TENNESSEE VALLEY AUTHORITY

NUCLEAR POWER GROUP
(FORMERLY OFFICE OF NUCLEAR POWER)
SEQUOYAH NUCLEAR PLANT

MONTHLY OPERATING REPORT

TO THE

NUCLEAR REGULATORY COMMISSION

AUGUST 1988

UNIT 1

DOCKET NUMBER 50-327

LICENSE NUMBER DPR-77

UNIT 2

DOCKET NUMBER 50-328

LICENSE NUMBER DPR-79

Submitted by: S. J. Smith

S. J. Smith, Plant Manager

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OPERATIONAL SUMMARY

PERFORMANCE SUMMARY

August 1988

The following summary describes the significant operational activities for the month of August. In support of this summary, a chronological log of significant events is included in this report.

UNIT 1

Unit 1 remained in an administrative shutdown the entire month because of design control review, configuration control updating, and resolution of significant employee concerns. Outage-related maintenance and modifications continue for restart. Unit 1 has been off line 1,105 days. Extensive testing and various system alignments as well as other restart activities are being performed.

Another significant milestone has been accomplished for the Sequoyah Restart Program. On August 4, 1988, the NRC agreed to the proposed schedule for unit 1 restart. This causes great anticipation and enthusiasm to prepare the unit for operational status.

Other major objectives that are being eagerly anticipated are criticality, power operation (generator synchronization), and full power operation (100 percent reactor power).

UNIT 2

Unit 2 continues to operate extraordinarily since restart. It was online the entire month with a capacity factor 92.53 percent. Since restart, unit 2 has generated over 2 million MWhs (2,012,420 MWh) of electrical power and has been in continuous operation for seventy (70) days.

SIGNIFICANT OPERATIONAL EVENTS

Unit 1

Date	Time	Event
08/01/88	0001E	Mode 5, RCS at 110 degrees F, atmospheric pressure. Activities continue for restart.
08/04/88	1400E	NRC and TVA meet to discuss restart issues.
08/06/88	2250E	Venting and sweeping of the RCS begins.
08/09/88	1800E	RCS venting and sweeping completed.
08/15/88	1652E	Loss of one offsite independent circuit because of thunderstorm. All four D/Gs started, 1B-B tied to the system. Entered various LCOs.
	1732E	All D/Gs returned to standby position.

SIGNIFICANT OPERATIONAL EVENTS

Unit 1 (continued)

Date	Time	Event
08/21/88	0558E	Bubble established in the pressurizer.
08/31/88	2400E	Maintenance activities continue toward restart.

Unit 2

Date	Time	Event
08/01/88	0001E	Reactor at 75 percent, 865 MWe. Maintenance continues on "2A" condensate booster pump.
08/02/88	0835E	Began power increase.
	1150E	Holding at 90 percent, 1020 MWe for power range adjustment.
	1335E	Resume power increase.
	1509E	Reactor at 98 percent, 1117 MWe. High steam flow alarm initiates at power greater than 98 percent reactor power.
08/15/88	1652E	Loss of one offsite independent circuit because of thunderstorm. All four D/Gs started, 1B-B tied to the system. Entered various LCOs.
	1732E	All D/G returned to standby position.
08/25/88	1940E	Began reducing load to 95 percent for the moderator coefficient test.
	2140E	Reactor stabilized at 95 percent, 1080 MWe.
08/26/88	0555E	Test complete.
	0620E	Began power ascension.
	1108E	Reactor at 98 percent, 1103 MWe.
08/31/88	2400E	Reactor at 98 percent, 1108 MWe.

FUEL PERFORMANCE

Unit 1

The core average fuel exposure accumulated during August was 0 MWD/MTU with the total accumulated core average fuel exposure of 0 MWD/MTU.

Unit 2

The core average fuel exposure accumulated during August was 1153.33 MWD/MTU with the total accumulated core average fuel exposure of 10963.67 MWD/MTU.

SPENT FUEL PIT STORAGE CAPABILITIES

The total storage capability in the SFP is 1,386. However, there are five cell locations which are incapable of storing spent fuel (SFP). Four locations (A10, A11, A24, and A25) are unavailable due to a suction strainer conflict, and one location (A16) is unavailable due to an instrumentation conflict. Presently, there is a total of 348 spent fuel bundles stored in the SFP. Thus, the remaining storage capacity is 1,033.

MISCELLANEOUS

Special Nuclear Material (SNM) Semiannual System Review

The semiannual system review of the plant's overall SNM Management Program was conducted August 3-5, 1988, by Nuclear Fuel, NE, Chattanooga, and representatives from the Controller Office with Coopers and Lybrands also present. This specific review consisted of all the SNM records and a complete videotape review of the spent fuel pit. No major discrepancies were observed in any areas; however, a minor documentation discrepancy resulted in a CAQR (SQT880001P) written by Nuclear Fuel and NE regarding the noninventory of a temporary storage area.

NOTE: A physical inventory on four other storage areas containing SNM was performed on July 28, 1988. No discrepancies were observed.

PORVs AND SAFETY VALVES SUMMARY

No PORVs or safety valves were challenged in August.

SPECIAL REPORTS

The following special report revision was submitted to the NRC for the month of August.

88-03 Rev. 1 — This revision provides the completion schedule for corrective action concerning a fire barrier being nonfunctional for greater than seven days.

LICENSEE EVENT REPORT(S)

The following licensee event reports (LERs) were transmitted to the Nuclear Regulatory Commission in August 1988.

LER	Description of Event
1-88027	On July 14, 1988, during a review of RM SIs, it was discovered that an incorrect source strength evaluation date existed in SI-83, "Channel Calibration for Radiation Monitoring System." At the time of the discovery, unit 1 was in mode 5 and unit 2 in mode 1. Upon review of SI-83, it was determined that the common fuel storage pool RMs (0-RM-90-102 and 0-RM-90-103) were affected by the incorrect evaluation date. This date resulted in 0-RM-90-103 being declared inoperable on July 14, 1988, until it could be verified that it was within acceptable TS setpoint limits for a high radiation trip. During the investigation, it was discovered that 0-RM-90-103 was out of calibration for a 3-month period (August 6, 1987, to October 23, 1987). The immediate cause for the out of TS tolerance condition for 0-RM-90-103 (August to October 1987) is attributed to an incorrect source strength evaluation date in SI-83. The root cause of this event is considered to be an inadequate checklist in Appendix F of SI-1, "Surveillance Program." Appendix F of SI-1 provides a checklist to ensure that technical and administrative concerns are addressed during the SI revision review process. Upon review of the Appendix F checklist, it was discovered that a verification did not exist to ensure that RMs source strength evaluation dates were correct. For immediate corrective action, on July 14, 1988, 0-RM-90-103 was verified within the present allowable TS setpoint limits by a performance of SI-83 with the correct source strength evaluation date. 0-RM-90-102 was also verified to be within the allowable setpoint limits. For long-term corrective action, a revision has been instituted, and is in use, to include the correct source strength evaluation date. A revision will be made to the SI-1, Appendix F checklist by November 1, 1988, to provide a verification to ensure that RMs source strength evaluation dates are correct.
1-88028	On July 23, 1988, with unit 1 in mode 5 and unit 2 in mode 1 at 98 percent power, the hourly fire watch patrol through the 734 foot elevation of the auxiliary building (refueling floor) was suspended from 0700E to 1500E because of an unexpected increase in the airborne radioactivity in that area.

Description of Event

LER	
1-88028 (cont.)	The fire watch was required by LCO 3.7.12 as a compensatory measure for three breached fire barriers. Fire barrier breaching permits were issued part of a workplan to reroute a cable to preclude a potential "Appendix R" cable interaction and to ensure the availability of RCS letdown following a postulated fire. The immediate cause of this event was the high level of airborne radioactivity in the auxiliary building. This condition represented an overriding personnel safety concern and access to the area was subsequently restricted. The root cause of this event was valve leaks that allowed nitrogen to leak into the RCS during SI system testing. The inleakage caused a rise in the indicated RCS level and prompted unit 1 operators to open the reactor vessel head vents. Since the head vents discharge to the pressure relief tank (PRT) and the PRT safety valves had been removed for maintenance, there was an increase in the activity level of the containment atmosphere. With the unit 1 blast doors open, the radioactivity from the containment atmosphere migrated into the auxiliary building. At 1500E on July 23, following manual operation of the ABGTS, the level of airborne radioactivity decreased to an acceptable level and fire protection personnel resumed the required fire watch patrols. Subsequently, the leaking SI system valves were repaired using standard work control practices.
1-88029	On August 4, 1988, at 2143E with unit 1 in mode 5 and unit 2 at 98 percent power, load shedding occurred on 6.9 kV shutdown board 1B-B during the performance of WP 7152-01. This WP provides instructions for modifying the load shedding and load sequencing logic to alleviate concerns regarding emergency D/G loading capabilities. Before this event, the control power fuses for the UVX (undervoltage) relays were pulled to facilitate the modification. Also, handswitch 43TL was placed in the "TEST" position to preclude inadvertent emergency D/G starts. Pulling the control fuses resulted in deenergizing the UVX relays and completed one half of the load shedding logic. During this event, a contact of a BOX (blackout) relay was to be connected in parallel with contacts of other BOX relays that are part of the control circuit for the annunciation timing relay. The annunciation relay receives control power from the same source as the UVY relays. Therefore, when a wire was lifted to connect a contact of the BOX relay in the circuit, power to all UVY relays downstream from the point was interrupted. Since the fuses to the UVX logic relays had already been pulled and now the UVY relays were deenergized, load shedding then occurred, causing a loss of RHR cooling. The initial investigation of the event mistakenly concluded that the performance of the WP did not cause the event and a second load shedding event occurred. The root cause of the first load shedding event was that the WP incorrectly stated that the steps of the WP could be worked in any order. The cause of the second load shedding event was the incomplete assessment of the cause of the first event. As immediate corrective action, Operations personnel responded to reestablish RHR flow. To aid in the prevention of recurrence, these events will be reviewed with the cognizant modifications engineer and the engineers in the Plant Reporting Section, Plant Assessment Section, and Work Oversight Section by September 30, 1988.

<u>Description of Event</u>

<u>LER</u>

1-88030 At approximately 0811E on August 6, 1988, with unit 1 in mode 5, a train "A" CVI signal was generated by the unit 1 SSPS. Since the CVI closed the containment isolation valves to the containment upper and lower compartment RMs inhibiting the air flow to each, both were inoperable and LCO 3.3.3.1 was entered. Following verification that the CVI was not caused by an actual high radiation condition, plant operators initiated recovery procedures. At approximately 0822E, one RM was restored to operable status and LCO 3.3.3.1 was exited. At approximately 0925E, the CVI recovery had been completed. Following an investigation of the ongoing work activities at the time the CVI was generated, it was concluded that the CVI was the result of an IM technician inadvertently contacting the wrong RM terminal during functional testing of unit 2 RMs. The root cause of this event has been attributed to the use of one terminal block for routing cables associated with RMs from both unit 1 and unit 2 without clearly identifying each cable and/or terminal. To prevent recurrence of this event, SQN will issue a design change to relabel the electrical cables in control room panel 0-M-12 that are associated with RMs capable of generating CVIs. In the interim, SQN will review this event with IM personnel who may be required to perform maintenance on RMs before the relabeling has been completed.

1-88032 On August 2, 1988, with unit 2 in mode 1 and unit 1 in mode 5, the EGTS (common to both units) was declared inoperable because of an incomplete system design. During a design review of the system, a single failure occurrence causing the discharge modulating damper in the automatic train to open prior to the initiation of the system or prior to arming of the swapover logic, could preclude the system from performing its design function. With this condition present, the initiation of EGTS operation on an accident signal could result in an unmodulated open path of air discharged to the environment. Design calculations have shown that with this condition present, the Site Boundary whole body gamma dose could exceed the 10 CFR 100.11 limits of 25 Rem. The cause of this condition is attributed to a design oversight. This specific scenario was not anticipated in the initial design of the system. Immediate corrective actions were to declare both trains inoperable until compensatory measures were incorporated into procedures to take manual control of both trains of EGTS. They were returned to operable status at approximately 2245E on August 2, 1988. Long-term corrective actions are to modify the present pressure switch logic to preclude any single failure occurrence on the discharge damper arrangement. To prevent recurrence, present design procedures that were not in place during the initial design of EGTS require encompassing plural reviews and established technical checkpoints to be evaluated on new design changes.

1-88007 Rev. 1 This revision changes the date in which a supplemental report will be submitted. Because the corrective actions necessary to resolve this issue have not been finalized, TVA must delay the submittal of a supplemental report until November 1, 1988.

Description of Event

LER

2-88031 On July 5, 1988, unit 2 in mode 1, Operations personnel noticed erratic performance of the MCR hydraulic pressure indicator for 2-FCV-87-21 and initiated a WR to investigate and repair the indicator. On July 8, 1988, at 1430E, the repairs were completed. At that time, it was noted that the hydraulic pressure in the accumulator for 2-FCV-87-21 was low (2647 psig). It was recharged to 3034 psig. At approximately 1630E on July 8, 1988, a meeting was held to discuss the ramification of the low hydraulic pressure. Systems Engineering and Maintenance were directed to develop an action plan to perform a nitrogen precharge check. Management stressed that the plan was to address contingencies in the event equipment was required to be replaced. At 1231E, on July 10, 1988, LCO 3.5.1.2 was entered to perform the nitrogen precharge check. The nitrogen pressure was found to be 1164.5 psig. A leaking Schrader valve on the nitrogen side of the accumulator was repaired and the nitrogen was recharged. At 1555E the LCO was exited. After discovering the low nitrogen pressure in the accumulator, Westinghouse was requested to evaluate the "as-found" affects of the nitrogen pressure on the response time of 2-FCV-87-21 and the applicable accident analyses. Westinghouse concluded that an additional 170 cubic feet of water would be injected into the reactor vessel. The UHI accumulator level switch is currently set to actuate at 1000 cubic feet of injected water. The SQN safety analysis for the UHI delivered water volume assumed 1180.5 cubic feet would inject. Thus, the 1170 cubic feet assumed to inject as a result of the low nitrogen pressure is within the latest accident analysis. The root cause of this event was that SI-744, "Monitoring of UHI Isolation Valve Accumulator Pressure," did not contain sufficient information to perform an adequate assessment of valve operability. In order to prevent this event from recurring, SI-744 will be revised to clarify the actions to be taken after an accumulator charge.

2-88033 On July 29, 1988, it was suspected that an inadequate SI used for the calibration of the UHI system accumulator tank level switches may have resulted in the SQN unit 2 being in noncompliance with the TS. At this time, unit 2 was in mode 1, unit 1 in mode 5. During the performance of a demonstrated accuracy calculation by DNE, it was discovered that incorrect level switch setpoint values existed in SI-196, "Periodic Calibration of Upper Head Injection System Instrumentation." This SI is used to calibrate the UHI system accumulator level switches to ensure compliance with TS and accident analysis for delivered water volume to the RCS. Upon verification that a noncompliance condition existed, unit 2 entered TS LCO 3.5.1.2, "Emergency Core Cooling Systems (ECCS) Upper Head Injection Accumulators," at 0000E on July 30, 1988. Since unit 1 was in mode 5, the subject LCO was not applicable. For immediate corrective action on July 30, 1988, SI-196 was revised to incorporate the correct level switch setpoints and subsequently performed to recalibrate all unit 2 level switches. Upon completion, the unit 2 UHI system was declared operable and the LCO was exited. For

LER	Description of Event
2-88033 (cont.)	long-term corrective action, correct level switch differential pressure values for unit 1 have been incorporated into SI-196. Also, the switches have been replaced by DCN 260. TVA will reverify that the vendor working line is marked at the correct elevation on both units, clearly identifiable, and preserved by placing signs on the tanks beside the marked working line.
2-83097 Rev. 3	This revision updates information on the planned corrective actions for the containment sump level transmitters.
2-88026 Rev. 1	This revision provides additional information regarding the corrective action SQN is taking to prevent recurrence of this event.

1. ABGTS - Auxiliary Building Gas Treatment System
2. ABSCE - Auxiliary Building Secondary Containment Enclosure
3. ABI - Auxiliary Building Isolation
4. AFW - Auxiliary Feedwater
5. AOI - Abnormal Operating Instruction
6. ASOS - Assistant Shift Operation Supervisor
7. AUO - Assistant Unit Operator
8. BAT - Boric Acid Storage Tank
9. BIT - Boron Injection Tank
10. CAQR - Condition Adverse To Quality Report
11. CCP - Centrifugal Charging Pump
12. CCW - Component Cooling Water
13. CRI - Control Room Isolation
14. CREVS - Control Room Emergency Ventilation System
15. CSS(CS) - Containment Spray System
16. CVI - Containment Ventilation Isolation
17. D/G(s) - Diesel Generator(s)
18. DCN - Design Change Notice
19. DCR - Design Change Request
20. ECCS ergency Core Cooling System
21. ECN ineering Change Notice
22. EGTS - ergency Gas Treatment System
23. EMI - Electromagnetic Interference
24. EQ - Environmentally Qualified/Environmental Qualification
25. ERCW - Essential Raw Cooling Water
26. ESF(A) - Engineered Safety Feature (Actuation)
27. FCV - Flow Control Valve
28. FSAR - Final Safety Analysis Report
29. FWI - Feedwater Isolation
30. GOI - General Operating Instruction
31. GPM - Gallons Per Minute
32. HO - Hold Order
33. IM - Instrument Mechanic
34. IMI - Instrument Maintenance Instruction
35. LCV - Level Control Valve
36. LCO - Limiting Condition for Operation
37. LOCA - Loss Of Coolant Accident
38. MAST - Maximum Allowable Stroke Time
39. MFI - Main Feedwater Isolation
40. MFP - Main Feedwater Pump
41. MOV - Motor Operated Valve
42. MSI - Main Steam Isolation
43. MSIV - Main Steam Isolation Valve
44. MCR - Main Control Room
45. NE - Nuclear Engineering (formerly Division of Nuclear Engineering)
46. NSS - Nuclear Security Service
47. NSSS - Nuclear Steam Supply System
48. PORC - Plant Operation Review Committee
49. PRO - Potential Reportable Occurrence

49. RCS - Reactor Coolant System
50. RHR - Residual Heat Removal
51. RM - Radiation Monitor (RAD Monitor/RAD MON)
52. RWST - Refueling Water Storage Tank
53. SCR - Significant Condition Report
54. SFP - Spent Fuel Pit
55. S/G(s) - Steam Generator(s)
56. SI - Surveillance Instruction/or Safety Injection
57. SMI - Special Maintenance Instruction
58. SOI - System Operating Instruction
59. SQN - Sequoyah Nuclear Plant
60. SR - Surveillance Requirement
61. SSPS - Solid State Protection System
62. TACF - Temporary Alteration Control Form
63. TI - Technical Instruction
64. TS(s) - Technical Specification(s)
65. UHI - Upper Head Injection
66. UO/(S)RO - Unit Operator/(Senior) Reactor Operator
67. VLV - Valve
68. WP - Workplan
69. WR - Work Request

SYSTEMS OF SEQUOYAH NUCLEAR PLANT

SYSTEM CODE	SYSTEM TITLE
1	Main Steam System (Turbine) (MSR)
2	Condensate System (FW Heaters)
3	Main and Auxiliary Feedwater System
5	Extraction Steam System
6	Heater Drains and Vents System
14	Condensate Demineralizer
15	Steam Generator Blowdown System
24	Raw Cooling Water System
27	Condenser Circulating Water System
35	Generator Cooling Systems
36	Feedwater/Secondary Treatment System
37	Gland Seal Water System
42	Main/Auxiliary Feedwater Control System
47	Turbogenerator Control System
54	Injection Water System
58	Generator Bus Cooling System
61	Ice Condenser System
62	Chemical and Volume Control System
63	Safety Injection System
64	Ice Condenser Containment System
65	Emergency Gas Treatment System
67	Essential Raw Cooling Water System
68	Reactor Coolant System (Steam Generator)
70	Component Cooling System
72	Residual Heat Removal System
82	Standby Diesel Generator System
87	Upper Head Injection System
90	Radiation Monitoring System

RADWASTE SUMMARY

August 1988

1. Total volume of solid waste shipped offsite:

   A. Dry active waste: 1764 $ft.^3$ Activity: 21.3308 curies

   B. Spent resins, sludges, bottoms: 0
   Activity: N/A curies

   Shipped: August 4, 1988 Barnwell, Inc.
   August 26, 1988 Barnwell, Inc.

2. Radwaste onsite and awaiting shipment:

   A. Resin in storage: 109 $ft.^3$

   B. Estimate resin that will be generated: 28 $ft.^3$

   C. Dry active waste awaiting shipment: 378 $ft.^3$

OFFSITE DOSE CALCULATION MANUAL CHANGES

No changes were made to the SQN Offsite Dose Calculation Manual (ODCM) in August 1988.

Correction: A change was made to the SQN Offsite Dose Calculation Manual (ODCM) in July 1988. This revision (Rev. 20) is found in Appendix IV.

OPERATING STATISTICS
(NRC REPORTS)

OPERATING DATA REPORT

DOCKET NO. 50-327
DATE SEPTEMBER 07, 1988
COMPLETED BY D.C.DUPREE
TELEPHONE (615)870-6734

OPERATING STATUS

1. UNIT NAME: SEQUOYAH NUCLEAR PLANT, UNIT 1 — NOTES:
2. REPORT PERIOD: AUGUST 1988
3. LICENSED THERMAL POWER(MWT): 3411.0
4. NAMEPLATE RATING (GROSS MWE): 1220.6
5. DESIGN ELECTRICAL RATING (NET MWE): 1148.0
6. MAXIMUM DEPENDABLE CAPACITY (GROSS MWE): 1183.0
7. MAXIMUM DEPENDABLE CAPACITY (NET MWE): 1148.0
8. IF CHANGES OCCUR IN CAPACITY RATINGS(ITEMS NUMBERS 3 THROUGH 7)SINCE LAST REPORT, GIVE REASONS: ____________
9. POWER LEVEL TO WHICH RESTRICTED, IF ANY(NET MWE): ________
10. REASONS FOR RESTRICTIONS, IF ANY: ____________

	THIS MONTH	YR.-TO-DATE	CUMULATIVE
11. HOURS IN REPORTING PERIOD	744.00	3855.00	62856.00
12. NUMBER OF HOURS REACTOR WAS CRITICAL	0.00	0.00	24444.91
13. REACTOR RESERVE SHUTDOWN HOURS	0.00	0.00	0.00
14. HOURS GENERATOR ON-LINE	0.00	0.00	23781.13
15. UNIT RESERVE SHUTDOWN HOURS	0.00	0.00	0.00
16. GROSS THERMAL ENERGY GENERATED (MWH)	0.00	0.00	77060971.91
17. GROSS ELECTRICAL ENERGY GEN. (MWH)	0.00	0.00	25976386.00
18. NET ELECTRICAL ENERGY GENERATED (MWH)	-8147.00	-39200.00	24815123.00
19. UNIT SERVICE FACTOR	0.00	0.00	37.83
20. UNIT AVAILABILITY FACTOR	0.00	0.00	37.83
21. UNIT CAPACITY FACTOR(USING MDC NET)	0.00	0.00	34.39
22. UNIT CAPACITY FACTOR(USING DER NET)	0.00	0.00	34.39
23. UNIT FORCED OUTAGE RATE	100.00	100.00	55.89

24. SHUTDOWNS SCHEDULED OVER NEXT 6 MONTHS (TYPE, DATE, AND DURATION OF EACH): ____________

25. IF SHUTDOWN AT END OF REPORT PERIOD, ESTIMATED DATE OF STARTUP: THE RESTART OF UNIT-1 IS SCHEDULED FOR SEPTEMBER 1988.

NOTE THAT THE THE YR.-TO-DATE AND CUMULATIVE VALUES HAVE BEEN UPDATED.

SEQUOYAH NUCLEAR PLANT
AVERAGE DAILY POWER LEVEL

DOCKET NO. : 50-327
UNIT : ONE
DATE : SEPTEMBER 07,1988
COMPLETED BY : D.C.DUPREE
TELEPHONE : (615)870-6722

MONTH: AUGUST 1988

DAY	AVERAGE DAILY POWER LEVEL (MWe Net)	DAY	AVERAGE DAILY POWER LEVEL (MWe Net)
01	-6	17	-6
02	-6	18	-5
03	-9	19	-8
04	-5	20	-6
05	-6	21	-6
06	-6	22	-5
07	-8	23	-10
08	-4	24	-5
09	-8	25	-8
10	-8	26	-6
11	-6	27	-9
12	-8	28	-6
13	-7	29	-6
14	-9	30	-8
15	-10	31	-6
16	-8		

UNIT SHUTDOWNS AND POWER REDUCTIONS

DOCKET NO. 50-327
UNIT NAME Sequoyah One
DATE September 7, 1988
COMPLETED BY C. Dupree
TELEPHONE (615) 870-6722

REPORT MONTH AUGUST 1988

No.	Date	Type[1]	Duration (Hours)	Reason[2]	Method of Shutting Down Reactor[3]	Licensee Event Report #	System Code[4]	Component Code[5]	Cause & Corrective Action to Prevent Recurrence
1	880101	F	744	F	4				Design Control, Configuration Updating, and Employee Concerns.

[1]F: Forced
S: Scheduled

[2]Reason:
A-Equipment Failure (Explain)
B-Maintenance or Test
C-Refueling
D-Regulatory Restriction
E-Operator Training & License Examination
F-Administrative
G-Operational Error (Explain)
H-Other (Explain)

[3]Method:
1-Manual
2-Manual Scram.
3-Automatic Scram.
4-Cont. of Existing Outage
5-Reduction
9-Other

[4]Exhibit G-Instructions for Preparation of Data Entry Sheets for Licensee Event Report (LER) File (NUREG-0161)

[5]Exhibit I-Same Source

OPERATING DATA REPORT

DOCKET NO. 50-328
DATE SEPTEMBER 07, 1988
COMPLETED BY D.C. BURRELL
TELEPHONE (615)870-6725

OPERATING STATUS

1. UNIT NAME: SEQUOYAH NUCLEAR PLANT, UNIT 2 — NOTES:
2. REPORT PERIOD: AUGUST 1988
3. LICENSED THERMAL POWER (MWT): 3411.0
4. NAMEPLATE RATING (GROSS MWE): 1220.6
5. DESIGN ELECTRICAL RATING (NET MWE): 1148.0
6. MAXIMUM DEPENDABLE CAPACITY (GROSS MWE): 1183.0
7. MAXIMUM DEPENDABLE CAPACITY (NET MWE): 1148.0
8. IF CHANGES OCCUR IN CAPACITY RATINGS(ITEMS NUMBERS 3 THROUGH 7)SINCE LAST REPORT, GIVE REASONS: ____________
9. POWER LEVEL TO WHICH RESTRICTED, IF ANY(NET MWE): ____________
10. REASONS FOR RESTRICTIONS, IF ANY: ____________

		THIS MONTH	YR.-TO-DATE	CUMULATIVE
11.	HOURS IN REPORTING PERIOD	744.00	5855.00	54816.00
12.	NUMBER OF HOURS REACTOR WAS CRITICAL	744.00	2278.10	24257.64
13.	REACTOR RESERVE SHUTDOWN HOURS	0.00	0.00	0.00
14.	HOURS GENERATOR ON-LINE	744.00	2169.75	23662.97
15.	UNIT RESERVE SHUTDOWN HOURS	0.00	0.00	0.00
16.	GROSS THERMAL ENERGY GENERATED (MWH)	2489410.00	6109405.64	75037382.36
17.	GROSS ELECTRICAL ENERGY GEN. (MWH)	814400.00	2012340.00	25549120.00
18.	NET ELECTRICAL ENERGY GENERATED (MWH)	779762.00	1851649.00	24359994.00
19.	UNIT SERVICE FACTOR	100.00	37.04	43.17
20.	UNIT AVAILABILITY FACTOR	100.00	37.04	43.17
21.	UNIT CAPACITY FACTOR(USING MDC NET)	91.30	27.55	38.71
22.	UNIT CAPACITY FACTOR(USING DER NET)	91.30	27.55	38.71
23.	UNIT FORCED OUTAGE RATE	0.00	52.99	52.59

24. SHUTDOWNS SCHEDULED OVER NEXT 6 MONTHS (TYPE, DATE, AND DURATION OF EACH): CYCLE FOUR REFUELING OUTAGE IS SCHEDULED FOR JANUARY 1989, WITH A DURATION OF 65 DAYS.

25. IF SHUTDOWN AT END OF REPORT PERIOD, ESTIMATED DATE OF STARTUP: ____________

NOTE THAT THE THE YR.-TO-DATE AND CUMULATIVE VALUES HAVE BEEN UPDATED.

SEQUOYAH NUCLEAR PLANT
AVERAGE DAILY POWER LEVEL

DOCKET NO. : 50-328
UNIT : TWO
DATE : SEPTEMBER 07,1988
COMPLETED BY : D.C.DUPREE
TELEPHONE : (615)870-6722

MONTH: AUGUST 1988

DAY	AVERAGE DAILY POWER LEVEL (MWe Net)	DAY	AVERAGE DAILY POWER LEVEL (MWe Net)
01	824	17	1066
02	959	18	1065
03	1073	19	1061
04	1079	20	1065
05	1078	21	1065
06	1066	22	1065
07	1064	23	1065
08	1066	24	1064
09	1072	25	1061
10	1081	26	1055
11	1052	27	1064
12	1063	28	1067
13	1061	29	1063
14	1063	30	1062
15	1069	31	1068
16	1067		

UNIT SHUTDOWNS AND POWER REDUCTIONS

REPORT MONTH AUGUST 1988

DOCKET NO. 50-328
UNIT NAME Sequoyah Two
DATE September 7, 1988
COMPLETED BY D. C. Dupree
TELEPHONE (615) 870-6722

No.	Date	Type[1]	Duration (Hours)	Reason[2]	Method of Shutting Down Reactor[3]	Licensee Event Report #	System Code[4]	Component Code[5]	Cause & Corrective Action to Prevent Recurrence
									No events for the month of August 1988.

[1]F: Forced
S: Scheduled

[2]Reason:
A-Equipment Failure (Explain)
B-Maintenance or Test
C-Refueling
D-Regulatory Restriction
E-Operator Training & License Examination
F-Administrative
G-Operational Error (Explain)
H-Other (Explain)

[3]Method:
1-Manual
2-Manual Scram.
3-Automatic Scram.
4-Cont. of Existing Outage
5-Reduction
9-Other

[4]Exhibit G-Instructions for Preparation of Data Entry Sheets for Licensee Event Report (LER) File (NUREG-0161)

[5]Exhibit I-Same Source

OPERATING STATISTICS
(TVA REPORTS)

OPERATING STATISTICS
(TVA REPORTS)

TVA : 382A (ONP-4-88)

NUCLEAR PLANT OPERATING STATISTICS

SEQUOYAH NUCLEAR Plant

Period Hours 744 Month AUGUST 19 88

	Item No.	Unit No.	UNIT ONE		UNIT TWO		PLANT
Generation	1	Average Hourly Gross Load, kW	0		1,094,624		1,094,624
	2	Maximum Hour Net Generation, MWh	0		1,088		1,088
	3	Core Thermal Energy Gen, GWD (t)[2]	0		102.4338		102.4338
	4	Steam Gen. Thermal Energy Gen., GWD (t)[2]	0		102.8399		102.8399
	5	Gross Electrical Gen., MWh	0		814,400		814,400
	6	Station Use, MWh	5,147		34,638		39,785
	7	Net Electrical Gen., MWh	-5,147		779,762		774,615
	8	Station Use, Percent	N/A		4.25		4.89
	9	Accum. Core Avg. Exposure, MWD/Ton[1]	0		10,964		10,964
	10	CTEG This Month, 10^6 BTU	0		8,390,553		8,390,553
	11	SGTEG This Month, 10^6 BTU	0		8,423,825		8,423,825
	12						
Factors & Use	13	Hours Reactor Was Critical	0.0		774.0		774.0
	14	Unit Use, Hours-Min.	0:00		744:00		774:00
	15	Capacity Factor, Percent	0.0		92.53		46.26
	16	Turbine Avail. Factor, Percent	0.0		100.0		50.0
	17	Generator Avail. Factor, Percent	0.0		100.0		50.0
	18	Turbogen. Avail. Factor, Percent	0.0		100.0		50.0
	19	Reactor Avail. Factor, Percent	0.0		100.0		50.0
	20	Unit Avail. Factor, Percent	0.0		100.0		50.0
	21	Turbine Startups	0		0		0
	22	Reactor Cold Startups	0		0		0
	23						
Efficiency	24	Gross Heat Rate, Btu/kWh	N/A		10,300		11,910
	25	Net Heat Rate, Btu/kWh	N/A		10,760		12,525
	26	Gross Heat Rate Btu/kWh(w/o oil)					10,300
	27	Net Heat Rate Btu/kWh(w/o oil)					10,830
Temp & Press	28	Throttle Pressure, psig	N/A		839.7		839.7
	29	Throttle Temperature, °F	N/A		525.7		525.7
	30	Exhaust Pressure, InHg Abs.	N/A		3.61		3.61
	31	Intake Water Temp., °F	N/A		78.8		78.8
	32						
Flows	33	Main Feedwater, M lb/hr	N/A		14.5		14.5
	34						
	35						
	36						
Misc.	37	Full Power Capacity, EFPD	404.86		365.65		768.51
	38	Accum. Cycle Full Power Days, EFPD	0.0		265.4703		285.4703
	39	Oil Fired for Generation, Gallons					9,504
	40	Oil Heating Value, Btu/Gal.					138,000
	41	Diesel Generation, MWh					144
	42						

Station Data	Item No.	Max. Hour Net Gen.			Max. Day Net Gen.		Load Factor, %
		MWh	Time	Date	MWh	Date	
	43	1,088	0200E	8-5-88	26,120	8-10-88	95.69

Remarks: [1] For BFNP this value is MWD/STU and for SQNP and WBNP this value is MWD/MTU.

[2] (t) indicates Thermal Energy.

Date Submitted SEP 13 1988 Date Revised

S. J. Smith
Plant Manager

TVA 6560C (PP 3-76)

UNIT OUTA[illegible]ND AVAILABILITY

SEQUOYAH Nuclear Plant

Unit No. ONE

Licensed Reactor Power 3411 MW(th)

Generator Rating 1220.5 MW(e)

Design Gross Electrical Rating 1183 MW

Month/Year AUGUST 1988

Period Hours 744

Day	Time Unit Available: Total Hrs	Min	Gen. Hrs	Min	Not Used Hrs	Min	Time Not Available: Turbine Hrs	Min	Gen. Hrs	Min	Reactor Hrs	Min	Unit Hrs	Min	Unit: Time Out Hrs	Min	Time In Hrs	Min	OUTAGE CAUSE	METHOD OF SHUTTING DOWN REACTOR	UNIT STATUS DURING OUTAGE	CORRECTIVE ACTION TAKEN TO PREVENT REPETITION
1							24	00	24	00	24	00	24	00					Design Control, Configuration Updating, and Employee Concerns.	N/A	Mode 5	
2							24	00	24	00	24	00	24	00								
3							24	00	24	00	24	00	24	00								
4							24	00	24	00	24	00	24	00								
5							24	00	24	00	24	00	24	00								
6							24	00	24	00	24	00	24	00								
7							24	00	24	00	24	00	24	00								
8							24	00	24	00	24	00	24	00								
9							24	00	24	00	24	00	24	00								
10							24	00	24	00	24	00	24	00								
11							24	00	24	00	24	00	24	00								
12							24	00	24	00	24	00	24	00								
13							24	00	24	00	24	00	24	00								
14							24	00	24	00	24	00	24	00								
15							24	00	24	00	24	00	24	00								
16							24	00	24	00	24	00	24	00								
17							24	00	24	00	24	00	24	00								
18							24	00	24	00	24	00	24	00								
19							24	00	24	00	24	00	24	00								
20							24	00	24	00	24	00	24	00								
21							24	00	24	00	24	00	24	00								
22							24	00	24	00	24	00	24	00								
23							24	00	24	00	24	00	24	00								
24							24	00	24	00	24	00	24	00								
25							24	00	24	00	24	00	24	00								
26							24	00	24	00	24	00	24	00								
27							24	00	24	00	24	00	24	00								
28							24	00	24	00	24	00	24	00								
29							24	00	24	00	24	00	24	00								
30							24	00	24	00	24	00	24	00								
31							24	00	24	00	24	00	24	00								
Total							744	00	744	00	744	00	744	00								

TVA 6560C (PP 3-76)

UNIT OUTA[illegible]D AVAILABILITY

SEQUOYAH Nuclear Plant

Unit No. TWO

Licensed Reactor Power 3411 MW(th)

Generator Rating 1220.5 MW(e)

Design Gross Electrical Rating 1183 MW

Month/Year AUGUST 1988

Period Hours 744

Day	Time Unit Available: Total Hrs	Total Min	Con. Hrs	Con. Min	Not Used Hrs	Not Used Min	Time Not Available: Turbine Hrs	Turbine Min	Gen. Hrs	Gen. Min	Reactor Hrs	Reactor Min	Unit Hrs	Unit Min	Unit: Time Out Hrs	Time Out Min	Time In Hrs	Time In Min	OUTAGE CAUSE	METHOD OF SHUTTING DOWN REACTOR	UNIT STATUS DURING OUTAGE	CORRECTIVE ACTION TAKEN TO PREVENT REPETITION
1	24	00	24	00																		
2	24	00	24	00																		
3	24	00	24	00																		
4	24	00	24	00																		
5	24	00	24	00																		
6	24	00	24	00																		
7	24	00	24	00																		
8	24	00	24	00																		
9	24	00	24	00																		
10	24	00	24	00																		
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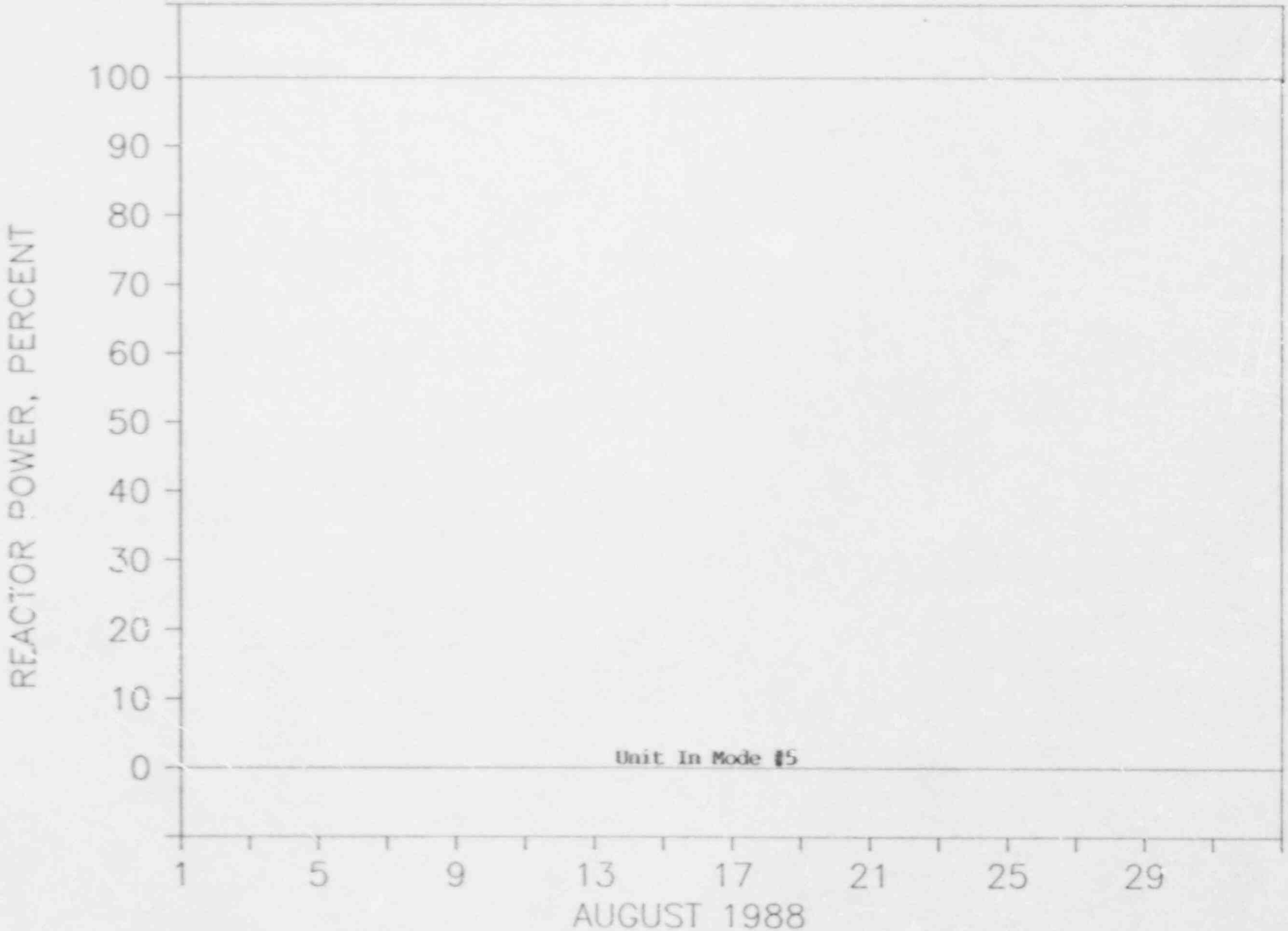
24	24	00	24	00																		
25	24	00	24	00																		
26	24	00	24	00																		
27	24	00	24	00																		
28	24	00	24	00																		
29	24	00	24	00																		
30	24	00	24	00																		
31	24	00	24	00																		
Total	744	00	744	00																		

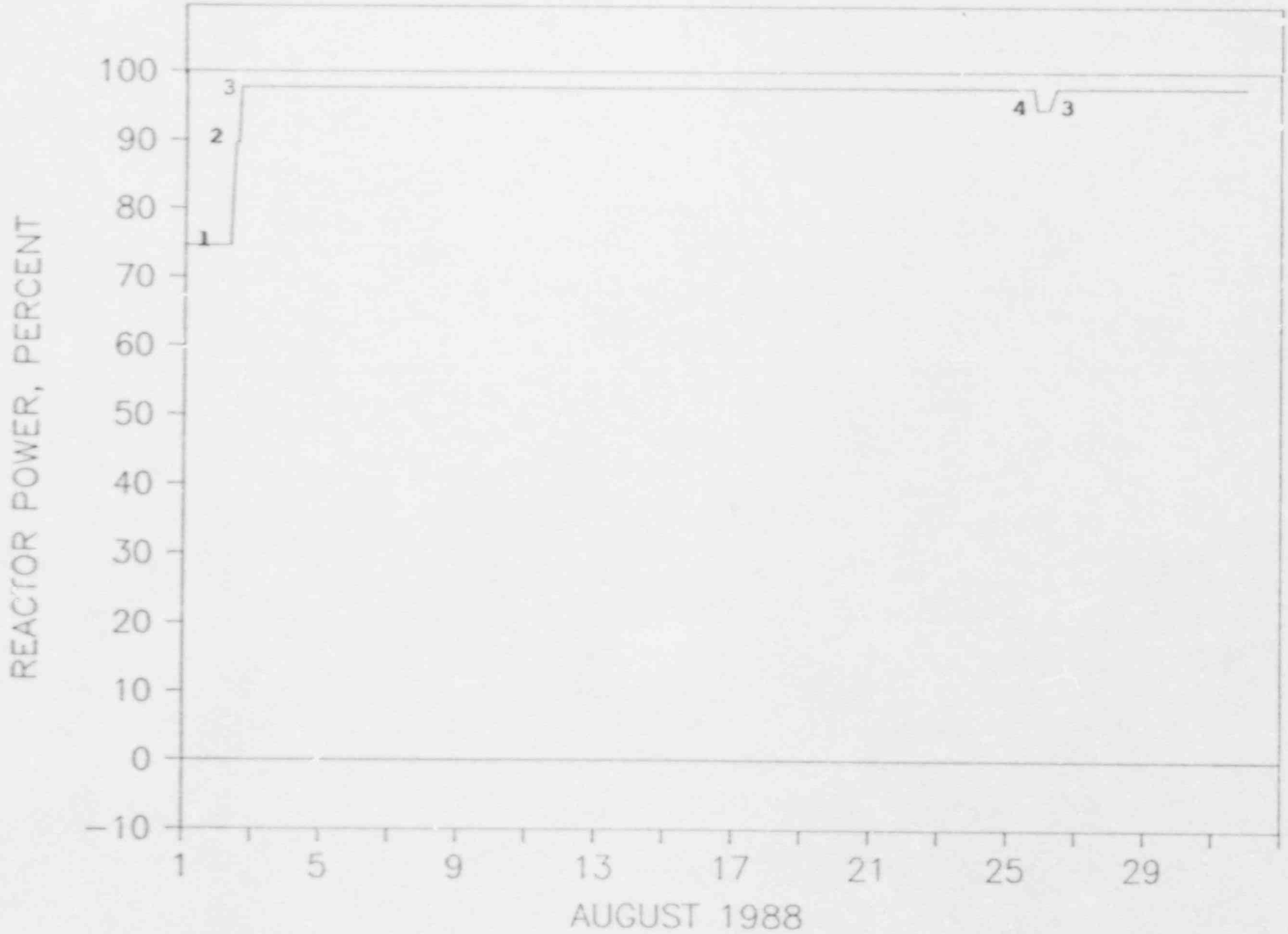
REACTOR HISTOGRAM

SEQUOYAH UNIT ONE



REACTOR HISTOGRAM

SEQUOYAH UNIT TWO



UNIT TWO REACTOR HISTOGRAM ANALYSIS

1. Maintenance on 2A condensate booster pump.

2. Holding for reactor power adjustment.

3. Reactor @ 98 percent, high steam flow alarm initiates at power greater than 98 percent.

4. Reduced load to perform moderator coefficient test.

SUMMARY OF MAINTENANCE ACTIVITIES

(NPRDS MAINTENANCE ITEMS)

MAINTENANCE SUMMARY
(ELECTRICAL)

MR2....	U	FUNC	SYS	ADDRESS.	COMP DATE.	DESCRIPTION...................	CORRECTIVE ACTION.....................
8298046	2	MVOP	067	0068	03/16/88	2-MVOP-067-0068-A,[XHPRD*,XP2*],MOTOR/OPERATOR IS NOT CLOSING VLV ALL THE WAY. PLEASE REPAIR OR REPLACE.	THE QUARTER-TURN GEAR BOX GEARS WERE BAD, POSSIBLY DUE TO NORMAL WEAR, CAUSING THE PIN TO SHEAR AND VALVE TO BIND. EXCHANGED QUARTER-TURN GEAR BOX WITH GEAR BOX FROM 2-MVOP-067-0066. RETERMINATED WIRING AND REINSTALLED OPERATOR. REPLACED "C-CLAMP" WITH A MORE EFFICIENT TYPE OF CLAMP ON VALVE STEM.

