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OFFSITE DOSE CALCULATION MANUAL

FOR

SOUTH CAROLINA ELECTRIC AND GAS COMPANY

VIRGIL C. SUMMER NUCLEAR STATION

PSRC Approval Gary Mayer / 3/8/91
Date

Revision 15

February 1991

Reviewed by: [signature] / 3-7-91
Date

Approved by: L. A. Blue / 3-8-91
Date

ODCM (Revision 17) Changes	Comment
References, p. ix; NUREG-0172, "Age Specific Radiation Dose Commitment Factors for a One Year Chronic Intake" was added as reference 13.	This reference provides ingestion dose factors beyond those given in USNRC Regulatory Guide 1.109. Values used to correct Table 2.2-2 in this revision were taken from this reference.
Introduction, p. x-xii; responsibilities incorporated.	Responsibilities are incorporated into the ODCM to ensure that procedural requirements delineated in the Radiological Effluent Technical Specifications will continue to be met upon relocation of RETS into the ODCM.
Table 1.2-1, Radioactive Gaseous Effluent Monitoring Instrumentation, p. 1.0-18; specification for the Waste Gas Holdup System explosive gas monitoring system was deleted.	This specification was deleted from the ODCM since it will remain in Technical Specifications.
Table 1.2-1, Table Notation, p. 1.0-19; applicability note ** was deleted.	This note was specific for the Waste Gas Holdup System explosive gas monitoring system which has been deleted from Table 1.2-1.
Table 1.2-1, Table Notation, p. 1.0-20; former actions 11 and 13 were deleted.	These actions were associated with the Explosive Gas Monitoring System. See above.
Table 1.2-2, Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements, p. 1.0-21; surveillance requirements for the explosive gas monitoring system were deleted.	See Table 1.2-1, above.
Table 1.2-2, Table Notation, p. 1.0-22; footnote concerning waste gas holdup system operation was deleted.	See Table 1.2-1, above.
Table 1.2-2, Table Notation, formerly p. 1.0-23; Notes (4) and (5) concerning the calibration of the Explosive Gas Monitoring System were deleted.	See Table 1.2-1, above.
Section 1.2-2, p. 1.0-23 through B/1.2.2, p. 1.0-46; page numbers changed.	Pages renumbered following deletion of former p. 1.0-23. No substantive changes.
Section B/1.2.1, Radioactive Gaseous Effluent Monitoring Instrumentation, p. 1.0-46; reference to the control of potentially explosive gas mixtures in the Waste Gas Holdup System was deleted.	See Table 1.2-1, above.

ODCM (Revision 15) Changes	Comment
Section B/1.2.3, p. 1.0-47 through section 1.7.8, p. 1.0-57; page numbers changed.	Pages renumbered following deletion of former page 1.0-23. No substantive changes.
Section 2.1.2.2, RML-7, Nuclear Blowdown Monitor Tank Discharge Line Monitor, p. 2.0-13; note was clarified by specifying that releases should not be made directly from the holdup tank to the penstocks.	Previously the note for RML-7 stated, "In no case should discharge be made directly from the Nuclear Blowdown Holdup tank. Its contents should always be processed via the Nuclear Blowdown Monitoring Tank". This note was provided in the ODCM to prevent a release from being made to the unrestricted area without adequately being processed, sampled and monitored. The note did not recognize the Nuclear Blowdown System - Turbine Building sump pathway for low specific activity water. With this process pathway water is processed through operable demineralizers then discharged to the Turbine Building sump. Once processed to the Turbine Building sump, the discharge of the effluent to the unrestricted area is controlled by RML-8. Sampling of the Turbine Building Sump effluent and setpoint determination for RML-8 will continue consistent with methods described in the ODCM.
Section 2.1.4, p. 2.0-16; a discussion was added to recognize the Nuclear Blowdown Processing System - Turbine Building sump process pathway for use with low specific activity water.	See Section 2.1.2.2, above.
Table 2.2-2, Adult Ingestion Dose Factors, p. 2.0-35; Br-82 was added to the table, values for Co-57 (Liver, Total Body, and GI-LLI) were corrected, and a footnote added to show F-18, Sb-124, Sb-125, Co-57, Br-82, and Sb-126 data source.	Br-82 was added since this nuclide is seen in plant gas samples and therefore, can be expected to be found in liquid effluents as entrained gas or in some bromide form. Other changes were transcription and typographical error corrections.
Table 2.2-2, p. 2.0-36; values for Sb-125 (Total Body), Te-125m (Bone) and Te-132 (Bone) were corrected. Sb-126 was added to the table. Typographical error labeling W-187 as W-197 was also corrected.	Sb-126 was added since this nuclide has been seen previously in liquid effluents. Other changes were transcription and typographical error corrections.

ODCM (Revision 15) Changes	Comment
Table 2.2-3, Site Related Ingestion Dose Commitment Factor, p. 2.0-37; Br-82 was added, values for Co-57 (Liver, Total Body and GI-LLI) were corrected.	Changes resulted from revision of Table 2.2-2.
Table 2.2-3, Site Related Ingestion Dose Commitment Factor, p. 2.0-38; Sb-126 was added.	Changes resulted from revision of Table 2.2-2.
Figure 2.1-1, Liquid Radwaste Treatment System, p. 2.0-39; figure was revised to explicitly show the discharge pathway of steam generator blowdown sample line effluent to the Turbine Building sump.	Figure revised in conjunction with the change to section 2.1.2.2, above.
Section 3.2.1, p. 3.0-12; typo correction only.	No substantive changes.

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13. "Age-Specific Radiation Dose Commitment Factors for a One-Year Chronic Intake", NUREG-0172 (November 1977).

INTRODUCTION

The OFFSITE DOSE CALCULATION MANUAL (ODCM) is an implementing and supporting document of the RADIOLOGICAL EFFLUENT TECHNICAL SPECIFICATIONS (RETS). In accordance with USNRC Generic Letter 89-01, entitled "Implementation of Programmatic Controls for Radiological Effluent Technical Specifications in the Administrative Controls Section of the Technical Specifications and the Relocation of Procedural Details of RETS to the Offsite Dose Calculation Manual or to the Process Control Program", the procedural details for implementing the Radiological Limiting Conditions for Operation have been incorporated into the ODCM. The ODCM describes the methodology and parameters to be used in the calculation of offsite doses due to radioactive liquid and gaseous effluents and in the calculation of liquid and gaseous effluent monitoring instrumentation alarm/trip setpoints. The ODCM contains a list and graphical description of the specific sample locations for the radiological environmental monitoring program. Configurations of the liquid and gaseous radwaste treatment systems are also included.

The ODCM will be maintained at the Station as the reference which details the Radiological Effluent Limiting Conditions for Operation of the V. C. Summer Nuclear Station. Additionally the ODCM will be maintained as the guide for accepted calculational methodologies. Changes in calculation methods or parameters will be incorporated into the ODCM in order to ensure that the ODCM represents the current methodology in all applicable areas. Computer software to perform described calculations will be maintained current with this ODCM.

RESPONSIBILITIES

The ODCM contains the radiological effluent limiting conditions for operation, their applicability, remedial actions, surveillance requirements, and their bases. Plant procedures implement responsibilities for compliance with the ODCM that include:

The Operations group is responsible for:

- Declaring radioactive liquid and gaseous effluent monitor channels operable or inoperable.
- Ensuring the minimum number of operable channels for radioactive liquid and gaseous effluent monitors.
- Notifying the responsible group to implement appropriate action if less than the minimum number of radioactive liquid and gaseous effluent monitor channels are operable.
- Initiating an Off Normal Occurence Report in accordance with SAP-132, when less than the minimum number of channels operable condition prevails for more than 30 days.
- Restoring to within limits, the concentration of liquid radioactive material exceeding ODCM limits released from the site.
- Ensuring radioactive liquid and gaseous effluent monitor setpoints are set as prescribed in the effluent release permit.
- Suspending release if radioactive liquid and gaseous effluent monitor setpoints are less conservative than ODCM requirements.
- Declaring liquid and gaseous radwaste treatment systems operable or inoperable.
- Ensuring operability of gaseous and liquid radwaste treatment systems and ventilation exhaust treatment system.
- Ensuring appropriate portions of the gaseous and liquid radwaste treatment systems are used to reduce the radioactive materials in liquid and gaseous waste prior to their discharge when the projected doses exceed limits specified by the ODCM.
- Initiating an Off Normal Occurrence Report in accordance with SAP-132, when liquid or gaseous radwaste system is inoperable for more than 31 days.
- Performing channel check and source check at the frequencies shown in Tables 1.1-2 and 1.2-2 for each radioactive liquid and gaseous effluent monitoring instrumentation channel.

Instrumentation and Controls group is responsible for:

- Performing channel calibration and analog channel operational test at the frequencies shown in Tables 1.1-2 and 1.2-2 for each radioactive liquid and gaseous effluent monitoring instrumentation channel.
- Informing the Operations group of surveillance test results.

The Health Physics group is responsible for:

- Establishing setpoints for radioactive liquid and gaseous effluent monitors, consistent with ODCM methodology, and providing setpoint information to Operations.
- Implementing remedial actions as requested by Operations. These actions include grab sampling and analysis and providing the results to Operations.
- Performing periodic radioactive effluent monitor checks to determine backgrounds, normal indications and verifying monitor correlation graphs, and providing this information as necessary to Operations.
- Implementing radioactive gaseous and liquid waste sampling and analysis program in accordance with ODCM Tables 1.1-4 and 1.2-3.
- Informing Operations when at least one Circulating Water Pump or the Circulating Water Jockey Pump is required to provide dilution to the discharge structure.
- Calculating cumulative dose contributions and performing dose projections from liquid and gaseous effluents in accordance with the ODCM and providing the information to Operations.
- Initiating an Off Normal Occurrence Report in accordance with SAP-132, when calculated dose from the discharge of radioactive materials in liquid or gaseous effluents are in excess of the limits specified by ODCM sections 1.1.3.1 or 1.2.3.1.
- Initiating an Off Normal Occurrence Report in accordance with SAP-132, when liquid or gaseous waste is discharged without treatment and is in excess of the limits specified by ODCM sections 1.1.4.1 or 1.2.3.1.
- Initiating an Off Normal Occurrence Report in accordance with SAP-132, when the dose or dose commitment to any member of the public due to releases of radioactivity and radiation is in excess of 25 mrem to the total body or any organ (except the thyroid, which shall be limited to less than or equal to 75 mrem) over 12 consecutive months.

The Corporate Health Physics and Environmental Programs group is responsible for:

- Implementing the Radiological Environmental Monitoring Program as specified in Section 1.4 of the ODCM.
- Initiating an Off Normal Occurrence Report in accordance with SAP-132, when the Radiological Environmental Monitoring Program limiting conditions for operation are exceeded.

