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FLORIDA POWER & LIGHT COMPANY

ST. LUCIE PLANT UNITS NO. 1 & 2

LICENSE NO. DPR-67 & NPF-16

COMBINED SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

FOR THE PERIOD

JULY 1, 1986 THROUGH DECEMBER 31, 1986

50-335
50-389

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TABLE OF CONTENTS

EFFLUENT AND WASTE DISPOSAL SUPPLEMENTAL INFORMATION

1. Regulatory Limits

1.1 For Liquid Waste Effluents

A. The concentration of radioactive material released from the site shall be limited to the concentrations specified in 10 CFR Part 20 Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2E-4 micro-Curies/ml total activity.

B. The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive material in liquid effluents released, from each reactor unit, to UNRESTRICTED AREAS shall be limited to:

During any calendar quarter to <= 1.5 mrems to the Total Body and to <= 5 mrems to any organ, and

During any calendar year to <= 3 mrems to the Total Body and to <= 10 mrems to any organ.

1.2 For Gaseous Waste Effluents:

A. The dose rate in UNRESTRICTED AREAS due to radioactive materials released in gaseous effluents from the site shall be limited to:

For Noble Gases: <= 500 mrems/yr to the total body and
<= 3000 mrems/yr to the skin, and

For Iodine-131, Iodine-133, Tritium, and all radionuclides in particulate form with half-lives greater than 8 days:

<= 1500 mrems/yr to any organ.

*B. The air dose 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 Iodine-131, Iodine-133, Tritium, and all radionuclides in particulate form, with half-lives > 8 Days in gaseous effluents released, from each reactor unit to areas at and beyond the site boundary, 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.

* The calculated doses contained in a semi-annual report shall not apply to any STS LCO. The reported values are based on actual release conditions instead of historical conditions that the STS LCO dose calcuations are based on. The STS LCO dose limits are therefore included in Item 1 of the report, for information only.

EFFLUENT AND WASTE DISPOSAL SUPPLEMENTAL INFORMATION
(Continued)

2. Maximum Permissible Concentrations

Water: As per 10 CFR Part 20, Appendix B, Table II, Column 2, except for entrained or dissolved noble gases as described in 1.1.A of this report.

Air: Release concentrations are limited to dose rate limits described in 1.2.A. of this report.

3. Average Energy of fission and activation gases in gaseous effluents is not applicable.

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.

4.1 Estimate of Errors

A. Sampling Error

The error associated with volume measurement devices, flow measuring devices, etc. based on calibration data and design tolerances has been conservatively estimated collectively to be less than plus or minus 10 percent.

B. Analytical error for nuclides

Type	Average	Maximum
Liquid	+ or - 9%	+ or - 30%
Gaseous	+ or - 10%	+ or - 35%

EFFLUENT AND WASTE DISPOSAL SUPPLEMENTAL INFORMATION
(Continued)

4. Measurements and Approximations of Total Radioactivity (Cont.)
4.1 (Continued)
B. (Continued)

TABLE 3.1

RADIOACTIVE LIQUID EFFLUENT SAMPLING AND ANALYSIS

Liquid Source	Sampling Frequency	Type of Analysis	Method of Analysis
Monitor Tank Releases[1]	Each Batch	Principal Gamma Emitters	p.h.a.
	Monthly Composite	Tritium Gross Alpha	L.S. G.F.P.
	Quarterly Composite	Sr-89, Sr-90, & Fe-55	C.S.
Continuous Releases	Daily Grab Samples	Principal Gamma Emitters & I-131 for 4/M Composite Analysis	p.h.a.
		Dissolved & Entrained Gases One Batch/ Month	p.h.a.
		Tritium Composite Monthly	L.S.
		Alpha Composite Monthly	G.F.P.
		Sr-89, Sr-90, & Fe-55 Composite Quarterly	C.S.

1-Boric Acid Evaporator Condensate is normally recovered to the Primary Water Storage Tank for recycling into the reactor coolant system and does not contribute to Liquid Waste Effluent Totals.
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
4/M-Four per Month

4. Measurements and Approximations of Total Radioactivity (Continued)
4.1 (Continued)
B. (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 Batch	Principal Gamma Emitters	p.h.a.
Containment Purge Releases	Each Purge	Principal Gamma Emitters Tritium	p.h.a. L.S.
Plant Vent	4/M	Principal Gamma Emitters Tritium	p.h.a. L.S.
	Monthly Composite	Particulate Gross Alpha	G.F.P.
	Quarterly Composite	Particulate Sr-89 & Sr-90	C.S.

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
4/M-Four per Month

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EFFLUENT AND WASTE DISPOSAL - SUPPLEMENTAL INFORMATION (CONTINUED)

5. BATCH RELEASES AND UNPLANNED RELEASES

LIQUIDS FOR : ST. LUCIE PLANT UNIT NO. 1

A. NUMBER OF BATCH RELEASES:	22.Ø	
B. TOTAL TIME PERIOD OF BATCH RELEASES:	127ØØ.	MINUTES
C. MAXIMUM TIME PERIOD FOR A BATCH RELEASE:	715.	MINUTES
D. AVERAGE TIME PERIOD FOR A BATCH RELEASE:	577.	MINUTES
E. MINIMUM TIME PERIOD FOR A BATCH RELEASE:	439.	MINUTES
F. AVERAGE STREAM FLOW DURING REPORTING PERIOD INTO A FLOWING STREAM:	1Ø19733.	G.P.M.

6. GASEOUS FOR : ST. LUCIE PLANT UNIT NO. 1

A. NUMBER OF BATCH RELEASES:	1.Ø	
B. TOTAL TIME PERIOD OF BATCH RELEASES:	6Ø8.	MINUTES
C. MAXIMUM TIME PERIOD FOR A BATCH RELEASE:	6Ø8.	MINUTES
D. AVERAGE TIME PERIOD FOR A BATCH RELEASE:	6Ø8.	MINUTES
E. MINIMUM TIME PERIOD FOR A BATCH RELEASE:	6Ø8.	MINUTES

UNPLANNED RELEASES

LIQUIDS FOR : ST. LUCIE PLANT UNIT NO. 1

A. NUMBER OF RELEASES:	Ø.	
B. TOTAL ACTIVITY RELEASED:	Ø.	CURIES

6. GASEOUS FOR : ST. LUCIE PLANT UNIT NO. 1

A. NUMBER OF RELEASES:	Ø.	
B. TOTAL ACTIVITY RELEASED:	Ø.	CURIES

SEE ATTACHMENTS (IF APPLICABLE) FOR:

A. A DESCRIPTION OF THE EVENT AND EQUIPMENT INVOLVED.
B. CAUSE(S) FOR THE UNPLANNED RELEASE.
C. ACTIONS TAKEN TO PREVENT A RECURRENCE.
D. CONSEQUENCES OF THE UNPLANNED RELEASE.

EFFLUENT AND WASTE DISPOSAL - SUPPLEMENTAL INFORMATION (CONTINUED)

5. BATCH RELEASES AND UNPLANNED RELEASES

LIQUIDS FOR : ST. LUCIE PLANT UNIT NO. 2

A. NUMBER OF BATCH RELEASES:	22.Ø	
B. TOTAL TIME PERIOD OF BATCH RELEASES:	127ØØ.	MINUTES
C. MAXIMUM TIME PERIOD FOR A BATCH RELEASE:	715.	MINUTES
D. AVERAGE TIME PERIOD FOR A BATCH RELEASE:	577.	MINUTES
E. MINIMUM TIME PERIOD FOR A BATCH RELEASE:	439.	MINUTES
F. AVERAGE STREAM FLOW DURING REPORTING PERIOD INTO A FLOWING STREAM:	1Ø19733.	G.P.M.

6. GASEOUS FOR : ST. LUCIE PLANT UNIT NO. 2

A. NUMBER OF BATCH RELEASES:	38.Ø	
B. TOTAL TIME PERIOD OF BATCH RELEASES:	2429.	MINUTES
C. MAXIMUM TIME PERIOD FOR A BATCH RELEASE:	22Ø.	MINUTES
D. AVERAGE TIME PERIOD FOR A BATCH RELEASE:	64.	MINUTES
E. MINIMUM TIME PERIOD FOR A BATCH RELEASE:	21.	MINUTES

UNPLANNED RELEASES

LIQUIDS FOR : ST. LUCIE PLANT UNIT NO. 2

A. NUMBER OF RELEASES:	Ø.	
B. TOTAL ACTIVITY RELEASED:	Ø.	CURIES

6. GASEOUS FOR : ST. LUCIE PLANT UNIT NO. 2

A. NUMBER OF RELEASES:	Ø.	
B. TOTAL ACTIVITY RELEASED:	Ø.	CURIES

SEE ATTACHMENTS (IF APPLICABLE) FOR:

A. A DESCRIPTION OF THE EVENT AND EQUIPMENT INVOLVED.
B. CAUSE(S) FOR THE UNPLANNED RELEASE.
C. ACTIONS TAKEN TO PREVENT A RECURRENCE.
D. CONSEQUENCES OF THE UNPLANNED RELEASE.

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EFFLUENT AND WASTE DISPOSAL - SUPPLEMENTAL INFORMATION

(Continued)

7. Assessment of radiation dose from radioactive effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY assume the visitor onsite for 40 hours, at an average distance of 0.3 Kilometers in the worst dispersion direction, and received exposure from each of the two reactor units on the St. Lucie Site.

