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OFFSITE DOSE CALCULATION MANUAL REVISION 38

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-NOTICE-

January 1, 1995

Subject: Offsite Dose Calculation Manual (ODCM)
Generic Section - Revision 38

The General Office Radiation Protection Staff is transmitting to you this date, Revision 38, of the Offsite Dose Calculation Manual. As this revision affects the manual's generic section, the approval of each station manager has been obtained. A list of affected pages is given below. Please insert this letter, with the attached Justification section, in front of the January 1, 1994, Revision 37, letter.

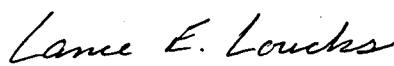
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Effective Date: 1/1/95


L. E. Loucks, Technical Manager
Radiation Protection


Effective Date: 1/1/95


W. R. McCollum, Jr., Manager
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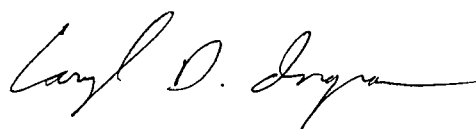
Effective Date: 1/1/95


E. M. Geddie, Jr., Manager
McGuire Nuclear Station

Effective Date: 1/1/95


B. L. Peele, Jr., Manager
Oconee Nuclear Station

If you have any questions concerning Revision 38, please call Caryl Ingram at (704) 382-4496.


Caryl D. Ingram, Senior Engineer
Radiation Protection
Station Support Division

9501190247 950105
PDR ADOCK 05000269
P PDR

JUSTIFICATION FOR REVISION 38

Most of the changes for Revision 38 were due to resolving the deficiencies identified by an ODCM audit performed by the NRC with the technical assistance of a contractor, EG&G Idaho, Inc.

The audit findings were transmitted to Duke Power Company by letter on February 8, 1991 (L. A. Wiens to M. S. Tuckman).

Page 1-2 and 1-3:

Added Section 1.2.2, "Radioiodines, Particulates and Others", which had been incorrectly omitted. (Identified by NRC Audit)

Table 1.2-2:

Recalculated P_i values using the GASPAR computer code. Included only the isotopes that are contained in the GASPAR radionuclide library. (Identified by NRC Audit)

Page 3-2:

Corrected the item in Section 3.1.2 which used terminology that implied that air doses are doses to an individual. (Identified by NRC Audit)

Page 3-8:

Added Section 3.1.4, "Effluent Apportionment", which documents how effluents are assigned on a per unit basis at each nuclear station. (Identified by NRC Audit) (Moved Section 3.2 to page 3-9 and Sections 3.3.3 and 3.3.4 to page 3-10)

Table 3.1-1:

Added correct sign (+ or -) to the exponents in the table.

Tables 3.1-2 through 3.1-9:

Corrected erroneous dose factors identified by the NRC Audit.

January 1, 1994

Subject: Offsite Dose Calculation Manual
Generic Section - Revision 37

The General Office Radwaste Processing & Management Staff is transmitting to you this date, Revision 37, of the Offsite Dose Calculation Manual. As this revision affects the manual's generic section, the approval of each station manager has been obtained. A list of affected pages is given below. Please insert this letter, with it's attachments, in front of the January 1, 1993, Revision 36, letter.

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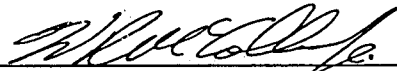
Effective Date: 1/1/94



G. J. Courtney
Radiation Protection Manager

Effective Date: 1/1/94

W. R. McCollum, Manager
Catawba Nuclear Station



Effective Date: 1/1/94



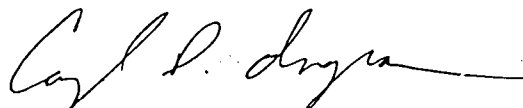
E. M. Geddie, Manager
McGuire Nuclear Station

Effective Date: 1/1/94



H. B. Barron, Manager
Oconee Nuclear Station

If you have any questions concerning Revision 37, please call Caryl Ingram at (704) 382-4496.



Caryl D. Ingram, Senior Engineer
Radwaste Processing & Management
Nuclear Services Division

JUSTIFICATION FOR REVISION 37

Page 2-2:

The K_i value for Xe-133 was changed from $2.94E+02$ to $2.06E+02$ to reflect the changes made to Table 1.2-1 by Revision 35.

January 1, 1993

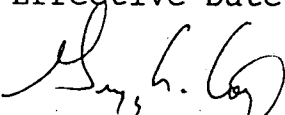
Subject: Offsite Dose Calculation Manual
Revision 36

The General Office Radwaste Processing & Management Staff is transmitting to you this date, Revision 36, of the Offsite Dose Calculation Manual. As this revision affects the manual's generic section, the approval of each station manager has been obtained. A list of affected pages is given below. Please insert this letter, with it's attachments, in front of the February 28, 1992, Revision 35, letter.

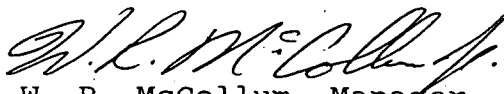
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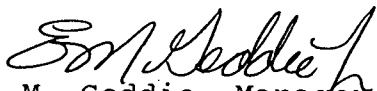
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Effective Date: 1/1/93


G. L. Courtney
Radiation Protection Manager


Approval Date: 1/1/93
Effective Date: 1/1/93


W. R. McCollum, Manager
Catawba Nuclear Station


Approval Date: 1/1/93
Effective Date: 1/1/93


E. M. Geddie, Manager
McGuire Nuclear Station

Approval Date: 1/1/93
Effective Date: 1/1/93


H. B. Barron, Manager
Oconee Nuclear Station

If you have any questions concerning Revision 36, please call Caryl Ingram at (704) 382-4496.


Caryl D. Ingram, Senior Engineer
Radwaste Processing & Management
Nuclear Services Division

JUSTIFICATION FOR REVISION 36

Page i:

Changed "SIMPLIFIED DOSE PROJECTIONS" section to "DOSE PROJECTIONS".

To increase the accuracy of the manual dose projections when needed, the "Simplified Dose Projection" sections of the ODCM have been removed. Manual calculations can be performed more accurately by applying site specific parameters to the generic methodology.

Page iii:

(1) Removed the words "and/or Technical Specifications" to reflect that all three stations have their Radiological Effluent Technical Specifications in their Selected Licensee Commitments manual.

(2) The changes made to the liquid and gaseous release rate requirements are being made in order to accommodate needed operational flexibility to facilitate implementation of the new 10 CFR 20 requirements.

The basic requirements for Selected Licensee Commitments (SLCs) concerning effluents from nuclear power reactors are stated in 10 CFR 50.36a. These requirements indicate that compliance with effluent SLCs will keep average annual releases of radioactive material in effluents to small percentages of the limits specified in the old 10 CFR 20.106 (new 10 CFR 20.1301). These requirements further indicate that operational flexibility is allowed, compatible with considerations of health and safety, which may temporarily result in releases higher than such small percentages, but still within the limits specified in the old 10 CFR 20.106 which references Appendix B, Table II concentrations (MPCs). These referenced concentrations are specific values which relate to an annual dose of 500 mrem. It is further indicated in 10 CFR 50.36a that when using operational flexibility, best efforts shall be exerted to keep levels of radioactive materials in effluents as low as is reasonably achievable (ALARA) as set forth in 10 CFR 50, Appendix I.

As stated in the Introduction to Appendix B of the new 10 CFR 20, the liquid effluent concentration (EC) limits given in Appendix B, Table 2, Column 2, are based on an annual dose of 50 mrem, and the gaseous EC limits given in Appendix B, Table 2, Column 1, are based on an annual dose of 50 mrem for isotopes for which inhalation or ingestion is limiting or 100 mrem for isotopes for which submersion (noble gases) is limiting. Since a release concentration corresponding to a limiting dose rate of 500 mrem/year has been acceptable as a SLC limit for liquid effluents to assure that the limits of 10 CFR 50, Appendix I and 40 CFR 190

are not likely to be exceeded, it should not be necessary to reduce this limit by a factor of 10. For gaseous effluents, since release concentrations corresponding to limiting dose rates less than or equal to 500 mrem/year to the whole body, 3000 mrem/year to the skin from noble gases, and 1500 mrem/year to any organ from Iodine-131, Iodine-133, tritium and all radionuclides in particulate form with half-lives greater than eight days at the site boundary has been acceptable as a SLC limit to assure that the limits of 10 CFR 50, Appendix I and 40 CFR 190 are not likely to be exceeded, it should not be necessary to restrict the operational flexibility by incorporating the dose rate associated with the EC value for isotopes based on inhalation/ingestion (50 mrem/year) or the dose rate associated with the EC value for isotopes based on submersion (100 mrem/year).

Having sufficient operational flexibility is especially important in establishing a basis for effluent monitor setpoint calculations. As discussed above, the concentrations stated in the new 10 CFR 20, Appendix B, Table 2, Columns 1 and 2, relate to a dose of 50 or 100 mrem in a year. When applied on an instantaneous basis, this corresponds to a dose rate of 50 or 100 mrem/year. These low values are impractical upon which to base effluent monitor setpoint calculations for many liquid and gaseous effluent release situations when monitor background, monitor sensitivity, and monitor performance must be taken into account.

Therefore, to accommodate operational flexibility needed for effluent releases, the limits associated with the liquid release rate SLC are based on ten times the concentrations stated in the new 10 CFR 20, Appendix B, Table 2, Column 2. The limits associated with gaseous release SLCs will be maintained at the current instantaneous dose rate limit for noble gases of 500 mrem/year to the whole body and 3000 mrem/year to the skin; and for Iodine-131, for Iodine-133, for tritium, and for all radionuclides in particulate form with half-lives greater than 8 days, an instantaneous dose rate limit of 1500 mrem/year to any organ.

Compliance with the limits of the new 10 CFR 20.1301 will be demonstrated by operating within the limits of 10 CFR 50, Appendix I, and 40 CFR 190. Operational history at Catawba, McGuire, and Oconee has demonstrated that the use of the concentration values for liquids and dose rate values for gases associated with the old 10 CFR 20.106 as SLC limits has resulted in calculated maximum individual doses to a member of the public that are small percentages of the limits of 10 CFR 50, Appendix I and 40 CFR 190.

Page 1-1:

Same as Page iii.

Page 2-1:

Same as Page iii.

Page 3-8:

Same as Page i.

Page 3-9:

Same as Page iii.

February 28, 1992

Subject: Offsite Dose Calculation Manual
Revision 35

The General Office Radiation Protection Staff is transmitting to you this date, Revision 35, of the Offsite Dose Calculation Manual. As this revision affects the manual's generic section, the approval of each station manager has been obtained. Please update your copy No. 32, and discard the affected pages.

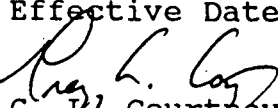
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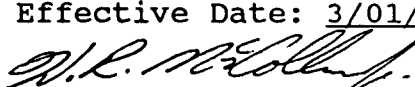
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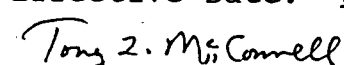
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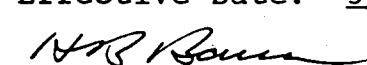
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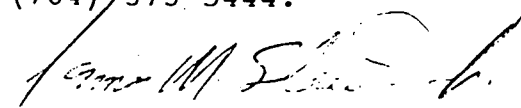
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G. L. Courtney
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Approval Date:
Effective Date: 3/01/92

W. R. McCollum, Manager
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Approval Date:
Effective Date: 3/01/92

T. L. McConnell, Manager
McGuire Nuclear Station

Approval Date:
Effective Date: 3/01/92

H. B. Barron, Manager
Oconee Nuclear Station

If you have any questions concerning Revision 35, please call Jim Stewart at (704) 373-5444.


James M. Stewart, Jr.
Scientist
Radiation Protection

Closure

JUSTIFICATIONS FOR REVISION 35

PAGE #

iii	Added the words "Selected License Commitments".
1-1	Same as Page iii
1-2	Added additional information to definition of Mi
Table 1.2-1	Added the residential shielding attenuation factor of 0.7 to ki values.
Table 1.2-2	Corrected the inhalation values for ZN-65 and TE-127M.
2-1	Same as Page iii
3-2	Corrected typo in formulas.
3-8	Added/Enhanced information provided in Sections 3.1.3 and 3.2.
3-9	Same as Page iii
3-10	Added reference to Ladtap and Gaspar to Section 3.3.5.

December 29, 1989

Subject: Offsite Dose Calculation Manual
Revision 28

The General Office Radiation Protection Staff is transmitting to you this date, Revision 28 of the Offsite Dose Calculation Manual. As this revision affects the manual's generic section, the approval of each station manager has been obtained. Please update your copy No. 32, and discard the affected pages.

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NOTE: As this letter, with it's attachments, contains "LOEP" information, please insert this letter in front of the December 28, 1989.

Approval Date: 12/21/89
Effective Date: 1/1/90

Mary L. Birch
Mary L. Birch
Radiation Protection Manager

Approval Date: 12/22/89
Effective Date: 1/1/90

T. B. Owen
T. B. Owen, Manager
Catawba Nuclear Station

Approval Date: 12/21/89
Effective Date: 1/1/90

Tony L. McConnell
T. L. McConnell, Manager
McGuire Nuclear Station

Approval Date: 12/19/89
Effective Date: 1/1/90

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

If you have any questions concerning Revision 28, please call Jim Stewart at (704) 373-5444.

James M. Stewart, Jr.
James M. Stewart, Jr.
Scientist
Radiation Protection

Enclosure

JUSTIFICATIONS FOR REVISION 28

These changes to the generic section of the Off-Site Dose Calculation Manual are made for the following reasons:

- 1) Updated Table of Contents to agree with current page numbers.
- 2) Changed "System Radwaste Engineer" to "System Radiation Protection Manager" to conform with current company titles.
- 3) Added Mo-99 dose calculation parameters to manual.
- 4) Corrected the Cerium cow-milk and goat-milk stable element transfer coefficient from $6.0E-04$ to $1.0E-04$, and changed affected tables.
- 5) Added Vegetable/Soil stable element transfer data and associated formulas to manual.
- 6) Correct several typographical errors in definitions and/or tables.

September 7, 1984

SUBJECT: OFFSITE DOES CALCULATION MANUAL - REVISION 5

The General Office Radwaste Engineering Staff is transmitting to you this date, Revision 5 of the Offsite Dose Calculation Manual. As this revision affects the manual's generic section, the approval of each station manager has been obtained. Please update your copy no. 32, and discard affected pages.

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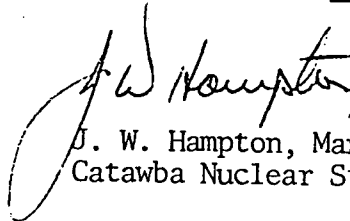
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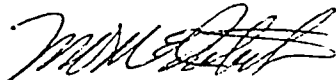
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System Engineer
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J. W. Hampton, Manager
Catawba Nuclear Station

Approval Date: 8/24/84
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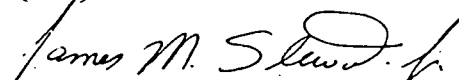


M. D. McIntosh, Manager
McGuire Nuclear Station



M. S. Tuckman, Manager
Oconee Nuclear Station

If you have any questions concerning Revision 5, please call Jim Stewart at (704) 373-5444.



James M. Stewart, Jr.
Associate Health Physicist
Radwaste Engineering
WC-2339

JMS/nem

OFFSITE DOSE CALCULATION MANUAL

FOR

DUKE POWER NUCLEAR STATIONS

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INTRODUCTION

The Offsite Dose Calculation Manual (ODCM) provides the methodology and parameters to be used in the calculation of offsite doses due to radioactive liquid and gaseous effluents to assure compliance with the dose limitations of the Selected Licensee Commitments. These dose limitations assure that:

- 1) the concentration of radioactive liquid effluents released from the site to the unrestricted area will be limited to 10 times the effluent concentration (EC) levels of 10CFR20, Appendix B, Table 2;
- 2) the exposures to any individual member of the public from radioactive liquid effluents will not result in doses greater than the design objectives of 10CFR50, Appendix I;
- 3) the dose rate at any time at the site boundary from radioactive gaseous effluents will be limited to: for noble gases; less than or equal to 500 mrem/yr to the whole body and less than or equal to 3000 mrem/yr to the skin; and for iodine-131 and 133, for tritium, and for all radioactive materials in particulate form with half-lives greater than 8 days; less than or equal to 1500 mrem/yr to any organ;
- 4) the exposure to any individual member of the public from radioactive gaseous effluents will not result in doses greater than the design objectives of 10CFR50, Appendix I; and
- 5) the dose to any individual member of the public from the nuclear fuel cycle will not exceed the limits of 40CFR190 and 10CFR20.

The methodology used to assure compliance with the dose limitations described above shall also be used to prepare the radioactive liquid and gaseous effluent reports required by the Selected Licensee Commitments and/or Technical Specifications. To assure compliance with 40CFR190 when twice the design objectives of 10CFR50, Appendix I are exceeded, the methodology and parameters to be used in calculating the offsite dose to any individual resulting from the entire fuel cycle except mining and waste management facilities are provided in the ODCM.

The ODCM also provides the methodology and parameters to be used in the calculation of radioactive liquid and gaseous effluent monitoring instrumentation alarm/trip setpoints to assure compliance with the concentration and dose rate limitations of the Selected Licensee Commitments. Changes to the methodology and parameters used in this ODCM shall be reviewed by a qualified reviewer(s), and approved by the Station Manager and the Manager of Nuclear Technical Services prior to implementation, and shall be audited by the Nuclear Safety Review Board. Changes to the ODCM shall be submitted to the Nuclear Regulatory Commission in accordance with plant Selected Licensee Commitments.

Normally GASPAR and LADTAP are used for the calculation of offsite doses, but this document also describes a method for the calculation of offsite doses when GASPAR and/or LADTAP are not available.

The ODCM does not replace any station implementing procedures.

1.0 RELEASE RATE CALCULATIONS

The release rate calculations presented in the following sections are site release limits. Sites containing two or more units shall administratively control releases to assure that the release rate calculations limit releases as stated in the Selected Licensee Commitments. Administrative controls could limit the number of releases occurring at one time and/or apportion the release rate between the units.

1.1 LIQUID EFFLUENTS

To comply with Selected Licensee Commitments and to assure that the concentration of radioactive liquid effluents released from the site to the unrestricted area is limited to 10 times the effluent concentrations (ECs) of 10CFR20, Appendix B, Table 2, Column 2, the following release rate calculation shall be performed:

$$f \leq F \div \left\{ \sigma \sum_{i=1}^n \frac{C_i}{(10 \times EC_i)} \right\}$$

where:

C_i = the concentration of radionuclide, 'i', in the undiluted liquid effluent, in $\mu\text{Ci/ml}$.

EC_i = the concentration of radionuclide, 'i', from 10CFR20, Appendix B, Table 2, Column 2, in $\mu\text{Ci/ml}$.

f = the undiluted effluent flow from the tank, in gpm.

F = the dilution flow from the site discharge structure to unrestricted area receiving waters, in gpm.

σ = recirculation factor at equilibrium; this factor accounts for the fraction of discharged water reused by the station; this factor is one for stations on rivers or lakes where discharged water cannot be reused, and varies for sites where water is recirculated and is specified in the appropriate Appendix.

1.2 GASEOUS EFFLUENTS

In order to comply with the Selected Licensee Commitments and to assure that the dose rate, at any time, in the unrestricted area due to radioactive materials released in gaseous effluents from the site is limited to: ≤ 500 mrem/yr to the total body, and ≤ 3000 mrem/yr to the skin for the noble gases, and is limited to ≤ 1500 mrem/yr to any organ for all radioiodine and for all radioactive materials in particulate form, and radionuclides other than noble gases with half lives greater than 8 days, the following release rate calculations shall be performed. These calculations, when solved for 'f', i.e. 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 release rate calculated shall control the release rate.

1.2.1 Noble Gases

$$\sum_i K_i \times \left\{ (\bar{X}/\bar{Q}) \cdot \tilde{Q}_i \right\} < 500 \text{ mrem/yr, and}$$

$$\sum_i (L_i + 1.1 M_i) \cdot \left\{ (\bar{X}/\bar{Q}) \cdot \tilde{Q}_i \right\} < 3000 \text{ mrem/yr}$$

where:

K_i = The total body dose factor due to gamma emissions for each identified noble gas radionuclide, in mrem/yr per $\mu\text{Ci}/\text{m}^3$ 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 $\mu\text{Ci}/\text{m}^3$ 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 $\mu\text{Ci}/\text{m}^3$ from Table 1.2-1 (unit conversion constant of 1.1 mrem/mrad converts air dose to skin dose; no correction for structural shielding is assumed - GASPAR uses a factor of 0.7 reduction in gamma contributions to the skin dose consistent with Regulatory Guide 1.109, equation B-9).

\bar{X}/\bar{Q} = The highest calculated annual average dispersion parameter for any area at or beyond the unrestricted area boundary.

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

$$\tilde{Q}_i = k_1 C_i f + k_2 = 4.72\text{E}+02 \cdot C_i f$$

where:

C_i = the concentration of radionuclide, "i", in undiluted gaseous effluent, in $\mu\text{Ci}/\text{ml}$.

f = the undiluted effluent flow, in cfm.

k_1 = conversion factor, $2.83\text{E}+04 \text{ ml}/\text{ft}^3$.

k_2 = conversion factor, $6.0\text{E}+01 \text{ sec}/\text{min}$.

1.2.2 Radioiodines, Particulates, and Others

$$\sum P_i \times \{ W \cdot \bar{Q}_i \} < 1500 \text{ mrem/yr}$$

where:

P_i = The dose parameter for radionuclides other than noble gases for the inhalation pathway, in mrem/yr per $\mu\text{Ci}/\text{m}^3$ and for the food and ground plane pathways in $(\text{m}^2 \times (\text{mrem/yr per } \mu\text{Ci/sec}))$ from Table 1.2-2. The dose factors are based on the critical individual organ and most restrictive age group.

W = The highest calculated annual average dispersion/deposition parameter for estimating the dose to an individual at a controlling location in the unrestricted area.

\bar{Q}_i = The release rate of radionuclide, 'i', in gaseous effluent from all release points at the site, in $\mu\text{Ci/sec}$.

DOSE FACTORS FOR NOBLE GASES AND DAUGHTERS*

<u>Radionuclide</u>	<u>Total Body Dose Factor K ** (mrem/yr per $\mu\text{Ci}/\text{m}^3$)</u>	<u>Skin Dose Factor L_i (mrem/yr per $\mu\text{Ci}/\text{m}^3$)</u>	<u>Gamma Air Dose Factor M_i (mrad/yr per $\mu\text{Ci}/\text{m}^3$)</u>	<u>Beta Air Dose Factor N_i (mrad/yr per $\mu\text{Ci}/\text{m}^3$)</u>
Kr-83m	5.29E-02***	---	1.93E+01	2.88E+02
Kr-85m	8.19E+02	1.46E+03	1.23E+03	1.97E+03
Kr-85	1.13E+01	1.34E+03	1.72E+01	1.95E+03
Kr-87	4.14E+03	9.73E+03	6.17E+03	1.03E+04
Kr-88	1.03E+04	2.37E+03	1.52E+04	2.93E+03
Kr-89	1.16E+04	1.01E+04	1.73E+04	1.06E+04
Kr-90	1.09E+04	7.29E+03	1.63E+04	7.83E+03
Xe-131m	6.40E+01	4.76E+02	1.56E+02	1.11E+03
Xe-133m	1.76E+02	9.94E+02	3.27E+02	1.48E+03
Xe-133	2.06E+02	3.06E+02	3.53E+02	1.05E+03
Xe-135m	2.18E+03	7.11E+02	3.36E+03	7.39E+02
Xe-135	1.27E+03	1.86E+03	1.92E+03	2.46E+03
Xe-137	9.94E+02	1.22E+04	1.51E+03	1.27E+04
Xe-138	6.18E+03	4.13E+03	9.21E+03	4.75E+03
Ar-41	6.19E+03	2.69E+03	9.30E+03	3.28E+03

*The listed dose factors obtained from Regulatory Guide 1.109, Table B-1 are for radionuclides that may be detected in gaseous effluents.

**Includes a residential structure shielding attenuation factor of 0.7.

*** $7.56\text{E}-02 = 7.56 \times 10^{-2}$
 $5.29\text{E}-02 = 5.29 \times 10^{-2}$

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DOSE PARAMETERS FOR RADIOIODINES AND RADIOACTIVE
PARTICULATE GASEOUS EFFLUENTS*

(P_i Dose Parameters)

<u>Radio- Nuclide</u>	<u>Pathways</u>		<u>Critical Age</u>
	<u>Inhalation</u> (mrem/yr per $\mu\text{Ci}/\text{m}^3$)	<u>Food and Ground</u> ($\text{m}^2 \cdot \text{mrem}/\text{yr}$ per $\mu\text{Ci}/\text{sec}$)	
H-3	1.12E+03	7.52E+03	Child
Cr-51	1.44E+04	1.84E+07	Adult
Mn-54	1.40E+06	2.35E+09	Adult
Fe-55	1.11E+05	1.11E+09	Child
Fe-59	1.02E+06	2.93E+09	Adult
Co-58	9.28E+05	1.28E+09	Adult
Co-60	5.97E+06	2.57E+10	Adult
Zn-65	9.95E+05	5.44E+09	Child
Sr-89	2.16E+06	4.66E+10	Child
Sr-90	1.01E+08	1.57E+12	Child
Zr-95	1.77E+06	2.93E+09	Adult
Sb-124	2.48E+06	3.99E+09	Adult
I-131	1.48E+07	5.79E+11	Infant
I-133	3.55E+06	5.38E+09	Infant
Cs-134	1.90E+05	1.57E+11	Infant
Cs-136	1.34E+05	1.56E+10	Infant
Cs-137	6.12E+05	1.47E+11	Infant
Ba-140	1.74E+06	3.49E+08	Child
Ce-141	6.13E+05	5.75E+08	Teen
Ce-144	1.34E+07	1.31E+10	Teen

* The P_i values were calculated using the GASPARG computer code by making single computer runs for each radionuclide with the X/Q, D/Q, and Q_i values set to 1. The resulting "dose" values given by GASPARG with all other parameters set to 1 yields the P_i values.

The P_i calculations and GASPARG computer runs can be obtained from the General Office Radiation Protection Group.

2.0 RADIATION MONITORING SETPOINTS

Effluent radiation monitor alarm/trip setpoints shall be determined using the calculations presented in the following sections. The calculations define the relationships between the measured effluent activity, the maximum allowable effluent activity, the effluent flowrate, and the dilution available in the restricted area (as defined for effluent releases in the Selected Licensee Commitments) which must be controlled to assure that the instantaneous release rate is not exceeded.

The setpoints shall be determined for those monitors listed in the appropriate tables of the Selected Licensee Commitments.

2.1 LIQUID MONITORS

The following equation shall be used to calculate liquid radiation monitor setpoints:

$$\frac{Cf}{F + f} \leq (10 \times EC)$$

where:

EC = the effluent concentration from 10CFR20, Appendix B, Table 2, Column 2, in $\mu\text{Ci/ml}$.

C = the radioactivity concentration in $\mu\text{Ci/ml}$, in the effluent line prior to dilution and subsequent release, which may be the setpoint and, if so, represents a value which, if exceeded, would result in concentrations exceeding 10 times EC.

f = the flow measured at the radiation monitor location in gpm.

F = the dilution water flow as measured prior to the release point in gpm.

(Note that if no dilution is provided, $C \leq (10 \times EC)$. Also, note that when (F) is large compared to (f), then $F + f \approx F$.)

2.2 GAS MONITORS

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

$$K_i(X/Q)Q_i < 500$$

$$Q_i = 4.72E+2 C f \quad (\text{See Section 1.2.1})$$

where:

C = the gross activity in undiluted effluent, in $\mu\text{Ci/ml}$.

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

K_i = from Table 1.2-1 for Xe-133, $2.06E+02$ mrem/yr per $\mu\text{Ci}/\text{m}^3$.

$\overline{X/Q}$ = the highest calculated annual average dispersion parameter for any area at or beyond the unrestricted area boundary for long term releases.

3.0 DOSE CALCULATIONS

3.1 DOSE MODELS FOR MAXIMUM EXPOSED INDIVIDUAL

3.1.1 Liquid Effluents

Of the possible exposure pathways in the aquatic environment, only two contribute significantly to the total dose; these pathways are ingestion of potable water and aquatic foods. The dose contributions, from these pathways, for measured quantities of radioactive materials identified in liquid effluents released to unrestricted areas shall be calculated for the maximum exposed individual in each age group using:

$$D_{at} = \sum_i [A_{air} \sum_{\ell=1}^m \Delta t_{\ell} C_{i\ell} F_{\ell}]$$

where:

D_{at} = the cumulative dose commitment to the total body or any organ, τ , for an individual of age group, a , from the liquid effluent for the total time period $\sum_{\ell=1}^m \Delta t_{\ell}$, in mrem.

Δt_{ℓ} = the length of the ℓ th time period over which $C_{i\ell}$ and F_{ℓ} are averaged for all liquid releases, in hours.

$C_{i\ell}$ = the average concentration of radionuclide, 'i', in undiluted liquid effluent during time period Δt_{ℓ} from any liquid release, in $\mu\text{Ci/ml}$.

F_{ℓ} = the near field average dilution factor for $C_{i\ell}$ during any liquid effluent release where:

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

where:

σ = recirculation factor at equilibrium; this factor accounts for the fraction of discharged water reused by the station. This factor is one for stations on rivers or lakes where discharged water cannot be reused and varies for sites where water is recirculated. It is specified in the appropriate Appendix.

f = liquid radwaste flow, in gpm.

F = dilution flow, in gpm.

A_{air} = the site related ingestion dose commitment factor for an individual of age group, a , to the total body or any organ, τ , for each identified principal gamma and beta emitter, mrem/hr per $\mu\text{Ci/ml}$.

$$A_{air} = 1.14\text{E}+05 (U_{aw}/D_w + U_{af}BF_i)DF_{air}$$

where:

$$1.14E5 = 10^6 \text{ pCi}/\mu\text{Ci} \times 10^3 \text{ ml/kg} \div 8760 \text{ hr/yr.}$$

U_{aw} = Water consumption by age group, $\ell/\text{yr.}$

infant	330
child	510
teen	510
adult	730

D_w = Dilution factor from the near field area to the potable water intake.

U_{af} = fish consumption by age group, kg/yr.

infant	---
child	6.9
teen	16
adult	21

BF_i = Bioaccumulation factor for radionuclide, 'i', in fish, pCi/kg per pCi/ℓ , from Table 3.1-1.

DF_{air} = Dose conversion factor for radionuclide, 'i', by age group in pre-selected organ, τ , in mrem/pCi , from Tables 3.1-2, 3.1-3, 3.1-4, and 3.1-5, respectively.

Using the above information, A_{air} values for the four age groups have been calculated for each site. This information is provided in Tables "X"4.0-3 through "X"4.0-6 where "X" is the appendix for the site in question.

3.1.2 Gaseous Effluents

The dose contributions from measured quantities of radioactive materials identified in gaseous effluent released to unrestricted areas shall be calculated for the maximum gamma and beta air dose from noble gases, and for the maximum exposed individual from radioiodines, particulates, and others using the following equations:

3.1.2.1 Noble Gases

For gamma radiation:

$$D_\gamma = 3.17E-08 \cdot \sum_i M_i \left\{ (\bar{X}/\bar{Q}) \bar{Q}_i \right\}$$

For beta radiation:

$$D_\beta = 3.17E-08 \cdot \sum_i N_i \left\{ (\bar{X}/\bar{Q}) \bar{Q}_i \right\}$$

where:

$3.17E-08$ = The inverse of the number of seconds in a year.

M_i = The air dose factor due to gamma emissions for each identified noble gas radionuclide, in mrad/yr per $\mu\text{Ci}/\text{m}^3$ from Table 1.2-1.

N_i = The air dose factor due to beta emissions for each identified noble gas radionuclide, in mrad/yr per $\mu\text{Ci}/\text{m}^3$ from Table 1.2-1.

$\overline{X/Q}$ = The highest calculated annual average relative concentration for any area at or beyond the unrestricted area boundary.

Q_i = The release of noble gas radionuclides, 'i', in gaseous effluents, in μCi .

3.1.2.2 Radioiodines, Particulates, and Others

These calculations apply to all radioiodines, radioactive materials in particulate form and radionuclides other than noble gases with half-lives greater than 8 days:

$$D = 3.17 \text{ E-8 } \sum_i R_i [WQ_i]$$

where:

3.17E-08 = The inverse of the number of seconds in a year.

Q_i = The release of radioiodines, radioactive materials in particulate form and radionuclides other than noble gases in gaseous effluents, 'i', in μCi . Releases shall be cumulative over the calendar quarter or year as appropriate.

W = The annual average dispersion or deposition parameter for estimating the dose to an individual at the controlling location.

$W = (\overline{X/Q})$ for the inhalation pathway, in sec/m^3 .

$W = (\overline{D/Q})$ for the food and ground plane pathways, in meters^{-2} .

R_i = The dose factor for each identified radionuclide, 'i', in $\text{m}^2 \cdot (\text{mrem}/\text{yr})$ per $\mu\text{Ci}/\text{sec}$ or mrem/yr per $\mu\text{Ci}/\text{m}^3$, for each pathway. (Tables 3.1-12 + 3.1-30)

where:

Inhalation Pathway Factor, $R_i^I [X/Q]$

$$R_i^I [X/Q] = K' (BR)_a (DFA_i)_a (\text{mrem}/\text{yr per } \mu\text{Ci}/\text{m}^3)$$

where:

K' = a constant of unit conversion, $10^6 \text{ pCi}/\mu\text{Ci}$.

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

The breathing rates (BR)_a for the various age groups are tabulated below, as given in Regulatory Guide 1.109.

Age Group (a)Breathing Rate (m³/yr)

Infant	1400
Child	3700
Teen	8000
Adult	8000

$(DFA_i)_a$ = the maximum organ inhalation dose factor the receptor of age group (a) for the ith radionuclide, in mrem/pCi. The total body is considered as an organ in the selection of $(DFA_i)_a$. See Tables 3.1-6, 3.1-7, 3.1-8, and 3.1-9.

Inhalation dose factors (DFA_i) for the various age groups are given in Tables 3.1-6, 3.1-7, 3.1-8, and 3.1-9^a (taken from Regulatory Guide 1.109 (Rev.1)).

Ground Plane Pathway Factor, R_i^G [D/Q]

$$R_i^G [D/Q] = K' K'' (SF) DFG_i [(1 - e^{-\lambda_i t}) / \lambda_i] \text{ (m}^2 \cdot \text{mrem/yr per } \mu\text{Ci/sec)}$$

where:

K' = a constant of unit conversion, 10^6 pCi/ μ Ci.

K'' = a constant of unit conversion, 8760 hr/year.

λ_i = the decay constant for the ith radionuclide, sec^{-1} .

t = the exposure time, 4.73×10^8 sec (15 years).

DFG_i = the ground plane dose conversion factor for the ith radionuclide (mrem/hr per pCi/m²).

SF = the shielding factor (dimensionless), 0.7 (Regulatory Guide 1.109 (Rev. 1)).

Ground plane dose conversion factors, DFG, are found in Table 3.1-10.

Grass-Cow-Milk Pathway Factor, R_i^C [D/Q]

$$R_i^C [D/Q] = K' E Q_F (U_{ap}) F_m (DFL_i)_a \left\{ \frac{(r)}{(\lambda_i + \lambda_w)} \times \left[\frac{f_p f_s}{Y_p} (1 - \exp(-(\lambda_i + \lambda_w)t_{ep})) \right. \right. \\ \left. \left. + \frac{(1 - f_p f_s)}{Y_s} (1 - \exp(-(\lambda_i + \lambda_w)t_{es})) \exp(-\lambda_i t_h) \right] + \frac{B_{iv}}{P \lambda_i} (1 - \exp(-\lambda_i t_b)) \right\} \exp(-\lambda_i t_f) \\ \text{(m}^2 \cdot \text{mrem/yr per } \mu\text{Ci/sec)}$$

where:

K' = a constant of unit conversion, 10^6 pCi/ μ Ci.

Q_F = the cow's consumption rate, in kg/day (wet weight), (Regulatory Guide 1.109 (Rev. 1)). (Milk cow = 50, Beef Cattle = 50, Goats = 6).

U_{ap} = the receptor's milk consumption rate for age (a), in liters/yr.

U_{ap} (liters/yr) - Infant 330
- Child 330
- Teen 400
- Adult 310 (Regulatory Guide 1.109 (Rev. 1))

Y_P = the agricultural productivity by unit area of pasture feed grass, in kg/m², 0.7.

Y_S = the agricultural productivity by unit area of stored feed, in kg/m², 2.0.

F_m = the stable element transfer coefficients, in days/liter, Table 3.1-11.

r = fraction of deposited activity retained on cow's feed grass, $r = 1$ for radioiodine and $r = 0.2$ for particulates (Regulatory Guide 1.109).

$(DFL_i)_a$ = the maximum organ ingestion dose factor for the i th radionuclide for the receptor in age group 'a', in mrem/pCi. See Tables 3.1-2, 3.1-3, 3.1-4, and 3.1-5.

λ_i = the decay constant for the i th radionuclide, in sec⁻¹.

λ_w = the decay constant for removal of activity on leaf and plant surfaces by weathering, 5.73×10^{-7} sec⁻¹ (corresponding to a 14 day half-life).

t_f = the transport time from pasture to cow, to milk, to receptor, in sec, 1.73×10^5 (2 days).

t_h = the transport time from pasture, to harvest, to cow, to milk, to receptor, in sec, 7.78×10^6 (90 days).

f_p = fraction of the year that the cow is on pasture (dimensionless), 1.0.

f_s = fraction of the cow feed that is pasture grass while the cow is on pasture (dimensionless), 1.0.

E = an adjustment fraction which accounts for the fraction of radionuclides in elemental form which contribute dose for this pathway, $E = 0.5$ for radioiodine, $E = 1.0$ for all others.

t_{ep} = period of pasture grass exposure during growing season, in seconds, $2.59E+06$ (corresponding to 30 days, Regulatory Guide 1.109).

t_{es} = period of stored feed crop/vegetation exposure during growing season, in seconds, $5.18E+06$ (corresponding to 60 days, Regulatory Guide 1.109).

B_{iv} = concentration factor for uptake of radionuclide i from soil by edible parts of crops, in pCi/Kg (wet weight) per pCi/Kg dry soil (Regulatory Guide 1.109). See Table 3.1-11.

P = the effective "surface density" for soil, in kg (dry soil)/m², 240 (Regulatory Guide 1.109).

t_b = period of long-term buildup for activity in soil, in seconds, $4.73E8$ (corresponding to 15 years, Regulatory Guide 1.109).

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

$$R_i^C [X/Q] = K' K''' F_m Q_{F_{ap}} (DFL_i)_a [0.75(0.5/H)] \text{ (mrem/yr per } \mu\text{Ci/m}^3\text{)}$$

where:

K''' = a constant of unit conversion, 10^3 gm/kg.

H = absolute humidity of the atmosphere, 8 gm/m^3 , (Regulatory Guide 1.109)

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.

Grass-Cow-Meat Pathway Factor, $R_i^M [D/Q]$

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

$$R_i^M [D/Q] = K' E Q_F (U_{ap}) F_f (DFL_i)_a \left\{ \frac{(r)}{(\lambda_i + \lambda_w)} \times \left[\frac{f_p f_s}{Y_p} (1 - \exp(-(\lambda_i + \lambda_w)t_{ep})) \right] \right. \\ \left. + \frac{(1 - f_p f_s)}{Y_s} (1 - \exp(-(\lambda_i + \lambda_w)t_{es})) \times \exp(-\lambda_i t_h) \right\} + \frac{B_{iv}}{P \lambda_i} (1 - \exp(-\lambda_i t_b)) \} \times \\ \exp(-\lambda_i t_f) \text{ (m}^2 \cdot \text{mrem/yr per } \mu\text{Ci/sec)}$$

where:

F_f = the stable element transfer coefficients, in days/kg, Table 3.1.11.

U_{ap} = the receptor's meat consumption rate for age (a), in kg/yr.

U_{ap} (kg/yr)	- Infant	0
	- Child	41
	- Teen	65
	- Adult	110

Taken from Regulatory Guide 1.109 (Rev. 1).

t_f = the transport time from pasture to cow, to meat, to receptor, in sec,
 1.73×10^6 (20 days).

t_h = the transport time from crop field to receptor, in sec, 7.78×10^6 (90 days).

The concentration of tritium in meat is based on its airborne concentration rather than the deposition. Therefore, the R_i^M is based on $[X/Q]$:

$$R_i^M [X/Q] = K' K'' F_{fF} U_{ap} (DFL_i)_a [0.75(0.5/H)] \text{ (mrem/yr per } \mu\text{Ci/m}^3\text{)}$$

where all terms are defined above.

Vegetation Pathway Factor, $R_i^V [D/Q]$

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 differs only in the time period between harvest and consumption, therefore:

$$R_i^V = K' E (DFL_i)_a \left[\frac{(r)}{Y_v(\lambda_i + \lambda_w)} (1 - \exp(-(\lambda_i + \lambda_w)t_e)) + \frac{B_{iv}}{P\lambda_i} (1 - \exp(-\lambda_i t_b)) \right] \times$$

$$[U_{aL}^L e^{-\lambda_i t_L} + U_{aG}^S e^{-\lambda_i t_h}]$$

($\text{m}^2 \cdot \text{mrem/yr per } \mu\text{Ci/sec}$)

where:

K' = a constant of unit conversion, $10^6 \text{ pCi}/\mu\text{Ci}$.

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

U_a^L = (kg/hr)	- Infant	0
	- Child	26
	- Teen	42
	- Adult	64

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

- Child	520
- Teen	630
- Adult	520

f_L = the fraction of the annual intake of fresh leafy vegetation grown locally, (1.0).

f_s = the fraction of the annual intake of stored vegetation grown locally, (0.76).

t_L = the average time between harvest of leafy vegetation and its consumption, in seconds, 8.6×10^4 (1 day).

t_s = the average time between harvest of stored vegetation and its consumption, in seconds, 5.18×10^6 (60 days).

Y_v = the vegetation area density, 2.0 kg/m^2 .

and all other factors are previously defined.

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

$$R_i^V[X/Q] = K'K'' U_{iL}^L + U_{iS}^S f (DFL_i)_A [0.75(0.5/H)] \text{ (mrem/yr per } \mu\text{Ci/m}^3\text{)}.$$

All terms defined previously.

3.1.3 Direct Radiation

Direct radiation is that radiation from confined sources and does not include any external component from radioactive effluents. The point kernel method has been used to calculate offsite dose rates from radioactive materials stored in the refueling water storage tanks, reactor makeup water storage tanks, and temporary onsite radwaste storage tanks. Dose calculations using this method performed for Duke Nuclear Stations indicate direct radiation doses are much less than 0.01 mrem/yr and, therefore, makes a negligible contribution to individual dose. Likewise, direct and air-scatter radiation dose contributions from the onsite Independent Spent Fuel Storage Installation (ISFSI) at Oconee have been calculated. The maximum dose rate to the nearest potential resident from the Oconee ISFSI is $< 0.1 \text{ mrem/yr}$. Direct radiation doses will not be calculated routinely.