WR....	U	FUNC	SYS	COMP ADDRESS.	DATE....	DESCRIPTION........................	CORRECTIVE ACTION........................
B239289	2	GENB	082	0002B	08/22/88	2-GENB-082-0002B-B,[*NPRD*],D/G FAILED TO START WHEN LOCAL START PUSH BUTTON WAS PUSHED. RELAYS TD3A AND TD3B APPEARS TO FAILED TO OPERATE. INVESTIGATE AND REPAIR. DN-1 STEP 6.2.4 & 6.2.5 SI-102 E/SA.	TIME DELAY RELAY (TD3A) HAS DEFECTIVE POSSIBLY DUE TO NORMAL WEAR. TERMINAL LUG ON VENDOR WIRING WAS PARTIALLY BROKEN, BUT DID NOT APPEAR TO BE THE CAUSE OF THE RELAY FAILURE. RETERMINATED WIRE #31. RELUGGED AND LAID WIRE BACK DOWN. REPLACED ELECTROMAGNETIC TIME DELAY RELAY (TD3A). VERIFIED PROPER OPERATION OF DIESEL GENERATOR USING SI-102E/SA. WR B239289.
B273907	1	BKRA	070	0087	08/19/88	1-BKRA-070-0087-B,[*NPRD*,*P2*],SHUNT BREAKER AUX CONTACTS 52A FAILED TO CLOSE PROBLEM FOUND DURING PERFORMING FUNCTIONAL TEST FOR VALVE 1-FCV-70-87-B	AUXILIARY CONTACT 52A, ON THE SHUNT TRIP BREAKER, FAILED TO CLOSE DUE TO NORMAL WEAR OF THE BREAKER CONTACTS. REPLACED THE 15 AMP SHUNT TRIP BREAKER LOCATED IN COMPT. 15E1 MOTOR OPERATED VALVE BOARD. VERIFIED PROPER OPERATION OF BREAKER USING SI-258.1. (WR B273907).
B753552	1	BCTD	067	0083	08/24/88	1-BCTD-067-0083-A,[*NPRD*],MOTOR CONTACTOR DOES NOT MAKE-UP EACH TIME VALVE IS STROKED. CLEAN CONTACTOR PER MI-10.40. FEEDS OFF MOV BD 1A1-A-4A.	AUXILIARY CONTACTS WERE STICKING DUE TO DEBRIS AND NORMAL WEAR ON CONTACTS. REPLACED BOTH FRONT AND SIDE MOUNTED AUXILIARY RELAY CONTACT ASSEMBLIES. (WR B753552).

MAINTENANCE SUMMARY
(INSTRUMENTATION)

MR2....	U	FUNC	SYS	ADDRESS.	COMP DATE....	DESCRIPTION..........................	CORRECTIVE ACTION....................
B237008	2	FM	001	0003L	08/04/88	2-FM-001-0003L-D,[*NPRD*],HIGH STEAM FLOW BI-STABLE PICKUP.	
B264138	2	FR	003	0090	08/01/88	2-FR-003-0090-,[*NPRD*],BLUE PEN TENSION ADJUSTMENT NOT WORKING PROPERLY REPAIR/REPLACE AS NECESSARY	
B789961	1	FT	063	0091B	08/02/88	1-FT-063-0091B-,[*NPRD*],VENT AND OR REPAIR FLOW TRANSMITTER-WHEN 1-FCV-74-33 WAS STROKED FLOW FAILED TO COME BACK TO NORMAL. AIR IS SUSPECTED IN TRANSMITTER	

MAINTENANCE SUMMARY
(MECHANICAL)

MR2....	U	FUNC	SYS	ADDRESS	COMP DATE....	DESCRIPTION..........................	CORRECTIVE ACTION..................
B204901	1	FCV	074	0016	08/10/88	1-FCV-074-0016-,[*P2*,*MPRD*],*C-ZONE*VALVE STEM LEAKING	NORMAL WEAR ON PACKING-REPACKED VALVE AND RETURNED TO SERVICE.
B218884	1	FCV	061	0191	08/07/88	1-FCV-061-0191-,[*MPRD*,*P2*],VALVE CLOSES IN REQUIRED TIME BUT IT TAKES THE VALVE 3 TO 5 MIN TO OPEN BACK UP.	NORMAL WEAR OF VALVE PARTS-REBUILT VALVE, REPLACED O-RINGS AND DIAPHRAGM. RETURNED VALVE TO SERVICE.
B244301	1	VLV	068	0515	07/10/88	1-VLV-068-0515-S,THE VALVE IS LEAKING BORON AT THE STEM. RWP REQUIRED	PACKING HAD BEEN ADJUSTED DOWN, NEEDED MORE PACKING. ADDED ONE PACKING RING AND WIPER RING. RETURNED TO SERVICE. (WR# B244301)
B278552	1	VLV	063	0548	08/18/88	1-VLV-063-0548-B,[*MPRD*],REPAIR VALVE SEAL LEAK USING APPROVED TVA PROCEDURES AS NECESSARY.	NORMAL WEAR ON PACKING-REPLACED PACKING AND RETURNED VALVE TO SERVICE.
B768899	2	FCV	001	0018	08/09/88	2-FCV-001-0018-B PLEASE ADJUST PACKING ON 2-FCV-1-18. BLOWING PRETTY GOOD.	PACKING WAS BLOWN OUT OR CUT BEYOND REPAIR. REMOVED OLD PACKING TO LANTERN RING, COULD NOT GET LANTERN RING OUT. PUT EIGHT RINGS OF NEW PACKING IN VALVE AND RETURNED TO SERVICE. (WR# B768899)
B789963	1	PMP	070	0046	08/03/88	1-PMP-070-0046-,[*MPRD*],PER DAVID RUSSELLS REQUEST; REPACK 1A COMPONENT COOLING SYSTEM PUMP PACKING	TEMPORARY LOSS OF COOLING WATER, CAUSE OF LOSS IS TEMPORARY UNKNOWN, POSSIBLE DUE TO AN INADVERTANT ISOLATION OF A VALVE.

MR#....	U	COMP SYS	ADDRESS.	DATE....	DESCRIPTION..........	CORRECTIVE ACTION..........
B209458	0	VLV 082	0516-1A1	07/29/88	0-VLV-082-0516-1A1-A,[#2#],AIR IS LEAKING FROM THE UNION ON THE BOTTOM SIDE OF THE VALVE. REPAIR OR REPLACE	BAD VALVE DUE TO NORMAL USE. REPLACED VALVE, ONE BOLT AND NUT ON HANGER. (WR# B209458)
B709394	0	SCR 067	0471	07/26/88	0-SCR-067-0471-,TRAVSCRN WILL NOT MOVE W/MOTOR ENERGIZED (PROBABLY SHEERED PIN IS PROBLEM) INVESTIGATE AND REPAIR (SCRN MUST BE OPERATED EVERY OTHER DAY PER SOI 67.1 E)	DEFECTIVE MOTOR TO GEARBOX COUPLING. RELACED COUPLING AND REINSTALLED COUPLING GUARD. (WR# B709394)

MECHANICAL MAINTENANCE MONTHLY REPORT FOR AUGUST 1988

Common

1. Completed repair on RAD MON pump 0-RM-90-12_.
2. Completed SI-191.1, "Fire Hose Inspection."
3. Completed repair on "B" service air compressor.

Unit 1

1. Completed work on ERCW "A" and "B" MIC header.
2. Completed diesel generator monthly inspection on 1A-A and 1B-B D/G.
3. Completed sweep and vent work on RCS.
4. Completed glycol outage.
5. Installed new UHI rupture disc.
6. Completed work on condensate booster pumps.
7. Completed work on ice condenser.
8. Completed repair on CCW traveling screens.
9. Completed repair on main steam check valves.
10. Working on containment spray outage.
11. Completed work on RWST outage (freeze plug).
12. Completed work on heater drain pumps.
13. Repacked ERCW pumps.
14. Repaired several reach rod indicators.
15. Completed work on several snubbers.
16. Completed repairs on lower outer airlock door.
17. Repaired arc strike on 1-FE-74-12.
18. Completed repair on 1B-B containment spray pump coupling.
19. Rebuilt emergency bearing lube water pump.
20. Installed new hydrogen analyzer pumps.
21. Repaired high point vent valve 1-VLV-3-352B.
22. Completed repair on feedwater long cycle valve 1-MV02-3-67.
23. Installed No. 5 hatch plug.
24. Completed repair on main turbine oil tank vapor extractor.
25. Replaced several sight glasses on pumps of various systems.
26. Completed repair on 1-VLV-78-24.
27. Completed repair on 1-FCV-72-39.
28. Completed repair on feedwater regulator valves.
29. Rebuilt two glycol chillers.
30. Installed No. 3 RCP plug.
31. Rebuilt 1B-B boric acid transfer pump.

Unit 2

1. Completed repair on condensate booster pump.
2. Replaced ERCW traveling screen couplings.
3. Completed diesel generator monthly inspection on D/G 2B-B.
4. Completed work on condenser vacuum pump.

Other

1. Continued closure of various CAQRs, CARs, DRs, etc.

MAINTENANCE SUMMARY
(MODIFICATIONS)

SUMMARY OF WORK COMPLETED

MODIFICATIONS - CURRENT STATUS

AUGUST 1988

Major Capital Projects:

PN7102: ECN 5938 - Replace Feedwater Heaters 3 and 4

No work in progress at this time.

PN7105: ECN 5009 - Essential Raw Cooling Water (ERCW) Piping Changeout From Carbon Steel to Stainless Steel

No additional pipe replacement is scheduled in the near future.

PN7108: ECN 6720 - Crane Consistency Program

Unit 1 polar crane blocks and limit switch weights remain to be painted.

Unit 2 polar crane post modification testing by Electrical Maintenance is not complete.

Auxiliary Building crane (WP 12569) has completed review cycle. Turbine Building 200-ton cranes (Unit 1/6720-04, Unit 2/6720-03) WPs are approved. Turbine Building 15-ton crane WPs (Unit 1/6720-06, Unit 2/6720-05) and 5-ton Service Building crane WP (6702-02) has been approved.

Modification of Turbine Building unit 2, 200-ton crane has begun.

PN7115: ECN 6719 - Volumetric Intrusion Detection System

ECN 6719 is in work. Design continues to work to make the system functional. Lighting is complete except for a decision to be made on output of light on one 50-foot mast. Field Change Request (FCR) 6645 for Nuclear Engineering (NE) changes is approved. Work is proceeding.

PN7122: DCR 1373 Secondary Side

No work in progress at this time.

PN7130: DCR 1156 - Post Accident Monitoring

This work is now scheduled by unit 1 cycle 4 (U1C4) and unit 2 by unit 2 cycle 4 (U2C4).

Major Capital Projects (cont.):

PN7132: DCN 0026 - Sewage Treatment Facility and Civil Upgrade

Work is nearing completion. Connections at the lift station and electrical supply to the pumps is in process now.

PN7136: ECN 6259 - MSR Tube Bundle Replacement

ECN is complete except for postmodification testing (PMT) and inservice leak test on unit 1. Leak checks will be performed during system heatup. Unit 2 leak checks are complete.

PN7161: ECN 5855 - Replacement of Doors A56 and A57

WP 09679 remains on hold and is partially complete.

PN7181: DCR 1898 - ECNs 6832 and 6596 - Dry Active Waste (DAW) Building

Electrical interface work is complete. Workplan closure held for Electrical Maintenance (WP 12478), checks and update of SOIs by Operations, and Operations (WP 12477) pending a revision for packing dry active waste.

Significant Items:

PN7199: Miscellaneous Activities Under $100,000

This was for various work orders prepared for work under $100,000 total site cost. This work was done as manpower resources were available.

Other Items:

ECN 5111 - Provide Permanent Power to Manholes 42-46

Four WPs remain in work.

ECN 5503 - Evacuation Alarms O&PS/Fire Detection O&PS

Work stopped for lack of funding.

ECN 5552 - Condensate Demineralizer Modifications and High Crud Filter

Upgrade to higher range instrumentation for condensate demineralizer system neutralization and nonreclaimable waste pumps.

WP 5552-03 - Fieldwork is complete.

ECN 5609 - Evacuation Alarm/Fire Detection Valve 26-290

WP 12387 is 90 percent complete and has been held due to manpower problems.

ECN 5609 - Alteration to the Makeup Water Treatment Plant

WP 12576 - Work is approximately 75 percent complete and is on hold for Electrical Maintenance to perform breaker tests. Need resolution of instrument tab description from NE.

WP 12633 - Work is approximately 80 percent complete. Hold for instrument tab (47B601-928) setpoint revisions.

WP 12731 - WP is approximately 80 percent complete. Hold for instrument tab (47B601-928) setpoints. Need connection diagram revisions from NE.

WP 12684 - WP is approximately 80 percent complete. Hold for instrument tab (47B601-928) setpoints. Need connection diagram revision from NE.

WP 12665 - WP is on hold for outage and is 95 percent complete.

WP 12682 - WP is on hold for outage and is 80 percent complete.

ECN 5626 - Containment Ladders, Unit 1

Modifications needs additional design information to complete. NE needs to issue all drawings listed on this ECN. Work has not begun because of this holdup.

Other Items (cont.):

ECN 5841 - Hot Shop Fire Protection/Evacuation Alarm -

WP 12360 is complete and in closure cycle. Need drawing deviation completed.

WP 12637 - All fieldwork for evacuation alarm is complete. Awaiting Work Request (WR) B240406 to be worked to restart fans to do functional test on fire protection.

ECN 5935 - Correct Power Block Lighting Deficiencies

WP 12437 is complete and in final review. WP 12275 is in work. Need WP revision for FCR 7706 to add approximately 40 more lights. WP 5935-01 is field complete.

ECN 6196 - Pressurizer Hangers and Valves

PMT is scheduled for unit 1 restart. Remaining unit 2 work is scheduled for U2C3 refueling outage.

ECN 6357 - Essential Raw Cooling Water (ERCW) Roof Access and Rails for Security Equipment

Original design for WP 12238 was rejected by Operations. NE to rework design to comply with Operations' needs and attempt to salvage existing work.

ECN 6388 - Hydrogen Monitors in Switchyard

WP 12223 - Work has been stopped due to a lack of funding.

ECN 6429 - Component Cooling Heat Exchanger B Replacement

Plate head exchanger and frame is complete. Hangers and pipe which can be installed prior to outage is in work. WP to remove old heat exchanger is in review cycle. NE procuring the remaining needed piping material. Estimated completion date for nonoutage work is during the month of October 1988.

ECN 6455 - Upgrade CU-3 Box Battery Packs

WP 12295 is field complete.

ECN 6543 - Install Public Safety Access Portals and Modify Entrance Road

Work is being held pending the release of drawings from NE.

Other Items (cont.):

ECN 6601 - Removal of Unit 1 Emergency Gas Treatment System (EGTS) Backdraft Dampers

PMT remains to be completed by the Mechanical Test Section. Fieldwork is complete.

ECN 6689 - Relocation of Main Steam Power Operated Relief Valves (PORV)

All work is complete for unit 2. Work on unit 1 in calibration stage. WP 12172 (tubing reroute) is 99 percent complete and holding for material consisting of tube fittings and clamps (PR 08-2768).

ECN 6706 - 79-14 Support Enhancement/Lost Calculations

Repairs continue on unit 1. This project has been combined with the calculation regeneration project for unit 1. Unit 2 work is complete and workplans are closed. All fieldwork is complete. Document closure for unit 1 restart is in progress.

ECN 6739 - Alternate Analysis

All unit 1 modification work has been completed. Review and closure is in progress for unit 1 restart.

ECN 6761 - East Valve Room (EVR) Blowout Panels

Unit 1 work is complete. Unit 2 work is complete.

ECN 6784 - Documentation to Show Pipe Class Breaks

Final closure is awaiting a revision to the plant modification procedure for deleting requirements to mark shift supervisor drawings.

ECN 6815 - 500-kV Switchyard Addition

Install 500-kV power circuit breaker and associated equipment for bay 1. Retire 161-kV PCB and associated equipment. A total of 10 workplans will be required. Foundations and conduit installation (WP 12654) are complete. WP 12740 for lighting, drain pipe, and surface ground mat is 95 percent complete. WP 12739 for the structural steel installation is 95 percent complete. WP 6815-02 is 90 percent complete. WPs 6815-01 and -03 are 90 percent complete. WPs 6815-04 and -05 for the electrical control board, main relay boards, and the communications room are 95 percent complete. WP 6815-06 for the addition of the Franklin solid state relay cabinets is field complete. The Watts Bar No. 1 line was energized by bay 1 on June 21, 1988. Energization of the Franklin line has been delayed because of problems with an existing power circuit breaker (PCB 5028), and incorrect supply voltage for the static relay carrier sets.

Other Items (cont.):

ECN 6860 - Control Room Bullet Resistivity - DCR 2268 - ECN 6860

WPs 12602 and 12604 are field complete. WP 12603 is held for disposition of CAQR 880183. WP 6860-01 is held for material on Contract 74014A. Essentially all work is complete except for pull handles, replacement of door closures, and rework of one lockset. Estimated date of completion is September 30, 1988.

WP 12605 is in closure cycle.

ECN 7078 - Install Hangers - Main Steam Piping

Complete.

DCN X00006A - Remove Hydrogen Analyzers Tubing

The workplan lacks PMT.

ECN 7093 - Replacement of Feedwater Pipe

Work is in progress and is 98 percent complete. Remaining work is held for D/G testing.

DCN Z00018B - Install Needle Valve for Hydrogen Analyzers

The workplan lacks PMT.

DCN 70 - Hydrogen Analyzer Check Valves

The workplan lacks PMT.

DCN 341 - Pressurizer Drain Pipe/Hangers

Work is in progress.

Instrumentation Verification Program

For unit 2, there have been 953 discrepancies issued to MODS to date with 476 not required for restart. All discrepancies required for restart have been completed; 69 nonrestart discrepancies are open.

For unit 1, there have been 532 discrepancies issued to MODS to date with 218 not required for restart. The 314 required for restart are complete.

Other Items (cont.):

DCN 224 - RHR Slope Rework

Train A complete, Train B needs outage.

ECN 7241 - Replace Valve Room Insulation

Work is continuing in both valve rooms.

DCN 27 - Double Isolation Valves

In work.

ECN 7345 - Valve Shims

Work complete, workplan in closure cycle.

DCN 373 - Flex Hose Rework

In work.

DCN 214 - AFW Tap Rotation

Complete, Instrument Maintenance to test.

DCN 242 - Sense Line Hangers

In work.

DCN 198 - Ice Condensate Expansion Bellows

Work is in process.

DCNs 229 and 231 - H_2 Analyzer Modification

Work is in progress on unit 1.

DCN 300 - ERCW Modification for Microbiologically Induced Corrosion (MIC) A Train is Complete, B Train in Work

Unit 1 work is complete.

ECN 6596 - Dry Active Waste Piping Interface

WP 12402 - Workplan is closed.

WP 12612 - Complete. Closure in process. SCIs are complete. The procedure for the fire detection system of the Dry Active Waste Building is in the process of being updated by Electrical Maintenance.

OFFSITE DOSE CALCULATION MANUAL CHANGES

REVISION NO. 20

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OFFSITE DOSE CALCULATION MANUAL
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1.0 Gaseous Effluents

1.1 Alarm/Trip Setpoints

Specification 3.11.2.1 requires that the dose rate at or beyond the site boundary (Figure 1.1) due to gaseous effluents from the site shall be limited at all times to the following values:

1. 500 mrem/y to the total body and 3,000 mrem/y to the skin from noble gases.

2. 1,500 mrem/y to any organ from radioiodines and particulates.

Specification 3.3.3.10 requires gaseous effluent monitors to have alarm/trip setpoints to ensure that the above dose rates are not exceeded. This section of the ODCM describes the methodology that will be used to determine these setpoints.

The methodology for determining alarm/trip setpoints is divided into two major parts. The first consists of backcalculating from a dose rate to a release rate limit, in μCi/s, for each nuclide and release point. The second consists of using the release rate limits to determine the physical settings on the monitors.

1.1.1 Release Rate Limit Methodology - μCi/s

Release Rate Limit Methodology - Dose Rates

First, a dose rate is calculated based on the design objective source term mix used in the licensing of the plant. Dose rates are determined for (1) noble gases and (2) iodines and particulates.

Release Rate Limit Methodology - Dose Rates - Noble Gas

Dose rates are calculated for total body and skin, due to submersion within a cloud of noble gases, using a semi-infinite cloud model. The dose rates are evaluated at the offsite locations with the highest expected concentrations, i.e., the nearest land site boundary points in each sector (from Table 1.1).

The noble gas radionuclide mix used in this calculation is based on the design objective source term given in Table 1.2. Dispersion of the released radioactivity is handled as described in Section 1.7 using historical annual average meteorological data given in Table 1.3.

No credit is taken for shielding by residence.

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To calculate the dose rate for any one of the 16 potential maximum-exposure points, the following equations are used.

Total Body Dose Rate

$$D_{TB} = \sum_i X_i \, DFB_i \qquad (1.1)$$

where

D_{TB} = total body dose rate, mrem/y.

X_i = air concentration of radionuclide i, $\mu Ci/m^3$. Air concentrations are calculated as described by Equation 1.16.

DFB_i = total body dose factor due to gamma radiation, mrem/y per $\mu Ci/m^3$ (Table 1.4).

Skin Dose Rate

$$D_s = \sum_i X_i \, (DFS_i + 1.11 \, DF_{\gamma i}) \qquad (1.2)$$

where

D_s = skin dose rate, mrem/y.

X_i = air concentration of radionuclide i, $\mu Ci/m^3$. Air concentrations are calculated as described by Equation 1.16.

DFS_i = skin dose factor due to beta radiation, mrem/y per $\mu Ci/m^3$ (Table 1.4).

1.11 = the average ratio of tissue to air energy absorption coefficients, mrem/mrad.

$DF_{\gamma i}$ = gamma-to-air dose factor for radionuclide i, mrad/y per $\mu Ci/m^3$ (Table 1.4).

Release Rate Limit Methodology - Iodine and Particulate Dose Rates

Initial Setpoints

For initial setpoints, the iodine and particulate dose rates are calculated for the design objective source term given in Table 1.2. Dose

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rates are calculated for the critical organ, thyroid, of the critical age group, infant. Pathways considered are inhalation, ground contamination and milk ingestion. The dose rates are evaluated at the offsite locations with the highest expected concentrations, i.e., the nearest land site boundary points in each of the 16 sectors (from Table 1.1). This calculation assumes that a (hypothetical) cow is at each of these locations. These cows are assumed, conservatively, to obtain 100 percent of their food from pasture grass.

The inhalation, ground contamination, and milk ingestion dose rates (in mrem/year) for the selected organ (thyroid) and age group (infant) are calculated using Equation 1.15 as described in Section 1.5.3. For determining the total thyroid dose rate from iodines and particulates:

$$D_{TH} = D_{THI} + D_{TBG} + D_{THM} \tag{1.3}$$

where:

D_{TH} = total thyroid dose rate, mrem/yr.

D_{THI} = thyroid dose rate due to inhalation, mrem/yr.

D_{TBG} = total body dose rate due to ground contamination, mrem/yr. The thyroid dose rate is assumed to be equal to the total body dose rate for this pathway.

D_{THM} = thyroid dose rate due to pasture grass-cow-milk ingestion, mrem/yr.

Release Mix Specific Setpoint

For release mix specific setpoints, the iodine and particulate dose rates are calculated for a known source term. Dose rates for each particular nuclide are calculated for the critical organ (bone, liver, thyroid, lung, kidney or lung) of the critical age group (adult, teen, child or infant). Pathways considered are inhalation, ground contamination, pasture grass-cow-milk ingestion, stored feed-cow-milk ingestion, pasture grass-beef ingestion, stored feed-beef ingestion, fresh leafy vegetable ingestion and stored vegetable ingestion. The dose rates are evaluated at the offsite locations with the highest expected concentrations, i.e., the nearest land site boundary points in each of the 16 sectors (from Table 1.1). This calculation assumes that hypothetical milk and beef cows are at each of these locations.

The dose rate (in mrem/year) for the selected organ and age group are calculated using Equation 1.15 as described in Section 1.5.3. Meteorological dispersion is handled as described in Section 1.7, using historical annual average meteorological data given in Table 1.3.

All pathways are evaluated for each nuclide.

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Release Rate Limit Methodology - Setpoints

Initial Setpoints

The dose rate limits of interest (Specification 3.11.2.1) are:

Total Body = 500 mrem/yr
Skin = 3000 mrem/yr
Maximum Organ = 1500 mrem/yr

For the determination of initial setpoints, the above limits are divided by the appropriate calculated dose rate:

$$\frac{\text{Dose rate limit}}{\text{Calculated dose rate}} = R$$

The ratio, R, represents how far above or below the guidelines the dose rate calculation was. Multiplying the original source term (in Table 1.2) by R will give release rates that should correspond to the dose rate limits given above.

Appropriate release rate limits in μCi/s for each nuclide and release point will be provided to plant personnel for use in establishing monitor setpoints. The setpoint for each gaseous effluent monitor will be established using plant instructions.

The general equation used by plant personnel in establishing setpoints in cpm from release rate limits in μCi/s is as follows:

$$C = \frac{Q\ e\ s\ 60}{v\ 28320} \qquad (1.4)$$

where:

C = monitor setpoint, cpm.

Q = release rate limit, μCi/s.

e = detector efficiency, cpm/μCi/cc.

s = safety factor; 0.2 for systems without automatic isolation; 0.5 for systems with automatic isolation.

60 = s/min.

28320 = cc/ft^3.

V = flow rate out the vent, cfm.

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Release Rate Limit Methodology - Setpoints

Release Mix Specific Setpoints

When release mixes are known, setpoints are calculated using the dose rate methodology given above, based on the known mix rather than the design source term mix. Using a normalized source term (q_i) for each nuclide, nuclide specific dose rates (D_i) are determined for each nuclide using the dose rate methodology described above. Dividing the applicable dose rate limit by the nuclide specific dose rate, D_i, yields:

$$\frac{\text{Dose Rate limit}}{D_i} = r_i$$

This ratio, r_i represents how far above or below the guidelines the nuclide specific dose rate (D_i) is. Multiplying the normalized source term (q_i) by r_i will give the maximum allowable release rate R_i for nuclide i.

The maximum allowable release rate, R_i, for each nuclide is also calculated by an alternate methodology based on the reporting requirements of 10 CFR 50.73 (2 times the 10 CFR 20 Appendix B, Table II air concentrations). Release rate limits, R_i in μCi/s, for each nuclide are calculated using this methodology as given below:

$$R_i = \frac{(2)(MPC_i)}{(5.12\times10^{-6})(10^{-6})} \qquad (1.5)$$

$$= 3.91\times10^{11}\ MPC_i$$

where

MPC_i = the 10 CFR 20, Appendix B. Table II, air concentration, μCi/cc.

5.12×10^{-6} = worst land site boundary X/Q, s/m³ (Table 1.1).

10^{-6} = conversion factor, m³/cc.

The release rate limit, R_i in μCi/s, for each nuclide will be the most restrictive one calculated using both methodologies.

For a known mixture of n nuclides the release rates, Q_i, must be such that:

$$\sum_{i=1}^{n} \frac{Q_i}{R_i} < 1$$

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The appropriate release rate limits, R_i, in μCi/s for each nuclide and release point will be provided to plant personnel for use in establishing monitor setpoints. The setpoint in counts per minute for each gaseous effluent monitor will be established using plant instructions. The general equation used by plant personnel in establishing setpoints in cpm from release rate limits in μCi/s is Equation 1.4.

1.2 Monthly Dose Calculations

Dose calculations will be performed once per 31 days to determine compliance with Specifications 3.11.2.2 and 3.11.2.3. These specifications require that the dose at or beyond the site boundary due to gaseous effluents from each reactor at the site shall be limited to the following:

For noble gases,

1. During any calendar quarter, 5 mrad per unit to air for gamma radiation and 10 mrad per unit to air for beta radiation.

2. During any calendar year, 10 mrad per unit to air for gamma radiation and 20 mrad per unit to air for beta radiation.

For I-131, I-133, tritium, and particulates with half lives greater than 8 days,

1. During any calendar quarter, 7.5 mrem per unit to any organ.

2. During any calendar year, 15 mrem per unit to any organ.

This section of the ODCM describes the methodology that will be used to perform these monthly calculations.

Doses will be calculated using the conservative model described in Sections 1.2.1 and 1.2.2. If 50 percent of the monthly fraction of the 2 unit annual Technical Specification Limit is exceeded, a realistic model, described in Sections 1.2.3 and 1.2.4, will be used.

1.2.1 Monthly Noble Gas Dose (Conservative Model)

Doses to be calculated are gamma and beta air doses due to exposure to a semi-infinite cloud of noble gases. Releases of Ar-41, Kr-85m, Kr-85, Kr-87, Kr-88, Xe-131m, Xe-133m, Xe-133, Xe-135m, Xe-135, and Xe-138 are considered. Because only these nuclides are considered, the dose is divided by 0.9, to account for a possible 10 percent contribution of dose from other nuclides.

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The dispersion factor used will be the highest annual-average X/Q based on 1972-1975 meteorological data (Table 1.3) for land-site boundary locations. Dispersion factors are calculated using the methodology described by Equation 1.17.

No credit is taken for radioactive decay.

Monthly Conservative Model - Gamma dose to air

$$D_\gamma = \frac{(X/Q)}{0.9} \quad \frac{10^6}{3.15\times10^7} \sum_i Q_i \, DF_{\gamma i} \qquad (1.6)$$

where:

D_γ = gamma dose to air, mrad.

X/Q = highest land-site boundary annual-average relative concentration, 5.12×10^{-6} s/m^3 (from Table 1.1).

0.9 = fraction of total gamma dose expected to be contributed by the assumed nuclides.

10^6 = µCi/Ci conversion factor.

3.15×10^7 = s/yr conversion factor.

Q_i = monthly release of radionuclide i, Ci.

$DF_{\gamma i}$ = gamma-to-air dose factor for radionuclide i, mrad/yr per µCi/m^3 (Table 1.4). For Kr-88 and Xe-138, the dose factors for Kr-88+D and Xe-138+D are used to account for daughter buildup.

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Monthly Conservative Model - Beta dose to air

$$D_\beta = \frac{(X/Q)}{0.9} \; \frac{10^6}{3.15x10^7} \sum_i Q_i \; DF_{\beta i} \qquad (1.7)$$

where:

D_β = beta dose to air, mrad.

X/Q = highest land-site boundary annual-average relative concentration, $5.12x10^{-6}$ s/m^3 (from Table 1.1).

0.9 = fraction of total beta dose expected to be contributed by the assumed nuclides.

10^6 = µCi/Ci conversion factor.

$3.15x10^7$ = s/yr conversion factor.

Q_i = monthly release of radionuclide i, Ci.

$DF_{\beta i}$ = beta-to-air dose factor for radionuclide i, mrad/yr per µCi/m^3 (Table 1.4). For Kr-88 and Xe-138, the dose factors for Kr-88+D and Xe-138+D are used to account for daughter buildup.

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1.2.2 Monthly dose from Iodines, Particulates, and Tritium (Conservative Model)

Doses are to be calculated for the infant thyroid from milk ingestion and for the child bone and teen gastrointestinal tract (GIT) from vegetable ingestion. Releases of H-3, I-131, and I-133 are considered for the milk pathway. H-3, Sr-89, Sr-90, Cs-134, and Cs-137 releases are considered for the vegetable pathway to the child bone. H-3, Co-58, and Co-60 releases are considered for the vegetable pathway to the teen GIT. The most critical real cow location is considered for the milk pathway and the most critical location with a home-use garden is considered for the vegetable pathways (see Table 1.1). The cow is assumed to graze on pasture grass for the whole year.

The highest annual-average X/Q and D/Q based on 1972-1975 meteorological data (Table 1.3) will be used for ingestion pathway locations. Dispersion values are calculated as described by Equations 1.17 and 1.18.

No credit is taken for radioactive decay.

Doses are divided by 0.9 to account for a possible 10 percent contribution from other nuclides.

Monthly Conservative Model - Infant Thyroid Dose from Milk Ingestion

The monthly thyroid dose from milk ingestion is calculated using the following equation:

$$D_{TH} = \frac{\sum_i (Q_i \; R_{CPi}) \; D/Q \; 10^6 + (Q_T \; R_{CPT}) \; X/Q}{0.9 \times 3.15 \times 10^7} \qquad (1.8)$$

where

Q_i = monthly release of iodine nuclide i, Ci.

Q_T = monthly release of H-3, Ci.

R_{CPi} = I-131 or I-133 pasture grass-cow-milk ingestion dose factor for infant thyroid, mrem/yr per µCi/m²-s. Dose factors are calculated as described in Section 1.6.1.

R_{CPT} = H-3 pasture grass-cow-milk ingestion dose factor for infant thyroid, mrem/yr per µCi/cc. The dose factor is calculated as described in Section 1.6.7.

D/Q = highest relative deposition rate for a location with an identified milk cow, 1.10×10^{-9} m^{-2} (from Table 1.1).

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X/Q = highest relative air concentration for a location with an identified milk cow, 6.18×10^{-8} s/m³ (from Table 1.1).

0.9 = fraction of dose expected to be contributed by I-131, I-133 and H-3.

3.15×10^{7} = s/yr.

10^{6} = µCi/Ci.

Monthly Conservative Model - Child Bone Dose from Vegetable Ingestion

The monthly bone dose from vegetable ingestion is calculated using the following equation:

$$DBC = \frac{\sum_i (Q_i \; DF_i) \; D/Q \; 10^{6} + Q_T \; DF_T \; X/Q}{0.9 \times 3.15 \times 10^{7}} \qquad (1.9)$$

where

Q_i = monthly release of Sr or Cs nuclide i, Ci.

Q_T = monthly release of H-3, Ci.

DF_i = Total vegetable ingestion dose factor to child bone for Sr-89, Sr-90, Cs-134 or Cs-137, mrem/yr per µCi/m²-s.
= $R_{VFi} + R_{VSi}$, where R_{VFi} is the dose factor for fresh leafy vegetables (as calculated in Section 1.6.5) and R_{VSi} is the dose factor for stored vegetables (as calculated in Section 1.6.6).

DF_T = Total vegetable ingestion dose factor for child bone for H-3, mrem/yr per µCi/cc.
= $R_{VFT} + R_{VST}$, where R_{VFT} is the tritium dose factor for fresh leafy vegetables (as calculated in Section 1.6.11) and R_{VST} is the tritium dose factor for stored vegetables (as calculated in Section 1.6.12).

D/Q = highest relative deposition rate for a location with an identified home use garden, 6.38×10^{-9} m^{-2} (from Table 1.1).

X/Q = highest relative air concentration for a location with an identified home use garden, 3.42×10^{-6} s/m³ (from Table 1.1).

3.15×10^{7} = s/yr.

10^{6} = µCi/Ci.

0.9 = fraction of total child bone dose expected to be contributed by H-3, Sr-89, Sr-90, Cs-134, and Cs-137.

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Monthly Conservative Model - Teen Gastrointestinal Tract (GIT) Dose from Vegetable Ingestion

The monthly teen GIT dose from vegetable ingestion is calculated using the following equation:

$$DGT = \frac{\sum_i (Q_i\ DF_i)\ D/Q\ \ 10^6\ +\ Q_T\ DF_T\ X/Q}{0.9 \times 3.15\times10^7} \qquad (1.10)$$

where

Q_i = monthly release of cobalt nuclide i, Ci.

Q_T = monthly release of H-3, Ci.

DF_i = Total vegetable ingestion dose factor to the teen GIT for Co-58 or Co-60, mrem/yr per $\mu Ci/m^2$-s.
= $R_{VFi} + R_{VSi}$, where R_{VFi} is the dose factor for fresh leafy vegetables (as calculated in Section 1.6.5) and R_{VSi} is the dose factor for stored vegetables (as calculated in Section 1.6.6).

DF_T = Total vegetable ingestion dose factor to the teen GIT for H-3, mrem/yr per µCi/cc.
= $R_{VFT} + R_{VST}$, where R_{VFT} is the tritium dose factor for fresh leafy vegetables (as calculated in Section 1.6.11) and R_{VSi} is the tritium dose factor for stored vegetables (as calculated in Section 1.6.12).

D/Q = highest relative deposition rate for a location with an identified home use garden, 6.38×10^{-9} m^{-2} (from Table 1.1).

X/Q = highest relative air concentration for a location with an identified home use garden, 3.42×10^{-6} s/m^3 (from Table 1.1).

3.15×10^7 = s/yr.

10^6 = µCi/Ci.

0.9 = fraction of total teen GIT dose expected to be contributed by H-3, Co-58, and Co-60.

Total Monthly Dose - Comparison to Limits

The calculated gamma-air and beta-air doses are compared to the monthly fraction of the annual 2-unit Technical Specification limits for these

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doses, i.e., 1.67 mrem for gamma-air and 3.33 mrem for beta-air. The maximum monthly organ dose is the highest of the three doses calculated; it is compared to the monthly fraction of its annual limit, i.e., 2.50 mrem. If any of the doses calculated by the conservative monthly dose model exceed 50 percent of the monthly fraction of the 2 unit annual Technical Specification limits, a more comprehensive dose assessment will be performed as described below. For doses calculated to be less than 50 percent of these limits, the results of the conservative monthly model will be used to determine cumulative quarterly and annual doses as described in Section 1.2.5.

1.2.3 Monthly Noble Gas Dose (Realistic Model)

In the realistic model, all measured radionuclides are used to calculate gamma and beta air doses. The dose is evaluated at the nearest land site boundary point in each sector using a semi-infinite cloud model.

Historical onsite meteorological data from the period 1972-1975 (Table 1.3) will be used to calculate dispersion factors as described in Section 1.7.

Radioactive decay is considered in this calculation.

The monthly release is averaged over one year to obtain an average release rate.

Realistic Model - Gamma dose to air

$$D_{\gamma n} = t_m \sum_i \chi_{ni} \, DF_{\gamma i} \qquad (1.11)$$

where:

$D_{\gamma n}$ = gamma dose to air for sector n, mrad.

χ_{ni} = air concentration of radionuclide i in sector n, $\mu Ci/m^3$. Air concentrations are calculated as described by Equation 1.16.

$DF_{\gamma i}$ = gamma-to-air dose factor for radionuclide i, mrad/yr per $\mu Ci/m^3$ (Table 1.4).

t_m = time period over which the release is averaged, yr.

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Realistic Model - Beta dose to air

$$D_{\beta n} = t_m \sum_i X_{ni} DF_{\beta i} \qquad (1.12)$$

where:

$D_{\beta n}$ = beta dose to air for sector n, mrad.

X_{ni} = air concentration of radionuclide i in sector n, $\mu Ci/m^3$. Air concentrations are calculated as described by Equation 1.16.

$DF_{\beta i}$ = beta to air dose factor for radionuclide i, mrad/yr per $\mu Ci/m^3$.

t_m = time period over which the release is averaged, yr.

The land site boundary locations having the highest gamma and beta doses are then used in the cumulative quarterly and annual dose determination to check compliance with Specification 3.11.2.2.

1.2.4 Iodines, Particulates and Tritium (Realistic Model)

Doses for releases of iodines, particulates, and tritium will be calculated using Equation 1.15 given in Section 1.5.3. The calculation will consider all measured radionuclide releases. The dose will be evaluated for all organs and all age groups, and the maximum organ dose selected. Actual land use survey data and grazing information will be used to determine the dose for real individuals and pathways.

The highest gamma-air and beta-air doses calculated will be used in the cumulative quarterly and annual dose determination to check compliance with Specification 3.11.2.2. The highest organ dose for a real receptor is determined by summing the dose contribution from all real pathways including ground contamination, inhalation, vegetable ingestion (for identified garden locations), cow and/or goat milk ingestion (if a cow or goat is identified for the location), beef ingestion (the beef ingestion dose for the location of highest beef dose for all receptors will be considered the beef dose for all receptors). The receptor having the highest organ dose is then used in the cumulative quarterly and annual dose determination to check compliance with Specification 3.11.2.3.

1.2.5 Cumulative Quarterly and Annual Doses

Cumulative calendar quarter doses are estimated by summing the doses calculated for each month in that quarter. Cumulative calendar year doses are estimated by summing the doses calculated for each month in that year. The cumulative calendar quarter and calendar year doses are compared to their respective 2-unit Technical Specification limits to determine compliance.

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1.3 Quarterly Dose Calculations

A complete dose analysis utilizing the total estimated gaseous releases for each calendar quarter will be performed and reported as required in Specifications 6.9.1.8 and 6.9.1.9. Methodology for this analysis is that which is described in Section 1.5, using the quarterly release values reported by the plant personnel. All real pathways and receptor locations (as identified in Table 1.1) are considered. In addition, actual meteorological data representative of a ground level release for each corresponding calendar quarter will be used.

The highest gamma-air and beta-air doses calculated will be used to check compliance with the quarterly limits of Specification 3.11.2.2. The highest organ dose for a real receptor is determined by summing the dose contribution from all real pathways including ground contamination, inhalation, vegetable ingestion (for identified garden locations), cow and/or goat milk ingestion (if a cow or goat is identified for the location), beef ingestion (the beef ingestion dose for the location of highest beef dose for all receptors will be considered the beef dose for all receptors). The receptor having the highest organ dose is then used to check compliance with the quarterly limits of Specification 3.11.2.3.

Population Doses

For determining population doses to the 50-mile population around the plant, each compass sector is broken down into elements. These elements are defined in Table 1.5. For each of these sector elements, an average dose is calculated, and then multiplied by the population in that sector element. Dispersion factors are calculated for the midpoint of each sector element (see Table 1.5).

For population doses resulting from ingestion, it is conservatively assumed that all food eaten by the average individual is grown locally.

The general equation used for calculating the population dose in a given sector element is:

$$Dose_{pop} = \sum_{P} RATIO_P * POPN * AGE * 0.001 * DOSE_P$$

where

$RATIO_P$ = ratio of average to maximum dose for pathway P. (Average ingestion rates are obtained from Regulatory Guide 1.109, Table E-4.)

= 0.5 for submersion and ground exposure pathways, a shielding/occupancy factor.

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= 1.0 for the inhalation pathway.

= 0.515, 0.515, 0.5, and 0.355 for milk, for infant, child, teen and adult, respectively. (It is assumed that the ratio of average to maximum infant milk ingestion rates is the same as that for child.)

= 1.0, 0.90, 0.91, 0.86 for beef ingestion, for infant, child, and adult, respectively.

= 1.0, 0.38, 0.38, 0.37 for vegetable ingestion, for infant, child, teen and adult, respectively. (It is assumed that the average individual eats no fresh leafy vegetables, only stored vegetables.)

POPN = the population of the sector element, persons (Table 1.6).

AGE = fraction of the population belonging to each age group.

= 0.015, 0.168, 0.153, 0.665 for infant, child, teen and adult, respectively (fractions taken from NUREG/CR-1004, Table 3.39).

0.001 = conversion from mrem to rem.

$DOSE_P$ = the dose for pathway P to the maximum individual at the location under consideration, mrem. For ingestion pathways, this dose is multiplied by an average decay correction to account for decay as the food is moved through the food distribution cycle. This average decay correction, ADC, is defined as:

$ADC = \exp(-\lambda_i t)$, for milk and vegetables,

where

λ_i = decay constant for nuclide i, seconds.

t = distribution time for food product under consideration (values from Regulatory Guide 1.109, Table D-1).

= 1.21E+06 seconds (14 days) for vegetables.

= 3.46E+05 seconds (4 days) for milk.

$$ADC = \frac{\exp(-\lambda_i t)\ \lambda_i t_{cb}}{1 - \exp(\lambda_i t_{cb})}$$, for meat,

where

λ_i = decay constant for nuclide i, seconds.

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t = additional distribution time for meat, over and above the time for slaughter to consumption described in Section 1.6.3, 7 days.

t_{cb} = time to consume a whole beef, as described in Section 1.6.3.

For beef ingestion, the additional factors in the calculation of ADC negate the integration of the dose term over the period during which a whole beef is consumed, for the calculation of population dose. This assumes that the maximum individual freezes and eats a whole beef, but the average individual buys smaller portions at a time.

Population doses are summed over all sector elements to obtain a total population dose for the 50-mile population.

1.4 Gaseous Radwaste Treatment System Operation

The gaseous radwaste treatment system (GRTS) described below shall be maintained and operated to keep releases ALARA.

1.4.1 System Description

A flow diagram for the GRTS is given in Figure 1.2. The system consists of two waste-gas compressor packages, nine gas decay tanks, and the associated piping, valves, and instrumentation. Gaseous wastes are received from the following: degassing of the reactor coolant and purging of the volume control tank prior to a cold shutdown, displacing of cover gases caused by liquid accumulation in the tanks connected to the vent header, and boron recycle process operation.

1.4.2 Dose Projections

In accordance with specification 3.11.2.4, dose projections will be performed. This will be done by averaging the calculated dose for the most recent month and the calculated dose for the previous month and assigning that average dose as the projection for the current month.

The projected doses are compared to the limits of specification 3.11.2.4, i.e., 0.4 mrad gamma, 0.8 mrad beta, and 0.6 mrem to any organ. If the projected doses exceed any of these limits, the gaseous radwaste treatment system and the ventilation exhaust treatment system shall be used to reduce radioactive materials in gaseous effluents to areas at or beyond the site boundary.

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1.5 GASEOUS RELEASES - Dose Calculation Equations

1.5.1 Noble gas - Gamma air dose

Gamma air doses due to exposure to noble gases will be estimated with the following equation:

$$D_\gamma = X_{im}\, DF_{\gamma i} \quad (1.13)$$

where:

D_γ = Gamma air dose, mrad.

X_{im} = concentration of nuclide i at location m, $\mu Ci/m^3$. Air concentrations are calculated as described by Equation 1.16.

$DF_{\gamma i}$ = dose conversion factor for external gamma for nuclide i, mrad/year per microcurie/m^3 (Table 1.4).

1.5.2 Noble gas - Beta air dose

Beta air doses due to exposure to noble gases will be estimated with the following equation:

$$D_\beta = X_{im}\, DF_{\beta i} \quad (1.14)$$

where:

D_β = Beta air dose, mrad.

X_{im} = concentration of nuclide i at location m, $\mu Ci/m^3$. Air concentrations are calculated as described by Equation 1.16.

$LF_{\beta i}$ = dose conversion factor for external beta for nuclide i, mrad/year per microcurie/m^3 (Table 1.4).

1.5.3 Radioiodine, particulate and tritium - Maximum organ dose

Organ doses due to radioiodine, particulate and tritium releases are calculated using the following equation:

$$D_{org} = 3.17E\text{-}08 \left[\sum_i \left(X/Q \sum_P R_{Pi} + D/Q\ R_{Gi} + X/Q\ RI_i \right) Q_i + \left(X/Q\ R_{PT} \right) Q_T \right] \quad (1.15)$$

where:

D_{org} = Organ dose, mrem.

3.17E-08 = conversion factor, year/second.

X/Q = Relative concentration for location under consideration, sec/m^3. Relative concentrations are calculated as described by Equation 1.17.

R_{Pi} = ingestion dose factor for pathway P for each identified nuclide i (except tritium), m^2-mrem/year per microcurie/second. Ingestion pathways available for consideration include:

pasture grass-cow-milk ingestion
stored feed-cow-milk ingestion
pasture grass-goat-milk ingestion
stored feed-goat-milk ingestion
pasture grass-beef ingestion
stored feed-beef ingestion
fresh leafy vegetable ingestion
stored vegetable ingestion

Equations for calculating these ingestion dose factors are given in sections 1.7.1 through 1.7.6.

D/Q = Relative deposition for location under consideration, m^{-2}. Relative deposition is calculated as described in Equation 1.18.

R_{Gi} = Dose factor for standing on contaminated ground, m^2-mrem/year per microcurie/second. The equation for calculating the ground plane dose factor is given in Section 1.6.14.

R_{Ii} = Inhalation dose factor, mrem/year per microcurie/m^3. The equation for calculating the inhalation dose factor is given in Section 1.6.13.

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Q_i = adjusted release rate for nuclide i for location under consideration, μCi/sec. The initial release rate is adjusted to account for decay between the release point and the location, depending on the frequency of wind speeds applicable to that sector. Hence, the adjusted release rate is equal to the actual release rate decayed for an average travel time during the period.

$$= Q_{i0} \sum_{j=1}^{9} f_j \exp(-\lambda_i\, x/u_j)$$

where

Q_{i0} = initial average release rate for nuclide i over the period, μCi/sec.

f_j = joint relative frequency of occurrence of winds in windspeed class j blowing toward this exposure point, expressed as a fraction.

λ_i = radiological decay constant for nuclide i, sec^{-1}.

x = downwind distance, meters.

u_j = midpoint value of wind speed class interval j, m/s.

R_{PT} = ingestion dose factor for pathway P for tritium, m^2-mrem/year per microcurie/second. Ingestion pathways available for consideration are the same as those listed above for R_{Pi}. Equations for calculating ingestion dose factors for tritium are given in sections 1.7.7 through 1.7.1?.

