2.0 GASEOUS RELEASES METHODOLOGY

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2.1 Gaseous Effluent Model Assumptions

Description of Site - (The FUSAR contains the official description of the site characteristics. The description that follows is a brief summary for dose calculation purposes only). The St. Lucie Plant is located on an island surrounded on two sides by the Atlantic Ocean and the Indian River, an estuary of the Atlantic Ocean. Private property adjoins the plant site in the north and south directions. A meteorological tower is located north of the plant near the site property line. There are 16 sectors, for dose calculation purposes, divided into 22.5° each. The MET tower is calibrated such that a zero degree bearing coincides with TRUE NORTH. A bearing of zero degrees dissects the north sector such that bearings of 348.75° and 11.25° define the boundaries of the north sector. The nearest distance to private property occurs in the north sector at approximately 0.97 miles. For ease of calculation, this 0.97 mile radius is assumed in all directions, although the real Unrestricted Area Boundary is defined in Figure 5.1-1 of the TS. Doses calculated over water areas do not apply to Controls or the annual report and may be listed as O.W. (over water) in lieu of performing calculations. The 0.97 mile range in the NW sector is O.W., but it was chosen as the worst sector for conservative dose calculations using the historical MET data.

Historical MET Data - MET data, between September 1, 1976 and August 31, 1978, from the St. Lucie MET Tower was analyzed by Dames & Moore of Washington, D.C. The methodology used by Dames & Moore was consistent with methods suggested by Regulatory Guide 1.111, Revision 1. Recirculation correction factors were also calculated for the St. Lucie Site and are incorporated into the historical MET tables (Tables M5, M6 and M7) in Appendix A of this manual. It was determined that these two years are representative data for this locale.

Dose Calculations - Dose calculations for Control dose limits are normally calculated using historical MET data and receptor location(s) which yield calculated doses no lower than the real location(s) experiencing the most exposure. Actual MET data factors are calculated and are normally used in dose calculations for the annual reports. Approximate and conservative methods may be used in lieu of actual meteorological measurements.

Live MET data and hour-by-hour dose calculations are beyond the scope of this manual. Historical information and conservative receptor locations, etc., are only used for ease of Control dose limit calculations. Dose calculations for Control dose limits may be performed using actual MET data and real receptor locations. Any dose calculations performed with actual data should note the source of the data in the annual report. Actual MET data reduction should be performed in accordance with Regulatory Guide 1.111, Revision 1 and should incorporate Recirculation Correction Factors from Table M-4 of this manual.

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2.1 (continued)

Dose Calculations - (continued)

The St. Lucie site uses the long term ground release model for all gaseous effluents. Only those radionuclides that appear in the gaseous effluent dose factor tables will be considered in any dose calculations. Radioiodines are defined as Iodine-131 and I-133 for application to Controls. Other nuclides of Iodine may be included in dose calculations for ease of performing calculations, but their dose contribution does not have to be included in the Control requirements. Land Census information will apply to the calendar year following the year that the census was taken in to avoid splitting quarters, etc.

2.2 Determining the Total Body and Skin Dose Rates for Noble Gas Releases And Establishing Setpoints for Effluent Monitors

Discussion - Control 3.11.2.1 limits the dose rate from noble gases in airborne releases to <500 mrem/yr - total body and <3000 mrem/yr - skin. Control 3.3.3.11 requires that the gaseous radioactive effluent monitoring instrumentation be operable with alarm/trip setpoints set to ensure that these dose rate limits are not exceeded. The results of the sampling and analysis program of Control Table 4.11-2 are used to demonstrate compliance with these limits.

The following calculation method is provided for determining the dose rates to the total body and skin from noble gases in airborne releases. The alarm/trip setpoints are based on the dose rate calculations. The Controls apply to all airborne releases on the site but all releases may be treated as if discharged from a single release point. Only those noble gases appearing in Table G-2 will be considered. The calculation methods are based on Sections 5.1 and 5.2 of NUREG-0133, November 1978. The equations are:

For TOTAL BODY Dose Rate:

$$DR_{TB} = \sum_{i}^{n} K_i \, (X/Q) \, (Q \; DOT)_i$$

For TOTAL SKIN Dose Rate:

$$DR_{skin} = \sum_{i}^{n} [L_i + 1.1 \; M_i] \, (X/Q) \, (Q \; DOT)_i$$

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2.2 (continued)

Where:

DR_{TB} = total body dose rate from noble gases in airborne releases (mrem/yr)

DR_{skin} = skin dose rate from noble gases in airborne releases (mrem/yr)

$\sum_{i}^{n}$ = a mathematical symbol to signify the operations to the right of the symbol are to be performed for each noble gas nuclide (i) through (n) and the individual nuclide doses are summed to arrive at the total dose rate for the release source.

K_i = the total body dose factor due to gamma emissions for each noble gas nuclide reported in the release source. (mrem-m^3/μCi-yr)

L_i = the skin dose factor due to beta emissions for each noble gas nuclide (i) reported in the assay of the release source. (mrem-m^3/μCi-yr)

M_i = the air dose factor due to gamma emissions for each noble gas nuclide (i) reported in the assay of the release source. The constant 1.1 converts mrad to mrem since the units of M_i are in (mrad-m^3/μCi-yr)

(X/Q) = for ground level, the highest calculated annual long term historic relative concentration for any of the 16 sectors, at or beyond the exclusion area boundary (sec/m^3)

$(Q\ DOT)_i$ = The release rate of noble gas nuclide (i) in μCi/sec from the release source of interest

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2.2 (continued)

1. Setpoint Determination

A. To comply with Control 3.3.3.10, the alarm/trip setpoints are established to ensure that all noble gas releases in progress do not exceed the ODCM Control 3.11.2.1 noble gas release rate limit for the site. Using pre-ODCM Revision 0 data, the total body dose was determined to be more limiting than the calculated skin dose, therefore the site release rate limit of total body dose rate of 500 mrem/yr has been determined to be equivalent to 3.5E+05 uCi/sec being released from the site. Using 3.5E+05 uCi/sec as the equivalent of 100 percent of the site limit, each release point on site may be allotted a portion of the 100 percent, such that the sum of all release point portions allotted shall be less than or equal to 100 percent. The release point's actual monitor setpoint shall take into account the physical release characteristics of maximum expected volume release rate and its percent allotment for a single release point since uCi/sec is proportional to volume rate. The ODCM actual release points and an example of percent allotments is provided:

Site Limit in Percent = 100%
Site Limit in uCi/sec = 3.5E+05 uCi/sec

ODCM Release Point	**(Example)** Percent Allotment
Unit 1 Plant Vent	40
Unit 1 Fuel Bldg. Vent	5
ECCS 1A	1
ECCS 1B	1
Unit 2 Plant Vent	40
Unit 2 Fuel Bldg. Vent	5
ECCS 2A	1
ECCS 2B	1
Blowdown Bldg. Vent	+ 5
Total Percent Allocated=	99 or 1 percent below the Site Limit

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2.2 (continued)

1. (continued)

A. (continued)

More or less percentage may be used for a release point, but the sum of the total percent allocated to the above Release Points shall never be allowed to exceed 100 percent. The ECCS Reactor Auxiliary Building Exhaust are not ODCM required monitored release points, but a small percentage should be allotted to each to cover short periodic fan surveillance runs. This allocation is controlled per Chemistry Procedure COP-07.05, Process Monitor Setpoints where Chemistry Supervisor approval is required. COP-07.05 provides calculation steps to calculate a Noble Gas Release Rate Setpoint based on the methodology steps described below. A release point's percent allotment will be converted into the release point's indicating engineering unit of uCi/cc that will be equivalent to the allocated portion of the site limit.

1. Obtain the release point's maximum expected process flow release rate **(V)** in Cubic Feet per Minute (cfm) from the Effluent Supervisor.

2. Obtain the release point's percent of site limit allotment **(PA)** from the Chemistry Supervisor.

3. Substitute the release point's **V** and **PA** values into the below equation(s) to obtain the Release Point's Setpoint (SP) in the desired engineering unit (uCi/cc or uCi/sec).

$$\frac{SP}{uCi/cc} = \frac{3.5E+05\ uCi}{sec} \times \frac{60\ sec}{min} \times \frac{min}{\mathbf{V}\ ft3} \times \frac{ft3}{28317\ cc} \times \frac{\mathbf{PA}}{100\%}$$

SP = _____ uCi/cc which is the TABLE 3.3-14 HIGH SETPOINT for
uCi/cc ODCM Effluent Gas Channels that have a "Allotted % of Site Limit" declared as their HIGH SETPOINT.

$$\frac{SP}{uCi/sec} = \frac{3.5E+05\ uCi}{sec} \times \frac{PA}{100\%}$$

SP = _____ uCi/sec
uCi/sec

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2.2 (continued)

1. (continued)

A. (continued)

In the case of Unit 2 Plant Vent there are 3 ODCM Effluent Gas Channels Monitoring the Plant Vent. The wide range channel 624 HIGH SETPOINT in uCi/sec is equivalent to 2A PV PIG LOW RANGE GAS and 2B PIG LOW RANGE GAS channel 624 uses the equivalent uCi/sec based on the uCi/cc at the maximum expected process flow rate. Since they are monitoring the same release point (i.e., each of these channels does not receive their own allotted % of the Site Limit).

4. The significance of an ODCM Effluent Gas Channel that has a "Allotted % of Site Limit" HIGH Setpoint requires further discussion (Mid and High Noble Gas Accident Channels are not part of this discussion):

a. For Plant Vent Release Points on each reactor unit, the "Allotted % of Site Limit" needs to be high enough to allow for Batch Releases from Gas Decay Tank and Containment Venting Operations, and at the same time COP-01.06, Processing Gaseous Waste shall provide instruction for administratively controlling Batch Releases such that the radioactive concentration and release rate will not be allowed to exceed the site limit at any time.

b. The receipt of a valid HIGH Alarm on a release point where the ODCM Low Range Gas Channel's radioactivity is approximately equal to the HIGH Alarm setpoint does not mean the site limit has been exceeded, rather it is at a concentration that is equivalent to the "Allotted % of Site Limit".

setpoint in uCi/cc V or Vmax ft3/minute vent flow

$$\text{SP} = \text{uCi/sec (equivalent)} = \frac{\text{uCi}}{\text{cc}} \times \frac{28317\ \text{cc}}{\text{ft3}} \times \frac{\text{Vmax ft3}}{\text{minute}} \times \frac{\text{minute}}{60\ \text{second}}$$

$$\text{SP} = \text{(uCi/sec)} = \frac{\text{uCi}}{\text{sec}}$$ equivalent to a channel indicating a uCi/cc concentration assuming a volume release rate of V or Vmax.

$$\text{SP} = \text{(\% of Site Limit)} = \frac{\text{uCi}}{\text{(above) sec}} \times \frac{100}{350{,}000\ \text{uCi/sec}} = \text{\_\_\_\_\_ \% of Site Limit}$$

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2.2 (continued)

1. (continued)

A. (continued)

4. (continued)

c. The receipt of a valid HIGH Alarm on a release point where the ODCM Low Range Gas Channel's radioactivity is greater than the HIGH Alarm setpoint may quickly be estimated based on:

$F_{SL} = RP_{SL}$ + (Sum of all other Release Point's RP_{SL} on site)

RP_{SL} = Rel Pt's Channel's uCi/cc x Rel Pt's Release Rate (V) x volume conv. const. x time conv. const. x 1/(site limit)

$$RP_{SL} = \frac{uCi}{cc} \times \frac{V\ ft^3}{min} \times \frac{28317\ cc}{ft_3} \times \frac{min}{60\ sec} \times \frac{sec}{3.5E{+}05\ uCi}$$

Where:
F_{SL} = Fraction of the Site Limit
RP_{SL} = Fraction of a Release Point's contribution to the site limit (Sum of all other Release Point's RP_{SL} on site) is normally less than 0.10 under normal operating conditions.
V = in ft^3/min, the Release Point's actual process Volume flow release rate

A value of RP_{SL} >1.0 or a F_{SL} >1.0 would be exceeding the Site Limit Based on the above estimate. Off Normal Procedure allow 1 hour to obtain a grab sample of the Release Point so that the actual site limit situation may be evaluated. This method is discussed in the following step.

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2.2 (continued)

1. (continued)

A. (continued)

5. To quantify the Release Point's actual Noble Gas Dose Rate, the following would need to be performed:

a. A Noble Gas Activity Grab Sample would be obtained and analyzed to determine each Noble Gas Isotopic concentration.

b. The results would be used to perform calculations per ODCM Step 2.2.2 for Noble Gas Total Body Dose Rate and Skin Dose Rate.

c. If the Release Point's HIGH Alarms were received on the Table 3.3-14 ODCM Related Particulate and/or Iodine Channel, then ODCM Step 2.3 calculations should be performed as soon as possible after the continuous collection medium(s) and a Tritium Sample can be pulled and analyzed to evaluate compliance with ODCM Control 3.11.2.1.b.

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2.2 (continued)

1. (continued)

B. No Particulate or Iodine Radioactivity Channels are required by the ODCM. Table 3.3-13 requires Iodine and Particulate Samplers only. Technical Specification Table 3.3-6 requires a Fuel Building Vent Particulate Channel (the bases for the setpoint on the Fuel Building Vent Particulate Channel is described in 2.2.1.C). The FUSAR does describe Particulate and Iodine Radioactivity Channels. These Channels are listed in ODCM Table 3.3-14 and ALERT and HIGH Setpoints are provided. The intent of providing these setpoints is to provide early warning that the effluent pathway conditions have increased such that a grab sample should be obtained if a HIGH Alarm Setpoint is reached or exceeded. The Particulate and Iodine HIGH Alarm Setpoint bases is that the collection mediums are fixed filter where continuing deposition of radioactivity would cause a increase in the channel count rate up to the setpoint level(s), the resulting dose rate can be shown to be less than 1 percent of the site limit for ODCM Control 3.11.2.1.b for Iodine-131, Iodine-133, and all radionuclides in particulate from with half-lives greater than 8 days, is that these channel detectors are gross activity monitors of the scintillation type where the count rate is not dependent (above threshold) on the energy of the isotope entrained on the collection medium, and that these channels are qualitative trend indicators since the channel count rate cannot be corrected for the accrued sample collection volume. Plant historical trends have shown that Noble Gas Activity may contribute to the count rate of the Reactor Auxiliary Building (Plant) Vent Particulate and Iodine Channel(s). In this event the Noble Gas contribution may be added to the Table 3.3-14 Alert and High Setpoints for Plant Vents only.

The sampling mediums associated with the Particulate and Iodine Channels in Table 3.3-14 are also controlled by the requirements of ODCM Table 4.11-2 which requires 4/M Minimum Analysis Frequency of the sampling mediums. These analysis are used to confirm and quantify the isotopic composition of the radioactivity being monitored by these channels. The presence of Noble Gas on collection medium would be confirmed by these analysis.

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2.2 (continued)

1. (continued)

B. (continued)

If an alarm occurs, Channel Check(s) should be performed on these channel(s), an ALERT Alarm should be investigated and a HIGH Alarm shall require isotopic analysis of particulate and/or iodine channel medium of the affected channel(s). The Isotopic analysis of the medium shall be used to evaluate particulate and/or iodine dose rate levels per the methodology of ODCM 2.3.

C. To comply with Technical Specification 3.3.3.1, Table 3.3-6 Radiation Monitoring Instrumentation, "Instrument 2.a.ii. Particulate Activity", with Alarm/Trip Setpoint determined and set in accordance with the requirements of the Offsite Dose Calculation Manual, the following is the BASES for Fuel Building Particulate Channel High Alarm Setpoints for Unit 1 and Unit 2:

Unit 1 Fuel Building:
The 10,000 cpm High Setpoint is based on an Infant's Maximum Exposed Organ Dose Rate (Liver) from Inhalation of Cs-137 at the Site Boundary. The value of 10,000 cpm is very conservative relative to the site dose rate limit of 1500 mrem/yr. The methodology is based on measured particulate channel count rates when the detector was calibrated with a known source activity of Cs-137, and on default assumptions as follows:

1. The particulate channel read 32,385 ccpm when exposed to a 7.67 uCi source of Cs-137.

2. Assuming that 7.67 uCi of Cs-137 were collected during 1 hour of skid sample collection (fixed filter), the typical sample volume would yield ~3.3E+06 cc's. Greater than 99% sample filter efficiency is assumed.

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2.2 (continued)

1. (continued)

C. (continued)

3. The maximum building process flow exhaust is ~24,576 cfm.

4. Q(dot) for Cs-137 uCi/sec release rate is approximately 27 uCi/sec as follows:

$$\frac{7.67\ \text{uCi}}{\text{hour}} \times \frac{\text{hour}}{3.3\text{E+06cc.s}} \times \frac{28317\ \text{cc's}}{\text{ft3}} \times \frac{24576\ \text{ft3}}{\text{min}} \times \frac{\text{min}}{60\ \text{sec}} = \frac{27\ \text{uCi}}{\text{sec}}$$

5. The default historical (X/Q)d for the worst sector (NW) at the site boundary is 1.3E-06 meters/sec.

6. The dose rate (equivalent to 10,000 cpm) is calculated per ODCM Section 2.3 Inhalation Dose Rate to an Infant. The resulting dose rates yield.

Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	W.Body
mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr
7.4E+00	7.9E+00	0.0E+00	4.2E-01	1.0E+00	1.5E-02	4.8E-01

7. The ODCM 3.11.2.1.b dose rate limit to any organ is 1500 mrem/yr. From the preceding calculation the Infant's Liver is the maximum exposed organ at 0.52 percent of the site dose rate limit.

8. A particulate channel setpoint of 10,000 cpm provides a conservative setpoint given that this channel analyzes gross activity on a fixed filter, Cs-137 is a typical long-lived fission product present at all times with spent fuel in the pool, and that sample collection intervals shorter than 1 hour would provide adequate warning response if significant particulate activity were being released, i.e., the above assumptions assume a Cs-137 activity of ~2.3E-06 uCi/cc.

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2.2 (continued)

1. (continued)

C. (continued)

9. The setpoint of 10,000 cpm was administratively chosen to provide early detection/alarm of a problem. The above dose rate calculations are provided to document that the particulate channel is capable of detection sensitivities to insure compliance with the ODCM site limit. Grab samples should be performed to accurately calculate actual releases associated with real high alarm events as per the ODCM methodology for performing dose rate calculations.
(End of Unit 1 Fuel Building evaluation)

Unit 2 Fuel Building:
The 10,000 cpm High Setpoint is based on an Infant's Maximum Exposed Organ Dose Rate (Liver) from Inhalation of Cs-137 at the Site Boundary. The value of 10,00 cpm is very conservative relative to the site dose rate limit of 1500 mrem/yr. The methodology is based on measured particulate channel count rates when the detector was calibrated with a known source activity of Cs-137, and on default assumptions as follows:

1. The particulate channel read 39,782 ccpm when exposed to a 7.59 uCi source of Cs-137 (decayed to June 19, 1996 data).

2. Assuming that 7.59 uCi of Cs-137 were collected during 1 hour of skid sample collection (fixed filter), the typical sample volume would yield ~5.32E+06 cc's. Greater than 99% sample filter efficiency is assumed.

3. The maximum building process flow exhaust is ~31,584 cfm.

4. Q(dot) for Cs-137 uCi/sec release rate is approximately 21 uCi/sec as follows:

$$\frac{7.59\ \text{uCi}}{\text{hour}} \times \frac{\text{hour}}{5.32\text{E+06cc.s}} \times \frac{28317\ \text{cc's}}{\text{ft3}} \times \frac{31584\ \text{ft3}}{\text{min}} \times \frac{\text{min}}{60\ \text{sec}} = \frac{21.26\ \text{uCi}}{\text{sec}}$$

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2.2 (continued)

1. (continued)

C. (continued)

5. The default historical (X/Q)d for the worst sector (NW) at the site boundary is 1.3E-06 meters/sec.

6. The dose rate (equivalent to 10,000 cpm) is calculated per ODCM Section 2.3 Inhalation Dose Rate to an Infant. The resulting dose rates yield.

Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	W.Body
mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr
4.8E+00	5.08E+00	0.0E+00	2.7E-01	7.0E-01	1.0E-02	3.1E-01

7. The ODCM 3.11.2.1.b dose rate limit to any organ is 1500 mrem/yr. From the preceding calculation the Infant's Liver is the maximum exposed organ at 0.34 percent of the site dose rate limit.

8. A particulate channel setpoint of 10,000 cpm provides a conservative setpoint given that this channel analyzes gross activity on a fixed filter, Cs-137 is a typical long-lived fission product present at all times with spent fuel in the pool, and that sample collection intervals shorter than 1 hour would provide adequate warning response if significant particulate activity were being released, i.e., the above assumptions assume a Cs-137 activity of ~1.4E-06 uCi/cc.

9. The setpoint of 10,000 cpm was administratively chosen to provide early detection/alarm of a problem. The above dose rate calculations are provided to document that the particulate channel is capable of detection sensitivities to insure compliance with the ODCM site limit. Grab samples should be performed to accurately calculate actual releases associated with real high alarm events as per the ODCM methodology for performing dose rate calculations.

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2.2 (continued)

2. Total Body and Skin Nuclide Specific Dose Rate Calculations

The following outline provides a step-by-step explanation of how the total body dose rate is calculated on a nuclide-by-nuclide basis to evaluate compliance with Control 3.11.2.1. This method is only used if the actual releases exceed the value of 3.5×10^5 µCi/sec.

A. The (X/Q) value =_____sec/m^3 and_____is the most limiting sector at the exclusion area. (See Table M-1 for value and sector.)

B. Enter the release rate in ft^3/min of the release source and convert it to:

$$= \frac{(\quad)ft^3}{\text{min}} \times \frac{2.8317 \times 10^4 cc}{ft^3} \times \frac{\text{min}}{60 \text{ sec}}$$

= cc/sec volume release rate

C. Solve for$(Q\ DOT)_i$ for nuclide (i) by obtaining the µCi/cc assay value of the release source and multiplying it by the product of 2.2.2.B above.

$(Q\ DOT)_i$ = (nuclide [i])

$$\frac{(assay) \quad \mu Ci}{cc} \times \frac{(2.2.2.B\ value)\ cc}{\text{sec}}$$

$(Q\ DOT)_i$ = µCi/sec for nuclide (i)

D. To evaluate the total body dose rate obtain the K_i value for nuclide (i) from Table G-2.

E. Solve for DR_{TBi}

$$DR_{TBi} = K_i(X/Q)\ (Q\ DOT)_i = \frac{mrem\text{-}m^3}{\mu Ci\text{-}yr} \times \frac{\text{sec}}{m^3} \times \frac{\mu Ci}{\text{sec}}$$

DR_{TBi} = $\frac{\text{mrem}}{\text{yr}}$ total body dose from nuclide (i) for the specified release source

2.2 (continued)

2. (continued)

F. To evaluate the skin dose rate, obtain the L_i and M_i values from Table G-2 for nuclide (i).

G. Solve for $DR_{skin\ i}$

$$DR_{skin\ i} = [L_i + 1.1\ M_i]\ (X/Q)(Q\ DOT)_i$$

$DR_{skin\ i}$ = $\frac{\text{mrem}}{\text{yr}}$ skin dose from nuclide (i) for the specified release source

H. Repeat steps 2.2.2.D through 2.2.2.G for each noble gas nuclide (i) reported in the assay of the release source.

I. The Dose Rate to the Total Body from radioactive noble gas gamma radiation from the specified release source is:

$$DR_{TB} = \sum_{i}^{n} DR_{TBi}$$

J. The Dose Rate to the skin from noble gas radiation from the specified release source is:

$$DR_{skin} = \sum_{i}^{n} DR_{skin\ i}$$

The dose rate contribution of this release source shall be added to all other gaseous release sources that are in progress at the time of interest. Refer to in-plant procedures and logs to determine the Total Dose Rate to the Total Body and Skin from noble gas effluents.

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2.3 Determining the Radioiodine & Particulate Dose Rate to Any Organ From Gaseous Releases

Discussion - Control 3.11.2.1 limits the dose rate from I-131, I-133, tritium and all radionuclides in particulate form with half lives >eight days to ≤1500 mrem/yr to any organ. The following calculation method is provided for determining the dose rate from radioiodines (see 2.1) and particulates and is based on Section 5.2.1 and 5.2.1.1 through 5.2.1.3 in NUREG-0133, November 1978. The Infant is the controlling age group in the inhalation, ground plane and cow/goat milk pathways, which are the only pathways considered for releases. The long term $(X/Q)_D$ (depleted) and (D/Q) values are based on historical MET data prior to implementing Appendix I. Only those nuclides that appear on their respective table will be considered. The equations are:

For Inhalation Pathway (excluding H-3):

$$DR_{I\&8DP_T} = \sum_i^n R^*_{i_T} (X/Q)_D (Q\ DOT)_I$$

For Ground Plane:

$$DR_{I\&8DP_T} = \sum_i^n P_{i_T} (D/Q)(Q\ DOT)_I$$

For Grass-Cow/Goat-Milk:

$$DR_{I\&8DP_T} = \sum_i^n R^*_{i_T} (D/Q)(Q\ DOT)_I$$

For Tritium Releases (Inhalation & Grass-Cow/Goat-Milk):

$$DR_{H3_T} = R^*_{H\text{-}3_T} (X/Q)_D (Q\ DOT)_{H\text{-}3}$$

* Normally should be Pi_T, but Ri_T values are the same, thus use Ri_T tables in Appendix A.

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2.3 (continued)

For Total Dose Rate from I & 8DP and H-3 To An Infant Organ T:

$$DR_T = \sum_Z [DR_{I\&8DP_T} + DR_{H\text{-}3_T}]$$

Where:

T = The organ of interest for the infant age group

z = The applicable pathways

$DR_{I\&8DP_T}$ = Dose Rate in mrem/yr to the organ T from iodines and 8 day particulates

$DR_{H\text{-}3T}$ = Dose Rate in mrem/yr to organ T from Tritium

DR_T = Total Dose Rate in mrem/yr to organ T from all pathways under consideration

$\sum_i^n$ = A mathematical symbol to signify the operations to the right of the symbol are to be performed for each nuclide (i) through (n) and the individual nuclide dose rates are summed to arrive at the total dose rate from the pathway.

$\sum_Z$ = A mathematical symbol to indicate that the total dose rate D_T to organ T is the sum of each of the pathways dose rates

R_i = The dose factor for nuclide (i) for organ T for the pathway specified (units vary by pathway)

P_i = The dose factor for instantaneous ground plane pathway in units of $\frac{\text{mrem-m}^2 \text{ sec}}{\mu\text{Ci-yr}}$

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2.3 (continued)

From an evaluation of the radioactive releases and environmental pathways, the grass-cow/goat-milk pathway has been identified as the most limiting pathway with the infant's thyroid being the critical organ. This pathway typically contributes >90% of the total dose received by the infant's thyroid and the radioiodine contribute essentially all of this dose. Therefore, it is possible to demonstrate compliance with the release rate limit of Control 3.11.2.1 for radioiodines and particulates by only evaluating the infant's thyroid dose for the release of radioiodines via the grass-cow/goat-milk pathway. The calculation method of Section 2.3.3 is used for this determination. If this limited analysis approach is used, the dose calculations for other radioactive particulate matter and other pathways need not be performed. Only the calculations of Section 2.3.3 for the radioiodines need be performed to demonstrate compliance with the Control dose rate limit.

The calculations of Sections 2.3.1, 2.3.2, 2.3.4 and 2.3.5 may be omitted. The dose rate calculations as specified in these sections are included for completeness and are to be used only for evaluating unusual circumstances where releases of particulate materials other than radioiodines in airborne releases are abnormally high. The calculations of Sections 2.3.1, 2.3.2, 2.3.4 and 2.3.5 will typically be used to demonstrate compliance with the dose rate limit of Control 3.11.2.1 for radioiodines and particulates when the measured releases of particulate material (other than radioiodines and with half lives >8 days) are >10 times the measured releases of radioiodines.

1. The Inhalation Dose Rate Method:

NOTE
The H-3 dose is calculated as per 2.3.4.

A. The controlling location is assumed to be an Infant located in the _____ sector at the _____ mile range. The $(X/Q)_D$ for this location is _____ sec/m^3. This value is common to all nuclides. (See Table M-2 for value, sector and range.)

B. Enter the release rate in ft^3/min of the release source and convert to cc/sec.

$$= \frac{ft^3}{\text{min}} \; X \; \frac{2.8317 \; X \; 10^4 cc}{ft^3} \; X \; \frac{\text{min}}{60 \text{ sec.}} = cc/\text{sec}$$

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2.3 (continued)

1. (continued)

C. Solve for $(Q\ DOT)_i$ for nuclide (i) by obtaining the µCi/cc assay value of the release source activity and multiplying it by the product of 2.3.1.B above.

$$(Q\ DOT)_i = \frac{(nuclide\ [i]\ assay)\ \mu Ci}{cc} \times \frac{(Value\ 2.3.1.B)\ cc}{\text{sec}}$$

$(Q\ DOT)_i$ = µCi/sec for nuclide (i)

D. Obtain the R_i value from Table G-5 for the organ T.

E. Solve for DR_i

$$DR_{iT} = R_{iT}\ (X/Q)_D\ (Q\ DOT)_i = \frac{mrem\text{-}m^3}{\mu Ci\text{-}yr} \times \frac{\text{sec}}{m^3} \times \frac{\mu Ci}{\text{sec}}$$

DR_{iT} = $\frac{\text{mrem}}{\text{yr}}$ The Dose Rate to organ T from nuclide (i)

F. Repeat steps 2.3.1.C through 2.3.1.E for each nuclide (i) reported in the assay of the release source.

G. The Dose Rate to the Infants organ T from the Inhalation Pathway is:

$$DR_{Inhalation_T} = DR_1 + DR_2 + \_\_\_\_\_ + DR_n$$

for all nuclides except H-3. This dose rate shall be added to the other pathways as per 2.3.5 - Total Organ Dose.

NOTE
Steps 2.3.1.C through 2.3.1.G need to be completed for each organ T of the Infant.

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2.3 (continued)

2. The Ground Plane Dose Rate Method:

NOTE
Tritium dose via the ground plane is zero.

A. The controlling location is assumed to be an Infant located in the _____ sector at the _____ mile range. The (D/Q) for this location is _____ $1/m^2$. This value is common to all nuclides. (See Table M-2 for sector, range and value.)

B. Enter the release rate in ft^3/min of the release source and convert to cc/sec.

$$= \frac{ft^3}{\text{min}} \; X \; \frac{2.8317 \; X \; 10^4 cc}{ft^3} \; X \; \frac{\text{min}}{60 \text{ sec.}} = cc/\text{sec}$$

C. Solve for $(Q\ DOT)_i$ for nuclide (i) by obtaining the µCi/cc assay value from the release source activity and multiplying it by the product of 2.3.2.B above.

$$(Q\ DOT)_i = \frac{(nuclide\ [i]\ assay)\ \mu Ci}{cc} \; X \; \frac{(Value\ 2.3.2.B)\ cc}{\text{sec}}$$

$(Q\ DOT)_i$ = µCi/sec for nuclide (i)

D. Obtain the P_i value from Table G-3

E. Solve for DR_i

$$DR_i = P_{iT}\ (D/Q)\ (Q\ DOT)_i = \frac{mrem\text{-}m^2 \text{ - sec}}{\mu Ci\text{-}yr} \; X \; \frac{1}{m^2} \; X \; \frac{\mu Ci}{\text{sec}}$$

$DR_i = \frac{\text{mrem}}{\text{yr}}$ The Dose Rate to organ T from nuclide (i)

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2.3 (continued)

2. (continued)

F. Repeat steps 2.3.2.C through 2.3.2.E for each nuclide (i) reported in the assay of the release source.

G. The Dose Rate to the Infant's Whole Body from the Ground Plane Pathway is:

$$DR_{Gr\ Pl} = DR_1 + DR_2 + \_\_\_\_\_ + DR_n$$

for all nuclides. This dose rate shall be added to the other pathways as per 2.3.5.

3. The Grass-Cow/Goat-Milk Dose Rate Method:

NOTE
H-3 dose is calculated as per 2.3.4.

A. The controlling animal was established as a _____ located in the _____ sector at _____ miles. The (D/Q) for this location is _____ $1/m^2$. This value is common to all nuclides. (See Table M-3 for sector, range and value.)

B. Enter the anticipated release rate in ft^3/min of the release source and convert to cc/sec.

$$= \frac{\_\_\_\_\_ ft^3}{\text{min}} \times \frac{2.8317 \times 10^4 cc}{ft_3} \times \frac{\text{min}}{60 \text{ sec.}} = cc/\text{sec}$$

C. Solve for $(Q\ DOT)_i$ for nuclide (i) by obtaining the µCi/cc assay value of the release source activity and multiplying it by the product of 2.3.3.B above.

$$(Q\ DOT)_i = \frac{(nuclide\ [i]\ assay)\ \mu Ci}{cc} \times \frac{(value\ 2.3.3.B)\ cc}{\text{sec}}$$

$(Q\ DOT)_i$ = µCi/sec for nuclide (i)

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2.3 (continued)

3. (continued)

D. Obtain the R_i value from Table G-6(7) (whichever is the controlling animal, cow/goat, for infant).

If the limited analysis approach is being used, limit the calculation to the infant thyroid.

E. Solve for DR_{iT}

$$DR_{iT} = R_{iT}\ (D/Q)\ (Q\ DOT)_i = \frac{mrem\text{-}m^2 - sec}{\mu Ci\text{-}yr} \times \frac{1}{m^2} \times \frac{\mu Ci}{sec}$$

$DR_{iT} = \frac{mrem}{yr}$ the Dose Rate to organ T from nuclide (i)

F. Repeat steps 2.3.3.C through 2.3.3.E for each nuclide (i) reported in the assay of the release source.

Only the radioiodines need to be included if the limited analysis approach is being used.

G. The Dose Rate to the Infant's organ T from Grass-_____-Milk pathway is:

DR_{grass}-_____-$Milk_T$ = $DR_1 + DR_2 +$ _____ + DR_n

for all nuclides. This dose rate shall be added to the other pathways as per 2.3.5 - Total Organ Dose.

NOTE
Steps 2.3.3.C through 2.3.3.G need to be completed for each organ of the Infant. Limit the calculation to the infant thyroid if the limited analysis approach is being used.

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2.3 (continued)

4. The H-3 Dose Rate Method:

A. The controlling locations and their $(X/Q)_D$ values for each pathway are:

Inhalation - Infant at _____ range in the _____ sector.

$(X/Q)_D$ = sec/m^3 (See Table M-2 for range, sector and value)

Ground Plane - Does not apply to H-3

Grass-Cow/Goat-Milk-_____ located in the _____ sector at _____miles with an Infant at the exclusion area in the _____ sector drinking the milk. The $(X/Q)_D$ for the _____ location is $(X/Q)_D$ = _____ sec/m^3. (From Table M-6 at the range and sector corresponding to the location of the Milk Animal above.)

