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* Entire contents issued July 24, 1987.

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Please sign and date a copy of this manual transmittal indicating receipt of the manual and return to the environmental protection programs coordinator at Beaver Valley Power Station by (Date) August 14, 1987.

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Figure 2.0-2

Attachment

DUQUESNE LIGHT COMPANY
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Review and Approval Sheet

UNIT 1 - OFFSITE DOSE CALCULATION MANUAL

ISSUE 2

Rev. No.	Pgs. Issd.	Tech. Rev. Sign. Date	OSC Review Date	Approv. Sign. Date	Eff. Date
0	TITLE PGS i thru viii 1-1 thru 1-17 2-1 thru 2-96 3-1 thru 3-14 4,1, 5-1 A-1 thru A-7 B-1 thru B-4	BV-RSC-11-87 BV-RSC-12-87 BV-RSC-14-87 May 29, 1987 W F Will	BV-OSC-17-87 June 12, 1987	7/16/87	7/24/87

BEAVER VALLEY POWER STATION

UNIT NO. 1

OFF-SITE DOSE

CALCULATION MANUAL

DUQUESNE LIGHT COMPANY
Beaver Valley Power Station Uni 1
Docket No. 50-334

BEAVER VALLEY POWER STATION UNIT 1
OFF-SITE DOSE CALCULATION MANUAL
(ODCM)

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PREFACE

This Offs.te Dose Calculation Manual (ODCM) provides the information and methodologies to be used by Beaver Valley Power Station Unit 1 (BVPS-1) to assure compliance with certain portions of BVPS-1 operating Technical Specifications. These portions are those related to liquid and gaseous radiological effluents. They are intended to show compliance with 10 CFR 20, 10 CFR 50.36a, Appendix I of 10 CFR 50, and 40 CFR 190.

This ODCM is based on "Radiological Effluent Technical Specifications for PWR's (NUREG-0472, Draft)", "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants (NUREG-0133)", and other inputs from the United States Nuclear Regulatory Commission (USNRC). Specific plant procedures for implementation of this manual will be developed. These procedures will be utilized by the operating staff of BVPS-1 to assure compliance with Technical Specifications.

The ODCM has been prepared as generically as possible in order to minimize the need for future versions. However, some changes to the ODCM will be expected in the future. Any such changes will be properly reviewed and approved as indicated in the Administrative Control Section, Specification 6.15.2 of the BVPS-1 Technical Specifications.

1.0 LIQUID EFFLUENTS

Beaver Valley Units 1 and 2 utilize the concept of a shared liquid radioactive waste system according to NUREG 0133. This permits the mixing of liquid radwaste for processing and allocating of dose due to release as defined in Section 1.3. In Section 1.1 effluent monitor setpoints for a conservative mix are based on the individual Units' specific parameters, but effluent monitor setpoints for analysis prior to release permit use of the total dilution flow available at the Site.

It must be noted differences exist between setpoint presentations of the radiation monitoring systems of BVPS-1 and BVPS-2. There is a conflict in setpoint terminology. Where BVPS-1 uses HIGH and HIGH-HIGH the BVPS-2 equilvalents are ALERT and HIGH. Also there is the difference that BVPS-2 setpoints are presented in µCi/ml rather than CPM as in BVPS-1. This difference is due to software which applies a conversion factor to the raw data (CPM). Note that the µCi/ml presentation is technically correct only for the specific isotopic mix used in the determination of the conversion factors. Therefore, Unit 2 setpoints determined on analysis prior to release will be correct for properly controlling dose rate but the indicated µCi/ml value may differ from the actual value.

1.1 Monitor Alarm Setpoint Determination

This procedure determines the monitor high-high alarm setpoint that indicates if the concentration of radionuclides in the liquid effluent released from the site to unrestricted areas exceeds the concentrations specified in 10CFR20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases or exceeds a concentration of 2 E-4 µCi/ml for dissolved or entrained noble gases.

The methodology described in Section 1.1.2 is an alternative method to be used to determine the monitor high-high alarm setpoint (HHSP). The methodology in Section 1.1.2 may be used for any batch release and shall be used when the total gamma activity concentration of the liquid effluent prior to dilution exceeds 1.49E-4 µCi/ml. This concentration is equivalent to the HHSP's of 1.69 E4 ncpm and 8.46 E4 ncpm (net counts per minute) derived in Section 1.1.1 and allows for a tritium concentration up to 1.5E-1 µCi/ml.

1.1.1 Setpoint Determination Based on a Conservative Mix

The high-high alarm setpoint for the Liquid Waste Effluent Monitor (LW-104) should be set at 1.69E4 ncpm and the high-high alarm setpoint for the Liquid Waste Contamination Monitor (LW-116) should be set at 8.46E4 ncpm. These setpoints are based on the following conditions:

- Source terms given in Table 1.1-1. These source terms have been generated from the computer code GALE, Revision 0 (NUREG-0017). The inputs to GALE are given in Appendix B.

- Dilution water flow rate of 15,000 gpm.

- Discharge flow rate prior to dilution of 50 gpm for the Liquid Waste Effluent Monitor (LW-104).

- Discharge flow rate prior to dilution of 10 gpm for the Liquid Waste Contamination Monitor (LW-116)

The above setpoints can be varied based on actual operating conditions resulting in changes in the discharge and dilution flow rates as follows:

$$HHSP = \frac{56.3\ F}{f} \qquad (1.1\text{-}1)$$

where:

HHSP = Monitor high-high alarm setpoint above background (ncpm)

56.3 = Proportionality constant based on nominal flow conditions (56.3 = 1.69 E4 ncpm x 50 gpm ÷ 1.5 E4 gpm for LW-104 or 56.3 = 8.46 E4 ncpm x 10 gpm ÷ 1.5 E4 gpm for LW-116).

F = Dilution water flow rate (gpm) BVPS-1 Cooling Tower Blowdown Rate (not including BVPS-2 Blowdown or the BV-2 release out through the Emergency Outfall Structure).

f = Discharge flow rate prior to dilution (gpm)

1.1.1.1 The "mix" (radionuclides and composition) of the liquid effluent was determined as follows:

a. The liquid source terms that are representative of the "mix" of the liquid effluent were determined. Liquid source terms are the radioactivity levels of the radionuclides in the effluent from Table 1.1-1.

b. The fraction of the total radioactivity in the liquid effluent comprised by radionuclide "i" (S_i) for each individual radionuclide in the liquid effluent was determined by equation 1.1-2.

$$S_i = \frac{A_i}{\sum_i A_i} \qquad (1.1\text{-}2)$$

where:

A_i = Annual release of radionuclide "i" in the liquid effluent from Table 1.1-1.

1.1.1.2 The maximum acceptable total radioactivity concentration in uCi/ml of all radionuclides in the liquid effluent prior to dilution (C_t) was determined by:

$$C_t = \frac{F}{f \sum_i \frac{S_i}{MPC_i}} \qquad (1.1\text{-}3)$$

where:

F = Dilution water flow rate (gpm) BVPS-1 Cooling Tower Blowdown Rate (not including BVPS-2 Blowdown or the BVPS-2 release out through the Emergency Outfall Structure)

= 15,000 gpm

f = Maximum acceptable discharge flow rate prior to dilution (gpm)

= 50 gpm for Liquid Waste Effluent Monitor (LW-104)

= 10 gpm for Liquid Waste Contamination Monitor (LW-116)

MPC_i = Liquid effluent radioactivity concentration limit for radionuclide "i" (µCi/ml) from Table 1.1-1 or if not listed in Table 1.1-1, obtained from Reference 3.

S_i = The fraction of total radioactivity attributed to radionuclide "i" (from Equation 1.1-2).

1.1.1.3 The maximum acceptable radioactivity concentration in µCi/ml of radionuclide "i" in the liquid effluent prior to dilution (C_i) was determined by:

$$C_i = S_i \, C_t \qquad (1.1\text{-}4)$$

1.1.1.4 The calculated monitor count rate in ncpm above background attributed to the radionuclides, C.R., was determined by:

$$C.R. = \sum_i C_i \, E_i \qquad (1.1\text{-}5)$$

where:

E_i = Detection efficiency of the monitor for radionuclide "i" (cpm/µCi/ml) from Table 1.1-1 or if not listed in Table 1.1-1 from Reference 4.

1.1.1.5 The monitor high-high alarm setpoint above background (ncpm) should be set at the C.R. value. Since only one tank can be released at a time, adjustment of this value is not necessary to compensate for release from more than one source.

1.1.2 Setpoint Determination Based on Analysis Prior to Release

The following method applies to liquid releases when determining the setpoint for the maximum acceptable discharge flow rate prior to dilution and the associated high-high alarm setpoint based on this flow rate for the Liquid Waste Effluent Monitor (LW-104) and the Liquid Waste Contamination Monitor (LW-116) during all operational conditions.

The monitor alarm setpoint is set slightly above (a factor of 1.25) the count rate that results from the concentration of gamma emitting radionuclides in order to avoid spurious alarms. To compensate for this increase in the monitor alarm setpoint, the allowable discharge flow rate is reduced by the same factor.

When the discharge flow rate is limited by the radwaste discharge pump rate capacity or by administrative selection rather than the allowable flow rate determined from activity concentration, the alarm setpoint will be proportionally adjusted based upon the excess dilution factor provided.

1.1.2.1 The maximum acceptable discharge flow rate (f) prior to dilution (in gpm) is determined by:

$$f = \frac{F}{1.25 \sum_i \frac{C_i}{MPC_i}} \qquad (1.1\text{-}6)$$

where:

F = Dilution water flow rate, BVPS-1 Cooling Tower blowdown (gpm)

The dilution water flow rate may include the combined cooling tower blowdown flow from both units exiting the discharge structure (but excluding emergency outfall structure flow) when simultaneous liquid discharges are administratively prohibited.

C_i = Radioactivity concentration of radionuclude "i" in the liquid effluent prior to dilution (μCi/ml) from analysis of the liquid effluent to be released.

Note: If the radioactivity of a radionuclide is below the LLD value specified in Table 4.11-1 of the BVPS-1 Technical Specifications, the radionuclide should not be included as a source term in this setpoint calculation.

1.25 = A factor to prevent spurious alarms caused by deviations in the mixture of radionuclides which affect the monitor response.

MPC_i = The liquid effluent radioactivity concentration limit for radionuclide "i" (μCi/ml) from Table 1.1-1 or if not listed in Table 1.1-1 from Reference 3.

1.1.2.2 The calculated monitor count rate (in ncpm) above background attributed to the radionuclides (C.R.) is determined by:

$$C.R. = 1.25 \sum_i C_i E_i \qquad (1.1\text{-}7)$$

where:

E_i = The detection efficiency of the monitor for radionuclide "i" (cpm/μCi/ml) from Table 1.1-1 or if not listed in Table 1.1-1 from Reference 4.

1.25 = A factor to prevent spurious alarms caused by deviations in the mixture of radionuclides which affect the monitor response.

1.1.2.3 The liquid effluent monitor high-high alarm setpoint above background (ncpm) should be set at the C.R. value adjusted by any excess dilution factor provided as defined in the following equation:

$$HHSP = C.R. \frac{f}{f} \qquad (1.1\text{-}8)$$

where:

HHSP = Monitor high-high alarm setpoint above background

C.R. = Calculated monitor count rate (in ncpm) from 1.1-7

f = Maximum acceptable discharge flow rate prior to dilution determined by equation 1.1-6

f = Actual maximum discharge flow rate to be maintained for the discharge. The reduced value of f may be due to pump limitations or administrative selection.

TABLE 1.1.-1 LIQUID SOURCE TERM

RADIONUCLIDE	ANNUAL RELEASE (Ci) (2)	MPC_i (µCi/ml) (3)	DETECTION EFFICIENCY, E_i (cpm/µCi/ml) (4)
Cr-51	9E-5	2E-3	1.07E7
Mn-54	2E-5	1E-4	8.80E7
Fe-55	8E-5	8E-4	5.20E3
Fe-59	5E-5	5E-5	9.02E7
Co-58	7.7E-4	9E-5	1.19E8
Co-60	1.0E-4	3E-5	1.72E8
Np-239	5E-5	1E-4	5.14E7
Br-83	6E-5	3E-6	1.36E6
Rb-86	1E-5	2E-5	7.57E6
Sr-89	2E-5	3E-6	7.84E3
Sr-91	1E-5	5E-5	1.27E8
Mo-99	3.90E-3	4E-5	2.42E7
Tc-99m	5.37E-3	3E-3	9.00E7
Te-127m	1E-5	5E-5	5.34E4
Te-127	3E-5	2E-4	4.17E5
Te-129m	7E-5	2E-5	5.37E6
Te-129	5E-5	8E-4	1.91E7
I-130	2.5E-4	3E-6	3.10E8
Te-131m	9E-5	4E-5	1.39E8
Te-131	2E-5	--	1.09E8
I-131	6.027E-2	3E-7	1.06E8
Te-132	1.15E-3	2E-5	1.17E8
I-132	5.38E-3	8E-6	2.75E8
I-133	5.769E-2	1E-6	1.01E8
I-134	1E-5	2E-5	2.43E8
Cs-134	3.80E-3	9E-6	2.06E8
I-135	1.338E-2	4E-5	1.22E8
Cs-136	1.90E-3	6E-5	3.02E8
Cs-137	2.70E-3	2E-5	7.65E7
Ba-140	1E-5	2E-5	5.21E7
La-140	1E-5	2E-5	1.74E8
All Others*	4E-5	1E-7	OEO
TOTAL	1.60E-1	--	-
H-3	1.60E+2	3E-3	OEO

*Excluding Tritium and Entrained Noble Gases.

REFERENCES

Liquid Effluent Monitor Setpoints

(1) "Beaver Valley Power Station, Appendix I Analysis - Docket No. 50-334 and 50-412", Table 2.1.3.

(2) "Beaver Valley Power Station, Appendix I Analysis - Docket No. 50-334 and 50-412", Table 2.1.2.

(3) 10CFR20, Appendix B, Table II, Column 2 and footnotes.

(4) "Duquesne Light Co., Beaver Valley Nuclear Plant, Specification No. BVPS 414, Table V Nuclide Data, 5/30/74", Table 2 and Figure 1.

1.2 Compliance with BVTS 3.11.1.1

Only nuclides for which activity concentrations are above the LLD's specified in Table 4.11-1 of Technical Specification 3.11.1.1 are considered to be present.

1.2.1 Batch Releases

1.2.1.1 Pre-Release

The radioactivity content of each batch release will be determined prior to release in accordance with Table 4.11-1 of Beaver Valley Unit 1 Technical Specifications (BVTS). In order to assure representative samples, at least two tank volumes of entrained fluid from each tank to be discharged shall be recirculated through the mixing eductors. This will be accomplished by recirculating the tank contents for at least the time periods indicated in Table 1.2-1. The Beaver Valley Power Station Unit 1 (BVPS-1) will show compliance with BVTS 3.11.1.1 in the following manner:

The activity of the various radionuclides in the batch release, determined in accordance with Table 4.11-1, is divided by the minimum dilution flow to obtain the concentration at the unrestricted area. This calculation is shown in the following equation:

$$Conc_i = \frac{C_i R}{MDF} \qquad (1.2\text{-}1)$$

where:

$Conc_i$ = concentration of radionuclide "i" at the unrestricted area, µCi/ml;

C_i = concentration of radionuclide "i" in the potential batch release, µCi/ml;

R = release rate of the batch, gpm;

MDF = minimum dilution flow, gpm. (May be combined BV-1/BV-2 flow when simultaneous liquid discharges are administratively prohibited)

The projected concentrations in the unrestricted area are compared to the concentrations in Appendix B, Table II of 10 CFR 20. The most common MPC_i concentrations are listed in Table 1.1-1 and were taken from Appendix B, Table II of 10 CFR 20. Before a release is authorized, Expression 1.2-2 must be satisfied.

$$\Sigma_i \, (Conc_i / MPC_i) \leq 1 \qquad (1.2\text{-}2)$$

where:

MPC_i = maximum permissible concentration of radionuclide "i" from Appendix B, Table II of 10 CFR 20, µCi/ml

1.2.1.2 Postrelease

The concentration of each radionuclide following release from the batch tank will be calculated in the unrestricted area in the following manner:

The average activity of radionuclide "i" during the time period of release is divided by the actual dilution flow during the period of release to obtain the concentration in the unrestricted area. This calculation is shown in the following equation:

$$Conc_{ik} = \frac{C_{ik} V_{tk}}{ADF_k} \qquad (1.2\text{-}3)$$

where:

$Conc_{ik}$ = the concentration of radionuclide "i" at the unrestricted area, during the release period of time k, μCi/ml;

Note: Since discharge is from an isolated well-mixed tank at essentially a uniform rate, the difference between average and peak concentration within any discharge period is minimal.

C_{ik} = concentration of radionuclide "i" in batch release during time period k, μCi/ml;

V_{tk} = volume of tank released during time period k, gal;

ADF_k = actual volume of dilution flow during the time period of release k, gal.

To show compliance with BVTS 3.11.1.1, the following relationship must hold:

$$\Sigma_i (Conc_{ik}/MPC_i) \leq 1 \qquad (1.2\text{-}4)$$

1.2.2 Continuous

Continuous releases of liquid effluents do not presently occur at the BVPS. If they did occur the concentration of various radionuclides in the unrestricted area would be calculated using Equation 1.2-1 with C_{ik}, the concentration of isotope i in the continuous release. To show compliance with BVTS 3.11.1.1, Expression 1.2-4 must again hold.

TABLE 1.2-1

RECIRCULATION TIMES REQUIRED BEFORE
SAMPLING OF LIQUID DISCHARGE TANKS

Name (by Operating Manual)	Mark No.	Approx. Recirc. Time[d] (hrs)
Laundry and Contaminated Shower Drain Tanks	1LW-TK-6A & 6B	4.5[a]
Low Level Waste Drain Tanks	1LW-TK-3A & 3B	2.5[a]
High Level Waste Drain Tanks[c]	1LW-TK-2A & 2B	6[a]
Evaporator Test Tanks	1LW-TK-5A & 5B	2[a]
Steam Generator Drain Tanks	1LW-TK-7A & 7B	11.5[a]
Boron Recovery Test Tanks	1BR-TK-2A & 2B	9.7[b]

a From BVPS-1 Operating Manual, Chapter 17, Section 4

b Derived from information in BVPS-1 Operating Manual, Chapter 8, Section 1

c Not normally a direct source of discharge

d The times listed are those required for <u>two</u> recirculations of a <u>full</u> tank with <u>one</u> recirculation pump in operation. Partially full tank recirculation times are directly proportional to the fraction of the tank capacity occupied by the entrained liquid waste after isolation.

1.3 Compliance With 10 CFR 50 (Liquids)

Beaver Valley Units 1 and 2 utilize the concept of a shared liquid radioactive waste system according to NUREG 0133. This permits mixing of the liquid radwaste for processing. Since the resulting effluent release cannot accurately be ascribed to a specific reactor unit, the treated effluent releases are allocated as defined below.

1.3.1 Cumulation of Doses

The dose contribution from the release of liquid effluents will be calculated monthly for each batch release during the month and a cumulative summation of the total body and organ doses will be maintained for each calendar month, current calendar quarter, and he calendar year to date. The dose contribution will be calculated using the following equation:

$$D_\tau = UAF \sum_i A_{i\tau} \sum_{k=1}^{m} \Delta t_k \, C_{ik} \, F_k \qquad (1.3\text{-}1)$$

where:

D_τ = the cumulative dose commitment to the total body or any organ, τ, from the liquid effluents for the total time period $\sum_{k=1}^{m} \Delta t_k$, mrem;

Δt_k = the length of the kth release over which C_{ik} and F_k are averaged for all liquid releases, hours;

C_{ik} = the average concentration of radionuclide, "i", in undiluted liquid effluent during time period Δt_k from any liquid release µCi/ml;

$A_{i\tau}$ = the site related ingestion dose commitment factor to the total body or any organ τ for each identified principal gamma and beta emitter, mrem-ml per hr-µCi;

m = number of releases contributing to the cumulative dose, D_τ

UAF = unit allocation factor. Provides apportionment of dose between Units 1 and 2. Normally set at 0.5 for each unit. (Must total to 1.0)

F_k = the near field average dilution factor for C_{ik} during any liquid effluent release. Defined as the ratio of the maximum undiluted liquid waste flow during release to the product of the average flow from the site discharge structure to unrestricted receiving waters times 3. (3 is the site specific applicable factor for the mixing effect of the BVPS-1 discharge structure).

$$= \frac{\text{Waste Flow}}{(3)(\text{Dilution water flow})}$$

The site specific applicable factor of 3 results in a conservative estimate of the near field dilution factor based upon Regulatory Guide 1.113 methodology and is a factor of ten below the limit specified in NUREG-0133, Section 4.3.

The dose factor A_{it} was calculated for an adult for each isotope using the following equation from NUREG-0133.

$$A_{it} = 1.14E5\ (730/D_w + 21BF_i)DF_{it} \qquad (1.3\text{-}2)$$

where:

$1.14E5 = 1E6\ \frac{pCi}{\mu Ci} \times 1E3\ \frac{ml}{l} \times \frac{1\ yr}{8760\ hr}$

730 = adult water consumption rate, liters/yr;

D_w = far field dilution factor from the near field area within one quarter mile of the release point to the potable water intake for adult water consumption;

21 = adult fish consumption, kg/yr;

BF_i = bioaccumulation factor for radionuclide "i" in fish from Table A-1 of Regulatory Guide 1.109 Rev. 1, pCi/kg per pCi/l, (if none, R.G. 1.109 Rev. 0);

DF_{it} = dose conversion factor for radionuclide "i" for adults for a particular organ t from Table E-11 of Regulatory Guide 1.109 Rev. 1, mrem/pCi, (If none, NUREG-0172 or R.G. 1.109 Rev. 0).

A table of A_{it} values for an adult at the BVPS-1 are presented in Table 1.3-1. The far field dilution factor (D_w) for the BVPS is 200. This value is based on a total dilution factor of 600 applicable to the Midland water intake located 1.3 miles downstream and on the opposite bank from the BVPS (ie. 200 = 600 ÷ 3). The total dilution factor of 600 represents a conservative fully mixed annual average condition. Since the Midland intake is located on the opposite bank and is below the water surface, essentially fully mixed conditions would have to exist for the radioactive effluent to be transported to the intake.

The cumulative doses for a calendar quarter and a calendar year are compared to the following BVPS-1 Technical Specification 3.11.1.2 limits:

For the calendar quarter,

$$D_\tau \leq 1.5 \text{ mrem total body} \qquad (1.3\text{-}3)$$

$$D_\tau \leq 5 \text{ mrem any organ} \qquad (1.3\text{-}4)$$

For the calendar year,

$$D_\tau \leq 3 \text{ mrem total body} \qquad (1.3\text{-}5)$$

$$D_\tau \leq 10 \text{ mrem any organ} \qquad (1.3\text{-}6)$$

If any of the limits in Expressions 1.3-3 through 1.3-6 are exceeded a Special Report pursuant to both Section IV.A of Appendix I of 10 CFR 50 and T.S. 3.11.1.2.a must be filed with the NRC at the identified locations.

1.3.2 Projection of Doses (Liquids)

Doses due to liquid releases shall be projected at least once per 31 days in accordance with BV-1 TS 4.11.1.3.1 and this section. The Liquid Radwaste Treatment System shall be used to reduce the radioactive materials in each liquid waste batch prior to its discharge in accordance with BV-1 TS 3.11.1.3 when the projected doses due to liquid effluent releases from the site averaged over 31 days would exceed 0.06 mrem to the total body or 0.2 mrem to any organ. Doses used in the projection are obtained according to equation 1.3-1. The 31-day dose projection shall be performed according to the following equations:

When including pre-release data

$$D_{31} = \left[\frac{A + B}{T}\right] 31 + C \qquad (1.3\text{-}7)$$

When not including pre-release data

$$D_{31} = \left[\frac{A}{T}\right] 31 + C \qquad (1.3\text{-}8)$$

where:

D_{31} = Projected 31 day dose, mrem
A^{31} = Cumulative dose for quarter, mrem
B = Projected dose from this release, mrem
T = Current days into quarter
C = Value which may be used to anticipate plant trends, mrem

TABLE 1.3-1

A_{it} VALUES FOR THE ADULT FOR THE BEAVER VALLEY SITE
(mrem/hr per μCi/ml)

NUCLIDE	BONE	LIVER	T-BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E-01	2.70E-01	2.70E-01	2.70E-01	2.70E-01	2.70E-01	2.70E-01
C-14	3.13E 04	6.26E 03	6.26E 03	6.26E 03	6.26E 03	6.26E 03	6.26E 03
NA-24	4.08E 02	4.08E 02	4.08E 02	4.08E 02	4.08E 02	4.08E 02	4.08E 02
P-32	4.62E 07	2.87E 06	1.79E 06	0.00E-01	0.00E-01	0.00E-01	5.19E 06
CR-51	0.00E-01	0.00E-01	1.27E 00	7.62E-01	2.81E-01	1.69E 00	3.21E 02
MN-54	0.00E-01	4.38E 03	8.35E 02	0.00E-01	1.30E 03	0.00E-01	1.34E 04
MN-56	0.00E-01	1.10E 02	1.95E 01	0.00E-01	1.40E 02	0.00E-01	3.52E 03
FE-55	6.59E 02	4.56E 02	1.06E 02	0.00E-01	0.00E-01	2.34E 02	2.61E 02
FE-59	1.04E 03	2.45E 03	9.38E 02	0.00E-01	0.00E-01	6.83E 02	8.15E 03
CO-57	0.00E-01	2.10E 01	3.50E 01	0.00E-01	0.00E-01	0.00E-01	5.33E 02
CO-58	0.00E-01	8.95E 01	2.01E 02	0.00E-01	0.00E-01	0.00E-01	1.81E 03
CO-60	0.00E-01	2.57E 02	5.67E 02	0.00E-01	0.00E-01	0.00E-01	4.83E 03
NI-63	3.12E 04	2.16E 03	1.05E 03	0.00E-01	0.00E-01	0.00E-01	4.51E 02
NI-65	1.27E 02	1.65E 01	7.51E 00	0.00E-01	0.00E-01	0.00E-01	4.17E 02
CU-64	0.00E-01	1.00E 01	4.70E 00	0.00E-01	2.52E 01	0.00E-01	8.53E 02
ZN-65	2.32E 04	7.37E 04	3.33E 04	0.00E-01	4.93E 04	0.00E-01	4.64E 04
ZN-69	4.93E 01	9.43E 01	6.56E 00	0.00E-01	6.13E 01	0.00E-01	1.42E 01
BR-33	0.00E-01	0.00E-01	4.04E 01	0.00E-01	0.00E-01	0.00E-01	5.82E 01
BR-84	0.00E-01	0.00E-01	5.24E 01	0.00E-01	0.00E-01	0.00E-01	4.11E-04
BR-85	0.00E-01	0.00E-01	2.15E 00	0.00E-01	0.00E-01	0.00E-01	0.00E-01
RB-86	0.00E-01	1.01E 05	4.71E 04	0.00E-01	0.00E-01	0.00E-01	1.99E 04
RB-88	0.00E-01	2.90E 02	1.54E 02	0.00E-01	0.00E-01	0.00E-01	4.00E-09
RB-89	0.00E-01	1.92E 02	1.35E 02	0.00E-01	0.00E-01	0.00E-01	1.12E-11
SR-89	2.22E 04	0.00E-01	6.39E 02	0.00E-01	0.00E-01	0.00E-01	3.57E 03
SR-90	5.48E 05	0.00E-01	1.34E 05	0.00E-01	0.00E-01	0.00E-01	1.58E 04
SR-91	4.10E 02	0.00E-01	1.65E 01	0.00E-01	0.00E-01	0.00E-01	1.95E 03
SR-92	1.55E 02	0.00E-01	6.72E 00	0.00E-01	0.00E-01	0.00E-01	3.08E 03
Y-90	5.80E-01	0.00E-01	1.55E-02	0.00E-01	0.00E-01	0.00E-01	6.15E 03
Y-91M	5.48E-03	0.00E-01	2.12E-04	0.00E-01	0.00E-01	0.00E-01	1.61E-02
Y-91	8.50E 00	0.00E-01	2.27E-01	0.00E-01	0.00E-01	0.00E-01	4.68E 03

TABLE 1.3-1

A_{it} VALUES FOR THE ADULT FOR THE BEAVER VALLEY SITE
(mrem/hr per μCi/ml)

NUCLIDE	BONE	LIVER	T-BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-92	5.09E-02	0.00E-01	1.49E-03	0.00E-01	0.00E-01	0.00E-01	8.92E 02
Y-93	1.62E-01	0.00E-01	4.46E-03	0.00E-01	0.00E-01	0.00E-01	5.12E 03
ZR-95	2.53E-01	8.11E-02	5.49E-02	0.00E-01	1.27E-01	0.00E-01	2.57E 02
ZR-97	1.40E-02	2.82E-03	1.29E-03	0.00E-01	4.26E-03	0.00E-01	8.73E 02
NB-95	4.47E 02	2.48E 02	1.34E 02	0.00E-01	2.46E 02	0.00E-01	1.51E 06
NB-97	3.75E 00	9.48E-01	3.46E-01	0.00E-01	1.11E 00	0.00E-01	3.50E 03
MO-99	0.00E-01	1.05E 02	2.00E 01	0.00E-01	2.38E 02	0.00E-01	2.43E 02
TC-99M	8.97E-03	2.54E-02	3.23E-01	0.00E-01	3.85E-01	1.24E-02	1.50E 01
TC-101	9.23E-03	1.33E-02	1.30E-01	0.00E-01	2.39E-01	6.79E-03	4.00E-14
RU-103	4.51E 00	0.00E-01	1.94E 00	0.00E-01	1.72E 01	0.00E-01	5.26E 02
RU-105	3.75E-01	0.00E-01	1.48E-01	0.00E-01	4.85E 00	0.00E-01	2.29E 02
RU-106	6.70E 01	0.00E-01	8.48E 00	0.00E-01	1.29E 02	0.00E-01	4.34E 03
AG-110M	9.48E-01	8.77E-01	5.21E-01	0.00E-01	1.72E 00	0.00E-01	3.58E 02
SB-124	7.87E 00	1.49E-01	3.12E 00	1.91E-02	0.00E-01	6.13E 00	2.23E 02
SB-125	5.03E 00	5.62E-02	1.20E 00	5.11E-03	0.00E-01	3.88E 00	5.54E 01
TE-125M	2.57E 03	9.30E 02	3.44E 02	7.72E 02	1.04E 04	0.00E-01	1.03E 04
TE-127M	6.49E 03	2.32E 03	7.90E 02	1.66E 03	2.63E 04	0.00E-01	2.17E 04
TE-127	1.05E 02	3.78E 01	2.28E 01	7.81E 01	4.29E 02	0.00E-01	8.32E 03
TE-129M	1.10E 04	4.11E 03	1.74E 03	3.78E 03	4.60E 04	0.00E-01	5.55E 04
TE-129	3.01E 01	1.13E 01	7.33E 00	2.31E 01	1.26E 02	0.00E-01	2.27E 01
TE-131M	1.66E 03	8.10E 02	6.75E 02	1.28E 03	8.21E 03	0.00E-01	8.05E 04
TE-131	1.89E 01	7.88E 00	5.96E 00	1.55E 01	8.27E 01	0.00E-01	2.67E 00
TE-132	2.41E 03	1.56E 03	1.47E 03	1.72E 03	1.50E 04	0.00E-01	7.39E 04
TE-134	3.10E 01	2.03E 01	1.25E 01	2.71E 01	1.96E 02	0.00E-01	3.44E-02
I-129	1.19E 02	1.02E 02	3.35E 02	2.63E 05	2.19E 02	0.00E-01	1.61E 01
I-130	2.75E 01	8.10E 01	3.20E 01	6.87E 03	1.26E 02	0.00E-01	6.97E 01
I-131	1.51E 02	2.16E 02	1.24E 02	7.08E 04	3.71E 02	0.00E-01	5.70E 01
I-132	7.37E 00	1.97E 01	6.90E 00	6.90E 02	3.14E 01	0.00E-01	3.71E 00
I-133	5.16E 01	8.97E 01	2.74E 01	1.32E 04	1.57E 02	0.00E-01	8.06E 01
I-134	3.85E 00	1.05E 01	3.74E 00	1.81E 02	1.66E 01	0.00E-01	9.12E-03

TABLE 1.3-1

A_{it} VALUES FOR THE ADULT FOR THE BEAVER VALLEY SITE
(mrem/hr per μCi/ml)

NUCLIDE	BONE	LIVER	T-BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-135	1.61E 01	4.21E 01	1.55E 01	2.78E 03	6.76E 01	0.00E-01	4.76E 01
CS-134	2.98E 05	7.09E 05	5.79E 05	0.00E-01	2.29E 05	7.61E 04	1.24E 04
CS-136	3.12E 04	1.23E 05	8.86E 04	0.00E-01	6.85E 04	9.39E 03	1.40E 04
CS-137	3.82E 05	5.22E 05	3.42E 05	0.00E-01	1.77E 05	5.89E 04	1.01E 04
CS-138	2.64E 02	5.22E 02	2.59E 02	0.00E-01	3.84E 02	3.79E 01	2.23E-03
BA-139	9.69E-01	6.90E-04	2.84E-02	0.00E-01	6.45E-04	3.92E-04	1.72E 00
BA-140	2.03E 02	2.55E-01	1.33E 01	0.00E-01	8.66E-02	1.46E-01	4.18E 02
BA-141	4.71E-01	3.56E-04	1.59E-02	0.00E-01	3.31E-04	2.02E-04	2.22E-10
BA-142	2.13E-01	2.19E-04	1.34E-02	0.00E-01	1.85E-04	1.24E-04	3.00E-19
LA-140	1.51E-01	7.59E-02	2.01E-02	0.00E-01	0.00E-01	0.00E-01	5.57E 03
LA-142	7.71E-03	3.51E-03	8.74E-04	0.00E-01	0.00E-01	0.00E-01	2.56E 01
CE-141	2.63E-02	1.78E-02	2.02E-03	0.00E-01	8.26E-03	0.00E-01	6.80E 01
CE-143	4.64E-03	3.43E 00	3.79E-04	0.00E-01	1.51E-03	0.00E-01	1.28E 02
CE-144	1.37E 00	5.73E-01	7.36E-02	0.00E-01	3.40E-01	0.00E-01	4.64E 02
PR-143	5.54E-01	2.22E-01	2.75E-02	0.00E-01	1.28E-01	0.00E-01	2.43E 03
PR-144	1.81E-03	7.53E-04	9.22E-05	0.00E-01	4.25E-04	0.00E-01	2.61E-10
ND-147	3.79E-01	4.38E-01	2.62E-02	0.00E-01	2.56E-01	0.00E-01	2.10E 03
W-187	2.96E 02	2.47E 02	8.65E 01	0.00E-01	0.00E-01	0.00E-01	8.10E 04
NP-239	2.90E-02	2.85E-03	1.57E-03	0.00E-01	8.89E-03	0.00E-01	5.85E 02

2.0 Gaseous Effluents

Technical specifications applicable to dose rate apply to the site. The site dose rate is due to the summation of releases from both units. Technical specifications applicable to accumulated dose apply individually to each unit. Releases at the Beaver Valley Site may be ground level or elevated in nature. All ground level releases are identified with a specific unit in the determination of site dose rate and dose attributed to that unit. Elevated releases from both units are considered to originate from a shared radwaste system and are discharged from a common release point, the Process Vent, at the top of the Unit 1 cooling tower. At Beaver Valley the dose from the shared radwaste system via the Process Vent is normally apportioned equally to the Units. However a containment purge via the Process Vent shall be attributed to a specific unit.

2.1 Monitor Alarm Setpoint Determination

Technical specifications for Beaver Valley require that the dose rate in unrestricted areas due to noble gas radionuclides in the gaseous effluent released from the site shall be limited to ≤ 500 mrem/yr to the total body and to ≤ 3000 mrem/yr to the skin.

This section describes the methodology used to maintain the release of noble gas radionuclides within the Technical Specifications limits for the site and determines monitor setpoints for this unit.

The methodologies described in Sections 2.1.3 and 2.1.4 provide an alternate means of determining monitor alarm setpoints that may be used when an analysis is performed prior to release.

Control of the site dose rate limit due to noble gases is exercised by a total of eight effluent stream monitors, of which three are located in Unit 1 (alternates exists for these monitors), and five are located in Unit 2. As previously noted, Unit 2 elevated releases are via the Unit 1 Process Vent.

At this point it is necessary to point out differences that exist between the setpoint presentations of the radiation monitoring systems of BVPS-1 and BVPS-2. First there is a conflict in setpoint terminology. Where BVPS-1 uses HIGH and HIGH-HIGH the BVPS-2 equivalents are ALERT and HIGH. The second difference is that the BVPS-2 setpoint is presented in µCi/cc rather than CPM as in BVPS-1. This difference is due to software which applies a conversion factor to the raw data (CPM). The user is cautioned that the µCi/cc presentation is technically correct only for the specific isotopic mix used in the determination of the conversion factor. In practice setpoints determined for a calculated mix are correct for that mix. Setpoints determined on analysis prior to release will be correct for properly controlling dose rate but the indicated µCi/cc value may differ from the actual value.

All effluent monitors specified herein have HIGH-HIGH (BV-1) or HIGH (BV-2) setpoints established at 30 percent of the site limit and except three monitors noted below, HIGH (BV-1) or ALERT (BV-2) setpoints established at 10 percent of the site limit.

Monitor Setpoint Specifications Based on Fraction of Site Limit

Unit, Release Point & Monitor	Fraction of Site Limiting Dose Rate	
Unit 1, Ventilation Vent RM-VS-101B (Alt. VS-109 CH #5)	30% (HIGH-HIGH)	10% (HIGH)
Unit 1, Containment Vent RM-VS-107B (Alt. VS-110 CH #5)	30% (HIGH-HIGH)	10% (HIGH)
Units 1/2, Process Vent RM-GW-108B (Alt. GW-109 CH #5)	30% (HIGH-HIGH)	10% (HIGH)
Unit 2, Containment Vent 2HVS*RQ109B	30% (HIGH)	10% (ALERT)
Unit 2, Ventilation Vent 2HVS-RQ101B	30% (HIGH)	10% (ALERT)
Unit 2, Waste Gas Storage Vault 2RMQ-RQ303B	30% (HIGH)	0.1% (ALERT)
Unit 2, Decontamination Building Vent 2RMQ-RQ301B	30% (HIGH)	0.3% (ALERT)
Unit 2, Condensate Polishing Building Vent 2HVL-RQ112B	30% (HIGH)	0.6% (ALERT)
Units 1/2, Turbine Building Vent	< 0.1% (Unmonitored)	

With the monitor setpoints based on fractions of the site limit as defined above, the following criteria may be applied to determine that the dose rate due to noble gas released from the site complies with Technical Specifications:

- The site dose rate is less than 50% of the site limit when all monitors are below the HIGH (BV-1) and ALERT (BV-2) setpoints.
- With all monitors below the normal HIGH-HIGH (BV-1) and HIGH (BV-2) setpoints, a combination of three HIGH (BV-1) or ALERT (BV-2) setpoint alarms indicate release may have exceeded site limits.
- To provide operational flexibility any one HIGH-HIGH (BV-1) or HIGH (BV-2), Containment, Ventilation, or Process vent monitor setpoint may be doubled to 60% of the Site limit if all other monitors in this group are held below the HIGH (BV-1) and ALERT (BV-2) setpoints.

- From this condition any one monitor alarm would indicate the site dose rate limit may have been exceeded.

A release may be batch or continuous in nature. Batch refers to releases that are intermittent in radionuclide concentrations or flow, such as releases from gas storage tanks, containment ventings and purges, and systems or components with infrequent use. Batch releases may be due to operational variations which result in radioactive releases greater than 50% of the releases normally considered as continuous. Batch releases from these sources during normal operation, including anticipated operational occurrences, are defined as those which occur for a total of 500 hours or less in a calendar year but not more than 150 hours in any quarter. The batch relative concentration value has been calculated in accordance with the guidelines provided in NUREG-0324 for short-term release. If simultaneous batch and continuous release out of one vent occurs, use the lowest setpoint obtained according to the following Sections 2.1.1 through 2.1.4.

2.1.1 Setpoint Determination Based on a Calculated Mix for Ventilation Vent and Containment Building Vent Releases (Ground Releases)

The calculated monitor count rate above background (C.R.), in ncpm, the monitor HIGH-HIGH alarm setpoint above background (HHSP), and the monitor HIGH alarm setpoint above background (HSP) for each vent and operational condition should be as follows:

		CPM above Background		
	PRIMARY MONITOR	C.R.	30% SITE LIMIT HHSP	10% SITE LIMIT HSP
• Continuous Release Via The Ventilation Vent	VS-101B	3.00E3	9.00E2	3.00E2
• Batch Release of Containment Purge Via the Ventilation Vent	VS-101B	3.90E2	1.17E2	3.90E1
• Continuous Release Via The Containment Building Vent	VS-107B	6.44E3	1.93E3	6.44E2
• Batch Release of Containment Purge Via the Containment Building Vent	VS-107B	1.93E3	5.80E2	1.93E2

When the primary monitor is O.O.S. and technical specifications can be met for the respective alternate monitor, the following setpoints may be utilized:

	ALTERNATE MONITOR	CPM Above Background C.R.	30% SITE LIMIT HSP	10% SITE LIMIT HSP
• Continuous Release Via The Ventilation Vent	VS-109 CHANNEL 5	1.47E3	4.40E2	1.47E2
• Batch Release of Containment Purge Via the Ventilation Vent	VS-109 CHANNEL 5	4.68E2	1.40E2	4.68E1
• Continuous Release Via The Containment Building Vent	VS-110 CHANNEL 5	3.38E3	1.01E3	3.38E2
• Batch Release of Containment Purge Via the Containment Building Vent	VS-110 CHANNEL 5	1.01E3	3.04E2	1.01E2

The setpoints were determined using the following conditions and information:

- Source terms given in Table 2.1-1. These gaseous source terms were derived from Stone & Webster computer codes GAS1BB (which is similar to the NRC CODE GALE, NUREG-0017) and DRAGON 4 (for the containment vacuum pump sources). Table 2.1-1 does not include particulates and iodines, which are not used in site noble gas dose rate calculations.
- Onsite meteorological data for the period January 1, 1976 through December 31, 1980.
- Discharge flow rate of 62,000 cfm for the Ventilation Vent (Continuous)
- Discharge flow rate of 92,000 cfm for the Ventilation Vent (Batch release of containment purge).
- Discharge flow rate of 49,300 cfm for the Containment Building Vent (Both continuous and batch release of containment purge).
- Information listed under References - Gaseous Effluent Monitor Setpoints.

The calculation method given in Sections 2.1.1.1 through 2.1.1.7 was used to derive the monitor setpoints for the following operational conditions:

- Continuous release via the Ventilation Vent.
- Continuous release via the Containment Building Vent.
- Batch release of containment purge via the Ventilation Vent.
- Batch release of containment purge via the Containment Building Vent.