Q_T = adjusted release rate for tritium for location under consideration, μCi/sec. Calculated in the same manner as Q_i above.

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1.6 GASEOUS RELEASES - Dose Factors

1.6.1 PASTURE GRASS-COW/GOAT-MILK INGESTION DOSE FACTORS - R_{CPi}
(m^2-mrem/year per microcuries/second)

$$R_{CPi} = 10^6 DFL_{iao} U_{ap} F_{mi} Q_f \exp(-\lambda_i t_{fm}) f_p \left\{ \frac{r(1-\exp(-\lambda_E t_{ep}))}{Y_p \lambda_E} + \frac{B_{iv}(1-\exp(-\lambda_i t_b))}{P \lambda_i} \right\}$$

where:

10^6 = conversion factor, picocurie/microcurie.

DFL_{iao} = ingestion dose conversion factor for nuclide i, age group a, organ o, mrem/picocurie (Table 1.7).

U_{ap} = milk ingestion rate for age group a, liters/year.

F_{mi} = transfer factor for nuclide i from animal's feed to milk, days/liter (Table 1.8).

Q_f = animal's consumption rate, kg/day.

λ_i = decay constant for nuclide i, seconds^{-1} (Table 1.8).

t_{fm} = transport time from milking to receptor, seconds.

f_p = fraction of time animal spends on pasture, dimensionless.

r = fraction of activity retained on pasture grass, dimensionless.

λ_E = the effective decay constant, due to radioactive decay and weathering, seconds^{-1}, equal to $\lambda_i + \lambda_w$.

λ_w = weathering decay constant for leaf and plant surfaces, seconds^{-1}.

t_{ep} = time pasture is exposed to deposition, seconds.

Y_p = agricultural productivity by unit area of pasture grass, kg/m^2.

B_{iv} = transfer factor for nuclide i from soil to vegetation, picocuries/kg (wet weight of vegetation) per picocuries/kg (dry soil).

t_b = time period over which accumulation on the ground is evaluated, seconds.

P = effective surface density of soil, kg/m^2.

NOTE: Factors defined above which do not reference a table for their numerical values, are listed in Table 1.9.

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1.6.2 STORED FEED-COW/GOAT-MILK INGESTION DOSE FACTORS - R_{CSi}
(m^2-mrem/year per microcuries/second)

$$R_{CSi} = 10^6 \, DFL_{iao} \, U_{ap} \, F_{mi} \, Q_f \, f_s \, \exp(-\lambda_i t_{fm}) \, \frac{(1-\exp(-\lambda_i t_{csf}))}{t_{csf} \, \lambda_i} \left\{ \frac{r(1-\exp(-\lambda_E t_{esf}))}{Y_{sf} \, \lambda_E} + \frac{B_{iv}(1-\exp(-\lambda_i t_b))}{P \, \lambda_i} \right\}$$

where:

10^6 = conversion factor, picocurie/microcurie.

DFL_{iao} = ingestion dose conversion factor for nuclide i, age group a, organ o, mrem/picocurie (Table 1.7).

U_{ap} = milk ingestion rate for age group a, liters/year.

F_{mi} = transfer factor for nuclide i from animal's feed to milk, days/liter (Table 1.8).

Q_f = animal's consumption rate, kg/day.

f_s = fraction of time animal spends on stored feed, dimensionless.

λ_i = decay constant for nuclide i, seconds^{-1} (Table 1.8).

t_{fm} = transport time from milking to receptor, seconds.

t_{csf} = time between harvest of stored feed and consumption by animal, seconds.

r = fraction of activity retained on pasture grass, dimensionless.

λ_E = the effective decay constant, due to radioactive decay and weathering, seconds^{-1}, equal to $\lambda_i + \lambda_w$.

λ_w = weathering decay constant for leaf and plant surfaces, seconds^{-1}.

t_{esf} = time stored feed is exposed to deposition, seconds.

Y_{sf} = agricultural productivity by unit area of stored feed, kg/m^2.

B_{iv} = transfer factor for nuclide i from soil to vegetation, picocuries/kg (wet weight of vegetation) per picocuries/kg (dry soil).

t_b = time period over which accumulation on the ground is evaluated, seconds.

P = effective surface density of soil, kg/m^2.

NOTE: Factors defined above which do not reference a table for their numerical values, are listed in Table 1.9.

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1.6.3 PASTURE GRASS-BEEF INGESTION DOSE FACTORS - R_{MPi}
(m^2-mrem/year per microcuries/second)

$$R_{MPi} = 10^6 \, DFL_{iao} \, U_{am} \, F_{fi} \, Q_f \, \frac{(1-\exp(-\lambda_i t_{cb}))}{\lambda_i \, t_{cb}} \exp(-\lambda_i t_s) \, f_p \left\{ \frac{r(1-\exp(-\lambda_E t_{ep}))}{Y_p \, \lambda_E} + \frac{B_{iv}(1-\exp(-\lambda_i t_b))}{P \, \lambda_i} \right\}$$

where:

10^6 = conversion factor, picocurie/microcurie.

DFL_{iao} = ingestion dose conversion factor for nuclide i, age group a, organ o, mrem/picocurie (Table 1.7).

U_{am} = meat ingestion rate for age group a, kg/year.

F_{fi} = transfer factor for nuclide i from cow's feed to meat, days/kg (Table 1.8).

Q_f = cow's consumption rate, kg/day.

λ_i = decay constant for nuclide i, seconds^{-1} (Table 1.8).

t_{cb} = time for receptor to consume a whole beef, seconds.

t_s = transport time from slaughter to consumer, seconds.

f_p = fraction of time cow spends on pasture, dimensionless.

r = fraction of activity retained on pasture grass, dimensionless.

λ_E = the effective decay constant, due to radioactive decay and weathering, seconds^{-1}, equal to $\lambda_i + \lambda_w$.

λ_w = weathering decay constant for leaf and plant surfaces, seconds^{-1}.

t_{ep} = time pasture is exposed to deposition, seconds.

Y_p = agricultural productivity by unit area of pasture grass, kg/m^2.

B_{iv} = transfer factor for nuclide i from soil to vegetation, picocuries/kg (wet weight of vegetation) per picocuries/kg (dry soil).

t_b = time over which accumulation on the ground is evaluated, seconds.

P = effective surface density of soil, kg/m^2.

NOTE: Factors defined above which do not reference a table for their numerical values, are listed in Table 1.9.

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1.6.4 STORED FEED-BEEF INGESTION DOSE FACTORS - R_{MSi} (m^2-mrem/year per microcuries/second)

$$R_{MSi} = 10^6 \, DFL_{iao} \, U_{am} \, F_{fi} \, Q_f \, \frac{(1-\exp(-\lambda_i t_{cb}))}{\lambda_i \, t_{cb}} \exp(-\lambda_i t_s)$$

$$f_s \, \frac{(1-\exp(-\lambda_i t_{csf}))}{\lambda_i \, t_{csf}} \left\{ \frac{r(1-\exp(-\lambda_E t_{esf}))}{Y_{sf} \, \lambda_E} + \frac{B_{iv}(1-\exp(-\lambda_i t_b))}{P \, \lambda_i} \right\}$$

where:

10^6 = conversion factor, picocurie/microcurie.

DFL_{iao} = ingestion dose conversion factor for nuclide i, age group a, organ o, mrem/picocurie (Table 1.7).

U_{am} = meat ingestion rate for age group a, kg/year.

F_{fi} = transfer factor for nuclide i from cow's feed to meat, days/kg (Table 1.8).

Q_f = cow's consumption rate, kg/day.

λ_i = decay constant for nuclide i, seconds^{-1} (Table 1.8).

t_{cb} = time for receptor to consume a whole beef, seconds.

t_s = transport time from slaughter to consumer, seconds.

f_s = fraction of time cow spends on stored feed, dimensionless.

t_{csf} = time between harvest of stored feed and consumption by cow, seconds.

r = fraction of activity retained on pasture grass, dimensionless.

t_{esf} = time stored feed is exposed to deposition, seconds.

Y_{sf} = agricultural productivity by unit area of stored feed, kg/m^2.

λ_E = the effective decay constant, due to radioactive decay and weathering, seconds^{-1}, equal to $\lambda_i + \lambda_w$.

λ_w = weathering decay constant for leaf and plant surfaces, seconds^{-1}.

B_{iv} = transfer factor for nuclide i from soil to vegetation, picocuries/kg (wet weight of vegetation) per picocuries/kg (dry soil).

t_b = time over which accumulation on the ground is evaluated, seconds.

P = effective surface density of soil, kg/m^2.

NOTE: Factors defined above which do not reference a table for their numerical values, are listed in Table 1.9.

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1.6.5 FRESH LEAFY VEGETABLE INGESTION DOSE FACTORS - R_{VFi}
(m^2-mrem/year per microcuries/second)

$$R_{VFi} = 10^6 \; DFL_{iao} \; e(-\lambda_i t_{hc}) \; U_{FLa} f_L \left\{ \frac{r(1-e(-\lambda_E t_e))}{Y_f \; \lambda_E} + \frac{B_{iv}(1-e(-\lambda_i t_b))}{P \; \lambda_i} \right\}$$

where:

10^6 = conversion factor, picocurie/microcurie.

DFL_{iao} = ingestion dose conversion factor for nuclide i, age group a, organ o, mrem/picocurie (Table 1.7).

λ_i = decay constant for nuclide i, $seconds^{-1}$ (Table 1.8).

t_{hc} = average time between harvest of vegetables and their consumption and/or storage, seconds.

U_{FLa} = consumption rate of fresh leafy vegetables by the receptor in age group a, kg/year.

f_L = fraction of fresh leafy vegetables grown locally, dimensionless.

r = fraction of deposited activity retained on vegetables, dimensionless.

λ_E = the effective decay constant, due to radioactive decay and weathering, $seconds^{-1}$.
= $\lambda_i + \lambda_w$

λ_w = decay constant for removal of activity on leaf and plant surfaces by weathering, $seconds^{-1}$.

t_e = exposure time in garden for fresh leafy and/or stored vegetables, seconds.

Y_f = vegetation areal density for fresh leafy vegetables, kg/m^2.

B_{iv} = transfer factor for nuclide i from soil to vegetables, picocuries/kg (wet weight of vegetation) per picocuries/kg (dry soil).

t_b = time period over which accumulation on the ground is evaluated, seconds.

P = effective surface density of soil, kg/m^2.

NOTE: Factors defined above which do not reference a table for their numerical values, are listed in Table 1.9.

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1.6.6 STORED VEGETABLE INGESTION DOSE FACTORS - R_{VSi} m^2-mrem/year per microcuries/second)

$$R_{VSi} = 10^6\, DFL_{iao} \exp(-\lambda_i t_{hc})\, U_{Sa} f_g \frac{(1-e(-\lambda_i t_{sv}))}{\lambda_i\, t_{sv}} \left\{\frac{r(1-e(-\lambda_E t_e))}{Y_{sv}\, \lambda_E} + \frac{B_{iv}(1-e(-\lambda_i t_b))}{P\, \lambda_i}\right\}$$

where:

10^6 = conversion factor, picocurie/microcurie.

DFL_{iao} = ingestion dose conversion factor for nuclide i, age group a, organ o, mrem/picocurie (Table 1.7).

λ_i = decay constant for nuclide i, $seconds^{-1}$ (Table 1.8).

t_{hc} = average time between harvest of vegetables and their consumption and/or storage, seconds.

U_{Sa} = consumption rate of stored vegetables by the receptor in age group a, kg/year.

f_g = fraction of stored vegetables grown locally, dimensionless.

t_{sv} = time between storage of vegetables and their consumption, seconds.

r = fraction of deposited activity retained on vegetables, dimensionless.

λ_E = the effective decay constant, due to radioactive decay and weathering, $seconds^{-1}$.
= $\lambda_i + \lambda_w$

λ_w = decay constant for removal of activity on leaf and plant surfaces by weathering, $seconds^{-1}$.

t_e = exposure time in garden for fresh leafy and/or stored vegetables, seconds.

Y_{sv} = vegetation areal density for stored vegetables, kg/m^2.

B_{iv} = transfer factor for nuclide i from soil to vegetables, picocuries/kg (wet weight of vegetation) per picocuries/kg (dry soil).

t_b = time period over which accumulation on the ground is evaluated, seconds.

P = effective surface density of soil, kg/m^2.

NOTE: Factors defined above which do not reference a table for their numerical values, are listed in Table 1.9.

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1.6.7 TRITIUM-PASTURE GRASS-COW/GOAT-MILK DOSE FACTOR - R_{CTP} (mrem/year per microcuries/m^3)

$$R_{CTP} = 10^3\ 10^6\ DFL_{Tao}\ F_{mT}\ Q_f\ U_{ap}\ [0.75(0.5/H)]\ f_p\ \exp(-\lambda_T t_{fm})$$

where:

10^3	= conversion factor, grams/kg.
10^6	= conversion factor, picocuries/microcuries.
DFL_{Tao}	= ingestion dose conversion factor for tritium for age group a, organ o, mrem/picocurie (Table 1.7).
F_{mT}	= transfer factor for tritium from animal's feed to milk, days/liter (Table 1.8).
Q_f	= animal's consumption rate, kg/day.
U_{ap}	= milk ingestion rate for age group a, liters/year.
0.75	= the fraction of total feed that is water.
0.5	= the ratio of the specific activity of the feed grass water to the atmospheric water.
H	= absolute humidity of the atmosphere, g/m^3.
f_p	= fraction of time animal spends on pasture, dimensionless.
λ_T	= decay constant for tritium, seconds^{-1} (Table 1.8).
t_{fm}	= transport time from milking to receptor, seconds.

NOTE: Factors defined above which do not reference a table for their numerical values, are listed in Table 1.9.

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1.6.8 TRITIUM-STORED FEED-COW/GOAT-MILK DOSE FACTOR - R_{CTS} (mrem/year per microcuries/m^3)

$$R_{CTS} = 10^3\ 10^6\ DFL_{Tao}\ F_{mT}\ Q_f\ U_{ap}\ [0.75(0.5/H)]\ f_s\ \frac{(1-\exp(-\lambda_T t_{csf}))}{\lambda_T\ t_{csf}}\ \exp(-\lambda_T t_{fm})$$

where:

10^3 = conversion factor, grams/kg.

10^6 = conversion factor, picocuries/microcuries.

DFL_{Tao} = ingestion dose conversion factor for tritium for age group a, organ o, mrem/picocurie (Table 1.7).

F_{mT} = transfer factor for tritium from animal's feed to milk, days/liter (Table 1.8).

Q_f = animal's consumption rate, kg/day.

U_{ap} = milk ingestion rate for age group a, liters/year.

0.75 = the fraction of total feed that is water.

0.5 = the ratio of the specific activity of the feed grass water to the atmospheric water.

H = absolute humidity of the atmosphere, g/m^3.

f_s = fraction of time animal spends on stored feed, dimensionless.

λ_T = decay constant for tritium, seconds^{-1} (Table 1.8).

t_{csf} = time between harvest of stored feed and consumption by animal, seconds.

t_{fm} = transport time from milking to receptor, seconds.

NOTE: Factors defined above which do not reference a table for their numerical values, are listed in Table 1.9.

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1.6.9 TRITIUM-PASTURE GRASS-BEEF DOSE FACTOR - R_{MT}
(mrem/year per microcuries/m^3)

$$R_{MTP} = 10^3\ 10^6\ DFL_{Tao}\ F_{fT}\ Q_f\ U_{am}\ [0.75(0.5/H)]\ f_p\ \exp(-\lambda_T t_s)\ \frac{(1-\exp(-\lambda_T t_{ep}))}{\lambda_T\ t_{ep}}\ \frac{(1-\exp(-\lambda_T t_{cb}))}{\lambda_T\ t_{cb}}$$

where:

10^3 = conversion factor, grams/kg.

10^6 = conversion factor, picocuries/microcuries.

DFL_{Tao} = ingestion dose conversion factor for tritium for age group a, organ o, mrem/picocurie (Table 1.7).

F_{fT} = transfer factor for tritium from cow's feed to meat, days/kg (Table 1.8).

Q_f = cow's consumption rate, kg/day.

U_{am} = meat ingestion rate for age group a, kg/year.

0.75 = the fraction of total feed that is water.

0.5 = the ratio of the specific activity of the feed grass water to the atmospheric water.

H = absolute humidity of the atmosphere, g/m^3.

f_p = fraction of time cow spends on pasture, dimensionless.

λ_T = decay constant for tritium, seconds^{-1} (Table 1.8).

t_s = transport time from slaughter to consumer, seconds.

t_{ep} = time pasture is exposed to deposition, seconds.

t_{cb} = time for receptor to consume a whole beef, seconds.

NOTE: Factors defined above which do not reference a table for their numerical values, are listed in Table 1.9.

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1.6.10 TRITIUM-STORED FEED-BEEF DOSE FACTOR - R_{MTS}
(mrem/year per microcuries/m^3)

$$R_{MTS} = 10^3\ 10^6\ DFL_{Tao}\ F_{fT}\ Q_f\ U_{am}\ [0.75(0.5/H)]\ f_s\ \exp(-\lambda_T t_s) \frac{(1-\exp(-\lambda_T t_{ep}))}{\lambda_T\ t_{ep}} \frac{(1-\exp(-\lambda_T t_{cb}))}{\lambda_T\ t_{cb}}$$

where:

10^3 = conversion factor, grams/kg

10^6 = conversion factor, picocuries/microcuries.

DFL_{Tao} = ingestion dose conversion factor for tritium for age group a, organ o, mrem/picocurie (Table 1.7).

F_{fT} = transfer factor for tritium from cow's feed to meat, days/kg (Table 1.8).

Q_f = cow's consumption rate, kg/day.

U_{am} = meat ingestion rate for age group a, kg/year.

0.75 = the fraction of total feed that is water.

0.5 = the ratio of the specific activity of the feed grass water to the atmospheric water.

H = absolute humidity of the atmosphere, g/m^3.

f_s = fraction of time cow spends on stored feed, dimensionless.

λ_T = decay constant for tritium, seconds^{-1} (Table 1.8).

t_s = transport time from slaughter to consumer, seconds.

t_{ep} = time pasture is exposed to deposition, seconds.

t_{cb} = time for receptor to consume a whole beef, seconds.

NOTE: Factors defined above which do not reference a table for their numerical values, are listed in Table 1.9.

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1.6.11 TRITIUM-FRESH LEAFY VEGETABLES DOSE FACTOR - R_{VTF}
(mrem/year per microcuries/m^3)

$$R_{VTF} = 10^3\ 10^6\ DFL_{Tao}\ [0.75(0.5/H)]\ U_{FLa}\ f_L\ \exp(-\lambda_T t_{hc})$$

where:

10^3 = conversion factor, grams/kg.

10^6 = conversion factor, picocuries/microcuries.

DFL_{Tao} = ingestion dose conversion factor for tritium for age group a, organ o, mrem/picocurie (Table 1.7).

0.75 = the fraction of total vegetation that is water.

0.5 = the ratio of the specific activity of the vegetables water to the atmospheric water.

H = absolute humidity of the atmosphere, g/m^3.

U_{FLa} = consumption rate of fresh leafy vegetables by the receptor in age group a, kg/year.

f_L = fraction of fresh leafy vegetables grown locally, dimensionless.

λ_T = decay constant for tritium, seconds^{-1} (Table 1.8).

t_{hc} = time between harvest of vegetables and their consumption and/or storage, seconds.

NOTE: Factors defined above which do not reference a table for their numerical values, are listed in Table 1.9.

1.6.12 TRITIUM-STORED VEGETABLES DOSE FACTOR - R_{VTS}
(mrem/year per microcuries/m^3)

$$R_{VTS} = 10^3\ 10^6\ DFI_{Tao}\ [0.75(0.5/H)]\ U_{Sa} f_g \frac{(1-\exp(-\lambda_T t_{sv}))}{\lambda_T\ t_{sv}} \exp(-\lambda_T t_{hc})$$

where:

10^3 = conversion factor, grams/kg.

10^6 = conversion factor, picocuries/microcuries.

DFL_{Tao} = ingestion dose conversion factor for tritium for age group a, organ o, mrem/picocurie (Table 1.7).

0.75 = the fraction of total vegetation that is water.

0.5 = the ratio of the specific activity of the vegetation water to the atmospheric water.

H = absolute humidity of the atmosphere, g/m^3.

U_{Sa} = consumption rate of stored vegetables by the receptor in age group a, kg/year.

f_g = fraction of stored vegetables grown locally, dimensionless.

λ_T = decay constant for tritium, $seconds^{-1}$ (Table 1.8).

t_{sv} = time between harvest of stored vegetables and their consumption and/or storage, seconds.

t_{hc} = time between harvest of vegetables and their storage, seconds.

NOTE: Factors defined above which do not reference a table for their numerical values, are listed in Table 1.9.

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1.6.13 INHALATION DOSE FACTORS- R_{Ii}
(mrem/year per microcuries/m^3)

$$R_{Ii} = DFA_{iao} \, BR_a \, 10^6$$

where:

DFA_{iao} = inhalation dose conversion factor for nuclide i, age group a and organ o, mrem/picocurie (Table 1.10).

BR_a = breathing rate for age group a, m^3/year (Table 1.9).

10^6 = conversion factor, picocurie/microcurie.

1.6.14 GROUND PLANE DOSE FACTORS - R_{Gi}
(m^2-mrem/year per microcuries/second)

$$R_{Gi} = DFG_{io} \, 1/\lambda_i \, 10^6 \, 8760 \, [1 - \exp(-\lambda_i t_b)]$$

where:

DFG_{io} = dose conversion factor for standing on contaminated ground for nuclide i and organ o (total body and skin), mrem/hr per picocurie/m^2 (Table 1.11).

λ_i = decay constant of nuclide i, $seconds^{-1}$ (Table 1.8).

10^6 = conversion factor, picocurie/microcurie.

8760 = conversion factor, hours/year.

t_b = time period over which the ground accumulation is evaluated, seconds (Table 1.9).

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1.7 Dispersion Methodology

Dispersion factors are calculated for radioactive effluent releases using hourly average meteorological data consisting of wind speed and direction measurements at 10m and temperature measurements at 9m and 46m.

A sector-average dispersion equation consistent with Regulatory Guide 1.111 is used. The dispersion model considers plume depletion (using information from Figure 1.3), and building wake effects. Terrain effects on dispersion are not considered.

Hourly average meteorological data are expressed as a joint-frequency distribution of wind speed, wind direction, and atmospheric stability. The joint-frequency distribution which represents the historical meteorological data for the period January 1972 to December 1975 is given in Table 1.3.

The wind speed classes that are used are as follows:

Number	Range (m/s)	Midpoint (m/s)
1	<0.3	0.13
2	0.3-0.6	0.45
3	0.7-1.5	1.10
4	1.6-2.4	1.99
5	2.5-3.3	2.88
6	3.4-5.5	4.45
7	5.6-8.2	6.91
8	8.3-10.9	9.59
9	>10.9	10.95

The stability classes that will be used are the standard A through G classifications. The stability classes 1-7 will correspond to A=1, B=2, ..., G=7.

1.7.1 Air Concentration - χ ($\mu Ci/m^3$)

Air concentrations of nuclides at downwind locations are calculated using the following equation:

$$\chi_i = \sum_{j=1}^{9} \sum_{k=1}^{7} (2/\pi)^{1/2} \frac{f_{jk}\, Q_i\, p}{\Sigma_{zk}\, u_j\, (2\pi x/n)} \exp(-\lambda_i\, x/u_j) \tag{1.16}$$

*Page added

where

f_{jk} = joint relative frequency of occurrence of winds in windspeed class j, stability class k, blowing toward this exposure point, expressed as a fraction.

Q_i = average annual release rate of radionuclide i, μCi/s.

p = fraction of radionuclide remaining in plume (Figure 1.3).

Σ_{zk} = vertical dispersion coefficient for stability class k which includes a building wake adjustment,

$= (\sigma_{zk}^2 + cA/\pi)^{1/2}$,

or $= \sqrt{3}\,\sigma_{zk}$, whichever is smaller.

where

σ_{zk} is the vertical dispersion coefficient for stability class k (m) (Figure 1.4),

c is a building shape factor (c=0.5),

A is the minimum building cross-sectional area (1800 m²).

u_j = midpoint value of wind speed class interval j, m/s.

x = downwind distance, m.

n = number of sectors, 16.

λ_i = radioactive decay coefficient of radionuclide i, s^{-1}

$2\pi x/n$ = sector width at point of interest, m.

1.7.2 Relative Concentration - χ/Q (sec/m³)

Relative concentrations of nuclides at downwind locations are calculated using the following equation:

$$\chi/Q = \sum_{j=1}^{9} \sum_{k=1}^{7} (2/\pi)^{1/2} \frac{f_{jk}}{\Sigma_{zk}\, u_j\, (2\pi x/n)} \qquad (1.17)$$

where

f_{jk} = joint relative frequency of occurrence of winds in windspeed class j, stability class k, blowing toward this exposure point, expressed as a fraction.

*Page added

Σ_{zk} = vertical dispersion coefficient for stability class k which includes a building wake adjustment,

= $(\sigma_{zk}^2 + cA/\pi)^{1/2}$,

or = $\sqrt{3}\,\sigma_{zk}$, whichever is smaller.

where

σ_{zk} is the vertical dispersion coefficient for stability class k (m) (Figure 1.4),

c is a building shape factor (c=0.5),

A is the minimum building cross-sectional area (1800 m^2).

u_j = midpoint value of wind speed class interval j, m/s.

x = downwind distance, m.

n = number of sectors, 16.

$2\pi x/n$ = sector width at point of interest, m.

1.7.3 Relative Deposition - D/Q (m^{-2})

Relative deposition of nuclides at downwind locations is calculated using the following equation:

$$D/Q = \sum_{j=1}^{9} \sum_{k=1}^{7} \frac{f_{jk}\, DR}{(2\pi x/n)} \qquad (1.18)$$

where

f_{jk} = joint relative frequency of occurrence of winds in windspeed class j and stability class k, blowing toward this exposure point, expressed as a fraction.

DR = relative deposition rate, m^{-1} (from Figure 1.5).

x = downwind distance, m.

n = number of sectors, 16.

$2\pi x/n$ = sector width at point of interest, m.

2.0 Liquid Effluents

2.1 Concentration

2.1.1 RETS Requirement

Specification 3.11.1.1 of the Radiological Effluent Technical Specifications (RETS) requires that the concentration of radioactive material released at any time from site to unrestricted areas shall be limited to the Maximum Permissible Concentration (MPC) specified in 10 CFR 20, Appendix B, Table II, Column 2 for nuclides other th dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to $2x10^{-4}$ µCi/mL total activity. To ensure compliance, the following approach will be used for each release.

2.1.2 Prerelease Analysis

Most tanks will be recirculated through two volume changes prior to sampling [illegible] that a representative sample is obtained. Because of their size, the high c[illegible]s, non-reclaimable waste tank, and cask decontamination tank will not necessarily be recirculated through two volumes. An appropriate recirculation time for these tanks will be determined by a one time test. The tank will be recirculated and periodically sampled for suspended particulates during the test. The appropriate recirculation time will be the time that the suspended particulate concentration reaches steady state. The condensate demineralizer waste evaporator blowdown tank cannot be recirculated. However the contents of the tank will be under administrative control and could be transferred to the distillate tanks prior to release.

Prior to release a grab sample will be analyzed for each release point for the concentration of each radionuclide.

$$C_j = \sum_{i=1}^{n} C_i \qquad (2.1)$$

where:

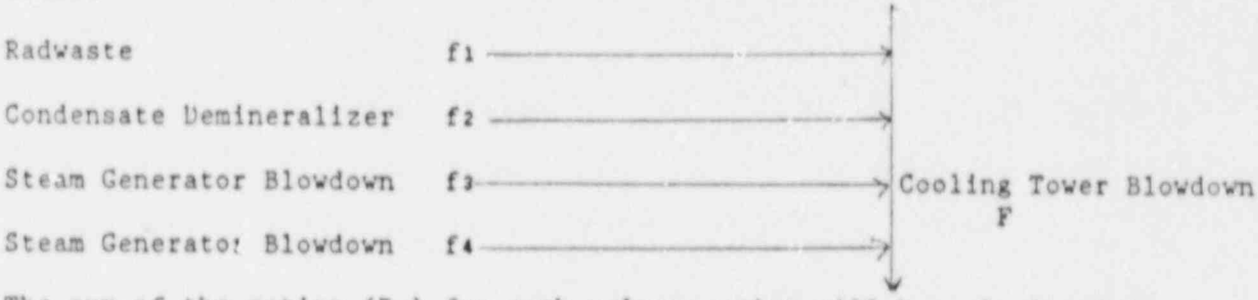
C_j = Total concentration in the liquid effluent at release point j, µCi/mL.

C_i = concentration of radionuclide i, µCi/mL.

*Numbering change only

2.1.3 MPC-Sum of the Ratios

There are two possible release points into the river, the turbine building sump and the cooling tower blowdown. The cooling tower blowdown is further subdivided into four separate liquid release paths as shown below.



The sum of the ratios (R_j) for each release point will be calculated by the following relationship.

$$R_j = \sum_i \frac{C_i}{MPC_i} \qquad (2.2)$$

where:

R_j = the sum of the ratios for release point j.

C_i = effluent concentration of radionuclide i, µCi/mL. For the turbine building sump, this will be the diluted concentration determined by daily grab sampling. For releases into the cooling tower blowdown, this will be the undiluted concentration in the tank as determined in Section 2.1.2.

MPC_i = the MPC of radionuclide i, as specified in Section 2.1.1, µCi/mL.

For releases into the cooling tower blowdown, the sum of the MPC ratios must be ≤ 1 due to the releases from any or all of the four release paths shown above. The following relationship will assure this criterion is met:

$$\frac{f_1R_1 + f_2R_2 + f_3R_3 + f_4R_4}{F} \leq 1 \qquad (2.3)$$

where:

f_1, f_2, f_3, f_4 = the effluent flow rate at the respective release point as determined by plant personnel, gallons/minute.

R_1, R_2, R_3, R_4 = the sum of the ratios of the respective release points as determined by Equation 2.2.

F = minimum dilution flow rate for prerelease analysis (cooling tower blowdown) = 15,000 gallons per minute.

*Numbering change only

2.2 Instrument Setpoints

2.2.1 Setpoint Determination

The setpoint for each liquid effluent monitor will be established using plant instructions. Concentration, flow rate, dilution, principal gamma emitter, geometry, and detector efficiency are combined to give an equivalent setpoint in counts per minute (cpm). The physical and technical description location and identification number for each liquid effluent radiation detector is contained in plant documentation.

The respective alarm/trip setpoints at each release point will be set such that the sum of the ratios (R_j) for all points, as calculated by Equation 2.3, will not exceed 1. The R_j is directly related to the total concentration calculated by Equation 2.1. An increase in the concentration would indicate an increase in the respective R_j. A large increase would cause the limits specified in Section 2.1.1 to be exceeded. The minimum alarm/trip setpoint value is equal to the release concentration, but for ease of operation it may be desired that the setpoint(s) be set above the effluent concentration (C_j). That is,

$$S_j = b_j (C_j + B) \qquad (2.4)$$

where

S_j = desired alarm/trip setpoint at release point j.

b_j = scaling factor to prevent alarms/trips due to variations in the effluent concentrations at release point j.

C_j = monitor response based on the total concentration in the liquid effluent at release point j specified by Equation 2.1, μCi/mL.

B = monitor background prior to release.

2.2.2 Post-Release Analysis

A post-release analysis will be done using actual release data to ensure that the limits specified in Section 2.1.1 were not exceeded.

A composite list of concentrations (C_i), by isotope, will be used with the actual liquid radwaste (f) and dilution (F) flow rates (or volumes) during the release. The data will be substituted into Equation 2.3 to demonstrate compliance with the limits in Section 2.1.1. This data and setpoints will be recorded in auditable records by plant personnel.

*Numbering change only

2.3 Dose

2.3.1 RETS Requirements

Specification 3.11.1.2 of the Radiological Effluent Technical Specification (RETS) requires that the dose or dose commitment to an individual from radioactive materials in liquid effluents released to unrestricted areas from each reactor shall be limited:

1. During any calendar quarter to ≤ 1.5 mrem to the total body and to ≤ 5 mrem to any organ, and
2. During any calendar year to ≤ 3 mrem to the total body and to ≤ 10 mrem to any organ.

To ensure compliance, cumulative dose calculations will be performed at least once per month according to the following methodology.

2.3.2 Monthly Analysis

Principal radionuclides will be used to conservatively estimate the monthly contribution to the cumulative dose. If the projected dose exceeds the above limits, the methodology in Section 2.3.3 will be implemented.

The 20 nuclides (listed below) contribute more than 95 percent of the dose to the total body and the most critical organs for each pathway. The critical organs considered for water and fish ingestion are the gastrointestinal tract (GIT), bone, thyroid and liver.

H-3	Na-24	Cr-51	Mn-54	Fe-55
Fe-59	Co-58	Co-60	Zn-65	Sr-89
Sr-90	Zr/Nb-95	Mo/Tc-99m	Ag-110m	Sb-124
I-131	I-133	Cs-134	Cs-136	Cs-137

A conservative calculation of the monthly dose will be done according to the following procedure. First, the monthly release data will be obtained and the activities released of each of the above 20 radionuclides, if identified, will be noted. This information will then be used in the following calculations.

*Numbering change only

2.3.2.1 Water Ingestion

The dose to an individual from ingestion of water is described by the following equation.

$$D_{jk} = \frac{1}{0.95} \sum_{i=1}^{20} DCF_{ijk}\, I_{ik} \qquad (2.5)$$

where:

D_{jk} = dose for the j^{th} organ from 20 radionuclides, rem.

j = the organ of interest (bone, GI tract, liver, thyroid and total body).

k = the age group being considered, adult or child.

0.95 = conservative correction factor, considering only 20 radionuclides.

DCF_{ijk} = critical ingestion dose commitment factor for the i^{th} radionuclide for the j^{th} organ for the k^{th} age group, rem/µCi, (Table 2.1).

I_{ik} = monthly activity ingested of the i^{th} radionuclide by the k^{th} age group, µCi.

I_{ij} is described by

$$I_{ik} = \frac{A_i\, V_k\, (30)}{F\, d\, (7.34 \times 10^{10})} \qquad (2.6)$$

where:

A_i = activity released of the i^{th} radionuclide during the month, µCi.

V_k = maximum individual's water consumption rate corresponding to the k^{th} age group selected for the critical DCF_{ijk} above (Adult: 2000 mL/d, Child: 1400 mL/d; Regulatory Guide 1.109).

30 = days per month.

F = average river flow at Chickamauga Dam for the month (cubic feet per second).

d = fraction of river flow available for dilution (1/5).

7.34×10^{10} = converts cubic feet per second to milliliters per month.

*Numbering change only

Considering the conversion factor from rem to mrem, the dose equation then becomes:

$$D_{jk} = \frac{2.15x10^{-6}}{F} \sum_{i=1}^{20} V_k \; DCF_{ijk} \; A_i \qquad (2.7)$$

2.3.2.2 Fish Ingestion

The dose to an individual from the consumption of fish is described by Equation 2.11. In this case the activity ingested of the i^{th} radionuclide (I_{ik}) is described by

$$I_{ik} = \frac{A_i \; B_i \; M_k}{F \; d \; (7.34x10^{10})} \qquad (2.8)$$

where

A_i = activity released of i^{th} radionuclide during the month, μCi.

B_i = effective fish concentration factor for the i^{th} radionuclide μCi/g per μCi/mL (Table 2.2).

M_k = amount of fish eaten monthly by maximum individual corresponding to the k^{th} age group selected for the critical DCF_{ijk} above (Adult: 1750g, Child: 575g: Regulatory Guide 1.109).

F = average river flow at Chickamauga Dam for month (cubic feet per second).

d = fraction of river flow available for dilution (1/5).

$7.34x10^{10}$ = converts from cubic feet per second to milliliters per month.

Considering the conversion factor from rem to mrem, the dose equation then becomes

$$D_{jk} = \frac{7.17x10^{-8}}{F} \sum_{i=1}^{20} A_i \; B_i \; M_k \; DCF_{ijk} \qquad (2.9)$$

*Numbering change only

Recreation

The total body dose to an individual via the shoreline recreation pathway is described by the following equation. For this calculation, the total dose is estimated based on a calculation for Co-58, Co-60, Cs-134, and Cs-137. These four nuclides are expected to contribute over 95 percent of the recreation dose.

$$D = \frac{0.1}{0.95} \sum_{i=1}^{4} \frac{RCDF_i \; \xi_i \; 67}{8760} \qquad (2.10)$$

where

D = shoreline recreation dose to the total body from plant releases, mrem.

$\frac{1}{0.95}$ = conservative correction factor, considering only 4 radionuclides.

$RDCF_i$ = shoreline recreation dose commitment factor for the i^{th} radionuclide, mrem/yr per $\mu Ci/cm^2$ (Table 2.3). (Note: For Cs-137, the dose commitment factor for its daughter, Ba-137m, is assumed.)

67 = assumed monthly exposure time for maximum individual, h.
= 500 h/year x 0.4 (fractional exposure for worst quarter) ÷ 3 (months/quarter).

8760 = conversion from year to hours.

0.1 = conversion factor combining conversions for m^2/cm^2 and mL/L.

ξ_i = concentration of i^{th} radionuclide in shoreline sediment ($\mu Ci/cm^2$), as described by the following equation (based on equation A-5 in Regulatory Guide 1.109).

$$= 100 \; RHL_i \; C_i \; W \; [1-\exp(-\lambda_i \; t)] \qquad (2.11)$$

where:

100 = transfer constant defined in Regulatory Guide 1.109, L per m^2-day.

RHL_i = radiological half-life of the i^{th} radioisotope, days, from Table 2.1.

W = shoreline width factor (0.3 for a lake shore, per Table A-2 of Regulatory Guide 1.109).

*Numbering change only

λ_i = decay constant of the i^{th} radionuclide
= $0.693/RHL_i$.

t = buildup time in sediment, assumed 15 years, per Regulatory Guide 1.109.

C_i = concentration of i^{th} radionuclide in the Tennessee River, µCi/mL.
= $A_i/(F\ d\ 7.34\times10^{10})$

where

A_i = activity released of i^{th} radionuclide during the month, µCi.

F = average river flow at Chickamauga Dam for the month, cubic feet per second.

d = fraction of river flow available for dilution (1/5).

7.34×10^{10} = cubic feet per second to milliliters per month.

The dose equation then becomes

$$D = \frac{1}{F}(0.00692\ A_1 + 0.00012\ A_2 + 0.00206\ A_3 + 0.00342\ A_4) \qquad (2.12)$$

where

A1, A2, A3, A4 = the activities of Co-60, Co-58, Cs-134 and Cs-137 respectively.

2.3.2.4 Monthly Summary

Calendar quarter doses are first estimated by summing the doses calculated for each month in that quarter. Calendar year doses are first estimated by summing the doses calculated for each month in that year. However, if the annual doses determined in this manner exceed or approach the specification limits, doses caclulated for previous quarters with the methodology of section 2.3.3 will be used instead of those quarterly doses estimated by summing monthly results. An annual check will be made to ensure that the monthly dose estimates account for at least 95 percent of the dose calculated by the method described in Section 2.3.3. If less than 95 percent of the dose has been estimated, either a new list of principal isotopes will be prepared or a new correction factor will be used. The latter option will not be used if less than 90 percent of the total dose is predicted.

*Numbering change only

2.3.2.5 Dose Projections

In accordance with specification 3.11.1.3, dose projections will be performed. This will be done by averaging the calculated dose for the most recent month and the calculated dose for the previous month and assigning that average dose as the projection for the current month.

2.3.3 Quarterly and Annual Analysis

A complete analysis utilizing the total estimated liquid releases for each calendar quarter will be performed and reported as required in section 6.9 of the technical specifications. This analysis will replace values calculated using section 2.3.2 methodology and will also include an approximation of population doses.

2.3.3.1 Individual Doses

The dose, D_{jk}, to the maximum individual from n nuclides is described by:

$$D_{jk} = \sum_{m=1}^{5} \sum_{i=1}^{n} D_{ijkm} \qquad (2.13)$$

$$D_{jk} = \sum_{i=1}^{n} \sum_{m=1}^{2} [DCF_{ijk} \; I_{ikm}] + \sum_{m=3}^{5} [RDCF_{ijm} \; \xi_{im} \; T_m \; \varphi] \qquad (2.14)$$

where:

D_{ijkm} = dose to the j^{th} organ for the k^{th} age group from the i^{th} radionuclide via the m^{th} exposure path.

j = the organ of interest (bone, GI tract, thyroid, liver, total body and skin).

k = the age group being considered; adult and child for the ingestion pathways; adult for the recreation pathways.

m = exposure pathway of interest:
1. water ingestion,
2. fish ingestion,
3. shoreline recreation,
4. above water recreation, and
5. in-water recreation.

*Numbering change only

$(DCF)_{ijk}$ = ingestion dose commitment factor for the j^{th} organ from the i^{th} radionuclide for the k^{th} age group, rem/µCi (Table 2.1).

$(RDCF)_{ijm}$ = recreation dose commitment factor for the j^{th} organ from the i^{th} radionuclide via the m^{th} pathway; mrem/yr per µCi/cm², (Table 2.3).

T_m = assumed exposure time of maximum individual for the m^{th} pathway
(3) shoreline 500 h/yr (10 h/week)
(4) above-water 1800 h/yr (6 h/d, 300 d/yr)
(5) in-water 920 h/yr (6 h/d, for five summer months).

φ = Fraction of annual recreation exposure for each quarter

1st Quarter	January-March	0.1
2nd Quarter	April-June	0.3
3rd Quarter	July-September	0.4
4th Quarter	October-December	0.2.

I_{ikm} = The activity ingested of the i^{th} radionuclide, via the m^{th} exposure pathway for the k^{th} age group, µCi.
= $C_i\ V_k\ N$ for the water ingestion pathway (2.14)
= $C_i\ B_i\ M_k$ for the fish ingestion pathway (2.15)

where:

V_k = water consumption for the k^{th} age group, per Regulatory Guide 1.109
for maximum individual:
adult - 2000 mL/d
child - 1400 mL/d
for average individual (population):
adult - 1010 mL/d
child - 710 mL/d.

N = number of days during the release period, day.

B_i = bioaccumulation factor for the i^{th} radionuclide in fish, µCi/g per µCi/mL (Table 2.2).

M_k = amount of fish consumed during the period for the k^{th} age group (fraction of year times the annual consumption rate per Regulatory Guide 1.109)
for maximum individual:
adult - 21 kg/yr
child - 6.9 kg/yr
for average individual (population):
adult - 6.9 kg/yr
child - 2.2 kg/yr.

*Numbering change only

C_i = concentration of the i^{th} radionuclide during the release period, µCi/mL
= $A_i/(F_\ell d)$.

where:

A_i = Activity released of i^{th} radionuclide during the release period, µCi.

F_ℓ = Total river flow at location ℓ during period, mL.

ℓ = Location of interest (For dose to the maximum individual the first down-river exposure point is used. For the population dose, various down-river locations are used to account for the total exposed population. Table 2.4 gives the river location of public water supplies; Tables 2.5 and 2.6 give the boundaries of the various reaches in which concentrations are calculated for the fish and recreation pathways).

d = fraction of river flow available for dilution (0.20 above Chickamauga Dam, 1 below the dam).

ξ_{im} = the concentration of the i^{th} radionuclide in the environmental medium pertaining to m^{th} pathway.
= $\xi_{i5} = C_i$, for above-water and in-water recreation pathways;
= $100\ RHL_i\ C_i\ W\ [1-\exp(-\lambda_i\ t)]$, for the shoreline recreation pathway;

where:

100 = transfer constant as defined in Regulatory Guide 1.109 equation A-4, L per m^2-day.

RHL_i = radiological half-life of the i^{th} isotope, days, (Table 2.1).

C_i = concentration of the i^{th} nuclide in water, µCi/mL.

W = shoreline width factor (0.3 for a lake shore, per Table A-2 of Regulatory Guide 1.109).

*Numbering change only

C_i = concentration of the i^{th} radionuclide during the release period, µCi/mL
= $A_i/(F_\ell d)$.

where:

A_i = Activity released of i^{th} radionuclide during the release period, µCi.

F_ℓ = Total river flow at location ℓ during period, mL.

ℓ = Location of interest (For dose to the maximum individual the first down-river exposure point is used. For the population dose, various down-river locations are used to account for the total exposed population. Table 2.4 gives the river location of public water supplies; Tables 2.5 and 2.6 give the boundaries of the various reaches in which concentrations are calculated for the fish and recreation pathways).

d = fraction of river flow available for dilution (0.20 above Chickamauga Dam, 1 below the dam).

ξ_{im} = the concentration of the i^{th} radionuclide in the environmental medium pertaining to m^{th} pathway.
= $\xi_{i5} = C_i$, for above-water and in-water recreation pathways;
= $100\ RHL_i\ C_i\ W\ [1-\exp(-\lambda_i\ t)]$, for the shoreline recreation pathway;

where:

100 = transfer constant as defined in Regulatory Guide 1.109 equation A-4, L per m^2-day.

RHL_i = radiological half-life of the i^{th} isotope, days, (Table 2.1).

C_i = concentration of the i^{th} nuclide in water, µCi/mL.

W = shoreline width factor (0.3 for a lake shore, per Table A-2 of Regulatory Guide 1.109).

*Numbering change only

2.4 Operability of Liquid Radwaste Equipment

Specification 3.11.1.3 of the Radiological Effluent Technical Specification requires that the liquid radwaste system shall be used to reduce the radioactive materials in liquid wastes prior to their discharge when the projected dose due to liquid effluent releases to unrestricted areas when averaged over 31 days would exceed 0.06 mrem to the total body of 0.21 mrem to any organ. Doses will be projected monthly to assure compliance.

*Numbering change only

3.0 Radiological Environmental Monitoring

3.1 Monitoring Program

An environmental radiological monitoring program shall be conducted in accordance with Technical Specification 3.12.1. The monitoring program described in Tables 3.1, 3.2, and 3.3, and in Figures 3.1, 3.2 and 3.3 shall be conducted. Results of this program shall be reported in accordance with Technical Specifications 6.9.1.6 and 6.9.1.7.

The atmospheric environmental radiological monitoring program shall consist of monitoring stations from which samples of air particulates and atmospheric radioiodine shall be collected.

The terrestrial monitoring program shall consist of the collection of vegetation, milk, soil, ground water, drinking water, and food crops. In addition, direct gamma radiation levels will be measured in the vicinity of the plant.

The reservoir sampling program shall consist of the collection of samples of surface water, sediment, clams, and fish.

Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, sample unavailability, or to malfunction of sampling equipment. If the latter, every effort shall be made to complete corrective action prior to the end of the next sampling period.

3.2 Detection Capabilities

Analytical techniques shall be such that the detection capabilities listed in Table 3.4 are achieved.

3.3 Interlaboratory Comparison Program

Analyses shall be performed on radioactive materials supplied as part of an Interlaboratory Comparison Program which has been approved by the NRC. A summary of the results obtained in the intercomparison shall be included in the Annual Radiological Environmental Operating Report (or the EPA program code designation may be provided).

If analyses are not performed as required corrective actions taken to prevent a recurrence shall be reported in the Annual Radiological Environmental Operating Report.

*Numbering change only

3.4 Land Use Census

A land use survey shall be conducted in accordance with SQN Technical Specification 3/4.12.2. The results of the survey shall be reported in the Annual Radiological Environmental Operating Report.

*Numbering change only

4.0 Annual Maximum Individual Doses - Total

To determine compliance with 40 CFR 190, the annual dose contributions to the maximum individual from SQN radioactive effluents and all other nearby uranium fuel cycle sources will be considered. The annual dose to the maximum individual will be conservatively estimated by first, summing the quarterly total body air submersion dose, the quarterly critical organ dose from gaseous effluents, the quarterly total body dose from liquid effluents, the quarterly critical organ dose from liquid effluents, and the direct radiation monitoring program, and then taking the sum for each quarter and summing over the four quarters.