VISITOR DOSE RESULTS FOR CALENDAR YEAR 1986 WERE:

GASEOUS PARTICULATES & IODINE EXPOSURE

ORGAN	DOSE (mrem)
Bone	7.80 E-05
Liver	2.43 E-04
Thyroid	2.92 E-02
Kidney	8.90 E-05
Lung	1.43 E-04
GI-LLI	1.50 E-04
Total Body	2.90 E-04

NOBLE GAS EXPOSURE

Gamma Air Dose	1.20 E-01 mrad
Beta Air Dose	2.29 E-01 mrad

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EFFLUENT AND WASTE DISPOSAL - SUPPLEMENTAL INFORMATION (Continued)

8. Offsite Dose Calculation Manual Revisions:

The affected pages for Revsion 07 to C-200 (ODCM) are included as Attachment-A to this report. The reasons for the changes are as follows:

1) Generic changes of an administrative nature:

$(\bar{D}/Q)$, $(\bar{X}/Q)$, $(\bar{X}/Q)_D$, $\dot{Q}$, Δt etc. were changed to read:

D/Q, X/Q X/Q_D, QDOT, and dt to reduce entry of typographical and double usage of these symbols through various word processor limitations and to eliminate the need for hand entered symbols. These changes should improve the Quality Control of the ODCM in this area.

2) Where references were made to the Technical Specifications and Limits, the ODCM was updated to the wording of the current Technical Specifications. Several typos concerning limits were corrected. These errors had been introduced by Rev 06 on a word processor where the proof reader missed the typos.

3) The only methodology change of Rev. 07 concerns Section 1.4 and Appendix -B. A limited analysis dose method may be used based on seven nuclides etc. Based on early 1986 effluent results, Iron-55 dose contribution indicated that a conservatism factor of 0.8 would not be sufficient to cover possible dose contribution from Iron-55. Since the original ODCM Appendix-B was not evaluated for Iron-55, and that Iron-55 results from Quarterly Composite Samples are not immediately availabe, twenty percent is now allocated to Iron-55 alone. This lowers the 0.8 factor of Section 1.4 to 0.6, which should provide more conservatism in estimating dose by the method precribed by this Section.

9. Solid Waste and Irradiated Fuel Shipments:

No irradiated fuel shipments were made from the site. Common Solid waste from ST. Lucie Units 1 and 2 were shipped jointly. A summation of these shipments is given in Table 3.9 of this report.

10. Process Control Program Revisions:

No revisions were made during the reporting period.

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TABLE 3.3-1
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

NUCLIDES RELEASED	UNIT	QUARTER #3	QUARTER #4
A. FISSION AND ACTIVATION PRODUCTS			
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CI	4.88E-Ø1	1.26E-Ø1
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	UCI/ML	9.64E-1Ø	2.46E-1Ø
B. TRITIUM			
1. TOTAL RELEASE	CI	6.93E Ø1	7.54E Ø1
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	UCI/ML	1.37E-Ø7	1.48E-Ø7
C. DISSOLVED AND ENTRAINED GASES			
1. TOTAL RELEASE	CI	2.6ØE-Ø1	1.54E-Ø1
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	UCI/ML	5.15E-1Ø	3.Ø2E-1Ø
D. GROSS ALPHA RADIOACTIVITY			
1. TOTAL RELEASE	CI	6.ØØE-Ø5	Ø.ØØE-Ø1
E. VOLUME OF WASTE RELEASED (PRIOR TO DILUTION)	LITERS	4.Ø8E Ø7	4.43E Ø7
F. VOLUME OF DILUTION WATER USED DURING REPORTING PERIOD	LITERS	5.Ø6E 11	5.11E 11

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TABLE 3.4-1

LIQUID EFFLUENTS

NUCLIDES RELEASED	UNIT	CONTINUOUS MODE QTR.#3	CONTINUOUS MODE QTR.#4	BATCH MODE QTR.#3	BATCH MODE QTR.#4
I-131	CI	1.60E-02	0.00E-01	3.03E-02	2.65E-02
I-133	CI	7.74E-03	0.00E-01	1.17E-03	7.26E-04
NA-24	CI	0.00E-01	0.00E-01	3.32E-04	0.00E-01
CR-51	CI	0.00E-01	0.00E-01	2.44E-03	1.31E-04
MN-54	CI	0.00E-01	0.00E-01	3.10E-04	6.54E-04
FE-55	CI	0.00E-01	0.00E-01	8.85E-03	4.37E-03
CO-57	CI	0.00E-01	0.00E-01	2.49E-04	0.00E-01
CO-58	CI	0.00E-01	0.00E-01	1.98E-01	5.73E-03
CO-60	CI	0.00E-01	0.00E-01	2.47E-02	2.06E-02
AG-110	CI	0.00E-01	0.00E-01	1.03E-04	2.45E-05
SB-122	CI	0.00E-01	0.00E-01	3.31E-04	0.00E-01
SB-124	CI	0.00E-01	0.00E-01	2.04E-02	7.79E-04
RB-88	CI	0.00E-01	0.00E-01	0.00E-01	1.39E-03
SR-89	CI	0.00E-01	4.21E-03	0.00E-01	2.21E-04
SR-90	CI	0.00E-01	0.00E-01	0.00E-01	2.30E-05
ZR-95	CI	0.00E-01	0.00E-01	2.38E-04	6.39E-05
NB-95	CI	0.00E-01	0.00E-01	7.08E-04	5.03E-04
NB-97	CI	0.00E-01	0.00E-01	2.64E-05	1.53E-05
TC-99M	CI	0.00E-01	0.00E-01	6.60E-05	0.00E-01
SB-125	CI	0.00E-01	0.00E-01	7.08E-02	8.23E-03
CS-134	CI	1.66E-03	0.00E-01	3.65E-02	1.71E-02
CS-136	CI	0.00E-01	0.00E-01	3.93E-05	6.11E-05
CS-137	CI	2.89E-03	0.00E-01	6.32E-02	3.37E-02
CS-138	CI	0.00E-01	0.00E-01	2.96E-04	3.24E-04
LA-140	CI	0.00E-01	0.00E-01	6.07E-04	3.32E-04
TOTAL FOR PERIOD	CI	2.83E-02	4.21E-03	4.60E-01	1.22E-01
KR-85M	CI	0.00E-01	0.00E-01	0.00E-01	2.42E-07
XE-131M	CI	0.00E-01	0.00E-01	8.99E-04	0.00E-01
XE-133	CI	0.00E-01	0.00E-01	2.50E-01	1.51E-01
XE-133M	CI	0.00E-01	0.00E-01	2.26E-03	8.20E-04
XE-135	CI	0.00E-01	0.00E-01	7.25E-03	2.83E-03
TOTAL FOR PERIOD	CI	0.00E-01	0.00E-01	2.60E-01	1.54E-01

FLORIDA POWER & LIGHT COMPANY

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TABLE 3.5-1

LIQUID EFFLUENTS - DOSE SUMMATION

Age Group: ADULT Location: Any ADULT

Exposure Interval: January 1, 1986 through December 31, 1986

FISH & SHELLFISH ORGAN	Calendar Year Dose (mrem)
Bone	4.66 E-Ø1
Liver	2.Ø6 E ØØ
Thyroid	1.56 E-Ø1
Kidney	8.94 E-Ø3
Lung	2.37 E ØØ
GI-LLI	1.13 E ØØ
Total Body	5.56 E-Ø1

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT NO. 2

SEMIANNUAL REPORT
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TABLE 3.3-2
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

NUCLIDES RELEASED	UNIT	QUARTER #3	QUARTER #4
A. FISSION AND ACTIVATION PRODUCTS			
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CI	4.60E-01	1.22E-01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	UCI/ML	9.08E-10	2.38E-10
B. TRITIUM			
1. TOTAL RELEASE	CI	6.92E 01	7.54E 01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	UCI/ML	1.37E-07	1.48E-07
C. DISSOLVED AND ENTRAINED GASES			
1. TOTAL RELEASE	CI	2.60E-01	1.54E-01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	UCI/ML	5.15E-10	3.02E-10
D. GROSS ALPHA RADIOACTIVITY			
1. TOTAL RELEASE	CI	6.00E-05	0.00E-01
E. VOLUME OF WASTE RELEASED (PRIOR TO DILUTION)	LITERS	1.55E 06	1.22E 06
F. VOLUME OF DILUTION WATER USED DURING REPORTING PERIOD	LITERS	5.06E 11	5.11E 11

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT NO. 2

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TABLE 3.4-2

LIQUID EFFLUENTS

NUCLIDES RELEASED	UNIT	CONTINUOUS MODE QTR.#3	CONTINUOUS MODE QTR.#4	BATCH MODE QTR.#3	BATCH MODE QTR.#4
I-131	CI	0.00E-01	0.00E-01	3.03E-02	2.65E-02
I-133	CI	0.00E-01	0.00E-01	1.17E-03	7.26E-04
NA-24	CI	0.00E-01	0.00E-01	3.32E-04	0.00E-01
CR-51	CI	0.00E-01	0.00E-01	2.44E-03	1.31E-04
MN-54	CI	0.00E-01	0.00E-01	3.10E-04	6.54E-04
FE-55	CI	0.00E-01	0.00E-01	8.85E-03	4.37E-03
CO-57	CI	0.00E-01	0.00E-01	2.49E-04	0.00E-01
CO-58	CI	0.00E-01	0.00E-01	1.98E-01	5.73E-03
CO-60	CI	0.00E-01	0.00E-01	2.47E-02	2.06E-02
AG-110	CI	0.00E-01	0.00E-01	1.03E-04	2.45E-05
SB-122	CI	0.00E-01	0.00E-01	3.31E-04	0.00E-01
SB-124	CI	0.00E-01	0.00E-01	2.04E-02	7.79E-04
RB-88	CI	0.00E-01	0.00E-01	0.00E-01	1.39E-03
SR-89	CI	0.00E-01	0.00E-01	0.00E-01	2.21E-04
SR-90	CI	0.00E-01	0.00E-01	0.00E-01	2.30E-05
ZR-95	CI	0.00E-01	0.00E-01	2.38E-04	6.39E-05
NB-95	CI	0.00E-01	0.00E-01	7.08E-04	5.03E-04
NB-97	CI	0.00E-01	0.00E-01	2.64E-05	1.53E-05
TC-99M	CI	0.00E-01	0.00E-01	6.60E-05	0.00E-01
SB-125	CI	0.00E-01	0.00E-01	7.08E-02	8.23E-03
CS-134	CI	0.00E-01	0.00E-01	3.65E-02	1.71E-02
CS-136	CI	0.00E-01	0.00E-01	3.93E-05	6.11E-05
CS-137	CI	0.00E-01	0.00E-01	6.32E-02	3.37E-02
CS-138	CI	0.00E-01	0.00E-01	2.96E-04	3.24E-04
LA-140	CI	0.00E-01	0.00E-01	6.07E-04	3.32E-04
TOTAL FOR PERIOD	CI	0.00E-01	0.00E-01	4.60E-01	1.22E-01
XE-131M	CI	0.00E-01	0.00E-01	8.99E-04	0.00E-01
XE-133	CI	0.00E-01	0.00E-01	2.50E-01	1.51E-01
XE-133M	CI	0.00E-01	0.00E-01	2.26E-03	8.20E-04
XE-135	CI	0.00E-01	0.00E-01	7.25E-03	2.83E-03
TOTAL FOR PERIOD	CI	0.00E-01	0.00E-01	2.60E-01	1.54E-01

