Table 3-1

DOSE FACTORS FOR NOBLE GASES AND DAUGHTERS*

Radionuclide	Total Body Dose Factor K_i (mrem/yr per μCi/m3)	Skin Dose Factor L_i (mrem/yr per μCi/m3)	Gamma Air Dose Factor M_i (mrad/yr per μCi/m3)	Beta Air Dose Factor N_i (mrad/yr per μCi/m3)
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.

**7.56E-02 = 7.56×10^{-2}.

The values listed above were taken from Table B-1 of NRC Regulatory Guide 1.109, Revision 1. The values were multiplied by 10^6 to convert picocuries^{-1} to microcuries^{-1}.

Table 3-2

DISTANCES (MILES) TO TYPICAL CONTROLLING LOCATIONS
AS MEASURED FROM CENTER OF COLUMBIA GENERATING STATION
CONTAINMENT BUILDING*

Location	Distance (miles)	Sector	Dose Pathways
Site Boundary	1.2	SE	Air dose measurement
One	4.2	ESE	Ground, vegetables, and inhalation
Two	6.4	SE	Ground, meat, and inhalation
Three	4.5	ESE	Ground, vegetables, and inhalation
Four	4.1	ENE	Ground, vegetables, and inhalation
Five	4.3	NE	Ground and inhalation
Six	7.2	ESE	Ground, Cow milk, and inhalation

*Typical locations and pathways are based on the current Land Use Census (LUC).

Table 3-3

LONG-TERM AVERAGE DISPERSION (X/Q) AND DEPOSITION (D/Q) VALUES FOR TYPICAL LOCATIONS

Location	Sector	Distance (miles)	Point of Release	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	Reactor Bldg.	2.7E-07	2.7E-07	2.6E-07	2.0E-09
			Turbine Bldg.	1.4E-05	1.3E-05	1.2E-05	1.2E-08
			Radwaste Bldg.	1.4E-05	1.3E-05	1.2E-05	1.2E-08
One	ESE	4.2	Reactor Bldg.	1.5E-06	1.5E-06	1.2E-06	6.0E-10
			Turbine Bldg.	1.1E-06	1.0E-06	8.1E-07	6.0E-10
			Radwaste Bldg.	1.1E-06	1.0E-06	8.1E-07	6.0E-10
Two	SE	6.4	Reactor Bldg.	3.7E-07	3.5E-07	3.4E-07	3.2E-10
			Turbine Bldg.	7.2E-07	6.8E-07	5.1E-07	2.6E-10
			Radwaste Bldg.	7.2E-07	6.8E-07	5.1E-07	2.6E-10
Three	ESE	4.5	Reactor Bldg.	1.6E-06	1.5E-06	1.3E-06	5.1E-10
			Turbine Bldg.	1.0E-06	9.8E-07	7.7E-07	5.1E-10
			Radwaste Bldg.	1.0E-06	9.8E-07	7.7E-07	5.1E-10
Four	ENE	4.1	Reactor Bldg.	9.8E-07	9.3E-07	7.7E-07	3.8E-10
			Turbine Bldg.	6.9E-07	6.5E-07	5.2E-07	3.7E-10
			Radwaste Bldg.	6.9E-07	6.5E-07	5.2E-07	3.7E-10
Five	NE	4.3	Reactor Bldg.	6.8E-08	6.6E-08	6.6E-08	1.3E-10
			Turbine Bldg.	6.7E-07	6.3E-07	5.0E-07	3.7E-10
			Radwaste Bldg.	6.7E-07	6.3E-07	5.0E-07	3.7E-10
Six	ESE	7.2	Reactor Bldg.	7.9E-07	7.1E-07	5.9E-07	1.9E-10
			Turbine Bldg.	5.2E-07	4.7E-07	3.6E-07	1.9E-10
			Radwaste Bldg.	5.2E-07	4.7E-07	3.6E-07	1.9E-10

Table 3-4

DOSE RATE PARAMETERS
IMPLEMENTATION OF 10 CFR 20, AIRBORNE RELEASES

		Child Dose Factor*		P_i^I
Nuclide	$\lambda(sec^{-1})$	DFA_i mrem/pCi	DFG_i mrem/hr pCi/m^2	Inhalation mrem/yr μCi/m^3
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
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

Table 3-4

DOSE RATE PARAMETERS
IMPLEMENTATION OF 10 CFR 20, AIRBORNE RELEASES

		Child Dose Factor*		P_i^I
Nuclide	$\lambda(sec^{-1})$	DFA_i mrem/pCi	DFG_i mrem/hr pCi/m^2	Inhalation mrem/yr μCi/m^3
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
Np-239	3.4E-06	1.7E-05	9.5E-10	6.4E+04

* 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.

Table 3-5a

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

Radionuclide	Inhalation (mrem/yr per μCi/M^3)	Ground Plane (M^2*mrem/yr per μCi/sec)	Cow Milk (M^2*mrem/yr per μCi/sec)	Goat Milk (M^2*mrem/yr per μCi/sec)	Animal Meat (M^2*mrem/yr per μCi/sec)	Vegetables (M^2*mrem/yr per μCi/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
NP239	1.2E+05	1.7E+06	3.7E+04	6.7E+03	2.6E+03	1.6E+07

NOTE: The Y-90 ground plane dose factor was used for Sr-90.
The PARTS subroutine of GASPAR II was used to produce this table.

Table 3-5b

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

Radionuclide	Inhalation (mrem/yr per μCi/M^3)	Ground Plane (M^2*mrem/yr per μCi/sec)	Cow Milk (M^2*mrem/yr per μCi/sec)	Goat Milk (M^2*mrem/yr per μCi/sec)	Animal Meat (M^2*mrem/yr per μCi/sec)	Vegetables (M^2*mrem/yr per μCi/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	1.6E+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
NP239	1.3E+05	1.7E+06	5.3E+04	9.6E+03	1.7E+03	1.4E+07

NOTE: The Y-90 ground plane dose factor was used for Sr-90.
The PARTS subroutine of GASPAR II was used to produce this table.

Table 3-5c

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

Radionuclide	Inhalation (mrem/yr per μCi/M^3)	Ground Plane (M^2*mrem/yr per μCi/sec)	Cow Milk (M^2*mrem/yr per μCi/sec)	Goat Milk (M^2*mrem/yr per μCi/sec)	Animal Meat (M^2*mrem/yr per μCi/sec)	Vegetables (M^2*mrem/yr per μCi/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	3.3E+06
BR 82	2.1E+04	2.1E+07	5.8E+07	1.0E+07	7.6E+02	9.5E+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
NP239	6.4E+04	1.7E+06	4.6E+04	8.3E+03	1.1E+03	1.0E+07

NOTE: The Y-90 ground plane dose factor was used for Sr-90.
The PARTS subroutine of GASPAR II was used to produce this table.

Table 3-5d

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

Radionuclide	Inhalation (mrem/yr per μCi/M^3)	Ground Plane (M^2*mrem/yr per μCi/sec)	Cow Milk (M^2*mrem/yr per μCi/sec)	Goat Milk (M^2*mrem/yr per μCi/sec)	Animal Meat (M^2*mrem/yr per μCi/sec)	Vegetables (M^2*mrem/yr per μCi/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	2.4E+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
NP239	6.0E+04	1.7E+06	4.7E+04	8.5E+03	0.0E-01	0.0E-01

NOTE: The Y-90 ground plane dose factor was used for Sr-90.
The PARTS subroutine of GASPAR II was used to produce this table.

Table 3-6

INPUT PARAMETERS FOR CALCULATING R_i^c

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
$(DFL_i)_a$ (mrem/pCi)	Each radionuclide	E-11 to E-14
Y_P (kg/m^2)	0.7	E-15
Y_s (kg/m^2)	2.0	E-15
t_f (seconds)	1.73×10^5 (2 days)	E-15
t_h (seconds)	7.78×10^6 (90 days)	E-15
Q_F (kg/day)	50 for cow	E-3
	6 for goat	E-3
fs (dimensionless)	1.0	NUREG-0133
fp (dimensionless)	0.5 for cow	Site specific
	0.75 for goat	Site specific

*Of Regulatory Guide 1.109, Revision 1 unless stated otherwise.

Table 3-7

INPUT PARAMETERS FOR CALCULATING R_i^M

Parameter		Value	Table*
r (dimensionless)		1.0 for radioiodine	E-15
		0.2 for particulates	E-15
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
$(DFL_i)_a$ (mrem/pCi)		Each radionuclide	E-11 to E-14
Y_p (kg/m^2)		0.7	E-15
Y_s (kg/m^2)		2.0	E-15
t_f (seconds)		1.73×10^6 (20 days)	E-15
t_h (seconds)		7.78×10^6 (90 days)	E-15
Q_F (kg/day)		50	E-3

*Of Regulatory Guide 1.109, Revision 1.

Table 3-8
INPUT PARAMETERS FOR CALCULATING R_i^V

Parameter		Value	Table*
r (dimensionless)		1.0 for radioiodine	E-1
		0.2 for particulates	E-1
$(DFL_i)_a$ (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)		0.42	Ref 2**
f_g (dimensionless)		0.76	E-15
t_L (seconds)		8.6×10^4 (1 day)	E-15
t_h (seconds)		5.18×10^6 (60 days)	E-15
Y_v (kg/m^2)		2.0	E-15

*Of Regulatory Guide 1.109, Revision 1.
**Refer to Table 3-14.

Table 3-9

INPUT PARAMETERS NEEDED FOR CALCULATING DOSE SUMMARIES TO THE MAXIMUM INDIVIDUAL AND THE POPULATION WITHIN 50 MILES FROM 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

Table 3-9 (contd.)

Input Parameter	Value	Reference*
X/Q values by sector for each distance (recirculation, no decay) (sec/m^3)	See Tables 3-10 and 3-11	Ref 10
X/Q values by sector for each distance (recirculation, 2.26 days decay, undepleted) (sec/m^3)	See Tables 3-10 and 3-11	Ref 10
X/Q values by sector for each distance (recirculation, 8.0 days decay, depleted) (sec/m^3)	See Tables 3-10 and 3-11	Ref 10
D/Q values by sector for each distance ($1/m^2$)	See Tables 3-10 and 3-11	Ref 10

*References are listed in Table 3-14.

TABLE 3-10

REACTOR BUILDING STACK X/Q AND D/Q VALUES

A) NO DECAY, UNDEPLETED
CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

DIRECTION FROM SITE	SEGMENT BOUNDARIES IN MILES FROM THE SITE									
	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	3.899E-07	1.486E-07	6.171E-08	3.982E-08	3.093E-08	2.000E-08	2.118E-07	1.769E-07	1.196E-07	8.944E-08
SSW	2.557E-07	9.471E-08	3.914E-08	2.553E-08	2.000E-08	1.411E-08	1.702E-07	1.431E-07	9.698E-08	7.264E-08
SW	1.635E-07	6.378E-08	3.299E-08	2.517E-08	1.999E-08	3.647E-08	1.045E-07	7.704E-08	5.209E-08	3.894E-08
WSW	6.676E-08	2.927E-08	1.506E-08	1.122E-08	8.872E-09	1.668E-08	5.532E-08	4.156E-08	2.808E-08	2.098E-08
W	6.588E-08	2.996E-08	1.509E-08	1.090E-08	8.368E-09	4.928E-09	2.837E-08	2.330E-08	1.569E-08	1.170E-08
WNW	1.279E-07	5.746E-08	3.018E-08	2.258E-08	1.781E-08	1.324E-08	5.160E-08	4.103E-08	2.750E-08	2.044E-08
NW	2.294E-07	8.625E-08	3.624E-08	2.423E-08	1.934E-08	1.543E-08	9.519E-08	7.785E-08	5.228E-08	3.891E-08
NNW	5.137E-07	1.770E-07	6.982E-08	4.507E-08	4.224E-08	2.976E-08	1.801E-07	1.479E-07	9.945E-08	7.407E-08
N	6.024E-07	2.016E-07	8.063E-08	5.264E-08	4.120E-08	2.146E-07	2.652E-07	1.430E-07	9.579E-08	7.115E-08
NNE	4.988E-07	1.690E-07	6.861E-08	4.526E-08	4.339E-08	2.904E-07	1.966E-07	1.057E-07	7.066E-08	5.243E-08
NE	3.347E-07	1.195E-07	4.965E-08	4.175E-08	1.400E-07	3.198E-07	1.723E-07	9.247E-08	6.174E-08	4.576E-08
ENE	4.184E-07	3.067E-07	4.347E-07	9.267E-07	8.436E-07	4.052E-07	1.641E-07	8.817E-08	5.893E-08	4.371E-08
E	4.207E-07	3.460E-07	4.968E-07	1.027E-06	8.714E-07	4.159E-07	1.669E-07	8.906E-08	5.928E-08	4.385E-08
ESE	6.224E-07	5.205E-07	7.813E-07	1.572E-06	1.364E-06	5.365E-07	2.045E-07	1.403E-07	9.350E-08	6.922E-08
SE	5.045E-07	2.156E-07	1.174E-07	3.944E-07	6.347E-07	3.083E-07	2.738E-07	1.923E-07	1.289E-07	9.576E-08
SSE	4.591E-07	1.855E-07	7.985E-08	5.319E-08	4.237E-08	3.085E-08	2.635E-07	2.188E-07	1.475E-07	1.100E-07

TABLE 3-10 (CONTD)

B) 2.260 DAY DECAY, UNDEPLETED
CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

DIRECTION FROM SITE	SEGMENT BOUNDARIES IN MILES FROM THE SITE									
	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	3.887E-07	1.477E-07	6.094E-08	3.904E-08	3.008E-08	1.898E-08	1.813E-07	1.424E-07	8.918E-08	6.201E-08
SSW	2.550E-07	9.411E-08	3.866E-08	2.504E-08	1.947E-08	1.341E-08	1.493E-07	1.190E-07	7.530E-08	5.275E-08
SW	1.630E-07	6.338E-08	3.255E-08	2.463E-08	1.939E-08	3.438E-08	9.132E-08	6.300E-08	3.969E-08	2.776E-08
WSW	6.657E-08	2.909E-08	1.484E-08	1.093E-08	8.533E-09	1.521E-08	4.618E-08	3.210E-08	1.995E-08	1.381E-08
W	6.563E-08	2.972E-08	1.488E-08	1.069E-08	8.157E-09	4.721E-09	2.319E-08	1.757E-08	1.077E-08	7.365E-09
WNW	1.275E-07	5.702E-08	2.970E-08	2.201E-08	1.717E-08	1.226E-08	4.063E-08	2.933E-08	1.765E-08	1.194E-08
NW	2.287E-07	8.575E-08	3.584E-08	2.381E-08	1.888E-08	1.470E-08	8.026E-08	6.139E-08	3.811E-08	2.642E-08
NNW	5.125E-07	1.760E-07	6.913E-08	4.439E-08	4.130E-08	2.853E-08	1.614E-07	1.269E-07	8.077E-08	5.711E-08
N	6.011E-07	2.006E-07	7.988E-08	5.189E-08	4.040E-08	2.000E-07	2.381E-07	1.202E-07	7.574E-08	5.313E-08
NNE	4.978E-07	1.682E-07	6.795E-08	4.456E-08	4.236E-08	2.707E-07	1.714E-07	8.475E-08	5.256E-08	3.639E-08
NE	3.339E-07	1.188E-07	4.909E-08	4.089E-08	1.348E-07	2.908E-07	1.447E-07	7.008E-08	4.277E-08	2.924E-08
ENE	4.172E-07	3.040E-07	4.272E-07	8.948E-07	7.996E-07	3.720E-07	1.390E-07	6.706E-08	4.134E-08	2.827E-08
E	4.194E-07	3.430E-07	4.885E-07	9.909E-07	8.315E-07	3.861E-07	1.445E-07	7.067E-08	4.346E-08	2.986E-08
ESE	6.207E-07	5.158E-07	7.670E-07	1.523E-06	1.306E-06	5.046E-07	1.776E-07	1.132E-07	7.012E-08	4.846E-08
SE	5.030E-07	2.142E-07	1.159E-07	3.850E-07	6.171E-07	2.946E-07	2.383E-07	1.554E-07	9.668E-08	6.701E-08
SSE	4.577E-07	1.843E-07	7.887E-08	5.214E-08	4.117E-08	2.911E-08	2.219E-07	1.724E-07	1.072E-07	7.416E-08

