

ADMENDMENT NO. 6
November 1988

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WNP-2
OFFSITE DOSE CALCULATION MANUAL
(ODCM)

The following instructional information and checklist is furnished to help you insert Amendment No. 6 into the Washington Public Power Supply System Plant No. 2 ODCM.

Discard the old sheets and insert the new sheets as listed below. Keep these instructions to serve as a record of changes.

If you have questions concerning insertion of this amendment, or if you are missing any pages, please contact Bernice Kasko/Linda Wilson (509) 377-2369.

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2.0 LIQUID EFFLUENT DOSE CALCULATION

2.1 Introduction

Liquid radwaste released from WNP-2 will meet 10 CFR 20 limits at the point of discharge to the Columbia River. This design objective will be kept at all times. Actual discharges of liquid radwaste effluents will only occur on a Batch Basis, and the average concentration at the point of discharge will be only a small percentage of the allowed limits. A simplified block diagram of the liquid waste management system and effluent pathways is contained in Figure 2-1. Solid radioactive wastes are disposed of by way of an approved disposal site. A simplified block diagram of the solid radwaste system is described in Figure 2-2.

The cumulative quarterly dose contributions due to radioactive liquid effluents released to the unrestricted areas will be determined once every 31 days using the LADTAP II computer code. The maximum exposed individual is assumed to be an adult whose exposure pathways include potable water and fish consumption. The choice of an adult as the maximum exposed individual is based on the highest fish and water consumption rates shown by that age group and the fact that most of the dose from the liquid effluent comes from these two pathways.

The dose contributions will be calculated for all radionuclides identified in the released effluent. The calculations are based on guidelines provided by Nureg-0133 and the LADTAP II computer code.

The methods for calculating the doses are discussed in Section 2.4 of this manual.

2.2 Radwaste Liquid Effluent Radiation Monitoring System

This monitoring subsystem measures the radioactivity in the liquid effluent prior to its entering the cooling tower blowdown line.

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unrestricted area would be calculated according to Equation (3) and Equation (4). To show compliance with 10 CFR 20, the two equations must again hold.

2.4 10 CFR 50, Appendix I, Release Rate Limits

Technical Specification 4.11.1.2 requires that the cumulative dose contributions be determined in accordance with the ODCM at least once per 31 days. Technical Specification 3.11.1.2 specifies that the dose to a member of the public from radioactive material in liquid effluents released to the unrestricted area shall be limited to:

≤ 1.5 mrem/Calendar Quarter - Total Body
and
 ≤ 5.0 mrem/Calendar Quarter - Any Organ.

The cumulative dose for the calendar year shall be limited to:

≤ 3 mrem - Total Body
and
 ≤ 10 mrem - Any Organ.

The dose contribution will be calculated for all radionuclides identified in the liquid effluent released to the unrestricted area, using the following equation:

$$D_{\tau} = \sum_i (A_{i\tau} \sum_{\ell=1}^m \Delta t_{\ell} C_{i\ell} F_{\ell}) \quad (5)$$

where:

D_{τ} = The cumulative dose commitment to the total body or organ, τ , from liquid effluents for the total time period $\sum_{\ell=1}^m \Delta t_{\ell}$, in mrem.
 $\ell = 1$

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- Δt_l = The length of the l th time period over which C_{il} and F_l are averaged for all liquid releases, in hours.
- m = The number of releases for the time period under consideration.
- C_{il} = The average concentration of radionuclide, i , in undiluted liquid effluent during time period Δt_l from any liquid release, in $\mu\text{Ci/ml}$.
- $A_{i\tau}$ = The site-related ingestion dose commitment factor to the total body or any organ τ for each identified principle gamma and beta emitter listed in Table 2-2, in $\text{mrem/hr per } \mu\text{Ci/ml}$.
- F_l = The near field average dilution factor for C_{il} during any liquid waste 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 500.

$$(F_l = \frac{\text{Liquid Radioactive Waste Flow}}{\text{Discharge Structure Exit Flow} \times 500} = \frac{f_w}{f_t \times 500} \quad (6)$$

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The term A_{ij} , the ingestion dose factors for the total body and critical organs, are tabulated in Table 2-2. It embodies the dose factor, fish bioaccumulation factor, pathway usage factor, and the dilution factor for the plant diffuser pipe to the Richland potable water intake. The following equation was used to calculate the ingestion dose factors:

$$A_{ij} = K_o \left(\frac{U_w}{D_w} + U_F B_{Fi} \right) D_{Fi} \quad (7)$$

where:

A_{ij} = The composite dose parameter for total body or critical organ of an adult for nuclide i (in mrem/hr per $\mu\text{Ci/ml}$).

K_o = A conversion factor:
 $1.14\text{E}+05 = (10^6 \text{ pCi}/\mu\text{Ci}) \times (10^3 \text{ ml/liter}) \div 8760 \text{ hr/yr.}$

U_w = 730 liter/yr - which is the annual water consumption by the maximum adult (Table E-4 of Regulatory Guide 1.109, Revision 1).

B_{Fi} = Bioaccumulation factor for radionuclide i in fish - ($\text{pCi/Kg per pCi/liter}$) (Table A-1 of Regulatory Guide 1.109, Revision 1 and NUREG/CR-4013).

D_{Fi} = Adult ingestion dose conversion factor for nuclide i - Total body or critical organ - (mrem/pCi) (Table E-11 of Regulatory Guide 1.109, Revision 1 and NUREG/CR-4013).

D_w = Dilution factor from near field area to the Richland potable water intake - 100.

U_F = Adult fish consumption, 21 kg/yr (Table E-5 of Regulatory Guide 1.109, Revision 1).

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d_i	The deposition rate of nuclide i , in pCi/m^2 per hour.
F	The flow rate of the liquid effluent, in ft^3/sec .
f_I	The fraction of the year crops are irrigated, dimensionless.
F_{iA}	The stable element transfer coefficient that relates the daily intake rate by an animal to the concentration in an edible portion of animal product, in pCi/liter (milk) per pCi/day or pCi/kg (animal product) per pCi/day .
M_p	The mixing ratio (reciprocal of the dilution factor) at the point of exposure (or the point of withdrawal of drinking water or point of harvest of aquatic food), dimensionless.
P	The effective "surface density" for soil, in kg (dry soil)/ m^2 (Table E-15, Regulatory Guide 1.109, Revision 1).
Q_{Aw}	The consumption rate of contaminated water by an animal, in liters/day .
Q_F	The consumption rate of contaminated feed or forage by an animal, in kg/day (wet weight).
Q_i	The release rate of nuclide i , in Ci/yr .
r	The fraction of deposited activity retained on crops, dimensionless (Table E-15, Regulatory Guide 1.109, Revision 1).

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W	The shoreline width factor, dimensionless (Table A-2, Regulatory Guide 1.109, Revision 1).
Y_v	The agricultural productivity (yield), in kg (wet weight) /m ² (Table E-15, Regulatory Guide 1.109, Revision 1).
λ_{Ei}	The effective removal rate constant for radionuclide i from crops, in hr ⁻¹ , where $\lambda_{Ei} = \lambda_i + \lambda_w$, λ_i is the radioactive decay constant, and λ_w is the removal rate constant for physical loss by weathering (Regulatory Guide 1.109, Revision 1, Table B-15).
λ_i	The radioactive decay constant of nuclide i, in hr ⁻¹ .
1100	The factor to convert from (Ci/yr)/(ft ³ /sec) to pCi/liter.
110,000	The factor to convert from (Ci/yr)/(ft ³ /sec) to pCi/liter and to account for the proportionality constant used in the sediment radioactivity model.

These equations yield the dose rates to various organs of individuals from the exposure pathways mentioned above.

2.7.2 Plant Parameters

WNP-2 is a river shoreline site with a variable effluent discharge flow rate 0 to 7500 gpm. The population center nearest WNP-2 is the city of Richland, where drinking water withdrawal takes place. The applicable dilution factor is 50,000, using average river flow. The time required for released liquids

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leased liquids to reach Richland, approximately 12 miles downstream, is estimated at 4.0 hours. Richland is the "realistic case" location, and doses calculated for the Richland location are typically applicable to the population as a whole. Individual and population doses based on Richland parameters are calculated for all exposure pathways.

Only the population downstream of the WNP-2 site is affected by the liquid effluents released. There is no significant commercial fish harvest in the 50-mile radius region around WNP-2. Sportfish harvest is estimated at 14,000 kg/year.

For irrigated foods exposure pathways, it can be assumed that production within the 50-mile radius region around WNP-2 is sufficient to satisfy consumption requirements.

Other relevant parameters relating to the irrigated foods pathways are defined as follows:

<u>Food Type</u>	<u>Irrigation Rate</u> (liter/m ² /mo)	<u>Annual Yield</u> (kg/m ²)	<u>Growing Period</u> (Days)
Vegetation	150	5.0	70
Leafy Vegetation	200	1.5	70
Feed for Milk Cows	200	1.3	30
Feed for Beef Cattle	160	2.0	130

Source terms are measured based on sampled effluent.

Table 2-3 summarizes the LADTAP II input parameters. Documentation and/or calculations of these parameters are discussed in detail in R.P.I. 2.3, and Rad. Prog. calculation Log 88-3.

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Table 2-1

FISH BIOACCUMULATION FACTORS (BF_i)⁽¹⁾
AND ADULT INGESTION DOSE CONVERSION FACTORS (DF_i)⁽²⁾

Nuclide	Fish Bioaccumulation Factor (BF _i) (pCi/kg per pCi/liter)	Dose Conversion Factor (DF _i)				
		Total Body	Bone	Thyroid	Liver	GI Tract
			(mRem per pCi Ingested)			
H-3	9.0E-01	6.0E-08	____(3)	6.0E-08	6.0E-08	6.0E-08
Na-24	1.0E+02	1.7E-06	1.7E-06	1.7E-06	1.7E-06	1.7E-06
P-32	1.0E+05	7.5E-06	1.9E-04	____(3)	1.2E-05	2.2E-05
Cr-51	2.0E+02	2.7E-09	____(3)	1.6E-09	____(3)	6.7E-07
Mn-54	4.0E+02	8.7E-07	____(3)	____(3)	4.6E-06	1.4E-05
Mn-56	4.0E+02	2.0E-08	____(3)	____(3)	1.2E-07	3.7E-06
Fe-55	1.0E+02	4.4E-07	2.8E-06	____(3)	1.9E-06	1.1E-06
Fe-59	1.0E+02	3.9E-06	4.3E-06	____(3)	1.0E-05	3.4E-05
Co-58	5.0E+01	1.7E-06	____(3)	____(3)	7.5E-07	1.5E-05
Co-60	5.0E+01	4.7E-06	____(3)	____(3)	2.1E-06	4.0E-05
Ni-65	1.0E+02	3.1E-08	5.3E-07	____(3)	6.9E-08	1.7E-06
Cu-64	5.0E+01	3.9E-08	____(3)	____(3)	8.3E-08	7.1E-06
Zn-65	2.0E+03	7.0E-06	4.8E-06	____(3)	1.5E-05	9.7E-06
Zn-69m	2.0E+03	3.7E-08	1.7E-07	____(3)	4.1E-07	2.5E-05
As-76	1.0E+02	4.8E-06	____(3)	____(3)	____(3)	4.4E-05
Br-82	4.2E+02	2.3E-06	____(3)	____(3)	____(3)	2.6E-06
Br-83	4.2E+02	4.0E-08	____(3)	____(3)	____(3)	5.8E-08
Br-84	4.2E+02	5.2E-08	____(3)	____(3)	____(3)	4.1E-13
Rb-89	2.0E+03	2.8E-08	____(3)	____(3)	4.0E-08	2.3E-21
Sr-89	3.0E+01	8.8E-06	3.1E-04	____(3)	____(3)	4.9E-05
Sr-90	3.0E+01	1.8E-04	8.7E-03	____(3)	____(3)	2.2E-04

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Table 2-1 (contd.)

