7.4.0 REPORTING REQUIREMENTS

ODCMS 7.4.1 Annual Radiological Environmental Operating Report

The Annual Radiological Environmental Operating Report shall be submitted in accordance with the requirements of Technical Specification 5.6.2. In addition to the requirements of Technical Specification 5.6.2, the Annual Radiological Environmental Operating Report shall include:

a. Summaries, interpretations, and an analysis of trends of the results of the radiological environmental surveillance activities for the report period, including a comparison with pre-operational studies, with operational controls (as appropriate), and with previous environmental surveillance reports, and an assessment of the observed impact of the plant operation on the environment;

b. Results of the land use census required by ODCMS 7.3.16;

c. A summary description of the radiological environmental monitoring program;

d. At least two legible maps of all sampling locations keyed to a table giving distances and directions from the centerline of one reactor (one map shall cover stations near the SITE BOUNDARY and the second map shall include more distant stations);

e. Results of the Interlaboratory Comparison Program required by ODCMS 7.3.17;

f. Discussion of all deviations from the sampling schedule of Table 7.3.15-1; and

g. Discussion of all analyses in which the LLD required by Table 7.3.15-3 was not achievable.

ODCMS 7.4.2 Radioactive Effluent Release Report

The Radioactive Effluent Release Report shall be submitted in accordance with the requirements of Technical Specification 5.6.3. In addition to the requirements of Technical Specification 5.6.3, the Radioactive Effluent Release Report shall include:

(continued)

7.4.0 REPORTING REQUIREMENTS (continued)

ODCMS 7.4.2 Radioactive Effluent Release Report (continued)

a. A summary of the quantities of radioactive liquid and gaseous effluents and solid waste released for the facility as outlined in Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactivity Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," Revision 1, June 1974, with data summarized on a quarterly basis similar to the format of Appendix B thereof.

b. Information specified below for each class of solid waste (as defined by 10 CFR Part 61, when implemented) shipped offsite during the report period:

1. Container volume;

2. Total curie quantity (specify whether determined by measurement or estimate);

3. Principal radionuclides (specify whether determined by measurement or estimate);

4. Source of waste and processing employed (e.g., dewatered spent resin, compacted dry waste, evaporator bottoms);

5. Type of container (e.g., LSA, Type A, Type B, Large Quantity); and

6. Solidification agent or absorbent (e.g., cement, urea formaldehyde).

c. A list and description of unplanned releases from the site to the UNRESTRICTED AREAS of radioactive materials in gaseous and liquid effluents made during the reporting period.

d. Any changes made during the reporting period to the Process Control Program (PCP) or the Offsite Dose Calculation Manual (ODCM), as well as a listing of new locations for dose calculations and/or environmental monitoring identified by the land use census pursuant to ODCMS 7.3.16.

(continued)

7.4.0 REPORTING REQUIREMENTS (continued)

ODCMS 7.4.2 Radioactive Effluent Release Report (continued)

e. A summary of radioactivity released from the site by incineration of radioactive waste oil.

f. An annual summary of hourly meteorological data collected over the previous calendar year. This annual summary may be either in the form of an hour-by-hour listing on magnetic tape of wind speed, wind direction, atmospheric stability, and precipitation (if measured), or in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability. In lieu of submission of this summary of required meteorological data with the Radioactive Effluent Release Report, the summary of required meteorological data may be retained in a file that shall be provided to the NRC upon request.

g. An assessment of radiation doses due to radioactive liquid and gaseous effluents released from the station during the previous calendar year.

7.5.0 MAJOR CHANGES TO RADIOACTIVE WASTE TREATMENT SYSTEMS

ODCMS 7.5.1 Licensee initiated major changes to the liquid, gaseous, and solid Radioactive Waste Treatment Systems shall be reported to the NRC as part of the Radioactive Effluent Release Report or as part of the annual UFSAR update. The discussion of each change shall contain:

a. A summary of the evaluation that led to the determination that the change could be made in accordance with 10 CFR Part 50.59;

b. Sufficient detailed information to totally support the reason for the change without benefit of additional or supplemental information;

c. A detailed description of the equipment, components, and processes involved and the interfaces with other plant systems;

d. An evaluation of the change that shows the predicted release of radioactive materials in the liquid and gaseous effluents and quantity of solid waste differ from those previously predicted in the license application and amendments thereto;

e. An evaluation of the change that shows the expected maximum exposure to an individual in the UNRESTRICTED AREA and to the general population that differ from those previously estimated in the license application and amendments thereto;

f. A comparison of the predicted releases of radioactive materials, in liquid and gaseous effluents and in solid wastes, to the actual releases for the period prior to when the changes are to be made;

g. An estimate of the exposure to plant operating personnel as a result of the change; and

h. Documentation of the fact that the change was reviewed and found acceptable by the PNSC.

ODCMS 7.5.2 The change shall become effective upon review and acceptance by the PNSC.

B 7.3.0 OFFSITE DOSE CALCULATION MANUAL SPECIFICATION (ODCMS) APPLICABILITY

BASES

ODCMSs

ODCMS 7.3.0.1 through ODCMS 7.3.0.6 establish the general requirements applicable to all Specifications and apply at all times, unless otherwise stated.

ODCMS 7.3.0.1

ODCMS 7.3.0.1 establishes the Applicability statement within each individual ODCMS as the requirement for when the ODCMS is required to be met (i.e., when the unit is in the MODES or other specified conditions of the Applicability statement of each ODCMS).

ODCMS 7.3.0.2

ODCMS 7.3.0.2 establishes that upon discovery of a failure to meet an ODCMS, the associated COMPENSATORY MEASURES shall be met. The Completion Time of each Required Compensatory Measure for a COMPENSATORY MEASURES Condition is applicable from the point in time that a COMPENSATORY MEASURES Condition is entered. The Required Compensatory Measures establish those remedial measures that must be taken within specified Completion Times when the requirements of an ODCMS are not met. This ODCMS establishes that:

a. Completion of the Required Compensatory Measures within the specified Completion Times constitutes compliance with an ODCMS; and

b. Completion of the Required Compensatory Measures is not required when an ODCMS is met within the specified Completion Time, unless otherwise specified.

There are two basic types of Required Compensatory Measures. The first type of Required Compensatory Measure specifies a time limit in which the ODCMS must be met. This time limit is the Completion Time to restore an inoperable system or component to OPERABLE status or to restore variables to within specified limits. If this type of Required Compensatory Measure is not completed within the specified Completion Time, a shutdown may be required to place the unit in a MODE or condition in which the ODCMS is not applicable. (Whether stated as a Required Compensatory Measure or not, correction of the entered

(continued)

BASES

ODCMS 7.3.0.2 (continued)

Condition is a compensatory measure that may always be considered upon entering COMPENSATORY MEASURES.) The second type of Required Compensatory Measure specifies the remedial measures that permit continued operation of the unit that is not further restricted by the Completion Time. In this case, compliance with the Required Compensatory Measures provides an acceptable level of safety for continued operation.

Completing the Required Compensatory Measures is not required when an ODCMS is met or is no longer applicable, unless otherwise stated in the individual ODCMSs.

The nature of some Required Compensatory Measures of some Conditions necessitates that, once the Condition is entered, the Required Compensatory Measures must be completed even though the associated Condition no longer exists. The individual ODCMS's COMPENSATORY MEASURES specify the Required Compensatory Measures where this is the case.

The Completion Times of the Required Compensatory Measures are also applicable when a system or component is removed from service intentionally. The reasons for intentionally relying on the COMPENSATORY MEASURES include, but are not limited to, performance of Tests, preventive maintenance, corrective maintenance, or investigation of operational problems. Entering COMPENSATORY MEASURES for these reasons must be done in a manner that does not compromise safety. Intentional entry into COMPENSATORY MEASURES should not be made for operational convenience. Alternatives that would not result in redundant equipment being inoperable should be used instead. Doing so limits the time both subsystems/ divisions of a safety function are inoperable. Individual ODCMSs may specify a time limit for performing a TR when equipment is removed from service or bypassed for testing. In this case, the Completion Times of the Required Compensatory Measures are applicable when this time limit expires, if the equipment remains removed from service or bypassed.

When a change in MODE or other specified condition is required to comply with Required Compensatory Measures, the unit may enter a MODE or other specified condition in which another ODCMS becomes applicable. In this case, the Completion Times of the associated

(continued)

BASES

ODCMS 7.3.0.2 (continued)

Required Compensatory Measures would apply from the point in time that the new ODCMS becomes applicable and the COMPENSATORY MEASURES Condition(s) are entered.

ODCMS 7.3.0.3

Not used.

ODCMS 7.3.0.4

ODCMS 7.3.0.4 establishes limitations on changes in MODES or other specified conditions in the Applicability when an ODCMS is not met. It precludes placing the unit in a MODE or other specified condition stated in that Applicability (e.g., Applicability desired to be entered) when the following exist:

a. Unit conditions are such that the requirements of the ODCMS would not be met in the Applicability desired to be entered; and

b. Continued noncompliance with the ODCMS requirements, if the Applicability were entered, would result in the unit being required to exit the Applicability desired to be entered to comply with the Required Compensatory Measures.

Compliance with Required Compensatory Measures that permit continued operation of the unit for an unlimited period of time in a MODE or other specified condition provides an acceptable level of safety for continued operation. This is without regard to the status of the unit before or after the MODE change. Therefore, in such cases, entry into a MODE or other specified condition in the Applicability may be made in accordance with the provisions of the Required Compensatory Measures. The provisions of this Specification should not be interpreted as endorsing the failure to exercise the good practice of restoring systems or components to OPERABLE status before unit startup.

The provisions of ODCMS 7.3.0.4 shall not prevent changes in MODES or other specified conditions in the Applicability that are required to comply with COMPENSATORY MEASURES. In addition, the provisions of ODCMS 7.3.0.4 shall not prevent changes in MODES or other specified conditions in the Applicability that result from any unit shutdown.

(continued)

BASES

ODCMS 7.3.0.4 (continued)

Exceptions to ODCMS 7.3.0.4 are stated in the individual Tests. Exceptions may apply to all the COMPENSATORY MEASURES or to a specific Required Compensatory Measure of an ODCMS.

Tests do not have to be performed on the associated inoperable equipment (or on variables outside the specified limits), as permitted by TR 7.3.0.1. Therefore, changing MODES or other specified conditions while in a COMPENSATORY MEASURES Condition, either in compliance with ODCMS 7.3.0.4 or where an exception to ODCMS 7.3.0.4 is stated, is not a violation of TR 7.3.0.1 or TR 7.3.0.4 for those Tests that do not have to be performed due to the associated inoperable equipment. However, TRs must be met to ensure OPERABILITY prior to declaring the associated equipment OPERABLE (or variable within limits) and restoring compliance with the affected ODCMS.

ODCMS 7.3.0.5

ODCMS 7.3.0.5 establishes the allowance for restoring equipment to service under administrative controls when it has been removed from service or declared inoperable to comply with COMPENSATORY MEASURES. The sole purpose of this ODCMS is to provide an exception to ODCMS 7.3.0.2 (e.g., to not comply with the applicable Required Compensatory Measure(s)) to allow the performance of TRs to demonstrate:

a. The OPERABILITY of the equipment being returned to service; or

b. The OPERABILITY of other equipment.

The administrative controls ensure the time the equipment is returned to service in conflict with the requirements of the COMPENSATORY MEASURES is limited to the time absolutely necessary to perform the allowed TRs. This ODCMS does not provide time to perform any other preventive or corrective maintenance.

An example of demonstrating the OPERABILITY of the equipment being returned to service is taking an inoperable channel or trip system out of the tripped condition after it has been tripped to comply with Required Compensatory Measures since it must be untripped to perform the TRs.

(continued)

BASES

ODCMS 7.3.0.5 (continued)	An example of demonstrating the OPERABILITY of other equipment is taking an inoperable channel or trip system out of the tripped condition to prevent the trip function from occurring during the performance of a TR on another channel in the other trip system. A similar example of demonstrating the OPERABILITY of other equipment is taking an inoperable channel or trip system out of the tripped condition to permit the logic to function and indicate the appropriate response during the performance of a TR on another channel in the same trip system.
ODCMS 7.3.0.6	ODCM 7.3.0.6 delineates the applicability of each ODCMS and associated COMPENSATORY MEASURE to Brunswick Unit 1 and Brunswick Unit 2 operations.

B 7.3.0 TEST REQUIREMENT (TR) APPLICABILITY

BASES

TRs

TR 7.3.0.1 through TR 7.3.0.5 establish the general requirements applicable to all ODCMSs and apply at all times, unless otherwise stated.

TR 7.3.0.1

TR 7.3.0.1 establishes the requirement that TRs must be met during the MODES or other specified conditions in the Applicability for which the requirements of the ODCMS apply, unless otherwise specified in the individual TRs. This ODCMS is to ensure that Tests are performed to verify the OPERABILITY of systems and components, and that variables are within specified limits. Failure to meet a Test within the specified Frequency, in accordance with TR 7.3.0.2, constitutes a failure to meet an ODCMS.

Systems and components are assumed to be OPERABLE when the associated TRs have been met. Nothing in this ODCMS, however, is to be construed as implying that systems or components are OPERABLE when:

a. The systems or components are known to be inoperable, although still meeting the TRs; or

b. The requirements of the Test(s) are known to be not met between required Test performances.

Tests do not have to be performed when the unit is in a MODE or other specified condition for which the requirements of the associated ODCMS are not applicable, unless otherwise specified.

Tests, including Tests invoked by Required Compensatory Measures, do not have to be performed on inoperable equipment because the COMPENSATORY MEASURES define the remedial measures that apply. Tests have to be met and performed in accordance with TR 7.3.0.2, prior to returning equipment to OPERABLE status.

Upon completion of maintenance, appropriate post maintenance testing is required to declare equipment OPERABLE. This includes ensuring applicable Tests are not failed and their most recent performance is in accordance with TR 7.3.0.2. Post maintenance testing may not be possible in the current MODE or other specified conditions in the

(continued)

BASES

TR 7.3.0.1 (continued)

Applicability due to the necessary unit parameters not having been established. In these situations, the equipment may be considered OPERABLE provided testing has been satisfactorily completed to the extent possible and the equipment is not otherwise believed to be incapable of performing its function. This will allow operation to proceed to a MODE or other specified condition where other necessary post maintenance tests can be completed.

TR 7.3.0.2

TR 7.3.0.2 establishes the requirements for meeting the specified Frequency for Tests and any Required Compensatory Measure with a Completion Time that requires the periodic performance of the Required Compensatory Measure on a "once per..." interval.

TR 7.3.0.2 permits a 25% extension of the interval specified in the Frequency. This extension facilitates Test scheduling and considers plant operating conditions that may not be suitable for conducting the Test (e.g., transient conditions or other ongoing Test or maintenance activities).

The 25% extension does not significantly degrade the reliability that results from performing the Test at its specified Frequency. This is based on the recognition that the most probable result of any particular Test being performed is the verification of conformance with the TRs.

As stated in TR 7.3.0.2, the 25% extension also does not apply to the initial portion of a periodic Completion Time that requires performance on a "once per..." basis. The 25% extension applies to each performance after the initial performance. The initial performance of the Required Compensatory Measure, whether it is a particular Test or some other remedial action, is considered a single compensatory measure with a single Completion Time. One reason for not allowing the 25% extension to this Completion Time is that such a compensatory measure may verify that no loss of function has occurred by checking the status of redundant or diverse components or accomplishes the function of the inoperable equipment in an alternative manner.

(continued)

BASES

TR 7.3.0.2 (continued)

The provisions of TR 7.3.0.2 are not intended to be used repeatedly merely as an operational convenience to extend Test intervals (other than those consistent with refueling intervals) or periodic Completion Time intervals beyond those specified.

TR 7.3.0.3

TR 7.3.0.3 establishes the flexibility to defer declaring affected equipment inoperable or an affected variable outside the specified limits when a Test has not been completed within the specified Frequency. A delay period of up to 24 hours or up to the limit of the specified Frequency, whichever is less, applies from the point in time that it is discovered that the Test has not been performed in accordance with TR 7.3.0.2, and not at the time that the specified Frequency was not met.

This delay period provides adequate time to complete Tests that have been missed. This delay period permits the completion of a Test before complying with Required Compensatory Measures or other remedial measures that might preclude completion of the Test.

The basis for this delay period includes consideration of unit conditions, adequate planning, availability of personnel, the time required to perform the Test, the safety significance of the delay in completing the required Test, and the recognition that the most probable result of any particular Test being performed is the verification of conformance with the requirements.

When a Test with a Frequency based not on time intervals, but upon specified unit conditions or operational situations, is discovered not to have been performed when specified, TR 7.3.0.3 allows the full delay period of 24 hours to perform the Test.

TR 7.3.0.3 also provides a time limit for completion of Tests that become applicable as a consequence of MODE changes imposed by Required Compensatory Measures.

(continued)

BASES

TR 7.3.0.3 (continued)

Failure to comply with specified Frequencies for TRs is expected to be an infrequent occurrence. Use of the delay period established by TR 7.3.0.3 is a flexibility which is not intended to be used as an operational convenience to extend Test intervals.

If a Test is not completed within the allowed delay period, then the equipment is considered inoperable or the variable is considered outside the specified limits and the Completion Times of the Required Compensatory Measures for the applicable ODCMS Conditions begin immediately upon expiration of the delay period. If a Test is failed within the delay period, then the equipment is inoperable, or the variable is outside the specified limits and the Completion Times of the Required Compensatory Measures for the applicable ODCMS Conditions begin immediately upon the failure of the Test.

Completion of the Test within the delay period allowed by this ODCMS, or within the Completion Time of the COMPENSATORY MEASURES, restores compliance with TR 7.3.0.1.

TR 7.3.0.4

TR 7.3.0.4 establishes the requirement that all applicable TRs must be met before entry into a MODE or other specified condition in the Applicability. This ODCMS ensures that system and component OPERABILITY requirements and variable limits are met before entry into MODES or other specified conditions in the Applicability for which these systems and components ensure safe operation of the unit.

However, in certain circumstances failing to meet a TR will not result in TR 7.3.0.4 restricting a MODE change or other specified condition change. When a system, subsystem, division, component, device, or variable is inoperable or outside its specified limits, the associated TR(s) are not required to be performed, per TR 7.3.0.1, which states that Tests do not have to be performed on inoperable equipment. When equipment is inoperable, TR 7.3.0.4 does not apply to the associated TR(s) since the requirement for the TR(s) to be performed is removed. Therefore, failing to perform the Test(s) within the specified Frequency does not result in a

(continued)

BASES

TR 7.3.0.4 (continued)

TR 7.3.0.4 restriction to changing MODES or other specified conditions of the Applicability. However, since the ODCMS is not met in this instance, ODCMS 7.3.0.4 will govern any restrictions that may (or may not) apply to MODE or other specified condition changes.

The provisions of TR 7.3.0.4 shall not prevent changes in MODES or other specified conditions in the Applicability that are required to comply with COMPENSATORY MEASURES. In addition, the provisions of TR 7.3.0.4 shall not prevent changes in MODES or other specified conditions in the Applicability that result from any unit shutdown.

The precise requirements for performance of TRs are specified such that exceptions to TR 7.3.0.4 are not necessary. The specific time frames and conditions necessary for meeting the TRs are specified in the Frequency, in the Test, or both. This allows performance of Tests when the prerequisite condition(s) specified in a Test procedure require entry into the MODE or other specified condition in the Applicability of the associated ODCMS prior to the performance or completion of a Test. A Test that could not be performed until after entering the ODCMS Applicability would have its Frequency specified such that it is not "due" until the specific conditions needed are met. Alternately, the Test may be stated in the form of a Note as not required (to be met or performed) until a particular event, condition, or time has been reached. Further discussion of the specific formats of TRs' annotation is found in ODCMS Section 7.1.4, Frequency.

TR 7.3.0.5

TR 7.3.0.5 delineates the applicability of the test activities to Brunswick Unit 1 and Brunswick Unit 2 operations.

B 7.3.1 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

BASES

The radioactive liquid effluent monitoring instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The alarm/trip setpoints for these instruments shall be calculated in accordance with the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50. The purpose of tank level indicating devices is to assure the detection and control of leaks that, if not controlled, could potentially result in the transport of radioactive materials to UNRESTRICTED AREAS.

The initial CHANNEL CALIBRATION for the Table 7.3.1-1, Functions 1 and 3, instruments was performed using National Bureau of Standards traceable sources which verified that each detector would operate properly over its intended energy range and measurement range. For instruments which were operational prior to this specification being implemented, previously established calibration procedures may be substituted for the initial requirement. Subsequent to CHANNEL CALIBRATIONS will be performed using sources that have been related to the initial calibration in order to ensure that each detector is still operational, but the sources need not span the full ranges used in the initial CHANNEL CALIBRATION.

B 7.3.2 RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

BASES

The radioactive gaseous effluent monitoring instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The alarm/trip setpoints for these instruments shall be calculated in accordance with the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60 and 64 of Appendix A to 10 CFR Part 50.

The main condenser air ejector monitoring instrumentation, the main condenser offgas treatment system monitor, and the explosive gas monitoring instrumentation shown in Table 7.3.2-1 are not considered effluent monitoring instrumentation in the same sense as the other instrumentation listed in the table. Therefore, their alarm/trip setpoints are not necessarily set to ensure that the limits of ODCMS 7.3.7 are not exceeded.

The main condenser air ejector monitoring instrumentation channels are provided to monitor and control gross radioactivity removed from the main condenser. The alarm/trip setpoints for the main condenser air ejector monitor are set to ensure that the limits of Technical Specification 3.7.5 are not exceeded. The alarm/trip setpoint for this monitor shall be calculated in accordance with NRC approved methods to provide reasonable assurance that the potential total body accident dose will not exceed a fraction of the limits specified in 10 CFR Part 100.

This specification also includes provisions for monitoring the concentrations of potentially explosive gas mixtures in the offgas treatment system (hydrogen monitors).

The initial CHANNEL CALIBRATION for the Table 7.3.2-1, Functions 1.a, 2.a, 3.a, 4 and 6, instruments was performed using National Bureau of Standards traceable sources which verified that each detector would operate properly over its intended energy range and measurement range. For instruments which were operational prior to this specification being implemented, previously established calibration procedures may be substituted for the initial requirement. Subsequent CHANNEL CALIBRATIONS will be performed using sources that have been related to the initial calibration in order to ensure that each detector is still operational, but the sources need not span the full ranges used in the initial CHANNEL CALIBRATION.

