December 28, 1987

Subject: Offsite Dose Calculation Manual
Revision 23

The General Office Radwaste Engineering Staff is transmitting to you this date, Revision 23 of the Offsite Dose Calculation Manual. As this revision only affects Oconee Nuclear Station, the approval of other station managers is not required. Please update your copy No. 1, and discard the affected pages.

REMOVE THESE PAGES		INSERT THESE PAGES	
A-5	Rev. 15	A-5	Rev. 23
A-8	Rev. 18	A-8	Rev. 23
A-13a	Rev. 21	A-13a	Rev. 23
A-14	Rev. 21	A-14	Rev. 23
A-15	Rev. 15	A-15	Rev. 23
A-16	Rev. 18	A-16	Rev. 23
A-17	Rev. 18	A-17	Rev. 23
A-18	Rev. 21	A-18	Rev. 23
A-19	Rev. 18	A-19	Rev. 23
A-20	Rev. 18	A-20	Rev. 23
A-21	Rev. 18	A-21	Rev. 23
A-22	Rev. 18	A-22	Rev. 23
A-23	Rev. 18	A-23	Rev. 23
A-24	Rev. 18	A-24	Rev. 23
Table A4.0-1	Rev. 15	Table A4.0-1a	Rev. 23
Table A4.0-2	Rev. 15	Table A4.0-1b	Rev. 23
Table A4.0-3	Rev. 15	Table A4.0-2a	Rev. 23
Table A4.0-4	Rev. 15	Table A4.0-2b	Rev. 23
NOTE: Table A4.0-3 (3 pages) dated 1/1/86 Rev. 10 does not change			
A-25	Rev. 18	A-25	Rev. 23
Table A5.0-1	Rev. 3	Table A5.0-1	Rev. 23
Figure A5.0-1	Rev. 15	Figure A5.0-1	Rev. 23

NOTE: As this letter, with it's attachments, contains "LOEP" information, please insert this letter in front of the December 27, 1988.

Approval Date: 12/28/88

Effective Date: 1/1/89

Mary L. Birch
Mary L. Birch
Radiation Protection Manager

Approval Date: 12-22-88

Effective Date: 1/1/89

M. S. Tuckman
M. S. Tuckman, Manager
Oconee Nuclear Station

If you have any questions concerning Revision 23, please call Jim Stewart at (704) 373-5444.

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Scientist
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JUSTIFICATIONS FOR REVISION 23

Page A-5	Changed ":" to "."
Page A-8	Added "/deposition" for clarity purposes
Page 13a	corrected error in section number
Page A-14	corrected formula to use ground level setpoint data
Page A-17	corrected table numbers
Page A-18	corrected table numbers
Section A4.0 Pages A-15 thru A-24	Updated sections using the first nine months of 1988 Effluent Release data and the 1988 Land Use Census Data.
Tables A4.0-1 thru A4.0-4	Changes table numbers due to number duplication
Page A-25	Changed the dates the latest Land Use Census was preformed.
Table A5.0-1	Changed per attached October 28,1988 letter from C T Yongue.
Figure A5.0-1	Changed per attached October 28,1988 letter from C T Yongue.

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TELEPHONE: AREA 803
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October 28, 1988

Dr. W. A. Haller, Manager
Nuclear Technical Services

ATTENTION: [redacted]

SUBJECT: Oconee Nuclear Station
Offsite Dose Calculation Manual
File No.: OS-778.00

Please incorporate the following changes to Table A5.0-1 and Figure A5.0-1. These changes are required to keep consistency between sampling location descriptions identified in the ODCM and station procedures used for sample collection.

Please change the location description for special interest sample 056, Table A5.0-1, from 8.5 miles SSW to 8.4 miles SSW. Monitoring locations were changed some time ago due to a high frequency in loss of TLDs at the previous monitoring location.

Please correct the locations for sample locations 064 and 056 on Figure A5.0-1 the next time Figure A5.0-1 is revised. Sample location 064 was incorrectly identified in Figure A5.0-1 as being on the point of land east of the actual sample location. The reason for the change to location 056 was previously explained.

See attached red marked copies of Table A5.0-1 and Figure A5.0-1 for changes.

Charlie Yongue / SACoy

C. T. Yongue
Station Health Physicist

RET/jw

Attachments

xc: Sarah Coy
Marcia Lane
Johnn Crain

A2.2 GASEOUS RELEASE RATE CALCULATIONS FOR SEMI-ELEVATED RELEASE POINTS

The unit vents are the release points for waste gas decay tanks, containment building purges, the condenser air ejector, and auxiliary building ventilation. The unit vent is treated as a semi-elevated release point. The applicable dispersion and deposition parameters are provided in Tables A4.0-1 and A4.0-2 respectively.

The condenser air ejector effluent is normally considered nonradioactive; that is, it is unlikely the effluent will contain measureable activity above background. It is assumed that no activity is present in the effluent until indicated by radiation monitoring measurements and by analyses of periodic samples collected from this source. Radiation monitoring alarm/trip setpoints in conjunction with administrative controls assure that release limits are not exceeded; see section on radiation monitoring setpoints.

The following calculations, when solved for flowrate, are the release rates for noble gases and for radioiodines, particulates and other radionuclides with half-lives greater than 8 days; the most conservative of release rates calculated in A2.2.1 and A2.2.2 shall control the release rates for a single release point.

A2.2.1 Release rate limit for noble gases:

$$\sum_i K_i \left[(\overline{X/Q})\tilde{Q}_i\right] < 500 \text{ mrem/yr, and}$$

$$\sum_i (L_i + 1.1\, M_i) \left[(\overline{X/Q})\tilde{Q}_i\right] < 3000 \text{ mrem/yr}$$

where the terms are defined below.