2.1.1.1 The "mix" (noble gas radionuclides and composition) of the gaseous effluent was determined as follows:

a. The gaseous source terms that are representative of the "mix" of the gaseous effluent were selected. Gaseous source terms are the radioactivity of the noble gas radionuclides in the effluent. Gaseous source terms can be obtained from Table 2.1-1.

b. The fraction of the total radioactivity in the gaseous effluent comprised of noble gas radionuclide "i" (S_i) for each individual noble gas radionuclide in the gaseous effluent was determined by:

$$S_i = \frac{A_i}{\sum_i A_i}$$

where:

A_i = The total radioactivity or radioactivity concentration of noble gas radionuclide "i" in the gaseous effluent from Table 2.1-1.

2.1.1.2 The maximum acceptable total release rate in uCi/sec of all noble gas radionuclides in the gaseous effluent ($\dot{Q}_t$) based upon the whole body exposure limit was calculated by:

$$\dot{Q}_t = \frac{500}{(X/Q) \sum_i K_i S_i} \qquad (2.1\text{-}2)$$

where:

$(X/Q)_{VV}$ = The highest calculated annual average relative concentration of effluents released via the Ventilation Vent for any area at or beyond the unrestricted area boundary for all sectors (sec/m^3) from Table 2.2-5.

= 1.03E-4 sec/m^3 for continuous releases.

$(X/q)_{VV}$ = The short term relative concentration of effluents released via the Ventilation Vent for any area at or beyond the unrestricted area boundary for all sectors (sec/m^3) from Table A-3 of Appendix A.

= 3.32E-4 sec/m^3 for batch release of containment purge.

$(X/Q)_{cv}$ = The highest calculated annual average relative concentration of effluents released via the Containment Building Vent for any area at or beyond the unrestricted area boundary for all sectors (sec/m^3) from Table 2.2-4.

= 9.24E-5 sec/m^3 for continuous releases

$(X/q)_{cv}$ = The short term relative concentration of effluents released via the containment building vent for any area at or beyond the unrestricted area boundary for all sectors (sec/m^3) from Table A-2 of Appendix A.

= 3.08E-4 sec/m^3 for batch release of containment purge

K_i = The total whole body dose factor due to gamma emmissions from noble gas radionuclide "i" (mrem/year/μCi/m^3) from Table 2.2-11.

S_i = From equation (2.1-1) above.

2.1.1.3 $\dot{Q}_t$ was also determined based upon the skin exposure limit by:

$$\dot{Q}_t = \frac{3000}{(X/Q) \sum_i (L_i + 1.1M_i) S_i} \qquad (2.1\text{-}3)$$

where:

L_i = The skin dose factor due to beta emissions from noble gas radionuclide "i" (mrem/year/μCi/m^3) from Table 2.2-11.

M_i = The air dose factor due to gamma emissions from noble gas radionuclide "i" (mrad/year/μCi/m^3) from Table 2.2-11.

1.1 = The ratio of the tissue to air absorption coefficients over the energy range of the photons of interest, (mrem/mrad).

(X/Q) = same as in Section 2.1.1.2.

2.1.1.4 The maximum acceptable release rate in μCi/sec of noble gas radionuclide "i" in the gaseous effluent ($\dot{Q}_i$) for each individual noble gas radionuclide in the gaseous effluent was determined by:

$$\dot{Q}_i = S_i \dot{Q}_t \qquad (2.1\text{-}4)$$

(NOTE: Use the lower of the $\dot{Q}_t$ values obtained in Section 2.1.1.2 and 2.1.1.3)

2.1.1.5 The maximum acceptable radioactivity concentration μCi/cc of noble gas radionuclide "i" in the gaseous effluent (C_i) for each individual noble gas radionuclide in the gaseous effluent was determined by:

$$C_i = \frac{2.12\ E\text{-}3\ \dot{Q}_i}{F} \qquad (2.1\text{-}5)$$

where:

F = The maximum acceptable effluent flow rate at the point of release (cfm)

= 62,000 cfm (Ventilation Vent)(1)

= 49,300 cfm (Containment Building Vent)(1)

2.12E-3 = Unit conversion factor (60 sec/min x 3.53 E-5 ft^3/cc).

2.1.1.6 The calculated monitor count rate in ncpm above background attributed to the noble gas radionuclide (C.R.) was determined by:

$$C.R. = \sum_i C_i E_i \qquad (2.1\text{-}6)$$

where:

E_i = The detection efficiency of the monitor for noble gas radionuclide "i" (cpm/μCi/cc) from Table 2.1-2.

2.1.1.7 The monitor alarm setpoints above background were determined as follows:

a. The monitor HIGH-HIGH alarm HHSP setpoint above background (in ncpm) was determined by:

$$HHSP = 0.30\ C.R. \qquad (2.1\text{-}7)$$

b. The monitor HIGH alarm setpoint HSP above background (in ncpm) was determined by:

$$HSP = 0.10\ C.R. \qquad (2.1\text{-}8)$$

NOTE: The values 0.3 for the HHSP and 0.1 for the HSP are fractions of the total radioactivity concentration that may be released via the monitored pathway to ensure that the site boundary limit is not exceeded due to simultaneous releases from both units.

2.1.2 Setpoint Determination Based on a Calculated Mix for Process Vent Releases (Elevated Releases)

The calculated monitor count rate above background (C.R.), in ncpm, the monitor HIGH-HIGH alarm setpoint above background (HHSP), and the monitor HIGH alarm setpoint above background (HSP) for each operational condition are as follows:

	PRIMARY MONITOR	C.R.	CPM Above Background 30% SITE LIMIT HHSP	CPM Above Background 10% SITE LIMIT HSP
• Continuous Release	GW-108B	3.83E7	1.15E7	3.83E6
• Batch Release of Decay Tanks	GW-108B	3.93E5	1.18E5	3.93E4
• Batch Release of Containment Purge	GW-108B	5.55E6	1.67E6	5.55E5

When the primary monitor is out of service and technical specifications can be met for the respective alternate monitor, the following setpoints may be utilized:

	ALTERNATE MONITOR	C.R.	CPM Above Background 30% SITE LIMIT HHSP	CPM Above Background 10% SITE LIMIT HSP
• Continuous Release	GW-109 CHANNEL 5	2.20E7	6.61E6	2.20E6
• Batch Release of Decay Tanks	GW-109 CHANNEL 5	7.87E6	2.36E6	7.87E5
• Batch Release of Containment Purge	GW-109 CHANNEL 5	7.37E6	2.21E6	7.37E5

The setpoints were determined using a calculated mix from the FSAR and discharge flow rate of 1450 cfm for the Process Vent.

The calculational method below was used to derive the monitor setpoints for the following operational conditions:

- Continuous release via the Process Vent
- Batch release of waste gas tank via the Process Vent
- Batch release of containment purge via the Process Vent

2.1.2.1 The "mix" (noble gases and composition) of the gaseous effluent was determined as follows:

a. The gaseous source terms that are representative of the "mix" of the gaseous effluent were evaluated. Gaseous source terms are the radioactivity of the noble gases radionuclides in the effluent. The gaseous source terms can be obtained from Table 2.1-1.

b. The fraction of the total radioactivity in the gaseous effluent comprised by noble gas radionuclide "i" (S_i) for each individual noble gas radionuclide in the gaseous effluent was calculated by:

$$S_i = \frac{A_i}{\sum_i A_i} \qquad (2.1\text{-}9)$$

where:

A_i = The total radioactivity or radioactivity concentration of noble gas radionuclide "i" in the gaseous effluent from Table 2.1-1.

2.1.2.2 The maximum acceptable total release rate (in μCi/sec) of all noble gas radionuclides in the gaseous effluent ($\dot{Q}_t$) based upon the whole body exposure limit was determined by:

$$\dot{Q}_t = \frac{500}{\sum_i V_i S_i} \qquad (2.1\text{-}10)$$

where:

V_i = The constant for noble gas radionuclide "i" accounting for the gamma radiation from the elevated finite plume (mrem/year/μCi/sec) from Table 2.2-12.

2.1.2.3 $\dot{Q}_t$ was also determined based upon the skin exposure limit as follows:

$$\dot{Q}_t = \frac{3000}{\sum_i [L_i (X/Q)_{pv} + 1.1 B_i] S_i} \qquad (2.1\text{-}11)$$

where:

L_i = The skin dose factor due to beta emissions from noble gas radionuclide "i" (mrem/year/μCi/m³) from Table 2.2-11.

$(X/Q)_{pv}$ = The highest calculated annual average relative concentration of effluents releases via the Process Vent for any area at or beyond the unrestricted area boundary for all sectors (sec/m^3) from Table 2.2-6.

= 2.31E-6 sec/m^3

$(X/q)_{pv}$ = The short term relative concentration of effluents released via the Process Vent for any area at or beyond the unrestricted area boundary for all sectors (sec/m^3) from Table A-5 of Appendix A.

= 1.07E-5 sec/m^3

B_i = The constant for long term releases (greater than 500 hrs/year) for noble gas radionuclide "i" accounting for the gamma radiation dose from the elevated finite plume (mrad/year/μCi/sec) from Table 2.2-12.

2.1.2.4 The maximum acceptable release rate (in μCi/sec) of noble gas radionuclide "i" in the gaseous effluent ($\dot{Q}_i$) for each individual noble gas radionuclide in the gaseous effluent was determined by:

$$\dot{Q}_i = S_i \dot{Q}_t \qquad (2.1\text{-}12)$$

(NOTE: Use the lower of the $\dot{Q}_t$ values obtained in Section 2.1.2.2 and 2.1.2.3)

2.1.2.5 The maximum acceptable radioactivity concentration (in μCi/cc) of noble gas radionuclide "i" in the gaseous effluent (C_i) for each individual noble gas radionuclide in the gaseous effluent was determined by:

$$C_i = \frac{2.12\ E\text{-}3\ \dot{Q}_i}{F} \qquad (2.1\text{-}13)$$

where:

2.12E-3 = Unit conversion factor (60 sec/min x 3.53E-5 ft^3/cc)

F = The maximum acceptable effluent flow rate at the point of release (cfm)

= 1450 cfm (Process Vent)

2.1.2.6 The calculated monitor count rate (in ncpm) above background attributed to the noble gas radionuclides (C.R.) was determined by:

$$C.R. = \sum_i C_i E_i \qquad (2.1\text{-}14)$$

where:

E_i = The detection efficiency of the monitor for noble gas radionuclide "i" (cpm/μCi/cc) from Table 2.1-2.

2.1.2.7 The monitor alarm setpoints above background were determined as follows:

a. The monitor HIGH-HIGH alarm setpoint (HHSP) above background (in ncpm) was determined by:

$$HHSP = 0.30\ C.R. \qquad (2.1\text{-}15)$$

b. The monitor HIGH alarm setpoint (HSP) above background (in ncpm) was determined by:

$$HSP = 0.10\ C.R. \qquad (2.1\text{-}16)$$

2.1.3 Setpoint Determination Based on Analysis Prior to Release for Ventilation Vent and Containment Building Vent Release (Ground Releases)

When the setpoints established using "the calculated mix" for ground releases do not provide adequate flexibility for operational needs, the method described below may be used in lieu of that set forth in Step 2.1.1. In this case, the results of sample analysis are used to determine the source term "mix". This calculational method applies to gaseous releases via the Ventilation Vent and via the Containment Building Vent when determining the setpoint for the maximum acceptable discharge flow rate and the associated HIGH-HIGH alarm setpoint based on this flow rate for the Ventilation Vent Gas Monitor (VS-101B) and the Containment Building Gas Monitor (VS-107B) during the following operational conditions:

- Batch release of containment purge via the Ventilation Vent
- Batch release of containment purge via the Containment Building Vent

NOTE: If the radioactivity of a noble gas radionuclide is below the LLD value specified in Table 4.11-2 of the BVPS Technical Specifications, the noble gas radionuclide should not be included as a source term in this setpoint calculation.

2.1.3.1 The maximum acceptable discharge flow rate from containment vent or ventilation vent during purging is determined as follows:

a. The maximum acceptable gaseous discharge flow rate (f) from containment or ventilation vent (in cfm) during purging based upon the whole body exposure limit is calculated by:

$$f = \frac{1.06\ S\ T}{(X/q)\ \sum_i K_i\ C_i} \qquad (2.1\text{-}17)$$

where:

1.06 = 500 mrem/yr x 2 12 E-3

500 mrem/yr = dose rate limit
2.12 E-3 = unit conversion factor
= (60 sec/min x 3.53 E-5 ft^3/cc)

S = Percent of site dose rate released via this pathway. Up to 60% of the site dose rate is permissible for one release point under the alarm set point rules of Section 2.1. To exceed 60% of the site limit from one release point, the remaining release point limits must be correspondingly reduced or secured to provide the necessary margin below the site dose rate limit.

T = Maximum valve for T is 16 based on the limiting restriction in T.S. 3.11.2.1.a where the dose rate for a containment purge may be averaged over a time period not to exceed 960 minutes. (As containment air volume change time period is 60 minutes; T = 960/60 = 16). See Reference (6).

$(X/q)_{vv}$ = The highest calculated short term relative concentration of effluents released via the Ventilation Vent for any area at or beyond the unrestricted area boundary for all sectors (sec/m^3) from Table A-3 of Appendix A.

= 3.32E-4 sec/m^3

$(X/q)_{cv}$ = The highest calculated short term relative concentration of effluents released via the Containment Building Vent for areas at or beyond the unrestricted area boundary for all sectors (sec/m^3) from Table A-4 of Appendix A.

= 3.08E-4 sec/m^3

K_i = The total whole body dose factor due to gamma emissions from noble gas radionuclide "i" (mrem/year/$\mu Ci/m^3$) from Table 2.2-11.

C_i = The undiluted radioactivity concentration of noble gas radionuclide "i" in the gaseous source ($\mu Ci/cc$) as determined by analysis of the gas to be released.

b. The flow rate (f) is also determined based upon the skin exposure limit as follows:

$$f = \frac{6.36 S\ T}{(X/q) \sum_i (L_i + 1.1M_i)\ C_i} \qquad (2.1\text{-}18)$$

where:

6.36 = 3000 mrem/yr x 2.12 E-3

3000 mrem/yr = dose rate limit
2.12 E-3 = unit conversion factor
= (60 sec/min x 3.53 E-5 ft^3/cc)

L_i = The skin dose factor due to beta emissions from noble gas radionuclide "i" (mrem/year/µCi/m^3) from Table 2.2-11.

M_i = The air dose factor due to gamma emissions from noble gas radionuclide "i" (mrad/year/µCi/m^3) from Table 2.2-11.

(X/q) = Same as in Section 2.1.3.1.a.

c. The flow rate (f) is determined by selecting the smaller of the calculated (f) values based on the whole body exposure limit (Section 2.1.3.1.a) and based on the skin exposure limit (Section 2.1.3.1.b). The actual purge flow rate in cfm must be maintained at or below this calculated (f) value or the discharge cannot be made from the vent.

2.1.3.2 The monitor alarm setpoints above background are determined as follows:

a. The calculated monitor HIGH-HIGH alarm setpoint (HHSP) above background (ncpm) attributed to the noble gas radionuclides is determined by:

$$HHSP = \frac{f \sum_i C_i\ E_i}{F'} \qquad (2.1\text{-}19)$$

where:

f = The maximum acceptable gaseous discharge flow rate (cfm) determined in Section 2.1.3.1.

F' = The maximum actual or design effluent flow rate (cfm) at the point of release.

= 92,000 cfm (Ventilation Vent -- design).(1)

= 49,300 cfm (Containment Building Vent -- design).(1)

C_i = The undiluted radioactivity concentration of noble gas radionuclide "i" in the gaseous source (µCi/cc) as determined by analysis of the gas to be released.

E_i = The detection efficiency of the monitor for noble gas radionuclide "i" (cpm/µCi/cc) from Table 2.1-2.

b. When a HIGH-HIGH set point has been calculated according to this section the monitor HIGH alarm setpoint above background (ncpm) is determined as follows:

$$HHSP \times 0.70 = HSP \qquad (2.1\text{-}20)$$

2.1.4 Setpoint Determination Based on Analysis Prior to Release for Process Vent Releases (Elevated Releases)

The following calculation method applies to gaseous releases via the Process Vent when the "calculated mix" does not provide adequate operational flexibility. This method is used to determine the setpoint for the maximum acceptable discharge flow rate and the associated HIGH-HIGH alarm setpoint based on this flow rate for the BVPS-1 Gaseous Waste Gas Monitor (GW-108B) or alternate (GW-109 CH #5) during the following operational conditions:

- Continuous release via the Process Vent
- Batch release of waste gas decay tank via the Process Vent
- Batch release of containment purge via the Process Vent

NOTE: If the radioactivity of a noble gas radionuclide is below the LLD value specified in the BVPS Technical Specifications, the noble gas radionuclide should not be included as a source term in this setpoint calculation.

2.1.4.1 Determine the maximum acceptable discharge flow rate for the release from the Process Vent for the analyzed mix.

a. The maximum acceptable gaseous discharge flow rate (f) in cfm based upon the whole body exposure limit is determined by:

$$f = \frac{1.06\ S}{\sum_i V_i\ C_i} \qquad (2.1\text{-}21)$$

where:

1.06 = 500 mrem/yr x 2.12 E-3

500 mrem/yr = dose rate limit, whole body exposure
2.12 E-3 = unit conversion factor
= (60 sec/min x 3.53 E-5 ft^3/cc)

S = Percent of site dose rate released via this pathway. Up to 60% of the site dose rate is permissible for one release point under the alarm set point rules of Section 2.1. To exceed 60% of the site limit from one release point, the remaining release point limits must be correspondingly reduced or secured to provide the necessary margin below the site dose rate limit.

V_i = The constant for noble gas radionuclide "i" accounting for the gamma radiation from the elevated plume (mrem/year/μCi/sec) from Table 2.2-12.

C_i = The undiluted radioactivity concentration of noble gas radionuclide "i" in the gaseous source (μCi/cc) as determined by analysis of the gas to be released.

b. Based upon the skin exposure limit, (f) is calculated by:

$$f = \frac{6.36\ S}{\sum_i \left[L_i (X/Q)_{pv} + 1.1 B_i\right] C_i} \qquad (2.1\text{-}22)$$

where:

6.36 = 3000 mrem/yr x 2.12 E-3

3000 mrem/yr = dose rate limit, skin exposure
2.12 E-3 = unit conversion factor
= (60 sec/min x 3.53 E-5 ft^3/cc)

L_i = The skin dose factor due to beta emissions from noble gas radionuclide "i" (mrem/year/μCi/m^3) from Table 2.2-11.

$(X/Q)_{pv}$ = The highest calculated annual average relative concentration of effluents released via the Process Vent for any area at or beyond the unrestricted area boundary for all sectors (sec/m^3) from Table 2.2-6.

= 2.31E-6 sec/m^3.

$(X/q)_{pv}$ = The short term relative concentration of effluents released via the Process Vent for any area at or beyond the unrestricted area boundary for all sectors (sec/m^3) from Table A-5 of Appendix "A"

= 1.07E-5 sec/m^3

B_i = The constant for long-term releases (greater than 500 hrs/year) for noble gas radionuclide "i" accounting for the gamma radiation from the gamma radiation from the elevated finite plume (mrad/year/μCi/sec) from Table 2.2-12.

c. Select the smaller of the calculated f values based on the whole body exposure limit (Section 2.1.4.1.a) and based on the skin exposure limit (Section 2.1.4.1.b). The actual discharge flow rate in (cfm) must be maintained at or below this f value.

2.1.4.2 The monitor alarm setpoints above background are determined as follows:

a. The calculated monitor HIGH-HIGH alarm setpoint (HHSP) above background (ncpm) attributed to the noble gas radionuclides is determined by:

$$HHSP = \frac{f \sum_i C_i E_i}{F'} \qquad (2.1\text{-}23)$$

where:

f = The maximum acceptable gaseous discharge flow rate (cfm) determined in Section 2.1.4.1.

F' = The maximum actual or design effluent flow rate (cfm) at the point of release.

= 1450 cfm (Process Vent)

C_i = The undiluted radioactivity of noble gas radionuclide "i" in the gaseous source (μCi/cc) as determined by analysis of the gas to be released.

E_i = The detection eificiency of the respective monitor GW-108B or GW-109 CH 5 for noble gas radionuclide "i" (cpm/μCi/cc) from Table 2.1-2.

b. When a HIGH-HIGH set point has been calculated accordir, to this Section the monitor HIGH alarm setpoint (HSP) above background (ncpm) is determined by:

$$HHSP \times 0.70 = HSP \qquad (2.1\text{-}24)$$

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RADIONUCLIDE MIX FOR GASEOUS EFFLUENTS FROM THE BEAVER VALLEY POWER STATION UNIT 1 (CI/YR)**

Nuclide	Containment Vent (Long Term) Containment Building* (Short Term)	Ventilation Vent Auxiliary Building Ventilation (Long Term)	Turbine Bldg. Vent Turbine Building Ventilation (Long Term)	PROCESS VENT Main Condenser/ Air Ejector (Long Term)	PROCESS VENT Containment Vacuum Pumps (Long Term)***	PROCESS VENT Radioactive Gaseous Waste System (Short Term)
Kr-83m	2.2E-02	4.2E-01	3.9E-05	2.7E-01	3.7E-04	0.0
Kr-85m	1.5E-01	1.9E+00	1.7E-04	1.2E+00	3.9E-03	7.3E-02
Kr-85	6.1E+01	2.5E+00	2.3E-04	1.6E+00	7.2E-01	2.3E+02
Kr-87	5.4E-02	1.3E+00	1.1E-04	8.2E-01	7.8E-04	0.0
Kr-88	2.4E-01	3.8E+00	3.5E-04	2.4E+00	5.0E-03	0.0
Kr-89	4.7E-04	1.2E-01	1.1E-05	7.7E-02	3.1E-06	0.0
Xe-131m	7.4E-01	1.3E-01	1.2E-05	8.0E-02	1.3E-02	1.3E+00
Xe-133m	8.9E-01	8.9E-01	8.1E-05	5.6E-01	2.2E-02	0.0
Xe-133	8.9E+01	3.6E+01	3.4E-03	2.3E+01	1.9E-00	2.3E+01
Xe-135m	4.5E-03	3.2E-01	2.9E-05	2.0E-01	4.4E-05	0.0
Xe-135	7.0E-01	4.5E+00	4.2E-04	2.8E+00	1.9E-02	0.0
Xe-137	1.0E-03	2.1E-01	2.1E-05	1.3E-01	6.3E-06	0.0
Xe-138	1.5E-02	1.1E+00	9.7E-05	6.6E-01	1.2E-04	0.0
Ar-41	2.5E+01	0.0	0.0	0.0	0.0	0.0

* Containment can be purged via Ventilation Vent, Containment Vent, or Process Vent

** Reference 2

*** See Section 2.1.1

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BV-1 ODCM TABLE 2.1-2 MONITOR DETECTOR EFFICIENCIES

EFFICIENCY IN CPM/μCi/cc, CORRECTED (1.)

RADIONUCLIDE	VENTILATION VENT GAS		PROCESS VENT GAS		CONTAINMENT-BUILDING VENT	
	VS-101B	VS-109 CH5	GW-108B	GW-109 CH5	VS-107B	VS-110 CH5
Kr-83m	-	-	-	-	-	-
Kr-85m	9.80 E7	2.39 E7	9.00 E7	2.43 E7	5.16 E7	2.57 E7
Kr-85	3.88 E5	2.47 E7	3.56 E5	2.51 E7	5.04 E7	2.67 E7
Kr-87	7.38 E7	2.95 E7	6.78 E7	3.00 E7	9.60 E7	3.19 E7
Kr-88	1.14 E8	2.11 E7	1.05 E8	2.14 E7	5.16 E7	2.28 E7
Kr-89	1.39 E8	2.93 E7	1.28 E8	2.98 E7	9.59 E7	3.16 E7
Kr-90	1.34 E8	3.05 E7	1.23 E8	3.10 E7	9.87 E7	3.29 E7
Xe-131m	2.25 E6	1.56 E7	2.07 E6	1.59 E7	2.94 E7	1.68 E7
Xe-133m	1.26 E7	1.94 E7	1.16 E7	1.97 E7	4.17 E7	2.09 E7
Xe-133	1.01 E7	1.24 E7	9.24 E6	1.26 E7	2.28 E7	1.33 E7
Xe-135m	7.15 E7	5.70 E6	6.58 E7	5.80 E6	1.51 E7	6.15 E6
Xe-135	1.12 E8	2.91 E7	1.03 E8	2.96 E7	6.42 E7	3.14 E7
Xe-137	3.16 E7	2.96 E7	2.91 E7	3.01 E7	1.05 E8	3.19 E7
Xe-138	1.15 E8	2.66 E7	1.06 E8	2.70 E7	7.35 E7	2.87 E7
Ar-41	7.17 E7	3.00 E7	6.59 E7	3.05 E7	7.19 E7	3.23 E7

(1.) Table 2.1-2 lists detector efficiencies for the respective Victoreen Monitors corrected for the reduced pressures observed and documented during operation. Also listed are the SPING Channel 5 efficiencies corrected for detector unique installation factors. (pressure corrections are not required for the SPING monitors) See reference (4) for additional information.

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REFERENCES

Gaseous Effluent Monitor Setpoints

(1) "Beaver Valley Power Station, Appendix I Analysis - Docket No. 50-334 and 50-412", Table 2.1.3.

(2) "Beaver Valley Power Station, Unit 2 FSAR", Table 11.3-1

(3) "Duquesne Light Co., Beaver Valley Nuclear Plant, Specification No. BVPS 414, Table V Nuclide Data, 5/30/74", Table 1 and Figure 1, Table 3, and Figure 2.

(4) Gaseous Effluent Monitor Efficiency Data; Calculation Package ERS-SFL-85-031.

(5) Unit 1/Unit 2 Setpoints Calculation Package ERS-MHM-87-014.

(6) BVPS-1 and BVPS-2 ODCM T Factor Justification; Calculation Package ERF-ATL-87-026.

2.2 Compliance with 10 CFR 20 (Gaseous)

2.2.1 Noble Gases

The dose rate in unrestricted areas resulting from noble gas effluents from the site is limited to 500 mrem/yr to the total body and 3,000 mrem/yr to the skin. Site gaseous effluents are the total of Beaver Valley Unit 1 and Unit 2 specific ground releases and a shared elevated release, the Process Vent. Based upon NUREG-0133 the following basic expressions are used to show compliance with BVTS 3.11.2.1.a.

$$\sum_i \left[V_i \dot{Q}_{is} + K_i (\overline{X/Q})_v \dot{Q}_{iv}\right] < 500 \text{ mrem/yr} \qquad (2.2\text{-}1)$$

$$\sum_i \left[\left[L_i (\overline{X/Q})_s + 1.1 B_i\right] \dot{Q}_{is} + \left[L_i + 1.1 M_i\right] (\overline{X/Q})_v \dot{Q}_{iv}\right] \leq 3000 \text{ mrem/yr} \qquad (2.2\text{-}2)$$

where:

K_i = the total body dose factor due to gamma emmissions for each identified noble gas radionuclide "i", mrem/year/μCi/m³.

L_i = the skin dose factor due to beta emissions for each identified noble gas radionuclide "i", mrem/year/μCi/m³.

M_i = the air dose factor due to gamma emissions for each identified noble gas radionuclide "i", mrad/year/μCi/m³.

V_i = the constant for each identified noble gas radionuclide "i" accounting for the gamma radiation from the elevated finite plume, mrem/year/μCi/sec.

B_i = the constant for long-term releases (greater than 500 hrs/year) for each identified noble gas radionuclide "i" accounting for the gamma radiation from the elevated finite plume, mrad/year/μCi/sec.

1.1 = the ratio of the tissue to air absorption coefficients over the energy range of the photon of interest, mrem/mrad.

$\dot{Q}_{is}$ = the release rate of noble gas radionuclide "i" in gaseous effluents from free-standing stack, μCi/sec.

$\dot{Q}_{iv}$ = the release rate of noble gas radionuclide "i" in gaseous effluents from all vent releases, μCi/sec.

$(\overline{X/Q})_s$ = the highest calculated annual average relative concentration for any area at or beyond the unrestricted area boundary for elevated releases (sec/m³).

$(\overline{X/Q})_v$ = the highest calculated annual average relative concentration for any area at or beyond the unrestricted area boundary for ground level releases (sec/m^3).

At the Beaver Valley Site gaseous releases may occur from:

1. the Containment Vents atop the containment domes
2. the Ventilation Vents atop the auxiliary buildings
3. the Process Vent atop the BVPS-1 cooling tower
4. the Turbine Building Vents
5. the BVPS-2 Condensate Polishing Building Vent
6. the BVPS-2 Decontamination Building Vent
7. the BVPS-2 Waste Gas Storage Vault Vent

Effluent from the Containment Vents are assumed ground level in nature. At BVPS-1 the source of these releases is the Supplementary Leak Collection and Release System (SLCRS). At BVPS-2 the source of these releases is normal auxiliary building ventilation. It is also possible to release containment purges from these vents. The Ventilation Vent Releases are ground level in nature. At BVPS-1 the sources of these releases are containment purges and normal auxiliary building ventilation. At BVPS-2 the sources of these releases are containment purges and contiguous areas ventilation. The Turbine Building Vents Releases are ground level in nature and the source of these releases are the turbine building ventilation. Release points 4, 5, 6, and 7 above are not normally radioactive release points. The Process Vent releases are elevated and the sources of these releases are the main condenser air ejectors and the waste gas decay tanks and containment vacuum.

Noble gas releases may normally occur from release points 1 through 3 above. To show compliance with site limits in BVTS 3.11.2.1.a, Expressions 2.2-1 and 2.2-2 are now expressed in terms of the actual release points for the site. Note that the expressions for release points 4, 5, 6, and 7 are included for use if radioactive releases via these release points are identified in the future.

For the total body dose:

$$\sum_i V_i \dot{Q}_{i_{pv}} + \Sigma_i K_i \left[(\overline{X/Q})_{cv} \dot{Q}_{i_{cv1}} + (\overline{X/Q})_{vv} \dot{Q}_{i_{vv1}} + (\overline{X/Q})_{tv} \dot{Q}_{i_{tv1}} + (\overline{X/Q})_{cv} \dot{Q}_{i_{cv2}} + \right.$$

$$(\overline{X/Q})_{vv} \dot{Q}_{i_{vv2}} + (\overline{X/Q})_{tv} \dot{Q}_{i_{tv2}} + (\overline{X/Q})_{cp} \dot{Q}_{i_{cp2}} + (\overline{X/Q})_{dv} \dot{Q}_{i_{dv2}} +$$

$$\left. (\overline{X/Q})_{wv} \dot{Q}_{i_{wv2}} \right] \leq 500 \text{ mrem/yr} \qquad (2.2\text{-}3)$$

For the skin dose:

$$\sum_i \left[L_i (\overline{X/Q})_{pv} + 1.1 B_i \right] \dot{Q}_{i_{pv}} + \Sigma_i \left[L_i + 1.1 M_i \right] \left[(\overline{X/Q})_{cv} \dot{Q}_{i_{cv1}} + (\overline{X/Q})_{vv} \dot{Q}_{i_{vv1}} + \right.$$

$$(\overline{X/Q})_{tv} \dot{Q}_{i_{tv1}} + (\overline{X/Q})_{cv} \dot{Q}_{i_{cv2}} + (\overline{X/Q})_{vv} \dot{Q}_{i_{vv2}} + (\overline{X/Q})_{tv} \dot{Q}_{i_{tv2}} + (\overline{X/Q})_{cp} \dot{Q}_{i_{cp2}} +$$

$$\left. (\overline{X/Q})_{dv} \dot{Q}_{i_{dv2}} + (\overline{X/Q})_{wv} \dot{Q}_{i_{wv2}} \right] \leq 3000 \text{ mrem/yr} \qquad (2.2\text{-}4)$$

where:

$\dot{Q}_{i_{pv}}$ = release rate of radionuclide "i" from the Process Vent, µCi/sec.

$\dot{Q}_{i_{cv1}}$ = release rate of radionuclide "i" from the BVPS-1 Containment Vent, µCi/sec.

$\dot{Q}_{i_{cv2}}$ = release rate of radionuclide "i" from the BVPS-2 Containment Vent, µCi/sec.

$\dot{Q}_{i_{vv1}}$ = release rate of radionuclide "i" from the BVPS-1 Ventilation Vent, µCi/sec.

$\dot{Q}_{i_{vv2}}$ = release rate of radionuclide "i" from the BVPS-2 Ventilation Vent, µCi/sec.

$\dot{Q}_{i_{tv1}}$ = release rate of radionuclide "i" from the BVPS-1 Turbine Building Vent, µCi/sec.

$\dot{Q}_{i_{tv2}}$ = release rate of radionuclide "i" from the BVPS-2 Turbine Building Vent, µCi/sec.

$\dot{Q}_{i_{cp2}}$ = release rate of radionuclide "i" from the BVPS-2 Condensate Polishing Building Vent, µCi/sec.

$\dot{Q}_{i_{dv2}}$ = release rate of radionuclide "i" from the BVPS-2 Decontamination Building Vent, µCi/sec.

$\dot{Q}_{i_{wv2}}$ = release rate of radionuclide "i" from the BVPS-2 Waste Gas Storage Vault Vent, µCi/sec.

$(\overline{X/Q})_{pv}$ = highest calculated annual average relative concentration for releases from the Process Vent, sec/m³.

$(\overline{X/Q})_{cv}$ = highest calculated annual average relative concentration for releases from the Containment Vent, sec/m³.

$(\overline{X/Q})_{vv}$ = highest calculated annual average relative concentration for releases from the Ventilation Vent, sec/m³.

$(\overline{X/Q})_{tv}$ = highest calculated annual average relative concentration for releases for the Turbine Building Vent, sec/m³.

$(\overline{X/Q})_{cp}$ = highest calculated annual average relative concentration for releases for the Condensate Polishing Building Vent, sec/m³.

$(\overline{X/Q})_{dv}$ = highest calculated annual average relative concentration for releases for the Decontamination Building Vent, sec/m³.

$(\overline{X/Q})_{wv}$ = highest calculated annual average relative concentration for releases for the Waste Gas Storage Vault Vent, sec/m³.

Note that the release rate for a containment purge is based on an averaged release rate in µCi/sec for the entire purge (Not to exceed 960 min in accordance with T.S. 3.11.2.1).

All other terms remain the same as those defined previously.

For the site, four potential modes of release are possible. The release modes identify the various combinations of sources of radioactivity and their release points which are used to determine the controlling locations. They are presented in Table 2.2-1. For Modes 1, 2, and 3, the controlling location for implementation of BVTS 3.11.2.1.a is 0.35 miles NW. Inserting the appropriate X/Q's from Tables 2.2-4 through 2.2-10 for this location, Expressions 2.2-3 and 2.2-4 become:

For the total body:

$$\sum_i V_i \dot{Q}_{i_{pv}} + \sum_i K_i \left[9.24E\text{-}5\ \dot{Q}_{i_{cv1}} + 1.03E\text{-}4\ \dot{Q}_{i_{vv1}} + 7.35E\text{-}5\ \dot{Q}_{i_{tv1}} + 9.24E\text{-}5\ \dot{Q}_{i_{cv2}} + 1.03E\text{-}4\ \dot{Q}_{i_{vv2}} + 7.35E\text{-}5\ \dot{Q}_{i_{tv2}} + 9.24E\text{-}5\ \dot{Q}_{i_{dv2}} + 9.24E\text{-}5\ \dot{Q}_{i_{wv2}} + 7.35E\text{-}5\ \dot{Q}_{i_{cp2}}\right] \leq 500 \text{ mrem/yr} \quad (2.2\text{-}5)$$

For the skin:

$$\sum_i \left[7.0E\text{-}10\ L_i + 1.1B_i\right] \dot{Q}_{i_{pv}} + \sum_i \left[L_i + 1.1M_i\right] \left[9.24E\text{-}5\ \dot{Q}_{i_{cv1}} + 1.03E\text{-}4\ \dot{Q}_{i_{vv1}} + 7.35E\text{-}5\ \dot{Q}_{i_{tv1}} + 9.24E\text{-}5\ \dot{Q}_{i_{cv2}} + 1.03E\text{-}4\ \dot{Q}_{i_{vv2}} + 7.35E\text{-}5\ \dot{Q}_{i_{tv2}} + 9.24E\text{-}5\ \dot{Q}_{i_{dv2}} + 9.24E\text{-}5\ \dot{Q}_{i_{wv2}} + 7.35E\text{-}5\ \dot{Q}_{i_{cp2}}\right] \leq 3000 \text{ mrem/yr} \quad (2.2\text{-}6)$$

For the release Mode 4, the controlling location is 0.75 miles N. Inserting the appropriate X/Q's from Tables 2.2-4 through 2.2-10 for this location, Expressions 2.2-3 and 2.2-4 become:

For the total body:

$$\sum_i V_i \dot{Q}_{i_{pv}} + \sum_i K_i \left[3.95E\text{-}6\ \dot{Q}_{i_{cv1}} + 4.99E\text{-}6\ \dot{Q}_{i_{vv1}} + 4.26E\text{-}6\ \dot{Q}_{i_{tv1}} + 3.95E\text{-}6\ \dot{Q}_{i_{cv2}} + 4.99E\text{-}6\ \dot{Q}_{i_{vv2}} + 4.26E\text{-}6\ \dot{Q}_{i_{tv2}} + 3.95E\text{-}6\ \dot{Q}_{i_{dv2}} + 3.95E\text{-}6\ \dot{Q}_{i_{wv2}} + 4.26E\text{-}6\ \dot{Q}_{i_{cp2}}\right] \leq 500 \text{ mrem/yr} \quad (2.2\text{-}7)$$

For the skin:

$$\sum_i [2.31E\text{-}6\ L_i + 1.1B_i]\ \dot{Q}_{i_{pv}} + \sum_i [L_i + 1.1M_i]\ [3.95E\text{-}6\ \dot{Q}_{i_{cv1}} + 4.99E\text{-}6\ \dot{Q}_{i_{vv1}} +$$

$$3.95E\text{-}6\ \dot{Q}_{i_{cv2}} + 4.99E\text{-}6\ \dot{Q}_{i_{vv2}} + 4.26E\text{-}6\ \dot{Q}_{i_{tv2}} + 4.26E\text{-}6\ \dot{Q}_{i_{tv1}} + 3.95E\text{-}6\ \dot{Q}_{i_{dv}} +$$

$$3.95E\text{-}6\ \dot{Q}_{i_{wv}} + 4.26E\text{-}6\ \dot{Q}_{i_{cp}} \leq 3000\ \text{mrem/yr} \qquad (2.2\text{-}8)$$

The determination of controlling location for implementation of BVTS 3.11.2.1.a for noble gase is a function of the following parameters:

1. radionuclide mix and their isotopic release rate

2. release mode

3. meteorology

The incorporation of these three parameters into Expressions 2.2-3 and 2.2-4 resulted in the expressions for the controlling locations as presented in Expressions 2.2-5 through 2.2-8.

The radionuclide mix used to determine controlling locations was based on source terms calculated with the Stone and Webster Engineering Corporation computer code GAS1BB which is similar to the NRC GALE code. Inputs were based on operating modes of the respective plants. The code inputs utilized are presented in Appendix B. The source term is presented in Table 2.2-2 as a function of release type and release point.

The X/Q values utilized in the equations for implementation of BVTS 3.11.2.1.a are based upon the maximum long-term annual average X/Q in the unrestricted area. Table 2.2-3 presents the distances from the release points to the nearest unrestricted area for each of the 16 sectors as well as to the nearest vegetable garden, cow, goat, and beef animal. Tables 2.2-4 through 2.2-10 present the long-term annual average ($\overline{X/Q}$) values for the Process Vent, Containment Vent, Ventilation Vent, Turbine Building Vent, and if applicable for BVPS-2, Decontamination Building Vent, Waste Gas Storage Vault Vent, and the Condensate Polishing Building Vent release points to the special locations presented in Table 2.2-3. A description of their derivation is provided in Appendix A.

For release modes, 1, 2, and 3, dose calculations were performed using the highest calculated site boundary X/Q values applicable to the release points involved and the projected radionuclide mix applicable to the release source. In that a simultaneous, continuous elevated release could contribute to the dose at a given location, the selection of the two highest sector X/Q values at the site boundary considered this contribution. From these results, the distance and sector associated with the highest calculated site boundary dose were selected as the controlling location.

For Modes 1, 2, and 3, the controlling location is 0.35 miles NW. In Mode 1, the dominant release is the auxiliary building ventilation (Ventilation Vent in Unit 1 and Containment Vent in Unit 2). In Modes 2 and 3, the dominant release is containment purge from the respective Ventilation Vent or Containment Vent.

For release Mode 4, a similar evaluation was performed. Long-term annual average X/Q values were calculated at the mid-point of the 10 standard distances listed in Tables 2.2-4 through 2.2-10. In that a simultaneous, ground level release could contribute to the dose at a given location, the selection of the two highest X/Q values at the controlling distance considered this contribution. Since the two maximum X/Q values occurred in the 0.5 - 1.0 mile radial band, the controlling distance was selected at 0.75 miles. From the calculated dose results, the controlling sector was shown to be North. In this Mode, the dominant release is containment purge via the process vent. Neither of the controlling receptor locations are presently inhabited.

Values for K_i, L_i and M_i, which were used in the determination of the controlling receptor location and which are to be used in Expressions 2.2-5 through 2.2-8 to show compliance with BVTS 3.11.2.1.2, are presented in Table 2.2-11. Values taken from Table B-1 of NRC Regulatory Guide 1.109, Revision 1, were multiplied by 1E6 to convert picocuries^{-1} to microcuries^{-1} for use in Table 2.2-11.

Values for V_i and B_i for the finite plume model can be expressed as shown in Equation 2.2-9 and 2.2-10. Values were calculated using the NRC code RABFIN at the site boundary location which would receive the highest total dose from combined Process Vent, Ventilation Vent and Turbine Building Vent and Containment Vent releases. These values are presented in Table 2.2-12 and calculated from the following relation:

$$B_i = \frac{K}{r_d} \sum_j \sum_k \sum_l \frac{f_{jk} A_{li} \mu_a E_l I}{u_j} \qquad (2.2\text{-}9)$$

where:

I = the results of numerical integration over the plume spatial distribution of the airborne activity as defined by the meteorological condition of wind speed (u_j) and atmospheric stability class "k" for a particular wind direction.

K = a numerical constant representing unit conversions.

$$= \frac{(260 \text{ mrad})(\text{radians})\ (\text{m}^3)\ (\text{transformation})}{(\text{sec})(\text{Mev})(\text{Ci})} \left[\frac{16 \text{ sectors}}{2\pi \text{ radians}}\right] \left[\frac{1\text{E-}6 \text{ Ci}}{\mu\text{Ci}}\right] \left[3.15\text{E}7 \frac{\text{sec}}{\text{yr}}\right]$$

= 2.1E4 mrad (m^3) (transformation)/yr(Mev)(μCi).

r_d = the distance from the release point to the receptor location, meters.

u_j = the mean wind speed assigned to the "j" th wind speed class, meters/sec.

f_{jk} = the joint frequency of occurrence of the "j" th wind speed class and kth stability class (dimensionless).

A_{li} = the number of photons of energy corresponding to the "l" th energy group emitted per transformation of the "i" th radionuclide, number/transformation.