TABLE 1.2-1

RADIOACTIVE GASEOUS EFFLUENT
MONITORING INSTRUMENTATION

	INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
1.	WASTE GAS HOLDUP SYSTEM			
a.	Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release (RM-A10 or RM-A3)	1	*	7
2.	MAIN PLANT VENT EXHAUST SYSTEM			
a.	Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release from Waste Gas Holdup System (RM-A3)	1	*	9
b.	Iodine Sampler	1	*	11
c.	Particulate Sample	1	*	11
d.	Flow Rate Measuring Device	1	*	8
e.	Sampler Flow Rate Measuring Device	1	*	8
3.	REACTOR BUILDING PURGE SYSTEM			
a.	Noble Gas Activity Monitor Providing Alarm and Automatic Termination of Release (RM-A4)	1	*	10
b.	Iodine Sampler	1	*	11
c.	Particulate Sample	1	*	11
d.	Flow Rate Measuring Device	1	*	8
e.	Sampler Flow Rate Measuring Device	1	*	8

TABLE 1.2-1 (Continued)

TABLE NOTATION

* At all times during releases via this pathway.

ACTION 7 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, the contents of the tank(s) may be released to the environment for up to 14 days provided that prior to initiating the release:

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

b. At least two technically qualified members of the Facility Staff independently verify the release rate calculations and discharge valve lineup;

Otherwise, suspend release of radioactive effluents via this pathway.

ACTION 8 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided the flow rate is estimated at least once per 4 hours.

ACTION 9 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided grab samples are taken at least once per 8 hours and these samples are analyzed for gross activity within 24 hours.

TABLE 1.2-1 (Continued)

TABLE NOTATION

ACTION 10 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, immediately suspend PURGING of radioactive effluents via this pathway.

ACTION 11 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via the affected pathway may continue for up to 30 days provided samples are continuously collected with auxiliary sampling equipment as required in Table 1.2-3.

TABLE 1.2-2

RADIOACTIVE GASEOUS EFFLUENT
MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

	INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	ANALOG CHANNEL OPERATIONAL TEST	MODES IN WHICH SURVEILLANCE REQUIRED
1.	WASTE GAS HOLDUP SYSTEM					
	a. Noble Gas Activity Monitor - RM-A10 or RM-A3	P	P	R(3)	Q(1)	*
2.	MAIN PLANT VENT EXHAUST SYSTEM					
	a. Noble Gas Activity Monitor - RM-A3	D	M	R(3)	Q(2)	*
	b. Iodine Sampler	W	N.A.	N.A	N.A.	*
	c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
	d. Flow Rate Measuring Device	D	N.A.	R	Q	*
	e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*
3.	REACTOR BUILDING PURGE SYSTEM					
	a. Noble Gas Activity Monitor - RM-A4	D	P,M	R(3)	Q(1)	*
	b. Iodine Sampler	W	N.A.	N.A	N.A.	*
	c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
	d. Flow Rate Measuring Device	D	N.A.	R	Q	*
	e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*

See Table 1.1-3 for explanation of frequency notation.

TABLE NOTATION

* At all times.

(1) The ANALOG CHANNEL OPERATIONAL TEST shall also demonstrate that automatic isolation of this pathway and control room alarm annunciation occurs if any of the following conditions exists:

1. Instrument indicates measured levels above the alarm/trip setpoint.
2. Loss of Power (alarm only).
3. Low flow (alarm only).
4. Instrument indicates a downscale failure (alarm only).
5. Normal/Bypass switch set in Bypass (alarm only).
6. Other instrument controls not set in operate mode.

(2) The ANALOG CHANNEL OPERATIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exists:

1. Instrument indicates measured levels above the alarm setpoint.
2. Loss of Power.
3. Low flow.
4. Instrument indicates a downscale failure.
5. Instrument controls not set in operate mode.

(3) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Institute of Standards and Technology (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used.

1.2.2 Gaseous Effluents: Dose Rate

LIMITING CONDITION FOR OPERATION

1.2.2.1 The dose rate in unrestricted areas due to radioactive materials released in gaseous effluents from the site (see Technical Specification Figure 5.1-3) shall be limited to the following:

a. For noble gases: Less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin, and

b. For all radioiodines and for all radioactive materials in particulate form and tritium with half lives greater than 8 days: Less than or equal to 1500 mrem/yr to any organ.

APPLICABLE: At all Times.

ACTION:

With the dose rate(s) exceeding the above limits, immediately decrease the release rate to within the above limit(s).

SURVEILLANCE REQUIREMENTS

1.2.2.2 The dose rate due to noble gases in gaseous effluents shall be determined to be within the above limits in accordance with the methods and procedures of the ODCM.

1.2.2.3 The dose rate due to radioiodines, tritium and radioactive materials in particulate form with half lives greater than 8 days in gaseous effluents shall be determined to be within the above limits in accordance with the methods and procedures of ODCM Section 3.2.2 by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Table 1.2-3.

TABLE 1.2-3

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

	Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) (μCi/ml)[a]
A.	Waste Gas Storage Tank	P Each Tank Grab Sample	P Each Tank	Principal Gamma Emitters[g]	1X10-4
B1	Reactor Building -36" Purge Line	P Each Purge[b,c]	P Each Purge[b]	Principal Gamma Emitters[g]	1X10-4
	-6" Purge Line			H-3	1X10-6
B2	Reactor Building -6" Purge Line (if continuous)	M[b] Grab Sample	M[b]	Principal Gamma Emitters[g]	1X10-4
				H-3	1X10-6
C.	Main Plant Vent	M[b,e] Grab Sample	M[b]	Principal Gamma Emitters[g]	1X10-4
				H-3	1X10-6
D1.	Reactor Building Purge	Continuous Sampler[f]	W[d] Charcoal Sample	I-131 I-133	1X10-12 1X10-10
2.	Main Plant Vent	Continuous Sampler[f]	W[d] Particulate Sample	Principal Gamma Emitters[g] I-131, others	1X10-11
		Continuous Sampler[f]	M Composite Particulate Sample	Gross Alpha	1X10-11
		Continuous Sampler[f]	Q Composite Particulate Sample	Sr-89,Sr-90	1X10-11
		Continuous Monitor	Noble Gas Monitor	Noble Gases Gross Beta	2X10-6

See Table 1.1-3 for explanation of frequency notation.

TABLE 1.2-3 (Continued)

TABLE NOTATION

a. See Table 1.1-4 notation (a) for definition of LLD.

b. Analyses shall be also be performed within 24 hours following shutdown, startup, or a THERMAL POWER change exceeding 15 percent of the RATED THERMAL POWER within a one hour period.

c. Tritium grab samples shall be taken at least once per 24 hours when the refueling canal is flooded.

d. Samples shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing (or after removal from sampler). Sampling shall also be performed at least once per 24 hours for a least 7 days following each shutdown, startup or THERMAL POWER change exceeding 15 percent of RATED THERMAL POWER in one hour and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLD's may be increased by a factor of 10.

e. Tritium grab samples shall be taken at least once per 7 days from the ventilation exhaust from the spent fuel pool area, whenever spent fuel is in the spent fuel pool.

f. The ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with ODCM Specifications 1.2.2.1, 1.2.3.1 and 1.2.4.1.

g. The principal gamma emitters for which the LLD specification applies exclusively are the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emissions and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141 and Ce-144 for particulate emissions. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported

1.2.3 Gaseous Effluents: Dose - Noble Gas

LIMITING CONDITION FOR OPERATION

1.2.3.1 The air dose due to noble gases released in gaseous effluents from the site (see Technical Specification Figure 5.1-3) shall be limited to the following:

a. During any calendar quarter: Less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation and,

b. During any calendar year: Less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation.

APPLICABLE: At all Times.

ACTION:

a. With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits, in lieu of any other report required by ODCM section 1.6, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2, a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with ODCM Specification 1.2.3.1.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

1.2.3.2 Dose Calculations Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with ODCM Section 3.2.3 at least once per 31 days.

1.2.4 Gaseous Effluents: Dose - Radioiodines, Tritium, and Radioactive Materials in Particulate Form.

LIMITING CONDITION FOR OPERATION

1.2.4.1 The dose to an individual from radioiodines, tritium, and radioactive materials in particulate form, and radionuclides (other than noble gases) with half-lives greater than 8 days in gaseous effluents (see Technical Specification Figure 5.1-3) shall be limited to the following:

a. During any calendar quarter: Less than or equal to 7.5 mrem to any organ and,

b. During any calendar year: Less than or equal to 15 mrem to any organ.

APPLICABLE: At all Times.

ACTION:

a. With the calculated dose from the release of tritium, radioiodines, and radioactive materials in particulate form with half lives greater than 8 days in gaseous effluents exceeding any of the above limits, in lieu of any other report required by ODCM Section 1.6, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2, a Special Report which identifies the cause(s) for exceeding the limit and defines the corrective actions to be taken to eleases and the proposed actions to be taken to assure that subsequent release will be in compliance with ODCM Specification 1.2.4.1.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

1.2.4.2 Dose Calculations Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with ODCM Section 3.2.3 at least once per 31 days.

1.2.5 Gaseous Effluents: Gaseous Radwaste Treatment

LIMITING CONDITION FOR OPERATION

1.2.5.1 The GASEOUS RADWASTE TREATMENT SYSTEM and the VENTILATION EXHAUST TREATMENT SYSTEM shall be OPERABLE. The appropriate portions of the GASEOUS RADWASTE TREATMENT SYSTEM shall be used to reduce radioactive materials in gaseous waste prior to their discharge when the projected gaseous effluent air doses due to gaseous effluent releases from the site (See Technical Specification Figure 5.1-3), when averaged over 31 days, would exceed 0.2 mrad for gamma radiation and 0.4 mrad for beta radiation. The appropriate portions of the VENTILATION EXHAUST TREATMENT SYSTEM shall be used to reduce radioactive materials in gaseous waste prior to their discharge when the projected doses due to gaseous effluent releases from the site when averaged over 31 days would exceed 0.3 mrem to any organ.

APPLICABLE: At all Times.

ACTION:

a. With the GASEOUS RADWASTE TREATMENT SYSTEM and/or the VENTILATION EXHAUST TREATMENT SYSTEM inoperable for more than 31 days or with gaseous waste being discharged without treatment and in excess of the above limits, in lieu of any other report required by ODCM section 1.6, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2, a Special Report which includes the following information:

   1. Identification of the inoperable equipment or subsystems and the reason for inoperability,

   2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

   3. Summary description of action(s) taken to prevent a recurrence.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

1.2.5.2 Doses due to gaseous releases from the reactor shall be projected at least once per 31 days, in accordance with ODCM Section 3.2.2 for air doses and ODCM Section 3.2.3 for organ doses.

1.2.5.3 The GASEOUS RADWASTE TREATMENT SYSTEM and VENTILATION EXHAUST TREATMENT SYSTEM shall be demonstrated OPERABLE by operating the GASEOUS RADWASTE TREATMENT SYSTEM equipment and VENTILATION EXHAUST TREATMENT SYSTEM equipment for at least 30 minutes, at least once per 92 days unless the appropriate system has been utilized to process radioactive gaseous effluents during the previous 92 days.