A2.2.2 Release rate limit for all radioiodines and radioactive materials in particulate form and radionuclides other than noble gases:

$$\sum_i P_i \left[W\, \tilde{Q}_i\right] < 1500 \text{ mrem/yr}$$

where:

K_i = The total body dose factor due to gamma emissions for each identified noble gas radionuclide, in mrem/yr per $\mu Ci/m^3$ from Table 1.2-1.

L_i = The skin dose factor due to beta emissions for each identified noble gas radionuclide, in mrem/yr per $\mu Ci/m^3$ from Table 1.2-1.

M_i = The air dose factor due to gamma emissions for each identified noble gas radionuclide, in mrad/yr per $\mu Ci/m^3$ from Table 1.2-1 (unit conversion constant of 1.1 mrem/mrad converts air dose to skin dose).

P_i = The dose parameter for radionuclides other than noble gases for the inhalation pathway, in mrem/yr per $\mu Ci/m^3$ and for the food and ground plane pathways in $m^2 \cdot$(mrem/yr) per μCi/sec from Table 1.1-2. The dose factors are based on the critical individual organ and most restrictive age group (child or infant).

$\tilde{Q}_i$ = The release rate of radionuclides, i, in gaseous effluent from all release points at the site, in μCi/sec.

$\overline{X/Q}$ = 9.2E-6 sec/m^3. The highest calculated annual average relative concentration for any area at or beyond the unrestricted area boundary. The location is the S sector @ 1.0 miles for ground-level releases.

W = The highest calculated annual average dispersion/disposition parameter for estimating the dose to an individual at a controlling location in the unrestricted area where the total inhalation, food and ground plane pathway dose is determined to be a maximum based on operational and design basis source term data, land use surveys, and NUREG 0133 guidance:

W = 9.8E-8 sec/m^3, for the inhalation pathway. The location is the WNW sector @ 4.50 miles for ground-level releases.

W = 2.1E-10 m^{-2}, for the food and ground plane pathways. The location is WNW sector @ 4.50 miles for ground-level releases.

$$\tilde{Q}_i = k_1 C_i f \div k_2 = 4.72E{+}2\ C_i f$$

where:

C_i = the concentration of radionuclide, i, in undiluted gaseous effluent, in μCi/ml.

f = the undiluted effluent flow, in cfm

k_1 = conversion factor, 2.83E+04 ml/ft^3

k_2 = conversion factor, 6.0E+01 sec/min

A3.3 GASEOUS RADIATION MONITOR SETPOINTS FOR GROUND-LEVEL RELEASE POINTS

The following equation shall be used to calculate final effluent noble gas radiation monitor setpoints based on Xe-133:

$$K(\overline{X/Q})\tilde{Q}_i < 500 \text{ mrem (See Section A2.2.1)}$$

$$\tilde{Q}_i = 4.72E+2\ C_i f \text{ (See Section A2.2.2)}$$

$$(K)(\overline{X/Q})(472)(C_i)(f) < 500$$

$$C_i < \frac{500}{(294)(9.2E-6)(472)} \div f$$

$$C_i < 3.92E+2/f$$

where:

C = the gross activity in undiluted effluent, in µCi/ml

f = the flow from the tank or building and varies for various release sources, in cfm

K = from Table 1.2-1 for Xe-133, 2.94E+2 mrem/yr per $\mu Ci/m^3$

$\overline{X/Q}$ = 9.2E-6 sec/m^3, as defined in section A2.3.2.

A3.3.1 Interim Radwaste Building Ventilation Exhaust

Ventilation exhaust from the Interim Radwaste Building is considered a separate release point. This exhaust is normally considered non-radioactive; that is, it is possible but unlikely that the effluent will contain measurable activity above background. Since the exhaust is continuous, a maximum concentration of gases in the exhaust, which also is the radiation monitor setpoint, is calculated to assure compliance with release limits. A typical radiation monitor setpoint may be calculated as follows:

$$C < 3.92E+2/f = 2.67E-2\ \mu Ci/ml$$

where:

f = 1.47E+04 cfm

A3.3.1 Hot Machine Shop Building Ventilation Exhaust

Ventilation exhaust from the Hot Machine Shop is considered to be a separate release point. This filtered exhaust is sampled and analyzed for particulates and radioiodines to assure that the effluent released has not exceeded station release limits. Since it is assumed that no noble gases will be generated by machine shop work, no provision for monitoring noble gas releases are provided.

A3.3.2 Contaminated Oil Burning In Auxiliary Boiler

Contaminated oil is burned in the auxiliary boiler which is not released through the unit vent and is considered a separate release point. The contaminated oil is filtered, mixed, and sampled to determine the total activity to be released and the allowable release (burn) rate.

By Technical Specification, releases from the auxiliary boiler from incineration of contaminated oil must meet the instantaneous release rate for iodines and particulates given in Section A2.2.2. Also, the total dose due to these releases must be less than 0.1% of the allowable yearly dose from particulate gaseous effluents.

Doses from incineration of contaminated oil are calculated for all organs and all pathways using either the models provided in Section 3.1.2.2 of this manual or the GASPAR computer program. Cumulative doses are calculated quarterly at a minimum.

All the activity in the contaminated oil is assumed to be released during incineration and the total is added to the station's quarterly and annual release records.

A3.3.3 Radwaste Facility Ventilation and Process Gas Exhaust

The ventilation and process gas exhaust from the Radwaste Facility considered a separate release point. This exhaust is sampled continuously for iodine and particulates and noble gases. This data is used in calculations to assure that the effluents released have not exceeded station release limits. A typical radiation monitor setpoint may be calculated as follows:

$$C < 3.92E+2/f = 3.02E-03\ \mu Ci/ml$$

where:

f = 129,700 cfm, The total combined ventilation and process SAS exhaust flow.

