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DIRECTOR OF NUC. REACTOR REGULATION  
U. S. NUC. REGULATORY COMMISSION  
MAIL STATION P1-137

February 24, 1993

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DC

Attached are the recent revisions to the Offsite Dose Calculation Manual's (ODCM) Chapter 10 and Appendix F for Byron Station. Please complete the following manual update:

REMOVE

Byron Station Annex  
Entire Chapter 10.  
p. 10-1 to 10-iii,  
10-1 to 10-17

Byron Station Annex  
Entire Appendix F  
p. F-1 to F-iv,  
F-1 to F-24

INSERT

Byron Station Annex  
Entire Chapter 10  
Revision O.K. Jan. 1993  
p. 10-1 to 10-v,  
10-1 to 10-19

Byron Station Annex  
Entire Appendix F  
Includes Rev. O.K.  
p. F-1 to F-iv,  
F-1 to F-24

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## CHAPTER 10

## RADIOACTIVE EFFLUENT TREATMENT AND MONITORING

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## RADIOACTIVE EFFLUENT TREATMENT AND MONITORING

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## CHAPTER 10

## RADIOACTIVE EFFLUENT TREATMENT AND MONITORING

## 10.1 AIRBORNE RELEASES

## 10.1.1 System Description

A simplified HVAC and gaseous effluent flow diagram is provided in Figure 10-1. The principal release points for potentially radioactive airborne effluents are the two auxiliary building vent stacks (designated Vent Stack 1 and Vent Stack 2 in Figure 10-1). In the classification scheme of Section 4.1.4, each is classified as a vent release point (see Table A-1 of Appendix A).

## 10.1.1.1 Waste Gas Holdup System

The waste gas holdup system is designed and installed to reduce radioactive gaseous effluents by collecting reactor coolant system off-gases from the reactor coolant system and providing for delay or holdup to reduce the total radioactivity by radiodecay prior to release to the environment. The system is described in Section 11.3.2 of the Byron/Braidwood UFSAR.

## 10.1.1.2 Ventilation Exhaust Treatment System

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

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

## 10.1.2 Radiation Monitors

## 10.1.2.1 Auxiliary Building Vent Effluent Monitors

Monitors 1RE-PRO28 (Unit 1) and 2RE-PRO28 (Unit 2) continuously monitor the final effluent from the auxiliary building vent stacks.

Both vent stack monitors feature automatic isokinetic sampling, grab sampling, iodine and particulate sampling and tritium sampling. In normal operation all three noble gas channels (low,

mid-range, high) are on line and active. On a high alarm the low and mid-range noble gas channels are closed and only the high range noble gas channel remains active. The iodine and particulate channels, however, continue to operate under all conditions.

No automatic isolation or control functions are performed by these monitors. Pertinent information on these monitors is provided in Byron/Braidwood UFSAR Table 11.5-1.

#### 10.1.2.2 Containment Purge Effluent Monitors

Monitors 1RE-PR001 (Unit 1) and 2RE-PR001 (Unit 2) continuously monitor the effluent from the Unit 1 and Unit 2 containments, respectively. When airborne radioactivity in the containment purge effluent stream exceeds a specified level station personnel will follow established procedures to terminate the release by manually activating the containment purge valves. Additionally, the auxiliary building vent effluent monitors provide an independent, redundant means of monitoring the containment purge effluent.

No automatic isolation or control functions are performed by these monitors.

Pertinent information on these monitors is provided in Byron/Braidwood UFSAR Table 11.5-1.

Monitors 1(2)RE-AR011 and 1(2)RE-AR012 monitor the containment atmosphere. On high alarm during a containment purge, these monitors will automatically terminate the purge.

#### 10.1.2.3 Waste Gas Decay Tank Monitors

Monitors ORE-PR002A/B continuously monitor the noble gas activity released from the gas decay tanks.

On high alarm, the monitors automatically initiate closure of the valve OGW104 thus terminating the release.

Pertinent information on these monitors and associated control devices is provided in Byron/Braidwood UFSAR Table 11.5-1.

#### 10.1.2.4 Gland Steam and Condenser Air Ejector Monitors

Monitors 1RE-PR027 and 2RE-PR027 continuously monitor the condenser air ejector gas from Units 1 and 2, respectively. No control device is initiated by these channels.

The following actions are initiated by this monitor:

- a) Start 00G01C, Off-Gas Ejector HVAC System Exhaust Fan
- b) Close 100G035 and 200G035
- c) Open 00G038, 100G037, and 200G037

Pertinent information on these monitors is provided in Byron/Braidwood UFSAR Table 11.5-1.

#### 10.1.2.5 Radwaste Building Ventilation Monitor

Monitor ORE-PR026 continuously monitors radioactivity in the radwaste building ventilation system. No control device is initiated by this channel.

Pertinent information on this monitor is provided in Byron/Braidwood UFSAR Tables 11.5-1.

#### 10.1.2.6 Component Cooling Water Monitor

Monitors ORE-PR009 (common), 1RE-PR009 (Unit 1), and 2RE-PR009 (Unit 2) continuously monitor the component cooling water heat exchanger outlets. On high alarm ORE-PR009 initiates closure of both component cooling water surge tank (CCWST) vents, 1RE-PR009 initiates closure of the Unit 1 CCWST vent, and 2RE-PR009 initiates closure of the Unit 2 CCWST vent.

Pertinent information on this monitor is provided in Byron/Braidwood UFSAR Table 11.5-1.

#### 10.1.2.7 Miscellaneous Ventilation Monitors

Monitor ORE-PR003 continuously monitors radioactivity in the ventilation exhaust from the laboratory fume hoods. No control device is initiated by this channel.

Pertinent information on this monitor and associated devices is provided in Byron/Braidwood UFSAR Table 11.5-1.

#### 10.1.3 Alarm and Trip Setpoints

##### 10.1.3.1 Setpoint Calculations

##### 10.1.3.1.1 Auxiliary Building Vent Effluent Monitors

The setpoints for the low range noble gas channel are conservatively established at 2.5% of the maximum permissible release rate for the high alarm and 1/4% of the maximum release rate for the alert alarm.

The setpoints for the high range noble gas channel are conservatively established at 50% of the maximum permissible release rate for the high alarm and 5% of the maximum release rate for the alert alarm.

#### 10.1.3.1.2 Containment Purge Effluent Monitors

The setpoints are established at 1.25 times the containment noble gas activity during purge.

However, per procedure, the total station release rate is limited to 1% of the maximum permissible release rate during this evolution. (See Section 10.1.3.2)

#### 10.1.3.1.3 Waste Gas Decay Tank Effluent Monitors

The setpoints are established at 1.25 times the analyzed waste gas tank activity during release.

However per procedure, the total station release rate is limited to 1% of the maximum permissible release rate during this evolution. (See Section 10.1.3.2)

#### 10.1.3.2 Release Limits

Alarm and trip setpoints of gaseous effluent monitors are established to ensure that the release rate limits of 10 CFR 20 are not exceeded. The release limits are found by solving Equations 10-1 and 10-2 for the total allowed release rate of vent releases,  $Q_{tv}$ .

$$(1.11)Q_{tv} \sum (\bar{V}_i f_i) \leq 500 \text{ mrem/yr} \quad (10-1)$$

$$Q_{tv} \sum \{ (f_i) [ \bar{C}_i (X/Q)_v \exp(-\lambda_i R/3600 u_v) + 1.11 V_i ] \} < 3000 \text{ mrem/yr} \quad (10-2)$$

The summations are over noble gas radionuclides  $i$ .

$f_i$  Fractional Radionuclide Composition

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



$Q_{TV}$  Total Allowed Release Rate,  
Vent Release [ $\mu\text{Ci/sec}$ ]

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

The remaining parameters in Equation 10-1 have the same definitions as in Equation A-8 of Appendix A. The remaining parameters in Equation 10-2 have the same definition as in Equation A-9 of Appendix A.

Equation 10-1 is based on Equation A-8 of Appendix A and the 10 CFR 20 restriction on whole body dose rate (500 mrem/yr) due to noble gases released in gaseous effluents (see Section A.1.3.1 of Appendix A). Equation 10-2 is based on Equation A-9 of Appendix A and the 10 CFR 20 restriction on skin dose rate (3000 mrem/yr) due to noble gases released in gaseous effluents (see Section A.1.3.2 of Appendix A).

Since the solution to Equation 10-2 is more conservative than the solution to Equation 10-1, the value of Equation 10-2 ( $1.02 \times 10^7 \mu\text{Ci/sec}$ ) is used as the limiting noble gas release rate. During evolutions involving releases from the containment or waste gas decay tanks, the total station release rate is procedurally limited to  $1 \times 10^5 \mu\text{Ci/sec}$  (1% of the maximum permissible release rate).

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

#### 10.1.3.3 Release Mixture

In the determination of alarm and trip setpoints, the radioactivity mixture in exhaust air is assumed to have the radionuclide composition of Table 10-1.

#### 10.1.3.4 Conversion Factors

The response curves used to determine the monitor count rates are based on the sensitivity to Xe-133 for conservatism.

#### 10.1.3.5 HVAC Dilution Flow Rates

The plant vent stack flow rates are obtained from the RM-11 console in the control room. If the values cannot be obtained from RM-11, the following default values are used.

Unit 1 -  $1.02 \times 10^8 \text{ cc/sec}$



Unit 2 -  $1.00 \times 10^8$  cc/sec

10.1.4 Allocation of Effluents from Common Release Points

Radioactive gaseous effluents released from the auxiliary building, miscellaneous ventilation systems and the gas decay tanks are comprised of contributions from both units. Consequently, allocation is made evenly between units.

10.1.5 Dose Projections for Batch Releases

The 10 CFR 20 dose limits have been converted into a station administrative release rate limit using the methodology in the ODCM. Compliance is verified prior to each release. Doses are calculated after purging the containment or venting the waste gas decay tanks. Per procedure, representative samples are obtained and analyzed, and the doses calculated on a monthly basis to verify compliance with 10CFR50.

10.2 LIQUID RELEASES

10.2.1 System Description

A simplified liquid release flowpath diagram is provided in Figure 10-3. A simplified liquid radwaste processing diagram is provided in Figure 10-2.

The liquid radwaste treatment system is designed and installed to reduce radioactive liquid effluents by collecting the liquids, providing for retention or holdup, and providing for treatment by demineralizer for the purpose of reducing the total radioactivity prior to release to the environment. The system is described in Section 11.2.2 of the Byron/Braidwood Updated Final Safety Analysis Report.

10.2.1.1 Release Tanks

There are two radwaste release tanks (OWX01T and OWX26T 30,000-gallon capacity each) which receive liquid waste before discharge to the Rock river.