Nuclide	Fish Bioaccumulation Factor (BF _f) (pCi/kg per pCi/liter)	Dose Conversion Factor (DF _i)				
		Total Body	Bone	Thyroid	Liver	GI Tract
Sr-91	3.0E+01	2.3E-07	5.7E-06	____(3)	____(3)	2.7E-05
Sr-92	3.0E+01	9.3E-08	2.2E-06	____(3)	____(3)	4.3E-05
Y-90	2.5E+01	2.6E-10	9.7E-09	____(3)	____(3)	1.0E-04
Y-91m	2.5E+01	3.5E-12	9.1E-11	____(3)	____(3)	2.7E-10
Y-91.	2.5E+01	3.8E-09	1.4E-07	____(3)	____(3)	7.8E-05
Y-92	2.5E+01	2.5E-11	8.5E-10	____(3)	____(3)	1.5E-05
Y-93	2.5E+01	7.4E-11	2.7E-09	____(3)	____(3)	8.5E-05
Zr-95	3.3E+00	6.6E-09	3.1E-08	____(3)	9.8E-09	3.1E-05
Nb-95	3.0E+04	1.9E-09	6.2E-09	____(3)	3.5E-09	2.1E-05
Zr-97	3.3E+00	1.6E-10	1.7E-09	____(3)	3.4E-10	1.1E-04
Nb-97	3.0E+04	4.8E-12	5.2E-11	____(3)	1.3E-11	4.9E-08
Mo-99	1.0E+01	8.2E-07	____(3)	____(3)	4.3E-06	1.0E-05
Tc-99m	1.5E+01	8.9E-09	2.5E-10	____(3)	7.0E-10	4.1E-07
Tc-101	1.5E+01	3.6E-09	2.5E-10	____(3)	3.7E-10	1.1E-21
Ru-103	1.0E+01	8.0E-08	1.9E-07	____(3)	____(3)	2.2E-05
Ru-105	1.0E+01	6.1E-09	1.5E-08	____(3)	____(3)	9.4E-06
Rh-105	1.0E+01	5.8E-08	1.2E-07	____(3)	8.9E-08	1.4E-05
Ru-106	1.0E+01	3.5E-07	2.8E-06	____(3)	____(3)	1.8E-04
Ag-110m	2.3E+00	8.8E-08	1.6E-07	____(3)	1.5E-07	6.0E-05
Sb-124	1.0E+00	1.1E-06	2.8E-06	6.8E-09	5.3E-08	8.0E-05
Sb-125	1.0E+00	4.3E-07	1.8E-06	1.8E-09	2.0E-08	2.0E-05
Sb-126	1.0E+00	4.2E-07	1.2E-06	7.0E-09	2.3E-08	9.4E-05
Sb-127	1.0E+00	9.9E-08	2.6E-07	3.1E-09	5.7E-09	5.9E-05
Te-127	4.0E+02	2.4E-08	1.1E-07	8.2E-08	4.0E-08	8.7E-06
Te-129m	4.0E+02	1.8E-06	1.2E-05	4.0E-06	4.3E-06	5.8E-05
Te-129	4.0E+02	7.7E-09	3.1E-08	2.4E-08	1.2E-08	2.4E-08

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Table 2-2

INGESTION DOSE FACTORS (A_{ij}) FOR TOTAL BODY AND CRITICAL ORGAN
(in mrem/hr per Ci/ml)

Liquid Effluent

Nuclide	Total Body	Bone	Thyroid	Liver	Gi Tract
H-3	1.8E-01	**	1.8E-01	1.8E-01	1.8E-01
Na-24	4.1E+02	4.1E+02	4.1E+02	4.1E+02	4.1E+02
P-32	1.8E+06	4.6E+07	**	2.9E+06	5.3E+06
Cr-51	1.3E+00	**	7.7E-01	**	3.2E+02
Mn-54	8.3E+02	**	**	4.4E+03	1.3E+04
Mn-56	1.9E+01	**	**	1.6E+02	3.6E+03
Fe-55	1.1E+02	6.7E+02	**	4.6E+02	2.6E+02
Fe-59	9.4E+02	1.0E+03	**	2.4E+03	8.2E+03
Co-58	2.1E+02	**	**	9.0E+01	1.8E+03
Co-60	5.7E+02	**	**	2.5E+02	4.8E+03
Ni-65	7.5E+00	1.3E+02	**	1.7E+01	4.1E+02
Cu-64	4.7E+00	**	**	1.0E+01	8.6E+02
Zn-65	3.4E+04	2.3E+04	**	7.2E+04	4.7E+04
Zn-69m	1.8E+02	8.1E+02	**	2.0E+03	1.2E+05
As-76	1.2E+03	**	**	**	1.1E+04
Br-82	2.3E+03	**	**	**	2.6E+03
Br-83	4.0E+01	**	**	**	5.8E+01
Br-84	5.2E+01	**	**	**	4.1E-04
Rb-89	1.3E+02	**	**	1.9E+02	1.1E-11
Sr-89	6.4E+02	2.3E+04	**	**	3.6E+03
Sr-90	1.3E+04	6.3E+05	**	**	1.6E+04
Sr-91	1.7E+01	4.1E+02	**	**	2.0E+03
Sr-92	6.8E+00	1.6E+02	**	**	3.1E+03

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Table 2-2 (contd.)

<u>Nuclide</u>	<u>Total Body</u>	<u>Bone</u>	<u>Thyroid</u>	<u>Liver</u>	<u>Gi Tract</u>
Y-90	1.6E-02	5.9E-01	**	**	6.1E+03
Y-91m	2.1E-04	5.5E-03	**	**	1.6E-02
Y-91	2.3E-01	8.5E+00	**	**	4.7E+03
Y-92	1.5E-03	5.2E-02	**	**	9.1E+02
Y-93	4.5E-03	1.6E-01	**	**	5.2E+03
Zr-95	5.3E-02	2.5E-01	**	7.9E-02	2.5E+02
Nb-95	1.4E+02	4.5E+02	**	2.5E+02	1.5E+06
Zr-97	1.3E-03	1.4E-02	**	2.7E-03	8.8E+02
Nb-97	3.5E-01	3.7E+00	**	9.3E-01	3.5E+03
Mo-99	2.0E+01	**	**	1.1E+02	2.5E+02
Tc-99m	3.3E-01	9.2E-03	**	2.6E-02	1.5E+01
Tc-101	1.3E-01	9.2E-03	**	1.4E-02	4.0E-14
Ru-103	2.0E+00	4.7E+00	**	**	5.5E+02
Ru-105	1.5E-01	3.7E-01	**	**	2.3E+02
Rh-105	1.4E+00	3.0E+00	**	2.2E+00	3.5E+02
Ru-106	8.7E+00	6.9E+01	**	**	4.5E+03
Ag-110m	5.6E-01	1.0E-00	**	9.5E-01	3.8E+02
Sb-124	3.6E+00	9.0E+00	2.2E-02	1.7E-01	2.6E+02
Sb-125	1.4E+00	5.8E+00	5.8E-03	6.5E-02	6.5E+01
Sb-126	1.4E+00	3.9E+00	2.3E-02	7.4E-02	3.0E+02
Sb-127	3.2E-01	8.4E-01	1.0E-02	1.8E-02	1.9E+02
Te-127	2.3E+01	1.1E+02	7.9E+01	3.8E+01	8.3E+03
Te-129m	1.7E+03	1.2E+04	3.8E+03	4.1E+03	5.6E+04
Te-129	7.4E+00	3.0E+01	2.3E+01	1.2E+01	2.3E+01
Te-131m	6.8E+02	1.6E+03	1.3E+03	8.2E+02	8.1E+04
Te-131	5.9E+00	1.9E+01	1.5E+01	7.9E+00	2.7E+00
Te-132	1.4E+03	2.4E+03	1.7E+03	1.5E+03	7.4E-04
I-131	1.3E+02	1.5E+02	7.4E+04	2.2E+02	5.9E+01
I-132	7.0E+00	7.4E+00	7.0E+02	2.0E+01	3.7E+00
I-133	2.8E+01	5.1E+01	1.3E+04	9.2E+01	8.1E+01
I-134	3.7E+00	4.0E+00	1.8E+02	1.1E+01	9.2E-03
I-135	1.6E+01	1.6E+01	2.8E+03	4.4E+01	4.8E+01

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Table 2-2 (contd.)

<u>Nuclide</u>	<u>Total Body</u>	<u>Bone</u>	<u>Thyroid</u>	<u>Liver</u>	<u>Gi Tract</u>
Cs-134	5.8E+05	3.0E+05	**	7.2E+05	1.3E+04
Cs-136	9.1E+04	3.1E+04	**	1.3E+05	1.4E+04
Cs-137	3.4E+05	3.8E+05	**	5.3E+05	1.0E+04
Cs-138	2.6E+02	2.6E+02	**	5.3E+02	2.3E-03
Ba-139	2.9E-02	1.0E-00	**	7.2E-04	1.8E+00
Ba-140	1.4E+01	2.1E+02	**	2.7E-01	4.4E+02
La-140	2.0E-02	1.5E-01	**	7.9E-02	5.6E+03
La-141	9.7E-04	1.9E-02	**	6.0E-03	7.3E+02
La-142	9.1E-04	7.9E-03	**	3.5E-03	2.6E+01
Ce-141	2.3E-03	3.0E-02	**	2.0E-02	7.7E+01
Ce-143	4.5E-04	5.5E-03	**	3.9E+00	1.5E+02
Ce-144	8.4E-02	1.6E+00	**	6.5E-01	5.5E+02
Pr-143	2.8E-02	5.6E-01	**	2.3E-01	2.4E+03
Nd-147	2.7E-02	3.8E-01	**	4.4E-01	2.1E+03
Hf-179m	4.2E+01	**	**	**	3.6E+02
Hf-181	3.8E+01	**	**	**	3.6E+02
W-185	4.0E+01	1.2E+03	**	4.0E+02	4.6E+04
W-187	8.6E+01	2.9E+02	**	2.5E+02	8.1E+04
Np-239	1.6E-03	3.0E-02	**	3.0E-03	6.0E+02

**No Ingestion Dose Factor (DF_i) is listed in NUREG/CR-4013. (Total body dose factor value will be used as an approximation.)

