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CHAPTER 10

RADIOACTIVE EFFLUENT TREATMENT AND MONITORING

10.1 AIRBORNE RELEASES

10.1.1 System Description

A simplified gaseous radwaste and gaseous effluent flow diagram is provided in Figure 10-1.

Each airborne release point is classified as stack, vent, or ground level in accordance with the definitions in Section 4.1.4 and the results in Table A-1 of Appendix A. The principal release points for potentially radioactive airborne effluents and their classifications are as follows:

- The ventilation chimney (a stack release point).
- The reactor building ventilation stack (a vent release point).

10.1.1.1 Condenser Offgas Treatment System

The condenser offgas treatment system is designed and installed to reduce radioactive gaseous effluents by collecting non-condensable off-gases from the condenser and providing for holdup to reduce the total radioactivity by radiodecay prior to release to the environment. The daughter products are retained by charcoal and HEPA filters. The system is described in Section 11.3.2.1.1 of the Quad Cities UFSAR.

10.1.1.2 Ventilation Exhaust Treatment System

Ventilation exhaust treatment systems are designed and installed to reduce gaseous radioiodine or radioactive material in particulate form in selected effluent streams by passing ventilation or vent exhaust gases through charcoal adsorbers and/or HEPA filters prior to release to the environment. Such a system is not considered to have any effect on noble gas effluents. The ventilation exhaust treatment systems are shown in Figure 10-1.

Engineered safety features atmospheric cleanup systems are not considered to be ventilation exhaust treatment system components.

10.1.2 Radiation Monitors

10.1.2.1 Plant Chimney Monitor

Monitors 1(2)-1730A/B continuously monitor the final effluent from the chimney.

The monitor system has isokinetic sampling, gaseous grab sampling, iodine and particulate sampling, and tritium sampling capability.

The chimney effluent is also monitored by a separate particulate, iodine, and noble gas (SPING-4) system and a Victoreen system. The SPING/Victoreen system has high range capabilities to deal with accident conditions including post-accident sampling capability. The Victoreen sampling system automatically begins taking samples after a high signal has been received on the SPING-4 low range noble gas monitor. Output from the SPING/Victoreen system is obtainable in the control room.

No automatic isolation or control functions are performed by these monitors. Pertinent information on these monitors is provided in the Quad Cities UFSAR Section 11.5.2.3.

10.1.2.2 Reactor Building Vent Stack Effluent Monitor

The combined reactor building ventilation is also monitored by a SPING-4. This monitor has high range capabilities to deal with accident conditions. The SPING-4 noble gas detectors have ranges that envelope the range for the reactor building vent effluent trip point.

The vent stack monitor has isokinetic sampling and iodine and particulate sampling capability.

No automatic isolation or control functions are performed by this monitor.

Pertinent information on this monitor is provided in the Quad Cities UFSAR Section 11.5.2.4.

10.1.2.3 Reactor Building Ventilation Monitors

Monitors 1(2)-1735A/B continuously monitor the effluent from the Unit 1(2) reactor building. On high-high alarm, the monitors automatically initiate closure of valves A01(2)A-5741, A01(2)B-5741, A01(2)A-5742, and A01(2)B-5742 thus isolating the Unit 1(2) reactor building, and initiate startup of the Unit 1(2) standby gas treatment system, and isolates control room HVAC.

In addition to the above monitors, there is continuous iodine and particulate sampling of the reactor building exhaust.

Pertinent information on these monitors is provided in Quad Cities UFSAR Section 11.5.2.4.

10.1.2.4 Condenser Air Ejector Monitors

Monitors 1(2)-1733A/B continuously monitor gross gamma activity downstream of the steam jet air ejector and prior to release to the main chimney.

On high high alarm the monitors automatically activate an interval timer which in turn initiates closure of air operated valve A01(2)-5406, thus terminating the release.

In addition, monitors 1(2)-1741 continuously monitor the final offgas effluent prior to entering the chimney, and monitors 1(2)-1738 continuously monitor gross gamma activity downstream of the steam jet air ejector. No control device is initiated by these monitors.

Pertinent information on these monitors is found in Quad Cities UFSAR Sections 11.5.2.1 and 11.5.2.2.

10.1.3 Alarm and Trip Setpoints

10.1.3.1 Setpoint Calculations

10.1.3.1.1 Reactor Building Vent Stack Monitors

The setpoint for the reactor building vent stack monitor is conservatively set at 2 mr/hr above background. The reactor building ventilation stack release rate, Q_{tv}, at 2 mr/hr is calculated to be 14,400 µCi/sec. Q_{tv} is then substituted into Equations 10-1 and 10-2 to determine Q_{ts}.

10.1.3.1.2 Condenser Air Ejector Monitors

The high-high trip setpoint is established at <100 µCi/sec per MWt (≈2.5E5 µCi/sec) and the SJAE monitor high alarm setpoints are selected at 1.5 times normal full power background with hydrogen addition to satisfy the licensing commitments associated with the MSL monitor Tech Spec amendment.

10.1.3.1.3 Plant Chimney Radiation Monitor

The setpoints for the plant chimney radiation monitor are conservatively set at 10,000 µCi/sec and 20,000 µCi/sec (high and high-high alarms respectively).

At this level the combined release from chimney and vent is approximately 10% of the RETS limit. This is determined by solving Equations 10-1 and 10-2 below.

10.1.3.2 Release Limits.

Alarm and trip setpoints of gaseous effluent monitors are established to ensure that the release rate limits of RETS are not exceeded. The release limit Q_{ts} is found by solving Equations 10-1 and 10-2.

$$\sum_i K_i \, f_i \left\{ (\chi/Q)_s^y Q_{ts} + (\chi/Q)_v^y Q_{tv} \right\} < 500 \text{ mrem/yr} \qquad (10-1)$$

$$\sum_i f_i \left\{ L_i \left[(\chi/Q)_s Q_{ts} + (\chi/Q)_v Q_{tv} \right] + (1.11)\, M_i \left[(\chi/Q)_s^y Q_{ts} + (\chi/Q)_v^y Q_{tv} \right] \right\} < 3000 \text{ mrem/yr} \qquad (10-2)$$

The summations are over noble gas radionuclides i.

f_i Fractional Radionuclide Composition

The release rate of noble gas radionuclide i divided by the total release rate of all noble gas radionuclides.

Q_{ts} Total Allowed Release Rate, Stack Release [μCi/sec]

The total Allowed release rate of all noble gas radionuclides released as stack releases.

Q_{tv} Total Allowed Release Rate, Vent Release [μCi/sec]

The total allowed release rate of all noble gas radionuclides released as vent releases.

The remaining parameters in Equation 10-1 have the same definitions as in Equation A-5 of Appendix A. The remaining parameters in Equation 10-2 have the same definition as in Equation A-6 of Appendix A.

Equation 10-1 is based on Equation A-5 of Appendix A and the RETS restriction on whole body dose rate (500 mrem/yr) due to noble gases released in gaseous effluents (see Section A.1.3.1 of Appendix A). Equation 10-2 is based on Equation A-6 of Appendix A and the RETS restriction on skin dose rate (3000 mrem/yr) due to noble gases released in gaseous effluents (see Section A.1.3.2 of Appendix A).

Equation 10-1 is used as the limiting noble gas release rate.

Calibration methods and surveillance frequency for the monitors will be conducted as specified in the RETS.

10.1.3.3 Release Mixture

In the determination of alarm and trip set points the radioactivity mixture in the exhaust air is assumed to be the same as the calculated effluent during the calendar quarter in which the monitor is recalibrated.

10.1.3.4 Conversion Factors

The conversion factors used to establish gaseous effluent monitor setpoints are obtained as follows.

- Reactor building vent effluent monitor.

  The monitor setpoint is established at 2 mr/hr above background. For the purpose of setpont determination it is assumed that the background is 1 mr/hr. There is sufficient conservatism in the setpoint calculation to accommodate routine variations in the background. However, the isotopic analysis in Section 10.1.3.3 is used to confirm that the setpoint is conservative.

- Condenser air ejector monitor.

  The isotopic analysis in Section 10.1.3.3 and the flow and monitor reading at the time of the analysis are used to establish the conversion factor.

Plant chimney monitor.

Calibration of the plant chimney monitor consists of recirculating an amount of off-gas (see 10.1.3.3) through the noble gas monitors and a Marinelli beaker. After readings have stabilized, the Marinelli beaker is removed and gamma isotopic analysis performed. The efficiency is determined from a plot of average gamma energy of the off-gas sample and net monitor readings.

10.1.3.5 HVAC Flow Rates

The HVAC exhaust flow rates may be obtained from the process computers, indication in the control room, or fan combinations. Setpoints were calculated using the following values:

Chimney Air Flow	350,000 cfm
Combined Reactor Vent* (1 fan)	48,000 cfm
Combined Reactor Vent* (2 fans)	96,000 cfm

* per unit

10.1.4 Allocation of Effluents from Common Release Points

Radioactive gaseous effluents released from the main chimney are comprised of contributions from both units. Under normal operating conditions, it is difficult to allocate the non-noble gaseous radioactivity between units due to fuel performance, in-plant leakage, power history, and other variables. Consequently, allocation is normally made evenly between the units. During extended unit shutdowns or periods of known differences, the apportionment is adjusted accordingly. The noble gaseous radioactivity is more easily allocated since the samples used for the calculations are unit specific. The allocation of effluents is estimated on a monthly basis.

10.1.5 Dose Projections

Because the gaseous releases are continuous, the doses are routinely calculated in accordance with the RETS.

10.2 LIQUID RELEASES

10.2.1 System Description

Simplified liquid radwaste and liquid effluent flow diagrams are provided in Figures 10-2 and 10-3.

The liquid radwaste treatment system is designed and installed to reduce radioactive liquid effluents by collecting the liquids, providing for retention or holdup, and providing for treatment by demineralizer for the purpose of reducing the total radioactivity prior to release to the environment. The system is described in Section 11.2 of the Quad Cities UFSAR.

10.2.1.1 River Discharge Tank

There is one river discharge tank (65,000 gallons capacity) which receives water for discharge to the Mississippi River. This is the only release path in use.

10.2.2 Radiation Monitors

10.2.2.1 Liquid Radwaste Effluent Monitor

Monitor 1/2-1799-01 is used to monitor all releases from the river discharge tank. On high alarm the release is terminated manually.

Pertinent information on the monitor and associated control devices is provided in Quad Cities UFSAR Sections 11.5.2 and 11.5.3.

10.2.2.2 Service Water Effluent Monitors

Monitors 1(2)-1799-01 continuously monitor the service water effluent. No control device is initiated by these monitors.

Pertinent information on these monitors is provided in Quad Cities UFSAR 11.5.3.

10.2.3 Alarm and Trip Setpoints

10.2.3.1 Setpoint Calculations

Alarm and trip setpoints of liquid effluent monitors at the principal release points are established to ensure that the limits of RETS are not exceeded in the unrestricted area.

Currently these setpoints are based on the most conservative releases during the previous 18 months. If it is determined that this is no longer conservative, the setpoints are reevaluated.

10.2.3.1.1 Liquid Radwaste Effluent Monitor

The monitor setpoint is found by solving equation 10-3 for the total isotopic activity.

$$P \leq (K) \times [\Sigma C_i^T / \Sigma (C_i^T / 10^*DWC_i)] \times [(0.5\ F^d_{AVG} + F^r_{max}) / F^r_{max}] + B \qquad (10 - 3)$$

P	Release Setpoint	[cpm]
C_i^T	Concentration of radionuclide i in the release tank.	[µCi/ml]
F^r_{max}	Maximum Release Tank Discharge Flow Rate The flow rate from the radwaste discharge tank.	[gpm]
K	Calibration constant	[cpm/µCi/ml]
DWC_i	Derived Water Concentration of radionuclide i From Appendix B, Table 2, Column 2 to 10CFR20.1001-20.2402.	[µCi/ml]
10	Multiplier granted in Technical Specifications applied to the DWC	
F^d_{AVG}	Average dilution flow of initial dilution stream	[gpm]
B	Background Count Rate	[cpm]

10.2.3.1.2 Service Water Effluent Monitors

The monitor setpoint is found by solving equation 10-4.

$$P \leq (K) \times [\Sigma C_i / \Sigma (C_i / 10^*DWC_i)] \times [(F^d_{AVG} + F^r_{max}) / F^r_{max}] + B \qquad (10\text{-}4)$$

C_i	Concentration of radionuclide i in service water If there is no detectable activity then $\Sigma C_i/\Sigma (C_i/10^*DWC_i)$ is assumed to be 1×10^{-5} µCi/ml.	
F^r_{max}	Maximum discharge rate of service water for one unit.	[gpm]

All other terms are as defined in equation 10-3.

10.2.3.2 Discharge Flow Rates

10.2.3.2.1 Release Tank Discharge Flow Rate

Prior to each batch release, a grab sample is obtained.

The results of the analysis of the sample determine the discharge rate of each batch as follows:

$$F^r_{max} = 0.1\ (0.5\ F^d / \Sigma\ (C_i / 10^*DWC_i)) \qquad (10\text{-}5)$$

The summation is over radionuclides i.

0.1 Reduction factor for conservatism.

F^r_{max} Maximum Permitted Discharge Flow Rate [gpm]

The maximum permitted flow rate from the radwaste discharge tank.

F^d Dilution Flow [gpm]

C_i Concentration of Radionuclide i in the Release Tank [µCi/ml]

The concentration of radioactivity in the radwaste discharge tank based on measurements of a sample drawn from the tank.

DWC_i Derived Water Concentration of radionuclide i [µCi/ml]

From Appendix B, Table 2, Column 2 to 10CFR20.1001-20.2402.

10 Multiplier granted in Technical Specifications applied to the DWC

10.2.3.3 Release Limits

Release limits are determined from RETS. Calculated maximum permissible discharge rates are divided by 10 and dilution flows are divided by 2 to ensure that releases are well below applicable limits. (The factor of 2 used in the dilution flows accounts for discharging the RDT tank to the south diffuser pipe).

10.2.3.4 Release Mixture

For the liquid radwaste effluent monitor the release mixture used for the setpoint determination is the radionuclide mix identified in the grab sample isotopic analysis, excluding tritium. Triitium is not used in this calculation since the monitor cannot detect tritium, a pure beta emmitter.

10.2.3.5 Conversion Factors

The readout for the liquid radwaste effluent monitor is in CPM. The calibration constant is based on the detector sensitivity to Cs-137.

10.2.3.6 Liquid Dilution Flow Rates

The dilution flow is determined using Equation 10-6 below.

$$F^d = (N^{cw} \times F^{cw} + N^{sw} \times F^{sw} - F^{ICE}) \quad (10\text{-}6)$$

F^d = Dilution flow (gpm)
N^{cw} = Number of circulating water pumps on.
F^{cw} = 157000 gpm
Flow with one circulating water pump on.
N^{sw} = Number of service water pumps on
F^{sw} = 13800 gpm
Flow with one service water pump on
F^{ICE} = Deicing flow

10.2.4 Allocation of Effluents from Common Release Points

Radioactive liquid effluent released from the release tank is comprised of contributions from both units.

Allocation of waste is achieved by comparing the pump timer totals for each unit's floor drain and equipment drain pumps to the amount of waste sent to the river discharge tank from the floor drain and waste collector storage tanks. Liquid effluents from laundry and chemical waste are allocated evenly between units. During extended unit shutdown or periods of significant plant input differences, the apportionment is adjusted accordingly. The allocation of the effluents is made on a monthly basis.

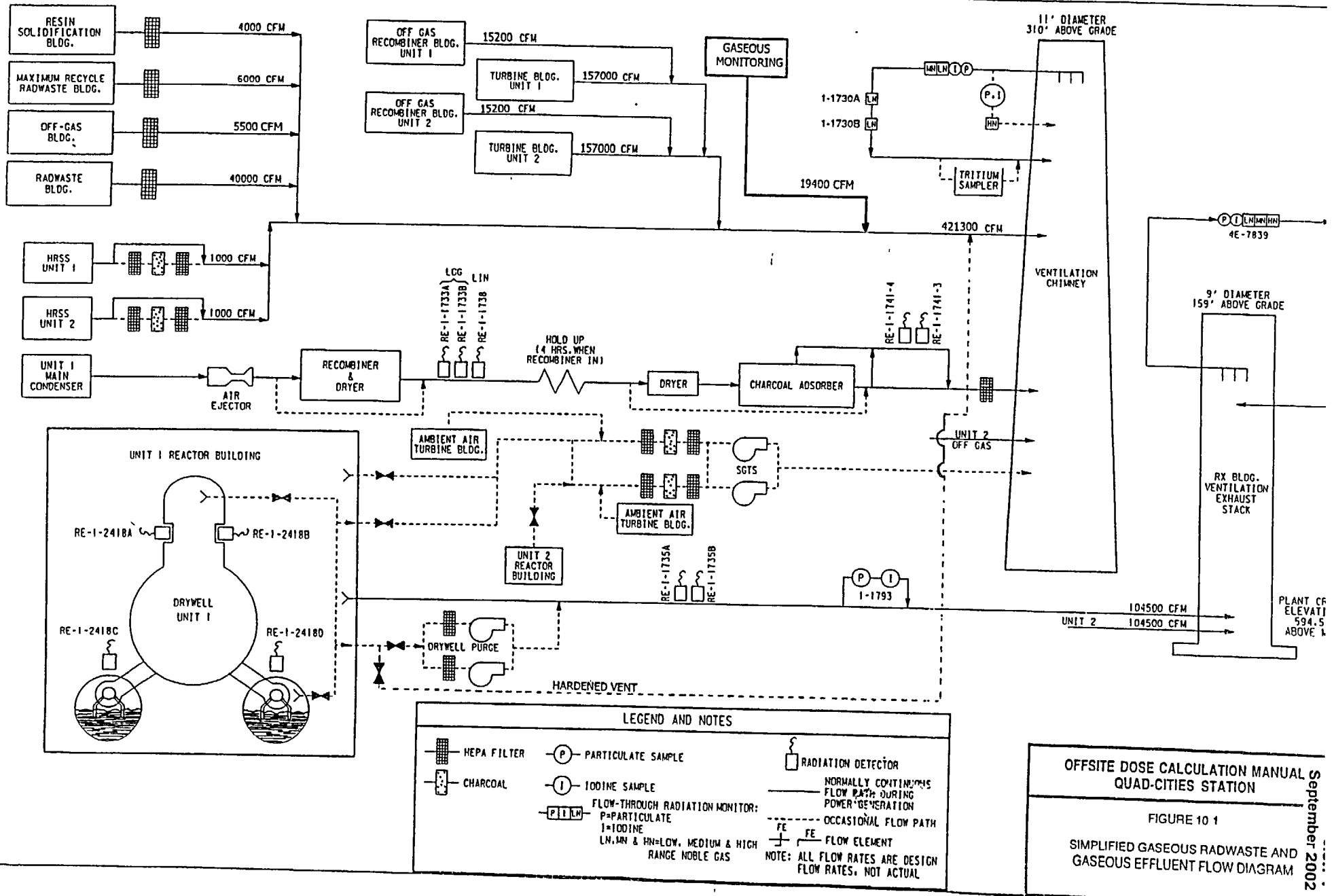
10.2.5 Projected Concentrations for Releases

If total DWC is greater than 25, the projected dose due to liquid effluent releases is calculated. Otherwise, the releases from the previous month are used to estimate the projected dose for the coming month using the methodology in Section A.2 of Appendix A. (See Section A.2.1 of Appendix A).

10.3 SOLIDIFICATION OF WASTE/PROCESS CONTROL PROGRAM

The Process Control Program (PCP) contains the current formulas, sampling, analysis, test, and determinations to be made to ensure that processing and packaging of solid radioactive wastes based on demonstrated processing of actual or simulated wet solid wastes will be accomplished in such a way as to assure compliance with 10 CFR Parts 20, 61, and 71, State regulations, burial ground requirements, and other requirements governing the disposal of solid radioactive waste. Figure 10-1, Simplified Gaseous Radwaste and Gaseous Effluent Flow Diagram.

Figure 10-4 is a simplified diagram of solid radwaste processing.



OFFSITE DOSE CALCULATION MANUAL
QUAD-CITIES STATION

FIGURE 10 1

SIMPLIFIED GASEOUS RADWASTE AND GASEOUS EFFLUENT FLOW DIAGRAM

Figure 10-2
Simplified Liquid Radwaste Processing Diagram

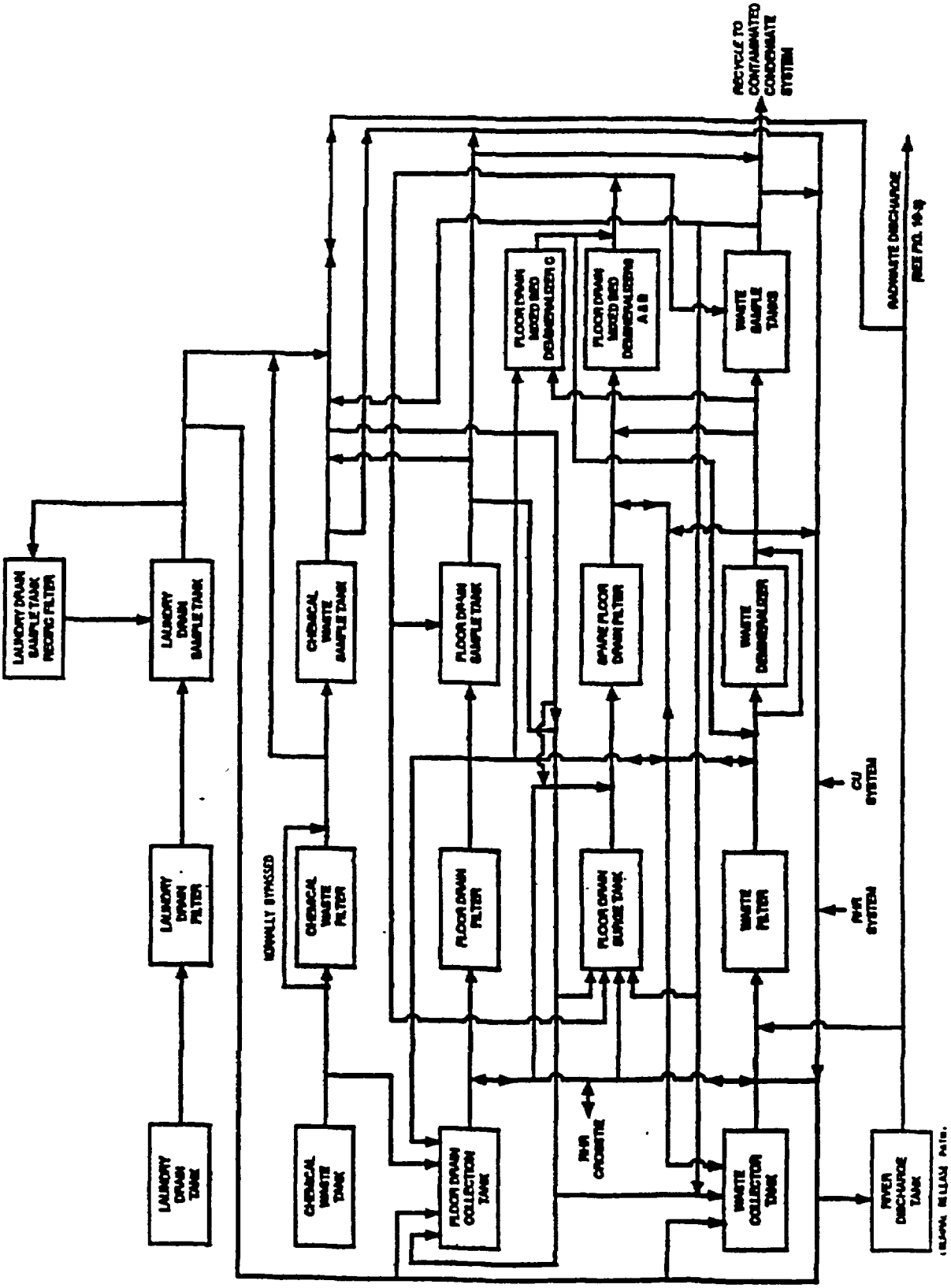


Figure 10-3
Simplified Liquid Effluent Flow Diagram

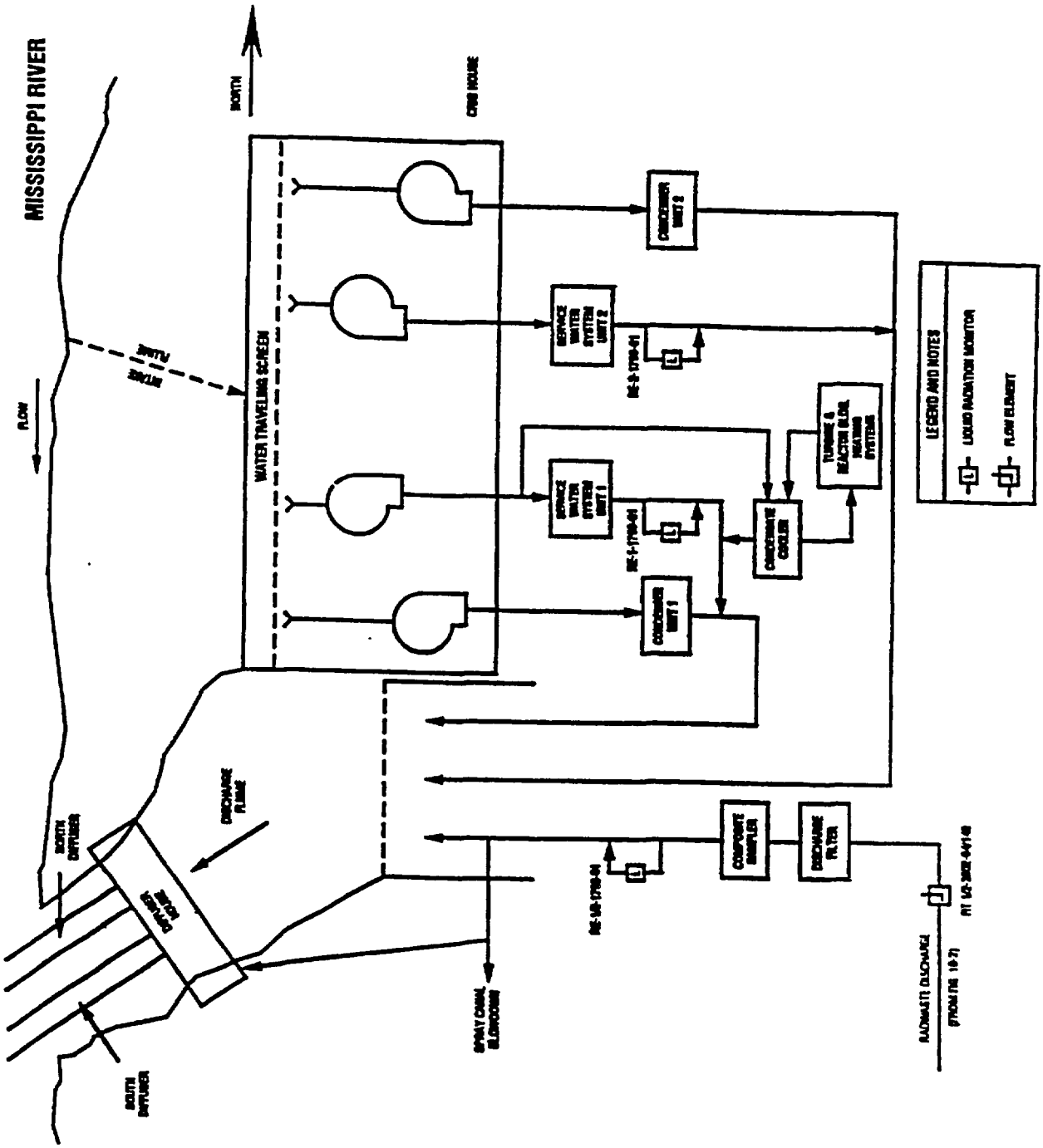
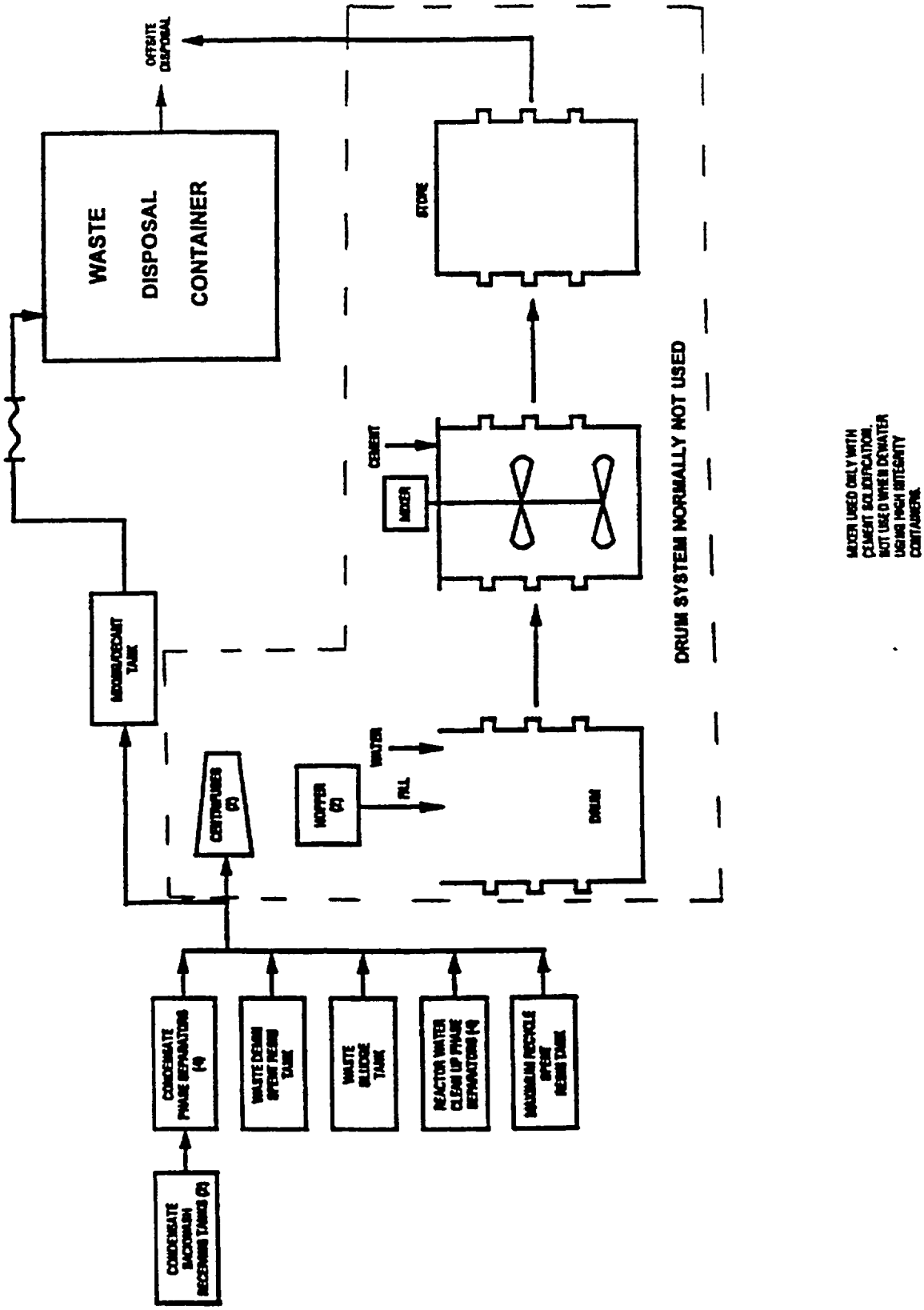


Figure 10-4
Simplified Solid Radwaste Processing Diagram



CHAPTER 11

Quad Cities Annex Revision 3

CHAPTER 11

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

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CHAPTER 11

Radiological Environmental Monitoring Program

The radiological environmental monitoring program for the environs around Quad Cities Station is presented in Table 11-1. Figures 11-1 through 11-3 show sampling locations and monitoring locations.

As part of the recent Technical Specification upgrade, the specifications which govern the Quad Cities Radiological Environmental Monitoring Program (REMP) were removed from the Technical Specifications and relocated within the Quad Cities Chapter 11 and 12 of the ODCM. Quad Cities Station will implement the Uniform Radiological Environmental Monitoring Program, which is described in Chapter 12 of the ODCM and detailed in this Chapter within Table 11-1, during the first sampling period of 1999. Figures generally denoting Quad Cities Station sample locations are contained herein. (Figures 11-1, 11-2, and 11-3).

Table 11-1

Radiological Environmental Monitoring Program

Exposure Pathway and/or Sample	Sample or Monitoring Location	Sampling or Collection Frequency	Type and Frequency of Analysis
1. Airborne Radioiodine and Particulates	a. Indicators-Near Field Q-01 Onsite No. 1 0.5 mi N (0.8 km A) Q-02 Onsite No. 2 0.4 mi ENE (0.7 km D) Q-03 Onsite No. 3 0.6 mi S (1.0 km J) Q-04 Nitrin 1.7 mi NE (2.7 km C) b. Indicators-Far Field Q-37 Meredosia Road 4.4 mi ENE (7.1 km D) Q-38 Fuller Road 4.7 mi E (7.6 km E) Q-13 Princeton 4.7 mi SW (7.6 km L) Q-16 Low Moor 5.7 mi NNW (9.2 km R) c. Control Q-7 Clinton 8.9 mi NE (14.3 km C)	Continuous sampler operation with sample collection weekly, or more frequently if required by dust loading.	Radioiodine Canisters: I-131 analysis bi-weekly on near field and control samples[1]. Particulate Sampler: Gross beta analysis following weekly filter change[2] and gamma isotopic analysis[3] quarterly on composite filters by location on near field and control samples.

Table 11-1 (Con't)

Radiological Environmental Monitoring Program

Exposure Pathway and/or Sample	Sample or Monitoring Location	Sampling or Collection Frequency	Type and Frequency of Analysis
2. Direct Radiation	a.Indicators-Inner Ring* Q-101-1, 0.6 mi N (0.9 km A) Q-101-2, 0.9 mi N (1.4 km A) Q-102-1, 1.3 mi NNE (2.2 km B) Q-102-3, 1.4 mi NNE (2.3 km B) Q-103-1, 1.2 mi NE (1.9 km C) Q-103-2, 1.2 mi NE (1.9 km C) Q-104-1, 1.1 mi ENE (1.9 km D) Q-104-2, 0.9 mi ENE (1.4 km D) Q-105-1, 0.8 mi E (1.2 km E) Q-105-2, 0.8 mi E (1.2 km E) Q-106-2, 0.7 mi ESE (1.1 km F) Q-106-3, 0.7 mi ESE (1.2 km F) Q-107-2, 0.7 mi SE (1.2 km G) Q-107-3, 0.8 mi SE (1.2 km G) Q-108-1, 1.0 mi SSE (1.5 km H) Q-108-2, 0.9 mi SSE (1.4 km H) Q-109-1, 0.9 mi S (1.4 km J) Q-109-2, 1.2 mi S (1.9 km J) Q-111-1, 2.6 mi SW (4.2 km L) Q-111-2, 2.5 mi SW (4.0 km L) Q-112-1, 2.5 mi WSW (4.0 km M) Q-112-2, 2.2 mi WSW (3.6 km M) Q-113-1, 2.5 mi W (4.1 km N) Q-113-2, 2.5 mi W (4.1 km N) Q-114-1, 2.1 mi WNW (3.5 km P) Q-114-2, 2.5 mi WNW (4.0 km P) Q-115-1, 2.6 mi NW (4.2 km Q) Q-115-2, 2.3 mi NW (3.6 km Q) Q-116-1, 2.3 mi NNW (3.7 km R) Q-116-3, 2.4 mi N (3.9 km R) * = Inner Ring TLDs are not placed within sector K because of the river at this range.	Quarterly	Gamma dose on each TLD quarterly

Table 11-1 (Con't)
Radiological Environmental Monitoring Program

Exposure Pathway and/or Sample	Sample or Monitoring Location	Sampling or Collection Frequency	Type and Frequency of Analysis
2. Direct Radiation (Cont'd)	b. Indicators-Outer Ring Q-201-1, 4.2 mi N (6.7 km A) Q-201-2, 4.2 mi N (6.7 km A) Q-202-1, 4.4 mi NNE (7.0 km B) Q-202-2, 4.8 mi NNE (7.7 km B) Q-203-1, 4.7 mi NE (7.5 km C) Q-203-2, 5.0 mi NE (8.0 km C) Q-204-1, 4.7 mi ENE (7.5 km D) Q-204-2, 4.5 mi ENE (7.2 km D) Q-205-1, 4.7 mi E (7.5 km E) Q-205-4, 4.8 mi E (7.7 km E) Q-206-1, 4.8 mi ESE (7.7 km F) Q-206-2, 4.8 mi ESE (7.7 km F) Q-207-1, 4.7 mi SE (7.6 km G) Q-207-4, 4.7 mi SE (7.6 km G) Q-208-1, 4.3 mi SSE (6.8 km H) Q-208-2, 4.9 mi SSE (7.9 km H) Q-209-1, 4.7 mi S (7.6 km J) Q-209-4, 4.7 mi S (7.6 km J) Q-210-1, 4.1 mi SSW (6.5 km K) Q-210-4, 4.1 mi SSW (6.5 km K) Q-211-1, 4.5 mi SW (7.3 km L) Q-211-2, 4.5 mi SW (7.3 km L) Q-212-1, 5.4 mi WSW (8.7 km M) Q-212-2, 4.4 mi WSW (7.2 km M) Q-213-1, 4.3 mi W (6.9 km N) Q-213-2, 4.8 mi W (7.8 km N) Q-214-1, 4.7 mi WNW (7.5 km P) Q-214-2, 4.4 mi WNW (7.1 km P) Q-215-1, 5.0 mi NW (8.0 km Q) Q-215-2, 4.2 mi NW (6.7 km Q) Q-216-1, 4.6 mi NNW (7.4 km R) Q-216-2, 4.3 mi NNW (7.0 km R)		

Table 11-1 (Con't)

Radiological Environmental Monitoring Program

Exposure Pathway and/or Sample	Sample or Monitoring Location	Sampling or Collection Frequency	Type and Frequency of Analysis
2. Direct Radiation (Cont'd)	c. Other Indicators One at each of the airborne location given in part 1.a and 1.b. Q-301-1, Public Observation Tower d. Controls One at each airborne control location given in part 1.c.		
3. Waterborne			
a. Ground/Well	a. Indicators Q-35, McMillan Well 1.5 mi S (2.4 km J) Q-36, Cordova Well 3.3 mi SSW (5.3 km K)	Quarterly	Gamma isotopic[3] and tritium analysis quarterly.
b. Drinking Water	a. Indicator There are no drinking water pathways within 6.2 mi downstream of Station.	Weekly grab sample	Gross beta and gamma Isotopic analysis[3] on monthly composite; tritium analysis on quarterly composite.
c. Surface Water	a. Indicator Q-33 Cordova, 3.3 mi SSW (5.3 km K)	Weekly grab sample	Gross beta and gamma isotopic analysis[3] on monthly composite; tritium analysis on quarterly composite.

Table 11-1 (Con't)

Radiological Environmental Monitoring Program

Exposure Pathway and/or Sample	Sample or Monitoring Location	Sampling or Collection Frequency	Type and Frequency of Analysis
3. Waterborne (Con't)			
d. Control	a. Control Q-34 Camanche 4.4 NNE (7.1 km C)	Weekly grab sample	Gross beta and gamma isotopic analysis[3] on monthly composite; tritium analysis on quarterly composite.
e. Sediments	a. Indicators Q-39 Cordova, Downstream on Mississippi River 0.8 mi SSW (1.3 km K)	Semiannually	Gamma isotopic analysis[3] semiannually.
4. Ingestion			
a. Milk	a. Indicators Q-26 Bill Stanley Dairy, 3.5 mi ESE (4.8 km F) There are no other participating dairies within 6.2 miles. b. Controls There are no control dairies within 9.3 to 18.6 miles.	Biweekly: May through October or monthly: November through April	Gamma isotopic[3] and I-131 analysis[4] biweekly May through October, monthly November through April.

Radiological Environmental Monitoring Program

Exposure Pathway and/or Sample	Sample or Monitoring Location	Sampling or Collection Frequency	Type and Frequency of Analysis
b. Fish	a. Indicator Q-24 Pool #14 of Miss. River, 0.5 mi SW (0.8 km L) b. Control Q-29 Missippi River-Upstream 1.0 mi N (1.6 kmA)	Two times annually	Gamma isotopic analysis[3] on edible portions
c. Food Products	a. Indicators Two sample locations from each of the four major quadrants within 6.2 mi. Sample locations for food products may vary based on availability and therefore are not required to be identified here but shall be taken. b. Controls Two samples grown within 9.3 to 18.6 mi.	Once annually.	Gamma isotopic analysis[3] on edible portions.

Table 11-1 (Con't)

Radiological Environmental Monitoring Program

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1 Far field samples are analyzed when near field results are inconsistent with previous measurements and radioactivity is confirmed as having its origin in airborne effluents released from the station, or at the discretion of the Health Physics Support Supervisor.

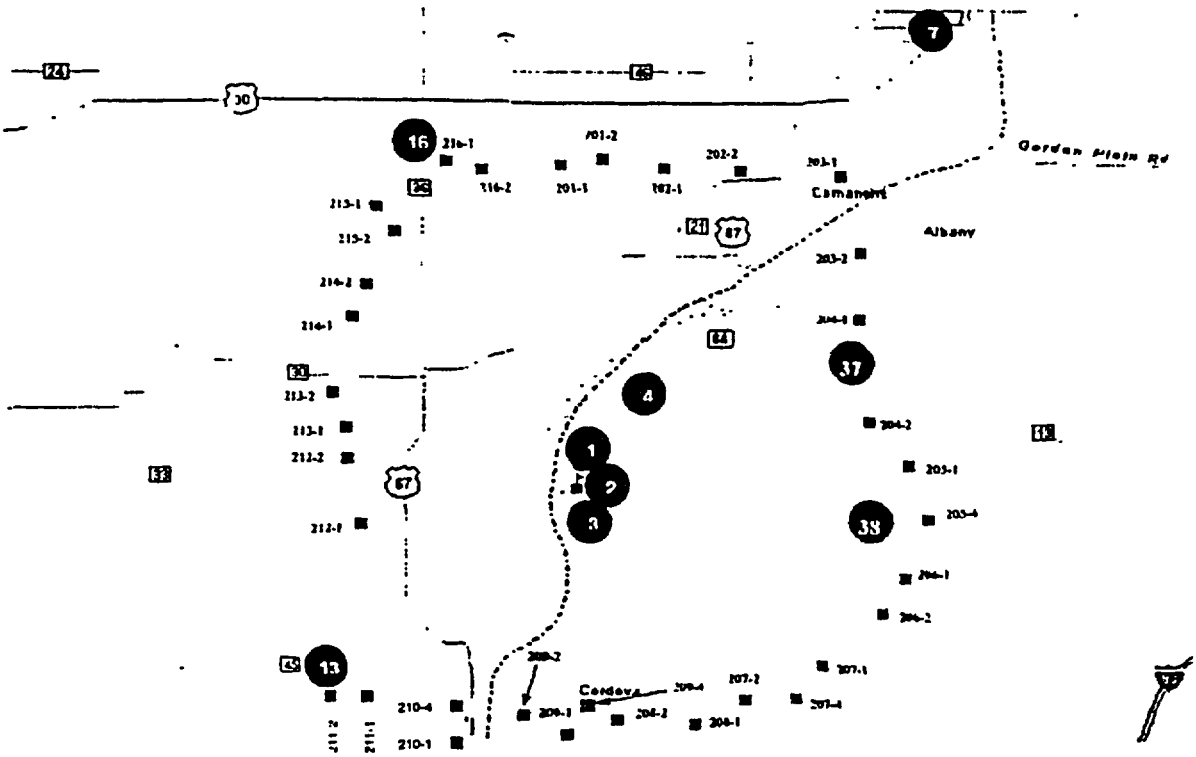
2 Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than 10 times the yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples.

3 Gamma isotopic analysis means the identification and quantification of gamma emitting radionuclides that may be attributable to the effluents from the station.

4 I-131 analysis means the analytical separation and counting procedure are specific for this radionuclide.

Figure 11-1.

Quad Cities Outer Ring TLD's
and Air Sampling Sites



● = Air Sampling Sites

■ = Outer Ring TLD Locations

Figure 11-2.

Quad Cities Inner Ring TLD Locations

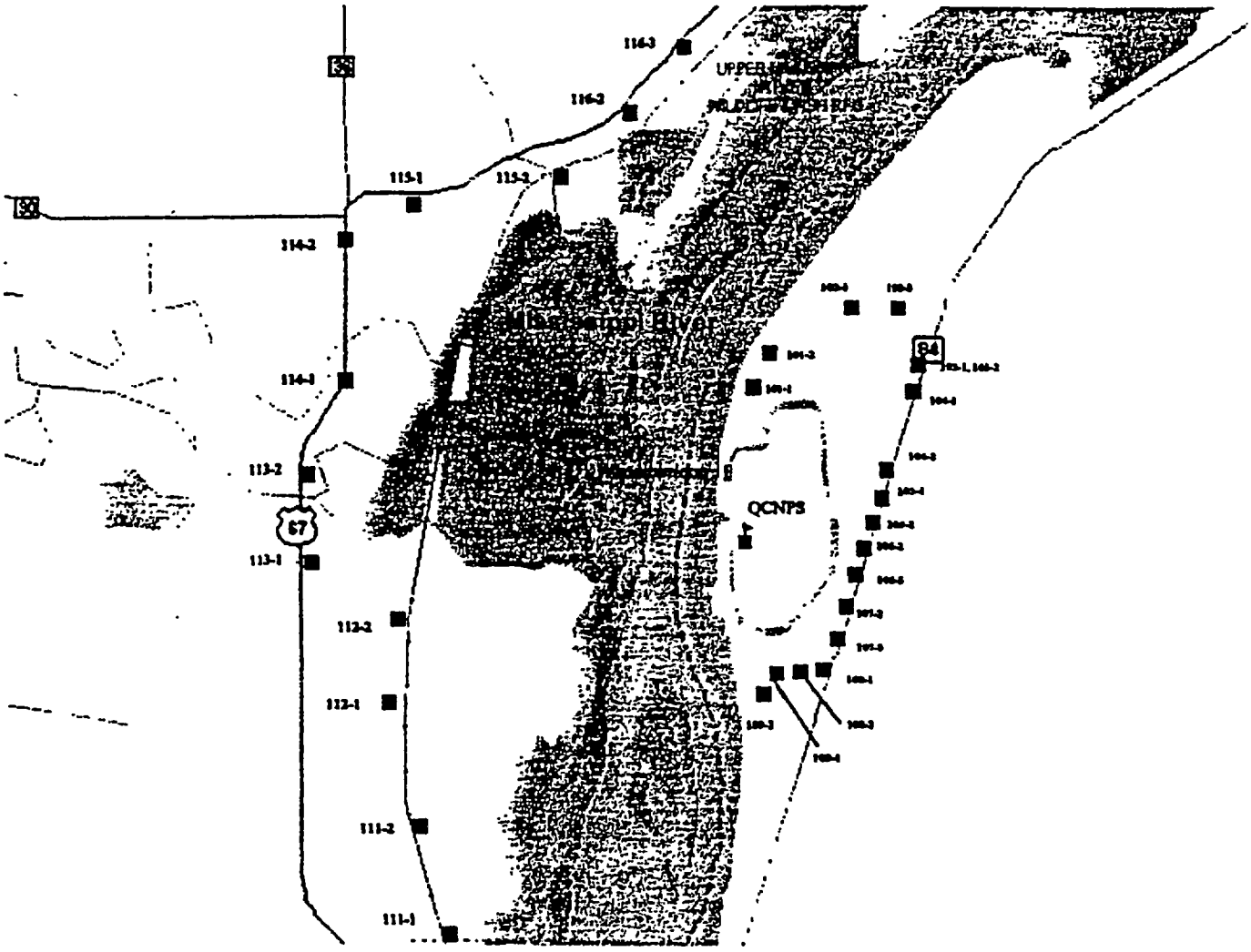
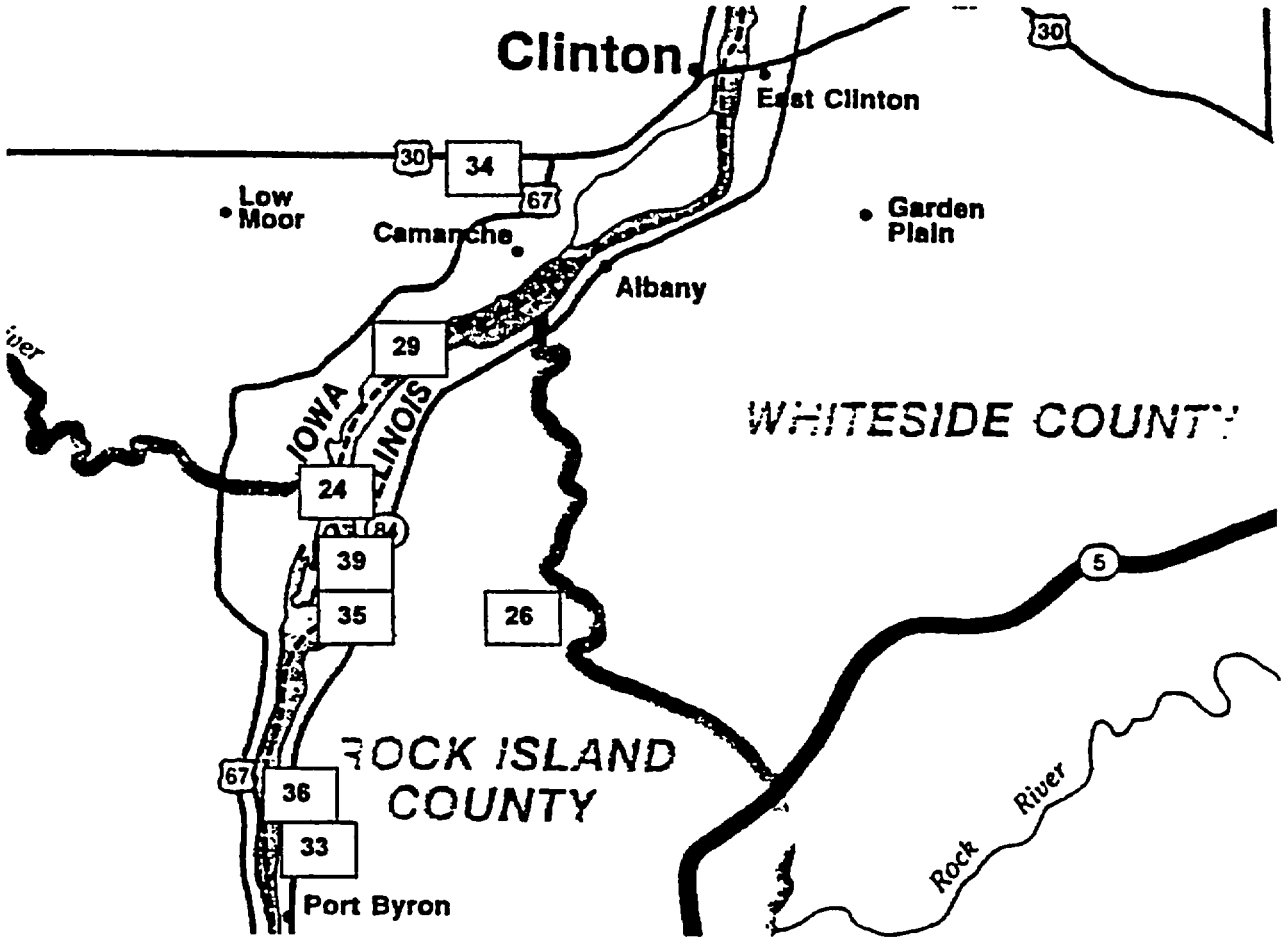


Figure 11-3.

Milk, Fish, Water and Sediment Sampling Locations



CHAPTER 12

Quad Cities Annex Index

Revision 5
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CHAPTER 12

RADIOACTIVE EFFLUENT TECHNICAL STANDARDS (RETS)

Table of Contents

CHAPTER 12

RADIOACTIVE EFFLUENT TECHNICAL STANDARDS (RETS)

LIST OF TABLES

12.0 RADIOLOGICAL EFFLUENT TECHNICAL STANDARDS

Chapter 12 of the Quad Cities Station ODCM is a compilation of the various regulatory requirements, surveillance and bases, commitments and/or components of the radiological effluent and environmental monitoring programs for Quad Cities Station. To assist in the understanding of the relationship between effluent regulations, ODCM equations, RETS (Chapter 12 section) and related Technical Specification requirements, Table 12.0-1 is a matrix which relates these various components. The Radiological Environmental Monitoring Program fundamental requirements are contained within this chapter, with Quad Cities specific information in Chapter 11 and with a supplemental matrix in Table 12.0-2.

Table 12.0-1

EFFLUENT COMPLIANCE MATRIX

Regulation	Dose Component Limit	ODCM Equation	RETS	Technical Specification
10 CFR 50 Appendix I	1. Gamma air dose and beta air dose due to airborne radioactivity in effluent plume.	A-1 A-2	12.4.2	5.5.4.h
	a. Total body and skin dose due to airborne radioactivity in effluent plume are reported only if certain gamma and beta air dose criteria are exceeded.	A-3 A-4	N/A	N/A
	2. Dose for all organs and all four age groups due to iodines and particulates in effluent plume. All pathways are considered.	A-7	12.4.3	5.5.4.i
	3. Dose for all organs and all four age groups due to radioactivity in liquid effluents.	A-17	12.3.2	5.5.4.d
10 CFR 20	1. Total Dose, totaling all external dose components (direct, ground and plume shine) and internal dose (all pathways, both airborne and liquid-borne).	A-25	12.4.6	5.5.4.c
40 CFR 190 (now by reference, also part of 10 CFR 20)	1. Total body dose due to direct dose, ground and plume shine from all sources at a station.	A-24	12.4.5	5.5.4.j
	2. Organ doses to an adult due to all pathways.	A-25		
Technical Specifications	1. "Instantaneous" whole body, skin, and organ dose rates due to radioactivity in airborne effluents. For the organ dose, only child inhalation is considered.	A-5 A-6 A-16	12.4.1	5.5.4.g
	2. "Instantaneous" concentration limits for liquid effluents.	A-21	12.3.1	5.5.4.b
Technical Specifications	1. Radioactive Effluent Release Report	NA	12.6.1	5.6.3

Table 12.0-2

REMP Compliance Matrix

Regulation	Component	RETS	Technical Specification
10CFR50 Appendix I Section IV.B.2	Implement environmental monitoring program.	12.5.1	N/A
10CFR50 Appendix I Section IV.B.3	Land Use Census	12.5.2	N/A
10CFR50 Appendix I Section IV.B.2	Interlaboratory Comparison Program	12.5.3	N/A
10CFR50 Appendix I Section IV.B.2 and Technical Specifications	Annual Radiological Environmental Operating Report	12.6.2	5.6.2

12.1 DEFINITIONS

1. Channel Calibration - A Channel Calibration shall be the adjustment, as necessary, of the channel output such that it responds with the necessary range and accuracy to known values of the parameter which the channel monitors. The Channel Calibration shall encompass the entire channel, including the sensor, alarm and trip functions, and shall include the channel Functional Test. Calibration of instrument channels with resistance temperature detector (RTD) or thermocouple sensors may consist of an inplace qualitative assessment of sensor behavior and normal calibration of the remaining adjustable devices in the channel. The Channel Calibration may be performed by any series of sequential, overlapping or total channel steps so that the entire channel is calibrated.

2. Channel Check - A Channel Check shall be the qualitative assessment,by observation, of channel behavior during operation. This determination shall include, where possible, comparison of the channel indication and status to other indications or status derived from independent instrument channels measuring the same parameter.

3. Channel Function Test - A Channel Functional Test shall be the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify Operability, including required alarm interlock, display trip functions and channel failure trips.

   The Channel Functional Test may be performed by any series of sequential, overlapping, or total channel steps such that the entire channel is tested.

4. Dose Equivalent I-131 - Dose Equivalent I-131 is that concentration of I-131 (microcurie/ gram) that alone would produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed in Table E-7 of Regulatory Guide 1.109, Rev. 1, NRC, 1977; or ICRP 30, Supplement to Part 1, PP 192-272, Table titled "Committed Dose Equipvalent in Target Organs or Tissues per Intake of Unit Activity". Table III of TID-14844, AEC, 1962 "Calculation of Distance Factors For Power and Test Reactor Sites."