B. Enter the anticipated release rate in ft^3/min of the release source and convert it to cc/sec.

$$= \frac{\text{\_\_\_\_\_}}{\text{min}} ft^3 \; X \; \frac{2.8317 \; X \; 10^4 \; cc}{ft^3} \; X \; \frac{\text{min}}{60 \text{ sec.}}$$

= cc/sec volume release rate

C. Solve for $(Q\ DOT)_{H\text{-}3}$ for Tritium, by obtaining the µCi/cc assay value of the release source and multiplying it by the product of 2.3.4.B above.

$$(Q\ DOT)_{H\text{-}3} = \frac{(H\text{-}3) \; \mu Ci}{cc} \; X \; \frac{(2.3.4.B \text{ value}) \; cc}{\text{sec}}$$

$(Q\ DOT)_{H\text{-}3}$ = µCi/sec activity release rate

D. Obtain the Tritium dose factor (R_i) for Infant organ T from:

PATH	TABLE #
Inhalation	G-5
Grass-Cow/Goat-Milk	G-6(7)

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2.3 (continued)

4. (continued)

E. Solve for D_{H-3} (Inhalation) using the $(X/Q)_D$ for inhalation from 2.3.4.A and R_{H-3} (Inhalation) from 2.3.4.D.

$$DR_{H\text{-}3_{Inh_T}} = R_{H\text{-}3}\ (X/Q)_D\ (Q\ DOT)_{H\text{-}3}$$

$DR_{H\text{-}3_{Inh_T}}$ = *mrem/yr from H-3 Infant Inhalation for organ T*

F. Solve for D_{H-3} (Grass-_____-Milk) using the $(X/Q)_D$ for Grass-_____-Milk from 2.3.4.A and R_{H-3} (Grass-_____-Milk) from 2.3.4.D

$$DR_{H\text{-}3_{G\ M_T}} = R_{H\text{-}3_{G\ M_T}}\ (X/Q)_D\ (Q\ DOT)_{H\text{-}3}$$

$DR_{H\text{-}3_{G\ M_T}}$ = *mrem/yr from H-3 Infant*

G. Repeat steps 2.3.4.D through 2.3.4.F for each Infant organ T of interest.

H. The individual organ dose rates from H-3 shall be added to the other organ pathway dose rates as per 2.3.5.

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2.3 (continued)

5. Determining the Total Organ Dose Rate from Iodines, 8D-Particulates, and H-3 from Release Source(s)

A. The following table describes all the pathways that must be summed to arrive at the total dose rate to an organ T:

PATHWAY	DOSE RATE	STEP # REF.
Inhalation (I&8DP)		2.3.1.G
Ground Plane (I&8DP)	(Whole Body only)	2.3.2.G
Gr-_____Milk (I&8DP)		2.3.3.G
Inhalation (H-3)		2.3.4.E
Gr-_____-Milk (H-3)		2.3.4.F
DR_T=	(sum of above)	

B. Repeat the above summation for each Infant organ T.

C. The DR_T above shall be added to all other release sources on the site that will be in progress at any instant. Refer to in-plant procedures and logs to determine the Total DR_T to each organ.

2.4 Determining the Gamma Air Dose for Radioactive Noble Gas Release Source(s)

Discussion - Control 3.11.2.2 limits the air dose due to noble gases in gaseous effluents for gamma radiation to <5 mrads for the quarter and to <10 mrads in any calendar year. The following calculation method is provided for determining the noble gas gamma air dose and is based on section 5.3.1 of NUREG-0133, November 1978. The dose calculation is independent of any age group. The equation may be used for Control dose calculation, the dose calculation for the annual report or for projecting dose, provided that the appropriate value of (X/Q) is used as outlined in the detailed explanation that follows. The equation for gamma air dose is:

$$D_\gamma\text{-}air = \sum_{i}^{n} 3.17\ X\ 10^{-8}\ M_i\ (X/Q)\ Q_i$$

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2.4 (continued)

Where:

D_γ-air = gamma air dose in mrad from radioactive noble gases.

Σ = A mathematical symbol to signify the operations to the right side of the symbol are to be performed for each nuclide (i) through (n) and summed to arrive at the total dose, from all nuclides reported during the interval. No units apply.

3.17×10^{-8} = the inverse of the number of seconds per year with units of year/sec.

M_i = the gamma air dose factor for radioactive noble gas nuclide (i) in units of $\frac{\text{mrad-m}^3}{\mu\text{Ci-yr}}$

(X/Q) = the long term atmospheric dispersion factor for ground level releases in units of sec/m^3. The value of (X/Q) is the same for all nuclides (i) in the dose calculation, but the value of (X/Q) does vary depending on the Limiting Sector the Control is based on, etc.

Q_i = the number of micro-curies of nuclide (i) released (or projected) during the dose calculation exposure period. (e.g., month, quarter or year)

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2.4 (continued)

The following steps provide a detailed explanation of how the radionuclide specific dose is calculated.

1. To determine the applicable (X/Q) refer to Table M-1 to obtain the value for the type of dose calculation being performed. (i.e., Quarterly Control or Dose Projection for examples). This value of (X/Q) applies to each nuclide (i).

2. Determine (M_i) the gamma air dose factor for nuclide (i) from Table G-2.

3. Obtain the micro-Curies of nuclide (i) from the in-plant radioactive gaseous waste management logs for the sources under consideration during the time interval.

4. Solve for D_i as follows:

$$D_i = \frac{3.17 \times 10^{-8}\ yr}{\text{sec}} \times \frac{M_i\ mrad\text{-}m^3}{\mu Ci\text{-}yr} \times \frac{(X/Q)\ \text{sec}}{m^3} \times \frac{Q_i\ \mu Ci}{1}$$

D_i = mrad = the dose from nuclide (i)

5. Perform steps 2.4.2 through 2.4.4 for each nuclide (i) reported during the time interval in the source.

6. The total gamma air dose for the pathway is determined by summing the D_i dose of each nuclide (i) to obtain D_γ-air dose.

$D_{\gamma\text{-air}} = D_1 + D_2 + \_\_\_\_\_ + D_n$ = mrad

7. Refer to in-plant procedures for comparing the calculated dose to any applicable limits that might apply.

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2.5 Determining the Beta Air Dose for Radioactive Noble Gas Releases

Discussion - Control 3.11.2.2 limits the quarterly air dose due to beta radiation from noble gases in gaseous effluents to <10 mrads in any calendar quarter and <20 mrads in any calendar year. The following calculation method is provided for determining the beta air dose and is based on Section 5.3.1 of NUREG-0133, November 1978. The dose calculation is independent of any age group. The equation may be used for Control dose calculation, dose calculation for annual reports or for projecting dose, provided that the appropriate value of (X/Q) is used as outlined in the detailed explanation that follows.

The equation for beta air dose is:

$$D_{B\text{-}air} \sum_{i}^{n} = 3.17 \ X \ 10^{-8} N_i (X/Q) \ Q_i$$

Where:

$D_{B\text{-}air}$ = beta air dose in mrad from radioactive noble gases.

$\sum_{i}^{n}$ = a mathematical symbol to signify the operations to the right side of the symbol are to be performed for each nuclide (i) through (n) and summed to arrive at the total dose, from all nuclides reported during the interval. No units apply.

3.17×10^{-8} = the inverse of the number of seconds per year with units of year/sec.

N_i = the beta air dose factor for radioactive noble gas nuclide (i) in units of $\frac{\text{mrad-m}^3}{\mu\text{Ci-yr}}$

(X/Q) = the long term atmospheric dispersion factor for ground level releases in units of sec/m^3. The value of (X/Q) is the same for all nuclides (i) in the dose calculation, but the value of (X/Q) does vary depending on the Limiting Sector the Control is based on, etc.

Q_i = the number of micro-Curies of nuclide (i) released (or projected) during the dose calculation exposure period

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2.5 (continued)

The following steps provide a detailed explanation of how the dose is calculated.

1. To determine the applicable (X/Q) refer to Table M-1 to obtain the value for the type of dose calculation being performed (i.e., quarterly Control or Dose projection for examples). This value of (X/Q) applies to each nuclide (i).

2. Determine (N_i) the beta air dose factor for nuclide (i) from Table G-2.

3. Obtain the micro-curies of nuclide (i) from the in-plant radioactive gaseous waste management logs for the source under consideration during the time interval.

4. Solve for D_i as follows:

$$D_i = \frac{3.17 \times 10^{-8}\ yr}{\text{sec}} \times \frac{N_i\ mrad\text{-}m^3}{\mu Ci\text{-}yr} \times \frac{(X/Q)\ \text{sec}}{M^3} \times \frac{Q_i\ \mu Ci}{1}$$

D_i = mrad = the dose from nuclide (i)

5. Perform steps 2.5.2 through 2.5.4 for each nuclide (i) reported during the time interval in the release source.

6. The total beta air dose for the pathway is determined by summing the D_i dose of each nuclide (i) to obtain $D_{B\text{-}air}$ dose.

$D_{B\text{-}air} = D_1 + D_2$ _____ $+ D_n$ = mrad

7. Refer to in-plant procedures for comparing the calculated dose to any applicable limits that might apply.

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2.6 Determining the Radioiodine and Particulate Dose To Any Age Group's Organ From Cumulative Releases

Discussion - Control 3.11.2.3 limits the dose to the whole body or any organ resulting from the release of I-131, I-133, tritium and particulates with half-lives >8 days to ≤7.5 mrem during any calendar quarter and ≤15 mrem during any calendar year. The following calculation method is provided for determining the critical organ dose due to releases of radioiodines and particulates and is based on Section 5.3.1 of NUREG-0133, November 1978. The equations can be used for any age group provided that the appropriate dose factors are used and the total dose reflects only those pathways that are applicable to the age group. The Effluent Supervisor will track which age group is the controlling (most restrictive) age group (see control 3.11.2.6.c). The $(X/Q)_D$ symbol represents a DEPLETED-(X/Q) which is different from the Noble Gas (X/Q) in that $(X/Q)_D$ takes into account the loss of I&8DP and H-3 from the plume as the semi-infinite cloud travels over a given distance. The (D/Q) dispersion factor represents the rate of fallout from the cloud that affects a square meter of ground at various distances from the site. The I&8DP and H-3 notations refer to I-131, I-133 Particulates having half-lives >8 days and Tritium. For ease of calculations, dose from other Iodine nuclides may be included (see 2.1). Tritium calculations are always based on $(X/Q)_D$. The first step is to calculate the I&8DP and H-3 dose for each pathway that applies to a given age group. The total dose to an organ can then be determined by summing the pathways that apply to the receptor in the sector. The infant age group does not apply to Grass-Cow-Meat or Vegetation pathway dose since they are assumed to eat only milk.

The equations are:

For Inhalation Pathway (excluding H-3):

$$D_{I\&8DP_T} = \sum_{i}^{n} 3.17\ X\ 10^{-8} R_i\ (X/Q)_D Q_i$$

For Ground Plane, Grass-Cow/Goat-Milk, Grass-Cow/Goat-Milk, or Vegetation

$$D_{I\&8DP_T} = \sum_{i}^{n} 3.17\ X\ 10^{-8} R_i\ (D/Q) Q_i$$

For each pathway above (excluding Ground Plane) For Tritium:

$$D_{H\text{-}3_T} = 3.17\ X\ 10^{-8} R_{H\text{-}3T} (X/Q)_D Q_i$$

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2.6 (continued)

For Total Dose from Particulate Gaseous effluent to organ T of a specified age group:

$$D_T = \sum_Z [D_{I\&8DP} + D_{H\text{-}3}]$$

Where:

T = the organ of interest of a specified age group

z = the applicable pathways for the age group of interest

$D_{I\&8DP}$ = Dose in mrem to the organ T of a specified age group from radioiodines and 8D Particulates

$D_{H\text{-}3}$ = Dose in mrem to the organ T of a specified age group from Tritium

D_T = Total Dose in mrem to the organ T of a specified age group from Gaseous particulate Effluents

$\sum_i^n$ = A mathematical symbol to signify the operations to the right of the symbol are to be performed for each nuclide (i) through (n) and the individual nuclide doses are summed to arrive at the total dose from the pathway of interest to organ T.

$\sum_Z$ = A mathematical symbol to indicate that the total dose D_T to organ T is the sum of each of the pathway doses of I&8DP and H-3 from gaseous particulate effluents.

3.17×10^{-8} = The inverse of the number of seconds per year with units of year/sec.

R_i = The dose factor for nuclide (i) (or H-3) for pathway Z to organ T of the specified age group. The units are either

$$\frac{mrem\text{-}m^3}{yr\text{-}\mu Ci} \text{ for pathways using } (X/Q)_D \quad OR \quad \frac{mrem\text{-}m^2 \text{ - sec}}{yr\text{-}\mu Ci} \text{ for pathways using } (D/Q)$$

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2.6 (continued)

$(X/Q)_D$ = The depleted-(X/Q) value for a specific location where the receptor is located (see discussion). The units are sec/m^3

(D/Q) = the deposition value for a specific location where the receptor is located (see discussion). The units are $1/m^2$ where m=meters.

Q_i = The number of micro-Curies of nuclide (i) released (or projected) during the dose calculation exposure period.

Q_{H-3} = the number of micro-Curies of H-3 released (or projected) during the dose calculation exposure period.

1. The Inhalation Dose Pathway Method:

NOTE
The H-3 dose should be calculated as per 2.6.4.

A. Determine the applicable $(X/Q)_D$ from Table M-2 for the location where the receptor is located. This value is common to each nuclide (i)

B. For the age group(s) of interest, determine the R_i factor of nuclide (i) for the organ T and age group from the appropriate table number.

Age Group	Inhalation Dose Factor Table Number
Infant	G-5
Child	G-8
Teen	G-13
Adult	G-18

C. Obtain the micro-Curies (Q_i) of nuclide (i) from the radioactive gas waste management logs for the release source(s) under consideration during the time interval.

D. Solve for D_i

$D_i = 3.17 \times 10^{-8} Ri(X/Q)_D Q_i$

$D_i =$ mrem from nuclide (i)

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2.6 (continued)

1. (continued)

   E. Perform steps 2.6.1.B through 2.6.1.D for each nuclide (i) reported during the time interval for each organ.

   F. The Inhalation dose to organ T of the specified age group is determined by summing the D_i Dose of each nuclide (i)

$$D_{Inhalation\ (Age\ Group)} = D_1 + D_2 + \_\_\_\_ + D_n = \qquad mrem$$

   Refer to 2.6.5 to determine the total dose to organ T from radioiodines & 8D Particulates

2. The Ground Plane Dose Pathway Method:

NOTE
Tritium dose via the ground plane is zero. The Whole Body is the only organ considered for the Ground Plane pathway dose.

   A. Determine the applicable (D/Q) from Table M-2 for the location where the receptor is located. This (D/Q) value is common to each nuclide (i)

   B. Determine the Ri factor of nuclide (i) for the whole body from Table G-4. The ground plane pathway dose is the same for all age groups.

   C. Obtain the micro-Curies (Q_i) of nuclide (i) from the radioactive gas waste management logs for the source under consideration.

   D. Solve for D_i

$$D_i = 3.17\ X\ 10^{-8} R_i\ (D/Q) Q_i$$

   D_i = mrem for nuclide (i)

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2.6 (continued)

2. (continued)

E. Perform steps 2.6.2.B through 2.6.2.D for each nuclide (i) reported during the time interval.

F. The Ground Plane dose to the whole body is determined by summing the Di Dose of each nuclide (i)

$D_{Gr.Pl-WBody} = D_1 + D_2 + \_\_\_\_\_ + D_n =$ mrem

Refer to step 2.6.5 to calculate total dose to the Whole Body.

3. The Grass-Cow/Goat-Milk Dose Pathway Method:

NOTE
Tritium dose is calculated as per 2.6.4.

A. A cow or a goat, will be the controlling animal; (i.e., dose will not be the sum of each animal), as the human receptor is assumed to drink milk from only the most restrictive animal. Refer to Table M-3 to determine which animal is controlling based on its (D/Q).

B. For the age group(s) of interest, determine the dose factor R_i for nuclide (i), for organ T, from the appropriate table number for the applicable milk animal.

Age Group	Cow Milk Dose Factor Table Number	Goat Milk Dose Factor Table Number
Infant	G-6	G-7
Child	G-9	G-10
Teen	G-14	G-15
Adult	G-19	G-20

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2.6 (continued)

3. (continued)

C. Obtain the micro-Curies (Q_i) of nuclide (i) from the radioactive gas waste management logs for the release source under consideration during the time interval.

D. Solve for D_i

$D_i = 3.17 \times 10^{-8} R_i (D/Q) Q_i$

D_i = mrem from nuclide (i)

E. Perform steps 2.6.3.B through 2.6.3.D for each nuclide (i) reported during the time interval. Only the radioiodines need to be included if the limited analysis approach is used.

F. The Grass-Cow-Milk (or Grass-Goat-Milk) pathway dose to organ T is determined by summing the Di dose of each nuclide(i).

$D_{G\text{-}C\text{-}M}$ (or $D_{G\text{-}G\text{-}M}$) = $D_1 + D_2 +$ _____ $+ D_n =$ mrem

The dose to each organ should be calculated in the same manner with steps 2.6.3.B through 2.6.3.F. Refer to step 2.6.5 to determine the total dose to organ T from radioiodines &8D Particulates. If the limited analysis approach is being used the infant thyroid dose via the grass-cow(goat)-milk pathway is the only dose that needs to be determined. Section 2.6.5 can be omitted.

4. The Grass-Cow/Goat-Meat Dose Pathway method:

NOTE
Tritium dose is calculated as per 2.6.6.

A. Determine the controlling herd location by:

1. For dose calculations (other than the annual report) the historical herd was determined to be located in Sector _____ at _____ miles. This herd shall be used for all ODCM Control required dose calculations.

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2.6 (continued)

4. (continued)

A. (continued)

2. For annual report dose calculations the herd from the Land Use Census having the highest (D/Q) at its location will be the reporting herd. The Land Use Census for 1978 (for example) shall apply to the calendar year 1979 (for example) and will locate the nearest herd in each sector over land. The real (D/Q) will be determined from actual met data that occurred during the reporting period.

B. Determine the applicable (D/Q) from Table M-3 for the location(s) of the herd as determined in 2.6.4.A above.

C. Determine the dose factor Ri for nuclide (i) for organ tau from the Table specified below:

Age	Meat Dose Factor Table No.
Infant	N/A *
Child	G-11
Teen	G-16
Adult	G-21

* The infant does not eat meat and therefore dose does not apply to this pathway.

D. Obtain the micro-Curies (Qi) of nuclide (i) from the radioactive gas waste management logs (for projected doses - the micro-Curies of nuclide (i) to be projected) for the release source(s) under consideration during the time interval. The dose can be calculated from a single release source, but the total dose for ODCM Control Limits or annual reports shall be from all gaseous release sources.

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2.6 (continued)

4. (continued)

E. Solve for Di

Di = 3.17 X 10 Ri (D/Q) Qi

Di = _____ mrem from nuclide (i)

F. Perform Steps 2.6.4.C through 2.8.4.E for each nuclide (i) reported during the time interval.

G. The Grass-Cow-Meat pathway dose to organ tau is determined by summing the Di dose of each nuclide (i).

Dose = D1 + D2 + D3 + ... + Dn = _____mrem

Grass-Cow-Meat
Excluding Tritium
(Child, Teen, or Adult)

5. The Vegetation (Garden) Dose Pathway method:

A. Determine the controlling garden location by:

1. For dose calculations (other than annual reports) the historical garden was determined to be located in Sector _____ at _____miles. This garden shall be used for all ODCM Control dose calculations.

2. For annual report dose calculations the Land Census Garden having the highest real (D/Q) at its location will be the reporting garden. The Land Use Census for 1978 (for example) shall apply to the calendar year 1979 (for example) and will locate the nearest garden in each sector. The real (D/Q) will be determined from actual met data that occurred during the reporting period.

B. Determine the applicable (D/Q) from Table M-3 for the location(s) of the garden(s) as determined above.

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2.6 (continued)

5. (continued)

C. Determine the dose factor Ri for nuclide (i) for organ tau from the Table specified below:

Age	Vegetation Dose Factor Table No.
Infant	N/A *
Child	G-12
Teen	G-17
Adult	G-22

* denotes the infant does not eat vegetation and therefore does not apply to this pathway.

D. Obtain the micro-Curies (Qi) of nuclide (i) from the radioactive gas waste management logs (for projected doses - the micro-Curies of nuclide (i) to be projected) for the release source(s) under consideration during the time interval. The dose can be calculated from a single release source, but the total dose for ODCM Control Limits or annual reports shall be from all gaseous release sources.

E. Solve for Di

$Di = 3.17 \times 10^{-8} Ri (D/Q) Qi$

Di = _____ mrem from nuclide (i)

F. Perform Steps 2.6.5.C through 2.6.5.E for each nuclide (i) reported during the time interval.

G. The Vegetation pathway dose to organ tau is determined by summing the Di dose of each nuclide (i).

Dose = D1 + D2 + D3 + ... + Dn = _____mrem

Vegetation
(Excluding Tritium)
(Child, Teen, or Adult)

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2.6 (continued)

6. The Gaseous Tritium Dose (Each Pathway) Method:

A. The controlling locations for the pathway(s) has already been determined by:
Inhalation - as per 2.6.1.A
Ground Plane - not applicable for H-3
Grass-Cow/Goat-Milk - as per 2.6.3.A
Grass-Cow/Goat-Milk - as per 2.6.4.A
Vegetation (Garden) - as per 2.6.5.A

B. Tritium dose calculations use the depleted $(X/Q)_D$ instead of (D/Q). Table M-2 describes where the $(X/Q)_D$ value should be obtained from.

C. For the age group(s) of interest, determine the Pathway Tritium dose factor (R_{H-3}) for the organ T of interest from the Table specified below:

AGE	INHALATION	MILK	
		COW	GOAT
Infant	G-5	G-6	G-7
Child	G-8	G-9	G-10
Teen	G-13	G-14	G-15
Adult	G-18	G-19	G-20

D. Obtain the micro-Curies (Q) of Tritium from the radioactive gas waste management logs (for projected doses - the micro-Curies of nuclide (i) to be projected) for the release source(s) under consideration during the time interval. The dose can be calculated from a single release source, but the total dose for Control limits or quarterly reports shall be from all gaseous release sources.

E. Solve for D_{H-3}

$$D_{H-3} = 3.17 \times 10^{-8} R_{H-3}(X/Q)_D Q$$

D_{H-3} = mrem from Tritium in the specified pathway for organ T of the specified age group

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2.6 (continued)

7. Determining the Total Organ Dose From Iodines, 8D-Particulates and H-3 From Cumulative Gaseous Releases

> NOTE
> Control dose limits for I&8DP shall consider dose from all release sources from the reactor unit of interest.

A. The following pathways shall be summed to arrive at the total dose to organ T from a release source or if applicable to Control, from all release sources:

Age Group: INFANT CHILD TEEN ADULT

Organ: BONE LIVER THYROID KIDNEY LUNG GI-LLI WHOLE BODY

PATHWAY	DOSE	Reference to STEP No.	Remark
Inhalation (I&8DP)		2.6.1.F	
Inhalation (Tritium)		2.6.6.E	
Ground Plane (I&8DP)		2.6.2.F	
Grass-_____-Milk (I&8DP)		2.6.3.F	
Grass-_____-Milk (Tritium)		2.6.6.E	
Grass-_____-Meat (I&8DP)		2.6.4.G	N/A for INFANT
Grass-_____-Meat (Tritium)		2.6.6.E	N/A for INFANT
Vegetable Garden (I&8DP)		2.6.5.G	N/A for INFANT
Vegetable Garden (Tritium)		2.6.6.E	N/A for INFANT
$Dose_T$ =	(sum of above)		

B. The dose to each of the applicable age group's ORGANS shall be calculated:

BONE, LIVER, THYROID, KIDNEY, LUNG, WHOLE BODY, & GI-LLI

The age group organ receiving the highest exposure relative to its Control Limit is the most critical organ for that age group resulting from the radioiodine & 8D Particulates gaseous effluents.

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2.7 Projecting Dose for Radioactive Gaseous Effluents

Discussion - Control 3.11.2.4 requires that the waste gas holdup system be used to reduce releases of radioactivity when the projected doses in 31 days due to gaseous effluent releases, from each unit, to areas at and beyond the SITE BOUNDARY (see TS Figure 5-1-1) would exceed 0.2 mrad for gamma radiation and 0.4 mrad for beta radiation. The following calculation method is provided for determining the projected doses. This method is based on using the results of the calculations performed in Sections 2.4 and 2.5.

1. Obtain the latest results of the monthly calculations of the gamma air dose (Section 2.4) and the beta air dose if performed (Section 2.5). These doses can be obtained from the in-plant records.

2. Divide these doses by the number of days the plant was operational during the month.

3. Multiply the quotient by the number of days the plant is projected to be operational during the next month. The product is the projected dose for the next month. The value should be adjusted as needed to account for any changes in failed-fuel or other identifiable operating conditions that could significantly alter the actual releases.

4. If the projected doses are >0.2 mrads gamma air dose or > 0.4 mrads beta air dose, the appropriate subsystems of the waste gas holdup system shall be used.

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3.0 40 CFR 190 Dose Evaluation

Discussion - Dose or dose commitment to a real individual from all uranium fuel cycle sources be limited to ≤25 mrem to the whole body or any organ (except thyroid, which is limited to ≤75 mrem) over a period of 12 consecutive months. The following approach should be used to demonstrate compliance with these dose limits. This approach is based on NUREG-0133, Section 3.8.

3.1 Evaluation Bases

Dose evaluations to demonstrate compliance with the above dose limits need only be performed if the quarterly doses calculated in Sections 1.4, 2.4 and 2.6 exceed twice the dose limits of Controls 3.11.1.2.a, 3.11.1.2.b, 3.11.2.2a, 3.1.2.2b, 3.11.2.3a and 3.11.2.3b respectively; i.e., quarterly doses exceeding 3 mrem to the whole body (liquid releases), 10 mrem to any organ (liquid releases), 10 mrads gamma air dose, 20 mrads beta air dose or 15 mrem to the thyroid or any organ from radioiodines and particulates (atmospheric releases). Otherwise, no evaluations are required and the remainder of this section can be omitted.

3.2 Doses From Liquid Releases

For the evaluation of doses to real individuals from liquid releases, the same calculation method as employed in Section 1.4 will be used. However, more realistic assumptions will be made concerning the dilution and ingestion of fish and shellfish by individuals who live and fish in the area. Also, the results of the Radiological Environmental Monitoring program will be included in determining more realistic dose to these real people by providing data on actual measured levels of plant related radionuclides in the environment.

3.3 Doses From Atmospheric Releases

For the evaluation of doses to real individuals from the atmospheric releases, the same calculation methods as employed in Section 2.4 and 2.6 will be used. In Section 2.4, the total body dose factor (K_i) should be substituted for the gamma air dose factor (M_i) to determine the total body dose. Otherwise the same calculation sequence applies. However, more realistic assumptions will be made concerning the actual location of real individuals, the meteorological conditions and the consumption of food (e.g., milk). Data obtained from the latest land use census (Control 3.12.2) should be used to determine locations for evaluating doses. Also, the results of the Radiological Environmental Monitoring program will be included in determining more realistic doses to these real people by providing data on actual measured levels of radioactivity and radiation at locations of interest.

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4.0 Annual Radioactive Effluent Report

Discussion - The information contained in a annual report shall not apply to any Control. The reported values are based on actual release conditions instead of historical conditions that the Control dose calculations are based on. The Control dose limits are therefore included in item 1 of the report, for information only. The ECLs in item 2 of the report shall be those listed in Tables L-1 and G-1 of this manual. The average energy in item 3 of the report is not applicable to the St. Lucie Plant. The format, order of nuclides and any values shown as an example in Tables 3.3 through 3.8 are samples only. Other formats are acceptable if they contain equivalent information. A table of contents should also accompany the report. The following format should be used:

RADIOACTIVE EFFLUENTS - SUPPLEMENTAL INFORMATION

1. Regulatory Limits:

1.1 For Radioactive liquid waste effluents:

a. The concentration of radioactive material released from the site (see TS Figure 5.1-1) shall be limited to ten times the concentrations specified in 10 CFR Part 20.1001-20.2401, Appendix B, Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2×10^{-4} μCi/ml total activity.

b. The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released from each reactor unit to unrestricted areas (See TS Fig. 5.1-1) shall be limited during any calendar quarter to ≤1.5 mrem to the whole body and to ≤5 mrem to any organ and ≤3 mrem to the whole body and ≤10 mrem to any organ during any calendar year.

1.2 For Radioactive Gaseous Waste Effluents:

a. The dose rate resulting from radioactive materials released in gaseous effluents to areas at or beyond the SITE BOUNDARY (See TS Figure 5.1-1) shall be limited to the following values:

The dose rate limit for noble gases shall be ≤500 mrem/yr to the total body and ≤3000 mrem/yr to the skin and

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4.0 (continued)

1. (continued)

1.2 (continued)

a. (continued)

The dose rate limit from I-131, I-133, Tritium and particulates with half-lives >8 days shall be ≤1500 mrem/yr to any organ.

b. The air dose (see TS Figure 5.1-1) due to noble gases released in gaseous effluents, from each reactor unit, to areas at and beyond the SITE BOUNDARY shall be limited to the following:

During any calendar quarter, to ≤5 mrad for gamma radiation and ≤10 mrad for beta radiation and during any calendar year to ≤10 mrad for gamma radiation and ≤20 mrad for beta radiation

c. The dose to a MEMBER OF THE PUBLIC from I-131, I-133, Tritium and all radionuclide in particulate form, with half-lives >8 days in gaseous effluents released from each reactor unit to areas at and beyond the SITE BOUNDARY (see Figure 5.1-1 in the TS-A) shall be limited to the following:

During any calendar quarter to ≤7.5 mrem to any organ and during any calendar year to ≤15 mrem to any organ.

2. Effluent Limiting Concentrations:

Air - as per attached Table G-1

Water - as per attached Table L-1

3. Average energy of fission and activation gases in gaseous effluents is not applicable to the St. Lucie Plant.

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4.0 (continued)

4. Measurements and Approximations of Total Radioactivity:

A summary of liquid effluent accounting methods is described in Table 3.1.

A summary of gaseous effluent accounting methods is described in Table 3.2.

Estimate of Errors:

Error Topic	LIQUID		GASEOUS	
	Avg. %	Max. %	Avg. %	Max. %
Release Point Mixing	2	5	NA	NA
Sampling	1	5	2	5
Sample Preparation	1	5	1	5
Sample Analysis	3	10	3	10
Release Volume	2	5	4	15
Total %	9	30	10	35

(above values are examples only)

The predictability of error for radioactive releases can only be applied to nuclides that are predominant in sample spectrums. Nuclides that are near background relative to the predominant nuclides in a given sample could easily have errors greater than the above listed maximums.

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4.0 (continued)

4. (continued)

TABLE 3.1
RADIOACTIVE LIQUID EFFLUENT SAMPLING AND ANALYSIS

LIQUID SOURCE	SAMPLING FREQUENCY	TYPE OF ANALYSIS	METHOD OF ANALYSIS
MONITOR TANK RELEASES	EACH BATCH	PRINCIPAL GAMMA EMITTERS	p.h.a.
	MONTHLY COMPOSITE	TRITIUM	L.S.
		GROSS ALPHA	A I.C.
	QUARTERLY COMPOSITE	Sr-89, Sr-90, Fe-55	C.S
STEAM GENERATOR BLOWDOWN RELEASES	FOUR PER MONTH	PRINCIPAL GAMMA EMITTERS AND DISSOLVED GASES	p.h.a.
	MONTHLY COMPOSITE	TRITIUM	L.S.
		GROSS ALPHA	A I.C.
	QUARTERLY COMPOSITE	Sr-89, Sr-90, Fe-55	C.S.

TABLE NOTATION:

p.h.a. - gamma spectrum pulse height analysis using Lithium Germanium detectors. All peaks are identified and quantified.

L.S. - Liquid Scintillation counting

C.S. - Chemical Separation

A.I.C. - Air Ion Chamber

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4.0 (continued)

4. (continued)

TABLE 3.2
RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS

GASEOUS SOURCE	SAMPLING FREQUENCY	TYPE OF ANALYSIS	METHOD OF ANALYSIS
Waste Gas Decay Tank Releases	Each Tank	Principal Gamma Emitters	G, p.h.a
Containment Purge Releases	Each Purge	Principal Gamma Emitters	G, p.h.a.
		H-3	L.S.
Plant Vent	Four per Month	Principal Gamma Emitters	(G, C, P) - p.h.a.
		H-3	L.S.
	Monthly Composite (Particulates)	Gross Alpha	P - A.I.C.
	Quarterly Composite (Particulates)	Sr-90 Sr-89	C.S.

G - Gaseous Grab Sample

C - Charcoal Filter Sample

P - Particulate Filter Sample

L.S. - Liquid Scintillation Counting

C.S. - Chemical Separation

p.h.a. - Gamma spectrum pulse height analysis using Lithium Germanium detectors. All peaks are identified and quantified.

A.I.C. - Air Ion Chamber

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4.0 (continued)

5. Batch Releases

A. Liquid

1. Number of batch releases: _____

2. Total time period of batch releases: _____minutes

3. Maximum time period for a batch release: _____minutes

4. Average time period for a batch release: _____minutes

5. Minimum time period for a batch release: _____minutes

6. Average dilution stream flow during the period (see Note 1 on Table 3.3): _____GPM

All liquid releases are summarized in tables

B. Gaseous

1. Number of batch releases: _____

2. Total time period for batch releases: _____minutes

3. Maximum time period for a batch release: _____minutes

4. Average time period for batch releases: _____minutes

5. Minimum time period for a batch release: _____minutes

All gaseous waste releases are summarized in tables

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4.0 (continued)

6. Unplanned Releases

   A. Liquid

      1. Number of releases: _____

      2. Total activity releases: _____Curies

   B. Gaseous

      1. Number of releases: _____

      2. Total activity released: _____Curies

   C. See attachments (if applicable) for:

      1. A description of the event and equipment involved.

      2. Cause(s) for the unplanned release.

      3. Actions taken to prevent a recurrence

      4. Consequences of the unplanned release

7. Description of dose assessment of radiation dose from radioactive effluents to the general public due to their activities inside the site are reported on the January annual report.

8. Offsite dose calculation manual revisions initiated during this reporting period. See Control 3.11.2.6 for required attachments to the Annual Report.

9. Solid waste and irradiated fuel shipments as per requirements of Control 3.11.2.6.

10. Process Control Program (PCP) revisions as per requirements of TS 6.13.

11. Major changes to Radioactive Liquid, Gaseous and Solid Waste Treatment Systems as per requirements of Control 3.11.2.5.