3.1.4 Effluent Apportionment

For Oconee Nuclear Station, dose commitments to members of the public are written in terms of the site rather than on a per unit basis, and, therefore, effluent releases and dose commitments are reported for the entire site. For the McGuire and Catawba Nuclear Stations the effluent releases are apportioned equally to each unit for each site as recommended by Section 3.1 of NUREG-0133, because the shared radwaste treatment systems at each site make it impractical to accurately ascribe releases to a specific reactor unit.

3.2 DOSE PROJECTIONS

Station dose projection calculations are periodically performed to determine the stations's status with respect to meeting annual ALARA goals specified in the Selected Licensing Commitment Manual. Such calculations are used to verify that adequate margin remains during a report period to allow normal station and radwaste system operation, including anticipated operational occurrences, for the remainder of the report period without exceeding applicable goals. Station dose projection calculations can be performed by using generic methodology, LADTAP and/or GASPAR, or by extrapolating from previous months dose calculation results.

3.3 FUEL CYCLE CALCULATIONS

In accordance with the requirements of 40CFR190, the annual dose commitment to any member of the general public shall be calculated to assure that doses are limited to 25 millirems to the total body or any organ with the exception of the thyroid which is limited to 75 millirems. In accordance with the requirements of the Selected Licensee Commitments, the annual dose commitment shall also be calculated any time that one of the quarterly dose limits of the Selected Licensee Commitments is exceeded; these annual dose commitments may not just be calculated for the calendar year.

The "Uranium fuel cycle" is defined in 40CFR Part 190.02(b) as:

"Uranium fuel cycle means the operations of milling or uranium ore, chemical conversion of uranium, isotopic enrichment of uranium, fabrication of uranium fuel, generation of electricity by a light-water-cooled nuclear power plant using uranium fuel, and reprocessing of spent uranium fuel, to the extent that these directly support the production of electrical power for public use utilizing nuclear energy, but excludes mining operations, operations at waste disposal sites, transportation of any radioactive material in support of these operations, and the reuse of recovered non-uranium special nuclear and by-product materials from the cycle."

Based on this definition of the fuel cycle and the information in 10CFR51, Table S-3, and Wash-1248, the radiological impact of the following operations has been assessed for Duke Nuclear Stations:

3.3.1 Milling

No milling operations occur within fifty miles of any Duke Nuclear Station. The increment of dose from milling operations to any individual within fifty miles of any Duke Nuclear Station is negligible.

3.3.2 Conversion

No uranium hexafluoride production occurs within fifty miles of any Duke Nuclear Station. The increment of dose from UF₆ production to any individual within fifty mile of any Duke Nuclear Station is negligible.

3.3.3 Enrichment

No uranium enrichment operations occur within fifty miles of any Duke Nuclear Station. The increment of dose from enrichment operations to any individual within fifty miles of any Duke Nuclear Station is negligible.

3.3.4 Fuel Fabrication

No fuel fabrication operations occur within fifty miles of any Duke Nuclear Station. The increment of dose from fabrication operations to any individual within fifty miles of any Duke Nuclear Station is negligible.

3.3.5 Nuclear Power Production

The production of electricity for public use using light-water-cooled nuclear power stations results in increments of dose to individuals within fifty miles of any station due to liquid and gaseous effluent releases and direct radiation or skyshine. The increments of dose resulting from liquid and gaseous effluent releases will be calculated using the methodology presented in Sections 3.1.1 and 3.1.2 or the LADTAP and GASPAR computer programs. The dose from direct radiation, skyshine, and radiation from the station storage facilities has been estimated using conservative assumptions (see Section 3.1.3).

In certain situations more than one nuclear power station site may contribute to the doses to be considered in making fuel cycle dose assessments in accordance with 40CFR190. Situations involving more than one station will be presented in the section on site specific information.

3.3.6 Fuel Reprocessing

No fuel reprocessing operations occur within fifty miles of any Duke Nuclear Station. The increment of dose from reprocessing operations to any individual within fifty miles of any Duke Nuclear Station is negligible.

To summarize, only dose increments from nuclear power production operations (Section 3.3.5) need be considered in calculations to demonstrate compliance with the requirements of 40CFR190.

TABLE 3.1-1*
(1 of 1)

BIOACCUMULATION FACTORS TO BE USED IN THE ABSENCE OF SITE-SPECIFIC DATA
(pCi/kg per pCi/liter)

FRESHWATER

<u>ELEMENT</u>	<u>FISH</u>	<u>INVERTEBRATE</u>
H	9.0E-01	9.0E-01
Na	1.0E+02	2.0E+02
Cr	2.0E+02	2.0E+03
Mn	4.0E+02	9.0E+04
Fe	1.0E+02	3.2E+03
Co	5.0E+01	2.0E+02
Ni	1.0E+02	1.0E+02
Cu	5.0E+01	4.0E+02
Zn	2.0E+03	1.0E+04
Br	4.2E+02	3.3E+02
Rb	2.0E+03	1.0E+03
Sr	3.0E+01	1.0E+02
Y	2.5E+01	1.0E+03
Zr	3.3E+00	6.7E+00
Nb	3.0E+04	1.0E+02
Mo	1.0E+01	1.0E+01
Tc	1.5E+01	5.0E+00
Ru	1.0E+01	3.0E+02
Rh	1.0E+01	3.0E+02
Te	4.0E+02	6.1E+03
I	1.5E+01	5.0E+00
Cs	2.0E+03	1.0E+03
Ba	4.0E+00	2.0E+02
La	2.5E+01	1.0E+03
Ce	1.0E+00	1.0E+03
Pr	2.5E+01	1.0E+03
Nd	2.5E+01	1.0E+03
W	1.2E+03	1.0E+01
Np	1.0E+01	4.0E+02

* Table taken from Regulatory Guide 1.109 (Revision 1)

TABLE 3.1-2*
(1 OF 3)

INGESTION DOSE FACTORS FOR ADULTS
(mRem per pCi Ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-ILLI
H 3	NO DATA	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07
Na 24	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06
Cr 51	NO DATA	NO DATA	2.66E-09	1.59E-09	5.86E-10	3.53E-09	6.69E-07
Mn 54	NO DATA	4.57E-06	8.72E-07	NO DATA	1.36E-06	NO DATA	1.40E-05
Mn 56	NO DATA	1.15E-07	2.04E-08	NO DATA	1.46E-07	NO DATA	3.67E-06
Fe 55	2.75E-06	1.90E-06	4.43E-07	NO DATA	NO DATA	1.06E-06	1.09E-06
Fe 59	4.34E-06	1.02E-05	3.91E-06	NO DATA	NO DATA	2.85E-06	3.40E-05
Co 58	NO DATA	7.45E-07	1.67E-06	NO DATA	NO DATA	NO DATA	1.51E-05
Co 60	NO DATA	2.14E-06	4.72E-06	NO DATA	NO DATA	NO DATA	4.02E-05
Ni 63	1.30E-04	9.01E-06	4.36E-06	NO DATA	NO DATA	NO DATA	1.88E-06
Ni 65	5.28E-07	6.86E-08	3.13E-08	NO DATA	NO DATA	NO DATA	1.74E-06
Cu 64	NO DATA	8.33E-08	3.91E-08	NO DATA	2.10E-07	NO DATA	7.10E-06
Zn 65	4.84E-06	1.54E-05	6.96E-06	NO DATA	1.03E-05	NO DATA	9.70E-06
Zn 69	1.03E-08	1.97E-08	1.37E-09	NO DATA	1.28E-08	NO DATA	2.96E-09
Br 83	NO DATA	NO DATA	4.02E-08	NO DATA	NO DATA	NO DATA	5.79E-08
Br 84	NO DATA	NO DATA	5.21E-08	NO DATA	NO DATA	NO DATA	4.09E-13
Br 85	NO DATA	NO DATA	2.14E-09	NO DATA	NO DATA	NO DATA	LT E-24
Rb 86	NO DATA	2.11E-05	9.83E-06	NO DATA	NO DATA	NO DATA	4.16E-06
Rb 88	NO DATA	6.05E-08	3.21E-08	NO DATA	NO DATA	NO DATA	8.36E-19
Rb 89	NO DATA	4.01E-08	2.82E-08	NO DATA	NO DATA	NO DATA	2.33E-21
Sr 89	3.08E-04	NO DATA	8.84E-06	NO DATA	NO DATA	NO DATA	4.94E-05
Sr 90	7.58E-03	NO DATA	1.86E-03	NO DATA	NO DATA	NO DATA	2.19E-04
Sr 91	5.67E-06	NO DATA	2.29E-07	NO DATA	NO DATA	NO DATA	2.70E-05
Sr 92	2.15E-06	NO DATA	9.30E-08	NO DATA	NO DATA	NO DATA	4.26E-05
Y 90	9.62E-09	NO DATA	2.58E-10	NO DATA	NO DATA	NO DATA	1.02E-04
Y 91M	9.09E-11	NO DATA	3.52E-12	NO DATA	NO DATA	NO DATA	2.67E-10
Y 91	1.41E-07	NO DATA	3.77E-09	NO DATA	NO DATA	NO DATA	7.76E-05
Y 92	8.45E-10	NO DATA	2.47E-11	NO DATA	NO DATA	NO DATA	1.48E-05

* Table taken from Regulatory Guide 1.109 (Revision 1)

TABLE 3.1-2*
(2 OF 3)

INGESTION DOSE FACTORS FOR ADULTS
(mRem per pCi Ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-ILLI
Y 93	2.68E-09	NO DATA	7.40E-11	NO DATA	NO DATA	NO DATA	8.50E-05
Zr 95	3.04E-08	9.75E-09	6.60E-09	NO DATA	1.53E-08	NO DATA	3.09E-05
Zr 97	1.68E-09	3.39E-10	1.55E-10	NO DATA	5.12E-10	NO DATA	1.05E-04
Nb 95	6.22E-09	3.46E-09	1.86E-09	NO DATA	3.42E-09	NO DATA	2.10E-05
Mo 99	NO DATA	4.31E-06	8.20E-07	NO DATA	9.76E-06	NO DATA	9.99E-06
Tc 99M	2.47E-10	6.98E-10	8.89E-09	NO DATA	1.06E-08	3.42E-10	4.13E-07
Tc 101	2.54E-10	3.66E-10	3.59E-09	NO DATA	6.59E-09	1.87E-10	1.10E-21
Ru 103	1.85E-07	NO DATA	7.97E-08	NO DATA	7.06E-07	NO DATA	2.16E-05
Ru 105	1.54E-08	NO DATA	6.08E-09	NO DATA	1.99E-07	NO DATA	9.42E-06
Ru 106	2.75E-06	NO DATA	3.48E-07	NO DATA	5.31E-06	NO DATA	1.78E-04
Ag 110M	1.60E-07	1.48E-07	8.79E-08	NO DATA	2.91E-07	NO DATA	6.04E-05
Te 125M	2.68E-06	9.71E-07	3.59E-07	8.06E-07	1.09E-05	NO DATA	1.07E-05
Te 127M	6.77E-06	2.42E-06	8.25E-07	1.73E-06	2.75E-05	NO DATA	2.27E-05
Te 127	1.10E-07	3.95E-08	2.38E-08	8.15E-08	4.48E-07	NO DATA	8.68E-06
Te 129M	1.15E-05	4.29E-06	1.82E-06	3.95E-06	4.80E-05	NO DATA	5.79E-05
Te 129	3.14E-08	1.18E-08	7.65E-09	2.41E-08	1.32E-07	NO DATA	2.37E-08
Te 131M	1.73E-06	8.46E-07	7.05E-07	1.34E-06	8.57E-06	NO DATA	8.40E-05
Te 131	1.97E-08	8.23E-09	6.22E-09	1.62E-08	8.63E-08	NO DATA	2.79E-09
Te 132	2.52E-06	1.63E-06	1.53E-06	1.80E-06	1.57E-05	NO DATA	7.71E-05
I 130	7.56E-07	2.23E-06	8.80E-07	1.89E-04	3.48E-06	NO DATA	1.92E-06
I 131	4.16E-06	5.95E-06	3.41E-06	1.95E-03	1.02E-05	NO DATA	1.57E-06
I 132	2.03E-07	5.43E-07	1.90E-07	1.90E-05	8.65E-07	NO DATA	1.02E-07
I 133	1.42E-06	2.47E-06	7.53E-07	3.63E-04	4.31E-06	NO DATA	2.22E-06
I 134	1.06E-07	2.88E-07	1.03E-07	4.99E-06	4.58E-07	NO DATA	2.51E-10
I 135	4.43E-07	1.16E-06	4.28E-07	7.65E-05	1.86E-06	NO DATA	1.31E-06
Cs 134	6.22E-05	1.48E-04	1.21E-04	NO DATA	4.79E-05	1.59E-05	2.59E-06
Cs 136	6.51E-06	2.57E-05	1.85E-05	NO DATA	1.43E-05	1.96E-06	2.92E-06
Cs 137	7.97E-05	1.09E-04	7.14E-05	NO DATA	3.70E-05	1.23E-05	2.11E-06
Cs 138	5.52E-08	1.09E-07	5.40E-08	NO DATA	8.01E-08	7.91E-09	4.65E-13
Ba 139	9.70E-08	6.91E-11	2.84E-09	NO DATA	6.46E-11	3.92E-11	1.72E-07

* Table taken from Regulatory Guide 1.109 (Revision 1)

TABLE 3.1-2*
(3 OF 3)

INGESTION DOSE FACTORS FOR ADULTS
(mRem per pCi Ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-ILLI
Ba 140	2.03E-05	2.55E-08	1.33E-06	NO DATA	8.67E-09	1.46E-08	4.18E-05
Ba 141	4.71E-08	3.56E-11	1.59E-09	NO DATA	3.31E-11	2.02E-11	2.22E-17
Ba 142	2.13E-08	2.19E-11	1.34E-09	NO DATA	1.85E-11	1.24E-11	3.00E-26
La 140	2.50E-09	1.26E-09	3.33E-10	NO DATA	NO DATA	NO DATA	9.25E-05
La 142	1.28E-10	5.82E-11	1.45E-11	NO DATA	NO DATA	NO DATA	4.25E-07
Ce 141	9.36E-09	6.33E-09	7.18E-10	NO DATA	2.94E-09	NO DATA	2.42E-05
Ce 143	1.65E-09	1.22E-06	1.35E-10	NO DATA	5.37E-10	NO DATA	4.56E-05
Ce 144	4.88E-07	2.04E-07	2.62E-08	NO DATA	1.21E-07	NO DATA	1.65E-04
Pr 143	9.20E-09	3.69E-09	4.56E-10	NO DATA	2.13E-09	NO DATA	4.03E-05
Pr 144	3.01E-11	1.25E-11	1.53E-12	NO DATA	7.05E-12	NO DATA	4.33E-18
Nd 147	6.29E-09	7.27E-09	4.35E-10	NO DATA	4.25E-09	NO DATA	3.49E-05
W 187	1.03E-07	8.61E-08	3.01E-08	NO DATA	NO DATA	NO DATA	2.82E-05
Np 239	1.19E-09	1.17E-10	6.45E-11	NO DATA	3.65E-10	NO DATA	2.40E-05

* Table taken from Regulatory Guide 1.109 (Revision 1)

TABLE 3.1-3*
(1 OF 3)

INGESTION DOSE FACTORS FOR TEENAGER
(mRem per pCi Ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07
Na 24	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06
Cr 51	NO DATA	NO DATA	3.60E-09	2.00E-09	7.89E-10	5.14E-09	6.05E-07
Mn 54	NO DATA	5.90E-06	1.17E-06	NO DATA	1.76E-06	NO DATA	1.21E-05
Mn 56	NO DATA	1.58E-07	2.81E-08	NO DATA	2.00E-07	NO DATA	1.04E-05
Fe 55	3.78E-06	2.68E-06	6.25E-07	NO DATA	NO DATA	1.70E-06	1.16E-06
Fe 59	5.87E-06	1.37E-05	5.29E-06	NO DATA	NO DATA	4.32E-06	3.24E-05
Co 58	NO DATA	9.72E-07	2.24E-06	NO DATA	NO DATA	NO DATA	1.34E-05
Co 60	NO DATA	2.81E-06	6.33E-06	NO DATA	NO DATA	NO DATA	3.66E-05
Ni 63	1.77E-04	1.25E-05	6.00E-06	NO DATA	NO DATA	NO DATA	1.99E-06
Ni 65	7.49E-07	9.57E-08	4.36E-08	NO DATA	NO DATA	NO DATA	5.19E-06
Cu 64	NO DATA	1.15E-07	5.41E-08	NO DATA	2.91E-07	NO DATA	8.92E-06
Zn 65	5.76E-06	2.00E-05	9.33E-06	NO DATA	1.28E-05	NO DATA	8.47E-06
Zn 69	1.47E-08	2.80E-08	1.96E-09	NO DATA	1.83E-08	NO DATA	5.16E-08
Br 83	NO DATA	NO DATA	5.74E-08	NO DATA	NO DATA	NO DATA	LT E-24
Br 84	NO DATA	NO DATA	7.22E-08	NO DATA	NO DATA	NO DATA	LT E-24
Br 85	NO DATA	NO DATA	3.05E-09	NO DATA	NO DATA	NO DATA	LT E-24
Rb 86	NO DATA	2.98E-05	1.40E-05	NO DATA	NO DATA	NO DATA	4.41E-06
Rb 88	NO DATA	8.52E-08	4.54E-08	NO DATA	NO DATA	NO DATA	7.30E-15
Rb 89	NO DATA	5.50E-08	3.89E-08	NO DATA	NO DATA	NO DATA	8.43E-17
Sr 89	4.40E-04	NO DATA	1.26E-05	NO DATA	NO DATA	NO DATA	5.24E-05
Sr 90	8.30E-03	NO DATA	2.05E-03	NO DATA	NO DATA	NO DATA	2.33E-04
Sr 91	8.07E-06	NO DATA	3.21E-07	NO DATA	NO DATA	NO DATA	3.66E-05
Sr 92	3.05E-06	NO DATA	1.30E-07	NO DATA	NO DATA	NO DATA	7.77E-05
Y 90	1.37E-08	NO DATA	3.69E-10	NO DATA	NO DATA	NO DATA	1.13E-04
Y 91M	1.29E-10	NO DATA	4.93E-12	NO DATA	NO DATA	NO DATA	6.09E-09
Y 91	2.01E-07	NO DATA	5.39E-09	NO DATA	NO DATA	NO DATA	8.24E-05
Y 92	1.21E-09	NO DATA	3.50E-11	NO DATA	NO DATA	NO DATA	3.32E-05

* Table taken from Regulatory Guide 1.109 (Revision 1)

TABLE 3.1-3*
(2 OF 3)

INGESTION DOSE FACTORS FOR TEENAGER
(mRem per pCi Ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-ILLI
Y 93	3.83E-09	NO DATA	1.05E-10	NO DATA	NO DATA	NO DATA	1.17E-04
Zr 95	4.12E-08	1.30E-08	8.94E-09	NO DATA	1.91E-08	NO DATA	3.00E-05
Zr 97	2.37E-09	4.69E-10	2.16E-10	NO DATA	7.11E-10	NO DATA	1.27E-04
Nb 95	8.22E-09	4.56E-09	2.51E-09	NO DATA	4.42E-09	NO DATA	1.95E-05
Mo 99	NO DATA	6.03E-06	1.15E-06	NO DATA	1.38E-05	NO DATA	1.08E-05
Tc 99M	3.32E-10	9.26E-10	1.20E-08	NO DATA	1.38E-08	5.14E-10	6.08E-07
Tc 101	3.60E-10	5.12E-10	5.03E-09	NO DATA	9.26E-09	3.12E-10	8.75E-18
Ru 103	2.55E-07	NO DATA	1.09E-07	NO DATA	8.99E-07	NO DATA	2.13E-05
Ru 105	2.18E-08	NO DATA	8.46E-09	NO DATA	2.75E-07	NO DATA	1.76E-05
Ru 106	3.92E-06	NO DATA	4.94E-07	NO DATA	7.56E-06	NO DATA	1.88E-04
Ag 110M	2.05E-07	1.94E-07	1.18E-07	NO DATA	3.70E-07	NO DATA	5.45E-05
Te 125M	3.83E-06	1.38E-06	5.12E-07	1.07E-06	NO DATA	NO DATA	1.13E-05
Te 127M	9.67E-06	3.43E-06	1.15E-06	2.30E-06	3.92E-05	NO DATA	2.41E-05
Te 127	1.58E-07	5.60E-08	3.40E-08	1.09E-07	6.40E-07	NO DATA	1.22E-05
Te 129M	1.63E-05	6.05E-06	2.58E-06	5.26E-06	6.82E-05	NO DATA	6.12E-05
Te 129	4.48E-08	1.67E-08	1.09E-08	3.20E-08	1.88E-07	NO DATA	2.45E-07
Te 131M	2.44E-06	1.17E-06	9.76E-07	1.76E-06	1.22E-05	NO DATA	9.39E-05
Te 131	2.79E-08	1.15E-08	8.72E-09	2.15E-08	1.22E-07	NO DATA	2.29E-09
Te 132	3.49E-06	2.21E-06	2.08E-06	2.33E-06	2.12E-05	NO DATA	7.00E-05
I 130	1.03E-06	2.98E-06	1.19E-06	2.43E-04	4.59E-06	NO DATA	2.29E-06
I 131	5.85E-06	8.19E-06	4.40E-06	2.39E-03	1.41E-05	NO DATA	1.62E-06
I 132	2.79E-07	7.30E-07	2.62E-07	2.46E-05	1.15E-06	NO DATA	3.18E-07
I 133	2.01E-06	3.41E-06	1.04E-06	4.76E-04	5.98E-06	NO DATA	2.58E-06
I 134	1.46E-07	3.87E-07	1.39E-07	6.45E-06	6.10E-07	NO DATA	5.10E-09
I 135	6.10E-07	1.57E-06	5.82E-07	1.01E-04	2.48E-06	NO DATA	1.74E-06
Cs 134	8.37E-05	1.97E-04	9.14E-05	NO DATA	6.26E-05	2.39E-05	2.45E-06
Cs 136	8.59E-06	3.38E-05	2.27E-05	NO DATA	1.84E-05	2.90E-06	2.72E-06
Cs 137	1.12E-04	1.49E-04	5.19E-05	NO DATA	5.07E-05	1.97E-05	2.12E-06
Cs 138	7.76E-08	1.49E-07	7.45E-08	NO DATA	1.10E-07	1.28E-08	6.76E-11
Ba 139	1.39E-07	9.78E-11	4.05E-09	NO DATA	9.22E-11	6.74E-11	1.24E-06

* Table taken from Regulatory Guide 1.109 (Revision 1)

TABLE 3.1-3*
(3 OF 3)

INGESTION DOSE FACTORS FOR TEENAGER
(mRem per pCi Ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-ILLI
Ba 140	2.84E-05	3.48E-08	1.83E-06	NO DATA	1.18E-08	2.34E-08	4.38E-05
Ba 141	6.71E-08	5.01E-11	2.24E-09	NO DATA	4.65E-11	3.43E-11	1.43E-13
Ba 142	2.99E-08	2.99E-11	1.84E-09	NO DATA	2.53E-11	1.99E-11	9.18E-20
La 140	3.48E-09	1.71E-09	4.55E-10	NO DATA	NO DATA	NO DATA	9.82E-05
La 142	1.79E-10	7.95E-11	1.98E-11	NO DATA	NO DATA	NO DATA	2.42E-06
Ce 141	1.33E-08	8.88E-09	1.02E-09	NO DATA	4.18E-09	NO DATA	2.54E-05
Ce 143	2.35E-09	1.71E-06	1.91E-10	NO DATA	7.67E-10	NO DATA	5.14E-05
Ce 144	6.96E-07	2.88E-07	3.74E-08	NO DATA	1.72E-07	NO DATA	1.75E-04
Pr 143	1.31E-08	5.23E-09	6.52E-10	NO DATA	3.04E-09	NO DATA	4.31E-05
Pr 144	4.30E-11	1.76E-11	2.18E-12	NO DATA	1.01E-11	NO DATA	4.74E-14
Nd 147	9.38E-09	1.02E-08	6.11E-10	NO DATA	5.99E-09	NO DATA	3.68E-05
W 187	1.46E-07	1.19E-07	4.17E-08	NO DATA	NO DATA	NO DATA	3.22E-05
Np 239	1.76E-09	1.66E-10	9.22E-11	NO DATA	5.21E-10	NO DATA	2.67E-05

* Table taken from Regulatory Guide 1.109 (Revision 1)

TABLE 3.1-4*
(1 OF 3)

INGESTION DOSE FACTORS FOR CHILD
(mRem per pCi Ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07
Na 24	5.80E-06	5.80E-06	5.80E-06	5.80E-06	5.80E-06	5.80E-06	5.80E-06
Cr 51	NO DATA	NO DATA	8.90E-09	4.94E-09	1.35E-09	9.02E-09	4.72E-07
Mn 54	NO DATA	1.07E-05	2.85E-06	NO DATA	3.00E-06	NO DATA	8.98E-06
Mn 56	NO DATA	3.34E-07	7.54E-08	NO DATA	4.04E-07	NO DATA	4.84E-05
Fe 55	1.15E-05	6.10E-06	1.89E-06	NO DATA	NO DATA	3.45E-06	1.13E-06
Fe 59	1.65E-05	2.67E-05	1.33E-05	NO DATA	NO DATA	7.74E-06	2.78E-05
Co 58	NO DATA	1.80E-06	5.51E-06	NO DATA	NO DATA	NO DATA	1.05E-05
Co 60	NO DATA	5.29E-06	1.56E-06	NO DATA	NO DATA	NO DATA	2.93E-05
Ni 63	5.38E-04	2.88E-05	1.83E-05	NO DATA	NO DATA	NO DATA	1.94E-06
Ni 65	2.22E-06	2.09E-07	1.22E-07	NO DATA	NO DATA	NO DATA	2.56E-05
Cu 64	NO DATA	2.45E-07	1.48E-07	NO DATA	5.92E-07	NO DATA	1.15E-05
Zn 65	1.37E-05	3.65E-05	2.27E-05	NO DATA	2.30E-05	NO DATA	6.41E-06
Zn 69	4.38E-08	6.33E-08	5.85E-09	NO DATA	3.84E-08	NO DATA	3.99E-06
Br 83	NO DATA	NO DATA	1.71E-07	NO DATA	NO DATA	NO DATA	LT E-24
Br 84	NO DATA	NO DATA	1.98E-07	NO DATA	NO DATA	NO DATA	LT E-24
Br 85	NO DATA	NO DATA	9.12E-09	NO DATA	NO DATA	NO DATA	LT E-24
Rb 86	NO DATA	6.70E-05	4.12E-05	NO DATA	NO DATA	NO DATA	4.31E-06
Rb 88	NO DATA	1.90E-07	1.32E-07	NO DATA	NO DATA	NO DATA	9.32E-09
Rb 89	NO DATA	1.17E-07	1.04E-07	NO DATA	NO DATA	NO DATA	1.02E-09
Sr 89	1.32E-03	NO DATA	3.77E-05	NO DATA	NO DATA	NO DATA	5.11E-05
Sr 90	1.70E-02	NO DATA	4.31E-03	NO DATA	NO DATA	NO DATA	2.29E-04
Sr 91	2.40E-05	NO DATA	9.06E-07	NO DATA	NO DATA	NO DATA	5.30E-05
Sr 92	9.03E-06	NO DATA	3.62E-07	NO DATA	NO DATA	NO DATA	1.71E-04
Y 90	4.11E-08	NO DATA	1.10E-09	NO DATA	NO DATA	NO DATA	1.17E-04
Y 91M	3.82E-10	NO DATA	1.39E-11	NO DATA	NO DATA	NO DATA	7.48E-07
Y 91	6.02E-07	NO DATA	1.61E-08	NO DATA	NO DATA	NO DATA	8.02E-05
Y 92	3.60E-09	NO DATA	1.03E-10	NO DATA	NO DATA	NO DATA	1.04E-04

* Table taken from Regulatory Guide 1.109 (Revision 1)

TABLE 3.1-4*
(2 OF 3)

INGESTION DOSE FACTORS FOR CHILD
(mRem per pCi Ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	1.14E-08	NO DATA	3.13E-10	NO DATA	NO DATA	NO DATA	1.70E-04
Zr 95	1.16E-07	2.55E-08	2.27E-08	NO DATA	3.65E-08	NO DATA	2.66E-05
Zr 97	6.99E-09	1.01E-09	5.96E-10	NO DATA	1.45E-09	NO DATA	1.53E-04
Nb 95	2.25E-08	8.76E-09	6.26E-09	NO DATA	8.23E-09	NO DATA	1.62E-05
Mo 99	NO DATA	1.33E-05	3.29E-06	NO DATA	2.84E-05	NO DATA	1.10E-05
Tc 99M	9.23E-10	1.81E-09	3.00E-08	NO DATA	2.63E-08	9.19E-10	1.03E-06
Tc 101	1.07E-09	1.12E-09	1.42E-08	NO DATA	1.91E-08	5.92E-10	3.56E-09
Ru 103	7.31E-07	NO DATA	2.81E-07	NO DATA	1.84E-06	NO DATA	1.89E-05
Ru 105	6.45E-08	NO DATA	2.34E-08	NO DATA	5.67E-07	NO DATA	4.21E-05
Ru 106	1.17E-05	NO DATA	1.46E-06	NO DATA	1.58E-05	NO DATA	1.82E-04
Ag 110M	5.39E-07	3.64E-07	2.91E-07	NO DATA	6.78E-07	NO DATA	4.33E-05
Te 125M	1.14E-05	3.09E-06	1.52E-06	3.20E-06	NO DATA	NO DATA	1.10E-05
Te 127M	2.89E-05	7.78E-06	3.43E-06	6.91E-06	8.24E-05	NO DATA	2.34E-05
Te 127	4.71E-07	1.27E-07	1.01E-07	3.26E-07	1.34E-06	NO DATA	1.84E-05
Te 129M	4.87E-05	1.36E-05	7.56E-06	1.57E-05	1.43E-04	NO DATA	5.94E-05
Te 129	1.34E-07	3.74E-08	3.18E-08	9.56E-08	3.92E-07	NO DATA	8.34E-06
Te 131M	7.20E-06	2.49E-06	2.65E-06	5.12E-06	2.41E-05	NO DATA	1.01E-04
Te 131	8.30E-08	2.53E-08	2.47E-08	6.35E-08	2.51E-07	NO DATA	4.36E-07
Te 132	1.01E-05	4.47E-06	5.40E-06	6.51E-06	4.15E-05	NO DATA	4.50E-05
I 130	2.92E-06	5.90E-06	3.04E-06	6.50E-04	8.82E-06	NO DATA	2.76E-06
I 131	1.72E-05	1.73E-05	9.83E-06	5.72E-03	2.84E-05	NO DATA	1.54E-06
I 132	8.00E-07	1.47E-06	6.76E-07	6.82E-05	2.25E-06	NO DATA	1.73E-06
I 133	5.92E-06	7.32E-06	2.77E-06	1.36E-03	1.22E-05	NO DATA	2.95E-06
I 134	4.19E-07	7.78E-07	3.58E-07	1.79E-05	1.19E-06	NO DATA	5.16E-07
I 135	1.75E-06	3.15E-06	1.49E-06	2.79E-04	4.83E-06	NO DATA	2.40E-06
Cs 134	2.34E-04	3.84E-04	8.10E-05	NO DATA	1.19E-04	4.27E-05	2.07E-06
Cs 136	2.35E-05	6.46E-05	4.18E-05	NO DATA	3.44E-05	5.13E-06	2.27E-06
Cs 137	3.27E-04	3.13E-04	4.62E-05	NO DATA	1.02E-04	3.67E-05	1.96E-06
Cs 138	2.28E-07	3.17E-07	2.01E-07	NO DATA	2.23E-07	2.40E-08	1.46E-07
Ba 139	4.14E-07	2.21E-10	1.20E-08	NO DATA	1.93E-10	1.30E-10	2.39E-05

* Table taken from Regulatory Guide 1.109 (Revision 1)

TABLE 3.1-4*
(3 OF 3)

INGESTION DOSE FACTORS FOR CHILD
(mRem per pCi Ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Ba 140	8.31E-05	7.28E-08	4.85E-06	NO DATA	2.37E-08	4.34E-08	4.21E-05
Ba 141	2.00E-07	1.12E-10	6.51E-09	NO DATA	9.69E-11	6.58E-10	1.14E-07
Ba 142	8.74E-08	6.29E-11	4.88E-09	NO DATA	5.09E-11	3.70E-11	1.14E-09
La 140	1.01E-08	3.53E-09	1.19E-09	NO DATA	NO DATA	NO DATA	9.84E-05
La 142	5.24E-10	1.67E-10	5.23E-11	NO DATA	NO DATA	NO DATA	3.31E-05
Ce 141	3.97E-08	1.98E-08	2.94E-09	NO DATA	8.68E-09	NO DATA	2.47E-05
Ce 143	6.99E-09	3.79E-06	5.49E-10	NO DATA	1.59E-09	NO DATA	5.55E-05
Ce 144	2.08E-06	6.52E-07	1.11E-07	NO DATA	3.61E-07	NO DATA	1.70E-04
Pr 143	3.93E-08	1.18E-08	1.95E-09	NO DATA	6.39E-09	NO DATA	4.24E-05
Pr 144	1.29E-10	3.99E-11	6.49E-12	NO DATA	2.11E-11	NO DATA	8.59E-08
Nd 147	2.79E-08	2.26E-08	1.75E-09	NO DATA	1.24E-08	NO DATA	3.58E-05
W 187	4.29E-07	2.54E-07	1.14E-07	NO DATA	NO DATA	NO DATA	3.57E-05
Np 239	5.25E-09	3.77E-10	2.65E-10	NO DATA	1.09E-09	NO DATA	2.79E-05

* Table taken from Regulatory Guide 1.109 (Revision 1)

TABLE 3.1-5*
(1 OF 3)

INGESTION DOSE FACTORS FOR INFANT
(mRem per pCi Ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07
Na 24	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05
Cr 51	NO DATA	NO DATA	1.41E-08	9.20E-09	2.01E-09	1.79E-08	4.11E-07
Mn 54	NO DATA	1.99E-05	4.51E-06	NO DATA	4.41E-06	NO DATA	7.31E-06
Mn 56	NO DATA	8.18E-07	1.41E-07	NO DATA	7.03E-07	NO DATA	7.43E-05
Fe 55	1.39E-05	8.98E-06	2.40E-06	NO DATA	NO DATA	4.39E-06	1.14E-06
Fe 59	3.08E-05	5.38E-05	2.12E-05	NO DATA	NO DATA	1.59E-05	2.57E-05
Co 58	NO DATA	3.60E-06	8.98E-06	NO DATA	NO DATA	NO DATA	8.97E-06
Co 60	NO DATA	1.08E-05	2.55E-05	NO DATA	NO DATA	NO DATA	2.57E-05
Ni 63	6.34E-04	3.92E-05	2.20E-05	NO DATA	NO DATA	NO DATA	1.95E-06
Ni 65	4.70E-06	5.32E-07	2.42E-07	NO DATA	NO DATA	NO DATA	4.05E-05
Cu 64	NO DATA	6.09E-07	2.82E-07	NO DATA	1.03E-06	NO DATA	1.25E-05
Zn 65	1.84E-05	6.31E-05	2.91E-05	NO DATA	3.06E-05	NO DATA	5.33E-05
Zn 69	9.33E-08	1.68E-07	1.25E-08	NO DATA	6.98E-08	NO DATA	1.37E-05
Br 83	NO DATA	NO DATA	3.63E-07	NO DATA	NO DATA	NO DATA	LT E-24
Br 84	NO DATA	NO DATA	3.82E-07	NO DATA	NO DATA	NO DATA	LT E-24
Br 85	NO DATA	NO DATA	1.94E-08	NO DATA	NO DATA	NO DATA	LT E-24
Rb 86	NO DATA	1.70E-04	8.40E-05	NO DATA	NO DATA	NO DATA	4.35E-06
Rb 88	NO DATA	4.98E-07	2.73E-07	NO DATA	NO DATA	NO DATA	4.85E-07
Rb 89	NO DATA	2.86E-07	1.97E-07	NO DATA	NO DATA	NO DATA	9.74E-08
Sr 89	2.51E-03	NO DATA	7.20E-05	NO DATA	NO DATA	NO DATA	5.16E-05
Sr 90	1.85E-02	NO DATA	4.71E-03	NO DATA	NO DATA	NO DATA	2.31E-04
Sr 91	5.00E-05	NO DATA	1.81E-06	NO DATA	NO DATA	NO DATA	5.92E-05
Sr 92	1.92E-05	NO DATA	7.13E-07	NO DATA	NO DATA	NO DATA	2.07E-04
Y 90	8.69E-08	NO DATA	2.33E-09	NO DATA	NO DATA	NO DATA	1.20E-04
Y 91M	8.10E-10	NO DATA	2.76E-11	NO DATA	NO DATA	NO DATA	2.70E-06
Y 91	1.13E-06	NO DATA	3.01E-08	NO DATA	NO DATA	NO DATA	8.10E-05
Y 92	7.65E-09	NO DATA	2.15E-10	NO DATA	NO DATA	NO DATA	1.46E-04

* Table taken from Regulatory Guide 1.109 (Revision 1)

TABLE 3.1-5*
(2 OF 3)

INGESTION DOSE FACTORS FOR INFANT
(mRem per pCi Ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	2.43E-08	NO DATA	6.62E-10	NO DATA	NO DATA	NO DATA	1.92E-04
Zr 95	2.06E-07	5.02E-08	3.56E-08	NO DATA	5.41E-08	NO DATA	2.50E-05
Zr 97	1.48E-08	2.54E-09	1.16E-09	NO DATA	2.56E-09	NO DATA	1.62E-04
Nb 95	4.20E-08	1.73E-08	1.00E-08	NO DATA	1.24E-08	NO DATA	1.46E-05
Mo 99	NO DATA	3.40E-05	6.63E-06	NO DATA	5.08E-05	NO DATA	1.12E-05
Tc 99M	1.92E-09	3.96E-09	5.10E-08	NO DATA	4.26E-08	2.07E-09	1.15E-06
Tc 101	2.27E-09	2.86E-09	2.83E-08	NO DATA	3.40E-08	1.56E-09	4.86E-07
Ru 103	1.48E-06	NO DATA	4.95E-07	NO DATA	3.08E-06	NO DATA	1.80E-05
Ru 105	1.36E-07	NO DATA	4.58E-08	NO DATA	1.00E-06	NO DATA	5.41E-05
Ru 106	2.41E-05	NO DATA	3.01E-06	NO DATA	2.85E-05	NO DATA	1.83E-04
Ag 110M	9.96E-07	7.27E-07	4.81E-07	NO DATA	1.04E-06	NO DATA	3.77E-05
Te 125M	2.33E-05	7.79E-06	3.15E-06	7.84E-06	NO DATA	NO DATA	1.11E-05
Te 127M	5.85E-05	1.94E-05	7.08E-06	1.69E-05	1.44E-04	NO DATA	2.36E-05
Te 127	1.00E-06	3.35E-07	2.15E-07	8.14E-07	2.44E-06	NO DATA	2.10E-05
Te 129M	1.00E-04	3.43E-05	1.54E-05	3.84E-05	2.50E-04	NO DATA	5.97E-05
Te 129	2.84E-07	9.79E-08	6.63E-08	2.38E-07	7.07E-07	NO DATA	2.27E-05
Te 131M	1.52E-05	6.12E-06	5.05E-06	1.24E-05	4.21E-05	NO DATA	1.03E-04
Te 131	1.76E-07	6.50E-08	4.94E-08	1.57E-07	4.50E-07	NO DATA	7.11E-06
Te 132	2.08E-05	1.03E-05	9.61E-06	1.52E-05	6.44E-05	NO DATA	3.81E-05
I 130	6.00E-06	1.32E-05	5.30E-06	1.48E-03	1.45E-05	NO DATA	2.83E-06
I 131	3.59E-05	4.23E-05	1.86E-05	1.39E-02	4.94E-05	NO DATA	1.51E-06
I 132	1.66E-06	3.37E-06	1.20E-06	1.58E-04	3.76E-06	NO DATA	2.73E-06
I 133	1.25E-05	1.82E-05	5.33E-06	3.31E-03	2.14E-05	NO DATA	3.08E-06
I 134	8.69E-07	1.78E-06	6.33E-07	4.15E-05	1.99E-06	NO DATA	1.84E-06
I 135	3.64E-06	7.24E-06	2.64E-06	6.49E-04	8.07E-06	NO DATA	2.62E-06
Cs 134	3.77E-04	7.03E-04	7.10E-05	NO DATA	1.81E-04	7.42E-05	1.91E-06
Cs 136	4.59E-05	1.35E-04	5.04E-05	NO DATA	5.38E-05	1.10E-05	2.05E-06
Cs 137	5.22E-04	6.11E-04	4.33E-05	NO DATA	1.64E-04	6.64E-05	1.91E-06
Cs 138	4.81E-07	7.82E-07	3.79E-07	NO DATA	3.90E-07	6.09E-08	1.25E-06
Ba 139	8.81E-07	5.84E-10	2.55E-08	NO DATA	3.51E-10	3.54E-10	5.58E-05

* Table taken from Regulatory Guide 1.109 (Revision 1)

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TABLE 3.1-5*
(3 OF 3)

INGESTION DOSE FACTORS FOR INFANT
(mRem per pCi Ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-ILLI
Ba 140	1.71E-04	1.71E-07	8.81E-06	NO DATA	4.06E-08	1.05E-07	4.20E-05
Ba 141	4.25E-07	2.91E-10	1.34E-08	NO DATA	1.75E-10	1.77E-10	5.19E-06
Ba 142	1.84E-07	1.53E-10	9.06E-09	NO DATA	8.81E-11	9.26E-11	7.59E-07
La 140	2.11E-08	8.32E-09	2.14E-09	NO DATA	NO DATA	NO DATA	9.77E-05
La 142	1.10E-09	4.04E-10	9.67E-11	NO DATA	NO DATA	NO DATA	6.86E-05
Ce 141	7.87E-08	4.80E-08	5.65E-09	NO DATA	1.48E-08	NO DATA	2.48E-05
Ce 143	1.48E-08	9.82E-06	1.12E-09	NO DATA	2.86E-09	NO DATA	5.73E-05
Ce 144	2.98E-06	1.22E-06	1.67E-07	NO DATA	4.93E-07	NO DATA	1.71E-04
Pr 143	8.13E-08	3.04E-08	4.03E-09	NO DATA	1.13E-08	NO DATA	4.29E-05
Pr 144	2.74E-10	1.06E-10	1.38E-11	NO DATA	3.84E-11	NO DATA	4.93E-06
Nd 147	5.53E-08	5.68E-08	3.48E-09	NO DATA	2.19E-08	NO DATA	3.60E-05
W 187	9.03E-07	6.28E-07	2.17E-07	NO DATA	NO DATA	NO DATA	3.69E-05
Np 239	1.11E-08	9.93E-10	5.61E-10	NO DATA	1.98E-09	NO DATA	2.87E-05

* Table taken from Regulatory Guide 1.109 (Revision 1)

TABLE 3.1-6*
(1 OF 1)

