-137 was not considered in the current analyses of record and is, therefore, not at issue in the present amendment request.

part length shield assemblies, and eight containing assemblies varying in enrichment, core location, and cycle burnup. The resulting fission product inventory concentrations were multiplied by 1.02 to address instrument uncertainty. The licensee used the ORIGEN-S code to perform these assessments. ORIGEN-S is an analytical module included in the NRC-sponsored SCALE (Standardized Computer Analyses for Licensing Evaluation). SCALE was developed at the Oak Ridge National Laboratory (ORNL) for the NRC. It is currently maintained by ORNL under the co-sponsorship of NRC and DOE. SCALE is maintained under a software quality assurance program that includes configuration management, module and data revision control, documentation, verification, and validation programmatic elements. SCALE module results have been benchmarked against actual measurements and against other domestic and internal analytical capabilities. As such, the NRC staff finds the licensee's use of ORIGEN-S to be acceptable. The NRC staff reviewed the modeling of the fuel irradiation and the fuel configuration parameters based on its experience in performing previous reviews and in performing core inventory calculations. The NRC staff finds, with reasonable assurance, that the core fission product inventory used by the licensee in support of the present amendment request is acceptable for use in this DBA application.

The licensee performed the comparison between the isotopic concentrations of the previous UFSAR and the Cycle 22 core fission product inventories using spread sheet analyses. The NRC staff reviewed the analysis spread sheets docketed by the licensee and found the analysis approach to be adequately conservative and therefore acceptable.

5.0 SUMMARY

As described above, the NRC staff reviewed the assumptions, inputs, and methods used by the licensee to assess the radiological impacts of the proposed continued operation of HBRSEP2 beyond the current limitation of 504 EFPD. The NRC staff finds that the licensee used analysis methods and assumptions consistent with the conservative regulatory requirements and guidance identified in Section 3.0 above. The NRC staff compared the doses estimated by the licensee to the applicable criteria identified in Section 3.0. The NRC staff finds, with reasonable assurance, that the licensee's estimates of the EAB, LPZ, and control room doses will continue to comply with these criteria. Therefore, the proposed removal of the license condition limiting operation to 504 EFPD is acceptable with regard to the radiological consequences of postulated design-basis accidents.

6.0 STATE CONSULTATION

In accordance with the Commission's regulations, the State of South Carolina official was notified of the proposed issuance of the amendment. The State official had no comments.

7.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The

Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (69 FR 5201). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

8.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: S. LaVie, SPSB

Date: March 10, 2004

March 10, 2004

Mr. J. W. Moyer, Vice President
Carolina Power & Light Company
H. B. Robinson Steam Electric Plant
Unit No. 2
3581 West Entrance Road
Hartsville, South Carolina 29550

SUBJECT: H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2 - ISSUANCE OF AN
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Dear Mr. Moyer:

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Sincerely,

/RA/

Chandu P. Patel, Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-261

Enclosures:

1. Amendment No. 200 to DPR-23
2. Safety Evaluation

cc w/enclosures:
See next page

Package No.: ML040700577
ADAMS Accession No.: ML040700561

NRR-058

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