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ST. LUCIE UNIT #_____

ANNUAL REPORT - ____/____/____ THROUGH ____/____/____

TABLE 3.3: LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

	UNIT	QUARTER #	QUARTER #
A. Fission and Activation Products			
1. Total Release - (Not including Tritium, Gases, Alpha)	Ci	_____E	_____E
2. Average Diluted Concentration During Period	µCi/ml	_____E	_____E
B. Tritium			
1. Total Release	Ci	_____E	_____E
2. Average Diluted Concentration During Period	µCi/ml	_____E	_____E
C. Dissolved and Entrained Gases			
1. Total Release	Ci	_____E	_____E
2. Average Diluted Concentration During Period	µCi/ml	_____E	_____E
D. Gross Alpha Radioactivity			
1. Total Release	Ci	_____E	_____E

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TABLE 3.3: LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES
(continued)

		UNIT	QUARTER #	QUARTER #
E.	Volume of Waste Released (Prior to Dilution)	LITERS	_____E	_____E
F.	Volume of Dilution Water Used During Period[1]	LITERS	_____E	_____E

1 - The volume reported should be for the entire interval of the reporting period, not just during release intervals. This volume should also be used to calculate average dilution stream flow during the period.

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ST. LUCIE UNIT #_____

ANNUAL REPORT - ____/____/____ THROUGH ____/____/____

TABLE 3.4: LIQUID EFFLUENTS (EXAMPLE FORMAT)

NUCLIDES RELEASED*	UNIT	CONTINUOUS MODE		BATCH MODE	
		QUARTER #	QUARTER #	QUARTER #	QUARTER #
I-131	CI	E	E	E	E
I-133	CI	E	E	E	E
I-135	CI	E	E	E	E
NA-24	CI	E	E	E	E
CR-51	CI	E	E	E	E
MN-54	CI	E	E	E	E
CO-57	CI	E	E	E	E
CO-58	CI	E	E	E	E
FE-59	CI	E	E	E	E
CO-60	CI	E	E	E	E
ZN-65	CI	E	E	E	E
NI-65	CI	E	E	E	E
AG-110	CI	E	E	E	E
SN-113	CI	E	E	E	E
SB-122	CI	E	E	E	E
SB-124	CI	E	E	E	E
W-187	CI	E	E	E	E
NP-239	CI	E	E	E	E
ZR-95	CI	E	E	E	E
MO-99	CI	E	E	E	E
RU-103	CI	E	E	E	E
CS-134	CI	E	E	E	E
CS-136	CI	E	E	E	E
CS-137	CI	E	E	E	E
BA-140	CI	E	E	E	E
CE-141	CI	E	E	E	E
BR-82	CI	E	E	E	E
ZR-97	CI	E	E	E	E
SB-125	CI	E	E	E	E

* All nuclides that were detected should be added to the partial list of the example format.

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TABLE 3.4: LIQUID EFFLUENTS (EXAMPLE FORMAT)
(continued)

NUCLIDES RELEASED	UNIT	CONTINUOUS MODE		BATCH MODE	
		QUARTER #	QUARTER #	QUARTER #	QUARTER #
CE-144	CI	E	E	E	E
SR-89	CI	E	E	E	E
SR-90	CI	E	E	E	E
UNIDENTIFIED	CI	E	E	E	E
TOTAL FOR PERIOD (ABOVE)	CI	E	E	E	E
AR-41	CI	E	E	E	E
KR-85	CI	E	E	E	E
XE-131M	CI	E	E	E	E
XE-133	CI	E	E	E	E
XE-133M	CI	E	E	E	E
XE-135	CI	E	E	E	E

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FLORIDA POWER & LIGHT COMPANY
ST. LUCIE UNIT #_____
TABLE 3.5
LIQUID EFFLUENTS - DOSE SUMMATION

Age Group: _____ Location: _____

Exposure Interval: From_____ Through_____

Fish & Shellfish Pathway to Organ	CALENDAR YEAR DOSE (mrem)
BONE	
LIVER	
THYROID	
KIDNEY	
LUNG	
GI-LLI	
WHOLE BODY	

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FLORIDA POWER & LIGHT COMPANY

ST. LUCIE UNIT #_____

ANNUAL REPORT - ____/____/____ THROUGH ____/____/____

TABLE 3.6: GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

	UNIT	QUARTER #	QUARTER #
A. Fission and Activation Gases			
1. Total Release	Ci	_____E	_____E
2. Average Release Rate For Period	μCi/SEC	_____E	_____E
B. Iodines			
1. Total Iodine-131	Ci	_____E	_____E
2. Average Release Rate for Period	μCi/SEC	_____E	_____E
C. Particulates			
1. Particulates T-1/2 > 8 Days	Ci	_____E	_____E
2. Average Release Rate for Period	μCi/SEC	_____E	_____E
3. Gross Alpha Radioactivity	Ci	_____E	_____E
D. Tritium			
1. Total Release	Ci	_____E	_____E
2. Average Release Rate for Period	μCi/SEC	_____E	_____E

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ST. LUCIE UNIT #_____

ANNUAL REPORT - ____/____/____ THROUGH ____/____/____

TABLE 3.7 GASEOUS EFFLUENTS - GROUND LEVEL RELEASES
(EXAMPLE FORMAT)

NUCLIDES RELEASED*	UNIT	CONTINUOUS MODE		BATCH MODE	
		QUARTER #	QUARTER #	QUARTER #	QUARTER #
1. Fission Gases					
AR-41	Ci	E	E	E	E
KR-85	Ci	E	E	E	E
KR-85M	Ci	E	E	E	E
KR-87	Ci	E	E	E	E
KR-88	Ci	E	E	E	E
XE-131M	Ci	E	E	E	E
XE-133	Ci	E	E	E	E
XE-133M	Ci	E	E	E	E
XE-135	Ci	E	E	E	E
XE-135M	Ci	E	E	E	E
XE-138	Ci	E	E	E	E
UNIDENTIFIED	Ci	E	E	E	E
TOTAL FOR PERIOD (ABOVE)	Ci	E	E	E	E
2. Iodines					
I-131	Ci	E	E	E	E
I-133	Ci	E	E	E	E
I-135	Ci	E	E	E	E
TOTAL FOR PERIOD (ABOVE)	Ci	E	E	E	E
3. Particulates					
CO-58	Ci	E	E	E	E
SR-89	Ci	E	E	E	E
SR-90	Ci	E	E	E	E

*All nuclides that were detected should be added to the partial list of the example format.

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TABLE 3.8
GASEOUS EFFLUENTS - DOSE SUMMATION - CALENDAR YEAR
AGE GROUP: INFANT EXPOSURE INTERVAL: FROM_____ THROUGH_____

PATHWAY	BONE (mrem)	LIVER (mrem)	THYROID (mrem)	KIDNEY (mrem)	LUNG (mrem	GI-LLI (mrem)	WHOLE BODY (mrem)
Ground Plane (A)							
Grass- -Milk (B)							
Inhalation (A)							
TOTAL							

(A)	SECTOR:	RANGE: miles

(B)	COW / GOAT	SECTOR:	RANGE: miles

NOBLE GASES	CALENDAR YEAR (mrad)
Gamma Air Dose	
Beta Air Dose	
Sector:	Range: 0.97 miles

NOTE
The dose values above were calculated using actual meteorological data during the specified time interval with MET data reduced as per Reg. Guide 1.111, March 1976.

APPENDIX A

ECL, DOSE FACTOR

AND

HISTORICAL METEOROLOGICAL TABLES

ST. LUCIE PLANT
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TABLE L-1
EFFLUENT CONCENTRATION LIMITS IN WATER
IN UNRESTRICTED AREAS

NOTE
If a nuclide is not listed below, refer to 10 CFR Part 20, Appendix B, Table 2 Effluent Concentrations Column 2 and use the most conservative ECL listed for the nuclide.

Nuclide	ECL (µCi/ml)	Nuclide	ECL (µCi/ml)	Nuclide	ECL (µCi/ml)
H-3	1 E-3	Sr-92	4 E-5	Te-129	4 E-4
C-14	3 E-5	Y-90	7 E-6	Te-131m	8 E-6
Na-24	5 E-5	Y-91m	2 E-3	Te-131	8 E-5
P-32	9 E-6	Y-91	8 E-6	Te-132	9 E-6
Cr-51	5 E-4	Y-92	4 E-5	I-130	2 E-5
Mn-54	3 E-5	Y-93	2 E-5	I-131	1 E-6
Mn-56	7 E-5	Zr-95	2 E-5	I-132	1 E-4
Fe-55	1 E-4	Zr-97	9 E-6	I-133	7 E-6
Fe-59	1 E-5	Nb-95	3 E-5	I-134	4 E-4
Co-57	6 E-5	Nb-97	3 E-4	I-135	3 E-5
Co-58	2 E-5	Mo-99	2 E-5	Cs-134	9 E-7
Co-60	3 E-6	Tc-99m	1 E-3	Cs-136	6 E-6
Ni-63	1 E-4	Tc-101	2 E-3	Cs-137	1 E-6
Ni-65	1 E-4	Ru-103	3 E-5	Cs-138	4 E-4
Cu-64	2 E-4	Ru-105	7 E-5	Ba-139	2 E-4
Zn-65	5 E-6	Ru-106	3 E-6	Ba-140	8 E-6
Zn-69	8 E-4	Ag-110	6 E-6	Ba-141	3 E-4
Br-82	4 E-5	Sn-113	3 E-5	Ba-142	7 E-4
Br-83	9 E-4	In-113m	7 E-4	La-140	9 E-6
Br-84	4 E-4	Sb-122	1 E-5	La-142	1 E-4
Rb-86	7 E-6	Sb-124	7 E-6	Ce-141	3 E-5
Rb-88	4 E-4	Sb-125	3 E-5	Ce-143	2 E-5
Rb-89	9 E-4	Te-125m	2 E-5	Ce-144	3 E-6
Sr-89	8 E-6	Te-127m	9 E-6	Pr-144	6 E-4
Sr-90	5 E-7	Te-127	1 E-4	W-187	3 E-5
Sr-91	2 E-5	Te-129m	7 E-6	Np-239	2 E-5

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TABLE L-2
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS FOR LIQUID DISCHARGES
PATHWAY - SALT WATER FISH AND SHELLFISH AGE GROUP - ADULT
ORGAN DOSE FACTOR (MREM/HR PER μCi/ML)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H-3	0.	3.60E-01	3.60E-01	3.60E-01	3.60E-01	3.60E-01	3.60E-01
C-14	1.45E+04	2.91E+03	2.91E+03	2.91E+03	2.91E+03	2.91E+03	2.91E+03
NA-24	6.08E-01	6.08E-01	6.08E-01	6.08E-01	6.08E-01	6.08E-01	6.08E-01
P-32	1.67E+07	1.05E+06	0.	0.	0.	1.88E+06	6.47E+05
CR-51	0.	0.	3.34E+00	1.23E+00	7.42E+00	1.41E+03	5.59E+00
MN-54	0.	7.07E+03	0.	2.10E+03	0.	2.17E+04	1.35E+03
MN-56	0.	1.78E+02	0.	2.26E+02	0.	5.68E+03	3.17E+01
FE-55	1.15E+05	5.19E+05	0.	0.	6.01E+05	2.03E+05	1.36E+05
FE-59	8.08E+04	1.92E+05	0.	0.	5.32E+04	6.33E+05	7.29E+04
CO-57	0.	1.42E+02	0.	0.	0.	3.60E+03	2.36E+02
CO-58	0.	6.05E+02	0.	0.	0.	1.22E+04	1.35E+03
CO-60	0.	1.74E+03	0.	0.	0.	3.26E+04	3.83E+03
Ni-63	4.97E+04	3.45E+03	0.	0.	0.	7.19E+02	1.67E+03
NI-65	2.02E+02	2.63E+01	0.	0.	0.	6.65E+02	1.20E+01
CU-64	0.	2.15E+02	0.	5.41E+02	0.	1.83E+04	1.01E+02
ZN-65	1.62E+05	5.13E+05	0.	3.43E+05	0.	3.23E+05	2.32E+05
ZN-69	3.43E+02	6.60E+02	0.	4.27E+02	0.	9.87E+01	4.57E+01

Based on 1 μCi/sec release rate of each isotope in discharge flow of 1 cc/sec with no additional dilution

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ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS FOR LIQUID DISCHARGES
PATHWAY - SALT WATER FISH AND SHELLFISH AGE GROUP - ADULT
ORGAN DOSE FACTOR (MREM/HR PER μCi/ML)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
BR-82	0.	0.	0.	0.	0.	4.68E+00	4.08E+00
BR-83	0.	0.	0.	0.	0.	1.05E-01	7.26E-02
BR-84	0.	0.	0.	0.	0.	7.38E-07	9.42E-02
BR-85	0.	0.	0.	0.	0.	0.	3.86E-03
RB-86	0.	6.25E+02	0.	0.	0.	1.23E+02	2.91E+02
RB-88	0.	1.79E+00	0.	0.	0.	0.	9.50E-01
RB-89	0.	1.19E+00	0.	0.	0.	0.	8.38E-01
SR-89	5.01E+03	0.	0.	0.	0.	8.01E+02	1.44E+02
SR-90	1.23E+05	0.	0.	0.	0.	1.65E+03	3.02E+04
SR-91	9.43E+01	0.	0.	0.	0.	4.75E+02	4.15E+00
SR-92	3.50E+01	0.	0.	0.	0.	6.91E+02	1.51E+00
Y-90	6.07E+00	0.	0.	0.	0.	6.43E+04	1.63E-01
Y-91M	5.74E-02	0.	0.	0.	0.	1.68E-01	2.23E-03
Y-91	8.89E+01	0.	0.	0.	0.	4.89E+04	2.38E+00
Y-92	5.34E-01	0.	0.	0.	0.	9.33E+03	1.56E-02

Based on 1 μCi/sec release rate of each isotope in discharge flow of 1 cc/sec with no additional dilution

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ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS FOR LIQUID DISCHARGES
PATHWAY - SALT WATER FISH AND SHELLFISH AGE GROUP - ADULT
ORGAN DOSE FACTOR (MREM/HR PER μCi/ML)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
Y-93	1.69E+00	0.	0.	0.	0.	5.36E+04	4.67E-02
ZR-95	1.60E+01	5.13E+00	0.	8.09E+00	0.	1.59E+04	3.47E+00
ZR-97	8.82E-01	1.78E-01	0.	2.69E-01	0.	5.51E+04	8.19E-02
NB-95	4.48E+02	2.49E+02	0.	2.47E+02	0.	1.51E+06	9.79E+01
NB-97	3.76E+00	9.50E-01	0.	1.11E+00	0.	3.51E+03	3.47E-01
MO-99	0.	1.28E+02	0.	2.90E+02	0.	2.97E+02	2.43E+01
TC-99M	1.30E-02	3.67E-02	0.	5.57E-01	1.80E-02	2.17E+01	4.67E-01
TC-101	1.33E-02	1.93E-02	0.	3.47E-01	9.82E-03	0.	1.89E-01
RU-103	1.07E+02	0.	0.	4.09E+02	0.	1.25E+04	4.61E+01
RU-105	8.90E+00	0.	0.	1.15E+02	0.	5.44E+03	3.51E+00
RU-106	1.59E+03	0.	0.	3.08E+03	0.	1.03E+05	2.01E+02
AG-110	1.57E+03	1.45E+03	0.	2.85E+03	0.	5.92E+05	8.62E+02
SB-124	2.78E+02	5.23E+00	6.71E-01	0.	2.15E+02	7.85E+03	1.10E+02
SB-125	2.20E+02	2.37E+00	1.96E-01	0.	2.30E+04	1.95E+03	4.42E+01
TE-125M	2.17E+02	7.89E+01	6.54E+01	8.83E+02	0.	8.67E+02	2.91E+01

Based on 1 μCi/sec release rate of each isotope in discharge flow of 1 cc/sec with no additional dilution

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TABLE L-2
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS FOR LIQUID DISCHARGES
PATHWAY - SALT WATER FISH AND SHELLFISH AGE GROUP - ADULT
ORGAN DOSE FACTOR (MREM/HR PER μCi/ML)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
TE-127M	5.50E+02	1.92E+02	1.40E+02	2.23E+03	0.	1.84E+03	6.70E+01
TE-127	8.92E+00	3.20E+00	6.61E+00	3.63E+01	0.	7.04E+02	1.93E+00
TE-129M	9.32E+02	3.49E+02	3.20E+02	3.89E+03	0.	4.69E+03	1.48E+02
TE-129	2.55E+00	9.65E-01	1.95E+00	1.07E+01	0.	1.92E+00	6.21E-01
TE-131M	1.41E+02	6.87E+01	1.09E+02	6.95E+02	0.	6.81E+03	5.72E+01
TE-131	1.60E+00	6.68E-01	1.31E+00	7.00E+00	0.	2.39E-01	5.04E-01
TE-132	2.05E+03	1.33E+02	1.46E+02	1.28E+03	0.	6.25E+03	1.24E+02
I-130	3.98E+01	1.18E+02	1.50E+04	1.83E+02	0.	1.01E+02	4.63E+01
I-131	2.18E+02	3.13E+02	1.02E+05	5.36E+02	0.	8.24E+01	1.79E+02
I-132	1.07E+01	2.85E+01	3.76E+03	4.55E+01	0.	5.36E+00	1.01E+01
I-133	7.51E+01	1.30E+02	2.51E+04	2.27E+02	0.	1.15E+02	3.98E+01
I-134	5.57E+00	1.51E+01	1.96E+03	2.41E+01	0.	1.32E-02	5.41E+00
I-135	2.33E+01	6.14E+01	8.03E+03	9.77E+01	0.	6.88E+01	2.25E+01
CS-134	6.85E+03	1.63E+04	0.	5.29E+03	1.75E+03	2.85E+02	1.33E+04
CS-136	7.17E+02	2.83E+03	0.	1.58E+03	2.16E+02	3.22E+02	2.04E+03

Based on 1 μCi/sec release rate of each isotope in discharge flow of 1 cc/sec with no additional dilution

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TABLE L-2
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS FOR LIQUID DISCHARGES
PATHWAY - SALT WATER FISH AND SHELLFISH AGE GROUP - ADULT
ORGAN DOSE FACTOR (MREM/HR PER μCi/ML)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
CS-137	8.79E+03	1.20E+04	0.	4.09E+03	1.36E+03	2.31E+02	7.88E+03
CS-138	6.08E+00	1.20E+01	0.	8.84E+00	8.73E-01	5.12E-05	5.96E+00
BA-139	7.87E+00	5.61E-03	0.	5.24E-03	3.18E-03	1.39E+01	2.30E-01
BA-140	1.65E+03	2.07E+00	0.	7.04E-01	1.18E+00	3.39E+03	1.09E+02
BA-141	0.	2.89E-03	0.	2.68E-03	1.64E-03	1.80E-09	1.29E-01
BA-142	1.73E+00	1.78E-03	0.	1.50E-03	1.01E-03	0.	1.09E-01
LA-140	1.58E+00	7.95E-01	0.	0.	0.	5.83E+04	2.11E-01
LA-142	8.07E-02	3.67E-02	0.	0.	0.	2.68E+02	9.15E-03
CE-141	3.43E+00	2.32E+00	0.	1.08E+00	0.	8.87E+03	2.63E-01
CE-143	6.05E-01	4.47E+02	0.	1.97E-01	0.	1.67E+04	4.95E-02
CE-144	1.79E+02	7.48E+01	0.	4.43E+01	0.	6.05E+04	9.60E+00
PR-144	1.91E-02	7.88E-03	0.	4.45E-03	0.	2.73E-09	9.65E-04
W-187	9.17E+00	7.68E+00	0.	0.	0.	2.51E+03	2.69E+00
NP-239	3.56E-02	3.50E-03	0.	1.08E-02	0.	7.12E+02	1.92E-03

Based on 1 μCi/sec release rate of each isotope in discharge flow of 1 cc/sec with no additional dilution

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TABLE L-3
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS FOR LIQUID DISCHARGES
PATHWAY - SALT WATER FISH AND SHELLFISH AGE GROUP - TEENAGER
ORGAN DOSE FACTOR (MREM/HR PER µCi/ML)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H----3	0.	2.17E-01	2.17E-01	2.74E-01	2.17E-01	2.17E-01	2.17E-01
C-14	2.94E+03	2.94E+03	2.94E+03	2.22E+03	2.94E+03	2.94E+03	2.94E+03
NA--24	4.63E-01	4.63E-01	4.63E-01	4.63E-01	4.63E-01	4.63E-01	4.63E-01
P---32	1.27E+07	7.98E+05	0.	0.	0.	1.43E+06	4.93E+05
CR--51	0.	0.	2.54E+00	9.38E-01	5.64E+00	1.07E+03	4.25E+00
MN--54	0.	5.38E+03	0.	1.60E+03	0.	1.65E+04	1.03E+03
MN--56	0	1.36E+02	0.	1.72E+02	0.	4.32E+03	2.42E+01
FE--55	8.78E+04	3.95E+05	0.	0.	4.57E+05	1.54E+05	1.04E+05
FE--59	6.14E+04	1.46E+05	0.	0.	4.05E+04	4.81E+05	5.55E+04
CO--57	0.	1.08E+02	0.	0.	0.	2.74E+03	1.79E+02
CO--58	0.	6.12E+02	0.	0.	0.	8.26E+03	1.39E+03
CO--60	0.	1.70E+03	0.	0.	0.	2.04E+04	3.88E+03
Ni-63	3.78E+04	2.63E+03	0.	0.	0.	5.47E+02	1.27E+03
NI--65	1.54E+02	2.00E+01	0.	0.	0.	5.07E+02	9.11E+00
CU--64	0.	1.64E+02	0.	4.12E+02	0.	1.39E+04	7.69E+01
ZN--65	1.23E+05	3.90E+05	0.	2.61E+05	0.	2.46E+05	1.77E+05
ZN--69	2.61E+02	5.02E+02	0.	3.24E+02	0.	7.50E+01	3.47E+01
BR--82	0.	0.	0.	0.	0.	3.55E+00	3.10E+00
BR--83	0.	0.	0.	0.	0.	7.95E-02	5.52E-02
BR--84	0.	0.	0.	0.	0.	5.61E-07	7.16E-02
BR--85	0	0.	0.	0	0.	0.	2.94E-03

Based on 1 µCi/sec release rate of each isotope in discharge flow of 1 cc/sec with no additional dilution

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TABLE L-3
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS FOR LIQUID DISCHARGES
PATHWAY - SALT WATER FISH AND SHELLFISH AGE GROUP - TEENAGER
ORGAN DOSE FACTOR (MREM/HR PER μCi/ML)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
RB--86	0.	4.76E+02	0.	0.	0.	9.37E+01	2.22E+02
RB--88	0.	1.37E+00	0.	0.	0.	0.	7.23E-01
RB--89	0.	9.04E-01	0.	0.	0.	0.	6.38E-01
SR--89	5.67E+03	0.	0.	0.	0.	6.15E+02	1.63E+02
SR--90	1.28E+05	0.	0.	0.	0.	2.71E+03	3.17E+04
SR--91	7.18E+01	0.	0.	0.	0.	3.61E+02	3.16E+00
SR--92	2.66E+01	0.	0.	0.	0.	5.25E+02	1.15E+00
Y---90	1.58E+01	0.	0.	0.	1.80E+04	5.23E+04	4.25E-01
Y--91M	4.36E-02	0.	0.	0.	0.	1.28E-01	1.69E-03
Y---91	9.40E+01	0.	0.	0.	0.	3.61E+04	2.51E+00
Y---92	4.06E-01	0.	0.	0.	0.	7.10E+03	1.18E-02
Y---93	1.29E+00	0.	0.	0.	0.	4.08E+04	3.55E-02
ZR--95	1.49E+01	4.96E+00	0.	6.16E+00	0.	1.07E+04	3.46E+00
ZR--97	6.72E-01	1.36E-01	0.	2.05E-01	0.	4.20E+04	6.24E-02
NB--95	3.97E+02	2.39E+02	0.	1.88E+02	0.	9.76E+05	1.35E+02
NB--97	2.87E+00	7.24E-01	0.	8.45E-01	0.	2.67E+03	2.64E-01
MO--99	0.	9.74E+01	0.	2.21E+02	0.	2.26E+02	1.85+01
TC-99M	9.87E-03	2.79E-02	0.	4.24E-01	1.37E-02	1.65E+01	3.56E-01
TC-101	1.02E-02	1.47E-02	0.	2.64E-01	7.47E-03	0.	1.44E-01

Based on 1 μCi/sec release rate of each isotope in discharge flow of 1 cc/sec with no additional dilution

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TABLE L-3
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS FOR LIQUID DISCHARGES
PATHWAY - SALT WATER FISH AND SHELLFISH AGE GROUP - TEENAGER
ORGAN DOSE FACTOR (MREM/HR PER μCi/ML)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
RU-103	1.04E+02	0.	0.	3.11E+02	0.	8.13E+03	4.66E+01
RU-105	6.77E+00	0.	0.	8.74E+01	0.	4.14E+03	2.67E+00
RU-106	1.76E+03	0.	0.	2.34E+03	0.	7.95E+04	2.21E+02
AG110	1.19E+03	1.10E+03	0.	2.17E+03	0.	4.51E+05	6.56E+02
SB-124	2.11E+02	3.99E+00	5.11E-01	0.	1.64E+02	5.98E+03	8.35E+01
SB-125	1.68E+02	1.81E+00	1.49E-01	0.	1.75E+04	1.48E+03	3.37E+01
TE 125M	2.36E+02	8.45E+01	6.66E+01	6.72E+02	0.	6.60E+02	3.13E+01
TE 127M	4.18E+02	1.46E+02	1.07E+02	1.70E+03	0.	1.40E+03	5.09E+01
TE-127	9.31E+00	3.28E+00	6.35E+00	2.76E+01	0.	7.52E+02	1.99E+00
TE 129M	1.02E+03	3.79E+02	3.27E+02	2.96E+03	0.	3.58E+03	1.61E+02
TE-129	1.94E+00	7.34E-01	1.49E+00	8.14E+00	0.	1.46E+00	4.72E-01
TE 131M	1.07E+02	5.22E+01	8.26E+01	5.29E+02	0.	5.18E+03	4.35E+01
TE-131	1.21E+00	5.08E-01	9.99E-01	5.33E+00	0.	1.82E-01	3.83E-01
TE-132	2.19E+02	1.37E+02	1.46E+02	9.74E+02	0.	4.93E+03	1.30E+02
I--130	3.03E+01	8.95E+01	1.14E+04	1.39E+02	0.	7.67E+01	3.52E+01
I--131	2.23E+02	3.14E+02	9.07E+04	4.08E+02	0.	5.95E+01	1.87E+02
I--132	8.11E+00	2.17E+01	2.86E+03	3.46E+01	0.	4.08E+00	7.71E+00
I--133	8.11E+01	1.37E+02	2.50E+04	1.73E+02	0.	9.99E+01	4.24E+01
I--134	4.24E+00	1.15E+01	1.49E+03	1.83E+01	0.	1.00E-02	4.12E+00

Based on 1 μCi/sec release rate of each isotope in discharge flow of 1 cc/sec with no additional dilution

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TABLE L-3
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS FOR LIQUID DISCHARGES
PATHWAY - SALT WATER FISH AND SHELLFISH AGE GROUP - TEENAGER
ORGAN DOSE FACTOR (MREM/HR PER μCi/ML)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
I--135	1.77E+01	4.68E+01	6.11E+03	7.43E+01	0.	5.23E+01	1.71E+01
CS-134	6.75E+03	1.63E+04	0.	4.03E+03	1.97E+03	1.88E+02	7.60E+03
CS-136	5.46E+02	2.16E+03	0.	1.20E+03	1.65E+02	2.45E+02	1.55E+03
CS-137	8.98E+03	1.21E+04	0.	3.11E+03	1.60E+03	1.61E+02	4.24E+03
CS-138	4.63E+00	9.15E+00	0.	6.73E+00	6.65E-01	3.90E-05	4.54E+00
BA-139	5.99E+00	4.27E-03	0.	3.99E-03	2.42E-03	1.06E+01	1.75E-01
BA-140	1.75E+03	2.15E+00	0.	5.35E-01	1.44E+00	2.55E+02	1.12E+02
BA-141	0.	2.20E-03	0.	2.04E-03	1.25E-03	1.37E-09	9.80E-02
BA-142	1.31E+00	1.35E-03	0.	1.14E-03	7.64E-04	0.	8.26E-02
LA-140	1.67E+00	8.25E-01	0.	0.	0.	4.55E+04	2.18E-01
LA-142	6.14E-02	2.79E-02	0.	0.	0.	2.04E+02	6.95E-03
CE-141	3.51E+00	2.36E+00	0.	8.19E-01	0.	6.38E+03	2.70E-01
CE-143	4.60E-01	3.40E+02	0.	1.50E-01	0.	1.27E+04	3.76E-02
CE-144	2.01E+02	8.25E+01	0.	3.37E+01	0.	4.74E+04	1.07E+01
PR-144	1.45E-02	5.99E-03	0.	3.39E-03	0.	2.08E-09	7.34E-04
W--187	6.98E+00	5.85E+00	0.	0.	0.	1.91E+03	2.05E+00
NP-239	2.71E-02	2.67E-03	0.	8.25E-03	0.	5.43E+02	1.46E-03

Based on 1 μCi/sec release rate of each isotope in discharge flow of 1 cc/sec with no additional dilution

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TABLE L-4
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS FOR LIQUID DISCHARGES
PATHWAY - SALT WATER FISH AND SHELLFISH AGE GROUP - CHILD
ORGAN DOSE FACTOR (MREM/HR PER µCi/ML)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H----3	0.	1.81E-01	1.81E-01	1.19E-01	1.81E-01	1.81E-01	1.81E-01
C-14	3.82E+03	3 82E+03	3.82E+03	9.61E+02	3.82E+03	3.82E+03	3.82E+03
NA--24	2.03E-01	2.03E-01	2.03E-01	2.03E-01	2.03E-01	2.03E-01	2.03E-01
P---32	5.53E+06	3 47E+05	0.	0.	0.	6.22E+05	2.14E+05
CR--51	0.	0.	1.12E+00	4.13E-01	2.48E+00	4.70E+02	1.87E+00
MN--54	0.	2.34E+03	0.	6.95E+02	0.	7.15E+03	4.46E+02
MN--56	0.	5 88E+01	0.	7.46E+01	0.	1.88E+03	1.05E+01
FE--55	3.87E+04	1.74E+05	0.	0.	2.02E+05	6.81E+04	4.58E+04
FE--59	2.71E+04	6.43E+04	0.	0.	1.79E+04	2.12E+05	2.45E+04
CO--57	0.	4.78E+01	0.	0.	0.	1.21E+03	7.94E+01
CO--58	0.	5.05E+02	0.	0.	0.	3.00E+03	1.52E+03
CO--60	0.	1.41E+03	0.	0.	0.	7.80E+03	4.23E+03
Ni-63	1.66E+04	1.15E+03	0.	0.	0.	2.39E+02	5.55E+02
NI--65	6.73E+01	8.74E+00	0.	0.	0.	2.22E+02	3.98E+00
CU--64	0.	7.15E+01	0.	1.80E+02	0.	6.09E+03	3.36E+01
ZN--65	5.47E+04	1.74E+05	0.	1.16E+05	0.	1.09E+05	7.86E+04
ZN--69	1.16E+02	2.23E+02	0.	1.44E+02	0.	3.34E+01	1.55E+01
BR--82	0.	0.	0.	0.	0.	1.59E+00	1.39E+00
BR--83	0.	0.	0.	0.	0.	3.55E-02	2.47E-02
BR--84	0.	0.	0.	0.	0.	2.51E-07	3.20E-02
BR--85	0.	0.	0.	0.	0.	0.	1.31E-03

Based on 1 µCi/sec release rate of each isotope in discharge flow of 1 cc/sec with no additional dilution

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TABLE L-4
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS FOR LIQUID DISCHARGES
PATHWAY - SALT WATER FISH AND SHELLFISH AGE GROUP - CHILD
ORGAN DOSE FACTOR (MREM/HR PER μCi/ML)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
RB--86	0.	2.08E+02	0.	0.	0.	4.09E+01	9.68E+01
RB--88	0.	5.96E-01	0.	0.	0.	0.	3.16E-01
RB--89	0.	3.95E-01	0.	0.	0.	0.	2.78E-01
SR--89	7.53E+03	0.	0.	0.	0.	2.81E+02	2.16E+02
SR--90	9.39E+04	0.	0.	0.	0.	1.25E+03	2.38E+04
SR--91	3.18E+01	0.	0.	0.	0.	1.60E+02	1.40E+00
SR--92	1.18E+01	0.	0.	0.	0.	2.33E+02	5.08E-01
Y---90	9.00E+00	0.	0.	0.	0.	2.57E+04	2.42E-01
Y--91M	1.95E-02	0.	0.	0.	0.	5.71E-02	7.55E-04
Y---91	1.25E+02	0.	0.	0.	0.	1.66E+04	3.34E+00
Y---92	1.81E-01	0.	0.	0.	0.	3.16E+03	5.28E-03
Y---93	5.73E-01	0.	0.	0.	0.	1.82E+04	1.58E-02
ZR--95	1.80E+01	4.19E+00	0.	2.67E+00	0.	4.33E+03	3.81E+00
ZR--97	2.91E-01	5.87E-02	0.	8.86E-02	0.	1.82E+04	2.70E-02
NB--95	4.61E+02	1.97E+02	0.	8.11E+01	0.	3.41E+05	1.45E+02
NB--97	1.24E+00	3.12E-01	0.	3.64E-01	0.	1.15E+03	1.14E-01
MO--99	0.	4.23E+01	0.	9.59E+01	0.	9.81E+01	8.05E+00
TC-99M	4.34E-03	1.23E-02	0.	1.86E-01	6.01E-03	7.26E+00	1.57E-01
TC-101	4.47E-03	6.45E-03	0.	1.16E-01	3.29E-03	0.	6.33E-02

Based on 1 μCi/sec release rate of each isotope in discharge flow of 1 cc/sec with no additional dilution

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TABLE L-4
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS FOR LIQUID DISCHARGES
PATHWAY - SALT WATER FISH AND SHELLFISH AGE GROUP - CHILD
ORGAN DOSE FACTOR (MREM/HR PER µCi/ML)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
RU-103	1.33E+02	0.	0.	1.39E+02	0.	3.50E+03	5.38E+01
RU-105	3.03E+00	0.	0.	3.91E+01	0.	1.85E+03	1.19E+00
RU-106	2.34E+03	0.	0.	1.05E+03	0.	3.63E+04	2.91E+02
AG110	5.18E+02	4.80E+02	0.	9.43E+02	0.	1.96E+05	2.85E+02
SB-124	9.13E+01	1.72E+00	2.21E-01	0.	7.08E+01	2.58E+03	3.61E+01
SB-125	7.24E+01	7.80E-01	6.43E-02	0.	7.57E+03	6.40E+02	1.46E+01
TE 125M	3.11E+02	8.43E+01	8.73E+01	2.97E+02	0.	3.00E+02	4.15E+01
TE 127M	1.85E+02	6.47E+01	4.72E+01	7.50E+02	0.	6.19E+02	2.25E+01
TE-127	1.23E+01	3.27E+00	8.46E+00	1.22E+01	0.	5.24E+02	2.63E+00
TE129M	1.35E+03	3.77E+02	4.31E+02	1.31E+03	0.	1.63E+03	2.09E+02
TE-129	8.59E-01	3.25E-01	6.58E-01	3.60E+00	0.	6.47E-01	2.09E-01
TE131M	4.75E+01	2.31E+01	3.66E+01	2.34E+02	0.	2.29E+03	1.93E+01
TE-131	5.38E-01	2.25E-01	4.42E-01	2.36E+00	0.	8.05E-02	1.70E-01
TE-132	2.78E+02	1.23E+02	1.81E+02	4.31E+02	0.	2.15E+03	1.48E+02
I--130	1.33E+01	3.94E+01	5.01E+03	6.12E+01	0.	3.38E+01	1.55E+01
I--131	2.87E+02	2.94E+02	9.55E+04	1.79E+02	0.	2.51E+01	2.22E+02
I--132	3.57E+00	9.55E+00	1.26E+03	1.52E+01	0.	1.79E+00	3.39E+00
I--133	1.05E+02	1.30E+02	3.13E+04	7.61E+01	0.	5.26E+01	5.10E+01
I--134	1.86E+00	5.06E+00	6.58E+02	8.07E+00	0.	4.41E-03	1.81E+00

Based on 1 µCi/sec release rate of each isotope in discharge flow of 1 cc/sec with no additional dilution

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TABLE L-4
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS FOR LIQUID DISCHARGES
PATHWAY - SALT WATER FISH AND SHELLFISH AGE GROUP - CHILD
ORGAN DOSE FACTOR (MREM/HR PER μCi/ML)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
I--135	7.79E+00	2.06E+01	2.69E+03	3.27E+01	0.	2.30E+01	7.54E+00
CS-134	8.14E+03	1.37E+04	0.	1.75E+03	1.52E+03	7.42E+01	2.92E+03
CS-136	2.37E+02	9.34E+02	0.	5.20E+02	7.13E+01	1.06E+02	6.73E+02
CS-137	1.13E+04	1.10E+04	0.	1.35E+03	1.29E+03	6.69E+01	1.64E+03
CS-138	2.01E+00	3.96E+00	0.	2.92E+00	2.88E-01	1.69E-05	1.97E+00
BA-139	2.65E+00	1.89E-03	0.	1.77E-03	1.07E-03	4.69E+00	7.75E-02
BA-140	2.25E+03	1.98E+00	0.	2.37E-01	1.18E+00	1.15E+02	1.32E+02
BA-141	0.	9.71E-04	0.	9.03E-04	5.51E-04	6.06E-10	4.34E-02
BA-142	5.81E-01	5.98E-04	0.	5.05E-04	3.38E-04	0.	3.66E-02
LA-140	2.16E+00	7.52E-01	0.	0.	0.	2.14E+04	2.54E-01
LA-142	2.74E-02	1.24E-02	0.	0.	0.	9.09E+01	3.10E-03
CE-141	4.67E+00	2.34E+00	0.	3.66E-01	0.	2.93E+03	3.48E-01
CE-143	2.05E-01	1.52E+02	0.	6.69E-02	0.	5.67E+03	1.68E-02
CE-144	2.66E+02	8.33E+01	0.	1.50E+01	0.	2.16E+04	1.42E+01
PR-144	6.46E-03	2.67E-03	0.	1.51E-03	0.	9.26E-10	3.27E-04
W--187	3.03E+00	2.54E+00	0.	0.	0.	8.31E+02	8.90E-01
NP-239	1.18E-02	1.16E-03	0.	3.58E-03	0.	2.36E+02	6.34E-04

Based on 1 μCi/sec release rate of each isotope in discharge flow of 1 cc/sec with no additional dilution

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TABLE G-1
EFFLUENT CONCENTRATION LIMITS IN AIR IN UNRESTRICTED AREAS

NOTE
If a nuclide is not listed below, refer to 10 CFR Part 20, Appendix B, Table 2 Effluent Concentrations Column 1 and use the most conservative ECL listed for the nuclide.