A4.0 DOSE CALCULATIONS

A4.1 FREQUENCY OF CALCULATIONS

Dose contributions to the maximum individual shall be calculated at least every 31 days, quarterly, semiannually, and annually (or as required by Technical Specifications) using the methodology in the generic information sections. This methodology shall also be used for any special reports. Dose calculations that are required for individual pre-release calculations, and/or abnormal releases shall not be calculated by using the simplified dose calculations. Station dose projections for these types and others that are known to vary from the station historical averages shall be calculated by using the methodology in the generic information sections. STATION Dose projections may be performed using simplified dose estimates.

Fuel cycle dose calculations shall be performed annually or as required by special reports. Dose contributions shall be calculated using the methodology in the appropriate generic information sections.

A4.2 DOSE MODELS FOR MAXIMUM EXPOSED INDIVIDUAL

A4.2.1 Liquid Effluents

For dose contributions from liquid radioactive effluent releases, it is assumed that the maximum exposed individual is an adult who consumes fish caught in the discharge area and drinks water from the nearest downstream water supply.

A4.2.2 Gaseous Effluents

A4.2.2.1 Noble Gases

For dose contributions from exposure to beta and gamma radiations from noble gases, it is assumed that the maximum exposed individual is an adult at a controlling location in the unrestricted area where the total noble gas dose from combined semi-elevated and ground level releases is determined to be a maximum; this location may not be controlling for semi-elevated or ground level releases considered separately, however.

A4.2.2.2 Radioiodines, Particulates, and Other Radionuclides with T 1/2 > 8 days

For dose contributions from radioiodines, particulates, and other radionuclides; it is assumed that the maximum exposed individual is a child or infant at a controlling location in the unrestricted area where the total inhalation, food and ground plane pathway dose is determined to be a maximum based on operational source term data, land use surveys, and NUREG-0133 guidance. The controlling location is determined based on total combined semi-elevated and ground level radioidine, particulates and other radionuclide releases with T 1/2 > 8 days; this location may not be controlling for semi-elevated or ground-level releases considered separately, however.

A4.3 SIMPLIFIED DOSE ESTIMATES

A4.3.1 Liquid Effluents

For dose estimates, a simplified calculation based on the assumptions presented in Section A4.2.1 and operational source term data is presented below. Updated operational source term data shall be used to revise these calculations as necessary.

$$D_{WB} = 6.43E{+}05 \sum_{\ell=1}^{m} (F_\ell)(T_\ell)\ (C_{Cs-134} + 0.59\ C_{Cs-137})$$

where:

$6.43E{+}05 = 1.14E{+}05\ (U_{aw}/D_w + U_{af}\ BF_i)\ DF_{ai\tau}\ \ (1.11)$

where:

$1.14E{+}05 = 10^6 pCi/\mu Ci \times 10^3 ml/kg \div 8760\ hr/yr$

U_{aw} = 730 kg/yr, adult water consumption

D_w = 27.5, dilution factor from the near field area to the potable water intake.

U_{af} = 21 kg/yr, adult fish consumption

BF_i = 2.00E+03, bioaccumulation factor for Cesium (Table 3.1-1)

$DF_{ai\tau}$ = 1.21E-04, adult, total body, ingestion dose factor (Table 3.1-2)

1.11 = factor derived from the assumption that 90% of dose is from Cs-134 and Cs-137 or 100% ÷ 90% = 1.11

where:

$$F_\ell = \frac{f\sigma}{F + f}$$

f = liquid radwaste flow, in gpm

σ = recirculation factor at equilibrium, 1.0

F = dilution flow, in gpm

and where:

T_ℓ = the length of time, in hours, over which C_{Cs-134}, C_{Cs-137}, and F_ℓ are averaged

C_{Cs-134} = the average concentration of Cs-134 in undiluted effluent, in μCi/ml, during the time period considered.

C_{Cs-137} = the average concentration of Cs-137 in undiluted effluent, in μCi/ml, during the time period considered.

0.59 = the ratio of the adult total body ingestion dose factors for Cs-134 and Cs-137 or 7.14E-05 ÷ 1.21E-04 = 0.59

A4.3.2 Gaseous Effluents From Semi-Elevated Release Points

Meteorological data for Unit Vent releases is provided in Tables A4.0-1a and A4.0-1b.

A4.3.2.1 Noble Gases

For dose estimates, simplified dose calculations based on the assumptions in A4.2.2.1 and operational source term data are presented below. Updated operational source term data shall be used to revise those calculations as necessary. These calculations further assume that the annual average dispersion parameter is used and that Xenon-133 contributes 90% of the gamma air dose and 80% of the beta air dose for semi-elevated releases.

$$D_\gamma = 4.59E\text{-}12 \; [\,\tilde{Q}\,]_{Xe\text{-}133} \; (1.11)$$

$$D_\beta = 1.36E\text{-}11 \; [\,\tilde{Q}\,]_{Xe\text{-}133} \; (1.25)$$

where:

4.59E-12 = (3.17E-8) (353) ($\overline{X/Q}$), derived from equation presented in Section 3.1.2.1.

1.36E-11 = (3.17E-8) (1050) ($\overline{X/Q}$), derived from equation presented in Section 3.1.2.1.

$[\,\tilde{Q}\,]_{Xe\text{-}133}$ = the total Xenon-133 activity released in μCi

$\overline{X/Q}$ = 4.1E-07 sec/m^3, the semi-elevated release dispersion parameter ($\overline{X/Q}$) corresponding to the controlling location (S @ 3.5 miles) defined in Section A4.2.2.1.