1.3 RADIOACTIVE EFFLUENTS: TOTAL DOSE

LIMITING CONDITION FOR OPERATION

1.3.1 The dose or dose commitment to any member of the public, due to releases of radioactivity and radiation, from uranium fuel cycle sources shall be limited to less than or equal to 25 mrem to the total body or any organ (except the thyroid, which shall be limited to less than or equal to 75 mrem) over 12 consecutive months.

APPLICABLE: At all Times.

ACTION:

a. With the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of ODCM Specification 1.1.3.1.a, 1.1.3.1.b, 1.2.3.1.a, 1.2.3.1.b, 1.2.4.1.a, or 1.2.4.1.b, in lieu of any other report required and ODCM Section 1.6, prepare and submit to the Commission, within 30 days, pursuant to Technical Specification 6.9.2, a Special Report which defines the corrective action to be taken to reduce subsequent releases to prevent recurrence of exceeding the limits of ODCM Specification 1.3.1. This Special Report shall include an analysis which estimates the radiation exposure (dose) to a member of the public from uranium fuel cycle sources (including all effluent pathways and direct radiation) for a 12 consecutive month period that includes the release(s) covered by this report. If the estimated dose(s) exceeds the limits of ODCM Specification 1.3.1, and if the release condition resulting in violation of 40 CFR 190 has not already been corrected, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR 190 and including information of § 190.11 (b). Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete. The variance only relates to the limits of 40 CFR 190, and does not apply in any way to the requirements for dose

limitation of 10 CFR Part 20, as addressed in ODCM Specifications 1.1.2 and 1.2.2.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

1.3.2 Dose Calculations Cumulative dose contributions from liquid and gaseous effluents shall be determined in accordance with ODCM Specifications 1.1.3.2, 1.2.3.2 and 1.2.4.2.

1.4 RADIOLOGICAL ENVIRONMENTAL MONITORING

1.4.1 Monitoring Program

LIMITING CONDITION FOR OPERATION

1.4.1.1 The radiological environmental monitoring program shall be conducted as specified in Table 1.4-1.

APPLICABILITY: At all times.

ACTION:

a. With the radiological environmental monitoring program not being conducted as specified in Table 1.4-1 in lieu of any other report required by ODCM Section 1.6, prepare and submit to the Commission, in the Annual Radiological Operating Report, a description of the reasons for not conducting the program as required and the plans for preventing a recurrence.

b. With the level of radioactivity in an environmental sampling medium exceeding the reporting levels of Table 1.4-2 when averaged over any calendar quarter, in lieu of any other report required by ODCM Section 1.6, prepare and submit to the Commission within 30 days from the end of the affected calendar quarter a Special Report. When more than one of the radionuclides in Table 1.4-2 are detected in the sampling medium, this report shall be submitted if:

$$\frac{\text{concentration (1)}}{\text{limit level (1)}} + \frac{\text{concentration (2)}}{\text{limit level (2)}} + \ldots \geq 1.0$$

When radionuclides other than those in Table 1.4-2 are detected and are the result of plant effluents, this report shall be submitted if the potential annual dose to an individual is equal to or greater than the calendar year limits of ODCM Specifications 1.1.3.1, 1.2.3.1

and 1.2.4.1. This report is not required if the measured level of radioactivity was not the result of plant effluents; however, in such an event, the condition shall be reported and described in the Annual Radiological Environmental Operating Report.

c. With milk or fresh leafy vegetable samples unavailable from one or more of the sample locations required by Table 1.4-1, in lieu of any other report required by ODCM Section 1.6 prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2, a Special Report which identifies the cause of he unavailability of samples and identifies locations for obtaining replacement samples. The locations from which samples were unavailable may then be deleted from those required by Table 1.4-1, provided the locations from which the replacement samples were obtained are added to the environmental monitoring program as replacement locations.

d. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

1.4.1.2 The radiological environmental monitoring samples shall be collected pursuant to Table 1.4-1 and shall be analyzed pursuant to the requirements of Tables 1.4-1 and 1.4-3.

Table 1.4-1 Radiological Environmental Monitoring Program
Virgil C. Summer Nuclear Station

Exposure Pathway and/or Sample	Minimum Number of Sample Locations and Criteria for Selection	Sampling and Collection Frequency	Type & Frequency of Analysis
AIRBORNE: I. Particulates	A) 3 indicator samples to be taken at locations (in different sectors) beyond but as close to the exclusion boundary as practicable where the highest offsite sectorial ground level concentrations are anticipated. (1)	Continuous sampler operation with weekly collection.	Gross beta following filter change; quarterly composite (by location) for gamma isotopic.
	B) 1 indicator sample to be taken in the sector beyond but as close to the exclusion boundary as practicable corresponding to the residence having the highest anticipated offsite ground level concentration or dose. (1)	Continuous sampler operation with weekly collection.	Gross beta following filter change; quarterly composite (by location) for gamma isotopic.
	C) 1 indicator sample to be taken at the location of one of the dairies most likely to be affected. (1) (2)	Continuous sampler operation with weekly collection.	Gross beta following filter change; quarterly composite (by location) for gamma isotopic.
	D) 1 Control sample to be taken at a location at least 10 air miles from the site and not in the most prevalent wind directions. (1)	Continuous sampler operation with weekly collection.	Gross beta following filter change; quarterly composite (by location) for gamma isotopic.
II. Radioiodine	A) 3 indicator samples to be taken at two locations as given in I.A. above.	Continuous sampler operation with weekly canister collection.	Gamma isotopic for I-131 weekly.
	B) 1 indicator sample to be taken at the location as given in I.B. above.	Continuous sampler operation with weekly canister collection.	Gamma isotopic for I-131 weekly.
	C) 1 indicator sample to be taken at the location as given in I.C. above.	Continuous sampler operation with weekly canister collection.	Gamma isotopic for I-131 weekly.
	D) 1 Control sample to be taken at a location as given in I.D. above.	Continuous sampler operation with weekly canister collection.	Gamma isotopic for I-131 weekly.
III. Direct	A) 13 indicator stations with two or more dosimeters to form an inner ring of stations in the 13 accessible sectors within 1 to 2 miles of the plant.	Monthly or quarterly (3,5)	Gamma dose monthly or quarterly.
	B) 16 indicator stations with two or more dosimeters to form an outer ring of stations in the 16 accessible sectors within 3 to 5 miles of the plant.	Monthly or quarterly (3,5)	Gamma dose monthly or quarterly.
	C) 8 Stations with two or more dosimeters to be placed in special interest areas such as population centers, nearby residences, schools and in 2 or 3 areas to serve as control stations.	Monthly or quarterly (3,5)	Gamma dose monthly or quarterly.

Table 1.4-1 Radiological Environmental Monitoring Program
Virgil C. Summer Nuclear Station

Exposure Pathway and/or Sample	Minimum Number of Sample Locations and Criteria for Selection	Sampling and Collection Frequency	Type & Frequency of Analysis
WATERBORNE: IV Surface Water	A) 1 indicator sample downstream to be taken at a location which allows for mixing and dilution in the ultimate receiving river	Time composite samples with collection every month (corresponds to USGS continuous sampling site) (3)	Gamma isotopic monthly with quarterly composite (by location) or monthly sample to be analyzed for tritium (5)
	B) 1 Control sample to be taken at a location on the receiving river sufficiently far upstream such that no effects of pumped storage operation are anticipated	Time composite samples with collection every month (corresponds to USGS continuous sampling site) (3)	Gamma isotopic monthly with quarterly composite (by location) or monthly sample to be analyzed for tritium (5)
	C) 1 indicator sample from a location immediately upstream of the nearest downstream municipal water supply	Time composite samples with collection every month (corresponds to USGS continuous sampling site) (3)	Gamma isotopic monthly with quarterly composite (by location) or monthly sample to be analyzed for tritium (5)
	D) 1 indicator sample to be taken in the upper reservoir of the pumped storage facility in the plant discharge canal	Time composite samples with collection every month (corresponds to USGS continuous sampling site) (3)	Gamma isotopic monthly with quarterly composite (by location) or monthly sample to be analyzed for tritium (5)
	E) 1 indicator sample to be taken in the upper reservoir's non-fluctuating recreational area	Grab sampling monthly (3)	Gamma isotopic monthly with quarterly composite (by location) or monthly sample to be analyzed for tritium (5)
	F) 1 Control sample to be taken at a location on a separate unaffected watershed reservoir	Grab sampling monthly (3)	Gamma isotopic monthly with quarterly composite (by location) or monthly sample to be analyzed for tritium (5)
V Ground Water	A) 2 indicator samples to be taken within the exclusion boundary and in the direction of potentially affected ground water supplies	Quarterly grab sampling (5)	Gamma isotopic and tritium analyses quarterly (5)
	B) 1 Control sample from unaffected location	Quarterly grab sampling (5)	Gamma isotopic and tritium analyses quarterly (5)
VI Drinking Water	A) 1 indicator sample from a nearby public ground water supply source	Monthly grab sampling (3)	Monthly (3) gamma isotopic and gross beta analyses and quarterly (5) composite for tritium analyses.
	B) 1 indicator (finished water) sample from the nearest downstream water supply	Monthly composite sampling	Monthly (3) gamma isotopic and gross beta analyses and quarterly (5) composite for tritium analyses.
	C) 1 Control (finished water) sample from the nearest unaffected public water supply.	Monthly composite sampling	Monthly (3) gamma isotopic and gross beta analyses and quarterly (5) composite for tritium analyses.

