ENCLOSURE 1

BROWNS FERRY NUCLEAR PLANT UNITS 1, 2, AND 3

(DOCKET NOS. 50-259, 50-260, AND 50-296)

PROPOSED CHANGES TO APPENDIX A

TECHNICAL SPECIFICATIONS

50-259/260/296
Ltr 6-29-79
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UNIT 1

1.0 DEFINITIONS (Cont'd)

10. Logic - A logic is an arrangement of relays, contacts, and other components that produces a decision output.

(a) Initiating - A logic that receive signals from channels and produces decision outputs to the actuation logic.

(b) Actuation - A logic that receives signals (either from initiation logic or channels) and produces decision outputs to accomplish a protective action.

11. Channel Calibration - Shall be the adjustment, as necessary, of the channel output such that it responds with necessary range and accuracy to known values of the parameters which the channel monitors. The channel calibration shall encompass the entire channel including alarm and/or trip functions and shall include the channel functional test. The channel calibration may be performed by any series of sequential, overlapping or total channel steps such that the entire channel is calibrated. Non-calibratable components shall be excluded from this requirement, but will be included in channel functional test and source check.

12. Channel Functional Test - Shall be :

a. Analog Channels - the injection of a simulated signal into the channel as close to the sensor as practicable to verify OPERABILITY including alarm and/or trip functions.
b. Bistable channels - the injection of a simulated signal into the sensor to verify OPERABILITY including alarm and/or trip functions.

13. Source Check - Shall be the qualitative assessment of channel response when the channel sensor is exposed to a radioactive sources or multiple of sources.

1.0 DEFINITIONS (Cont'd)

W. Functional Tests - A functional test is the manual operation or initiation of a system, subsystem, or component to verify that it functions within design tolerances (e.g., the manual start of a core spray pump to verify that it runs and that it pumps the required volume of water).

X. Shutdown - The reactor is in a shutdown condition when the reactor mode switch is in the shutdown mode position and no core alterations are being performed.

Y. Engineered Safeguard - An engineered safeguard is a safety system the actions of which are essential to a safety action required in response to accidents.

Z. Cumulative Downtime - The cumulative downtime for those safety components and systems whose downtime is limited to 7 consecutive days prior to requiring reactor shutdown shall be limited to any 7 days in a consecutive 30 day period.

AA. Solidification - Shall be the conversion of radioactive wastes to conform to the license requirement of the receiving burial ground.

BB. Offsite Dose Calculation Manual (ODCM) Shall be a manual describing the environmental monitoring program and the methodology and parameters used in the calculation of release rate limits and off-site doses due to radioactive gaseous and liquid effluents.

CC. Unrestricted Area - All area beyond the site boundary access to which is not controlled for protection of individuals from exposure to radiation and radioactive materials.

TABLE 1.1

SURVEILLANCE FREQUENCY NOTATION

NOTATION	FREQUENCY
S	At least once per 12 hours.
D	At least once per 24 hours.
W	At least once per 7 days.
M	At least once per 31 days.
Q	At least once per 92 days.
SA	At least once per 6 months.
R	At least once per 18 months.
S/U	Prior to each reactor startup.
N.A.	Not applicable.

3.2.K <u>Radioactive Gaseous Effluent Monitoring Instrumentation</u>

1. The radioactive gaseous effluent monitoring instruments listed in table 3.2.K shall be operable at all times with their alarm/trip setpoints set to ensure that the limits of specification 3.8.B.1 are not exceeded.

2. The action required when the number of operable channels is less than the Minimum Channels Operable requirement is specified in the notes for table 3.2.K.

4.2.K <u>Radioactive Gaseous Effluent Monitoring Instrumentation</u>

1. Each of the radioactive gaseous effluent monitoring instruments shall be demonstrated operable by performance of tests in accordance with table 4.2.K.

TABLE 3.2.K

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

Instrument	Minimum Channels Operable	Applicability	Parameter	Action
1. Stack				
a. Noble Gas Activity Monitor	(1)	*	Release Rate Measurement	A/C
b. Iodine Cartridge	NA	*	Installed	B
c. Particulate filter	NA	*	Installed	B
2. Reactor/Turbine Building Ventilation				
a. Noble Gas Activity Monitor	(1)	*	Release Rate Measurement	A/C
b. Iodine Monitor	(1)	*	Release Rate Measurement	B/C
c. Particulate Monitor	(1)	*	Release Rate Measurement	B/C
3. Turbine Building Exhaust				
a. Noble Gas Activity Monitor	(1)	*	Release Rate Measurement	A/C
b. Iodine Monitor	(1)	*	Release Rate Measurement	B/C
c. Particulate Monitor	(1)	*	Release Rate Measurement	B/C

3.2.K (Continued)
RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

Instrument	Minimum Channels Operable	Applicability	Parameter	Action
4. Radwaste Building Ventilation				
a. Noble Gas Activity Monitor	(1)	*	Release Rate	A/C
b. Iodine Monitor	(1)	*	Release Rate Measurement	B/C
c. Particulate Monitor	(1)	*	Release Rate Measurement	B/C

NOTES FOR TABLE 3.2.K

*During releases via this pathway.

ACTION A

With the number of channels OPERABLE less than required by the Minimum Channels Operable requirement, effluent releases via the affected pathway may continue for up to 7 days provided a temporary monitoring system is installed or grab samples are taken and analyzed at least once every 4 hours.

ACTION B

With the number of channels OPERABLE less than required by the Minimum Channels Operable requirement, effluent releases via this pathway may continue for up to 28 days, provided samples are continuously collected with auxiliary sampling equipment for periods on the order of seven (7) days and analyzed within 48 hours after the end of the sampling period.

ACTION C

A monitoring system may be out of service for 4 hours for functional testing, calibration, or repair without providing temporary monitor or initiating grab sampling.

TABLE 4.2.K

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

Instrument	Instrument Check	Source Check	Channel Calibration	Channel Functional Test	Modes In Which Surveillance Required
1. Stack					
a. Noble Gas Activity Monitor	D	M	Q(1)	M(2)	*
2. Reactor/Turbine Building Ventilation					
a. Noble Gas Activity Monitor	D	M	Q(1)	M(2)	*
b. Iodine Monitor	D	M	Q(1)	M(2)	*
c. Particulate Monitor	D	M	Q(1)	M(2)	*
3. Turbine Building Exhaust					
a. Noble Gas Activity Monitor	D	M	Q(1)	M(2)	*
b. Iodine Monitor	D	M	Q(1)	M(2)	*
c. Particulate Monitor	D	M	Q(1)	M(2)	*
4. Radwaste Building Ventilation					
a. Noble Gas Activity Monitor	D	M	Q(1)	M(2)	*
b. Iodine Monitor	D	M	Q(1)	M(2)	*
c. Particulate Monitor	D	M	Q(1)	M(2)	*

NOTES FOR TABLE 4.2.K

*During releases via this pathway.

(1) The CHANNEL CALIBRATION shall include the use of a known (traceable to the National Bureau of standards radiation measurement system) radioactive source (s) positioned in a reproducible geometry with respect to the sensor.

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

1. Instrument indicates measured levels above the alarm/trip setpoint.

2. Instrument indicates an inoperable downscale failure.

3.2 BASES

For each parameter monitored, as listed in Table 3.2.F, there are two channels of instrumentation except as noted. By comparing readings between the two channels, a near continuous surveillance of instrument performance is available. Any deviation in readings will initiate an early recalibration, thereby maintaining the quality of the instrument readings.

Instrumentation is provided for isolating the control room and initiating a pressurizing system that processes outside air before supplying it to the control room. An accident signal that isolates primary containment will also automatically isolate the control room and initiate the emergency pressurization system. In addition, there are radiation monitors in the normal ventilation system that will isolate the control room and initiate the emergency pressurization system. Activity required to cause automatic actuation is about one mRem/hr.

Because of the constant surveillance and control exercised by TVA over the Tennessee Valley, flood levels of large mangitudes can be predicted in advance of their actual occurrence. In all cases, full advantage will be taken of advance warning to take appropriate action whenever reservoir levels above normal pool are predicted; however, the plant flood protection is always in place and does not depend in any way on advanced warning. Therefore, during flood conditions, the plant will be permitted to operate until water begins to run across the top of the pumping station at elevation 565. Seismically qualified, redundant level switches each powered from a separate division of power are provided at the pumping station to give main control room indication of this condition. At that time an orderly shutdown of the plant will be initiated, although surges even to a depth of several feet over the pumping station deck will not cause the loss of the main condenser circulating water pumps.

The operability of the meteorological instrumentation ensures that sufficient meteorological data is available for estimating potential radiation dose to the public as a result of routine or accidental release of radioactive materials to the atmosphere. This capability is required to evaluate the need for initiating protective measures to protect the health and safety of the public.

The operability of the seismic instrumentation ensures that sufficient capability is available to promptly determine the magnitude of a seismic event and evaluate the response of those features important to safety. This capability is required to permit comparison of the measured response to that used in the design basis for Browns Ferry Nuclear Plant. The instrumentation provided is consistent with specific portions of the recommendations of Regulatory Guide 1.12 "Instrumentation for Earthquakes."

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The alarm/trip setpoints for these instruments will be calculated in accordance with plant approved procedures to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20.

there is no true minimum. The curve does have a definite knee and very little reduction in system unavailability is achieved by testing at a shorter interval than computed by the equation for a single channel.

The best test procedure of all those examined is to perfectly stagger the tests. That is, if the test interval is four months, test one or the other channel every two months. This is shown in Curve No. 5. The difference between Cases 4 and 5 is negligible. There may be other arguments, however, that more strongly support the perfectly staggered tests, including reductions in human error.

The conclusions to be drawn are these:

1. A 1 out of n system may be treated the same as a single channel in terms of choosing a test interval; and

2. more than one channel should not be bypassed for testing at any one time.

The radiation monitors in the refueling area ventilation duct which initiate building isolation and standby gas treatment operation are arranged in two 1 out of 2 logic systems. The bases given for the rod blocks apply here also and were used to arrive at the functional testing frequency. The off-gas post treatment monitors are connected in a 2 out of 2 logic arrangement. Based on experience with instruments of similar design, a testing interval of once every three months has been found adequate.

The automatic pressure relief instrumentation can be considered to be a 1 out of 2 logic system and the discussion above applies also.

The criteria for ensuring the reliability and accuracy of the radioactive gaseous effluent instrumentation in listed in Table 4.2.K.

3.8 RADIOACTIVE MATERIALS

Applicability

Applies to the controlled release of radioactive liquids and gases from the facility.

Objective

To define the limits and conditions for the release of radioactive effluents to the environs to assure that any radioactive releases are as low as reasonably achieveable and within the limits of 10 CFR Part 20.

Specification

A. Liquid Effluents

1. The concentration of radioactive material released at any time from the site to unrestricted areas (see Figure 4.8.A.1) shall be limited to the concentrations specified in 10 CFR Part 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2E-4 μCi/ml total activity.

2. If the limits of 3.8.A.1 are exceeded, appropriate action shall be initiated to bring the release within limits. Provide prompt notification to the NRC pursuant to Section 6.7.2.a.

3. The dose or dose commitment to an individual from radioactive materials in liquid effluents released from each unit to unrestricted areas (See Figure 4.8.A.1) shall be limited:

4.8 RADIOACTIVE MATERIALS

Applicability

Applies to the periodic test and record requirements and sampling and monitoring methods used for facility effluents.

Objective

To ensure that radioactive liquid and gaseous releases from the facility are maintained within the limits specified by Specifications 3.8.A and 3.8.B.

Specification

A. Liquid Effluents

1. Facility records shall be maintained of radioactive concentrations and volume before dilution of each batch of liquid effluent released, and of the average dilution flow and length of time over which each discharge occurred.

2. Radioactive liquid waste sampling and activity analysis of each liquid waste batch to be discharged shall be performed prior to release in accordance with Table 4.8.A.

3. The liquid effluent radiation monitor shall be calibrated at least quarterly by means of a known radioactive source(s). The monitor shall also have an instrument channel functional test monthly and an instrument check daily.

3.8.A Liquid Effluents

a. During any calendar quarter to <1.5 mrem to the total body and to ≤5 mrem to any organ and,

b. During any calendar year to≤3 mrem to the total body and≤10 mrem to any organ.

4. If the limits specified in 3.8.A.3. a&b above are exceeded, prepare and submit Special Report persuant to Section 6.7.3.C.2.

5. The liquid radwaste system shall be maintained and operated to process liquid radwaste when it appears during quarterly operation that the releases to unrestricted areas (see Figure 4.8.A.1) when averaged over 31 days would exceed 0.06 mrem to the total body and 0.21 mrem to any organ.

6. During a quarter if radioactive liquid waste must be discharded without treatment after the limits specified in 3.8.A.5 above are exceeded, prepare and submit the Special Report pursuant to Section 6.7.3.C.3.

7. During release of radioactive wastes from the radwaste processing system, the following conditions shall be met:

a. Liquid waste activity and flow rate shall be continuously monitored and recorded during release and shall be set to alarm and automatically close the waste discharge valve before exceeding the limits specified in 3.8.A.1. above. If this requirement cannot be met, continued release of liquid effluents shall be permitted only during the succeeding 48 hour period, two independent samples of each tank shall be analyzed and two station personnel shall independently check valving before the discharge.

4.8.A Liquid Effluents

4. The operation of the automatic isolation valves and discharge tank selection values shall be checked annually.

5. The accuracy of the radwaste effluent flow rate monitor shall be checked at least monthly.

6. Cummulative quarterly and yearly dose contributions from liquid effluents shall be determined as specified in plant approved procedures at least once every 31 days.

7. Doses due to liquid releases to unrestricted areas shall be projected at least once per 31 days.

3.8 RADIOACTIVE MATERIALS

B. Airborne Effluents

1. The dose rate at any time in the unrestricted areas (see Figure 4.8.B.1) due to radioactivity released in gaseous effluents from the site shall be limited to the following values:

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

   b. The dose rate limit for all radioiodines for all radioactive materials in particulate form, and for radionuclides other than noble gases with half lives greater than 8 days shall be 1500 mrem/yr to any organ.

2. If the limits of 3.8.B.1 are exceeded, appropriate corrective action shall be initiated to bring the releases within limits. Provide prompt notification to the NRC pursuant to section 6.7.2.a.

4.8 RADIOACTIVE MATERIALS

B. Airborne Effluents

1. The gross β/ and particulate activity of gaseous wastes released to the environment shall be monitored and recorded:

   a. For effluent streams having continuous monitoring capability, the activity and flow rate shall be monitored and recorded to enable release rates of gross radioactivity to be determined on an hourly basis using instruments specified in Table 3.2.K.

   b. For effluent stream without continuous monitoring capability, the activit shall be monitored and recorded and the releases throuc these streams shall be controlled so that the release rates from all streams are within the limits specified in 3.8.B

2. Radioactive gaseous waste sampling and activity analysis shall be performe in accordance with Table 4.8.B.

3. The air dose in unrestricted areas (see Figure 4.8.B.1) due to noble gases released in gaseous effluents per unit shall be limited to the following:

   a. During any calendar quarter, to ≤ 5 mrad for gamma radiation and ≤ 10 mrad for beta radiation;

   b. During any calendar year, to ≤ 10 mrad for gamma radiation and ≤ 20 mrad for beta radiation.

4. If the calculated air dose exceeds the limits specified in 3.8.B.3 above, prepare and submit a special report pursuant to section 6.7.3.C.5

5. The dose to an individual from radioiodines, radioactive materials in particulate form, and radionuclides other than noble gases with half lives greater than 8 days in gaseous effluent released per unit to unrestricted areas (see Figure 4.8.B. 1) shall be limited to the following:

   a. During any calendar quarter to ≤ 7.5 mrem;

   b. During any calendar year to ≤ 15 mrem;

3. Cumulative quarterly and yearly dose contributions shall be determined as specified in plant approve procedures at least once every 31 days.

4. Doses due to gaseous releases to unrestricted areas shall be projected at least once per 31 days.

5. Samples of offgass effluents shall be analyzed at least weekly to determine the identity and quantity of the principal radionuclides being released.

6. If the calculated doses exceed the limits of 3.8.B.5 above, prepare and submit a special report pursuant to section 6.7.3.C.4

7. During operation above 50% power the discharge of the SJAE must be routed through the charcoal adsorbers when the projected gaseous effluent releases to unrestricted areas (see Figure 4.8.B.1) when averaged over 31 days would exceed 0.2 mrad for gamma radiation and 0.4 mrad for beta radiation.

8. With gaseous wastes being discharged for more than 31 days without treatment and in excess of the limits of 3.8.B.7 above, prepare and submit a special report pursuant to section 6.7.3.C.3

3.8.C Radioactive Effluents - Dose

1. The dose or dose commitment to a real individual from all uranium fuel cycle sources is limited to ≤ 25 mrem to the total body or any organ (except the thyroid, which is limited to ≤ 75 mrem) over a period of 12 consecutive months.

2. With the calculated dose from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of specification 3.8.A.3, 3.8.B.3, or 3.8.B.5, prepare and submit a Special Report to the Commission pursuant to specification 6.7.3.C.6 and limit the subsequent releases such that the limits of 3.8.C.1 are not exceeded.

D. Mechanical Vacuum Pump

1. The mechanical vacuum pump shall be capable of being automatically isolated and secured on a signal or high radioactivity in the steam lines whenever the main steam isolation valves are open.

2. If the limits of 3.8.C.1 are not met, the vacuum pump shall be isolated.

4.8.C Radioactive Effluents - Dose

1. Cumulative dose contributions from liquid and gaseous effluents shall be determined in accordance with specifications 3.8.A.3, 3.8.B.3, and 3.8.B.5.

D. Mechanical Vacuum Pump

At least once during each operating cycle verify automatic securing and isolation of the mechanical vacuum pump.

3.8 RADIOACTIVE MATERIALS

E. Miscellaneous Radioactive Materials Sources

1. Source Leakage Test

Each sealed source containing radioactive material in excess of those quantities of byproduct material listed in 10 CFR 30.71 Schedule B and all other sources, including alpha emitters, in excess of 0.1 microcurie, shall be free of ≥ 0.005 microcurie of removable contamination. Each sealed source with removable contamination in excess of the above limit shall be immediately withdrawn from use and (a) either decontaminated and repaired, or (b) disposed of in accordance with Commission regulations.

4.8 RADIOACTIVE MATERIALS

E. Miscellaneous Radioactive Materials Sources

1. Surveillance Requirement

Tests for leakage and/or contamination shall be performed by the licensee or by other persons specifically authorized by the Commission or an agreement State, as follows:

a. Each sealed source, except startup sources subject to core flux, containing radioactive material, other than Hydrogen 3, with a half-life greater than thirty days and in any form other than gas, shall be tested for leakage and/or contamination at intervals not to exceed six months. The leakage test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample.

TABLE 4.8.A

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

LIQUID RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD) (μCi/ml)
Batch Waste Releases [1]	Each Batch	Each Batch prior to release	Principal Gamma Emitters [4]	5 E-7 [3]
	One Batch per Month	Monthly	Dissolved and Entrained Gases	1 E-5
	Monthly Proportional Composite (2)	Monthly	Tritium	1 E-5
			Gross α	1 E-7
			P-32	1 E-6
	Quarterly Proportional Composite (2)	Quarterly	Sr-89 , Sr-90	5 E-8
			Fe-55	1 E-6

TABLE NOTATION - TABLE 4.8.A

(1) A batch release is the discharge of liquid wastes of a discrete volume.

(2) A proportional composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged from the plant.

(3) For certain radionuclides with low gamma yield or low energies, or for certain radionuclide mixtures, it may not be possible to measure radionuclides in concentrations near their sensitivity limits when other nuclides are present in the sample in much greater concentrations. Under these circumstances, it will be more appropriate to calculate the concentrations of such radionuclides using observed ratios with those radionuclides which are measurable or the lower limit of detection may be increased proportionally to the magnitude of the gamma yield (i.e., 5 E-7/I where I is the photon abundance expressed as a decimal fraction), but in no case shall the lower limit of detection as calculated in this manner be greater than 10% of the MPC value specified in 10 CFR Part 20, Appendix B, Table II, Column 2.

(4) The principal gamma emitters (those expected to account for ∿95% of the total activity present) for which the LLD specification will apply are exclusively the following radionuclides: Cr-51, Zn-65, Co-60, Cs-137, Zr-95, Nb-95, I-131, Na-24, Mn-54, Co-58, Ag-110m, Cs-134, I-133, Cu-64, Mo/Tc-99, and Fe-59 for liquid releases. This list does not mean that only these nuclides are to be detected and reported. Other nuclides which influence accounting for ∿95% of the total activity, together with the above nuclides, shall also be identified and reported as being present. Nuclides which are below the LLD for the analysis may not be reported as being present at the LLD Level for that nuclide. When unusual circumstances result in LLD's higher than required the reasons shall be documented in the semi-annual effluent report.

TABLE 4.8.B

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) (μCi/ml)
A. Containment Purge	Each Purge Grab Sample	Each Purge	Principal Gamma Emitters (3) H-3	1E-4 (1) 1E-6
B. 1. Stack			Principal Gamma Emitters (3)	1E-4 (1)
2. Building Ventilation	Grab Sample	Monthly	H-3	1E-6
a. Reactor/Turbine				
b. Turbine Exhaust				
c. Radwaste				
C. All Release Points listed in B. above	Continuous	Charcoal Sample Weekly	I-131 I-133	1E-12 (2) 1E-10 (2)
	Continuous	Particulate Sample Weekly	Principal Gamma Emitters (3)	1E-11 (2)
	Continuous	Composite Particulate Sample Monthly	Gross	1E-11
	Continuous	Composite Particulate Sample Quarterly	Sr-89, Sr 90	1E-11

TABLE NOTATION - 4.8.B

(1) For certain radionuclides with low gamma yield or low energies, or for certain radionuclide mixtures, it may not be possible to measure radionuclides in concentrations near their sensitivity limits when other nuclides are present in the sample in much greater concentrations. Under these circumstances, it will be more appropriate to calculate the concentrations of such radionuclides using observed ratios with those radionuclides which are measurable or the lower limit of detection may be increased proportionally to the magnitude of the gamma yield (i.e. 1E-4/I where I is the photon abundance expressed as a decimal fraction), but in no case shall the lower limit of detection as calculated in this manner be greater than 10% of the MPC value specified in 10 CFR Part 20, Appendix B, Table II, Column 1.

(2) When samples are taken more often than that shown, the minimum detectable concentrations can be correspondingly higher.

(3) The principal gamma emitters for which the LLD specification will apply are exclusively the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emissions and Mn-54, Fe-59, Co-58, Co-60, Zn-65, MO-99, Cs-134, Cs-137, Ce-141, and Ce-144 for parciculate emissions. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level for that nuclide. When unusual circumstances result in LLD's higher than required, the reasons shall be documented in the semi-annual effluent report. The principal gamma emitters (those expected to account for a 95% of the activity present) for which the LLD specification will apply are exclusively the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emissions and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, and Cs-137 for particulate emissions. This list does not mean that only these nuclides are to be detected and reported. Other nuclides which influence accounting for 95% of the total activity together with the above nuclides shall also be identified and reported. Nuclides which are below the LLD for the analyses may not be reported as being present at the LLD level for that nuclide. When unusual circumstances result in the LLD's higher than required, the reason shall be documented in the semi-annual effluent report.

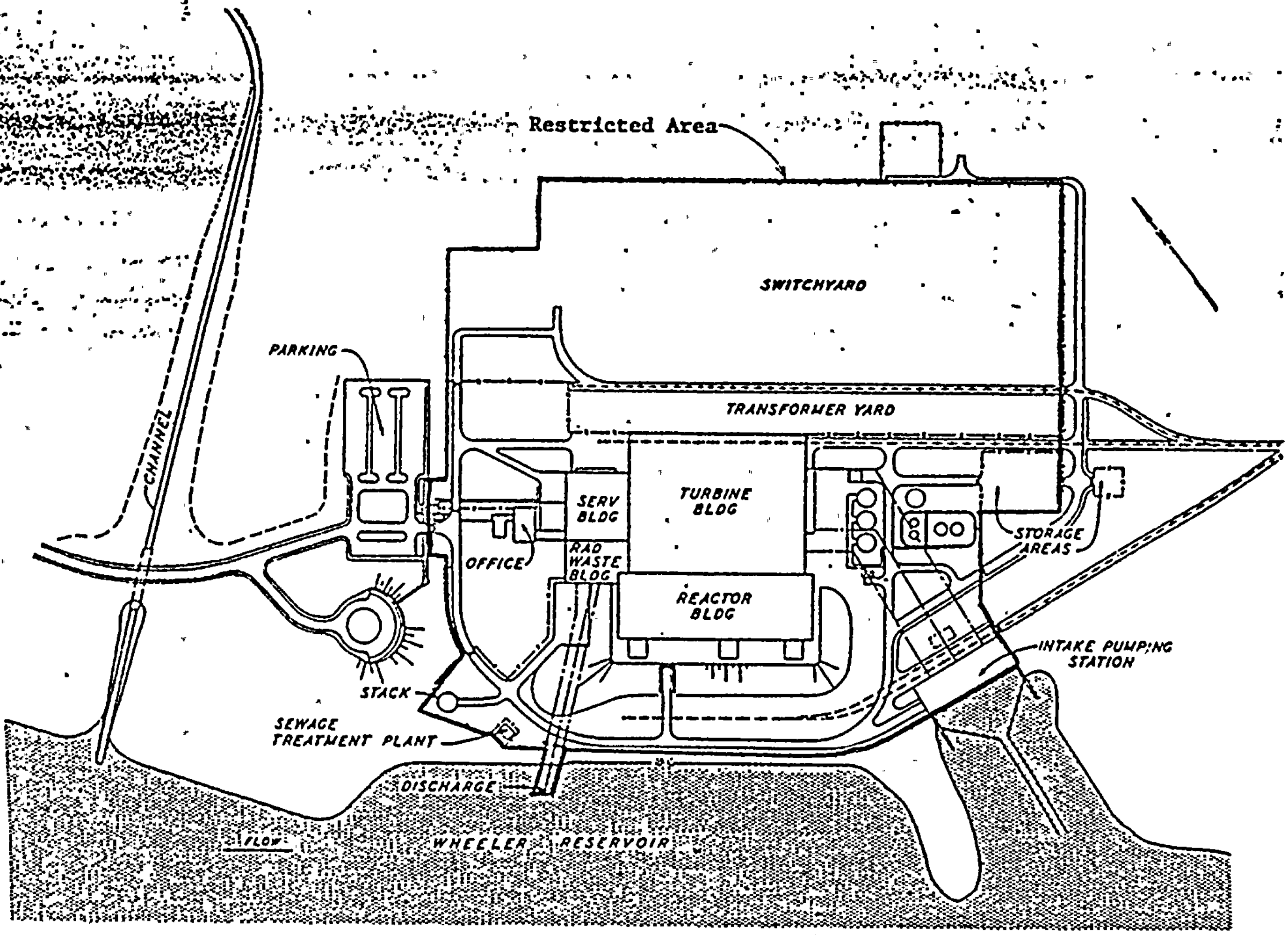


FIGURE 4.8.A.1 Assumed Liquid Effluent Restricted Area

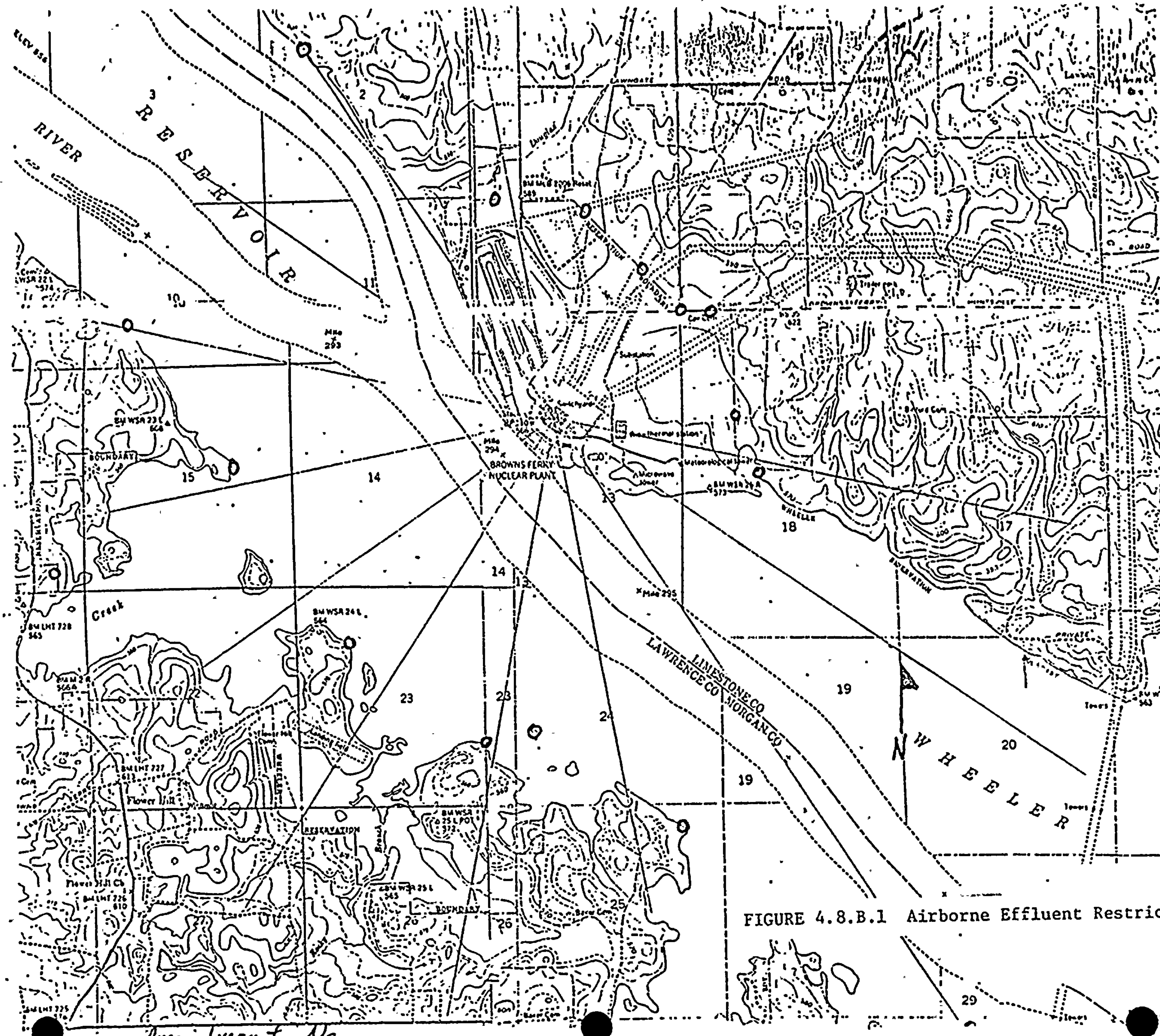


FIGURE 4.8.B.1 Airborne Effluent Restricted Area

3.8 BASES

Radioactive waste release levels to unrestricted areas should be kept "as low as reasonably achievable" and are not to exceed the concentration limits specified in 10 CFR Part 20. At the same time, these specifications permit the flexibility of operation, compatible with considerations of health and safety, to assure that the public is provided a dependable source of power under unusual operating conditions which may temporarily result in releases higher than design objectives but still within the concentration limits specified in 10 CFR Part 20. It is expected that by using this operational flexibility under unusual operating conditions, and exerting every effort to keep levels of radioactive materials released as low as reasonably achievable, the annual releases will not exceed a small fraction of the annual average concentration limits specified in 10 CFR Part 20.

3.8.A LIQUID EFFLUENTS

Specification 3.8.A.1 is provided to ensure that the concentration of radioactive materials released in liquid waste effluents from the site to unrestricted areas will be less than the concentration levels specified in 10 CFR Part 20, Appendix B, Table II. This limitation provides additional assurance that the levels of radioactive materials in bodies of water outside the site will not result in exposures within (1) the Section 11.A design objectives of Appendix I, 10 CFR Part 50, to an individual and (2) the limits of 10 CFR Part 20.106 (e) to the population. The concentration limit for noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

Specification 3.8.A.3 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 11.A of Appendix I.

Specification 3.8.A.4 provides the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents will be kept "as low as is reasonably achievable". Also, for fresh water sites with drinking water supplies which can be potentially affected by plant operations, there is reasonable assurance that the operation of the facility will not result in radionuclide concentrations in the finished drinking water that are in excess of the requirements of 40 CFR 141. The dose calculations in the ODCM implement the requirements in section III.A of Appendix I that conformance with

3.8.A LIQUID EFFLUENTS (cont'd)

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-0133 provides methods for dose calculations consistent with Regulatory Guides 1.109 and 1.113.

Specification 3.8.A.5 requires that the appropriate portions of the liquid radwaste treatment system be used when specified. This 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. The specified limits governing the use of appropriate portions of the liquid radwaste treatment system were specified as a suitable fraction of the guide set forth in Section 11.A of Appendix I, 10 Cfr Part 50, for liquid effluents.

Specification 3.8.A.6 requires submittal of a special report if the limiting values of Specification 3.8.A.5 are exceeded and unexpected failures of non-redundant radwaste processing equipment halt waste treatment.

Specification 3.8.A.7 requires that suitable equipment to control and monitor the releases of radioactive materials in the liquid effluents are operating during any period when these releases are taking place.

3.8.B AIRBORNE EFFLUENTS

Specification 3.8.B.1 is provided to ensure that the dose rate at anytime at the exclusion boundary from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 for unrestricted areas. The annual dose limits are the doses associated with the concentrations of 10 CFR Part 20, Appendix B, Table II. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of an individual in an unrestricted area, either within or outside the exclusion area boundary, to annual average concentrations exceeding the limits specified in Appendix B, Table II of 10 CFR Part 20 (10 CFR Part 20.106(b)0. For individuals who may at times be within the exclusion area boundary, the occupancy of the individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the exclusion area boundary.

3.8.B AIRBORNE EFFLUENTS (Cont'd)

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 exclusion area boundary to ≤ (500) mrem/year to the total body or to ≤ (3000) mrem/year to the skin. These release rate limits also restrict, at all times. the corresponding thyroid dose rate above background to an infant via the cow-milk-infant pathway to ≤ 1500 mrem/year for the nearest cow to the plant.

Specification 3.8.B.2 requires that appropriate corrective action (s) be taken to reduce gaseous effluent releases if the limits of 3.8.B.1 are exceeded.

Specification 3.8.B.5 is provided to implement the requirements of Section II.C, III.A, and IV of Appendix I, 10 CFR Part 50. The limiting conditions for operation are the guides set forth in Section II.c of Appendix I.

Specification 3.8.B.6 provides 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 reasonably achievable." The ODCM calculational methods specified in the surveillance requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways 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, "Calculating 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 I, 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 doeses based upon the historical average atmospheric conditions. The release rate specifications for radioiodines, 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 are examined in the development of these calculations are: 1) individual inhalation of airborne radionuclides, 2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, 3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, and 4) deposition on the ground with subsequent exposure of man.

Specification 3.8.B.6 requires that a special report be prepared and submitted to explain violations of the limiting doses contained in Specification 3.8.B.5.

AIRBORNE EFFLUENTS

Specification 3.8.B.7 requires that the offgas charcoal adsorber beds be used when specified to treat gaseous effluents prior to their release to the environment. This provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." This specification implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and design objective Section IID of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the guide set forth in Sections II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents.

Specification 3.8.B.8 requires that a special report be prepared and submitted to explain reasons for any failure to comply with Specification 3.8.B.7.

Specification 3.8.B.3 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 IV.A of B of Appendix I.

Specification 3.8.B.4 provides 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 provided for determining the air doses at the exclusion area boundary will be based upon the historical average atmospheric conditions. NUREG-0133 provides methods for dose calculations consistent with Regulatory Guides 1.109 and 1.111. Specification 3.8.B.4 requires that a special report be prepared and submitted to explain violations of the limiting doese contained in Specification 3.8.B.3.

3.8.D.4.8.D Mechanical Vacuum Pump

The purpose of isolating the mechanical vacuum pump line is to limit the release of activity from the main condenser. During an accident, fission products would be transported from the reactor through the main steam lines to the condenser. The fission product radioactivity would be sensed by the main steam line radioactivity monitors which initiate isolation.

4.8.A AND 4.8.B BASES

The surveillance requirements given under Specification 4.8.A and 4.8.B provide assurance that liquid and gaseous wastes are properly controlled and monitored during any release of radioactive materials in the liquid and gaseous effluents. These surveillance requirements provide the data for the licensee and the Commission to evaluate the station's performance relative to radioactive wastes released to the environment. Reports on the quantities of radioactive materials released in effluents shall be furnished to the Commission on the basis of Section 6 of these technical specifications. On the basis of such reports and any additional information the Commission may obtain from the licensee or others, the Commission may from time to time require the licensee to take such actions as the Commission deems appropriate.

3.8.E and 4.8.E BASES

The objective of this specification is to assure that leakage from byproduct, source, and special nuclear radioactive material sources does not exceed allowable limits.

(b). Annual Operating Report

A tabulation on an annual basis of the number of station, utility and other personnel (including contractors) receiving exposures greater than 100 mrem/yr and their associated man rem exposure according to work and job functions,* e.g., reactor operations and surveillance, inservice inspection, routine maintenance, special maintenance (describe maintenance), waste processing, and refueling. The dose assignment to various duty functions may be estimates based on pocket dosimeter, TLD, or film badge measurements. Small exposures totalling less than 20% of the individual total dose need not be accounted for. In the aggregate, at least 80% of the total whole body dose received from external sources shall be assigned to specific major work functions.

c. Monthly Operating Report. Routine reports of operating statistics and shutdown experience shall be submitted on a monthly basis to the Office of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, with a copy to the appropriate Regional Office, to be submitted no later than the tenth of each month following the calendar month covered by the report. A narrative summary of operating experience shall be submitted in the above schedule.

Any changes to the Offsite Dose Calculation Manual of Specification 6.10 shall be submitted with the Monthly Operating Report within 90 days in which the change(s) was made effective.

6.0 ADMINISTRATIVE CONTROLS

d. Radiological Environmental Monitoring

1. TVA shall prepare a report entitled "Environmental Radioactivity Levels - Browns Ferry Nuclear Plant - Annual Report." The report shall cover the previous 12 months of operation and shall be submitted to the Director of the NRC Region II Office (with a copy to the Director, Office of Nuclear Reactor Regulation) within 120 days after January 1 of each year. The report format shown in Regulatory Guide 4.8 Title 1 shall be used. The report shall include summaries, interpretations, and evaluations of the results of the radiological environmental surveillance activities for the report period, including a comparison with preoperational studies and/or operational controls (as appropriate), and an assessment of the observed impacts of the plant operation on the environment. If harmful effects or evidence of irreversible damage are detected by the monitoring, the licensee shall provide an analysis of the problem and a proposed course of action to alleviate the problem.

2. Results of all radiological environmental samples taken shall be summarized and tabulated on an annual basis. In the event that some results are not available within the 120-day period, 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.

2. Reportable Occurrences

Reportable occurrences, including corrective actions and measures to prevent reoccurrence, shall be reported to the NRC. Supplemental reports may be required to fully describe final resolution of occurrence. In case of corrected or supplemental reports, a licensee event report shall be completed and reference shall be made to the original report date.

(9) Performance of structures, systems, or components that requires remedial action or corrective measures to prevent operation in a manner less conservative than assumed in the accident analyses in the safety analysis report or technical specifications bases; or discovery during plant life of conditions not specifically considered in the safety analysis report or technical specifications that require remedial action or corrective measures to prevent the existence or development of an unsafe condition.

Note: This item is intended to provide for reporting of potentially generic problems.

(10) The concentration of radioactive material in liquid effluents released to unrestricted areas exceeds the concentrations specified in 10 CFR Part 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. Concentration of dissolved or entrained noble gases exceeds 2×10^{-4} Ci/ml total activity.

(11) (a). The dose rate for noble gases equals or exceeds 500 mrem/yr to the total body or 3000 mrem/yr to the skin.

(b). The dose rate for all radioiodines, for all radioactive materials in particular form, and for radionuclides other than noble gases with half lives greater than 8 days exceeds 1500 mrem/yr to any organ.

b. Thirty-Day Written Reports. The reportable occurrences discussed below shall be the subject of written reports to the Director of the appropriate Regional Office within thirty days of occurrence of the event. The written report shall include, as a minimum, a completed copy of a licensee event report form. Information provided on the licensee event report form shall be supplemented, as needed, by additional narrative material to provide complete explanation of the circumstances surrounding the event.

(1) Reactor protection system or engineered safety feature instrument settings which are found to be less conservative than those established by the technical specifications but which do not prevent the fulfillment of the functional requirements of affected systems.

(2) Conditions leading to operation in a degraded mode permitted by a limiting condition for operation or plant shutdown required by a limiting condition for operation.

Note: Routine surveillance testing, instrument calibration, or preventative maintenance which require system configurations as described in items 2.b.(1) and 2.b.(2) need not be reported except where test results themselves reveal a degraded mode as described above.

(3) Observed inadequacies in the implementation of administrative or procedural controls which threaten to cause reduction of degree of redundancy provided in reactor protection systems or engineered safety feature systems.

(4) Abnormal degradation of systems other than those specified in item 2.a(3) above designed to contain radioactive material resulting from the fission process.

Note: Sealed sources or calibration sources are not included under this item. Leakage of valve packing or gaskets within the limits for identified leakage set forth in technical specifications need not be reported under this item.

(5) An unplanned offsite release of 1) more than 1 curie of radioactive material in liquid effluents, 2) more than 150 curies of noble gas in gaseous effluents, or 3) more than 0.05 curies of radioiodine in gaseous effluents. The report of an unplanned offsite release of radioactive material shall include the following information:

1. A description of the event and equipment involved.

2. Cause(s) for the unplanned release.

3. Actions taken to prevent recurrence.

4. Consequences of the unplanned release.

6.0 ADMINISTRATIVE CONTROLS

c. Anomalous Measurements -Radiological Environmental Monitoring

(1.) If, during any 12-month report period, a measured level of radioactivity in any environmental medium other than those associated with gaseous radioiodine releases exceeds ten times the control station value, a written notification will be submitted within one week advising the NRC of this condition.* This notification should include an evaluation of any release conditions, environmental factors, or other aspects necessary to explain the anomalous result.

(2.) If, during any 12-month report period, a measured level of radioactivity in any environmental medium other than those associated with gaseous radioiodine releases exceeds four times the control station value, a written notification will be submitted within 30 days advising the NRC of this condition. This notification should include an evaluation of any release conditions, environmental factors, or other aspects necessary to explain the anomalous result.

(3.) If individual milk samples show I-131 concentrations of 10 picocuries per liter or greater, a plan shall be submitted within 10 days advising the NRC of the proposed action to ensure the plant related annual doses will be within the design objective of 15 mrem/yr/reactor to the thyroid of any individual.

(4.) If milk samples collected over a calendar quarter show average concentrations of 6.0 picocuries per liter or greater, a plan shall be submitted within 30 days advising the NRC of the proposed action to ensure the plant-related annual doses will be within the design objective of 15 mrem/yr/reactor to the thyroid of any individual.

*In the case of a tentatively anomalous value for radiostrontium, a confirmatory reanalysis of the original, a duplicate or a new sample may be desirable. In this instance the results of the confirmatory analysis shall be completed at the earliest time consistent with the analysis, and if the high value is real, the report to the NRC shall be submitted within one week following this analysis.

(5.) If such levels as discussed in 6.7.2.c.3 and 6.7.2.c.4 can be definitely shown to result from sources other than the Browns Ferry Nuclear Plant, the reporting action called for in ~~5.6.3~~(a)3 and 5.6.3(a)4 need not be taken. Justification for assigning high levels of radioactivity to sources other than the Browns Ferry Nuclear Plant must be provided in the annual report.

6.7.3 Unique Reporting Requirements

A. Radioactive Effluent Release Report

A report on the radioactive discharges released from the site during the previous 6 months of operation shall be submitted to the Director of the Regional Office of Inspection and Enforcement within 60 days after January 1 and July 1 of each year. The report shall include a summary of the quantities of radioactive liquid and gaseous effluents released and solid waste shipped from the plant as delineated in Regulatory Guide 1.21, Revision 1, "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," with data summarized on a quarterly basis following the format of Appendix B thereof.

The report shall include a summary of the meterological conditions concurrent with the release of gaseous effluents during each quarter as outlined in Regulatory Guide 1.21, Revision 1, with data summarized on a quarterly basis following the format of Appendix B thereof. Calculated offsite dose to humans resulting from the release of effluents and their subsequent dispersion in the atmosphere shall be reported as recommended in Regulatory Guide 1.21, Revision 1. Doses to individuals outside the site boundary (UNRESTRICTED AREA) shall be calculated in accordance with the ODCM.

B. Source Tests

Results of required leak tests performed on sources if the tests reveal the presence of 0.005 microcurie or more of removable contamination.

C. Special Reports (in writing to the Director of Regional Office of Inspection and Enforcement).

1. Reports on the following areas shall be submitted as noted:

a.	Secondary Containment Leak Rate Testing (5)	4.7.C	Within 90 days of completion of each test.
b.	Fatigue Usage Evaluation	6.6	Annual Operating Report
c.	Seismic Instrumentation Inoperability	3.2.J.3	Within 10 days after 30 days of inoperability

2. 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 action(s) to be taken to reduce the releases of radioactive material in liquid effluents during the remainder of the current calendar quarter and during the subsequent three calendar quarters so that the average dose or dose commitment to an individual from such releases during these four calendar quarters is within 3 mrem to the total body and 10 mrem to any organ. This Special Report shall also include: (1) the results of radiological analyses of the drinking water sources (if applicable), and (2) the radiological impact on finished drinking water supplies with regard to the requirements of 40 CFR 141, Safe Drinking Water Act. (Applicable only if drinking water supply is taken from the receiving water body.) See item 6 below.

3. Prepare and submit to the Commission within 30 days, a Special Report which includes the following information:

   a. Identification of equipment of subsystems not OPERABLE and the reason for nonoperability.
   b. Action(s) taken to restore the non operable equipment to OPERABLE status.

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

4. 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 to be taken to reduce the releases of radioiodines, radioactive materials in particulate form, and radionuclides other than noble gases with half-lives greater than 8 days in gaseous effluents during the remainder of the current calendar quarter and during the subsequent three calendar quarters so that the average dose or dose commitment to an individual from such releases during these four calendar quarters is within 15 mrem to any organ. See item 6 below.

5. 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 reduce the releases of radioactive noble gases in gaseous effluents during the remainder of the current calendar quarter and during the subsequent three calendar quarters so that the average dose during these four calendar quarters is within 10 mrad for gamma radiation and (20) mrad for beta radiation. See item 6 below.

6. Prepare and submit to the Commission a Special Report which includes an analysis demonstrating that radiation exposures to all real individuals 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.

UNIT 2

1.0 DEFINITIONS (Cont'd)

10. Logic - A logic is an arrangement of relays, contacts, and other components that produces a decision output.

(a) Initiating - A logic that receive signals from channels and produces decision outputs to the actuation logic.

(b) Actuation - A logic that receives signals (either from initiation logic or channels) and produces decision outputs to accomplish a protective action.

11. Channel Calibration - Shall be the adjustment, as necessary, of the channel output such that it responds with necessary range and accuracy to known values of the parameters which the channel monitors. The channel calibration shall encompass the entire channel including alarm and/or trip functions and shall include the channel functional test. The channel calibration may be performed by any series of sequential, overlapping or total channel steps such that the entire channel is calibrated. Non-calibratable components shall be excluded from this requirement, but will be included in channel functional test and source check.

12. Channel Functional Test - Shall be :

a. Analog Channels - the injection of a simulated signal into the channel as close to the sensor as practicable to verify OPERABILITY including alarm and/or trip functions.
b. Bistable channels - the injection of a simulated signal into the sensor to verify OPERABILITY including alarm and/or trip functions.

13. Source Check - Shall be the qualitative assessment of channel response when the channel sensor is exposed to a radioactive sources or multiple of sources.

1.0 DEFINITIONS (Cont'd)

W. Functional Tests - A functional test is the manual operation or initiation of a system, subsystem, or component to verify that it functions within design tolerances (e.g., the manual start of a core spray pump to verify that it runs and that it pumps the required volume of water).

X. Shutdown - The reactor is in a shutdown condition when the reactor mode switch is in the shutdown mode position and no core alterations are being performed.

Y. Engineered Safeguard - An engineered safeguard is a safety system the actions of which are essential to a safety action required in response to accidents.

Z. Cumulative Downtime - The cumulative downtime for those safety components and systems whose downtime is limited to 7 consecutive days prior to requiring reactor shutdown shall be limited to any 7 days in a consecutive 30 day period.

AA. Solidification - Shall be the conversion of radioactive wastes to conform to the license requirement of the receiving burial ground.

BB. Offsite Dose Calculation Manual (ODCM) Shall be a manual describing the environmental monitoring program and the methodology and parameters used in the calculation of release rate limits and off-site doses due to radioactive gaseous and liquid effluents.

CC. Unrestricted Area - All area beyond the site boundary access to which is not controlled for protection of individuals from exposure to radiation and radioactive materials.

TABLE 1.1

SURVEILLANCE FREQUENCY NOTATION

NOTATION	FREQUENCY
S	At least once per 12 hours.
D	At least once per 24 hours.
W	At least once per 7 days.
M	At least once per 31 days.
Q	At least once per 92 days.
SA	At least once per 6 months.
R	At least once per 18 months.
S/U	Prior to each reactor startup.
N.A.	Not applicable.

3.2.K Radioactive Gaseous Effluent Monitoring Instrumentation

1. The radioactive gaseous effluent monitoring instruments listed in table 3.2.K shall be operable at all times with their alarm/trip setpoints set to ensure that the limits of specification 3.8.B.1 are not exceeded.

2. The action required when the number of operable channels is less than the Minimum Channels Operable requirement is specified in the notes for table 3.2.K.

4.2.K Radioactive Gaseous Effluent Monitoring Instrumentation

1. Each of the radioactive gaseous effluent monitoring instruments shall be demonstrated operable by performance of tests in accordance with table 4.2.K.

TABLE 3.2.K
RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

Instrument	Minimum Channels Operable	Applicability	Parameter	Action
1. Stack				
a. Noble Gas Activity Monitor	(1)	*	Release Rate Measurement	A/C
b. Iodine Cartridge	NA	*	Installed	B
c. Particulate filter	NA	*	Installed	B
2. Reactor /Turbine Building Ventilation				
a. Noble Gas Activity Monitor	(1)	*	Release Rate Measurement	A/C
b. Iodine Monitor	(1)	*	Release Rate Measurement	B/C
c. Particulate Monitor	(1)	*	Release Rate Measurement	B/C
3. Turbine Building Exhaust				
a. Noble Gas Activity Monitor	(1)	*	Release Rate Measurement	A/C
b. Iodine Monitor	(1)	*	Release Rate Measurement	B/C
c. Particulate Monitor	(1)	*	Release Rate Measurement	B/C

3.2.K (Continued)
RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

	Instrument	Minimum Channels Operable	Applicability	Parameter	Action
4.	Radwaste Building Ventilation				
	a. Noble Gas Activity Monitor	(1)	*	Release Rate	A/C
	b. Iodine Monitor	(1)	*	Release Rate Measurement	B/C
	c. Particulate Monitor	(1)	*	Release Rate Measurement	B/C

NOTES FOR TABLE 3.2.K

*During releases via this pathway.

ACTION A

With the number of channels OPERABLE less than required by the Minimum Channels Operable requirement, effluent releases via the affected pathway may continue for up to 7 days provided a temporary monitoring system is installed or grab samples are taken and analyzed at least once every 4 hours.

ACTION B

With the number of channels OPERABLE less than required by the Minimum Channels Operable requirement, effluent releases via this pathway may continue for up to 28 days, provided samples are continuously collected with auxiliary sampling equipment for periods on the order of seven (7) days and analyzed within 48 hours after the end of the sampling period.

ACTION C

A monitoring system may be out of service for 4 hours for functional testing, calibration, or repair without providing temporary monitor or initiating grab sampling.