10.2.1.2 Turbine Building Fire and Oil Sump

The turbine building fire and oil sump receives water from selected turbine building sumps, the tendon tunnel sumps, and the diesel fuel oil storage sumps, all of which are normally non-radioactive but potentially contaminated. The effluent from this sump is monitored, and if radioactive contamination exceeds a

predetermined level pump operation is automatically terminated. The water may then be sent to the liquid radwaste treatment system.

#### 10.2.1.3 Condensate Polisher Sump

The condensate polisher sump receives waste water from the condensate polisher system which is normally non-radioactive but potentially contaminated. The effluent from this sump is monitored and if radioactive contamination exceeds a predetermined level sump discharge is terminated and major condensate polisher inputs to the sump are automatically isolated. The water may then be sent to the liquid radwaste treatment system.

#### 10.2.2 Radiation Monitors

##### 10.2.2.1 Liquid Radwaste Effluent Monitors

Monitor ORE-PR001 is used to monitor all releases from the release tanks. On high alarm, the monitor automatically initiates closure of valves OWX-353 and OWX-869 to terminate the release.

Pertinent information on the monitor and associated control devices is provided in Byron/Braidwood UFSAR Table 11.5-2.

##### 10.2.2.2 Station Blowdown Monitor

Monitor ORE-PR010 continuously monitors the recirculating water blowdown. No control device is initiated by this channel.

Pertinent information on this monitor is provided in Byron/Braidwood UFSAR Table 11.5-2.

##### 10.2.2.3 Reactor Containment Fan Cooler (RCFC) and Essential Service Water (ESSW) Outlet Line Monitors

Monitors 1RE-PR002, 2RE-PR002, 1RE-PR003, and 2RE-PR003 continuously monitor the RCFC and ESSW outlet lines.

No control device is initiated by these channels.

Pertinent information on these monitors is provided in Byron/Braidwood UFSAR Table 11.5-2.

## 10.2.2.4 Turbine Building Fire and Oil Sump Monitor

Monitor ORE-PR005 continuously monitors the fire and oil sump discharge. On high alarm the monitor automatically initiates an interlock to trip the discharge pumps, close valve 00D030, and terminate the release. Pertinent information on this monitor is provided in Byron/Braidwood UFSAR Table 11.5-2.

## 10.2.2.5 Condensate Polisher Sump Monitor

Monitor ORE-PR041 continuously monitors the condensate polisher sump discharge. On high alarm the monitor automatically initiates an interlock to trip the discharge pumps and terminate the release. Pertinent information on this monitor is provided in Byron/Braidwood UFSAR Table 11.5.2

## 10.2.3 Alarm and Trip Setpoints

## 10.2.3.1 Setpoint Calculations

Alarm and trip setpoints of liquid effluent monitors at the principal release points are established to ensure that the limits of 10 CFR 20 are not exceeded in the unrestricted area.

## 10.2.3.1.1 Liquid Radwaste Effluent Monitor

During release the setpoint is established at 1.5 times the analyzed tank activity plus the background reading.

However, per procedure, the maximum release rate is limited to a value that will result in less than 50% MPC at the discharge point. (See Section 10.2.3.2).

## 10.2.3.1.2 Station Blowdown Monitor

The monitor setpoint is found by solving equation 10-3.

$$P \leq C^{CW} + (1.25 \times C^T) \times \left( F'_{\max} / (F^{CW} + F'_{\max}) \right) \quad (10-3)$$

P Release Setpoint [ $\mu$ Ci/ml]

1.25 Factor to account for minor fluctuations in count rate

$C^{CW}$  Concentration of activity in the circulating water blowdown at the time of discharge ("Background reading") [μCi/ml]

$C^T$  Analyzed activity in the release tank excluding tritium [μCi/ml]

$F^{CW}$   
Circulating Water Blowdown Rate [gpm]

$F'_{max}$   
Maximum Release Tank Discharge Flow Rate [gpm]  
The flow rate from the radwaste discharge tank.

#### 10.2.3.2 Discharge Flow Rates

##### 10.2.3.2.1 Release Tank Discharge Flow Rate

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

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

$$F'_{max} = 0.5(F_{act}^d / \sum (C_i / MPC_i)) \quad (10-4)$$

The summation is over radionuclides  $i$ .

$F'_{max}$  Maximum Permitted Discharge Flow Rate

The maximum permitted flow rate from the radwaste discharge tank based on radiological limits (not chemistry limits which may be more restrictive) [gpm]

$F_{act}^d$  Circulating Water Blowdown Rate [gpm]

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

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

MPC<sub>i</sub> Maximum Permissible Concentration of Radionuclide i [μCi/ml]

#### 10.2.3.3 Release Limits

Release limits are determined from 10 CFR 20. Discharge rates and setpoints are adjusted to ensure that 50% of applicable maximum permissible concentrations (MPC) are not exceeded.

#### 10.2.3.4 Release Mixture

For monitors ORE-PR001 and ORE-PR010 the release mixture used for the setpoint determination is the radionuclide mix identified in the grab sample isotopic analysis.

For all other liquid effluent monitors the release mixture is the radionuclides which are listed in Table 10-2. Each nuclide in the mix is at a concentration which is 10% of the MPC value given in 10 CFR 20 Appendix 2, Table II, Column 2.

#### 10.2.3.5 Conversion Factors

The readouts for the liquid effluent monitors are in μCi/ml. The cpm to μCi/ml conversion is based on the detector sensitivity to Cs-137.

#### 10.2.3.6 Liquid Dilution Flow Rates

Dilution flow rates are obtained from the main control board in the control room. Liquid effluents are not released if this information is unavailable.

#### 10.2.4 Allocation of Effluents from Common Release Points

Radioactive liquid effluents released from either release tank (OWX01T or OWX26T) are comprised of contributions from both units. Under normal operating conditions, it is difficult to apportion the radioactivity between the units. Consequently, allocation is made evenly between units.

#### 10.2.5 Projected Concentrations for Releases

After determining  $F'_{max}$  from Equation 10-4, 10 CFR 20 compliance is verified using Equations 10-5 and 10-6.

$$C_i^e = C_i [F'_{\text{max}} / (F'_{\text{max}} + F_{\text{act}}^d)] \quad (10-5)$$

$$\sum (C_i^e / \text{MPC}_i) \leq 1 \quad (10-6)$$

The summation is over radionuclides i.

$C_i^e$  Concentration of Radionuclide i in the Unrestricted Area [ $\mu\text{Ci/mL}$ ]

The calculated concentration of radionuclide i in the unrestricted area as determined by Equation 10-5.

$\text{MPC}_i$  Maximum Permissible Concentration of radionuclide i [ $\mu\text{Ci/mL}$ ]

$F'_{\text{max}}$  Maximum Release Tank Discharge Flow Rate [gpm]

$F_{\text{act}}^d$  Circulating Water Blowdown Rate [gpm]



## 10.3 SOLIDIFICATION OF WASTE/PROCESS CONTROL PROGRAM

The process control program (PCP) contains the sampling, analysis, and formulation determination by which solidification of radioactive wastes from liquid systems is ensured.

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



Table 10-1

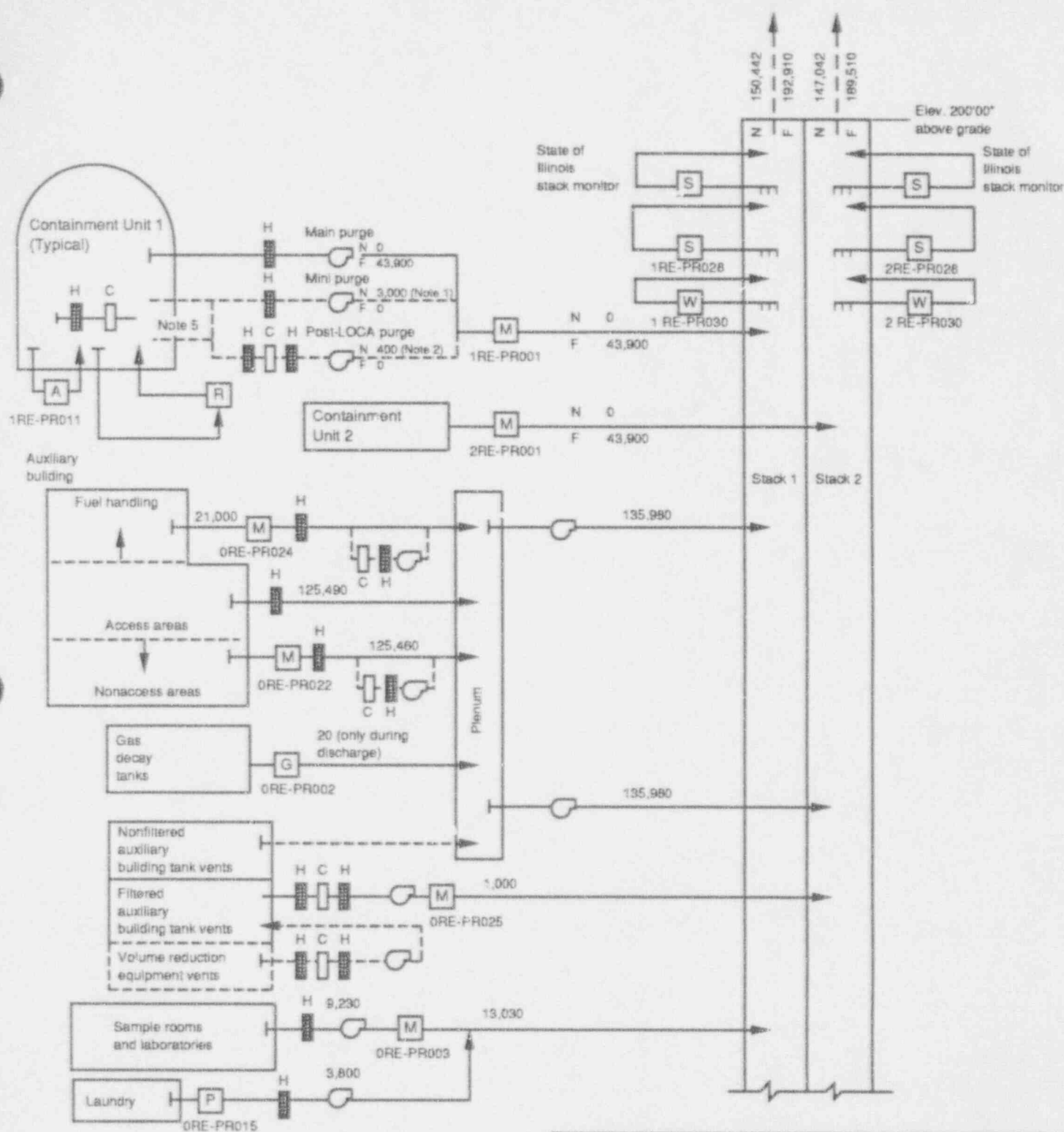
Assumed Composition of the Byron Station  
Noble Gas Effluent