INHALATION DOSE FACTORS FOR ADULTS
(mRem per pCi Inhaled)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-ILLI
H 3	NO DATA	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07
Cr 51	NO DATA	NO DATA	1.25E-08	7.44E-09	2.85E-09	1.80E-06	4.15E-07
Mn 54	NO DATA	4.95E-06	7.87E-07	NO DATA	1.23E-06	1.75E-04	9.67E-06
Fe 55	3.07E-06	2.12E-06	4.93E-07	NO DATA	NO DATA	9.01E-06	7.54E-07
Fe 59	1.47E-06	3.47E-06	1.32E-06	NO DATA	NO DATA	1.27E-04	2.35E-05
Co 58	NO DATA	1.98E-07	2.59E-07	NO DATA	NO DATA	1.16E-04	1.33E-05
Co 60	NO DATA	1.44E-06	1.85E-06	NO DATA	NO DATA	7.46E-04	3.56E-05
Zn 65	4.05E-06	1.29E-05	5.82E-06	NO DATA	8.62E-06	1.08E-04	6.68E-06
Sr 89	8.30E-05	NO DATA	1.09E-06	NO DATA	NO DATA	1.75E-04	4.37E-05
Sr 90	1.24E-02	NO DATA	7.62E-04	NO DATA	NO DATA	1.20E-03	9.02E-05
Zr 95	1.34E-05	4.30E-06	2.91E-06	NO DATA	6.77E-06	2.21E-04	7.88E-05
Mo 99	NO DATA	1.51E-08	2.87E-09	NO DATA	3.64E-08	1.14E-05	3.10E-05
Sb 124	3.90E-06	7.36E-08	1.55E-06	9.44E-09	NO DATA	3.10E-04	5.08E-05
I 131	3.15E-06	4.47E-06	2.56E-06	1.49E-03	7.66E-06	NO DATA	7.85E-07
I 133	1.08E-06	1.85E-06	5.65E-07	2.69E-04	3.23E-06	NO DATA	1.11E-06
Cs 134	4.66E-05	1.06E-04	9.10E-05	NO DATA	3.59E-05	1.22E-05	1.30E-06
Cs 136	4.88E-06	1.83E-05	1.38E-05	NO DATA	1.07E-05	1.50E-06	1.46E-06
Cs 137	5.98E-05	7.76E-05	5.35E-05	NO DATA	2.78E-05	9.40E-06	1.05E-06
Ba 140	4.88E-06	6.13E-09	3.21E-07	NO DATA	2.09E-09	1.59E-04	2.73E-05
Ce 141	2.49E-06	1.69E-06	1.91E-07	NO DATA	7.83E-07	4.52E-05	1.50E-05
Ce 144	4.29E-04	1.79E-04	2.30E-05	NO DATA	1.06E-04	9.72E-04	1.02E-04

* Table taken from NUREG-0597

TABLE 3.1-7*
(1 OF 1)

INHALATION DOSE FACTORS FOR TEENAGER
(mRem per pCi Inhaled)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	1.59E-07	1.59E-07	1.59E-07	1.59E-07	1.59E-07	1.59E-07
Cr 51	NO DATA	NO DATA	1.69E-08	9.37E-09	3.84E-09	2.62E-06	3.75E-07
Mn 54	NO DATA	6.39E-06	1.05E-06	NO DATA	1.59E-06	2.48E-04	8.35E-06
Fe 55	4.18E-06	2.98E-06	6.93E-07	NO DATA	NO DATA	1.55E-06	7.99E-07
Fe 59	1.99E-06	4.62E-06	1.79E-06	NO DATA	NO DATA	1.91E-04	2.23E-05
Co 58	NO DATA	2.59E-07	3.47E-07	NO DATA	NO DATA	1.68E-04	1.19E-05
Co 60	NO DATA	1.89E-06	2.48E-06	NO DATA	NO DATA	1.09E-03	3.24E-05
Zn 65	4.82E-06	1.67E-05	7.80E-06	NO DATA	1.08E-05	1.55E-04	5.83E-06
Sr 89	5.43E-05	NO DATA	1.56E-06	NO DATA	NO DATA	3.02E-04	4.64E-05
Sr 90	1.34E-02	NO DATA	8.35E-04	NO DATA	NO DATA	2.06E-03	9.56E-05
Zr 95	1.82E-05	5.73E-06	3.94E-06	NO DATA	8.42E-06	3.36E-04	1.86E-05
Mo 99	NO DATA	2.11E-08	4.03E-09	NO DATA	5.14E-08	1.92E-05	3.36E-05
Sb 124	5.38E-06	9.92E-08	2.10E-06	1.22E-08	NO DATA	4.81E-04	4.98E-05
I 131	4.43E-06	6.14E-06	3.30E-06	1.83E-03	1.05E-05	NO DATA	8.11E-07
I 133	1.52E-06	2.56E-06	7.78E-07	3.65E-04	4.49E-06	NO DATA	1.29E-06
Cs 134	6.28E-05	1.41E-04	6.86E-05	NO DATA	4.69E-05	1.83E-05	1.22E-06
Cs 136	6.44E-06	2.42E-05	1.71E-05	NO DATA	1.38E-05	2.22E-06	1.36E-06
Cs 137	8.38E-05	1.06E-04	3.89E-05	NO DATA	3.80E-05	1.51E-05	1.06E-06
Ba 140	6.84E-06	8.38E-09	4.40E-07	NO DATA	2.85E-09	2.54E-04	2.86E-05
Ce 141	3.55E-06	2.37E-06	2.71E-07	NO DATA	1.11E-06	7.67E-05	1.58E-05
Ce 144	6.11E-04	2.53E-04	3.28E-05	NO DATA	1.51E-04	1.67E-03	1.08E-04

* Table taken from NUREG-0597

TABLE 3.1-8*
(1 OF 1)

INHALATION DOSE FACTORS FOR CHILD
(mRem per pCi Inhaled)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	3.04E-07	3.04E-07	3.04E-07	3.04E-07	3.04E-07	3.04E-07
Cr 51	NO DATA	NO DATA	4.17E-08	2.31E-08	6.57E-09	4.59E-06	2.93E-07
Mn 54	NO DATA	1.16E-05	2.57E-06	NO DATA	2.71E-06	4.26E-04	6.19E-06
Fe 55	1.28E-05	6.80E-06	2.10E-06	NO DATA	NO DATA	3.00E-05	7.75E-07
Fe 59	5.59E-06	9.04E-06	4.51E-06	NO DATA	NO DATA	3.43E-04	1.91E-05
Co 58	NO DATA	4.79E-07	8.55E-07	NO DATA	NO DATA	2.99E-04	9.29E-06
Co 60	NO DATA	3.55E-06	6.12E-06	NO DATA	NO DATA	1.91E-03	2.60E-05
Zn 65	1.15E-05	3.06E-05	1.90E-05	NO DATA	1.93E-05	2.69E-04	4.41E-06
Sr 89	1.69E-04	NO DATA	4.66E-06	NO DATA	NO DATA	5.83E-04	4.52E-05
Sr 90	2.73E-02	NO DATA	1.74E-03	NO DATA	NO DATA	3.99E-03	9.28E-05
Zr 95	5.13E-05	1.13E-05	1.00E-05	NO DATA	1.16E-05	6.03E-04	1.65E-05
Mo 99	NO DATA	4.66E-08	1.15E-08	NO DATA	1.06E-07	3.66E-05	3.42E-05
Sb 124	1.55E-05	2.00E-07	5.41E-06	3.41E-08	NO DATA	8.76E-04	4.43E-05
I 131	1.30E-05	1.30E-05	7.37E-06	4.39E-03	2.13E-05	NO DATA	7.68E-07
I 133	4.48E-06	5.49E-06	2.08E-06	1.04E-03	9.13E-06	NO DATA	1.48E-06
Cs 134	1.76E-04	2.74E-04	6.07E-05	NO DATA	8.93E-05	3.27E-05	1.04E-06
Cs 136	1.76E-05	4.62E-05	3.14E-05	NO DATA	2.58E-05	3.93E-06	1.13E-06
Cs 137	2.45E-04	2.23E-04	3.47E-05	NO DATA	7.63E-05	2.81E-05	9.78E-07
Ba 140	2.00E-05	1.75E-08	1.17E-06	NO DATA	5.71E-09	4.71E-04	2.75E-05
Ce 141	1.06E-05	5.28E-06	7.83E-07	NO DATA	2.31E-06	1.47E-04	1.53E-05
Ce 144	1.83E-03	5.72E-04	9.77E-05	NO DATA	3.17E-04	3.23E-03	1.05E-04

* Table taken from NUREG-0597

TABLE 3.1-9*
(1 OF 1)

INHALATION DOSE FACTORS FOR INFANT
(mRem per pCi Inhaled)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-ILLI
H 3	NO DATA	4.62E-07	4.62E-07	4.62E-07	4.62E-07	4.62E-07	4.62E-07
Cr 51	NO DATA	NO DATA	6.39E-08	4.11E-08	9.45E-09	9.17E-06	2.55E-07
Mn 54	NO DATA	1.81E-05	3.56E-06	NO DATA	3.56E-06	7.14E-04	5.04E-06
Fe 55	1.41E-05	8.39E-06	2.38E-06	NO DATA	NO DATA	6.21E-05	7.82E-07
Fe 59	9.69E-06	1.68E-05	6.77E-06	NO DATA	NO DATA	7.25E-04	1.77E-05
Co 58	NO DATA	8.71E-07	1.30E-06	NO DATA	NO DATA	5.55E-04	7.95E-06
Co 60	NO DATA	5.73E-06	8.41E-06	NO DATA	NO DATA	3.22E-03	2.28E-05
Zn 65	1.38E-05	4.47E-05	2.22E-05	NO DATA	2.32E-05	4.62E-04	3.67E-05
Sr 89	2.84E-04	NO DATA	8.15E-06	NO DATA	NO DATA	1.45E-03	4.57E-05
Sr 90	2.92E-02	NO DATA	1.85E-03	NO DATA	NO DATA	8.03E-03	9.36E-05
Zr 95	8.24E-05	1.99E-05	1.45E-05	NO DATA	2.22E-05	1.25E-03	1.55E-05
Mo 99	NO DATA	1.18E-07	2.31E-08	NO DATA	1.89E-07	9.63E-05	3.48E-05
Sb 124	2.71E-05	3.97E-07	8.56E-06	7.18E-08	NO DATA	1.89E-03	4.22E-05
I 131	2.71E-05	3.17E-05	1.40E-05	1.06E-02	3.70E-05	NO DATA	7.56E-07
I 133	9.46E-06	1.37E-05	4.00E-06	2.54E-03	1.60E-05	NO DATA	1.54E-06
Cs 134	2.83E-04	5.02E-04	5.32E-05	NO DATA	1.36E-04	5.69E-05	9.53E-07
Cs 136	3.45E-05	9.61E-05	3.78E-05	NO DATA	4.03E-05	8.40E-06	1.02E-06
Cs 137	3.92E-04	4.37E-04	3.25E-05	NO DATA	1.23E-04	5.09E-05	9.53E-07
Ba 140	4.00E-05	4.00E-08	2.07E-06	NO DATA	9.59E-09	1.14E-03	2.74E-05
Ce 141	1.98E-05	1.19E-05	1.42E-06	NO DATA	3.75E-06	3.69E-04	1.54E-05
Ce 144	2.28E-03	8.65E-04	1.26E-04	NO DATA	3.84E-04	7.03E-03	1.06E-04

* Table taken from NUREG-0597

TABLE 3.1-10*
(1 of 2)
EXTERNAL DOSE FACTORS FOR STANDING ON CONTAMINATED GROUND

(mrem/hr per pCi/m²)

<u>Element</u>	<u>Total Body</u>	<u>Skin</u>
H-3	0.0	0.0
Na-24	2.50E-08	2.90E-08
Cr-51	2.20E-10	2.60E-10
Mn-54	5.80E-09	6.80E-09
Mn-56	1.10E-08	1.30E-08
Fe-55	0.0	0.0
Fe-59	8.00E-09	9.40E-09
Co-58	7.00E-09	8.20E-09
Co-60	1.70E-08	2.00E-08
Ni-63	0.0	0.0
Ni-65	3.70E-09	4.30E-09
Cu-64	1.50E-09	1.70E-09
Zn-65	4.00E-09	4.60E-09
Zn-69	0.0	0.0
Br-83	6.40E-11	9.30E-11
Br-84	1.20E-08	1.40E-08
Br-85	0.0	0.0
Rb-86	6.30E-10	7.20E-10
Rb-88	3.50E-09	4.00E-09
Rb-89	1.50E-08	1.80E-08
Sr-89	5.60E-13	6.50E-13
Sr-91	7.10E-09	8.30E-09
Sr-92	9.00E-09	1.00E-08
Y-90	2.20E-12	2.60E-12
Y-91M	3.80E-09	4.40E-09
Y-91	2.40E-11	2.70E-11
Y-92	1.60E-09	1.90E-09
Y-93	5.70E-10	7.80E-10
Zr-95	5.00E-09	5.80E-09
Zr-97	5.50E-09	6.40E-09
Nb-95	5.10E-09	6.00E-09
Mo-99	1.90E-09	2.20E-09
Tc-99M	9.60E-10	1.10E-09
Tc-101	2.70E-09	3.00E-09
Ru-103	3.60E-09	4.20E-09
Ru-105	4.50E-09	5.10E-09
Ru-106	1.50E-09	1.80E-09
Ag-110M	1.80E-08	2.10E-08
Te-125M	3.50E-11	4.80E-11
Te-127M	1.10E-12	1.30E-12
Te-127	1.00E-11	1.10E-11
Te-129M	7.70E-10	9.00E-10
Te-129	7.10E-10	8.40E-10

*Taken from Regulatory Guide 1.109 (Rev. 1)

TABLE 3.1-10
(1 of 2)

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TABLE 3.1-10 (cont'd)
(2 of 2)

EXTERNAL DOSE FACTORS FOR STANDING ON CONTAMINATED GROUND

(mrem/hr per pCi/m²)

<u>Element</u>	<u>Total Body</u>	<u>Skin</u>
Te-131M	8.40E-09	9.90E-09
Te-131	2.20E-09	2.60E-06
Te-132	1.70E-09	2.00E-09
I-130	1.40E-08	1.70E-08
I-131	2.80E-09	3.40E-09
I-132	1.70E-08	2.00E-08
I-133	3.70E-09	4.50E-09
I-134	1.60E-08	1.90E-08
I-135	1.20E-08	1.40E-08
Cs-134	1.20E-08	1.40E-08
Cs-136	1.50E-08	1.70E-08
Cs-137	4.20E-09	4.90E-09
Cs-138	2.10E-08	2.40E-08
Ba-139	2.40E-09	2.70E-09
Ba-140	2.10E-09	2.40E-09
Ba-141	4.30E-09	4.90E-09
Ba-142	7.90E-09	9.00E-09
La-140	1.50E-08	1.70E-08
La-142	1.50E-08	1.80E-08
Ce-141	5.50E-10	6.20E-10
Ce-143	2.20E-09	2.50E-09
Ce-144	3.20E-10	3.70E-10
Pr-143	0.0	0.0
Pr-144	2.00E-10	2.30E-10
Nd-147	1.00E-09	1.20E-09
W-187	3.10E-09	3.60E-09
Np-239	9.50E-10	1.10E-09

TABLE 3.1-10
(2 of 2)

TABLE 3.1-11*
(1 of 1)
STABLE ELEMENT TRANSFER DATA

<u>Element</u>	B_{iv} <u>Veg/Soil</u>	F_m (Cow) <u>Milk (d/l)</u>	F_f <u>Meat (d/kg)</u>
H	4.8E+00	1.0E-02**	1.2E-02
Na	5.2E-02	4.0E-02	3.0E-02
Cr	2.5E-04	2.2E-03	2.4E-03
Mn	2.9E-02	2.5E-04	8.0E-04
Fe	6.6E-04	1.2E-03**	4.0E-02
Co	9.4E-03	1.0E-03	1.3E-02
Ni	1.9E-02	6.7E-03	5.3E-02
Cu	1.2E-01	1.4E-02**	8.0E-03
Zn	4.0E-01	3.9E-02	3.0E-02
Rb	1.3E-01	3.0E-02	3.1E-02
Sr	1.7E-02	8.0E-04**	6.0E-04
Y	2.6E-03	1.0E-05	4.6E-03
Zr	1.7E-04	5.0E-06	3.4E-02
Nb	9.4E-03	2.5E-03	2.8E-01
Mo	1.2E-01	7.5E-03	8.0E-03
Tc	2.5E-01	2.5E-02	4.0E-01
Ru	5.0E-02	1.0E-06	4.0E-01
Rh	1.3E+01	1.0E-02	1.5E-03
Ag	1.5E-01	5.0E-02	1.7E-02
Te	1.3E+00	1.0E-03	7.7E-02
I	2.0E-02	6.0E-03**	2.9E-03
Cs	1.0E-02	1.2E-02**	4.0E-03
Ba	5.0E-03	4.0E-04	3.2E-03
La	2.5E-03	5.0E-06	2.0E-04
Ce	2.5E-03	1.0E-04	1.2E-03
Pr	2.5E-03	5.0E-06	4.7E-03
Nd	2.4E-03	5.0E-06	3.3E-03
W	1.8E-02	5.0E-04	1.3E-03
Np	2.5E-03	5.0E-06	2.0E-04

*Taken from Regulatory Guide 1.109 (Rev. 1)

**Nuclide Transfer parameters for Goat's milk

<u>Element</u>	<u>Fm (d/l)</u>
H	0.17
Fe	1.30E-04
Cu	0.013
Sr	0.014
I	0.06
Cs	0.30

TABLE 3.1-12
(1 of 1)
R_i VALUES - GROUND PATHWAY - ALL AGES

<u>NUCLIDE</u>	<u>T.BODY</u>	<u>SKIN</u>
H 3	NO DATA	NO DATA
CR 51	4.65E+06	5.49E+06
MN 54	1.38E+09	1.62E+09
FE 55	NO DATA	NO DATA
FE 59	2.72E+08	3.20E+08
CO 58	3.79E+08	4.44E+08
CO 60	2.15E+10	2.53E+10
ZN 65	7.44E+08	8.56E+08
SR 89	2.16E+04	2.50E+04
SR 90	NO DATA	NO DATA
ZR 95	2.51E+08	2.91E+08
MO 99	4.63E+06	4.00E+06
SB 124	5.98E+08	6.91E+08
I 131	8.59E+06	1.04E+07
I 133	1.22E+06	1.49E+06
CS 134	6.82E+09	7.96E+09
CS 136	1.50E+08	1.70E+08
CS 137	1.03E+10	1.20E+10
BA 140	2.05E+07	2.34E+07
CE 141	1.36E+07	1.54E+07
CE 144	6.92E+07	8.01E+07

TABLE 3.1-13
(1 of 1)
R_i VALUES - VEGETABLE PATHWAY - ADULT

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	2.28E+03	2.28E+03	2.28E+03	2.28E+03	2.28E+03	2.28E+03
CR 51	0.0	0.0	4.58E+04	2.74E+04	1.01E+04	6.07E+04	1.15E+07
MN 54	0.0	3.07E+08	5.86E+07	0.0	9.14E+07	0.0	9.41E+08
FE 55	1.99E+08	1.38E+08	3.21E+07	0.0	0.0	7.68E+07	7.90E+07
FE 59	1.23E+08	2.90E+08	1.11E+08	0.0	0.0	8.09E+07	9.66E+08
CO 58	0.0	2.99E+07	6.71E+07	0.0	0.0	0.0	6.07E+08
CO 60	0.0	1.66E+08	3.67E+08	0.0	0.0	0.0	3.12E+09
ZN 65	4.00E+08	1.27E+09	5.76E+08	0.0	8.52E+08	0.0	8.02E+08
SR 89	9.75E+09	0.0	2.80E+08	0.0	0.0	0.0	1.56E+09
SR 90	6.70E+11	0.0	1.64E+11	0.0	0.0	0.0	1.94E+10
ZR 95	1.16E+06	3.73E+05	2.52E+05	0.0	5.85E+05	0.0	1.18E+09
MO 99	0.0	6.20E+06	1.18E+06	0.0	1.40E+07	0.0	1.44E+07
SB 124	1.01E+08	1.91E+06	4.01E+07	2.45E+05	0.0	7.88E+07	2.87E+09
I 131	4.03E+07	5.76E+07	3.30E+07	1.89E+10	9.88E+07	0.0	1.52E+07
I 133	1.04E+06	1.80E+06	5.50E+05	2.65E+08	3.15E+06	0.0	1.62E+06
CS 134	4.54E+09	1.08E+10	8.83E+09	0.0	3.49E+09	1.16E+09	1.89E+08
CS 136	4.23E+07	1.67E+08	1.20E+08	0.0	9.30E+07	1.27E+07	1.90E+07
CS 137	6.63E+09	9.07E+09	5.94E+09	0.0	3.08E+09	1.02E+09	1.76E+08
BA 140	1.28E+08	1.61E+05	8.40E+06	0.0	5.47E+04	9.22E+04	2.64E+08
CE 141	1.94E+05	1.31E+05	1.49E+04	0.0	6.09E+04	0.0	5.02E+08
CE 144	3.15E+07	1.31E+07	1.69E+06	0.0	7.80E+06	0.0	1.06E+10

TABLE 3.1-14
(1 of 1)
R_i VALUES - VEGETABLE PATHWAY - TEENAGER

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	2.61E+03	2.61E+03	2.61E+03	2.61E+03	2.61E+03	2.61E+03
CR 51	0.0	0.0	6.08E+04	3.38E+04	1.33E+04	8.68E+04	1.02E+07
MN 54	0.0	4.46E+08	8.85E+07	0.0	1.33E+08	0.0	9.15E+08
FE 55	3.10E+08	2.20E+08	5.13E+07	0.0	0.0	1.39E+08	9.51E+07
FE 59	1.75E+08	4.09E+08	1.58E+08	0.0	0.0	1.29E+08	9.68E+08
CO 58	0.0	4.25E+07	9.79E+07	0.0	0.0	0.0	5.86E+08
CO 60	0.0	2.47E+08	5.57E+08	0.0	0.0	0.0	3.22E+09
ZN 65	5.35E+08	1.86E+09	8.66E+08	0.0	1.19E+09	0.0	7.86E+08
SR 89	1.48E+10	0.0	4.24E+08	0.0	0.0	0.0	1.76E+09
SR 90	8.32E+11	0.0	2.05E+11	0.0	0.0	0.0	2.34E+10
ZR 95	1.70E+06	5.38E+05	3.70E+05	0.0	7.90E+05	0.0	1.24E+09
MO 99	0.0	5.69E+06	1.09E+06	0.0	1.30E+07	0.0	1.02E+07
SB 124	1.51E+08	2.78E+06	5.88E+07	3.42E+05	0.0	1.32E+08	3.04E+09
I 131	3.83E+07	5.37E+07	2.88E+07	1.57E+10	9.24E+07	0.0	1.06E+07
I 133	9.63E+05	1.63E+06	4.98E+05	2.28E+08	2.87E+06	0.0	1.24E+06
CS 134	6.90E+09	1.62E+10	7.54E+09	0.0	5.16E+09	1.97E+09	2.02E+08
CS 136	4.33E+07	1.71E+08	1.15E+08	0.0	9.28E+07	1.46E+07	1.37E+07
CS 137	1.06E+10	1.41E+10	4.90E+09	0.0	4.78E+09	1.86E+09	2.00E+08
BA 140	1.38E+08	1.69E+05	8.88E+06	0.0	5.72E+04	1.14E+05	2.12E+08
CE 141	2.78E+05	1.86E+05	2.13E+04	0.0	8.75E+04	0.0	5.32E+08
CE 144	5.04E+07	2.09E+07	2.71E+06	0.0	1.25E+07	0.0	1.27E+10

TABLE 3.1-15
(1 of 1)
R_i VALUES - VEGETABLE PATHWAY - CHILD

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	4.04E+03	4.04E+03	4.04E+03	4.04E+03	4.04E+03	4.04E+03
CR 51	0.0	0.0	1.15E+05	6.40E+04	1.75E+04	1.17E+05	6.12E+06
MN 54	0.0	6.53E+08	1.74E+08	0.0	1.83E+08	0.0	5.48E+08
FE 55	7.62E+08	4.04E+08	1.25E+08	0.0	0.0	2.29E+08	7.49E+07
FE 59	3.88E+08	6.29E+08	3.13E+08	0.0	0.0	1.82E+08	6.54E+08
CO 58	0.0	6.27E+07	1.92E+08	0.0	0.0	0.0	3.66E+08
CO 60	0.0	3.76E+08	1.11E+09	0.0	0.0	0.0	2.08E+09
ZN 65	1.02E+09	2.73E+09	1.70E+09	0.0	1.72E+09	0.0	4.80E+08
SR 89	3.52E+10	0.0	1.00E+09	0.0	0.0	0.0	1.36E+09
SR 90	1.38E+12	0.0	3.49E+11	0.0	0.0	0.0	1.86E+10
ZR 95	3.82E+06	8.40E+05	7.48E+05	0.0	1.20E+06	0.0	8.77E+08
MO 99	0.0	7.77E+06	1.92E+06	0.0	1.66E+07	0.0	6.43E+06
SB 124	3.44E+08	4.46E+06	1.20E+08	7.59E+05	0.0	1.91E+08	2.15E+09
I 131	7.13E+07	7.17E+07	4.08E+07	2.37E+10	1.18E+08	0.0	6.39E+06
I 133	1.76E+06	2.17E+06	8.22E+05	4.03E+08	3.62E+06	0.0	8.75E+05
CS 134	1.56E+10	2.56E+10	5.40E+09	0.0	7.93E+09	2.85E+09	1.38E+08
CS 136	8.16E+07	2.24E+08	1.45E+08	0.0	1.19E+08	1.78E+07	7.88E+06
CS 137	2.49E+10	2.39E+10	3.52E+09	0.0	7.78E+09	2.80E+09	1.50E+08
BA 140	2.76E+08	2.42E+05	1.61E+07	0.0	7.87E+04	1.44E+05	1.40E+08
CE 141	6.45E+05	3.22E+05	4.78E+04	0.0	1.41E+05	0.0	4.02E+08
CE 144	1.22E+08	3.81E+07	6.48E+06	0.0	2.11E+07	0.0	9.93E+09

TABLE 3.1-16
(1 of 1)
R_i VALUES - MEAT PATHWAY - ADULT

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	3.27E+02	3.27E+02	3.27E+02	3.27E+02	3.27E+02	3.27E+02
CR 51	0.0	0.0	5.86E+03	3.50E+03	1.29E+03	7.77E+03	1.47E+06
MN 54	0.0	6.83E+06	1.30E+06	0.0	2.03E+06	0.0	2.09E+07
FE 55	2.13E+08	1.47E+08	3.43E+07	0.0	0.0	8.20E+07	8.44E+07
FE 59	2.12E+08	4.99E+08	1.91E+08	0.0	0.0	1.39E+08	1.66E+09
CO 58	0.0	1.41E+07	3.17E+07	0.0	0.0	0.0	2.87E+08
CO 60	0.0	5.56E+07	1.23E+08	0.0	0.0	0.0	1.04E+09
ZN 65	3.01E+08	9.57E+08	4.32E+08	0.0	6.40E+08	0.0	6.03E+08
SR 89	2.39E+08	0.0	6.86E+06	0.0	0.0	0.0	3.83E+07
SR 90	9.67E+09	0.0	2.37E+09	0.0	0.0	0.0	2.79E+08
ZR 95	1.47E+06	4.72E+05	3.20E+05	0.0	7.41E+05	0.0	1.50E+09
MO 99	0.0	9.38E+04	1.78E+04	0.0	2.12E+05	0.0	2.17E+05
SB 124	1.55E+07	2.93E+05	6.15E+06	3.76E+04	0.0	1.21E+07	4.40E+08
I 131	4.92E+06	7.03E+06	4.03E+06	2.30E+09	1.21E+07	0.0	1.86E+06
I 133	1.69E-01	2.94E-01	8.97E-02	4.32E+01	5.14E-01	0.0	2.65E-01
CS 134	4.83E+08	1.15E+09	9.39E+08	0.0	3.72E+08	1.23E+08	2.01E+07
CS 136	1.06E+07	4.20E+07	3.03E+07	0.0	2.34E+07	3.21E+06	4.78E+06
CS 137	6.58E+08	9.00E+08	5.89E+08	0.0	3.05E+08	1.02E+08	1.74E+07
BA 140	2.56E+07	3.22E+04	1.68E+06	0.0	1.09E+04	1.84E+04	5.27E+07
CE 141	1.15E+04	7.79E+03	8.84E+02	0.0	3.62E+03	0.0	2.98E+07
CE 144	1.07E+06	4.49E+05	5.76E+04	0.0	2.66E+05	0.0	3.63E+08

TABLE 3.1-17
(1 of 1)
 R_i VALUES - MEAT PATHWAY - TEENAGER

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02
CR 51	0.0	0.0	4.68E+03	2.60E+03	1.03E+03	6.69E+03	7.87E+05
MN 54	0.0	5.21E+06	1.03E+06	0.0	1.55E+06	0.0	1.07E+07
FE 55	1.73E+08	1.23E+08	2.86E+07	0.0	0.0	7.78E+07	5.31E+07
FE 59	1.70E+08	3.96E+08	1.53E+08	0.0	0.0	1.25E+08	9.36E+08
CO 58	0.0	1.09E+07	2.51E+07	0.0	0.0	0.0	1.50E+08
CO 60	0.0	4.31E+07	9.72E+07	0.0	0.0	0.0	5.62E+08
ZN 65	2.11E+08	7.34E+08	3.43E+08	0.0	4.70E+08	0.0	3.11E+08
SR 89	2.02E+08	0.0	5.78E+06	0.0	0.0	0.0	2.40E+07
SR 90	6.26E+09	0.0	1.55E+09	0.0	0.0	0.0	1.76E+08
ZR 95	1.18E+06	3.72E+05	2.56E+05	0.0	5.47E+05	0.0	8.58E+08
MO 99	0.0	7.75E+04	1.48E+04	0.0	1.77E+05	0.0	1.39E+05
SB 124	1.27E+07	2.33E+05	4.94E+06	2.87E+04	0.0	1.11E+07	2.55E+08
I 131	4.09E+06	5.72E+06	3.07E+06	1.67E+09	9.85E+06	0.0	1.13E+06
I 133	1.42E-01	2.40E-01	7.32E-02	3.35E+01	4.21E-01	0.0	1.82E-01
CS 134	3.84E+08	9.04E+08	4.19E+08	0.0	2.87E+08	1.10E+08	1.12E+07
CS 136	8.30E+06	3.27E+07	2.19E+07	0.0	1.78E+07	2.80E+06	2.63E+06
CS 137	5.46E+08	7.27E+08	2.53E+08	0.0	2.47E+08	9.61E+07	1.03E+07
BA 140	2.12E+07	2.59E+04	1.36E+06	0.0	8.79E+03	1.74E+04	3.26E+07
CE 141	9.67E+03	6.46E+03	7.42E+02	0.0	3.04E+03	0.0	1.85E+07
CE 144	9.04E+05	3.74E+05	4.86E+04	0.0	2.24E+05	0.0	2.27E+08

TABLE 3.1-18
(1 of 1)
R_i VALUES - MEAT PATHWAY - CHILD

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	2.36E+02	2.36E+02	2.36E+02	2.36E+02	2.36E+02	2.36E+02
CR 51	0.0	0.0	7.31E+03	4.06E+03	1.11E+03	7.40E+03	3.87E+05
MN 54	0.0	5.96E+06	1.59E+06	0.0	1.67E+06	0.0	5.00E+06
FE 55	3.32E+08	1.76E+08	5.45E+07	0.0	0.0	9.95E+07	3.26E+07
FE 59	3.01E+08	4.86E+08	2.42E+08	0.0	0.0	1.41E+08	5.06E+08
CO 58	0.0	1.27E+07	3.90E+07	0.0	0.0	0.0	7.43E+07
CO 60	0.0	5.12E+07	1.51E+08	0.0	0.0	0.0	2.84E+08
ZN 65	3.17E+08	8.45E+08	5.26E+08	0.0	5.33E+08	0.0	1.48E+08
SR 89	3.82E+08	0.0	1.09E+07	0.0	0.0	0.0	1.48E+07
SR 90	8.08E+09	0.0	2.05E+09	0.0	0.0	0.0	1.09E+08
ZR 95	2.09E+06	4.60E+05	4.10E+05	0.0	6.59E+05	0.0	4.80E+08
MO 99	0.0	1.08E+05	2.67E+04	0.0	2.30E+05	0.0	8.92E+04
SB 124	2.29E+07	2.97E+05	8.03E+06	5.06E+04	0.0	1.27E+07	1.43E+08
I 131	7.58E+06	7.62E+06	4.33E+06	2.52E+09	1.25E+07	0.0	6.78E+05
I 133	2.63E-01	3.25E-01	1.23E-01	6.04E+01	5.42E-01	0.0	1.31E-01
CS 134	6.77E+08	1.11E+09	2.34E+08	0.0	3.44E+08	1.24E+08	5.99E+06
CS 136	1.43E+07	3.94E+07	2.55E+07	0.0	2.10E+07	3.13E+06	1.38E+06
CS 137	1.01E+09	9.63E+08	1.42E+08	0.0	3.14E+08	1.13E+08	6.03E+06
BA 140	3.91E+07	3.42E+04	2.28E+06	0.0	1.11E+04	2.04E+04	1.98E+07
CE 141	1.82E+04	9.08E+03	1.35E+03	0.0	3.98E+03	0.0	1.13E+07
CE 144	1.70E+06	5.34E+05	9.10E+04	0.0	2.96E+05	0.0	1.39E+08

TABLE 3.1-19
(1 of 1)
R_i VALUES - COW MILK PATHWAY - ADULT

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	7.69E+02	7.69E+02	7.69E+02	7.69E+02	7.69E+02	7.69E+02
CR 51	0.0	0.0	2.38E+04	1.42E+04	5.24E+03	3.15E+04	5.98E+06
MN 54	0.0	6.26E+06	1.19E+06	0.0	1.86E+06	0.0	1.92E+07
FE 55	1.82E+07	1.26E+07	2.94E+06	0.0	0.0	7.03E+06	7.22E+06
FE 59	2.37E+07	5.58E+07	2.14E+07	0.0	0.0	1.56E+07	1.86E+08
CO 58	0.0	3.66E+06	8.19E+06	0.0	0.0	0.0	7.41E+07
CO 60	0.0	1.21E+07	2.68E+07	0.0	0.0	0.0	2.28E+08
ZN 65	1.16E+09	3.69E+09	1.67E+09	0.0	2.47E+09	0.0	2.32E+09
SR 89	1.15E+09	0.0	3.30E+07	0.0	0.0	0.0	1.84E+08
SR 90	3.64E+10	0.0	8.93E+09	0.0	0.0	0.0	1.05E+09
ZR 95	7.38E+02	2.37E+02	1.60E+02	0.0	3.71E+02	0.0	7.50E+05
MO 99	0.0	2.32E+07	4.42E+06	0.0	5.25E+07	0.0	5.38E+07
SB 124	2.02E+07	3.81E+05	7.99E+06	4.89E+04	0.0	1.57E+07	5.72E+08
I 131	1.36E+08	1.94E+08	1.11E+08	6.36E+10	3.32E+08	0.0	5.12E+07
I 133	1.80E+06	3.13E+06	9.55E+05	4.61E+08	5.47E+06	0.0	2.82E+06
CS 134	4.15E+09	9.88E+09	8.08E+09	0.0	3.20E+09	1.06E+09	1.73E+08
CS 136	2.33E+08	9.22E+08	6.63E+08	0.0	5.13E+08	7.03E+07	1.05E+08
CS 137	5.57E+09	7.62E+09	4.99E+09	0.0	2.59E+09	8.59E+08	1.47E+08
BA 140	2.39E+07	3.01E+04	1.57E+06	0.0	1.02E+04	1.72E+04	4.93E+07
CE 141	3.99E+03	2.70E+03	3.06E+02	0.0	1.25E+03	0.0	1.03E+07
CE 144	2.64E+05	1.10E+05	1.42E+04	0.0	6.55E+04	0.0	8.93E+07

TABLE 3.1-19
(1 of 1)

TABLE 3.1-20
(1 of 1)
R_i VALUES - COW MILK PATHWAY - TEENAGER

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	1.00E+03	1.00E+03	1.00E+03	1.00E+03	1.00E+03	1.00E+03
CR 51	0.0	0.0	4.15E+04	2.31E+04	9.10E+03	5.93E+04	6.98E+06
MN 54	0.0	1.04E+07	2.07E+06	0.0	3.11E+06	0.0	2.14E+07
FE 55	3.23E+07	2.29E+07	5.34E+06	0.0	0.0	1.45E+07	9.92E+06
FE 59	4.14E+07	9.67E+07	3.73E+07	0.0	0.0	3.05E+07	2.29E+08
CO 58	0.0	6.15E+06	1.42E+07	0.0	0.0	0.0	8.48E+07
CO 60	0.0	2.06E+07	4.63E+07	0.0	0.0	0.0	2.68E+08
ZN 65	1.78E+09	6.18E+09	2.88E+09	0.0	3.96E+09	0.0	2.62E+09
SR 89	2.12E+09	0.0	6.07E+07	0.0	0.0	0.0	2.53E+08
SR 90	5.14E+10	0.0	1.27E+10	0.0	0.0	0.0	1.44E+09
ZR 95	1.29E+03	4.07E+02	2.80E+02	0.0	5.98E+02	0.0	9.39E+05
MO 99	0.0	4.19E+07	7.99E+06	0.0	9.59E+07	0.0	7.50E+07
SB 124	3.60E+07	6.62E+05	1.40E+07	8.16E+04	0.0	3.14E+07	7.25E+08
I 131	2.46E+08	3.44E+08	1.85E+08	1.01E+11	5.93E+08	0.0	6.81E+07
I 133	3.29E+06	5.58E+06	1.70E+06	7.79E+08	9.79E+06	0.0	4.22E+06
CS 134	7.21E+09	1.70E+10	7.87E+09	0.0	5.39E+09	2.06E+09	2.11E+08
CS 136	3.97E+08	1.56E+09	1.05E+09	0.0	8.51E+08	1.34E+08	1.26E+08
CS 137	1.01E+10	1.34E+10	4.68E+09	0.0	4.57E+09	1.78E+09	1.91E+08
BA 140	4.32E+07	5.30E+04	2.78E+06	0.0	1.80E+04	3.56E+04	6.67E+07
CE 141	7.31E+03	4.88E+03	5.61E+02	0.0	2.30E+03	0.0	1.40E+07
CE 144	4.86E+05	2.01E+05	2.61E+04	0.0	1.20E+05	0.0	1.22E+08

TABLE 3.1-20
(1 of 1)

TABLE 3.1-21
(1 of 1)
R_i VALUES - COW MILK PATHWAY - CHILD

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	1.58E+03	1.58E+03	1.58E+03	1.58E+03	1.58E+03	1.58E+03
CR 51	0.0	0.0	8.47E+04	4.70E+04	1.28E+04	8.58E+04	4.49E+06
MN 54	0.0	1.56E+07	4.16E+06	0.0	4.38E+06	0.0	1.31E+07
FE 55	8.11E+07	4.30E+07	1.33E+07	0.0	0.0	2.43E+07	7.97E+06
FE 59	9.61E+07	1.55E+08	7.74E+07	0.0	0.0	4.51E+07	1.62E+08
CO 58	0.0	9.40E+06	2.88E+07	0.0	0.0	0.0	5.48E+07
CO 60	0.0	3.19E+07	9.41E+07	0.0	0.0	0.0	1.77E+08
ZN 65	3.49E+09	9.31E+09	5.79E+09	0.0	5.87E+09	0.0	1.63E+09
SR 89	5.25E+09	0.0	1.50E+08	0.0	0.0	0.0	2.03E+08
SR 90	8.69E+10	0.0	2.20E+10	0.0	0.0	0.0	1.17E+09
ZR 95	3.00E+03	6.59E+02	5.86E+02	0.0	9.43E+02	0.0	6.87E+05
MO 99	0.0	7.62E+07	1.89E+07	0.0	1.63E+08	0.0	6.30E+07
SB 124	8.51E+07	1.10E+06	2.98E+07	1.88E+05	0.0	4.72E+07	5.32E+08
I 131	5.97E+08	6.00E+08	3.41E+08	1.98E+11	9.85E+08	0.0	5.34E+07
I 133	8.00E+06	9.89E+06	3.74E+06	1.84E+09	1.65E+07	0.0	3.98E+06
CS 134	1.66E+10	2.73E+10	5.75E+09	0.0	8.45E+09	3.03E+09	1.47E+08
CS 136	8.97E+08	2.47E+09	1.60E+09	0.0	1.31E+09	1.96E+08	8.67E+07
CS 137	2.43E+10	2.33E+10	3.44E+09	0.0	7.59E+09	2.73E+09	1.46E+08
BA 140	1.04E+08	9.14E+04	6.09E+06	0.0	2.98E+04	5.45E+04	5.29E+07
CE 141	1.80E+04	8.98E+03	1.33E+03	0.0	3.94E+03	0.0	1.12E+07
CE 144	1.20E+06	3.76E+05	6.40E+04	0.0	2.08E+05	0.0	9.80E+07

TABLE 3.1-21
(1 of 1)

TABLE 3.1-22
(1 of 1)
 R_i VALUES - COW MILK PATHWAY - INFANT

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	2.40E+03	2.40E+03	2.40E+03	2.40E+03	2.40E+03	2.40E+03
CR 51	0.0	0.0	1.34E+05	8.75E+04	1.91E+04	1.70E+05	3.91E+06
MN 54	0.0	2.90E+07	6.58E+06	0.0	6.43E+06	0.0	1.07E+07
FE 55	9.81E+07	6.34E+07	1.69E+07	0.0	0.0	3.10E+07	8.04E+06
FE 59	1.79E+08	3.13E+08	1.23E+08	0.0	0.0	9.26E+07	1.50E+08
CO 58	0.0	1.88E+07	4.69E+07	0.0	0.0	0.0	4.69E+07
CO 60	0.0	6.52E+07	1.54E+08	0.0	0.0	0.0	1.55E+08
ZN 65	4.69E+09	1.61E+10	7.42E+09	0.0	7.80E+09	0.0	1.36E+10
SR 89	9.98E+09	0.0	2.86E+08	0.0	0.0	0.0	2.05E+08
SR 90	9.45E+10	0.0	2.41E+10	0.0	0.0	0.0	1.18E+09
ZR 95	5.32E+03	1.30E+03	9.20E+02	0.0	1.40E+03	0.0	6.46E+05
MO 99	0.0	1.95E+08	2.08E+07	0.0	2.91E+08	0.0	6.42E+07
SB 124	1.64E+08	2.41E+06	5.08E+07	4.35E+05	0.0	1.03E+08	5.06E+08
I 131	1.25E+09	1.47E+09	6.45E+08	4.82E+11	1.71E+09	0.0	5.24E+07
I 133	1.69E+07	2.46E+07	7.20E+06	4.47E+09	2.89E+07	0.0	4.16E+06
CS 134	2.68E+10	4.99E+10	5.04E+09	0.0	1.29E+10	5.27E+09	1.36E+08
CS 136	1.75E+09	5.15E+09	1.92E+09	0.0	2.05E+09	4.20E+08	7.83E+07
CS 137	3.88E+10	4.54E+10	3.22E+09	0.0	1.22E+10	4.94E+09	1.42E+08
BA 140	2.15E+08	2.15E+05	1.11E+07	0.0	5.10E+04	1.32E+05	5.27E+07
CE 141	3.57E+04	2.18E+04	2.56E+03	0.0	6.71E+03	0.0	1.12E+07
CE 144	1.72E+06	7.03E+05	9.62E+04	0.0	2.84E+05	0.0	9.85E+07

TABLE 3.1-22
(1 of 1)