(continued)

BASES

Regulatory Guide 1.21 requires continuous sampling of iodine and particulate in gaseous effluents and subsequent analysis at least weekly. However, a short downtime period of the sample devices is necessary to accomplish applicable ODCM test requirements, sample analysis, or system purging. This time will be accounted for in sample volume calculations. As such, 45 minutes is provided to initiate the auxiliary sampling system or restore the normal sampling devices to OPERABLE status.

Reference ODCMS 7.3.0.5 and B 7.3.0.5 for the performance of post maintenance testing.

Upon identification of a loss of radioactive gaseous effluent monitoring instrumentation, steps shall be taken immediately to install auxiliary sampling. If this cannot be accomplished, releases via the associated effluent pathway shall be secured. Any monitor downtime will be accounted for in sample volume calculations.

B 7.3.3 CONCENTRATION—LIQUID EFFLUENTS

BASES

This specification is provided to ensure that the concentration of radioactive materials released in liquid waste effluents to UNRESTRICTED AREAS after dilution in the discharge canal will be less than or equal to 10 times the concentration levels specified in 10 CFR Part 20, Appendix B, Table 2, Column 2 to 10 CFR 20.1001-20.2401 for radionuclides other than dissolved and entrained noble gases. This limitation provides additional assurance that the levels of radioactive materials in bodies of water in UNRESTRICTED AREAS will not result in exposures within (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a MEMBER OF THE PUBLIC and (2) the limits of 10 CFR Part 20.1302(b)(2)(i) to the population. The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP), Publication 2.

The required detection capabilities for radioactive materials in liquid waste samples are tabulated in terms of the Lower Limits of Detection (LLDs). Detailed discussion of the LLD and other detection limits can be found in HASL Procedures Manuals, HASL-300 (revised annually), Currie, L. A. "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry" Anal. Chem. 40, 586-93 (1968), and Hartwell, J. K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

Note that for batch releases, recirculation of at least two tank volumes shall be considered adequate for thorough mixing.

The stabilization pond and service water liquid release types represent potential release pathways and not actual release pathways. Tests of these pathways is intended to alert the plant to a potential problem; analysis for principal gamma emitters should be sufficient to meet this intent. If analysis for principal gamma emitters indicates a problem (i.e., exceeds the trigger level of 5×10^{-6} μCi/ml), then complete sampling and analyses shall be performed as per Table 7.3.3-2. The trigger level of 5×10^{-6} μCi/ml was chosen as being sufficient to provide reasonable assurance of accountability of all nuclides released based upon lower limits of detection and expected concentrations.

B 7.3.4 DOSE—LIQUID EFFLUENTS

BASES

This specification is provided to implement the requirements of Sections II.A, III.A, and IV.A of Appendix I, 10 CFR Part 50. ODCMS 7.3.4 implements the guides set forth in Section II.A of Appendix I. The COMPENSATORY MEASURES provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I of 10 CFR Part 50 to assure that releases of radioactive material in liquid effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The dose calculations in the ODCM implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents will be consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

The dose or dose commitment to a MEMBER OF THE PUBLIC is based on the 10 CFR Part 50, Appendix I, guideline of:

a. 1.5 mrem to the total body and 5.0 mrem to any organ during any calendar quarter, and

b. 3 mrem to the total body and 10 mrem to any organ during any calendar year,

from radioactive material in liquid effluents from each reactor unit to UNRESTRICTED AREAS. This specification is written for a two unit site.

B 7.3.5 LIQUID RADWASTE TREATMENT SYSTEM

BASES

The requirement that appropriate portions of this system be used, when specified, provides assurance that the releases of radioactive materials in liquid effluents will be kept "as low as reasonably achievable." This specification implements the requirements of 10 CFR Part 50.36a, General Design Criteria 60 of Appendix A to 10 CFR Part 50 and the design objectives given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the Liquid Radwaste Treatment System were specified as a suitable fraction of the dose design objectives set forth in Section II.A of Appendix I, 10 CFR Part 50, for liquid effluents.

Mechanical filtration as per system design is considered to be an appropriate component of the Liquid Radwaste Treatment System.

The requirements of 0.12 mrem total body or 0.4 mrem to any organ in a 31-day period is based on two reactor units having a shared Liquid Radwaste Treatment System.

B 7.3.6 LIQUID HOLDUP TANKS

BASES

The tanks listed in this specification include all those outdoor tanks that are not surrounded by liners, dikes, or walls capable of holding the tank contents and do not have tank overflows and surrounding area drains connected to the Liquid Radwaste Treatment System.

Since the condensate storage tanks have continuous influent and effluent, stratification should not occur. Samples taken from the operating condensate transfer pump(s) vent or drain shall be deemed representative of this system.

Appropriate alternatives to the COMPENSATORY MEASURES and TEST REQUIREMENTS are acceptable if they provide reasonable assurance that in the event of an uncontrolled release of the tank's content, the resulting concentrations would be less than 10 times the concentration values in Appendix B, Table 2, Column 2 to 10 CFR 20.1001-20.2401 at the nearest potable water supply and the nearest surface water supply in an UNRESTRICTED AREA.

B 7.3.7 DOSE RATE—GASEOUS EFFLUENTS

BASES

This specification is provided to ensure that the dose rate at and beyond the SITE BOUNDARY from gaseous effluents from all units on the site will be within the annual dose rate limits of 10 CFR Part 20 for UNRESTRICTED AREAS. The annual dose limits are the doses associated with the concentrations of 10 CFR Part 20, Appendix B, Table 2, Column 1. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of a MEMBER OF THE PUBLIC in an UNRESTRICTED AREA, either within or outside the SITE BOUNDARY, to annual average concentrations exceeding the limits specified in Appendix B, Table 2, of 10 CFR Part 20 (10 CFR Part 20.1302(b)(2)(i)). For MEMBERS OF THE PUBLIC who may at times be within the SITE BOUNDARY, the occupancy of that MEMBER OF THE PUBLIC will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the SITE BOUNDARY. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to a MEMBER OF THE PUBLIC at or beyond the SITE BOUNDARY to less than or equal to 500 mrems/year to the total body or to less than or equal to 3000 mrems/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrems/year.

This specification applies to the release of gaseous effluents from all reactors at the site and from the incineration of waste oil.

With regard to footnotes (c) and (g) of Table 7.3.7-1, (1) to determine whether the Dose Equivalent I-131 concentration in the primary coolant has increased by more than a factor of 3, the iodine-131 analysis performed after the transient will be compared to the most recent routine analysis for Dose Equivalent I-131 concentration performed before the transient; and (2) to determine whether the main condenser air ejector noble gas monitor has increased by more than a factor of 3, the activity indicated on the monitor's chart recorder after the transient will be compared to the activity indicated on the recorder just before the transient occurred.

The required detection capabilities for radioactive materials in gaseous waste samples are tabulated in terms of the Lower Limits of Detection (LLDs). Detailed discussion of the LLD and other detection limits can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, L. A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry" Anal. Chem. 40, 586-93 (1968), and Hartwell, J. K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

B 7.3.8 DOSE RATE—NOBLE GASES

BASES

This specification is provided to implement the requirements of Sections II.B, III.A, and IV.A of Appendix I, 10 CFR Part 50. ODCMS 7.3.8 implements the guides set forth in Section II.B of Appendix I. The COMPENSATORY MEASURES provide the required operating flexibility and, at the same time, implement the guides set forth in Section IV.A of Appendix I, to assure that the releases of radioactive materials in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The TEST REQUIREMENTS implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I is to be shown by calculational procedures based on models and data such that the actual exposure of a MEMBER OF THE PUBLIC through the appropriate pathways is unlikely to be substantially underestimated. The dose calculations established in the ODCM for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents will be consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors," Revision 1, July 1977. The ODCM equations provided for determining the air doses at and beyond the SITE BOUNDARY will be based upon the historical annual average atmospheric conditions. NUREG-0133 provides methods for dose calculations consistent with Regulatory Guides 1.109 and 1.111. The limits of this specification are twice the 10 CFR 50 Appendix I per reactor guidelines because they are written for a two unit site.

B 7.3.9 DOSE - IODINE-131, IODINE-133, TRITIUM, AND RADIONUCLIDES IN PARTICULATE FORM

BASES

This specification is provided to implement the requirements of Section II.C, III.A, and IV.A of Appendix I, 10 CFR Part 50. ODCMS 7.3.9 implements the guides set forth in Section II.C of Appendix I. The COMPENSATORY MEASURES provide the required operating flexibility and, at the same time, implements the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The ODCM calculational methods specified in the TEST REQUIREMENTS implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The ODCM calculational methods for calculating the doses due to the actual release rates of the subject materials are required to be consistent with the methodology provided in Regulatory Guide 1.109, "Calculating of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors," Revision 1, July 1977. These equations also provide for determining the actual doses based upon the historical average atmospheric conditions. The release rate specification for iodine-131, iodine-133, tritium, and radioactive material in particulate form with half-lives greater than 8 days are dependent on the existing radionuclide pathways to man in the areas at and beyond the SITE BOUNDARY. The pathways which are examined in the development of these calculations are: (1) individual inhalation of airborne radionuclides, (2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, (3) deposition onto grassy areas where milk animals and meat producing animals graze, with consumption of the milk and meat by man, and (4) deposition on the ground with subsequent exposure of man. The limits of this specification are twice the 10 CFR 50 Appendix I per reactor guidelines because they are written for a two unit site.

Doses due to the incineration of waste oil will be determined in accordance with the ODCM.

B 7.3.10 GASEOUS RADWASTE TREATMENT SYSTEM

BASES

This requirement provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as reasonably achievable." This specification implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and the design objectives given in Section II.D of Appendix I to 10 CFR Part 50. The GASEOUS RADWASTE TREATMENT SYSTEM refers to the 30-minute offgas holdup line, stack filter house filtration, and the Augmented Off-Gas-Treatment System.

B 7.3.11 VENTILATION EXHAUST TREATMENT SYSTEM

BASES

This requirement provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as reasonably achievable." This specification implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and the design objectives given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of the systems were specified as a suitable fraction of the dose design objectives set forth in Sections II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents. At the Brunswick Steam Electric Plant, the only VENTILATION EXHAUST TREATMENT SYSTEMS shall be those installed for the Turbine Buildings' ventilation.

B 7.3.12 EXPLOSIVE GAS MIXTURE

BASES

This specification is provided to ensure that the concentration of potentially explosive gas mixtures contained in the waste gas treatment system is maintained below the flammability limits of hydrogen. Maintaining the concentration of hydrogen below the flammability limits provides assurance that the releases of radioactive materials will be controlled in conformance with the requirements of General Design Criterion 60 of Appendix A to 10 CFR Part 50.

B 7.3.13 DRYWELL VENTING or PURGING

BASES

This specification provides reasonable assurance that releases from drywell VENTING or PURGING operations will not exceed the annual dose limits of 10 CFR Part 20 for UNRESTRICTED AREAS.

B 7.3.14 TOTAL DOSE (40 CFR PART 190)

BASES

This specification is provided to meet the dose limitations of 40 CFR Part 190 that have now been incorporated into 10 CFR Part 20 by 46 FR 18525. The specification requires the preparation and submittal of a Special Report whenever the calculated doses from plant generated radioactive effluents and direct radiation exceed 25 mrems to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems. For sites containing up to 4 reactors, it is highly unlikely that the resultant dose to a MEMBER OF THE PUBLIC will exceed the dose limits of 40 CFR Part 190 if the individual reactors remain within the reporting requirement level. The Special Report will describe a course of action that should result in the limitation of the annual dose to a MEMBER OF THE PUBLIC to within the 40 CFR Part 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to the MEMBER OF THE PUBLIC from other uranium fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 8 km must be considered. If the dose to any MEMBER OF THE PUBLIC is estimated to exceed the requirements of 40 CFR Part 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR Part 190 have not already been corrected) in accordance with the provisions of 40 CFR Part 190.11 and 10 CFR Part 20.2203(a)(4) is considered to be a timely request and fulfills the requirements of 40 CFR Part 190 until NRC staff action is completed. The variance only relates to the limits of 40 CFR Part 190, and does not apply in any way to the other requirements for dose limitation of 10 CFR Part 20, as addressed in ODCMSs 7.3.3 through 7.3.14. An individual is not considered a MEMBER OF THE PUBLIC during any period in which he/she is engaged in carrying out any operation that is part of the nuclear fuel cycle.

B 7.3.15 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

BASES

The radiological environmental monitoring program required by this specification provides measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposures of MEMBERS OF THE PUBLIC resulting from station operation. This monitoring program implements Section IV.B.2 of Appendix I to 10 CFR Part 50 and thereby supplements the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials are not higher than expected on the basis of effluent measurements and the modeling of the environmental exposure pathways.

The required detection capabilities for environmental sample analyses are tabulated in terms of the Lower Limits of Detection (LLDs). The LLDs required by Table 7.3.15-3 are considered optimum for routine environmental measurements in industrial laboratories. It should be recognized that the LLD is defined as a priori (before the fact) limit representing the capability of a measurement system and not as a posteriori (after the fact) limit for a particular measurement.

Detailed discussion of the LLD and other detection limits can be found in HASL Procedure Manual, HASL-300 (revised annually), Currie, L. A., "Limits for Qualitative Detection and Quantitative Determination Application to Radiochemistry" Anal. Chem 40, 586-93 (1968), and Hartwell, L. K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

Groundwater is not monitored by this specification because plant liquid effluents are not tapped as a source for drinking or irrigation purposes.

In the absence of the availability of leafy vegetables intended for human consumption, sampling of indigenous broadleaf vegetation may be performed since the objective of sampling broadleaf vegetation (i.e., to approximate fallout from plant operation) is satisfied in either case.

B 7.3.16 LAND USE CENSUS

BASES

This specification is provided to ensure that changes in the use of the area at and beyond the SITE BOUNDARY are identified and that modifications to the radiological environmental monitoring program are made, if required, as a result of the census. The best information from door-to-door surveys, aerial surveys, or consulting with local agricultural authorities shall be used. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50. Restricting the census to gardens of greater than 50 m^2 provides assurance that significant exposure pathways via leafy vegetables will be identified and monitored since a garden of this size is the minimum required to produce the quantity (26 kg/yr) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption by a child. To determine the minimum garden size, the following assumptions were made: (1) 20% of the garden was used for growing broadleaf vegetation (i.e., similar to lettuce and cabbage; and (2) a vegetation yield of 2 kg/m^2.

B 7.3.17 INTERLABORATORY COMPARISON PROGRAM

BASES

The requirement for participation in the Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring in order to demonstrate that the results are reasonably valid for the purposes of Section IV.B.2 of Appendix I to 10 CFR Part 50.

LIST OF TABLES

LIST OF TABLES (Cont'd)

APPENDIX A

METEOROLOGICAL DISPERSION FACTOR COMPUTATIONS

Carolina Power & Light Company (CP&L) engaged the services of Dames and Moore to assess the transport and dispersion of the effluent in the atmosphere as outlined in Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants, NUREG 0133 (USNRC, 1978). The methodology for this assessment was based on guidelines presented in Regulatory Guide (RG) 1.111, Revision 1 (USNRC, 1977). The results of the assessment were to provide the relative depositions flux and relative concentrations (undepleted and depleted) based on numerical models acceptable for use in Appendix I evaluations.

Regulatory Guide 1.111 presented three acceptable diffusion models for use in estimating deposition flux and concentrations. These are (1) particle-in-cell model (a variable trajectory model based on the gradient-transport theory), (2) puff-advection model (a variable trajectory model based on the statistical approach to diffusion), and (3) the constant mean wind direction model referred to here as the straight-line trajectory Gaussian diffusion model (the most widely used model based on a statistical approach). It was resolved that for operational efficiency, the straight line described in XOQDOQ Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations (Draft), NUREG 0324 (USNRC, September 1977) would be used for generating the required analyses of Appendix I. To provide a more realistic accounting of the variability of wind around the plant site, terrain/ recirculation correction factors (TCF) were to be determined from a combined puff-advection/straight-line scheme for a one-year meteorological data base.

Dames and Moore was provided a one-year record of meteorological data from the on-site meteorological program at the Brunswick Steam Electric Plant. This data consisted of all collected parameters at both the 11.46-meter and 104.55-meter tower levels for the year 1977. The description of the model used and the results of the computations are presented in Reference 1. The following tables from Reference 1 provide the basis for the meteorological dilution factor development of the Technical Specifications for Appendix I and were the source of the χ/Q and D/Q values utilized to show compliance with 10CFR20 and 10CFR50 for noble gases and radioiodines and particulates.

Tables A-1 through A-6	Relative undepleted concentration, relative depleted concentration, and relative deposition flux estimates for ground-level release for both standard distances and special locations.
Tables A-7 through A-12	Relative undepleted concentration, relative depleted concentration, and relative deposition flux estimates for mixed-mode release for both standard distances and special locations.

Tables A-13 through A-18	Relative undepleted concentration, relative depleted concentration, and relative deposition flux estimates for elevated release for both standard distances and special locations.

Values for χ/Q, depleted χ/Q, and D/Q for releases to special locations are from the standard distance tables. The values used are from the distance nearest the special location in the appropriate sector.

Future Operation Computations

The NRC "XOQDOQ" Program (Revision 1) was obtained and installed on the CP&L computer system. For routine meteorological dispersion evaluations, the "XOQDOQ" Program will be run with the appropriate physical plant data, appropriate meteorological information for the standard distances, and special locations of interest without a terrain/recirculation factor. The input to "XOQDOQ" for ground-level releases are presented in Table A-19 and for elevated releases in Table A-20. The resulting computations will have applied the TCFs to produce a final atmospheric diffusion estimate for the site.

In general, it is concluded that the straight-line model is as reasonable a projection of concentrations as the puff-advection model. By inclusion of the terrain correction factors developed by a combination of the puff-advection/straight-line scheme with the results of the XOQDOQ Program, ready evaluation of on-site meteorological data may be made.

Reference

Chandler, Martin W. and George Hoopes, Revised Radiological Effluent Technical Specifications: Gaseous Effluent Dilution Factors, Prepared for Carolina Power & Light Company, Brunswick Facility, Dames and Moore, January 18, 1979.

TABLE A-1

χ/Q Values at the Special Locations for Releases From the Turbine Buildings

Carolina Power & Light Company - Brunswick
Release Type: Annual
Release Mode: Ground Level
Variable: Relative Concentration (Sec./Cubic Meter)
Calculation Points: Special
Model: Straight Line (ANNX009)
Application of Terrain Correction Factors: Yes
Number of Observations: 8678

Affected Sector	Site Boundary	Dairy*	Meat*	Resident*	Garden*
NNE	2.3E-06	0.	9.4E-07	9.4E-07	9.4E-07
NE	2.9E-06	1.4E-07	0.	0.	0.
ENE	3.2E-06	0.	0.	0.	0.
E	3.9E-06	0.	1.5E-06	1.5E-06	0.
ESE	5.2E-06	0.	5.2E-06	1.0E-06	1.0E-06
SE	3.4E-06	0.	3.4E-06	3.4E-06	0.
SSE	7.5E-06	0.	7.5E-06	7.5E-06	7.5E-06
S	3.8E-06	0.	0.	1.6E-06	9.8E-07
SSW	2.8E-06	0.	1.2E-06	1.2E-06	1.2E-06
SW	2.5E-06	0.	2.5E-06	2.5E-06	2.5E-06
WSW	1.8E-06	0.	3.8E-07	7.5E-07	7.5E-07
W	1.5E-06	0.	0.	1.5E-06	1.5E-06
WNW	1.2E-06	0.	0.	1.2E-06	1.2E-06
NW	9.7E-07	0.	0.	9.7E-07	9.7E-07
NNW	1.3E-06	0.	0.	1.3E-06	1.3E-06
N	1.4E-06	0.	0.	1.4E-06	1.4E-06

*A zero indicates that this point was not calculated.

TABLE A-2

Depleted χ/Q Values at the Special Locations for Releases From the Turbine Buildings

Carolina Power & Light Company - Brunswick
Release Type: Annual
Release Mode: Ground Level
Variable: Relative Depleted Concentration (Sec./Cubic Meter)
Calculation Points: Special
Model: Straight Line (ANNX009)
Application of Terrain Correction Factors: Yes
Number of Observations: 8678

Affected Sector	Site Boundary	Dairy*	Meat*	Resident*	Garden*
NNE	2.0E-06	0.	8.1E-07	8.1E-07	8.1E-07
NE	2.6E-06	1.0E-07	0.	0.	0.
ENE	2.9E-06	0.	0.	0.	0.
E	3.4E-06	0.	1.3E-06	1.3E-06	0.
ESE	4.6E-06	0.	4.6E-06	8.7E-07	8.7E-07
SE	3.1E-06	0.	3.1E-06	3.1E-06	0.
SSE	6.8E-06	0.	6.8E-06	6.8E-06	6.8E-06
S	3.5E-06	0.	0.	1.3E-06	8.1E-07
SSW	2.5E-06	0.	1.0E-06	1.0E-06	1.0E-06
SW	2.4E-06	0.	2.4E-06	2.4E-06	2.4E-06
WSW	1.5E-06	0.	3.2E-07	6.4E-07	6.4E-07
W	1.3E-06	0.	0.	1.3E-06	1.3E-06
WNW	1.1E-06	0.	0.	1.1E-06	1.1E-06
NW	8.7E-07	0.	0.	8.7E-07	8.7E-07
NNW	1.1E-06	0.	0.	1.1E-06	1.1E-06
N	1.2E-06	0.	0.	1.2E-06	1.2E-06

*A zero indicates that this point was not calculated.

TABLE A-3

D/Q Values at the Special Locations for Releases From the Turbine Buildings

Carolina Power & Light Company - Brunswick
Release Type: Annual
Release Mode: Ground Level
Variable: Relative Deposition (Meter**-2)
Calculation Points: Special
Model: Straight Line (ANNX009)
Application of Terrain Correction Factors: Yes
Number of Observations: 8678

Affected Sector	Site Boundary	Dairy*	Meat*	Resident*	Garden*
NNE	1.3E-08	0.	4.8E-09	4.8E-09	4.8E-09
NE	1.9E-08	5.7E-10	0.	0.	0.
ENE	9.4E-09	0.	0.	0.	0.
E	8.6E-09	0.	3.1E-09	3.1E-09	0.
ESE	1.3E-08	0.	1.3E-08	2.2E-09	2.2E-09
SE	8.4E-09	0.	8.4E-09	8.4E-09	0.
SSE	1.5E-08	0.	1.5E-08	1.5E-08	1.5E-08
S	8.3E-09	0.	0.	3.2E-09	1.8E-09
SSW	7.7E-09	0.	3.0E-09	3.0E-09	3.0E-09
SW	1.1E-08	0.	1.1E-08	1.1E-08	1.1E-08
WSW	7.0E-09	0.	1.3E-09	2.7E-09	2.7E-09
W	5.1E-09	0.	0.	5.1E-09	5.1E-09
WNW	3.8E-09	0.	0.	3.8E-09	3.8E-09
NW	3.5E-09	0.	0.	3.5E-09	3.5E-09
NNW	5.0E-09	0.	0.	5.0E-09	5.0E-09
N	6.3E-09	0.	0.	6.3E-09	6.3E-09

*A zero indicates that this point was not calculated.