*Numbering change only

Table 1.1
SQN - OFFSITE RECEPTOR LOCATION DATA

POINT	SECTOR	DIST (m)	X/Q (s/m^3)	D/Q (1/m^2)	fp (cow milk)	fp (goat milk)	fp (beef)
Land Site Boundary	N	950	5.12E-06	1.29E-08	1.00	1.00	1.00
Land Site Boundary	NNE	2260	1.93E-06	5.28E-09	1.00	1.00	1.00
Land Site Boundary	NE	1910	2.32E-06	5.33E-09	1.00	1.00	1.00
Land Site Boundary	ENE	1680	1.12E-06	2.64E-09	1.00	1.00	1.00
Land Site Boundary	E	1570	7.10E-07	1.46E-09	1.00	1.00	1.00
Land Site Boundary	ESE	1460	7.91E-07	1.58E-09	1.00	1.00	1.00
Land Site Boundary	SE	1460	9.14E-07	2.41E-09	1.00	1.00	1.00
Land Site Boundary	SSE	1550	1.34E-06	3.23E-09	1.00	1.00	1.00
Land Site Boundary	S	1570	2.37E-06	4.18E-09	1.00	1.00	1.00
Land Site Boundary	SSW	1840	4.51E-06	9.26E-09	1.00	1.00	1.00
Land Site Boundary	SW	2470	1.08E-06	2.63E-09	1.00	1.00	1.00
Land Site Boundary	WSW	910	2.93E-06	3.86E-09	1.00	1.00	1.00
Land Site Boundary	W	670	3.63E-06	3.74E-09	1.00	1.00	1.00
Land Site Boundary	WNW	660	2.49E-06	2.44E-09	1.00	1.00	1.00
Land Site Boundary	NW	660	2.85E-06	3.67E-09	1.00	1.00	1.00
Land Site Boundary	NNW	730	3.95E-06	6.59E-09	1.00	1.00	1.00
Resident	N	1370	2.98E-06	7.10E-09	1.00	1.00	1.00
Resident	NNE	2710	1.49E-06	3.88E-09	1.00	1.00	1.00
Resident, Garden	NE	2140	1.98E-06	5.21E-09	1.00	1.00	1.00
Resident	ENE	2290	7.13E-07	1.57E-09	1.00	1.00	1.00
Resident	E	1790	5.85E-07	1.18E-09	1.00	1.00	1.00
Resident	ESE	1790	5.86E-07	1.14E-09	1.00	1.00	1.00
Resident	SE	1680	7.42E-07	1.92E-09	1.00	1.00	1.00
Resident, Garden	SSE	2210	7.99E-07	1.79E-09	1.00	1.00	1.00
Resident	S	2020	1.65E-06	2.75E-09	1.00	1.00	1.00
Resident, Garden	SSW	2290	3.31E-06	6.38E-09	1.00	1.00	1.00
Resident	SW	3010	1.04E-06	1.88E-09	1.00	1.00	1.00
Resident	WSW	1140	2.09E-06	2.67E-09	1.00	1.00	1.00
Resident	W	1750	8.53E-07	7.82E-10	1.00	1.00	1.00
Resident, Garden	WNW	1750	5.71E-07	4.98E-10	1.00	1.00	1.00
Resident	NW	1140	1.25E-06	1.50E-09	1.00	1.00	1.00
Resident, Garden	NNW	800	3.42E-06	5.67E-09	1.00	1.00	1.00
Garden	N	1680	2.20E-06	5.10E-09	1.00	1.00	1.00
Garden	NNE	3010	1.28E-06	3.24E-09	1.00	1.00	1.00
Garden	E	2630	3.38E-07	6.14E-10	1.00	1.00	1.00
Garden	ESE	1980	5.08E-07	9.57E-10	1.00	1.00	1.00
Garden	SE	3010	3.19E-07	7.16E-10	1.00	1.00	1.00
Garden	S	2290	1.38E-06	2.22E-09	1.00	1.00	1.00
Garden	SW	3660	7.96E-07	1.34E-09	1.00	1.00	1.00
Garden	WSW	1680	1.16E-06	1.43E-09	1.00	1.00	1.00
Garden	W	1830	8.02E-07	7.26E-10	1.00	1.00	1.00
Garden	NW	1180	1.19E-06	1.42E-09	1.00	1.00	1.00
Milk Cow Adult	N	4120	6.18E-07	1.10E-09	0.10	1.00	1.00
Milk Cow Adult	NE	6750	3.94E-07	7.03E-10	0.10	1.00	1.00
Milk Cow Adult	WNW	1750	5.71E-07	4.98E-10	0.25	1.00	1.00
Milk Cow Adult	NW	1980	5.61E-07	6.09E-10	0.57	1.00	1.00

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Table 1.2
EXPECTED ANNUAL ROUTINE GASEOUS RELEASES FROM ONE UNIT AT SEQUOYAH NUCLEAR PLANT
Curies/year

NUCLIDE	AUXILIARY BUILDING	CONTAINMENT	TURBINE BUILDING	SERVICE BUILDING
Kr-85m	2.2E-00	2.3E-00	1.5E-00	6.1E-02
Kr-85	2.0E-00	5.1E+02	1.2E-00	5.1E-00
Kr-87	1.2E-00	8.1E-01	8.2E-01	2.8E-02
Kr-88	4.1E-00	3.6E-00	2.7E-00	1.0E-01
Kr-89	2.7E-02	8.3E-03	6.4E-02	9.9E-04
Xe-131m	1.7E+00	2.6E+01	1.1E+00	2.9E-01
Xe-133m	3.7E+00	1.6E+01	2.4E+00	2.2E-01
Xe-133	2.9E+02	2.4E+03	1.8E+02	2.9E+01
Xe-135m	1.8E+01	7.8E-02	2.0E-01	1.8E-01
Xe-135	6.8E+00	9.9E+00	4.4E+00	2.1E-01
Xe-137	5.6E-02	1.8E-02	1.2E-01	1.9E-03
Xe-138	5.9E-01	2.4E-01	6.2E-01	1.5E-02
Br-84	3.5E-04	4.9E-06	1.7E-05	3.7E-06
Br-85	1.2E-05	1.3E-07	2.4E-07	1.2E-07
I-131	4.5E-02	1.2E-02	9.2E-03	6.6E-04
I-132	1.7E-02	3.7E-04	2.6E-03	2.0E-04
I-133	6.5E-02	3.3E-03	1.4E-02	8.2E-04
I-134	7.1E-03	1.1E-04	5.0E-04	7.7E-05
I-135	3.3E-02	9.0E-04	5.4E-03	3.9E-04
Rb-88	1.6E+00	2.1E-02	1.0E-04	1.6E-02
Cs-134	5.5E-05	1.1E-05	6.3E-05	1.3E-06
Cs-136	2.9E-05	2.6E-06	3.6E-05	6.8E-07
Cs-137	4.0E-05	7.8E-06	5.3E-05	1.0E-06
Cr-51	2.0E-06	2.6E-07	3.6E-07	2.6E-08
Mn-54	1.6E-06	3.1E-07	4.5E-07	2.4E-08
Fe-59	2.1E-06	3.2E-07	5.4E-07	3.0E-08
Co-58	5.3E-07	8.8E-08	9.0E-06	9.6E-08
Co-60	1.6E-06	3.1E-07	2.7E-07	2.2E-08
Sr-89	7.6E-07	1.2E-07	1.6E-07	1.0E-08
Sr-90	2.2E-08	4.3E-09	8.4E-09	3.5E-10
Sr-91	1.5E-06	1.2E-08	8.9E-08	1.6E-08
Y-90	3.8E-08	4.7E-09	8.2E-09	5.1E-10
Y-91m	9.1E-07	7.4E-09	4.1E-08	9.6E-09
Y-91	4.4E-06	7.0E-07	1.9E-06	7.0E-08
Y-93	3.0E-07	2.4E-09	3.6E-08	3.4E-09
Zr-95	1.3E-07	2.1E-08	8.4E-08	2.4E-09
Nb-95	1.1E-07	2.2E-08	8.4E-08	2.2E-09
Mo-99	9.9E-04	3.0E-05	1.4E-04	1.2E-05
Tc-99m	8.9E-04	2.8E-05	1.0E-04	1.0E-05
Ru-106	2.2E-08	4.1E-09	8.4E-09	3.5E-10
Te-132	6.0E-05	2.0E-06	2.1E-05	8.3E-07
Ba-140	4.8E-07	4.4E-08	2.1E-07	7.3E-09
La-140	3.4E-07	4.6E-08	1.4E-07	5.3E-09
Ce-144	7.2E-08	1.4E-08	4.2E-08	1.3E-09
Pr-143	1.1E-07	1.1E-08	4.2E-08	1.3E-09
Pr-144	7.7E-08	1.4E-08	2.8E-08	1.2E-09
Np-239	2.7E-06	7.0E-08	1.2E-06	4.0E-08

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Table 1.3 (1 of 8)

JOINT PERCENTAGE FREQUENCIES OF WIND DIRECTION AND WIND SPEED FOR DIFFERENT STABILITY CLASSES*

STABILITY CLASS A
DELTA T≤-1.9 DEG. C/100M

SEQUOYAH NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN. 1, 72 - DEC. 31, 75

WIND DIRECTION	CALM	0.6-1.4	1.5-3.4	WIND SPEED(MPH) 3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>24.5	TOTAL
N	.01	0.01	0.01	0.03	0.04	0.04	0.0	0.0	0.0	0.13
NNE	0.0	0.0	0.04	0.19	0.20	0.16	0.01	0.0	0.0	0.60
NE	0.0	0.0	0.08	0.20	0.15	0.13	0.0	0.0	0.0	0.56
ENE	0.0	0.0	0.03	0.03	0.01	0.0	0.0	0.0	0.0	0.07
E	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.01
ESE	0.0	0.0	0.01	0.01	0.0	0.0	0.01	0.0	0.0	0.03
SE	0.0	0.0	0.01	0.02	0.0	0.0	0.0	0.0	0.0	0.03
SSE	0.0	0.0	0.01	0.03	0.02	0.02	0.01	0.0	0.0	0.09
S	0.0	0.0	0.01	0.04	0.06	0.05	0.01	0.0	0.0	0.17
SSW	0.0	0.0	0.01	0.09	0.18	0.16	0.01	0.0	0.0	0.45
SW	0.0	0.0	0.04	0.12	0.10	0.09	0.02	0.0	0.0	0.37
WSW	0.0	0.0	0.02	0.03	0.03	0.02	0.02	0.0	0.0	0.12
W	0.0	0.0	0.01	0.0	0.01	0.02	0.0	0.0	0.0	0.04
WNW	0.0	0.0	0.0	0.0	0.0	0.01	0.01	0.0	0.0	0.02
NW	0.0	0.0	0.01	0.01	0.01	0.05	0.01	0.0	0.0	0.09
NNW	0.0	0.0	0.01	0.0	0.02	0.08	0.01	0.0	0.0	0.12
SUBTOTAL	0.01	0.01	0.31	0.80	0.83	0.83	0.12	0.0	0.0	2.90

958 STABILITY CLASS A OCCURRENCES OUT OF TOTAL 32723 VALID TEMPERATURE DIFFERENCE READINGS

934 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 958 STABILITY CLASS A OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED .74 MILES SW OF SEQUOYAH NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 and 150 FEET ABOVE GROUND
WIND INSTRUMENTS 33 FEET ABOVE GROUND

*Numbering change only

TABLE 1.3 (2 of 8)

JOINT PERCENTAGE FREQUENCIES OF WIND DIRECTION AND WIND SPEED FOR DIFFERENT STABILITY CLASSES*

STABILITY CLASS B
-1.9 < DELTA T<-1.7 DEG. C/100M

SEQUOYAH NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN. 1, 72 - DEC. 31, 75

WIND DIRECTION	CALM	WIND SPEED(MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	<24.5	TOTAL
N	0.0	0.0	0.01	0.01	0.02	0.03	0.0	0.0	0.0	0.07
NNE	0.0	0.0	0.05	0.23	0.20	0.18	0.01	0.0	0.0	0.67
NE	.01	0.0	0.08	0.29	0.09	0.06	0.0	0.0	0.0	0.52
ENE	0.0	0.0	0.03	0.03	0.01	0.0	0.0	0.0	0.0	0.07
F	0.0	0.0	0.02	0.01	0.0	0.0	0.0	0.0	0.0	0.03
ESE	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.01
SE	0.0	0.0	0.01	0.02	0.0	0.01	0.0	0.0	0.0	0.04
SSE	0.0	0.0	0.01	0.03	0.0	0.02	0.0	0.0	0.0	0.06
S	0.0	0.0	0.03	0.03	0.07	0.04	0.01	0.0	0.0	0.18
SSW	0.0	0.0	0.04	0.09	0.20	0.20	0.03	0.0	0.0	0.56
SW	0.0	0.0	0.03	0.11	0.14	0.10	0.02	0.0	0.0	0.40
WSW	0.0	0.0	0.01	0.01	0.03	0.02	0.01	0.01	0.0	0.09
W	0.0	0.0	0.0	0.0	0.01	0.01	0.0	0.0	0.0	0.02
WNW	0.0	0.0	0.0	0.01	0.01	0.03	0.0	0.0	0.0	0.05
NW	0.0	0.0	0.0	0.0	0.01	0.05	0.0	0.0	0.0	0.06
NNW	0.0	0.0	0.01	0.02	0.02	0.06	0.01	0.0	0.0	0.12
SUBTOTAL	0.01	0.0	0.33	0.90	0.81	0.81	0.09	0.01	0.0	2.95

969 STABILITY CLASS B OCCURRENCES OUT OF TOTAL 32723 VALID TEMPERATURE DIFFERENCE READINGS

953 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 969 STABILITY CLASS B OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED .74 MILES SW OF SEQUOYAH NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 and 150 FEET ABOVE GROUND
WIND INSTRUMENTS 33 FEET ABOVE GROUND

*Numbering change only

TABLE 1.3 (3 of 8)

JOINT PERCENTAGE FREQUENCIES OF WIND DIRECTION AND WIND SPEED FOR DIFFERENT STABILITY CLASSES*

STABILITY CLASS C
-1.7 < DELTA T≤-1.5 DEG. C/100M

SEQUOYAH NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN. 1, 72 - DEC. 31, 75

WIND DIRECTION	CALM	WIND SPEED(MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>24.5	TOTAL
N	0.0	0.0	0.01	0.02	0.02	0.02	0.0	0.0	0.0	0.07
NNE	0.0	0.0	0.05	0.12	0.11	0.11	0.0	0.0	0.0	0.39
NE	0.0	0.0	0.05	0.14	0.05	0.03	0.0	0.0	0.0	0.27
ENE	0.0	0.0	0.03	0.02	0.0	0.0	0.0	0.0	0.0	0.05
E	0.0	0.0	0.01	0.01	0.0	0.0	0.0	0.0	0.0	0.02
ESE	0.0	0.0	0.01	0.01	0.0	0.0	0.0	0.0	0.0	0.02
SE	0.0	0.0	0.01	0.01	0.0	0.0	0.0	0.0	0.0	0.02
SSE	0.0	0.0	0.01	0.02	0.0	0.02	0.0	0.0	0.0	0.05
S	0.0	0.0	0.03	0.04	0.06	0.05	0.0	0.0	0.0	0.18
SSW	0.0	0.0	0.01	0.11	0.14	0.13	0.02	0.0	0.0	0.41
SW	0.0	0.0	0.03	0.08	0.12	0.07	0.01	0.0	0.0	0.31
WSW	0.0	0.0	0.01	0.02	0.03	0.02	0.0	0.01	0.0	0.08
W	0.0	0.0	0.0	0.01	0.0	0.01	0.01	0.0	0.0	0.03
WNW	0.0	0.0	0.0	0.01	0.01	0.01	0.0	0.0	0.0	0.03
NW	0.0	0.0	0.0	0.0	0.02	0.03	0.01	0.0	0.0	0.06
NNW	0.0	0.0	0.0	0.02	0.02	0.05	0.0	0.0	0.0	0.09
SUBTOTAL	0.0	0.0	0.26	0.64	0.58	0.55	0.05	0.0	0.0	2.08

684 STABILITY CLASS C OCCURRENCES OUT OF TOTAL 32723 VALID TEMPERATURE DIFFERENCE READINGS

672 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 684 STABILITY CLASS C OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED .74 MILES SW OF SEQUOYAH NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 and 150 FEET ABOVE GROUND
WIND INSTRUMENTS 33 FEET ABOVE GROUND

*Numbering change only

*Numbering change only

TABLE 1.3 (4 of 8)

JOINT PERCENTAGE FREQUENCIES OF WIND DIRECTION AND WIND SPEED
FOR DIFFERENT STABILITY CLASSES*

STABILITY CLASS D
-1.5 < DELTA T≤-0.5 DEG. C/100M

SEQUOYAH NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN. 1, 72 - DEC. 31, 75

WIND DIRECTION	WIND SPEED(MPH) CALM	0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>24.5	TOTAL
N	0.003	0.01	0.24	0.22	0.16	0.17	0.0	0.0	0.0	0.80
NNE	0.017	0.05	0.73	1.03	0.84	0.78	0.07	0.0	0.0	3.51
NE	0.006	0.02	0.76	0.88	0.42	0.42	0.05	0.0	0.0	2.55
ENE	0.003	0.01	0.21	0.11	0.03	0.0	0.0	0.0	0.0	0.36
E	0.003	0.01	0.12	0.03	0.02	0.01	0.0	0.0	0.0	0.19
ESE	0.003	0.01	0.06	0.02	0.0	0.0	0.0	0.0	0.0	0.09
SE	0.0	0.0	0.12	0.08	0.0	0.0	0.0	0.0	0.0	0.20
SSE	0.0	[illegible]	0.15	0.15	0.05	0.06	0.01	0.01	0.0	0.43
S	0.003	0.01	0.31	0.53	0.38	0.25	0.02	0.0	0.0	1.50
SSW	0.003	0.01	0.44	1.25	0.95	0.70	0.07	0.0	0.0	3.42
SW	0.003	0.01	0.47	1.17	1.03	0.52	0.03	0.01	0.0	3.24
WSW	0.0	0.0	0.22	0.34	0.18	[illegible]	0.07	0.01	0.0	1.03
W	0.003	0.01	0.06	0.08	0.10	0.19	0.02	0.01	0.0	0.47
WNW	0.003	0.01	0.06	0.05	0.11	0.18	0.01	0.0	0.0	0.42
NW	0.0	0.0	0.08	0.08	0.22	0.31	0.03	0.0	0.0	0.72
NNW	0.003	0.01	0.15	0.14	0.25	0.36	0.02	0.0	0.0	0.93
SUBTOTAL	0.05	0.18	4.18	6.16	4.74	4.16	0.40	0.04	0.0	19.86

6567 STABILITY CLASS D OCCURRENCES OUT OF TOTAL 32723 VALID TEMPERATURE DIFFERENCE READINGS

6345 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 6567 STABILITY CLASS D OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED .74 MILES SW OF SEQUOYAH NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 and 150 FEET ABOVE GROUND
WIND INSTRUMENTS 33 FEET ABOVE GROUND

1157c

*Numbering change only

TABLE 1.3 (5 of 8)

JOINT PERCENTAGE FREQUENCIES OF WIND DIRECTION AND WIND SPEED FOR DIFFERENT STABILITY CLASSES*

STABILITY CLASS E
-0.5 < DELTA T ≤ 1.5 DEG. C/100M

SEQUOYAH NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN. 1, 72 - DEC. 31, 75

WIND DIRECTION	CALM	WIND SPEED(MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>24.5	TOTAL
N	0.017	0.23	1.26	0.83	0.39	0.27	0.0	0.0	0.0	2.98
NNE	0.023	0.31	2.83	2.46	1.07	0.92	0.03	0.0	0.0	7.62
NE	0.011	0.15	1.03	0.71	0.31	0.18	0.01	0.0	0.0	2.39
ENE	0.009	0.12	0.48	0.16	0.04	0.0	0.0	0.0	0.0	0.80
E	0.010	0.14	0.24	0.05	0.01	0.01	0.0	0.0	0.0	0.45
ESE	0.007	0.09	0.11	0.01	0.01	0.01	0.01	0.0	0.0	0.24
SE	0.007	0.10	0.37	0.06	0.01	0.01	0.0	0.0	0.0	0.55
SSE	0.008	0.11	0.58	0.24	0.13	0.23	0.04	0.02	0.0	1.35
S	0.013	0.17	1.33	1.49	0.91	1.05	0.08	0.0	0.0	5.03
SSW	0.007	0.10	1.67	2.32	1.67	1.45	0.11	0.0	0.0	7.32
SW	0.013	0.17	1.59	2.07	1.30	0.99	0.10	0.0	0.0	6.22
WSW	0.010	0.13	0.87	0.55	0.35	0.40	0.06	0.0	0.0	2.36
W	0.007	0.10	0.42	0.28	0.21	0.22	0.03	0.0	0.0	1.26
WNW	0.010	0.14	0.37	0.22	0.19	0.27	0.02	0.0	0.0	1.21
NW	0.007	0.10	0.50	0.37	0.43	0.38	0.02	0.0	0.0	1.80
NNW	0.011	0.15	0.80	0.68	0.57	0.40	0.01	0.0	0.0	2.61
SUBTOTAL	0.17	2.31	14.45	12.50	7.60	6.79	0.52	0.02	0.0	44.19

14624 STABILITY CLASS E OCCURRENCES OUT OF TOTAL 32723 VALID TEMPERATURE DIFFERENCE READINGS

14146 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 14624 STABILITY CLASS E OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED .74 MILES SW OF SEQUOYAH NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 and 150 FEET ABOVE GROUND
WIND INSTRUMENTS 33 FEET ABOVE GROUND

TABLE 1.3 (6 of 8)

JOINT PERCENTAGE FREQUENCIES OF WIND DIRECTION AND WIND SPEED FOR DIFFERENT STABILITY CLASSES*

STABILITY CLASS F
1.5 < DELTA T ≤ 4.0 DEG. C/100M

SEQUOYAH NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN. 1, 72 - DEC. 31, 75

WIND DIRECTION	CALM	0.6-1.4	1.5-3.4	WIND SPEED(MPH) 3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>24.5	TOTAL
N	.011	0.21	1.37	0.44	0.04	0.0	0.0	0.0	0.0	2.06
NNE	.018	0.35	3.61	0.84	0.05	0.0	0.0	0.0	0.0	4.85
NE	.011	0.21	1.15	0.28	0.01	0.0	0.0	0.0	0.0	1.65
ENE	.008	0.16	0.39	0.03	0.0	0.0	0.0	0.0	0.0	0.58
E	.010	0.20	0.22	0.0	0.0	0.0	0.0	0.0	0.0	0.42
ESE	.007	0.13	0.18	0.02	0.0	0.0	0.0	0.0	0.0	0.33
SE	.007	0.14	0.23	0.02	0.0	0.0	0.0	0.0	0.0	0.39
SSE	.008	0.15	0.37	0.07	0.03	0.01	0.0	0.0	0.0	0.63
S	.009	0.17	0.77	0.30	0.10	0.06	0.0	0.0	0.0	1.40
SSW	.006	0.12	1.13	0.71	0.26	0.11	0.0	0.0	0.0	2.33
SW	.005	0.10	0.99	0.86	0.27	0.13	0.0	0.0	0.0	2.35
WSW	.005	0.09	0.46	0.19	0.04	0.01	0.0	0.0	0.0	0.79
W	.004	0.07	0.20	0.07	0.01	0.0	0.0	0.0	0.0	0.35
WNW	.005	0.10	0.24	0.07	0.01	0.0	0.0	0.0	0.0	0.42
NW	.003	0.05	0.29	0.15	0.05	0.01	0.0	0.0	0.0	0.55
NNW	.005	0.09	0.52	0.34	0.05	0.01	0.0	0.0	0.0	1.01
SUBTOTAL	0.12	2.34	12.12	4.39	0.92	0.34	0.0	0.0	0.0	20.11

6542 STABILITY CLASS F OCCURRENCES OUT OF TOTAL 32723 VALID TEMPERATURE DIFFERENCE READINGS

6461 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 6542 STABILITY CLASS F OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED .74 MILES SW OF SEQUOYAH NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 and 150 FEET ABOVE GROUND
WIND INSTRUMENTS 33 FEET ABOVE GROUND

*Numbering change only

TABLE 1.3 (7 of 8)

JOINT PERCENTAGE FREQUENCIES OF WIND DIRECTION AND WIND SPEED FOR DIFFERENT STABILITY CLASSES*

STABILITY CLASS G
DELTA T > 4.0 DEG. C/100M

SEQUOYAH NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN. 1, 72 - DEC. 31, 75

WIND DIRECTION	CALM	0.6-1.4	1.5-3.4	WIND SPEED(MPH) 3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>24.5	TOTAL
N	.003	0.06	0.33	0.09	0.0	0.0	0.0	0.0	0.0	0.48
NNE	.005	0.10	1.03	0.20	0.0	0.0	0.0	0.0	0.0	1.33
NE	.005	0.09	0.74	0.12	0.0	0.0	0.0	0.0	0.0	0.95
ENE	.007	0.13	0.42	0.02	0.0	0.0	0.0	0.0	0.0	0.57
E	.007	0.14	0.18	0.01	0.0	0.0	0.0	0.0	0.0	0.33
ESE	.006	0.11	0.08	0.01	0.0	0.0	0.0	0.0	0.0	0.20
SE	.005	0.09	0.08	0.0	0.0	0.0	0.0	0.0	0.0	0.17
SSE	.008	0.16	0.21	0.0	0.01	0.0	0.0	0.0	0.0	0.37
S	.006	0.11	0.39	0.04	0.02	0.0	0.0	0.0	0.0	0.55
SSW	.003	0.06	0.48	0.32	0.06	0.01	0.0	0.0	0.0	0.89
SW	.002	0.03	0.44	0.42	0.0	0.0	0.0	0.0	0.0	0.95
WSW	.001	0.01	0.11	0.07	0.0	0.0	0.0	0.0	0.0	0.19
W	.002	0.03	0.08	0.02	0.0	0.0	0.0	0.0	0.0	0.13
WNW	.001	0.01	0.03	0.01	0.0	0.01	0.0	0.0	0.0	0.06
NW	.001	0.02	0.06	0.03	0.0	0.0	0.0	0.0	0.0	0.11
NNW	.001	0.02	0.08	0.03	0.0	0.0	0.0	0.0	0.0	0.13
SUBTOTAL	0.06	1.17	4.74	1.39	0.09	0.2	0.0	0.0	0.0	7.41

2379 STABILITY CLASS G OCCURRENCES OUT OF TOTAL 32723 VALID TEMPERATURE DIFFERENCE READINGS

2378 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 2379 STABILITY CLASS G OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED .74 MILES SW OF SEQUOYAH NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 and 150 FEET ABOVE GROUND
WIND INSTRUMENTS 33 FEET ABOVE GROUND

*Numbering change only

*Numbering change only

TABLE 1.3 (8 of 8)

PERCENTAGE OCCURRENCE OF WIND
SPEED FOR ALL WIND DIRECTIONS

SEQUOYAH NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN. 1, 72 - DEC. 31, 75

WIND DIRECTION	CALM	WIND SPEED(MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>24.5	TOTAL
N	.044	0.51	3.20	1.63	0.67	0.58	0.0	0.0	0.0	6.59
NNE	.063	0.82	8.30	5.05	2.46	2.18	0.11	0.0	0.0	18.92
NE	.043	0.48	3.86	2.59	1.01	0.83	0.06	0.0	0.0	8.83
ENE	.027	0.42	1.58	0.39	0.09	0.0	0.01	0.0	0.0	2.49
E	.030	0.50	0.80	0.11	0.03	0.02	0.01	0.0	0.0	1.47
ESE	.023	0.33	0.45	0.07	0.02	0.01	0.02	0.0	0.0	0.90
SE	.019	0.34	0.82	0.19	0.01	0.02	0.0	0.0	0.0	1.38
SSE	.024	0.43	1.36	0.55	0.23	0.36	0.06	0.02	0.0	2.99
S	.031	0.47	2.89	2.49	1.58	1.53	0.14	0.0	0.0	9.10
SSW	.019	0.29	3.79	4.91	3.44	2.84	0.24	0.0	0.0	15.51
SW	.023	0.30	3.55	4.79	3.02	1.93	0.20	0.02	0.0	13.81
WSW	.016	0.24	1.68	1.19	0.66	0.69	0.16	0.02	0.0	4.64
W	.016	0.21	0.78	0.47	0.35	0.44	0.06	0.01	0.0	2.32
WNW	.019	0.27	0.70	0.36	0.34	0.51	0.03	0.0	0.0	2.21
NW	.011	0.18	0.93	0.63	0.74	0.82	0.07	0.0	0.0	3.38
NNW	.020	0.27	1.55	1.23	0.93	0.99	0.04	0.0	0.0	5.01
SUBTOTAL	0.43	6.04	36.24	26.65	15.58	13.76	1.21	0.07	0.0	99.55

32338 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF 35040 TOTAL HOURS = 92.29 PERCENT

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED .74 MILES SW OF SEQUOYAH NUCLEAR PLANT
WIND INSTRUMENTS 33 FEET ABOVE GROUND

Table 1.4
DOSE FACTORS FOR SUBMERSION IN NOBLE GASES

	DFB_i*	DFS_i*	$DF_{\lambda i}$**	$DF_{\beta i}$**
	mrem/yr per $\mu Ci/m^3$		mrad/yr per $\mu Ci/m^3$	
Kr-85m	1.17E+03	1.46E+03	1.21E+03	3.86E+03
Kr-85	1.61E+01	1.34E+03	1.69E+01	3.83E+03
Kr-87	5.92E+03	9.73E+03	6.05E+03	2.01E+04
Kr-88	1.4[illegible]	2.37E+03	1.50E+04	5.72E+03
Kr-88+D	---	2.02E+04	---	3.72E+04
Kr-89	1.66E+04	1.01E+04	1.59E+04	1.88E+04
Xe-131m	9.15E+01	4.76E+02	1.53E+02	2.18E+03
Xe-133m	2.51E+02	9.94E+02	3.17E+02	2.90E+03
Xe-133	2.94E+02	3.06E+02	3.46E+02	2.06E+03
Xe-135m	3.12E+03	7.11E+02	3.30E+03	1.45E+03
Xe-135	1.81E+03	1.86E+03	1.88E+03	4.84E+03
Xe-137	1.42E+03	1.22E+04	1.48E+03	2.50E+04
Xe-138	8.83E+03	4.13E+03	9.00E+03	9.25E+03
Xe-138+D	---	[illegible]	2.65E+04	2.81E+04
Ar-41	8.84E+03	2.69E+03	9.76E+03	5.54E+03

References:

* Regulatory Guide 1.109.

** TVA generated values.

Table 1.5
SECTOR ELEMENTS CONSIDERED FOR POPULATION DOSES

Range of Sector Element	Midpoint of Sector Element
Site boundary - 1 mile	0.8 mile
1 - 2 miles	1.5 miles
2 - 3 miles	2.5 miles
3 - 4 miles	3.5 miles
4 - 5 miles	4.5 miles
5 - 10 miles	7.5 miles
10 - 20 miles	15 miles
20 - 30 miles	25 miles
30 - 40 miles	35 miles
40 - 50 miles	45 miles

*Page added

Table 1.6
POPULATION WITHIN EACH SECTOR ELEMENT

	0.8	1.5	2.5	3.5	4.5	7.5	15	25	35	45
N	0	15	35	10	5	615	4865	2725	2535	10050
NNE	0	0	45	65	35	265	8315	4770	4635	6275
NE	0	0	0	35	20	235	1220	2765	7000	14370
ENE	0	10	0	75	100	335	3715	8470	37275	12635
E	0	20	15	60	50	330	17245	3625	3450	4415
ESE	5	50	50	100	60	875	60490	3660	1190	11935
SE	5	145	15	65	65	550	12205	3165	1795	2370
SSE	0	25	85	255	80	530	10085	9950	64775	3470
S	0	60	5	145	200	775	12560	10250	36795	8350
SSW	0	45	40	155	85	2260	139250	72170	17640	6430
SW	0	0	35	130	35	3770	174125	44450	10435	5170
WSW	5	50	250	490	465	7305	33710	5435	17105	14995
W	5	30	85	205	215	6245	1655	5700	4005	3880
WNW	0	20	110	305	790	4730	3210	3465	3835	1835
NW	5	30	140	160	390	9050	1235	1660	870	16300
NNW	5	60	10	30	270	1200	505	2725	1635	4420

*Page added

Table 1.7 (1 of 8)
INGESTION DOSE FACTORS
(mrem/pCi ingested)

ADULT

	bone	liver	t body	thyroid	kidney	lung	gi-lli
H-3	1.05E-07	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
Na-24	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06
P-32	1.93E-04	1.20E-05	7.46E-06	0.00E+00	0.00E+00	0.00E+00	2.17E-05
Cr-51	0.00E+00	0.00E+00	2.66E-09	1.59E-09	5.86E-10	3.53E-09	6.69E-07
Mn-54	0.00E+00	4.57E-06	8.72E-07	0.00E+00	1.36E-06	0.00E+00	1.40E-05
Mn-56	0.00E+00	1.15E-07	2.04E-08	0.00E+00	2.46E-07	0.00E+00	3.67E-06
Fe-55	2.75E-06	1.90E-06	4.43E-07	0.00E+00	0.00E+00	1.06E-06	1.09E-06
Fe-59	4.34E-06	1.02E-05	3.91E-06	0.00E+00	0.00E+00	2.85E-06	3.40E-05
Co-58	0.00E+00	7.45E-07	1.67E-06	0.00E+00	0.00E+00	0.00E+00	1.51E-05
Co-60	0.00E+00	2.14E-06	4.72E-06	0.00E+00	0.00E+00	0.00E+00	4.02E-05
Ni-63	1.30E-04	9.01E-06	4.36E-06	0.00E+00	0.00E+00	0.00E+00	1.88E-06
Ni-65	5.28E-07	6.86E-08	3.13E-08	0.00E+00	0.00E+00	0.00E+00	1.74E-06
Cu-64	0.00E+00	8.33E-08	3.91E-08	0.00E+00	2.10E-07	0.00E+00	7.10E-06
Zn-65	4.84E-06	1.54E-05	6.96E-06	0.00E+00	1.03E-05	0.00E+00	9.70E-06
Zn-69	1.03E-08	1.97E-08	1.37E-09	0.00E+00	1.28E-08	0.00E+00	2.96E-09
Br-83	0.00E+00	0.00E+00	4.02E-08	0.00E+00	0.00E+00	0.00E+00	5.79E-08
Br-84	0.00E+00	0.00E+00	5.21E-08	0.00E+00	0.00E+00	0.00E+00	4.09E-13
Br-85	0.00E+00	0.00E+00	2.14E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	2.11E-05	9.83E-06	0.00E+00	0.00E+00	0.00E+00	4.16E-06
Rb-88	0.00E+00	6.05E-08	3.21E-08	0.00E+00	0.00E+00	0.00E+00	8.36E-19
Rb-89	0.00E+00	4.01E-08	2.82E-08	0.00E+00	0.00E+00	0.00E+00	2.33E-21
Sr-89	3.08E-04	0.00E+00	8.84E-06	0.00E+00	0.00E+00	0.00E+00	4.94E-05
Sr-90	7.58E-03	0.00E+00	1.86E-03	0.00E+00	0.00E+00	0.00E+00	2.19E-04
Sr-91	5.67E-06	0.00E+00	2.29E-07	0.00E+00	0.00E+00	0.00E+00	2.70E-05
Sr-92	2.15E-06	0.00E+00	9.30E-08	0.00E+00	0.00E+00	0.00E+00	4.26E-05
Y-90	9.62E-09	0.00E+00	2.58E-10	0.00E+00	0.00E+00	0.00E+00	1.02E-04
Y-91m	9.09E-11	0.00E+00	3.52E-12	0.00E+00	0.00E+00	0.00E+00	2.67E-10
Y-91	1.41E-07	0.00E+00	3.77E-09	0.00E+00	0.00E+00	0.00E+00	7.76E-05
Y-92	8.45E-10	0.00E+00	2.47E-11	0.00E+00	0.00E+00	0.00E+00	1.48E-05
Y-93	2.68E-09	0.00E+00	7.40E-11	0.00E+00	0.00E+00	0.00E+00	8.50E-05
Zr-95	3.04E-08	9.75E-09	6.60E-09	0.00E+00	1.53E-08	0.00E+00	3.09E-05
Zr-97	1.68E-09	3.39E-10	1.55E-10	0.00E+00	5.12E-10	0.00E+00	1.05E-04
Nb-95	6.22E-09	3.46E-09	1.86E-09	0.00E+00	3.42E-09	0.00E+00	2.10E-05
Mo-99	0.00E+00	4.31E-06	8.20E-07	0.00E+00	9.76E-06	0.00E+00	9.99E-06
Tc-99m	2.47E-10	6.98E-10	8.89E-09	0.00E+00	1.06E-08	3.42E-10	4.13E-07
Tc-101	2.54E-10	3.66E-10	3.59E-09	0.00E+00	6.59E-09	1.87E-10	1.10E-21
Ru-103	1.85E-07	0.00E+00	7.97E-08	0.00E+00	7.06E-07	0.00E+00	2.16E-05
Ru-105	1.54E-08	0.00E+00	6.08E-09	0.00E+00	1.99E-07	0.00E+00	9.42E-06
Ru-106	2.75E-06	0.00E+00	3.48E-07	0.00E+00	5.31E-06	0.00E+00	1.78E-04
Ag-110m	1.60E-07	1.48E-07	8.79E-08	0.00E+00	2.91E-07	0.00E+00	6.04E-05
Te-125m	2.68E-06	9.71E-07	3.59E-07	8.06E-07	1.09E-05	0.00E+00	1.07E-05
Te-127m	6.77E-06	2.42E-06	8.25E-07	1.73E-06	2.75E-05	0.00E+00	2.27E-05
Te-127	1.10E-07	3.95E-08	2.38E-08	8.15E-08	4.48E-07	0.00E+00	8.68E-06

*Numbering change only

Table 1.7 (2 of 8)
INGESTION DOSE FACTORS
(mrem/pCi ingested)

ADULT

	bone	liver	t body	thyroid	kidney	lung	gi-lli
Te-129m	1.15E-05	4.29E-06	1.82E-06	3.95E-06	4.80E-05	0.00E+00	5.79E-05
Te-129	3.14E-08	1.18E-08	7.65E-09	2.41E-08	1.32E-07	0.00E+00	2.37E-08
Te-131m	1.73E-06	8.46E-07	7.05E-07	1.34E-06	8.57E-06	0.00E+00	8.40E-05
Te-131	1.97E-08	8.23E-09	6.22E-09	1.62E-08	8.63E-08	0.00E+00	2.79E-09
Te-132	2.52E-06	1.63E-06	1.53E-06	1.80E-06	1.57E-05	0.00E+00	7.71E-05
I-130	7.56E-07	2.23E-06	8.80E-07	1.89E-04	3.48E-06	0.00E+00	1.92E-06
I-131	4.16E-06	5.95E-06	3.41E-06	1.95E-03	1.02E-05	0.00E+00	1.57E-06
I-132	2.03E-07	5.43E-07	1.90E-07	1.90E-05	8.65E-07	0.00E+00	1.02E-07
I-133	1.42E-06	2.47E-06	7.53E-07	3.63E-04	4.31E-06	0.00E+00	2.22E-06
I-134	1.06E-07	2.88E-07	1.03E-07	4.99E-06	4.58E-07	0.00E+00	2.51E-10
I-135	4.43E-07	1.16E-06	4.28E-07	7.65E-05	1.86E-06	0.00E+00	1.31E-06
Cs-134	6.22E-05	1.48E-04	1.21E-04	0.00E+00	4.79E-05	1.59E-05	2.59E-06
Cs-136	6.51E-06	2.57E-05	1.85E-05	0.00E+00	1.43E-05	1.96E-06	2.92E-06
Cs-137	7.97E-05	1.09E-04	7.14E-05	0.00E+00	3.70E-05	1.23E-05	2.11E-06
Cs-138	5.52E-08	1.09E-07	5.40E-08	0.00E+00	8.01E-08	7.91E-09	4.65E-13
Ba-139	9.70E-08	6.91E-11	2.84E-09	0.00E+00	6.46E-11	3.92E-11	1.72E-07
Ba-140	2.03E-05	2.55E-08	1.33E-06	0.00E+00	8.67E-09	1.46E-08	4.18E-05
Ba-141	4.71E-08	3.56E-11	1.59E-09	0.00E+00	3.31E-11	2.02E-11	2.22E-17
Ba-142	2.13E-08	2.19E-11	1.34E-09	0.00E+00	1.85E-11	1.24E-11	3.00E-26
La-140	2.50E-09	1.26E-09	3.33E-10	0.00E+00	0.00E+00	0.00E+00	9.25E-05
La-142	1.28E-10	5.82E-11	1.45E-11	0.00E+00	0.00E+00	0.00E+00	4.25E-07
Ce-141	9.36E-09	6.33E-09	7.18E-10	0.00E+00	2.94E-09	0.00E+00	2.42E-05
Ce-143	1.65E-09	1.22E-06	1.3[illegible]E-10	0.00E+00	5.37E-10	0.00E+00	4.56E-05
Ce-144	4.88E-07	2.04E-07	2.62E-08	0.00E+00	1.21E-07	0.00E+00	1.65E-04
Pr-143	9.20E-09	3.69E-09	4.56E-10	0.00E+00	2.13E-09	0.00E+00	4.03E-05
Pr-144	3.01E-11	1.25E-11	1.53E-12	0.00E+00	7.05E-12	0.00E+00	4.33E-18
Nd-147	6.29E-09	7.27E-09	4.35E-10	0.00E+00	4.25E-09	0.00E+00	3.49E-05
W-187	1.03E-07	8.61E-08	3.01E-08	0.00E+00	0.00E+00	0.00E+00	2.82E-05
Np-239	1.19E-09	1.17E-10	6.45E-11	0.00E+00	3.65E-10	0.00E+00	2.40E-05

Reference:

Regulatory Guide 1.109, Table E-11

NOTE: The tritium dose factor for bone is assumed to be equal to the total body dose factor.

*Numbering change only

Table 1.7 (3 of 8)
INGESTION DOSE FACTORS
(mrem/pCi ingested)

TEEN

	bone	liver	t body	thyroid	kidney	lung	gi-lli
H-3	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.05E-07
C-14	4.06E-06	8.12E-07	8.12E-07	8.12E-07	8.12E-07	8.12E-07	8.12E-07
Na-24	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06
P-32	2.76E-04	1.71E-05	1.07E-05	0.00E+00	0.00E+00	0.00E+00	2.32E-05
Cr-51	0.00E+00	0.00E+00	3.60E-09	2.00E-09	7.89E-10	5.14E-09	6.05E-07
Mn-54	0.00E+00	5.90E-06	1.17E-06	0.00E+00	1.76E-06	0.00E+00	1.21E-05
Mn-56	0.00E+00	1.58E-07	2.81E-08	0.00E+00	2.00E-07	0.00E+00	1.04E-05
Fe-55	3.78E-06	2.68E-06	6.25E-07	0.00E+00	0.00E+00	1.70E-06	1.16E-06
Fe-59	5.87E-06	1.37E-05	5.29E-06	0.00E+00	0.00E+00	4.32E-06	3.24E-05
Co-58	0.00E+00	9.72E-07	2.24E-06	0.00E+00	0.00E+00	0.00E+00	1.34E-05
Co-60	0.00E+00	2.81E-06	6.33E-06	0.00E+00	0.00E+00	0.00E+00	3.66E-05
Ni-63	1.77E-04	1.25E-05	6.00E-06	0.00E+00	0.00E+00	0.00E+00	1.99E-06
Ni-65	7.49E-07	9.57E-08	4.36E-08	0.00E+00	0.00E+00	0.00E+00	5.19E-06
Cu-64	0.00E+00	1.15E-07	5.41E-08	0.00E+00	2.91E-07	0.00E+00	8.92E-06
Zn-65	5.76E-06	2.00E-05	9.33E-06	0.00E+00	1.28E-05	0.00E+00	8.47E-06
Zn-69	1.47E-08	2.80E-08	1.96E-09	0.00E+00	1.83E-08	0.00E+00	5.16E-08
Br-83	0.00E+00	0.00E+00	5.74E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	7.22E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	3.05E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	2.98E-05	1.40E-05	0.00E+00	0.00E+00	0.00E+00	4.41E-06
Rb-88	0.00E+00	8.52E-08	4.54E-08	0.00E+00	0.00E+00	0.00E+00	7.30E-15
Rb-89	0.00E+00	5.50E-08	3.89E-08	0.00E+00	0.00E+00	0.00E+00	8.43E-17
Sr-89	4.40E-04	0.00E+00	1.26E-05	0.00E+00	0.00E+00	0.00E+00	5.24E-05
Sr-90	8.30E-03	0.00E+00	2.05E-03	0.00E+00	0.00E+00	0.00E+00	2.33E-04
Sr-91	8.07E-06	0.00E+00	3.21E-07	0.00E+00	0.00E+00	0.00E+00	3.66E-05
Sr-92	3.05E-06	0.00E+00	1.30E-07	0.00E+00	0.00E+00	0.00E+00	7.77E-05
Y-90	1.37E-08	0.00E+00	3.69E-10	0.00E+00	0.00E+00	0.00E+00	1.13E-04
Y-91m	1.29E-10	0.00E+00	4.93E-12	0.00E+00	0.00E+00	0.00E+00	6.09E-09
Y-91	2.01E-07	0.00E+00	5.39E-09	0.00E+00	0.00E+00	0.00E+00	8.24E-05
Y-92	1.21E-09	0.00E+00	3.50E-11	0.00E+00	0.00E+00	0.00E+00	3.32E-05
Y-93	3.83E-09	0.00E+00	1.05E-10	0.00E+00	0.00E+00	0.00E+00	1.17E-04
Zr-95	4.1[illegible]E-08	1.30E-08	8.94E-09	0.00E+00	1.91E-08	0.00E+00	3.00E-05
Zr-97	2.37E-09	4.69E-10	2.16E-10	0.00E+00	7.11E-10	0.00E+00	1.27E-04
Nb-95	8.22E-09	4.56E-09	2.51E-09	0.00E+00	4.42E-09	0.00E+00	1.95E-05
Mo-99	0.00E+00	6.03E-06	1.15E-06	0.00E+00	1.38E-05	0.00E+00	1.08E-05
Tc-99m	3.32E-10	9.26E-10	1.20E-08	0.00E+00	1.38E-08	5.14E-10	6.08E-07
Tc-101	3.60E-10	5.12E-10	5.03E-09	0.00E+00	9.26E-09	3.12E-10	8.75E-17
Ru-103	2.55E-07	0.00E+00	1.09E-07	0.00E+00	8.99E-07	0.00E+00	2.13E-05
Ru-105	2.18E-08	0.00E+00	8.46E-09	0.00E+00	2.75E-07	0.00E+00	1.76E-05
Ru-106	3.92E-06	0.00E+00	4.94E-07	0.00E+00	7.56E-06	0.00E+00	1.88E-04
Ag-110m	2.05E-07	1.94E-07	1.18E-07	0.00E+00	3.70E-07	0.00E+00	5.45E-05
Te-125m	3.83E-06	1.38E-06	5.12E-07	1.07E-06	0.00E+00	0.00E+00	1.13E-05
Te-127m	9.67E-06	3.43E-06	1.15E-06	2.30E-06	3.92E-05	0.00E+00	2.41E-05
Te-127	1.58E-07	5.60E-08	3.40E-08	1.09E-07	6.40E-07	0.00E+00	1.22E-05

*Numbering change only

Table 1.7 (4 of 8)
INGESTION DOSE FACTORS
(mrem/pCi ingested)

TEEN

	bone	liver	t body	thyroid	kidney	lung	gi-lli
Te-129m	1.63E-05	6.05E-06	2.58E-06	5.26E-06	6.82E-05	0.00E+00	6.12E-05
Te-129	4.48E-08	1.67E-08	1.09E-08	3.20E-08	1.88E-07	0.00E+00	2.45E-07
Te-131m	2.44E-06	1.17E-06	9.76E-07	1.76E-06	1.22E-05	0.00E+00	9.39E-05
Te-131	2.79E-08	1.15E-08	8.72E-09	2.15E-08	1.22E-07	0.00E+00	2.29E-09
Te-132	3.49E-06	2.21E-06	2.08E-06	2.33E-06	2.12E-05	0.00E+00	7.00E-05
I-130	1.03E-06	2.98E-06	1.19E-06	2.43E-04	4.59E-06	0.00E+00	2.29E-06
I-131	5.85E-06	8.19E-06	4.40E-06	2.39E-03	1.41E-05	0.00E+00	1.62E-06
I-132	2.79E-07	7.30E-07	2.62E-07	2.46E-05	1.15E-06	0.00E+00	3.18E-07
I-133	2.01E-06	3.41E-06	1.04E-06	4.76E-04	5.98E-06	0.00E+00	2.58E-06
I-134	1.46E-07	3.87E-07	1.39E-07	6.45E-06	6.10E-07	0.00E+00	5.10E-09
I-135	6.10E-07	1.57E-06	5.82E-07	1.01E-04	2.48E-06	0.00E+00	1.74E-06
Cs-134	8.37E-05	1.97E-04	9.14E-05	0.00E+00	6.26E-05	2.39E-05	2.45E-06
Cs-136	8.59E-06	3.38E-05	2.27E-05	0.00E+00	1.84E-05	2.90E-06	2.72E-06
Cs-137	1.12E-04	1.49E-04	5.19E-05	0.00E+00	5.07E-05	1.97E-05	2.12E-06
Cs-138	7.76E-08	1.49E-07	7.45E-08	0.00E+00	1.10E-07	1.28E-08	6.76E-11
Ba-139	1.39E-07	9.78E-11	[illegible].05E-09	0.00E+00	9.22E-11	6.74E-11	1.24E-06
Ba-140	2.84E-05	3.48E-08	1.83E-06	0.00E+00	1.18E-08	2.34E-08	4.38E-05
Ba-141	6.71E-08	5.01E-11	2.24E-09	0.00E+00	4.65E-11	3.43E-11	1.43E-13
Ba-142	2.99E-08	2.99E-11	1.84E-09	0.00E+00	2.53E-11	1.99E-11	9.18E-20
La-140	3.48E-09	1.71E-09	4.55E-10	0.00E+00	0.00E+00	0.00E+00	9.82E-05
La-142	1.79E-10	7.95E-11	1.98E-11	0.00E+00	0.00E+00	0.00E+00	2.42E-06
Ce-141	1.33E-08	8.88E-09	1.02E-09	0.00E+00	4.18E-09	0.00E+00	2.54E-05
Ce-143	2.35E-09	1.71E-06	1.91E-10	0.00E+00	7.67E-10	0.00E+00	5.14E-05
Ce-144	6.96E-07	2.88E-07	3.74E-08	0.00E+00	1.72E-07	0.00E+00	1.75E-04
Pr-143	1.31E-08	5.23E-09	6.52E-10	0.00E+00	3.04E-09	0.00E+00	4.31E-05
Pr-144	4.30E-11	1.76E-11	2.18E-12	0.00E+00	1.01E-11	0.00E+00	4.74E-14
Nd-147	9.38E-09	1.02E-08	6.11E-10	0.00E+00	5.99E-09	0.00E+00	3.68E-05
W-187	1.46E-07	1.19E-07	4.17E-08	0.00E+00	0.00E+00	0.00E+00	3.22E-05
Np-239	1.76E-09	1.66E-10	9.22E-11	0.00E+00	5.21E-10	0.00E+00	2.67E-05

Reference:

Regulatory Guide 1.109, Table E-12

NOTE: The tritium dose factor for bone is assumed to be equal to the total body dose factor.