<u>Isotope</u>	<u>Percent of Effluent</u>
Ar-41	00.89
Kr-85m	00.18
Kr-85	24.9
Kr-87	00.4
Kr-88	00.28
Xe-131m	01.4
Xe-133m	00.57
Xe-133	71.1
Xe-135	00.53
Xe-138	00.04

Table 10-2

Assumed Composition of the Byron Station Liquid Effluent

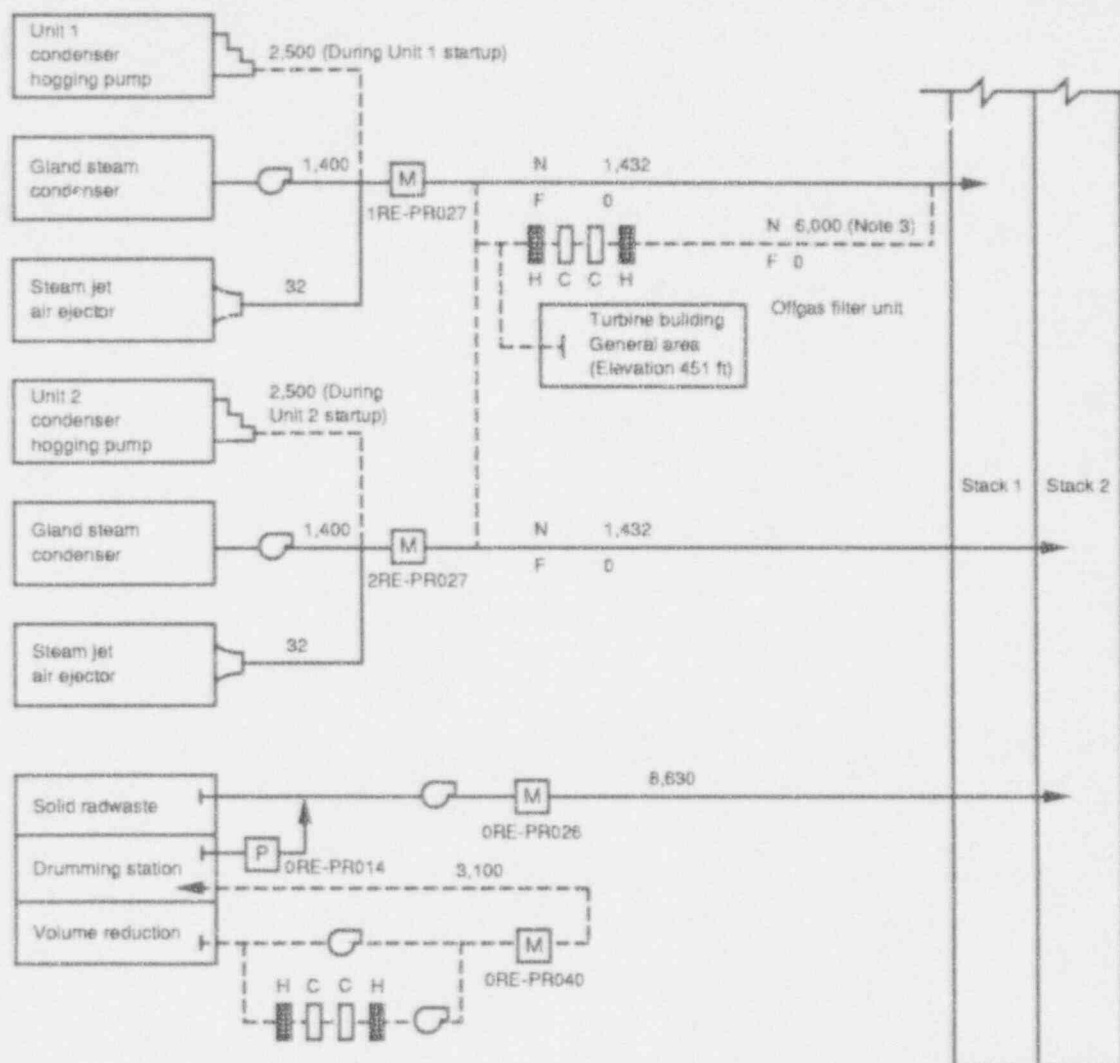
Isotope	Concentration	Isotope	Concentration
	( $\mu\text{Ci/ml}$ )		( $\mu\text{Ci/ml}$ )
Ru-103	8.00E - 06	Mn-54	1.00E - 05
Ag-110m	3.00E - 06	Fe-59	5.00E - 06
Te-127	2.00E - 05	Co-58	9.00E - 06
Te-129m	2.00E - 06	Co-60	3.00E - 06
Te-131m	4.00E - 06	Rb-86	2.00E - 06
Te-132	2.00E - 06	Zr-95	6.00E - 06
I-130	3.00E - 07	Nb-95	1.00E - 05
I-131	3.00E - 08	Mo-99	4.00E - 06
I-132	8.00E - 07		
I-133	1.00E - 07		
I-135	4.00E - 07		
Cs-134	9.00E - 07		
Cs-136	9.00E - 06		
Cs-137	2.00E - 06		
Ce-144	1.00E - 06		
Np-239	1.00E - 05		



OFFSITE DOSE CALCULATION MANUAL  
BYRON STATION

FIGURE 10-1

SIMPLIFIED HVAC AND GASEOUS  
EFFLUENT FLOW DIAGRAM  
(SHEET 1 OF 2)



#### Legend

- Normal or frequent flow path
- - - Occasional flow path
- A Containment atmosphere radiation monitor
- C Charcoal filter
- F Refueling
- G Noble gas radiation monitor (offline)
- H HEPA filter
- M Three-channel radiation monitor for particulate, iodine, and noble gas (offline)
- N Normal operation
- P particulate monitor (offline)
- R Hydrogen recombiner
- S Normal range stack radiation monitor (particulate, iodine, and noble gas)
- W Wide-range stack noble radiation monitor

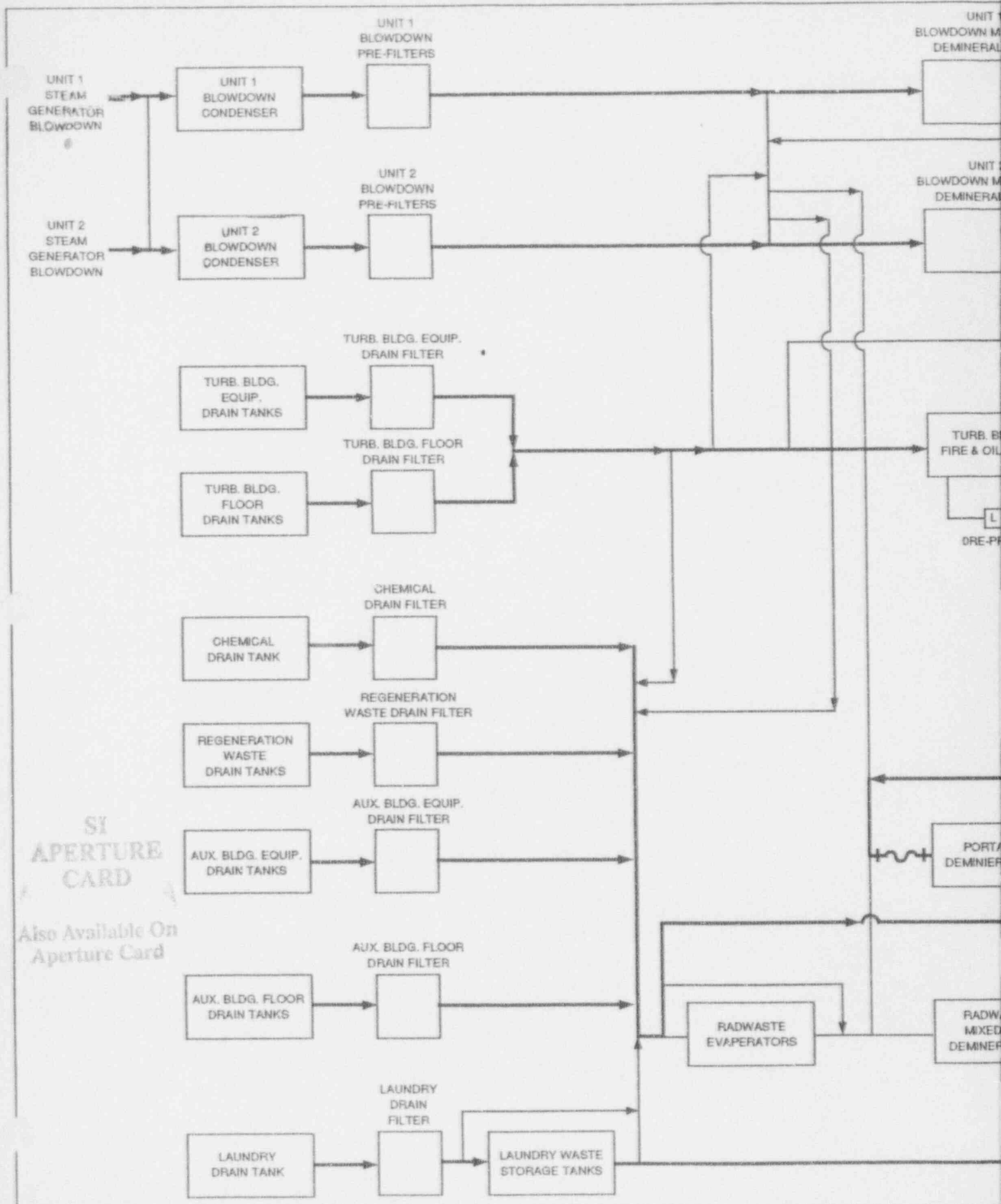
#### Notes

1. Used intermittently to vent containment during normal operation.
2. Used only during postaccident operation.
3. Filter unit operates only when high radiation is detected in offgas system effluent.
4. All flow rates are design flow rates in cubic feet per minute.
5. Integrated Leak Rate Test (ILRT) pressure relief point (an alternate release point that is seldom used).