1.11 = factor derived from the assumption that 90% of the Gamma Air dose is contributed by Xe-133

1.25 = factor derived from the assumption that 80% of the Beta-Air dose is contributed by Xe-133

A4.3.2.2 Radioiodines, Particulates, and Other Radionuclides with $T\ 1/2 > 8$ Days

For dose estimates, simplified dose calculations based on the assumptions in A4.2.2.2 and operational source term data are presented below. Updated operational source term data shall be used to revise these calculations as necessary. These calculations further assume that the annual average dispersion/deposition parameter is used and that 99% of the semi-elevated release dose results from Iodine-131 ingested by the maximally exposed individual via the cow milk pathway at the controlling location. The simplified dose estimate for exposure to the thyroid of an infant is:

$$D = 1.53E{+}04\ W\ (\tilde{Q})_{I-131}\ (1.01)$$

where:

W = 9.2E-10, the semi-elevated release deposition parameter ($\overline{D/Q}$) for food and ground plane pathway, in m^{-2} corresponding to the controlling location (WNW @ 4.5 miles) defined in Section A4.2.2.2.

$(\tilde{Q})_{I-131}$ = the total Iodine-131 activity released in μCi.

1.53E+04 = (3.17E-08) (R_i^C [$\overline{D/Q}$]) with the appropriate substitutions for the cow milk pathway factor, R_i^C [$\overline{D/Q}$], for Iodine-131. See Section 3.1.2.2.

1.01 = factor derived from the assumption that 99% of the total inhalation, food and ground plane pathway dose to the maximally exposed individual is contributed by I-131 via the cow milk pathway.

A4.3.3 Gaseous Effluents From Ground-Level Release Points

Meteorological data for Hot Machine Shop Building Ventilation exhaust, Radwaste Facility exhaust, and Interim Radwaste Building releases is provided in Tables A4.0-2a and A4.0-2b.

A4.3.3.1 Noble Gases

For dose estimates, simplified dose calculations based on the assumptions in A4.2.2.1 and operational and design basis source term data are presented below. These calculations further assume that the annual average dispersion parameter is used and that Xenon-133 contributes 85% of the gamma air dose and 85% of the beta air dose for ground-level releases.

$$D_\gamma = 8.28E{-}10\ [\ \tilde{Q}\ ]_{Xe-133}\ (1.18)$$

$$D_\beta = 3.06E{-}11\ [\ \tilde{Q}\ ]_{Xe-133}\ (1.18)$$

where:

8.28E-12 = (3.17E-8) (353) ($\overline{X/Q}$), derived from equation presented in Section 3.1.2.1.

3.06E-11 = (3.17E-8) (1050) ($\overline{X/Q}$), derived from equation presented in Section 3.1.2.1.

$[\tilde{Q}]_{Xe-133}$ = the total Xenon-133 activity released in µCi

$\overline{X/Q}$ = 7.4E-07 sec/m³, the ground level release dispersion parameter ($\overline{X/Q}$) corresponding to the controlling location (S @ 4.0 miles) defined in Section A4.2.2.1.

1.18 = factor derived from the assumption that 85% of the Gamma Air dose is contributed by Xe-133

1.18 = factor derived from the assumption that 85% of the Beta-Air dose is contributed by Xe-133

A4.3.3.2 Radioiodines, Particulates, and Other Radionuclides with T 1/2 > 8 Days

For dose estimates, simplified dose calculations based on the assumptions in A4.2.2.2 and operational and design basis source term data are presented below. These calculations further assume that the annual average dispersion/deposition parameters are used and that 94% of the ground-level release dose is from I-131 ingested by the maximally exposed individual via the cow milk pathway at the controlling location. The simplified dose estimate for exposure to the infant thyroid is:

$$D = 1.53E{+}04\ W\ (\tilde{Q})_{I-131}\ (1.06)$$

where:

W = 2.10E-10 ($\overline{D/Q}$) for food and ground plane pathway, in m^{-2} corresponding to the controlling location (WNW @ 4.50 miles) defined in Section A4.2.2.2.

$(\tilde{Q})_{I-131}$ = the total I-131 activity released from Oconee ground-level release points in µCi.

1.53E+04 = (3.17E-08) ($R_i^C[\overline{D/Q}]$) with the appropriate substitutions for

the infant-cow milk garden pathway, ($R_i^C[\overline{D/Q}]$), for

I-131. See Section 3.1.2.2.

1.06 = factor derived from the assumption that 94% of the total inhalation, food and ground plane pathway dose to the maximally exposed individual is contributed by I-131 via the cow milk pathway.

A4.4 FUEL CYCLE CALCULATIONS

As discussed in Section 3.3.5, more than one nuclear power station site may contribute to the doses to be considered in accordance with 40CFR190. The fuel cycle dose assessments for Oconee Nuclear Station only include liquid and gaseous dose contributions from Oconee Nuclear Station since no other uranium fuel cycle facility contributes significantly to Oconee's maximum exposed individual. For this dose assessment, the total body and maximum organ dose contributions to the maximum exposed individual from Oconee's liquid and gaseous releases are estimated using the following calculations:

$$D_{WB}(T) \qquad D_T = D_{WB}(l_o) + D_{WB}(g_e) + D_{WB}(g_g)$$

$$D_{MO}(T) \qquad D_T = D_{MO}(l_o) + D_{MO}(g_e) + D_{MO}(g_g)$$

where:

$D_{WB}(T)$ = Total estimated fuel cycle whole body dose commitment resulting from the combined liquid and gaseous effluents from Oconee during the calendar year of interest, in mrem.

$D_{MO}(T)$ = Total estimated fuel cycle maximum organ dose commitment resulting from the combined liquid and gaseous effluents from Oconee during the calendar year of interest, in mrem.