TABLE 3-10 (CONTD)

C) 8.000 DAY DECAY, UNDEPLETED
CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

DIRECTION FROM SITE	SEGMENT BOUNDARIES IN MILES FROM THE SITE									
	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	3.793E-07	1.434E-07	5.872E-08	3.765E-08	2.919E-08	1.879E-08	1.925E-07	1.497E-07	9.326E-08	6.496E-08
SSW	2.479E-07	9.089E-08	3.705E-08	2.403E-08	1.880E-08	1.325E-08	1.561E-07	1.226E-07	7.691E-08	5.388E-08
SW	1.572E-07	6.070E-08	3.115E-08	2.387E-08	1.896E-08	3.473E-08	9.189E-08	6.223E-08	3.871E-08	2.694E-08
WSW	6.375E-08	2.776E-08	1.416E-08	1.057E-08	8.356E-09	1.572E-08	4.792E-08	3.295E-08	2.035E-08	1.407E-08
W	6.471E-08	2.914E-08	1.449E-08	1.047E-08	8.037E-09	4.713E-09	2.534E-08	1.922E-08	1.182E-08	8.138E-09
WNW	1.255E-07	5.587E-08	2.901E-08	2.171E-08	1.709E-08	1.261E-08	4.452E-08	3.233E-08	1.960E-08	1.335E-08
NW	2.228E-07	8.309E-08	3.451E-08	2.300E-08	1.837E-08	1.471E-08	8.579E-08	6.505E-08	4.009E-08	2.769E-08
NNW	4.947E-07	1.686E-07	6.558E-08	4.219E-08	3.996E-08	2.820E-08	1.654E-07	1.272E-07	7.938E-08	5.547E-08
N	5.785E-07	1.917E-07	7.566E-08	4.927E-08	3.863E-08	2.032E-07	2.372E-07	1.154E-07	7.127E-08	4.939E-08
NNE	4.769E-07	1.602E-07	6.423E-08	4.232E-08	4.105E-08	2.728E-07	1.696E-07	8.150E-08	4.985E-08	3.425E-08
NE	3.220E-07	1.141E-07	4.688E-08	3.977E-08	1.366E-07	2.947E-07	1.433E-07	6.805E-08	4.121E-08	2.806E-08
ENE	4.056E-07	2.988E-07	3.849E-07	7.340E-07	6.588E-07	2.951E-07	1.033E-07	4.759E-08	2.806E-08	1.864E-08
E	4.072E-07	3.375E-07	4.406E-07	8.152E-07	6.738E-07	3.000E-07	1.042E-07	4.785E-08	2.822E-08	1.877E-08
ESE	5.997E-07	5.068E-07	6.926E-07	1.240E-06	1.053E-06	3.916E-07	1.247E-07	7.545E-08	4.463E-08	2.978E-08
SE	4.883E-07	2.075E-07	1.122E-07	3.874E-07	6.185E-07	2.852E-07	2.217E-07	1.413E-07	8.648E-08	5.940E-08
SSE	4.476E-07	1.796E-07	7.640E-08	5.064E-08	4.029E-08	2.929E-08	2.179E-07	1.669E-07	1.027E-07	7.085E-08

TABLE 3-10 (CONTD)

D) REACTOR BUILDING D/Q

RELATIVE DEPOSITION PER UNIT AREA (M**-2) BY DOWNWIND SECTORS

SEGMENT BOUNDARIES IN MILES

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	4.044E-09	1.146E-09	3.717E-10	1.874E-10	1.127E-10	4.635E-11	3.868E-11	2.283E-11	1.219E-11	7.548E-12
SSW	2.643E-09	7.296E-10	2.324E-10	1.165E-10	7.000E-11	2.916E-11	2.663E-11	1.596E-11	8.526E-12	5.278E-12
SW	1.429E-09	4.068E-10	1.407E-10	6.799E-11	4.016E-11	3.192E-11	2.386E-11	9.555E-12	5.104E-12	3.160E-12
WSW	4.407E-10	1.347E-10	4.908E-11	2.400E-11	1.423E-11	1.224E-11	9.617E-12	3.865E-12	2.064E-12	1.278E-12
W	5.587E-10	1.780E-10	6.665E-11	3.253E-11	1.929E-11	7.707E-12	6.116E-12	3.617E-12	1.932E-12	1.196E-12
WNW	1.110E-09	3.459E-10	1.262E-10	6.186E-11	3.674E-11	2.357E-11	1.640E-11	6.963E-12	3.719E-12	2.302E-12
NW	2.199E-09	6.289E-10	2.051E-10	1.036E-10	6.242E-11	2.625E-11	2.528E-11	1.520E-11	8.117E-12	5.025E-12
NNW	5.161E-09	1.411E-09	4.463E-10	2.231E-10	1.382E-10	5.828E-11	5.329E-11	3.186E-11	1.702E-11	1.053E-11
N	7.312E-09	1.932E-09	6.001E-10	2.970E-10	1.774E-10	1.307E-10	8.654E-11	3.430E-11	1.832E-11	1.134E-11
NNE	6.688E-09	1.751E-09	5.437E-10	2.675E-10	1.637E-10	1.566E-10	6.754E-11	2.677E-11	4.430E-11	8.851E-12
NE	4.654E-09	1.223E-09	3.808E-10	1.931E-10	2.225E-10	1.592E-10	4.683E-11	1.873E-11	1.000E-11	6.191E-12
ENE	4.842E-09	1.277E-09	6.137E-10	5.265E-10	3.056E-10	1.189E-10	3.440E-11	1.364E-11	7.286E-12	4.511E-12
E	4.004E-09	1.121E-09	6.044E-10	5.617E-10	3.268E-10	1.248E-10	3.590E-11	1.441E-11	7.695E-12	4.763E-12
ESE	6.270E-09	1.764E-09	9.704E-10	9.016E-10	5.207E-10	2.008E-10	5.788E-11	2.316E-11	1.237E-11	7.659E-12
SE	5.027E-09	1.477E-09	5.218E-10	5.481E-10	6.894E-10	2.662E-10	7.839E-11	3.142E-11	1.678E-11	1.039E-11
SSE	4.426E-09	1.321E-09	4.452E-10	2.267E-10	1.366E-10	5.692E-11	4.873E-11	2.896E-11	1.547E-11	9.573E-12

TABLE 3-11

TURBINE OR RADWASTE BUILDING X/Q AND D/Q VALUES

A) NO DECAY, UNDEPLETED
CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

DIRECTION FROM SITE	SEGMENT BOUNDARIES IN MILES FROM THE SITE									
	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	2.782E-05	7.806E-06	2.832E-06	1.567E-06	1.037E-06	5.081E-07	2.113E-07	1.153E-07	7.771E-08	5.794E-08
SSW	2.117E-05	6.000E-06	2.195E-06	1.220E-06	8.099E-07	3.989E-07	1.671E-07	9.172E-08	6.199E-08	4.631E-08
SW	1.211E-05	3.404E-06	1.236E-06	6.834E-07	4.521E-07	2.214E-07	9.199E-08	5.019E-08	3.381E-08	2.520E-08
WSW	6.468E-06	1.831E-06	6.680E-07	3.702E-07	2.451E-07	1.202E-07	5.001E-08	2.729E-08	1.837E-08	1.369E-08
W	4.034E-06	1.113E-06	3.982E-07	2.186E-07	1.439E-07	6.994E-08	2.873E-08	1.555E-08	1.043E-08	7.751E-09
WNW	7.812E-06	2.127E-06	7.518E-07	4.096E-07	2.682E-07	1.292E-07	5.239E-08	2.809E-08	1.873E-08	1.387E-08
NW	1.386E-05	3.830E-06	1.370E-06	7.517E-07	4.944E-07	2.397E-07	9.809E-08	5.290E-08	3.538E-08	2.624E-08
NNW	2.549E-05	7.081E-06	2.548E-06	1.402E-06	9.242E-07	4.498E-07	1.849E-07	1.001E-07	6.703E-08	4.976E-08
N	2.640E-05	7.275E-06	2.599E-06	1.424E-06	9.356E-07	4.528E-07	1.845E-07	9.915E-08	6.615E-08	4.897E-08
NNE	2.061E-05	5.617E-06	1.986E-06	1.082E-06	7.085E-07	3.410E-07	1.379E-07	7.372E-08	4.906E-08	3.626E-08
NE	1.800E-05	4.929E-06	1.749E-06	9.543E-07	6.251E-07	3.009E-07	1.217E-07	6.502E-08	4.323E-08	3.193E-08
ENE	1.715E-05	4.677E-06	1.656E-06	9.030E-07	5.914E-07	2.848E-07	1.152E-07	6.164E-08	4.103E-08	3.032E-08
E	1.821E-05	4.961E-06	1.751E-06	9.521E-07	6.221E-07	2.982E-07	1.198E-07	6.368E-08	4.221E-08	3.111E-08
ESE	2.834E-05	7.730E-06	2.730E-06	1.484E-06	9.699E-07	4.651E-07	1.870E-07	9.951E-08	6.602E-08	4.868E-08
SE	3.509E-05	9.697E-06	3.466E-06	1.899E-06	1.247E-06	6.035E-07	2.459E-07	1.322E-07	8.823E-08	6.534E-08
SSE	3.628E-05	1.013E-05	3.656E-06	2.015E-06	1.330E-06	6.485E-07	2.677E-07	1.453E-07	9.755E-08	7.255E-08

TABLE 3-11 (CONTD)

B) 2.260 DAY DECAY, UNDEPLETED
CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

DIRECTION FROM SITE	SEGMENT BOUNDARIES IN MILES FROM THE SITE									
	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	2.763E-05	7.701E-06	2.766E-06	1.515E-06	9.933E-07	4.745E-07	1.848E-07	9.291E-08	5.799E-08	4.022E-08
SSW	2.104E-05	5.933E-06	2.152E-06	1.186E-06	7.812E-07	3.766E-07	1.492E-07	7.615E-08	4.802E-08	3.355E-08
SW	1.203E-05	3.361E-06	1.208E-06	6.623E-07	4.343E-07	2.077E-07	8.127E-08	4.111E-08	2.581E-08	1.801E-08
WSW	6.405E-06	1.797E-06	6.466E-07	3.537E-07	2.313E-07	1.098E-07	4.210E-08	2.083E-08	1.286E-08	8.865E-09
W	4.001E-06	1.095E-06	3.867E-07	2.097E-07	1.363E-07	6.412E-08	2.424E-08	1.183E-08	7.228E-09	4.937E-09
WNW	7.732E-06	2.084E-06	7.250E-07	3.891E-07	2.510E-07	1.163E-07	4.274E-08	2.033E-08	1.222E-08	8.256E-09
NW	1.376E-05	3.776E-06	1.337E-06	7.256E-07	4.724E-07	2.229E-07	8.513E-08	4.216E-08	2.614E-08	1.810E-08
NNW	2.537E-05	7.013E-06	2.506E-06	1.369E-06	8.966E-07	4.286E-07	1.683E-07	8.590E-08	5.449E-08	3.842E-08
N	2.626E-05	7.199E-06	2.551E-06	1.387E-06	9.044E-07	4.289E-07	1.659E-07	8.349E-08	5.244E-08	3.668E-08
NNE	2.047E-05	5.544E-06	1.941E-06	1.047E-06	6.792E-07	3.187E-07	1.208E-07	5.960E-08	3.687E-08	2.548E-08
NE	1.784E-05	4.844E-06	1.696E-06	9.137E-07	5.910E-07	2.753E-07	1.025E-07	4.952E-08	3.013E-08	2.055E-08
ENE	1.701E-05	4.603E-06	1.610E-06	8.673E-07	5.613E-07	2.621E-07	9.803E-08	4.756E-08	2.901E-08	1.980E-08
E	1.808E-05	4.891E-06	1.707E-06	9.184E-07	5.938E-07	2.769E-07	1.037E-07	5.047E-08	3.090E-08	2.115E-08
ESE	2.813E-05	7.623E-06	2.663E-06	1.434E-06	9.278E-07	4.336E-07	1.634E-07	8.016E-08	4.941E-08	3.402E-08
SE	3.486E-05	9.574E-06	3.389E-06	1.840E-06	1.197E-06	5.654E-07	2.165E-07	1.075E-07	6.672E-08	4.615E-08
SSE	3.600E-05	9.979E-06	3.562E-06	1.942E-06	1.268E-06	6.016E-07	2.313E-07	1.150E-07	7.125E-08	4.919E-08

TABLE 3-11 (CONTD)

C) 8.000 DAY DECAY, DEPLETED
CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

DIRECTION FROM SITE	SEGMENT BOUNDARIES IN MILES FROM THE SITE									
	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	2.487E-05	6.658E-06	2.286E-06	1.213E-06	7.751E-07	3.540E-07	1.275E-07	5.998E-08	3.588E-08	2.411E-08
SSW	1.892E-05	5.121E-06	1.774E-06	9.460E-07	6.067E-07	2.788E-07	1.015E-07	4.823E-08	2.906E-08	1.964E-08
SW	1.082E-05	2.904E-06	9.977E-07	5.294E-07	3.382E-07	1.545E-07	5.566E-08	2.623E-08	1.571E-08	1.058E-08
WSW	5.777E-06	1.559E-06	5.378E-07	2.856E-07	1.824E-07	8.320E-08	2.980E-08	1.391E-08	8.267E-09	5.523E-09
W	3.605E-06	9.486E-07	3.209E-07	1.688E-07	1.072E-07	4.847E-08	1.714E-08	7.924E-09	4.679E-09	3.111E-09
WNW	6.978E-06	1.811E-06	6.046E-07	3.155E-07	1.992E-07	8.908E-08	3.092E-08	1.406E-08	8.205E-09	5.403E-09
NW	1.239E-05	3.267E-06	1.106E-06	5.816E-07	3.693E-07	1.668E-07	5.900E-08	2.734E-08	1.619E-08	1.080E-08
NNW	2.280E-05	6.047E-06	2.061E-06	1.089E-06	6.935E-07	3.153E-07	1.129E-07	5.307E-08	3.181E-08	2.145E-08
N	2.362E-05	6.211E-06	2.101E-06	1.105E-06	7.013E-07	3.169E-07	1.123E-07	5.225E-08	3.110E-08	2.086E-08
NNE	1.843E-05	4.793E-06	1.604E-06	8.381E-07	5.298E-07	2.377E-07	8.323E-08	3.832E-08	2.263E-08	1.507E-08
NE	1.608E-05	4.201E-06	1.409E-06	7.367E-07	4.655E-07	2.085E-07	7.255E-08	3.311E-08	1.939E-08	1.282E-08
ENE	1.532E-05	3.988E-06	1.335E-06	6.977E-07	4.409E-07	1.976E-07	6.893E-08	3.155E-08	1.853E-08	1.227E-08
E	1.628E-05	4.232E-06	1.413E-06	7.366E-07	4.646E-07	2.075E-07	7.206E-08	3.291E-08	1.932E-08	1.281E-08
ESE	2.534E-05	6.595E-06	2.203E-06	1.149E-06	7.248E-07	3.241E-07	1.128E-07	5.170E-08	3.045E-08	2.024E-08
SE	3.137E-05	8.274E-06	2.799E-06	1.471E-06	9.331E-07	4.210E-07	1.487E-07	6.892E-08	4.086E-08	2.729E-08
SSE	3.242E-05	8.636E-06	2.949E-06	1.558E-06	9.928E-07	4.510E-07	1.609E-07	7.503E-08	4.461E-08	2.984E-08