Nuclide	ECL µCi/ml	Nuclide	ECL µCi/ml	Nuclide	ECL µCi/ml
Ar-41	1 E-8	Co-57	9 E-10	Sb-124	3 E-10
Kr-83m	5 E-5	Co-58	1 E-9	Sb-125	7 E-10
Kr-85m	1 E-7	Fe-59	5 E-10	Te-125m	1 E-9
Kr-85	7 E-7	Co-60	5 E-11	Te-127m	4 E-10
Kr-87	2 E-8	Zn-65	4 E-10	Te-129m	3 E-10
Kr-88	9 E-9	Rb-86	1 E-9	I-130	3 E-9
Kr-89	None	Rb-88	9 E-8	I-131	2 E-10
Kr-90	None	Sr-89	2 E-10	I-132	2 E-8
Xe-131m	2 E-6	Sr-90	6 E-12	I-133	1 E-9
Xe-133m	6 E-7	Y-91	2 E-10	I-134	6 E-8
Xe-133	5 E-7	Zr-95	4 E-10	I-135	6 E-9
Xe-135m	4 E-8	Nb-95	2 E-9	Cs-134	2 E-10
Xe-135	7 E-8	Ru-103	9 E-10	Cs-136	9 E-10
Xe-137	None	Ru-106	2 E-11	Cs-137	2 E-10
Xe-138	2 E-8	Ag-110	1 E-10	Ba-140	2 E-9
H-3	1 E-7	Sn-113	8 E-10	La-140	2 E-9
P-32	1 E-9	In-113m	2 E-7	Ce-141	8 E-10
Cr-51	3 E-8	Sn-123	2 E-10	Ce-144	2 E-11
Mn-54	1 E-9	Sn-126	8 E-11		

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TABLE G-2
DOSE FACTORS FOR NOBLE GASES*

RADIONUCLIDE	TOTAL BODY DOSE FACTOR K_i (mrem/yr per $\mu Ci/m^3$)	SKIN DOSE FACTOR L_i (mrem/yr per $\mu Ci/m^3$)	GAMMA AIR DOSE FACTOR M_i (mrad/yr per $\mu Ci/m^3$)	BETA AIR DOSE FACTOR N_i (mrad/yr per $\mu Ci/m^3$)
Kr-83m	7.56E-02**	--------	1.93E+01	2.88E+02
Kr-85m	1.17E+03	1.46E+03	1.23E+03	1.97E+03
Kr-85	1.61E+01	1.34E+03	1.72E+01	1.95E+03
Kr-87	5.92E+03	9.73E+03	6.17E+03	1.03E+04
Kr-88	1.47E+04	2.37E+03	1.52E+04	2.93E+03
Kr-89	1.66E+04	1.01E+04	1.73E+04	1.06E+04
Kr-90	1.56E+04	7.29E+03	1.63E+04	7.83E+03
Xe-131m	9.15E+01	4.76E+02	1.56E+02	1.11E+03
Xe-133m	2.51E+02	9.94E+02	3.27E+02	1.48E+03
Xe-133	2.94E+02	3.06E+02	3.53E+02	1.05E+03
Xe-135m	3.12E+03	7.11E+02	3.36E+03	7.39E+02
Xe-135	1.81E+03	1.86E+03	1.92E+03	2.46E+03
Xe-137	1.42E+03	1.22E+04	1.51E+03	1.27E+04
Xe-138	8.83E+03	4.13E+03	9.21E+03	4.75E+03
Ar-41	8.84E+03	2.69E+03	9.30E+03	3.28E+03

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

** 7.56E-02 = 7.56 X 10^{-2}

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TABLE G-3
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS P (I) FOR GASEOUS DISCHARGES
PATHWAY - GROUND PLANE DEPOSITION AGE GROUP - INFANT
ORGAN DOSE FACTOR (SQ. METER - MREM/YR PER μCi/Sec)

NUCLIDE	WHOLE BODY
H-3	0.
CR-51	6.68E+06
MN-54	1.10E+09
FE-59	3.92E+08
CO-57	1.64E+08
CO-58	5.27E+08
CO-60	4.40E+09
ZN-65	6.87E+08
RB-86	1.29E+07
SR-89	3.07E+04
SR-90	5.94E+05
Y-91	1.53E+06
ZR-95	6.94E+08
NB-95	1.95E+08
RU-103	1.57E+08
RU-106	2.99E+08
AG-110	3.18E+09

Based on 1 μCi/sec release rate of each isotope in and a Value of 1. for X/Q, depleted X/Q and Relative Deposition

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TABLE G-3
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS P (I) FOR GASEOUS DISCHARGES
PATHWAY - GROUND PLANE DEPOSITION AGE GROUP - INFANT
ORGAN DOSE FACTOR (SQ. METER - MREM/YR PER μCi/Sec)

NUCLIDE	WHOLE BODY
SN-126	4.80E+09
SB-124	8.42E+08
SB-125	7.56E+08
TE-125M	2.19E+06
TE-127M	1.15E+06
TE-129M	5.49E+07
I-130	7.90E+06
I-131	2.46E+07
I-132	1.78E+06
I-133	3.54E+06
I-134	6.43E+05
I-135	3.66E+06
CS-134	2.82E+09
CS-136	2.13E+08
CS-137	1.15E+09
BA-140	2.39E+08
CE-141	1.95E+07
CE-144	9.52E+07

Based on 1 μCi/sec release rate of each isotope in and a Value of 1. for X/Q, depleted X/Q and Relative Deposition

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TABLE G-4
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R (I) FOR GASEOUS DISCHARGES
PATHWAY - GROUND PLANE DEPOSITION AGE GROUP - CHILD - TEEN-ADULT & INFANT
ORGAN DOSE FACTOR (SQ. METER - MREM/YR PER μCi/Sec)

NUCLIDE	WHOLE BODY
H-3	0.
CR-51	4.68E+06
MN-54	1.38E+09
FE-59	2.75E+08
CO-57	1.89E+08
CO-58	3.80E+08
CO-60	2.15E+10
ZN-65	7.43E+08
RB-86	9.01E+06
SR-89	2.17E+04
SR-90	5.35E+06
Y-91	1.08E+06
ZR-95	5.01E+08
NB-95	1.36E+08
RU-103	1.10E+08
RU-106	4.19E+08
AG-110	3.58E+09

Based on 1 μCi/sec release rate of each isotope in and a Value of 1. for X/Q, depleted X/Q and Relative Deposition

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TABLE G-4
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R (I) FOR GASEOUS DISCHARGES
PATHWAY - GROUND PLANE DEPOSITION AGE GROUP - CHILD - TEEN-ADULT & INFANT
ORGAN DOSE FACTOR (SQ. METER - MREM/YR PER μCi/Sec)

NUCLIDE	WHOLE BODY
SN-126	5.16E+10
SB-124	5.98E+08
SB-125	2.30E+09
TE-125M	1.55E+06
TE-127M	8.79E+05
TE-129M	3.85E+07
I-130	5.53E+06
I-131	1.72E+07
I-132	1.25E+06
I-133	2.48E+06
I-134	4.50E+05
I-135	2.56E+06
CS-134	6.99E+09
CS-136	1.49E+08
CS-137	1.03E+10
BA-140	1.68E+08
CE-141	1.37E+07
CE-144	1.13E+08

Based on 1 μCi/sec release rate of each isotope in and a Value of 1. for X/Q, depleted X/Q and Relative Deposition

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TABLE G-5
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I)/P(I) FOR GASEOUS DISCHARGES
PATHWAY - INHALATION AGE GROUP - INFANT
ORGAN DOSE FACTOR (MREM/YR PER μCi/Cu Meter)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H-3	0.	4.30E+02	4.30E+02	1.88E+02	4.30E+02	4.30E+02	4.30E+02
P-32	2.31E+05	1.35E+04	0.	0.	0.	1.51E+04	8.78E+03
CR-51	0.	0.	1.40E+01	3.99E+00	2.52E+03	5.81E+02	1.75E+01
MN-54	0.	6.93E+03	0.	1.72E+03	2.45E+05	1.35E+04	1.10E+03
FE-59	2.06E+03	4.86E+06	0.	0.	1.78E+05	3.29E+04	1.85E+03
CO-57	0.	1.21E+02	0.	0.	6.47E+04	5.50E+03	1.18E+02
CO-58	0.	1.18E+02	0.	0.	8.79E+05	1.21E+04	1.68E+02
CO-60	0.	8.40E+02	0.	0.	5.57E+06	3.28E+04	1.17E+03
ZN-65	5.67E+03	1.81E+04	0.	1.21E+04	1.53E+05	9.35E+03	8.15E+03
RB-86	0.	2.37E+04	0.	0.	0.	2.91E+03	1.03E+04
SR-89	4.31E+04	0.	0.	0.	2.31E+06	6.80E+04	1.24E+03
SR-90	1.32E+07	0.	0.	0.	1.53E+07	1.39E+05	8.06E+05
Y-91	5.98E+04	0.	0.	0.	2.63E+06	7.17E+04	1.60E+03
ZR-95	1.08E+04	2.73E+03	0.	9.48E+03	1.81E+06	1.41E+04	1.95E+03
NB-95	1.28E+03	5.75E+02	0.	1.35E+03	4.77E+05	1.21E+04	3.37E+02
RU-103	1.69E+02	0.	0.	1.02E+03	5.66E+05	1.58E+04	5.85E+01
RU-106	9.31E+03	0.	0.	2.34E+04	1.50E+07	1.76E+05	1.14E+03
AG-110	1.89E+03	1.75E+03	0.	3.44E+03	8.12E+05	5.29E+04	1.04E+03

Based on 1 μCi/sec release rate of each isotope in and a Value of 1. for X/Q, depleted X/Q and Relative Deposition

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TABLE G-5
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I)/P(I) FOR GASEOUS DISCHARGES
PATHWAY - INHALATION AGE GROUP - INFANT
ORGAN DOSE FACTOR (MREM/YR PER μCi/Cu Meter)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
SN-123	3.11E+04	6.45E+02	6.45E+02	0.	3.61E+06	5.99E+04	1.02E+03
SN-126	2.21E+05	5.85E+03	1.72E+03	0.	1.64E+06	2.23E+04	8.40E+03
SB-124	5.46E+03	1.03E+02	1.32E+01	0.	4.34E+05	7.11E+04	2.17E+03
SB-125	1.16E+04	1.25E+02	1.03E+01	0.	3.85E+05	1.76E+04	2.32E+03
TE-125M	4.54E+02	1.95E+02	1.53E+02	2.17E+03	4.96E+05	1.36E+04	6.16E+01
TE-127M	2.21E+03	9.83E+02	5.75E+02	8.01E+03	1.68E+05	2.62E+04	2.74E+02
TE-129M	1.32E+03	5.80E+02	5.08E+02	6.40E+03	1.83E+06	7.32E+04	2.06E+02
I-130	8.02E+02	2.35E+03	3.05E+05	3.65E+03	0.	1.35E+03	9.25E+02
I-131	3.63E+04	4.27E+04	1.41E+07	1.07E+04	0.	1.07E+03	2.51E+04
I-132	2.03E+02	5.70E+02	7.67E+04	9.09E+02	0.	7.11E+01	2.03E+02
I-133	1.34E+04	1.93E+04	4.66E+06	4.55E+03	0.	2.28E+03	5.87E+03
I-134	1.13E+02	3.02E+02	4.02E+04	4.82E+02	0.	1.76E-01	1.08E+02
I-135	4.70E+02	1.22E+03	1.64E+05	1.95E+03	0.	9.18E+02	4.51E+02
CS-134	4.80E+05	8.25E+05	0.	5.04E+04	1.01E+05	1.37E+03	7.32E+04
CS-136	6.85E+03	2.56E+04	0.	1.50E+04	2.10E+03	2.04E+03	1.95E+04
CS-137	6.86E+05	7.31E+05	0.	3.89E+04	9.45E+04	1.32E+03	4.41E+04
BA-140	5.70E+03	4.27E+00	0.	2.93E+00	1.64E+06	3.88E+03	2.95E+02
CE-141	2.52E+03	1.55E+03	0.	1.10E+03	5.24E+05	2.06E+04	1.81E+02
CE-144	4.68E+05	1.82E+05	0.	1.48E+05	1.27E+07	1.61E+05	2.49E+04

Based on 1 μCi/sec release rate of each isotope in and a Value of 1. for X/Q, depleted X/Q and Relative Deposition

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TABLE G-6
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I)/P(I) FOR GASEOUS DISCHARGES
PATHWAY - COWS MILK (CONTAMINATED FORAGE) AGE GROUP - INFANT
ORGAN DOSE FACTOR (SQ. METER - MREM/YR PER μCi/Sec)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H-3	0.	2.37E+03	2.37E+03	1.04E+03	2.37E+03	2.37E+03	2.37E+03
P-32	1.82E+10	1.14E+09	0.	0.	0.	2.05E+09	7.05E+08
CR-51	0.	0.	1.82E+04	6.72E+03	4.04E+04	7.66E+06	3.05E+04
MN-54	0.	8.96E+06	0.	2.67E+06	0.	2.74E+07	1.71E+06
FE-59	3.17E+07	7.52E+07	0.	0.	2.09E+07	2.48E+08	2.86E+07
CO-57	0.	1.36E+06	0.	0.	0.	3.46E+07	2.27E+06
CO-58	0.	2.55E+07	0.	0.	0.	6.60E+07	6.24E+07
CO-60	0.	8.73E+07	0.	0.	0.	2.16E+08	2.09E+08
ZN-65	1.46E+09	4.65E+09	0.	3.11E+09	0.	2.93E+09	2.10E+09
RB-86	0.	2.77E+09	0.	0.	0.	5.45E+08	1.29E+09
SR-89	1.47E+10	0.	0.	0.	0.	2.75E+08	4.22E+08
SR-90	1.65E+11	0.	0.	0.	0.	1.61E+09	4.21E+10
Y-91	8.12E+04	0.	0.	0.	0.	5.37E+06	2.16E+03
ZR-95	2.12E+05	9.41E+04	0.	1.86E+04	0.	7.47E+07	5.56E+04
NB-95	5.49E+05	2.47E+05	0.	4.84E+04	0.	1.98E+08	1.45E+05
RU-103	8.30E+03	0.	0.	4.16E+03	0.	1.04E+05	2.86E+03
RU-106	2.01E+05	0.	0.	4.20E+04	0.	1.56E+06	2.46E+04
AG-110	6.21E+07	5.75E+07	0.	1.13E+08	0.	2.35E+10	3.42E+07

Based on 1 μCi/sec release rate of each isotope in and a Value of 1. for X/Q, depleted X/Q and Relative Deposition
Note: The units for C-14 and H-3 are (MREM/YR Per μCi/Cu. Meter)

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TABLE G-6
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I)/P(I) FOR GASEOUS DISCHARGES
PATHWAY - COWS MILK (CONTAMINATED FORAGE) AGE GROUP - INFANT
ORGAN DOSE FACTOR (SQ. METER - MREM/YR PER μCi/Sec)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
SN-126	1.75E+09	3.48E+07	1.01E+07	0.	4.97E+06	1.16E+09	5.25E+07
SB-124	2.75E+07	5.19E+05	6.64E+04	0.	2.13E+07	7.78E+08	1.09E+07
SB-125	3.59E+07	3.27E+06	2.93E+06	3.96E+06	2.83E+09	2.43E+08	6.62E+06
TE-125M	1.57E+08	5.30E+07	5.18E+07	7.05E+07	0.	7.57E+07	2.10E+07
TE-127M	5.54E+07	1.93E+07	1.79E+07	2.00E+08	0.	3.24E+08	7.38E+06
TE-129M	5.87E+08	2.02E+08	2.21E+08	2.70E+08	0.	3.54E+08	8.95E+07
I-130	4.54E+05	1.35E+06	1.71E+08	2.09E+06	0.	1.15E+06	5.29E+05
I-131	2.59E+09	3.09E+09	9.94E+11	7.24E+08	0.	1.16E+08	1.81E+09
I-132	1.78E-01	4.76E-01	6.26E+01	7.58E-01	0.	8.93E-02	1.69E-01
I-133	3.75E+07	5.48E+07	1.30E+10	1.29E+07	0.	9.74E+06	1.66E+07
I-134	0.	0.	1.06E-09	0.	0.	0.	0.
I-135	1.49E+04	3.94E+04	5.15E+06	6.26E+04	8.07E-02	4.41E+04	1.44E+04
CS-134	4.43E+10	7.97E+10	0.	4.65E+09	9.12E+09	1.90E+08	6.75E+09
CS-136	2.78E+08	1.10E+09	0.	6.11E+08	8.37E+07	1.25E+08	7.90E+08
CS-137	6.44E+10	7.21E+10	0.	3.66E+09	8.69E+09	1.86E+08	4.14E+09
BA-140	2.45E+08	2.47E+05	0.	1.22E+04	1.51E+05	8.13E+06	1.27E+07
CE-141	2.65E+05	1.62E+05	0.	9.72E+03	0.	7.87E+07	1.90E+04
CE-144	2.10E+07	8.29E+06	0.	5.67E+05	0.	8.66E+08	1.13E+06

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition.
Note: The units for C-14 and H-3 are (MREM/YR Per μCi/Cu. Meter)

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TABLE G-7
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I)/P(I) FOR GASEOUS DISCHARGES
PATHWAY - GOATS MILK (CONTAMINATED FORAGE) AGE GROUP - INFANT
ORGAN DOSE FACTOR (SQ. METER - MREM/YR PER µCi/Sec)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H-3	0.	4.84E+03	4.84E+03	2.11E+03	4.84E+03	4.84E+03	4.84E+03
P-32	2.19E+10	1.37E+09	0.	0.	0.	2.46E+09	8.46E+08
CR-51	0.	0.	2.19E+03	8.07E+02	4.85E+03	9.19E+05	3.66E+03
MN-54	0.	1.08E+06	0.	3.20E+05	0.	3.29E+06	2.05E+05
FE-59	4.12E+05	9.78E+05	0.	0.	2.72E+05	3.23E+06	3.72E+05
CO-57	0.	1.64E+05	0.	0.	0.	4.15E+06	2.72E+05
CO-58	0.	3.06E+06	0.	0.	0.	7.92E+06	7.49E+06
CO-60	0.	1.05E+07	0.	0.	0.	2.59E+07	2.51E+07
ZN-65	1.76E+08	5.57E+08	0.	3.73E+08	0.	3.51E+08	2.52E+08
RB-86	0.	3.32E+08	0.	0.	0.	6.54E+07	1.55E+08
SR-89	3.09E+10	0.	0.	0.	0.	5.77E+08	8.87E+08
SR-90	3.46E+11	0.	0.	0.	0.	3.35E+09	8.83E+10
Y-91	9.74E+03	0.	0.	0.	0.	6.45E+05	2.60E+02
ZR-95	2.54E+04	1.13E+04	0.	2.23E+03	0.	8.95E+06	6.67E+03
NB-95	6.59E+04	2.97E+04	0.	5.81E+03	0.	2.37E+07	1.75E+04
RU-103	9.96E+02	0.	0.	4.99E+02	0.	1.24E+04	3.43E+02
RU-106	2.41E+04	0.	0.	5.04E+03	0.	1.87E+05	2.96E+03
AG-110	7.45E+06	6.90E+06	0.	1.36E+07	0.	2.81E+09	4.10E+06

Based on 1 µCi/sec release rate of each isotope in and a Value of 1. for X/Q, depleted X/Q and Relative Deposition

Note: The units for C-14 and H-3 are 1MREM/Yr per µCi/Cu meter.

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TABLE G-7
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I)/P(I) FOR GASEOUS DISCHARGES
PATHWAY - GOATS MILK (CONTAMINATED FORAGE) AGE GROUP - INFANT
ORGAN DOSE FACTOR (SQ. METER - MREM/YR PER μCi/Sec)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
SN-126	2.10E+08	4.17E+06	1.22E+06	0.	5.97E+05	1.40E+08	6.30E+06
SB-124	3.30E+06	6.22E+04	7.97E+03	0.	2.56E+06	9.33E+07	1.30E+06
SB-125	4.31E+06	3.92E+05	3.52E+05	4.76E+05	3.40E+08	2.92E+07	7.94E+05
TE-125M	1.89E+07	6.36E+06	6.21E+06	8.46E+06	0.	9.09E+06	2.52E+06
TE-127M	6.64E+06	2.31E+06	2.15E+06	2.40E+07	0.	3.88E+07	8.85E+05
TE-129M	7.05E+07	2.42E+07	2.66E+07	3.23E+07	0.	4.25E+07	1.07E+07
I-130	5.45E+05	1.61E+06	2.05E+08	2.51E+06	0.	1.38E+06	6.35E+05
I-131	3.11E+09	3.70E+09	1.19E+12	9.28E+08	0.	1.39E+08	2.17E+09
I-132	2.13E-01	5.71E-01	7.51E+01	9.10E-01	0.	1.07E-01	2.03E-01
I-133	4.50E+07	6.57E+07	1.55E+10	1.55E+07	0.	1.17E+07	1.99E+07
I-134	0.	0.	1.27E-09	0.	0.	0.	0.
I-135	1.79E+04	4.72E+04	6.18E+06	7.51E+04	2.42E-01	5.29E+04	1.73E+04
CS-134	1.33E+11	2.39E+11	0.	1.39E+10	2.74E+10	5.69E+08	2.02E+10
CS-136	8.34E+08	3.29E+09	0.	1.83E+09	2.51E+08	3.74E+08	2.37E+09
CS-137	1.93E+11	2.16E+11	0.	1.10E+10	2.61E+10	5.59E+08	1.24E+10
BA-140	2.95E+07	2.96E+04	0.	1.47E+03	1.81E+04	9.76E+05	1.52E+06
CE-141	3.17E+04	1.95E+04	0.	1.17E+03	0.	9.44+06	2.28E+03
CE-144	2.52E+06	9.95E+05	0.	6.80E+04	0.	1.04E+08	1.36E+05

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition.

Note: The units for C-14 and H-3 are 1MREM/Yr per μCi/Cu meter.

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TABLE G-8
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - INHALATION AGE GROUP - CHILD
ORGAN DOSE FACTOR (MREM/YR PER μCi/CU. METER)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H----3	0.	7.51E+02	7.51E+02	4.96E+02	7.51E+02	7.51E+02	7.51E+02
P---32	6.11E+05	3.57E+04	0.	0.	0.	4.00E+04	2.32E+04
CR--51	0.	0.	2.75E+01	1.06E+01	6.66E+03	1.54E+03	4.63E+01
MN--54	0.	1.83E+04	0.	4.55E+03	6.48E+05	3.58E+04	2.91E+03
FE--59	5.44E+03	1.28E+07	0.	0.	4.70E+05	8.70E+04	4.88E+03
CO--57	0.	3.20E+02	0.	0.	1.71E+05	1.45E+04	3.10E+02
CO--58	0.	1.52E+02	0.	0.	1.13E+06	3.62E+04	2.68E+02
CO--60	0.	1.07E+03	0.	0.	6.92E+06	9.36E+04	1.88E+03
ZN--65	1.50E+04	4.77E+04	0.	3.19E+04	4.03E+05	2.47E+04	2.15E+04
RB--86	0.	6.25E+04	0.	0.	0.	7.70E+03	2.73E+04
SR--89	5.37E+04	0.	0.	0.	2.24E+06	1.69E+05	1.54E+03
SR--90	1.64E+07	0.	0.	0.	1.48E+07	3.45E+05	9.99E+05
Y---91	7.44E+04	0.	0.	0.	2.55E+06	1.78E+05	1.98E+03
ZR--95	1.41E+04	3.28E+03	0.	2.51E+04	2.12E+06	5.74E+04	2.98E+03
NB--95	1.70E+03	7.25E+02	0.	3.58E+03	5.85E+05	3.32E+04	5.33E+02
RU-103	2.16E+02	0.	0.	2.70E+03	6.33E+05	4.22E+04	8.73E+01
RU-106	1.15E+04	0.	0.	6.18E+04	1.45E+07	4.37E+05	1.44E+03
AG110	5.00E+03	4.63E+03	0.	9.10E+03	2.15E+06	1.40E+05	2.75E+03

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

ST. LUCIE PLANT
CHEMISTRY OPERATING PROCEDURE NO. C-200, REVISION 25
OFFSITE DOSE CALCULATION MANUAL (ODCM)

TABLE G-8
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - INHALATION AGE GROUP - CHILD
ORGAN DOSE FACTOR (MREM/YR PER μCi/CU. METER)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
SN-123	3.85E+04	6.44E+02	6.81E+02	0.	3.50E+06	1.49E+05	1.27E+03
SN-126	5.85E+05	1.55E+04	4.55E+03	0.	4.33E+06	5.88E+04	2.22E+04
SB-124	1.44E+04	2.72E+02	3.49E+01	0.	1.15E+06	1.88E+05	5.74E+03
SB-125	3.06E+04	3.30E+02	2.72E+01	0.	1.02E+06	4.66E+04	6.14E+03
TE 125M	5.62E+02	1.94E+02	1.61E+02	5.74E+03	4.81E+05	3.38E+04	7.62E+01
TE 127M	5.85E+03	2.60E+03	1.52E+03	2.12E+04	4.44E+05	6.92E+04	7.25E+02
TE 129M	1.64E+03	5.85E+02	5.40E+02	1.69E+04	1.80E+06	1.82E+05	2.60E+02
I--130	2.12E+03	6.22E+03	8.07E+05	9.66E+03	0.	3.56E+03	2.45E+03
I--131	4.55E+04	4.63E+04	1.54E+07	2.84E+04	0.	2.65E+03	3.50E+04
I--132	5.37E+02	1.51E+03	2.03E+05	2.40E+03	0.	1.88E+02	5.37E+02
I--133	1.68E+04	2.05E+04	5.03E+06	1.20E+04	0.	5.55E+03	8.03E+03
I--134	2.98E+02	7.99E+02	1.06E+05	1.27E+03	0.	4.66E-01	2.85E+02
I--135	1.24E+03	3.23E+03	4.33E+05	5.14E+03	0.	2.43E+03	1.19E+03
CS-134	6.22E+05	9.95E+05	0.	1.33E+05	1.19E+05	3.77E+03	2.23E+05
CS-136	1.81E+04	6.77E+04	0.	3.96E+04	5.55E+03	5.40E+03	5.14E+04
CS-137	8.66E+05	7.99E+05	0.	1.03E+05	1.00E+05	3.41E+03	1.25E+05
BA-140	7.14E+03	4.66E+00	0.	7.73E+00	1.74E+06	9.92E+03	4.22E+02
CE-141	3.13E+03	1.57E+03	0.	2.90E+03	5.14E+05	5.44E+04	2.33E+02
CE-144	5.81E+05	1.82E+05	0.	3.92E+05	1.23E+07	4.00E+05	3.10E+04

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

ST. LUCIE PLANT
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TABLE G-9
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - COWS MILK (CONTAMINATED FORAGE) AGE GROUP - CHILD
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H----3	0.	1.57E+03	1.57E+03	1.04E+03	1.57E+03	1.57E+03	1.57E+03
P---32	1.82E+10	1.14E+09	0.	0.	0.	2.05E+09	7.05E+08
CR--51	0.	0.	1.82E+04	6.72E+03	4.04E+04	7.66E+06	3.05E+04
MN--54	0.	8.96E+06	0.	2.67E+06	0.	2.74E+07	1.71E+06
FE--59	3.17E+07	7.52E+07	0.	0.	2.09E+07	2.48E+08	2.86E+07
CO--57	0.	1.36E+06	0.	0.	0.	3.46E+07	2.27E+06
CO--58	0.	1.25E+07	0.	0.	0.	7.41E+07	3.76E+07
CO--60	0.	4.22E+07	0.	0.	0.	2.33E+08	1.27E+08
ZN--65	1.46E+09	4.65E+09	0.	3.11E+09	0.	2.93E+09	2.10E+09
RB--86	0.	2.77E+09	0.	0.	0.	5.45E+08	1.29E+09
SR--89	6.92E+09	0.	0.	0.	0.	2.58E+08	1.98E+08
SR--90	1.13E+11	0.	0.	0.	0.	1.52E+09	2.87E+10
Y---91	3.80E+04	0.	0.	0.	0.	5.05E+06	1.01E+03
ZR--95	1.06E+05	4.47E+04	0.	1.86E+04	0.	7.68E+07	3.29E+04
NB--95	2.75E+05	1.18E+05	0.	4.84E+04	0.	2.03E+08	8.63E+04
RU-103	3.99E+03	0.	0.	4.16E+03	0.	1.05E+05	1.61E+03
RU-106	9.39E+04	0.	0.	4.20E+04	0.	1.46E+06	1.17E+04
AG110	6.21E+07	5.75E+07	0.	1.13E+08	0.	2.35E+10	3.42E+07

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

Note - the units for C---14 and H----3 are (mrem/yr per μCi/cu. meter)

ST. LUCIE PLANT
CHEMISTRY OPERATING PROCEDURE NO. C-200, REVISION 25
OFFSITE DOSE CALCULATION MANUAL (ODCM)

TABLE G-9
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - COWS MILK (CONTAMINATED FORAGE) AGE GROUP - CHILD
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
SN-123	0.	0.	0.	0.	0.	0.	0.
SN-126	1.75E+09	3.48E+07	1.01E+07	0.	4.97E+06	1.16E+09	5.25E+07
SB-124	2.75E+07	5.19E+05	6.64E+04	0.	2.13E+07	7.78E+08	1.09E+07
SB-125	3.13E+07	1.41E+06	1.18E+06	3.96E+06	2.83E+09	2.43E+08	5.99E+06
TE 125M	7.38E+07	2.00E+07	2.07E+07	7.05E+07	0.	7.12E+07	9.84E+06
TE 127M	5.18E+07	1.78E+07	1.46E+07	2.00E+08	0.	2.99E+08	6.60E+06
TE 129M	2.77E+08	7.73E+07	8.85E+07	2.70E+08	0.	3.33E+08	4.28E+07
I--130	4.54E+05	1.35E+06	1.71E+08	2.09E+06	0.	1.15E+06	5.29E+05
I--131	1.24E+09	1.27E+09	4.12E+11	7.74E+08	0.	1.09E+08	9.56E+08
I--132	1.78E-01	4.76E-01	6.26E+01	7.58E-01	0.	8.93E-02	1.69E-01
I--133	1.78E+07	2.20E+07	5.30E+09	1.29E+07	0.	8.90E+06	8.63E+06
I--134	0.	0.	1.06E-09	0.	0.	0.	0.
I--135	1.49E+04	3.94E+04	5.15E+06	6.26E+04	8.07E-02	4.41E+04	1.44E+04
CS-134	2.17E+10	3.65E+10	0.	4.65E+09	4.06E+09	1.97E+08	7.76E+09
CS-136	2.78E+08	1.10E+09	0.	6.11E+08	8.37E+07	1.25E+08	7.90E+08
CS-137	3.08E+10	2.98E+10	0.	3.66E+09	3.49E+09	1.81E+08	4.44E+09
BA-140	1.17E+08	1.02E+05	0.	1.22E+04	6.09E+04	7.75E+06	6.84E+06
CE-141	1.24E+05	6.22E+04	0.	9.72E+03	0.	7.80E+07	9.26E+03
CE-144	1.00E+07	3.14E+06	0.	5.67E+05	0.	8.15E+08	5.34E+05

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

Note - the units for C---14 and H----3 are (mrem/yr per μCi/cu. meter)