Table 1.4-1 Radiological Environmental Monitoring Program
Virgil C. Summer Nuclear Station

Exposure Pathway and/or Sample	Minimum Number of Sample Locations and Criteria for Selection	Sampling and Collection Frequency	Type & Frequency of Analysis
INGESTION:			
VII. Milk(2)	A) Samples from milking animals in 3 locations within 5 km distance having the highest dose potential. If there are none then 1 sample from milking animals in each of 3 areas between 5 to 8 km distance where doses are calculated to be greater than 1 mrem per year.	Semi-monthly when animals are on pasture; (6) monthly other times (3)	Gamma isotopic and I-131 analysis semi-monthly (6) when animals are on pasture; monthly (3) at other times.
	B) 1 Control sample to be taken at the location of a dairy greater than 20 miles distance and not in the most prevalent wind direction (1)	Semi-monthly when animals are on pasture; (6) monthly other times (3)	Gamma isotopic and I-131 analysis semi-monthly (6) when animals are on pasture; monthly (3) at other times.
	C) 1 Indicator grass (forage) sample to be taken at one of the locations beyond but as close to the exclusion boundary as practicable where the highest offsite sectorial ground level concentrations are anticipated (1)	Monthly when available (3)	Gamma isotopic.
	D) 1 Indicator grass (forage) sample to be taken at the location of VII(A) above when animals are on pasture.	Monthly when available (3)	Gamma isotopic.
	E) 1 Control grass (forage) sample to be taken at the location of VII(B) above.	Monthly when available (3)	Gamma isotopic.
VIII. Food Products	A) 2 samples of broadleaf vegetation grown in the 2 nearest offsite location of highest calculated annual average ground level D/Q if milk sampling is not performed within 3 km or if milk sampling is not performed at a location within 5-10 km where the doses are calculated to be greater than 1 mrem/yr.	Monthly when available. (3)	Gamma isotopic on edible portion.
	B) 1 Control sample for the same foods taken at a location at least 10 miles distance and not in the most prevalent wind direction if milk sampling is not performed within 3 km or if milk sampling is not at a location within 5 to 8 km where doses are calculated to be greater than 1 mrem/yr.	Monthly when available (3)	Gamma isotopic on edible portion.
IX. Fish	A) 1 Indicator sample to be taken at a location in the upper reservoir.	Semiannual (7) collection of the following specie types if available: bass; bream, crappie; catfish, carp; forage fish (shad).	Gamma isotopic on edible portions semiannually.
	B) 1 Indicator sample to be taken at a location in the lower reservoir.	Semiannual (7) collection of the following specie types if available: bass; bream, crappie; catfish, carp; forage fish (shad).	Gamma isotopic on edible portions semiannually.
	C) 1 Indicator sample to be taken at a location in the upper reservoir's non-fluctuating recreational area.	Semiannual (7) collection of the following specie types if available: bass; bream, crappie; catfish, carp; forage fish (shad).	Gamma isotopic on edible portions semiannually.

Table 1.4-1 Radiological Environmental Monitoring Program
Virgil C. Summer Nuclear Station

Exposure Pathway and/or Sample	Minimum Number of Sample Locations and Criteria for Selection	Sampling and Collection Frequency	Type & Frequency of Analysis
IX Fish (continued)	D) 1 Control sample to be taken at a location on the receiving river sufficiently far upstream such that no effects of pumped storage operation are anticipated.	Semiannual(7) collection of the following specie types if available: bass; bream; crappie; catfish; carp; forage fish (shad).	Gamma isotopic on edible portions semiannually.
AQUATIC: X Sediment	A) 1 Indicator sample to be taken at a location in the upper reservoir.	Semiannual grab sample (7)	Gamma isotopic.
	B) 1 Indicator sample to be taken at a location in the upper reservoir's non-fluctuating recreational area.	Semiannual grab sample (7)	Gamma isotopic.
	C) 1 Indicator sample to be taken on the shoreline of the lower reservoir.	Semiannual grab sample (7)	Gamma isotopic.
	D) 1 Control sample to be taken at a location on the receiving river sufficiently far upstream such that no effects of pumped storage operation are anticipated.	Semiannual grab sample (7)	Gamma isotopic.

NOTES

1. Sample site locations are based on the meteorological analysis for the period of record as presented in Chapters 5 and 6 of the OLER.

2. Milking animal and garden survey results will be analyzed annually. Should the survey indicate new dairying activity, the owners shall be contacted with regard to a contract for supplying sufficient samples. If contractual arrangements can be made, site(s) will be added for additional milk sampling up to a total of 3 indicator locations.

3. Not to exceed 35 days.

4. Time composite samples are samples which are collected with equipment capable of collecting an aliquot at time intervals which are short (e.g., hourly) relative to the compositing period.

5. At least once per 100 days.

6. At least once per 18 days.

7. At least once per 200 days.

NOTE: Deviations from this sampling schedule may occasionally be necessary if sample media are unobtainable due to hazardous conditions, seasonal unavailability, insufficient sample size, malfunctions of automatic sampling or analysis equipment and other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunction, every effort shall be made to complete corrective action prior to the end of the next sampling period. Deviations from sampling-analysis schedules will be described in the annual report.

TABLE 1.4-2

Reporting Levels for Radioactivity Concentrations in Environmental Samples
Reporting Levels

Analysis	Water (pCi/l)	Airborne Particulate or Gases(pCi/m3)	Fish (pCi/kg, wet)	Milk (pCi/l)	Food Products (pCi/Kg, wet)
H-3	20,000(a)	N.A.	N.A.	N.A.	N.A.
Mn-54	1,000	N.A.	30,000	N.A.	N.A.
Fe-59	400	N.A.	10,000	N.A.	N.A.
Co-58	1,000	N.A.	30,000	N.A.	N.A.
Co-60	300	N.A.	10,000	N.A.	N.A.
Zn-65	300	N.A.	20,000	N.A.	N.A.
Zr-95	400	N.A.	N.A.	N.A.	N.A.
Nb-95	400	N.A.	N.A.	N.A.	N.A.
I-131	2	0.9	N.A.	3	100
Cs-134	30	10	1,000	60	1,000
Cs-137	50	20	2,000	70	2,000
Ba-140	200	N.A.	N.A.	300	N.A.
La-140	200	N.A.	N.A.	300	N.A.

(a) For drinking water samples. This is the 40 CFR Part 141 value.

TABLE 1.4-3

Maximum Values for the Lower Limits of Detection (LLD)[a,c]
Reporting Levels

Analysis	Water (pCi/l)	Airborne Particulate or Gases(pCi/m^3)	Fish (pCi/kg, wet)	Milk (pCi/l)	Food Products (pCi/Kg, wet)	Sediment (pCi/Kg, dry)
Gross Beta	4	1 X 10^{-2}	N.A.	N.A.	N.A.	N.A.
H-3	2000[b]	N.A.	N.A.	N.A.	N.A.	N.A.
Mn-54	15	N.A.	130	N.A.	N.A.	N.A.
Fe-59	30	N.A.	260	N.A.	N.A.	N.A.
Co-58	15	N.A.	130	N.A.	N.A.	N.A.
Co-60	15	N.A.	130	N.A.	N.A.	N.A.
Zn-65	30	N.A.	260	N.A.	N.A.	N.A.
Zr-95	30	N.A.	N.A.	N.A.	N.A.	N.A.
Nb-95	15	N.A.	N.A.	N.A.	N.A.	N.A.
I-131	1[b]	7 X 10^{-2}	N.A.	1	60	N.A
Cs-134	15	5 X 10^{-2}	130	15	60	150
Cs-137	18	6 X 10^{-2}	150	18	80	180
Ba-140	60	N.A.	N.A.	60	N.A.	N.A.
La-140	15	N.A.	N.A.	15	N.A.	N.A.

TABLE 1.4-3 (Continued)

TABLE NOTATION

a. Table 1.4-3 lists detection capabilities for radioactive materials in environmental samples. These detection capabilities are tabulated in terms of the lower limits of detection (LLDs). See Table 1.1-4 notation (a) for definition of LLD.

b. LLD for drinking water samples.

c. Other peaks potentialiy due to reactor operations (fission and activation products) which are measurable and identifiable, together with the radionuclides in Table 1.4-3, shall be identified and reported.

1.4.2 Land Use Census

LIMITING CONDITION FOR OPERATION

1.4.2.1 A land use census shall be conducted and shall identify the location of the nearest milk animal, the nearest residence and the nearest garden* of greater than 500 square feet producing fresh leafy vegetables in each of the 16 meteorological sectors within a distance of five miles.

APPLICABILITY: At all times.

ACTION:

a. With a land use census identifying a location(s) which yields a calculated dose or dose commitment greater than the values currently being calculated in ODCM Specification 1.2.4.2, in lieu of any other report required by ODCM Section 1.6, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2, a Special Report which identifies the new location(s).

b. With a land use census identifying a location(s) which yields a calculated dose or dose commitment (via the same exposure pathway) 20 percent greater than at a location from which samples are currently being obtained in accordance with ODCM Specification 1.4.1.1, in lieu of any other report required by ODCM Section 1.6, prepare and submit to the Commission with in 30 days, pursuant to Technical Specification 6.9.2, a Special Report which identifies the new location. The new location shall be added to the radiological environmental monitoring program within 30 days. The sampling location, excluding the control station location, having the lowest

c. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

*Broad leaf vegetation sampling may be performed at the site boundary in the direction sector with the highest D/Q in lieu of the garden census.

calculated dose or dose commitment (via the same exposure pathway) may be deleted from this monitoring program after October 31 of the year in which this land use census was conducted.

SURVEILLANCE REQUIREMENTS

1.4.2.2 The land use census shall be conducted at least once per 12 months between the dates of June 1 and October 1 using that information which will provide the best results, such as by a door-to-door survey, aerial survey, or by consulting local agriculture authorities.

1.4.3 Interlaboratory Comparison Program

LIMITING CONDITION FOR OPERATION

1.4.3.1 Analyses shall be performed on radioactive materials supplied as part of an Interlaboratory Comparison Program which has been approved by the Commission.

APPLICABILITY: At all times.

ACTION:

a. With analyses not being performed as required above, report the corrective actions taken to prevent a recurrence to the Commission in the Annual Radiological Environmental Operating Report.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

1.4.3.2 A summary of the results obtained as part of the above required Interlaboratory Comparison Program shall be included in the Annual Radiological Environmental Operating Report (participants in the EPA crosscheck program shall provide the EPA program code designation for the unit).

1.5 BASES

B/1.1 LIQUID EFFLUENTS

B/1.1.1 Radioactive Liquid Effluent Monitoring Instrumentation

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The alarm/trip setpoints for these instruments shall be calculated in accordance with the procedures in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63 and 64 of Appendix A to 10CFR Part 50.

B/1.1.2 Concentration

This specification is provided to ensure that concentration of radioactive materials released in liquid waste effluents from the site will be less than the concentration levels specified in 10 CFR Part 20, Appendix B, Table II, Column 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water outside the site will result in exposures within:

(1) the Section II.A design objectives of Appendix I, 10 CFR 50, to an individual, and

(2) the limits of 10 CFR 20. 106 (e) to the population.

The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-135 the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

B/1.1.3 Dose

This specification is provided to implement the requirements of Sections II.A, III.A and IV.A of Appendix I, 10 CFR Part 50. The Limiting Condition for Operation implements the guides set forth in Section II.A. of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents will be kept "as low as is reasonably achievable." Also, for fresh water sites with drinking water supplies which can be potentially affected by plant operations, there is reasonable assurance that the operation of the facility will not result in radionuclide concentrations in the finished drinking water that are in excess of the requirements of 40 CFR 141. The dose calculations in the ODCM implement the requirements in Section III.A of Appendix I that conformance with guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants", section 4.3. NUREG-0133 implements Regulatory Guide 1.109, Revision 1, October 1977 (section C.1 and Appendix A) and Regulatory Guide 1.113, April 1977. Regulatory Guide 1.109, October

1977, is titled "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I". Regulatory Guide 1.113, April 1977, is titled "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I".

B/1.1.4 Liquid Waste Treatment

The OPERABILITY of the liquid radwaste treatment system ensures that this system will be available for use whenever liquid effluents require treatment prior to release to the environment. The requirement that the appropriate portions of this system be used when specified provides assurance that the releases of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable." This specification implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50 and the design objective given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the liquid radwaste treatment system were specified as a suitable fraction of the dose design objectives set forth in Section II.A of Appendix I, 10 CFR Part 50, for liquid effluents.