TABLE 3-11 (CONTD)

D) TURBINE OR RADWASTE DEPOSITION, D/Q.
RELATIVE DEPOSITION PER UNIT AREA (M**-2) BY DOWNWIND SECTORS

DIRECTION FROM SITE	SEGMENT BOUNDARIES IN MILES									
	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	2.664E-08	5.457E-09	1.425E-09	6.398E-10	3.620E-10	1.392E-10	4.027E-11	1.596E-11	8.523E-12	5.275E-12
SSW	1.853E-08	3.796E-09	9.909E-10	4.450E-10	2.518E-10	9.682E-11	2.801E-11	1.110E-11	5.928E-12	3.669E-12
SW	1.160E-08	2.375E-09	6.201E-10	2.785E-10	1.575E-10	6.058E-11	1.753E-11	6.947E-12	3.710E-12	2.296E-12
WSW	4.652E-09	9.529E-10	2.488E-10	1.117E-10	6.321E-11	2.431E-11	7.032E-12	2.787E-12	1.488E-12	9.212E-13
W	4.254E-09	8.714E-10	2.275E-10	1.022E-10	5.780E-11	2.223E-11	6.430E-12	2.549E-12	1.361E-12	8.424E-13
WNW	8.379E-09	1.716E-09	4.481E-10	2.012E-10	1.138E-10	4.378E-11	1.266E-11	5.020E-12	2.681E-12	1.659E-12
NW	1.761E-08	3.608E-09	9.419E-10	4.230E-10	2.393E-10	9.203E-11	2.662E-11	1.055E-11	5.635E-12	3.488E-12
NNW	3.707E-08	7.593E-09	1.982E-09	8.903E-10	5.036E-10	1.937E-10	5.603E-11	2.221E-11	1.186E-11	7.340E-12
N	4.270E-08	8.746E-09	2.283E-09	1.025E-09	5.801E-10	2.231E-10	6.454E-11	2.558E-11	1.366E-11	8.455E-12
NNE	3.448E-08	7.062E-09	1.844E-09	8.280E-10	4.684E-10	1.801E-10	5.211E-11	2.065E-11	1.103E-11	6.827E-12
NE	2.465E-08	5.050E-09	1.318E-09	5.921E-10	3.349E-10	1.288E-10	3.726E-11	1.477E-11	7.887E-12	4.881E-12
ENE	2.235E-08	4.579E-09	1.195E-09	5.368E-10	3.037E-10	1.168E-10	3.379E-11	1.339E-11	7.151E-12	4.426E-12
E	2.363E-08	4.841E-09	1.264E-09	5.676E-10	3.211E-10	1.235E-10	3.572E-11	1.416E-11	7.560E-12	4.679E-12
ESE	3.810E-08	7.804E-09	2.037E-09	9.150E-10	5.176E-10	1.991E-10	5.759E-11	2.282E-11	1.219E-11	7.544E-12
SE	4.168E-08	8.537E-09	2.229E-09	1.001E-09	5.663E-10	2.178E-10	6.300E-11	2.497E-11	1.333E-11	8.253E-12
SSE	3.672E-08	7.521E-09	1.963E-09	8.818E-10	4.988E-10	1.918E-10	5.550E-11	2.200E-11	1.175E-11	7.270E-12

Table 3-13

CHARACTERISTICS OF GASEOUS EFFLUENT RELEASE POINTS

	Reactor Building	Radwaste Building	Turbine Building
Height of release point above ground level (m)	70.3	20.4	36.3
Annual average rate of air flow from release point (m^3/sec)	37.8	39.2	169.9
Annual average heat flow from release point (cal/sec)	1.06×10^6	2.9×10^6	9.1×10^5
Type and size of release point (m)	Duct 1.14 x 3.05	3 Louver houses, Each 1.37 x 2.44 x 0.75	4 Exhaust fans, Each 1.45 x 2.01
Effective vent area (m^2)	3.48	11.58**	8.74***
Vent velocity (m/sec)*	10.9	3.4	19.5
Effective diameter (m) (πr^2 = area)	2.1	3.8	3.3
Building height (m)	70.1	31.8****	42.4

*Reactor Building exhaust in vertical direction. Radwaste and Turbine Building exhaust in horizontal plane.
**Equivalent to two vents (as per FSAR Section 9.4.3.2, 2 of 3 will normally be in operation).
***Equivalent to three vents (as per FSAR Section 9.4.6.2.2, 3 of 4 will normally be in operation).
****Height of the Radwaste and Control Building.

Table 3-14

REFERENCES FOR VALUES LISTED IN TABLES 3-8 and 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, Columbia Generating Station FSAR, Table 2.3-1
Reference 5	Section 2.3, Columbia Generating Station FSAR, page 2.3-3
Reference 6	Columbia Generating Station 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	Effluent Analysis for Applicable Time Period
Reference 9	Health Physics Calculation Log No. 93-2
Reference 10	NUREG/CR-2919 XOQDOQ: Computer Program For The Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations, September 1982.

Table 3-15
DESIGN BASE PERCENT NOBLE GAS (30-MINUTE DECAY)*

Isotope	Percent of Total Activity
Kr-83M	2.9
Kr-85M	5.6
Kr-85	0
Kr-87	15
Kr-88	18
Kr-89	0.2
Xe-131M	0.02
Xe-133M	0.3
Xe-133	8.2
Xe-135M	6.9
Xe-135	22
Xe-137	0.7
Xe-138	21

*From Table 11.3-1 FSAR

TABLE 3-16

ANNUAL DOSES AT TYPICAL LOCATIONS

Source: 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
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

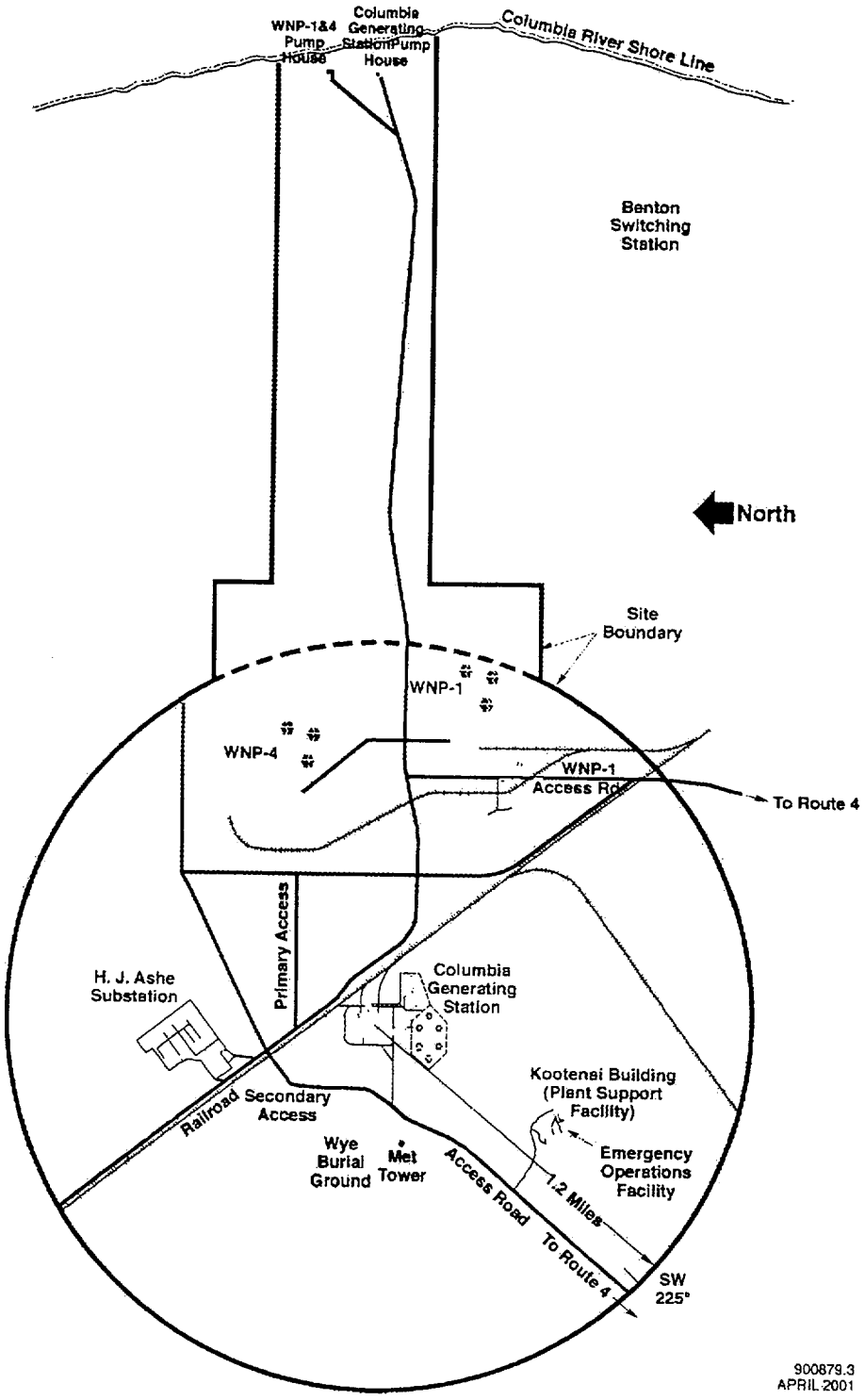
* The sector with the highest X/Q values (within 0-0.5 mile radius) was used.
** Closest residential area representative of maximum individual dose from plume, ground, ingestion, and inhalation exposure pathways. Included for comparison.
*** Assumed continuously occupied. Actual occupancy is very low. Doses from Inhalation and Ground Exposure pathways. No food crops.

TABLE 3-17

ANNUAL OCCUPIED AIR DOSE AT TYPICAL LOCATIONS

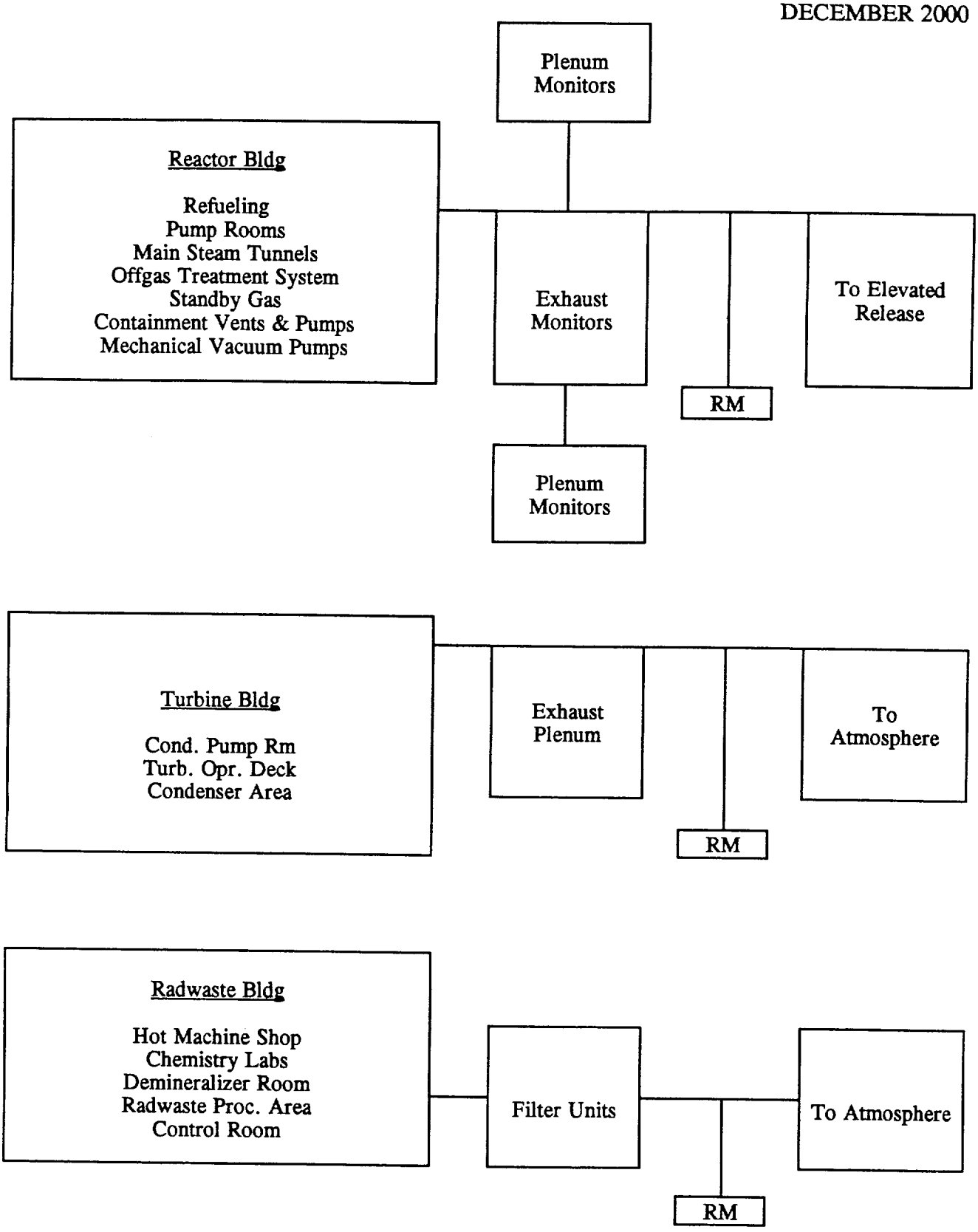
Location	Annual Beta Air dose (mrad)	Annual Gamma Air Dose
BPA Ashe Substation	8.9E-01	1.5E+00
DOE Train	5.3E-02	9.2E-02
Wye Burial Site	3.2E-03	5.7E-03
WNP-1	3.3E-02	2.8E-02
WNP-4	5.3E-02	8.5E-02
Visitor Center	7.0E-02	1.2E-01
Taylor Flats*	2.3E-02	1.4E-02
Site Boundary	8.7E-01	1.5E+00

*Closest residential area.