FLORIDA POWER & LIGHT COMPANY

ST. LUCIE UNIT NO. 2

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TABLE 3.5-2

LIQUID EFFLUENTS - DOSE SUMMATION

Age Group: ADULT Location: Any ADULT

Exposure Interval: January 1, 1986 through December 31, 1986

FISH & SHELLFISH ORGAN	Calendar Year Dose (mrem)
Bone	4.64 E-Ø1
Liver	2.Ø6 E ØØ
Thyroid	1.31 E-Ø1
Kidney	8.Ø3 E-Ø3
Lung	2.37 E ØØ
GI-LLI	1.13 E ØØ
Total Body	5.54 E-Ø1

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TABLE 3.6-1

GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

NUCLIDES RELEASED	UNIT	QUARTER #3	QUARTER #4
A. FISSION AND ACTIVATION GASES			
1. TOTAL RELEASE	CI	8.87E Ø3	5.35E Ø3
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	1.12E Ø3	6.73E Ø2
B. IODINES			
1. TOTAL IODINE-131	CI	2.76E-Ø2	1.95E-Ø2
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	3.47E-Ø3	2.46E-Ø3
C. PARTICULATES			
1. PARTICULATES T-1/2 > 8 DAYS	CI	2.Ø4E-Ø5	1.13E-Ø5
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	2.57E-Ø6	1.43E-Ø6
3. GROSS ALPHA RADIOACTIVITY	CI	1.5ØE-Ø7	1.75E-Ø8
D. TRITIUM			
1. TOTAL RELEASE	CI	6.45E ØØ	4.2ØE ØØ
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	8.11E-Ø1	5.28E-Ø1

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT NO. 1

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TABLE 3.7-1

GASEOUS EFFLUENTS - GROUND LEVEL RELEASES

NUCLIDES RELEASED	UNIT	CONTINUOUS MODE QTR.#3	CONTINUOUS MODE QTR.#4	BATCH MODE QTR.#3	BATCH MODE QTR.#4
1. NOBLE GASES					
AR-41	CI	Ø.ØØE-Ø1	Ø.ØØE-Ø1	2.94E-Ø2	Ø.ØØE-Ø1
KR-85M	CI	6.32E Ø1	8.Ø5E Ø1	2.37E-Ø2	Ø.ØØE-Ø1
KR-87	CI	1.51E ØØ	5.6ØE ØØ	Ø.ØØE-Ø1	Ø.ØØE-Ø1
KR-88	CI	4.55E Ø1	6.73E Ø1	Ø.ØØE-Ø1	Ø.ØØE-Ø1
XE-131M	CI	Ø.ØØE-Ø1	Ø.ØØE-Ø1	7.36E-Ø1	Ø.ØØE-Ø1
XE-133	CI	7.97E Ø3	4.42E Ø3	7.28E Ø1	Ø.ØØE-Ø1
XE-133M	CI	8.Ø8E Ø1	6.8ØE Ø1	7.5ØE-Ø1	Ø.ØØE-Ø1
XE-135	CI	6.39E Ø2	7.11E Ø2	1.ØØE ØØ	Ø.ØØE-Ø1
XE-135M	CI	Ø.ØØE-Ø1	2.Ø3E ØØ	Ø.ØØE-Ø1	Ø.ØØE-Ø1
TOTAL FOR PERIOD	CI	8.8ØE Ø3	5.35E Ø3	7.53E Ø1	Ø.ØØE-Ø1
2. IODINE					
I-131	CI	2.76E-Ø2	1.95E-Ø2		
I-132	CI	6.57E-Ø3	4.29E-Ø2		
I-133	CI	3.91E-Ø2	4.19E-Ø2		
I-135	CI	1.Ø7E-Ø2	3.56E-Ø2		
TOTAL FOR PERIOD	CI	8.39E-Ø2	1.4ØE-Ø1		
3. PARTICULATE					
CO-6Ø	CI	6.2ØE-Ø6	Ø.ØØE-Ø1		
RB-88	CI	1.17E ØØ	9.29E-Ø1		
SR-9Ø	CI	Ø.ØØE-Ø1	1.17E-Ø6		
TC-99M	CI	1.41E-Ø4	Ø.ØØE-Ø1		
CS-137	CI	1.42E-Ø5	1.Ø2E-Ø5		
TOTAL FOR PERIOD	CI	1.17E ØØ	9.29E-Ø1		

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT # 1

TABLE 3.8-1

GASEOUS EFFLUENTS - DOSE SUMMATION - QUARTER # N.A.
Age Group: INFANT   Exposure Interval: January 1, 1986 through December 31, 1986

NOTE: The below dose results were calculated using actual meterological data during the specified time interval with Met data reduced as per Reg. Guide 1.111, March 1976

PATHWAY	BONE mrem	LIVER mrem	THYROID mrem	KIDNEY mrem	LUNG mrem	GI-LLI mrem	T. BODY mrem
Ground Plane (A)	0.00 E-01	0.00 E-01	0.00 E-01	0.00 E-01	0.00 E-01	0.00 E-01	2.19 E-04
Grass-Cow-Milk(B)	1.49 E-02	1.82 E-02	5.70 E 00	4.59 E-03	2.85 E-04	1.03 E-03	1.06 E-02
Inhalation (A)	2.05 E-04	4.79 E-04	7.63 E-02	1.64 E-04	2.14 E-04	2.34 E-04	3.34 E-04
TOTAL	1.51 E-02	1.87 E-02	5.78 E 00	4.76 E-03	4.99 E-04	1.27 E-03	1.11 E-02

(A)-Sector : SOUTH   Range: 3.25 miles
(B)-Sector : WEST   Range: 4.25 miles (Default Animal)

NOBLE GASES	CALENDAR YEAR (mrad)
Gamma Air Dose	2.91 E-01
Beta Air Dose	6.07 E-01
Sector : SOUTH	Range: 3.25 miles

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT NO. 2

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TABLE 3.6-2

GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

NUCLIDES RELEASED	UNIT	QUARTER #3	QUARTER #4
A. FISSION AND ACTIVATION GASES			
1. TOTAL RELEASE	CI	2.52E 03	2.41E 03
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	3.18E 02	3.03E 02
B. IODINES			
1. TOTAL IODINE-131	CI	1.36E-02	1.02E-02
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	1.71E-03	1.28E-03
C. PARTICULATES			
1. PARTICULATES T-1/2 > 8 DAYS	CI	1.26E-05	2.04E-06
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	1.58E-06	2.57E-07
3. GROSS ALPHA RADIOACTIVITY	CI	3.97E-08	4.10E-08
D. TRITIUM			
1. TOTAL RELEASE	CI	1.28E 01	1.69E 01
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	1.61E 00	2.13E 00

FLORI · POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT NO. 2

SEMIANNUAL REPORT
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TABLE 3.7-2

GASEOUS EFFLUENTS - GROUND LEVEL RELEASES

NUCLIDES RELEASED	UNIT	CONTINUOUS MODE QTR.#3	CONTINUOUS MODE QTR.#4	BATCH MODE QTR.#3	BATCH MODE QTR.#4
1. NOBLE GASES					
AR-41	CI	Ø.ØØE-Ø1	Ø.ØØE-Ø1	8.46E-Ø1	3.65E-Ø1
KR-85	CI	Ø.ØØE-Ø1	Ø.ØØE-Ø1	1.19E-Ø2	Ø.ØØE-Ø1
KR-85M	CI	1.62E Ø1	2.18E Ø1	1.29E-Ø2	8.88E-Ø3
KR-88	CI	1.Ø4E Ø1	1.97E Ø1	3.98E-Ø4	2.72E-Ø3
XE-131M	CI	Ø.ØØE-Ø1	Ø.ØØE-Ø1	4.26E-Ø1	2.3ØE-Ø1
XE-133	CI	2.18E Ø3	2.Ø5E Ø3	3.2ØE Ø1	1.55E Ø1
XE-133M	CI	1.11E Ø1	1.88E Ø1	2.84E-Ø1	1.56E-Ø1
XE-135	CI	2.74E Ø2	2.79E Ø2	2.86E-Ø1	1.71E-Ø1
TOTAL FOR PERIOD	CI	2.49E Ø3	2.39E Ø3	3.39E Ø1	1.64E Ø1
2. IODINE					
I-131	CI	1.36E-Ø2	1.Ø2E-Ø2		
I-132	CI	1.34E-Ø3	3.96E-Ø4		
I-133	CI	1.25E-Ø2	8.89E-Ø3		
TOTAL FOR PERIOD	CI	2.74E-Ø2	1.95E-Ø2		
3. PARTICULATE					
RB-88	CI	Ø.ØØE-Ø1	1.77E ØØ		
CS-137	CI	1.26E-Ø5	2.Ø4E-Ø6		
CS-138	CI	2.68E-Ø2	Ø.ØØE-Ø1		
TOTAL FOR PERIOD	CI	2.68E-Ø2	1.77E ØØ		

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT # 2

TABLE 3.8-2

GASEOUS EFFLUENTS - DOSE SUMMATION - QUARTER # N.A.
Age Group: INFANT Exposure Interval: January 1, 1986 through December 31, 1986