A4.4.1 LIQUID EFFLUENTS

Liquid pathway dose estimates are based on values and assumptions presented in Section A.4.3.1. Station operational source terms shall be used to update these simplified calculations as necessary.

Based on operational history, the Oconee fuel cycle maximum exposed individual whole body dose resulting from Oconee's liquid effluent releases ($D_{WB}(l_o)$) is estimated using the simplified dose calculation given below:

$$D_{WB}(l_o) = (6.43E+05) \ (F_{\ell}) (T_{\ell}) (C_{Cs-134} + 0.59 \ C_{Cs-137})$$

where:

$$6.43E+05 = 1.14E+05 (U_{aw} / D_w + U_{af} \times BF_i) (DF_{ait}) (1.11)$$

where:

1.14E+05 = (1.0E-06 pCi/uCi x 1.0E+03 ml/kg) / (8760 hr/yr)

U_{aw} = 730 ℓ/yr, Adult water consumption

D_w = 27.5, Dilution factor from the near field area to the nearest potable water intake

U_{af} = 21 kg/yr, Adult fish consumption

BF_i = 2.00E+03, Bioaccumulation factor for Cesium (Table 3.1-1)

DF_{ait} = 1.21E-04, Adult total body ingestion dose factor for Cs-134 (Table 3.1-2)

1.11 = Factor derived from the assumption that 90% of the dose is derived from Cs-134 and Cs-137 or 100% / 90% = 1.11

where:

$F_\ell = (f)\ (\sigma)\ /\ (F + f)$

where:

f = Oconee's liquid radwaste flow, in gpm

F = Oconee's dilution flow, in gpm

σ = 1.0, the recirculation factor at equilibrium

where:

T_ℓ = 8760 hours, the time period of time over which C_{Cs-134}, C_{Cs-137} and F_ℓ are averaged.

C_{Cs-134} = The average concentration of Cs-134 in Oconee's undiluted effluent, in uCi/ml, during the calendar year of interest.

C_{Cs-137} = The average concentration of Cs-137 in Oconee's undiluted effluent, in uCi/ml, during the calendar year of interest.

0.59 = The ratio of the adult total body ingestion dose factors for Cs-134 and Cs-137 or 7.14E-05 / 1.21E-04 = 0.59

Based on operational history, the Oconee fuel cycle maximum exposed individual maximum organ dose (Infant-Thyroid) resulting from Oconee's liquid effluent releases ($D_{MO}(l_o)$) is estimated using the simplified dose calculation given below:

$$D_{MO}(l_o) = (\ 2.24E+04\ )\ (\ F_\ell\ )\ (\ T_\ell\ )\ (\ C_{I-131}\ )$$

where:

$$2.24E+04 = 1.14E+05\ (\ U_{aw} / D_w + U_{af} \times BF_i\ )\ (\ DF_{ait}\ )\ (\ 1.18\ )$$

where:

1.14E+05 = (1.0E+06 pCi/uCi x 1.0E+03 ml/kg) / (8760 hr/yr)

U_{aw} = 330 ℓ/yr, Infant water consumption

D_w = 27.5, Dilution factor from the near field area to the nearest potable water intake

U_{af} = 0 kg/yr, Infant fish consumption

BF_i = 1.50E+01, Bioaccumulation factor for Iodine (Table 3.1-1)

DF_{ait} = 1.39E-02, Infant Thyroid ingestion dose factor for I-131 (Table 3.1-2)

1.18 = Factor derived from the assumption that 85% of the dose is derived from I-131 or 100% / 85% = 1.18

where:

$$F_{\ell} = (f)\ (\sigma)\ /\ (F + f)$$

where:

f = Oconee's liquid radwaste flow, in gpm

F = Oconee's dilution flow, in gpm

σ = 1.0, the recirculation factor at equilibrium

where:

T_{ℓ} = 8760 hours, the time period of time over which C_{I-131} and F_{ℓ} are are averaged.

C_{I-131} = The average concentration of I-131 in Oconee's undiluted effluent, in uCi/ml, during the calendar year of interest.

A4.4.2 GASEOUS EFFLUENTS FROM SEMI-ELEVATED RELEASE POINTS

Airborne effluent pathway dose estimates are based on the values and assumptions presented in Section A4.3.2. Station operational source term data shall be used to update these calculations as necessary.

Based on operational history, the Oconee fuel cycle maximum exposed individual whole body dose resulting from Oconee's semi-elevated gaseous effluent releases ($D_{WB}(g_e)$) is estimated using the simplified dose calculation given below:

$$D_{WB}(g_e) = (\ 9.32E-06\ )\ (\ w\ )\ (\ \tilde{Q}_{Xe-133}\ )\ (S_F)\ (\ 1.11\ )$$

where:

w = 4.10E-07 = $(\overline{X/Q})$ defined in Section A4.3.2.1.

$\tilde{Q}_{Xe-133}$ = The total Xe-133 activity released from Oconee during the calendar year of interest, in uCi.

9.32E-06 = (3.17E-08) (K_i), with appropriate substitutions for whole body exposure in a semi-infinite cloud of Xe-133. See Section 1.2.1.

S_F = 0.7 = External radiation shielding factor for individuals.

1.11 = The factor derived from the conservative assumption (based on historical data) that 90% of the whole body dose to the maximally exposed individual is contributed by Xe-133.

Based on operational history, the Oconee fuel cycle maximum exposed individual maximum organ dose (Infant Thyroid) resulting from Oconee's semi-elevated gaseous effluent releases ($D_{MO}(g_e)$) is conservatively estimated using the simplified dose calculation given below:

$$D_{MO}(g_e) = (1.53E{+}04) (w) (\tilde{Q}_{I-131}) (1.01)$$

where:

All parameters defined in Section A4.3.2.2.

