



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
CAROLINA POWER AND LIGHT COMPANY
BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2
DOCKET NOS. 50-325/324

1.0 INTRODUCTION

On December 27, 1983 the staff issued Amendment Nos. 62 and 82 to Facility Operating License Nos. DPR-71 and DPR-62 for the Brunswick Steam Electric Plant, Units 1 and 2 (Brunswick). The amendments incorporated the Radiological Effluent Technical Specifications (RETS) into the Brunswick Technical Specifications (TS). Section 6.13 of the TS referenced an Offsite Dose Calculation Manual (ODCM) and prescribed the methods for its change.

2.0 EVALUATION

The docketed submittal on December 13, 1982 of an ODCM by Carolina Power and Light Company (CP&L, licensee) received NRC approval by letter dated December 27, 1983 from D. Vassallo to the licensee.

Since 1983 a number of changes have been made in the Brunswick ODCM and reported to NRC in ODCM revisions in accordance with Brunswick 1 and 2 TS 6.13.2. The latest of these, Revision 4, approved May 30, 1985 and submitted August 23, 1985, has been reviewed for us by Franklin Research Center (FRC) as part of our technical assistance contract program. Their report (the enclosed section from TER-C5506-589) provides their technical evaluation of the compliance of the Licensee's submittal with NRC criteria. The staff has reviewed this report, and agrees with the evaluation that the Brunswick ODCM, Rev. 4, generally uses documented and approved methods that are consistent with the methodology and guidelines in NUREG-0133. Therefore, we conclude that this ODCM is an acceptable reference for use with Brunswick TS 6.13. However, several minor discrepancies listed in Attachment 1 should be addressed within six months in another revision.

3.0 CONCLUSIONS

The Brunswick ODCM, Rev. 4, is acceptable. The changes incorporated in Revs. 3 and 4 are in compliance with Brunswick 1 and 2 TS 6.13.2.

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Dated: June 3, 1986

ATTACHMENT 1

Minor discrepancies in Brunswick ODCM, Rev. 4:

- o Since the Licensee does not include iodine-133 in the sampling and analysis program documented in Brunswick RETS Table 4.11.2-1, the Licensee should document in the ODCM methods of estimating iodine-133 in accordance with the NRC staff guidance. The Licensee did not provide such information in the revisions submitted for the ODCM.
- o The newly revised Table 3.2-2 shows the location of the highest annual average of relative concentration (X/Q) at the site boundary to be 0.7 miles from the plant and in the SSE sector. The Licensee, however, identifies different locations with lower (X/Q) values for the gaseous dose calculations.
- o The sample location identification (ID) numbers differ completely from those provided in the Licensee's 1984 (and also 1983) annual report; the milk locations (ID Nos. 600-603) were described as on the "as available" basis rather than the actual locations identified; the fish and invertebrates indicator locations (ID Nos. 700-702) were identified at locations (0.5 miles at south-southeast sector of the Atlantic Ocean) different from the locations (5.5 miles at south-southwest sector of Atlantic Ocean) presented in the Licensee's 1984 annual report.

APPENDIX D

EVALUATION OF LICENSEE-REPORTED REVISIONS TO ODCM

D.1. EVALUATION OF LICENSEE-REPORTED REVISIONS TO ODCM

The Licensee has made numerous changes to the existing ODCM that was issued by the Licensee on December 13, 1982 and approved by NRC on December 27, 1983.* These changes appeared as Revisions 1 through 4 to the ODCM in the Semiannual Radioactive Effluent Release Reports as issued by the Licensee in 1984 and in the first 6 months of 1985.

These changes have been incorporated into the Licensee's existing ODCM and reviewed as a whole. The result of the evaluation is intended to be a standalone document, and is given in the following attachment as Supplement A to Appendix D.

*Letter from D. B. Vassallo (NRC/DL) to E. E. Utley (CP&L), December 27, 1983.

SUPPLEMENT A

TO

APPENDIX D

EVALUATION OF LICENSEE-REPORTED REVISIONS TO THE ODCM

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1. INTRODUCTION

1.1 PURPOSE OF REVIEW

The purpose of this document is to review and evaluate the Offsite Dose Calculation Manual (ODCM), updated through June 30, 1985, as revised by the Brunswick Steam Electric Plant Units 1 and 2 since December 13, 1982 when the ODCM was issued by the Licensee as Revision 0 [1], which was subsequently approved by the NRC [2].