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TABLE 2-3
INPUT PARAMETERS USED TO CALCULATE MAXIMUM INDIVIDUAL DOSE
FROM LIQUID EFFLUENTS

Drinking Water

River Dilution:	50,000	
River Transit Time:	4 hours	
Usage Factors:	Adult = 730 1/yr	Teenager = 510 1/yr
	Child = 510 1/yr	Infant = 330 1/yr

Boating and Aquatic Food

River Dilution:	2,000	
Transit Time:	2 hours	
Usage Factors: (Aquatic Food)	Adult = 21 kg/yr	Teenager = 16 kg/yr
	Child = 6.9 kg/yr	Infant = 0
(Boating)	Adult = 100 hr/yr	Teenager = 100 hr/yr
	Child = 85 hr/yr	Infant = 0

Recreation

River Dilution:	20,000	
Shoreline Width Factor:	0.2	
Usage Factors:	Shoreline Activities:	Adult = 90 hr/yr
		Teenager = 500 hr/yr
		Child = 105 hr/yr
		Infant = 0
	Swimming:	Adult = 18 hr/yr
		Teenager = 100 hr/yr
		Child = 21 hr/yr

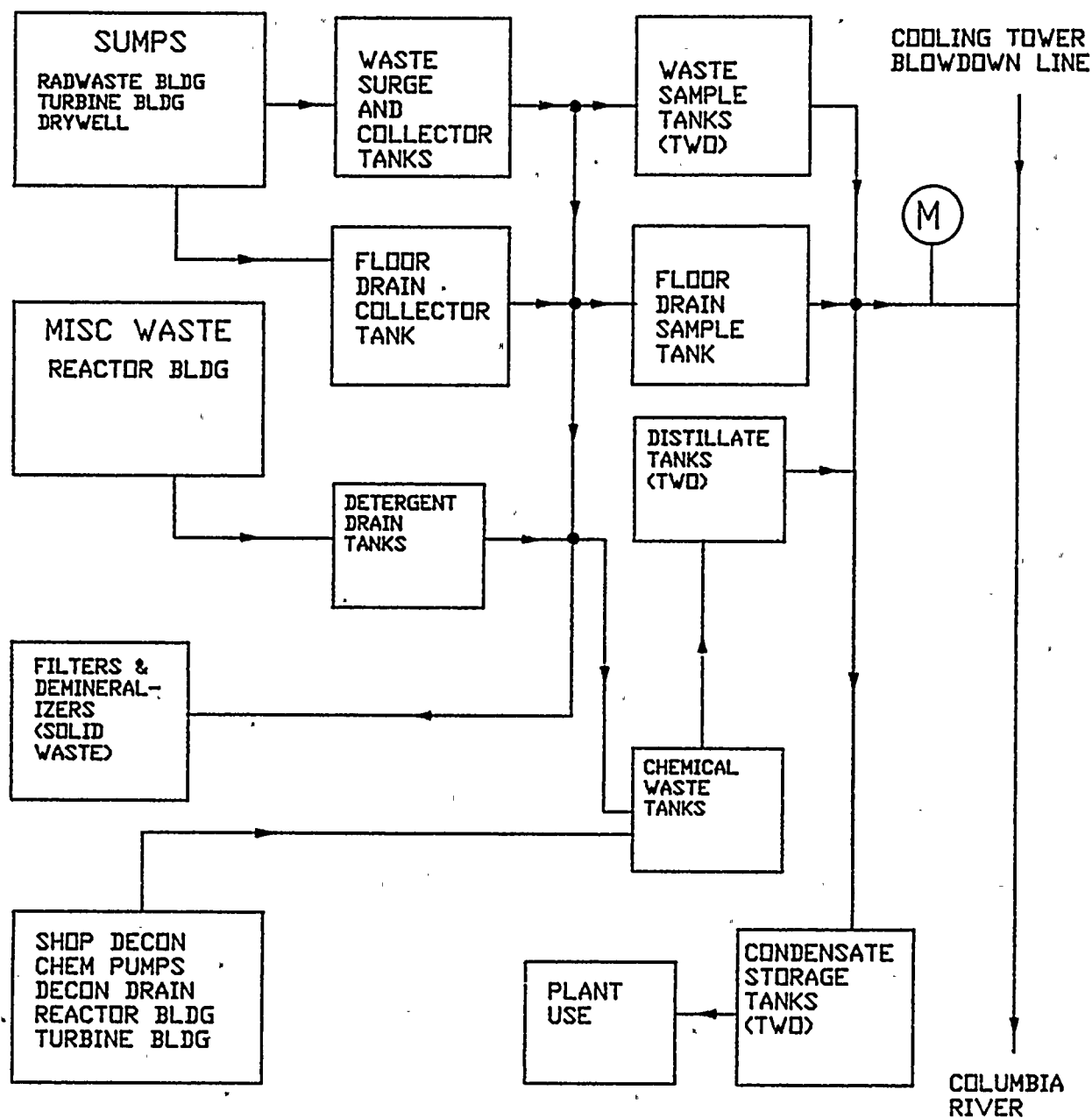
Irrigated Foodstuffs

River Dilution:	50,000
River Transit Time:	4 hours

	<u>Vegetables</u>	<u>Milk</u>	<u>Meat</u>	<u>Leafy Vegetables</u>
	14 days	48 hours	20 days	24 hours
Food Delivery Time:				
Usage Factors:				
Adult	520 kg/yr	310 1/yr	110 kg/yr	64 kg/yr
Teenager	630 kg/yr	400 1/yr	65 kg/yr	42 kg/yr
Child	520 kg/yr	330 1/yr	41 kg/yr	26 kg/yr
Monthly Irrigation Rate:	180 1/m ²	200 1/m ²	160 1/m ²	200 1/m ²
Annual Yield:	5.0 kg/m ²	1.3 1/m ²	2.0 kg/m ²	1.5 kg/m ²
Annual Growing Period:	70 days	30 days	130 days	70 days
Annual 50-Mile Production:	3.5E+09 kg	2.8E+08 L	2.3E+07 kg	1.9E+06 kg

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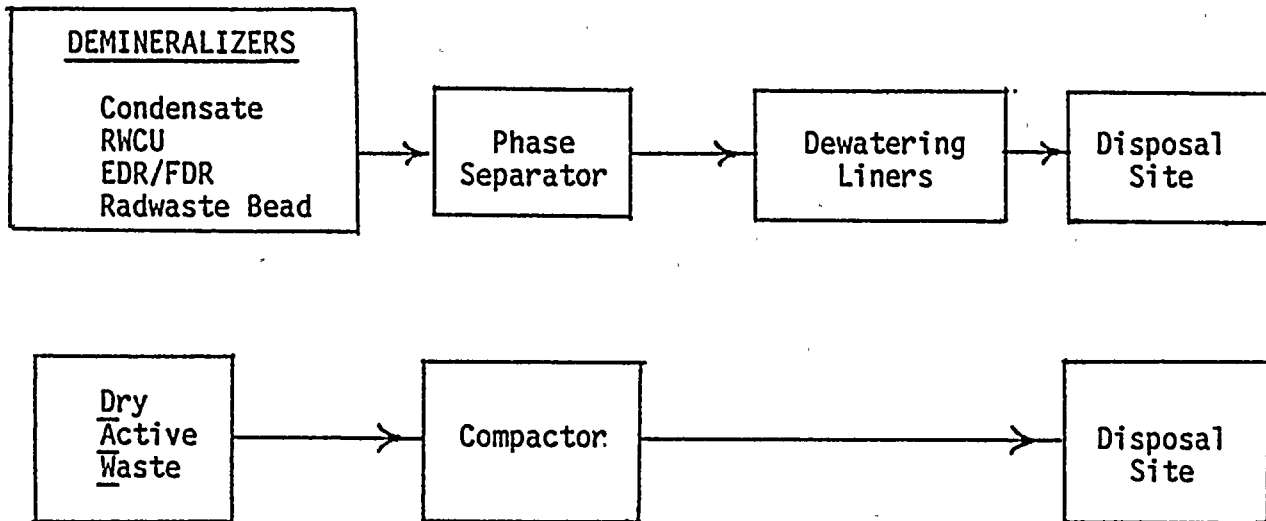


SIMPLIFIED BLOCK DIAGRAM OF
LIQUID WASTE SYSTEM

FIGURE 2-1

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SIMPLIFIED BLOCK DIAGRAM
OF
SOLID RADWASTE SYSTEM

Figure 2-2

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All other locations listed in Figure 3-1 support WNP-2 activities and are controlled by the Supply System. Figure 3-2 provides a simplified block diagram of the gaseous radwaste system for the reactor, turbine and radwaste buildings. Figure 3-3 provides a simplified block diagram for the Off-Gas Treatment System.

Air doses and doses to individuals at these locations were calculated based on the NRC GALE code design base mixture, location specific estimated occupancy, and X/Qs from XOQDOQ. (Note: Desert Sigmas were used in calculating X/Q and D/Q values, and are listed in Table 3-10 to 3-12). These doses are listed in Tables 3-16 and 3-17 along with the doses to the maximum exposed individual. The most likely exposed member of the public is considered to be residing in Taylor Flats (4.2 miles ESE of WNP-2). This is the closest residential area with the high- est X/Q and D/Q values.

3.2 Gaseous Effluent Radiation Monitoring System

3.2.1 Main Plant Release Point

The Main Plant Release is instrument monitored for gaseous radioactivity prior to discharge to the environment via the main plant vent release point. Particulates and iodine activity are accumulated in filters which will be changed and analyzed as per Technical Specification 4.11.2.1.2 and Table 4.11.2. The effluent is supplied from: the gland seal exhaust, mechanical vacuum pumps, treated off gas, standby gas treatment, and exhaust air from the entire reactor building's ventilation.

Two 100-percent capacity vanaxial fans supply 98,000 CFM ventilation air. One is normally operating, the other is in standby. The radiation monitors are located on the ventilation exhaust plenum.

Effluent monitoring consists of a low range beta scintillator, an intermediate range beta scintillator and two ion chamber LOCA monitors. The beta scintillators are mounted in thick lead shielded chambers. The low range beta scintillator has an approximate response of 80 cpm/pCi/cc to Kr-85, and 50 cpm/pCi/cc to Xe-133 and a meter range of $10\text{--}10^6$ cpm. The intermediate

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range has a response from 10^{-2} to 10^3 μ Ci/cc Xe-133 equivalent, and reads in panel meter units (PMU) with a meter range of 10^0 - 10^5 PMU.

The readouts and recorder are located in the main control room panel BD-RAD-24. Power is provided from 125 VDC divisional buses. This monitor has no control function but annunciates in the main control room. The alarm will initiate proper action as defined in the WNP-2 Plant Procedures.

3.2.2 Radwaste Building Ventilation Exhaust Monitor

The radwaste building ventilation exhaust monitoring system monitors the radioactivity in the exhaust air prior to discharge. Radioactivity can originate from: radwaste tank vents, laboratory hoods, and various cubicles housing liquid process treatment equipment and systems.

The radwaste building exhaust system has three 50 percent capacity exhaust filter units of 42,000 cfm capacity. Each exhaust unit has a medium-efficiency prefilter, a high efficiency particulate air filter (HEPA) and two centrifugal fans. Total exhaust flow will vary as the combined exhaust unit maintains a radwaste building differential pressure of -0.25 inches H_2O to the environment.

Particulate and iodine air sample filters are changed weekly for laboratory analysis. After the particulate and iodine filters, the air sample streams are combined in a manifold prior to being monitored by a beta scintillator.