A4.4.3 GASEOUS EFFLUENTS FROM GROUND-LEVEL RELEASE POINTS

Airborne effluent pathway dose estimates are based on the values and assumptions presented in Section A4.3.2. Station operational source term data shall be used to update these calculations as necessary.

Based on design basis source term data and operational history, the Oconee fuel cycle maximum exposed individual whole body dose resulting from Oconee's ground-level gaseous effluent releases ($D_{WB}(g_g)$) is estimated using the simplified dose calculation given below:

$$D_{WB}(g_g) = (9.32E{-}06) (w) (\tilde{Q}_{Xe-133}) (S_F) (1.18)$$

where:

w = 7.40E-07 = $(\overline{X/Q})$ as defined in Section A4.3.3.1.

$\tilde{Q}_{Xe-133}$ = The total Xe-133 activity released from Oconee during the calendar year of interest, in uCi.

9.32E-06 = (3.17E-08) (K_i), with appropriate substitutions for whole body exposure in a semi-infinite cloud of Xe-133. See Section 1.2.1.

S_F = 0.7 = External radiation shielding factor for individuals.

1.18 = The factor derived from the conservative assumption (based on historical data) that 85% of the whole body dose to the maximally exposed individual is contributed by Xe-133.

Based on design basis source term data and operational history, the Oconee fuel cycle maximum exposed individual maximum organ dose (Infant-thyroid) resulting from Oconee's ground-level gaseous effluent releases ($D_{MO}(g_g)$) is conservatively estimated using the simplified dose calculation given below:

$$D_{MO}(g_g) = (1.53E+04) (w) (\tilde{Q}_{I-131}) (1.06)$$

where:

All parameters defined in Section A4.3.3.2.

TABLE A4.0-1a

OCONEE NUCLEAR STATION
(1 of 1)

DISPERSION PARAMETER (X/Q) FOR SEMI-ELEVATED LONG TERM RELEASES > 500 HR/YR OR > 125 HR/QTR

(sec/m^3)

Distance to the control location, in miles

Sector	0-0.5*	0.5-1.0*	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N			6.5E-8	4.8E-8	4.7E-8	4.7E-8	4.7E-8	6.3E-8	5.9E-8	5.6E-8
NNE			1.1E-7	9.3E-8	8.7E-8	8.9E-8	9.2E-8	9.2E-8	7.2E-8	5.9E-8
NE			7.5E-8	7.2E-8	6.8E-8	5.8E-8	6.1E-8	6.4E-8	6.0E-8	5.7E-8
ENE			6.0E-8	6.4E-8	5.9E-8	6.1E-8	5.7E-8	5.7E-8	5.6E-8	5.6E-8
E			4.1E-8	3.7E-8	5.7E-8	4.8E-8	5.2E-8	4.9E-8	4.7E-8	4.5E-8
ESE			3.0E-8	4.0E-8	6.7E-8	5.8E-8	4.3E-8	5.3E-8	4.9E-8	4.7E-8
SE			2.8E-8	2.8E-8	6.0E-8	5.1E-8	4.1E-8	3.7E-8	3.8E-8	3.8E-8
SSE			2.3E-7	2.0E-7	3.2E-7	2.5E-7	3.7E-7	2.9E-7	2.7E-7	2.5E-7
S			2.6E-7	3.0E-7	2.1E-7	2.1E-7	3.6E-7	4.1E-7	3.7E-7	3.6E-7
SSW			3.2E-7	3.1E-7	2.9E-7	2.7E-7	2.0E-7	1.7E-7	1.7E-7	1.7E-7
SW			7.3E-8	7.1E-8	7.1E-8	5.9E-8	3.9E-8	4.4E-8	4.5E-8	4.5E-8
WSW			5.3E-8	5.2E-8	5.3E-8	4.2E-8	4.8E-8	4.3E-8	4.2E-8	4.2E-8
W			2.7E-8	3.2E-8	3.7E-8	3.7E-8	3.9E-8	3.9E-8	3.7E-8	3.6E-8
WNW			2.3E-8	2.5E-8	3.5E-8	3.5E-8	3.3E-8	3.2E-8	3.0E-8	2.9E-8
NW			3.2E-8	3.7E-8	3.1E-8	3.3E-8	3.0E-8	3.1E-8	2.9E-8	2.8E-8
NNW			6.8E-8	7.7E-8	8.3E-8	7.7E-8	7.8E-8	6.5E-8	6.3E-8	6.2E-8

* Inside Exclusion Area Boundary (EAB)

TABLE A4.0-1b

OCONEE NUCLEAR STATION
(1 of 1)

DEPOSITION PARAMETER ($\overline{D/Q}$) FOR SEMI-ELEVATED LONG TERM RELEASES > 500 HR/YR OR > 125 HR/QTR

(m^{-2})