*Numbering change only

Table 1.7 (5 of 8)
INGESTION DOSE FACTORS
(mrem/pCi ingested)

CHILD

	bone	liver	t body	thyroid	kidney	lung	gi-lli
H-3	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07
C-14	1.21E-05	2.42E-06	2.42E-06	2.42E-06	2.42E-06	2.42E-06	2.42E-06
Na-24	5.80E-06	5.80E-06	5.80E-06	5.80E-06	5.80E-06	5.80E-06	5.80E-06
P-32	8.25E-04	3.86E-05	3.18E-05	0.00E+00	0.00E+00	0.00E+00	2.28E-05
Cr-51	0.00E+00	0.00E+00	8.90E-09	4.94E-09	1.35E-09	9.02E-09	4.72E-07
Mn-54	0.00E+00	1.07E-05	2.85E-06	0.00E+00	3.00E-06	0.00E+00	8.98E-06
Mn-56	0.00E+00	3.34E-07	7.54E-08	0.00E+00	4.04E-07	0.00E+00	4.84E-05
Fe-55	1.15E-05	6.10E-06	1.89E-06	0.00E+00	0.00E+00	3.45E-06	1.13E-06
Fe-59	1.65E-05	2.67E-05	1.33E-05	0.00E+00	0.00E+00	7.74E-06	2.78E-05
Co-58	0.00E+00	1.80E-06	5.51E-06	0.00E+00	0.00E+00	0.00E+00	1.05E-05
Co-60	0.00E+00	5.29E-06	1.56E-05	0.00E+00	0.00E+00	0.00E+00	2.93E-05
Ni-63	5.38E-04	2.88E-05	1.83E-05	0.00E+00	0.00E+00	0.00E+00	1.94E-06
Ni-65	2.22E-06	2.09E-07	1.22E-07	0.00E+00	0.00E+00	0.00E+00	2.56E-05
Cu-64	0.00E+00	2.45E-07	1.48E-07	0.00E+00	5.92E-07	0.00E+00	1.15E-05
Zn-65	1.37E-05	3.65E-05	2.27E-05	0.00E+00	2.30E-05	0.00E+00	6.41E-06
Zn-69	4.38E-08	6.33E-08	5.85E-09	0.00E+00	3.84E-08	0.00E+00	3.99E-06
Br-83	0.00E+00	0.00E+00	1.71E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	1.98E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	9.12E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	6.70E-05	4.12E-05	0.00E+00	0.00E+00	0.00E+00	4.31E-06
Rb-88	0.00E+00	1.90E-07	1.32E-07	0.00E+00	0.00E+00	0.00E+00	9.32E-09
Rb-89	0.00E+00	1.17E-07	1.04E-07	0.00E+00	0.00E+00	0.00E+00	1.02E-09
Sr-89	1.32E-03	0.00E+00	3.77E-05	0.00E+00	0.00E+00	0.00E+00	5.11E-05
Sr-90	1.70E-02	0.00E+00	4.31E-03	0.00E+00	0.00E+00	0.00E+00	2.29E-04
Sr-91	2.40E-05	0.00E+00	9.06E-07	0.00E+00	0.00E+00	0.00E+00	5.30E-05
Sr-92	9.03E-06	0.00E+00	3.62E-07	0.00E+00	0.00E+00	0.00E+00	1.71E-04
Y-90	4.11E-08	0.00E+00	1.10E-09	0.00E+00	0.00E+00	0.00E+00	1.17E-04
Y-91m	3.82E-10	0.00E+00	1.39E-11	0.00E+00	0.00E+00	0.00E+00	7.48E-07
Y-91	6.02E-07	0.00E+00	1.61E-08	0.00E+00	0.00E+00	0.00E+00	8.02E-05
Y-92	3.60E-09	0.00E+00	1.03E-10	0.00E+00	0.00E+00	0.00E+00	1.04E-04
Y-93	1.14E-08	0.00E+00	3.13E-10	0.00E+00	0.00E+00	0.00E+00	1.70E-04
Zr-95	1.16E-07	2.55E-08	2.27E-08	0.00E+00	3.65E-08	0.00E+00	2.66E-05
Zr-97	6.99E-09	1.01E-09	5.96E-10	0.00E+00	1.45E-09	0.00E+00	1.53E-04
Nb-95	2.25E-08	8.76E-09	6.26E-09	0.00E+00	8.23E-09	0.00E+00	1.62E-05
Mo-99	0.00E+00	1.33E-05	3.29E-06	0.00E+00	2.84E-05	0.00E+00	1.10E-05
Tc-99m	9.23E-10	1.81E-09	3.00E-08	0.00E+00	2.63E-08	9.19E-10	1.03E-06
Tc-101	1.07E-09	1.12E-09	1.42E-08	0.00E+00	1.91E-08	5.92E-10	3.56E-09
Ru-103	7.31E-07	0.00E+00	2.81E-07	0.00E+00	1.84E-06	0.00E+00	1.89E-05
Ru-105	6.45E-08	0.00E+00	2.34E-08	0.00E+00	5.67E-07	0.00E+00	4.21E-05
Ru-106	1.17E-05	0.00E+00	1.46E-06	0.00E+00	1.58E-05	0.00E+00	1.82E-04
Ag-110m	5.39E-07	3.64E-07	2.91E-07	0.00E+00	6.78E-07	0.00E+00	4.33E-05
Te-125m	1.14E-05	3.09E-06	1.52E-06	3.20E-06	0.00E+00	0.00E+00	1.10E-05
Te-127m	2.89E-05	7.78E-06	3.43E-06	6.91E-06	8.24E-05	0.00E+00	2.34E-05
Te-127	4.71E-07	1.27E-07	1.01E-07	3.26E-07	1.34E-06	0.00E+00	1.84E-05

*Numbering change only

Table 1.7 (6 of 8)
INGESTION DOSE FACTORS
(mrem/pCi ingested)

CHILD

	bone	liver	t body	thyroid	kidney	lung	gi-lli
Te-129m	4.87E-05	1.36E-05	7.56E-06	1.57E-05	1.43E-04	0.00E+00	5.94E-05
Te-129	1.34E-07	3.74E-08	3.18E-08	9.56E-08	3.92E-07	0.00E+00	8.34E-06
Te-131m	7.20E-06	2.49E-06	2.65E-06	5.12E-06	2.41E-05	0.00E+00	1.01E-04
Te-131	8.30E-08	2.53E-08	2.47E-08	6.35E-08	2.51E-07	0.00E+00	4.36E-07
Te-132	1.01E-05	4.47E-06	5.40E-06	6.51E-06	4.15E-05	0.00E+00	4.50E-05
I-130	2.92E-06	5.90E-06	3.04E-06	6.50E-04	8.82E-06	0.00E+00	2.76E-06
I-131	1.72E-05	1.73E-05	9.83E-06	5.72E-03	2.84E-05	0.00E+00	1.54E-06
I-132	8.00E-07	1.47E-06	6.76E-07	6.82E-05	2.25E-06	0.00E+00	1.73E-06
I-133	5.92E-06	7.32E-06	2.77E-06	1.36E-03	1.22E-05	0.00E+00	2.95E-06
I-134	4.19E-07	7.78E-07	3.58E-07	1.79E-05	1.19E-06	0.00E+00	5.16E-07
I-135	1.75E-06	3.15E-06	1.49E-06	2.79E-04	4.83E-06	0.00E+00	2.40E-06
Cs-134	2.34E-04	3.84E-04	8.10E-05	0.00E+00	1.19E-04	4.27E-05	2.07E-06
Cs-136	2.35E-05	6.46E-05	4.18E-05	0.00E+00	3.44E-05	5.13E-06	2.27E-06
Cs-137	3.27E-04	3.13E-04	4.62E-05	0.00E+00	1.02E-04	3.67E-05	1.96E-06
Cs-138	2.28E-07	3.17E-07	2.01E-07	0.00E+00	2.23E-07	2.40E-08	1.46E-07
Ba-139	4.14E-07	2.21E-10	1.20E-08	0.00E+00	1.93E-10	1.30E-10	2.39E-05
Ba-140	8.31E-05	7.28E-08	4.85E-06	0.00E+00	2.37E-08	4.34E-08	4.21E-05
Ba-141	2.00E-07	1.12E-10	6.51E-09	0.00E+00	9.69E-11	6.58E-10	1.14E-07
Ba-142	8.74E-08	6.29E-11	4.88E-09	0.00E+00	5.09E-11	3.70E-11	1.14E-09
La-140	1.01E-08	3.53E-09	1.19E-09	0.00E+00	0.00E+00	0.00E+00	9.84E-05
La-142	5.24E-10	1.67E-10	5.23E-11	0.00E+00	0.00E+00	0.00E+00	3.31E-05
Ce-141	3.97E-08	1.98E-08	2.94E-09	0.00E+00	8.68E-09	0.00E+00	2.47E-05
Ce-143	6.99E-09	3.79E-06	5.49E-10	0.00E+00	1.59E-09	0.00E+00	5.55E-05
Ce-144	2.08E-06	6.52E-07	1.11E-07	0.00E+00	3.61E-07	0.00E+00	1.70E-04
Pr-143	3.93E-08	1.18E-08	1.95E-09	0.00E+00	6.39E-09	0.00E+00	4.24E-05
Pr-144	1.29E-10	3.99E-11	6.49E-12	0.00E+00	2.11E-11	0.00E+00	8.59E-08
Nd-147	2.79E-08	2.26E-08	1.75E-09	0.00E+00	1.24E-08	0.00E+00	3.58E-05
W-187	4.29E-07	2.54E-07	1.14E-07	0.00E+00	0.00E+00	0.00E+00	3.57E-05
Np-239	5.25E-09	3.77E-10	2.65E-10	0.00E+00	1.09E-09	0.00E+00	2.79E-05

Reference:

Regulatory Guide 1.109, Table E-13

NOTE: The tritium dose factor for bone is assumed to be equal to the total body dose factor.

*Numbering change only

Table 1.7 (7 of 8)
INGESTION DOSE FACTORS
(mrem/pCi ingested)

INFANT

	bone	liver	t body	thyroid	kidney	lung	gi-lli
H-3	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07
C-14	2.37E-05	5.06E-06	5.06E-06	5.06E-06	5.06E-06	5.06E-06	5.06E-06
Na-24	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05
P-32	1.70E-03	1.00E-04	6.59E-05	0.00E+00	0.00E+00	0.00E+00	2.30E-05
Cr-51	0.00E+00	0.00E+00	1.41E-08	9.20E-09	2.01E-09	1.79E-08	4.11E-07
Mn-54	0.00E+00	1.99E-05	4.51E-06	0.00E+00	4.41E-06	0.00E+00	7.31E-06
Mn-56	0.00E+00	8.18E-07	1.41E-07	0.00E+00	7.03E-07	0.00E+00	7.43E-05
Fe-55	1.39E-05	8.98E-06	2.40E-06	0.00E+00	0.00E+00	4.39E-06	1.14E-06
Fe-59	3.08E-05	5.38E-05	2.12E-05	0.00E+00	0.00E+00	1.59E-05	2.57E-05
Co-58	0.00E+00	3.60E-06	8.98E-06	0.00E+00	0.00E+00	0.00E+00	8.97E-06
Co-60	0.00E+00	1.08E-05	2.55E-05	0.00E+00	0.00E+00	0.00E+00	2.57E-05
Ni-63	6.34E-04	3.92E-05	2.20E-05	0.00E+00	0.00E+00	0.00E+00	1.95E-06
Ni-65	4.70E-06	5.32E-07	2.42E-07	0.00E+00	0.00E+00	0.00E+00	4.05E-05
Cu-64	0.00E+00	6.09E-07	2.82E-07	0.00E+00	1.03E-06	0.00E+00	1.25E-05
Zn-65	1.84E-05	6.31E-05	2.91E-05	0.00E+00	3.06E-05	0.00E+00	5.33E-05
Zn-69	9.33E-08	1.68E-07	1.25E-08	0.00E+00	6.98E-08	0.00E+00	1.37E-05
Br-83	0.00E+00	0.00E+00	3.63E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	3.82E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	1.94E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	1.70E-04	8.40E-05	0.00E+00	0.00E+00	0.00E+00	4.35E-06
Rb-88	0.00E+00	4.96E-07	2.73E-07	0.00E+00	0.00E+00	0.00E+00	4.85E-07
Rb-89	0.00E+00	2.86E-07	1.97E-07	0.00E+00	0.00E+00	0.00E+00	9.74E-08
Sr-89	2.51E-03	0.00E+00	7.20E-05	0.00E+00	0.00E+00	0.00E+00	5.16E-05
Sr-90	1.85E-02	0.00E+00	4.71E-03	0.00E+00	0.00E+00	0.00E+00	2.31E-04
Sr-91	5.00E-05	0.00E+00	1.81E-06	0.00E+00	0.00E+00	0.00E+00	5.92E-05
Sr-92	1.92E-05	0.00E+00	7.13E-07	0.00E+00	0.00E+00	0.00E+00	2.07E-04
Y-90	8.69E-08	0.00E+00	2.33E-09	0.00E+00	0.00E+00	0.00E+00	1.20E-04
Y-91m	8.10E-10	0.00E+00	2.76E-11	0.00E+00	0.00E+00	0.00E+00	2.70E-06
Y-91	1.13E-06	0.00E+00	3.01E-08	0.00E+00	0.00E+00	0.00E+00	8.10E-05
Y-92	7.65E-09	0.00E+00	2.15E-10	0.00E+00	0.00E+00	0.00E+00	1.46E-04
Y-93	2.43E-08	0.00E+00	6.62E-10	0.00E+00	0.00E+00	0.00E+00	1.92E-04
Zr-95	2.06E-07	5.02E-08	3.56E-08	0.00E+00	5.41E-08	0.00E+00	2.50E-05
Zr-97	1.48E-08	2.54E-09	1.16E-09	0.00E+00	2.56E-09	0.00E+00	1.62E-04
Nb-95	4.20[illegible]8	1.73E-08	1.00E-08	0.00E+00	1.24E-08	0.00E+00	1.46E-05
Mo-99	0.00[illegible]	3.40E-05	6.63E-06	0.00E+00	5.08E-05	0.00E+00	1.12E-05
Tc-99m	1.92E-09	3.96E-09	5.10E-08	0.00E+00	4.26E-08	2.07E-09	1.15E-06
Tc-101	2.27E-09	2.86E-09	2.83E-08	0.00E+00	3.40E-08	1.56E-09	4.86E-07
Ru-103	1.48E-06	0.00E+00	4.95E-07	0.00E+00	3.08E-06	0.00E+00	1.80E-05
Ru-105	1.36E-07	0.00E+00	4.58E-08	0.00E+00	1.00E-06	0.00E+00	5.41E-05
Ru-106	2.41E-05	0.00E+00	3.01E-06	0.00E+00	2.85E-05	0.00E+00	1.83E-04
Ag-110m	9.96E-07	7.27E-07	4.81E-07	0.00E+00	1.04E-06	0.00E+00	3.77E-05
Te-125m	2.33E-05	7.79E-06	3.15E-06	7.84E-06	0.00E+00	0.00E+00	1.11E-05
Te-127m	5.85E-05	1.94E-05	7.08E-06	1.69E-05	1.44E-04	0.00E+00	2.36E-05
Te-127	1.00E-06	3.35E-07	2.15E-07	8.14E-07	2.44E-06	0.00E+00	2.10E-05

*Numbering change only

Table 1.7 (8 of 8)
INGESTION DOSE FACTORS
(mrem/pCi ingested)

INFANT

	bone	liver	t body	thyroid	kidney	lung	gi-lli
Te-129m	1.00E-04	3.43E-05	1.54E-05	3.84E-05	2.50E-04	0.00E+00	5.97E-05
Te-129	2.84E-07	9.79E-08	6.63E-08	2.38E-07	7.07E-07	0.00E+00	2.27E-05
Te-131m	1.52E-05	6.12E-06	5.05E-06	1.24E-05	4.21E-05	0.00E+00	1.03E-04
Te-131	1.76E-07	6.50E-08	4.94E-08	1.57E-07	4.50E-07	0.00E+00	7.11E-06
Te-132	2.08E-05	1.03E-05	9.61E-06	1.52E-05	6.44E-05	0.00E+00	3.81E-05
I-130	6.00E-06	1.32E-05	5.30E-06	1.48E-03	1.45E-05	0.00E+00	2.83E-06
I-131	3.59E-05	4.23E-05	1.86E-05	1.39E-02	4.94E-05	0.00E+00	1.51E-06
I-132	1.66E-06	3.37E-06	1.20E-06	1.58E-04	3.76E-06	0.00E+00	2.73E-06
I-133	1.25E-05	1.82E-05	5.33E-06	3.31E-03	2.14E-05	0.00E+00	3.08E-06
I-134	8.69E-07	1.78E-06	6.33E-07	4.15E-05	1.99E-06	0.00E+00	1.84E-06
I-135	3.64E-06	7.24E-06	2.64E-06	6.49E-04	8.07E-06	0.00E+00	2.62E-06
Cs-134	3.77E-04	7.03E-04	7.10E-05	0.00E+00	1.81E-04	7.42E-05	1.91E-06
Cs-136	4.59E-05	1.35E-04	5.04E-05	0.00E+00	5.38E-05	1.10E-05	2.05E-06
Cs-137	5.22E-04	6.11E-04	4.33E-05	0.00E+00	1.64E-04	6.64E-05	1.91E-06
Cs-138	4.81E-07	7.82E-07	3.79E-07	0.00E+00	3.90E-07	6.09E-08	1.25E-06
Ba-139	8.81E-07	5.84E-10	2.55E-08	0.00E+00	3.51E-10	3.54E-10	5.58E-05
Ba-140	1.71E-04	1.71E-07	8.81E-06	0.00E+00	4.06E-08	1.05E-07	4.20E-05
Ba-141	4.25E-07	2.91E-10	1.34E-08	0.00E+00	1.75E-10	1.77E-10	5.19E-06
Ba-142	1.84E-07	1.53E-10	9.06E-09	0.00E+00	8.81E-11	9.26E-11	7.59E-07
La-140	2.11E-08	8.32E-09	2.14E-09	0.00E+00	0.00E+00	0.00E+00	9.77E-05
La-142	1.10E-09	4.04E-10	9.67E-11	0.00E+00	0.00E+00	0.00E+00	6.86E-05
Ce-141	7.87E-08	4.80E-08	5.65E-09	0.00E+00	1.48E-08	0.00E+00	2.48E-05
Ce-143	1.48E-08	9.82E-06	1.12E-09	0.00E+00	2.86E-09	0.00E+00	5.73E-05
Ce-144	2.98E-06	1.22E-06	1.67E-07	0.00E+00	4.93E-07	0.00E+00	1.71E-04
Pr-143	8.13E-08	3.04E-08	4.03E-09	0.00E+00	1.13E-08	0.00E+00	4.29E-05
Pr-144	2.74E-10	1.06E-10	1.38E-11	0.00E+00	3.84E-11	0.00E+00	4.93E-06
Nd-147	5.53E-08	5.68E-08	3.48E-09	0.00E+00	2.19E-08	0.00E+00	3.60E-05
W-187	9.03E-07	6.28E-07	2.17E-07	0.00E+00	0.00E+00	0.00E+00	3.69E-05
Np-239	1.11E-08	9.93E-10	5.61E-10	0.00E+00	1.98E-09	0.00E+00	2.87E-05

Reference:

Regulatory Guide 1.109, Table E-14

NOTE: The tritium dose factor for bone is assumed to be equal to the total body dose factor.

*Numbering change only

Table 1.8 (1 of 2)
RADIONUCLIDE DECAY AND TRANSFER DATA

	Half-Live (Days)	λ (1/s)	B_{iv}	F_{mi} (cow)	F_{mi} (goat)	F_{fi} (beef)
H-3	4.49E+03	1.79E-09	4.80E+00	1.00E-02	1.70E-01	1.20E-02
C-14	2.09E+06	3.84E-12	5.50E+00	1.20E-02	1.00E-01	3.10E-02
N-13	6.94E-03	1.16E-03	7.50E+00	2.20E-02	2.20E-02	7.70E-02
O-19	3.36E-04	2.39E-02	1.60E+00	2.00E-02	2.00E-02	1.60E-02
F-18	7.62E-02	1.05E-04	6.50E-04	1.40E-02	1.40E-02	1.50E-01
Na-24	6.33E-01	1.27E-05	5.20E-02	4.00E-02	4.00E-02	3.00E-02
P-32	1.43E+01	5.61E-07	1.10E+00	2.50E-02	2.50E-01	4.60E-02
Ar-41	7.63E-02	1.05E-04	6.00E-01	2.00E-02	2.00E-02	2.00E-02
Cr-51	2.78E+01	2.89E-07	2.50E-04	2.20E-03	2.20E-03	2.40E-03
Mn-54	3.03E+02	2.65E-08	2.90E-02	2.50E-04	2.50E-04	8.00E-04
Mn-56	1.07E-01	7.50E-05	2.90E-02	2.50E-04	2.50E-04	8.00E-04
Fe-59	4.50E+01	1.78E-07	6.60E-04	1.20E-03	1.30E-04	4.00E-02
Co-58	7.13E-01	1.12E-07	9.40E-03	1.00E-03	1.00E-03	1.30E-02
Co-60	1.92E-03	4.18E-09	9.40E-03	1.00E-03	1.00E-03	1.30E-02
Zn-69m	5.75E-01	1.39E-05	4.00E-01	3.90E-02	3.90E-02	3.00E-02
Zn-69	3.96E-02	2.03E-04	4.00E-01	3.90E-02	3.90E-02	3.00E-02
Br-84	2.21E-02	3.63E-04	7.60E-01	5.00E-02	5.00E-02	2.60E-02
Br-85	2.08E-03	3.86E-03	7.60E-01	5.00E-02	5.00E-02	2.60E-02
Kr-85m	1.83E-01	4.38E-05	3.00E+00	2.00E-02	2.00E-02	2.00E-02
Kr-85	3.93E+03	2.04E-09	3.00E-00	2.00E-02	2.00E-02	2.00E-02
Kr-87	5.28E-02	1.52E-04	3.00E-00	2.00E-02	2.00E-02	2.00E-02
Kr-88	1.17E-01	6.86E-05	3.00E-00	2.00E-02	2.00E-02	2.00E-02
Kr-89	2.21E-03	3.63E-01	3.00E-00	2.00E-02	2.00E-02	2.00E-02
Rb-88	1.24E-02	6.47E-04	1.30E-01	3.00E-02	3.00E-02	3.10E-02
Rb-89	1.07E-02	7.50E-04	1.30E-01	3.00E-02	3.00E-02	3.10E-02
Sr-89	5.20E+01	1.54E-07	1.70E-02	1.40E-03	1.40E-02	6.00E-04
Sr-90	1.03E+04	7.79E-10	1.70E-02	1.40E-03	1.40E-02	6.00E-04
Sr-91	4.03E-01	1.99E-05	1.70E-02	1.40E-03	1.40E-02	6.00E-04
Sr-92	1.13E-01	7.10E-05	1.70E-02	1.40E-03	1.40E-02	6.00E-04
Sr-93	5.56E-03	1.44E-03	1.70E-02	1.40E-03	1.40E-02	6.00E-04
Y-90	2.67E+00	3.00E-06	2.60E-03	1.00E-05	1.00E-05	4.60E-03
Y-91m	3.47E-02	2.31E-04	2.60E-03	1.00E-05	1.00E-05	4.60E-03
Y-91	5.88E+01	1.36E-07	2.60E-03	1.00E-05	1.00E-05	4.60E-03
Y-92	1.47E-01	5.46E-05	2.60E-03	1.00E-05	1.00E-05	4.60E-03
Y-93	4.29E-01	1.87E-05	2.60E-03	1.00E-05	1.00E-05	4.60E-03
Zr-95	6.50E+01	1.23E-07	1.70E-04	5.00E-06	5.00E-06	3.40E-02
Nb-95m	3.75E+00	2.14E-06	9.40E-03	2.50E-03	2.50E-03	2.80E-01
Nb-95	3.50E+01	2.29E-07	9.40E-03	2.50E-03	2.50E-03	2.80E-01
Mo-99	2.79E+00	2.87E-06	1.20E-01	7.50E-03	7.50E-03	8.00E-03
Tc-99m	2.50E-01	3.21E-05	2.50E-01	2.50E-02	2.50E-02	4.00E-01
Tc-99	7.74E+07	1.04E-13	2.50E-01	2.50E-02	2.50E-02	4.00E-01
Tc-104	1.25E-02	6.42E-04	2.50E-01	2.50E-02	2.50E-02	4.00E-01

References:
NUREG/CR-1004 for Iodine, Strontium, and Cesium milk transfer factors.
Regulatory Guide 1.109 for all other nuclides' transfer factors.

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Table 1.8 (2 of 2)
RADIONUCLIDE DECAY AND TRANSFER DATA

	Half-Live (Days)	λ (1/s)	B_{iv}	F_{mi} (cow)	F_{mi} (goat)	F_{fi} (beef)
Ru-106	3.67E+02	2.19E-08	5.00E-02	1.00E-06	1.00E-06	4.00E-01
Te-132	3.24E+00	2.48E-06	1.30E+00	1.00E-03	1.00E-03	7.70E-02
I-129	6.21E+09	1.29E-15	2.00E-02	1.20E-02	4.30E-01	2.86E-03
I-131	8.08E+00	9.96E-07	2.00E-02	1.20E-02	4.30E-01	2.90E-03
I-132	9.58E-02	8.37E-05	2.00E-02	1.20E-02	4.30E-01	2.90E-03
I-133	8.75E-01	9.17E-06	2.00E-02	1.20E-02	4.30E-01	2.90E-03
I-134	3.61E-02	2.22E-04	2.00E-02	1.20E-02	4.30E-01	2.90E-03
I-135	2.79E-01	2.87E-05	2.00E-02	1.20E-02	4.30E-01	2.90E-03
Xe-131m	1.18E+01	6.80E-07	1.00E+01	2.00E-02	2.00E-02	2.00E-03
Xe-133m	2.26E+00	3.55E-06	1.00E+01	2.00E-02	2.00E-02	2.00E-03
Xe-133	5.27E+00	1.52E-06	1.00E+01	2.00E-02	2.00E-02	2.00E-03
Xe-135m	1.08E-02	7.43E-04	1.00E+01	2.00E-02	2.00E-02	2.00E-03
Xe-135	3.83E-01	2.09E-05	1.00E+01	2.00E-02	2.00E-02	2.00E-03
Xe-137	2.71E-03	2.96E-03	1.00E+01	2.00E-02	2.00E-02	2.00E-02
Xe-138	1.18E-02	6.80E-04	1.00E+01	2.00E-02	2.00E-02	2.00E-02
Cs-134	7.48E+02	1.07E-08	1.00E-02	8.00E-03	3.00E-01	1.50E-02
Cs-135	1.10E+09	7.29E-15	1.00E-02	8.00E-03	3.00E-01	1.50E-02
Cs-136	1.30E+01	6.17E-07	1.00E-02	8.00E-03	3.00E-01	1.50E-02
Cs-137	1.10E+04	7.29E-10	1.00E-02	8.00E-03	3.00E-01	1.50E-02
Cs-138	2.24E-02	3.58E-04	1.00E-02	8.00E-03	3.00E-01	1.50E-02
Ba-139	5.76E-02	1.39E-04	5.00E-03	4.00E-04	4.00E-04	3.20E-03
Ba-140	1.28E+01	6.27E-07	5.00E-03	4.00E-04	4.00E-04	3.20E-03
La-140	1.68E+00	4.77E-06	2.50E-03	5.00E-06	5.00E-06	2.00E-04
Ce-144	2.84E+02	2.82E-08	2.50E-03	1.00E-04	6.00E-04	1.20E-03
Pr-143	1.36E+01	5.90E-07	2.50E-03	5.00E-06	5.00E-06	4.70E-03
Pr-144	1.20E-02	6.68E-04	2.50E-03	5.00E-06	5.00E-06	4.70E-03
Np-239	2.35E+00	3.41E-06	2.50E-03	5.00E-06	5.00E-06	2.00E-04

References:

NUREG/CR-1004 for Iodine, Strontium, and Cesium milk transfer factors.
Regulatory Guide 1.109 for all other nuclides' transfer factors.

*Entire page changed and renumbered

Table 1.9 (1 of 2)
DOSE CALCULATION FACTORS

Factor	Value	Units	Reference
BR_a (infant)	1400	m^3/year	ICRP 23
BR_a (child)	5500	m^3/year	ICRP 23
BR_a (teen)	8000	m^3/year	ICRP 23
BR_a (adult	8100	m^3/year	ICRP 23
f_g	1		TVA Value
f_L	1		TVA Value
f_p (monthly)	1		TVA Value
f_p (for calculations other than monthly doses)	see Table 1.4		
f_s (monthly)	0		TVA Value
f_s (for calculations other than monthly doses)	$1-f_p$		
H	9	g/m^3	TVA Value
P	240	kg/m^2	R. G. 1.109
Q_f (cow)	64	kg/day	NUREG/CR-1004 (Sect. 3.4)
Q_f (goat)	08	kg/day	NUREG/CR-1004 (Sect. 3.4)
r	0.47		NUREG/CR-1004 (Sect. 3.2)
t_b	1.11E+09 (35 years)	seconds	TVA Value
t_{cb}	7.78E+06 (90 days)	seconds	TVA Value
t_{csf}	1.56E+07 (180 days)	seconds	TVA Value
t_e	5.18E+06 (60 days)	seconds	R. G. 1.109
t_{ep}	2.59E+06 (30 days)	seconds	R. G. 1.109
t_{esf}	7.78E+06 (90 days)	seconds	R. G. 1.109
t_{fm}	8.64E+04 (1 day)	seconds	TVA Value
t_{hc}	8.64E+04 (1 day)	seconds	NUREG/CR-1004, Table 3.40
t_s	1.12E+06 (13 days)	seconds	NUREG/CR-1004, Table 3.40
t_{sv}	2.38E+07 (275 days)	seconds	TVA Value
U_{am} (infant)	0	kg/year	R. G. 1.109
U_{am} (child)	41	kg/year	R. G. 1.109
U_{am} (teen)	65	kg/year	R. G. 1.109
U_{am} (adult)	110	kg/year	R. G. 1.109
U_{ap} (infant)	330	L/year	R. G. 1.109
U_{ap} (child)	330	L/year	R. G. 1.109
U_{ap} (teen)	400	L/year	R. G. 1.109
U_{ap} (adult)	310	L/year	R. G. 1.109

*Page added

Table 1.9 (2 of 2)
DOSE CALCULATION FACTORS

Factor	Value	Units	Reference
U_{FLa} (infant)	0	kg/year	R. G. 1.109
U_{FLa} (child)	26	kg/year	R. G. 1.109
U_{FLa} (teen)	42	kg/year	R. G. 1.109
U_{FLa} (adult)	64	kg/year	R. G. 1.109
U_{Sa} (infant)	0	kg/year	R. G. 1.109
U_{Sa} (child)	520	kg/year	R. G. 1.109
U_{Sa} (teen)	630	kg/year	R. G. 1.109
U_{Sa} (adult)	520	kg/year	R. G. 1.109
Y_f	1.85	kg/m^2	NUREG/CR-1004, Sect. 3.1
Y_p	1.18	kg/m^2	NUREG/CR-1004, Sect. 3.1
Y_{sf}	0.64	kg/m^2	NUREG/CR-1004, Sect. 3.1
Y_{sv}	0.57	kg/m^2	NUREG/CR-1004, Sect. 3.1 (value selected is for non-leafy vegetables)
λ_w (iodines)	7.29E-07	sec^{-1}	NUREG/CR-1004, Sect. 3.3
λ_w (particulates)	5.35E-07	sec^{-1}	NUREG/CR-1004, Sect. 3.3

*Numbering change only

Table 1.10 (1 of 8)
INHALATION DOSE FACTORS
(mrem/pCi inhaled)

ADULT

	bone	liver	t body	thyroid	kidney	lung	gi-lli
H-3	0.00E+00	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07
C-14	2.27E-06	4.26E-07	4.26E-07	4.26E-07	4.26E-07	4.26E-07	4.26E-07
Na-24	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.28E-06
P-32	1.65E-04	9.64E-06	6.26E-06	0.00E+00	0.00E+00	0.00E+00	1.08E-05
Cr-51	0.00E+00	0.00E+00	1.25E-08	7.44E-09	2.85E-09	1.80E-06	4.15E-07
Mn-54	0.00E+00	4.95E-06	7.87E-07	0.00E+00	1.23E-06	1.75E-04	9.67E-06
Mn-56	0.00E+00	1.55E-10	2.29E-11	0.00E+00	1.63E-10	1.18E-06	2.53E-06
Fe-55	3.07E-06	2.12E-06	4.93E-07	0.00E+00	0.00E+00	9.01E-06	7.54E-07
Fe-59	1.47E-06	3.47E-06	1.32E-06	0.00E+00	0.00E+00	1.27E-04	2.35E-05
Co-58	0.00E+00	1.98E-07	2.59E-07	0.00E+00	0.00E+00	1.16E-04	1.33E-05
Co-60	0.00E+00	1.44E-06	1.85E-06	0.00E+00	0.00E+00	7.46E-04	3.56E-05
Ni-63	5.40E-05	3.93E-06	1.81E-06	0.00E+00	0.00E+00	2.23E-05	1.67E-06
Ni-65	1.92E-10	2.62E-11	1.14E-11	0.00E+00	0.00E+00	7.00E-07	1.54E-06
Cu-64	0.00E+00	1.83E-10	7.69E-11	0.00E+00	5.78E-10	8.48E-07	6.12E-06
Zn-65	4.05E-06	1.29E-05	5.82E-06	0.00E+00	8.62E-06	1.08E-04	6.68E-06
Zn-69	4.23E-12	8.14E-12	5.65E-13	0.00E+00	5.27E-12	1.15E-07	2.04E-09
Br-83	0.00E+00	0.00E+00	3.01E-08	0.00E+00	0.00E+00	0.00E+00	2.90E-08
Br-84	0.00E+00	0.00E+00	3.91E-08	0.00E+00	0.00E+00	0.00E+00	2.05E-13
Br-85	0.00E+00	0.00E+00	1.60E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	1.69E-05	7.37E-06	0.00E+00	0.00E+00	0.00E+00	2.08E-06
Rb-88	0.00E+00	4.84E-08	2.41E-08	0.00E+00	0.00E+00	0.00E+00	4.18E-19
Rb-89	0.00E+00	3.20E-08	2.12E-08	0.00E+00	0.00E+00	0.00E+00	1.16E-21
Sr-89	3.80E-05	0.00E+00	1.09E-06	0.00E+00	0.00E+00	1.75E-04	4.37E-05
Sr-90	1.24E-02	0.00E+00	7.62E-04	0.00E+00	0.00E+00	1.20E-03	9.02E-05
Sr-91	7.74E-09	0.00E+00	3.13E-10	0.00E+00	0.00E+00	4.56E-06	2.39E-05
Sr-92	8.43E-10	0.00E+00	3.64E-11	0.00E+00	0.00E+00	2.06E-06	5.38E-06
Y-90	2.61E-07	0.00E+00	7.01E-09	0.00E+00	0.00E+00	2.12E-05	6.32E-05
Y-91m	3.26E-11	0.00E+00	1.27E-12	0.00E+00	0.00E+00	2.40E-07	1.66E-10
Y-91	5.78E-05	0.00E+00	1.55E-06	0.00E+00	0.00E+00	2.13E-04	4.81E-05
Y-92	1.29E-09	0.00E+00	3.77E-11	0.00E+00	0.00E+00	1.96E-06	9.19E-06
Y-93	1.18E-08	0.00E+00	3.26E-10	0.00E+00	0.00E+00	6.06E-06	5.27E-05
Zr-95	1.34E-05	4.30E-06	2.91E-06	0.00E+00	6.77E-06	2.21E-04	1.88E-05
Zr-97	1.21E-08	2.45E-09	1.13E-09	0.00E+00	3.71E-09	9.84E-06	6.54E-05
Nb-95	1.76E-06	9.77E-07	5.26E-07	0.00E+00	9.67E-07	6.31E-05	1.30E-05
Mo-99	0.00E+00	1.51E-08	2.87E-09	0.00E+00	3.64E-08	1.14E-05	3.10E-05
Tc-99m	1.29E-13	3.64E-13	4.63E-12	0.00E+00	5.52E-12	9.55E-08	5.20E-07
Tc-101	5.22E-15	7.52E-15	7.38E-14	0.00E+00	1.35E-13	4.99E-08	1.36E-21
Ru-103	1.91E-07	0.00E+00	8.23E-08	0.00E+00	7.29E-07	6.31E-05	1.38E-05
Ru-105	9.88E-11	0.00E+00	3.89E-11	0.00E+00	1.27E-10	1.37E-06	6.02E-06
Ru-106	8.64E-06	0.00E+00	1.09E-06	0.00E+00	1.67E-05	1.17E-03	1.14E-04
Ag-110m	1.35E-06	1.25E-06	7.48E-07	0.00E+00	2.46E-06	5.79E-04	3.78E-05
Te-125m	4.27E-07	1.98E-07	5.84E-08	1.31E-07	1.55E-06	3.92E-05	8.83E-06
Te-127m	1.58E-06	7.21E-07	1.96E-07	4.11E-07	5.72E-06	1.20E-04	1.87E-05
Te-127	1.75E-10	8.03E-11	3.87E-11	1.32E-10	6.37E-10	8.14E-07	7.17E-06

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Table 1.10 (2 of 8)
INHALATION DOSE FACTORS
(mrem/pCi inhaled)

ADULT

	bone	liver	t body	thyroid	kidney	lung	gi-lli
Te-129m	1.22E-06	5.84E-07	1.98E-07	4.30E-07	4.57E-06	1.45E-04	4.79E-05
Te-129	6.22E-12	2.99E-12	1.55E-12	4.87E-12	2.34E-11	2.42E-07	1.96E-08
Te-131m	8.74E-09	5.45E-09	3.63E-09	6.88E-09	3.86E-08	1.82E-05	6.95E-05
Te-131	1.39E-12	7.44E-13	4.49E-13	1.17E-12	5.46E-12	1.74E-07	2.30E-09
Te-132	3.25E-08	2.69E-08	2.02E-08	2.37E-08	1.82E-07	[illegible].60E-05	6.37E-05
I-130	5.72E-07	1.68E-06	6.60E-07	1.42E-04	2.61E-06	0.00E+00	9.61E-07
I-131	3.15E-06	4.47E-06	2.56E-06	1.49E-03	7.66E-06	0.00E+00	7.85E-07
I-132	1.45E-07	4.07E-07	1.45E-07	1.43E-05	6.48E-07	0.00E+00	5.08E-08
I-133	1.08E-06	1.85E-06	5.65E-07	2.69E-04	3.23E-06	0.00E+00	1.11E-06
I-134	8.05E-08	2.16E-07	7.69E-08	3.73E-06	3.44E-07	0.00E+00	1.26E-10
I-135	3.35E-07	8.73E-07	3.21E-07	5.60E-05	1.39E-06	0.00E+00	6.56E-07
Cs-134	4.66E-05	1.06E-04	9.10E-05	0.00E+00	3.59E-05	1.22E-05	1.30E-06
Cs-136	4.88E-06	1.83E-05	1.38E-05	0.00E+00	1.07E-05	1.50E-06	1.46E-06
Cs-137	5.98E-05	7.76E-05	5.35E-05	0.00E+00	2.78E-05	9.40E-06	1.05E-06
Cs-138	4.14E-08	7.76E-08	4.05E-08	0.00E+00	6.00E-08	6.07E-09	2.33E-13
Ba-139	1.17E-10	8.32E-14	3.42E-12	0.00E+00	7.78E-14	4.70E-07	1.12E-07
Ba-140	4.88E-06	6.13E-09	3.21E-07	0.00E+00	2.09E-09	1.59E-04	2.73E-05
Ba-141	1.25E-11	9.41E-15	4.20E-13	0.00E+00	8.75E-15	2.42E-07	1.45E-17
Ba-142	3.29E-12	3.38E-15	2.07E-13	0.00E+00	2.86E-15	1.49E-07	1.96E-26
La-140	4.30E-08	2.17E-08	5.73E-09	0.00E+00	0.00E+00	1.70E-05	5.73E-05
La-142	8.54E-11	3.88E-11	9.65E-12	0.00E+00	0.00E+00	7.91E-07	2.64E-07
Ce-141	2.49E-06	1.69E-06	1.91E-07	0.00E+00	7.83E-07	4.52E-05	1.50E-05
Ce-143	2.33E-08	1.72E-08	1.91E-09	0.00E+00	7.60E-09	9.97E-06	2.83E-05
Ce-144	4.29E-04	1.79E-04	2.30E-05	0.00E+00	1.06E-04	9.72E-04	1.02E-04
Pr-143	1.17E-06	4.69E-07	5.80E-08	0.00E+00	2.7[illegible]E-07	3.51E-05	2.50E-05
Pr-144	3.76E-12	1.56E-12	1.91E-13	0.00E+00	8.81E-13	1.27E-07	2.69E-18
Nd-147	6.59E-07	7.62E-07	4.56E-08	0.00E+00	4.45E-07	2.76E-05	2.16E-05
W-187	1.06E-09	8.85E-10	3.10E-10	0.00E+00	0.00E+00	3.63E-06	1.94E-05
Np-239	2.87E-08	2.82E-09	1.55E-09	0.00E+00	8.75E-09	4.70E-06	1.49E-05

Reference:
Regulatory Guide 1.109, Table E-7

*Page added

Table 1.10 (3 of 8)
INHALATION DOSE FACTORS
(mrem/pCi inhaled)