NOTE: The below dose results were calculated using actual meterological data during the specified time interval with Met data reduced as per Reg. Guide 1.111, March 1976

PATHWAY	BONE mrem	LIVER mrem	THYROID mrem	KIDNEY mrem	LUNG mrem	GI-LLI mrem	T. BODY mrem
Ground Plane (A)	0.00 E-01	0.00 E-01	0.00 E-01	0.00 E-01	0.00 E-01	0.00 E-01	3.85 E-05
Grass-Cow-Milk(B)	2.33 E-03	3.07 E-03	8.77 E-01	8.09 E-04	2.83 E-04	3.88 E-04	1.87 E-03
Inhalation (A)	2.69 E-05	2.45 E-04	1.02 E-02	1.00 E-04	2.12 E-04	2.13 E-04	2.27 E-04
TOTAL	2.36 E-03	3.31 E-03	8.87 E-01	9.10 E-04	4.95 E-04	6.01 E-04	2.13 E-03

(A)-Sector : SOUTH Range: 3.25 miles
(B)-Sector : WEST Range: 4.25 miles (Default Animal)

NOBLE GASES	CALENDAR YEAR (mrad)
Gamma Air Dose	1.37 E-01
Beta Air Dose	2.06 E-01
Sector : SOUTH	Range: 3.25 miles

FLORIDA POWER & LIGHT COMPANY
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UNITS 1 AND 2, TABLE 3.9

SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

A. Solid Waste Shipped Off-site for Burial or Disposal

1. TYPE OF WASTE

TYPE OF WASTE	UNIT	6 MONTH PERIOD	ERROR %
a. Spent Resins, Process Filters	M^3	5.10E+1	2.0E+1
	Ci	1.40E+2	
b. Dry Compressible Waste	M^3	1.62E+2	2.0E+1
	Ci	6.92E+0	
c. Irradiated Components	M^3	0.00	N/A
	Ci	0.00	
d. Other			
1. Solidified STP* Sludge	M^3	1.17E+1	2.0E+1
	CI	1.70E-2	

2. Estimate of Major Nuclide Composition (by type of waste)

a.	60 Co	%	25.2
	58 Co	%	22.3
	137 Cs	%	22.0
	134 Cs	%	10.5
	55 Fe	%	7.3
	63 Ni	%	2.9
	54 Mn	%	2.2
	95 Nb	%	2.0
	3 H	%	2.0
	51 Cr	%	1.3
	95 Zr	%	1.0
b.	137 Cs	%	26.4
	60 Co	%	18.3
	134 Cs	%	14.4
	55 Fe	%	13.9
	14 C	%	9.7
	58 Co	%	8.0
	54 Mn	%	2.1
	63 Ni	%	2.0
	3 H	%	1.8
	125 Sb	%	0.9
	144 Ce	%	0.8
	131 I	%	0.8

*STP - Sewage Treatment Plant

c. -----	-	----	N/A
d. 60 Co	%	93.0	
137 Cs	%	4.0	

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
14	Sole Use Truck	Barnwell, S.C.

B. Irradiated Fuel Shipments

Number of Shipment	Mode of Transportation	Destination
0	N/A	N/A

N/A - Not Applicable

Waste Classification	Total Volume	Total Curies Note 1	Principal Radionuclide Notes 1 & 2	Type of Waste Note 3	Category R.G. 1.21	Type of Container Note 4	Solidification Agent
Class A	$5520 ft^3$	0.96	N/A	PWR Trash	1.b.	Non-specification strong tight package	None
Class A	$412 ft^3$	0.017	N/A	STP* Sludge	1.d.	Non-specification strong tight package	Cement
Class A	$909 ft^3$	2.03	Cs^{137}	PWR Ion - Exchange Resin	1.a.	Non-specification strong tight package	None
Class A	$193 ft^3$	5.96	Cs^{137}, C^{14}, Sr^{90}, Ni^{63}	PWR Trash	1.b.	NRC Certified LSA >Type A	None
Class A	$386 ft^3$	22.48	Cs^{137}, Co^{60}, Sr^{90}, Ni^{63}	PWR Ion - Exchange Resin	1.a.	NRC Certified LSA >Type A	None
Class B	$386 ft^3$	51.07	Co^{60}, Cs^{137}, Sr^{90}, Ni^{63}	PWR Ion - Exchange Resin	1.a.	NRC Certified LSA >Type A	None
Class C	$119 ft^3$	63.7	Co^{60}, Cs^{137}, Sr^{90} Ni^{63}, Pu^{241}	PWR Process Filters	1.a.	NRC Certified Type B .	None

*Sewage Treatment Plant

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UNITS 1 AND 2 TABLE 3.9 (CONT.)
SOLID WASTE SUPPLEMENT

NOTE 1: The total curie quantity and radionuclide composition of solid waste shipped from the St. Lucie Unit 1 & 2 are determined using a combination of qualitative and quantitive techniques. In general, the St. Lucie Plant follows the guidelines outlined in the Low Level Waste Licensing Branch Technical Position (BTP) on Radioactive Waste Classification (5/11/83) for these determinations.

The most frequently used techniques for determining the total curie quantity in a package are the dose to curie methods and the (concentration) x (Volume or Mass) calculations. Where appropriate, engineering type activation analyses may be applied. Since each of the above methodologies involves to some extent qualitative parameters, the total curie quantity is considered to be an estimate.

The composition of radionuclides in the waste is determined by both on-site analyses for principal gamma emitters and periodic off-site analyses for other radionuclides. The on-site analyses are performed either on a batch basis or on a routine basis using reasonably representative samples as appropriate for the waste type. Off-site analyses are used to establish scaling factors or other estimates for radionuclides such as ^{3}H, ^{14}C, ^{99}Tc, ^{129}I, TRU^{241}Pu, ^{242}Cm, ^{63}Ni, and ^{55}Fe.

NOTE 2: "Principal Radionuclides" refer to those radionuclides contained in the waste in concentrations greater than .01 times the concentration of the nuclides listed in Table 1 or .01 times the smallest concentration of the nuclides listed in Table 2 of 10 CFR 61.

NOTE 3: "Type of Waste is generally specified as described in NUREG 0782, Draft Environment Impact Statement on 10 CFR 61 "Licensing Requirements for Land Disposal of Radioactive Waste".

NOTE 4: "Type of Container" refers to the transport package.

ATTACHMENT-A

TO SEMIANNUAL REPORT

O.D.C.M. REVISED PAGES

AS PER TECHNICAL SPECIFICATION 6.14.2

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT
CHEMISTRY OPERATING PROCEDURE NO. C-200
REVISION 7

COPY 2

TITLE:

Offsite Dose Calculation Manual (ODCM)

REVIEW AND APPROVAL:

Reviewed by Facility Review Group ____________ April 22, 1982

Approved by C. M. Wethy Plant Manager April 27, 1982

Revision 7 Reviewed by F R G ____________ 11-18 1986

Approved by J H Barrow Jr Plant Manager 1-5 1987

S	OPS
DATE	
DOCT	PROCEDURE
DOCN	C-200
SYS	
COMP	COMPLETED
ITM	7

GLOSSARY OF COMMONLY USED TERMS

D_B	– Dose from Beta Radiation /R7
cc	– Cubic centimeter
Ci	– Curies – a unit of radioacivity see uCi
C_i	– Activity or concentration of a nuclide in the release source. Units of uCi, uCi/cc, or uCi/ml
CFR	– Code of Federal Regulations
Dose	– The exposure, in mrem or mrad, the organ or the individual receives from radioactive effluents
Dose Factor	– Normally, a factor that converts the effect of ingesting radioactive material into the body, to dose to a specific organ. Body elimination, radioactive decay, and organ uptake are some of the factors that determine a dose factor for a given nuclide
Dose Pathway	– A specific path that radioactive material physically travels through prior to exposing an individual to radiation. The Grass-Cow-Milk-Infant is a dose pathway
Dose Rate	– The dose received per unit time
(D/Q)	– A long term D over Q – a factor with units of $1/M^2$ which describes the deposition of particulate matter from a plume at a point downrange from the source. It can be thought of as what part of the cloud is going to fallout and deposit over one square meter of ground. (See Appendix F). /R7
γ	– A gamma photon – The dose from Gammas in air, etc.
Ground Plane	– Radioactive material deposited uniformly over the ground emits radiation that produces an exposure pathway when an individual is standing, sitting, etc., in the area. It is assumed that an adult receives the same exposure as an infant, regardless of the physical height differences. Only the total body is considered for the ODCM.
H-3	– Hydrogen-3, or Tritium, a weak Beta emitter
I&8DP	– Radioiodines and particulates with half-lives greater than 8 days
LCO	– Limiting condition for operation in STS
m^3	– Cubic Meters
m^2	– Square Meters
MPC	– Maximum Permissible Concentration
nuclide	– For the purposes of this manual, a radioactive isotope. Nuclide (i) signifies a specific nuclide, the 1st, 2nd, 3rd one under consideration. If nuclide (i) is I-131, then the Mi (dose factor) under consideration should be M_{I-131} for example.