The beta scintillators, on the 487' level are mounted in lead shielded chambers. The low range beta scintillator has an approximate response of 80 cpm/pCi/cc to Kr-85, and 50 cpm/pCi/cc to Xe-133 and a meter range of 10 - 10^6 cpm. The intermediate range has a response from 10^{-2} - 10^3 μ Ci/cc Xe-133 equivalent, and reads in panel meter units (PMU) with a meter range of 10^0 - 10^5 PMU. The readouts and recorder are located in the main control room panel BD-RAD-24. Power is provided from 125 VDC divisional buses. This monitor has no control functions but annunciates in the main control room. The alarm will initiate proper action as defined in the WNP-2 plant procedures.

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3.2.3 Turbine Building (Ventilation) Exhaust Monitor

This monitoring system detects fission and the activation products from the turbine building air which may be present due to leaks from the turbine and other primary components in the building.

The turbine building main exhaust system consists of four roof-mounted centrifugal fans which draw air from a central exhaust plenum. Three fans operate continuously, with one in standby to provide a flow of 260,000 cfm.

A representative sample is extracted from the exhaust vent and passed through a particulate and charcoal filter. The air sample then passes to a beta scintillator.

The beta scintillators are mounted in lead shielded chambers. The low range beta scintillator has an approximate response of 80 cpm/pCi/cc to Kr-85, and 50 cpm/pCi/cc to Xe-133 and a meter range of 10^{-10} to 10^{-6} cpm. The intermediate range has a response from 10^{-2} to 10^{-3} μ Ci/cc Xe-133 equivalent, and reads in panel meter units (PMU) with a meter range of 10^0 to 10^5 PMU. The monitors are on the 525' level of the radwaste building and the readouts and the recorder are located in the main control room panel BD-RAD-24. Power is provided from the 125 VDC divisional buses. This monitor has no control functions but annunciates in the main control room. The alarm will initiate proper action as defined in the WNP-2 plant procedures.

3.3 10 CFR 20 Release Rate Limits

Limits for release of airborne effluents to the unrestricted area are stated in Technical Specification 3.11.2.1. The dose rate in unrestricted areas due to radioactive materials released in gaseous effluents from the site shall be limited to the following values:

- (a) "The dose rate limit for noble gases shall be ≤ 500 mrem/yr to the total body and ≤ 3000 mrem/yr to the skin.
- (b) "The dose rate limit for all radioiodines and for all radioactive materials in particulate form and radionuclides other than noble gases with half-lives greater than eight days shall be ≤ 1500 mrem/yr to any organ."

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3.3.1 Noble Gases

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In order to comply with Technical Specification 3.11.2.1, the following equations must hold:

Whole body:

$$\sum_i K_i \left[(\overline{X/Q})_m \dot{Q}_{im} + (\overline{X/Q})_g \dot{Q}_{ig} \right] \leq 500 \text{ mrem/yr} \quad (1)$$

Skin

$$\sum_i \left[(L_i + 1.1M_i) \left((\overline{X/Q})_m \dot{Q}_{im} + (\overline{X/Q})_g \dot{Q}_{ig} \right) \right] \leq 3000 \text{ mrem/yr} \quad (2)$$

3.3.2 Radioiodines and Particulates

Part "b" of Technical Specification 3.11.2.1 requires that the release rate limit for all radioiodines and radioactive materials in particulate form and radionuclides other than noble gases must meet the following relationship:

Any organ:

$$\sum_i P_i \left[W_M \dot{Q}_{im} + W_g \dot{Q}_{ig} \right] \leq 1500 \text{ mrem/yr} \quad (3)$$

The terms used in equations 1 through 3 are defined as follows:

K_i = The total body dose factor due to gamma emissions for each identified noble gas radionuclide i (mrem/yr per $\mu\text{Ci}/\text{m}^3$).

L_i = The skin dose factor due to beta emissions for each identified noble gas radionuclide i (mrem/yr per $\mu\text{Ci}/\text{m}^3$).

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q_{im} = The average release of noble gas radionuclides in gaseous effluents, i , for short-term releases (equal to or less than 500 hr/yr) from the main plant release point, in μCi . Releases shall be cumulative over the calendar quarter or year, as appropriate.

q_{ig} = The average release of noble gas radionuclides in gaseous effluents, i , for short-term releases (equal to or less than 500 hr/yr) from Radwaste and Turbine Building, in μCi . Releases shall be cumulative over the calendar quarter or year, as appropriate.

Q_{im} = The average release of noble gas radionuclides in gaseous releases, i , for long-term releases (greater than 500 hr/yr) from the main plant release point, in μCi . Release shall be cumulative over the calendar quarter or year, as appropriate.

Q_{ig} = The average release of noble gas radionuclides in gaseous effluents, i , for long-term releases (greater than 500 hr/yr) from Radwaste and Turbine Building, in μCi . Releases shall be cumulative over the calendar quarter or year, as appropriate.

3.17×10^{-8} = The inverse of the number of seconds in a year.

3.4.2 Radioiodines, Tritium and Particulates (Technical Specification
3.11.2.3)

The following equation calculates the dose to an individual from radioiodines, tritium radioactive material in particulate form, and radionuclides other than noble gases with half-lives greater than eight days in gaseous effluents released to the unrestricted areas:

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3.4.2.1 Dose Parameter for Radionuclide R_i **CONTROLLED COPY**

The R_i values used in equations 12 and 13 of this section are calculated separately for each of the following potential exposure pathways:

- o Inhalation
- o Ground plane contamination
- o Grass-cow/goat-milk pathway
- o Grass-cow-meat pathway
- o Vegetation pathway

Monthly dose assessments for WNP-2 gaseous effluent will be done for all age groups.

Calculation of R_i^I (Inhalation Pathway Factor)

$$R_i^I (\text{Inhalation}) = K' (BR)_a (DFA_i)_a (\text{mrem/yr per } \mu\text{Ci/m}^3) \quad (14)$$

where:

- R_i^I = The inhalation pathway factor (mrem/yr per $\mu\text{Ci/m}^3$).
- K' = A constant of unit conversion, 10^6 pCi/ μCi .
- $(BR)_a$ = The breathing rate of the receptor of age group (a) in meter³/yr. (Infant = 1400, child = 3,700, teen = 8,000, adult = 8,000. From P.32 NUREG-0133).

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$(DFA_i)_a$ = The maximum organ-inhalation dose factor for receptor of age group (a) for the i th radionuclide (mrem/pCi). The total body is considered as an organ in the selection of $(DFA_i)_a$. $(DFA_i)_a$ values are listed in Tables E-7 through E-10 of Regulatory Guide 1.109 manual, Revision 1 and NUREG/CR-4013. Values of R_i^I are listed in Table 3-5.

Calculation of R_i^G (Ground Plane Pathway Factor)

$$R_i^G(\text{Ground Plane}) = K^A K^B (SF)(DFG_i) (1 - e^{-\lambda_i t}) / \lambda_i \quad (m^2 \times \text{mrem/yr per } \mu\text{Ci/sec}) \quad (15)$$

where:

R_i^G = Ground plane pathway factor ($m^2 \times \text{mrem/yr per } \mu\text{Ci/sec}$).

K^A = A conversion constant of ($10^6 \text{ pCi}/\mu\text{Ci}$).

K^B = A conversion constant - (8760 hr/yr).

λ_i = The decay constant for the i th radionuclide (sec^{-1}).

t = Exposure time, $6.31 \times 10^8 \text{ sec}$ (20 years).

DFG_i = The ground plane dose conversion factor for the i th radionuclide, as listed in Table E-6 of Regulatory Guide 1.109, Revision 1 and NUREG/CR-4013 ($\text{mrem/hr per pCi}/m^2$).

SF = Shielding Factor (dimensionless)--0.7 if building is present, as suggested in Table E-15 of Regulatory Guide 1.109, Revision 1.

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(DFL_i)_a = The maximum organ ingestion dose factor for the ith radionuclide for the receptor in age group (a), in mrem/pCi (Tables E-11 to E-14 of Regulatory Guide 1.109, Revision 1 and NUREG/CR-4013).

λ_i = The decay constant for the ith radionuclide, in sec⁻¹.

λ_w = The decay constant for removal of activity on leaf and plant surfaces by weathering, 5.73×10^{-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 cow/goat is on pasture (dimensionless).

f_s = Fraction of the cow/goat feed that is pasture grass while the cow is on pasture (dimensionless).

NOTE: For radioiodines, multiply R_i^C value by 0.5 to obtain the amount of elemental iodine present.

The input parameters used for calculating R_i^C are listed in Table 3-6 and the R_i^M values are tabulated in Table 3-7.

For Tritium:

In calculating R_T^C , pertaining to tritium in milk, the airborne concentration rather than the deposition will be used:

R_T^C (Grass-Cow/Goat-Milk Factor) =

$$K^A K^C F_m Q_F U_{ap} (DFL_i)_a [0.75(0.5/H)] \text{ (mrem/yr per } \mu\text{Ci/m}^3\text{)} \quad (17)$$

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 t_f = The transport time from pasture to receptor, in sec.

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

NOTE: For radioiodines, multiply R_i^M value by 0.5 to obtain the amount of elemental iodine present.

The input parameters needed for solving equation 18 are listed in Table 3-7.

For Tritium:

In calculating the R_T^M for tritium in meat, the airborne concentration is used rather than the deposition rate. The following equation is used to calculate the R_T^M values for tritium:

R_T^M (Grass-Cow-Meat Pathway) =

$$K^A K^C \left[F_f Q_F U_{ap} (DFL_i)_a \right] \left[0.75(0.5/H) \right] \text{ (mrem/yr per } \mu\text{Ci/m}^3 \text{)} \quad (19)$$

Where the terms are as defined in equations 16-18, R_i^M values for tritium pertaining to the infant age group is zero since there is no meat consumption by this age group.

Calculation of R_i^V (Vegetation Pathway Factor)

R_i^V (Vegetation Pathway Factor) =

$$K' \left[\frac{(r)}{Y_v(\lambda_i + \lambda_w)} (DFL_i)_a \right] \left[U_{afL}^L e^{-\lambda_i t_L} + U_{afg}^S e^{-\lambda_i t_h} \right] \quad (20)$$

($m^2 \times$ mrem/yr per $\mu\text{Ci/sec}$)

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where:

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K' = A constant of unit conversion, $10^6 \text{pCi}/\mu\text{Ci}$.

U_a^L = The consumption rate of fresh leafy vegetation by the receptor in age group (a), in kg/yr.

U_a^S = 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 .

NOTE: For radioiodines, multiply R_i^V value by 0.5 to obtain the amount of elemental iodine present.

All other items are as defined in equations 16-18.

For Tritium:

In calculating the R_T^V for tritium, the concentration of tritium in vegetation is based on airborne concentration rather than the deposition rate. The following equation is used to calculate R_T^V for tritium:

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mrem/yr to the whole body or 3000 mrem/yr to the skin. The initial setpoints determination is calculated using a conservative radionuclide mix obtained from the WNP-2 GALE code. Once the plant is operating and sufficient measurable process fission gases are in the effluent, then the actual radionuclide mix will be used to calculate the alarm setpoint.

3.6.2 Setpoint Determination for all Gaseous Release Paths

The setpoints for gaseous effluent are based on instantaneous noble gas dose rates. Sampling and analysis of radioiodines and radionuclides in particulate form will be performed in accordance with technical specifications to ensure compliance with 10 CFR 20 and 10 CFR 50 Appendix I limits. The three release points will be partitioned such that their sum does not exceed 100 percent of the limit. Originally, the setpoints will be set at 40 percent for the reactor building, 40 percent for the turbine building and 20 percent for the radwaste building. These percentages could vary at the plant discretion, should the operational conditions warrant such change. However, the combined releases due to variations in the setpoints will not result in doses which exceed the limit stated in technical specification. Both skin dose and whole body setpoints will be calculated and the lower limit will be used.