TEEN

	bone	liver	t body	thyroid	kidney	lung	gi-lli
H-3	0.00E+00	1.59E-07	1.59E-07	1.59E-07	1.59E-07	1.59E-07	1.59E-07
C-14	3.25E-06	6.09E-07	6.09E-07	6.09E-07	6.09E-07	6.09E-07	6.09E-07
Na-24	1.72E-06	1.72E-06	1.72E-06	1.72E-06	1.72E-06	1.72E-06	1.72E-06
P-32	2.36E-04	1.37E-05	8.95E-06	0.00E+00	0.00E+00	0.00E+00	1.16E-05
Cr-51	0.00E+00	0.00E+00	1.69E-08	9.37E-09	3.84E-09	2.62E-06	3.75E-07
Mn-54	0.00E+00	6.39E-06	1.05E-06	0.00E+00	1.59E-06	2.48E-04	8.35E-06
Mn-56	0.00E+00	2.12E-10	3.15E-11	0.00E+00	2.24E-10	1.90E-06	7.18E-06
Fe-55	4.18E-06	2.98E-06	6.93E-07	0.00E+00	0.00E+00	1.55E-05	7.99E-07
Fe-59	1.99E-06	4.62E-06	1.79E-06	0.00E+00	0.00E+00	1.91E-04	2.23E-05
Co-58	0.00E+00	2.59E-07	3.47E-07	0.00E+00	0.00E+00	1.68E-04	1.19E-05
Co-60	0.00E+00	1.89E-06	2.48E-06	0.00E+00	0.00E+00	1.09E-03	3.24E-05
Ni-63	7.25E-05	5.43E-06	2.47E-06	0.00E+00	0.00E+00	3.84E-05	1.77E-06
Ni-65	2.73E-10	3.66E-11	1.59E-11	0.00E+00	0.00E+00	1.17E-06	4.59E-06
Cu-64	0.00E+00	2.54E-10	1.06E-10	0.00E+00	8.01E-10	1.39E-06	7.68E-06
Zn-65	4.82E-06	1.67E-05	7.80E-06	0.00E+00	1.08E-05	1.55E-04	5.83E-06
Zn-69	6.04E-12	1.15E-11	8.07E-13	0.00E+00	7.53E-12	1.98E-07	3.56E-08
Br-83	0.00E+00	0.00E+00	4.30E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	5.41E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	2.29E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	2.38E-05	1.05E-05	0.00E+00	0.00E+00	0.00E+00	2.21E-06
Rb-88	0.00E+00	6.82E-08	3.40E-08	0.00E+00	0.00E+00	0.00E+00	3.65E-15
Rb-89	0.00E+00	4.40E-08	2.91E-08	0.00E+00	0.00E+00	0.00E+00	4.22E-17
Sr-89	5.43E-05	0.00E+00	1.56E-06	0.00E+00	0.00E+00	3.02E-04	4.64E-05
Sr-90	1.35E-02	0.00E+00	8.35E-04	0.00E+00	0.00E+00	2.06E-03	9.56E-05
Sr-91	1.10E-08	0.00E+00	4.39E-10	0.00E+00	0.00E+00	7.59E-06	3.24E-05
Sr-92	1.19E-09	0.00E+00	5.08E-11	0.00E+00	0.00E+00	3.43E-06	1.49E-05
Y-90	3.73E-07	0.00E+00	1.00E-08	0.00E+00	0.00E+00	3.66E-05	6.99E-05
Y-91m	4.63E-11	0.00E+00	1.77E-12	0.00E+00	0.00E+00	4.00E-07	3.77E-09
Y-91	8.26E-05	0.00E+00	2.21E-06	0.00E+00	0.00E+00	3.67E-04	5.11E-05
Y-92	1.84E-09	0.00E+00	5.36E-11	0.00E+00	0.00E+00	3.35E-06	2.06E-05
Y-93	1.69E-08	0.00E+00	4.65E-10	0.00E+00	0.00E+00	1.04E-05	7.24E-05
Zr-95	1.82E-05	5.73E-06	3.94E-06	0.00E+00	8.42E-06	3.36E-04	1.86E-05
Zr-97	1.72E-08	3.40E-09	1.57E-09	0.00E+00	5.15E-09	1.62E-05	7.88E-05
Nb-95	2.32E-06	1.29E-06	7.08E-07	0.00E+00	1.25E-06	9.39E-05	1.21E-05
Mo-99	0.00E+00	2.11E-08	4.03E-09	0.00E+00	5.14E-08	1.92E-05	3.36E-05
Tc-99m	1.73E-13	4.83E-13	6.24E-12	0.00E+00	7.20E-12	1.44E-07	7.66E-07
Tc-101	7.40E-15	1.05E-14	1.03E-13	0.00E+00	1.90E-13	8.34E-08	1.09E-16
Ru-103	2.63E-07	0.00E+00	1.12E-07	0.00E+00	9.29E-07	9.79E-05	1.36E-05
Ru-105	1.40E-10	0.00E+00	5.42E-11	0.00E+00	1.76E-10	2.27E-06	1.13E-05
Ru-106	1.23E-05	0.00E+00	1.55E-06	0.00E+00	2.38E-05	2.01E-03	1.20E-04
Ag-110m	1.73E-06	1.64E-06	9.99E-07	0.00E+00	3.13E-06	8.44E-04	3.41E-05
Te-125m	6.10E-07	2.80E-07	8.34E-08	1.75E-07	0.00E+00	6.70E-05	9.38E-06
Te-127m	2.25E-06	1.02E-06	2.73E-07	5.48E-07	8.17E-06	2.07E-04	1.99E-05
Te-127	2.51E-10	1.14E-10	5.52E-11	1.77E-10	9.10E-10	1.40E-06	1.01E-05

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Table 1.10 (4 of 8)
INHALATION DOSE FACTORS
(mrem/pCi inhaled)

TEEN

	bone	liver	t body	thyroid	kidney	lung	gi-lli
Te-129m	1.74E-06	8.23E-07	2.81E-07	5.72E-07	6.49E-06	2.47E-04	5.06E-05
Te-129	8.87E-12	4.22E-12	2.20E-12	6.48E-12	3.32E-11	4.12E-07	2.02E-07
Te-131m	1.23E-08	7.51E-09	5.03E-09	9.06E-09	5.49E-08	2.97E-05	7.76E-05
Te-131	1.97E-12	1.04E-12	6.30E-13	1.55E-12	7.72E-12	2.92E-07	1.89E-09
Te-132	4.50E-08	3.63E-08	2.74E-08	3.07E-08	2.44E-07	5.61E-05	5.79E-05
I-130	7.80E-07	2.24E-06	8.96E-07	1.86E-04	3.44E-06	0.00E+00	1.14E-06
I-131	4.43E-06	6.14E-06	3.30E-06	1.83E-03	1.05E-05	0.00E+00	8.11E-07
I-132	1.99E-07	5.47E-07	1.97E-07	1.89E-05	8.65E-07	0.00E+00	1.59E-07
I-133	1.52E-06	2.56E-06	7.78E-07	3.65E-04	4.49E-06	0.00E+00	1.29E-06
I-134	1.11E-07	2.90E-07	1.05E-07	4.94E-06	4.58E-07	0.00E+00	2.55E-09
I-135	4.62E-07	1.18E-06	4.36E-07	7.76E-05	1.86E-06	0.00E+00	8.69E-07
Cs-134	6.28E-05	1.41E-04	6.86E-05	0.00E+00	4.69E-05	1.83E-05	1.22E-06
Cs-136	6.44E-06	2.42E-05	1.71E-05	0.00E+00	1.38E-05	2.22E-06	1.36E-06
Cs-137	8.38E-05	1.06E-04	3.89E-05	0.00E+00	3.80E-05	1.51E-05	1.06E-06
Cs-138	5.82E-08	1.07E-07	5.58E-08	0.00E+00	8.28E-08	9.84E-09	3.33E-11
Ba-139	1.67E-10	1.18E-13	4.87E-12	0.00E+00	1.11E-13	8.08E-07	8.06E-07
Ba-140	6.84E-06	8.38E-09	4.40E-07	0.00E+00	2.85E-09	2.54E-04	2.86E-05
Ba-141	1.78E-11	1.32E-14	5.93E-13	0.00E+00	1.23E-14	4.11E-07	9.33E-14
Ba-142	4.62E-12	4.63E-15	2.84E-13	0.00E+00	3.92E-15	2.39E-07	5.99E-20
La-140	5.99E-08	2.95E-08	7.82E-09	0.00E+00	0.00E+00	2.68E-05	6.09E-05
La-142	1.20E-10	5.31E-11	1.32E-11	0.00E+00	0.00E+00	1.27E-06	1.50E-06
Ce-141	3.55E-06	2.37E-06	2.71E-07	0.00E+00	1.11E-06	7.67E-05	1.58E-05
Ce-143	3.32E-08	2.42E-08	2.70E-09	0.00E+00	1.08E-08	1.63E-05	3.19E-05
Ce-144	6.11E-04	2.53E-04	3.28E-05	0.00E+00	1.51E-04	1.67E-03	1.08E-04
Pr-143	1.67E-06	6.64E-07	8.28E-08	0.00E+00	3.86E-07	6.04E-05	2.67E-05
Pr-144	5.37E-12	2.20E-12	2.72E-13	0.00E+00	1.26E-12	2.19E-07	2.94E-14
Nd-147	9.83E-07	1.07E-06	6.41E-08	0.00E+00	6.28E-07	4.65E-05	2.28E-05
W-187	1.50E-09	1.22E-09	4.29E-10	0.00E+00	0.00E+00	5.92E-06	2.21E-05
Np-239	4.23E-08	3.99E-09	2.21E-09	0.00E+00	1.25E-08	8.11E-06	1.65E-05

Reference:
Regulatory Guide 1.109, Table E-8

*Page added

Table 1.10 (5 of 8)
INHALATION DOSE FACTORS
(mrem/pCi inhaled)

CHILD

	bone	liver	t body	thyroid	kidney	lung	gi-lli
H-3	0.00E+00	3.04E-07	3.04E-07	3.04E-07	3.04E-07	3.04E-07	3.04E-07
C-14	9.70E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06
Na-24	4.35E-06	4.35E-06	4.35E-06	4.35E-06	4.35E-06	4.35E-06	4.35E-06
P-32	7.04E-04	3.09E-05	2.67E-05	0.00E+00	0.00E+00	0.00E+00	1.14E-05
Cr-51	0.00E+00	0.00E+00	4.17E-08	2.31E-08	6.57E-09	4.59E-06	2.93E-07
Mn-54	0.00E+00	1.16E-05	2.57E-06	0.00E+00	2.71E-06	4.26E-04	6.19E-06
Mn-56	0.00E+00	4.48E-10	8.43E-11	0.00E+00	0.00E+00	3.55E-06	3.33E-05
Fe-55	1.28E-05	6.80E-06	2.10E-06	0.00E+00	0.00E+00	3.00E-05	7.75E-07
Fe-59	5.59E-06	9.04E-06	4.51E-06	0.00E+00	0.00E+00	3.43E-04	1.91E-05
Co-58	0.00E+00	4.79E-07	8.55E-07	0.00E+00	0.00E+00	2.99E-04	9.29E-06
Co-60	0.00E+00	3.55E-06	6.12E-06	0.00E+00	0.00E+00	1.91E-03	2.60E-05
Ni-63	2.22E-04	1.25E-05	7.56E-06	0.00E+00	0.00E+00	7.43E-05	1.71E-06
Ni-65	8.08E-10	7.99E-11	4.44E-11	0.00E+00	0.00E+00	2.21E-06	2.27E-05
Cu-64	0.00E+00	5.39E-10	2.90E-10	0.00E+00	1.63E-09	2.59E-06	9.92E-06
Zn-65	1.15E-05	3.06E-05	1.90E-05	0.00E+00	1.93E-05	2.69E-04	4.41E-06
Zn-69	1.81E-11	2.61E-11	2.41E-12	0.00E+00	1.58E-11	3.84E-07	2.75E-06
Br-83	0.00E+00	0.00E+00	1.28E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	1.48E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	6.84E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	5.36E-05	3.09E-05	0.00E+00	0.00E+00	0.00E+00	2.16E-06
Rb-88	0.00E+00	1.52E-07	9.90E-08	0.00E+00	0.00E+00	0.00E+00	4.66E-09
Rb-89	0.00E+00	9.33E-08	7.83E-08	0.00E+00	0.00E+00	0.00E+00	5.11E-10
Sr-89	1.62E-04	0.00E+00	4.66E-06	0.00E+00	0.00E+00	5.83E-04	4.52E-05
Sr-90	2.73E-02	0.00E+00	1.74E-03	0.00E+00	0.00E+00	3.99E-03	9.28E-05
Sr-91	3.28E-08	0.00E+00	1.24E-09	0.00E+00	0.00E+00	1.44E-05	4.70E-05
Sr-92	3.54E-09	0.00E+00	1.42E-10	0.00E+00	0.00E+00	6.49E-06	6.55E-05
Y-90	1.11E-06	0.00E+00	2.99E-08	0.00E+00	0.00E+00	7.07E-05	7.24E-05
Y-91m	1.37E-10	0.00E+00	4.98E-12	0.00E+00	0.00E+00	7.60E-07	4.64E-07
Y-91	2.47E-04	0.00E+00	6.59E-06	0.00E+00	0.00E+00	7.10E-04	4.97E-05
Y-92	5.50E-09	0.00E+00	1.57E-10	0.00E+00	0.00E+00	6.46E-06	6.46E-05
Y-93	5.04E-08	0.00E+00	1.38E-09	0.00E+00	0.00E+00	2.01E-05	1.05E-04
Zr-95	5.13E-05	1.13E-05	1.00E-05	0.00E+00	1.61E-05	6.03E-04	1.65E-05
Zr-97	5.07E-08	7.34E-09	4.32E-09	0.00E+00	1.05E-08	3.06E-05	9.49E-05
Nb-95	6.35E-06	2.48E-06	1.77E-06	0.00E+00	2.33E-06	1.66E-04	1.00E-05
Mo-99	0.00E+00	4.66E-08	1.15E-08	0.00E+00	1.06E-07	3.66E-05	3.42E-05
Tc-99m	4.81E-13	9.41E-13	1.56E-11	0.00E+00	1.37E-11	2.57E-07	1.30E-06
Tc-101	2.19E-14	2.30E-14	2.91E-13	0.00E+00	3.92E-13	1.58E-07	4.41E-09
Ru-103	7.55E-07	0.00E+00	2.90E-07	0.00E+00	1.90E-06	1.79E-04	1.21E-05
Ru-105	4.13E-10	0.00E+00	1.50E-10	0.00E+00	3.63E-10	4.30E-06	2.69E-05
Ru-106	3.68E-05	0.00E+00	4.57E-06	0.00E+00	4.97E-05	3.87E-03	1.16E-04
Ag-110m	4.56E-06	3.08E-06	2.47E-06	0.00E+00	5.74E-06	1.48E-03	2.71E-05
Te-125m	1.82E-06	6.29E-07	2.47E-07	5.20E-07	0.00E+00	1.29E-04	9.13E-06
Te-127m	6.72E-06	2.31E-06	8.16E-07	1.64E-06	1.72E-05	4.00E-04	1.93E-05
Te-127	7.49E-10	2.57E-10	1.65E-10	5.30E-10	1.91E-09	2.71E-06	1.52E-05

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Table 1.10 (6 of 8)
INHALATION DOSE FACTORS
(mrem/pCi inhaled)

CHILD

	bone	liver	t body	thyroid	kidney	lung	gi-lli
Te-129m	5.19E-06	1.85E-06	8.22E-07	1.71E-06	1.36E-05	4.76E-04	4.91E-05
Te-129	2.64E-11	9.45E-12	6.44E-12	1.93E-11	6.94E-11	7.93E-07	6.89E-06
Te-131m	3.63E-08	1.60E-08	1.37E-08	2.64E-08	1.08E-07	5.56E-05	8.32E-05
Te-131	5.87E-12	2.28E-12	1.78E-12	4.59E-12	1.59E-11	5.55E-07	3.60E-07
Te-132	1.30E-07	7.36E-08	7.12E-08	8.58E-08	4.79E-07	1.02E-04	3.72E-05
I-130	2.21E-06	4.43E-06	2.28E-06	4.99E-04	6.61E-06	0.00E+00	1.38E-06
I-131	1.30E-05	1.30E-05	7.37E-06	4.39E-03	2.13E-05	0.00E+00	7.68E-07
I-132	5.72E-07	1.10E-06	5.07E-07	5.23E-05	1.69E-06	0.00E+00	8.65E-07
I-133	4.48E-06	5.49E-06	2.08E-06	1.04E-03	9.13E-06	0.00E+00	1.48E-06
I-134	3.17E-07	5.84E-07	2.69E-07	1.37E-05	8.92E-07	0.00E+00	2.58E-07
I-135	1.33E 06	2.36E-06	1.12E-06	2.14E-04	3.62E-06	0.00E+00	1.20E-06
Cs-134	1.76E-04	2.74E-04	6.07E-05	0.00E+00	8.93E-05	3.27E-05	1.04E-06
Cs-136	1.76E-05	4.62E-05	3.14E-05	0.00E+00	2.58E-05	3.93E-06	1.13E-06
Cs-137	2.45E-04	2.23E-04	3.47E-05	0.00E+00	7.63E-05	2.81E-05	9.78E-07
Cs-138	1.71E-07	2.27E-07	1.50E-07	0.00E+00	1.68E-07	1.84E-08	7.29E-08
Ba-139	4.98E-10	2.66E-13	1.45E-11	0.00E+00	2.33E-13	1.56E-06	1.56E-05
Ba-140	2.00E-05	1.75E-08	1.17E-06	0.00E+00	5.71E-09	4.71E-04	2.75E-05
Ba-141	5.29E-11	2.95E-14	1.72E-12	0.00E+00	2.56E-14	7.89E-07	7.44E-08
Ba-142	1.35E-11	9.73E-15	7.54E-13	0.00E+00	7.87E-15	4.44E-07	7.41E-10
La-140	1.74E-07	6.08E-08	2.04E-08	0.00E+00	0.00E+00	4.94E-05	6.10E-05
La-142	3.50E-10	1.11E-10	3.49E-11	0.00E+00	0.00E+00	2.35E-06	2.05E-05
Ce-141	1.06E-05	5.28E-06	7.83E-07	0.00E+00	2.31E-06	1.47E-04	1.53E-05
Ce-143	9.89E-08	5.37E-08	7.77E-09	0.00E+00	2.26E-08	3.12E-05	3.44E-05
Ce-144	1.83E-03	5.72E-04	9.77E-05	0.00E+00	3.17E-04	3.23E-03	1.05E-04
Pr-143	4.99E-06	1.50E-06	2.47E-07	0.00E+00	8.11E-07	1.17E-04	2.63E-05
Pr-144	1.61E-11	4.99E-12	8.10E-13	0.00E+00	2.64E-12	4.23E-07	5.32E-08
Nd-147	2.92E-06	2.36E-06	1.84E-07	0.00E+00	1.30E-06	8.87E-05	2.22E-05
W-187	4.41E-09	2.61E-09	1.17E-09	0.00E+00	0.00E+00	1.11E-05	2.46E-05
Np-239	1.26E-07	9.04E-09	6.35E-09	0.00E+00	2.63E-08	1.57E-05	1.73E-05

Reference:
Regulatory Guide 1.109, Table E-9

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Table 1.10 (7 of 8)
INHALATION DOSE FACTORS
(mrem/µCi inhaled)

INFANT

	bone	liver	t body	thyroid	kidney	lung	gi-lli
H-3	0.00E+00	4.62E-07	4.62E-07	4.62E-07	4.62E-07	4.62E-07	4.62E-07
C-14	1.89E-05	3.79E-06	3.79E-06	3.79E-06	3.79E-06	3.79E-06	3.79E-06
Na-24	7.54E-06	7.54E-06	7.54E-06	7.54E-06	7.54E-06	7.54E-06	7.54E-06
P-32	1.45E-03	8.03E+05	5.53E-05	0.00E+00	0.00E+00	0.00E+00	1.15E-05
Cr-51	0.00E+00	0.00E+00	6.39E-08	4.11E-08	9.45E-09	9.17E-06	2.55E-07
Mn-54	0.00E+00	1.81E-05	3.56E-06	0.00E+00	3.56E-06	7.14E-04	5.04E-06
Mn-56	0.00E+00	1.10E-09	1.58E-10	0.00E+00	7.86E-10	8.95E-06	5.12E-05
Fe-55	1.41E-05	8.39E-06	2.38E-06	0.00E+00	0.00E+00	6.21E-05	7.82E-07
Fe-59	9.69E-06	1.68E-05	6.77E-06	0.00E+00	0.00E+00	7.25E-04	1.77E-05
Co-58	0.00E+00	8.71E-07	1.30E-06	0.00E+00	0.00E+00	5.55E-04	7.95E-06
Co-60	0.00E+00	5.73E-06	8.41E-06	0.00E+00	0.00E+00	3.22E-03	2.28E-05
Ni-63	2.42E-04	1.46E-05	8.29E-06	0.00E+00	0.00E+00	1.49E-04	1.73E-06
Ni-65	1.71E-09	2.03E-10	8.79E-11	0.00E+00	0.00E+00	5.80E-06	3.58E-05
Cu-64	0.00E+00	1.34E-09	5.53E-10	0.00E+00	2.84E-09	6.64E-06	1.07E-05
Zn-65	1.38E-05	4.47E-05	2.22E-05	0.00E+00	2.32E-05	4.62E-04	3.67E-05
Zn-69	3.85E-11	6.91E-11	5.13E-12	0.00E+00	2.87E-11	1.05E-06	9.44E-06
Br-83	0.00E+00	0.00E+00	2.72E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	2.86E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	1.46E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	1.36E-04	6.30E-05	0.00E+00	0.00E+00	0.00E+00	2.17E-06
Rb-88	0.00E+00	3.98E-07	2.05E-07	0.00E+00	0.00E+00	0.00E+00	2.42E-07
Rb-89	0.00E+00	2.29E-07	1.47E-07	0.00E+00	0.00E+00	0.00E+00	4.87E-08
Sr-89	2.84E-04	0.00E+00	8.15E-06	0.00E+00	0.00E+00	1.45E-03	4.57E-05
Sr-90	2.92E-02	0.00E+00	1.85E-03	0.00E+00	0.00E+00	8.03E-03	9.36E-05
Sr-91	6.83E-08	0.00E+00	2.47E-09	0.00E+00	0.00E+00	3.76E-05	5.24E-05
Sr-92	7.50E-09	0.00E+00	2.79E-10	0.00E+00	0.00E+00	1.70E-05	1.00E-04
Y-90	2.35E-06	0.00E+00	6.30E-08	0.00E+00	0.00E+00	1.92E-04	7.43E-05
Y-91m	2.91E-10	0.00E+00	9.90E-12	0.00E+00	0.00E+00	[illegible]	1.68E-06
Y-91	4.20E-04	0.00E+00	1.12E-05	0.00E+00	0.00E+00	1.75E-03	5.02E-05
Y-92	1.17E-08	0.00E+00	3.29E-10	0.00E+00	0.00E+00	1.75E-05	9.04E-05
Y-93	1.07E-07	0.00E+00	2.91E-09	0.00E+00	0.00E+00	5.46E-05	1.19E-04
Zr-95	8.24E-05	1.99E-05	1.45E-05	0.00E+00	2.22E-05	1.25E-03	1.55E-05
Zr-97	1.07E-07	1.83E-08	8.36E-09	0.00E+00	1.85E-08	7.86E-05	1.00E-04
Nb-95	1.12E-05	4.59E-06	2.70E-06	0.00E+00	3.37E-06	3.42E-04	9.05E-06
Mo-99	0.00E+00	1.18E-07	2.31E-08	0.00E+00	1.89E-07	9.63E-05	3.48E-05
Tc-99m	9.98E-13	2.06E-12	2.66E-11	0.00E+00	2.22E-11	5.79E-07	1.45E-06
Tc-101	4.65E-14	5.88E-04	5.80E-13	0.00E+00	6.99E-13	4.17E-07	6.03E-07
Ru-103	1.44E-06	0.00E+00	4.85E-07	0.00E+00	3.03E-06	3.94E-04	1.15E-05
Ru-105	8.74E-10	0.00E+00	2.93E-10	0.00E+00	6.42E-10	1.12E-05	3.46E-05
Ru-106	6.20E-05	0.00E+00	7.77E-06	0.00E+00	7.61E-05	8.26E-03	1.17E-04
Ag-110m	7.13E-06	5.16E-06	3.57E-06	0.00E+00	7.80E-06	2.62E-03	2.36E-05
Te-125m	3.40E-06	1.42E-06	4.70E-07	1.16E-06	0.00E+00	3.19E-04	9.22E-06
Te-127m	1.19E-05	4.93E-06	1.48E-06	3.48E-06	2.68E-05	9.37E-04	1.95E-05
Te-127	1.59E-09	6.81E-10	3.49E-10	1.32E-09	3.47E-09	7.39E-06	1.74E-05

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Table 1.10 (8 of 8)
INHALATION DOSE FACTORS
(mrem/pCi inhaled)

INFANT

	bone	liver	t body	thyroid	kidney	lung	gi-lli
Te-129m	1.01E-05	4.35E-06	1.59E-06	3.91E-06	2.27E-05	1.20E-03	4.93E-05
Te-129	5.63E-11	2.48E-11	1.34E-11	4.82E-11	1.25E-10	2.14E-06	1.88E-05
Te-131m	7.62E-08	3.93E-08	2.59E-08	6.38E-08	1.89E-07	1.42E-04	8.51E-05
Te-131	1.24E-11	5.87E-12	3.57E-12	1.13E-11	2.85E-11	1.47E-06	5.87E-06
Te-132	2.6[illegible]E-07	1.69E-07	1.26E-07	1.99E-07	7.39E-07	2.43E-04	8.15E-05
I-130	4.54E-06	9.91E-06	3.98E-06	1.14E-03	1.09E-05	0.00E+00	1.42E-06
I-131	2.71E-05	3.17E-05	1.40E-05	1.06E-02	3.70E-05	0.00E+00	7.56E-07
I-132	1.21E-06	2.53E-06	8.99E-07	1.21E-04	2.82E-06	0.00E+00	1.36E-06
I-133	9.46E-06	1.37E-05	4.00E-06	2.54E-03	1.60E-05	0.00E+00	1.54E-06
I-134	6.58E-07	1.34E-06	4.75E-07	3.18E-05	1.49E-06	0.00E+00	9.21E-07
I-135	2.76E-06	5.43E-06	1.98E-06	4.97E-04	6.05E-06	0.00E+00	1.31E-06
Cs-134	2.83E-04	5.02E-04	5.32E-05	0.00E+00	1.36E-04	5.69E-05	9.53E-07
Cs-136	3.45E-05	9.61E-05	3.78E-05	0.00E+00	4.03E-05	8.40E-06	1.02E-06
Cs-137	3.92E-04	4.37E-04	3.25E-05	0.00E+00	1.23E-04	5.09E-05	9.53E-07
Cs-138	3.61E-07	5.58E-07	2.84E-07	0.00E+00	2.93E-07	4.57E-08	6.26E-07
La-139	1.06E-09	7.03E-13	3.07E-11	0.00E+00	4.23E-13	4.25E-06	3.64E-05
Ba-140	4.00E-05	4.00E-08	2.07E-06	0.00E+00	9.59E-09	1.14E-03	2.74E-05
Ba-141	1.12E-10	7.70E-04	3.55E-12	0.00E+00	4.64E-14	2.12E-06	3.39E-06
Ba-142	2.84E-11	2.36E-14	1.40E-12	0.00E+00	1.36E-14	1.11E-06	4.95E-07
La-140	3.61E-07	1.43E-07	3.68E-08	0.00E+00	0.00E+00	1.[illegible]E-04	6.06E-05
La-142	7.36E-10	2.69E-10	6.46E-11	0.00E+00	0.00E+00	5.87E-06	4.25E-05
Ce-141	1.98E-05	1.19E-05	1.42E-06	0.00E+00	3.75E-06	3.69E-04	1.54E-05
Ce-143	2.09E-07	1.38E-07	1.58E-08	0.00E+00	4.03E-08	8.30E-05	3.55E-05
Ce-144	2.28E-03	8.65E-04	1.26E-04	0.00E+00	3.84E-04	7.03E-03	1.06E-04
Pr-143	1.00E-05	3.74E-06	4.99E-07	0.00E+00	1.41E-06	3.09E-04	2.66E-05
Pr-144	3.42E-11	1.32E-11	1.72E-12	0.00E+00	4.80E-12	1.15E-06	3.06E-06
Nd-147	5.67E-06	5.81E-06	3.57E-07	0.00E+00	2.25E-06	2.30E-04	2.23E-05
W-187	9.26E-09	6.44E-09	2.23E-09	0.00E+00	0.00E+00	2.83E-05	2.54E-05
Np-239	2.65E-07	2.37E-08	1.34E-08	0.00E+00	4.73E-08	4.25E-05	1.78E-05

Reference:
Regulatory Guide 1.109, Table E-10

*Page added

Table 1.11 (1 of 2)
EXTERNAL DOSE FACTORS FOR STANDING ON CONTAMINATED GROUND
(mrem/h per pCi/m^2)

Nuclide	Total Body	Skin
H-3	0.0	0.0
C-14	0.0	0.0
Na-24	2.50E-08	2.90E-08
P-32	0.0	0.0
Cr-51	2.20E-10	2.60E-10
Mn-54	5.80E-09	6.80E-09
Mn-56	1.10E-08	1.30E-08
Fe-55	0.0	0.0
Fe-59	8.00E-09	9.40E-09
Co-58	7.00E-09	8.20E-09
Co-60	1.70E-08	2.0[illegible]E-08
Ni-63	0.0	0.0
Ni-65	3.70E-09	4.30E-09
Cu-64	1.50E-09	1.70E-09
Zn-65	4.00E-09	4.60E-09
Zn-69	0.0	0.0
Br-83	6.40E-11	9.30E-11
Br-84	1.20E-08	1.40E-08
Br-85	0.0	0.0
Rb-86	6.30E-10	7.20E-10
Rb-88	3.50E-09	4.00E-09
Rb-89	1.50E-08	1.80E-08
Sr-89	5.60E-13	6.50E-13
Sr-91	7.10E-09	8.30E-09
Sr-92	9.00E-09	1.00E-08
Y-90	2.20E-12	2.60E-12
Y-91m	3.80E-09	4.40E-09
Y-91	2.40E-11	2.70E-11
Y-92	1.60E-09	1.90E-09
Y-93	5.70E-10	7.80E-10
Zr-95	5.00E-09	5.80E-09
Zr-97	5.50E-09	6.40E-09
Nb-95	5.10E-09	6.00E-09
Mo-99	1.90E-09	2.20E-09
Tc-99m	9.60E-10	1.10E-09
Tc-101	2.70E-09	3.00E-09
Ru-103	3.60E-09	4.20E-09
Ru-105	4.50E-09	5.10E-09
Ru-106	1.50E-09	1.80E-09
Ag-110m	1.80E-08	2.10E-08
Te-125m	3.50E-11	4.80E-11
Te-127m	1.10E-12	1.30E-12
Te-127	1.00E-11	1.10E-11

Reference:
Regulatory Guide 1.109.

*Page added

Table 1.11 (2 of 2)
EXTERNAL DOSE FACTORS FOR STANDING ON CONTAMINATED GROUND
(mrem/h per pCi/m^2)

Nuclide	Total Body	Skin
Te-129m	7.70E-10	9.00E-10
Te-129	7.10E-10	8.40E-10
Te-131m	8.40E-09	9.90E-09
Te-131	2.20E-09	2.60E-06
Te-132	1.70E-09	2.00E-09
I-130	1.40E-08	1.70E-08
I-131	2.80E-09	3.40E-09
I-132	1.70E-08	2.00E-08
I-133	3.70E-09	4.50E-09
I-134	1.60E-08	1.90E-08
I-135	1.20E-08	1.40E-08
Cs-134	1.20E-08	1.40E-08
Cs-136	1.50E-08	1.70E-08
Cs-137	4.20E-09	4.90E-09
Cs-138	2.10E-08	2.40E-08
Ba-139	2.40E-09	2.70E-09
Ba-140	2.10E-09	2.40E-09
Ba-141	4.30E-09	4.90E-09
Ba-142	7.90E-09	9.00E-09
La-140	1.50E-08	1.70E-08
La-142	1.50E-08	1.80E-08
Ce-141	5.50E-10	6.20E-10
Ce-143	2.20E-09	2.50E-09
Ce-144	3.20E-10	3.70E-10
Pr-143	0.0	0.0
Pr-144	2.00E-10	2.30E-10
Nd-147	1.00E-09	1.20E-09
W-187	3.10E-09	3.60E-09
Np-239	9.50E-10	1.10E-09

Reference:
Regulatory Guide 1.109.

*Page added

*Numbering change only

TABLE 2.1 (1 of 4)

DOSE COMMITMENT FACTORS—(REM/MICROCI)

NUCLIDE	HALF-LIFE (DAYS)	ADULT					CHILD				
		BONE	GI TRACT	THYROID	TOTAL BODY	LIVER	BONE	GI TRACT	THYROID	TOTAL BODY	LIVER
H-3	4.50E+03	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.05E-04	2.03E-04	2.03E-04	2.03E-04	2.03E-04	2.03E-04
C-14	2.08E+06	2.84E-03	5.68E-04	5.68E-04	5.68E-04	5.68E-04	1.21E-02	2.42E-03	2.42E-03	2.42E-03	2.42E-03
Na-22	9.49E+02	2.50E-02	1.35E-02	1.21E-02	1.36E-02	1.40E-02	2.50E-02	1.35E-02	1.21E-02	1.36E-02	1.40E-02
Mg-24	6.26E-01	1.70E-03	1.70E-03	1.70E-03	1.70E-03	1.70E-03	5.80E-03	5.80E-03	5.80E-03	5.80E-03	5.80E-03
P-32	1.43E+01	1.93E-01	2.17E-02	7.46E-03	7.46E-03	1.20E-02	8.25E-01	2.28E-02	3.18E-02	3.18E-02	3.86E-02
Cr-51	2.77E+01	2.66E-06	6.68E-04	1.59E-16	2.66E-06	2.66E-06	8.90E-06	4.72E-04	4.94E-06	8.90E-06	8.90E-06
Mn-54	3.12E+02	8.72E-04	1.40E-02	8.72E-04	8.72E-04	4.57E-03	2.85E-03	8.98E-03	2.85E-03	2.85E-03	1.07E-02
Mn-56	1.08E-01	2.04E-05	3.67E-03	2.04E-05	2.04E-05	1.15E-04	7.54E-05	4.84E-02	7.54E-05	7.54E-05	3.34E-04
Fe-55	9.86E+02	2.75E-03	1.09E-03	4.43E-04	4.43E-04	1.90E-03	1.15E-02	1.13E-03	1.89E-03	1.89E-03	6.10E-03
Fe-59	4.46E+01	4.34E-03	3.40E-02	3.91E-03	3.91E-03	1.02E-02	1.65E-02	2.78E-02	1.33E-02	1.33E-02	2.67E-02
Co-57	2.71E+02	3.57E-04	4.56E-03	1.10E-04	1.84E-04	2.53E-04	3.57E-04	4.56E-03	1.10E-04	1.84E-04	2.53E-04
Co-58	7.08E+01	1.67E-03	1.51E-02	1.67E-03	1.67E-03	7.45E-04	5.51E-03	1.05E-02	5.51E-03	5.51E-03	1.80E-03
Co-60	1.92E+03	4.72E-03	4.02E-02	4.72E-03	4.72E-03	2.14E-03	1.56E-02	2.93E-02	1.56E-02	1.56E-02	5.29E-03
Ni-63	3.65E+04	1.30E-01	1.88E-03	4.36E-03	4.36E-03	9.01E-03	5.38E-01	1.94E-03	1.83E-02	1.83E-02	2.88E-02
Ni-65	1.05E-01	5.28E-04	1.74E-03	3.13E-05	3.13E-05	6.86E-05	2.22E-03	2.56E-02	1.22E-04	1.22E-04	2.09E-04
Cu-64	5.30E-01	3.91E-05	7.10E-03	3.91E-05	3.91E-05	8.33E-05	1.48E-04	1.15E-02	1.48E-04	1.48E-04	2.45E-04
Zn-65	2.44E+02	4.84E-03	9.70E-03	6.86E-03	6.96E-03	1.54E-02	1.37E-02	6.41E-03	2.27E-03	2.27E-03	3.65E-02
Zn-69	3.96E-02	1.03E-05	2.96E-06	1.37E-06	1.37E-06	1.97E-05	4.38E-05	3.99E-03	5.85E-06	5.85E-06	6.33E-05
As-74	1.78E+01	2.90E-04	3.88E-02	2.90E-04	2.90E-04	2.51E-04	2.90E-04	3.88E-02	2.90E-04	2.90E-04	2.51E-04
As-76	1.10E+00	4.49E-05	9.70E-02	4.49E-05	4.49E-05	4.70E-05	4.49E-05	9.70E-02	4.49E-05	4.49E-05	4.70E-05
Br-83	1.00E-01	4.02E-05	5.79E-05	4.02E-05	4.02E-05	4.02E-05	1.71E-04	0.00E+00	1.71E-04	1.71E-04	1.71E-04
Br-84	2.21E-02	5.21E-05	4.0[illegible]E-10	5.21E-05	5.21E-05	5.21E-05	1.98E-04	0.00E+00	1.98E-04	1.98E-04	1.98E-04
Br-85	1.99E-03	2.14E-06	[illegible]00E-21	2.14E-06	2.14E-06	2.14E-06	9.12E-06	0.00E+00	9.12E-06	9.12E-06	9.12E-06
Kr-839	7.75E-02	0.00E+00	1.46E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.46E-04	0.00E+00	0.00E+00	0.00E+00
Kr-85m	1.87E-01	0.00E+00	3.30E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.30E-03	0.00E+00	0.00E+00	0.00E+00
Kr-85	3.91E+03	0.00E+00	4.62E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.62E-02	0.00E+00	0.00E+00	0.00E+00
Rb-86	1.87E+01	9.83E-03	4.16E-03	9.83E-03	9.83E-03	2.11E-02	4.12E-02	4.31E-03	4.12E-02	4.12E-02	6.70E-02
Rb-88	1.23E-02	3.21E-05	8.36E-16	3.21E-05	3.21E-05	6.05E-05	1.32E-04	9.32E-06	1.32E-04	1.32E-04	1.90E-04
Rb-89	1.07E-02	2.82E-05	2.33E-18	2.82E-05	2.82E-05	4.01E-05	1.04E-04	1.02E-06	1.04E-04	1.04E-04	1.17E-04
Sr-89	5.05E+01	3.08E-01	4.94E-02	8.84E-03	8.84E-03	8.84E-03	1.32E+00	5.11E-02	3.77E-02	3.77E-02	3.77E-02
Sr-90	1.06E+04	7.58E+00	2.19E-01	1.86E+00	1.86E+00	1.86E+00	1.70E+0[illegible]	2.29E-01	4.31E+00	4.31E+00	4.31E+00
Sr-91	3.97E-01	5.67E-03	2.70E-02	2.29E-04	2.29E-04	2.29E-04	2.40E-02	5.30E-02	9.06E-04	9.06E-04	9.06E-04
Sr-92	1.13E-01	2.15E-03	4.26E-02	9.30E-05	9.30E-05	4.30E-05	9.03E-03	1.71E-01	3.62E-04	3.62E-04	3.62E-04
Y-90	2.67E+00	9.62E-06	1.02E-01	2.58E-07	2.58E-07	2.58E-07	4.11E-05	1.17E-01	1.10E-06	1.10E-06	1.10E-06
Y-91	5.86E+01	1.41E-04	7.76E-02	3.77E-06	3.77E-06	3.77E-06	6.02E-04	8.02E-02	1.61E-05	1.61E-05	1.61E-05

TABLE 2.1 (2 of 4)

DOSE COMMITMENT FACTORS--(REM/MICROCI)

NUCLIDE	HALF-LIFE (DAYS)	ADULT BONE	ADULT GI TRACT	ADULT THYROID	ADULT TOTAL BODY	ADULT LIVER	CHILD BONE	CHILD GI TRACT	CHILD THYROID	CHILD TOTAL BODY	CHILD LIVER
Y-91M	3.45E-02	9.09E-08	2.67E-07	3.52E-09	3.52E-09	3.52E-09	3.82E-07	7.48E-04	1.39E-08	1.39E-08	1.39E-08
Y-92	1.48E-01	1.48E-02	2.47E-08	2.47E-08	2.47E-06	2.47E-08	3.60E-06	1.04E-01	1.03E-07	1.03E-07	1.03E-07
Y-93	4.21E-01	2.68E-06	8.50E-02	7.40E-08	7.40E-08	7.40E-08	1.14E-05	1.70E-01	3.13E-07	3.13E-07	3.13E-07
Zr-95	6.40E+01	3.04E-05	3.09E-02	6.60E-06	6.60E-06	9.75E-06	1.16E-04	2.66E-02	2.27E-05	2.27E-05	2.55E-05
Zr-97	7.00E-01	1.68E-06	1.05E-01	1.55E-07	1.55E-07	3.39E-07	6.99E-06	1.53E-01	5.96E-07	5.96E-07	1.01E-06
Nb-95	3.50E+00	6.22E-06	2.10E-02	1.86E-06	1.86E-06	3.46E-06	2.25E-05	1.62E-02	6.26E-06	6.26E-06	8.76E-06
Nb-95m	3.61E+00	5.95E-07	2.43E-02	2.54E-07	2.54E-07	4.63E-07	5.95E-07	2.43E-02	2.54E-07	2.54E-07	4.63E-07
Nb-97	5.11E-02	1.56E-05	1.43E-03	7.85E-07	2.90E-05	1.62E-05	1.56E-05	1.43E-03	7.85E-07	2.90E-05	1.62E-05
Nb-97m	6.25E-04	3.48E-07	2.71E-05	3.12E-08	6.28E-07	4.73E-07	3.48E-07	2.71E-05	3.12E-08	6.28E-07	4.73E-07
Mo-99	2.75E+00	8.20E-04	9.99E-03	8.20E-04	8.20E-04	4.31E-03	3.29E-03	1.10E-02	3.29E-03	3.29E-03	1.33E-02
Tc-99	7.77E+07	4.10E-04	3.20E-03	1.41E-02	2.14E-04	6.28E-04	4.10E-04	3.20E-03	1.41E-02	2.14E-04	6.28E-04
Tc-99m	2.51E-01	2.47E-07	4.13E-04	8.89E-06	8.89E-06	6.98E-07	9.23E-07	1.03E-03	3.00E-05	3.00E-05	1.81E-06
Ru-103	3.94E+01	1.85E-04	2.16E-02	7.97E-05	7.97E-05	7.97E-05	7.31E-04	1.89E-02	2.81E-04	2.81E-04	2.81E-04
Ru-105	1.85E-01	1.54E-05	9.42E-03	6.08E-06	6.08E-06	6.08E-06	6.45E-05	4.21E-02	2.34E-05	2.34E-05	2.34E-05
Ru-106	3.68E+02	2.75E-03	1.78E-01	3.48E-04	3.48E-04	3.48E-04	1.17E-02	1.82E-01	1.46E-03	1.46E-03	1.46E-03
Rh103m	3.89E-02	4.05E-08	9.27E-05	1.58E-08	8.96E-07	2.21E-08	4.05E-08	9.27E-05	1.58E-08	8.96E-07	2.21E-08
Rh-105	1.48E+00	5.68E-05	1.41E-02	1.30E-05	1.02E-04	3.35E-05	5.68E-05	1.41E-02	1.30E-05	1.02E-04	3.35E-05
Rh105m	4.40E-04	2.72E-08	7.78E-06	4.91E-09	6.34E-08	2.00E-08	2.72E-08	7.78E-06	4.91E-09	6.34E-08	2.00E-08
Rh-106	3.46E-04	1.86E-08	7.20E-05	2.80E-09	1.89E-07	3.57E-08	1.86E-08	7.20E-05	2.80E-09	1.89E-07	3.57E-08
Ag110m	2.52E+02	1.60E-04	6.04E-02	8.79E-05	8.79E-05	1.48E-04	5.39E-04	4.33E-02	2.91E-04	2.91E-04	3.64E-04
Ag-111	7.47E+00	5.65E-05	4.85E-02	1.26E-05	1.26E-05	2.46E-05	5.65E-05	4.85E-02	1.26E-05	1.26E-05	2.46E-05
Sb-122	2.72E+00	2.29E-04	6.47E-02	3.11E-06	6.70E-05	4.51E-06	2.29E-04	6.47E-02	3.11E-06	6.70E-05	4.51E-06
Sb-124	6.02E+01	2.75E-03	9.70E-02	7.14E-06	1.16E-03	5.47E-07	2.75E-03	9.70E-02	7.14E-06	1.16E-03	5.47E-07
Sb-127	3.80E+00	5.45E-04	7.00E-02	1.19E-04	6.13E-04	2.95E-04	5.45E-04	7.00E-02	1.19E-04	6.13E-04	2.95E-04
Te125m	5.80E+01	2.69E-03	1.07E-02	8.06E-04	3.59E-04	8.71E-04	1.14E-02	1.10E-02	3.20E-03	1.52E-03	3.09E-03
Te-127	3.92E-01	1.10E-04	8.68E-03	8.15E-05	2.38E-05	3.95E-05	4.71E-04	1.84E-02	3.26E-04	1.01E-04	1.27E-04
Te127m	1.09E+02	6.77E-03	2.27E-02	1.73E-03	8.25E-04	2.42E-03	2.89E-02	2.34E-02	6.91E-03	3.43E-03	7.78E-03
Te-129	4.86E-02	3.14E-05	2.37E-05	2.41E-05	7.65E-06	1.18E-05	1.34E-03	8.34E-03	9.5[illegible]-05	3.18E-05	3.74E-05
Te129m	3.34E+01	1.15E-02	5.79E-02	3.95E-03	1.82E-03	4.29E-03	4.87E-02	5.94E-02	1.57E-02	7.56E-03	1.36E-02
Te-131m	1.25E+00	1.73E-03	8.40E-02	1.34E-03	7.05E-04	8.46E-04	7.20E-03	1.01E-01	5.12E-03	2.65E-03	2.49E-03
Te-131	1.74E-02	1.97E-05	2.79E-06	1.62E-05	6.22E-06	8.23E-06	8.30E-05	4.36E-04	6.35E-05	2.47E-05	2.53E-05
Te-132	3.25E+00	2.52E-03	7.71E-02	1.80E-03	1.53E-03	1.63E-03	1.01E-02	4.50E-02	5.51E-03	5.40E-03	4.47E-03
I-129	5.80E+09	9.42E-04	7.84E-05	7.80E+00	3.18E-03	7.24E-04	9.42E-04	7.84E-05	7.80E+00	3.18E-03	7.24E-04
I-130	5.15E-01	7.56E-04	1.92E-03	1.89E-01	8.80E-04	2.23E-03	2.92E-03	2.76E-03	6.50E-01	3.04E-04	5.90E-03
I-131	8.04E+00	4.16E-03	1.57E-03	1.95E+00	3.41E-03	5.95E-03	1.72E-02	1.54E-03	5.72E+00	9.83E-03	1.73E-02

*Numbering change only

*Numbering change only

TABLE 2.1 (3 of 4)
DOSE COMMITMENT FACTORS--(REM/MICROCI)