GLOSSARY OF COMMONLY USED TERMS
(continued)

Organ	– For the ODCM either the bone, liver, thyroid, kidney, lung, GI-LLI, or the T. Body. Total Body is considered an organ for ease of writing the methodology in the ODCM.
$(_{Q}Dot)_i$	– $(Q_Dot)_i$ – Denotes a release rate in uCi/sec for nuclide (i). /R7
Q_i	– Denotes uCi of nuclide (i) released over a specified time interval.
Radioiodines	– Iodine-131 and Iodine I-133 for gaseous release pathways.
Receptor	– The individual receiving the exposure in a given location or who ingests food products from an animal for example. A receptor can receive dose from one or more pathways.
Release Source(s)	– A subsystem, tank, or vent where radioactive material can be released independently of other radioactive release points.
STS	– The St. Lucie Plant Standard Technical Specifications
uCi	– micro Curies. 1 uCi = 10^{-6} Curies. The uCi is the standard unit of radioactivity for all dose calculations in the ODCM.
(X/Q)	– A long term Chi over Q. It describes the physical dispersion characteristics of a semi-infinite cloud of noble gases as the cloud traverses downrange from the release point. Since Noble Gases are inert, they do not tend to settle out on the ground. (See Appendix F). /R7
$(X/Q)_D$	– A long term Depleted Chi over Q. It describes the physical dispersion characteristics of a semi-infinite cloud of radioactive iodines and particulates as the cloud travels downrange. Since Iodines and particulates tend to settle out (fallout of the cloud) on the ground, the $(X/Q)_D$ represents what physically remains of the cloud and its dispersion qualities at a given location downrange from the release point. (See Appendix F). /R7
dt	– A specific delta time interval that corresponds with the release interval data etc. /R7

1.2 (continued)

R = The undiluted release rate in gpm of the release source. Liquid Rad Waste = 150 gpm   Steam Generator = 125 gpm/Steam Generator /R7

D = The dilution flow in gpm of Intake Cooling Water or Circulating Water Pumps
Intake Cooling flow is 14,500 gpm/pump
Circulating Water flow is 121,000 gpm/pump

C_i = The undiluted concentration of nuclide (i) in uCi/ml from sample assay

$(MPC)_i$ = The maximum permissible concentration of nuclide (i) in uCi/ml from Table L-1. For dissolved or entrained noble gases the MPC value is 2 X 10^{-4} uCi/ml for the sum of all gases.

The fraction of the 10CFR20 MPC limit may be determined by a nuclide-by-nuclide evaluation or for purposes of simplifying the calculation by a cumulative activity evaluation. If the simplified method is used, the value of 3 X 10^{-8} uCi/ml (unidentified MPC value) should be substituted for $(MPC)_i$ and the cumulative concentration (sum of all identified radionuclide concentrations) or the gross concentration should be substituted for C_i. As long as the diluted concentration (C_{total} R/D) is less than 3 X 10^{-8} uCi/ml, the nuclide-by-nuclide calculation is not required to demonstrate compliance with the 10CFR20 MPC limit. The following section provides a step-by-step procedure for determining the MPC fraction.

1. Calculation Process for Solids

   A. Obtain from the in-plant procedures, the release rate value (R) in gpm for the release source.

   B. Obtain from the in-plant procedures, the dilution rate (D) in gpm. No credit is taken for any dilution beyond the discharge canal flow.

   C. Obtain (C_i), the undiluted assay value of nuclide (i), in uCi/ml. If the simplified method is used, the cumulative concentration (C_{total}) is used.

   D. From Table L-1, obtain the corresponding (MPC) for nuclide (i) in uCi/ml. The value of 3 X 10^{-8} uCi/ml should be used for the simplified method.

   E. Divide C_i by $(MPC)_i$ and write down the quotient

   F. If the simplified method is used, proceed to the next step. If determining the MPC fraction by the nuclide-by-nuclide evaluation, repeat steps 1.2.1.C through 1.2.1.E for each nuclide reported in the assay, for H_3 from previous month composite, and for SR89/90 and Fe55 from previous quarter composite.

   G. Add each C_i/(MPC) quotient from step 1.2.1.E and solve for F_L as follows: /R7

$$F_L = \frac{R}{D} \sum_{i=1}^{n} \frac{C_i}{(MPC)i}$$

1.2 (continued)

1. (continued)

G. (continued)

F_L = a unit-less value where:

the value of F_L could be $\leq$ or >1. The purpose of the caluculation is to determine what the initial value of F_L is for a given set of release conditions. If F_L is >1, administrative steps are taken to ensure that the actual release conditions for dilution will ensure that F_L is ≤ 1 during the actual release. F_L is called the fraction of 10CFR20 MPC because it should never be allowed to be >1.

2. Calculation Process for Gases in Liquid

A. Sum the uCi/ml of each noble gas activity reported in the release.

B. The values of R and D from 1.2.1 above shall be used in the calculations below:

$$F_g = \frac{\text{(sum of 1.2.2.A) uCi/ml}}{1} \times \frac{R}{D}$$ /R7

C. F_g shall be less than 2×10^{-4} uCi/ml for the site for all releases in progress. Each release point will be administratively controlled. Consult in-plant procedures for instructions

1.3 Determining Setpoints for Radioactive Liquid Effluent Monitors

Discussion - Technical Specification 3.3.3.9 requires that the liquid effluent monitoring instrumentation alarm/trip setpoints be set to initiate an alarm or trip so that the radioactivity concentration in water in the unrestricted area does not exceed the concentration of 10CFR20, Appendix B, Table II as a result of radioactivity in liquid effluents. (Technical Specification 3.11.1.1). This section presents the method to be used for determining the instrumentation setpoints.

Gross cpm vs, total liquid activity curves are available for Liquid Effluent Monitors based on a composite of real release data. A direct correlation between gross cpm and the concentrations that would achieve 10CFR20 MPC levels in the discharge canal can be estimated. The 1978 liquid release data from semi-annual reports was used to determine the average undiluted release concentration. These concentrations were then projected to a diluted concentration in the discharge canal assuming a 1 gpm release rate and a constant dilution flow of 121,000 gpm from 1 circ. water pump. This diluted activity was divided by the nuclide's respective 10CFR20 MPC value (Table L-1) to obtain the Mi column on the table that follows:

1.3 (continued)

A_{Tot} is the total average uCi/ml concentration of the reference mixture and M_{Tot} is the fraction of the MPC of all nuclides for the release conditions specified. Dividing A_{Tot} by M_{Tot} yields A_{Max}, which is the maximum total activity concentration equivalent to the MPC limit for the nuclide distribution typical of radwaste discharges.

$$A_{Max} = \frac{A_{Tot}}{M_{Tot}} = \frac{4.01\ E\text{-}4}{1.33\ E\text{-}3} = 0.302\ uCi/ml$$

The assumption that the mixture does not change is only used for calculational purposes.

1. The (C_{max}) value in cpm should be obtained for the A_{max} (0.302 uCi/ml) from the release sources radioactive liquid effluent monitor curve of cpm vs. uCi/ml.

> **NOTE**
> This setpoint is for a specified release of 1 gpm into 121000 gpm dilution flow.

2. For establishing the setpoint prior to liquid radwaste discharges, the (C_{max}) will be adjusted as needed to account for actual release conditions (i.e., actual liquid discharge flow rate and dilution flow).

1.4 Determining the Dose for Radioactive Liquid Releases

Discussion - Technical Specification 3.11.1.2 requires calculations be performed at least once per 31 days to verify that cumulative radioactive liquid effluents do not cause a dose in excess of 1.5 mrem to the total body and 5 mrem to any organ during any calendar quarter and not in excess of 3 mrem to the total body and 10 mrem to any organ during any calendar year. This section presents calculational method to be used for this verification.

This method is based on the methodology suggested by sections 4.3 and 4.3.1 of NUREG-0133 Revision 1, November, 1978. The dose factors are a composite of both the fish and shellfish pathways so that the fish-shellfish pathway is the only pathway for which dose will be calculated. For St. Lucie Plant, the adult is the most limiting age group, but the dose for child, and teenager can also be calculated by this method provided that their appropriate dose factors are available for the organ of interest. Only those nuclides that appear in the Tables of this manual will be considered.

1. This method provides for a dose calculation to the total body or any organ for a given age group based on real release conditions during a specified time interval for radioactive liquid release sources. The equation is:

$$D_{1_T} = \frac{A_{iT}\ dt_1\ Q_{i1}}{(DF)_1}$$ /R7

1.4 (continued)

1. (continued)

Where: D_{l_T} = dose commitment in mrem received by organ T of age group (to be specified) during the release time interval dt_l.

A_{iT} = the composite dose factor for the fish-shellfish pathway for nuclide (i) for organ T of age group (to be specified). The A_{iT} values listed in the Tables in this manual are independent of any site specific information and have the units $\frac{\text{mrem-ml}}{\text{uCi-hr}}$

dt_l = the number of hours that the release occurs.

Q_{il} = The total quantity of nuclide (i) release during dt_l (uCi)

$(DF)_l$= The total volume of dilution that occurred during the release time period dt_l (i.e., the circulating water flow times time)

The doses associated with each release may then be summed to provide the cumulative dose over a desired time period (e.g., sum all doses for release during a 31 day period, calendar quarter or a year).

$$D_{total_T} = \sum D_{l_T}$$

Where: D_{t_T} = the total dose commitment to organ $_T$ due to all releases during the desired time interval (mrem)

Based on the radionuclide distribution typical in radioactive effluents, the calculated doses to individuals are dominated by the radionuclides Fe-59, Co-58, Co-60, Zn-65, Nb-95, Cs-134 and Cs-137. These nuclides typically contribute over 95% of the total body dose and over 90% of the GI-LLI dose, which is the critical organ. Therefore, the dose commitment due to radioactivity in liquid effluents may be reasonably evaluated by limiting the dose calculation process to these radionuclides for the adult total body and adult GI-LLI. To allow for any unexpected variability in the radionuclide distribution, a conservatism factor of 0.6 is introduced into the equation. After calculating the dose based on these 7 nuclides, the cumulative dose should be divided by 0.6, the conservatism factor. (i.e., $D_T = D_T/0.6$). Refer to Appendix B for a detailed evaluation and explanation of this limited analysis approach.

The methodology that follows is a step-by-step breakdown to calculate doses based on the above equation. Refer to the in-plant procedures to determine the applicable organs, age groups, and pathway factors. If the limited analysis approach is used, the calculation should be limited to the Adult total body dose and Adult GI-LLI dose from the fish and shellfish pathways. Only the 7 previously specified radionuclides should be evaluated. For the dose calculations to be included in semi-annual reports, the doses to the adult groups and all organs should be evaluated for all radionuclides identified in the liquid effluents.

NOTE
Table 1.4 provides a convenient form for compiling the dose accounting

/R7

1.4 (continued)

1. (continued)

A. Determine the time interval dt_1 that the release took place. The in-plant procedures shall describe the procedure for calculating dt_1 for official release purposes.