TABLE 3.1-23
(1 of 1)
R_i VALUES - GOAT MILK PATHWAY - ADULT

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	1.57E+03	1.57E+03	1.57E+03	1.57E+03	1.57E+03	1.57E+03
CR 51	0.0	0.0	2.85E+03	1.71E+03	6.28E+02	3.79E+03	7.17E+05
MN 54	0.0	7.51E+05	1.43E+05	0.0	2.24E+05	0.0	2.30E+06
FE 55	2.37E+06	1.64E+06	3.82E+05	0.0	0.0	9.13E+05	9.39E+05
FE 59	3.09E+06	7.25E+06	2.78E+06	0.0	0.0	2.03E+06	2.42E+07
CO 58	0.0	4.39E+05	9.83E+05	0.0	0.0	0.0	8.89E+06
CO 60	0.0	1.46E+06	3.21E+06	0.0	0.0	0.0	2.73E+07
ZN 65	1.39E+08	4.43E+08	2.00E+08	0.0	2.96E+08	0.0	2.79E+08
SR 89	2.42E+09	0.0	6.93E+07	0.0	0.0	0.0	3.87E+08
SR 90	7.64E+10	0.0	1.87E+10	0.0	0.0	0.0	2.21E+09
ZR 95	8.85E+01	2.84E+01	1.92E+01	0.0	4.46E+01	0.0	9.00E+04
MO 99	0.0	2.78E+06	5.30E+05	0.0	6.31E+06	0.0	6.45E+06
SB 124	2.42E+06	4.57E+04	9.59E+05	5.87E+03	0.0	1.88E+06	6.87E+07
I 131	1.63E+08	2.33E+08	1.33E+08	7.63E+10	3.99E+08	0.0	6.14E+07
I 133	2.16E+06	3.76E+06	1.15E+06	5.53E+08	6.56E+06	0.0	3.38E+06
CS 134	1.25E+10	2.96E+10	2.42E+10	0.0	9.59E+09	3.18E+09	5.19E+08
CS 136	7.00E+08	2.76E+09	1.99E+09	0.0	1.54E+09	2.11E+08	3.14E+08
CS 137	1.67E+10	2.28E+10	1.50E+10	0.0	7.76E+09	2.58E+09	4.42E+08
BA 140	2.87E+06	3.61E+03	1.88E+05	0.0	1.23E+03	2.07E+03	5.92E+06
CE 141	4.79E+02	3.24E+02	3.67E+01	0.0	1.50E+02	0.0	1.24E+06
CE 144	3.17E+04	1.33E+04	1.70E+03	0.0	7.86E+03	0.0	1.07E+07

TABLE 3.1-23
(1 of 1)

TABLE 3.1-24
(1 of 1)
R_i VALUES - GOAT MILK PATHWAY - TEENAGER

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-ILLI
H 3	0.0	204E+03	2.04E+03	2.04E+03	2.04E+03	2.04E+03	2.04E+03
CR 51	0.0	0.0	4.98E+03	2.77E+03	1.09E+03	7.11E+03	8.37E+05
MN 54	0.0	1.25E+06	2.48E+05	0.0	3.73E+05	0.0	2.57E+06
FE 55	4.20E+06	2.98E+06	6.95E+05	0.0	0.0	1.89E+06	1.29E+06
FE 59	5.39E+06	1.26E+07	4.85E+06	0.0	0.0	3.96E+06	2.97E+07
CO 58	0.0	7.39E+05	1.70E+06	0.0	0.0	0.0	1.02E+07
CO 60	0.0	2.47E+06	5.56E+06	0.0	0.0	0.0	3.21E+07
ZN 65	2.14E+08	7.42E+08	3.46E+08	0.0	4.75E+08	0.0	3.14E+08
SR 89	4.45E+09	0.0	1.28E+08	0.0	0.0	0.0	5.30E+08
SR 90	1.08E+11	0.0	2.67E+10	0.0	0.0	0.0	3.03E+09
ZR 95	1.55E+02	4.88E+01	3.36E+01	0.0	7.18E+01	0.0	1.13E+05
MO 99	0.0	5.03E+06	9.59E+05	0.0	1.15E+07	0.0	9.00E+06
SB 124	4.31E+06	7.95E+04	1.68E+06	9.79E+03	0.0	3.77E+06	8.70E+07
I 131	2.95E+08	4.13E+08	2.22E+08	1.21E+11	7.12E+08	0.0	8.18E+07
I 133	3.95E+06	6.70E+06	2.04E+06	9.35E+08	1.17E+07	0.0	5.07E+06
CS 134	2.16E+10	5.09E+10	2.36E+10	0.0	1.62E+10	6.17E+09	6.33E+08
CS 136	1.19E+09	4.69E+09	3.15E+09	0.0	2.55E+09	4.03E+08	3.78E+08
CS 137	3.03E+10	4.03E+10	1.40E+10	0.0	1.37E+10	5.33E+09	5.73E+08
BA 140	5.19E+06	6.35E+03	3.34E+05	0.0	2.15E+03	4.27E+03	8.00E+06
CE 141	8.77E+02	5.86E+02	6.73E+01	0.0	2.76E+02	0.0	1.68E+06
CE 144	5.83E+04	2.41E+04	3.14E+03	0.0	1.44E+04	0.0	1.47E+07

TABLE 3.1-24
(1 of 1)

TABLE 3.1-25
(1 of 1)
R_i VALUES - GOAT MILK PATHWAY - CHILD

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-ILLI
H 3	0.0	3.23E+03	3.23E+03	3.23E+03	3.23E+03	3.23E+03	3.23E+03
CR 51	0.0	0.0	1.02E+04	5.64E+03	1.54E+03	1.03E+04	5.39E+05
MN 54	0.0	1.87E+06	4.99E+05	0.0	5.25E+05	0.0	1.57E+06
FE 55	1.05E+07	5.59E+06	1.73E+06	0.0	0.0	3.16E+06	1.04E+06
FE 59	1.25E+07	2.02E+07	1.01E+07	0.0	0.0	5.86E+06	2.10E+07
CO 58	0.0	1.13E+06	3.45E+06	0.0	0.0	0.0	6.58E+06
CO 60	0.0	3.83E+06	1.13E+07	0.0	0.0	0.0	2.12E+07
ZN 65	4.19E+08	1.12E+09	6.95E+08	0.0	7.04E+08	0.0	1.96E+08
SR 89	1.10E+10	0.0	3.15E+08	0.0	0.0	0.0	4.27E+08
SR 90	1.82E+11	0.0	4.62E+10	0.0	0.0	0.0	2.46E+09
ZR 95	3.60E+02	7.91E+01	7.04E+01	0.0	1.13E+02	0.0	8.25E+04
MO 99	0.0	9.15E+06	2.26E+06	0.0	1.95E+07	0.0	7.57E+06
SB 124	1.02E+07	1.32E+05	3.58E+06	2.25E+04	0.0	5.67E+06	6.38E+07
I 131	7.16E+08	7.20E+08	4.09E+08	2.38E+11	1.18E+09	0.0	6.41E+07
I 133	9.59E+06	1.19E+07	4.49E+06	2.20E+09	1.98E+07	0.0	4.78E+06
CS 134	4.99E+10	8.18E+10	1.73E+10	0.0	2.54E+10	9.10E+09	4.41E+08
CS 136	2.69E+09	7.40E+09	4.79E+09	0.0	3.94E+09	5.88E+08	2.60E+08
CS 137	7.30E+10	6.98E+10	1.03E+10	0.0	2.28E+10	8.19E+09	4.37E+08
BA 140	1.25E+07	1.10E+04	7.31E+05	0.0	3.57E+03	6.54E+03	6.34E+06
CE 141	2.16E+03	1.08E+03	1.60E+02	0.0	4.72E+02	0.0	1.34E+06
CE 144	1.44E+05	4.51E+04	7.68E+03	0.0	2.50E+04	0.0	1.18E+07

TABLE 3.1-25
(1 of 1)

TABLE 3.1-26
(1 of 1)
R_i VALUES - GOAT MILK PATHWAY - INFANT

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-ILLI
H 3	0.0	4.90E+03	4.90E+03	4.90E+03	4.90E+03	4.90E+03	4.90E+03
CR 51	0.0	0.0	1.61E+04	1.05E+04	2.29E+03	2.04E+04	4.69E+05
MN 54	0.0	3.48E+06	7.89E+05	0.0	7.72E+05	0.0	1.28E+06
FE 55	1.27E+07	8.24E+06	2.20E+06	0.0	0.0	4.03E+06	1.05E+06
FE 59	2.33E+07	4.07E+07	1.60E+07	0.0	0.0	1.20E+07	1.95E+07
CO 58	0.0	2.26E+06	5.63E+06	0.0	0.0	0.0	5.62E+06
CO 60	0.0	7.82E+06	1.85E+07	0.0	0.0	0.0	1.86E+07
ZN 65	5.63E+08	1.93E+09	8.91E+08	0.0	9.36E+08	0.0	1.63E+09
SR 89	2.10E+10	0.0	6.01E+08	0.0	0.0	0.0	4.31E+08
SR 90	1.98E+11	0.0	5.05E+10	0.0	0.0	0.0	2.48E+09
ZR 95	6.39E+02	1.56E+02	1.10E+02	0.0	1.68E+02	0.0	7.75E+04
MO 99	0.0	2.34E+07	4.56E+06	0.0	3.49E+07	0.0	7.70E+06
SB 124	1.97E+07	2.90E+05	6.10E+06	5.22E+04	0.0	1.23E+07	6.07E+07
I 131	1.49E+09	1.76E+09	7.74E+08	5.79E+11	2.06E+09	0.0	6.29E+07
I 133	2.03E+07	2.95E+07	8.64E+06	5.36E+09	3.47E+07	0.0	4.99E+06
CS 134	8.03E+10	1.50E+11	1.51E+10	0.0	3.86E+10	1.58E+10	4.07E+08
CS 136	5.26E+09	1.55E+10	5.77E+09	0.0	6.16E+09	1.26E+09	2.35E+08
CS 137	1.16E+11	1.36E+11	9.66E+09	0.0	3.66E+10	1.48E+10	4.26E+08
BA 140	2.58E+07	2.58E+04	1.33E+06	0.0	6.12E+03	1.58E+04	6.33E+06
CE 141	4.28E+03	2.61E+03	3.07E+02	0.0	8.05E+02	0.0	1.35E+06
CE 144	2.06E+05	8.44E+04	1.15E+04	0.0	3.41E+04	0.0	1.18E+07

TABLE 3.1-26
(1 of 1)

TABLE 3.1-27
(1 of 1)
R_i VALUES - INHALATION PATHWAY - ADULT

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	1.26E+03	1.26E+03	1.26E+03	1.26E+03	1.26E+03	1.26E+03
CR 51	0.0	0.0	9.99E+01	5.94E+01	2.28E+01	5.94E+04	3.32E+03
MN 54	0.0	3.95E+04	6.29E+03	0.0	9.83E+03	1.40E+06	7.72E+04
FE 55	2.45E+04	1.69E+04	3.94E+03	0.0	0.0	7.20E+04	6.02E+03
FE 59	1.17E+04	2.77E+04	1.05E+04	0.0	0.0	1.01E+06	1.88E+05
CO 58	0.0	1.58E+03	2.07E+03	0.0	0.0	9.27E+05	1.06E+05
CO 60	0.0	1.15E+04	1.48E+04	0.0	0.0	5.96E+06	2.84E+05
ZN 65	3.24E+04	1.03E+05	4.65E+04	0.0	6.89E+04	8.63E+05	5.34E+04
SR 89	3.04E+05	0.0	8.71E+03	0.0	0.0	1.40E+06	3.49E+05
SR 90	9.91E+07	0.0	6.09E+06	0.0	0.0	9.59E+06	7.21E+05
ZR 95	1.07E+05	3.44E+04	2.32E+04	0.0	5.41E+04	1.77E+06	1.50E+05
MO 99	0.0	1.21E+02	2.30E+01	0.0	2.92E+02	9.13E+04	2.48E+05
SB 124	3.12E+04	5.88E+02	1.24E+04	7.54E+01	0.0	2.48E+06	4.06E+05
I 131	2.52E+04	3.57E+04	2.05E+04	1.19E+07	6.12E+04	0.0	6.27E+03
I 133	8.63E+03	1.48E+04	4.51E+03	2.15E+06	2.58E+04	0.0	8.87E+03
CS 134	3.72E+05	8.47E+05	7.27E+05	0.0	2.87E+05	9.75E+04	1.04E+04
CS 136	3.90E+04	1.46E+05	1.10E+05	0.0	8.55E+04	1.20E+04	1.17E+04
CS 137	4.78E+05	6.20E+05	4.27E+05	0.0	2.22E+05	7.51E+04	8.39E+03
BA 140	3.90E+04	4.90E+01	2.56E+03	0.0	1.67E+01	1.27E+06	2.18E+05
CE 141	1.99E+04	1.35E+04	1.53E+03	0.0	6.25E+03	3.61E+05	1.20E+05
CE 144	3.43E+06	1.43E+06	1.84E+05	0.0	8.47E+05	7.76E+06	8.15E+05

TABLE 3.1-27
(1 of 1)

TABLE 3.1-28
(1 of 1)
R_i VALUES - INHALATION PATHWAY - TEENAGER

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	1.27E+03	1.27E+03	1.27E+03	1.27E+03	1.27E+03	1.27E+03
CR 51	0.0	0.0	1.35E+02	7.49E+01	3.07E+01	2.09E+04	3.00E+03
MN 54	0.0	5.10E+04	8.39E+03	0.0	1.27E+04	1.98E+06	6.67E+04
FE 55	3.34E+04	2.38E+04	5.54E+03	0.0	0.0	1.24E+05	6.38E+03
FE 59	1.59E+04	3.69E+04	1.43E+04	0.0	0.0	1.53E+06	1.78E+05
CO 58	0.0	2.07E+03	2.77E+03	0.0	0.0	1.34E+06	9.51E+04
CO 60	0.0	1.51E+04	1.98E+04	0.0	0.0	8.71E+06	2.59E+05
ZN 65	3.85E+04	1.33E+05	6.23E+04	0.0	8.63E+04	1.24E+06	4.66E+04
SR 89	4.34E+05	0.0	1.25E+04	0.0	0.0	2.41E+06	3.71E+05
SR 90	1.08E+08	0.0	6.67E+06	0.0	0.0	1.65E+07	7.64E+05
ZR 95	1.45E+05	4.58E+04	3.15E+04	0.0	6.73E+04	2.68E+06	1.49E+05
MO 99	0.0	1.69E+02	3.23E+01	0.0	4.12E+02	1.54E+05	2.69E+05
SB 124	4.30E+04	7.92E+02	1.68E+04	9.75E+01	0.0	3.84E+06	3.98E+05
I 131	3.54E+04	4.90E+04	2.64E+04	1.46E+07	8.39E+04	0.0	6.48E+03
I 133	1.21E+04	2.05E+04	6.21E+03	2.92E+06	3.59E+04	0.0	1.03E+04
CS 134	5.02E+05	1.13E+06	5.48E+05	0.0	3.75E+05	1.46E+05	9.75E+03
CS 136	5.14E+04	1.93E+05	1.37E+05	0.0	1.10E+05	1.77E+04	1.09E+04
CS 137	6.69E+05	8.47E+05	3.11E+05	0.0	3.04E+05	1.21E+05	8.47E+03
BA 140	5.46E+04	6.69E+01	3.51E+03	0.0	2.28E+01	2.03E+06	2.28E+05
CE 141	2.84E+04	1.89E+04	2.16E+03	0.0	8.87E+03	6.13E+05	1.26E+05
CE 144	4.88E+06	2.02E+06	2.62E+05	0.0	1.21E+06	1.33E+07	8.63E+05

TABLE 3.1-28
(1 of 1)

TABLE 3.1-29
(1 of 1)
R₁ VALUES - INHALATION PATHWAY - CHILD

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	1.12E+03	1.12E+03	1.12E+03	1.12E+03	1.12E+03	1.12E+03
CR 51	0.0	0.0	1.54E+02	8.53E+01	2.43E+01	1.70E+04	1.08E+03
MN 54	0.0	4.29E+04	9.50E+03	0.0	1.00E+04	1.57E+06	2.29E+04
FE 55	4.73E+04	2.51E+04	7.76E+03	0.0	0.0	1.11E+05	2.86E+03
FE 59	2.07E+04	3.34E+04	1.67E+04	0.0	0.0	1.27E+06	7.06E+04
CO 58	0.0	1.77E+03	3.16E+03	0.0	0.0	1.10E+06	3.43E+04
CO 60	0.0	1.31E+04	2.26E+04	0.0	0.0	7.06E+06	9.61E+04
ZN 65	4.25E+04	1.13E+05	7.02E+04	0.0	7.13E+04	9.94E+05	1.63E+04
SR 89	5.99E+05	0.0	1.72E+04	0.0	0.0	2.15E+06	1.67E+05
SR 90	1.01E+08	0.0	6.43E+06	0.0	0.0	1.47E+07	3.43E+05
ZR 95	1.90E+05	4.17E+04	3.69E+04	0.0	5.95E+04	2.23E+06	6.10E+04
MO 99	0.0	1.73E+02	4.26E+01	0.0	3.93E+02	1.36E+05	1.27E+05
SB 124	5.73E+04	7.39E+02	2.00E+04	1.26E+02	0.0	3.24E+06	1.64E+05
I 131	4.80E+04	4.80E+04	2.72E+04	1.62E+07	7.87E+04	0.0	2.84E+03
I 133	1.66E+04	2.03E+04	7.68E+03	3.84E+06	3.37E+04	0.0	5.47E+03
CS 134	6.50E+05	1.01E+06	2.24E+05	0.0	3.30E+05	1.21E+05	3.84E+03
CS 136	6.50E+04	1.71E+05	1.16E+05	0.0	9.53E+04	1.45E+04	4.17E+03
CS 137	9.05E+05	8.24E+05	1.28E+05	0.0	2.82E+05	1.04E+05	3.61E+03
BA 140	7.39E+04	6.47E+01	4.32E+03	0.0	2.11E+01	1.74E+06	1.02E+05
CE 141	3.92E+04	1.95E+04	2.89E+03	0.0	8.53E+03	5.43E+05	5.65E+04
CE 144	6.76E+06	2.11E+06	3.61E+05	0.0	1.17E+06	1.19E+07	3.88E+05

TABLE 3.1-29
(1 of 1)

TABLE 3.1-30
(1 of 1)
R_i VALUES - INHALATION PATHWAY - INFANT

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	6.46E+02	6.46E+02	6.46E+02	6.46E+02	6.46E+02	6.46E+02
CR 51	0.0	0.0	8.93E+01	5.75E+01	1.32E+01	1.28E+04	3.56E+02
MN 54	0.0	2.53E+04	4.98E+03	0.0	4.98E+03	9.98E+05	7.05E+03
FE 55	1.97E+04	1.17E+04	3.33E+03	0.0	0.0	8.68E+04	1.09E+03
FE 59	1.35E+04	2.35E+04	9.46E+03	0.0	0.0	1.01E+06	2.47E+04
CO 58	0.0	1.22E+03	1.82E+03	0.0	0.0	7.76E+05	1.11E+04
CO 60	0.0	8.01E+03	1.18E+04	0.0	0.0	4.50E+06	3.19E+04
ZN 65	1.93E+04	6.25E+04	3.10E+04	0.0	3.24E+04	6.46E+05	5.13E+04
SR 89	3.97E+05	0.0	1.14E+04	0.0	0.0	2.03E+06	6.39E+04
SR 90	4.08E+07	0.0	2.59E+06	0.0	0.0	1.12E+07	1.31E+05
ZR 95	1.15E+05	2.78E+04	2.03E+04	0.0	3.10E+04	1.75E+06	2.17E+04
MO 99	0.0	1.65E+02	3.24E+01	0.0	2.65E+02	1.35E+05	4.88E+04
SB 124	3.79E+04	5.55E+02	1.20E+04	1.00E+02	0.0	2.64E+06	5.90E+04
I 131	3.79E+04	4.43E+04	1.96E+04	1.48E+07	5.17E+04	0.0	1.06E+03
I 133	1.32E+04	1.92E+04	5.59E+03	3.55E+06	2.24E+04	0.0	2.15E+03
CS 134	3.96E+05	7.02E+05	7.44E+04	0.0	1.90E+05	7.95E+04	1.33E+03
CS 136	4.82E+04	1.34E+05	5.28E+04	0.0	5.63E+04	1.17E+04	1.43E+03
CS 137	5.48E+05	6.11E+05	4.54E+04	0.0	1.72E+05	7.12E+04	1.33E+03
BA 140	5.59E+04	5.59E+01	2.89E+03	0.0	1.34E+01	1.59E+06	3.83E+04
CE 141	2.77E+04	1.66E+04	1.99E+03	0.0	5.24E+03	5.16E+05	2.15E+04
CE 144	3.19E+06	1.21E+06	1.76E+05	0.0	5.37E+05	9.83E+06	1.48E+05

TABLE 3.1-30
(1 of 1)

January 1, 1995

Subject: Offsite Dose Calculation Manual (ODCM)
Oconee Nuclear Station Section
Revision 35

The General Office Radiation Protection Staff is transmitting to you this date, Revision 35, of the Oconee Offsite Dose Calculation Manual. As this revision only affects Oconee Nuclear Station, the approval of other station managers is not required. A list of affected pages is given below. Please insert this letter, with the attached Justification section, in front of the January 1, 1994, Revision 34, letter.

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Effective Date: 1/1/95

Effective Date: 1/1/95

Lance E. Loucks

L. E. Loucks, Technical Manager
Radiation Protection

B. L. Peele

B. L. Peele, Jr., Manager
Oconee Nuclear Station

If you have any questions concerning Revision 35, please call Caryl Ingram at (704) 382-4496.

Caryl D. Ingram

Caryl D. Ingram, Senior Engineer
Radiation Protection
Station Support Division

JUSTIFICATION FOR REVISION 35

Page A-6:

Updated D/Q value to reflect 1994 Land Use Census data.

Page A-8:

Updated D/Q value to reflect 1994 Land Use Census data.

Page A-9:

Corrected typographical error in the value 2.22×10^6 .

Page A-16 and A-17:

Removed references related to using "simplified dose calculation methods" which are no longer given in the ODCM as an option for performing dose calculations.

Updated section reflecting the application of Land Use Census data. Broadleaf vegetation is sampled in lieu of a garden census, therefore the garden pathway is assumed to exist in every location.

Page A-20:

Corrected typographical error in the section designations for "Liquid Effluents" and "Gaseous Effluents".

Tables A4.0-1A, A4.0-1B, A4.0-2A, A4.0-2B:

Added information to provide the assumptions and methodology used to generate the values given in the X/Q and D/Q tables.

Tables A4.0-3, A4.0-4, A4.0-5, A4.0-6:

Added information to provide the assumptions and methodology used to generate the values given in the A_{air} tables.

Table A4.0-7:

Updated X/Qs and D/Qs to reflect 1994 Land Use Census data.

Table A4.0-8:

Updated pathways to reflect 1994 Land Use Census data.

Figure A4.0-1:

Changes were made to the LADTAP input template to reflect a revision made to the cesium bioaccumulation factor in fish (2000 L/Kg to 10000 L/Kg), and the dilution factor assumed for the drinking water pathway (1 to 10000). The justification for these changes is as follows:

The 1993 fish samples from environmental sample location #063 indicated an average Cs-137 concentration of 79.6 pCi/kg. The LADTAP model estimated the Cs-137 concentration to be 19.8 pCi/kg based on 1993 Cs-137 releases. Elevated cesium levels in fish near Oconee were evaluated in detail from 1986-1988 by Duke and the NRC, and it was concluded that no unmonitored releases were occurring at Oconee, and that the LADTAP model was adequate. However, data from NUREG/CR-3332, "U.S. NRC, Radiological Assessment, A Textbook on Environmental Dose Analysis" indicates that the 2000 L/Kg cesium bioaccumulation factor used by LADTAP is not necessarily conservative. For example, NUREG/CR-3332 lists the cesium bioaccumulation factor for Sunfish to be 9500 L/Kg. In order to conservatively calculate the maximum individual dose from the fish pathway at Oconee, a decision was made to increase the cesium bioaccumulation factor from the LADTAP default value of 2000 L/Kg to a more conservative value of 10000 L/Kg. The factor of 5 increase in the cesium bioaccumulation factor has a linear effect on dose for that pathway. Calculated liquid pathway doses at Oconee are expected to continue to be only a fraction of a millirem.

In 1989 the Clemson water intake was closed in favor of taking water from the Anderson water intake located 31.5 miles from Oconee on a separate arm of Lake Hartwell. Justification that includes both hydrology and environmental sample results supports the assertion that Oconee liquid discharges have no impact on the Anderson water intake. A dilution factor of 10000 for the drinking water pathway has been added to the Oconee LADTAP input files.

Figure A4.0-3:

Updated X/Qs and D/Qs to reflect 1994 Land Use Census data.

Figure A4.0-4 (pg 9 of 9):

Updated X/Qs and D/Qs to reflect 1994 Land Use Census data.

Page A-21:

Clarified how the land-use census data is used for environmental monitoring and dose assessment purposes.

Table A5.0-1:

Corrected typographical error in sample location # 059.

Table A5.0-2:

Updated the table to reflect changes made in the Oconee environmental sampling program. The changes are discussed in the 1994 Oconee Environmental report.

Figure A5.0-1:

Updated the figure to reflect changes made in the Oconee environmental sampling and TLD program. The changes are discussed in the 1994 Oconee Environmental report.

January 1, 1994

Subject: Oconee Nuclear Station
Offsite Dose Calculation Manual
Revision 34

The General Office Radwaste Processing & Management Staff is transmitting to you this date, Revision 34, of the Oconee Offsite Dose Calculation Manual. As this revision only affects Oconee Nuclear Station, the approval of other station managers is not required. A list of affected pages is given below.

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Effective Date: 1/1/94

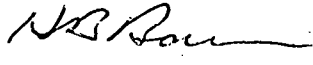

G. L. Courtney
Radiation Protection Manager

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Effective Date: 1/1/94


H. B. Barron, Manager
Oconee Nuclear Station

If you have any questions concerning Revision 34, please call Caryl Ingram at (704) 382-4496.


Caryl D. Ingram, Senior Engineer
Radwaste Processing & Management
Nuclear Services Division

JUSTIFICATION FOR REVISION 34

Most of the changes associated with Revision 34 were made for the following reasons:

(1) X/Q and D/Q Tables were revised:

In order to show compliance with 10CFR20.1301(a)(2) (2 mrem/hr limit) it was necessary to generate X/Q and D/Q values at the Protected Area (PA) fence. The ODCM X/Q and D/Q tables were recalculated in order to be consistent with the assumptions and meteorological data used to calculate the PA fence values. The new values were calculated using the NRC approved computer code "XOQDOQ", NUREG/CR-2919. Attachment 1 provides the X/Q and D/Q tables, and Attachment 2 shows comparisons between the current and revised X/Qs and D/Qs for each sector.

(2) Revision in how the Land Use Census is applied:

Using the new X/Q and D/Q values, a review was performed to see if it would be feasible to assume that all dose pathways exist in every sector around the station. Based on 1992 effluent releases, the calculated increase in the maximum organ dose was easily low enough to allow Ocone to assume all pathways exist in each sector starting 1/1/94. The maximum gamma and beta air dose was unaffected by this new assumption. This revision would also provide the basis to eliminate the annual Land Use Census at Ocone if the decision is made to pursue this option.

Changes that were made in Revision 34 other than those related to reasons (1) and (2) shown above were minor administrative error corrections.

ATTACHMENT 1

New Oconeec X/Q and D/Q Tables

The differences in the revised and the current X/Q and D/Q tables are due primarily to the use of the NRC approved computer model, "XOQDOQ", rather than the computer code "RELCON" used for the current values, and to a lesser extent the meteorological data used in the calculation. The current values are based on 1975 met data. The revised values assume five years (1988-1992) of met data. The larger number of years applied in the calculation makes the joint frequency distribution of wind speed; wind direction; and stability more representative of the average conditions at the station. Biases from any unusual conditions in a particular year would be insignificant with the larger data base.

Semi-Elevated Release (Unit Vent Release Point)

For the Gamma, Beta Air Doses and the Inhalation Pathway Dose the highest X/Q value equals $\implies 1.672\text{E-}06 \text{ sec/m}^3$ at the SW Sector @ 1.0 mile.

For the Food and Ground Plane Pathways the highest D/Q value equals $\implies 1.295\text{E-}08 \text{ m}^2$ at the NE Sector @ 1.0 mile.

Ground Level Release (HMS, Radwaste Facility)

For the Gamma, Beta Air Doses and the Inhalation Pathway Dose the highest X/Q value equals $\implies 7.308\text{E-}06 \text{ sec/m}^3$ at the SE Sector @ 1.0 mile.

For the Food and Ground Plane Pathways the highest D/Q value equals $\implies 1.717\text{E-}08 \text{ m}^2$ at the SW Sector @ 1.0 mile.

TABLE A4.0-1A
 OCONEE NUCLEAR STATION
 (1 OF 1)

DISPERSION PARAMETER (\bar{X}/Q) FOR SEMI-ELEVATED LONG TERM RELEASES > 500 HR/YR OR > 125 HR/QTR
 (SEC/M3)

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			5.220E-07	2.650E-07	1.594E-07	1.069E-07	7.719E-08	7.321E-08	5.665E-08	4.542E-08
NNE			8.379E-07	4.734E-07	2.690E-07	2.003E-07	1.385E-07	1.091E-07	8.379E-08	6.676E-08
NE			9.503E-07	6.350E-07	3.962E-07	2.535E-07	1.847E-07	1.497E-07	1.157E-07	9.246E-08
ENE			8.116E-07	4.856E-07	2.919E-07	2.196E-07	1.619E-07	1.239E-07	9.609E-08	7.720E-08
E			5.950E-07	3.202E-07	2.015E-07	2.270E-07	1.745E-07	1.292E-07	1.024E-07	8.308E-08
ESE			4.531E-07	3.300E-07	3.623E-07	4.020E-07	2.822E-07	2.109E-07	1.688E-07	1.405E-07
SE			7.505E-07	4.573E-07	5.490E-07	5.110E-07	3.560E-07	2.648E-07	2.063E-07	1.665E-07
SSE			1.419E-06	7.428E-07	4.527E-07	3.489E-07	2.866E-07	2.131E-07	1.659E-07	1.337E-07
S			1.170E-06	6.099E-07	3.701E-07	2.496E-07	1.810E-07	1.552E-07	1.218E-07	9.867E-08
SSW			1.214E-06	6.327E-07	3.564E-07	2.301E-07	1.621E-07	1.213E-07	9.481E-08	7.660E-08
SW			1.672E-06	7.285E-07	4.057E-07	2.720E-07	1.891E-07	1.400E-07	1.085E-07	8.708E-08
WSW			1.558E-06	6.820E-07	3.804E-07	2.438E-07	1.708E-07	1.271E-07	1.010E-07	8.114E-08
W			1.193E-06	5.214E-07	2.909E-07	1.867E-07	1.372E-07	1.032E-07	8.326E-08	6.654E-08
WNW			4.658E-07	2.480E-07	1.760E-07	1.482E-07	1.024E-07	7.695E-08	5.943E-08	4.796E-08
NW			4.831E-07	2.524E-07	1.965E-07	1.291E-07	9.959E-08	7.356E-08	5.682E-08	4.566E-08
NNW			5.375E-07	2.769E-07	2.128E-07	1.394E-07	1.072E-07	7.913E-08	6.110E-08	4.907E-08

REVISION 34
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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
 (1/M2)

SECTOR	DISTANCE TO THE CONTROL LOCATION, IN MILES									
	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			2.890E-09	1.184E-09	6.225E-10	3.812E-10	2.586E-10	3.380E-10	2.510E-10	1.943E-10
NNE			9.113E-09	3.989E-09	2.013E-09	1.248E-09	8.235E-10	8.997E-10	6.667E-10	5.138E-10
NE			1.295E-08	5.666E-09	2.919E-09	1.729E-09	1.145E-09	1.224E-09	9.140E-10	7.067E-10
ENE			7.899E-09	3.385E-09	1.756E-09	1.095E-09	9.819E-10	7.671E-10	5.749E-10	4.466E-10
E			4.454E-09	1.775E-09	9.252E-10	7.164E-10	7.491E-10	5.267E-10	3.981E-10	3.125E-10
ESE			4.361E-09	1.838E-09	1.086E-09	1.322E-09	8.696E-10	6.161E-10	5.153E-10	4.139E-10
SE			3.397E-09	1.385E-09	8.341E-10	1.649E-09	1.080E-09	7.595E-10	5.629E-10	4.340E-10
SSE			3.333E-09	1.323E-09	6.920E-10	4.404E-10	7.307E-10	5.202E-10	3.922E-10	3.091E-10
S			3.192E-09	1.256E-09	6.530E-10	4.020E-10	2.788E-10	2.177E-10	1.759E-10	1.501E-10
SSW			5.190E-09	1.972E-09	9.899E-10	5.895E-10	3.928E-10	2.842E-10	2.192E-10	1.778E-10
SW			1.205E-08	4.399E-09	2.193E-09	1.299E-09	8.521E-10	6.028E-10	4.518E-10	3.546E-10
WSW			1.047E-08	3.824E-09	1.908E-09	1.127E-09	7.422E-10	5.277E-10	3.980E-10	3.145E-10
W			5.577E-09	2.044E-09	1.025E-09	6.094E-10	4.134E-10	3.405E-10	3.962E-10	3.052E-10
WNW			2.185E-09	9.042E-10	5.220E-10	6.464E-10	4.227E-10	3.188E-10	2.360E-10	1.868E-10
NW			2.097E-09	8.759E-10	5.225E-10	3.196E-10	4.521E-10	3.178E-10	2.353E-10	1.812E-10
NNW			2.461E-09	1.028E-09	6.219E-10	3.765E-10	5.128E-10	3.604E-10	2.667E-10	2.054E-10

REVISION 34
 1/1/94

TABLE A4.0-2A
 OCONEE NUCLEAR STATION
 (1 OF 1)

DISPERSION PARAMETER (\bar{X}/Q) FOR GROUND LEVEL, LONG TERM RELEASES > 500 HR/YR OR > 125 HR/QTR
 (SEC/M3)

SECTOR	DISTANCE TO THE CONTROL LOCATION, IN MILES									
	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			2.115E-06	8.389E-07	4.495E-07	2.822E-07	1.952E-07	1.443E-07	1.117E-07	8.961E-08
NNE			2.898E-06	1.137E-07	6.047E-07	3.775E-07	2.602E-07	1.916E-07	1.480E-07	1.184E-07
NE			3.886E-06	1.529E-06	8.158E-07	5.108E-07	3.529E-07	2.604E-07	2.015E-07	1.616E-07
ENE			3.226E-06	1.277E-06	6.848E-07	4.305E-07	2.983E-07	2.207E-07	1.711E-07	1.374E-07
E			3.522E-06	1.410E-06	7.658E-07	4.866E-07	3.400E-07	2.534E-07	1.977E-07	1.596E-07
ESE			5.964E-06	2.407E-06	1.321E-06	8.459E-07	5.950E-07	4.457E-07	3.493E-07	2.832E-07
SE			7.308E-06	2.972E-06	1.631E-06	1.044E-06	7.342E-07	5.497E-07	4.307E-07	3.490E-07
SSE			6.604E-06	2.657E-06	1.440E-06	9.117E-07	6.354E-07	4.723E-07	3.676E-07	2.962E-07
S			5.278E-06	2.121E-06	1.146E-06	7.237E-06	5.032E-07	3.734E-07	2.901E-07	2.335E-07
SSW			3.986E-06	1.589E-06	8.536E-07	5.370E-07	3.721E-07	2.753E-07	2.135E-07	1.714E-07
SW			4.108E-06	1.620E-06	8.628E-07	5.390E-07	3.715E-07	2.735E-07	2.112E-07	1.689E-07
WSW			3.804E-06	1.503E-06	8.018E-07	5.015E-07	3.460E-07	2.549E-07	1.970E-07	1.577E-07
W			2.978E-06	1.186E-06	6.361E-07	3.995E-07	2.765E-07	2.043E-07	1.583E-07	1.270E-07
WNW			2.201E-06	8.791E-07	4.726E-07	2.974E-07	2.062E-07	1.526E-07	1.183E-07	9.502E-08
NW			2.104E-06	8.385E-07	4.499E-07	2.826E-07	1.957E-07	1.447E-07	1.121E-07	8.991E-08
NNW			2.221E-06	8.860E-07	4.755E-07	2.988E-07	2.069E-07	1.529E-07	1.185E-07	9.508E-08

REVISION 34
 1/1/94

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
(1/M2)

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			6.916E-09	2.484E-09	1.232E-09	7.255E-10	4.750E-10	3.342E-10	2.477E-10	1.909E-10
NNE			1.642E-08	5.897E-09	2.924E-09	1.722E-09	1.128E-09	7.934E-10	5.880E-10	4.531E-10
NE			2.259E-08	8.114E-09	4.024E-09	2.369E-09	1.551E-09	1.092E-09	8.090E-10	6.235E-10
ENE			1.428E-08	5.130E-09	2.544E-09	1.498E-09	9.810E-10	6.902E-10	5.115E-10	3.942E-10
E			9.899E-09	3.556E-09	1.763E-09	1.038E-09	6.798E-10	4.784E-10	3.545E-10	2.732E-10
ESE			1.336E-08	4.798E-09	2.379E-09	1.401E-09	9.174E-10	6.455E-10	4.784E-10	3.686E-10
SE			1.401E-08	5.034E-09	2.496E-09	1.470E-09	9.625E-10	6.772E-10	5.019E-10	3.868E-10
SSE			1.226E-08	4.404E-09	2.184E-09	1.286E-09	8.420E-10	5.925E-10	4.391E-10	3.384E-10
S			1.008E-08	3.620E-09	1.795E-09	1.057E-09	6.922E-10	4.871E-10	3.610E-10	2.782E-10
SSW			9.941E-09	3.571E-09	1.771E-09	1.043E-09	6.828E-10	4.804E-10	3.560E-10	2.744E-10
SW			1.717E-08	6.169E-09	3.059E-09	1.801E-09	1.180E-09	8.300E-10	6.151E-10	4.740E-10
WSW			1.574E-08	5.655E-09	2.804E-09	1.651E-09	1.081E-09	7.608E-10	5.638E-10	4.345E-10
W			9.988E-09	3.588E-09	1.779E-09	1.048E-09	6.860E-10	4.827E-10	3.577E-10	2.757E-10
WNW			5.953E-09	2.138E-09	1.060E-09	6.244E-10	4.088E-10	2.877E-10	2.132E-10	1.643E-10
NW			5.891E-09	2.116E-09	1.049E-09	6.179E-10	4.046E-10	2.847E-10	2.110E-10	1.626E-10
NNW			6.672E-09	2.397E-09	1.188E-09	6.998E-10	4.582E-10	3.224E-10	2.390E-10	1.841E-10

REVISION 34
1/1/94

ATTACHMENT 2

Current versus Revised X/Q and D/Q Comparison Tables

The top line for each sector gives the current X/Q and D/Q values. The second line for each sector gives the revised X/Q and D/Q values. The third line for each sector gives the ratio of the Revised value to the Current value, i.e., Revised/Current ratio.

The shaded area shows the sector that contains the highest revised X/Q and D/Q values.

Since the Semi-Elevated values are applied to the highest activity releases at Oconee, only those values are shown in the comparison tables.