5. Frequency - Table 12.1-1 provides the definitions of various frequencies for which surveillance, sampling, etc. are performed unless defined otherwise. The provisions of Technical Specifications SR3.0.2 and SR3.0.3 are applicable to the frequencies except that they do not apply to frequencies associated with the Radiological Environmental Monitoring Program (Section 12.5).

6. Immediate - Immediate means that the required action should be pursued without delay and in a controlled manner

7. Member(s) of the Public - Member(s) of the Public means any individual except when that individual is receiving an occupational dose.

8. Mode-A MODE shall correspond to any one inclusive combination of mode switch position, average reactor coolant temperature, and reactor vessel head closure bolt tensioning specified in Table 12.1-2 with fuel in the reactor vessel.

9. Occupational Dose-Occupational dose means the dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation and/or to radioactive material from licensed and unlicensed sources of radiation, whether in the possession of the licensee or other person. Occupational dose does not include dose from background radiation, as a patient from medical practices, from voluntary participation in medical research programs, or as a member of the public.

10. Offsite Dose Calculation Manual (ODCM)
    a. The ODCM shall contain the methodology and parameters used in the calculation of offsite doses resulting from radioactive gaseous and liquid effluents, in the calculation of gaseous and liquid effluent monitoring alarm and trip setpoints, and in the conduct of the Radiological Environmental Monitoring Program.
    b. The ODCM shall also contain the radioactive effluent controls and Radiological Environmental Monitoring Programs required by Sections 12-5 and (2) descriptions of the information that should be included in the Annual Radiological Environmental Operating and Radioactive Effluent Release Reports required by Sections 12.6.2 and 12.6.1.

11. Operable - Operability - A system, subsystem, division, component, or device shall be Operable or have Operability when it is capable of performing its specified safety function(s) and when all necessary attendant instrumentation, controls, normal and emergency electrical power sources, cooling and seal water, lubrication and other auxiliary equipment that are required for the system, subsystem, division, component, and device to perform its specified safety function(s) are also capable of performing their related support function(s).

12. Operating - Operating means that a system, subsystem, train, component or device is performing its intended functions in its required manner.

13. Operating Cycle - Operating Cycle is the interval between the end of one Refueling Outage for a particular unit and the end of the next subsequent Refueling Outage for the same unit.

14. Process Control Program (PCP) - The PCP shall contain the current formulas, sampling, analyses, test, and determinations to be made to ensure that processing and packaging of solid radioactive wastes based on demonstrated processing of actual or simulated wet solid wastes will be accomplished in such a way as to assure compliance with 10CFR Parts 20, 61, and 71, State regulations, burial ground requirements, and other requirements governing the disposal of solid radioactive waste.

15. Protective Instrumentation Definitions - Protective instrumentation definitions are as follows:

    a. Channel - A Channel is an arrangement of a sensor and associated components used to evaluate plant variables and produce discrete outputs used in logic. A Channel terminates and loses its identity where individual Channel outputs are combined in a logic.

    b. Trip System - A Trip System means an arrangement of instrument Channel trip signals and auxiliary equipment required to initiate action to accomplish a protective trip function. A Trip System may require one or more instrument Channel trip signals related to one or more plant parameters in order to initiate Trip System action. Initiation of Protective Action may require the tripping of a single Trip System or the coincident tripping of two Trip Systems.

    c. Protective Action - An action initiated by the protection system when a limit is reached. A Protective Action can be at the Channel or system level.

    d. Protective Function - A system protective action which results form the Protective Action of the Channels monitoring a particular plant condition.

16. Rated Thermal Power – RTP shall be a total reactor core heat transfer rate to the reactor coolant in MWt.

17. Reactor Power Operation - Reactor Power Operation is any operation with the mode switch in the Startup/Hot Standby or Run position with the reactor critical and above 1% Rated Thermal Power.

18. Reactor Vessel Pressure - Reactor Vessel Pressures listed in the Technical Specifications, unless otherwise indicated, are those measured by the reactor vessel steam space detector.

19. Refueling Outage - Refueling Outage is the period of time between the shutdown of the unit prior to a refueling and startup of the plant subsequent to that refueling. For the purpose of designating frequency of testing and surveillance, a Refueling Outage shall mean a regularly scheduled Refueling Outage; however, where such outages occur within 8 months of the completion of the previous Refueling Outage, the required surveillance testing need not be performed until the next regularly scheduled outage.

20. Site Boundary - Site Boundary shall be that line beyond which the land is neither owned, nor leased, nor otherwise controlled by the licensee.

21. Unrestricted Area - Unrestricted Area means an area, access to which is neither limited nor controlled by the licensee.

22. Source Check - Source Check is the qualitative assessment of channel response when the channel sensor is exposed to a radioactive source.

23. Definitions Related to Estimating Dose to the Public Using the Appendix I Computer Program:

    a. Actual - Refers to using known release data to project the dose to the public for the previous month. This data is stored in the database and used to demonstrate compliance with the reporting requirements of Chapter 12.

    b. Projected - Refers to using known release data from the previous month or estimated release data to forecast a future dose to the public. This data is NOT incorporated into the database.

TABLE 12.1-1

SURVEILLANCE FREQUENCY NOTATION

NOTATION		FREQUENCY
S	(Shiftly)	At least once per scheduled shift
D	(Daily)	At least once per 24 hours
W	(Weekly)	At least once per 7 days
M	(Monthly)	At least once per 31 days
Q	(Quarterly)	At least once per 92 days
SA	(Semiannually)	At least once per 184 days
A	(Annually)	At least once per 366 days
B	(Biennially)	At least once per 24 months (731 days)
S/U	(Startup)	Prior to reactor startup
NA	(Not Applicable)	Not Applicable

TABLE 12.1-2

MODES

MODE	TITLE	REACTOR MODE SWITCH POSITION	AVERAGE REACTOR COOLANT TEMPERATURE(°F)
1.	POWER OPERATION	Run	N/A
2.	STARTUP	Refuel[a] or Startup/Hot Standby	N/A
3.	HOT SHUTDOWN[a]	Shutdown	> 212
4.	COLD SHUTDOWN[a]	Shutdown	≤ 212
5.	REFUELING[b]	Shutdown or Refuel	N/A

(a) All reactor vessel head closure bolts fully tensioned.

(b) One or more vessel head closure bolts less than fully tensioned or with the head removed.

12.2 INSTRUMENTATION

12.2.1 Radioactive Liquid Effluent Instrumentation

Operability Requirements

12.2.1.A The effluent monitoring instrumentation shown in Table 12.2-1 shall be OPERABLE with alarm setpoints set to ensure that the limits of 12.3.1.A are not exceeded. The alarm setpoints shall be determined in accordance with the ODCM.

Applicability: Applies to radioactive effluents from the plant.

Action:

1. With a radioactive liquid effluent monitoring instrument alarm/trip setpoint less conservative than required, without delay suspend the release of radioactive liquid effluents monitored by the affected instrument, or declare the instrument inoperable, or change the setpoint so it is acceptably conservative.

2. With one or more radioactive liquid effluent monitoring instruments INOPERABLE, take the ACTION shown in Table 12.2-1. Exert best efforts to return the instrument to operable status within 30 days and, if unsuccessful, explain in the next Radioactive Effluent Release Report why the inoperability was not corrected in a timely manner.

3. In the event a limiting condition for operation and associated action requirements cannot be satisfied because of circumstances in excess of those addressed in the specifications, provide a 30-day written report to the NRC and no changes are required in the operational condition of the plant, and this does not prevent the plant from entry into an operational mode.

Surveillance Requirements

12.2.1.B Each radioactive liquid effluent monitoring instrument shown in Table 12.2-2 shall be demonstrated operable by performance of the given source check, Channel Check, Channel Calibration, and Functional Test operations at the frequencies shown in Table 12.2-2.

Applicability: Applies to the periodic measurements of radioactive effluents.

Bases

12.2.1.C The radioactive liquid effluent instrumentation is provided to monitor the release of radioactive materials in liquid effluents during releases. The alarm setpoints for the instruments are provided to ensure that the alarms will occur prior to exceeding the limits of RETS and 10 CFR 20.

TABLE 12.2-1

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

Minimum No. of Operable Channels	Total No. of Channels	Parameter	Action[1]
1	1	Service Water Effluent Gross Activity Monitor	A
1	1	Liquid Radwaste Effluent Flow Rate Monitor	C
1	1	Liquid Radwaste Effluent Gross Activity Monitor	B

[1] Notes

Action A: With less than the minimum number of operable channels, releases via this pathway may continue, provided that at least once per 12 hours grab samples are collected and analyzed for beta or gamma activity at an LLD of less than or equal to 10^{-7} μCi/ml.

Action B: With less than the minimum number of operable channels, effluent releases via this pathway may continue, provided that prior to initiating a release, at least 2 independent samples are analyzed in accordance with Section 12.3.A.1, and at least 2 members of the facility staff independently verify the release calculation and discharge valving. Otherwise, suspend release of radioactive effluents via this pathway.

Action C: With less than the minimum number of operable channels, releases via this pathway may continue, provided the flow rate is estimated at least once per 4 hours during actual releases. Pump curves may be utilized to estimate flow.

TABLE 12.2-2

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

Instrument	Channel Check(1)	Channel Calibration(1)(3)	Channel Functional Test(1)(2)	Source Check(1)
Liquid Radwaste Effluent Gross Activity Monitor	D	B	Q (7)	(5)(6)
Service Water Effluent Gross Activity Monitor	D	B	Q (7)	(5)
Liquid Radwaste Effluent Flow Rate Monitor	(4)	B	NA	NA

Notes

(1) D = once per 24 hours
Q = once per 92 days
B = once per 24 months (731 days)

(2) The Instrument Functional Test shall also demonstrate that control room alarm annunciation occurs, if any of the following conditions exist, where applicable.

a. Instrument indicates levels above the alarm setpoints.
b. Circuit failure.
c. Instrument indicates a downscale failure.
d. Instrument controls not set in OPERATE mode.

(3) Channel Calibration shall include performance of a Functional Test.

(4) Channel Instrument Check to verify flow during periods of release.

(5) Channel Calibration shall include performance of a source check.

(6) Source check shall consist of observing instrument response during a discharge.

(7) Channel Functional test may be performed by using trip check and test circuitry associated with the monitor chassis.

12.2 INSTRUMENTATION

12.2.2 Radioactive Gaseous Effluent Instrumentation

Operability Requirement

12.2.2.A The effluent monitoring instrumentation shown in Table 12.2-3 shall be OPERABLE with alarm/trip setpoints set to ensure that the limits of Section 12.4 are not exceeded. The alarm/trip setpoints shall be determined in accordance with the ODCM.

Applicability: As shown in Table 12.2-3.

Action:

1. With a radioactive gaseous effluent monitoring instrument alarm/trip set point less conservative than required, without delay suspend the release of radioactive gaseous effluents monitored by the affected instrument, or declare the instrument inoperable, or change the setpoint so it is acceptably conservative.

2. With one or more radioactive gaseous effluent monitoring instruments inoperable, take the action shown in Table 12.2-3. Exert best efforts to return the instrument to operable status within 30 days and, if unsuccessful, explain in the next Semi-Annual Radioactive Effluent Release Report why the inoperability was not corrected in a timely manner. This is in lieu of an LER.

3. In the event a limiting condition for operation and associated action requirement cannot be satisfied because circumstances in excess of those addressed in the specifications, provide a 30-day written report to the NRC and no changes are required in the operational condition of the plant, and this does not prevent the plant from entry into an operational mode.

Surveillance Requirements

12.2.2.B Each radioactive gaseous radiation monitoring instrument in Table 12.2-4 shall be demonstrated operable by performance of the given source check, Channel Check, Channel Calibration, and Functional Test operations at the frequency shown in Table 12.2-4.

Bases

12.2.2.C The radioactive gaseous effluent instrumentation is provided to monitor the release of radioactive materials in gaseous effluents during releases. The alarm setpoints for the instruments are provided to ensure that the alarms will occur prior to exceeding the limits of RETS and 10 CFR 20.

TABLE 12.2-3

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

Minimum No. of Operable Channels[1]	Total No. of Channels	Parameter	Action [2]
1	2	SJAE Radiation Monitors	D
1	2	Main Chimney Noble Gas Activity Monitor	A
1	1	Main Chimney Iodine Sampler	C
1	1	Main Chimney Particulate Sampler	C
1	1	Reactor Bldg. Vent Sampler Flow Rate Monitor	B
1	1	Reactor Bldg. Vent Iodine Sampler	C
1	1	Reactor Bldg. Vent Particulate Sampler	C
1	1	Main Chimney Sampler Flow Rate Monitor	B
1	1	Main Chimney Flow Rate Monitor	B
1	2	Reactor Bldg. Vent Noble Gas Monitor	E
1	1	Main Chimney High Range Noble Gas Monitor	F

Notes

(1) For SJAE monitors, applicable during SJAE operation. For other instrumentation, applicable at all times.

(2) Action A: With the number of operable channels less than the minimum requirement, effluent releases via this pathway may continue, provided grab samples are taken at least once per 8 hour shift and these samples are analyzed within 24 hours.

TABLE 12.2-3 (Con't)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

Action B: With the number of operable channels less than the minimum required, effluent releases via this pathway may continue provided that the flow rate is estimated at least once per 4 hours.

Action C: With less than the minimum channels operable, effluent releases via this pathway may continue provided samples are continuously collected with auxiliary sampling equipment, as required in Table 12.4-1.

Action D: With less than the minimum channels operable, gases from the main condenser off gas system may be released to the environment for up to 72 hours provided at least one chimney monitor is operable; otherwise, be in MODE 2 in 12 hours.

Action E: With less than the minimum channels operable, immediately suspend release of radioactive effluents via this pathway.

Action F: With less than the minimum channels operable, initiate the preplanned alternate method of monitoring the appropriate parameter(s) within 72 hours, and:

(1) either restore the inoperable channel(s) to operable status within 7 days of the event, or

(2) prepare and submit a Special Report to the Commission within 30 days following the event outlining the action taken, the cause of the inoperability and the plans and schedule for restoring the system to operable status.

TABLE 12.2-4

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

Instrument	Mode(2)	Channel Check(1)	Channel Calibration(1)(4)	Channel Functional Test(1)(3)	Source Check(1)
Main Chimney Noble Gas Activity Monitor	B	D	B	Q	M
Main Chimney Sampler Flow Rate Monitor	B	D	B	Q[6]	NA
Reactor Bldg. Vent Sampler Flow Rate Monitor	B	D	B	Q[6]	NA
Main Chimney Flow Rate Monitor	B	D	B	NA	NA
Reactor Bldg Vent Activity Monitor	B	D	B	Q	Q
SJAE	A	D	B	Q	B
Main Chimney Iodine and Particulate Sampler	B	D[5]	NA	NA	NA
Reactor Bldg. Vent Iodine and Particulate Sampler	B	D[5]	NA	NA	NA
Main Chimney High Range Noble Gas Monitor	B	D[5]	B	Q	M

Notes

(1) D = once per 24 hours
M = once per 31 days
Q = once per 92 days
B= once per 24 months (731 days)

(2) A = during SJAE operation
B = at all times

(3) The Instrument Functional Test shall also demonstrate that control room alarm annunciation occurs, if any of the following conditions exist, where applicable:

a. Instrument indicates levels above the alarm setpoint
b. Circuit failure
c. Instrument indicates a downscale failure
d. Instrument controls not set in OPERATE mode

TABLE 12.2-4 (cont'd)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

(4) Channel Calibration shall include performance of a functional test.

(5) Channel Instrument Check to verify operability of the instrument; that the instrument is in place and functioning properly.

(6) Channel Functional Test shall be performed on local switches providing low flow alarm.

12.3 LIQUID EFFLUENTS

12.3.1 Concentration

Operability Requirements

12.3.1.A. The concentration of radioactive material released from the site to unrestricted areas (at or beyond the site boundary, see Quad Cities Station ODCM Annex, Appendix F, Figure F-1) shall be limited to 10 times the concentrations specified in Appendix B, Table 2, Column 2 to 10 CFR 20.1001-20.2402 with the Table 12.3-1 values representing the AC's for noble gases.

Applicability: At all times

Action:

With the concentration of radioactive material released from the site to unrestricted areas exceeding the above limits, without delay decrease the release rate of radioactive materials and/or increase the dilution flow rate to restore the concentration to within the above limits.

Surveillance Requirements

12.3.1.B The concentration of radioactive material in unrestricted areas shall be determined to be within the prescribed limits by obtaining the representative samples in accordance with the sampling a analysis program specified in Table 12.3-2. The sample analysis results will be used with the calculational methods in the ODCM to determine that the concentrations are within the limits of Specification 12.3.A.

Bases

12.3.1.C This specification is provided to ensure that the concentration of radioactive materials released liquid waste effluents from the site to unrestricted areas will be less than 10 times the concentration levels specified in Appendix B, Table 2, Column 2 to 10CFR20.1001 - 20.2402. The concentration limit for noble gases was converted to an equivalent concentration in water using the International Commission on Radiological Protection (ICRP) Publication 2.

TABLE 12.3-1

ALLOWABLE CONCENTRATION (AC) OF DISSOLVED OR ENTRAINED NOBLE GASES RELEASED FROM THE SITE TO UNRESTRICTED AREAS IN LIQUID WASTE

NUCLIDE	AC(μCi/ml)*
Kr-85m	2×10^{-4}
Kr-85	5×10^{-4}
Kr-87	4×10^{-5}
Kr-88	9×10^{-5}
Ar-41	7×10^{-5}
Xe-131m	7×10^{-4}
Xe-133m	5×10^{-4}
Xe-133	6×10^{-4}
Xe-135m	2×10^{-4}
Xe-135	2×10^{-4}

* Computed from Equation 20 of ICRP Publication 2 (1959), adjusted for infinite cloud submersion in water, and R = 0.01 rem/week, density = 1.0 g/cc and Pw/Pt = 1.0.

TABLE 12.3-2
RADIOACTIVE LIQUID WASTE SAMPLING
AND ANALYSIS PROGRAM

LIQUID RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION[a] (LLD) (μCi/ml)
A. Batch Waste Release Tanks	Prior to Each Batch	Prior to Each Batch	Principal Gamma Emitters[e]	$5x10^{-7}$
			I-131	$1x10^{-6}$
	Prior to Each Batch	M Composite[b]	Gross Alpha	$1x10^{-7}$
			H-3	$1x10^{-5}$
	Prior to Each Batch	Q Composite[b]	Fe-55	$1x10^{-6}$
			Sr-89, Sr-90	$5x10^{-8}$
	Prior to One Batch/M	M	Dissolved & Entrained Gases[f] (Gamma Emitters)	$1x10^{-5}$
B. Plant Continuous Releases	M[c] (Grab Sample)	M[c]	I-131	$1x10^{-6}$
			Principle Gamma Emitters[e]	$5x10^{-7}$
			Dissolved and Entrained Gases[f] (Gamma Emitters)	$1x10^{-5}$
			H-3	$1x10^{-5}$
			Gross Alpha	$1x10^{-7}$
	Q[c] (Grab Sample)	Q[c]	Sr-89, Sr-90	$5x10^{-8}$
			Fe-55	$1x10^{-6}$

TABLE 12-3-2 (Continued)

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

TABLE NOTATION

a. The LLD is defined in Notation A of Table 12.5-3.

b. A composite sample is one in which the quantity of liquid samples is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen which is representative of the liquids released.

c. If the alarm setpoint of the service water effluent monitor as determined in the ODCM is exceeded, the frequency of analysis shall be increased to daily until the condition no longer exists.

d. A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analyses, each batch shall be isolated then thoroughly mixed to assure representative sampling. A continuous release is the discharge of liquid wastes of a nondiscrete volume; e.g., from a volume or system that has an input flow during the release.

e. The principal gamma emitters for which the LLD specification applies exclusively are the following radionuclides: Mn-54, Fe-59, Co-60, Zn-65, Co-58, Mo-99, Cs-134, Cs-137 and Ce-141. Ce-144 shall also be measured with an LLD of 5×10^{-6}. Other peaks which are measurable and identifiable by gamma ray spectrometry together with the above nuclides, shall be also identified and reported when the actual analysis is performed on a sample. Nuclides which are below the LLD for the analyses shall not be reported as being present at the LLD level for that nuclide.

f. The dissolved and entrained gases (gamma emitters) for which the LLD specification applies exclusively are the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138. Other dissolved and entrained gases (gamma emitters) which are measurable and identifiable by gamma-ray spectrometry, together with the above nuclides, shall also be identified and reported when an actual analysis is performed on a sample. Nuclides which are below the LLD for the analyses shall not be reported as being present at the LLD level for that nuclide.

12.3 LIQUID EFFLUENTS

12.3.2 Dose

Operability Requirements

12.3.2.A The dose or dose commitment above background to a member of the public from radioactive materials in liquid effluents released to unrestricted areas (at or beyond the site boundary) from the site shall be limited to the following:

1. During any calendar quarter:
   (a) Less than or equal to 3 mrem to the whole body.
   (b) Less than or equal to 10 mrem to any organ.

Applicability: At all times

2. During any calendar year:
   (a) Less than or equal to 6 mrem to the whole body.
   (b) Less than or equal to 20 mrem to any organ.

Action:

1. With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions taken and the proposed actions to be taken to ensure that future releases are in compliance with 12.3.2.A. This is in lieu of a Licensee Event Report.

2. With the calculated dose from the release of radioactive materials in liquid effluents exceeding the limits of Specification 12.3.2.A., prepare and submit a Special Report to the Commission within 30 days an limit the subsequent releases such that the dose or dose commitment to a member of the public from all uranium fuel cycle sources is limited to less than or equal to 25 mrem to the total body or any organ (except thyroid, which is limited to less than or equal to 75 mrem) over 12 consecutive months.

   This Special Report shall include an analysis which demonstrates that radiation exposures to all members of the public from all uranium fuel cycle sources (including all effluent pathways and direct radiation) are less than the 40 CFR Part 190 Standard. Otherwise obtain a variance from the Commission to permit releases which exceed the 40 CFR Part 190 Standard. The radiation exposure analysis contained in the Special Report shall use methods prescribed in the ODCM. This report is in lieu of a Licensee Event Report.

3. With the projected annual whole body or any internal organ dose computed at the nearest downstream community water system is equal to or exceeds 2 mrem from all radioactive materials released in liquid effluents from the Station, prepare and submit a Special Report within 30 days to the operator of the community water system. The report is prepared to assist the operator in meeting the requirements of 40 CFR 141: EPA Primary Drinking Water Standards. A copy of this report will be sent to the NRC. This is in lieu of a Licensee Event Report.

12.3 LIQUID EFFLUENTS

12.3.2 Dose (Cont.)

Surveillance Requirements

12.3.2.B.1. The dose contributions from measured quantities of radioactive material shall be determined by calculation at least once per 31 days and a cumulative summation of these total body and organ doses shall be maintained for each calendar quarter.

12.3.2.B.2 Doses computed at the nearest community water system will consider only the drinking water pathway and shall be projected using the methods prescribed in the ODCM at least once per 92 days.

Bases

12.3.2.C This specification is provided to implement the requirements of Sections II.A, III.A and IV.A of Appendix I, 10 CFR Part 50. The Limiting Condition for Operation implements the guides set forth in Section II.A of Appendix I. The statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents will be kept "as low as is reasonably achievable". The dose calculations in the ODCM implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents will be consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I", Revision 1, October 1977 and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I", April 1977. NUREG-0113 provides methods for dose calculations consistent with Reg Guide 1.109 and 1.113.

12.3 LIQUID EFFLUENTS

12.3.3 Liquid Radwaste Treatment System

Operability Requirements

12.3.3.A At all times during processing prior to discharge to the environs, process and control equipment provided to reduce the amount or concentration of radioactive materials shall be operated when the projected dose due to liquid effluent releases to unrestricted areas (see Appendix F, Figure F-1), when averaged over 31 days, exceeds 0.13 mrem to the total body or 0.42 mrem to any organ

Action:

1. If liquid waste has to be or is being discharged without treatment as required above, prepare and submit to the Commission within 30 days, a report which includes the following information:

   a. Identification of the defective equipment.
   b. Cause of the defective equipment.
   c. Action(s) taken to restore the equipment to an operating status.
   d. Length of time the above requirements were not satisfied.
   e. Volume and curie content of the waste discharged which was not processed by the inoperable equipment but which required processing.
   f. Action(s) taken to prevent a recurrence of equipment failures.

2. In the event a limited and/or associated action requirements identified in Sections 12.3.3.A cannot be satisfied because of circumstances in excess of those addressed in this Section, no changes are required in the operational condition of the plant, and this does not prevent the plant from entry into an operational mode.

Surveillance Requirements

12.3.3.B Doses due to liquid releases to unrestricted areas (at or beyond the site boundary) shall be projected at least once per 31 days in accordance with ODCM.

Bases

12.3.3.C The operability of the liquid radwaste treatment system ensures that this system will be available for use whenever liquid effluents require treatment prior to release to the environment. The requirement that the appropriate portions of this system be used when specified provides assurance that the releases of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable". This specification implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50 and design objective Section 11.D of Appendix I to 10 CFR Part 50.

12.4 GASEOUS EFFLUENTS

12.4.1 Dose Rate

Operability Requirements

12.4.1.A The dose rate in unrestricted areas (at or beyond the site boundary, see Quad Cities Station ODCM Annex, Appendix F, Figure F-1) due to radioactive materials released in gaseous effluents from the site shall be limited to the following:

1. For Noble Gases:

   (a) Less than 500 mrem/year to the whole body.
   (b) Less than 3000 mrem/year to the skin.

2. For iodine-131, for iodine 133, and for all radionuclides in particulate form with half-lives greater than 8 days less than 1500 mrem/year.

Action:

If the dose rates exceed the above limits, without delay decrease the release rates to bring the dose rates within the limits, and to provide prompt notification to the Commission (12.6)

Surveillance Requirements

12.4.1.B The dose rates due to radioactive materials released in gaseous effluents from the site shall be determined to be within the prescribed limits by obtaining representative samples in accordance with the sampling and analysis program specified in Table 12.4-1. The dose rates are calculated using methods prescribed in the Offsite Dose Calculation Manual (ODCM).

Bases

12.4.1.C This specification provides reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of a Member of the Public in an Unrestricted Area, either at or beyond the Site Boundary in excess of the design objectives of appendix I to 10 CFR part 50. This specification is provided to ensure that gaseous effluents from all units on the site will be appropriately controlled. It provides operational flexibility for releasing gaseous effluents to satisfy the Section II.A design objectives of appendix I to 10 CFR part 50. For Members of the Public who may at times be within the Site Boundary, the occupancy will usually be sufficiently low to compensate for the reduced atmospheric dispersion of gaseous effluents relative to that for the Site Boundary. Examples of calculations for such Members of the Public, w ith appropriate occupancy factors, shall be given in the ODCM. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to an individual at or beyond the unrestricted area boundary to less than or equal to a dose rate of 500 mrem/year to the total body or to not less than or equal to a dose rate of 3000 mrem/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to a child via the inhalation pathway to not less than or equal to a dose rate of 1500 mrem/year. For purposes of calculating doses resulting from airborne releases the main chimney is considered to be an elevated release point, and the reactor vent stack is considered to be a mixed mode release point.

TABLE 12.4-1

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

GASEOUS RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION[a] (LLD) (μCi/ml)
A. Main Chimney Reactor Bldg. Vent Stack	M Grab Sample	M[b]	Principal Gamma Emitters[e]	$1x10^{-4}$
		M	Tritium	$1x10^{-6}$
B. All Release Types as Listed in A Above	Continuous (d)	W[c] Charcoal Sample	I-131	$1x10^{-12}$
			I-133	$1x10^{-10}$
	Continuous (d)	W[c] Particulate Sample	Principal Gamma Emitters[e] (I-131, others)	$1x10^{-11}$
	Continuous (d)	Q Composite Particulate Sample	SR-89	$1x10^{-11}$
			SR-90	$1x10^{-11}$
	Continuous (d)	M Composite Particulate Sample	Gross Alpha	$1x10^{-11}$
C. Main Chimney	Continuous (d)	Noble Gas Monitor	Noble Gases	$1x10^{-6}$
D. Reactor Bldg. Vent Stack	Continuous (d)	Noble Gas Monitor	Noble Gases	$1x10^{-4}$

TABLE 12.4-1 (Continued)

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

TABLE NOTATION

a. The lower limit of detection (LLD) is defined in Notation A of Table 12.5-3.

b. Sampling and analyses shall also be performed following shutdown, startup, or a thermal power change exceeding 20% RTP in 1 hour unless (1) analysis shows that the DOSE EQUIVALENT I-131 concentration in the primary coolant has not increased more than a factor of 5, and (2) the noble gas activity monitor shows that effluent activity has not increased by more than a factor of 3.

c. Samples shall be changed at least once per 7 days and the analyses completed within 48 hours after removal from the sampler. Sampling shall also be performed within 24 hours following each shutdown, startup, or thermal power level change exceeding 20% of RTP in one hour. This requirement does not apply if (1) analysis shows that the DOSE EQUIVALENT I-131 concentration in the primary coolant has not increased more than a factor of 5, and (2) the noble gas activity monitor shows that effluent activity has not increased by more than a factor of 3. When samples collected for 24 hours are analyzed, the corresponding LLD's may be increased by a factor of 10.

d. The ratio of sample flow rate to the sampled stream flow rate shall be known.

e. The principal gamma emitters for which the LLD specification applies exclusively are the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emissions, and Mn-54, Fe-59, Co-60, Zn-65, Co-58, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144 for particulate emissions. Other peaks which are measurable and identifiable by gamma ray spectrometry, together with the above nuclides, shall be also identified and reported when an actual analysis is performed on a sample. Nuclides which are below the LLD for the analyses shall not be reported as being present at the LLD level for that nuclide.

12.4 GASEOUS EFFLUENTS

12.4.2 Dose - Noble Gases

Operability Requirements

12.4.2.A The air dose in unrestricted areas (at or beyond the site boundary) due to Noble Gases released in gaseous effluents from the unit shall be limited to the following:

1. For gamma radiation:
   (a) Less than or equal to 5 mrad during any calendar quarter.
   (b) Less than or equal to 10 mrad during any calendar year.

2. For Beta radiation:
   (a) Less than or equal to 10 mrad during any calendar quarter.
   (b) Less than or equal to 20 mrad during any calendar year.

Action:

1. With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to ensure that future releases are in compliance with 12.4.2.A. This is in lieu of a Licensee Event Report.

2. With the calculated air dose from radioactive noble gases in gaseous effluents exceeding the limits of Specification 12.4.2.A, prepare and submit a Special Report to the Commission within 30 days and limit the subsequent releases such that the doses or dose commitment to a member of the public from all uranium fuel cycle sources is limited to less than or equal to 25 mrem to the total body or any organ (except thyroid, which is limited to less than or equal to 75 mrem) over 12 consecutive months. This Special Report shall include an analysis which demonstrates that radiation exposure to all members of the public from all uranium fuel cycle sources (including all effluent pathways and direct radiation) are less than the 40 CFR Part 190 Standard. Otherwise, obtain a variance from the Commission to permit releases which exceed the 40 CFR Part 190 Standard. The radiation exposure analysis contained in the Special Report shall use the methods prescribed in the ODCM. This report is in lieu of a Licensee Event Report.

Surveillance Requirements

12.4.2.B The air dose due to releases of radioactive noble gases in gaseous effluents shall be determined to be within the prescribed limits by obtaining representative samples in accordance with the sampling and analysis program specified in sections A and B of Table 12.4-1. The allocation of effluents between units having shared effluent control systems and the air doses are determined using methods prescribed in the ODCM at least once every 31 days.

12.4 GASEOUS EFFLUENTS

12.4.2 Dose - Noble Gases (Cont.)

Bases

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

12.4 GASEOUS EFFLUENTS

12.4.3 Dose - Radioiodine - 131 and 133, Tritium and Radionuclides in Particulate Form

Operability Requirements

12.4.3.A The dose to a member of the public in unrestricted areas (at or beyond the site boundary) from iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released from the unit shall be limited to the following:

1. Less than or equal to 7.5 mrem to any organ during any calendar quarter.

2. Less than or equal to 15 mrem to any organ during any calendar year.

Applicability: At all times

Action:

1. With the calculated dose from the release of iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, a Special Report which identifies the cause(s) for exceeding the limit and defines the corrective actions taken and the proposed actions to be taken to ensure that future releases are in compliance with 12.4.3.A This is in lieu of a Licensee Event Report.

2. With the calculated dose from the release of iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents exceeding the limits of Section 12.4.3.A, prepare and submit a Special Report to the Commission within 30 days and limit subsequent releases such that the dose or dose commitment to a member of the public from all uranium fuel cycle sources is limited to less than or equal to 25 mrem to the total body or organ (except the thyroid, which is limited to less than or equal to 75 mrem) over 12 consecutive months. This Special Report shall include an analysis which demonstrates that radiation exposures to all members of the public from all uranium fuel cycle sources (including all effluent pathways and direct radiation) are less than the 40 CFR Part 190 Standard. Otherwise, obtain a variance from the Commission to permit releases which exceed the 40 CFR Part 190 Standard. The radiation exposure analysis contained in the Special Report shall use the methods prescribed in the ODCM. This report is in lieu of a Licensee Event Report.

12.4 GASEOUS EFFLUENTS

12.4.3 Dose - Radioiodine - 131 and 133, Tritium and Radionuclides in Particulate Form (Cont.)

Surveillance Requirements

12.4.3.B.1 The dose to a member of the public due to releases of iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days shall be determined to be within the prescribed limits by obtaining representative samples in accordance with the sampling and analysis program specified in Table 12.4-1.

12.4.3.B.2 For radionuclides not determined in each batch or weekly composite, the dose contribution to the current calendar quarter cumulative summation may be estimated by assuming an average monthly concentration based on the previous monthly or quarterly composite analyses. However, for reporting purposes, the calculated dose contributions shall be based on the actual composite analyses when possible. The allocation of effluents between units having shared effluent control systems and the doses are determined using the methods prescribed in the ODCM at least once every 31 days.

Bases

12.4.3.C This specification is provided to implement the requirements of Sections II.C, III.A and IV.A of Appendix I, 10 CFR Part 50. The Limiting Conditions for Operation are the guides set forth in Section II.C of Appendix I. The statements provide the required operating flexibility and at the same time implement the guides set forth in Section Iv.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonable achievable." The ODCM calculational methods specified in the surveillance requirements implements the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The ODCM calculational methods approved by NRC for calculating the doses due to the actual release rates of the subject materials are required to be consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I", Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous effluents in Routine Releases from Light-Water-Cooled Reactors," Revision 1, July 1977. These equations also provide for determining the actual doses based upon the historical average atmospheric conditions.

The release rate specifications for radioiodine, radioactive material in particulate form and radionuclides other than noble gases are dependent on the existing radionuclide pathways to man, in the unrestricted area. The pathways which were examined in the development of these specifications were: 1) individual inhalation of airborne radionuclides, 2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man and 3) deposition onto grassy areas where milk animals graze with consumption of the milk by man.

12.4 GASEOUS EFFLUENTS

12.4.4 Off-Gas System

Operability Requirements

12.4.4.A During processing for discharge to the environs, process and control equipment provided to reduce the amount or concentration of radioactive materials shall be operated.

Applicability and Action:
The above specification shall not apply for the Off-Gas Charcoal Adsorber Beds below 30 percent of RTP.

1. With the unit operating in MODE 1, MODE 2 or MODE 3 with any main steam line not isolated and with the steam jet air ejector (SJAE) in operation the release rate of the sum of the activities from the noble gases measured at the main condenser air ejector shall be limited to less than or equal to 251,100 microcuries/sec (after 30 minutes decay). With the release rate of the sum of the activities from noble gases at the main condenser air ejector exceeding 251,100 microcuries/sec per MWt (after 30 minutes decay), restore, the release rate to within its limits within 72 hours, either isolate all main steam lines or the steam jet air ejector within the next 12 hours, or be in MODE 3 in the next 12 hours and MODE 4 in the next 24 hours (refer to Technical Specification 3.7.6).

2. With all charcoal beds bypassed for more than 7 days in a calendar quarter while operating above 30 % RTP, prepare and submit to the Commission within 30 days a special report which includes the following information:

   a. Identification of the defective equipment.
   b. Cause of the defective equipment.
   c. Action(s) taken to restore the equipment to an operating status.
   d. Length of time the above requirements were not satisfied.
   e. Volume and curie content of the waste discharged which was not processed by the inoperable equipment but which required processing.
   f. Action(s) taken to prevent a recurrence of equipment failures.

Surveillance Requirements

12.4.4.B.1 Doses due to treated gases released to unrestricted areas at or beyond the site boundary shall be projected at least once per 31 days in accordance with the ODCM.

12.4 GASEOUS EFFLUENTS

12.4.4 Off-Gas System (Continued)

12.4.4.B.2 The radioactivity rate of noble gases at (near) the outlet of the main condenser air ejector shall be continuously monitored in accordance with Specification 12.2.2.A. The release rate of the sum of the activities from noble gases from the main condenser air ejector shall be determined to be within the limits of Specification 12.4.4.A at the following frequencies by performing an isotope analysis of a representative sample of gases taken at the recombiner outlet, or at the air ejector outlet if the recombiner is bypassed.

a. At least once per 31 days.

b. Once after a >50% increase in the nominal steady state fission gas release after factoring out increases due to changes in thermal power level.

c. Not required to be performed until 31 days after any main steam line not isolated and steam jet air ejector (SJAE) in operation.

Bases

12.4.4.C The requirement that the appropriate portions of these systems be used, when specified, provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonable achievable". This specification implements the requirements of 10 CFR 50.36a, General Design Criterion 60 of Appendix A to 10CFR50, and the design objectives given in Section 11.0 of Appendix I to 10CFR50. The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the dose design objectives set forth in Sections 11.3 and 11.0 of Appendix I, 10CFR50, for gaseous effluents.

12.4 GASEOUS EFFLUENTS

12.4.5 Total Dose

Operability Requirements

12.4.5.A The annual (calendar year) dose or dose commitment to any MEMBER OF THE PUBLIC due to releases of radioactivity and to radiation from uranium fuel cycle sources shall be limited to less than or equal to 25 mrems to the whole body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems.

Applicability: At all times.

Action:

1. With the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Sections 12.3.2, 12.4.2, or 12.4.3, calculations should be made including direct radiation contributions from the units and from outside storage tanks to determine whether the above limits of Section 12.4.5.A have been exceeded. If such is the case, prepare and submit to the Commission within 30 days, a Special Report that defines the corrective action to be taken to reduce subsequent releases to prevent recurrence of exceeding the above limits and includes the schedule for achieving conformance with the above limits. This Special Report, as defined in 10 CFR 20.2203, shall include an analysis that estimates the radiation exposure (dose) to a MEMBER OF THE PUBLIC from uranium fuel cycle sources, including all effluent pathways and direct radiation, for the calendar year that includes the release(s) covered by this report. It shall also describe levels of radiation and concentration of radioactive material involved, and the cause of the exposure levels or concentrations. If the estimated dose(s) exceeds the above limits, and if the release condition resulting in violation of 40 CFR Part 190 has not already been corrected, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR Part 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

Surveillance Requirements

12.4.5.1.A Cumulative dose contributions from liquid and gaseous effluents shall be determined in accordance with Sections 12.3.2, 12.4.2, and 12.4.3, and in accordance with the methodology and parameters in the ODCM.

12.4.5.2.B Cumulative dose contributions from direct radiation from the units and from radwaste storage tanks shall be determined in accordance with the methodology and parameters in the ODCM. This requirement is applicable only under conditions set forth in ACTION 1 of Section 12.4.5.A.

12.4 GASEOUS EFFLUENTS

12.4.5 Total Dose (Cont.)

Bases

12.4.5.C This section is provided to meet the dose limitations of 40 CFR Part 190 that have been incorporated into 10 CFR Part 20 by 46 FR 18525. The section requires the preparation and submittal of a Special Report whenever the calculated doses due to releases of radioactivity and to radiation from uranium fuel cycle sources exceed 25 mrems to the whole body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems. For sites containing up to four reactors, it is highly unlikely that the resultant dose to a MEMBER OF THE PUBLIC will exceed the dose limits of 40 CFR Part 190 if the individual reactors remain within twice the dose design objectives of Appendix I, and if direct radiation doses from the reactor units and outside storage tanks are kept small. The Special Report will describe a course of action that should result in the limitation of the annual dose to a MEMBER OF THE PUBLIC to within the 40 CFR Part 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to the MEMBER OF THE PUBLIC from other uranium fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 8 km must be considered. If the dose to any MEMBER OF THE PUBLIC is estimated to exceed the requirements of 40 CFR Part 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR Part 190 have not already been corrected), in accordance with the provisions of 40 CFR 190.11 and 10 CFR 20.2203, is considered to be a timely request and fulfills the requirements of 40 CFR Part 190 until NRC staff action is completed. The variance only relates to the limits of 40 CFR Part 190, and does not apply in any way to the other requirements for dose limitation of 10 CFR Part 20, as addressed in Sections 12.3.1 and 12.4.1. An individual is not considered a MEMBER OF THE PUBLIC during any period in which he/she is engaged in carrying out any operation that is part of the nuclear fuel cycle.

12.4 GASEOUS EFFLUENTS

12.4.6 Dose Limits for Members of the Public

Operability Requirements

12.4.6.A The licensee shall conduct operations such that the TEDE to individual MEMBERS OF THE PUBLIC does not exceed 100 mrem in a year. In addition, the dose in any unrestricted area from external sources does not exceed 2 mrem in any one hour. The Effluents Program shall implement monitoring, sampling, and analysis of radioactive liquid and gaseous effluents in accordance with 10CFR20.1302 and with the methodology and parameters in the ODCM.

Applicability: At all times.

Action:

1. If the calculated dose from the release or exposure of radiation meets or exceeds the 100 mrem/year limit for the MEMBER OF THE PUBLIC, prepare and submit a report to the Commission in accordance with 10CFR20.2203.

2. If the dose in any unrestricted area from external sources of radiation meets or exceeds the 2 mrem in any one hour limit for the MEMBER OF THE PUBLIC, prepare and submit a report to the Commission in accordance with 10CFR20.2203.

Surveillance Requirements

12.4.6.B Calculate the total dose to individual MEMBERS OF THE PUBLIC annually to determine compliance with the 100 mrem/year limit in accordance with the ODCM. In addition, evaluate and/or determine if direct radiation exposures exceed 2 mrem in any hour in unrestricted areas.

Bases

12.4.6.C This section applies to direct exposure of radioactive materials as well as radioactive materials released in gaseous and liquid effluents. 10CFR20.1301 sets forth the 100 mrem/year dose limit to members of the public; 2 mrem in any one hour limit in the unrestricted area; and reiterates that the licensee is also required to meet the 40CFR190 standards. 10CFR20.1302 provides options to determine compliance to 10CFR20.1301. Compliance to the above operability requirement is based on 10CFR20, 40CFR190 and Quad Cities Station Technical Specification 5.5.4.j.

12.5 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

12.5.1 Monitoring Program

Operability Requirements

12.5.1.A The environmental monitoring program given in Table 12.5-1 shall be conducted as specified below.

Applicability: At all times

Action:

1. With the radiological environmental monitoring program not being conducted as specified in Table 12.5-1, prepare and submit to the Commission, in the Annual Radiological Operating Report, a description of the reasons for not conducting the program as required and the plans for preventing a recurrence.

   Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of sampling equipment, if a person/business who participates in the program goes out of business or can no longer provide sample, or contractor omission which is corrected as soon as discovered. If the equipment malfunctions, corrective actions shall be completed as soon as practical. If a person/business supplying samples goes out of business, a replacement supplier shall be found as soon as possible. All deviations from the sampling schedule willl be described in the Annual Radiological Environmental Operating Report.

2. With the level of radioactivity in an environmental sampling medium at one or more of the locations specified in the ODCM exceeding the limits of Table 12.5-2 when averaged over any calendar quarter, prepare and submit to the Commission within 30 days, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce radioactive effluents so that the potential annual dose* to a MEMBER OF THE PUBLIC is less than calendar year limits of Section 12.3.2, 12.4.2, or 12.4.3. When more than one of the radionuclides in Table 12.5.2 are detected in the sampling medium, this report shall be submitted if:

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

   When radionuclides other than those in Table 12.5-2 are detected and are the result of plant effluents, this report shall be submitted if the potential dose* to a MEMBER OF THE PUBLIC from all radionuclides is equal to or greater than the calendar year limits of Section 12.3.2, 12.4.2, or 12.4.3. This report is not required if the measured level of radioactivity was not the result of plant effluents; however, in such an event the condition shall be reported and described in the Annual Radiological Environmental Operating Report.

*The methodology and parameters used to estimate the potential annual dose to a MEMBER OF THE PUBLIC shall be indicated in this report.

12.5. RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (Continued)

If the sample type or sampling location(s) as required by Table 12.5-1 become(s) permanently unavailable, identify suitable alternative sampling media for the pathway of interest and/or specific locations for obtaining replacement samples and add them to the radiological environmental monitoring program as soon as practicable. The specified locations from which samples were unavailable may then be deleted from the monitoring program.

Prepare and submit controlled version of the ODCM within 180 days including a revised figure(s) and table reflecting the new location(s) with supporting information identifying the cause of the unavailability of samples and justifying the selection of new location(s) for obtaining samples.

Surveillance Requirements

12.5.1.B The radiological environmental monitoring program samples shall be collected pursuant to Table 12.5-1 from the specific locations given in the table and figure(s) in the ODCM, and shall be analyzed pursuant to the requirements of Table 12.5-1 and the detection capabilities required by Table 12.5-3.

Bases

12.5.1.C The Radiological Environmental Monitoring Program required by this section provides representative measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposures of MEMBERS OF THE PUBLIC resulting from the station operation. This monitoring program implements Section IV.B.2 of Appendix I to 10 CFR Part 50 and thereby supplements the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and the modeling of the environmennal exposure pathways. Guidance for this monitoring program is provided by the Radiological Assessment Branch Technical Position on Environmental Monitoring. The initially specified monitoring program will be effective for at least the first 3 years of commercial operation. Following this period, program changes may be initiated based o on operational experience.

The required detection capabilities for environmental sample analyses are tabulated in terms of the lower limits of detection (LLDs). The LLDs required by Table 12.5-3 are considered optimum for routine environmental measurements in industrial laboratories. It should be recognized that the LLD is defined as a before the fact limit representing the capability of a measurement system and not as an after the fact limit for a particular measurement.

Detailed discussion of the LLD, and other detection limits, can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, LA., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem. 40, 586-93 (1968), and Hartwell, J.K., "Detection Limits for Radioanalytical Counting Techniques ," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

12.5 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (Continued)

Interpretations

12.5.1.D Table 12.5-1 requires "one sample of each community drinking water supply downstream of the plant within 10 kilometers." Drinking water supply is defined as water taken from rivers, lakes, or,reservoirs (not well water) which is used for drinking.

TABLE 12.5-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS[1]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
1. Airborne Radioiodine and Particulates	Samples from a total of eight locations: a. Indicator- Near Field Four samples from locations within 4.0 km (2.5mi) in different sectors. b. Indicator- Far Field Three additional locations within 4.0 to 10 km (2.5 to 6.2 mi.) in different sectors. c. Control One sample from a control location within 10 to 30 km (6.2 to 18.6 mi.).	Continuous particulate sampler operation with sample collection weekly, or more frequently if required due to dust loading, and radioiodine canister collection biweekly.	Radioiodine Canister: I-131 analysis biweekly on near field samples and control.[2] Particulate Sampler: Gross beta analysis following weekly filter change[3] and gamma isotopic analysis[4] quarterly on composite filters by location on near field samples and control.[2]

TABLE 12.5-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS[1]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
2. Direct Radiation[5]	Forty routine monitoring stations either with a thermoluminescent dosimeter (TLD) or with one instrument for measuring dose rate continuously, placed as follows: a. Indicator- Inner Ring (100 Series TLD) One in each meteorological sector, in the general area of the SITE BOUNDARY (0.1 to 3 miles); b. Indicator- Outer Ring (200 Series TLD) One in each meteorological sector, within 6.0 to 8.0 km (3.7 to 5.0 mi); and c. Other One at each Airborne location given in part 1.a. and 1.b. The balance of the TLDs to be placed at special interest locations beyond the Restricted Area where either a MEMBER OF THE PUBLIC or Exelon Nuclear employees have routine access. (300 Series TLD)	Quarterly	Gamma dose on each TLD quarterly.

TABLE 12.5-1 (Continued)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS[1]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
2. Direct Radiation[5] (Cont'd)	d. Control One at each Airborne control location given in part 1.c	Quarterly	Gamma dose on each TLD quarterly.
3. Waterborne a. Ground/Well	a. Indicator Samples from two sources only if likely to be affected.[6]	Quarterly	Gamma isotopic[4] and tritium analysis quarterly.
b. Drinking[7]	a. Indicator One Sample from each community drinking water supply that could be affected by the station discharge within 10 km (6.2 mi) downstream of discharge.	Weekly grab samples.	Gross beta and gamma isotopic analyses[4] on monthly composite; tritium analysis on quarterly composite. I-131[10] when calculated dose greater than 1 mrem/yr.
c. Surface Water[7]	If no community water supply (Drinking Water) exists within 10 km downstream of discharge then surface water sampling shall be performed. a. Indicator One sample downstream	Weekly grab samples.	Gross beta and gamma isotopic analyses[4] on monthly composite; tritium analysis on quarterly composite.
d. Control Sample	a. Control One surface sample upstream of discharge.	Weekly grab samples.	Gross beta and gamma isotopic analyses[4] on monthly composite; tritium analysis on quarterly composite.

TABLE 12.5-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS[1]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
e. Sediment	a. Indicator At least one sample from downstream[7] area within 10 km (6.2 mi).	Semiannually.	Gamma isotopic analysis [4] semiannually.
4. Ingestion	a. Indicator	Biweekly [9] when animals are on pasture (May through October), monthly at other times (November through April).	Gamma isotopic[4] and I-131[10] analysis on each sample.
a. Milk [8]	Samples from milking animals from a maximum of three locations within 10 km (6.2 mi) distance. b. Control One sample from milking animals at a control location within 15 to 30 km (9.3 to 18.6 mi).		
b. Fish	a. Indicator Representative samples of commercially and recreationally important species in discharge area. b. Control Representative samples of commercially and recreationally important species in control locations upstream of discharge.	Two times annually.	Gamma isotopic analysis[4] on edible portions

TABLE 12.5-1 (Continued)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS[1]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
c. Food Products	a. Indicator Two representative samples from the principal food pathways grown in each of four major quadrants within 10 km (6.2 mi): At least one root vegetable sample[11] At least one broad leaf vegetable (or vegetation)[11] b. Control Two representative samples similar to indicator samples grown within 15 to 30 km (9.3 to 18.6 mi).	Annually	Gamma isotopic[4] analysis on each sample. I-131[10] analysis on each sample.

TABLE 12.5-1 (Continued)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
TABLE NOTATIONS

(1) Specific parameters of distance and direction from the centerline of the midpoint of the two units and additional description where pertinent, shall be provided for each and every sample location in Table 1.1-1 of the ODCM Station Annexes. Refer to NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," October 1978, and to Radiological Assessment Branch Technical Position, Revision 1, November 1979.

(2) Far field samples are analyzed when the respective near field sample results are inconsistent with previous measurements and radioactivity is confirmed as having its origin in airborne effluents from the station, or at the discretion of the Radiation Protection Director.

(3) Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than 10 times the yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples.

(4) Gamma isotopic analysis means the identification and quantification of gamma emitting radionuclides that may be attributable to the effluents from the station.

(5) One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. Film badges shall not be used as dosimeters for measuring direct radiation. The 40 locations is not an absolute number. The number of direct radiation monitoring stations may be reduced according to geographical limitations; e.g., If a station is adjacent to a lake, some sectors may be over water thereby reducing the number of dosimeters which could be placed at the indicated distances. The frequency of analysis or readout for TLD systems will depend upon the characteristics of the specific system used and should be selected to obtain optimum dose information with minimal fading.

(6) Groundwater samples shall be taken when this source is tapped for drinking or irrigation purposes in areas where the hydraulic gradient or recharge properties are suitable for contamination.

(7) The "downstream" sample shall be taken in an area beyond but near the mixing zone. The "upstream sample" shall be taken at a distance beyond significant influence of the discharge. Upstream samples in an estuary must be taken far enough upstream to be beyond the station influence.

(8) If milking animals are not found in the designated indicator locations, or if the owners decline to participate in the REMP, all milk sampling may be discontinued.

(9) Biweekly refers to every two weeks.

(10) I-131 analysis means the analytical separation and counting procedure are specific for this radionuclide.

(11) One sample shall consist of a volume/weight of sample large enough to fill contractor specified container.

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES
REPORTING LEVELS

ANALYSIS	WATER (pCi/l)	AIRBORNE PARTICULATE OR GASES (pCi/m^3)	FISH (pCi/kg, wet)	MILK (pCi/l)	FOOD PRODUCTS (pCi/kg, wet)
H-3	20,000[1]				
Mn-54	1,000		30,000		
Fe-59	400		10,000		
Co-58	1,000		30,000		
Co-60	300		10,000		
Zn-65	300		20,000		
Zr-Nb-95	400				
I-131	2[2]	0.9		3	100
Cs-134	30	10	1,000	60	1,000
Cs-137	50	20	2,000	70	2,000
Ba-La-140	200			300	

(1) For drinking water samples. This is 40 CFR Part 141 value. If no drinking water pathway exists, a value of 30,000 pCi/l may be used.
(2) If no drinking water pathway exists, a value of 20 pCi/l may be used.

TABLE 12.5-3

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS[1]

LOWER LIMIT OF DETECTION (LLD)[2][3]

ANALYSIS	WATER (pCi/l)	AIRBORNE PARTICULATE OR GASES (pCi/m^3)	FISH (pCi/kg, wet)	MILK (pCi/l)	FOOD PRODUCTS (pCi/kg, wet)	SEDIMENT (pCi/kg, dry)
Gross Beta	4	0.01				
H-3	2,000					
Mn-54	15		130			
Fe-59	30		260			
Co-58,60	15		130			
Zn-65	30		260			
Zr-95	30					
Nb-95	15					
I-131	1[4]	0.07		1	60	
Cs-134	15	0.01	130	15	60	150
Cs-137	18	0.01	150	18	80	180
Ba-140	60			60		
La-140	15			15		

TABLE 12.5-3 (Continued)
DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS
TABLE NOTATIONS

(1) The nuclides on this list are not the only nuclides intended to be considered. Other peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Annual Radiological Environmental Operating Report.

(2) Required detection capabilities for thermoluminescent dosimeters used for environmental measurements shall be in accordance with the recommendations of Regulatory Guide 4.13.

(3) The Lower Limit of Detection (LLD) is defined, for purposes of these specifications, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation, the LLD is defined as follows:

$$LLD = \frac{4.66\ S_b + 3/t_b}{(E)\ (V)\ (2.22)\ (Y)\ (\exp(-\lambda\Delta t))}$$

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

Where: $4.66\ S_b >> 3/t_b$

LLD = the "a priori" Lower Limit of Detection (picoCuries per unit mass or volume),

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

$$= \frac{\text{Sqrt(Total Counts)}}{t_b}$$

E = the counting efficiency(counts per disintegration),

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

2.22 = the number of disintegrations per minute per picoCurie,

Y = the fractional radiochemical yield, when applicable,

λ = the radioactive decay constant for the particular radionuclide (sec^{-1}),

TABLE 12.5-3 (Continued)
DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS
TABLE NOTATIONS

t_b = counting time of the background or blank (minutes), and

Δt = the elapsed time between sample collection, or end of the sample collection period, and the time of counting (sec).

Typical values of E, V,,Y, and Δt should be used in the calculation.

It should be recognized that the LLD is defined as a before the fact limit representing the capability of a measurement system and not as an after the fact limit for a particular measurement.

Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally, background fluctuations, unavoidable small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors shall be identified and described in the Annual Radiological Environmental Operating Report.

(4) If no drinking water pathway exists, the value of 15 pCi/l may be used.

(5) A value of 0.5 pCi/l shall be used when the animals are on pasture (May through October) and a value of 5 pCi/l shall be used at all other times (November through April).

3) This LLD applies only when the analytical separation and counting procedure are specific for this radionuclide.

12.5.2 Land Use Census

Operability Requirements

12.5.2.A. A Land Use Census shall be conducted and shall identify within a distance of 10 km (6.2 miles) the location in each of the 16 meteorological sectors* of the nearest milk animal, the nearest residence**, and an enumeration of livestock. For dose calculation, a garden will be assumed at the nearest residence.