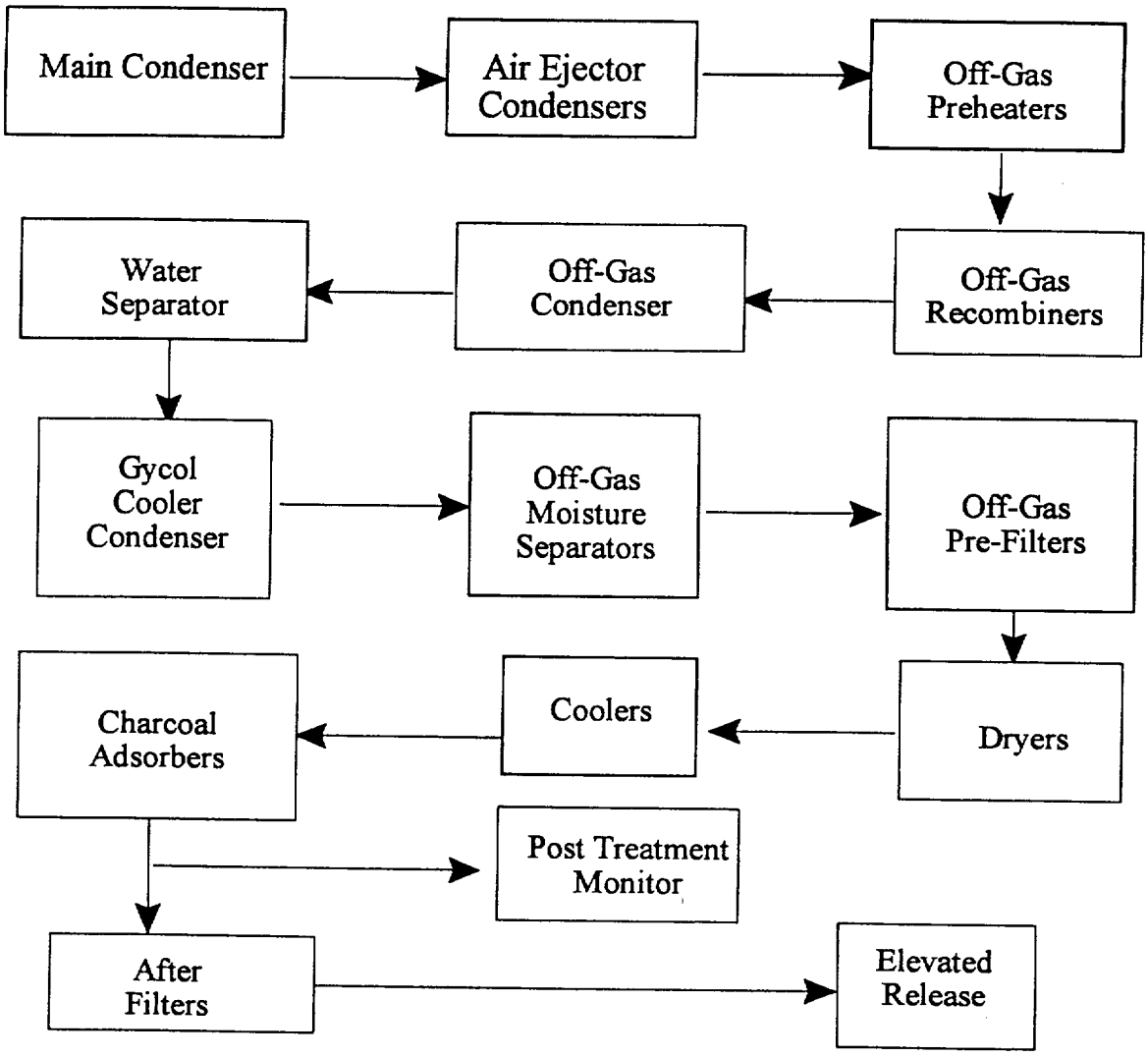


SITE BOUNDARY FOR RADIOACTIVE GASEOUS AND LIQUID EFFLUENTS

Figure 3-1

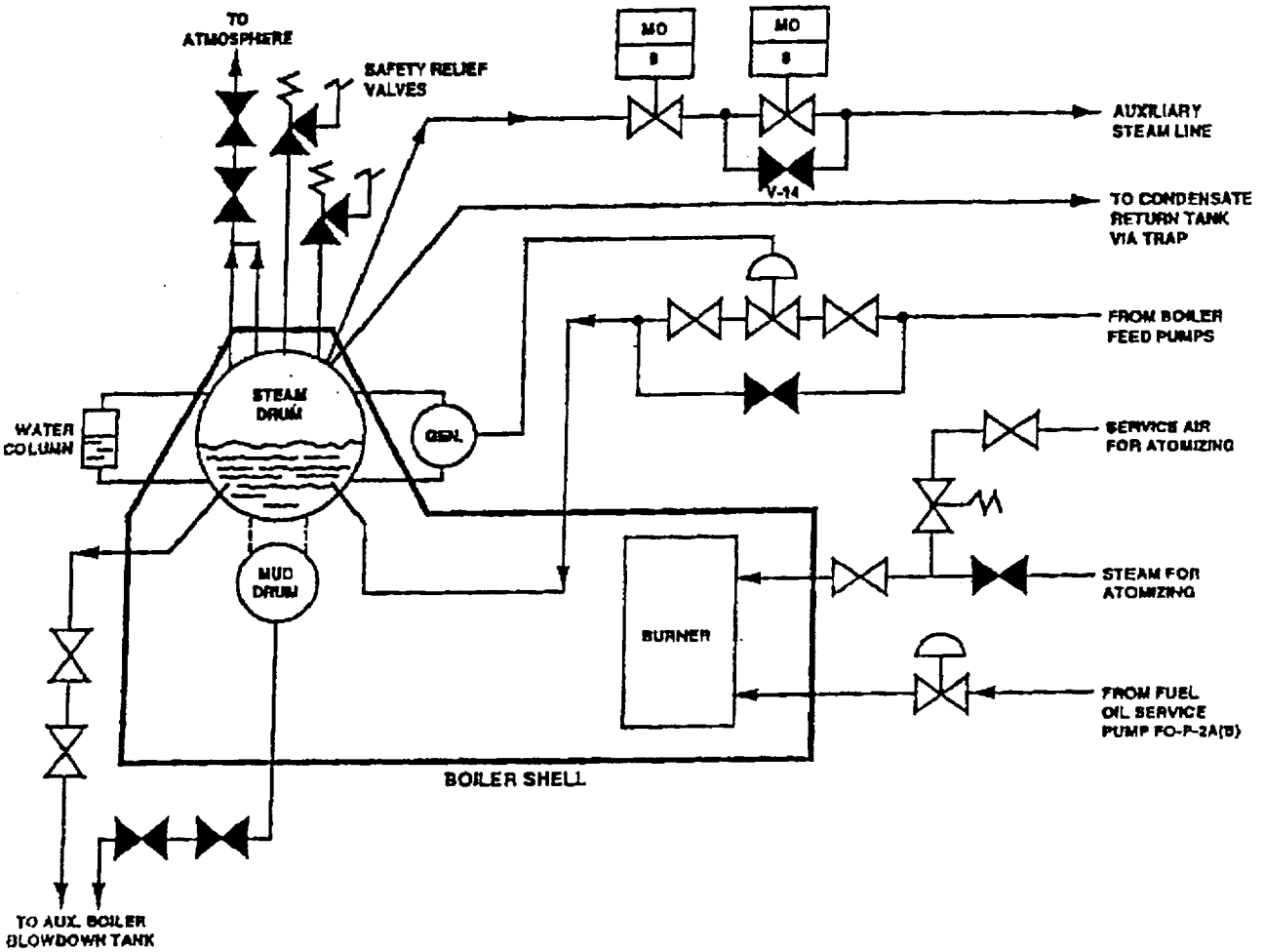


SIMPLIFIED BLOCK DIAGRAM OF
GASEOUS WASTE SYSTEM
Figure 3-2



SIMPLIFIED BLOCK DIAGRAM
OF
OFF-GAS TREATMENT SYSTEM

Figure 3-3



AUXILIARY BOILER
Figure 3-4

4.0 COMPLIANCE WITH 40 CFR 190

4.1 Requirement For Operability

Requirement for Operability 6.2.4.1 states, "The annual (calendar year) dose or dose commitment to any Member of the Public, due to releases of radioactivity and radiation, from uranium fuel cycle sources shall be limited to less than or equal to 25 mrems to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems."

4.2 ODCM Methodology for Determining Dose and Dose Commitment from Uranium Fuel Cycle Sources

The annual dose or dose commitment to a Member of the Public for the uranium fuel cycle sources is determined as:

a) Dose to the total body due to the release of radioactive materials in liquid effluents.

b) Dose to any organ due to the release of radioactive materials in liquid effluents.

c) Air doses due to noble gases released in gaseous effluents.

d) Dose to any organ due to the release of radioiodines, tritium and radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents.

e) Dose due to direct radiation from the plant.

The annual dose or dose commitment to a Member of the Public from the uranium fuel cycle sources is determined whenever the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceed twice the limits in Requirement for Operability 6.2.1.2.a, 6.2.1.2.b, 6.2.2.2.a, 6.2.2.2.b, 6.2.2.3.a, or 6.2.2.3.b. Direct radiation measurements will also be made to determine if the limits of Requirement for Operability 6.2.4.1 have been exceeded.

4.2.1 Total Dose from Liquid Effluents

The annual dose to a Member of the Public from liquid effluents will be determined using NRC LADTAP II computer code, and methodology presented by Equation (5) in Section 2.4. It is assumed that dose contribution pathways to a Member of the Public do not exist for areas within the site boundary.

4.2.2 Total Dose from Gaseous Effluents

The annual dose to a Member of the Public from gaseous effluents will be determined using NRC GASPAR II computer code, and methodology presented by Equations (10), (11) and (13) in Section 3.4. Appropriate atmospheric dispersion parameters will be used.

4.2.3 Direct Radiation Contribution

The dose to a Member of the Public due to direct radiation from the reactor plant will be determined using thermoluminescent dosimeters (TLDs) or may be calculated. TLDs are placed at sample locations and analyzed as per Table 5-1. The direct radiation contribution will be documented in the Radioactive Effluent Release Report submitted 60 days after January 1 of each year.

5.0 RADIOLOGICAL ENVIRONMENTAL MONITORING

Radiological environmental monitoring is intended to supplement radiological effluent monitoring by verifying that measurable concentrations of radioactive materials and levels of radiation in the environment are not greater than expected based on effluent measurement and dose modeling of environmental exposure pathways. The Radiological Environmental Monitoring Program (REMP) for Columbia Generating Station provides for measurements of radiation and radioactive materials in those exposure pathways and for those radionuclides for which the highest potential dose commitment to a Member of the Public would result due to plant operations.

The REMP is designed to conform to regulatory guidance provided by Regulatory Guide 4.1, 4.8, 4.15 and the Radiological Assessment Branch Technical Position (BTP), taking into consideration certain site specific characteristics. The unique nature of the site on Federally owned and administered land (Hanford Reservation) dedicated to energy facilities, research, waste management and as a natural reserve, forms the basis for many of the site specific parameters. Amongst the many site specific parameters considered is demographic data such as:

1) No significant clusters of population including schools, hospitals, business facilities or primary public transportation routes are located within 8 km (5 mile) radius of the plant.

2) No private residences are located on the Hanford Reservation.

3) The closest resident is east of the Columbia River at a distance of approximately 4 miles.

Radiological environmental monitoring activities implemented as detailed in sections 5.1 through 5.4, meet or exceed the criteria of the REMP plan as specified by Requirement for Operability, 6.3.1.1.

5.1 Radiological Environmental Monitoring Program (REMP)

Environmental samples for the REMP are collected in accordance with Table 5-1. This table provides a detailed outline of the Requirement for Operability environmental sampling plan items by sample type, sample location code, sampling and collection frequency, and type and frequency of analysis of samples collected within exposure pathway. Deviations from the sampling frequency detailed in Table 5-1 may occur due to circumstances such as hazardous conditions, malfunction of automatic sampling equipment, seasonal unavailability, or other legitimate reasons. When sample media is unobtainable due to equipment malfunction, special actions per program instruction shall be taken to ensure that corrective action is implemented prior to the end of the next sampling period. In some cases, alternate sample collection may be substituted for the missing specimen. All deviations from the sampling plan Requirement for Operability items detailed in the sampling plan, Table 5-1, shall be documented and reported in the Annual Radiological Environmental Operating Report in accordance with Regulatory Guide 4.8 and BTP.

In the event that it becomes impossible or impractical to continue sampling a media of choice at currently established location(s) or time, an evaluation shall be made to determine a suitable alternative media and/or location to provide appropriate exposure pathway evaluations. The evaluation and any substitution made shall be implemented in the sampling program within 30 days of identification of the problem. All changes implemented in the sampling program due to unavailability of samples shall be fully documented in the next Radioactive Effluent Release Report and ODCM. Revised sampling plan table(s) and figure(s) reflecting the new locations and/or media shall be included with the documentation.

Sampling stations are described in Table 5-2. Each station is identified by an assigned number or alphanumeric designation, meteorological sector (16 different, 22-1/2° compass sections) in which the station is located, and radial distance from plant containment as estimated from map positions. Also included in Table 5-2 is information identifying the type(s) of samples collected at each station and whether or not the specific sample type satisfies a Requirement for Operability criteria. Figures 5-1 and 5-2 depict the geographical locations of each of the sample stations listed in Table 5-2.

5.2 Land Use Census

A Land Use Census shall be conducted in accordance with the requirements of Requirement for Operability 6.3.2.1. It shall identify within a distance of 8 km (5 miles) in each of the 16 meteorological sectors, the location of the nearest milk animal, the nearest residence and the nearest garden of greater than $50m^2$ ($500 ft^2$) producing broad leaf vegetation. Field activities pertaining to the Land Use Census will be initiated during the growing season and completed no later than September 30 each year. The information obtained during the field survey is used along with other demographic data to assess population changes in the unrestricted area that might require modifications in the sampling plan to ensure adequate evaluation of dose or dose commitment.

The results of the Land Use Census will be submitted no later than October 31 of each year for evaluation of maximum individual doses or dose commitment. All changes, such as a location yielding a greater estimated dose or dose commitment or different location with a 20 percent greater estimated dose or dose commitment than a currently sampled location, will be reported in the next Radioactive Effluent Release Report in accordance with Requirement for Operability 6.3.2.1. The REMP plan, ODCM, will be changed to reflect new sampling location(s). The new sampling location(s) will be added to the REMP within 30 days.

The best available census information, whether obtained by aerial survey, door-to-door survey, or consultation with local authorities, shall be used to complete the Land Use Census and the census results shall be reported in the Annual Radiological Environmental Operating Report, in accordance with Technical Specification requirements.

5.3 Laboratory Intercomparison Program

Analysis of REMP samples is contracted to a provider of radiological analytical services. By contract, this analytical service vendor is required to conduct all activities in accordance with Regulatory Guides 4.1, 4.8, and 4.15 and to include in each quarterly report, actions pertinent to their participation in the Interlaboratory Comparison Program. A precontract award survey and periodic audit at the contractor's facility ensure that the contractor is participating in the Crosscheck Program, as reported.

The results of the contractor's analysis of Crosscheck samples shall be included in the Annual Radiological Environmental Operating Report in accordance with Requirement for Operability 6.3.3.1.

Besides the vendor's required participation in the Interlaboratory Comparison Program, the Department of Health (DOH) of the State of Washington oversees an analytical program for the Energy Facility Site Evaluation Council (EFSEC) to provide an independent test of REMP sample analyses. The Columbia Generating Station DOH split samples are analyzed by Washington State's Office of Public Health Laboratories and Epidemiology, Environmental Radiation Laboratory (ERL). The results of the ERL analysis and Interlaboratory Comparison Program data are included in an annual report, "Environmental Radiation Program, Environmental Health Surveillance, State of Washington" and are available for comparison with the Columbia Generating Station data.

Energy Northwest participates in the International Intercomparison of Environmental Dosimeter Program. Results of this intercomparison program are reported in the REMP Annual Report, when available.