TABLE A-4

χ/Q Values at the Standard Distances for Releases from the Turbine Buildings

Carolina Power & Light Company - Brunswick
Release Type: Annual
Release Mode: Ground Level
Variable: Relative Concentration (Sec./Cubic Meter)
Calculation Points: Standard
Model: Straight Line (ANNX009)
Application of Terrain Correction Factors: Yes
Number of Observations: 8678

		Base Distance in Miles/Kilometers									
Aftd Sect	Design Dist Mi	.25 .40	.75 1.21	1.25 2.01	1.75 2.82	2.25 3.62	2.75 4.42	3.25 5.23	3.75 6.03	4.25 6.84	4.75 7.64
NNE	0.	1.5E-05	2.3E-06	9.4E-07	5.9E-07	3.5E-07	2.4E-07	1.9E-07	1.5E-07	1.2E-07	9.0E-08
NE	0.	2.0E-05	2.9E-06	1.3E-06	7.3E-07	4.5E-07	3.4E-07	2.7E-07	2.0E-07	1.7E-07	1.4E-07
ENE	0.	2.1E-05	3.2E-06	1.2E-06	6.5E-07	4.8E-07	3.6E-07	2.9E-07	2.1E-07	1.8E-07	1.4E-07
E	0.	2.9E-05	3.9E-06	1.5E-06	9.1E-07	6.6E-07	4.4E-07	3.5E-07	2.8E-07	2.2E-07	1.9E-07
ESE	0.	3.2E-05	5.2E-06	2.2E-06	1.0E-06	6.5E-07	4.4E-07	3.6E-07	2.9E-07	2.4E-07	1.9E-07
SE	0.	2.3E-05	3.4E-06	1.6E-06	7.9E-07	4.8E-07	3.3E-07	2.4E-07	2.2E-07	1.8E-07	1.6E-07
SSE	0.	4.4E-05	7.5E-06	3.1E-06	1.8E-06	1.2E-06	7.7E-07	5.1E-07	3.9E-07	3.2E-07	2.5E-07
S	0.	2.7E-05	3.8E-06	1.6E-06	9.8E-07	7.2E-07	4.9E-07	3.7E-07	2.9E-07	2.2E-07	1.8E-07
SSW	0.	1.9E-05	2.8E-06	1.2E-06	8.0E-07	4.9E-07	2.9E-07	2.3E-07	2.2E-07	1.3E-07	1.1E-07
SW	0.	1.8E-05	2.5E-06	1.1E-06	6.6E-07	4.9E-07	2.8E-07	2.2E-07	1.7E-07	1.4E-07	1.1E-07
WSW	0.	1.5E-05	1.8E-06	7.5E-07	3.8E-07	2.8E-07	1.8E-07	1.5E-07	1.2E-07	9.5E-08	7.9E-08
W	0.	1.3E-05	1.5E-06	6.9E-07	3.3E-07	2.2E-07	1.5E-07	1.1E-07	9.4E-08	8.1E-08	5.2E-08
WNW	0.	1.0E-05	1.2E-06	6.0E-07	2.8E-07	1.6E-07	1.3E-07	8.6E-08	7.2E-08	5.4E-08	4.4E-08
NW	0.	7.1E-06	9.7E-07	3.5E-07	2.1E-07	1.6E-07	1.2E-07	7.8E-08	6.6E-08	4.6E-08	3.9E-08
NNW	0.	8.9E-06	1.3E-06	5.4E-07	2.7E-07	1.7E-07	1.3E-07	1.1E-07	9.3E-08	6.6E-08	5.3E-08
N	0.	9.2E-06	1.4E-06	5.1E-07	3.3E-07	2.1E-07	1.6E-07	1.3E-07	1.1E-07	8.1E-08	7.0E-08

Number of Valid Observations	8678
Number of Invalid Observations	82
Number of Calms Lower Level	125
Number of Calms Upper Level	0

TABLE A-5

Depleted χ/Q Values at the Standard Distances for Releases from the Turbine Buildings

Carolina Power & Light Company - Brunswick
Release Type: Annual
Release Mode: Ground Level
Variable: Relative Concentration (Sec./Cubic Meter)
Calculation Points: Standard
Model: Straight Line (ANNX009)
Application of Terrain Correction Factors: Yes
Number of Observations: 8678

Base Distance in Miles/Kilometers

Aftd Sect	Design Dist Mi	.25 .40	.75 1.21	1.25 2.01	1.75 2.82	2.25 3.62	2.75 4.42	3.25 5.23	3.75 6.03	4.25 6.84	4.75 7.64
NNE	0.	1.5E-05	2.0E-06	8.1E-07	4.8E-07	2.8E-07	1.9E-07	1.5E-07	1.1E-07	8.9E-08	6.8E-08
NE	0.	1.8E-05	2.6E-06	1.1E-06	6.1E-07	3.7E-07	2.6E-07	2.1E-07	1.5E-07	1.2E-07	1.0E-07
ENE	0.	2.0E-05	2.9E-06	1.0E-06	5.5E-07	3.9E-07	2.8E-07	2.2E-07	1.6E-07	1.3E-07	1.0E-07
E	0.	2.7E-05	3.4E-06	1.3E-06	7.6E-07	5.3E-07	3.5E-07	2.6E-07	2.2E-07	1.6E-07	1.4E-07
ESE	0.	3.0E-05	4.6E-06	1.9E-06	8.7E-07	5.3E-07	3.5E-07	2.8E-07	2.3E-07	1.7E-07	1.4E-07
SE	0.	2.2E-05	3.1E-06	1.3E-06	6.6E-07	3.9E-07	2.6E-07	1.9E-07	1.6E-07	1.3E-07	1.2E-07
SSE	0.	4.2E-05	6.8E-06	2.7E-06	1.5E-06	9.9E-07	6.1E-07	4.0E-07	3.0E-07	2.4E-07	1.9E-07
S	0.	2.5E-05	3.5E-06	1.3E-06	8.1E-07	5.9E-07	3.9E-07	2.9E-07	2.2E-07	1.6E-07	1.4E-07
SSW	0.	1.9E-05	2.5E-06	1.0E-06	6.6E-07	4.0E-07	2.3E-07	1.8E-07	1.6E-07	1.0E-07	8.3E-08
SW	0.	1.7E-05	2.4E-06	9.8E-07	5.5E-07	3.9E-07	2.3E-07	1.7E-07	1.3E-07	1.1E-07	9.0E-08
WSW	0.	1.4E-05	1.5E-06	6.4E-07	3.2E-07	2.2E-07	1.4E-07	1.1E-07	9.2E-08	7.0E-08	5.9E-08
W	0.	1.2E-05	1.3E-06	5.9E-07	2.7E-07	1.8E-07	1.1E-07	8.3E-08	7.2E-08	6.1E-08	3.8E-08
WNW	0.	9.9E-06	1.1E-06	5.2E-07	2.4E-07	1.3E-07	1.0E-07	6.6E-08	5.5E-08	4.1E-08	3.3E-08
NW	0.	6.7E-06	8.7E-07	3.0E-07	1.8E-07	1.3E-07	9.4E-08	6.1E-08	5.1E-08	3.5E-08	3.0E-08
NNW	0.	8.5E-06	1.1E-06	4.7E-07	2.2E-07	1.3E-07	1.1E-07	8.3E-08	7.2E-08	5.0E-08	3.9E-08
N	0.	8.6E-06	1.2E-06	4.4E-07	2.8E-07	1.7E-07	1.3E-07	1.0E-07	8.2E-08	6.1E-08	5.1E-08

Number of Valid Observations	8678
Number of Invalid Observations	82
Number of Calms Lower Level	125
Number of Calms Upper Level	0

TABLE A-6

D/Q Values at the Standard Distances for Releases from the Turbine Buildings

Carolina Power & Light Company - Brunswick
Release Type: Annual
Release Mode: Ground Level
Variable: Relative Deposition (Meter**-2)
Calculation Points: Standard
Model: Straight Line (ANNX009)
Application of Terrain Correction Factors: Yes
Number of Observations: 8678

Base Distance in Miles/Kilometers

Aftd Sect	Design Dist Mi	.25 .40	.75 1.21	1.25 2.01	1.75 2.82	2.25 3.62	2.75 4.42	3.25 5.23	3.75 6.03	4.25 6.84	4.75 7.64
NNE	0.	8.6E-08	1.3E-08	4.8E-09	2.8E-09	1.5E-09	9.9E-10	7.7E-10	5.7E-10	4.3E-10	3.3E-10
NE	0.	1.3E-07	1.9E-08	7.6E-09	4.0E-09	2.3E-09	1.6E-09	1.3E-09	8.8E-10	6.8E-10	5.7E-10
ENE	0.	5.8E-08	9.4E-09	3.2E-09	1.6E-09	1.1E-09	7.5E-10	5.5E-10	3.9E-10	3.0E-10	2.3E-10
E	0.	6.2E-08	8.6E-09	3.1E-09	1.7E-09	1.1E-09	6.9E-10	5.1E-10	3.9E-10	2.9E-10	2.3E-10
ESE	0.	7.2E-08	1.3E-08	5.0E-09	2.2E-09	1.2E-09	7.6E-10	6.0E-10	4.7E-10	3.5E-10	2.6E-10
SE	0.	5.1E-08	8.4E-09	3.3E-09	1.6E-09	8.6E-10	5.6E-10	3.8E-10	3.3E-10	2.6E-10	2.2E-10
SSE	0.	8.2E-08	1.5E-08	5.8E-09	3.0E-09	1.8E-09	1.1E-09	6.8E-10	4.9E-10	3.8E-10	2.9E-10
S	0.	5.6E-08	8.3E-09	3.2E-09	1.8E-09	1.2E-09	7.5E-10	5.4E-10	3.9E-10	2.9E-10	2.3E-10
SSW	0.	5.2E-08	7.7E-09	3.0E-09	1.9E-09	1.1E-09	5.8E-10	4.3E-10	3.8E-10	2.2E-10	1.8E-10
SW	0.	7.5E-08	1.1E-08	4.3E-09	2.4E-09	1.6E-09	8.8E-10	6.4E-10	4.6E-10	3.7E-10	3.1E-10
WSW	0.	6.0E-08	7.0E-09	2.7E-09	1.3E-09	8.8E-10	5.2E-10	4.0E-10	3.3E-10	2.4E-10	2.0E-10
W	0.	4.1E-08	5.1E-09	2.0E-09	9.2E-10	5.7E-10	3.6E-10	2.6E-10	2.1E-10	1.7E-10	1.0E-10
WNW	0.	3.4E-08	3.8E-09	1.7E-09	7.3E-10	3.9E-10	3.0E-10	1.9E-10	1.5E-10	1.1E-10	8.4E-11
NW	0.	2.7E-08	3.5E-09	1.1E-09	6.6E-10	4.7E-10	3.3E-10	2.1E-10	1.7E-10	1.1E-10	9.6E-11
NNW	0.	3.6E-08	5.0E-09	1.9E-09	8.5E-10	5.0E-10	3.8E-10	2.8E-10	2.4E-10	1.6E-10	1.3E-10
N	0.	4.4E-08	6.3E-09	2.1E-09	1.3E-09	8.0E-10	5.6E-10	4.5E-10	3.5E-10	2.5E-10	2.1E-10

Number of Valid Observations	8678
Number of Invalid Observations	82
Number of Calms Lower Level	125
Number of Calms Upper Level	0

TABLE A-7

χ/Q Values at the Special Locations for Releases From the Reactor Buildings

Carolina Power & Light Company - Brunswick
Release Type: Annual
Release Mode: Mixed Mode
Variable: Relative Concentration (Sec./Cubic Meter)
Calculation Points: Special
Model: Straight Line (ANNX009)
Application of Terrain Correction Factors: Yes
Number of Observations: 8678

Affected Sector	Site Boundary	Dairy*	Meat*	Resident*	Garden*
NNE	1.0E-07	0.	7.8E-08	7.8E-08	7.8E-08
NE	2.0E-07	4.1E-08	0.	0.	0.
ENE	6.5E-08	0.	0.	0.	0.
E	4.8E-08	0.	3.5E-08	3.5E-08	0.
ESE	6.9E-08	0.	6.9E-08	3.9E-08	3.9E-08
SE	4.1E-08	0.	4.1E-08	4.1E-08	0.
SSE	7.6E-08	0.	7.6E-08	7.6E-08	7.6E-08
S	4.5E-08	0.	0.	3.5E-08	2.8E-08
SSW	4.7E-08	0.	4.7E-08	4.7E-08	4.7E-08
SW	6.4E-08	0.	6.4E-08	6.4E-08	6.4E-08
WSW	4.1E-08	0.	3.9E-08	4.3E-08	4.3E-08
W	3.4E-08	0.	0.	3.4E-08	3.4E-08
WNW	1.8E-08	0.	0.	1.8E-08	1.8E-08
NW	1.9E-08	0.	0.	1.9E-08	1.9E-08
NNW	3.2E-08	0.	0.	3.2E-08	3.2E-08
N	4.0E-08	0.	0.	4.0E-08	4.0E-08

*A zero indicates that this point was not calculated.

TABLE A-8

Depleted χ/Q Values at the Special Locations for Releases From the Reactor Buildings

Carolina Power & Light Company - Brunswick
Release Type: Annual
Release Mode: Mixed Mode
Variable: Relative Depleted Concentration (Sec./Cubic Meter)
Calculation Points: Special
Model: Straight Line (ANNX009)
Application of Terrain Correction Factors: Yes
Number of Observations: 8678

Affected Sector	Site Boundary	Dairy*	Meat*	Resident*	Garden*
NNE	9.1E-08	0.	7.8E-08	7.8E-08	7.8E-08
NE	1.9E-07	3.7E-08	0.	0.	0.
ENE	6.1E-08	0.	0.	0.	0.
E	4.4E-08	0.	3.2E-08	3.2E-08	0.
ESE	6.4E-08	0.	6.4E-08	3.7E-08	3.7E-08
SE	3.8E-08	0.	3.8E-08	3.8E-08	0.
SSE	7.1E-08	0.	7.1E-08	7.1E-08	7.1E-08
S	4.2E-08	0.	0.	3.3E-08	2.7E-08
SSW	4.3E-08	0.	4.4E-08	4.4E-08	4.4E-08
SW	6.0E-08	0.	6.0E-08	6.0E-08	6.0E-08
WSW	3.9E-08	0.	3.8E-08	4.2E-08	4.2E-08
W	3.3E-08	0.	0.	3.3E-08	3.3E-08
WNW	1.7E-08	0.	0.	1.7E-08	1.7E-08
NW	1.8E-08	0.	0.	1.8E-08	1.8E-08
NNW	3.0E-08	0.	0.	3.0E-08	3.0E-08
N	3.7E-08	0.	0.	3.7E-08	3.7E-08

*A zero indicates that this point was not calculated.

TABLE A-9

D/Q Values at the Special Locations for Releases From the Reactor Buildings

Carolina Power & Light Company - Brunswick
Release Type: Annual
Release Mode: Mixed Mode
Variable: Relative Deposition (Meter**-2)
Calculation Points: Special
Model: Straight Line (ANNX009)
Application of Terrain Correction Factors: Yes
Number of Observations: 8678

Affected Sector	Site Boundary	Dairy*	Meat*	Resident*	Garden*
NNE	2.0E-09	0.	1.1E-09	1.1E-09	1.1E-09
NE	4.3E-09	2.7E-10	0.	0.	0.
ENE	1.1E-09	0.	0.	0.	0.
E	4.6E-10	0.	2.5E-10	2.5E-10	0.
ESE	1.1E-09	0.	1.1E-09	3.3E-10	3.3E-10
SE	7.6E-10	0.	7.6E-10	7.6E-10	0.
SSE	1.2E-09	0.	1.2E-09	1.2E-09	1.2E-09
S	5.7E-10	0.	0.	3.4E-10	2.3E-10
SSW	7.7E-10	0.	5.2E-10	5.2E-10	5.2E-10
SW	1.2E-09	0.	1.2E-09	1.2E-09	1.2E-09
WSW	8.9E-10	0.	4.1E-10	5.9E-10	5.9E-10
W	6.6E-10	0.	0.	6.6E-10	6.6E-10
WNW	2.7E-10	0.	0.	2.7E-10	2.7E-10
NW	3.1E-10	0.	0.	3.1E-10	3.1E-10
NNW	4.0E-10	0.	0.	4.0E-10	4.0E-10
N	5.6E-10	0.	0.	5.6E-10	5.6E-10

*A zero indicates that this point was not calculated.

TABLE A-10

χ/Q Values at the Standard Distances for Releases from the Reactor Buildings

Carolina Power & Light Company - Brunswick
Release Type: Annual
Release Mode: Mixed Mode
Variable: Relative Concentration (Sec./Cubic Meter)
Calculation Points: Standard
Model: Straight Line (ANNX009)
Application of Terrain Correction Factors: Yes
Number of Observations: 8678

Base Distance in Miles/Kilometers

Aftd Sect	Design Dist Mi	.25 .40	.75 1.21	1.25 2.01	1.75 2.82	2.25 3.62	2.75 4.42	3.25 5.23	3.75 6.03	4.25 6.84	4.75 7.64
NNE	0.	5.6E-07	1.0E-07	7.8E-08	6.3E-08	5.2E-08	4.1E-08	3.6E-08	3.1E-08	2.7E-08	2.4E-08
NE	0.	5.5E-07	2.0E-07	1.5E-07	1.2E-07	9.4E-08	7.6E-08	6.3E-08	5.3E-08	4.6E-08	4.1E-08
ENE	0.	1.6E-06	6.5E-08	5.8E-08	5.4E-08	4.9E-08	4.3E-08	3.9E-08	3.5E-08	3.1E-08	2.9E-08
E	0.	2.9E-07	4.8E-08	3.5E-08	2.9E-08	2.7E-08	2.3E-08	2.2E-08	1.8E-08	1.7E-08	1.5E-08
ESE	0.	1.2E-07	6.9E-08	5.0E-08	3.9E-08	3.5E-08	3.1E-08	2.6E-08	2.3E-08	2.0E-08	1.7E-08
SE	0.	7.8E-08	4.1E-08	3.6E-08	2.7E-08	2.0E-08	1.8E-08	1.7E-08	1.5E-08	1.3E-08	1.2E-08
SSE	0.	2.2E-07	7.6E-08	5.6E-08	4.2E-08	3.5E-08	2.9E-08	2.5E-08	2.2E-08	1.9E-08	1.6E-08
S	0.	4.2E-07	4.5E-08	3.5E-08	2.8E-08	2.5E-08	2.4E-08	2.1E-08	1.8E-08	1.6E-08	1.4E-08
SSW	0.	5.9E-07	4.7E-08	4.7E-08	4.1E-08	3.7E-08	2.9E-08	2.7E-08	2.3E-08	2.0E-08	1.8E-08
SW	0.	1.8E-07	6.4E-08	5.5E-08	4.4E-08	3.8E-08	3.1E-08	2.7E-08	2.4E-08	2.1E-08	1.9E-08
WSW	0.	8.9E-08	4.1E-08	4.3E-08	3.9E-08	3.4E-08	2.8E-08	2.5E-08	2.5E-08	2.2E-08	1.9E-08
W	0.	3.6E-08	3.4E-08	3.8E-08	3.7E-08	3.1E-08	2.8E-08	2.6E-08	2.2E-08	2.1E-08	1.8E-08
WNW	0.	4.1E-08	1.8E-08	2.2E-08	2.4E-08	2.3E-08	2.0E-08	1.8E-08	1.6E-08	1.4E-08	1.2E-08
NW	0.	3.0E-08	1.9E-08	2.3E-08	2.0E-08	1.9E-08	1.9E-08	1.6E-08	1.4E-08	1.3E-08	1.2E-08
NNW	0.	4.9E-07	3.2E-08	2.7E-08	2.4E-08	2.0E-08	1.8E-08	1.6E-08	1.5E-08	1.4E-08	1.3E-08
N	0.	6.3E-07	4.0E-08	3.0E-08	2.9E-08	2.7E-08	2.6E-08	2.6E-08	2.1E-08	1.8E-08	1.7E-08

Number of Valid Observations 8678
Number of Invalid Observations 82
Number of Calms Lower Level 125
Number of Calms Upper Level 0

TABLE A-11

Depleted x/Q Values at the Standard Distances for Releases from the Reactor Buildings

Carolina Power & Light Company - Brunswick
Release Type: Annual
Release Mode: Mixed Mode
Variable: Relative Depleted Concentration (Sec./Cubic Meter)
Calculation Points: Standard
Model: Straight Line (ANNX009)
Application of Terrain Correction Factors: Yes
Number of Observations: 8678