Applicability: At all times.

Action:

1. With a Land Use Census identifying a location(s) that yields a calculated dose or dose commitment, via the same exposure pathway 20% greater than at a location from which samples are currently being obtained in accordance with Section 12.5.1, add the new location(s) within 30 days to the Radiological Environmental Monitoring Program given in Chapter 11. The sampling location(s), excluding the control location, having the lowest calculated dose or dose commitment(s), via the same exposure pathway, may be deleted from this monitoring program after October 31 of the year in which this Land Use Census was conducted. Submit in the next Annual Radiological Environmental Operating Report documentation for a change in the ODCM including a revised figure(s) and table(s) for the ODCM reflecting the new location(s) with information supporting the change in sampling locations.

*This requirement may be reduced according to geographical limitations; e.g. at a lake site where some sector's will be over water.

**The nearest industrial facility shall also be documented if closer than the nearest residence.

Surveillance Requirements

12.5.2.B The Land Use Census shall be conducted during the growing season, between June 1 and October 1, at least once per 12 months using that information that will provide the best results, such as by a door-to-door survey, aerial survey, or by consulting local agriculture authorities. The results of the Land Use Census shall be included in the Annual Radiological Environmental Operating Report.

Bases

12.5.2.C This specification is provided to ensure that changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the Radiological Environmental Monitoring Program given in the ODCM are made if required by the results of this census.

This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50. An annual garden census will not be required since the licensee will assume that there is a garden at the nearest residence in each sector for dose calculations.

1 Interlaboratory Comparison Program

Operability Requirements

12.5.3.A Analyses shall be performed on radioactive materials supplied as part of an Interlaboratory Comparison Program that is traceable to NIST.

Applicability: At all times.

Action:

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

Surveillance Requirements

12.5.3.B A summary of the results obtained as part of the above required Interlaboratory Comparison Program shall be included in the Annual Radiological Environmental Operating Report.

Bases

12.5.3.C The requirement for participation in an Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental samples matrices are performed as part of the quality assurance program for environmental monitoring in order to demonstrate that the results are valid for the purposes of Section IV.B.2 of Appendix I to 10 CFR Part 50.

12.6 REPORTING REQUIREMENTS

Records and/or logs relative to the following items shall be kept in a manner convenient for review and shall be retained for at least 5 years:

- Records and periodic checks, inspection and/or calibrations performed to verify that the surveillance requirements (see the applicable surveillance in the Instrumentation, Liquid Effluents, Gaseous Effluents and Radiological Environmental Monitoring Sections) are being met (all equipment failing to meet surveillance requirements and the corrective action taken shall be recorded);

-Records of radioactive shipments;

Records and/or logs relative to the following items shall be recorded in a manner convenient for review and shall be retained for the life of the plant:

-Records of offsite environmental monitoring surveys;

-Records of radioactivity in liquid and gaseous wastes released to the environment;

-Records of reviews performed for changes made to the Offsite Dose Calculation Manual.

12.6.1 Radioactive Effluent Release Report*

The Radioactive Effluent Release Reports covering the operation of the unit during the previous calendar year of operation shall be submitted in accordance with 10CFR50.36.9 prior to May 1 of each year.

The Annual Radioactive Effluent Release Reports shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit. The material provided shall be consistent with the objectives outlined in the ODCM and the PCP and in accordance with 10CFR50.36 and 10CFR50, Appendix I, Section IV.B.1 The report shall be outlined consistent with Regulatory Guide 1.21, "Measuring Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," Revision 1, June 1974, with data summarized on a quarterly basis following the format of Appendix B thereof.

The Annual Radioactive Effluent Release Reports shall include a list and description of unplanned releases from the site to UNRESTRICTED AREAS of radioactive materials in gaseous and liquid effluents made during the reporting period.

The Annual Radioactive Effluent Release Reports shall include any changes made during the reporting period to the PCP as well as any major changes to Liquid, Gaseous or Solid Radwaste Treatment Systems, pursuant to Section 12.6.3.

The Annual Radioactive Effluent Release Reports shall also include the following: an explanation as to why the inoperability of liquid or gaseous effluent monitoring instrumentation was not corrected within the specified time and description of the events leading to liquid holdup tanks or gas storage tanks exceeding the limits of Technical Specifications.

*A single submittal may be made for a multiple unit station. The submittal should combine sections that are common to all units at the station; however, for units with separate radwaste systems, the submittal shall specify the releases of radioactive material from each unit.

12.6.2 Annual Radiological Environmental Operating Report*

The Annual Radiological Environmental Operating Report covering the operation of the Unit during the previous calendar year shall be submitted prior to May 15 of each year.

The Annual Radiological Environmental Operating Report shall include summaries, interpretations, and an analysis of trends of the results of The Radiological Environmental Monitoring Program for the report period. The material provided shall be consistent with the objectives outlined in the ODCM, and in 10CFR50, Appendix I, Sections IV.B.2, IV.B.3, and IV.C. The report shall include a comparison with preoperational studies, with operational controls as appropriate, and with previous environmental surveillance reports, and an assessment of the observed impacts of the plant operation on the environment.

The Annual Radiological Environmental Operating Report shall include the results of all radiological environmental samples and of all environmental radiation measurements taken during the period pursuant to the locations specified in the tables and figures in Chapter 11 of the ODCM, as well as summarized and tabulated results of these analyses and measurements in the format of the table in the Radiological Assessment Branch Technical Position, Revision 1, November 1979. In the event that some individual results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted as soon as possible in a supplementary report.

The reports shall also include the following: a summary description of the Radiological Environmental Monitoring Program; legible maps covering all sampling locations keyed to a table giving distances and directions from the midpoint between the two units; reasons for not conducting the Radiological Environmental Monitoring Program as required by Section 12.5.1, a Table of Missed Samples and a Table of Sample Anomalies for all deviations from the sampling schedule of Table 11.1-1; discussion of environmental sample measurements that exceed the reporting levels of Table 12.5-2 but are not the result of plant effluents, discussion of all analyses in which the LLD required by Table 12.5-3 was not achievable; result of the Land Use Census required by Section 12.5.2; and the results of the licensee participation in an Interlaboratory Comparison Program and the corrective actions being taken if the specified program is not being performed as required by Section 12.5.3.

The Annual Radiological Environmental Operating Report shall also include an annual summary of hourly meteorological data collected over the applicable year. This annual summary may be either in the form of an hour-by-hour listing on magnetic tape of wind speed, wind direction, atmospheric stability, and precipitation (if measured), or in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability. In lieu of submission with the Annual Radiological Environmental Operating Report, the licensee has the option of retaining this summary of required meteorological data on site in a file that shall be provided to the NRC upon request.

The Annual Radiological Environmental Operating Report shall also include an assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from the Unit or Station during the previous calendar year. This report shall also include an assessment of the radiation doses to the most likely exposed MEMBER OF THE PUBLIC from reactor releases and other near-by uranium fuel cycle sources including doses from primary effluent pathways and direct radiation for the previous calendar year. The assessment of radiation doses shall be performed in accordance with the methodology and parameters in the ODCM, and in compliance with 10CFR20 and 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operation."

*A single submittal may be made for a multiple unit station. The submittal should combine sections common to all units at the station.

12.6.3 OFFSITE DOSE CALCULATION MANUAL (ODCM)

a. The (ODCM) shall contain the methodology and parameters used in the calculation of offsite doses resulting from radioactive gaseous and liquid effluents, in the calculation of gaseous and liquid effluent monitoring Alarm andTrip Setpoints, and in the conduct of the radiological environmental monitoring program.

b. The ODCM shall also contain the radioactive effluent controls and radiological environmental monitoring program activities and descriptions of the information that should be included in the Annual Radiological Environmental Operating and Radioactive Effluent Release reports required by sections 12.6.2 and 13.6.1.

Licensee initiated changes to the ODCM:

1. Shall be documented and records of reviews performed shall be retained as required by the Quality Assurance (QA) Manual. This documentation shall contain:

   a. Sufficient information to support the change(s) together with the appropriate analyses or evaluations justifying the change(s), and

   b. A determination that the change(s) will maintain the levels of radioactive effluent control required by 10 CFR 20.1302, 40 CFR Part 190, 10 CFR 50.36a, and 10 CFR 50, Appendix I and do not adversely impact the accuracy or reliability of effluent, dose, or setpoint calculations.

2. Shall become effective after approval of the Station Manager on the date specified by the Onsite Review and Investigative Function.

3. Shall be submitted to the NRC in the form of a complete, legible copy of the entire ODCM as a part of or concurrent with the Radioactive Effluent Release Report for the period of the report in which any change to the ODCM was made effective. Each change shall be identified by markings in the margin of the affected pages, clearly indicating the area of the page that was changed, and shall indicate the date (i.e month and year) the change was implemented.

12.6.4 MAJOR CHANGES TO RADIOACTIVE WASTE TREATMENT SYSTEMS (LIQUID AND GASEOUS)

A. Licensee initiated major changes to the radioactive waste systems may be made provided:

1. The change is reported in the Monthly Operating Report for the period in which the evaluation was reviewed by the onsite review function. The discussion of each change shall contain:

   a. A summary of the evaluation that led to the determination that the change could be made in accordance with 10CFR50.59;

   b. Sufficient detailed information to support the reason for the change;

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

   d. An evaluation of the change which shows the predicted releases of radioactive materials in liquid and gaseous effluents and (or quantity of solid waste that differ from those previously predicted in the license application and amendments);

   e. A comparison of the predicted releases of radioactive materials in liquid and gaseous effluents and in solid waste to the actual releases for the period in which the changes were made;

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

   g. Documentation of the fact that the change was reviewed and found acceptable by the onsite review function.

2. The change shall become effective upon review and acceptance by onsite review function.

ATTACHMENT 1
DESIGN ANALYSIS APPROVAL
Page 1 of 2

DESIGN ANALYSIS NO. QDC-1700-N-1137 PAGE NO. 1 of 12

Major REV Number: 0 Minor Rev Number: 0

[ ] BRAIDWOOD STATION
[ ] BYRON STATION
[ ] DRESDEN STATION
[ ] LASALLE CO. STATION
[X] QUAD CITIES STATION

Unit: [X] 0 [ ] 1 [ ] 2 [ ] 3

DESCRIPTION CODE: (C018) R01

DISCIPLINE CODE: (C011) N

SYSTEM CODE: (C011) PR

TITLE: Radioactive Liquid Tank Failure Analysis for Quad Cities

[ ] Safety Related [X] Augmented Quality [ ] Non-Safety Related

ATTRIBUTES: (C016)

Type	Value
Elevation	595' (bottom of CCST)
Software	NUREG 0133 RATAF Computer Code

COMPONENT EPN: (C014 Panel)

EPN	TYPE
0-3303-A	T05
0-3303-B	T05

DOCUMENT NUMBERS: (C012 Panel) (Design Analysis References)

Type/Sub	Document Number	Input (Y/N)
PROC / NSP	CY-AB-120-200 Rev.1	N
/	10CFR20 Appendix B	N
/	Action Tracking # 50496-01	N
/		
/		
/		
/		

REMARKS:

E-FORM

PORC 01-018

ATTACHMENT 1
Design Analysis Approval
Page 2 of 2

DESIGN ANALYSIS NO. QDC-1700-N-1137 **REV:** 0 **PAGE NO.** 2 of 12

Revision Summary (including EC's incorporated):

Electronic Calculation Data Files:
(Program Name, Version, File Name extension/size/date/hour/min)

Design impact review completed? [ ] Yes [ ] N/A, Per EC#:_____
(If yes, attach impact review sheet)

Prepared by: _____/_____/_____
Print Sign Date

Reviewed by: _____/_____/_____
Print Sign Date

Method of Review: [ ] Detailed [ ] Alternate [ ] Test

This Design Analysis supersedes: _____ **in its entirety.**

Supplemental Review Required? [ ] Yes [ ] No

[ ] Additional Review [ ] Special Review Team

Additional Reviewer or Special Review Team Leader: _____/_____/_____
Print Sign Date

Special Review Team: (N/A for Additional Review)

Reviewers: 1) _____/_____/_____ 2) _____/_____/_____
Print Sign Date Print Sign Date

3) _____/_____/_____ 4) _____/_____/_____
Print Sign Date Print Sign Date

Supplemental Review Results:

Approved by: _____/_____/_____
Print Sign Date

External Design Analysis Review (Attachment 3 Attached)

Reviewed by: James Wardridge /[signature]/ 6-11-01
Print Sign Date

Approved by: Paul Behnen /Paul A Behnen/ 6-11-01
Print Sign Date

Do any ASSUMPTIONS / ENGINEERING JUDGEMENTS require later verification? [ ] Yes [X] No
Tracked By: AT#, EC# etc.) N/A.

ATTACHMENT 3
Review Checklist for External Design Analysis
Page 1 of 1

		Yes	No	N/A
1.	Do assumptions have sufficient rationale?	☒	☐	☐
2.	Are assumptions consistent with the way the plant is operated and with the licensing basis?	☒	☐	☐
3.	Do the design inputs have sufficient rationale?	☒	☐	☐
4.	Are design inputs correct and reasonable?	☒	☐	☐
5.	Are design inputs correctly incorporated into the analysis?	☒	☐	☐
6.	Are design inputs consistent with the way the plant is operated and with the licensing basis?	☒	☐	☐
7.	Do Engineering Judgments have sufficient rationale?	☐	☐	☒
8.	Are Engineering Judgments consistent with the way the plant is operated and with the licensing basis?	☐	☐	☒
9.	Do the results and conclusions correspond to the purpose and objective and address the acceptability of the result with respect to design bases or operating limits?	☒	☐	☐
10.	Do the results and conclusions follow expected trends based on any previous experience?	☐	☐	☒
11.	Does the design analysis include the applicable design basis documentation?	☒	☐	☐
12.	Are computer programs used in the design analysis validated under the vendor's QA program and applicable to the problem?	☐	☐	☒ *
13.	Have any limitations on the use of the results been identified and transmitted to the appropriate organizations?	☐	☐	☒
14.	Are there any unverified assumptions?	☐	☒	☐
15.	Do all unverified assumption have a tracking and closure mechanism in place?	☐	☐	☒

* The computer program used is specified in NUREG 0133

Key Solutions

Key Solutions Inc. Calculation Number: 0100201

Prepared by: James F. Key, Jr.
James F. Key, Jr.

Date: 1/2/01

Key Solutions

Radioactive Liquid Tank Failure

Key Solutions

1. Introduction

Key Solutions, Inc. was requested by Exelon's Quad Cities Station to provide an analysis of the consequences in the event of the failure of certain radioactive storage tanks. This was requested in support of the Extended Power Uprate project. The tanks of concern are those outdoor radwaste tanks that are not surrounded by liners, dikes or walls capable of holding the tank contents and that do not have tank overflows and surrounding area drains which connect to the liquid radwaste treatment system. For these tanks, the NRC typically restricts the quantity of radioactive material content such that in the event of an uncontrolled release of the tank's contents, the resulting concentrations would be less than the limits of 10 CFR 20, Appendix B, Table 2, Column 2 at the nearest potable and surface water supply in the unrestricted area.

The contents of the tanks are limited by specifying a curie limit based upon the methodology of the NRC RATAF computer code as discussed in NUREG 0133. The methodology is based on the calculated radioactive inventory in the tank at 80% capacity using a design basis fission product source term of: a fission produce release consistent with a noble gas release rate of 100 μCi.MWt-sec at 30 minutes decay for a BWR. The computer code determines the radionuclide tank inventory which would result in concentrations equal to the concentration limits of 10 CFR 20, Appendix B, Table 2, Column 2 at the nearest potable and surface water supplies in the unrestricted area.

Tritium and dissolved or entrained noble gases are both excluded from surveillance analysis, since these can be estimated for any license event report (per NUREG 0133, Section 4.4). Thus the assessment addresses only the curie limits for activation and mixed fission products.

The specific tanks of concern were the Contaminated Condensate Storage Tanks (CCSTs). The parameters used in the calculation and the justification for using these values are discussed in Section 3 of this report.

The need for this analysis was driven by the fact that the Quad Cities Station plans to implement a Technical Specification requiring a curie limit in each outdoor tank. This is part of the station's initiative to implement Improved Technical Specifications. In addition, these calculations are based on an increase in reactor power by 17.8% This increase is due to a planned power uprate.

Key Solutions

2. Methodology

The NRC computer code, "RATAF" was used in the calculation of the CCST curie limits for fission and activation products. (Note that this code is referred to as "RATAFR" in NUREG 0133). The RATAF code was purchased from the Radiation Safety Information Computational Center (RSICC) at Oak Ridge Nation Laboratories. RSICC is a specialized information analysis center operated under the Department of Energy. It is authorized to collect, analyze, maintain and distribute computer software and data sets in the areas of radiation transport and safety. In January 1999, the NRC began using RSICC for their software distribution center.

The RATAF code (RSICC Code Package CCC-681) is written in FORTRAN 77 and complied to execute on PC compatible computers under MSDOS. The package as received from RSICC includes a sample problem for purposes of validation.

For BWR plants, the RATAF code considers tanks in two separate processing systems:

1. Waste Drain Processing System
2. Regenerate Solutions Processing System

The inventory limits for the CCSTs were calculated using the Regenerate Solutions Processing System (RSPS) portion of the code. The waste flow rates and activity for the RSPS are calculated by the code using the waste volumes and activities given in NUREG 0016, Table 1.

In addition to using values from NUREG 0016, the code also utilizes parameters specific to the reactor. The site specific parameters which must be supplied are:

- Thermal Power Level (in units of MWt)
- Total Steam Flow Rate (in units of 1E6 lbs/hr)
- Mass of Coolant in the Reactor Vessel (in units of 1E6 lbs)
- Cleanup Demineralizer Flow (in units of 1E6 lbs/hr)
- Condensate Demineralizer Regeneration Time (in units of demineralizer-days - i.e. the product of the number of demineralizers and the regeneration frequency in days)
- Fraction of Feed Water through Condensate Demineralizer (dimensionless)
- Hydrological Travel Time (in units of days)
- Hydrological Dilution Factor (dimensionless)
- Volume of Tank to be Failed (in units of gallons)
- The Flow Rate of the Inlet Stream (in units of gallons/day)
- Tank Factors (The reciprocal of the Decontamination Factor)

RATAF calculates the Reactor Coolant Concentration, the Failed Tank Concentration and the Critical Receptor Concentration in units of μCi/ml for each nuclide considered. The Critical

Key Solutions

Receptor Concentration is derived from the Failed Tank Concentration and considers both dilution and decay during transit. The fraction of the 10 CFR 20 concentration limits (10 CFR 20, Appendix B, Table 2, Column 2) at the location of the Critical Receptor is calculated. From this fraction the maximum quantity of fission and activation products is determined for the Failed Tank.

While tritium and dissolved or entrained noble gases are excluded from the Tech Spec requirement, RATAF also reports a maximum quantity of tritium for the tank.

The limiting 10 CFR 20 concentrations used by RATAF are those values associated with 10 CFR 20 prior to the 1993 revision and as such are the "old MPC" (Maximum Permissible Concentration) values and not the "new ECL" (Effluent Concentration Limit) values. Rather than revise the RATAF data files, conservative assumptions were made in the running of the RATAF code to address this specific problem.

Individual nuclide10 CFR 20 fractions that are less than 1E-4 are not listed by the RATAF code output. The RATAF code limits the maximum quantity of fission and activation products reported in the output to 15 curies. Although the RATAF code may determine that a curie content of greater than 15 curies will not exceed the concentration limits for the Critical Receptor, it will not report a maximum tank inventory in excess of 15 curies.

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3. RATAF Input Parameters

Table 1 lists the parameters based upon the Extended Power Uprate project and supplied to the RATAF Code for determination of tank inventory limits.

Table 1
RATAF Code Parameters Used for Quad Cities

Parameter	Value	Units
Thermal Power Level	2957	Megawatts
Total Steam Flow Rate	11.713	1E6 pounds per hour
Mass of Coolant in Rx Vessel	0.63	1E6 pounds
Cleanup Demineralizer Flow	0.125	1E6 pounds per hour
Condensate Demineralizer Regeneration Time	0.001[1]	Days
Fraction of Feed Water Through Condensate Demin	0.01	Dimensionless
Hydrological Travel Time	0.33	Days
Hydrological Dilution Factor	3.86E+05[2]	Dimensionless
Inlet Stream Flow Rate	86,400	Gallons per Day
Tank Volume	300,000	Gallons
Iodine Tank Factor[3]	1	Dimensionless
Cesium Tank Factor[3]	1	Dimensionless
Other Nuclides Tank Factor[3]	1	Dimensionless

[1] Value provided by Quad Cities was "0.0". See text for additional explanation.
[2] Value provided by Quad Cities was "3.86E+7". See text for additional explanation.
[3] No values supplied by Quad Cities.

Quad Cities supplied the values for the parameters in Table 1 with the exception of the Condensate Demineralizer Regeneration Time, Hydrological Dilution Factor and the Tank Factors.

The value supplied by Quad Cities for the Condenstate Demineralizer Regeneration Time (in days) was "0.0." However the RATAF code would not accept a values less than 0.001 days (~ 2 minutes). As this parameter is used to indicate the amount of time the demineralizer is unavailable for processing, the use of "0.001" was determined to have a negligible impact on the calculations.

The Hydrological Dilution Factor is the ratio of the annual volume water flowing past the potable water supplied to the total volume of liquid waste released from the failed tank (assuming release of 80% of design basis of tank). Quad Cities provided a value of 3.86E+7 based upon conservative estimates of river flow. A value of 3.86E+5 (100 times lower) was used in the assessment calculations. As previously mentioned the RATAF code uses the "old 10 CFR 20 MPC" values and not the ECL values currently listed in 10 CFR 20 Appendix B, Table 2. Comparison of the two sets of values shows that, on the average, the ECL values are about 10 times lower and therefore 10 times more restrictive than the MPC values. It follows that the

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RATAF codes use of the "old MPCs" would result in an overestimation of the tank contents. In order to compensate for the use the MPC values the Hydrological Dilution Factor was reduced by a factor of 10. This Hydrological Dilution Factor was reduced again by an order of magnitude to provide a reasonable level of conservatism in the calculations.

The Tank Factors indicate the type of processing the waste stream has undergone preceding entry into the tank. The Tank Factors allow credit to be taken for removal of radionuclides by demineralizers prior to the waste stream input into the tank. RATAF allows Tank Factors to be specified for halogens, cesium (and rubidium) and other nuclides.

No credit was taken for waste stream treatment by demineralizers, thus the Tank Factors used in the RATAF calculation were set to "1." This added an additional level of conservatism to the calculations.

The input file for the Quad Cities RATAF calculations is given in Figure 1.

```
NUCLEAR DATA FOR REFERENCE LWR                                              2
     0.632      0.333      2.000    1.0E-25112000 1 0 0
CARD  1  NAME   NAME OF REACTOR QUAD CITIES ANALYSIS 12/00          TYPE =    BWR
CARD  2  POWTH  THERMAL POWER LEVEL (MEGAWATTS)                          2957.
CARD  3  GTO    TOTAL STEAM FLOW (MILLION LBS/HR)                        11.713
CARD  4  WL1Q   MASS OF WATER IN REACTOR VESSEL (MILLION LBS)            0.63
CARD  5  GDE    CLEAN-UP DEMINERALIZER FLOW (MILLION LBS/HR)             0.125
CARD  6  REGENT CONDENSATE DEMINERALIZER REGENERATION TIME (DAYS)        0.001
CARD  7  FFCDM  FRACTION FEED WATER THROUGH CONDENSATE DEMIN             1.0
CARD 8   HYTRTM HYDROLOGICAL TRAVEL TIME (DAYS)                         0.33
CARD 9   HYDF   HYDROLOGICAL DILUTION FACTOR                            3.9E+05
CARD 10         HIGH PURITY WASTE  INPUT  86400.  GPD AT .200 PCA
CARD 11         TANK NAME WASTE COLLECTION          TANK VOLUME 000000.  GAL
CARD 12         IS TANK IN SYSTEM A BOTTOMS TANK 0 IF NO  1 IF YES             0
CARD 13         DFI= 1.0E+00DFCS= 1.0E+00DFO = 1.0E+00
CARD 14         REGENERATION SOLTNS INPUT 86400.       GPD
CARD 15         TANK NAME CCST                       TANK VOLUME 300000   GAL
CARD 16         IS TANK IN SYSTEM A BOTTOMS TANK 0 IF NO  1 IF YES             0
CARD 17         DFI= 1.0E+00DFCS= 1.0E+00DFO = 1.0E+00
```

Figure 1. Quad Cities RATAF Input File Listing.

Key Solutions

4. RATAF Results

The results of the RATAF calculations are shown in Figure 2. The code predicts a primary coolant activity concentration of 1.64 μCi/ml excluding tritium. The failed tank concentration is determined to be 0.64 μCi/ml. The concentration at the location of the critical receptor determined by decay correcting for transit time (0.33 days) and for dilution (3.9E+5). The critical receptor concentration for each nuclide is divided by the 10 CFR 20 MPC value to obtain the "FRACTION 10CFR20."

The tank limit is determined by dividing the total tank activity by the total FRACTION 10CFR20.

The total tank activity in this case is:

$$6.40E-01\frac{\mu Ci}{ml}\times 3785\frac{ml}{gal}\times 240{,}000\ gal\times 1.0E-06\frac{Ci}{\mu Ci}=581\ Ci$$

The total tank activity inventory limit is:

$$\frac{581\ Ci}{2.7}=215\ Ci$$

The RATAF methodology limits the total tank inventory to 15 Curies or less, thus the printout provided in Figure 2 states the maximum quantity of corrosion and fission products (excluding tritium) in the tank is 15 curies.

QUAD CITIES ANALYSIS 12/00 BWR

THERMAL POWER LEVEL (MEGAWATTS)	2957.0000
PLANT CAPACITY FACTOR	0.80
TOTAL STEAM FLOW (MILLION LBS/HR)	11.7130
MASS OF WATER IN REACTOR VESSEL (MILLION LBS)	0.6300
OFF-GAS RELEASE RATE(UC/SEC)	350000.
FISSION PRODUCT CARRY-OVER FRACTION	0.0010
HALOGEN CARRY-OVER FRACTION.	0.0200
CLEAN-UP DEMINERALIZER FLOW (MILLION LBS/HR)	0.1250
CONDENSATE DEMINERALIZER REGENERATION TIME (DAYS)	0.0010
FRACTION FEED WATER THROUGH CONDENSATE DEMIN	1.0000
HYDROLOGICAL TRAVEL TIME (DAYS)	0.33
HYDROLOGICAL DILUTION FACTOR	390000.
REGENERATION SOLTNS INPU GPD	8.64E+04

FAILED TANK PARAMETERS

FAILED TANK	VOLUME	TANK FACTORS I	CS	OTHERS
CCST	300000.	1.00E+00	1.00E+00	1.00E+00

QUAD CITIES ANALYSIS 12/00 LIQUID TANK FAILURE
NAME OF TANK FAILED: CCST
VOLUME OF TANK FAILED: 240000. GAL. (80% OF TANK CAPACITY)
HYDROLOGICAL TRAVEL TIME (DAYS): 0.33
HYDROLOGICAL DILUTION FACTOR: 390000.

NUCLIDE	HALF-LIFE (DAYS)	PRIMARY COOLANT CONC. (UCI/ML)	10CFR20 LIMITS (UCI/ML)	FAILED TANK CONC. (UCI/ML)	CRITICAL RECEPTOR CONC. (UCI/ML)	FRACTION 10CFR20
CORROSION AND ACTIVATION PRODUCTS						
FISSION PRODUCTS						
I131	8.05E+00	2.65E-02	3.00E-07	2.40E-01	5.90E-07	2.0000
I133	8.75E-01	9.68E-02	1.00E-06	3.40E-01	6.70E-07	0.6700
I135	2.79E-01	8.50E-02	4.00E-06	3.20E-02	3.60E-08	0.0091
ALL OTHERS		1.43E+00		3.40E-02	6.70E-08	0.0013
TOTAL EXCEPT TRITIUM		1.64E+00		6.40E-01	1.40E-06	2.7000

THE MAXIMUM QUANTITY OF TRITIUM IN THE TANK IS 5.0E+03 CURIES.

THE MAXIMUM QUANTITY OF CORROSION AND FISSION PRODUCTS (EXCLUDING TRITIUM) IN THE TANK IS 1.5E+01 CURIES.

Figure 2. Quad Cities RATAF Output Listing.

APPENDIX F

QUAD CITIES ANNEX INDEX

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UNITS 1 AND 2
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APPENDIX F
STATION-SPECIFIC DATA FOR QUAD CITIES
UNITS 1 AND 2

F.1 INTRODUCTION

This appendix contains data relevant to the Quad Cities site. Included are a diagram of the unrestricted area boundary and values of parameters used in offsite dose assessment.

F.2 REFERENCES

1. Sargent & Lundy, Nuclear Analysis and Technology Division Quad Cities Calculation No. ATD-0148, Revisions 0, 1 and 2.

2. Sargent & Lundy, "N-16 Skyshine Ground Level Dose from Quad Cities Turbine Systems and Piping," Revision 0.

3. "Quad Cities Public Water Supply" letter form B.S. Ferguson (NSEP) to G. Wassenhove U.S. Army Corps of Engineers, February 16, 1989.

4. "Verification of Environmental Parameters Used for Commonwealth Edison Company's Offsite Dose Calculations," NUTECH Engineering Group, 1992.

5. "Verification of Environmental Parameters Used for Commonwealth Edison Company's Offsite Dose Calculations," NUS Corporation, 1988.

6. RP Calculation 00-EXT-001.

Table F-1
Aquatic Environmental Dose Parameters

General Information[a]

Existence of irrigation not mentioned in Quad Cities Final Safety Analysis Report (FSAR), UFSAR, or Plant Design Analysis

Recreation includes one or more of the following: boating, water skiing, swimming, and sport fishing.

The station liquid discharge flows into the Mississippi River. Mississippi River Lock and Dam Number 14 is located between the station discharge and the E. Moline intake (see Figure 12 of the Quad Cities Unit 1 Plant Design Analysis, Volume II, and Figure 2.4.1 of the Quad Cities Safety Analysis Report.)

Water and Fish Ingestion Parameters

Parameter[b]	Value
D^w	10
Z	16

Limits on Radioactivity in Unprotected Outdoor Tanks [c]

Outside Storage Tank ≤ 10 Ci per Tank [d]

Per Technical Specification 5.5.8.b

[a] Quad Cities Updated Final Safety Analysis Report (USFAR) updated through Amendment 5. (9-3-87) Section 1.5.2 and Quad Cities Plant Design Analysis, Section 4.4

[b] The parameters are defined in Section A.2.1 of Appendix A.

[c] See section A.2.4 of Appendix A.

[d] Tritium and dissolved or entrained noble gasses are excluded from this limit.

Table F-2

Station Characteristics

STATION: Quad Cities

LOCATION: Cordova, Illinois

Characteristics of Elevated Release Point

1) Release Height = 94.49 m 2) Diameter = 3.35 m

3) Exit Speed = 16.0 ms^{-1} 4) Heat Content 68 Kcal s^{-1}

Characteristics of Vent Stack Release Point

1) Release Height = 48.5 m^a 2) Diameter = 2 74 m

3) Exit Speed = 14.8 ms^{-1a}

Characteristics of Ground Level Point

1) Release Height = 0 m

2) Building Factor (D) = 43.46 m^a

Meterological Data

A 296 ft Tower is Located 1623 m SSE of Elevated Release Point

---

Tower Data Used in Calculations

Release Point	Wind Speed and Direction	Differential Temperature
Elevated	296 ft	296-33 ft
Vent	196 ft	196-30 ft
Ground	33 ft	196-30 ft

[a] Used in calculating the meteorological and dose factors in Tables F-5, F-6, and F-7. See Sections B.3 through B.6 of Appendix B.

Table F-3

Critical Ranges

Direction	Unrestricted Area Boundary[a] (m)	Restricted Area Boundary[b] (m)	Nearest Resident[c] (m)	Nearest Dairy Farm within 5 Miles[d] (m)
N	864	219	800	None
NNE	1029	224	1200	None
NE	1212	265	2000	None
ENE	1367	393	2000	None
E	1170	867	3600	None
ESE	1170	924	4800	5600
SE	1189	1010	4000	None
SSE	1422	1059	1600	None
S	1198	762	1200	None
SSW	2140	335	4800	None
SW	1372	232	4800	None
WSW	823	189	3200	None
W	713	189	3600	None
WNW	713	183	3600	None
NW	823	210	3600	None
NNW	1481	224	2800	None

[a] Nearest land in unrestricted area. Used in calculating the meteorological dose factors in Tables F-5 and F-7. See Sections B.3 through B.6 of Appendix B.

[b] These values are to the edge of the Mississippi River, where applicable.

[c] The distances are rounded to the nearest conservative 100 meters.

[d] Used in calculating the D/Q values in Table F-6. The distances are rounded to the nearest conservative 100 meters. A default value of 8000 meters is used when there are no dairies within 5 miles.

Table F-4

Average Wind Speeds

Downwind Direction	Average Wind Speed (m/sec)[a]		
	Elevated[b]	Mixed Mode	Ground Level[b]
N	6.9	5.0	2.6
NNE	6.2	4.6	2.8
NE	5.3	3.7	2.4
ENE	6.0	4.4	2.8
E	6.9	5.0	3.2
ESE	7.1	5.2	3.7
SE	6.5	4.9	3.6
SSE	5.7	4.5	3.5
S	5.6	4.4	3.4
SSW	5.5	4.4	3.3
SW	5.8	4.6	3.0
WSW	6.0	4.7	3.4
W	6.1	4.8	3.1
WNW	6.0	4.5	2.6
NW	5.9	4.4	2.4
NNW	6.5	4.7	2.5

[a] Based on Quad Cities site meteorological data, January 1978 through December 1987 data for ground level and mixed mode release analysis and 1982-1987 data for elevated releases. Calculated in Reference 1 of Section F.2 using formulas in Section B.1.3 of Appendix B.

Table F-5
X/Q and D/Q Maxima at or Beyond the Unrestricted Area Boundary

Downwind Direction	Elevated(Stack) Release				Mixed Mode(Vent) Release			Ground Level Release		
	Radius (meters)	X/Q (sec/m**3)	Radius (meters)	D/Q (1/m**2)	Radius (meters)	X/Q (sec/m**3)	D/Q (1/m**2)	Radius (meters)	X/Q (sec/m**3)	D/Q (1/m**2)
N	4400.	1.344E-08	864.	9.643E-10	864.	3.427E-07	2.869E-09	864.	3.817E-06	1.105E-08
NNE	4023.	1.703E-08	1029.	1.407E-09	1029.	2.219E-07	3.049E-09	1029.	2.597E-06	1.052E-08
NE	4828.	1.287E-08	1212.	7.019E-10	1212.	1.321E-07	1.299E-09	1212.	2.249E-06	6.701E-09
ENE	4400.	1.091E-08	1367.	6.723E-10	1367.	1.213E-07	1.319E-09	1367.	1.446E-06	4.806E-09
E	3600.	1.513E-08	1170.	1.139E-09	1170.	2.215E-07	2.811E-09	1170.	2.212E-06	9.318E-09
ESE	3600.	2.126E-08	1170.	1.536E-09	1170.	2.332E-07	3.437E-09	1170.	2.094E-06	1.047E-08
SE	4023.	1.758E-08	1189.	1.082E-09	1189.	1.439E-07	2.384E-09	1189.	1.255E-06	6.450E-09
SSE	4023.	1.259E-08	1422.	6.915E-10	1422.	8.279E-08	1.167E-09	1422.	6.885E-07	3.222E-09
S	4400.	1.005E-08	1500.	4.437E-10	1198.	6.887E-08	9.516E-10	1198.	8.371E-07	3.350E-09
SSW	4400.	8.621E-09	2140.	3.110E-10	2140.	5.104E-08	4.693E-10	2140.	4.296E-07	1.380E-09
SW	4400.	1.102E-08	1500.	4.856E-10	1372.	1.006E-07	1.116E-09	1372.	1.224E-06	3.856E-09
WSW	4400.	1.123E-08	1500.	4.674E-10	823.	2.158E-07	2.298E-09	823.	2.968E-06	1.093E-08
W	4828.	1.139E-08	1500.	4.704E-10	713.	3.445E-07	2.737E-09	713.	5.271E-06	1.522E-08
WNW	4828.	9.486E-09	1500.	4.025E-10	713.	5.025E-07	2.816E-09	713.	7.554E-06	1.788E-08
NW	4828.	9.752E-09	823.	5.475E-10	823.	2.981E-07	2.009E-09	823.	4.739E-06	1.144E-08
NNW	4400.	1.045E-08	1481.	6.127E-10	1481.	1.712E-07	1.202E-09	1481.	1.928E-06	4.543E-09

QUAD CITIES SITE METEOROLOGICAL DATA 1/78 - 12/87

Note: Based on Reference 2 of Section F.2 and the formulas in Sections B.3 and B.4 of Appendix B.

X/Q is used for beta air, beta skin, and inhalation dose pathways. See Sections A.1.2, A.1.3, and A.1.4.2 of Appendix A.

D/Q is used for produce and leafy vegetable pathways. See Section A.1.4 of Appendix A.

Radius is the approximate distance from midpoint between gaseous effluent release points to location of highest X/Q or D/Q at or beyond the unrestricted area boundary (UAB)

Table F-5a

X/Q and D/Q Maxima at or Beyond the Restricted Area Boundary

Downwind Direction	Elevated(Stack) Release				Mixed Mode(Vent) Release			Ground Level Release		
	Radius (meters)	X/Q (sec/m**3)	Radius (meters)	D/Q (1/m**2)	Radius (meters)	X/Q (sec/m**3)	D/Q (1/m**2)	Radius (meters)	X/Q (sec/m**3)	D/Q (1/m**2)
N	4400.	1.344E-08	420.	1.244E-09	219.	3.171E-06	1.377E-08	219.	3.908E-05	8.926E-08
NNE	480.	2.173E-08	420.	2.103E-09	224.	2.086E-06	1.548E-08	224.	3.155E-05	1.096E-07
NE	4828.	1.287E-08	420.	1.006E-09	265.	1.070E-06	6.653E-09	265.	2.583E-05	7.200E-08
ENE	4400.	1.091E-08	420.	1.010E-09	393.	5.774E-07	5.329E-09	393.	9.932E-06	3.539E-08
E	3600.	1.513E-08	867.	1.319E-09	867.	3.073E-07	3.999E-09	867.	3.485E-06	1.525E-08
ESE	3600.	2.126E-08	924.	1.688E-09	924.	2.949E-07	4.507E-09	924.	2.997E-06	1.544E-08
SE	4023.	1.758E-08	1010.	1.126E-09	1010.	1.657E-07	2.875E-09	1010.	1.611E-06	8.445E-09
SSE	4023.	1.259E-08	1059.	7.178E-10	1059.	1.024E-07	1.611E-09	1059.	1.080E-06	5.287E-09
S	4400.	1.005E-08	1500.	4.437E-10	762.	1.070E-07	1.511E-09	762.	1.672E-06	7.035E-09
SSW	4400.	8.621E-09	420.	4.004E-10	335.	4.092E-07	3.719E-09	335.	7.714E-06	2.774E-08
SW	4400.	1.102E-08	1500.	4.856E-10	232.	1.173E-06	7.186E-09	232.	2.231E-05	6.181E-08
WSW	4400.	1.123E-08	1500.	4.674E-10	189.	2.260E-06	1.271E-08	189.	3.588E-05	1.002E-07
W	4828.	1.139E-08	1500.	4.704E-10	189.	3.196E-06	1.355E-08	189.	5.242E-05	1.109E-07
WNW	4828.	9.486E-09	420.	4.079E-10	183.	5.215E-06	1.491E-08	183.	8.197E-05	1.362E-07
NW	4828.	9.752E-09	420.	6.595E-10	210.	2.909E-06	1.002E-08	210.	5.006E-05	9.064E-08
NNW	4400.	1.045E-08	420.	1.027E-09	224.	3.092E-06	1.192E-08	224.	4.464E-05	8.717E-08

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Table F-5b
Maximum Offsite Gamma-χ/Q

Downwind Direction	Radius (meters)	Ground Gamma-χ/Q (sec/m**3)	Stack Gamma-χ/Q (sec/m**3)	Vent Gamma-χ/Q (sec/m**3)
N	864.	6.36E-07	8.54E-08	2.23E-07
NNE	1029.	5.02E-07	8.54E-08	2.02E-07
NE	1212.	3.72E-07	5.27E-08	1.20E-07
ENE	1367.	2.47E-07	3.47E-08	8.62E-08
E	1170.	4.32E-07	5.12E-08	1.48E-07
ESE	1170.	4.33E-07	6.75E-08	1.66E-07
SE	1189.	2.60E-07	5.75E-08	1.20E-07
SSE	1422.	1.34E-07	3.45E-08	6.43E-08
S	1198.	1.51E-07	3.47E-08	6.48E-08
SSW	2140.	6.23E-08	1.55E-08	2.83E-08
SW	1372.	1.97E-07	3.27E-08	7.17E-08
WSW	823.	5.27E-07	5.93E-08	1.66E-07
W	713.	8.56E-07	7.73E-08	2.22E-07
WNW	713.	1.14E-06	6.95E-08	2.30E-07
NW	823.	7.20E-07	6.64E-08	1.81E-07
NNW	1481.	2.66E-07	3.73E-08	9.59E-08

Table F-6

χ/Q and D/Q at the Nearest Resident Locations Within 5 Miles

Location Description	Direction	Distance		Ground Level Release		Mixed Mode (Vent) Release		Elevated Mode (Stack) Release	
		miles	meters	χ/Q (sec/m^3)	D/Q (m^{-2})	χ/Q (sec/m^3)	D/Q (m^{-2})	χ/Q (sec/m^3)	D/Q (m^{-2})
NEAREST RESIDENCE	N	0.5	800	7.60E-06	9.80E-09	3.10E-08	1.00E-09	1.90E-08	1.20E-09
NEAREST RESIDENCE	NNE	0.75	1200	3.00E-06	6.30E-09	4.90E-08	1.30E-09	3.10E-08	1.60E-09
NEAREST RESIDENCE	NE	1.24	2000	1.50E-06	3.30E-09	8.00E-08	8.40E-10	2.30E-08	6.20E-10
NEAREST RESIDENCE	ENE	1.24	2000	1.40E-06	2.40E-09	6.00E-08	6.00E-10	1.90E-08	6.00E-10
NEAREST RESIDENCE	E	2.24	3600	6.60E-07	1.20E-09	8.90E-08	4.80E-10	2.30E-08	4.30E-10
NEAREST RESIDENCE	ESE	2.98	4800	5.50E-07	7.50E-10	9.00E-08	2.90E-10	2.20E-08	3.20E-10
NEAREST RESIDENCE	SE	2.49	4000	6.20E-07	1.00E-09	9.10E-08	4.20E-10	2.80E-08	4.50E-10
NEAREST RESIDENCE	SSE	0.99	1600	1.70E-06	2.90E-09	3.60E-08	6.30E-10	1.60E-08	7.30E-10
NEAREST RESIDENCE	S	0.75	1200	3.10E-06	5.50E-09	3.90E-08	1.00E-09	1.50E-08	7.20E-10
NEAREST RESIDENCE	SSW	2.98	4800	3.00E-07	4.20E-10	4.60E-08	1.80E-10	1.50E-08	2.10E-10
NEAREST RESIDENCE	SW	2.98	4800	2.90E-07	4.60E-10	5.40E-08	1.90E-10	1.50E-08	1.90E-10
NEAREST RESIDENCE	WSW	1.99	3200	7.00E-07	1.20E-09	8.00E-08	4.20E-10	2.00E-08	3.90E-10
NEAREST RESIDENCE	W	2.24	3600	9.80E-07	1.00E-09	6.80E-08	3.00E-10	2.20E-08	3.10E-10
NEAREST RESIDENCE	WNW	2.24	3600	1.10E-06	1.10E-09	6.90E-08	2.70E-10	1.80E-08	2.80E-10
NEAREST RESIDENCE	NW	2.24	3600	7.10E-07	8.50E-10	6.20E-08	2.20E-10	1.50E-08	2.30E-10
NEAREST RESIDENCE	NNW	1.74	2800	1.10E-06	1.40E-09	5.90E-08	3.00E-10	1 90E-08	4 00E-10

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Table F-6a

χ/Q and D/Q at the Nearest Cow Milk Locations Within 5 Miles

Location Description	Direction	Distance		Ground Level Release		Mixed Mode (Vent) Release		Elevated Mode (Stack) Release	
		miles	meters	χ/Q (sec/m^3)	D/Q (m^{-2})	χ/Q (sec/m^3)	D/Q (m^{-2})	χ/Q (sec/m^3)	D/Q (m^{-2})
COW MILK	N	4.97	8000	2.10E-07	1.80E-10	4.30E-08	5.30E-11	1.20E-08	9.00E-11
COW MILK	NNE	4.97	8000	1.60E-07	2.30E-10	4.80E-08	8.60E-11	1.40E-08	1.30E-10
COW MILK	NE	4.97	8000	1.80E-07	2.80E-10	6.10E-08	1.20E-10	1.30E-08	9.70E-11
COW MILK	ENE	4.97	8000	1.70E-07	2.10E-10	5.10E-08	8.30E-11	1.00E-08	9.10E-11
COW MILK	E	4.97	8000	2.00E-07	3.00E-10	6.00E-08	1.50E-10	1.30E-08	1.40E-10
COW MILK	ESE	3.48	5600	4.40E-07	5.70E-10	8.40E-08	2.30E-10	2.00E-08	2.60E-10
COW MILK	SE	4.97	8000	2.20E-07	3.00E-10	6.30E-08	1.50E-10	1.90E-08	1.70E-10
COW MILK	SSE	4.97	8000	1.50E-07	1.70E-10	4.00E-08	7.10E-11	1.40E-08	9.90E-11
COW MILK	S	4.97	8000	1.70E-07	2.00E-10	4.00E-08	9.30E-11	1.20E-08	8.60E-11
COW MILK	SSW	4.97	8000	1.40E-07	1.70E-10	3.40E-08	8.10E-11	1.10E-08	9.80E-11
COW MILK	SW	4.97	8000	1.40E-07	1.80E-10	4.00E-08	8.40E-11	1.10E-08	9.00E-11
COW MILK	WSW	4.97	8000	1.80E-07	2.40E-10	5.20E-08	1.10E-10	1.30E-08	1.20E-10
COW MILK	W	4.97	8000	3.10E-07	2.50E-10	4.90E-08	9.30E-11	1.50E-08	1.00E-10
COW MILK	WNW	4.97	8000	3.50E-07	2.80E-10	5.10E-08	8.20E-11	1.30E-08	9.20E-11
COW MILK	NW	4.97	8000	2.30E-07	2.00E-10	4.50E-08	6.80E-11	1.10E-08	7.50E-11
COW MILK	NNW	4.97	8000	2.50E-07	2.20E-10	4.90E-08	7.00E-11	1.10E-08	9.60E-11

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Table F-6b

χ/Q and D/Q at the Nearest Cow Meat Locations Within 5 Miles

Location Description	Direction	Distance		Ground Level Release		Mixed Mode (Vent) Release		Elevated Mode (Stack) Release	
		miles	meters	χ/Q (sec/m^3)	D/Q (m^{-2})	χ/Q (sec/m^3)	D/Q (m^{-2})	χ/Q (sec/m^3)	D/Q (m^{-2})
COW MEAT	N	2.49	4000	5.60E-07	6.30E-10	5.50E-08	1.50E-10	1.70E-08	2.50E-10
COW MEAT	NNE	3.48	5600	2.70E-07	4.40E-10	6.00E-08	1.50E-10	1.70E-08	2.20E-10
COW MEAT	NE	4.97	8000	1.80E-07	2.80E-10	6.10E-08	1.20E-10	1.30E-08	9.70E-11
COW MEAT	ENE	2.98	4800	3.70E-07	5.20E-10	6.70E-08	1.80E-10	1.50E-08	2.00E-10
COW MEAT	E	2.98	4800	4.30E-07	7.40E-10	8.10E-08	3.20E-10	2.00E-08	2.90E-10
COW MEAT	ESE	2.98	4800	5.50E-07	7.50E-10	9.00E-08	2.90E-10	2.20E-08	3.20E-10
COW MEAT	SE	4.72	7600	2.40E-07	3.30E-10	6.60E-08	1.60E-10	1.90E-08	1.80E-10
COW MEAT	SSE	2.49	4000	4.10E-07	6.00E-10	5.50E-08	2.00E-10	2.00E-08	2.70E-10
COW MEAT	S	1.49	2400	9.90E-07	1.70E-09	6.00E-08	5.00E-10	1.80E-08	4.10E-10
COW MEAT	SSW	4.97	8000	1.40E-07	1.70E-10	3.40E-08	8.10E-11	1.10E-08	9.80E-11
COW MEAT	SW	2.49	4000	3.80E-07	6.30E-10	5.80E-08	2.40E-10	1.60E-08	2.40E-10
COW MEAT	WSW	2.98	4800	3.80E-07	6.00E-10	7.20E-08	2.40E-10	1.80E-08	2.50E-10
COW MEAT	W	2.24	3600	9.80E-07	1.00E-09	6.80E-08	3.00E-10	2.20E-08	3.10E-10
COW MEAT	WNW	3.48	5600	5.80E-07	5.20E-10	6.10E-08	1.50E-10	1.60E-08	1.60E-10
COW MEAT	NW	3.98	6400	3.10E-07	3.10E-10	5.10E-08	9.70E-11	1.30E-08	1.10E-10
COW MEAT	NNW	2.24	3600	7.90E-07	9.10E-10	6.30E-08	2.30E-10	1.80E-08	3.10E-10

Quad Cities Site Meteorological Data - 1998

Table F-7

Maximum Offsite Finite Plume Gamma Dose Factors Based on 1 cm Depth at the Unrestricted Area Boundary for Kr-83m

Downwind Direction	Unrestricted Area Bound (meters)	Elevated(Stack) Release Radius (meters)	S (mrad/yr)/(uCi/sec)	SBAR	Mixed Mode(Vent) Release Radius (meters)	V (mrad/yr)/(uCi/sec)	VBAR	Ground Level Release Radius (meters)	G (mrad/yr)/(uCi/sec)	GBAR
N	864.	864.	1.193E-06	8.998E-07	864.	4.094E-05	3.087E-05	864.	3.885E-04	2.929E-04
NNE	1029.	1029.	1.785E-06	1.346E-06	1029.	2.796E-05	2.108E-05	1029.	2.651E-04	1.999E-04
NE	1212.	1212.	9.747E-07	7.349E-07	1212.	1.639E-05	1.236E-05	1212.	2.162E-04	1.630E-04
ENE	1367.	1367.	9.035E-07	6.812E-07	1367.	1.409E-05	1.063E-05	1367.	1.373E-04	1.036E-04
E	1170.	1170.	1.378E-06	1.039E-06	1170.	2.602E-05	1.962E-05	1170.	2.220E-04	1.674E-04
ESE	1170.	1170.	1.775E-06	1.338E-06	1170.	2.752E-05	2.075E-05	1170.	2.113E-04	1.593E-04
SE	1189.	1189.	1.286E-06	9.695E-07	1189.	1.748E-05	1.318E-05	1189.	1.248E-04	9.407E-05
SSE	1422.	1422.	9.303E-07	7.014E-07	1422.	9.663E-06	7.286E-06	1422.	6.648E-05	5.012E-05
S	1198.	1198.	4.932E-07	3.719E-07	1198.	8.591E-06	6.478E-06	1198.	8.157E-05	6.150E-05
SSW	2140.	2140.	6.664E-07	5.025E-07	2140.	5.469E-06	4.124E-06	2140.	3.670E-05	2.767E-05
SW	1372.	1372.	6.134E-07	4.625E-07	1372.	1.175E-05	8.862E-06	1372.	1.164E-04	8.775E-05
WSW	823.	823.	4.376E-07	3.300E-07	823.	2.665E-05	2.010E-05	823.	3.016E-04	2.274E-04
W	713.	713.	4.936E-07	3.722E-07	713.	4.059E-05	3.060E-05	713.	5.263E-04	3.968E-04
WNW	713.	713.	4.839E-07	3.648E-07	713.	5.484E-05	4.135E-05	713.	7.361E-04	5.550E-04
NW	823.	823.	8.023E-07	6.049E-07	823.	3.493E-05	2.634E-05	823.	4.707E-04	3.549E-04
NNW	1481.	1481.	9.575E-07	7.220E-07	1481.	1.950E-05	1.470E-05	1481.	1.814E-04	1.368E-04

QUAD CITIES SITE METEOROLOGICAL DATA 1/78 - 12/87

Note: Based on References 1 and 2 of Section F.2 and the formulas in Sections B.5 and B.6 of Appendix B.