### OFFSITE DOSE CALCULATION MANUAL BYRON STATION

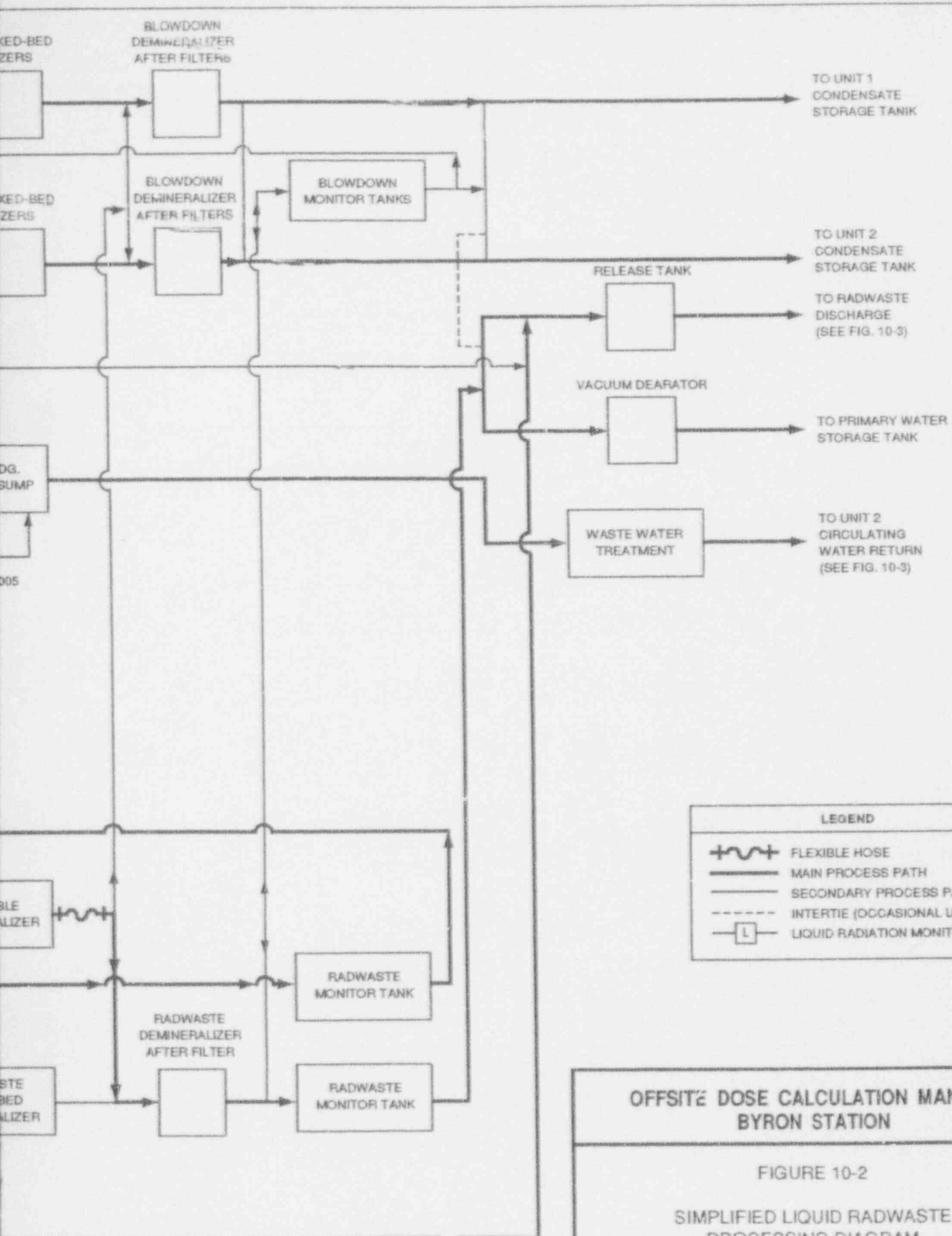
FIGURE 10-1

SIMPLIFIED HVAC AND GASEOUS  
EFFLUENT FLOW DIAGRAM  
(SHEET 2 OF 2)



SI  
APERTURE  
CARD

Also Available On  
Aperture Card

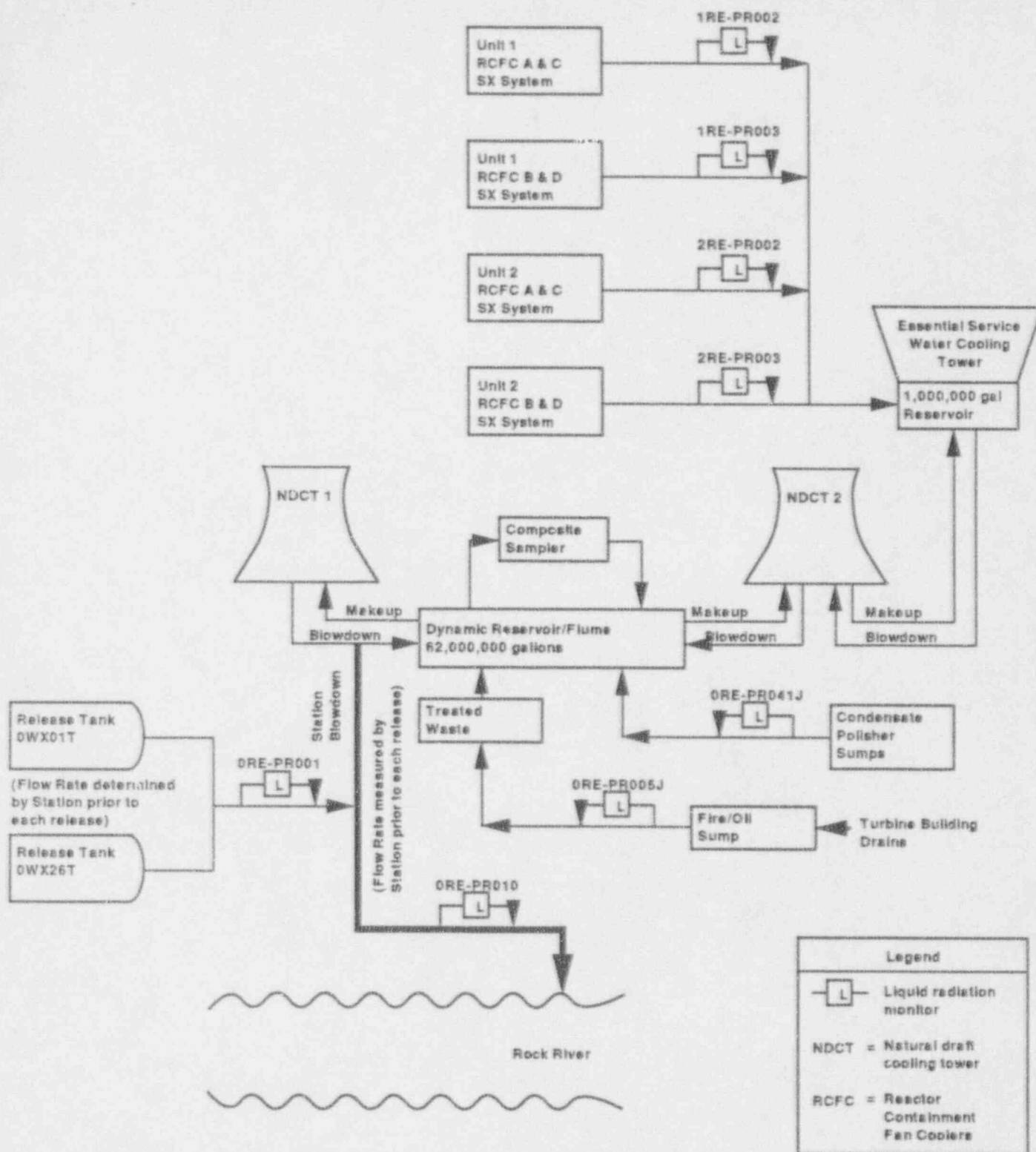


OFFSITE DOSE CALCULATION MANUAL  
BYRON STATION

FIGURE 10-2

SIMPLIFIED LIQUID RADWASTE  
PROCESSING DIAGRAM

10-17  
9303290144-01

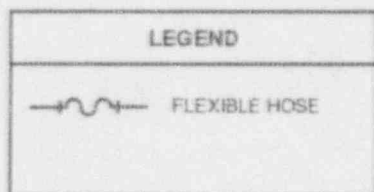
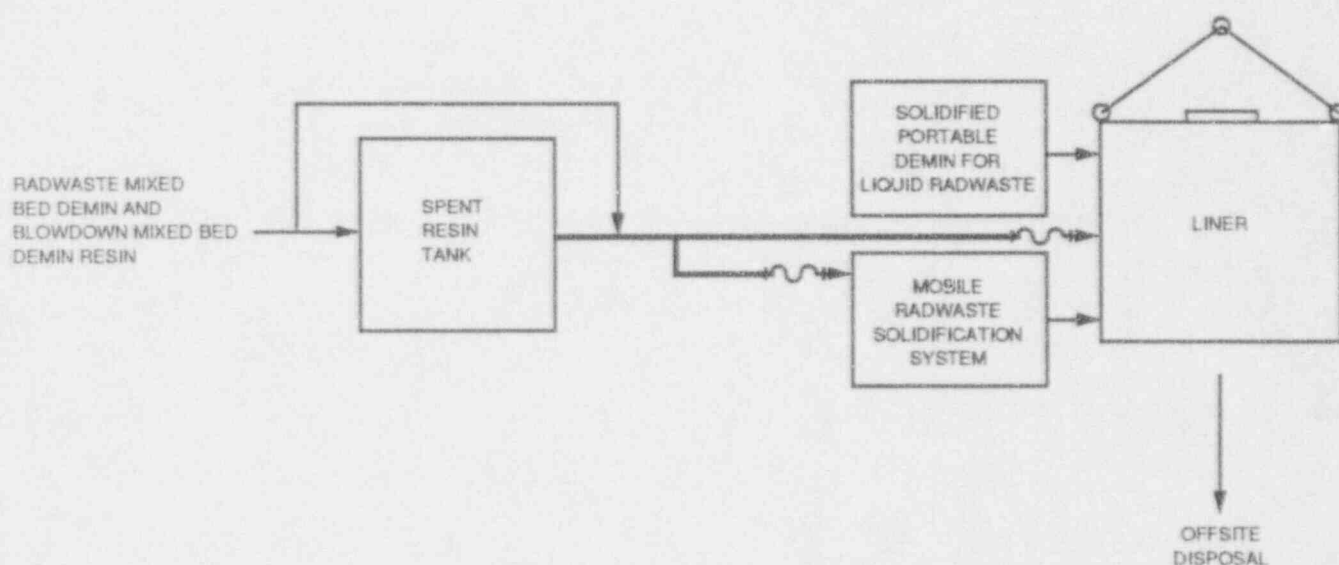


# OFFSITE DOSE CALCULATION MANUAL BYRON STATION

FIGURE 10-3

LIQUID RELEASE FLOWPATH





OFFSITE DOSE CALCULATION MANUAL  
BYRON STATION

FIGURE 10-4  
SIMPLIFIED SOLID RADWASTE  
PROCESSING DIAGRAM

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APPENDIX F  
STATION-SPECIFIC DATA FOR BYRON UNITS 1 AND 2

## F.1 INTRODUCTION

This appendix contains data relevant to the Byron site. Included is a figure showing the unrestricted area boundary and values of parameters used in offsite dose assessment.

## F.2 REFERENCES

1. U.S. Atomic Energy Commission, HERMES -- A Digital Computer Code for Estimating Regional Radiological Effects from the Nuclear Power Industry, Hanford Engineering Development Laboratory, HEDL-TME-71-168, UC-80, December 1971.
2. Sargent & Lundy, Nuclear Safeguards and Licensing Division Byron Calculation No. BY-ER-02, Revs. 0 and 1.