B/1.2 GASEOUS EFFLUENTS

B/1.2.1 Radioactive Gaseous Effluent Monitoring Instrumentation

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The alarm/trip setpoints for these instruments shall be calculated in accordance with the procedures in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63 and 64 of Appendix A to 10 CFR Part 50.

B/1.2.2 Dose Rate

This specification is provided to ensure that the dose at any time at the site boundary from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 for unrestricted areas. The annual dose limits are the doses associated with the concentration of 10 CFR Part 20, Appendix B, Table II, Column 1. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of an individual in an unrestricted area, either within or outside the site boundary, to annual average concentrations exceeding the limits specified in Appendix B, Table II of 10 CFR Part 20 (10 CFR Part 20. 106 (b)). For individuals who may at times be within the site boundary,the occupancy of the individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the site boundary. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to an individual at or beyond the site boundary to less than or equal to 500 mrem/year to the total body or to less than or equal 3000 mrem/year to the skin. These release rate

limits also restrict, at all times, the corresponding thyroid dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrem/year.

B/1.2.3 Dose - Noble Gases

This specification is provided to implement the requirements of Sections II.B, IIIA and IV.A of Appendix I, 10 CFR Part 50. The Limiting Condition for Operation implements the guides set forth in Section II.B of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in gaseous effluents will be kept "as low as is reasonably achievable". The Surveillance Requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The dose calculations established in the ODCM for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents are consistent with the methodology provided in NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants", section 5.3. NUREG-0133 implements Regulatory Guide 1.109, Revision 1, October 1977 and Regulatory Guide 1.111, Revision 1, July 1977. Regulatory Guide 1.109 is entitled "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I, "Revision 1, October 1977 and Regulatory Guide 1.111 is entitled "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors, "Revision 1, July 1977. The ODCM equations provided for determining the air doses at the site boundary are based upon the historical average atmospheric conditions.

B/1.2.4 Dose-Radioiodines, Tritium and Radioactive Materials in Particulate Form

This specification is provided to implement the requirements of Sections II.C, III.A and IV.A of Appendix I, 10 CFR Part 50. The Limiting Conditions for Operation are the guides set forth in Section II.C of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A Appendix I to assure that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." The ODCM calculational methods specified in the Surveillance Requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of an individual through appropriate pathways in unlikely to be substantially underestimated. The ODCM calculational methods for calculating the doses due to the actual release rates of the subject materials are consistent with the methodology provided in NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants", section 5.3. NUREG-0133 implements Regulatory Guide 1.109, Revision 1, October 1977 and Regulatory Guide 1.111, Revision 1, July 1977. Regulatory Guide 1.109 is entitled "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I, "Revision 1, October 1977 and Regulatory Guide 1.111 is entitled

"Methods for Estimating Atmospheric Transport and Dispersion of of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors, "Revision 1, July 1977. These equations also provide for determining the actual doses based upon the historical average atmospheric conditions. The release rate specifications for radioiodines, tritium, and radioactive materials in particulate form are dependent on the existing radionuclide pathways to man, in the unrestricted area. The pathways which were examined in the development of these calculations were: 1) individual inhalation of airborne radionuclides, 2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, 3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, and 4) deposition on the ground with subsequent exposure of man.

B/1.2.5 Gaseous Radwaste Treatment

The OPERABILITY of the GASEOUS RADWASTE TREATMENT SYSTEM and the VENTILATION EXHAUST TREATMENT SYSTEM ensures that the systems will be available for use whenever gaseous effluents require treatment prior to release to the environment. The requirement that the appropriate portions of these systems be used, when specified, provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable". This specification implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and the design objectives given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the dose design objectives set forth in Sections II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents.

B/1.3 RADIOACTIVE EFFLUENTS: TOTAL DOSE

The specification is provided to meet the dose limitations of 40 CFR 190. The specification requires the preparation and submittal of a Special Report whenever the calculated doses from plant radioactive effluents exceed twice the design objective doses of Appendix I. For sites containing up to 4 reactors, it is highly unlikely that the resultant dose to a member of the public will exceed the dose limits of 40 CFR 190 if the individual reactors remain within the reporting requirement level. The Special Report will describe a course of action which should result in the limitation of dose to a member of the public for 12 consecutive months to within the 40 CFR 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to the member of the public from other uranium fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 5 miles must be considered. If the dose to any member of the public is estimated to exceed the requirements of 40 CFR 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR 190 have not already been corrected), in accordance with the provisions of 40 CFR 190.11, is considered to be a timely request and fulfills the requirements of 40 CFR 190 until NRC staff action is completed. An individual is not considered a member of the public during any period in which he/she is engaged in carrying out any operation which is part of the nuclear fuel cycle.

B/1.4.1 Monitoring Program

The radiological monitoring program required by this specification provides measurements of radiation of radioactive materials in those exposure pathways and for those radionuclides, which lead to the highest potential radiation exposures of individuals resulting from the station operation. This monitoring program thereby supplements the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and modeling of the environmental exposure pathways. The initially specified monitoring program will be effective for at least the first three years of commercial operation. Following this period, program changes may be initiated based on operational experience.

The detection capabilities required by Table 1.4-3 are state-of-the-art for routine environmental measurements in industrial laboratories. It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as a posteriori (after the fact) limit for a particular measurement. Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors will be identified and described in the Annual Radiological Environmental Operating Report.

B/1.4.2 Land Use Census

This specification is provided to ensure that changes in the use of unrestricted areas are identified and that modifications to the monitoring program are made if required by the results of this census. The best survey information from the door-to-door, aerial or consulting with local agricultural authorities shall be used. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50. Restricting the census to gardens of greater than 500 square feet provides assurance that significant exposure pathways via leafy vegetables will be identified and monitored since a garden of this size is the minimum required to produce the quantity (26 kg/year) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption by a child. To determine this minimum garden size, the following assumptions were used, 1) that 20% of the garden was used for growing broad leaf vegetation (i.e., similar to lettuce and cabbage), and 2) a vegetation yield of 2 kg/square meter.

B/1.4.3 Interlaboratory Comparison Program

The requirement for participation in an Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring in order to demonstrate that the results are reasonably valid.

1.6 REPORTING REQUIREMENTS

1.6.1 Annual Radiological Environmental Operating Report

1.6.1.1 Routine radiological environmental operating reports covering the operation of the unit during the previous calendar year shall be submitted prior to May 1 of each year. The initial report shall be submitted prior to May 1 of the year following initial criticality.

1.6.1.2 The annual radiological environmental operating reports shall include summaries, interpretations, and an analysis of trends of the results of the radiological environmental surveillance activities for the report period, including a comparison with preoperational studies, operational controls (as appropriate), and previous environmental surveillance reports and an assessment of the observed impacts of the plant operation on the environment. The reports shall also include the results of land use censuses required by ODCM Specification 1.4.2.1. If harmful effects or evidence of irreversible damage are detected by the monitoring, the report shall provide an analysis of the problem and a planned course of action to alleviate the problem.

The annual radiological environmental operating reports shall include summarized and tabulated results in the format of Regulatory Guide 4.8, December 1975 of all radiological environmental samples taken during the report period. In the event that some results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for missing results. The missing data shall be submitted as soon as possible in a supplementary report.

The report shall also include the following: a summary description of the radiological environmental monitoring program; a map of all sampling locations keyed to a table giving distances and directions from one reactor; and the results of licensee participation in the Interlaboratory Comparison Program, required by ODCM Specification 1.4.3.1.

1.6.2 Semiannual Radioactive Effluent Release Report

1.6.2.1 Routine radioactive effluent release reports covering the operation of the unit during the previous 6 months of operation shall be submitted within 60 days after January 1 and July 1 of each year. The period of the first report shall begin with the date of initial criticality.

1.6.2.2 The radioactive effluent release reports shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit as outlined in Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants", Revision 1, June 1974, with data summarized on a quarterly basis following the format of Appendix B thereof.

The radioactive effluent release report to be submitted within 60 days after January 1 of each year shall include an annual summary of hourly meteorological data collected over the previous year. This annual summary may be either in the form of an hour-by-hour listing of wind speed, wind direction, and atmospheric stability, and precipitation (if measured) on magnetic tape, or in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability. This same report shall include an assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from the unit or station during the previous calendar year. This same report shall also include an assessment of the radiation doses from radioactive liquid and gaseous effluents to members of the public due to their activities inside the site boundary (Figures 5.1-3 and 5.1-4 of the VCSNS Technical Specifications) during the year. All assumptions used in making these assessments (i.e., specific activity, exposure time and location) shall be included in these reports. Historical annual average meteorology or meteorological conditions concurrent with the time of release of radioactive materials in gaseous effluents (as determined by sampling frequency and measurement) shall be used for determining the gaseous pathway doses. The assessment of radiation doses shall be performed in accordance with the OFFSITE DOSE CALCULATION MANUAL (ODCM).

The radioactive effluent release report to be submitted within 60 days after January 1 of each year shall also include an assessment of radiation doses to the likely most exposed member of the public from reactor releases and other nearby uranium fuel cycle sources (including doses from primary effluent pathways and direct radiation) for the previous 12 consecutive months to show conformance with 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operation. Acceptable methods for calculating the dose contribution from liquid and gaseous effluents are given in Regulatory Guide 1.109, Rev. 1.

The radioactive effluent release reports shall include unplanned releases from site to unrestricted areas of radioactive materials in gaseous and liquid effluents on a quarterly basis.

1.6.3 Changes to the ODCM

1.6.3.1 Licensee initiated changes to ODCM:

1. Shall be submitted to the Commission in the Monthly Operating Report within 90 days of the date the change(s) was made effective. This submittal shall contain:

   a. Sufficiently detailed information to totally support the rationale for the change without benefit of additional or supplemental information. Information submitted should consist of a package of these pages of the ODCM to be changed with each page numbered and provided with an approval and date box, together with appropriate analyses or evaluations justifying the change(s);

   b. A determination that the change will not reduce the accuracy or reliability of dose calculations or setpoint determinations; and

   c. Documentation of the fact that the change has been reviewed and found acceptable by the PSRC.