The ODCM is a supplementary document for implementing the Radiological Technical Specifications (RETS) in compliance with 10CFR50, Appendix I requirements [3].

1.2 SCOPE OF REVIEW

As specified in NUREG-0472 [4] and NUREG-0473 [5], the ODCM is to be developed by the Licensee to document the methodology and approaches used to calculate offsite doses and maintain the operability of the effluent system. As a minimum, the ODCM should provide equations and methodology for the following topics:

- o alarm and trip setpoint on effluent instrumentation
- o liquid effluent concentration in unrestricted areas
- o gaseous effluent dose rate at or beyond the site boundary
- o liquid and gaseous effluent dose contributions
- o liquid and gaseous effluent dose projections.

In addition, the ODCM should contain flow diagrams, consistent with the systems being used at the station, defining the treatment paths and the components of the radioactive liquid, gaseous, and solid waste management systems. A description and the location of samples in support of the environmental monitoring program are also needed in the ODCM.

1.3 PLANT-SPECIFIC BACKGROUND

On behalf of Brunswick Steam Electric Plant Units 1 and 2, the Carolina Power and Light Company submitted changes to the existing ODCM [1] in the Semiannual Radioactive Effluent Release Reports issued by the Licensee. The

Licensee issued Revisions 1 and 2 of the ODCM in the first 6 months of 1984 [6]; Revision 3 in the second 6 months [7]; and Revision 4 in the first 6 months of 1985 [8].

The Licensee's Semiannual Reports and the changes of the ODCM were transmitted to an independent review team at the Franklin Research Center (FRC) for review. The review was subsequently conducted by FRC, and the results and conclusions of the ODCM evaluation are presented in Sections 3 and 4 of this document.

2. REVIEW CRITERIA

Review criteria for the ODCM were provided by the NRC in three documents:

NUREG-0472 [4], RETS for PWRs

NUREG-0473 [5], RETS for BWRs

NUREG-0133 [10], Preparation of RETS for Nuclear Power Plants.

In the ODCM review, the following NRC guidelines are used: "General Contents of the Offsite Dose Calculation Manual," Revision 1 [9], and NUREG-0133 [10]. Regulatory Guide 1.109 [11] also provides technical guidance for the review. The ODCM format is left to the Licensee and may be simplified by tables and grid printouts.

3. EVALUATION

The Licensee has followed the methodology of NUREG-0133 [10] to determine the alarm and trip setpoints for the liquid and gaseous effluent monitors, which ensures that the maximum permissible concentrations, as specified in 10CFR20, will not be exceeded by discharges from various liquid or gaseous release points. To augment conservatism in the case of simultaneous releases, the Licensee has introduced a conservative factor of 10 for liquid effluent setpoint calculations. For gaseous effluent setpoint calculations, fractional release concentration limits based on the plant experience are assigned: 0.1 for each turbine building vent of both units; 0.2 for each reactor building vent of both units; and 0.4 for the main stack. The Licensee's method for setpoint calculations meets the guidelines of NUREG-0133.

The Licensee demonstrated the method of calculating the radioactive liquid concentration by describing in the ODCM the means of collecting and analyzing representative samples prior to and after releasing liquid effluents into the circulating water discharge. The method provides for liquid effluent concentration added assurance of compliance with 10CFR20 for liquid effluent releases, and thus satisfies the guidance specified by NUREG-0133.

Methods are also included for showing that dose rates at or beyond the site boundary due to noble gases, radioiodines, tritium, and particulates with half-lives greater than 8 days are in compliance with 10CFR20. In this calculation, the Licensee has considered effluent releases from the turbine building, the reactor building, and the main stack; those releases are being treated as ground level, mixed level, and elevated level, respectively. The Licensee has made a commitment to use the highest annual average values of relative concentration (X/Q) and relative deposition (D/Q) to determine the controlling locations. The revised values for (X/Q) are 7.50×10^{-6} (sec/m^3) and 2.0×10^{-7} (sec/m^3) for the turbine building and reactor building, respectively. For elevated releases from the main stack, the Licensee has documented a highest (X/Q) of 6.3×10^{-9} (sec/m^3) at the site boundary. The Licensee has also considered the elevated release from the main stack the direct radiation contribution from exposure to the finite plume.