B. Obtain $(DF)_1$ for the time period dt_1 from Liquid Waste Management Records for the release source(s) of interest.

C. Obtain Q_{i1} for nuclide (i) for the time period dt_1 from the Liquid Waste Management Records

D. Obtain A_{iT} from the appropriate Liquid Dose Factor Table

TABLE 1.4
FISH AND SHELLFISH PATHWAY

TIME/DATE START: _____ __/__/__ TIME/DATE STOP: _____ __/__/__ _____ HOURS
TOTAL DILUTION VOLUME: ________ mls
AGE GROUP: ________ ORGAN: ________ DOSE FACTOR TABLE #: ________

NUCLIDE (i)	C_i (uCi)	A_{iT}	DOSE (i) mrem
Fe-59			
Co-58			
Co-60			
Zn-65			
Nb-95			
Cs-134			
Cs-137			
OTHERS			
		TOTAL DOSE $_T$ =	mrem
		If based on limited analysis, divide by 0.6	mrem

E. Solve for Dose (i)

$$\text{Dose (i)} = \frac{Q_{i1} \; dt_1 \; A_{iT}}{(DF)_1}$$

/R7

1.4 (continued)

1. (continued)

F. Repeat steps 1.4.1.C through 1.4.1.E for each nuclide reported and each organ required. If the limited analysis method is used, limit the radionuclides to Fe-59, Co-58, Co-60, Zn-65, Nb-95, Cs-134, and Cs-137 and determine the adult total body dose and the adult GI-LLI dose.

G. Sum the Dose (i) values to obtain the total dose to organ T from the fish-shellfish pathway. If the limited analysis method is being used, divide the cumulative dose by a conservatism factor of 0.6 to account for any unexpected variability in radionuclide distribution /R7

1.5 Projecting Dose for Radioactive Liquid Effluents

Discussion - Technical Specification 3.11.1.3 requires that appropriate subsystems of the liquid radwaste treatment system be used to reduce radioactive material in liquid effluents when the projected monthly dose due to liquid releases to unrestricted areas when averaged over 31 days would exceed 0.06 mrem to the total body or 0.2 mrem to any organ. Doses are to be projected at least once per 31 days. The following calculation method is provided for performing this dose projection. The method is based on dose as calculated in section 1.4 with the adult as the bases for projecting.

1. Obtain the latest result of the monthly calculation of the adult total body dose and the adult's highest organ dose. These doses can be obtained from the in-plant records.

2. Divide each dose by the number of days the reactor plant was operational during the month.

3. Multiply the quotient of each dose by the number of days the reactor plant is projected to be operational during the next month. The products are the projected dose for the next month. These values 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 dose is greater than 0.06 mrem to the total body or greater than 0.2 mrem to the adults highest exposed organ, the liquid radwaste system shall be used to reduce the radioactivity levels prior to release.

2.1 Gaseous Effluent Model Assumptions

Description of Site - (The FSAR 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 STS. Doses calculated over water areas do not apply to /R7 the STS LCO's 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 Technical Specification 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 used in dose calculations for the Semi-annual reports.

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 STS LCO dose limit calculations. Dose calculations for STS dose limits may be performed using actual MET data, real receptor locations, and sector wind frequency distribution if desired. 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. 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 S.T.S. LCO's. 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 STS LCO 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 - Technical Specification 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. Technical Specification 3.3.3.10 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 Technical Specification Table 4.11-2 are used to demonstrate compliance with these limits. /R7

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 Technical Specification LCO's 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: /R7

For TOTAL BODY Dose Rate:

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

For TOTAL SKIN Dose Rate:

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

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/uCi-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/uCi-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/uCi-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)
- $(QDOT)_i$ = The release rate of noble gas nuclide (i) in uCi/sec from the release source of interest

/R7

2.2 (continued)

1. Simplified Total Body Dose Rate Calculation

From an evaluation of past releases, an effective total body dose factor (K_{eff}) can be derived. This dose factor is in effect a weighted average total body dose factor, i.e., weighted by the radionuclide distribution typical of past operation. (Refer to Appendix C for a detailed explanation and evaluation of K_{eff}). The value of K_{eff} has been derived from the radioactive noble gas effluents for the years 1978, 1979, and 1980. The value is:

$$K_{eff} = 6.8 \times 10^{2} \ \frac{\text{mrem-m}^3}{\text{uCi-yr}}$$

This value may be used in conjunction with the total noble gas release rate $(Q\ DOT)_i$ to verify that the dose rate is within the allowable limits. To allow for any unexpected variability in the radionuclide distribution, a conservatism factor of 0.8 is introduced into the calculation. The simplified equation is: /R7

$$DR_{TB} = \frac{K_{eff}\ (X/Q)}{0.8} \sum_i \frac{(Q\ DOT)_i}{Q_i}$$ /R7

To further simplify the determination, the historical annual average meteorological X/Q of 1.6×10^{-6} sec/m^3 (From Table M-1) may be substituted into the equation. Also, the dose limit of 500 mrem/yr may be subtitituted for DR_{TB}. Making these substitutions yields a single cumulative (or gross) noble gas release rate limit. This value is:

Noble gas release rate limit = 3.5×10^5 uCi/sec

As long as the noble gas release rates do not exceed this value (3.5×10^5 uCi/sec), no additional dose rate calculations are needed to verify compliance with Technical Specification 3.11.2.1.

2. Setpoint Determination

To comply with Tech. Spec. 3.3.3.10, the alarm/trip setpoints are established to ensure that the noble gas releases do not exceed the value of 3.5×10^5 uCi/sec, which corresponds to a total body dose rate of 500 mrem/yr. The method that follows is a step-by-step procedure for establishing the setpoints. To allow for multiple sources of releases from different or common release points, the allowable operating setpoints will be controlled administratively by allocating a percentage of the total allowable release to each of the release sources.

A. Determine (V) the maximum volume release rate potential from the in-plant procedures for the release source under consideration. The units of (V) are ft^3/min.

2.2 (continued)

1. (continued)

B. Solve for A, the activity concentration in uCi/cc that would produce the Y dose rate LCO

$$A = \frac{3.5 \times 10^5 \text{ uCi}}{\text{sec}} \times \frac{\text{min}}{(V)\ ft^3} \times \frac{ft^3}{2.8317 \times 10^4 cc} \times \frac{60 \text{ sec}}{\text{min}}$$

A = uCi/cc

C. Refer to the uCi/cc vs. cpm curve for the Release Source's Gaseous Effluent Monitor cpm value (C), corresponding to the value of A above.

D. C is the 100% setpoint, assuming that there are no other release sources on the site.

E. Obtain the current % allocated to this release source from the gaseous waste management logs.

F. The Operating setpoint SP

$$SP = (C) \text{ cpm} \times \frac{\text{\% allotted by in-plant procedures}}{100\%}$$

The total body dose is more limiting than the calculated skin dose. (Refer to Appendix C for a detailed evaluation.) Therefore, the skin dose rate calculations are not required if the simplified dose rate calculation is used (i.e., use of K_{eff} to determine release rate limits).

The calculation process of the following Section (2.2.3) is to be used if actual releases of noble gases exceed the above limit of 3.5×10^5 uCi/sec.

Under these conditions, a nuclide-by-nuclide evaluation is required to evaluate compliance with the dose rate limits of Technical Specification 3.11.2.1.

3. 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 Tech. Spec. 3.11.2.1. This method is only used if the actual releases exceed the value of 3.5×10^5 uCi/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.) /R7

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

2.2 (continued)

3. (continued)

C. Solve for $(Q\ DOT)_i$ for nuclide (i) by obtaining the uCi/cc assay value of the release source and multiplying it by the product of 2.2.3.B above.

$$(Q\ DOT)_i = \frac{\text{(nuclide [i]) (assay) uCi}}{\text{cc}} \times \frac{\text{(2.2.3.B value) cc}}{\text{sec}}$$

$(Q\ DOT)_i$ = uCi/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}

$$DR_{TBi} = K_i(X/Q)(Q\ DOT)_i = \frac{\text{mrem-m}^3}{\text{uCi-yr}} \times \frac{\text{sec}}{\text{m3}} \times \frac{\text{uCi}}{\text{sec}}$$

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

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 2.2.3.D through 2.2.3.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:

$$DR_{TB} = \sum_i^n DR_{TBi}$$

/R7

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

Discussion – Tech. Spec. 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:

$$DR_{I\&8DP} = \sum_i^n R_{i_T}^{*} (D/Q) (Q\ DOT)_i$$

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

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

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

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

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

/R7

2.3 (continued)

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 Tech. Spec. 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.

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

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

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

$$(Q\ DOT)_i = \qquad uCi/sec \text{ for nuclide (i)}$$

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

E. Solve for DR_i

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

$DR_{iT} = \frac{mrem}{yr}$ 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.

2.3 (continued)

1. (continued)

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.

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.

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

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

$$(Q\ DOT)_i = \frac{(\text{nuclide [i] assay})\ uCi}{cc} \times \frac{(\text{Value 2.3.2.B})\ cc}{sec}$$

$$(Q\ DOT)_i = \qquad uCi/sec \text{ for nuclide (i)}$$

D. Obtain the P_i value from Table G-3

E. Solve for DR_i

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

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

/R7

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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 Total body from the Ground Plane Pathway is: /R7

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

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: /R7

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 /R7

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.

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

C. Solve for $(Q\ DOT)_i$ for nuclide (i) by obtaining the uCi/cc assay value of the release source activity and multiplying it by the product of 2.3.3.B above. /R7

$$((Q\ DOT)_i = \frac{(nuclide\ [i]\ assay)\ uCi}{cc} \times \frac{(value\ 2.3.3.B)\ cc}{sec}$$ /R7

$(Q\ DOT)_i =$ uCi/sec for nuclide (i) /R7

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.

2.3 (continued)

3. (continued)

E. Solve for DR_{iT}

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

DR_{iT} = 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: /R7

$DR_{grass\text{-}\_\_\_\_\_\_\text{-}Milk_T} = DR_1 + DR_2 + \_\_\_\_\_\_ + DR_n$

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.