Base Distance in Miles/Kilometers

Aftd Sect	Design Dist Mi	.25 .40	.75 1.21	1.25 2.01	1.75 2.82	2.25 3.62	2.75 4.42	3.25 5.23	3.75 6.03	4.25 6.84	4.75 7.64
NNE	0.	5.4E-07	9.1E-08	7.8E-08	5.9E-08	4.9E-08	3.8E-08	3.3E-08	2.8E-08	2.5E-08	2.2E-08
NE	0.	5.3E-07	1.9E-07	1.4E-07	1.1E-07	8.7E-08	7.1E-08	5.9E-08	5.0E-08	4.3E-08	3.7E-08
ENE	0.	1.5E-06	6.1E-08	5.6E-08	5.2E-08	4.7E-08	4.1E-08	3.7E-08	3.3E-08	3.0E-08	2.8E-08
E	0.	2.8E-07	4.4E-08	3.2E-08	2.7E-08	2.5E-08	2.2E-08	2.1E-08	1.8E-08	1.6E-08	1.4E-08
ESE	0.	1.1E-07	6.4E-08	4.6E-08	3.7E-08	3.3E-08	2.9E-08	2.4E-08	2.2E-08	1.8E-08	1.6E-08
SE	0.	7.4E-08	3.8E-08	3.3E-08	2.5E-08	1.9E-08	1.7E-08	1.5E-08	1.4E-08	1.2E-08	1.2E-08
SSE	0.	2.1E-07	7.1E-08	5.2E-08	3.9E-08	3.2E-08	2.6E-08	2.3E-08	2.0E-08	1.7E-08	1.5E-08
S	0.	4.0E-07	4.2E-08	3.3E-08	2.7E-08	2.3E-08	2.3E-08	1.9E-08	1.7E-08	1.5E-08	1.3E-08
SSW	0.	5.9E-07	4.3E-08	4.4E-08	3.9E-08	3.5E-08	2.7E-08	2.6E-08	2.2E-08	1.9E-08	1.7E-08
SW	0.	1.7E-07	6.0E-08	5.2E-08	4.2E-08	3.6E-08	2.9E-08	2.5E-08	2.2E-08	2.0E-08	1.7E-08
WSW	0.	8.2E-08	3.9E-08	4.2E-08	3.8E-08	3.2E-08	2.7E-08	2.4E-08	2.4E-08	2.1E-08	1.8E-08
W	0.	3.4E-08	3.3E-08	3.6E-08	3.6E-08	3.0E-08	2.7E-08	2.5E-08	2.1E-08	2.0E-08	1.7E-08
WNW	0.	3.9E-08	1.7E-08	2.1E-08	2.3E-08	2.2E-08	1.9E-08	1.7E-08	1.6E-08	1.3E-08	1.1E-08
NW	0.	2.9E-08	1.8E-08	2.3E-08	2.0E-08	1.8E-08	1.8E-08	1.6E-08	1.4E-08	1.3E-08	1.2E-08
NNW	0.	4.5E-07	3.0E-08	2.5E-08	2.3E-08	1.9E-08	1.7E-08	1.5E-08	1.4E-08	1.3E-08	1.2E-08
N	0.	5.8E-07	3.7E-08	2.9E-08	2.8E-08	2.6E-08	2.5E-08	2.4E-08	2.0E-08	1.7E-08	1.6E-08

Number of Valid Observations 8678
Number of Invalid Observations 82
Number of Calms Lower Level 12
Number of Calms Upper Level 0

TABLE A-12

D/Q Values at the Standard Distances for Releases from the Reactor Buildings

Carolina Power & Light Company - Brunswick
Release Type: Annual
Release Mode: Mixed Mode
Variable: Relative Deposition (Meter**-2)
Calculation Points: Standard
Model: Straight Line (ANNX009)
Application of Terrain Correction Factors: Yes
Number of Observations: 8678

Base Distance in Miles/Kilometers

Aftd Sect	Design Dist Mi	.25 .40	.75 1.21	1.25 2.01	1.75 2.82	2.25 3.62	2.75 4.42	3.25 5.23	3.75 6.03	4.25 6.84	4.75 7.64
NNE	0.	1.1E-08	2.0E-09	1.1E-09	7.2E-10	5.0E-10	3.5E-10	2.8E-10	2.2E-10	1.7E-10	1.5E-10
NE	0.	1.1E-08	4.3E-09	2.3E-09	1.5E-09	9.8E-10	7.2E-10	5.3E-10	4.2E-10	3.3E-10	2.7E-10
ENE	0.	1.9E-08	1.1E-09	5.8E-10	3.9E-10	2.8E-10	2.2E-10	1.7E-10	1.4E-10	1.1E-10	9.7E-11
E	0.	2.1E-09	4.6E-10	2.5E-10	1.6E-10	1.2E-10	9.0E-11	7.5E-11	5.7E-11	4.8E-11	3.8E-11
ESE	0.	1.3E-09	1.1E-09	5.4E-10	3.3E-10	2.4E-10	1.9E-10	1.3E-10	1.1E-10	8.3E-11	6.9E-11
SE	0.	1.3E-09	7.6E-10	4.9E-10	2.8E-10	1.8E-10	1.3E-10	1.1E-10	8.9E-11	6.7E-11	6.1E-11
SSE	0.	2.4E-09	1.2E-09	6.7E-10	4.1E-10	2.8E-10	2.1E-10	1.6E-10	1.3E-10	1.0E-10	8.2E-11
S	0.	3.6E-09	5.7E-10	3.4E-10	2.3E-10	1.7E-10	1.4E-10	1.0E-10	8.2E-11	6.5E-11	5.5E-11
SSW	0.	8.0E-09	7.7E-10	5.2E-10	3.5E-10	2.6E-10	1.8E-10	1.5E-10	1.1E-10	9.3E-11	7.4E-11
SW	0.	3.4E-09	1.2E-09	7.3E-10	4.5E-10	3.3E-10	2.3E-10	1.7E-10	1.4E-10	1.2E-10	9.4E-11
WSW	0.	1.8E-09	8.9E-10	5.9E-10	4.1E-10	2.9E-10	2.1E-10	1.7E-10	1.5E-10	1.2E-10	1.0E-10
W	0.	7.9E-10	6.6E-10	4.3E-10	2.9E-10	1.9E-10	1.5E-10	1.2E-10	8.6E-11	7.7E-11	6.4E-11
WNW	0.	5.8E-10	2.7E-10	2.0E-10	1.7E-10	1.3E-10	8.8E-11	6.8E-11	5.5E-11	4.2E-11	3.3E-11
NW	0.	5.4E-10	3.1E-10	2.3E-10	1.5E-10	1.1E-10	8.9E-11	6.9E-11	5.4E-11	4.4E-11	3.9E-11
NNW	0.	5.3E-09	4.0E-10	2.2E-10	1.6E-10	1.0E-10	7.6E-11	6.1E-11	5.0E-11	4.2E-11	3.4E-11
N	0.	8.7E-09	5.6E-10	2.8E-10	2.1E-10	1.6E-10	1.4E-10	1.1E-10	8.1E-11	6.4E-11	5.7E-11

Number of Valid Observations 8678
Number of Invalid Observations 82
Number of Calms Lower Level 12
Number of Calms Upper Level 0

TABLE A-13

χ/Q Values at the Special Locations for Releases From the Stack

Carolina Power & Light Company - Brunswick
Release Type: Annual
Release Mode: Elevated
Variable: Relative Concentration
Calculation Points: Special
Model: Straight Line
Application of Terrain Correction Factors: Yes
Number of Observations: 8678

Accounting for Stack Center Offset

Affected Sector	Site Boundary	Dairy*	Meat*	Resident*	Garden*
NNE	1.3E-08	0.	2.3E-08	2.3E-08	2.3E-08
NE	2.5E-08	2.4E-08	0.	0.	0.
ENE	7.2E-09	0.	0.	0.	0.
E	3.6E-09	0.	7.6E-09	7.6E-09	0.
ESE	7.7E-09	0.	7.7E-09	1.3E-08	1.3E-08
SE	8.7E-09	0.	8.7E-09	8.7E-09	0.
SSE	1.2E-08	0.	1.2E-08	1.2E-08	1.2E-08
S	4.7E-09	0.	0.	8.5E-09	9.6E-09
SSW	6.0E-09	0.	1.4E-08	1.4E-08	1.4E-08
SW	1.3E-08	0.	1.3E-08	1.3E-08	1.3E-08
WSW	9.0E-09	0.	1.8E-08	1.6E-08	1.6E-08
W	1.0E-08	0.	0.	1.0E-08	1.0E-08
WNW	5.3E-09	0.	0.	5.3E-09	5.3E-09
NW	6.5E-09	0.	0.	6.5E-09	6.5E-09
NNW	4.2E-09	0.	0.	4.2E-09	4.2E-09
N	4.5E-09	0.	0.	4.5E-09	4.5E-09

*A zero indicates that this point was not calculated.

TABLE A-14

Depleted χ/Q Values at the Special Locations for Releases From the Stack

Carolina Power & Light Company - Brunswick
Release Type: Annual
Release Mode: Elevated
Variable: Relative Depleted Concentrations
Calculation Points: Special
Model: Straight Line
Application of Terrain Correction Factors: Yes
Number of Observations: 8678

Accounting for Stack Center Offset

Affected Sector	Site Boundary	Dairy*	Meat*	Resident*	Garden*
NNE	1.2E-08	0.	2.2E-08	2.2E-08	2.2E-08
NE	2.5E-08	2.3E-08	0.	0.	0.
ENE	7.1E-09	0.	0.	0.	0.
E	3.6E-09	0.	7.6E-09	7.6E-09	0.
ESE	7.5E-09	0.	7.5E-09	1.2E-08	1.2E-08
SE	8.7E-09	0.	8.7E-09	8.7E-09	0.
SSE	1.2E-08	0.	1.2E-08	1.2E-08	1.2E-08
S	4.6E-09	0.	0.	8.5E-09	9.6E-09
SSW	6.0E-09	0.	1.4E-08	1.4E-08	1.4E-08
SW	1.3E-08	0.	1.3E-08	1.3E-08	1.3E-08
WSW	9.0E-09	0.	9.2E-08	1.5E-08	1.5E-08
W	1.0E-08	0.	0.	1.0E-08	1.0E-08
WNW	5.1E-09	0.	0.	5.1E-09	5.1E-09
NW	6.5E-09	0.	0.	6.5E-09	6.5E-09
NNW	4.1E-09	0.	0.	4.1E-09	4.1E-09
N	4.5E-09	0.	0.	4.5E-09	4.5E-09

*A zero indicates that this point was not calculated.

TABLE A-15

D/Q Values at the Special Locations for Releases from the Stack

Carolina Power & Light Company - Brunswick
Release Type: Annual
Release Mode: Elevated
Variable: Relative Deposition (Meter**-2)
Calculation Points: Special
Model: Straight Line
Application of Terrain Correction Factors: Yes
Number of Observations: 8678

Accounting for Stack Center Offset

Affected Sector	Site Boundary	Dairy*	Meat*	Resident*	Garden*
NNE	6.0E-10	0.	5.3E-10	5.3E-10	5.3E-10
NE	1.4E-09	2.2E-10	0.	0.	0.
ENE	3.2E-10	0.	0.	0.	0.
E	1.6E-10	0.	1.3E-10	1.3E-10	0.
ESE	4.1E-10	0.	4.1E-10	2.0E-10	2.0E-10
SE	4.2E-10	0.	4.2E-10	4.2E-10	0.
SSE	5.4E-10	0.	5.4E-10	5.4E-10	5.4E-10
S	2.0E-10	0.	0.	1.9E-10	1.4E-10
SSW	2.7E-10	0.	2.9E-10	2.9E-10	2.9E-10
SW	5.6E-10	0.	5.6E-10	5.6E-10	5.6E-10
WSW	3.8E-10	0.	3.0E-10	3.6E-10	3.6E-10
W	3.9E-10	0.	0.	3.9E-10	3.9E-10
WNW	1.7E-10	0.	0.	1.7E-10	1.7E-10
NW	2.0E-10	0.	0.	2.0E-10	2.0E-10
NNW	1.5E-10	0.	0.	1.5E-10	1.5E-10
N	1.9E-10	0.	0.	1.9E-10	1.9E-10

*A zero indicates that this point was not calculated.

TABLE A-16

χ/Q Values at the Standard Distances for Releases from the Stack

Carolina Power & Light Company - Brunswick
Release Type: Annual
Release Mode: Elevated
Variable: Relative Concentration (Sec./Cubic Meter)
Calculation Points: Standard
Model: Straight Line (ANNX009)
Application of Terrain Correction Factors: Yes
Number of Observations: 8678

Base Distance in Miles/Kilometers

Aftd Sect	Design Dist Mi	.25 .40	.75 1.21	1.25 2.01	1.75 2.82	2.25 3.62	2.75 4.42	3.25 5.23	3.75 6.03	4.25 6.84	4.75 7.64
NNE	0.	1.5E-09	1.3E-08	2.3E-08	2.5E-08	2.4E-08	2.1E-08	1.9E-08	1.7E-08	1.5E-08	1.4E-08
NE	0.	2.5E-09	2.5E-08	4.0E-08	4.4E-08	4.2E-08	3.8E-08	3.3E-08	3.0E-08	2.6E-08	2.4E-08
ENE	0.	8.7E-10	7.2E-09	1.6E-08	2.1E-08	2.2E-08	2.1E-08	2.0E-08	1.9E-08	1.8E-08	1.7E-08
E	0.	7.5E-10	3.6E-09	7.6E-09	8.9E-09	1.0E-08	9.3E-09	9.4E-09	8.1E-09	7.6E-09	7.5E-09
ESE	0.	1.1E-09	7.7E-09	1.1E-08	1.3E-08	1.3E-08	1.3E-08	1.1E-08	1.0E-08	9.3E-09	8.5E-09
SE	0.	1.6E-09	8.7E-09	1.1E-08	1.0E-08	9.1E-09	8.9E-09	8.0E-09	7.3E-09	6.5E-09	6.5E-09
SSE	0.	1.5E-09	1.2E-08	1.6E-08	1.6E-08	1.5E-08	1.3E-08	1.3E-08	1.1E-08	1.0E-08	8.9E-09
S	0.	7.7E-10	4.7E-09	8.5E-09	9.6E-09	9.7E-09	1.1E-08	9.4E-09	8.3E-09	7.7E-09	7.2E-09
SSW	0.	4.9E-10	6.0E-09	1.4E-08	1.6E-08	1.7E-08	1.4E-08	1.4E-08	1.2E-08	1.1E-08	1.0E-08
SW	0.	1.5E-09	1.3E-08	1.8E-08	1.8E-08	1.8E-08	1.6E-08	1.4E-08	1.3E-08	1.1E-08	1.0E-08
WSW	0.	1.5E-09	9.0E-09	1.6E-08	1.8E-08	1.8E-08	1.6E-08	1.4E-08	1.4E-08	1.3E-08	1.2E-08
W	0.	1.4E-09	1.0E-08	1.5E-08	1.7E-08	1.6E-08	1.5E-08	1.4E-08	1.2E-08	1.2E-08	1.1E-08
WNW	0.	8.4E-10	5.3E-09	8.4E-09	1.1E-08	1.2E-08	1.0E-08	9.3E-09	8.6E-09	7.3E-09	6.7E-09
NW	0.	1.0E-09	6.5E-09	1.0E-08	1.0E-08	1.0E-08	1.0E-08	9.5E-09	8.6E-09	7.6E-09	7.5E-09
NNW	0.	1.1E-09	4.2E-09	7.6E-09	9.2E-09	8.5E-09	8.0E-09	7.4E-09	7.0E-09	6.9E-09	6.1E-09
N	0.	8.1E-10	4.5E-09	8.4E-09	1.1E-08	1.2E-08	1.3E-08	1.3E-08	1.1E-08	9.3E-09	9.2E-09

Number of Valid Observations 8678
Number of Invalid Observations 82
Number of Calms Lower Level 0
Number of Calms Upper Level 0

TABLE A-17

Depleted χ/Q Values at the Standard Distances for Releases from the Stack

Carolina Power & Light Company - Brunswick
Release Type: Annual
Release Mode: Elevated
Variable: Relative Depleted Concentration (Sec./Cubic Meter)
Calculation Points: Standard
Model: Straight Line (ANNX009)
Application of Terrain Correction Factors: Yes
Number of Observations: 8678

Base Distance in Miles/Kilometers

Aftd Sect	Design Dist Mi	.25 .40	.75 1.21	1.25 2.01	1.75 2.82	2.25 3.62	2.75 4.42	3.25 5.23	3.75 6.03	4.25 6.84	4.75 7.64
NNE	0.	1.5E-09	1.2E-08	2.2E-08	2.4E-08	2.4E-08	2.1E-08	1.9E-08	1.7E-08	1.5E-08	1.4E-08
NE	0.	2.5E-09	2.5E-08	4.0E-08	4.3E-08	4.1E-08	3.7E-08	3.2E-08	2.9E-08	2.5E-08	2.3E-08
ENE	0.	8.7E-10	7.1E-09	1.6E-08	2.1E-08	2.2E-08	2.0E-08	1.9E-08	1.8E-08	1.7E-08	1.7E-08
E	0.	7.5E-10	3.6E-09	7.6E-09	8.9E-09	9.3E-09	9.3E-09	9.4E-09	8.1E-09	7.6E-09	6.8E-09
ESE	0.	1.1E-09	7.5E-09	1.1E-08	1.2E-08	1.3E-08	1.3E-08	1.1E-08	1.0E-08	9.3E-09	8.2E-09
SE	0.	1.6E-09	8.7E-09	1.1E-08	1.0E-08	8.5E-09	8.2E-09	8.0E-09	7.2E-09	6.3E-09	6.3E-09
SSE	0.	1.5E-09	1.2E-08	1.6E-08	1.5E-08	1.4E-08	1.3E-08	1.2E-08	1.0E-08	9.3E-09	8.1E-09
S	0.	7.7E-10	4.6E-09	8.5E-09	9.6E-09	9.7E-09	1.1E-08	9.4E-09	8.2E-09	7.4E-09	6.9E-09
SSW	0.	4.9E-10	6.0E-09	1.4E-08	1.6E-08	1.6E-08	1.4E-08	1.4E-08	1.1E-08	1.0E-08	9.3E-09
SW	0.	1.5E-09	1.3E-08	1.8E-08	1.0E-08	1.8E-08	1.5E-08	1.4E-08	1.2E-08	1.1E-08	1.0E-08
WSW	0.	1.5E-09	9.0E-09	1.5E-08	9.2E-08	1.7E-08	1.5E-08	1.3E-08	1.4E-08	1.2E-08	1.1E-08
W	0.	1.4E-09	1.0E-08	1.5E-08	1.1E-08	1.5E-08	1.5E-08	1.4E-08	1.2E-08	1.2E-08	1.1E-08
WNW	0.	8.4E-10	5.1E-09	8.4E-09	1.1E-08	1.2E-08	1.0E-08	9.3E-09	8.6E-09	7.3E-09	6.5E-09
NW	0.	1.0E-09	6.5E-09	1.0E-08	1.0E-08	9.6E-09	1.0E-08	8.7E-09	7.8E-09	7.3E-09	7.1E-09
NNW	0.	1.1E-09	4.1E-09	7.5E-09	9.2E-09	8.5E-09	8.0E-09	7.3E-09	6.8E-09	6.6E-09	6.0E-09
N	0.	8.1E-10	4.5E-09	8.4E-09	1.1E-08	1.1E-08	1.3E-08	1.3E-08	1.0E-08	9.3E-09	9.2E-09

Number of Valid Observations 8678
Number of Invalid Observations 82
Number of Calms Lower Level 0
Number of Calms Upper Level 0

TABLE A-18

D/Q Values at the Standard Distances for Releases from the Stack

Carolina Power & Light Company - Brunswick
Release Type: Annual
Release Mode: Elevated
Variable: Relative Deposition (Meter**-2)
Calculation Points: Standard
Model: Straight Line (ANNX009)
Application of Terrain Correction Factors: Yes
Number of Observations: 8678

Base Distance in Miles/Kilometers

Aftd Sect	Design Dist Mi	.25 .40	.75 1.21	1.25 2.01	1.75 2.82	2.25 3.62	2.75 4.42	3.25 5.23	3.75 6.03	4.25 6.84	4.75 7.64
NNE	0.	1.2E-09	6.0E-10	5.3E-10	4.3E-10	3.4E-10	2.5E-10	2.0E-10	1.6E-10	1.4E-10	1.2E-10
NE	0.	1.4E-09	1.4E-09	1.1E-09	8.8E-10	6.7E-10	5.2E-10	3.9E-10	3.1E-10	2.6E-10	2.2E-10
ENE	0.	1.8E-09	3.2E-10	3.0E-10	2.5E-10	2.0E-10	1.6E-10	1.3E-10	1.1E-10	9.3E-11	8.1E-11
E	0.	2.2E-10	1.6E-10	1.3E-10	1.0E-10	8.7E-11	6.6E-11	5.7E-11	4.4E-11	3.7E-11	3.1E-11
ESE	0.	1.9E-10	4.1E-10	2.7E-10	2.0E-10	1.7E-10	1.4E-10	1.1E-10	8.2E-11	6.6E-11	5.6E-11
SE	0.	3.2E-10	4.2E-10	3.1E-10	2.1E-10	1.4E-10	1.1E-10	8.7E-11	7.3E-11	5.8E-11	5.3E-11
SSE	0.	5.8E-10	5.4E-10	3.9E-10	2.8E-10	2.1E-10	1.7E-10	1.4E-10	1.1E-10	8.5E-11	7.1E-11
S	0.	5.4E-10	2.0E-10	1.9E-10	1.4E-10	1.1E-10	1.1E-10	8.3E-11	6.6E-11	5.5E-11	4.6E-11
SSW	0.	1.1E-09	2.7E-10	2.9E-10	2.4E-10	1.9E-10	1.4E-10	1.3E-10	9.5E-11	7.9E-11	6.5E-11
SW	0.	7.6E-10	5.6E-10	4.3E-10	3.1E-10	2.4E-10	1.8E-10	1.4E-10	1.1E-10	9.5E-11	8.0E-11
WSW	0.	4.1E-10	3.8E-10	3.6E-10	3.0E-10	2.3E-10	1.7E-10	1.4E-10	1.3E-10	1.0E-10	8.6E-11
W	0.	2.8E-10	3.9E-10	3.0E-10	2.1E-10	1.5E-10	1.3E-10	1.0E-10	7.8E-11	6.9E-11	5.9E-11
WNW	0.	2.4E-10	1.7E-10	1.5E-10	1.4E-10	1.0E-10	7.4E-11	5.8E-11	4.8E-11	3.7E-11	2.9E-11
NW	0.	2.6E-10	2.0E-10	1.7E-10	1.2E-10	8.8E-11	7.5E-11	6.0E-11	4.8E-11	4.0E-11	3.6E-11
NNW	0.	7.2E-10	1.5E-10	1.3E-10	1.0E-10	7.3E-11	5.4E-11	4.3E-11	3.6E-11	3.2E-11	2.6E-11
N	0.	8.1E-10	1.9E-10	1.5E-10	1.3E-10	1.1E-10	9.9E-11	7.9E-11	6.0E-11	4.9E-11	4.4E-11

Number of Valid Observations 8678
Number of Invalid Observations 82
Number of Calms Lower Level 0
Number of Calms Upper Level 0

TABLE A-19

Brunswick Plant Site Information To Be Used
for Ground Level Calculations with NRC "XOQDOQ" Program

Card Type	Columns	Description	Value to be Used in XOQDOQ
1	1	Print input data	1
	38	Calculate annual χ/Qs for points of interest	1
	39	Calculate annual χ/Q averages for site radial segments	1
	41	Print out set distance χ/Qs and D/Qs	1
	55	Calculate annual D/Q averages for the set radial segments	1
	56	Allow depleted χ/Qs (if Decays (1), (2), or (3) are negative)	1
	58	Calculate annual D/Qs for points of interest	1
2	1-80	Title card	N/A
3	1-5	Number of wind velocity categories	7
	6-10	Number of stability categories	7
	11-15	Number of distances within terrain data for each sector	1
	16-20	Total number of hours in joint wind frequency distribution	*
	21-25	Increment in % for which plotted results are to be printed	5
	26-30	Number of titles of receptor types	
	31-35	Number of release exit locations	1
4	1-5	Height of the measured wind	11
	6-20	Half-life (days) used in the χ/Q calculations	101.00 2.26 8.00

*Appropriate data to be supplied.