5.4 Reporting Requirements

Columbia Generating Station radiological environmental monitoring program activities are presented annually in the Annual Radiological Environmental Operating Report (AREOR). The approved report is submitted to the Administrator, Region IV Office of Inspection and Enforcement, with copies to the Director, Office of Nuclear Reactor Regulation, and the State of Washington Energy Facility Site Evaluation Council (EFSEC) and Radiation Control Section, DOH, by May 15 of each year for program activities conducted the previous calendar year. The period of the first operational report begins with the date of initial criticality.

The annual report is to include the following types of information: a tabulated summary; interpretations and analyses of trends for results of radiological environmental surveillance activities for the report period, including comparisons with operational controls, preoperational studies, and previous environmental surveillance reports as appropriate; an assessment of the observed impacts of plant operation on the environment; a brief description of the radiological environmental monitoring program; maps representing sampling station locations, keyed to tables of distance and direction from reactor containment; results of the Land Use Census; and the results of analytical laboratory participation in the Interlaboratory Comparison Program. The tabulated summary shall be presented in a format represented in Table 5-3. A supplementary report is required if all analytical results are not available for inclusion in the annual report within the specified time frame. The missing data shall be submitted as soon as possible upon receipt of the results. Along with the missing data, the supplementary report shall include an explanation as to the cause for the delay in completion of the analysis within the report period.

A nonroutine radiological environmental operating report is required to be submitted within 30 days from the end of any quarter in which a confirmed measured radionuclide concentration in an environmental sample averaged over the quarter sampling period exceeds a reporting level. Table 5-4 specifies the reporting level (RL) for most radionuclides of environmental importance due to potential impact from plant operations. When more than one of the nuclides listed in Table 5-4 is detected in a sample, the reporting level is considered to be exceeded and a nonroutine report required if the following conditions are satisfied:

$$\frac{\text{Concentration (1)}}{\text{Reporting Level (1)}} + \frac{\text{Concentration (2)}}{\text{Reporting Level (2)}} + \text{-----} \geq 1$$

For radionuclides other than those listed in Table 5-4, the reporting level is considered to have been exceeded if the potential annual dose to an individual is greater than or equal to the design objective doses of Appendix I, 10 CFR 50. When a nonroutine report on an unlisted (Table 5-4) radionuclide must be issued, it shall include an evaluation of any release conditions, environmental factors, or other aspects necessary to explain the anomalous sample results.

When it can be demonstrated that the anomalous sample result(s) exceeding reporting levels is not the result of plant effluents, a nonroutine report does not have to be submitted. A full discussion of the sample result and subsequent evaluation or investigation of the anomolous result will be included in the Annual Radiological Environmental Operational Report.

TABLE 5-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM PLAN

Sample Type	Sample Location Code*	Sampling and Collection Frequency[1]	Type and Frequency of Analysis[1]
1. AIRBORNE			
a. Particulates and radioiodine	4, 8, 9A, 40, 48, 57	Continuous sampling Weekly collection	Particulate: Gross beta[2], weekly; gamma isotopic[3], quarterly composite (by location) Radioiodine: I-131 analysis, weekly
2. DIRECT RADIATION			
TLD[4]	1, 2, 4-9A, 10, 13-20, 22, 24, 25, 40-46, 49-51, 53-56	Quarterly, annually	TLD converted to exposure quarterly and annually
3. WATERBORNE			
a. Surface/Drinking[6]	26, 27, and 29	Composite aliquots[5], monthly	Gamma isotopic[3], gross beta, monthly; tritium, quarterly composite strontium-90, iodine-131, when requested[6]
b. Ground water	31 and 52	Quarterly	Gamma isotopic[3] and tritium, quarterly
c. Sediment from shoreline	34	Semiannually	Gamma isotopic[3], semiannually
4. INGESTION			
a. Milk[7]	9B, 36, 64	Semimonthly during grazing season, monthly at other times	Gamma isotopic[3] and iodine-131, monthly/ semimonthly strontium-90, when requested[7]
b. Fish[8]	30, 38	Annually, unless an impact is indicated, then semiannually[8]	Gamma isotopic[3], when sampled

TABLE 5-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM PLAN

Sample Type	Sample Location Code*	Sampling and Collection Frequency[1]	Type and Frequency of Analysis[1]
c. Garden produce[9]	9C, 37	Monthly during growing season in the Riverview area of Pasco and a control near Grandview.	Gamma isotopic[3], when sampled

*Sample locations are graphically depicted in Figures 5-1 and 5-2.

[1]Deviations are permitted if samples are unobtainable due to hazardous conditions, seasonal availability, malfunction of automatic sampling equipment, or other legitimate reasons. All deviations will be documented in the Annual Radiological Environmental Monitoring Report.

[2]Particulate sample filters will be analyzed for gross beta after at least 24-hour decay. If gross beta activity is greater than 10 times the yearly mean of the control sample, gamma isotopic analysis shall be performed on the individual sample.

[3]Gamma isotopic means identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents of the facility.

[4]TLD refers to thermoluminescent dosimeter. For purposes of REMP, a TLD is a phosphor card with multiple read-out areas in each badge case. TLDs used in REMP meet the requirements of Regulatory Guide 4.13 (ANSI N545-1975), except for specified energy-dependence response. Correction factors are available for energy ranges with response outside of the specified tolerances.

[5]Composite samples will be collected with equipment which is capable of collecting an aliquot at time intervals which are short relative to the compositing period and in which the method of sampling employed results in a specimen that is representative of the liquid flow.

[6]Station 26, makeup water intake from the Columbia River, satisfies the Requirement for Operability criteria for upstream surface water and drinking water control samples. The discharge water (Station 27) samples are used to fulfill the Requirement for Operability criteria for a downstream sample. However, they provide very conservative estimates of downstream concentrations. Drinking water samples are not routinely analyzed for I-131 from two week composite, but I-131 analysis will be performed when the calculated dose for the consumption of water is greater than 1 mrem per year to the maximum organ. When the gross beta result in drinking water is greater than ten times the mean of the previous month's data for the control location or greater than 8 pCi/liter, Sr-90 analysis shall be performed.

TABLE 5-1 (contd.)

[7]Milk samples will be obtained from farms or individual milk animals which are located in sectors with high calculated annual average ground-level D/Qs and high dose potential. There are no milk animals located within 5 km of the site. If cesium-134 or cesium-137 is measured in an individual milk sample in excess of 30 pCi/l, then strontium-90 analysis shall be performed.

[8]There are no commercially important species in the Hanford reach of the Columbia River. Most recreationally important species in the area are anadromous, primarily salminoids. Three species will normally be collected by electroshock technique in the vicinity of the plant discharge (Station 30). If electroshocking produces insufficient fish samples, anadromous species may be obtained from Ringold Fish Hatchery. Control samples are normally collected from the Snake River, in the vicinity of Ice Harbor Dam (salminoids may be obtained through the National Marine Fisheries Service at Lower Granite Dam). Three species (same ones obtained from the Columbia River) will be collected from the control location. If any of the analytical results of the Columbia River fish samples are significantly higher than the results of the Snake River samples or the results of previous fish samples, sampling will be conducted semiannually.

[9]Garden produce will routinely be obtained from farms or gardens using Columbia River water for irrigation. One sample of a root crop, leafy vegetable, and a fruit should be collected each sample period if available. The variety of the produce sample will be dependent on seasonal availability.

TABLE 5-2

REMP LOCATIONS

Station	Sector	Radial Miles[a]	TLD	AP/AI	SW	DW	GW	SE	MI	FI	GP
1	S	1.3	0								
2	NNE	1.8	0								
4	SSE	9.3	0	0							
5	ESE	7.7	0								
6	S	7.7	0								
7	WNW	2.7	0								
8	ESE	4.5	0	0							
9A*	WSW	30.0	0	0							
9C	WSW	33.0									0
10	E	3.1	0								
13	SW	1.4	0								
14	WSW	1.4	0								
15	W	1.4	0								
16	WNW	1.4	0								
17	NNW	1.2	0								

TABLE 5-2 (Continued)

Station	Sector	Radial Miles[a]	TLD	AP/AI	SW	DW	GW	SE	MI	FI	GP
18	N	1.1	0								
19	NE	1.8	0								
20	ENE	1.9	0								
22	E	2.1	0								
24	SE	1.9	0								
25	SSE	1.6	0								
26*	E	3.2			0	0					
27	E	3.2			0						
29	SSE	11.0				0					
30	E	3.3								0	
31	ESE	1.1					0				
34	ESE	3.5						0			
36	ESE	7.2							0		
37	SSE	17.0									0
38*	E	26.5								0	

TABLE 5-2 (Continued)

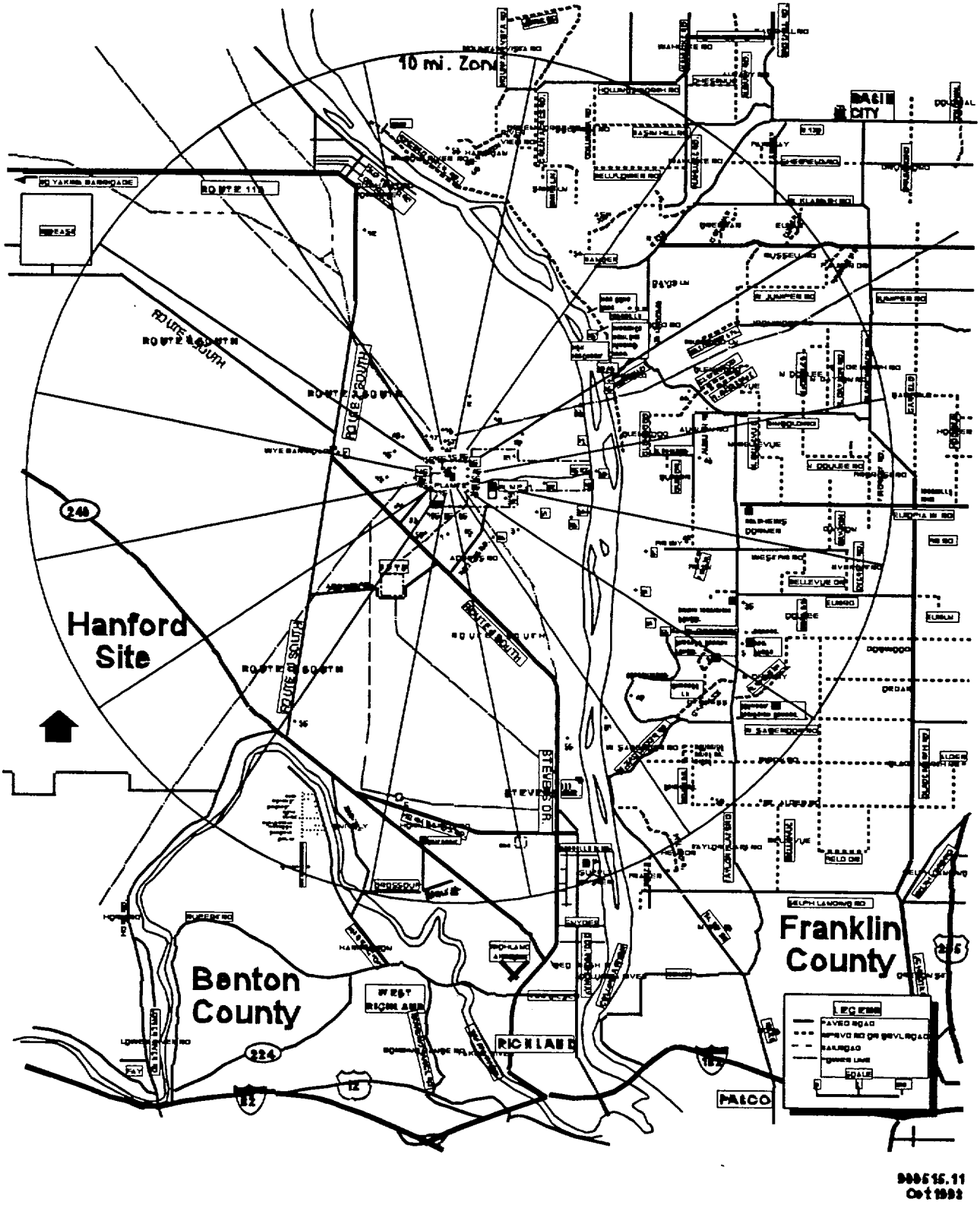
Station	Sector	Radial Miles[a]	TLD	AP/AI	SW	DW	GW	SE	MI	FI	GP
40	SE	6.4	0	0							
41	SE	5.8	0								
42	ESE	5.6	0								
43	E	5.8	0								
44	ENE	5.8	0								
45	ENE	4.3	0								
46	NE	5.0	0								
48	NE	4.5		0							
49	NW	1.2	0								
50	SSW	1.2	0								
51	ESE	2.1	0								
52	N	0.1					0				
53	N	7.5	0								
54	NNE	6.5	0								
55	SSE	6.2	0								
56	SSW	7.0	0								
57	N	0.8		0							
64	ESE	9.9							0		
96*	WSW	36.0							0		

TABLE 5-2 (Continued)

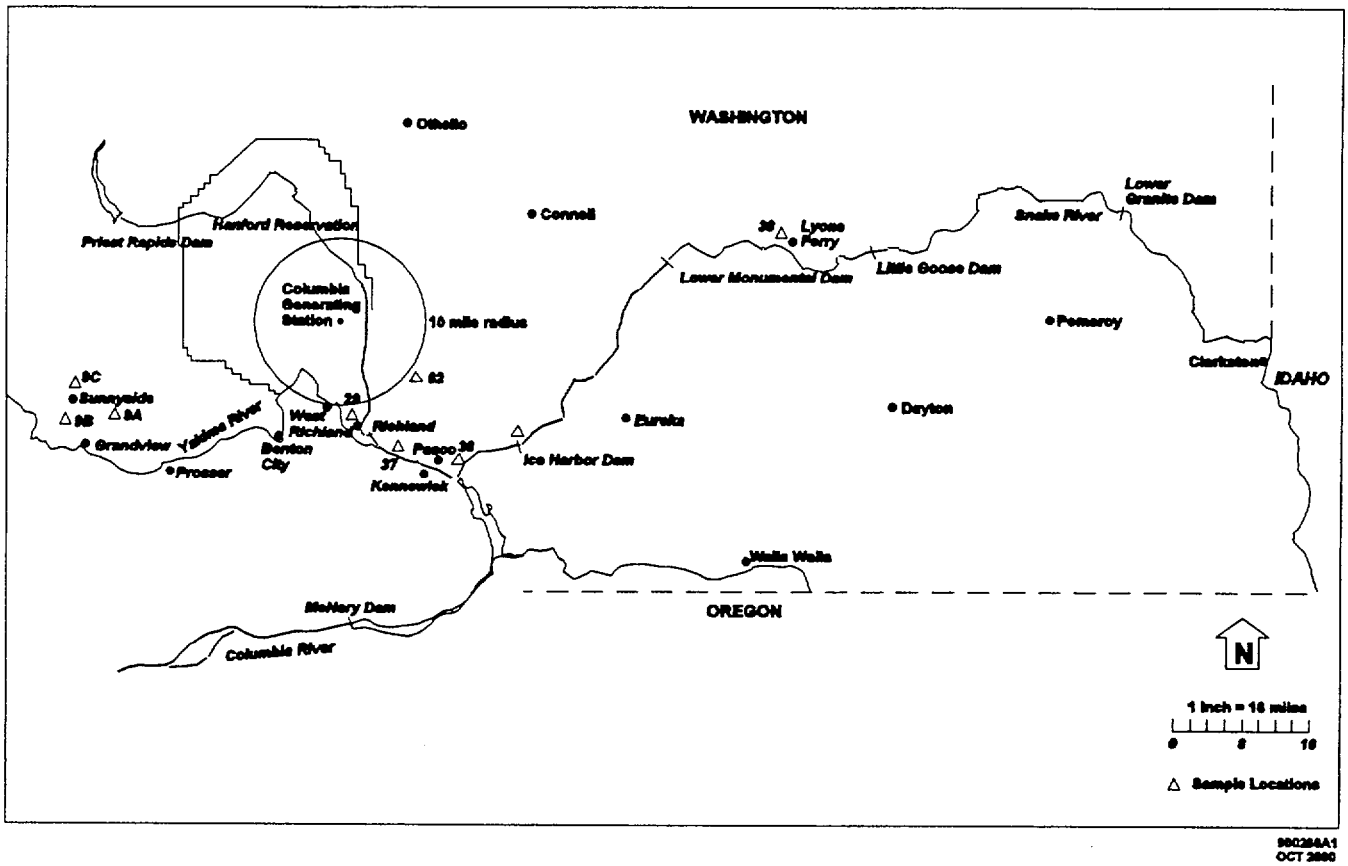
Station	Sector	Radial Miles[a]	TLD	AP/AI	SW	DW	GW	SE	MI	FI	GP

*Control location.