Table F-7 (Continued)

Maximum Offsite Finite Plume Gamma Dose Factors Based on 1 cm Depth at the Unrestricted Area Boundary for Kr-85m

Downwind Direction	Unrestricted Area Bound (meters)	Elevated(Stack) Release Radius (meters)	S (mrad/yr)/(uCi/sec)	SBAR	Mixed Mode(Vent) Release Radius (meters)	V (mrad/yr)/(uCi/sec)	VBAR	Ground Level Release Radius (meters)	G (mrad/yr)/(uCi/sec)	GBAR
N	864.	864.	1.266E-04	1.225E-04	864.	4.908E-04	4.728E-04	864.	2.089E-03	2.000E-03
NNE	1029.	1029.	1.322E-04	1.278E-04	1029.	4.358E-04	4.204E-04	1029.	1.591E-03	1.525E-03
NE	1212.	1212.	8.448E-05	8.172E-05	1212.	2.793E-04	2.694E-04	1212.	1.383E-03	1.326E-03
ENE	1367.	1367.	5.783E-05	5.593E-05	1367.	2.056E-04	1.983E-04	1367.	9.249E-04	8.872E-04
E	1170.	1170.	8.118E-05	7.850E-05	1170.	3.308E-04	3.187E-04	1170.	1.393E-03	1.336E-03
ESE	1170.	1170.	1.067E-04	1.032E-04	1170.	3.662E-04	3.530E-04	1170.	1.337E-03	1.282E-03
SE	1189.	1189.	9.118E-05	8.820E-05	1189.	2.618E-04	2.525E-04	1189.	8.091E-04	7.760E-04
SSE	1422.	1422.	5.797E-05	5.606E-05	1422.	1.518E-04	1.464E-04	1422.	4.523E-04	4.340E-04
S	1198.	1198.	5.611E-05	5.428E-05	1198.	1.469E-04	1.417E-04	1198.	5.192E-04	4.978E-04
SSW	2140.	2140.	3.024E-05	2.924E-05	2140.	7.862E-05	7.579E-05	2140.	2.775E-04	2.663E-04
SW	1372.	1372.	5.402E-05	5.226E-05	1372.	1.697E-04	1.636E-04	1372.	7.514E-04	7.204E-04
WSW	823.	823.	8.767E-05	8.484E-05	823.	3.499E-04	3.372E-04	823.	1.633E-03	1.564E-03
W	713.	713.	1.112E-04	1.076E-04	713.	4.644E-04	4.473E-04	713.	2.573E-03	2.461E-03
WNW	713.	713.	1.000E-04	9.678E-05	713.	5.046E-04	4.854E-04	713.	3.454E-03	3.302E-03
NW	823.	823.	9.794E-05	9.476E-05	823.	3.993E-04	3.846E-04	823.	2.406E-03	2.302E-03
NNW	1481.	1481.	6.223E-05	6.018E-05	1481.	2.449E-04	2.360E-04	1481.	1.147E-03	1.099E-03

QUAD CITIES SITE METEOROLOGICAL DATA 1/78 - 12/87

Table F-7 (Continued)

Maximum Offsite Finite Plume Gamma Dose Factors Based on 1 cm Depth at the Unrestricted Area Boundary for Kr-85

Downwind Direction	Unrestricted Area Bound (meters)	Elevated(Stack) Release Radius (meters)	S (mrad/yr)/(uCi/sec)	SBAR	Mixed Mode(Vent) Release Radius (meters)	V (mrad/yr)/(uCi/sec)	VBAR	Ground Level Release Radius (meters)	G (mrad/yr)/(uCi/sec)	GBAR
N	864.	864.	1.753E-06	1.695E-06	864.	5.814E-06	5.622E-06	864.	2.347E-05	2.269E-05
NNE	1029.	1029.	1.834E-06	1.773E-06	1029.	5.237E-06	5.064E-06	1029.	1.792E-05	1.733E-05
NE	1212.	1212.	1.185E-06	1.146E-06	1212.	3.399E-06	3.287E-06	1212.	1.595E-05	1.542E-05
ENE	1367.	1367.	8.083E-07	7.817E-07	1367.	2.473E-06	2.391E-06	1367.	1.072E-05	1.037E-05
E	1170.	1170.	1.116E-06	1.079E-06	1170.	3.908E-06	3.779E-06	1170.	1.578E-05	1.525E-05
ESE	1170.	1170.	1.461E-06	1.413E-06	1170.	4.335E-06	4.192E-06	1170.	1.510E-05	1.460E-05
SE	1189.	1189.	1.259E-06	1.217E-06	1189.	3.118E-06	3.015E-06	1189.	9.186E-06	8.883E-06
SSE	1422.	1422.	8.057E-07	7.791E-07	1422.	1.829E-06	1.769E-06	1422.	5.211E-06	5.039E-06
S	1198.	1198.	7.916E-07	7.655E-07	1198.	1.774E-06	1.716E-06	1198.	5.956E-06	5.760E-06
SSW	2140.	2140.	4.230E-07	4.090E-07	2140.	9.632E-07	9.314E-07	2140.	3.375E-06	3.264E-06
SW	1372.	1372.	7.572E-07	7.322E-07	1372.	2.039E-06	1.971E-06	1372.	8.743E-06	8.454E-06
WSW	823.	823.	1.239E-06	1.198E-06	823.	4.157E-06	4.020E-06	823.	1.828E-05	1.768E-05
W	713.	713.	1.570E-06	1.519E-06	713.	5.481E-06	5.300E-06	713.	2.847E-05	2.753E-05
WNW	713.	713.	1.414E-06	1.367E-06	713.	5.906E-06	5.711E-06	713.	3.816E-05	3.690E-05
NW	823.	823.	1.372E-06	1.327E-06	823.	4.734E-06	4.578E-06	823.	2.700E-05	2.610E-05
NNW	1481.	1481.	8.575E-07	8.292E-07	1481.	2.931E-06	2.834E-06	1481.	1.350E-05	1.305E-05

QUAD CITIES SITE METEOROLOGICAL DATA 1/78 - 12/87

Table F-7 (Continued)

Maximum Offsite Finite Plume Gamma Dose Factors Based on 1 cm Depth at the Unrestricted Area Boundary for Kr-87

Downwind Direction	Unrestricted Area Bound (meters)	Elevated(Stack) Release Radius (meters)	S (mrad/yr)/(uCi/sec)	SBAR (mrad/yr)/(uCi/sec)	Mixed Mode(Vent) Release Radius (meters)	V (mrad/yr)/(uCi/sec)	VBAR (mrad/yr)/(uCi/sec)	Ground Level Release Radius (meters)	G (mrad/yr)/(uCi/sec)	GBAR (mrad/yr)/(uCi/sec)
N	864.	864.	6.162E-04	5.987E-04	864.	1.698E-03	1.649E-03	864.	5.808E-03	5.639E-03
NNE	1029.	1029.	6.389E-04	6.207E-04	1029.	1.557E-03	1.512E-03	1029.	4.508E-03	4.377E-03
NE	1212.	1212.	4.118E-04	4.001E-04	1212.	9.907E-04	9.622E-04	1212.	3.742E-03	3.633E-03
ENE	1367.	1367.	2.753E-04	2.675E-04	1367.	7.128E-04	6.923E-04	1367.	2.504E-03	2.432E-03
E	1170.	1170.	3.853E-04	3.743E-04	1170.	1.146E-03	1.113E-03	1170.	3.929E-03	3.815E-03
ESE	1170.	1170.	5.023E-04	4.880E-04	1170.	1.270E-03	1.234E-03	1170.	3.806E-03	3.695E-03
SE	1189.	1189.	4.324E-04	4.201E-04	1189.	9.253E-04	8.986E-04	1189.	2.291E-03	2.225E-03
SSE	1422.	1422.	2.723E-04	2.646E-04	1422.	5.290E-04	5.137E-04	1422.	1.256E-03	1.220E-03
S	1198.	1198.	2.704E-04	2.628E-04	1198.	5.202E-04	5.052E-04	1198.	1.424E-03	1.383E-03
SSW	2140.	2140.	1.354E-04	1.315E-04	2140.	2.615E-04	2.540E-04	2140.	7.068E-04	6.863E-04
SW	1372.	1372.	2.581E-04	2.507E-04	1372.	5.872E-04	5.702E-04	1372.	2.001E-03	1.943E-03
WSW	823.	823.	4.379E-04	4.255E-04	823.	1.238E-03	1.202E-03	823.	4.588E-03	4.454E-03
W	713.	713.	5.602E-04	5.443E-04	713.	1.632E-03	1.585E-03	713.	7.313E-03	7.101E-03
WNW	713.	713.	5.039E-04	4.896E-04	713.	1.729E-03	1.679E-03	713.	9.810E-03	9.525E-03
NW	823.	823.	4.859E-04	4.721E-04	823.	1.388E-03	1.348E-03	823.	6.654E-03	6.461E-03
NNW	1481.	1481.	2.903E-04	2.820E-04	1481.	8.192E-04	7.955E-04	1481.	2.955E-03	2.869E-03

QUAD CITIES SITE METEOROLOGICAL DATA 1/78 - 12/87

Table F-7 (Continued)

Maximum Offsite Finite Plume Gamma Dose Factors Based on 1 cm Depth at the Unrestricted Area Boundary for Kr-88

Downwind Direction	Unrestricted Area Bound (meters)	Elevated(Stack) Release Radius (meters)	S (mrad/yr)/(uCi/sec)	SBAR	Mixed Mode(Vent) Release Radius (meters)	V (mrad/yr)/(uCi/sec)	VBAR	Ground Level Release Radius (meters)	G (mrad/yr)/(uCi/sec)	GBAR
N	864.	864.	1.594E-03	1.551E-03	864.	4.220E-03	4.104E-03	864.	1.481E-02	1.438E-02
NNE	1029.	1029.	1.665E-03	1.621E-03	1029.	3.885E-03	3.779E-03	1029.	1.143E-02	1.111E-02
NE	1212.	1212.	1.083E-03	1.054E-03	1212.	2.515E-03	2.447E-03	1212.	9.828E-03	9.548E-03
ENE	1367.	1367.	7.271E-04	7.078E-04	1367.	1.805E-03	1.756E-03	1367.	6.599E-03	6.411E-03
E	1170.	1170.	1.002E-03	9.755E-04	1170.	2.853E-03	2.775E-03	1170.	1.001E-02	9.728E-03
ESE	1170.	1170.	1.301E-03	1.266E-03	1170.	3.165E-03	3.078E-03	1170.	9.639E-03	9.364E-03
SE	1189.	1189.	1.124E-03	1.094E-03	1189.	2.307E-03	2.244E-03	1189.	5.837E-03	5.671E-03
SSE	1422.	1422.	7.148E-04	6.957E-04	1422.	1.340E-03	1.303E-03	1422.	3.258E-03	3.165E-03
S	1198.	1198.	7.126E-04	6.937E-04	1198.	1.312E-03	1.276E-03	1198.	3.701E-03	3.596E-03
SSW	2140.	2140.	3.636E-04	3.539E-04	2140.	6.814E-04	6.628E-04	2140.	1.963E-03	1.908E-03
SW	1372.	1372.	6.784E-04	6.604E-04	1372.	1.485E-03	1.444E-03	1372.	5.313E-03	5.161E-03
WSW	823.	823.	1.144E-03	1.114E-03	823.	3.068E-03	2.984E-03	823.	1.160E-02	1.127E-02
W	713.	713.	1.459E-03	1.420E-03	713.	4.024E-03	3.913E-03	713.	1.827E-02	1.774E-02
WNW	713.	713.	1.313E-03	1.278E-03	713.	4.274E-03	4.156E-03	713.	2.451E-02	2.379E-02
NW	823.	823.	1.265E-03	1.231E-03	823.	3.452E-03	3.357E-03	823.	1.699E-02	1.650E-02
NNW	1481.	1481.	7.588E-04	7.386E-04	1481.	2.083E-03	2.026E-03	1481.	8.020E-03	7.791E-03

QUAD CITIES SITE METEOROLOGICAL DATA 1/78 - 12/87

Table F-7 (Continued)

Maximum Offsite Finite Plume Gamma Dose Factors Based on 1 cm Depth at the Unrestricted Area Boundary for Kr-89

Downwind Direction	Unrestricted Area Bound (meters)	Elevated(Stack) Release Radius (meters)	S (mrad/yr)/(uCi/sec)	SBAR	Mixed Mode(Vent) Release Radius (meters)	V (mrad/yr)/(uCi/sec)	VBAR	Ground Level Release Radius (meters)	G (mrad/yr)/(uCi/sec)	GBAR
N	864.	864.	7.380E-04	7.172E-04	864.	1.425E-03	1.385E-03	864.	2.034E-03	1.976E-03
NNE	1029.	1029.	6.261E-04	6.085E-04	1029.	1.149E-03	1.116E-03	1029.	1.603E-03	1.557E-03
NE	1212.	1212.	3.167E-04	3.078E-04	1212.	5.081E-04	4.936E-04	1212.	7.823E-04	7.598E-04
ENE	1367.	1367.	2.047E-04	1.989E-04	1367.	3.701E-04	3.595E-04	1367.	5.059E-04	4.914E-04
E	1170.	1170.	3.698E-04	3.594E-04	1170.	8.126E-04	7.894E-04	1170.	1.310E-03	1.273E-03
ESE	1170.	1170.	5.046E-04	4.904E-04	1170.	9.740E-04	9.462E-04	1170.	1.566E-03	1.522E-03
SE	1189.	1189.	4.116E-04	4.000E-04	1189.	6.659E-04	6.469E-04	1189.	9.264E-04	8.998E-04
SSE	1422.	1422.	2.003E-04	1.946E-04	1422.	2.810E-04	2.730E-04	1422.	3.822E-04	3.712E-04
S	1198.	1198.	2.189E-04	2.127E-04	1198.	3.175E-04	3.084E-04	1198.	4.622E-04	4.490E-04
SSW	2140.	2140.	5.751E-05	5.588E-05	2140.	7.519E-05	7.304E-05	2140.	8.761E-05	8.510E-05
SW	1372.	1372.	1.914E-04	1.860E-04	1372.	3.241E-04	3.149E-04	1372.	4.441E-04	4.313E-04
WSW	823.	823.	4.790E-04	4.655E-04	823.	1.113E-03	1.081E-03	823.	2.203E-03	2.140E-03
W	713.	713.	6.760E-04	6.569E-04	713.	1.569E-03	1.524E-03	713.	3.460E-03	3.361E-03
WNW	713.	713.	6.075E-04	5.904E-04	713.	1.513E-03	1.470E-03	713.	4.161E-03	4.041E-03
NW	823.	823.	5.447E-04	5.293E-04	823.	1.114E-03	1.082E-03	823.	2.198E-03	2.135E-03
NNW	1481.	1481.	2.270E-04	2.206E-04	1481.	3.806E-04	3.697E-04	1481.	3.958E-04	3.844E-04

QUAD CITIES SITE METEOROLOGICAL DATA 1/78 - 12/87

Table F-7 (Continued)

Maximum Offsite Finite Plume Gamma Dose Factors Based on 1 cm Depth at the Unrestricted Area Boundary for Kr-90

Downwind Direction	Unrestricted Area Bound (meters)	Elevated(Stack) Release Radius (meters)	S (mrad/yr)/(uCi/sec)	SBAR	Mixed Mode(Vent) Release Radius (meters)	V (mrad/yr)/(uCi/sec)	VBAR	Ground Level Release Radius (meters)	G (mrad/yr)/(uCi/sec)	GBAR
N	864.	864.	1.025E-04	9.947E-05	864.	1.001E-04	9.715E-05	864.	3.226E-05	3.128E-05
NNE	1029.	1029.	4.953E-05	4.807E-05	1029.	4.309E-05	4.181E-05	1029.	1.549E-05	1.502E-05
NE	1212.	1212.	1.210E-05	1.174E-05	1212.	7.167E-06	6.953E-06	1212.	2.958E-06	2.869E-06
ENE	1367.	1367.	8.572E-06	8.320E-06	1367.	7.121E-06	6.908E-06	1367.	3.357E-06	3.255E-06
E	1170.	1170.	2.876E-05	2.792E-05	1170.	3.061E-05	2.970E-05	1170.	1.687E-05	1.636E-05
ESE	1170.	1170.	4.141E-05	4.019E-05	1170.	3.846E-05	3.731E-05	1170.	2.748E-05	2.665E-05
SE	1189.	1189.	2.685E-05	2.606E-05	1189.	2.120E-05	2.056E-05	1189.	1.306E-05	1.267E-05
SSE	1422.	1422.	5.661E-06	5.494E-06	1422.	4.092E-06	3.970E-06	1422.	2.460E-06	2.385E-06
S	1198.	1198.	9.811E-06	9.523E-06	1198.	7.891E-06	7.656E-06	1198.	6.776E-06	6.571E-06
SSW	2140.	2140.	5.194E-07	5.040E-07	2140.	2.996E-07	2.907E-07	2140.	1.827E-07	1.772E-07
SW	1372.	1372.	6.788E-06	6.588E-06	1372.	6.147E-06	5.963E-06	1372.	3.347E-06	3.246E-06
WSW	823.	823.	5.697E-05	5.530E-05	823.	8.167E-05	7.923E-05	823.	8.406E-05	8.151E-05
W	713.	713.	1.054E-04	1.023E-04	713.	1.550E-04	1.504E-04	713.	1.486E-04	1.441E-04
WNW	713.	713.	9.367E-05	9.092E-05	713.	1.286E-04	1.247E-04	713.	1.211E-04	1.174E-04
NW	823.	823.	6.316E-05	6.131E-05	823.	6.467E-05	6.275E-05	823.	3.606E-05	3.497E-05
NNW	1481.	1481.	8.234E-06	7.992E-06	1481.	6.106E-06	5.924E-06	1481.	1.127E-06	1.093E-06

QUAD CITIES SITE METEOROLOGICAL DATA 1/78 - 12/87

Table F-7 (Continued)

Maximum Offsite Finite Plume Gamma Dose Factors Based on 1 cm Depth at the Unrestricted Area Boundary for Xe-131m

Downwind Direction	Unrestricted Area Bound (meters)	Elevated(Stack) Release Radius (meters)	S (mrad/yr)/(uCi/sec)	SBAR	Mixed Mode(Vent) Release Radius (meters)	V (mrad/yr)/(uCi/sec)	VBAR	Ground Level Release Radius (meters)	G (mrad/yr)/(uCi/sec)	GBAR
N	864.	864.	3.647E-06	3.327E-06	864.	4.407E-05	3.544E-05	864.	3.834E-04	2.985E-04
NNE	1029.	1029.	4.237E-06	3.798E-06	1029.	3.179E-05	2.595E-05	1029.	2.633E-04	2.057E-04
NE	1212.	1212.	2.587E-06	2.338E-06	1212.	1.947E-05	1.596E-05	1212.	2.279E-04	1.782E-04
ENE	1367.	1367.	1.965E-06	1.747E-06	1367.	1.602E-05	1.302E-05	1367.	1.466E-04	1.149E-04
E	1170.	1170.	2.839E-06	2.511E-06	1170.	2.808E-05	2.266E-05	1170.	2.237E-04	1.750E-04
ESE	1170.	1170.	3.680E-06	3.262E-06	1170.	2.997E-05	2.426E-05	1170.	2.118E-04	1.657E-04
SE	1189.	1189.	2.967E-06	2.654E-06	1189.	1.963E-05	1.599E-05	1189.	1.267E-04	9.918E-05
SSE	1422.	1422.	1.993E-06	1.769E-06	1422.	1.114E-05	9.095E-06	1422.	6.993E-05	5.482E-05
S	1198.	1198.	1.599E-06	1.463E-06	1198.	1.013E-05	8.309E-06	1198.	8.492E-05	6.642E-05
SSW	2140.	2140.	1.206E-06	1.050E-06	2140.	6.337E-06	5.144E-06	2140.	4.359E-05	3.422E-05
SW	1372.	1372.	1.650E-06	1.493E-06	1372.	1.332E-05	1.082E-05	1372.	1.252E-04	9.792E-05
WSW	823.	823.	2.220E-06	2.075E-06	823.	2.888E-05	2.335E-05	823.	2.959E-04	2.304E-04
W	713.	713.	2.761E-06	2.589E-06	713.	4.243E-05	3.407E-05	713.	4.991E-04	3.877E-04
WNW	713.	713.	2.521E-06	2.357E-06	713.	5.524E-05	4.391E-05	713.	6.941E-04	5.386E-04
NW	823.	823.	2.732E-06	2.507E-06	823.	3.710E-05	2.977E-05	823.	4.622E-04	3.593E-04
NNW	1481.	1481.	2.099E-06	1.868E-06	1481.	2.184E-05	1.759E-05	1481.	1.999E-04	1.561E-04

QUAD CITIES SITE METEOROLOGICAL DATA 1/78 - 12/87

Table F-7 (Continued)

Maximum Offsite Finite Plume Gamma Dose Factors Based on 1 cm Depth at the Unrestricted Area Boundary for Xe-133m

Downwind Direction	Unrestricted Area Bound (meters)	Elevated(Stack) Release Radius (meters)	S (mrad/yr)/(uCi/sec)	SBAR	Mixed Mode(Vent) Release Radius (meters)	V (mrad/yr)/(uCi/sec)	VBAR	Ground Level Release Radius (meters)	G (mrad/yr)/(uCi/sec)	GBAR
N	864.	864.	1.894E-05	1.812E-05	864.	1.039E-04	9.305E-05	864.	6.441E-04	5.482E-04
NNE	1029.	1029.	2.025E-05	1.928E-05	1029.	8.483E-05	7.710E-05	1029.	4.614E-04	3.957E-04
NE	1212.	1212.	1.285E-05	1.226E-05	1212.	5.369E-05	4.897E-05	1212.	4.033E-04	3.465E-04
ENE	1367.	1367.	9.011E-06	8.562E-06	1367.	4.123E-05	3.733E-05	1367.	2.642E-04	2.277E-04
E	1170.	1170.	1.267E-05	1.202E-05	1170.	6.835E-05	6.147E-05	1170.	3.977E-04	3.419E-04
ESE	1170.	1170.	1.660E-05	1.576E-05	1170.	7.460E-05	6.727E-05	1170.	3.783E-04	3.255E-04
SE	1189.	1189.	1.402E-05	1.334E-05	1189.	5.149E-05	4.671E-05	1189.	2.278E-04	1.962E-04
SSE	1422.	1422.	9.051E-06	8.594E-06	1422.	2.975E-05	2.704E-05	1422.	1.270E-04	1.096E-04
S	1198.	1198.	8.431E-06	8.074E-06	1198.	2.808E-05	2.563E-05	1198.	1.505E-04	1.293E-04
SSW	2140.	2140.	4.938E-06	4.658E-06	2140.	1.613E-05	1.459E-05	2140.	8.011E-05	6.932E-05
SW	1372.	1372.	8.224E-06	7.852E-06	1372.	3.413E-05	3.088E-05	1372.	2.212E-04	1.900E-04
WSW	823.	823.	1.283E-05	1.234E-05	823.	7.137E-05	6.430E-05	823.	4.990E-04	4.250E-04
W	713.	713.	1.619E-05	1.558E-05	713.	9.876E-05	8.833E-05	713.	8.170E-04	6.918E-04
WNW	713.	713.	1.461E-05	1.405E-05	713.	1.166E-04	1.029E-04	713.	1.121E-03	9.465E-04
NW	823.	823.	1.457E-05	1.396E-05	823.	8.573E-05	7.661E-05	823.	7.625E-04	6.468E-04
NNW	1481.	1481.	9.664E-06	9.184E-06	1481.	5.202E-05	4.667E-05	1481.	3.480E-04	2.982E-04

QUAD CITIES SITE METEOROLOGICAL DATA 1/78 - 12/87

Table F-7 (Continued)

Maximum Offsite Finite Plume Gamma Dose Factors Based on 1 cm Depth at the Unrestricted Area Boundary for Xe-133

Downwind Direction	Unrestricted Area Bound (meters)	Elevated(Stack) Release Radius (meters)	S (mrad/yr)/(uCi/sec)	SBAR	Mixed Mode(Vent) Release Radius (meters)	V (mrad/yr)/(uCi/sec)	VBAR	Ground Level Release Radius (meters)	G (mrad/yr)/(uCi/sec)	GBAR
N	864.	864.	1.741E-05	1.678E-05	864.	1.161E-04	1.068E-04	864.	7.126E-04	6.308E-04
NNE	1029.	1029.	1.886E-05	1.810E-05	1029.	9.493E-05	8.825E-05	1029.	5.171E-04	4.609E-04
NE	1212.	1212.	1.186E-05	1.140E-05	1212.	5.974E-05	5.567E-05	1212.	4.541E-04	4.054E-04
ENE	1367.	1367.	8.561E-06	8.203E-06	1367.	4.602E-05	4.266E-05	1367.	2.989E-04	2.675E-04
E	1170.	1170.	1.214E-05	1.162E-05	1170.	7.658E-05	7.065E-05	1170.	4.478E-04	4.000E-04
ESE	1170.	1170.	1.606E-05	1.538E-05	1170.	8.356E-05	7.724E-05	1170.	4.264E-04	3.811E-04
SE	1189.	1189.	1.340E-05	1.286E-05	1189.	5.757E-05	5.344E-05	1189.	2.572E-04	2.301E-04
SSE	1422.	1422.	8.767E-06	8:399E-06	1422.	3.309E-05	3.076E-05	1422.	1.438E-04	1.289E-04
S	1198.	1198.	7.778E-06	7.503E-06	1198.	3.131E-05	2.919E-05	1198.	1.695E-04	1.513E-04
SSW	2140.	2140.	4.975E-06	4.743E-06	2140.	1.790E-05	1.657E-05	2140.	9.115E-05	8.184E-05
SW	1372.	1372.	7.778E-06	7.484E-06	1372.	3.803E-05	3.523E-05	1372.	2.491E-04	2.224E-04
WSW	823.	823.	1.135E-05	1.099E-05	823.	7.956E-05	7.348E-05	823.	5.527E-04	4.896E-04
W	713.	713.	1.419E-05	1.375E-05	713.	1.096E-04	1.006E-04	713.	8.936E-04	7.872E-04
WNW	713.	713.	1.281E-05	1.241E-05	713.	1.283E-04	1.166E-04	713.	1.218E-03	1.070E-03
NW	823.	823.	1.308E-05	1.262E-05	823.	9.513E-05	8.731E-05	823.	8.374E-04	7.389E-04
NNW	1481.	1481.	9.317E-06	8.932E-06	1481.	5.833E-05	5.372E-05	1481.	3.907E-04	3.480E-04

QUAD CITIES SITE METEOROLOGICAL DATA 1/78 - 12/87

Table F-7 (Continued)

Maximum Offsite Finite Plume Gamma Dose Factors Based on 1 cm Depth at the Unrestricted Area Boundary for Xe-135m

Downwind Direction	Unrestricted Area Bound (meters)	Elevated(Stack) Release Radius (meters)	S (mrad/yr)/(uCi/sec)	SBAR	Mixed Mode(Vent) Release Radius (meters)	V (mrad/yr)/(uCi/sec)	VBAR	Ground Level Release Radius (meters)	G (mrad/yr)/(uCi/sec)	GBAR
N	864.	864.	2.899E-04	2.803E-04	864.	8.530E-04	8.236E-04	864.	2.453E-03	2.363E-03
NNE	1029.	1029.	2.877E-04	2.781E-04	1029.	7.645E-04	7.384E-04	1029.	1.941E-03	1.870E-03
NE	1212.	1212.	1.756E-04	1.697E-04	1212.	4.447E-04	4.296E-04	1212.	1.382E-03	1.332E-03
ENE	1367.	1367.	1.163E-04	1.125E-04	1367.	3.217E-04	3.107E-04	1367.	9.117E-04	8.789E-04
E	1170.	1170.	1.741E-04	1.683E-04	1170.	5.632E-04	5.438E-04	1170.	1.662E-03	1.602E-03
ESE	1170.	1170.	2.308E-04	2.231E-04	1170.	6.317E-04	6.100E-04	1170.	1.681E-03	1.620E-03
SE	1189.	1189.	1.959E-04	1.894E-04	1189.	4.536E-04	4.381E-04	1189.	1.003E-03	9.670E-04
SSE	1422.	1422.	1.166E-04	1.127E-04	1422.	2.398E-04	2.316E-04	1422.	5.084E-04	4.901E-04
S	1198.	1198.	1.163E-04	1.124E-04	1198.	2.423E-04	2.340E-04	1198.	5.714E-04	5.507E-04
SSW	2140.	2140.	5.156E-05	4.984E-05	2140.	1.028E-04	9.925E-05	2140.	2.160E-04	2.082E-04
SW	1372.	1372.	1.099E-04	1.063E-04	1372.	2.682E-04	2.590E-04	1372.	7.263E-04	7.000E-04
WSW	823.	823.	1.979E-04	1.914E-04	823.	6.335E-04	6.118E-04	823.	2.055E-03	1.979E-03
W	713.	713.	2.585E-04	2.499E-04	713.	8.524E-04	8.229E-04	713.	3.381E-03	3.255E-03
WNW	713.	713.	2.323E-04	2.246E-04	713.	8.874E-04	8.564E-04	713.	4.500E-03	4.332E-03
NW	823.	823.	2.227E-04	2.153E-04	823.	6.913E-04	6.674E-04	823.	2.772E-03	2.670E-03
NNW	1481.	1481.	1.264E-04	1.222E-04	1481.	3.575E-04	3.452E-04	1481.	9.461E-04	9.117E-04

QUAD CITIES SITE METEOROLOGICAL DATA 1/78 - 12/87

Table F-7 (Continued)

Maximum Offsite Finite Plume Gamma Dose Factors Based on 1 cm Depth at the Unrestricted Area Boundary for Xe-135

Downwind Direction	Unrestricted Area Bound (meters)	Elevated(Stack) Release Radius (meters)	S (mrad/yr)/(uCi/sec)	SBAR	Mixed Mode(Vent) Release Radius (meters)	V (mrad/yr)/(uCi/sec)	VBAR	Ground Level Release Radius (meters)	G (mrad/yr)/(uCi/sec)	GBAR
N	864.	864.	1.787E-04	1.729E-04	864.	6.779E-04	6.555E-04	864.	2.851E-03	2.753E-03
NNE	1029.	1029.	1.867E-04	1.807E-04	1029.	6.045E-04	5.847E-04	1029.	2.178E-03	2.103E-03
NE	1212.	1212.	1.196E-04	1.158E-04	1212.	3.894E-04	3.766E-04	1212.	1.917E-03	1.851E-03
ENE	1367.	1367.	8.192E-05	7.928E-05	1367.	2.660E-04	2.766E-04	1367.	1.285E-03	1.242E-03
E	1170.	1170.	1.145E-04	1.108E-04	1170.	4.571E-04	4.420E-04	1170.	1.913E-03	1.848E-03
ESE	1170.	1170.	1.504E-04	1.456E-04	1170.	5.067E-04	4.900E-04	1170.	1.833E-03	1.771E-03
SE	1189.	1189.	1.287E-04	1.246E-04	1189.	3.627E-04	3.508E-04	1189.	1.113E-03	1.075E-03
SSE	1422.	1422.	8.204E-05	7.939E-05	1422.	2.113E-04	2.044E-04	1422.	6.264E-04	6.052E-04
S	1198.	1198.	7.961E-05	7.705E-05	1198.	2.044E-04	1.977E-04	1198.	7.175E-04	6.931E-04
SSW	2140.	2140.	4.304E-05	4.165E-05	2140.	1.103E-04	1.067E-04	2140.	3.945E-04	3.812E-04
SW	1372.	1372.	7.655E-05	7.409E-05	1372.	2.359E-04	2.282E-04	1372.	1.046E-03	1.010E-03
WSW	823.	823.	1.242E-04	1.202E-04	823.	4.833E-04	4.674E-04	823.	2.225E-03	2.149E-03
W	713.	713.	1.573E-04	1.522E-04	713.	6.395E-04	6.183E-04	713.	3.478E-03	3.358E-03
WNW	713.	713.	1.415E-04	1.370E-04	713.	6.923E-04	6.693E-04	713.	4.660E-03	4.498E-03
NW	823.	823.	1.384E-04	1.340E-04	823.	5.510E-04	5.328E-04	823.	3.277E-03	3.164E-03
NNW	1481.	1481.	8.796E-05	8.512E-05	1481.	3.406E-04	3.293E-04	1481.	1.605E-03	1.550E-03

QUAD CITIES SITE METEOROLOGICAL DATA 1/78 - 12/87

Table F-7 (Continued)

Maximum Offsite Finite Plume Gamma Dose Factors Based on 1 cm Depth at the Unrestricted Area Boundary for Xe-137

Downwind Direction	Unrestricted Area Bound (meters)	Elevated(Stack) Release Radius (meters)	S (mrad/yr)/(uCi/sec)	SBAR	Mixed Mode(Vent) Release Radius (meters)	V (mrad/yr)/(uCi/sec)	VBAR	Ground Level Release Radius (meters)	G (mrad/yr)/(uCi/sec)	GBAR
N	864.	864.	9.587E-05	9.280E-05	864.	2.169E-04	2.100E-04	864.	3.650E-04	3.532E-04
NNE	1029.	1029.	8.396E-05	8.127E-05	1029.	1.789E-04	1.731E-04	1029.	2.883E-04	2.789E-04
NE	1212.	1212.	4.406E-05	4.265E-05	1212.	8.327E-05	8.059E-05	1212.	1.506E-04	1.457E-04
ENE	1367.	1367.	2.876E-05	2.784E-05	1367.	6.062E-05	5.866E-05	1367.	9.706E-05	9.392E-05
E	1170.	1170.	5.014E-05	4.854E-05	1170.	1.280E-04	1.239E-04	1170.	2.375E-04	2.298E-04
ESE	1170.	1170.	6.821E-05	6.603E-05	1170.	1.517E-04	1.468E-04	1170.	2.747E-04	2.658E-04
SE	1189.	1189.	5.604E-05	5.425E-05	1189.	1.044E-04	1.010E-04	1189.	1.631E-04	1.578E-04
SSE	1422.	1422.	2.842E-05	2.751E-05	1422.	4.591E-05	4.443E-05	1422.	6.975E-05	6.749E-05
S	1198.	1198.	3.027E-05	2.930E-05	1198.	5.064E-05	4.901E-05	1198.	8.267E-05	7.999E-05
SSW	2140.	2140.	8.925E-06	8.639E-06	2140.	1.344E-05	1.301E-05	2140.	1.753E-05	1.696E-05
SW	1372.	1372.	2.697E-05	2.611E-05	1372.	5.261E-05	5.091E-05	1372.	8.334E-05	8.064E-05
WSW	823.	823.	6.236E-05	6.037E-05	823.	1.682E-04	1.628E-04	823.	3.760E-04	3.638E-04
W	713.	713.	8.655E-05	8.378E-05	713.	2.349E-04	2.274E-04	713.	5.968E-04	5.775E-04
WNW	713.	713.	7.777E-05	7.529E-05	713.	2.298E-04	2.224E-04	713.	7.354E-04	7.115E-04
NW	823.	823.	7.090E-05	6.863E-05	823.	1.705E-04	1.650E-04	823.	3.973E-04	3.845E-04
NNW	1481.	1481.	3.192E-05	3.090E-05	1481.	6.298E-05	6.095E-05	1481.	7.935E-05	7.678E-05

QUAD CITIES SITE METEOROLOGICAL DATA 1/78 - 12/87

Table F-7 (Continued)

Maximum Offsite Finite Plume Gamma Dose Factors Based on 1 cm Depth at the Unrestricted Area Boundary for Xe-138

Downwind Direction	Unrestricted Area Bound (meters)	Elevated(Stack) Release Radius (meters)	S	SBAR	Mixed Mode(Vent) Release Radius (meters)	V	VBAR	Ground Level Release Radius (meters)	G	GBAR
			(mrad/yr)/(uCi/sec)			(mrad/yr)/(uCi/sec)			(mrad/yr)/(uCi/sec)	
N	864.	864.	7.602E-04	7.388E-04	864.	1.909E-03	1.854E-03	864.	5.007E-03	4.860E-03
NNE	1029.	1029.	7.527E-04	7.315E-04	1029.	1.728E-03	1.679E-03	1029.	3.991E-03	3.874E-03
NE	1212.	1212.	4.600E-04	4.471E-04	1212.	1.005E-03	9.759E-04	1212.	2.814E-03	2.731E-03
ENE	1367.	1367.	3.014E-04	2.929E-04	1367.	7.202E-04	6.995E-04	1367.	1.859E-03	1.804E-03
E	1170.	1170.	4.505E-04	4.378E-04	1170.	1.258E-03	1.222E-03	1170.	3.418E-03	3.318E-03
ESE	1170.	1170.	5.943E-04	5.775E-04	1170.	1.414E-03	1.373E-03	1170.	3.473E-03	3.371E-03
SE	1189.	1189.	5.059E-04	4.916E-04	1189.	1.022E-03	9.929E-04	1189.	2.076E-03	2.015E-03
SSE	1422.	1422.	2.995E-04	2.910E-04	1422.	5.384E-04	5.229E-04	1422.	1.049E-03	1.018E-03
S	1198.	1198.	3.027E-04	2.941E-04	1198.	5.469E-04	5.312E-04	1198.	1.174E-03	1.139E-03
SSW	2140.	2140.	1.297E-04	1.260E-04	2140.	2.269E-04	2.204E-04	2140.	4.390E-04	4.262E-04
SW	1372.	1372.	2.843E-04	2.763E-04	1372.	6.005E-04	5.832E-04	1372.	1.480E-03	1.436E-03
WSW	823.	823.	5.252E-04	5.104E-04	823.	1.428E-03	1.387E-03	823.	4.220E-03	4.095E-03
W	713.	713.	6.885E-04	6.691E-04	713.	1.914E-03	1.859E-03	713.	6.917E-03	6.712E-03
WNW	713.	713.	6.188E-04	6.014E-04	713.	1.974E-03	1.917E-03	713.	9.182E-03	8.910E-03
NW	823.	823.	5.894E-04	5.728E-04	823.	1.550E-03	1.505E-03	823.	5.640E-03	5.474E-03
NNW	1481.	1481.	3.244E-04	3.152E-04	1481.	7.909E-04	7.681E-04	1481.	1.903E-03	1.847E-03

QUAD CITIES SITE METEOROLOGICAL DATA 1/78 - 12/87

Table F-7 (Continued)

Maximum Offsite Finite Plume Gamma Dose Factors Based on 1 cm Depth at the Unrestricted Area Boundary for Ar-41

Downwind Direction	Unrestricted Area Bound (meters)	Elevated(Stack) Release Radius (meters)	S (mrad/yr)/(uCi/sec)	SBAR	Mixed Mode(Vent) Release Radius (meters)	V (mrad/yr)/(uCi/sec)	VBAR	Ground Level Release Radius (meters)	G (mrad/yr)/(uCi/sec)	GBAR
N	864.	864.	9.169E-04	8.875E-04	864.	2.639E-03	2.555E-03	864.	9.453E-03	9.150E-03
NNE	1029.	1029.	9.534E-04	9.229E-04	1029.	2.410E-03	2.333E-03	1029.	7.295E-03	7.061E-03
NE	1212.	1212.	6.143E-04	5.947E-04	1212.	1.545E-03	1.496E-03	1212.	6.170E-03	5.973E-03
ENE	1367.	1367.	4.130E-04	3.998E-04	1367.	1.116E-03	1.080E-03	1367.	4.131E-03	3.999E-03
E	1170.	1170.	5.768E-04	5.564E-04	1170.	1.782E-03	1.725E-03	1170.	6.371E-03	6.167E-03
ESE	1170.	1170.	7.494E-04	7.254E-04	1170.	1.976E-03	1.913E-03	1170.	6.148E-03	5.951E-03
SE	1189.	1189.	6.447E-04	6.241E-04	1189.	1.435E-03	1.389E-03	1189.	3.710E-03	3.591E-03
SSE	1422.	1422.	4.090E-04	3.959E-04	1422.	8.282E-04	8.017E-04	1422.	2.052E-03	1.986E-03
S	1198.	1198.	4.040E-04	3.910E-04	1198.	8.103E-04	7.843E-04	1198.	2.334E-03	2.259E-03
SSW	2140.	2140.	2.070E-04	2.004E-04	2140.	4.157E-04	4.024E-04	2140.	1.195E-03	1.157E-03
SW	1372.	1372.	3.864E-04	3.740E-04	1372.	9.192E-04	8.898E-04	1372.	3.318E-03	3.212E-03
WSW	823.	823.	6.504E-04	6.296E-04	823.	1.917E-03	1.856E-03	823.	7.433E-03	7.196E-03
W	713.	713.	8.303E-04	8.037E-04	713.	2.525E-03	2.445E-03	713.	1.179E-02	1.141E-02
WNW	713.	713.	7.474E-04	7.235E-04	713.	2.689E-03	2.603E-03	713.	1.583E-02	1.532E-02
NW	823.	823.	7.219E-04	6.988E-04	823.	2.157E-03	2.088E-03	823.	1.085E-02	1.050E-02
NNW	1481.	1481.	4.362E-04	4.222E-04	1481.	1.291E-03	1.249E-03	1481.	4.963E-03	4.805E-03

QUAD CITIES SITE METEOROLOGICAL DATA 1/78 - 12/87

Table F-8
Parameters for Calculations of N-16 Skyshine Radiation
From Quad Cities

Location Number k	Activity	Occupancy Hours OH_k[a]	Occupancy Factor OF_k	Shielding Factor SF_k	Distance R_k (m)
1	Living at home (nearest resident)	8616	0.9836	0.7	800[b]
2	Fishing	36	0.00410	1.0	233[c]
3	Fishing	51	0.00586	1.0	344[c]
4	Fishing	31	0.00351	1.0	361[c]
5	Fishing	26	0.00293	1.0	680[c]

$M_h = 3$[e]
K = 3.80E-05 mrem/(MWe-hr)

These parameters are used to obtain an initial estimate of skyshine dose to the maximally exposed member of the public using Equation A-23 in Appendix A. If desired, more realistic parameters could be used in place of these to refine the estimate. For example, one could determine whether the nearest resident really fishes the specific number of hours at the specified location.

[a] The amount of time in a year that a maximally exposed fisherman would spend fishing near the site is estimated as 12 hours per week for 8 months per year. This yields an estimate of:

[12 hours/week] [(8 months/yr)/(12 months/yr)] x [52 weeks/yr] = 416 hours/yr

The remaining time is assumed to be spent at the nearest residence.

[b] Distance to nearest resident (See Table F-3).

[c] Estimated from drawings of the site.

[d] The OF_k is the quotient of the number of hours a location is occupied and the number of hours in a year. Thus OH_k/8760 hours = OF_k rounded to the 0.01 digit.

[e] Multiplication factor for hydrogen addition from Reference 6. Refer to equation A-23 of Appendix A.

Table 9
Site Specific Potable Water Dose Factors for Adult Age Group

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	4.98E-01	4.98E-01	4.98E-01	4.98E-01	4.98E-01	4.98E-01
Na-24	1.41E+01	1.41E+01	1.41E+01	1.41E+01	1.41E+01	1.41E+01	1.41E+01
Cr-51	0.00E+00	0.00E+00	2.21E-02	1.32E-02	4.88E-03	2.94E-02	5.57E+00
Mn-54	0.00E+00	3.80E+01	7.26E+00	0.00E+00	1.13E+01	0.00E+00	1.17E+02
Mn-56	0.00E+00	9.57E-01	1.70E-01	0.00E+00	1.22E+00	0.00E+00	3.05E+01
Fe-55	2.29E+01	1.58E+01	3.69E+00	0.00E+00	0.00E+00	8.82E+00	9.07E+00
Fe-59	3.61E+01	8.49E+01	3.25E+01	0.00E+00	0.00E+00	2.37E+01	2.83E+02
Co-58	0.00E+00	6.20E+00	1.39E+01	0.00E+00	0.00E+00	0.00E+00	1.26E+02
Co-60	0.00E+00	1.78E+01	3.93E+01	0.00E+00	0.00E+00	0.00E+00	3.35E+02
Ni-63	1.08E+03	7.50E+01	3.63E+01	0.00E+00	0.00E+00	0.00E+00	1.56E+01
Ni-65	4.39E+00	5.71E-01	2.60E-01	0.00E+00	0.00E+00	0.00E+00	1.45E+01
Cu-64	0.00E+00	6.93E-01	3.25E-01	0.00E+00	1.75E+00	0.00E+00	5.91E+01
Zn-65	4.03E+01	1.28E+02	5.79E+01	0.00E+00	8.57E+01	0.00E+00	8.07E+01
Zn-69	8.57E-02	1.64E-01	1.14E-02	0.00E+00	1.07E-01	0.00E+00	2.46E-02
Br-83	0.00E+00	0.00E+00	3.35E-01	0.00E+00	0.00E+00	0.00E+00	4.82E-01
Br-84	0.00E+00	0.00E+00	4.34E-01	0.00E+00	0.00E+00	0.00E+00	3.40E-06
Br-85	0.00E+00	0.00E+00	1.78E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	1.76E+02	8.18E+01	0.00E+00	0.00E+00	0.00E+00	3.46E+01
Rb-88	0.00E+00	5.03E-01	2.67E-01	0.00E+00	0.00E+00	0.00E+00	6.96E-12
Rb-89	0.00E+00	3.34E-01	2.35E-01	0.00E+00	0.00E+00	0.00E+00	1.94E-14
Sr-89	2.56E+03	0.00E+00	7.36E+01	0.00E+00	0.00E+00	0.00E+00	4.11E+02
Sr-90	7.25E+04	0.00E+00	1.46E+03	0.00E+00	0.00E+00	0.00E+00	1.82E+03
Sr-91	4.72E+01	0.00E+00	1.91E+00	0.00E+00	0.00E+00	0.00E+00	2.25E+02
Sr-92	1.79E+01	0.00E+00	7.74E-01	0.00E+00	0.00E+00	0.00E+00	3.55E+02
Y-90	8.01E-02	0.00E+00	2.15E-03	0.00E+00	0.00E+00	0.00E+00	8.49E+02
Y-91M	7.56E-04	0.00E+00	2.93E-05	0.00E+00	0.00E+00	0.00E+00	2.22E-03
Y-91	1.17E+00	0.00E+00	3.14E-02	0.00E+00	0.00E+00	0.00E+00	6.46E+02
Y-92	7.03E-03	0.00E+00	2.06E-04	0.00E+00	0.00E+00	0.00E+00	1.23E+02
Y-93	2.23E-02	0.00E+00	6.16E-04	0.00E+00	0.00E+00	0.00E+00	7.07E+02
Zr-95	2.53E-01	8.11E-02	5.49E-02	0.00E+00	1.27E-01	0.00E+00	2.57E+02
Zr-97	1.40E-02	2.82E-03	1.29E-03	0.00E+00	4.26E-03	0.00E+00	8.74E+02
Nb-95	5.18E-02	2.88E-02	1.55E-02	0.00E+00	2.85E-02	0.00E+00	1.75E+02
Mo-99	0.00E+00	3.59E+01	6.82E+00	0.00E+00	8.12E+01	0.00E+00	8.31E+01
Tc- 99M	2.06E-03	5.81E-03	7.40E-02	0.00E+00	8.82E-02	2.85E-03	3.44E+00
Tc-101	2.11E-03	3.05E-03	2.99E-02	0.00E+00	5.48E-02	1.56E-03	9.15E-15
Ru-103	1.54E+00	0.00E+00	6.63E-01	0.00E+00	5.88E+00	0.00E+00	1.80E+02
Ru-105	1.28E-01	0.00E+00	5.06E-02	0.00E+00	1.66E+00	0.00E+00	7.84E+01
Ru-106	2.29E+01	0.00E+00	2.90E+00	0.00E+00	4.42E+01	0.00E+00	1.48E+03
Ag-110M	1.33E+00	1.23E+00	7.32E-01	0.00E+00	2.42E+00	0.00E+00	5.03E+02
Te-125M	2.23E+01	8.08E+00	2.99E+00	6.71E+00	9.07E+01	0.00E+00	8.90E+01

Table 9 (continued)
Site Specific Potable Water Dose Factors for Adult Age Group

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-127M	5.63E+01	2.01E+01	6.87E+00	1.44E+01	2.29E+02	0.00E+00	1.89E+02
Te-127	9.15E-01	3.29E-01	1.98E-01	6.78E-01	3.73E+00	0.00E+00	7.22E+01
Te-129M	9.57E+01	3.57E+01	1.51E+01	3.29E+01	3.99E+02	0.00E+00	4.82E+02
Te-129	2.61E-01	9.82E-02	6.37E-02	2.01E-01	1.10E+00	0.00E+00	1.97E-01
Te-131M	1.44E+01	7.04E+00	5.87E+00	1.12E+01	7.13E+01	0.00E+00	6.99E+02
Te-131	1.64E-01	6.85E-02	5.18E-02	1.35E-01	7.18E-01	0.00E+00	2.32E-02
Te-132	2.10E+01	1.36E+01	1.27E+01	1.50E+01	1.31E+02	0.00E+00	6.42E+02
I-130	6.29E+00	1.86E+01	7.32E+00	1.57E+03	2.90E+01	0.00E+00	1.60E+01
I-131	3.46E+01	4.95E+01	2.84E+01	1.62E+04	8.49E+01	0.00E+00	1.31E+01
I-132	1.69E+00	4.52E+00	1.58E+00	1.58E+02	7.20E+00	0.00E+00	8.49E-01
I-133	1.18E+01	2.06E+01	6.27E+00	3.02E+03	3.59E+01	0.00E+00	1.85E+01
I-134	8.82E-01	2.40E+00	8.57E-01	4.15E+01	3.81E+00	0.00E+00	2.09E-03
I-135	3.69E+00	9.65E+00	3.56E+00	6.37E+02	1.55E+01	0.00E+00	1.09E+01
Cs-134	5.18E+02	1.23E+03	1.01E+03	0.00E+00	3.99E+02	1.32E+02	2.16E+01
Cs-136	5.42E+01	2.14E+02	1.54E+02	0.00E+00	1.19E+02	1.63E+01	2.43E+01
Cs-137	6.63E+02	9.07E+02	5.94E+02	0.00E+00	3.08E+02	1.02E+02	1.76E+01
Cs-138	4.59E-01	9.07E-01	4.49E-01	0.00E+00	6.67E-01	6.58E-02	3.87E-06
Ba-139	8.07E-01	5.75E-04	2.36E-02	0.00E+00	5.38E-04	3.26E-04	1.43E+00
Ba-140	1.69E+02	2.12E-01	1.11E+01	0.00E+00	7.22E-02	1.22E-01	3.48E+02
Ba-141	3.92E-01	2.96E-04	1.32E-02	0.00E+00	2.75E-04	1.68E-04	1.85E-10
Ba-142	1.77E-01	1.82E-04	1.12E-02	0.00E+00	1.54E-04	1.03E-04	2.50E-19
La-140	2.08E-02	1.05E-02	2.77E-03	0.00E+00	0.00E+00	0.00E+00	7.70E+02
La-142	1.07E-03	4.84E-04	1.21E-04	0.00E+00	0.00E+00	0.00E+00	3.54E+00
Ce-141	7.79E-02	5.27E-02	5.98E-03	0.00E+00	2.45E-02	0.00E+00	2.01E+02
Ce-143	1.37E-02	1.02E+01	1.12E-03	0.00E+00	4.47E-03	0.00E+00	3.79E+02
Ce-144	4.06E+00	1.70E+00	2.18E-01	0.00E+00	1.01E+00	0.00E+00	1.37E+03
Pr-143	7.66E-02	3.07E-02	3.79E-03	0.00E+00	1.77E-02	0.00E+00	3.35E+02
Pr-144	2.50E-04	1.04E-04	1.27E-05	0.00E+00	5.87E-05	0.00E+00	3.60E-11
Nd-147	5.23E-02	6.05E-02	3.62E-03	0.00E+00	3.54E-02	0.00E+00	2.90E+02
W-187	8.57E-01	7.17E-01	2.50E-01	0.00E+00	0.00E+00	0.00E+00	2.35E+02
Np-239	9.90E-03	9.74E-04	5.37E-04	0.00E+00	3.04E-03	0.00E+00	2.00E+02

Notes:

1) Units are mrem/hr per µCi/ml.

Table 9a
Site Specific Potable Water Dose Factors for Teen Age Group

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	3.51E-01	3.51E-01	3.51E-01	3.51E-01	3.51E-01	3.51E-01
Na-24	1.34E+01	1.34E+01	1.34E+01	1.34E+01	1.34E+01	1.34E+01	1.34E+01
Cr-51	0.00E+00	0.00E+00	2.09E-02	1.16E-02	4.59E-03	2.99E-02	3.52E+00
Mn-54	0.00E+00	3.43E+01	6.80E+00	0.00E+00	1.02E+01	0.00E+00	7.03E+01
Mn-56	0.00E+00	9.19E-01	1.63E-01	0.00E+00	1.16E+00	0.00E+00	6.05E+01
Fe-55	2.20E+01	1.56E+01	3.63E+00	0.00E+00	0.00E+00	9.88E+00	6.74E+00
Fe-59	3.41E+01	7.97E+01	3.08E+01	0.00E+00	0.00E+00	2.51E+01	1.88E+02
Co-58	0.00E+00	5.65E+00	1.30E+01	0.00E+00	0.00E+00	0.00E+00	7.79E+01
Co-60	0.00E+00	1.63E+01	3.68E+01	0.00E+00	0.00E+00	0.00E+00	2.13E+02
Ni-63	1.03E+03	7.27E+01	3.49E+01	0.00E+00	0.00E+00	0.00E+00	1.16E+01
Ni-65	4.35E+00	5.56E-01	2.53E-01	0.00E+00	0.00E+00	0.00E+00	3.02E+01
Cu-64	0.00E+00	6.69E-01	3.15E-01	0.00E+00	1.69E+00	0.00E+00	5.19E+01
Zn-65	3.35E+01	1.16E+02	5.42E+01	0.00E+00	7.44E+01	0.00E+00	4.92E+01
Zn-69	8.55E-02	1.63E-01	1.14E-02	0.00E+00	1.06E-01	0.00E+00	3.00E-01
Br-83	0.00E+00	0.00E+00	3.34E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	4.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	1.77E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	1.73E+02	8.14E+01	0.00E+00	0.00E+00	0.00E+00	2.56E+01
Rb-88	0.00E+00	4.95E-01	2.64E-01	0.00E+00	0.00E+00	0.00E+00	4.24E-08
Rb-89	0.00E+00	3.20E-01	2.26E-01	0.00E+00	0.00E+00	0.00E+00	4.90E-10
Sr-89	2.56E+03	0.00E+00	7.33E+01	0.00E+00	0.00E+00	0.00E+00	3.05E+02
Sr-90	5.93E+04	0.00E+00	1.19E+03	0.00E+00	0.00E+00	0.00E+00	1.35E+03
Sr-91	4.69E+01	0.00E+00	1.87E+00	0.00E+00	0.00E+00	0.00E+00	2.13E+02
Sr-92	1.77E+01	0.00E+00	7.56E-01	0.00E+00	0.00E+00	0.00E+00	4.52E+02
Y-90	7.97E-02	0.00E+00	2.15E-03	0.00E+00	0.00E+00	0.00E+00	6.57E+02
Y-91M	7.50E-04	0.00E+00	2.87E-05	0.00E+00	0.00E+00	0.00E+00	3.54E-02
Y-91	1.17E+00	0.00E+00	3.13E-02	0.00E+00	0.00E+00	0.00E+00	4.79E+02
Y-92	7.03E-03	0.00E+00	2.03E-04	0.00E+00	0.00E+00	0.00E+00	1.93E+02
Y-93	2.23E-02	0.00E+00	6.10E-04	0.00E+00	0.00E+00	0.00E+00	6.80E+02
Zr-95	2.40E-01	7.56E-02	5.20E-02	0.00E+00	1.11E-01	0.00E+00	1.74E+02
Zr-97	1.38E-02	2.73E-03	1.26E-03	0.00E+00	4.13E-03	0.00E+00	7.38E+02
Nb-95	4.78E-02	2.65E-02	1.46E-02	0.00E+00	2.57E-02	0.00E+00	1.13E+02
Mo-99	0.00E+00	3.51E+01	6.69E+00	0.00E+00	8.02E+01	0.00E+00	6.28E+01
Tc- 99M	1.93E-03	5.38E-03	6.98E-02	0.00E+00	8.02E-02	2.99E-03	3.53E+00
Tc-101	2.09E-03	2.98E-03	2.92E-02	0.00E+00	5.38E-02	1.81E-03	5.09E-10
Ru-103	1.48E+00	0.00E+00	6.34E-01	0.00E+00	5.23E+00	0.00E+00	1.24E+02
Ru-105	1.27E-01	0.00E+00	4.92E-02	0.00E+00	1.60E+00	0.00E+00	1.02E+02
Ru-106	2.28E+01	0.00E+00	2.87E+00	0.00E+00	4.40E+01	0.00E+00	1.09E+03
Ag-110M	1.19E+00	1.13E+00	6.86E-01	0.00E+00	2.15E+00	0.00E+00	3.17E+02
Te-125M	2.23E+01	8.02E+00	2.98E+00	6.22E+00	0.00E+00	0.00E+00	6.57E+01

Table 9a (continued)
Site Specific Potable Water Dose Factors for Teen Age Group

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-127M	5.62E+01	1.99E+01	6.69E+00	1.34E+01	2.28E+02	0.00E+00	1.40E+02
Te-127	9.19E-01	3.26E-01	1.98E-01	6.34E-01	3.72E+00	0.00E+00	7.09E+01
Te-129M	9.48E+01	3.52E+01	1.50E+01	3.06E+01	3.97E+02	0.00E+00	3.56E+02
Te-129	2.60E-01	9.71E-02	6.34E-02	1.86E-01	1.09E+00	0.00E+00	1.42E+00
Te-131M	1.42E+01	6.80E+00	5.67E+00	1.02E+01	7.09E+01	0.00E+00	5.46E+02
Te-131	1.62E-01	6.69E-02	5.07E-02	1.25E-01	7.09E-01	0.00E+00	1.33E-02
Te-132	2.03E+01	1.28E+01	1.21E+01	1.35E+01	1.23E+02	0.00E+00	4.07E+02
I-130	5.99E+00	1.73E+01	6.92E+00	1.41E+03	2.67E+01	0.00E+00	1.33E+01
I-131	3.40E+01	4.76E+01	2.56E+01	1.39E+04	8.20E+01	0.00E+00	9.42E+00
I-132	1.62E+00	4.24E+00	1.52E+00	1.43E+02	6.69E+00	0.00E+00	1.85E+00
I-133	1.17E+01	1.98E+01	6.05E+00	2.77E+03	3.48E+01	0.00E+00	1.50E+01
I-134	8.49E-01	2.25E+00	8.08E-01	3.75E+01	3.55E+00	0.00E+00	2.97E-02
I-135	3.55E+00	9.13E+00	3.38E+00	5.87E+02	1.44E+01	0.00E+00	1.01E+01
Cs-134	4.87E+02	1.15E+03	5.31E+02	0.00E+00	3.64E+02	1.39E+02	1.42E+01
Cs-136	4.99E+01	1.97E+02	1.32E+02	0.00E+00	1.07E+02	1.69E+01	1.58E+01
Cs-137	6.51E+02	8.66E+02	3.02E+02	0.00E+00	2.95E+02	1.15E+02	1.23E+01
Cs-138	4.51E-01	8.66E-01	4.33E-01	0.00E+00	6.40E-01	7.44E-02	3.93E-04
Ba-139	8.08E-01	5.69E-04	2.35E-02	0.00E+00	5.36E-04	3.92E-04	7.21E+00
Ba-140	1.65E+02	2.02E-01	1.06E+01	0.00E+00	6.86E-02	1.36E-01	2.55E+02
Ba-141	3.90E-01	2.91E-04	1.30E-02	0.00E+00	2.70E-04	1.99E-04	8.31E-07
Ba-142	1.74E-01	1.74E-04	1.07E-02	0.00E+00	1.47E-04	1.16E-04	5.34E-13
La-140	2.02E-02	9.94E-03	2.65E-03	0.00E+00	0.00E+00	0.00E+00	5.71E+02
La-142	1.04E-03	4.62E-04	1.15E-04	0.00E+00	0.00E+00	0.00E+00	1.41E+01
Ce-141	7.73E-02	5.16E-02	5.93E-03	0.00E+00	2.43E-02	0.00E+00	1.48E+02
Ce-143	1.37E-02	9.94E+00	1.11E-03	0.00E+00	4.46E-03	0.00E+00	2.99E+02
Ce-144	4.05E+00	1.67E+00	2.17E-01	0.00E+00	1.00E+00	0.00E+00	1.02E+03
Pr-143	7.62E-02	3.04E-02	3.79E-03	0.00E+00	1.77E-02	0.00E+00	2.51E+02
Pr-144	2.50E-04	1.02E-04	1.27E-05	0.00E+00	5.87E-05	0.00E+00	2.76E-07
Nd-147	5.45E-02	5.93E-02	3.55E-03	0.00E+00	3.48E-02	0.00E+00	2.14E+02
W-187	8.49E-01	6.92E-01	2.42E-01	0.00E+00	0.00E+00	0.00E+00	1.87E+02
Np-239	1.02E-02	9.65E-04	5.36E-04	0.00E+00	3.03E-03	0.00E+00	1.55E+02

Notes:

1) Units are mrem/hr per µCi/ml.