TABLE A-19 (Cont'd)

Card Type	Columns	Description	Value to be Used in XOQDOQ
5	N/A	N/A	
6	1-80	Joint wind frequency distribution	*
7	1-5	Wind velocity units correction	200.00
	6-75	Maximum wind speed in each wind class (m/sec)	0.75 3.50 7.50 12.50 18.50 25.00 26.00
8	1-80	Distance in meters at which terrain heights are given	All are 100
9	1-80	Terrain heights (in meters, above plant grade) correspond to distances in Card Type 8	All are 0
10	1-25	Number of receptor locations for a particular receptor type	
		Site Boundary	16
		Dairy	1
		Meat	5
		Residence	14
		Garden	11
11	1-16	Title of receptor type for receptor locations	Site Boundary
			Dairy
			Meat
			Residence

*Appropriate data to be supplied.

TABLE A-19 (Cont'd)

Card Type	Columns	Description	Value to be Used in XOQDOQ
	1-16 Cont'd	Title of receptor type for receptor locations (Cont'd)	Garden
12	1-80	Receptor direction and distance	(See Table 1)
13	1-80	Title for release point whose characteristics are described on Card Type 14	*
14	1-5	Vent average velocity (m/sec)	1.0
	6-10	Vent inside diameter (m)	1.0
	11-15	Height of vent release point (m)	0.000
	16-20	Height of the vent's building (m)	56.9
	21-25	Minimum cross-sectional area for the vent's building (m^2)	2120.0
	26-30	Wind height used for vent elevated release	11.0
	31-35	Vent heat emission rate (cal/sec)	0.0
15	1	Identification for release point	A
	2-5	Intermittent releases	0
	6-10	Number of intermittent releases per year for this release point	0
	11-15	Average number of hours per intermittent release	0

*Appropriate data to be supplied.

TABLE A-20

Brunswick Plant Site Information To Be Used
for Elevated Release Calculations with NRC "XOQDOQ" Program

Card Type	Columns	Description	Value to Be Used in XOQDOQ
1	1	Print input data	1
	4	Release to be elevated 100% of the time	1
	38	Calculate annual χ/Qs for points of interest	1
	39	Calculate annual χ/Q averages for site radial segments	1
	41	Print out set distance χ/Qs and D/Qs	1
	55	Calculate annual D/Q averages for the set radial segments	1
	56	Allow depleted χ/Qs (if Decays (1), (2), or (3) are negative)	1
	58	Calculate annual D/Qs for points of interest	1
2	1-80	Title card	N/A
3	1-5	Number of wind velocity categories	7
	6-10	Number of stability categories	7
	11-15	Number of distances within terrain data for each sector	1
	16-20	Total number of hours in joint wind frequency distribution	*
	21-25	Increment in % for which plotted results are to be printed	5
	26-30	Number of titles of receptor types	5
	31-35	Number of release exit locations	1
4	1-5	Height of the measured wind	104
	6-20	Half-life (days) used in the χ/Q calculations	101.00 2.26

*Appropriate data to be supplied.

TABLE A-20 (Cont'd)

Card Type	Columns	Description	Value to Be Used in XOQDOQ
	6-20 (Cont'd)	Half-life (days) used in the χ/Q calculations (Cont'd)	8.00
5	N/A	N/A	
6	1-80	Joint wind frequency distribution	*
7	1-5	Wind velocity units correction	200.00
	6-75	Maximum wind speed in each wind class (m/sec)	0.75
			3.50
			7.50
			12.50
			18.50
			25.00
			26.00
8	1-80	Distance in meters at which terrain heights are given	All are 100
9	1-80	Terrain heights (in meters, above plant grade) correspond to distances in Card Type 8	All are 0
10	1-25	Number of receptor locations for a particular receptor type	
		Site Boundary	16
		Dairy	1
		Meat	5
		Residence	14
		Garden	11

*Appropriate data to be supplied.

TABLE A-20 (Cont'd)

Card Type	Columns	Description	Value to Be Used in XOQDOQ
11	1-16	Title of receptor type for receptor locations	Site Boundary
			Dairy
			Meat
			Residence
			Garden
12	1-80	Receptor direction and distance (See Table 1)	
13	1-80	Title for release point whose characteristics are described on Card Type 14	*
14	1-5	Vent average velocity (m/sec)	4.66
	6-10	Vent inside diameter (m)	3.58
	11-15	Height of vent release point (m)	100.9
	16-20	Height of the vent's building (m)	0.0
	21-25	Minimum cross-sectional area for the vent's building (m^2)	0.00
	26-30	Wind height used for vent elevated release	104.0
	31-35	Vent heat emission rate (cal/sec)	0.0
15	1	Identification for release point	A
	2-5	Intermittent releases	0
	6-10	Number of intermittent releases per year for this release point	0
	11-15	Average number of hours per intermittent release	0

*Appropriate data to be supplied.

LIST OF TABLES

LIST OF TABLES (Cont'd)

LIST OF TABLES (Cont'd)

APPENDIX B

Calculation of V_i and B_i Values for the Elevated Plume

Values of V_i and B_i were calculated for the elevated plume release from the Brunswick stack using the NRC computer program RABFIN. This program was used to determine the controlling location based upon the releases of Table 3.2-1. In addition it was used to develop the V_i and B_i values for the various noble gas radionuclides at the site boundary at each of the 16 sectors. Table B-7 presents the V_i and B_i values for the NE sector which is the controlling location for noble gases for showing compliance with 10CFR20 and 10CFR50. Table B-8 presents the joint frequency distribution for the NE sector. Tables B-1 through B-6 and B-9 through B-32 present the V_i and B_i values and the joint frequency distribution for the remaining sectors. The inputs which were utilized in the RABFIN code are presented below.

1. Height of Stack - 100.9 (m)
2. Stack Diameter - 3.6 (m)
3. Exit Velocity - 5.0 m/sec
4. Wind Height - 104.6 (m)

TABLE B-1

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
ENE SITE BOUNDARY*

Noble Gas Radionuclides	V_i Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	B_i Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	1.64E-09	1.42E-07
Kr-85m	9.03E-05	1.34E-04
Kr-85	1.34E-06	2.02E-06
Kr-87	4.10E-04	6.17E-04
Kr-88	1.06E-03	1.60E-03
Kr-89	6.41E-04	9.63E-04
Xe-131m	2.13E-05	3.35E-05
Xe-133m	1.61E-05	2.62E-05
Xe-133	1.69E-05	2.63E-05
Xe-135m	2.13E-04	3.23E-04
Xe-135	1.45E-04	2.17E-04
Xe-137	5.51E-05	8.33E-05
Xe-138	6.51E-04	9.77E-04
Xe-139	1.96E-05	2.94E-05
Ar-41	7.74E-04	1.16E-03

*The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TABLE B-2

JOINT FREQUENCY DISTRIBUTION FOR ENE SECTOR (%)
PERIOD 1-1-77 THROUGH 12-31-77
BRUNSWICK STEAM ELECTRIC PLANT

MAXIMUM WIND SPEED (m/sec)							
Stability	Total	1.50	3.00	5.00	7.50	10.00	12.50
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.17	0.00	0.01	0.01	0.07	0.03	0.05
4	3.30	0.02	0.17	0.61	1.21	0.83	0.46
5	4.81	0.02	0.18	0.81	1.63	1.39	0.78
6	1.14	0.05	0.20	0.28	0.27	0.14	0.20
7	0.46	0.01	0.12	0.15	0.09	0.09	0.00
Total	9.88	0.10	0.68	1.86	3.27	2.48	1.49
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)			
Mean	Ground	Elevated	Combined
Arithmetic	0.00	6.75	6.75
Harmonic	0.00	5.27	5.27

TABLE B-3

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
N SITE BOUNDARY*

Noble Gas Radionuclides	V_i Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	B_i Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	8.97E-10	1.26E-07
Kr-85m	4.38E-05	6.50E-05
Kr-85	6.45E-07	9.78E-07
Kr-87	1.96E-04	2.94E-04
Kr-88	5.16E-04	7.75E-04
Kr-89	2.67E-04	4.01E-04
Xe-131m	1.05E-05	1.66E-05
Xe-133m	7.95E-06	1.31E-05
Xe-133	8.40E-06	1.32E-05
Xe-135m	9.77E-05	1.48E-04
Xe-135	7.00E-05	1.05E-04
Xe-137	2.20E-05	3.33E-05
Xe-138	3.10E-04	4.65E-04
Xe-139	6.00E-06	9.01E-06
Ar-41	3.70E-04	5.56E-04

*The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TABLE B-4

JOINT FREQUENCY DISTRIBUTION FOR N SECTOR (%)
PERIOD 1-1-77 THROUGH 12-31-77
BRUNSWICK STEAM ELECTRIC PLANT

MAXIMUM WIND SPEED (m/sec)							
Stability	Total	1.50	3.00	5.00	7.50	10.00	12.50
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.01	0.00	0.00	0.00	0.01	0.00	0.00
3	0.11	0.00	0.00	0.01	0.07	0.03	0.00
4	1.79	0.01	0.16	0.70	0.65	0.18	0.09
5	2.00	0.00	0.15	0.46	0.65	0.29	0.45
6	0.68	0.02	0.06	0.29	0.12	0.07	0.12
7	0.15	0.02	0.10	0.01	0.00	0.01	0.01
Total	4.74	0.05	0.47	1.47	1.50	0.58	0.67
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)			
Mean	Ground	Elevated	Combined
Arithmetic	0.00	6.00	6.00
Harmonic	0.00	4.61	4.61

TABLE B-5

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
NNE SITE BOUNDARY*

Noble Gas Radionuclides	V_i Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	B_i Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	1.78E-09	3.05E-07
Kr-85m	8.12E-05	1.21E-04
Kr-85	1.18E-06	1.79E-06
Kr-87	3.63E-04	5.46E-04
Kr-88	9.34E-04	1.40E-03
Kr-89	5.84E-04	8.77E-04
Xe-131m	1.96E-05	3.11E-05
Xe-133m	1.48E-05	2.44E-05
Xe-133	1.57E-05	2.48E-05
Xe-135m	1.91E-04	2.89E-04
Xe-135	1.29E-04	1.94E-04
Xe-137	5.09E-05	7.69E-05
Xe-138	5.76E-04	8.65E-04
Xe-139	1.93E-05	2.90E-05
Ar-41	6.82E-04	1.02E-03

*The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TABLE B-6

JOINT FREQUENCY DISTRIBUTION FOR NNE SECTOR (%)
PERIOD 1-1-77 THROUGH 12-31-77
BRUNSWICK STEAM ELECTRIC PLANT

MAXIMUM WIND SPEED (m/sec)							
Stability	Total	1.50	3.00	5.00	7.50	10.00	12.50
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.07	0.00	0.00	0.01	0.05	0.01	0.00
3	0.45	0.00	0.00	0.03	0.25	0.15	0.02
4	4.51	0.01	0.16	0.56	1.79	1.38	0.61
5	2.90	0.00	0.17	0.21	0.88	0.78	0.86
6	0.65	0.02	0.12	0.22	0.09	0.07	0.13
7	0.45	0.05	0.14	0.08	0.07	0.10	0.01
Total	9.03	0.08	0.59	1.11	3.13	2.49	1.63
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)			
Mean	Ground	Elevated	Combined
Arithmetic	0.00	7.13	7.13
Harmonic	0.00	5.63	5.63

TABLE B-7

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
NE SITE BOUNDARY*

Noble Gas Radionuclides	V_i Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	B_i Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	2.93E-09	5.97E-07
Kr-85m	1.22E-04	1.81E-04
Kr-85	1.74E-06	2.64E-06
Kr-87	5.39E-04	8.11E-04
Kr-88	1.36E-03	2.05E-03
Kr-89	9.47E-04	1.42E-03
Xe-131m	2.96E-05	4.73E-05
Xe-133m	2.23E-05	3.72E-05
Xe-133	2.40E-05	3.80E-05
Xe-135m	2.94E-04	4.46E-04
Xe-135	1.92E-04	2.89E-04
Xe-137	8.47E-05	1.28E-04
Xe-138	8.60E-04	1.29E-03
Xe-139	3.57E-05	5.37E-05
Ar-41	1.01E-03	1.51E-03

*The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TABLE B-8

JOINT FREQUENCY DISTRIBUTION FOR NE SECTOR (%)
PERIOD 1-1-77 THROUGH 12-31-77
BRUNSWICK STEAM ELECTRIC PLANT

MAXIMUM WIND SPEED (m/sec)							
Stability	Total	1.50	3.00	5.00	7.50	10.00	12.50
1	0.02	0.00	0.00	0.00	0.01	0.00	0.01
2	0.21	0.00	0.00	0.00	0.05	0.10	0.06
3	1.13	0.00	0.00	0.03	0.28	0.50	0.32
4	7.30	0.01	0.15	0.63	2.50	2.51	1.50
5	5.15	0.03	0.09	0.30	1.21	1.99	1.53
6	1.04	0.01	0.06	0.32	0.33	0.24	0.08
7	0.41	0.01	0.12	0.10	0.13	0.03	0.02
Total	15.26	0.06	0.42	1.38	4.51	5.37	3.52
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)			
Mean	Ground	Elevated	Combined
Arithmetic	0.00	7.81	7.81
Harmonic	0.00	6.63	6.63

TABLE B-9

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
E SITE BOUNDARY*

Noble Gas Radionuclides	V_i Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	B_i Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	9.82E-10	6.10E-08
Kr-85m	6.43E-05	9.54E-05
Kr-85	9.71E-07	1.47E-06
Kr-87	2.99E-04	4.49E-04
Kr-88	7.78E-04	1.17E-03
Kr-89	4.59E-04	6.90E-04
Xe-131m	1.49E-05	2.33E-05
Xe-133m	1.13E-05	1.82E-05
Xe-133	1.16E-05	1.80E-05
Xe-135m	1.53E-04	2.32E-04
Xe-135	1.04E-04	1.56E-04
Xe-137	3.89E-05	5.89E-05
Xe-138	4.73E-04	7.10E-04
Xe-139	1.37E-05	2.05E-05
Ar-41	5.66E-04	8.49E-04

*The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TABLE B-10

JOINT FREQUENCY DISTRIBUTION FOR E SECTOR (%)
PERIOD 1-1-77 THROUGH 12-31-77
BRUNSWICK STEAM ELECTRIC PLANT

MAXIMUM WIND SPEED (m/sec)							
Stability	Total	1.50	3.00	5.00	7.50	10.00	12.50
1	0.01	0.00	0.00	0.00	0.00	0.01	0.00
2	0.03	0.00	0.00	0.00	0.01	0.01	0.01
3	0.09	0.00	0.00	0.03	0.02	0.01	0.03
4	1.42	0.01	0.15	0.55	0.32	0.23	0.16
5	2.07	0.03	0.10	0.62	0.74	0.50	0.08
6	1.08	0.02	0.14	0.30	0.38	0.15	0.09
7	0.64	0.03	0.13	0.24	0.10	0.08	0.06
Total	5.34	0.09	0.52	1.74	1.57	0.99	0.43
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)			
Mean	Ground	Elevated	Combined
Arithmetic	0.00	5.80	5.80
Harmonic	0.00	4.41	4.41

TABLE B-11

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
ESE SITE BOUNDARY*

Noble Gas Radionuclides	V_i Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	B_i Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	1.10E-09	1.90E-07
Kr-85m	5.59E-05	8.31E-05
Kr-85	8.23E-07	1.25E-06
Kr-87	2.55E-04	3.83E-04
Kr-88	6.50E-04	9.76E-04
Kr-89	4.38E-04	6.58E-04
Xe-131m	1.33E-05	2.10E-05
Xe-133m	1.01E-05	1.64E-05
Xe-133	1.05E-05	1.65E-05
Xe-135m	1.36E-04	2.07E-04
Xe-135	8.94E-05	1.34E-04
Xe-137	3.86E-05	5.84E-05
Xe-138	4.05E-04	6.08E-04
Xe-139	1.75E-05	2.63E-05
Ar-41	4.79E-04	7.19E-04

*The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TABLE B-12

JOINT FREQUENCY DISTRIBUTION FOR ESE SECTOR (%)
PERIOD 1-1-77 THROUGH 12-31-77
BRUNSWICK STEAM ELECTRIC PLANT

MAXIMUM WIND SPEED (m/sec)							
Stability	Total	1.50	3.00	5.00	7.50	10.00	12.50
1	0.06	0.00	0.00	0.01	0.00	0.05	0.00
2	0.15	0.00	0.00	0.01	0.03	0.06	0.05
3	0.31	0.00	0.00	0.02	0.13	0.03	0.13
4	1.71	0.00	0.07	0.31	0.58	0.46	0.29
5	2.02	0.01	0.08	0.31	0.52	0.80	0.30
6	0.85	0.03	0.06	0.17	0.18	0.36	0.05
7	0.46	0.01	0.07	0.12	0.07	0.07	0.12
Total	5.56	0.05	0.28	0.95	1.51	1.83	0.94
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)			
Mean	Ground	Elevated	Combined
Arithmetic	0.00	7.15	7.15
Harmonic	0.00	5.67	5.67

TABLE B-13

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
SE SITE BOUNDARY*

Noble Gas Radionuclides	V_i Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	B_i Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	1.34E-09	3.71E-07
Kr-85m	5.76E-05	8.56E-05
Kr-85	8.42E-07	1.28E-06
Kr-87	2.60E-04	3.91E-04
Kr-88	6.65E-04	9.98E-04
Kr-89	4.39E-04	6.59E-04
Xe-131m	1.40E-05	2.23E-05
Xe-133m	1.06E-05	1.76E-05
Xe-133	1.12E-05	1.77E-05
Xe-135m	1.39E-04	2.10E-04
Xe-135	9.18E-05	1.38E-04
Xe-137	3.86E-05	5.84E-05
Xe-138	4.13E-04	6.21E-04
Xe-139	1.65E-05	2.48E-05
Ar-41	4.89E-04	7.34E-04

*The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TABLE B-14

JOINT FREQUENCY DISTRIBUTION FOR SE SECTOR (%)
PERIOD 1-1-77 THROUGH 12-31-77
BRUNSWICK STEAM ELECTRIC PLANT

MAXIMUM WIND SPEED (m/sec)							
Stability	Total	1.50	3.00	5.00	7.50	10.00	12.50
1	0.11	0.00	0.00	0.00	0.00	0.06	0.05
2	0.31	0.00	0.00	0.01	0.14	0.15	0.01
3	0.53	0.00	0.00	0.14	0.18	0.18	0.03
4	1.44	0.02	0.08	0.25	0.51	0.41	0.17
5	1.46	0.01	0.09	0.31	0.50	0.46	0.09
6	0.89	0.02	0.05	0.02	0.30	0.44	0.06
7	0.63	0.01	0.13	0.09	0.14	0.21	0.05
Total	5.37	0.06	0.35	0.82	1.77	1.91	0.46
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)			
Mean	Ground	Elevated	Combined
Arithmetic	0.00	6.78	6.78
Harmonic	0.00	5.37	5.37

TABLE B-15

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
SSE SITE BOUNDARY*

Noble Gas Radionuclides	V_i Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	B_i Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	1.29E-09	2.74E-07
Kr-85m	5.96E-05	8.85E-05
Kr-85	8.78E-07	1.33E-06
Kr-87	2.70E-04	4.07E-04
Kr-88	6.97E-04	1.05E-03
Kr-89	4.51E-04	6.78E-04
Xe-131m	1.43E-05	2.27E-05
Xe-133m	1.09E-05	1.79E-05
Xe-133	1.14E-05	1.80E-05
Xe-135m	1.43E-04	2.17E-04
Xe-135	9.53E-05	1.43E-04
Xe-137	3.96E-05	5.99E-05
Xe-138	4.30E-04	6.45E-04
Xe-139	1.71E-05	2.57E-05
Ar-41	5.10E-04	7.65E-04

*The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TABLE B-16

JOINT FREQUENCY DISTRIBUTION FOR SSE SECTOR (%)
PERIOD 1-1-77 THROUGH 12-31-77
BRUNSWICK STEAM ELECTRIC PLANT

MAXIMUM WIND SPEED (m/sec)							
Stability	Total	1.50	3.00	5.00	7.50	10.00	12.50
1	0.02	0.00	0.00	0.00	0.01	0.01	0.00
2	0.13	0.00	0.00	0.02	0.02	0.09	0.00
3	0.49	0.00	0.00	0.14	0.24	0.09	0.02
4	2.35	0.05	0.16	0.32	0.80	0.70	0.32
5	1.40	0.00	0.08	0.23	0.46	0.58	0.05
6	0.84	0.02	0.05	0.13	0.18	0.31	0.15
7	0.32	0.03	0.02	0.05	0.07	0.13	0.02
Total	5.55	0.10	0.31	0.89	1.78	1.91	0.56
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)			
Mean	Ground	Elevated	Combined
Arithmetic	0.00	6.81	6.81
Harmonic	0.00	5.21	5.21

TABLE B-17

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
S SITE BOUNDARY*

Noble Gas Radionuclides	V_i Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	B_i Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	8.80E-10	9.50E-08
Kr-85m	5.11E-05	7.59E-05
Kr-85	7.66E-07	1.16E-06
Kr-87	2.34E-04	3.53E-04
Kr-88	6.13E-04	9.19E-04
Kr-89	3.71E-04	5.57E-04
Xe-131m	1.20E-05	1.88E-05
Xe-133m	9.10E-06	1.48E-05
Xe-133	9.44E-06	1.47E-05
Xe-135m	1.20E-04	1.82E-04
Xe-135	8.23E-05	1.24E-04
Xe-137	3.19E-05	4.83E-05
Xe-138	3.71E-04	5.56E-04
Xe-139	1.33E-05	2.00E-05
Ar-41	4.44E-04	6.66E-04