3.6.2.1 Setpoints Calculations Based on Whole Body Dose Limits

The fraction (π_i) of the total gaseous radioactivity in each gaseous effluent release path (j) for each noble gas radionuclide i will be determined by using the following equation:

$$\pi_{ij} = \frac{M_{ij}}{M_{Tj}} \quad (\text{dimensionless}) \quad (22)$$

where:

M_{ij} = The measured individual concentration of radionuclide i in the gaseous effluent release path j ($\mu\text{Ci/cc}$).

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 M_{Tj} = The measured total concentration of any noble gases identified in the gaseous effluent release path j ($\mu\text{Ci/cc}$).

Based on Technical Specification 3.11.2.1, the maximum acceptable release rate of all noble gases in the gaseous effluent release path j is calculated by using the following equation:

$$Q_{Tj} = \frac{F_j 500}{X/Q_j \sum_{i=1}^m (K_i)(\pi_{ij})} \quad (\mu\text{Ci/sec}) \quad (23)$$

where:

Q_{Tj} = The maximum acceptable release rate ($\mu\text{Ci/sec}$) of all noble gases in the gaseous effluent release path j ($\mu\text{Ci/cc}$).

F_j = Fraction of total dose allocated to release path j.

500 = Whole body dose rate limit of 500 mrem/yr as specified in Technical Specification 3.11.2.1a.

X/Q_j = Maximum normalized diffusion coefficient of effluent release path j at the site boundary (sec/m^3). Turbine Building and Radwaste Building values are based on average annual ground level values. Main plant vent release values are for mixed mode and may be either short term or average annual value dependent upon type of release.

K_i = The total whole body dose factor due to gamma emission from noble gas nuclide i (mrem/yr per $\mu\text{Ci/m}^3$) (as listed in Table B-1 of Regulatory Guide 1.109, Revision 1).

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π_{ij} = As defined in Equation 22

m = Total number of radionuclides in the gaseous effluent.

j = Different release pathways.

The total maximum acceptable concentration (C_{Tj}) of noble gas radionuclides in the gaseous effluent release path j ($\mu\text{Ci/cc}$) will be calculated by using the following equation:

$$C_{Tj} = \frac{Q_{Tj}}{R_j} (\mu\text{Ci/cc}) \quad (24)$$

where:

C_{Tj} = The total allowed concentration of all noble gas radionuclides in the gaseous effluent release path j ($\mu\text{Ci/cc}$).

Q_{Tj} = The maximum acceptable release rate ($\mu\text{Ci/sec}$) of all noble gases in the gaseous effluent release path j .

R_j = The effluent release rate (cc/sec) at the point of release.

To determine the maximum acceptable concentration (C_{ij}) of noble gas radionuclide i in the gaseous effluent for each individual noble gas in the gaseous effluent ($\mu\text{Ci/cc}$), the following equation will be used:

$$C_{ij} = \pi_{ij} C_{Tj} (\mu\text{Ci/cc}) \quad (25)$$

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Table 3-2

DISTANCES (MILES) TO CONTROLLING LOCATIONS
AS MEASURED FROM CENTER OF WNP-2 CONTAINMENT BUILDING*

<u>Location</u>	<u>Distance (miles)</u>	<u>Sector</u>	<u>Comments</u>
Site Boundary	1.2	SE	Air dose measurement.
Taylor Flats	4.2	ESE	The nearest significant residence in the southern direction with vegetable gardens, milk, and meat production.
Ringold	4.0	ENE	The nearest significant residence in the northern direction with vegetable gardens, milk, and meat production.

*Selection of location sector is based on the highest annual average X/Q values.

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Table 3-3

WNP-2 ANNUAL AVERAGE DISPERSION (X/Q)
AND DEPOSITION (D/Q) VALUES FOR SPECIAL LOCATIONS

<u>Location</u>	<u>Sector</u>	<u>Distance</u> (miles)	<u>Point of Release</u>	X/Q No Decay No Depletion (sec/m ³)	X/Q 2.3 Days Decay No Depletion (sec/m ³)	X/Q 8.0 Days Decay Depleted (sec/m ³)	D/Q (m ⁻²)
Site Boundary	SE	1.2	Containment Bldg.	1.8E-06	1.8E-06	1.6E-06	1.0E-08
			Turbine Bldg.	1.1E-05	1.1E-05	1.0E-05	8.3E-08
			Radwaste Bldg.	1.1E-05	1.1E-05	1.0E-05	8.3E-08
Taylor Flats	ESE	4.2	Containment Bldg.	4.1E-07	4.1E-07	3.8E-07	8.2E-10
			Turbine Bldg.	8.9E-07	8.7E-07	6.8E-07	7.2E-10
			Radwaste Bldg.	8.9E-07	8.7E-07	6.8E-07	7.2E-10
Ringold	ENE	4.0	Containment Bldg.	2.5E-07	2.5E-07	1.9E-07	3.3E-10
			Turbine Bldg.	3.9E-07	3.8E-07	3.0E-07	3.3E-10
			Radwaste Bldg.	3.9E-07	3.8E-07	3.0E-07	3.3E-10
BPA Ashe Substation	N	0.5	Containment Bldg.	6.4E-06	6.4E-06	5.8E-06	3.7E-08
			Turbine Bldg.	3.0E-05	2.9E-05	2.7E-05	7.8E-08
			Radwaste Bldg.	3.0E-05	2.9E-05	2.7E-05	7.8E-08

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Table 3-4

DOSE RATE PARAMETERS IMPLEMENTATION OF 10 CFR 20, AIRBORNE RELEASES

Nuclide	$\text{sec}^{\lambda-1}$	Child Dose Factor*		P_i^I Inhalation $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$
		DFA _i	DFG _i $\frac{\text{mrem/hr}}{\mu\text{Ci/m}^2}$	
H-3	1.8E-09	1.7E-07	0.0	6.3E+02
Na-24	1.3E-05	4.4E-06	2.9E-08	1.6E+04
Cr-51	2.9E-07	4.6E-06	2.6E-10	1.7E+04
Mn-54	2.6E-08	4.3E-04	6.8E-09	1.6E+06
Mn-56	7.5E-05	3.3E-05	1.3E-08	1.2E+05
Fe-55	8.5E-09	3.0E-05	0.0	1.1E+05
Fe-59	1.8E-07	3.4E-04	9.4E-09	1.3E+06
Co-58	1.1E-07	3.0E-04	8.2E-09	1.1E+06
Co-60	4.2E-09	1.9E-03	2.0E-08	7.0E+06
Cu-64	1.5E-05	9.9E-06	1.7E-09	3.7E+04
Zn-65	3.3E-08	2.7E-04	4.6E-09	1.0E+06
Zn-69m	1.4E-05	2.7E-05	3.4E-09	1.0E+05
As-76	7.3E-06	1.9E-05	1.7E-07	7.0E+04
Br-82	5.5E-06	5.7E-06	2.2E-08	2.1E+04
Sr-89	1.5E-07	5.8E-04	6.5E-13	2.2E+06
Sr-90	7.9E-10	1.0E-02	2.6E-12**	3.7E+07
Zr-95	1.2E-07	6.0E-04	5.8E-09	2.2E+06
Nb-95	2.3E-07	1.7E-04	6.0E-09	6.3E+05
Zr-97	1.1E-05	9.5E-05	6.4E-09	3.5E+05
Nb-97	1.6E-04	7.5E-06	5.4E-09	2.8E+04
Mo-99	2.9E-06	3.7E-05	2.2E-09	1.4E+05
Tc-99m	3.2E-05	1.3E-06	1.1E-09	4.8E+03
Ru-106	2.2E-08	3.9E-03	1.8E-09	1.4E+07
Ag-110m	3.2E-08	1.5E-03	2.1E-08	5.6E+06
Sb-124	1.3E-07	8.8E-04	1.5E-08	3.3E+06
Sb-125	7.9E-09	6.3E-04	3.5E-09	2.3E+06
Sb-126	6.5E-07	2.9E-04	1.0E-08	1.1E+06
Sb-127	2.1E-06	6.2E-05	6.6E-09	2.3E+05

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Table 3-4

DOSE RATE PARAMETERS IMPLEMENTATION OF 10 CFR 20, AIRBORNE RELEASES

Nuclide	λ^{-1} sec	Child Dose Factor*		p_i^I Inhalation mrem/yr $\mu\text{Ci}/\text{m}^3$
		DFA_i mrem/pCi	DFG_i mrem/hr pCi/m ²	
Te-127	2.1E-05	1.5E-05	1.1E-11	5.6E+04
Te-131m	6.4E-06	8.3E-05	9.9E-09	3.1E+05
I-131	1.0E-06	4.4E-03	3.4E-09	1.6E+07
I-132	8.4E-05	5.2E-05	2.0E-08	1.9E+05
I-133	9.2E-06	1.0E-03	4.5E-09	3.7E+06
I-135	2.9E-05	2.1E-04	1.4E-08	7.8E+05
Cs-134	1.1E-08	2.7E-04	1.4E-08	1.0E+06
Cs-137	7.3E-10	2.5E-04	4.9E-09	9.3E+05
Cs-138	3.6E-04	2.3E-07	2.4E-08	8.5E+02
Ba-140	6.3E-07	4.7E-04	2.4E-09	1.7E+06
La-140	4.8E-06	6.1E-05	1.7E-08	2.3E+05
Ce-141	2.4E-07	1.5E-04	6.2E-10	5.6E+05
Ce-144	2.8E-08	3.2E-03	3.7E-10	1.2E+07
Nd-147	7.2E-07	8.9E-05	1.2E-09	3.3E+05
Hf-179m	3.7E-02	2.0E-05	NO DATA	7.4E+04
Hf-181	1.8E-07	6.0E-05	1.2E-08	2.2E+05
W-185	1.1E-07	1.9E-04	0.0	7.0E+05

* Maximum Organ

**No data is listed for Sr-90 in Table E-6 of Regulatory Guide 1.109, Revision 1. Y-90 values were used for dose conversion factor Sr-90.