O	-	Radiological Environmental Requirement for Operability sample collected at station.
a	-	Estimated from center of plant Containment from map positions.
TLD	=	Thermoluminescent dosimeter
AP/AI	=	Air Particulate and Iodine
SW	=	Surface Water (River Water)
DW	=	Drinking Water
GW	=	Ground Water
SE	=	Shoreline Sediment
MI	=	Milk
FI	=	Fish
GP	=	Garden Produce

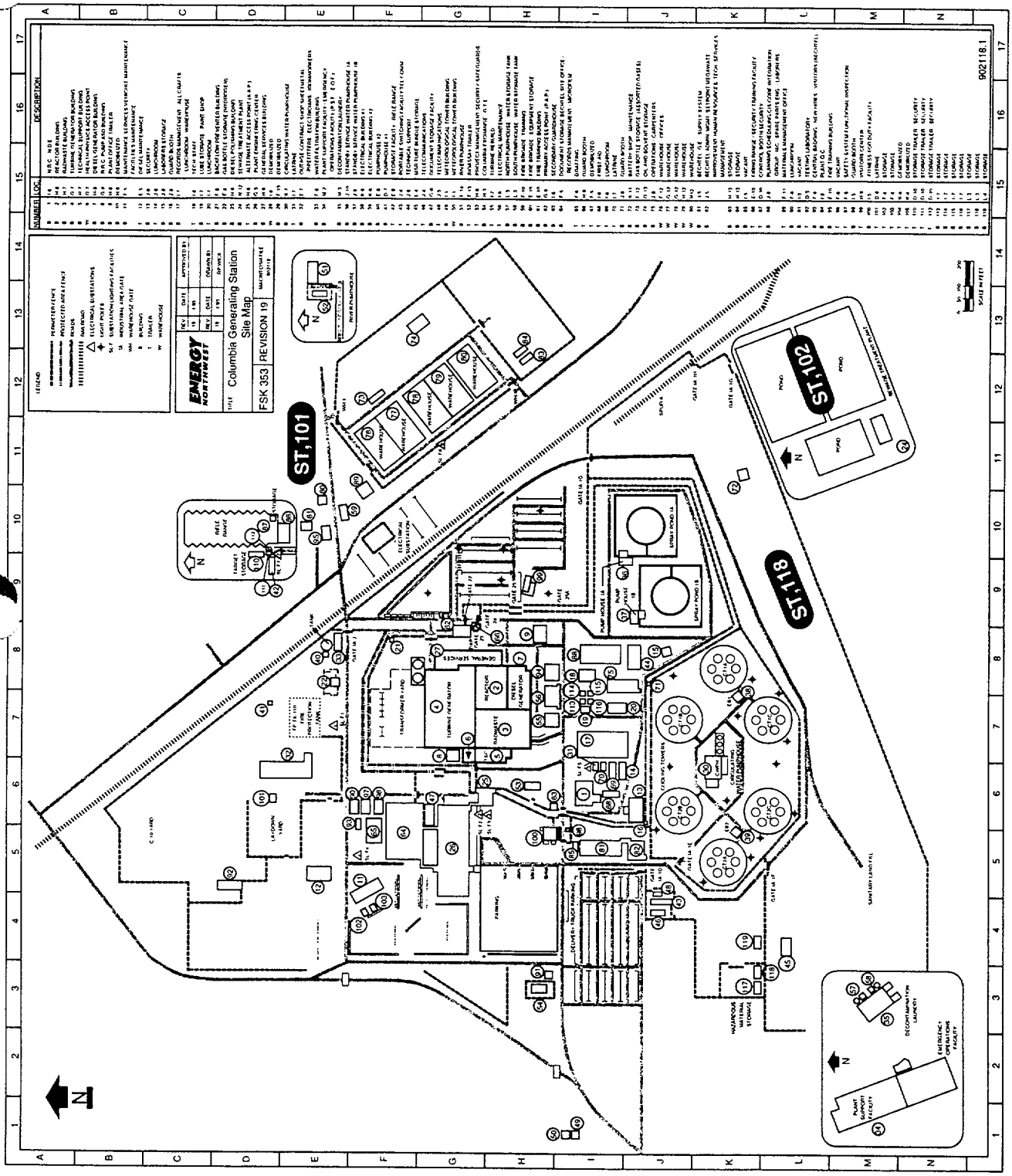


RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS
INSIDE OF 10 MILE RADIUS
Figure 5-1



Radiological Environmental Monitoring Sample Locations Outside of 10-Mile Radius

Figure 5-2



Radiological Environmental Monitoring Sample Locations Near Plant 2

Figure 5-3

TABLE 5-3

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM ANNUAL SUMMARY[a]

Name of Facility _____ Docket No. _____

Location of Facility _____ Reporting Period _____
(County, State)

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (f)[c] Range	Location with Highest Annual Mean		Control Locations Mean (f)[c] Range	Number of Nonroutine Reported Measurements
				Name	Mean (f)[c]		
				Distance and Direction	Range		
Air particulates (pCi/m^3)	Gross γ 416	0.01	0.08 (200/312) (0.05-2.0)	Middletown 5 mi. 340°	0.10 (5/52) (0.08-2.0)	0.08 (8/104) (1.05-1.40)	1
	γ-Spec 32						
	137_{Cs}	0.01	0.05 (4/24) (0.03-0.13)	Smithville 2.5 mi. 160°	0.08 (2/4) (0.03-2.0)	LLD	4
	131_{I}	0.07	0.12 (2/24) (0.09-0.18)	Podunk 4.0 mi. 270°	0.20 (2/4) (0.10-0.31)	0.02 (2/4)	1
Fish (pCi/kg) (wet weight)	γ-Spec. 8						
	137_{Cs}	130	LLD		LLD	90 (1/4)	0
	134_{Cs}	130	LLD		LLD	LLD	0
	60_{Co}	130	180 (3/4) (150-225)	River Mile 35	See Column 4	LLD	0

[a]Summary Table is taken from the NRC's Branch Technical Position, Rev. 1, Nov. 1979, and provided for illustrative purposes only.

[c]Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f).

TABLE 5-4

REPORTING LEVELS FOR NONROUTINE OPERATING REPORTS

Reporting Level (RL)

Analysis	Water (pCi/l)	Airborne Particulate or Gases (pCi/M^3)	Fish (pCi/kg, wet)	Milk (pCi/l)	Broad Leaf Vegetation (pCi/Kg, wet)
H-3	2×10^4*				
Mn-54	1×10^3		3×10^4		
Fe-59	4×10^2		1×10^4		
Co-58	1×10^3		3×10^4		
Co-60	3×10^2		1×10^4		
Zn-65	3×10^2		2×10^4		
Zr-Nb-95	4×10^2				
I-131	2	0.9		3	1×10^2
Cs-134	30	10	1×10^3	60	1×10^3
Cs-137	50	20	2×10^3	70	2×10^3
Ba-La-140	2×10^2			3×10^2	

*For drinking water samples. This is 40 CFR Part 141 value.

6.0 CONDUCT OF TESTS AND INSPECTIONS

IN SUPPORT OF

COLUMBIA GENERATING STATION

RADIOACTIVE EFFLUENT AND RADIOLOGICAL

ENVIRONMENTAL MONITORING PROGRAMS

6.0 INTRODUCTION

NOTE: Technical Specification Amendment 98, in accordance with Generic Letter 89-01, relocated the following Limiting Conditions for Operations (LCO) from the Technical Specifications to the ODCM. To differentiate between Technical Specifications and ODCM programs, the following title changes were made:

Limiting Condition for Operation	-	Requirement for Operability
Applicability	-	Relevant Conditions
Action	-	Compensatory Measures
Surveillance, Surveillance Requirements	-	Periodic Tests and Inspections

Notations of periodic tests and inspections frequencies are defined in the requirements for operability frequency notation table (Table 6.0-1).

Applicable definitions of the ODCM, Licensee Controlled Specifications, and Technical Specifications (Section 1.0) shall be followed with respect to ODCM requirements for operability. Further, Section 3.0 of the Technical Specifications shall be followed in conforming to this section and LCO applicability statements 3.0.1, 3.0.2, 3.0.3, and 3.0.4 of the Technical Specifications are to be followed as applied in the text of the requirements for operability.

In cases where compensatory measures refer to Technical Specifications 3.0.3 and 3.0.4 as not being applicable, they refer to LCO applicability.

6.0.1 DEFINITIONS

The following definitions and definitions of Technical Specifications and Licensee Controlled Specifications apply to Chapter 6 of the ODCM. They are defined so that uniform interpretation of these requirements for operability may be achieved. The defined terms appear in capitalized type and shall be applicable throughout the ODCM.

6.0.1.1 MEMBER(S) OF THE PUBLIC

MEMBERS OF THE PUBLIC shall include all persons who are not occupationally associated with the plant. This category does not include employees of the utility, its contractors or vendors. Also excluded from this category are persons who enter the site to service equipment or to make deliveries. This category does include persons who use portions of the site for recreational, occupational or other purposes not associated with the plant.

6.0.1.2 OPERATIONAL CONDITION - CONDITION

See Technical Specification definition of MODE.

6.0.1.3 PURGE - PURGING

PURGE - PURGING shall be the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration or other operating condition, in such a manner that replacement air or gas is required to purify the confinement.

6.0.1.4 SITE BOUNDARY

The SITE BOUNDARY shall be as generally depicted in ODCM, Figure 3-1.

6.0.1.5 SOURCE CHECK

A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to a radioactive source.

6.0.1.6 UNRESTRICTED AREA

An UNRESTRICTED AREA shall be any area at or beyond the SITE BOUNDARY access to which is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials, or any area within the site boundary used for residential quarters or for industrial, commercial, institutional, and/or recreational purposes.

6.0.1.7 VENTILATION EXHAUST TREATMENT SYSTEM

A VENTILATION EXHAUST TREATMENT SYSTEM shall be any system designed and installed to reduce gaseous radioiodine or radioactive material in particulate form in effluents by passing ventilation or vent exhaust gases through charcoal adsorbers and/or HEPA filters for the purpose of removing iodines or particulates from the gaseous exhaust stream prior to the release to the environment (such a system is not considered to have any effect on noble gas effluents). Engineered Safety Features (ESF) atmospheric cleanup systems are not considered to be VENTILATION EXHAUST TREATMENT SYSTEM components.

6.0.1.8 VENTING

VENTING shall be the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration, or other operating condition, in such a manner that replacement air or gas is not provided or required during VENTING. Vent, used in system names, does not imply a VENTING process.

TABLE 6.0-1

RFO FREQUENCY NOTATION

NOTATION	FREQUENCY
S	At least once per 12 hours.
D	At least once per 24 hours.
W	At least once per 7 days.
M	At least once per 31 days.
Q	At least once per 92 days.
SA	At least once per 184 days.
A	At least once per 366 days.
R	At least once per 18 months (550 days).
S/U	Prior to each reactor startup.
P	Prior to each radioactive release.
N.A.	Not applicable.

6.1 INSTRUMENTATION

IN SUPPORT OF

COLUMBIA GENERATING STATION

RADIOACTIVE EFFLUENT MONITORING

REQUIREMENT FOR OPERABILITY

6.1 INSTRUMENTATION

6.1.1 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

CONTROLS

6.1.1.1 The radioactive liquid effluent monitoring instrumentation channels shown in Table 6.1.1.1-1 shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Requirement for Operability 6.2.1.1 are not exceeded. The alarm/trip setpoints of these channels shall be determined and adjusted in accordance with the methodology and parameters described in the OFFSITE DOSE CALCULATION MANUAL (ODCM).

RELEVANT CONDITIONS: As shown in Table 6.1.1.1-1.

COMPENSATORY MEASURES:

a. With a radioactive liquid effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required by the above specification, immediately suspend the release of radioactive liquid effluents monitored by the affected channel or declare the channel inoperable.

b. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels OPERABLE, take the COMPENSATORY MEASURES shown in Table 6.1.1.1-1. Restore the inoperable instrumentation to OPERABLE status within 30 days or, in lieu of a Licensee Event Report, explain why this inoperability was not corrected within the time specified in the next Radioactive Effluent Release Report.

c. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS and INSPECTIONS

6.1.1.1.1 Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL FUNCTIONAL TEST operations at the frequencies shown in Table 6.1.1.1.1-1.

TABLE 3.1.1-1

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT		MINIMUM CHANNELS OPERABLE	RELEVANT CONDITIONS	COMPENSATORY MEASURES
1.	GROSS RADIOACTIVITY MONITORS PROVIDING ALARM AND AUTOMATIC TERMINATION OF RELEASE			
	a. Liquid Radwaste Effluent Line	1	(1)	100
	b. Turbine Building Sump	1/Sump	(1)	101
2.	GROSS RADIOACTIVITY MONITORS PROVIDING ALARM BUT NOT PROVIDING AUTOMATIC TERMINATION OF RELEASE			
	a. Service Water System Effluent Line	1	At all times	101
	b. RHR Service Water System Effluent Line	1/Loop	At all times	101
3.	FLOW RATE MEASUREMENT DEVICES			
	a. Liquid Radwaste Effluent Line	1	(1)	102
	b. Plant Discharge-Blowdown Line	1	(1)	102

(1) When effluents are being discharged via this pathway.

TABLE 6.1.1.1-1 (Continued)

COMPENSATORY MEASURES

COMPENSATORY MEASURE 100 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirements, effluent releases via this pathway may continue provided that prior to initiating a release:

a. At least two independent samples of the batch are analyzed in accordance with Periodic Tests and Inspections 6.2.1.1.1 and 6.2.1.1.2 and

b. At least two technically qualified members of the facility staff independently verify the release rate calculations and the discharge valve lineup;

COMPENSATORY MEASURE 101 - With the number of channels OPERABLE less than required by the Minimum Channel OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided that, at least once per 12 hours, grab samples are collected and are analyzed for radioactivity (beta or gamma) at a limit of detection of at least 10^{-7} microcurie/mL.

COMPENSATORY MEASURE 102 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided that the flow rate is estimated at least once per 4 hours during actual releases. Pump performance curves generated in place may be used to estimate flow.