*The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TABLE B-18

JOINT FREQUENCY DISTRIBUTION FOR S SECTOR (%)
PERIOD 1-1-77 THROUGH 12-31-77
BRUNSWICK STEAM ELECTRIC PLANT

MAXIMUM WIND SPEED (m/sec)							
Stability	Total	1.50	3.00	5.00	7.50	10.00	12.50
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.03	0.00	0.00	0.00	0.03	0.00	0.00
3	0.16	0.00	0.00	0.02	0.14	0.00	0.00
4	1.74	0.01	0.13	0.28	0.55	0.54	0.23
5	1.32	0.03	0.08	0.25	0.45	0.46	0.05
6	0.93	0.02	0.08	0.17	0.24	0.33	0.09
7	0.37	0.05	0.03	0.05	0.12	0.07	0.05
Total	4.55	0.11	0.32	0.77	1.53	1.40	0.42
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)			
Mean	Ground	Elevated	Combined
Arithmetic	0.00	6.57	6.57
Harmonic	0.00	4.84	4.84

TABLE B-19

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
SSW SITE BOUNDARY*

Noble Gas Radionuclides	V_i Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	B_i Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	1.10E-09	1.39E-07
Kr-85m	5.60E-05	8.31E-05
Kr-85	8.22E-07	1.25E-06
Kr-87	2.53E-04	3.81E-04
Kr-88	6.51E-04	9.76E-04
Kr-89	4.06E-04	6.10E-04
Xe-131m	1.33E-05	2.10E-05
Xe-133m	1.01E-05	1.65E-05
Xe-133	1.06E-05	1.66E-05
Xe-135m	1.34E-04	2.03E-04
Xe-135	8.94E-05	1.34E-04
Xe-137	3.52E-05	5.32E-05
Xe-138	4.02E-04	6.04E-04
Xe-139	1.21E-05	1.81E-05
Ar-41	4.77E-04	7.15E-04

*The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TABLE B-20

JOINT FREQUENCY DISTRIBUTION FOR SSW SECTOR (%)
PERIOD 1-1-77 THROUGH 12-31-77
BRUNSWICK STEAM ELECTRIC PLANT

MAXIMUM WIND SPEED (m/sec)							
Stability	Total	1.50	3.00	5.00	7.50	10.00	12.50
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.19	0.00	0.00	0.07	0.05	0.06	0.01
4	2.47	0.01	0.03	0.53	0.99	0.62	0.29
5	1.88	0.01	0.15	0.37	0.56	0.74	0.05
6	1.12	0.01	0.12	0.14	0.28	0.55	0.02
7	0.51	0.01	0.03	0.10	0.22	0.13	0.02
Total	6.17	0.04	0.33	1.21	2.10	2.10	0.39
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)			
Mean	Ground	Elevated	Combined
Arithmetic	0.00	6.61	6.61
Harmonic	0.00	5.44	5.44

TABLE B-21

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
SW SITE BOUNDARY*

Noble Gas Radionuclides	V_i Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	B_i Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	1.40E-09	3.22E-07
Kr-85m	6.11E-05	9.08E-05
Kr-85	8.94E-07	1.35E-06
Kr-87	2.73E-04	4.11E-04
Kr-88	7.10E-04	1.07E-03
Kr-89	4.19E-04	6.29E-04
Xe-131m	1.48E-05	2.36E-05
Xe-133m	1.12E-05	1.86E-05
Xe-133	1.19E-05	1.88E-05
Xe-135m	1.41E-04	2.14E-04
Xe-135	9.75E-05	1.47E-04
Xe-137	3.60E-05	5.44E-05
Xe-138	4.33E-04	6.50E-04
Xe-139	1.16E-05	1.74E-05
Ar-41	5.15E-04	7.73E-04

*The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TABLE B-22

JOINT FREQUENCY DISTRIBUTION FOR SW SECTOR (%)
PERIOD 1-1-77 THROUGH 12-31-77
BRUNSWICK STEAM ELECTRIC PLANT

MAXIMUM WIND SPEED (m/sec)							
Stability	Total	1.50	3.00	5.00	7.50	10.00	12.50
1	0.01	0.00	0.00	0.00	0.00	0.01	0.00
2	0.10	0.00	0.00	0.02	0.07	0.01	0.00
3	0.53	0.00	0.02	0.10	0.30	0.09	0.02
4	2.32	0.01	0.14	0.50	0.98	0.52	0.17
5	1.71	0.02	0.09	0.39	0.40	0.68	0.13
6	0.88	0.05	0.05	0.20	0.46	0.12	0.00
7	0.56	0.00	0.07	0.15	0.22	0.12	0.00
Total	6.11	0.08	0.37	1.36	2.43	1.55	0.32
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)			
Mean	Ground	Elevated	Combined
Arithmetic	0.00	6.22	6.22
Harmonic	0.00	4.98	4.98

TABLE B-23

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
WSW SITE BOUNDARY*

Noble Gas Radionuclides	V_i Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	B_i Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	1.42E-09	3.10E-07
Kr-85m	6.27E-05	9.31E-05
Kr-85	9.16E-07	1.39E-06
Kr-87	2.80E-04	4.21E-04
Kr-88	7.26E-04	1.09E-03
Kr-89	4.28E-04	6.42E-04
Xe-131m	1.52E-05	2.42E-05
Xe-133m	1.15E-05	1.90E-05
Xe-133	1.22E-05	1.93E-05
Xe-135m	1.45E-04	2.20E-04
Xe-135	9.99E-05	1.50E-04
Xe-137	3.67E-05	5.55E-05
Xe-138	4.44E-04	6.67E-04
Xe-139	1.12E-05	1.68E-05
Ar-41	5.27E-04	7.91E-04

*The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TABLE B-24

JOINT FREQUENCY DISTRIBUTION FOR WSW SECTOR (%)
PERIOD 1-1-77 THROUGH 12-31-77
BRUNSWICK STEAM ELECTRIC PLANT

MAXIMUM WIND SPEED (m/sec)							
Stability	Total	1.50	3.00	5.00	7.50	10.00	12.50
1	0.02	0.00	0.00	0.00	0.02	0.00	0.00
2	0.18	0.00	0.01	0.00	0.14	0.00	0.03
3	0.36	0.00	0.01	0.15	0.15	0.05	0.00
4	2.64	0.00	0.15	0.54	1.12	0.75	0.08
5	1.73	0.02	0.09	0.37	0.84	0.39	0.02
6	0.87	0.02	0.08	0.25	0.37	0.14	0.01
7	0.36	0.03	0.03	0.13	0.17	0.00	0.00
Total	6.16	0.07	0.37	1.44	2.81	1.33	0.14
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)			
Mean	Ground	Elevated	Combined
Arithmetic	0.00	5.97	5.97
Harmonic	0.00	4.91	4.91

TABLE B-25

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
W SITE BOUNDARY*

Noble Gas Radionuclides	V_i Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	B_i Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	1.33E-09	3.17E-07
Kr-85m	5.83E-05	8.66E-05
Kr-85	8.61E-07	1.30E-06
Kr-87	2.57E-04	3.87E-04
Kr-88	6.92E-04	1.04E-03
Kr-89	3.34E-04	5.01E-04
Xe-131m	1.42E-05	2.27E-05
Xe-133m	1.08E-05	1.79E-05
Xe-133	1.14E-05	1.80E-05
Xe-135m	1.24E-04	1.89E-04
Xe-135	9.33E-05	1.40E-04
Xe-137	2.72E-05	4.11E-05
Xe-138	4.05E-04	6.08E-04
Xe-139	6.46E-06	9.70E-06
Ar-41	4.89E-04	7.34E-04

*The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TABLE B-26

JOINT FREQUENCY DISTRIBUTION FOR W SECTOR (%)
PERIOD 1-1-77 THROUGH 12-31-77
BRUNSWICK STEAM ELECTRIC PLANT

MAXIMUM WIND SPEED (m/sec)							
Stability	Total	1.50	3.00	5.00	7.50	10.00	12.50
1	0.05	0.00	0.00	0.00	0.05	0.00	0.00
2	0.10	0.00	0.00	0.00	0.10	0.00	0.00
3	0.37	0.00	0.05	0.18	0.12	0.02	0.00
4	1.95	0.02	0.10	0.47	1.07	0.29	0.00
5	2.00	0.01	0.14	0.53	1.07	0.22	0.03
6	0.85	0.07	0.10	0.29	0.36	0.01	0.02
7	0.37	0.06	0.08	0.18	0.05	0.00	0.00
Total	5.69	0.16	0.47	1.65	2.82	0.54	0.05
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)			
Mean	Ground	Elevated	Combined
Arithmetic	0.00	5.30	5.30
Harmonic	0.00	4.13	4.13

TABLE B-27

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
WNW SITE BOUNDARY*

Noble Gas Radionuclides	V_i Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	B_i Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	9.41E-10	2.22E-07
Kr-85m	4.43E-05	6.58E-05
Kr-85	6.61E-07	1.00E-06
Kr-87	1.98E-04	2.98E-04
Kr-88	5.34E-04	8.01E-04
Kr-89	2.54E-04	3.81E-04
Xe-131m	1.07E-05	1.70E-05
Xe-133m	8.13E-06	1.34E-05
Xe-133	8.52E-06	1.34E-05
Xe-135m	9.52E-05	1.44E-04
Xe-135	7.12E-05	1.07E-04
Xe-137	2.05E-05	3.09E-05
Xe-138	3.12E-04	4.68E-04
Xe-139	4.91E-06	7.38E-06
Ar-41	3.77E-04	5.66E-04

*The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TABLE B-28

JOINT FREQUENCY DISTRIBUTION FOR WNW SECTOR (%)
PERIOD 1-1-77 THROUGH 12-31-77
BRUNSWICK STEAM ELECTRIC PLANT

MAXIMUM WIND SPEED (m/sec)							
Stability	Total	1.50	3.00	5.00	7.50	10.00	12.50
1	0.01	0.00	0.00	0.01	0.00	0.00	0.00
2	0.09	0.00	0.00	0.08	0.01	0.00	0.00
3	0.24	0.00	0.05	0.17	0.02	0.00	0.00
4	1.03	0.01	0.10	0.45	0.45	0.02	0.00
5	1.19	0.03	0.14	0.37	0.50	0.13	0.02
6	0.63	0.05	0.12	0.28	0.17	0.01	0.00
7	0.19	0.03	0.03	0.07	0.06	0.00	0.00
Total	3.38	0.12	0.44	1.43	1.21	0.16	0.02
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)			
Mean	Ground	Elevated	Combined
Arithmetic	0.00	4.65	4.65
Harmonic	0.00	3.58	3.58

TABLE B-29

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
NW SITE BOUNDARY*

Noble Gas Radionuclides	V_i Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	B_i Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	1.02E-9	2.45E-07
Kr-85m	4.69E-05	6.97E-05
Kr-85	6.96E-07	1.05E-06
Kr-87	2.09E-04	3.14E-04
Kr-88	5.61E-04	8.41E-04
Kr-89	2.66E-04	4.00E-04
Xe-131m	1.14E-05	1.81E-05
Xe-133m	8.64E-06	1.43E-05
Xe-133	9.09E-06	1.43E-05
Xe-135m	1.01E-04	1.53E-04
Xe-135	7.53E-05	1.13E-04
Xe-137	2.15E-05	3.24E-05
Xe-138	3.29E-04	4.94E-04
Xe-139	5.39E-06	8.09E-06
Ar-41	3.96E-04	5.95E-04

*The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TABLE B-30

JOINT FREQUENCY DISTRIBUTION FOR NW SECTOR (%)
PERIOD 1-1-77 THROUGH 12-31-77
BRUNSWICK STEAM ELECTRIC PLANT

MAXIMUM WIND SPEED (m/sec)							
Stability	Total	1.50	3.00	5.00	7.50	10.00	12.50
1	0.01	0.00	0.00	0.01	0.00	0.00	0.00
2	0.12	0.00	0.01	0.08	0.03	0.00	0.00
3	0.24	0.00	0.02	0.17	0.05	0.00	0.00
4	1.14	0.01	0.16	0.54	0.33	0.09	0.01
5	1.08	0.02	0.12	0.40	0.28	0.10	0.16
6	0.57	0.05	0.17	0.17	0.16	0.01	0.01
7	0.35	0.03	0.07	0.12	0.13	0.00	0.00
Total	3.51	0.11	0.55	1.49	0.98	0.20	0.18
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)			
Mean	Ground	Elevated	Combined
Arithmetic	0.00	4.81	4.81
Harmonic	0.00	3.59	3.59

TABLE B-31

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
NNW SITE BOUNDARY*

Noble Gas Radionuclides	V_i Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	B_i Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	6.97E-10	9.17E-08
Kr-85m	3.96E-05	5.87E-05
Kr-85	5.96E-07	9.04E-07
Kr-87	1.80E-04	2.71E-04
Kr-88	4.83E-04	7.24E-04
Kr-89	2.39E-04	3.59E-04
Xe-131m	9.37E-06	1.47E-05
Xe-133m	7.10E-06	1.15E-05
Xe-133	7.36E-06	1.15E-05
Xe-135m	8.70E-05	1.32E-04
Xe-135	6.39E-05	9.60E-05
Xe-137	1.94E-05	2.94E-05
Xe-138	2.83E-04	4.25E-04
Xe-139	6.08E-06	9.13E-06
Ar-41	3.42E-04	5.14E-04

*The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TABLE B-32

JOINT FREQUENCY DISTRIBUTION FOR NNW SECTOR (%)
PERIOD 1-1-77 THROUGH 12-31-77
BRUNSWICK STEAM ELECTRIC PLANT

MAXIMUM WIND SPEED (m/sec)							
Stability	Total	1.50	3.00	5.00	7.50	10.00	12.50
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.02	0.00	0.00	0.01	0.01	0.00	0.00
3	0.12	0.00	0.00	0.06	0.06	0.00	0.00
4	1.00	0.01	0.14	0.36	0.37	0.09	0.03
5	1.17	0.02	0.12	0.27	0.25	0.12	0.39
6	0.82	0.02	0.13	0.23	0.17	0.03	0.24
7	0.34	0.05	0.10	0.14	0.00	0.05	0.00
Total	3.47	0.10	0.49	1.07	0.86	0.29	0.66
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)			
Mean	Ground	Elevated	Combined
Arithmetic	0.00	5.89	5.89
Harmonic	0.00	4.02	4.02

LIST OF TABLES

APPENDIX C

DOSE PARAMETERS FOR RADIOIODINES, PARTICULATES AND TRITIUM

This appendix contains the methodology which was used to calculate the dose parameters for radioiodines, particulates, and tritium to show compliance with 10CFR 20 and Appendix I of 10CFR50 for gaseous effluents. These dose parameters P_i and R_i were calculated using the methodology outlined in NUREG 0133, Regulatory Guide 1.109 Revision 1, and letter to J. W. Davis, "Dose Factors for Hf-181 and SN-113", BSEP File: B10-10530, May 24, 1988. The following sections provide the specific methodology which was utilized in calculating the P_i and R_i values for the various exposure pathways.

C.1 CALCULATION OF P_i

The parameter P_i contained in the radioiodine and particulate portion of Section 3.2, includes pathway transport parameters of the ith radionuclide, the receptor's usage of the pathway media and the dosimetry of the exposure. Pathway usage rates and the internal dosimetry are functions of the receptor's age; however, the youngest age group, the infant, will always receive the maximum dose under the exposure conditions for ODCM, Section 1, 3.11.2.1(b). For the infant exposure, separate values of P_i may be calculated for the inhalation pathway which is combined with a W parameter based on (χ/Q), and the food (milk) and ground pathway which is combined with a W parameter normally based on (D/Q), except for tritium. The following sections provide in detail the methodology which was used in calculating the P_i values for inclusion into this ODCM.

C.1.1 Inhalation Pathway

$$P_{ij} = K' (BR) DFA_i \qquad (C.1\text{-}1)$$

where:

P_{ij} = dose parameter for radionuclide i for the inhalation pathway, mrem/yr per $\mu Ci/m^3$

K' = a constant of unit conversion

= 10^6 pCi/μCi

BR = the breathing rate of the infant age group, m^3/yr

DFA_i = the maximum organ inhalation dose factor for the infant age group for radionuclide i, mrem/pCi

The age group considered is the infant group. The infant's breathing rate is taken as 1400 m^3/yr from Table E-5 of Regulatory Guide 1.109 Revision 1. The inhalation dose factors for the infant, DFA_i, are presented in Table E-10 of Regulatory Guide 1.109, BSEP File: B10-10530, Letter to J. W. Davis "Dose Factors for Hf-181 and Sn-113, "May 24, 1988, and NUREG CR4653 for Am-241, in units of mrem/pCi. The total body is considered as an organ in the selection of DFA_i.

The incorporation of breathing rate of an infant and the unit conversion factor results in the following:

$$P_{il} = 1.4 \times 10^9 \, DFA_i \qquad \text{(C.1-2)}$$

C.1.2 Ground Plane Pathway

$$P_{iG} = K'K''DFG_i(1-e^{-\lambda it})/\lambda_i \qquad \text{(C.1-3)}$$

where:

P_{iG} = Dose parameter for radionuclide i for the ground plane pathway, mrem/yr per μCi/sec per m^{-2}

K' = A constant of unit conversion

= 10^6pCi/μCi

K'' = A constant of unit conversion

= 8760 hr/yr

λ_i = The radiological decay constant for radionuclide i, sec^{-1}

t = The exposure period

= 3.15×10^7 sec (1 year)

DFG_i = The ground plane dose conversion factor for radionuclide i, mrem/hr per pCi/m^2

The deposition rate onto the ground plane results in a ground plane concentration that is assumed to persist over a year with radiological decay the only operating removal mechanism for each radionuclide. The ground plane dose conversion factors for radionuclide i, DFG_i, are presented in Table E-6 of Regulatory Guide 1.109, Revision 1. BSEP File: B10-10530, Letter to J. W. Davis "Dose Factors for Hf-181 and Sn-113," May 24, 1988, and NUREG CR4653 for Am-241.

Resolution of the units yields:

$$P_{iG} = 8.76 \times 10^{9}\ DFG_i(1-e^{-\lambda_i t})/\lambda_i \qquad \text{(C.1-4)}$$

C.1.3 Milk

$$P_{iM} = \frac{K' r\ Q_F\ (U_{ap})\ F_m}{Y_p\ (\lambda_i + \lambda_w)}\ DFL_i\ e^{-\lambda_i t_f} \qquad \text{(C.1-5)}$$

where:

P_{iM} = Dose parameter for radionuclide i for the cow milk or goat milk pathway, mrem/yr per μCi/sec per m^{-2}

K' = A constant of unit conversion

= 10^6 pCi/μCi

Q_F = The cow's or goat's consumption rate of feed, kg/day (wet weight)

U_{ap} = The infant's milk consumption rate, liters/yr

Y_p = The agricultural productivity by unit area, kg/m^2

F_m = The stable element transfer coefficient, pCi/liter per pCi/day

r = Fraction of deposited activity retained on cow's or goat's feed grass

DFL_i = The maximum organ ingestion dose factor for radionuclide i, mrem/pCi

λ_i = The radiological decay constant for radionuclide i sec^{-1}

λ_w = The decay constant for removal of activity on leaf and plant surfaces by weathering, sec^{-1}

= 5.73×10^{-7} sec^{-1} (corresponding to a 14 day half-time)

t_f = The transport time from pasture to cow or goat to milk to infant, sec

A fraction of the airborne deposition is captured by the ground plant vegetation cover. The captured material is removed from the vegetation (grass) by both radiological decay and weathering processes.

Various parameters which were utilized to determine the P_i values for the cow and goat milk pathways are provided in Table C-1. Table E-1 of Regulatory Guide 1.109, Revision 1, provides the stable element transfer coefficients, F_m, and Table E-14 of the same regulatory guide provides the ingestion dose factors, DFL_i, BSEP File: B10-10530, Letter to J. W. Davis "Dose Factors for Hf-181 and Sn-113," May 24, 1988, and NUREG CR4653 for AM-241, for the infant's organs. The organ with the maximum value of DFL_i was used in the determination of P_i for this pathway. The incorporation of the various constants of Table C-1 into Equation C.1-5 results in the following:

For cow's milk for radioiodines and particulates:

$$P_{iM} = 2.14 \times 10^{10} \frac{rFm}{\lambda_i + \lambda_w} DFL_i \; e^{-\lambda_i t_f} \qquad \text{(C.1-6)}$$

For the goat milk pathway for radioiodines and particulates:

$$P_{iM} = 2.8 \times 10^{9} \frac{rFm}{\lambda_i + \lambda_w} DFL_i \; e^{-\lambda_i t_f} \qquad \text{(C.1-7)}$$

For tritium, the concentration of tritium in milk is based on its airborne concentration rather than the deposition rate.

$$P_{T_M} = K'K'''F_m Q_F U_{ap} DFL_T \, [0.75 \, (0.5/H)] \qquad \text{(C.1-8)}$$

where:

P_{T_M} = Dose parameter for tritium for the cow milk and goat milk pathways, mrem/yr per $\mu Ci/m^3$

K''' = A constant of unit conversion

= 10^3 gm/kg

H = Absolute humidity of the atmosphere, gm/m^3

0.75 = The fraction of total feed that is water

0.5 = The ratio of the specific activity of the feed grass water to the atmospheric water

DFL_T = Maximum organ ingestion dose factor for tritium, mrem/pCi

C.2 CALCULATION OF R_i

The Radioiodine and Particulate ODCM Specification 7.3.9 is applicable to the location in the unrestricted area where the combination of existing pathways and receptor age groups indicates the maximum potential exposure occurs. The inhalation and ground plane exposure pathways shall be considered to exist at all locations. The grass-goat-milk, the grass-cow-milk, grass-cow-meat, and vegetation pathways are considered based on their existence at the various locations. R_i values have been calculated for the adult, teen, child, and infant age groups for the ground plane, cow milk, goat milk, vegetable and beef ingestion pathways. The methodology which was utilized to calculate these values is presented below.

C.2.1 Inhalation Pathway

$$R_{i_i} = K' (BR)_a (DFA_i)_a \qquad \text{(C.2-1)}$$

where:

R_{i_i} = Dose factor for each identified radionuclide i of the organ of interest, mrem/yr per $\mu Ci/m^3$

K' = A constant of unit conversion

= 10^6 pCi/μCi

$(BR)_a$ = Breathing rate of the receptor of age group a, m^3/yr

$(DFA_i)_a$ = Organ inhalation dose factor for radionuclide i for the receptor of age group a, mrem/pCi

The breathing rates $(BR)_a$ for the various age groups are tabulated below, as given in Table E-5 of the Regulatory Guide 1.109, Revision 1.