Table 9b
Site Specific Potable Water Dose Factors for Child Age Group

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	6.74E-01	6.74E-01	6.74E-01	6.74E-01	6.74E-01	6.74E-01
Na-24	3.37E+01	3.37E+01	3.37E+01	3.37E+01	3.37E+01	3.37E+01	3.37E+01
Cr-51	0.00E+00	0.00E+00	5.17E-02	2.87E-02	7.85E-03	5.24E-02	2.74E+00
Mn-54	0.00E+00	6.22E+01	1.66E+01	0.00E+00	1.74E+01	0.00E+00	5.22E+01
Mn-56	0.00E+00	1.94E+00	4.38E-01	0.00E+00	2.35E+00	0.00E+00	2.81E+02
Fe-55	6.69E+01	3.55E+01	1.10E+01	0.00E+00	0.00E+00	2.01E+01	6.57E+00
Fe-59	9.59E+01	1.55E+02	7.73E+01	0.00E+00	0.00E+00	4.50E+01	1.62E+02
Co-58	0.00E+00	1.05E+01	3.20E+01	0.00E+00	0.00E+00	0.00E+00	6.10E+01
Co-60	0.00E+00	3.08E+01	9.07E+01	0.00E+00	0.00E+00	0.00E+00	1.70E+02
Ni-63	3.13E+03	1.67E+02	1.06E+02	0.00E+00	0.00E+00	0.00E+00	1.13E+01
Ni-65	1.29E+01	1.22E+00	7.09E-01	0.00E+00	0.00E+00	0.00E+00	1.49E+02
Cu-64	0.00E+00	1.42E+00	8.60E-01	0.00E+00	3.44E+00	0.00E+00	6.69E+01
Zn-65	7.97E+01	2.12E+02	1.32E+02	0.00E+00	1.34E+02	0.00E+00	3.73E+01
Zn-69	2.55E-01	3.68E-01	3.40E-02	0.00E+00	2.23E-01	0.00E+00	2.32E+01
Br-83	0.00E+00	0.00E+00	9.94E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	1.15E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	5.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	3.90E+02	2.40E+02	0.00E+00	0.00E+00	0.00E+00	2.51E+01
Rb-88	0.00E+00	1.10E+00	7.67E-01	0.00E+00	0.00E+00	0.00E+00	5.42E-02
Rb-89	0.00E+00	6.80E-01	6.05E-01	0.00E+00	0.00E+00	0.00E+00	5.93E-03
Sr-89	7.67E+03	0.00E+00	2.19E+02	0.00E+00	0.00E+00	0.00E+00	2.97E+02
Sr-90	1.49E+05	0.00E+00	2.99E+03	0.00E+00	0.00E+00	0.00E+00	1.33E+03
Sr-91	1.40E+02	0.00E+00	5.27E+00	0.00E+00	0.00E+00	0.00E+00	3.08E+02
Sr-92	5.25E+01	0.00E+00	2.10E+00	0.00E+00	0.00E+00	0.00E+00	9.94E+02
Y-90	2.39E-01	0.00E+00	6.40E-03	0.00E+00	0.00E+00	0.00E+00	6.80E+02
Y-91M	2.22E-03	0.00E+00	8.08E-05	0.00E+00	0.00E+00	0.00E+00	4.35E+00
Y-91	3.50E+00	0.00E+00	9.36E-02	0.00E+00	0.00E+00	0.00E+00	4.66E+02
Y-92	2.09E-02	0.00E+00	5.99E-04	0.00E+00	0.00E+00	0.00E+00	6.05E+02
Y-93	6.63E-02	0.00E+00	1.82E-03	0.00E+00	0.00E+00	0.00E+00	9.88E+02
Zr-95	6.74E-01	1.48E-01	1.32E-01	0.00E+00	2.12E-01	0.00E+00	1.55E+02
Zr-97	4.06E-02	5.87E-03	3.47E-03	0.00E+00	8.43E-03	0.00E+00	8.90E+02
Nb-95	1.31E-01	5.09E-02	3.64E-02	0.00E+00	4.78E-02	0.00E+00	9.42E+01
Mo-99	0.00E+00	7.73E+01	1.91E+01	0.00E+00	1.65E+02	0.00E+00	6.40E+01
Tc- 99M	5.37E-03	1.05E-02	1.74E-01	0.00E+00	1.53E-01	5.34E-03	5.99E+00
Tc-101	6.22E-03	6.51E-03	8.26E-02	0.00E+00	1.11E-01	3.44E-03	2.07E-02
Ru-103	4.25E+00	0.00E+00	1.63E+00	0.00E+00	1.07E+01	0.00E+00	1.10E+02
Ru-105	3.75E-01	0.00E+00	1.36E-01	0.00E+00	3.30E+00	0.00E+00	2.45E+02
Ru-106	6.80E+01	0.00E+00	8.49E+00	0.00E+00	9.19E+01	0.00E+00	1.06E+03
Ag-110M	3.13E+00	2.12E+00	1.69E+00	0.00E+00	3.94E+00	0.00E+00	2.52E+02
Te-125M	6.63E+01	1.80E+01	8.84E+00	1.86E+01	0.00E+00	0.00E+00	6.40E+01

Table 9b (continued)
Site Specific Potable Water Dose Factors for Child Age Group

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-127M	1.68E+02	4.52E+01	1.99E+01	4.02E+01	4.79E+02	0.00E+00	1.36E+02
Te-127	2.74E+00	7.38E-01	5.87E-01	1.90E+00	7.79E+00	0.00E+00	1.07E+02
Te-129M	2.83E+02	7.91E+01	4.40E+01	9.13E+01	8.31E+02	0.00E+00	3.45E+02
Te-129	7.79E-01	2.17E-01	1.85E-01	5.56E-01	2.28E+00	0.00E+00	4.85E+01
Te-131M	4.19E+01	1.45E+01	1.54E+01	2.98E+01	1.40E+02	0.00E+00	5.87E+02
Te-131	4.83E-01	1.47E-01	1.44E-01	3.69E-01	1.46E+00	0.00E+00	2.53E+00
Te-132	5.87E+01	2.60E+01	3.14E+01	3.78E+01	2.41E+02	0.00E+00	2.62E+02
I-130	1.70E+01	3.43E+01	1.77E+01	3.78E+03	5.13E+01	0.00E+00	1.60E+01
I-131	1.00E+02	1.01E+02	5.72E+01	3.33E+04	1.65E+02	0.00E+00	8.95E+00
I-132	4.65E+00	8.55E+00	3.93E+00	3.97E+02	1.31E+01	0.00E+00	1.01E+01
I-133	3.44E+01	4.26E+01	1.61E+01	7.91E+03	7.09E+01	0.00E+00	1.72E+01
I-134	2.44E+00	4.52E+00	2.08E+00	1.04E+02	6.92E+00	0.00E+00	3.00E+00
I-135	1.02E+01	1.83E+01	8.66E+00	1.62E+03	2.81E+01	0.00E+00	1.40E+01
Cs-134	1.36E+03	2.23E+03	4.71E+02	0.00E+00	6.92E+02	2.48E+02	1.20E+01
Cs-136	1.37E+02	3.76E+02	2.43E+02	0.00E+00	2.00E+02	2.98E+01	1.32E+01
Cs-137	1.90E+03	1.82E+03	2.69E+02	0.00E+00	5.93E+02	2.13E+02	1.14E+01
Cs-138	1.33E+00	1.84E+00	1.17E+00	0.00E+00	1.30E+00	1.40E-01	8.49E-01
Ba-139	2.41E+00	1.28E-03	6.98E-02	0.00E+00	1.12E-03	7.56E-04	1.39E+02
Ba-140	4.83E+02	4.23E-01	2.82E+01	0.00E+00	1.38E-01	2.52E-01	2.45E+02
Ba-141	1.16E+00	6.51E-04	3.78E-02	0.00E+00	5.63E-04	3.83E-03	6.63E-01
Ba-142	5.08E-01	3.66E-04	2.84E-02	0.00E+00	2.96E-04	2.15E-04	6.63E-03
La-140	5.87E-02	2.05E-02	6.92E-03	0.00E+00	0.00E+00	0.00E+00	5.72E+02
La-142	3.05E-03	9.71E-04	3.04E-04	0.00E+00	0.00E+00	0.00E+00	1.92E+02
Ce-141	2.31E-01	1.15E-01	1.71E-02	0.00E+00	5.05E-02	0.00E+00	1.44E+02
Ce-143	4.06E-02	2.20E+01	3.19E-03	0.00E+00	9.24E-03	0.00E+00	3.23E+02
Ce-144	1.21E+01	3.79E+00	6.45E-01	0.00E+00	2.10E+00	0.00E+00	9.88E+02
Pr-143	2.28E-01	6.86E-02	1.13E-02	0.00E+00	3.72E-02	0.00E+00	2.47E+02
Pr-144	7.50E-04	2.32E-04	3.77E-05	0.00E+00	1.23E-04	0.00E+00	4.99E-01
Nd-147	1.62E-01	1.31E-01	1.02E-02	0.00E+00	7.21E-02	0.00E+00	2.08E+02
W-187	2.49E+00	1.48E+00	6.63E-01	0.00E+00	0.00E+00	0.00E+00	2.08E+02
Np-239	3.05E-02	2.19E-03	1.54E-03	0.00E+00	6.34E-03	0.00E+00	1.62E+02

Notes:

1) Units are mrem/hr per µCi/ml.

Table 9c
Site Specific Potable Water Dose Factors for Infant Age Group

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	6.62E-01	6.62E-01	6.62E-01	6.62E-01	6.62E-01	6.62E-01
Na-24	3.80E+01	3.80E+01	3.80E+01	3.80E+01	3.80E+01	3.80E+01	3.80E+01
Cr-51	0.00E+00	0.00E+00	5.30E-02	3.46E-02	7.56E-03	6.73E-02	1.55E+00
Mn-54	0.00E+00	7.49E+01	1.70E+01	0.00E+00	1.66E+01	0.00E+00	2.75E+01
Mn-56	0.00E+00	3.08E+00	5.30E-01	0.00E+00	2.64E+00	0.00E+00	2.80E+02
Fe-55	5.23E+01	3.38E+01	9.03E+00	0.00E+00	0.00E+00	1.65E+01	4.29E+00
Fe-59	1.16E+02	2.02E+02	7.98E+01	0.00E+00	0.00E+00	5.98E+01	9.67E+01
Co-58	0.00E+00	1.35E+01	3.38E+01	0.00E+00	0.00E+00	0.00E+00	3.37E+01
Co-60	0.00E+00	4.06E+01	9.59E+01	0.00E+00	0.00E+00	0.00E+00	9.67E+01
Ni-63	2.39E+03	1.47E+02	8.28E+01	0.00E+00	0.00E+00	0.00E+00	7.34E+00
Ni-65	1.77E+01	2.00E+00	9.10E-01	0.00E+00	0.00E+00	0.00E+00	1.52E+02
Cu-64	0.00E+00	2.29E+00	1.06E+00	0.00E+00	3.87E+00	0.00E+00	4.70E+01
Zn-65	6.92E+01	2.37E+02	1.09E+02	0.00E+00	1.15E+02	0.00E+00	2.01E+02
Zn-69	3.51E-01	6.32E-01	4.70E-02	0.00E+00	2.63E-01	0.00E+00	5.15E+01
Br-83	0.00E+00	0.00E+00	1.37E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	1.44E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	7.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	6.40E+02	3.16E+02	0.00E+00	0.00E+00	0.00E+00	1.64E+01
Rb-88	0.00E+00	1.87E+00	1.03E+00	0.00E+00	0.00E+00	0.00E+00	1.82E+00
Rb-89	0.00E+00	1.08E+00	7.41E-01	0.00E+00	0.00E+00	0.00E+00	3.66E-01
Sr-89	9.44E+03	0.00E+00	2.71E+02	0.00E+00	0.00E+00	0.00E+00	1.94E+02
Sr-90	1.06E+05	0.00E+00	2.16E+03	0.00E+00	0.00E+00	0.00E+00	8.69E+02
Sr-91	1.88E+02	0.00E+00	6.81E+00	0.00E+00	0.00E+00	0.00E+00	2.23E+02
Sr-92	7.22E+01	0.00E+00	2.68E+00	0.00E+00	0.00E+00	0.00E+00	7.79E+02
Y-90	3.27E-01	0.00E+00	8.77E-03	0.00E+00	0.00E+00	0.00E+00	4.51E+02
Y-91M	3.05E-03	0.00E+00	1.04E-04	0.00E+00	0.00E+00	0.00E+00	1.02E+01
Y-91	4.25E+00	0.00E+00	1.13E-01	0.00E+00	0.00E+00	0.00E+00	3.05E+02
Y-92	2.88E-02	0.00E+00	8.09E-04	0.00E+00	0.00E+00	0.00E+00	5.49E+02
Y-93	9.14E-02	0.00E+00	2.49E-03	0.00E+00	0.00E+00	0.00E+00	7.22E+02
Zr-95	7.75E-01	1.89E-01	1.34E-01	0.00E+00	2.04E-01	0.00E+00	9.41E+01
Zr-97	5.57E-02	9.56E-03	4.36E-03	0.00E+00	9.63E-03	0.00E+00	6.09E+02
Nb-95	1.58E-01	6.51E-02	3.76E-02	0.00E+00	4.66E-02	0.00E+00	5.49E+01
Mo-99	0.00E+00	1.28E+02	2.49E+01	0.00E+00	1.91E+02	0.00E+00	4.21E+01
Tc- 99M	7.22E-03	1.49E-02	1.92E-01	0.00E+00	1.60E-01	7.79E-03	4.33E+00
Tc-101	8.54E-03	1.08E-02	1.06E-01	0.00E+00	1.28E-01	5.87E-03	1.83E+00
Ru-103	5.57E+00	0.00E+00	1.86E+00	0.00E+00	1.16E+01	0.00E+00	6.77E+01
Ru-105	5.12E-01	0.00E+00	1.72E-01	0.00E+00	3.76E+00	0.00E+00	2.04E+02
Ru-106	9.07E+01	0.00E+00	1.13E+01	0.00E+00	1.07E+02	0.00E+00	6.88E+02
Ag-110M	3.75E+00	2.73E+00	1.81E+00	0.00E+00	3.91E+00	0.00E+00	1.42E+02
Te-125M	8.77E+01	2.93E+01	1.19E+01	2.95E+01	0.00E+00	0.00E+00	4.18E+01

Table 9c (continued)
Site Specific Potable Water Dose Factors for Infant Age Group

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-127M	2.20E+02	7.30E+01	2.66E+01	6.36E+01	5.42E+02	0.00E+00	8.88E+01
Te-127	3.76E+00	1.26E+00	8.09E-01	3.06E+00	9.18E+00	0.00E+00	7.90E+01
Te-129M	3.76E+02	1.29E+02	5.79E+01	1.44E+02	9.41E+02	0.00E+00	2.25E+02
Te-129	1.07E+00	3.68E-01	2.49E-01	8.95E-01	2.66E+00	0.00E+00	8.54E+01
Te-131M	5.72E+01	2.30E+01	1.90E+01	4.66E+01	1.58E+02	0.00E+00	3.87E+02
Te-131	6.62E-01	2.45E-01	1.86E-01	5.91E-01	1.69E+00	0.00E+00	2.67E+01
Te-132	7.82E+01	3.87E+01	3.62E+01	5.72E+01	2.42E+02	0.00E+00	1.43E+02
I-130	2.26E+01	4.97E+01	1.99E+01	5.57E+03	5.45E+01	0.00E+00	1.06E+01
I-131	1.35E+02	1.59E+02	7.00E+01	5.23E+04	1.86E+02	0.00E+00	5.68E+00
I-132	6.24E+00	1.27E+01	4.51E+00	5.94E+02	1.41E+01	0.00E+00	1.03E+01
I-133	4.70E+01	6.85E+01	2.01E+01	1.25E+04	8.05E+01	0.00E+00	1.16E+01
I-134	3.27E+00	6.70E+00	2.38E+00	1.56E+02	7.49E+00	0.00E+00	6.92E+00
I-135	1.37E+01	2.72E+01	9.93E+00	2.44E+03	3.04E+01	0.00E+00	9.86E+00
Cs-134	1.42E+03	2.64E+03	2.67E+02	0.00E+00	6.81E+02	2.79E+02	7.19E+00
Cs-136	1.73E+02	5.08E+02	1.90E+02	0.00E+00	2.02E+02	4.14E+01	7.71E+00
Cs-137	1.96E+03	2.30E+03	1.63E+02	0.00E+00	6.17E+02	2.50E+02	7.19E+00
Cs-138	1.81E+00	2.94E+00	1.43E+00	0.00E+00	1.47E+00	2.29E-01	4.70E+00
Ba-139	3.31E+00	2.20E-03	9.59E-02	0.00E+00	1.32E-03	1.33E-03	2.10E+02
Ba-140	6.43E+02	6.43E-01	3.31E+01	0.00E+00	1.53E-01	3.95E-01	1.58E+02
Ba-141	1.60E+00	1.09E-03	5.04E-02	0.00E+00	6.58E-04	6.66E-04	1.95E+01
Ba-142	6.92E-01	5.76E-04	3.41E-02	0.00E+00	3.31E-04	3.48E-04	2.86E+00
La-140	7.94E-02	3.13E-02	8.05E-03	0.00E+00	0.00E+00	0.00E+00	3.68E+02
La-142	4.14E-03	1.52E-03	3.64E-04	0.00E+00	0.00E+00	0.00E+00	2.58E+02
Ce-141	2.96E-01	1.81E-01	2.13E-02	0.00E+00	5.57E-02	0.00E+00	9.33E+01
Ce-143	5.57E-02	3.69E+01	4.21E-03	0.00E+00	1.08E-02	0.00E+00	2.16E+02
Ce-144	1.12E+01	4.59E+00	6.28E-01	0.00E+00	1.85E+00	0.00E+00	6.43E+02
Pr-143	3.06E-01	1.14E-01	1.52E-02	0.00E+00	4.25E-02	0.00E+00	1.61E+02
Pr-144	1.03E-03	3.99E-04	5.19E-05	0.00E+00	1.44E-04	0.00E+00	1.85E+01
Nd-147	2.08E-01	2.14E-01	1.31E-02	0.00E+00	8.24E-02	0.00E+00	1.35E+02
W-187	3.40E+00	2.36E+00	8.16E-01	0.00E+00	0.00E+00	0.00E+00	1.39E+02
Np-239	4.18E-02	3.74E-03	2.11E-03	0.00E+00	7.45E-03	0.00E+00	1.08E+02

Notes:

1) Units are mrem/hr per µCi/ml.

Table 10
Site Specific Fish Ingestion Dose Factors for Adult Age Group

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	1.29E-01	1.29E-01	1.29E-01	1.29E-01	1.29E-01	1.29E-01
Na-24	4.07E+02	4.07E+02	4.07E+02	4.07E+02	4.07E+02	4.07E+02	4.07E+02
Cr-51	0.00E+00	0.00E+00	1.27E+00	7.61E-01	2.81E-01	1.69E+00	3.20E+02
Mn-54	0.00E+00	4.38E+03	8.35E+02	0.00E+00	1.30E+03	0.00E+00	1.34E+04
Mn-56	0.00E+00	1.10E+02	1.95E+01	0.00E+00	1.40E+02	0.00E+00	3.51E+03
Fe-55	6.58E+02	4.55E+02	1.06E+02	0.00E+00	0.00E+00	2.54E+02	2.61E+02
Fe-59	1.04E+03	2.44E+03	9.36E+02	0.00E+00	0.00E+00	6.82E+02	8.14E+03
Co-58	0.00E+00	8.92E+01	2.00E+02	0.00E+00	0.00E+00	0.00E+00	1.81E+03
Co-60	0.00E+00	2.56E+02	5.65E+02	0.00E+00	0.00E+00	0.00E+00	4.81E+03
Ni-63	3.11E+04	2.16E+03	1.04E+03	0.00E+00	0.00E+00	0.00E+00	4.50E+02
Ni-65	1.26E+02	1.64E+01	7.49E+00	0.00E+00	0.00E+00	0.00E+00	4.17E+02
Cu-64	0.00E+00	9.97E+00	4.68E+00	0.00E+00	2.51E+01	0.00E+00	8.50E+02
Zn-65	2.32E+04	7.37E+04	3.33E+04	0.00E+00	4.93E+04	0.00E+00	4.64E+04
Zn-69	4.93E+01	9.43E+01	6.56E+00	0.00E+00	6.13E+01	0.00E+00	1.42E+01
Br-83	0.00E+00	0.00E+00	4.04E+01	0.00E+00	0.00E+00	0.00E+00	5.82E+01
Br-84	0.00E+00	0.00E+00	5.24E+01	0.00E+00	0.00E+00	0.00E+00	4.11E-04
Br-85	0.00E+00	0.00E+00	2.15E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	1.01E+05	4.71E+04	0.00E+00	0.00E+00	0.00E+00	1.99E+04
Rb-88	0.00E+00	2.90E+02	1.54E+02	0.00E+00	0.00E+00	0.00E+00	4.00E-09
Rb-89	0.00E+00	1.92E+02	1.35E+02	0.00E+00	0.00E+00	0.00E+00	1.12E-11
Sr-89	2.21E+04	0.00E+00	6.35E+02	0.00E+00	0.00E+00	0.00E+00	3.55E+03
Sr-90	6.26E+05	0.00E+00	1.26E+04	0.00E+00	0.00E+00	0.00E+00	1.57E+04
Sr-91	4.07E+02	0.00E+00	1.64E+01	0.00E+00	0.00E+00	0.00E+00	1.94E+03
Sr-92	1.54E+02	0.00E+00	6.68E+00	0.00E+00	0.00E+00	0.00E+00	3.06E+03
Y-90	5.76E-01	0.00E+00	1.54E-02	0.00E+00	0.00E+00	0.00E+00	6.10E+03
Y-91M	5.44E-03	0.00E+00	2.11E-04	0.00E+00	0.00E+00	0.00E+00	1.60E-02
Y-91	8.44E+00	0.00E+00	2.26E-01	0.00E+00	0.00E+00	0.00E+00	4.64E+03
Y-92	5.06E-02	0.00E+00	1.48E-03	0.00E+00	0.00E+00	0.00E+00	8.86E+02
Y-93	1.60E-01	0.00E+00	4.43E-03	0.00E+00	0.00E+00	0.00E+00	5.09E+03
Zr-95	2.40E-01	7.70E-02	5.21E-02	0.00E+00	1.21E-01	0.00E+00	2.44E+02
Zr-97	1.33E-02	2.68E-03	1.22E-03	0.00E+00	4.04E-03	0.00E+00	8.30E+02
Nb-95	4.47E+02	2.48E+02	1.34E+02	0.00E+00	2.46E+02	0.00E+00	1.51E+06
Mo-99	0.00E+00	1.03E+02	1.96E+01	0.00E+00	2.34E+02	0.00E+00	2.39E+02
Tc- 99M	8.87E-03	2.51E-02	3.19E-01	0.00E+00	3.81E-01	1.23E-02	1.48E+01
Tc-101	9.12E-03	1.31E-02	1.29E-01	0.00E+00	2.37E-01	6.72E-03	3.95E-14
Ru-103	4.43E+00	0.00E+00	1.91E+00	0.00E+00	1.69E+01	0.00E+00	5.17E+02
Ru-105	3.69E-01	0.00E+00	1.46E-01	0.00E+00	4.76E+00	0.00E+00	2.26E+02
Ru-106	6.58E+01	0.00E+00	8.33E+00	0.00E+00	1.27E+02	0.00E+00	4.26E+03
Ag-110M	8.81E-01	8.15E-01	4.84E-01	0.00E+00	1.60E+00	0.00E+00	3.33E+02

Te-125M	2.57E+03	9.30E+02	3.44E+02	7.72E+02	1.04E+04	0.00E+00	1.02E+04

Table 10 (continued)
Site Specific Fish Ingestion Dose Factors for Adult Age Group

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-127M	6.48E+03	2.32E+03	7.90E+02	1.66E+03	2.63E+04	0.00E+00	2.17E+04
Te-127	1.05E+02	3.78E+01	2.28E+01	7.80E+01	4.29E+02	0.00E+00	8.31E+03
Te-129M	1.10E+04	4.11E+03	1.74E+03	3.78E+03	4.60E+04	0.00E+00	5.54E+04
Te-129	3.01E+01	1.13E+01	7.33E+00	2.31E+01	1.26E+02	0.00E+00	2.27E+01
Te-131M	1.66E+03	8.10E+02	6.75E+02	1.28E+03	8.21E+03	0.00E+00	8.04E+04
Te-131	1.89E+01	7.88E+00	5.96E+00	1.55E+01	8.26E+01	0.00E+00	2.67E+00
Te-132	2.41E+03	1.56E+03	1.47E+03	1.72E+03	1.50E+04	0.00E+00	7.38E+04
I-130	2.71E+01	8.01E+01	3.16E+01	6.79E+03	1.25E+02	0.00E+00	6.89E+01
I-131	1.49E+02	2.14E+02	1.22E+02	7.00E+04	3.66E+02	0.00E+00	5.64E+01
I-132	7.29E+00	1.95E+01	6.82E+00	6.82E+02	3.11E+01	0.00E+00	3.66E+00
I-133	5.10E+01	8.87E+01	2.70E+01	1.30E+04	1.55E+02	0.00E+00	7.97E+01
I-134	3.81E+00	1.03E+01	3.70E+00	1.79E+02	1.64E+01	0.00E+00	9.01E-03
I-135	1.59E+01	4.17E+01	1.54E+01	2.75E+03	6.68E+01	0.00E+00	4.70E+01
Cs-134	2.98E+05	7.09E+05	5.79E+05	0.00E+00	2.29E+05	7.61E+04	1.24E+04
Cs-136	3.12E+04	1.23E+05	8.86E+04	0.00E+00	6.85E+04	9.38E+03	1.40E+04
Cs-137	3.82E+05	5.22E+05	3.42E+05	0.00E+00	1.77E+05	5.89E+04	1.01E+04
Cs-138	2.64E+02	5.22E+02	2.59E+02	0.00E+00	3.84E+02	3.79E+01	2.23E-03
Ba-139	9.29E-01	6.62E-04	2.72E-02	0.00E+00	6.19E-04	3.75E-04	1.65E+00
Ba-140	1.94E+02	2.44E-01	1.27E+01	0.00E+00	8.30E-02	1.40E-01	4.00E+02
Ba-141	4.51E-01	3.41E-04	1.52E-02	0.00E+00	3.17E-04	1.93E-04	2.13E-10
Ba-142	2.04E-01	2.10E-04	1.28E-02	0.00E+00	1.77E-04	1.19E-04	2.87E-19
La-140	1.50E-01	7.54E-02	1.99E-02	0.00E+00	0.00E+00	0.00E+00	5.54E+03
La-142	7.66E-03	3.48E-03	8.68E-04	0.00E+00	0.00E+00	0.00E+00	2.54E+01
Ce-141	2.24E-02	1.52E-02	1.72E-03	0.00E+00	7.04E-03	0.00E+00	5.79E+01
Ce-143	3.95E-03	2.92E+00	3.23E-04	0.00E+00	1.29E-03	0.00E+00	1.09E+02
Ce-144	1.17E+00	4.88E-01	6.27E-02	0.00E+00	2.90E-01	0.00E+00	3.95E+02
Pr-143	5.51E-01	2.21E-01	2.73E-02	0.00E+00	1.27E-01	0.00E+00	2.41E+03
Pr-144	1.80E-03	7.48E-04	9.16E-05	0.00E+00	4.22E-04	0.00E+00	2.59E-10
Nd-147	3.76E-01	4.35E-01	2.60E-02	0.00E+00	2.54E-01	0.00E+00	2.09E+03
W-187	2.96E+02	2.47E+02	8.65E+01	0.00E+00	0.00E+00	0.00E+00	8.10E+04
Np-239	2.85E-02	2.80E-03	1.54E-03	0.00E+00	8.74E-03	0.00E+00	5.75E+02

Notes:

1) Units are mrem/hr per μCi/ml.

Table 10a
Site Specific Fish Ingestion Dose Factors for Teen Age Group

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	9.92E-02	9.92E-02	9.92E-02	9.92E-02	9.92E-02	9.92E-02
Na-24	4.20E+02	4.20E+02	4.20E+02	4.20E+02	4.20E+02	4.20E+02	4.20E+02
Cr-51	0.00E+00	0.00E+00	1.31E+00	7.30E-01	2.88E-01	1.88E+00	2.21E+02
Mn-54	0.00E+00	4.30E+03	8.54E+02	0.00E+00	1.28E+03	0.00E+00	8.83E+03
Mn-56	0.00E+00	1.15E+02	2.05E+01	0.00E+00	1.46E+02	0.00E+00	7.59E+03
Fe-55	6.89E+02	4.89E+02	1.14E+02	0.00E+00	0.00E+00	3.10E+02	2.12E+02
Fe-59	1.07E+03	2.50E+03	9.65E+02	0.00E+00	0.00E+00	7.88E+02	5.91E+03
Co-58	0.00E+00	8.86E+01	2.04E+02	0.00E+00	0.00E+00	0.00E+00	1.22E+03
Co-60	0.00E+00	2.56E+02	5.77E+02	0.00E+00	0.00E+00	0.00E+00	3.34E+03
Ni-63	3.23E+04	2.28E+03	1.09E+03	0.00E+00	0.00E+00	0.00E+00	3.63E+02
Ni-65	1.37E+02	1.75E+01	7.95E+00	0.00E+00	0.00E+00	0.00E+00	9.47E+02
Cu-64	0.00E+00	1.05E+01	4.93E+00	0.00E+00	2.65E+01	0.00E+00	8.14E+02
Zn-65	2.10E+04	7.30E+04	3.40E+04	0.00E+00	4.67E+04	0.00E+00	3.09E+04
Zn-69	5.36E+01	1.02E+02	7.15E+00	0.00E+00	6.68E+01	0.00E+00	1.88E+02
Br-83	0.00E+00	0.00E+00	4.40E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	5.53E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	2.34E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	1.09E+05	5.11E+04	0.00E+00	0.00E+00	0.00E+00	1.61E+04
Rb-88	0.00E+00	3.11E+02	1.66E+02	0.00E+00	0.00E+00	0.00E+00	2.66E-05
Rb-89	0.00E+00	2.01E+02	1.42E+02	0.00E+00	0.00E+00	0.00E+00	3.08E-07
Sr-89	2.41E+04	0.00E+00	6.89E+02	0.00E+00	0.00E+00	0.00E+00	2.87E+03
Sr-90	5.58E+05	0.00E+00	1.12E+04	0.00E+00	0.00E+00	0.00E+00	1.27E+04
Sr-91	4.42E+02	0.00E+00	1.76E+01	0.00E+00	0.00E+00	0.00E+00	2.00E+03
Sr-92	1.67E+02	0.00E+00	7.11E+00	0.00E+00	0.00E+00	0.00E+00	4.25E+03
Y-90	6.25E-01	0.00E+00	1.68E-02	0.00E+00	0.00E+00	0.00E+00	5.15E+03
Y-91M	5.88E-03	0.00E+00	2.25E-04	0.00E+00	0.00E+00	0.00E+00	2.78E-01
Y-91	9.17E+00	0.00E+00	2.46E-01	0.00E+00	0.00E+00	0.00E+00	3.76E+03
Y-92	5.52E-02	0.00E+00	1.60E-03	0.00E+00	0.00E+00	0.00E+00	1.51E+03
Y-93	1.75E-01	0.00E+00	4.79E-03	0.00E+00	0.00E+00	0.00E+00	5.34E+03
Zr-95	2.48E-01	7.82E-02	5.38E-02	0.00E+00	1.15E-01	0.00E+00	1.81E+02
Zr-97	1.43E-02	2.82E-03	1.30E-03	0.00E+00	4.28E-03	0.00E+00	7.64E+02
Nb-95	4.50E+02	2.50E+02	1.37E+02	0.00E+00	2.42E+02	0.00E+00	1.07E+06
Mo-99	0.00E+00	1.10E+02	2.10E+01	0.00E+00	2.52E+02	0.00E+00	1.97E+02
Tc- 99M	9.08E-03	2.53E-02	3.28E-01	0.00E+00	3.78E-01	1.41E-02	1.66E+01
Tc-101	9.85E-03	1.40E-02	1.38E-01	0.00E+00	2.53E-01	8.54E-03	2.39E-09
Ru-103	4.65E+00	0.00E+00	1.99E+00	0.00E+00	1.64E+01	0.00E+00	3.89E+02
Ru-105	3.98E-01	0.00E+00	1.54E-01	0.00E+00	5.02E+00	0.00E+00	3.21E+02
Ru-106	7.15E+01	0.00E+00	9.01E+00	0.00E+00	1.38E+02	0.00E+00	3.43E+03
Ag-110M	8.60E-01	8.14E-01	4.95E-01	0.00E+00	1.55E+00	0.00E+00	2.29E+02
Te-125M	2.79E+03	1.01E+03	3.74E+02	7.81E+02	0.00E+00	0.00E+00	8.24E+03

Table 10a (continued)
Site Specific Fish Ingestion Dose Factors for Teen Age Group

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-127M	7.06E+03	2.50E+03	8.39E+02	1.68E+03	2.86E+04	0.00E+00	1.76E+04
Te-127	1.15E+02	4.09E+01	2.48E+01	7.95E+01	4.67E+02	0.00E+00	8.90E+03
Te-129M	1.19E+04	4.41E+03	1.88E+03	3.84E+03	4.98E+04	0.00E+00	4.47E+04
Te-129	3.27E+01	1.22E+01	7.95E+00	2.33E+01	1.37E+02	0.00E+00	1.79E+02
Te-131M	1.78E+03	8.54E+02	7.12E+02	1.28E+03	8.90E+03	0.00E+00	6.85E+04
Te-131	2.04E+01	8.39E+00	6.36E+00	1.57E+01	8.90E+01	0.00E+00	1.67E+00
Te-132	2.55E+03	1.61E+03	1.52E+03	1.70E+03	1.55E+04	0.00E+00	5.11E+04
I-130	2.82E+01	8.15E+01	3.26E+01	6.65E+03	1.26E+02	0.00E+00	6.27E+01
I-131	1.60E+02	2.24E+02	1.20E+02	6.54E+04	3.86E+02	0.00E+00	4.43E+01
I-132	7.63E+00	2.00E+01	7.17E+00	6.73E+02	3.15E+01	0.00E+00	8.70E+00
I-133	5.50E+01	9.33E+01	2.85E+01	1.30E+04	1.64E+02	0.00E+00	7.06E+01
I-134	3.99E+00	1.06E+01	3.80E+00	1.76E+02	1.67E+01	0.00E+00	1.40E-01
I-135	1.67E+01	4.30E+01	1.59E+01	2.76E+03	6.79E+01	0.00E+00	4.76E+01
Cs-134	3.05E+05	7.19E+05	3.33E+05	0.00E+00	2.28E+05	8.72E+04	8.94E+03
Cs-136	3.13E+04	1.23E+05	8.28E+04	0.00E+00	6.71E+04	1.06E+04	9.92E+03
Cs-137	4.09E+05	5.44E+05	1.89E+05	0.00E+00	1.85E+05	7.19E+04	7.73E+03
Cs-138	2.83E+02	5.44E+02	2.72E+02	0.00E+00	4.01E+02	4.67E+01	2.47E-01
Ba-139	1.01E+00	7.14E-04	2.95E-02	0.00E+00	6.73E-04	4.92E-04	9.05E+00
Ba-140	2.07E+02	2.54E-01	1.34E+01	0.00E+00	8.61E-02	1.71E-01	3.20E+02
Ba-141	4.90E-01	3.66E-04	1.63E-02	0.00E+00	3.39E-04	2.50E-04	1.04E-06
Ba-142	2.18E-01	2.18E-04	1.34E-02	0.00E+00	1.85E-04	1.45E-04	6.70E-13
La-140	1.59E-01	7.80E-02	2.07E-02	0.00E+00	0.00E+00	0.00E+00	4.48E+03
La-142	8.16E-03	3.63E-03	9.03E-04	0.00E+00	0.00E+00	0.00E+00	1.10E+02
Ce-141	2.43E-02	1.62E-02	1.86E-03	0.00E+00	7.62E-03	0.00E+00	4.63E+01
Ce-143	4.29E-03	3.12E+00	3.48E-04	0.00E+00	1.40E-03	0.00E+00	9.38E+01
Ce-144	1.27E+00	5.25E-01	6.82E-02	0.00E+00	3.14E-01	0.00E+00	3.19E+02
Pr-143	5.97E-01	2.38E-01	2.97E-02	0.00E+00	1.39E-01	0.00E+00	1.97E+03
Pr-144	1.96E-03	8.03E-04	9.94E-05	0.00E+00	4.61E-04	0.00E+00	2.16E-06
Nd-147	4.28E-01	4.65E-01	2.79E-02	0.00E+00	2.73E-01	0.00E+00	1.68E+03
W-187	3.20E+02	2.60E+02	9.13E+01	0.00E+00	0.00E+00	0.00E+00	7.05E+04
Np-239	3.21E-02	3.03E-03	1.68E-03	0.00E+00	9.50E-03	0.00E+00	4.87E+02

Notes:

1) Units are mrem/hr per µCi/ml.

Table 10b
Site Specific Fish Ingestion Dose Factors for Child Age Group

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	8.21E-02	8.21E-02	8.21E-02	8.21E-02	8.21E-02	8.21E-02
Na-24	4.56E+02	4.56E+02	4.56E+02	4.56E+02	4.56E+02	4.56E+02	4.56E+02
Cr-51	0.00E+00	0.00E+00	1.40E+00	7.77E-01	2.12E-01	1.42E+00	7.43E+01
Mn-54	0.00E+00	3.37E+03	8.97E+02	0.00E+00	9.44E+02	0.00E+00	2.83E+03
Mn-56	0.00E+00	1.05E+02	2.37E+01	0.00E+00	1.27E+02	0.00E+00	1.52E+04
Fe-55	9.05E+02	4.80E+02	1.49E+02	0.00E+00	0.00E+00	2.71E+02	8.89E+01
Fe-59	1.30E+03	2.10E+03	1.05E+03	0.00E+00	0.00E+00	6.09E+02	2.19E+03
Co-58	0.00E+00	7.08E+01	2.17E+02	0.00E+00	0.00E+00	0.00E+00	4.13E+02
Co-60	0.00E+00	2.08E+02	6.14E+02	0.00E+00	0.00E+00	0.00E+00	1.15E+03
Ni-63	4.23E+04	2.27E+03	1.44E+03	0.00E+00	0.00E+00	0.00E+00	1.53E+02
Ni-65	1.75E+02	1.64E+01	9.60E+00	0.00E+00	0.00E+00	0.00E+00	2.01E+03
Cu-64	0.00E+00	9.64E+00	5.82E+00	0.00E+00	2.33E+01	0.00E+00	4.52E+02
Zn-65	2.16E+04	5.74E+04	3.57E+04	0.00E+00	3.62E+04	0.00E+00	1.01E+04
Zn-69	6.89E+01	9.96E+01	9.20E+00	0.00E+00	6.04E+01	0.00E+00	6.28E+03
Br-83	0.00E+00	0.00E+00	5.65E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	6.54E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	3.01E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	1.05E+05	6.48E+04	0.00E+00	0.00E+00	0.00E+00	6.78E+03
Rb-88	0.00E+00	2.99E+02	2.08E+02	0.00E+00	0.00E+00	0.00E+00	1.47E+01
Rb-89	0.00E+00	1.84E+02	1.64E+02	0.00E+00	0.00E+00	0.00E+00	1.60E+00
Sr-89	3.11E+04	0.00E+00	8.90E+02	0.00E+00	0.00E+00	0.00E+00	1.21E+03
Sr-90	6.04E+05	0.00E+00	1.22E+04	0.00E+00	0.00E+00	0.00E+00	5.40E+03
Sr-91	5.66E+02	0.00E+00	2.14E+01	0.00E+00	0.00E+00	0.00E+00	1.25E+03
Sr-92	2.13E+02	0.00E+00	8.54E+00	0.00E+00	0.00E+00	0.00E+00	4.04E+03
Y-90	8.08E-01	0.00E+00	2.16E-02	0.00E+00	0.00E+00	0.00E+00	2.30E+03
Y-91M	7.51E-03	0.00E+00	2.73E-04	0.00E+00	0.00E+00	0.00E+00	1.47E+01
Y-91	1.18E+01	0.00E+00	3.17E-01	0.00E+00	0.00E+00	0.00E+00	1.58E+03
Y-92	7.08E-02	0.00E+00	2.03E-03	0.00E+00	0.00E+00	0.00E+00	2.05E+03
Y-93	2.24E-01	0.00E+00	6.16E-03	0.00E+00	0.00E+00	0.00E+00	3.34E+03
Zr-95	3.01E-01	6.62E-02	5.89E-02	0.00E+00	9.47E-02	0.00E+00	6.90E+01
Zr-97	1.81E-02	2.62E-03	1.55E-03	0.00E+00	3.76E-03	0.00E+00	3.97E+02
Nb-95	5.31E+02	2.07E+02	1.48E+02	0.00E+00	1.94E+02	0.00E+00	3.82E+05
Mo-99	0.00E+00	1.05E+02	2.59E+01	0.00E+00	2.23E+02	0.00E+00	8.65E+01
Tc- 99M	1.09E-02	2.14E-02	3.54E-01	0.00E+00	3.10E-01	1.08E-02	1.22E+01
Tc-101	1.26E-02	1.32E-02	1.68E-01	0.00E+00	2.25E-01	6.99E-03	4.20E-02
Ru-103	5.75E+00	0.00E+00	2.21E+00	0.00E+00	1.45E+01	0.00E+00	1.49E+02
Ru-105	5.07E-01	0.00E+00	1.84E-01	0.00E+00	4.46E+00	0.00E+00	3.31E+02
Ru-106	9.20E+01	0.00E+00	1.15E+01	0.00E+00	1.24E+02	0.00E+00	1.43E+03
Ag-110M	9.75E-01	6.59E-01	5.26E-01	0.00E+00	1.23E+00	0.00E+00	7.83E+01
Te-125M	3.59E+03	9.72E+02	4.78E+02	1.01E+03	0.00E+00	0.00E+00	3.46E+03

Table 10b (continued)
Site Specific Fish Ingestion Dose Factors for Child Age Group

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-127M	9.09E+03	2.45E+03	1.08E+03	2.17E+03	2.59E+04	0.00E+00	7.36E+03
Te-127	1.48E+02	4.00E+01	3.18E+01	1.03E+02	4.22E+02	0.00E+00	5.79E+03
Te-129M	1.53E+04	4.28E+03	2.38E+03	4.94E+03	4.50E+04	0.00E+00	1.87E+04
Te-129	4.22E+01	1.18E+01	1.00E+01	3.01E+01	1.23E+02	0.00E+00	2.62E+03
Te-131M	2.27E+03	7.83E+02	8.34E+02	1.61E+03	7.58E+03	0.00E+00	3.18E+04
Te-131	2.61E+01	7.96E+00	7.77E+00	2.00E+01	7.90E+01	0.00E+00	1.37E+02
Te-132	3.18E+03	1.41E+03	1.70E+03	2.05E+03	1.31E+04	0.00E+00	1.42E+04
I-130	3.45E+01	6.96E+01	3.59E+01	7.67E+03	1.04E+02	0.00E+00	3.26E+01
I-131	2.03E+02	2.04E+02	1.16E+02	6.75E+04	3.35E+02	0.00E+00	1.82E+01
I-132	9.44E+00	1.73E+01	7.98E+00	8.05E+02	2.65E+01	0.00E+00	2.04E+01
I-133	6.99E+01	8.64E+01	3.27E+01	1.60E+04	1.44E+02	0.00E+00	3.48E+01
I-134	4.94E+00	9.18E+00	4.22E+00	2.11E+02	1.40E+01	0.00E+00	6.09E+00
I-135	2.06E+01	3.72E+01	1.76E+01	3.29E+03	5.70E+01	0.00E+00	2.83E+01
Cs-134	3.68E+05	6.04E+05	1.27E+05	0.00E+00	1.87E+05	6.72E+04	3.26E+03
Cs-136	3.70E+04	1.02E+05	6.58E+04	0.00E+00	5.41E+04	8.07E+03	3.57E+03
Cs-137	5.14E+05	4.92E+05	7.27E+04	0.00E+00	1.60E+05	5.77E+04	3.08E+03
Cs-138	3.59E+02	4.99E+02	3.16E+02	0.00E+00	3.51E+02	3.78E+01	2.30E+02
Ba-139	1.30E+00	6.95E-04	3.78E-02	0.00E+00	6.07E-04	4.09E-04	7.52E+01
Ba-140	2.61E+02	2.29E-01	1.53E+01	0.00E+00	7.46E-02	1.37E-01	1.32E+02
Ba-141	6.29E-01	3.52E-04	2.05E-02	0.00E+00	3.05E-04	2.07E-03	3.59E-01
Ba-142	2.75E-01	1.98E-04	1.54E-02	0.00E+00	1.60E-04	1.16E-04	3.59E-03
La-140	1.99E-01	6.94E-02	2.34E-02	0.00E+00	0.00E+00	0.00E+00	1.94E+03
La-142	1.03E-02	3.28E-03	1.03E-03	0.00E+00	0.00E+00	0.00E+00	6.51E+02
Ce-141	3.12E-02	1.56E-02	2.31E-03	0.00E+00	6.83E-03	0.00E+00	1.94E+01
Ce-143	5.50E-03	2.98E+00	4.32E-04	0.00E+00	1.25E-03	0.00E+00	4.37E+01
Ce-144	1.64E+00	5.13E-01	8.73E-02	0.00E+00	2.84E-01	0.00E+00	1.34E+02
Pr-143	7.73E-01	2.32E-01	3.83E-02	0.00E+00	1.26E-01	0.00E+00	8.34E+02
Pr-144	2.54E-03	7.85E-04	1.28E-04	0.00E+00	4.15E-04	0.00E+00	1.69E+00
Nd-147	5.49E-01	4.44E-01	3.44E-02	0.00E+00	2.44E-01	0.00E+00	7.04E+02
W-187	4.05E+02	2.40E+02	1.08E+02	0.00E+00	0.00E+00	0.00E+00	3.37E+04
Np-239	4.13E-02	2.97E-03	2.08E-03	0.00E+00	8.57E-03	0.00E+00	2.19E+02

Notes:

1) Units are mrem/hr per μCi/ml.

2) The infant age group is assumed to receive no dose through the fish ingestion pathway, therefore no dose factors are supplied.

Table 11
Ground Plane Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Na-24	1.20E+07	1.20E+07	1.20E+07	1.20E+07	1.20E+07	1.20E+07	1.20E+07
Cr-51	4.65E+06	4.65E+06	4.65E+06	4.65E+06	4.65E+06	4.65E+06	4.65E+06
Mn-54	1.38E+09	1.38E+09	1.38E+09	1.38E+09	1.38E+09	1.38E+09	1.38E+09
Mn-56	9.03E+05	9.03E+05	9.03E+05	9.03E+05	9.03E+05	9.03E+05	9.03E+05
Fe-55	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-59	2.73E+08	2.73E+08	2.73E+08	2.73E+08	2.73E+08	2.73E+08	2.73E+08
Co-58	3.80E+08	3.80E+08	3.80E+08	3.80E+08	3.80E+08	3.80E+08	3.80E+08
Co-60	2.45E+10	2.45E+10	2.45E+10	2.45E+10	2.45E+10	2.45E+10	2.45E+10
Ni-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ni-65	2.97E+05	2.97E+05	2.97E+05	2.97E+05	2.97E+05	2.97E+05	2.97E+05
Cu-64	6.05E+05	6.05E+05	6.05E+05	6.05E+05	6.05E+05	6.05E+05	6.05E+05
Zn-65	7.46E+08	7.46E+08	7.46E+08	7.46E+08	7.46E+08	7.46E+08	7.46E+08
Zn-69	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-83	4.87E+03	4.87E+03	4.87E+03	4.87E+03	4.87E+03	4.87E+03	4.87E+03
Br-84	2.03E+05	2.03E+05	2.03E+05	2.03E+05	2.03E+05	2.03E+05	2.03E+05
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	9.01E+06	9.01E+06	9.01E+06	9.01E+06	9.01E+06	9.01E+06	9.01E+06
Rb-88	3.31E+04	3.31E+04	3.31E+04	3.31E+04	3.31E+04	3.31E+04	3.31E+04
Rb-89	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05
Sr-89	2.16E+04	2.16E+04	2.16E+04	2.16E+04	2.16E+04	2.16E+04	2.16E+04
Sr-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-91	2.14E+06	2.14E+06	2.14E+06	2.14E+06	2.14E+06	2.14E+06	2.14E+06
Sr-92	7.76E+05	7.76E+05	7.76E+05	7.76E+05	7.76E+05	7.76E+05	7.76E+05
Y-90	4.50E+03	4.50E+03	4.50E+03	4.50E+03	4.50E+03	4.50E+03	4.50E+03
Y-91M	1.00E+05	1.00E+05	1.00E+05	1.00E+05	1.00E+05	1.00E+05	1.00E+05
Y-91	1.07E+06	1.07E+06	1.07E+06	1.07E+06	1.07E+06	1.07E+06	1.07E+06
Y-92	1.80E+05	1.80E+05	1.80E+05	1.80E+05	1.80E+05	1.80E+05	1.80E+05
Y-93	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05
Zr-95	2.45E+08	2.45E+08	2.45E+08	2.45E+08	2.45E+08	2.45E+08	2.45E+08
Zr-97	2.96E+06	2.96E+06	2.96E+06	2.96E+06	2.96E+06	2.96E+06	2.96E+06
Nb-95	1.37E+08	1.37E+08	1.37E+08	1.37E+08	1.37E+08	1.37E+08	1.37E+08
Mo-99	3.99E+06	3.99E+06	3.99E+06	3.99E+06	3.99E+06	3.99E+06	3.99E+06
Tc- 99M	1.84E+05	1.84E+05	1.84E+05	1.84E+05	1.84E+05	1.84E+05	1.84E+05
Tc-101	2.03E+04	2.03E+04	2.03E+04	2.03E+04	2.03E+04	2.03E+04	2.03E+04
Ru-103	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
Ru-105	6.36E+05	6.36E+05	6.36E+05	6.36E+05	6.36E+05	6.36E+05	6.36E+05
Ru-106	4.22E+08	4.22E+08	4.22E+08	4.22E+08	4.22E+08	4.22E+08	4.22E+08
Ag-110M	3.45E+09	3.45E+09	3.45E+09	3.45E+09	3.45E+09	3.45E+09	3.45E+09

Table 11 (Continued)
Ground Plane Dose Factors (same for all age groups)

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	1.56E+06	1.56E+06	1.56E+06	1.56E+06	1.56E+06	1.56E+06	1.56E+06
Te-127M	9.16E+04	9.16E+04	9.16E+04	9.16E+04	9.16E+04	9.16E+04	9.16E+04
Te-127	2.99E+03	2.99E+03	2.99E+03	2.99E+03	2.99E+03	2.99E+03	2.99E+03
Te-129M	1.98E+07	1.98E+07	1.98E+07	1.98E+07	1.98E+07	1.98E+07	1.98E+07
Te-129	2.62E+04	2.62E+04	2.62E+04	2.62E+04	2.62E+04	2.62E+04	2.62E+04
Te-131M	8.02E+06	8.02E+06	8.02E+06	8.02E+06	8.02E+06	8.02E+06	8.02E+06
Te-131	2.92E+04	2.92E+04	2.92E+04	2.92E+04	2.92E+04	2.92E+04	2.92E+04
Te-132	4.22E+06	4.22E+06	4.22E+06	4.22E+06	4.22E+06	4.22E+06	4.22E+06
I-130	5.50E+06	5.50E+06	5.50E+06	5.50E+06	5.50E+06	5.50E+06	5.50E+06
I-131	1.72E+07	1.72E+07	1.72E+07	1.72E+07	1.72E+07	1.72E+07	1.72E+07
I-132	1.25E+06	1.25E+06	1.25E+06	1.25E+06	1.25E+06	1.25E+06	1.25E+06
I-133	2.45E+06	2.45E+06	2.45E+06	2.45E+06	2.45E+06	2.45E+06	2.45E+06
I-134	4.46E+05	4.46E+05	4.46E+05	4.46E+05	4.46E+05	4.46E+05	4.46E+05
I-135	2.53E+06	2.53E+06	2.53E+06	2.53E+06	2.53E+06	2.53E+06	2.53E+06
Cs-134	6.94E+09	6.94E+09	6.94E+09	6.94E+09	6.94E+09	6.94E+09	6.94E+09
Cs-136	1.50E+08	1.50E+08	1.50E+08	1.50E+08	1.50E+08	1.50E+08	1.50E+08
Cs-137	1.76E+10	1.76E+10	1.76E+10	1.76E+10	1.76E+10	1.76E+10	1.76E+10
Cs-138	3.59E+05	3.59E+05	3.59E+05	3.59E+05	3.59E+05	3.59E+05	3.59E+05
Ba-139	1.06E+05	1.06E+05	1.06E+05	1.06E+05	1.06E+05	1.06E+05	1.06E+05
Ba-140	2.05E+07	2.05E+07	2.05E+07	2.05E+07	2.05E+07	2.05E+07	2.05E+07
Ba-141	4.17E+04	4.17E+04	4.17E+04	4.17E+04	4.17E+04	4.17E+04	4.17E+04
Ba-142	4.44E+04	4.44E+04	4.44E+04	4.44E+04	4.44E+04	4.44E+04	4.44E+04
La-140	1.92E+07	1.92E+07	1.92E+07	1.92E+07	1.92E+07	1.92E+07	1.92E+07
La-142	7.60E+05	7.60E+05	7.60E+05	7.60E+05	7.60E+05	7.60E+05	7.60E+05
Ce-141	1.37E+07	1.37E+07	1.37E+07	1.37E+07	1.37E+07	1.37E+07	1.37E+07
Ce-143	2.31E+06	2.31E+06	2.31E+06	2.31E+06	2.31E+06	2.31E+06	2.31E+06
Ce-144	6.96E+07	6.96E+07	6.96E+07	6.96E+07	6.96E+07	6.96E+07	6.96E+07
Pr-143	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pr-144	1.84E+03	1.84E+03	1.84E+03	1.84E+03	1.84E+03	1.84E+03	1.84E+03
Nd-147	8.48E+06	8.48E+06	8.48E+06	8.48E+06	8.48E+06	8.48E+06	8.48E+06
W-187	2.35E+06	2.35E+06	2.35E+06	2.35E+06	2.35E+06	2.35E+06	2.35E+06
Np-239	1.71E+06	1.71E+06	1.71E+06	1.71E+06	1.71E+06	1.71E+06	1.71E+06

Notes:

1) Units are m^2 mrem/yr per μCi/sec.

2) All age groups are assumed to receive the same dose.