E_l = the energy assigned to the "l" th energy group, Mev.

μ_a = the energy absorption coefficient in air for photon energy H_l, $meters^{-1}$.

The V_i factor is computed with conversion from air dose to tissue depth dose, thus:

$$V_i = 1.1 \frac{K}{r_d} \sum_j \sum_k \sum_l \frac{f_{jk} A_{li} \mu_a E_l I e^{-\mu_T T_d}}{u_j} \qquad (2.2\text{-}10)$$

where:

μ_T = the tissue energy absorption coefficient for photons of energy E_l, cm^2/gm.

T_d = the tissue density thickness taken to represent the total body dose ($5 gm/cm^2$).

1.1 = the ratio of the tissue to air absorption coefficients over the energy range of photons of interest, mrem/mrad.

2.2.2 Iodine-131, Tritium, and Radionuclides in Particulate Form ($T_{\frac{1}{2}}$ > 8 Day)

The dose rate in unrestricted areas resulting from the of inhalation of I-131, tritium, and all radionuclides in particulate form (excluding C-14) with half lives greater than 8 days released in gaseous effluents shall be limited to 1,500 mrem/yr to any organ. Based upon NUREG-0133, the following basic expression is used to show compliance with BVTS 3.11.2.1.b:

$$\sum_i P_{it} [(\overline{X/Q})_s \dot{Q}_{is} + (\overline{X/Q})_v \dot{Q}_{iv}] \leq 1{,}500 \text{ mrem/yr} \qquad (2.2\text{-}11)$$

where:

P_{it} = dose parameter for any organ τ for each identified radionuclide "i", mrem/yr per $\mu Ci/m^3$;

$\dot{Q}_{is}$ = the release rate of radionuclide "i", in gaseous effluents from elevated releases, $\mu Ci/sec$.

$\dot{Q}_{iv}$ = the release rate of radionuclide "i", in gaseous effluents from ground level releases, $\mu Ci/sec$.

$(\overline{X/Q})_s$ = the highest calculated annual average relative concentration at the unrestricted area boundary for elevated releases, sec/m^3;

$(\overline{X/Q})_v$ = the highest calculated annual average relative concentration at the unrestricted area boundary for ground level releases, sec/m^3;

Note: The dispersion parameters specified in Section 2.2.2 are limited to the site boundary as defined above.

Releases may occur from any of the site vents in the release modes listed in Table 2.2-1. To show compliance with BVTS 3.11.2.1.b, Expression 2.2-11 is now expressed in terms of the actual release points for the site.

$$\sum_i P_{it} \left[(\overline{X/Q})_{pv} \dot{Q}_{i_{pv}} + (\overline{X/Q})_{cv} \dot{Q}_{i_{cv1}} + (\overline{X/Q})_{vv} \dot{Q}_{i_{vv1}} + (\overline{X/Q})_{tv} \dot{Q}_{i_{tv1}} + (\overline{X/Q})_{cv} \dot{Q}_{i_{cv2}} \right.$$

$$\left. + (\overline{X/Q})_{vv} \dot{Q}_{i_{vv2}} + (\overline{X/Q})_{tv} \dot{Q}_{i_{tv2}} + (\overline{X/Q})_{cp} \dot{Q}_{i_{cp2}} + (\overline{X/Q})_{dv} \dot{Q}_{i_{dv2}} + (\overline{X/Q})_{wv} \dot{Q}_{i_{wv2}} \right]$$

$$\leq 1500 \text{ mrem/yr} \qquad (2.2\text{-}12)$$

where:

$(\overline{X/Q})_{pv}$ = highest calculated annual average relative concentration for releases from the Process Vent, sec/m^3;

$(\overline{X/Q})_{cv}$ = highest calculated annual average relative concentration for releases from the Containment Vents, sec/m^3;

$(\overline{X/Q})_{vv}$ = highest calculated annual average relative concentration for releases from the Ventilation Vents, sec/m^3;

$(\overline{X/Q})_{tv}$ = highest calculated annual average relative concentration for releases from the Turbine Building Vents, sec/m^3;

$(\overline{X/Q})_{cp}$ = highest calculated annual average relative concentration for releases from the BVPS-2 Condensate Polishing Building Vent, sec/m^3;

$(\overline{X/Q})_{dv}$ = highest calculated annual average relative concentration for releases from the BVPS-2 Decontamination Building Vent, sec/m^3;

$(\overline{X/Q})_{wv}$ = highest calculated annual average relative concentration for release from the BVPS-2 Waste Gas Storage Vault, sec/m^3;

$\dot{Q}_{i_{pv}}$ = long-term release rate of radionuclide "i" from the Process Vent, µCi/sec;

$\dot{Q}_{i_{cv1}}$ = long-term release rate of radionuclide "i" from the BVPS-1 Containment Vent, µCi/sec;

$\dot{Q}_{i_{cv2}}$ = long-term release rate of radionuclide "i" from the BVPS-2 Containment Vent, µCi/sec;

$\dot{Q}_{i_{vv1}}$ = long-term release rate of radionuclide "i" from the BVPS-1 Ventilation Vent, µCi/sec;

$\dot{Q}_{i_{vv2}}$ = long-term release rate of radionuclide "i" from the BVPS-2 Ventilation Vent, µCi/sec;

$\dot{Q}_{i_{tv1}}$ = long-term release rate of radionuclide "i" from the BVPS-1 Turbine Building Vent, µCi/sec;

$\dot{Q}_{i_{tv2}}$ = long-term release rate of radionuclide "i" from the BVPS-2 Turbine Building Vent, µCi/sec;

$\dot{Q}_{i_{cp2}}$ = long-term release rate of radionuclide "i" from the Condensate Polishing Building Vent, µCi/sec;

$\dot{Q}_{i_{dv2}}$ = long-term release rate of radionuclide "i" from the Decontamination Building Vent, µCi/sec;

$\dot{Q}_{i_{wv2}}$ = long-term release rate of radionuclide "i" from the Waste Gas Storage Vault Vent, µCi/sec;

All other terms are the same as those defined previously.

The Turbine Building Vent, Condensate Polishing Building Vent, Decontamination Building Vent, and Waste Gas Storage Vault Vent are not normal radioactive release points. These release points are included only for use if radioactive releases via these vents are identified in the future. In the calculation to show compliance with BVTS 3.11.2.1.b only the inhalation pathway is considered.

Values of the organ dose parameters, P_{i_τ}, were calculated using methodology given in NUREG-0133. For the child age group, the following equation was used for all nuclides. The P_{i_τ}, values are presented in Table 2.2-13.

$$P_{i_\tau} = 3.7E9\ DFA_{i_\tau} \qquad (2.2\text{-}13)$$

where:

3.7E9 = breathing rate of child (3,700 m^3/yr) x unit conversion factor (1E6 pCi/μCi).

DFA_{i_τ} = the organ inhalation dose factor for a child from Table 6 of USNRC NUREG-0172, Nov. 1977, for organ τ, nuclide "i", in units of mrem/pCi.

For release modes 1 through 4, the controlling location is the site boundary, 0.35 miles NW.

Expression 2.2-12 becomes:

$$\sum_i P_{i_\tau} [7.00E\text{-}10\ \dot{Q}_{i_{pv}} + 9.24E\text{-}5\ \dot{Q}_{i_{cv1}} + 1.03E\text{-}4\ \dot{Q}_{i_{vv1}} + 7.35E\text{-}5\ \dot{Q}_{i_{tv1}} + 9.24E\text{-}5\ \dot{Q}_{i_{cv2}} + 1.03E\text{-}4\ \dot{Q}_{i_{vv2}} + 7.35E\text{-}5\ \dot{Q}_{i_{tv2}} + 7.35E\text{-}5\ \dot{Q}_{i_{cp2}} + 9.24E\text{-}5\ \dot{Q}_{i_{dv2}} + 9.24E\text{-}5\ \dot{Q}_{i_{wv2}} \leq 1500\ \text{mrem/yr} \qquad (2.2\text{-}14)$$

The determination of the controlling location for implementation of BVTS 3.11.2.1.b for radioiodines and particulates is a function of the same three parameters as for noble gases plus a fourth, the actual receptor pathways. The incorporation of these parameters into Expression 2.2-12 results in the respective equations for each release mode at the site boundary controlling locations. The radionuclide mix was again based upon the source terms presented in Table 2.2-2 as a function of release type and release point.

In the determination of the controlling site boundary for each release mode, the highest two site boundary X/Q values for each release point were utilized in conjunction with the radionuclide mix and the release rate for each release point to determine the controlling location.

The P_{i_τ} values are presented in Table 2.2-13.

The X/Q values in Expression 2.2-14 were obtained from Tables 2.2-4 through 2.2-10.

A description of the derivation of the X/Q values is provided in Appendix A.

TABLE 2.2-1
MODES OF GASEOUS RELEASE FROM BEAVER VALLEY SITE VENTS
FOR IMPLEMENTATION OF 10 CFR 20 AND 10 CFR 50

Release Point	Mode 1	Mode 2	Mode 3	Mode 4
BVPS-1 - BVPS-2[2] Process Vent (pv)	Main Cond. Air Ejector, Waste Gas, Containment Vacuum	Same as Mode 1	Same as Mode 1	Same as Mode 1 and Containment Purge
BVPS-1 Ventilation[1] Vent (vv1)	Aux. Bldg. Ventilation	Containment Purge[3]	Same as Mode 1	Same as Mode 1
BVPS-1 Containment[1] Vent (cv1)	Leakage Collection Exhaust	Same as Mode 1	Same as Mode 1 and Containment Purge[3]	Same as Mode 1
BVPS-1 Turbine Bldg.[1] Vent (tv1)	Turbine Bldg Exhaust*	Same as Mode 1*	Same as Mode 1*	Same as Mode 1*
BVPS-2 Ventilation[1] Vent (vv2)	Contiguous Areas	Containment Purge[3]	Same as Mode 1	Same as Mode 1
BVPS-2 Containment[1] Vent (cv2)	Aux. Bldg. Ventilation	Same as Mode 1	Same as Mode 1 and Containment Purge[3]	Same as Mode 1
BVPS-2 Turbine Bldg.[1] Vent (tv2)	Turbine Bldg Exhaust*	Same as Mode 1*	Same as Mode 1*	Same as Mode 1*
BVPS-2 Condensate[1] Polishing Bldg. Vent (cp2)	*	*	*	*
BVPS-2 Decontamination[1] Bldg. Vent (dv2)	*	*	*	*
BVPS-2 Waste Gas[1] Storage Vault Vent (wv2)	*	*	*	*

*Not normally a radioactive release point

Note: For the purpose of implementing 10 CFR 50, batch charges may use continuous meteorology since short term meteorology is used at the time of the annual report.

[1]Continuous ground level meteorology is applicable
[2]Continuous elevated meteorology is applicable
[3]Mode established by purge from one unit, all other release points remain same as Mode 1.

BV-1 ODCM TABLE 2.2-2

RADIONUCLIDE MIX FOR GASEOUS EFFLUENTS FROM THE BEAVER VALLEY POWER STATION UNIT 1 (Ci/YR)**

Nuclide	Containment Vent (Long Term) Containment Building* (Short Term)	Ventilation Vent Auxiliary Building Ventilation (Long Term)	Turbine Bldg. Vent Turbine Building Ventilation (Long Term)	PROCESS VENT Main Condenser/ Air Ejector (Long Term)	PROCESS VENT Containment Vacuum Pumps (Long Term)***	PROCESS VENT Radioactive Gaseous Waste System (Short Term)
Kr-83m	2.2E-02	4.2E-01	3.9E-05	2.7E-01	3.7E-04	0.0
Kr-85m	1.5E-01	1.9E+00	1.7E-04	1.2E+00	3.9E-03	1.2E-02
Kr-85	6.1E+01	2.5E+00	2.3E-04	1.6E+00	7.2E-01	2.3E+02
Kr-87	5.4E-02	1.3E+00	1.1E-04	8.2E-01	7.8E-04	0.0
Kr-88	2.4E-01	3.8E+00	3.5E-04	2.4E+00	5.0E-03	0.0
Kr-89	4.7E-04	1.2E-01	1.1E-05	7.7E-02	3.1E-06	0.0
Xe-131m	7.4E-01	1.3E-01	1.2E-05	8.0E-02	1.3E-02	8.3E-01
Xe-133m	8.9E-01	8.9E-01	8.1E-05	5.6E-01	2.2E-02	0.0
Xe-133	8.9E+01	3.6E+01	3.4E-03	2.3E+01	1.9E-00	8.2E+00
Xe-135m	4.5E-03	3.2E-01	2.9E-05	2.0E-01	4.4E-02	0.0
Xe-135	7.0E-01	4.5E+00	4.2E-04	2.8E+00	1.9E-02	0.0
Xe-137	1.0E-03	2.1E-01	2.1E-05	1.3E-01	6.3E-06	0.0
Xe-138	1.5E-02	1.1E+00	9.7E-05	6.6E-01	1.2E-04	0.0
I-131	1.2E-03	4.6E-03	6.5E-04	2.1E-02	4.7E-04	0.0
I-132	0.0	0.0	0.0	0.0	2.5E-06	0.0
I-133	2.0E-04	6.7E-03	8.7E-04	3.0E-02	8.4E-05	0.0
I-134	0.0	0.0	0.0	0.0	4.7E-07	0.0
I-135	0.0	0.0	0.0	0.0	1.4E-05	0.0
Co-58	7.5E-04	6.0E-04	0.0	0.0	1.6E-05	0.0
Co-60	3.4E-04	2.7E-04	0.0	0.0	7.4E-06	0.0
Mn-54	2.2E-04	1.8E-04	0.0	0.0	4.9E-06	0.0
Fe-59	7.5E-05	6.0E-05	0.0	0.0	1.6E-06	0.0
Sr-89	1.7E-05	1.3E-05	0.0	0.0	3.7E-07	0.0
Sr-90	3.0E-06	2.0E-06	0.0	0.0	6.6E-08	0.0
Cs-134	2.2E-04	1.8E-04	0.0	0.0	4.9E-06	0.0
Cs-137	3.8E-04	3.0E-04	0.0	0.0	8.4E-06	0.0
C-14	1.0E+00	0.0	0.0	0.0	0.0	7.0E+00
Ar-41	2.5E+01	0.0	0.0	0.0	0.0	0.0

* Containment can be purged via Ventilation Vent, Containment Vent, or Process Vent

** Reference 3 pg 2-20

*** See Section 2.1.1

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TABLE 2.2-3

DISTANCES OF LIMITING MAXIMUM INDIVIDUAL RECEPTORS TO RELEASE POINTS (METERS) FOR ANNUAL X/Q VALUES*

Down-wind Sector	Site Boundary			Vegetable Garden		Milk Cow		Milk Goat		Meat Animal		Resident	
	Ground (1)	Ground (2)	Elevated	Ground	Elevated	Ground	Elevated	Ground	Elevated	Ground	Elevated	Ground	Elevated
N	670	579	413	2,623	2,423	-	-	4,651	4,418	4,152	3,919	2,527	2,295
NNE	535	792	632	2,704	2,461	-	-	6,276	6,033	2,848	2,605	2,639	2,461
NE	490	442	327	724	901	7,741	7,526	20,760	20,545	7,741	7,526	708	790
ENE	490	448	394	1,674	1,658	-	-	6,824	6,671	-	-	708	1,562
E	545	546	551	1,979	1,922	7,065	6,998	4,265	4,200	4,265	4,200	756	1,922
ESE	575	607	672	1,577	1,619	-	-	2,665	2,899	1,577	1,619	1,577	1,650
SE	575	701	815	1,835	1,961	5,729	5,848	5,729	5,848	3,299	3,420	1,835	1,961
SSE	655	762	912	1,738	1,933	5,053	5,244	9,977	10,166	1,770	1,964	1,432	1,628
S	850	887	1,054	3,138	3,372	3,347	3,539	-	-	2,253	2,487	2,189	2,423
SSW	975	1,064	1,226	2,317	2,560	3,347	3,590	5,616	5,859	2,317	2,560	1,223	1,466
SW	1,435	1,439	1,574	2,221	2,439	-	-	2,993	3,210	2,414	2,632	2,221	2,439
WSW	595	561	660	2,301	2,463	5,182	5,341	-	-	2,446	2,608	2,301	2,463
W	685	640	681	3,556	3,635	5,118	5,195	-	-	4,088	4,166	3,556	3,635
WNW	810	701	676	3,605	3,590	4,538	4,521	22,529	22,507	3,605	3,590	3,605	3,590
NW	655	567	482	1,464	1,415	-	-	10,944	10,832	4,570	4,461	1,432	1,393
NNW	645	558	420	1,464	1,285	-	-	15,450	15,262	3,959	3,774	1,143	1,253

NOTE:

* Distances for ground releases are measured from the centerpoint between the BVPS-1 and BVPS-2 Containment Buildings.
Distances for elevated release are measured from the BVPS-1 Cooling Tower.
Elevated release is applicable to the Process Vent.
Ground release is applicable to all other release points.
Site boundary ground releases: (1) BVPS-2 Turbine Building and Condensate Polishing Building.
(2) All other ground release points.

TABLE 2.2-4

BEAVER VALLEY SITE CONTAINMENT VENTS ANNUAL AVERAGE, GROUND LEVEL, χ/Q VALUES ($\times 10^{-7}$ sec/m^3)
FOR CONTINUOUS GROUND LEVEL RELEASES, FOR SPECIAL DISTANCES (IDENTIFIED IN TABLE 2.2-3) AND SELECTED CONTROL LOCATIONS

	Individual Receptors						Distances to the Control Location, in miles									
Downwind Sector	Site Boundary	Vegetable Garden	Milk Cow	Milk Goat	Meat Animal	Residence	0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N	125.0	12.80	-	5.360	6.27	13.50	233.0	39.5	18.70	11.80	7.68	5.82	4.240	3.480	2.660	2.230
NNE	56.2	6.92	-	2.040	6.42	7.16	148.0	26.8	10.80	6.62	4.60	3.54	2.690	2.190	1.830	1.560
NE	102.0	47.40	1.200	0.265	1.20	49.10	120.0	21.6	11.60	6.99	4.81	3.55	2.370	1.910	1.450	1.230
ENE	85.8	12.50	-	0.124	-	42.20	103.0	18.4	9.55	5.70	4.14	3.04	2.340	1.880	1.260	1.060
E	54.5	6.16	0.807	1.910	1.91	32.60	89.5	15.7	6.08	3.65	2.49	1.83	1.300	1.040	0.859	0.726
ESE	31.1	6.92	-	3.010	6.92	6.92	59.1	10.5	5.16	3.10	1.95	1.43	1.020	0.815	0.612	0.517
SE	27.8	6.70	0.994	0.994	2.74	6.70	65.9	12.0	5.89	3.54	2.41	1.77	1.160	0.931	0.768	0.649
SSE	24.1	6.68	1.030	0.372	6.50	9.01	67.2	12.0	5.46	3.30	1.91	1.41	0.997	0.803	0.665	0.563
S	27.5	3.40	3.090	-	5.57	5.81	59.9	17.5	6.77	4.11	2.84	2.10	1.490	1.200	0.999	0.848
SSW	23.8	6.31	3.700	1.740	6.31	19.30	110.0	19.9	7.83	4.80	3.33	2.48	1.940	1.580	1.190	1.020
SW	22.3	13.90	-	9.050	12.30	13.90	160.0	29.2	16.10	9.94	5.85	4.37	3.430	2.790	2.110	1.800
WSW	163.0	19.30	5.720	-	17.70	19.30	283.0	49.8	23.50	14.60	10.30	7.72	5.690	4.650	3.620	3.090
W	278.0	15.70	9.540	-	13.00	15.70	615.0	103.0	49.00	31.00	15.40	11.70	9.320	7.660	5.460	5.550
WNW	487.0	40.70	30.100	1.810	40.70	40.70	1290.0	203.0	92.10	59.20	40.60	31.20	25.000	20.700	14.200	12.200
NW	924.0	194.00	-	8.660	40.50	200.00	1710.0	262.0	123.00	79.80	55.00	42.30	34.000	28.200	19.400	16.700
NNW	302.0	63.00	-	1.720	15.40	92.30	547.0	86.4	40.80	26.20	17.60	13.50	10.100	8.350	6.560	5.660

TABLE 2.2-5

BEAVER VALLEY SITE VENTILATION VENTS ANNUAL AVERAGE, GROUND LEVEL, χ/Q VALUES (x 10^{-7} sec/m^3)
FOR CONTINUOUS GROUND LEVEL RELEASES, FOR SPECIAL DISTANCES (IDENTIFIED IN TABLE 2.2-3) AND SELECTED CONTROL LOCATIONS

	Individual Receptors						Distances to the Control Location, in miles									
Downwind Sector	Site Boundary	Vegetable Garden	Milk Cow	Milk Goat	Meat Animal	Residence	0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N	152.0	15.00	-	5.980	7.06	15.90	276.0	49.9	22.70	13.70	8.75	6.52	4.69	3.810	2.900	2.470
NNE	62.3	7.66	-	2.150	7.08	7.95	189.0	32.0	12.20	7.31	4.99	3.69	2.87	2.320	1.920	1.630
NE	132.0	57.90	1.240	0.269	1.24	60.20	156.0	24.8	12.70	7.51	5.09	3.73	2.47	1.980	1.500	1.270
ENE	110.0	13.60	-	1.270	-	50.40	135.0	20.6	10.20	6.01	4.31	3.14	2.41	1.930	1.290	1.080
E	67.8	6.66	0.828	1.990	1.99	38.80	116.0	17.7	6.57	3.86	2.61	1.90	1.34	1.070	0.883	0.774
ESE	38.0	7.64	-	3.200	7.64	7.64	76.7	11.9	5.59	3.29	2.05	1.49	1.05	0.842	0.630	0.531
SE	33.3	7.27	1.030	1.030	2.88	7.27	86.2	13.5	6.37	3.75	2.53	1.84	1.20	0.960	0.790	0.666
SSE	29.1	7.41	1.080	0.382	7.19	10.10	87.0	13.7	5.98	3.53	2.02	1.48	1.04	0.833	0.688	0.531
S	32.8	3.65	3.300	-	6.10	6.38	127.0	20.3	7.56	4.48	3.04	2.23	1.57	1.260	1.050	0.885
SSW	28.7	7.08	4.040	1.850	7.08	22.90	140.0	23.6	8.87	5.28	3.60	2.66	2.07	1.670	1.260	1.070
SW	26.2	15.70	-	9.980	13.80	15.70	204.0	34.8	18.40	11.40	6.38	4.71	3.66	2.960	2.230	1.900
WSW	201.0	22.40	6.230	-	20.40	22.40	347.0	61.3	27.70	16.60	11.40	8.49	6.19	5.020	3.880	3.300
W	345.0	18.00	10.600	-	14.70	18.00	715.0	132.0	60.30	36.50	17.70	13.20	10.40	8.440	7.060	6.040
WNW	598.0	48.60	35.000	1.920	48.60	48.60	1410.0	269.0	120.00	73.00	48.50	36.40	28.70	23.400	15.900	13.600
NW	1030.0	262.00	-	9.520	47.80	271.00	1820.0	350.0	164.00	100.00	66.60	50.10	39.50	32.300	21.900	18.800
NNW	345.0	83.40	-	1.840	18.10	121.00	601.0	114.0	52.80	32.20	21.00	15.80	11.60	9.460	7.360	6.310

TABLE 2.2-6

BEAVER VALLEY SITE PROCESS VENT ANNUAL AVERAGE, ELEVATED RELEASE, χ/Q VAULES ($\times 10^{-7}$ sec/m^3)
FOR CONTINUOUS ELEVATED RELEASES, FOR SPECIAL DISTANCES (IDENTIFIED IN TABLE 2.2-3) AND SELECTED CONTROL LOCATIONS

	Individual Receptors						Distances to the Control Location, in miles									
Downwind Sector	Site* Boundary	Vegetable Garden	Milk Cow	Milk Goat	Meat Animal	Residence	0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N	0.0082	6.720	-	1.910	2.27	6.790	0.0289	23.1000	8.2700	5.32	2.56	1.91	1.480	1.200	0.996	0.846
NNE	0.0280	6.590	-	1.430	6.14	6.890	0.0175	14.5000	6.9800	5.47	3.27	2.69	1.770	1.430	1.290	1.100
NE	0.0110	.074	1.610	0.350	1.61	0.055	0.0069	0.1160	.2300	7.10	5.38	3.68	2.880	2.090	1.880	1.570
ENE	0.0110	9.090	-	1.770	-	0.525	0.0135	0.3310	7.2800	6.02	4.75	3.22	2.620	2.030	1.710	1.100
E	0.0360	8.300	1.240	2.870	2.87	8.300	0.0124	17.1000	7.8600	6.20	3.67	2.83	2.190	1.700	1.280	1.200
ESE	0.0420	11.600	-	4.570	11.60	11.200	0.0208	12.7000	8.1400	4.78	3.00	2.20	1.360	1.160	0.830	0.727
SE	0.0750	7.890	1.230	1.230	3.05	7.890	0.4770	7.4000	7.5700	4.45	2.79	2.05	1.460	1.180	0.811	0.686
SSE	0.2060	7.390	1.160	0.357	7.20	9.770	0.3030	9.4400	6.9300	4.06	2.58	1.89	1.170	0.937	0.646	0.546
S	5.740	3.760	3.490	-	6.06	6.310	0.7960	8.5100	8.4900	4.98	3.37	2.47	1.380	1.110	0.774	0.655
SSW	7.640	3.610	2.140	0.872	3.61	5.820	26.1000	9.1000	4.0300	3.11	2.11	1.56	1.030	0.834	0.807	0.684
SW	6.500	3.900	-	2.560	3.47	3.900	36.1000	15.9000	4.9300	3.12	1.77	1.57	1.210	1.060	1.150	0.977
WSW	0.126	4.350	1.420	-	3.98	4.350	0.3870	17.8000	4.9000	3.53	2.36	1.64	1.460	1.210	0.920	0.781
W	0.029	2.490	0.746	-	2.02	2.490	0.0147	8.7200	6.2300	3.68	2.50	1.84	0.741	1.120	0.851	0.795
WNW	0.033	2.530	1.780	0.163	2.53	2.530	0.0202	0.0549	0.0809	3.07	2.50	1.84	1.110	0.686	0.791	0.731
NW	0.007	0.074	-	0.305	1.67	0.073	0.0084	0.0650	0.1170	3.66	2.30	1.69	1.210	0.903	0.804	0.683
NNW	0.008	6.460	-	0.224	1.81	6.590	0.0135	6.7800	5.0200	2.96	1.93	1.49	1.050	0.849	0.705	0.599

*Elevated release χ/Q value at site boundary location where ground level release χ/Qs maximize.

TABLE 2.2-7

BEAVER VALLEY TURBINE BUILDING VENTS ANNUAL AVERAGE, GROUND LEVEL, x/Q VALUES (x 10^{-7} sec/m^3)
FOR CONTINUOUS GROUND LEVEL RELEASES, FOR SPECIAL DISTANCES (IDENTIFIED IN TABLE 2.2-3) AND SELECTED CONTROL LOCATIONS

	Individual Receptors						Distances to the Control Location, in miles									
Downwind Sector	Site Boundary	Vegetable Garden	Milk Cow	Milk Goat	Meat Animal	Residence	0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N	105.0	14.00	-	5.740	6.74	14.80	244.0	42.6	20.50	12.70	8.18	6.15	4.45	3.640	2.770	2.380
NNE	102.0	7.37	-	2.130	6.83	7.64	161.0	28.8	11.40	6.94	4.79	3.56	2.78	2.250	1.870	1.590
NE	96.6	51.90	1.230	0.268	1.23	53.80	132.0	23.0	12.10	7.24	4.95	3.64	2.42	1.950	1.480	1.250
ENE	84.1	13.20	-	1.280	-	46.30	115.0	19.4	9.89	5.85	4.23	3.09	2.38	1.900	1.270	1.070
E	60.7	6.49	.829	1.980	1.98	35.70	99.2	16.6	6.32	3.75	2.55	1.87	1.32	1.060	0.871	0.735
ESE	37.1	7.25	-	3.100	7.25	7.25	65.8	11.1	5.36	3.19	2.00	1.46	1.03	0.829	0.621	0.524
SE	41.8	7.06	1.020	1.020	2.85	7.06	73.5	12.6	6.12	3.64	2.47	1.81	1.18	0.945	0.779	0.658
SSE	34.0	7.16	1.070	0.384	6.96	9.69	74.2	12.7	5.71	3.41	1.97	1.45	1.02	0.818	0.676	0.572
S	32.7	3.64	3.310	-	6.00	6.27	109.0	18.6	7.13	4.29	2.94	2.17	1.53	1.230	1.020	0.866
SSW	29.7	6.73	3.890	1.800	6.73	20.90	120.0	21.3	8.31	5.03	3.46	2.57	2.00	1.620	1.230	1.040
SW	24.1	14.80	-	9.550	13.10	14.80	174.0	31.2	17.20	10.40	6.10	4.54	3.54	2.870	2.170	1.850
WSW	159.0	20.80	6.010	-	19.10	20.80	301.0	53.6	25.30	15.60	10.80	8.09	5.93	4.830	3.750	3.200
W	264.0	16.90	10.100	-	13.90	16.90	636.0	111.0	53.90	33.50	16.50	12.40	9.82	8.040	6.760	5.790
WNW	404.0	44.50	32.500	1.870	44.50	44.50	1310.0	218.0	104.00	65.40	44.20	33.60	26.70	22.000	15.000	12.900
NW	735.0	216.00	-	9.100	43.90	222.00	1720.0	279.0	140.00	88.80	60.30	45.90	36.60	30.100	20.600	17.700
NNW	247.0	71.00	-	1.820	17.00	99.40	557.0	924.0	45.90	28.90	19.20	14.60	10.80	8.880	6.950	5.980

TABLE 2.2-8

FOR INFORMATION ONLY - USED IN CALCULATION OF BVPS-2 CONTRIBUTION TO SITE DOSE RATE LIMITS

BVPS-2 DECONTAMINATION BUILDING ANNUAL AVERAGE, GROUND LEVEL, X/Q VALUES ($\times 10^{-7}$ sec/m^3)
FOR CONTINUOUS GROUND LEVEL RELEASES, FOR SPECIAL DISTANCES (IDENTIFIED IN TABLE 2.2-3) AND SELECTED CONTROL LOCATIONS

	Individual Receptors						Distances to the Control Location, in miles									
Downwind Sector	Site Boundary	Vegetable Garden	Milk Cow	Milk Goat	Meat Animal	Residence	0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N	125.00	12.80	-	5.360	6.27	13.50	233.0	39.50	18.70	11.80	7.68	5.82	4.240	3.480	2.660	2.280
NNE	30.20	6.92	-	2.040	6.42	7.16	148.0	26.80	10.80	6.62	4.60	3.44	2.690	2.190	1.830	1.560
NE	102.00	47.40	1.20	0.265	1.20	49.10	120.0	21.60	11.60	6.99	4.81	3.55	2.370	1.910	1.450	1.230
ENE	85.80	12.50	-	1.240	-	42.20	103.0	18.40	9.55	5.70	4.14	3.04	2.340	1.880	1.260	1.060
E	54.50	6.16	0.867	1.910	1.91	32.60	89.5	15.70	6.08	3.65	2.49	1.83	1.300	1.040	0.859	0.726
ESE	31.10	6.92	-	3.010	6.92	6.92	59.1	10.50	5.16	3.10	1.95	1.43	1.020	0.815	0.612	0.517
SE	27.80	6.70	1.994	0.994	2.74	6.70	65.9	12.00	5.89	3.54	2.41	1.77	1.160	0.931	0.768	0.649
SSE	24.10	6.68	1.030	0.372	6.50	9.01	67.2	12.00	5.46	3.30	1.91	1.41	0.997	0.803	0.665	0.563
S	27.50	3.40	3.090	-	5.57	5.81	99.9	17.50	6.77	4.11	2.84	2.10	1.490	1.200	0.999	0.848
SSW	23.80	6.31	3.700	1.740	6.31	19.30	110.0	19.90	7.83	4.80	3.33	2.48	1.940	1.580	1.190	1.020
SW	22.30	13.90	-	9.050	12.30	13.90	160.0	29.20	16.10	9.94	5.85	4.37	3.430	2.790	2.110	1.800
WSW	163.00	19.30	5.720	-	17.70	19.30	283.0	49.80	23.50	14.60	10.30	7.72	5.690	4.650	3.620	3.090
W	278.00	15.70	9.540	-	13.00	15.70	615.00	103.00	49.00	31.00	15.40	11.70	9.320	7.660	6.460	5.550
WNW	487.00	40.70	30.100	1.810	40.70	40.70	1290.00	203.00	92.10	59.20	40.60	31.20	25.000	20.700	14.200	12.200
NW	924.00	194.00	-	8.660	40.50	200.00	1710.00	262.00	123.00	79.80	55.00	42.30	34.000	28.200	19.400	16.700
NNW	302.00	63.00	-	1.720	15.40	92.30	547.00	86.40	40.80	26.30	17.60	13.50	10.100	8.350	6.560	5.660

TABLE 2.2-9

FOR INFORMATION ONLY - USED IN THE CALCULATION OF BVPS-2 CONTRIBUTION TO SITE DOSE RATE LIMITS

BVPS-2 WASTE GAS STORAGE VAULT VENT ANNUAL AVERAGE, GROUND LEVEL, X/Q VALUES ($\times 10^{-7}$ sec/m^3)
FOR CONTINUOUS GROUND LEVEL RELEASES, FOR SPECIAL DISTANCES (IDENTIFIED IN TABLE 2.2-3) AND SELECTED CONTROL LOCATIONS

Down-wind Sec-tor	Individual Receptors						Distances to the Control Location, in miles									
	Site Bound-ary	Vege-table Garden	Milk Cow	Milk Goat	Meat Ani-mal	Resi-dence	0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N	125.00	12.80	-	5.360	6.27	13.50	233.0	39.50	18.70	11.80	7.[illegible]	[illegible].82	4.240	3.480	2.660	2.280
NNE	50.20	6.92	-	2.040	6.42	7.16	148.0	26.80	10.80	6.62	4.6[illegible]	[illegible].44	2.690	2.190	1.830	1.560
NE	102.00	47.40	1.20	0.265	1.20	49.10	120.0	21.60	11.60	6.99	4.81	3.55	2.370	1.910	1.450	1.230
ENE	85.80	12.50	-	1.240	-	42.20	103.0	18.40	9.55	5.70	4.14	3.04	2.340	1.880	1.260	1.060
E	54.50	6.16	0.807	1.910	1.91	32.60	89.5	15.70	6.08	3.65	2.49	1.83	1.300	1.040	0.859	0.726
ESE	31.10	6.92	-	3.010	6.92	6.92	59.1	10.50	5.16	3.10	1.95	1.43	1.020	0.815	0.612	0.517
SE	27.80	6.70	0.994	0.994	2.74	6.70	65.9	12.00	5.89	3.54	2.41	1.77	1.160	0.931	0.768	0.649
SSE	24.10	6.68	1.030	0.372	6.50	9.01	67.2	12.00	5.46	3.30	1.91	1.41	0.997	0.803	0.665	0.563
S	27.50	3.40	3.090	-	5.57	5.81	99.9	17.50	6.77	4.11	2.84	2.10	1.490	1.200	0.999	0.848
SSW	23.80	6.31	3.700	1.740	6.31	19.30	110.0	19.90	7.83	4.80	3.33	2.48	1.940	1.580	1.190	1.020
SW	22.30	13.90	-	9.050	12.30	13.90	160.0	29.20	16.10	9.94	5.85	4.37	3.430	2.790	2.110	1.800
WSW	163.00	19.30	5.720	-	17.70	19.30	283.0	49.80	23.50	14.60	10.30	7.72	5.690	4.650	3.620	3.090
W	278.00	15.70	9.540	-	13.00	15.70	615.00	103.00	49.00	31.00	15.40	11.70	9.320	7.660	6.460	5.550
WNW	487.00	40.70	30.100	1.810	40.70	40.70	1290.00	203.00	92.10	59.20	40.60	31.20	25.000	20.700	14.200	12.200
NW	924.00	194.00	-	8.660	40.50	200.00	1710.00	262.00	123.00	79.80	55.00	42.30	34.000	28.200	19.400	16.700
NNW	302.00	63.00	-	1.720	15.40	92.30	547.00	86.40	40.80	26.30	17.60	13.50	10.100	8.350	6.560	5.660

TABLE 2.2-10

FOR INFORMATION ONLY - USED IN CALCULATION OF BVPS-2 CONTRIBUTION TO SITE DOSE RATE LIMITS

BVPS-2 CONDENSATE POLISHING BUILDING VENT ANNUAL AVERAGE, GROUND LEVEL, χ/Q VALUES ($\times 10^{-7}$ sec/m^3)
FOR CONTINUOUS GROUND LEVEL RELEASES, FOR SPECIAL DISTANCES (IDENTIFIED IN TABLE 2.2-3) AND SELECTED CONTROL LOCATIONS

	Individual Receptors						Distances to the Control Location, in miles									
Downwind Sector	Site Boundary	Vegetable Garden	Milk Cow	Milk Goat	Meat Animal	Residence	0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N	105.0	14.00	-	5.740	6.74	14.80	244.0	42.6	20.50	12.70	8.18	6.15	4.45	3.640	2.770	2.380
NNE	102.0	7.37	-	2.130	6.83	7.64	161.0	28.8	11.40	6.94	4.79	3.56	2.78	2.250	1.870	1.590
NE	96.6	51.90	1.230	0.268	1.23	53.80	132.0	23.0	12.10	7.24	4.95	3.64	2.42	1.950	1.480	1.250
ENE	84.1	13.20	-	1.280	-	46.30	115.0	19.4	9.89	5.85	4.23	3.09	2.38	1.900	1.270	1.070
E	60.7	6.49	.829	1.980	1.98	35.70	99.2	16.6	6.32	3.75	2.55	1.87	1.32	1.000	0.871	0.735
ESE	37.1	7.25	-	3.100	7.25	7.25	65.8	11.1	5.36	3.19	2.00	1.46	1.03	0.829	0.621	0.524
SE	41.8	7.06	1.020	1.020	2.85	7.06	73.5	12.6	6.12	3.64	2.47	1.81	1.18	0.945	0.779	0.658
SSE	34.0	7.16	1.070	0.384	6.96	9.69	74.2	12.7	5.71	3.41	1.97	1.45	1.02	0.818	0.676	0.572
S	32.7	3.64	3.310	-	6.00	6.27	109.0	18.6	7.13	4.29	2.94	2.17	1.53	1.230	1.020	0.866
SSW	29.7	6.73	3.890	1.800	6.73	20.90	120.0	21.3	8.31	5.03	3.46	2.57	2.00	1.620	1.230	1.040
SW	24.1	14.80	-	9.550	13.10	14.80	174.0	31.2	17.20	10.40	6.10	4.54	3.54	2.870	2.170	1.850
WSW	159.0	20.80	6.010	-	19.10	20.80	301.0	53.6	25.30	15.60	10.80	8.09	5.93	4.830	3.750	3.200
W	264.0	16.90	10.100	-	13.90	16.90	636.0	111.0	53.90	33.50	16.50	12.40	9.82	8.040	6.760	5.790
WNW	404.0	44.50	32.500	1.870	44.50	44.50	1310.0	218.0	104.00	65.40	44.20	33.60	26.70	22.000	15.000	12.900
NW	739.0	216.00	-	9.100	43.90	222.00	1720.0	279.0	140.00	88.80	60.30	45.90	36.60	30.100	20.600	17.700
NNW	247.0	71.00	-	1.820	17.00	99.40	557.0	924.0	45.90	28.90	19.20	14.60	10.80	8.880	6.950	5.980

TABLE 2.2-11

DOSE FACTORS FOR NOBLE GASES AND DAUGHTERS*

Radionuclide	Total Body Dose Factor K_i (mrem/yr per µCi/m^3)	Skin Dose Factor L_i (mrem/yr per µCi/m^3)	Gamma Air Dose Factor M_i (mrad/yr per µCi/m^3)	Beta Air Dose Factor N_i (mrad/yr per µCi/m^3)
Kr-83m	7.56E-02	---	1.93E+01	2.88E+02
Kr-85m	1.17E+03	1.46E+03	1.23E+03	1.97E+03
Kr-85	1.61E+01	1.34E+03	1.72E+01	1.95E+03
Kr-87	5.92E+03	9.73E+03	6.17E+03	1.03E+04
Kr-88	1.47E+04	2.37E+03	1.52E+04	2.93E+03
Kr-89	1.66E+04	1.01E+04	1.73E+04	1.06E+04
Kr-90	1.56E+04	7.29E+03	1.63E+04	7.83E+03
Xe-131m	9.15E+01	4.76E+02	1.56E+02	1.11E+03
Xe-133m	2.51E+02	9.94E+02	3.27E+02	1.48E+03
Xe-133	2.94E+02	3.06E+02	3.53E+02	1.05E+03
Xe-135m	3.12E+03	7.11E+02	3.36E+03	7.39E+02
Xe-135	1.81E+03	1.86E+03	1.92E+03	2.46E+03
Xe-137	1.42E+03	1.22E+04	1.51E+03	1.27E+04
Xe-138	8.83E+03	4.13E+03	9.21E+03	4.75E+03
Ar-41	8.84E+03	2.69E+03	9.30E+03	3.28E+03

*The listed dose factors are for radionuclides that may be detected in gaseous effluents.