ST. LUCIE PLANT
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TABLE G-10
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - GOATS MILK (CONTAMINATED FORAGE) AGE GROUP - CHILD
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER µCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H----3	0.	3.20E+03	3.20E+03	2.11E+03	3.20E+03	3.20E+03	3.20E+03
P---32	2.19E+10	1.37E+09	0.	0.	0.	2.46E+09	8.46E+08
CR--51	0.	0.	2.19E+03	8.07E+02	4.85E+03	9.19E+05	3.66E+03
MN--54	0.	1.08E+06	0.	3.20E+05	0.	3.29E+06	2.05E+05
FE--59	4.12E+05	9.78E+05	0.	0.	2.72E+05	3.23E+06	3.72E+05
CO--57	0.	1.64E+05	0.	0.	0.	4.15E+06	2.72E+05
CO--58	0.	1.50E+06	0.	0.	0.	8.90E+06	4.51E+06
CO--60	0.	5.06E+06	0.	0.	0.	2.80E+07	1.52E+07
ZN--65	1.76E+08	5.57E+08	0.	3.73E+08	0.	3.51E+08	2.52E+08
RB--86	0.	3.32E+08	0.	0.	0.	6.54E+07	1.55E+08
SR--89	1.45E+10	0.	0.	0.	0.	5.43E+08	4.16E+08
SR--90	2.37E+11	0.	0.	0.	0.	3.16E+09	6.02E+10
Y---91	4.56E+03	0.	0.	0.	0.	6.06E+05	1.22E+02
ZR--95	1.27E+04	5.37E+03	0.	2.23E+03	0.	9.22E+06	3.96E+03
NB--95	3.30E+04	1.41E+04	0.	5.81E+03	0.	2.44E+07	1.04E+04
RU-103	4.79E+02	0.	0.	4.99E+02	0.	1.26E+04	1.94E+02
RU-106	1.13E+04	0.	0.	5.04E+03	0.	1.75E+05	1.40E+03
AG110	7.45E+06	6.90E+06	0.	1.36E+07	0.	2.81E+09	4.10E+06

Based on 1 µCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

Note - the units for C---14 and H----3 are (mrem/yr per µCi/cu. meter)

ST. LUCIE PLANT
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TABLE G-10
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - GOATS MILK (CONTAMINATED FORAGE) AGE GROUP - CHILD
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER µCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
SN-123	0.	0.	0.	0.	0.	0.	0.
SN-126	2.10E+08	4.17E+06	1.22E+06	0.	5.97E+05	1.40E+08	6.30E+06
SB-124	3.30E+06	6.22E+04	7.97E+03	0.	2.56E+06	9.33E+07	1.30E+06
SB-125	3.75E+06	1.70E+05	1.43E+05	4.76E+05	3.40E+08	2.92E+07	7.19E+05
TE 125M	8.85E+06	2.40E+06	2.49E+06	8.46E+06	0.	8.54E+06	1.18E+06
TE 127M	6.21E+06	2.14E+06	1.75E+06	2.40E+07	0.	3.58E+07	7.92E+05
TE 129M	3.32E+07	9.27E+06	1.06E+07	3.23E+07	0.	4.00E+07	5.15E+06
I--130	5.45E+05	1.61E+06	2.05E+08	2.51E+06	0.	1.38E+06	6.35E+05
I--131	1.48E+09	1.52E+09	4.94E+11	9.28E+08	0.	1.30E+08	1.15E+09
I--132	2.13E-01	5.71E-01	7.51E+01	9.10E-01	0.	1.07E-01	2.03E-01
I--133	2.14E+07	2.64E+07	6.36E+09	1.55E+07	0.	1.07E+07	1.04E+07
I--134	0.	0.	1.27E-09	0.	0.	0.	0.
I--135	1.79E+04	4.72E+04	6.18E+06	7.51E+04	2.42E-01	5.29E+04	1.73E+04
CS-134	6.50E+10	1.10E+11	0.	1.39E+10	1.22E+10	5.92E+08	2.33E+10
CS-136	8.34E+08	3.29E+09	0.	1.83E+09	2.51E+08	3.74E+08	2.37E+09
CS-137	9.23E+10	8.93E+10	0.	1.10E+10	1.05E+10	5.44E+08	1.33E+10
BA-140	1.40E+07	1.23E+04	0.	1.47E+03	7.31E+03	9.30E+05	8.21E+05
CE-141	1.49E+04	7.46E+03	0.	1.17E+03	0.	9.36E+06	1.11E+03
CE-144	1.20E+06	3.76E+05	0.	6.80E+04	0.	9.78E+07	6.41E+04

Based on 1 µCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

Note - the units for C---14 and H----3 are (mrem/yr per µCi/cu. meter)

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TABLE G-11
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - MEAT (CONTAMINATED FORAGE) AGE GROUP - CHILD
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H----3	0.	2.33E+02	2.33E+02	1.54E+02	2.33E+02	2.33E+02	2.33E+02
P---32	1.74E+09	1.09E+08	0.	0.	0.	1.96E+08	6.73E+07
CR--51	0.	0.	1.58E+03	5.82E+02	3.50E+03	6.63E+05	2.64E+03
MN--54	0.	3.42E+06	0.	1.02E+06	0.	1.05E+07	6.54E+05
FE--59	9.95E+07	2.36E+08	0.	0.	6.55E+07	7.79E+08	8.98E+07
CO--57	0.	2.10E+06	0.	0.	0.	5.33E+07	3.50E+06
CO--58	0.	1.69E+07	0.	0.	0.	1.00E+08	5.10E+07
CO--60	0.	6.77E+07	0.	0.	0.	3.75E+08	2.03E+08
ZN--65	1.33E+08	4.22E+08	0.	2.82E+08	0.	2.66E+08	1.91E+08
RB--86	0.	1.82E+08	0.	0.	0.	3.59E+07	8.50E+07
SR--89	5.04E+08	0.	0.	0.	0.	1.88E+07	1.44E+07
SR--90	1.05E+10	0.	0.	0.	0.	7.02E+08	2.67E+09
Y---91	1.76E+06	0.	0.	0.	0.	2.33E+08	4.69E+04
ZR--95	4.62E+06	1.51E+06	0.	7.47E+05	0.	2.22E+09	1.20E+06
NB--95	2.68E+06	1.15E+06	0.	4.72E+05	0.	1.98E+09	8.41E+05
RU-103	1.45E+08	0.	0.	1.51E+08	0.	3.81E+09	5.87E+07
RU-106	4.51E+09	0.	0.	2.02E+09	0.	7.01E+10	5.61E+08
AG110	2.50E+06	2.31E+06	0.	4.55E+06	0.	9.44E+08	1.38E+06

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

Note - the units for C---14 and H----3 are (mrem/yr per μCi/cu. meter)

ST. LUCIE PLANT
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TABLE G-11
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - MEAT (CONTAMINATED FORAGE) AGE GROUP - CHILD
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
SN-123	0.	0.	0.	0.	0.	0.	0.
SN-126	6.92E+09	1.37E+08	4.02E+07	0.	2.41E+06	2.31E+09	1.98E+08
SB-124	7.40E+06	1.40E+05	1.79E+04	0.	5.74E+06	2.10E+08	2.93E+06
SB-125	7.66E+07	1.84E+07	1.90E+07	6.47E+07	9.26E+08	1.44E+08	1.08E+07
TE 125M	5.69E+08	1.54E+08	1.60E+08	5.44E+08	0.	5.49E+08	7.59E+07
TE 127M	4.40E+08	1.51E+08	1.24E+08	1.70E+09	0.	2.54E+09	5.61E+07
TE 129M	1.84E+09	5.12E+08	5.87E+08	1.78E+09	0.	2.21E+09	2.84E+08
I--130	8.87E-07	2.63E-06	3.34E-04	4.08E-06	0.	2.25E-06	1.03E-06
I--131	1.58E+07	1.62E+07	5.25E+09	9.86E+06	0.	1.38E+06	1.22E+07
I--132	0.	0.	0.	0.	0.	0.	0.
I--133	6.86E-01	8.47E-01	2.04E+02	4.97E-01	0.	3.43E-01	3.33E-01
I--134	0.	0.	0.	0.	0.	0.	0.
I--135	3.21E-02	2.96E-02	0.	1.12E-02	3.37E-03	6.92E-04	1.32E-02
CS-134	8.83E+08	1.49E+09	0.	1.89E+08	1.65E+08	8.04E+06	3.16E+08
CS-136	4.41E+06	1.74E+07	0.	9.69E+06	1.33E+06	1.98E+06	1.25E+07
CS-137	1.27E+09	1.23E+09	0.	1.51E+08	1.44E+08	7.50E+06	1.84E+08
BA-140	4.37E+07	3.84E+04	0.	4.59E+03	2.29E+04	6.03E+06	2.57E+06
CE-141	2.10E+04	1.05E+04	0.	1.65E+03	0.	1.32E+07	1.57E+03
CE-144	2.38E+06	7.46E+05	0.	1.35E+05	0.	1.94E+08	1.27E+05

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

Note - the units for C---14 and H----3 are (mrem/yr per μCi/cu. meter)

ST. LUCIE PLANT
CHEMISTRY OPERATING PROCEDURE NO. C-200, REVISION 25
OFFSITE DOSE CALCULATION MANUAL (ODCM)

TABLE G-12
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - FRESH FRUITS AND VEGETABLES AGE GROUP - CHILD
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H----3	0.	2.47E+02	2.47E+02	1.63E+02	2.47E+02	2.47E+02	2.47E+02
P---32	4.22E+08	2.64E+07	0.	0.	0.	4.74E+07	1.63E+07
CR--51	0.	0.	4.68E+03	1.73E+03	1.04E+04	1.97E+06	7.83E+03
MN--54	0.	1.98E+07	0.	5.89E+06	0.	6.07E+07	3.78E+06
FE--59	1.48E+07	3.51E+07	0.	0.	9.75E+06	1.16E+08	1.34E+07
CO--57	0.	7.53E+05	0.	0.	0.	1.91E+07	1.25E+06
CO--58	0.	6.94E+06	0.	0.	0.	4.13E+07	2.09E+07
CO--60	0.	2.33E+07	0.	0.	0.	1.29E+08	6.98E+07
ZN--65	2.08E+07	6.59E+07	0.	4.41E+07	0.	4.15E+07	2.98E+07
RB--86	0.	5.28E+07	0.	0.	0.	1.04E+07	2.46E+07
SR--89	4.84E+09	0.	0.	0.	0.	1.81E+08	1.39E+08
SR--90	7.79E+10	0.	0.	0.	0.	1.52E+09	1.98E+10
Y---91	2.12E+06	0.	0.	0.	0.	2.82E+08	5.65E+04
ZR--95	4.06E+05	9.87E+04	0.	6.07E+04	0.	1.08E+08	8.81E+04
NB--95	6.20E+04	2.64E+04	0.	1.09E+04	0.	4.58E+07	1.94E+04
RU-103	2.24E+06	0.	0.	2.34E+06	0.	5.88E+07	9.05E+05
RU-106	5.19E+07	0.	0.	2.32E+07	0.	8.07E+08	6.46E+06
AG110	6.87E+05	6.36E+05	0.	1.25E+06	0.	2.59E+08	3.78E+05

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

ST. LUCIE PLANT
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TABLE G-12
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - FRESH FRUITS AND VEGETABLES AGE GROUP - CHILD
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
SN-123	1.71E-05	2.14E-07	2.26E-07	0.	0.	8.50E-06	4.21E-07
SN-126	3.87E+08	7.68E+06	2.25E+06	0.	1.75E+06	3.44E+08	1.19E+07
SB-124	1.02E+07	1.93E+05	2.47E+04	0.	7.93E+06	2.89E+08	4.04E+06
SB-125	1.22E+07	6.99E+05	6.22E+05	2.09E+06	1.04E+09	9.02E+07	2.29E+06
TE 125M	4.12E+07	1.12E+07	1.16E+07	3.94E+07	0.	3.97E+07	5.49E+06
TE 127M	2.88E+07	9.90E+06	8.09E+06	1.11E+08	0.	1.65E+08	3.67E+06
TE 129M	1.56E+08	4.35E+07	4.99E+07	1.51E+08	0.	1.88E+08	2.41E+07
I--130	1.60E+05	4.73E+05	6.02E+07	7.35E+05	0.	4.05E+05	1.86E+05
I--131	1.24E+08	1.27E+08	4.13E+10	7.75E+07	0.	1.09E+07	9.58E+07
I--132	2.26E+01	6.05E+01	7.97E+03	9.65E+01	0.	1.14E+01	2.15E+01
I--133	3.61E+06	4.46E+06	1.08E+09	2.62E+06	0.	1.81E+06	1.75E+06
I--134	4.18E-05	1.14E-04	1.47E-02	1.81E-04	0.	9.89E-08	4.06E-05
I--135	1.64E+04	4.33E+04	5.67E+06	6.89E+04	3.51E-03	4.85E+04	1.59E+04
CS-134	9.97E+08	1.68E+09	0.	2.14E+08	1.87E+08	9.08E+06	3.57E+08
CS-136	1.35E+07	5.32E+07	0.	2.96E+07	4.06E+06	6.05E+06	3.83E+07
CS-137	1.41E+09	1.37E+09	0.	1.68E+08	1.60E+08	8.34E+06	2.04E+08
BA-140	1.70E+08	1.56E+05	0.	1.78E+04	8.87E+04	2.08E+08	9.96E+06
CE-141	1.17E+05	5.84E+04	0.	9.13E+03	0.	7.33E+07	8.69E+03
CE-144	9.23E+06	2.89E+06	0.	5.22E+05	0.	7.51E+08	4.92E+05

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

ST. LUCIE PLANT
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TABLE G-13
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - INHALATION AGE GROUP - TEENAGER
ORGAN DOSE FACTOR (MREM/YR PER µCI/CU. METER)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H----3	0.	8.48E+02	8.48E+02	1.07E+03	8.48E+02	8.48E+02	8.48E+02
P---32	1.32E+06	7.72E+04	0.	0.	0.	8.64E+04	5.02E+04
CR--51	0.	0.	5.95E+01	2.28E+01	1.44E+04	3.32E+03	1.00E+02
MN--54	0.	3.96E+04	0.	9.84E+03	1.40E+06	7.74E+04	6.30E+03
FE--59	1.18E+04	2.78E+07	0.	0.	1.02E+06	1.88E+05	1.06E+04
CO--57	0.	6.92E+02	0.	0.	3.70E+05	3.14E+04	6.71E+02
CO--58	0.	1.76E+02	0.	0.	1.37E+06	9.52E+04	2.34E+02
CO--60	0.	1.24E+03	0.	0.	8.56E+06	2.35E+05	1.65E+03
ZN--65	3.24E+04	1.03E+05	0.	6.90E+04	8.72E+05	5.34E+04	4.66E+04
RB--86	0.	1.35E+05	0.	0.	0.	1.66E+04	5.90E+04
SR--89	3.87E+04	0.	0.	0.	2.50E+06	3.54E+05	1.11E+03
SR--90	1.18E+07	0.	0.	0.	1.66E+07	7.24E+05	7.23E+05
Y---91	5.38E+04	0.	0.	0.	2.86E+06	3.74E+05	1.44E+03
ZR--95	1.09E+04	3.63E+03	0.	5.42E+04	2.56E+06	1.33E+05	2.54E+03
NB--95	1.36E+03	8.24E+02	0.	7.74E+03	7.17E+05	8.80E+04	4.62E+02
RU-103	1.63E+02	0.	0.	5.83E+03	7.51E+05	9.44E+04	7.32E+01
RU-106	8.40E+03	0.	0.	1.34E+05	1.64E+07	9.28E+05	1.06E+03
AG110	1.08E+04	1.00E+04	0.	1.97E+04	4.64E+06	3.02E+05	5.94E+03

Based on 1 µCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

ST. LUCIE PLANT
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TABLE G-13
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - INHALATION AGE GROUP - TEENAGER
ORGAN DOSE FACTOR (MREM/YR PER μCI/CU. METER)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
SN-123	2.79E+04	6.14E+02	4.92E+02	0.	3.91E+06	3.13E+05	9.20E+02
SN-126	1.26E+06	3.34E+04	9.84E+03	0.	9.36E+06	1.27E+05	4.80E+04
SB-124	3.12E+04	5.89E+02	7.55E+01	0.	2.48E+06	4.06E+05	1.24E+04
SB-125	6.61E+04	7.13E+02	5.87E+01	0.	2.20E+06	1.01E+05	1.33E+04
TE 125M	4.07E+02	1.86E+02	1.17E+02	1.24E+04	5.36E+05	7.08E+04	5.53E+01
TE 127M	1.26E+04	5.62E+03	3.29E+03	4.58E+04	9.60E+05	1.50E+05	1.57E+03
TE 129M	1.19E+03	5.64E+02	3.90E+02	3.66E+04	2.03E+06	3.84E+05	1.92E+02
I--130	4.58E+03	1.34E+04	1.74E+06	2.09E+04	0.	7.69E+03	5.29E+03
I--131	3.37E+04	4.72E+04	1.39E+07	6.14E+04	0.	5.96E+03	2.82E+04
I--132	1.16E+03	3.26E+03	4.38E+05	5.19E+03	0.	4.06E+02	1.16E+03
I--133	1.23E+04	2.06E+04	3.83E+06	2.60E+04	0.	1.00E+04	6.34E+03
I--134	6.45E+02	1.73E+03	2.30E+05	2.75E+03	0.	1.01E+00	6.16E+02
I--135	2.69E+03	6.99E+03	9.36E+05	1.11E+04	0.	5.25E+03	2.58E+03
CS-134	4.83E+05	1.10E+06	0.	2.88E+05	1.44E+05	8.96E+03	5.44E+05
CS-136	3.91E+04	1.46E+05	0.	8.56E+04	1.20E+04	1.17E+04	1.11E+05
CS-137	6.42E+05	8.24E+05	0.	2.22E+05	1.18E+05	7.68E+03	3.03E+05
BA-140	5.30E+03	4.85E+00	0.	1.67E+01	2.02E+06	2.12E+04	3.42E+02
CE-141	2.27E+03	1.52E+03	0.	6.26E+03	5.83E+05	1.14E+05	1.74E+02
CE-144	4.19E+05	1.74E+05	0.	8.48E+05	1.38E+07	8.40E+05	2.24E+04

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

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TABLE G-14
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - COWS MILK (CONTAMINATED FORAGE) AGE GROUP - TEENAGER
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H----3	0.	9.93E+02	9.93E+02	1.26E+03	9.93E+02	9.93E+02	9.93E+02
P---32	2.21E+10	1.38E+09	0.	0.	0.	2.48E+09	8.54E+08
CR--51	0.	0.	2.21E+04	8.15E+03	4.90E+04	9.29E+06	3.69E+04
MN--54	0.	1.09E+07	0.	3.23E+06	0.	3.33E+07	2.07E+06
FE--59	3.84E+07	9.12E+07	0.	0.	2.53E+07	3.01E+08	3.47E+07
CO--57	0.	1.65E+06	0.	0.	0.	4.19E+07	2.75E+06
CO--58	0.	8.10E+06	0.	0.	0.	1.10E+08	1.85E+07
CO--60	0.	2.73E+07	0.	0.	0.	3.27E+08	6.23E+07
ZN--65	1.77E+09	5.63E+09	0.	3.77E+09	0.	3.55E+09	2.55E+09
RB--86	0.	3.35E+09	0.	0.	0.	6.61E+08	1.56E+09
SR--89	2.80E+09	0.	0.	0.	0.	3.03E+08	8.03E+07
SR--90	8.29E+10	0.	0.	0.	3.38E+06	1.76E+09	2.05E+10
Y---91	1.54E+04	0.	0.	0.	0.	5.93E+06	4.12E+02
ZR--95	4.78E+04	2.84E+04	0.	2.25E+04	0.	1.15E+08	1.60E+04
NB--95	1.24E+05	7.46E+04	0.	5.87E+04	0.	3.05E+08	4.21E+04
RU-103	1.69E+03	0.	0.	5.04E+03	0.	1.32E+05	7.56E+02
RU-106	3.83E+04	0.	0.	5.09E+04	0.	1.73E+06	4.81E+03
AG-110	7.53E+07	6.97E+07	0.	1.37E+08	0.	2.84E+10	4.14E+07

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

Note - the units for C---14 and H----3 are (mrem/yr per μCi/cu. meter)

ST. LUCIE PLANT
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TABLE G-14
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - COWS MILK (CONTAMINATED FORAGE) AGE GROUP - TEENAGER
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
SN-123	0.	0.	0.	0.	0.	0.	0.
SN-126	2.12E+09	4.21E+07	1.24E+07	0.	6.03E+06	1.41E+09	6.37E+07
SB-124	3.33E+07	6.29E+05	8.05E+04	0.	2.59E+07	9.43E+08	1.32E+07
SB-125	3.45E+07	9.58E+05	5.05E+05	4.80E+06	3.43E+09	2.95E+08	6.82E+06
TE 125M	3.00E+07	1.08E+07	8.47E+06	8.55E+07	0.	8.39E+07	3.98E+06
TE 127M	6.02E+07	2.11E+07	1.59E+07	2.43E+08	0.	3.02E+08	7.45E+06
TE 129M	1.13E+08	4.18E+07	3.61E+07	3.27E+08	0.	3.93E+08	1.78E+07
I--130	5.51E+05	1.63E+06	2.07E+08	2.53E+06	0.	1.40E+06	6.41E+05
I--131	5.12E+08	7.24E+08	2.09E+11	9.38E+08	0.	1.37E+08	4.31E+08
I--132	2.16E-01	5.76E-01	7.59E+01	9.19E-01	0.	1.08E-01	2.05E-01
I--133	7.33E+06	1.24E+07	2.26E+09	1.56E+07	0.	9.02E+06	3.83E+06
I--134	0.	0.	1.29E-09	0.	0.	0.	0.
I--135	1.81E+04	4.77E+04	6.24E+06	7.58E+04	9.79E-02	5.34E+04	1.75E+04
CS-134	9.44E+09	2.28E+10	0.	5.63E+09	2.76E+09	2.63E+08	1.06E+10
CS-136	3.37E+08	1.33E+09	0.	7.41E+08	1.02E+08	1.51E+08	9.58E+08
CS-137	1.28E+10	1.72E+10	0.	4.43E+09	2.28E+09	2.29E+08	6.04E+09
BA-140	4.84E+07	5.95E+04	0.	1.48E+04	3.98E+04	9.16E+06	3.11E+06
CE-141	5.05E+04	3.39E+04	0.	1.18E+04	0.	9.18E+07	3.89E+03
CE-144	4.10E+06	1.68E+06	0.	6.87E+05	0.	9.65E+08	2.17E+05

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

Note - the units for C---14 and H----3 are (mrem/yr per μCi/cu. meter)

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TABLE G-15
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - GOATS MILK (CONTAMINATED FORAGE) AGE GROUP - TEENAGER
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER µCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H----3	0.	2.03E+03	2.03E+03	2.56E+03	2.03E+03	2.03E+03	2.03E+03
P---32	2.65E+10	1.66E+09	0.	0.	0.	2.98E+09	1.03E+09
CR--51	0.	0.	2.65E+03	9.78E+02	5.88E+03	1.11E+06	4.43E+03
MN--54	0.	1.30E+06	0.	3.88E+05	0.	3.99E+06	2.49E+05
FE--59	4.99E+05	1.19E+06	0.	0.	3.29E+05	3.91E+06	4.51E+05
CO--57	0.	1.98E+05	0.	0.	0.	5.03E+06	3.30E+05
CO--58	0.	9.72E+05	0.	0.	0.	1.31E+07	2.22E+06
CO--60	0.	3.28E+06	0.	0.	0.	3.93E+07	7.48E+06
ZN--65	2.13E+08	6.76E+08	0.	4.52E+08	0.	4.26E+08	3.06E+08
RB--86	0.	4.02E+08	0.	0.	0.	7.93E+07	1.88E+08
SR--89	5.87E+09	0.	0.	0.	0.	6.37E+08	1.69E+08
SR--90	1.74E+11	0.	0.	0.	4.05E+05	3.68E+09	4.30E+10
Y---91	1.85E+03	0.	0.	0.	0.	7.11E+05	4.94E+01
ZR--95	5.74E+03	3.41E+03	0.	2.70E+03	0.	1.38E+07	1.93E+03
NB--95	1.49E+04	8.96E+03	0.	7.05E+03	0.	3.66E+07	5.05E+03
RU-103	2.03E+02	0.	0.	6.05E+02	0.	1.58E+04	9.08E+01
RU-106	4.59E+03	0.	0.	6.11E+03	0.	2.08E+05	5.78E+02
AG110	9.04E+06	8.36E+06	0.	1.64E+07	0.	3.41E+09	4.97E+06

Based on 1 µCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

Note - the units for C---14 and H----3 are (mrem/yr per µCi/cu. meter)

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TABLE G-15
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - GOATS MILK (CONTAMINATED FORAGE) AGE GROUP - TEENAGER
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
SN-123	0.	0.	0.	0.	0.	0.	0.
SN-126	2.54E+08	5.05E+06	1.48E+06	0.	7.23E+05	1.69E+08	7.64E+06
SB-124	4.00E+06	7.54E+04	9.66E+03	0.	3.10E+06	1.13E+08	1.58E+06
SB-125	4.14E+06	1.15E+05	6.06E+04	5.77E+05	4.12E+08	3.54E+07	8.19E+05
TE 125M	3.61E+06	1.29E+06	1.02E+06	1.03E+07	0.	1.01E+07	4.78E+05
TE 127M	7.23E+06	2.52E+06	1.91E+06	2.92E+07	0.	3.63E+07	8.94E+05
TE 129M	1.35E+07	5.02E+06	4.34E+06	3.92E+07	0.	4.72E+07	2.13E+06
I--130	6.61E+05	1.96E+06	2.49E+08	3.04E+06	0.	1.68E+06	7.69E+05
I--131	6.15E+08	8.68E+08	2.50E+11	1.13E+09	0.	1.64E+08	5.17E+08
I--132	2.59E-01	6.92E-01	9.11E+01	1.10E+00	0.	1.30E-01	2.46E-01
I--133	8.79E+06	1.49E+07	2.71E+09	1.88E+07	0.	1.08E+07	4.59E+06
I--134	0.	0.	1.55E-09	0.	0.	0.	0.
I--135	2.17E+04	5.73E+04	7.49E+06	9.10E+04	2.94E-01	6.41E+04	2.10E+04
CS-134	2.83E+10	6.83E+10	0.	1.69E+10	8.27E+09	7.88E+08	3.19E+10
CS-136	1.01E+09	3.99E+09	0.	2.22E+09	3.05E+08	4.54E+08	2.87E+09
CS-137	3.84E+10	5.16E+10	0.	1.33E+10	6.85E+09	6.88E+08	1.81E+10
BA-140	5.81E+06	7.14E+03	0.	1.78E+03	4.78E+03	1.10E+06	3.73E+05
CE-141	6.06E+03	4.07E+03	0.	1.41E+03	0.	1.10E+07	4.66E+02
CE-144	4.92E+05	2.02E+05	0.	8.24E+04	0.	1.16E+08	2.61E+04

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

Note - the units for C---14 and H----3 are (mrem/yr per μCi/cu. meter)

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TABLE G-16
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - MEAT (CONTAMINATED FORAGE) AGE GROUP - TEENAGER
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H----3	0.	1.93E+02	1.93E+02	2.44E+02	1.93E+02	1.93E+02	1.93E+02
P---32	2.76E+09	1.73E+08	0.	0.	0.	3.10E+08	1.07E+08
CR--51	0.	0.	2.50E+03	9.22E+02	5.55E+03	1.05E+06	4.18E+03
MN--54	0.	5.42E+06	0.	1.61E+06	0.	1.66E+07	1.04E+06
FE--59	1.58E+08	3.74E+08	0.	0.	1.04E+08	1.24E+09	1.42E+08
CO--57	0.	3.33E+06	0.	0.	0.	8.45E+07	5.54E+06
CO--58	0.	1.44E+07	0.	0.	0.	1.94E+08	3.27E+07
CO--60	0.	5.73E+07	0.	0.	0.	6.87E+08	1.31E+08
ZN--65	2.11E+08	6.69E+08	0.	4.47E+08	0.	4.21E+08	3.03E+08
RB--86	0.	2.89E+08	0.	0.	0.	5.69E+07	1.35E+08
SR--89	2.66E+08	0.	0.	0.	0.	2.89E+07	7.64E+06
SR--90	1.01E+10	0.	0.	0.	2.79E+08	1.02E+09	2.49E+09
Y---91	9.34E+05	0.	0.	0.	0.	3.59E+08	2.49E+04
ZR--95	2.67E+06	1.24E+06	0.	1.18E+06	0.	4.20E+09	7.61E+05
NB--95	1.58E+06	9.51E+05	0.	7.48E+05	0.	3.88E+09	5.37E+05
RU-103	8.05E+07	0.	0.	2.40E+08	0.	6.28E+09	3.60E+07
RU-106	2.40E+09	0.	0.	3.20E+09	0.	1.09E+11	3.02E+08
AG110	3.97E+06	3.67E+06	0.	7.21E+06	0.	1.50E+09	2.18E+06

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

Note - the units for C---14 and H----3 are (mrem/yr per μCi/cu. meter)

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TABLE G-16
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - MEAT (CONTAMINATED FORAGE) AGE GROUP - TEENAGER
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER µCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
SN-123	0.	0.	0.	0.	0.	0.	0.
SN-126	1.10E+10	2.18E+08	6.38E+07	0.	3.82E+06	3.66E+09	3.14E+08
SB-124	1.17E+07	2.21E+05	2.84E+04	0.	9.11E+06	3.32E+08	4.64E+06
SB-125	5.01E+07	1.31E+07	1.02E+07	1.03E+08	1.47E+09	2.25E+08	7.60E+06
TE 125M	3.03E+08	1.08E+08	8.55E+07	8.63E+08	0.	8.47E+08	4.02E+07
TE 127M	6.68E+08	2.34E+08	1.77E+08	2.69E+09	0.	3.35E+09	8.28E+07
TE 129M	9.78E+08	3.63E+08	3.13E+08	2.83E+09	0.	3.41E+09	1.53E+08
I--130	1.41E-06	4.16E-06	5.30E-04	6.47E-06	0.	3.57E-06	1.64E-06
I--131	8.54E+06	1.21E+07	3.48E+09	1.56E+07	0.	2.28E+06	7.19E+06
I--132	0.	0.	0.	0.	0.	0.	0.
I--133	3.69E-01	6.26E-01	1.14E+02	7.88E-01	0.	4.55E-01	1.93E-01
I--134	0.	0.	0.	0.	0.	0.	0.
I--135	5.08E-02	4.69E-02	0.	1.78E-02	5.34E-03	1.10E-03	2.08E-02
CS-134	5.03E+08	1.21E+09	0.	3.00E+08	1.47E+08	1.40E+07	5.66E+08
CS-136	6.99E+06	2.76E+07	0.	1.54E+07	2.11E+06	3.14E+06	1.99E+07
CS-137	6.92E+08	9.31E+08	0.	2.40E+08	1.24E+08	1.24E+07	3.27E+08
BA-140	2.37E+07	2.93E+04	0.	7.28E+03	1.95E+04	9.19E+06	1.53E+06
CE-141	1.12E+04	7.51E+03	0.	2.61E+03	0.	2.03E+07	8.61E+02
CE-144	1.28E+06	5.23E+05	0.	2.14E+05	0.	3.00E+08	6.76E+04

Based on 1 µCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

Note - the units for C---14 and H----3 are (mrem/yr per µCi/cu. meter)

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TABLE G-17
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - FRESH FRUITS AND VEGETABLES AGE GROUP - TEENAGER
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H----3	0.	2.09E+02	2.09E+02	2.64E+02	2.09E+02	2.09E+02	2.09E+02
P---32	6.81E+08	4.27E+07	0.	0.	0.	7.66E+07	2.64E+07
CR--51	0.	0.	7.56E+03	2.79E+03	1.68E+04	3.18E+06	1.27E+04
MN--54	0.	3.20E+07	0.	9.52E+06	0.	9.80E+07	6.11E+06
FE--59	2.39E+07	5.67E+07	0.	0.	1.57E+07	1.87E+08	2.16E+07
CO--57	0.	1.22E+06	0.	0.	0.	3.09E+07	2.02E+06
CO--58	0.	6.01E+06	0.	0.	0.	8.12E+07	1.37E+07
CO--60	0.	2.01E+07	0.	0.	0.	2.41E+08	4.58E+07
ZN--65	3.35E+07	1.06E+08	0.	7.12E+07	0.	6.70E+07	4.82E+07
RB--86	0.	8.52E+07	0.	0.	0.	1.68E+07	3.97E+07
SR--89	2.61E+09	0.	0.	0.	0.	2.83E+08	7.48E+07
SR--90	7.61E+10	0.	0.	0.	2.41E+08	2.31E+09	1.88E+10
Y---91	1.15E+06	0.	0.	0.	0.	4.41E+08	3.06E+04
ZR--95	2.35E+05	8.19E+04	0.	9.81E+04	0.	1.92E+08	5.61E+04
NB--95	3.72E+04	2.24E+04	0.	1.76E+04	0.	9.14E+07	1.26E+04
RU-103	1.27E+06	0.	0.	3.77E+06	0.	9.87E+07	5.66E+05
RU-106	2.82E+07	0.	0.	3.75E+07	0.	1.28E+09	3.54E+06
AG110	1.11E+06	1.03E+06	0.	2.02E+06	0.	4.19E+08	6.10E+05

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

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TABLE G-17
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - FRESH FRUITS AND VEGETABLES AGE GROUP - TEENAGER
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
SN-123	9.25E-06	1.53E-07	1.22E-07	0.	0.	1.33E-05	2.28E-07
SN-126	6.25E+08	1.24E+07	3.64E+06	0.	2.83E+06	5.55E+08	1.94E+07
SB-124	1.65E+07	3.12E+05	3.99E+04	0.	1.28E+07	4.67E+08	6.53E+06
SB-125	1.73E+07	5.97E+05	3.48E+05	3.38E+06	1.68E+09	1.45E+08	3.40E+06
TE 125M	2.23E+07	7.99E+06	6.30E+06	6.36E+07	0.	6.24E+07	2.96E+06
TE 127M	4.46E+07	1.55E+07	1.18E+07	1.80E+08	0.	2.23E+08	5.51E+06
TE 129M	8.46E+07	3.14E+07	2.71E+07	2.45E+08	0.	2.95E+08	1.33E+07
I--130	2.58E+05	7.64E+05	9.72E+07	1.19E+06	0.	6.55E+05	3.00E+05
I--131	6.84E+07	9.66E+07	2.79E+10	1.25E+08	0.	1.83E+07	5.76E+07
I--132	3.65E+01	9.77E+01	1.29E+04	1.56E+02	0.	1.84E+01	3.47E+01
I--133	1.98E+06	3.36E+06	6.10E+08	4.23E+06	0.	2.44E+06	1.04E+06
I--134	6.75E-05	1.83E-04	2.38E-02	2.92E-04	0.	1.60E-07	6.56E-05
I--135	2.65E+04	7.00E+04	9.15E+06	1.11E+05	5.67E-03	7.84E+04	2.57E+04
CS-134	5.79E+08	1.40E+09	0.	3.45E+08	1.69E+08	1.61E+07	6.52E+08
CS-136	2.18E+07	8.60E+07	0.	4.78E+07	6.56E+06	9.77E+06	6.19E+07
CS-137	7.83E+08	1.05E+09	0.	2.72E+08	1.40E+08	1.41E+07	3.70E+08
BA-140	9.38E+07	1.21E+05	0.	2.88E+04	7.73E+04	3.19E+08	6.04E+06
CE-141	6.32E+04	4.24E+04	0.	1.47E+04	0.	1.15E+08	4.86E+03
CE-144	5.03E+06	2.06E+06	0.	8.43E+05	0.	1.19E+09	2.67E+05