TABLE 4.2.K

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

Instrument	Instrument Check	Source Check	Channel Calibration	Channel Functional Test	Modes In Which Surveillance Required
1. Stack					
a. Noble Gas Activity Monitor	D	M	Q(1)	M(2)	*
2. Reactor/Turbine Building Ventilation					
a. Noble Gas Activity Monitor	D	M	Q(1)	M(2)	*
b. Iodine Monitor	D	M	Q(1)	M(2)	*
c. Particulate Monitor	D	M	Q(1)	M(2)	*
3. Turbine Building Exhaust					
a. Noble Gas Activity Monitor	D	M	Q(1)	M(2)	*
b. Iodine Monitor	D	M	Q(1)	M(2)	*
c. Particulate Monitor	D	M	Q(1)	M(2)	*
4. Radwaste Building Ventilation					
a. Noble Gas Activity Monitor	D	M	Q(1)	M(2)	*
b. Iodine Monitor	D	M	Q(1)	M(2)	*
c. Particulate Monitor	D	M	Q(1)	M(2)	*

NOTES FOR TABLE 4.2.K

*During releases via this pathway.

(1) The CHANNEL CALIBRATION shall include the use of a known (traceable to the National Bureau of standards radiation measurement system) radioactive source (s) positioned in a reproducible geometry with respect to the sensor.

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

   1. Instrument indicates measured levels above the alarm/trip setpoint.

   2. Instrument indicates an inoperable downscale failure.

3.2 BASES

For each parameter monitored, as listed in Table 3.2.F, there are two channels of instrumentation except as noted. By comparing readings between the two channels, a near continuous surveillance of instrument performance is available. Any deviation in readings will initiate an early recalibration, thereby maintaining the quality of the instrument readings.

Instrumentation is provided for isolating the control room and initiating a pressurizing system that processes outside air before supplying it to the control room. An accident signal that isolates primary containment will also automatically isolate the control room and initiate the emergency pressurization system. In addition, there are radiation monitors in the normal ventilation system that will isolate the control room and initiate the emergency pressurization system. Activity required to cause automatic actuation is about one mRem/hr.

Because of the constant surveillance and control exercised by TVA over the Tennessee Valley, flood levels of large mangitudes can be predicted in advance of their actual occurrence. In all cases, full advantage will be taken of advance warning to take appropriate action whenever reservoir levels above normal pool are predicted; however, the plant flood protection is always in place and does not depend in any way on advanced warning. Therefore, during flood conditions, the plant will be permitted to operate until water begins to run across the top of the pumping station at elevation 565. Seismically qualified, redundant level switches each powered from a separate division of power are provided at the pumping station to give main control room indication of this condition. At that time an orderly shutdown of the plant will be initiated, although surges even to a depth of several feet over the pumping station deck will not cause the loss of the main condenser circulating water pumps.

The operability of the meteorological instrumentation ensures that sufficient meteorological data is available for estimating potential radiation dose to the public as a result of routine or accidental release of radioactive materials to the atmosphere. This capability is required to evaluate the need for initiating protective measures to protect the health and safety of the public.

The operability of the seismic instrumentation ensures that sufficient capability is available to promptly determine the magnitude of a seismic event and evaluate the response of those features important to safety. This capability is required to permit comparison of the measured response to that used in the design basis for Browns Ferry Nuclear Plant. The instrumentation provided is consistent with specific portions of the recommendations of Regulatory Guide 1.12 "Instrumentation for Earthquakes."

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The alarm/trip setpoints for these instruments will be calculated in accordance with plant approved procedures to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20.

there is no true minimum. The curve does have a definite knee and very little reduction in system unavailability is achieved by testing at a shorter interval than computed by the equation for a single channel.

The best test procedure of all those examined is to perfectly stagger the tests. That is, if the test interval is four months, test one or the other channel every two months. This is shown in Curve No. 5. The difference between Cases 4 and 5 is negligible. There may be other arguments, however, that more strongly support the perfectly staggered tests, including reductions in human error.

The conclusions to be drawn are these:

1. A 1 out of n system may be treated the same as a single channel in terms of choosing a test interval; and

2. more than one channel should not be bypassed for testing at any one time.

The radiation monitors in the refueling area ventilation duct which initiate building isolation and standby gas treatment operation are arranged in two 1 out of 2 logic systems. The bases given for the rod blocks apply here also and were used to arrive at the functional testing frequency. The off-gas post treatment monitors are connected in a 2 out of 2 logic arrangement. Based on experience with instruments of similar design, a testing interval of once every three months has been found adequate.

The automatic pressure relief instrumentation can be considered to be a 1 out of 2 logic system and the discussion above applies also.

The criteria for ensuring the reliability and accuracy of the radioactive gaseous effluent instrumentation in listed in Table 4.2.K.

3.8 RADIOACTIVE MATERIALS

Applicability

Applies to the controlled release of radioactive liquids and gases from the facility.

Objective

To define the limits and conditions for the release of radioactive effluents to the environs to assure that any radioactive releases are as low as reasonably achieveable and within the limits of 10 CFR Part 20.

Specification

A. Liquid Effluents

1. The concentration of radioactive material released at any time from the site to unrestricted areas (see Figure 4.8.A.1) shall be limited to the concentrations specified in 10 CFR Part 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2E-4 μCi/ml total activity.

2. If the limits of 3.8.A.1 are exceeded, appropriate action shall be initiated to bring the release within limits. Provide prompt notification to the NRC pursuant to Section 6.7.2.a.

3. The dose or dose commitment to an individual from radioactive materials in liquid effluents released from each unit to unrestricted areas (See Figure 4.8.A.1) shall be limited:

4.8 RADIOACTIVE MATERIALS

Applicability

Applies to the periodic test and record requirements and sampling and monitoring methods used for facility effluents.

Objective

To ensure that radioactive liquid and gaseous releases from the facility are maintained within the limits specified by Specifications 3.8.A and 3.8.B.

Specification

A. Liquid Effluents

1. Facility records shall be maintained of radioactive concentrations and volume before dilution of each batch of liquid effluent released, and of the average dilution flow and length of time over which each discharge occurred.

2. Radioactive liquid waste sampling and activity analysis of each liquid waste batch to be discharged shall be performed prior to release in accordance with Table 4.8.A.

3. The liquid effluent radiation monitor shall be calibrated at least quarterly by means of a known radioactive source(s). The monitor shall also have an instrument channel functional test monthly and an instrument check daily.

3.8.A Liquid Effluents

a. During any calendar quarter to <1.5 mrem to the total body and to ≤5 mrem to any organ and,

b. During any calendar year to ≤3 mrem to the total body and ≤10 mrem to any organ.

4. If the limits specified in 3.8.A.3. a&b above are exceeded, prepare and submit Special Report persuant to Section 6.7.3.C.2.

5. The liquid radwaste system shall be maintained and operated to process liquid radwaste when it appears during quarterly operation that the releases to unrestricted areas (see Figure 4.8.A.1) when averaged over 31 days would exceed 0.06 mrem to the total body and 0.21 mrem to any organ.

6. During a quarter if radioactive liquid waste must be discharded without treatment after the limits specified in 3.8.A.5 above are exceeded, prepare and submit the Special Report pursuant to Section 6.7.3.C.3.

7. During release of radioactive wastes from the radwaste processing system, the following conditions shall be met:

a. Liquid waste activity and flow rate shall be continuously monitored and recorded during release and shall be set to alarm and automatically close the waste discharge valve before exceeding the limits specified in 3.8.A.1. above. If this requirement cannot be met, continued release of liquid effluents shall be permitted only during the succeeding 48 hour period, two independent samples of each tank shall be analyzed and two station personnel shall independently check valving before the discharge.

4.8.A Liquid Effluents

4. The operation of the automatic isolation valves and discharge tank selection values shall be checked annually.

5. The accuracy of the radwaste effluent flow rate monitor shall be checked at least monthly.

6. Cummulative quarterly and yearly dose contributions from liquid effluents shall be determined as specified in plant approved procedures at least once every 31 days.

7. Doses due to liquid releases to unrestricted areas shall be projected at least once per 31 days.

3.8 RADIOACTIVE MATERIALS

B. Airborne Effluents

1. The dose rate at any time in the unrestricted areas (see Figure 4.8.B.1) due to radioactivity released in gaseous effluents from the site shall be limited to the following values:

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

   b. The dose rate limit for all radioiodines for all radioactive materials in particulate form, and for radionuclides other than noble gases with half lives greater than 8 days shall be 1500 mrem/yr to any organ.

2. If the limits of 3.8.B.1 are exceeded, appropriate corrective action shall be initiated to bring the releases within limits. Provide prompt notification to the NRC pursuant to section 6.7.2.a.

4.8 RADIOACTIVE MATERIALS

B. Airborne Effluents

1. The gross β/ and particulate activity of gaseous wastes released to the environment shall be monitored and recorded:

   a. For effluent streams having continuous monitoring capability, the activity and flow rate shall be monitored and recorded to enable release rates of gross radioactivity to be determined on an hourly basis using instruments specified in Table 3.2.K.

   b. For effluent stream without continuous monitoring capability, the activit shall be monitored and recorded and the releases throug these streams shall be controlled so that the release rates from all streams are within the limits specified in 3.8.B

2. Radioactive gaseous waste sampling and activity analysis shall be performe in accordance with Table 4.8.B.

Limiting Conditions for Operation

3. The air dose in unrestricted areas (see Figure 4.8.B.1) due to noble gases released in gaseous effluents per unit shall be limited to the following:

   a. During any calendar quarter, to ≤ 5 mrad for gamma radiation and ≤ 10 mrad for beta radiation;

   b. During any calendar year, to ≤ 10 mrad for gamma radiation and ≤ 20 mrad for beta radiation.

4. If the calculated air dose exceeds the limits specified in 3.8.B.3 above, prepare and submit a special report pursuant to section 6.7.3.C.5

5. The dose to an individual from radioiodines, radioactive materials in particulate form, and radionuclides other than noble gases with half lives greater than 8 days in gaseous effluent released per unit to unrestricted areas (see Figure 4.8.B.1) shall be limited to the following:

   a. During any calendar quarter to ≤ 7.5 mrem;

   b. During any calendar year to ≤ 15 mrem;

Surveillance Requirements

3. Cumulative quarterly and yearly dose contributions shall be determined as specified in plant approve procedures at least once every 31 days.

4. Doses due to gaseous releases to unrestricted areas shall be projected at least once per 31 days.

5. Samples of offgass effluents shall be analyzed at least weekly to determine the identity and quantity of the principal radionuclides being released.

6. If the calculated doses exceed the limits of 3.8.B.5 above, prepare and submit a special report pursuant to section 6.7.3.C.4

7. During operation above 50% power the discharge of the SJAE must be routed through the charcoal adsorbers when the projected gaseous effluent releases to unrestricted areas (see Figure 4.8.B.1) when averaged over 31 days would exceed 0.2 mrad for gamma radiation and 0.4 mrad for beta radiation.

8. With gaseous wastes being discharged for more than 31 days without treatment and in excess of the limits of 3.8.B.7 above, prepare and submit a special report pursuant to section 6.7.3.C.3

3.8.C Radioactive Effluents - Dose

1. The dose or dose commitment to a real individual from all uranium fuel cycle sources is limited to ≤ 25 mrem to the total body or any organ (except the thyroid, which is limited to ≤ 75 mrem) over a period of 12 consecutive months.

2. With the calculated dose from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of specification 3.8.A.3, 3.8.B.3, or 3.8.B.5, prepare and submit a Special Report to the Commission pursuant to specification 6.7.3.C.6 and limit the subsequent releases such that the limits of 3.8.C.1 are not exceeded.

4.8.C Radioactive Effluents - Dose

1. Cumulative dose contributions from liquid and gaseous effluents shall be determined in accordance with specifications 3.8.A.3, 3.8.B.3, and 3.8.B.5.

D. Mechanical Vacuum Pump

1. The mechanical vacuum pump shall be capable of being automatically isolated and secured on a signal or high radioactivity in the steam lines whenever the main steam isolation valves are open.

2. If the limits of 3.8.C.1 are not met, the vacuum pump shall be isolated.

D. Mechanical Vacuum Pump

At least once during each operating cycle verify automatic securing and isolation of the mechanical vacuum pump.

3.8 RADIOACTIVE MATERIALS

E. Miscellaneous Radioactive Materials Sources

1. Source Leakage Test

Each sealed source containing radioactive material in excess of those quantities of byproduct material listed in 10 CFR 30.71 Schedule B and all other sources, including alpha emitters, in excess of 0.1 microcurie, shall be free of ≥ 0.005 microcurie of removable contamination. Each sealed source with removable contamination in excess of the above limit shall be immediately withdrawn from use and (a) either decontaminated and repaired, or (b) disposed of in accordance with Commission regulations.

4.8 RADIOACTIVE MATERIALS

E. Miscellaneous Radioactive Materials Sources

1. Surveillance Requirement

Tests for leakage and/or contamination shall be performed by the licensee or by other persons specifically authorized by the Commission or an agreement State, as follows:

a. Each sealed source, except startup sources subject to core flux, containing radioactive material, other than Hydrogen 3, with a half-life greater than thirty days and in any form other than gas shall be tested for leakage and/or contamination at intervals not to exceed six months. The leakage test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample.

TABLE 4.8.A

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

LIQUID RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD) (μCi/ml)
Batch Waste Releases [1]	Each Batch	Each Batch prior to release	Principal Gamma Emitters [4]	5 E-7 [3]
	One Batch per Month	Monthly	Dissolved and Entrained Gases	1 E-5
	Monthly Proportional Composite (2)	Monthly	Tritium	1 E-5
			Gross α	1 E-7
			P-32	1 E-6
	Quarterly Proportional Composite (2)	Quarterly	Sr-89 , Sr-90	5 E-8
			Fe-55	1 E-6

TABLE NOTATION - TABLE 4.8.A

(1) A batch release is the discharge of liquid wastes of a discrete volume.

(2) A proportional composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged from the plant.

(3) For certain radionuclides with low gamma yield or low energies, or for certain radionuclide mixtures, it may not be possible to measure radionuclides in concentrations near their sensitivity limits when other nuclides are present in the sample in much greater concentrations. Under these circumstances, it will be more appropriate to calculate the concentrations of such radionuclides using observed ratios with those radionuclides which are measurable or the lower limit of detection may be increased proportionally to the magnitude of the gamma yield (i.e., 5 E-7/I where I is the photon abundance expressed as a decimal fraction), but in no case shall the lower limit of detection as calculated in this manner be greater than 10% of the MPC value specified in 10 CFR Part 20, Appendix B, Table II, Column 2.

(4) The principal gamma emitters (those expected to account for ~95% of the total activity present) for which the LLD specification will apply are exclusively the following radionuclides: Cr-51, Zn-65, Co-60, Cs-137, Zr-95, Nb-95, I-131, Na-24, Mn-54, Co-58, Ag-110m, Cs-134, I-133, Cu-64, Mo/Tc-99, and Fe-59 for liquid releases. This list does not mean that only these nuclides are to be detected and reported. Other nuclides which influence accounting for ~95% of the total activity, together with the above nuclides, shall also be identified and reported as being present. Nuclides which are below the LLD for the analysis may not be reported as being present at the LLD Level for that nuclide. When unusual circumstances result in LLD's higher than required the reasons shall be documented in the semi-annual effluent report.

TABLE 4.8.B

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) μCi/ml
A. Containment Purge	Each Purge Grab Sample	Each Purge	Principal Gamma Emitters (3) H-3	1E-4 (1) 1E-6
B. 1. Stack			Principal Gamma Emitters (3)	1E-4 (1)
2. Building Ventilation	Grab Sample	Monthly	H-3	1E-6
a. Reactor/Turbine				
b. Turbine Exhaust				
c. Radwaste				
C. All Release Points listed in B. above	Continuous	Charcoal Sample Weekly	I-131 I-133	1E-12 (2) 1E-10 (2)
	Continuous	Particulate Sample Weekly	Principal Gamma Emitters (3)	1E-11 (2)
	Continuous	Composite Particulate Sample Monthly	Gross	1E-11
	Continuous	Composite Particulate Sample Quarterly	Sr-89, Sr 90	1E-11

TABLE NOTATION - 4.8.B

(1) For certain radionuclides with low gamma yield or low energies, or for certain radionuclide mixtures, it may not be possible to measure radionuclides in concentrations near their sensitivity limits when other nuclides are present in the sample in much greater concentrations. Under these circumstances, it will be more appropriate to calculate the concentrations of such radionuclides using observed ratios with those radionuclides which are measurable or the lower limit of detection may be increased proportionally to the magnitude of the gamma yield (i.e. 1E-4/I where I is the photon abundance expressed as a decimal fraction), but in no case shall the lower limit of detection as calculated in this manner be greater than 10% of the MPC value specified in 10 CFR Part 20, Appendix B, Table II, Column 1.

(2) When samples are taken more often than that shown, the minimum detectable concentrations can be correspondingly higher.

(3) The principal gamma emitters for which the LLD specification will apply are exclusively the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emissions and Mn-54, Fe-59, Co-58, Co-60, Zn-65, MO-99, Cs-134, Cs-137, Ce-141, and Ce-144 for parciculate emissions. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level for that nuclide. When unusual circumstances result in LLD's higher than required, the reasons shall be documented in the semi-annual effluent report. The principal gamma emitters (those expected to account for a 95% of the activity present) for which the LLD specification will apply are exclusively the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emissions and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, and Cs-137 for particulate emissions. This list does not mean that only these nuclides are to be detected and reported. Other nuclides which influence accounting for 95% of the total activity together with the above nuclides shall also be identified and reported. Nuclides which are below the LLD for the analyses may not be reported as being present at the LLD level for that nuclide. When unusual circumstances result in the LLD's higher than required, the reason shall be documented in the semi-annual effluent report.

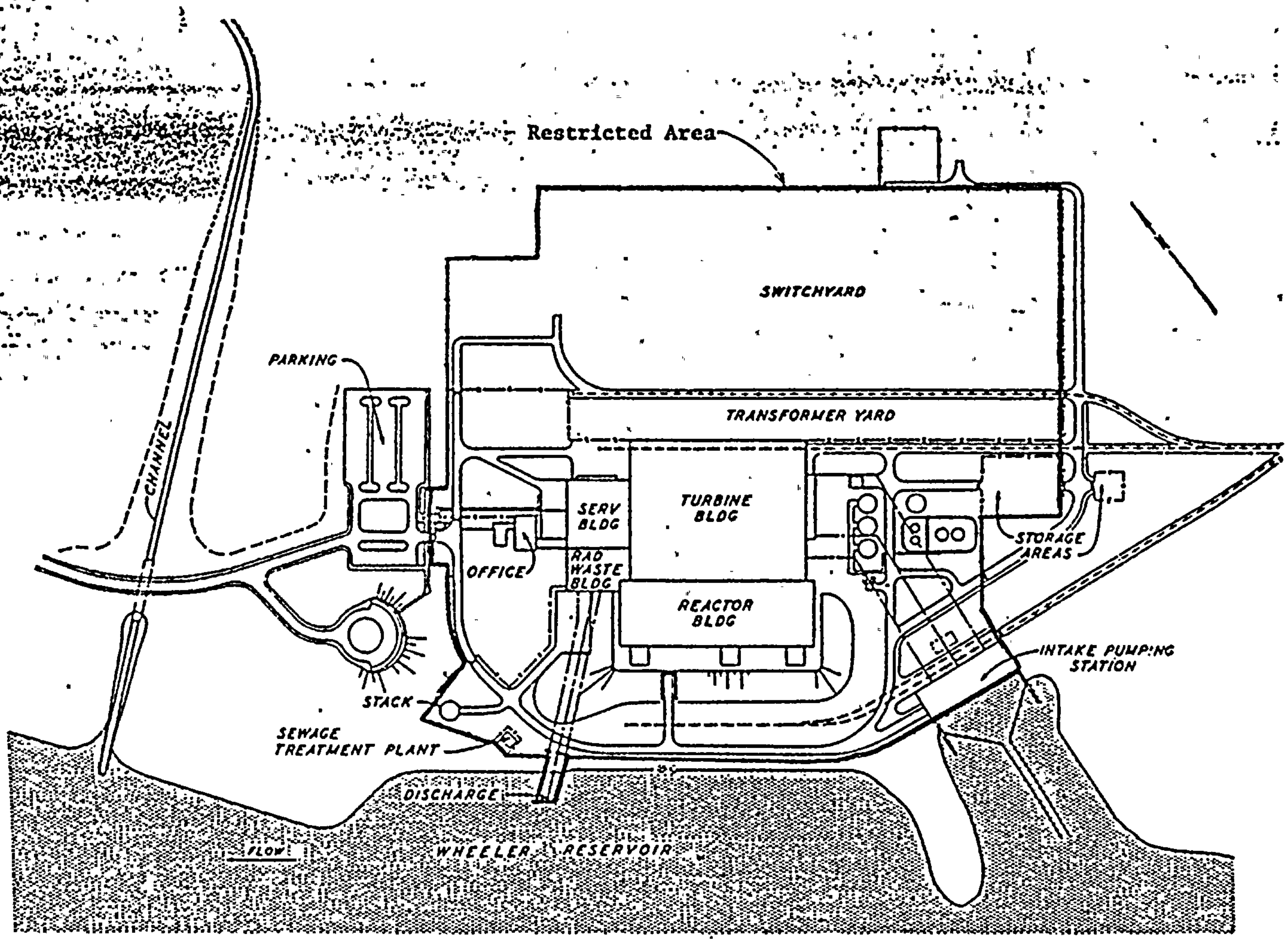


FIGURE 4.8.A.1 Assumed Liquid Effluent Restricted Area

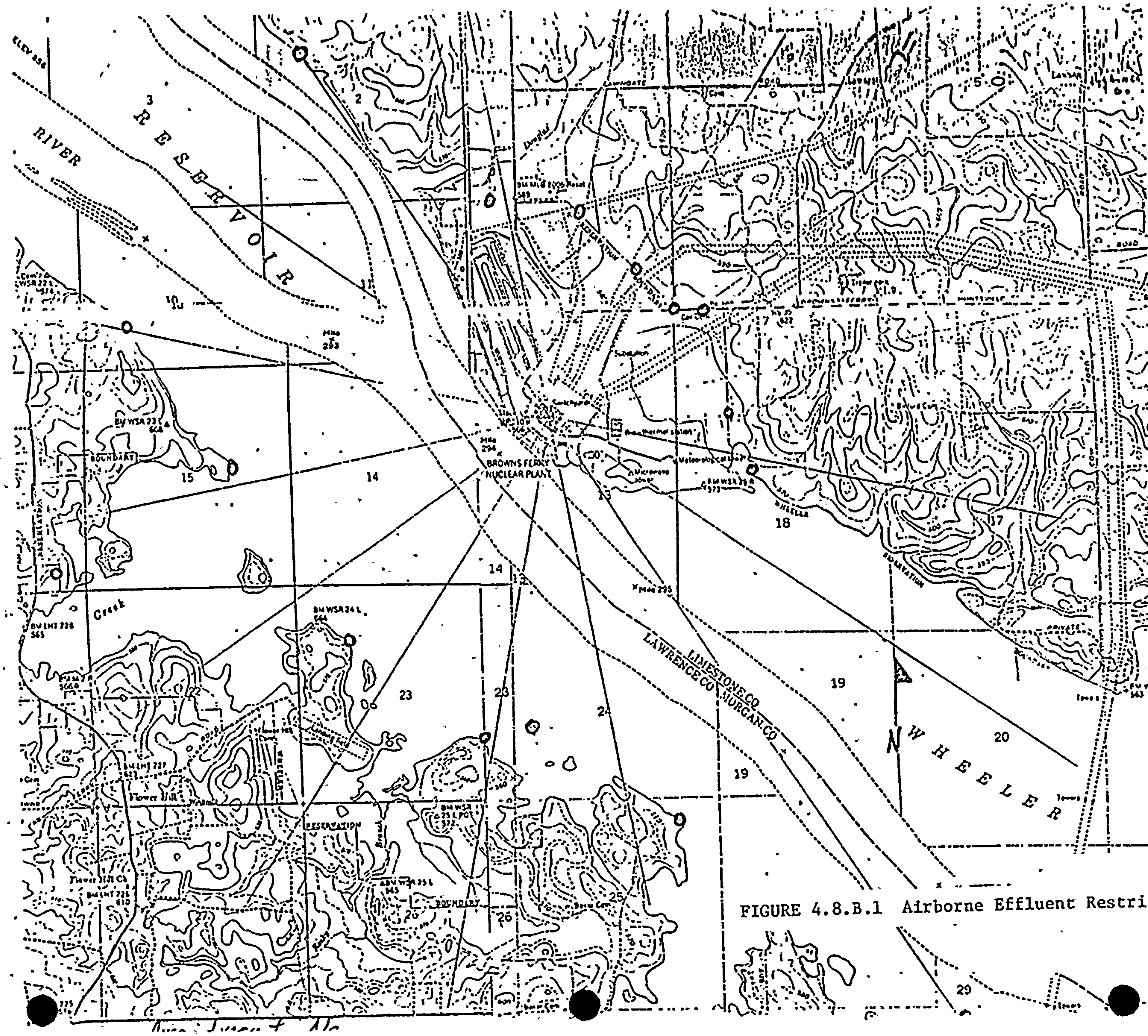


FIGURE 4.8.B.1 Airborne Effluent Restricted Area

3.8 BASES

Radioactive waste release levels to unrestricted areas should be kept "as low as reasonably achievable" and are not to exceed the concentration limits specified in 10 CFR Part 20. At the same time, these specifications permit the flexibility of operation, compatible with considerations of health and safety, to assure that the public is provided a dependable source of power under unusual operating conditions which may temporarily result in releases higher than design objectives but still within the concentration limits specified in 10 CFR Part 20. It is expected that by using this operational flexibility under unusual operating conditions, and exerting every effort to keep levels of radioactive materials released as low as reasonably achievable, the annual releases will not exceed a small fraction of the annual average concentration limits specified in 10 CFR Part 20.

3.8.A LIQUID EFFLUENTS

Specification 3.8.A.1 is provided to ensure that the concentration of radioactive materials released in liquid waste effluents from the site to unrestricted areas will be less than the concentration levels specified in 10 CFR Part 20, Appendix B, Table II. This limitation provides additional assurance that the levels of radioactive materials in bodies of water outside the site will not result in exposures within (1) the Section 11.A design objectives of Appendix I, 10 CFR Part 50, to an individual and (2) the limits of 10 CFR Part 20.106 (e) to the population. The concentration limit for noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

Specification 3.8.A.3 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 11.A of Appendix I.

Specification 3.8.A.4 provides the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents will be kept "as low as is reasonably achievable". Also, for fresh water sites with drinking water supplies which can be potentially affected by plant operations, there is reasonable assurance that the operation of the facility will not result in radionuclide concentrations in the finished drinking water that are in excess of the requirements of 40 CFR 141. The dose calculations in the ODCM implement the requirements in section III.A of Appendix I that conformance with

3.8.A LIQUID EFFLUENTS (cont'd)

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-0133 provides methods for dose calculations consistent with Regulatory Guides 1.109 and 1.113.

Specification 3.8.A.5 requires that the appropriate portions of the liquid radwaste treatment system be used when specified. This 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. The specified limits governing the use of appropriate portions of the liquid radwaste treatment system were specified as a suitable fraction of the guide set forth in Section 11.A of Appendix I, 10 Cfr Part 50, for liquid effluents.

Specification 3.8.A.6 requires submittal of a special report if the limiting values of Specification 3.8.A.5 are exceeded and unexpected failures of non-redundant radwaste processing equipment halt waste treatment.

Specification 3.8.A.7 requires that suitable equipment to control and monitor the releases of radioactive materials in the liquid effluents are operating during any period when these releases are taking place.

3.8.B AIRBORNE EFFLUENTS

Specification 3.8.B.1 is provided to ensure that the dose rate at anytime at the exclusion boundary from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 for unrestricted areas. The annual dose limits are the doses associated with the concentrations of 10 CFR Part 20, Appendix B, Table II. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of an individual in an unrestricted area, either within or outside the exclusion area boundary, to annual average concentrations exceeding the limits specified in Appendix B, Table II of 10 CFR Part 20 (10 CFR Part 20.106(b)0. For individuals who may at times be within the exclusion area boundary, the occupancy of the individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the exclusion area boundary.

3.8.B AIRBORNE EFFLUENTS (Cont'd)

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 exclusion area boundary to $\leq$ (500) mrem/year to the total body or to $\leq$ (3000) mrem/year to the skin. These release rate limits also restrict, at all times. the corresponding thyroid dose rate above background to an infant via the cow-milk-infant pathway to $\leq$ 1500 mrem/year for the nearest cow to the plant.

Specification 3.8.B.2 requires that appropriate corrective action (s) be taken to reduce gaseous effluent releases if the limits of 3.8.B.1 are exceeded.

Specification 3.8.B.5 is provided to implement the requirements of Section II.C, III.A, and IV of Appendix I, 10 CFR Part 50. The limiting conditions for operation are the guides set forth in Section II.c of Appendix I.

Specification 3.8.B.6 provides 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 reasonably achievable." The ODCM calculational methods specified in the surveillance requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways 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, "Calculating 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 I, 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 doeses based upon the historical average atmospheric conditions. The release rate specifications for radioiodines, 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 are examined in the development of these calculations are: 1) individual inhalation of airborne radionuclides, 2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, 3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, and 4) deposition on the ground with subsequent exposure of man.

Specification 3.8.B.6 requires that a special report be prepared and submitted to explain violations of the limiting doses contained in Specification 3.8.B.5.

AIRBORNE EFFLUENTS

Specification 3.8.B.7 requires that the offgas charcoal adsorber beds be used when specified to treat gaseous effluents prior to their release to the environment. This provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." This specification implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and design objective Section IID of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the guide set forth in Sections II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents.

Specification 3.8.B.8 requires that a special report be prepared and submitted to explain reasons for any failure to comply with Specification 3.8.B.7.

Specification 3.8.B.3 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 IV.A of B of Appendix I.

Specification 3.8.B.4 provides 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 provided for determining the air doses at the exclusion area boundary will be based upon the historical average atmospheric conditions. NUREG-0133 provides methods for dose calculations consistent with Regulatory Guides 1.109 and 1.111. Specification 3.8.B.4 requires that a special report be prepared and submitted to explain violations of the limiting doese contained in Specification 3.8.B.3.

3.8.D.4.8.D Mechanical Vacuum Pump

The purpose of isolating the mechanical vacuum pump line is to limit the release of activity from the main condenser. During an accident, fission products would be transported from the reactor through the main steam lines to the condenser. The fission product radioactivity would be sensed by the main steam line radioactivity monitors which initiate isolation.

4.8.A AND 4.8.B BASES

The surveillance requirements given under Specification 4.8.A and 4.8.B provide assurance that liquid and gaseous wastes are properly controlled and monitored during any release of radioactive materials in the liquid and gaseous effluents. These surveillance requirements provide the data for the licensee and the Commission to evaluate the station's performance relative to radioactive wastes released to the environment. Reports on the quantities of radioactive materials released in effluents shall be furnished to the Commission on the basis of Section 6 of these technical specifications. On the basis of such reports and any additional information the Commission may obtain from time to time require the licensee to take such actions as the Commission deems appropriate.

3.8.E and 4.8.E BASES

The objective of this specification is to assure that leakage from byproduct, source, and special nuclear radioactive material sources does not exceed allowable limits.

(b). Annual Operating Report

A tabulation on an annual basis of the number of station, utility and other personnel (including contractors) receiving exposures greater than 100 mrem/yr and their associated man rem exposure according to work and job functions,* e.g., reactor operations and surveillance, inservice inspection, routine maintenance, special maintenance (describe maintenance), waste processing, and refueling. The dose assignment to various duty functions may be estimates based on pocket dosimeter, TLD, or film badge measurements. Small exposures totalling less than 20% of the individual total dose need not be accounted for. In the aggregate, at least 80% of the total whole body dose received from external sources shall be assigned to specific major work functions.

c. Monthly Operating Report. Routine reports of operating statistics and shutdown experience shall be submitted on a monthly basis to the Office of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, with a copy to the appropriate Regional Office, to be submitted no later than the tenth of each month following the calendar month covered by the report. A narrative summary of operating experience shall be submitted in the above schedule.

Any changes to the Offsite Dose Calculation Manual of Specification 6.10 shall be submitted with the Monthly Operating Report within 90 days in which the change(s) was made effective.

6.0 ADMINISTRATIVE CONTROLS

d. Radiological Environmental Monitoring

1. TVA shall prepare a report entitled "Environmental Radioactivity Levels - Browns Ferry Nuclear Plant - Annual Report." The report shall cover the previous 12 months of operation and shall be submitted to the Director of the NRC Region II Office (with a copy to the Director, Office of Nuclear Reactor Regulation) within 120 days after January 1 of each year. The report format shown in Regulatory Guide 4.8 Title 1 shall be used. The report shall include summaries, interpretations, and evaluations of the results of the radiological environmental surveillance activities for the report period, including a comparison with preoperational studies and/or operational controls (as appropriate), and an assessment of the observed impacts of the plant operation on the environment. If harmful effects or evidence of irreversible damage are detected by the monitoring, the licensee shall provide an analysis of the problem and a proposed course of action to alleviate the problem.

2. Results of all radiological environmental samples taken shall be summarized and tabulated on an annual basis. In the event that some results are not available within the 120-day period, 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.

2. Reportable Occurrences

Reportable occurrences, including corrective actions and measures to prevent reoccurrence, shall be reported to the NRC. Supplemental reports may be required to fully describe final resolution of occurrence. In case of corrected or supplemental reports, a licensee event report shall be completed and reference shall be made to the original report date.

(9) Performance of structures, systems, or components that requires remedial action or corrective measures to prevent operation in a manner less conservative than assumed in the accident analyses in the safety analysis report or technical specifications bases; or discovery during plant life of conditions not specifically considered in the safety analysis report or technical specifications that require remedial action or corrective measures to prevent the existence or development of an unsafe condition.

Note: This item is intended to provide for reporting of potentially generic problems.

(10) The concentration of radioactive material in liquid effluents released to unrestricted areas exceeds the concentrations specified in 10 CFR Part 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. Concentration of dissolved or entrained noble gases exceeds 2×10^{-4} Ci/ml total activity.

(11) (a). The dose rate for noble gases equals or exceeds 500 mrem/yr to the total body or 3000 mrem/yr to the skin.

(b). The dose rate for all radioiodines, for all radioactive materials in particular form, and for radionuclides other than noble gases with half lives greater than 8 days exceeds 1500 mrem/yr to any organ.

b. Thirty-Day Written Reports. The reportable occurrences discussed below shall be the subject of written reports to the Director of the appropriate Regional Office within thirty days of occurrence of the event. The written report shall include, as a minimum, a completed copy of a licensee event report form. Information provided on the licensee event report form shall be supplemented, as needed, by additional narrative material to provide complete explanation of the circumstances surrounding the event.

(1) Reactor protection system or engineered safety feature instrument settings which are found to be less conservative than those established by the technical specifications but which do not prevent the fulfillment of the functional requirements of affected systems.

(2) Conditions leading to operation in a degraded mode permitted by a limiting condition for operation or plant shutdown required by a limiting condition for operation.

Note: Routine surveillance testing, instrument calibration, or preventative maintenance which require system configurations as described in items 2.b.(1) and 2.b.(2) need not be reported except where test results themselves reveal a degraded mode as described above.

(3) Observed inadequacies in the implementation of administrative or procedural controls which threaten to cause reduction of degree of redundancy provided in reactor protection systems or engineered safety feature systems.

(4) Abnormal degradation of systems other than those specified in item 2.a(3) above designed to contain radioactive material resulting from the fission process.

Note: Sealed sources or calibration sources are not included under this item. Leakage of valve packing or gaskets within the limits for identified leakage set forth in technical specifications need not be reported under this item.

(5) An unplanned offsite release of 1) more than 1 curie of radioactive material in liquid effluents, 2) more than 150 curies of noble gas in gaseous effluents, or 3) more than 0.05 curies of radioiodine in gaseous effluents. The report of an unplanned offsite release of radioactive material shall include the following information:

1. A description of the event and equipment involved.

2. Cause(s) for the unplanned release.

3. Actions taken to prevent recurrence.

4. Consequences of the unplanned release.

6.0 ADMINISTRATIVE CONTROLS

c. Anomalous Measurements -Radiological Environmental Monitoring

(1.) If, during any 12-month report period, a measured level of radioactivity in any environmental medium other than those associated with gaseous radioiodine releases exceeds ten times the control station value, a written notification will be submitted within one week advising the NRC of this condition.* This notification should include an evaluation of any release conditions, environmental factors, or other aspects necessary to explain the anomalous result.

(2.) If, during any 12-month report period, a measured level of radioactivity in any environmental medium other than those associated with gaseous radioiodine releases exceeds four times the control station value, a written notification will be submitted within 30 days advising the NRC of this condition. This notification should include an evaluation of any release conditions, environmental factors, or other aspects necessary to explain the anomalous result.

(3.) If individual milk samples show I-131 concentrations of 10 picocuries per liter or greater, a plan shall be submitted within 10 days advising the NRC of the proposed action to ensure the plant related annual doses will be within the design objective of 15 mrem/yr/reactor to the thyroid of any individual.

(4.) If milk samples collected over a calendar quarter show average concentrations of 6.0 picocuries per liter or greater, a plan shall be submitted within 30 days advising the NRC of the proposed action to ensure the plant-related annual doses will be within the design objective of 15 mrem/yr/reactor to the thyroid of any individual.

*In the case of a tentatively anomalous value for radiostrontium, a confirmatory reanalysis of the original, a duplicate or a new sample may be desirable. In this instance the results of the confirmatory analysis shall be completed at the earliest time consistent with the analysis, and if the high value is real, the report to the NRC shall be submitted within one week following this analysis.

(5.) If such levels as discussed in 6.7.2.c.3 and 6.7.2.c.4 can be definitely shown to result from sources other than the Browns Ferry Nuclear Plant, the reporting action called for in ~~5.6.3~~(a)3 and 5.6.3(a)4 need not be taken. Justification for assigning high levels of radioactivity to sources other than the Browns Ferry Nuclear Plant must be provided in the annual report.

6.7.3 Unique Reporting Requirements

A. Radioactive Effluent Release Report

A report on the radioactive discharges released from the site during the previous 6 months of operation shall be submitted to the Director of the Regional Office of Inspection and Enforcement within 60 days after January 1 and July 1 of each year. The report shall include a summary of the quantities of radioactive liquid and gaseous effluents released and solid waste shipped from the plant as delineated in Regulatory Guide 1.21, Revision 1, "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," with data summarized on a quarterly basis following the format of Appendix B thereof.

The report shall include a summary of the meterological conditions concurrent with the release of gaseous effluents during each quarter as outlined in Regulatory Guide 1.21, Revision 1, with data summarized on a quarterly basis following the format of Appendix B thereof. Calculated offsite dose to humans resulting from the release of effluents and their subsequent dispersion in the atmosphere shall be reported as recommended in Regulatory Guide 1.21, Revision 1. Doses to individuals outside the site boundary (UNRESTRICTED AREA) shall be calculated in accordance with the ODCM.

B. Source Tests

Results of required leak tests performed on sources if the tests reveal the presence of 0.005 microcurie or more of removable contamination.

C. Special Reports (in writing to the Director of Regional Office of Inspection and Enforcement).

1. Reports on the following areas shall be submitted as noted:

a.	Secondary Containment Leak Rate Testing (5)	4.7.C	Within 90 days of completion of each test.
b.	Fatigue Usage Evaluation	6.6	Annual Operating Report
c.	Seismic Instrumentation Inoperability	3.2.J.3	Within 10 days after 30 days of inoperability

2. 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 action(s) to be taken to reduce the releases of radioactive material in liquid effluents during the remainder of the current calendar quarter and during the subsequent three calendar quarters so that the average dose or dose commitment to an individual from such releases during these four calendar quarters is within 3 mrem to the total body and 10 mrem to any organ. This Special Report shall also include: (1) the results of radiological analyses of the drinking water sources (if applicable), and (2) the radiological impact on finished drinking water supplies with regard to the requirements of 40 CFR 141, Safe Drinking Water Act. (Applicable only if drinking water supply is taken from the receiving water body.) See item 6 below.

3. Prepare and submit to the Commission within 30 days, a Special Report which includes the following information:

   a. Identification of equipment of subsystems not OPERABLE and the reason for nonoperability.
   b. Action(s) taken to restore the non operable equipment to OPERABLE status.

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

4. 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 to be taken to reduce the releases of radioiodines, radioactive materials in particulate form, and radionuclides other than noble gases with half-lives greater than 8 days in gaseous effluents during the remainder of the current calendar quarter and during the subsequent three calendar quarters so that the average dose or dose commitment to an individual from such releases during these four calendar quarters is within 15 mrem to any organ. See item 6 below.

5. 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 reduce the releases of radioactive noble gases in gaseous effluents during the remainder of the current calendar quarter and during the subsequent three calendar quarters so that the average dose during these four calendar quarters is within 10 mrad for gamma radiation and (20) mrad for beta radiation. See item 6 below.

6. Prepare and submit to the Commission a Special Report which includes an analysis demonstrating that radiation exposures to all real individuals 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.

UNIT 3

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 conincident tripping of two trip systems.

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

8. Protective Function - A system protective action which results from the protective action of the channels monitoring a particular plant condition.

9. Simulated Automatic Acutation - Simulated automatic acutation means applying a simulated signal to the sensor to actuate the circuit in question.

10. Logic - A logic is an arrangement of relays, contacts, and other components that produces a decision output.

    (a) Initiating - A logic that receives signals from channels and produces decision outputs to the actuation logic.

    (b) Actuation - A logic that receives signals (either from initiation logic or channels) and produces decision outputs to accomplish a protective action.

11. Channel Calibration - Shall be the adjustment, as necessary, of the channel output such that it responds with necessary range and accuracy to known values of the parameters which the channel monitors. The channel calibration shall encompass the entire channel including alarm and/or trip functions and shall include the channel functional test. The channel calibration may be performed by any series of sequential, overlapping or total channel steps such that the entire channel is calibrated. Non-calibratable components shall be excluded from this requirement, but will be included in channel functional test and source check.

12. Channel Functional Test - Shall be :

a. Analog Channels - the injection of a simulated signal into the channel as close to the sensor as practicable to verify OPERABILITY including alarm and/or trip functions.

b. Bistable channels - the injection of a simulated signal into the sensor to verify OPERABILITY including alarm and/or trip functions.

13. Source Check - Shall be the qualitative assessment of channel response when the channel sensor is exposed to a radioactive sources or multiple of sources.

W. Functional Tests - A functional test is the manual operation or initiation of a system, subsystem, or component to verify that it functions within design tolerances (e.g., the manual start of a core spray pump to verify that it runs and that it pumps the required volume of water).

X. Shutdown - The reactor is in a shutdown condition when the reactor mode switch is in the shutdown mode position and no core alterations are being performed.

Y. Engineered Safeguard - An engineered safeguard is a safety system the actions of which are essential to a safety action required in response to accidents.

Z. Cumulative Downtime - The cumulative downtime for those safety components and systems whose downtime is limited to 7 consecutive days prior to requiring reactor shutdown shall be limited to any 7 days in a consecutive 30 day period.

AA. Solidification - Shall be the conversion of radioactive wastes to conform to the license requirement of the receiving burial ground.

BB. Offsite Dose Calculation Manual (ODCM) Shall be a manual describing the environmental monitoring program and the methodology and parameters used in the calculation of release rate limits and off-site doses due to radioactive gaseous and liquid effluents.

CC. Unrestricted Area - All area beyond the site boundary access to which is not controlled for protection of individuals from exposure to radiation and radioactive materials.

TABLE 1.1

SURVEILLANCE FREQUENCY NOTATION

NOTATION	FREQUENCY
S	At least once per 12 hours.
D	At least once per 24 hours.
W	At least once per 7 days.
M	At least once per 31 days.
Q	At least once per 92 days.
SA	At least once per 6 months.
R	At least once per 18 months.
S/U	Prior to each reactor startup.
N.A.	Not applicable.

Amendment No.

3.2.K <u>Radioactive Gaseous Effluent Monitoring Instrumentation</u>

1. The radioactive gaseous effluent monitoring instruments listed in table 3.2.K shall be operable at all times with their alarm/trip setpoints set to ensure that the limits of specification 3.8.B.1 are not exceeded.

2. The action required when the number of operable channels is less than the Minimum Channels Operable requirement is specified in the notes for table 3.2.K.

4.2.K <u>Radioactive Gaseous Effluent Monitoring Instrumentation</u>

1. Each of the radioactive gaseous effluent monitoring instruments shall be demonstrated operable by performance of tests in accordance with table 4.2.K.

TABLE 3.2.K

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

Instrument	Minimum Channels Operable	Applicability	Parameter	Action
1. Stack				
a. Noble Gas Activity Monitor	(1)	*	Release Rate Measurement	A/C
b. Iodine Cartridge	NA	*	Installed	B
c. Particulate filter	NA	*	Installed	B
2. Reactor /Turbine Building Ventilation				
a. Noble Gas Activity Monitor	(1)	*	Release Rate Measurement	A/C
b. Iodine Monitor	(1)	*	Release Rate Measurement	B/C
c. Particulate Monitor	(1)	*	Release Rate Measurement	B/C
3. Turbine Building Exhaust				
a. Noble Gas Activity Monitor	(1)	*	Release Rate Measurement	A/C
b. Iodine Monitor	(1)	*	Release Rate Measurement	B/C
c. Particulate Monitor	(1)	*	Release Rate Measurement	B/C

3.2.K (Continued)
RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

Instrument	Minimum Channels Operable	Applicability	Parameter	Action
4. Radwaste Building Ventilation				
a. Noble Gas Activity Monitor	(1)	*	Release Rate	A/C
b. Iodine Monitor	(1)	*	Release Rate Measurement	B/C
c. Particulate Monitor	(1)	*	Release Rate Measurement	B/C

NOTES FOR TABLE 3.2.K

*During releases via this pathway.

ACTION A

With the number of channels OPERABLE less than required by the Minimum Channels Operable requirement, effluent releases via the affected pathway may continue for up to 7 days provided a temporary monitoring system is installed or grab samples are taken and analyzed at least once every 4 hours.

ACTION B

With the number of channels OPERABLE less than required by the Minimum Channels Operable requirement, effluent releases via this pathway may continue for up to 28 days, provided samples are continuously collected with auxiliary sampling equipment for periods on the order of seven (7) days and analyzed within 48 hours after the end of the sampling period.

ACTION C

A monitoring system may be out of service for 4 hours for functional testing, calibration, or repair without providing temporary monitor or initiating grab sampling.

TABLE 4.2.K
RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

Instrument	Instrument Check	Source Check	Channel Calibration	Channel Functional Test	Modes In Which Surveillance Required
1. Stack					
a. Noble Gas Activity Monitor	D	M	Q(1)	M(2)	*
2. Reactor/Turbine Building Ventilation					
a. Noble Gas Activity Monitor	D	M	Q(1)	M(2)	*
b. Iodine Monitor	D	M	Q(1)	M(2)	*
c. Particulate Monitor	D	M	Q(1)	M(2)	*
3. Turbine Building Exhaust					
a. Noble Gas Activity Monitor	D	M	Q(1)	M(2)	*
b. Iodine Monitor	D	M	Q(1)	M(2)	*
c. Particulate Monitor	D	M	Q(1)	M(2)	*
4. Radwaste Building Ventilation					
a. Noble Gas Activity Monitor	D	M	Q(1)	M(2)	*
b. Iodine Monitor	D	M	Q(1)	M(2)	*
c. Particulate Monitor	D	M	Q(1)	M(2)	*

NOTES FOR TABLE 4.2.K

*During releases via this pathway.

(1) The CHANNEL CALIBRATION shall include the use of a known (traceable to the National Bureau of standards radiation measurement system) radioactive source (s) positioned in a reproducible geometry with respect to the sensor.

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

1. Instrument indicates measured levels above the alarm/trip setpoint.

2. Instrument indicates an inoperable downscale failure.

The operability of the seismic instrumentation ensures that sufficient capability is available to promptly determine the magnitude of a siesmic event and evaluate the response of those features important to safety. This capability is required to permit comparison of the measured response to that used in the design basis for Browns Ferry Nuclear Plant. The instrumentation provided is consistent with specific portions of the recommendations of Regulatory Guide 1.12 "Instrumentation for Earthquakes."

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The alarm/trip setpoints for these instruments will be calculated in accordance with plant approved procedures to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20.

The most likely case would be to stipulate that one channel be bypassed, tested, and restored, and then immediately following, the second channel be bypassed, tested, and restored. This is shown by Curve No. 4. Note that there is no true minimum. The curve does have a definite knee and very little reduction in system unavailability is achieved by testing at a shorter interval than computed by the equation for a single channel.

The best test procedure of all those examined is to perfectly stagger the tests. That is, if the test interval is four months, test one or the other channel every two months. This is shown in Curve No. 5. The difference between Cases 4 and 5 is negligible. There may be other arguments, however, that more strongly support the perfectly staggered tests, including reductions in human error.

The conclusions to be drawn are these:

1. A 1 out of n system may be treated the same as a single channel in terms of choosing a test interval; and

2. more than one channel should not be bypassed for testing at any one time.

The radiation monitors in the refueling area ventilation duct which initiate building isolation and standby gas treatment operation are arranged in two 1 out of 2 logic systems. The bases given for the rod blocks apply here also and were used to arrive at the functional testing frequency. The off-gas post treatment monitors are connected in a 2 out of 2 logic arrangement. Based on experience with instruments of similar design, a testing interval of once every three months has been found adequate.

The automatic pressure relief instrumentation can be considered to be a 1 out of 2 logic system and the discussion above applies also.

The criteria for ensuring the reliability and accuracy of the radioactive gaseous effluent instrumentation in listed in Table 4.2.K.

LIMITING CONDITIONS FOR OPERATION

3.8 RADIOACTIVE MATERIALS

Applicability

Applies to the controlled release of radioactive liquids and gases from the facility.

Objective

To define the limits and conditions for the release of radioactive effluents to the environs to assure that any radioactive releases are as low as reasonably achieveable and within the limits of 10 CFR Part 20.

Specification

A. Liquid Effluents

1. The concentration of radioactive material released at any time from the site to unrestricted areas (see Figure 4.8.A.1 shall be limited to the concentrations specified in 10 CFR Part 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2E-4 μCi/ml total activity.

2. If the limits of 3.8.A.1 are exceeded, appropriate action shall be initiated to bring the release within limits. Provide prompt notification to the NRC pursuant to Section 6.7.2.a.

3. The dose or dose commitment to an individual from radioactive materials in liquid effluents released from each unit to unrestricted areas (See Figure 4.8.A.1) shall be limited:

SURVEILLANCE REQUIREMENTS

4.8 RADIOACTIVE MATERIALS

Applicability

Applies to the periodic test and record requirements and sampling and monitoring methods used for facility effluents.

Objective

To ensure that radioactive liquid and gaseous releases from the facility are maintained within the limits specified by Specifications 3.8.A and 3.8.B.

Specification

A. Liquid Effluents

1. Facility records shall be maintained of radioactive concentrations and volume before dilution of each batch of liquid effluent released, and of the average dilution flow and length of time over which each discharge occurred.

2. Radioactive liquid waste sampling and activity analysis of each liquid waste batch to be discharged shall be performed prior to release in accordance with Table 4.8.A.

3. The liquid effluent radiation monitor shall be calibrated at least quarterly by means of a known radioactive source(s). The monitor shall also have an instrument channel functional test monthly and an instrument check daily.

3.8.A Liquid Effluents

a. During any calendar quarter to <1.5 mrem to the total body and to ≤5 mrem to any organ and,

b. During any calendar year to≤3 mrem to the total body and≤10 mrem to any organ.

4. If the limits specified in 3.8.A.3. a&b above are exceeded, prepare and submit Special Report persuant to Section 6.7.3.C.2.

5. The liquid radwaste system shall be maintained and operated to process liquid radwaste when it appears during quarterly operation that the releases to unrestricted areas (see Figure 4.8.A.1) when averaged over 31 days would exceed 0.06 mrem to the total body and 0.21 mrem to any organ.