NUCLIDE	HALF-LIFE (DAYS)	ADULT					CHILD				
		BONE	GI TRACT	THYROID	TOTAL BODY	LIVER	BONE	GI TRACT	THYROID	TOTAL BODY	LIVER
I-132	9.54E-02	2.03E-04	1.02E-04	1.90E-02	1.90E-04	5.43E-04	8.00E-04	1.73E-03	6.82E-02	6.76E-04	1.47E-03
I-133	8.67E-01	1.42E-03	2.22E-03	3.63E-01	7.53E-04	2.47E-03	5.92E-03	2.95E-03	1.36E+00	2.77E-03	7.32E-03
I-134	3.65E-02	1.06E-04	2.51E-07	4.99E-03	1.03E-04	2.88E-04	4.19E-04	5.16E-04	1.79E-02	3.58E-04	7.78E-04
I-135	2.74E-01	4.43E-04	1.31E-03	7.65E-02	4.28E-04	1.16E-03	1.75E-03	2.40E-03	2.79E-01	1.49E-03	3.15E-03
Xe133m	2.19E+00	0.00E+00	2.45E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.45E-02	0.00E+00	0.00E+00	0.00E+00
Xe-133	5.25E+00	0.00E+00	2.58E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.58E-02	0.00E+00	0.00E+00	0.00E+00
Xe135m	1.06E-02	0.00E+00	3.29E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.29E-04	0.00E+00	0.00E+00	0.00E+00
Xe-135	3.79E-01	0.00E+00	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-02	0.00E+00	0.00E+00	0.00E+00
Cs-134	7.53E+02	6.22E-02	2.59E-03	1.21E-01	1.21E-01	1.48E-01	2.34E-01	2.07E-03	8.10E-02	8.10E-02	3.84E-01
Cs-135	8.40E+08	1.30E-02	5.35E-04	1.13E-02	6.61E-03	1.12E-02	1.30E-02	5.35E-04	1.13E-02	6.61E-03	1.12E-02
Cs-136	1.31E+01	6.51E-03	2.92E-03	1.85E-02	1.85E-02	2.57E-02	2.35E-02	2.27E-03	4.18E-02	4.18E-02	6.46E-02
Cs-137	1.10E+04	7.97E-02	2.11E-03	7.14E-02	7.14E-02	1.09E-01	3.27E-01	1.96E-03	4.62E-02	4.62E-02	3.13E-01
Cs-138	2.24E-02	5.52E-02	4.65E-10	5.40E-05	5.40E-05	1.09E-04	2.28E-04	1.46E-04	2.01E-04	2.01E-04	3.17E-04
Ba137m	1.77E-03	2.93E-07	2.87E-05	4.07E-08	5.12E-07	5.29E-07	2.93E-07	2.87E-05	4.07E-08	5.12E-07	5.29E-07
Ba-139	5.78E-02	9.70E-05	1.72E-04	2.84E-06	2.84E-06	6.91E-08	4.14E-04	2.39E-02	1.20E-05	1.20E-05	2.21E-07
Ba-140	1.28E+01	2.03E-02	4.18E-02	1.33E-03	1.33E-03	2.55E-05	8.31E-02	4.21E-02	4.85E-03	4.85E-03	7.28E-05
Ba-141	1.26E-02	4.71E-05	2.22E-14	1.59E-06	1.59E-06	3.56E-08	2.00E-04	1.14E-04	6.51E-06	6.51E-06	1.12E-07
Ba-142	7.43E-03	2.13E-05	3.00E-23	1.34E-06	1.34E-06	2.19E-08	8.74E-05	1.14E-06	4.88E-06	4.88E-06	6.29E-08
La-140	1.68E+00	2.50E-06	9.25E-02	3.33E-07	3.33E-07	1.26E-06	1.01E-05	9.84E-02	1.19E-06	1.19E-06	3.53E-06
La-142	6.42E-02	1.28E-07	4.25E-04	1.45E-08	1.45E-08	5.82E-08	5.24E-07	3.31E-02	5.23E-08	5.23E-08	1.67E-07
Ce-141	3.25E+01	9.36E-06	2.42E-02	7.18E-07	7.18E-07	6.33E-06	3.97E-05	2.47E-02	2.94E-06	2.94E-06	1.98E-05
Ce-143	1.38E+00	1.65E-06	4.56E-02	1.35E-07	1.35E-07	1.22E-03	6.99E-06	5.55E-02	5.49E-07	5.49E-07	3.79E-03
Ce-144	2.84E+02	4.88E-04	1.65E-01	2.62E-05	2.62E-05	2.04E-04	2.08E-03	1.70E-01	1.11E-04	1.11E-04	6.52E-04
Pr-143	1.36E+01	9.20E-06	4.03E-02	4.56E-07	4.56E-07	3.69E-06	3.93E-05	4.24E-02	1.95E-06	1.95E-06	1.18E-05
Pr-144	1.20E-02	3.01E-08	4.33E-15	1.53E-09	1.53E-09	1.25E-08	1.29E-07	8.59E-05	6.49E-09	6.49E-09	3.99E-08
Pr144m	5.00E-03	8.86E-08	5.69E-04	5.14E-09	3.29E-06	9.58E-08	8.86E-08	5.69E-04	5.14E-09	3.29E-06	9.58E-08
Nd-147	1.10E+01	6.29E-06	3.49E-02	4.35E-07	4.35E-07	7.27E-06	2.79E-05	3.58E-02	1.75E-06	1.75E-06	2.26E-05
Pm-147	9.57E+02	2.87E-05	1.17E-02	5.38E-07	5.02E-05	1.02E-04	2.87E-05	1.17E-02	5.38E-07	5.02E-05	1.02E-04
Pm-149	2.21E+00	1.53E-06	4.85E-02	1.24E-07	1.24E-07	2.50E-07	1.53E-06	4.85E-02	1.24E-07	1.24E-07	2.50E-07
Sm-147	3.94E+13	3.20E-01	4.26E-02	1.18E-03	2.98E-02	2.20E-01	3.20E-01	4.26E-02	1.18E-03	2.98E-02	2.20E-01
Sm-151	3.37E+04	6.87E-05	4.85E-03	2.84E-06	2.84E-06	1.18E-05	6.87E-05	4.85E-03	2.84E-06	2.84E-06	1.18E-05
Sm-153	1.95E+00	7.90E-07	2.43E-02	6.13E-08	6.13E-08	7.61E-07	7.90E-07	2.43E-02	6.13E-08	6.13E-08	7.61E-07
Eu-155	1.74E+03	4.63E-05	9.70E-03	5.26E-06	5.26E-06	1.08-05	4.63E-05	9.70E-03	5.26E-06	5.26E-06	1.08E-05
Ta-182	1.15E+02	1.72E-05	4.85E-02	8.75E-06	8.75E-06	6.37E-05	1.72E-05	4.85E-02	8.75E-06	8.75E-06	6.37E-05

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*Numbering change only

TABLE 2.1 (4 of 4)
DOSE COMMITMENT FACTORS—(REM/MICROCI)

NUCLIDE	HALF-LIFE (DAYS)	ADULT					CHILD				
		BONE	GI TRACT	THYROID	TOTAL BODY	LIVER	BONE	GI TRACT	THYROID	TOTAL BODY	LIVER
W-187	9.96E-01	1.03E-04	2.82E-02	3.01E-05	3.01E-05	8.61E-05	4.79E-04	3.57E-02	1.14E-04	1.14E-04	2.54E-04
Pb-210	8.14E+03	2.10E+01	2.03E-02	3.00E-01	1.70E+00	1.40E+00	2.10E+01	2.03E-02	3.00E-01	1.70E+00	1.40E+00
Pb-212	4.43E-01	1.20E-01	7.57E-02	5.22E-04	2.57E-03	5.85E-03	1.20E-01	7.57E-02	5.22E-04	2.57E-03	5.85E-03
Pb-214	1.86E-02	3.03E-04	3.14E-03	1.18E-05	5.64E-05	2.97E-05	3.03E-04	3.14E-03	1.18E-05	5.64E-05	2.97E-05
Bi-212	4.21E-02	3.03E-04	5.90E-03	4.97E-05	1.26E-04	7.24E-05	3.03E-04	5.90E-03	4.97E-05	1.26E-04	7.24E-05
Bi-214	1.38E-02	4.16E-05	3.18E-03	5.11E-06	2.97E-05	1.58E-05	4.16E-05	3.18E-03	5.11E-06	2.97E-05	1.58E-05
Po-212	3.50E-12	1.50E-33	9.17E-13	3.48E-34	1.96E-15	1.08E-33	1.50E-33	9.17E-13	3.48E-34	1.96E-15	1.08E-33
Po-214	1.89E-09	4.80E-12	4.28E-10	7.01E-14	1.30E-12	3.35E-13	4.80E-12	4.28E-10	7.01E-14	1.30E-12	3.35E-13
Po-216	1.74E-06	9.35E-07	3.68E-07	3.11E-09	1.85E-08	7.39E-08	9.35E-07	3.68E-07	3.11E-09	1.85E-08	7.39E-08
Po-218	2.12E-03	9.60E-05	6.84E-04	1.64E-06	8.62E-06	1.11E-05	9.60E-05	6.84E-04	1.64E-06	8.62E-06	1.11E-09
Ra-224	3.66E+00	3.30E+00	6.60E-01	8.32E-02	7.47E-02	8.90E-02	3.30E+00	6.60E-01	8.32E-02	7.47E-02	8.90E-02
Ra-226	5.84E+05	4.30E+01	3.30E-01	5.90E-01	3.40E+00	5.90E-01	4.30E+01	3.30E-01	5.90E-01	3.40E+00	5.90E-01
Ra-228	2.10E+03	2.10E+01	7.14E-02	4.00E-01	1.70E+00	4.00E-01	2.10E+01	7.14E-02	4.00E-01	1.70E+00	4.00E-01
Ac-228	2.55E-01	3.48E-03	8.07E-03	6.13E-06	1.99E-04	3.54E-04	3.48E-03	8.07E-03	6.13E-06	1.99E-04	3.54E-04
Th-228	6.98E+02	4.10E+00	4.70E-01	7.42E-03	3.80E-02	2.34E-02	4.10E+00	4.70E-01	7.42E-03	3.80E-02	2.34E-02
Th-230	2.81E+07	1.60E+01	1.80E-01	4.56E-03	9.24E-02	2.18E-02	1.60E+01	1.80E-01	4.56E-03	9.24E-02	2.18E-02
Th-232	5.11E+12	1.80E+01	1.50E-01	3.94E-03	9.63E-02	1.68E-02	1.80E+01	1.50E-01	3.94E-03	9.63E-02	1.88E-02
Th-234	2.41E+01	4.91E-05	1.60E-01	1.60E-06	6.39E-04	1.46E-05	4.91E-05	1.60E-01	1.60E-06	6.39E-04	1.46E-05
Pa-234	2.79E-01	3.00E-04	1.11E-02	7.20E-06	3.12E-04	2.28E-04	3.00E-04	1.11E-02	7.20E-06	3.12E-04	2.28E-04
U-234	8.91E+07	3.10E+01	1.80E-01	6.32E-02	2.30E+00	6.32E-02	3.10E+01	1.80E-01	6.32E-02	2.30E+00	6.32E-02
U-238	1.63E+12	2.80E+01	1.70E-01	5.63E-02	2.00E+00	5.35E-02	2.80E+01	1.70E-01	5.63E-02	2.00E+00	5.35E-02
Np-238	2.12E+00	4.42E-03	3.21E-02	1.22E-05	4.03E-04	1.06E-03	4.42E-03	3.21E-02	1.22E-05	4.03E-04	1.08E-03
Np-239	2.35E+00	1.19E-06	2.40E-02	6.45E-08	6.45E-08	1.17E-07	5.25E-06	2.79E-02	2.65E-07	2.65E-07	3.77E-07
Pu-238	3.20E+04	2.10E+00	2.10E-01	3.23E-03	2.83E-02	4.40E-01	2.10E+00	2.10E-01	3.23E-03	2.83E-02	4.40E-01
Pu-239	8.80E+06	2.60E+00	2.00E-01	3.63E-03	3.13E-02	4.90E-01	2.60E+00	2.00E-01	3.63E-03	3.13E-02	4.90E-01
Pu-240	2.39E+06	2.60E+00	2.00E-01	3.62E-03	3.13E-02	4.90E-01	2.60E+00	2.00E-01	3.62E-03	3.13E-02	4.90E-01
Pu-241	5.37E+03	4.83E-02	9.92E-04	7.49E-05	6.19E-04	9.50E-03	4.83E-02	9.92E-04	7.49E-05	6.19E-04	9.50E-03
Pu-242	1.37E+08	2.60E+00	1.90E-01	3.45E-03	2.98E-02	4.70E-01	2.60E+00	1.90E-01	3.45E-03	2.98E-02	4.70E-01
Am-241	1.58E+05	8.00E+01	2.10E-01	1.20E-01	1.00E+00	1.70E+01	8.00E+01	2.10E-01	1.20E-01	1.00E+00	1.70E+01
Am-242	6.68E-01	5.19E-03	9.26E-03	1.06E-05	1.44E-04	1.51E-03	5.19E-03	9.26E-03	1.06E-05	1.44E-04	1.51E-03
Am-243	2.69E+06	8.50E+01	2.20E-01	1.30E-01	1.00E+00	1.70E+01	8.50E+01	2.20E-01	1.30E-01	1.00E+00	1.70E+01
Cm-242	1.63E+02	1.50E+00	2.30E-01	2.72E-03	2.58E-02	4.40E-01	1.50E+00	2.30E-01	2.72E-03	2.58E-02	4.40E-01
Cm-243	1.04E+04	4.86E+01	2.50E-01	8.22E-02	7.70E-01	1.20E+01	6.00E+03	1.00E+03	1.01E+03	2.01E+03	1.00E+03
Cm-244	6.61E+03	3.80E+01	2.20E-01	6.40E-02	5.60E-01	9.30E+00	3.80E+01	2.20E-01	6.40E-02	5.60E-01	9.30E-00

Dose factors were taken from the following references in order of preference:

1. Regulatory Guide 1.109, USNRC, Obtober 1977
2. NUREG/CR-0150, D. E. Dunning, OPNL, October 1981
3. ORNL-4992, G. G. Killough and L. R. McKay, March 1976

Table 2.2 (1 of 2)
FISH CONCENTRATION FACTORS*

NUCLIDE		NUCLIDE		NUCLIDE	
H-3	9.00E-01	Tc-99m	1.50E+01	Ce-144	1.00E+00
C-14	4.60E+03	Ru-103	1.00E+01	Pr-143	2.50E+01
Na-22	1.00E+02	Ru-105	1.00E+01	Pr-144	2.50E+01
Na-24	1.00E+02	Ru-106	1.00E+01	Pr-144m	2.50E+01
P-32	3.00E+03	Rh-103m	1.00E+01	Nd-147	2.50E+01
Cr-51	2.00E+02	Rh-105	1.00E+01	Pm-147	2.50E+01
Mn-54	4.00E+02	Rh-105m	1.00E+01	Pm-149	2.50E+01
Mn-56	4.00E+02	Rh-106	1.00E+01	Sm-147	2.50E+01
Fe-55	1.00E+02	Ag-110m	2.31E+00	Sm-151	2.50E+01
Fe-59	1.00E+02	Ag-111	2.31E+00	Sm-153	2.50E+01
Co-57	5.00E+01	Sb-122	1.00E+00	Eu-155	2.50E+01
Co-58	5.00E+01	Sb-124	1.00E+00	Ta-182	3.00E+04
Co-60	5.00E+01	Sb-127	1.00E+00	W-187	1.20E+03
Ni-63	1.00E+02	Te-125m	4.00E+02	Pr-210	3.00E+02
Ni-65	1.00E+02	Te-127	4.00E+02	Pb-212	3.00E+02
Cu-64	5.00E+01	Te-127m	4.00E+02	Pb-214	3.00E-02
Zn-65	2.00E+03	Te-129	4.00E+02	Bi-212	1.50E+01
Zn-69	2.00E+03	Te-129m	4.00E+02	Bi-214	1.50E+01
As-74	1.00E+02	Te-131	4.00E+02	Po-212	5.00E+01
As-76	1.00E+02	Te-131m	4.00E+02	Po-214	5.00E+01
Br-83	4.20E+02	Te-132	4.00E+02	Po-216	5.00E+01
Br-84	4.20E+02	I-129	1.50E+01	Po-218	5.00E+01
Br-85	4.20E+02	I-130	1.50E+01	Ra-224	5.00E+01
Kr-83m	1.00E+00	I-131	1.50E+01	Ra-226	5.00E+01
Kr-85m	1.00E+00	I-132	1.50E+01	Ra-228	5.00E+01
Kr-85	1.00E+00	I-133	1.50E+01	Ac-228	2.50E+01
Rb-86	2.00E+03	I-134	1.50E+01	Th-228	3.00E+01
Rb-88	2.00E+03	I-135	1.50E+01	Th-230	3.00E+01
Rb-89	2.00E+03	Xe-133m	1.00E+00	Th-232	3.00E+01
Sr-89	3.00E+01	Xe-133	1.00E+00	Th-234	3.00E+01
Sr-90	3.00E+01	Xe-135m	1.00E+00	Pa-234	1.10E+01
Sr-91	3.00E+01	Xe-135	1.00E+00	U-234	1.00E+01
Sr-92	3.00E+01	Cs-134	2.00E+03	U-238	1.00E+01
Y-90	2.50E+01	Cs-135	2.00E+03	Np-238	1.00E+01
Y-91	2.50E+01	Cs-136	2.00E+03	Np-239	1.00E+01
Y-91m	2.50E+01	Cs-137	2.00E+03	Pu-238	3.50E+02
Y-92	2.50E+01	Cs-138	2.00E+03	Pu-239	3.50E+02
Y-93	2.50E+01	Ba-137m	4.00E+00	Pu-240	3.50E+02
Zr-95	3.33E+00	Ba-139	4.00E+00	Pu-241	3.50E+02
Zr-97	3.33E+00	Ba-140	4.00E+00	Pu-242	3.50E+02
Nb-95	3.00E+04	Ba-141	4.00E+00	Am-241	2.50E+01
Nb-95m	3.00E+04	Ba-142	4.00E+00	Am-247	2.50E+01
Nb-97	3.00E+04	La-140	2.50E+01	Am-243	2.50E+01

*Numbering change only

Table 2.2 (2 of 2)
FISH CONCENTRATION FACTORS*

NUCLIDE		NUCLIDE		NUCLIDE	
Nb-97m	3.00E+04	La-142	2.50E+01	Cm-242	2.50E+01
Mo-99	1.00E+01	Ce-141	1.00E+00	Cm-243	2.50E+01
Tc-99	1.50E+01	Ce-143	1.00E+00	Cm-244	2.50E+01

*The source for the fish concentration factors, given in order of preference is:

NUREG/CR-1336, "The Bioaccumulation Factor for Phosphorus-32 in Edible Fish Tissue," B. Kahn and K. S. Turgeon, Georgia Institute of Technology, March 1980.

Regulatory Guide 1.109, October 1977.

UCRL-50564, "Concentration Factors of Chemical Elements in Edible Aquatic Organisms," S. E. Thompson, et al.; Lawrence Livermore Laboratory, October 1972.

UCRL-50163, "Prediction of the Maximum Dosage to Man from the Fallout of Nuclear Devices: IV. Handbook for Estimating the Maximum Internal Dose from Radionuclides Released to the Biosphere," Y. C. Ng, et al.; Lawrence Livermore Laboratory, May 1968.

Regulatory Guide 1.109, Draft, Marcy 1976.

TVA generated numbers for noble gases.

*Numbering change only

*Numbering change only

TABLE 2.3 (1 of 4)

RECREATION DOSE FACTORS

NUCLIDE	SWIMMING (MREM/YEAR PER UCI/ML)					
	BONE	GI TRACT	THYROID	TB	LIVER	SKIN
H-3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
C-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Na-22	3.14E+07	2.49E+07	2.30E+07	2.67E+07	2.27E+07	3.16E+07
Na-24	5.66E+07	5.92E+07	6.22E+07	5.39E+07	4.80E+07	6.16E+07
P-32	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cr-51	5.43E+05	3.07E+05	3.38E+05	3.79E+05	3.09E+05	4.56E+05
Mn-54	1.16E+07	8.57E+06	7.35E+06	9.68E+06	8.26E+07	1.24E+06
Mn-56	2.33E+07	2.14E+07	1.82E+07	2.07E+07	1.81E+07	2.54E+07
Fe-55	3.16E+01	3.47E+01	6.94E+00	1.68E+02	1.47E-01	3.16E+03
Fe-59	1.64E+07	1.38E+07	1.23E+07	1.45E+07	1.23E+07	1.76E+07
Co-57	2.71E+06	9.80E+05	1.69E+06	1.48E+06	1.13E+06	1.75E+06
Co-58	1.38E+07	1.03E+07	8.78E+06	1.13E+07	9.68E+06	1.43E+07
Co-60	3.46E+07	3.02E+07	2.73E+07	3.11E+07	2.62E+07	3.67E+07
Ni-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ni-65	7.65E+06	6.86E+06	6.50E+06	6.94E+06	5.84E+06	7.93E+06
Cu-64	2.83E+06	2.20E+06	1.85E+06	2.23E+06	1.92E+06	2.67E+06
Zn-65	7.99E+06	6.49E+06	5.58E+06	6.96E+06	5.90E+06	8.67E+06
Zn-69	9.55E+01	6.49E+01	6.09E+01	7.12E+01	6.00E+01	8.51E+01
As-74	1.70E+05	1.30E+05	1.40E+05	1.40E+05	1.10E+05	1.60E+05
As-76	8.31E+04	6.68E+04	7.04E+04	6.83E+04	5.73E+04	8.12E+04
Br-83	1.12E+05	8.64E+04	7.24E+04	8.81E+04	7.59E+04	1.06E+05
Br-84	2.46E+07	2.42E+07	2.59E+07	2.28E+07	2.03E+07	2.69E+07
Br-85	2.86E+05	[illegible]	1.81E+05	2.39E+05	2.04E+05	3.07E+05
Kr-83m	5.24E+02	1.22E+02	1.22E+02	9.46E+02	3.71E+01	1.13E+04
Kr-85m	3.21E+06	1.36E+06	1.97E+06	1.93E+06	1.50E+06	2.30E+06
Kr-85	3.34E+04	2.59E+04	2.17E+04	2.62E+04	2.26E+04	3.14E+04
Rb-86	1.29E+06	1.04E+06	8.73E+05	1.12E+06	9.50E+05	1.42E+06
Rb-88	8.99E+06	9.16E+06	8.10E+06	8.32E+06	7.33E+06	9.90E+06
Rb-89	2.89E+07	2.67E+07	2.41E+07	2.61E+07	2.27E+07	3.17E+07
Br-89	1.88E+03	1.41E+03	1.18E+03	1.58E+03	1.35E+03	2.05E+03
Sr-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-91	9.71E+06	7.32E+06	6.32E+06	8.17E+06	6.96E+06	1.04E+07
Sr-92	1.86E+07	1.68E+07	1.59E+07	1.70E+07	1.43E+07	1.93E+07
Y-90	1.10E+00	2.90E-01	[illegible]	1.32E+00	2.77E-02	1.06E+01
Y-91	4.99E+04	4.25E+04	3.77E+04	4.43E+04	3.75E+04	5.33E+04

NUCLIDE	SHORELINE (MREM/YEAR PER UCI/SQUARE CENTIMETER)					
	BONE	GI TRACT	THYROID	TB	LIVER	SKIN
H-3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
C-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Na-22	2.76E+06	2.19E+06	2.01E+06	2.33E+06	1.99E+06	2.76E+06
Na-24	3.96E+06	4.10E+06	4.28E+06	3.76E+06	3.33E+06	4.29E+06
P-32	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cr-51	5.45E+04	3.08E+04	3.39E+04	3.81E+04	3.10E+04	4.69E+04
Mn-54	1.04E+05	7.69E+05	6.60E+05	8.63E+05	7.42E+05	1.11E+06
Mn-56	1.88E+06	1.69E+06	1.44E+06	1.66E+06	1.45E+06	2.05E+06
Fe-55	2.71E+01	2.98E+01	5.96E+00	1.44E+02	1.26E-01	2.71E+03
Fe-59	1.36E+06	1.15E+06	1.02E+06	1.20E+06	1.02E+06	1.46E+06
Co-57	2.82E+05	1.02E+05	1.76E+05	1.55E+05	1.17E+05	1.94E+05
Co-58	1.25E+06	9.36E+05	8.00E+05	1.03E+06	8.82E+05	1.30E+06
Co-60	2.83E+06	2.46E+06	2.23E+06	2.54E+06	2.14E+06	3.00E+06
Ni-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ni-65	6.18E+05	5.52E+05	5.22E+05	5.60E+05	4.71E+05	6.41E+05
Cu-64	2.71E+05	2.11E+05	1.78E+05	2.14E+05	1.84E+05	2.59E+05
Zn-65	6.75E+05	5.48E+05	4.71E+05	5.88E+05	4.98E+05	7.40E+05
Zn-69	9.40E+00	6.39E+00	6.00E+00	7.01E+00	5.90E+00	8.38E+00
As-74	1.36E+06	1.10E+06	1.16E+06	1.12E+06	9.40E+05	1.33E+06
As-76	6.82E+05	5.48E+05	5.78E+03	5.60E+05	4.70E+05	6.66E+05
Br-83	1.07E+04	8.29E+03	6.95E+03	8.45E+03	7.28E+03	1.02E+04
Br-84	1.80E+06	1.73E+06	1.79E+06	1.65E+06	1.46E+06	1.96E+06
Br-85	2.55E+04	1.88E+04	1.61E+04	2.13E+04	1.82E+04	2.74E+04
Kr-83m	4.33E+02	1.18E+02	5.97E+01	9.66E+02	1.12E+01	1.23E+04
Kr-85m	3.30E+05	1.39E+05	2.02E+05	1.99E+05	1.54E+05	2.39E+05
Kr-85	3.22E+03	2.49E+03	2.09E+03	2.53E+03	2.18E+03	3.03E+03
Rb-86	1.10E+05	8.79E+04	7.40E+04	9.50E+04	8.06E+04	1.20E+05
Rb-88	6.77E+05	6.82E+05	5.97E+05	6.24E+05	5.49E+05	7.46E+05
Rb-89	2.27E+06	2.06E+06	1.85E+06	2.04E+06	1.77E+06	2.49E+06
Br-89	1.66E+02	1.24E+02	1.04E+02	1.40E+02	1.19E+02	1.81E+02
Sr-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-91	8.56E+05	6.43E+05	5.56E+05	7.19E+05	6.13E+05	9.13E+05
Sr-92	1.50E+05	1.35E+06	1.28E+06	1.37E+06	1.15E+06	1.55E+06
Y-90	7.97E-01	2.17E-01	7.68E-02	9.65E-01	1.91E-02	7.87E+00
Y-91	4.12E+03	3.51E+03	3.11E+03	3.66E+03	3.10E+03	4.41E+03

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*Numbering change only

TABLE 2.3 (2 of 4)
RECREATION DOSE FACTORS

SWIMMING (MREM/YEAR PER UCI/ML)

NUCLIDE	BONE	GI TRACT	THYROID	TB	LIVER	SKIN
Y-91M	7.83E+06	6.02E+06	5.06E+06	6.21E+06	5.34E+06	7.53E+06
Y-92	3.51E+06	2.80E+06	2.49E+06	3.02E+06	2.57E+06	3.72E+06
Y-93	1.30E+06	1.10E+06	9.91E+05	1.10E+06	9.42E+05	1.33E+06
Zr-95	1.04E+07	7.78E+06	6.64E+06	8.56E+06	7.32E+06	1.08E+07
Zr-97	2.57E+06	2.04E+06	1.87E+06	2.18E+06	1.86E+06	2.62E+06
Nb-95	1.08E+07	8.01E+06	6.84E+06	8.87E+06	7.59E+06	1.12E+07
Nb-95m	1.17E+06	5.59E+05	7.04E+05	7.59E+05	5.90E+05	9.51E+05
Nb-97	9.40E+06	7.11E+06	6.03E+06	7.61E+06	6.52E+06	9.43E+06
Nb-97m	1.03E+07	7.67E+06	6.54E+06	8.44E+06	7.22E+06	1.06E+07
Mo-99	2.41E+06	1.63E+06	1.52E+06	1.87E+06	1.57E+06	2.34E+06
Tc-99	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m	2.74E+06	1.03E+06	1.69E+06	1.55E+06	1.18E+06	1.83E+06
Ru-103	7.05E+06	5.44E+06	4.57E+06	5.51E+06	4.75E+06	6.60E+06
Tc-99	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m	2.74E+06	1.03E+06	1.69E+06	1.55E+06	1.18E+06	1.83E+06
Ru-103	7.05E+06	5.44E+06	4.57E+06	5.51E+06	4.75E+06	6.60E+06
Ru-105	1.15E+07	8.32E+06	7.34E+06	9.16E+06	7.79E+06	1.14E+07
Ru-106	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rh103m	3.73E+03	4.88E+02	1.27E+03	2.82E+03	3.92E+02	1.27E+04
Rh-105	1.35E+06	7.56E+05	8.38E+05	9.39E+05	7.64E+05	1.12E+06
Rh105m	6.12E+05	2.18E+05	3.75E+05	3.42E+05	2.51E+05	4.51E+05
Rh-106	2.99E+06	2.30E+06	1.96E+06	2.41E+06	2.07E+06	2.93E+06
Ag110m	3.87E+07	2.97E+07	2.58E+07	3.28E+07	2.79E+07	4.03E+07
Ag-111	4.03E+05	2.32E+05	2.51E+05	2.63E+05	2.31E+05	3.39E+05
Sb-122	8.06E+04	6.27E+04	6.58E+04	6.31E+04	5.26E+04	7.73E+04
Sb-124	2.61E+07	2.28E+07	2.67E+07	2.29E+07	1.98E+07	2.71E+07
Sb-127	1.01E+07	7.39E+06	6.47E+06	8.03E+06	6.85E+06	9.91E+06
Te125m	2.47E+05	2.93E+04	1.24E+05	1.35E+05	4.71E+04	3.39E+05
Te-127	7.84E+04	5.17E+04	4.98E+04	5.77E+04	4.83E+04	6.89E+04
Te127m	6.91E+04	1.33E+04	3.45E+04	3.82E+04	1.28E+04	9.89E+04
Te-129	8.68E+05	6.12E+05	5.58E+05	6.69E+05	5.60E+05	8.33E+05
Te129m	4.73E+05	3.23E+05	2.94E+05	3.71E+05	3.02E+05	5.03E+05
Te-131	6.79E+06	4.21E+06	4.37E+06	4.99E+06	4.13E+06	6.11E+06
Te131m	2.06E+07	1.53E+07	1.39E+07	1.70E+07	1.45E+07	2.12E+07
Te-132	4.27E+06	1.92E+06	2.54E+06	2.68E+06	2.04E+06	3.32E+06
I-129	2.25E+05	4.84E+04	1.19E+05	1.15E+05	[illegible].75E+04	2.49E+05

SHORELINE (MREM/YEAR PER UCI/SQUARE CENTIMETER)

NUCLIDE	BONE	GI TRACT	THYROID	TB	LIVER	SKIN
Y-91M	7.48E+05	5.74E+05	4.83E+05	5.93E+05	5.10E+05	7.20E+05
Y-92	3.02E+05	2.39E+05	2.12E+05	2.59E+05	2.20E+05	3.19E+05
Y-93	1.10E+05	8.91E+04	8.17E+04	9.13E+04	7.77E+04	1.10E+05
Zr-95	9.56E+05	7.13E+05	6.08E+05	7.84E+05	6.71E+05	9.88E+05
Zr-97	2.23E+05	1.74E+03	1.60E+05	1.88E+05	1.60E+05	2.27E+05
Nb-95	9.82E+05	7.31E+05	6.24E+05	8.09E+05	6.92E+05	1.02E+06
Nb-95m	1.22E+05	5.66E+04	7.17E+04	8.05E+04	5.98E+04	1.23E+05
Nb-97	8.77E+05	6.63E+05	5.62E+05	7.10E+05	6.08E+05	8.79E+05
Nb-97m	9.42E+05	7.03E+05	5.99E+05	7.73E+05	6.01E+05	9.74E+05
Mo-99	2.27E+05	1.51E+05	1.43E+05	1.75E+05	1.47E+05	2.21E+05
Tc-99	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m	2.83E+05	1.07E+05	1.74E+05	1.60E+05	1.21E+05	1.93E+05
Ru-103	6.81E+05	5.25E+05	4.41E+05	5.32E+05	4.58E+05	6.37E+05
Tc-99	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m	2.83E+05	1.07E+05	1.74E+05	1.60E+06	1.21E+05	1.93E+05
Ru-103	6.81E+05	5.25E+05	4.41E+05	5.32E+05	4.58E+05	6.37E+05
Ru-105	1.08E+06	7.76E+05	6.88E+05	8.57E+05	7.29E+05	1.06E+06
Ru-106	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rh103m	1.74E+03	2.10E+02	5.66E+02	1.36E+03	1.63E+02	6.42E+03
Rh-105	1.36E+05	7.59E+04	8.41E+04	9.43E+04	7.67E+04	1.13E+05
Rh105m	7.05E+04	2.30E+04	4.10E+04	4.11E+04	2.66E+04	7.39E+04
Rh-106	2.81E+05	2.16E+05	1.84E+05	2.25E+05	1.94E+05	2.74E+05
Ag110m	3.41E+06	2.61E+06	2.35E+06	2.88E+06	2.45E+06	3.55E+06
Ag-111	4.03E+04	2.32E+04	2.51E+04	2.83E+04	2.31E+04	3.39E+04
Sb-122	6.83E+05	5.31E+05	5.57E+05	5.35E+05	4.46E+05	6.54E+05
Sb-124	2.18E+06	1.86E+06	1.69E+06	1.90E+06	1.64E+06	2.25E+06
Sb-127	9.52E+05	6.94E+05	6.09E+05	7.55E+05	6.43E+05	9.31E+05
Te125m	4.60E+04	9.08E+03	2.32E+04	2.50E+04	8.75E+03	6.29E+04
Te-127	7.74E+03	5.10E+03	4.92E+03	5.69E+03	4.77E+03	6.80E+03
Te127m	1.31E+04	2.54E+03	6.60E+03	7.2[illegible]E+03	2.44E+03	1.86E+04
Te-129	8.52E+04	5.87E+04	5.43E+04	6.50E+04	5.37E+04	8.28E+04
Te129m	4.89E+04	3.09E+04	2.98E+04	3.71E+04	2.88E+04	5.38E+04
Te-131	6.49E+05	3.94E+05	4.16E+05	4.71E+05	3.88E+05	5.78E+05
Te131m	1.84E+06	1.35E+06	1.23E+06	1.51E+05	1.28E+06	1.89E+06
Te-132	4.55E+05	1.98E+05	2.68E+05	2.83E+05	2.12E+05	3.60E+05
I-129	5.02E+04	1.07E+04	2.67E+04	2.57E+04	1.05E+04	5.70E+04

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*Numbering change only

TABLE 2.3 (3 of 4)
RECREATION DOSE FACTORS

NUCLIDE	SWIMMING (MREM/YEAR PER UCI/ML)						SHORELINE (MREM/YEAR PER UCI/SQUARE CENTIMETER)					
	BONE	GI TRACT	THYROID	TB	LIVER	SKIN	BONE	GI TRACT	THYROID	TB	LIVER	SKIN
I-130	3.09E+07	2.3[illegible]E+07	2.00E+07	2.50E+07	2.14E+07	3.08E+07	2.88E+06	2.17E+06	1.86E+06	2.32E+06	1.99E+06	2.86E+06
I-131	6.22E+06	3.93E+06	3.92E+06	4.54E+06	3.77E+06	5.47E+06	6.16E+05	3.87E+05	3.88E+05	4.49E+05	3.72E+05	5.41E+05
I-132	3.23E+07	2.45E+07	2.16E+07	2.68E+07	2.29E+07	3.32E+07	2.91E+06	2.20E+06	1.93E+06	2.41E+06	2.06E+06	2.99E+06
I-133	8.96E+06	6.90E+06	5.89E+06	7.18E+06	6.16E+06	8.69E+06	8.44E+05	6.49E+05	5.54E+05	6.75E+05	5.79E+05	8.17E+05
I-134	3.67E+07	2.84E+07	2.49E+07	3.11E+07	2.65E+07	3.89E+07	3.22E+06	2.46E+06	2.16E+06	2.71E+06	2.32E+06	3.40E+06
I-135	2.19E+07	1.95E+07	1.75E+07	1.96E+07	1.67E+07	2.33E+07	1.78E+06	1.57E+06	1.41E+06	1.58E+06	1.35E+06	1.89E+06
Xe133m	6.05E+05	2.38E+05	3.55E+05	3.71E+05	2.61E+05	5.27E+05	8.09E+04	2.81E+04	4.65E+04	4.77E+04	3.05E+04	7.71E+04
Xe-133	8.52E+05	2.53E+05	4.84E+05	4.24E+05	2.74E+05	5.73E+05	1.11E+05	3.17E+04	6.28E+04	5.57E+04	3.39E+04	8.27E+04
Xe135m	6.41E+06	4.94E+06	4.15E+06	5.04E+06	4.33E+06	6.08E+06	6.21E+05	4.75E+05	4.01E+05	4.87E+05	4.17E+05	5.90E+05
Xe135	4.54E+06	2.28E+06	2.76E+06	3.02E+06	2.40E+06	3.63E+06	4.59E+05	2.29E+05	2.79E+05	3.04E+05	2.41E+05	3.67E+05
Cs-134	2.22E+07	1.67E+07	1.43E+07	1.81E+07	1.55E+07	2.26E+07	2.04E+06	1.54E+06	1.32E+06	1.67E+06	1.43E+06	2.08E+06
Cs-135	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-136	3.10E+07	2.26E+07	2.03E+07	2.55E+07	2.15E+07	3.21E+07	2.77E+06	2.00E+06	1.81E+06	2.26E+06	1.91E+06	2.85E+06
Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-138	3.29E+07	3.03E+07	2.86E+07	2.98E+07	2.56E+07	3.46E+07	2.62E+06	2.37E+06	2.23E+06	2.35E+06	2.02E+06	2.74E+06
Ba137m	8.56E+06	6.45E+06	5.48E+06	6.92E+06	5.93E+06	8.59E+06	8.01E+05	6.02E+05	5.12E+05	6.47E+05	5.54E+05	8.04E+05
Ba-139	7.49E+05	3.44E+05	4.73E+05	4.66E+05	3.60E+05	5.55E+05	7.61E+04	3.38E+04	4.75E+04	4.67E+04	3.57E+04	5.52E+04
Ba-140	2.29E+06	1.50E+06	1.46E+06	1.73E+06	1.46E+06	2.10E+06	2.29E+05	1.56E+05	1.46E+05	1.71E+05	1.42E+05	2.13E+05
Ba-141	1.31E+07	3.90E+06	8.96E+06	1.02E+07	8.49E+06	1.22E+07	1.21E+06	7.97E+05	8.15E+05	9.26E+05	7.70E+05	1.12E+06
Ba-142	1.51E+07	1.11E+07	1.02E+07	1.24E+07	1.04E+07	1.54E+07	1.34E+06	9.38E+05	9.03E+05	1.10E+06	9.17E+05	1.36E+06
La-140	3.20E+07	2.91E+07	2.73E+07	2.88E+07	2.46E+07	3.31E+07	2.60E+06	2.32E+06	2.18E+06	2.32E+06	1.98E+06	2.67E+06
La-142	3.74E+07	3.80E+07	3.72E+07	3.47E+07	3.10E+07	4.10E+07	2.75E+06	2.73E+06	2.64E+06	2.53E+06	2.52E+06	3.00E+06
Ce-141	1.59E+06	5.94E+05	9.70E+05	9.01E+05	6.75E+05	1.09E+06	1.69E+05	6.20E+04	1.02E+05	9.52E+04	7.07E+04	1.16E+05
Ce-143	4.54E+05	2.64E+06	2.79E+06	3.22E+06	2.60E+06	4.00E+06	4.66E+05	2.61E+05	2.83E+05	3.24E+05	2.57E+05	4.07E+05
La-142	3.74E+07	3.80E+07	3.72E+07	3.47E+07	3.10E+07	4.10E+07	2.75E+06	2.73E+06	2.64E+06	2.53E+06	2.52E+06	3.00E+06
Ce-141	1.59E+06	5.94E+05	9.70E+05	9.01E+05	6.75E+05	1.07E+06	1.69E+05	6.20E+04	1.02E+05	9.52E+04	7.07E+04	1.16E+05
Ce-143	4.54E+05	2.64E+06	2.79E+06	3.22E+06	2.60E+06	4.00E+06	4.66E+05	2.61E+05	2.83E+05	3.24E+05	2.57E+05	4.07E+05
Ce-144	4.18E+05	1.42E+05	2.51E+05	2.26E+05	1.63E+05	2.81E+05	4.64E+04	1.55E+04	2.76E+04	2.50E+04	1.76E+04	3.18E+04
Pr-143	1.26E-01	9.38E-02	8.00E-02	1.03E-01	8.83E-02	1.30E-01	1.15E-02	8.60E-03	7.33E-03	9.45E-03	8.09E-03	1.19E-02
Pr-144	4.40E-05	4.24E+05	3.74E+05	3.97E+05	3.50E+05	4.75E+05	3.46E+04	2.24E+04	2.87E+04	3.10E+04	2.72E+04	3.71E+04
Pr144M	1.42E+05	3.32E+04	7.19E+04	6.95E+04	3.23E+04	1.25E+05	2.28E+04	5.33E+03	1.15E+04	1.12E+04	5.17E+03	2.06E+04
Nd-147	2.33E+06	1.34E+06	1.44E+06	1.57E+06	1.25E+06	1.93E+06	2.47E+05	1.35E+05	1.50E+05	1.62E+05	1.27E+05	2.03E+05
Pm-147	7.86E+01	2.76E+01	4.92E+01	4.26E+01	3.23E+01	4.93E+01	8.17E+00	2.92E+00	5.11E+00	4.43E+00	3.36E+00	5.17E+00
Pm-149	1.98E+05	1.12E+05	1.23E+05	1.39E+05	1.13E+05	1.69E+05	1.98E+04	1.11E+04	1.22E+04	1.38E+04	1.12E+04	1.67E+04
Sm-147	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-151	1.69E+01	2.20E+00	5.68E+00	1.33E+01	1.61E+00	6.78E+01	7.60E+00	1.04E+00	2.56E+00	6.24E+00	7.22E-01	3.55E+01

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TABLE 2.3 (4 of 4)
RECREATION DOSE FACTORS

NUCLIDE	SWIMMING (MREM/YEAR PER UCI/ML)						SHORELINE (MREM/YEAR PER UCI/SQUARE CENTIMETER)					
	BONE	GI TRACT	THYROID	TB	LIVER	SKIN	BONE	GI TRACT	THYROID	TB	LIVER	SKIN
Sm-153	1.25E+06	3.89E+05	7.21E+05	6.33E+05	4.25E+05	8.08E+05	1.57E+05	4.71E+04	8.79E+04	7.83E+04	5.07E+04	1.04E+05
Eu-155	1.35E+06	4.28E+05	7.98E+05	6.81E+05	4.78E+05	8.21E+05	1.54E+05	4.82E+04	8.98E+04	7.73E+04	5.35E+04	9.49E+04
Ta-182	2.42E+05	1.90E+05	1.80E+05	2.04E+06	1.68E+05	2.44E+05	1.94E+06	1.41E+06	1.45E+06	1.63E+06	1.35E+06	1.96E+06
W-187	7.25E+06	5.09E+06	4.57E+06	5.55E+06	4.68E+06	6.81E+06	6.99E+05	4.84E+05	4.39E+05	5.30E+05	4.45E+05	6.52E+05
Pb-210	3.69E+04	9.75E+03	1.71E+04	1.76E+04	9.16E+03	3.27E+04	5.31E+03	1.46E+03	2.42E+03	3.05E+03	1.28E+03	1.43E+04
Pb-212	2.89E+06	1.26E+06	1.72E+06	1.78E+06	1.36E+06	2.13E+06	2.99E+05	1.29E+05	1.78E+05	1.83E+05	1.40E+05	2.25E+05
Pb-214	4.29E+06	2.39E+06	2.65E+06	2.95E+06	2.39E+06	3.55E+06	[illegible]	2.39E+05	2.66E+05	2.96E+05	2.39E+05	3.61E+05
Bi-212	2.59E+06	2.08E+06	1.89E+06	2.22E+06	1.90E+06	2.69E+06	2.25E+05	1.78E+05	1.61E+05	1.92E+05	1.63E+05	2.36E+05
Bi-214	2.10E+07	1.89E+07	1.69E+07	1.87E+07	1.62E+07	2.23E+07	1.71E+06	1.51E+06	1.35E+06	1.51E+06	1.31E+06	1.81E+06
Po-212	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Po-214	1.54E+03	1.14E+03	9.75E+02	1.27E+03	1.09E+03	1.62E+03	1.39E+02	1.03E+02	8.84E+01	1.15E+02	9.85E+01	1.46E+02
Po-216	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	[illegible]	0.00E+00	0.00E+00
Po-218	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ra-224	1.87E+05	8.92E+04	1.13E+05	1.21E+05	9.45E+04	1.45E+05	[illegible]	9.04E+03	[illegible]	1.22E+04	9.58E+03	1.49E+04
Ra-226	1.37E+05	5.79E+04	8.19E+04	8.21E+04	6.26E+04	9.83E+04	1.41E+04	5.94E+03	8.41E+03	8.45E+03	6.41E+03	1.05E+04
Ra-228	8.53E-05	9.39E-05	1.88E-05	4.53E-04	3.98E-07	8.53E-03	7.89E-05	8.68E-05	1.74E-05	4.19E-04	3.68E-07	7.89E-03
Ac-228	1.32E+07	9.95E+06	8.99E+06	1.10E+07	9.30E+06	1.37E+07	1.17E+06	8.65E+05	7.86E+05	9.64E+05	8.14E+05	1.23E+06
Th-228	4.33E+04	1.54E+04	2.56E+04	2.41E+04	1.74E+04	3.33E+04	4.75E+03	1.67E+03	2.74E+03	2.95E+03	1.84E+03	8.88E+03
Th-230	8.79E+03	2.86E+03	4.78E+03	4.83E+03	3.07E+03	1.00E+04	1.11E+03	3.53E+02	5.44E+02	6.92E+02	3.39E+02	5.86E+03
Th-232	3.91E+03	1.20E+03	2.03E+03	2.21E+03	1.23E+03	6.81E+03	5.93E+02	1.78E+02	2.53E+02	6.10E+02	1.45E+02	5.44E+03
Th-234	1.90E+05	6.00E+04	1.10E+05	9.53E+04	6.63E+04	1.18E+05	2.14E+04	6.70E+03	1.23E+04	1.11E+04	7.33E+03	1.94E+04
Pa-234	2.89E+07	2.07E+07	1.92E+07	2.34E+07	1.98E+07	2.93E+07	2.61E+06	1.83E+06	1.72E+06	2.10E+06	1.77E+06	2.69E+06
U-234	2.77E+03	8.30E+02	1.38E+03	1.80E+03	8.36E+02	8.05E+03	5.71E+02	1.46E+02	1.85E+02	7.43E+02	1.00E+02	7.34E+03
U-238	9.69E+02	2.47E+02	3.66E+02	8.02E+02	1.97E+02	5.91E+03	3.32E+02	8.41E+01	7.05E+01	5.46E+02	2.97E+01	6.06E+03
Np-238	7.50E+06	5.76E+06	4.77E+06	6.38E+06	5.43E+06	8.32E+06	[illegible]	4.99E+05	4.12E+05	5.54E+05	4.69E+05	7.45E+05
Np-239	[illegible]	1.40E+06	2.14E+06	2.02E+06	1.57E+06	2.43E+06	[illegible]	1.45E+05	2.22E+05	2.13E+05	1.62E+05	2.90E+05
Pu-238	9.79E+02	2.32E+02	3.16E+02	1.00E+03	1.67E+02	8.46E+03	[illegible]	1.42E+02	[illegible]	7.97E+02	2.54E+01	8.55E+03
Pu-239	1.39E+03	4.51E+02	7.98E+02	9.42E+02	5.05E+02	3.87E+03	2.83E+02	8.55E+01	9.52E+01	3.60E+02	[illegible]	3.32E+03
Pu-240	1.01E+03	2.33E+02	3.34E+02	9.90E+02	[illegible]	8.10E+03	4.65E+02	1.36E+02	7.17E+01	7.64E+02	2.69E+01	[illegible]
Pu-241	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pu-242	8.25E+02	1.93E+02	2.83E+02	7.96E+02	1.52E+02	6.40E+03	3.68E+02	6.23E+01	5.81E+01	6.03E+02	[illegible]	6.41E+03
Am-241	5.01E+05	1.43E+05	2.47E+05	2.37E+05	1.42E+05	3.12E+05	6.40E+04	1.81E+04	3.11E+04	3.16E+04	1.79E+04	5.77E+04
Am-242	3.08E+05	1.04E+05	1.95E+05	1.62E+05	1.21E+05	1.96E+05	3.32E+04	1.11E+04	2.07E+04	1.80E+04	1.29E+04	2.97E+04
Am-243	[illegible]	3.71E+05	6.70E+05	5.97E+05	3.96E+05	7.28E+05	1.37E+05	4.16E+04	7.49E+04	6.79E+04	4.42E+04	9.30E+04
Cm-242	1.08E+03	2.95E+02	2.97E+02	1.14E+03	1.56E+02	9.49E+03	6.08E+02	2.02E+02	7.14E+01	9.05E+02	2.57E+01	9.00E+03
Cm-143	2.57E+06	1.06E+06	1.59E+06	1.53E+06	1.18E+06	1.85E+06	2.68E+05	1.09E+05	1.64E+05	1.62E+05	1.22E+05	2.33E+05
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.76E+02	4.96E+01	8.07E+02	1.34E+01	8.15E+03

*Numbering change only

Table 2.4
PUBLIC WATER SUPPLY INFORMATION*

TRM	2020 POPULATION	WATER SUPPLY
484.5		Sequoyah Nuclear Plant
473.0	2000	ICI America Inc.
473.0	900	C. F. Industries
470.5	4000	E. I. duPont, Co.
465.3	610700	Chattanooga
418.0	4400	South Pittsburg
413.6	3400	Bridgeport
407.6	500	Widows Creek Steam Plant
405.2	500	Mead Paper Board
392.0		Bellefonte Nuclear Plant
385.8	38700	Scottsboro
382.1	18600	Sand Mountain Water Authority
368.2	125	Christian Youth Camp
358.0	14900	Guntersville
334.5	4500	NE Morgan County Water and Fire
334.2	168600	Huntsville
330.2	10000	Redstone Arsenal
324.2		Redstone Arsenal
306.0	84600	Decatur
294.0		Browns Ferry Nuclear Plant
283.0	500	U. S. Plywood-Champion Paper
274.9	50	Wheeler Dam
259.6	14,100	Muscle Shoals
259.5	2,700	TVA-NFDC
254.3	21,100	Sheffield
245.0	520	Colbert Steam Plant
239.3	3,900	Cherokee
238.7	350	U.S. Steel Agri-Chemicals, Inc.
217.4	1	Yellow Creek Nuclear Plant
206.8	2,400	Hardin Co. Water District
193.5	1,900	Tri-County Utility District
158.0	1,100	Clifton
101.9	170	Foote Mineral Co.
100.5	6,100	New Johnsonville
100.4	13,300	Camden
100.0	375	Johnsonville Steam Plant
98.5	900	E. I. Dupont Company
95.5	700	Consolidated Aluminum Corporation
94.5	250	Inland Container Corporation
79.5	120	Bass Bay Resort
39.3	4,300	Jonathan Creek Water District
28.5	9,100	North Marshall Water District
23.6	650	Grand Rivers
17.8	600	B. F. Goodrich Chemical Co.
17.4	106	Airco Carbide
16.8	592	Airco Alloys
16.7	510	Air Products and Chemicals
1.1	69,800	Paducah

*From TVA Water Quality Branch, updated December 1979

Table 2.5
FISH HARVEST DATA

RIVER SPAN (TRM)	NAME OF REACH	FISH HARVEST (LBS/YR) SPORT*	COMMERCIAL**
484.5 - 471.0	Chickamauga Lake below SQN	5.4E+05	2.0E+05
471.0 - 452.0	Nickajack Lake (Part 1 of 2)	1.2E+05	4.6E+04
452.0 - 424.7	Nickajack Lake (Part 2 of 2)	2.9E+05	1.1E+05
424.7 - 417.5	Guntersville Lake (Part 1 of 4)	2.6E+05	9.5E+04
417.5 - 392.0	Guntersville Lake above BLN	5.2E+05	1.9E+05
392.0 - 373.0	Guntersville Lakebelow BLN	7.8E+05	2.9E+05
373.0 - 349.0	Guntersville Lake (Part 4 of 4)	1.0E+06	3.8E+05
349.0 - 294.0	Wheeler Lake above BFN	1.0E+06	3.8E+05
294.0 - 274.9	Wheeler Lake below BFN	1.5E+06	5.7E+05
274.9 - 259.4	Wilson Lake	5.9E+05	2.2E+05
259.4 - 217.4	Pickwick Lake above YCN	1.3E+06	4.9E+05
217.4 - 206.7	Pickwick Lake below YCN	3.3E+05	1.2E+05
206.7 - 165.0	Kentucky Lake (Part 1 of 4)	6.1E+05	2.3E+05
165.0 - 121.0	Kentucky Lake (Part 2 of 4)	6.1E+05	2.3E+05
121.0 - 76.0	Kentucky Lake (Part 3 of 4)	1.8E+06	6.8E+05
76.0 - 22.4	Kentucky Lake (Part 4 of 4)	3.1E+06	1.1E+06

*Derived from "Situation Assessment and Planning Assumptions," Division of Forestry, Fisheries, and Wildlife, TVA, December 1978.