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

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TABLE G-18
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - INHALATION AGE GROUP - ADULT
ORGAN DOSE FACTOR (MREM/YR PER μCI/CU. METER)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H----3	0.	1.07E+03	1.07E+03	1.07E+03	1.07E+03	1.07E+03	1.07E+03
P---32	1.32E+06	7.72E+04	0.	0.	0.	8.64E+04	5.02E+04
CR--51	0.	0.	5.95E+01	2.28E+01	1.44E+04	3.32E+03	1.00E+02
MN--54	0.	3.96E+04	0.	9.84E+03	1.40E+06	7.74E+04	6.30E+03
FE--59	1.18E+04	2.78E+07	0.	0.	1.02E+06	1.88E+05	1.06E+04
CO--57	0.	6.92E+02	0.	0.	3.70E+05	3.14E+04	6.71E+02
CO--58	0.	1.58E+03	0.	0.	9.28E+05	1.06E+05	2.07E+03
CO--60	0.	1.15E+04	0.	0.	5.98E+06	2.85E+05	1.48E+04
ZN--65	3.24E+04	1.03E+05	0.	6.90E+04	8.72E+05	5.34E+04	4.66E+04
RB--86	0.	1.35E+05	0.	0.	0.	1.66E+04	5.90E+04
SR--89	3.04E+05	0.	0.	0.	1.40E+06	3.50E+05	8.72E+03
SR--90	9.92E+07	0.	0.	0.	9.60E+06	7.22E+05	6.10E+06
Y---91	4.62E+05	0.	0.	0.	1.70E+06	3.85E+05	1.24E+04
ZR--95	1.07E+05	3.44E+04	0.	5.42E+04	1.78E+06	1.50E+05	2.33E+04
NB--95	1.41E+04	7.82E+03	0.	7.74E+03	5.06E+05	1.04E+05	4.21E+03
RU-103	1.53E+03	0.	0.	5.83E+03	5.06E+05	1.10E+05	6.58E+02
RU-106	6.91E+04	0.	0.	1.34E+05	9.44E+06	9.12E+05	8.72E+03
AG110	1.08E+04	1.00E+04	0.	1.97E+04	4.64E+06	3.02E+05	5.94E+03

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

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TABLE G-18
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - INHALATION AGE GROUP - ADULT
ORGAN DOSE FACTOR (MREM/YR PER µCI/CU. METER)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
SN-123	2.42E+05	5.33E+03	4.53E+03	0.	2.30E+06	3.14E+05	7.86E+03
SN-126	1.26E+06	3.34E+04	9.84E+03	0.	9.36E+06	1.27E+05	4.80E+04
SB-124	3.12E+04	5.89E+02	7.55E+01	0.	2.48E+06	4.06E+05	1.24E+04
SB-125	6.61E+04	7.13E+02	5.87E+01	0.	2.20E+06	1.01E+05	1.33E+04
TE 125M	3.42E+03	1.58E+03	1.05E+03	1.24E+04	3.14E+05	7.06E+04	4.67E+02
TE 127M	1.26E+04	5.62E+03	3.29E+03	4.58E+04	9.60E+05	1.50E+05	1.57E+03
TE 129M	9.76E+03	4.67E+03	3.44E+03	3.66E+04	1.16E+06	3.83E+05	1.58E+03
I--130	4.58E+03	1.34E+04	1.74E+06	2.09E+04	0.	7.69E+03	5.29E+03
I--131	2.52E+04	3.58E+04	1.19E+07	6.14E+04	0.	6.28E+03	2.05E+04
I--132	1.16E+03	3.26E+03	4.38E+05	5.19E+03	0.	4.06E+02	1.16E+03
I--133	8.64E+03	1.49E+04	2.93E+06	2.60E+04	0.	8.72E+03	4.54E+03
I--134	6.45E+02	1.73E+03	2.30E+05	2.75E+03	0.	1.01E+00	6.16E+02
I--135	2.69E+03	6.99E+03	9.36E+05	1.11E+04	0.	5.25E+03	2.58E+03
CS-134	3.74E+05	8.48E+05	0.	2.88E+05	9.76E+04	1.04E+04	7.29E+05
CS-136	3.91E+04	1.46E+05	0.	8.56E+04	1.20E+04	1.17E+04	1.11E+05
CS-137	4.78E+05	6.22E+05	0.	2.22E+05	7.53E+04	8.40E+03	4.29E+05
BA-140	3.90E+04	4.90E+01	0.	1.67E+01	1.27E+06	2.18E+05	2.57E+03
CE-141	1.99E+04	1.35E+04	0.	6.26E+03	3.62E+05	1.20E+05	1.53E+03
CE-144	3.43E+06	1.43E+06	0.	8.48E+05	7.78E+06	8.16E+05	1.84E+05

Based on 1 µCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

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TABLE G-19
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - COWS MILK (CONTAMINATED FORAGE) AGE GROUP - ADULT
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H----3	0.	9.73E+02	9.73E+02	9.73E+02	9.73E+02	9.73E+02	9.73E+02
P---32	1.71E+10	1.07E+09	0.	0.	0.	1.92E+09	6.62E+08
CR--51	0.	0.	1.71E+04	6.32E+03	3.80E+04	7.20E+06	2.86E+04
MN--54	0.	8.41E+06	0.	2.50E+06	0.	2.58E+07	1.61E+06
FE--59	2.98E+07	7.06E+07	0.	0.	1.96E+07	2.33E+08	2.69E+07
CO--57	0.	1.28E+06	0.	0.	0.	3.25E+07	2.13E+06
CO--58	0.	4.72E+06	0.	0.	0.	9.56E+07	1.06E+07
CO--60	0.	1.65E+07	0.	0.	0.	3.08E+08	3.62E+07
ZN--65	1.37E+09	4.36E+09	0.	2.92E+09	0.	2.75E+09	1.98E+09
RB--86	0.	2.60E+09	0.	0.	0.	5.12E+08	1.21E+09
SR--89	1.46E+09	0.	0.	0.	0.	2.33E+08	4.17E+07
SR--90	4.70E+10	0.	0.	0.	0.	6.37E+08	1.15E+10
Y---91	8.60E+03	0.	0.	0.	0.	4.73E+06	2.31E+02
ZR--95	3.18E+04	1.75E+04	0.	1.75E+04	0.	1.05E+08	6.95E+03
NB--95	8.26E+04	4.59E+04	0.	4.55E+04	0.	2.79E+08	1.80E+04
RU-103	1.02E+03	0.	0.	3.91E+03	0.	1.19E+05	4.41E+02
RU-106	2.04E+04	0.	0.	3.95E+04	0.	1.32E+06	2.58E+03
AG110	5.84E+07	5.40E+07	0.	1.06E+08	0.	2.20E+10	3.21E+07

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

Note - the units for C---14 and H----3 are (mrem/yr per μCi/cu. meter)

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TABLE G-19
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - COWS MILK (CONTAMINATED FORAGE) AGE GROUP - ADULT
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
SN-123	0.	0.	0.	0.	0.	0.	0.
SN-126	1.65E+09	3.27E+07	9.56E+06	0.	4.67E+06	1.09E+09	4.94E+07
SB-124	2.58E+07	4.87E+05	6.24E+04	0.	2.00E+07	7.31E+08	1.02E+07
SB-125	2.64E+07	6.06E+05	2.99E+05	3.72E+06	2.66E+09	2.29E+08	5.23E+06
TE 125M	1.63E+07	5.91E+06	4.91E+06	6.63E+07	0.	6.50E+07	2.18E+06
TE 127M	4.63E+07	1.63E+07	1.21E+07	1.88E+08	0.	2.11E+08	5.72E+06
TE 129M	6.06E+07	2.27E+07	2.09E+07	2.53E+08	0.	3.04E+08	9.61E+06
I--130	4.27E+05	1.26E+06	1.61E+08	1.96E+06	0.	1.08E+06	4.97E+05
I--131	2.96E+08	4.25E+08	1.39E+11	7.27E+08	0.	1.12E+08	2.43E+08
I--132	1.67E-01	4.47E-01	5.88E+01	7.12E-01	0.	8.39E-02	1.59E-01
I--133	4.00E+06	6.94E+06	1.33E+09	1.21E+07	0.	6.10E+06	2.12E+06
I--134	0.	0.	9.98E-10	0.	0.	0.	0.
I--135	1.40E+04	3.70E+04	4.84E+06	5.88E+04	7.58E-02	4.14E+04	1.36E+04
CS-134	5.66E+09	1.35E+10	0.	4.36E+09	1.45E+09	2.36E+08	1.10E+10
CS-136	2.61E+08	1.03E+09	0.	5.74E+08	7.87E+07	1.17E+08	7.43E+08
CS-137	7.39E+09	1.01E+10	0.	3.44E+09	1.14E+09	1.95E+08	6.62E+09
BA-140	2.69E+07	3.38E+04	0.	1.15E+04	1.93E+04	5.70E+07	1.78E+06
CE-141	2.91E+04	1.97E+04	0.	9.13E+03	0.	7.52E+07	2.23E+03
CE-144	2.15E+06	8.97E+05	0.	5.32E+05	0.	7.26E+08	1.15E+05

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

Note - the units for C---14 and H----3 are (mrem/yr per μCi/cu. meter)

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TABLE G-20
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - GOATS MILK (CONTAMINATED FORAGE) AGE GROUP - ADULT
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H----3	0.	1.99E+03	1.99E+03	1.99E+03	1.99E+03	1.99E+03	1.99E+03
P---32	2.05E+10	1.29E+09	0.	0.	0.	2.31E+09	7.94E+08
CR--51	0.	0.	2.05E+03	7.58E+02	4.56E+03	8.64E+05	3.43E+03
MN--54	0.	1.01E+06	0.	3.00E+05	0.	3.09E+06	1.93E+05
FE--59	3.87E+05	9.18E+05	0.	0.	2.55E+05	3.03E+06	3.50E+05
CO--57	0.	1.54E+05	0.	0.	0.	3.90E+06	2.55E+05
CO--58	0.	5.67E+05	0.	0.	0.	1.15E+07	1.27E+06
CO--60	0.	1.98E+06	0.	0.	0.	3.70E+07	4.34E+06
ZN--65	1.65E+08	5.24E+08	0.	3.50E+08	0.	3.30E+08	2.37E+08
RB--86	0.	3.12E+08	0.	0.	0.	6.15E+07	1.45E+08
SR--89	3.06E+09	0.	0.	0.	0.	4.89E+08	8.76E+07
SR--90	9.87E+10	0.	0.	0.	0.	1.32E+09	2.41E+10
Y---91	1.03E+03	0.	0.	0.	0.	5.68E+05	2.77E+01
ZR--95	3.82E+03	2.10E+03	0.	2.10E+03	0.	1.26E+07	8.34E+02
NB--95	9.92E+03	5.51E+03	0.	5.46E+03	0.	3.34E+07	2.17E+03
RU-103	1.23E+02	0.	0.	4.69E+02	0.	1.43E+04	5.30E+01
RU-106	2.45E+03	0.	0.	4.73E+03	0.	1.58E+05	3.10E+02
AG110	7.00E+06	6.48E+06	0.	1.27E+07	0.	2.64E+09	3.85E+06

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

Note - the units for C---14 and H----3 are (mrem/yr per μCi/cu. meter)

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TABLE G-20
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - GOATS MILK (CONTAMINATED FORAGE) AGE GROUP - ADULT
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
SN-123	0.	0.	0.	0.	0.	0.	0.
SN-126	1.97E+08	3.92E+06	1.15E+06	0.	5.61E+05	1.31E+08	5.92E+06
SB-124	3.10E+06	5.85E+04	7.49E+03	0.	2.40E+06	8.77E+07	1.22E+06
SB-125	3.16E+06	7.28E+04	3.58E+04	4.47E+05	3.19E+08	2.74E+07	6.29E+05
TE 125M	1.96E+06	7.10E+05	5.89E+05	7.95E+06	0.	7.81E+06	2.62E+05
TE 127M	5.57E+06	1.94E+06	1.47E+06	2.26E+07	0.	2.52E+07	6.86E+05
TE 129M	7.27E+06	2.72E+06	2.51E+06	3.04E+07	0.	3.65E+07	1.15E+06
I--130	5.12E+05	1.52E+06	1.93E+08	2.36E+06	0.	1.30E+06	5.96E+05
I--131	3.56E+08	5.10E+08	1.67E+11	8.72E+08	0.	1.34E+08	2.92E+08
I--132	2.00E-01	5.36E-01	7.06E+01	8.55E-01	0.	1.01E-01	1.91E-01
I--133	4.80E+06	8.32E+06	1.60E+09	1.45E+07	0.	7.32E+06	2.54E+06
I--134	0.	0.	1.20E-09	0.	0.	0.	0.
I--135	1.68E+04	4.44E+04	5.80E+06	7.05E+04	2.28E-01	4.97E+04	1.63E+04
CS-134	1.70E+10	4.04E+10	0.	1.31E+10	4.34E+09	7.06E+08	3.30E+10
CS-136	7.84E+08	3.09E+09	0.	1.72E+09	2.36E+08	3.52E+08	2.23E+09
CS-137	2.22E+10	3.03E+10	0.	1.03E+10	3.42E+09	5.83E+08	1.99E+10
BA-140	3.23E+06	4.05E+03	0.	1.38E+03	2.32E+03	6.84E+06	2.13E+05
CE-141	3.49E+03	2.36E+03	0.	1.10E+03	0.	9.02E+06	2.68E+02
CE-144	2.58E+05	1.08E+05	0.	6.39E+04	0.	8.71E+07	1.38E+04

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

Note - the units for C---14 and H----3 are (mrem/yr per μCi/cu. meter)

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TABLE G-21
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - MEAT (CONTAMINATED FORAGE) AGE GROUP - ADULT
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER µCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H----3	0.	4.13E+02	4.13E+02	4.13E+02	4.13E+02	4.13E+02	4.13E+02
P---32	4.67E+09	2.93E+08	0.	0.	0.	5.25E+08	1.81E+08
CR--51	0.	0.	4.23E+03	1.56E+03	9.38E+03	1.78E+06	7.07E+03
MN--54	0.	9.18E+06	0.	2.73E+06	0.	2.81E+07	1.75E+06
FE--59	2.67E+08	6.33E+08	0.	0.	1.76E+08	2.09E+09	2.41E+08
CO--57	0.	5.64E+06	0.	0.	0.	1.43E+08	9.38E+06
CO--58	0.	1.83E+07	0.	0.	0.	3.70E+08	4.09E+07
CO--60	0.	7.55E+07	0.	0.	0.	1.41E+09	1.66E+08
ZN--65	3.56E+08	1.13E+09	0.	7.57E+08	0.	7.13E+08	5.12E+08
RB--86	0.	4.89E+08	0.	0.	0.	9.64E+07	2.28E+08
SR--89	3.03E+08	0.	0.	0.	0.	4.84E+07	8.67E+06
SR--90	1.25E+10	0.	0.	0.	0.	1.45E+09	3.05E+09
Y---91	1.14E+06	0.	0.	0.	0.	6.26E+08	3.05E+04
ZR--95	3.78E+06	1.67E+06	0.	2.01E+06	0.	8.30E+09	8.26E+05
NB--95	2.30E+06	1.28E+06	0.	1.27E+06	0.	7.75E+09	5.02E+05
RU-103	1.06E+08	0.	0.	4.06E+08	0.	1.24E+10	4.59E+07
RU-106	2.80E+09	0.	0.	5.41E+09	0.	1.81E+11	3.54E+08
AG110	6.71E+06	6.21E+06	0.	1.22E+07	0.	2.53E+09	3.69E+06

Based on 1 µCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

Note - the units for C---14 and H----3 are (mrem/yr per µCi/cu. meter)

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TABLE G-21
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - MEAT (CONTAMINATED FORAGE) AGE GROUP - ADULT
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
SN-123	0.	0.	0.	0.	0.	0.	0.
SN-126	1.86E+10	3.69E+08	1.08E+08	0.	6.46E+06	6.19E+09	5.33E+08
SB-124	1.99E+07	3.75E+05	4.80E+04	0.	1.54E+07	5.62E+08	7.85E+06
SB-125	6.65E+07	1.58E+07	1.29E+07	1.74E+08	2.49E+09	3.80E+08	1.05E+07
TE 125M	3.59E+08	1.30E+08	1.08E+08	1.46E+09	0.	1.43E+09	4.81E+07
TE 127M	1.13E+09	3.93E+08	2.96E+08	4.56E+09	0.	5.11E+09	1.39E+08
TE 129M	1.14E+09	4.29E+08	3.95E+08	4.79E+09	0.	5.76E+09	1.82E+08
I--130	2.38E-06	7.05E-06	8.96E-04	1.10E-05	0.	6.04E-06	2.77E-06
I--131	1.08E+07	1.55E+07	5.06E+09	2.65E+07	0.	4.07E+06	8.85E+06
I--132	0.	0.	0.	0.	0.	0.	0.
I--133	4.40E-01	7.63E-01	1.47E+02	1.33E+00	0.	6.71E-01	2.33E-01
I--134	0.	0.	0.	0.	0.	0.	0.
I--135	8.60E-02	7.94E-02	0.	3.01E-02	9.04E-03	1.86E-03	3.53E-02
CS-134	6.58E+08	1.57E+09	0.	5.08E+08	1.68E+08	2.74E+07	1.28E+09
CS-136	1.18E+07	4.67E+07	0.	2.60E+07	3.56E+06	5.31E+06	3.36E+07
CS-137	8.73E+08	1.19E+09	0.	4.06E+08	1.35E+08	2.30E+07	7.82E+08
BA-140	2.88E+07	3.63E+04	0.	1.23E+04	2.07E+04	6.87E+07	1.90E+06
CE-141	1.41E+04	9.52E+03	0.	4.41E+03	0.	3.63E+07	1.08E+03
CE-144	1.46E+06	6.10E+05	0.	3.62E+05	0.	4.93E+08	7.83E+04

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

Note - the units for C---14 and H----3 are (mrem/yr per μCi/cu. meter)

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TABLE G-22
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - FRESH FRUITS AND VEGETABLES AGE GROUP - ADULT
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
H----3	0.	4.02E+02	4.02E+02	4.02E+02	4.02E+02	4.02E+02	4.02E+02
P---32	1.04E+09	6.51E+07	0.	0.	0.	1.17E+08	4.02E+07
CR--51	0.	0.	1.15E+04	4.25E+03	2.56E+04	4.85E+06	1.93E+04
MN--54	0.	4.87E+07	0.	1.45E+07	0.	1.49E+08	9.31E+06
FE--59	3.64E+07	8.64E+07	0.	0.	2.40E+07	2.85E+08	3.29E+07
CO--57	0.	1.85E+06	0.	0.	0.	4.70E+07	3.08E+06
CO--58	0.	6.89E+06	0.	0.	0.	1.40E+08	1.54E+07
CO--60	0.	2.38E+07	0.	0.	0.	4.46E+08	5.23E+07
ZN--65	5.11E+07	1.62E+08	0.	1.09E+08	0.	1.02E+08	7.34E+07
RB--86	0.	1.30E+08	0.	0.	0.	2.56E+07	6.06E+07
SR--89	2.67E+09	0.	0.	0.	0.	4.26E+08	7.64E+07
SR--90	8.49E+10	0.	0.	0.	0.	2.14E+09	2.07E+10
Y---91	1.26E+06	0.	0.	0.	0.	6.92E+08	3.37E+04
ZR--95	2.93E+05	9.82E+04	0.	1.49E+05	0.	3.34E+08	6.38E+04
NB--95	4.87E+04	2.71E+04	0.	2.68E+04	0.	1.64E+08	1.06E+04
RU-103	1.50E+06	0.	0.	5.75E+06	0.	1.76E+08	6.49E+05
RU-106	2.95E+07	0.	0.	5.71E+07	0.	1.91E+09	3.74E+06
AG110	1.69E+06	1.56E+06	0.	3.08E+06	0.	6.38E+08	9.30E+05

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

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TABLE G-22
ENVIRONMENTAL PATHWAY-DOSE CONVERSION FACTORS R(I) FOR GASEOUS DISCHARGES
PATHWAY - FRESH FRUITS AND VEGETABLES AGE GROUP - ADULT
ORGAN DOSE FACTOR (SQ. METER-MREM/YR PER μCI/SEC)

NUCLIDE	BONE	LIVER	THYROID	KIDNEY	LUNG	GI-LLI	WHOLE BODY
SN-123	1.00E-05	1.66E-07	1.41E-07	0.	0.	2.04E-05	2.45E-07
SN-126	9.52E+08	1.89E+07	5.54E+06	0.	4.31E+06	8.46E+08	2.94E+07
SB-124	2.52E+07	4.75E+05	6.08E+04	0.	1.95E+07	7.12E+08	9.94E+06
SB-125	2.58E+07	7.23E+05	4.03E+05	5.14E+06	2.56E+09	2.22E+08	5.10E+06
TE 125M	2.38E+07	8.65E+06	7.17E+06	9.69E+07	0.	9.51E+07	3.19E+06
TE 127M	6.75E+07	2.36E+07	1.77E+07	2.73E+08	0.	3.06E+08	8.32E+06
TE 129M	8.93E+07	3.34E+07	3.08E+07	3.73E+08	0.	4.49E+08	1.42E+07
I--130	3.93E+05	1.16E+06	1.48E+08	1.81E+06	0.	9.98E+05	4.58E+05
I--131	7.78E+07	1.12E+08	3.65E+10	1.91E+08	0.	2.94E+07	6.38E+07
I--132	5.57E+01	1.49E+02	1.96E+04	2.38E+02	0.	2.80E+01	5.29E+01
I--133	2.13E+06	3.69E+06	7.10E+08	6.44E+06	0.	3.24E+06	1.13E+06
I--134	1.03E-04	2.79E-04	3.63E-02	4.45E-04	0.	2.43E-07	9.99E-05
I--135	4.04E+04	1.07E+05	1.40E+07	1.70E+05	8.65E-03	1.19E+05	3.91E+04
CS-134	6.82E+08	1.62E+09	0.	5.26E+08	1.74E+08	2.84E+07	1.33E+09
CS-136	3.32E+07	1.31E+08	0.	7.29E+07	9.99E+06	1.49E+07	9.43E+07
CS-137	8.90E+08	1.22E+09	0.	4.14E+08	1.37E+08	2.34E+07	7.98E+08
BA-140	1.03E+08	1.35E+05	0.	4.39E+04	7.38E+04	6.65E+08	6.77E+06
CE-141	7.16E+04	4.85E+04	0.	2.25E+04	0.	1.85E+08	5.49E+03
CE-144	5.19E+06	2.17E+06	0.	1.29E+06	0.	1.75E+09	2.78E+05

Based on 1 μCi/sec release rate of each isotope in and a value of 1. for X/Q, depleted X/Q and relative deposition

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TABLE M-1

Selecting the Appropriate Long Term (X/Q) for Dose Calculations Involving Noble Gases for:

(1) Total Body dose from instantaneous releases

(2) Skin dose from instantaneous releases

(3) Gamma air dose (cumulative)

(4) Beta air dose (cumulative)

<table>
<tr><th>TYPE OF DOSE CALCULATION</th><th>LIMITING RANGE (miles)</th><th>LIMITING Sector</th><th>(X/Q) VALUE sec/m^3</th></tr>
<tr><td>Instantaneous</td><td>0.97</td><td>NW</td><td>1.6 X 10^{-6}</td></tr>
<tr><td>1/31 days</td><td>0.97</td><td colspan="2" rowspan="3">1. Normally (X/Q) = 1.6 X 10^{-6} sec/m^3

2. May use option of actual meteorological data for time of concern.</td></tr>
<tr><td>Quarterly Yearly</td><td>0.97</td></tr>
<tr><td>12 Consecutive months</td><td>0.97</td></tr>
<tr><td>Annual Report</td><td>0.97</td><td>N/A</td><td>Note-1</td></tr>
</table>

NOTE 1

The (X/Q) has to be calculated based on actual meteorological data that occurred during the period of interest. The sector of interest is N/A because the limiting (X/Q) will be determined from the actual meteorological data and may occur in any sector.

0.97 miles Corresponds to the minimum site boundary distance in the north direction and 0.97 miles was chosen for all other sectors for ease of calculations when the averaging is done for quarterly reports.

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TABLE M-2

Selecting the Appropriate Long Term $(X/Q)_D$ or (D/Q) for Dose

Calculations Involving Radioiodines & 8 D Particulates for:

(1) Inhalation (2) Tritium (All gas pathways) (3) Ground Plane

TYPE OF DOSE CALCULATION	LIMITING RANGE (miles)	LIMITING SECTOR (OL)	$(X/Q)_D$ sec/m^3	(D/Q) 1/m^2
Instantaneous	0.97	NW	B 1.3×10^{-6}	[illegible]
		WNW	[illegible]	8.2×10^{-9}
Annual Report	0.97	A	A, B	[illegible]
	0.97	A	[illegible]	A
1/31 days, Qtr. yearly, Annual Total Dose	0.97	NW	B 1.3×10^{-6}	[illegible]
	0.97	WNW	[illegible]	8.2×10^{-9}

(OL) Over land areas only

(A) To be determined by reduction of actual met data occurring during each quarter

(B) For Tritium in the Milk Animal Pathway, the $(X/Q)_D$ value should be that of the respective controlling sector and range where the Milk Animal is located as per Table M-3. Example: If a cow was located at 4.25 miles in NW sector, use the $(X/Q)_D$ for 4.25 miles NW.

ST. LUCIE PLANT
CHEMISTRY OPERATING PROCEDURE NO. C-200, REVISION 25
OFFSITE DOSE CALCULATION MANUAL (ODCM)

TABLE M-3

Selecting the Appropriate Long Term (D/Q) for Dose Calculations Involving Radioiodines and 8D Particulates for Grass-Cow-Milk or Grass-Goat-Milk:

TYPE OF DOSE CALCULATION	LIMITING RANGE	LIMITING SECTOR	(D/Q) Value $1/m^2$
Release Rate	A	A	A
1/31 Days	B	B	B
Quarterly - Yearly	B	B	B
Annual (Calendar Year)	B	B	B
Annual Report	C	C	C

A. The worst cow or goat as per locations from land census. If no milk animal in any sector, assume a cow at 4.25 miles in the highest (D/Q) sector over land.

B. The historical (D/Q) of all land sectors with the worst cow or goat from each sector as reported in the Land Census. A 4.25 mile cow should be assumed in the worst sector over land when no milk animal is reported.

C. The highest (D/Q) at a milk animal location of all milk animals reported in the Land Census Report. (If no milk animals within 5 miles a 4.25 mile cow should be assumed in the sector having the highest (D/Q) at 4.25 miles over land). Actual Met Data should be used for the selection of the worst case milk animal and for the dose calculations. If both goat and milk animals are reported inside 5 miles, dose calculations should be performed on each animal and the higher dose animal contribution should be used.

The historical wind frequency fractions for each sector are listed in Table M-8.

ST. LUCIE PLANT
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TABLE M-4
TERRAIN CORRECTION FACTORS

Florida Power & Light Company
St. Lucie Unit 1
Hutchinson Island, Florida
Dames and Moore Job No: 4598 - 112

Terrain Correction Factors (PUFF / STRAIGHT LINE)
Period of Record: 8/29/77 to 8/31/78
Base Distance in Miles/Kilometers

AFFECTED SECTOR	DESIGN DISTANCE MILES	.25 .40	.75 1.21	1.25 2.01	1.75 2.82	2.25 3.62	2.75 4.42	3.25 5.23	3.75 6.03	4.25 6.84	4.75 7.64
NNE	0.	1.906	1.576	1.465	1.404	1.338	1.318	1.334	1.386	1.346	1.338
NE	0.	1.887	1.581	1.461	1.391	1.310	1.259	1.164	1.128	1.101	1.116
ENE	0.	1.452	1.230	1.122	1.081	1.047	1.033	.941	.941	.906	.902
E	0.	1.662	1.425	1.277	1.193	1.151	1.123	1.097	1.121	1.123	1.122
ESE	0.	1.690	1.483	1.328	1.260	1.246	1.190	1.134	1.094	1.032	.968
SE	0.	1.818	1.691	1.470	1.427	1.435	1.361	1.366	1.331	1.279	1.239
SSE	0.	1.812	1.586	1.370	1.302	1.270	1.263	1.229	1.193	1.171	1.151
S	0.	1.398	1.321	1.125	1.083	1.108	1.127	1.073	1.063	1.047	1.024
SSW	0.	1.534	1.411	1.296	1.192	1.205	1.132	1.135	1.116	1.077	1.060
SW	0.	1.685	1.492	1.294	1.233	1.200	1.222	1.160	1.160	1.198	1.196
WSW	0.	1.620	1.333	1.210	1.173	1.082	1.091	1.099	1.056	1.034	1.004
W	0.	1.651	1.415	1.290	1.218	1.154	1.099	1.081	1.067	1.093	1.083
WNW	0.	1.720	1.430	1.267	1.185	1.150	1.133	1.125	1.085	1.033	1.045
NW	0.	1.681	1.407	1.257	1.173	1.119	1.078	1.063	.995	.998	.978
NNW	0.	1.739	1.488	1.316	1.212	1.172	1.122	1.135	1.080	1.099	1.091
N	0.	1.816	1.524	1.389	1.285	1.257	1.263	1.285	1.267	1.231	1.213

Note 1: Any interpolations between stated mileages will be done by log-log

ST. LUCIE PLANT
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OFFSITE DOSE CALCULATION MANUAL (ODCM)

TABLE M-5
HISTORICAL LONG TERM - (X/Q) (Frequency corrected)

Terrain / Recirculation Adjusted Program ANNXOQ9 Version - 11/18/76

Florida Power & Light Company
St. Lucie Unit 1 Average Annual Relative Concentration (sec/cubic meter)
Hutchinson Island, Florida Period of Record: 9/1/76 to 8/31/78
Dames and Moore Job No: 1.4598 - 112 Base Distance in Miles/Kilometers

AFFECTED SECTOR	DESIGN DISTANCE MILES	.25 .40	.75 1.21	1.25 2.01	1.75 2.82	2 25 3.62	2 75 4.42	3.25 5.23	3.75 6 03	4.25 6 84	4.75 7.64
NNE	0.	1.1E-05	1.7E-06	7.8E-07	4.5E-07	3.1E-07	2.2E-07	1.7E-07	1.5E-07	1.2E-07	1.0E-07
NE	0	1.3E-05	2.1E-06	8 9E-07	5 1E-07	3 4E-07	2.4E-07	1.7E-07	1.4E-07	1.1E-07	9 8E-08
ENE	0.	9.3E-06	1.4E-06	6.2E-07	3.7E-07	2.5E-07	1.9E-07	1.3E-07	1.1E-07	8 8E-08	7.5E-08
E	0	9 8E-06	1.6E-06	6 5E-07	3 7E-07	2.5E-07	1.8E-07	1.4E-07	1.2E-07	9.9E-08	8 4E-08
ESE	0.	1.2E-05	1.9E-06	8.1E-07	4.8E-07	3.2E-07	2.4E-07	1.8E-07	1.4E-07	1.1E-07	9 0E-08
SE	0	1.4E-05	2.4E-06	9.7E-07	5 7E-07	4 0E-07	2.9E-07	2.3E-07	1.9E-07	1.4E-07	1.2E-07
SSE	0.	1.1E-05	1 7E-06	7.3E-07	4 3E-07	2.9E-07	2.1E-07	1.6E-07	1.3E-07	1.1E-07	9.1E-08
S	0.	6.2E-06	1.0E-06	4.2E-07	2.5E-07	1.8E-07	1.4E-07	1.0E-07	8.0E-08	6 6E-08	5.5E-08
SSW	0.	5.7E-06	9.0E-07	4.0E-07	2.3E-07	1.6E-07	1.1E-07	8 9E-08	7.0E-08	5.7E-08	4.8E-08
SW	0.	6.1E-06	9.4E-07	3.9E-07	2.2E-07	1.6E-07	1.1E-07	8 6E-08	7.0E-08	6 0E-08	5.1E-08
WSW	0.	7.3E-06	1.1E-06	4.6E-07	2.7E-07	1.7E-07	1.3E-07	1.0E-07	8 0E-08	6.5E-08	5 4E-08
W	0.	7.6E-06	1.2E-06	5.2E-07	2.9E-07	2.0E-07	1.3E-07	1.0E-07	8.4E-08	7.2E-08	6.1E-08
WNW	0.	1.4E-05	2.1E-06	9.1E-07	5.2E-07	3.4E-07	2.6E-07	2.0E-07	1.5E-07	1.2E-07	1.0E-07
NW	0.	1.6E-05	2.4E-06	1.0E-06	5.9E-07	3.9E-07	2.8E-07	2.1E-07	1.7E-07	1.4E-07	1.2E-07
NNW	0.	1.5E-05	2.2E-06	9.6E-07	5.5E-07	3 6E-07	2.6E-07	2.0E-07	1.6E-07	1.3E-07	1.2E-07
N	0.	9.1E-06	1.4E-06	6 3E-07	3.6E-07	2.4E-07	1.8E-07	1.4E-07	1.2E-07	9.4E-08	7.9E-08

Number of Valid Observations = 17135 Number of Calms Lower Level = 95
Number of Invalid Observations = 385 Number of Calms Upper Level = 0
Note 1 - Any interpolations between stated mileages will be done by log-log

ST. LUCIE PLANT
CHEMISTRY OPERATING PROCEDURE NO. C-200, REVISION 25
OFFSITE DOSE CALCULATION MANUAL (ODCM)

TABLE M-6
HISTORICAL LONG TERM DEPLETED - $(X/Q)_D$ (Frequency corrected)
Terrain / Recirculation Adjusted Program ANNXOQ9 Version - 11/18/76

Florida Power & Light Company
St. Lucie Unit 1 Average Annual Relative Concentration Depleted (sec/cubic meter)
Hutchinson Island, Florida Period of Record: 9/1/76 to 8/31/78
Dames and Moore Job No: 4598 - 112 Base Distance in Miles/Kilometers