Age Group (a)	Breathing Rate (m^3/yr)
Infant	1400
Child	3700
Teen	8000
Adult	8000

Inhalation dose factors $(DFA_i)_a$ for the various age groups are given in Tables E-7 through E-10 of Regulatory Guide 1.109, Revision 1, BSEP File: B10-10530, Letter to J. W. Davis "Dose Factors for Hf-181 and Sn-113," May 24, 1988, and NUREG CR4653 for AM-241.

C.2.2 Ground Plane Pathway

$$R_{i_G} = I_i K'K''(SF)DFG_i (1-e^{-\lambda_i t}) / \lambda_i \qquad \text{(C.2-2)}$$

where:

R_{i_G} = Dose factor for the ground plane pathway for each identified radionuclide i for the organ of interest, mrem/yr per μCi/sec per m^{-2}

K' = A constant of unit conversion

= 10^6 pCi/μCi

K'' = A constant of unit conversion

= 8760 hr/year

λ_i = The radiological decay constant for radionuclide i, sec^{-1}

t = The exposure time, sec

= 4.73×10^8 sec (15 years)

DFG_i = The ground plane dose conversion factor for radionuclide i; mrem/hr per pCi/m^2

SF = The shielding factor (dimensionless)

I_i = Factor to account for fractional deposition of radionuclide i

For radionuclides other than iodine, the factor I_i is equal to one. For radioiodines, the value of I_i may vary. However, a value of 1.0 was used in calculating the R values in Table 3.3-2.

A shielding factor of 0.7 is suggested in Table E-15 of Regulatory Guide 1.109 Revision 1. A tabulation of DFG_i values is presented in Table E-6 of Regulatory Guide 1.109, Revision 1.

C.2.3 Grass-Cow or Goat Milk Pathway

$$R_{iM} = I_i K' Q_F U_{ap} F_m (DFL_i)_a e^{-\lambda_i t_f}$$

$$\left\{ f_p f_s \left[\frac{r(1-e^{-\lambda_{Ei} t_e})}{Y_p \lambda_{Ei}} + \frac{B_{iv}(1-e^{-\lambda_i t_b})}{P\lambda_i} \right] + (1-f_p f_s) \left[\frac{r(1-e^{-\lambda_{Ei} t_e})}{Y_s \lambda_{Ei}} + \frac{B_{iv}(1-e^{-\lambda_i t_b})}{P\lambda_i} \right] e^{-\lambda_i t_h} \right\}$$

(C.2-3)

where:

R_{iM} = Dose factor for the cow milk or goat milk pathway, for each identified radionuclide i for the organ of interest, mrem/yr per μCi/sec per m^{-2}

K′ = A constant of unit conversion

= 10^6 pCi/μCi

Q_F = The cow's or goat's feed consumption rate. kg/day (wet weight)

U_{ap} = The receptor's milk consumption rate for age group a, liters/yr

Y_p = The agricultural productivity by unit area of pasture feed grass, kg/m^2

Y_s = The agricultural productivity by unit area of stored feed, kg/m^2

F_m = The stable element transfer coefficients, pCi/liter per pCi/day

r = Fraction of deposited activity retained on cow's feed grass

$(DFL_i)_a$ = The organ ingestion dose factor for radionuclide i for the receptor in age group a, mrem/pCi

λ_{E_i} = $\lambda_i + \lambda_w$

λ_i = The radiological decay constant for radionuclide i, sec^{-1}

λ_w = The decay constant for removal of activity on leaf and plant surfaces by weathering sec^{-1}

= 5.73×10^{-7} sec^{-1} (corresponding to a 14 day half-life)

t_f = The transport time from feed to cow or goat to milk, to receptor, sec

t_h = The transport time from harvest to cow or goat consumption, sec

t_b = Period of time that soil is exposed to gaseous effluents, sec

B_{iv} = Concentration factor for uptake of radionuclide i from the soil by the edible parts of crops, pCi/Kg (wet weight) per pCi/Kg (dry soil)

P = Effective surface density for soil, Kg (dry soil)/m^2

f_p = Fraction of the year that the cow or goat is on pasture

f_s = Fraction of the cow feed that is pasture grass while the cow is on pasture

t_e = Period of pasture grass and crop exposure during the growing season, sec

I_i = Factor to account for fractional deposition of radionuclide i

For radionuclides other than iodine, the factor I_i is equal to one. For radioiodines, the value of I_i may vary. However, a value of 1.0 was used in calculating the R values Tables 3.3-9 through 3.3-16.

Milk cattle and goats are considered to be fed from two potential sources, pasture grass and stored feeds. Following the development in Regulatory Guide 1.109, Revision 1, the value of f_s was considered unity in lieu of site-specific information. The value of f_p was 0.667 based upon an 8-month grazing period.

Table C-1 contains the appropriate parameter values and their source in Regulatory Guide 1.109, Revision 1.

The concentration of tritium in milk is based on the airborne concentration rather than the deposition. Therefore, the R_i is based on X/Q:

$$R_{T_M} = K'K'''F_m Q_F U_{ap} (DFL_i)_a \left[0.75\left(\frac{0.5}{H}\right)\right] \quad \text{(C.2-4)}$$

where:

R_{T_M} = Dose factor for the cow or goat milk pathway for tritium for the organ of interest, mrem/yr per $\mu Ci/m^3$

K' = A constant unit of conversion, 10^6 pCi/μCi

K''' = A constant unit of conversion

= 10^3gm/kg

H = Absolute humidity of the atmosphere, gm/m^3

0.75 = The fraction of total feed that is water

0.5 = The ratio of the specific activity of the feed grass water to the atmospheric water

Other parameters and values as defined previously. A value for H of 8 grams/meter^3, was used in lieu of site-specific information.

C.2.4 Grass-Cow-Meat Pathway

The integrated concentration in meat follows in a similar manner to the development for the milk pathway, therefore:

$$R_{i_B} = l_i K' Q_F U_{ap} F_f (DFL_i)_a e^{-\lambda_i t_s} \left\{ f_p f_s \left[\frac{r(1-e^{-\lambda_{E_i} t_e})}{Y_p \lambda_{E_i}} + \frac{B_{iv}(1-e^{-\lambda_i t_b})}{P\lambda_i} \right] + (1-f_p f_s) \left[\frac{r(1-e^{-\lambda_{E_i} t_e})}{Y_s \lambda_{E_i}} + \frac{B_{iv}(1-e^{-\lambda_i t_b})}{P\lambda_i} \right] e^{-\lambda_i t_h} \right\} \quad \text{(C.2-5)}$$

where:

R_{i_B} = Dose factor for the meat ingestion pathway for radionuclide i for any organ of interest, mrem/yr per μCi/sec per m^{-2}

F_f = The stable element transfer coefficients, pCi/Kg per pCi/day

U_{ap} = The receptor's meat consumption rate for age group a, kg/yr

t_s = The transport time from slaughter to consumption, sec

t_h = The transport time from harvest to animal consumption, sec

t_e = Period of pasture grass and crop exposure during the growing season, sec

I_i = Factor to account for fractional deposition of radionuclide i

For radionuclides other than iodine, the factor I_i is equal to one. For radioiodines, the value of I_i may vary. However, a value of 1.0 was used in calculating the R values in Tables 3.3-6 through 3.3-8.

All other terms remain the same as defined in Equation C.2-3. Table C-2 contains the values which were used in calculating R_i for the meat pathway.

The concentration of tritium in meat is based on its airborne concentration rather than the deposition. Therefore, R_i is based on X/Q.

$$R_{T_B} = K'K'''F_f Q_F U_{ab} (DFL_i)_a \left[0.75\left(\frac{0.5}{H}\right)\right] \qquad \text{(C.2-6)}$$

where:

R_{T_B} = Dose factor for the meat ingestion pathway for tritium for any organ of interest, mrem/yr per $\mu Ci/m^3$

All other terms are as defined in Equation C.2-4 and C.2-5, above.

C.2.5 Vegetation Pathway

The integrated concentration in vegetation consumed by man follows the expression developed in the derivation of the milk factor. Man is considered to consume two types of vegetation (fresh and stored) that differ only in the time period between harvest and consumption, therefore:

$$R_{iV} = I_i K'(DFL_i)_a$$

$$\left\{ U_a^L f_L \, e^{-\lambda_i t_L} \left[\frac{r(1-e^{-\lambda_{Ei} t_e})}{Y_V \lambda_{Ei}} + \frac{B_{iv}(1-e^{-\lambda_i t_b})}{P\lambda_i} \right] + U_a^S f_g \, e^{-\lambda_i t_h} \left[\frac{r(1-e^{-\lambda_{Ei} t_e})}{Y_V \lambda_{Ei}} + \frac{B_{iv}(1-e^{-\lambda_i t_b})}{P\lambda_i} \right] \right\} \quad \text{(C.2-7)}$$

where:

R_{iV} = Dose factor for vegetable pathway for radio nuclide i for the organ of interest mrem/yr per μCi/sec per m^{-2}

K' = a constant of unit conversion

= 10^6 pCi/μCi

U_a^L = The consumption rate of fresh leafy vegetation by the receptor age group a, kg/yr

U_a^S = The consumption rate of stored vegetation by the receptor in age group a, kg/yr

f_g = The fraction of the annual intake of stored vegetation grown locally

f_L = The fraction of annual intake of fresh, leafy vegetables grown locally

t_L = The average time between harvest of leafy vegetation and its consumption, sec

t_h = The average time between harvest of stored vegetation and its consumption, sec

Y_V = The vegetation area density, kg/m^2

t_e = Period of leafy vegetable exposure during growing season, sec

I_i = Factor to account for fractional deposition of radionuclide i

For radionuclides other than iodine, the factor I_i is equal to one. For radioiodines, the value of I_i may vary. However, a value of 1.0 was used in Tables 3.3-3 through 3.3-5.

All other factors were defined above.

Table C-3 presents the appropriate parameter values and their source in Regulatory Guide 1.109, Revision 1.

In lieu of site-specific data default values for f_L and f_g, 1.0 and 0.76, respectively, were used in the calculation of R_i. These values were obtained from Table E-15 of Regulatory Guide 1.109, Revision 1.

The concentration of tritium in vegetation is based on the airborne concentration rather than the deposition. Therefore, the R_i is bases on χ/Q:

$$R_{T_V} = K'K''' \left[U_a^L f_L + U_a^S f_g\right] (DFL_i)_a \left[0.075\left(\frac{0.5}{H}\right)\right] \quad \text{(C.2-8)}$$

where:

R_{T_V} = Dose factor for the cow or goat milk pathway for tritium for the organ of interest, mrem/yr per $\mu Ci/m^3$

All other terms remain the same as those in Equations C.2-4 and C.2-7.

TABLE C-1

PARAMETERS FOR COW AND GOAT MILK PATHWAYS

Parameter	Value	Reference (Reg. Guide 1.109, Rev. 1)
Q_F (kg/day)	50 (cow)	Table E-3
	6 (goat)	Table E-3
Y_p (kg/m^2)	0.7	Table E-15
t_f (seconds)	1.73×10^5 (2 days)	Table E-15
r	1.0 (radioiodines) 0.2 (particulates)	Table E-15 Table E-15
$(DFL_i)_a$ (mrem/pCi)	Each radionuclide	Tables E-11 to E-14*
F_m (pCi/1 per pCi/day)	Each stable element	Table E-1 (cow)* Table E-2 (goat)**
t_b (seconds)	4.73×10^8 (15 yr)	Table E-15
Y_s (kg/m^2)	2.0	Table E-15
Y_p (kg/m^2)	0.7	Table E-15
t_h (seconds)	7.78×10^6 (90 days)	Table E-15
U_{ap} (liters/yr)	330 infant 330 child 400 teen 310 adult	Table E-5 Table E-5 Table E-5 Table E-5
t_e (seconds)	2.59×10^6 (pasture) 5.18×10^6 (stored feed)	Table E-15
B_{iv} pCi/Kg (wet weight) per pCi/Kg (dry soil)	Each stable element	Table E-1
P Kg (dry soil)/m^2	240	Table E-15

*Reference 1, BSEP File: B10-10530, Letter to J. W. Davis "Dose Factors for Hf-181 and Sn-113," May 24, 1988, and NUREG CR4653 for AM-241.

**Where goat data was not available, cow value F_m was assumed.

TABLE C-2

PARAMETERS FOR THE MEAT PATHWAY

Parameter	Value	Reference (Reg. Guide 1.109, Rev. 1)
r	1.0 (radioiodines) 0.2 (particulates)	Table E-15 Table E-15
F_f (pCi/Kg per pCi/day)	Each stable element	Table E-1*
U_{ap} (Kg/yr)	0 infant 41 child 65 teen 110 adult	Table E-5 Table E-5 Table E-5 Table E-5
$(DFL_i)_a$ (mrem/pCi)	Each radionuclide	Tables E-11 to E-14
Y_p (kg/m^2)	0.7	Table E-15
Y_s (kg/m^2)	2.0	Table E-15
t_b (seconds)	4.73×10^8 (15 yr)	Table E-15
t_s (seconds)	1.73×10^6 (20 days)	Table E-15
t_h (seconds)	7.78×10^6 (90 days)	Table E-15
t_e (seconds)	2.59×10^6 (pasture) 5.18×10^6 (stored feed)	Table E-15
Q_F (kg/day)	50	Table E-3
B_{iv} pCi/Kg (wet weight) per pCi/Kg (dry soil)	Each stable element	Table E-1*
P kg (dry soil)/m^2	240	Table E-15

*Reference 1, BSEP File: B10-10530, Letter to J. W. Davis "Dose Factors for Hf-181 and Sn-113," May 24, 1988, and NUREG CR4653 for AM-241.

TABLE C-3

PARAMETERS FOR THE VEGETABLE PATHWAY

Parameter		Value	Reference (Reg. Guide 1.109, Rev. 1)
r (dimensionless)		1.0 (radioiodines) 0.2 (particulates)	Table E-1 Table E-1
$(DFL_i)_a$ (mrem/Ci)		Each radionuclide	Tables E-11 to E-14*
U_a^L (kg/yr)	-Infant	0	Table E-5
	-Child	26	Table E-5
	-Teen	42	Table E-5
	-Adult	64	Table E-5
U_a^S (kg/yr)	-Infant	0	Table E-5
	-Child	520	Table E-5
	-Teen	630	Table E-5
	-Adult	520	Table E-5
t_L (seconds)		8.6×10^4 (1 day)	Table E-15
t_h (seconds)		5.18×10^6 (60 days)	Table E-15
Y_V (kg/m^2)		2.0	Table E-15
t_e (seconds)		5.18×10^6 (60 days)	Table E-15
t_b (seconds)		4.73×10^8 (15 yr)	Table E-15
P (Kg[dry soil]/m^2)		240	Table E-15
B_{iv}	(pCi/Kg[wet weight] per pCi/kg [dry soil])	Each stable element	Table E-1*

*Reference 1, BSEP File: B10-10530, Letter to J. W. Davis "Dose Factors for Hf-181 and Sn-113," May 24, 1988, and NUREG CR4653 for AM-241.

APPENDIX D

LOWER LIMIT OF DETECTION (LLD)

The following discussion of LLD is taken from NUREG-0473, Rev. 2, February 1, 1980. It represents the bases for LLD footnotes (e) in Table 7.3.3-1, (e) in Table 7.3.3-2, (a) in Table 7.3.7-1, and (b) in Table 7.3.15-3 of the BSEP ODCM Specifications. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95 percent probability with 5 percent probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\, s_b}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot \exp(-\lambda \Delta t)}$$

LLD is the "a priori" lower limit of detection as defined above (as microcurie per unit mass or volume),

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute),

E is the counting efficiency (as counts per transformation),

V is the sample size (in units of mass or volume),

2.22×10^6 is the number of transformations per minute per microcurie,

Y is the fractional radiochemical yield (when applicable),

λ is the radioactive decay constant for the particular radionuclide, and Δt is the elapsed time between midpoint of sample collection and time of counting (for plants effluents, not environmental samples).

The value of s_b used in the calculation of the LLD for a detection system shall be based on the actual observed variance of the background counting rate or of the counting rate of the blank samples (as appropriate) rather than on an unverified theoretically predicted variance. Typical values of E, V, Y, and Δt shall be used in the calculation.

APPENDIX E

RADIOACTIVE LIQUID AND GASEOUS EFFLUENT MONITORING INSTRUMENTATION NUMBERS

I.	Liquid Effluent Monitoring Instruments		
	A.	Liquid Radwaste Radioactivity Monitor	2-D12-RM-K604
	B.	Liquid Radwaste Effluent Flow Measurement Device	2-G16-FIT-N057
	C.	Main Service Water Effluent Radioactivity Monitor	1(2)-D12-RM-K605
	D.	Stabilization Pond Effluent Composite Sampler	2-DST-XE-5027
	E.	Stabilization Pond Effluent Flow Measurement Device	2-DST-FIT-5026
	F.	Condensate Storage Tank Level Indicating Device	1(2)-CO-LIT-1160
II.	Gaseous Effluent Monitoring Instruments		
	1.	Main Stack Monitoring System	
		a. Noble Gas Activity Monitor	2-D12-RM-23S (2-D12-RE-4982)
		b. Iodine Sampler Cartridge	IRSH35 Prefilters A or B
		c. Particulate Sampler Filter	IRSH35 Prefilters A or B
		d. System Effluent Flow Rate Measurement Device	2-VA-FIQ-5902-1 OR -2
		e. Sampler Flow Rate Measurement Device	2-D12-FE-4597
	2.	Reactor Building Ventilation Monitoring System	
		a. Noble Gas Activity Monitor	1(2)-CAC-AQH-1264-3
		b. Iodine Sampler Cartridge	1(2)-CAC-AQH-1264-2 (collection cartridge only)
		c. Particulate Sampler Filter	1(2)-CAC-AQH-1264-1 (collection filter only)
		d. System Effluent Flow Rate Measurement Device	1(2)-VA-FIQ-3356
		e. Sampler Flow Rate Measurement Device	1(2)-CAC-FI-1264

RADIOACTIVE LIQUID AND GASEOUS EFFLUENT MONITORING INSTRUMENTATION NUMBERS (Cont'd)

3.	Turbine Building Ventilation Monitoring System	
	a. Noble Gas Activity Monitor	1(2)-D12-RM-23 (1(2)-D12-RE-4563)
	b. Iodine Sampler Cartridge	1(2)-IRTB32 Prefilters A or B
	c. Particulate Sampler Filter	1(2)-IRTB32 Prefilters A or B
	d. System Effluent Flow Rate Measurement Device	1(2)-VA-FIQ-3358
	e. Sampler Flow Rate Measurement Device	1(2)-D12-FE-4542
4.	Main Condenser Off-Gas Treatment System (AOG) Monitor	
	a. Noble Gas Activity Monitor	1(2)-AOG-RM-103
5.	Main Condenser Off-Gas Treatment System Explosive Gas Monitoring System	
	a. Recombiner Train A	
	1. First Hydrogen Monitor	1(2)-OG-AIT-4284 - Stream 1
	2. Second Hydrogen Monitor	1(2)-OG-AIT-4324 - Stream 2
	b. Recombiner Train B	
	1. First Hydrogen Monitor	1(2)-OG-AIT-4324 - Stream 1
	2. Second Hydrogen Monitor	1(2)-OG-AIT-4284 - Stream 2
6.	Main Condenser Air Ejector Radioactivity Monitor	
	a. Noble Gas Activity Monitor	1(2)-D12-RM-K601 A and B
7.	Hot Shop Ventilation Monitoring System	
	a. Iodine Sampler Cartridge	
	b. Particulate Sampler Filter	

RADIOACTIVE LIQUID AND GASEOUS EFFLUENT MONITORING INSTRUMENTATION NUMBERS (Cont'd)

8. Radioactive Materials Container and Storage Building Decontamination Facility
   a. Iodine Sampler Cartridge
   b. Particulate Sampler Filter