**Derived from "Estimated Commercial Fish and Mussel Harvest from the Tennessee Valley," Fisheries and Aquatic Ecology Branch, TVA, 1980.

*Numbering change only

Table 2.6
RECREATION USAGE DATA*

RIVER SPAN (TRM)	NAME OF REACH	HOURS OF USAGE PER YEAR		
		SHORELINE	ABOVE-WATER	IN-WATER
484.5 - 471.0	Chickamauga Lake below SQN	5.5E+06	1.0E+06	4.9E+06
471.0 - 452.0	Nickajack Lake (Part 1 of 2)	1.2E+05	2.5E+04	1.1E+05
452.0 - 424.7	Nickajack Lake (Part 2 of 2)	2.0E+05	4.0E+04	1.8E+05
424.7 - 417.5	Guntersville Lake (Part 1 of 4)	7.0E+04	1.5E+04	6.0E+04
417.5 - 392.0	Guntersville Lake above BLN	5.2E+05	1.0E+05	4.7E+05
392.0 - 373.0	Guntersville Lake below BLN	4.7E+06	8.9E+05	4.2E+06
373.0 - 349.0	Guntersville Lake (Part 4 of 4)	1.1E+07	2.1E+06	9.8E+06
349.0 - 294.0	Wheeler Lake above BFN	4.0E+06	7.6E+05	3.6E+06
294.0 - 274.9	Wheeler Lake below BFN	5.2E+06	1.0E+06	4.7E+04
274.9 - 259.4	Wilson Lake	3.9E+06	7.4E+05	3.5E+06
259.4 - 217.4	Pickwick Lake above YCN	2.0E+06	3.5E+05	2.0E+06
217.4 - 206.7	Pickwick Lake below YCN	2.0E+06	4.0E+05	1.8E+06
206.7 - 165.0	Kentucky Lake (Part 1 of 4)	6.0E+05	1.2E+05	5.4E+05
165.0 - 121.0	Kentucky Lake (Part 2 of 4)	1.2E+06	2.3E+05	1.1E+06
121.0 - 76.0	Kentucky Lake (Part 3 of 4)	2.4E+06	4.7E+05	2.2E+06
76.0 - 22.4	Kentucky Lake (Part 4 of 4)	2.6E+07	4.9E+06	2.3E+07

*Based on "Extent of Recreation Development and Use of TVA Lake Frontage Property;" (unpublished data from 1974 Annual Recreation Survey); and Observations of Recreation Use of TVA Reservoirs, Division of Reservoir Properties, Recreation Resources Branch, TVA, 1975.

*Numbering change only

*Numbering change only

TABLE 3.1 (Sheet 1 of 4)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Sample Locations*	Sampling and Collection Frequency	Type and Frequency of Analysis
1. AIRBORNE			
a. Particulates	4 samples from locations (in different sectors) at or near the site boundary (LM 2, 3, 4, and 5)	Continuous sampler operation with sample collection once per 7 days (more frequently if required by dust loading)	Analyze for gross beta radioactivity $\geq$ 24 hours following filter change. Perform gamma isotopic analysis on each sample if gross beta > 10 times yearly mean of control sample. Composite at least once per 31 days (by location for gamma scan)
	4 samples from communities approximately 5-10 miles distance from the plant (PM 2, 3, 8, and 9)		
	4 samples from control locations greater than 10 miles from the plant (RM 1, 2, 3, and 4)		
b. Radioiodine	Samples from same locations as air particulates	Continuous sampler operation with filter collection once per 7 days	^{131}I at least once per 7 days
c. Soil	Samples from same locations as air particulates	Once per year	Gamma scan, ^{89}Sr, ^{90}Sr once each year
2. DIRECT RADIATION	2 or more dosimeters placed at 11 of the air particulate sampling stations (LM-3, LM-4, LM-5, PM-2, PM-3, PM-8, PM-9, RM-1, RM-2, RM-3, and RM-4)	Once per 92 days	Gamma dose at least once per 92 days
	2 or more dosimeters placed at each of at least 30 other locations. (Figures 3.1, 3.2, and 3.3)		

*Sample locations are listed in Tables 3.2 and 3.3 and shown on Figures 3.1, 3.2, and 3.3.

*Numbering change only

TABLE 3.1 (Sheet 2 of 4)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Sample Locations*	Sampling and Collection Frequency	Type and Frequency of Analysis
3. WATERBORNE			
a. Surface	TRM 497.0 TRM 483.4 TRM 473.2	Collected by automatic sequential-type sampler** with composite samples collected over a period of ≤ 32 days	Gamma scan of each composite sample. Composite for tritium analysis at least once per 92 days
b. Ground	1 sample adjacent to plant (location W-6)	At least once per 92 days	Gross beta, gamma scan and tritium analysis at least once per 92 days
	1 sample from ground water source upgradient		
c. Drinking	1 sample at the first potable surface water supply downstream from the plant (TRM 473.0)	Collected by automatic sequential-type sampler** with composite sample collected over a period of ≤ 31 days	Gross beta and gamma scan of each composite sample. Composite for tritium, ^{89}Sr, ^{90}Sr at least once per 92 days
	1 sample at the next 2 downstream potable surface water suppliers (greater than 10 miles downstream) (TRM 470.5 and 465.3)	Grab sample once per 31 days	
	2 samples at control locations (TRM 497.0 and TRM 503.8)	Samples collected by automatic sequential-type sampler with composite sample collected over a period of ≤ 31 days	
d. Sediment	TRM 496.5 TRM 483.4 TRM 480.8 TRM 472.8	At least once per 184 days	Gamma scan of each sample

*Sample locations are listed in Tables 3.2 and 3.3 and shown on Figures 3.1, 3.2, and 3.3.
**Samples shall be collected by collecting an aliquot at intervals not exceeding 2 hours.

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*Numbering change only

TABLE 3.1 (Sheet 3 of 4)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Sample Locations*	Sampling and Collection Frequency	Type and Frequency of Analysis
e. Shoreline Sediment	TRM 485 TRM 478 TRM 477	At least once per 184 days	Gamma scan of each sample
4. INGESTION			
a. Milk	1 sample from milk producing animals in each of 1-3 areas indicated by the cow census where doses are calculated to be highest. If samples are not available from a milk animal location, doses to that area will be estimated by projecting the doses from concentrations detected in milk from other sectors or by sampling vegetation where milk is not available (Table 3.1, 4.d) At least 1 sample from a control location.	At least once per 15 days	Gamma isotopic and ^{131}I analysis of each sample. ^{89}Sr, ^{90}Sr once per quarter
b. Fish	1 sample each for Nickajack, Chickamauga, and Watts Bar Reservoirs	At least once per 184 days. One sample of each of the following species: Channel Catfish Crappie Smallmouth Buffalo	Gamma scan on edible portion

*Sample locations are listed in Tables 3.2 and 3.3 and shown on Figures 3.1, 3.2, and 3.3.

TABLE 3.1 (Sheet 4 of 4)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Sample Locations*	Sampling and Collection Frequency	Type and Frequency of Analysis
c. Invertebrates (Asiatic Clams)	TRM 496.5 TRM 483.4 TRM 480.8	At least once per 184 days.	Gamma scan on edible portion
d. Food Products	1 sample each of principal food products grown at private gardens and/or farms in the immediate vicinity of the plant.	At least once per 365 days at time of harvest. The types of foods available for sampling will vary. Following is a list of typical foods which may be available: Cabbage and/or Lettuce Corn Green Beans Potatoes Tomatoes	Gamma scan on edible portion
e. Vegetation	Samples from the nearby milk producing farms (Farms J, Hw, H, EM, and Br) and from the local air monitoring stations (LM-2, -3, -4, and -5. Control samples from one remote air monitor (RM-4) and one control dairy farm (Farm 5).	At least once per 31 days	I-131 and gamma scan at least once per 31 days. ^{89}Sr and ^{90}Sr analysis at least once per 92 days

*Sample locations are listed in Tables 3.2 and 3.3 and shown on Figures 3.1, 3.2, and 3.3.

TABLE 3.2 (1 of 2)

SEQUOYAH NUCLEAR PLANT

Environmental Radiological Monitoring Program
Sampling Locations

Map Location Number[a]	Station	Sector	Approximate Distance (Miles)	Indicator (I) or Control (C)	Samples Collected[b]
2	LM-2	N	0.8	I	AP, CF, S, V
3	LM-3	SSW	1.2	I	AP, CF, S, V
4	LM-4	NE	1.5	I	AP, CF, S, V
5	LM-5	NNE	1.8	I	AP, CF, S, V
7	PM-2	SW	3.8	I	AP, CF, S
8	PM-3	W	5.6	I	AP, CF, S
9	PM-8	SSW	8.7	I	AP, CF, S
10	PM-9	WSW	2.6	I	AP, CF, S
11	RM-1	SW	16.7	C	AP, CF, S
12	RM-2	NNE	17.8	C	AP, CF, S
13	RM-3	ESE	11.3	C	AP, CF, S
14	RM-4	WNW	18.9	C	AP, CF, S, V
15	Farm B	NE	43.0	C	M
16	Farm C	NE	16.0	C	M
17	Farm S	NNE	12.0	C	M, V
18	Farm J	WNW	1.1	I	M, V
19	Farm HW	NW	1.2	I	M, V, W[c]
20	Farm EM	N	2.6	I	V
21	Farm Br	SSW	2.2	I	V
24	Well No. 6	NNE	0.15	I	W
31	TRM[d] 473.0 (C.F. Industries)	--	11.5[e]	I	PW
32	TRM 470.5 (E.I. DuPont)	--	14.0[e]	I	PW
33	TRM 465.3 (Chattanooga)	--	19.2[e]	I	PW
34	TRM 497.0	--	12.5[e]	C[f]	SW
35	TRM 503.8 (Dayton)	--	19.3[e]	C	PW
36	TRM 496.5	--	12.0[e]	C	CL, SD
37	TRM 485.0	--	0.5[e]	C	SS
38	TRM 483.4	--	1.1[e]	I	CL, SD, SW
39	TRM 480.8	--	3.7[e]	I	CL, SD
40	TRM 477.0	--	7.5[e]	I	SS
41	TRM 473.2	--	11.3[e]	I	SW
42	TRM 472.8	--	11.7[e]	I	SD
44	TRM 478.8	--	6.5[e]	I	SS

*Page renumbered

TABLE 3.2 (2 of 2)

SEQUOYAH NUCLEAR PLANT

Environmental Radiological Monitoring Program
Sampling Locations

Map Location Number[a]	Station	Sector	Approximate Distance (Miles)	Indicator (I) or Control (C)	Samples Collected[b]
45	TRM 425-471 (Nickajack Reservoir)	--	--	I	F
46	TRM 471-530 (Chickamauga Reservoir)	--	--	I	F
47	TRM 530-602 (Watts Bar Reservoir)	--	--	C	F
48	Farm H	NE	4.2	I	M, V

a. See figures 3.1, 3.2, and 3.3

b. Sample Codes
AP = Air particulate filter
CF = Charcoal filter
CL = Clams
F = Fish
M = Milk
PW = Public water
R = Rainwater
S = Soil
SD = Sediment
SS = Shoreline sediment
SW = Surface water
V = Vegetation
W = Well water

c. A control for well water.

d. TRM = Tennessee River Mile.

e. Distance from plant discharge (TRM 484.5)

f. Surface water sample also used as a control for public water.

Table 3.3 (1 of 2)

SEQUOYAH NUCLEAR PLANT

Thermoluminescent Dosimeter Locations

Map Location Number	Station	Sector	Approximate Distance (Miles)	Onsite (On)[a] or Offsite (Off)
3	SSW-1A	SSW	1.2	On
4	NE-1A	NE	1.5	On
5	NNE-1	NNE	1.8	On
7	SW-2	SW	3.8	Off
8	W-3	W	5.6	Off
9	SSW-3	SSW	8.7	Off
10	WSW-2A	WSW	2.6	Off
11	SW-3	SW	16.7	Off
12	NNE-4	NNE	17.8	Off
13	ESE-3	ESE	11.3	Off
14	WNW-3	WNW	18.9	Off
49	N-1	N	0.6	On
50	N-2	N	2.1	Off
51	N-3	N	5.2	Off
52	N-4	N	10.0	Off
53	NNE-2	NNE	4.5	Off
54	NNE-3	NNE	12.1	Off
55	NE-1	NE	2.4	Off
56	NE-2	NE	4.1	Off
57	ENE-1	ENE	0.4	On
58	ENE-2	ENE	5.1	Off
59	E-1	E	1.2	On
60	E-2	E	5.2	Off
61	ESE-A	ESE	0.4	On
62	ESE-1	ESE	1.2	On
63	ESE-2	ESE	4.9	Off
64	SE-A	SE	0.4	On
65	SE-B	SE	0.4	On
66	SE-1	SE	1.4	On
67	SE-2	SE	1.9	On
68	SE-4	SE	5.2	Off
69	SSE-1	SSE	1.6	On
70	SSE-2	SSE	4.6	Off
71	S-1	S	1.5	On
72	S-2	S	4.7	Off
73	SSW-1	SSW	0.6	On
74	SSW-2	SSW	4.0	Off

*Numbering change only

Table 3.3 (2 of 2)

SEQUOYAH NUCLEAR PLANT

Thermoluminescent Dosimeter Locations

Map Location Number	Station	Sector	Approximate Distance (Miles)	Onsite (On)[a] or Offsite (Off)
75	SW-1	SW	0.9	On
76	WSW-1	WSW	0.9	On
77	WSW-2	WSW	2.5	Off
78	WSW-3	WSW	5.7	Off
79	WSW-4	WSW	7.8	Off
80	WSW-5	WSW	10.1	Off
81	W-1	W	0.8	On
82	W-2	W	4.3	Off
83	WNW-1	WNW	0.4	On
84	WNW-2	WNW	5.3	Off
85	NW-1	NW	0.4	On
86	NW-2	NW	5.2	Off
87	NNW-1	NNW	0.6	On
88	NNW-2	NNW	1.7	On
89	NNW-3	NNW	5.3	Off

a. TLDs designated onsite are those located two miles or less from the plant.
TLDs designated offsite are those located more than two miles from the plant.

*Numbering change only

Table 3.4 (1 of 2)
MAXIMUM VALUES FOR THE LOWER LIMITS OF DETECTION (LLD)[a,c]

Analysis (pCi/L)	Water (pCi/L)	Airborne Particulate or Gas (pCi/m^3)	Fish (pCi/kg,wet)	Milk (pCi/L)	Food Products (pCi/kg,wet)	Sediment (pCi/kg,dry)
gross beta	4	1×10^{-2}	N.A.	N.A.	N.A.	N.A.
H-3	2000	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-58,60	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]	7×10^{-2}	N.A.	1	60	N.A.
Cs-134	15	5×10^{-2}	130	15	60	150
Cs-137	18	6×10^{-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 NOTATION

a The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ s_b}{E\ \ V\ \ 2.22\ \ Y\ \ \exp(-\lambda \Delta t)}$$

*Numbering change only

Table 3.4 (1 of 2)
MAXIMUM VALUES FOR THE LOWER LIMITS OF DETECTION (LLD)[a,c]

TABLE NOTATION (continued)

Where:

LLD is the "a priori" lower limit of detection as defined above (picocurie per unit mass or volume),

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (counts per minute),

E is the counting efficiency (counts per transformation),

V is the sample size (units of mass or volume),

2.22 is the number of transformations per minute per picocurie,

Y is the fractional radiochemical yield (when applicable),

λ is the radioactive decay constant for the particular radionuclide, and

Δt is the elapsed time between sample collection (or end of the sample collection period) and time of counting (for environmental samples, not plant effluent samples).

The value of s_b used in the calculation of the LLD for a detection system shall be based on the actual observed variance of the background counting rate or of the counting rate of the blank samples (as appropriate) rather than on an unverified theoretically predicted variance. In calculating the LLD for a radionuclide determined by gamma-ray spectrometry, the background shall include the typical contributions of other radionuclides normally present in the samples (e.g., potassium-40 in milk samples). Typical values of E, V, Y, and Δt shall be used in the calculations.

b The LLD for analysis of drinking water and surface water samples shall be performed by gamma spectroscopy at approximately 15 pCi/L. If levels greater than 15 pCi/L are identified in surface water samples downstream from the plant, or in the event of an unanticipated release of I-131, drinking water samples will be analyzed at a LLD of 1.0 pCi/L for I-131.

c Other peaks which are measurable and identifiable, together with the radionuclides in Table 4.12-1, shall be identified and reported.

*Numbering change only

Figure 1.1
SQN LAND SITE BOUNDARY

*Page added

Figure 1.2
GASEOUS RADWASTE TREATMENT SYSTEM

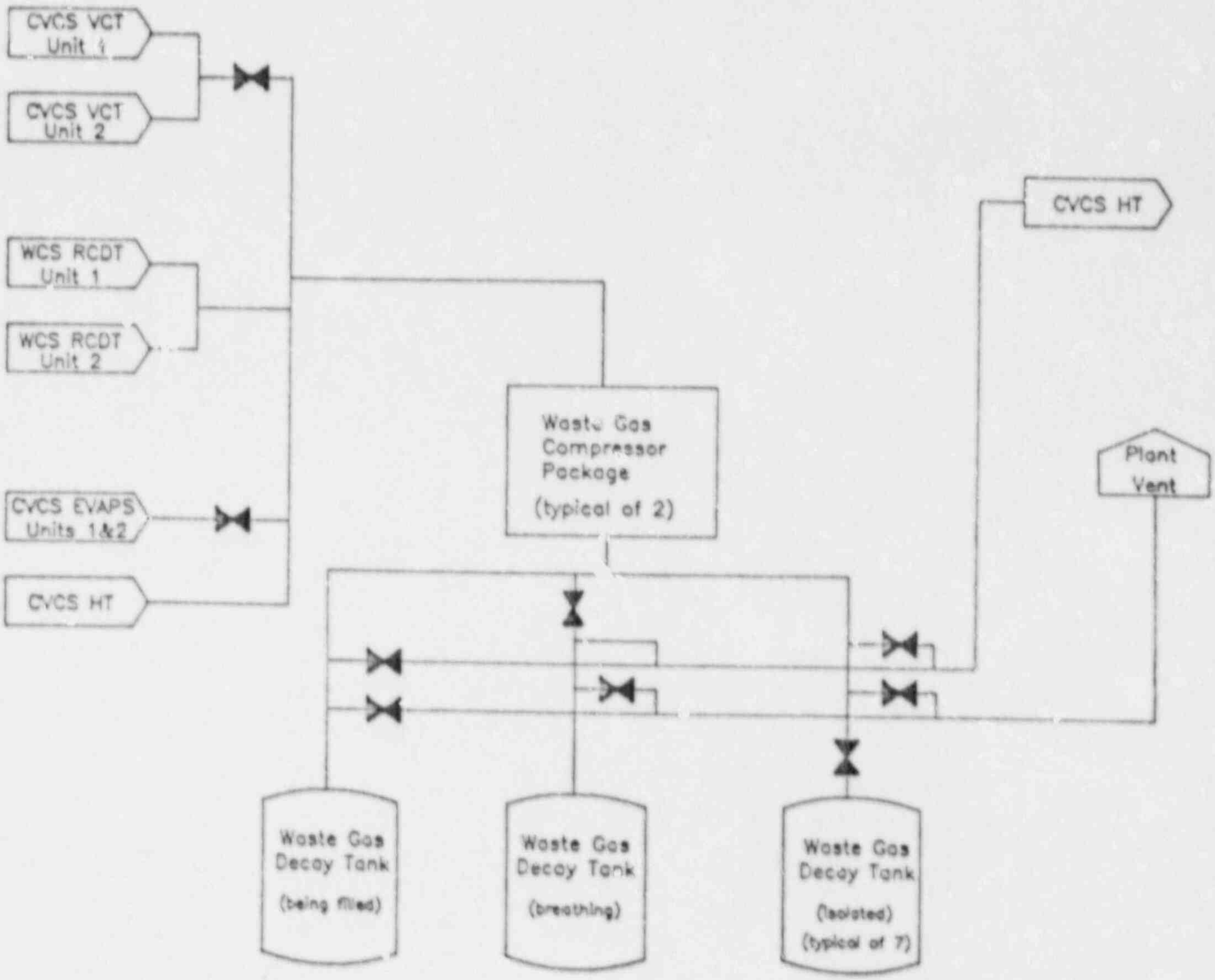

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Figure 1.3
PLUME DEPLETION EFFECT FOR GROUND LEVEL RELEASES
(All Stability Classes)

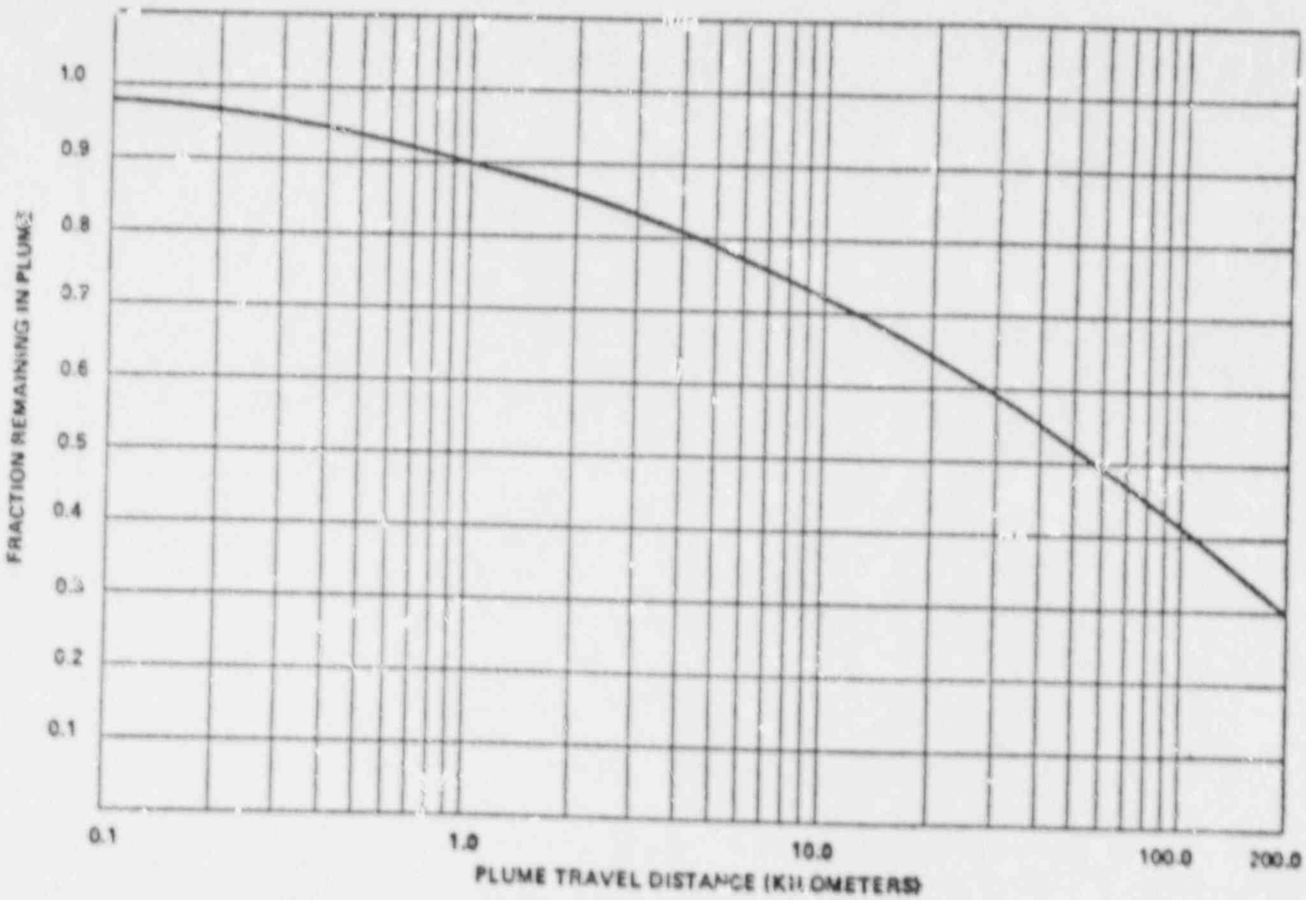

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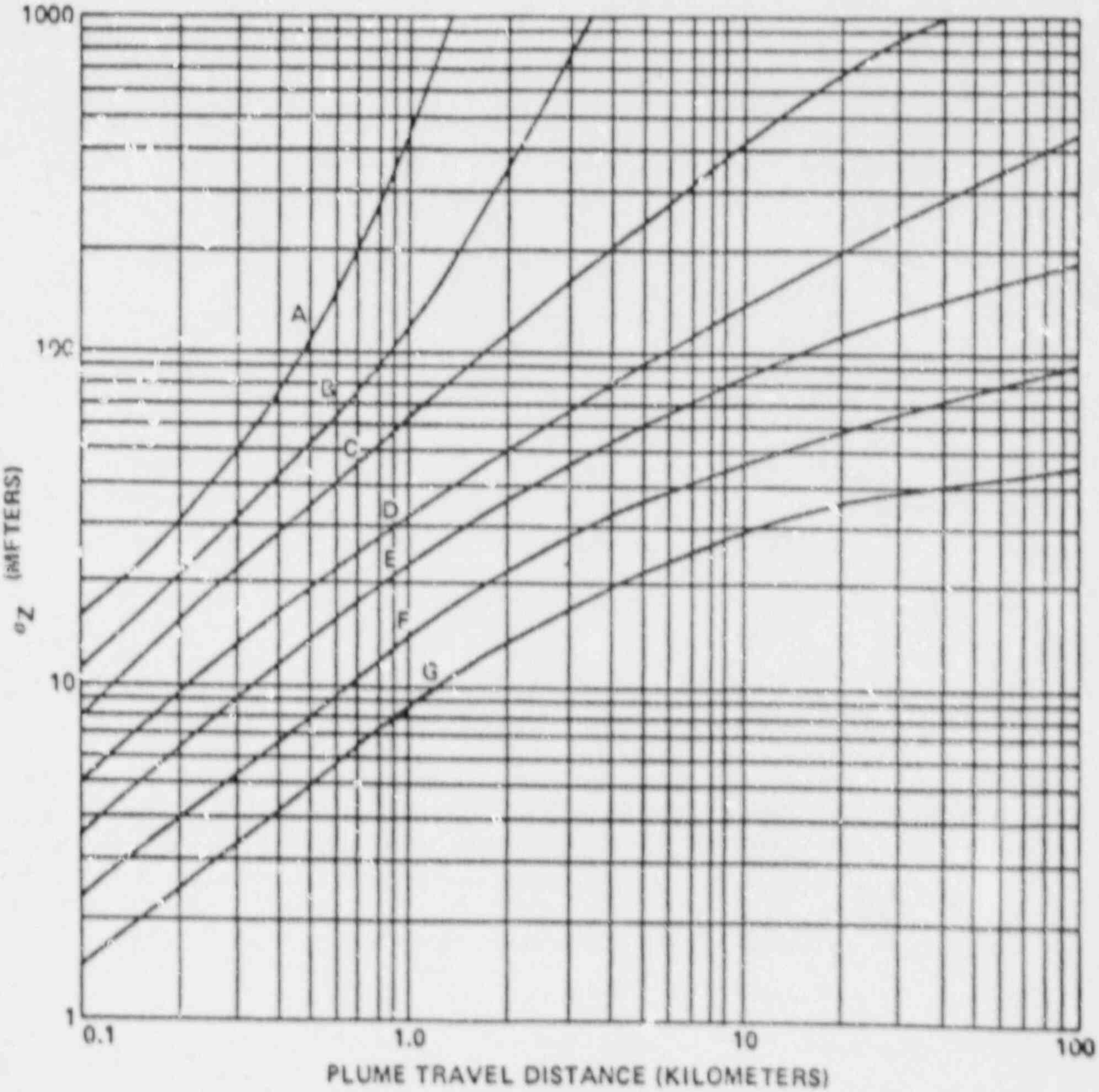
Figure 1.4
Vertical Standard Deviation of Material in a Plume



Vertical Standard Deviation of Material in a Plume (Letters denote Pasquill Stability Class)

*Page added

Figure 1.5
RELATIVE DEPOSITION FOR GROUND LEVEL RELEASES
(All Stability Classes)

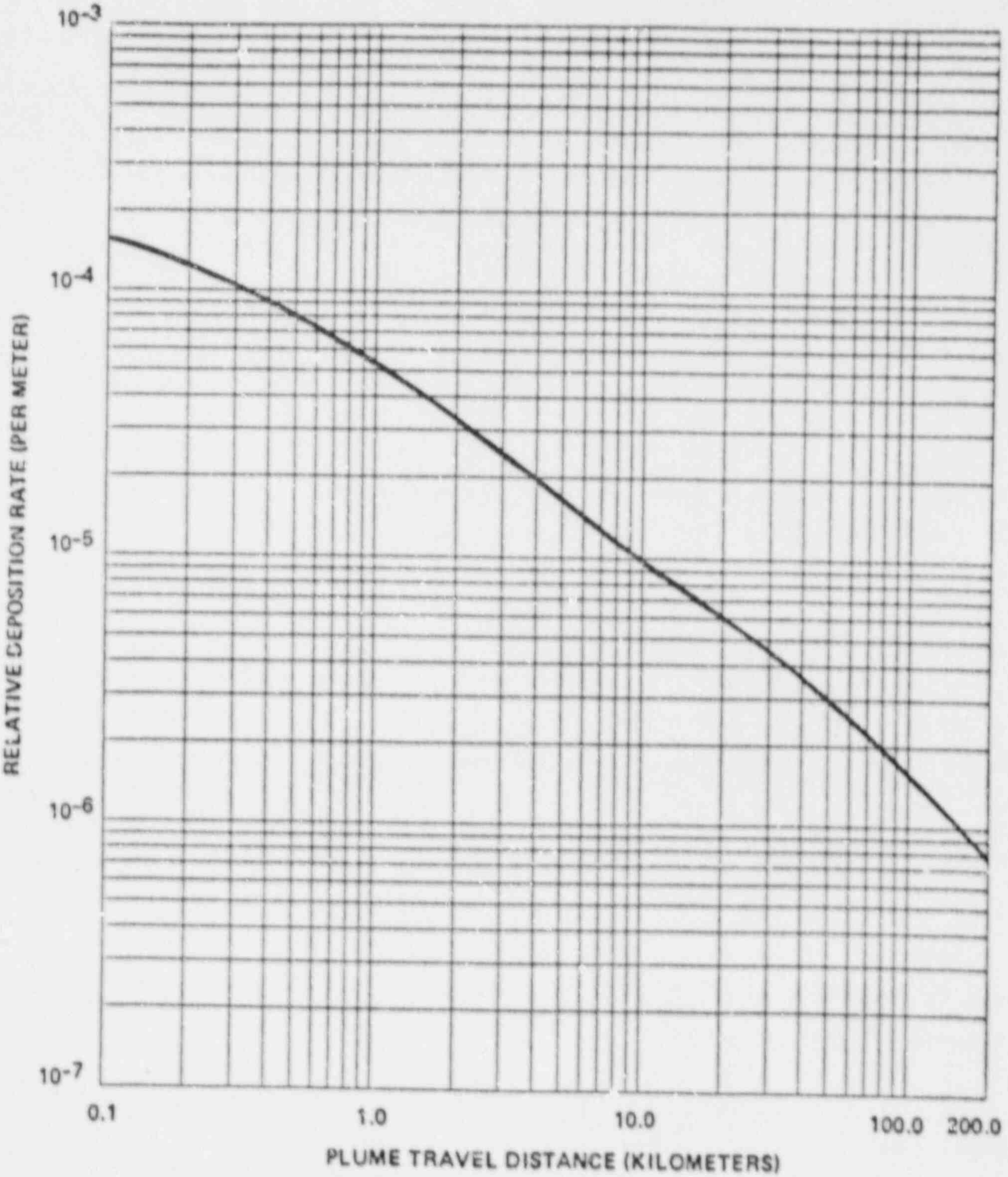


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Figure 3.1

Environmental Radiological Sampling Locations

Within 1 Mile of Plant

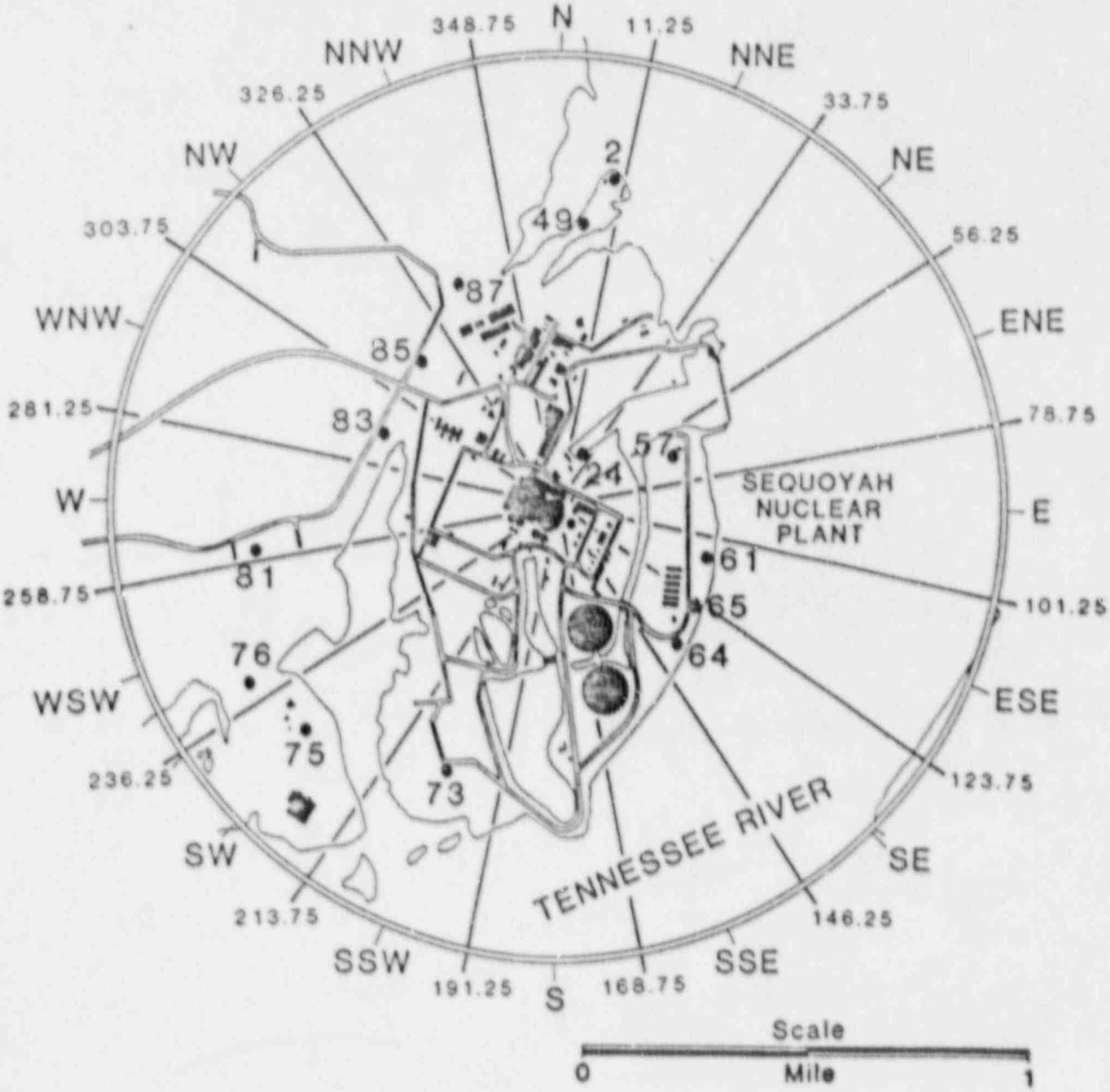

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Figure 3.2

Environmental Radiological Sampling Locations

From 1 to 5 Miles From The Plant

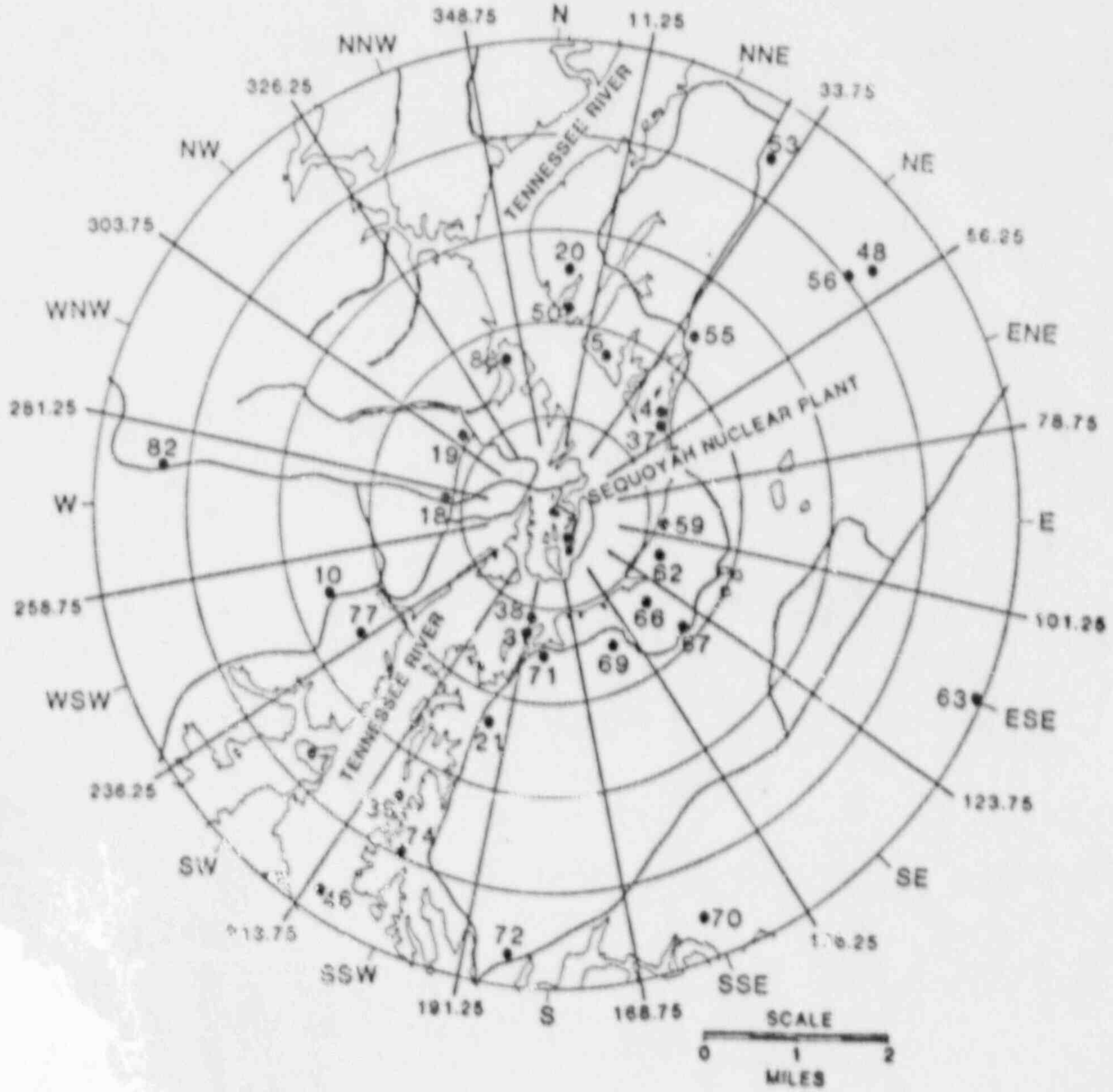

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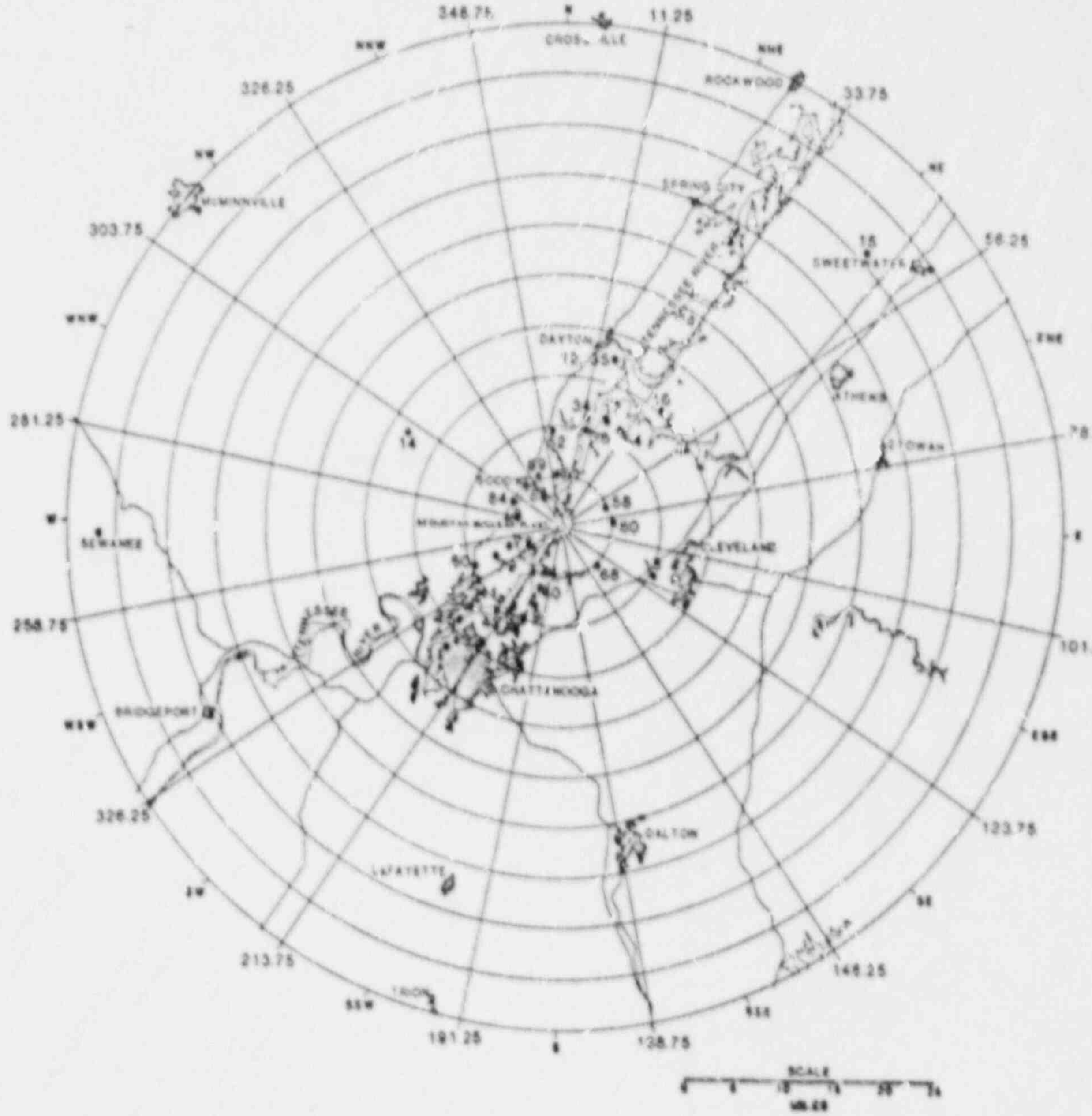
Figure 3.3

Environmental Radiological Sampling Locations

Greater Than 5 Miles From The Plant



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CONCURRENCE SHEET

DOCUMENT NAME: SEQUOYAH NUCLEAR PLANT (SQN) OFFSITE DOSE CALCULATION MANUAL (ODCM) - REVISION 20

ORIGINATING ORGANIZATION: Radiological Protection Branch

DOCUMENT PREPARED BY: R. M. Nicoll

ACCESSION NO.: L61 880803 839 DATE: AUG 08 1988

CONCURRENCES		
Name	Signature - Comment	Date
R. M. Nicoll	[signature]	8/3/88
C. G. Hudson	CG Hudson	8/3/88

INSTRUCTIONS:

1. After each individual concurs, check a or b
   _____ a. forward to next individual
   _____ b. contact this person __________________ ext. __________
2. When concurrences are complete, forward to ______________________ extension __________
3. Other instructions.

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TENNESSEE VALLEY AUTHORITY

Sequoyah Nuclear Plant
P. O. Box 2000
Soddy-Daisy, Tennessee 37379

September 13, 1988

Nuclear Regulatory Commission
Office of Management Information
and Program Control
Washington, DC 20555

Gentlemen:

Enclosed is the August 1988 Monthly Operating Report to NRC for Sequoyah Nuclear Plant.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

S. J. Smith
Plant Manager

Enclosure
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