TABLE 6.1.1.1.1-1

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION PERIODIC TESTS AND INSPECTIONS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
1. GROSS RADIOACTIVITY MONITORS PROVIDING ALARM AND AUTOMATIC TERMINATION OF RELEASE				
a. Liquid Radwaste Effluent Line	D	P	R(3)	Q(1,2)
b. Turbine Building Sump	D	M	R(3)	Q(1,5)
2. GROSS RADIOACTIVITY MONITORS PROVIDING ALARM BUT NOT PROVIDING AUTOMATIC TERMINATION OF RELEASE				
a. Service Water System Effluent Line	D	M	R(3)	(5)
b. RHR Service Water System Effluent Line	D	M	R(3)	Q(2)
3. FLOW RATE MEASUREMENT DEVICES				
a. Liquid Radwaste Effluent Line	D(4)	N.A.	R	Q
b. Plant Discharge-Blowdown Line	D(4)	N.A.	R	Q

TABLE 6.1.1.1.1-1 (Continued)

TABLE NOTATIONS

(1) The CHANNEL FUNCTIONAL TEST shall also demonstrate that automatic isolation of this pathway occurs if the:

Instrument indicates measured levels above the alarm setpoint.

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

1. Instrument indicates measured levels above the alarm setpoint.

2. High voltage abnormally low.

3. Instrument indicates a downscale failure.

4. Instrument controls not set in operate mode.

(3) The initial CHANNEL CALIBRATION shall be performed using one or more reference standards certified by the National Institute of Science and Technology (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used.

(4) CHANNEL CHECK shall consist of verifying indication of flow during periods of release. CHANNEL CHECK shall be made at least once per 24 hours when continuous, periodic, or batch releases are made.

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

1. Instrument indicates measured levels above the alarm setpoint.

2. High voltage abnormally low.

3. Instrument indicates a downscale failure.

6.1 INSTRUMENTATION

6.1.2 RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

CONTROLS

6.1.2 The radioactive gaseous effluent monitoring instrumentation channels shown in Table 6.1.2.1-1 shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Requirements for Operability 6.2.2.1 are not exceeded. The alarm/trip setpoint of these channels shall be determined in accordance with the methodology and parameters described in the ODCM.

RELEVANT CONDITION: As shown in Table 6.1.2.1-1.

COMPENSATORY MEASURES:

a. With a radioactive gaseous effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required by the above specification, immediately initiate action to suspend the release of radioactive gaseous effluents monitored by the affected channel or change the setpoint so it is acceptably conservative or declare the channel inoperable.

b. With less than the minimum number of radioactive gaseous effluent monitoring instrumentation channels OPERABLE, take the COMPENSATORY MEASURES shown in Table 6.1.2.1-1. If the inoperable instrumentation is not restored to OPERABLE status within 30 days, in lieu of a Licensee Event Report, explain why this inoperability was not corrected within the time specified in the next Radioactive Effluent Release Report.

c. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.1.2.1.1 Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL FUNCTIONAL TEST operations at the frequencies shown in Table 6.1.2.1.1-1.

TABLE 3.1.2.1-1

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	RELEVANT CONDITIONS	COMPENSATORY MEASURES
1. Main Condenser Offgas Post-Treatment Radiation Monitor			
a. Gross Gamma Detection Alarm and Automatic Isolation of the Offgas System Outlet and Drain Valves	1	(2)	110
2. Main Condenser Offgas Pre-Treatment Radiation Monitor	1	(2)	114
a. Gamma Sensitive Ion-Chamber Located Upstream of Holdup Line			
3. Main Plant Vent Release Monitor			
a. Low Range Noble Gas Monitor	1	(1)	110
b. Iodine Sampler	1	(1)	112
c. Particulate Sampler	1	(1)	112
d. Effluent System Flow Rate Monitor	1	(3)	113
e. Sampler Flow Rate Monitor	1	(3)	113

TABLE 6.1.2-1 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	RELEVANT CONDITIONS	COMPENSATORY MEASURES
4. Turbine Building Ventilation Exhaust Monitor			
a. Noble Gas Activity Monitor			
1) Low Range	1	(1)	110
2) Intermediate Range	1	(1)	111
b. Iodine Sampler	1	(1)	112
c. Particulate Sampler	1	(1)	112
d. Effluent System Flow Rate Monitor	1	(3)	113
e. Sampler Flow Rate Monitor	1	(3)	113
5. Radwaste Building Ventilation Exhaust			
a. Noble Gas Activity Monitor			
1) Low Range	1	(1)	110
2) Intermediate Range	1	(1)	111
b. Iodine Sampler	1	(1)	112
c. Particulate Sampler	1	(1)	112
d. Effluent System Flow Rate Measurement Device #	1	(3)	113
e. Sampler Flow Rate Monitor	1	(3)	113

TABLE 6.1.2.1-1 (Continued)
TABLE NOTATIONS

(1) At all times.
(2) During main condenser offgas treatment system operation.
(3) During building exhaust system operation.
The System Flow Rate Measurement Device for the Radwaste Building ventilation is the exhaust fan. There are 3 fans; WEA-FN-1A, WEA-FN-1B and WEA-FN-1C. The system flow rate is based on fan motor current and the number of operating fans, and is displayed on the plant process computer.

COMPENSATORY MEASURES

COMPENSATORY MEASURE 110	-	With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, collect grab samples(a) at least once per 8 hours and analyze for noble gas gamma emitters within 24 hours.
COMPENSATORY MEASURE 111	-	With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, collect grab samples at least once per 8 hours and analyze for noble gas gamma emitters within 24 hours. This sampling is not required if the Low Range Activity Monitor is OPERABLE and is not in ALARM.
COMPENSATORY MEASURE 112	-	With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, within 4 hours after the channel has been declared inoperable establish auxiliary sampling equipment as required in Table 6.2.2.1.2-1(a). In the event of inoperable auxiliary sampling equipment, sampling must be restored within 4 hours. If auxiliary sampling can not be performed, collect relevant information to provide an estimate of effluent releases, and report this event in the next Radioactive Effluent Release Report.
COMPENSATORY MEASURE 113	-	With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, estimate the flow rate at least once per 4 hours.
COMPENSATORY MEASURE 114	-	With the number of channels operable less than required by the Minimum Channels OPERABLE requirement, gases from the main condenser offgas treatment system may be released to the environment for up to 72 hours provided: a. The offgas treatment system is not bypassed, and b. The offgas post-treatment monitor used in a pretreatment function shall be OPERABLE, or install a temporary replacement ionization chamber for the pre-treatment monitor. If the conditions of a. and b. can not be met, be in HOT STANDBY within the following 12 hours.

(a) When building exhaust is secured, collect building ambient air samples.

TABLE 4.2.1.1-1

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION PERIODIC TESTS AND INSPECTIONS REQUIREMENTS

	INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES IN WHICH PERIODIC TESTS AND INSPECTIONS ARE REQUIRED
1.	Main Condenser Offgas Post-Treatment Radiation Monitor					
	a. Gross gamma detector alarm and automatic isolation of the offgas system outlet and drain valves	D	D	R(2)	Q(1)	**
2.	Main Condenser Offgas Pre-Treatment Radiation Monitor					
	a. Gamma sensitive ion chamber located upstream of holdup line	D	M	R(2)	Q(1)	**
3.	Main Plant Release Monitor					
	a. Low Range Activity Monitor	D	M	R(2)	Q(1)	*
	b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
	c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
	d. Effluent System Flow Rate Monitor	D	N.A.	R	Q	*
	e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*

TABLE 6.1.2-1 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION PERIODIC TESTS AND INSPECTIONS REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES IN WHICH PERIODIC TESTS AND INSPECTIONS ARE REQUIRED
4. Turbine Building Ventilation Exhaust Monitor					
a. Noble Gas Activity Monitor					
1) Low Range	D	M	R(2)	Q(1)	*
2) Intermediate Range	D	M	R(2)	Q(6)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Effluent System Flow Rate Monitor	D	N.A.	R	Q	*
e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*
5. Radwaste Building Ventilation Exhaust					
a. Noble Gas Activity Monitor					
1) Low Range	D	M	R(2)	Q(1)	*
2) Intermediate Range	D	M	R(2)	Q(6)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Effluent System Flow Rate Monitor	D(3)	N.A.	R(5)	Q(4)	*
e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*

TABLE 6.1.2.1.1-1 (Continued)

TABLE NOTATIONS

* At all times.
** During main condenser offgas treatment system operation

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

a. Instrument indicates measured levels above the alarm setpoint.

b. Circuit failure.

(2) The initial CHANNEL CALIBRATION shall be performed using one or more reference radioactive standards traceable to the NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system over its intended range of energy and measurement range. Subsequent CHANNEL CALIBRATION shall be performed using the initial radioactive standards or other standards of equivalent quality or radioactive sources that have been related to the initial calibration.

(3) The CHANNEL CHECK shall be performed by comparing a computer reading or power signal comparing each fan's local amperage reading with preestablished baseline values.

(4) The CHANNEL FUNCTIONAL TEST shall be performed by measurement of the phase currents for each fan.

(5) The CHANNEL CALIBRATION shall be performed by using a flow measurement device to determine the fan current to flow relationship.

(6) For the CHANNEL FUNCTIONAL TEST on the intermediate range noble gas activity monitors, demonstrate that circuit failures or instrument controls when set in the OFF position produce control room alarm annunciation.

6.2 REQUIREMENT FOR OPERABILITY

IN

SUPPORT

OF

RADIOACTIVE EFFLUENT MONITORING

PROGRAMS

6.2 RADIOACTIVE EFFLUENTS

6.2.1 LIQUID EFFLUENTS

6.2.1.1 CONCENTRATION

REQUIREMENTS FOR OPERABILITY

6.2.1.1 The concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS (see ODCM Figure 3-1) shall be limited to the concentrations specified in 10 CFR Part 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2×10^{-4} microcurie/ml total activity.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

With the concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS exceeding the above limits, immediately restore the concentration to the above limits.

PERIODIC TESTS AND INSPECTIONS

6.2.1.1.1 Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program of Table 6.2.1.1.1-1.

6.2.1.1.2 The results of the radioactivity analyses shall be used in accordance with the methodology and parameters in the ODCM to assure that the concentrations at the point of release are maintained within the limits of Requirement for Operability 6.2.1.1.

TABLE 6.2.1.1.1-1

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

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

TABLE 6.2.1.1.1-1 (Continued)

TABLE NOTATIONS

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

For a particular measurement system, which may include radiochemical separation:

Where:

LLD is the "a priori" lower limit of detection as defined above, as microcuries per unit mass or volume,

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

E is the counting efficiency as counts per disintegration,

V is the sample size in units of mass or volume,

2.22×10^6 is the number of disintegrations per minute per microcurie,

Y is the fractional radiochemical yield, when applicable,

λ is the radioactive decay constant for the particular radionuclide, and

$\Delta\tau$ for plant effluents is the elapsed time between the midpoint of sample collection and time of counting.

Typical values of E, V, Y, and $\Delta\tau$ should be used in the calculation.

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

TABLE 6.2.1.1.1-1 (Continued)

TABLE NOTATIONS

[b] A batch release is the discharge of liquid wastes of a discrete volume.
Prior to sampling for analyses, each batch shall be isolated, and then thoroughly mixed by a method described in the ODCM to assure representative sampling.

[c] The principal gamma emitters for which the LLD specification applies include the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Radioactive Effluent Release Report, ODCM 6.4.2.

[d] A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen that is representative of the liquids released. This may be accomplished through composites of grab samples obtained prior to discharge after the tanks have been recirculated.

6.2 RADIOACTIVE EFFLUENTS

6.2.1 LIQUID EFFLUENTS

6.2.1.2 DOSE

REQUIREMENT FOR OPERABILITY

6.2.1.2 The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released to UNRESTRICTED AREAS (see ODCM Figure 3-1) shall be limited:

a. During any calendar quarter to less than or equal to 1.5 mrems to the total body and to less than or equal to 5 mrems to any organ, and

b. During any calendar year to less than or equal to 3 mrems to the total body and to less than or equal to 10 mrems to any organ.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days, pursuant to 10 CFR 50, Appendix I, Section IV.A, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective action to be taken to assure that subsequent releases will be in compliance with the above limits. This Special Report shall also include (1) the results of radiological analyses of the drinking water source and (2) the radiological impact on finished drinking water supplies with regard to the requirements of 40 CFR Part 141.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.2.1.2.1 Cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year shall be determined in accordance with the methodology and parameters in the ODCM at least once per 31 days.

6.2 RADIOACTIVE EFFLUENTS

6.2.1 LIQUID EFFLUENTS

6.2.1.3 LIQUID RADWASTE TREATMENT SYSTEM

REQUIREMENT FOR OPERABILITY

6.2.1.3 The liquid radwaste treatment system shall be OPERABLE. The appropriate portions of the system shall be used to reduce the releases of radioactivity when the projected doses due to the liquid effluent, from each reactor unit, to UNRESTRICTED AREAS (see ODCM Figure 3-1) would exceed 0.06 mrem to the total body or 0.2 mrem to any organ in a 31-day period.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With radioactive liquid waste being discharged without treatment and in excess of the above limits and any portion of the liquid radwaste treatment system not in operation, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days pursuant to 10 CFR 50, Appendix I, Section IV.A, a Special Report that includes the following information:

   1. Explanation of why liquid radwaste was being discharged without treatment, identification of any inoperable equipment or subsystems, and the reason for the inoperability,

   2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

   3. Summary description of actions(s) taken to prevent a recurrence.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.2.1.3.1 Doses due to liquid releases from each reactor unit to UNRESTRICTED AREAS shall be projected at least once per 31 days in accordance with the methodology and parameters in the ODCM.

6.2.1.3.2 The installed liquid radwaste treatment system shall be demonstrated OPERABLE by meeting Requirement for Operability 6.2.1.1 and 6.2.1.2.

6.2 RADIOACTIVE EFFLUENTS

6.2.2 GASEOUS EFFLUENTS

6.2.2.1 DOSE RATE

REQUIREMENT FOR OPERABILITY

6.2.2.1 The dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY (see ODCM Figure 3-1) shall be limited to the following:

a. For noble gases: Less than or equal to 500 mrems/yr to the total body and less than or equal to 3000 mrems/yr to the skin, and

b. For iodine-131, for iodine-133, for tritium, and for all radionuclides in particulate form with half-lives greater than 8 days: Less than or equal to 1500 mrems/yr to any organ.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

With the dose rate exceeding the above limits, immediately restore the release rate to within the above limit(s).

PERIODIC TESTS AND INSPECTIONS

6.2.2.1.1 The dose rate due to noble gases in gaseous effluents shall be determined to be within the above limits in accordance with the methodology and parameters in the ODCM.

6.2.2.1.2 The dose rate due to iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents shall be determined to be within the above limits in accordance with the methodology and parameters in the ODCM by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Table 6.2.2.1.2-1.