AFFECTED SECTOR	DESIGN DISTANCE MILES	.25 .40	.75 1.21	1.25 2 01	1.75 2 82	2.25 3 62	2.75 4.42	3.25 5.23	3.75 6.03	4.25 6 84	4.75 7.64
NNE	0	1.1E-05	1.6E-06	6 6E-07	3 8E-07	2.4E-07	1.7E-07	1.3E-07	1.1E-07	9.2E-08	7.6E-08
NE	0.	1.2E-05	1.7E-06	7.6E-07	4.3E-07	2.8E-07	1.9E-07	1.4E-07	1.1E-07	8 6E-08	7.4E-08
ENE	0	8.9E-06	1.2E-06	5 3E-07	3 0E-07	2.0E-07	1.4E-07	1.0E-07	8.4E-08	6.6E-08	5.6E-08
E	0	9.1E-06	1.3E-06	5 6E-07	3.1E-07	2.1E-07	1.5E-07	1.1E-07	9.1E-08	7.5E-08	6.3E-08
ESE	0.	1.2E-05	1.6E-06	6 9E-07	3.9E-07	2.6E-07	1.9E-07	1.4E-07	1.1E-07	8.5E-08	6.7E-08
SE	0.	1.3E-05	2.0E-06	8.2E-07	4.7E-07	3.3E-07	2 3E-07	1.8E-07	1.3E-07	1.1E-07	9.0E-08
SSE	0.	1.1E-05	1.6E-06	6 3E-07	3.5E-07	2.4E-07	1.8E-07	1.4E-07	1.0E-07	8.2E-08	6 8E-08
S	0.	5.9E-06	9 1E-07	3 6E-07	2.1E-07	1.4E-07	1.1E-07	7.7E-08	6.2E-08	5.0E-08	4.1E-08
SSW	0	5.4E-06	8 0E-07	3 4E-07	1.9E-07	1.3E-07	8 9E-08	6.9E-08	5.5E-08	4.3E-08	3.6E-08
SW	0.	5.7E-06	8 4E-07	3 4E-07	1.8E-07	1.2E-07	9.2E-08	6.7E-08	5.3E-08	4.6E-08	3.8E-08
WSW	0.	7.0E-06	9 6E-07	4 0E-07	2.2E-07	1.4E-07	1.0E-07	8.0E-08	6.1E-08	5.0E-08	4.0E-08
W	0.	7.3E-06	1.1E-06	4.4E-07	2.4E-07	1.6E-07	1.1E-07	8.2E-08	6 4E-08	5.5E-08	4.4E-08
WNW	0.	1.3E-05	1.9E-06	7.9E-07	4.4E-07	2.9E-07	2.0E-07	1.6E-07	1.2E-07	9.3E-08	7.8E-08
NW	0.	1.5E-05	2.1E-06	8.9E-07	4.9E-07	3.1E-07	2.3E-07	1.7E-07	1.3E-07	1.0E-07	8 5E-08
NNW	0	1.4E-05	2.1E-06	8 3E-07	4.5E-07	2.9E-07	2.0E-07	1.6E-07	1.2E-07	1.0E-07	8.6E-08
N	0	8.7E-06	1.3E-06	5.4E-07	3 0E-07	2.0E-07	1.4E-07	1.1E-07	8.9E-08	7.0E-08	5 8E-08

Number of Valid Observations = 17135 Number of Calms Lower Level = 95
Number of Invalid Observations = 385 Number of Calms Upper Level = 0
Note 1 - Any interpolations between stated mileages will be done by log-log

ST. LUCIE PLANT
CHEMISTRY OPERATING PROCEDURE NO. C-200, REVISION 25
OFFSITE DOSE CALCULATION MANUAL (ODCM)

TABLE M-7
HISTORICAL LONG TERM - (D/Q) (Frequency corrected)
TERRAIN / RECIRCULATION ADJUSTED PROGRAM ANNXOQ9 VERSION - 11/18/76

Florida Power & Light Company
St. Lucie Unit 1
Hutchinson Island, Florida
Dames and Moore Job No: 4598 - 112

Average Annual Relative Deposition Rate (square meter - 1)
Period of Record: 9/1/76 to 8/31/78
Base Distance in Miles/Kilometers

AFFECTED SECTOR	DESIGN DISTANCE MILES	.25 .40	.75 1.21	1.25 2.01	1.75 2 82	2.25 3 62	2.75 4.42	3.25 5.23	3.75 6 03	4.25 6 84	4.75 7.64
NNE	0.	6.5E-08	9.3E-09	3.7E-09	2.1E-09	1.3E-09	9.0E-10	6.8E-10	5.5E-10	4.3E-10	3.5E-10
NE	0.	6.0E-08	8 9E-09	3 5E-09	1.9E-09	1.2E-09	8 1E-10	5.6E-10	4.3E-10	3.3E-10	2.8E-10
ENE	0.	3 2E-08	4.8E-09	1.9E-09	1.0E-09	6 6E-10	4 6E-10	3 2E-10	2.4E-10	1.9E-10	1.5E-10
E	0	3 0E-08	4.6E-09	1.8E-09	9 5E-10	6.0E-10	4 2E-10	3.1E-10	2 5E-10	2 0E-10	1.6E-10
ESE	0.	3 7E-08	5 8E-09	2.3E-09	1.2E-09	8 0E-10	5 4E-10	3.9E-10	3.0E-10	2.2E-10	1.7E-10
SE	0.	6 4E-08	1.0E-08	4.0E-09	2.1E-09	1.4E-09	9.7E-10	7.2E-10	5.6E-10	4.3E-10	3.5E-10
SSE	0.	6.2E-08	9 5E-09	3.6E-09	2.0E-09	1.2E-09	8.7E-10	6.4E-10	4.9E-10	3 9E-10	3 1E-10
S	0.	4.2E-08	7.0E-09	2.6E-09	1.4E-09	9 5E-10	6 9E-10	4.9E-10	3.8E-10	3 0E-10	2.5E-10
SSW	0.	3.4E-08	5 4E-09	2.2E-09	1.1E-09	7.5E-10	5 0E-10	3.7E-10	2.9E-10	2.3E-10	1.8E-10
SW	0	4.5E-08	7.0E-09	2.6E-09	1.5E-09	9.0E-10	6 6E-10	4.6E-10	3.6E-10	3 0E-10	2.5E-10
WSW	0	5 3E-08	7.7E-09	3.0E-09	1.6E-09	1.0E-09	7.3E-10	5 5E-10	4.1E-10	3.3E-10	2.6E-10
W	0	5.0E-08	7.5E-09	3.0E-09	1.6E-09	9 8E-10	6.7E-10	5.0E-10	3.8E-10	3.2E-10	2.6E-10
WNW	0	8.8E-08	1.3E-08	4.9E-09	2.6E-09	1.7E-09	1.1E-09	8.7E-10	6 6E-10	5.1E-10	4.2E-10
NW	0.	8.2E-08	1.2E-08	4.7E-09	2.5E-09	1.6E-09	1.1E-09	7.9E-10	5 8E-10	4.7E-10	3.8E-10
NNW	0	8 2E-08	1.2E-08	4 6E-09	2 4E-09	1.5E-09	1.1E-09	8 1E-10	5.9E-10	4.8E-10	4.0E-10
N	0.	5 1E-08	7.3E-09	2.9E-09	1.5E-09	9 8E-10	7.1E-10	5 4E-10	4 2E-10	3 2E-10	2.7E-10

Number of Valid Observations = 17135 Number of Calms Lower Level = 95
Number of Invalid Observations = 385 Number of Calms Upper Level = 0
Note 1 - Any interpolations between stated mileages will be done by log-log

ST. LUCIE PLANT
CHEMISTRY OPERATING PROCEDURE NO. C-200, REVISION 25
OFFSITE DOSE CALCULATION MANUAL (ODCM)

TABLE M-8

Joint Wind Frequency Distribution Data Period: September 1, 1976 - August 31, 1978

All Winds
Data Source: On-Site
Wind Sensor Height 10.00 Meters
Table Generated: 12/05/78. 07.42.18.

St. Lucie Unit 2
Hutchinson Island, Florida
Florida Power & Light Co.
Dames and Moore Job No: 4598 - 112 - 27

Wind Speed Categories (Meters per Second)

WIND SECTOR	0.0-1.5	1.5-3.0	3.0-5.0	5.0-7.5	7.5-10.0	>10.0	TOTAL[1]	MEAN SPEED
NNE	71 .43	206 1.25	318 1.92	71 .43	3 .02	0 0.00	669 4.05	3.32
NE	62 .38	292 1.77	385 2 33	128 .77	0 0.00	0 0.00	867 5 25	3.43
ENE	60 .36	334 2.02	505 3.06	158 .96	0 0.00	0 0.00	1057 6.40	3 51
E	69 .42	355 2.15	510 3.09	76 .46	0 0.00	0 0.00	1010 6 11	3.25
ESE	115 .70	684 4.14	744 4.50	72 .44	1 .01	0 0.00	1616 9.78	3.04
SE	183 1.11	660 3.99	749 4 53	28 .17	0 0.00	0 0 00	1620 9.81	2.88
SSE	129 .78	579 3.50	656 3.97	93 .56	1 .01	0 0.00	1458 8.82	3.10
S	72 .44	310 1.88	407 2.46	99 .60	8 .05	1 .01	897 5.43	3.36
SSW	84 .51	372 2.25	446 2.70	105 .64	33 .20	4 .02	1044 6 32	3.48
SW	129 .78	440 2 66	336 2.03	106 .64	14 .08	0 0.00	1025 6.20	3 10
WSW	155 .94	320 1.94	186 1.13	29 .18	5 .03	0 0.00	695 4.21	2.59
W	174 1.05	267 1.62	119 .72	37 .22	2 .01	0 0.00	599 3.63	2.43
WNW	203 1.23	304 1.84	172 1.04	17 .10	0 0.00	0 0.00	696 4.21	2.34
NW	143 .87	518 3 14	424 2.57	50 .30	0 0.00	0 0.00	1135 6.87	2.85
NNW	85 .51	379 2.29	535 3 24	70 .42	1 .01	0 0 00	1070 6.46	3.22
N	91 .55	194 1.17	531 3.21	148 .90	5 .03	0 0.00	969 5.86	3.69
CALM	95 .57						95 .57	CALM
TOTAL	1920 11.62	6214 37.61	7023 42.51	1287 7.79	73 .44	5 .03	16522 100.00	3.10

NUMBER OF VALID OBSERVATIONS	16522	94.30 PCT.	Key	XXX Number of Occurrences
NUMBER OF INVALID OBSERVATIONS	988	5 70 PCT.		XXX Percent Occurrences
TOTAL NUMBER OF OBSERVATIONS	17520	100.00 PCT.		

[1] - Totals below are given in hours & percent for wind frequency by sectors

ST. LUCIE PLANT
CHEMISTRY OPERATING PROCEDURE NO. C-200, REVISION 25
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APPENDIX B
RADIOLOGICAL ENVIRONMENTAL SURVEILLANCE
ST. LUCIE PLANT
Key to Sample Locations

PATHWAY	LOCATION	DESCRIPTION	SAMPLES COLLECTED	SAMPLE COLLECTION FREQUENCY	APPROXIMATE DISTANCE (miles)	DIRECTION SECTOR
Direct Radiation	N-1	North of Blind Creek	TLD	Quarterly	1	N
Direct Radiation	NNW-5	South of Pete Stone Creek	TLD	Quarterly	5	NNW
Direct Radiation	NNW-10	C. G. Station	TLD	Quarterly	9	NNW
Direct Radiation	NW-5	Indian River Drive at Rio Vista Drive	TLD	Quarterly	6	NW
Direct Radiation	NW-10	Intersection of SR 68 and SR 607	TLD	Quarterly	10	NW
Direct Radiation	WNW-2	Cemetery South of 7107 Indian River Drive	TLD	Quarterly	3	WNW
Direct Radiation	WNW-5	US-1 at SR 712	TLD	Quarterly	5	WNW
Direct Radiation	WNW-10	SR 70, West of Turnpike	TLD	Quarterly	10	WNW
Direct Radiation	W-2	7609 Indian River Drive	TLD	Quarterly	2	W
Direct Radiation	W-5	Oleander and Sager Streets	TLD	Quarterly	5	W
Direct Radiation	W-10	I-95 and SR 709	TLD	Quarterly	9	W
Direct Radiation	WSW-2	8503 Indian River Drive	TLD	Quarterly	2	WSW
Direct Radiation	WSW-5	Prima Vista Blvd. at Yacht Club	TLD	Quarterly	5	WSW
Direct Radiation	WSW-10	Del Rio and Davis Streets	TLD	Quarterly	10	WSW
Direct Radiation	SW-2	9207 Indian River Drive	TLD	Quarterly	2	SW
Direct Radiation	SW-5	US 1 and Village Green Drive	TLD	Quarterly	5	SW
Direct Radiation	SW-10	Port St. Lucie Blvd. and Cairo Road	TLD	Quarterly	10	SW
Direct Radiation	SSW-2	10307 Indian River Drive	TLD	Quarterly	3	SSW

ST. LUCIE PLANT
CHEMISTRY OPERATING PROCEDURE NO. C-200, REVISION 25
OFFSITE DOSE CALCULATION MANUAL (ODCM)

APPENDIX B
RADIOLOGICAL ENVIRONMENTAL SURVEILLANCE
(continued)
ST. LUCIE PLANT
Key to Sample Locations

PATHWAY	LOCATION	DESCRIPTION	SAMPLES COLLECTED	SAMPLE COLLECTION FREQUENCY	APPROXIMATE DISTANCE (miles)	DIRECTION SECTOR
Direct Radiation	SSW-5	Port St. Lucie Blvd. and US 1	TLD	Quarterly	6	SSW
Direct Radiation	SSW-10	Pine Valley and Westmoreland Roads	TLD	Quarterly	8	SSW
Direct Radiation	S-5	13179 Indian River Drive	TLD	Quarterly	5	S
Direct Radiation	S-10	US 1 and SR 714	TLD	Quarterly	10	S
Direct Radiation	S/SSE-10	Indian River Drive and Quail Run Lane	TLD	Quarterly	10	SSE
Direct Radiation	SSE-5	Entrance of Nettles Island	TLD	Quarterly	5	SSE
Direct Radiation	SSE-10	Elliot Museum	TLD	Quarterly	10	SSE
Direct Radiation	SE-1	South of Cooling Canal	TLD	Quarterly	1	SE
Direct Radiation	*H-32	U. of Florida - 1FAS Entomology Lab Vero Beach	TLD	Quarterly	19	NNW
Airborne	H08	FPL Substation - Weatherby Road	Radioiodine & Particulates	Weekly	6	WNW
Airborne	*H12	FPL Substation - SR 76, Stuart	Radioiodine & Particulates	Weekly	12	S
Airborne	H14	Onsite - near south property line	Radioiodine & Particulates	Weekly	1	SE
Airborne	H30	Power Line - 7609 Indian River Drive	Radioiodine & Particulates	Weekly	2	W

*Denotes Control Sample

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APPENDIX B
RADIOLOGICAL ENVIRONMENTAL SURVEILLANCE
(continued)
ST. LUCIE PLANT
Key to Sample Locations

PATHWAY	LOCATION	DESCRIPTION	SAMPLES COLLECTED	SAMPLE COLLECTION FREQUENCY	APPROXIMATE DISTANCE (miles)	DIRECTION SECTOR
Airborne	H34	Onsite - At Meteorological Tower	Radioiodine & Particulates	Weekly	0.5	N
Waterborne	H15	Atlantic Ocean vicinity of public beaches east side of Route A1A	Surface Water (ocean) Sediment from shoreline	Weekly Semi-Annually	< 1	ENE/E/ESE
Waterborne	*H59	Near south end of Hutchinson Island	Surface Water (ocean) Sediment from shoreline	Monthly Semi-Annually	10-20	S/SSE
Food Products	H15	Ocean side vicinity of St. Lucie Plant (NOTE 1)	Crustacea Fish	Semi-Annually Semi-Annually	<1	ENE/E/ESE
Food Products	H51	Offsite near north property line	Broad Leaf vegetation (mangrove)	Monthly (when available)	1	N/NNW

*Denotes control sample

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APPENDIX B
RADIOLOGICAL ENVIRONMENTAL SURVEILLANCE
(continued)
ST. LUCIE PLANT
Key to Sample Locations

PATHWAY	LOCATION	DESCRIPTION	SAMPLES COLLECTED	SAMPLE COLLECTION FREQUENCY	APPROXIMATE DISTANCE (miles)	DIRECTION SECTOR
Food Products	H52	Offsite near south property line	Broad leaf vegetation (mangrove)	Monthly (when available)	1	S/SSE
Food Products	*H59	Near south end of Hutchinson Island	Crustacea Fish Broad leaf vegetation (mangrove)	Semi-Annually Semi-Annually Monthly	10-20	S/SSE
Food Products	WSW 3.5	Goat Milk per land use census (2000) off east end of Tilton Road	Milk	Quarterly (when available)	3.5	WSW

*Denotes control sample

It is the policy of Florida Power & Light Company (FPL) that the St. Lucie 1 & 2 Radiological Environmental Monitoring Programs are conducted by the State of Florida Department of Health (DOH) and Rehabilitative Services (DHRS), pursuant to an Agreement between FPL and DOH and; that coordination of the Radiological Environmental Monitoring Programs with DOH and compliance with the Radiological Environmental Monitoring Program Controls are the responsibility of the Nuclear Plant Support Services Department.

NOTE 1
These samples may be collected from or supplemented by samples collected from the plant intake canal if the required analyses are unable to be performed due to unavailability or inadequate quantity of sample from the ocean side location.

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FIGURE 1-1
SITE AREA MAP & ENVIRONMENTAL SAMPLE LOCATIONS

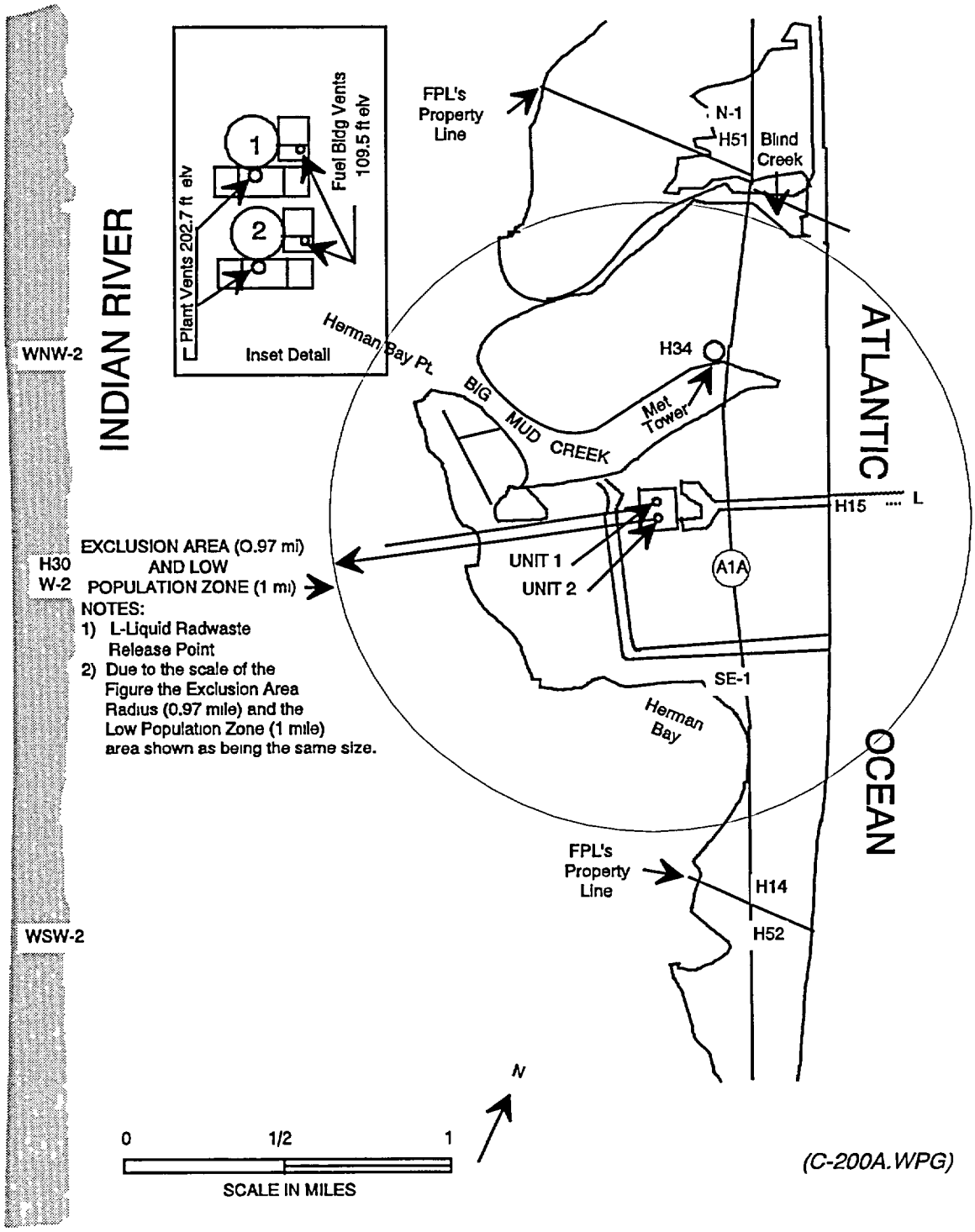

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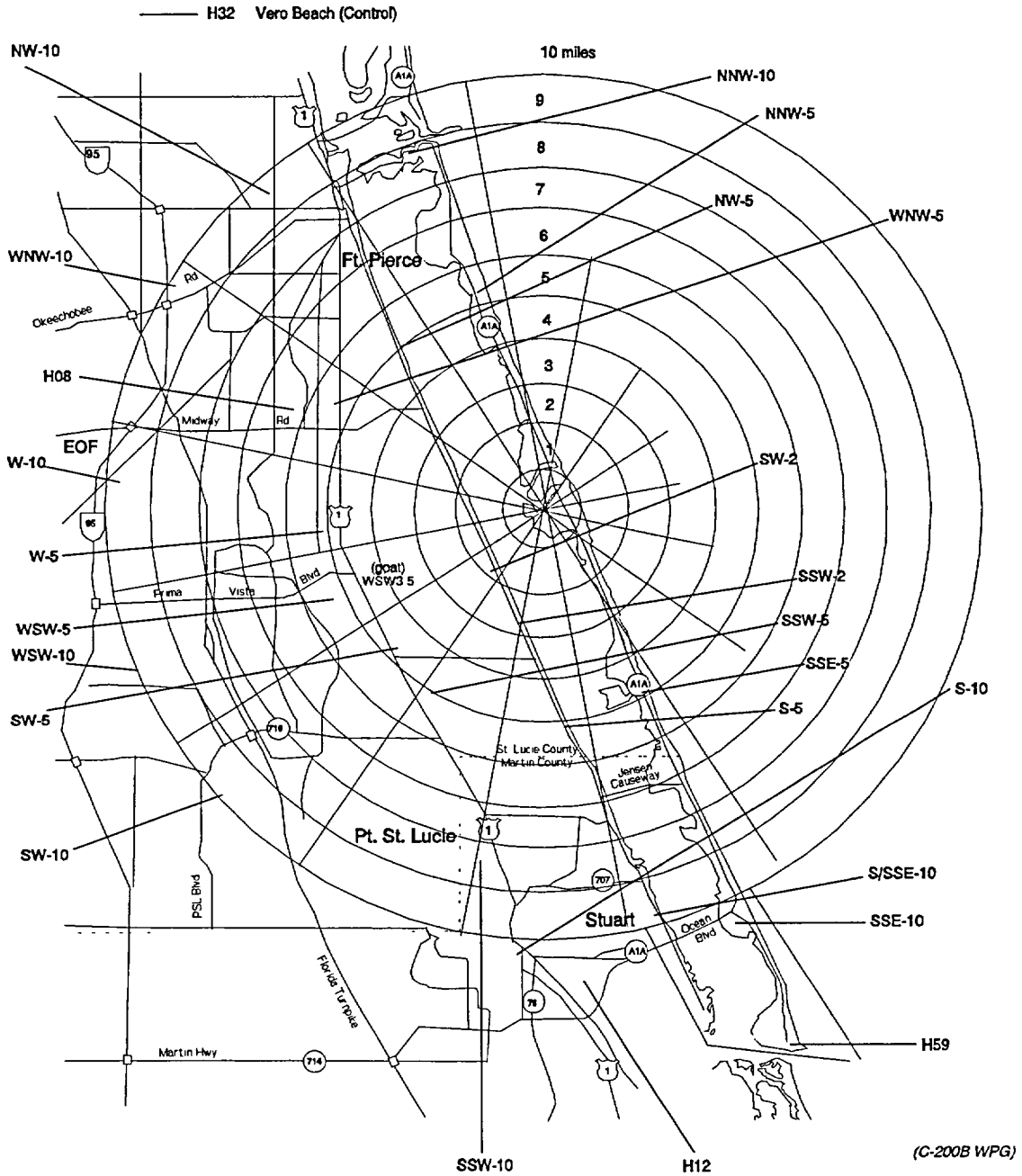
FIGURE 1-2
ENVIRONMENTAL SAMPLE LOCATIONS (10 MILES)



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APPENDIX C
METEOROLOGICAL DISPERSION FORMULAS*

For X/Q:

$$X/Q = \frac{2.032}{(\bar{u})D\sqrt{(\sigma_z^2 + \frac{cV^2}{\pi})}} \qquad \text{EQ (1)}$$

$$X/Q = \frac{2.032}{\sqrt{3}\ \sigma_z\ (\bar{u})D} \qquad \text{EQ (2)}$$

Where:

C = .5

V = 207.5 ft. (63.2 meters)

$(\bar{u})$ = a name for one term

X/Q was calculated using each of the above EQs for each hour. The highest X/Q from EQ (1) or EQ (2) was selected. The total integrated relative concentration at each sector and distance was then divided by the total number of hours in the data base.

* Terrain correction factors given by Table M-4 were also applied to Dispersion Formulas

APPENDIX C
METEOROLOGICAL DISPERSION FORMULAS*
(continued)

For Depleted X/Q:

$(X/Q)_D$ = (X/Q) X (Depletion factor of Figure 2 of R.G. 1.111-R1)

For Deposition (D/Q):

D/Q = RDep/(2 sin [11.25] X) X (Freq. distribution)

Where:

D/Q = Ground deposition rate

X = Calculation distance

RDep = Relative ground deposition rate from Figure 6 of R.G. 1.111, R1

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APPENDIX D
DESCRIPTION OF THE INTERLABORATORY COMPARISON PROGRAM (ICP)

(Page 1 of 2)

The State of Florida, Department of Health-Bureau of Radiation Control (BRC) Laboratory shall participate in an INTERLABORATORY COMPARISON PROGRAM.

1. The sample matrices and analytical methods shall be:

   A. Gamma isotopic on a filter sample simulating airborne radioiodine and particulate collection.

   B. Gamma isotopic on a water sample simulating a surface water grab sample.

   C. Gamma isotopic on either sediment (or soil) or broad leaf vegetation.

NOTE
Steps D, E and F reference NRC IR 99-04, PMAI 99-0716.

   D. Gross Beta on an Air Filter matrix.

   E. Tritium in water, using method employed in REMP.

   F. Gamma isotopic on a water sample (above) is used for milk matrix if milk samples are being obtained per land use census identified milk animals within 5 miles of the plant site.

2. The source of samples for this program:

   A. A Federal Government Laboratory Program (e.g., DOE-LAP, EPA Safe Drinking Water Program)

   B. A State, Federal, or private (commercial) laboratory capable of providing NIST traceable samples. To be eligible, a Commercial Laboratory shall meet the FPL Quality Assurance criteria of "Quality Related".

   C. For Gamma Analysis only, a FPL Nuclear Site Laboratory may prepare sample matrices using known quantities of radioactivity from isotopes provided by a FPL Contract Laboratory currently approved as PC-1 Level vendor. These prepared matrices may be prepared by the vendor, or by FPL personnel, but shall not exceed the participant(s) form and/or license quantities for allowed radioactivity.

APPENDIX D
DESCRIPTION OF THE INTERLABORATORY COMPARISON PROGRAM (ICP)

(Page 2 of 2)

3. Analysis of Matrix samples shall be capable of achieving ODCM Table 4.12-1 prescribed LLDs on a blank sample.

4. Results within 20% of expected shall be considered acceptable. Results exceeding 20% but within 35% require a description of probable cause and actions performed to bring the analysis into conformance. Results exceeding 35% are considered Not Acceptable; the Matrix shall be replaced and reanalyzed.

5. The frequency for performing the interlaboratory comparison program shall be annually with a maximum of 15 months between comparisons of similar matrices.

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE
ANNUAL REPORT
EFFLUENT AND WASTE DISPOSAL SUPPLEMENTAL INFORMATION.

Attachment - C

ODCM Revisions 24 and 25
Mark Up Pages

(Total Attachment C Pages Including Cover Page - 30)

Page
No.. C-200 ODCM Reasons for changes Page 1 of 2

3 thru 7 INDEX needs correct page numbers entered per the Index topic(s)

8 Insert Reg. Guide 4.15. Adding reference plus why it appears in the ODCM. Currently, reference to this Reg. Guide can only be found in the FUSAR. This Reg. Guide is the bases for performing QC cross-check as stated. This is an admin change to improve visibility of the R.G. in a Chemistry Procedure.

8 Including reference to COP-05.02's reference to Met Data Processing. This is admin change.

20, 21 Note "(1)" allows ODCM Action statements frequency to have a 25 percent maximum allowable extension after the initial sample is obtained within the ACTION Statement's frequency(no grace period on the 1st sample of an ACTION Statement). The ODCM ACTION Statements are not equivalent to Technical Specification ACTIONs. The 25 percent grace period is allowed after the initial sample.

27,28 Note "(1)" is the same case as Page 20, 21 above

28 Note "(2)" This Note explains that no physical sample may be available in MODE 4, when there is no steam flowing (MSIV's and MSIV by-pass valves are closed) to the Air Ejector Nozzles The sample may be omitted under these circumstances, but a provision to keep checking the Air Ejector Status is provided to check on Steam being cut into the Air Ej. Nozzles to initiate grab sampling.

29 Add Note "q"to Vent Channels "Alert" alarms. The administration does
30B not desire Alert alarms to occur during anticipated outage evolutions. This allows the Alert Set Point to be set higher than 5 X Bkg.(Background), but less than the existing "High Alarm" set point. Note "q" is explained on Page 30B. High alarms provide control of Site Limit release rates. The Alert Alarms are Administratively set below high alarm concentrtions.

29 Note "p" is included to explain the common alert and high alarm function shared by Channels 621, 622, and 623, plus related ECCS 2A and 2B monitor channels 601, 602, 603, and 611, 612, 613..
Note "p" is described on Page 30A and 30B. Briefly, Note "p" dexribes Limitations of the Common Alarm, and what has to be considered during Accident Conditions for Plant Vent # 2 process flow ft3/minute per running Fans.

35 and Table 4.11-1, Item D. Settling Basin Note (9). Identifies a source of radioactivity
37 influent for information and cross reference to COP-01.05. This note is intended to avoid conflicting interpretations between Table Items C. and D.

57 3 year review noted Appendix –E had been renamed Appendix – B. Admin change to correct reference to Appendix.

101 Providing more specific engineering units, ft to ft3 for typo correction in formula for calculating "SP", and providing method to calculate "SP" in units of uCi/sec as well as uCi/cc, since Wide Range Unit 2 skids need Channel 4 set points in units of uCi/sec rather than uCi/cc.

102 2.1.A.4.b. – Calculation methodology provides for converting a Set Point in uC/cc to equivalent uCi/sec and in terms of percent of the ODCM site limit of 3.5E+05 uCi/sec.

Page No. . C-200 ODCM Reasons for changes Page 2 of 2

103 formula in 2.2.A.4.c. "(V)" was not clearly denoted. Added "(V)" to consistently label the variable expressions

142 Analysis method has changed from gas flow proportional counter

143 to an air ion chamber. These pages provide examples of the Annual Report format.

222 Changing reference to name of State of Florida department from DHRS to DOH, and Nuclear Energy Services to Nuclear Plant Support. Admin changes

227 Appendix D, Step 1.F.- changing cross check based on milk sampling to specify Gamma isotopic instead of Strontium-89 and Strontium-90 being the cross check comparison. Admin change. There was no valid requirement to perform Strontium cross-checks.

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INDEX

Typist re number index pages to match Procedure

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CONTROLS SECTION

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CONTROLS SECTION

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FIGURE

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METHODOLOGY SECTION

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METHODOLOGY SECTION

ST. LUCIE PLANT
CHEMISTRY OPERATING PROCEDURE NO. C-200, REVISION 23A
OFFSITE DOSE CALCULATION MANUAL (ODCM)

INTRODUCTION

The ODCM consists of the Controls Section followed by the Methodology Section.

The Controls Section provides the Control Statements, Limits, ACTION Statements, Surveillance Requirements and BASES for ensuring that Radioactive Liquid and Gaseous Effluents released to UNRESTRICTED AREAS and/or the SITE BOUNDARY will be maintained within the requirements of 10 CFR Part 20, 40 CFR Part 190, 10 CFR 50.36.a and 10 CFR Part 50 Appendix-I radioactive release criteria. All Control Statements and most Administrative Control Statements in the ODCM are directly tied to and reference the Plant Technical Specification (TS) Administrative Section. The Administrative Control for Major Changes to Radioactive Liquid, Gaseous and Solid Treatment Systems is as per the guidance of NUREG-1301, April 1991, Supplement No. 1 to NRC Generic Letter 89-01. The numbering sequences of Control Statements also follow the guidance of NUREG-1301 as applicable, to minimize differences.

The Methodology Section uses the models suggested by NUREG-0133, November, 1978 and Regulatory Guide 1.109 to provide calculation methods and parameters for determining results in compliance with the Controls Section of the ODCM. Simplifying assumptions have been applied where applicable to provide a more workable document for implementing the Control requirements. Alternate calculation methods may be used from those presented as long as the overall methodology does not change or as long as most up-to-date revisions of the Regulatory Guide 1.109 dose conversion factors and environmental transfer factors are substituted for those currently included and used in this document.

Insert

RECORDS AND NOTIFICATIONS

All records of reviews performed for changes to the ODCM shall be maintained in accordance with QI 17-PSL-1. All FRG approved changes to the ODCM, with required documentation of the changes per TS 6.14, shall be submitted to the NRC in the Annual Effluent Release Report. Procedures that directly implement, administer or supplement the requirements of the ODCM Controls and Surveillances are:

COP-01.05, Processing Aerated Liquid Waste
COP-01.06, Processing Gaseous Wastes
COP-05.04, Chemistry Department Surveillances and Parameters
COP-07.05, Process Monitor Setpoints
The Radiological Environmental Monitoring Program is performed by the State of Florida as per FPL Juno Nuclear Plant Services Corporate Environmental Procedure Number NBS-NPS-HP-WP-002.
COP-05.02 Conduct of Chemistry - Met Tower Data Processing

Regulatory Guide 4.15, Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment, 6.3.1 and 6.3.2, provide the background for the need to maintain Quality Assurance programs for Effluent releases and Radiological Environmental Monitoring

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TABLE 3.3-12 (Continued)

ACTION STATEMENTS

ACTION 35 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases may continue for up to 14 days provided that prior to initiating a release:

a. At least two independent samples are analyzed in accordance with the Surveillance Requirement for concentration limit of Control 4.11.1.1.1. and

b. At least two technically qualified members of the Facility Staff independently verify the release rate calculations and discharge line valving.