6. During a quarter if radioactive liquid waste must be discharded without treatment after the limits specified in 3.8.A.5 above are exceeded, prepare and submit the Special Report pursuant to Section 6.7.3.C.3.

7. During release of radioactive wastes from the radwaste processing system, the following conditions shall be met:

a. Liquid waste activity and flow rate shall be continuously monitored and recorded during release and shall be set to alarm and automatically close the waste discharge valve before exceeding the limits specified in 3.8.A.1. above. If this requirement cannot be met, continued release of liquid effluents shall be permitted only during the succeeding 48 hour period, two independent samples of each tank shall be analyzed and two station personnel shall independently check valving before the discharge.

4.8.A Liquid Effluents

4. The operation of the automatic isolation valves and discharge tank selection values shall be checked annually.

5. The accuracy of the radwaste effluent flow rate monitor shall be checked at least monthly.

6. Cummulative quarterly and yearly dose contributions from liquid effluents shall be determined as specified in plant approved procedures at least once every 31 days.

7. Doses due to liquid releases to unrestricted areas shall be projected at least once per 31 days.

3.8 RADIOACTIVE MATERIALS

B. Airborne Effluents

1. The dose rate at any time in the unrestricted areas (see Figure 4.8.B.1) due to radioactivity released in gaseous effluents from the site shall be limited to the following values:

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

b. The dose rate limit for all radioiodines for all radioactive materials in particulate form, and for radionuclides other than noble gases with half lives greater than 8 days shall be 1500 mrem/yr to any organ.

2. If the limits of 3.8.B.1 are exceeded, appropriate corrective action shall be initiated to bring the releases within limits. Provide prompt notification to the NRC pursuant to section 6.7.2.a.

4.8 RADIOACTIVE MATERIALS

B. Airborne Effluents

1. The gross β/γ and particulate activity of gaseous wastes released to the environment shall be monitored and recorded.

a. For effluent streams having continuous monitoring capability, the activity and flow rate shall be monitored and recorded to enable release rates of gross radioactivity to be determined on an hourly basis using instruments specified in Table 3.2.K.

b. For effluent streams without continuous monitoring capability, the activity shall be monitored and recorded and the releases through these streams shall be controlled so that the release rates from all streams are within the limits specified in 3.8.B

2. Radioactive gaseous waste sampling and activity analysis shall be performed in accordance with Table 4.8.B.

3. The air dose in unrestricted areas (see Figure 4.8.B.1) due to noble gases released in gaseous effluents per unit shall be limited to the following:

   a. During any calendar quarter, to ≤ 5 mrad for gamma radiation and ≤ 10 mrad for beta radiation;

   b. During any calendar year, to ≤ 10 mrad for gamma radiation and ≤ 20 mrad for beta radiation.

4. If the calculated air dose exceeds the limits specified in 3.8.B.3 above, prepare and submit a special report pursuant to section 6.7.3.C.5

5. The dose to an individual from radioiodines, radioactive materials in particulate form, and radionuclides other than noble gases with half lives greater than 8 days in gaseous effluent released per unit to unrestricted areas (see Figure) shall be limited to the following:

   a. During any calendar quarter to ≤ 7.5 mrem;

   b. During any calendar year to ≤ 15 mrem;

3. Cumulative quarterly and yearly dose contributions shall be determined as specified in plant approve procedures at least once every 31 days.

4. Doses due to gaseous releases to unrestricted areas shall be projected at least once per 31 days.

5. Samples of offgass effluents shall be analyzed at least weekly to determine the identity and quantity of the principal radionuclides being released.

6. If the calculated doses exceed the limits of 3.8.B.5 above, prepare and submit a special report pursuant to section 6.7.3.C.4

7. During operation above 50% power the discharge of the SJAE must be routed through the charcoal adsorbers when the projected gaseous effluent releases to unrestricted areas (see Figure 4.8.B.1) when averaged over 31 days would exceed 0.2 mrad for gamma radiation and 0.4 mrad for beta radiation.

8. With gaseous wastes being discharged for more than 31 days without treatment and in excess of the limits of 3.8.B.7 above, prepare and submit a special report pursuant to section 6.7.3.C.3

3.8.C Radioactive Effluents - Dose

1. The dose or dose commitment to a real individual from all uranium fuel cycle sources is limited to ≤ 25 mrem to the total body or any organ (except the thyroid, which is limited to ≤ 75 mrem) over a period of 12 consecutive months.

2. With the calculated dose from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of specification 3.8.A3, 3.8.B.3, or 3.8.B.5, prepare and submit a Special Report to the Commission pursuant to specification 6.7.3.C.6 and limit the subsequent releases such that the limits of 3.8.C.1 are not exceeded.

4.8.C Radioactive Effluents - Dose

1. Cumulative dose contributions from liquid and gaseous effluents shall be determined in accordance with specifications 3.8.A. 3, 3.8.B.3, and 3.8.B.5.

D. Mechanical Vacuum Pump

1. The mechanical vacuum pump shall be capable of being automatically isolated and secured on a signal or high radioactivity in the steam lines whenever the main steam isolation valves are open.

2. If the limits of 3.8.C.1 are not met, the vacuum pump shall be isolated.

D. Mechanical Vacuum Pump

At least once during each operating cycle verify automatic securing and isolation of the mechanical vacuum pump.

3.8 RADIOACTIVE MATERIALS

E. Miscellaneous Radioactive Materials Sources

1. Source Leakage Test

Each sealed source containing radioactive material in excess of those quantities of byproduct material listed in 10 CFR 30.71 Schedule B and all other sources, including alpha emitters, in excess of 0.1 microcurie, shall be free of ≥ 0.005 microcurie of removable contamination. Each sealed source with removable contamination in excess of the above limit shall be immediately withdrawn from use and (a) either decontaminated and repaired, or (b) disposed of in accordance with Commission regulations.

4.8 RADIOACTIVE MATERIALS

E. Miscellaneous Radioactive Materials Sources

1. Surveillance Requirement

Tests for leakage and/or contamination shall be performed by the licensee or by other persons specifically authorized by the Commission or an agreement State, as follows:

a. Each sealed source, except startup sources subject to core flux, containing radioactive material, other than Hydrogen 3, with a half-life greater than thirty days and in any form other than gas, shall be tested for leakage and/or contamination at intervals not to exceed six months. The leakage test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample.

TABLE 4.8.A

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

LIQUID RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD) (μCi/ml)
Batch Waste Releases [1]	Each Batch	Each Batch prior to release	Principal Gamma Emitters [4]	5 E-7 [3]
	One Batch per Month	Monthly	Dissolved and Entrained Gases	1 E-5
	Monthly Proportional Composite (2)	Monthly	Tritium	1 E-5
			Gross α	1 E-7
			P-32	1 E-6
	Quarterly Proportional Composite (2)	Quarterly	Sr-89 , Sr-90	5 E-8
			Fe-55	1 E-6

TABLE NOTATION - TABLE 4.8.A

(1) A batch release is the discharge of liquid wastes of a discrete volume.

(2) A proportional composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged from the plant.

(3) For certain radionuclides with low gamma yield or low energies, or for certain radionuclide mixtures, it may not be possible to measure radionuclides in concentrations near their sensitivity limits when other nuclides are present in the sample in much greater concentrations. Under these circumstances, it will be more appropriate to calculate the concentrations of such radionuclides using observed ratios with those radionuclides which are measurable or the lower limit of detection may be increased proportionally to the magnitude of the gamma yield (i.e., 5 E-7/I where I is the photon abundance expressed as a decimal fraction), but in no case shall the lower limit of detection as calculated in this manner be greater than 10% of the MPC value specified in 10 CFR Part 20, Appendix B, Table II, Column 2.

(4) The principal gamma emitters (those expected to account for ∿95% of the total activity present) for which the LLD specification will apply are exclusively the following radionuclides: Cr-51, Zn-65, Co-60, Cs-137, Zr-95, Nb-95, I-131, Na-24, Mn-54, Co-58, Ag-110m, Cs-134, I-133, Cu-64, Mo/Tc-99, and Fe-59 for liquid releases. This list does not mean that only these nuclides are to be detected and reported. Other nuclides which influence accounting for ∿95% of the total activity, together with the above nuclides, shall also be identified and reported as being present. Nuclides which are below the LLD for the analysis may not be reported as being present at the LLD Level for that nuclide. When unusual circumstances result in LLD's higher than required the reasons shall be documented in the semi-annual effluent report.

TABLE 4.8.B

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) (μCi/ml)
A. Containment Purge	Each Purge Grab Sample	Each Purge	Principal Gamma Emitters (3) H-3	1E-4 (1) 1E-6
B. 1. Stack			Principal Gamma Emitters (3)	1E-4 (1)
2. Building Ventilation	Grab Sample	Monthly	H-3	1E-6
a. Reactor/Turbine				
b. Turbine Exhaust				
c. Radwaste				
C. All Release Points listed in B. above	Continuous	Charcoal Sample Weekly	I-131 I-133	1E-12 (2) 1E-10 (2)
	Continuous	Particulate Sample Weekly	Principal Gamma Emitters (3)	1E-11 (2)
	Continuous	Composite Particulate Sample Monthly	Gross	1E-11
	Continuous	Composite Particulate Sample Quarterly	Sr-89, Sr 90	1E-11

TABLE NOTATION - 4.8.B

(1) For certain radionuclides with low gamma yield or low energies, or for certain radionuclide mixtures, it may not be possible to measure radionuclides in concentrations near their sensitivity limits when other nuclides are present in the sample in much greater concentrations. Under these circumstances, it will be more appropriate to calculate the concentrations of such radionuclides using observed ratios with those radionuclides which are measurable or the lower limit of detection may be increased proportionally to the magnitude of the gamma yield (i.e. 1E-4/I where I is the photon abundance expressed as a decimal fraction), but in no case shall the lower limit of detection as calculated in this manner be greater than 10% of the MPC value specified in 10 CFR Part 20, Appendix B, Table II, Column 1.

(2) When samples are taken more often than that shown, the minimum detectable concentrations can be correspondingly higher.

(3) The principal gamma emitters for which the LLD specification will apply are exclusively the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emissions and Mn-54, Fe-59, Co-58, Co-60, Zn-65, MO-99, Cs-134, Cs-137, Ce-141, and Ce-144 for parciculate emissions. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level for that nuclide. When unusual circumstances result in LLD's higher than required, the reasons shall be documented in the semi-annual effluent report. The principal gamma emitters (those expected to account for a 95% of the activity present) for which the LLD specification will apply are exclusively the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emissions and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, and Cs-137 for particulate emissions. This list does not mean that only these nuclides are to be detected and reported. Other nuclides which influence accounting for 95% of the total activity together with the above nuclides shall also be identified and reported. Nuclides which are below the LLD for the analyses may not be reported as being present at the LLD level for that nuclide. When unusual circumstances result in the LLD's higher than required, the reason shall be documented in the semi-annual effluent report.

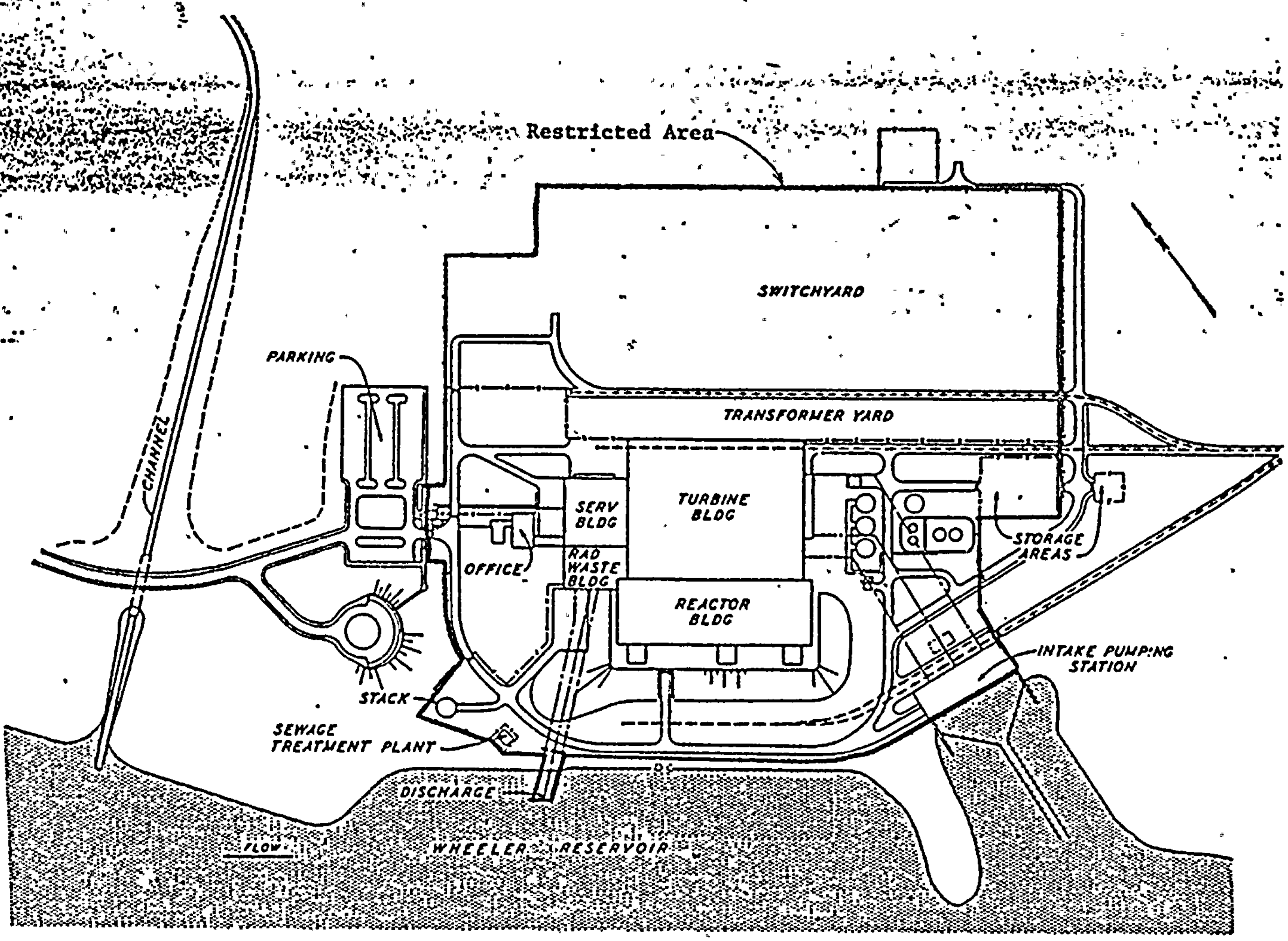


FIGURE 4.8.A.1 Assumed Liquid Effluent Restricted Area

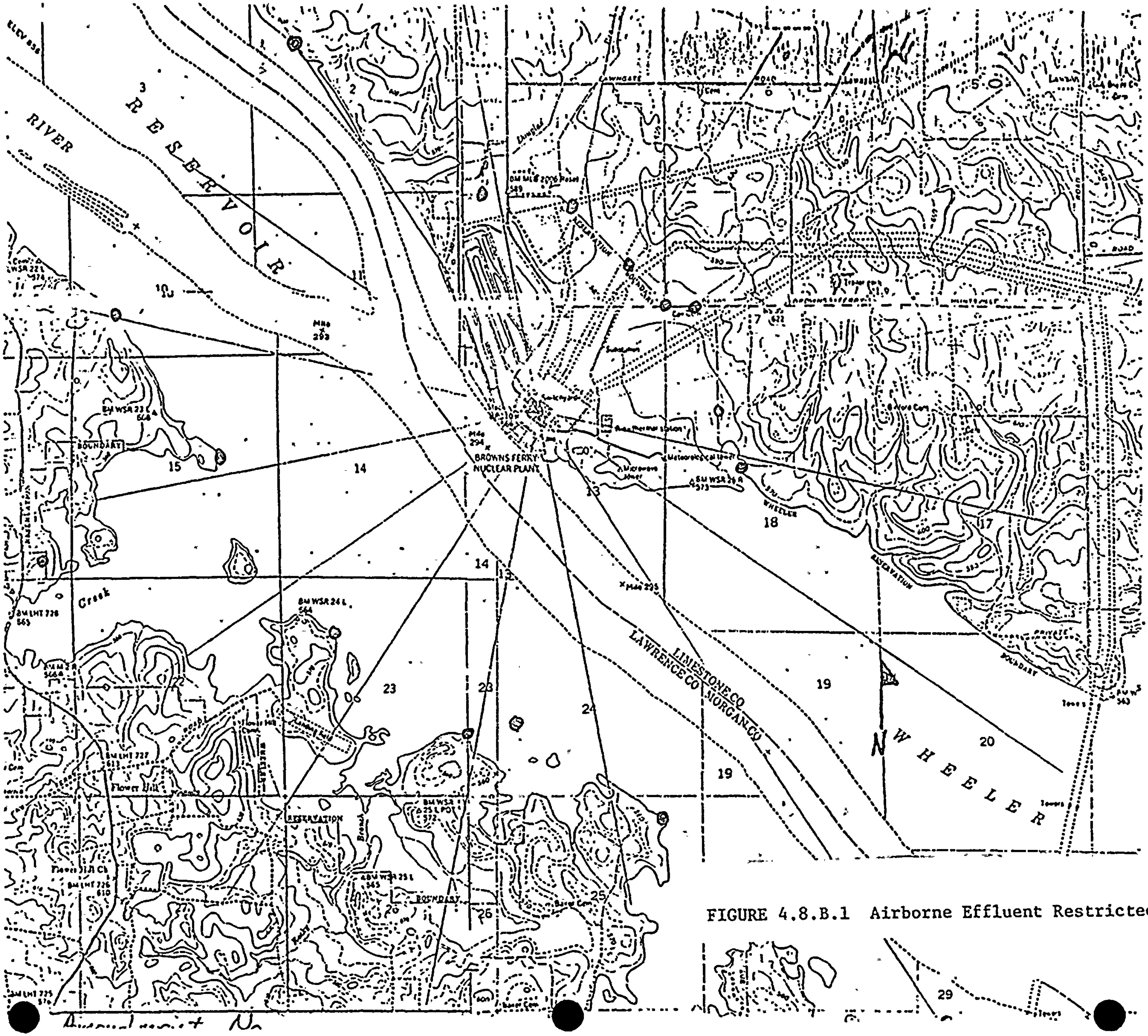


FIGURE 4.8.B.1 Airborne Effluent Restricted Area

3.8 BASES

Radioactive waste release levels to unrestricted areas should be kept "as low as reasonably achievable" and are not to exceed the concentration limits specified in 10 CFR Part 20. At the same time, these specifications permit the flexibility of operation, compatible with considerations of health and safety, to assure that the public is provided a dependable source of power under unusual operating conditions which may temporarily result in releases higher than design objectives but still within the concentration limits specified in 10 CFR Part 20. It is expected that by using this operational flexibility under unusual operating conditions, and exerting every effort to keep levels of radioactive materials released as low as reasonably achievable, the annual releases will not exceed a small fraction of the annual average concentration limits specified in 10 CFR Part 20.

3.8.A LIQUID EFFLUENTS

Specification 3.8.A.1 is provided to ensure that the concentration of radioactive materials released in liquid waste effluents from the site to unrestricted areas will be less than the concentration levels specified in 10 CFR Part 20, Appendix B, Table II. This limitation provides additional assurance that the levels of radioactive materials in bodies of water outside the site will not result in exposures within (1) the Section 11.A design objectives of Appendix I, 10 CFR Part 50, to an individual and (2) the limits of 10 CFR Part 20.106 (e) to the population. The concentration limit for noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

Specification 3.8.A.3 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 11.A of Appendix I.

Specification 3.8.A.4 provides the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents will be kept "as low as is reasonably achievable". Also, for fresh water sites with drinking water supplies which can be potentially affected by plant operations, there is reasonable assurance that the operation of the facility will not result in radionuclide concentrations in the finished drinking water that are in excess of the requirements of 40 CFR 141. The dose calculations in the ODCM implement the requirements in section III.A of Appendix I that conformance with

3.8.A LIQUID EFFLUENTS (cont'd)

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 ODMC 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-0133 provides methods for dose calculations consistent with Regulatory Guides 1.109 and 1.113.

Specification 3.8.A.5 requires that the appropriate portions of the liquid radwaste treatment system be used when specified. This 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. The specified limits governing the use of appropriate portions of the liquid radwaste treatment system were specified as a suitable fraction of the guide set forth in Section 11.A of Appendix I, 10 Cfr Part 50, for liquid effluents.

Specification 3.8.A.6 requires submittal of a special report if the limiting values of Specification 3.8.A.5 are exceeded and unexpected failures of non-redundant radwaste processing equipment halt waste treatment.

Specification 3.8.A.7 requires that suitable equipment to control and monitor the releases of radioactive materials in the liquid effluents are operating during any period when these releases are taking place.

3.8.B AIRBORNE EFFLUENTS

Specification 3.8.B.1 is provided to ensure that the dose rate at anytime at the exclusion boundary from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 for unrestricted areas. The annual dose limits are the doses associated with the concentrations of 10 CFR Part 20, Appendix B, Table II. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of an individual in an unrestricted area, either within or outside the exclusion area boundary, to annual average concentrations exceeding the limits specified in Appendix B, Table II of 10 CFR Part 20 (10 CFR Part 20.106(b)0. For individuals who may at times be within the exclusion area boundary, the occupancy of the individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the exclusion area boundary.

3.8.B AIRBORNE EFFLUENTS (Cont'd)

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 exclusion area boundary to ≤ (500) mrem/year to the total body or to ≤ (3000) mrem/year to the skin. These release rate limits also restrict, at all times. the corresponding thyroid dose rate above background to an infant via the cow-milk-infant pathway to ≤ 1500 mrem/year for the nearest cow to the plant.

Specification 3.8.B.2 requires that appropriate corrective action (s) be taken to reduce gaseous effluent releases if the limits of 3.8.B.1 are exceeded.

Specification 3.8.B.5 is provided to implement the requirements of Section II.C, III.A, and IV of Appendix I, 10 CFR Part 50. The limiting conditions for operation are the guides set forth in Section II.c of Appendix I.

Specification 3.8.B.6 provides 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 reasonably achievable." The ODCM calculational methods specified in the surveillance requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways 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, "Calculating 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 I, 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 doeses based upon the historical average atmospheric conditions. The release rate specifications for radioiodines, 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 are examined in the development of these calculations are: 1) individual inhalation of airborne radionuclides, 2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, 3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, and 4) deposition on the ground with subsequent exposure of man.

Specification 3.8.B.6 requires that a special report be prepared and submitted to explain violations of the limiting doses contained in Specification 3.8.B.5.

AIRBORNE EFFLUENTS

Specification 3.8.B.7 requires that the offgas charcoal adsorber beds be used when specified to treat gaseous effluents prior to their release to the environment. This provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." This specification implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and design objective Section IID of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the guide set forth in Sections II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents.

Specification 3.8.B.8 requires that a special report be prepared and submitted to explain reasons for any failure to comply with Specification 3.8.B.7.

Specification 3.8.B.3 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 IV.A of B of Appendix I.

Specification 3.8.B.4 provides 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 provided for determining the air doses at the exclusion area boundary will be based upon the historical average atmospheric conditions. NUREG-0133 provides methods for dose calculations consistent with Regulatory Guides 1.109 and 1.111. Specification 3.8.B.4 requires that a special report be prepared and submitted to explain violations of the limiting doese contained in Specification 3.8.B.3.

3.8.D/4.8.D Mechanical Vacuum Pump

The purpose of isolating the mechanical vacuum pump line is to limit the release of activity from the main condenser. During an accident, fission products would be transported from the reactor through the main steam lines to the condenser. The fission product radioactivity would be sensed by the main steam line radioactivity monitors which initiate isolation.

4.8.A AND 4.8.B BASES

The surveillance requirements given under Specification 4.8.A and 4.8.B provide assurance that liquid and gaseous wastes are properly controlled and monitored during any release of radioactive materials in the liquid and gaseous effluents. These surveillance requirements provide the data for the licensee and the Commission to evaluate the station's performance relative to radioactive wastes released to the environment. Reports on the quantities of radioactive materials released in effluents shall be furnished to the Commission on the basis of Section 6 of these technical specifications. On the basis of such reports and any additional information the Commission may obtain from time to time require the licensee to take such actions as the Commission deems appropriate.

3.8.E and 4.8.E BASES

The objective of this specification is to assure that leakage from byproduct, source, and special nuclear radioactive material sources does not exceed allowable limits.

(b). Annual Operating Report

A tabulation on an annual basis of the number of station, utility and other personnel (including contractors) receiving exposures greater than 100 mrem/yr and their associated man rem exposure according to work and job functions,* e.g., reactor operations and surveillance, inservice inspection, routine maintenance, special maintenance (describe maintenance), waste processing, and refueling. The dose assignment to various duty functions may be estimates based on pocket dosimeter, TLD, or film badge measurements. Small exposures totalling less than 20% of the individual total dose need not be accounted for. In the aggregate, at least 80% of the total whole body dose received from external sources shall be assigned to specific major work functions.

c. Monthly Operating Report. Routine reports of operating statistics and shutdown experience shall be submitted on a monthly basis to the Office of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, with a copy to the appropriate Regional Office, to be submitted no later than the tenth of each month following the calendar month covered by the report. A narrative summary of operating experience shall be submitted in the above schedule.

Any changes to the Offsite Dose Calculation Manual of Specification 6.10 shall be submitted with the Monthly Operating Report within 90 days in which the change(s) was made effective.

d. Radiological Environmental Monitoring

1. TVA shall prepare a report entitled "Environmental Radioactivity Levels - Browns Ferry Nuclear Plant - Annual Report." The report shall cover the previous 12 months of operation and shall be submitted to the Director of the NRC Region II Office (with a copy to the Director, Office of Nuclear Reactor Regulation) within 120 days after January 1 of each year. The report format shown in Regulatory Guide 4.8 Title 1 shall be used. The report shall include summaries, interpretations, and evaluations of the results of the radiological environmental surveillance activities for the report period, including a comparison with preoperational studies and/or operational controls (as appropriate), and an assessment of the observed impacts of the plant operation on the environment. If harmful effects or evidence of irreversible damage are detected by the monitoring, the licensee shall provide an analysis of the problem and a proposed course of action to alleviate the problem.

2. Results of all radiological environmental samples taken shall be summarized and tabulated on an annual basis. In the event that some results are not available within the 120-day period, 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.

2. Reportable Occurrences

Reportable occurrences, including corrective actions and measures to prevent reoccurrence, shall be reported to the NRC. Supplemental reports may be required to fully describe final resolution of occurrence. In case of corrected or supplemental reports, a licensee event report shall be completed and reference shall be made to the original report date.

(9) Performance of structures, systems, or components that requires remedial action or corrective measures to prevent operation in a manner less conservative than assumed in the accident analyses in the safety analysis report or technical specifications bases; or discovery during plant life of conditions not specifically considered in the safety analysis report or technical specifications that require remedial action or corrective measures to prevent the existence or development of an unsafe condition.

Note: This item is intended to provide for reporting of potentially generic problems.

(10) The concentration of radioactive material in liquid effluents released to unrestricted areas exceeds the concentrations specified in 10 CFR Part 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. Concentration of dissolved or entrained noble gases exceeds 2×10^{-4} Ci/ml total activity.

(11) (a). The dose rate for noble gases equals or exceeds 500 mrem/yr to the total body or 3000 mrem/yr to the skin.

(b). The dose rate for all radioiodines, for all radioactive materials in particular form, and for radionuclides other than noble gases with half lives greater than 8 days exceeds 1500 mrem/yr to any organ.

b. Thirty-Day Written Reports. The reportable occurrences discussed below shall be the subject of written reports to the Director of the appropriate Regional Office within thirty days of occurrence of the event. The written report shall include, as a minimum, a completed copy of a licensee event report form. Information provided on the licensee event report form shall be supplemented, as needed, by additional narrative material to provide complete explanation of the circumstances surrounding the event.

(1) Reactor protection system or engineered safety feature instrument settings which are found to be less conservative than those established by the technical specifications but which do not prevent the fulfillment of the functional requirements of affected systems.

(2) Conditions leading to operation in a degraded mode permitted by a limiting condition for operation or plant shutdown required by a limiting condition for operation.

Note: Routine surveillance testing, instrument calibration, or preventative maintenance which require system configurations as described in items 2.b.(1) and 2.b.(2) need not be reported except where test results themselves reveal a degraded mode as described above.

(3) Observed inadequacies in the implementation of administrative or procedural controls which threaten to cause reduction of degree of redundancy provided in reactor protection systems or engineered safety feature systems.

(4) Abnormal degradation of systems other than those specified in item 2.a(3) above designed to contain radioactive material resulting from the fission process.

Note: Sealed sources or calibration sources are not included under this item. Leakage of valve packing or gaskets within the limits for identified leakage set forth in technical specifications need not be reported under this item.

(5) An unplanned offsite release of 1) more than 1 curie of radioactive material in liquid effluents, 2) more than 150 curies of noble gas in gaseous effluents, or 3) more than 0.05 curies of radioiodine in gaseous effluents. The report of an unplanned offsite release of radioactive material shall include the following information:

1. A description of the event and equipment involved.

2. Cause(s) for the unplanned release.

3. Actions taken to prevent recurrence.

4. Consequences of the unplanned release.

c. Anomalous Measurements -Radiological Environmental Monitoring

(1.) If, during any 12-month report period, a measured level of radioactivity in any environmental medium other than those associated with gaseous radioiodine releases exceeds ten times the control station value, a written notification will be submitted within one week advising the NRC of this condition.* This notification should include an evaluation of any release conditions, environmental factors, or other aspects necessary to explain the anomalous result.

(2.) If, during any 12-month report period, a measured level of radioactivity in any environmental medium other than those associated with gaseous radioiodine releases exceeds four times the control station value, a written notification will be submitted within 30 days advising the NRC of this condition. This notification should include an evaluation of any release conditions, environmental factors, or other aspects necessary to explain the anomalous result.

(3.) If individual milk samples show I-131 concentrations of 10 picocuries per liter or greater, a plan shall be submitted within 10 days advising the NRC of the proposed action to ensure the plant related annual doses will be within the design objective of 15 mrem/yr/reactor to the thyroid of any individual.

(4.) If milk samples collected over a calendar quarter show average concentrations of 6.0 picocuries per liter or greater, a plan shall be submitted within 30 days advising the NRC of the proposed action to ensure the plant-related annual doses will be within the design objective of 15 mrem/yr/reactor to the thyroid of any individual.

*In the case of a tentatively anomalous value for radiostrontium, a confirmatory reanalysis of the original, a duplicate or a new sample may be desirable. In this instance the results of the confirmatory analysis shall be completed at the earliest time consistent with the analysis, and if the high value is real, the report to the NRC shall be submitted within one week following this analysis.

(5.) If such levels as discussed in 6.7.2.c.3 and 6.7.2.c.4 can be definitely shown to result from sources other than the Browns Ferry Nuclear Plant, the reporting action called for in 5.6.3(a)3 and 5.6.3(a)4 need not be taken. Justification for assigning high levels of radioactivity to sources other than the Browns Ferry Nuclear Plant must be provided in the annual report.

6.7.3 Unique Reporting Requirements

A. Radioactive Effluent Release Report

A report on the radioactive discharges released from the site during the previous 6 months of operation shall be submitted to the Director of the Regional Office of Inspection and Enforcement within 60 days after January 1 and July 1 of each year. The report shall include a summary of the quantities of radioactive liquid and gaseous effluents released and solid waste shipped from the plant as delineated in Regulatory Guide 1.21, Revision 1, "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," with data summarized on a quarterly basis following the format of Appendix B thereof.

The report shall include a summary of the meterological conditions concurrent with the release of gaseous effluents during each quarter as outlined in Regulatory Guide 1.21, Revision 1, with data summarized on a quarterly basis following the format of Appendix B thereof. Calculated offsite dose to humans resulting from the release of effluents and their subsequent dispersion in the atmosphere shall be reported as recommended in Regulatory Guide 1.21, Revision 1. Doses to individuals outside the site boundary (UNRESTRICTED AREA) shall be calculated in accordance with the ODCM.

B. Source Tests

Results of required leak tests performed on sources if the tests reveal the presence of 0.005 microcurie or more of removable contamination.

C. Special Reports (in writing to the Director of Regional Office of Inspection and Enforcement).

1. Reports on the following areas shall be submitted as noted:

a. Secondary Containment Leak Rate Testing (5)	4.7.C	Within 90 days of completion of each test.
b. Fatigue Usage Evaluation	6.6	Annual Operating Report

2. 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 action(s) to be taken to reduce the releases of radioactive material in liquid effluents during the remainder of the current calendar quarter and during the subsequent three calendar quarters so that the average dose or dose commitment to an individual from such releases during these four calendar quarters is within 3 mrem to the total body and 10 mrem to any organ. This Special Report shall also include: (1) the results of radiological analyses of the drinking water sources (if applicable), and (2) the radiological impact on finished drinking water supplies with regard to the requirements of 40 CFR 141, Safe Drinking Water Act. (Applicable only if drinking water supply is taken from the receiving water body.) See item 6 below.

3. Prepare and submit to the Commission within 30 days, a Special Report which includes the following information:

   a. Identification of equipment of subsystems not OPERABLE and the reason for nonoperability.
   b. Action(s) taken to restore the non operable equipment to OPERABLE status.

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

4. 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 to be taken to reduce the releases of radioiodines, radioactive materials in particulate form, and radionuclides other than noble gases with half-lives greater than 8 days in gaseous effluents during the remainder of the current calendar quarter and during the subsequent three calendar quarters so that the average dose or dose commitment to an individual from such releases during these four calendar quarters is within 15 mrem to any organ. See item 6 below.

5. 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 reduce the releases of radioactive noble gases in gaseous effluents during the remainder of the current calendar quarter and during the subsequent three calendar quarters so that the average dose during these four calendar quarters is within 10 mrad for gamma radiation and (20) mrad for beta radiation. See item 6 below.

6. Prepare and submit to the Commission a Special Report which includes an analysis demonstrating that radiation exposures to all real individuals 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.

ENCLOSURE 2

BROWNS FERRY NUCLEAR PLANT UNITS 1, 2, AND 3

(DOCKET NOS. 50-259, 50-260, AND 50-296)

PROPOSED CHANGES TO APPENDIX B

TECHNICAL SPECIFICATIONS

UNIT 1

4.1.3 Special Studies

Objective

To demonstrate the adequacy of weekly sampling of chlorine residual during chlorination of the auxiliary raw cooling water systems by demonstrating that chlorine residual in auxiliary raw cooling water (RCW) systems remains relatively constant during chlorination.

Specification

TVA will perform special studies during the first two periods (including a spring and a fall period) of chlorination of the RCW systems after September 1975, which are of at least 3 weeks' duration. During the special studies period when the RCW systems are being chlorinated, samples will be taken daily from the RCW systems and analyzed for chlorine residual. Records of the daily sampling and analyses will be maintained and submitted to the NRC staff for their review following the end of the special study period. Chlorine feed rate and equivalent RCW concentration will be reported for the special studies period.

Sampling during the special study period will be considered to satisfy the monitoring requirements of Section 2.2.2 of the environmental technical specifications.

4.2 Radiological Environmental Monitoring Program

DELETED

5.0 ADMINISTRATIVE CONTROLS

Objective

This section describes the administrative and management controls established to provide continuing protection to the environment and to implement the environmental technical specifications. Measures to be specified in this section include the assignment of responsibilities, organizational structure, operating procedures, review and audit functions, and reporting requirements.

Specifications

5.1 Responsibility

5.1.1 The power plant superintendent has responsibility for operating the plant within the limiting conditions for operation (LCO).

5.1.2 The Director, Division of Environmental Planning, is responsible for the environmental monitoring program outside the plant.

5.2 Organization

5.2.1 The organization of TVA management which directly relates to operation of the plant is shown on Figure 5.2-1.

5.2.2 The principal divisions within TVA which are concerned with environmental matters related to nuclear power plant operation are the Division of Power Production (DPP), Division of Forestry, Fisheries, and Wildlife Development (FFWD), Division of Power Resource Planning (DPRP), and the Division of Environmental Planning (DEP). The DPP and DPRP are in the Office of Power. The Office of Power Quality Assurance and Audit Staff is a special staff within the Office of Power. The Office of Power, DEP, and FFWD report to the General Manager. This is depicted in Figure 5.2-2.

5.3 Review and Audit

5.3.1 The Director, DEP, is responsible for review of plant operation related to LCO to insure that plant operation is being conducted within the limits defined in Section 2 of this document.

5.3.2 The Office of Power Quality Assurance and Audit Staff shall conduct a periodic audit of the environmental monitoring program at least once per calendar year.

5.3.3 The DPRP and/or DEP shall review and contribute to the following items:

a. Preparation of the proposed environmental technical specifications.

b. Coordination of environmental technical specification development with the safety technical specifications to avoid conflicts and maintain consistency.

c. Proposed changes to the environmental technical specifications and the evaluated impact of the change.

d. Proposed written procedures, as described in Section 5.5 and proposed changes thereto which could significantly affect the plant's environmental impact.

e. Proposed changes or modifications to plant systems or equipment which could significantly affect the plant's environmental impact and the evaluated impact of the changes.

f. Results of the environmental monitoring programs prior to their submittal in each Annual Operating Report. See Sections 5.6.1 and 5.6.2.

g. Reported instances of violations of environmental technical specifications. Where investigation indicates, evaluation and formulation of recommendations to prevent recurrence.

5.4 Action to be Taken if an Environmental LCO is Exceeded

5.4.1 Follow any remedial action permitted by the technical specifications until the condition can be met.

5.4.2 DEP will conduct an independent investigation of the incident. This investigation shall consist of the circumstances leading to and resulting from the situation together with recommendations to prevent a recurrence. The results of the investigation shall be reported to the Director, DPP.

5.4.3 Notification of the Director of the Regional Regulatory Operations Office, Region II of NRC within 24 hours shall be made as specified in Section 5.6.3. Reporting requirements for this paragraph are described in Section 5.6.3.

5.5 Procedures

5.5.1 Detailed written procedures for the in-plant nonradiological monitoring program, including check-off lists, where applicable, shall be prepared by DPP and approved by the plant superintendent (or his designee) and adhered to.

5.5.3 All procedures described in Section 5.5.1 and all changes thereto shall be reviewed and approved prior to implementation and on an annual basis thereafter by the plant management. Temporary changes to procedures which do not change the intent of the original procedure may be made, provided such changes are documented and are approved by two of the following plant personnel:

Superintendent
Assistant Superintendent
Operations Supervisor
Assistant Operations Supervisor
Shift Engineer

5.6 Reporting Requirements

5.6.1 A report shall be prepared by DEP and submitted to DPP following the end of each 12-month period of operation, which shall summarize the results of the nonradiological environmental monitoring program.

5.6.2 Routine Reporting

a. A summary report shall be prepared for both the inplant monitoring program and the nonradiological monitoring programs and submitted to the Director of Division of Operating Reactors, NRC, as part of the Annual Operating Report within 120 days after December 31 of each year.

5.6.3 Non-Routine Reports

Nonradiological

a. In the event a limiting condition for operation is exceeded or an unusual event with a potential for a significant environmental impact occurs, a report shall be made within 24 hours by telephone or telegraph to the Director of the Regional Office of Inspection and Enforcement, Region II, followed by a written report within 10 days to the Director of the Regional Office of Inspection and Enforcement, Region II (copy to the Director of Division of Operating Reactors).

Changes

b. 1. Where a change to the plant design, the plant operation, or to procedures is planned which could have a significant adverse effect on the environment or which involves an environmental matter or question not previously reviewed and evaluated by the NRC, a request for the change shall be made to the NRC before implementation.

2. Changes or additions to permits and certificates required for the protection of the environment shall be reported. When the required changes are submitted to the concerned agency for approval, they shall also be submitted to the Director, Division of Operating Reactors, USNRC, for information.

3. Requests for changes in environmental technical specifications shall be submitted to the Director, Division of Operating Reactors, USNRC, for prior review and authorization.

5.7 Environmental Records

5.7.1 Operational information concerning the inplant portion of the environmental technical specifications shall be kept by DPP in a manner convenient for review. This includes plant records and/or logs as indicated below:

a. Related plant operations

b. Related maintenance activities

c. LCO violation

d. Updated, corrected, and as-built drawings of the plant

Item (a) through (c) above shall be retained for a period of at least six years and item (d) shall be retained for the life of the plant.

5.7.2 Records and/or logs shall be maintained by DEP and/or DWM in a manner convenient for review. This information concerning the environmental monitoring program is indicated below:

a. Checks, inspections, tests, and calibration of components and systems.

b. Principal maintenance activities associated with environmental monitoring equipment and systems.

c. Results of environmental monitoring surveys related to BFNP.

Items (a) and (b) shall be retained for a period of at least six years and item (c) shall be retained for the life of the plant.

Table 3.1.2-1

Sources of Added Chemicals and Resulting End Product Chemicals

System	Chemical Added Source Chemical	Maximum[c] Annual Use lbs	Waste End Product Chemical	Maximum Resulting[a] End Product Annual lbs	Maximum Resulting[a] End Product Mean Daily lbs
Makeup Water Treatment Plant	Alum $Al_2(SO_4)_3 \cdot 18\ H_2O$	15,800	$Al(OH)_3$[b]	3,700	~10
			SO_4^{--}	6,800	~21
			Suspended solids[b,c]	13,500	~37
	Soda Ash $Na_2\ CO_3$ (100%)	7,900	Na^+	3,400	~10
	Sodium Hypochlorite NaOCl (21% Solution)	3,950	Na^+	260	~ .1
			OCl^-	570	~ 2
	Coagulation Aid	590	Coag. Aid[b]	590	~ 2
Makeup water Treatment Plant Demineralizer Regeneration	Sulfuric Acid 98%	270,000	SO_4^{--}	259,000	~710
	Sodium Hydroxide (50%)	205,000	Na^+	59,000	~160
Auxiliary Steam Generator Blowdown	Ammonia	Variable[d]	NH_3	6	~0.02
	Hydrazine	Variable[e]	NH_3	0.4	~0.001
Raw cooling water System	Chlorine	Variable	OCl^- and Cl^-	Variable	1,620

a. Based on 24-hour operation 365 days/year at demonstrated maximum capacity of equipment.
b. Suspended materials that will make up the water treatment plant sludge, on a dry weight basis.
c. Estimates from suspended solids data observed at TRM 300.3.
d. Ammonia will be added as needed to keep pH of system at 9.0.
e. Hydrazine will be added as needed as a DO scavenger.

Table 3.1.2-2

SUMMARY OF CHEMICAL DISCHARGES

Waste Product Chemical	Maximum[a] Annual Discharge of Product Chemical lbs	Waste[b] Product Chemical Contribution to Discharge Concentrations mg/l	Observed Concentrations in Reservoir Water at TRM 300.3 mg/l		Total Concentrations[c] in River After Mixing mg/l		Maximum[g] Allowable Concentrations in River mg/l
			Average	Maximum	Average	Maximum	
Sulfates (SO_4^{--})	265,800	0.031	15.0	23.0	15.027	23.027	250
Sodium (Na^+)	62,700	0.007	5.92	9.18	5.9263	9.1863	d
Chlorides[e]	34,600	0.068	14.0	21.0	14.060	21.060	250
Ammonia[f] NH_3	6.4	nil	0.02	0.07	0.02	0.07	d
Total Dissolved Solids	363,106	0.106	104.0	129.0	104.093	129.093	500

a. Based on 24-hour operation, 365 days per year at demonstrated maximum capacity of equipment and chemical requirements.
b. Discharge flows based on 3-unit operation.
c. Concentrations based on downstream riverflow of 5,000 ft^3/s. However, heat dissipation considerations will require minimum of 23,000 ft^3/s for open mode.

d. No specific standard has been identified but contribution to dissolved solids has been included.
e. Computation is for chlorides since the chlorine demand of the cooling water is such that no residual chlorine will be discharged. Chlorides and total dissolved solids reflect maximum daily use of chlorine in raw cooling water.
f. Ammonia and hydrazine added to auxiliary steam generator for pH and dissolved oxygen control. Hydrazine conservatively assumed to decompose to ammonia.
g. Alabama Water Improvement Commission Stream Standards.

Table 4.1-1

SUMMARY OF NONRADIOLOGICAL MONITORING PROGRAM

BROWNS FERRY NUCLEAR PLANT

Station TRM	Water Samples	Zooplankton, Chlorophyll and Phytoplankton Sampling	Productivity Measurements	Benthic Fauna	Sediment	Fish[a]
Second Creek Embayment Station						X
277.98	X[b]	X	X	X	X	
283.94	X[c]	X	X	X		X
Elk River Embayment Station						X
288.78	X[b]	X	X	X	X	
291.76	X[c]	X	X	X		X
293.70	X[b]	X	X	X	X	X
295.87	X[c]	X	X	X		
299.00						X
301.06		X	X	X		
307.52	X[b]	X	X	X	X	X

X - Indicates at least one quarterly sample collected at the specified station.

a. Fish sampling at a specific station will be by either gill net, trap net, rotenone, or electrofishing. However, depending upon the sampling method the frequency of sampling at each location may be less than quarterly.

b. Analysis - Dissolved oxygen and temperature.

c. Analysis - Dissolved oxygen, temperature BOD_5, COD, pH, alkalinity, specific conductance, Na, SO_4, chlorides, nitrogens (NH_3, NO_2+NO_3, and organic) and solids (dissolved, suspended, and total).

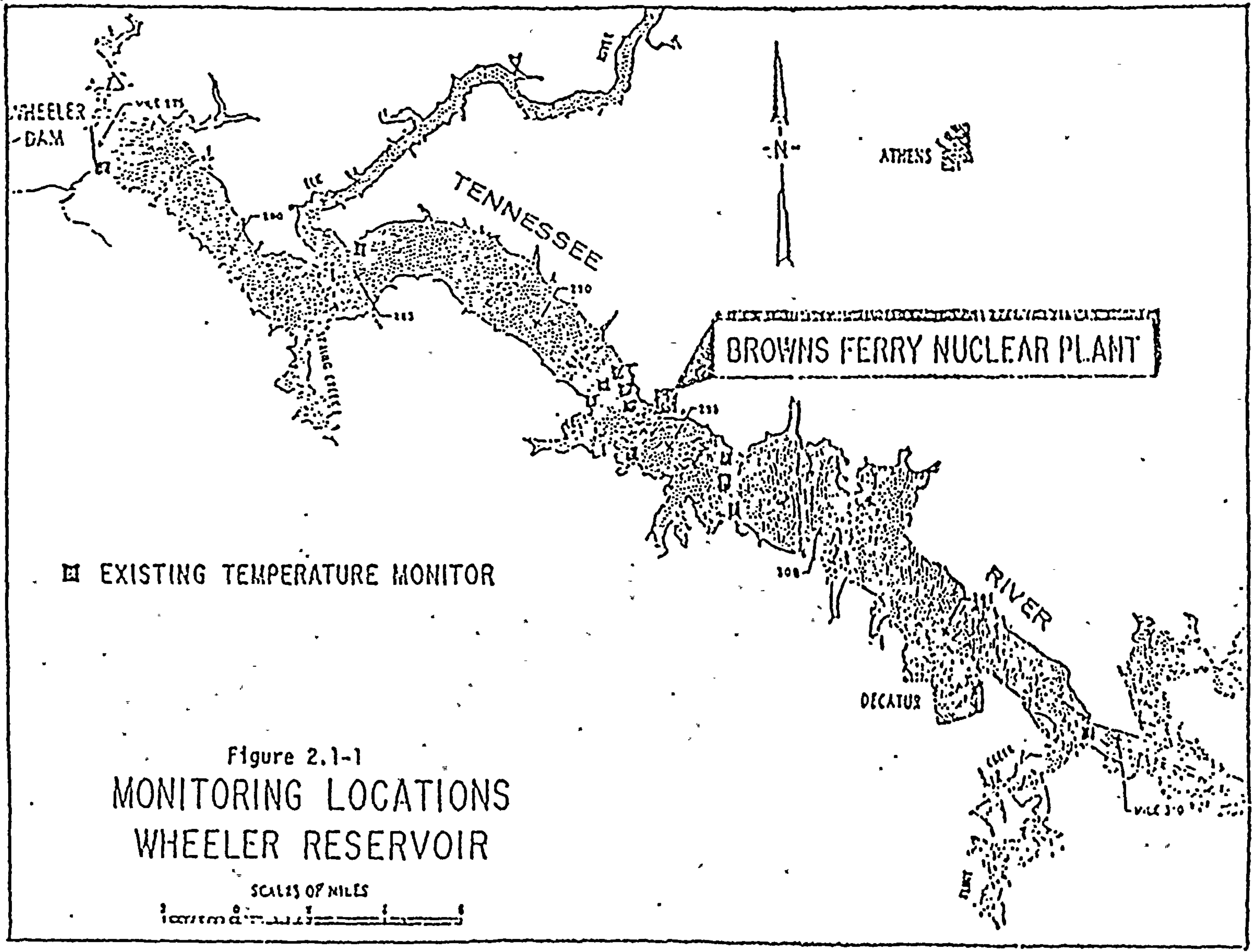
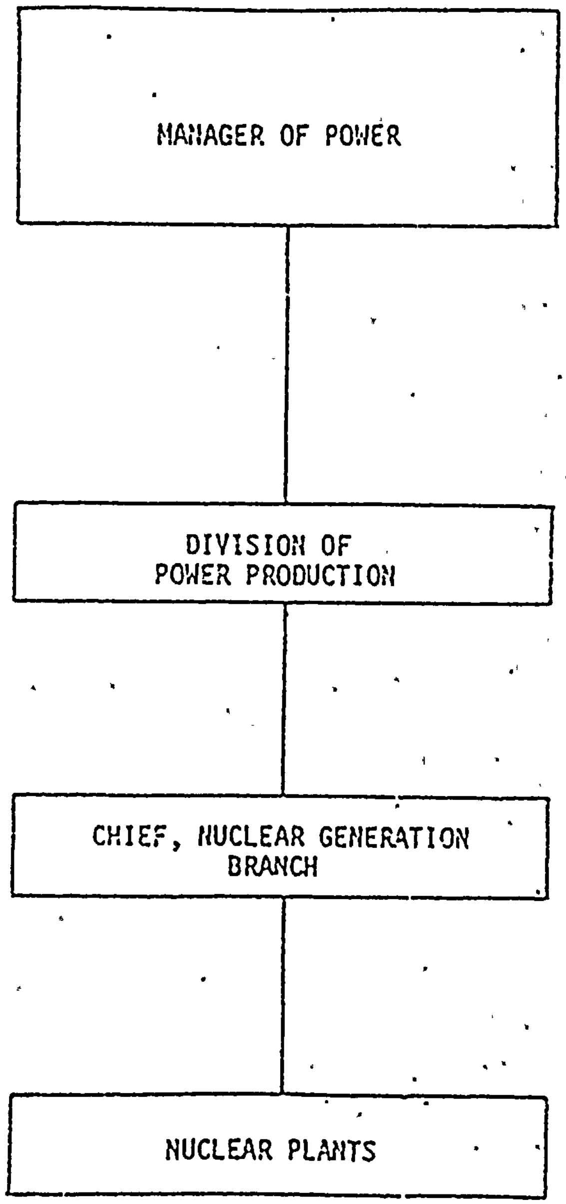


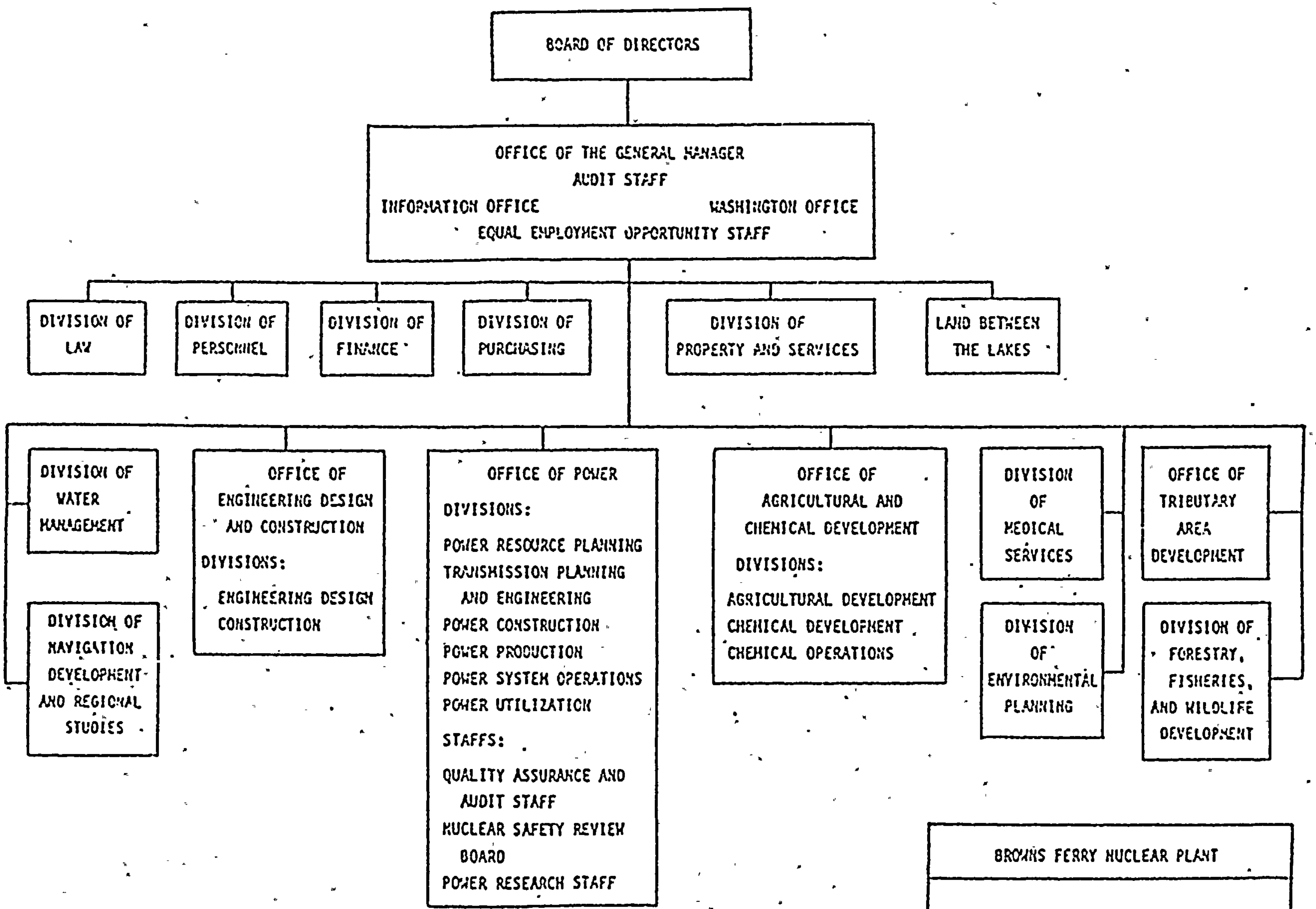
Figure 2.1-1
MONITORING LOCATIONS
WHEELER RESERVOIR



BROWNS FERRY NUCLEAR PLANT

TVA Office of Power Organization for Operation of Nuclear Plants

Figure 5.2-I



BROWNS FERRY NUCLEAR PLANT

Organization of the Tennessee Valley Authority

Figure 5.2-2

UNIT 2

4.1.3 Special Studies

Objective

To demonstrate the adequacy of weekly sampling of chlorine residual during chlorination of the auxiliary raw cooling water systems by demonstrating that chlorine residual in auxiliary raw cooling water (RCW) systems remains relatively constant during chlorination.