The Licensee intends to use the maximally exposed individual and the critical organ as the reference receptor. The Licensee has also considered pathways from inhalation, food, and ground-plane deposition, although the ingestion pathways from food and ground-plane deposition are not strictly required for gaseous dose rate calculations. The Licensee has demonstrated that the described methods and relevant parameters have followed the conservative approaches provided by NUREG-0133 and Regulatory Guide 1.109 for liquid effluent dose rate calculations. However, since the Licensee has not included iodine-133 in the sampling analysis program, a statement should be added to record the method to account for iodine-133 in the dose rate calculation. Discrepancies, however, are found in the Licensee's determination of controlling locations. The Licensee identifies the control locations at 0.7 miles ENE sector for the noble gas exposure and 0.7 mile NE for the iodines and particulates exposure for the inhalation pathway, thereby resulting in a set of lower (X/Q) values compared with the maximum values identified at the site boundary of 0.7 miles SSE sector.

Evaluation of the cumulative dose is to ensure that the quarterly and annual dose design objectives specified in RETS are not exceeded.

For liquid releases, the Licensee has identified fish and invertebrate consumption as the two viable pathways. In the calculation, the Licensee has used near-field and far-field dilution factors specific to the plant; all other key parameters follow the suggested values given in Regulatory Guide 1.109. As in the case of dose rate calculation, the Licensee has used the maximally exposed individual as the reference receptor. To correctly assess the cumulative dose, the Licensee intends to estimate the dose once per 31 days. These approaches to liquid dose calculations satisfy the guidance specified by NUREG-0133.

Evaluation of the cumulative dose from noble gas releases includes both beta and gamma and air doses at and beyond the site boundary. The critical organs under consideration are the total body and skin for gamma and beta radiation, respectively. Again, discrepancies were found in the (X/Q) values used by the Licensee for the controlling locations. Instead of using the maximum (X/Q) values at the site boundary 0.7 miles SSE sector, the Licensee used a lower (X/Q) value at the site boundary of 0.7 miles ENE sector.

For radioiodines, tritium, and particulates with half-lives greater than 8 days, the Licensee has provided a method to demonstrate that cumulative doses calculated from the release meet both quarterly and annual design objectives. The Licensee has demonstrated a method of calculating the dose using maximum annual average (X/Q) values for the inhalation pathway and has included (D/Q) values for the food and ground-plane pathways. The Licensee has identified the controlling locations at the milk pathway at 4.75 miles in the northeast sector. The Licensee's approaches are consistent with the methodology of NUREG-0133. As in the case for dose rate calculation, the Licensee should also record the method to account for iodine-133 in the dose calculation.

Using the existing methodology for gaseous and liquid dose calculations, the Licensee has demonstrated a procedure to determine the monthly dose and to ensure that the design objectives for the liquid radwaste system and the ventilation exhaust system are not exceeded. This approach on dose projections satisfies the guidance specified by NUREG-0133.

Adequate flow diagrams defining the effluent paths and components of the radioactive liquid and gaseous waste treatment systems have been provided by the Licensee. Radiation monitors specified in the Licensee-submitted RETS are also properly identified in the flow diagrams. The information provided by the Licensee has satisfactorily met the guidance of NUREG-0133.

The Licensee has provided a description of the revised sampling locations in the ODCM and has identified them in Table 4.0-1 and also in Figures 4.0-1a through 4.0-1c of the revised versions. These changes are consistent with the sampling locations specified in the Licensee's RETS Table 3.12.1-1 on environmental monitoring, and thus satisfies the guidance of NUREG-0133. However, several discrepancies were noted in these sample locations: The location identification (ID) numbers in the ODCM differ completely from those provided in the Licensee's 1984 (and also 1983) annual report; the milk locations (ID Nos. 600-603) were described as on the "as available" basis rather than the actual locations identified; and the fish and invertebrates indicator locations (ID Nos. 700-702) (0.5 miles at south-southeast sector of Atlantic Ocean) differ from the locations (5.5 miles at south-southwest sector of Atlantic Ocean) as presented in the Licensee's 1984 annual report.