2. Shall become effective upon review and acceptance as set forth in Technical Specification 6.5.

1.6.4 Major Changes To Radioactive Waste Treatment Systems (Liquid and Gaseous)

1.6.4.1 Licensee initiated major changes to the radioactive waste systems (liquid and gaseous):

1. Shall be reported to the Commission in the Monthly Operating Report for the period in which the evaluation was reviewed by the Plant Safety Review Committee. The discussion of each change shall contain:

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

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

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

   d. An evaluation of the change which shows the predicted releases or radioactive materials in liquid and gaseous effluents that differs from those previously predicted in the license application and amendments thereto;

   e. An evaluation of the change which shows the expected maximum exposures to individual in the unrestricted area and to the general population that differ from those previously estimated in the license application and amendments thereto;

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

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

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

2. Shall become effective upon review and acceptance as set forth in Technical Specification 6.5.

1.7 Definitions

ACTION

1.7.1 ACTION shall be that part of a specification which prescribes measures required under designated conditions.

ANALOG CHANNEL OPERATIONAL TEST

1.7.2 An ANALOG CHANNEL OPERATIONAL TEST shall be the injection of a simulated signal into the channel as close to the sensor as practicable to verify OPERABILITY of alarm, interlock and/or trip functions. The ANALOG CHANNEL OPERATIONAL TEST shall include adjustments, as necessary, of the alarm, interlock and/or trip setpoints such that the setpoints are within the required range and accuracy.

CHANNEL CALIBRATION

1.7.3 A CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel such that it responds within the required range and accuracy to known values of input. The CHANNEL CALIBRATION shall encompass the entire channel including the sensors and alarm, interlock and/or trip functions, and may be performed by any series of sequential, overlapping or total channel steps such that the entire channel is calibrated.

CHANNEL CHECK

1.7.4 A CHANNEL CHECKS shall be the qualitative assessment of channel behavior during operation by observation. This determination shall include, where possible, comparison of the channel indication and/or status with other indications and/or status derived from independent instrument channels measuring the same parameter.

GASEOUS RADWASTE TREATMENT SYSTEM

1.7.5 A GASEOUS RADWASTE TREATMENT SYSTEM is any system designed and installed to reduce radioactive gaseous effluents by collecting primary coolant system off gases from the primary system and providing for delay or holdup for the purpose of reducing the total radioactivity prior to release to the environment.

OPERABLE - OPERABILITY

1.7.6 A system, subsystem, train, component or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified function(s), and when all necessary attendant instrumentation, controls, electrical power, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component or device to perform its function(s) are also capable of performing their related support function(s).

SOURCE CHECK

1.7.7 A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to a radioactive source.

VENTILATION EXHAUST TREATMENT SYSTEM

1.7.8 A VENTILATION EXHAUST TREATMENT SYSTEM is any system designed and installed to reduce gaseous radioiodine or radioactive material in particulate form in effluents by passing ventilation or vent exhaust gases through charcoal absorbers and/or HEPA filters for the purpose of removing iodines or particulates from the gaseous exhaust stream prior to the release to the environment (such a system is not considered to have any effect on noble gas effluents). Engineered Safety Feature (ESF) atmospheric cleanup systems are not considered to be VENTILATION EXHAUST TREATMENT SYSTEM components.

If A < 1, No release may be made. Reevaluate the alternatives presented in Step 3.

NOTE: If calculated setpoint values are near actual concentrations planned for release, it may be impractical to set the monitor alarm at this value. In this case a new setpoint may be calculated following the remedial methodology presented in Step 3 for the case of $f_t < f_{dx}$.

Within the limits of the conditions stated above, the specific monitor setpoint concentrations for the three liquid radiation monitors RM-L5, RM-L7, and RM-L9 are determined as follows:

2.1.2.1 RM-L5, Waste Monitor Tank Discharge Line Monitor:

$$C_M \leq \left| \sum_g C_g \right|_M (A) \qquad (11)$$

C_M is in uCi/ml

*See GENERAL NOTE under 2.1.

2.1.2.2 RM-L7, Nuclear Blowdown Monitor Tank Discharge Line Monitor:

$$C_B \leq \left| \sum_g C_g \right|_B (A) \qquad (12)$$

C_B is in uCi/ml

NOTE: In no case should discharge be made directly from the Nuclear Blowdown Holdup Tank to the penstocks.

*See GENERAL NOTE under 2.1.

In reality, all of these effluent pathways utilize the circulating water as dilution to the effluent stream, with the circulating water discharge canal being the point of release into an unrestricted area. However, to compensate for uncertainties in the transit times of activity discharge to the Industrial and Sanitary Waste System, discharges to that system will not be credited with dilution for the purpose of monitor setpoint calculations.

The Turbine Building Sump and Condensate Demineralizer Backwash Effluents enter Circulating Water via the sumps and ponds of the Industrial and Sanitary Waste System. Steam Generator Blowdown Effluent may be released to the Circulating Water either directly in the Condenser outflow (the normal flow path) or in the first hours following startup via the Industrial and Sanitary Waste System for chemical reasons.

For the sake of clarity, two mutually exclusive setpoint calculation processes are outlined below. Section 2.1.4.1 is to be used whenever Steam Generator Blowdown is being released directly to the Circulating Water in the Condenser outflow, which is the normal mode. Section 2.1.4.2 is to be used whenever Steam Generator Blowdown is being released to the Industrial and Sanitary Waste System, or diverted to the Nuclear Blowdown Processing System, both of which are alternate modes. Each section covers all four monitors (RM-L3, RM-L8, RM-L10 and RM-L11).

Normally, water collected by the Nuclear Blowdown Processing System has very low specific activity. This water may be processed to the Turbine Building sump.

NOTE: When Circulating Water is unavailable for effluent dilution, releases containing activity above LLD should be discouraged via pathways which lead to it. Steam Generator Blowdown should be diverted to the Nuclear Blowdown Processing System. Condensate Demineralizer Backwash may be diverted to the Turbine Building Sump or not released. Turbine Building Sump effluent should be diverted to the Excess Liquid Waste Processing System. (These steps are to keep the calculated dose to individuals as low as reasonably achievable.) Furthermore, sampling and analysis of the Industrial and Sanitary Waste System is to be initiated and the measured concentrations used in the dose calculations of Section 2.2.

TABLE 2.2-2

ADULT INGESTION DOSE FACTORS*
(mrem/pCi ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07
C-14	2.84E-06	5.68E-07	5.68E-07	5.68E-07	5.68E-07	5.68E-07	5.68E-07
†F-18	6.24E-07	NO DATA	6.92E-08	NO DATA	NO DATA	NO DATA	1.85E-08
NA-24	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.07E-06	1.70E-06
P-32	1.93E-04	1.20E-05	7.46E-06	NO DATA	NO DATA	NO DATA	2.17E-05
CR-51	NO DATA	NO DATA	2.66E-09	1.59E-09	5.86E-10	3.53E-09	6.69E-07
MN-54	NO DATA	4.57E-06	8.72E-07	NO DATA	1.36E-06	NO DATA	1.40E-05
MN-56	NO DATA	1.15E-07	2.04E-08	NO DATA	1.46E-07	NO DATA	3.67E-06
FE-55	2.75E-06	1.90E-06	4.43E-07	NO DATA	NO DATA	1.06E-06	1.09E-06
FE-59	4.34E-06	1.02E-05	3.91E-06	NO DATA	NO DATA	2.85E-06	3.40E-05
†CO-57	NO DATA	1.75E-07	2.91E-07	NO DATA	NO DATA	NO DATA	4.44E-06
CO-58	NO DATA	7.45E-07	1.67E-06	NO DATA	NO DATA	NO DATA	1.51E-05
CO-60	NO DATA	2.14E-06	4.72E-06	NO DATA	NO DATA	NO DATA	4.02E-05
NI-63	1.30E-04	9.01E-06	4.36E-06	NO DATA	NO DATA	NO DATA	1.88E-06
NI-65	5.28E-07	6.86E-08	3.13E-08	NO DATA	NO DATA	NO DATA	1.74E-06
CU-64	NO DATA	8.33E-08	3.91E-08	NO DATA	2.10E-07	NO DATA	7.10E-06
ZN-65	4.84E-06	1.54E-05	6.76E-06	NO DATA	1.03E-05	NO DATA	9.70E-06
ZN-69	1.03E-08	1.97E-08	1.37E-09	NO DATA	1.28E-08	NO DATA	2.96E-09
†BR-82	NO DATA	NO DATA	2.26E-06	NO DATA	NO DATA	NO DATA	2.59E-06
BR-83	NO DATA	NO DATA	4.02E-08	NO DATA	NO DATA	NO DATA	5.79E-08
BR-84	NO DATA	NO DATA	5.21E-08	NO DATA	NO DATA	NO DATA	4.09E-13
BR-85	NO DATA	NO DATA	2.14E-09	NO DATA	NO DATA	NO DATA	LT E-24**
RB-86	NO DATA	2.11E-05	9.83E-06	NO DATA	NO DATA	NO DATA	4.16E-06
RB-88	NO DATA	6.05E-08	3.21E-08	NO DATA	NO DATA	NO DATA	8.36E-19
RB-89	NO DATA	4.01E-08	2.82E-08	NO DATA	NO DATA	NO DATA	2.33E-21
SR-89	3.08E-04	NO DATA	8.84E-06	NO DATA	NO DATA	NO DATA	4.94E-05
SR-90	7.58E-03	NO DATA	1.86E-03	NO DATA	NO DATA	NO DATA	2.19E-04
SR-91	5.67E-06	NO DATA	2.29E-07	NO DATA	NO DATA	NO DATA	2.70E-05
SR-92	2.15E-06	NO DATA	9.30E-08	NO DATA	NO DATA	NO DATA	4.26E-05
Y-90	9.62E-09	NO DATA	2.58E-10	NO DATA	NO DATA	NO DATA	1.02E-04
Y-91M	9.09E-11	NO DATA	3.52E-12	NO DATA	NO DATA	NO DATA	2.67E-10
Y-91	1.41E-07	NO DATA	3.77E-09	NO DATA	NO DATA	NO DATA	7.76E-05
Y-92	8.45E-10	NO DATA	2.47E-11	NO DATA	NO DATA	NO DATA	1.48E-05
Y-93	2.68E-09	NO DATA	7.40E-11	NO DATA	NO DATA	NO DATA	8.50E-05
ZR-95	3.04E-08	9.75E-09	6.60E-09	NO DATA	1.53E-08	NO DATA	3.09E-05
ZR-97	1.68E-09	3.39E-10	1.55E-10	NO DATA	5.12E-10	NO DATA	1.05E-04
NB-95	6.22E-09	3.46E-09	1.86E-09	NO DATA	3.42E-09	NO DATA	2.10E-05
MO-99	NO DATA	4.31E-06	8.20E-07	NO DATA	9.76E-06	NO DATA	9.99E-06

†Values taken from Reference 13, Table 4.
*Values in Table 2.2-2 are taken from Reference 3, Table E-11.
**Less than E-24.