Oconee Nuclear Station
Dispersion Parameters - Current, Revised and Revised/Current Ratio
Semi-Elevated
Distance in Miles From the Site

Sector	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5
N	6.50E-08	4.80E-08	4.70E-08	4.70E-08	4.70E-08	6.30E-08	5.90E-08	5.60E-08
	5.22E-07	2.65E-07	1.59E-07	1.07E-07	7.72E-08	7.32E-08	5.67E-08	4.54E-08
	8.03	5.52	3.39	2.27	1.64	1.16	0.96	0.81
NNE	1.10E-07	9.30E-08	8.70E-08	8.90E-08	9.20E-08	9.20E-08	7.20E-08	5.90E-08
	8.38E-07	4.73E-07	2.69E-07	2.00E-07	1.39E-07	1.09E-07	8.38E-08	6.68E-08
	7.62	5.09	3.09	2.25	1.51	1.19	1.16	1.13
NE	7.50E-08	7.20E-08	6.80E-08	5.80E-08	6.10E-08	6.40E-08	6.00E-08	5.70E-08
	9.50E-07	6.35E-07	3.96E-07	2.54E-07	1.85E-07	1.50E-07	1.16E-07	9.25E-08
	12.67	8.82	5.83	4.37	3.03	2.34	1.93	1.62
ENE	6.00E-08	6.40E-08	5.90E-08	6.10E-08	5.70E-08	5.70E-08	5.60E-08	5.60E-08
	8.12E-07	4.86E-07	2.92E-07	2.20E-07	1.62E-07	1.24E-07	9.61E-08	7.72E-08
	13.53	7.59	4.95	3.60	2.84	2.17	1.72	1.38
E	4.10E-08	3.70E-08	5.70E-08	4.80E-08	5.20E-08	4.90E-08	4.70E-08	4.50E-08
	5.95E-07	3.20E-07	2.02E-07	2.27E-07	1.75E-07	1.29E-07	1.02E-07	8.31E-08
	14.51	8.65	3.54	4.73	3.36	2.64	2.18	1.85
ESE	3.00E-08	4.00E-08	6.70E-08	5.80E-08	4.30E-08	5.30E-08	4.90E-08	4.70E-08
	4.53E-07	3.30E-07	3.62E-07	4.02E-07	2.82E-07	2.11E-07	1.69E-07	1.41E-07
	15.10	8.25	5.41	6.93	6.56	3.98	3.44	2.99
SE	2.80E-08	2.80E-08	6.00E-08	5.10E-08	4.10E-08	3.70E-08	3.80E-08	3.80E-08
	7.51E-07	4.57E-07	5.49E-07	5.11E-07	3.56E-07	2.65E-07	2.06E-07	1.67E-07
	26.80	16.33	9.15	10.02	8.68	7.16	5.43	4.38
SSE	2.30E-07	2.00E-07	3.20E-07	2.50E-07	3.70E-07	2.90E-07	2.70E-07	2.50E-07
	1.42E-06	7.43E-07	4.53E-07	3.49E-07	2.87E-07	2.13E-07	1.66E-07	1.34E-07
	6.17	3.71	1.41	1.40	0.77	0.73	0.61	0.53
S	2.60E-07	3.00E-07	2.10E-07	2.10E-07	3.60E-07	4.10E-07	3.70E-07	3.60E-07
	1.17E-06	6.10E-07	3.70E-07	2.50E-07	1.81E-07	1.55E-07	1.22E-07	9.87E-08
	4.50	2.03	1.76	1.19	0.50	0.38	0.33	0.27
SSW	3.20E-07	3.10E-07	2.90E-07	2.70E-07	2.00E-07	1.70E-07	1.70E-07	1.70E-07
	1.21E-06	6.33E-07	3.56E-07	2.30E-07	1.62E-07	1.21E-07	9.48E-08	7.66E-08
	3.79	2.04	1.23	0.85	0.81	0.71	0.56	0.45
SW	7.30E-08	7.10E-08	7.10E-08	5.90E-08	3.90E-08	4.40E-08	4.50E-08	4.50E-08
	1.67E-06	7.29E-07	4.06E-07	2.72E-07	1.89E-07	1.40E-07	1.09E-07	8.71E-08
	22.90	10.26	5.71	4.61	4.85	3.18	2.41	1.94
WSW	5.30E-08	5.20E-08	5.30E-08	4.20E-08	4.80E-08	4.30E-08	4.20E-08	4.20E-08
	1.56E-06	6.82E-07	3.80E-07	2.44E-07	1.71E-07	1.27E-07	1.01E-07	8.11E-08
	29.40	13.12	7.18	5.80	3.56	2.96	2.40	1.93
W	2.70E-08	3.20E-08	3.70E-08	3.70E-08	3.90E-08	3.90E-08	3.70E-08	3.60E-08
	1.19E-06	5.21E-07	2.91E-07	1.87E-07	1.37E-07	1.03E-07	8.33E-08	6.65E-08
	44.19	16.29	7.86	5.05	3.52	2.65	2.25	1.85
WNW	2.30E-08	2.50E-08	3.50E-08	3.50E-08	3.30E-08	3.20E-08	3.00E-08	2.90E-08
	4.66E-07	2.48E-07	1.76E-07	1.48E-07	1.02E-07	7.70E-08	5.94E-08	4.80E-08
	20.25	9.92	5.03	4.23	3.10	2.40	1.98	1.65
NW	3.20E-08	3.70E-08	3.10E-08	3.30E-08	3.00E-08	3.10E-08	2.90E-08	2.80E-08
	4.83E-07	2.52E-07	1.97E-07	1.29E-07	9.96E-08	7.36E-08	5.68E-08	4.57E-08
	15.10	6.82	6.34	3.91	3.32	2.37	1.96	1.63
NNW	6.80E-08	7.70E-08	8.30E-08	7.70E-08	7.80E-08	6.50E-08	6.30E-08	6.20E-08
	5.38E-07	2.77E-07	2.13E-07	1.39E-07	1.07E-07	7.91E-08	6.11E-08	4.91E-08
	7.90	3.60	2.56	1.81	1.37	1.22	0.97	0.79

Oconee Nuclear Station
Deposition Parameters - Current, Revised and Revised/Current Ratio
Semi-Elevated

Distance in Miles From the Site

Sector	1 - 1.5	1.5 - 2	2 - 2.5	2.5 - 3	3 - 3.5	3.5 - 4	4 - 4.5	4.5 - 5
N	2.40E-09	1.40E-09	8.70E-10	6.00E-10	4.70E-10	3.60E-10	2.80E-10	2.30E-10
	2.89E-09	1.18E-09	6.23E-10	3.81E-10	2.59E-10	3.38E-10	2.51E-10	1.94E-10
	1.20	0.85	0.72	0.64	0.55	0.94	0.90	0.84
NNE	4.10E-09	2.20E-09	1.40E-09	9.60E-10	7.40E-10	5.70E-10	4.40E-10	3.60E-10
	9.11E-09	3.99E-09	2.01E-09	1.25E-09	8.24E-10	9.00E-10	6.67E-10	5.14E-10
	2.22	1.81	1.44	1.30	1.11	1.58	1.52	1.43
NE	2.70E-09	1.50E-09	9.70E-10	6.60E-10	5.00E-10	3.90E-10	3.10E-10	2.50E-10
	1.30E-08	5.67E-09	2.92E-09	1.73E-09	1.15E-09	1.22E-09	9.14E-10	7.07E-10
	4.80	3.78	3.01	2.62	2.29	3.14	2.95	2.83
ENE	1.50E-09	8.40E-10	5.40E-10	3.70E-10	2.80E-10	2.20E-10	1.70E-10	1.40E-10
	7.90E-09	3.39E-09	1.76E-09	1.10E-09	9.82E-10	7.67E-10	5.75E-10	4.47E-10
	5.27	4.03	3.25	2.96	3.51	3.49	3.38	3.19
E	1.60E-09	8.70E-10	5.60E-10	3.90E-10	3.00E-10	2.30E-10	1.80E-10	1.50E-10
	4.45E-09	1.78E-09	9.25E-10	7.16E-10	7.49E-10	5.27E-10	3.98E-10	3.13E-10
	2.78	2.04	1.65	1.84	2.50	2.29	2.21	2.08
ESE	1.30E-09	7.00E-10	4.50E-10	3.00E-10	2.30E-10	1.80E-10	1.40E-10	1.10E-10
	4.36E-09	1.84E-09	1.09E-09	1.32E-09	8.70E-10	6.16E-10	5.15E-10	4.14E-10
	3.35	2.63	2.41	4.41	3.78	3.42	3.68	3.76
SE	8.00E-10	4.40E-10	2.90E-10	2.00E-10	1.50E-10	1.10E-10	8.90E-11	7.30E-11
	3.40E-09	1.39E-09	8.34E-10	1.65E-09	1.08E-09	7.60E-10	5.63E-10	4.34E-10
	4.25	3.15	2.88	8.25	7.20	6.90	6.32	5.95
SSE	2.70E-09	1.60E-09	1.10E-09	7.50E-10	6.00E-10	4.60E-10	3.60E-10	3.00E-10
	3.33E-09	1.32E-09	6.92E-10	4.40E-10	7.31E-10	5.20E-10	3.92E-10	3.09E-10
	1.23	0.83	0.63	0.59	1.22	1.13	1.09	1.03
S	4.50E-09	2.60E-09	1.70E-09	1.20E-09	9.00E-10	7.00E-10	5.50E-10	4.50E-10
	3.19E-09	1.26E-09	6.53E-10	4.02E-10	2.79E-10	2.18E-10	1.76E-10	1.50E-10
	0.71	0.48	0.38	0.34	0.31	0.31	0.32	0.33
SSW	4.30E-09	2.50E-09	1.60E-09	1.10E-09	8.50E-10	6.50E-10	5.00E-10	4.00E-10
	5.19E-09	1.97E-09	9.90E-10	5.90E-10	3.93E-10	2.84E-10	2.19E-10	1.78E-10
	1.21	0.79	0.62	0.54	0.46	0.44	0.44	0.44
SW	1.40E-09	8.40E-10	5.50E-10	3.90E-10	3.00E-10	2.30E-10	1.80E-10	1.50E-10
	1.21E-08	4.40E-09	2.19E-09	1.30E-09	8.52E-10	6.03E-10	4.52E-10	3.55E-10
	8.61	5.24	3.99	3.33	2.84	2.62	2.51	2.36
WSW	1.60E-09	9.10E-10	6.00E-10	4.10E-10	3.20E-10	2.50E-10	1.90E-10	7.40E-11
	1.05E-08	3.82E-09	1.91E-09	1.13E-09	7.42E-10	5.28E-10	3.98E-10	3.15E-10
	6.54	4.20	3.18	2.75	2.32	2.11	2.09	4.25
W	1.40E-09	7.90E-10	5.10E-10	3.60E-10	2.70E-10	2.10E-10	1.60E-10	1.30E-10
	5.58E-09	2.04E-09	1.03E-09	6.09E-10	4.13E-10	3.41E-10	3.96E-10	3.05E-10
	3.98	2.59	2.01	1.69	1.53	1.62	2.48	2.35
WNW	7.70E-10	4.40E-10	2.90E-10	2.00E-10	1.50E-10	1.20E-10	9.20E-11	7.40E-11
	2.19E-09	9.04E-10	5.22E-10	6.46E-10	4.23E-10	3.19E-10	2.36E-10	1.87E-10
	2.84	2.06	1.80	3.23	2.82	2.66	2.57	2.52
NW	1.10E-09	5.90E-10	3.80E-10	2.60E-10	2.00E-10	1.60E-10	1.20E-10	9.90E-11
	2.10E-09	8.76E-10	5.23E-10	3.20E-10	4.52E-10	3.18E-10	2.35E-10	1.81E-10
	1.91	1.48	1.38	1.23	2.26	1.99	1.96	1.83
NNW	1.90E-09	1.00E-09	6.60E-10	4.50E-10	3.50E-10	2.70E-10	2.10E-10	1.70E-10
	2.46E-09	1.03E-09	6.22E-10	3.77E-10	5.13E-10	3.60E-10	2.67E-10	2.05E-10
	1.30	1.03	0.94	0.84	1.47	1.33	1.27	1.21

January 1, 1993

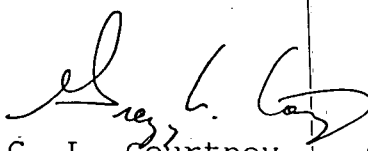
Subject: Oconee Nuclear Station
Offsite Dose Calculation Manual
Revision 33

The General Office Radwaste Processing & Management Staff is transmitting to you this date, Revision 33, of the Oconee Offsite Dose Calculation Manual. As this revision only affects Oconee Nuclear Station, the approval of other station managers is not required. A list of affected pages is given below.

List of Affected Pages

A-3
A-10
A-11
A-18 - A-21
A-22
A-23
Table A4.0-7
Table A4.0-8
Figure A4.0-3
Figure A4.0-4
A-24

Approval Date: 1/1/93
Effective Date: 1/1/93



G. L. Courtney
Radiation Protection Manager

Approval Date: 1/1/93
Effective Date: 1/1/93



H. B. Barron, Manager
Oconee Nuclear Station

If you have any questions concerning Revision 33, please call Caryl Ingram at (704) 382-4496.



Caryl D. Ingram, Senior Engineer
Radwaste Processing & Management
Nuclear Services Division

JUSTIFICATION FOR REVISION 33

Page A-3:

The changes made to the liquid and gaseous release rate setpoint calculations are being made in order to accommodate needed operational flexibility to facilitate implementation of the new 10 CFR 20 requirements.

The basic requirements for Selected Licensee Commitments (SLCs) concerning effluents from nuclear power reactors are stated in 10 CFR 50.36a. These requirements indicate that compliance with effluent SLCs will keep average annual releases of radioactive material in effluents to small percentages of the limits specified in the old 10 CFR 20.106 (new 10 CFR 20.1301). These requirements further indicate that operational flexibility is allowed, compatible with considerations of health and safety, which may temporarily result in releases higher than such small percentages, but still within the limits specified in the old 10 CFR 20.106 which references Appendix B, Table II concentrations (MPCs). These referenced concentrations are specific values which relate to an annual dose of 500 mrem. It is further indicated in 10 CFR 50.36a that when using operational flexibility, best efforts shall be exerted to keep levels of radioactive materials in effluents as low as is reasonably achievable (ALARA) as set forth in 10 CFR 50, Appendix I.

As stated in the Introduction to Appendix B of the new 10 CFR 20, the liquid effluent concentration (EC) limits given in Appendix B, Table 2, Column 2, are based on an annual dose of 50 mrem, and the gaseous EC limits given in Appendix B, Table 2, Column 1, are based on an annual dose of 50 mrem for isotopes for which inhalation or ingestion is limiting or 100 mrem for isotopes for which submersion (noble gases) is limiting. Since a release concentration corresponding to a limiting dose rate of 500 mrem/year has been acceptable as a SLC limit for liquid effluents to assure that the limits of 10 CFR 50, Appendix I and 40 CFR 190 are not likely to be exceeded, it should not be necessary to reduce this limit by a factor of 10. For gaseous effluents, since release concentrations corresponding to limiting dose rates less than or equal to 500 mrem/year to the whole body, 3000 mrem/year to the skin from noble gases, and 1500 mrem/year to any organ from Iodine-131, Iodine-133, tritium and all radionuclides in particulate form with half-lives greater than eight days at the site boundary has been acceptable as a SLC limit to assure that the limits of 10 CFR 50, Appendix I and 40 CFR 190 are not likely to be exceeded, it should not be necessary to restrict the operational flexibility by incorporating the dose rate associated with the EC value for isotopes based on inhalation/ingestion (50 mrem/year) or the dose rate associated with the EC value for isotopes based on submersion (100 mrem/year).

Having sufficient operational flexibility is especially important in establishing a basis for effluent monitor setpoint calculations. As discussed above, the concentrations stated in the new 10 CFR 20, Appendix B, Table 2, Columns 1 and 2, relate to a dose of 50 or 100 mrem in a year. When applied on an instantaneous basis, this corresponds to a dose rate of 50 or 100 mrem/year. These low values are impractical upon which to base effluent monitor setpoint calculations for many liquid and gaseous effluent release situations when monitor background, monitor sensitivity, and monitor performance must be taken into account.

Therefore, to accommodate operational flexibility needed for effluent releases, the limits associated with the liquid release rate SLC are based on ten times the concentrations stated in the new 10 CFR 20, Appendix B, Table 2, Column 2. The limits associated with gaseous release SLCs will be maintained at the current instantaneous dose rate limit for noble gases of 500 mrem/year to the whole body and 3000 mrem/year to the skin; and for Iodine-131, for Iodine-133, for tritium, and for all radionuclides in particulate form with half-lives greater than 8 days, an instantaneous dose rate limit of 1500 mrem/year to any organ.

Compliance with the limits of the new 10 CFR 20.1301 will be demonstrated by operating within the limits of 10 CFR 50, Appendix I, and 40 CFR 190. Operational history at Oconee has demonstrated that the use of the concentration values for liquids and dose rate values for gases associated with the old 10 CFR 20.106 as SLC limits has resulted in calculated maximum individual doses to a member of the public that are small percentages of the limits of 10 CFR 50, Appendix I and 40 CFR 190.

Page A-10:

Same as Page A-3.

The justification for using the Cs-134 Effluent Concentration (EC) value of $9.0E-07$ $\mu\text{Ci/ml}$ is provided in 10 CFR 20, Appendix B, Note 2. A review of past liquid effluent release data for the applicable pathways at Oconee shows that Cs-134 has the lowest EC value for any detectable radionuclide that is not known to be absent from the liquid effluent. An annual review of the effluent release data will be performed to assure that this assumption remains valid.

Page A-11:

Same as Page A-10.

Pages A-18 - A-21:

To increase the accuracy of the manual dose projections when needed, the "Simplified Dose Estimates" section of the Oconee ODCM has been removed. Manual calculations can be performed more accurately by applying site specific parameters to the generic methodology.

Page A-22:

Changed the section number and page number to reflect the removal of the Simplified Dose Estimates section.

Page A-23:

Same as Page A-22.

Table A4.0-7:

Meteorological parameter information was changed to reflect the June 1992 site survey results.

Table A4.0-8:

Added this Table to clarify use of the site survey data for pathway applicability.

Figure A4.0-3:

Same as Table A4.0-7.

Figure A4.0-4:

Same as Table A4.0-7.

Page A-24:

Same as Table A4.0-7 and Page A-22.

December 26, 1990

SUBJECT: Offsite Dose Calculation Manual
Revision 29

The General Offsite Radiation Protection Staff is transmitting to you this date, Revision 29 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. 32, and discard the affected pages.

REMOVE THESE PAGES

Pages A-16
thru Page A-24 Rev. 27
A-25 Rev. 27
Tabls A5.0-2 Rev. 27

INSERT THESE PAGES

Pages A-16
thru Page A-24 Rev. 29
A-25 Rev. 29
Table A5.0-2 Rev. 29

NOTE: As this letter, with its attachments, contains "LOEP" information, please insert this letter in front of the December 29, 1989 letter.

Approval Date: 12/17/90

Effective Date: 1/1/91

Mary L. Birch

Mary L. Birch
Radiation Protection Manager

Approval Date: 12-12-90

Effective Date: 1/1/91

H. B. Barron

H. B. Barron
Oconee Nuclear Station

If you have any questions concerning Revision 29, please call Jim Stewart at (704) 373-5444.

James M. Stewart, Jr.

James M. Stewart, Jr.
Scientist
Radiation Protection

JMS/prm.091

JUSTIFICATIONS FOR REVISION 29

Pages A-16 thru A-24

Updated section using dose calculations based on 1990 Effluent Release data (first nine months) and the 1990 Land Use Census Data.

Page A-25

Changed the dates the latest Land Use Census was performed.

Table A5.0-2

Changed name of location 069 from "Powell Residence" to "ORR's Dairy".

December 28, 1989

Subject: Offsite Dose Calculation Manual
Revision 27

The General Office Radiation Protection Staff is transmitting to you this date, Revision 27 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. 32, and discard the affected pages.

REMOVE THESE PAGES

Figure A1.0-1	Rev. 11
Figure A1.0-2	No Rev. #
(all four pages)	
A-3	Rev. 18
A-5	Rev. 23
A-6	Rev. 27
A-7	Rev. 15
A-8	Rev. 23
A-10	Rev. 11
A-14	Rev. 23
Pages A-16	Rev. 23
thru	
Page A-24	Rev. 23
A-25	Rev. 23
Table A5.0-2	Rev. 21

INSERT THESE PAGES

Figure A1.0-1	Rev. 27
Figure A1.0-2	Rev. 27
(all four pages)	
A-3	Rev. 27
A-5	Rev. 27
A-6	Rev. 27
A-7	Rev. 27
A-8	Rev. 27
A-10	Rev. 27
A-14	Rev. 27
Pages A-16	Rev. 27
thru	
Page A-24	Rev. 27
A-25	Rev. 27
Table A5.0-2	Rev. 27

NOTE: As this letter, with it's attachments, contains "LOEP" information, please insert this letter in front of the December 27, 1989.

Approval Date: Dec. 21, 1989

Effective Date: 1/1/90

Mary L. Birch

Mary L. Birch
Radiation Protection Manager

Approval Date: Dec. 19, 1989

Effective Date: 1/1/90

M. S. Tuckman

M. S. Tuckman, Manager
Oconee Nuclear Station

If you have any questions concerning Revision 27, please call Jim Stewart at (704) 373-5444.

James M. Stewart, Jr.

James M. Stewart, Jr.
Scientist
Radiation Protection

Enclosure

JUSTIFICATIONS FOR REVISION 27

Figure A1.0-1

Replaced figure with CAD drawing.
Updated to reflect actual station operation and/or to provide additional information.

Figure A1.0-2
(4 pages)

Replaced figure with CAD drawing.
Updated to reflect actual station operation and/or to provide additional information.

Page A-3

Changed wording to reflect actual station operation.
Changed the minimum dilution flow rate available from 17054 gpm to $3.41E+04$ gpm in order to take credit for the additional dilution flow provided by the Keowee Hydro Fire Protection-LWR Mixing Line.

Page A-5

Corrected typo errors in Table Numbers.

Page A-6

Provided additional information for clarity purposes and changed mileage information for consistency purposes.

Page A-7

Corrected typo errors in Table Numbers.

Page A-8

Corrected "dispersion/dispersion" to "dispersion/deposition".
Provided additional information for clarity purposes and changed mileage information for consistency purposes.

Page A-10

Changed wording to reflect actual station operation.

Page A-14

Added "is" to sentence and corrected "SAS" to "gas".

Section A4.3
Pages A-16 thru A-24

Updated section using dose calculations based on 1989 Effluent Release data (first nine months) and the 1989 Land Use Census Data.

Page A-25

Changed wording to reflect actual station operation. Changed the dates the latest Land Use Census was performed.

Table A5.0-2

Changed per attached August 29, 1989 letter from C. T. Yongue.

August 29, 1989

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

ATTENTION: ~~XXXXXXXXXX~~

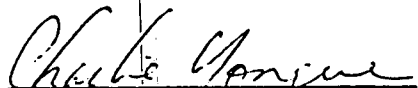
SUBJECT: Oconee Nuclear Station
Radiological Environmental Monitoring Program
File: OS-778.00

I am making the requests listed below as a result of the closing of the Clemson Water Plant. As of July 1 of this year, the University's drinking water plant was shut down with no plans to restart the facility. Clemson University now obtains drinking water from the Anderson water system.

- Delete the drinking water location 065, Clemson, from Table A5.0-2 and Figure A5.0-1 at the next revision to the ODCM. Redmarked copies of the needed changes are attached. In addition to the deletion, please correct the sector listed for location 073 from NNW to NW.
- Identify in the next Semi-Annual Effluent Release Report the deletion of the Clemson drinking water sample point from Oconee's Radiological Environmental Monitoring Program.
- Review the ODCM and make any necessary changes to effluent dose calculation parameters due to the plant's closing.
- Review the need to add a drinking water location further downstream of Anderson, if possible. Oconee Technical Specification 4.11, Table 4.11-1, specifies that the monitoring program include 3 drinking water sites. Anderson is currently the only site downstream of plant discharges. Seneca and Greenville both use Lake Keowee as their reservoir. We have installed a sampler to collect from the water used to supply the steam plant at the University. This water is collected from the same line that fed the water plant. The difference is that the sample will be raw water rather than finished water. This sample point will be considered a special supplemental sample since it is neither a drinking water or surface water sample, and it will not be included in the ODCM. The sample results will be trended and used in the evaluation of surface water and drinking water results as needed.

Page 2
Radiological Environmental Monitoring Program
August 29, 1989

Please contact Libby Wehrman at extension 3207 to discuss these requests.


C. T. Yongue, Manager
Radiation Protection

xc: J. W. Crain
C. F. Lan
S. A. Coy
J. J. Sevic
M. D. Lane

OCONEE RADIOLOGICAL MONITORING PROGRAM SAMPLING LOCATIONS
(OTHER SAMPLING LOCATIONS)

CODE:

W - Weekly (< 7 days)
SM - Semimonthly (< 15 days)
M - Monthly (< 31 days)
SA - Semiannually (< 184 days)

SAMPLING-LOCATION-DESCRIPTION		Air Radioiodines and Particulates	Surface Water	Drinking Water	Shoreline Sediment	Milk	Fish	Broadleaf Vegetation
028	Site Boundary (0.5 miles S)							M
060	New Greenville Water Intake Rd. (2.5 miles NNE) *	W		M			SA	M
061	Old Hwy. 183 (1.5 miles SSW)	W						
062	Lake Keowee/Hydro Intake (0.7 mile ENE) (CONTROL)		M					
063	Lake Hartwell - Hwy 183 Bridge (0.8 mile ESE) (000.7)		M		SA		SA	
064	Seneca (6.7 miles SW) (004.1) (CONTROL)			M				
065	Clemson (8.1 miles SSE) (006.1) DELETED			M				
066	Anderson (19.0 miles SSE) (012) (CONTROL FOR MILK ONLY)			M		SM		
067	Lawrence Ramsey Bridge, Hwy 27 (4.2 miles SSE) (005.2)				SA		SA	
068	High Falls County Park (2.0 miles W) (CONTROL)				SA			
069	Powell Residence (4.5 miles WNW) (002.1)					SM		
071	Clemson Dairy (10.3 miles SSE) (006.3)					SM		
072	Hwy 130 (1.7 miles S)	W						
073	Tamassee Dar School (9.0 miles W NW) (CONTROL)	W						M
074	Keowee Key Resort (1.7 miles NNW)	W						
075	Willimon Residence (6.0 miles NE) DELETED					SM		

* Control for Fish only

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. 32, and discard the affected pages.

REMOVE THESE PAGES

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

INSERT THESE PAGES

A-5	Rev. 23
A-8	Rev. 23
A-13a	Rev. 23
A-14	Rev. 23
A-15	Rev. 23
A-16	Rev. 23
A-17	Rev. 23
A-18	Rev. 23
A-19	Rev. 23
A-20	Rev. 23
A-21	Rev. 23
A-22	Rev. 23
A-23	Rev. 23
A-24	Rev. 23
Table A4.0-1a	Rev. 23
Table A4.0-1b	Rev. 23
Table A4.0-2a	Rev. 23
Table A4.0-2b	Rev. 23
A-25	Rev. 23
Table A5.0-1	Rev. 23
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.

James M. Stewart, Jr.
James M. Stewart, Jr.
Scientist
Radiation Protection

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.

DUKE POWER COMPANY

OCONEE NUCLEAR STATION
SENECA, S. C. 29679

P. O. BOX 1439

TELEPHONE: AREA 803
882-5363

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

July 15, 1988

Subject: Offsite Dose Calculation Manual
Revision 21

The General Office Radwaste Engineering Staff is transmitting to you this date, Revision 21 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. 32, and discard the affected pages.

REMOVE THESE PAGES

A-12	Rev. 15
A-13	Rev. 11
A-14	Rev. 15
A-18	Rev. 15
Table A5.0-2	Rev. 18

REPLACE/ADD THESE PAGES

A-12	Rev. 21
A-13	Rev. 21
A-13a	Rev. 21
A-14	Rev. 21
A-18	Rev. 18
Table A5.0-2	Rev. 21

NOTE: As this letter, with it's attachments, contains "LOEP" information, please insert this letter in front of the June 10, 1988 letter.

Approval Date:

7/19/88

Effective Date: 8/1/88

Mary L. Birch
Mary L. Birch
System Radwaste Engineer

Approval Date:

7/5/88

Effective Date: 8/1/88

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

If you have any questions concerning Revision 21, please call Jim Stewart at (704) 373-5444.

James M. Stewart, Jr.
James M. Stewart, Jr.
Production Health Physicist
Radwaste Engineering

Enclosure

JUSTIFICATIONS FOR REVISION 21

Pages A-12, A-13,
A-13a and A-14

Pages were changed/added/re-arranged to separate Semi-elevated Gaseous Radiation monitor setpoint information from Ground-level Gaseous Radiation monitor setpoint information.

Page A-18

Corrected typo error; "Auxiliary" should have been "Interim Radwaste".

Table A5.0-2

Added footnote for clarification purposes.

December 22, 1987

Subject: Offsite Dose Calculation Manual
Revision 18

The General Office Radwaste Engineering Staff is transmitting to you this date, Revision 18 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. 32, and discard the affected pages.

REMOVE THESE PAGES

A-3	Rev. 11
A-6	Rev. 15
A-8	Rev. 15
A-16	Rev. 15
A-17	Rev. 15
A-18	Rev. 15
A-19	Rev. 15
A-20	Rev. 15
A-21	Rev. 15
A-22	Rev. 15
A-23	Rev. 15
A-24	Rev. 15
A-25	Rev. 15
Table A5.0-2	Rev. 15

INSERT THESE PAGES

A-3	Rev. 18
A-6	Rev. 18
A-8	Rev. 18
A-16	Rev. 18
A-17	Rev. 18
A-18	Rev. 18
A-19	Rev. 18
A-20	Rev. 18
A-21	Rev. 18
A-22	Rev. 18
A-23	Rev. 18
A-24	Rev. 18
A-25	Rev. 18
Table A5.0-2	Rev. 18

NOTE: As this letter, with it's attachments, contains "LOEP" information, please insert this letter in front of the December 21, 1987.

Approval Date: 12/17/87

Effective Date: 1/1/88

Mary L. Birch
Mary L. Birch
System Radwaste Engineer

Approval Date: 12/11/87

Effective Date: 1/1/88

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

If you have any questions concerning Revision 18, please call Jim Stewart at (704) 373-5444.

James M. Stewart, Jr.
James M. Stewart, Jr.
Production Health Physicist
Radwaste Engineering

Enclosure

JUSTIFICATIONS FOR REVISION 18

Section A2.1.1
Page A-3

Corrected typo error.

Pages A-6, A-8 and
Pages A-16 thru A-24

Updated sections using 1986 Effluent Release Data (latest complete year available) and 1987 Land Use Census Data. Also changed water consumption units from kg/yr to l/yr in liquid equations.

Page A-25

Added paragraph to list the dates the Land Use Census was performed.

Table A5.0-2

Deleted sample point due to stoppage in cow's milk production. Other sample points are still available to meet Tech. Spec. requirements.

DECEMBER 31, 1986

Subject: Offsite Dose Calculation Manual
Revision 15

The General Office Radwaste Engineering Staff is transmitting to you this date, Revision 15 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. 32, and discard the affected pages.

REMOVE THESE PAGES

Remove all pages from the
OCONEE section (Appendix B)
of the manual.

INSERT THESE PAGES

Insert the attached package in
the OCONEE section (Appendix B)
of the manual.

NOTE: As this letter, with it's attachments, contains "LOEP" information, please insert this letter in front of the December 30, 1986 letter.

Approval Date: 12/17/86

Effective Date: 1/1/87

Mary L. Birch

Mary L. Birch
System Radwaste Engineer

Approval Date: 12/23/86

Effective Date: 1/1/87

M. S. Tuckman

M. S. Tuckman, Manager
Oconee Nuclear Station

If you have any questions concerning Revision 15, please call Jim Stewart at (704) 373-5444.

James M. Stewart, Jr.

James M. Stewart, Jr.
Associate Health Physicist
Radwaste Engineering

Enclosures

JUSTIFICATIONS FOR REVISION 15

Section A2.2
(Pages A-5
thru A-8)

Split original section into Semi-elevated and Ground-level Release points to incorporate the Radwaste Facility and corrected typo's.

Section A3.2.2
(Page A-12)

Corrected typo.

Section A3.2.6
(Page A-14)

Added title information and setpoint information.

Section A4.2.2.1
and
Section A4.2.2.2
(Page A-15)

Updated sections to reflect actual practices.

Section A4.3.1
(Page A-16)

Updated section using latest plant data.

Section A4.3.2
(Pages A-17
thru A-19)

Split original section into Semi-elevated and Ground-level Release points to incorporate the Radwaste Facility and updated section using latest plant data.

Section A4.4
(Pages A-20
thru A-24)

Updated section with a more exact fuel cycle calculation.

Table A4.0-1
and
Table A4.0-2

Added "Semi-elevated" to the name.

Table A4.0-3
and
Table A4.0-4

New tables added to cover Ground-level releases.

Table A5.0-2

Added monitoring location.

September 8, 1986

SUBJECT: Offsite Dose Calculation Manual
Revision 11

The General Office Radwaste Engineering staff is transmitting to you this date, Revision 11 of the Offsite Dose Calculation Manual. As this revision only affects Oconee Nuclear Station, the approval of other station managers is not necessary. Please update your copy No. 32, and discard affected pages.

REMOVE THESE PAGES

A-1
Figure A1.0-1
Figure A1.0-2
Page 4 of 4

A-3

A-4

A-5

A-6

A-7

A-9

Rev. 10
No Rev. #

No Rev. #

Rev. 3

Rev. 3

Rev. 10

Rev. 10

Rev. 3

Rev. 10

INSERT THESE PAGES

A-1
Figure A1.0-1
Figure A1.0-2
Page 4 of 4

A-3

A-3a

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A-6a

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A-9

Rev. 11
Rev. 11

Rev. 11

Rev. 11

Rev. 11

Rev. 11

Rev. 11

Rev. 11

Rev. 11

Rev. 11

Rev. 11

NOTE: As this letter contains "LOEP" information, please insert this in front of the December 17, 1985 letter.

Approval Date: 9/8/86

Effective Date: 9/12/86

Mary L. Birch
Mary L. Birch
System Radwaste Engineer

Approval Date: 9/12/86

Effective Date: 9/12/86

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

If you have any questions concerning Revision 11, please call Jim Stewart at (704) 373-5444.

James M. Stewart, Jr.
James M. Stewart, Jr.
Associate Health Physicist
Radwaste Engineering

JMS/pja.020

Enclosures

JUSTIFICATIONS FOR REVISION 11

Section A1.1(E)
(Page A-1)

Added reference to VR dryer located in the new Radwaste Facility.

Figure A1.0-1

Incorporated Radwaste Facility into drawing.

Figure A1.0-2
(Page 4 of 4)

Incorporated Radwaste Facility into drawing.

Section A2.1.1
(Page A-3)

Changed title; added/changed words for clarification purposes; no change in meaning.

Section A2.1.2
(Page A3-a)

New page. Updated description of #3 Chemical Treatment Pond and incorporated Radwaste Facility into description.

Page A-4

No change in content, only location of information.

Page A-5

No change in content, only location of information.

Page A-6

No change in content, only location of information.

Section A3.0
(Page A-6)

Added information to show differences between gas monitor systems of the Radwaste Facility and other station gas monitors.

Section A3.1.1
(Page A-6)

Retitled section to clarify topic; added detail to the information given on monitor setpoints.

Section A-3.1.3
(Page A-6a)

New page and section, incorporated Radwaste Facility Effluent Discharge Line radiation monitor setpoint information.

Page A-7

No change in content, only location of information.

Section A3.2.6
(Page A-9)

New section, incorporated Radwaste Facility Ventilation Exhaust information.

December 17, 1985

SUBJECT: Offsite Dose Calculation Manual
Revision 10

The General Office Radwaste Engineering staff is transmitting to you this date, Revision 10 of the Offsite Dose Calculation Manual. As this revision only affects Oconee Nuclear Station, the approval of other station managers is not necessary. Please update your copy No. 32, and discard affected pages.

REMOVE THESE PAGES

Appendix A -
Table of Contents

A-5

A-6

A-8

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A-10, A-11, A-12

Table A4.0-1

Table A4.0-2

Table A4.0-3

(3 pages)

Table A5.0-3

Rev. 3

Rev. 3

Rev. 3

Rev. 3

Rev. 3

Rev. 3

Rev. 3

Rev. 3

Rev. 3

Rev. 3

INSERT THESE PAGES

Appendix A -

Table of Contents

A-5

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A-10, A-11, A-12 &
A-13

Table A4.0-1

Table A4.0-2

Table A4.0-3

(3 pages)

A-14

Table A5.0-3

Rev. 10

Rev. 10

Rev. 10

Rev. 10

Rev. 10

Rev. 10

Rev. 10

Rev. 10

Rev. 10

Rev. 10

Rev. 10

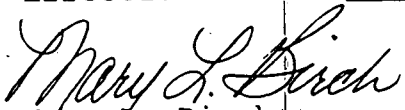
NOTE: As this letter contains "LOEP" information, please insert this in front of the December 16, 1985 letter.

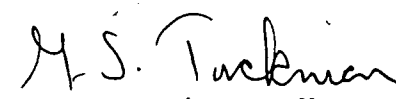
Approval Date: 12/6/85

Approval Date: 12/10/85

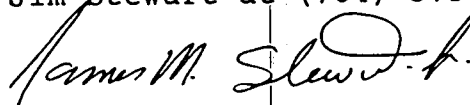
Effective Date: 1/1/86

Effective Date: 1/1/86


Mary L. Birch
System Radwaste Engineer


M. S. Tuckman, Manager
Oconee Nuclear Station

If you have any questions concerning Revision 10, please call Jim Stewart at (704) 373-5444.


James M. Stewart, Jr.
Associate Health Physicist
Radwaste Engineering

JMS/pja.020

Enclosures

JUSTIFICATIONS FOR REVISION 10

Section A2.2.2
(Page A-5)

Typo error: " m^2 (mrem/yr) per μ Ci/sec"
should read " m^2 . (mrem/yr) per μ Ci/sec".

Due to a change in controlling receptor locations:

Change "4.5E-9" to "7.5E-8"; change
"S sector" to "NE sector".

Change "2.5E-9" to "2.7E-9"; change
"SSW sector" to "NE sector"; delete
the word "residence" for clarification
purposes.

Section A3.0
(Page A-6)

Added/changed words for clarification
purposes, no change in meaning.

Section A3.2
(Page A-8)

Added words for clarification purposes, no
change in meaning.

Section A3.2.1
(Page A-8)

Added section to describe gaseous Radwaste
effluent line similar to section A.3.1.1
which describes the liquid radwaste effluent
line.

Changed subsequent section numbers to reflect
added section (pages A-8 and A-9).

Page A-10

Began section A4.3 on next page (A-11) for
clarification purposes.

Section A.4.3

This section has been updated using the
latest plant release data and land use
census data available.

Section A4.3.2.1
(Page A-12)

Typo error: added bar over "X/Q" for clari-
fication purposes, no change in meaning
(3 places).

Section A4.3.2.2
(Page A-13)

Changed "95%" to "99%" as a result of using
the latest plant release data and land use
census data available (3 places).

Typo error: added bar over "D/Q" for clari-
fication purposes, no change in meaning
(3 places).

Due to a change in controlling receptor locations:

Change "3.0E-10" to "2.7E-9"; change "ESE" to "NE"; change "2.8 miles" to "1.0 miles".

Typo error: change " R^C " to " R_i^C ".

Change "1.67E+04" to "1.53E+04" (2 places);

This updated number is found by using information found in Table 3.1-22 rather than deriving the old number by long-hand.

Add "and Table 3.1-22" for clarification purposes.

Typo error: "A4.3" should read "A4.4".

Section A4.3
(Page A-13)

Table A4.0-1

Typo errors: added bar over "X/Q" for clarification purposes; added "s" to "Release"; added units " sec/m^3 " for clarification purposes.

Table A4.0-2

Typo errors: added bar over "D/Q" for clarification purposes; added "s" to "Release"; added units " m^2 " for clarification purposes

Table A4.0-3
(3 pages)

Typo error: added units "mrem/hr per $\mu\text{Ci/mL}$ " for clarification purposes.

Page A-14

Page number change only.

Table A5.0-3

See attached letter dated November 26, 1985 from J. W. Crain (ONS) for justification.

December 22, 1983

SUBJECT: Offsite Dose Calculation Manual - Revision 3

The General Office Radwaste Engineering staff is transmitting to you this date, Revision 3 of the Offsite Dose Calculation Manual. As this revision only affects Oconee Nuclear Station, the approval of the manager of McGuire Nuclear Station is not necessary. Please update your copy No. 32, and discard affected pages.

REMOVE THESE PAGES

Remove all pages currently located behind the tab labeled "Oconee", and in front of the tab labeled "McGuire".

INSERT THESE PAGES

Insert this package behind the tab labeled "Oconee", and in front of the tab labeled "McGuire".

NOTE: As this letter contains "LOEP" information, please insert this letter in front of the September 30, 1983 letter.

Approval Date: 12/12/83

Effective Date: 01/01/84

Approval Date: 12/14/83

Effective Date: 01/01/84

Mary L. Birch

Mary L. Birch
System Radwaste Engineer

J. Ed Smith

J. Ed Smith, Manager
Oconee Nuclear Station

If you have any questions concerning Revision 3, please call Jim Stewart at (704) 373-5444.

James M. Stewart, Jr.

James M. Stewart, Jr.
Associate Health Physicist

MLB/JES/JMS/dkt

Enclosures

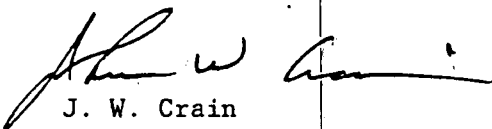
November 26, 1985

ATTN: J. M. Stewart, Jr.
Associate Health Physicist
Radwaste Engineering

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

Please incorporate the following changes to Table A5.0-2:

- 1) Add semi-annual fish collection to Location 067, which will allow comparison of historical data with fish collected at Location 063.
- 2) Add shoreline sedimentation sample at Location 063 to allow comparison with fish results.
- 3) Add drinking water sample at Location 060 to respond to change in land use. Greenville Water Treatment Plant started water production mid-October.
- 4) Add broad leaf vegetation sample at Location 060 due to D/Q values as identified by audit of R. E. Sorber on April 4, 1985.
- 5) Add fish collection at Location 060 and delete fish collection at Location 064. Catfish are extremely difficult to collect at 064 due to water depth and lack of suitable habitat for catfish. Location 060 should prove to be a more suitable location.



J. W. Crain
Environmental Chemistry Supervisor

JWC/dcr

xc: Sarah Coy
Mike Thorne

APPENDIX A

OCONEE NUCLEAR STATION
SITE SPECIFIC INFORMATION

APPENDIX A

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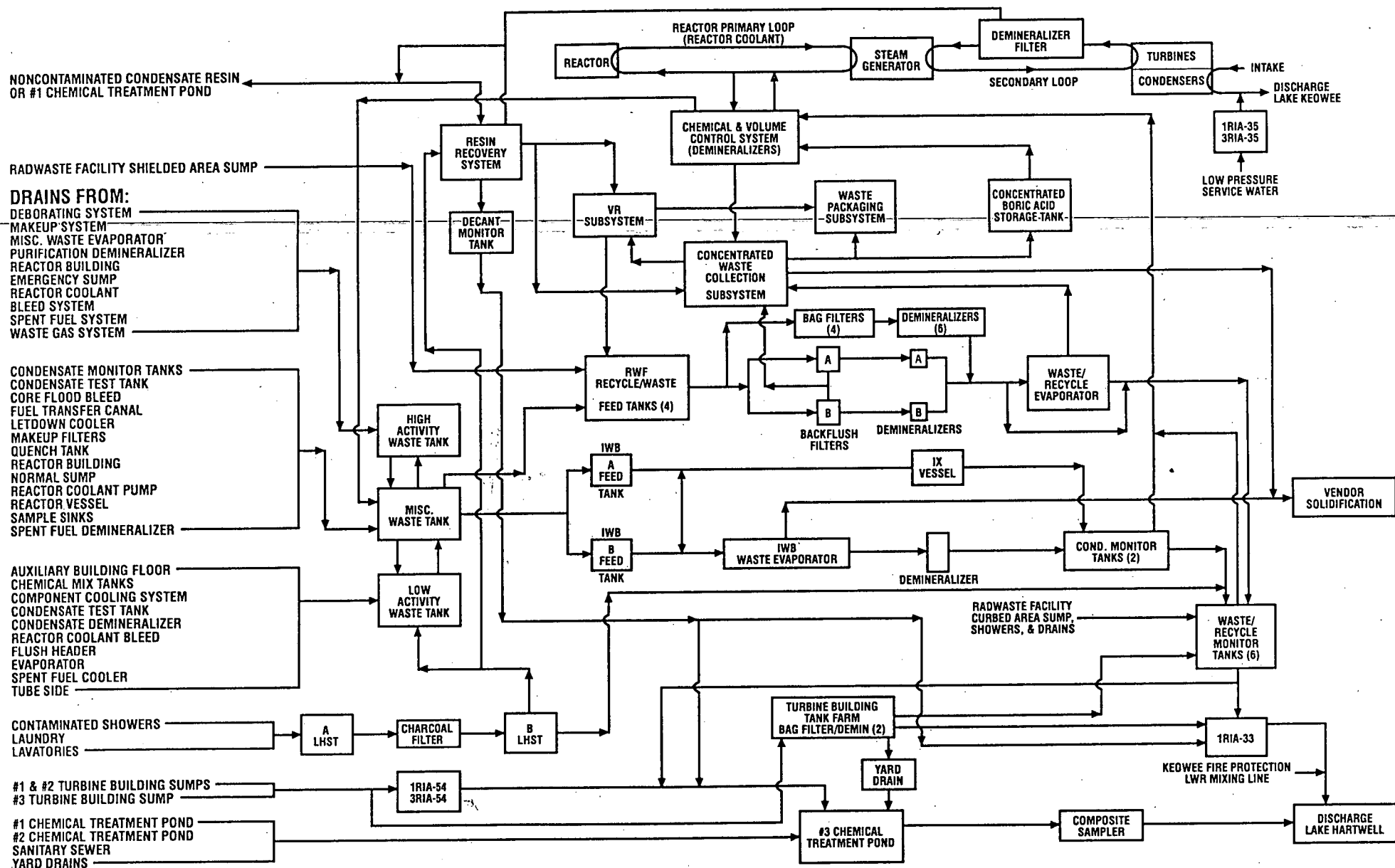
A1.0 OCONEE NUCLEAR STATION RADWASTE SYSTEMS

A1.1 LIQUID RADWASTE PROCESSING

The liquid radwaste system at Oconee Nuclear Station (ONS) is used to collect and treat fluid chemical and radiochemical by-products of unit operation. The systems produce effluents which can be reused in the plant or discharged in small, dilute quantities to the environment. The means of treatment vary with waste type and desired product in the various systems:

- A) Filtration - waste sources are filtered prior to processing as necessary.
- B) Ion Exchange - ion exchange is used to remove radioactive ions from solution. Also, ion exchange is normally used in removing cations (cobalt, manganese) and anions (chloride, fluoride) from evaporator feed and/or distillates in order to purify the distillates for reuse as makeup water. Distillate from the Waste Evaporator System or the Waste and Recycle Evaporator can be treated by this method.
- C) Gas Stripping - removal of gaseous radioactive fission products is accomplished in Evaporators and the venting of atmospheric holdup tanks.
- D) Distillation - production of pure water from the waste by boiling it away from the contaminated solution which originally contained it is accomplished by both evaporators. Proper control of the process will yield water which can be reused for makeup. Polishing of this product can be achieved by ion exchange as indicated above.
- E) Concentration - in all Evaporators, radioactivity and dissolved chemicals are concentrated as water is boiled away. In the case of the Waste Evaporator, the volume of water containing waste chemicals and radionuclides is reduced so that the waste may be more easily and economically solidified and shipped for burial. In the case of the VR dryer, all water is removed and the dry salts are solidified for burial.