Distance to the control location, in miles

Sector	0-0.5*	0.5-1.0*	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N			2.4E-9	1.4E-9	8.7E-10	6.0E-10	4.7E-10	3.6E-10	2.8E-10	2.3E-10
NNE			4.1E-9	2.2E-9	1.4E-9	9.6E-10	7.4E-10	5.7E-10	4.4E-10	3.6E-10
NE			2.7E-9	1.5E-9	9.7E-10	6.6E-10	5.0E-10	3.9E-10	3.1E-10	2.5E-10
ENE			1.5E-9	8.4E-10	5.4E-10	3.7E-10	2.8E-10	2.2E-10	1.7E-10	1.4E-10
E			1.6E-9	8.7E-10	5.6E-10	3.9E-10	3.0E-10	2.3E-10	1.8E-10	1.5E-10
ESE			1.3E-9	7.0E-10	4.5E-10	3.0E-10	2.3E-10	1.8E-10	1.4E-10	1.1E-10
SE			8.0E-10	4.4E-10	2.9E-10	2.0E-10	1.5E-10	1.2E-10	8.9E-11	7.3E-11
SSE			2.7E-9	1.6E-9	1.1E-9	7.5E-10	6.0E-10	4.6E-10	3.6E-10	3.0E-10
S			4.5E-9	2.6E-9	1.7E-9	1.2E-9	9.0E-10	7.0E-10	5.5E-10	4.5E-10
SSW			4.3E-9	2.5E-9	1.6E-9	1.1E-9	8.5E-10	6.5E-10	5.0E-10	4.2E-10
SW			1.4E-9	8.4E-10	5.5E-10	3.9E-10	3.0E-10	2.3E-10	1.8E-10	1.5E-10
WSW			1.6E-9	9.1E-10	6.0E-10	4.1E-10	3.2E-10	2.5E-10	1.9E-10	1.6E-10
W			1.4E-9	7.9E-10	5.1E-10	3.6E-10	2.7E-10	2.1E-10	1.6E-10	1.3E-10
WNW			7.7E-10	4.4E-10	2.9E-10	2.0E-10	1.5E-10	1.2E-10	9.2E-10	7.4E-11
NW			1.1E-9	5.9E-10	3.8E-10	2.6E-10	2.0E-10	1.6E-10	1.2E-10	9.9E-11
NNW			1.9E-9	1.0E-9	6.6E-10	4.5E-10	3.5E-10	2.7E-10	2.1E-10	1.7E-10

* Inside Exclusion Area Boundary (EAB)

TABLE A4.0-2a

OCONEE NUCLEAR STATION
(1 of 1)

DISPERSON PARAMETER ($\overline{X/Q}$) FOR GROUND LEVEL, LONG TERM RELEASES > 500 HR/YR OR > 125 HR/QTR

(sec/m^3)

Distance to the control location, in miles

Sector	0-0.5*	0.5-1.0*	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N			2.7E-6	1.1E-6	6.1E-7	3.9E-7	2.8E-7	2.1E-7	1.6E-7	1.3E-7
NNE			2.4E-6	9.8E-7	5.4E-7	3.4E-7	2.4E-7	1.8E-7	1.4E-7	1.2E-7
NE			2.9E-6	1.2E-6	6.5E-7	4.2E-7	2.9E-7	2.2E-7	1.7E-7	1.4E-7
ENE			2.6E-6	1.0E-6	5.7E-7	3.6E-7	2.6E-7	1.9E-7	1.5E-7	1.2E-7
E			3.0E-6	1.2E-6	6.6E-7	4.3E-7	3.0E-7	2.3E-7	1.8E-7	1.4E-7
ESE			3.1E-6	1.2E-6	6.9E-7	4.5E-7	3.2E-7	2.4E-7	1.9E-7	1.6E-7
SE			3.7E-6	1.5E-6	8.4E-7	5.4E-7	3.9E-7	2.9E-7	2.3E-7	1.9E-7
SSE			5.3E-6	2.2E-6	1.2E-6	7.9E-7	5.7E-7	4.3E-7	3.4E-7	2.8E-7
S			9.2E-6	3.7E-6	2.1E-6	1.4E-6	9.8E-7	7.4E-7	5.9E-7	4.8E-7
SSW			4.4E-6	1.8E-6	1.0E-6	6.5E-7	4.6E-7	3.5E-7	2.8E-7	2.3E-7
SW			4.5E-6	1.8E-6	1.0E-6	6.5E-7	4.6E-7	3.5E-7	2.7E-7	2.2E-7
WSW			2.6E-6	1.1E-6	5.9E-7	3.8E-7	2.7E-7	2.0E-7	1.6E-7	1.3E-7
W			2.2E-6	9.1E-7	5.0E-7	3.2E-7	2.3E-7	1.7E-7	1.3E-7	1.1E-7
WNW			1.6E-6	6.6E-7	3.6E-7	2.3E-7	1.7E-7	1.2E-7	9.8E-8	8.0E-8
NW			1.9E-6	7.7E-7	4.2E-7	2.7E-7	1.9E-7	1.4E-7	1.1E-7	9.1E-8
NNW			2.4E-6	9.9E-7	5.4E-7	3.5E-7	2.5E-7	1.9E-7	1.5E-7	1.2E-7

* Inside Exclusion Area Boundary (EAB)

TABLE A4.0-2b

OCONEE NUCLEAR STATION
(1 of 1)

DEPOSITION PARAMETER ($\overline{D/Q}$) FOR GROUND LEVEL, LONG TERM RELEASES > 500 HR/YR OR > 125 HR/QTR

(m^{-2})