4. The H-3 Dose Rate Method: /R7

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/m³ (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/m³. (From Table M-6 at the range and sector corresponding to the location of the Milk Animal above.) /R7

2.3 (continued)

4. (continued)

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

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

= cc/sec volume release rate

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

$$(Q\ DOT)_{H-3} = \frac{(H\text{-}3)\ uCi}{cc} \times \frac{(2.3.4.B\ value)\ cc}{sec}$$

$(Q\ DOT)_{H-3}$ = uCi/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)

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.

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

$DR_{H-3_{Inh_T}}$ = 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

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

$DR_{H-3_{G-\ -M_T}}$ = mrem/yr from H-3 Infant G-__________-Milk for organ T

/R7

2.3 (continued)

4. (continued)

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.

5. Determining the Total Organ Dose Rate from Iodines, 8D-Particulates, and H-3 from Release Source(s) /R7

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 Pl. (I&8DP)	(T. 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 - Tech. Spec. 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 STS 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: /R7

$$D_\gamma\text{-air} = \sum_i^n 3.17 \times 10^{-8} M_i \, (X/Q) \, Q_i$$ /R7

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 $\frac{\text{mrad-m}^3}{\text{uCi-yr}}$

(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 L.C.O. is based on, etc. /R7

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)

From an evaluation of past releases, a single effective gamma air dose factor (M_{eff}) has been derived, which is representative of the radionuclide abundances and corresponding dose contributions typical of past operation. (Refer to Appendix C for a detailed explanation and evaluation of M_{eff}). The value of M_{eff} has been derived from the radioactive noble gas effluents for the years 1978, 1979, and 1980. The value is

$$M_{eff} = 7.4 \times 10^2 \ \frac{\text{mrad/yr}}{\text{uCi/m}^3}$$

This value may be used in conjunction with the total noble gas releases (Q_i) to simplify the dose evaluation and to verify that the cumulative gamma air dose is within the limits of Specification 3.11.2.2. To allow for any unexpected variability in the radionuclide distribution, a conservatism factor of 0.8 is introduced into the calculation. The simplified equation is

$$D_{\gamma\text{-air}} = \frac{3.17 \times 10^{-8}}{0.8} M_{eff} \, X/Q \sum_i Q_i$$

2.4 (continued)

For purposes of calculations, the appropriate meteorological dispersion (X/Q)from Table M-1 should be used. Tech. Spec. 3.11.2.2 requires that the doses be evaluated once per 31 days, (i.e., monthly). The quarterly dose limit is 5 mrads, which corresponds to a monthly allotment of 1.7 mrads. If the 1.7 mrads is substituted for $D_{\gamma\text{-air}}$, a cumulative noble gas monthly release objective can be calculated. This value is 36,000 Ci/month, noble gases. /R7

As long as this value is not exceeded in any month, no additional calculations are needed to verify compliance with the quarterly noble gas release limits of Specification 3.11.2.2. Also, the gamma air dose is more limiting than the beta air dose. Therefore, the beta air dose does not need to be calculated per Section 2.5 if the M_{eff} dose factor is used to determine the gamma air dose. Refer to Appendix C for a detailed evaluation and explanation.

The calculations of Section 2.5 may be omitted when this limited analysis approach is used, but should be performed if the radionuclide specific dose analysis is performed. Also, the radionuclide specific calculations will be performed for inclusion in Semi-annual reports.

The following steps provide a detailed explanation of how the radionuclide specific dose is calculated. This method is used to evaluate quarterly doses in accordance with Tech. Spec. 3.11.2.2 if the releases of noble gases during any month of the quarter exceed 36,000 Ci. /R7

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 L.C.O. or Dose Projection for examples). This value of (X/Q) applies to each nuclide(i). /R7

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:

$$D_i = \frac{3.17 \text{ X } 10^{-8} \text{ yr}}{\text{sec}} \text{ X } \frac{M_i \text{ mrad-m}^3}{\text{uCi-yr}} \text{ X } \frac{(X/Q) \text{ sec}}{\text{m}^3} \text{ X } \frac{Q_i \text{ uCi}}{1}$$ /R7

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.

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

2.4 (continued)

6. (continued)

> **NOTE**
> Compliance with a 1/31 day LCO, Quarterly LCO, yearly or 12 consecutive months LCO can be demonstrated by the limited analysis approach using M_{eff}. Using this method only requires that steps 2.4.2 through 2.4.5 be performed one time, remembering that the dose must be divided by 0.8, the conservatism factor.

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

2.5 Determining the Beta Air Dose for Radioactive Noble Gas Releases

Discussion - Tech. Spec. 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 Sections 5.3.1 of NUREG-0133, November 1978. The dose calculation is independent of any age group. The equation may be used for STS 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. /R7

2.5 (continued)

The equation for beta air dose is:

$$D_{B\text{-}air} \sum_{i}^{n} = 3.17 \times 10^{-8} N_i (X/Q)\, Q_i$$ /R7

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 $\frac{\text{mrad-m}^3}{\text{uCi-yr}}$

(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 LCO is based on, etc. /R7

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

The beta air dose does not have to be evaluated if the noble gas gamma air dose is evaluated by the use of the effective gamma air dose factor (M_{eff}). However, if the nuclide specific dose calculation is used to evaluate compliance with the quarterly gamma air dose limits (Section 2.4), the beta air dose should also be evaluated as outlined below for the purpose of evaluating compliance with the quarterly beta air dose limits of Tech. Spec. 3.11.2.2. 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 LCO or Dose projection for examples). This value of (X/Q) applies to each nuclide (i). /R7
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.

2.5 (continued)

4. Solve for D_i as follows:

$$D_i = \frac{3.17 \times 10^{-8}\ yr}{sec} \times \frac{N_i\ mrad\text{-}m^3}{uCi\text{-}yr} \times \frac{(X/Q)\ sec}{m^3} \times \frac{Q_i uCi}{1}$$ /R7

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.

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

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

2.6 <u>Determining the Radioiodine and Particulate Dose To Any Organ From Cumulative Releases</u>

<u>Discussion</u> - Technical Specification 3.11.2.3 limits the dose to the total 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 equation 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 $(X/Q)_D$ 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 equations are: /R7

For Inhalation Pathway (excluding H-3):

$$D_{I\&8DP_T} = \sum_{i}^{n} 3.17 \times 10^{-8} R_i (X/Q)_D Q_i$$ /R7

For Ground Plane or Grass-Cow/Goat-Milk

$$D_{I\&8DP_T} = \sum_{i}^{n} 3.17 \times ^{-8} R_i (D/Q) Q_i$$ /R7

2.6 (continued)

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

$D_{H\text{-}3_T} = \quad 3.17 \times 10^{-8} R_{H\text{-}3T} (X/Q)_D Q_i$ /R7

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 $\frac{mrem\text{-}m^3}{yr\text{-}uCi}$ for pathways using $(X/Q)_D$ OR $\frac{mrem\text{-}m^2 - sec}{yr\text{-}uCi}$ for pathways using (D/Q) /R7

$(X/Q)_D$ = The depleted-(X/Q) value for a specific location where the receptor is located (see discussion). The units are sec/m^3 /R7

(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. /R7

2.6 (continued)

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.

As discussed in Section 2.3, 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 contributes essentially all of this dose. Therefore, it is possible to demonstrate compliance with the dose limit of Tech. Spec. 3.11.2.3 for radioiodines and particulates by only evaluating the infant's thyroid dose due to the release of radioiodines via the grass-cow/goat-milk pathway. The calculation method of Section 2.6.3 is used for this determination. /R7

The dose determined by Section 2.6.3 should be divided by a conservatism factor of 0.8. This added conservatism provides assurance that the dose determined by this limited analysis approach will be < the dose that would be determined by evaluating all radionuclides and all pathways. 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 2.6.3 for the radioiodines are required to demonstrate compliance with the Tech. Spec. dose limit. However, for the dose assessment included in Semi-Annual Reports, doses will be evaluated for the infant age groups and all organs via all designated pathways from radioiodines and particulates measured in the gaseous effluents according to the sampling and analyses required in Tech. Spec. Table 4.11-2. The following steps provide a detailed explanation of how the dose is calculated for the given pathways:

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) /R7

B. Determine the R_i factor of nuclide (i) for the organ T and age group from Table G-5.

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
$D_i = 3.17 \times 10^{-8} Ri (X/Q)_D Q_i$ /R7
D_i = mrem from nuclide (i)

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

2.6 (continued)

1. (continued)

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

$D_{Inhalation\,(Age\,Group)} = D_1 + D_2 + \_\_\_ + D_n =$ 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 total Body is the only organ considered for the Ground Plant 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) /R7

B. Determine the Ri factor of nuclide (i) for the total 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

$D_i = 3.17 \times 10^{-8} R_i\ (D/Q) Q_i$ /R7

$D_i =$ mrem for nuclide (i)

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 total body is determined by summing the Di Dose of each nuclide (i)

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

Refer to step 2.6.5 to calculate total dose to the Total 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). /R7

2.6 (continued)

3. (continued)

B. Determine the dose factor R_i for nuclide (i), for organ T, from

1. From Table G-6 for a cow, or;

2. From Table G-7 for a goat.

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

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 /R7

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

$D_i =$ 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-C-M} (or D_{G-G-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. <u>The Gaseous Tritium Dose (Each Pathway) Method:</u>

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

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. /R7

C. Determine the Pathway Tritium dose factor (R_{H-3}) for the organ T of interest from the Table specified below:

AGE	INHALATION	MILK COW	MILK GOAT
Infant	G-5	G-6	G-7

2.6 (continued)

4. (continued)

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 S.T.S. limits or quarterly reports shall be from all gaseous release sources.

E. Solve for D_{H-3}

$D_{H-3} = 3.17 \times 10^{-8} R_{H-3}(X/Q)_{D}Q$ /R7

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

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

> NOTE
> STS LCO dose limits for I&8DP shall consider dose from all release sources from St. Lucie Unit 1.