Figure A1.0-1 is a schematic representation of the liquid radwaste system at Oconee.



**LIQUID RADWASTE SYSTEM
 OCONEE NUCLEAR STATION
 Figure A1.0-1**

A1.2 GASEOUS WASTE PROCESSING

The purpose of the gaseous waste disposal system is to:

- (1) Maintain a non-oxidizing cover gas of nitrogen in tanks and equipment that contain potentially radioactive gas,
- (2) Hold up radioactive gas for decay, and
- (3) Release gases (radioactive or non-radioactive) to the atmosphere under controlled conditions.

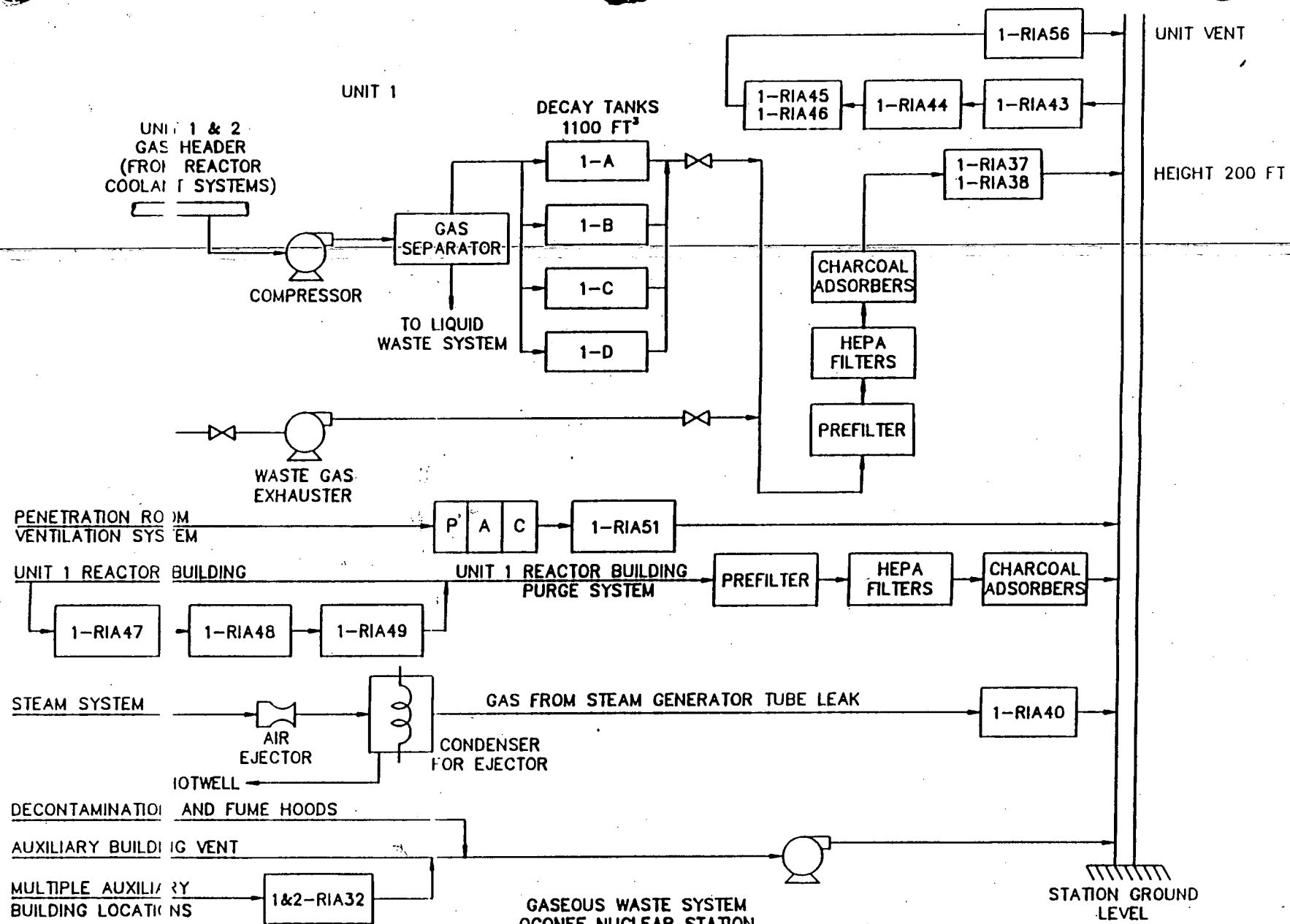
During power operation of the facilities, radioactive materials released to the atmosphere in gaseous effluents include low concentrations of fission product noble gases (krypton and xenon), halogens (mostly iodines), tritium contained in water vapor and particulate material including both fission products and activated corrosion products.

The primary source of gaseous radioactive wastes is from the degassing of the primary coolant during letdown of the cooling water into the various holding tanks. Additional sources of gaseous waste activity include the auxiliary building exhaust, spent fuel area exhaust, the discharge from the steam jet air ejectors, purging and venting of the reactor containment building.

All components that can contain potentially radioactive gases are vented to a vent header. The vent gases are subsequently drawn from this vent header by one of four waste gas compressors or a waste gas exhauster. The waste gas compressor discharges through a waste gas separator to one of seven waste gas tanks. The waste gas tanks and the waste gas exhauster discharge to the unit vent after passing through a filter bank consisting of a prefilter, an absolute filter, and a charcoal filter.

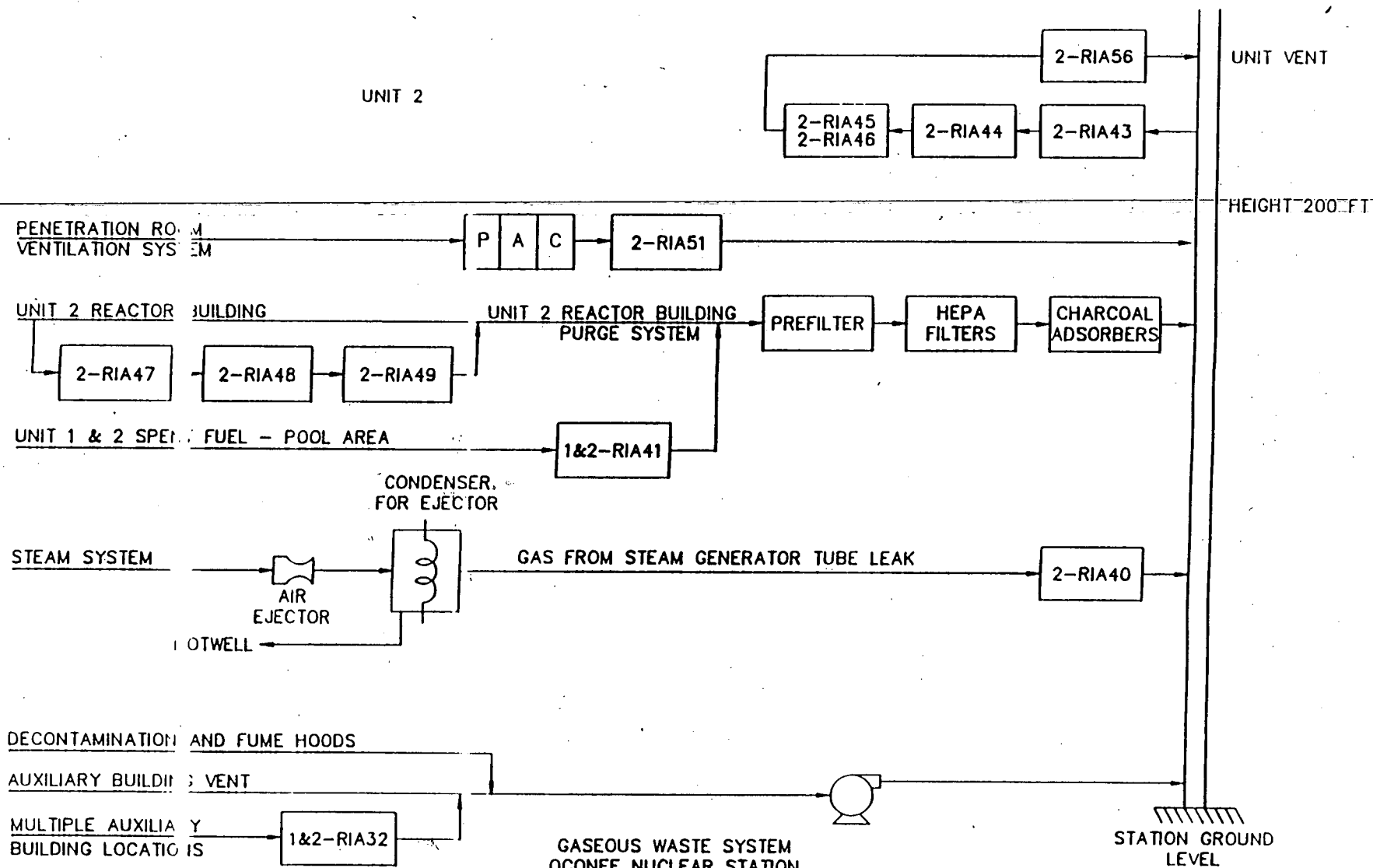
Radioactive gases may be released inside the reactor containment building when components of the primary system are opened to the building atmosphere for operational reasons or where minor leaks occur in the primary system. Prior to access, the reactor containment atmosphere will be monitored for activity and, when necessary, purged through prefilters, high-efficiency particulate air (HEPA) filters and charcoal adsorbers and released to atmosphere through the unit vent. The purge equipment is sized for a flow rate of 50,000 cfm providing approximately 1.5 air changes per hour in the reactor building. Units 1, 2 & 3 have a separate vent stack from each reactor building.

The gaseous waste handling and treatment systems for the Oconee Nuclear Station are shown schematically in Fig. A1.0-2.



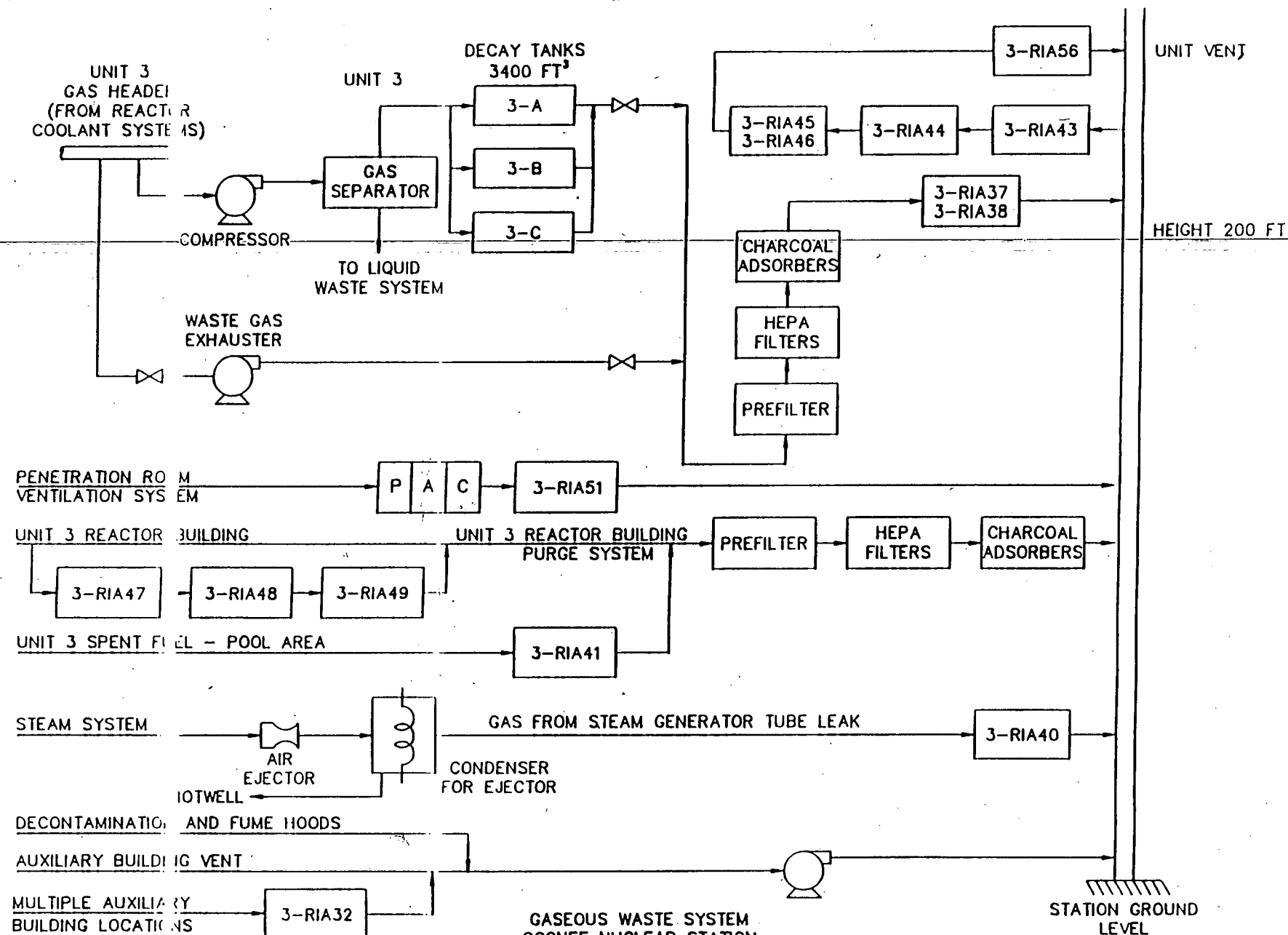
GASEOUS WASTE SYSTEM
 OCONEE NUCLEAR STATION
 FIGURE A1.0-2
 PAGE 1 OF 4

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GASEOUS WASTE SYSTEM
OCONEE NUCLEAR STATION
FIGURE A1.0-2
PAGE 2 OF 4

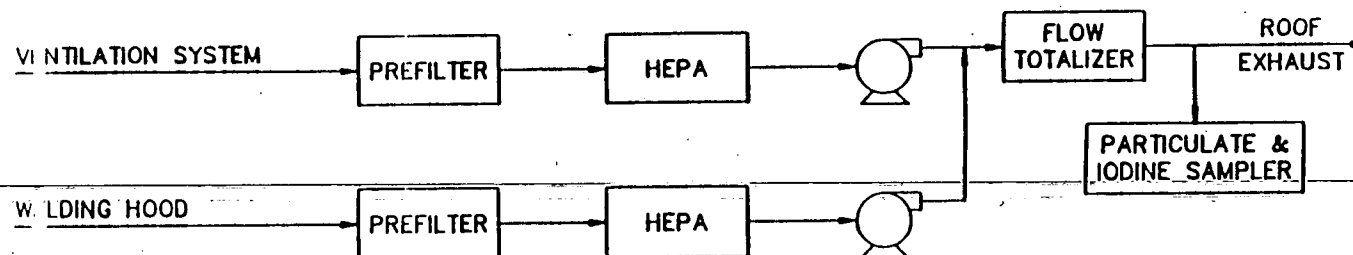
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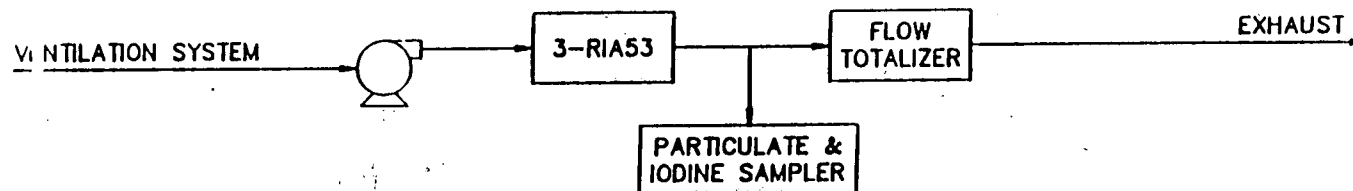
GASEOUS WASTE SYSTEM
 OCONEE NUCLEAR STATION
 FIGURE A1.0-2
 PAGE 3 OF 4

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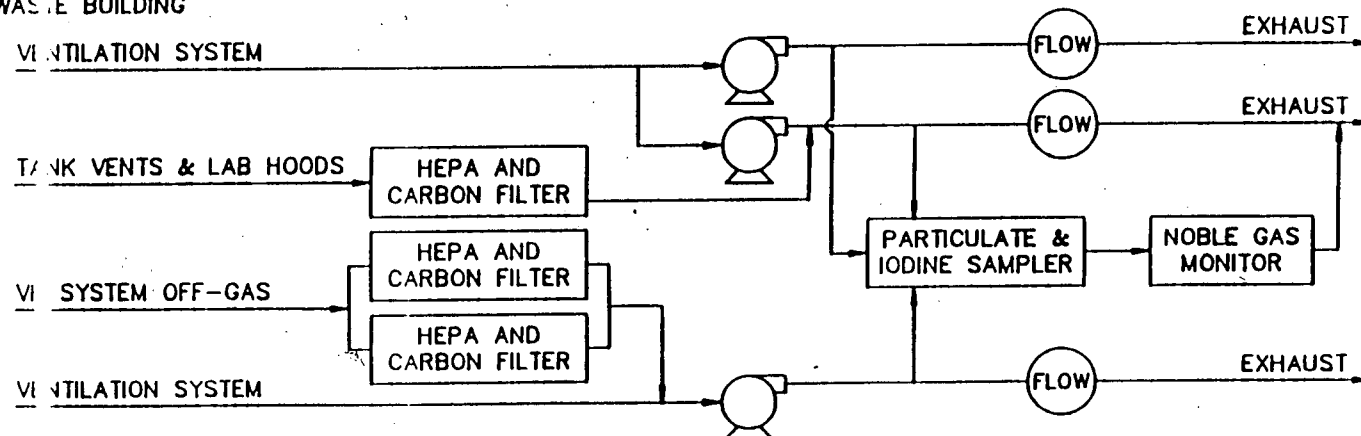
HOT MACHINE SHOP



INTERIM RAI WASTE FACILITY



RADWASTE BUILDING



A2.0 RELEASE RATE CALCULATION

Generic release rate calculations are presented in Section 1.0; these calculations will be used to calculate release rates from Oconee Nuclear Station.

A2.1 LIQUID RELEASE RATE CALCULATIONS

There are two potential release points at Oconee, the liquid radwaste effluent line to the Keowee Hydroelectric Unit Tailrace and the #3 Chemical Treatment Pond effluent line to the Keowee River.

A2.1.1 Liquid Radwaste Effluent Line To The Keowee Hydroelectric Unit Tailrace

To simplify calculations for the liquid radwaste effluent line, it is assumed that no activity above background is present in the #3 Chemical Treatment Pond effluent. This assumption shall be confirmed by radiation monitoring and/or the sampling of the pond's radioactive inputs, and by periodic analysis of the composite sample collected at the #3 Chemical Treatment Pond discharge. For the liquid radwaste effluent line the following calculation shall be performed to determine a discharge flow, in gpm:

$$f \leq F \div \left[\sigma \sum_{i=1}^n \frac{C_i}{(10 \times EC_i)} \right]$$

where:

f = the undiluted effluent flow, in gpm.

C_i = the concentration of radionuclide, 'i', in undiluted effluent as determined by laboratory analyses, in $\mu\text{Ci/ml}$.

EC_i = the concentration of radionuclide, 'i', from 10CFR20, Appendix B, Table 2, Column 2. If radionuclide, 'i', is a dissolved noble gas, the EC = $1.0\text{E-}4 \mu\text{Ci/ml}$.

F = the dilution flow available, in gpm

typical flow rates are:

3.41E+04 gpm (based on a leakage rate of 38 cfs, plus the Keowee Hydro Fire Protection - LWR mixing line whose flow rate is 38 cfs)

2.9E+6 gpm (based on one hydro unit operating at 50% power, 6600 cfs)

σ = the recirculation factor at equilibrium is 1.0. (See Section 1.1)

A2.1.2 #3 Chemical Treatment Pond Effluent Line

The #3 Chemical Treatment Pond effluent is the release point for station effluents that are normally considered to be non-radioactive; that is, the pond's effluent will not normally contain measurable activity above background. It is assumed that no activity is present in the effluent until indicated by radiation monitoring measurements on the pond's inputs and/or by periodic analyses of the composite sample collected at the pond's discharge point. Inputs to this pond include the plant's yard drain system, the decant water from the Powdex system, the discharge from the Turbine Building Sump system, and Radwaste Facility monitor tanks whose contents have been determined to be below background. Inputs that have radiation monitors associated with them will be set to assure that Selected Licensee Commitment 16.11-1.1 will not be exceeded.

The #3 Chemical Treatment Pond may also be the discharge path for large volumes of slightly contaminated water following a primary-secondary leak so long as administrative procedures are implemented to assure that release rate calculations similar to that used in Section A2.1.1 are performed, that all detectable radionuclides will be accounted for, and that no station limits will be exceeded.

A2.1.3 Low Pressure Service Water Effluent Line

The Low Pressure Service water effluent is normally considered nonradioactive; that is, it is unlikely the effluent will contain measurable activity above background. It is assumed that no activity is present in the effluent until indicated by radiation monitoring measurements. Radiation monitoring alarm setpoints, in conjunction with administrative controls, assure that release limits are not exceeded.

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, containment building vents, 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 A4.0-1a and A4.0-1b 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:

$$\sum_i K_i [(X/Q)Q_i] < 500 \text{ mrem/yr, and}$$

$$\sum_i (L_i + 1.1 M_i) [(X/Q)Q_i] < 3000 \text{ mrem/yr}$$

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:

$$\sum_i P_i [W Q_i] < 1500 \text{ mrem/yr}$$

where:

K_i = The total body dose factor due to gamma emissions for each identified noble gas radionuclide, in mrem/yr per $\mu\text{Ci}/\text{m}^3$ 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 $\mu\text{Ci}/\text{m}^3$ 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 $\mu\text{Ci}/\text{m}^3$ 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 $\mu\text{Ci}/\text{m}^3$ and for the food and ground plane pathways in $\text{m}^2 \cdot (\text{mrem/yr})$ per $\mu\text{Ci}/\text{sec}$ from Table 1.2-2. The dose factors are based on the critical individual organ and most restrictive age group (child or infant).

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

\bar{X}/\bar{Q} = $1.672\text{E-}6 \text{ sec/m}^3$. The highest calculated annual average relative concentration for any area at or beyond the unrestricted area boundary. The location is the SW sector @ 1.0 mile for semi-elevated releases.

W = The highest calculated annual average dispersion/deposition 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 resulting from semi-elevated releases is determined to be a maximum based on Table A4.0-1a (X/Q) and Table A4.0-1b (D/Q):

W = $1.672\text{E-}6 \text{ sec/m}^3$, for the inhalation pathway. The location is the SW sector @ 1.0 mile.

W = $7.067\text{E-}10 \text{ 1/m}^2$, for the food and ground plane pathways. The location is the NE sector @ 5.0 miles.

$$\bar{Q}_i = k_1 C_i f \div k_2 = 4.72\text{E+}02 C_i f$$

where:

C_i = the concentration of radionuclide, i, in undiluted gaseous effluent, in $\mu\text{Ci/ml}$.

f = the undiluted effluent flow, in cfm

k_1 = conversion factor, $2.83\text{E+}04 \text{ ml/ft}^3$

k_2 = conversion factor, $6.0\text{E+}01 \text{ sec/min}$

A2.3 GASEOUS RELEASE RATE CALCULATIONS FOR GROUND LEVEL RELEASE POINTS

Hot Machine Shop Building ventilation exhaust, Radwaste Facility Exhaust, and Auxiliary Boiler releases are treated as ground-level release points. The applicable dispersion and deposition parameters are provided in Tables A4.0-2a and A4.0-2b respectively.

It is assumed that no activity is present in effluent from these sources until indicated by radiation monitoring measurements and by analyses of periodic samples collected from these sources. 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 A2.3.1 and A2.3.2 shall control the release rates for a single release point.

A2.3.1 Release rate limit for noble gases:

$$\sum_i K_i [(X/Q)Q_i] < 500 \text{ mrem/yr, and}$$

$$\sum_i (L_i + 1.1 M_i) [(X/Q)Q_i] < 3000 \text{ mrem/yr}$$

where the terms are defined below:

A2.3.2 Release rate limit for all radioiodines and radioactive materials in particulate form and radionuclides other than noble gases:

$$\sum_i P_i [W Q_i] < 1500 \text{ mrem/yr}$$

where:

K_i = The total body dose factor due to gamma emissions for each identified noble gas radionuclide, in mrem/yr per $\mu\text{Ci}/\text{m}^3$ 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 $\mu\text{Ci}/\text{m}^3$ 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 $\mu\text{Ci}/\text{m}^3$ 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 $\mu\text{Ci}/\text{m}^3$ and for the food and ground plane pathways in $\text{m}^2 \cdot (\text{mrem/yr})$ per $\mu\text{Ci}/\text{sec}$ from Table 1.2-2. The dose factors are based on the critical individual organ and most restrictive age group (child or infant).

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

\bar{X}/\bar{Q} = $7.308\text{E-}6 \text{ sec/m}^3$. The highest calculated annual average relative concentration for any area at or beyond the unrestricted area boundary. The location is the SE sector @ 1.0 mile for ground-level releases.

W = The highest calculated annual average dispersion/deposition 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 resulting from ground level releases is determined to be a maximum based on Table A4.0-2a (X/Q) and Table A4.0-2b (D/Q):

W = $7.308\text{E-}6 \text{ sec/m}^3$, for the inhalation pathway. The location is the SE sector @ 1.0 mile.

W = $6.235\text{E-}10 \text{ 1/m}^2$, for the food and ground plane pathways. The location is the NE sector @ 5.0 miles.

$$\bar{Q}_i = k_1 C_i f + k_2 = 4.72\text{E+}02 C_i f$$

where:

C_i = the concentration of radionuclide, i, in undiluted gaseous effluent, in $\mu\text{Ci/ml}$.

f = the undiluted effluent flow, in cfm

k_1 = conversion factor, $2.83\text{E+}04 \text{ ml/ft}^3$

k_2 = conversion factor, $6.0\text{E+}01 \text{ sec/min}$

A3.0

RADIATION MONITOR SETPOINTS

Using the generic calculations presented in Section 2.0, final radiation monitoring setpoints are calculated for monitoring as required by the Selected Licensee Commitments.

All final effluent radiation monitors for Oconee are off-line. These monitors alarm on low flow; the minimum flow alarm level for the liquid monitors is 3 gallons per minute and for all gas monitors, except in the Radwaste Facility, is 7 standard cubic feet per minute. These monitors measure the activity in the liquid or gas volume exposed to the detector and are independent of flow rate if a minimum flow rate is assured. The Radwaste Facility gas monitors have a minimum flow alarm level of 2 standard cubic feet per minute and adjusts flow rate as the line flow changes.

Radiation monitoring setpoints calculated in the following sections are expressed in activity concentrations; in reality the monitor readout is in counts per minute, except for the Radwaste Facility gas monitor where its readout is in ($\mu\text{Ci/ml}$). The relationship between concentration and counts per minute shall be established by station procedure using the following relationship: Station radiation monitor setpoint procedures which correlate concentration and counts per minute shall be based on the formula below and will be determined using the monitor's correlation graph. The correlation graph shows concentration ($\mu\text{Ci/ml}$) vs. monitor reading (cpm) based on empirical data.

$$c = \frac{r}{2.22 \times 10^6 e v}$$

where:

c = the gross activity, in $\mu\text{Ci/ml}$
 r = the count rate, in cpm
 2.22×10^6 = the disintegration per minute per μCi
 e = the counting efficiency, cpm/dpm
 v = the volume of fluid exposed to the detector, in ml.

A3.1 LIQUID RADIATION MONITORS

A3.1.1 Liquid Radwaste Effluent Line To The Keowee Hydroelectric Unit Tailrace

As described in Section A2.1.1 of this manual on release rate calculations for the waste liquid effluent, the release is controlled by limiting the flow rate of effluent from the station. Although the release rate is flow rate controlled, the radiation monitor setpoint shall be set to terminate the release if the effluent activity should exceed that used to calculate the release rate. Also, a radiation monitor setpoint shall be set to alarm if the effluent activity should exceed that determined by laboratory analyses.

A3.1.2 Turbine Building Sump Discharge Line

As described in Section A2.1.2 of this manual on release rate calculations for the turbine building sump effluent, the effluent is normally considered nonradioactive; that is, it is unlikely the effluent will contain measurable activity above background. It is assumed that no activity is present in the effluent until indicated by radiation monitoring and by routine analysis of the composite sample collected at the #3 Chemical Treatment Pond. Since the system discharges automatically, the maximum system concentration, which also is the radiation monitor setpoint, is calculated to assure compliance with release limits.

A typical setpoint is calculated as follows:

$$c \leq \frac{10 \times EC \times F}{\sigma f} = 2.0E-4 \text{ } \mu\text{Ci/ml}$$

where:

- c = the gross activity in undiluted effluent, in $\mu\text{Ci/ml}$.
- f = the flow rate of undiluted effluent which may vary from 0-750 gpm, but is assumed to be 750 gpm.
- EC = $9.0E-07 \text{ } \mu\text{Ci/ml}$, the EC for Cs-134, which is the lowest effluent concentration value for any detectable radionuclide that is not known to be absent from the TBS effluent.
- σ = 1 (See Section A2.1.1)
- F = the flow may vary from 38 to 6,600 cfs, but is conservatively estimated at 38 cfs ($1.7E+04 \text{ gpm}$), the minimum flow available.

A3.1.3 Radwaste Facility Effluent Line To CTP #3

As described in Section A2.1.2 of this manual on release rate calculations, the Radwaste Facility Effluent is normally considered non-radioactive; that is, it is unlikely the effluent will contain measurable activity above background. It is assumed that no activity is present in the effluent until indicated by radiation monitoring and/or by routine analyses of the composite sample collected at the discharge of the #3 Chemical Treatment Pond. In order to assure that no activity is unknowingly discharged into the pond, the inputs to the Radwaste Facility Effluent Line are released in discrete batches where each batch is sampled for activity prior to release.

--- The justification for this assumption is provided in 10 CFR 20, Appendix B, Note 2. A review of past liquid effluent release data shows that Cs-134 has the lowest effluent concentration value for any detectable radionuclide in the effluent. An annual review of the effluent release data will be performed to assure that this assumption remains valid.

A3.1.4 Low Pressure Service Water Discharge Line

As described in Section A2.1.3 of this manual on release rate calculations for the Low Pressure Service water effluent, the effluent is normally considered nonradioactive; that is, it is unlikely the effluent will contain measurable activity above background. It is assumed that no activity is present in the effluent until indicated by radiation monitoring equipment. Since the system discharges automatically, the maximum system concentration which is also the radiation monitor setpoint, is calculated to assure compliance with release limits.

A typical monitor setpoint is calculated as follows:

$$C \leq \frac{EC \times 10 \times F}{of} = 1.04E-3 \text{ } \mu\text{Ci/ml}$$

where:

C = the gross activity in undiluted effluent, in $\mu\text{Ci/ml}$.

f = the flow rate of undiluted effluent which may vary from 0 to 10,500 gpm but is assumed to be 10,500 gpm.

EC = $9.0E-07 \text{ } \mu\text{Ci/ml}$, the EC for Cs-134, which is the lowest effluent concentration value for any detectable radionuclide that is not known to be absent from the LPSW effluent. ---

σ = recirculation factor for Lake Keowee, 1.02.

F = the flow rate of the condensate cooling water is based on having seven CCW pumps in operation, $1.24E+06 \text{ gpm}$. Should the number of operating pumps decrease, the setpoint must be recalculated.

--- The justification for this assumption is provided in 10 CFR 20, Appendix B, Note 2. A review of past liquid effluent release data shows that Cs-134 has the lowest effluent concentration value for any detectable radionuclide in the effluent. An annual review of the effluent release data will be performed to assure that this assumption remains valid.

A3.2 GASEOUS RADIATION MONITOR SETPOINTS FOR SEMI-ELEVATED RELEASE POINTS

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

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

$$\bar{Q} = 4.72\text{E}+2 \text{ Cf (See Section A2.2.2)}$$

$$(K)(\bar{X}/\bar{Q})(472)(C)(f) < 500$$

$$C < \frac{500}{(206)(1.672\text{E}-6)(472)} + f$$

$$C < 3.08\text{E}+3/f$$

where:

C = the gross activity in undiluted effluent, in $\mu\text{Ci/ml}$

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, $2.06\text{E}+2 \text{ mrem/yr per } \mu\text{Ci/m}^3$

\bar{X}/\bar{Q} = $1.672\text{E}-6 \text{ sec/m}^3$, as defined in section A2.2.2.

A3.2.1 Gaseous Radwaste Effluent Line - Waste Gas Decay Tanks

As described in Section 2.2, the release is controlled by limiting the flow rate of the effluent from the station. Although the release rate is flow rate controlled, the radiation monitor setpoint shall be set to terminate the release if the effluent activity should exceed that determined by laboratory analyses and that used to calculate the release rate. A typical radiation monitor setpoint may be calculated as follows:

$$C < 3.08\text{E}+3/f = 1.03\text{E}+02 \mu\text{Ci/ml}$$

where:

$$f = 30 \text{ cfm}$$

A3.2.2 Unit Vent

As stated in Section A2.2, the unit vent is the release point for waste gas decay tanks, containment building purges, containment building vents, the condenser air ejector, and auxiliary building ventilation. Since all of these releases are through the unit vent, the radiation monitor on the unit vent may be used to assure that station release limits are not exceeded. Depending on the stack flow, a typical radiation monitor setpoint may be calculated as follows:

$$C < 3.08E+3/f = 3.24E-2 \mu\text{Ci/ml}$$

where:

$$f = 45,000 \text{ cfm (auxiliary building)} + 50,000 \text{ cfm (containment purge)} = 95,000 \text{ cfm}$$

or

$$C < 3.08E+3/f = 6.84E-2 \mu\text{Ci/ml}$$

where:

$$f = 45,000 \text{ cfm (auxiliary building ventilation)}$$

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:

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

$$\bar{Q}_i = 4.72\text{E}+2 \text{ Cf (See Section A2.2.2)}$$

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

$$C < \frac{500}{(206)(7.308\text{E}-6)(472)} + f$$

$$C < 7.04\text{E}+2/f$$

where:

C = the gross activity in undiluted effluent, in $\mu\text{Ci/ml}$

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, $2.06\text{E}+2 \text{ mrem/yr per } \mu\text{Ci/m}^3$

\bar{X}/\bar{Q} = $7.308\text{E}-6 \text{ sec/m}^3$, 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:

$$C < 7.04\text{E}+2/f = 4.79\text{E}-2 \mu\text{Ci/ml}$$

where:

$$f = 1.47\text{E}+04 \text{ cfm}$$

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 may be 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 Selected Licensee Commitments, 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 GASPAP 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 is 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:

$$C < 7.04E+2/f = 5.43E-03 \mu\text{Ci/ml}$$

where:

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

A4.0 DOSE CALCULATIONS

A4.1 FREQUENCY OF CALCULATIONS

Dose contributions to the maximum exposed 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 or the LADTAP and GASPAR computer programs. Example input templates for Oconee LADTAP and GASPAR computer program calculations are provided in Figures A4.0-1 and A4.0-2. One of these methods shall also be used for any special reports.

Station long-term historical and dose projection calculations are periodically performed to determine the station's status with respect to meeting annual ALARA goals specified in the Oconee Nuclear Station Selected Licensing Commitment Manual. Such calculations are used to verify that adequate margin remains during a report period to allow normal station and radwaste system operation, including anticipated operational occurrences, for the remainder of the report period without exceeding applicable goals. Station dose projections can be performed using generic methodology or the LADTAP and GASPAR computer codes.

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 or the LADTAP and GASPAR computer programs.

A4.2 DOSE MODELS FOR MAXIMUM EXPOSED INDIVIDUAL

A4.2.1 Liquid Effluents

Generic methodology for calculating liquid pathway exposures to the maximum exposed individual is presented in Section 3.1.1. Oconee site specific parameters to be used in the generic methodology are presented as follows:

A_{ait} = Tables A4.0-3 through A4.0-6

$$F_1 = \frac{f\sigma}{F+f} \quad (0.058 \text{ default for projections})$$

Where:

f = Oconee average liquid radwaste flow, gpm (1.8E+04 default for projections)

σ = Recirculation factor at equilibrium, 1.0

F = Oconee average dilution flow for period of interest, gpm (2.9E+05 default for projections - based on 1983 - 1990 worst-case annual average)

An input template for Oconee LADTAP computer program calculations is provided in Figure A4.0-1. The input template includes default dilution parameters. Radionuclide release input (C_i/period) and optional non-default dilution flow (CFS) parameters are necessary to perform LADTAP calculations to determine offsite dose impact from specific releases during the period that dilution flow is averaged over.

A4.2.2 Gaseous Effluents

A4.2.2.1 Noble Gases

Gamma Air and Beta Air Dose

Generic methodology for calculating noble gas airborne pathway gamma air (D_γ) and beta air (D_β) doses is presented in Section 3.1.2.1. Oconee site specific parameters to be used in the generic methodology are presented as follows:

Semi-elevated Releases

$(\overline{X/Q}) = 1.672\text{E-}6 \text{ sec/m}^3$. The highest calculated annual average relative concentration for any area at or beyond the unrestricted area boundary. The location is the SW sector @ 1.0 mile for semi-elevated releases.

Ground Level Releases

$(\overline{X/Q}) = 7.308\text{E-}6 \text{ sec/m}^3$. The highest calculated annual average relative concentration for any area at or beyond the unrestricted area boundary. The location is the SE sector @ 1.0 mile for ground level releases.

An input template for Oconee GASPAR computer program noble gas airborne pathway gamma air (D_γ) and beta air (D_β) dose calculations is provided in Figure A4.0-2. The input template includes the maximum Oconee site specific semi-elevated and ground level annual average relative concentration parameters. Radionuclide release input (C_i/period) and optional non-default relative concentration parameters are necessary to perform GASPAR calculations to determine offsite dose impact from specific releases.

A4.2.2.2 Radioiodines, Particulate, and Other Radionuclides with $T_{1/2} > 8$ Days

Generic methodology for calculating airborne pathway maximum organ (D_{mo}) exposures to the maximum exposed individual is presented in Section 3.1.2.2. External exposure from deposited ground contamination and inhalation exposure pathways, and internal exposure from the vegetable garden pathway are considered to exist at all locations offsite. Other food pathways, which include the meat and milk pathways, are analyzed only at locations where site surveys have verified that meat producing animals, or cow and goat milk producing animals exist, however. Therefore, the location of the maximum

individual may vary depending on the mixture and levels of radionuclides released during a period of time. Additionally, the critical (or limiting) age group and organ will vary based on the location (i.e., combination of dose pathways contributing dose) and mixture/level of radionuclide releases during the release period.

Performing calculations separately for semi-elevated and ground level release types and for all potential maximum locations, age groups and organs assures that a maximum location is identified and that a conservative estimate is obtained for maximum offsite dose impact to any organ or age group. Oconee site specific meteorological dispersion (X/Q) and deposition (D/Q) parameters and applicable terrestrial/food pathways for the potential maximum locations to be analyzed using generic methodology are presented in Table A4.0-7.

An input template for Oconee GASPAR computer program airborne pathway maximum organ (D_{max}) dose calculations is provided in Figures A4.0-3 through A4.0-10. The input template includes the maximum Oconee site specific semi-elevated and ground level annual average meteorological parameters. Radionuclide release input (C_i/period) and optional non-default meteorological parameters and pathway applicability flags are necessary to perform GASPAR calculations to determine offsite dose impact from specific releases.

An alternative method for estimating offsite dose involves performing calculations for all offsite locations and comparing the combined semi-elevated and ground level release dose totals for each location to determine the maximum organ exposure. Table A4.0-8 provides site survey data indicating the applicable food pathways to be considered for each offsite location.

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:

$$D_{tb}(T) = D_{tb}(l) + D_{tb}(g_e) + D_{tb}(g_g)$$

$$D_{mo}(T) = D_{mo}(l) + D_{mo}(g_e) + D_{mo}(g_g)$$

where:

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

$D_{tb}(l)$ = Estimated fuel cycle total body dose contribution resulting from Oconee liquid effluents during the calendar year of interest, in mrem.

$D_{tb}(g_e)$ = Estimated fuel cycle total body dose contribution resulting from Oconee gaseous effluents released from semi-elevated release points during the calendar year of interest, in mrem.

$D_{tb}(g_g)$ = Estimated fuel cycle total body dose contribution resulting from Oconee gaseous effluents released from ground level release points 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.

$D_{mo}(l)$ = Estimated fuel cycle maximum organ dose contribution resulting from Oconee liquid effluents during the calendar year of interest, in mrem.

$D_{mo}(g_e)$ = Estimated fuel cycle maximum organ dose contribution resulting from Oconee gaseous effluents released from semi-elevated release points during the calendar year of interest, in mrem.

$D_{mo}(g_g)$ = Estimated fuel cycle maximum organ dose contribution resulting from Oconee gaseous effluents released from ground level release points during the calendar year of interest, in mrem.

A4.3.1 LIQUID EFFLUENTS

Liquid pathway dose estimates are calculated using generic methodology or the LADTAP computer program. The values for $D_{lb}(l)$ and $D_{mo}(l)$ liquid pathway dose contributions are calculated based on the methodology, values and assumptions presented in Section A4.2.1.

A4.3.2 GASEOUS EFFLUENTS

Total Body

The methodology for calculating noble gas airborne pathway total body exposures to the maximum individual, $D_{lb}(g_e)$ and $D_{lb}(g_g)$, is derived from Section 3.1.2.1 generic methodology for gamma air and beta air dose calculations as follows:

$$D_{lb} = 3.17E-8 \sum_i K_i [(X/Q)Q_i] \text{ mrem/yr}$$

Generic methodology parameters K_i are described and provided in Section 1.2.1. Oconee site specific parameters for semi-elevated and ground level X/Q values are $1.672E-6$ and $7.308E-6$, respectively, as described in Section A4.2.2.1 for Oconee gamma air and beta air dose calculations.

Maximum Organ

Airborne pathway maximum organ dose estimates are calculated using generic methodology or the GASPAR computer program. The values for $D_{mo}(g_e)$ and $D_{mo}(g_g)$ airborne pathway dose contributions are calculated based on the methodology, presented in Section A4.2.2.2. The maximum organ dose is established by calculating doses to all organs for each potential maximum offsite location identified in Table A4.0-7. Calculations must be performed separately for semi-elevated and ground level gaseous release types and for all potential maximum locations, age groups and organs in order to assure that the maximum location, organ and age group is indeed analyzed and identified. A conservative estimate (i.e., overestimate) of the fuel cycle maximum organ dose is obtained by 1) performing liquid pathway calculations for each age group and organ, 2) performing gaseous pathway calculations for each age group and organ for all potential maximum exposure locations (see Table A4.0-7) 3) adding the exposure values for each airborne release type (i.e., semi-elevated and ground level) to the same organ dose resulting from liquid releases, 4) comparing total organ dose values for each potential limiting gaseous dose location and determining the maximum organ dose values for each age group, and airborne pathway components are added for all organs and determining maximum organ dose values calculated or each potential limiting gaseous dose location age group, and 5) comparing maximum total doses for each organ and age group and determining the maximum (or limiting) organ and age group. A worksheet is presented in Figure A4.0-11.