Otherwise, suspend release of radioactive effluents via this pathway.

ACTION 36 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided grab samples are analyzed for gross radioactivity (beta or gamma) at a limit of detection of at least 2.E-07 micro-Curie/ml:

a. At least once per 8 hours (1) when the specific activity of the secondary coolant is greater than 0.01 micro-Curies/gram DOSE EQUIVALENT I-131 or

b. At least once per 24 hours (1) when the specific activity of the secondary coolant is less than or equal to 0.01 micro-Curies/gram DOSE EQUIVALENT I-131.

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TABLE 3.3-12 (Continued)

ACTION STATEMENTS
(continued)

ACTION 37 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, isotopic grab samples shall be obtained and analyzed at a Lower Limit of Detection for I-131, Co-58, Co-60, Cs-134, and Cs-137 to achieve detection sensitivity capable of detecting a primary-to-secondary leak rate of 5 gallons per day, provided that the Reactor Coolant System has sufficient activity present.

The applicable frequency shall be:

In MODES 1, 2, 3, 4

a. At least once per day (1) for isotopic activity on the affected Steam Generator, provided that the Air Ejector Gas Activity Monitor is OPERABLE,

OR

b. At least every 8 hours (1) for isotopic activity on the affected Steam Generator, if the Air Ejector Gas Activity Monitor is INOPERABLE.

This requirement is intended to meet EPRI PWR Primary-to-Secondary Leak Guidelines (TR-104788-R2) per reference PMAI 00-08-109.

ACTION 38 - Minimum system design flow of required running pumps shall be utilized for ECL calculations for discharge canal flow and maximum system design flow be utilized for ECL calculations for effluent line flow.

TABLE 3.3-12 Notation

(1)- The initial sample shall be completed prior to the frequency interval specified. Subsequent samples (of the same INOPERABLE condition) may be performed per ODCM Surveillance Requirement 4.0.2 (a maximum allowable extension not to exceed 25% of the surveillance interval) IR23

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TABLE 3.3-13 (Continued)
TABLE NOTATIONS

* - At all times while making releases via this pathway
** - At all times when air ejector exhaust is not directed to plant vent.
Rx - Denotes reactor

ACTION STATEMENTS

ACTION 45 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, the contents of the tank(s) may be released to the environment for up to 14 days provided that prior to initiating a release:

a. At least two independent samples of the tank's contents are analyzed and

b. At least two technically qualified members of the facility staff independently verify the release rate calculations and discharge valve lineup.

Otherwise, suspend release of radioactive effluents via this pathway.

ACTION 46 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided the flow rate is estimated at least once per 4 hours.

ACTION 47 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE, effluent releases via this pathway may continue for up to 30 days provided:

a. If channel inoperability is due to loss of activity indication, Then grab samples are taken at least once per 8 hours(1) and these samples are analyzed for isotopic activity within 24 hours.

OR

b. If channel inoperability is due to loss of Control Room alarm annunciation discovered during a channel functional test because of any one or more of the following reasons listed, Then channel checks are performed once per hour(1) to verify normal indication and current assigned setpoints are NOT exceeded.

1. Failure to annunciate when testing alarm/trip setpoints.

2. Circuit failure.

3. Downscale failure.

4. Controls NOT set in OPERATE mode.

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TABLE 3.3-13 (Continued)
TABLE NOTATIONS

ACTION STATEMENTS
(continued)

ACTION 48 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, noble gas isotopic grab samples shall be obtained and analyzed at a Lower Limit of Detection for Ar-41, Kr-88, Xe-133, Xe-133m, and Xe-135 to achieve detection sensitivity capable of detecting a primary-to-secondary leak rate of 5 gallons per day, provided that the Reactor Coolant System has sufficient activity present.

The applicable frequency shall be:

a. At least once per 12 hours (1),(2) for noble gas isotopic activity on the Air Ejector Exhaust provided that each affected Unit's Steam Generator Blowdown Monitor is OPERABLE,

OR

b. At least once per 8 hours (1),(2) for noble gas isotopic activity on the Air Ejector Exhaust if either of the affected Unit's Steam Generator Blowdown Monitors is INOPERABLE.

This requirement is intended to meet EPRI PWR Primary-to-Secondary Leak Guidelines (TR-104788-R2), therefore grab samples shall be taken regardless of the Alignment of the Air Ejector Exhaust while in Modes 1, 2, 3, 4. (Reference PMAI 00-08-109.)

ACTION 51 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via the affected pathway may continue for up to 30 days provided samples are continuously collected with auxiliary sampling equipment as required in Table 4.11-2.

ACTION 53 - Maximum system flows shall be utilized in the determination of the instantaneous release monitor alarm setpoint.

TABLE 3.13-13 NOTATION

(1) - The initial sample shall be completed prior to the frequency interval specified. Subsequent samples (of the same INOPERABLE CONDITION) may be performed per ODCM Surveillance Requirement 4.0.2 (A maximum allowable extension not to exceed 25 percent of the surveillance interval) /R23

(2) - If there is ~~not~~ no steam ~~out Onto~~ Flow To the air ejector nozzles while the Reactor is in Mode 4, Then the sample may be omitted, but the steam flow condition (status) to the air ejector shall be reverified once per 8 hours to initiate grab samples if steam flow to the air ejector nozzles is established.

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TABLE 3.3-14
RADIOACTIVE EFFLUENT MONITOR SETPOINT BASIS

ODCM Effluent Gas Channels	CHANNEL ID	BASIS DOCUMENT	ALERT SETPOINT[e]	HIGH SETPOINT[e]
1PV LOW RANGE GAS	01-05	C-200[a]	5 x Bkg.[q]	Allotted % Of Site Limit[g]
1FHB LOW RANGE GAS	04-05	C-200[a]	5 x Bkg.[q]	Allotted % Of Site Limit[g]
2A PV PIG LOW RANGE GAS	423	C-200[a]	5 x Bkg.[q]	Allotted % Of Site Limit[g] For Plant Vent #2
2B PV PIG LOW RANGE GAS	433	C-200[a]	5 x Bkg.	
~~2PV WRGM LOW RANGE GAS~~	~~621~~	~~C-200[a]~~	~~5 x Bkg.[P,q]~~	
2FHB LOW RANGE GAS	413	C-200[a]	5 x Bkg.	Allotted % Of Site Limit[g]
SGBDB LOW RANGE GAS	45-6	C-200[a]	5 x Bkg.	Allotted % Of Site Limit[g]
1 CONDENSER AIR EJECTOR	35	C-200	2 x Bkg.[b]	3 x Bkg.
2 CONDENSER AIR EJECTOR	403	C-200	2 x Bkg.[b]	3 x Bkg.
1 BATCH GAS EFFLUENT	42	C-200[a]	As Per COP-01.06	As Per COP-01.06[a,h]
2 BATCH GAS EFFLUENT	203	C-200[a]	As Per COP-01.06	As Per COP-01.06[a,h]

ODCM Related Particulate Channels	CHANNEL ID	BASIS DOCUMENT	ALERT SETPOINT[e]	HIGH SETPOINT[e]
1PV PARTICULATE	01-01	FUSAR	5000 CPM	10,000 CPM[c]
1FHB PARTICULATE	04-01	FUSAR & TS[d]	5000 CPM	10,000 CPM[c]
2A PV PIG PARTICULATE	421	FUSAR	5000 CPM	10,000 CPM[c]
2B PV PIG PARTICULATE	431	FUSAR	5000 CPM	10,000 CPM[c]
2FHB PARTICULATE	411	FUSAR & TS[d]	5000 CPM	10,000 CPM[c]
SGBDB PARTICULATE	45-4	FUSAR	5000 CPM	10,000 CPM[c]
2PV WRGM Low Range Gas Mid Range Gas High Range Gas	Chan 621 622 623	624[P]	C-200[a]	5x Bkg[P] uCi/sec	allotted % of Site Limit uCi/sec [P]
2A ECCS WRGM Low Range Gas Mid Range Gas High Range Gas	Chan 601 602 603	604[P]	C-200[a]	~~0.75x High~~ uCi/sec 0.75x High[P]	allotted % of Site Limit uCi/sec [P]
2B ECCS WRGM Low Range Gas Mid Range Gas High Range Gas	Chan 611 612 613	614[P]	C-200[a]	0.75x High[P] uCi/sec	allotted % of Site Limit uCi/sec [P]

St. Lucie Plant ODCM Controls

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TABLE 3.3-14 (continued)
RADIOACTIVE EFFLUENT MONITOR SETPOINT BASIS

ODCM Related Iodine Channels	CHANNEL ID	BASIS DOCUMENT	ALERT SETPOINT[a]	HIGH SETPOINT[a]
1PV IODINE	01-03	FUSAR	5000 CPM	10,000 CPM[c]
1FHB IODINE	04-03	FUSAR	5000 CPM	10,000 CPM[c]
2A PV PIG IODINE	422	FUSAR	5000 CPM	10,000 CPM[c]
2B PV PIG IODINE	432	FUSAR	5000 CPM	10,000 CPM[c]
2FHB IODINE	412	FUSAR	5000 CPM	10,000 CPM[c]
SGBDB IODINE	45-5	FUSAR	5000 CPM	10,000 CPM[c]

ODCM Related Liquid Channels	CHANNEL ID	BASIS DOCUMENT	ALERT SETPOINT[a]	HIGH SETPOINT[a]
1A S/G BLOWDOWN	44	C-200	2 x Bkg.	2.E-04 uCi/ml[f,m]
1B S/G BLOWDOWN	45	C-200	2 x Bkg.	2.E-04 uCi/ml[f,m]
2A S/G BLOWDOWN	121	C-200	2 x Bkg.	2.E-04 uCi/ml[m]
2B S/G BLOWDOWN	122	C-200	2 x Bkg.	2.E-04 uCi/ml[m]
1 BATCH LIQUID EFFLUENT	R6627	C-200	As Per COP-01.05	As Per COP-01.05[n]
2 BATCH LIQUID EFFLUENT	301	C-200	As Per COP-01.05	As Per COP-01.05[n]

Monitor Channels not listed are covered per COP-07.05

Table Notations:

a - ODCM Control 3.11.2.1a

b - ODCM Table 4.11-1 Note (7)

c - ODCM Control 3.11.2 1.b

d - TS Table 3 3-6 required instrument 2.a ii with setpoint per ODCM

e - Setpoints may be rounded for analog and digital display input limitations.

f - The channel setpoint to be in cpm equivalent to this activity

g - per ODCM Methodology Step 2.2.2

h - Batch Gaseous Release Rate and Maximum activity limits shall be used such that Plant Vent (PV) Release HIGH setpoints should not be exceeded.

i, j, k, and l not used in notation for clarity

m - Continuous Liquid setpoint methodology per ODCM 1.3.2

n - Batch liquid setpoint methodology per ODCM 1.3.1

FUSAR - Channel listed in fusar, but not required by ODCM Control 3.3 10 Table 3.3-13. The setpoints are used to provide alarm well before exceeding ODCM Control 3.11.2.1.b Site Dose Rate Limit. The inoperability of a fusar channel above does not involve an ACTION statement unless TS (Technical Specification) is noted.

2 x Bkg., 3 x Bkg., 5 x Bkg etc., denotes the number of times the normal channel reading is the appropriate Alarm Setting These type of setpoints should be periodically evaluated to insure alarm sensitivity is maintained as per COP-07.05.

o - note "oscar" is not used in this Table notation

St. Lucie Plant ODCM Controls

Insert Notes "p", "q", and "r" per attached pages 30A & 30B

C200_rev24.doc INSERT for Page 30

Note "p" for Table 3.3-14

p - The individual Channel 621, 622, and 623 (Plant Vent No. 2)
Channel 601, 602, and 603 (ECCS 2A)
and Channel 611, 612, and 613 (ECCS 2B)
Data Base Alert and High Alarm Set Point Items do not provide activation of a Control Room Alarm. Only the Skid's Effluent Channel Set Point provides an alarm function. After the first Alert and High Effluent Channel Alarms are received they will stay locked in if the release is increasing to higher activity levels. Transfer of Skid internal control to Effluent Channel input from the Mid or High Range Gas Channels will not reset an alarm, nor provide additional alarms. The Effluent Channel on the respective Skid has to be reset to new Set Points by I & C. References to "Alert Alarm" and "High Alarm" settings for the Low Mid and High Channels are for display information only. This is why Table 3.3-14 only list Channel 624, 604, and 614 as the Channel ID for Alarm Set Points. These are the respective Skid's Alarm Channel..

Channel ID number 604 and 614 are the uCi/sec indication and ALERT/HIGH Alarm channels for ECCS 2A and ECCS 2B respectively. The ECCS exhaust pathways each have a single fan. Their Skid's Monitor Item # 059 will be set per the measured ft3/minute exhaust rate. Their Skid's Monitor Item # 060(Accident Flow rate) will be set to zero since there is only one flow rate possible for these ECCS pathways. The uCi/sec value indicated on ECCS skids should be valid regardless of Normal or Accident conditions.

The Channel ID number 624(generically called the Plant Vent 2 Skid's Channel 4) is the uCi/sec and Control Room active ALERT/HIGH Alarm that is Common(shared by) to the Low(621), Mid(622), and High(623) Range Gas Channels. The Plant Vent 2's skid Monitor Item # 059 will be set for the maximum ft3/minute flow rate that could occur under all circumstances. The Plant Vent 2 Channel 624's actual uCi/sec is dependent what is set in Monitor Item # 059 and Monitor Item # 060 as follows:

The NORMAL value for the Common Channel 624 uCi/sec indication and ALERT/High Alarms should be based on the equivalent uCi/sec of the 5 x Bkg(use COP-07.05) uCi/cc of the Low Range Channel # 621 and RIM 26-90 Monitor Item # 059(the MAXIMUM process ft3/minute flow rate that could occur in the Unit 2 Plant Vent.

The ACCIDENT value for the Common Channel 624's uCi/sec is based on the Skid switching(at a preset activity value) input from the Low Range Channel to calculate/display a uCi/sec value based on receiving activity uCi/cc input from either the Mid Range Channel 622(OR from the High Range Channel 623) and RIM 26-90 Monitor Item #060 6,600 ft3/minute(use COP-07.05) flow rate that is expected during a LOCA Safety Injection sequence.

During an ACCIDENT you have to access the running status of 2-HVE-6A, 2-HVE-6B, 2-HVE-7A, 2-HVE-7B, 2-HVE-8A, 2-HVE-8B, 2-HVE-10A, and 2-HVE-10B to determine actual Plant Vent exhaust flow rate ft3/minute. This is the flow rate that should be inserted into Plant Vent # 2 Skid's Monitor Item #060 with new Set Points for Alert and High Alarms in units of uCi/sec calculated by using the actual Plant Vent exhaust flow during the Accident. If fan operating status changes, the Effluent Channel 624 uCi/sec indication and existing Alert and High Alarm Set Points will not be valid for a new flow rate. This is the reason that EPIP-09 does not utilize Channel 624 indication for calculating off-site dose.

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Note "q" for Table 3.3-14

q - During an outage, the Low Range gas activity ALERT Alarm Set Point may be set to slightly above outage anticipated activity levels, but shall always be set to a value less than the High Alarm Set Point. Examples of outage activities are initiating a Containment Main Purge and venting the S/G primary side bowls.

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TABLE 4.11-1 RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection LLD (1) (µCi/ml)
A. Batch Waste Release Tanks (2)	P Each Batch	Each Batch	P.G.E. (3)	5.E-07
			I-131	1.E-06
	P One Batch/M	M	Dissolved and Entrained Gases (Gamma Emitters)	1.E-05
	P Each Batch	M Composite (4)	H-3	1.E-05
			Gross Alpha	1.E-07
	P Each Batch	Q Composite (4)	Sr-89, Sr-90	5.E-08
			C-14, Fe-55, Ni-63	1.E-06
B. Continuous Releases (5, 6)	Daily	4/M Composite	P.G.E.(3)	5.E-07
			I-131	1.E-06
	Daily Grab Sample	4/M Composite	Dissolved and Entrained Gases (Gamma Emitters)	1.E-05
	Daily	M Composite	H-3	1.E-05
			Gross Alpha	1.E-07
	Daily	Q Composite	Sr-89, Sr-90	5.E-08
			C-14, Fe-55, Ni-63	1.E-06
C. Settling Basin (7)	W Grab Sample	W	P.G.E. (3)	5.E-07
			I-131	1.E-06
D. Settling Basin as a Batch Release Pathway. (9) (Reference CR 99-1165 PMAI 99-08-084 PMAI-01-04-115	P Each Batch (8)	Each Batch	P.G.E. (3)	5.E-07
			I-131	1.E-06
			Dissolved and Entrained Gases (Gamma Emitters)	1.E-05
	Each Batch	Each Batch	H-3	1.E-05
			Gross Alpha	1.E-07
			Sr-89, Sr-90	5.E-08
			C-14, Fe-55, Ni-63	1.E-06

/R23

P.G.E. - Denotes Principal Gamma Emitter

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TABLE 4.11-1 (Continued)

TABLE NOTATIONS (Continued)

(2) A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analyses, each batch shall be isolated and then thoroughly mixed by a method described in the ODCM to assure representative sampling.

(3) The principal gamma emitters for which the LLD control applies include the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137 and Ce-141 and Ce-144. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Annual Radioactive Effluent Release Report pursuant to Control 3.11.2.6 in the format outlined in Regulatory Guide 1.21, Appendix B, Revision 1, June 1974.

(4) A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen that is representative of the liquids released.

(5) A continuous release is the discharge of liquid wastes of a nondiscrete volume, e.g., from a volume of a system that has an input flow during the continuous release.

(6) If Component Cooling Water activity is > 1.E-5 µCi/ml, perform a weekly gross activity on the Intake Cooling Water System outlet to ensure the activity level is less than or equal to 2.E-07 µCi/ml LLD limit. If ICW is >2.E-07 µCi/ml, perform analysis in accordance with a Plant Continuous Release on this Table.

(7) Grab samples to be taken when there is confirmed primary to secondary system leakage indicated by the air ejector monitor indicating greater than or equal to 2x background.

(8) At least two independent samples are analyzed in accordance with the surveillance requirement for concentration limit of control 4.11.1.1.1 and at least two technically qualified members of the facility staff independently verify the release rate calculations.

(9) The Settling Basin(s) may receive low level activity per the guidance of COP-01,05, therefore these samples shall be taken regardless of the absence of a primary-to-secondary leak (Note (7) on Liquid Release Type C. Settling Basin does not apply to Liquid Release Type D. Settling Basin as a Batch Release Pathway)

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TABLE 3.12-1 (Continued)

TABLE NOTATIONS

a. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment or other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunction, corrective action shall be taken prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented in the Annual Radiological Environmental Operating Report pursuant to Control 3.12.4.

b. Specific parameters of distance and direction sector from the centerline of one reactor and additional description where pertinent, shall be provided for each sample location required by Table 3.12-1, in Appendix-~~A~~ B and applicable figures.

c. At times, it may not be possible or practicable to continue to obtain samples of the media of choice at the most desired location or time. In these instances suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the radiological environmental monitoring program.

d. The following definition of frequencies shall apply to Table 3.12-1 only:

Weekly - Not less than once per calendar week. A maximum interval of 11 days is allowed between the collection of any two consecutive samples.

Semi-Monthly - Not less than 2 times per calendar month with an interval of not less than 7 days between sample collections. A maximum interval of 24 days is allowed between collection of any two consecutive samples.

Monthly - Not less than once per calendar month with an interval of not less than 10 days between sample collections.

Quarterly - Not less than once per calendar quarter.

Semiannually - One sample each between calendar dates (January 1 - June 30) and (July 1 - December 31). An interval of not less than 30 days will be provided between sample collections.

The frequency of analyses is to be consistent with the sample collection frequency.

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2.2 (continued)

1. (continued)

A. (continued)

More or less percentage may be used for a release point, but the sum of the total percent allocated to the above Release Points shall never be allowed to exceed 100 percent. The ECCS Reactor Auxiliary Building Exhaust are not ODCM required monitored release points, but a small percentage should be allotted to each to cover short periodic fan surveillance runs. This allocation is controlled per Chemistry Procedure COP-07.05, Process Monitor Setpoints where Chemistry Supervisor approval is required. COP-07.05 provides calculation steps to calculate a Noble Gas Release Rate Setpoint based on the methodology steps described below. A release point's percent allotment will be converted into the release point's indicating engineering unit of uCi/cc that will be equivalent to the allocated portion of the site limit.

1. Obtain the release point's maximum expected process flow release rate (V) in Cubic Feet per Minute (cfm) from the Effluent Supervisor.

2. Obtain the release point's percent of site limit allotment (PA) from the Chemistry Supervisor.

3. Substitute the release point's V and PA values into the below equation(s) to obtain the Release Point's Setpoint (SP) in the desired engineering unit (uCi/cc or uCi/sec). (omit)

$$SP_{uCi/cc} = \frac{3.5E+05\ uCi}{sec} \times \frac{60\ sec}{min} \times \frac{min}{V\ ft3} \times \frac{ft3}{28317\ cc} \times \frac{PA}{100\%}$$

(add "3" to "ft3")

$SP_{uCi/cc}$ = _____ uCi/cc which is the TABLE 3.3-14 HIGH SETPOINT for ODCM Effluent Gas Channels that have a "Allotted % of Site Limit" declared as their HIGH SETPOINT.

$$SP_{uCi/sec} = \frac{3.5E+05\ uCi}{sec} \times \frac{PA}{100\%}$$

$SP_{uCi/sec}$ = _____ uCi/sec

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2.2 (continued)

1. (continued)

A. (continued)

Channel 624 uses the equivalent uCi/sec based on the uCi/cc at the maximum expected process flow rate.

Wide Range Channel 624 uCi/sec is equivalent to 2A PV PIG LOW RANGE GAS and 2B PIG LOW RANGE GAS ~~and 2PV-WRGM-LOW RANGE GAS~~ since they are monitoring the same release point (i.e., each of these channels does not receive their own allotted % of the Site Limit).

~~In the case of Unit 2 Plant Vent there are 3 ODCM Effluent Gas Channels Monitoring the Plant Vent. The HIGH SETPOINT in uCi/cc is the same for~~

4. The significance of an ODCM Effluent Gas Channel that has a "Allotted % of Site Limit" HIGH Setpoint requires further discussion (Mid and High Noble Gas Accident Channels are not part of this discussion):

   a. For Plant Vent Release Points on each reactor unit, the "Allotted % of Site Limit" needs to be high enough to allow for Batch Releases from Gas Decay Tank and Containment Venting Operations, and at the same time COP-01.06, Processing Gaseous Waste shall provide instruction for administratively controlling Batch Releases such that the radioactive concentration and release rate will not be allowed to exceed the site limit at any time.

   b. The receipt of a valid HIGH Alarm on a release point where the ODCM Low Range Gas Channel's radioactivity is approximately equal to the HIGH Alarm setpoint does not mean the site limit has been exceeded, rather it is at a concentration that is equivalent to the "Allotted % of Site Limit".

$$SP_{uCi/sec\ (equivalent)} = \frac{\text{setpoint in } uCi/cc}{uCi/cc} \times \frac{28317\ cc}{ft^3} \times \frac{V \text{ or } V_{max} \text{ vent flow } ft^3/minute}{V_{max}\ ft^3/minute} \times \frac{minute}{60\ second}$$

$SP_{(uCi/sec)}$ = ____ $\frac{uCi}{sec}$ equivalent to a Channel indicating a uCi/cc concentration assuming a volume release rate of V or V_{max}.

$$SP_{(\%\ of\ Site\ Limit)} = \frac{\quad}{(above)}\ \frac{uCi}{sec} \times \frac{100}{350{,}000\ uCi/sec} = \quad\%\ \text{of Site Limit}$$

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2.2 (continued)

1. (continued)

A. (continued)

4. (continued)

c. The receipt of a valid HIGH Alarm on a release point where the ODCM Low Range Gas Channel's radioactivity is greater than the HIGH Alarm setpoint may quickly be estimated based on:

$F_{SL} = RP_{SL}$ + (Sum of all other Release Point's RP_{SL} on site)

RP_{SL} = Rel Pt's Channel's uCi/cc x Rel Pt's Release Rate (V) x volume conv. const. x time conv. const. x 1/(site limit)

$$RP_{SL} = \frac{uCi}{cc} \times \frac{V\ ft^3}{min} \times \frac{28317\ cc}{ft_3} \times \frac{min}{60\ sec} \times \frac{sec}{3.5E{+}05\ uCi}$$

Where:
F_{SL} = Fraction of the Site Limit
RP_{SL} = Fraction of a Release Point's contribution to the site limit (Sum of all other Release Point's RP_{SL} on site) is normally less than 0.10 under normal operating conditions.
V = in ft^3/min, the Release Point's actual process Volume flow release rate

A value of RP_{SL} >1.0 or a F_{SL} >1.0 would be exceeding the Site Limit Based on the above estimate. Off Normal Procedure allow 1 hour to obtain a grab sample of the Release Point so that the actual site limit situation may be evaluated. This method is discussed in the following step.

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4.0 (continued)

4. (continued)

TABLE 3.1
RADIOACTIVE LIQUID EFFLUENT SAMPLING AND ANALYSIS

LIQUID SOURCE	SAMPLING FREQUENCY	TYPE OF ANALYSIS	METHOD OF ANALYSIS
MONITOR TANK RELEASES	EACH BATCH	PRINCIPAL GAMMA EMITTERS	p.h.a.
	MONTHLY COMPOSITE	TRITIUM	L.S.
		GROSS ALPHA	~~G.F.P.~~ A.I.C.
	QUARTERLY COMPOSITE	Sr-89, Sr-90, Fe-55	C.S.
STEAM GENERATOR BLOWDOWN RELEASES	FOUR PER MONTH	PRINCIPAL GAMMA EMITTERS AND DISSOLVED GASES	p.h.a.
	MONTHLY COMPOSITE	TRITIUM	L.S.
		GROSS ALPHA	~~G.F.P.~~ A.I.C.
	QUARTERLY COMPOSITE	Sr-89, Sr-90, Fe-55	C.S.

TABLE NOTATION:

p.h.a. - gamma spectrum pulse height analysis using Lithium Germanium detectors. All peaks are identified and quantified.

L.S. - Liquid Scintillation counting

C.S. - Chemical Separation

~~G.F.P. - Gas Flow Proportional Counting~~

A.I.C. - Air Ion Chamber

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METHODOLOGY SECTION

4.0 (continued)

4. (continued)

TABLE 3.2
RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS

GASEOUS SOURCE	SAMPLING FREQUENCY	TYPE OF ANALYSIS	METHOD OF ANALYSIS
Waste Gas Decay Tank Releases	Each Tank	Principal Gamma Emitters	G, p.h.a.
Containment Purge Releases	Each Purge	Principal Gamma Emitters	G, p.h.a.
		H-3	L.S.
Plant Vent	Four per Month	Principal Gamma Emitters	(G, C, P) - p.h.a.
		H-3	L.S.
	Monthly Composite (Particulates)	Gross Alpha	~~P - G.F.P.~~ P - A.I.C.
	Quarterly Composite (Particulates)	Sr-90 Sr-89	C.S.

G - Gaseous Grab Sample

C - Charcoal Filter Sample

P - Particulate Filter Sample

L.S. - Liquid Scintillation Counting

C.S. - Chemical Separation

p.h.a. - Gamma spectrum pulse height analysis using Lithium Germanium detectors. All peaks are identified and quantified.

~~G.F.P. - Gas Flow Proportional Counting~~
A.I.C. - Air Ion Chamber

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APPENDIX B
RADIOLOGICAL ENVIRONMENTAL SURVEILLANCE
(continued)
ST. LUCIE PLANT
Key to Sample Locations

PATHWAY	LOCATION	DESCRIPTION	SAMPLES COLLECTED	SAMPLE COLLECTION FREQUENCY	APPROXIMATE DISTANCE (miles)	DIRECTION SECTOR
Food Products	H52	Offsite near south property line	Broad leaf vegetation (mangrove)	Monthly (when available)	1	S/SSE
Food Products	*H59	Near south end of Hutchinson Island	Crustacea Fish Broad leaf vegetation (mangrove)	Semi-Annually Semi-Annually Monthly	10-20	S/SSE
Food Products	WSW 3.5	Goat Milk per land use census (2000) off east end of Tilton Road	Milk	Quarterly (when available)	3.5	WSW

/R23

*Denotes control sample

It is the policy of Florida Power & Light Company (FPL) that the St. Lucie 1 & 2 Radiological Environmental Monitoring Programs are conducted by the State of Florida Department of Health and Rehabilitative Services (DHRS), pursuant to an Agreement between FPL and ~~DHRS~~ and; that coordination of the Radiological Environmental Monitoring Programs with ~~DHRS~~ and compliance with the Radiological Environmental Monitoring Program Controls are the responsibility of the Nuclear ~~Energy~~ Services Department.

DOH (DOH) DOH Plant Support

NOTE 1

These samples may be collected from or supplemented by samples collected from the plant intake canal if the required analyses are unable to be performed due to unavailability or inadequate quantity of sample from the ocean side location.

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APPENDIX D
DESCRIPTION OF THE INTERLABORATORY COMPARISON PROGRAM (ICP)
(Page 1 of 2)

The State of Florida, Department of Health-Bureau of Radiation Control (BRC) Laboratory shall participate in an INTERLABORATORY COMPARISON PROGRAM.

1. The sample matrices and analytical methods shall be:

   A. Gamma isotopic on a filter sample simulating airborne radioiodine and particulate collection.

   B. Gamma isotopic on a water sample simulating a surface water grab sample.

   C. Gamma isotopic on either sediment (or soil) or broad leaf vegetation.

   NOTE
   Steps D, E and F reference NRC IR 99-04, PMAI 99-0716.

   D. Gross Beta on an Air Filter matrix.

   E. Tritium in water, using method employed in REMP.

   F. ~~Strontium-89 and Strontium-90 in water medium~~ Gamma isotopic on a water sample (above) is used for milk matrix if milk samples are being obtained per land use census identified milk animals within 5 miles of the plant site.

2. The source of samples for this program:

   A. A Federal Government Laboratory Program (e.g., DOE-LAP, EPA Safe Drinking Water Program)

   B. A State, Federal, or private (commercial) laboratory capable of providing NIST traceable samples. To be eligible, a Commercial Laboratory shall meet the FPL Quality Assurance criteria of "Quality Related".

   C. For Gamma Analysis only, a FPL Nuclear Site Laboratory may prepare sample matrices using known quantities of radioactivity from isotopes provided by a FPL Contract Laboratory currently approved as PC-1 Level vendor. These prepared matrices may be prepared by the vendor, or by FPL personnel, but shall not exceed the participant(s) form and/or license quantities for allowed radioactivity.

Justification for revision to the Off-Site Dose Calculation Manual to remove the requirement to suspend liquid releases after 14 days if the liquid radioactive waste monitor is out of service:

- The Unit 1 UFSAR states the purpose of the liquid radioactive waste monitor is to effectively act as a verification of the sample analysis; monitor set points are established based on the tank sample results. The Unit 2 design is similar. When the radiation monitor or its flow measuring device is out of service, at least two independent samples are analyzed in accordance with Table 4.11-1 of C-200, ODCM and at least two technically qualified members of the facility staff independently verify the release rate calculations and discharge line valve alignment. These additional measures provide assurance the sample is representative of the tank being discharged and the independent valve line-up verifies the correct release configuration is established. The above requirements are specified in the ODCM and are controlled by Chemistry Operating Procedure (COP)-01.05, "Processing Aerated Liquid Wastes" and Operations procedure 1-NOP-06.01, "Controlled Liquid Release to the Circulating Water Discharge".

- The radiological effluent technical specifications were initially implemented as technical specifications and were based on draft NUREG-0472 (March 1979), which included the 14-day requirement. This NUREG was later superceded by NUREG-1301 and Generic Letter 89-01. St. Lucie's radiological effluent technical specifications were subsequently removed from the technical specifications and relocated to the ODCM in accordance with NRC guidance. Reviews of these documents in addition to 10CFR50.36a failed to identify any requirement to suspend liquid releases after 14 days if the liquid radioactive waste monitor is out of service.

- The Turkey Point ODCM does not have a 14-day restriction for the liquid radioactive waste monitor being out of service. Turkey Point also has provisions for taking two independent samples and two independent valve line-ups if the monitor is out of service.

- Unit 1 UFSAR Sections 11.2 and 11.4 and Unit 2 UFSAR Sections 11.2 and 11.5 were reviewed. The UFSARs were not affected by this change.

- The requirement to provide two independent samples performed by two technically qualified members of the facility staff and an independent valve line-up provide reasonable assurance that the correct tank is being discharged and that the limits specified in the ODCM will not be exceeded if the monitor is out of service.

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TABLE 3.3-12 (Continued)

ACTION STATEMENTS

ACTION 35 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases may continue ~~for up to 14 days~~ provided that prior to initiating a release:

a. At least two independent samples are analyzed in accordance with the Surveillance Requirement for concentration limit of Control 4.11.1.1.1. and

b. At least two technically qualified members of the Facility Staff independently verify the release rate calculations and discharge line valving.

Otherwise, suspend release of radioactive effluents via this pathway.

ACTION 36 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided grab samples are analyzed for gross radioactivity (beta or gamma) at a limit of detection of at least 2.E-07 micro-Curie/ml:

a. At least once per 8 hours[1] when the specific activity of the secondary coolant is greater than 0.01 micro-Curies/gram DOSE EQUIVALENT I-131 or /R24

b. At least once per 24 hours[1] when the specific activity of the secondary coolant is less than or equal to 0.01 micro-Curies/gram DOSE EQUIVALENT I-131. /R24

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TABLE 3.3-13 (Continued)
TABLE NOTATIONS

* - At all times while making releases via this pathway
** - At all times when air ejector exhaust is not directed to plant vent.
Rx - Denotes reactor

ACTION STATEMENTS

ACTION 45 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, the contents of the tank(s) may be released to the environment ~~for up to 14 days~~ provided that prior to initiating a release:

a. At least two independent samples of the tank's contents are analyzed and

b. At least two technically qualified members of the facility staff independently verify the release rate calculations and discharge valve lineup.

Otherwise, suspend release of radioactive effluents via this pathway.

ACTION 46 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided the flow rate is estimated at least once per 4 hours.

ACTION 47 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE, effluent releases via this pathway may continue for up to 30 days provided:

a. If channel inoperability is due to loss of activity indication, Then grab samples are taken at least once per 8 hours[1] and these samples are analyzed for isotopic activity within 24 hours. /R24

OR

b. If channel inoperability is due to loss of Control Room alarm annunciation discovered during a channel functional test because of any one or more of the following reasons listed, Then channel checks are performed once per hour[1] to verify normal indication and current assigned setpoints are NOT exceeded. /R24

1. Failure to annunciate when testing alarm/trip setpoints.
2. Circuit failure.
3. Downscale failure.
4. Controls NOT set in OPERATE mode.