Distance to the control location, in miles

Sector	0-0.5*	0.5-1.0*	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N			1.2E-8	4.3E-9	2.1E-9	1.3E-9	8.2E-10	5.8E-10	4.3E-10	3.3E-10
NNE			1.5E-8	5.2E-9	2.6E-9	1.5E-9	1.0E-9	7.0E-10	5.2E-10	4.0E-10
NE			1.7E-8	5.9E-9	2.9E-9	1.7E-9	1.1E-9	8.0E-10	5.9E-10	4.6E-10
ENE			1.1E-8	3.9E-9	1.9E-9	1.1E-9	7.5E-10	5.3E-10	3.9E-10	3.0E-10
E			1.2E-8	4.2E-9	2.1E-9	1.2E-9	8.0E-10	5.6E-10	4.2E-10	3.2E-10
ESE			1.1E-8	3.8E-9	1.9E-9	1.1E-9	7.3E-10	5.1E-10	3.8E-10	2.9E-10
SE			9.5E-9	3.4E-9	1.7E-9	1.0E-9	6.5E-10	4.6E-10	3.4E-10	2.6E-10
SSE			1.2E-8	4.2E-9	2.1E-9	1.2E-9	7.9E-10	5.6E-10	4.1E-10	3.2E-10
S			2.1E-8	7.5E-9	3.7E-9	2.2E-9	1.4E-9	1.0E-9	7.4E-10	5.7E-10
SSW			1.2E-8	4.1E-9	2.1E-9	1.2E-9	7.9E-10	5.6E-10	4.1E-10	3.2E-10
SW			1.6E-8	5.9E-9	2.9E-9	1.7E-9	1.1E-9	8.0E-10	5.9E-10	4.5E-10
WSW			1.3E-8	4.5E-9	2.2E-9	1.3E-9	8.6E-10	6.1E-10	4.5E-10	3.5E-10
W			9.8E-9	3.5E-9	1.8E-9	1.0E-9	6.7E-10	4.7E-10	3.5E-10	2.7E-10
WNW			5.9E-9	2.1E-9	1.1E-9	6.2E-10	4.1E-10	2.9E-10	2.1E-10	1.6E-10
NW			7.3E-9	2.6E-9	1.3E-9	7.7E-10	5.0E-10	3.5E-10	2.6E-10	2.0E-10
NNW			9.7E-9	3.5E-9	1.7E-9	1.0E-9	6.6E-10	4.7E-10	3.5E-10	2.7E-10

* Inside Exclusion Area Boundary (EAB)

A5.0 RADIOLOGICAL ENVIRONMENTAL MONITORING

The radiological environmental monitoring program shall be conducted in accordance with Technical Specification 4.11.

The monitoring program locations and analyses are given in Tables A5.0-1 through A5.0-3 and Figure A5.0-1.

Site specific characteristics make ground water sampling, special low-level I-131 analyses on drinking water, and food product sampling unnecessary. Ground water recharge is from precipitation and the ground water gradient is toward the effluent discharge area; therefore, contamination of ground water from liquid effluents is highly improbable. Special low level I-131 analyses in drinking water will not be performed routinely since the expected I-131 dose from this pathway is less than 1 mrem/year. Food products will not be sampled since lake water irrigation of crops is not practiced in the vicinity.

The laboratory performing the radiological environmental analyses shall participate in an interlaboratory comparison program which has been approved by the NRC. This program is the Environmental Protection Agency's (EPA's) Environmental Radioactivity Laboratory Intercomparison Studies (Crosscheck) Program, our participation code is CP.

The dates of the land-use census that was used to identify the controlling receptor locations was 07/25/88 - 07/29/88.

TABLE A5.0-1

OCONEE RADIOLOGICAL MONITORING PROGRAM SAMPLING LOCATIONS

(TLD LOCATIONS)

SAMPLING LOCATION DESCRIPTION *			SAMPLING LOCATION DESCRIPTION *		
020	SITE BOUNDARY	(0.2 MILES N)	040	4-5 MILE RADIUS	(4.5 MILES E)
021	SITE BOUNDARY	(0.2 MILES NNE)	041	4-5 MILE RADIUS	(4.0 MILES ESE)
022	SITE BOUNDARY	(0.5 MILES NE)	042	4-5 MILE RADIUS	(5.0 MILES SE)
023	SITE BOUNDARY	(0.9 MILES ENE)	043	4-5 MILE RADIUS	(4.0 MILES SSE)
024	SITE BOUNDARY	(0.8 MILES E)	044	4-5 MILE RADIUS	(4.0 MILES S)
025	SITE BOUNDARY	(0.6 MILES ESE)	045	4-5 MILE RADIUS	(5.0 MILES SSW)
026	SITE BOUNDARY	(0.3 MILES SE)	046	4-5 MILE RADIUS	(4.5 MILES SW)
027	SITE BOUNDARY	(0.3 MILES SSE)	047	4-5 MILE RADIUS	(4.0 MILES WSW)
028	SITE BOUNDARY	(0.5 MILES S)	048	4-5 MILE RADIUS	(4.0 MILES W)
029	SITE BOUNDARY	(0.6 MILES SSW)	049	4-5 MILE RADIUS	(4.0 MILES WNW)
030	SITE BOUNDARY	(0.4 MILES SW)	050	4-5 MILE RADIUS	(4.0 MILES NW)
031	SITE BOUNDARY	(0.2 MILES WSW)	051	4-5 MILE RADIUS	(4.5 MILES NNW)
032	SITE BOUNDARY	(0.2 MILES W)	052	SPECIAL INTEREST	(12.0 MILES ENE)
033	SITE BOUNDARY	(0.2 MILES WNW)	053	SPECIAL INTEREST	(11.0 MILES E)
034	SITE BOUNDARY	(0.2 MILES NW)	054	SPECIAL INTEREST	(9.5 MILES ESE)
035	SITE BOUNDARY	(0.1 MILES NNW)	055	SPECIAL INTEREST	(9.5 MILES SSE)
036	4-5 MILE RADIUS	(4.0 MILES N)	056	SPECIAL INTEREST	(8.4 MILES SSW)
037	4-5 MILE RADIUS	(4.5 MILES NNE)	057	SPECIAL INTEREST	(9.0 MILES SW)
038	4-5 MILE RADIUS	(4.0 MILES NE)	058	SPECIAL INTEREST	(10.0 MILES WSW)
039	4-5 MILE RADIUS	(4.0 MILES ENE)	059	SPECIAL INTEREST	(9.0 MILES NW)

* All sampling locations are collected quarterly