TABLE 2.2-2 (continued)

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NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
TC-99M	2.47E-10	6.98E-10	8.89E-09	NO DATA	1.06E-08	3.42E-10	4.13E-07
TC-101	2.54E-10	3.66E-10	3.59E-09	NO DATA	6.59E-09	1.87E-10	1.10E-21
RU-103	1.85E-07	NO DATA	7.97E-08	NO DATA	7.06E-07	NO DATA	2.16E-05
RU-105	1.54E-08	NO DATA	6.08E-07	NO DATA	1.99E-07	NO DATA	9.42E-06
RU-106	2.75E-06	NO DATA	3.48E-07	NO DATA	5.31E-06	NO DATA	1.78E-04
AG-110M	1.60E-07	1.48E-07	8.79E-08	NO DATA	2.91E-07	NO DATA	8.64E-05
†SB-124	2.80E-06	5.29E-08	1.11E-06	6.79E-09	NO DATA	2.18E-06	7.95E-05
†SB-125	1.79E-06	2.00E-08	4.26E-07	1.82E-09	NO DATA	1.38E-06	1.97E-05
†SB-126	1.15E-06	2.34E-08	4.15E-07	7.04E-09	NO DATA	7.05E-07	9.40E-05
TE-125M	2.68E-06	9.71E-07	3.59E-07	8.06E-07	1.09E-05	NO DATA	1.07E-05
TE-127M	6.77E-06	2.42E-06	8.25E-07	1.73E-06	2.75E-05	NO DATA	2.27E-05
TE-127	1.10E-07	3.95E-08	2.38E-08	8.15E-08	4.48E-07	NO DATA	8.68E-06
TE-129M	1.15E-05	4.29E-06	1.82E-06	3.95E-06	4.80E-05	NO DATA	5.79E-05
TE-129	3.14E-08	1.18E-08	7.65E-09	2.41E-08	1.32E-07	NO DATA	2.37E-08
TE-131M	1.73E-06	8.46E-07	7.05E-07	1.34E-06	8.57E-06	NO DATA	8.40E-05
TE-131	1.97E-08	8.23E-09	6.22E-09	1.62E-08	8.63E-08	NO DATA	2.79E-09
TE-132	2.52E-06	1.63E-06	1.53E-06	1.80E-06	1.57E-05	NO DATA	7.71E-05
I-130	7.56E-06	2.23E-06	8.80E-07	1.89E-04	3.48E-06	NO DATA	1.92E-06
I-131	4.16E-06	5.95E-06	3.41E-06	1.95E-03	1.02E-05	NO DATA	1.57E-06
I-132	2.03E-07	5.43E-07	1.90E-07	1.90E-05	8.65E-07	NO DATA	1.02E-07
I-133	1.42E-06	2.47E-06	7.53E-07	3.63E-04	4.31E-06	NO DATA	2.22E-06
I-134	1.06E-07	2.88E-07	1.03E-07	4.99E-06	4.58E-07	NO DATA	2.51E-10
I-135	4.43E-07	1.16E-06	4.28E-07	7.65E-05	1.86E-06	NO DATA	1.31E-06
CS-134	6.22E-05	1.48E-04	1.21E-04	NO DATA	4.79E-05	1.59E-05	2.59E-06
CS-136	6.51E-06	2.57E-05	1.85E-05	NO DATA	1.43E-05	1.96E-06	2.92E-06
CS-137	7.97E-05	1.09E-04	7.14E-05	NO DATA	3.70E-05	1.23E-05	2.11E-06
CS-138	5.52E-08	1.09E-07	5.40E-08	NO DATA	8.01E-08	7.91E-09	4.65E-13
BA-139	9.70E-08	6.91E-11	2.84E-09	NO DATA	6.46E-11	3.92E-11	1.72E-07
BA-140	2.03E-05	2.55E-08	1.33E-06	NO DATA	8.67E-09	1.46E-08	4.18E-05
BA-141	4.71E-08	3.56E-11	1.59E-09	NO DATA	3.31E-11	2.02E-11	2.22E-17
BA-142	2.13E-08	2.19E-11	1.34E-09	NO DATA	1.85E-11	1.24E-11	3.00E-26
LA-140	2.50E-09	1.26E-09	3.33E-10	NO DATA	NO DATA	NO DATA	9.25E-05
LA-142	1.28E-10	5.82E-11	1.45E-11	NO DATA	NO DATA	NO DATA	4.25E-07
CE-141	9.36E-09	6.33E-09	7.18E-10	NO DATA	2.94E-09	NO DATA	2.42E-05
CE-143	1.65E-09	1.22E-06	1.35E-10	NO DATA	5.37E-10	NO DATA	4.56E-05
CE-144	4.88E-07	2.04E-07	2.62E-08	NO DATA	1.21E-07	NO DATA	1.65E-04
PR-143	9.20E-09	3.69E-09	4.56E-10	NO DATA	2.13E-09	NO DATA	4.03E-05
PR-144	3.01E-11	1.25E-11	1.53E-12	NO DATA	7.05E-12	NO DATA	4.33E-18
ND-147	6.29E-09	7.27E-09	4.35E-10	NO DATA	4.25E-09	NO DATA	3.49E-05
W-187	1.03E-07	8.61E-08	3.01E-08	NO DATA	NO DATA	NO DATA	2.82E-05
NP-239	1.19E-09	1.17E-10	6.45E-11	NO DATA	3.65E-10	NO DATA	2.40E-05

TABLE 2.2-3
SITE RELATED INGESTION
DOSE COMMITMENT FACTOR, A_{it}*
(mrem/hr per μCi/ml)
Page 1 of 2

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	8.96E + 00	8.96E + 00	8.96E + 00	8.96E + 00	8.96E + 00	8.96E + 00
C-14	3.15E + 04	6.30E + 03	6.30E + 03	6.30E + 03	6.30E + 03	6.30E + 03	6.30E + 03
F-18	6.69E + 01	NO DATA	7.42E + 00	NO DATA	NO DATA	NO DATA	1.98E + 00
NA-24	5.48E + 02	5.48E + 02	5.48E + 02	5.48E + 02	5.48E + 02	5.48E + 02	5.48E + 02
P-32	4.62E + 07	2.87E + 06	1.79E + 06	NO DATA	NO DATA	NO DATA	5.20E + 06
CR-51	NO DATA	NO DATA	1.49E + 00	8.94E-01	3.29E-01	1.98E + 00	3.76E + 02
MN-54	NO DATA	4.76E + 03	9.08E + 02	NO DATA	1.42E + 03	NO DATA	1.46E + 04
MN-56	NO DATA	1.20E + 02	2.12E + 01	NO DATA	1.52E + 02	NO DATA	3.82E + 03
FE-55	8.87E + 02	6.13E + 02	1.43E + 02	NO DATA	NO DATA	3.42E + 02	3.52E + 02
FE-59	1.40E + 03	3.29E + 03	1.26E + 03	NO DATA	NO DATA	9.19E + 02	1.10E + 04
CO-57	NO DATA	3.55E + 01	5.91E + 01	NO DATA	NO DATA	NO DATA	9.01E + 02
CO-58	NO DATA	1.51E + 02	3.39E + 02	NO DATA	NO DATA	NO DATA	3.06E + 03
CO-60	NO DATA	4.34E + 02	9.58E + 02	NO DATA	NO DATA	NO DATA	8.16E + 03
NI-63	4.19E + 04	2.91E + 03	1.41E + 03	NO DATA	NO DATA	NO DATA	6.07E + 02
NI-65	1.70E + 02	2.21E + 01	1.01E + 01	NO DATA	NO DATA	NO DATA	5.61E + 02
CU-64	NO DATA	1.69E + 01	7.93E + 00	NO DATA	4.26E + 01	NO DATA	1.44E + 03
ZN-65	2.36E + 04	7.50E + 04	3.39E + 04	NO DATA	5.02E + 04	NO DATA	4.73E + 04
ZN-69	5.02E + 01	9.60E + 01	6.67E + 00	NO DATA	6.24E + 01	NO DATA	1.44E + 01
BR-82	NO DATA	NO DATA	2.46E + 03	NO DATA	NO DATA	NO DATA	2.82E + 03
BR-83	NO DATA	NO DATA	4.38E + 01	NO DATA	NO DATA	NO DATA	6.30E + 01
BR-84	NO DATA	NO DATA	5.67E + 01	NO DATA	NO DATA	NO DATA	4.45E - 04
BR-85	NO DATA	NO DATA	2.33E + 00	NO DATA	NO DATA	NO DATA	1.09E - 15
RB-86	NO DATA	1.03E + 05	4.79E + 04	NO DATA	NO DATA	NO DATA	2.03E + 04
RB-88	NO DATA	2.95E + 02	1.56E + 02	NO DATA	NO DATA	NO DATA	4.07E - 09
RB-89	NO DATA	1.95E + 02	1.37E + 02	NO DATA	NO DATA	NO DATA	1.13E - 11
SR-89	4.78E + 04	NO DATA	1.37E + 03	NO DATA	NO DATA	NO DATA	7.66E + 03
SR-90	1.18E + 06	NO DATA	2.88E + 05	NO DATA	NO DATA	NO DATA	3.48E + 04
SR-91	8.79E + 02	NO DATA	3.55E + 01	NO DATA	NO DATA	NO DATA	4.19E + 03
SR-92	3.33E + 02	NO DATA	1.44E + 01	NO DATA	NO DATA	NO DATA	6.60E + 03
Y-90	1.38E + 00	NO DATA	3.69E - 02	NO DATA	NO DATA	NO DATA	1.46E + 04
Y-91M	1.30E - 02	NO DATA	5.04E - 04	NO DATA	NO DATA	NO DATA	3.82E - 02
Y-91	2.02E + 01	NO DATA	5.39E - 01	NO DATA	NO DATA	NO DATA	1.11E + 04
Y-92	1.21E - 01	NO DATA	3.53E - 03	NO DATA	NO DATA	NO DATA	2.12E + 03
Y-93	3.83E - 01	NO DATA	1.06E - 02	NO DATA	NO DATA	NO DATA	1.22E + 04
ZR-95	2.77E + 00	8.88E - 01	6.01E - 01	NO DATA	1.39E + 00	NO DATA	2.82E + 03
ZR-97	1.53E - 01	3.09E - 02	1.41E - 02	NO DATA	4.67E - 02	NO DATA	9.57E + 03
NB-95	4.47E + 02	2.49E + 02	1.34E + 02	NO DATA	2.46E + 02	NO DATA	1.51E + 06

*Calculated using equation (32) and Tables 2.2-1 and 2.2-2.