Table 12
Adult Inhalation Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	7.18E+02	7.18E+02	7.18E+02	7.18E+02	7.18E+02	7.18E+02
Na-24	1.02E+04	1.02E+04	1.02E+04	1.02E+04	1.02E+04	1.02E+04	1.02E+04
Cr-51	0.00E+00	0.00E+00	1.00E+02	5.95E+01	2.28E+01	1.44E+04	3.32E+03
Mn-54	0.00E+00	3.96E+04	6.30E+03	0.00E+00	9.84E+03	1.40E+06	7.74E+04
Mn-56	0.00E+00	1.24E+00	1.83E-01	0.00E+00	1.30E+00	9.44E+03	2.02E+04
Fe-55	2.46E+04	1.70E+04	3.94E+03	0.00E+00	0.00E+00	7.21E+04	6.03E+03
Fe-59	1.18E+04	2.78E+04	1.06E+04	0.00E+00	0.00E+00	1.02E+06	1.88E+05
Co-58	0.00E+00	1.58E+03	2.07E+03	0.00E+00	0.00E+00	9.28E+05	1.06E+05
Co-60	0.00E+00	1.15E+04	1.48E+04	0.00E+00	0.00E+00	5.97E+06	2.85E+05
Ni-63	4.32E+05	3.14E+04	1.45E+04	0.00E+00	0.00E+00	1.78E+05	1.34E+04
Ni-65	1.54E+00	2.10E-01	9.12E-02	0.00E+00	0.00E+00	5.60E+03	1.23E+04
Cu-64	0.00E+00	1.46E+00	6.15E-01	0.00E+00	4.62E+00	6.78E+03	4.90E+04
Zn-65	3.24E+04	1.03E+05	4.66E+04	0.00E+00	6.90E+04	8.64E+05	5.34E+04
Zn-69	3.38E-02	6.51E-02	4.52E-03	0.00E+00	4.22E-02	9.20E+02	1.63E+01
Br-83	0.00E+00	0.00E+00	2.41E+02	0.00E+00	0.00E+00	0.00E+00	2.32E+02
Br-84	0.00E+00	0.00E+00	3.13E+02	0.00E+00	0.00E+00	0.00E+00	1.64E-03
Br-85	0.00E+00	0.00E+00	1.28E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	1.35E+05	5.90E+04	0.00E+00	0.00E+00	0.00E+00	1.66E+04
Rb-88	0.00E+00	3.87E+02	1.93E+02	0.00E+00	0.00E+00	0.00E+00	3.34E-09
Rb-89	0.00E+00	2.56E+02	1.70E+02	0.00E+00	0.00E+00	0.00E+00	9.28E-12
Sr-89	3.04E+05	0.00E+00	8.72E+03	0.00E+00	0.00E+00	1.40E+06	3.50E+05
Sr-90	2.87E+07	0.00E+00	5.77E+05	0.00E+00	0.00E+00	9.60E+06	7.22E+05
Sr-91	6.19E+01	0.00E+00	2.50E+00	0.00E+00	0.00E+00	3.65E+04	1.91E+05
Sr-92	6.74E+00	0.00E+00	2.91E-01	0.00E+00	0.00E+00	1.65E+04	4.30E+04
Y-90	2.09E+03	0.00E+00	5.61E+01	0.00E+00	0.00E+00	1.70E+05	5.06E+05
Y-91M	2.61E-01	0.00E+00	1.02E-02	0.00E+00	0.00E+00	1.92E+03	1.33E+00
Y-91	4.62E+05	0.00E+00	1.24E+04	0.00E+00	0.00E+00	1.70E+06	3.85E+05
Y-92	1.03E+01	0.00E+00	3.02E-01	0.00E+00	0.00E+00	1.57E+04	7.35E+04
Y-93	9.44E+01	0.00E+00	2.61E+00	0.00E+00	0.00E+00	4.85E+04	4.22E+05
Zr-95	1.07E+05	3.44E+04	2.33E+04	0.00E+00	5.42E+04	1.77E+06	1.50E+05
Zr-97	9.68E+01	1.96E+01	9.04E+00	0.00E+00	2.97E+01	7.87E+04	5.23E+05
Nb-95	1.41E+04	7.82E+03	4.21E+03	0.00E+00	7.74E+03	5.05E+05	1.04E+05
Mo-99	0.00E+00	1.21E+02	2.30E+01	0.00E+00	2.91E+02	9.12E+04	2.48E+05
Tc- 99M	1.03E-03	2.91E-03	3.70E-02	0.00E+00	4.42E-02	7.64E+02	4.16E+03
Tc-101	4.18E-05	6.02E-05	5.90E-04	0.00E+00	1.08E-03	3.99E+02	1.09E-11
Ru-103	1.53E+03	0.00E+00	6.58E+02	0.00E+00	5.83E+03	5.05E+05	1.10E+05
Ru-105	7.90E-01	0.00E+00	3.11E-01	0.00E+00	1.02E+00	1.10E+04	4.82E+04
Ru-106	6.91E+04	0.00E+00	8.72E+03	0.00E+00	1.34E+05	9.36E+06	9.12E+05
Ag-110M	1.08E+04	1.00E+04	5.94E+03	0.00E+00	1.97E+04	4.63E+06	3.02E+05

Table 12 (Continued)
Adult Inhalation Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	3.42E+03	1.58E+03	4.67E+02	1.05E+03	1.24E+04	3.14E+05	7.06E+04
Te-127M	1.26E+04	5.77E+03	1.57E+03	3.29E+03	4.58E+04	9.60E+05	1.50E+05
Te-127	1.40E+00	6.42E-01	3.10E-01	1.06E+00	5.10E+00	6.51E+03	5.74E+04
Te-129M	9.76E+03	4.67E+03	1.58E+03	3.44E+03	3.66E+04	1.16E+06	3.83E+05
Te-129	4.98E-02	2.39E-02	1.24E-02	3.90E-02	1.87E-01	1.94E+03	1.57E+02
Te-131M	6.99E+01	4.36E+01	2.90E+01	5.50E+01	3.09E+02	1.46E+05	5.56E+05
Te-131	1.11E-02	5.95E-03	3.59E-03	9.36E-03	4.37E-02	1.39E+03	1.84E+01
Te-132	2.60E+02	2.15E+02	1.62E+02	1.90E+02	1.46E+03	2.88E+05	5.10E+05
I-130	4.58E+03	1.34E+04	5.28E+03	1.14E+06	2.09E+04	0.00E+00	7.69E+03
I-131	2.52E+04	3.58E+04	2.05E+04	1.19E+07	6.13E+04	0.00E+00	6.28E+03
I-132	1.16E+03	3.26E+03	1.16E+03	1.14E+05	5.18E+03	0.00E+00	4.06E+02
I-133	8.64E+03	1.48E+04	4.52E+03	2.15E+06	2.58E+04	0.00E+00	8.88E+03
I-134	6.44E+02	1.73E+03	6.15E+02	2.98E+04	2.75E+03	0.00E+00	1.01E+00
I-135	2.68E+03	6.98E+03	2.57E+03	4.48E+05	1.11E+04	0.00E+00	5.25E+03
Cs-134	3.73E+05	8.48E+05	7.28E+05	0.00E+00	2.87E+05	9.76E+04	1.04E+04
Cs-136	3.90E+04	1.46E+05	1.10E+05	0.00E+00	8.56E+04	1.20E+04	1.17E+04
Cs-137	4.78E+05	6.21E+05	4.28E+05	0.00E+00	2.22E+05	7.52E+04	8.40E+03
Cs-138	3.31E+02	6.21E+02	3.24E+02	0.00E+00	4.80E+02	4.86E+01	1.86E-03
Ba-139	9.36E-01	6.66E-04	2.74E-02	0.00E+00	6.22E-04	3.76E+03	8.96E+02
Ba-140	3.90E+04	4.90E+01	2.57E+03	0.00E+00	1.67E+01	1.27E+06	2.18E+05
Ba-141	1.00E-01	7.53E-05	3.36E-03	0.00E+00	7.00E-05	1.94E+03	1.16E-07
Ba-142	2.63E-02	2.70E-05	1.66E-03	0.00E+00	2.29E-05	1.19E+03	1.57E-16
La-140	3.44E+02	1.74E+02	4.58E+01	0.00E+00	0.00E+00	1.36E+05	4.58E+05
La-142	6.83E-01	3.10E-01	7.72E-02	0.00E+00	0.00E+00	6.33E+03	2.11E+03
Ce-141	1.99E+04	1.35E+04	1.53E+03	0.00E+00	6.26E+03	3.62E+05	1.20E+05
Ce-143	1.86E+02	1.38E+02	1.53E+01	0.00E+00	6.08E+01	7.98E+04	2.26E+05
Ce-144	3.43E+06	1.43E+06	1.84E+05	0.00E+00	8.48E+05	7.78E+06	8.16E+05
Pr-143	9.36E+03	3.75E+03	4.64E+02	0.00E+00	2.16E+03	2.81E+05	2.00E+05
Pr-144	3.01E-02	1.25E-02	1.53E-03	0.00E+00	7.05E-03	1.02E+03	2.15E-08
Nd-147	5.27E+03	6.10E+03	3.65E+02	0.00E+00	3.56E+03	2.21E+05	1.73E+05
W-187	8.48E+00	7.08E+00	2.48E+00	0.00E+00	0.00E+00	2.90E+04	1.55E+05
Np-239	2.30E+02	2.03E+02	1.24E+01	0.00E+00	7.00E+01	3.76E+04	1.19E+05

Notes:

1) Units are mrem/yr per $\mu Ci/m^3$.

Table 12a
Teen Inhalation Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	7.25E+02	7.25E+02	7.25E+02	7.25E+02	7.25E+02	7.25E+02
Na-24	1.38E+04	1.38E+04	1.38E+04	1.38E+04	1.38E+04	1.38E+04	1.38E+04
Cr-51	0.00E+00	0.00E+00	1.35E+02	7.50E+01	3.07E+01	2.10E+04	3.00E+03
Mn-54	0.00E+00	5.11E+04	8.40E+03	0.00E+00	1.27E+04	1.98E+06	6.68E+04
Mn-56	0.00E+00	1.70E+00	2.52E-01	0.00E+00	1.79E+00	1.52E+04	5.74E+04
Fe-55	3.34E+04	2.38E+04	5.54E+03	0.00E+00	0.00E+00	1.24E+05	6.39E+03
Fe-59	1.59E+04	3.70E+04	1.43E+04	0.00E+00	0.00E+00	1.53E+06	1.78E+05
Co-58	0.00E+00	2.07E+03	2.78E+03	0.00E+00	0.00E+00	1.34E+06	9.52E+04
Co-60	0.00E+00	1.51E+04	1.98E+04	0.00E+00	0.00E+00	8.72E+06	2.59E+05
Ni-63	5.80E+05	4.34E+04	1.98E+04	0.00E+00	0.00E+00	3.07E+05	1.42E+04
Ni-65	2.18E+00	2.93E-01	1.27E-01	0.00E+00	0.00E+00	9.36E+03	3.67E+04
Cu-64	0.00E+00	2.03E+00	8.48E-01	0.00E+00	6.41E+00	1.11E+04	6.14E+04
Zn-65	3.86E+04	1.34E+05	6.24E+04	0.00E+00	8.64E+04	1.24E+06	4.66E+04
Zn-69	4.83E-02	9.20E-02	6.46E-03	0.00E+00	6.02E-02	1.58E+03	2.85E+02
Br-83	0.00E+00	0.00E+00	3.44E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	4.33E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	1.83E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	1.90E+05	8.40E+04	0.00E+00	0.00E+00	0.00E+00	1.77E+04
Rb-88	0.00E+00	5.46E+02	2.72E+02	0.00E+00	0.00E+00	0.00E+00	2.92E-05
Rb-89	0.00E+00	3.52E+02	2.33E+02	0.00E+00	0.00E+00	0.00E+00	3.38E-07
Sr-89	4.34E+05	0.00E+00	1.25E+04	0.00E+00	0.00E+00	2.42E+06	3.71E+05
Sr-90	3.31E+07	0.00E+00	6.66E+05	0.00E+00	0.00E+00	1.65E+07	7.65E+05
Sr-91	8.80E+01	0.00E+00	3.51E+00	0.00E+00	0.00E+00	6.07E+04	2.59E+05
Sr-92	9.52E+00	0.00E+00	4.06E-01	0.00E+00	0.00E+00	2.74E+04	1.19E+05
Y-90	2.98E+03	0.00E+00	8.00E+01	0.00E+00	0.00E+00	2.93E+05	5.59E+05
Y-91M	3.70E-01	0.00E+00	1.42E-02	0.00E+00	0.00E+00	3.20E+03	3.02E+01
Y-91	6.61E+05	0.00E+00	1.77E+04	0.00E+00	0.00E+00	2.94E+06	4.09E+05
Y-92	1.47E+01	0.00E+00	4.29E-01	0.00E+00	0.00E+00	2.68E+04	1.65E+05
Y-93	1.35E+02	0.00E+00	3.72E+00	0.00E+00	0.00E+00	8.32E+04	5.79E+05
Zr-95	1.46E+05	4.58E+04	3.15E+04	0.00E+00	6.74E+04	2.69E+06	1.49E+05
Zr-97	1.38E+02	2.72E+01	1.26E+01	0.00E+00	4.12E+01	1.30E+05	6.30E+05
Nb-95	1.86E+04	1.03E+04	5.66E+03	0.00E+00	1.00E+04	7.51E+05	9.68E+04
Mo-99	0.00E+00	1.69E+02	3.22E+01	0.00E+00	4.11E+02	1.54E+05	2.69E+05
Tc- 99M	1.38E-03	3.86E-03	4.99E-02	0.00E+00	5.76E-02	1.15E+03	6.13E+03
Tc-101	5.92E-05	8.40E-05	8.24E-04	0.00E+00	1.52E-03	6.67E+02	8.72E-07
Ru-103	2.10E+03	0.00E+00	8.96E+02	0.00E+00	7.43E+03	7.83E+05	1.09E+05
Ru-105	1.12E+00	0.00E+00	4.34E-01	0.00E+00	1.41E+00	1.82E+04	9.04E+04
Ru-106	9.84E+04	0.00E+00	1.24E+04	0.00E+00	1.90E+05	1.61E+07	9.60E+05
Ag-110M	1.38E+04	1.31E+04	7.99E+03	0.00E+00	2.50E+04	6.75E+06	2.73E+05

Table 12a (Continued)
Teen Inhalation Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	4.88E+03	2.24E+03	6.67E+02	1.40E+03	0.00E+00	5.36E+05	7.50E+04
Te-127M	1.80E+04	8.16E+03	2.18E+03	4.38E+03	6.54E+04	1.66E+06	1.59E+05
Te-127	2.01E+00	9.12E-01	4.42E-01	1.42E+00	7.28E+00	1.12E+04	8.08E+04
Te-129M	1.39E+04	6.58E+03	2.25E+03	4.58E+03	5.19E+04	1.98E+06	4.05E+05
Te-129	7.10E-02	3.38E-02	1.76E-02	5.18E-02	2.66E-01	3.30E+03	1.62E+03
Te-131M	9.84E+01	6.01E+01	4.02E+01	7.25E+01	4.39E+02	2.38E+05	6.21E+05
Te-131	1.58E-02	8.32E-03	5.04E-03	1.24E-02	6.18E-02	2.34E+03	1.51E+01
Te-132	3.60E+02	2.90E+02	2.19E+02	2.46E+02	1.95E+03	4.49E+05	4.63E+05
I-130	6.24E+03	1.79E+04	7.17E+03	1.49E+06	2.75E+04	0.00E+00	9.12E+03
I-131	3.54E+04	4.91E+04	2.64E+04	1.46E+07	8.40E+04	0.00E+00	6.49E+03
I-132	1.59E+03	4.38E+03	1.58E+03	1.51E+05	6.92E+03	0.00E+00	1.27E+03
I-133	1.22E+04	2.05E+04	6.22E+03	2.92E+06	3.59E+04	0.00E+00	1.03E+04
I-134	8.88E+02	2.32E+03	8.40E+02	3.95E+04	3.66E+03	0.00E+00	2.04E+01
I-135	3.70E+03	9.44E+03	3.49E+03	6.21E+05	1.49E+04	0.00E+00	6.95E+03
Cs-134	5.02E+05	1.13E+06	5.49E+05	0.00E+00	3.75E+05	1.46E+05	9.76E+03
Cs-136	5.15E+04	1.94E+05	1.37E+05	0.00E+00	1.10E+05	1.78E+04	1.09E+04
Cs-137	6.70E+05	8.48E+05	3.11E+05	0.00E+00	3.04E+05	1.21E+05	8.48E+03
Cs-138	4.66E+02	8.56E+02	4.46E+02	0.00E+00	6.62E+02	7.87E+01	2.70E-01
Ba-139	1.34E+00	9.44E-04	3.90E-02	0.00E+00	8.88E-04	6.46E+03	6.45E+03
Ba-140	5.47E+04	6.70E+01	3.52E+03	0.00E+00	2.28E+01	2.03E+06	2.29E+05
Ba-141	1.42E-01	1.06E-04	4.74E-03	0.00E+00	9.84E-05	3.29E+03	7.46E-04
Ba-142	3.70E-02	3.70E-05	2.27E-03	0.00E+00	3.14E-05	1.91E+03	4.79E-10
La-140	4.79E+02	2.36E+02	6.26E+01	0.00E+00	0.00E+00	2.14E+05	4.87E+05
La-142	9.60E-01	4.25E-01	1.06E-01	0.00E+00	0.00E+00	1.02E+04	1.20E+04
Ce-141	2.84E+04	1.90E+04	2.17E+03	0.00E+00	8.88E+03	6.14E+05	1.26E+05
Ce-143	2.66E+02	1.94E+02	2.16E+01	0.00E+00	8.64E+01	1.30E+05	2.55E+05
Ce-144	4.89E+06	2.02E+06	2.62E+05	0.00E+00	1.21E+06	1.34E+07	8.64E+05
Pr-143	1.34E+04	5.31E+03	6.62E+02	0.00E+00	3.09E+03	4.83E+05	2.14E+05
Pr-144	4.30E-02	1.76E-02	2.18E-03	0.00E+00	1.01E-02	1.75E+03	2.35E-04
Nd-147	7.86E+03	8.56E+03	5.13E+02	0.00E+00	5.02E+03	3.72E+05	1.82E+05
W-187	1.20E+01	9.76E+00	3.43E+00	0.00E+00	0.00E+00	4.74E+04	1.77E+05
Np-239	3.38E+02	2.88E+02	1.77E+01	0.00E+00	1.00E+02	6.49E+04	1.32E+05

Notes:

1) Units are mrem/yr per $\mu Ci/m^3$.

Table 12b
Child Inhalation Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	6.40E+02	6.40E+02	6.40E+02	6.40E+02	6.40E+02	6.40E+02
Na-24	1.61E+04	1.61E+04	1.61E+04	1.61E+04	1.61E+04	1.61E+04	1.61E+04
Cr-51	0.00E+00	0.00E+00	1.54E+02	8.55E+01	2.43E+01	1.70E+04	1.08E+03
Mn-54	0.00E+00	4.29E+04	9.51E+03	0.00E+00	1.00E+04	1.58E+06	2.29E+04
Mn-56	0.00E+00	1.66E+00	3.12E-01	0.00E+00	1.67E+00	1.31E+04	1.23E+05
Fe-55	4.74E+04	2.52E+04	7.77E+03	0.00E+00	0.00E+00	1.11E+05	2.87E+03
Fe-59	2.07E+04	3.34E+04	1.67E+04	0.00E+00	0.00E+00	1.27E+06	7.07E+04
Co-58	0.00E+00	1.77E+03	3.16E+03	0.00E+00	0.00E+00	1.11E+06	3.44E+04
Co-60	0.00E+00	1.31E+04	2.26E+04	0.00E+00	0.00E+00	7.07E+06	9.62E+04
Ni-63	8.21E+05	4.63E+04	2.80E+04	0.00E+00	0.00E+00	2.75E+05	6.33E+03
Ni-65	2.99E+00	2.96E-01	1.64E-01	0.00E+00	0.00E+00	8.18E+03	8.40E+04
Cu-64	0.00E+00	1.99E+00	1.07E+00	0.00E+00	6.03E+00	9.58E+03	3.67E+04
Zn-65	4.26E+04	1.13E+05	7.03E+04	0.00E+00	7.14E+04	9.95E+05	1.63E+04
Zn-69	6.70E-02	9.66E-02	8.92E-03	0.00E+00	5.85E-02	1.42E+03	1.02E+04
Br-83	0.00E+00	0.00E+00	4.74E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	5.48E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	2.53E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	1.98E+05	1.14E+05	0.00E+00	0.00E+00	0.00E+00	7.99E+03
Rb-88	0.00E+00	5.62E+02	3.66E+02	0.00E+00	0.00E+00	0.00E+00	1.72E+01
Rb-89	0.00E+00	3.45E+02	2.90E+02	0.00E+00	0.00E+00	0.00E+00	1.89E+00
Sr-89	5.99E+05	0.00E+00	1.72E+04	0.00E+00	0.00E+00	2.16E+06	1.67E+05
Sr-90	3.85E+07	0.00E+00	7.66E+05	0.00E+00	0.00E+00	1.48E+07	3.43E+05
Sr-91	1.21E+02	0.00E+00	4.59E+00	0.00E+00	0.00E+00	5.33E+04	1.74E+05
Sr-92	1.31E+01	0.00E+00	5.25E-01	0.00E+00	0.00E+00	2.40E+04	2.42E+05
Y-90	4.11E+03	0.00E+00	1.11E+02	0.00E+00	0.00E+00	2.62E+05	2.68E+05
Y-91M	5.07E-01	0.00E+00	1.84E-02	0.00E+00	0.00E+00	2.81E+03	1.72E+03
Y-91	9.14E+05	0.00E+00	2.44E+04	0.00E+00	0.00E+00	2.63E+06	1.84E+05
Y-92	2.04E+01	0.00E+00	5.81E-01	0.00E+00	0.00E+00	2.39E+04	2.39E+05
Y-93	1.86E+02	0.00E+00	5.11E+00	0.00E+00	0.00E+00	7.44E+04	3.89E+05
Zr-95	1.90E+05	4.18E+04	3.70E+04	0.00E+00	5.96E+04	2.23E+06	6.11E+04
Zr-97	1.88E+02	2.72E+01	1.60E+01	0.00E+00	3.89E+01	1.13E+05	3.51E+05
Nb-95	2.35E+04	9.18E+03	6.55E+03	0.00E+00	8.62E+03	6.14E+05	3.70E+04
Mo-99	0.00E+00	1.72E+02	4.26E+01	0.00E+00	3.92E+02	1.35E+05	1.27E+05
Tc- 99M	1.78E-03	3.48E-03	5.77E-02	0.00E+00	5.07E-02	9.51E+02	4.81E+03
Tc-101	8.10E-05	8.51E-05	1.08E-03	0.00E+00	1.45E-03	5.85E+02	1.63E+01
Ru-103	2.79E+03	0.00E+00	1.07E+03	0.00E+00	7.03E+03	6.62E+05	4.48E+04
Ru-105	1.53E+00	0.00E+00	5.55E-01	0.00E+00	1.34E+00	1.59E+04	9.95E+04
Ru-106	1.36E+05	0.00E+00	1.69E+04	0.00E+00	1.84E+05	1.43E+07	4.29E+05
Ag-110M	1.69E+04	1.14E+04	9.14E+03	0.00E+00	2.12E+04	5.48E+06	1.00E+05

Table 12b (Continued)
Child Inhalation Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	6.73E+03	2.33E+03	9.14E+02	1.92E+03	0.00E+00	4.77E+05	3.38E+04
Te-127M	2.49E+04	8.55E+03	3.02E+03	6.07E+03	6.36E+04	1.48E+06	7.14E+04
Te-127	2.77E+00	9.51E-01	6.11E-01	1.96E+00	7.07E+00	1.00E+04	5.62E+04
Te-129M	1.92E+04	6.85E+03	3.04E+03	6.33E+03	5.03E+04	1.76E+06	1.82E+05
Te-129	9.77E-02	3.50E-02	2.38E-02	7.14E-02	2.57E-01	2.93E+03	2.55E+04
Te-131M	1.34E+02	5.92E+01	5.07E+01	9.77E+01	4.00E+02	2.06E+05	3.08E+05
Te-131	2.17E-02	8.44E-03	6.59E-03	1.70E-02	5.88E-02	2.05E+03	1.33E+03
Te-132	4.81E+02	2.72E+02	2.63E+02	3.17E+02	1.77E+03	3.77E+05	1.38E+05
I-130	8.18E+03	1.64E+04	8.44E+03	1.85E+06	2.45E+04	0.00E+00	5.11E+03
I-131	4.81E+04	4.81E+04	2.73E+04	1.62E+07	7.88E+04	0.00E+00	2.84E+03
I-132	2.12E+03	4.07E+03	1.88E+03	1.94E+05	6.25E+03	0.00E+00	3.20E+03
I-133	1.66E+04	2.03E+04	7.70E+03	3.85E+06	3.38E+04	0.00E+00	5.48E+03
I-134	1.17E+03	2.16E+03	9.95E+02	5.07E+04	3.30E+03	0.00E+00	9.55E+02
I-135	4.92E+03	8.73E+03	4.14E+03	7.92E+05	1.34E+04	0.00E+00	4.44E+03
Cs-134	6.51E+05	1.01E+06	2.25E+05	0.00E+00	3.30E+05	1.21E+05	3.85E+03
Cs-136	6.51E+04	1.71E+05	1.16E+05	0.00E+00	9.55E+04	1.45E+04	4.18E+03
Cs-137	9.07E+05	8.25E+05	1.28E+05	0.00E+00	2.82E+05	1.04E+05	3.62E+03
Cs-138	6.33E+02	8.40E+02	5.55E+02	0.00E+00	6.22E+02	6.81E+01	2.70E+02
Ba-139	1.84E+00	9.84E-04	5.37E-02	0.00E+00	8.62E-04	5.77E+03	5.77E+04
Ba-140	7.40E+04	6.48E+01	4.33E+03	0.00E+00	2.11E+01	1.74E+06	1.02E+05
Ba-141	1.96E-01	1.09E-04	6.36E-03	0.00E+00	9.47E-05	2.92E+03	2.75E+02
Ba-142	5.00E-02	3.60E-05	2.79E-03	0.00E+00	2.91E-05	1.64E+03	2.74E+00
La-140	6.44E+02	2.25E+02	7.55E+01	0.00E+00	0.00E+00	1.83E+05	2.26E+05
La-142	1.30E+00	4.11E-01	1.29E-01	0.00E+00	0.00E+00	8.70E+03	7.59E+04
Ce-141	3.92E+04	1.95E+04	2.90E+03	0.00E+00	8.55E+03	5.44E+05	5.66E+04
Ce-143	3.66E+02	1.99E+02	2.87E+01	0.00E+00	8.36E+01	1.15E+05	1.27E+05
Ce-144	6.77E+06	2.12E+06	3.61E+05	0.00E+00	1.17E+06	1.20E+07	3.89E+05
Pr-143	1.85E+04	5.55E+03	9.14E+02	0.00E+00	3.00E+03	4.33E+05	9.73E+04
Pr-144	5.96E-02	1.85E-02	3.00E-03	0.00E+00	9.77E-03	1.57E+03	1.97E+02
Nd-147	1.08E+04	8.73E+03	6.81E+02	0.00E+00	4.81E+03	3.28E+05	8.21E+04
W-187	1.63E+01	9.66E+00	4.33E+00	0.00E+00	0.00E+00	4.11E+04	9.10E+04
Np-239	4.66E+02	3.01E+02	2.35E+01	0.00E+00	9.73E+01	5.81E+04	6.40E+04

Notes:

1) Units are mrem/yr per $\mu Ci/m^3$.

Table 12c
Infant Inhalation Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	3.68E+02	3.68E+02	3.68E+02	3.68E+02	3.68E+02	3.68E+02
Na-24	1.06E+04	1.06E+04	1.06E+04	1.06E+04	1.06E+04	1.06E+04	1.06E+04
Cr-51	0.00E+00	0.00E+00	8.95E+01	5.75E+01	1.32E+01	1.28E+04	3.57E+02
Mn-54	0.00E+00	2.53E+04	4.98E+03	0.00E+00	4.98E+03	1.00E+06	7.06E+03
Mn-56	0.00E+00	1.54E+00	2.21E-01	0.00E+00	1.10E+00	1.25E+04	7.17E+04
Fe-55	1.97E+04	1.17E+04	3.33E+03	0.00E+00	0.00E+00	8.69E+04	1.09E+03
Fe-59	1.36E+04	2.35E+04	9.48E+03	0.00E+00	0.00E+00	1.02E+06	2.48E+04
Co-58	0.00E+00	1.22E+03	1.82E+03	0.00E+00	0.00E+00	7.77E+05	1.11E+04
Co-60	0.00E+00	8.02E+03	1.18E+04	0.00E+00	0.00E+00	4.51E+06	3.19E+04
Ni-63	3.39E+05	2.04E+04	1.16E+04	0.00E+00	0.00E+00	2.09E+05	2.42E+03
Ni-65	2.39E+00	2.84E-01	1.23E-01	0.00E+00	0.00E+00	8.12E+03	5.01E+04
Cu-64	0.00E+00	1.88E+00	7.74E-01	0.00E+00	3.98E+00	9.30E+03	1.50E+04
Zn-65	1.93E+04	6.26E+04	3.11E+04	0.00E+00	3.25E+04	6.47E+05	5.14E+04
Zn-69	5.39E-02	9.67E-02	7.18E-03	0.00E+00	4.02E-02	1.47E+03	1.32E+04
Br-83	0.00E+00	0.00E+00	3.81E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	4.00E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	2.04E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	1.90E+05	8.82E+04	0.00E+00	0.00E+00	0.00E+00	3.04E+03
Rb-88	0.00E+00	5.57E+02	2.87E+02	0.00E+00	0.00E+00	0.00E+00	3.39E+02
Rb-89	0.00E+00	3.21E+02	2.06E+02	0.00E+00	0.00E+00	0.00E+00	6.82E+01
Sr-89	3.98E+05	0.00E+00	1.14E+04	0.00E+00	0.00E+00	2.03E+06	6.40E+04
Sr-90	1.55E+07	0.00E+00	3.12E+05	0.00E+00	0.00E+00	1.12E+07	1.31E+05
Sr-91	9.56E+01	0.00E+00	3.46E+00	0.00E+00	0.00E+00	5.26E+04	7.34E+04
Sr-92	1.05E+01	0.00E+00	3.91E-01	0.00E+00	0.00E+00	2.38E+04	1.40E+05
Y-90	3.29E+03	0.00E+00	8.82E+01	0.00E+00	0.00E+00	2.69E+05	1.04E+05
Y-91M	4.07E-01	0.00E+00	1.39E-02	0.00E+00	0.00E+00	2.79E+03	2.35E+03
Y-91	5.88E+05	0.00E+00	1.57E+04	0.00E+00	0.00E+00	2.45E+06	7.03E+04
Y-92	1.64E+01	0.00E+00	4.61E-01	0.00E+00	0.00E+00	2.45E+04	1.27E+05
Y-93	1.50E+02	0.00E+00	4.07E+00	0.00E+00	0.00E+00	7.64E+04	1.67E+05
Zr-95	1.15E+05	2.79E+04	2.03E+04	0.00E+00	3.11E+04	1.75E+06	2.17E+04
Zr-97	1.50E+02	2.56E+01	1.17E+01	0.00E+00	2.59E+01	1.10E+05	1.40E+05
Nb-95	1.57E+04	6.43E+03	3.78E+03	0.00E+00	4.72E+03	4.79E+05	1.27E+04
Mo-99	0.00E+00	1.65E+02	3.23E+01	0.00E+00	2.65E+02	1.35E+05	4.87E+04
Tc- 99M	1.40E-03	2.88E-03	3.72E-02	0.00E+00	3.11E-02	8.11E+02	2.03E+03
Tc-101	6.51E-05	8.23E-05	8.12E-04	0.00E+00	9.79E-04	5.84E+02	8.44E+02
Ru-103	2.02E+03	0.00E+00	6.79E+02	0.00E+00	4.24E+03	5.52E+05	1.61E+04
Ru-105	1.22E+00	0.00E+00	4.10E-01	0.00E+00	8.99E-01	1.57E+04	4.84E+04
Ru-106	8.68E+04	0.00E+00	1.09E+04	0.00E+00	1.07E+05	1.16E+07	1.64E+05
Ag-110M	9.98E+03	7.22E+03	5.00E+03	0.00E+00	1.09E+04	3.67E+06	3.30E+04

Table 12c (Continued)
Infant Inhalation Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	4.76E+03	1.99E+03	6.58E+02	1.62E+03	0.00E+00	4.47E+05	1.29E+04
Te-127M	1.67E+04	6.90E+03	2.07E+03	4.87E+03	3.75E+04	1.31E+06	2.73E+04
Te-127	2.23E+00	9.53E-01	4.89E-01	1.85E+00	4.86E+00	1.03E+04	2.44E+04
Te-129M	1.41E+04	6.09E+03	2.23E+03	5.47E+03	3.18E+04	1.68E+06	6.90E+04
Te-129	7.88E-02	3.47E-02	1.88E-02	6.75E-02	1.75E-01	3.00E+03	2.63E+04
Te-131M	1.07E+02	5.50E+01	3.63E+01	8.93E+01	2.65E+02	1.99E+05	1.19E+05
Te-131	1.74E-02	8.22E-03	5.00E-03	1.58E-02	3.99E-02	2.06E+03	8.22E+03
Te-132	3.72E+02	2.37E+02	1.76E+02	2.79E+02	1.03E+03	3.40E+05	4.41E+04
I-130	6.36E+03	1.39E+04	5.57E+03	1.60E+06	1.53E+04	0.00E+00	1.99E+03
I-131	3.79E+04	4.44E+04	1.96E+04	1.48E+07	5.18E+04	0.00E+00	1.06E+03
I-132	1.69E+03	3.54E+03	1.26E+03	1.69E+05	3.95E+03	0.00E+00	1.90E+03
I-133	1.32E+04	1.92E+04	5.60E+03	3.56E+06	2.24E+04	0.00E+00	2.16E+03
I-134	9.21E+02	1.88E+03	6.65E+02	4.45E+04	2.09E+03	0.00E+00	1.29E+03
I-135	3.86E+03	7.60E+03	2.77E+03	6.96E+05	8.47E+03	0.00E+00	1.83E+03
Cs-134	3.96E+05	7.03E+05	7.45E+04	0.00E+00	1.90E+05	7.97E+04	1.33E+03
Cs-136	4.83E+04	1.35E+05	5.29E+04	0.00E+00	5.64E+04	1.18E+04	1.43E+03
Cs-137	5.49E+05	6.12E+05	4.55E+04	0.00E+00	1.72E+05	7.13E+04	1.33E+03
Cs-138	5.05E+02	7.81E+02	3.98E+02	0.00E+00	4.10E+02	6.54E+01	8.76E+02
Ba-139	1.48E+00	9.84E-04	4.30E-02	0.00E+00	5.92E-04	5.95E+03	5.10E+04
Ba-140	5.60E+04	5.60E+01	2.90E+03	0.00E+00	1.34E+01	1.60E+06	3.84E+04
Ba-141	1.57E-01	1.08E-04	4.97E-03	0.00E+00	6.50E-05	2.97E+03	4.75E+03
Ba-142	3.98E-02	3.30E-05	1.96E-03	0.00E+00	1.90E-05	1.55E+03	6.93E+02
La-140	5.05E+02	2.00E+02	5.15E+01	0.00E+00	0.00E+00	1.68E+05	8.48E+04
La-142	1.03E+00	3.77E-01	9.04E-02	0.00E+00	0.00E+00	8.22E+03	5.95E+04
Ce-141	2.77E+04	1.67E+04	1.99E+03	0.00E+00	5.25E+03	5.17E+05	2.16E+04
Ce-143	2.93E+02	1.93E+02	2.21E+01	0.00E+00	5.64E+01	1.16E+05	4.97E+04
Ce-144	3.19E+06	1.21E+06	1.76E+05	0.00E+00	5.38E+05	9.84E+06	1.48E+05
Pr-143	1.40E+04	5.24E+03	6.99E+02	0.00E+00	1.97E+03	4.33E+05	3.72E+04
Pr-144	4.79E-02	1.85E-02	2.41E-03	0.00E+00	6.72E-03	1.61E+03	4.28E+03
Nd-147	7.94E+03	8.13E+03	5.00E+02	0.00E+00	3.15E+03	3.22E+05	3.12E+04
W-187	1.30E+01	9.02E+00	3.12E+00	0.00E+00	0.00E+00	3.96E+04	3.56E+04
Np-239	3.71E+02	2.98E+02	1.88E+01	0.00E+00	6.62E+01	5.95E+04	2.49E+04

Notes:

1) Units are mrem/yr per $\mu Ci/m^3$.

Table 13
Adult Vegetation Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	1.29E+03	1.29E+03	1.29E+03	1.29E+03	1.29E+03	1.29E+03
Na-24	2.69E+05	2.69E+05	2.69E+05	2.69E+05	2.69E+05	2.69E+05	2.69E+05
Cr-51	0.00E+00	0.00E+00	4.64E+04	2.77E+04	1.02E+04	6.15E+04	1.17E+07
Mn-54	0.00E+00	3.13E+08	5.97E+07	0.00E+00	9.31E+07	0.00E+00	9.58E+08
Mn-56	0.00E+00	1.54E+01	2.73E+00	0.00E+00	1.95E+01	0.00E+00	4.91E+02
Fe-55	2.10E+08	1.45E+08	3.38E+07	0.00E+00	0.00E+00	8.08E+07	8.31E+07
Fe-59	1.26E+08	2.96E+08	1.13E+08	0.00E+00	0.00E+00	8.27E+07	9.87E+08
Co-58	0.00E+00	3.08E+07	6.90E+07	0.00E+00	0.00E+00	0.00E+00	6.24E+08
Co-60	0.00E+00	1.67E+08	3.69E+08	0.00E+00	0.00E+00	0.00E+00	3.14E+09
Ni-63	1.04E+10	7.21E+08	3.49E+08	0.00E+00	0.00E+00	0.00E+00	1.50E+08
Ni-65	5.97E+01	7.75E+00	3.54E+00	0.00E+00	0.00E+00	0.00E+00	1.97E+02
Cu-64	0.00E+00	9.09E+03	4.27E+03	0.00E+00	2.29E+04	0.00E+00	7.75E+05
Zn-65	3.17E+08	1.01E+09	4.56E+08	0.00E+00	6.75E+08	0.00E+00	6.36E+08
Zn-69	4.95E-06	9.48E-06	6.59E-07	0.00E+00	6.16E-06	0.00E+00	1.42E-06
Br-83	0.00E+00	0.00E+00	3.00E+00	0.00E+00	0.00E+00	0.00E+00	4.32E+00
Br-84	0.00E+00	0.00E+00	2.20E-11	0.00E+00	0.00E+00	0.00E+00	1.72E-16
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	2.20E+08	1.03E+08	0.00E+00	0.00E+00	0.00E+00	4.34E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	9.95E+09	0.00E+00	2.86E+08	0.00E+00	0.00E+00	0.00E+00	1.60E+09
Sr-90	6.95E+11	0.00E+00	1.40E+10	0.00E+00	0.00E+00	0.00E+00	1.75E+10
Sr-91	3.01E+05	0.00E+00	1.22E+04	0.00E+00	0.00E+00	0.00E+00	1.43E+06
Sr-92	4.12E+02	0.00E+00	1.78E+01	0.00E+00	0.00E+00	0.00E+00	8.17E+03
Y-90	1.33E+04	0.00E+00	3.57E+02	0.00E+00	0.00E+00	0.00E+00	1.41E+08
Y-91M	4.93E-09	0.00E+00	1.91E-10	0.00E+00	0.00E+00	0.00E+00	1.45E-08
Y-91	5.12E+06	0.00E+00	1.37E+05	0.00E+00	0.00E+00	0.00E+00	2.82E+09
Y-92	8.95E-01	0.00E+00	2.62E-02	0.00E+00	0.00E+00	0.00E+00	1.57E+04
Y-93	1.67E+02	0.00E+00	4.62E+00	0.00E+00	0.00E+00	0.00E+00	5.31E+06
Zr-95	1.18E+06	3.77E+05	2.55E+05	0.00E+00	5.92E+05	0.00E+00	1.20E+09
Zr-97	3.35E+02	6.77E+01	3.09E+01	0.00E+00	1.02E+02	0.00E+00	2.10E+07
Nb-95	1.43E+05	7.95E+04	4.27E+04	0.00E+00	7.86E+04	0.00E+00	4.83E+08
Mo-99	0.00E+00	6.14E+06	1.17E+06	0.00E+00	1.39E+07	0.00E+00	1.42E+07
Tc- 99M	3.06E+00	8.64E+00	1.10E+02	0.00E+00	1.31E+02	4.23E+00	5.11E+03
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	4.77E+06	0.00E+00	2.05E+06	0.00E+00	1.82E+07	0.00E+00	5.57E+08
Ru-105	5.27E+01	0.00E+00	2.08E+01	0.00E+00	6.81E+02	0.00E+00	3.23E+04
Ru-106	1.93E+08	0.00E+00	2.44E+07	0.00E+00	3.72E+08	0.00E+00	1.25E+10
Ag-110M	1.05E+07	9.75E+06	5.79E+06	0.00E+00	1.92E+07	0.00E+00	3.98E+09

Table 13 (Continued)
Adult Vegetation Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	9.67E+07	3.50E+07	1.30E+07	2.91E+07	3.93E+08	0.00E+00	3.86E+08
Te-127M	3.49E+08	1.25E+08	4.26E+07	8.92E+07	1.42E+09	0.00E+00	1.17E+09
Te-127	5.68E+03	2.04E+03	1.23E+03	4.21E+03	2.31E+04	0.00E+00	4.48E+05
Te-129M	2.51E+08	9.37E+07	3.97E+07	8.62E+07	1.05E+09	0.00E+00	1.26E+09
Te-129	7.14E-04	2.68E-04	1.74E-04	5.48E-04	3.00E-03	0.00E+00	5.39E-04
Te-131M	9.09E+05	4.45E+05	3.71E+05	7.04E+05	4.50E+06	0.00E+00	4.41E+07
Te-131	1.26E-15	5.26E-16	3.97E-16	1.03E-15	5.51E-15	0.00E+00	1.78E-16
Te-132	4.28E+06	2.77E+06	2.60E+06	3.06E+06	2.67E+07	0.00E+00	1.31E+08
I-130	3.89E+05	1.15E+06	4.52E+05	9.72E+07	1.79E+06	0.00E+00	9.87E+05
I-131	8.07E+07	1.15E+08	6.62E+07	3.78E+10	1.98E+08	0.00E+00	3.05E+07
I-132	5.58E+01	1.49E+02	5.22E+01	5.22E+03	2.38E+02	0.00E+00	2.80E+01
I-133	2.08E+06	3.62E+06	1.10E+06	5.32E+08	6.31E+06	0.00E+00	3.25E+06
I-134	8.55E-05	2.32E-04	8.31E-05	4.02E-03	3.69E-04	0.00E+00	2.02E-07
I-135	3.87E+04	1.01E+05	3.74E+04	6.68E+06	1.62E+05	0.00E+00	1.14E+05
Cs-134	4.67E+09	1.11E+10	9.08E+09	0.00E+00	3.59E+09	1.19E+09	1.94E+08
Cs-136	4.25E+07	1.68E+08	1.21E+08	0.00E+00	9.33E+07	1.28E+07	1.90E+07
Cs-137	6.36E+09	8.70E+09	5.70E+09	0.00E+00	2.95E+09	9.81E+08	1.68E+08
Cs-138	3.32E-11	6.56E-11	3.25E-11	0.00E+00	4.82E-11	4.76E-12	2.80E-16
Ba-139	2.71E-02	1.93E-05	7.92E-04	0.00E+00	1.80E-05	1.09E-05	4.80E-02
Ba-140	1.29E+08	1.61E+05	8.42E+06	0.00E+00	5.49E+04	9.24E+04	2.65E+08
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	1.98E+03	9.97E+02	2.63E+02	0.00E+00	0.00E+00	0.00E+00	7.32E+07
La-142	1.94E-04	8.83E-05	2.20E-05	0.00E+00	0.00E+00	0.00E+00	6.45E-01
Ce-141	1.97E+05	1.33E+05	1.51E+04	0.00E+00	6.19E+04	0.00E+00	5.09E+08
Ce-143	9.94E+02	7.35E+05	8.13E+01	0.00E+00	3.24E+02	0.00E+00	2.75E+07
Ce-144	3.29E+07	1.38E+07	1.77E+06	0.00E+00	8.16E+06	0.00E+00	1.11E+10
Pr-143	6.27E+04	2.51E+04	3.11E+03	0.00E+00	1.45E+04	0.00E+00	2.75E+08
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	3.37E+04	3.90E+04	2.33E+03	0.00E+00	2.28E+04	0.00E+00	1.87E+08
W-187	3.79E+04	3.17E+04	1.11E+04	0.00E+00	0.00E+00	0.00E+00	1.04E+07
Np-239	1.42E+03	1.40E+02	7.72E+01	0.00E+00	4.37E+02	0.00E+00	2.87E+07

Notes:

1) Units are m^2 mrem/yr per µCi/sec with the exception of H-3.

2) For H-3, the units are mrem/yr per $\mu Ci/m^3$.

Table 13a
Teen Vegetation Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	1.47E+03	1.47E+03	1.47E+03	1.47E+03	1.47E+03	1.47E+03
Na-24	2.39E+05	2.39E+05	2.39E+05	2.39E+05	2.39E+05	2.39E+05	2.39E+05
Cr-51	0.00E+00	0.00E+00	6.16E+04	3.42E+04	1.35E+04	8.79E+04	1.03E+07
Mn-54	0.00E+00	4.54E+08	9.01E+07	0.00E+00	1.36E+08	0.00E+00	9.32E+08
Mn-56	0.00E+00	1.39E+01	2.47E+00	0.00E+00	1.76E+01	0.00E+00	9.13E+02
Fe-55	3.26E+08	2.31E+08	5.39E+07	0.00E+00	0.00E+00	1.47E+08	1.00E+08
Fe-59	1.79E+08	4.18E+08	1.61E+08	0.00E+00	0.00E+00	1.32E+08	9.89E+08
Co-58	0.00E+00	4.37E+07	1.01E+08	0.00E+00	0.00E+00	0.00E+00	6.02E+08
Co-60	0.00E+00	2.49E+08	5.60E+08	0.00E+00	0.00E+00	0.00E+00	3.24E+09
Ni-63	1.61E+10	1.13E+09	5.45E+08	0.00E+00	0.00E+00	0.00E+00	1.81E+08
Ni-65	5.55E+01	7.10E+00	3.23E+00	0.00E+00	0.00E+00	0.00E+00	3.85E+02
Cu-64	0.00E+00	8.24E+03	3.87E+03	0.00E+00	2.08E+04	0.00E+00	6.39E+05
Zn-65	4.24E+08	1.47E+09	6.86E+08	0.00E+00	9.41E+08	0.00E+00	6.23E+08
Zn-69	4.64E-06	8.84E-06	6.19E-07	0.00E+00	5.78E-06	0.00E+00	1.63E-05
Br-83	0.00E+00	0.00E+00	2.81E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	2.00E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	2.75E+08	1.29E+08	0.00E+00	0.00E+00	0.00E+00	4.06E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	1.51E+10	0.00E+00	4.33E+08	0.00E+00	0.00E+00	0.00E+00	1.80E+09
Sr-90	9.22E+11	0.00E+00	1.84E+10	0.00E+00	0.00E+00	0.00E+00	2.11E+10
Sr-91	2.81E+05	0.00E+00	1.12E+04	0.00E+00	0.00E+00	0.00E+00	1.27E+06
Sr-92	3.84E+02	0.00E+00	1.64E+01	0.00E+00	0.00E+00	0.00E+00	9.78E+03
Y-90	1.24E+04	0.00E+00	3.35E+02	0.00E+00	0.00E+00	0.00E+00	1.02E+08
Y-91M	4.59E-09	0.00E+00	1.75E-10	0.00E+00	0.00E+00	0.00E+00	2.17E-07
Y-91	7.84E+06	0.00E+00	2.10E+05	0.00E+00	0.00E+00	0.00E+00	3.21E+09
Y-92	8.41E-01	0.00E+00	2.43E-02	0.00E+00	0.00E+00	0.00E+00	2.31E+04
Y-93	1.57E+02	0.00E+00	4.30E+00	0.00E+00	0.00E+00	0.00E+00	4.80E+06
Zr-95	1.72E+06	5.44E+05	3.74E+05	0.00E+00	7.99E+05	0.00E+00	1.26E+09
Zr-97	3.10E+02	6.14E+01	2.83E+01	0.00E+00	9.31E+01	0.00E+00	1.66E+07
Nb-95	1.93E+05	1.07E+05	5.90E+04	0.00E+00	1.04E+05	0.00E+00	4.58E+08
Mo-99	0.00E+00	5.63E+06	1.07E+06	0.00E+00	1.29E+07	0.00E+00	1.01E+07
Tc- 99M	2.70E+00	7.52E+00	9.75E+01	0.00E+00	1.12E+02	4.17E+00	4.94E+03
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	6.82E+06	0.00E+00	2.91E+06	0.00E+00	2.40E+07	0.00E+00	5.69E+08
Ru-105	4.90E+01	0.00E+00	1.90E+01	0.00E+00	6.18E+02	0.00E+00	3.95E+04
Ru-106	3.09E+08	0.00E+00	3.90E+07	0.00E+00	5.97E+08	0.00E+00	1.48E+10
Ag-110M	1.52E+07	1.44E+07	8.73E+06	0.00E+00	2.74E+07	0.00E+00	4.03E+09

Table 13a (Continued)
Teen Vegetation Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	1.49E+08	5.35E+07	1.99E+07	4.15E+07	0.00E+00	0.00E+00	4.38E+08
Te-127M	5.51E+08	1.96E+08	6.56E+07	1.31E+08	2.24E+09	0.00E+00	1.37E+09
Te-127	5.36E+03	1.90E+03	1.15E+03	3.70E+03	2.17E+04	0.00E+00	4.14E+05
Te-129M	3.61E+08	1.34E+08	5.72E+07	1.17E+08	1.51E+09	0.00E+00	1.36E+09
Te-129	6.68E-04	2.49E-04	1.63E-04	4.77E-04	2.80E-03	0.00E+00	3.65E-03
Te-131M	8.42E+05	4.04E+05	3.37E+05	6.07E+05	4.21E+06	0.00E+00	3.24E+07
Te-131	1.17E-15	4.82E-16	3.66E-16	9.01E-16	5.11E-15	0.00E+00	9.60E-17
Te-132	3.89E+06	2.46E+06	2.32E+06	2.60E+06	2.36E+07	0.00E+00	7.81E+07
I-130	3.47E+05	1.01E+06	4.01E+05	8.20E+07	1.55E+06	0.00E+00	7.73E+05
I-131	7.68E+07	1.08E+08	5.78E+07	3.14E+10	1.85E+08	0.00E+00	2.13E+07
I-132	5.03E+01	1.32E+02	4.72E+01	4.43E+03	2.07E+02	0.00E+00	5.73E+01
I-133	1.93E+06	3.28E+06	1.00E+06	4.58E+08	5.75E+06	0.00E+00	2.48E+06
I-134	7.73E-05	2.05E-04	7.36E-05	3.41E-03	3.23E-04	0.00E+00	2.70E-06
I-135	3.49E+04	8.99E+04	3.33E+04	5.78E+06	1.42E+05	0.00E+00	9.97E+04
Cs-134	7.10E+09	1.67E+10	7.75E+09	0.00E+00	5.31E+09	2.03E+09	2.08E+08
Cs-136	4.35E+07	1.71E+08	1.15E+08	0.00E+00	9.31E+07	1.47E+07	1.38E+07
Cs-137	1.01E+10	1.35E+10	4.69E+09	0.00E+00	4.59E+09	1.78E+09	1.92E+08
Cs-138	3.07E-11	5.89E-11	2.94E-11	0.00E+00	4.35E-11	5.06E-12	2.67E-14
Ba-139	2.55E-02	1.79E-05	7.42E-04	0.00E+00	1.69E-05	1.23E-05	2.27E-01
Ba-140	1.38E+08	1.69E+05	8.90E+06	0.00E+00	5.74E+04	1.14E+05	2.13E+08
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	1.81E+03	8.88E+02	2.36E+02	0.00E+00	0.00E+00	0.00E+00	5.10E+07
La-142	1.78E-04	7.92E-05	1.97E-05	0.00E+00	0.00E+00	0.00E+00	2.41E+00
Ce-141	2.83E+05	1.89E+05	2.17E+04	0.00E+00	8.89E+04	0.00E+00	5.40E+08
Ce-143	9.29E+02	6.76E+05	7.55E+01	0.00E+00	3.03E+02	0.00E+00	2.03E+07
Ce-144	5.27E+07	2.18E+07	2.83E+06	0.00E+00	1.30E+07	0.00E+00	1.33E+10
Pr-143	7.01E+04	2.80E+04	3.49E+03	0.00E+00	1.63E+04	0.00E+00	2.31E+08
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	3.67E+04	4.00E+04	2.39E+03	0.00E+00	2.35E+04	0.00E+00	1.44E+08
W-187	3.53E+04	2.87E+04	1.01E+04	0.00E+00	0.00E+00	0.00E+00	7.78E+06
Np-239	1.38E+03	1.30E+02	7.24E+01	0.00E+00	4.09E+02	0.00E+00	2.10E+07

Notes:

1) Units are m^2 mrem/yr per µCi/sec with the exception of H-3.

2) For H-3, the units are mrem/yr per µCi/m^3.