Specification

TVA will perform special studies during the first two periods (including a spring and a fall period) of chlorination of the RCW systems after September 1975, which are of at least 3 weeks' duration. During the special studies period when the RCW systems are being chlorinated, samples will be taken daily from the RCW systems and analyzed for chlorine residual. Records of the daily sampling and analyses will be maintained and submitted to the NRC staff for their review following the end of the special study period. Chlorine feed rate and equivalent RCW concentration will be reported for the special studies period.

Sampling during the special study period will be considered to satisfy the monitoring requirements of Section 2.2.2 of the environmental technical specifications.

4.2 Radiological Environmental Monitoring Program

DELETED

5.0 ADMINISTRATIVE CONTROLS

Objective

This section describes the administrative and management controls established to provide continuing protection to the environment and to implement the environmental technical specifications. Measures to be specified in this section include the assignment of responsibilities, organizational structure, operating procedures, review and audit functions, and reporting requirements.

Specifications

5.1 Responsibility

5.1.1 The power plant superintendent has responsibility for operating the plant within the limiting conditions for operation (LCO).

5.1.2 The Director, Division of Environmental Planning, is responsible for the environmental monitoring program outside the plant.

5.2 Organization

5.2.1 The organization of TVA management which directly relates to operation of the plant is shown on Figure 5.2-1.

5.2.2 The principal divisions within TVA which are concerned with environmental matters related to nuclear power plant operation are the Division of Power Production (DPP), Division of Forestry, Fisheries, and Wildlife Development (FFWD), Division of Power Resource Planning (DPRP), and the Division of Environmental Planning (DEP). The DPP and DPRP are in the Office of Power. The Office of Power Quality Assurance and Audit Staff is a special staff within the Office of Power. The Office of Power, DEP, and FFWD report to the General Manager. This is depicted in Figure 5.2-2.

5.3 Review and Audit

5.3.1 The Director, DEP, is responsible for review of plant operation related to LCO to insure that plant operation is being conducted within the limits defined in Section 2 of this document.

5.3.2 The Office of Power Quality Assurance and Audit Staff shall conduct a periodic audit of the environmental monitoring program at least once per calendar year.

5.3.3 The DPRP and/or DEP shall review and contribute to the following items:

a. Preparation of the proposed environmental technical specifications.

b. Coordination of environmental technical specification development with the safety technical specifications to avoid conflicts and maintain consistency.

c. Proposed changes to the environmental technical specifications and the evaluated impact of the change.

d. Proposed written procedures, as described in Section 5.5 and proposed changes thereto which could significantly affect the plant's environmental impact.

e. Proposed changes or modifications to plant systems or equipment which could significantly affect the plant's environmental impact and the evaluated impact of the changes.

f. Results of the environmental monitoring programs prior to their submittal in each Annual Operating Report. See Sections 5.6.1 and 5.6.2.

g. Reported instances of violations of environmental technical specifications. Where investigation indicates, evaluation and formulation of recommendations to prevent recurrence.

5.4 Action to be Taken if an Environmental LCO is Exceeded

5.4.1 Follow any remedial action permitted by the technical specifications until the condition can be met.

5.4.2 DEP will conduct an independent investigation of the incident. This investigation shall consist of the circumstances leading to and resulting from the situation together with recommendations to prevent a recurrence. The results of the investigation shall be reported to the Director, DPP.

5.4.3 Notification of the Director of the Regional Regulatory Operations Office, Region II of NRC within 24 hours shall be made as specified in Section 5.6.3. Reporting requirements for this paragraph are described in Section 5.6.3.

5.5 Procedures

5.5.1 Detailed written procedures for the in-plant nonradiological monitoring program, including check-off lists, where applicable, shall be prepared by DPP and approved by the plant superintendent (or his designee) and adhered to.

5.5.3 All procedures described in Section 5.5.1 and all changes thereto shall be reviewed and approved prior to implementation and on an annual basis thereafter by the plant management. Temporary changes to procedures which do not change the intent of the original procedure may be made, provided such changes are documented and are approved by two of the following plant personnel:

Superintendent
Assistant Superintendent
Operations Supervisor
Assistant Operations Supervisor
Shift Engineer

5.6 Reporting Requirements

5.6.1 A report shall be prepared by DEP and submitted to DPP following the end of each 12-month period of operation, which shall summarize the results of the nonradiological environmental monitoring program.

5.6.2 Routine Reporting

a. A summary report shall be prepared for both the inplant monitoring program and the nonradiological monitoring programs and submitted to the Director of Division of Operating Reactors, NRC, as part of the Annual Operating Report within 120 days after December 31 of each year.

5.6.3 Non-Routine Reports

Nonradiological

a. In the event a limiting condition for operation is exceeded or an unusual event with a potential for a significant environmental impact occurs, a report shall be made within 24 hours by telephone or telegraph to the Director of the Regional Office of Inspection and Enforcement, Region II, followed by a written report within 10 days to the Director of the Regional Office of Inspection and Enforcement, Region II (copy to the Director of Division of Operating Reactors).

Changes

b.

1. Where a change to the plant design, the plant operation, or to procedures is planned which could have a significant adverse effect on the environment or which involves an environmental matter or question not previously reviewed and evaluated by the NRC, a request for the change shall be made to the NRC before implementation.

2. Changes or additions to permits and certificates required for the protection of the environment shall be reported. When the required changes are submitted to the concerned agency for approval, they shall also be submitted to the Director, Division of Operating Reactors, USNRC, for information.

3. Requests for changes in environmental technical specifications shall be submitted to the Director, Division of Operating Reactors, USNRC, for prior review and authorization.

5.7 Environmental Records

5.7.1 Operational information concerning the inplant portion of the environmental technical specifications shall be kept by DPP in a manner convenient for review. This includes plant records and/or logs as indicated below:

a. Related plant operations

b. Related maintenance activities

c. LCO violation

d. Updated, corrected, and as-built drawings of the plant

Item (a) through (c) above shall be retained for a period of at least six years and item (d) shall be retained for the life of the plant.

5.7.2 Records and/or logs shall be maintained by DEP and/or DWM in a manner convenient for review. This information concerning the environmental monitoring program is indicated below:

a. Checks, inspections, tests, and calibration of components and systems.

b. Principal maintenance activities associated with environmental monitoring equipment and systems.

c. Results of environmental monitoring surveys related to BFNP.

Items (a) and (b) shall be retained for a period of at least six years and item (c) shall be retained for the life of the plant.

Table 3.1.2-1

Sources of Added Chemicals and Resulting End Product Chemicals

System	Chemical Added Source Chemical	Maximum[c] Annual Use lbs	Waste End Product Chemical	Maximum Resulting[a] End Product Annual lbs	Maximum Resulting[a] End Product Mean Daily lbs
Makeup Water Treatment Plant	Alum $Al_2(SO_4)_3 \cdot 18\ H_2O$	15,800	$Al(OH)_3$[b]	3,700	~10
			SO_4^{--}	6,800	~21
			Suspended solids[b,c]	13,500	~37
	Soda Ash Na_2CO_3 (100%)	7,900	Na^+	3,400	~10
	Sodium Hypochlorite NaOCl (21% Solution)	3,950	Na^+	260	~ .1
			OCl^-	570	~ 2
	Coagulation Aid	590	Coag. Aid[b]	590	~ 2
Makeup water Treatment Plant Demineralizer Regeneration	Sulfuric Acid 98%	270,000	SO_4^{--}	259,000	~710
	Sodium Hydroxide (50%)	205,000	Na^+	59,000	~160
Auxiliary Steam Generator Blowdown	Ammonia	Variable[d]	NH_3	6	~0.02
	Hydrazine	Variable[e]	NH_3	0.4	~0.001
Raw cooling water System	Chlorine	Variable	OCl^- and Cl^-	Variable	1,620

a. Based on 24-hour operation 365 days/year at demonstrated maximum capacity of equipment.
b. Suspended materials that will make up the water treatment plant sludge, on a dry weight basis.
c. Estimates from suspended solids data observed at TRM 300.3.
d. Ammonia will be added as needed to keep pH of system at 9.0.
e. Hydrazine will be added as needed as a DO scavenger.

Table 3.1.2-2

SUMMARY OF CHEMICAL DISCHARGES

Waste Product Chemical	Maximum[a] Annual Discharge of Product Chemical lbs	Waste[b] Product Chemical Contribution to Discharge Concentrations mg/l	Observed Concentrations in Reservoir Water at TRM 300.3 mg/l Average	Observed Concentrations in Reservoir Water at TRM 300.3 mg/l Maximum	Total Concentrations[c] in River After Mixing mg/l Average	Total Concentrations[c] in River After Mixing mg/l Maximum	Maximum[g] Allowable Concentrations in River mg/l
Sulfates (SO_4^{--})	265,800	0.031	15.0	23.0	15.027	23.027	250
Sodium (Na^+)	62,700	0.007	5.92	9.18	5.9263	9.1863	d
Chlorides[e]	34,600	0.068	14.0	21.0	14.060	21.060	250
Ammonia[f] NH_3	6.4	nil	0.02	0.07	0.02	0.07	d
Total Dissolved Solids	363,106	0.106	104.0	129.0	104.093	129.093	500

a. Based on 24-hour operation 365 days per year at demonstrated maximum capacity of equipment and chemical requirements.
b. Discharge flows based on 3-unit operation.
c. Concentrations based on downstream riverflow of 5,000 ft^3/s. However, heat dissipation considerations will require minimum of 23,000 ft^3/s for open mode.

d. No specific standard has been identified but contribution to dissolved solids has been included.
e. Computation is for chlorides since the chlorine demand of the cooling water is such that no residual chlorine will be discharged. Chlorides and total dissolved solids reflect maximum daily use of chlorine in raw cooling water.
f. Ammonia and hydrazine added to auxiliary steam generator for pH and dissolved oxygen control. Hydrazine conservatively assumed to decompose to ammonia.
g. Alabama Water Improvement Commission Stream Standards.

Table 4.1-1

SUMMARY OF NONRADIOLOGICAL MONITORING PROGRAM

BROWNS FERRY NUCLEAR PLANT

Station TRM	Water Samples	Zooplankton, Chlorophyll and Phytoplankton Sampling	Productivity Measurements	Benthic Fauna	Sediment	Fish[a]
Second Creek Embayment Station						X
277.98	X[b]	X	X	X	X	
283.94	X[c]	X	X	X		X
Elk River Embayment Station						X
288.78	X[b]	X	X	X	X	
291.76	X[c]	X	X	X		X
293.70	X[b]	X	X	X	X	X
295.87	X[c]	X	X	X		
299.00						X
301.06		X	X	X		
307.52	X[b]	X	X	X	X	X

X - Indicates at least one quarterly sample collected at the specified station.

a. Fish sampling at a specific station will be by either gill net, trap net, rotenone, or electrofishing. However, depending upon the sampling method the frequency of sampling at each location may be less than quarterly.

b. Analysis - Dissolved oxygen and temperature.

c. Analysis - Dissolved oxygen, temperature BOD_5, COD, pH, alkalinity, specific conductance, Na, SO_4, chlorides, nitrogens (NH_3, NO_2+NO_3, and organic) and solids (dissolved, suspended, and total).

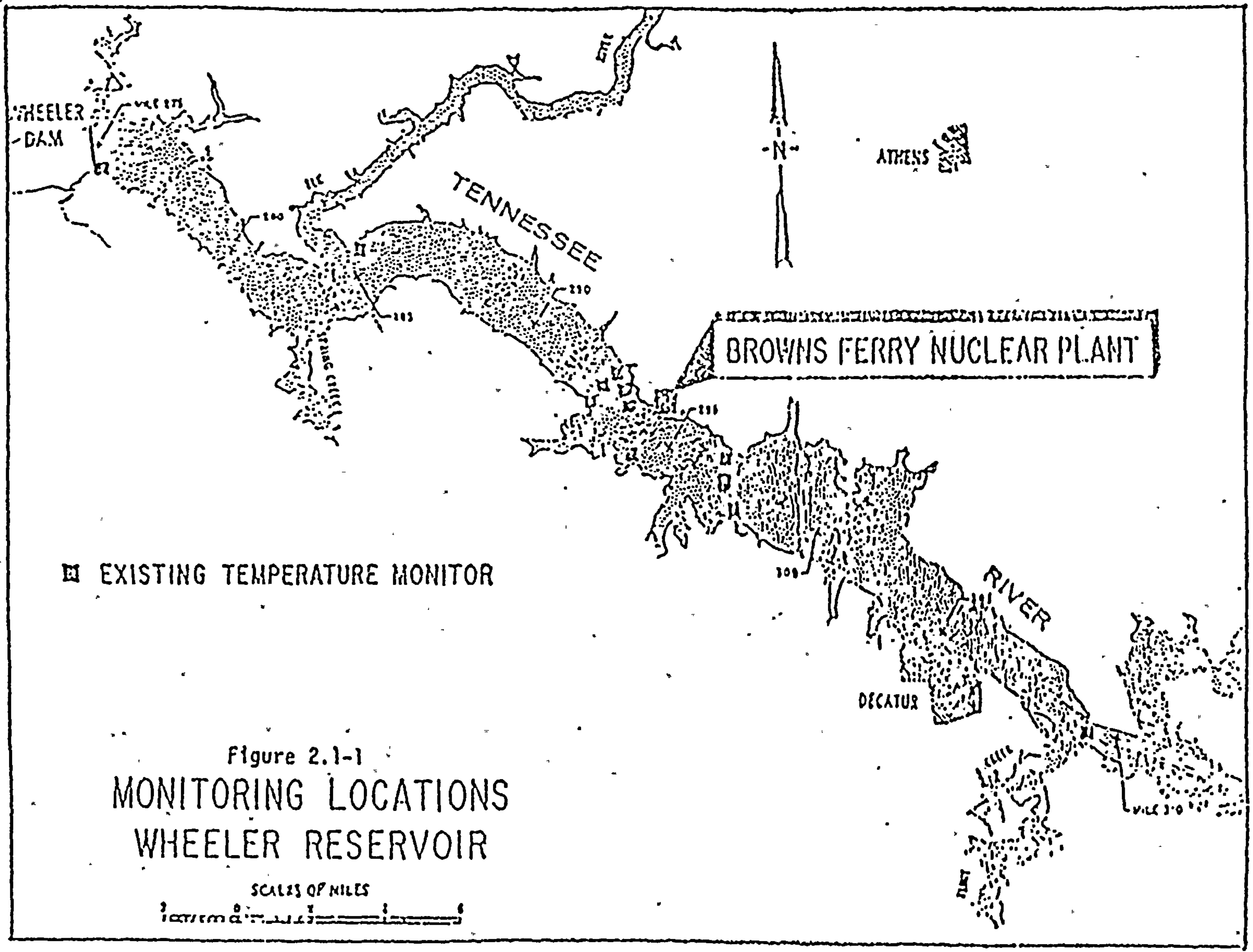
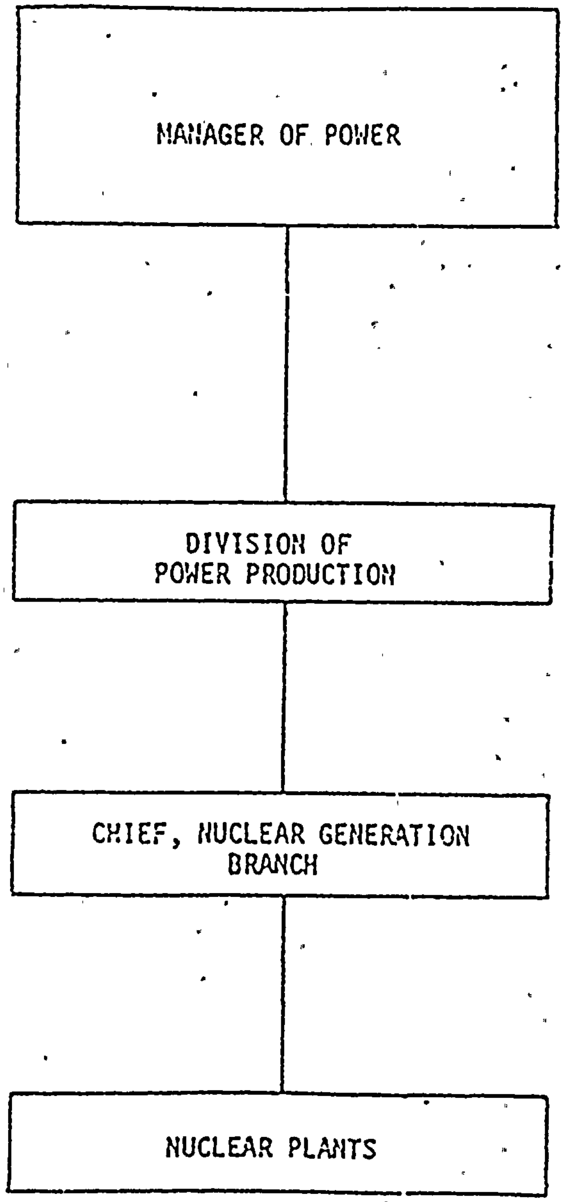


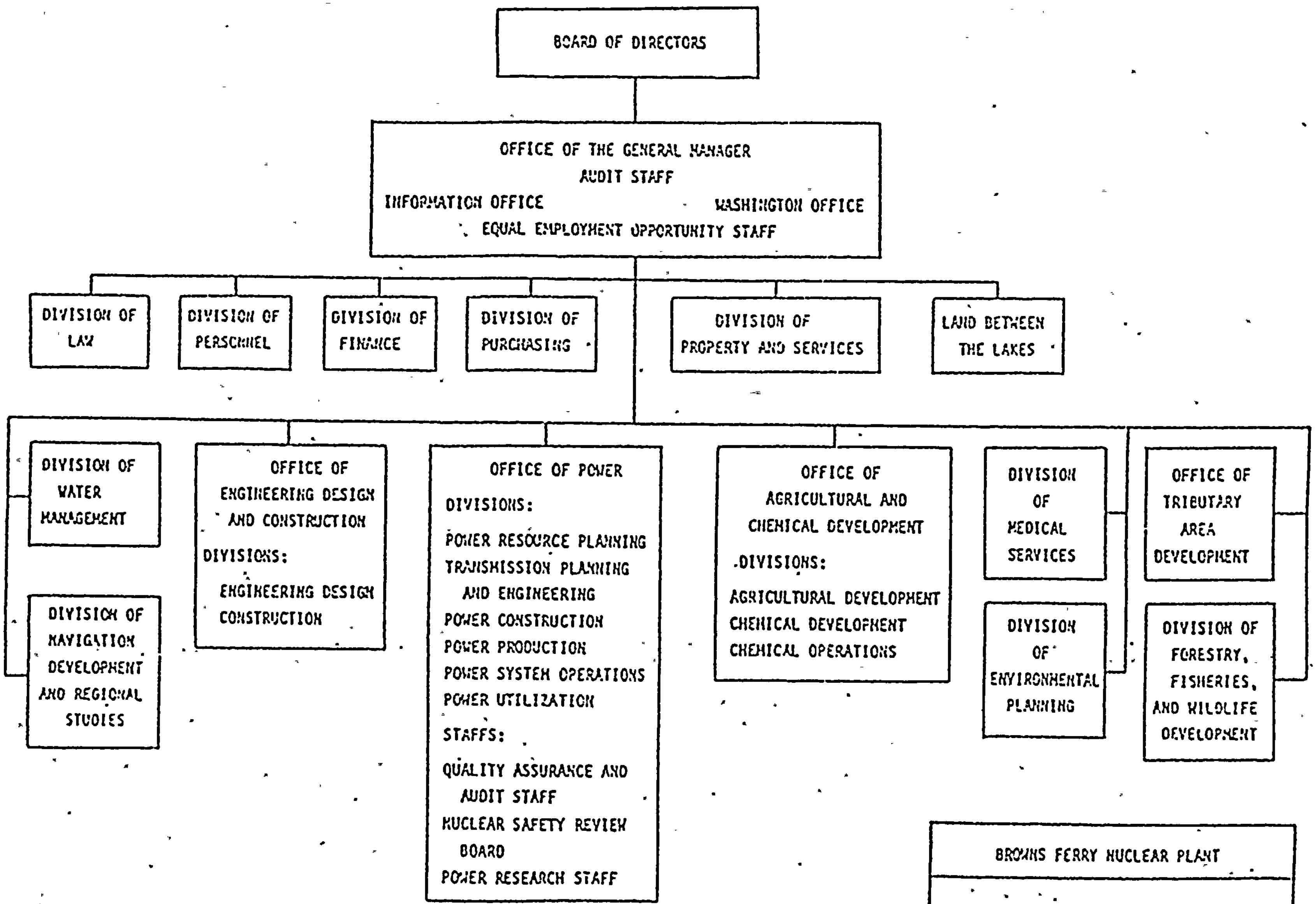
Figure 2.1-1
MONITORING LOCATIONS
WHEELER RESERVOIR



BROWNS FERRY NUCLEAR PLANT

TVA Office of Power Organization for Operation of Nuclear Plants

Figure 5.2-I



BROWNS FERRY NUCLEAR PLANT

Organization of the Tennessee Valley Authority

Figure 5.2-2

UNIT 3

4.1.3 Special Studies

Objective

To demonstrate the adequacy of weekly sampling of chlorine residual during chlorination of the auxiliary raw cooling water systems by demonstrating that chlorine residual in auxiliary raw cooling water (RCW) systems remains relatively constant during chlorination.

Specification

TVA will perform special studies during the first two periods (including a spring and a fall period) of chlorination of the RCW systems after September 1975, which are of at least 3 weeks' duration. During the special studies period when the RCW systems are being chlorinated, samples will be taken daily from the RCW systems and analyzed for chlorine residual. Records of the daily sampling and analyses will be maintained and submitted to the NRC staff for their review following the end of the special study period. Chlorine feed rate and equivalent RCW concentration will be reported for the special studies period.

Sampling during the special study period will be considered to satisfy the monitoring requirements of Section 2.2.2 of the environmental technical specifications.

4.2 Radiological Environmental Monitoring Program

DELETED

5.0 ADMINISTRATIVE CONTROLS

Objective

This section describes the administrative and management controls established to provide continuing protection to the environment and to implement the environmental technical specifications. Measures to be specified in this section include the assignment of responsibilities, organizational structure, operating procedures, review and audit functions, and reporting requirements.

Specifications

5.1 Responsibility

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5.3 Review and Audit

5.3.1 The Director, DEP, is responsible for review of plant operation related to LCO to insure that plant operation is being conducted within the limits defined in Section 2 of this document.

5.3.2 The Office of Power Quality Assurance and Audit Staff shall conduct a periodic audit of the environmental monitoring program at least once per calendar year.

5.3.3 The DPRP and/or DEP shall review and contribute to the following items:

a. Preparation of the proposed environmental technical specifications.

b. Coordination of environmental technical specification development with the safety technical specifications to avoid conflicts and maintain consistency.

c. Proposed changes to the environmental technical specifications and the evaluated impact of the change.

d. Proposed written procedures, as described in Section 5.5 and proposed changes thereto which could significantly affect the plant's environmental impact.

e. Proposed changes or modifications to plant systems or equipment which could significantly affect the plant's environmental impact and the evaluated impact of the changes.

f. Results of the environmental monitoring programs prior to their submittal in each Annual Operating Report. See Sections 5.6.1 and 5.6.2.

g. Reported instances of violations of environmental technical specifications. Where investigation indicates, evaluation and formulation of recommendations to prevent recurrence.

5.4 Action to be Taken if an Environmental LCO is Exceeded

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5.4.2 DEP will conduct an independent investigation of the incident. This investigation shall consist of the circumstances leading to and resulting from the situation together with recommendations to prevent a recurrence. The results of the investigation shall be reported to the Director, DPP.

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a. A summary report shall be prepared for both the inplant monitoring program and the nonradiological monitoring programs and submitted to the Director of Division of Operating Reactors, NRC, as part of the Annual Operating Report within 120 days after December 31 of each year.

5.6.3 Non-Routine Reports

Nonradiological

a. In the event a limiting condition for operation is exceeded or an unusual event with a potential for a significant environmental impact occurs, a report shall be made within 24 hours by telephone or telegraph to the Director of the Regional Office of Inspection and Enforcement, Region II, followed by a written report within 10 days to the Director of the Regional Office of Inspection and Enforcement, Region II (copy to the Director of Division of Operating Reactors).

Changes

b. 1. Where a change to the plant design, the plant operation, or to procedures is planned which could have a significant adverse effect on the environment or which involves an environmental matter or question not previously reviewed and evaluated by the NRC, a request for the change shall be made to the NRC before implementation.

2. Changes or additions to permits and certificates required for the protection of the environment shall be reported. When the required changes are submitted to the concerned agency for approval, they shall also be submitted to the Director, Division of Operating Reactors, USNRC, for information.

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c. LCO violation

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Table 3.1.2-1

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			SO_4^{--}	6,800	~21
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	Soda Ash Na_2CO_3 (100%)	7,900	Na^+	3,400	~10
	Sodium Hypochlorite NaOCl (21% Solution)	3,950	Na^+	260	~.1
			OCl^-	570	~ 2
	Coagulation Aid	590	Coag. Aid[b]	590	~ 2
Makeup water Treatment Plant Demineralizer Regeneration	Sulfuric Acid 98%	270,000	SO_4^{--}	259,000	~710
	Sodium Hydroxide (50%)	205,000	Na^+	59,000	~160
Auxiliary Steam Generator Blowdown	Ammonia	Variable[d]	NH_3	6	~0.02
	Hydrazine	Variable[e]	NH_3	0.4	~0.001
Raw cooling water System	Chlorine	Variable	OCl^- and Cl^-	Variable	1,620

a. Based on 24-hour operation 365 days/year at demonstrated maximum capacity of equipment.
b. Suspended materials that will make up the water treatment plant sludge, on a dry weight basis.
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d. Ammonia will be added as needed to keep pH of system at 9.0.
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Table 3.1.2-2

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			Average	Maximum	Average	Maximum	
Sulfates (SO_4^{--})	265,800	0.031	15.0	23.0	15.027	23.027	250
Sodium (Na^+)	62,700	0.007	5.92	9.18	5.9263	9.1863	d
Chlorides[e]	34,600	0.068	14.0	21.0	14.060	21.060	250
Ammonia[f] NH_3	6.4	nil	0.02	0.07	0.02	0.07	d
Total Dissolved Solids	363,106	0.106	104.0	129.0	104.093	129.093	500

a. Based on 24-hour operation 365 days per year at demonstrated maximum capacity of equipment and chemical requirements.
b. Discharge flows based on 3-unit operation.
c. Concentrations based on downstream riverflow of 5,000 ft^3/s. However, heat dissipation considerations will require minimum of 23,000 ft^3/s for open mode.

d. No specific standard has been identified but contribution to dissolved solids has been included.
e. Computation is for chlorides since the chlorine demand of the cooling water is such that no residual chlorine will be discharged. Chlorides and total dissolved solids reflect maximum daily use of chlorine in raw cooling water.
f. Ammonia and hydrazine added to auxiliary steam generator for pH and dissolved oxygen control. Hydrazine conservatively assumed to decompose to ammonia.
g. Alabama Water Improvement Commission Stream Standards.

Table 4.1-1

SUMMARY OF NONRADIOLOGICAL MONITORING PROGRAM
BROWNS FERRY NUCLEAR PLANT

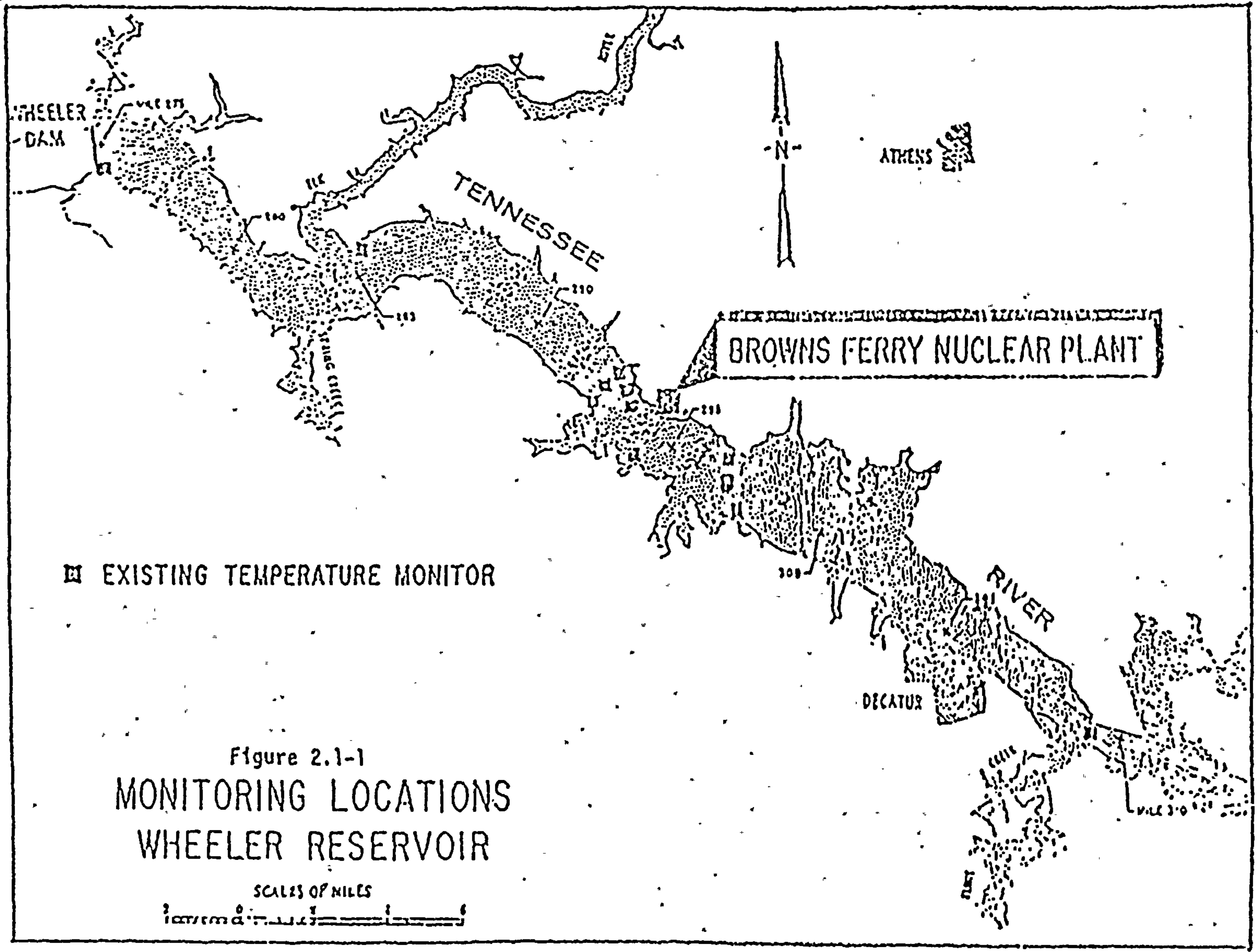
Station TRM	Water Samples	Zooplankton, Chlorophyll and Phytoplankton Sampling	Productivity Measurements	Benthic Fauna	Sediment	Fish[a]
Second Creek Embayment Station						X
277.98	X[b]	X	X	X	X	
283.94	X[c]	X	X	X		X
Elk River Embayment Station						X
288.78	X[b]	X	X	X	X	
291.76	X[c]	X	X	X		X
293.70	X[b]	X	X	X	X	X
295.87	X[c]	X	X	X		
299.00						X
301.06		X	X	X		
307.52	X[b]	X	X	X	X	X

X - Indicates at least one quarterly sample collected at the specified station.

a. Fish sampling at a specific station will be by either gill net, trap net, rotenone, or electrofishing. However, depending upon the sampling method the frequency of sampling at each location may be less than quarterly.

b. Analysis - Dissolved oxygen and temperature.

c. Analysis - Dissolved oxygen, temperature BOD_5, COD, pH, alkalinity, specific conductance, Na, SO_4, chlorides, nitrogens (NH_3, NO_2+NO_3, and organic) and solids (dissolved, suspended, and total).

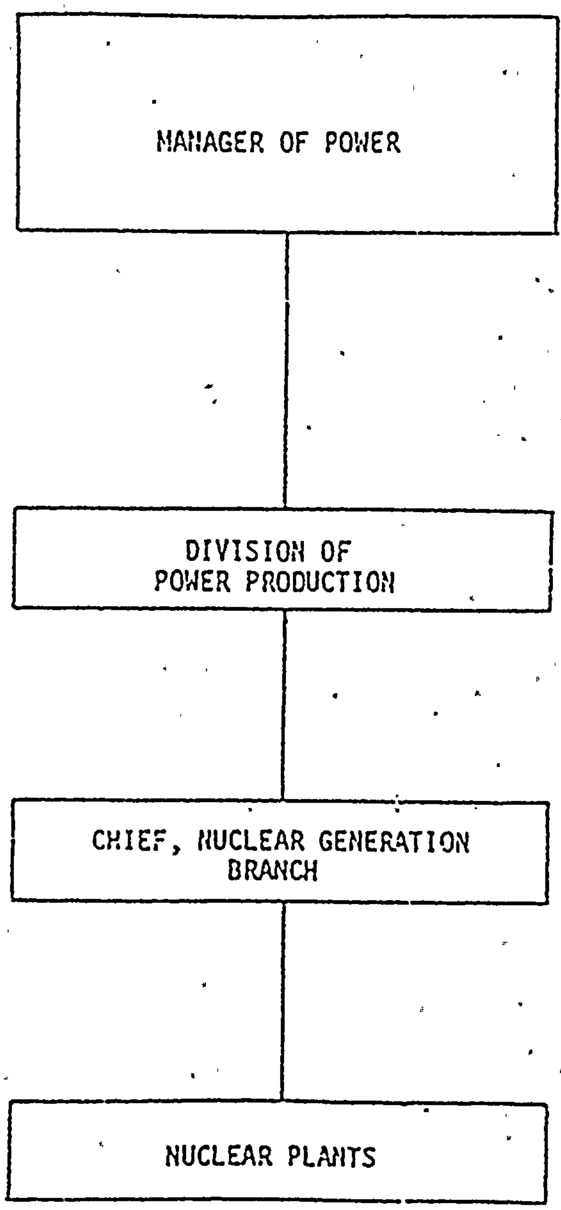


⌧ EXISTING TEMPERATURE MONITOR

Figure 2.1-1

MONITORING LOCATIONS
WHEELER RESERVOIR

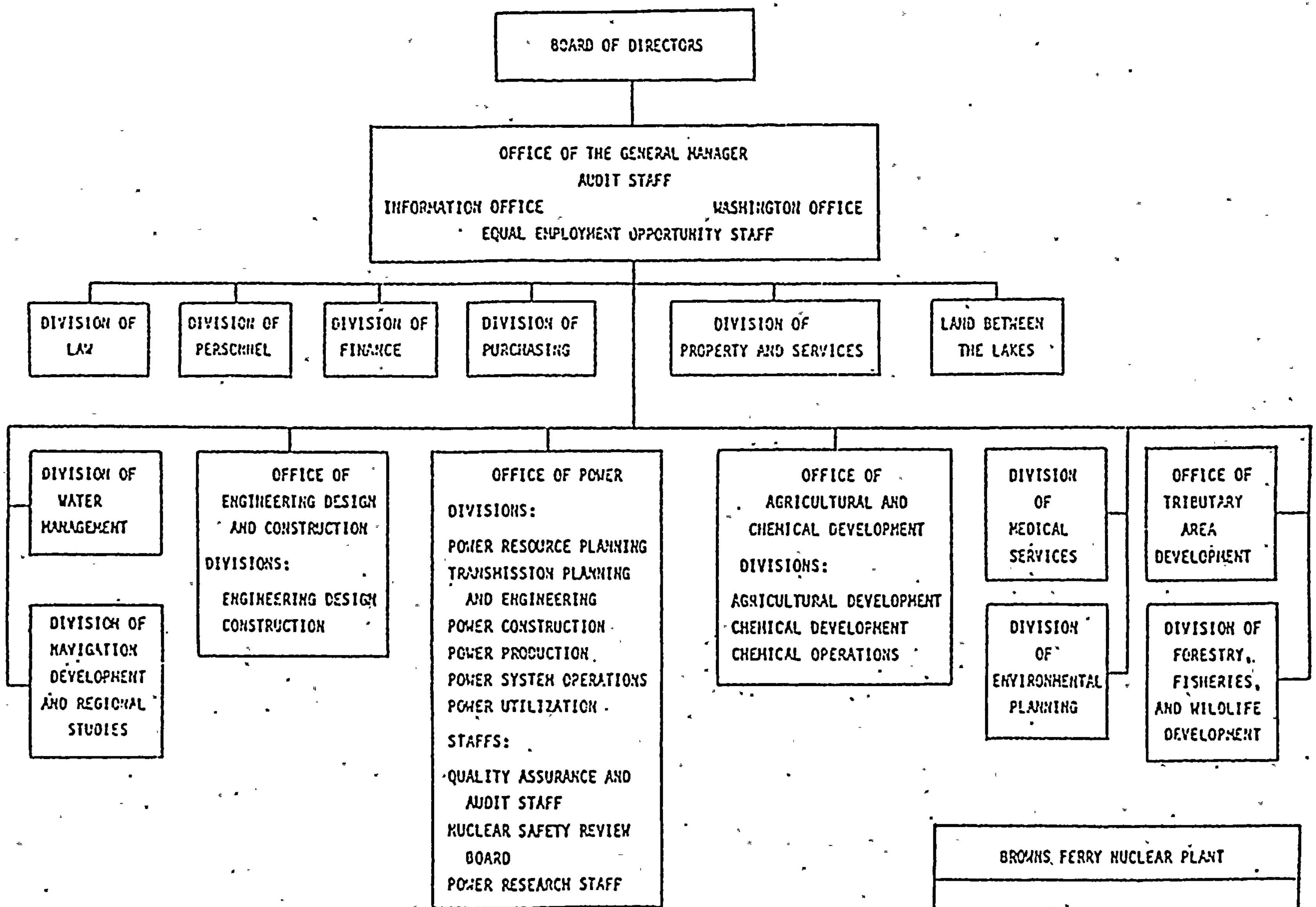
SCALES OF MILES



BROWNS FERRY NUCLEAR PLANT

TVA Office of Power Organization for Operation of Nuclear Plants

Figure 5.2-I



BROWNS FERRY NUCLEAR PLANT

Organization of the Tennessee Valley Authority

Figure 5.2-2

ENCLOSURE 3

7907060357

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT

TECHNICAL INSTRUCTION 47

OFFSITE DOSE CALCULATION MANUAL (ODCM)

Approved: ______________________
Plant Superintendent

Date: June 21, 1979

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1. Gaseous Effluents

1.1 Alarm/Trip Setpoints

Specification 3.8.B.1 requires that the dose rate in unrestricted areas due to gaseous effluents from the site shall be limited at all times to the following values:

1. 500 mrem/y to the total body and 3,000 mrem/y to the skin from noble gases.
2. 1,500 mrem/y to any organ from radioiodines and particulates.

Specification 3.2.K.1 requires gaseous effluent monitors to have alarm/trip setpoints to ensure that the above dose rates are not exceeded. This section of the ODCM describes the methodology that will be used to determine these setpoints.

The methodology for determining alarm/trip setpoints is divided into two major parts. The first consists of backcalculating from a dose rate to a release rate limit, in μCi/s, for each nuclide and release point. The second consists of using the release rate limits to determine the physical settings on the monitors. The methodology for the latter is contained in Technical Instruction 15.

1.1.1 Release Rate Limit Methodology - μCi/s

Step 1

The first step involves calculating a dose rate based on the design objective source term mix used in the licensing of the plant. Historical meteorological data used are in this calculation.

Doses are determined for (1) noble gases and (2) iodines and particulates. Depending on the pathway involved, either air concentrations or ground concentrations are calculated.

A. Equations and assumptions for calculating doses from noble gases are as follows:

Assumptions

1. Doses to be calculated are total body and skin.
2. Exposure pathway is submersion within a cloud of noble gases.
3. Noble gas radionuclide mix is based on the expected source term given in Table 1.1.
4. Basic radionuclide data are given in Table 1.2.
5. Releases are treated as ground-level, split-level, or elevated.
6. Meteorological data are expressed as joint frequency distributions (JFD's) of wind speed, wind direction, and atmospheric stability for the period January 1974 to December 1975 (Table 1.3). Releases from the turbine building are treated as 100 percent ground level, whereas stack releases are considered 100 percent elevated. Releases from the reactor building and radwaste building are treated as split-level; i.e., partly elevated and partly ground level.
7. Raw meteorological data for ground-level releases consist of wind speed and direction measurements at 10 m and temperature measurements at 10 m and 45 m. The ground-level portion of the split-level JFD was based on wind speeds and directions measured at the 10 m level and temperature measurements at 10 and 45 m. The elevated portion of the split-level JFD was based on wind speeds and directions measured at 46 m and temperature measurements at 45 and 90 m. Wind speeds and directions for elevated releases were measured at 93 m. Stability class D was assumed to persist during the entire period for elevated releases.
8. Dose is to be evaluated at the offsite exposure point where maximum concentrations are expected to exist.
9. Potential maximum-exposure (Table 1.4) considered are the nearest site boundary points in each sector.

10. A semi-infinite cloud model is used.

11. No credit is taken for shielding by residence.

12. Plume depletion and radioactive decay are considered.

13. Building wake effects on effluent dispersion are considered.

14. A sector-average dispersion equation is used.

15. The wind speed classes that are used are as follows:

Number	Range (m/s)	Midpoint (m/s)
1	<0.3	0.13
2	0.3-0.6	0.45
3	0.7-1.5	1.10
4	1.6-2.4	1.99
5	2.5-3.3	2.80
6	3.4-5.5	4.45
7	5.6-8.2	6.91
9	>10.9	13.00

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

17. Terrain elevations are considered.

Equations

To calculate the dose from radioactive effluents discharged from a given release point for any one of the 16 potential maximum-exposure points, the following equations are used.

For determining the air concentration of any radionuclide:

$$\chi_i = \sum_{j=1}^{9} \sum_{k=1}^{7} \left(\frac{2}{\pi}\right)^{1/2} \frac{f_{jk} Q_i p}{\Sigma_{zk} u_j (2\pi x/n)} \exp\left(-\lambda_i \frac{x}{u_j}\right) \exp\left(-h_e^2/2\sigma_{zk}^2\right) \quad (1.1)$$

where

χ_i = air concentration of radionuclide i, $\mu Ci/m^3$.

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

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

p = fraction of radionuclide remaining in plume, Figure 1.1.

Σ_{zk} = vertical dispersion coefficient for stability class k which includes a building wake adjustment, $\Sigma_{zk} = \left[\sigma_{zk}^2 + 0.5A/\pi\right]^{1/2}$, where σ_{zk} is the vertical dispersion coefficient for stability class k (m), and A is the minimum building cross-sectional area (2,350 m^2), m.

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

x = downwind distance, m.

n = number of sectors, 16.

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

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

h_e = effective release height, m.

For effluents exhausted from release points that are higher than twice the height of adjacent structures (elevated releases) the effective release height is determined by

$$h_e = h_s + h_{pr} - h_t - c \quad (1.1a)$$

where

c = correction for low relative exit velocity, $c = 3(1.5 - W_o/\bar{u})\,d$, where W_o = vertical plume exit velocity (m/s), $\bar{u}$ = mean windspeed (m/s), and d = inside diameter of the release point, m.

h_{pr} = plume rise above release point, m.

h_s = physical height of release point, m.

h_t = maximum terrain height between release point and receptor location (h_t can be any real number), m.

For effluents released from points less than the height of adjacent structures, a ground level release is assumed ($h_e = 0$).

For effluents released from points at the level of or above adjacent structures, but lower than elevated release points, releases are treated as follows:

Case 1 - elevated if $W_o/\bar{u} \geq 5$

Case 2 - ground-level ($h_e = 0$) if $W_o/\bar{u} \leq 1$.

Case 3 - split-level if $1 < W_o/\bar{u} < 5$.

Under Case 3 a split-level dispersion approach is implemented using a model that requires for each release point two JFD's, one for elevated releases and one for ground-level releases. The summation of the elevated and ground-level JFD's account for the total period of record. Releases are considered to be elevated 100 $(1-E_t)$ percent of the time and ground-level 100 E_t percent of the time where the entrainment coefficient, E_t, is defined by

$$E_t = 2.58 - 1.58\,(W_o/\bar{u}) \text{ for } 1 < W_o/\bar{u} \leq 1.5 \qquad (1.1b)$$

$$E_t = 0.3 - 0.06\,(W_o/\bar{u}) \text{ for } 1.5 < W_o/\bar{u} \leq 5 \qquad (1.1c)$$

For determining the total body dose rate

$$D_{TB} = 1x10^6 \sum_i \chi_i \, DFB_i \qquad (1.2)$$

where

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

χ_i = air concentration of radionuclide i, μCi/m³.

DFB_i = total body dose factor due to gamma radiation, mrem/y per pCi/m³ (Table 1.5).

$1x10^6$ = pCi/μCi conversion factor.

For determining the skin dose rate

$$D_s = 1x10^6 \sum_i \chi_i \, [DFS_i + 1.11 \, DF\gamma_i] \qquad (1.3)$$

where

D_s = skin dose rate, mrem/y.

χ_i = air concentration of radionuclide i, μCi/m³.

DFS_i = skin dose factor due to beta radiation, mrem/y per pCi/m³ (Table 1.5).

$DF\gamma_i$ = gamma-to-air dose factor for radionuclide i, mrem/y per pCi/m³ (Table 1.5).

$1x10^6$ = pCi/μCi conversion factor.

The above dose calculations are repeated for each release point (vent or stack) and then summed to obtain maximum total body and skin dose rates. The maximum total body and skin does rates will then be used in step 2.

B. Equations and assumptions for calculating doses from radioiodines and particulates are as follows:

<u>Assumptions</u>

1. Dose is to be calculated for the critical organ, thyroid, and the critical age group, infant.
2. Exposure pathways from iodines and particulates are milk ingestion, ground contamination, and inhalation.
3. The radioiodine and particulate mix is based on the expected source term given in Table 1.1.
4. Basic radionuclide data are given in Table 1.2.
5. Releases are treated as ground-level, split-level, or elevated.
6. Meteorological data are expressed as joint frequency distributions (JFD's) of wind speed, wind direction, and atmospheric stability for the period January 1974 to December 1975 (Table 1.3). Releases from the turbine building are treated as 100 percent ground level, whereas stack releases are considered 100 percent elevated. Releases from the reactor building and radwaste building are treated as split-level; i.e., partly elevated and partly ground level.
7. Raw meteorological data for ground-level releases consist of wind speed and direction measurements at 10 m and temperature measurements at 10 m and 45 m. The ground-level portion of the split-level JFD was based on wind speeds and directions measured at the 10 m level and temperature measurements at 10 and 45 m. The elevated portion of the split-level JFD was based on wind speeds and directions measured at 46 m and temperature measurements at 45 and 90 m. Wind speeds and directions for elevated releases

were measured at 93 m. Stability class D was assumed to persist during the entire period for elevated releases.

8. Dose is to be evaluated at the potential offsite exposure point where maximum concentrations are expected to exist.
9. Real cow and garden locations are not considered.
10. Potential maximum-exposure points (Table 1.4) considered are the nearest site boundary points in each sector.
11. Terrain elevations are considered.
12. Building wake effects on effluent dispersion are considered.
13. Plume depletion and radioactive decay are considered for air-concentration calculations.
14. Radioactive decay is considered for ground-concentration calculations.
15. Deposition is calculated based on the curves given in Figure 1.2.
16. A milk cow obtains 100 percent of her food from pasture grass.
17. No credit is taken for shielding by residence.

Equations

To calculate the dose from radioactive effluents discharged from a given release point for any one of the potential maximum-exposure points, the following equations are used.

1. Inhalation

Equation for calculating air concentration, χ, is the same as in the Noble Gas Section, 1.1.1.A.

For determining the thyroid dose rate:

$$D_{THI} = 1x10^6 \sum_i X_i \, DFI_i \, BR \quad (1.4)$$

where:

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

X_i = air concentration of radionuclide i, $\mu Ci/m^3$.

DFI_i = infant inhalation dose factor, mrem/pCi (Table 1.7).

BR = infant breathing rate, 1,400 m^3/y.

$1x10^6$ = pCi/µCi conversion factor.