Table F-1  
Aquatic Environment Dose Parameters

<u>Parameter</u> <sup>a</sup>	<u>Value</u>	<u>Basis</u> <sup>b</sup>
$1/M^w, 1/M^f$	1	C
$F^w$ , cfs	5.2E4	D
$F^f$ , cfs	4.7E3	E
$t^f$ , hr	24	F
$t^w$ , hr	115	G

Limits on Radioactivity in Unprotected Outdoor Tanks<sup>c</sup>

Primary Water Storage Tank  $\leq$  2000 Ci<sup>d</sup>

Outside Temporary Tank  $\leq$  10 Ci<sup>d</sup>

(per Technical Specification 3.11.1.4)

<sup>a</sup> The parameters are defined in Section A.2.1 of Appendix A.

<sup>b</sup> Basis codes:

A: Reference 1 in Section F.2.

B: Table E-5 of Reference 6.

C: Conservative assumption (implies no additional dilution).

D: The receiving body of water is taken as the Mississippi River, whose confluence is approximately 115 miles downstream of the plant.  $F^w$  is taken as the sum of the following average flow rates:

Rock River at Como, Illinois (45 miles downstream of plant)	5.0E3 cfs per Byron Station Environmental Report, Section 2.4.1.2
---	--



Table F-1 (Cont'd)

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Notes (Cont'd):

Mississippi River near Dewitt, Iowa (approximately 35 miles upstream of con- fluence with Rock River)	4.7E4 cfs per Quad- Cities Station Units 1 and 2 Safety Analysis Report, Section 2.4
--	--

- E. The near-field receiving body of water is the Rock River.  $F^f$  is taken as the average flow of the Rock River at the site, 4.7E3 cfs per Byron Station Environmental Report, Section 2.4.1.2.
- F. Assumption.
- G. There are no potable water intakes on the Rock River downstream of the plant (per Byron Station Environmental Report, Section 2.1.3.2.1). For 10 CFR 50 compliance evaluation purposes,  $t^w$  is taken as 115 hr, the estimated time of flow to the Mississippi River. The confluence of the Rock River with the Mississippi River is approximately 115 miles downstream of the plant (per Byron Station Environmental Report, Section 2.1.3.2.1). The flow rate is estimated as 1 mph based on the data in Table 2.2-5 of the Byron Station Environmental Report.

<sup>c</sup>See Section A.2.4 of Appendix A.

<sup>d</sup>Tritium and dissolved or entrained noble gases are excluded from this limit.

Table F-2  
Station Characteristics

STATION: Byron

LOCATION: 3.7 miles SSW of Byron, Illinois

CHARACTERISTICS OF ELEVATED RELEASE POINT: Not Applicable (NA)

1) Release Height = \_\_\_\_\_ m      2) Diameter = \_\_\_\_\_ m

3) Exit Speed = \_\_\_\_\_  $\text{ms}^{-1}$       4) Heat Content = \_\_\_\_\_  $\text{KCal s}^{-1\text{a}}$

CHARACTERISTICS OF VENT STACK RELEASE POINT

1) Release Height = 60.66  $\text{m}^{\text{a}}$       2) Effective  
Diameter = 2.80 m

3) Exit Speed = 13.00  $\text{ms}^{-1\text{a}}$

\*The station has two adjacent rectangular vent stack release points of the same height and cross section. Their centers are 15.01 m apart.

CHARACTERISTICS OF GROUND LEVEL RELEASE

1) Release Height = 0 m

2) Building Factor (D) = 60.6  $\text{m}^{\text{a}}$

METEOROLOGICAL DATA

A 250 ft Tower is Located 1036m SW of vent stack release point

Tower Data Used in Calculations

Release Point	Wind Speed and Direction	Differential Temperature
<u>Elevated</u>	<u>(NA)</u>	<u>(NA)</u>
<u>Vent</u>	<u>250</u>	<u>250-30 ft</u>
<u>Ground</u>	<u>30</u>	<u>250-30 ft</u>

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

Table F-3  
Critical Ranges

Direction	Restricted Area Boundary <sup>a</sup> (m)	Nearest Resident <sup>b</sup> (m)	Nearest Dairy Farm Within 5 Miles <sup>c</sup> (m)
N	1875	3100	None
NNE	1829	2400	None
NE	1585	1400	3400
ENE	1234	2100	None
E	1227	1900	None
ESE	991	2600	5100
SE	1006	1800	5300
SSE	800	1900	None
S	945	1100	3200
SSW	975	1000	None
SW	1067	1400	None
WSW	1212	2700	None
W	1189	3200	3100
WNW	1227	1300	5300
NW	1128	1900	5100
NNW	1044	2100	None

<sup>a</sup>Approximate distance from midpoint between gaseous effluent release points. (See FSAR Table 2.1-1a and ER Table 2.1-1.) Used in calculating the meteorological and dose factors in Tables F-5 and F-7. See Sections B.3 through B.6 of Appendix B.

<sup>b</sup>Approximate distance from center of plant per 1988 annual survey by Teledyne Isotopes Midwest Laboratories.

<sup>c</sup>Approximate distance from center of plant per 1983 annual survey by Teledyne Isotopes Midwest Laboratories. Used in calculating the D/Q values in Table F-6.

Table F-4  
Average Wind Speeds

Downwind Direction	Average Wind Speed (m/sec) <sup>a</sup>		
	Elevated	Mixed Mode	Ground Level
N	7.9	6.3	4.2
NNE	7.6	6.3	4.5
NE	6.8	5.8	4.1
ENE	6.6	5.6	4.0
E	6.9	5.9	4.5
ESE	6.9	5.9	4.5
SE	6.5	5.7	4.0
SSE	6.2	5.4	3.7
S	6.3	5.4	4.0
SSW	6.0	5.3	3.9
SW	6.1	5.4	4.2
WSW	6.4	5.6	4.1
W	6.8	5.5	3.4
WNW	7.1	5.7	3.7
NW	7.1	5.7	3.8
NNW	7.7	6.0	4.1

<sup>a</sup>Based on Byron site meteorological data, January 1978 through December 1987. Calculated in Reference 2 of Section F.2 using formulas in Section B.1.3 of Appendix B.

<sup>b</sup>The elevated and ground level values are provided for reference purposes only. Routine dose calculations are performed using the mixed mode values.

Table F-5

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

Downwind Direction	Radius (meters)	Mixed Mode (Vent) Release X/Q (sec/m**3)	Radius (meters)	D/Q (1/m**2)	Radius (meters)	Ground Level Release X/Q (sec/m**3)	D/Q (1/m**2)
N	1875	1.987E-07	1875	1.983E-09	1875	8.675E-07	4.671E-09
NNE	1829	1.677E-07	1829	1.927E-09	1829	7.530E-07	4.271E-09
NE	1585	1.530E-07	1585	1.821E-09	1585	7.875E-07	4.388E-09
ENE	1234	1.353E-07	1234	1.764E-09	1234	8.807E-07	5.036E-09
E	1227	1.688E-07	1227	2.335E-09	1227	1.143E-06	6.226E-09
ESE	991	2.519E-07	991	3.540E-09	991	1.691E-06	9.896E-09
SE	1006	3.020E-07	1006	3.578E-09	1006	2.480E-06	1.118E-08
SSE	800	4.497E-07	800	3.761E-09	800	4.152E-06	1.420E-08
S	945	2.249E-07	945	2.792E-09	945	1.945E-06	9.364E-09
SSW	975	1.476E-07	975	1.970E-09	975	1.305E-06	6.672E-09
SW	1067	1.148E-07	1067	1.786E-09	1067	9.278E-07	5.316E-09
WSW	1212	1.199E-07	1212	1.903E-09	1212	7.645E-07	5.002E-09
W	1189	1.758E-07	1189	1.870E-09	1189	9.347E-07	5.330E-09
WNW	1227	1.205E-07	1227	1.292E-09	1227	6.543E-07	3.745E-09
NW	1128	1.685E-07	1128	1.719E-09	1128	8.806E-07	4.984E-09
NNW	1044	3.047E-07	1044	3.223E-09	1044	1.431E-06	8.871E-09

Byron Site Meteorological Data 1/78 - 12/87

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

<sup>a</sup>The elevated (stack) and ground level release data are provided for reference purposes only. Routine dose calculations are performed using mixed mode (vent) release data.

<sup>b</sup>Approximate distance from midpoint between gaseous effluent release points to location of highest X/Q or D/Q at or beyond the unrestricted area boundary.

Table F-6  
D/Q at the Nearest Milk Cow and Meat Animal Locations Within 5 Miles

Downwind Direction	Nearest Milk Cow Radius (meters)	Mixed Release	D/Q(1/m**2) Ground Release	Nearest Meat Animal Radius (meters)	Mixed Release	D/Q(1/m**2) Ground Release
N	8000.	1.835E-10	3.543E-10	1900.	1.944E-09	4.566E-09
NNE	8000.	1.835E-10	3.192E-10	2600.	1.133E-09	2.330E-09
NE	3400.	5.954E-10	1.175E-09	1800.	1.523E-09	3.533E-09
ENE	8000.	1.096E-10	1.928E-10	2400.	7.175E-10	1.616E-09
E	8000.	1.417E-10	2.361E-10	1900.	1.316E-09	2.959E-09
ESE	5100.	3.419E-10	5.896E-10	2400.	1.082E-09	2.209E-09
SE	5300.	3.371E-10	5.374E-10	2600.	9.992E-10	2.226E-09
SSE	8000.	1.387E-10	2.664E-10	2400.	9.047E-10	2.234E-09
S	3200.	5.512E-10	1.172E-09	1300.	1.889E-09	5.514E-09
SSW	8000.	9.795E-11	1.729E-10	2600.	5.548E-10	1.262E-09
SW	8000.	9.554E-11	1.596E-10	1400.	1.285E-09	3.367E-09
WSW	8000.	1.202E-10	1.858E-10	1400.	1.606E-09	3.920E-09
W	3100.	4.851E-10	1.030E-09	3200.	4.628E-10	9.748E-10
WNW	5300.	1.464E-10	2.968E-10	2600.	4.412E-10	1.037E-09
NW	5100.	1.794E-10	3.671E-10	2300.	6.194E-10	1.480E-09
NNW	8000.	1.349E-10	2.571E-10	2400.	9.551E-10	2.156E-09

Byron Site Meteorological Data 2/87

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

- <sup>a</sup>Approximate distance from center of plant as determined by annual census.
- <sup>b</sup>The elevated and ground level release data are provided for reference purposes only. Routine dose calculations are performed using mixed mode release data.
- <sup>c</sup>Approximate distance from center of plant per ER Table Q470.2-1 (Amendment 2, September 1981).