TABLE 2.2-12

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
BEAVER VALLEY SITE*

Noble Gas Radionuclides	V_i[1] Total Body Dose Rate mrem/yr / µCi/sec	B_i[1,2] Gamma Air Dose Rate mrad/yr / µCi/sec	V_i[3] Total Body Dose Rate mrem/yr / µCi/sec	B_i[3] Gamma Air Dose Rate mrad/yr / µCi/sec
Kr-83m	3.19E-10	1.75E-8	4.58E-8	3.96E-5
Kr-85m	7.81E-5	1.16E-4	4.70E-4	7.06E-4
Kr-85	1.55E-6	2.35E-6	5.54E-6	8.40E-6
Kr-87	5.13E-4	7.74E-4	1.45E-3	2.19E-3
Kr-88	1.39E-3	2.09E-3	4.09E-3	6.16E-3
Kr-89	7.99E-4	1.20E-3	1.. 3E-3	1.88E-3
Xe-131m	1.64E-5	2.47E-5	1.67E-4	3.09E-4
Xe-133m	1.38E-5	2.11E-5	1.32E-4	2.61E-4
Xe-133	1.05E-5	1.56E-4	1.54E-4	2.76E-4
Xe-135m	2.41E-4	3.66E-4	6.21E-4	9.50E-4
Xe-135	1.41E-4	2.12E-4	6.96E-4	1.05E-3
Xe-137	6.00E-5	9.05E-5	9.66E-5	1.46E-4
Xe-138	8.11E-4	1.22E-3	2.22E-3	3.34E-3
Ar-41	1.02E-3	1.53E-3	2.68E-3	4.02E-3

*The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

[1] V_i and B_i values used to implement Modes 1, 2, and 3 of Section 2.2.1. (10CFR20)

[2] B_i values used to implement Modes 1, 2, 3, and 4 of Section 2.3.1. (10CFR50)

[3] V_i and B_i values to implement Mode 4 of Section 2.2.1. (10CFR20) and to implement monitor setpoint determinations of Section 2.1.2 and 2.1.4

TABLE 2.2-13

P_{i_τ} VALUES FOR A CHILD FOR BEAVER VALLEY SITE

(mrem/yr per $\mu Ci/m^3$)

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E-01	1.12E 03	1.12E 03	1.12E 03	1.12E 03	1.12E 03	1.12E 03
CR-51	0.00E-01	0.00E-01	1.54E 02	8.55E 01	2.43E 01	1.70E 04	1.08E 03
MN-54	0.00E-01	4.29E 04	9.51E 03	0.00E-01	1.00E 04	1.58E 06	2.29E 04
FE-59	2.07E 04	3.34E 04	1.67E 04	0.00E-01	0.00E-01	1.27E 06	7.07E 04
CO-57	0.00E-01	9.03E 02	1.07E 03	0.00E-01	0.00E-01	5.07E 05	1.32E 04
CO-58	0.00E-01	1.77E 03	3.16E 03	0.00E-01	0.00E-01	1.11E 06	3.44E 04
CO-60	0.00E-01	1.31E 04	2.26E 04	0.00E-01	0.00E-01	7.07E 06	9.62E 04
ZN-65	4.26E 04	1.13E 05	7.03E 04	0.00E-01	7.14E 04	9.95E 05	1.63E 04
SR-89	5.99E 05	0.00E-01	1.72E 04	0.00E-01	0.00E-01	2.16E 06	1.67E 05
SR-90	1.01E 08	0.00E-01	6.44E 06	0.00E-01	0.00E-01	1.48E 07	3.43E 05
ZR-95	1.90E 05	4.18E 04	3.70E 04	0.00E-01	5.96E 04	2.23E 06	6.11E 04
NB-95	2.35E 04	9.18E 03	6.55E 03	0.00E-01	8.62E 03	6.14E 05	3.70E 04
NB-97	4.29E-01	7.70E-02	3.60E-02	0.00E-01	8.55E-02	3.42E 03	2.78E 04
MO-99	0.00E-01	1.72E 02	4.25E 01	0.00E-01	3.92E 02	1.35E 05	1.27E 05
TC-99	4.96E 02	5.51E 02	1.98E 02	0.00E-01	6 48E 03	1.25E 06	2.87E 04
AG-110M	1.69E 04	1.14E 04	9.14E 03	0.00E-01	2.12E 04	5.48E 06	1.00E 05
SB-124	5.74E 04	7.40E 02	2.00E 04	1.26E 02	0.00E-01	3.24E 06	1.64E 05
SB-125	9.84E 04	7.59E 02	2.07E 04	0.10E 01	0.00E-01	2.32E 06	4.03E 04
I-131	4.81E 04	4.81E 04	2.73E 04	1.62E 07	7.88E 04	0.00E-01	2.84E 03
CS-134	6.51E 05	1.01E 06	2.25E 05	0.00E-01	3.30E 05	1.21E 05	3.35E 03
CS-137	9.07E 05	8.25E 05	1.28E 05	0.00E-01	2.82E 05	1.04E 05	3.62E 03
BA-140	7.40E 04	6.48E 01	4.33E 03	0.00E-01	2.11E 01	1.74E 06	1.02E 05
LA-140	6.44E 02	2.25E 02	7.55E 01	0.00E-01	0.00E-01	1.83E 05	2.26E 05
CE-141	3.92E 04	1.95E 04	2.90E 03	0.00E-01	8.55E 03	5.44E 05	5.60E 04
CE-144	6.77E 06	2.12E 06	3.61E 05	0.00E-01	1.17E 06	1.20E 07	3.89E 05

2.3 Compliance with 10 CFR 50 (Gaseous)

At the Beaver Valley Site all elevated gaseous releases are considered to originate from a shared radwaste system. The effluent from both Units are mixed and discharged from a common release point, the process vent, at the top of the Unit 1 cooling tower. The resulting dose for the purpose of implementing 10 CFR 50 is normally apportioned equally to each unit. The only exception would be a containment purge via the process vent. The resulting dose shall be attributed to the contributing reactor unit. Since this operation is expected to be rare, equations are shown throughout this section with the apportionment set at 0.5.

2.3.1 Noble Gases

2.3.1.1 Cumulation of Doses

Section II.B.1 of Appendix I of 10 CFR 50 (BVTS 3.11.2.2) limits the releases of gaseous effluents from each reactor such that the estimated annual gamma air dose is limited to 10 millirad and the beta air dose is limited to 20 millirad. In addition, BVTS 3.11.2.4 requires use of radwaste system if air doses when averaged over 31 days exceed 0.2 mrad for gamma and 0.4 mrad for beta. Based upon NUREG-0133, the air dose limits in the unrestricted area due to noble gases released in gaseous effluents are defined by the following expressions:

During any calendar quarter, for gamma radiation:

$$3.17E\text{-}8 \sum_i \left[M_i \left[(\overline{X/Q})_v Q_{iv} + (\overline{X/q})_v q_{iv} \right] + \left[B_i Q_{is} + b_i q_{is} \right] \right] \leq 5 \text{ mrad}, \tag{2.3-1}$$

During any calendar quarter, for beta radiation:

$$3.17E\text{-}8 \sum_i N_i \left[(\overline{X/Q})_v Q_{iv} + (\overline{X/q})_v q_{iv} + (\overline{X/Q})_s Q_{is} + (\overline{X/q})_s q_{is} \right] \leq 10 \text{ mrad}, \tag{2.3-2}$$

During any calendar year, for gamma radiation:

$$3.17E\text{-}8 \sum_i \left[M_i \left[(\overline{X/Q})_v Q_{iv} + (\overline{X/q})_v q_{iv} \right] + \left[B_i Q_{is} + b_i q_{is} \right] \right] \leq 10 \text{ mrad}, \tag{2.3-3}$$

During any calendar year, for beta radiation:

$$3.17E\text{-}8 \sum_i N_i \left[(\overline{X/Q})_v Q_{iv} + (\overline{X/q})_v q_{iv} + (\overline{X/Q})_s Q_{is} + (\overline{X/q})_s q_{is} \right] \leq 20 \text{ mrad}, \tag{2.3-4}$$

When averaged over 31 days, for the gamma radiation projection:

$$3.17E\text{-}8 \sum_i \left[M_i \left[(\overline{X/Q})_v Q_{iv} + (\overline{X/q})_v q_{iv} \right] + \left[B_i Q_{is} + b_i q_{is} \right] \right] \leq 0.2 \text{ mrad}, \quad (2.3\text{-}5)$$

Averaged over 31 days, for the beta radiation projection:

$$3.17E\text{-}8 \sum_i N_i \left[(\overline{X/Q})_v Q_{iv} + (\overline{X/q})_v q_{iv} + (\overline{X/Q})_s Q_{is} + (\overline{X/q})_s q_{is} \right] \leq 0.4 \text{ mrad} \quad (2.3\text{-}6)$$

where:

M_i = the air dose factor due to gamma emissions for each identified noble gas radionuclide "i", mrad/yr per µCi/m³;

N_i = the air dose factor due to beta emissions for each identified noble gas radionuclide "i", mrad/yr per µCi/m³;

$(\overline{X/Q})_v$ = the annual average relative concentration for areas at or beyond the unrestricted area boundary for long-term vent releases (greater than 500 hrs/year), sec/m³;

$(\overline{X/q})_v$ = the relative concentration for areas at or beyond the unrestricted area boundary for short-term vent releases (equal to or less than 500 hrs/year), sec/m³;

$(\overline{X/Q})_s$ = the annual average relative concentration for areas at or beyond the unrestricted area boundary for long-term free standing stack releases (greater than 500 hrs/year), sec/m³;

$(\overline{X/q})_s$ = the relative concentration for areas at or beyond the unrestricted area boundary for short-term free standing stack releases (equal to or less than 500 hrs/year), sec/m³;

q_{is} = release of noble gas radionuclide "i" in gaseous effluents for short-term stack releases (equal to or less than 500 hrs/year), µCi;

q_{iv} = release of noble gas radionuclide "i" in gaseous effluents for short-term vent releases (equal to or less than 500 hrs/year), µCi;

Q_{is} = release of noble gas radionuclide "i" in gaseous effluents for long-term free standing stack releases (greater than 500 hrs/year), µCi;

Q_{iv} = release of noble gas radionuclide "i" in gaseous effluents for long-term vent releases (greater than 500 hrs/year), µCi;

B_i = the constant for long-term releases (greater than 500 hrs/year) for each identified noble gas radionuclide "i" accounting for the gamma radiation from the elevated finite plume, mrad/yr per µCi/sec;

b_i = the constant for short-term releases (equal to or less than 500 hrs/year) for each identified noble gas radionuclide "i" accounting for the gamma radiation from the elevated finite plume, mrad/yr per µCi/sec;

3.17E-8 = the inverse of the number of seconds in a year.

NUREG 0133 permits eliminating the short-term release term and short-term meteorological terms in the determination of doses when short term releases are sufficiently random in both time of day and duration to be represented by annual average dispersion conditions.

This special consideration is applied in expressions 2.3-1 through 2.3-6, however a summary of the "real time" meteorological data coupled with the corresponding releases shall be included in the Semi-Annual Radioactive Effluent Release Report.

Short-term releases are also evaluated annually in computer codes technically consistant with XOQDOQ and GASPAR for inclusion in the Annual Radiological Environmental Report.

The incorporation of this option and the release modes of Table 2.3-1 results in the following expressions to show compliance with 10 CFR 50 for the calendar quarter or year.

For Release Modes 1, 2, 3, and 4

During any month, calendar quarter, or year:

Gamma Radiation (mrad)

$$3.17E\text{-}8 \sum_i \left[M_i \left[(\overline{X/Q})_{cv} Q_{i_{cv}} + (\overline{X/Q})_{vv} Q_{i_{vv}} \right] + 0.5\, B_i Q_{i_{pv}} \right] \leq \begin{array}{r} 0.2 \text{ mrad (per 31 days)} \\ 5.0 \text{ mrad (per quarter)} \\ 10.0 \text{ mrad (per year)} \end{array} \quad (2.3\text{-}7)$$

Beta Radiation (mrad)

$$3.17E\text{-}8 \sum_i N_i \left[(\overline{X/Q})_{cv} Q_{i_{cv}} + (\overline{X/Q})_{vv} Q_{i_{vv}} + 0.5\, (\overline{X/Q})_{pv} Q_{i_{pv}} \right] \leq \begin{array}{r} 0.4 \text{ mrad (per 31 days)} \\ 10.0 \text{ mrad (per quarter)} \\ 20.0 \text{ mrad (per year)} \end{array} \quad (2.3\text{-}8)$$

where:

$(\overline{X/Q})_{cv}$ = annual average relative concentration for releases from the Containment Building Vent, sec/m^3;

$(\overline{X/Q})_{vv}$ = annual average relative concentration for releases from the Ventilation Vent, sec/m³;

$(\overline{X/Q})_{pv}$ = annual average relative concentration for releases from the Process Vent, sec/m³;

$(\overline{X/Q})_{tv}$ = annual average relative concentration for releases from the Turbine Building Vent, sec/m³;

$Q_{i_{cv}}$ = release of radionuclide "i" from the Containment Building Vent, µCi;

$Q_{i_{vv}}$ = release of radionuclide "i" from the Ventilation Vent, µCi;

$Q_{i_{pv}}$ = release of radionuclide "i" from the Process Vent, µCi;

$Q_{i_{tv}}$ = release of radionuclide "i" from the Turbine Building Vent, µCi;

For modes 1, 2, 3, and 4 the controlling location is 0.35 miles NW. Substitution of the appropriate X/Q values into Expressions 2.3-7 and 2.3-8 results in the following:

Release Modes 1, 2, 3, and 4

During any month, calendar quarter or year:

Gamma Radiation (mrad)

$$3.17E\text{-}8 \sum_i \left[M_i [9.24E\text{-}5 Q_{i_{cv}} + 1.03E\text{-}4 Q_{i_{vv}} + 7.35E\text{-}5 Q_{i_{tv}}] + 0.5\, B_i Q_{i_{pv}} \right]$$

$$\leq \begin{array}{r} 0.2 \text{ mrad (per 31 days)} \\ 5.0 \text{ mrad (per quarter)} \\ 10.0 \text{ mrad (per year)} \end{array} \qquad (2.3\text{-}9)$$

Beta Radiation (mrad)

$$3.17E\text{-}8 \sum_i N_i \left[9.24E\text{-}5 Q_{i_{cv}} + 1.03E\text{-}4 Q_{i_{vv}} + 7.35E\text{-}5 Q_{i_{tv}} + (0.5)\, 7.0E\text{-}10 Q_{i_{pv}} \right]$$

$$\leq \begin{array}{r} 0.4 \text{ mrad (per 31 days)} \\ 10.0 \text{ mrad (per quarter)} \\ 20.0 \text{ mrad (per year)} \end{array} \qquad (2.3\text{-}10)$$

The determination of the controlling locations for implementation of 10 CFR 50 is a function of the following parameters:

(1) radionuclide mix and their isotopic release
(2) release mode
(3) meteorology.

The incorporation of these parameters into Expressions 2.3-7 and 2.3-8 resulted in the expressions for the controlling locations as presented in Expressions 2.3-9 and 2.3-10. The radionuclide mix was based upon source terms calculated using the NRC GALE Code (inputs presented in Appendix B) and is presented in Table 2.2-2 as a function of release type and release point.

As in Section 2.2.1, for each release mode, the two highest boundary X/Q values for each release point and release duration were utilized in conjunction with the radionuclide mix and release for each release point to determine the controlling site boundary location. Since elevated releases occur from the BVPS site and their maximum X/Q values may not decrease with distance (i.e., the site boundary may not have highest X/Q values), the two highest X/Q values for those distances, greater than the site boundary, were also considered in conjunction with the radionuclide mix to determine the controlling location. These values of X/Q were obtained for the midpoint of the 10 standard distance intervals previously presented in Tables 2.2-4 through 2.2-10.

For each release mode a particular combination of release point mix and meteorology dominates in the determination of the controlling location. For release modes 1, 2, 3, and 4, the controlling release is the Ventilation Vent. For release mode 3, the controlling release is the Containment Building Vent.

Values for M_i and N_i, which were used in the determination of the controlling location and which are to be used by BVPS-1 in Expressions (2.3-9) and (2.3-10) to show compliance with 10 CFR 50 were presented in Table 2.2-11. Values taken from Table B-1 of Regulatory Guide 1.109, Revision 1 were multiplied by 1E6 to convert from picocuries^{-1} to microcuries^{-1} for use in Table 2.2-11.

In the determination of the controlling location for Modes 1, 2, 3, and 4, Tables 2.2-4 through 2.2-7 are utilized for X/Q values. The B_i values to be utilized are the same values which were presented in Table 2.2-12. A description of the derivation of the various X/Q values is presented in Appendix A.

The following relationship should hold for BVPS-1 to show compliance with Technical Specification 3.11.2.2:

For the calendar quarter:

$$D_\gamma \leq 5 \text{ mrad} \quad (2.3\text{-}11)$$

$$D_\beta \leq 10 \text{ mrad} \quad (2.3\text{-}12)$$

For the calendar year:

$$D_\gamma \leq 10 \text{ mrad} \quad (2.3\text{-}13)$$

$$D_\beta \leq 20 \text{ mrad} \quad (2.3\text{-}14)$$

where:

D_γ = the air dose from gamma radiation, mrad.

D_β = the air dose from beta radiation, mrad.

The quarterly limits given above represent one-half the annual design objective of Section II.B.1 of Appendix I of 10 CFR 50. If any of the limits of Expressions 2.3-11 through 2.3-14 are exceeded, a special report pursuant to both Section IV.A of Appendix I of 10 CFR 50 and Technical Specification 3.11.2.2.a must be filed with the NRC at the identified locations.

In addition, BVTS 3.1.2.4 requires that the gaseous radwaste system must be used to reduce radioactive materials in that waste when projected doses averaged over 31 days exceed any of the following:

$$D_\gamma \leq 0.2 \text{ mrad} \quad (2.3\text{-}15)$$

$$D_\beta \leq 0.4 \text{ mrad} \quad (2.3\text{-}16)$$

2.3.1.2 Projection of Doses (Noble Gas)

Doses due to gaseous releases from BVPS-1 shall be projected at least once per 31 days in accordance with BVTS 4.11.2.4 and this section. (See also Section 2.3.2.2 Projection of Doses). The Gaseous Radwaste Treatment System and the Ventilation Exhaust Treatment System shall be used to reduce radioactive materials in gaseous waste prior to their discharge in accordance with BVTS 3.11.2.4 when the projected gaseous effluent air dose due to gaseous effluent releases from the site averaged over 31 days would exceed 0.2 mrad for gamma radiation and 0.4 mrad for beta radiation. (See also Section 2.3.2.2 Projection of Doses for additional specifications). The doses used in the 31-day dose projection will be calculated using Expressions 2.3-9 and 2.3-10 as appropriate. The 31-day dose projection shall be performed according to the following equations:

When including pre-release data

$$D_{31} = \left[\frac{A + B}{T}\right] 31 + C \quad (2.3\text{-}17)$$

When not including pre-release data

$$D_{31} = \left[\frac{A}{T}\right]31 + C \qquad (2.3\text{-}18)$$

Where:

D_{31} = Projected 31 day dose, mrad
A = Cumulative dose for quarter, mrad
B = Projected dose from this release, mrad
T = Current days into quarter
C = Value which may be used to anticipate plant trends, mrad

2.3.2 Radioiodine and Particulates

2.3.2.1 Cumulation of Doses

Section IIC of Appendix I of 10 CFR 50 (BVTS 3.11.2.3 and 3.11.2.4) limits the release of radioiodines and radioactive material in particulate form from each reactor such that estimated dose or dose commitment to an individual in an unrestricted area from all pathways of exposure is not in excess of 15 mrem to any organ. In addition, BVTS 3.11.2.4 requires the use of gaseous radwaste treatment system when projected doses averaged over 31 days to any organ from gaseous waste would exceed 0.3 mrem. Based upon NUREG-0133, the dose to an organ of an individual from radioiodines and particulates, and radionuclides other than noble gases with half-lives greater than 8 days in gaseous effluents released to unrestricted areas, can be determined by the following expression:

During any month, calendar quarter or year:

$$3.17E\text{-}8 \sum_i R_{it}[W_s Q_{is} + w_s q_{is} + W_v Q_{iv} + w_v q_{iv}] \leq \begin{array}{l} 0.3 \text{ mrem (per 31 days)} \\ 7.5 \text{ mrem (per quarter)} \\ 15.0 \text{ mrem (per calendar year)} \end{array} \qquad (2.3\text{-}19)$$

where:

Q_{is} = release of radionuclide "i" for long-term free standing stack releases (greater than 500 hrs/yr), µCi;

Q_{iv} = release of radionuclide "i" for long-term vent releases (greater than 500 hrs/yr), µCi;

q_{is} = release of radionuclide "i" for short-term free standing stack releases (equal to or less than 500 hrs/yr), µCi;

q_{iv} = release of radionuclide "i" for short-term vent releases (equal to or less than 500 hrs/yr), µCi;

W_s = dispersion parameter for estimating dose to an individual at the controlling location for long-term free standing stack releases (greater than 500 hrs/yr);

= sec/m^3 for the inhalation pathway, $(\overline{X/Q})_s$;

= $meters^{-2}$ for the food and ground plane pathway, $(\overline{D/Q})_s$;

W_v = the dispersion parameter for estimating the dose to an individual at the controlling location for long-term vent releases (greater than 500 hrs/yr);

= sec/m^3 for the inhalation pathway, $(\overline{X/Q})_v$;

= $meters^{-2}$ for the food and ground plane pathway, $(\overline{D/Q})_v$;

w_s = dispersion parameter for estimating the dose to an individual at the controlling location for short-term stack releases (equal to or less than 500 hrs/yr);

= sec/m^3 for the inhalation pathway, $(\overline{X/q})_s$;

= $meters^{-2}$ for the food and ground plane pathway, $(\overline{D/q})_s$;

w_v = the dispersion parameter for estimating the dose to an individual at the controlling location for short-term vent releases (equal to or less than 500 hrs/yr);

= sec/m^3 for the inhalation pathway, $(\overline{X/q})_v$;

= $meters^{-2}$ for the food and ground plane pathway, $(\overline{D/q})_v$;

3.17E-8 = the inverse of the number of seconds in a year;

$R_{i\tau}$ = the dose factor for each identified radionuclide "i" for the organ "τ" of interest, mrem/yr per μCi/sec per m^{-2} or mrem/yr per μCi/m^3.

Radionuclides and particulates may be released from any of the BVPS-1 vents in the release modes identified in Table 2.3-1. As described previously in Section 2.3.1.1 at Beaver Valley Unit 1, NUREG 0133 permits use of long-term annual average dispersion calculations which with the release modes of Table 2.3-1 results in the following expressions to show compliance with BVTS 3.11.2.3 and BVTS 3.11.2.4. For a particular organ, Expression 2.3-19 becomes:

$$3.17E\text{-}8 \sum_i R_{it}\left[0.5\, W_{pv}Q_{i_{pv}} + W_{cv}Q_{i_{cv}} + W_{vv}Q_{i_{vv}} + W_{tv}Q_{i_{tv}}\right]$$

$$\leq \begin{array}{l} 0.3 \text{ mrem (per 31 days)} \\ 7.5 \text{ mrem (per quarter)} \\ 15.0 \text{ mrem (per calendar year)} \end{array} \qquad (2.3\text{-}20)$$

where:

W_{pv} = dispersion parameter for releases from the Process vent;

W_{cv} = dispersion parameter for releases from the Containment Building Vent;

W_{vv} = dispersion parameter for releases from the Ventilation Vent;

W_{tv} = dispersion parameter for releases from the Turbine Building Vent;

$Q_{i_{pv}}$ = release of radionuclide "i" from the Process Vent, µCi;

$Q_{i_{cv}}$ = release of radionuclide "i" from the Containment Building Vent, µCi;

$Q_{i_{vv}}$ = release of radionuclide "i" from the Ventilation Vent, µCi;

$Q_{i_{tv}}$ = release of radionuclide "i" from the Turbine Building Vent, µCi;

The Turbine Building Vent is not normally a radioactive release point. It is included only for use if a radioactive release is identified in the future.

In determining the dose at a particular location, dispersion parameter W, is a function of the pathway. For the food and ground plane pathway, W is in terms of D/Q. If the inhalation pathway is considered, W is in terms of X/Q. Incorporation of the various pathways into Expression 2.3-20 results in the following expression for a particular organ:

$$3.17E\text{-}8 \sum_i \left[\left[R_{i\tau_G} + R_{i\tau_M} + R_{i\tau_V} + R_{i\tau_B} \right] \left[0.5\, W_{pv} Q_{i_{pv}} + W_{cv} Q_{i_{cv}} + W_{vv} Q_{i_{vv}} + W_{tv} Q_{i_{tv}} \right] + R_{i\tau_I} \left[0.5\, (X/Q)_{pv} Q_{i_{pv}} + (X/Q)_{cv} Q_{i_{cv}} + (X/Q)_{vv} Q_{i_{vv}} + (X/Q)_{tv} Q_{i_{tv}} \right] \right]$$

$$\leq \begin{array}{l} 0.3 \text{ mrem (per 31 days)} \\ 7.5 \text{ mrem (per quarter)} \\ 15.0 \text{ mrem (per year)} \end{array} \qquad (2.3\text{-}21)$$

where:

$R_{i\tau_G}$ = dose factor for an organ "τ" for radionuclide "i" for the ground plane exposure pathway, mrem/yr per μCi/sec per m^{-2};

$R_{i\tau_M}$ = dose factor for an organ "τ" for radionuclide "i" for either the cow milk or goat milk pathway, mrem/yr per μCi/sec per m^{-2};

$R_{i\tau_V}$ = dose factor for an organ "τ" for radionuclide "i" for the vegetable pathway, mrem/yr per μCi/sec per m^{-2};

$R_{i\tau_B}$ = dose factor for an organ "τ" for radionuclide "i" for the meat pathway, mrem/yr per μCi/sec per m^{-2};

$R_{i\tau_I}$ = dose factor for an organ "τ" for radionuclide "i" for the inhalation pathway, mrem/yr per μCi/m^3;

It should be noted that W_{pv}, W_{cv}, and W_{vv} in Expression 2.3-21 are in terms of D/Q(m^{-2}).

Values of the dose factor, $R_{i\tau}$, were calculated using the methodology of NUREG-0133. The following equations were used for all nuclides except tritium:

$$R_{i\tau_I} = K'(BR)_a \, (DFA_{i\tau})_a \text{ (mrem/yr per μCi/m}^3\text{)} \qquad (2.3\text{-}22)$$

where:

K' = a constant of unit conversion 1E6 pCi/μCi;

$(BR)_a$ = the breathing rate of the receptor of age group (a), in m^3/yr;

$(DFA_{i\tau})_a$ = each organ inhalation dose factor for the receptor of age group (a) for the "i" th radionuclide, in mrem/pCi. Inhalation dose factors ($DFA_{i\tau}$) by organ for the various age groups are given in Table E-7 through E-10 of Regulatory Guide 1.109, Rev. 1 or Tables 5 through 8 of NUREG-0172.

The breathing rates $(BR)_a$ used for the various age groups are tabulated below, as given 'n Table E-5 of the Regulatory Guide 1.109.

Age Group(a)	Breathing Rate (m^3/yr)
Infant	1400
Child	3700
Teen	8000
Adult	8000

$$R_{i\tau_G} = K'K'' (SF)DFG_{i\tau}[(1 - e^{-\lambda_i t})/\lambda_i] \quad (m^2\text{-mrem/yr per } \mu Ci/sec) \qquad (2.3\text{-}23)$$

where:

K' = a constant of unit conversion 1E6 pCi/μCi;

K'' = a constant of unit conversion, 8760 hr/year;

λ_i = the decay constant for the "i" th radionuclide, sec^{-1};

t = the exposure time, 4.73E8 sec (15 years);

$DFG_{i\tau}$ = the groundplane dose conversion factor for organ "τ" for the "i" th radionuclide (mrem/hr per pCi/m^2). A tabulation of $DFG_{i\tau}$ values is presented in Table E-6 of Regulatory Guide 1.109;

SF = the shielding factor (dimensionless). A shielding factor of 0.7 as suggested in Table E-15 of Regulatory Guide 1.109 is used.

$$R_{i\tau_M} = K' \frac{Q_F(U_{ap})}{\lambda_i + \lambda_w} F_m (r)(DFL_a)_{i\tau} \left[\frac{f_p f_s}{Y_p} + \frac{(1 - f_p f_s)e^{-\lambda_i t_h}}{Y_S}\right] e^{-\lambda_i t_f}$$

$$(m^2\text{-mrem/yr per } \mu Ci/sec) \qquad (2.3\text{-}24)$$

where:

K' = a constant of unit conversion, 1E6 pCi/μCi;

Q_F = the animals' consumption rate, in kg/day (wet weight);

U_{ap} = the receptor's milk consumption rate, for age (a), in liters/yr;

Y_p = the agricultural productivity by unit area of pasture feed grass, in kg/m^2;

Y_S = the agricultural productivity by unit area of stored feed, in kg/m^2;

F_m = the stable element transfer coefficients, in days/liter;

r = fraction of deposited activity retained on animals feed grass;

$(DFL_{it})_a$ = the maximum organ ingestion dose factor for the "i" th radionuclide for the receptor in age group (a), in mrem/pCi. Ingestion dose factors $(DFL_{it})_a$ for the various age groups are given in Table E-11 through E-14 of Regulatory Guide 1.109 or Tables 1 through 4 of NUREG-0172.

λ_i = the decay constant for the "i" th radionuclide, in sec^{-1};

λ_w = the decay constant for removal of activity on leaf and plant surfaces by weathering 5.73E-7 sec^{-1} (corresponding to a 14 day half-life);

t_f = the transport time from pasture to animal, to milk, to receptor, in sec;

t_h = the transport time from pasture, to harvest, to animal, to milk, to receptor, in sec;

f_p = fraction of the year that the animal is on pasture (dimensionless);

f_s = fraction of the animal feed that is pasture grass while the animal is on pasture (dimensionless).

Tabulated below are the parameter values used for cow's milk and their reference to Regulatory Guide 1.109.

Parameter	Value	Table
r (dimensionless)	1.0 for radioiodine	E-15
	0.2 for particulates	E-15
F_m (days/liter)	Each Stable element	E-1
U_{ap} (liters/yr) - Infant	330	E-5
Child	330	E-5
Teen	400	E-5
Adult	310	E-5
$(DFL_{it})_a$ (mrem/pCi)	Each radionuclide	E-11 to E-14
Y_p (kg/m²)	0.7	E-15
Y_s (kg/m²)	2.0	E-15
t_f (seconds)	1.73E5 (2 days)	E-15
t_h (seconds)	7.78E6 (90 days)	E-15
Q_F (kg/day)	50	E-3
f_p	0.5	—
f_s	1.0	—

For goat's milk, all values remain the same except for Q_F which is 6 kg/day.

$$R_{it}^{B} = K' \frac{Q_F(U_{ap})}{\lambda_i + \lambda_w} F_f(r)(DFL_{it})_a \left[\frac{f_p f_s}{Y_p} + \frac{(1 - f_p f_s)e^{-\lambda_i t_h}}{Y_S}\right] e^{-\lambda_i t_f}$$

$$(m^2\text{-mrem/yr per } \mu Ci/sec) \qquad (2.3\text{-}25)$$

where:

F_f = the stable element transfer coefficients, in days/kg;

U_{ap} = the receptor's meat consumption rate for age (a) in kg/yr;

t_f = the transport time from pasture to receptor, in sec;

t_h = the transport time from crop field to receptor, in sec.

All parameter values are the same as the milk pathway parameter values except F_f which is obtained from Table E-1 of Regulatory Guide 1.109 and U_{ap} which is obtained from Table E-5 of Regulatory Guide 1.109. The values used are as follows:

Parameter		Value	Table
F_f (days/kg)		Each stable element	E-1
U_{ap} (kg/yr)	- Infant	0	E-5
	Child	41	E-5
	Teen	65	E-5
	Adult	110	E-5

Man is considered to consume two types of vegetation (fresh and stored) that differ only in the time period between harvest and consumption; therefore:

$$R_{it} = K' \left[\frac{(r)}{Y_v(\lambda_i + \lambda_w)}\right](DFL_{it})_a \left[U^L_{fa} e^{-\lambda_i t_L} + U^S_{fg} e^{-\lambda_i t_h}\right]$$

$$(m^2\text{-mrem/yr per } \mu Ci/sec) \qquad (2.3\text{-}26)$$

where:

K' = a constant of unit conversion 1E6 pCi/μCi;

U^L_a = the consumption rate of fresh leafy vegetation by the receptor in age group (a), in kg/yr;

U^S_a = the consumption rate of stored vegetation by the receptor in age group (a) in kg/yr;

f_L = the fraction of the annual intake of fresh leafy vegetation grown locally;

f_g = the fraction of the annual intake of stored vegetation grown locally;

t_L = the average time between harvest of leafy vegetation and its consumption, in seconds;

t_h = the average time between harvest of stored vegetation and its consumption, in seconds;

Y_v = the vegetation area density, in kg/m^2;

and all other factors are defined previously.

Tabulated below are the appropriate parameter values and their reference to Regulatory Guide 1.109.

Parameter	Value	Table
r (dimensionless)	1.0 for radioiodines	E-15
	0.2 for particulates	E-15
$(DFL_{i\tau})_a$ (mrem/pCi)	Each Radionuclide	E-11 to E-14
U_a^L (kg/yr) - Infant	0	E-5
Child	26	E-5
Teen	42	E-5
Adult	64	E-5
U_a^S (kg/yr) - Infant	0	E-5
Child	520	E-5
Teen	630	E-5
Adult	520	E-5
f_L (dimensionless)	1.0	E-15
F_g (dimensionless)	0.76	E-15
t_L (seconds)	8.6E4 (1 day)	E-15
t_h (seconds)	5.18E6 (60 days)	E-15
Y_v (kg/m²)	2.0	E-15

As discussed in Section 2.2.2, for tritium the parameter W for the food pathway is based upon X/Q. The ground plane pathway is not appropriate for tritium. Therefore, the left-hand portion of Expression 2.3-20 may be expressed for purposes of implementation of 40 CFR 190, discussed in Section 4.0, as:

For tritium:

$$3.17E\text{-}8\ (R_{T\tau_M} + R_{T\tau_V} + R_{T\tau_B} + R_{T\tau_I})\ [0.5\ (X/Q)_{pv}Q_{T_{pv}} + (X/Q)_{cv}Q_{T_{cv}} + (X/Q)_{vv}Q_{T_{vv}} + (X/Q)_{tv}Q_{T_{tv}}] \qquad (2.3\text{-}27)$$

where:

$R_{T\tau_M}$ = dose factor for organ "τ" for tritium for the milk pathway, mrem/yr per $\mu Ci/sec^3$;

$R_{T\tau_V}$ = dose factor for organ "τ" for tritium for the vegetable pathway, mrem/yr per $\mu Ci/m^3$;

$R_{T\tau_B}$ = dose factor for organ "τ" for tritium for the beef pathway, mrem/yr per $\mu Ci/m^3$;

$R_{T\tau_I}$ = dose factor for organ "τ" for tritium for the inhalation pathway, mrem/yr per $\mu Ci/m^3$.

Expression 2.3-27 is used to show compliance with 40 CFR 190, as discussed in Section 4.0.

The concentration of tritium in milk is based on the airborne concentration rather than the deposition. Therefore, the $R_{T\tau_M}$ is based on [X/Q]:

$$R_{T\tau_M} = K'K'''F_m Q_F U_{ap} (DFL_{i\tau})_a [0.75(0.5/H)] \text{ (mrem/yr per } \mu Ci/m^3) \quad (2.3\text{-}28)$$

where:

K''' = a constant of unit conversion, 10^3 gm/kg;

H = absolute humidity of the atmosphere, in gm/m^3;

0.75 = the fraction of total feed that is water;

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

and other parameters and values are the same as for $R_{i\tau_M}$. The value of H used is 8 grams/meter^3.

The concentration of tritium in vegetation is based on the airborne concentration rather than the deposition. Therefore, the $R_{t\tau_V}$ is based on [X/Q]:

$$R_{T\tau_V} = K'K''' [U_a^L f_L + U_a^S f_g] (DFL_{i\tau})_a [0.75(0.5/H)]$$

$$\text{(mrem/yr per } \mu Ci/m^3) \quad (2.3\text{-}29)$$

where all terms have been defined above.

The concentration of tritium in meat is based on its airborne concentration rather than the deposition. Therefore, the $R_{T\tau_B}$ is based on [X/Q]:

$$R_{T\tau_B} = K'K'''F_f Q_F U_{ap} (DFL_{i\tau})_a [0.75(0.5/H)]$$

$$\text{(mrem/yr per } \mu Ci/m^3) \quad (2.3\text{-}30)$$

where all terms have been defined above.

To show compliance with BVTS 3.11.2.3 and BVTS 3.11.2.4, Equation 2.3-21 is evaluated at the controlling pathway location. For release modes 1 through 4, the controlling location is a residence 0.69 miles in the NW sector. Inserting appropriate X/Q values from Tables 2.2-4 to 2.2-10 and D/Q values from Tables 2.3-28 to 2.3-34, Expression 2.3-21 becomes:

Release Modes 1 through 4

Per month, calendar quarter or year:

$$3.17E\text{-}8 \sum_i \left[[R_{it_G} + R_{it_V}][(0.5)4.22E\text{-}10\ Q_{i_{pv}} + 1.56E\text{-}8\ Q_{cv} + 1.56E\text{-}8\ Q_{i_{vv}} + 1.55E\text{-}8\ Q_{i_{tv}}] + R_{it_I}[(0.5)\ 7.30E\text{-}9\ Q_{i_{pv}} + 2.00E\text{-}5\ Q_{i_{cv}} + 2.71E\text{-}5\ Q_{i_{vv}} + 2.22E\text{-}5\ Q_{i_{tv}}] \right]$$

$$\leq \begin{array}{l} 0.3 \text{ mrem (per 31 days)} \\ 7.5 \text{ mrem (per quarter)} \\ 15.0 \text{ mrem (per year)} \end{array} \qquad (2.3\text{-}31)$$

For tritium, for purposes of implementation of 40 CFR 190, as discussed in Section 4.0, Expression 2.3-28 reduces to:

$$3.17E\text{-}8\ [R_{T_{t_V}} + R_{T_{t_I}}][(0.5)7.30E\text{-}9\ Q_{i_{pv}} + 2.00E\text{-}5\ Q_{i_{cv}} + 2.71E\text{-}5\ Q_{i_{vv}}] \qquad (2.3\text{-}32)$$

The determination of a controlling locating for implementation of BVTS 3.11.2.3 and BVTS 3.11.2.4 for radioiodines and particulates is a function of:

(1) radionuclide mix and their isotopic release
(2) release mode
(3) meteorology
(4) exposure pathway
(5) receptor's age

The incorporation of these parameters into Expression 2.3-19 results in the respective equations for each release mode at the controlling location.

In the determination of the controlling location for each release mode, the radionuclide mix of radioiodines and particulates was based upon the source terms calculated using the GALE code. This mix was presented in Table 2.2-2 as a function of release mode and release point. For the ground plane exposure pathway, all radionuclides (excluding H-3 and C-14) were considered in the determination of the controlling location. For the inhalation and food pathways H-3 and C-14 were also considered in determination of the controlling location.

In the determination of the controlling location for each release mode, all of the exposure pathways, as presented in Table 2.2-3, were evaluated. These include cow milk, goat milk, beef and vegetable ingestion and inhalation and ground plane exposure. An infant was assumed to be present at all milk pathway locations. A child was assumed to be present at all vegetable garden and beef animal locations. The ground plane and inhalation exposure pathways were considered to be present at all locations.

For the determination of the controlling location, the highest D/Q and X/Q values for each release point and release mode for the vegetable garden, cow milk, and goat milk pathways were selected. The organ dose was calculated at each of these locations using the radionuclide mix and release of Table 2.2-2. Based upon these calculations, it was determined that the controlling location for release modes 1 through 4 is the residence (vegetable garden)/child pathway.

For release mode 1 through 4, the controlling release point and mix is the Ventilation Vent.

Tables 2.3-2 through 2.3-20 present R_i values for the total body, GI-tract, bone, liver, kidney, thyroid, and lung organs for the ground plane, inhalation, cow milk, goat milk, vegetable, and meat ingestion pathways for the infant, child, teen and adult age groups as appropriate to the pathways. These values were calculated using the methodology described in NUREG-0133 using a grazing period of 6 months.

In the determination of the controlling location for release Modes 1-4, Tables 2.2-4 through 2.2-7 are utilized for the X/Q for releases from the process vent, containment building vent, the ventilation vent, and the turbine building vent. Tables 2.3-28 through 2.3-34 are utilized for long term D/Q values from the process vent, containment building vent, the ventilation vent, and the turbine building vent. A description of the derivation of the various X/Q and D/Q values is presented in Appendix A.

Long-term D/Q values for the process vent, containment building vent, the ventilation vent, and turbine building vent are provided for the midpoints of the following distances:

0.0-0.5 mi., 0.5-1.0 mi., 1.0-1.5 mi., 1.5-2.0 mi., 2.0-2.5 mi., 2.5-3.0 mi., 3.0-3.5 mi., 3.5-4.0 mi., 4.0-4.5 mi., 4.5-5.0 mi.

The values appear in Tables 2.3-21 through 2.3-27. These values may be utilized if an additional special location arises different from those presented in the special locations of Table 2.2-3.

The following relationship should hold for BVPS-1 to show compliance with BVPS Technical Specification 3.11.2.3.

For the calendar quarter:

$$D_t \leq 7.5 \text{ mrem to any organ} \qquad (2.3\text{-}33)$$

For the calendar year:

$$D_\tau \leq 15 \text{ mrem to any organ} \qquad (2.3\text{-}34)$$

where:

D_τ = the dose to any organ from radioiodines and particulates, mrem.

The quarterly limits given above represent one-half the annual design objective of Section IIC of Appendix I of 10 CFR 50. If any of the limits of Expressions 2.3-33 and 2.3-34 are exceeded, a special report pursuant to both Section IV.A of Appendix I of 10 CFR 50 and Technical Specification 3.11.2.3.a must be filed with the NRC at the identified locations.

2.3.2.2 Projection of Doses (Iodines and Particulates)

Doses due to gaseous releases from the BVPS-1 shall be projected at least once per 31 days in accordance with BVTS 4.11.2.4 and this section. (See also Section 2.3.1.2 Projection of Doses). The appropriate portions of the Ventilation Exhaust Treatment System shall be used to reduce radioactive materials in gaseous waste prior to their discharge in accordance with BVTS 3.11.2.4 when the projected doses due to gaseous effluent release from the site averaged over 31 days would exceed 0.3 mrem to any organ. (See also Section 2.3.1.2 Projection of Doses for additional specifications). Doses resulting from the gaseous effluent release of radioiodines and particulates will be calculated for use in the 31-day dose projection using Expression (2.3-31). The 31-day dose projection shall be performed according to the following equations:

When including pre-release data

$$D_{31} = \left[\frac{A + B}{T}\right] 31 + C \qquad (2.3\text{-}35)$$

When not including pre-release data

$$D_{31} = \left[\frac{A}{T}\right] 31 + C \qquad (2.3\text{-}36)$$

where:

D_{31} = Projected 31 day dose, mrem
A = Cumulative dose for quarter, mrem
B = Projected dose for this release, mrem
T = Current days into quarter
C = Value which may be used to anticipate plant trends, mrem

TABLE 2.3-1
MODES OF GASEOUS RELEASE FROM BEAVER VALLEY SITE VENTS
FOR IMPLEMENTATION OF 10 CFR 20 AND 10 CFR 50

Release Point	Mode 1	Mode 2	Mode 3	Mode 4
BVPS-1 - BVPS-2[2] Process Vent (pv)	Main Cond. Air Ejector, Waste Gas, Containment Vacuum	Same as Mode 1	Same as Mode 1	Same as Mode 1 and Containment Purge
BVPS-1 Ventilation[1] Vent (vv1)	Aux. Bldg. Ventilation	Containment Purge[3]	Same as Mode 1	Same as Mode 1
BVPS-1 Containment[1] Vent (cv1)	Leakage Collection Exhaust	Same as Mode 1	Same as Mode 1 and Containment Purge[3]	Same as Mode 1
BVPS-1 Turbine Bldg.[1] Vent (tv1)	Turbine Bldg Exhaust*	Same as Mode 1*	Same as Mode 1*	Same as Mode 1*
BVPS-2 Ventilation[1] Vent (vv2)	Contiguous Areas	Containment Purge[3]	Same as Mode 1	Same as Mode 1
BVPS-2 Containment[1] Vent (cv2)	Aux. Bldg. Ventilation	Same as Mode 1	Same as Mode 1 and Containment Purge[3]	Same as Mode 1
BVPS-2 Turbine Bldg.[1] Vent (tv2)	Turbine Bldg Exhaust*	Same as Mode 1*	Same as Mode 1*	Same as Mode 1*
BVPS-2 Condensate[1] Polishing Bldg. Vent (cp2)	*	*	*	*
BVPS-2 Decontamination[1] Bldg. Vent (dv2)	*	*	*	*
BVPS-2 Waste Gas[1] Storage Vault Vent (wv2)	*	*	*	*

*Not normally a radioactive release point

Note: For the purpose of implementing 10 CFR 50, batch discharges may use continuous meteorology since short term meteorology is used at the time of the annual report.