Table 13b
Child Vegetation Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	2.29E+03	2.29E+03	2.29E+03	2.29E+03	2.29E+03	2.29E+03
Na-24	3.73E+05	3.73E+05	3.73E+05	3.73E+05	3.73E+05	3.73E+05	3.73E+05
Cr-51	0.00E+00	0.00E+00	1.17E+05	6.49E+04	1.77E+04	1.18E+05	6.20E+06
Mn-54	0.00E+00	6.65E+08	1.77E+08	0.00E+00	1.86E+08	0.00E+00	5.58E+08
Mn-56	0.00E+00	1.82E+01	4.10E+00	0.00E+00	2.20E+01	0.00E+00	2.63E+03
Fe-55	8.01E+08	4.25E+08	1.32E+08	0.00E+00	0.00E+00	2.40E+08	7.87E+07
Fe-59	3.97E+08	6.42E+08	3.20E+08	0.00E+00	0.00E+00	1.86E+08	6.69E+08
Co-58	0.00E+00	6.45E+07	1.97E+08	0.00E+00	0.00E+00	0.00E+00	3.76E+08
Co-60	0.00E+00	3.78E+08	1.12E+09	0.00E+00	0.00E+00	0.00E+00	2.10E+09
Ni-63	3.95E+10	2.11E+09	1.34E+09	0.00E+00	0.00E+00	0.00E+00	1.42E+08
Ni-65	1.02E+02	9.59E+00	5.60E+00	0.00E+00	0.00E+00	0.00E+00	1.18E+03
Cu-64	0.00E+00	1.09E+04	6.56E+03	0.00E+00	2.62E+04	0.00E+00	5.10E+05
Zn-65	8.12E+08	2.16E+09	1.35E+09	0.00E+00	1.36E+09	0.00E+00	3.80E+08
Zn-69	8.56E-06	1.24E-05	1.14E-06	0.00E+00	7.50E-06	0.00E+00	7.80E-04
Br-83	0.00E+00	0.00E+00	5.18E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	3.39E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	4.54E+08	2.79E+08	0.00E+00	0.00E+00	0.00E+00	2.92E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	3.59E+10	0.00E+00	1.03E+09	0.00E+00	0.00E+00	0.00E+00	1.39E+09
Sr-90	1.87E+12	0.00E+00	3.77E+10	0.00E+00	0.00E+00	0.00E+00	1.67E+10
Sr-91	5.17E+05	0.00E+00	1.95E+04	0.00E+00	0.00E+00	0.00E+00	1.14E+06
Sr-92	7.04E+02	0.00E+00	2.82E+01	0.00E+00	0.00E+00	0.00E+00	1.33E+04
Y-90	2.31E+04	0.00E+00	6.18E+02	0.00E+00	0.00E+00	0.00E+00	6.57E+07
Y-91M	8.42E-09	0.00E+00	3.06E-10	0.00E+00	0.00E+00	0.00E+00	1.65E-05
Y-91	1.87E+07	0.00E+00	4.99E+05	0.00E+00	0.00E+00	0.00E+00	2.49E+09
Y-92	1.55E+00	0.00E+00	4.43E-02	0.00E+00	0.00E+00	0.00E+00	4.47E+04
Y-93	2.89E+02	0.00E+00	7.94E+00	0.00E+00	0.00E+00	0.00E+00	4.31E+06
Zr-95	3.86E+06	8.50E+05	7.56E+05	0.00E+00	1.22E+06	0.00E+00	8.86E+08
Zr-97	5.67E+02	8.19E+01	4.83E+01	0.00E+00	1.18E+02	0.00E+00	1.24E+07
Nb-95	4.12E+05	1.61E+05	1.15E+05	0.00E+00	1.51E+05	0.00E+00	2.97E+08
Mo-99	0.00E+00	7.69E+06	1.90E+06	0.00E+00	1.64E+07	0.00E+00	6.36E+06
Tc- 99M	4.64E+00	9.10E+00	1.51E+02	0.00E+00	1.32E+02	4.62E+00	5.18E+03
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	1.53E+07	0.00E+00	5.89E+06	0.00E+00	3.86E+07	0.00E+00	3.96E+08
Ru-105	8.97E+01	0.00E+00	3.25E+01	0.00E+00	7.89E+02	0.00E+00	5.86E+04
Ru-106	7.45E+08	0.00E+00	9.30E+07	0.00E+00	1.01E+09	0.00E+00	1.16E+10
Ag-110M	3.21E+07	2.17E+07	1.74E+07	0.00E+00	4.04E+07	0.00E+00	2.58E+09

Table 13b (Continued)
Child Vegetation Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	3.51E+08	9.52E+07	4.68E+07	9.86E+07	0.00E+00	0.00E+00	3.39E+08
Te-127M	1.32E+09	3.56E+08	1.57E+08	3.16E+08	3.77E+09	0.00E+00	1.07E+09
Te-127	9.89E+03	2.67E+03	2.12E+03	6.84E+03	2.81E+04	0.00E+00	3.86E+05
Te-129M	8.40E+08	2.35E+08	1.30E+08	2.71E+08	2.47E+09	0.00E+00	1.02E+09
Te-129	1.24E-03	3.45E-04	2.94E-04	8.83E-04	3.62E-03	0.00E+00	7.70E-02
Te-131M	1.54E+06	5.32E+05	5.66E+05	1.09E+06	5.15E+06	0.00E+00	2.16E+07
Te-131	2.15E-15	6.57E-16	6.41E-16	1.65E-15	6.51E-15	0.00E+00	1.13E-14
Te-132	6.97E+06	3.09E+06	3.73E+06	4.49E+06	2.86E+07	0.00E+00	3.11E+07
I-130	6.10E+05	1.23E+06	6.35E+05	1.36E+08	1.84E+06	0.00E+00	5.76E+05
I-131	1.43E+08	1.44E+08	8.17E+07	4.75E+10	2.36E+08	0.00E+00	1.28E+07
I-132	8.93E+01	1.64E+02	7.54E+01	7.61E+03	2.51E+02	0.00E+00	1.93E+02
I-133	3.52E+06	4.36E+06	1.65E+06	8.09E+08	7.26E+06	0.00E+00	1.76E+06
I-134	1.37E-04	2.55E-04	1.17E-04	5.86E-03	3.90E-04	0.00E+00	1.69E-04
I-135	6.20E+04	1.12E+05	5.28E+04	9.89E+06	1.71E+05	0.00E+00	8.51E+04
Cs-134	1.60E+10	2.63E+10	5.55E+09	0.00E+00	8.16E+09	2.93E+09	1.42E+08
Cs-136	8.18E+07	2.25E+08	1.46E+08	0.00E+00	1.20E+08	1.79E+07	7.90E+06
Cs-137	2.39E+10	2.29E+10	3.38E+09	0.00E+00	7.46E+09	2.68E+09	1.43E+08
Cs-138	5.58E-11	7.75E-11	4.92E-11	0.00E+00	5.45E-11	5.87E-12	3.57E-11
Ba-139	4.69E-02	2.51E-05	1.36E-03	0.00E+00	2.19E-05	1.47E-05	2.71E+00
Ba-140	2.77E+08	2.43E+05	1.62E+07	0.00E+00	7.90E+04	1.45E+05	1.40E+08
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	3.25E+03	1.13E+03	3.82E+02	0.00E+00	0.00E+00	0.00E+00	3.16E+07
La-142	3.23E-04	1.03E-04	3.22E-05	0.00E+00	0.00E+00	0.00E+00	2.04E+01
Ce-141	6.55E+05	3.27E+05	4.85E+04	0.00E+00	1.43E+05	0.00E+00	4.08E+08
Ce-143	1.71E+03	9.28E+05	1.34E+02	0.00E+00	3.89E+02	0.00E+00	1.36E+07
Ce-144	1.27E+08	3.98E+07	6.78E+06	0.00E+00	2.21E+07	0.00E+00	1.04E+10
Pr-143	1.46E+05	4.38E+04	7.24E+03	0.00E+00	2.37E+04	0.00E+00	1.57E+08
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	7.27E+04	5.89E+04	4.56E+03	0.00E+00	3.23E+04	0.00E+00	9.33E+07
W-187	6.41E+04	3.80E+04	1.70E+04	0.00E+00	0.00E+00	0.00E+00	5.34E+06
Np-239	2.55E+03	1.83E+02	1.29E+02	0.00E+00	5.30E+02	0.00E+00	1.36E+07

Notes:

1) Units are m^2 mrem/yr per µCi/sec with the exception of H-3.

2) For H-3, the units are mrem/yr per $\mu Ci/m^3$.

3) The infant age group is assumed to receive no due through the vegetation ingestion pathway therefore no dose factors are supplied.

Table 14
Adult Grass-Cow-Milk Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	4.35E+02	4.35E+02	4.35E+02	4.35E+02	4.35E+02	4.35E+02
Na-24	2.46E+06	2.46E+06	2.46E+06	2.46E+06	2.46E+06	2.46E+06	2.46E+06
Cr-51	0.00E+00	0.00E+00	2.86E+04	1.71E+04	6.29E+03	3.79E+04	7.18E+06
Mn-54	0.00E+00	8.41E+06	1.61E+06	0.00E+00	2.50E+06	0.00E+00	2.58E+07
Mn-56	0.00E+00	4.13E-03	7.32E-04	0.00E+00	5.24E-03	0.00E+00	1.32E-01
Fe-55	2.51E+07	1.74E+07	4.05E+06	0.00E+00	0.00E+00	9.68E+06	9.95E+06
Fe-59	2.97E+07	6.98E+07	2.67E+07	0.00E+00	0.00E+00	1.95E+07	2.33E+08
Co-58	0.00E+00	4.72E+06	1.06E+07	0.00E+00	0.00E+00	0.00E+00	9.56E+07
Co-60	0.00E+00	1.64E+07	3.62E+07	0.00E+00	0.00E+00	0.00E+00	3.08E+08
Ni-63	6.73E+09	4.66E+08	2.26E+08	0.00E+00	0.00E+00	0.00E+00	9.73E+07
Ni-65	3.70E-01	4.81E-02	2.19E-02	0.00E+00	0.00E+00	0.00E+00	1.22E+00
Cu-64	0.00E+00	2.36E+04	1.11E+04	0.00E+00	5.95E+04	0.00E+00	2.01E+06
Zn-65	1.37E+09	4.36E+09	1.97E+09	0.00E+00	2.92E+09	0.00E+00	2.75E+09
Zn-69	2.01E-12	3.84E-12	2.67E-13	0.00E+00	2.50E-12	0.00E+00	5.78E-13
Br-83	0.00E+00	0.00E+00	9.65E-02	0.00E+00	0.00E+00	0.00E+00	1.39E-01
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	2.60E+09	1.21E+09	0.00E+00	0.00E+00	0.00E+00	5.12E+08
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	1.45E+09	0.00E+00	4.16E+07	0.00E+00	0.00E+00	0.00E+00	2.33E+08
Sr-90	5.38E+10	0.00E+00	1.08E+09	0.00E+00	0.00E+00	0.00E+00	1.35E+09
Sr-91	2.87E+04	0.00E+00	1.16E+03	0.00E+00	0.00E+00	0.00E+00	1.37E+05
Sr-92	4.84E-01	0.00E+00	2.09E-02	0.00E+00	0.00E+00	0.00E+00	9.58E+00
Y-90	7.10E+01	0.00E+00	1.90E+00	0.00E+00	0.00E+00	0.00E+00	7.52E+05
Y-91M	6.42E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.89E-19
Y-91	8.59E+03	0.00E+00	2.30E+02	0.00E+00	0.00E+00	0.00E+00	4.73E+06
Y-92	5.57E-05	0.00E+00	1.63E-06	0.00E+00	0.00E+00	0.00E+00	9.75E-01
Y-93	2.22E-01	0.00E+00	6.12E-03	0.00E+00	0.00E+00	0.00E+00	7.03E+03
Zr-95	9.44E+02	3.03E+02	2.05E+02	0.00E+00	4.75E+02	0.00E+00	9.59E+05
Zr-97	4.32E-01	8.72E-02	3.99E-02	0.00E+00	1.32E-01	0.00E+00	2.70E+04
Nb-95	8.26E+04	4.60E+04	2.47E+04	0.00E+00	4.54E+04	0.00E+00	2.79E+08
Mo-99	0.00E+00	2.47E+07	4.70E+06	0.00E+00	5.60E+07	0.00E+00	5.73E+07
Tc- 99M	3.31E+00	9.35E+00	1.19E+02	0.00E+00	1.42E+02	4.58E+00	5.53E+03
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	1.02E+03	0.00E+00	4.39E+02	0.00E+00	3.88E+03	0.00E+00	1.19E+05
Ru-105	8.51E-04	0.00E+00	3.36E-04	0.00E+00	1.10E-02	0.00E+00	5.20E-01
Ru-106	2.04E+04	0.00E+00	2.58E+03	0.00E+00	3.94E+04	0.00E+00	1.32E+06
Ag-110M	5.82E+07	5.39E+07	3.20E+07	0.00E+00	1.06E+08	0.00E+00	2.20E+10

Table 14 (Continued)
Adult Grass-Cow-Milk Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	1.63E+07	5.91E+06	2.18E+06	4.90E+06	6.63E+07	0.00E+00	6.51E+07
Te-127M	4.58E+07	1.64E+07	5.58E+06	1.17E+07	1.86E+08	0.00E+00	1.54E+08
Te-127	6.66E+02	2.39E+02	1.44E+02	4.94E+02	2.71E+03	0.00E+00	5.26E+04
Te-129M	6.02E+07	2.24E+07	9.52E+06	2.07E+07	2.51E+08	0.00E+00	3.03E+08
Te-129	2.83E-10	1.06E-10	6.88E-11	2.17E-10	1.19E-09	0.00E+00	2.13E-10
Te-131M	3.61E+05	1.76E+05	1.47E+05	2.79E+05	1.79E+06	0.00E+00	1.75E+07
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	2.39E+06	1.55E+06	1.45E+06	1.71E+06	1.49E+07	0.00E+00	7.32E+07
I-130	4.18E+05	1.23E+06	4.86E+05	1.04E+08	1.92E+06	0.00E+00	1.06E+06
I-131	2.96E+08	4.23E+08	2.43E+08	1.39E+11	7.26E+08	0.00E+00	1.12E+08
I-132	1.65E-01	4.40E-01	1.54E-01	1.54E+01	7.02E-01	0.00E+00	8.27E-02
I-133	3.88E+06	6.74E+06	2.06E+06	9.91E+08	1.18E+07	0.00E+00	6.06E+06
I-134	1.89E-12	5.13E-12	1.83E-12	8.89E-11	8.16E-12	0.00E+00	4.47E-15
I-135	1.29E+04	3.38E+04	1.25E+04	2.23E+06	5.42E+04	0.00E+00	3.82E+04
Cs-134	5.65E+09	1.35E+10	1.10E+10	0.00E+00	4.35E+09	1.45E+09	2.35E+08
Cs-136	2.63E+08	1.04E+09	7.46E+08	0.00E+00	5.77E+08	7.91E+07	1.18E+08
Cs-137	7.38E+09	1.01E+10	6.61E+09	0.00E+00	3.43E+09	1.14E+09	1.95E+08
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	4.43E-08	3.16E-11	1.30E-09	0.00E+00	2.95E-11	1.79E-11	7.86E-08
Ba-140	2.69E+07	3.38E+04	1.76E+06	0.00E+00	1.15E+04	1.93E+04	5.54E+07
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	4.52E+00	2.28E+00	6.02E-01	0.00E+00	0.00E+00	0.00E+00	1.67E+05
La-142	1.89E-11	8.59E-12	2.14E-12	0.00E+00	0.00E+00	0.00E+00	6.28E-08
Ce-141	4.84E+03	3.28E+03	3.72E+02	0.00E+00	1.52E+03	0.00E+00	1.25E+07
Ce-143	4.15E+01	3.07E+04	3.39E+00	0.00E+00	1.35E+01	0.00E+00	1.15E+06
Ce-144	3.58E+05	1.50E+05	1.92E+04	0.00E+00	8.87E+04	0.00E+00	1.21E+08
Pr-143	1.58E+02	6.34E+01	7.83E+00	0.00E+00	3.66E+01	0.00E+00	6.92E+05
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	9.48E+01	1.10E+02	6.56E+00	0.00E+00	6.41E+01	0.00E+00	5.26E+05
W-187	6.51E+03	5.44E+03	1.90E+03	0.00E+00	0.00E+00	0.00E+00	1.78E+06
Np-239	3.67E+00	3.61E-01	1.99E-01	0.00E+00	1.12E+00	0.00E+00	7.40E+04

Notes:

1) Units are m^2 mrem/yr per µCi/sec with the exception of H-3.

2) For H-3, the units are mrem/yr per $\mu Ci/m^3$.

Table 14a
Teen Grass-Cow-Milk Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	5.66E+02	5.66E+02	5.66E+02	5.66E+02	5.66E+02	5.66E+02
Na-24	4.29E+06	4.29E+06	4.29E+06	4.29E+06	4.29E+06	4.29E+06	4.29E+06
Cr-51	0.00E+00	0.00E+00	4.99E+04	2.77E+04	1.09E+04	7.12E+04	8.38E+06
Mn-54	0.00E+00	1.40E+07	2.78E+06	0.00E+00	4.18E+06	0.00E+00	2.87E+07
Mn-56	0.00E+00	7.32E-03	1.30E-03	0.00E+00	9.27E-03	0.00E+00	4.82E-01
Fe-55	4.45E+07	3.16E+07	7.36E+06	0.00E+00	0.00E+00	2.00E+07	1.37E+07
Fe-59	5.18E+07	1.21E+08	4.67E+07	0.00E+00	0.00E+00	3.81E+07	2.86E+08
Co-58	0.00E+00	7.94E+06	1.83E+07	0.00E+00	0.00E+00	0.00E+00	1.09E+08
Co-60	0.00E+00	2.78E+07	6.26E+07	0.00E+00	0.00E+00	0.00E+00	3.62E+08
Ni-63	1.18E+10	8.35E+08	4.01E+08	0.00E+00	0.00E+00	0.00E+00	1.33E+08
Ni-65	6.78E-01	8.66E-02	3.94E-02	0.00E+00	0.00E+00	0.00E+00	4.70E+00
Cu-64	0.00E+00	4.21E+04	1.98E+04	0.00E+00	1.06E+05	0.00E+00	3.26E+06
Zn-65	2.11E+09	7.31E+09	3.41E+09	0.00E+00	4.68E+09	0.00E+00	3.10E+09
Zn-69	3.70E-12	7.05E-12	4.94E-13	0.00E+00	4.61E-12	0.00E+00	1.30E-11
Br-83	0.00E+00	0.00E+00	1.78E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	4.73E+09	2.22E+09	0.00E+00	0.00E+00	0.00E+00	7.01E+08
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	2.67E+09	0.00E+00	7.66E+07	0.00E+00	0.00E+00	0.00E+00	3.18E+08
Sr-90	8.13E+10	0.00E+00	1.63E+09	0.00E+00	0.00E+00	0.00E+00	1.86E+09
Sr-91	5.27E+04	0.00E+00	2.10E+03	0.00E+00	0.00E+00	0.00E+00	2.39E+05
Sr-92	8.85E-01	0.00E+00	3.77E-02	0.00E+00	0.00E+00	0.00E+00	2.26E+01
Y-90	1.30E+02	0.00E+00	3.51E+00	0.00E+00	0.00E+00	0.00E+00	1.08E+06
Y-91M	1.18E-19	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.55E-18
Y-91	1.58E+04	0.00E+00	4.24E+02	0.00E+00	0.00E+00	0.00E+00	6.48E+06
Y-92	1.03E-04	0.00E+00	2.98E-06	0.00E+00	0.00E+00	0.00E+00	2.82E+00
Y-93	4.09E-01	0.00E+00	1.12E-02	0.00E+00	0.00E+00	0.00E+00	1.25E+04
Zr-95	1.65E+03	5.21E+02	3.58E+02	0.00E+00	7.65E+02	0.00E+00	1.20E+06
Zr-97	7.87E-01	1.56E-01	7.17E-02	0.00E+00	2.36E-01	0.00E+00	4.22E+04
Nb-95	1.41E+05	7.82E+04	4.30E+04	0.00E+00	7.58E+04	0.00E+00	3.34E+08
Mo-99	0.00E+00	4.46E+07	8.51E+06	0.00E+00	1.02E+08	0.00E+00	8.00E+07
Tc- 99M	5.74E+00	1.60E+01	2.07E+02	0.00E+00	2.39E+02	8.89E+00	1.05E+04
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	1.81E+03	0.00E+00	7.74E+02	0.00E+00	6.38E+03	0.00E+00	1.51E+05
Ru-105	1.55E-03	0.00E+00	6.03E-04	0.00E+00	1.96E-02	0.00E+00	1.25E+00
Ru-106	3.75E+04	0.00E+00	4.73E+03	0.00E+00	7.24E+04	0.00E+00	1.80E+06
Ag-110M	9.63E+07	9.11E+07	5.54E+07	0.00E+00	1.74E+08	0.00E+00	2.56E+10

Table 14a (Continued)
Teen Grass-Cow-Milk Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	3.01E+07	1.08E+07	4.02E+06	8.40E+06	0.00E+00	0.00E+00	8.87E+07
Te-127M	8.44E+07	2.99E+07	1.00E+07	2.01E+07	3.42E+08	0.00E+00	2.10E+08
Te-127	1.24E+03	4.38E+02	2.66E+02	8.52E+02	5.00E+03	0.00E+00	9.54E+04
Te-129M	1.10E+08	4.09E+07	1.74E+07	3.55E+07	4.61E+08	0.00E+00	4.13E+08
Te-129	5.20E-10	1.94E-10	1.27E-10	3.72E-10	2.18E-09	0.00E+00	2.84E-09
Te-131M	6.57E+05	3.15E+05	2.63E+05	4.74E+05	3.28E+06	0.00E+00	2.53E+07
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	4.27E+06	2.71E+06	2.55E+06	2.85E+06	2.60E+07	0.00E+00	8.57E+07
I-130	7.35E+05	2.13E+06	8.49E+05	1.73E+08	3.27E+06	0.00E+00	1.63E+06
I-131	5.37E+08	7.52E+08	4.04E+08	2.19E+11	1.29E+09	0.00E+00	1.49E+08
I-132	2.92E-01	7.64E-01	2.74E-01	2.57E+01	1.20E+00	0.00E+00	3.33E-01
I-133	7.08E+06	1.20E+07	3.66E+06	1.68E+09	2.11E+07	0.00E+00	9.09E+06
I-134	3.35E-12	8.89E-12	3.19E-12	1.48E-10	1.40E-11	0.00E+00	1.17E-13
I-135	2.29E+04	5.91E+04	2.19E+04	3.80E+06	9.33E+04	0.00E+00	6.54E+04
Cs-134	9.82E+09	2.31E+10	1.07E+10	0.00E+00	7.34E+09	2.80E+09	2.87E+08
Cs-136	4.47E+08	1.76E+09	1.18E+09	0.00E+00	9.58E+08	1.51E+08	1.42E+08
Cs-137	1.34E+10	1.78E+10	6.20E+09	0.00E+00	6.06E+09	2.35E+09	2.53E+08
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	8.20E-08	5.77E-11	2.39E-09	0.00E+00	5.44E-11	3.98E-11	7.31E-07
Ba-140	4.85E+07	5.95E+04	3.13E+06	0.00E+00	2.02E+04	4.00E+04	7.49E+07
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	8.12E+00	3.99E+00	1.06E+00	0.00E+00	0.00E+00	0.00E+00	2.29E+05
La-142	3.41E-11	1.51E-11	3.77E-12	0.00E+00	0.00E+00	0.00E+00	4.61E-07
Ce-141	8.88E+03	5.93E+03	6.81E+02	0.00E+00	2.79E+03	0.00E+00	1.70E+07
Ce-143	7.62E+01	5.55E+04	6.20E+00	0.00E+00	2.49E+01	0.00E+00	1.67E+06
Ce-144	6.58E+05	2.72E+05	3.54E+04	0.00E+00	1.63E+05	0.00E+00	1.66E+08
Pr-143	2.90E+02	1.16E+02	1.44E+01	0.00E+00	6.74E+01	0.00E+00	9.55E+05
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	1.82E+02	1.98E+02	1.19E+01	0.00E+00	1.17E+02	0.00E+00	7.16E+05
W-187	1.19E+04	9.71E+03	3.40E+03	0.00E+00	0.00E+00	0.00E+00	2.63E+06
Np-239	7.00E+00	6.60E-01	3.67E-01	0.00E+00	2.07E+00	0.00E+00	1.06E+05

Notes:

1) Units are m^2 mrem/yr per µCi/sec with the exception of H-3.

2) For H-3, the units are mrem/yr per $\mu Ci/m^3$.

Table 14b
Child Grass-Cow-Milk Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	8.97E+02	8.97E+02	8.97E+02	8.97E+02	8.97E+02	8.97E+02
Na-24	8.93E+06	8.93E+06	8.93E+06	8.93E+06	8.93E+06	8.93E+06	8.93E+06
Cr-51	0.00E+00	0.00E+00	1.02E+05	5.65E+04	1.54E+04	1.03E+05	5.39E+06
Mn-54	0.00E+00	2.10E+07	5.59E+06	0.00E+00	5.88E+06	0.00E+00	1.76E+07
Mn-56	0.00E+00	1.28E-02	2.88E-03	0.00E+00	1.54E-02	0.00E+00	1.85E+00
Fe-55	1.12E+08	5.93E+07	1.84E+07	0.00E+00	0.00E+00	3.35E+07	1.10E+07
Fe-59	1.20E+08	1.94E+08	9.69E+07	0.00E+00	0.00E+00	5.64E+07	2.02E+08
Co-58	0.00E+00	1.21E+07	3.71E+07	0.00E+00	0.00E+00	0.00E+00	7.08E+07
Co-60	0.00E+00	4.32E+07	1.27E+08	0.00E+00	0.00E+00	0.00E+00	2.39E+08
Ni-63	2.96E+10	1.59E+09	1.01E+09	0.00E+00	0.00E+00	0.00E+00	1.07E+08
Ni-65	1.66E+00	1.56E-01	9.11E-02	0.00E+00	0.00E+00	0.00E+00	1.91E+01
Cu-64	0.00E+00	7.39E+04	4.47E+04	0.00E+00	1.79E+05	0.00E+00	3.47E+06
Zn-65	4.13E+09	1.10E+10	6.85E+09	0.00E+00	6.94E+09	0.00E+00	1.93E+09
Zn-69	9.10E-12	1.32E-11	1.22E-12	0.00E+00	7.98E-12	0.00E+00	8.29E-10
Br-83	0.00E+00	0.00E+00	4.37E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	8.78E+09	5.40E+09	0.00E+00	0.00E+00	0.00E+00	5.65E+08
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	6.62E+09	0.00E+00	1.89E+08	0.00E+00	0.00E+00	0.00E+00	2.56E+08
Sr-90	1.68E+11	0.00E+00	3.38E+09	0.00E+00	0.00E+00	0.00E+00	1.51E+09
Sr-91	1.29E+05	0.00E+00	4.88E+03	0.00E+00	0.00E+00	0.00E+00	2.86E+05
Sr-92	2.16E+00	0.00E+00	8.67E-02	0.00E+00	0.00E+00	0.00E+00	4.09E+01
Y-90	3.23E+02	0.00E+00	8.64E+00	0.00E+00	0.00E+00	0.00E+00	9.19E+05
Y-91M	2.87E-19	0.00E+00	1.04E-20	0.00E+00	0.00E+00	0.00E+00	5.62E-16
Y-91	3.90E+04	0.00E+00	1.04E+03	0.00E+00	0.00E+00	0.00E+00	5.20E+06
Y-92	2.53E-04	0.00E+00	7.23E-06	0.00E+00	0.00E+00	0.00E+00	7.30E+00
Y-93	1.00E+00	0.00E+00	2.75E-02	0.00E+00	0.00E+00	0.00E+00	1.50E+04
Zr-95	3.83E+03	8.43E+02	7.50E+02	0.00E+00	1.21E+03	0.00E+00	8.79E+05
Zr-97	1.91E+00	2.77E-01	1.63E-01	0.00E+00	3.97E-01	0.00E+00	4.19E+04
Nb-95	3.18E+05	1.24E+05	8.85E+04	0.00E+00	1.16E+05	0.00E+00	2.29E+08
Mo-99	0.00E+00	8.12E+07	2.01E+07	0.00E+00	1.73E+08	0.00E+00	6.72E+07
Tc- 99M	1.32E+01	2.58E+01	4.28E+02	0.00E+00	3.75E+02	1.31E+01	1.47E+04
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	4.28E+03	0.00E+00	1.65E+03	0.00E+00	1.08E+04	0.00E+00	1.11E+05
Ru-105	3.79E-03	0.00E+00	1.38E-03	0.00E+00	3.33E-02	0.00E+00	2.48E+00
Ru-106	9.24E+04	0.00E+00	1.15E+04	0.00E+00	1.25E+05	0.00E+00	1.44E+06
Ag-110M	2.09E+08	1.41E+08	1.13E+08	0.00E+00	2.63E+08	0.00E+00	1.68E+10

Table 14b (Continued)
Child Grass-Cow-Milk Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	7.38E+07	2.00E+07	9.84E+06	2.07E+07	0.00E+00	0.00E+00	7.12E+07
Te-127M	2.08E+08	5.60E+07	2.47E+07	4.97E+07	5.93E+08	0.00E+00	1.68E+08
Te-127	3.04E+03	8.19E+02	6.51E+02	2.10E+03	8.64E+03	0.00E+00	1.19E+05
Te-129M	2.71E+08	7.58E+07	4.21E+07	8.75E+07	7.97E+08	0.00E+00	3.31E+08
Te-129	1.28E-09	3.58E-10	3.05E-10	9.16E-10	3.75E-09	0.00E+00	7.99E-08
Te-131M	1.60E+06	5.53E+05	5.88E+05	1.14E+06	5.35E+06	0.00E+00	2.24E+07
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	1.02E+07	4.52E+06	5.46E+06	6.58E+06	4.19E+07	0.00E+00	4.55E+07
I-130	1.72E+06	3.47E+06	1.79E+06	3.82E+08	5.19E+06	0.00E+00	1.62E+06
I-131	1.30E+09	1.31E+09	7.45E+08	4.33E+11	2.15E+09	0.00E+00	1.17E+08
I-132	6.91E-01	1.27E+00	5.84E-01	5.89E+01	1.94E+00	0.00E+00	1.49E+00
I-133	1.72E+07	2.13E+07	8.05E+06	3.95E+09	3.55E+07	0.00E+00	8.57E+06
I-134	7.94E-12	1.47E-11	6.79E-12	3.39E-10	2.26E-11	0.00E+00	9.78E-12
I-135	5.43E+04	9.78E+04	4.62E+04	8.66E+06	1.50E+05	0.00E+00	7.45E+04
Cs-134	2.26E+10	3.72E+10	7.84E+09	0.00E+00	1.15E+10	4.13E+09	2.00E+08
Cs-136	1.01E+09	2.77E+09	1.80E+09	0.00E+00	1.48E+09	2.20E+08	9.75E+07
Cs-137	3.22E+10	3.09E+10	4.55E+09	0.00E+00	1.01E+10	3.62E+09	1.93E+08
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	2.01E-07	1.08E-10	5.84E-09	0.00E+00	9.39E-11	6.33E-11	1.16E-05
Ba-140	1.17E+08	1.03E+05	6.84E+06	0.00E+00	3.34E+04	6.12E+04	5.94E+07
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	1.95E+01	6.80E+00	2.29E+00	0.00E+00	0.00E+00	0.00E+00	1.90E+05
La-142	8.24E-11	2.63E-11	8.22E-12	0.00E+00	0.00E+00	0.00E+00	5.20E-06
Ce-141	2.19E+04	1.09E+04	1.62E+03	0.00E+00	4.78E+03	0.00E+00	1.36E+07
Ce-143	1.87E+02	1.01E+05	1.47E+01	0.00E+00	4.26E+01	0.00E+00	1.49E+06
Ce-144	1.62E+06	5.09E+05	8.66E+04	0.00E+00	2.82E+05	0.00E+00	1.33E+08
Pr-143	7.18E+02	2.16E+02	3.57E+01	0.00E+00	1.17E+02	0.00E+00	7.75E+05
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	4.48E+02	3.63E+02	2.81E+01	0.00E+00	1.99E+02	0.00E+00	5.75E+05
W-187	2.89E+04	1.71E+04	7.67E+03	0.00E+00	0.00E+00	0.00E+00	2.40E+06
Np-239	1.72E+01	1.24E+00	8.69E-01	0.00E+00	3.58E+00	0.00E+00	9.15E+04

Notes:

1) Units are m^2 mrem/yr per µCi/sec with the exception of H-3.

2) For H-3, the units are mrem/yr per µCi/m^3.

Table 14c
Infant Grass-Cow-Milk Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	1.36E+03	1.36E+03	1.36E+03	1.36E+03	1.36E+03	1.36E+03
Na-24	1.56E+07	1.56E+07	1.56E+07	1.56E+07	1.56E+07	1.56E+07	1.56E+07
Cr-51	0.00E+00	0.00E+00	1.61E+05	1.05E+05	2.30E+04	2.05E+05	4.70E+06
Mn-54	0.00E+00	3.90E+07	8.84E+06	0.00E+00	8.64E+06	0.00E+00	1.43E+07
Mn-56	0.00E+00	3.13E-02	5.39E-03	0.00E+00	2.69E-02	0.00E+00	2.84E+00
Fe-55	1.35E+08	8.73E+07	2.33E+07	0.00E+00	0.00E+00	4.27E+07	1.11E+07
Fe-59	2.24E+08	3.92E+08	1.54E+08	0.00E+00	0.00E+00	1.16E+08	1.87E+08
Co-58	0.00E+00	2.43E+07	6.05E+07	0.00E+00	0.00E+00	0.00E+00	6.04E+07
Co-60	0.00E+00	8.82E+07	2.08E+08	0.00E+00	0.00E+00	0.00E+00	2.10E+08
Ni-63	3.49E+10	2.16E+09	1.21E+09	0.00E+00	0.00E+00	0.00E+00	1.07E+08
Ni-65	3.51E+00	3.97E-01	1.81E-01	0.00E+00	0.00E+00	0.00E+00	3.02E+01
Cu-64	0.00E+00	1.84E+05	8.51E+04	0.00E+00	3.11E+05	0.00E+00	3.77E+06
Zn-65	5.55E+09	1.90E+10	8.78E+09	0.00E+00	9.23E+09	0.00E+00	1.61E+10
Zn-69	1.94E-11	3.49E-11	2.60E-12	0.00E+00	1.45E-11	0.00E+00	2.85E-09
Br-83	0.00E+00	0.00E+00	9.27E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	2.23E+10	1.10E+10	0.00E+00	0.00E+00	0.00E+00	5.70E+08
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	1.26E+10	0.00E+00	3.61E+08	0.00E+00	0.00E+00	0.00E+00	2.59E+08
Sr-90	1.86E+11	0.00E+00	3.77E+09	0.00E+00	0.00E+00	0.00E+00	1.52E+09
Sr-91	2.70E+05	0.00E+00	9.76E+03	0.00E+00	0.00E+00	0.00E+00	3.19E+05
Sr-92	4.60E+00	0.00E+00	1.71E-01	0.00E+00	0.00E+00	0.00E+00	4.96E+01
Y-90	6.82E+02	0.00E+00	1.83E+01	0.00E+00	0.00E+00	0.00E+00	9.42E+05
Y-91M	6.09E-19	0.00E+00	2.07E-20	0.00E+00	0.00E+00	0.00E+00	2.03E-15
Y-91	7.33E+04	0.00E+00	1.95E+03	0.00E+00	0.00E+00	0.00E+00	5.25E+06
Y-92	5.37E-04	0.00E+00	1.51E-05	0.00E+00	0.00E+00	0.00E+00	1.02E+01
Y-93	2.14E+00	0.00E+00	5.83E-02	0.00E+00	0.00E+00	0.00E+00	1.69E+04
Zr-95	6.81E+03	1.66E+03	1.18E+03	0.00E+00	1.79E+03	0.00E+00	8.26E+05
Zr-97	4.05E+00	6.96E-01	3.18E-01	0.00E+00	7.01E-01	0.00E+00	4.44E+04
Nb-95	5.94E+05	2.45E+05	1.41E+05	0.00E+00	1.75E+05	0.00E+00	2.07E+08
Mo-99	0.00E+00	2.08E+08	4.05E+07	0.00E+00	3.10E+08	0.00E+00	6.84E+07
Tc- 99M	2.74E+01	5.65E+01	7.27E+02	0.00E+00	6.08E+02	2.95E+01	1.64E+04
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	8.67E+03	0.00E+00	2.90E+03	0.00E+00	1.80E+04	0.00E+00	1.05E+05
Ru-105	8.00E-03	0.00E+00	2.69E-03	0.00E+00	5.88E-02	0.00E+00	3.18E+00
Ru-106	1.90E+05	0.00E+00	2.38E+04	0.00E+00	2.25E+05	0.00E+00	1.44E+06
Ag-110M	3.86E+08	2.82E+08	1.86E+08	0.00E+00	4.03E+08	0.00E+00	1.46E+10

Table 14c (Continued)
Infant Grass-Cow-Milk Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	1.51E+08	5.04E+07	2.04E+07	5.08E+07	0.00E+00	0.00E+00	7.19E+07
Te-127M	4.21E+08	1.40E+08	5.10E+07	1.22E+08	1.04E+09	0.00E+00	1.70E+08
Te-127	6.45E+03	2.16E+03	1.39E+03	5.25E+03	1.57E+04	0.00E+00	1.35E+05
Te-129M	5.57E+08	1.91E+08	8.58E+07	2.14E+08	1.39E+09	0.00E+00	3.33E+08
Te-129	2.72E-09	9.38E-10	6.35E-10	2.28E-09	6.77E-09	0.00E+00	2.17E-07
Te-131M	3.37E+06	1.36E+06	1.12E+06	2.75E+06	9.35E+06	0.00E+00	2.29E+07
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	2.10E+07	1.04E+07	9.71E+06	1.54E+07	6.51E+07	0.00E+00	3.85E+07
I-130	3.53E+06	7.77E+06	3.12E+06	8.71E+08	8.53E+06	0.00E+00	1.67E+06
I-131	2.72E+09	3.20E+09	1.41E+09	1.05E+12	3.74E+09	0.00E+00	1.14E+08
I-132	1.43E+00	2.91E+00	1.04E+00	1.36E+02	3.25E+00	0.00E+00	2.36E+00
I-133	3.63E+07	5.29E+07	1.55E+07	9.62E+09	6.22E+07	0.00E+00	8.95E+06
I-134	1.65E-11	3.37E-11	1.20E-11	7.87E-10	3.77E-11	0.00E+00	3.49E-11
I-135	1.13E+05	2.25E+05	8.19E+04	2.01E+07	2.50E+05	0.00E+00	8.13E+04
Cs-134	3.65E+10	6.80E+10	6.87E+09	0.00E+00	1.75E+10	7.18E+09	1.85E+08
Cs-136	1.97E+09	5.80E+09	2.16E+09	0.00E+00	2.31E+09	4.72E+08	8.80E+07
Cs-137	5.15E+10	6.02E+10	4.27E+09	0.00E+00	1.62E+10	6.55E+09	1.88E+08
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	4.29E-07	2.84E-10	1.24E-08	0.00E+00	1.71E-10	1.72E-10	2.72E-05
Ba-140	2.41E+08	2.41E+05	1.24E+07	0.00E+00	5.72E+04	1.48E+05	5.92E+07
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	4.06E+01	1.60E+01	4.12E+00	0.00E+00	0.00E+00	0.00E+00	1.88E+05
La-142	1.73E-10	6.35E-11	1.52E-11	0.00E+00	0.00E+00	0.00E+00	1.08E-05
Ce-141	4.34E+04	2.64E+04	3.11E+03	0.00E+00	8.15E+03	0.00E+00	1.37E+07
Ce-143	3.96E+02	2.63E+05	3.00E+01	0.00E+00	7.65E+01	0.00E+00	1.53E+06
Ce-144	2.33E+06	9.52E+05	1.30E+05	0.00E+00	3.85E+05	0.00E+00	1.33E+08
Pr-143	1.49E+03	5.56E+02	7.37E+01	0.00E+00	2.07E+02	0.00E+00	7.84E+05
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	8.88E+02	9.12E+02	5.59E+01	0.00E+00	3.51E+02	0.00E+00	5.78E+05
W-187	6.08E+04	4.23E+04	1.46E+04	0.00E+00	0.00E+00	0.00E+00	2.48E+06
Np-239	3.64E+01	3.26E+00	1.84E+00	0.00E+00	6.50E+00	0.00E+00	9.42E+04

Notes:

1) Units are m^2 mrem/yr per µCi/sec with the exception of H-3.

2) For H-3, the units are mrem/yr per $\mu Ci/m^3$.

Table 15
Adult Grass-Goat-Milk Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	8.88E+02	8.88E+02	8.88E+02	8.88E+02	8.88E+02	8.88E+02
Na-24	2.95E+05	2.95E+05	2.95E+05	2.95E+05	2.95E+05	2.95E+05	2.95E+05
Cr-51	0.00E+00	0.00E+00	3.43E+03	2.05E+03	7.55E+02	4.55E+03	8.62E+05
Mn-54	0.00E+00	1.01E+06	1.93E+05	0.00E+00	3.00E+05	0.00E+00	3.09E+06
Mn-56	0.00E+00	4.95E-04	8.79E-05	0.00E+00	6.29E-04	0.00E+00	1.58E-02
Fe-55	3.26E+05	2.26E+05	5.26E+04	0.00E+00	0.00E+00	1.26E+05	1.29E+05
Fe-59	3.86E+05	9.07E+05	3.48E+05	0.00E+00	0.00E+00	2.53E+05	3.02E+06
Co-58	0.00E+00	5.66E+05	1.27E+06	0.00E+00	0.00E+00	0.00E+00	1.15E+07
Co-60	0.00E+00	1.97E+06	4.34E+06	0.00E+00	0.00E+00	0.00E+00	3.70E+07
Ni-63	8.07E+08	5.60E+07	2.71E+07	0.00E+00	0.00E+00	0.00E+00	1.17E+07
Ni-65	4.44E-02	5.77E-03	2.63E-03	0.00E+00	0.00E+00	0.00E+00	1.46E-01
Cu-64	0.00E+00	2.63E+03	1.23E+03	0.00E+00	6.63E+03	0.00E+00	2.24E+05
Zn-65	1.65E+08	5.24E+08	2.37E+08	0.00E+00	3.50E+08	0.00E+00	3.30E+08
Zn-69	2.41E-13	4.61E-13	3.21E-14	0.00E+00	3.00E-13	0.00E+00	6.93E-14
Br-83	0.00E+00	0.00E+00	1.16E-02	0.00E+00	0.00E+00	0.00E+00	1.67E-02
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	3.12E+08	1.45E+08	0.00E+00	0.00E+00	0.00E+00	6.15E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	3.05E+09	0.00E+00	8.74E+07	0.00E+00	0.00E+00	0.00E+00	4.88E+08
Sr-90	1.13E+11	0.00E+00	2.27E+09	0.00E+00	0.00E+00	0.00E+00	2.84E+09
Sr-91	6.03E+04	0.00E+00	2.44E+03	0.00E+00	0.00E+00	0.00E+00	2.87E+05
Sr-92	1.02E+00	0.00E+00	4.39E-02	0.00E+00	0.00E+00	0.00E+00	2.01E+01
Y-90	8.52E+00	0.00E+00	2.28E-01	0.00E+00	0.00E+00	0.00E+00	9.03E+04
Y-91M	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.26E-20
Y-91	1.03E+03	0.00E+00	2.76E+01	0.00E+00	0.00E+00	0.00E+00	5.67E+05
Y-92	6.68E-06	0.00E+00	1.95E-07	0.00E+00	0.00E+00	0.00E+00	1.17E-01
Y-93	2.66E-02	0.00E+00	7.34E-04	0.00E+00	0.00E+00	0.00E+00	8.43E+02
Zr-95	1.13E+02	3.63E+01	2.46E+01	0.00E+00	5.70E+01	0.00E+00	1.15E+05
Zr-97	5.19E-02	1.05E-02	4.79E-03	0.00E+00	1.58E-02	0.00E+00	3.24E+03
Nb-95	9.92E+03	5.52E+03	2.97E+03	0.00E+00	5.45E+03	0.00E+00	3.35E+07
Mo-99	0.00E+00	2.97E+06	5.65E+05	0.00E+00	6.72E+06	0.00E+00	6.88E+06
Tc- 99M	3.97E-01	1.12E+00	1.43E+01	0.00E+00	1.70E+01	5.50E-01	6.64E+02
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	1.22E+02	0.00E+00	5.26E+01	0.00E+00	4.66E+02	0.00E+00	1.43E+04
Ru-105	1.02E-04	0.00E+00	4.03E-05	0.00E+00	1.32E-03	0.00E+00	6.25E-02
Ru-106	2.45E+03	0.00E+00	3.10E+02	0.00E+00	4.73E+03	0.00E+00	1.58E+05
Ag-110M	6.99E+06	6.46E+06	3.84E+06	0.00E+00	1.27E+07	0.00E+00	2.64E+09

Table 15 (Continued)
Adult Grass-Goat-Milk Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	1.96E+06	7.09E+05	2.62E+05	5.88E+05	7.95E+06	0.00E+00	7.81E+06
Te-127M	5.49E+06	1.96E+06	6.69E+05	1.40E+06	2.23E+07	0.00E+00	1.84E+07
Te-127	8.00E+01	2.87E+01	1.73E+01	5.92E+01	3.26E+02	0.00E+00	6.31E+03
Te-129M	7.22E+06	2.69E+06	1.14E+06	2.48E+06	3.01E+07	0.00E+00	3.64E+07
Te-129	3.39E-11	1.27E-11	8.26E-12	2.60E-11	1.43E-10	0.00E+00	2.56E-11
Te-131M	4.33E+04	2.12E+04	1.76E+04	3.35E+04	2.14E+05	0.00E+00	2.10E+06
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	2.87E+05	1.86E+05	1.74E+05	2.05E+05	1.79E+06	0.00E+00	8.78E+06
I-130	5.01E+05	1.48E+06	5.84E+05	1.25E+08	2.31E+06	0.00E+00	1.27E+06
I-131	3.55E+08	5.08E+08	2.91E+08	1.67E+11	8.71E+08	0.00E+00	1.34E+08
I-132	1.98E-01	5.29E-01	1.85E-01	1.85E+01	8.42E-01	0.00E+00	9.93E-02
I-133	4.65E+06	8.09E+06	2.47E+06	1.19E+09	1.41E+07	0.00E+00	7.27E+06
I-134	2.27E-12	6.15E-12	2.20E-12	1.07E-10	9.79E-12	0.00E+00	5.36E-15
I-135	1.55E+04	4.06E+04	1.50E+04	2.68E+06	6.51E+04	0.00E+00	4.58E+04
Cs-134	1.70E+10	4.04E+10	3.30E+10	0.00E+00	1.31E+10	4.34E+09	7.06E+08
Cs-136	7.88E+08	3.11E+09	2.24E+09	0.00E+00	1.73E+09	2.37E+08	3.53E+08
Cs-137	2.21E+10	3.03E+10	1.98E+10	0.00E+00	1.03E+10	3.42E+09	5.86E+08
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	5.32E-09	3.79E-12	1.56E-10	0.00E+00	3.54E-12	2.15E-12	9.44E-09
Ba-140	3.23E+06	4.05E+03	2.11E+05	0.00E+00	1.38E+03	2.32E+03	6.64E+06
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	5.43E-01	2.74E-01	7.23E-02	0.00E+00	0.00E+00	0.00E+00	2.01E+04
La-142	2.27E-12	1.03E-12	2.57E-13	0.00E+00	0.00E+00	0.00E+00	7.53E-09
Ce-141	5.81E+02	3.93E+02	4.46E+01	0.00E+00	1.83E+02	0.00E+00	1.50E+06
Ce-143	4.98E+00	3.68E+03	4.07E-01	0.00E+00	1.62E+00	0.00E+00	1.38E+05
Ce-144	4.29E+04	1.79E+04	2.30E+03	0.00E+00	1.06E+04	0.00E+00	1.45E+07
Pr-143	1.90E+01	7.60E+00	9.40E-01	0.00E+00	4.39E+00	0.00E+00	8.31E+04
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	1.14E+01	1.32E+01	7.87E-01	0.00E+00	7.69E+00	0.00E+00	6.31E+04
W-187	7.82E+02	6.53E+02	2.28E+02	0.00E+00	0.00E+00	0.00E+00	2.14E+05
Np-239	4.40E-01	4.33E-02	2.39E-02	0.00E+00	1.35E-01	0.00E+00	8.88E+03

Notes:

1) Units are m^2 mrem/yr per $\mu Ci/sec$ with the exception of H-3.

2) For H-3, the units are mrem/yr per $\mu Ci/m^3$.

Table 15a
Teen Grass-Goat-Milk Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	1.16E+03	1.16E+03	1.16E+03	1.16E+03	1.16E+03	1.16E+03
Na-24	5.15E+05	5.15E+05	5.15E+05	5.15E+05	5.15E+05	5.15E+05	5.15E+05
Cr-51	0.00E+00	0.00E+00	5.99E+03	3.33E+03	1.31E+03	8.55E+03	1.01E+06
Mn-54	0.00E+00	1.68E+06	3.34E+05	0.00E+00	5.02E+05	0.00E+00	3.45E+06
Mn-56	0.00E+00	8.78E-04	1.56E-04	0.00E+00	1.11E-03	0.00E+00	5.78E-02
Fe-55	5.79E+05	4.11E+05	9.57E+04	0.00E+00	0.00E+00	2.60E+05	1.78E+05
Fe-59	6.74E+05	1.57E+06	6.07E+05	0.00E+00	0.00E+00	4.96E+05	3.72E+06
Co-58	0.00E+00	9.53E+05	2.20E+06	0.00E+00	0.00E+00	0.00E+00	1.31E+07
Co-60	0.00E+00	3.34E+06	7.52E+06	0.00E+00	0.00E+00	0.00E+00	4.35E+07
Ni-63	1.42E+09	1.00E+08	4.81E+07	0.00E+00	0.00E+00	0.00E+00	1.59E+07
Ni-65	8.13E-02	1.04E-02	4.73E-03	0.00E+00	0.00E+00	0.00E+00	5.63E-01
Cu-64	0.00E+00	4.69E+03	2.20E+03	0.00E+00	1.19E+04	0.00E+00	3.64E+05
Zn-65	2.53E+08	8.78E+08	4.09E+08	0.00E+00	5.62E+08	0.00E+00	3.72E+08
Zn-69	4.44E-13	8.46E-13	5.92E-14	0.00E+00	5.53E-13	0.00E+00	1.56E-12
Br-83	0.00E+00	0.00E+00	2.13E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	5.68E+08	2.67E+08	0.00E+00	0.00E+00	0.00E+00	8.41E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	5.61E+09	0.00E+00	1.61E+08	0.00E+00	0.00E+00	0.00E+00	6.69E+08
Sr-90	1.71E+11	0.00E+00	3.41E+09	0.00E+00	0.00E+00	0.00E+00	3.90E+09
Sr-91	1.11E+05	0.00E+00	4.41E+03	0.00E+00	0.00E+00	0.00E+00	5.02E+05
Sr-92	1.86E+00	0.00E+00	7.92E-02	0.00E+00	0.00E+00	0.00E+00	4.74E+01
Y-90	1.56E+01	0.00E+00	4.21E-01	0.00E+00	0.00E+00	0.00E+00	1.29E+05
Y-91M	1.41E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.66E-19
Y-91	1.90E+03	0.00E+00	5.08E+01	0.00E+00	0.00E+00	0.00E+00	7.77E+05
Y-92	1.23E-05	0.00E+00	3.57E-07	0.00E+00	0.00E+00	0.00E+00	3.39E-01
Y-93	4.90E-02	0.00E+00	1.34E-03	0.00E+00	0.00E+00	0.00E+00	1.50E+03
Zr-95	1.98E+02	6.25E+01	4.30E+01	0.00E+00	9.18E+01	0.00E+00	1.44E+05
Zr-97	9.44E-02	1.87E-02	8.61E-03	0.00E+00	2.83E-02	0.00E+00	5.06E+03
Nb-95	1.69E+04	9.38E+03	5.16E+03	0.00E+00	9.09E+03	0.00E+00	4.01E+07
Mo-99	0.00E+00	5.36E+06	1.02E+06	0.00E+00	1.23E+07	0.00E+00	9.59E+06
Tc- 99M	6.89E-01	1.92E+00	2.49E+01	0.00E+00	2.86E+01	1.07E+00	1.26E+03
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	2.17E+02	0.00E+00	9.29E+01	0.00E+00	7.66E+02	0.00E+00	1.81E+04
Ru-105	1.86E-04	0.00E+00	7.24E-05	0.00E+00	2.35E-03	0.00E+00	1.51E-01
Ru-106	4.50E+03	0.00E+00	5.67E+02	0.00E+00	8.68E+03	0.00E+00	2.16E+05
Ag-110M	1.16E+07	1.09E+07	6.65E+06	0.00E+00	2.09E+07	0.00E+00	3.07E+09

Table 15a (Continued)
Teen Grass-Goat-Milk Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	3.61E+06	1.30E+06	4.82E+05	1.01E+06	0.00E+00	0.00E+00	1.06E+07
Te-127M	1.01E+07	3.59E+06	1.20E+06	2.41E+06	4.10E+07	0.00E+00	2.52E+07
Te-127	1.48E+02	5.25E+01	3.19E+01	1.02E+02	6.00E+02	0.00E+00	1.14E+04
Te-129M	1.32E+07	4.90E+06	2.09E+06	4.26E+06	5.53E+07	0.00E+00	4.96E+07
Te-129	6.24E-11	2.33E-11	1.52E-11	4.46E-11	2.62E-10	0.00E+00	3.41E-10
Te-131M	7.88E+04	3.78E+04	3.15E+04	5.68E+04	3.94E+05	0.00E+00	3.03E+06
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	5.13E+05	3.25E+05	3.06E+05	3.42E+05	3.12E+06	0.00E+00	1.03E+07
I-130	8.82E+05	2.55E+06	1.02E+06	2.08E+08	3.93E+06	0.00E+00	1.96E+06
I-131	6.45E+08	9.02E+08	4.85E+08	2.63E+11	1.55E+09	0.00E+00	1.78E+08
I-132	3.50E-01	9.17E-01	3.29E-01	3.09E+01	1.44E+00	0.00E+00	3.99E-01
I-133	8.50E+06	1.44E+07	4.40E+06	2.01E+09	2.53E+07	0.00E+00	1.09E+07
I-134	4.03E-12	1.07E-11	3.83E-12	1.78E-10	1.68E-11	0.00E+00	1.41E-13
I-135	2.75E+04	7.09E+04	2.63E+04	4.56E+06	1.12E+05	0.00E+00	7.85E+04
Cs-134	2.94E+10	6.93E+10	3.22E+10	0.00E+00	2.20E+10	8.41E+09	8.62E+08
Cs-136	1.34E+09	5.28E+09	3.54E+09	0.00E+00	2.87E+09	4.53E+08	4.25E+08
Cs-137	4.02E+10	5.34E+10	1.86E+10	0.00E+00	1.82E+10	7.06E+09	7.60E+08
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	9.84E-09	6.92E-12	2.87E-10	0.00E+00	6.53E-12	4.77E-12	8.78E-08
Ba-140	5.82E+06	7.14E+03	3.75E+05	0.00E+00	2.42E+03	4.80E+03	8.98E+06
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	9.75E-01	4.79E-01	1.27E-01	0.00E+00	0.00E+00	0.00E+00	2.75E+04
La-142	4.09E-12	1.82E-12	4.53E-13	0.00E+00	0.00E+00	0.00E+00	5.53E-08
Ce-141	1.07E+03	7.12E+02	8.17E+01	0.00E+00	3.35E+02	0.00E+00	2.04E+06
Ce-143	9.15E+00	6.66E+03	7.44E-01	0.00E+00	2.99E+00	0.00E+00	2.00E+05
Ce-144	7.90E+04	3.27E+04	4.24E+03	0.00E+00	1.95E+04	0.00E+00	1.99E+07
Pr-143	3.48E+01	1.39E+01	1.73E+00	0.00E+00	8.08E+00	0.00E+00	1.15E+05
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	2.19E+01	2.38E+01	1.43E+00	0.00E+00	1.40E+01	0.00E+00	8.59E+04
W-187	1.43E+03	1.17E+03	4.08E+02	0.00E+00	0.00E+00	0.00E+00	3.15E+05
Np-239	8.40E-01	7.92E-02	4.40E-02	0.00E+00	2.49E-01	0.00E+00	1.27E+04

Notes:

1) Units are m^2 mrem/yr per µCi/sec with the exception of H-3.

2) For H-3, the units are mrem/yr per $\mu Ci/m^3$.