Table F-7  
Site Boundary Finite Plume Gamma Dose Factors for Kr-83m

Downwind Unrestricted Direction Area Bound (meters)	Mixed Mode(Vent) Radius (meters)	V (mrad/yr)/(uCi/sec)	Release VBAR (uCi/sec)	Ground Level Release Radius (meters)	G (mrad/yr)/(uCi/sec)	GBAR
N	1875	2.330E-05	5.562E-06	1875	9.565E-05	2.324E-05
NNE	1829	1.937E-05	4.707E-06	1829	8.084E-05	1.964E-05
NE	1585	1.773E-05	4.307E-06	1585	8.469E-05	2.058E-05
ENE	1234	1.672E-05	4.062E-06	1234	1.002E-04	2.435E-05
E	1227	2.049E-05	4.980E-06	1227	1.252E-04	3.043E-05
ESE	991	3.142E-05	7.635E-06	991	1.925E-04	4.677E-05
SE	1006	3.694E-05	8.976E-06	1006	2.683E-04	6.519E-05
SSE	800	5.135E-05	1.248E-05	800	4.267E-04	1.037E-04
S	945	2.723E-05	6.617E-06	945	2.121E-04	5.155E-05
SSW	975	1.795E-05	4.361E-06	975	1.407E-04	3.420E-05
SW	1067	1.379E-05	3.352E-06	1067	9.817E-05	2.385E-05
WSW	1212	1.483E-05	3.604E-06	1212	8.590E-05	2.087E-05
W	1189	2.193E-05	5.330E-06	1189	1.100E-04	2.673E-05
WNW	1227	1.514E-05	3.679E-06	1227	7.802E-05	1.896E-05
NW	1128	2.112E-05	5.133E-06	1128	1.033E-04	2.510E-05
NNW	1044	3.852E-05	9.360E-06	1044	1.691E-04	4.110E-05

Byron Site Meteorological Data 1/78 - 12/87

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

<sup>a</sup>The elevated (stack) and ground level release data are provided for reference purposes only. Routine dose calculations are performed using mixed mode (vent) release data.

<sup>b</sup>Approximate distance from midpoint between gaseous effluent release points.



Table F-7 (Cont'd)  
Site Boundary Finite Plume Gamma Dose Factors for Kr-85m

Downwind Unrestricted		Mixed Mode(Vent) Release			Ground Level Release		
Direction	Area Bound	Radius	V	VBAR	Radius	G	GBAR
	(meters)	(meters)	(mrad/yr)/(uCi/sec)		(meters)	(mrad/yr)/(uCi/sec)	
N	1875.	1875.	2.177E-04	1.818E-04	1875.	6.403E-04	5.298E-04
NNE	1829.	1829.	2.076E-04	1.738E-04	1829.	5.544E-04	4.589E-04
NE	1585.	1585.	2.022E-04	1.694E-04	1585.	5.773E-04	4.778E-04
ENE	1234.	1234.	1.984E-04	1.664E-04	1234.	6.395E-04	5.285E-04
E	1227.	1227.	2.331E-04	1.954E-04	1227.	7.968E-04	6.580E-04
ESE	991.	991.	3.260E-04	2.728E-04	991.	1.136E-03	9.363E-04
SE	1006.	1006.	3.710E-04	3.102E-04	1006.	1.584E-03	1.305E-03
SSE	800.	800.	4.393E-04	3.660E-04	800.	2.273E-03	1.865E-03
S	945.	945.	2.813E-04	2.353E-04	945.	1.240E-03	1.021E-03
SSW	975.	975.	2.079E-04	1.743E-04	975.	8.631E-04	7.119E-04
SW	1067.	1067.	1.688E-04	1.416E-04	1067.	6.286E-04	5.191E-04
WSW	1212.	1212.	1.751E-04	1.468E-04	1212.	5.594E-04	4.627E-04
W	1189.	1189.	2.092E-04	1.748E-04	1189.	6.723E-04	5.553E-04
WNW	1227.	1227.	1.464E-04	1.224E-04	1227.	4.690E-04	3.872E-04
NW	1128.	1128.	1.926E-04	1.607E-04	1128.	6.017E-04	4.961E-04
NNW	1044.	1044.	3.126E-04	2.603E-04	1044.	9.676E-04	7.974E-04

Byron Site Meteorological Data 1/78 - 12/87

Table F-7 (Cont'd)  
Site Boundary Finite Plume Gamma Dose Factors for Kr-85

Downwind Unrestricted Direction	Area Bound (meters)	Mixed Mode(Vent) Radius (meters)	Release		Ground Level Release Radius (meters)	Release	
			V (mrad/yr)	VBAR ( $\mu$ Ci/sec)		G (mrad/yr)	GBAR ( $\mu$ Ci/sec)
N	1875	1875	2.535E-06	2.140E-06	1875	7.318E-06	6.177E-06
NNE	1829	1829	2.469E-06	2.084E-06	1829	6.382E-06	5.386E-06
NE	1585	1585	2.415E-06	2.038E-06	1585	6.622E-06	5.589E-06
ENE	1234	1234	2.367E-06	1.998E-06	1234	7.225E-06	6.098E-06
E	1227	1227	2.787E-06	2.352E-06	1227	9.101E-06	7.681E-06
ESE	991	991	3.828E-06	3.231E-06	991	1.270E-05	1.072E-05
SE	1006	1006	4.364E-06	3.683E-06	1006	1.803E-05	1.521E-05
SSE	800	800	5.153E-06	4.349E-06	800	2.577E-05	2.175E-05
S	945	945	3.321E-06	2.803E-06	945	1.404E-05	1.185E-05
SSW	975	975	2.493E-06	2.104E-06	975	9.869E-06	8.329E-06
SW	1067	1067	2.018E-06	1.703E-06	1067	7.232E-06	6.104E-06
WSW	1212	1212	2.070E-06	1.747E-06	1212	6.309E-06	5.324E-06
W	1189	1189	2.436E-06	2.056E-06	1189	7.472E-06	6.306E-06
WNW	1227	1227	1.708E-06	1.442E-06	1227	5.191E-06	4.381E-06
NW	1128	1128	2.238E-06	1.889E-06	1128	6.678E-06	5.637E-06
NNW	1044	1044	3.579E-06	3.021E-06	1044	1.071E-05	9.042E-06

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Table F-7 (Cont'd)  
Site Boundary Finite Plume Gamma Dose Factors for Kr-87

Downwind Direction	Unrestricted Area Bound (meters)	Mixed Mode(Vent) Radius (meters)	Release V (mrad/yr)/(uCi/sec)	Ground Level Radius (meters)	Release G (mrad/yr)/(uCi/sec)	GBAR
N	1875	1875	7.122E-04	1875	1.811E-03	1.563E-03
NNE	1829	1829	6.891E-04	1829	1.555E-03	1.343E-03
NE	1585	1585	6.817E-04	1585	1.522E-03	1.400E-03
ENE	1234	1234	6.838E-04	1234	1.822E-03	1.572E-03
E	1227	1227	7.930E-04	1227	2.214E-03	1.911E-03
ESE	991	991	1.126E-03	991	3.256E-03	2.810E-03
SE	1006	1006	1.264E-03	1006	4.356E-03	3.759E-03
SSE	800	800	1.455E-03	800	6.185E-03	5.338E-03
S	945	945	9.680E-04	945	3.451E-03	2.978E-03
SSW	975	975	7.216E-04	975	2.374E-03	2.049E-03
SW	1067	1067	5.927E-04	1067	1.725E-03	1.489E-03
WSW	1212	1212	6.132E-04	1212	1.613E-03	1.392E-03
W	1189	1189	7.081E-04	1189	1.971E-03	1.701E-03
WNW	1227	1227	4.978E-04	1227	1.381E-03	1.192E-03
NW	1128	1128	6.517E-04	1128	1.753E-03	1.513E-03
NNW	1044	1044	1.040E-03	1044	2.826E-03	2.439E-03

Byron Site Meteorological Data 1/78 - 12/87

Table F-7 (Cont'd)  
Site Boundary Finite Plume Gamma Dose Factors for Kr-88

Downwind Unrestricted Direction Area Bound (meters)	Mixed Mode(Vent) Radius (meters)	Release V (mrad/yr)/(uCi/sec)	Ground Level Release Radius (meters)	Release G (mrad/yr)/(uCi/sec)
N	1875.	1.781E-03	1875.	4.631E-03
NNE	1829.	1.744E-03	1829.	4.012E-03
NE	1585.	1.725E-03	1585.	4.174E-03
ENE	1234.	1.721E-03	1234.	4.617E-03
E	1227.	2.008E-03	1227.	5.701E-03
ESE	991.	2.794E-03	991.	8.165E-03
SE	1006.	3.153E-03	1006.	1.124E-02
SSE	800.	3.656E-03	800.	1.601E-02
S	945.	2.414E-03	945.	8.831E-03
SSW	975.	1.821E-03	975.	6.146E-03
SW	1067.	1.486E-03	1067.	4.488E-03
WSW	1212.	1.525E-03	1212.	4.060E-03
W	1189.	1.756E-03	1189.	4.882E-03
WNW	1227.	1.235E-03	1227.	3.406E-03
NW	1128.	1.611E-03	1128.	4.344E-03
NNW	1044.	2.548E-03	1044.	6.974E-03

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Table F-7 (Cont'd)  
Site Boundary Finite Plume Gamma Dose Factors for Kr-89

Downwind Unrestricted Direction	Area Bound (meters)	Mixed Mode(Vent) Radius (meters)	Release		Ground Level Release		
			V (mrad/yr)	VBAR (uCi/sec)	Radius (meters)	G (mrad/yr)	GBAR (uCi/sec)
N	1875	1875	3.874E-04	3.353E-04	1875	5.119E-04	4.428E-04
NNE	1829	1829	3.917E-04	3.390E-04	1829	4.514E-04	3.904E-04
NE	1585	1585	4.092E-04	3.542E-04	1585	4.994E-04	4.320E-04
ENE	1234	1234	4.909E-04	4.250E-04	1234	7.066E-04	6.111E-04
E	1227	1227	5.876E-04	5.087E-04	1227	8.980E-04	7.767E-04
ESE	991	991	1.001E-03	8.669E-04	991	1.662E-03	1.437E-03
SE	1006	1006	1.052E-03	9.110E-04	1006	1.834E-03	1.586E-03
SSE	800	800	1.274E-03	1.103E-03	800	2.736E-03	2.366E-03
S	945	945	8.388E-04	7.261E-04	945	1.633E-03	1.413E-03
SSW	975	975	6.103E-04	5.283E-04	975	1.138E-03	9.838E-04
SW	1067	1067	4.877E-04	4.222E-04	1067	8.395E-04	7.261E-04
WSW	1212	1212	4.748E-04	4.110E-04	1212	7.570E-04	6.547E-04
W	1189	1189	5.142E-04	4.451E-04	1189	8.490E-04	7.342E-04
WNW	1227	1227	3.590E-04	3.108E-04	1227	5.905E-04	5.107E-04
NW	1128	1128	5.205E-04	4.505E-04	1128	8.806E-04	7.615E-04
NNW	1044	1044	9.408E-04	8.142E-04	1044	1.738E-03	1.503E-03