[1]Continuous ground level meteorology is applicable
[2]Continuous elevated meteorology is applicable
[3]Mode established by purge from one unit, all other release points remain same as Mode 1.

TABLE 2.3-2

R VALUES FOR BEAVER VALLEY SITE

Pathway = Inhal
Age Group = Adult

Nuclide	T-Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
H 3	1.26E 03	1.26E 03	0.00E-01	1.26E 03	1.26E 03	1.26E 03	1.26E 03	1.26E 03
P 32	5.00E 04	8.63E 04	1.32E 06	7.70E 04	0.00E-01	0.00E-01	0.00E-01	0.00E-01
MN 54	6.29E 03	7.72E 04	0.00E-01	3.95E 04	9.83E 03	0.00E-01	1.49E 06	0.00E-01
FE 59	1.05E 04	1.88E 05	1.17E 04	2.77E 04	0.00E-01	0.00E-01	1.01E 06	0.00E-01
CO 58	2.07E 03	1.06E 05	0.00E-01	1.58E 03	0.00E-01	0.00E-01	9.27E 05	0.00E-01
CO 60	1.48E 04	2.84E 05	0.00E-01	1.15E 04	0.00E-01	0.00E-01	5.96E 06	0.00E-01
ZN 65	4.65E 04	5.34E 04	3.24E 04	1.03E 05	6.89E 04	0.00E-01	8.63E 05	0.00E-01
RB 86	5.89E 04	1.66E 04	0.00E-01	1.35E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	8.71E 03	3.49E 05	3.04E 05	0.00E-01	0.00E-01	0.00E-01	1.40E 06	0.00E-01
SR 90	6.09E 06	7.21E 05	9.91E 07	0.00E-01	0.00E-01	0.00E-01	9.59E 06	0.00E-01
Y 91	1.24E 04	3.84E 05	4.62E 05	0.00E-01	0.00E-01	0.00E-01	1.70E 06	0.00E-01
ZR 95	2.32E 04	1.50E 05	1.07E 05	3.44E 04	5.41E 04	0.00E-01	1.77E 06	0.00E-01
NB 95	4.20E 03	1.04E 05	1.41E 04	7.80E 03	7.72E 03	0.00E-01	5.04E 05	0.00E-01
RU103	6.57E 02	1.10E 05	1.53E 03	0.00E-01	5.82E 03	0.00E-01	5.04E 05	0.00E-01
RU106	8.71E 03	9.11E 05	6.90E 04	0.00E-01	1.33E 05	0.00E-01	9.35E 06	0.00E-01
AG110M	5.94E 03	3.02E 05	1.08E 04	9.99E 03	1.97E 04	0.00E-01	4.63E 06	0.00E-01
TE127M	1.57E 03	1.49E 05	1.26E 04	5.76E 03	4.57E 04	3.28E 03	9.59E 05	0.00E-01
TE129M	1.58E 03	3.83E 05	9.75E 03	4.67E 03	3.65E 04	3.44E 03	1.16E 06	0.00E-01
I 131	2.05E 04	6.27E 03	2.52E 04	3.57E 04	6.12E 04	1.19E 07	0.00E-01	0.00E-01
I 133	4.51E 03	8.87E 03	8.63E 03	1.48E 04	2.58E 04	2.15E 06	0.00E-01	0.00E-01
CS134	7.27E 05	1.04E 04	2.72E 05	8.47E 05	2.87E 05	0.00E-01	9.75E 04	0.00E-01
CS136	1.10E 05	1.17E 04	3.90E 04	1.46E 05	8.55E 04	0.00E-01	1.20E 04	0.00E-01
CS137	4.27E 05	8.39E 03	4.78E 05	6.20E 05	2.22E 05	0.00E-01	7.51E 04	0.00E-01
BA140	2.56E 03	2.18E 05	3.90E 04	4.90E 01	1.67E 01	0.00E-01	1.27E 06	0.00E-01
CE141	1.53E 03	1.20E 05	1.99E 04	1.35E 04	6.25E 03	0.00E-01	3.61E 05	0.00E-01
CE144	1.84E 05	8.15E 05	3.43E 06	1.43E 06	8.47E 05	0.00E-01	7.76E 06	0.00E-01

*R values in units of mrem/yr per $\mu Ci/m^3$ for inhalation pathway and all tritium pathways, and in units of m^2-mrem/yr per μCi/sec for all other pathways.

TABLE 2.3-3

R VALUES FOR BEAVER VALLEY SITE

Pathway = Inhal
Age Group = Teen

Nuclide	T-Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
H 3	1.27E 03	1.27E 03	0.00E-01	1.27E 03	1.27E 03	1.27E 03	1.27E 03	1.27E 03
P 32	7.15E 04	9.27E 04	1.89E 06	1.09E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
MN 54	8.39E 03	6.67E 04	0.00E-01	5.10E 04	1.27E 04	0.00E-01	1.98E 06	0.00E-01
FE 59	1.43E 04	1.78E 05	1.59E 04	3.69E 04	0.00E-01	0.00E-01	1.53E 06	0.00E-01
CO 58	2.77E 03	9.51E 04	0.00E-01	2.07E 03	0.00E-01	0.00E-01	1.34E 06	0.00E-01
CO 60	1.98E 04	2.59E 05	0.00E-01	1.51E 04	0.00E-01	0.00E-01	8.71E 06	0.00E-01
ZN 65	6.23E 04	4.66E 04	3.85E 04	1.33E 05	8.63E 04	0.00E-01	1.24E 06	0.00E-01
RB 86	8.39E 04	1.77E 04	0.00E-01	1.90E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	1.25E 04	3.71E 05	4.34E 05	0.00E-01	0.00E-01	0.00E-01	2.41E 06	0.00E-01
SR 90	6.67E 06	7.64E 05	1.08E 08	0.00E-01	0.00E-01	0.00E-01	1.65E 07	0.00E-01
Y 91	1.77E 04	4.08E 05	6.60E 05	0.00E-01	0.00E-01	0.00E-01	2.93E 06	0.00E-01
ZR 95	3.15E 04	1.49E 05	1.45E 05	4.58E 04	6.73E 04	0.00E-01	2.68E 06	0.00E-01
NB 95	5.66E 03	9.67E 04	1.85E 04	1.03E 04	9.99E 03	0.00E-01	7.50E 05	0.00E-01
RU103	8.95E 02	1.09E 05	2.10E 03	0.00E-01	7.42E 03	0.00E-01	7.82E 05	0.00E-01
RU106	1.24E 04	9.59E 05	9.83E 04	0.00E-01	1.90E 05	0.00E-01	1.61E 07	0.00E-01
AG110M	7.98E 03	2.72E 05	1.38E 04	1.31E 04	2.50E 04	0.00E-01	6.74E 06	0.00E-01
TE127M	2.18E 03	1.59E 05	1.80E 04	8.15E 03	6.53E 04	4.38E 03	1.65E 06	0.00E-01
TE129M	2.24E 03	4.04E 05	1.39E 04	6.57E 03	5.18E 04	4.57E 03	1.97E 06	0.00E-01
I 131	2.64E 04	6.48E 03	3.54E 04	4.09E 04	8.39E 04	1.46E 07	0.00E-01	0.00E-01
I 133	6.21E 03	1.03E 04	1.21E 04	2.05E 04	3.59E 04	2.92E 06	0.00E-01	0.00E-01
CS134	5.48E 05	9.75E 03	5.02E 05	1.13E 06	3.75E 05	0.00E-01	1.46E 05	0.00E-01
CS136	1.37E 05	1.09E 04	5.14E 04	1.93E 05	1.10E 05	0.00E-01	1.77E 04	0.00E-01
CS137	3.11E 05	8.47E 03	6.69E 05	8.47E 05	3.04E 05	0.00E-01	1.21E 05	0.00E-01
BA140	3.51E 03	2.28E 05	5.46E 04	6.69E 01	2.28E 01	0.00E-01	2.03E 06	0.00E-01
CE141	2.16E 05	1.26E 05	2.84E 04	1.89E 04	8.87E 03	0.00E-01	6.13E 05	0.00E-01
CE144	2.62E 05	8.63E 05	4.88E 06	2.02E 06	1.21E 06	0.00E-01	1.33E 07	0.00E-01

*R values in units of mrem/yr per $\mu Ci/m^3$ for inhalation pathway and all tritium pathways, and in units of m^2-mrem/yr per uCi/sec for all other pathways.

TABLE 2.3-4

R VALUES FOR BEAVER VALLEY SITE

Pathway = Inhal
Age Group = Child

Nuclide	T-Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
H 3	1.12E 03	1.12E 03	0.00E-01	1.12E 03	1.12E 03	1.12E 03	1.12E 03	1.12E 03
P 32	9.86E 04	4.21E 04	2.60E 06	1.14E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
MN 54	9.50E 03	2.29E 04	0.00E-01	4.29E 04	1.00E 04	0.00E-01	1.57E 06	0.00E-01
FE 59	1.67E 04	7.06E 04	2.07E 04	3.34E 04	0.00E-01	0.00E-01	1.27E 06	0.00E-01
CO 58	3.16E 03	3.43E 04	0.00E-01	1.77E 03	0.00E-01	0.00E-01	1.10E 06	0.00E-01
CO 60	2.26E 04	9.61E 04	0.00E-01	1.31E 04	0.00E-01	0.00E-01	7.06E 06	0.00E-01
ZN 65	7 02E 04	1.63E 04	4.25E 04	1.13E 05	7.13E 04	0.00E-01	9.94E 05	0.00E-01
RB 86	1.14E 05	7.98E 03	0.00E-01	1.98E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	1.72E 04	1.67E 05	5.99E 05	0.00E-01	0.00E-01	0.00E-01	2.15E 06	0.00E-01
SR 90	6.43E 06	3.43E 05	1.01E 08	0.00E-01	0.00E-01	0.00E-01	1.47E 07	0.00E-01
Y 91	2.43E 04	1.84E 05	9.13E 05	0.00E-01	0.00E-01	0.00E-01	2.62E 06	0.00E-01
ZR 95	3.69E 04	6.10E 04	1.90E 05	4.17E 04	5.95E 04	0.00E-01	2.23E 06	0.00E-01
NB 95	6.54E 03	3.69E 04	2.35E 04	9.16E 03	8.61E 03	0.00E-01	6.13E 05	0.00E-01
RU103	1.07E 03	4.47E 04	2.79E 03	0.00E-01	7.02E 03	0.00E-01	6.61E 05	0.00E-01
RU106	1.69E 04	4.29E 05	1.36E 05	0.00E-01	1.84E 05	0.00E-01	1.43E 07	0.00E-01
AG110M	9.13E 03	1.00E 05	1.68E 04	1.14E 04	2.12E 04	0.00E-01	5.47E 06	0.00E-01
TE127M	3.01E 03	7.13E 04	2.48E 04	8.53E 03	6.35E 04	6.06E 03	1.48E 06	0.00E-01
TE129M	3.04E 03	1.91E 05	1.92E 04	6.84E 03	5.02E 04	6.32E 03	1.76E 06	0.00E-01
I 131	2.72E 04	2.84E 03	4.80E 04	4.80E 04	7.87E 04	1.62E 07	0.00E-01	0.00E-01
I 133	7.68E 03	5.47E 03	1.66E 04	2.03E 04	3.37E 04	3.84E 06	0.00E-01	0.00E-01
CS134	2.24E 05	3.84E 03	6.50E 05	1.01E 06	3.30E 05	0.00E-01	1.21E 05	0.00E-01
CS136	1.16E 05	4.17E 03	6.50E 04	1.71E 05	9.53E 04	0.00E-01	1.45E 04	0.00E-01
CS137	1.28E 05	3.61E 03	9.05E 05	8.24E 05	2.82E 05	0.00E-01	1.04E 05	0.00E-01
BA140	4.32E 03	1.02E 05	7.39E 04	6.47E 01	2.11E 01	0.00E-01	1.74E 06	0.00E-01
CE141	2.89E 03	5.65E 04	3.9_E 04	1.95E 04	8.53E 03	0.00E-01	5.43E 05	0.00E-01
CE144	3.61E 05	3.88E 05	6.76E 06	2.11E 06	1.17E 06	0.00E-01	1.19E 07	0.00E-01

*R values in units of mrem/yr per $\mu Ci/m^3$ for inhalation pathway and all tritium pathways, and in units of m^2-mrem/yr per μCi/sec for all other pathways.

TABLE 2.3-5

R VALUES FOR BEAVER VALLEY SITE

Pathway = Inhal
Age Group = Infant

Nuclide	T-Body	G.I.-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
H 3	6.46E 02	6.46E 02	0.00E-01	6.46E 02	6.46E 02	6.46E 02	6.46E 02	6.46E 02
P 32	7.73E 04	1.61E 04	2.03E 06	1.12E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
MN 54	4.98E 03	7.05E 03	0.00E-01	2.53E 04	4.98E 03	0.00E-01	9.98E 05	0.00E-01
FE 59	9.46E 03	2.47E 04	1.35E 04	2.35E 04	0.00E-01	0.00E-01	1.01E 06	0.00E-01
CO 58	1.82E 03	1.11E 04	0.00E-01	1.22E 03	0.00E-01	0.00E-01	7.76E 05	0.00E-01
CO 60	1.18E 04	3.19E 04	0.00E-01	8.01E 03	0.00E-01	0.00E-01	4.50E 06	0.00E-01
ZN 65	3.10E 04	5.13E 04	1.93E 04	6.25E 04	3.24E 04	0.00E-01	6.46E 05	0.00E-01
RB 86	8.81E 04	3.03E 03	0.00E-01	1.90E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	1.14E 04	6.39E 04	3.97E 05	0.00E-01	0.00E-01	0.00E-01	2.03E 06	0.00E-01
SR 90	2.59E 06	1.31E 05	4.08E 07	0.00E-01	0.00E-01	0.00E-01	1.12E 07	0.00E-01
Y 91	1.57E 04	7.02E 04	5.87E 05	0.00E-01	0.00E-01	0.00E-01	2.45E 06	0.00E-01
ZR 95	2.03E 04	2.17E 04	1.15E 05	2.78E 04	3.10E 04	0.00E-01	1.75E 06	0.00E-01
NB 95	3.77E 03	1.27E 04	1.57E 04	6.42E 03	4.71E 03	0.00E-01	4.78E 05	0.00E-01
RU103	6.78E 02	1.61E 04	2.01E 03	0.00E-01	4.24E 03	0.00E-01	5.51E 05	0.00E-01
RU106	1.09E 04	1.64E 05	8.67E 04	0.00E-01	1.06E 05	0.00E-01	1.15E 07	0.00E-01
AG110M	4.99E 03	3.30E 04	9.97E 03	7.21E 03	1.09E 04	0.00E-01	3.66E 06	0.00E-01
TE127M	2.07E 03	2.73E 04	1.66E 04	6.89E 03	3.75E 04	4.86E 03	1.31E 06	0.00E-01
TE129M	2.22E 03	6.89E 04	1.41E 04	6.08E 03	3.17E 04	5.47E 03	1.68E 06	0.00E-01
I 131	1.96E 04	1.06E 03	3.79E 04	4.43E 04	5.17E 04	1.48E 07	0.00E-01	0.00E-01
I 133	5.59E 03	2.15E 03	1.32E 04	1.92E 04	2.24E 04	3.55E 06	0.00E-01	0.00E-01
CS134	7.44E 04	1.33E 03	3.96E 05	7.02E 05	1.90E 05	0.00E-01	7.95E 04	0.00E-01
CS136	5.28E 04	1.43E 03	4.82E 04	1.34E 05	5.63E 04	0.00E-01	1.17E 04	0.00E-01
CS137	4.54E 04	1.33E 03	5.48E 05	6.11E 05	1.72E 05	0.00E-01	7.12E 04	0.00E-01
BA140	2.89E 03	3.83E 04	5.59E 04	5.59E 01	1.34E 01	0.00E-01	1.59E 06	0.00E-01
CE141	1.99E 03	2.15E 04	2.77E 04	1.66E 04	5.24E 03	0.00E-01	5.16E 05	0.00E-01
CE144	1.76E 05	1.48E 05	3.19E 06	1.21E 06	5.37E 05	0.00E-01	9.83E 06	0.00E-01

*R values in units of mrem/yr per $\mu Ci/m^3$ for inhalation pathway and all tritium pathways, and in units of m^2-mrem/yr per μCi/sec for all other pathways.

TABLE 2.3-6

R VALUES FOR BEAVER VALLEY SITE

Pathway = Ground

Nuclide	T-Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
MN 54	1.34E 09	1.34E 09	1.34E 09	1.34E 09	1.34E 09	1.34E 09	1.34E 09	1.57E 09
FE 59	2.75E 08	2.75E 08	2.75E 08	2.75E 08	2.75E 08	2.75E 08	2.75E 08	3.23E 08
CO 58	3.79E 08	3.79E 08	3.79E 08	3.79E 08	3.79E 08	3.79E 08	3.79E 08	4.44E 08
CO 60	2.15E 10	2.15E 10	2.15E 10	2.15E 10	2.15E 10	2.15E 10	2.15E 10	2.52E 10
ZN 65	7.49E 08	7.49E 08	7.49E 08	7.49E 08	7.49E 08	7.49E 08	7.49E 08	8.61E 08
RB 86	8.99E 06	8.99E 06	8.99E 06	8.99E 06	8.99E 06	8.99E 06	8.99E 06	1.03E 07
SR 89	2.23E 04	2.23E 04	2.23E 04	2.23E 04	2.23E 04	2.23E 04	2.23E 04	2.58E 04
Y 91	1.08E 06	1.08E 06	1.08E 06	1.08E 06	1.08E 06	1.08E 06	1.08E 06	1.22E 06
ZR 95	2.49E 08	2.49E 08	2.49E 08	2.49E 08	2.49E 08	2.49E 08	2.49E 08	2.89E 08
NB 95	1.36E 08	1.36E 08	1.36E 08	1.36E 08	1.36E 08	1.36E 08	1.36E 08	1.60E 08
RU103	1.09E 08	1.09E 08	1.09E 08	1.09E 08	1.09E 08	1.09E 08	1.09E 08	1.27E 08
RU106	4.19E 08	4.19E 08	4.19E 08	4.19E 08	4.19E 08	4.19E 08	4.19E 08	5.03E 08
AG110M	3.48E 09	3.48E 09	3.48E 09	3.48E 09	3.48E 09	3.48E 09	3.48E 09	4.06E 09
TE127M	9.15E 04	9.15E 04	9.15E 04	9.15E 04	9.15E 04	9.15E 04	9.15E 04	1.08E 05
TE129M	2.00E 07	2.00E 07	2.00E 07	2.00E 07	2.00E 07	2.00E 07	2.00E 07	2.34E 07
I 131	1.72E 07	1.72E 07	1.72E 07	1.72E 07	1.72E 07	1.72E 07	1.72E 07	2.09E 07
I 133	2.47E 06	2.47E 06	2.47E 06	2.47E 06	2.47E 06	2.47E 06	2.47E 06	3.00E 06
CS134	6.82E 09	6.82E 09	6.82E 09	6.82E 09	6.82E 09	6.82E 09	6.82E 09	7.96E 09
CS136	1.49E 08	1.49E 08	1.49E 08	1.49E 08	1.49E 08	1.49E 08	1.49E 08	1.69E 08
CS137	1.03E 10	1.03E 10	1.03E 10	1.03E 10	1.03E 10	1.03E 10	1.03E 10	1.20E 10
BA140	2.05E 07	2.05E 07	2.05E 07	2.05E 07	2.05E 07	2.05E 07	2.05E 07	2.34E 07
CE141	1.36E 07	1.36E 07	1.36E 07	1.36E 07	1.36E 07	1.36E 07	1.36E 07	1.53E 07
CE144	6.95E 07	6.95E 07	6.95E 07	6.95E 07	6.95E 07	6.95E 07	6.95E 07	8.03E 07

*R values in units of mrem/yr per $\mu Ci/m^3$ for inhalation pathway and all tritium pathways, and in units of m^2-mrem/yr per μCi/sec for all other pathways.

TABLE 2.3-7

R VALUES FOR BEAVER VALLEY SITE

Pathway = Veget
Age Group = Adult

Nuclide	T-Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
H 3	2.28E 03	2.28E 03	0.00E-01	2.28E 03	2.28E 03	2.28E 03	2.28E 03	2.28E 03
P 32	5.91E 07	1.72E 08	1.53E 09	9.51E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
MN 54	5.83E 07	9.36E 08	0.00E-01	3.05E 08	9.09E 07	0.00E-01	0.00E-01	0.00E-01
FE 59	1.12E 08	9.75E 08	1.24E 08	2.93E 08	0.00E-01	0.00E-01	8.17E 07	0.00E-01
CO 58	6.71E 07	6.07E 08	0.00E-01	2.99E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	3.67E 08	3.12E 09	0.00E-01	1.66E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	5.77E 08	8.04E 08	4.01E 08	1.28E 09	8.54E 08	0.00E-01	0.00E-01	0.00E-01
RB 86	1.03E 08	4.36E 07	0.00E-01	2.21E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	2.87E 08	1.60E 09	1.00E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	1.64E 11	1.93E 10	6.70E 11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	1.34E 05	2.76E 09	5.01E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	2.51E 05	1.17E 09	1.16E 06	3.71E 05	5.82E 05	0.00E-01	0.00E-01	0.00E-01
NB 95	4.19E 04	4.73E 08	1.40E 05	7.79E 04	7.70E 04	0.00E-01	0.00E-01	0.00E-01
RU103	2.04E 06	5.53E 08	4.74E 06	0.00E-01	1.81E 07	0.00E-01	0.00E-01	0.00E-01
RU106	2.46E 07	1.26E 10	1.94E 08	0.00E-01	3.75E 08	0.00E-01	0.00E-01	0.00E-01
AG110M	6.23E 06	4.28E 09	1.13E 07	1.05E 07	2.06E 07	0.00E-01	0.00E-01	0.00E-01
TE127M	6.12E 07	1.68E 09	5.02E 08	1.80E 08	2.04E 09	1.28E 08	0.00E-01	0.00E-01
TE129M	4.71E 0.	1.50E 09	2.98E 08	1.11E 08	1.24E 09	1.02E 08	0.00E-01	0.00E-01
I 131	6.61E 07	3.04E 07	8.07E 07	1.15E 08	1.98E 08	3.78E 10	0.00E-01	0.00E-01
I 133	1.12E 06	3.30E 06	2.11E 06	3.67E 06	6.40E 06	5.39E 08	0.00E-01	0.00E-01
CS134	8.83E 09	1.89E 08	4.54E 09	1.08E 10	3.49E 09	0.00E-01	1.16E 09	0.00E-01
CS136	1.19E 08	1.88E 07	4.19E 07	1.66E 08	9.21E 07	0.00E-01	1.26E 07	0.00E-01
CS137	5.94E 09	1.76E 08	6.63E 09	9.07E 09	3.08E 09	0.00E-01	1.02E 09	0.00E-01
BA140	8.40E 06	2.64E 08	1.28E 08	1.61E 05	5.47E 04	0.00E-01	9.22E 04	0.00E-01
CE141	1.48E 04	4.99E 08	1.93E 05	1.31E 05	6.07E 04	0.00E-01	0.00E-01	0.00E-01
CE144	1.69E 06	1.06E 10	3.15E 07	1.32E 07	7.80E 06	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per $\mu Ci/m^3$ for inhalation pathway and all tritium pathways, and in units of m^2-mrem/yr per $\mu Ci/sec$ for all other pathways.

TABLE 2.3-8

R VALUES FOR BEAVER VALLEY SITE

Pathway = Veget
Age Group = Teen

Nuclide	T-Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
H 3	2.61E 03	2.61E 03	0.00E-01	2.61E 03	2.61E 03	2.61E 03	2.61E 03	2.61E 03
P 32	6.80E 07	1.47E 08	1.75E 09	1.09E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
MN 54	8.79E 07	9.09E 08	0.00E-01	4.43E 08	1.32E 08	0.00E-01	0.00E-01	0.00E-01
FE 59	1.60E 08	9.78E 08	1.77E 08	4.14E 08	0.00E-01	0.00E-01	1.30E 08	0.00E-01
CO 58	9.79E 07	5.85E 08	0.00E-01	4.25E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	5.57E 08	3.22E 09	0.00E-01	2.47E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	8.68E 08	7.88E 08	5.36E 08	1.86E 09	1.19E 09	0.00E-01	0.00E-01	0.00E-01
RB 86	1.30E 08	4.09E 07	0.00E-01	2.76E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	4.36E 08	1.81E 09	1.52E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	2.05E 11	2.33E 10	8.32E 11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	2.06E 05	3.15E 09	7.68E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	3.68E 05	1.23E 09	1.69E 06	5.35E 05	7.86E 05	0.00E-01	0.00E-01	0.00E-01
NB 95	5.77E 04	4.48E 08	1.89E 05	1.05E 05	1.02E 05	0.00E-01	0.00E-01	0.00E-01
RU103	2.90E 06	5.66E 08	6.78E 06	0.00E-01	2.39E 07	0.00E-01	0.00E-01	0.00E-01
RU106	3.93E 07	1.50E 10	3.12E 08	0.00E-01	6.02E 08	0.00E-01	0.00E-01	0.00E-01
AG110M	9.39E 06	4.34E 09	1.63E 07	1.54E 07	2.95E 07	0.00E-01	0.00E-01	0.00E-01
TE127M	9.44E 07	1.98E 09	7.93E 08	2.81E 08	3.22E 09	1.89E 08	0.00E-01	0.00E-01
TE129M	6.79E 07	1.61E 09	4.29E 08	1.59E 08	1.79E 09	1.38E 08	0.00E-01	0.00E-01
I 131	5.77E 07	2.13E 07	7.68E 07	1.07E 08	1.85E 08	3.14E 10	0.00E-01	0.00E-01
I 133	1.01E 06	2.51E 06	1.96E 06	3.32E 06	5.83E 06	4.64E 08	0.00E-01	0.00E-01
CS134	7.54E 09	2.02E 08	6.90E 09	1.62E 10	5.16E 09	0.00E-01	1.97E 09	0.00E-01
CS136	1.13E 08	1.35E 07	4.28E 07	1.68E 08	9.16E 07	0.00E-01	1.44E 07	0.00E-01
CS137	4.90E 09	2.00E 08	1.06E 10	1.41E 10	4.78E 09	0.00E-01	1.86E 09	0.00E-01
BA140	8.88E 06	2.12E 08	1.38E 08	1.69E 05	5.72E 04	0.00E-01	1.14E 05	0.00E-01
CE141	2.12E 04	5.29E 08	2.77E 05	1.85E 05	8.70E 04	0.00E-01	0.00E-01	0.00E-01
CE144	2.71E 06	1.27E 10	5.04E 07	2.09E 07	1.25E 07	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per $\mu Ci/m^3$ for inhalation pathway and all tritium pathways, and in units of m^2-mrem/yr per μCi/sec for all other pathways.

TABLE 2.3-9

R VALUES FOR BEAVER VALLEY SITE

Pathway = Veget
Age Group = Child

Nuclide	T-Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
H 3	4.04E 03	4.04E 03	0.00E-01	4.04E 03	4.04E 03	4.04E 03	4.04E 03	4.04E 03
P 32	1.42E 08	1.01E 08	3.67E 09	1.72E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
MN 54	1.73E 08	5.44E 08	0.00E-01	6.49E 08	1.82E 08	0.00E-01	0.00E-01	0.00E-01
FE 59	3.17E 08	6.62E 08	3.93E 08	6.36E 08	0.00E-01	0.00E-01	1.84E 08	0.00E-01
CO 58	1.92E 08	3.66E 08	0.00E-01	6.27E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	1.11E 09	2.08E 09	0.00E-01	3.76E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	1.70E 09	4.81E 08	1.03E 09	2.74E 09	1.73E 09	0.00E-01	0.00E-01	0.00E-01
RB 86	2.81E 08	2.94E 07	0.00E-01	4.56E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	1.03E 09	1.40E 09	3.62E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	3.49E 11	1.86E 10	1.38E 12	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	4.89E 05	2.44E 09	1.83E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	7.44E 05	8.71E 08	3.80E 06	8.35E 05	1.20E 06	0.00E-01	0.00E-01	0.00E-01
NB 95	1.12E 05	2.91E 08	4.04E 05	1.57E 05	1.48E 05	0.00E-01	0.00E-01	0.00E-01
RU103	5.86E 06	3.94E 08	1.52E 07	0.00E-01	3.84E 07	0.00E-01	0.00E-01	0.00E-01
RU106	9.38E 07	1.17E 10	7.52E 08	0.00E-01	1.02E 09	0.00E-01	0.00E-01	0.00E-01
AG110M	1.87E 07	2.78E 09	3.46E 07	2.34E 07	4.35E 07	0.00E-01	0.00E-01	0.00E-01
TE127M	2.26E 08	1.54E 09	1.90E 09	5.12E 08	5.42E 09	4.55E 08	0.00E-01	0.00E-01
TE129M	1.55E 08	1.22E 09	9.98E 08	2.79E 08	2.93E 09	3.22E 08	0.00E-01	0.00E-01
I 131	8.16E 07	1.28E 07	1.43E 08	1.44E 08	2.36E 08	4.75E 10	0.00E-01	0.00E-01
I 133	1.67E 06	1.78E 06	3.57E 06	4.42E 06	7.36E 06	8.21E 08	0.00E-01	0.00E-01
CS134	5.40E 09	1.38E 08	1.56E 10	2.56E 10	7.93E 09	0.00E-01	2.84E 09	0.00E-01
CS136	1.43E 08	7.77E 06	8.04E 07	2.21E 08	1.18E 08	0.00E-01	1.76E 07	0.00E-01
CS137	3.52E 09	1.50E 08	2.49E 10	2.39E 10	7.78E 09	0.00E-01	2.80E 09	0.00E-01
BA140	1.61E 07	1.40E 08	2.76E 08	2.42E 05	7.87E 04	0.00E-01	1.44E 05	0.00E-01
CE141	4.75E 04	3.99E 08	6.42E 05	3.20E 05	1.40E 05	0.00E-01	0.00E-01	0.00E-01
CE144	6.49E 06	9.94E 09	1.22E 08	3.81E 07	2.11E 07	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per μCi/m^3 for inhalation pathway and all tritium pathways, and in units of m^2-mrem/yr per μCi/sec for all other pathways.

TABLE 2.3-10

R VALUES FOR BEAVER VALLEY SITE

Pathway = Meat
Age Group = Adult

Nuclide	T-Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
H 3	3.27E 02	3.27E 02	0.00E-01	3.27E 02	3.27E 02	3.27E 02	3.27E 02	3.27E 02
P 32	8.85E 07	2.57E 08	2.29E 09	1.42E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
MN 54	8.98E 05	1.44E 07	0.00E-01	4.71E 06	1.40E 06	0.00E-01	0.00E-01	0.00E-01
FE 59	1.12E 08	9.73E 08	1.24E 08	2.92E 08	0.00E-01	0.00E-01	8.16E 07	0.00E-01
CO 58	1.95E 07	1.76E 08	0.00E-01	8.68E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	8.87E 07	7.55E 08	0.00E-01	4.02E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	3.06E 08	4.27E 08	2.13E 08	6.78E 08	4.53E 08	0.00E-01	0.00E-01	0.00E-01
RB 86	1.07E 08	4.53E 07	0.00E-01	2.30E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	4.12E 06	2.30E 07	1.43E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	1.76E 09	2.07E 08	7.17E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	1.43E 04	2.94E 08	5.35E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	1.94E 05	9.07E 08	8.92E 05	2.86E 05	4.49E 05	0.00E-01	0.00E-01	0.00E-01
NB 95	3.18E 05	3.59E 09	1.06E 06	5.91E 05	5.84E 05	0.00E-01	0.00E-01	0.00E-01
RU103	2.11E 07	5.73E 09	4.91E 07	0.00E-01	1.87E 08	0.00E-01	0.00E-01	0.00E-01
RU106	1.86E 08	9.53E 10	1.47E 09	0.00E-01	2.84E 09	0.00E-01	0.00E-01	0.00E-01
AG110M	1.99E 06	1.36E 09	3.61E 06	3.34E 06	6.57E 06	0.00E-01	0.00E-01	0.00E-01
TE127M	8.37E 07	2.30E 09	6.87E 08	2.46E 08	2.79E 09	1.76E 08	0.00E-01	0.00E-01
TE129M	9.05E 07	2.88E 09	5.72E 08	2.13E 08	2.39E 09	1.96E 08	0.00E-01	0.00E-01
I 131	4.33E 06	1.99E 06	5.28E 06	7.55E 06	1.29E 07	2.48E 09	0.00E-01	0.00E-01
I 133	1.13E-01	3.34E-01	2.14E-01	3.72E-01	6.49E-01	5.46E 01	0.00E-01	0.00E-01
CS134	6.68E 08	1.43E 07	3.43E 08	8.17E 08	2.64E 08	0.00E-01	8.78E 07	0.00E-01
CS136	1.61E 07	2.53E 06	5.65E 06	2.23E 07	1.24E 07	0.00E-01	1.70E 06	0.00E-01
CS137	4.33E 08	1.28E 07	4.83E 08	6.61E 08	2.24E 08	0.00E-01	7.46E 07	0.00E-01
BA140	9.01E 05	2.83E 07	1.38E 07	1.73E 04	5.87E 03	0.00E-01	9.89E 03	0.00E-01
CE141	4.96E 02	1.67E 07	6.47E 03	4.38E 03	2.03E 03	0.00E-01	0.00E-01	0.00E-01
CE144	3.96E 04	2.49E 08	7.37E 05	3.08E 05	1.83E 05	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per $\mu Ci/m^3$ for inhalation pathway and all tritium pathways, and in units of m^2-mrem/yr per μCi/sec for all other pathways.

TABLE 2.3-11

R VALUES FOR BEAVER VALLEY SITE

Pathway = Meat
Age Group = Teen

Nuclide	T-Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
H 3	1.95E 02	1.95E 02	0.00E-01	1.95E 02	1.95E 02	1.95E 02	1.95E 02	1.95E 02
P 32	7.50E 07	1.63E 08	1.94E 09	1.20E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
MN 54	7.12E 05	7.37E 06	0.00E-01	3.59E 06	1.07E 06	0.00E-01	0.00E 01	0.00E-01
FE 59	8.95E 07	5.48E 08	9.93E 07	2.32E 08	0.00E-01	0.00E-01	7.31E 07	0.00E-01
CO 58	1.54E 07	9.22E 07	0.00E-01	6.69E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	7.03E 07	4.06E 08	0.00E-01	3.12E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	2.43E 08	2.20E 08	1.50E 08	5.20E 08	3.33E 08	0.00E-01	0.00E-01	0.00E-01
RB 86	9.00E 07	2.84E 07	0.00E-01	1.92E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	3.47E 06	1.44E 07	1.21E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	1.15E 09	1.30E 08	4.64E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	1.21E 04	1.85E 08	4.51E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	1.55E 05	5.20E 08	7.15E 05	2.25E 05	3.31E 05	0.00E-01	0.00E-01	0.00E-01
NB 95	2.53E 05	1.97E 09	8.30E 05	4.60E 05	4.46E 05	0.00E-01	0.00E-01	0.00E-01
RU103	1.71E 07	3.34E 09	4.00E 07	0.00E-01	1.41E 08	0.00E-01	0.00E-01	0.00E-01
RU106	1.56E 08	5.95E 10	1.24E 09	0.00E-01	2.39E 09	0.00E-01	0.00E-01	0.00E-01
AG110M	1.58E 06	7.27E 08	2.74E 06	2.59E 06	4.94E 06	0.00E-01	0.00E-01	0.00E-01
TE127M	6.90E 07	1.45E 09	5.80E 08	2.06E 08	2.35E 09	1.38E 08	0.00E-01	0.00E-01
TE129M	7.58E 07	1.80E 09	4.79E 08	1.78E 08	2.00E 09	1.54E 08	0.00E-01	0.00E-01
I 131	3.30E 06	1.22E 06	4.39E 06	6.14E 06	1.06E 07	1.79E 09	0.00E-01	0.00E-01
I 133	9.25E-02	2.30E-01	1.79E-01	3.03E-01	5.32E-01	4.23E 01	0.00E-01	0.00E-01
CS134	2.98E 08	7.99E 06	2.73E 08	6.42E 08	2.04E 08	0.00E-01	7.79E 07	0.00E-01
CS136	1.16E 07	1.40E 06	4.41E 06	1.73E 07	9.44E 06	0.00E-01	1.49E 06	0.00E-01
CS137	1.86E 08	7.59E 06	4.01E 08	5.34E 08	1.82E 08	0.00E-01	7.06E 07	0.00E-01
BA140	7.33E 05	1.75E 07	1.14E 07	1.39E 04	4.72E 03	0.00E-01	9.37E 03	0.00E-01
CE141	4.17E 02	1.04E 07	5.43E 03	3.63E 03	1.71E 03	0.00E-01	0.00E-01	0.00E-01
CE144	3.34E 04	1.56E 08	1.21E 05	2.57E 05	1.53E 05	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per $\mu Ci/m^3$ for inhalation pathway and all tritium pathways, and in units of m^2-mrem/yr per μCi/sec for all other pathways.

TABLE 2.3-12

R VALUES FOR BEAVER VALLEY SITE

Pathway = Meat
Age Group = Child

Nuclide	T-Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
H 3	2.36E 02	2.36E 02	0.00E-01	2.36E 02	2.36E 02	2.36E 02	2.36E 02	2.36E 02
P 32	1.41E 08	1.01E 08	3.65E 09	1.71E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
MN 54	1.09E 06	3.45E 06	0.00E-01	4.11E 06	1.15E 06	0.00E-01	0.00E-01	0.00E-01
FE 59	1.42E 08	2.97E 08	1.76E 08	2.85E 08	0.00E-01	0.00E-01	8.26E 07	0.00E-01
CO 58	2.39E 07	4.56E 07	0.00E-01	7.82E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	1.09E 08	2.05E 08	0.00E-01	3.70E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	3.72E 08	1.05E 08	2.25E 08	5.99E 08	3.77E 08	0.00E-01	0.00E-01	0.00E-01
RB 86	1.67E 08	1.75E 07	0.00E-01	2.72E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	6.55E 06	8.87E 06	2.29E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	1.52E 09	8.08E 07	6.00E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	2.28E 04	1.13E 08	8.51E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	2.48E 05	2.91E 08	1.27E 06	2.79E 05	3.99E 05	0.00E-01	0.00E-01	0.00E-01
NB 95	3.99E 05	1.03E 09	1.43E 06	5.58E 05	5.24E 05	0.00E-01	0.00E-01	0.00E-01
RU103	2.78E 07	1.87E 09	7.23E 07	0.00E-01	1.82E 08	0.00E-01	0.00E-01	0.00E-01
RU106	2.91E 08	3.63E 10	2.34E 09	0.00E-01	3.15E 09	0.00E-01	0.00E-01	0.00E-01
AG110M	2.45E 06	3.65E 08	4.54E 06	3.06E 06	5.71E 06	0.00E-01	0.00E-01	0.00E-01
TE127M	1.30E 08	8.85E 08	1.09E 09	2.94E 08	3.12E 09	2.61E 08	0.00E-01	0.00E-01
TE129M	1.40E 08	1.10E 09	9.02E 08	2.52E 08	2.65E 09	2.91E 08	0.00E-01	0.00E-01
I 131	4.65E 06	7.29E 05	8.14E 06	8.19E 06	1.34E 07	2.71E 09	0.00E-01	0.00E-01
I 133	1.55E-01	1.66E-01	3.32E-01	4.11E-01	6.85E-01	7.63E 01	0.00E-01	0.00E-01
CS134	1.67E 08	4.26E 06	4.81E 08	7.90E 08	2.45E 08	0.00E-01	8.78E 07	0.00E-01
CS136	1.35E 07	7.34E 05	7.60E 06	2.09E 07	1.11E 07	0.00E-01	1.66E 06	0.00E-01
CS137	1.04E 08	4.43E 06	7.39E 08	7.07E 08	2.30E 08	0.00E-01	8.29E 07	0.00E-01
BA140	1.22E 06	1.06E 07	2.10E 07	1.84E 04	5.98E 03	0.00E-01	1.10E 04	0.00E-01
CE141	7.57E 02	6.36E 06	1.02E 04	5.10E 03	2.24E 03	0.00E-01	0.00E-01	0.00E-01
CE144	6.25E 04	9.57E 07	1.17E 06	3.67E 05	2.03E 05	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per $\mu Ci/m^3$ for inhalation pathway and all tritium pathways, and in units of m^2-mrem/yr per $\mu Ci/sec$ for all other pathways.

TABLE 2.3-13

R VALUES FOR BEAVER VALLEY SITE

Pathway = Cow Milk
Age Group = Adult

Nuclide	T-Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
H 3	7.69E 02	7.69E 02	0.00E-01	7.69E 02	7.69E 02	7.69E 02	7.69E 02	7.69E 02
P 32	3.25E 08	9.45E 08	8.40E 09	5.22E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
MN 54	8.25E 05	1.32E 07	0.00E-01	4.32E 06	1.29E 06	0.00E-01	0.00E-01	0.00E-01
FE 59	1.25E 07	1.09E 08	1.39E 07	3.26E 07	0.00E-01	0.00E-01	9.10E 06	0.00E-01
CO 58	5.03E 06	4.55E 07	0.00E-01	2.24E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	1.93E 07	1.65E 08	0.00E-01	8.77E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	1.18E 09	1.65E 09	8.21E 08	2.61E 09	1.75E 09	0.00E-01	0.00E-01	0.00E-01
RB 86	5.69E 08	2.41E 08	0.00E-01	1.22E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	1.97E 07	1.10E 08	6.85E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	6.62E 09	7.80E 08	2.70E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	1.08E 02	2.23E 06	4.05E 03	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	9.72E 01	4.55E 05	4.48E 02	1.44E 02	2.25E 02	0.00E-01	0.00E-01	0.00E-01
NB 95	1.14E 04	1.29E 08	3.82E 04	2.12E 04	2.10E 04	0.00E-01	0.00E-01	0.00E-01
RU103	2.04E 02	5.54E 04	4.74E 02	0.00E-01	1.81E 03	0.00E-01	0.00E-01	0.00E-01
RU106	1.36E 03	6.95E 05	1.07E 04	0.00E-01	2.07E 04	0.00E-01	0.00E-01	0.00E-01
AG110M	1.73E 07	1.19E 10	3.15E 07	2.91E 07	5.72E 07	0.00E-01	0.00E-01	0.00E-01
TE127M	3.44E 06	9.45E 07	2.82E 07	1.01E 07	1.15E 08	7.21E 06	0.00E-01	0.00E-01
TE129M	4.78E 06	1.52E 08	3.02E 07	1.13E 07	1.26E 08	1.04E 07	0.00E-01	0.00E-01
I 131	1.19E 08	5.49E 07	1.45E 08	2.08E 08	3.57E 08	6.82E 10	0.00E-01	0.00E-01
I 133	1.05E 06	3.09E 06	1.98E 06	3.44E 06	6.01E 06	5.06E 08	0.00E-01	0.00E-01
CS134	5.74E 09	1.23E 08	2.95E 09	7.02E 09	2.27E 09	0.00E-01	7.45E 08	0.00E-01
CS136	3.55E 08	5.60E 07	1.25E 08	4.93E 08	2.74E 08	0.00E-01	3.76E 07	0.00E-01
CS137	3.66E 09	1.08E 08	4.09E 09	5.59E 09	1.90E 09	0.00E-01	6.31E 08	0.00E-01
BA140	8.43E 05	2.65E 07	1.29E 07	1.62E 04	5.49E 03	0.00E-01	9.25E 03	0.00E-01
CE141	1.71E 02	5.78E 06	2.24E 03	1.51E 03	7.02E 02	0.00E-01	0.00E-01	0.00E-01
CE144	9.71E 03	6.11E 07	1.81E 05	7.56E 04	4.48E 04	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per $\mu Ci/m^3$ for inhalation pathway and all tritium pathways, and in units of m^2-mrem/yr per μCi/sec for all other pathways.