An alternative method for estimating fuel cycle maximum organ dose involves performing calculations for all offsite locations and comparing the combined liquid, semi-elevated and ground level release dose totals for each location to determine the maximum organ exposure. Table A4.0-8 provides site survey data indicating the applicable food pathways to be considered for each offsite location.

TABLE A4.0-1A
 OCONEE NUCLEAR STATION
 (1 OF 2)

DISPERSION PARAMETER ($\overline{X/Q}$) FOR SEMI-ELEVATED LONG TERM RELEASES > 500 HR/YR OR > 125 HR/QTR
 (SEC/M3)

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			5.220E-07	2.650E-07	1.594E-07	1.069E-07	7.719E-08	7.321E-08	5.665E-08	4.542E-08
NNE			8.379E-07	4.734E-07	2.690E-07	2.003E-07	1.385E-07	1.091E-07	8.379E-08	6.676E-08
NE			9.503E-07	6.350E-07	3.962E-07	2.535E-07	1.847E-07	1.497E-07	1.157E-07	9.246E-08
ENE			8.116E-07	4.856E-07	2.919E-07	2.196E-07	1.619E-07	1.239E-07	9.609E-08	7.720E-08
E			5.950E-07	3.202E-07	2.015E-07	2.270E-07	1.745E-07	1.292E-07	1.024E-07	8.308E-08
ESE			4.531E-07	3.300E-07	3.623E-07	4.020E-07	2.822E-07	2.109E-07	1.688E-07	1.405E-07
SE			7.505E-07	4.573E-07	5.490E-07	5.110E-07	3.560E-07	2.648E-07	2.063E-07	1.665E-07
SSE			1.419E-06	7.428E-07	4.527E-07	3.489E-07	2.866E-07	2.131E-07	1.659E-07	1.337E-07
S			1.170E-06	6.099E-07	3.701E-07	2.496E-07	1.810E-07	1.552E-07	1.218E-07	9.867E-08
SSW			1.214E-06	6.327E-07	3.564E-07	2.301E-07	1.621E-07	1.213E-07	9.481E-08	7.660E-08
SW			1.672E-06	7.285E-07	4.057E-07	2.720E-07	1.891E-07	1.400E-07	1.085E-07	8.708E-08
WSW			1.558E-06	6.820E-07	3.804E-07	2.438E-07	1.708E-07	1.271E-07	1.010E-07	8.114E-08
W			1.193E-06	5.214E-07	2.909E-07	1.867E-07	1.372E-07	1.032E-07	8.326E-08	6.654E-08
WNW			4.658E-07	2.480E-07	1.760E-07	1.482E-07	1.024E-07	7.695E-08	5.943E-08	4.796E-08
NW			4.831E-07	2.524E-07	1.965E-07	1.291E-07	9.959E-08	7.356E-08	5.682E-08	4.566E-08
NNW			5.375E-07	2.769E-07	2.128E-07	1.394E-07	1.072E-07	7.913E-08	6.110E-08	4.907E-08

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OCONEE NUCLEAR STATION

The values presented in this table were generated by using the computer program XOQDOQ (NUREG/CR-2919) which implements NRC Regulatory Guide 1.111 (1977), and by using the following assumptions:

1. Data Collection Period, 1988 to 1992.
2. Semi-Elevated Releases.
3. Open Terrain Recirculation Correction Factors.
4. No Decay, Undepleted
5. Vent and Building Parameters:

Release Height (meters)	= 60.70	Rep. Wind Height (meters)	= 60.7
Diameter (meters)	= 1.80	Building Height (meters)	= 58.0
Exit Velocity (meters)	= 11.10	Bldg. Min. X-Sec. Area (sq. m.)	= 2296.0
		Heat Emission Rate (cal/s)	= 0.0

6. At the Release Height:

<u>Vent Release Mode</u>	<u>Wind Speed (meters/sec)</u>
Elevated	Less Than 2.220
Mixed	Between 2.220 and 11.100
Ground Level	Above 11.100

7. At the Measured Wind Speed (10.0 meters):

<u>Vent Release Mode</u>	<u>Wind Speed (meters/sec)</u>	
	<u>Stable Conditions</u>	<u>Unstable/Neutral Conditions</u>
Elevated	Less Than 0.901	Less Than 1.414
Mixed	Between 0.901 and 4.505	Between 1.414 and 7.072
Ground Level	Above 4.505	Above 7.072

TABLE A4.0-1B
 OCONEE NUCLEAR STATION
 (1 OF 2)

DEPOSITION PARAMETER ($\overline{D/Q}$) FOR SEMI-ELEVATED LONG TERM RELEASES > 500 HR/YR OR > 125 HR/QTR
 (1/M2)

SECTOR	DISTANCE TO THE CONTROL LOCATION, IN MILES									
	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			2.890E-09	1.184E-09	6.225E-10	3.812E-10	2.586E-10	3.380E-10	2.510E-10	1.943E-10
NNE			9.113E-09	3.989E-09	2.013E-09	1.248E-09	8.235E-10	8.997E-10	6.667E-10	5.138E-10
NE			1.295E-08	5.666E-09	2.919E-09	1.729E-09	1.145E-09	1.224E-09	9.140E-10	7.067E-10
ENE			7.899E-09	3.385E-09	1.756E-09	1.095E-09	9.819E-10	7.671E-10	5.749E-10	4.466E-10
E			4.454E-09	1.775E-09	9.252E-10	7.164E-10	7.491E-10	5.267E-10	3.981E-10	3.125E-10
ESE			4.361E-09	1.838E-09	1.086E-09	1.322E-09	8.696E-10	6.161E-10	5.153E-10	4.139E-10
SE			3.397E-09	1.385E-09	8.341E-10	1.649E-09	1.080E-09	7.595E-10	5.629E-10	4.340E-10
SSE			3.333E-09	1.323E-09	6.920E-10	4.404E-10	7.307E-10	5.202E-10	3.922E-10	3.091E-10
S			3.192E-09	1.256E-09	6.530E-10	4.020E-10	2.788E-10	2.177E-10	1.759E-10	1.501E-10
SSW			5.190E-09	1.972E-09	9.899E-10	5.895E-10	3.928E-10	2.842E-10	2.192E-10	1.778E-10
SW			1.205E-08	4.399E-09	2.193E-09	1.299E-09	8.521E-10	6.028E-10	4.518E-10	3.546E-10
WSW			1.047E-08	3.824E-09	1.908E-09	1.127E-09	7.422E-10	5.277E-10	3.980E-10	3.145E-10
W			5.577E-09	2.044E-09	1.025E-09	6.094E-10	4.134E-10	3.405E-10	3.962E-10	3.052E-10
WNW			2.185E-09	9.042E-10	5.220E-10	6.464E-10	4.227E-10	3.188E-10	2.360E-10	1.868E-10
NW			2.097E-09	8.759E-10	5.225E-10	3.196E-10	4.521E-10	3.178E-10	2.353E-10	1.812E-10
NNW			2.461E-09	1.028E-09	6.219E-10	3.765E-10	5.128E-10	3.604E-10	2.667E-10	2.054E-10

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OCONEE NUCLEAR STATION

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1. Data Collection Period, 1988 to 1992.
2. Semi-Elevated Releases.
3. Open Terrain Recirculation Correction Factors.
4. No Decay, Undepleted
5. Vent and Building Parameters:

Release Height (meters)	= 60.70	Rep. Wind Height (meters)	= 60.7
Diameter (meters)	= 1.80	Building Height (meters)	= 58.0
Exit Velocity (meters)	= 11.10	Bldg. Min. X-Sec. Area (sq. m.)	= 2296.0
		Heat Emission Rate (cal/s)	= 0.0

6. At the Release Height:

<u>Vent Release Mode</u>	<u>Wind Speed (meters/sec)</u>
Elevated	Less Than 2.220
Mixed	Between 2.220 and 11.100
Ground Level	Above 11.100

7. At the Measured Wind Speed (10.0 meters):

<u>Vent Release Mode</u>	<u>Wind Speed (meters/sec)</u>	
	<u>Stable Conditions</u>	<u>Unstable/Neutral Conditions</u>
Elevated	Less Than 0.901	Less Than 1.414
Mixed	Between 0.901 and 4.505	Between 1.414 and 7.072
Ground Level	Above 4.505	Above 7.072

TABLE A4.0-2A
 OCONEE NUCLEAR STATION
 (1 OF 2)

DISPERSION PARAMETER ($\overline{X/Q}$) FOR GROUND LEVEL, LONG TERM RELEASES > 500 HR/YR OR > 125 HR/QTR
 (SEC/M3)

SECTOR	DISTANCE TO THE CONTROL LOCATION, IN MILES									
	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			2.115E-06	8.389E-07	4.495E-07	2.822E-07	1.952E-07	1.443E-07	1.117E-07	8.961E-08
NNE			2.898E-06	1.137E-07	6.047E-07	3.775E-07	2.602E-07	1.916E-07	1.480E-07	1.184E-07
NE			3.886E-06	1.529E-06	8.158E-07	5.108E-07	3.529E-07	2.604E-07	2.015E-07	1.616E-07
ENE			3.226E-06	1.277E-06	6.848E-07	4.305E-07	2.983E-07	2.207E-07	1.711E-07	1.374E-07
E			3.522E-06	1.410E-06	7.658E-07	4.866E-07	3.400E-07	2.534E-07	1.977E-07	1.596E-07
ESE			5.964E-06	2.407E-06	1.321E-06	8.459E-07	5.950E-07	4.457E-07	3.493E-07	2.832E-07
SE			7.303E-06	2.972E-06	1.631E-06	1.044E-06	7.342E-07	5.497E-07	4.307E-07	3.490E-07
SSE			6.604E-06	2.657E-06	1.440E-06	9.117E-07	6.354E-07	4.723E-07	3.676E-07	2.962E-07
S			5.278E-06	2.121E-06	1.146E-06	7.237E-06	5.032E-07	3.734E-07	2.901E-07	2.335E-07
SSW			3.986E-06	1.589E-06	8.536E-07	5.370E-07	3.721E-07	2.753E-07	2.135E-07	1.714E-07
SW			4.108E-06	1.620E-06	8.628E-07	5.390E-07	3.715E-07	2.735E-07	2.112E-07	1.689E-07
WSW			3.804E-06	1.503E-06	8.018E-07	5.015E-07	3.460E-07	2.549E-07	1.970E-07	1.577E-07
W			2.978E-06	1.186E-06	6.361E-07	3.995E-07	2.765E-07	2.043E-07	1.583E-07	1.270E-07
WNW			2.201E-06	8.701E-07	4.726E-07	2.974E-07	2.062E-07	1.526E-07	1.183E-07	9.502E-08
NW			2.104E-06	8.385E-07	4.499E-07	2.826E-07	1.957E-07	1.447E-07	1.121E-07	8.991E-08
NNW			2.221E-06	8.860E-07	4.755E-07	2.988E-07	2.069E-07	1.529E-07	1.185E-07	9.508E-08

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OCONEE NUCLEAR STATION

The values presented in this table were generated by using the computer program XOQDOQ (NUREG/CR-2919) which implements NRC Regulatory Guide 1.111 (1977), and by using the following assumptions:

1. Data Collection Period, 1988 to 1992.
2. Ground Level Releases.
3. Open Terrain Recirculation Correction Factors.
4. No Decay, Undepleted
5. Vent and Building Parameters:

Release Height (meters)	= 10.00	Rep. Wind Height (meters)	= 10.0
Diameter (meters)	= 0.00	Building Height (meters)	= 58.0
Exit Velocity (meters)	= 0.00	Bldg. Min. X-Sec. Area (sq. m.)	= 2296.0
		Heat Emission Rate (cal/s)	= 0.0

TABLE A4.0-2B
OCONEE NUCLEAR STATION
(1 OF 2)

DEPOSITION PARAMETER ($\overline{D/Q}$) FOR GROUND LEVEL, LONG TERM RELEASES > 500 HR/YR OR > 125 HR/QTR
(1/M2)

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			6.916E-09	2.484E-09	1.232E-09	7.255E-10	4.750E-10	3.342E-10	2.477E-10	1.909E-10
NNE			1.642E-08	5.897E-09	2.924E-09	1.722E-09	1.128E-09	7.934E-10	5.880E-10	4.531E-10
NE			2.259E-08	8.114E-09	4.024E-09	2.369E-09	1.551E-09	1.092E-09	8.090E-10	6.235E-10
ENE			1.428E-08	5.130E-09	2.544E-09	1.498E-09	9.810E-10	6.902E-10	5.115E-10	3.942E-10
E			9.899E-09	3.556E-09	1.763E-09	1.038E-09	6.798E-10	4.784E-10	3.545E-10	2.732E-10
ESE			1.336E-08	4.798E-09	2.379E-09	1.401E-09	9.174E-10	6.455E-10	4.784E-10	3.686E-10
SE			1.401E-08	5.034E-09	2.496E-09	1.470E-09	9.625E-10	6.772E-10	5.019E-10	3.868E-10
SSE			1.226E-08	4.404E-09	2.184E-09	1.286E-09	8.420E-10	5.925E-10	4.391E-10	3.384E-10
S			1.008E-08	3.620E-09	1.795E-09	1.057E-09	6.922E-10	4.871E-10	3.610E-10	2.782E-10
SSW			9.941E-09	3.571E-09	1.771E-09	1.043E-09	6.828E-10	4.804E-10	3.560E-10	2.744E-10
SW			1.717E-08	6.169E-09	3.059E-09	1.801E-09	1.180E-09	8.300E-10	6.151E-10	4.740E-10
WSW			1.574E-08	5.655E-09	2.804E-09	1.651E-09	1.081E-09	7.608E-10	5.638E-10	4.345E-10
W			9.988E-09	3.588E-09	1.779E-09	1.048E-09	6.860E-10	4.827E-10	3.577E-10	2.757E-10
WNW			5.953E-09	2.138E-09	1.060E-09	6.244E-10	4.088E-10	2.877E-10	2.132E-10	1.643E-10
NW			5.891E-09	2.116E-09	1.049E-09	6.179E-10	4.046E-10	2.847E-10	2.110E-10	1.626E-10
NNW			6.672E-09	2.397E-09	1.188E-09	6.998E-10	4.582E-10	3.224E-10	2.390E-10	1.841E-10

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TABLE A4.0-2B
(2 OF 2)

OCONEE NUCLEAR STATION

The values presented in this table were generated by using the computer program XOQDOQ (NUREG/CR-2919) which implements NRC Regulatory Guide 1.111 (1977), and by using the following assumptions:

1. Data Collection Period, 1988 to 1992.
2. Ground Level Releases.
3. Open Terrain Recirculation Correction Factors.
4. No Decay, Undepleted
5. Vent and Building Parameters:

Release Height (meters)	=	10.00	Rep. Wind Height	(meters)	=	10.0
Diameter (meters)	=	0.00	Building Height	(meters)	=	58.0
Exit Velocity (meters)	=	0.00	Bldg. Min. X-Sec. Area	(sq. m.)	=	2296.0
			Heat Emission Rate	(cal/s)	=	0.0

TABLE A4.0-3
(1 OF 2)

OCONEE NUCLEAR STATION
LIQUID EFFLUENT DOSE - ADULT PARAMETERS
A(I) MREM/HR PER UCI/ML

RADIONUCLIDE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
1 H 3	0.0	2.27E-01	2.27E-01	2.27E-01	2.27E-01	2.27E-01	2.27E-01
11 NA 24	4.07E+02	4.07E+02	4.07E+02	4.07E+02	4.07E+02	4.07E+02	4.07E+02
24 CR 51	0.0	0.0	1.27E+00	7.61E-01	2.81E-01	1.69E+00	3.20E+02
25 MN 54	0.0	4.38E+03	8.35E+02	0.0	1.30E+03	0.0	1.34E+04
25 MN 56	0.0	1.10E+02	1.95E+01	0.0	1.40E+02	0.0	3.51E+03
26 FE 55	6.58E+02	4.55E+02	1.06E+02	0.0	0.0	2.54E+02	2.61E+02
26 FE 59	1.04E+03	2.44E+03	9.36E+02	0.0	0.0	6.82E+02	8.14E+03
27 CO 58	0.0	8.92E+01	2.00E+02	0.0	0.0	0.0	1.81E+03
27 CO 60	0.0	2.56E+02	5.65E+02	0.0	0.0	0.0	4.81E+03
28 NI 63M	3.11E+04	2.16E+03	1.04E+03	0.0	0.0	0.0	4.50E+02
28 NI 65	1.26E+02	1.64E+01	7.49E+00	0.0	0.0	0.0	4.17E+02
29 CU 64	0.0	9.97E+00	4.68E+00	0.0	2.51E+01	0.0	8.50E+02
30 ZN 65M	2.32E+04	7.37E+04	3.33E+04	0.0	4.93E+04	0.0	4.64E+04
30 ZN 69	4.93E+01	9.43E+01	6.56E+00	0.0	6.13E+01	0.0	1.42E+01
35 BR 83	0.0	0.0	4.04E+01	0.0	0.0	0.0	5.82E+01
35 BR 85	0.0	0.0	2.15E+00	0.0	0.0	0.0	0.0
37 RB 86M	0.0	1.01E+05	4.71E+04	0.0	0.0	0.0	1.99E+04
37 RB 88	0.0	2.90E+02	1.54E+02	0.0	0.0	0.0	4.00E-09
37 RB 89	0.0	1.92E+02	1.35E+02	0.0	0.0	0.0	1.12E-11
38 SR 89	2.21E+04	0.0	6.35E+02	0.0	0.0	0.0	3.55E+03
38 SR 90	2.76E+05	0.0	7.40E+04	0.0	0.0	0.0	1.57E+04
38 SR 91	4.07E+02	0.0	1.64E+01	0.0	0.0	0.0	1.94E+03
38 SR 92	1.54E+02	0.0	6.68E+00	0.0	0.0	0.0	3.06E+03
39 Y 90	5.76E-01	0.0	1.54E-02	0.0	0.0	0.0	6.11E+03
39 Y 91	5.44E-03	0.0	2.11E-04	0.0	0.0	0.0	1.60E-02
39 Y 91	8.44E+00	0.0	2.26E-01	0.0	0.0	0.0	4.65E+03
39 Y 92	5.06E-02	0.0	1.48E-03	0.0	0.0	0.0	8.86E+02
39 Y 93	1.60E-01	0.0	4.43E-03	0.0	0.0	0.0	5.09E+03
40 ZR 95	2.40E-01	7.71E-02	5.22E-02	0.0	1.21E-01	0.0	2.44E+02
40 ZR 97	1.33E-02	2.68E-03	1.23E-03	0.0	4.05E-03	0.0	8.30E+02
41 NB 95	4.47E+02	2.48E+02	1.34E+02	0.0	2.46E+02	0.0	1.51E+06
42 MO 99	0.0	1.03E+02	1.96E+01	0.0	2.34E+02	0.0	2.39E+02
43 TC 99	8.87E-03	2.51E-02	3.19E-01	0.0	3.81E-01	1.23E-02	1.48E+01
43 TC 101	9.12E-03	1.31E-02	1.29E-01	0.0	2.37E-01	6.72E-03	3.95E-14
44 RU 103	4.43E+00	0.0	1.91E+00	0.0	1.69E+01	0.0	5.17E+02
44 RU 105M	3.69E-01	0.0	1.46E-01	0.0	4.77E+00	0.0	2.26E+02
44 RU 106	6.59E+01	0.0	8.33E+00	0.0	1.27E+02	0.0	4.26E+03
47 AG 110M	8.82E-01	8.16E-01	4.85E-01	0.0	1.60E+00	0.0	3.33E+02
52 TE 125	2.57E+03	9.30E+02	3.44E+02	7.72E+02	1.04E+04	0.0	1.02E+04
52 TE 127	6.48E+03	2.32E+03	7.90E+02	1.66E+03	2.63E+04	0.0	2.17E+04
52 TE 127	1.05E+02	3.78E+01	2.28E+01	7.80E+01	4.29E+02	0.0	8.31E+03
52 TE 129	1.10E+04	4.11E+03	1.74E+03	3.78E+03	4.60E+04	0.0	5.54E+04
52 TE 129	3.01E+01	1.13E+01	7.33E+00	2.31E+01	1.26E+02	0.0	2.27E+01
52 TE 131	1.66E+03	8.10E+02	6.75E+02	1.28E+03	8.21E+03	0.0	8.04E+04
52 TE 131	1.89E+01	7.88E+00	5.96E+00	1.55E+01	8.26E+01	0.0	2.67E+00
52 TE 132	2.41E+03	1.56E+03	1.47E+03	1.72E+03	1.50E+04	0.0	7.38E+04
53 I 130M	2.72E+01	8.01E+01	3.16E+01	6.79E+03	1.25E+02	0.0	6.90E+01
53 I 131	1.49E+02	2.14E+02	1.22E+02	7.00E+04	3.66E+02	0.0	5.64E+01
53 I 132	7.29E+00	1.95E+01	6.82E+00	6.82E+02	3.11E+01	0.0	3.66E+00
53 I 133	5.10E+01	8.87E+01	2.70E+01	1.30E+04	1.55E+02	0.0	7.97E+01
53 I 135	1.59E+01	4.17E+01	1.54E+01	2.75E+03	6.68E+01	0.0	4.71E+01
55 CS 134	1.49E+06	3.54E+06	2.90E+06	0.0	1.15E+06	3.81E+05	6.20E+04
55 CS 136	1.56E+05	6.15E+05	4.43E+05	0.0	3.42E+05	4.69E+04	6.99E+04
55 CS 137	1.91E+06	2.61E+06	1.71E+06	0.0	8.86E+05	2.94E+05	5.05E+04
55 CS 138	1.32E+03	2.61E+03	1.29E+03	0.0	1.92E+03	1.89E+02	1.11E-02
56 BA 139	9.30E-01	6.62E-04	2.72E-02	0.0	6.19E-04	3.76E-04	1.65E+00
56 BA 140M	1.95E+02	2.44E-01	1.27E+01	0.0	8.31E-02	1.40E-01	4.01E+02
56 BA 141	4.51E-01	3.41E-04	1.52E-02	0.0	3.17E-04	1.94E-04	2.13E-10
56 BA 142	2.04E-01	2.10E-04	1.28E-02	0.0	1.77E-04	1.19E-04	2.88E-19
57 LA 140	1.50E-01	7.54E-02	1.99E-02	0.0	0.0	0.0	5.54E+03
57 LA 142	7.66E-03	3.48E-03	8.68E-04	0.0	0.0	0.0	2.54E+01
58 CE 141	2.25E-02	1.52E-02	1.72E-03	0.0	7.06E-03	0.0	5.81E+01
58 CE 143M	3.96E-03	2.93E+00	3.24E-04	0.0	1.29E-03	0.0	1.10E+02
58 CE 144	1.17E+00	4.90E-01	6.29E-02	0.0	2.91E-01	0.0	3.96E+02
59 PR 143	5.51E-01	2.21E-02	2.73E-02	0.0	1.27E-01	0.0	2.41E+03
59 PR 144	1.80E-03	7.48E-04	9.16E-05	0.0	4.22E-04	0.0	2.59E-10
60 ND 147	3.77E-01	4.35E-01	2.60E-02	0.0	2.54E-01	0.0	2.09E+03
74 W 187	2.96E+02	2.47E+02	8.65E+01	0.0	0.0	0.0	8.10E+04
93 NP 239	2.85E-02	2.80E-03	1.54E-03	0.0	8.74E-03	0.0	5.75E+02

Table A4.0-3
(2 of 2)

Oconee Nuclear Station
Liquid Effluent Dose - Adult Parameters
 A_{air} mrem/hr per $\mu\text{Ci/ml}$

From Generic Section 3.1.1:

A_{air} = the site related ingestion dose commitment factor for an individual of age group, 'a', to the total body or any organ, ' τ ', for each identified principal gamma and beta emitter, mrem/hr per $\mu\text{Ci/ml}$.

$$A_{air} = 1.14\text{E}+05 (U_{aw}/D_w + U_{af}BF_i) DF_{air}$$

where:

$$1.14\text{E}5 = 10^6 \text{ pCi}/\mu\text{Ci} \times 10^3 \text{ ml/kg} \div 8760 \text{ hr/yr.}$$

U_{aw} = Water consumption by age group, ℓ/yr .

infant	330
child	510
teen	510
adult	730

D_w = Dilution factor from the near field area to the potable water intake.

U_{af} = fish consumption by age group, kg/yr.

infant	---
child	6.9
teen	16
adult	21

BF_i = Bioaccumulation factor for radionuclide, 'i', in fish, pCi/kg per pCi/ ℓ , from Table 3.1-1.

DF_{air} = Dose conversion factor for radionuclide, 'i', by age group in pre-selected organ, τ , in mrem/pCi, from Tables 3.1-2, 3.1-3, 3.1-4, and 3.1-5, respectively.

Sample Calculation for Adult, I-131, Thyroid:

$$\begin{aligned} A(\text{Adult, I-131, Thyroid}) &= 1.14\text{E}+05 (730/1.00\text{E}+04 + 21(15)) 1.95\text{E}-03 \\ &= 7.00\text{E}+04 \text{ mrem/hr per } \mu\text{Ci/ml} \end{aligned}$$

TABLE A4.0-4
(1 OF 2)

OCONEE NUCLEAR STATION
LIQUID EFFLUENT DOSE - TEEN PARAMETERS
A(I) MREM/HR PER UCI/ML

RADIONUCLIDE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
1 H 3	0.0	1.75E-01	1.75E-01	1.75E-01	1.75E-01	1.75E-01	1.75E-01
11 NA 24	4.20E+02	4.20E+02	4.20E+02	4.20E+02	4.20E+02	4.20E+02	4.20E+02
24 CR 51	0.0	0.0	1.31E+00	7.30E-01	2.88E-01	1.88E+00	2.21E+02
25 MN 54	0.0	4.30E+03	8.54E+02	0.0	1.28E+03	0.0	8.83E+03
25 MN 56	0.0	1.15E+02	2.05E+01	0.0	1.46E+02	0.0	7.59E+03
26 FE 55	6.89E+02	4.89E+02	1.14E+02	0.0	0.0	3.10E+02	2.12E+02
26 FE 59	1.07E+03	2.50E+03	9.65E+02	0.0	0.0	7.88E+02	5.91E+03
27 CO 58	0.0	8.87E+01	2.04E+02	0.0	0.0	0.0	1.22E+03
27 CO 60	0.0	2.56E+02	5.77E+02	0.0	0.0	0.0	3.34E+03
28 NI 63	3.23E+04	2.28E+03	1.09E+03	0.0	0.0	0.0	3.63E+02
28 NI 65	1.37E+02	1.75E+01	7.95E+00	0.0	0.0	0.0	9.47E+02
29 CU 64	0.0	1.05E+01	4.93E+00	0.0	2.65E+01	0.0	8.14E+02
30 ZN 65	2.10E+04	7.30E+04	3.40E+04	0.0	4.67E+04	0.0	3.09E+04
30 ZN 69	5.36E+01	1.02E+02	7.15E+00	0.0	6.68E+01	0.0	1.88E+02
35 BR 83	0.0	0.0	4.40E+01	0.0	0.0	0.0	0.0
35 BR 85	0.0	0.0	2.34E+00	0.0	0.0	0.0	0.0
37 RB 86	0.0	1.09E+05	5.11E+04	0.0	0.0	0.0	1.61E+04
37 RB 88	0.0	3.11E+02	1.66E+02	0.0	0.0	0.0	2.66E-05
37 RB 89	0.0	2.01E+02	1.42E+02	0.0	0.0	0.0	3.08E-07
38 SR 89	2.41E+04	0.0	6.90E+02	0.0	0.0	0.0	2.87E+03
38 SR 90	2.45E+05	0.0	6.57E+04	0.0	0.0	0.0	1.38E+04
38 SR 91	4.42E+02	0.0	1.76E+01	0.0	0.0	0.0	2.00E+03
38 SR 92	1.67E+02	0.0	7.11E+00	0.0	0.0	0.0	4.25E+03
39 Y 90	6.25E-01	0.0	1.68E-02	0.0	0.0	0.0	5.15E+03
39 Y 91	5.88E-03	0.0	2.25E-04	0.0	0.0	0.0	2.78E-01
39 Y 91	9.17E+00	0.0	2.46E-01	0.0	0.0	0.0	3.76E+03
39 Y 92	5.52E-02	0.0	1.60E-03	0.0	0.0	0.0	1.51E+03
39 Y 93	1.75E-01	0.0	4.79E-03	0.0	0.0	0.0	5.34E+03
40 ZR 95	2.48E-01	7.83E-02	5.39E-02	0.0	1.15E-01	0.0	1.81E+02
40 ZR 97	1.43E-02	2.83E-03	1.30E-03	0.0	4.28E-03	0.0	7.65E+02
41 NB 95	4.50E+02	2.50E+02	1.37E+02	0.0	2.42E+02	0.0	1.07E+06
42 MO 99	0.0	1.10E+02	2.10E+01	0.0	2.52E+02	0.0	1.97E+02
43 TC 99	9.09E-03	2.53E-02	3.28E-01	0.0	3.78E-01	1.41E-02	1.66E+01
43 TC 101	9.85E-03	1.40E-02	1.38E-01	0.0	2.53E-01	8.54E-03	2.39E-09
44 RU 103	4.65E+00	0.0	1.99E+00	0.0	1.64E+01	0.0	3.89E+02
44 RU 105	3.98E-01	0.0	1.54E-01	0.0	5.02E+00	0.0	3.21E+02
44 RU 106	7.15E+01	0.0	9.01E+00	0.0	1.38E+02	0.0	3.43E+03
47 AG 110	8.61E-01	8.15E-01	4.96E-01	0.0	1.55E+00	0.0	2.29E+02
52 TE 125	2.79E+03	1.01E+03	3.74E+02	7.81E+02	0.0	0.0	8.24E+03
52 TE 127	7.06E+03	2.50E+03	8.39E+02	1.68E+03	2.86E+04	0.0	1.76E+04
52 TE 127	1.15E+02	4.09E+01	2.48E+01	7.95E+01	4.67E+02	0.0	8.90E+03
52 TE 129	1.19E+04	4.41E+03	1.88E+03	3.84E+03	4.98E+04	0.0	4.47E+04
52 TE 129	3.27E+01	1.22E+01	7.95E+00	2.33E+01	1.37E+02	0.0	1.79E+02
52 TE 131	1.78E+03	8.54E+02	7.12E+02	1.28E+03	8.90E+03	0.0	6.85E+04
52 TE 131	2.04E+01	8.39E+00	6.36E+00	1.57E+01	8.90E+01	0.0	1.67E+00
52 TE 132	2.55E+03	1.61E+03	1.52E+03	1.70E+03	1.55E+04	0.0	5.11E+04
53 I 130	2.82E+01	8.16E+01	3.26E+01	6.65E+03	1.26E+02	0.0	6.27E+01
53 I 131	1.60E+02	2.24E+02	1.20E+02	6.54E+04	3.86E+02	0.0	4.43E+01
53 I 132	7.64E+00	2.00E+01	7.17E+00	6.73E+02	3.15E+01	0.0	8.70E+00
53 I 133	5.50E+01	9.33E+01	2.85E+01	1.30E+04	1.64E+02	0.0	7.06E+01
53 I 135	1.67E+01	4.30E+01	1.59E+01	2.76E+03	6.79E+01	0.0	4.76E+01
55 CS 134	1.53E+06	3.59E+06	1.67E+06	0.0	1.14E+06	4.36E+05	4.47E+04
55 CS 136	1.57E+05	6.17E+05	4.14E+05	0.0	3.36E+05	5.29E+04	4.96E+04
55 CS 137	2.04E+06	2.72E+06	9.47E+05	0.0	9.25E+05	3.59E+05	3.87E+04
55 CS 138	1.42E+03	2.72E+03	1.36E+03	0.0	2.01E+03	2.33E+02	1.23E+00
56 BA 139	1.01E+00	7.14E-04	2.96E-02	0.0	6.73E-04	4.92E-04	9.05E+00
56 BA 140	2.07E+02	2.54E-01	1.34E+01	0.0	8.62E-02	1.71E-01	3.20E+02
56 BA 141	4.90E-01	3.66E-04	1.64E-02	0.0	3.40E-04	2.50E-04	1.04E-06
56 BA 142	2.18E-01	2.18E-04	1.34E-02	0.0	1.85E-04	1.45E-04	6.70E-13
57 LA 140	1.59E-01	7.80E-02	2.08E-02	0.0	0.0	0.0	4.48E+03
57 LA 142	8.16E-03	3.63E-03	9.03E-04	0.0	0.0	0.0	1.10E+02
58 CE 141	2.43E-02	1.62E-02	1.87E-03	0.0	7.65E-03	0.0	4.65E+01
58 CE 143	4.30E-03	3.13E+00	3.49E-04	0.0	1.40E-03	0.0	9.41E+01
58 CE 144	1.27E+00	5.27E-01	6.84E-02	0.0	3.15E-01	0.0	3.20E+02
59 PR 143	5.97E-01	2.39E-01	2.97E-02	0.0	1.39E-01	0.0	1.97E+03
59 PR 144	1.96E-03	8.03E-04	9.94E-05	0.0	4.61E-04	0.0	2.16E-06
60 ND 147	4.28E-01	4.65E-01	2.79E-02	0.0	2.73E-01	0.0	1.68E+03
74 W 187	3.20E+02	2.60E+02	9.13E+01	0.0	0.0	0.0	7.05E+04
93 NP 239	3.21E-02	3.03E-03	1.68E-03	0.0	9.51E-03	0.0	4.87E+02

Table A4.0-4
(2 of 2)

Oconee Nuclear Station
Liquid Effluent Dose - Teen Parameters
 A_{air} mrem/hr per $\mu\text{Ci/ml}$

From Generic Section 3.1.1:

A_{air} = the site related ingestion dose commitment factor for an individual of age group, 'a', to the total body or any organ, ' τ ', for each identified principal gamma and beta emitter, mrem/hr per $\mu\text{Ci/ml}$.

$$A_{air} = 1.14\text{E}+05 (U_{aw}/D_w + U_{af}BF_i) DF_{air}$$

where:

$$1.14\text{E}5 = 10^6 \text{ pCi}/\mu\text{Ci} \times 10^3 \text{ ml/kg} \div 8760 \text{ hr/yr.}$$

U_{aw} = Water consumption by age group, ℓ/yr .

infant	330
child	510
teen	510
adult	730

D_w = Dilution factor from the near field area to the potable water intake.

U_{af} = fish consumption by age group, kg/yr .

infant	---
child	6.9
teen	16
adult	21

BF_i = Bioaccumulation factor for radionuclide, 'i', in fish, pCi/kg per pCi/ℓ , from Table 3.1-1.

DF_{air} = Dose conversion factor for radionuclide, 'i', by age group in pre-selected organ, τ , in mrem/pCi , from Tables 3.1-2, 3.1-3, 3.1-4, and 3.1-5, respectively.

Sample Calculation for Teen, I-131, Thyroid:

$$\begin{aligned} A(\text{Teen, I-131, Thyroid}) &= 1.14\text{E}+05 (510/1.00\text{E}+04 + 16(15)) 2.39\text{E}-03 \\ &= 6.54\text{E}+04 \text{ mrem/hr per } \mu\text{Ci/ml} \end{aligned}$$

TABLE A4.0-5
(1 OF 2)

OCONEE NUCLEAR STATION
LIQUID EFFLUENT DOSE - CHILD PARAMETERS
A(I) MREM/HR PER UCI/ML

RADIONUCLIDE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
1 H 3	0.0	1.45E-01	1.45E-01	1.45E-01	1.45E-01	1.45E-01	1.45E-01
11 NA 24	4.56E+02	4.56E+02	4.56E+02	4.56E+02	4.56E+02	4.56E+02	4.56E+02
24 CR 51	0.0	0.0	1.40E+00	7.77E-01	2.12E-01	1.42E+00	7.43E+01
25 MN 54	0.0	3.37E+03	8.97E+02	0.0	9.44E+02	0.0	2.83E+03
25 MN 56	0.0	1.05E+02	2.37E+01	0.0	1.27E+02	0.0	1.52E+04
26 FE 55	9.05E+02	4.80E+02	1.49E+02	0.0	0.0	2.71E+02	8.89E+01
26 FE 59	1.30E+03	2.10E+03	1.05E+03	0.0	0.0	6.09E+02	2.19E+03
27 CO 58	0.0	7.08E+01	2.17E+02	0.0	0.0	0.0	4.13E+02
27 CO 60	0.0	2.08E+02	6.14E+02	0.0	0.0	0.0	1.15E+03
28 NI 63	4.23E+04	2.27E+03	1.44E+03	0.0	0.0	0.0	1.53E+02
28 NI 65	1.75E+02	1.64E+01	9.60E+00	0.0	0.0	0.0	2.01E+03
29 CU 64	0.0	9.64E+00	5.82E+00	0.0	2.33E+01	0.0	4.52E+02
30 ZN 65	2.16E+04	5.74E+04	3.57E+04	0.0	3.62E+04	0.0	1.01E+04
30 ZN 69	6.89E+01	9.96E+01	9.20E+00	0.0	6.04E+01	0.0	6.28E+03
35 BR 83	0.0	0.0	5.65E+01	0.0	0.0	0.0	0.0
35 BR 85	0.0	0.0	3.01E+00	0.0	0.0	0.0	0.0
37 RB 86	0.0	1.05E+05	6.48E+04	0.0	0.0	0.0	6.78E+03
37 RB 88	0.0	2.99E+02	2.08E+02	0.0	0.0	0.0	1.47E+01
37 RB 89	0.0	1.84E+02	1.64E+02	0.0	0.0	0.0	1.60E+00
38 SR 89	3.12E+04	0.0	8.90E+02	0.0	0.0	0.0	1.21E+03
38 SR 90	2.67E+05	0.0	7.15E+04	0.0	0.0	0.0	5.41E+03
38 SR 91	5.66E+02	0.0	2.14E+01	0.0	0.0	0.0	1.25E+03
38 SR 92	2.13E+02	0.0	8.54E+00	0.0	0.0	0.0	4.04E+03
39 Y 90	8.08E-01	0.0	2.16E-02	0.0	0.0	0.0	2.30E+03
39 Y 91	7.51E-03	0.0	2.73E-04	0.0	0.0	0.0	1.47E+01
39 Y 91	1.18E+01	0.0	3.17E-01	0.0	0.0	0.0	1.58E+03
39 Y 92	7.08E-02	0.0	2.03E-03	0.0	0.0	0.0	2.05E+03
39 Y 93	2.24E-01	0.0	6.16E-03	0.0	0.0	0.0	3.34E+03
40 ZR 95	3.02E-01	6.63E-02	5.91E-02	0.0	9.50E-02	0.0	6.92E+01
40 ZR 97	1.82E-02	2.63E-03	1.55E-03	0.0	3.77E-03	0.0	3.98E+02
41 NB 95	5.31E+02	2.07E+02	1.48E+02	0.0	1.94E+02	0.0	3.82E+05
42 MO 99	0.0	1.05E+02	2.59E+01	0.0	2.24E+02	0.0	8.66E+01
43 TC 99	1.09E-02	2.14E-02	3.54E-01	0.0	3.10E-01	1.08E-02	1.22E+01
43 TC 101	1.26E-02	1.32E-02	1.68E-01	0.0	2.25E-01	6.99E-03	4.20E-02
44 RU 103	5.75E+00	0.0	2.21E+00	0.0	1.45E+01	0.0	1.49E+02
44 RU 105	5.08E-01	0.0	1.84E-01	0.0	4.46E+00	0.0	3.31E+02
44 RU 106	9.21E+01	0.0	1.15E+01	0.0	1.24E+02	0.0	1.43E+03
47 AG 110	9.78E-01	6.61E-01	5.28E-01	0.0	1.23E+00	0.0	7.86E+01
52 TE 125	3.59E+03	9.72E+02	4.78E+02	1.01E+03	0.0	0.0	3.46E+03
52 TE 127	9.09E+03	2.45E+03	1.08E+03	2.17E+03	2.59E+04	0.0	7.36E+03
52 TE 127	1.48E+02	4.00E+01	3.18E+01	1.03E+02	4.22E+02	0.0	5.79E+03
52 TE 129	1.53E+04	4.28E+03	2.38E+03	4.94E+03	4.50E+04	0.0	1.87E+04
52 TE 129	4.22E+01	1.18E+01	1.00E+01	3.01E+01	1.23E+02	0.0	2.62E+03
52 TE 131	2.27E+03	7.83E+02	8.34E+02	1.61E+03	7.58E+03	0.0	3.18E+04
52 TE 131	2.61E+01	7.96E+00	7.77E+00	2.00E+01	7.90E+01	0.0	1.37E+02
52 TE 132	3.18E+03	1.41E+03	1.70E+03	2.05E+03	1.31E+04	0.0	1.42E+04
53 I 130	3.45E+01	6.96E+01	3.59E+01	7.67E+03	1.04E+02	0.0	3.26E+01
53 I 131	2.03E+02	2.04E+02	1.16E+02	6.75E+04	3.35E+02	0.0	1.82E+01
53 I 132	9.44E+00	1.74E+01	7.98E+00	8.05E+02	2.66E+01	0.0	2.04E+01
53 I 133	6.99E+01	8.64E+01	3.27E+01	1.61E+04	1.44E+02	0.0	3.48E+01
53 I 135	2.07E+01	3.72E+01	1.76E+01	3.29E+03	5.70E+01	0.0	2.83E+01
55 CS 134	1.84E+06	3.02E+06	6.37E+05	0.0	9.36E+05	3.36E+05	1.63E+04
55 CS 136	1.85E+05	5.08E+05	3.29E+05	0.0	2.71E+05	4.04E+04	1.79E+04
55 CS 137	2.57E+06	2.46E+06	3.63E+05	0.0	8.02E+05	2.89E+05	1.54E+04
55 CS 138	1.79E+03	2.49E+03	1.58E+03	0.0	1.75E+03	1.89E+02	1.15E+03
56 BA 139	1.31E+00	6.97E-04	3.78E-02	0.0	6.08E-04	4.10E-04	7.53E+01
56 BA 140	2.62E+02	2.29E-01	1.53E+01	0.0	7.47E-02	1.37E-01	1.33E+02
56 BA 141	6.30E-01	3.53E-04	2.05E-02	0.0	3.05E-04	2.07E-03	3.59E-01
56 BA 142	2.76E-01	1.98E-04	1.54E-02	0.0	1.60E-04	1.17E-04	3.59E-03
57 LA 140	1.99E-01	6.94E-02	2.34E-02	0.0	0.0	0.0	1.94E+03
57 LA 142	1.03E-02	3.29E-03	1.03E-03	0.0	0.0	0.0	6.51E+02
58 CE 141	3.15E-02	1.57E-02	2.33E-03	0.0	6.88E-03	0.0	1.96E+01
58 CE 143	5.54E-03	3.00E+00	4.35E-04	0.0	1.26E-03	0.0	4.40E+01
58 CE 144	1.65E+00	5.17E-01	8.80E-02	0.0	2.86E-01	0.0	1.35E+02
59 PR 143	7.73E-01	2.32E-01	3.84E-02	0.0	1.26E-01	0.0	8.34E+02
59 PR 144	2.54E-03	7.85E-04	1.28E-04	0.0	4.15E-04	0.0	1.69E+00
60 ND 147	5.49E-01	4.45E-01	3.44E-02	0.0	2.44E-01	0.0	7.04E+02
74 W 187	4.05E+02	2.40E+02	1.08E+02	0.0	0.0	0.0	3.37E+04
93 NP 239	4.13E-02	2.97E-03	2.09E-03	0.0	8.58E-03	0.0	2.20E+02

Table A4.0-5
(2 of 2)

Oconee Nuclear Station
Liquid Effluent Dose - Child Parameters
 A_{air} mrem/hr per $\mu\text{Ci/ml}$

From Generic Section 3.1.1:

A_{air} = the site related ingestion dose commitment factor for an individual of age group, 'a', to the total body or any organ, 'r', for each identified principal gamma and beta emitter, mrem/hr per $\mu\text{Ci/ml}$.

$$A_{air} = 1.14\text{E}+05 (U_{aw}/D_w + U_{af}BF_i) DF_{air}$$

where:

$$1.14\text{E}5 = 10^6 \text{ pCi}/\mu\text{Ci} \times 10^3 \text{ ml/kg} \div 8760 \text{ hr/yr.}$$

U_{aw} = Water consumption by age group, $\ell/\text{yr.}$

infant	330
child	510
teen	510
adult	730

D_w = Dilution factor from the near field area to the potable water intake.