2. Ground Contamination

For determining the ground concentration of any nuclide:

$$G_i = 3.15x10^7 \sum_{k=1}^{7} \frac{f_k \, Q_i \, DR}{(2\pi x/n) \, \lambda_i} \left[1-\exp{-(\lambda_i \, t_b)}\right] \quad (1.5)$$

where

G_i = ground concentration of radionuclide i, $\mu Ci/m^2$.

k = stability class.

f_k = joint relative frequency of occurrence of winds in stability class k blowing toward this exposure point, expressed as a fraction.

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

DR = relative deposition rate, m^{-1} (Figure 1.2). The choice of figure is governed by the effective release height calculated by equation 1.1a. A linear interpolation is used for effective release heights that fall in between the given curves.

x = downwind distance, m.

n = number of sectors, 16.

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

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

t_b = time for buildup of radionuclides on the ground, 35y.

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

For determining the thyroid dose rate from ground contamination:

$$D_{THG} = (8,760)(1x10^6) \sum_i G_i \, DFG_i \tag{1.6}$$

where:

D_{THG} = thyroid dose rate due to ground contamination, mrem/y.

G_i = ground concentration of radionuclide i, $\mu Ci/m^2$.

DFG_i = dose factor for standing on contaminated ground, mrem/h per pCi/m^2 (Table 1.8).

8,760 = occupation time, h/y.

$1x10^6$ = pCi/µCi conversion factor

3. Milk Ingestion

For determining the concentration of any nuclide (except C-14 and H-3) in and on vegetation:

$$CV_i = 3,600 \sum_{k=1}^{7} \frac{f_k \, Q_i \, DR}{(2\pi x/n)} \left\{ \frac{r[1-\exp(-\lambda_{Ei} \, t_e)]}{Y_v \, \lambda_{Ei}} + \frac{B_{iv} \, [1-\exp(-\lambda_i \, t_b)]}{P \, \lambda_i} \right\} \tag{1.7}$$

where:

CV_i = concentration of radionuclide i in and on vegetation, µCi/kg.

k = stability class.

f_k = frequency of this stability class and wind direction combination, expressed as a fraction.

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

DR = relative deposition rate, m^{-1} (Figure 1.2. The choice of figure is governed by the effective release height calculated by equation 1.1a. A linear interpolation is used for effective release heights that fall in between the given curves.

x = downwind distance, m.

n = number of sectors, 16.

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

r = fraction of deposited activity retained on vegetation (1.0 for iodines, 0.2 for particulates).

λ_{Ei} = effective removal rate constant, $\lambda_{Ei} = \lambda_i + \lambda_w$, where λ_i is the radioactive decay coefficient, h^{-1}, and λ_w is a measure of physical loss by weathering (λ_w = .0021 h^{-1}), h^{-1}.

t_e = period over which deposition occurs, 720 h.

Y_v = agricultural yield, 0.7 kg/m^2.

B_{iv} = transfer factor from soil to vegetation of radionuclide i (Table 1.6).

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

t_b = time for buildup of radionuclides on the ground, 3.07×10^5 h (35y).

P = effective surface density of soil, 240 kg/m^2.

3,600 = s/h conversion factor.

For determining the concentration of C-14 in vegetation:

$$CV_{14} = 1x10^3 \chi_{14} (0.11/0.16) \tag{1.8}$$

where

CV_{14} = concentration of C-14 in vegetation, µCi/kg.

χ_{14} = air concentration of C-14, µCi/m³.

0.11 = fraction of total plant mass that is natural carbon.

0.16 = concentration of natural carbon in the atmosphere, g/m³.

$1x10^3$ = g/kg conversion factor.

For determining the concentration of H-3 in vegetation:

$$CV_T = 1x10^3 \chi_T (0.75)(0.5/H) \tag{1.9}$$

where

CV_T = concentration of H-3 in vegetation, µCi/kg.

χ_T = air concentration of H-3, µCi/m³.

0.75 = fraction of total plant mass that is water.

0.5 = ratio of tritium concentration in plant water to tritium concentration in atmospheric water.

H = absolute humidity of the atmosphere, g/m³.

$1x10^3$ = g/kg conversion factor.

For determining the concentration of any nuclide in cow's milk:

$$CM_i = CV_i \ FM_i \ Q_f \ \exp^{(-\lambda_i \ t_f)} \qquad (1.10)$$

where

CM_i = concentration of radionuclide i (including C-14 and H-3) in cow's mil µCi/l.

CV_i = concentration of radionuclide i in and on vegetation, µCi/kg.

FM_i = transfer factor from feed to milk for radionuclide i, d/l.

Q_f = amount of feed consumed by the cow per day, kg/d.

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

t_f = transport time of activity from feed to milk to receptor, 2 days.

For determining the thyroid dose rate from ingestion of cow's milk:

$$D_{THM} = 1x10^6 \sum_i CM_i \ DFING_i \ UM \qquad (1.11)$$

where

D_{THM} = thyroid dose rate due to milk ingestion, mrem/y.

CM_i = concentration of radionuclide i in cow's milk, µCi/l.

$DFING_i$ = infant ingestion dose factor from Reg. Guide 1.109 (Rev. 1), mrem/pCi (Table 1.7).

UM = infant ingestion rate for milk, 330 l/y.

$1x10^6$ = pCi/µCi conversion factor.

4. Total Thyroid Dose Rate

For determining the total thyroid dose rate from iodines and particulates:

$$D_{TH} = D_{THI} + D_{THG} + D_{THM} \qquad (1.12)$$

where

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

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

D_{THG} = thyroid dose rate due to ground contamination, mrem/y.

D_{THM} = thyroid dose rate due to milk ingestion, mrem/y.

The above dose calculations are repeated for each release point and then summed to obtain thyroid dose rates. The maximum thyroid dose rate will then be used in step 2.

Step 2

The dose rate limits of interest (10CFR20) are

Total Body = 500 mrem/y

Skin = 3,000 mrem/y

Maximum Organ = 1,500 mrem/y

Dividing the above limits by the appropriate dose calculated in step 1 yields a useful ratio.

$$\frac{\text{Dose limit}}{\text{Dose step 1}} = R$$

This ratio, R, represents how far above or below the guidelines the step 1 calculation was. Multiplying the original source terms by R will give release rates that should correspond to the dose limits given above.

Release rate limits in µCi/s for each nuclide and release point are now available.

1.2 Monthly Dose Calculations

Dose calculations will be performed monthly to determine compliance with specifications 3.8.B.3 and 3.8.B.5. These specifications require that the dose rate in unrestricted areas due to gaseous effluents from each reactor at the site shall be limited to the following values:

For noble gases,

1. During any calendar quarter, 5 mrad to air for gamma radiation and 10 mrad to air for beta radiation.
2. During any calendar year, 10 mrad to air for gamma radiation and 20 mrad to air for beta radiation.

For iodines and particulates,

1. During any calendar quarter, 7.5 mrem to any organ.
2. During any calendar year, 15 mrem to any organ.

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

Doses will first be calculated by a simplified conservative approach (step 1). If these exceed the specification limits, a more realistic calculation will be performed (step 2).

1.2.1 Noble Gases

Step 1

Doses will be calculated using the methodology described in this step. If any limits are exceeded, step 2 will be performed.

Equations and assumptions for calculating doses from releases of noble gases are as follows:

Assumptions

1. Doses to be calculated are gamma and beta air doses.
2. The highest annual-average χ/Q based on licensing meteorology for ground-level releases for any offsite location will be used
3. No credit is taken for radioactive decay.
4. For gamma doses, releases of Xe-133, Xe-138, Kr-85m, and Kr-88 are considered.
5. For beta doses, releases of Xe-133, Xe-138, Kr-85m, and Kr-88 are considered.
6. Dose factors are calculated using data from TVA's nuclide library.
7. The nuclides considered are expected to contribute at least 90 percent of the total dose. However, the calculations extrapolate doses assuming that only 90 percent of total dose was contributed.
8. A semi-infinite cloud model is used.
9. Building wake effects on effluent dispersion are considered.

Equations

For determining the gamma dose to air:

$$D_\gamma = \frac{(\chi/Q)}{0.9} \sum_i Q_i \, DF\gamma_i \qquad (1.13)$$

where:

D_γ = gamma dose to air from continuous releases, mrad.

χ/Q = highest annual-average relative concentration, 2.26×10^{-6} s/m^3

0.9 = fraction of total gamma dose expected to be contributed by these nuclides (actually 0.94).

Q_i = monthly release of radionuclide i, Ci.

$DF\gamma_i$ = gamma-to-air dose factor for radionuclide i, mrad/s per Ci/m^3 (Table 1.5).

This equation then reduces to

$$D_\gamma = 2.51\times10^{-6} \sum_i Q_i \, DF\gamma_i \qquad (1.14)$$

For determining the beta dose to air:

$$D_\beta = \frac{(\chi/Q)}{0.9} \sum_i Q_i \, DF\beta_i \qquad (1.15)$$

where:

D_β = beta dose to air, mrad.

χ/Q = highest annual-average relative concentration, 2.26×10^{-6} s/m^3.

0.9 = fraction of total beta dose expected to be contributed by these nuclides (actually 0.90).

Q_i = monthly release of radionuclide i, Ci.

$DF\beta_i$ = beta-to-air dose factor for radionuclide i, mrad/s per Ci/m^3 (Table 1.5).

This equation then reduces to:

$$D_\beta = 2.51\times10^{-6} \sum_i Q_i \, DF\beta_i \qquad (1.16)$$

Step 2

This methodology is to be used if the calculations in Step 1 yield doses that exceed applicable limits.

Equations and assumptions for calculating doses to air from releases of noble gases are as follows:

Assumptions

1. Doses to be calculated are gamma and beta air doses.
2. Dose is to be evaluated at the nearest site boundary point in each sector.
3. Historical onsite meteorological data for the appropriate months from the period 1974-1975 will be used.
4. All measured radionuclide releases are considered.
5. A semi-infinite cloud model is used.
6. Radioactive decay is considered.
7. Building wake effects on effluent dispersion are considered.
8. Dose factors are calculated using data from TVA's radionuclide library.

Equations

Equation for calculating air concentration, χ, is the same as in Section 1.1.1, step 1, part A. Air concentrations are calculated for the site boundary in each sector.

For determining the gamma dose to air

$$D_{\gamma n} = t_m \sum_i \chi_{ni} \, DF_{\gamma i} \qquad (1.24)$$

where:

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

χ_{ni} = air concentration of radionuclide i in sector n, Ci/m^3.

$DF\gamma_i$ = gamma-to-air dose factor for radionuclide i, mrad/s per Ci/m^3 (Table 1.5).

t_m = time period considered (1 month, but number of s/mo is variable), s.

For determining the beta dose to air:

$$D_{\beta n} = t_m \sum_i \chi_{ni} \, DF\beta_i \qquad (1.25)$$

where:

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

χ_{ni} = air concentration of radionuclide i in sector n, Ci/m^3.

$DF\beta_i$ = beta to air dose factor for radionuclide i, mrad/s per Ci/m^3.

t_m = time period considered (number of seconds in this month), s.

The sector having the highest total dose is then used to check compliance with specification 3.8.3.3.

1.2.2 Iodines and Particulates

Step 1

Doses will be calculated using the methodology described in this step. If any limits are exceeded, step 2 will be performed.

Equations and assumptions for calculating doses from releases of iodines and particulates are as follows:

Assumptions

1. Dose is to be calculated for the critical organ, thyroid, and the critical age group, infant.
2. Exposure pathway considered is milk ingestion.
3. The highest annual-average D/Q based on licensing meteorology for ground-level releases for any real cow location will be used for I-131 and I-133 doses.
4. The highest annual-average χ/Q based on licensing meteorology for ground-level releases for any cow location will be used for C-14 doses.
5. No credit is taken for radioactive decay.
6. Releases of I-131, I-133, and C-14 are considered.
7. The radionuclides considered are expected to contribute at least 99 percent of the total dose. However, the calculations

extrapolate doses assuming that only 90 percent of the total dose was contributed.

8. Releases of C-14 are based on the expected source term.

9. The cow is assumed to graze on pasture grass for the whole year.

Equations

For determining the thyroid dose from milk ingestion of I-131 or I-133:

$$DTH_{131(133)} = \frac{Q_{131(133)}\ DF_{131(133)}\ D/Q}{3.15\times10^{7}} \qquad (1.26)$$

where:

$DTH_{131(133)}$ = thyroid dose from I-131(I-133), mrem.

$Q_{131(133)}$ = monthly release of I-131(133), Ci.

$DF_{131(133)}$ = I-131(133) milk ingestion dose factor to infant, mrem/y per Ci/m^2-s.

D/Q = relative deposition rate, $5.66\times10^{-9} m^{-2}$.

3.15×10^{7} = s/y.

For determining the thyroid dose from milk ingestion of C-14:

$$DTH_{14} = \frac{Q_{14}\ DF_{14}\ \chi/Q}{3.15\times10^{7}} \qquad (1.27)$$

where:

DTH_{14} = thyroid dose from C-14, mrem.

Q_{14} = monthly release of radionuclide i, Ci.

DF_{14} = C-14 milk ingestion dose factor, mrem/y per Ci/m^3.

χ/Q = relative dispersion factor, $2.26\times10^{-6}\ s/m^3$.

3.15×10^{7} = s/y.

For determining the total thyroid dose from releases:

$$DTH = \frac{DTH_{131} + DTH_{133} + DTH_{14}}{0.9} \quad (1.28)$$

where:

DTH = thryoid dose, mrem.

DTH_{131} = thyroid dose from release of I-131, mrem.

DTH_{133} = thyroid dose from release of I-133, mrem.

DTH_{14} = thyroid dose from release of C-14, mrem.

0.9 = fraction of total thyroid dose expected to be contributed by these radionuclides (actually 0.99).

Step 2

This methodology is to be used if the calculations in step 1 yield doses that exceed applicable limits.

Doses for releases of iodines and particulates shall be calculated using the methodology in Section 1.1.1, step 1, part B, with the following exceptions:

1. All measured radionuclide releases will be used.
2. Dose will be evaluated at real cow locations and will consider actual grazing information.

The receptor having the highest total dose is then used to check compliance with specification 3.8.B.5.

1.3 Gaseous Radwaste Treatment System Operation

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

1.3.1 System Description

A flow diagram for the GRTS is given in Figure 1.3. The system includes the subsystems that process and dispose of the gases from the main condenser air ejectors, the startup vacuum pumps, and the gland seal condensers. One gaseous radwaste treatment system is provided for each unit. The processed gases from each unit are routed to the plant stack for dilution and elevated release to the atmosphere. The air ejector off-gas line of each unit and the stack are continuously monitored by radiation monitors.

1.3.2 Dose Calculations

Doses will be calculated monthly using the methodology described in Section 1.2. These doses will be used to ensure that the GRTS is operating as designed.

TABLE 1.1

EXPECTED ANNUAL ROUTINE ATMOSPHERIC RELEASES FROM ONE UNIT AT BROWNS FERRY NUCLEAR PLANT (Ci/y/unit)

ISOTOPE	REACTOR COMPLEX VENT	RADWASTE BUILDING VENT	TURBINE BUILDING VENTS	STACK: GLAND SEAL AND OFFGAS	STACK: MVP
Kr-85m	6	<1	2	1.10 E4	0
Kr-87	6	<1	95	873	0
Kr-88	9	<1	102	1.22 E4	0
Kr-89	1	34	503	0	0
Xe-133m	0	60	0	633	0
Xe-133	103	294	581	5.40 E4	300
Xe-135m	111	667	464	1212	0
Xe-135	173	328	672	868	200
Xe-137	78	113	386	0	0
Xe-138	12	2	1179	1483	0
I-131 I	0.0594	0.0050	0.0156	0.0041	0.0085
I-132 I	0.594	0.050	0.1786	0.0469	0.0973
I-133 I	0.297	0.025	0.1231	0.0323	0.0671
I-134 I	1.485	0.125	0.0267	0.0070	0.0145
I-135 I	0.594	0.050	0.1231	0.0323	0.0671
I-131 O	0.0316	0.029	0.0065	0.0332	0.2741
I-132 O	0.316	0.290	0.0744	0.3801	3.1384
I-133 O	0.158	0.145	0.0513	0.2619	2.1626
I-134 O	0.790	0.725	0.0111	0.0568	0.4687
I-135 O	0.316	0.290	0.0513	0.2619	2.1626
Cr 51	3 E-3	9 E-4	1 E-3	1 E-4	0
Mn 54	3 E-3	5 E-3	2 E-3	4 E-5	0
Co 58	2 E-3	4 E-4	9 E-5	2 E-5	0
Fe 59	1 E-4	8 E-4	4 E-4	2 E-4	0
Co 60	3 E-2	6 E-3	3 E-3	1 E-5	0
Zn 65	3 E-3	2 E-4	4 E-4	9 E-5	0
Sr 89	1 E-2	3 E-1	*	*	0
Sr 90	2 E-3	4 E-3	*	*	0
Nb 95	3 E-4	2 E-4	9 E-6	8 E-5	0
Zr 95	1 E-4	1 E-4	8 E-6	8 E-5	0
Ru 103	3 E-5	1 E-4	2 E-4	1 E-4	0
Ag 110m	7 E-6	*	*	*	0
Sb 124	3 E-5	3 E-4	6 E-5	8 E-5	0
Cs 134	5 E-3	3 E-4	5 E-4	2 E-5	0
Cs 136	2 E-3	5 E-5	1 E-4	9 E-8	0
Cs 137	7 E-3	4 E-4	2 E-3	7 E-4	0
Ba 140	4 E-3	5 E-4	2 E-2	8 E-3	0
Ce 141	4 E-4	2 E-4	2 E-3	2 E-5	0
Ce 144	5 E-6	*	*	4 E-6	0
Ar-41	25	0	0	0	0
C-14	0	0	0	9.5	0
H-3	0	9.5	0	0	0

*Not available

I denotes nonorganic iodine (elemental, particulate, HIO)
O denotes organic iodine

TABLE 1.2 BASIC RADIONUCLIDE DATA

	NUCLIDE		HALF-LIFE (DAYS)	LAMDA (1/S)	T	C	BETA (MEV/DIS)	GAMMA (MEV/DIS)	WASH (1/S)
1	TRITIUM	101	4.49E 03	1.79E-09	2	1	5.68E-03	0.0	2.86E-07
2	C-14	604	2.09E 06	3.84E-12	2	1	5.17E-02	0.0	0.0
3	N-13	702	6.94E-03	1.16E-03	2	1	4.91E-01	1.02E 00	1.00E-02
4	O-19	804	3.36E-04	2.39E-02	2	1	1.02E 00	1.05E 00	1.00E-02
5	F-18	902	7.62E-02	1.05E-04	2	1	2.41E-01	9.88E-01	1.00E-04
6	NA-24	1104	6.33E-01	1.27E-05	5	1	5.55E-01	4.12E 00	1.00E-04
7	P-32	1504	1.43E 01	5.61E-07	5	1	6.95E-01	0.0	1.00E-04
8	AR-41	1805	7.63E-02	1.05E-04	2	1	3.63E-01	1.28E 00	0.0
9	CR-51	2405	2.78E 01	2.89E-07	5	1	3.75E-03	3.28E-02	1.00E-04
10	MN-54	2508	3.03E 02	2.65E-08	5	1	4.17E-03	8.36E-01	1.00E-04
11	MN-56	2509	1.07E-01	7.50E-05	5	1	7.93E-01	1.76E 00	1.00E-04
12	FE-59	2604	4.50E 01	1.78E-07	5	1	1.18E-01	1.19E 00	1.00E-04
13	CO-58	2706	7.13E 01	1.12E-07	5	1	2.05E-01	9.76E-01	1.00E-04
14	CO-60	2708	1.92E 03	4.18E-09	5	1	9.08E-02	2.50E 00	1.00E-04
15	ZN-69M	3007	5.75E-01	1.39E-05	5	1	0.0	4.15E 00	1.00E-04
16	ZN-69	3006	3.96E-02	2.03E-04	5	1	3.19E-01	0.0	1.00E-04
17	BR-84	3516	2.21E-02	3.63E-04	2	1	1.28E 00	1.68E 00	1.00E-04
18	BR-85	3518	2.08E-03	3.86E-03	2	2	1.04E 00	8.40E-01	1.00E-04
19	KR-85M	3611	1.83E-01	4.38E-05	1	2	2.53E-01	1.59E-01	1.00E-11
20	KR-85	3610	3.93E 03	2.04E-09	1	1	2.51E-01	2.21E-03	1.00E-11
21	KR-87	3612	5.28E-02	1.52E-04	1	1	1.32E 00	7.93E-01	1.00E-11
22	KR-88	3613	1.17E-01	6.86E-05	1	1	3.75E-01	1.96E 00	1.00E-11
23	KR-89	3614	2.21E-03	3.63E-03	1	1	1.23E 00	2.08E 00	1.00E-11
24	RB-88	3713	1.24E-02	6.47E-04	5	1	2.06E 00	6.86E-01	1.00E-04
25	RB-89	3714	1.07E-02	7.50E-04	5	1	0.0	2.40E 00	1.00E-04
26	SR-89	3808	5.20E 01	1.54E-07	5	1	5.73E-01	1.36E-04	2.67E-07
27	SR-90	3810	1.03E 04	7.79E-10	5	1	1.96E-01	0.0	2.67E-07
28	SR-91	3811	4.03E-01	1.99E-05	5	2	6.50E-01	6.95E-01	2.67E-07
29	SR-92	3812	1.13E-01	7.10E-05	5	1	1.95E-01	1.34E 00	2.67E-07
30	SR-93	3813	5.56E-03	1.44E-03	5	1	1.61E 00	6.28E-01	2.67E-07
31	Y-90	3916	2.67E 00	3.00E-06	5	1	9.36E-01	0.0	1.00E-04
32	Y-91M	3919	3.47E-02	2.31E-04	5	1	0.0	5.56E-01	1.00E-04
33	Y-91	3918	5.88E 01	1.36E-07	5	1	6.06E-01	3.61E-03	1.00E-04
34	Y-92	3920	1.47E-01	5.46E-05	5	1	1.44E 00	2.50E-01	1.00E-04
35	Y-93	3921	4.29E-01	1.87E-05	5	1	1.17E 00	8.94E-02	1.00E-04
36	ZR-95	4014	6.50E 01	1.23E-07	5	2	1.20E-01	7.35E-01	1.00E-04
37	NB-95M	4115	3.75E 00	2.14E-06	5	1	2.85E-01	5.87E-02	1.00E-04
38	NB-95	4114	3.50E 01	2.29E-07	5	1	4.50E-02	7.64E-01	1.00E-04
39	MO-99	4209	2.79E 00	2.87E-06	5	2	3.96E-01	1.62E-01	1.00E-04
40	TC-99M	4314	2.50E-01	3.21E-05	5	1	4.85E-03	1.43E-01	1.00E-04
41	TC-99	4313	7.74E 07	1.04E-13	5	1	8.38E-02	0.0	1.00E-04
42	TC-104	4320	1.25E-02	6.42E-04	5	1	0.0	0.0	1.00E-04
43	RU-106	4407	3.67E 02	2.19E-08	5	1	1.01E-02	0.0	1.00E-04
44	TE-132	5223	3.24E 00	2.48E-06	5	1	1.00E-01	2.05E-01	1.00E-04
45	I-129	5315	6.21E 09	1.29E-15	3	1	4.02E-02	3.77E-03	5.00E-06
46	I-131	5317	8.05E 00	9.96E-07	3	2	1.94E-01	3.81E-01	5.00E-06
47	MI-131	15317	8.05E 00	9.96E-07	4	2	1.94E-01	3.81E-01	5.00E-06
48	I-132	5318	9.58E-02	8.37E-05	3	1	5.14E-01	2.33E 00	5.00E-06
49	MI-132	15318	9.58E-02	8.37E-05	4	1	5.14E-01	2.33E 00	5.00E-06
50	I-133	5319	8.75E-01	9.17E-06	3	2	4.08E-01	6.10E-01	5.00E-06
51	MI-133	15319	8.75E-01	9.17E-06	4	2	4.08E-01	6.10E-01	5.00E-06
52	I-134	5320	3.61E-02	2.22E-04	3	1	6.10E-01	2.59E 00	5.00E-06
53	MI-134	15320	3.61E-02	2.22E-04	4	1	6.10E-01	2.59E 00	5.00E-06
54	I-135	5321	2.79E-01	2.87E-05	3	2	3.68E-01	1.58E 00	5.00E-06
55	MI-135	15321	2.79E-01	2.87E-05	4	2	3.68E-01	1.58E 00	5.00E-06
56	XE-131M	5412	1.18E 01	6.80E-07	1	1	1.43E-01	2.01E-02	1.00E-11
57	XE-133M	5414	2.26E 00	3.55E-06	1	1	1.90E-01	4.16E-02	1.00E-11
58	XE-133	5413	5.27E 00	1.52E-06	1	1	1.35E-01	4.54E-02	1.00E-11
59	XE-135M	5416	1.08E-02	7.43E-04	1	1	9.50E-02	4.32E-01	1.00E-11
60	XE-135	5415	3.83E-01	2.09E-05	1	1	3.17E-01	2.47E-01	1.00E-11
61	XE-137	5417	2.71E-03	2.96E-03	1	1	1.64E 00	1.94E-01	1.00E-11
62	XE-138	5418	1.18E-02	6.80E-04	1	1	6.06E-01	1.18E 00	1.00E-11
63	CS-134	5510	7.48E 02	1.07E-08	5	1	1.57E-01	1.04E 00	1.00E-04
64	CS-135	5512	1.10E 09	7.29E-15	5	1	5.74E-02	0.0	1.00E-04
65	CS-136	5514	1.30E 01	6.17E-07	5	1	1.01E-01	2.20E 00	1.00E-04
66	CS-137	5515	1.10E 04	7.29E-10	5	1	2.52E-01	5.97E-01	1.00E-04
67	CS-138	5516	2.24E-02	3.58E-04	5	1	1.23E 00	2.30E 00	1.00E-04
68	BA-139	5615	5.76E-02	1.39E-04	5	1	6.54E-01	5.05E-02	1.00E-04
69	BA-140	5616	1.28E 01	6.27E-07	5	1	3.15E-01	1.95E-01	1.00E-04
70	LA-140	5715	1.68E 00	4.77E-06	5	1	5.40E-01	2.31E 00	1.00E-04
71	CE-144	5815	2.84E 02	2.82E-08	5	1	9.13E-02	3.29E-02	1.00E-04
72	PR-143	5912	1.36E 01	5.90E-07	5	1	3.14E-01	0.0	1.00E-04
73	PR-144	5913	1.20E-02	6.68E-04	5	1	1.23E 00	3.10E-02	1.00E-04
74	NP-239	9310	2.35E 00	3.41E-06	5	1	1.24E-01	2.08E 00	1.00E-04

Table [illegible].3

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

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

BROWNS FERRY NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN. 1, 74 - DEC 31, 75

WIND DIRECTION	WIND SPEED (MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.0	0.11	0.17	0.20	0.04	0.0	0.0	0.52
NNE	0.0	0.04	0.13	0.15	0.25	0.04	0.0	0.0	0.61
NE	0.0	0.04	0.10	0.07	0.02	0.0	0.0	0.0	0.23
ENE	0.0	0.01	0.04	0.02	0.0	0.0	0.0	0.0	0.07
E	0.0	0.01	0.03	0.02	0.0	0.0	0.0	0.0	0.06
ESE	0.0	0.05	0.19	0.14	0.05	0.0	0.0	0.0	0.43
SE	0.0	0.26	1.35	0.38	0.10	0.0	0.0	0.0	2.09
SSE	0.0	0.23	0.80	0.09	0.02	0.0	0.0	0.0	1.14
S	0.01	0.15	0.50	0.12	0.02	0.0	0.0	0.0	0.80
SSW	0.0	0.02	0.07	0.01	0.01	0.0	0.0	0.0	0.11
SW	0.0	0.02	0.10	0.01	0.01	0.0	0.0	0.0	0.14
WSW	0.0	0.02	0.13	0.09	0.05	0.0	0.0	0.0	0.29
W	0.0	0.01	0.06	0.06	0.04	0.0	0.01	0.0	0.18
WNW	0.0	0.02	0.06	0.12	0.18	0.07	0.01	0.0	0.46
NW	0.0	0.0	0.02	0.12	0.26	0.14	0.01	0.0	0.55
NNW	0.0	0.0	0.02	0.03	0.09	0.12	0.0	0.0	0.26
SUBTOTAL	0.01	0.88	3.71	1.60	1.30	0.41	0.03	0.0	7.94

CALM = 0.01

1337 STABILITY CLASS A OCCURRENCES OUT OF TOTAL 16559 VALID TEMPERATURE DIFFERENCE READINGS

1296 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 1337 STABILITY CLASS A OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED 0.78 MILES ESE OF BROWNS FERRY NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 AND 150 FEET ABOVE GROUND
RADWASTE BUILDING-GROUND LEVEL RELEASE 33 FEET WIND INFORMATION.

Table 1.3 (Continued)

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

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

BROWNS FERRY NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN. 1, 74 - DEC 31, 75

WIND DIRECTION	WIND SPEED(MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.03	0.15	0.11	0.23	0.02	0.0	0.0	0.54
NNE	0.0	0.06	0.12	0.12	0.16	0.01	0.0	0.0	0.47
NE	0.0	0.03	0.07	0.06	0.01	0.0	0.0	0.0	0.17
ENE	0.0	0.02	0.04	0.01	0.01	0.0	0.0	0.0	0.08
E	0.0	0.03	0.02	0.03	0.0	0.0	0.0	0.0	0.08
ESE	0.0	0.07	0.06	0.04	0.01	0.0	0.0	0.0	0.18
SE	0.0	0.35	0.53	0.08	0.04	0.0	0.0	0.0	1.00
SSE	0.01	0.26	0.23	0.02	0.01	0.0	0.0	0.0	0.53
S	0.0	0.13	0.31	0.05	0.01	0.0	0.0	0.0	0.50
SSW	0.0	0.04	0.07	0.03	0.0	0.0	0.0	0.0	0.14
SW	0.0	0.07	0.11	0.01	0.01	0.0	0.0	0.0	0.20
WSW	0.0	0.04	0.24	0.07	0.09	0.01	0.0	0.0	0.45
W	0.0	0.01	0.12	0.12	0.09	0.02	0.01	0.0	0.37
WNW	0.0	0.02	0.13	0.20	0.33	0.09	0.02	0.0	0.79
NW	0.0	0.01	0.11	0.15	0.40	0.10	0.01	0.0	0.78
NNW	0.0	0.01	0.03	0.12	0.34	0.11	0.01	0.0	0.62
SUBTOTAL	0.01	1.18	2.34	1.22	1.74	0.36	0.05	0.0	6.90

CALM = 0.0

1147 STABILITY CLASS B OCCURRENCES OUT OF TOTAL 16559 VALID TEMPERATURE DIFFERENCE READINGS

1119 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 1147 STABILITY CLASS B OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED 0.78 MILES ESE OF BROWNS FERRY NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 AND 150 FEET ABOVE GROUND
RADWASTE BUILDING-GROUND LEVEL RELEASE 33 FEET WIND INFORMATION.

Table 1.3 (Continued)

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

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

BROWNS FERRY NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN 1, 74 - DEC 31, 75

WIND DIRECTION	WIND SPEED (MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.02	0.08	0.09	0.17	0.04	0.0	0.0	0.40
NNE	0.0	0.04	0.07	0.06	0.07	0.02	0.0	0.0	0.26
NE	0.0	0.03	0.04	0.01	0.0	0.0	0.0	0.0	0.08
ENE	0.0	0.01	0.03	0.01	0.0	0.0	0.0	0.0	0.05
E	0.0	0.01	0.04	0.01	0.0	0.0	0.0	0.0	0.06
ESE	0.0	0.04	0.10	0.06	0.01	0.0	0.0	0.0	0.21
SE	0.0	0.28	0.21	0.05	0.02	0.0	0.0	0.0	0.56
SSE	0.0	0.21	0.12	0.01	0.0	0.0	0.0	0.0	0.34
S	0.0	0.15	0.12	0.01	0.0	0.0	0.0	0.0	0.28
SSW	0.0	0.02	0.04	0.01	0.0	0.0	0.0	0.0	0.07
SW	0.0	0.02	0.07	0.0	0.01	0.0	0.0	0.0	0.10
WSW	0.0	0.02	0.10	0.06	0.02	0.0	0.0	0.0	0.20
W	0.0	0.0	0.14	0.09	0.07	0.06	0.0	0.0	0.36
WNW	0.0	0.05	0.11	0.13	0.12	0.08	0.04	0.0	0.53
NW	0.0	0.01	0.09	0.07	0.23	0.08	0.01	0.0	0.49
NNW	0.0	0.02	0.06	0.10	0.27	0.15	0.01	0.0	0.61
SUBTOTAL	0.0	0.93	1.42	0.77	0.99	0.43	0.06	0.0	4.60

CALM = 0.0

757 STABILITY CLASS C OCCURRENCES OUT OF TOTAL 16559 VALID TEMPERATURE DIFFERENCE READINGS

739 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 757 STABILITY CLASS C OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED 0.78 MILES ESE OF BROWNS FERRY NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 AND 150 FEET ABOVE GROUND
RADWASTE BUILDING-GROUND LEVEL RELEASE 33 FEET WIND INFORMATION.

Table 1.3 (Continued)

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

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

BROWNS FERRY NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN 1, 74 - DEC 31, 75

WIND DIRECTION	WIND SPEED(MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.04	0.31	0.41	0.53	0.89	0.12	0.0	0.0	2.30
NNE	0.01	0.42	0.48	0.38	0.35	0.02	0.0	0.0	1.66
NE	0.01	0.40	0.30	0.12	0.06	0.01	0.0	0.0	0.90
ENE	0.02	0.36	0.22	0.02	0.03	0.0	0.0	0.0	0.65
E	0.02	0.23	0.22	0.04	0.02	0.0	0.0	0.0	0.53
ESE	0.01	0.51	0.74	0.36	0.28	0.0	0.0	0.0	1.90
SE	0.05	1.44	1.45	0.58	0.35	0.03	0.0	0.0	3.90
SSE	0.01	0.97	0.54	0.13	0.04	0.0	0.0	0.0	1.69
S	0.01	1.06	0.75	0.18	0.02	0.0	0.0	0.0	2.02
SSW	0.01	0.33	0.23	0.07	0.01	0.0	0.0	0.0	0.65
SW	0.02	0.33	0.23	0.03	0.01	0.0	0.0	0.0	0.62
WSW	0.01	0.54	0.64	0.27	0.23	0.12	0.0	0.0	1.81
W	0.0	0.35	0.88	0.56	0.57	0.15	0.0	0.0	2.51
WNW	0.0	0.18	0.42	0.42	0.62	0.36	0.05	0.01	2.06
NW	0.01	0.10	0.24	0.40	0.85	0.40	0.03	0.01	2.04
NNW	0.01	0.26	0.36	0.36	1.26	0.50	0.01	0.0	2.76
SUBTOTAL	0.24	7.79	8.11	4.45	5.59	1.71	0.09	0.02	28.00

CALM = 0.01

4648 STABILITY CLASS D OCCURRENCES OUT OF TOTAL 16559 VALID TEMPERATURE DIFFERENCE READINGS

4564 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 4648 STABILITY CLASS D OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED 0.78 MILES ESE OF BROWNS FERRY NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 AND 150 FEET ABOVE GROUND
RADWASTE BUILDING-GROUND LEVEL RELEASE 33 FEET WIND INFORMATION.

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Table 1.3 (Continued)

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

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

BROWNS FERRY NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN 1, 74 - DEC 31, 75

WIND DIRECTION	WIND SPEED(MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.06	0.55	0.52	0.37	0.26	0.01	0.0	0.0	1.77
NNE	0.10	0.77	0.50	0.26	0.13	0.01	0.0	0.0	1.77
NE	0.07	0.47	0.45	0.10	0.05	0.0	0.0	0.0	1.14
ENE	0.10	0.58	0.15	0.02	0.0	0.0	0.0	0.0	0.85
E	0.03	0.74	0.44	0.08	0.02	0.0	0.0	0.0	1.31
ESE	0.04	0.97	1.09	0.48	0.17	0.0	0.0	0.0	2.75
SE	0.23	2.31	1.87	1.01	0.53	0.0	0.0	0.0	5.95
SSE	0.22	1.08	0.56	0.21	0.09	0.0	0.0	0.0	2.16
S	0.14	0.94	0.84	0.63	0.23	0.0	0.0	0.0	2.78
SSW	0.17	0.58	0.28	0.18	0.08	0.01	0.0	0.0	1.30
SW	0.10	0.45	0.12	0.04	0.01	0.0	0.0	0.0	0.72
WSW	0.04	0.56	0.34	0.12	0.11	0.02	0.0	0.0	1.19
W	0.02	0.56	0.65	0.25	0.15	0.04	0.0	0.0	1.67
WNW	0.04	0.15	0.16	0.13	0.13	0.06	0.0	0.0	0.67
NW	0.05	0.15	0.21	0.09	0.26	0.09	0.0	0.0	0.85
NNW	0.08	0.50	0.56	0.39	0.31	0.04	0.0	0.0	1.88
SUBTOTAL	1.49	11.36	8.74	4.36	2.53	0.28	0.0	0.0	28.76

CALM = 0.06

4764 STABILITY CLASS E OCCURRENCES OUT OF TOTAL 16559 VALID TEMPERATURE DIFFERENCE READINGS

4700 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 4764 STABILITY CLASS E OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED 0.78 MILES ESE OF BROWNS FERRY NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 AND 150 FEET ABOVE GROUND
RADWASTE BUILDING-GROUND LEVEL RELEASE 33 FEET WIND INFORMATION.

Table 1.3 (Continued)

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

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

BROWNS FERRY NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN 1, 74 - DEC 31, 75

WIND DIRECTION	0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	≥24.5	TOTAL
	WIND SPEED(MPH)								
N	0.10	0.45	0.34	0.12	0.02	0.0	0.0	0.0	1.03
NNE	0.12	0.85	0.36	0.10	0.0	0.0	0.0	0.0	1.43
NE	0.10	0.51	0.15	0.02	0.0	0.0	0.0	0.0	0.78
ENE	0.09	0.60	0.06	0.0	0.0	0.0	0.0	0.0	0.75
E	0.06	0.93	0.36	0.0	0.0	0.0	0.0	0.0	1.35
ESE	0.07	0.72	0.28	0.04	0.0	0.0	0.0	0.0	1.11
SE	0.25	1.34	0.61	0.23	0.08	0.0	0.0	0.0	2.51
SSE	0.14	0.59	0.25	0.15	0.10	0.0	0.0	0.0	1.23
S	0.09	0.50	0.43	0.30	0.20	0.0	0.0	0.0	1.52
SSW	0.06	0.16	0.07	0.01	0.0	0.0	0.0	0.0	0.30
SW	0.04	0.15	0.01	0.0	0.0	0.0	0.0	0.0	0.20
WSW	0.05	0.10	0.0	0.01	0.01	0.0	0.0	0.0	0.17
W	0.04	0.09	0.02	0.01	0.0	0.0	0.0	0.0	0.16
WNW	0.02	0.13	0.03	0.01	0.0	0.0	0.0	0.0	0.19
NW	0.04	0.12	0.10	0.01	0.0	0.01	0.0	0.0	0.28
NNW	0.08	0.33	0.34	0.11	0.01	0.0	0.0	0.0	0.87
SUBTOTAL	1.35	7.57	3.41	1.12	0.42	0.01	0.0	0.0	13.88

CALM = 0.07

2286 STABILITY CLASS F OCCURRENCES OUT OF TOTAL 16559 VALID TEMPERATURE DIFFERENCE READINGS

2267 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 2286 STABILITY CLASS F OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED 0.78 MILES ESE OF BROWNS FERRY NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 AND 150 FEET ABOVE GROUND
RADWASTE BUILDING-GROUND LEVEL RELEASE 33 FEET WIND INFORMATION.

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

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

BROWNS FERRY NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN 1, 74 - DEC 31, 75

WIND DIRECTION	WIND SPEED(MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	≥24.5	TOTAL
N	0.29	0.93	0.17	0.04	0.0	0.0	0.0	0.0	1.43
NNE	0.20	1.28	0.10	0.02	0.0	0.0	0.0	0.0	1.60
NE	0.14	0.44	0.02	0.0	0.0	0.0	0.0	0.0	0.60
ENE	0.09	0.52	0.02	0.0	0.0	0.0	0.0	0.0	0.63
E	0.07	0.66	0.15	0.0	0.0	0.0	0.0	0.0	0.88
ESE	0.04	0.35	0.01	0.0	0.0	0.0	0.0	0.0	0.40
SE	0.15	0.74	0.09	0.03	0.01	0.0	0.0	0.0	1.02
SSE	0.19	0.61	0.13	0.04	0.02	0.0	0.0	0.0	0.99
S	0.14	0.54	0.14	0.06	0.0	0.0	0.0	0.0	0.88
SSW	0.07	0.06	0.0	0.0	0.0	0.0	0.0	0.0	0.13
SW	0.06	0.05	0.0	0.0	0.0	0.0	0.0	0.0	0.11
WSW	0.04	0.04	0.0	0.0	0.0	0.0	0.0	0.0	0.08
W	0.01	0.04	0.01	0.0	0.0	0.0	0.0	0.0	0.06
WNW	0.07	0.06	0.01	0.0	0.0	0.0	0.0	0.0	0.14
NW	0.07	0.09	0.01	0.0	0.0	0.0	0.0	0.0	0.17
NNW	0.18	0.36	0.10	0.04	0.0	0.0	0.0	0.0	0.68
SUBTOTAL	1.81	6.77	0.96	0.23	0.03	0.0	0.0	0.0	9.80

CALM = 0.09

1620 STABILITY CLASS G OCCURRENCES OUT OF TOTAL 16559 VALID TEMPERATURE DIFFERENCE READINGS

1612 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 1620 STABILITY CLASS G OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED 0.78 MILES ESE OF BROWNS FERRY NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 AND 150 FEET ABOVE GROUND
RADWASTE BUILDING-GROUND LEVEL RELEASE 33 FEET WIND INFORMATION.

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

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

BROWNS FERRY NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN 1, 74 - DEC 31, 75

WIND DIRECTION	WIND SPEED(MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.02	0.12	0.23	0.79	0.92	0.31	0.01	2.40
NNE	0.01	0.10	0.21	0.34	1.04	0.86	0.13	0.0	2.69
NE	0.01	0.04	0.15	0.20	0.72	0.32	0.01	0.0	1.45
ENE	0.01	0.03	0.07	0.14	0.34	0.07	0.0	0.0	0.66
E	0.0	0.04	0.11	0.17	0.19	0.01	0.0	0.0	0.52
ESE	0.0	0.13	0.17	0.18	0.42	0.10	0.07	0.02	1.09
SE	0.0	0.22	0.55	0.54	1.25	0.81	0.48	0.19	4.04
SSE	0.01	0.32	0.40	0.41	0.84	0.72	0.39	0.11	3.20
S	0.0	0.18	0.26	0.31	0.78	0.59	0.28	0.15	2.55
SSW	0.0	0.11	0.20	0.12	0.56	0.67	0.28	0.15	2.09
SW	0.01	0.24	0.33	0.20	0.58	0.53	0.18	0.04	2.11
WSW	0.0	0.17	0.47	0.28	0.36	0.41	0.16	0.13	1.98
W	0.01	0.10	0.39	0.40	0.56	0.48	0.28	0.21	2.43
WNW	0.0	0.09	0.22	0.40	0.75	0.55	0.30	0.21	2.52
NW	0.0	0.10	0.43	0.47	1.18	0.92	0.60	0.22	3.92
NNW	0.01	0.04	0.21	0.20	0.73	1.40	0.58	0.07	3.24
SUBTOTAL	0.07	1.93	4.29	4.59	11.09	9.36	4.05	1.51	36.89

CALM = 0.01

6114 STABILITY CLASS D OCCURRENCES OUT OF TOTAL 16481 VALID TEMPERATURE DIFFERENCE READINGS

6038 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 6114 STABILITY CLASS D OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED 0.78 MILES ESE OF BROWNS FERRY NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 300 AND 150 FEET ABOVE GROUND
WIND INSTRUMENTS AT 300 FEET ABOVE GROUND

PERCENT OCCURRENCE OF WIND SPEED
FOR ALL WIND DIRECTIONS

BROWNS FERRY NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN 1, 74 - DEC 31, 75

WIND DIRECTION	WIND SPEED(MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>24.5	TOTAL
N	0.02	0.23	0.29	0.46	1.71	1.96	0.51	0.02	5.20
NNE	0.03	0.24	0.38	0.56	2.06	2.36	0.60	0.07	6.30
NE	0.01	0.15	0.40	0.49	1.80	1.83	0.50	0.03	5.21
ENE	0.03	0.15	0.36	0.46	1.25	0.85	0.21	0.01	3.32
E	0.01	0.23	0.49	0.51	1.02	0.37	0.04	0.0	2.67
ESE	0.03	0.34	0.53	0.50	1.62	1.12	0.29	0.05	4.56
SE	0.04	0.56	1.19	1.33	3.63	2.74	1.39	0.56	11.44
SSE	0.08	0.64	0.99	1.22	3.11	2.66	1.24	0.67	10.61
S	0.03	0.48	0.83	1.04	2.74	2.69	1.08	0.74	9.63
SSW	0.03	0.40	0.63	0.56	2.17	2.71	1.42	0.50	8.42
SW	0.04	0.49	0.63	0.67	1.77	1.08	0.67	0.20	6.35
WSW	0.02	0.37	0.90	0.66	1.20	0.87	0.27	0.23	4.52
W	0.03	0.27	0.77	0.74	1.36	0.84	0.43	0.28	4.72
WNW	0.03	0.18	0.42	0.89	1.39	0.90	0.42	0.26	4.49
NW	0.02	0.31	0.70	0.84	2.08	1.50	0.85	0.27	6.57
NNW	0.03	0.23	0.47	0.53	1.54	2.27	0.71	0.09	5.87
SUBTOTAL	0.48	5.27	9.98	11.54	30.45	27.55	10.63	3.98	99.88

CALM = 0.11

16850 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF 17520 TOTAL HOURS = 96.18 PERCENT

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED 0.78 MILES ESE OF BROWNS FERRY NUCLEAR PLANT
WIND INSTRUMENTS AT 300 FEET ABOVE GROUND

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TABLE 1.4

BROWNS FERRY NUCLEAR PLANT LAND SITE BOUNDARY DATA

Sector	Distance (m)	Elevated χ/Q[1]	Elevated D/Q[2]	Ground χ/Q[1]	Ground D/Q[2]
N	1,550	1.88(-10)[3]	9.55(-10)	2.26(-6)	5.66(-9)
NNE	1,400	4.06(-11)	7.71(-10)	1.02(-6)	2.05(-9)
NE	1,370	3.51(-11)	5.72(-10)	7.93(-7)	1.65(-9)
ENE	1,400	1.65(-11)	4.14(-10)	9.34(-7)	3.18(-9)
E	1,570	6.08(-11)	4.73(-10)	8.04(-7)	3.34(-9)
ESE	1,470	2.79(-11)	4.27(-10)	6.81(-7)	3.39(-9)
SE	5,460	9.33(-9)	3.18(-10)	1.11(-7)	3.83(-10)
SSE	2,740	1.82(-9)	5.99(-10)	7.03(-7)	1.90(-9)
S	2,380	8.43(-10)	5.47(-10)	1.19(-6)	2.51(-9)
SSW	2,410	1.08(-9)	6.61(-10)	1.32(-6)	2.40(-9)
SW	2,160	4.93(-10)	5.60(-10)	8.50(-7)	1.45(-9)
WSW	3,120	1.87(-9)	3.16(-10)	4.90(-7)	6.11(-10)
W	2,350	5.23(-10)	2.82(-10)	8.83(-7)	1.37(-9)
WNW	3,120	2.66(-9)	4.34(-10)	6.16(-7)	1.38(-9)
NW	3,440	7.97(-9)	9.76(-10)	1.29(-6)	2.84(-9)
NNW	1,620	1.73(-10)	1.09(-9)	2.20(-6)	4.84(-9)

1. s/m^3
2. m^{-2}
3. 1.88(-10) = 1.88×10^{-10}

TABLE 1.5

DOSE FACTORS FOR SUBMERSION IN NOBLE GASES

	DFB[1]	DFγ[2]	DFS[1]	DFβ[2]
Kr-85m	1.17(+3)[3]	1.21(+3)	1.46(+3)	3.86(+3)
Kr-85	1.61(+1)	1.69(+1)	1.34(+3)	3.83(+3)
Kr-87	5.92(+3)	6.05(+3)	9.73(+3)	2.01(+4)
Kr-88	1.47(+4)	1.50(+4)	2.37(+3)	5.72(+3)
Kr-89	1.66(+4)	1.59(+4)	1.01(+4)	1.88(+4)
Xe-131m	9.15(+1)	1.53(+2)	4.76(+2)	2.18(+3)
Xe-133m	2.51(+2)	3.17(+2)	9.94(+2)	2.90(+3)
Xe-133	2.94(+2)	3.46(+2)	3.06(+2)	2.06(+3)
Xe-135m	3.12(+3)	3.30(+3)	7.11(+2)	1.45(+3)
Xe-135	1.81(+3)	1.88(+3)	1.86(+3)	4.84(+3)
Xe-137	1.42(+3)	1.48(+3)	1.22(+4)	2.50(+4)
Xe-138	8.83(+3)	9.00(+3)	4.13(+3)	9.25(+3)
Ar-41	8.84(+3)	9.76(+3)	2.69(+3)	5.54(+3)

1. mrem/y per $\mu Ci/m^3$.
2. mrad/y per $\mu Ci/m^3$.
3. 1.17(+3) = 1.17×10^3.