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

PATHWAY	DOSE (mrem)	STEP # REF.
Inhalation (I&8DP)		2.6.1.F
Ground Plane (I&8DP)	(T. Body Only)	2.6.2.F
Grass- -Milk (I&8DP)		2.6.3.F
Inhalation (H-3)		2.6.4.E
Grass- -Milk (H-3)		2.6.4.E
$Dose_T$ =	Sum of Above	

B. The dose to each of the INFANT'S ORGANS shall be calculated:

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

The INFANT organ receiving the highest exposure relative to its STS Limit is the most critical organ for the radioiodine & 8D Particulates gaseous effluents.

2.7 Projecting Dose for Radioactive Gaseous Effluents

Discussion - Tech. Spec. 3.11.2.4 requires that the gaseous radwaste treatment system be used to reduce radioactive materials in waste prior to discharge when the projected dose due to gaseous effluents 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.

2.7 (continued)

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 gaseous radwaste system shall be used to reduce the radioactivity levels prior to release. /R7

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 total 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 Tech. Specs. 3.11.1.2.a, 3.11.2.2a, and 3.11.2.3a, respectively; i.e., quarterly doses exceeding 3 mrem to the total 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 (Tech. Spec. 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.

4.0 Semi-Annual Radioactive Effluent Report

Discussion - The information contained in a semi-annual report shall not apply to any STS LCO. The reported values are based on actual release conditions instead of historical conditions that the STS LCO dose calculations are based on. The STS LCO dose limits are therefore included in item 1 of the report, for information only. The MPC's 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 Figure 5.1-1 in STS-A) shall be limited to the concentrations specified in 10CFR20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2 X 10^{-4} uCi/ml total activity. /R7

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 Fig. 5.1-1 in STS-A) shall be limited during any calendar quarter to $\leq$1.5 mrem to the total body and to $\leq$5 mrem to any organ and $\leq$3 mrem to the total body and $\leq$10 mrem to any organ during any calendar year. /R7

1.2 For Radioactive Gaseous Waste Effluents:

a. The dose rate in unrestricted areas (see Fig. 5.1-1 in the STS-A) due to radioactive materials released in gaseous effluents from the site shall be limited to the following values:

The dose rate limit for noble gases shall be $\leq$500 mrem/yr to the total body and $\leq$3000 mrem/yr to the skin, and /R7

The dose rate limit from I-131, I-133, Tritium, and particulates with half-lives >8 days shall be $\leq$1500 mrem/yr to any organ. /R7

4.0 (continued)

1. (continued)

1.1 (continued)

b. The air dose (see Figure 5.1-1 in the STS-A) 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: /R7

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 STS-A) shall be limited to the following: /R7

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

2. Maximum Permissible 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.

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:

a. Sampling Error

The error associated with volume measurement devices, flow measuring devices, etc. based on calibration data and design tolerances has been conservatively estimated collectively to be less than ± ________ %

b. Analytical Error for Nuclides

TYPE	AVERAGE %	MAXIMUM %
Liquid	± ______	± ______
Gaseous	± ______	± ______

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[1]	EACH BATCH	PRINCIPAL GAMMA EMITTERS	p.h.a.
	MONTHLY COMPOSITE	TRITIUM	L.S.
		GROSS ALPHA	G.F.P.
	QUARTERLY COMPOSITE	Sr-89, Sr-90, Fe-55	C.S. & L.S.
STEAM GENERATOR BLOWDOWN RELEASES	WEEKLY	PRINCIPAL GAMMA EMITTERS AND DISSOLVED GASES	p.h.a.
	MONTHLY COMPOSITE	TRITIUM	L.S.
		GROSS ALPHA	G.F.P.
	QUARTERLY COMPOSITE	Sr-89, Sr-90, Fe-55	C.S. & L.S

/R7

TABLE NOTATION:

1 Boric Acid Evaporator condensate is normally recovered to the Primary Water Storage Tank for recycling into the reactor coolant system and normally does not contribute to liquid waste effluent totals.

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

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	Weekly	Principal Gamma Emitters	(G,C,P)-p.h.a.
		H-3	L.S.
	Monthly Composite (Particulates)	Gross Alpha	P - G.F.P.
	Quarterly Composite (Particulates)	Sr-90 Sr-89	C.S. & L.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

TABLE M-1

Selecting the Appropriate Long Term (X/Q) for Dose Calculations Involving Noble Gases for: /R7

(1) Total Body dose from instantaneous releases

(2) Skin dose from instantaneous releases

(3) Gamma air dose (cumulative)

(4) Beta air dose (cumulative)

/R7

TYPE OF DOSE CALCULATION	LIMITING RANGE (miles)	LIMITING Sector	(X/Q) VALUE sec/m^3
Instantaneous-LCO	0.97	NW	1.6×10^{-6}
1/31 days - LCO	0.97	1. Normally (X/Q) = 1.6×10^{-6} sec/m^3 /R7	
Quarterly - LCO Yearly	0.97		
12 Consecutive months - LCO	0.97	2. May use option of actual meteorological data for time of concern	
Semi-Annual Report	0.97	N/A	Note-1

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. /R7

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.

TABLE M-2

Selecting the Appropriate Long Term $(X/Q)_D$ or (D/Q) for Dose Calculations Involving Radioiodines & 8 D Particulates for: /R7

(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 LCO	0.97	NW	B 1.3×10^{-6}	//////
		WNW	///////	8.2×10^{-9}
Quarterly for	0.97	A	A, B	//////
Semiannual Reports	0.97	A	///////	A
1/31 days LCO, Qtr. yearly LCO,	0.97	NW	B 1.3×10^{-6}	//////
12 consecutive month LCO	0.97	WNW	///////	8.2×10^{-9}

/R7

(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. /R7

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 - LCO	A	A	A
1/31 Days - LCO	B	B	B
Quarterly-Yearly - LCO	B	B	B
12 Consecutive Months - LCO	B	B	B
Semi-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. /R7

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 when no milk animal is reported. /R7

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/O) at 4.25 miles). 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. /R7

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

TABLE M-5
HISTORICAL LONG TERM - (X/Q) (Frequency corrected) /R7

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: 1.4598 - 112

Average Annual Relative Concentration (sec/cubic meter)
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.	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

TABLE M-6

HISTORICAL LONG TERM DEPLETED - $(X/Q)_D$ (Frequency corrected)

TERRAIN / RECIRCULATION ADJUSTED
PROGRAM ANNX009 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 CONCENTRATION DEPLETED (sec/cubic meter)
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.	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 7
OFFSITE DOSE CALCULATION MANUAL (ODCM)

TABLE M-7
HISTORICAL LONG TERM - (D/Q) (Frequency corrected) /R7

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 7
OFFSITE DOSE CALCULATION MANUAL (ODCM)

APPENDIX B

Limited Analysis Dose Assessment for Liquid Radioactive Effluents

The radioactive liquid effluents for the years 1978, 1979, and 1980 were evaluated to determine the dose contribution of the radionuclide distribution. This analysis was performed to evaluate the use of a limited dose analysis for determining environmental doses. Limiting the dose calculation to a few selected radionuclides that contribute the majority of the dose provides a simplified method of determining compliance with the dose limits of Technical Specificaiton 3.11.1.2.

Tables B-1 and B-2 present the results of this evaluation. Table B-1 presents the fraction of the adult total body dose contributed by the major radionuclides. Table B-2 presents the same data for the adult GI-LLI dose. The adult total body and adult GI-LLI were determined to be the limiting doses based on an evaluation of all age groups (adult, teenager, child, and infant) and all organs (bone, liver, kidney, lung, and GI-LLI). As the data in the tables show, the radionuclides Fe-59, Co-58, Co-60, Zn-65, Cs-134, and Cs-137 dominate the total body dose; the radionuclides, Fe-59, Co-58, Co-60, Zn-65, and Nb-95 dominate the GI-LLI dose. In all but one case (1979-fish, GI-LLI dose) these radionuclides contribute 90% or more of the total dose. If for 1979 the fish and shellfish pathways are combined as is done to determine the total dose, the contribution from these nuclides is 84%[A] of the total GI-LLI dose. /R7

Therefore, the dose commitment due to radioactive material in liquid effluents can be reasonably estimated by limiting the dose calculation to the radionuclides, Fe-59, Co-58, Co-60, Zn-65, Nb-95, Cs-134, and Cs-137, which cumulatively contribute the majority of the total dose calculated by using all radionuclides detected. This limited analysis dose assessment method is a simplified calculation that provides a reasonable evaluation of doses due to liquid radioactive effluents and allows for an estimate of Fe-55 contribution to dose. /R7

Tritium is not included in the limited analysis dose assessment for liquid releases because the potential dose resulting from normal reactor releases is negligible and is essentially independent of radwaste system operation. The amount of tritium releases annually is about 300 curies. At St. Lucie, 300 Ci/yr released to the Atlantic Ocean produces a calculated whole body dose of 5×10^{-7} mrem/yr via the fish and shellfish pathways. This amounts to less than 0.001% of the design objective dose of 3 mrem/yr. Furthermore, the release of tritium is a function of operating time and power level and is essentially unrelated to radwaste system operation.

A- The does due to Iron -55 made it necessary to change the conservatism factor from 0.8 to 0.6, which was done on Revision 7 to the ODCM, based on early 1986 data. /R7

APPENDIX F

METEOROLOGICAL DISPERSION FORMULAS*

For X/Q:

$$X/Q = \frac{2.032}{(\text{u-Bar})D\,(\Sigma_z^2 + cV^2/\text{pi})^{1/2}} \qquad \text{EQ (1)}$$

$$X/Q = \frac{2.032}{(3)^{1/2}\,\Sigma_z\,(\text{u-Bar})D} \qquad \text{EQ (2)}$$

Where C = .5 V = 207.5 ft. (63.2 meters) (u-Bar) = a name for one term

$\frac{1}{2}$ in EQ (1) and EQ(2) denotes take the square root of the term in parentheses

Σ in EQ(1) and EQ(2) should be a lower case sigma if this is compared to references concerning Meteorological data

X/Q was calculated using each of the above EQ's 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.

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

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