TABLE 2.3-14

R VALUES FOR BEAVER VALLEY SITE

Pathway = Cow Milk
Age Group = Teen

Nuclide	T-Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
H 3	1.00E 03	1.00E 03	0.00E-01	1.00E 03	1.00E 03	1.00E 03	1.00E 03	1.00E 03
P 32	6.01E 08	1.30E 09	1.55E 10	9.60E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
MN 54	1.43E 06	1.48E 07	0.00E-01	7.20E 06	2.15E 06	0.00E-01	0.00E-01	0.00E-01
FE 59	2.18E 07	1.34E 08	2.42E 07	5.65E 07	0.00E-01	0.00E-01	1.78E 07	0.00E-01
CO 58	8.70E 06	5.21E 07	0.00E-01	3.78E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	3.35E 07	1.94E 08	0.00E-01	1.49E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	2.04E 09	1.85E 09	1.26E 09	4.38E 09	2.80E 09	0.00E-01	0.00E-01	0.00E-01
RB 86	1.05E 09	3.29E 08	0.00E-01	2.23E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	3.62E 07	1.50E 08	1.26E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	9.42E 09	1.07E 09	3.81E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	2.00E 02	3.05E 06	7.45E 03	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	1.70E 02	5.70E 05	7.83E 02	2.47E 02	3.63E 02	0.00E-01	0.00E-01	0.00E-01
NB 95	1.99E 04	1.54E 08	6.51E 04	3.61E 04	3.50E 04	0.00E-01	0.00E-01	0.00E-01
RU103	3.61E 02	7.05E 04	8.43E 02	0.00E-01	2.97E 03	0.00E-01	0.00E-01	0.00E-01
RU106	2.49E 03	9.47E 05	1.97E 04	0.00E-01	3.81E 04	0.00E-01	0.00E-01	0.00E-01
AG110M	3.00E 07	1.38E 10	5.20E 07	4.92E 07	9.39E 07	0.00E-01	0.00E-01	0.00E-01
TE127M	6.18E 06	1.30E 08	5.20E 07	1.84E 07	2.11E 08	1.24E 07	0.00E-01	0.00E-01
TE129M	8.75E 06	2.07E 08	5.53E 07	2.05E 07	2.31E 08	1.76E 07	0.00E-01	0.00E-01
I 131	1.98E 08	7.31E 07	2.64E 08	3.69E 08	6.36E 08	1.08E 11	0.00E-01	0.00E-01
I 133	1.87E 06	4.64E 06	3.61E 06	6.13E 06	1.08E 07	8.56E 08	0.00E-01	0.00E-01
CS134	5.60E 09	1.50E 08	5.12E 09	1.21E 10	3.83E 09	0.00E-01	1.46E 09	0.00E-01
CS136	5.62E 08	6.73E 07	2.13E 08	8.37E 08	4.55E 08	0.00E-01	7.18E 07	0.00E-01
CS137	3.44E 09	1.40E 08	7.42E 09	9.87E 09	3.36E 09	0.00E-01	1.30E 09	0.00E-01
BA140	1.50E 06	3.58E 07	2.32E 07	2.84E 04	9.65E 03	0.00E-01	1.91E 04	0.00E-01
CE141	3.14E 02	7.83E 06	4.10E 03	2.74E 03	1.29E 03	0.00E-01	0.00E-01	0.00E-01
CE144	1.79E 04	8.37E 07	3.33E 05	1.38E 05	8.22E 04	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per $\mu Ci/m^3$ for inhalation pathway and all tritium pathways, and in units of m^2-mrem/yr per μCi/sec for all other pathways.

TABLE 2.3-15

R VALUES FOR BEAVER VALLEY SITE

Pathway = Cow Milk
Age Group = Child

Nuclide	T-Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
H 3	1.58E 03	1.58E 03	0.00E-01	1.58E 03	1.58E 03	1.58E 03	1.58E 03	1.58E 03
P 32	1.47E 09	1.06E 09	3.82E 10	1.79E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01
MN 54	2.87E 06	9.04E 06	0.00E-01	1.08E 07	3.02E 06	0.00E-01	0.00E-01	0.00E-01
FE 59	4.52E 07	9.45E 07	5.61E 07	9.08E 07	0.00E-01	0.00E-01	2.63E 07	0.00E-01
CO 58	1.77E 07	3.37E 07	0.00E-01	5.77E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	6.81E 07	1.28E 08	0.00E-01	2.31E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	4.10E 09	1.16E 09	2.47E 09	6.59E 09	4.15E 09	0.00E-01	0.00E-01	0.00E-01
RB 86	2.54E 09	2.65E 08	0.00E-01	4.13E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	8.93E 07	1.21E 08	3.13E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	1.63E 10	8.68E 08	6.44E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	4.92E 02	2.45E 06	1.84E 04	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	3.56E 02	4.17E 05	1.84E 03	4.00E 02	5.72E 02	0.00E-01	0.00E-01	0.00E-01
NB 95	4.09E 04	1.06E 08	1.47E 05	5.73E 04	5.38E 04	0.00E-01	0.00E-01	0.00E-01
RU103	7.67E 02	5.16E 04	1.99E 03	0.00E-01	5.02E 03	0.00E-01	0.00E-01	0.00E-01
RU106	6.07E 03	7.56E 05	4.86E 04	0.00E-01	6.57E 04	0.00E-01	0.00E-01	0.00E-01
AG110M	6.09E 07	9.07E 09	1.13E 08	7.62E 07	1.42E 08	0.00E-01	0.00E-01	0.00E-01
TE127M	1.52E 07	1.04E 08	1.28E 08	3.45E 07	3.65E 08	3.06E 07	0.00E-01	0.00E-01
TE129M	2.11E 07	1.66E 08	1.36E 08	3.80E 07	4.00E 08	4.39E 07	0.00E-01	0.00E-01
I 131	3.66E 08	5.73E 07	6.40E 08	6.44E 08	1.06E 09	2.13E 11	0.00E-01	0.00E-01
I 133	4.11E 06	4.38E 06	8.78E 06	1.09E 07	1.81E 07	2.02E 09	0.00E-01	0.00E-01
CS134	4.09E 09	1.05E 08	1.18E 10	1.94E 10	6.01E 09	0.00E-01	2.16E 09	0.00E-01
CS136	8.53E 08	4.63E 07	4.80E 08	1.32E 09	7.02E 08	0.00E-01	1.05E 08	0.00E-01
CS137	2.52E 09	1.07E 08	1.79E 10	1.71E 10	5.57E 09	0.00E-01	2.00E 09	0.00E-01
BA140	3.27E 06	2.84E 07	5.60E 07	4.91E 04	1.60E 04	0.00E-01	2.93E 04	0.00E-01
CE141	7.47E 02	6.28E 06	1.01E 04	5.03E 03	2.21E 03	0.00E-01	0.00E-01	0.00E-01
CE144	4.38E 04	6.71E 07	8.20E 05	2.57E 05	1.42E 05	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per $\mu Ci/m^3$ for inhalation pathway and all tritium pathways, and in units of m^2-mrem/yr per μCi/sec for all other pathways.

TABLE 2.3-16

R VALUES FOR BEAVER VALLEY SITE

Pathway = Cow Milk
Age Group = Infant

Nuclide	T-Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
H 3	2.40E 03	2.40E 03	0.00E-01	2.40E 03	2.40E 03	2.40E 03	2.40E 03	2.40E 03
P 32	3.05E 09	1.07E 09	7.88E 10	4.63E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01
MN 54	4.54E 06	7.36E 06	0.00E-01	2.00E 07	4.44E 06	0.00E-01	0.00E-01	0.00E-01
FE 59	7.21E 07	8.74E 07	1.05E 08	1.83E 08	0.00E-01	0.00E-01	5.41E 07	0.00E-01
CO 58	2.88E 07	2.88E 07	0.00E-01	1.15E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	1.11E 08	1.12E 08	0.00E-01	4.71E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	5.26E 09	9.63E 09	3.32E 09	1.14E 10	5.53E 09	0.00E-01	0.00E-01	0.00E-01
RB 86	5.17E 09	2.68E 08	0.00E-01	1.05E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	1.70E 08	1.22E 08	5.94E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	1.79E 10	8.75E 08	7.01E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	9.20E 02	2.48E 06	3.46E 04	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	5.58E 02	3.92E 05	3.23E 03	7.87E 02	8.48E 02	0.00E-01	0.00E-01	0.00E-01
NB 95	6.54E 04	9.54E 07	2.75E 05	1.13E 05	8.10E 04	0.00E-01	0.00E-01	0.00E-01
RU103	1.35E 03	4.91E 04	4.04E 03	0.00E-01	8.40E 03	0.00E-01	0.00E-01	0.00E-01
RU106	1.25E 04	7.60E 05	1.00E 05	0.00E-01	1.18E 05	0.00E-01	0.00E-01	0.00E-01
AG110M	1.01E 08	7.89E 09	2.09E 08	1.52E 08	2.18E 08	0.00E-01	0.00E-01	0.00E-01
TE127M	3.14E 07	1.05E 08	2.59E 08	8.60E 07	6.38E 08	7.49E 07	0.00E-01	0.00E-01
TE129M	4.31E 07	1.67E 08	2.80E 08	9.59E 07	6.99E 08	1.07E 08	0.00E-01	0.00E-01
I 131	6.92E 08	5.62E 07	1.34E 09	1.57E 09	1.84E 09	5.17E 11	0.00E-01	0.00E-01
I 133	7.91E 06	4.57E 06	1.85E 07	2.70E 07	3.17E 07	4.91E 09	0.00E-01	0.00E-01
CS134	3.59E 09	9.65E 07	1.90E 10	3.55E 10	9.14E 09	0.00E-01	3.75E 09	0.00E-01
CS136	1.03E 09	4.19E 07	9.37E 08	2.76E 09	1.10E 09	0.00E-01	2.25E 08	0.00E-01
CS137	2.37E 09	1.04E 08	2.85E 10	3.34E 10	8.96E 09	0.00E-01	3.63E 09	0.00E-01
BA140	5.94E 06	2.83E 07	1.15E 08	1.15E 05	2.74E 04	0.00E-01	7.08E 04	0.00E-01
CE141	1.44E 03	6.30E 06	2.00E 04	1.22E 04	3.76E 03	0.00E-01	0.00E-01	0.00E-01
CE144	6.59E 04	6.75E 07	1.18E 06	4.81E 04	1.94E 05	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per $\mu Ci/m^3$ for inhalation pathway and all tritium pathways, and in units of m^2-mrem/yr per μCi/sec for all other pathways.

TABLE 2.3-17

R VALUES FOR BEAVER VALLEY SITE

Pathway = Goat Milk
Age Group = Adult

Nuclide	T-Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
H 3	1.57E 03	1.57E 03	0.00E-01	1.57E 03	1.57E 03	1.57E 03	1.57E 03	1.57E 03
P 32	3.90E 08	1.13E 09	1.01E 10	6.27E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
MN 54	9.89E 04	1.59E 06	0.00E-01	5.19E 05	1.54E 05	0.00E-01	0.00E-01	0.00E-01
FE 59	1.62E 05	1.41E 06	1.80E 05	4.23E 05	0.00E-01	0.00E-01	1.18E 05	0.00E-01
CO 58	6.03E 05	5.46E 06	0.00E-01	2.69E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	2.32E 06	1.98E 07	0.00E-01	1.05E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	1.42E 08	1.97E 08	9.85E 07	3.14E 08	2.10E 08	0.00E-01	0.00E-01	0.00E-01
RB 86	6.83E 07	2.89E 07	0.00E-01	1.47E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	4.13E 07	2.31E 08	1.44E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	1.39E 10	1.64E 09	5.67E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	1.30E 01	2.67E 05	4.86E 02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	1.17E 01	5.46E 04	5.37E 01	1.72E 01	2.70E 01	0.00E-01	0.00E-01	0.00E-01
NB 95	1.37E 03	1.55E 07	4.58E 03	2.55E 03	2.52E 03	0.00E-01	0.00E-01	0.00E-01
RU103	2.45E 01	6.64E 03	5.69E 01	0.00E-01	2.17E 02	0.00E-01	0.00E-01	0.00E-01
RU106	1.[illegible]E 02	8.34E 04	1.29E 03	0.00E-01	2.49E 03	0.00E-01	0.00E-01	0.00E-01
AG110M	2.07E 06	1.43E 09	3.78E 06	3.49E 06	6.87E 06	0.00E-01	0.00E-01	0.00E-01
TE127M	4.12E 05	1.13E 07	3.38E 06	1.21E 06	1.37E 07	8.65E 05	0.00E-01	0.00E-01
TE129M	5.74E 05	1.83E 07	3.63E 06	1.35E 06	1.51E 07	1.25E 06	0.00E-01	0.00E-01
I 131	1.43E 08	6.59E 07	1.74E 08	2.50E 08	4.28E 08	8.18E 10	0.00E-01	0.00E-01
I 133	1.26E 06	3.71E 06	2.37E 06	4.13E 06	7.21E 06	6.07E 08	0.00E-01	0.00E-01
CS134	1.72E 10	3.69E 08	8.85E 09	2.11E 10	6.82E 09	0.00E-01	2.26E 09	0.00E-01
CS136	1.06E 09	1.68E 08	3.75E 08	1.48E 09	8.23E 08	0.00E-01	1.13E 08	0.00E-01
CS137	1.10E 10	3.25E 08	1.23E 10	1.68E 10	5.70E 09	0.00E-01	1.89E 09	0.00E-01
BA140	1.01E 05	3.18E 06	1.54E 06	1.94E 03	6.59E 02	0.00E-01	1.11E 03	0.00E-01
CE141	2.06E 01	6.94E 05	2.68E 02	1.81E 02	8.43E 01	0.00E-01	0.00E-01	0.00E-01
CE144	1.17E 03	7.34E 06	2.17E 04	9.07E 03	5.38E 03	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per $\mu Ci/m^3$ for inhalation pathway and all tritium pathways, and in units of m^2-mrem/yr per $\mu Ci/sec$ for all other pathways.

TABLE 2.3-18

R VALUES FOR BEAVER VALLEY SITE

Pathway = Goat Milk
Age Group = Teen

Nuclide	T-Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
H 3	2.04E 03	2.04E 03	0.00E-01	2.04E 03	2.04E 03	2.04E 03	2.04E 03	2.04E 03
P 32	7.21E 08	1.56E 09	1.86E 10	1.15E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01
MN 54	1.71E 05	1.77E 06	0.00E-01	8.64E 05	2.58E 05	0.00E-01	0.00E-01	0.00E-01
FE 59	2.83E 05	1.74E 06	3.14E 05	7.34E 05	0.00E-01	0.00E-01	2.31E 05	0.00E-01
CO 58	1.04E 06	6.25E 06	0.00E-01	4.53E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	4.02E 06	2.32E 07	0.00E-01	1.78E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	2.45E 08	2.22E 08	1.51E 08	5.25E 08	3.36E 08	0.00E-01	0.00E-01	0.00E-01
RB 86	1.25E 08	3.95E 07	0.00E-01	2.67E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	7.59E 07	3.16E 08	2.65E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	1.98E 10	2.25E 09	8.01E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	2.40E 01	3.66E 05	8.94E 02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	2.04E 01	6.84E 04	9.40E 01	2.97E 01	4.36E 01	0.00E-01	0.00E-01	0.00E-01
NB 95	2.39E 03	1.85E 07	7.81E 03	4.34E 03	4.20E 03	0.00E-01	0.00E-01	0.00E-01
RU103	4.33E 01	8.45E 03	1.01E 02	0.00E-01	3.57E 02	0.00E-01	0.00E-01	0.00E-01
RU106	2.99E 02	1.14E 05	2.37E 03	0.00E-01	4.57E 03	0.00E-01	0.00E-01	0.00E-01
AG110M	3.59E 06	1.66E 09	6.24E 06	5.91E 06	1.13E 07	0.00E-01	0.00E-01	0.00E-01
TE127M	7.42E 05	1.55E 07	6.24E 06	2.21E 06	2.53E 07	1.48E 06	0.00E-01	0.00E-01
TE129M	1.05E 06	2.49E 07	6.63E 06	2.46E 06	2.77E 07	2.14E 06	0.00E-01	0.00E-01
I 131	2.38E 08	8.77E 07	3.17E 08	4.43E 08	7.63E 08	1.29E 11	0.00E-01	0.00E-01
I 133	2.24E 06	5.57E 06	4.34E 06	7.36E 06	1.29E 07	1.03E 09	0.00E-01	0.00E-01
CS134	1.68E 10	4.50E 08	1.54E 10	3.62E 10	1.15E 10	0.00E-01	4.39E 09	0.00E-01
CS136	1.69E 09	2.02E 08	6.38E 08	2.51E 09	1.37E 09	0.00E-01	2.15E 08	0.00E-01
CS137	1.03E 10	4.21E 08	2.22E 10	2.96E 10	1.01E 10	0.00E-01	3.91E 09	0.00E-01
BA140	1.80E 05	4.30E 06	2.79E 06	3.41E 03	1.16E 03	0.00E-01	2.30E 03	0.00E-01
CE141	3.77E 01	9.39E 05	4.92E 02	3.28E 02	1.55E 02	0.00E-01	0.00E-01	0.00E-01
CE144	2.15E 03	1.00E 07	3.99E 04	1.65E 04	9.87E 03	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per $\mu Ci/m^3$ for inhalation pathway and all tritium pathways, and in units of m^2-mrem/yr per μCi/sec for all other pathways.

TABLE 2.3-19

R VALUES FOR BEAVER VALLEY SITE

Pathway = Goat Milk
Age Group = Child

Nuclide	T-Body	GI Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
H 3	3.23E 03	3.23E 03	0.00E-01	3.23E 03	3.23E 03	3.23E 03	3.23E 03	3.23E 03
P 32	1.77E 09	1.27E 09	4.59E 10	2.15E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01
MN 54	3.44E 05	1.08E 06	0.00E-01	1.29E 06	3.62E 05	0.00E-01	0.00E-01	0.00E-01
FE 59	5.88E 05	1.23E 06	7.29E 05	1.18E 06	0.00E-01	0.00E-01	3.42E 05	0.00E-01
CO 58	2.12E 06	4.04E 06	0.00E-01	6.92E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	8.17E 06	1.53E 07	0.00E-01	2.77E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	4.92E 08	1.39E 08	2.97E 08	7.91E 08	4.98E 08	0.00E-01	0.00E-01	0.00E-01
RB 86	3.05E 08	3.19E 07	0.00E-01	4.95E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	1.87E 08	2.54E 08	6.56E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	3.43E 10	1.82E 09	1.35E 11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	5.91E 01	2.94E 05	2.21E 03	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	4.27E 01	5.01E 04	2.18E 02	4.80E 01	6.87E 01	0.00E-01	0.00E-01	0.00E-01
NB 95	4.91E 03	1.27E 07	1.76E 04	6.87E 03	6.45E 03	0.00E-01	0.00E-01	0.00E-01
RU103	9.20E 01	6.19E 03	2.39E 02	0.00E-01	6.03E 02	0.00E-01	0.00E-01	0.00E-01
RU106	7.28E 02	9.08E 04	5.83E 03	0.00E-01	7.88E 03	0.00E-01	0.00E-01	0.00E-01
AG110M	7.31E 06	1.09E 09	1.35E 07	9.15E 06	1.70E 07	0.00E-01	0.00E-01	0.00E-01
TE127M	1.82E 06	1.24E 07	1.54E 07	4.14E 06	4.38E 07	3.68E 06	0.00E-01	0.00E-01
TE129M	2.54E 06	1.99E 07	1.63E 07	4.56E 06	4.80E 07	5.27E 06	0.00E-01	0.00E-01
I 131	4.39E 08	6.88E 07	7.68E 08	7.72E 08	1.27E 09	2.55E 11	0.00E-01	0.00E-01
I 133	4.93E 06	5.25E 06	1.05E 07	1.30E 07	2.17E 07	2.42E 09	0.00E-01	0.00E-01
CS134	1.23E 10	3.14E 08	3.55E 10	5.82E 10	1.80E 10	0.00E-01	6.47E 09	0.00E-01
CS136	2.56E 09	1.39E 08	1.44E 09	3.96E 09	2.11E 09	0.00E-01	3.14E 08	0.00E-01
CS137	7.57E 09	3.21E 08	5.36E 10	5.13E 10	1.67E 10	0.00E-01	6.01E 09	0.00E-01
BA140	3.92E 05	3.41E 06	6.72E 06	5.89E 03	1.92E 03	0.00E-01	3.51E 03	0.00E-01
CE141	8.97E 01	7.54E 05	1.21E 03	6.04E 02	2.65E 02	0.00E-01	0.00E-01	0.00E-01
CE144	5.25E 03	8.05E 06	9.85E 04	3.09E 04	1.71E 04	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per $\mu Ci/m^3$ for inhalation pathway and all tritium patnways, and in units of m^2-mrem/yr per μCi/sec for all other pathways.

TABLE 2.3-20

R VALUES FOR BEAVER VALLEY SITE

Pathway = Goat Milk
Age Group = Infant

Nuclide	T-Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
H 3	4.90E 03	4.90E 03	0.00E-01	4.90E 03	4.90E 03	4.90E 03	4.90E 03	4.90E 03
P 32	3.66E 09	1.28E 09	9.45E 10	5.56E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01
MN 54	5.45E 05	8.83E 05	0.00E-01	2.40E 06	5.33E 05	0.00E-01	0.00E-01	0.00E-01
FE 59	9.37E 05	1.14E 06	1.36E 06	2.38E 06	0.00E-01	0.00E-01	7.03E 05	0.00E-01
CO 58	3.45E 06	3.45E 06	0.00E-01	1.38E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	1.34E 07	1.35E 07	0.00E-01	5.65E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	6.31E 08	1.16E 09	3.99E 08	1.37E 09	6.63E 08	0.00E-01	0.00E-01	0.00E-01
RB 86	6.21E 08	3.22E 07	0.00E-01	1.26E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	3.58E 08	2.57E 08	1.25E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	3.75E 10	1.84E 09	1.47E 11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	1.10E 02	2.97E 05	4.15E 03	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	6.70E 01	4.70E 04	3.88E 02	9.45E 01	1.02E 02	0.00E-01	0.00E-01	0.00E-01
NB 95	7.84E 03	1.15E 07	3.29E 04	1.36E 04	9.73E 03	0.00E-01	0.00E-01	0.00E-01
RU103	1.62E 02	5.89E 03	4.85E 02	0.00E-01	1.01E 03	0.00E-01	0.00E-01	0.00E-01
RU106	1.50E 03	9.13E 04	1.20E 04	0.00E-01	1.42E 04	0.00E-01	0.00E-01	0.00E-01
AG110M	1.21E 07	9.47E 08	2.50E 07	1.83E 07	2.61E 07	0.00E-01	0.00E-01	0.00E-01
TE127M	3.77E 06	1.26E 07	3.11E 07	1.03E 07	7.66E 07	8.99E 06	0.00E-01	0.00E-01
TE129M	5.17E 06	2.00E 07	3.36E 07	1.15E 07	8.39E 07	1.29E 07	0.00E-01	0.00E-01
I 131	8.31E 08	6.74E 07	1.60E 09	1.89E 09	2.21E 09	6.21E 11	0.00E-01	0.00E-01
I 133	9.49E 06	5.48E 06	2.23E 07	3.24E 07	3.81E 07	5.89E 09	0.00E-01	0.00E-01
CS134	1.08E 10	2.89E 08	5.71E 10	1.07E 11	2.74E 10	0.00E-01	1.12E 10	0.00E-01
CS136	3.09E 09	1.26E 08	2.81E 09	8.27E 09	3.30E 09	0.00E-01	6.74E 08	0.00E-01
CS137	7.10E 09	3.13E 08	8.55E 10	1.00E 11	2.69E 10	0.00E-01	1.09E 10	0.00E-01
BA140	7.13E 05	3.40E 06	1.38E 07	1.38E 04	3.29E 03	0.00E-01	8.50E 00	0.00E-01
CE141	1.72E 02	7.57E 05	2.40E 03	1.46E 03	4.52E 02	0.00E-01	0.00E-01	0.00E-01
CE144	7.90E 03	8.09E 06	1.41E 05	5.77E 04	2.33E 04	0.00E-01	0.00E-01	0.00E-01

*R values in units of mrem/yr per $\mu Ci/m^3$ for inhalation pathway and all tritium pathways, and in units of m^2-mrem/yr per μCi/sec for all other pathways.

TABLE 2.3-21

BEAVER VALLEY SITE PROCESS VENT DISPERSION PARAMETERS ($\overline{D/Q}$), m^{-2},
FOR CONTINUOUS ELEVATED RELEASES >500 hrs/yr or >150 hrs/qtr

	Distances to the Control Locations, in Miles									
Sector	0.0 - 0.5	0.5 - 1.0	1.0 - 1.5	1.5 - 2.0	2.0 - 2.5	2.5 - 3.0	3.0 - 3.5	3.5 - 4.0	4.0 - 4.5	4.5 - 5.0
N	6.00E-10	8.60E-09	3.14E-09	1.76E-09	8.12E-10	5.70E-10	4.24E-10	3.29E-10	2.63E-10	2.15E-10
NNE	6.66E-10	5.64E-09	1.98E-09	2.55E-09	1.33E-09	1.07E-09	6.75E-10	5.23E-10	4.56E-10	3.74E-10
NE	1.03E-09	1.57E-09	1.32E-09	3.62E-09	2.63E-09	1.64E-09	1.23E-09	6.13E-10	7.85E-10	6.42E-10
ENE	1.13E-09	1.55E-09	3.69E-09	3.27E-09	2.31E-09	1.29E-09	1.21E-09	6.78E-10	6.72E-10	3.89E-10
E	1.35E-09	1.28E-08	4.09E-09	3.12E-09	1.91E-09	1.36E-09	1.01E-09	7.83E-10	4.15E-10	5.10E-10
ESE	9.82E-10	7.85E-09	4.40E-09	2 46E-09	1.47E-09	1.03E-09	5.65E-10	5.05E-10	3.25E-10	3.00E-10
SE	2.76E-09	6.41E-09	3.52E-09	1.97E-09	1.18E-09	8.27E-10	5.68E-10	4.40E-10	2.93E-10	2.43E-10
SSE	2.22E-09	4.66E-09	3.01E-09	1.68E-09	1.02E-09	7.14E-10	4.25E-10	3.29E-10	2.19E-10	1.80E-10
S	3.00E-09	4.81E-09	3.76E-09	2.10E-09	1.36E-09	9.52E-10	5.12E-10	3.96E-10	2.68E-10	2.20E-10
SSW	1.44E-08	2.89E-09	7.83E-10	8.84E-10	5.70E-10	4.00E-10	2.55E-10	1.98E-10	1.84E-10	1.51E-10
SW	1.89E-08	5.55E-09	1.55E-09	8.71E-10	2.61E-10	3.94E-10	1.57E-10	2.50E-10	2.54E-10	2.08E-10
WSW	1.57E-09	6.63E-09	1.36E-09	1.04E-09	5.44E-10	2.39E-10	3.84E-10	2.98E-10	2.17E-10	1.78E-10
W	3.78E-10	2.95E-09	1.84E-09	1.03E-09	6.63E-10	4.66E-10	1.37E-10	2.68E-10	1.12E-10	1.75E-10
WNW	4.54E-10	4.13E-10	3.09E-10	4.71E-10	7.35E-10	5.16E-10	1.93E-10	1.10E-10	1.12E-10	1.80E-10
NW	4.52E-10	4.09E-10	2.86E-10	1.18E-09	7.04E-10	4.94E-10	3.37E-10	2.10E-10	2.09E-10	1.71E-10
NNW	3.40E-10	2.05E-09	1.63E-09	9.12E-10	5.86E-10	4.13E-10	2.79E-10	2.16E-10	1.73E-10	1.42E-10

TABLE 2.3-22

BEAVER VALLEY SITE CONTAINMENT VENTS DISPERSION PARAMETERS ($\overline{D/Q}$), m^{-2},
FOR CONTINUOUS GROUND LEVEL RELEASES > 500 hrs/yr or > 150 hrs/qtr

	Distances to the Control Locations, in Miles									
Sector	0.0 - 0.5	0.5 - 1.0	1.0 - 1.5	1.5 - 2.0	2.0 - 2.5	2.5 - 3.0	3.0 - 3.5	3.5 - 4.0	4.0 - 4.5	4.5 - 5.0
N	4.46E-08	7.73E-09	3.24E-09	1.81E-09	1.08E-09	7.57E-10	5.16E-10	4.00E-10	2.91E-10	2.38E-10
NNE	5.42E-08	9.39E-09	3.37E-09	1.89E-09	1.22E-09	8.54E-10	6.35E-10	4.92E-10	3.94E-10	3.22E-10
NE	7.32E-08	1.27E-08	6.21E-09	3.47E-09	2.24E-09	1.57E-09	1.00E-09	7.77E-10	5.69E-10	4.66E-10
ENE	7.77E-08	1.35E-08	6.51E-09	3.64E-09	2.50E-09	1.76E-09	1.31E-09	1.01E-09	6.58E-10	5.39E-10
E	6.08E-08	1.05E-08	3.79E-09	2.12E-09	1.37E-09	9.59E-10	6.54E-10	5.06E-10	4.05E-10	3.32E-10
ESE	3.23E-08	5.60E-09	2.54E-09	1.42E-09	8.46E-10	5.94E-10	4.05E-10	3.14E-10	2.28E-10	1.87E-10
SE	3.29E-08	5.70E-09	2.59E-09	1.45E-09	9.32E-10	6.55E-10	4.12E-10	3.19E-10	2.55E-10	2.09E-10
SSE	2.84E-08	4.92E-09	2.06E-09	1.15E-09	6.29E-10	4.42E-10	2.99E-10	2.32E-10	1.85E-10	1.52E-10
S	3.67E-08	6.37E-09	2.26E-09	1.26E-09	8.14E-10	5.71E-10	3.86E-10	2.99E-10	2.39E-10	1.96E-10
SSW	2.61E-08	4.52E-09	1.60E-09	8.97E-10	5.78E-10	4.06E-10	3.02E-10	2.34E-10	1.70E-10	1.39E-10
SW	3.06E-08	5.30E-09	2.62E-09	1.47E-09	8.01E-10	5.62E-10	4.18E-10	3.24E-10	2.35E-10	1.93E-10
WSW	4.60E-08	7.97E-09	3.34E-09	1.87E-09	1.20E-09	8.45E-10	5.87E-10	4.55E-10	3.38E-10	2.77E-10
W	6.49E-08	1.13E-08	4.72E-09	2.64E-09	1.19E-09	8.36E-10	6.22E-10	4.82E-10	3.85E-10	3.15E-10
WNW	9.25E-08	1.60E-08	6.43E-09	3.60E-09	2.21E-09	1.55E-09	1.16E-09	8.96E-10	5.79E-10	4.75E-10
NW	1.19E-07	2.07E-08	8.68E-09	4.86E-09	2.99E-09	2.10E-09	1.56E-09	1.21E-09	7.83E-10	6.41E-10
NNW	5.22E-08	9.04E-09	3.79E-09	2.12E-09	1.28E-09	9.00E-10	6.25E-10	4.84E-10	3.59E-10	2.94E-10

TABLE 2.3-23

BEAVER VALLEY SITE VENTILATION VENTS DISPERSION PARAMETERS ($\overline{D/Q}$), m^{-2},
FOR CONTINUOUS GROUND LEVEL RELEASES >500 hrs/yr or >150 hrs/qtr

	Distances to the Control Locations, in Miles									
Sector	0.0 - 0.5	0.5 - 1.0	1.0 - 1.5	1.5 - 2.0	2.0 - 2.5	2.5 - 3.0	3.0 - 3.5	3.5 - 4.0	4.0 - 4.5	4.5 - 5.0
N	4.46E-08	7.73E-09	3.24E-09	1.81E-09	1.08E-09	7.57E-10	5.16E-10	4.00E-10	2.91E-10	2.38E-10
NNE	5.42E-08	9.39E-09	3.37E-09	1.89E-09	1.22E-09	8.54E-10	6.35E-10	4.92E-10	3.94E-10	3.22E-10
NE	7.32E-08	1.27E-08	6.21E-09	3.47E-09	2.24E-09	1.57E-09	1.00E-09	7.71E-10	5.69E-10	4.66E-10
ENE	7.77E-08	1.35E-08	6.51E-09	3.64E-09	2.50E-09	1.76E-09	1.31E-09	1.01E-09	6.58E-10	5.39E-10
E	6.08E-08	1.05E-08	3.79E-09	2.12E-09	1.37E-09	9.59E-10	6.54E-10	5.06E-10	4.05E-10	3.32E-10
ESE	3.23E-08	5.60E-09	2.54E-09	1.42E-09	8.46E-10	5.94E-10	4.05E-10	3.14E-10	2.28E-10	1.87E-10
SE	3.29E-08	5.70E-09	2.59E-09	1.45E-09	9.32E-10	6.55E-10	4.12E-10	3.19E-10	2.55E-10	2.09E-10
SSE	2.84E-08	4.92E-09	2.06E-09	1.15E-09	6.29E-10	4.42E-10	2.99E-10	2.32E-10	1.85E-10	1.52E-10
S	3.67E-08	6.37E-09	2.26E-09	1.26E-09	8.14E-10	5.71E-10	3.86E-10	2.99E-10	2.39E-10	1.96E-10
SSW	2.61E-08	4.52E-09	1.60E-09	8.97E-10	5.78E-10	4.06E-10	3.02E-10	2.34E-10	1.70E-10	1.39E-10
SW	3.06E-08	5.30E-09	2.62E-09	1.47E-09	8.01E-10	5.62E-00	4.18E-10	3.24E-10	2.35E-10	1.93E-10
WSW	4.60E-08	7.97E-09	3.34E-09	1.87E-09	1.20E-09	8.45E-10	5.87E-10	4.55E-10	3.38E-10	2.77E-10
W	6.49E-08	1.13E-08	4.72E-09	2.64E-09	1.19E-09	8.36E-10	6.22E-10	4.82E-10	3.85E-10	3.15E-10
WNW	9.25E-08	1.60E-08	6.43E-09	3.60E-09	2.21E-09	1.55E-09	1.16E-09	8.96E-10	5.79E-10	4.75E-10
NW	1.19E-07	2.07E-08	8.68E-09	4.86E-09	2.99E-09	2.19E-09	1.56E-09	1.21E-09	7.83E-10	6.41E-10
NNW	5.22E-08	9.04E-09	3.79E-09	2.12E-09	1.28E-09	9.00E-10	6.25E-10	4.84E-10	3.59E-10	2.94E-10

TABLE 2.3-24

BEAVER VALLEY SITE TURBINE BUILDING VENTS DISPERSION PARAMETERS ($\overline{D/Q}$), m^{-2},
FOR CONTINUOUS GROUND LEVEL RELEASES >500 hrs/yr or >150 hrs/qtr

	Distances to the Control Locations, in Miles									
Sector	0.0 - 0.5	0.5 - 1.0	1.0 - 1.5	1.5 - 2.0	2.0 - 2.5	2.5 - 3.0	3.0 - 3.5	3.5 - 4.0	4.0 - 4.5	4.5 - 5.0
N	4.46E-08	7.73E-09	3.24E-09	1.81E-09	1.08E-09	7.57E-10	5.16E-10	4.00E-10	2.91E-10	2.38E-10
NNE	5.42E-08	9.39E-09	3.37E-09	1.89E-09	1.22E-09	8.54E-10	6.35E-10	4.97E-10	3.94E-10	3.22E-10
NE	7.32E-08	1.27E-08	6.21E-09	3.47E-09	2.24E-09	1.57E-09	1.00E-09	7.77E-10	5.69E-10	4.66E-10
ENE	7.77E-08	1.35E-08	6.51E-09	3.64E-09	2.50E-09	1.76E-09	1.31E-09	1.01E-09	6.58E-10	5.39E-10
E	6.08E-08	1.05E-08	3.79E-09	2.12E-09	1.37E-09	9.59E-10	6.54E-10	5.06E-10	4.05E-10	3.32E-10
ESE	3.23E-08	5.60E-09	2.54E-09	1.42E-09	8.46E-10	5.94E-10	4.05E-10	3.14E-10	2.28E-10	1.87E-10
SE	3.29E-08	5.70E-09	2.59E-09	1.45E-09	9.32E-10	6.55E-10	4.12E-10	3.19E-10	2.55E-10	2.09E-10
SSE	2.84E-08	4.92E-09	2.06E-09	1.15E-09	6.29E-10	4.42E-10	2.99E-10	2.32E-10	1.85E-10	1.52E-10
S	3.67E-08	6.37E-09	2.26E-09	1.26E-09	8.14E-10	5.71E-10	3.86E-10	2.99E-10	2.39E-10	1.96E-10
SSW	2.61E-08	4.52E-09	1.60E-09	8.97E-10	5.78E-10	4.06E-10	3.02E-10	2.34E-10	1.70E-10	1.39E-10
SW	3.06E-08	5.30E-09	2.62E-09	1.47E-09	8.01E-10	5.62E-00	4.18E-10	3.24E-10	2.35E-10	1.98E-10
WSW	4.60E-08	7.97E-09	3.34E-09	1.87E-09	1.20E-09	8.45E-10	5.87E-10	4.55E-10	3.38E-10	2.77E-10
W	6.49E-08	1.13E-08	4.72E-09	2.64E-09	1.19E-09	8.36E-10	6.22E-10	4.82E-10	3.85E-10	3.15E-10
WNW	9.25E-08	1.60E-08	6.43E-09	3.60E-09	2.21E-09	1.55E-09	1.16E-09	8.96E-10	5.79E-10	4.75E-10
NW	1.19E-07	2.07E-08	8.68E-09	4.86E-09	2.99E-09	2.19E-09	1.56E-09	1.21E-09	7.83E-10	6.41E-10
NNW	5.22E-08	9.04E-09	3.79E-09	2.12E-09	1.28E-09	9.00E-10	6.25E-10	4.84E-10	3.59E-10	2.94E-10

TABLE 2.3-25

FOR INFORMATION ONLY

BEAVER VALLEY UNIT 2 CONDENSATE POLISHING BUILDING VENT DISPERSION PARAMETERS ($\overline{D/Q}$), m^{-2},
FOR CONTINUOUS GROUND LEVEL RELEASES >500 hrs/yr or >150 hrs/qtr

	Distances to the Control Locations, in Miles									
Sector	0.0 - 0.5	0.5 - 1.0	1.0 - 1.5	1.5 - 2.0	2.0 - 2.5	2.5 - 3.0	3.0 - 3.5	3.5 - 4.0	4.0 - 4.5	4.5 - 5.0
N	4.46E-08	7.73E-09	3.24E-09	1.81E-09	1.08E-09	7.57E-10	5.16E-10	4.00E-10	2.91E-10	2.38E-10
NNE	5.42E-08	9.39E-09	3.37E-09	1.89E-09	1.22E-09	8.54E-10	6.35E-10	4.92E-10	3.94E-10	3.22E-10
NE	7.32E-08	1.27E-08	6.21E-09	3.47E-09	2.24E-09	1.57E-09	1.00E-09	7.77E-10	5.69E-10	4.60E-10
ENE	7.77E-08	1.35E-08	6.51E-09	3.64E-09	2.50E-09	1.76E-09	1.31E-09	1.01E-09	6.58E-10	5.39E-10
E	6.08E-08	1.05E-08	3.79E-09	2.12E-09	1.37E-09	9.59E-10	6.54E-10	5.06E-10	4.05E-10	3.32E-10
ESE	3.23E-08	5.60E-09	2.54E-09	1.42E-09	9.46E-10	5.94E-10	4.05E-10	3.14E-10	2.28E-10	1.87E-10
SE	3.29E-08	5.70E-09	2.59E-09	1.45E-09	9.32E-10	6.55E-10	4.12E-10	3.19E-10	2.55E-10	2.09E-10
SSE	2.84E-08	4.92E-09	2.06E-09	1.15E-09	6.29E-10	4.42E-10	2.99E-10	2.32E-10	1.85E-10	1.52E-10
S	3.67E-08	6.37E-09	2.26E-09	1.26E-09	8.14E-10	5.71E-10	3.86E-10	2.99E-10	2.39E-10	1.96E-10
SSW	2.61E-08	4.52E-09	1.60E-09	8.97E-10	5.78E-10	4.06E-10	3.02E-10	2.34E-10	1.70E-10	1.39E-10
SW	3.06E-08	5.30E-09	2.62E-09	1.47E-09	8.01E-10	5.62E-00	4.18E-10	3.24E-10	2.35E-10	1.93E-10
WSW	4.60E-08	7.97E-09	3.34E-09	1.87E-09	1.20E-09	8.45E-10	5.87E-10	4.55E-10	3.38E-10	2.77E-10
W	6.49E-08	1.13E-08	4.72E-09	2.64E-09	1.19E-09	8.36E-10	6.22E-10	4.82E-10	3.85E-10	3.15E-10
WNW	9.25E-08	1.60E-08	6.43E-09	3.60E-09	2.21E-09	1.55E-09	1.16E-09	8.96E-10	5.79E-10	4.75E-10
NW	1.19E-07	2.07E-08	8.68E-09	4.86E-09	2.99E-09	2.19E-09	1.56E-09	1.21E-09	7.83E-10	6.41E-10
NNW	5.22E-08	9.04E-09	3.79E-09	2.12E-09	1.28E-09	9.00E-10	6.25E-10	4.84E-10	3.59E-10	2.94E-10

TABLE 2.3-26

FOR INFORMATION ONLY

BEAVER VALLEY UNIT 2 DECONTAMINATION BUILDING VENT DISPERSION PARAMETERS ($\overline{D/Q}$), m^{-2},
FOR CONTINUOUS GROUND LEVEL RELEASES >500 hrs/yr or >150 hrs/qtr