TABLE 1.6

STABLE ELEMENT TRANSFER DATA

Element	B_{iv} Veg/Soil	F_m (Cow) Milk (d/l)
H	4.8E 00	1.0E-02
C	5.5E 00	1.2E-02
Na	5.2E-02	4.0E-02
P	1.1E 00	2.5E-02
Cr	2.5E-04	2.2E-03
Mn	2.9E-02	2.5E-04
Fe	6.6E-04	1.2E-03
Co	9.4E-03	1.0E-03
Ni	1.9E-02	6.7E-03
Cu	1.2E-01	1.4E-02
Zn	4.0E-01	3.9E-02
Rb	1.3E-01	3.0E-02
Sr	1.7E-02	8.0E-04
Y	2.6E-03	1.0E-05
Zr	[illegible]	5.0E-06
Nb	9.4E-03	2.5E-03
Mo	1.2E-01	7.5E-03
Tc	2.5E-01	2.5E-02
Ru	5.0E-02	1.0E-06
Rh	1.3E 01	1.0E-02
Ag	1.5E-01	5.0E-02
Te	1.3E 00	1.0E-03
I	2.0E-02	6.0E-03
Cs	1.0E-02	1.2E-02
Ba	5.0E-03	4.0E-04
La	2.5E-03	5.0E-06
Ce	2.5E-03	1.0E-04
Pr	2.5E-03	5.0E-06
Nd	2.4E-03	5.0E-06
W	1.8E-02	5.0E-04
Np	2.5E-03	5.0E-06

TABLE 1.7

INTERNAL DOSE FACTORS - INFANT THYROID

Radionuclide	Inhalation (mrem/pCi)	Ingestion (mrem/pCi)
H-3	4.62(-7)	3.08(-7)
C-14	3.79(-6)	5.06(-6)
Cr-51	4.11(-8)	9.20(-9)
Te-132	1.99(-7)	1.52(-5)
I-131	1.06(-2)	1.39(-2)
I-132	1.21(-4)	1.58(-4)
I-133	2.54(-3)	3.31(-3)
I-134	3.18(-5)	4.15(-5)
I-135	4.97(-4)	6.49(-4)

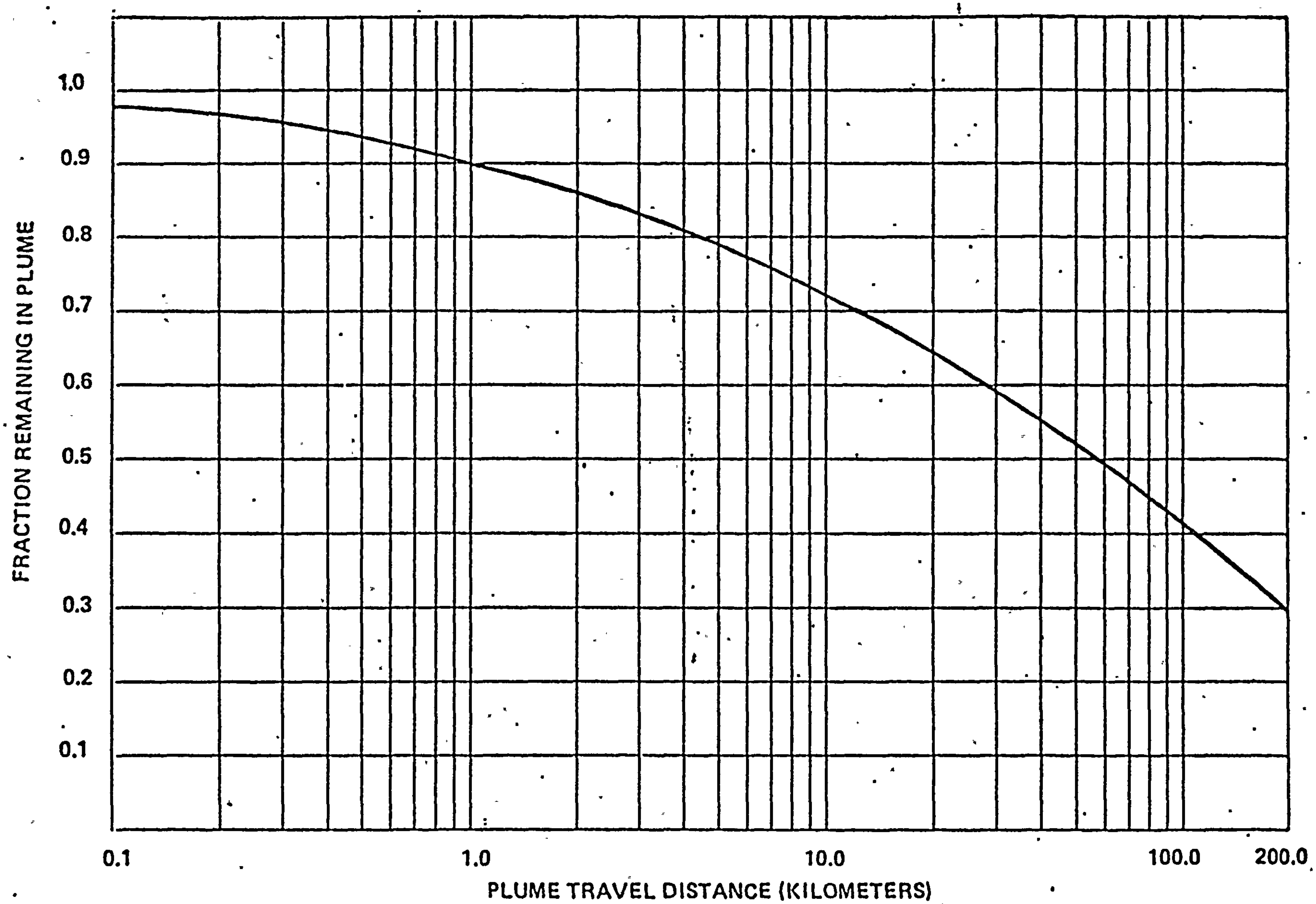
Table 1.8

EXTERNAL DOSE FACTORS FOR STANDING ON CONTAMINATED GROUND

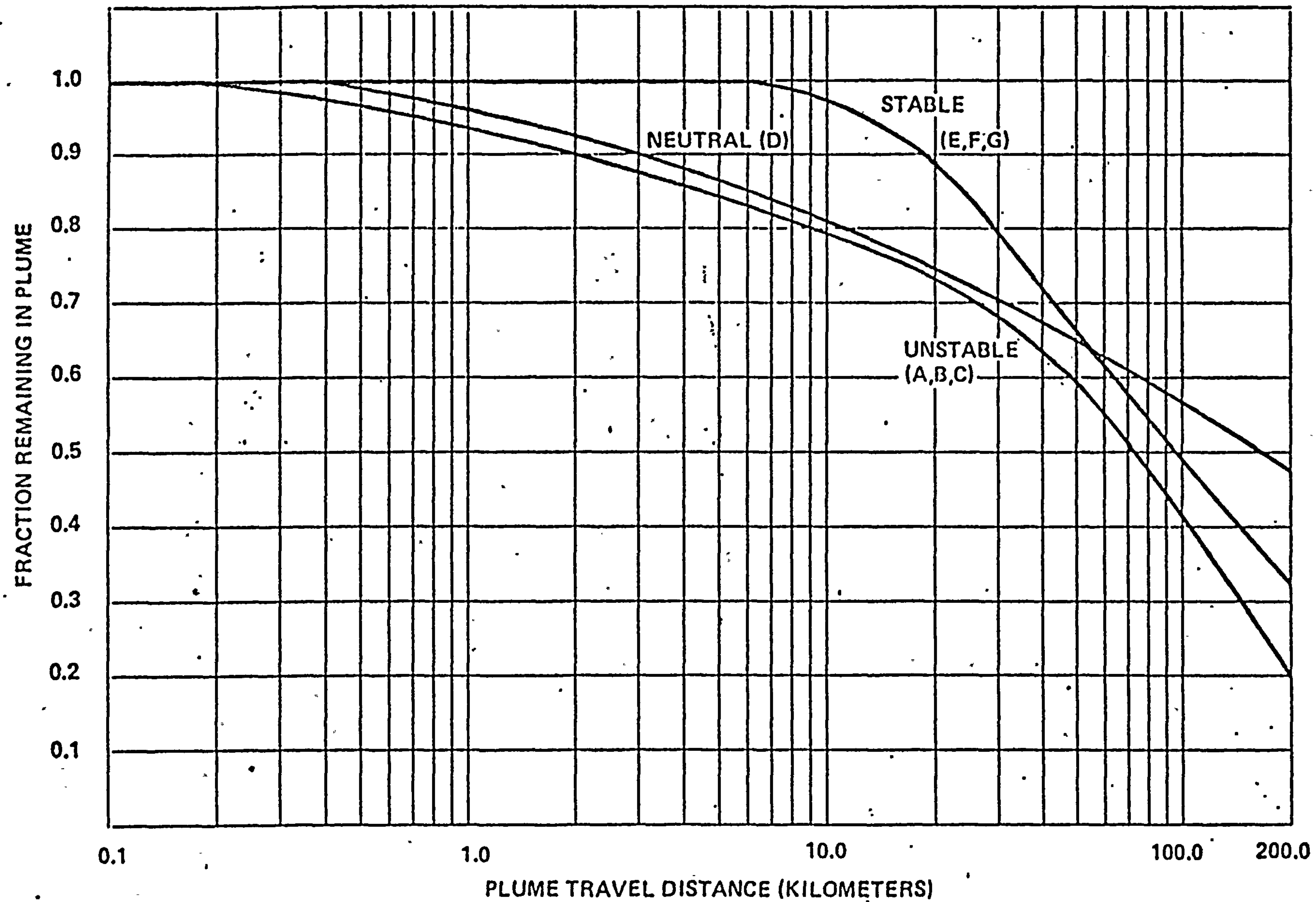
(mrem/hr per pCi/m^2)

Element	Total Body	Skin
H-3	0.0	0.0
C-14	0.0	0.0
NA-24	2.50E-08	2.90E-08
P-32	0.0	0.0
Cr-51	2.20E-10	2.60E-10
Mn-54	5.80E-09	6.80E-09
Mn-56	1.10E-08	1.30E-08
Fe-55	0.0	0.0
Fe-59	8.00E-09	9.40E-09
Co-58	7.00E-09	8.20E-09
Co-60	1.70E-08	2.00E-08
Ni-63	0.0	0.0
Ni-65	3.70E-09	4.30E-09
Cu-64	1.50E-09	1.70E-09
Zn-65	4.00E-09	4.60E-09
Zn-69	0.0	0.0
Br-83	6.40E-11	9.30E-11
Br-84	1.20E-08	1.40E-08
Br-85	0.0	0.0
Rb-86	6.30E-10	7.20E-10
Rb-88	3.50E-09	4.00E-09
Rb-89	1.50E-08	1.80E-08
Sr-89	5.60E-13	6.50E-13
Sr-91	7.10E-09	8.30E-09
Sr-92	9.00E-09	1.00E-08
Y-90	2.20E-12	2.60E-12
Y-91M	3.80E-09	4.40E-09
Y-91	2.40E-11	2.70E-11
Y-92	1.60E-09	1.90E-09
Y-93	5.70E-10	7.80E-10
Zr-95	5.00E-09	5.80E-09
Zr-97	5.50E-09	6.40E-09
Nb-95	5.10E-09	6.00E-09
Mo-99	1.90E-09	2.20E-09
Tc-99M	9.60E-10	1.10E-09
Tc-101	2.70E-09	3.00E-09
Ru-103	3.60E-09	4.20E-09
Ru-105	4.50E-09	5.10E-09
Ru-106	1.50E-09	1.80E-09
Ag-110M	1.80E-08	2.10E-08
Te-125M	3.50E-11	4.80E-11
Te-127M	1.10E-12	1.30E-12
Te-127	1.00E-11	1.10E-11
Te-129M	7.70E-10	9.00E-10
Te-129	7.10E-10	8.40E-10
Te-131M	8.40E-09	9.90E-09
Te-131	2.20E-09	2.60E-06
Te-132	1.70E-09	2.00E-09
I-130	1.40E-08	1.70E-08
I-131	2.80E-09	3.40E-09
I-132	1.70E-08	2.00E-08
I-133	3.70E-09	4.50E-09
I-134	1.60E-08	1.90E-08
I-135	1.20E-08	1.40E-08
Cs-134	1.20E-08	1.40E-08
Cs-136	1.50E-08	1.70E-08
Cs-137	4.20E-09	4.90E-09
Cs-138	2.10E-08	2.40E-08
Ba-139	2.40E-09	2.70E-09
Ba-140	2.10E-09	2.40E-09
Ba-141	4.30E-09	4.90E-09
Ba-142	7.90E-09	9.00E-09
La-140	1.50E-08	1.70E-08
La-142	1.50E-08	1.80E-08
Ce-141	5.50E-10	6.20E-10
Ce-143	2.20E-09	2.50E-09
Ce-144	3.20E-10	3.70E-10
Pr-143	0.0	0.0
Pr-144	2.00E-10	2.30E-10
Nd-147	1.00E-09	1.20E-09
W-187	3.10E-09	3.60E-09
Np-239	9.50E-10	1.10E-09

FIGURE 1.1

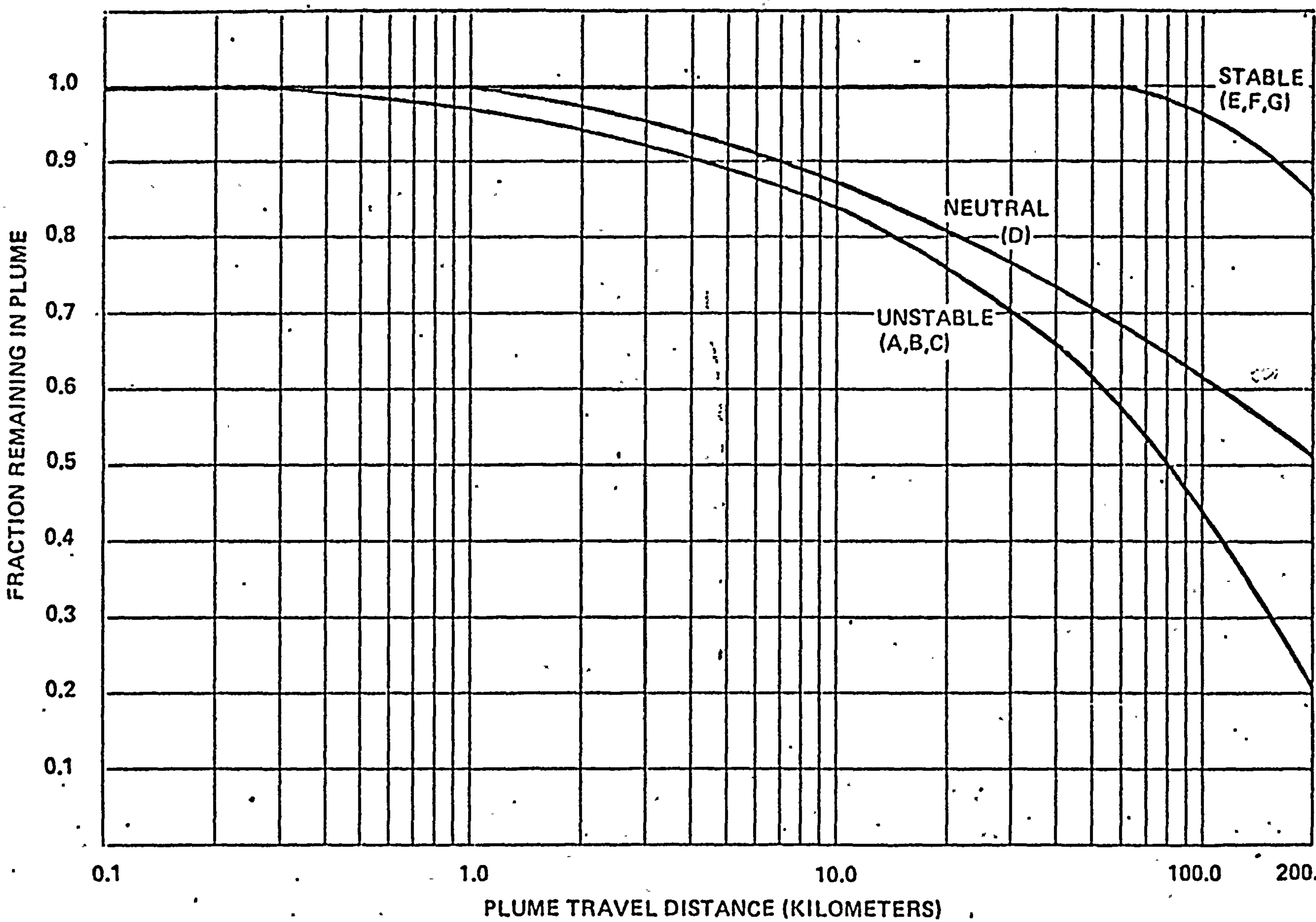


Plume Depletion Effect for Ground Level Releases (All Atmospheric Stability Classes)



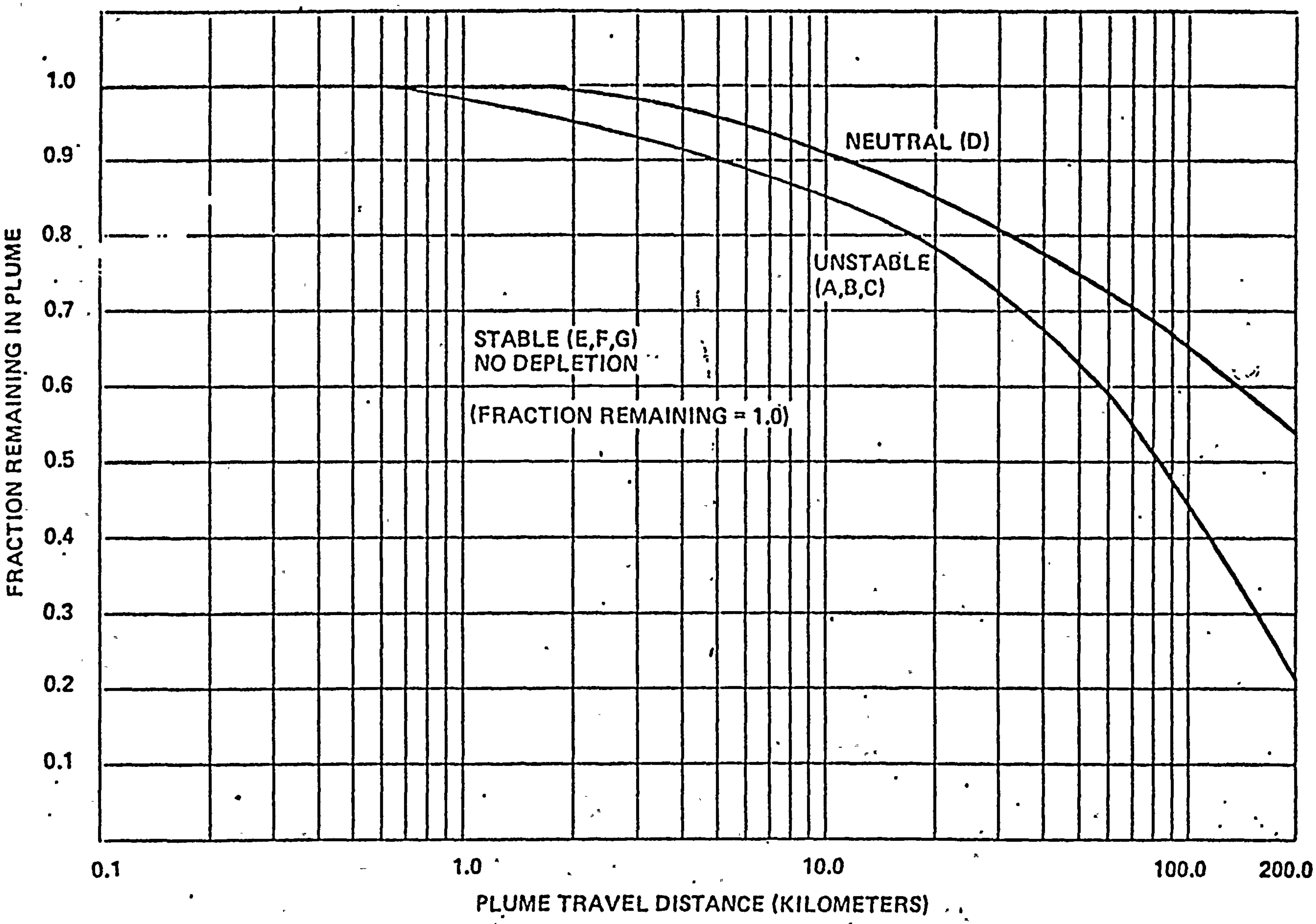
Plume Depletion Effect for 30m Releases (Letters denote Pasquill Stability Class)

FIGURE 1.[illegible] (CONTINUED)



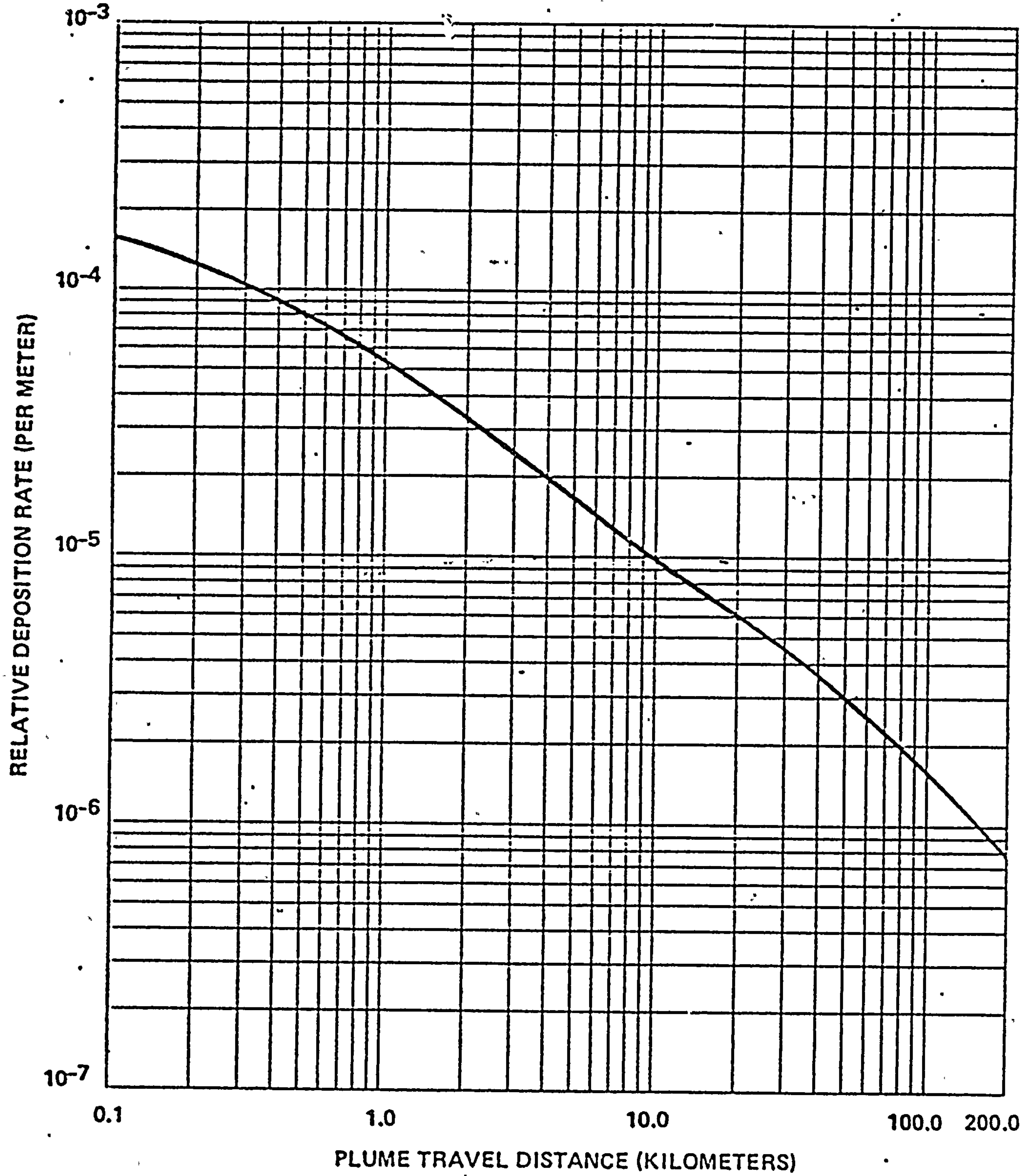
Plume Depletion Effect for 60m Releases (Letters denote Pasquill Stability Class)

FIGURE I.1 (CONTINUED)



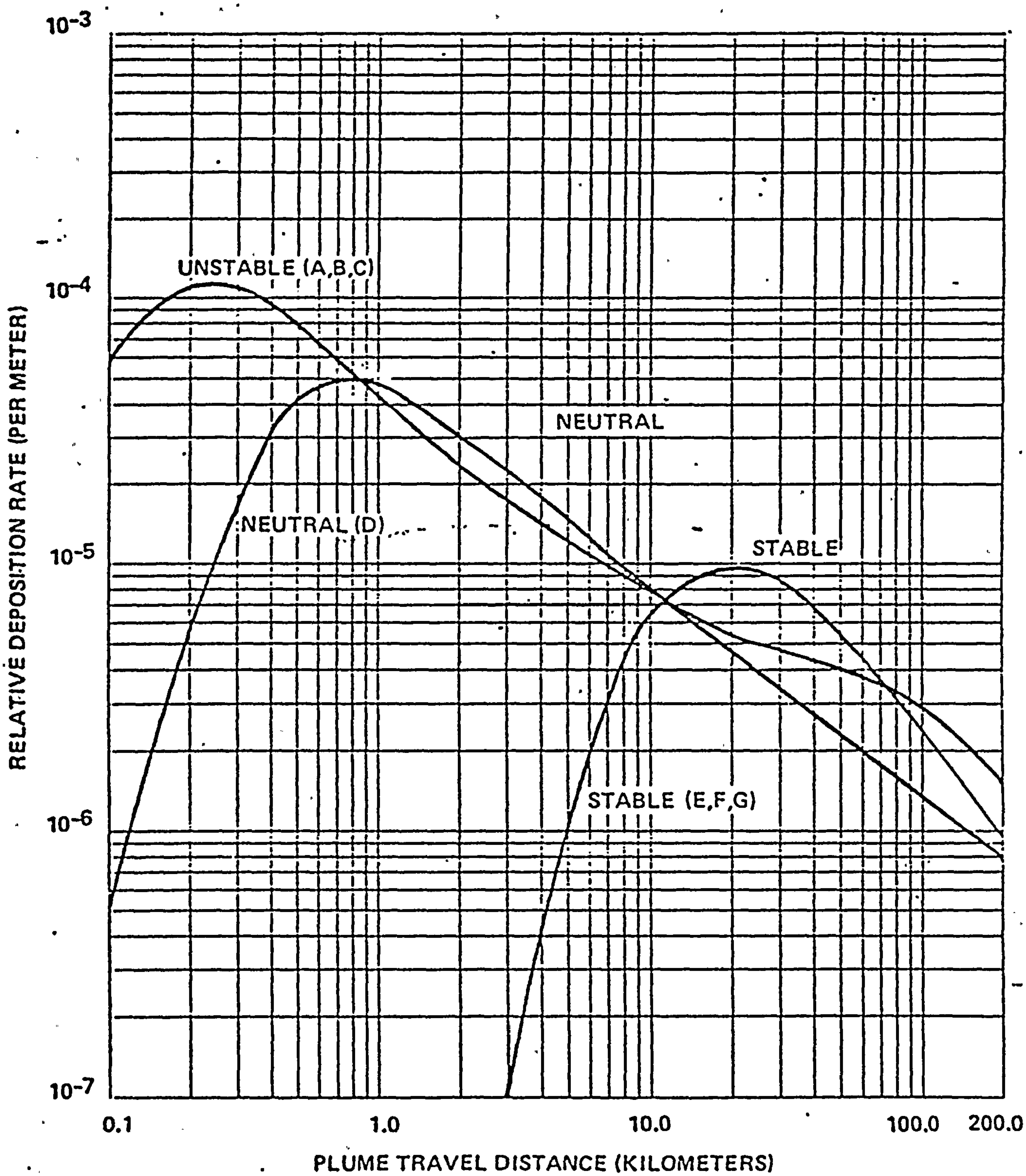
Plume Depletion Effect for 100m Releases (Letters denote Pasquill Stability Class)

FIGURE 1.2

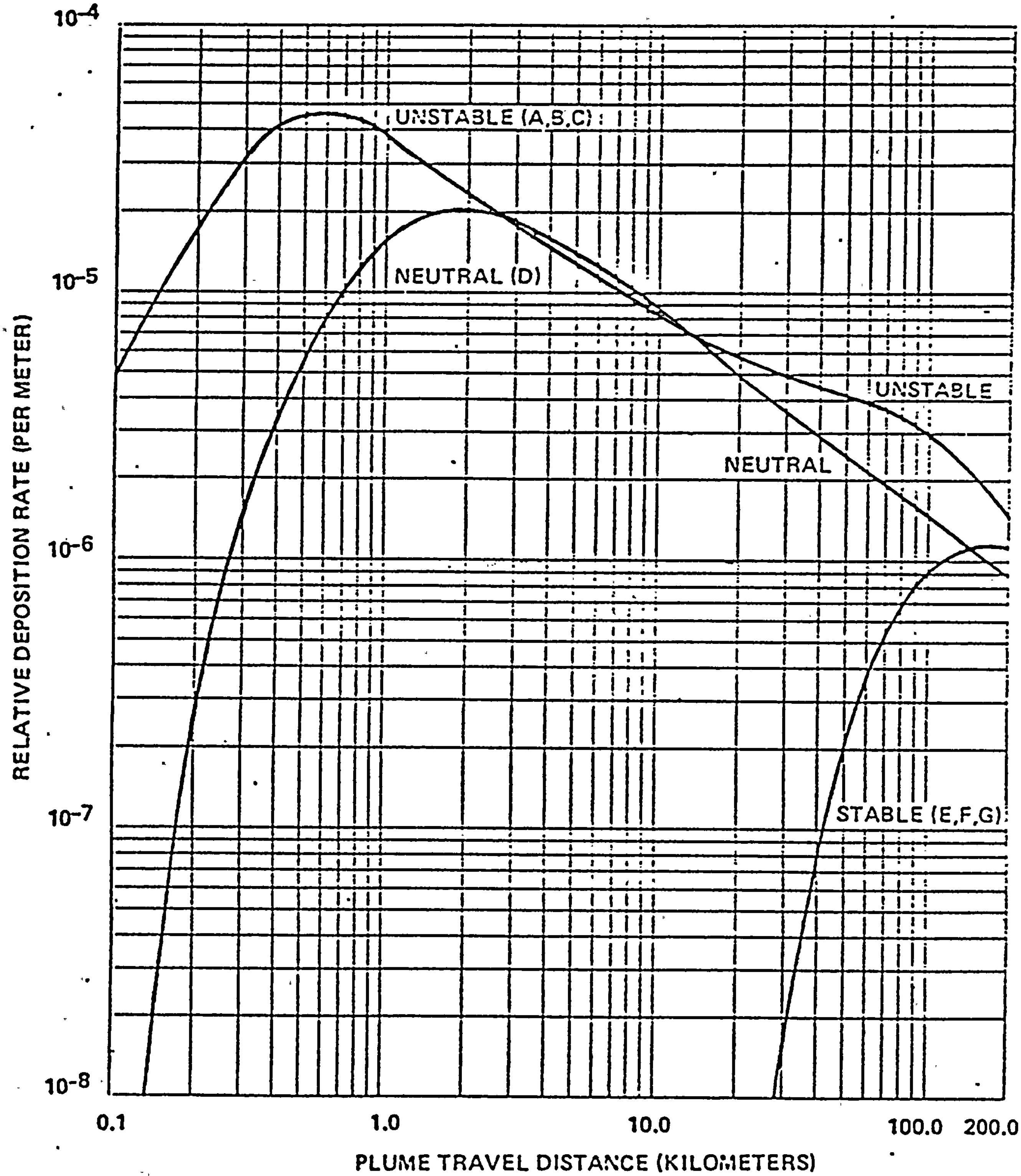


Relative Deposition for Ground Level Releases (All Atmospheric Stability Classes)

FIGURE 1.2 (CONTINUED)

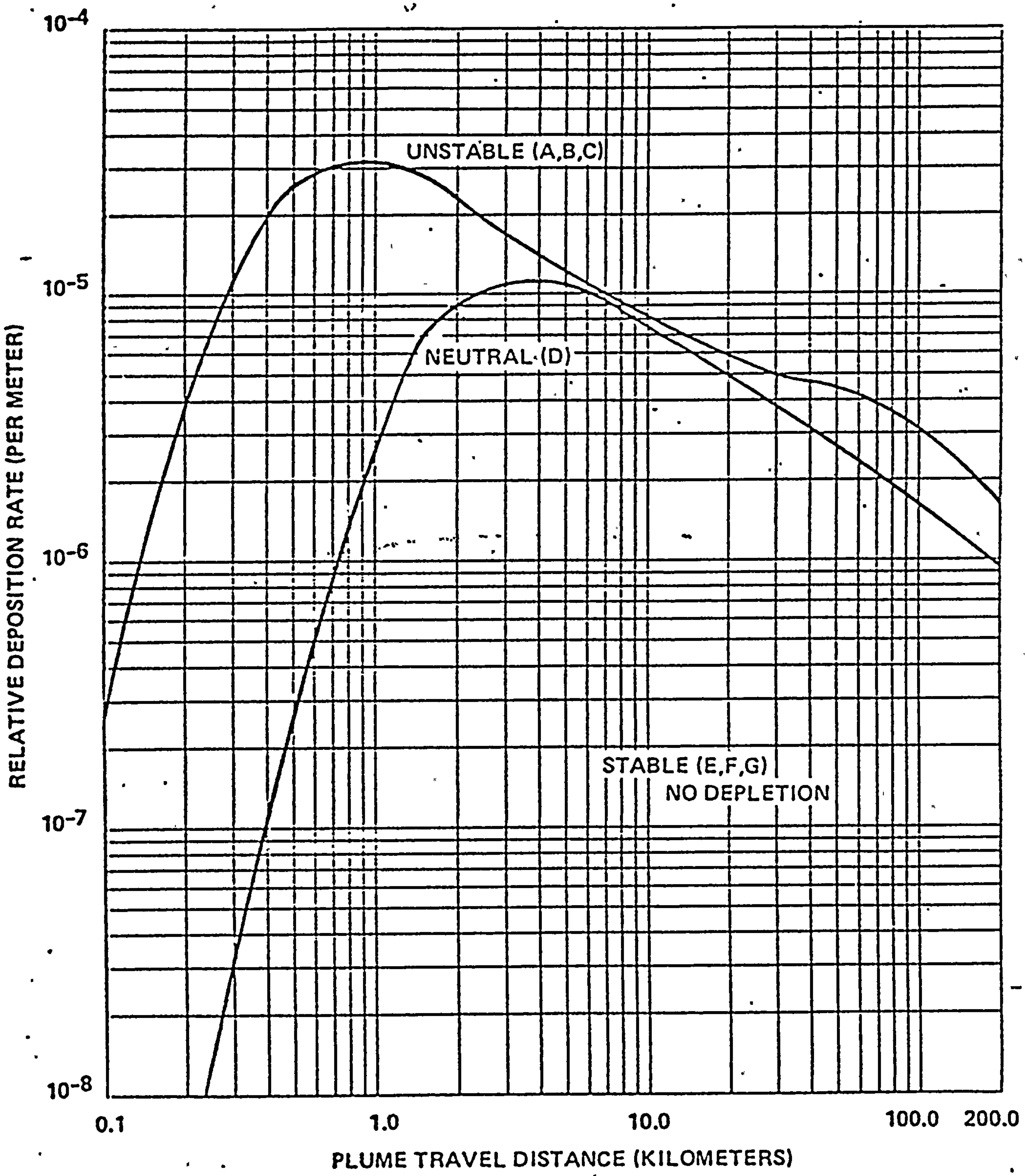


Relative Deposition for 30m Releases (Letters denote Pasquill Stability Class)



Relative Deposition for 60m Releases (Letters denote Pasquill Stability Class)

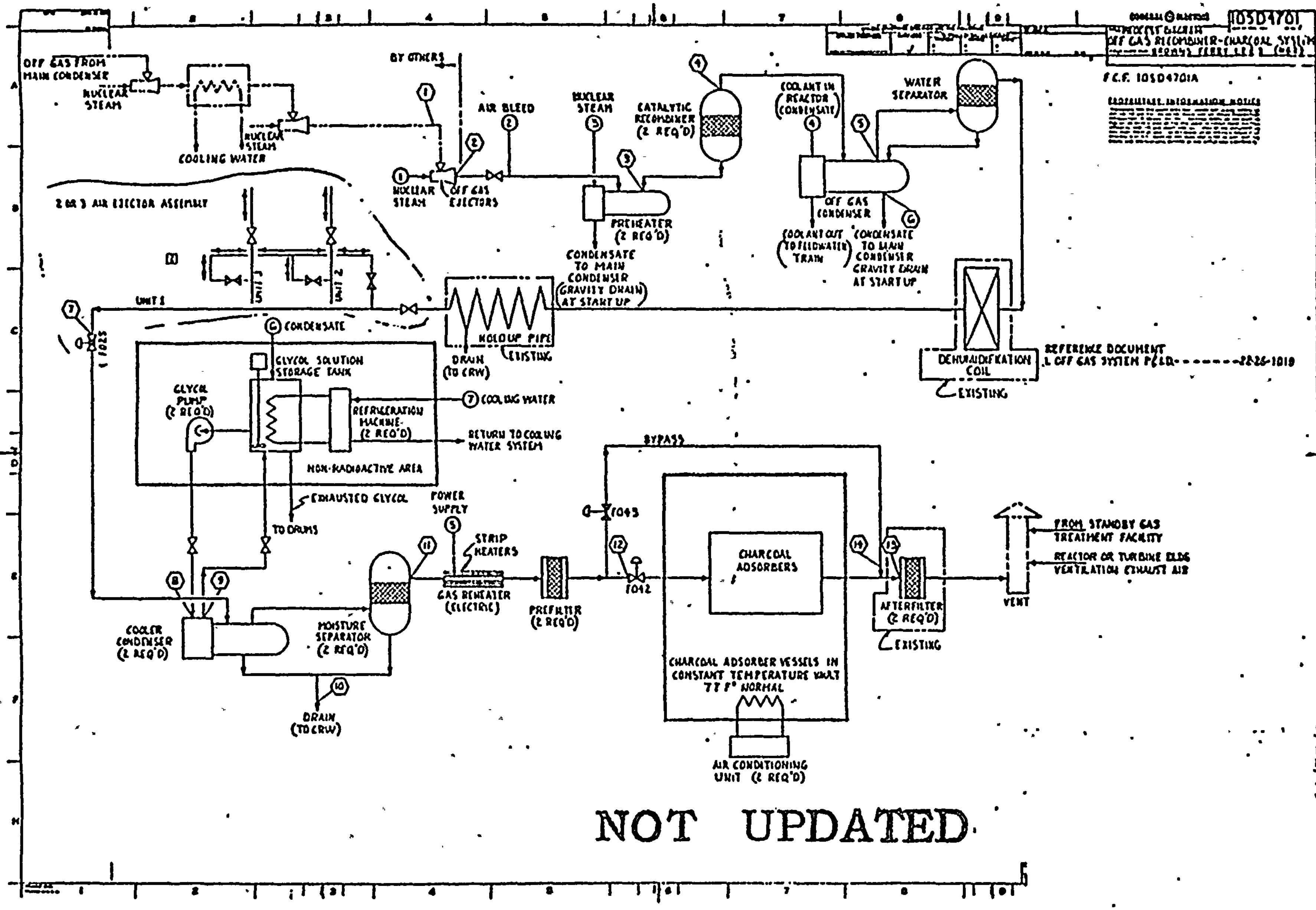
FIGURE 1.2 (CONTINUED)



Relative Deposition for 100m Releases (Letters denote Pasquill Stability Class)

FIGURE .3

GASEOUS RADWASTE TREATMENT SYSTEM FLOW DIAGRAM



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2. Liquid Effluents

2.1 Concentration

2.1.1 RETS Requirement

Specification 3.8.A.1 of the Radiological Effluent Technical Specifications (RETS) requires that the concentration of radioactive material released at any time from the site to unrestricted areas (see Figure 2.1) shall be limited to the Maximum Permissible Concentration (MPC, attached as Appendix I) specified in 10CFR20, Appendix B, Table II, Column 2 for nuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2×10^{-4} µCi/ml total activity. To ensure compliance, the following approach will be used for each release.

2.1.2 Prerelease Analysis

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

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

where:

C = total concentration in the liquid effluent, µCi/ml.

C_i = concentration of radionuclide i, µCi/ml.

2.1.3 MPC-Sum of the Ratios

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

$$R = \frac{C_A}{MPC_A} + \frac{C_B}{MPC_B} + \ldots + \frac{C_i}{MPC_i} \ldots + \frac{C_n}{MPC_n} \qquad (2.2)$$

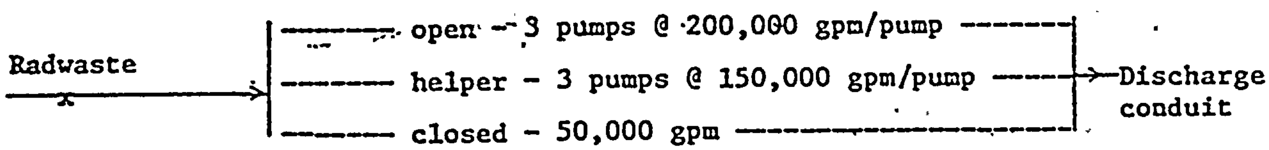
where:

C_i = undiluted effluent concentration of radionuclide i, as determined in Section 2.1.2, µCi/ml.

MPC_i = the MPC of radionuclide i, µCi/ml.

R = the sum of the ratios for the release.

For prerelease and post-release analysis each C_i is first assumed to be unknown and the MPC is then $1x10^{-7}$ µCi/ml for each radionuclide i. If the R calculated is too large for equation 2.3 then the appropriate MPC_i will be used for each C_i. There is one liquid release point into the discharge canal by one of 3 possible modes.



The following relationship will assure concentrations are within allowable limits.

$$f(R-1) \leq F \qquad (2.3)$$

where:

f = the radwaste flow rate (gallons/minute) before dilution.

R = the sum of the ratios of the release as determined by Equation 2.2.

F = minimum dilution flow rate for prerelease analysis.

2.2 Instrument Setpoints

2.2.1 Setpoint Determination

The respective alarm/trip setpoints at each release point will be set such that Equation 2.3 is satisfied. The methodology describing the setpoint determination is contained in Technical Instruction 45.

2.2.2 Post-Release Analysis

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

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

2.3 Dose

2.3.1 RETS Requirement

Specification 3.8.A.2 of the Radiological Effluent Technical Specification (RETS) requires that the dose or dose commitment to an individual from radioactive materials in liquid effluents released to unrestricted areas from each reactor (see Figure 2.1) shall be limited:

a. During any calendar quarter to $\leq$ 1.5 mrem to the total body and to $\leq$ 5 mrem to any organ, and

b. During any calendar year to $\leq$ 3 mrem to the total body and to $\leq$ 10 mrem to any organ.

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

2.3.2 Monthly Analysis

Principal radionuclides will be used to conservatively estimate the monthly contribution to the cumulative dose. If the projected dose exceeds the above limits, the methodology in Section 2.3.2 will be implemented.

The following radionuclides contribute at least 98 percent of the total estimated dose based on four years of operational source terms.

	Percent of Fish Dose		Percent of Ingestion Dose	
	Total Body	GI Tract	Total Body	Thyroid
H-3	-	-	8.5	1.0
Na-24	-	-	2.5	.3
Co-60	-	.5	1.8	.2
Zn-65	5.0	3.9	3.7	.4
Sr-90	.9	-	32.2	3.8
Nb-95	-	67.4	-	-
I-131	-	.1	1.2	81.1
I-133	-	-	-	5.9
Cs-134	40.4	8.3	20.7	2.4
Cs-136	2.4	3.3	1.7	.2
Cs-137	51.0	14.5	26.1	3.1
	99.7	98.0	98.4	98.4

A conservative calculation of the monthly dose will be done according to the following procedure. First, the monthly operating report containing the release data will be obtained and the activities released of each of the above 11 radionuclides will be noted. This information will then be used in the following calculations.

2.3.2.1 Water Ingestion

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

$$D_j = \frac{1}{.95} \sum_{i=1}^{11} (DCF)_{ij} \times I_i \text{ rem} \qquad (2.11)$$

where:

D_j = dose for the j^{th} organ from 11 radionuclides, rem.

j = the organ of interest (thyroid or total body).

.95 = conservative correction factor, considering only 11 radionuclides.

DCF_{ij} = adult ingestion dose commitment factor for the j^{th} organ from the i^{th} radionuclide rem/µCi, see attached Table 2.1.

I_i = monthly activity ingested of the i^{th} radionuclide, µCi.

I_i is described by

$$\bar{I_i} = \frac{365\ A_i\ V}{12\ \upsilon\ d}, \qquad (2.12)$$

where:

365 = days per year

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

V = average rate of water consumption (730 ml/d ICRP 23, p. 358)

12 = months per year

υ = total cooling tower blowdown during releases, ml.

d = minimum diffuser pipe dilution (5)

The dose equation then becomes

$$D_j = \frac{4.6\text{x}10^6}{\upsilon} \sum_{i=1}^{11} (DCF)_{ij} \times A_i \text{ mrem} \qquad (2.13)$$

2.3.2.2 Fish Ingestion

The dose to an individual from the consumption of fish may be described by Equation 2.11 where i is described by

$$I_i = \frac{A_i \, B_i \, M}{\upsilon \, d}, \quad \mu Ci \qquad (2.14)$$

where:

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

B_i = fish concentration factor of i^{th} radionuclide $\frac{\mu Ci/gm}{\mu Ci/ml}$, see attached Table 2.1.

M = amount of fish eaten monthly (1.9×10^3 gm)

υ = total cooling tower blowdown during releases, ml.

d = minimum diffuser pipe dilution (5)

The dose equation then becomes

$$Dg = \frac{4 \times 10^5}{\upsilon} \sum_{i=1}^{11} A_i \times B_i \times DCF_i \quad \text{mrem} \qquad (2.15)$$

If these calculated monthly doses exceed limits specified in Section 2.3.1, then a more accurate and complete calculation will be done as described in Section 2.3.3. An annual check will be made to ensure that the monthly dose estimates account for at least 95 percent of the dose calculated by the method described in Section 2.3.3. If less than 95 percent of the dose has been estimated, a new list of principal isotopes will be prepared.

2.3.3 Annual Analysis

A complete analysis utilizing the total source release will be done at least annually (monthly if necessary). This analysis will replace previous estimates calculated in Section 2.3.2 and consists of the following approach. The dose to the j^{th} organ from m radionuclides, D_j, is described by

$$D_j = \sum_{i=1}^{m} D_{ij}, \text{ rem} \qquad (2.16)$$

$$= \sum_{i=1}^{m} (DCF)_{ij} \times I_i, \text{ rem} \qquad (2.17)$$

where:

D_{ij} = dose to the j^{th} organ from the i^{th} radionuclide, rem.

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

$(DCF)_{ij}$ = adult ingestion dose commitment factor for the j^{th} organ from the i^{th} radionuclide, rem/μCi, see attached Table 2.1.

I_i for water ingestion is described by

$$I_i = \frac{A_i \, V \, n}{\upsilon \, d}, \ \mu Ci \qquad (2.18)$$

and for fish ingestion I_i is described by

$$I_i = \frac{A_i \, B_i \, M}{\upsilon \, d}, \ \mu Ci \qquad (2.19)$$

where:

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

V = average rate of water consumption (730 ml/d).

n = number of days during the release period (d).

υ = cooling tower blowdown during the release period, ml.

B_i = fish concentration factor of the i^{th} radionuclide, $\frac{\mu Ci/gm}{\mu Ci/ml}$

M = amount of fish eaten monthly (1.9×10^3 gm).

d = minimum diffuser pipe dilution (5).

2.4 Operability of Liquid Radwaste Equipment

Specification 3.8.A.5 of the Radiological Effluent Technical Specifications requires that the liquid radwaste system shall be used to reduce the radioactive materials in liquid wastes prior to their discharge when the projected dose per unit due to liquid efflient releases to unrestricted areas (see Figure 2.1.) when averaged over 31 days would exceed 0.06 mrem to the total body or 0.21 mrem to any organ. The following methodology will be implemented to assure compliance.

2.4.1 Release Limit

The liquid radwaste operability limit is an activity release limit based upon four years of operational releases excluding tritium. The curie limit is dependent upon the future operational mix being similar to past operational mix. The most restrictive pathway is to the GI tract by ingestion of fish. The individual dose from the operational source terms was calculated to be .04 mrem/mo. This dose is a factor of 5 below the operability limit of 0.21 mrem to any organ. The total activity released excluding tritium is 0.10 curies. The allowable release without exceeding 0.21 mrem/mo is 5 times 0.1 curies, or 0.50 curies/mo excluding tritium.

$$A_{limit} = 0.50 \text{ Ci/mo. excluding tritium}$$

The value of 0.50 Ci/mo will correspond to the limits specified in Section 2.4 if the mixture of isotopes is similar to the historical mixture.