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Table F-7 (Cont'd)  
Site Boundary Finite Plume Gamma Dose Factors for Kr-90

Downwind Direction	Unrestricted Area Bound (meters)	Mixed Model(Vent) Radius (meters)	Release V (mrad/yr)/(uCi/sec)	VBAR (uCi/sec)	Radius (meters)	Ground Level G (mrad/yr)	Release GBAR (uCi/sec)
N	1875	1875	5.729E-06	4.928E-06	1875	2.499E-06	2.146E-06
NNE	1829	1829	6.704E-06	5.766E-06	1829	3.550E-06	3.050E-06
NE	1585	1585	8.897E-06	7.652E-06	1585	5.093E-06	4.374E-06
ENE	1234	1234	2.065E-05	1.776E-05	1234	1.415E-05	1.215E-05
E	1227	1227	3.111E-05	2.675E-05	1227	2.640E-05	2.268E-05
ESE	991	991	8.428E-05	7.247E-05	991	7.903E-05	6.786E-05
SE	1006	1006	7.483E-05	6.436E-05	1006	6.589E-05	5.658E-05
SSE	800	800	1.281E-04	1.102E-04	800	1.367E-04	1.174E-04
S	945	945	6.382E-05	5.489E-05	945	6.374E-05	5.473E-05
SSW	975	975	4.060E-05	3.492E-05	975	3.621E-05	3.109E-05
SW	1067	1067	2.851E-05	2.452E-05	1067	2.698E-05	2.317E-05
WSW	1212	1212	2.087E-05	1.795E-05	1212	1.563E-05	1.342E-05
W	1189	1189	2.105E-05	1.811E-05	1189	8.775E-06	7.536E-06
WNW	1227	1227	1.541E-05	1.326E-05	1227	8.279E-06	7.110E-06
NW	1128	1128	2.698E-05	2.321E-05	1128	1.614E-05	1.386E-05
NNW	1044	1044	6.070E-05	5.220E-05	1044	4.455E-05	3.825E-05

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Table F-7 (Cont'd)  
Site Boundary Finite Plume Gamma Dose Factors for Xe-131m

Direction	Unrestricted Area Bound (meters)	Mixed Mode(Vent) Radius (meters)	Release		Ground Level Release		
			V (mrad/yr)/(uCi/sec)	VBAR (uCi/sec)	Radius (meters)	G (mrad/yr)/(uCi/sec)	GBAR (uCi/sec)
N	1875.	1875.	2.385E-05	8.592E-06	1875.	9.757E-05	3.206E-05
NNE	1829.	1829.	2.062E-05	7.706E-06	1829.	8.424E-05	2.775E-05
NE	1585.	1585.	1.931E-05	7.318E-06	1585.	8.807E-05	2.896E-05
ENE	1234.	1234.	1.814E-05	6.971E-06	1234.	1.003E-04	3.262E-05
E	1227.	1227.	2.206E-05	8.382E-06	1227.	1.290E-04	4.175E-05
ESE	991.	991.	3.255E-05	1.208E-05	991.	1.885E-04	6.032E-05
SE	1006.	1006.	3.838E-05	1.408E-05	1006.	2.741E-04	8.722E-05
SSE	800.	800.	5.287E-05	1.849E-05	800.	4.308E-04	1.341E-04
S	945.	945.	2.861E-05	1.056E-05	945.	2.140E-04	6.805E-05
SSW	975.	975.	1.939E-05	7.399E-06	975.	1.451E-04	4.653E-05
SW	1067.	1067.	1.511E-05	5.849E-06	1067.	1.030E-04	3.330E-05
WSW	1212.	1212.	1.568E-05	6.055E-06	1212.	8.542E-05	2.796E-05
W	1189.	1189.	2.220E-05	8.064E-06	1189.	1.056E-04	3.420E-05
WNW	1227.	1227.	1.534E-05	5.595E-06	1227.	7.423E-05	2.397E-05
NW	1128.	1128.	2.119E-05	7.601E-06	1128.	9.904E-05	3.171E-05
NNW	1044.	1044.	3.749E-05	1.307E-05	1044.	1.610E-04	5.138E-05

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Table F-7 (Cont'd)  
Site Boundary Finite Plume Gamma Dose Factors for Xe-133m

Downwind Direction	Unrestricted Area Bound (meters)	Mixed Model(Ven*) Radius (meters)	Release V (mrad/yr)/(uCi/sec)	VBAR (mrad/yr)/(uCi/sec)	Radius (meters)	Ground Level Release G (mrad/yr)/(uCi/sec)
N	1875	1875	5.052E-05	3.087E-05	1875	1.779E-04
NNE	1829	1829	4.621E-05	2.913E-05	1829	1.541E-04
NE	1585	1585	4.420E-05	2.818E-05	1585	1.606E-04
ENE	1234	1234	4.244E-05	2.736E-05	1234	1.799E-04
E	1227	1227	5.072E-05	3.240E-05	1227	2.292E-04
ESE	991	991	7.221E-05	4.526E-05	991	3.291E-04
SE	1006	1006	8.369E-05	5.197E-05	1006	4.733E-04
SSE	800	800	1.068E-04	6.344E-05	800	7.166E-04
S	945	945	6.295E-05	3.929E-05	945	3.693E-04
SSW	975	975	4.488E-05	2.877E-05	975	2.539E-04
SW	1067	1067	3.574E-05	2.316E-05	1067	1.825E-04
WSW	1212	1212	3.697E-05	2.391E-05	1212	1.549E-04
W	1189	1189	4.767E-05	2.934E-05	1189	1.883E-04
WNW	1227	1227	3.316E-05	2.049E-05	1227	1.318E-04
NW	1128	1128	4.462E-05	2.716E-05	1128	1.731E-04
NNW	1044	1044	7.543E-05	4.466E-05	1044	2.800E-04

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Table F-7 (Cont'd)  
Site Boundary Finite Plume Gamma Dose Factors for Xe-133

Downwind Direction	Unrestricted Area Bound (meters)	Mixed Model(Vent) Radius (meters)	Release V (mrad/yr)	Release VBAR (uCi/sec)	Radius (meters)	Ground Level Release G (mrad/yr)	Release GBAR (uCi/sec)
N	1875.	1875.	5.651E-05	3.917E-05	1875.	2.014E-04	1.315E-04
NNE	1829.	1829.	5.150E-05	3.642E-05	1829.	1.746E-04	1.142E-04
NE	1585.	1585.	4.921E-05	3.506E-05	1585.	1.820E-04	1.188E-04
ENE	1234.	1234.	4.702E-05	3.372E-05	1234.	2.030E-04	1.313E-04
E	1227.	1227.	5.610E-05	3.997E-05	1227.	2.582E-04	1.662E-04
ESE	991.	991.	7.996E-05	5.625E-05	991.	3.684E-04	2.344E-04
SE	1006.	1006.	9.261E-05	6.471E-05	1006.	5.287E-04	3.343E-04
SSE	800.	800.	1.173E-04	7.936E-05	800.	7.899E-04	4.869E-04
S	945.	945.	6.950E-05	4.871E-05	945.	4.122E-04	2.605E-04
SSW	975.	975.	4.942E-05	3.525E-05	975.	2.848E-04	1.816E-04
SW	1067.	1067.	3.944E-05	2.836E-05	1067.	2.054E-04	1.320E-04
WSW	1212.	1212.	4.094E-05	2.942E-05	1212.	1.751E-04	1.139E-04
W	1189.	1189.	5.295E-05	3.682E-05	1189.	2.119E-04	1.365E-04
WNW	1227.	1227.	3.679E-05	2.564E-05	1227.	1.481E-04	9.508E-05
NW	1128.	1128.	4.943E-05	3.409E-05	1128.	1.938E-04	1.233E-04
NNW	1044.	1044.	8.376E-05	5.674E-05	1044.	3.130E-04	1.986E-04

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Table F-7 (Cont'd)  
Site Boundary Finite Plume Gamma Dose Factors for Xe-135m

Downwind Unrestricted Direction Area Bound	Radius (meters)	Mixed Mode(Vent) Release		Ground Level Release		
		Radius (meters)	V (mrad/yr)/(uCi/sec)	VBAR (mrad/yr)/(uCi/sec)	Radius (meters)	G (mrad/yr)/(uCi/sec)
N	1875.	1875.	3.355E-04	2.813E-04	1875.	7.574E-04
NNE	1829.	1829.	3.191E-04	2.677E-04	1829.	6.353E-04
NE	1585.	1585.	3.171E-04	2.662E-04	1585.	6.645E-04
ENE	1234.	1234.	3.275E-04	2.750E-04	1234.	7.919E-04
E	1227.	1227.	3.794E-04	3.185E-04	1227.	9.382E-04
ESE	991.	991.	5.722E-04	4.802E-04	991.	1.502E-03
SE	1006.	1006.	6.280E-04	5.269E-04	1006.	1.826E-03
SSE	800.	800.	7.139E-04	5.985E-04	800.	2.546E-03
S	945.	945.	4.850E-04	4.070E-04	945.	1.505E-03
SSW	975.	975.	3.539E-04	2.971E-04	975.	1.019E-03
SW	1067.	1067.	2.924E-04	2.455E-04	1067.	7.378E-04
WSW	1212.	1212.	3.058E-04	2.567E-04	1212.	7.396E-04
W	1189.	1189.	3.530E-04	2.960E-04	1189.	9.316E-04
WNW	1227.	1227.	2.475E-04	2.075E-04	1227.	6.545E-04
NW	1128.	1128.	3.325E-04	2.787E-04	1128.	8.492E-04
NNW	1044.	1044.	5.542E-04	4.641E-04	1044.	1.425E-03

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Table F-7 (Cont'd)  
Site Boundary Finite Plume Gamma Dose Factors for Xe-135

Downwind Unrestricted Direction Area Bound (meters)	Mixed Mode (Vent) Radius (meters)	Release V (mrad/yr)/(uCi/sec)	Ground Level Release Radius (meters)	Release G (mrad/yr)/(uCi/sec)	GBAR
N	1875.	2.998E-04	1875.	8.831E-04	7.474E-04
NNE	1829.	2.878E-04	1829.	7.672E-04	6.493E-04
NE	1585.	2.805E-04	1585.	7.977E-04	6.751E-04
ENE	1234.	2.749E-04	1234.	8.772E-04	7.422E-04
E	1227.	3.233E-04	1227.	1.099E-03	9.295E-04
ESE	991.	4.486E-04	991.	1.549E-03	1.310E-03
SE	1006.	5.112E-04	1006.	2.178E-03	1.842E-03
SSE	800.	6.045E-04	800.	3.113E-03	2.630E-03
S	945.	3.878E-04	945.	1.701E-03	1.438E-03
SSW	975.	2.880E-04	975.	1.190E-03	1.007E-03
SW	1067.	2.337E-04	1067.	8.696E-04	7.356E-04
WSW	1212.	2.415E-04	1212.	7.667E-04	6.488E-04
W	1189.	2.873E-04	1189.	9.146E-04	7.737E-04
WNW	1227.	2.012E-04	1227.	6.366E-04	5.385E-04
NW	1128.	2.641E-04	1128.	8.175E-04	6.913E-04
NNW	1044.	4.267E-04	1044.	1.313E-03	1.110E-03