	Distances to the Control Locations, in Miles									
Sector	0.0 - 0.5	0.5 - 1.0	1.0 - 1.5	1.5 - 2.0	2.0 - 2.5	2.5 - 3.0	3.0 - 3.5	3.5 - 4.0	4.0 - 4.5	4.5 - 5.0
N	4.46E-08	7.73E-09	3.24E-09	1.81E-09	1.08E-09	7.57E-10	5.16E-10	4.00E-10	2.91E-10	2.38E-10
NNE	5.42E-08	9.39E-09	3.37E-09	1.89E-09	1.22E-09	8.54E-10	6.35E-10	4.92E-10	3.94E-10	3.22E-10
NE	7.32E-08	1.27E-08	6.21E-09	3.47E-09	2.24E-09	1.57E-09	1.00E-09	7.77E-10	5.69E-10	4.66E-10
ENE	7.77E-08	1.35E-08	6.51E-09	3.64E-09	2.50E-09	1.76E-09	1.31E-09	1.01E-09	6.58E-10	5.39E-10
E	6.09E-08	1.05E-08	3.79E-09	2.12E-09	1.37E-09	9.59E-10	6.54E-10	5.06E-10	4.05E-10	3.32E-10
ESE	3.23E-08	5.60E-09	2.54E-09	1.42E-09	8.46E-10	5.94E-10	4.05E-10	3.14E-10	2.28E-10	1.87E-10
SE	3.29E-08	5.70E-09	2.59E-09	1.45E-09	9.32E-10	6.55E-10	4.12E-10	3.19E-10	2.55E-10	2.09E-10
SSE	2.84E-08	4.92E-09	2.06E-09	1.15E-09	6.29E-10	4.42E-10	2.99E-10	2.32E-10	1.85E-10	1.52E-10
S	3.67E-08	6.37E-09	2.26E-09	1.26E-09	8.14E-10	5.71E-10	3.86E-10	2.99E-10	2.39E-10	1.96E-10
SSW	2.61E-08	4.52E-09	1.60E-09	8.97E-10	5.78E-10	4.06E-10	3.02E-10	2.34E-10	1.70E-10	1.39E-10
SW	3.06E-08	5.30E-09	2.62E-09	1.47E-09	8.01E-10	5.62E-00	4.18E-10	3.24E-10	2.35E-10	1.93E-10
WSW	4.60E-08	7.97E-09	3.34E-09	1.87E-09	1.20E-09	8.45E-10	5.87E-10	4.55E-10	3.38E-10	2.77E-10
W	6.49E-08	1.13E-08	4.72E-09	2.64E-09	1.19E-09	8.36E-10	6.22E-10	4.82E-10	3.85E-10	3.15E-10
WNW	9.25E-08	1.60E-08	6.43E-09	3.60E-09	2.21E-09	1.55E-09	1.16E-09	8.96E-10	5.79E-10	4.75E-10
NW	1.19E-07	2.07E-08	8.68E-09	4.86E-09	2.99E-09	2.19E-09	1.56E-09	1.21E-09	7.83E-10	6.41E-10
NNW	5.22E-08	9.04E-09	3.75E-09	2.12E-09	1.28E-09	9.00E-10	6.25E-10	4.84E-10	3.59E-10	2.94E-10

TABLE 2.3-27

FOR INFORMATION ONLY

BEAVER VALLEY UNIT 2 WASTE GAS STORAGE VAULT VENT DISPERSION PARAMETER ($\overline{D/Q}$), m^{-2},
FOR CONTINUOUS GROUND LEVEL RELEASES >500 hrs/yr or >150 hrs/qtr

	Distances to the Control Locations, in Miles									
Sector	0.0 - 0.5	0.5 - 1.0	1.0 - 1.5	1.5 - 2.0	2.0 - 2.5	2.5 - 3.0	3.0 - 3.5	3.5 - 4.0	4.0 - 4.5	4.5 - 5.0
N	4.46E-08	7.73E-09	3.24E-09	1.81E-09	1.08E-09	7.57E-10	5.16E-10	4.00E-10	2.91E-10	2.38E-10
NNE	5.42E-08	9.39E-09	3.37E-09	1.89E-09	1.22E-09	8.54E-10	6.35E-10	4.92E-10	3.94E-10	3.22E-10
NE	7.32E-08	1.27E-08	6.21E-09	3.47E-09	2.24E-09	1.57E-09	1.00E-09	7.77E-10	5.69E-10	4.66E-10
ENE	7.77E-08	1.35E-08	6.51E-09	3.64E-09	2.50E-09	1.76E-09	1.31E-09	1.01E-09	6.58E-10	5.39E-10
E	6.08E-08	1.05E-08	3.79E-09	2.12E-09	1.37E-09	9.59E-10	6.54E-10	5.06E-10	4.05E-10	3.32E-10
ESE	3.23E-08	5.60E-09	2.54E-09	1.42E-09	8.46E-10	5.94E-10	4.05E-10	3.14E-10	2.28E-10	1.87E-10
SE	3.29E-08	5.70E-09	2.59E-09	1.45E-09	9.32E-10	6.55E-10	4.12E-10	3.19E-10	2.55E-10	2.09E-10
SSE	2.84E-08	4.92E-09	2.06E-09	1.15E-09	6.29E-10	4.42E-10	2.99E-10	2.32E-10	1.85E-10	1.52E-10
S	3.67E-08	6.37E-09	2.26E-09	1.26E-09	8.14E-10	5.71E-10	3.86E-10	2.99E-10	2.39E-10	1.96E-10
SSW	2.61E-08	4.52E-09	1.60E-09	8.97E-10	5.78E-10	4.06E-10	3.02E-10	2.34E-10	1.70E-10	1.39E-10
SW	3.06E-08	5.30E-09	2.62E-09	1.47E-09	8.01E-10	5.62E-00	4.18E-10	3.24E-10	2.35E-10	1.93E-10
WSW	4.60E-08	7.97E-09	3.34E-09	1.87E-09	1.20E-09	8.45E-10	5.87E-10	4.55E-10	3.38E-10	2.77E-10
W	6.49E-08	1.13E-08	4.72E-09	2.64E-09	1.19E-09	8.36E-10	6.22E-10	4.82E-10	3.85E-10	3.15E-10
WNW	9.25E-08	1.60E-08	6.43E-09	3.60E-09	2.21E-09	1.55E-09	1.16E-09	8.96E-10	5.79E-10	4.75E-10
NW	1.19E-07	2.07E-08	8.68E-09	4.86E-09	2.99E-09	2.19E-09	1.56E-09	1.21E-09	7.83E-10	6.41E-10
NNW	5.22E-08	9.04E-09	3.79E-09	2.12E-09	1.28E-09	9.00E-10	6.25E-10	4.84E-10	3.59E-10	2.94E-10

TABLE 2.3-28

BEAVER VALLEY SITE PROCESS VENT DISPERSION PARAMETERS (D/Q), X 10^{-9} m^{-2}
FOR CONTINUOUS ELEVATED LEVEL RELEASES >500 HRS/YR or >150 HRS/QTR
FOR SPECIAL DISTANCES (IDENTIFIED IN TABLE 2.2-3)

		Individual Receptors				
Downwind Sector	Site Boundary	Vegetable Garden	Milk Cow	Milk Goat	Meat Animal	Residence
N	.600	2.340	-	.572	.707	2.510
NNE	.673	3.220	-	.524	2.920	3.220
NE	.766	1.280	.660	.111	.660	1.200
ENE	1.010	5.080	-	.702	-	1.760
E	1.370	4.420	.401	1.290	1.290	4.420
ESE	.984	6.390	-	2.340	6.390	6.180
SE	11.000	3.680	.466	.466	1.300	3.680
SSE	7.060	3.220	.423	.105	3.140	4.320
S	5.780	1.540	1.410	-	2.610	2.730
SSW	2.040	1.040	.578	.208	1.040	1.460
SW	1.610	1.120	-	.693	.979	1.120
WSW	1.710	1.310	.370	-	1.190	1.310
W	.377	.659	.138	-	.518	.659
WNW	.424	.746	.491	.029	.746	.746
NW	.447	.425	-	.070	.488	.422
NNW	.340	1.840	-	.043	.545	1.92

TABLE 2.3-29

BEAVER VALLEY SITE CONTAINMENT VENTS DISPERSION PARAMETERS (D/Q), X 10^{-9} m^{-2}
FOR CONTINUOUS GROUND LEVEL RELEASES >500 HRS/YR or >150 HRS/QTR
FOR SPECIAL DISTANCES (IDENTIFIED IN TABLE 2.2-3)

		Individual Receptors				
Downwind Sector	Site Boundary	Vegetable Garden	Milk Cow	Milk Goat	Meat Animal	Residence
N	25.40	2.05	-	.693	.847	2.19
NNE	18.80	2.02	-	.459	1.850	2.11
NE	63.40	29.30	.455	.078	.455	30.40
ENE	65.90	8.92	-	.661	-	32.20
E	38.00	3.90	.382	1.020	1.020	22.70
ESE	17.10	3.56	-	1.380	3.560	3.56
SE	13.80	3.03	.350	.350	1.100	3.03
SSE	10.50	2.65	.317	.094	2.570	3.68
S	10.60	1.05	.934	-	1.860	1.95
SSW	5.59	1.26	.663	.266	1.260	4.42
SW	3.94	2.21	-	1.320	1.920	2.21
WSW	27.50	2.65	.596	-	2.380	2.65
W	31.60	1.23	.645	-	.960	1.23
WNW	39.10	2.23	1.490	.045	2.230	2.23
NW	70.60	15.00	-	.276	1.990	15.60
NNW	31.50	6.52	-	.068	1.090	9.91

TABLE 2.3-30

BEAVER VALLEY SITE VENTILATION VENTS DISPERSION PARAMETERS (D/Q), X 10^{-9} m^{-2}
FOR CONTINUOUS GROUND LEVEL RELEASES >500 HRS/YR or >150 HRS/QTR
FOR SPECIAL DISTANCES (IDENTIFIED IN TABLE 2.2-3)

		Individual Receptors				
Downwind Sector	Site Boundary	Vegetable Garden	Milk Cow	Milk Goat	Meat Animal	Residence
N	25.40	2.05	-	.693	.847	2.19
NNE	18.80	2.02	-	.459	1.850	2.11
NE	63.40	29.30	.455	.078	.455	30.40
ENE	65.90	8.92	-	.661	-	32.20
E	38.00	3.90	382	1.020	1.020	22.70
ESE	17.10	3.56	-	1.380	3.560	3.56
SE	13.80	3.03	.350	.350	1.100	3.03
SSE	10.50	2.65	.317	.094	2.570	3.68
S	10.60	1.05	.934	-	1.860	1.95
SSW	5.59	1.26	.663	.266	1.260	4.42
SW	3.94	2.21	-	1.320	1.320	2.21
WSW	27.50	2.65	.596	-	2.380	2.65
W	31.60	1.23	.645	-	.960	1.23
WNW	39.10	2.23	1.490	.045	2.230	2.23
NW	70.60	15.00	-	.276	1.990	15.60
NNW	31.50	6.52	-	.068	1.090	9.91

TABLE 2.3-31

BEAVER VALLEY SITE TURBINE BUILDING VENTS DISPERSION PARAMETERS (D/Q), X 10^{-9} m^{-2}
FOR CONTINUOUS GROUND LEVEL RELEASES >500 HRS/YR OR >150 HRS/QTR
FOR SPECIAL DISTANCES (IDENTIFIED IN TABLE 2.2-3)

		Individual Receptors				
Downwind Sector	Site Boundary	Vegetable Garden	Milk Cow	Milk Goat	Meat Animal	Residence
N	20.20	2.05	-	.693	.847	2.190
NNE	34.90	2.02	-	.459	1.850	2.110
NE	54.20	29.30	.455	.078	.455	30.400
ENE	57.50	8.92	-	.661	-	32.200
E	38.10	3.90	.382	1.020	1.020	22.700
ESE	18.60	3.56	-	1.380	3.560	3.560
SE	19.00	3.03	.351	.351	1.100	3.030
SSE	13.30	2.65	.318	.094	2.570	3.690
S	11.30	10.40	.934	-	1.860	1.950
SSW	6.44	1.26	.664	.266	1.260	4.430
SW	3.95	2.21	-	1.320	1.920	2.210
WSW	25.10	2.65	.597	-	2.380	2.650
W	28.40	1.23	.646	-	.961	1.230
WNW	30.90	2.23	1.490	.045	2.230	2.230
NW	56.10	14.90	-	.276	1.980	15.500
NNW	25.10	6.53	-	.068	1.100	9.920

TABLE 2.3-32

FOR INFORMATION ONLY

BEAVER VALLEY UNIT 2 CONDENSATE POLISHING BUILIDNG VENT DISPERSION PARAMETERS (D/Q), X 10^{-9} m^{-2}
FOR CONTINUOUS GROUND LEVEL RELEASES >500 HRS/YR OR >150 HRS/QTR
FOR SPECIAL DISTANCES (IDENTIFIED IN TABLE 2.2-3)

		Individual Receptors				
Downwind Sector	Site Boundary	Vegetable Garden	Milk Cow	Milk Goat	Meat Animal	Residence
N	20.20	2.05	-	.693	.847	2.190
NNE	34.90	2.02	-	.459	1.850	2.110
NE	54.20	29.30	.455	.078	.455	30.400
ENE	57.50	8.92	-	.661	-	32.200
E	38.10	3.90	.382	1.020	1.020	22.700
ESE	18.60	3.56	-	1.380	3.560	3.560
SE	19.00	3.03	.351	.351	1.100	3.030
SSE	13.30	2.65	.318	.094	2.570	3.690
S	11.30	10.40	.934	-	1.860	1.950
SSW	6.44	1.26	.664	.266	1.260	4.430
SW	3.95	2.21	-	1.320	1.920	2.210
WSW	25.10	2.65	.597	-	2.380	2.650
W	28.40	1.23	.646	-	.961	1.230
WNW	30.90	2.23	1.490	.045	2.230	2.230
NW	56.10	14.90	-	.276	1.980	15.500
NNW	25.10	6.53	-	.068	1.100	9.920

TABLE 2.3-33

FOR INFORMATION ONLY

BEAVER VALLEY UNIT 2 DECONTAMINATION BUILDING VENT DISPERSION PARAMETERS (D/Q), X 10^{-9} m^{-2}
FOR CONTINUOUS GROUND LEVEL RELEASES > 500 HRS/YR OR > 150 HRS/QTR
FOR SPECIAL DISTANCES (IDENTIFIED IN TABLE 2.2-3)

		Individual Receptors				
Downwind Sector	Site Boundary	Vegetable Garden	Milk Cow	Milk Goat	Meat Animal	Residence
N	25.40	2.05	-	.693	.847	2.190
NNE	18.80	2.02	-	.459	1.850	2.110
NE	63.40	29.30	.455	.078	.455	30.400
ENE	65.90	8.92	-	.661	-	32.200
E	38.00	3.90	.382	1.020	1.020	22.700
ESE	17.10	3.56	-	1.380	3.560	3.560
SE	13.80	3.03	.350	.350	1.100	3.030
SSE	10.50	2.65	.317	.094	2.570	3.680
S	10.60	1.05	.934	-	1.860	1.950
SSW	5.59	1.26	.663	.266	1.260	4.420
SW	3.94	2.21	-	1.320	1.920	2.210
WSW	27.50	2.65	.596	-	2.380	2.650
W	31.60	1.23	.645	-	.960	1.230
WNW	39.10	2.23	1.490	.045	2.230	2.230
NW	70.60	15.00	-	.276	1.990	15.600
NNW	31.50	6.52	-	.068	1.090	9.910

TABLE 2.3-34

FOR INFORMATION ONLY

BEAVER VALLEY UNIT 2 WASTE GAS STORAGE VAULT VENT DISPERSION PARAMETERS (D/Q), X 10^{-9} m^{-2}
FOR CONTINUOUS GROUND LEVEL RELEASES > 500 HRS/YR OR >150 HRS/QTR
FOR SPECIAL DISTANCES (IDENTIFIED IN TABLE 2.2-3)

		Individual Receptors				
Downwind Sector	Site Boundary	Vegetable Garden	Milk Cow	Milk Goat	Meat Animal	Residence
N	25.40	2.05	-	.693	.847	2.190
NNE	18.80	2.02	-	.459	1.850	2.110
NE	63.40	29.30	.455	.078	.455	30.400
ENE	65.90	8.92	-	.661	-	32.200
E	38.00	3.90	.382	1.020	1.020	22.700
ESE	17.10	3.56	-	1.380	3.560	3.560
SE	13.80	3.03	.350	.350	1.100	3.030
SSE	10.50	2.65	.317	.094	2.570	3.680
S	10.60	1.05	.934	-	1.860	1.950
SSW	5.59	1.26	.663	.266	1.260	4.420
SW	3.94	2.21	-	1.320	1.920	2.210
WSW	27.50	2.65	.596	-	2.380	2.650
W	31.60	1.23	.645	-	.960	1.230
WNW	39.10	2.23	1.490	.045	2.230	2.230
NW	70.60	15.00	-	.276	1.990	15.600
NNW	31.50	6.52	-	.068	1.090	9.910

3.0 Radiological Environmental Monitoring Program

Table 3.0-1 contains the DLC site number, sector, distance sample point description, sampling and collection frequency, analysis, and analysis frequency for various exposure pathways in the vicinity of the Beaver Valley Power Stations (BVPS) for the radiological monitoring program. Figures 3.0-1 through 3.0-9 show the location of the various sampling points.

TABLE 3.0-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	DLC Site No.	Sector[1]	Miles[2]	Sample Point Description[3]	Sampling and Collection Frequency	Type and Frequency of Analyses
1. AIRBORNE						
Radioiodine and Particulates	13	11	1.6	Hookstown (Meyer's Farm)	Continuous sampler operation with collection at least weekly.	Radioiodine Cartridge: I-131 analysis weekly.
	30	4	0.6	Shippingport (Cooke's Ferry Substation)		Particulate Sampler: Gross beta analysis following filter change;[5] Gamma isotopic analysis on composite (by location) quarterly.
	32	15	0.8	Midland (Midland Substation)		
	46.1	6	2.0	Industry		
	48	10	16.5	Weirton, WV[4] (Weirton Water Storage Tank)		
2. DIRECT RADIATION	10	4	0.8	Shippingport Boro (Post Office)	Continuous measurement with quarterly collection.	Gamma dose quarterly.
	13	11	1.6	Meyer's Farm		
	14	11	2.6	Hookstown		
	15	14	3.3	Georgetown		
	27	7	6.2	Brunton's Farm		
	28	1	8.7	Sherman's Farm		
	29B	3	8.1	Beaver County Hospital		
	30	4	0.6	Shippingport Boro (Cooke's Ferry)		
	32	15	0.8	Midland Boro (Midland Substation)		
	45	5	2.2	Raccoon Township (Mt. Pleasant Church)		
	45.1	6	2.0	Raccoon Township (Kennedy's Corner)		
	46	3	2.5	Industry (Church)		
	46.1	3	2.1	Industry (Tire Company)		
	47	14	4.8	East Liverpool, OH (Water Company)		
	48	10	16.5	Weirton, WV (Water Company)		
	51	5	8.0	Aliquippa		
	59	7	1.1	Iron's Farm		
	60	13	3.7	Haney's Farm		

TABLE 3.0-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

	Exposure Pathway and/or Sample	DLC Site No.	Sector[1]	Miles[2]	Sample Point Description[3]	Sampling and Collection Frequency	Type and Frequency of Analyses
2.	DIRECT RADIATION (Continued)	70	1	3.0	Western Beaver High School	Continuous measurement with quarterly collection.	Gamma dose quarterly.
		71	2	5.6	Brighton Township School		
		72	3	3.2	Logan School		
		73	4	2.2	Potter Township School		
		74	4	6.8	Center Township (Community College)		
		75	5	4.3	Raccoon Township (Holt Road)		
		76	6	3.8	Raccoon Township School		
		77	6	5.8	Raccoon Township (Green Garden Road)		
		78	7	2.3	Raccoon Township Municipal Building		
		79	8	4.6	Raccoon Township (Routes 18 & 151)		
		80	9	8.4	Raccoon Park		
		81	9	3.9	Southside School		
		82	9	7.1	Hanover Township Municipal Building		
		83	10	4.5	Greene Township (Mill Creek Road)		
		84	11	8.5	Hancock County, WV (Children's Home)		
		85	12	5.8	Hancock County, WV (Routes 8 & 30)		
		86	13	6.5	East Liverpool, OH (Cahill's)		
		87	14	7.0	Calcutta, OH		
		88	15	3.1	Midland Heights		
		89	15	4.7	Ohioville		
		90	16	5.2	Fairview School		
		91	2	3.7	Brighton Township (Pine Grove & Doyle Roads)		
		92	12	3.0	Greene Township (Georgetown Road)		
		93	16	1.3	Midland (Sunset Hills)		
		94	8	2.4	Raccoon Township (McCleary Road)		
		95	10	2.4	Greene Township (McCleary Road)		

TABLE 3.0-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample'	DLC Site No.	Sector[1]	Miles[2]	Sample Point Description[3]	Sampling and Collection Frequency	Type and Frequency of Analyses
3. WATERORNE						
a. Surface (River)	49.1	4	5.0	Upstream - in vicinity of Montgomery Dam[4] (ARCO Chemical Company, formerly ARCO Polymers)	Composite sample with sample collection at least monthly.[6]	Gamma isotopic analysis monthly; tritium analysis on composite (by location) quarterly.
	2.1	14	1.3	Downstream - Midland		
b. Drinking Water	4	14	1.3	Midland (Midland Water Treatment Plant)	Composite sample with sample collection at least bi-weekly.[6]	I-131 analysis bi-weekly; gamma isotopic analysis on composite (by location) monthly; tritium analysis on composite (by location) quarterly.
	5	14	4.8	East Liverpool, OH (East Liverpool Water Treatment Plant)		
c. Ground Water				None required[7]		
d. Shoreline Sediment	2A	13	0.2	Vicinity of BVPS Discharge Structure	Semi-annually.	Gamma isotopic analysis semi-annually.
4. INGESTION						
a. Milk	25	10	2.1	Searight's Dairy	At least bi-weekly when animals are on pasture; at least monthly at other times.	Gamma isotopic and I-131 analysis on each sample.
	*8	-	-			
	*8	-	-			
	*8	-	-			
	96	10	10.3	Windshimer's Dairy[4]		

TABLE 3.0-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample'	DLC Site No.	Sector[1]	Miles[2]	Sample Point Description[3]	Sampling and Collection Frequency	Type and Frequency of Analyses
4. INGESTION (Continued)						
b. Fish	2A	13	0.2	Downstream - in vicinity of BVPS Discharge Structure	Semi-annually	Gamma isotopic analysis on edible portion
	49	3	4.7	Upstream - in vicinity of Montgomery Dam		
c. Food Products (Leafy Vegetables)	10	4	0.8	Three (3) locations within 5 miles of BVPS	Annually at harvest time	Gamma isotopic and I-131 analysis on edible portion
	15	14	3.3			
	46	3	2.5			
	48	10	16.5	One (1) location[4] (Weirton, WV area)		

[1]Sector numbers 1-16 correspond to the 16 compass direction sectors N - NNW.

[2]Distance (in miles) is as measured from BVPS Unit 1 Containment Building.

[3]All Sample Points, unless otherwise noted, are in the Commonwealth of Pennsylvania. Maps showing the approximate locations of the Sample Points are provided as Figures 3.0-1 through 3.0-9.

[4]This is a Control Station and is presumed to be outside the influence of BVPS effluents.

[5]A gamma isotopic analysis is to be performed on each sample when the gross beta activity is found to be greater than 10 times the mean of the Control Station sample.

[6]Composite samples are obtained by collecting an aliquot at intervals not exceeding 2 hours.

[7]Collection of Ground Water samples is not required as the hydraulic gradient or recharge properties are directed toward the river because of the high terrain in the river valley at the BVPS; thus, station effluents do not affect local wells and ground water sources in the area.

[8]These Sample Points will vary and are chosen based upon calculated annual deposition factors (highest).

FIGURE 3.0-1

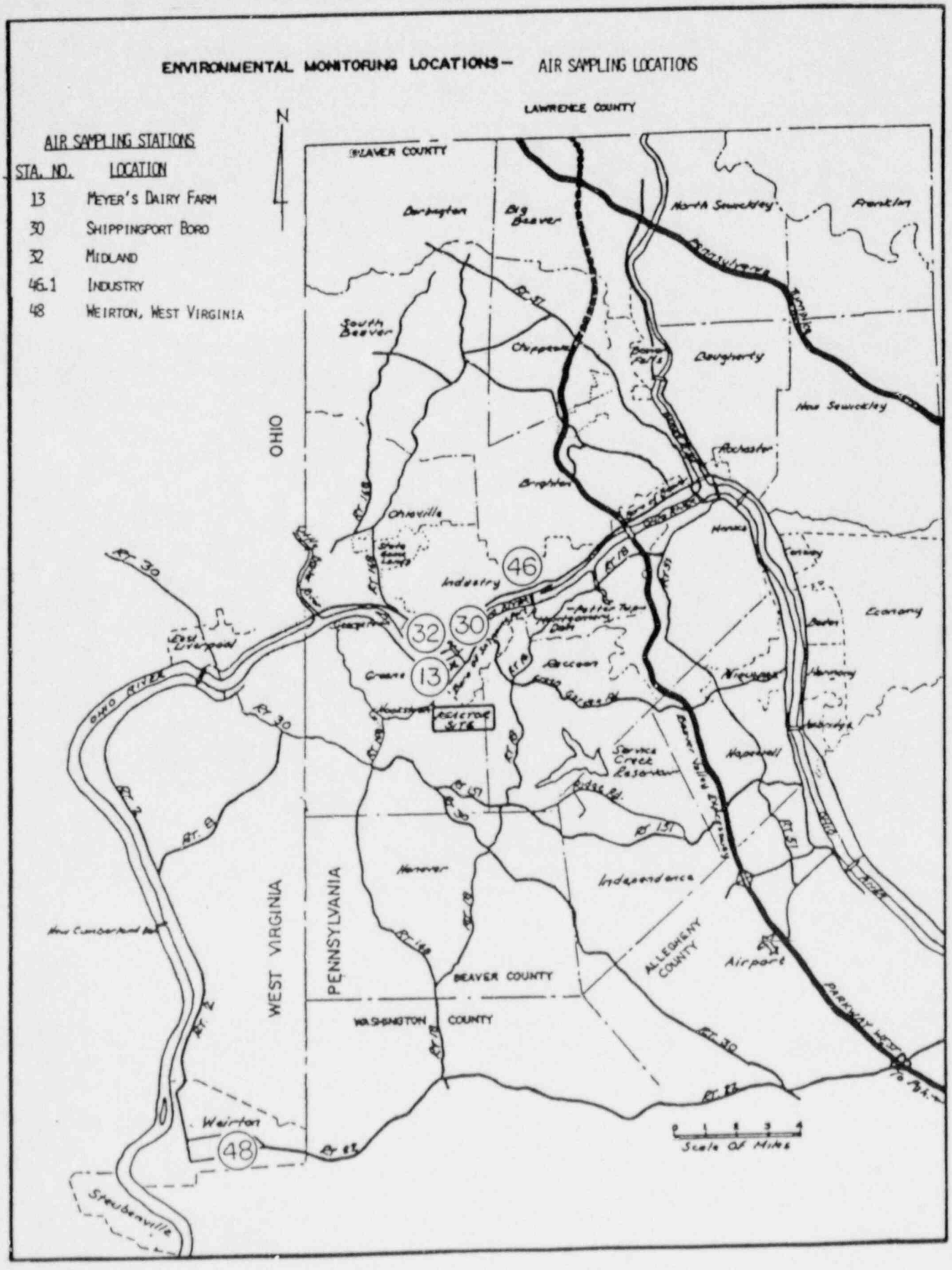

ENVIRONMENTAL MONITORING LOCATIONS – AIR SAMPLING LOCATIONS
AIR SAMPLING STATIONS
STA. NO. LOCATION
13 MEYER'S DAIRY FARM
30 SHIPPINGPORT BORO
32 MIDLAND
46.1 INDUSTRY
48 WEIRTON, WEST VIRGINIA
N
LAWRENCE COUNTY
BEAVER COUNTY
OHIO
WEST VIRGINIA
PENNSYLVANIA
BEAVER COUNTY
WASHINGTON COUNTY
ALLEGHENY COUNTY
OHIO RIVER
Industry
Midland
Shippingport
Weirton
Steubenville
Airport
Scale Of Miles

FIGURE 3.0-2

TLD LOCATIONS

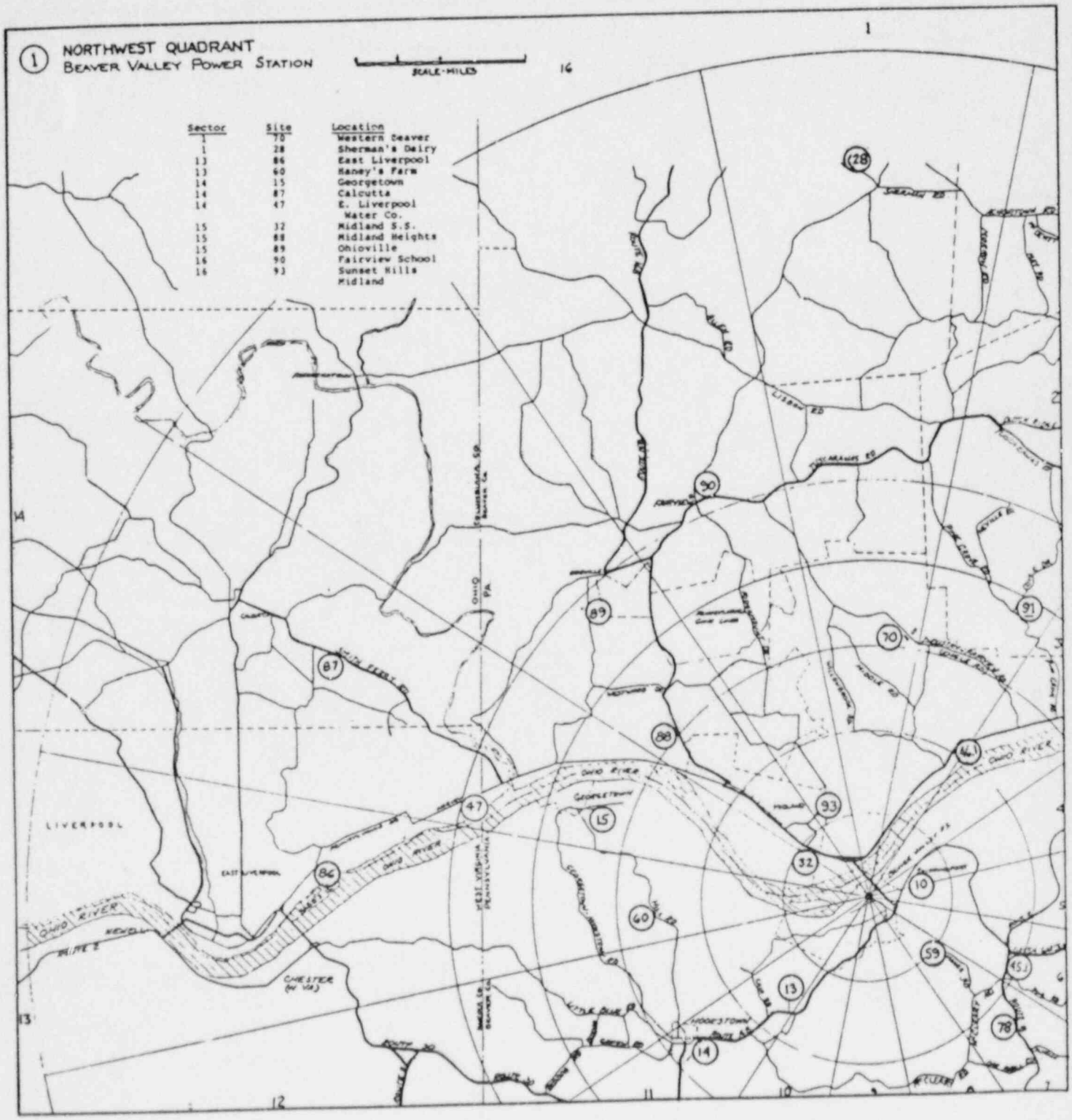


FIGURE 3.0-3

TLD LOCATIONS

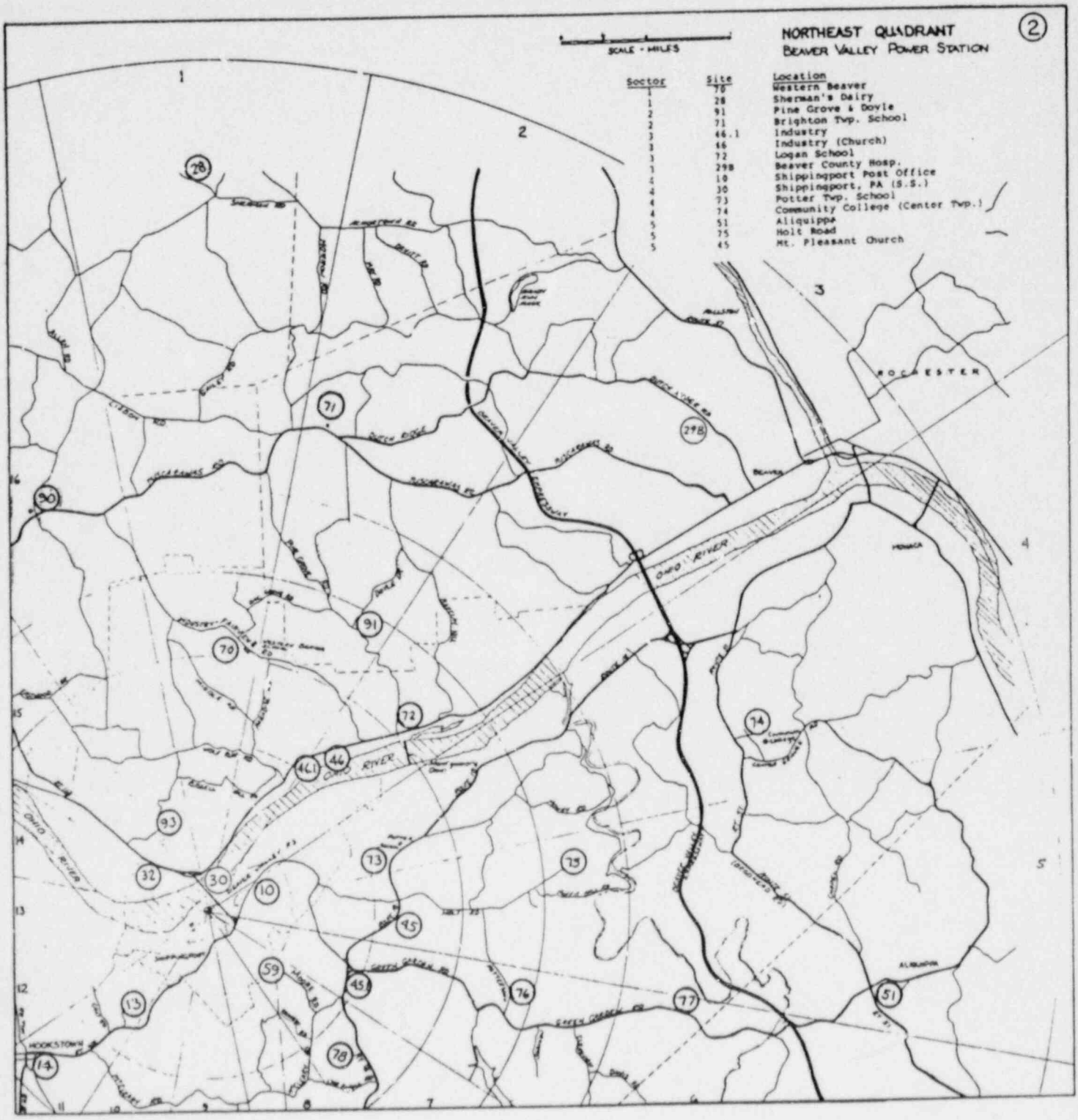


FIGURE 3.0-4

TLD LOCATIONS

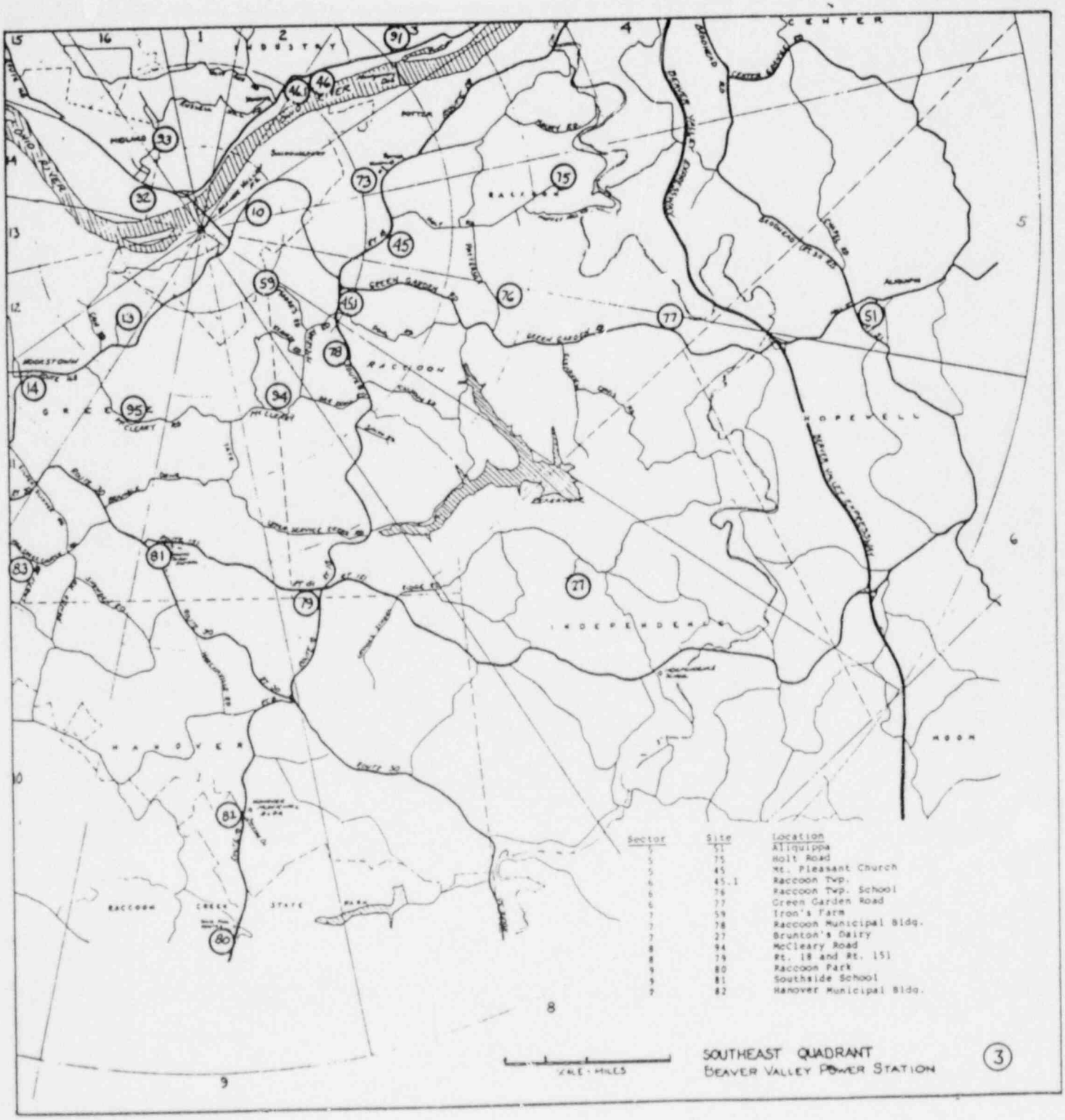
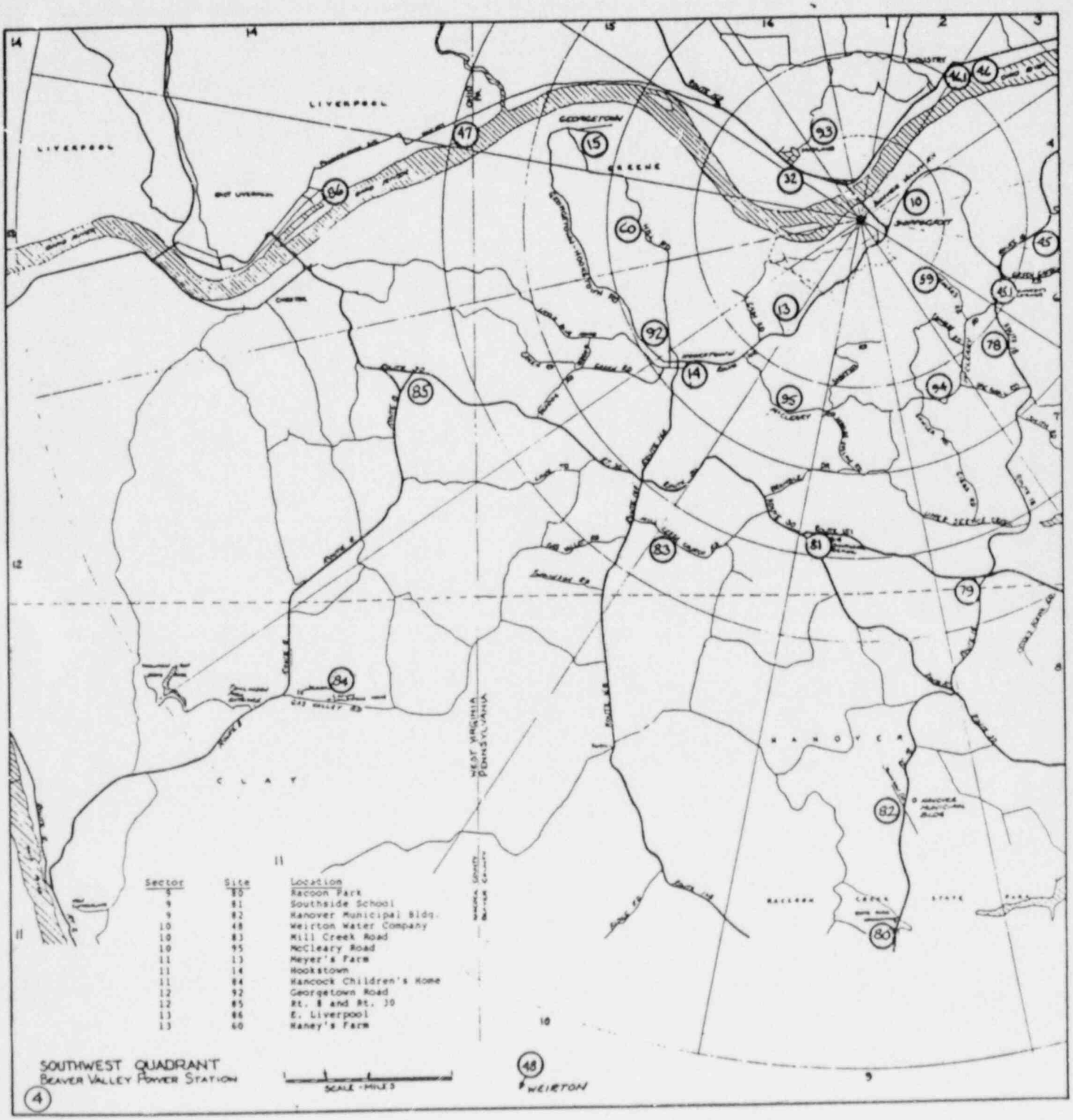