TABLE 2.1

DOSE CALCULATION DATA

NUCLIDE	RADIOLC. HALF-LIFE (DAYS)	BIOLOGICAL HALF-LIFE (DAYS)	EFFECTIVE HALF/LIFE (DAYS)	HUMAN DOSE COMMITMENT FACTORS (REM/UCI) BONE	GI TRACT	THYROID	TOTAL BODY	FISH CONCENTRATION FACT. STABLE	RADIOLO.	BIOLOG. HALF-LIFE (DAYS)
H-3	4.49E 03	1.00E 01	9.90E 00	9.77E-05	9.77E-05	9.77E-05	9.77E-05	1.00E 00	1.00E 00	0.0
C-14	2.09E 06	1.00E 01	1.00E 01	2.85E-03	5.70E-04	5.70E-04	5.70E-04	4.55E 03	4.55E 03	0.0
NA-24	6.33E-01	1.10E 01	5.99E-01	1.73E-03	5.32E-02	1.73E-03	1.73E-03	1.00E 02	1.00E 02	0.0
P-32	1.43E 01	2.57E 02	1.35E 01	1.99E-01	1.24E-01	7.47E-03	7.47E-03	1.00E 05	1.00E 05	0.0
K-40	4.60E 11	5.00E 01	5.00E 01	3.45E-02	0.0	3.45E-02	3.45E-02	2.50E 03	2.50E 03	0.0
CR-51	2.78E 01	6.16E 02	2.66E 01	3.21E-06	1.71E-03	3.39E-06	3.21E-06	2.00E 02	2.00E 02	0.0
MN-54	3.03E 02	1.70E 01	1.61E 01	8.83E-04	2.43E-02	8.83E-04	8.83E-04	4.00E 02	4.00E 02	0.0
MN-56	1.07E-01	1.70E 01	1.06E-01	2.04E-05	4.68E-03	2.04E-05	2.04E-05	4.00E 02	4.00E 02	0.0
FE-55	9.50E 02	8.00E 02	4.34E 02	3.83E-04	1.13E-03	2.74E-04	2.74E-04	1.00E 02	1.00E 02	0.0
FE-59	4.50E 01	8.00E 02	4.31E 01	3.32E-03	5.54E-02	3.01E-03	3.01E-03	1.00E 02	1.00E 02	0.0
CO-58	7.13E 01	9.50E 00	8.38E 00	1.69E-03	3.29E-02	1.69E-03	1.69E-03	5.00E 01	2.98E 01	1.00E 02
CO-60	1.92E 03	9.50E 00	9.45E 00	4.73E-03	8.58E-02	4.73E-03	4.73E-03	5.00E 01	4.75E 01	1.00E 02
NI-65	1.07E-01	6.67E 02	1.07E-01	5.38E-04	3.16E-03	3.27E-05	3.27E-05	1.00E 02	1.00E 02	0.0
ZN-65	2.45E 02	9.33E 02	1.94E 02	3.01E-03	1.69E-02	7.13E-03	7.13E-03	2.00E 03	1.42E 03	1.00E 02
ZN-69M	5.75E-01	9.33E 02	5.75E-01	1.55E-04	2.91E-03	3.64E-05	3.64E-05	2.00E 03	1.14E 01	1.00E 02
ZN-69	3.96E-02	9.33E 02	3.96E-02	1.03E-05	9.97E-04	1.37E-06	1.37E-06	2.00E 03	7.92E-01	1.00E 02
BR-83	1.00E-01	8.00E 00	9.88E-02	3.55E-05	1.30E-03	3.55E-05	3.55E-05	4.20E 02	4.20E 02	0.0
BR-84	2.21E-02	8.00E 00	2.20E-02	6.04E-05	4.53E-03	6.04E-05	6.04E-05	4.20E 02	4.20E 02	0.0
BR-85	2.08E-03	8.00E 00	2.08E-03	5.17E-07	7.24E-05	5.17E-07	5.17E-07	4.20E 02	4.20E 02	0.0
KR-83M	7.75E-02	1.00E 00	7.19E-02	0.0	1.46E-04	0.0	0.0	1.00E 00	1.00E 00	0.0
KR-85M	1.83E-01	1.00E 00	1.55E-01	0.0	3.30E-03	0.0	0.0	1.00E 00	1.00E 00	0.0
KR-85	3.93E 03	1.00E 00	1.00E 00	0.0	4.62E-02	0.0	0.0	1.00E 00	1.00E 00	0.0
RB-88	1.24E-02	4.50E 01	1.24E-02	3.34E-05	3.89E-03	3.34E-05	3.34E-05	2.00E 03	2.00E 03	0.0
RB-89	1.07E-02	4.50E 01	1.07E-02	2.86E-05	1.76E-03	2.86E-05	2.86E-05	2.00E 03	2.00E 03	0.0
SR-89	5.27E 01	1.30E 04	5.25E 01	1.39E-01	1.04E-01	9.22E-03	9.22E-03	3.00E 01	1.04E 01	1.00E 02
SR-90	1.01E 04	1.30E 04	5.68E 03	1.17E 01	3.58E-02	1.76E 00	1.76E 00	3.00E 01	2.97E 01	1.00E 02
SR-91	4.03E-01	1.30E 04	4.03E-01	1.72E-03	2.06E-02	1.92E-04	1.92E-04	3.00E 01	1.20E-01	1.00E 02
SR-92	1.13E-01	1.30E 04	1.13E-01	9.17E-04	1.35E-03	6.89E-05	6.89E-05	3.00E 01	3.39E-02	1.00E 02
SR-93	5.56E-03	1.30E 04	5.56E-03	6.39E-05	1.89E-03	9.90E-06	8.90E-06	3.00E 01	1.67E-03	1.00E 02
Y-90	2.67E 00	1.40E 04	2.67E 00	9.62E-06	1.25E-01	2.57E-07	2.57E-07	2.50E 01	2.50E 01	0.0
Y-91M	3.47E-02	1.40E 04	3.47E-02	2.17E-08	5.06E-04	1.72E-09	1.72E-09	2.50E 01	2.50E 01	0.0
Y-91	5.88E 01	1.40E 04	5.86E 01	1.37E-04	1.10E-01	3.66E-06	3.66E-06	2.50E 01	2.50E 01	0.0
Y-92	1.47E-01	1.40E 04	1.47E-01	8.49E-07	1.27E-02	2.47E-08	2.47E-08	2.50E 01	2.50E 01	0.0
Y-93	4.29E-01	1.40E 04	4.29E-01	1.97E-06	3.51E-02	5.51E-08	5.51E-08	2.50E 01	2.50E 01	0.0
ZR-95	6.55E 01	4.50E 02	5.72E 01	2.54E-05	4.28E-02	6.38E-06	6.38E-06	3.33E 00	3.33E 00	0.0
ZR-97	7.03E-01	4.50E 02	7.07E-01	1.64E-06	4.79E-02	1.55E-07	1.55E-07	3.33E 00	3.33E 00	0.0
NB-95M	3.75E 00	7.60E 02	3.73E 00	5.86E-07	3.55E-02	2.88E-07	2.88E-07	3.00E 04	3.00E 04	0.0
NB-95	3.50E 01	7.60E 02	3.35E 01	5.12E-06	3.01E-02	1.83E-06	1.83E-06	3.00E 04	3.00E 04	0.0
NB-97	5.00E-02	7.60E 02	5.00E-02	4.90E-09	2.10E-03	4.60E-09	4.60E-09	3.00E 04	3.00E 04	0.0
MO-99	2.78E 00	5.00E 00	1.79E 00	8.47E-04	5.93E-02	8.47E-04	8.47E-04	1.00E 01	1.00E 01	0.0
TC-99M	2.52E-01	1.00E 00	2.01E-01	2.44E-07	6.09E-04	9.37E-06	9.37E-06	1.50E 01	1.50E 01	0.0
TC-99	7.74E 07	1.00E 00	1.00E 00	1.27E-04	1.89E-02	5.06E-05	5.06E-05	1.50E 01	1.50E 01	0.0
TC-101	9.93E-03	1.00E 00	9.83E-03	2.57E-07	7.99E-04	3.60E-06	3.60E-06	1.50E 01	1.50E 01	0.0
RU-103	3.96E 01	7.30E 00	6.16E 00	1.04E-04	2.55E-02	7.98E-05	7.98E-05	1.00E 01	1.00E 01	0.0
RU-106	3.68E 02	7.30E 00	7.16E 00	2.68E-03	2.67E-01	3.50E-04	3.50E-04	1.00E 01	1.00E 01	0.0

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TABLE 2.1 (CONTINUED)

NUCLIDE	RADIOLOG. HALF-LIFE (DAYS)	BIOLOGICAL HALF-LIFE (DAYS)	EFFECTIVE HALF/LIFE (DAYS)	HUMAN DOSE COMMITMENT FACTORS (REM/UCI) BONE	GI TRACT	THYROID	TOTAL BODY	FISH CONCENTRATION FACT. STABLE	RADIOLOG.	BIOLOG. HALF-LIFE (DAYS)
RH103M	3.46E-02	7.30E 00	3.94E-02	1.67E-07	1.21E-04	4.99E-08	4.99E-08	1.00E 01	1.00E 01	0.0
AG110M	2.53E 02	5.00E 00	4.90E 00	1.33E-04	9.27E-02	8.78E-05	8.78E-05	2.00E 00	2.00E 00	0.0
TE125M	5.80E 01	1.50E 01	1.19E 01	2.52E-03	2.25E-02	8.15E-04	4.55E-04	4.00E 02	4.00E 02	0.0
TE127M	1.09E 02	1.50E 01	1.32E 01	8.91E-03	1.56E-02	2.37E-03	1.12E-03	4.00E 02	4.00E 02	0.0
TE-127	3.92E-01	1.50E 01	3.82E-01	1.13E-04	6.76E-03	8.36E-05	2.44E-05	4.00E 02	4.00E 02	0.0
TE129M	3.41E 01	1.50E 01	1.04E 01	1.14E-02	4.96E-02	3.96E-03	1.84E-03	4.00E 02	4.00E 02	0.0
TE-129	4.77E-02	1.50E 01	4.75E-02	3.00E-05	1.77E-03	2.32E-05	7.37E-06	4.00E 02	4.00E 02	0.0
TE131M	1.25E 00	1.50E 01	1.15E 00	7.15E-04	3.61E-02	6.77E-04	4.89E-04	4.00E 02	4.00E 02	0.0
TE-131	1.72E-02	1.50E 01	1.72E-02	1.39E-05	1.79E-03	1.61E-05	6.44E-06	4.00E 02	4.00E 02	0.0
TE-132	3.24E 00	1.50E 01	2.66E 00	2.44E-03	2.21E-02	1.88E-03	1.50E-03	4.00E 02	4.00E 02	0.0
TE-134	2.92E-02	1.50E 01	2.91E-02	2.10E-05	8.93E-05	2.00E-05	1.57E-05	4.00E 02	4.00E 02	0.0
I-129	6.21E 09	1.38E 02	1.38E 02	3.10E-03	0.0	9.61E 00	1.24E-02	5.00E 01	5.00E 01	1.00E 00
I-131	8.05E 00	1.38E 02	7.61E 00	4.06E-03	4.44E-02	2.01E 00	3.52E-03	5.00E 01	4.45E 01	1.00E 00
I-132	9.42E-02	1.38E 02	9.41E-02	1.97E-04	4.25E-03	7.51E-02	1.97E-04	5.00E 01	4.30E 00	1.00E 00
I-133	8.46E-01	1.38E 02	8.41E-01	1.36E-03	3.78E-02	4.69E-01	7.51E-04	5.00E 01	2.29E 01	1.00E 00
I-134	3.61E-02	1.38E 02	3.61E-02	7.84E-05	3.40E-03	2.94E-02	7.47E-05	5.00E 01	1.74E 00	1.00E 00
I-135	2.78E-01	1.38E 02	2.77E-01	3.78E-04	1.17E-02	1.47E-01	3.98E-04	5.00E 01	1.09E 01	1.00E 00
XE133M	2.26E 00	1.00E 00	6.93E-01	0.0	2.45E-02	0.0	0.0	1.00E 00	1.00E 00	0.0
XE-133	5.27E 00	1.00E 00	8.41E-01	0.0	2.50E-02	0.0	0.0	1.00E 00	1.00E 00	0.0
XE135M	1.08E-02	1.00E 00	1.07E-02	0.0	3.29E-04	0.0	0.0	1.00E 00	1.00E 00	0.0
XE-135	3.83E-01	1.00E 00	2.77E-01	0.0	1.00E-02	0.0	0.0	1.00E 00	1.00E 00	0.0
CS-134	7.47E 02	7.00E 01	6.40E 01	5.49E-02	7.67E-02	1.20E-01	1.20E-01	2.00E 03	2.00E 03	1.00E 00
CS-135	1.10E 09	1.15E 02	1.15E 02	1.96E-02	0.0	8.06E-03	8.06E-03	2.00E 03	2.00E 03	1.00E 00
CS-136	1.31E 01	7.00E 01	1.15E 01	5.80E-03	8.77E-02	2.03E-02	2.03E-02	2.00E 03	1.86E 03	1.00E 00
CS-137	1.10E 04	7.00E 01	6.96E 01	7.87E-02	6.40E-02	7.28E-02	7.28E-02	2.00E 03	2.00E 03	1.00E 00
CS-138	2.24E-02	7.00E 01	2.24E-02	9.94E-06	2.61E-03	5.72E-05	5.72E-05	2.00E 03	4.30E 01	1.00E 00
BA-139	5.76E-02	6.50E 01	5.75E-02	1.05E-04	3.34E-03	3.07E-06	3.07E-06	4.00E 00	4.00E 00	0.0
BA-140	1.28E 01	6.50E 01	1.07E 01	1.61E-02	6.03E-02	1.23E-03	1.23E-03	4.00E 00	4.00E 00	0.0
LA-140	1.68E 00	5.00E 02	1.67E 00	1.80E-06	8.55E-02	3.09E-07	3.09E-07	2.50E 01	2.50E 01	0.0
LA-141	1.63E-01	5.00E 01	1.63E-01	3.90E-07	9.60E-03	2.03E-08	2.03E-08	2.50E 01	2.50E 01	0.0
CE-141	3.25E 01	5.63E 02	3.07E 01	9.32E-06	3.75E-02	7.72E-07	7.72E-07	2.50E 01	2.50E 01	0.0
CE-143	1.38E 00	5.63E 02	1.38E 00	5.53E-06	5.09E-02	3.56E-08	3.56E-08	2.50E 01	2.50E 01	0.0
CE-144	2.84E 02	5.63E 02	1.89E 02	4.90E-04	1.87E-02	2.64E-05	2.64E-05	2.50E 01	2.50E 01	0.0
PR-143	1.36E 01	7.50E 02	1.34E 01	9.24E-06	5.80E-02	4.60E-07	4.60E-07	2.50E 01	2.50E 01	0.0
PR-144	1.20E-02	7.50E 02	1.20E-02	3.04E-08	1.95E-03	1.54E-09	1.54E-09	2.50E 01	2.50E 01	0.0
ND-147	1.11E 01	6.56E 02	1.09E 01	6.37E-06	5.00E-02	4.55E-07	4.55E-07	2.50E 01	2.50E 01	0.0
PM-147	9.57E 02	6.56E 02	3.89E 02	7.60E-05	1.33E-02	2.09E-06	2.09E-06	2.50E 01	2.50E 01	0.0
PM-149	2.21E 00	6.56E 02	2.20E 00	1.54E-06	4.86E-02	8.07E-08	8.07E-08	2.50E 01	2.50E 01	0.0
PM-151	1.16E 00	6.56E 02	1.16E 00	6.74E-07	3.17E-02	5.91E-08	5.91E-08	2.50E 01	2.50E 01	0.0
SM-151	3.19E 04	6.56E 02	6.43E 02	6.07E-05	4.37E-03	1.56E-06	1.56E-06	2.50E 01	2.50E 01	0.0
SM-153	1.95E 00	6.56E 02	1.94E 00	1.03E-06	3.50E-02	6.66E-08	6.66E-08	2.50E 01	2.50E 01	0.0
SM-156	3.92E-01	6.56E 02	3.92E-01	4.63E-07	5.86E-03	5.33E-08	5.33E-08	2.50E 01	2.50E 01	0.0
EU-155	6.61E 02	6.35E 02	3.24E 02	5.75E-05	1.35E-02	3.35E-06	3.35E-06	2.50E 01	2.50E 01	0.0
EU-156	1.54E 01	6.35E 02	1.50E 01	1.31E-05	1.02E-01	1.65E-06	1.65E-06	2.50E 01	2.50E 01	0.0
W-187	9.96E-01	1.00E 00	4.99E-01	8.70E-05	2.54E-02	2.70E-05	2.70E-05	1.20E 03	1.20E 03	0.0
NP-239	2.35E 00	3.90E 04	2.35E 00	1.45E-06	3.10E-02	7.74E-08	7.74E-08	1.00E 01	1.00E 01	0.0

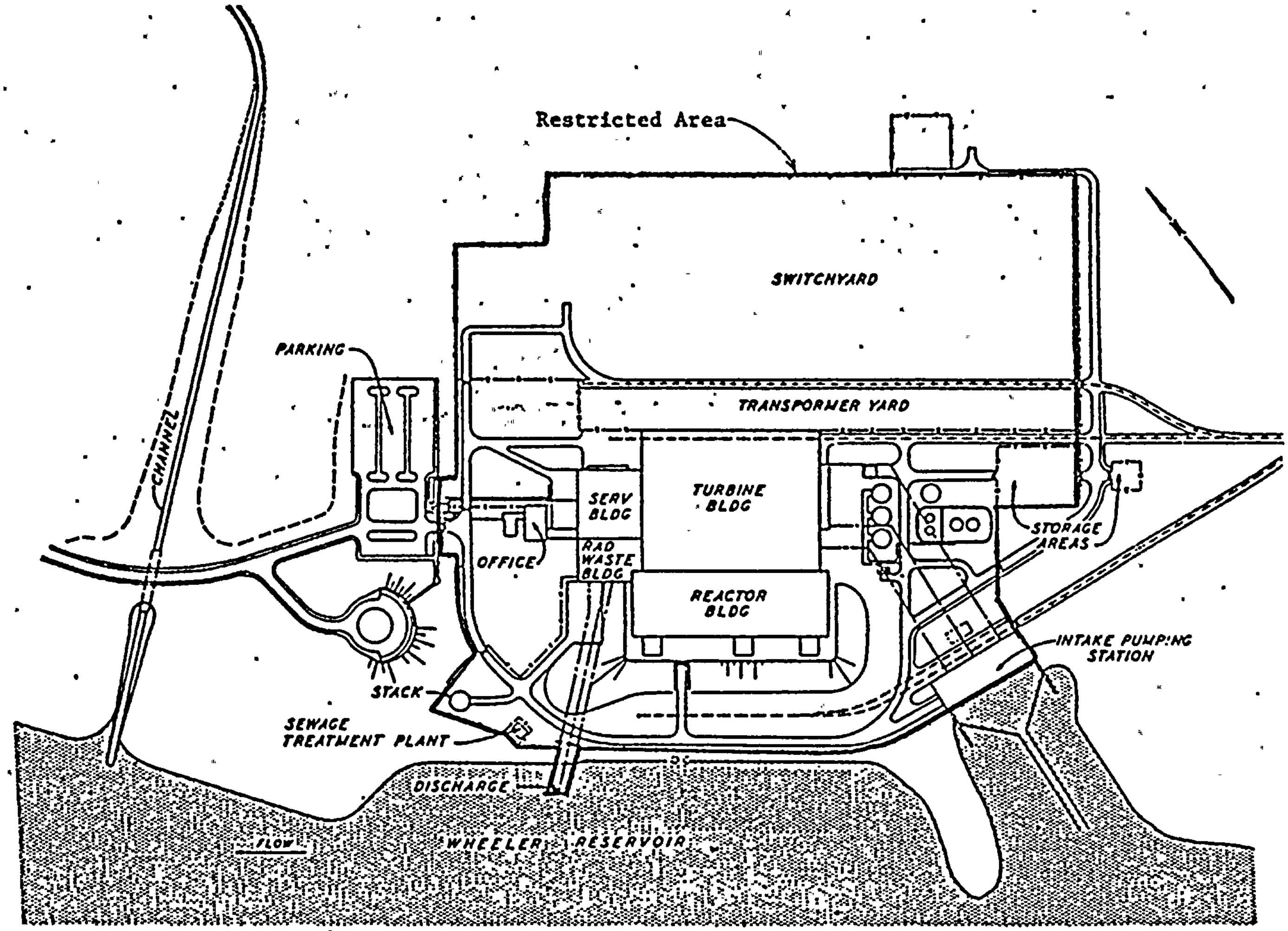


Figure 2.1--Assumed Liquid Effluent Restricted Area

3.0 Radiological Environmental Monitoring

3.1 Monitoring Program

An environmental radiological monitoring program shall be conducted as described in Tables 3.1-1, 3.1-2 and 3.1-3, and in Figures 3.1-1, 3.1-2, 3.1-3, and 3.1-4. Results of this program shall be reported in accordance with Technical Specifications 6.7.1.d and 6.7.2.c.

The atmospheric environmental radiological monitoring program shall consist of 11 monitoring stations from which samples of air particulates, atmospheric radioiodine, rainwater, and heavy particle fallout shall be collected.

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

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

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

3.2 Detection Capabilities

Analytical techniques shall be such that the detection capabilities listed in Table 3.2-1 are achieved.

TABLE 3.1-1

ENVIRONMENTAL RADIOLOGICAL MONITORING

Exposure Pathway and/or Sample	Sample Locations*	Sampling and Collection Frequency	Type of Frequency of Analysis
AIRBORNE			
Particulates	4 samples from locations (in different sectors) at or near the site boundary (LM 1, 2, 3, & 5)		
	1 sample from the residence having the highest χ/Q (LM-4)	Continuous sampler operation with sample collection weekly	Gross beta following filter change composite (by location) monthly for gamma scan. Composite quarterly for ^{89}Sr, ^{90}Sr. If any filter indicates a gross beta concentration 1.0 pCi/m^3 greater than the average of the control stations, a gamma scan will be performed on the filter
	4 samples from communities approximately 10 miles distant from the plant (PM 1-4)		
	2 samples from control locations greater than 10 miles from the plant (RM 1&2)		
Radioiodine	Samples from same locations as air particulates	Continuous sampler operation with filter collection weekly	^{131}I weekly
Fallout	Samples from same locations as air particulates	Heavy particle fallout collected continuously on gummed acetate paper with paper collection monthly	Gross beta monthly
Rainwater	Samples from same locations as air particulates	Rainwater collected continuously with composite sample analyzed monthly	Gamma scan, monthly
Soil	Samples from same locations as air particulates	Once per 3 years	Gamma scan, ^{89}Sr, ^{90}Sr once each 3 years

*Sample locations are shown in Figures 3.1-1, 3.1-2, 3.1-3, and 3.1-4.

TABLE 3.1-1 (Continued)

Exposure Pathway and/or Sample	Sample Locations*	Sampling and Collection Frequency	Type and Frequency of Analysis
DIRECT	2 or more dosimeters placed at the air particulate sampling stations located greater than 5 miles from the plant (PM 1-4 and RM 1 & 2)	Quarterly	Gamma dose quarterly
	2 or more dosimeters placed at 8 locations (in different sectors) at or near the site boundary (Figure 3.1-2)		
WATERBORNE			
Surface (Figure 3.1-4)	TRM 305.0 TRM 293.5 TRM 285.2	Collected by automatic sequential-type sampler with composite sample taken monthly	Gamma scan monthly Composite for tritium, ^{89}Sr and ^{90}Sr quarterly
Ground (Figure 3.1-3)	1 sample adjacent to plant	Collected by automatic sequential-type sampler with composite sample taken monthly	Gamma scan monthly. Composite quarterly for tritium.
	1 sample from ground water source upgradient	Monthly grab sample	Gamma scan monthly. Composite quarterly for tritium
Drinking (Table 3.1-3) (Figure 3.1-4)	1 sample at the first potable surface water supply downstream from the plant (TRM 282.6)	Collected by automatic sequential-type sampler with composite sample taken monthly	Gross beta and gamma scan monthly. Composite quarterly for ^{89}Sr, ^{90}Sr, and tritium.

*Sample locations are shown in Figures 3.1-1, 3.1-2, 3.1-3, and 3.1-4.

TABLE 3.1-1 (Continued)

Exposure Pathway and/or Sample	Sample Locations*	Sampling and Collection Frequency	Type and Frequency of Analysis
	1 sample at the next 2 downstream potable surface water supplies (greater than 10 miles downstream) (TRM's 274.9 and 254.3)	Monthly grab sample	Gross beta and gamma scan monthly. Composite quarterly for tritium, ^{89}Sr, and ^{90}Sr.
	1 sample at a control location (TRM 306.0)	Monthly grab sample	
Sediment (Figure 3.1-4)	TRM 307.5 TRM 393.7 TRM 288.8 TRM 278.0	Semiannually	Gamma scan, ^{89}Sr, and ^{90}Sr analyses semiannually
INGESTION			
Milk (Figure 3.1-3)	1 sample from milk producing animals in each of 1-3 areas indicated by the cow census where doses are calculated to be highest. If samples are not available from an area, doses to that area will be estimated by projecting the doses from concentrations detected in milk from other sectors or by sampling vegetation where milk is not available	Semimonthly when animals are on pasture. Monthly when animals are off pasture.	^{131}I analysis semimonthly or monthly on collection. Gamma scan, ^{89}Sr, and ^{90}Sr monthly.
	1 sample from a control location		

*Sample locations are shown in Figures 3.1-1, 3.1-2, 3.1-3, and 3.1-4.

TABLE 3.1-1 (Continued)

Exposure Pathway and/or Sample			
Fish	1 sample each of a commercial and a game species in Guntersville Reservoir above the plant		
	1 sample each of a commercial and a game species in Wheeler Reservoir near the plant	Semiannually	Gamma scan semiannually.
	1 sample each of a commercial and a game species in Wilson Reservoir below the plant		
Food Products	1 sample each of principal food products grown at private gardens and/or farms in the immediate vicinity of the plant. Selection of locations to be based on the land use census.	Annually, at time of harvest. The types of foods available for sampling will vary. Following is a list of typical foods which may be available: cabbage and/or lettuce, corn, green beans, potatoes, and tomatoes.	Gamma scan on edible portion
	1 sample each of the same good products grown at control locations.		

*Sample locations are shown in Figures 3.1-1, 3.1-2, 3.1-3, and 3.1-4.

TABLE 3.1-2

ATMOSPHERIC AND TERRESTRIAL MONITORING STATION LOCATIONS

BROWNS FERRY NUCLEAR PLANT

	Location and Approximate Distance and Direction from Plant
LM-1 BF	1.0 mile N
LM-2 BF	0.9 miles NNE
LM-3 BF	1.0 miles NE
LM-4 BF	1.7 miles NNW
LM-5 BF	2.5 miles WSW
PM-1 BF (Rogersville, AL)	13.8 miles NW
PM-2 BF (Athens, AL)	10.9 miles NE
PM-3 BF (Decatur/Trinity, AL)	8.2 miles SSE
PM-4 BF (Courtland, AL)	10.5 miles WSW
RM-1 BF (Muscle Shoals, AL)	32.0 miles W
RM-2 BF (Lawrenceburg, TN)	40.5 miles NNW
Farm B	7.0 miles NNW
Farm S	4.8 miles N
Farm Bi	4.5 miles ENE
Farm L	5.8 miles ENE
Farm T	7.0 miles ENE
Farm N (control)	27 miles NW
Farm J (control)	40 miles NNW
Farm C (control)	32 miles N
Farm Ca (control)	32 miles W

TABLE 3.1-3

LISTING OF TENNESSEE RIVER SURFACE WATER SUPPLIES TO BE SAMPLED IN ENVIRONMENTAL MONITORING PROGRAM

Supply	Source	Distance from Plant (miles)
Courtland (Champion Paper Co.)[a]	Tennessee River (mile 282.6)	11.6
Decatur[b]	Tennessee River (mile 306.0)	12.0
Wheeler Hydro Plant	Tennessee River (mile 274.9)	19.1
Sheffield	Tennessee River (mile 254.3)	39.7

a. First potable water supply downstream of the plant. Sample collected automatically and analyzed monthly.

b. Decatur is upstream of the Browns Ferry Nuclear Plant.

Table 3.2-1

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS

A. Specific Analyses

NOMINAL LOWER LIMIT OF DETECTION (LLD)[a]

	Air Particulates pCi/m³	Charcoal pCi/m³	Fallout mCi/Km²	Water pCi/l	Vegetation and grain pCi/g, dry	Soil and Sediment pCi/g, dry	Fish, clam flesh, plankton, pCi/g, dry	Clam shells pCi/g, dry	Foods, meat, poultry, pCi/Kgm, wet	Milk pCi/l
Total α					0.01				1.5	
Gross α	0.005		0.05	2.0	0.05	0.35	0.1	0.7		
Gross β	0.01			2.3	0.20	0.70	0.1	0.7	25	
^{3}H				330						
^{131}I		0.01								0.5
^{89}Sr	0.005			10	0.25	1.5	0.5	5.0	40	10
^{90}Sr	0.001			2	0.05	0.3	0.1	1.0	8	2

B. Gamma Analyses

NOMINAL LOWER LIMIT OF DETECTION (LLD)

	Air particulates pCi/m³		Water and milk pCi/l		Vegetation and grain * pCi/g, dry		Soil and sediment pCi/g, dry		Fish pCi/g, dry		Clam flesh and plankton pCi/g, dry		Clam shells pCi/g, dry		Foods, tomatoes potatoes, etc.) pCi/Kgm, wet		Meat and poultry pCi/Kgm, wet	
	NaI*	Ge(Li)**	NaI	Ge(Li)	NaI	Ge(Li)	NaI	Ge(Li)	NaI	Ge(Li)	NaI	Ge(Li)	NaI	Ge(Li)	NaI	Ge(Li)	NaI	Ge(Li)
$^{141,144}Ce$	0.03		38		0.55		0.35		0.35				0.35		38		90	
^{144}Ce		0.02		33		0.22		0.06		0.06		0.35		0.06		33		40
^{51}Cr	0.07	0.03	60	44	1.10	0.47	0.60	0.10	0.60	0.10		0.56	0.60	0.10	60	44	200	90
^{131}I	0.01	0.01	15	8	0.35	0.09	0.20	0.02	0.20	0.02		0.07	0.20	0.02	15	8	50	20
$^{103,106}Ru$	0.04		40		0.65		0.45		0.45				0.45		40		150	
^{106}Ru		0.03		40		0.51		0.11		0.11		0.74		0.11		40		90
^{134}Cs	0.01	0.02	10	26	0.20	0.33	0.12	0.08	0.12	0.08		0.48	0.12	0.08	10	26	40	50
^{137}Cs	0.01	0.01	10	5	0.20	0.06	0.12	0.02	0.12	0.02		0.08	0.12	0.02	10	5	40	15
^{95}Zr-Nb	0.01		10		0.20		0.12		0.12				0.12		10		40	
^{95}Zr		0.01		10		0.11		0.03		0.03		0.15		0.03		10		20
^{95}Nb		0.01		5		0.05		0.01		0.01		0.07		0.01		5		15
^{58}Co	0.02	0.01	15	5	0.23	0.05	0.20	0.01	0.20	0.01		0.07	0.20	0.01	15	5	55	15
^{54}Mn	0.02	0.01	10	5	0.20	0.05	0.15	0.01	0.15	0.01		0.08	0.15	0.01	10	5	40	15
^{65}Zn	0.02	0.01	15	9	0.25	0.11	0.23	0.02	0.23	0.02		0.17	0.23	0.02	15	9	70	20
^{60}Co	0.01	0.01	10	5	0.17	0.06	0.11	0.01	0.11	0.01		0.08	0.11	0.01	10	5	30	15
^{40}K	0.10		150		2.50		0.90		0.90				0.90		150		400	
^{140}Ba-La	0.02		15		0.68		0.15		0.15				0.15		15		50	
^{140}Ba		0.02		25		0.34		0.07		0.07		0.30		0.07		25		50
^{140}La		0.01		7		0.08		0.02		0.02		0.10		0.02		7		15

TABLE 3.2-1 (Continued)

TABLE NOTATIONS

* The NaI(Tl) LLD values are calculated by the method developed by Pasternak and Harley as described in HASL-300 and Nucl. Instr. Methods, 533-40 (1971). These LLD values are expected to vary depending on the activities of the components in the samples. These figures do not represent the LLD values achievable on a given sample. Water is counted in a 3.5-L Marinelli beaker. Vegetation, fish, soil, and sediment are counted in a 1-pint container as dry weight. The average dry weight is 120 grams for vegetation and 400-500 grams for soil sediment and fish. Meat and poultry are counted in a 1-pint container as dry weight, then corrected to wet weight using an average moisture content of 70%. Average dry weight is 250 grams. Air particulates are counted in a well crystal. The counting system consists of a multichannel analyzer and either a 4" x 5" well NaI(Tl) crystal. The counting time is 4000 seconds. All calculations are performed by the least-squares computer program ALPHA-M. The assumption is made that the samples are analyzed within one week of the collection date.

** The Ge(Li) LLD values are calculated by the methods developed by Pasternak and Harley as described in HASL-300. These LLD values are expected to vary depending on the activities of the components in the samples. These figures do not represent the LLD values achievable on given samples. Water is counted in either a 0.5-L or 3.5-L Marinelli beaker. Solid samples such as soil, sediment, and clam shells are counted in a 0.5-L Marinelli beaker as dry weight. The average dry weight is 400-500 grams. Air filters and very small volume samples are counted in petrie dishes centered in the detector endcap. The counting system consists of a ND-4420 multichannel analyzer and either a 8%, 14%, or 18% Ge(Li) detector. The counting time is normally 8 hours. All spectral analysis is performed using the software provided with the ND-4420. The assumption is made that all samples are analyzed within one week of the collection date.

a. All LLD values for isotopic separations are calculated by the method developed by Pasternak and Harley as described in HASL-300. Factors such as sample size, decay times, chemical yield, and counting efficiency may vary for a given sample; these variations may change the LLD value for the given sample. The assumption is made that all samples are analyzed within one week of the collection date.

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

TABLE 3.2-1 (Continued)

TABLE NOTATION

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

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

where

LLD is the lower limit of detection as defined above (as pCi per unit mass or volume)

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

E is the counting efficiency (as counts per transformation)

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

2.22 is the number of transformation per minute per picocurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

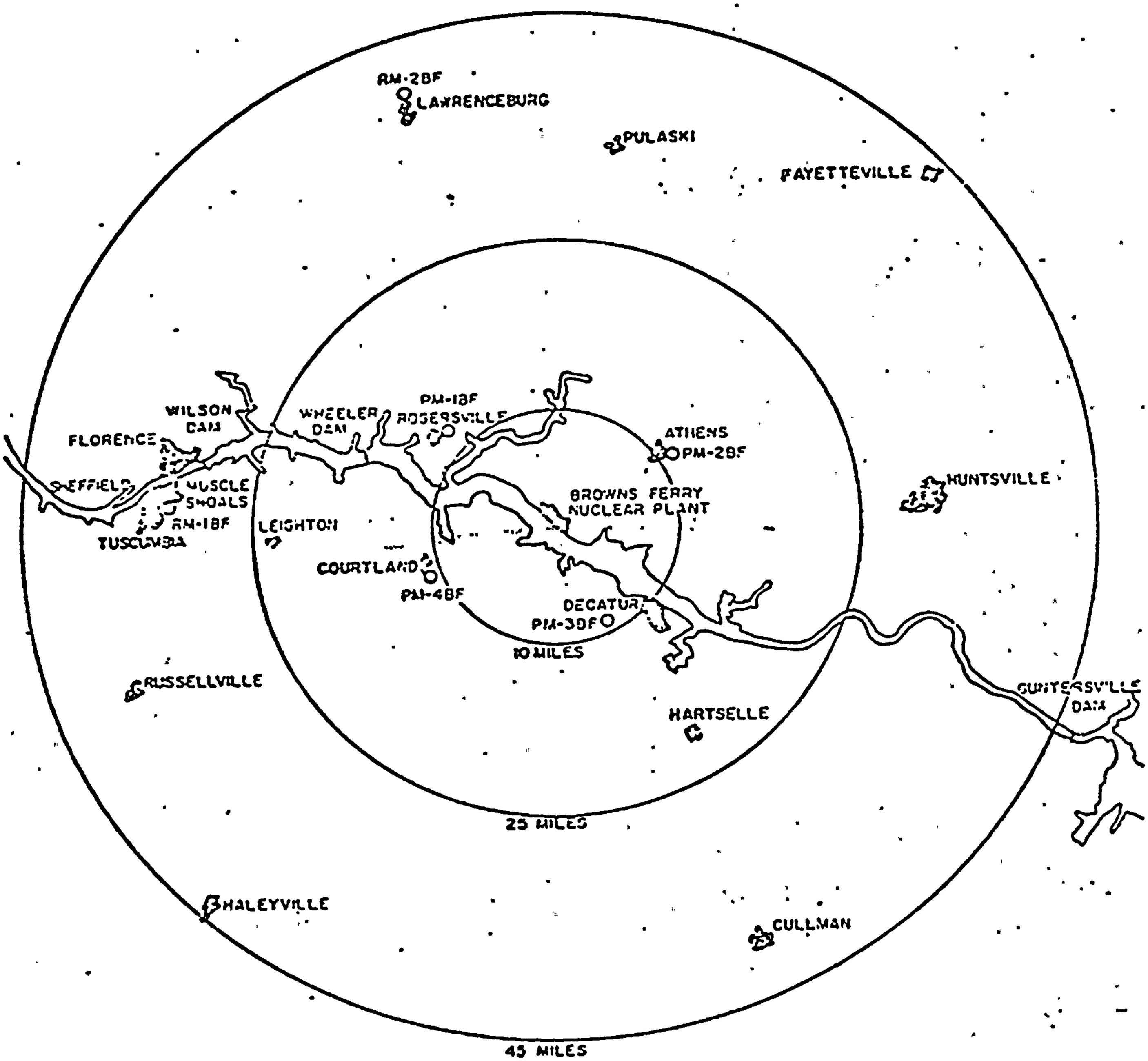
Δt is the elapsed time between sample collection (or end of the sample collection period) and time of counting

The value of s_b used in the calculation of the LLD for a detection system shall be based on the actual observed variance of the background counting rate or of the counting rate of the blank samples (as appropriate) rather than on an unverified theoretically predicted variance.

Figure 3.1-1

Browns Ferry Nuclear Plant

ATMOSPHERIC AND TERRESTRIAL MONITORING NETWORK



O—ENVIRONMENTAL MONITORING STATION

NOTE: THE FOLLOWING SAMPLES ARE COLLECTED FROM EACH STATION:

AIR PARTICULATES	RAINWATER
RADIOIODINE	SOIL
HEAVY PARTICLE FALLOUT	VEGETATION

Figure 3.1-2

LOCAL MONITORING STATIONS

BROWNS FERRY NUCLEAR PLANT

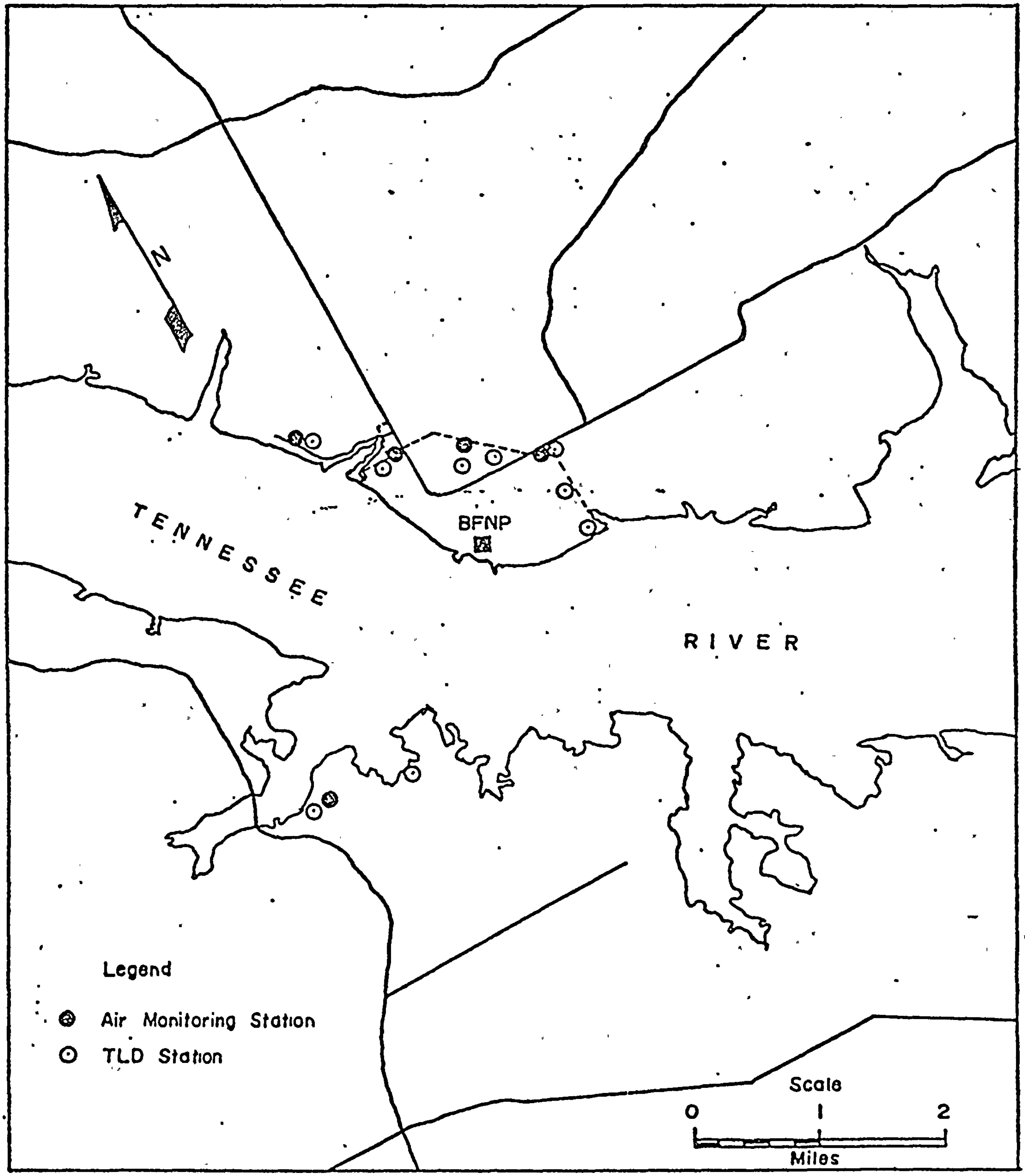


Figure 3.1-3

LOCAL MONITORING STATIONS

BROWNS FERRY NUCLEAR PLANT

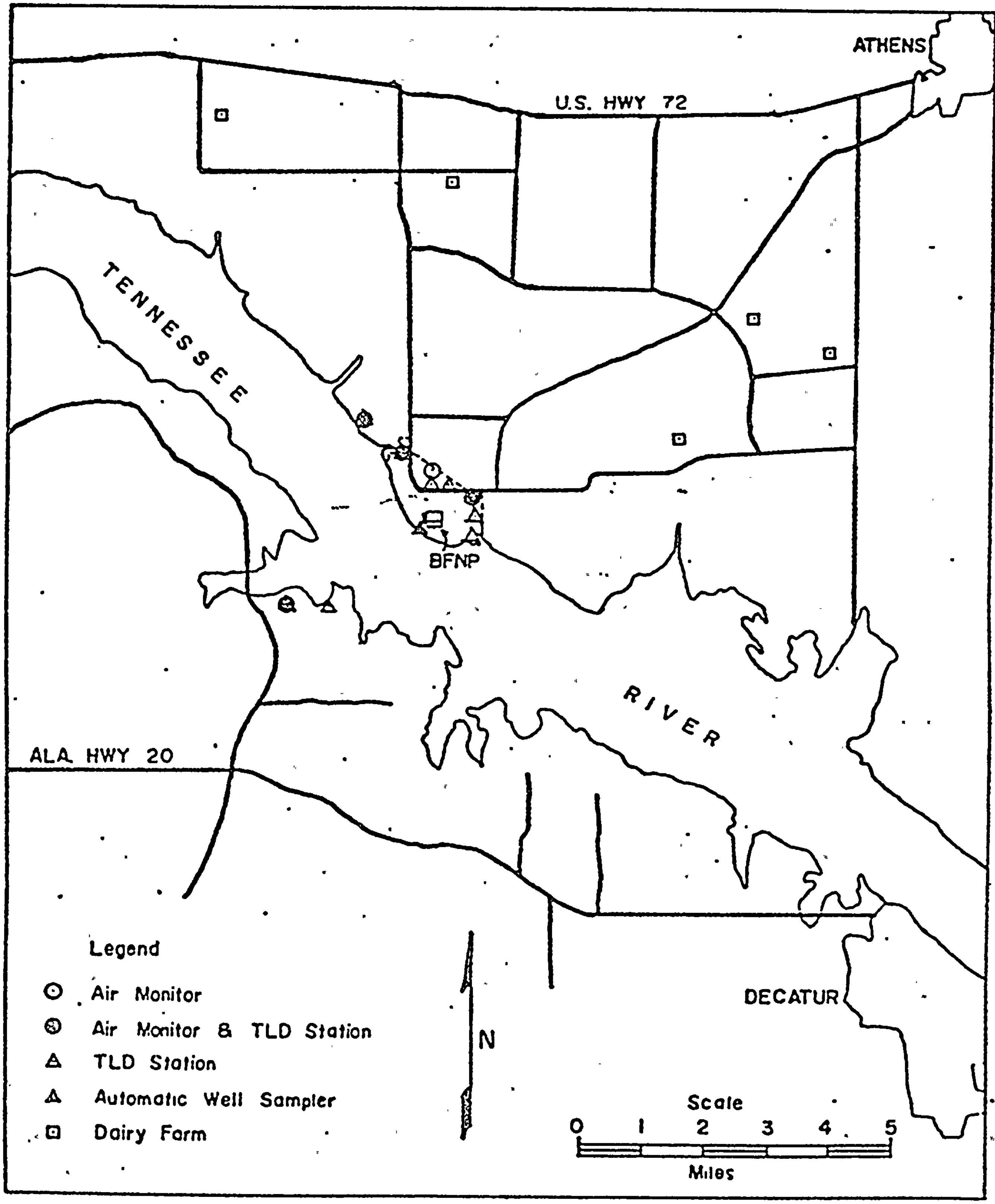
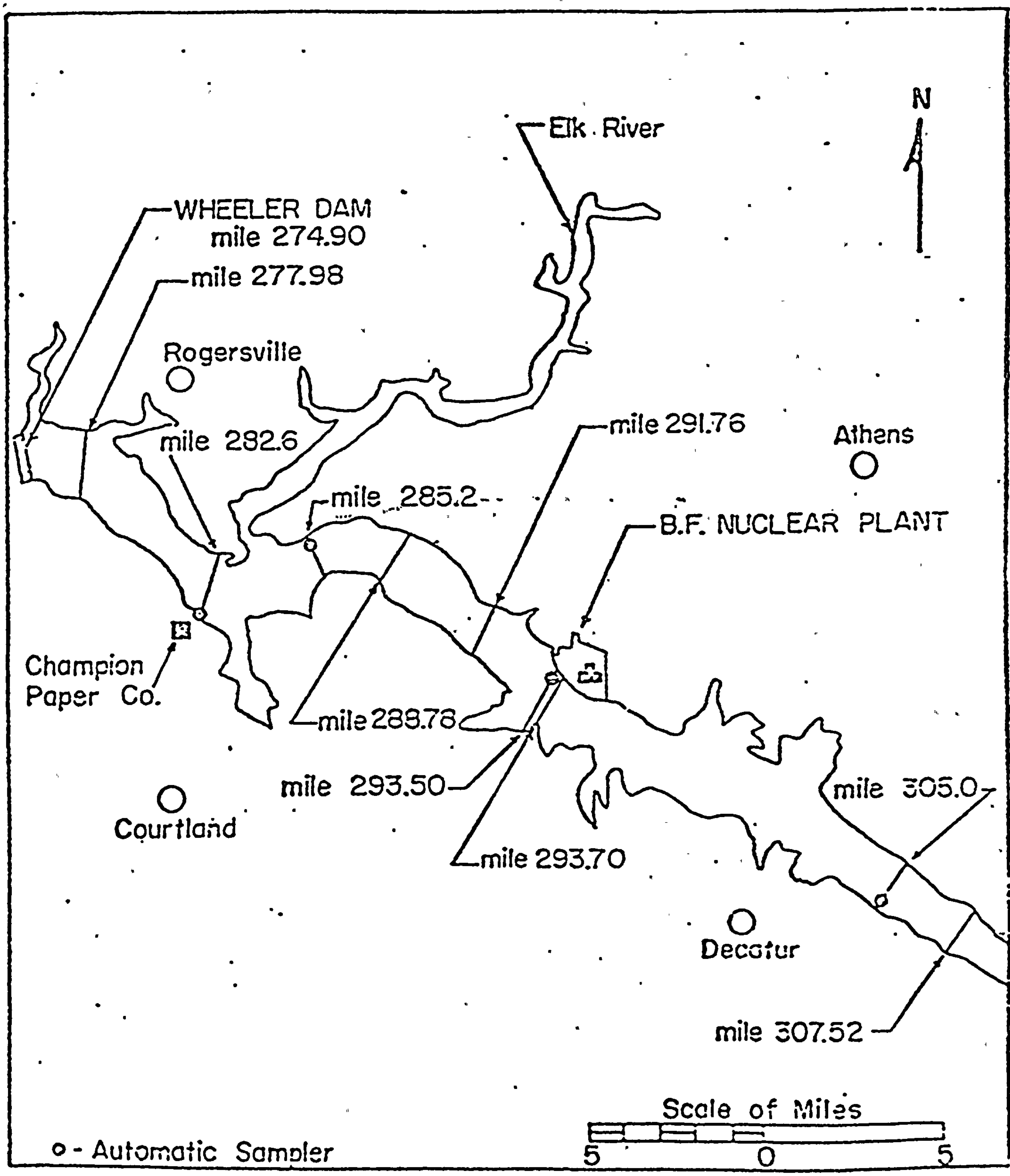


Figure 3.1-4

Browns Ferry Nuclear Plant

RESERVOIR MONITORING NETWORK



Appendix I

This appendix contains 10CFR20, Appendix B. The values in this appendix are the maximum permissible concentrations (MPC) in air and water above natural background.