Table 15b
Child Grass-Goat-Milk Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	1.83E+03	1.83E+03	1.83E+03	1.83E+03	1.83E+03	1.83E+03
Na-24	1.07E+06	1.07E+06	1.07E+06	1.07E+06	1.07E+06	1.07E+06	1.07E+06
Cr-51	0.00E+00	0.00E+00	1.22E+04	6.78E+03	1.85E+03	1.24E+04	6.47E+05
Mn-54	0.00E+00	2.52E+06	6.70E+05	0.00E+00	7.06E+05	0.00E+00	2.11E+06
Mn-56	0.00E+00	1.53E-03	3.46E-04	0.00E+00	1.85E-03	0.00E+00	2.22E-01
Fe-55	1.45E+06	7.71E+05	2.39E+05	0.00E+00	0.00E+00	4.36E+05	1.43E+05
Fe-59	1.56E+06	2.53E+06	1.26E+06	0.00E+00	0.00E+00	7.33E+05	2.63E+06
Co-58	0.00E+00	1.46E+06	4.46E+06	0.00E+00	0.00E+00	0.00E+00	8.49E+06
Co-60	0.00E+00	5.18E+06	1.53E+07	0.00E+00	0.00E+00	0.00E+00	2.87E+07
Ni-63	3.56E+09	1.90E+08	1.21E+08	0.00E+00	0.00E+00	0.00E+00	1.28E+07
Ni-65	1.99E-01	1.87E-02	1.09E-02	0.00E+00	0.00E+00	0.00E+00	2.29E+00
Cu-64	0.00E+00	8.24E+03	4.98E+03	0.00E+00	1.99E+04	0.00E+00	3.87E+05
Zn-65	4.96E+08	1.32E+09	8.22E+08	0.00E+00	8.33E+08	0.00E+00	2.32E+08
Zn-69	1.09E-12	1.58E-12	1.46E-13	0.00E+00	9.57E-13	0.00E+00	9.95E-11
Br-83	0.00E+00	0.00E+00	5.24E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	1.05E+09	6.48E+08	0.00E+00	0.00E+00	0.00E+00	6.78E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	1.39E+10	0.00E+00	3.97E+08	0.00E+00	0.00E+00	0.00E+00	5.38E+08
Sr-90	3.53E+11	0.00E+00	7.11E+09	0.00E+00	0.00E+00	0.00E+00	3.16E+09
Sr-91	2.72E+05	0.00E+00	1.03E+04	0.00E+00	0.00E+00	0.00E+00	6.00E+05
Sr-92	4.54E+00	0.00E+00	1.82E-01	0.00E+00	0.00E+00	0.00E+00	8.60E+01
Y-90	3.87E+01	0.00E+00	1.04E+00	0.00E+00	0.00E+00	0.00E+00	1.10E+05
Y-91M	3.45E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.75E-17
Y-91	4.68E+03	0.00E+00	1.25E+02	0.00E+00	0.00E+00	0.00E+00	6.24E+05
Y-92	3.03E-05	0.00E+00	8.67E-07	0.00E+00	0.00E+00	0.00E+00	8.75E-01
Y-93	1.20E-01	0.00E+00	3.31E-03	0.00E+00	0.00E+00	0.00E+00	1.80E+03
Zr-95	4.60E+02	1.01E+02	9.00E+01	0.00E+00	1.45E+02	0.00E+00	1.05E+05
Zr-97	2.30E-01	3.32E-02	1.96E-02	0.00E+00	4.77E-02	0.00E+00	5.03E+03
Nb-95	3.82E+04	1.49E+04	1.06E+04	0.00E+00	1.40E+04	0.00E+00	2.75E+07
Mo-99	0.00E+00	9.75E+06	2.41E+06	0.00E+00	2.08E+07	0.00E+00	8.06E+06
Tc- 99M	1.58E+00	3.10E+00	5.14E+01	0.00E+00	4.50E+01	1.57E+00	1.76E+03
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	5.14E+02	0.00E+00	1.97E+02	0.00E+00	1.29E+03	0.00E+00	1.33E+04
Ru-105	4.55E-04	0.00E+00	1.65E-04	0.00E+00	4.00E-03	0.00E+00	2.97E-01
Ru-106	1.11E+04	0.00E+00	1.38E+03	0.00E+00	1.50E+04	0.00E+00	1.72E+05
Ag-110M	2.51E+07	1.69E+07	1.35E+07	0.00E+00	3.15E+07	0.00E+00	2.01E+09

Table 15b (Continued)
Child Grass-Goat-Milk Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	8.86E+06	2.40E+06	1.18E+06	2.49E+06	0.00E+00	0.00E+00	8.55E+06
Te-127M	2.50E+07	6.72E+06	2.96E+06	5.97E+06	7.12E+07	0.00E+00	2.02E+07
Te-127	3.64E+02	9.83E+01	7.82E+01	2.52E+02	1.04E+03	0.00E+00	1.42E+04
Te-129M	3.26E+07	9.09E+06	5.05E+06	1.05E+07	9.56E+07	0.00E+00	3.97E+07
Te-129	1.54E-10	4.30E-11	3.66E-11	1.10E-10	4.51E-10	0.00E+00	9.59E-09
Te-131M	1.92E+05	6.63E+04	7.06E+04	1.36E+05	6.42E+05	0.00E+00	2.69E+06
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	1.22E+06	5.42E+05	6.55E+05	7.89E+05	5.03E+06	0.00E+00	5.46E+06
I-130	2.06E+06	4.17E+06	2.15E+06	4.59E+08	6.23E+06	0.00E+00	1.95E+06
I-131	1.56E+09	1.57E+09	8.94E+08	5.20E+11	2.58E+09	0.00E+00	1.40E+08
I-132	8.29E-01	1.52E+00	7.00E-01	7.07E+01	2.33E+00	0.00E+00	1.79E+00
I-133	2.06E+07	2.55E+07	9.66E+06	4.74E+09	4.25E+07	0.00E+00	1.03E+07
I-134	9.53E-12	1.77E-11	8.14E-12	4.07E-10	2.71E-11	0.00E+00	1.17E-11
I-135	6.52E+04	1.17E+05	5.55E+04	1.04E+07	1.80E+05	0.00E+00	8.94E+04
Cs-134	6.79E+10	1.11E+11	2.35E+10	0.00E+00	3.45E+10	1.24E+10	6.01E+08
Cs-136	3.03E+09	8.32E+09	5.39E+09	0.00E+00	4.43E+09	6.61E+08	2.92E+08
Cs-137	9.67E+10	9.26E+10	1.37E+10	0.00E+00	3.02E+10	1.09E+10	5.80E+08
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	2.42E-08	1.29E-11	7.01E-10	0.00E+00	1.13E-11	7.59E-12	1.40E-06
Ba-140	1.41E+07	1.23E+04	8.21E+05	0.00E+00	4.01E+03	7.34E+03	7.12E+06
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	2.33E+00	8.16E-01	2.75E-01	0.00E+00	0.00E+00	0.00E+00	2.27E+04
La-142	9.88E-12	3.15E-12	9.87E-13	0.00E+00	0.00E+00	0.00E+00	6.24E-07
Ce-141	2.62E+03	1.31E+03	1.94E+02	0.00E+00	5.74E+02	0.00E+00	1.63E+06
Ce-143	2.25E+01	1.22E+04	1.76E+00	0.00E+00	5.11E+00	0.00E+00	1.78E+05
Ce-144	1.95E+05	6.11E+04	1.04E+04	0.00E+00	3.38E+04	0.00E+00	1.59E+07
Pr-143	8.62E+01	2.59E+01	4.28E+00	0.00E+00	1.40E+01	0.00E+00	9.30E+04
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	5.37E+01	4.35E+01	3.37E+00	0.00E+00	2.39E+01	0.00E+00	6.89E+04
W-187	3.47E+03	2.05E+03	9.21E+02	0.00E+00	0.00E+00	0.00E+00	2.88E+05
Np-239	2.07E+00	1.48E-01	1.04E-01	0.00E+00	4.29E-01	0.00E+00	1.10E+04

Notes:

1) Units are m^2 mrem/yr per µCi/sec with the exception of H-3.

2) For H-3, the units are mrem/yr per $\mu Ci/m^3$.

Table 15c
Infant Grass-Goat-Milk Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	2.78E+03	2.78E+03	2.78E+03	2.78E+03	2.78E+03	2.78E+03
Na-24	1.87E+06	1.87E+06	1.87E+06	1.87E+06	1.87E+06	1.87E+06	1.87E+06
Cr-51	0.00E+00	0.00E+00	1.93E+04	1.26E+04	2.76E+03	2.46E+04	5.64E+05
Mn-54	0.00E+00	4.68E+06	1.06E+06	0.00E+00	1.04E+06	0.00E+00	1.72E+06
Mn-56	0.00E+00	3.75E-03	6.47E-04	0.00E+00	3.22E-03	0.00E+00	3.41E-01
Fe-55	1.76E+06	1.13E+06	3.03E+05	0.00E+00	0.00E+00	5.55E+05	1.44E+05
Fe-59	2.92E+06	5.09E+06	2.01E+06	0.00E+00	0.00E+00	1.51E+06	2.43E+06
Co-58	0.00E+00	2.91E+06	7.26E+06	0.00E+00	0.00E+00	0.00E+00	7.25E+06
Co-60	0.00E+00	1.06E+07	2.50E+07	0.00E+00	0.00E+00	0.00E+00	2.52E+07
Ni-63	4.19E+09	2.59E+08	1.45E+08	0.00E+00	0.00E+00	0.00E+00	1.29E+07
Ni-65	4.21E-01	4.77E-02	2.17E-02	0.00E+00	0.00E+00	0.00E+00	3.63E+00
Cu-64	0.00E+00	2.05E+04	9.48E+03	0.00E+00	3.46E+04	0.00E+00	4.20E+05
Zn-65	6.66E+08	2.28E+09	1.05E+09	0.00E+00	1.11E+09	0.00E+00	1.93E+09
Zn-69	2.33E-12	4.19E-12	3.12E-13	0.00E+00	1.74E-12	0.00E+00	3.42E-10
Br-83	0.00E+00	0.00E+00	1.11E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	2.67E+09	1.32E+09	0.00E+00	0.00E+00	0.00E+00	6.84E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	2.64E+10	0.00E+00	7.58E+08	0.00E+00	0.00E+00	0.00E+00	5.43E+08
Sr-90	3.91E+11	0.00E+00	7.92E+09	0.00E+00	0.00E+00	0.00E+00	3.19E+09
Sr-91	5.66E+05	0.00E+00	2.05E+04	0.00E+00	0.00E+00	0.00E+00	6.70E+05
Sr-92	9.65E+00	0.00E+00	3.59E-01	0.00E+00	0.00E+00	0.00E+00	1.04E+02
Y-90	8.19E+01	0.00E+00	2.20E+00	0.00E+00	0.00E+00	0.00E+00	1.13E+05
Y-91M	7.31E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.44E-16
Y-91	8.79E+03	0.00E+00	2.34E+02	0.00E+00	0.00E+00	0.00E+00	6.30E+05
Y-92	6.44E-05	0.00E+00	1.81E-06	0.00E+00	0.00E+00	0.00E+00	1.23E+00
Y-93	2.57E-01	0.00E+00	6.99E-03	0.00E+00	0.00E+00	0.00E+00	2.03E+03
Zr-95	8.17E+02	1.99E+02	1.41E+02	0.00E+00	2.15E+02	0.00E+00	9.91E+04
Zr-97	4.87E-01	8.35E-02	3.81E-02	0.00E+00	8.42E-02	0.00E+00	5.33E+03
Nb-95	7.13E+04	2.94E+04	1.70E+04	0.00E+00	2.10E+04	0.00E+00	2.48E+07
Mo-99	0.00E+00	2.49E+07	4.86E+06	0.00E+00	3.72E+07	0.00E+00	8.21E+06
Tc- 99M	3.29E+00	6.78E+00	8.73E+01	0.00E+00	7.29E+01	3.54E+00	1.97E+03
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	1.04E+03	0.00E+00	3.48E+02	0.00E+00	2.16E+03	0.00E+00	1.27E+04
Ru-105	9.60E-04	0.00E+00	3.23E-04	0.00E+00	7.06E-03	0.00E+00	3.82E-01
Ru-106	2.28E+04	0.00E+00	2.85E+03	0.00E+00	2.70E+04	0.00E+00	1.73E+05
Ag-110M	4.63E+07	3.38E+07	2.24E+07	0.00E+00	4.84E+07	0.00E+00	1.75E+09

Table 15c (Continued)
Infant Grass-Goat-Milk Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	1.81E+07	6.05E+06	2.45E+06	6.09E+06	0.00E+00	0.00E+00	8.62E+06
Te-127M	5.05E+07	1.68E+07	6.12E+06	1.46E+07	1.24E+08	0.00E+00	2.04E+07
Te-127	7.74E+02	2.59E+02	1.66E+02	6.30E+02	1.89E+03	0.00E+00	1.63E+04
Te-129M	6.68E+07	2.29E+07	1.03E+07	2.57E+07	1.67E+08	0.00E+00	3.99E+07
Te-129	3.26E-10	1.13E-10	7.62E-11	2.74E-10	8.13E-10	0.00E+00	2.61E-08
Te-131M	4.05E+05	1.63E+05	1.35E+05	3.30E+05	1.12E+06	0.00E+00	2.74E+06
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	2.52E+06	1.25E+06	1.17E+06	1.84E+06	7.81E+06	0.00E+00	4.62E+06
I-130	4.24E+06	9.32E+06	3.74E+06	1.04E+09	1.02E+07	0.00E+00	2.00E+06
I-131	3.26E+09	3.85E+09	1.69E+09	1.26E+12	4.49E+09	0.00E+00	1.37E+08
I-132	1.72E+00	3.49E+00	1.24E+00	1.64E+02	3.90E+00	0.00E+00	2.83E+00
I-133	4.36E+07	6.35E+07	1.86E+07	1.15E+10	7.46E+07	0.00E+00	1.07E+07
I-134	1.98E-11	4.05E-11	1.44E-11	9.44E-10	4.53E-11	0.00E+00	4.19E-11
I-135	1.36E+05	2.70E+05	9.83E+04	2.42E+07	3.01E+05	0.00E+00	9.76E+04
Cs-134	1.09E+11	2.04E+11	2.06E+10	0.00E+00	5.25E+10	2.15E+10	5.54E+08
Cs-136	5.91E+09	1.74E+10	6.49E+09	0.00E+00	6.93E+09	1.42E+09	2.64E+08
Cs-137	1.54E+11	1.81E+11	1.28E+10	0.00E+00	4.85E+10	1.96E+10	5.65E+08
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	5.14E-08	3.41E-11	1.49E-09	0.00E+00	2.05E-11	2.07E-11	3.26E-06
Ba-140	2.89E+07	2.89E+04	1.49E+06	0.00E+00	6.87E+03	1.78E+04	7.11E+06
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	4.88E+00	1.92E+00	4.95E-01	0.00E+00	0.00E+00	0.00E+00	2.26E+04
La-142	2.08E-11	7.62E-12	1.82E-12	0.00E+00	0.00E+00	0.00E+00	1.29E-06
Ce-141	5.20E+03	3.17E+03	3.73E+02	0.00E+00	9.78E+02	0.00E+00	1.64E+06
Ce-143	4.75E+01	3.15E+04	3.60E+00	0.00E+00	9.19E+00	0.00E+00	1.84E+05
Ce-144	2.79E+05	1.14E+05	1.56E+04	0.00E+00	4.62E+04	0.00E+00	1.60E+07
Pr-143	1.78E+02	6.67E+01	8.84E+00	0.00E+00	2.48E+01	0.00E+00	9.41E+04
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	1.07E+02	1.09E+02	6.70E+00	0.00E+00	4.22E+01	0.00E+00	6.93E+04
W-187	7.29E+03	5.07E+03	1.75E+03	0.00E+00	0.00E+00	0.00E+00	2.98E+05
Np-239	4.37E+00	3.91E-01	2.21E-01	0.00E+00	7.80E-01	0.00E+00	1.13E+04

Notes:

1) Units are m^2 mrem/yr per µCi/sec with the exception of H-3.

2) For H-3, the units are mrem/yr per µCi/m^3.

Table 16
Adult Grass-Cow-Meat Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	1.85E+02	1.85E+02	1.85E+02	1.85E+02	1.85E+02	1.85E+02
Na-24	1.45E-03	1.45E-03	1.45E-03	1.45E-03	1.45E-03	1.45E-03	1.45E-03
Cr-51	0.00E+00	0.00E+00	7.04E+03	4.21E+03	1.55E+03	9.34E+03	1.77E+06
Mn-54	0.00E+00	9.18E+06	1.75E+06	0.00E+00	2.73E+06	0.00E+00	2.81E+07
Mn-56	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-55	2.93E+08	2.03E+08	4.72E+07	0.00E+00	0.00E+00	1.13E+08	1.16E+08
Fe-59	2.65E+08	6.24E+08	2.39E+08	0.00E+00	0.00E+00	1.74E+08	2.08E+09
Co-58	0.00E+00	1.82E+07	4.09E+07	0.00E+00	0.00E+00	0.00E+00	3.70E+08
Co-60	0.00E+00	7.52E+07	1.66E+08	0.00E+00	0.00E+00	0.00E+00	1.41E+09
Ni-63	1.89E+10	1.31E+09	6.33E+08	0.00E+00	0.00E+00	0.00E+00	2.73E+08
Ni-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cu-64	0.00E+00	2.52E-07	1.18E-07	0.00E+00	6.36E-07	0.00E+00	2.15E-05
Zn-65	3.56E+08	1.13E+09	5.12E+08	0.00E+00	7.57E+08	0.00E+00	7.13E+08
Zn-69	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	4.88E+08	2.28E+08	0.00E+00	0.00E+00	0.00E+00	9.63E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	3.01E+08	0.00E+00	8.65E+06	0.00E+00	0.00E+00	0.00E+00	4.83E+07
Sr-90	1.43E+10	0.00E+00	2.87E+08	0.00E+00	0.00E+00	0.00E+00	3.59E+08
Sr-91	1.43E-10	0.00E+00	5.79E-12	0.00E+00	0.00E+00	0.00E+00	6.83E-10
Sr-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-90	1.08E+02	0.00E+00	2.91E+00	0.00E+00	0.00E+00	0.00E+00	1.15E+06
Y-91M	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-91	1.13E+06	0.00E+00	3.03E+04	0.00E+00	0.00E+00	0.00E+00	6.23E+08
Y-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-93	4.39E-12	0.00E+00	1.21E-13	0.00E+00	0.00E+00	0.00E+00	1.39E-07
Zr-95	1.87E+06	6.01E+05	4.07E+05	0.00E+00	9.43E+05	0.00E+00	1.91E+09
Zr-97	2.04E-05	4.12E-06	1.88E-06	0.00E+00	6.22E-06	0.00E+00	1.28E+00
Nb-95	2.30E+06	1.28E+06	6.89E+05	0.00E+00	1.27E+06	0.00E+00	7.78E+09
Mo-99	0.00E+00	9.93E+04	1.89E+04	0.00E+00	2.25E+05	0.00E+00	2.30E+05
Tc- 99M	0.00E+00	1.22E-20	1.56E-19	0.00E+00	1.85E-19	0.00E+00	7.23E-18
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	1.05E+08	0.00E+00	4.53E+07	0.00E+00	4.01E+08	0.00E+00	1.23E+10
Ru-105	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-106	2.80E+09	0.00E+00	3.54E+08	0.00E+00	5.40E+09	0.00E+00	1.81E+11
Ag-110M	6.68E+06	6.18E+06	3.67E+06	0.00E+00	1.22E+07	0.00E+00	2.52E+09

Table 16 (Continued)
Adult Grass-Cow-Meat Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	3.59E+08	1.30E+08	4.81E+07	1.08E+08	1.46E+09	0.00E+00	1.43E+09
Te-127M	1.12E+09	3.99E+08	1.36E+08	2.85E+08	4.53E+09	0.00E+00	3.74E+09
Te-127	2.50E-10	8.98E-11	5.41E-11	1.85E-10	1.02E-09	0.00E+00	1.97E-08
Te-129M	1.13E+09	4.23E+08	1.79E+08	3.89E+08	4.73E+09	0.00E+00	5.71E+09
Te-129	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-131M	4.49E+02	2.20E+02	1.83E+02	3.48E+02	2.23E+03	0.00E+00	2.18E+04
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	1.40E+06	9.03E+05	8.48E+05	9.98E+05	8.70E+06	0.00E+00	4.27E+07
I-130	2.03E-06	5.98E-06	2.36E-06	5.07E-04	9.33E-06	0.00E+00	5.15E-06
I-131	1.07E+07	1.54E+07	8.80E+06	5.03E+09	2.63E+07	0.00E+00	4.05E+06
I-132	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	3.70E-01	6.43E-01	1.96E-01	9.45E+01	1.12E+00	0.00E+00	5.78E-01
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	4.66E-17	1.22E-16	4.50E-17	8.04E-15	1.95E-16	0.00E+00	1.38E-16
Cs-134	6.58E+08	1.57E+09	1.28E+09	0.00E+00	5.07E+08	1.68E+08	2.74E+07
Cs-136	1.20E+07	4.73E+07	3.40E+07	0.00E+00	2.63E+07	3.61E+06	5.37E+06
Cs-137	8.72E+08	1.19E+09	7.81E+08	0.00E+00	4.05E+08	1.35E+08	2.31E+07
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-140	2.88E+07	3.61E+04	1.88E+06	0.00E+00	1.23E+04	2.07E+04	5.92E+07
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	3.76E-02	1.90E-02	5.01E-03	0.00E+00	0.00E+00	0.00E+00	1.39E+03
La-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ce-141	1.40E+04	9.49E+03	1.08E+03	0.00E+00	4.41E+03	0.00E+00	3.63E+07
Ce-143	1.99E-02	1.47E+01	1.63E-03	0.00E+00	6.47E-03	0.00E+00	5.49E+02
Ce-144	1.46E+06	6.09E+05	7.83E+04	0.00E+00	3.61E+05	0.00E+00	4.93E+08
Pr-143	2.10E+04	8.42E+03	1.04E+03	0.00E+00	4.86E+03	0.00E+00	9.20E+07
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	7.21E+03	8.33E+03	4.98E+02	0.00E+00	4.87E+03	0.00E+00	4.00E+07
W-187	2.07E-02	1.73E-02	6.04E-03	0.00E+00	0.00E+00	0.00E+00	5.66E+00
Np-239	2.57E-01	2.53E-02	1.40E-02	0.00E+00	7.90E-02	0.00E+00	5.19E+03

Notes:

1) Units are m^2 mrem/yr per µCi/sec with the exception of H-3.

2) For H-3, the units are mrem/yr per $\mu Ci/m^3$.

Table 16a
Teen Grass-Cow-Meat Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	1.10E+02	1.10E+02	1.10E+02	1.10E+02	1.10E+02	1.10E+02
Na-24	1.16E-03	1.16E-03	1.16E-03	1.16E-03	1.16E-03	1.16E-03	1.16E-03
Cr-51	0.00E+00	0.00E+00	5.63E+03	3.13E+03	1.23E+03	8.04E+03	9.46E+05
Mn-54	0.00E+00	7.00E+06	1.39E+06	0.00E+00	2.09E+06	0.00E+00	1.44E+07
Mn-56	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-55	2.38E+08	1.69E+08	3.94E+07	0.00E+00	0.00E+00	1.07E+08	7.31E+07
Fe-59	2.12E+08	4.95E+08	1.91E+08	0.00E+00	0.00E+00	1.56E+08	1.17E+09
Co-58	0.00E+00	1.41E+07	3.24E+07	0.00E+00	0.00E+00	0.00E+00	1.94E+08
Co-60	0.00E+00	5.83E+07	1.31E+08	0.00E+00	0.00E+00	0.00E+00	7.60E+08
Ni-63	1.52E+10	1.07E+09	5.15E+08	0.00E+00	0.00E+00	0.00E+00	1.71E+08
Ni-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cu-64	0.00E+00	2.06E-07	9.68E-08	0.00E+00	5.21E-07	0.00E+00	1.60E-05
Zn-65	2.50E+08	8.69E+08	4.05E+08	0.00E+00	5.56E+08	0.00E+00	3.68E+08
Zn-69	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	4.08E+08	1.91E+08	0.00E+00	0.00E+00	0.00E+00	6.03E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	2.54E+08	0.00E+00	7.28E+06	0.00E+00	0.00E+00	0.00E+00	3.03E+07
Sr-90	9.89E+09	0.00E+00	1.98E+08	0.00E+00	0.00E+00	0.00E+00	2.26E+08
Sr-91	1.21E-10	0.00E+00	4.80E-12	0.00E+00	0.00E+00	0.00E+00	5.47E-10
Sr-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-90	9.13E+01	0.00E+00	2.46E+00	0.00E+00	0.00E+00	0.00E+00	7.53E+05
Y-91M	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-91	9.54E+05	0.00E+00	2.56E+04	0.00E+00	0.00E+00	0.00E+00	3.91E+08
Y-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-93	3.71E-12	0.00E+00	1.02E-13	0.00E+00	0.00E+00	0.00E+00	1.13E-07
Zr-95	1.50E+06	4.74E+05	3.26E+05	0.00E+00	6.96E+05	0.00E+00	1.09E+09
Zr-97	1.70E-05	3.37E-06	1.55E-06	0.00E+00	5.10E-06	0.00E+00	9.11E-01
Nb-95	1.80E+06	9.98E+05	5.49E+05	0.00E+00	9.67E+05	0.00E+00	4.27E+09
Mo-99	0.00E+00	8.21E+04	1.57E+04	0.00E+00	1.88E+05	0.00E+00	1.47E+05
Tc- 99M	0.00E+00	0.00E+00	1.24E-19	0.00E+00	1.43E-19	0.00E+00	6.29E-18
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	8.56E+07	0.00E+00	3.66E+07	0.00E+00	3.02E+08	0.00E+00	7.15E+09
Ru-105	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-106	2.36E+09	0.00E+00	2.97E+08	0.00E+00	4.55E+09	0.00E+00	1.13E+11
Ag-110M	5.06E+06	4.79E+06	2.91E+06	0.00E+00	9.13E+06	0.00E+00	1.35E+09

Table 16a (Continued)
Teen Grass-Cow-Meat Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	3.03E+08	1.09E+08	4.06E+07	8.47E+07	0.00E+00	0.00E+00	8.95E+08
Te-127M	9.41E+08	3.34E+08	1.12E+08	2.24E+08	3.82E+09	0.00E+00	2.35E+09
Te-127	2.12E-10	7.53E-11	4.57E-11	1.46E-10	8.60E-10	0.00E+00	1.64E-08
Te-129M	9.49E+08	3.52E+08	1.50E+08	3.06E+08	3.97E+09	0.00E+00	3.56E+09
Te-129	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-131M	3.75E+02	1.80E+02	1.50E+02	2.70E+02	1.87E+03	0.00E+00	1.44E+04
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	1.14E+06	7.24E+05	6.81E+05	7.63E+05	6.94E+06	0.00E+00	2.29E+07
I-130	1.63E-06	4.72E-06	1.88E-06	3.85E-04	7.27E-06	0.00E+00	3.63E-06
I-131	8.92E+06	1.25E+07	6.71E+06	3.64E+09	2.15E+07	0.00E+00	2.47E+06
I-132	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	3.09E-01	5.25E-01	1.60E-01	7.32E+01	9.20E-01	0.00E+00	3.97E-01
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	3.79E-17	9.75E-17	3.61E-17	6.27E-15	1.54E-16	0.00E+00	1.08E-16
Cs-134	5.23E+08	1.23E+09	5.71E+08	0.00E+00	3.91E+08	1.49E+08	1.53E+07
Cs-136	9.34E+06	3.68E+07	2.47E+07	0.00E+00	2.00E+07	3.15E+06	2.96E+06
Cs-137	7.24E+08	9.63E+08	3.36E+08	0.00E+00	3.28E+08	1.27E+08	1.37E+07
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-140	2.38E+07	2.91E+04	1.53E+06	0.00E+00	9.88E+03	1.96E+04	3.67E+07
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	3.09E-02	1.52E-02	4.04E-03	0.00E+00	0.00E+00	0.00E+00	8.73E+02
La-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ce-141	1.18E+04	7.87E+03	9.04E+02	0.00E+00	3.70E+03	0.00E+00	2.25E+07
Ce-143	1.67E-02	1.22E+01	1.36E-03	0.00E+00	5.46E-03	0.00E+00	3.66E+02
Ce-144	1.23E+06	5.08E+05	6.60E+04	0.00E+00	3.04E+05	0.00E+00	3.09E+08
Pr-143	1.77E+04	7.05E+03	8.79E+02	0.00E+00	4.10E+03	0.00E+00	5.81E+07
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	6.35E+03	6.90E+03	4.14E+02	0.00E+00	4.05E+03	0.00E+00	2.49E+07
W-187	1.73E-02	1.41E-02	4.94E-03	0.00E+00	0.00E+00	0.00E+00	3.82E+00
Np-239	2.25E-01	2.12E-02	1.18E-02	0.00E+00	6.66E-02	0.00E+00	3.41E+03

Notes:

1) Units are m^2 mrem/yr per µCi/sec with the exception of H-3.

2) For H-3, the units are mrem/yr per µCi/m^3.

Table 16b
Child Grass-Cow-Meat Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	1.34E+02	1.34E+02	1.34E+02	1.34E+02	1.34E+02	1.34E+02
Na-24	1.84E-03	1.84E-03	1.84E-03	1.84E-03	1.84E-03	1.84E-03	1.84E-03
Cr-51	0.00E+00	0.00E+00	8.78E+03	4.87E+03	1.33E+03	8.90E+03	4.66E+05
Mn-54	0.00E+00	8.01E+06	2.13E+06	0.00E+00	2.25E+06	0.00E+00	6.72E+06
Mn-56	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-55	4.57E+08	2.42E+08	7.51E+07	0.00E+00	0.00E+00	1.37E+08	4.49E+07
Fe-59	3.76E+08	6.08E+08	3.03E+08	0.00E+00	0.00E+00	1.76E+08	6.34E+08
Co-58	0.00E+00	1.64E+07	5.03E+07	0.00E+00	0.00E+00	0.00E+00	9.59E+07
Co-60	0.00E+00	6.93E+07	2.04E+08	0.00E+00	0.00E+00	0.00E+00	3.84E+08
Ni-63	2.91E+10	1.56E+09	9.91E+08	0.00E+00	0.00E+00	0.00E+00	1.05E+08
Ni-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cu-64	0.00E+00	2.77E-07	1.67E-07	0.00E+00	6.68E-07	0.00E+00	1.30E-05
Zn-65	3.75E+08	1.00E+09	6.22E+08	0.00E+00	6.30E+08	0.00E+00	1.76E+08
Zn-69	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	5.78E+08	3.55E+08	0.00E+00	0.00E+00	0.00E+00	3.72E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	4.81E+08	0.00E+00	1.37E+07	0.00E+00	0.00E+00	0.00E+00	1.86E+07
Sr-90	1.57E+10	0.00E+00	3.15E+08	0.00E+00	0.00E+00	0.00E+00	1.40E+08
Sr-91	2.26E-10	0.00E+00	8.54E-12	0.00E+00	0.00E+00	0.00E+00	5.00E-10
Sr-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-90	1.73E+02	0.00E+00	4.62E+00	0.00E+00	0.00E+00	0.00E+00	4.92E+05
Y-91M	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-91	1.80E+06	0.00E+00	4.82E+04	0.00E+00	0.00E+00	0.00E+00	2.40E+08
Y-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-93	6.97E-12	0.00E+00	1.91E-13	0.00E+00	0.00E+00	0.00E+00	1.04E-07
Zr-95	2.67E+06	5.86E+05	5.22E+05	0.00E+00	8.39E+05	0.00E+00	6.11E+08
Zr-97	3.16E-05	4.57E-06	2.70E-06	0.00E+00	6.56E-06	0.00E+00	6.93E-01
Nb-95	3.11E+06	1.21E+06	8.64E+05	0.00E+00	1.14E+06	0.00E+00	2.24E+09
Mo-99	0.00E+00	1.14E+05	2.82E+04	0.00E+00	2.44E+05	0.00E+00	9.44E+04
Tc- 99M	0.00E+00	1.18E-20	1.96E-19	0.00E+00	1.72E-19	0.00E+00	6.72E-18
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	1.55E+08	0.00E+00	5.95E+07	0.00E+00	3.90E+08	0.00E+00	4.00E+09
Ru-105	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-106	4.44E+09	0.00E+00	5.54E+08	0.00E+00	5.99E+09	0.00E+00	6.90E+10
Ag-110M	8.39E+06	5.67E+06	4.53E+06	0.00E+00	1.06E+07	0.00E+00	6.74E+08

Table 16b (Continued)
Child Grass-Cow-Meat Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	5.70E+08	1.54E+08	7.59E+07	1.60E+08	0.00E+00	0.00E+00	5.50E+08
Te-127M	1.77E+09	4.78E+08	2.11E+08	4.24E+08	5.06E+09	0.00E+00	1.44E+09
Te-127	3.99E-10	1.08E-10	8.56E-11	2.76E-10	1.14E-09	0.00E+00	1.56E-08
Te-129M	1.79E+09	5.00E+08	2.78E+08	5.77E+08	5.25E+09	0.00E+00	2.18E+09
Te-129	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-131M	6.97E+02	2.41E+02	2.57E+02	4.96E+02	2.33E+03	0.00E+00	9.78E+03
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	2.09E+06	9.23E+05	1.12E+06	1.34E+06	8.57E+06	0.00E+00	9.30E+06
I-130	2.92E-06	5.89E-06	3.04E-06	6.49E-04	8.81E-06	0.00E+00	2.76E-06
I-131	1.65E+07	1.66E+07	9.45E+06	5.50E+09	2.73E+07	0.00E+00	1.48E+06
I-132	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	5.75E-01	7.10E-01	2.69E-01	1.32E+02	1.18E+00	0.00E+00	2.86E-01
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	6.86E-17	1.23E-16	5.84E-17	1.09E-14	1.89E-16	0.00E+00	9.40E-17
Cs-134	9.22E+08	1.51E+09	3.19E+08	0.00E+00	4.69E+08	1.68E+08	8.16E+06
Cs-136	1.61E+07	4.43E+07	2.87E+07	0.00E+00	2.36E+07	3.52E+06	1.56E+06
Cs-137	1.33E+09	1.28E+09	1.88E+08	0.00E+00	4.16E+08	1.50E+08	7.99E+06
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-140	4.39E+07	3.84E+04	2.56E+06	0.00E+00	1.25E+04	2.29E+04	2.22E+07
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	5.66E-02	1.98E-02	6.67E-03	0.00E+00	0.00E+00	0.00E+00	5.52E+02
La-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ce-141	2.22E+04	1.11E+04	1.64E+03	0.00E+00	4.85E+03	0.00E+00	1.38E+07
Ce-143	3.14E-02	1.70E+01	2.46E-03	0.00E+00	7.14E-03	0.00E+00	2.49E+02
Ce-144	2.32E+06	7.26E+05	1.24E+05	0.00E+00	4.02E+05	0.00E+00	1.89E+08
Pr-143	3.34E+04	1.00E+04	1.66E+03	0.00E+00	5.44E+03	0.00E+00	3.61E+07
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	1.19E+04	9.65E+03	7.47E+02	0.00E+00	5.29E+03	0.00E+00	1.53E+07
W-187	3.21E-02	1.90E-02	8.52E-03	0.00E+00	0.00E+00	0.00E+00	2.67E+00
Np-239	4.23E-01	3.04E-02	2.14E-02	0.00E+00	8.79E-02	0.00E+00	2.25E+03

Notes:

1) Units are m^2 mrem/yr per µCi/sec with the exception of H-3.

2) For H-3, the units are mrem/yr per $\mu Ci/m^3$.

3) The infant age group is assumed to receive no dose through the meat ingestion pathway therefore no dose factors are supplied.

Supplemental Table A
Mixed Mode Joint Frequency Distribution Table Summaries

296 Foot Elevation Data

Summary Table of Percent by Direction and Class

Class	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
A	.076	.064	.045	.031	.055	.064	.164	.192	.236	.574	.211	.229	.457	.571	.360	.179	3.541
B	.060	.075	.073	.060	.050	.064	.129	.189	.249	.385	.183	.199	.273	.324	.218	.158	2.690
C	.147	.136	.185	.155	.151	.151	.168	.343	.391	.529	.312	.281	.478	.658	.440	.309	4.832
D	2.472	2.105	2.729	2.803	2.669	2.152	2.062	2.103	2.755	3.314	2.630	2.527	3.654	5.503	4.501	3.027	47.006
E	1.175	1.004	1.363	1.533	1.992	1.651	1.775	2.131	3.111	3.193	2.229	1.520	1.773	1.916	1.871	1.219	29.457
F	.287	.267	.324	.324	.601	.815	.936	.979	1.128	1.010	.593	.365	.352	.469	.397	.353	9.200
G	.042	.069	.060	.063	.117	.168	.400	.517	.574	.482	.294	.136	.111	.097	.076	.045	3.273
Total	4.260	3.720	4.778	4.989	5.666	5.066	5.634	6.454	8.445	9.487	6.453	5.258	7.097	9.538	7.864	5.291	100.000

Summary Table of Percent by Direction and Speed

Speed	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
.45	.008	.009	.010	.005	.013	.007	.005	.002	.004	.005	.000	.006	.001	.000	.003	.005	.082
1.05	.021	.025	.025	.035	.029	.023	.029	.026	.022	.032	.038	.038	.041	.038	.031	.031	.485
2.05	.182	.182	.196	.192	.218	.199	.220	.190	.208	.325	.397	.299	.221	.239	.193	.188	3.650
3.05	.428	.366	.451	.407	.441	.406	.453	.384	.434	.787	.752	.473	.478	.500	.481	.393	7.632
4.05	.552	.561	.627	.643	.624	.596	.598	.608	.643	1.136	.897	.589	.563	.636	.680	.681	10.634
5.05	.684	.649	.752	.722	.803	.664	.756	.759	.831	1.264	1.130	.674	.692	.885	.977	.801	13.043
6.05	.712	.602	.725	.749	.939	.712	.913	.967	1.229	1.448	1.130	.812	.948	1.248	1.199	1.029	15.361
8.05	1.143	.796	1.190	1.247	1.481	1.515	1.714	2.013	2.538	2.516	1.459	1.341	2.022	2.883	2.324	1.494	27.676
10.05	.363	.314	.548	.611	.653	.671	.793	.979	1.544	1.250	.464	.588	1.254	1.804	1.347	.514	13.697
13.05	.149	.173	.218	.324	.375	.245	.141	.440	.866	.596	.144	.321	.653	1.078	.566	.136	6.428
18.00	.016	.042	.035	.054	.086	.028	.013	.084	.123	.125	.042	.116	.212	.218	.062	.019	1.276
99.00	.001	.001	.000	.000	.001	.000	.000	.001	.003	.004	.000	.003	.012	.009	.000	.000	.037
Total	4.260	3.720	4.778	4.989	5.666	5.066	5.634	6.454	8.445	9.487	6.453	5.258	7.097	9.538	7.864	5.291	100.000

NOTE: Wind directions in tables are presented in "wind from" and not "wind to" direction.

Supplemental Table A - Continued
Mixed Mode Joint Frequency Distribution Table Summaries

296 Foot Elevation Data

Summary Table of Percent by Speed and Class

Class / Speed	A	B	C	D	E	F	G
.45	.000	.006	.003	.016	.031	.019	.007
1.05	.003	.006	.006	.158	.170	.089	.053
2.05	.066	.045	.119	1.692	1.012	.478	.237
3.05	.176	.185	.308	3.840	1.925	.777	.422
4.05	.289	.299	.522	5.012	2.924	1.105	.484
5.05	.369	.362	.716	5.799	3.931	1.367	.496
6.05	.571	.400	.736	6.631	4.835	1.596	.532
8.05	.998	.718	1.272	12.230	8.759	2.859	.841
10.05	.588	.391	.661	7.034	4.032	.804	.186
13.05	.391	.214	.385	3.767	1.557	.100	.013
18.00	.085	.056	.101	.753	.274	.007	.000
99.00	.006	.009	.004	.012	.006	.000	.000

Supplemental Table B

Mixed Mode Joint Frequency Distribution Table Summaries

196 Foot Elevation Data

Summary Table of Percent by Direction and Class

Class	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
A	.158	.151	.168	.127	.107	.161	.192	.324	.365	.741	.187	.212	.416	.453	.539	.252	4.552
B	.049	.044	.070	.046	.043	.087	.073	.068	.100	.212	.080	.060	.117	.177	1.156	.078	1.459
C	.130	.135	.172	.194	.185	.164	.170	.211	.283	.494	.269	.242	.395	.421	.350	.247	4.063
D	1.397	1.290	1.866	2.073	1.889	1.508	1.388	1.441	1.735	2.308	1.967	1.899	2.881	3.767	2.712	1.908	32.028
E	1.025	.905	1.323	1.778	2.029	1.551	1.643	1.947	2.558	3.048	2.280	1.841	2.437	2.656	2.102	1.157	30.281
F	.342	.319	.433	.501	.726	.863	.776	.936	1.291	1.051	.506	.337	.415	.475	.374	.311	9.655
G	.125	.127	.167	.203	.380	.598	.843	.980	.955	.767	.306	.174	.203	.148	.102	.118	6.196
Total	3.225	2.970	4.200	4.922	5.359	4.932	5.086	5.907	7.287	8.620	5.596	4.765	6.865	8.097	6.334	4.071	88.234

Summary Table of Percent by Direction and Speed

Speed	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
.45	.006	.015	.006	.006	.006	.006	.008	.010	.012	.008	.018	.009	.002	.015	.000	.006	.131
1.05	.046	.035	.064	.050	.048	.062	.058	.079	.060	.075	.097	.064	.054	.064	.052	.050	.959
2.05	.305	.265	.255	.356	.348	.342	.367	.391	.385	.621	.719	.499	.445	.383	.362	.331	6.372
3.05	.520	.477	.702	.680	.787	.767	.699	.711	.744	1.289	1.295	.769	.790	.792	.810	.607	12.440
4.05	.761	.665	.769	.981	.975	.886	1.081	1.172	1.228	1.725	1.389	1.000	1.217	1.191	1.132	.809	16.983
5.05	.607	.611	.848	.963	1.069	1.014	1.116	1.138	1.376	1.673	.991	.912	1.308	1.603	1.240	.796	17.265
6.05	.426	.372	.645	.684	.801	.760	.850	.899	1.266	1.303	.563	.631	1.099	1.435	1.024	.656	13.415
8.05	.412	.399	.650	.832	.821	.782	.721	.953	1.406	1.337	.453	.603	1.272	1.745	1.206	.643	14.237
10.05	.113	.086	.226	.302	.389	.249	.147	.417	.661	.520	.056	.220	.509	.702	.412	.156	5.165
13.05	.028	.045	.034	.068	.111	.064	.036	.133	.144	.068	.014	.053	.160	.163	.094	.016	1.232
18.00	.000	.000	.002	.001	.003	.000	.000	.004	.004	.001	.001	.005	.008	.004	.000	.001	.034
99.00	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Total	3.225	2.970	4.200	4.922	5.359	4.932	5.086	5.907	7.287	8.620	5.596	4.765	6.865	8.097	6.334	4.071	88.234

NOTE: Wind directions in tables are presented in "wind from" and not "wind to" direction.

In order to determine the final mixed mode values, 88 234% of the elevated value (presented in the 296 FT Mixed Mode table) and 11 766% of the ground level value (presented in the 33 FT Mixed Mode table) are used to calculate the final values.

Supplemental Table B -Continued
Mixed Mode Joint Frequency Distribution Table Summaries

196 Foot Elevation Data

Summary Table of Percent by Speed and Class

Class / Speed	A	B	C	D	E	F	G
.45	.000	.000	.000	.023	.056	.014	.039
1.05	.002	.002	.008	.249	.307	.166	.224
2.05	.089	.050	.184	2.680	1.748	.785	.837
3.05	.358	.180	.684	4.451	3.666	1.724	1.378
4.05	.794	.331	.869	5.305	5.832	2.387	1.466
5.05	.885	.309	.724	5.544	6.119	2.367	1.317
6.05	.850	.190	.640	4.731	4.847	1.458	.699
8.05	1.026	.281	.610	5.969	5.482	.655	.216
10.05	.459	.102	.267	2.423	1.798	.096	.020
13.05	.089	.014	.077	.636	.411	.004	.000
18.00	.001	.000	.000	.018	.015	.000	.000
99.00	.000	.000	.000	.000	.000	.000	.000

Supplemental Table B -Continued
Mixed Mode Joint Frequency Distribution Table Summaries

33 Foot Elevation Data

Summary Table of Percent by Direction and Class

Class	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
A	.022	.020	.015	.017	.018	.036	.033	.064	.067	.131	.026	.023	.079	.076	.069	.037	.732
B	.006	.006	.008	.005	.006	.011	.013	.009	.012	.027	.008	.010	.018	.026	.027	.009	.202
C	.016	.019	.017	.024	.023	.023	.025	.028	.041	.057	.024	.026	.063	.069	.041	.028	.527
D	.186	.203	.226	.328	.270	.190	.152	.170	.213	.268	.224	.335	.547	.815	.405	.247	4.779
E	.097	.102	.171	.263	.290	.277	.245	.345	.394	.383	.225	.252	.453	.379	.245	.126	4.247
F	.012	.026	.048	.048	.084	.116	.099	.117	.104	.059	.022	.022	.045	.036	.018	.014	.868
G	.003	.006	.007	.017	.058	.133	.052	.053	.036	.009	.006	.003	.013	.006	.005	.002	.410
Total	.341	.382	.493	.702	.749	.786	.619	.787	.868	.934	.535	.672	1.218	1.408	.810	.463	11.766

Summary Table of Percent by Direction and Speed

Speed	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
.45	.000	.000	.000	.001	.000	.001	.001	.001	.003	.000	.001	.001	.000	.001	.000	.000	.010
1.05	.004	.005	.008	.012	.020	.036	.030	.036	.031	.009	.012	.010	.009	.005	.005	.005	.239
2.05	.029	.031	.056	.058	.107	.167	.131	.163	.160	.091	.077	.078	.092	.072	.038	.032	1.381
3.05	.047	.058	.090	.121	.126	.153	.149	.173	.206	.245	.173	.139	.231	.159	.097	.066	2.234
4.05	.066	.078	.106	.151	.123	.137	.132	.159	.175	.283	.144	.137	.247	.275	.176	.114	2.503
5.05	.068	.069	.089	.115	.101	.096	.073	.094	.121	.163	.075	.105	.214	.291	.174	.111	1.981
6.05	.044	.055	.056	.064	.091	.090	.050	.077	.091	.068	.024	.063	.136	.244	.140	.076	1.390
8.05	.051	.040	.056	.109	.116	.074	.040	.076	.071	.064	.014	.047	.156	.240	.145	.046	1.343
10.05	.025	.040	.032	.049	.042	.028	.009	.008	.009	.011	.014	.080	.093	.110	.035	.010	.594
13.05	.006	.006	.000	.002	.022	.003	.004	.000	.000	.000	.000	.014	.034	.011	.000	.003	.105
18.00	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.006	.000	.000	.000	.006
99.00	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Total	.341	.382	.493	.702	.749	.786	.619	.787	.868	.934	.535	.672	1.218	1.408	.810	.463	11.766

NOTE: Wind directions in tables are presented in "wind from" and not "wind to" direction.

Supplemental Table B -Continued
Mixed Mode Joint Frequency Distribution Table Summaries

33 Foot Elevation Data

Summary Table of Percent by Speed and Class

Class Speed	A	B	C	D	E	F	G
.45	.000	.000	.000	.000	.001	.002	.007
1.05	.008	.000	.000	.008	.042	.078	.103
2.05	.018	.006	.010	.149	.509	.457	.231
3.05	.095	.023	.068	.644	1.105	.244	.055
4.05	.197	.053	.128	1.080	.981	.059	.004
5.05	.177	.044	.122	.981	.617	.017	.002
6.05	.131	.035	.075	.767	.373	.004	.005
8.05	.093	.027	.090	.742	.383	.005	.002
10.05	.012	.011	.031	.340	.199	.002	.000
13.05	.001	.001	.003	.067	.032	.000	.000
18.00	.000	.000	.000	.000	.006	.000	.000
99.00	.000	.000	.000	.000	.000	.000	.000

Supplemental Table C
Ground Level Joint Frequency Distribution Table Summary

33 Foot Elevation

Summary Table of Percent by Direction and Class

Class	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
A	.180	.185	.133	.155	.133	.224	.243	.352	.363	.856	.294	.247	.556	.539	.516	.303	5.280
B	.058	.058	.071	.048	.044	.095	.093	.079	.087	.222	.122	.083	.164	.180	.168	.085	1.658
C	.151	.189	.195	.201	.187	.195	.211	.220	.267	.527	.350	.313	.454	.527	.342	.253	4.582
D	1.614	1.666	1.966	2.403	2.014	1.814	1.566	1.537	1.562	2.410	2.476	2.451	3.540	4.726	2.898	2.124	36.788
E	.948	1.011	1.561	2.128	2.275	2.129	1.985	2.335	2.585	3.085	2.739	2.277	3.197	3.168	1.953	1.169	34.543
F	.255	.383	.631	.574	.863	1.222	1.085	1.175	1.016	.718	.491	.403	.619	.564	.296	.227	10.523
G	.088	.151	.205	.279	.886	1.841	.863	.691	.457	.212	.241	.126	.265	.175	.082	.068	6.628
Total	3.291	3.644	4.763	5.788	6.402	7.519	6.065	6.389	6.337	8.030	6.712	5.900	8.795	9.879	6.259	4.229	100.000

Summary Table of Percent by Direction and Speed

Speed	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
.45	.047	.055	.086	.089	.083	.095	.132	.146	.115	.070	.123	.083	.073	.068	.054	.039	1.358
1.05	.214	.257	.417	.419	.723	.991	.860	.898	.730	.593	.782	.583	.504	.394	.214	.172	8.753
2.05	.612	.713	1.138	1.109	1.629	2.537	1.901	1.965	1.826	1.769	2.096	1.700	1.967	1.611	.987	.663	24.241
3.05	.713	.825	1.061	1.281	1.341	1.609	1.443	1.476	1.601	2.434	2.038	1.534	2.336	2.005	1.285	.935	23.916
4.05	.624	.701	.875	1.103	.983	.881	.925	.985	1.051	1.814	1.041	.974	1.629	1.905	1.395	.974	17.860
5.05	.489	.473	.576	.719	.607	.595	.429	.481	.576	.881	.452	.493	1.068	1.617	1.034	.751	11.259
6.05	.265	.323	.317	.471	.454	.446	.257	.278	.305	.299	.124	.296	.632	1.188	.717	.437	6.808
8.05	.263	.205	.238	.504	.481	.296	.102	.153	.124	.133	.037	.133	.413	.910	.504	.228	4.723
10.05	.056	.085	.058	.091	.073	.064	.012	.008	.010	.015	.019	.091	.114	.170	.066	.027	.956
13.05	.008	.008	.000	.002	.029	.006	.004	.000	.000	.000	.000	.014	.035	.012	.000	.004	.120
18.00	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.006	.000	.000	.000	.006
99.00	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Total	3.291	3.644	4.763	5.788	6.402	7.519	6.065	6.389	6.337	8.030	6.712	5.900	8.795	9.879	6.255	4.229	100.000

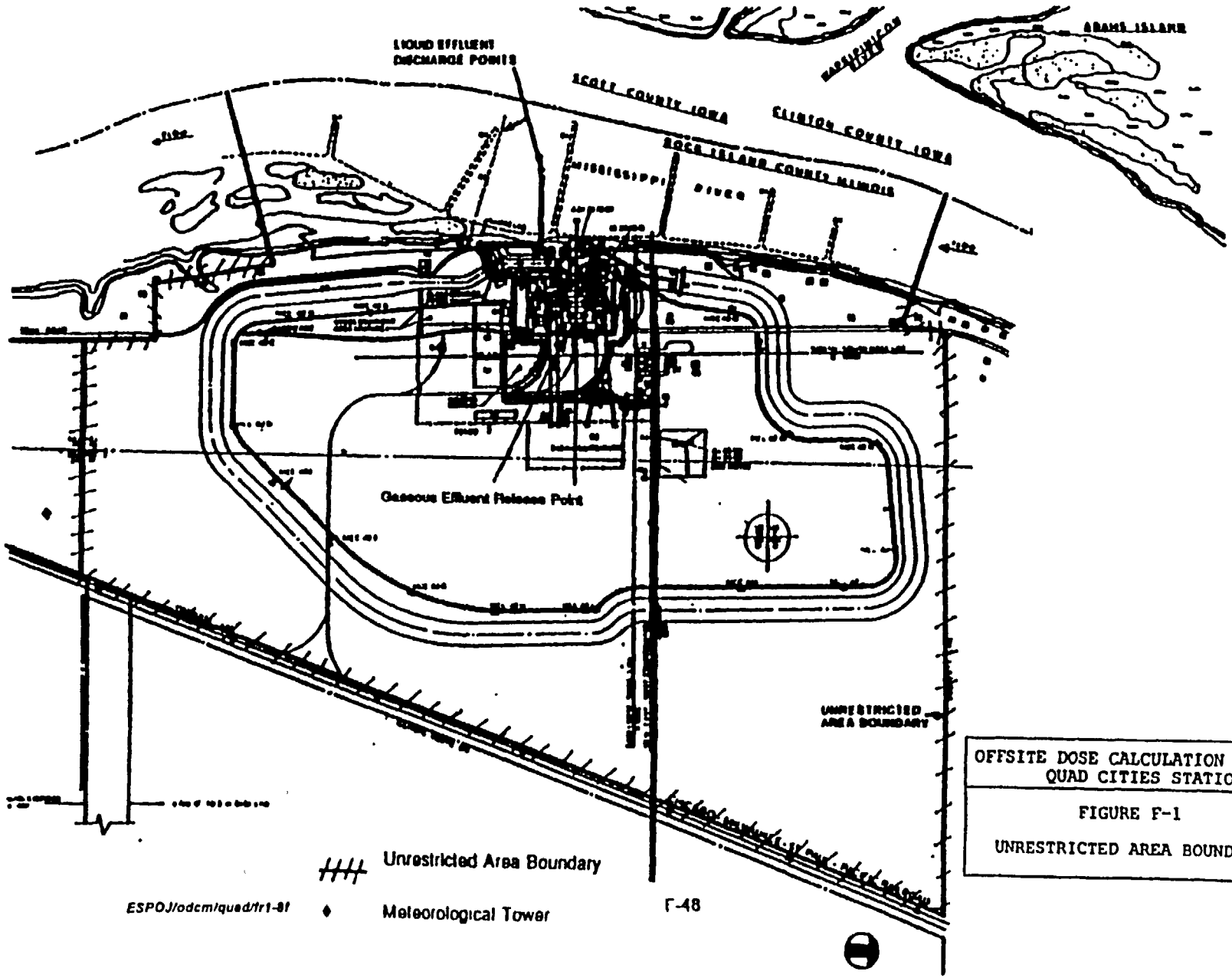
NOTE Wind directions in tables are presented in "wind from" and not "wind to" direction.

Supplemental Table C - Continued
Ground Level Joint Frequency Distribution Table Summary

33 Foot Elevation Data

Summary Table of Percent by Speed and Class

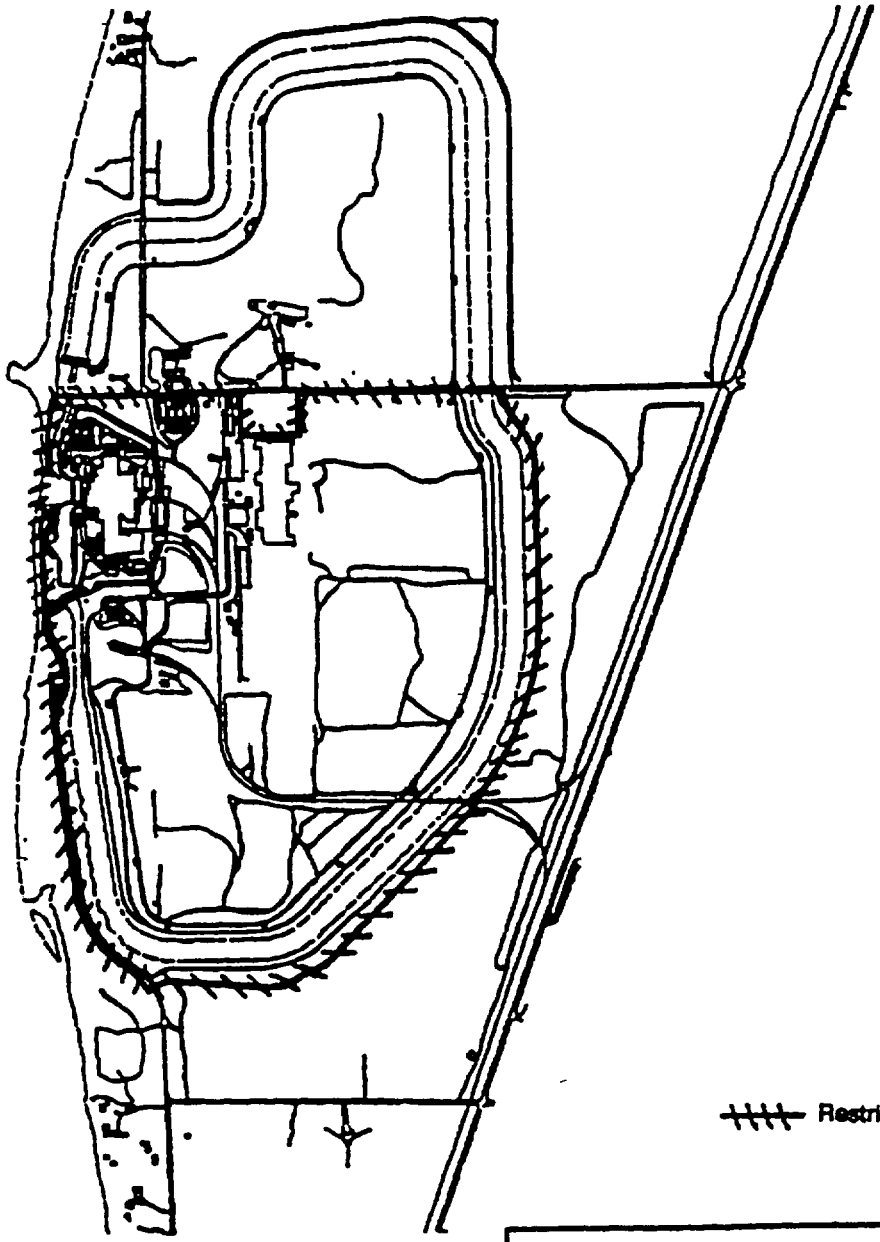
Class Speed	A	B	C	D	E	F	G
.45	.000	.000	.002	.056	.299	.375	.626
1.05	.041	.012	.054	.902	2.390	2.569	2.786
2.05	.439	.158	.553	5.844	9.138	5.363	2.747
3.05	1.285	.481	1.321	8.821	9.831	1.773	.404
4.05	1.544	.462	1.109	8.235	6.180	.307	.023
5.05	1.012	.255	.765	5.683	3.435	.097	.012
6.05	.618	.182	.388	3.856	1.721	.017	.025
8.05	.313	.089	.328	2.755	1.215	.017	.006
10.05	.027	.017	.058	.556	.294	.004	.000
13.05	.002	.002	.004	.077	.035	.000	.000
18.00	.000	.000	.000	.000	.006	.000	.000
99.00	.000	.000	.000	.000	.000	.000	.000



OFFSITE DOSE CALCULATION MANUAL
QUAD CITIES STATION

FIGURE F-1

UNRESTRICTED AREA BOUNDARY



OFFSITE DOSE CALCULATION MANUAL
QUAD CITIES STATION

FIGURE F-2
RESTRICTED AREA BOUNDARY