FIGURE 3.0-5

TLD LOCATIONS



Sector	Site	Location
9	80	Racoon Park
9	81	Southside School
9	82	Hanover Municipal Bldg.
10	48	Weirton Water Company
10	83	Mill Creek Road
10	95	McCleary Road
11	13	Meyer's Farm
11	14	Hookstown
11	84	Hancock Children's Home
12	92	Georgetown Road
12	85	Rt. 8 and Rt. 30
13	86	E. Liverpool
13	60	Haney's Farm

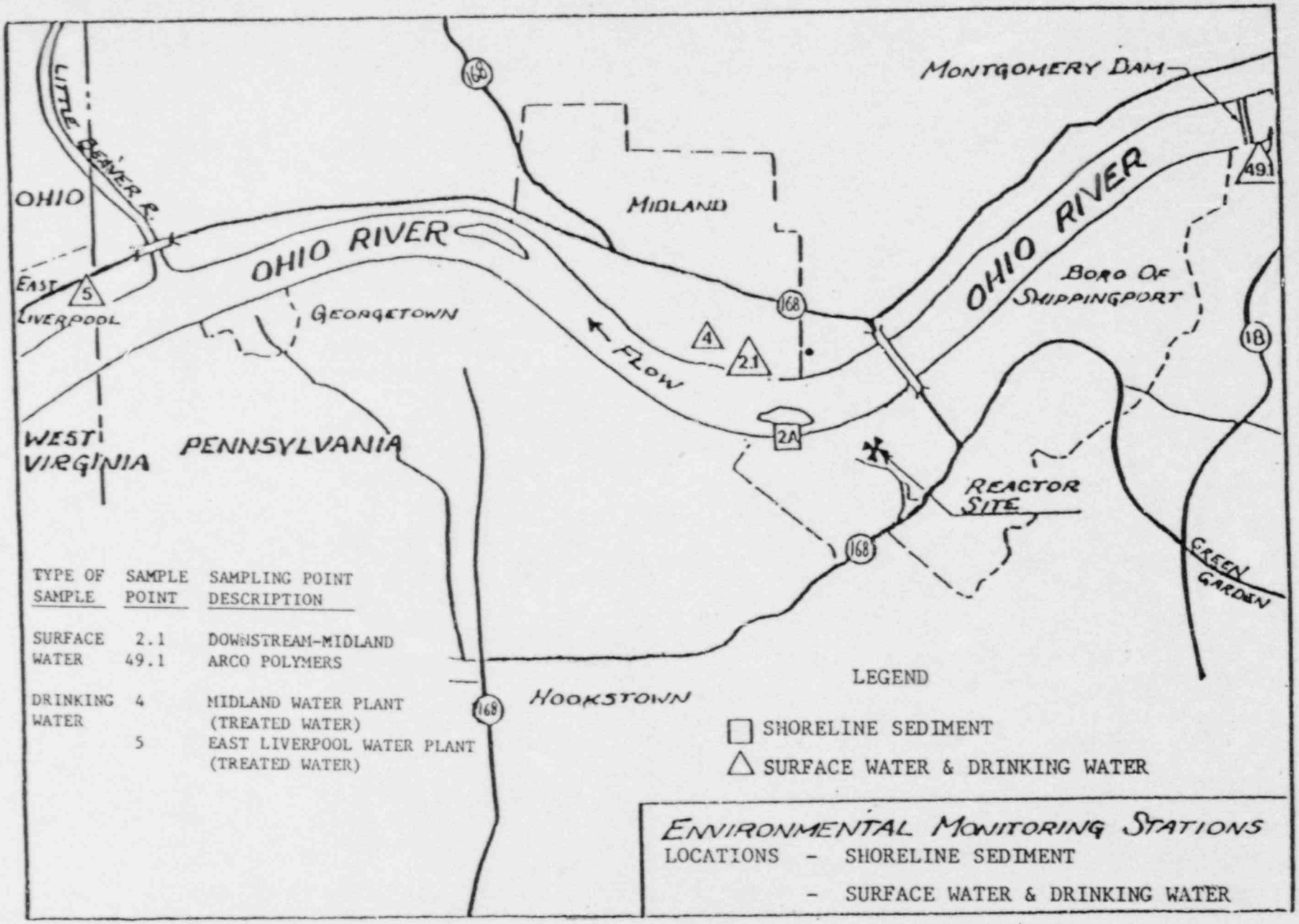

LITTLE BEAVER R.
OHIO
EAST LIVERPOOL
WEST VIRGINIA
PENNSYLVANIA
OHIO RIVER
GEORGETOWN
MIDLAND
FLOW
MONTGOMERY DAM
OHIO RIVER
BORO OF SHIPPINGPORT
REACTOR SITE
GREEN GARDEN
HOOKSTOWN
168
18
49.1
2A
TYPE OF SAMPLE | SAMPLE POINT | SAMPLING POINT DESCRIPTION
SURFACE WATER | 2.1 | DOWNSTREAM-MIDLAND
49.1 | ARCO POLYMERS
DRINKING WATER | 4 | MIDLAND WATER PLANT (TREATED WATER)
5 | EAST LIVERPOOL WATER PLANT (TREATED WATER)
LEGEND
SHORELINE SEDIMENT
SURFACE WATER & DRINKING WATER
ENVIRONMENTAL MONITORING STATIONS
LOCATIONS - SHORELINE SEDIMENT
- SURFACE WATER & DRINKING WATER

FIGURE 3.0-6

FIGURE 3.0-7

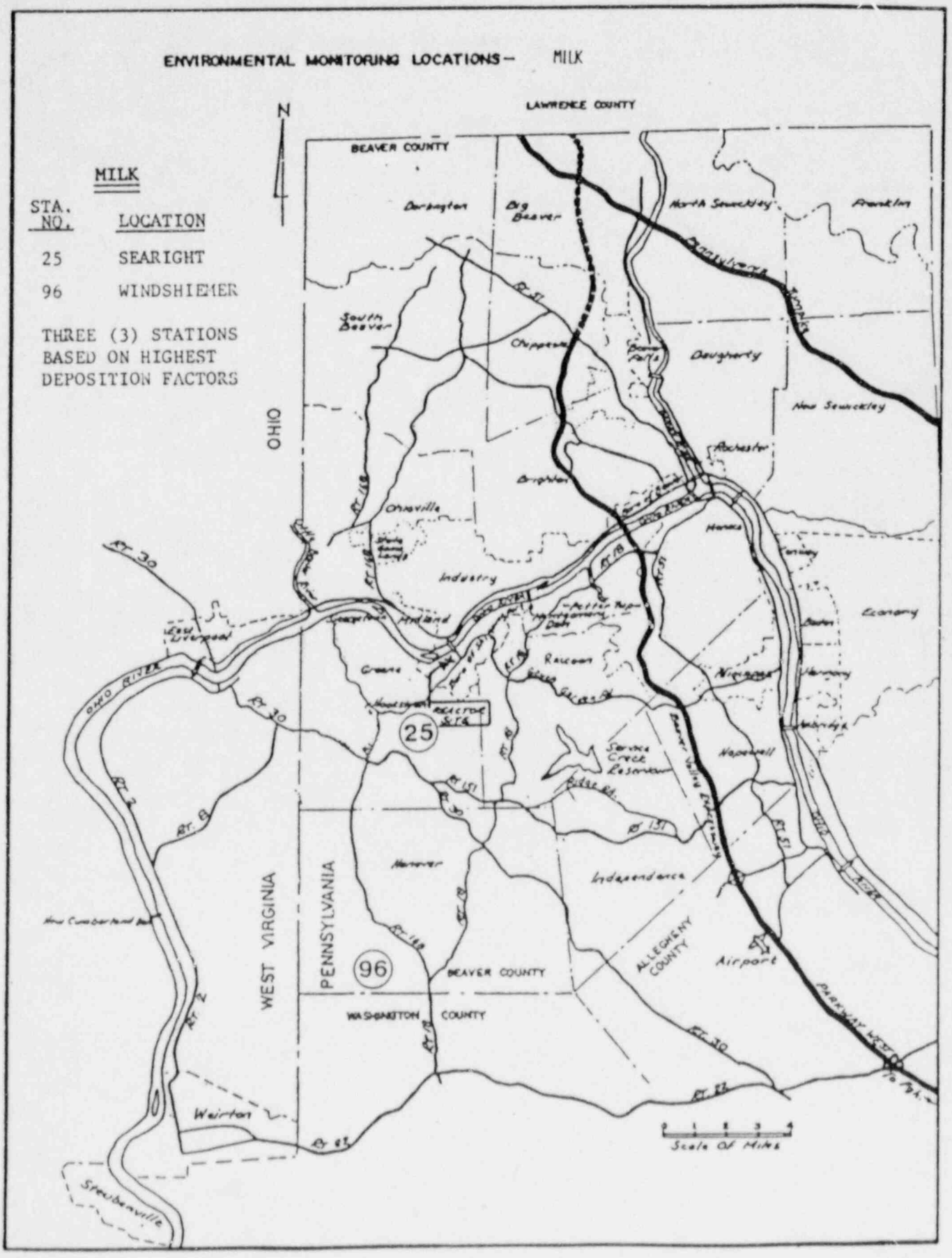
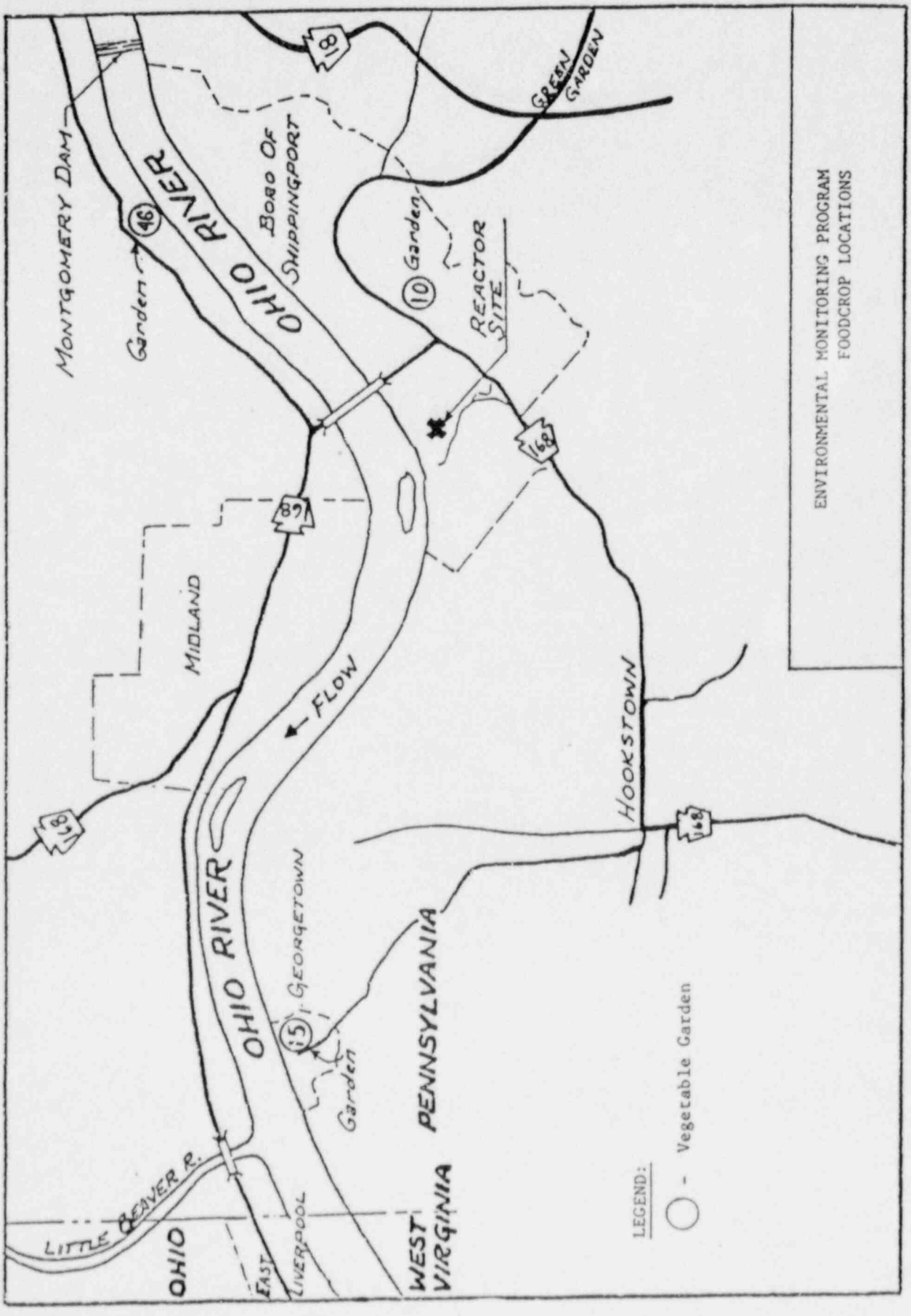

ENVIRONMENTAL MONITORING LOCATIONS – MILK
MILK
STA. NO. LOCATION
25 SEARIGHT
96 WINDSHIEMER
THREE (3) STATIONS BASED ON HIGHEST DEPOSITION FACTORS
N
LAWRENCE COUNTY
BEAVER COUNTY
OHIO
WEST VIRGINIA
PENNSYLVANIA
OHIO RIVER
REACTOR SITE
25
96
BEAVER COUNTY
WASHINGTON COUNTY
ALLEGHENY COUNTY
Airport
Weirton
Steubenville
Scale Of Miles

FIGURE 3.0-8


ENVIRONMENTAL MONITORING PROGRAM
FOODCROP LOCATIONS
LEGEND:
○ - Vegetable Garden
MONTGOMERY DAM
Garden (46)
OHIO RIVER
BORO OF SHIPPINGPORT
GREEN GARDEN
(18)
(10) Garden
REACTOR SITE
(168)
(89)
MIDLAND
FLOW
HOOKSTOWN
(168)
(168)
OHIO RIVER
(15) GEORGETOWN
Garden
PENNSYLVANIA
WEST VIRGINIA
LITTLE BEAVER R.
OHIO
EAST LIVERPOOL

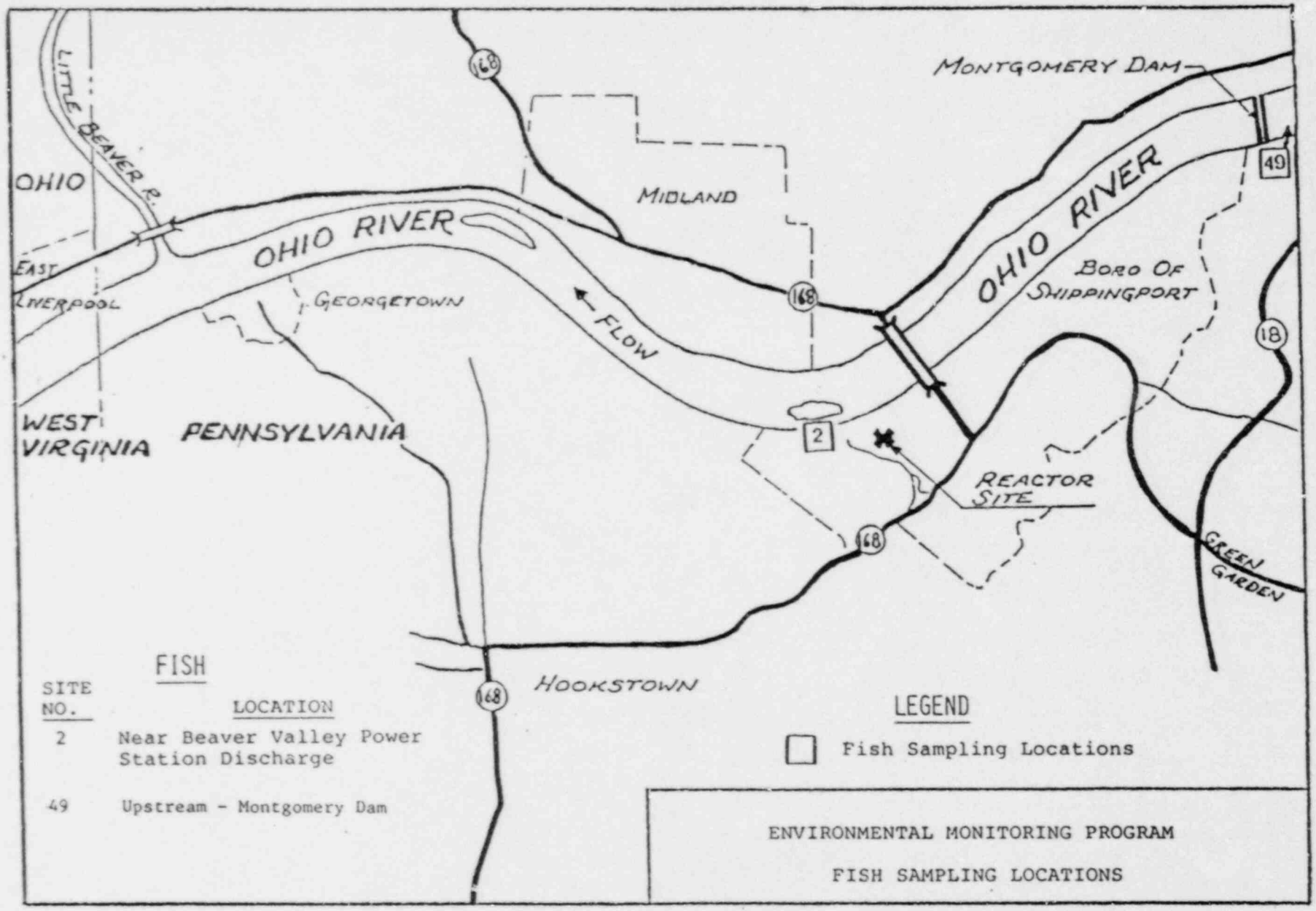

LITTLE BEAVER R.
OHIO
EAST LIVERPOOL
WEST VIRGINIA
PENNSYLVANIA
OHIO RIVER
GEORGETOWN
FLOW
MIDLAND
MONTGOMERY DAM
OHIO RIVER
BORO OF SHIPPINGPORT
REACTOR SITE
GREEN GARDEN
HOOKSTOWN
168
49
18
2
FISH
SITE NO.
LOCATION
2 Near Beaver Valley Power Station Discharge
49 Upstream - Montgomery Dam
LEGEND
Fish Sampling Locations
ENVIRONMENTAL MONITORING PROGRAM
FISH SAMPLING LOCATIONS

FIGURE 3.0-9

4.0 INFORMATION RELATED TO 40 CFR 190

Technical Specification 3.11.4.1.a requires that when the calculated doses associated with the effluent releases exceed twice the limits of Specifications 3.11.1.2.a, 3.11.1.2.b, 3.11.2.2.a, 3.11.2.2.b, 3.11.2.3.a, or 3.11.2.3.b, the licensee shall prepare and submit a Special Report to the Commission and limit subsequent releases such that the dose or dose commitment to member(s) of the public from all facility releases is limited to ≤ 25 mrem to the total body, any organ (except the thyroid, which is limited to ≤ 75 mrem) for a calendar year. The BVPS-1 Technical Specifications consider doses to members of the public due to the operation of BVPS-1 but do not include doses due to BVPS-2, any other part of the uranium fuel cycle, or direct shine from site reactors. If a Special Report to the Commission is prepared by the licensee as required by Specification 3.11.4.1.a, the evaluation should address:

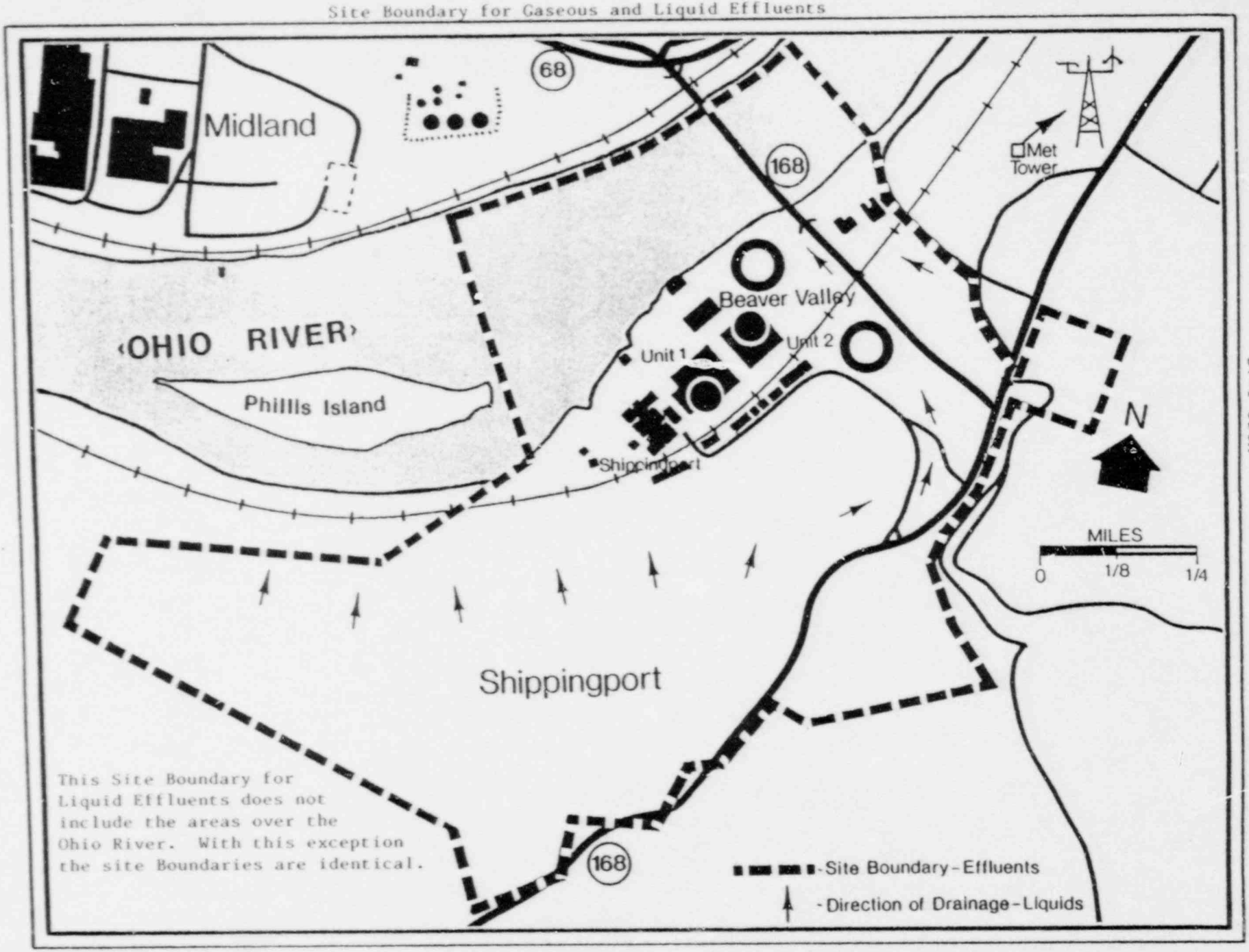
1) A determination of the maximum exposed member of the public.

2) A determination of the total dose to this person from all existing pathways and sources of radioactive effluents. Where additional information on pathways and nuclides is needed, the best available information will be used and documented.

3) A determination of the dose resulting from direct radiation from the site facilities.

Total body and organ doses resulting from liquid effluents from the BVPS SITE will be summed with the doses resulting from releases of noble gases, radiodines, particulates, and tritium (excluding C-14). These doses will be based upon releases from the BVPS SITE during the appropriate time period in which twice the unit specification was exceeded. Direct dose components due to skyshine will be determined either by calculation, using methodology specified in NUREG-0133, or by actual measurement. The dose from both releases and direct radiation will be summed.

Site Boundary for Gaseous and Liquid Effluents



APPENDIX A

SUMMARY OF DISPERSION CALCULATIONAL PROCEDURES

Annual average and grazing season average values of relative concentration (X/Q) and deposition (D/Q) were calculated for continuous and intermittent gaseous releases of activity from the site according to the straight-line airflow (Gaussian) model described in NRC Regulatory Guide 1.111, Revision 1. Undecayed and undepleted sector average X/Q and D/Q values were obtained for each of sixteen 22.5-degree sectors at the site boundary and maximum individual receptors. For an elevated release, defined as occurring at a height that is twice the height or more of a nearby structure, credit was taken for the effective release height which is comprised of the physical release height plus momentum plume rise minus the terrain height at a given receptor. A building wake correction factor was used to adjust calculations for ground-level releases. Airflow reversals were also accounted for by applying site-specific terrain recirculation factors for both ground and elevated releases at the site (Albersheim, 1978). The methodology employed in the calculation of intermittent release X/Q and D/Q values is that described in NUREG/CR-2919 (Sagendorf, et. al. 1982).

The site continuous gaseous release points that have been evaluated include the process vent attached to the BVPS-1 natural draft cooling tower, the Containment Vents, Ventilation Vents, Turbine Building Vents, the BVPS-2 Condensate Polishing Building Vent, Decontamination Building Vent, and Gaseous Waste Storage Tank Vault Vent. The intermittent releases are from the Process Vent, Containment Vents, and Ventilation Vents. Only the process vent was considered to be an elevated release with all other release points being treated as ground-level releases. A summary of the release characteristics and their locations is given in Table A-1.

Onsite meteorological data for the period January 1, 1976 through December 31, 1980, were used as input for the annual-average calculations. The grazing season was represented by a six-month period from May 1 through October 31 for each year of the 5-year meteorological data base. This grazing season corresponds reasonably well with the growing season. The data were collected according to guidance in NRC Regulatory Guide 1.23 as described in Section 2.3 of the BVPS-2 FSAR. The parameters used in the X/Q-D/Q calculations consist of wind speed, wind direction, and ΔT as an indicator of atmospheric stability. The lower level winds (35 ft) and ΔT (150-35 ft) were used for all release points except the process vent which required the use of 500-ft winds and ΔT (500-35 ft) which are representative of the release height (510 ft).

The annual-average and grazing season X/Q and D/Q values for the continuous and intermittent radioactive releases were calculated at the site boundary, nearest resident, nearest vegetable garden, nearest milk cow, nearest milk goat, and nearest meat animal. In the case of the process vent releases, several of each receptor type were evaluated in each downwind sector to determine the maximum X/Q-D/Q values. The distances of the limiting maximum individual receptors from the radioactive release points are given in Table 2.2-3. The continuous release annual average X/Q values at the special locations for the Containment Vents, Ventilation Vents, Process Vent, Turbine Building Vents, Decontamination Building Vent, Waste Gas Storage Vault Vent, and Condensate Polishing Building Vent, are given in Tables 2.2-4 through 2.2-10 respectively. Continuous release annual average X/Q's for these same release points are also given at ten incremental downwind distances. Continuous release D/Q values for these same release points are given in Tables 2.3-21 through 2.3-27 for the incremental distances and in Tables 2.3-28 through 2.3-34 for the special locations. Due to their location adjacent to the containment building, the BVPS-2 Decontamination Building and Gaseous Waste Storage Tank Vault X/Q's and D/Q's are the same as the containment vent X/Q's and D/Q's. Likewise, the Turbine Building Vent X/Q's and D/Q's apply to the BVPS-2 Condensate Polishing Building as well due to its location adjacent to the Turbine Building.

Tables A-2 through A-5 contain short term X/Q values for batch releases originating from the Containment Vent, Ventilation Vent, and Process Vent releases, respectively. The values in these tables are based on 32 hours per year of Containment and Ventilation Vent purges and 74 hours per year of Process Vent purges.

Albersheim, S. R., Development of Terrain Adjustment Factors for Use at the Beaver Valley Power Station for the Straight-Line Atmospheric Dispersion Model, NUS-2173, NUS Corporation, June 1978

Sagendorf, J. F., Goll, J. T. and Sandusky, W. F., XODQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations, NUREG/CR-2919, U. S. Nuclear Regulatory Comission, September, 1982.

TABLE A-1

BEAVER VALLEY SITE RELEASE CONDITIONS

	Ventilation Vent	Containment Vent	Process Vent	Turbine Building
Type Release	Ground Level (Long & Short-Term)	Ground Level (Long & Short-Term)	Elevated (Long & Short-Term)	Ground Level
Release Point Height (m)	26	47	155	33
Adjacent Building Height (m)	19	44	155	33
Relative Location to Adjacent Structures	E. Side of Primary Auxiliary Building	Top Center of Containment Dome	Atop Cooling Tower	Turbine Building
Exit Velocity (m/sec)	NA	NA	9.4	NA
Internal Stack Diameter (m)	NA	NA	0.25	NA
Building Cross-Sectional Area (m2)	1600	1600	NA	NA
Purge Frequency* (hours/year)	32	32	74	NA
Purge Duration (hrs/release)	8	8	NA	NA

*Applied to short-term calculations only

TABLE A-2

BEAVER VALLEY SITE CONTAINMENT VENTS DISPERSION PARAMETERS (X/q), sec/m3
FOR BATCH GROUND LEVEL RELEASES ≤ 500 hrs/yr or ≤ 150 hrs/qtr
FOR SPECIAL LOCATIONS (IDENTIFIED IN TABLE 2.2-3)

Sector*	Site Boundary	Vegetable Garden	Cow	Goat	Beef	Residents
N	8.21E-5	8.38E-6	-	3.72E-6	4.34E-6	8.82E-6
NNE	3.04E-5	4.71E-6	-	1.40E-6	4.38E-6	4.87E-6
NE	4.59E-5	2.21E-5	6.05E-7	1.38E-7	6.05E-7	2.28E-5
ENE	3.72E-5	5.25E-6	-	5.66E-7	-	1.88E-5
E	2.93E-5	3.79E-6	5.15E-7	1.17E-6	1.17E-6	1.78E-5
ESE	2.47E-5	5.61E-6	-	2.34E-6	5.61E-6	5.61E-6
SE	2.14E-5	5.00E-6	8.13E-7	8.13E-7	2.03E-6	5.00E-6
SSE	2.21E-5	6.31E-6	1.11E-6	3.92E-7	6.13E-6	8.49E-6
S	2.15E-5	3.03E-6	2.76E-6	-	4.93E-6	5.14E-6
SSW	2.18E-5	6.58E-6	3.81E-6	1.82E-6	6.58E-6	1.78E-5
SW	1.82E-5	1.03E-5	-	6.67E-6	9.12E-6	1.03E-5
WSW	1.09E-4	1.29E-5	4.10E-6	-	1.19E-5	1.29E-5
W	1.49E-4	1.05E-5	6.55E-6	-	8.77E-6	1.05E-5
WNW	1.91E-4	1.72E-5	1.28E-5	1.23E-6	1.72E-5	1.72E-5
NW	3.08E-4	6.13E-5	-	3.80E-6	1.36E-5	6.36E-5
NNW	1.80E-4	3.54E-5	-	1.35E-6	9.27E-6	5.29E-5

*Measured relevant to center point between Unit 1 and Unit 2 Containment Buildings
Period of Record: 1976 - 1980

TABLE A-3

BEAVER VALLEY SITE VENTILATION VENT DISPERSION PARAMETERS (X/q), sec/m3
FOR BATCH GROUND LEVEL RELEASES ≤ 500 hrs/yr or ≤ 150 hrs/qtr
FOR SPECIAL DISTANCES (IDENTIFIED IN TABLE 2.2-3)

Sector*	Site Boundary	Vegetable Garden	Cow	Goat	Beef	Residents
N	9.75E-5	1.00E-5	-	4.21E-6	4.95E-6	1.06E-5
NNE	3.78E-5	5.11E-6	-	1.43E-6	4.72E-6	5.30E-6
NE	6.13E-5	2.70E-5	6.20E-7	1.40E-7	6.20E-7	2.81E-5
ENE	4.83E-5	5.58E-6	-	5.71E-7	-	2.24E-5
E	3.66E-5	3.99E-6	5.25E-7	1.19E-6	1.19E-6	2.10E-5
ESE	2.99E-5	6.13E-6	-	2.43E-6	6.13E-6	6.13E-6
SE	2.55E-5	5.29E-6	8.24E-7	8.24E-7	2.13E-6	5.29E-6
SSE	2.65E-5	6.72E-6	1.12E-6	3.95E-7	6.53E-6	9.22E-6
S	2.52E-5	3.14E-6	2.83E-6	-	5.29E-6	5.53E-6
SSW	2.60E-5	7.34E-6	4.15E-6	1.92E-6	7.34E-6	2.09E-5
SW	2.13E-5	1.18E-5	-	7.41E-6	1.04E-5	1.18E-5
WSW	1.34E-4	1.51E-5	4.46E-6	-	1.38E-5	1.51E-5
W	1.77E-4	1.25E-5	7.40E-6	-	1.02E-5	1.25E-5
WNW	2.33E-4	2.07E-5	1.49E-5	1.30E-6	2.07E-5	2.07E-5
NW	3.32E-4	8.57E-5	-	4.24E-6	1.64E-5	8.85E-5
NNW	1.90E-4	4.69E-5	-	1.45E-6	1.09E-5	6.75E-5

*Measured relevant to center point between Unit 1 and Unit 2 Containment Buildings
Period of Record: 1976 - 1980

TABLE A-4

BEAVER VALLEY SITE PROCESS VENT DISPERSION PARAMETERS (X/Q), SEC/m3,
FOR BATCH ELEVATED RELEASES ≤ 500 hrs/yr or ≤ 150 hrs/qtr
FOR SPECIAL DISTANCES (IDENTIFIED IN TABLE 2.2-3)

Sector*	Site Boundary	Vegetable Garden	Cow	Goat	Beef	Residents
N	3.09E-9	3.30E-6	-	1.13E-6	1.34E-6	3.36E-6
NNE	2.85E-9	2.68E-6	-	6.52E-7	2.47E-6	2.68E-6
NE	2.02E-10	7.42E-9	5.44E-7	1.24E-7	5.44E-7	5.51E-9
ENE	1.02E-9	3.21E-6	-	6.29E-7	-	1.67E-9
E	2.15E-9	2.91E-6	4.96E-7	1.14E-6	1.14E-6	2.91E-6
ESE	6.90E-9	4.97E-6	-	1.95E-6	4.97E-6	4.81E-6
SE	2.91E-6	3.52E-6	6.02E-7	6.02E-7	1.43E-6	3.52E-6
SSE	4.91E-6	3.56E-6	6.53E-7	2.18E-7	3.47E-6	4.71E-6
S	2.41E-6	1.78E-6	1.65E-6	-	2.84E-6	2.96E-6
SSW	4.83E-6	2.52E-6	1.50E-6	6.60E-7	2.52E-6	3.96E-6
SW	4.82E-6	2.75E-6	-	1.78E-6	2.44E-6	2.75E-6
WSW	5.77E-7	2.81E-6	8.79E-7	-	2.57E-6	2.81E-6
W	2.88E-9	1.68E-6	4.89E-7	-	1.37E-6	1.68E-6
WNW	3.40E-9	1.61E-6	1.13E-6	1.10E-7	1.61E-6	1.61E-6
NW	1.34E-9	3.31E-8	-	2.03E-7	1.07E-6	3.10E-8
NNW	1.52E-9	3.73E-6	-	1.73E-7	1.31E-6	3.81E-6

*Measured reative to Unit 1 natural draft cooling tower.
Period of Record: 1976 - 1980

TABLE A-5

BEAVER VALLEY SITE PROCESS VENT DISPERSION PARAMETERS (X/Q), SEC/m3,
FOR BATCH ELEVATED RELEASES ≤ 500 hrs/yr or ≤ 150 hrs/qtr*

Distances to the Control Locations, in Miles

Sector	0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N	2.75E-15	1.07E-5	4.10E-6	2.61E-6	1.51E-6	1.13E-6	8.84E-7	7.13E-7	5.93E-7	5.06E-7
NNE	5.90E-17	5.39E-6	2.83E-6	2.19E-6	1.36E-6	1.13E-6	8.05E-7	6.51E-7	5.64E-7	4.81E-7
NE	4.45E-16	1.67E-8	7.39E-8	2.28E-6	1.72E-6	1.19E-6	9.28E-7	6.76E-7	..34E-7	5.32E-7
ENE	1.92E-15	8.87E-8	2.60E-6	2.21E-6	1.66E-6	1.13E-6	9.25E-7	7.23E-7	6.06E-7	3.82E-7
E	1.84E-15	5.10E-6	2.77E-6	2.23E-6	1.44E-6	1.12E-6	8.74E-7	6.92E-7	5.11E-7	4.82E-7
ESE	2.96E-13	5.26E-6	3.48E-6	2.04E-6	1.34E-6	9.93E-7	6.70E-7	5.76E-7	4.37E-7	3.83E-7
SE	9.16E-8	3.13E-6	3.38E-6	1.99E-6	1.31E-6	9.58E-7	7.14E-7	5.74E-7	4.32E-7	3.68E-7
SSE	3.50E-8	4.86E-6	3.33E-6	1.95E-6	1.29E-6	9.42E-7	6.55E-7	5.24E-7	3.95E-7	3.32E-7
S	1.22E-7	4.12E-6	3.97E-6	2.34E-6	1.59E-6	1.17E-6	7.75E-7	6.24E-7	4.74E-7	4.00E-7
SSW	1.75E-5	6.22E-6	2.84E-6	2.18E-6	1.48E-6	1.08E-6	7.83E-7	6.31E-7	5.62E-7	4.77E-7
SW	2.08E-5	9.11E-6	3.47E-6	2.19E-6	1.25E-6	1.11E-6	8.19E-7	7.17E-7	6.89E-7	5.85E-7
WSW	8.56E-8	9.35E-6	3.16E-6	2.29E-6	1.46E-6	1.01E-6	9.06E-7	7.52E-7	5.99E-7	5.07E-7
W	5.44E-17	4.52E-6	4.21E-6	2.49E-6	1.69E-6	1.25E-6	4.86E-7	7.68E-7	5.80E-7	5.48E-7
WNW	9.25E-18	1.44E-8	5.66E-8	1.92E-6	1.59E-6	1.17E-6	7.75E-7	4.61E-7	5.28E-7	4.89E-7
NW	2.61E-16	1.98E-8	8.37E-8	2.24E-6	1.46E-6	1.08E-6	8.09E-7	6.12E-7	5.42E-7	4.60E-7
NNW	1.91E-15	3.91E-6	3.66E-6	2.15E-6	1.40E-6	1.08E-6	8.03E-7	6.08E-7	5.37E-7	4.56E-7

*Transmittal via Stone and Webster Engineering Corp letter 2DLS-29981 under J.O. 12241 on January 30, 1987

APPENDIX B

INPUTS TO GALE CODE FOR GENERATION OF LIQUID SOURCE TERM MIX

INPUTS TO SWEC GAS1BB FOR GENERATION OF GASEOUS SOURCE TERM MIXES

APPENDIX B

INPUTS TO GALE CODE FOR GENERATION OF LIQUID SOURCE TERM MIX

BEAVER VALLEY UNIT 1	PWR
Thermal power level (megawatts)	2766.000
Plant capacity factor	.800
Mass of primary coolant (thousand lbs)	345.000
Percent fuel with cladding defects	.120
Primary system letdown rate (gpm)	60.000
Letdown cation demineralizer flow	6.000
Number of steam generators	3.000
Total steam flow (million lbs/hr)	11.620
Mass of steam in each steam generator (thousand lbs)	6.772
Mass of liquid in each steam generator (thousand lbs)	97.000
Total mass of secondary coolant (thousand lbs)	1296.000
Mass of water in steam generator (thousand lbs)	291.000
Blowdown rate (thousand lbs/hr)	33.900
Primary to secondary leak rate (lbs/day)	100.000
Fission product carry-over fraction	.001
Halogen carry-over fraction	.010
Condensate demineralizer flow fracton	0.000
Radwaste dilution flow (thousand gpm)	22.500

LIQUID WASTE INPUTS

Stream	Flow Rate (gal/day)	Fraction of PCA	Fraction Discharge	Collection Time (Days)	Delay Time (Days)	Decontamination Factors		
						I	Cs,	Others
Shim Bleed Rate	1.32E4	1.000	0.000	11.260	7.220	1.00E7	1.00E7	1.00E7
Equipment Drains	6.00E2	1.000	0.000	11.260	7.220	1.00E7	1.00E7	1.00E7
Clean Waste Input	7.50E1	1.000	1.000	0.071	0.648	1.00E5	2.00E4	1.00E5
Dirty Waste Input	1.35E3	0.035	1.000	0.071	0.648	1.00E5	2.00E4	1.00E5
Blowdown	9.75E4		1.000	0.071	0.648	1.00E5	2.00E4	1.00E5
Untreated Blowdown	0.0							

APPENDIX B

INPUTS TO SWEC CODE GAS1BB FOR GENERATION OF GASEOUS SOURCE TERM MIXES

BEAVER VALLEY UNIT 1	PWR
Thermal power level (megawatts)	2766.000
Plant capacity factor	.800
Mass of primary coolant (thousand lbs)	385.000
Percent fuel with cladding defects	.120
Primary system letdown rate (gpm)	57.000
Letdown cation demineralizer flow	5.700
Number of steam generators	3.000
Total steam flow (million lbs/hr)	11.600
Mass of steam in each steam generator (thousand lbs)	8.700
Mass of liquid in each steam generator (thousand lbs)	100.000
Total mass of secondary coolant (thousand lbs)	2000.000
Mass of water in steam generator (thousand lbs)	298.000
Blowdown rate (thousand lbs/hr)	52.000
Primary to secondary leak rate (lbs/day)	100.000
Fission product carry-over fraction	.001
Halogen carry-over fraction	.010
Condensate demineralizer flow fracton	0.000
Radwaste dilution flow (thousand gpm)	15.000

GASEOUS WASTE INPUTS

There is not continuous stripping of full letdown flow	
Hold up time for xenon (days)	39.000
Hold up time for krypton (days)	2.000
Primary coolant leak to auxiliary building (lb/day)	160.000
Auxiliary building leak iodine partition factor	7.5E-3
Gas waste system particulate release fraction	0.000
Auxiliary building charcoiodine release fraction	0.100
particulate release fraction	0.010
Containment volume (million cu-ft)	1.800
Frequency of primary coolant degassing (times/yr)	2.000
Primary to secondary leak rate (lb/day)	100.000
There is a kidney filter	
Containment atmosphrere cleanup rate (thousand cfm)	2.000
Purge time of containment (hours)	8.000
There is not a condensate demineralizer	
Iodine partition factor (gas/liq) in steam generator	0.010
Frequency of containment building high vol purge (times/year)*	4.000
Containment volume purge iodine release fraction	1.000
particulate release fraction	1.000
Steam leak to turbine building (lbs/hr)	1700.000
Fraction iodine released from blowdown tank vent	0.000
Fraction iodine released from main condensate air ejector	0.440
There is not a cryogenic off gas system	

*2 cold and 2 hot purges