U_{af} = fish consumption by age group, kg/yr.

infant	---
child	6.9
teen	16
adult	21

BF_i = Bioaccumulation factor for radionuclide, 'i', in fish, $\text{pCi/kg per pCi}/\ell$, from Table 3.1-1.

DF_{air} = Dose conversion factor for radionuclide, 'i', by age group in pre-selected organ, τ , in mrem/pCi , from Tables 3.1-2, 3.1-3, 3.1-4, and 3.1-5, respectively.

Sample Calculation for Child, I-131, Thyroid:

$$\begin{aligned} A(\text{Child, I-131, Thyroid}) &= 1.14\text{E}+05 (510/1.00\text{E}+04 + 6.9(15)) 5.72\text{E}-03 \\ &= 6.75\text{E}+04 \text{ mrem/hr per } \mu\text{Ci/ml} \end{aligned}$$

TABLE A4.0-6

(1 OF 2)

OCONEE NUCLEAR STATION
LIQUID EFFLUENT DOSE - INFANT PARAMETERS
A(I) MREM/HR PER UCI/ML

RADIONUCLIDE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
1 H 3	0.0	1.16E-03	1.16E-03	1.16E-03	1.16E-03	1.16E-03	1.16E-03
11 NA 24	3.80E-02	3.80E-02	3.80E-02	3.80E-02	3.80E-02	3.80E-02	3.80E-02
24 CR 51	0.0	0.0	5.30E-05	3.46E-05	7.56E-06	6.73E-05	1.55E-03
25 MN 54	0.0	7.49E-02	1.70E-02	0.0	1.66E-02	0.0	2.75E-02
25 MN 56	0.0	3.08E-03	5.30E-04	0.0	2.64E-03	0.0	2.80E-01
26 FE 55	5.23E-02	3.38E-02	9.03E-03	0.0	0.0	1.65E-02	4.29E-03
26 FE 59	1.16E-01	2.02E-01	7.98E-02	0.0	0.0	5.98E-02	9.67E-02
27 CO 58	0.0	1.35E-02	3.38E-02	0.0	0.0	0.0	3.37E-02
27 CO 60	0.0	4.06E-02	9.59E-02	0.0	0.0	0.0	9.67E-02
28 NI 63	2.39E+00	1.47E-01	8.28E-02	0.0	0.0	0.0	7.34E-03
28 NI 65	1.77E-02	2.00E-03	9.10E-04	0.0	0.0	0.0	1.52E-01
29 CU 64	0.0	2.29E-03	1.06E-03	0.0	3.87E-03	0.0	4.70E-02
30 ZN 65	6.92E-02	2.37E-01	1.09E-01	0.0	1.15E-01	0.0	2.01E-01
30 ZN 69	3.51E-04	6.32E-04	4.70E-05	0.0	2.63E-04	0.0	5.15E-02
35 BR 83	0.0	0.0	1.37E-03	0.0	0.0	0.0	0.0
35 BR 85	0.0	0.0	7.30E-05	0.0	0.0	0.0	0.0
37 RB 86	0.0	6.40E-01	3.16E-01	0.0	0.0	0.0	1.64E-02
37 RB 88	0.0	1.87E-03	1.03E-03	0.0	0.0	0.0	1.82E-03
37 RB 89	0.0	1.08E-03	7.41E-04	0.0	0.0	0.0	3.66E-04
38 SR 89	9.44E+00	0.0	2.71E-01	0.0	0.0	0.0	1.94E-01
38 SR 90	4.70E+01	0.0	1.27E+01	0.0	0.0	0.0	8.59E-01
38 SR 91	1.88E-01	0.0	6.81E-03	0.0	0.0	0.0	2.23E-01
38 SR 92	7.22E-02	0.0	2.68E-03	0.0	0.0	0.0	7.79E-01
39 Y 90	3.27E-04	0.0	8.77E-06	0.0	0.0	0.0	4.51E-01
39 Y 91	3.05E-06	0.0	1.04E-07	0.0	0.0	0.0	1.02E-02
39 Y 91	4.25E-03	0.0	1.13E-04	0.0	0.0	0.0	3.05E-01
39 Y 92	2.88E-05	0.0	5.09E-07	0.0	0.0	0.0	5.49E-01
39 Y 93	9.14E-05	0.0	2.49E-06	0.0	0.0	0.0	7.22E-01
40 ZR 95	7.75E-04	1.89E-04	1.34E-04	0.0	2.04E-04	0.0	9.40E-02
40 ZR 97	5.57E-05	9.56E-06	4.36E-06	0.0	9.63E-06	0.0	6.09E-01
41 NB 95	1.58E-04	6.51E-05	3.76E-05	0.0	4.66E-05	0.0	5.49E-02
42 MO 99	0.0	1.28E-01	2.49E-02	0.0	1.91E-01	0.0	4.21E-02
43 TC 99	7.22E-06	1.49E-05	1.92E-04	0.0	1.60E-04	7.79E-06	4.33E-03
43 TC 101	8.54E-06	1.08E-05	1.06E-04	0.0	1.28E-04	5.87E-06	1.83E-03
44 RU 103	5.57E-03	0.0	1.86E-03	0.0	1.16E-02	0.0	6.77E-02
44 RU 105	5.12E-04	0.0	1.72E-04	0.0	3.76E-03	0.0	2.04E-01
44 RU 106	9.07E-02	0.0	1.13E-02	0.0	1.07E-01	0.0	6.88E-01
47 AG 110	3.75E-03	2.73E-03	1.81E-03	0.0	3.91E-03	0.0	1.42E-01
52 TE 125	8.77E-02	2.93E-02	1.19E-02	2.95E-02	0.0	0.0	4.18E-02
52 TE 127	2.20E-01	7.30E-02	2.66E-02	6.36E-02	5.42E-01	0.0	8.88E-02
52 TE 127	3.76E-03	1.26E-03	8.09E-04	3.06E-03	9.18E-03	0.0	7.90E-02
52 TE 129	3.76E-01	1.29E-01	5.79E-02	1.44E-01	9.41E-01	0.0	2.25E-01
52 TE 129	1.07E-03	3.68E-04	2.49E-04	8.95E-04	2.66E-03	0.0	8.54E-02
52 TE 131	5.72E-02	2.30E-02	1.90E-02	4.66E-02	1.58E-01	0.0	3.87E-01
52 TE 131	6.62E-04	2.45E-04	1.86E-04	5.91E-04	1.69E-03	0.0	2.67E-02
52 TE 132	7.82E-02	3.87E-02	3.62E-02	5.72E-02	2.42E-01	0.0	1.43E-01
53 I 130	2.26E-02	4.97E-02	1.99E-02	5.57E+00	5.45E-02	0.0	1.06E-02
53 I 131	1.35E-01	1.59E-01	7.00E-02	5.23E+01	1.86E-01	0.0	5.68E-03
53 I 132	6.24E-03	1.27E-02	4.51E-03	5.94E-01	1.41E-02	0.0	1.03E-02
53 I 133	4.70E-02	6.85E-02	2.01E-02	1.25E+01	8.05E-02	0.0	1.16E-02
53 I 135	1.37E-02	2.72E-02	9.93E-03	2.44E+00	3.04E-02	0.0	9.86E-03
55 CS 134	1.42E+00	2.64E+00	2.67E-01	0.0	6.81E-01	2.79E-01	7.19E-03
55 CS 136	1.73E-01	5.08E-01	1.90E-01	0.0	2.02E-01	4.14E-02	7.71E-03
55 CS 137	1.96E+00	2.30E+00	1.63E-01	0.0	6.17E-01	2.50E-01	7.19E-03
55 CS 138	1.81E-03	2.94E-03	1.43E-03	0.0	1.47E-03	2.29E-04	4.70E-03
56 BA 139	3.31E-03	2.20E-06	9.59E-05	0.0	1.32E-06	1.33E-06	2.10E-01
56 BA 140	6.43E-01	6.43E-04	3.31E-02	0.0	1.53E-04	3.95E-04	1.58E-01
56 BA 141	1.60E-03	1.09E-06	5.04E-05	0.0	6.58E-07	6.66E-07	1.95E-02
56 BA 142	6.92E-04	5.76E-07	3.41E-05	0.0	3.31E-07	3.48E-07	2.86E-03
57 LA 140	7.94E-05	3.13E-05	8.05E-06	0.0	0.0	0.0	3.68E-01
57 LA 142	4.14E-06	1.52E-06	3.64E-07	0.0	0.0	0.0	2.58E-01
58 CE 141	2.96E-04	1.81E-04	2.13E-05	0.0	5.57E-05	0.0	9.33E-02
58 CE 143	5.57E-05	3.69E-02	4.21E-06	0.0	1.08E-05	0.0	2.16E-01
58 CE 144	1.12E-02	4.59E-03	6.28E-04	0.0	1.85E-03	0.0	6.43E-01
59 PR 143	3.06E-04	1.14E-04	1.52E-05	0.0	4.25E-05	0.0	1.61E-01
59 PR 144	1.03E-06	3.99E-07	5.19E-08	0.0	1.44E-07	0.0	1.85E-02
60 ND 147	2.08E-04	2.14E-04	1.31E-05	0.0	8.24E-05	0.0	1.35E-01
74 W 187	3.40E-03	2.36E-03	8.16E-04	0.0	0.0	0.0	1.39E-01
93 NP 239	4.18E-05	3.74E-06	2.11E-06	0.0	7.45E-06	0.0	1.08E-01

Table A4.0-6
(2 of 2)

Oconee Nuclear Station
Liquid Effluent Dose - Infant Parameters
 A_{air} mrem/hr per $\mu\text{Ci/ml}$

From Generic Section 3.1.1:

A_{air} = the site related ingestion dose commitment factor for an individual of age group, 'a', to the total body or any organ, ' τ ', for each identified principal gamma and beta emitter, mrem/hr per $\mu\text{Ci/ml}$.

$$A_{air} = 1.14\text{E}+05 (U_{aw}/D_w + U_{af}BF_i) DF_{air}$$

where:

$$1.14\text{E}5 = 10^6 \text{ pCi}/\mu\text{Ci} \times 10^3 \text{ ml/kg} \div 8760 \text{ hr/yr.}$$

U_{aw} = Water consumption by age group, ℓ/yr .

infant	330
child	510
teen	510
adult	730

D_w = Dilution factor from the near field area to the potable water intake.

U_{af} = fish consumption by age group, kg/yr .

infant	---
child	6.9
teen	16
adult	21

BF_i = Bioaccumulation factor for radionuclide, 'i', in fish, pCi/kg per pCi/ℓ , from Table 3.1-1.

DF_{air} = Dose conversion factor for radionuclide, 'i', by age group in pre-selected organ, τ , in mrem/pCi , from Tables 3.1-2, 3.1-3, 3.1-4, and 3.1-5, respectively.

Sample Calculation for Infant, I-131, Thyroid:

$$\begin{aligned} A(\text{Infant, I-131, Thyroid}) &= 1.14\text{E}+05 (330/1.00\text{E}+04 + 0(15)) 1.39\text{E}-02 \\ &= 5.23\text{E}+01 \text{ mrem/hr per } \mu\text{Ci/ml} \end{aligned}$$

Table A4.0-7 - Meteorological Parameter and Applicable Pathways
Potential Worst-Case Offsite Locations for
Analyzing Offsite Doses from Particulate, Iodine
and Other Radionuclides

Semi-Elevated Release Worst-Case Locations*

	<u>(X/Q)</u>	<u>(D/Q)</u>
	sec/m ³	1/m ²
(1) Inhalation, 1.0 mi, SW	1.672E-6	1.205E-8
(2) Garden, 1.0 mi, NE	9.503E-7	1.295E-8
(3) Meat Animal, 1.75 mi, W	5.214E-7	2.044E-9
(4) Milk Animal, 5.0 mi, NE	9.246E-8	7.067E-10
(5) Combination, 5.0 mi, NE	9.246E-8	7.067E-10

Ground Level Release Worst-Case Locations*

	<u>(X/Q)</u>	<u>(D/Q)</u>
	sec/m ³	1/m ²
(1) Inhalation, 1.0 mi, SE	7.308E-6	1.401E-8
(2) Garden, 1.0 mi, NE	3.886E-6	2.259E-8
(3) Meat Animal, 1.9 mi, ESE	2.407E-6	4.798E-9
(4) Milk Animal, 5.0 mi, NE	1.616E-7	6.235E-10
(5) Combination, 5.0 mi, NE	1.616E-7	6.235E-10

* The Ground Plane, Inhalation, and Vegetable pathways are assumed to exist in each sector for dose calculation purposes. All pathways are assumed to exist at the 5.0-mile boundary in each sector for dose calculation purposes.

TABLE A4.0-8

PATHWAY APPLICABILITY FOR ALL LOCATIONS BASED ON SITE SURVEY*

OCONEE NUCLEAR STATION
(1 of 1)

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	X	X	VI	VI	VI	VI	VI	VI	VI	VIMG
NNE	X	X	VI	VI	VI	VI	VI	VI	VI	VIMG
NE	X	X	VI	VI	VI	VI	VI	VI	VIM	VIMG
ENE	X	X	VI	VI	VI	VI	VIM	VIM	VIM	VIMG
E	X	X	VI	VI	VI	VIM	VIM	VIM	VIM	VIMG
ESE	X	X	VI	VIM	VIM	VIM	VIM	VIM	VIM	VIMG
SE	X	X	VI	VI	VI	VI	VI	VI	VI	VIMG
SSE	X	X	VI	VI	VI	VI	VI	VI	VI	VIMG
S	X	X	VI	VI	VI	VI	VI	VI	VI	VIMG
SSW	X	X	VI	VI	VI	VI	VI	VI	VI	VIMG
SW	X	X	VI	VI	VI	VI	VI	VI	VI	VIMG
WSW	X	X	VI	VI	VI	VI	VI	VI	VI	VIMG
W	X	X	VI	VIM	VIM	VIM	VIM	VIM	VIM	VIMG
WNW	X	X	VI	VI	VI	VI	VI	VI	VIC	VIMG
NW	X	X	VI	VI	VI	VI	VI	VI	VI	VIMG
NNW	X	X	VI	VI	VI	VI	VI	VI	VI	VIMG

PATHWAYS: X - None V - VEGETABLE M - MEAT G - GOAT MILK C - COW MILK I - INHALATION

* The Vegetable and Inhalation pathways are assumed to exist in each sector for dose calculation purposes. All pathways are assumed to exist at the 5.0-mile boundary in each sector for dose calculation purposes.

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FIGURE A4.0-1
(1 of 2)

OCONEE LADTAP INPUT TEMPLATE
FOR LIQUID RADIONUCLIDE RELEASE OFFSITE DOSE CALCULATIONS

***** TOP OF DATA *****

Column -----1-----2-----3-----4-----5-----6-----7--

000001 LADTAP INPUT FOR OCONEE ODCM METHOD - DEFAULT DILUTION

000002 0 6.4E+02 1.0 1 2

000003 / CESIUM BIOACCUMULATION FACTOR ALTERED FROM 2000 TO 10000'

000004 13** A55 10000 E T

000005 1.0

000006 LIQUID RELEASE SOURCE TERMS - CURIES PER RELEASE PERIOD

000007 H 3 0.00E+00

000008 NA24 0.00E+00

000009 CR51 0.00E+00

000010 MN54 0.00E+00

000011 MN56 0.00E+00

000012 FE55 0.00E+00

000013 FE59 0.00E+00

000014 CO58 0.00E+00

000015 CO60 0.00E+00

000016 NI63 0.00E+00

000017 NI65 0.00E+00

000018 CU64 0.00E+00

000019 ZN65 0.00E+00

000020 CN69 0.00E+00

000021 BR83 0.00E+00

000022 BR85 0.00E+00

000023 RB86 0.00E+00

000024 RB88 0.00E+00

000025 RB89 0.00E+00

000026 SR89 0.00E+00

000027 SR90 0.00E+00

000028 SR91 0.00E+00

000029 SR92 0.00E+00

000030 Y 90 0.00E+00

000031 Y 91 M 0.00E+00

000032 Y 91 0.00E+00

000033 Y 92 0.00E+00

000034 Y 93 0.00E+00

000035 ZR95 0.00E+00

000036 ZR97 0.00E+00

000037 NB95 0.00E+00

000038 MO99 0.00E+00

000039 TC99 M 0.00E+00

000040 TC101 0.00E+00

000041 RU103 0.00E+00

000042 RU105 0.00E+00

000043 RU106 0.00E+00

000044 AG110M 0.00E+00

000045 TE125M 0.00E+00

000046 TE127M 0.00E+00

000047 TE127 0.00E+00

000048 TE129M 0.00E+00

000049 TE129 0.00E+00

000050 TE131M 0.00E+00

000051 TE131 0.00E+00

000052 TE132 0.00E+00

FIGURE A4.0-1
(2 of 2)

OCONEE LADTAP INPUT TEMPLATE
FOR LIQUID RADIONUCLIDE RELEASE OFFSITE DOSE CALCULATIONS

Column	1	2	3	4	5	6	7
000053	I 130	0.00E+00					
000054	I 131	0.00E+00					
000055	I 132	0.00E+00					
000056	I 133	0.00E+00					
000057	I 135	0.00E+00					
000058	CS134	0.00E+00					
000059	CS136	0.00E+00					
000060	CS137	0.00E+00					
000061	CS138	0.00E+00					
000062	BA139	0.00E+00					
000063	BA140	0.00E+00					
000064	BA141	0.00E+00					
000065	BA142	0.00E+00					
000066	LA140	0.00E+00					
000067	LA142	0.00E+00					
000068	CE141	0.00E+00					
000069	CE143	0.00E+00					
000070	CE144	0.00E+00					
000071	PR143	0.00E+00					
000072	PR144	0.00E+00					
000073	ND147	0.00E+00					
000074	W 187	0.00E+00					
000075	NP239	0.00E+00					
000076							
000077							
000078		0.2	1.0	1.0	10000.	0.0	0.0
000079							
000080							
000081							
*****	***** BOTTOM OF DATA *****						

FIGURE A4.0-2

OCONEE GASPAR INPUT TEMPLATE

FOR NOBLE GAS RADIONUCLIDE RELEASE WORST-CASE LOCATIONS

```

***** ***** TOP OF DATA *****
=COLS> -----1-----2-----3-----4-----5-----6-----7--
000001 GASPAR INPUT FOR OCONEE ODCM METHOD - MAX NOBLE GAS DOSE CALCULATIONS
000002 0          1.0          0.0          0.0          0.0
000003 1 1
000004          1.0          1.0          1.0          0.76          1.0
000005 SEMI-ELEVATED NOBLE GAS RELEASE SOURCE TERM - CURIES PER RELEASE PERIOD
000006          1.0
000007 AR41          0.00E+00
000008 KR83 M          0.00E+00
000009 KR85          0.00E+00
000010 KR85 M          0.00E+00
000011 KR87          0.00E+00
000012 KR88          0.00E+00
000013 KR89          0.00E+00
000014 XE131M          0.00E+00
000015 XE133          0.00E+00
000016 XE133M          0.00E+00
000017 XE135          0.00E+00
000018 XE135M          0.00E+00
000019 XE137          0.00E+00
000020 XE138          0.00E+00
000021
000022 SEMI-ELEV MAX      SW 1.0      1.672E-06 1.672E-06 1.672E-06 1.205E-08
000023
000024 GROUND LEVEL NOBLE GAS RELEASE SOURCE TERM - CURIES PER RELEASE PERIOD
000025          1.0
000026 AR41          0.00E+00
000027 KR83 M          0.00E+00
000028 KR85          0.00E+00
000029 KR85 M          0.00E+00
000030 KR87          0.00E+00
000031 KR88          0.00E+00
000032 KR89          0.00E+00
000033 XE131M          0.00E+00
000034 XE133          0.00E+00
000035 XE133M          0.00E+00
000036 XE135          0.00E+00
000037 XE135M          0.00E+00
000038 XE137          0.00E+00
000039 XE138          0.00E+00
000040
000041 GROUND MAX          SE 1.0      7.308E-06 7.308E-06 7.308E-06 1.401E-08
000042
***** ***** BOTTOM OF DATA *****

```

FIGURE A4.0-3

OCONEE GASPAR INPUT TEMPLATE

FOR PARTICULATE, IODINE AND OTHER RADIONUCLIDE RELEASE WORST-CASE LOCATIONS

```

***** ***** TOP OF DATA *****
=COLS> -----1-----2-----3-----4-----5-----6-----7--
000001 GASPAR INPUT FOR OCONEE ODCM METHOD - PART, I, AND OTHER - INHALATION
000002 0          1.0          0.0          0.0          0.0
000003 1 1
000004          1.0          1.0          1.0          0.76          1.0
000005 ELEV RELEASE PART, I AND OTHER SOURCES - CURIES PER RELEASE PERIOD
000006          1.0
000007 H 3          0.00E+00
000008 CR51          0.00E+00
000009 MN54          0.00E+00
000010 FE55          0.00E+00
000011 FE59          0.00E+00
000012 CO58          0.00E+00
000013 CO60          0.00E+00
000014 ZN65          0.00E+00
000015 SR89          0.00E+00
000016 SR90          0.00E+00
000017 ZR95          0.00E+00
000018 MO99          0.00E+00
000019 I 131          0.00E+00
000020 I 133          0.00E+00
000021 CS134          0.00E+00
000022 CS136          0.00E+00
000023 CS137          0.00E+00
000024 BA140          0.00E+00
000025 CE141          0.00E+00
000026 CE144          0.00E+00
000027
000028 LOCATION 1          SW 1.0          1.672E-06 1.672E-06 1.672E-06 1.205E-08
000029
000030 GROUND RELEASE PART, I AND OTHER SOURCES - CURIES PER RELEASE PERIOD
000031          1.0
000032 H 3          0.00E+00
000033 CR51          0.00E+00
000034 MN54          0.00E+00
000035 FE55          0.00E+00
000036 FE59          0.00E+00
000037 CO58          0.00E+00
000038 CO60          0.00E+00
000039 ZN65          0.00E+00
000040 SR89          0.00E+00
000041 SR90          0.00E+00
000042 ZR95          0.00E+00
000043 MO99          0.00E+00
000044 I 131          0.00E+00
000045 I 133          0.00E+00
000046 CS134          0.00E+00
000047 CS136          0.00E+00
000048 CS137          0.00E+00
000049 BA140          0.00E+00
000050 CE141          0.00E+00
000051 CE144          0.00E+00
000052
000053 LOCATION 1          SE 1.0          7.308E-06 7.308E-06 7.308E-06 1.401E-08
000054
***** ***** BOTTOM OF DATA *****

```

FIGURE A4.0-3 (Cont'd)

OCONEE GASPAR INPUT TEMPLATE

FOR PARTICULATE, IODINE AND OTHER RADIONUCLIDE RELEASE WORST-CASE LOCATIONS

FOR OTHER LOCATIONS, REPLACE FOLLOWING INPUT LINES:

LOCATION 2 - WORST VEGETABLE GARDEN

000001 GASPAR INPUT FOR OCONEE ODCM METHOD - PART, I, AND OTHER - GARDEN
000002 0 1.0 0.0 0.0 0.0
000028 LOCATION 2 NE 1.00 9.503E-07 9.503E-07 9.503E-07 1.295E-08
000053 LOCATION 2 NE 1.00 3.886E-06 3.886E-06 3.886E-06 2.259E-08

LOCATION 3 - WORST MEAT ANIMAL

000001 GASPAR INPUT FOR OCONEE ODCM METHOD - PART, I, AND OTHER - MEAT
000002 0 1.0 1.0 0.0 0.0
000028 LOCATION 3 W 1.75 5.214E-07 5.214E-07 5.214E-07 2.044E-09
000053 LOCATION 3 ESE 1.90 2.407E-06 2.407E-06 2.407E-06 4.798E-09

LOCATION 4 - WORST MILK ANIMAL

000001 GASPAR INPUT FOR OCONEE ODCM METHOD - PART, I, AND OTHER - MILK
000002 0 1.0 1.0 0.0 1.0
000028 LOCATION 4 NE 5.00 9.246E-08 9.246E-08 9.246E-08 7.067E-10
000053 LOCATION 4 NE 5.00 1.616E-07 1.616E-07 1.616E-07 6.235E-10

LOCATION 5 - WORST COMBINATION

000001 GASPAR INPUT FOR OCONEE ODCM METHOD - PART, I, AND OTHER - COMBINATION
000002 0 1.0 1.0 0.0 1.0
000028 LOCATION 5 NE 5.00 9.246E-08 9.246E-08 9.246E-08 7.067E-10
000053 LOCATION 5 NE 5.00 1.616E-07 1.616E-07 1.616E-07 6.235E-10

Figure A4.0-4 (Cont.d) - Fuel Cycle Dose Calculation Worksheet for Organ Doses
All Age Groups

Maximum Organ Dose ***

Organ = _____
Age Group = _____
Dose = _____ mrem/yr

Meteorological Parameters Used to Evaluate Airborne Pathway Doses:

- [1] Semi-elevated evaluation location for Inhalation is 1.0 mi, SW
 $\overline{X/Q} = 1.672\text{E-}06 \text{ sec/m}^3$, $\overline{D/Q} = 1.205\text{E-}08 \text{ 1/m}^2$
Ground Level evaluation location for Inhalation is 1.0 mi, SE
 $\overline{X/Q} = 7.308\text{E-}06 \text{ sec/m}^3$, $\overline{D/Q} = 1.401\text{E-}08 \text{ 1/m}^2$
- [2] Semi-elevated evaluation location for the Garden is 1.0 mi, NE
 $\overline{X/Q} = 9.503\text{E-}07 \text{ sec/m}^3$, $\overline{D/Q} = 1.295\text{E-}08 \text{ 1/m}^2$
Ground Level evaluation location for the Garden is 1.0 mi, NE
 $\overline{X/Q} = 3.886\text{E-}06 \text{ sec/m}^3$, $\overline{D/Q} = 2.259\text{E-}08 \text{ 1/m}^2$
- [3] Semi-elevated evaluation location for Meat Animal is 1.75 mi, W
 $\overline{X/Q} = 5.214\text{E-}07 \text{ sec/m}^3$, $\overline{D/Q} = 2.044\text{E-}09 \text{ 1/m}^2$
Ground Level evaluation location for Meat Animal is 1.90 mi, ESE
 $\overline{X/Q} = 2.407\text{E-}06 \text{ sec/m}^3$, $\overline{D/Q} = 4.798\text{E-}09 \text{ 1/m}^2$
- [4] Semi-elevated evaluation location for Milk/Comb. is 5.0 mi, NE
 $\overline{X/Q} = 9.246\text{E-}08 \text{ sec/m}^3$, $\overline{D/Q} = 7.067\text{E-}10 \text{ 1/m}^2$
Ground Level evaluation location for Milk/Comb. is 5.0 mi, NE
 $\overline{X/Q} = 1.616\text{E-}07 \text{ sec/m}^3$, $\overline{D/Q} = 6.235\text{E-}10 \text{ 1/m}^2$

Notes:

- * Fuel cycle dose for age group a and organ o at analyzed limiting food pathway locations ($D_{a,o}(l_o) + D_{a,o}(g_e) + D_{a,o}(g_g)$).
- ** Limiting dose estimates for each organ for age group a (maximums of "Total*" values calculated for Locations 1 through 5).
- *** Limiting dose estimate for any organ or age group (maximum of "Total" value calculated for any age group)

Figure A4.0-4 (Cont'd) - Fuel Cycle Dose Calculation Worksheet For Organ
Doses

Teen Age Group

Liquid Pathway Organ Doses $D_{a,o}(l_o)$

Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
_____	_____	_____	_____	_____	_____	_____

Airborne Pathway Organ Doses $D_{a,o}(g_e)$ and $D_{a,o}(g_g)$ - Particulate, Iodine and
Other Radionuclides with $T_{1/2} > 8$ Days

Location 1 - Worst-case Inhalation Location [1]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev	_____	_____	_____	_____	_____	_____	_____
Ground	_____	_____	_____	_____	_____	_____	_____
Total*	_____	_____	_____	_____	_____	_____	_____

Location 2 - Worst-Case Vegetable Garden Location [2]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev	_____	_____	_____	_____	_____	_____	_____
Ground	_____	_____	_____	_____	_____	_____	_____
Total*	_____	_____	_____	_____	_____	_____	_____

Location 3 - Worst-case Meat Animal Location [3]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev	_____	_____	_____	_____	_____	_____	_____
Ground	_____	_____	_____	_____	_____	_____	_____
Total*	_____	_____	_____	_____	_____	_____	_____

Locations 4 and 5 - Worst-case Milk/Combination Location [4]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev	_____	_____	_____	_____	_____	_____	_____
Ground	_____	_____	_____	_____	_____	_____	_____
Total*	_____	_____	_____	_____	_____	_____	_____

Teen Organ Maximums**

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Total	_____	_____	_____	_____	_____	_____	_____

Figure A4.0-4 (Cont'd) - Fuel Cycle Dose Calculation Worksheet For Organ Doses

Child Age Group

Liquid Pathway Organ Doses $D_{a,o}(l_o)$

Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
_____	_____	_____	_____	_____	_____	_____

Airborne Pathway Organ Doses $D_{a,o}(g_e)$ and $D_{a,o}(g_g)$ - Particulate, Iodine and Other Radionuclides with $T_{1/2} > 8$ Days

Location 1 - Worst-case Inhalation Location [1]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev	_____	_____	_____	_____	_____	_____	_____
Ground	_____	_____	_____	_____	_____	_____	_____
Total*	_____	_____	_____	_____	_____	_____	_____

Location 2 - Worst-Case Vegetable Garden Location [2]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev	_____	_____	_____	_____	_____	_____	_____
Ground	_____	_____	_____	_____	_____	_____	_____
Total*	_____	_____	_____	_____	_____	_____	_____

Location 3 - Worst-case Meat Animal Location [3]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev	_____	_____	_____	_____	_____	_____	_____
Ground	_____	_____	_____	_____	_____	_____	_____
Total*	_____	_____	_____	_____	_____	_____	_____

Locations 4 and 5 - Worst-case Milk/Combination Location [4]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev	_____	_____	_____	_____	_____	_____	_____
Ground	_____	_____	_____	_____	_____	_____	_____
Total*	_____	_____	_____	_____	_____	_____	_____

Child Organ Maximums**

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Total	_____	_____	_____	_____	_____	_____	_____

Figure A4.0-4 (Cont'd) - Fuel Cycle Dose Calculation Worksheet For Organ Doses

Infant Age Group

Liquid Pathway Organ Doses $D_{a,o}(l_o)$

Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
------	-------	--------	---------	--------	------	--------

Airborne Pathway Organ Doses $D_{a,o}(g_e)$ and $D_{a,o}(g_g)$ - Particulate, Iodine and Other Radionuclides with $T_{1/2} > 8$ Days

Location 1 - Worst-case Inhalation Location [1]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev							
Ground							
Total*							

Location 2 - Worst-Case Vegetable Garden Location [2]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev							
Ground							
Total*							

Location 3 - Worst-case Meat Animal Location [3]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev							
Ground							
Total*							

Locations 4 and 5 - Worst-case Milk/Combination Location [4]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev							
Ground							
Total*							

Infant Organ Maximums**

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Total							

Figure A4.0-4 - Fuel Cycle Dose Calculation Worksheet For Organ Doses

Adult Age Group

Liquid Pathway Organ Doses $D_{a,o}(l_o)$

Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
_____	_____	_____	_____	_____	_____	_____

Airborne Pathway Organ Doses $D_{a,o}(g_e)$ and $D_{a,o}(g_g)$ - Particulate, Iodine and Other Radionuclides with $T_{1/2} > 8$ Days

Location 1 - Worst-case Inhalation Location [1]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev	_____	_____	_____	_____	_____	_____	_____
Ground	_____	_____	_____	_____	_____	_____	_____
Total*	_____	_____	_____	_____	_____	_____	_____

Location 2 - Worst-Case Vegetable Garden Location [2]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev	_____	_____	_____	_____	_____	_____	_____
Ground	_____	_____	_____	_____	_____	_____	_____
Total*	_____	_____	_____	_____	_____	_____	_____

Location 3 - Worst-case Meat Animal Location [3]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev	_____	_____	_____	_____	_____	_____	_____
Ground	_____	_____	_____	_____	_____	_____	_____
Total*	_____	_____	_____	_____	_____	_____	_____

Locations 4 and 5 - Worst-case Milk/Combination Location [4]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev	_____	_____	_____	_____	_____	_____	_____
Ground	_____	_____	_____	_____	_____	_____	_____
Total*	_____	_____	_____	_____	_____	_____	_____

Adult Organ Maximums**

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Total	_____	_____	_____	_____	_____	_____	_____

Figure A4.0-4 (Cont'd) - Fuel Cycle Dose Calculation Worksheet For Organ Doses

Teen Age Group

Liquid Pathway Organ Doses $D_{a,o}(l_o)$

Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
------	-------	--------	---------	--------	------	--------

Airborne Pathway Organ Doses $D_{a,o}(g_e)$ and $D_{a,o}(g_g)$ - Particulate, Iodine and Other Radionuclides with $T_{1/2} > 8$ Days

Location 1 - Worst-case Inhalation Location [1]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev							
Ground							
Total*							

Location 2 - Worst-Case Vegetable Garden Location [2]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev							
Ground							
Total*							

Location 3 - Worst-case Meat Animal Location [3]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev							
Ground							
Total*							

Locations 4 and 5 - Worst-case Milk/Combination Location [4]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev							
Ground							
Total*							

Teen Organ Maximums**

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Total							

Figure A4.0-4 (Cont'd) - Fuel Cycle Dose Calculation Worksheet For Organ Doses

Child Age Group

Liquid Pathway Organ Doses $D_{a,o}(l_o)$

Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
------	-------	--------	---------	--------	------	--------

Airborne Pathway Organ Doses $D_{a,o}(g_e)$ and $D_{a,o}(g_g)$ - Particulate, Iodine and Other Radionuclides with $T_{1/2} > 8$ Days

Location 1 - Worst-case Inhalation Location [1]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev							
Ground							
Total*							

Location 2 - Worst-Case Vegetable Garden Location [2]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev							
Ground							
Total*							

Location 3 - Worst-case Meat Animal Location [3]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev							
Ground							
Total*							

Locations 4 and 5 - Worst-case Milk/Combination Location [4]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev							
Ground							
Total*							

Child Organ Maximums**

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Total							

Figure A4.0-4 (Cont'd) - Fuel Cycle Dose Calculation Worksheet For Organ Doses

Infant Age Group

Liquid Pathway Organ Doses $D_{a,o}(l_o)$

Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
------	-------	--------	---------	--------	------	--------

Airborne Pathway Organ Doses $D_{a,o}(g_e)$ and $D_{a,o}(g_g)$ - Particulate, Iodine and Other Radionuclides with $T\ 1/2 > 8$ Days

Location 1 - Worst-case Inhalation Location [1]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev							
Ground							
Total*							

Location 2 - Worst-Case Vegetable Garden Location [2]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev							
Ground							
Total*							

Location 3 - Worst-case Meat Animal Location [3]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev							
Ground							
Total*							

Locations 4 and 5 - Worst-case Milk/Combination Location [4]

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
S-Elev							
Ground							
Total*							

Infant Organ Maximums**

	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Total							

Figure A4.0-4 (Cont.d) - Fuel Cycle Dose Calculation Worksheet for Organ Doses

All Age Groups

Maximum Organ Dose ***

Organ = _____
Age Group = _____
Dose = _____ mrem/yr

Meteorological Parameters Used to Evaluate Airborne Pathway Doses:

- [1] Semi-elevated evaluation location for Inhalation is 1.0 mi, SW
 $\overline{X/Q} = 1.672E-06 \text{ sec/m}^3$, $\overline{D/Q} = 1.205E-08 \text{ 1/m}^2$
Ground Level evaluation location for Inhalation is 1.0 mi, SE
 $\overline{X/Q} = 7.308E-06 \text{ sec/m}^3$, $\overline{D/Q} = 1.401E-08 \text{ 1/m}^2$
- [2] Semi-elevated evaluation location for the Garden is 1.0 mi, NE
 $\overline{X/Q} = 9.503E-07 \text{ sec/m}^3$, $\overline{D/Q} = 1.295E-08 \text{ 1/m}^2$
Ground Level evaluation location for the Garden is 1.0 mi, NE
 $\overline{X/Q} = 3.886E-06 \text{ sec/m}^3$, $\overline{D/Q} = 2.259E-08 \text{ 1/m}^2$
- [3] Semi-elevated evaluation location for Meat Animal is 1.75 mi, W
 $\overline{X/Q} = 5.214E-07 \text{ sec/m}^3$, $\overline{D/Q} = 2.044E-09 \text{ 1/m}^2$
Ground Level evaluation location for Meat Animal is 1.90 mi, ESE
 $\overline{X/Q} = 2.407E-06 \text{ sec/m}^3$, $\overline{D/Q} = 4.798E-09 \text{ 1/m}^2$
- [4] Semi-elevated evaluation location for Milk/Comb. is 5.0 mi, NE
 $\overline{X/Q} = 9.246E-08 \text{ sec/m}^3$, $\overline{D/Q} = 7.067E-10 \text{ 1/m}^2$
Ground Level evaluation location for Milk/Comb. is 5.0 mi, NE
 $\overline{X/Q} = 1.616E-07 \text{ sec/m}^3$, $\overline{D/Q} = 6.235E-10 \text{ 1/m}^2$

Notes:

- * Fuel cycle dose for age group a and organ o at analyzed limiting food pathway locations ($D_{a,o}(l_o) + D_{a,o}(g_e) + D_{a,o}(g_g)$).
- ** Limiting dose estimates for each organ for age group a (maximums of "Total" values calculated for Locations 1 through 5).
- *** Limiting dose estimate for any organ or age group (maximum of "Total" value calculated for any age group)

A5.0 RADIOLOGICAL ENVIRONMENTAL MONITORING

The radiological environmental monitoring program shall be conducted in accordance with Selected Licensee Commitment 16.11-6.

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 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. However, some ground water sampling is performed to verify this.

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 land-use census data is used to identify the worst-case location for a particular ingestion pathway (milk, meat, etc.). Environmental monitoring measurements taken from the identified worst-case locations are then used to perform dose calculations that serve as a verification of the dose calculations that are performed for technical specification and licensee commitment (i.e., Compliance) purposes.

The dates of the land-use census that were used to identify the controlling receptor sample locations were 07/04/94 - 07/07/94.

The 1994 land-use census did not identify any locations where environmental monitoring samples are required but were not available for collection.

TABLE A5.0-1
(1 of 1)

OCONEE RADIOLOGICAL MONITORING PROGRAM SAMPLING LOCATIONS
(TLD LOCATIONS)

SAMPLING LOCATION DESCRIPTION *			SAMPLING LOCATION DESCRIPTION *		
020	SITE BOUNDARY	(0.1 MILES N)	040	4-5 MILE RADIUS	(4.5 MILES E)
021	SITE BOUNDARY	(0.3 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	(0.4 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	(0.4 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	(0.3 MILES WSW)	051	4-5 MILE RADIUS	(4.5 MILES NNW)
032	SITE BOUNDARY	(0.2 MILES WNW)	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	(0.2 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	(9.4 MILES WSW)
039	4-5 MILE RADIUS	(4.0 MILES ENE)	059	SPECIAL INTEREST	(9.2 MILES NW)
			076	SITE BOUNDARY	(0.2 MILES W)

* All sampling locations are collected quarterly

TABLE -2
(1 of 1)
OCONEE RADIOLOGICAL MONITORING PROGRAM SAMPLING LOCATIONS
(OTHER SAMPLING LOCATIONS)

CODE:

W - Weekly (≤ 7 days)
SM - Semimonthly (≤ 15 days)
M - Monthly (≤ 31 days)
SA - Semiannually (≤ 184 days)

		Air Radioiodines and Particulates	Surface Water	Drinking Water	Shoreline Sediment	Milk	Fish	Broadleaf Vegetation
-----SAMPLING LOCATION DESCRIPTION-----								
028	Site Boundary (0.5 miles S)							M
060	New Greenville Water Intake Rd. (2.6 miles NNE) *	W		M			SA	M
062	Lake Keowee/Hydro Intake (0.8 mile ENE) (CONTROL)		M					
063	Lake Hartwell - Hwy 183 Bridge (0.8 mile ESE) (000.7)		M		SA		SA	
064	Seneca (6.7 miles SW) (004.1) (CONTROL)			M				
066	Anderson (19.0 miles SSE) (012)			M				
067	Lawrence Ramsey Bridge, Hwy 27 (4.2 miles SSE) (005.2)				SA		SA	
068	High Falls County Park (2.0 miles W) (CONTROL)				SA			
069	Orr's Dairy (4.5 miles WNW) (002.1)					SM		
071	Clemson Dairy (10.3 miles SSE) (006.3)					SM		
073	Tamassee Dar School (9.2 miles NW) (CONTROL)	W						M
074	Keowee Key Resort (2.3 miles NNW)	W						
077	Skimmer Wall (1.0 mile SW)	W						M
078	Recreation Site (0.6 mile WSW)	W						
079	Keowee Dam (0.5 mile NE)	W						M
080	Martin's Dairy (19.0 miles SSE)					SM		

* Control for Fish only

TABLE A5.0-3
(1 of 1)

OCONEE RADIOLOGICAL MONITORING PROGRAM ANALYSES

<u>SAMPLE MEDIUM</u>	<u>ANALYSIS SCHEDULE</u>	<u>ANALYSES</u>				
		<u>GAMMA ISOTOPIC</u>	<u>TRITIUM</u>	<u>LOW LEVEL I-131</u>	<u>GROSS BETA</u>	<u>TLD</u>
1. Air Radioiodine and Particulates	Weekly	X				
2. Direct Radiation	Quarterly					X
3. Surface Water	Monthly Quarterly Composite	X		X		
4. Drinking Water	Monthly Quarterly Composite	X		X		X
5. Shoreline Sediment	Semiannually	X				
6. Milk	Semimonthly		X		X	
7. Fish	Semiannually	X				
8. Broadleaf Vegetation	Monthly	X				

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