APPENDIX B

Concentrations in Air and Water Above Natural Background

(See notes at end of appendix)

Element (atomic number)	Isotope[1]		Table I Column 1 Air (μc/ml)	Table I Column 2 Water (μc/ml)	Table II Column 1 Air (μc/ml)	Table II Column 2 Water (μc/ml)
Actinium (89)	Ac 227	S	2×10^{-12}	6×10^{-5}	8×10^{-14}	2×10^{-6}
		I	3×10^{-11}	9×10^{-3}	9×10^{-13}	3×10^{-4}
	Ac 228	S	8×10^{-8}	3×10^{-3}	3×10^{-9}	9×10^{-5}
		I	2×10^{-8}	3×10^{-3}	6×10^{-10}	9×10^{-5}
Americium (95)	Am 241	S	6×10^{-12}	1×10^{-4}	2×10^{-13}	4×10^{-6}
		* I	1×10^{-10}	8×10^{-4}	4×10^{-12}	3×10^{-5}
	Am 242m	S	6×10^{-12}	1×10^{-4}	2×10^{-13}	4×10^{-6}
		I	3×10^{-10}	3×10^{-3}	9×10^{-12}	9×10^{-5}
	Am 242	S	4×10^{-8}	4×10^{-3}	1×10^{-9}	1×10^{-4}
		I	5×10^{-8}	4×10^{-3}	2×10^{-9}	1×10^{-4}
	Am 243	S	6×10^{-12}	1×10^{-4}	2×10^{-13}	4×10^{-6}
		I	1×10^{-10}	8×10^{-4}	4×10^{-12}	3×10^{-5}
	Am 244	S	4×10^{-6}	1×10^{-1}	1×10^{-7}	5×10^{-3}
		I	2×10^{-5}	1×10^{-1}	8×10^{-7}	5×10^{-3}
Antimony (51)	Sb 122	S	2×10^{-7}	8×10^{-4}	6×10^{-9}	3×10^{-5}
		I	1×10^{-7}	8×10^{-4}	5×10^{-9}	3×10^{-5}
	Sb 124	S	2×10^{-7}	7×10^{-4}	5×10^{-9}	2×10^{-5}
		I	2×10^{-8}	7×10^{-4}	7×10^{-10}	2×10^{-5}
	Sb 125	S	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	3×10^{-8}	3×10^{-3}	9×10^{-10}	1×10^{-4}
Argon (18)	A 37	Sub[2]	6×10^{-3}	......	1×10^{-4}	......
	A 41	Sub	2×10^{-6}	......	4×10^{-8}	......
Arsenic (33)	As 73	S	2×10^{-6}	1×10^{-2}	7×10^{-8}	5×10^{-4}
		I	4×10^{-7}	1×10^{-2}	1×10^{-8}	5×10^{-4}
	As 74	S	3×10^{-7}	2×10^{-3}	1×10^{-8}	5×10^{-5}
		I	1×10^{-7}	2×10^{-3}	4×10^{-9}	5×10^{-5}
	As 76	S	1×10^{-7}	6×10^{-4}	4×10^{-9}	2×10^{-5}
		I	1×10^{-7}	6×10^{-4}	3×10^{-9}	2×10^{-5}
	As 77	S	5×10^{-7}	2×10^{-3}	2×10^{-8}	8×10^{-5}
		I	4×10^{-7}	2×10^{-3}	1×10^{-8}	8×10^{-5}
Astatine (85)	At 211	S	7×10^{-9}	5×10^{-5}	2×10^{-10}	2×10^{-6}
		I	3×10^{-8}	2×10^{-3}	1×10^{-9}	7×10^{-5}
Barium (56)	Ba 131	S	1×10^{-6}	5×10^{-3}	4×10^{-8}	2×10^{-4}
		I	4×10^{-7}	5×10^{-3}	1×10^{-8}	2×10^{-4}
	Ba 140	S	1×10^{-7}	8×10^{-4}	4×10^{-9}	3×10^{-5}
		I	4×10^{-8}	7×10^{-4}	1×10^{-9}	2×10^{-5}
Berkelium (97)	Bk 249	S	9×10^{-10}	2×10^{-2}	3×10^{-11}	6×10^{-4}
		I	1×10^{-7}	2×10^{-2}	4×10^{-9}	6×10^{-4}
	Bk 250	S	1×10^{-7}	6×10^{-3}	5×10^{-9}	2×10^{-4}
		I	1×10^{-6}	6×10^{-3}	4×10^{-8}	2×10^{-4}
Beryllium (4)	Be 7	S	6×10^{-6}	5×10^{-2}	2×10^{-7}	2×10^{-3}
		I	1×10^{-6}	5×10^{-2}	4×10^{-8}	2×10^{-3}
Bismuth (83)	Bi 206	S	2×10^{-7}	1×10^{-3}	6×10^{-9}	4×10^{-5}
		I	1×10^{-7}	1×10^{-3}	5×10^{-9}	4×10^{-5}
	Bi 207	S	2×10^{-7}	2×10^{-3}	6×10^{-9}	6×10^{-5}
		I	1×10^{-8}	2×10^{-3}	5×10^{-10}	6×10^{-5}
	Bi 210	S	6×10^{-9}	1×10^{-3}	2×10^{-10}	4×10^{-5}
		I	6×10^{-9}	1×10^{-3}	2×10^{-10}	4×10^{-5}
	[illegible]	[illegible]	1×10^{-7}	1×10^{-2}	3×10^{-9}	4×10^{-4}

APPENDIX B

Concentrations in Air and Water Above Natural Background—Continued

(See notes at end of appendix)

Element (atomic number)	Isotope[1]		Table I Column 1 Air (μc/ml)	Table I Column 2 Water (μc/ml)	Table II Column 1 Air (μc/ml)	Table II Column 2 Water (μc/ml)
Bromine (35)	Br 82	S	1×10^{-6}	8×10^{-3}	4×10^{-8}	3×10^{-4}
		I	2×10^{-7}	1×10^{-3}	6×10^{-9}	4×10^{-5}
Cadmium (48)	Cd 109	S	5×10^{-8}	5×10^{-3}	2×10^{-9}	2×10^{-4}
		I	7×10^{-8}	5×10^{-3}	3×10^{-9}	2×10^{-4}
	Cd 115m	S	4×10^{-8}	7×10^{-4}	1×10^{-9}	3×10^{-5}
		I	4×10^{-8}	7×10^{-4}	1×10^{-9}	3×10^{-5}
	Cd 115	S	2×10^{-7}	1×10^{-3}	8×10^{-9}	3×10^{-5}
		I	2×10^{-7}	1×10^{-3}	6×10^{-9}	4×10^{-5}
Calcium (20)	Ca 45	S	3×10^{-8}	3×10^{-4}	1×10^{-9}	9×10^{-6}
		I	1×10^{-7}	5×10^{-3}	4×10^{-9}	2×10^{-4}
	Ca 47	S	2×10^{-7}	1×10^{-3}	6×10^{-9}	5×10^{-5}
		I	2×10^{-7}	1×10^{-3}	6×10^{-9}	3×10^{-5}
Californium (98)	Cf 249	S	2×10^{-12}	1×10^{-4}	5×10^{-14}	4×10^{-6}
		I	1×10^{-10}	7×10^{-4}	3×10^{-12}	2×10^{-5}
	Cf 250	S	5×10^{-12}	4×10^{-4}	2×10^{-13}	1×10^{-5}
		I	1×10^{-10}	7×10^{-4}	3×10^{-12}	3×10^{-5}
	Cf 251	S	2×10^{-12}	1×10^{-4}	6×10^{-14}	4×10^{-6}
		I	1×10^{-10}	8×10^{-4}	3×10^{-12}	3×10^{-5}
	Cf 252	* S	6×10^{-12}	2×10^{-4}	2×10^{-13}	7×10^{-6}
		* I	3×10^{-11}	2×10^{-4}	1×10^{-12}	7×10^{-6}
	Cf 253	S	8×10^{-10}	4×10^{-3}	3×10^{-11}	1×10^{-4}
		I	8×10^{-10}	4×10^{-3}	3×10^{-11}	1×10^{-4}
	Cf 254	S	5×10^{-12}	4×10^{-6}	2×10^{-13}	1×10^{-7}
		I	5×10^{-12}	4×10^{-6}	2×10^{-13}	1×10^{-7}
Carbon (6)	C 14	S	4×10^{-6}	2×10^{-2}	1×10^{-7}	8×10^{-4}
	(CO_2)	Sub	5×10^{-5}	......	1×10^{-6}	......
Cerium (58)	Ce 141	S	4×10^{-7}	3×10^{-3}	2×10^{-8}	9×10^{-5}
		I	2×10^{-7}	3×10^{-3}	5×10^{-9}	9×10^{-5}
	Ce 143	S	3×10^{-7}	1×10^{-3}	9×10^{-9}	4×10^{-5}
		I	2×10^{-7}	1×10^{-3}	7×10^{-9}	4×10^{-5}
	Ce 144	S	1×10^{-8}	3×10^{-4}	3×10^{-10}	1×10^{-5}
		I	6×10^{-9}	3×10^{-4}	2×10^{-10}	1×10^{-5}
Cesium (55)	Cs 131	S	1×10^{-5}	7×10^{-2}	4×10^{-7}	2×10^{-3}
		I	3×10^{-6}	3×10^{-2}	1×10^{-7}	9×10^{-4}
	Cs 134m	S	4×10^{-5}	2×10^{-1}	1×10^{-6}	6×10^{-3}
		I	6×10^{-6}	3×10^{-2}	2×10^{-7}	1×10^{-3}
	Cs 134	S	4×10^{-8}	3×10^{-4}	1×10^{-9}	9×10^{-6}
		I	1×10^{-8}	1×10^{-3}	4×10^{-10}	4×10^{-5}
	Cs 135	S	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	9×10^{-8}	7×10^{-3}	3×10^{-9}	2×10^{-4}
	Cs 136	S	4×10^{-7}	2×10^{-3}	1×10^{-8}	9×10^{-5}
		I	2×10^{-7}	2×10^{-3}	6×10^{-9}	6×10^{-5}
	Cs 137	S	6×10^{-8}	4×10^{-4}	2×10^{-9}	2×10^{-5}
		I	1×10^{-8}	1×10^{-3}	5×10^{-10}	4×10^{-5}
Chlorine (17)	Cl 36	S	4×10^{-7}	2×10^{-3}	1×10^{-8}	8×10^{-5}
		I	2×10^{-8}	2×10^{-3}	8×10^{-10}	6×10^{-5}
	Cl 38	S	3×10^{-6}	1×10^{-2}	9×10^{-8}	4×10^{-4}
		I	2×10^{-6}	1×10^{-2}	7×10^{-8}	4×10^{-4}
Chromium (24)	Cr 51	S	1×10^{-5}	5×10^{-2}	4×10^{-7}	2×10^{-3}
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

BR TT 47 6/21/72

APPENDIX B

Concentrations in Air and Water Above Natural Background—Continued

(See notes at end of appendix)

Element (atomic number)	Isotope[1]		Table I Column 1 Air (μc/ml)	Table I Column 2 Water (μc/ml)	Table II Column 1 Air (μc/ml)	Table II Column 2 Water (μc/ml)
Cobalt (27)	Co 57	S	3×10^{-6}	2×10^{-2}	1×10^{-7}	5×10^{-4}
		I	2×10^{-7}	1×10^{-2}	6×10^{-9}	4×10^{-4}
	Co 58m	S	2×10^{-5}	8×10^{-2}	6×10^{-7}	3×10^{-3}
		I	9×10^{-6}	6×10^{-2}	3×10^{-7}	2×10^{-3}
	Co 58	S	8×10^{-7}	4×10^{-3}	3×10^{-8}	1×10^{-4}
		I	5×10^{-8}	3×10^{-3}	2×10^{-9}	9×10^{-5}
	Co 60	S	3×10^{-7}	1×10^{-3}	1×10^{-8}	5×10^{-5}
		I	9×10^{-9}	1×10^{-3}	3×10^{-10}	3×10^{-5}
Copper (29)	Cu 64	S	2×10^{-6}	1×10^{-2}	7×10^{-8}	3×10^{-4}
		I	1×10^{-6}	6×10^{-3}	4×10^{-8}	2×10^{-4}
Curium (96)	Cm 242	S	1×10^{-10}	7×10^{-4}	4×10^{-12}	2×10^{-5}
	*	I	2×10^{-10}	7×10^{-4}	6×10^{-12}	2×10^{-5}
	Cm 243	S	6×10^{-12}	1×10^{-4}	2×10^{-13}	5×10^{-6}
		I	1×10^{-10}	7×10^{-4}	3×10^{-12}	2×10^{-5}
	Cm 244	S	9×10^{-12}	2×10^{-4}	3×10^{-13}	7×10^{-6}
		I	1×10^{-10}	8×10^{-4}	3×10^{-12}	3×10^{-5}
	Cm 245	S	5×10^{-12}	1×10^{-4}	2×10^{-13}	4×10^{-6}
		I	1×10^{-10}	8×10^{-4}	4×10^{-12}	3×10^{-5}
	Cm 246	S	5×10^{-12}	1×10^{-4}	2×10^{-13}	4×10^{-6}
		I	1×10^{-10}	8×10^{-4}	4×10^{-12}	3×10^{-5}
	Cm 247	S	5×10^{-12}	1×10^{-4}	2×10^{-13}	4×10^{-6}
		I	1×10^{-10}	6×10^{-4}	4×10^{-12}	2×10^{-5}
	Cm 248	S	6×10^{-13}	1×10^{-5}	2×10^{-14}	4×10^{-7}
		I	1×10^{-11}	4×10^{-5}	4×10^{-13}	1×10^{-6}
	Cm 249	S	1×10^{-5}	6×10^{-2}	4×10^{-7}	2×10^{-3}
		I	1×10^{-5}	6×10^{-2}	4×10^{-7}	2×10^{-3}
Dysprosium (66)	Dy 165	S	3×10^{-6}	1×10^{-2}	9×10^{-8}	4×10^{-4}
		I	2×10^{-6}	1×10^{-2}	7×10^{-8}	4×10^{-4}
	Dy 166	S	2×10^{-7}	1×10^{-3}	8×10^{-9}	4×10^{-5}
		I	2×10^{-7}	1×10^{-3}	7×10^{-9}	4×10^{-5}
Einsteinium (99)	Es 253	S	8×10^{-10}	7×10^{-4}	3×10^{-11}	2×10^{-5}
		I	6×10^{-10}	7×10^{-4}	2×10^{-11}	2×10^{-5}
	Es 254m	S	5×10^{-9}	5×10^{-4}	2×10^{-10}	2×10^{-5}
		I	6×10^{-9}	5×10^{-4}	2×10^{-10}	2×10^{-5}
	Es 254	S	2×10^{-11}	4×10^{-4}	6×10^{-13}	1×10^{-5}
		I	1×10^{-10}	4×10^{-4}	4×10^{-12}	1×10^{-5}
	Es 255	S	5×10^{-10}	8×10^{-4}	2×10^{-11}	3×10^{-5}
		I	4×10^{-10}	8×10^{-4}	1×10^{-11}	3×10^{-5}
Erbium (68)	Er 169	S	6×10^{-7}	3×10^{-3}	2×10^{-8}	9×10^{-5}
		I	4×10^{-7}	3×10^{-3}	1×10^{-8}	9×10^{-5}
	Er 171	S	7×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	6×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
Europium (63)	Eu 152	S	4×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-5}
	(T/2 = 9.2 hrs)	I	3×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-5}
	Eu 152	S	1×10^{-8}	2×10^{-3}	4×10^{-10}	8×10^{-5}
	(T/2 = 13 yrs)	I	2×10^{-9}	2×10^{-3}	6×10^{-11}	8×10^{-5}
	Eu 154	S	4×10^{-9}	6×10^{-4}	1×10^{-10}	2×10^{-5}
		I	7×10^{-10}	6×10^{-4}	2×10^{-11}	2×10^{-5}
	Eu 155	S	9×10^{-8}	6×10^{-3}	3×10^{-9}	2×10^{-4}
		I	7×10^{-8}	6×10^{-3}	3×10^{-9}	2×10^{-4}

*Amended 37 FR 23319

APPENDIX B

Concentrations in Air and Water Above Natural Background—Continued

(See notes at end of appendix)

Element (atomic number)	Isotope[1]		Table I Column 1 Air (μc/ml)	Table I Column 2 Water (μc/ml)	Table II Column 1 Air (μc/ml)	Table II Column 2 Water (μc/ml)
Fermium (100)	Fm 254	S	6×10^{-8}	4×10^{-3}	2×10^{-9}	1×10^{-4}
		I	7×10^{-8}	4×10^{-3}	2×10^{-9}	1×10^{-4}
	Fm 255	S	2×10^{-8}	1×10^{-3}	6×10^{-10}	3×10^{-5}
		I	1×10^{-8}	1×10^{-3}	4×10^{-10}	3×10^{-5}
	Fm 256	S	3×10^{-9}	3×10^{-5}	1×10^{-10}	9×10^{-7}
		I	2×10^{-9}	3×10^{-5}	6×10^{-11}	9×10^{-7}
Fluorine (9)	F 18	S	5×10^{-6}	2×10^{-2}	2×10^{-7}	8×10^{-4}
		I	3×10^{-6}	1×10^{-2}	9×10^{-8}	5×10^{-4}
Gadolinium (64)	Gd 153	S	2×10^{-7}	6×10^{-3}	8×10^{-9}	2×10^{-4}
		I	9×10^{-8}	6×10^{-3}	3×10^{-9}	2×10^{-4}
	Gd 159	S	5×10^{-7}	2×10^{-3}	2×10^{-8}	8×10^{-5}
		I	4×10^{-7}	2×10^{-3}	1×10^{-8}	8×10^{-5}
Gallium (31)	Ga 72	S	2×10^{-7}	1×10^{-3}	8×10^{-9}	4×10^{-5}
		I	2×10^{-7}	1×10^{-3}	6×10^{-9}	4×10^{-5}
Germanium (32)	Ge 71	S	1×10^{-5}	5×10^{-2}	4×10^{-7}	2×10^{-3}
		I	6×10^{-6}	5×10^{-2}	2×10^{-7}	2×10^{-3}
Gold (79)	Au 196	S	1×10^{-6}	5×10^{-3}	4×10^{-8}	2×10^{-4}
		I	6×10^{-7}	4×10^{-3}	2×10^{-8}	1×10^{-4}
	Au 198	S	3×10^{-7}	2×10^{-3}	1×10^{-8}	5×10^{-5}
		I	2×10^{-7}	1×10^{-3}	8×10^{-9}	5×10^{-5}
	Au 199	S	1×10^{-6}	5×10^{-3}	4×10^{-8}	2×10^{-4}
		I	8×10^{-7}	4×10^{-3}	3×10^{-8}	2×10^{-4}
Hafnium (72)	Hf 181	S	4×10^{-8}	2×10^{-3}	1×10^{-9}	7×10^{-5}
		I	7×10^{-8}	2×10^{-3}	3×10^{-9}	7×10^{-5}
Holmium (67)	Ho 166	S	2×10^{-7}	9×10^{-4}	7×10^{-9}	3×10^{-5}
		I	2×10^{-7}	9×10^{-4}	6×10^{-9}	3×10^{-5}
Hydrogen (1)	H3	S	5×10^{-6}	1×10^{-1}	2×10^{-7}	3×10^{-3}
		I	5×10^{-6}	1×10^{-1}	2×10^{-7}	3×10^{-3}
		Sub	2×10^{-3}	....	4×10^{-5}	....
Indium (49)	In 113m	S	8×10^{-6}	4×10^{-2}	3×10^{-7}	1×10^{-3}
		I	7×10^{-6}	4×10^{-2}	2×10^{-7}	1×10^{-3}
	In 114m	S	1×10^{-7}	5×10^{-4}	4×10^{-9}	2×10^{-5}
		I	2×10^{-8}	5×10^{-4}	7×10^{-10}	2×10^{-5}
	In 115m	S	2×10^{-6}	1×10^{-2}	8×10^{-8}	4×10^{-4}
		I	2×10^{-6}	1×10^{-2}	6×10^{-8}	4×10^{-4}
	In 115	S	2×10^{-7}	3×10^{-3}	9×10^{-9}	9×10^{-5}
		I	3×10^{-8}	3×10^{-3}	1×10^{-9}	9×10^{-5}
Iodine (53)	I 125	S	5×10^{-9}	4×10^{-5}	8×10^{-11}	2×10^{-7}
		I	2×10^{-7}	6×10^{-3}	6×10^{-9}	2×10^{-4}
	I 126	S	8×10^{-9}	5×10^{-5}	9×10^{-11}	3×10^{-7}
		I	3×10^{-7}	3×10^{-3}	1×10^{-8}	9×10^{-5}
	I 129	S	2×10^{-9}	1×10^{-5}	2×10^{-11}	6×10^{-8}
		I	7×10^{-8}	6×10^{-3}	2×10^{-9}	2×10^{-4}
	I 131	S	9×10^{-9}	6×10^{-5}	1×10^{-10}	3×10^{-7}
		I	3×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-5}
	I 132	S	2×10^{-7}	2×10^{-3}	3×10^{-9}	8×10^{-6}
		I	9×10^{-7}	5×10^{-3}	3×10^{-8}	2×10^{-4}
	I 133	S	3×10^{-8}	2×10^{-4}	4×10^{-10}	1×10^{-6}
		I	2×10^{-7}	1×10^{-3}	7×10^{-9}	4×10^{-5}
	I 134	S	5×10^{-7}	4×10^{-3}	6×10^{-9}	2×10^{-5}

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APPENDIX B

Concentrations in Air and Water Above Natural Background—Continued

(See notes at end of appendix)

Element (atomic number)	Isotope[1]		Table I Column 1 Air (μc/ml)	Table I Column 2 Water (μc/ml)	Table II Column 1 Air (μc/ml)	Table II Column 2 Water (μc/ml)
Iodine (53)	I 134	I	3×10^{-6}	2×10^{-2}	1×10^{-7}	6×10^{-4}
	I 135	S	1×10^{-7}	7×10^{-4}	1×10^{-9}	4×10^{-6}
		I	4×10^{-7}	2×10^{-3}	1×10^{-8}	7×10^{-5}
Iridium (77)	Ir 190	S	1×10^{-6}	6×10^{-3}	4×10^{-8}	2×10^{-4}
		I	4×10^{-7}	5×10^{-3}	1×10^{-8}	2×10^{-4}
	Ir 192	S	1×10^{-7}	1×10^{-3}	4×10^{-9}	4×10^{-5}
		I	3×10^{-8}	1×10^{-3}	9×10^{-10}	4×10^{-5}
	Ir 194	S	2×10^{-7}	1×10^{-3}	8×10^{-9}	3×10^{-5}
		I	2×10^{-7}	9×10^{-4}	5×10^{-9}	3×10^{-5}
Iron (26)	Fe 55	S	9×10^{-7}	2×10^{-2}	3×10^{-8}	8×10^{-4}
		I	1×10^{-6}	7×10^{-2}	3×10^{-8}	2×10^{-3}
	Fe 59	S	1×10^{-7}	2×10^{-3}	5×10^{-9}	6×10^{-5}
		I	5×10^{-8}	2×10^{-3}	2×10^{-9}	5×10^{-5}
Krypton (36)	Kr 85m	Sub	6×10^{-6}	....	1×10^{-7}	....
	Kr 85	Sub	1×10^{-5}	....	3×10^{-7}	....
	Kr 87	Sub	1×10^{-6}	....	2×10^{-8}	....
	Kr 88	Sub	1×10^{-6}	....	2×10^{-8}	....
Lanthanum (57)	La 140	S	2×10^{-7}	7×10^{-4}	5×10^{-9}	2×10^{-5}
		I	1×10^{-7}	7×10^{-4}	4×10^{-9}	2×10^{-5}
Lead (82)	Pb 203	S	3×10^{-6}	1×10^{-2}	9×10^{-8}	4×10^{-4}
		I	2×10^{-6}	1×10^{-2}	6×10^{-8}	4×10^{-4}
	Pb 210	S	1×10^{-10}	4×10^{-6}	4×10^{-12}	1×10^{-7}
		I	2×10^{-10}	5×10^{-3}	8×10^{-12}	2×10^{-4}
	Pb 212	S	2×10^{-8}	6×10^{-4}	6×10^{-10}	2×10^{-5}
		I	2×10^{-8}	5×10^{-4}	7×10^{-10}	2×10^{-5}
Lutetium (71)	Lu 177	S	6×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
Manganese (25)	Mn 52	S	2×10^{-7}	1×10^{-3}	7×10^{-9}	3×10^{-5}
		I	1×10^{-7}	9×10^{-4}	5×10^{-9}	3×10^{-5}
	Mn 54	* S	4×10^{-7}	4×10^{-3}	1×10^{-8}	1×10^{-4}
		I	4×10^{-8}	3×10^{-3}	1×10^{-9}	1×10^{-4}
	Mn 56	S	8×10^{-7}	4×10^{-3}	3×10^{-8}	1×10^{-4}
		I	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
Mercury (80)	Hg 197m	S	7×10^{-7}	6×10^{-3}	3×10^{-8}	2×10^{-4}
		I	8×10^{-7}	5×10^{-3}	3×10^{-8}	2×10^{-4}
	Hg 197	S	1×10^{-6}	9×10^{-3}	4×10^{-8}	3×10^{-4}
		I	3×10^{-6}	1×10^{-2}	9×10^{-8}	5×10^{-4}
	Hg 203	S	7×10^{-8}	5×10^{-4}	2×10^{-9}	2×10^{-5}
		I	1×10^{-7}	3×10^{-3}	4×10^{-9}	1×10^{-4}
Molybdenum (42)	Mo 99	S	7×10^{-7}	5×10^{-3}	3×10^{-8}	2×10^{-4}
		I	2×10^{-7}	1×10^{-3}	7×10^{-9}	4×10^{-5}
Neodymium (60)	Nd 144	S	8×10^{-11}	2×10^{-3}	3×10^{-12}	7×10^{-5}
		I	3×10^{-10}	2×10^{-3}	1×10^{-11}	8×10^{-5}
	Nd 147	S	4×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-5}
		I	2×10^{-7}	2×10^{-3}	8×10^{-9}	6×10^{-5}
	Nd 149	S	2×10^{-6}	8×10^{-3}	6×10^{-8}	3×10^{-4}
		I	1×10^{-6}	8×10^{-3}	5×10^{-8}	3×10^{-4}

*Amended 37 FR 23319

APPENDIX B

Concentrations in Air and Water Above Natural Background—Continued

(See notes at end of appendix)

Element (atomic number)	Isotope[1]		Table I Column 1 Air (μc/ml)	Table I Column 2 Water (μc/ml)	Table II Column 1 Air (μc/ml)	Table II Column 2 Water (μc/ml)
Neptunium (93)	Np 237	S	4×10^{-12}	9×10^{-5}	1×10^{-13}	3×10^{-6}
		I	1×10^{-10}	9×10^{-4}	4×10^{-12}	3×10^{-5}
	Np 239	S	8×10^{-7}	4×10^{-3}	3×10^{-8}	1×10^{-4}
		I	7×10^{-7}	4×10^{-3}	2×10^{-8}	1×10^{-4}
Nickel (28)	Ni 59	S	5×10^{-7}	6×10^{-3}	2×10^{-8}	2×10^{-4}
		I	8×10^{-7}	6×10^{-2}	3×10^{-8}	2×10^{-3}
	Ni 63	S	6×10^{-8}	8×10^{-4}	2×10^{-9}	3×10^{-5}
		I	3×10^{-7}	2×10^{-2}	1×10^{-8}	7×10^{-4}
	Ni 65	S	9×10^{-7}	4×10^{-3}	3×10^{-8}	1×10^{-4}
		I	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
Niobium (Columbium) (41)	Nb 93m	S	1×10^{-7}	1×10^{-2}	4×10^{-9}	4×10^{-4}
		I	2×10^{-7}	1×10^{-2}	5×10^{-9}	4×10^{-4}
	Nb 95	S	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	1×10^{-7}	3×10^{-3}	3×10^{-9}	1×10^{-4}
	Nb 97	S	6×10^{-6}	3×10^{-2}	2×10^{-7}	9×10^{-4}
		I	5×10^{-6}	3×10^{-2}	2×10^{-7}	7×10^{-4}
Osmium (76)	Os 185	S	5×10^{-7}	2×10^{-3}	2×10^{-8}	7×10^{-5}
		I	5×10^{-8}	2×10^{-3}	2×10^{-9}	7×10^{-5}
	Os 191m	S	2×10^{-5}	7×10^{-2}	6×10^{-7}	3×10^{-3}
		I	9×10^{-6}	7×10^{-2}	3×10^{-7}	3×10^{-3}
	Os 191	S	1×10^{-6}	5×10^{-3}	4×10^{-8}	2×10^{-4}
		I	4×10^{-7}	5×10^{-3}	1×10^{-8}	2×10^{-4}
	Os 193	S	4×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-5}
		I	3×10^{-7}	2×10^{-3}	9×10^{-9}	5×10^{-5}
Palladium (46)	Pd 103	S	1×10^{-6}	1×10^{-2}	5×10^{-8}	3×10^{-4}
		I	7×10^{-7}	8×10^{-3}	3×10^{-8}	3×10^{-4}
	Pd 109	S	6×10^{-7}	3×10^{-3}	2×10^{-8}	9×10^{-5}
		I	4×10^{-7}	2×10^{-3}	1×10^{-8}	7×10^{-5}
Phosphorus (15)	P 32	S	7×10^{-8}	5×10^{-4}	2×10^{-9}	2×10^{-5}
		I	8×10^{-8}	7×10^{-4}	3×10^{-9}	2×10^{-5}
Platinum (78)	Pt 191	S	8×10^{-7}	4×10^{-3}	3×10^{-8}	1×10^{-4}
		I	6×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
	Pt 193m	S	7×10^{-6}	3×10^{-2}	2×10^{-7}	1×10^{-3}
		I	5×10^{-6}	3×10^{-2}	2×10^{-7}	1×10^{-3}
**	Pt 193	S	1×10^{-6}	3×10^{-2}	4×10^{-8}	9×10^{-4}
		I	3×10^{-7}	5×10^{-2}	1×10^{-8}	2×10^{-3}
	Pt 197m	S	6×10^{-6}	3×10^{-2}	2×10^{-7}	1×10^{-3}
		I	5×10^{-6}	3×10^{-2}	2×10^{-7}	9×10^{-4}
	Pt 197	S	8×10^{-7}	4×10^{-3}	3×10^{-8}	1×10^{-4}
		I	6×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
Plutonium (94)	Pu 238	S	2×10^{-12}	1×10^{-4}	7×10^{-14}	5×10^{-6}
		I	3×10^{-11}	8×10^{-4}	1×10^{-12}	3×10^{-5}
	Pu 239	S	2×10^{-12}	1×10^{-4}	6×10^{-14}	5×10^{-6}
		I	4×10^{-11}	8×10^{-4}	1×10^{-12}	3×10^{-5}
	Pu 240	S	2×10^{-12}	1×10^{-4}	6×10^{-14}	5×10^{-6}
		I	4×10^{-11}	8×10^{-4}	1×10^{-12}	3×10^{-5}
	Pu 241	S	9×10^{-11}	7×10^{-3}	3×10^{-12}	2×10^{-4}
		I	4×10^{-8}	4×10^{-2}	1×10^{-9}	1×10^{-3}

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Concentrations in Air and Water Above Natural Background—Continued

(See notes at end of appendix)

Element (atomic number)	Isotope [1]		Table I Column 1 Air (μc/ml)	Table I Column 2 Water (μc/ml)	Table II Column 1 Air (μc/ml)	Table II Column 2 Water (μc/ml)
Plutonium (94)	Pu 242	S	2×10^{-12}	1×10^{-4}	6×10^{-14}	5×10^{-6}
		I	4×10^{-11}	9×10^{-4}	1×10^{-12}	3×10^{-5}
	Pu 243	S	2×10^{-6}	1×10^{-2}	6×10^{-8}	3×10^{-4}
		I	2×10^{-6}	1×10^{-2}	8×10^{-8}	3×10^{-4}
	Pu 244	S	2×10^{-12}	1×10^{-4}	6×10^{-14}	4×10^{-6}
		I	3×10^{-11}	3×10^{-4}	1×10^{-12}	1×10^{-5}
Polonium (84)	Po 210	S	5×10^{-10}	2×10^{-5}	2×10^{-11}	7×10^{-7}
		I	2×10^{-10}	8×10^{-4}	7×10^{-12}	3×10^{-5}
Potassium (19)	K 42	S	2×10^{-6}	9×10^{-3}	7×10^{-8}	3×10^{-4}
		I	1×10^{-7}	6×10^{-4}	4×10^{-9}	2×10^{-5}
Praseodymium (59)	Pr 142	S	2×10^{-7}	9×10^{-4}	7×10^{-9}	3×10^{-5}
		I	2×10^{-7}	9×10^{-4}	5×10^{-9}	3×10^{-5}
	Pr 143	S	3×10^{-7}	1×10^{-3}	1×10^{-8}	5×10^{-5}
		I	2×10^{-7}	1×10^{-3}	6×10^{-9}	5×10^{-5}
Promethium (61)	Pm 147	S	6×10^{-8}	6×10^{-3}	2×10^{-9}	2×10^{-4}
		I	1×10^{-7}	6×10^{-3}	3×10^{-9}	2×10^{-4}
	Pm 149	S	3×10^{-7}	1×10^{-3}	1×10^{-8}	4×10^{-5}
		I	2×10^{-7}	1×10^{-3}	8×10^{-9}	4×10^{-5}
Protoactinium (91)	Pa 230	S	2×10^{-9}	7×10^{-3}	6×10^{-11}	2×10^{-4}
		I	8×10^{-10}	7×10^{-3}	3×10^{-11}	2×10^{-4}
	Pa 231	S	1×10^{-12}	3×10^{-5}	4×10^{-14}	9×10^{-7}
		I	1×10^{-10}	8×10^{-4}	4×10^{-12}	2×10^{-5}
	Pa 233	S	6×10^{-7}	4×10^{-3}	2×10^{-8}	1×10^{-4}
		I	2×10^{-7}	3×10^{-3}	6×10^{-9}	1×10^{-4}
Radium (88)	Ra 223	S	2×10^{-9}	2×10^{-5}	6×10^{-11}	7×10^{-7}
		I	2×10^{-10}	1×10^{-4}	8×10^{-12}	4×10^{-6}
	Ra 224	S	5×10^{-9}	7×10^{-5}	2×10^{-10}	2×10^{-6}
		I	7×10^{-10}	2×10^{-4}	2×10^{-11}	5×10^{-6}
	Ra 226	S	3×10^{-11}	4×10^{-7}	3×10^{-12}	3×10^{-8}
		I	5×10^{-11}	9×10^{-4}	2×10^{-12}	3×10^{-5}
	Ra 228	S	7×10^{-11}	8×10^{-7}	2×10^{-12}	3×10^{-8}
		I	4×10^{-11}	7×10^{-4}	1×10^{-12}	3×10^{-5}
Radon (86)	Rn 220	S	3×10^{-7}	....	1×10^{-8}	....
	Rn 222	S	1×10^{-7}	....	3×10^{-9}	....
Rhenium (75)	Re 183	S	3×10^{-6}	2×10^{-2}	9×10^{-8}	6×10^{-4}
		I	2×10^{-7}	8×10^{-4}	5×10^{-9}	3×10^{-5}
	Re 186	S	6×10^{-7}	3×10^{-3}	2×10^{-8}	9×10^{-5}
		I	2×10^{-7}	1×10^{-3}	8×10^{-9}	5×10^{-5}
	Re 187	S	9×10^{-6}	7×10^{-2}	3×10^{-7}	3×10^{-3}
		I	5×10^{-7}	4×10^{-2}	2×10^{-8}	2×10^{-3}
	Re 188	S	4×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-5}
		I	2×10^{-7}	9×10^{-4}	6×10^{-9}	3×10^{-5}
Rhodium (45)	Rh 103m	S	8×10^{-5}	4×10^{-1}	3×10^{-6}	1×10^{-2}
		I	6×10^{-5}	3×10^{-1}	2×10^{-6}	1×10^{-2}
	Rh 105	S	8×10^{-7}	4×10^{-3}	3×10^{-8}	1×10^{-4}
		I	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
Rubidium (37)	Rb 86	S	3×10^{-7}	2×10^{-3}	1×10^{-8}	7×10^{-5}
		I	7×10^{-8}	7×10^{-4}	2×10^{-9}	2×10^{-5}
	Rb 87	S	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	7×10^{-8}	5×10^{-3}	2×10^{-9}	2×10^{-4}
Ruthenium (44)	Ru 97	S	2×10^{-6}	1×10^{-2}	8×10^{-8}	4×10^{-4}
		I	2×10^{-6}	1×10^{-2}	6×10^{-8}	3×10^{-4}
	Ru 103	S	5×10^{-7}	2×10^{-3}	2×10^{-8}	8×10^{-5}
		I	8×10^{-8}	2×10^{-3}	3×10^{-9}	8×10^{-5}
	Ru 105	S	7×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
	Ru 106	S	8×10^{-8}	4×10^{-4}	3×10^{-9}	1×10^{-5}
		I	6×10^{-9}	3×10^{-4}	2×10^{-10}	1×10^{-5}
Samarium (62)	Sm 147	S	7×10^{-11}	2×10^{-3}	2×10^{-12}	6×10^{-5}
		I	3×10^{-10}	2×10^{-3}	9×10^{-12}	7×10^{-5}
	Sm 151	S	6×10^{-8}	1×10^{-2}	2×10^{-9}	4×10^{-4}
		I	1×10^{-7}	1×10^{-2}	5×10^{-9}	4×10^{-4}
	Sm 153	S	5×10^{-7}	2×10^{-3}	2×10^{-8}	8×10^{-5}
		I	4×10^{-7}	2×10^{-3}	1×10^{-8}	8×10^{-5}
Scandium (21)	Sc 46	S	2×10^{-7}	1×10^{-3}	8×10^{-9}	4×10^{-5}
		I	2×10^{-8}	1×10^{-3}	8×10^{-10}	4×10^{-5}
	Sc 47	S	6×10^{-7}	3×10^{-3}	2×10^{-8}	9×10^{-5}
		I	5×10^{-7}	3×10^{-3}	2×10^{-8}	9×10^{-5}
	Sc 48	S	2×10^{-7}	8×10^{-4}	6×10^{-9}	3×10^{-5}
		I	1×10^{-7}	8×10^{-4}	5×10^{-9}	3×10^{-5}
Selenium (34)	Se 75	S	1×10^{-6}	9×10^{-3}	4×10^{-8}	3×10^{-4}
		I	1×10^{-7}	8×10^{-3}	4×10^{-9}	3×10^{-4}
Silicon (14)	Si 31	S	6×10^{-6}	3×10^{-2}	2×10^{-7}	9×10^{-4}
		I	1×10^{-6}	6×10^{-2}	3×10^{-8}	2×10^{-4}
Silver (47)	Ag 105	S	6×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	8×10^{-8}	3×10^{-3}	3×10^{-9}	1×10^{-4}
	Ag 110m	S	2×10^{-7}	9×10^{-4}	7×10^{-9}	3×10^{-5}
		I	1×10^{-8}	9×10^{-4}	3×10^{-10}	3×10^{-5}
	Ag 111	S	3×10^{-7}	1×10^{-3}	1×10^{-8}	4×10^{-5}
		I	2×10^{-7}	1×10^{-3}	8×10^{-9}	4×10^{-5}
Sodium (11)	Na 22	S	2×10^{-7}	1×10^{-3}	6×10^{-9}	4×10^{-5}
		I	9×10^{-9}	9×10^{-4}	3×10^{-10}	3×10^{-5}
	Na 24	S	1×10^{-6}	6×10^{-3}	4×10^{-8}	2×10^{-4}
		I	1×10^{-7}	8×10^{-4}	5×10^{-9}	3×10^{-5}
Strontium (38)	Sr 85m	S	4×10^{-5}	2×10^{-1}	1×10^{-6}	7×10^{-3}
		I	3×10^{-5}	2×10^{-1}	1×10^{-6}	7×10^{-3}
	Sr 85	S	2×10^{-7}	3×10^{-3}	8×10^{-9}	1×10^{-4}
		I	1×10^{-7}	5×10^{-3}	4×10^{-9}	2×10^{-4}
	Sr 89	S	3×10^{-8}	3×10^{-4}	3×10^{-10}	3×10^{-6}
		I	4×10^{-8}	8×10^{-4}	1×10^{-9}	3×10^{-5}
	Sr 90	S	1×10^{-9}	1×10^{-5}	3×10^{-11}	3×10^{-7}
		I	5×10^{-9}	1×10^{-3}	2×10^{-10}	4×10^{-5}
	Sr 91	S	4×10^{-7}	2×10^{-3}	2×10^{-8}	7×10^{-5}
		I	3×10^{-7}	1×10^{-3}	9×10^{-9}	5×10^{-5}
	Sr 92	S	4×10^{-7}	2×10^{-3}	2×10^{-8}	7×10^{-5}
		I	3×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-5}
Sulfur (16)	S 35	S	3×10^{-7}	2×10^{-3}	9×10^{-9}	6×10^{-5}
		I	3×10^{-7}	8×10^{-3}	9×10^{-9}	3×10^{-4}
Tantalum (73)	Ta 182	S	4×10^{-8}	1×10^{-3}	1×10^{-9}	4×10^{-5}
		I	2×10^{-8}	1×10^{-3}	7×10^{-10}	4×10^{-5}

APPENDIX B

Concentrations in Air and Water Above Natural Background—Continued

(See notes at end of appendix)

Element (atomic number)	Isotope[1]		Table I Column 1 Air (μc/ml)	Table I Column 2 Water (μc/ml)	Table II Column 1 Air (μc/ml)	Table II Column 2 Water (μc/ml)
Technetium (43)	Tc 96m	S	8×10^{-5}	4×10^{-1}	3×10^{-6}	1×10^{-2}
		I	3×10^{-6}	3×10^{-1}	1×10^{-7}	1×10^{-2}
	Tc 96	S	6×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	2×10^{-7}	1×10^{-3}	8×10^{-9}	5×10^{-5}
	Tc 97m	S	2×10^{-6}	1×10^{-2}	8×10^{-8}	4×10^{-4}
		I	2×10^{-7}	5×10^{-3}	5×10^{-9}	2×10^{-4}
	Tc 97	S	1×10^{-5}	5×10^{-2}	4×10^{-7}	2×10^{-3}
		I	3×10^{-7}	2×10^{-2}	1×10^{-8}	8×10^{-4}
	Tc 99m	S	4×10^{-5}	2×10^{-1}	1×10^{-6}	6×10^{-3}
		I	1×10^{-5}	8×10^{-2}	5×10^{-7}	3×10^{-3}
	Tc 99	S	2×10^{-6}	1×10^{-2}	7×10^{-8}	3×10^{-4}
		I	6×10^{-8}	5×10^{-3}	2×10^{-9}	2×10^{-4}
Tellurium (52)	Te 125m	S	4×10^{-7}	5×10^{-3}	1×10^{-8}	2×10^{-4}
		I	1×10^{-7}	3×10^{-3}	4×10^{-9}	1×10^{-4}
	Te 127m	S	1×10^{-7}	2×10^{-3}	5×10^{-9}	6×10^{-5}
		I	4×10^{-8}	2×10^{-3}	1×10^{-9}	5×10^{-5}
	Te 127	S	2×10^{-6}	8×10^{-3}	6×10^{-8}	3×10^{-4}
		I	9×10^{-7}	5×10^{-3}	3×10^{-8}	2×10^{-4}
	Te 129m	S	8×10^{-8}	1×10^{-3}	3×10^{-9}	3×10^{-5}
		I	3×10^{-8}	6×10^{-4}	1×10^{-9}	2×10^{-5}
	Te 129	S	5×10^{-6}	2×10^{-2}	2×10^{-7}	8×10^{-4}
		I	4×10^{-6}	2×10^{-2}	1×10^{-7}	8×10^{-4}
	Te 131m	S	4×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-5}
		I	2×10^{-7}	1×10^{-3}	6×10^{-9}	4×10^{-5}
	Te 132	S	2×10^{-7}	9×10^{-4}	7×10^{-9}	3×10^{-5}
		I	1×10^{-7}	6×10^{-4}	4×10^{-9}	2×10^{-5}
Terbium (65)	Tb 160	S	1×10^{-7}	1×10^{-3}	3×10^{-9}	4×10^{-5}
		I	3×10^{-8}	1×10^{-3}	1×10^{-9}	4×10^{-5}
Thallium (81)	Tl 200	S	3×10^{-6}	1×10^{-2}	9×10^{-8}	4×10^{-4}
		I	1×10^{-6}	7×10^{-3}	4×10^{-8}	2×10^{-4}
	Tl 201	S	2×10^{-6}	9×10^{-3}	7×10^{-8}	3×10^{-4}
		I	9×10^{-7}	5×10^{-3}	3×10^{-8}	2×10^{-4}
	Tl 202	S	8×10^{-7}	4×10^{-3}	3×10^{-8}	1×10^{-4}
		I	2×10^{-7}	2×10^{-3}	8×10^{-9}	7×10^{-5}
	Tl 204	S	6×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	3×10^{-8}	2×10^{-3}	9×10^{-10}	6×10^{-5}
Thorium (90)	Th 227	S	3×10^{-10}	5×10^{-4}	1×10^{-11}	2×10^{-5}
		I	2×10^{-10}	5×10^{-4}	6×10^{-12}	2×10^{-5}
	Th 228	S	9×10^{-12}	2×10^{-4}	3×10^{-13}	7×10^{-6}
		I	6×10^{-12}	4×10^{-4}	2×10^{-13}	1×10^{-5}
	Th 230	S	2×10^{-12}	5×10^{-5}	8×10^{-14}	2×10^{-6}
		I	1×10^{-11}	9×10^{-4}	3×10^{-13}	3×10^{-5}
	Th 231	S	1×10^{-6}	7×10^{-3}	5×10^{-8}	2×10^{-4}
		I	1×10^{-6}	7×10^{-3}	4×10^{-8}	2×10^{-4}
	Th 232	S	3×10^{-11}	5×10^{-5}	1×10^{-12}	2×10^{-6}
		I	3×10^{-11}	1×10^{-3}	1×10^{-12}	4×10^{-5}
	Th natural	S	3×10^{-11}	3×10^{-5}	1×10^{-12}	1×10^{-6}
		I	3×10^{-11}	3×10^{-4}	1×10^{-12}	1×10^{-5}

APPENDIX B

Concentrations in Air and Water Above Natural Background—Continued

(See notes at end of appendix)

Element (atomic number)	Isotope[1]		Table I Column 1 Air (μc/ml)	Table I Column 2 Water (μc/ml)	Table II Column 1 Air (μc/ml)	Table II Column 2 Water (μc/ml)
Thorium (90)	Th 234	S	6×10^{-8}	5×10^{-4}	2×10^{-9}	2×10^{-5}
		I	3×10^{-8}	5×10^{-4}	1×10^{-9}	2×10^{-5}
Thulium (69)	Tm 170	S	4×10^{-8}	1×10^{-3}	1×10^{-9}	5×10^{-5}
		I	3×10^{-8}	1×10^{-3}	1×10^{-9}	5×10^{-5}
	Tm 171	S	1×10^{-7}	1×10^{-2}	4×10^{-9}	5×10^{-4}
		I	2×10^{-7}	1×10^{-2}	8×10^{-9}	5×10^{-4}
Tin (50)	Sn 113	S	4×10^{-7}	2×10^{-3}	1×10^{-8}	9×10^{-5}
		I	5×10^{-8}	2×10^{-3}	2×10^{-9}	8×10^{-5}
	Sn 125	S	1×10^{-7}	5×10^{-4}	4×10^{-9}	2×10^{-5}
		I	8×10^{-8}	5×10^{-4}	3×10^{-9}	2×10^{-5}
Tungsten (Wolfram) (74)	W 181	S	2×10^{-6}	1×10^{-2}	8×10^{-8}	4×10^{-4}
		I	1×10^{-7}	1×10^{-2}	4×10^{-9}	3×10^{-4}
	W 185	S	8×10^{-7}	4×10^{-3}	3×10^{-8}	1×10^{-4}
		I	1×10^{-7}	3×10^{-3}	4×10^{-9}	1×10^{-4}
	W 187	S	4×10^{-7}	2×10^{-3}	2×10^{-8}	7×10^{-5}
		I	3×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-5}
Uranium (92)	U 230	S	3×10^{-10}	1×10^{-4}	1×10^{-11}	5×10^{-6}
		I	1×10^{-10}	1×10^{-4}	4×10^{-12}	5×10^{-6}
	U 232	S	1×10^{-10}	8×10^{-4}	3×10^{-12}	3×10^{-5}
		I	3×10^{-11}	8×10^{-4}	9×10^{-13}	3×10^{-5}
	U 233	S	5×10^{-10}	9×10^{-4}	2×10^{-11}	3×10^{-5}
		I	1×10^{-10}	9×10^{-4}	4×10^{-12}	3×10^{-5}
	U 234	S	6×10^{-10}	9×10^{-4}	2×10^{-11}	3×10^{-5}
		I	1×10^{-10}	9×10^{-4}	4×10^{-12}	3×10^{-5}
	U 235	S	5×10^{-10}	8×10^{-4}	2×10^{-11}	3×10^{-5}
		I	1×10^{-10}	8×10^{-4}	4×10^{-12}	3×10^{-5}
	U 236	S	6×10^{-10}	1×10^{-3}	2×10^{-11}	3×10^{-5}
		I	1×10^{-10}	1×10^{-3}	4×10^{-12}	3×10^{-5}
	U 238	S	7×10^{-11}	1×10^{-3}	3×10^{-12}	4×10^{-5}
		I	1×10^{-10}	1×10^{-3}	5×10^{-12}	4×10^{-5}
	U 240	S	2×10^{-7}	1×10^{-3}	8×10^{-9}	3×10^{-5}
		I	2×10^{-7}	1×10^{-3}	6×10^{-9}	3×10^{-5}
	U-natural	S	7×10^{-11}	5×10^{-4}	3×10^{-12}	2×10^{-5}
		I	6×10^{-11}	5×10^{-4}	2×10^{-12}	2×10^{-5}
Vanadium (23)	V 48	S	2×10^{-7}	9×10^{-4}	6×10^{-9}	3×10^{-5}
		I	6×10^{-8}	8×10^{-4}	2×10^{-9}	3×10^{-5}
Xenon (54)	Xe 131m	Sub	2×10^{-5}	....	4×10^{-7}	....
	Xe 133	Sub	1×10^{-5}	....	3×10^{-7}	....
	Xe 133m	Sub	1×10^{-5}	....	3×10^{-7}	....
	Xe 135	Sub	4×10^{-6}	....	1×10^{-7}	....
Ytterbium (70)	Yb 175	S	7×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	6×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
Yttrium (39)	Y 90	S	1×10^{-7}	6×10^{-4}	4×10^{-9}	2×10^{-5}
		I	1×10^{-7}	6×10^{-4}	3×10^{-9}	2×10^{-5}
	Y 91m	S	2×10^{-5}	1×10^{-1}	8×10^{-7}	3×10^{-3}
		I	2×10^{-5}	1×10^{-1}	6×10^{-7}	3×10^{-3}
	Y 91	S	4×10^{-8}	8×10^{-4}	1×10^{-9}	3×10^{-5}
		I	3×10^{-8}	8×10^{-4}	1×10^{-9}	3×10^{-5}
	Y 92	S	4×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-5}

APPENDIX B

Concentrations in Air and Water Above Natural Background—Continued

(See notes at end of appendix)

Element (atomic number)	Isotope[1]		Table I Column 1 Air (μc/ml)	Table I Column 2 Water (μc/ml)	Table II Column 1 Air (μc/ml)	Table II Column 2 Water (μc/ml)
Zinc (30)	Zn 65	S	1×10^{-7}	3×10^{-3}	4×10^{-9}	1×10^{-4}
		I	6×10^{-8}	5×10^{-3}	2×10^{-9}	2×10^{-4}
	Zn 69m	S	4×10^{-7}	2×10^{-3}	1×10^{-8}	7×10^{-5}
		I	3×10^{-7}	2×10^{-3}	1×10^{-8}	6×10^{-5}
	Zn 69	S	7×10^{-6}	5×10^{-2}	2×10^{-7}	2×10^{-3}
		I	9×10^{-6}	5×10^{-2}	3×10^{-7}	2×10^{-3}
Zirconium (40)	Zr 93	S	1×10^{-7}	2×10^{-2}	4×10^{-9}	8×10^{-4}
		I	3×10^{-7}	2×10^{-2}	1×10^{-8}	8×10^{-4}
	Zr 95	S	1×10^{-7}	2×10^{-3}	4×10^{-9}	6×10^{-5}
		I	3×10^{-8}	2×10^{-3}	1×10^{-9}	6×10^{-5}
	Zr 97	S	1×10^{-7}	5×10^{-4}	4×10^{-9}	2×10^{-5}
		I	9×10^{-8}	5×10^{-4}	3×10^{-9}	2×10^{-5}
Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life less than 2 hours.	....	Sub	1×10^{-6}	......	3×10^{-8}	......
Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life greater than 2 hours.	....		3×10^{-9}	9×10^{-5}	1×10^{-10}	3×10^{-6}
Any single radionuclide not listed above, which decays by alpha emission or spontaneous fission.	....		6×10^{-13}	4×10^{-7}	2×10^{-14}	~~3×10^{-9}~~ 3×10^{-8}

☆ [1] Soluble (S); Insoluble (I).

[2] "Sub" means that values given are for submersion in a semispherical infinite cloud of airborne material.

NOTE. In any case where there is a mixture in air or water of more than one radionuclide, the limiting values for purposes of this Appendix should be determined as follows:

1. If the identity and concentration of each radionuclide in the mixture are known, the limiting values should be derived as follows: Determine, for each radionuclide in the mixture, the ratio between the quantity present in the mixture and the limit otherwise established in Appendix B for the specific radionuclide when not in a mixture. The sum of such ratios for all the radionuclides in the mixture may not exceed "1" (i.e., "unity").

EXAMPLE: If radionuclides A, B, and C are present in concentrations C_A, C_B, and C_C, and if the applicable MPC's are MPC_A, MPC_B, and MPC_C respectively, then the concentrations shall be limited so that the following relationship exists:

$$\frac{C_A}{MPC_A}+\frac{C_B}{MPC_B}+\frac{C_C}{MPC_C}\leq 1$$

☆ 2. If either the identity or the concentration of any radionuclide in the mixture is not known, the limiting values for purposes of Appendix B shall be:

a. For purposes of Table I, Col. 1—6×10^{-13}

b. For purposes of Table I, Col. 2—4×10^{-7}

c. For purposes of Table II, Col. 1—2×10^{-14}

d. For purposes of Table II, Col. 2—3×10^{-8}

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3. If any of the conditions specified below are met, the corresponding values specified below may be used in lieu of those specified in paragraph 2 above.

a. If the identity of each radionuclide in the mixture is known but the concentration of one or more of the radionuclides in the mixture is not known, the concentration limit for the mixture is the limit specified in Appendix "B" for the radionuclide in the mixture having the lowest concentration limit; or

b. If the identity of each radionuclide in the mixture is not known, but it is known that certain radionuclides specified in Appendix "B" are not present in the mixture, the concentration limit for the mixture is the lowest concentration limit specified in Appendix "B" for any radionuclide which is not known to be absent from the mixture; or

c.

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c. Element (atomic number) and isotope	Table I Column 1 Air (µc/ml)	Table I Column 2 Water (µc/ml)	Table II Column 1 Air (µc/ml)	Table II Column 2 Water (µc/ml)
If it is known that Sr 90, I 125, I 126, I 129, I 131, (I 133, table II only), Pb 210, Po 210, At 211, Ra 223, Ra 224, Ra 226, Ac 227, Ra 228, Th 230, Pa 231, Th 232, Th-nat, Cm 248, Cf 254, and Fm 256 are not present	....	9×10^{-5}	....	3×10^{-6}
If it is known that Sr 90, I 125, I 126, I 129, (I 131, I 133, table II only), Pb 210, Po 210, Ra 223, Ra 226, Ra 228, Pa 231, Th-nat, Cm 248, Cf 254, and Fm 256 are not present	....	6×10^{-5}	....	2×10^{-6}
If it is known that Sr 90, I 129, (I 125, I 126, I 131, table II only), Pb 210, Ra 226, Ra 228, Cm 248, and Cf 254 are not present	....	2×10^{-4}	....	6×10^{-6}
If it is known that (I 129, table II only), Ra 226, and Ra 228 are not present	....	3×10^{-3}	....	1×10^{-4}
☆☆ If it is known that alpha emitters and Sr 90, I 129, Pb 210, Ac 227, Ra 228, Pa 230, Pu 241, and Bk 249 are not present	3×10^{-9}	....	1×10^{-10}	....
If it is known that alpha emitters and Pb 210, Ac 227, Ra 228, and Pu 241 are not present	3×10^{-10}	....	1×10^{-11}	....
If it is known that alpha emitters and Ac 227 are not present	3×10^{-11}	....	1×10^{-12}	....
If it is known that Ac 227, Th 230, Pa 231, Pu 238, Pu 239, Pu 240, Pu 242, Pu 244, Cm 248, Cf 249 and Cf 251 are not present	3×10^{-12}	....	1×10^{-13}	....

4. If the mixture of radionuclides consists of uranium and its daughter products in ore dust prior to chemical processing of the uranium ore, the values specified below may be used in lieu of those determined in accordance with paragraph 1 above or those specified in paragraphs 2 and 3 above.

a. For purposes of Table I, Col. 1—1×10^{-10} µc/ml gross alpha activity; or 5×10^{-11} µc/ml natural uranium; or 75 micrograms per cubic meter of air natural uranium.

b. For purposes of Table II, Col. 1—3×10^{-12} µc/ml gross alpha activity; or 2×10^{-12} µc/ml natural uranium; or 3 micrograms per cubic meter of air natural uranium.

5. For purposes of this note, a radionuclide may be considered as not present in a mixture if (a) the ratio of the concentration of that radionuclide in the mixture (C_A) to the concentration limit for that radionuclide specified in Table II of Appendix "B" (MPC_A) does not exceed $\frac{1}{10}$, (i.e. $\frac{C_A}{MPC_A}\leq\frac{1}{10}$) and (b) the sum of such ratios for all the radionuclides considered as not present in the mixture does not exceed $\frac{1}{4}$, i.e.

$$\frac{C_A}{MPC_A}+\frac{C_B}{MPC_B}+\cdots\leq\frac{1}{4}).$$

☆Revised 30 FR 15801

☆☆ERRATUM: This line should read: "210, Ac 227, Ra 228, Pa 230, Pu 241, and Bk 249 are not"