APPENDIX F

LIQUID AND GASEOUS EFFLUENT SYSTEM DIAGRAMS

FIGURE F-1

Liquid Radwaste Effluent System

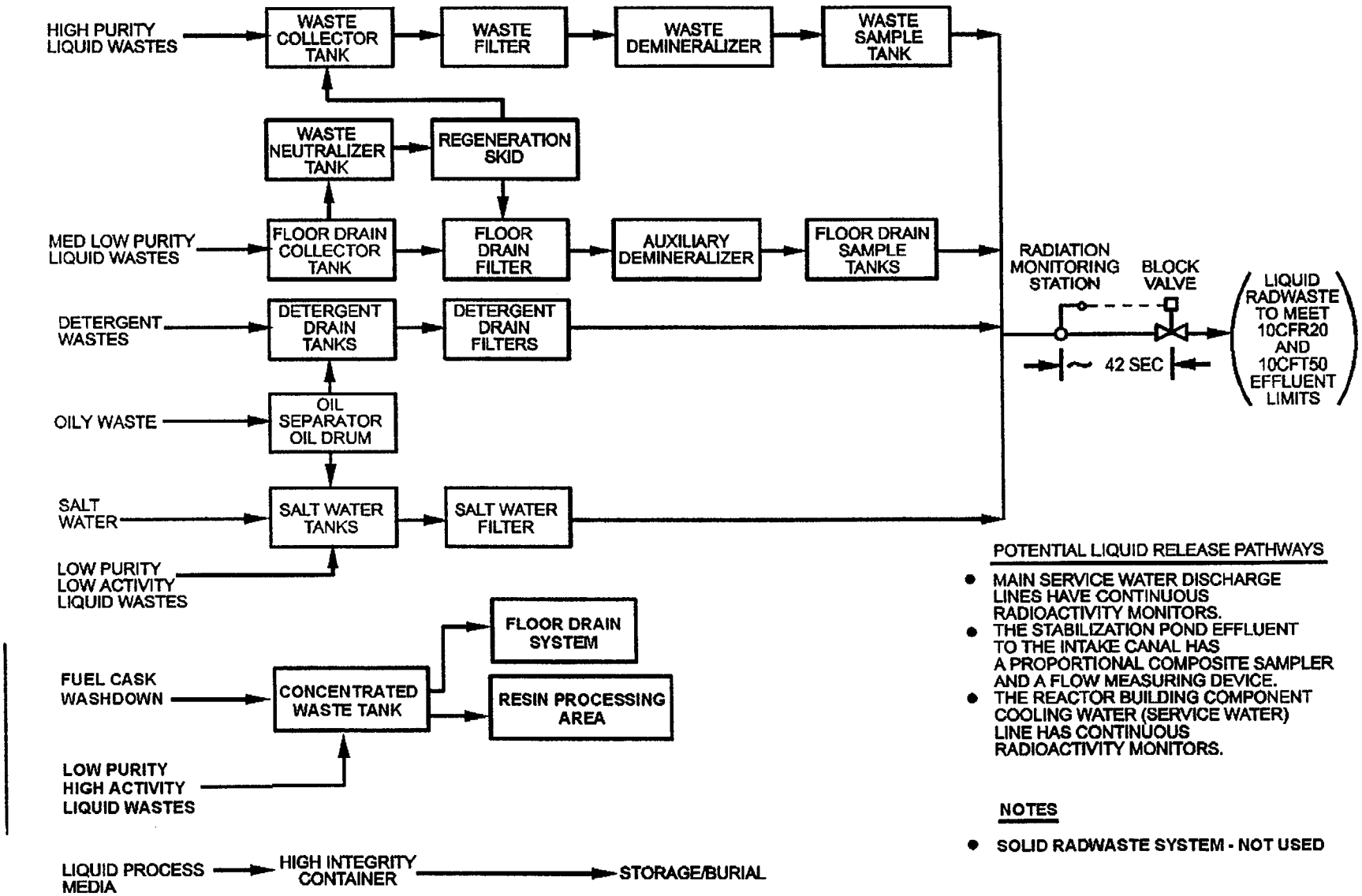
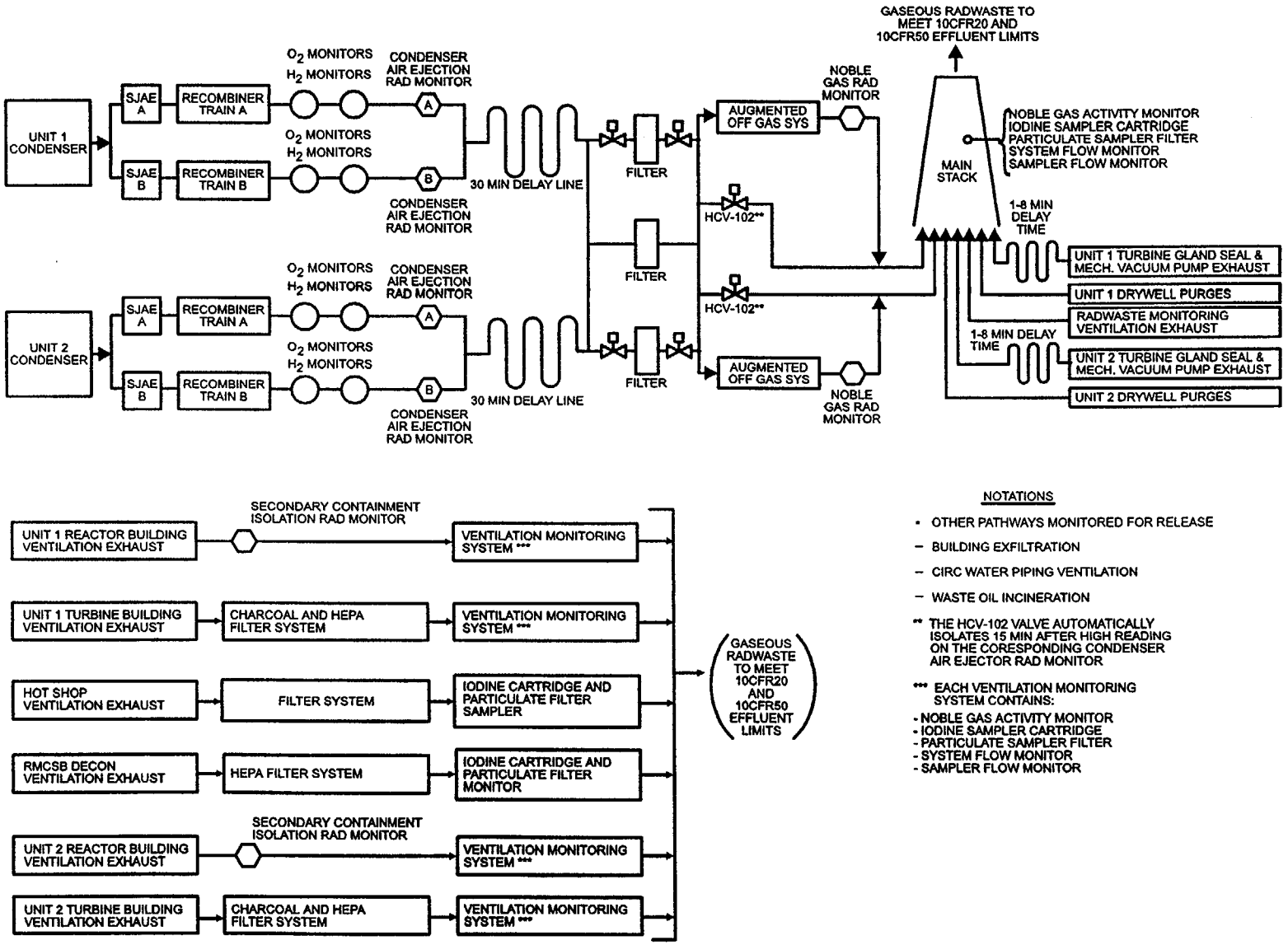


FIGURE F-2

Gaseous Radwaste Effluent System



APPENDIX G

ODCM SOFTWARE PACKAGE

In order to minimize calculational errors and to facilitate the use of the ODCM, BSEP has developed an ODCM software package. All applicable calculations listed in the ODCM have been included in this software.

During periods when the ODCM software is not available, the following alternate method may be used to assess dose or dose rates to the public from liquid or gaseous effluents:

$$Dt = (Dh \times Ct)/Ch$$

where: Dt = the unknown dose/dose rate for the time period
Dh = the known dose/dose rate from historical data
Ct = the total curies released for the time period
Ch = the total curies used to calculate the known dose/dose rate

When the ODCM software becomes available again, all doses to the public will be reassessed using the software package.

APPENDIX H

METHODOLOGY AND CALCULATIONS FOR BURNING WASTE OIL

To permit burning of slightly contaminated waste oil in the clean trash incinerator, an insignificant fraction (0.1%) of the following regulations must be met: 10CFR20; 10CFR50, Appendix I; and 40CFR190. The following sections contain the methodology and the calculations to determine the concentration and the cumulative total activity to be used in procedures to demonstrate compliance with the above regulations.

I. Compliance with 10CFR20 for I-131, I-133, Particulates, and Tritium

The inhalation dose rate associated with burning waste oil is insignificant by definition. Regulatory Guide 1.109 states, "A pathway is considered significant if a conservative evaluation yields an additional dose increment equal to or more than 10 percent of the total from all pathways considered." Since the release rate by incineration of waste oil is ≤ 10% of the plant's total release rate, the dose rate via waste oil is insignificant.

10CFR20 Limit = 1500 mrem/yr (Inhalation to a child's most critical organ)

Insignificant = 150 mrem/yr (10% of limit)

0.1% of 10CRF20 = 1.5 mrem/yr, this more than meets the above criteria and is a consistent fraction as listed in ODCM Specification 7.3.9.c.

Since the limit is going to be limited to 0.1% of 10CFR20, the maximum release rate (μCi/sec) can be calculated by the following equation:

$$Q_i = \frac{1.5 \text{ mrem/yr}}{(R_{ij})\ (X/Q)}$$

where =

R_{ij} = Dose factor for the most restrictive organ to a child (lung) for inhalation using Co-60 (7.06E6 mrem/yr/μCi/m^3)

$\overline{X/Q}$ = Annual average relative concentration for release from the Turbine Building, 7.5E-6 sec/m^3

Since the incinerator operates > 500 hrs/yr and the stack height is considered to be ground level, the meteorology used for dilution will be the same as the Turbine Buildings (ground level continuous). From Appendix A, Table A-1 the most restrictive sector is SSE (7.5E-6 sec/m^3).

For the source term mix, 100% of the activity is assumed to be Cobalt-60. Most of the activity in the slightly contaminated oil is corrosion and activation products with occasional detection of Cesium-134 and Cesium-137.

No iodines will be permitted in the waste oil for incineration. Cobalt-60 is the most restrictive radionuclide for the inhalation pathway to a child's lung (Table 3.3-18).

Therefore,

$$Q_i = \frac{1.5 \text{ mrem/yr}}{(7.06E6 \text{ mrem/yr}/\mu\text{Ci}/\text{m}^3)\ (7.5E-6 \text{ sec}/\text{m}^3)}$$

$$Q_i = 2.83E\text{-}2\ \mu\text{Ci/sec}$$

The maximum oil flow rate for burning oil in the incinerator is six gal/min. The maximum flow rate in cc/sec is calculated as follows:

(6 gal/min) (min/60 sec) (3785 cc/gal) = 378.5 cc/sec

The main fuel oil tank for the incinerator shall not contain more than 20% by volume of slightly contaminated oil. Therefore, the maximum waste oil flow rate would be 1.2 gal/min in lieu of 6 gal/min. For additional conservatism, the flow rate will equal 6 gallons/min for burning oil.

The maximum concentration (μCi/cc) of waste oil to be burned can be determined by the following equation:

$$\text{Max. Conc. } (\mu\text{Ci/cc}) = \frac{Q_i}{f}$$

Where:

f = waste oil flow rate 378.5 cc/sec

$$\text{Max. Conc. } (\mu\text{Ci/cc}) = \frac{2.83E\text{-}2\ \mu\text{Ci/sec}}{378.5 \text{ cc/sec}} = 7.48E\text{-}5\ \mu\text{Ci/cc}$$

The maximum concentration of waste oil to be incinerated is limited to 7.48E-5 μCi/cc which is 0.1% of 10CFR20 limits. This shall be controlled by procedures, sampling, and analyzing the waste oil prior to burning. Limiting the concentration to an insignificant release rate meets the intent of ODCM Specification 7.3.7.

II. <u>Compliance with 10CFR50, Appendix I for I-131, I-133, Particulates and Tritium</u>

ODCM Specification 7.3.9.c limits the burning of waste oil in the incinerator to 0.1% of two times 10CFR50, Appendix I (two-unit site). For conservatism, burning of waste oil shall be limited to 10CFR50, Appendix I.

Therefore:

0.001 x 7.5 mrems = 0.0075 mrem to any organ during any calendar quarter

0.001 x 15 mrems = 0.0150 mrem to any organ during any calendar year

The cumulative dose for the above yearly limit is determined by the following equation:

$$0.015 \text{ (mrem)} \leq 3.17E\text{-}8\ [(R_{i_G} + R_{i_M} + R_{i_V} + R_{i_B})\ (D / Q_{tb})\ (Q_{i_{oil}}) + (R_{i_I})\ (X / Q_{tb})\ (Q_{i_{oil}})]$$

The above equation can be further reduced as follows:

$$0.015 \text{ (mrem)} \leq 3.17E\text{-}8\ [(Q_{i_{oil}})[(R_{i_G} + R_{i_M} + R_{i_V} + R_{i_B})\ (D / Q_{tb}) + (R_{i_I})\ (X / Q_{tb})]\ ]$$

The activity in the slightly contaminated waste oil is long lived fission, corrosion, and activation products. There is no Iodine-131 or Iodine-133 in the oil. Using the most conservative radionuclides (Cesium-134, Cesium-137, and Cobalt-60), a quarterly and yearly activity can be calculated for all organs and all age groups for the summation of all pathway doses. The maximum activity to be released for a calendar quarter and calendar year can be determined as follows:

$$Q_{i_{oil}} = \frac{0.015}{(3.17E\text{-}8)[R_{i_G} + R_{i_M} + R_{i_V} + R_{i_B})(D / Q_{tb}) + (R_{i_I})(X / Q_{tb})]}$$

where:

$3.17E\text{-}8$ = The inverse of the number of seconds in a year

R_{i_G} = Dose factor for an organ for radionuclide i for the ground plane exposure pathway, mrem/yr per µCi/sec per m^{-2}, Table 3.3-1

R_{i_M} = Dose factor for an organ for radionuclide i for the cow milk pathway, mrem/yr per μCi/sec per m^{-2}, Tables 3.3-8, 3.3-9, 3.3-10, and 3.3-11, there is no goat milk production within 5 miles of site

R_{i_V} = Dose factor for an organ for radionuclide i for the vegetable pathway, mrem/yr per μCi/sec per m^{-2}, Tables 3.3-2, 3.3-3 and 3.3-4

R_{i_B} = Dose factor for an organ for radionuclide i for the meat pathway, mrem/yr per μCi/sec per m^{-2}, Tables 3.3-5, 3.3-6, and 3.3-7

R_{i_I} = Dose factor for an organ for radionuclide i for the inhalation pathway, mrem/yr per μCi/m^3, Tables 3.3-16, 3.3-17, 3.3-18, and 3.3-19

D/Q_{tb} = Annual average deposition for release from the Turbine Buildings, NE Sector

= 1.9E-8 m^{-2}, most restrictive, from Appendix A, Table A-3

X/Q_{tb} = Annual average relative concentration for releases from the Turbine Buildings, SSE sector

= 7.5E-6 sec/m^3, most restrictive, from Appendix A, Table A-1

The most restrictive age group and organ is Child Bone. The maximum release in any calendar year is 436 μCi. The maximum release in any calendar quarter is 436 x 1/2 = 218 μCi.

All slightly contaminated waste oil that is to be burned in the incinerator shall be controlled by procedures demonstrating that the quarterly limit (218 μCi) and yearly limit (436 μCi) are not exceeded. Doubling these μCi limits shall be used for calculating percent of technical specification limit in the semiannual report. At the end of each calendar year a dose assessment will be made using the NRC approved computer code GASPAR.

Summary of Co-60, Cs-137, and Cs-134
μCi Release Yearly Limit by Age Group and Organ

	T Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Co-60								
Adult	1,132	965	1,158	1,147	1,158	1,158	1,044	988
Teen	1,120	977	1,158	1,142	1,158	1,158	999	988
Child	1,091	1,037	1,158	1,134	1,158	1,158	1,025	988
Infant	1,153	1,151	1,158	1,155	1,158	1,158	1,070	988
Cs-137								
Adult	1,179	2,349	1,112	928	1,564	2,418	2,053	2,075
Teen	1,278	2,333	826	678	1,292	2,418	1,812	2,075
Child	1,474	2,349	436*	453	1,001	2,418	1,603	2,075
Infant	1,910	2,390	575	509	1,205	2,418	1,714	2,075
Cs-134								
Adult	1,063	3,471	1,623	1,125	1,857	3,652	2,766	3,129
Teen	1,163	3,452	1,233	649	1,478	3,652	2,337	3,129
Child	1,441	3,517	672	442	1,120	3,652	2,017	3,129
Infant	2,258	3,594	851	513	1,417	3,652	2,217	3,129

*Most restrictive quantity in μCi resulting in 0.1% of 10CFR50 Appendix I limit.

III. Compliance with 40CRF190

The annual (calendar year) dose or dose commitment to any MEMBER OF THE PUBLIC due to releases of radioactivity and radiation from uranium fuel cycle sources shall be limited to less than or equal to 25 mrem to the total body or any organ except the thyroid, which shall be limited to less than or equal to 75 mrem. Incinerating waste oil is limited to 0.015 mrem to the most critical organ (including the whole body) using all pathways. 40CFR190 is automatically complied with since 0.015 mrem is ≤ 0.1% of 25 mrem.

ATTACHMENT 2
Page 1 of 1

Request for Process Control Program Chang

Originator: Bob Denne Date: 7-2-96 Rev. 5 to 9

Pages and Sections Revised: Page 1, section 3.1; Page 2, section 3.2.1.2 and note; Page 3, section 4.2

Reason for Change: Non-intent change to align responsibilities for review to those organizations best equipped to perform the reviews, change organization and personnel titles, and allow topical reports to be approved by the disposal facility.

Safety Analysis Complete: [signature] Date: 7-2-96

REVIEWS:

[signature] 1st Safety Reviewer — Recommended/Not Recommended Date: 7-2-96

[signature] 2nd Safety Reviewer — Recommended/Not Recommended Date: 7-29-96

[signature] RC Specialist — Recommended/Not Recommended Date: 7-2-96

Robert Kemp RC Manager — Recommended/Not Recommended Date: 8-9-96

Donald L. Griffith Radwaste Operations — Recommended/Not Recommended Date: 8-9-96

APPROVALS:

[signature] Manager - E&RC — Recommended/Not Recommended Date: 9 Aug 96

[signature] Manager - Operations — Recommended/Not Recommended Date: 27 Aug 96

[signature] PNSC Chairman — Recommended/Not Recommended Date: 9/12/96

[signature] Plant General Manager — Recommended/Not Recommended Date: 9/12/96

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NUCLEAR DOCUMENT CONTROL

ATTACHMENT 2
Page 1 of 1
Request for Process Control Program Change

Originator: Bob Denne Date: 7-2-96 Rev. 3 to 4

Pages and Sections Revised: Page 1, section 3.1; Page 2, section 3.2.1.2 and note; Page 3, section 4.2

Reason for Change: non-intent change to align responsibilities for review to those organizations best equipped to perform the reviews, change organization and personnel titles, and allow topical reports to be approved by the disposal facility.

Safety Analysis Complete: R R Denne Date: 7-2-96

REVIEWS:

R R Denne — 1st Safety Reviewer — Recommended/Not Recommended Date: 7-2-96

M. Tuson — 2nd Safety Reviewer — Recommended/Not Recommended Date: 7-29-96

R R Denne — RC Specialist — Recommended/Not Recommended Date: 7-29-96

Robert Kemp — RC Manager — Recommended/Not Recommended Date: 8-9-96

Donald L. Griffith — Radwaste Operations — Recommended/Not Recommended Date: 8-9-96

APPROVALS:

Manager - E&RC — Recommended/Not Recommended Date: 19 Aug 96

Manager - Operations — Recommended/Not Recommended Date: 27 Aug 96

PNSC Chairman — Recommended/Not Recommended Date: 9/12/96

Plant General Manager — Recommended/Not Recommended Date: 9/12/96

CAROLINA POWER & LIGHT COMPANY

BRUNSWICK NUCLEAR PLANT

PROCESS CONTROL PROGRAM
(PCP)

DOCKET NOS. 50-324 AND 50-325

REVISION 5

REVISION SUMMARY

The PCP is being revised to:

1. Change reference from current Technical Specifications to UFSAR.

LIST OF EFFECTIVE PAGES

Page(s)	Revision
1-5	5

1.0 Scope

This program establishes the management system and controls that the Brunswick Nuclear Plant (BNP) uses to ensure safe and effective solidification and dewatering of various low-level radioactive waste liquids and slurries for off-site disposal.

2.0 Objective

It is the objective of this program that the solidification and/or dewatering of various low-level radioactive waste liquids and slurries (including oily waste) for off-site disposal will be performed by qualified vendors. The quality of the solidified and/or dewatered product shall meet or exceed regulatory requirements and the disposal site criteria prior to release from the Brunswick site for shallow land disposal.

3.0 Management Program

3.1 Responsibilities

3.1.1 The Manager - E&RC is responsible for:

3.1.1.1 Ensuring the waste is shipped in accordance with the appropriate state and federal regulations.

3.1.1.2 Advising the Plant General Manager on the appropriate technical standards, regulations, and requirements as related to solidification, dewatering, and shipping.

3.1.1.3 Ensuring the vendor's Process Control Program and proposed contractual agreements are reviewed, and advising the Plant General Manager as to their adequacy.

3.1.1.4 Retaining vendor supplied documentation for NRC inspection and review.

3.1.2 The Manager - Operations is responsible for:

3.1.2.1 Monitoring vendor operations to assure compliance with UFSAR 12.5.3.8, CP&L practices and procedures, as well as contractual agreements.

3.1.2.2 Ensuring the vendor's on-site operating procedures are reviewed, and advising the Plant General Manager as to their adequacy.

3.2 Specification for Vendors

The qualified solidification vendor will:

3.2.1 Provide a qualified process control program or a program approved by:

3.2.1.1 NRC, or

3.2.1.2 Disposal site licensee or State Regulatory Agency

NOTE

Qualified process control program has been interpreted to mean that testing of the product is underway (to meet the 10CFR Part 61 requirement) or test results have been transmitted to the Nuclear Regulatory Commission, disposal site licensee, or State Regulatory Agency in the form of a topical report.

3.2.2 Demonstrate the ability to meet:

3.2.2.1 NRC solidification standards

3.2.2.2 Disposal site specifications for solidified liquid wastes

3.2.2.3 NRC dewatering standards

3.2.2.4 Disposal site specification for freestanding liquids

3.2.2.5 DOT shipping regulations

3.2.2.6 CP&L radiation protection procedures and practices

3.2.3 Provide documentation on the following for CP&L review, evaluation, and retention:

3.2.3.1 Solidification and dewatering system design including a sketch of the processing system(s)

3.2.3.2 Identification of solidification agent(s)

3.2.3.3 Operating process control procedures with the process control parameters identified (including those for exothermic reactions required to be met prior to container's closure) and provisions to verify the absence of free liquids

3.2.3.4 Results of process tests including:

A. Identification of the representative sample of every tenth batch

B. Identification of actions taken if sample fails to verify solidification

C. Formulation used by the process

3.2.3.5 Topical or qualified report for dewatering

3.2.3.6 Topical or qualified report for high-integrity containers

3.3 Program Operations

3.3.1 The vendor will solidify or dewater and package the supplied liquid waste slurries (including the oily waste) according to their Process Control Program.

3.3.2 The vendor will perform the tests described in their Process Control Program.

3.3.3 The vendor will supply the Manager - E&RC and/or the Manager - Operations with all documentation required to demonstrate compliance with solidification and/or dewatering requirements.

3.3.4 The vendor will report actual or suspected deviations from this procedure, the vendor's QA plan, the vendor's procedure or other abnormalities to the Manager - Operations BNP immediately. These deviations may be initially provided verbally; however, a written report will be provided within 48 hours which discusses the how, when, where, why, how much, and appropriate corrective actions.

3.3.5 The Manager - E&RC will retain vendor supplied documentation required to demonstrate compliance with solidification and/or dewatering requirements and standards. (This does not include documentation of deviations addressed in Step 3.3.4 and addressed in UFSAR 12.5.3.8, which is the responsibility of the Manager - Operations.)

4.0 Management/Contractor Interactions

4.1 The vendor is accountable to the Manager - Operations for the solidification and/or dewatering of liquid wastes.

4.2 The E&RC subunit handles the shipping of solidified and dewatered wastes and maintains required shipping documentation. The vendor and the E&RC Shipping Supervisor or designee may communicate on these matters as necessary.