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Table F-7 (Cont'd)  
Site Boundary Finite Plume Gamma Dose Factors for Xe-137

Direction	Downwind Unrestricted		Mixed Mode(Vent) Release		Ground Level Release		
	Area Bound	Radius	V	VBAR	Radius	G	GBAR
	(meters)	(meters)	(mrad/yr)	(uCi/sec)	(meters)	(mrad/yr)	(uCi/sec)
N	1875.	1875.	6.403E-05	5.429E-05	1875.	9.597E-05	8.133E-05
NNE	1829.	1829.	6.358E-05	5.391E-05	1829.	8.275E-05	7.013E-05
NE	1585.	1585.	6.560E-05	5.562E-05	1585.	9.063E-05	7.681E-05
ENE	1234.	1234.	7.607E-05	6.451E-05	1234.	1.243E-04	1.054E-04
E	1227.	1227.	9.065E-05	7.687E-05	1227.	1.555E-04	1.317E-04
ESE	991.	991.	1.509E-04	1.280E-04	991.	2.805E-04	2.377E-04
SE	1006.	1006.	1.596E-04	1.353E-04	1006.	3.144E-04	2.664E-04
SSE	800.	800.	1.905E-04	1.615E-04	800.	4.627E-04	3.921E-04
S	945.	945.	1.267E-04	1.074E-04	945.	2.775E-04	2.351E-04
SSW	975.	975.	9.229E-05	7.827E-05	975.	1.933E-04	1.638E-04
SW	1067.	1067.	7.424E-05	6.296E-05	1067.	1.418E-04	1.201E-04
WSW	1212.	1212.	7.355E-05	6.237E-05	1212.	1.309E-04	1.109E-04
W	1189.	1189.	8.087E-05	6.857E-05	1189.	1.518E-04	1.286E-04
WNW	1227.	1227.	5.651E-05	4.792E-05	1227.	1.056E-04	8.945E-05
NW	1128.	1128.	8.102E-05	6.870E-05	1128.	1.535E-04	1.301E-04
NNW	1044.	1044.	1.454E-04	1.232E-04	1044.	2.944E-04	2.495E-04

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Table F-7 (Cont'd)  
Site Boundary Finite Plume Gamma Dose Factors for Xe-138

Downwind Unrestricted Direction Area Bound (meters)	Mixed Mode(Vent) Radius (meters)	V (mrad/yr)	Release VBAR (uCi/sec)	Ground Level Release Radius (meters)	G (mrad/yr)	Release GBAR (uCi/sec)
N	1875	7.317E-04	6.318E-04	1875	1.559E-03	1.344E-03
NNE	1829	7.040E-04	6.080E-04	1829	1.310E-03	1.129E-03
NE	1585	7.054E-04	6.093E-04	1585	1.371E-03	1.182E-03
ENE	1234	7.357E-04	6.356E-04	1234	1.634E-03	1.409E-03
E	1227	8.489E-04	7.333E-04	1227	1.936E-03	1.669E-03
ESE	991	1.282E-03	1.107E-03	991	3.103E-03	2.675E-03
SE	1006	1.402E-03	1.211E-03	1006	3.755E-03	3.236E-03
SSE	800	1.589E-03	1.372E-03	800	5.212E-03	4.491E-03
S	945	1.089E-03	9.410E-04	945	3.103E-03	2.675E-03
SSW	975	7.991E-04	6.904E-04	975	2.107E-03	1.817E-03
SW	1067	6.618E-04	5.718E-04	1067	1.531E-03	1.321E-03
WSW	1212	6.871E-04	5.936E-04	1212	1.535E-03	1.323E-03
W	1189	7.811E-04	6.746E-04	1189	1.925E-03	1.660E-03
WNW	1227	5.482E-04	4.734E-04	1227	1.351E-03	1.165E-03
NW	1128	7.355E-04	6.351E-04	1128	1.756E-03	1.514E-03
NNW	1044	1.215E-03	1.049E-03	1044	2.955E-03	2.547E-03

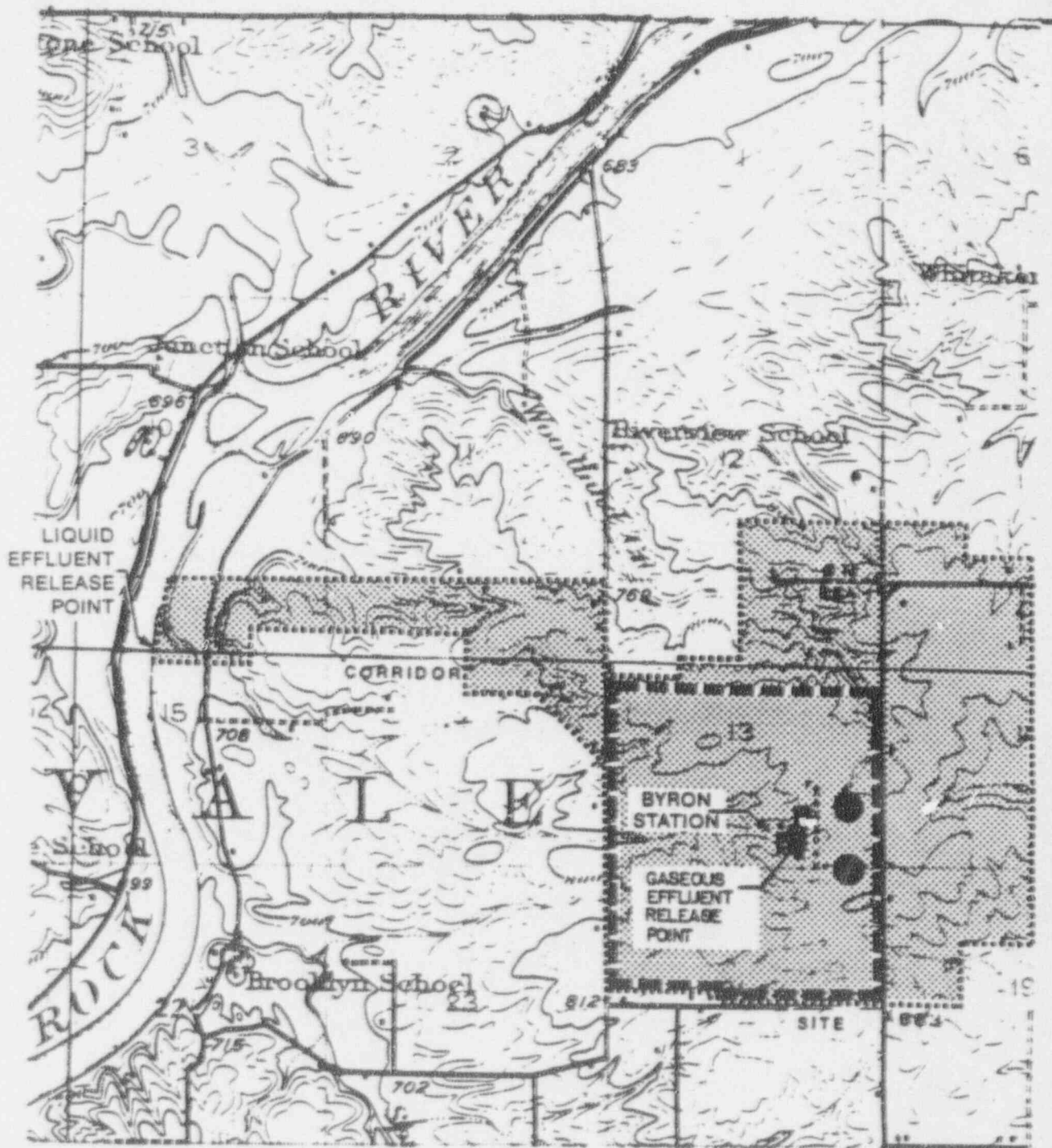
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Table F-7 (Cont'd)  
Site Boundary Finite Plume Gamma Dose Factors for Ar-41

Downwind Direction	Unrestricted Area Bound (meters)	Mixed Radius (meters)	Mode(Vent) V (mrad/yr)	Release VBAR (uCi/sec)	Radius (meters)	Ground Level G (mrad/yr)	Release GBAR (uCi/sec)
N	1875.	1875.	1.120E-03	9.541E-04	1875.	2.935E-03	2.501E-03
NNE	1829.	1829.	1.085E-03	9.244E-04	1829.	2.531E-03	2.156E-03
NE	1585.	1585.	1.071E-03	9.124E-04	1585.	2.637E-03	2.247E-03
ENE	1234.	1234.	1.069E-03	9.111E-04	1234.	2.943E-03	2.508E-03
E	1227.	1227.	1.244E-03	1.060E-03	1227.	3.609E-03	3.075E-03
ESE	991.	991.	1.753E-03	1.493E-03	991.	5.240E-03	4.464E-03
SE	1006.	1006.	1.975E-03	1.683E-03	1006.	7.123E-03	6.069E-03
SSE	800.	800.	2.290E-03	1.951E-03	800.	1.015E-02	8.650E-03
S	945.	945.	1.510E-03	1.286E-03	945.	5.616E-03	4.785E-03
SSW	975.	975.	1.128E-03	9.611E-04	975.	3.884E-03	3.309E-03
SW	1067.	1067.	9.228E-04	7.862E-04	1067.	2.826E-03	2.408E-03
WSW	1212.	1212.	9.527E-04	8.117E-04	1212.	2.594E-03	2.210E-03
W	1189.	1189.	1.105E-03	9.414E-04	1189.	3.148E-03	2.682E-03
WNW	1227.	1227.	7.765E-04	6.616E-04	1227.	2.201E-03	1.875E-03
NW	1128.	1128.	1.016E-03	8.658E-04	1128.	2.803E-03	2.388E-03
NNW	1044.	1044.	1.621E-03	1.382E-03	1044.	4.510E-03	3.842E-03

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0 1/2 1 KM

0 1/2 1 MILE



EXCLUSION AREA BOUNDARY  
RESTRICTED AREA BOUNDARY

# OFFSITE DOSE CALCULATION MANUAL BYRON STATION

FIGURE F-1

RESTRICTED AREA BOUNDARY