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31, 32

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TABLE 3-5 a

DOSE PARAMETERS FOR 10 CFR 50 EVALUATIONS, AIRBORNE RELEASES
AGE GROUP: ADULT ORGAN OF REFERENCE: MAXIMUM ORGAN
R(1), INDIVIDUAL PATHWAY DOSE PARAMETERS FOR RADIONUCLIDES OTHER THAN NOBLE GASES

RADIO- NUCLIDE	INHALATION (MREM/YR PER UCI/M3)	GROUND PLANE (M2.MREM/YR PER UCI/SEC)	COW-MILK (M2.MREM/YR PER UCI/SEC)	GOAT-MILK (M2.MREM/YR PER UCI/SEC)	ANIMAL-MEAT (M2.MREM/YR PER UCI/SEC)	VEGETABLES (M2.MREM/YR PER UCI/SEC)
H 3	7.2E+02	0.0E-01	5.8E+02	1.2E+03	2.4E+02	1.6E+03
NA 24	1.0E+04	1.2E+07	1.2E+06	2.2E+05	7.2E-04	1.1E+05
CR 51	1.4E+04	4.7E+06	3.3E+06	5.9E+05	8.2E+05	2.3E+07
MN 54	1.4E+06	1.4E+09	1.4E+07	2.1E+06	1.5E+07	9.4E+08
MN 56	2.0E+04	9.0E+05	6.2E-02	1.1E-02	0.0E-01	2.0E+02
FE 55	7.2E+04	0.0E-01	1.4E+07	2.2E+06	1.6E+08	1.9E+08
FE 59	1.0E+06	2.7E+08	1.1E+08	2.0E+07	9.8E+08	1.5E+09
CO 58	9.3E+05	3.8E+08	4.7E+07	7.6E+06	1.8E+08	8.0E+08
CO 60	6.0E+06	2.3E+10	1.7E+08	2.5E+07	8.0E+08	2.9E+09
CU 64	4.9E+04	6.1E+05	1.0E+06	1.7E+05	1.1E-05	3.3E+05
ZN 65	8.6E+05	7.5E+08	2.7E+09	4.0E+08	7.0E+08	1.3E+09
ZN 69M	1.4E+05	1.3E+06	1.3E+07	2.4E+06	1.2E-03	1.4E+06
AS 76	1.5E+05	3.8E+06	2.1E+07	3.8E+06	2.9E+01	8.0E+06
BR 82	1.4E+04	2.1E+07	1.9E+07	3.4E+06	7.0E+02	7.7E+05
SR 89	1.4E+06	2.2E+04	6.9E+08	2.0E+09	1.4E+08	1.5E+10
SR 90	2.9E+07	6.7E+06	3.4E+10	8.3E+10	8.9E+09	7.4E+11
ZR 95	1.8E+06	2.5E+08	4.6E+05	7.6E+04	9.2E+08	1.6E+09
NB 95	5.1E+05	1.4E+08	1.3E+08	2.2E+07	3.6E+09	8.4E+08
ZR 97	5.2E+05	3.0E+06	1.4E+04	2.4E+03	6.4E-01	8.8E+06
NB 97	2.4E+03	1.8E+05	1.6E-09	2.9E-10	0.0E-01	8.1E-04
MO 99	2.5E+05	4.0E+06	2.9E+07	5.2E+06	1.2E+05	9.3E+06
TC 99M	4.2E+03	1.8E+05	2.8E+03	5.0E+02	3.6E-18	2.2E+03
RU106	9.4E+06	4.2E+08	7.3E+05	1.1E+05	1.0E+11	1.2E+10
AG110M	4.6E+06	3.5E+09	1.2E+10	1.8E+09	1.4E+09	4.4E+09
SB124	2.5E+06	6.0E+08	3.5E+08	5.8E+07	2.7E+08	4.0E+09
SB125	1.7E+06	2.4E+09	1.3E+08	1.8E+07	1.2E+08	1.4E+09
SB126	7.7E+05	8.4E+07	2.2E+08	4.0E+07	7.6E+07	1.6E+09
SB127	3.0E+05	1.7E+07	5.2E+07	9.3E+06	1.9E+06	1.2E+08
TE127	5.7E+04	3.0E+03	2.6E+04	4.7E+03	8.4E-09	2.0E+05
TE131M	5.6E+05	8.0E+06	8.9E+06	1.6E+06	1.1E+04	2.0E+07
I 131	1.2E+07	8.6E+06	3.4E+10	6.1E+10	1.2E+09	4.4E+10
I 132	1.1E+05	6.2E+05	3.9E+00	6.9E+00	0.0E-01	1.1E+03
I 133	2.2E+06	1.2E+06	2.5E+08	4.5E+08	2.4E+01	1.1E+08
I 135	4.5E+05	1.3E+06	5.5E+05	9.8E+05	1.7E-15	1.4E+06
CS134	8.5E+05	6.9E+09	7.4E+09	2.7E+10	8.6E+08	1.0E+10
CS136	1.5E+05	1.5E+08	5.0E+08	2.2E+09	2.3E+07	4.6E+08
CS137	6.2E+05	1.3E+10	6.0E+09	2.1E+10	7.1E+08	8.6E+09
CS138	6.2E+02	3.6E+05	1.0E-23	4.6E-23	0.0E-00	3.0E-11
BA140	1.3E+06	2.1E+07	2.7E+07	4.8E+06	2.8E+07	7.3E+08
LA140	4.6E+05	1.9E+07	8.4E+04	1.5E+04	7.0E+02	3.3E+07
CE141	3.6E+05	1.4E+07	5.8E+06	1.0E+06	1.7E+07	9.3E+08
CE144	7.8E+06	7.0E+07	6.4E+07	9.6E+06	2.6E+08	1.1E+10
ND147	2.2E+05	8.5E+06	2.5E+05	4.6E+04	1.9E+07	5.1E+08
HF179M	1.6E+05	0.0E-01	0.0E-01	0.0E-01	0.0E-01	0.0E-01
HF181	4.8E+05	2.1E+08	5.5E+05	9.3E+04	1.2E+10	1.8E+09
W 185	4.5E+05	1.8E+04	2.4E+07	3.9E+06	1.9E+07	8.4E+08

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TABLE 3-5 D

DOSE PARAMETERS FOR 10 CFR 50 EVALUATIONS, AIRBORNE RELEASES
AGE GROUP: TEEN ORGAN OF REFERENCE: MAXIMUM ORGAN
R(I), INDIVIDUAL PATHWAY DOSE PARAMETERS FOR RADIONUCLIDES OTHER THAN NOBLE GASES

RADIO- NUCLIDE	INHALATION (M2.MREM/YR PER UCI/M3)	GROUND PLANE (M2.MREM/YR PER UCI/SEC)	COW-MILK (M2.MREM/YR PER UCI/SEC)	GOAT-MILK (M2.MREM/YR PER UCI/SEC)	ANIMAL-MEAT (M2.MREM/YR PER UCI/SEC)	VEGETABLES (M2.MREM/YR PER UCI/SEC)
H 3	7.3E+02	0.0E-01	7.5E+02	1.5E+03	1.5E+02	1.9E+03
NA 24	1.4E+04	1.2E+07	2.1E+06	3.9E+05	5.8E-04	1.0E+05
CR 51	2.1E+04	4.7E+06	3.9E+06	6.8E+05	4.4E+05	2.5E+07
MN 54	2.0E+06	1.4E+09	1.6E+07	2.3E+06	7.8E+06	9.6E+08
MN 56	5.7E+04	9.0E+05	2.3E-01	4.1E-02	0.0E-00	3.7E+02
FE 55	1.2E+05	0.0E-01	2.4E+07	3.8E+06	1.3E+08	3.0E+08
FE 59	1.5E+06	2.7E+08	1.3E+08	2.5E+07	5.5E+08	1.7E+09
CO 58	1.3E+06	3.8E+08	5.3E+07	8.7E+06	9.4E+07	8.3E+08
CO 60	8.7E+06	2.3E+10	2.1E+08	3.0E+07	4.3E+08	3.1E+09
CU 64	6.1E+04	6.1E+05	1.6E+06	2.7E+05	8.0E-06	2.7E+05
ZN 65	1.2E+06	7.5E+08	4.5E+09	6.7E+08	5.4E+08	2.0E+09
ZN 69M	1.7E+05	1.3E+06	2.1E+07	3.8E+06	9.1E-04	1.1E+06
AS 76	1.5E+05	3.8E+06	2.7E+07	4.9E+06	1.7E+01	5.3E+06
BR 82	1.8E+04	2.1E+07	2.8E+07	5.1E+06	4.9E+02	6.1E+05
SR 89	2.4E+06	2.2E+04	1.3E+09	3.7E+09	1.2E+08	2.4E+10
SR 90	3.3E+07	6.7E+06	5.1E+10	1.3E+11	6.2E+09	1.0E+12
ZR 95	2.7E+06	2.5E+08	5.8E+05	9.5E+04	5.3E+08	1.8E+09
NB 95	7.5E+05	1.4E+08	1.4E+08	2.7E+07	2.0E+09	9.1E+08
ZR 97	6.3E+05	3.0E+06	2.1E+04	3.8E+03	4.6E-01	7.0E+06
NB 97	3.9E+03	1.8E+05	1.9E-08	3.3E-09	0.0E-01	4.8E-03
MO 99	2.7E+05	4.0E+06	5.1E+07	9.2E+06	9.4E+04	1.1E+07
TC 99M	6.1E+03	1.8E+05	5.3E+03	9.5E+02	3.2E-18	2.1E+03
RU106	1.6E+07	4.2E+08	9.9E+05	1.5E+05	6.2E+10	1.5E+10
AG110M	6.8E+06	3.5E+09	1.4E+10	2.1E+09	7.6E+08	4.6E+09
SB124	3.8E+06	6.0E+08	4.5E+08	7.3E+07	1.6E+08	4.6E+09
SB125	2.7E+06	2.4E+09	1.6E+08	2.3E+07	6.8E+07	1.6E+09
SB126	1.2E+06	8.4E+07	2.8E+08	5.1E+07	4.5E+07	1.8E+09
SB127	3.2E+05	1.7E+07	6.9E+07	1.2E+07	1.2E+06	1.2E+08
TE127	8.1E+04	3.0E+03	4.8E+04	8.6E+03	7.0E-09	1.8E+05
TE131M	6.2E+05	8.0E+06	1.3E+07	2.3E+06	7.4E+03	1.5E+07
I 131	1.5E+07	8.6E+06	5.4E+10	9.7E+10	9.0E+08	6.1E+10
I 132	1.5E+05	6.2E+05	6.4E+00	1.2E+01	0.0E-00	9.3E+02
I 133	2.9E+06	1.2E+06	4.2E+08	7.5E+08	1.8E+01	9.6E+07
I 135	6.2E+05	1.3E+06	9.3E+05	1.7E+06	1.3E-15	1.2E+06
CS134	1.1E+06	6.9E+09	1.3E+10	4.6E+10	6.8E+08	1.6E+10
CS136	1.9E+05	1.5E+08	8.4E+08	3.8E+09	1.8E+07	7.0E+08
CS137	8.5E+05	1.3E+10	1.1E+10	3.8E+10	5.7E+08	1.4E+10
CS138	8.6E+02	3.6E+05	1.8E-23	8.1E-23	0.0E-00	2.7E-11
BA140	2.0E+06	2.1E+07	3.6E+07	6.4E+06	1.8E+07	8.8E+08
LA140	4.9E+05	1.9E+07	1.1E+05	2.1E+04	4.4E+02	2.4E+07
CE141	6.1E+05	1.4E+07	7.9E+06	1.4E+06	1.0E+07	1.1E+09
CE144	1.3E+07	7.0E+07	8.8E+07	1.3E+07	1.6E+08	1.3E+10
ND147	3.7E+05	8.5E+06	3.5E+05	6.2E+04	1.2E+07	6.1E+08
HF179M	7.1E+04	0.0E-01	0.0E-01	0.0E-01	0.0E-01	0.0E-01
HF181	4.8E+05	2.1E+08	7.1E+05	1.2E+05	7.0E+09	2.1E+09
W 185	7.7E+05	1.8E+04	3.3E+07	5.4E+06	1.2E+07	1.0E+09

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TABLE 3-5 c

DOSE PARAMETERS FOR 10 CFR 50 EVALUATIONS, AIRBORNE RELEASES
AGE GROUP: CHILD ORGAN OF REFERENCE: MAXIMUM ORGAN
R(I), INDIVIDUAL PATHWAY DOSE PARAMETERS FOR RADIONUCLIDES OTHER THAN NOBLE GASES