TABLE 2.2-3
SITE RELATED INGESTION
DOSE COMMITMENT FACTOR, A_{it}*
(mrem/hr per μCi/ml)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
MO-99	NO DATA	4.62E + 02	8.79E + 01	NO DATA	1.05E + 03	NO DATA	1.07E + 03
TC-99M	2.94E - 02	8.32E - 02	1.06E + 00	NO DATA	1.26E + 00	4.07E - 02	4.92E + 01
TC-101	3.03E - 02	4.36E - 02	4.28E - 01	NO DATA	7.85E - 01	2.23E-02	1.31E - 13
RU-103	1.98E + 01	NO DATA	8.54E - 01	NO DATA	7.57E + 01	NO DATA	2.31E + 03
RU-105	1.65E + 00	NO DATA	6.52E - 01	NO DATA	2.13E + 01	NO DATA	1.01E + 03
RU-106	2.95E + 02	NO DATA	3.73E + 01	NO DATA	5.69E + 02	NO DATA	1.91E + 04
AG-110M	1.42E + 01	1.31E + 01	7.80E + 00	NO DATA	2.58E + 01	NO DATA	5.36E + 03
SB-124	2.40E + 02	4.53E + 00	9.50E + 01	5.81E-01	NO DATA	1.87E + 02	6.81E + 03
SB-125	1.53E + 02	1.71E + 00	3.65E + 01	1.56E-01	NO DATA	1.18E + 02	1.69E + 03
SB-126	9.85E + 01	2.00E + 00	3.55E + 01	6.03E-01	NO DATA	6.04E + 01	8.05E + 03
TE-125M	2.79E + 03	1.01E + 03	3.74E + 02	8.39E + 02	1.13E + 04	NO DATA	1.11E + 04
TE-127M	7.05E + 03	2.52E + 03	8.59E + 02	1.80E + 03	2.86E + 04	NO DATA	2.36E + 04
TE-127	1.14E + 02	4.11E + 01	2.48E + 01	8.48E + 01	4.66E + 02	NO DATA	9.03E + 03
TE-129M	1.20E + 04	4.47E + 03	1.89E + 03	4.11E + 03	5.00E + 04	NO DATA	6.03E + 04
TE-129	3.27E + 01	1.23E + 01	7.96E + 00	2.51E + 01	1.37E + 02	NO DATA	2.47E + 01
TE-131M	1.88E + 03	8.81E + 02	7.34E + 02	1.39E + 01	8.92E + 03	NO DATA	8.74E + 04
TE-131	2.05E + 01	8.57E + 00	6.47E + 00	1.69E + 01	8.98E + 01	NO DATA	2.90E + 00
TE-132	2.62E + 03	1.70E + 03	1.59E + 03	1.87E + 03	1.63E + 04	NO DATA	8.02E + 04
I-130	9.01E + 01	2.66E + 02	1.05E + 02	2.25E + 04	4.15E + 02	NO DATA	2.29E + 02
I-131	4.96E + 02	7.09E + 02	4.06E + 02	2.32E + 05	1.22E + 03	NO DATA	1.87E + 02
I-132	2.42E + 01	6.47E + 01	2.26E + 01	2.26E + 03	1.03E + 02	NO DATA	1.22E + 01
I-133	1.69E + 02	2.94E + 02	8.97E + 01	4.32E + 04	5.13E + 02	NO DATA	2.64E + 02
I-134	1.26E + 01	3.43E + 01	1.23E + 01	5.94E + 02	5.46E + 01	NO DATA	2.99E - 02
I-135	5.28E + 01	1.38E + 02	5.10E + 01	9.11E + 03	2.22E + 02	NO DATA	1.56E + 02
CS-134	3.03E + 05	7.21E + 05	5.89E + 05	NO DATA	2.33E + 05	7.75E + 04	1.26E + 04
CS-136	3.17E + 04	1.25E + 05	9.01E + 04	NO DATA	6.97E + 04	9.55E + 03	1.42E + 04
CS-137	3.28E + 05	5.31E + 05	3.48E + 05	NO DATA	1.88E + 05	5.99E + 04	1.03E + 04
CS-138	2.69E + 02	5.31E + 02	2.63E + 02	NO DATA	3.90E + 02	3.85E + 01	2.27E - 03
BA-139	9.00E + 00	6.41E - 03	2.64E - 01	NO DATA	5.99E - 03	3.64E - 03	1.60E + 01
BA-140	1.88E + 03	2.37E + 00	1.23E + 02	NO DATA	8.05E - 01	1.35E + 00	3.88E + 03
BA-141	4.27E + 00	3.30E - 03	1.48E - 01	NO DATA	3.07E - 03	1.87E - 03	2.06E - 09
BA-142	1.98E + 00	2.03E - 03	1.24E - 01	NO DATA	1.72E - 03	1.15E - 03	2.78E - 18
LA-140	3.58E - 01	1.80E - 01	4.76E - 02	NO DATA	NO DATA	NO DATA	1.32E + 04
LA-142	1.83E - 02	8.33E - 03	2.07E - 03	NO DATA	NO DATA	NO DATA	6.08E + 01
CE-141	8.01E - 01	5.42E - 01	6.15E - 02	NO DATA	2.52E - 01	NO DATA	2.07E + 03
CE-143	1.41E - 01	1.04E + 02	1.16E - 02	NO DATA	4.60E - 02	NO DATA	3.90E + 03
CE-144	4.18E + 01	1.77E + 01	2.24E + 00	NO DATA	1.04E + 01	NO DATA	1.41E + 04
PR-143	1.32E + 00	5.28E - 01	6.52E - 02	NO DATA	3.05E - 01	NO DATA	5.77E + 03
PR-144	4.31E - 03	1.79E - 03	2.19E - 04	NO DATA	1.01E - 03	NO DATA	6.19E - 10
ND-147	9.00E - 01	1.04E + 00	6.22E - 02	NO DATA	6.08E - 01	NO DATA	4.99E + 03
W-187	3.04E + 02	2.55E + 02	8.90E + 01	NO DATA	NO DATA	NO DATA	8.34E + 04
NP-239	1.28E - 01	1.25E - 02	6.91E - 03	NO DATA	3.91E - 02	NO DATA	2.57E + 03

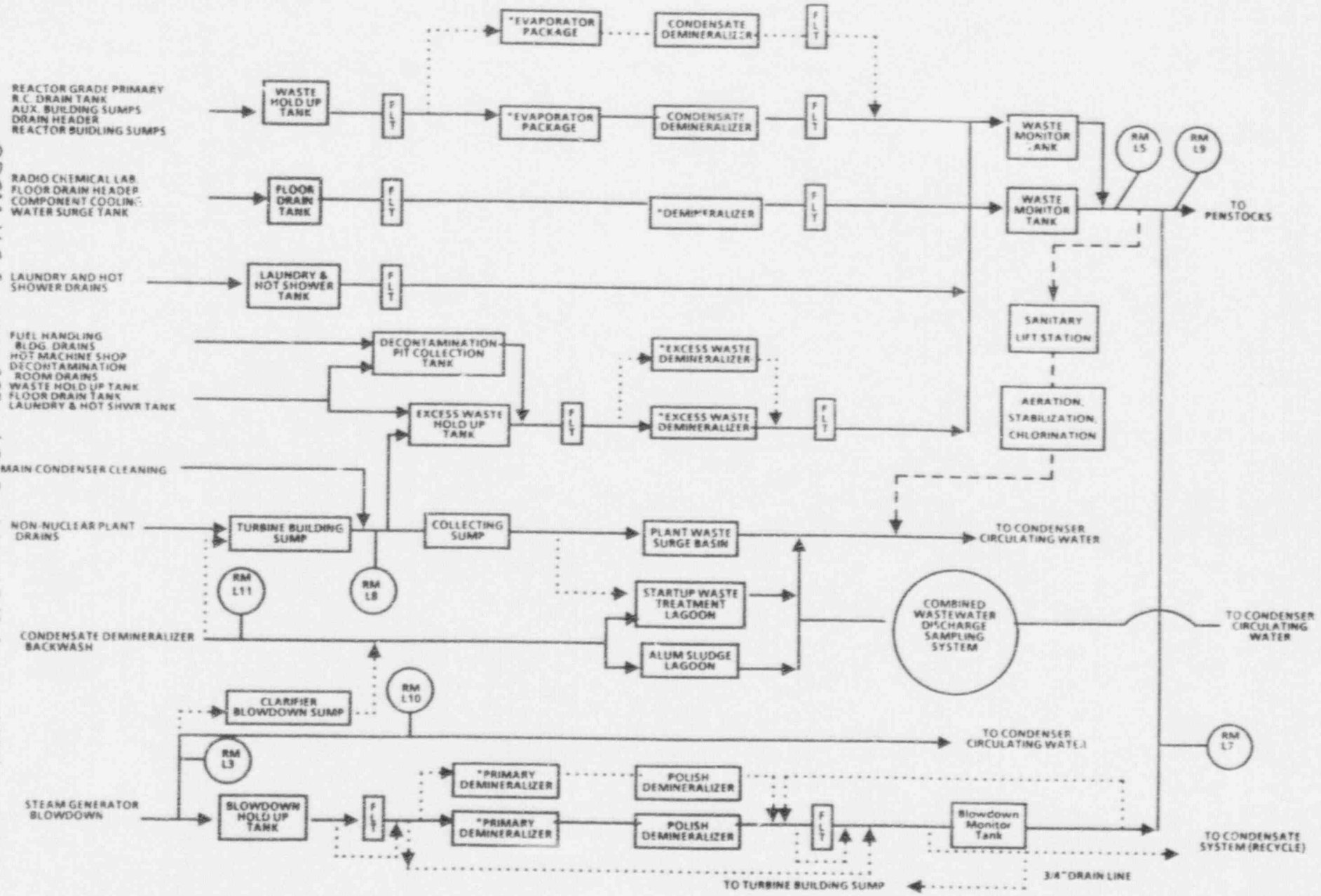

Figure 2.1-1
LIQUID RADWASTE TREATMENT SYSTEM

3.2 Dose Calculation for Gaseous Effluent

3.2.1 Gaseous Effluent Dose Calculation Parameters

Term		Definition	Section of Initial Use
D_o	=	average organ dose rate in the current year (mrem/yr).	(3.2.2.2)
D_p	=	dose to an individual from radioiodine and radionuclides in particulate form and radionuclides (other than noble gases), with half-lives greater than eight days (mrem).	(3.2.3.2)
D_s	=	average skin dose rate in current year (mrem/year).	(3.2.2.1)
D_t	=	current total body dose rate (mrem/yr)	(3.2.21)
D_β	=	air dose due to beta emissions from noble gas radionuclides (mrad).	(3.2.3.1)
D_γ	=	air dose due to gamma emissions from noble gas radionuclides (mrad).	(3.2.3.1)
K_i	=	total body dose factor due to gamma emissions from isotope i (mrem/year per uCi/m^3) from Table 3.1-1.	(3.2.2.1)
L_i	=	skin dose factor due to beta emissions from noble gas radionuclide i (mrad/yr per µCi/m^3) from Table 3.1-1.	(3.2.2.1)
M_i	=	air dose factor due to gamma emissions from noble gas radionuclide i (mrad/yr per µCi/m^3) from Table 3.1-1.	(3.2.2.1)
N_i	=	air dose factor due to beta emissions from noble gas radionuclide i (mrad per uCi/m^3) from Table 3.1-1.	(3.2.3.1)
P_i	=	dose parameter for radionuclide i, (mrem/yr per uCi/m^3) for inhalation, from Table 3.2-1.	(3.2.2.2)
$\overline{Q}_i$	=	the release rate of noble gas radionuclide i as determined from the concentrations measured in the analysisof the appropriate sample required by Table 1.2-3 (µCi/sec).	(3.2.2.1)