In summary, the Licensee's ODCM and the revised changes use documented and approved methods that are generally consistent with the methodology and guidance in NUREG-0133, and therefore is an acceptable reference.

4. CONCLUSIONS

The Licensee's Revision 4 to the Offsite Dose Calculation Manual (ODCM Rev. 0, dated December 14, 1982 [1]) consisting of change pages submitted in the Licensee's Semiannual Radioactive Effluent Release Reports for 1984 [6, 7] and for the first 6 months of 1985 [8] uses documented and approved methods and is consistent with the criteria of NUREG-0133, except for the following discrepancies:

- o Since the Licensee does not include iodine-133 in the sampling and analysis program as documented in Brunswick RETS Table 4.11.2-1, the Licensee is required to document methods of estimating iodine-133 in the ODCM in accordance with the NRC staff guidance [12]. The Licensee did not provide such information in the revisions submitted for the ODCM.
- o The newly revised table shows the location of the highest annual average of relative concentration (X/Q) at the site boundary 0.7 miles from the plant and in the SSE sector. The Licensee, however, identifies different locations with lower (X/Q) values for the gaseous dose calculations.
- o The sample location identification (ID) numbers differ completely from those provided in the Licensee's 1984 (and also 1983) annual report; the milk locations (ID Nos. 600-603) were described as on the "as available" basis rather than the actual locations identified; the fish and invertebrates indicator locations (ID Nos. 700-702) were identified at locations (0.5 miles at south-southeast sector of the Atlantic Ocean) different from the locations (5.5 miles at south-southwest sector of Atlantic Ocean) as presented in the Licensee's 1984 annual report.

5. REFERENCES

1. Offsite Dose Calculation Manual for Brunswick Steam Electric Plant, Units 1 and 2, Rev. 0
Carolina Power and Light Company
NRC Docket Nos. 50-325/324
December 13, 1982
2. D. B. Vassallo (NRC/DL)
Letter to E. E. Utley (CP&L)
Subject: NRC/DL Approval of Brunswick ODCM and PCP
NRC Docket Nos. 50-325/324
December 27, 1983
3. Title 10, Code of Federal Regulations, Part 50, Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion, 'As Low As Is Reasonably Achievable,' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents"
4. "Radiological Effluent Technical Specifications for Pressurized Water Reactors," Rev. 3, Draft 7", intended for contractor guidance in reviewing RETS proposals for operating reactors
NRC, September 1982
NUREG-0472
5. "Radiological Effluent Technical Specifications for Boiling Water Reactors," Rev. 3, Draft", intended for contractor guidance in reviewing RETS proposals for operating reactors
NRC, September 1982
NUREG-0473
6. "Semiannual Radioactive Effluent Release Report - January 1 through June 30, 1984," Brunswick Steam Electric Plant Units 1 and 2, Carolina Power and Light Company
NRC Docket Nos. 50-325/324
August 21, 1984
7. "Semiannual Radioactive Effluent Release Report - July 1 through December 31, 1984," Brunswick Steam Electric Plants Units 1 and 2, Carolina Power and Light Company
NRC Docket Nos. 50-325/324
April 26, 1985
8. "Semiannual Radioactive Effluent Release Report - January 1 through June 30, 1985," Brunswick Steam Electric Plants Units 1 and 2, Carolina Power and Light Company
NRC Docket Nos. 50-325/324
August 23, 1985
9. "General Contents of the Offsite Dose Calculation Manual," Revision 1
Branch Technical Position, Radiological Assessment Branch
NRC, February 8, 1979

10. "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants, A Guidance Manual for Users of Standard Technical Specifications"
NRC, October 1978
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11. "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR50, Appendix I"
NRC, October 1977
Regulatory Guide 1.109, Rev. 1
12. W. P. Gamill/F. Congel (NRC)
Memo to ETSB/RAB (NRC)
"Radiological Effluent Technical Specifications (RETS) Provisions for I-133"
November 29, 1982