RADIO- NUCLIDE	INHALATION (MREM/YR PER UCI/M3)	GROUND PLANE (M2.MREM/YR PER UCI/SEC)	COW-MILK (M2.MREM/YR PER UCI/SEC)	GOAT-MILK (M2.MREM/YR PER UCI/SEC)	ANIMAL-MEAT (M2.MREM/YR PER UCI/SEC)	VEGETABLES (M2.MREM/YR PER UCI/SEC)
H 3	6.4E+02	0.0E-01	1.2E+03	2.4E+03	1.8E+02	2.9E+03
NA 24	1.6E+04	1.2E+07	4.5E+06	8.0E+05	9.2E-04	1.6E+05
CR 51	1.7E+04	4.7E+06	2.5E+06	4.4E+05	2.2E+05	1.6E+07
MN 54	1.6E+06	1.4E+09	1.1E+07	1.7E+06	4.3E+06	6.9E+08
MN 56	1.2E+05	9.0E+05	8.8E-01	1.6E-01	0.0E-00	1.1E+03
FE 55	1.1E+05	0.0E-01	6.1E+07	9.6E+06	2.5E+08	7.6E+08
FE 59	1.3E+06	2.7E+08	9.5E+07	1.7E+07	3.0E+08	1.2E+09
CO 58	1.1E+06	3.8E+08	3.4E+07	5.6E+06	4.7E+07	5.3E+08
CO 60	7.1E+06	2.3E+10	1.4E+08	2.0E+07	2.2E+08	2.1E+09
CU 64	3.7E+04	6.1E+05	1.7E+06	2.9E+05	6.5E-06	2.2E+05
ZN 65	1.0E+06	7.5E+08	6.8E+09	1.0E+09	6.2E+08	3.0E+09
ZN 69M	1.0E+05	1.3E+06	2.2E+07	4.0E+06	7.2E-04	9.0E+05
AS 76	7.0E+04	3.8E+06	2.2E+07	4.0E+06	1.1E+01	3.5E+06
BR 82	2.1E+04	2.1E+07	5.8E+07	1.0E+07	7.6E+02	9.9E+05
SR 89	2.2E+06	2.2E+04	3.1E+09	9.2E+09	2.3E+08	6.0E+10
SR 90	3.8E+07	6.7E+06	1.0E+11	2.6E+11	9.8E+09	2.1E+12
ZR 95	2.2E+06	2.5E+08	4.2E+05	7.0E+04	3.0E+08	1.3E+09
NB 95	6.1E+05	1.4E+08	1.1E+08	1.8E+07	1.0E+09	6.2E+08
ZR 97	3.5E+05	3.0E+06	2.1E+04	3.8E+03	3.5E-01	5.2E+06
NB 97	2.8E+04	1.8E+05	4.2E-07	7.6E-08	0.0E-01	8.2E-02
MO 99	1.3E+05	4.0E+06	8.7E+07	1.6E+07	1.2E+05	1.6E+07
TC 99M	4.8E+03	1.8E+05	7.4E+03	1.3E+03	3.4E-18	2.2E+03
RU106	1.4E+07	4.2E+08	7.9E+05	1.2E+05	3.8E+10	1.2E+10
AG110M	5.5E+06	3.5E+09	9.4E+09	1.4E+09	3.8E+08	3.0E+09
SB124	3.2E+06	6.0E+08	3.3E+08	5.4E+07	8.8E+07	3.3E+09
SB125	2.3E+06	2.4E+09	1.2E+08	1.7E+07	3.8E+07	1.2E+09
SB126	1.1E+06	8.4E+07	2.2E+08	4.0E+07	2.7E+07	1.4E+09
SB127	2.3E+05	1.7E+07	5.5E+07	1.0E+07	7.2E+05	9.2E+07
TE127	5.6E+04	3.0E+03	5.9E+04	1.1E+04	6.7E-09	1.7E+05
TE131M	3.1E+05	8.0E+06	1.1E+07	2.1E+06	5.0E+03	9.9E+06
I 131	1.6E+07	8.6E+06	1.1E+11	1.9E+11	1.4E+09	1.2E+11
I 132	1.9E+05	6.2E+05	1.5E+01	2.7E+01	0.0E-00	1.6E+03
I 133	3.8E+06	1.2E+06	9.9E+08	1.8E+09	3.3E+01	1.7E+08
I 135	7.9E+05	1.3E+06	2.1E+06	3.8E+06	2.3E-15	2.1E+06
CS134	1.0E+06	6.9E+09	2.0E+10	7.5E+10	8.3E+08	2.6E+10
CS136	1.7E+05	1.5E+08	1.3E+09	6.0E+09	2.1E+07	1.1E+09
CS137	9.1E+05	1.3E+10	1.9E+10	6.8E+10	7.9E+08	2.5E+10
CS138	8.4E+02	3.6E+05	3.2E-23	1.4E-22	0.0E-00	3.6E-11
BA140	1.7E+06	2.1E+07	5.6E+07	1.0E+07	2.1E+07	1.4E+09
LA140	2.3E+05	1.9E+07	9.5E+04	1.7E+04	2.8E+02	1.6E+07
CE141	5.4E+05	1.4E+07	6.3E+06	1.1E+06	6.4E+06	9.0E+08
CE144	1.2E+07	7.0E+07	7.0E+07	1.1E+07	1.0E+08	1.1E+10
ND147	3.3E+05	8.5E+06	2.8E+05	5.0E+04	7.4E+06	4.8E+08
HF179M	7.4E+04	0.0E-01	0.0E-01	0.0E-01	0.0E-01	0.0E-01
HF181	2.2E+05	2.1E+08	5.9E+05	9.9E+04	4.4E+09	1.8E+09
W 185	6.9E+05	1.8E+04	2.7E+07	4.3E+06	7.3E+06	8.3E+08

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TABLE 3-5 d

DOSE PARAMETERS FOR 10 CFR 50 EVALUATIONS, AIRBORNE RELEASES
AGE GROUP: INFANT ORGAN OF REFERENCE: MAXIMUM ORGAN
R(1), INDIVIDUAL PATHWAY DOSE PARAMETERS FOR RADIONUCLIDES OTHER THAN NOBLE GASES

RADIO- NUCLIDE	INHALATION (MREM/YR PER UCI/M3)	GROUND PLANE (M2.MREM/YR PER UCI/SEC)	COW-MILK (M2.MREM/YR PER UCI/SEC)	GOAT-MILK (M2.MREM/YR PER UCI/SEC)	ANIMAL-MEAT (M2.MREM/YR PER UCI/SEC)	VEGETABLES (M2.MREM/YR PER UCI/SEC)
H 3	3.7E+02	0.0E-01	1.8E+03	3.7E+03	0.0E-01	0.0E-01
NA 24	1.1E+04	1.2E+07	7.8E+06	1.4E+06	0.0E-01	0.0E-01
CR 51	1.3E+04	4.7E+06	2.2E+06	3.8E+05	0.0E-01	0.0E-01
MN 54	1.0E+06	1.4E+09	2.1E+07	3.1E+06	0.0E-01	0.0E-01
MN 56	7.2E+04	9.0E+05	1.3E+00	2.4E-01	0.0E-01	0.0E-01
FE 55	8.7E+04	0.0E-01	7.4E+07	1.2E+07	0.0E-01	0.0E-01
FE 59	1.0E+06	2.7E+08	1.8E+08	3.4E+07	0.0E-01	0.0E-01
CO 58	7.8E+05	3.8E+08	2.9E+07	4.8E+06	0.0E-01	0.0E-01
CO 60	4.5E+06	2.3E+10	1.2E+08	1.7E+07	0.0E-01	0.0E-01
CU 64	1.5E+04	6.1E+05	1.9E+06	3.2E+05	0.0E-01	0.0E-01
ZN 65	6.5E+05	7.5E+08	1.2E+10	1.7E+09	0.0E-01	0.0E-01
ZN 69M	4.1E+04	1.3E+06	2.4E+07	4.3E+06	0.0E-01	0.0E-01
AS 76	2.7E+04	3.8E+06	2.2E+07	4.0E+06	0.0E-01	0.0E-01
BR 82	1.3E+04	2.1E+07	9.8E+07	1.8E+07	0.0E-01	0.0E-01
SR 89	2.0E+06	2.2E+04	6.0E+09	1.8E+10	0.0E-01	0.0E-01
SR 90	1.6E+07	6.7E+06	1.2E+11	2.9E+11	0.0E-01	0.0E-01
ZR 95	1.8E+06	2.5E+08	4.0E+05	6.5E+04	0.0E-01	0.0E-01
NB 95	4.8E+05	1.4E+08	9.6E+07	1.7E+07	0.0E-01	0.0E-01
ZR 97	1.4E+05	3.0E+06	2.2E+04	4.0E+03	0.0E-01	0.0E-01
NB 97	2.7E+04	1.8E+05	1.1E-06	1.9E-07	0.0E-01	0.0E-01
MO 99	1.3E+05	4.0E+06	1.6E+08	2.8E+07	0.0E-01	0.0E-01
TC 99M	2.0E+03	1.8E+05	8.2E+03	1.5E+03	0.0E-01	0.0E-01
RU106	1.2E+07	4.2E+08	8.0E+05	1.2E+05	0.0E-01	0.0E-01
AG110M	3.7E+06	3.5E+09	8.2E+09	1.2E+09	0.0E-01	0.0E-01
SB124	2.6E+06	6.0E+08	3.1E+08	5.1E+07	0.0E-01	0.0E-01
SB125	1.6E+06	1.6E+09	1.1E+08	1.6E+07	0.0E-01	0.0E-01
SB126	9.6E+05	8.4E+07	2.1E+08	3.7E+07	0.0E-01	0.0E-01
SB127	2.2E+05	1.7E+07	5.5E+07	9.9E+06	0.0E-01	0.0E-01
TE127	2.4E+04	3.0E+03	6.8E+04	1.2E+04	0.0E-01	0.0E-01
TE131M	2.0E+05	8.0E+06	1.2E+07	2.1E+06	0.0E-01	0.0E-01
I 131	1.5E+07	8.6E+06	2.6E+11	4.7E+11	0.0E-01	0.0E-01
I 132	1.7E+05	6.2E+05	3.4E+01	6.1E+01	0.0E-01	0.0E-01
I 133	3.6E+06	1.2E+06	2.4E+09	4.3E+09	0.0E-01	0.0E-01
I 135	7.0E+05	1.3E+06	4.9E+06	8.9E+06	0.0E-01	0.0E-01
CS134	7.0E+05	6.9E+09	3.7E+10	1.4E+11	0.0E-01	0.0E-01
CS136	1.3E+05	1.5E+08	2.8E+09	1.2E+10	0.0E-01	0.0E-01
CS137	6.1E+05	1.3E+10	3.6E+10	1.3E+11	0.0E-01	0.0E-01
CS138	8.8E+02	3.6E+05	1.2E-22	5.6E-22	0.0E-01	0.0E-01
BA140	1.6E+06	2.1E+07	1.2E+08	2.1E+07	0.0E-01	0.0E-01
LA140	1.7E+05	1.9E+07	9.4E+04	1.7E+04	0.0E-01	0.0E-01
CE141	5.2E+05	1.4E+07	6.4E+06	1.1E+06	0.0E-01	0.0E-01
CE144	9.8E+06	7.0E+07	7.1E+07	1.1E+07	0.0E-01	0.0E-01
ND147	3.2E+05	8.5E+06	2.8E+05	5.0E+04	0.0E-01	0.0E-01
HF179M	2.8E+04	0.0E-01	0.0E-01	0.0E-01	0.0E-01	0.0E-01
HF181	8.4E+04	2.1E+08	5.9E+05	9.9E+04	0.0E-01	0.0E-01
W 185	6.3E+05	1.8E+04	2.7E+07	4.4E+06	0.0E-01	0.0E-01

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AMENDMENT NO. 6
November 1988

Table 3-9

INPUT PARAMETERS NEEDED FOR CALCULATING DOSE SUMMARIES TO THE MAXIMUM INDIVIDUAL AND THE POPULATION WITHIN 50 MILES FROM WNP-2 GASEOUS EFFLUENT

Input Parameter	Value	Reference*
Distance to Maine (miles)	3000	Ref 1
Fraction of year leafy vegetables are grown	0.42	Ref 2
Fraction of year cows are on pasture	0.5	Ref 2
Fraction of crop from garden	0.76	Ref 3
Fraction of daily intake of cows derived from pasture while on pasture	1.0	Ref 2
Annual average relative humidity (%)	53.8	Ref 4
Annual average temperature (F°)	53.0	Ref 5
Fraction of year goats are on pasture	0.75	Ref 2
Fraction of daily intake of goats derived from pasture while on pasture	1.0	Ref 2
Fraction of year beef cattle are on pasture	0.5	Ref 2
Fraction of daily intake of beef cattle derived from pasture while on pasture	1.0	Ref 2
Population within 50 miles of plant by direction and radii interval in miles.	252,356	Ref 6
Annual 50-mile milk production (liters/yr)	2.8E+08	Refs 7 & 9
Annual 50-mile meat production (kg/yr)	2.3E+07	Refs 7 & 9
Annual 50-mile vegetable production (kg/yr)	3.5E+09	Refs 7 & 9
Source terms		Ref 8

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Table 3-14

REFERENCES FOR VALUES LISTED IN TABLE 3-9

- | | |
|--------------|--|
| Reference 1 | U.S. Map |
| Reference 2 | Site Specific |
| Reference 3 | Regulatory Guide 1.109, Revision 1, Table E-15 |
| Reference 4 | Section 2.3, WNP-2 FSAR, Table 2.3-1 |
| Reference 5 | Section 2.3, WNP-2 FSAR, page 2.3-3 |
| Reference 6 | WNP-1 & WNP-2 Emergency Preparedness Plan Table 12.1,
Permanent Population Distribution, Rev 5, Feb. 88 |
| Reference 7 | 1986 50-Mile Land Use Census, WPPSS REMP |
| Reference 8 | WNP-2 Effluent Analysis for Applicable Time Period |
| Reference 9 | Radiological Programs Calculation Log No. 88-3 |
| Reference 10 | WNP-2 XOQDOQ Computer Run |

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TABLE 3-16 ANNUAL DOSES AT SPECIAL LOCATIONS WITHIN WNP-2 SITE BOUNDARY

Source: WNP-2 Gaseous Effluent

Location	Distance (Miles)	Occupancy (hrs/yr)	Whole Body Dose (mrem/yr)	Thyroid Dose (mrem/yr)
BPA Ashe Substation	0.5 N	2080	1.1E+00	1.7E+00
DOE Train	0.5 SE*	78	6.7E-02	1.0E-01
Wye Burial Site	0.5 WNW	8	4.1E-03	6.5E-03
WNP-1	1.2 ESE	2080	3.8E-02	1.3E-01
WNP-4	1.0 ENE	2080	7.0E-02	1.1E-01
WNP-2 Visitor Center	0.08 ESE	8	8.6E-02	1.3E-01
Taylor Flats**	4.2 ESE	8760	3.1E-02	5.2E+00
Site Boundary***	1.2 SE	8760	1.1E+00	1.7E+00

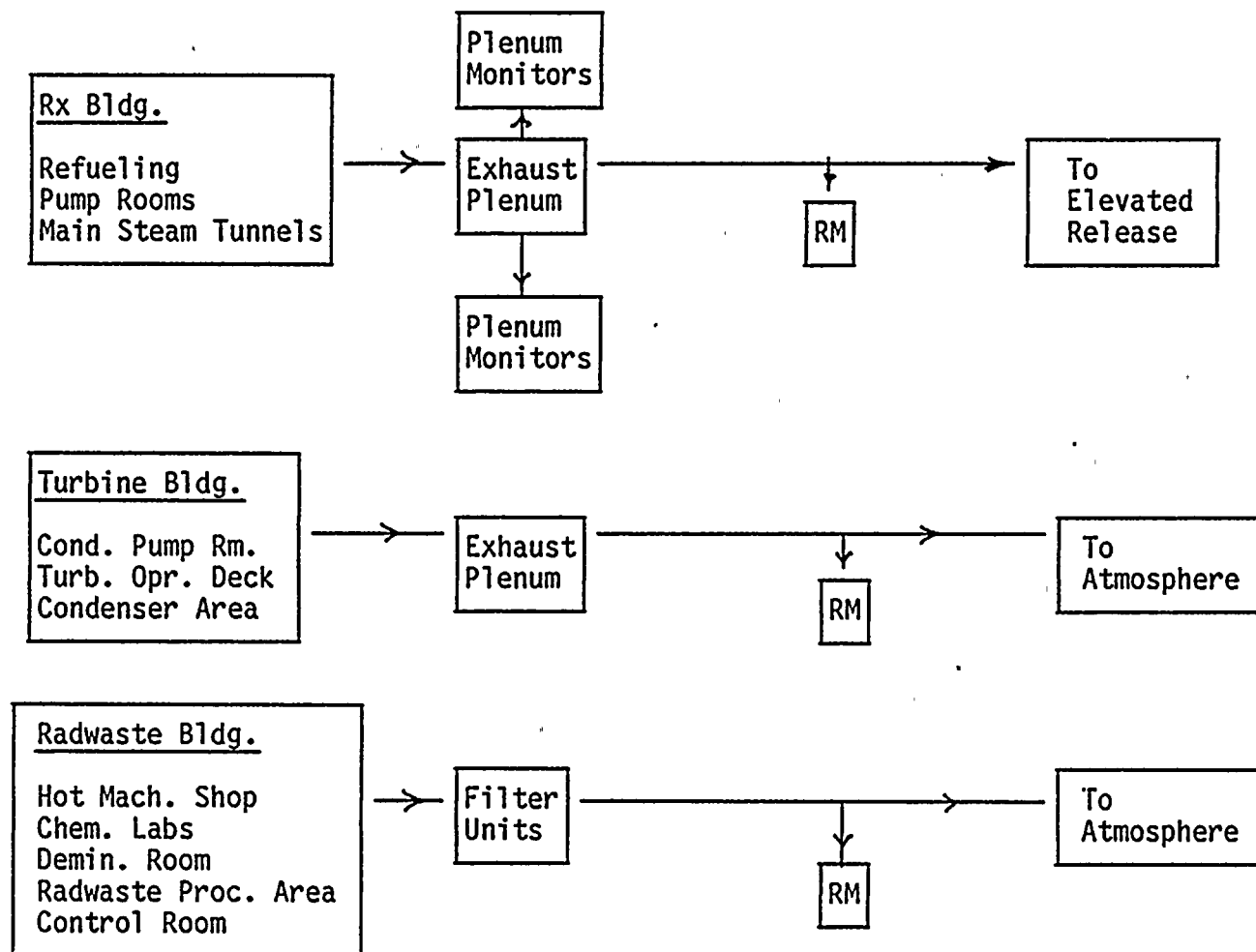
*The sector with the highest X/Q values (within 0-0.5 mile radius) was used.

**Not within site boundary. Closest residential area representative of maximum individual dose from plume, ground, ingestion, and inhalation exposure pathways. Included for comparison.

***Assumed continuously occupied. Actual occupancy is very low. Doses from Inhalation and Ground Exposure pathways. No food crops.

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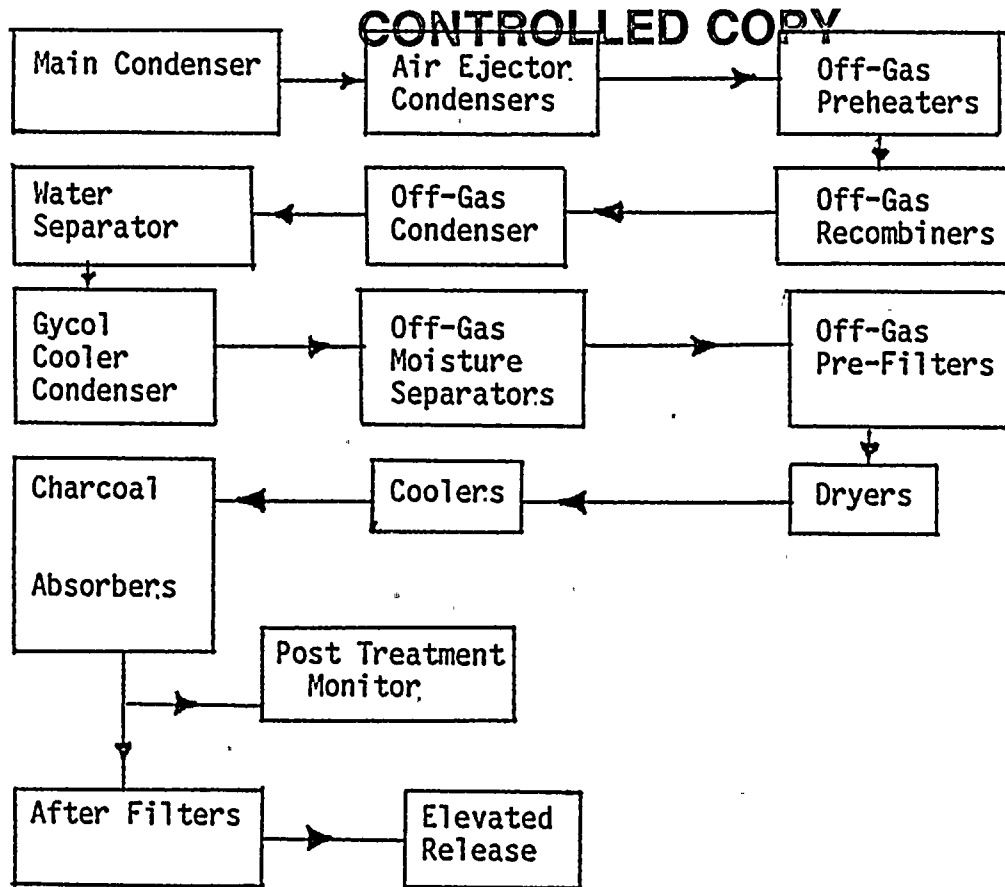
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SIMPLIFIED BLOCK DIAGRAM
OF
GASEOUS WASTE SYSTEM

Figure 3-2

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SIMPLIFIED BLOCK DIAGRAM
OF
OFF-GAS TREATMENT SYSTEM

Figure 3-3

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RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS INSIDE OF 10 MILE RADIUS

Figure 5-1

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