TABLE 12.1.2-1

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

GASEOUS RELEASE TYPE		SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD)[a] (μCi/ml)
A.	Primary Containment PURGE and VENT	P [b,h] Each PURGE and VENT [b]	P [b,h,i] Each PURGE and VENT	Principal Gamma Emitters[f]	$1x10^{-4}$
		Grab Sample	M	H-3	$1x10^{-6}$
B.	Main Plant Vent	M[b,d] Grab Sample	M[b,i]	Principal Gamma Emitters[f]	$1x10^{-4}$
			W	H-3	$1x10^{-6}$
C.	Turbine Building Vents and Radwaste Building Vents	M Grab Sample	M	Principal Gamma Emitters[f]	$1x10^{-4}$
				H-3	$1x10^{-6}$
D.	All Release Types as listed in A, B, and C above	Continuous[e]	W[c,g,j] Charcoal Sample	I-131 I-131	$1x10^{-12}$ $1x10^{-10}$
		Continuous[e]	W[c,g,j] Particulate Sample	Principal Gamma Emitters[f]	$1x10^{-11}$
		Continuous[e] M	Composite Particulate Sample	Gross Alpha	$1x10^{-11}$
		Continuous[e] Q	Composite Particulate Sample	Sr-89, Sr-90	$1x10^{-11}$
		Continuous[e]	Noble Gas Monitor	Noble Gases Gross Beta or Gamma	$1x10^{-6}$ (Xe-133 equivalent)

TABLE 6.2.2.1.2-1 (Continued)

TABLE NOTATIONS

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

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66 s_b}{E \bullet V \bullet 2.22 \times 10^{6} \bullet Y \bullet \exp(-\lambda \Delta t)}$$

Where:

LLD is the "a priori" lower limit of detection as defined above, as microcuries per unit mass or volume,

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

E is the counting efficiency, as counts per disintegration,

V is the sample size in units of mass or volume,

2.22×10^6 is the number of disintegrations per minute per microcurie,

Y is the fractional radiochemical yield, when applicable,

λ is the radioactive decay constant for the particular radionuclide, and

Δt for plant effluents is the elapsed time between the midpoint of sample collection and time of counting.

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

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

TABLE 6.2.2.1.2-1 (Continued)

TABLE NOTATIONS

b. Sampling and analysis shall also be performed following startup or shutdown.

c. Sampling shall also be performed at least once per 24 hours for at least 7 days following each shutdown or startup, and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10.

This requirement does not apply if:

(1) a. Analysis shows that the DOSE EQUIVALENT 1-131 concentration in the primary coolant is less than or equal to 1.0E-03 μi/cc.

or

b. When the DOSE EQUIVALENT 1-131 concentration in the primary coolant is greater than 1.0E-03 μCi/cc, it has not increased more than a factor of 3;

and

(2) a. When the noble gas monitor is less than or equal to 2.0% of the setpoint determined in accordance with ODCM Section 3.6.

or

b. When the noble gas monitor is greater than 2.0% of its setpoint, it shows that effluent activity has not increased more than a factor of 3.

d. Tritium grab samples shall be taken at least once per 7 days from the main plant vent stack to determine tritium releases in the ventilation exhaust from the spent fuel pool area whenever spent fuel is in the spent fuel pool.

e. The ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with Requirement for Operability 6.2.2.1, 6.2.2.2 and 6.2.2.3.

f. The principal gamma emitters for which the LLD specification applies include the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 in noble gas releases and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, I-131, Cs-134, Cs-137, Ce-141 and Ce-144 in iodine and particulate releases. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Radioactive Effluent Release Report.

TABLE 6.2.2.1.2-1 (Continued)

TABLE NOTATIONS

g. Analyses shall be completed within 48 hours after changing, or after removal from sampler.

h. Sampling and analysis is not required for primary containment VENTING or PURGING when the path is through the 2-inch exhaust valves and the standby gas treatment system, and the containment noble gas monitoring instrumentation indicates less than the alarm setpoint.

i. Sampling and analysis shall also be performed following a THERMAL POWER change exceeding 15% of RATED THERMAL POWER within a 1-hour period, when the noble gas release rate, as indicated by the main condenser offgas pretreatment monitor, is greater than 15,000 μCi/sec.

j. Sampling shall also be performed at least once per 24 hours for at least seven days following each THERMAL POWER change exceeding 15% of RATED THERMAL POWER in one hour when the noble gas release rate, as indicated by the main condenser offgas pretreatment monitor, is greater than 15,000 μCi/sec. Analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10.

This requirement does not apply if:

(1) a. Analysis shows that the DOSE EQUIVALENT 1-131 concentration in the primary coolant is less than or equal to 1.0E-03 μi/cc.

or

b. When the DOSE EQUIVALENT 1-131 concentration in the primary coolant is greater than 1.0E-03 μCi/cc, it has not increased more than a factor of 3;

and

(2) a. When the noble gas monitor is less than or equal to 2.0% of the setpoint determined in accordance with ODCM Section 3.6.

or

b. When the noble gas monitor is greater than 2.0% of its setpoint, it shows that effluent activity has not increased more than a factor of 3.

6.2 RADIOACTIVE EFFLUENTS

6.2.2 GASEOUS EFFLUENTS

6.2.2.2 DOSE - NOBLE GASES

REQUIREMENT FOR OPERABILITY

6.2.2.2 The air dose due to noble gases released in gaseous effluents, from each reactor unit, to areas at and beyond the SITE BOUNDARY (see ODCM Figure 3-1) shall be limited to the following:

a. During any calendar quarter: Less than or equal to 5 mrads for gamma radiation and less than or equal to 10 mrads for beta radiation and,

b. During any calendar year: Less than or equal to 10 mrads for gamma radiation and less than or equal to 20 mrads for beta radiation.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days, pursuant to 10 CFR 50, Appendix I, Section IV.A, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.2.2.2.1 Cumulative dose contributions for the current calendar quarter and current calendar year for noble gases shall be determined in accordance with the methodology and parameters in the ODCM at least once per 31 days.

6.2 RADIOACTIVE EFFLUENTS

6.2.2 GASEOUS EFFLUENTS

6.2.2.3 DOSE - IODINE-131, IODINE-133, TRITIUM, AND RADIONUCLIDES IN PARTICULATE FORM

REQUIREMENT FOR OPERABILITY

6.2.2.3 The dose to a MEMBER OF THE PUBLIC from iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released, from each reactor unit, to areas at and beyond the SITE BOUNDARY (see ODCM Figure 3-1) shall be limited to the following:

a. During any calendar quarter: Less than or equal to 7.5 mrems to any organ and,

b. During any calendar year: Less than or equal to 15 mrems to any organ.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With the calculated dose from the release of iodine-131, iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents exceeding any of the above limits, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days, pursuant to 10 CFR 50, Appendix I, Section IV.A, a Special Report that identifies the cause(s) for exceeding the limit and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.2.2.3.1 Cumulative dose contributions for the current calendar quarter and current calendar year for iodine-131, iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days shall be determined in accordance with the methodology and parameters in the ODCM at least once per 31 days.

6.2 RADIOACTIVE EFFLUENTS

6.2.2 GASEOUS EFFLUENT

6.2.2.4 GASEOUS OFFGAS RADWASTE TREATMENT SYSTEM

REQUIREMENT FOR OPERABILITY

6.2.2.4 The GASEOUS OFFGAS RADWASTE TREATMENT SYSTEM* shall be in operation in either the normal or charcoal bypass mode. The charcoal bypass mode shall not be used unless the offgas post-treatment radiation monitor is OPERABLE as specified in Table 6.1.2.1-1.

RELEVANT CONDITIONS: Whenever the main condenser steam jet air ejector (evacuation) system is in operation.

COMPENSATORY MEASURES:

a. With the GASEOUS OFFGAS RADWASTE TREATMENT SYSTEM not used in the normal mode for more than 7 days, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days, pursuant to 10 CFR 50, Appendix I, Section IV.A, a Special Report which includes the following information:

   1. Identification of the inoperable equipment or subsystems and the reason for inoperability,

   2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

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

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.2.2.4.1 The GASEOUS OFFGAS RADWASTE TREATMENT SYSTEM shall be verified to be in operation in either the normal or charcoal bypass mode at least once per 7 days whenever the main condenser steam jet air ejector (evacuation) system is in operation.

* A GASEOUS OFFGAS RADWASTE TREATMENT SYSTEM shall be any system designed and installed to reduce radioactive gaseous effluents by collecting primary coolant system offgases from the primary system and providing for delay or holdup for the purpose of reducing the total radioactivity prior to release to the environment.

6.2 RADIOACTIVE EFFLUENTS

6.2.2 GASEOUS EFFLUENTS

6.2.2.5 VENTILATION EXHAUST TREATMENT SYSTEM

REQUIREMENT FOR OPERABILITY

6.2.2.5 The appropriate portions of the VENTILATION EXHAUST TREATMENT SYSTEM shall be OPERABLE and shall be used to reduce radioactive materials in gaseous waste prior to their discharge when the projected doses due to gaseous effluent releases from each reactor unit to areas at and beyond the SITE BOUNDARY (see ODCM Figure 3-1) when averaged over 31 days would exceed 0.3 mrem to any organ in a 31-day period.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With the VENTILATION EXHAUST TREATMENT SYSTEM inoperable for more than 31 days, or with gaseous waste being discharged without treatment and in excess of the above limits, in lieu of a Licensee Event Report, prepare and submit to the Commission within 10 days, pursuant to 10 CFR 50, Appendix I, Section IV.A, a Special Report which includes the following information:

   1. Identification of the inoperable equipment or subsystems, and the reason for the inoperability,

   2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

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

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.2.2.5.1 Doses due to gaseous release to areas at and beyond the SITE BOUNDARY shall be projected at least once per 31 days in accordance with the methodology and parameters in the ODCM.

6.2.2.5.2 The VENTILATION EXHAUST TREATMENT SYSTEM shall be demonstrated OPERABLE by operating the VENTILATION EXHAUST TREATMENT SYSTEM equipment for at least 10 minutes, at least once per 92 days unless the appropriate system has been utilized to process radioactive gaseous effluents during the previous 92 days.

6.2.2 RADIOACTIVE EFFLUENTS

6.2.2 GASEOUS EFFLUENTS

6.2.2.6 VENTING OR PURGING

REQUIREMENT FOR OPERABILITY

6.2.2.6 VENTING or PURGING of the Mark II containment shall be through the standby gas treatment system or the primary containment vent and purge system. The first 24 hours of any vent or purge operation shall be through one standby gas treatment system.

RELEVANT CONDITIONS: All containment vents and purges in Mode 1, 2, or 3, and when de-inerting.

COMPENSATORY MEASURES:

a. With the requirements of the above specification not satisfied, suspend all VENTING and PURGING of the containment.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.2.2.6.1 The containment shall be determined to be aligned for VENTING or PURGING through the standby gas treatment system or the primary containment vent and purge system within 4 hours prior to start of and at least once per 12 hours during VENTING or PURGING of the drywell.

6.2.2.6.2 When VENTING or PURGING through the 2-inch exhaust lines through the standby gas treatment system, the standby gas treatment system train used for VENTING or PURGING shall be functional for filtration of the primary containment effluent.

6.2.2.6.3 In Modes 1, 2, or 3, when VENTING or PURGING through the 24-inch or 30-inch exhaust lines through the standby gas treatment system, the standby gas treatment system train NOT used for PURGING or VENTING shall be OPERABLE, and the standby gas treatment system train used for VENTING or PURGING shall be functional for filtration of the primary containment effluent.

6.2.2.6.4 In Mode 4 when de-inerting through the 24-inch or 30-inch exhaust lines through the standby gas treatment system, the standby gas treatment system train used for VENTING or PURGING shall be functional for filtration of the primary containment effluent.

PERIODIC TESTS AND INSPECTIONS (Continued)

6.2.2.6.5 When VENTING or PURGING in Modes 1, 2, or 3, only one of the standby gas treatment system trains may be used.

6.2.2.6.6 When VENTING or PURGING, the containment atmosphere shall be sampled and analyzed per Table 6.2.2.1.2-1 of Requirements for Operability 6.2.2.1 within 8 hours prior to the start of the VENT or PURGE. If the Main Plant Vent effluent monitor is not operable, sampling and analysis shall be completed at least once per 12 hours during the VENT or PURGE.

6.2 RADIOACTIVE EFFLUENTS

6.2.3 SOLID RADIOACTIVE WASTE

6.2.3.1 SOLID RADIOACTIVE WASTE

REQUIREMENT FOR OPERABILITY

6.2.3.1 Radioactive wastes shall be SOLIDIFIED or dewatered in accordance with the PROCESS CONTROL PROGRAM to meet shipping and transportation requirements during transit, and disposal site requirements when received at the disposal site.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With SOLIDIFICATION* or dewatering not meeting disposal site and shipping and transportation requirements, suspend shipment of the inadequately processed wastes and correct the PROCESS CONTROL PROGRAM, the procedures and/or the solid waste system as necessary to prevent recurrence.

b. With SOLIDIFICATION or dewatering not performed in accordance with the PROCESS CONTROL PROGRAM, (1) test the improperly processed waste in each container to ensure that it meets burial ground and shipping requirements and (2) take appropriate administrative action to prevent recurrence.

c. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.2.3.1.1 SOLIDIFICATION of at least one representative test specimen from at least every tenth batch of each type of wet radioactive wastes (e.g., filter sludges, spent resins, evaporator bottoms, boric acid solutions, and sodium sulfate solutions) shall be verified in accordance with the PROCESS CONTROL PROGRAM.

a. If any test specimen fails to verify SOLIDIFICATION, the SOLIDIFICATION of the batch under test shall be suspended until such time as additional test specimens can be obtained, alternative SOLIDIFICATION parameters can be determined in accordance with the PROCESS CONTROL PROGRAM, and a subsequent test verifies SOLIDIFICATION. SOLIDIFICATION of the batch may then be resumed using the alternative SOLIDIFICATION parameters determined by the PROCESS CONTROL PROGRAM.

PERIODIC TESTS AND INSPECTIONS (Continued)

* SOLIDIFICATION shall be the conversion of radioactive wastes from liquid systems to a homogeneous (uniformly distributed), monolithic, immobilized solid with definite volume and shape, bounded by a stable surface of distinct outline on all sides (free-standing).

b. If the initial test specimen from a batch of waste fails to verify SOLIDIFICATION, the PROCESS CONTROL PROGRAM shall provide for the collection and testing of representative test specimens from each consecutive batch of the same type of wet waste until at least three consecutive initial test specimens demonstrate SOLIDIFICATION. The PROCESS CONTROL PROGRAM shall be modified as required, as provided in FSAR 11.4.3, to assure SOLIDIFICATION of subsequent batches of waste.

c. With the installed equipment incapable of meeting Requirement for Operability 6.2.3.1 or declared inoperable, restore the equipment to OPERABLE status or provide for contract capability to process wastes as necessary to satisfy all applicable transportation and disposal requirements.

6.2 RADIOACTIVE EFFLUENTS

6.2.4 TOTAL DOSE

REQUIREMENT FOR OPERABILITY

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

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Requirement for Operability 6.2.1.2.a, 6.2.1.2.b, 6.2.2.2.a, 6.2.2.2.b, 6.2.2.3.a, or 6.2.2.3.b, calculations shall be made including direct radiation contributions from the reactor units and from outside storage tanks to determine whether the above limits of Requirement for Operability 6.2.4.1 have been exceeded. If such is the case, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days, pursuant to 10 CFR 50, Appendix I, Section IV.A, a Special Report that defines the corrective action to be taken to reduce subsequent releases to prevent recurrence of exceeding the above limits and includes the schedule for achieving conformance with the above limits. This Special Report, as defined in 10 CFR 20.2203.A, shall include an analysis that estimates the radiation exposure (dose) to a MEMBER OF THE PUBLIC from uranium fuel cycle sources, including all effluent pathways and direct radiation, for the calendar year that includes the release(s) covered by this report. It shall also describe levels of radiation and concentrations of radioactive material involved, and the cause of the exposure levels or concentrations. If the estimated dose(s) exceeds the above limits, and if the release condition resulting in violation of 40 CFR Part 190 has not already been corrected, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR Part 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

6.2 RADIOACTIVE EFFLUENTS

6.2.4 TOTAL DOSE (Continued)

PERIODIC TESTS AND INSPECTIONS

6.2.4.1.1 Cumulative dose contributions from liquid and gaseous effluents shall be determined in accordance with PERIODIC TESTS AND INSPECTIONS 6.2.1.2.1, 6.2.2.2.1, and 6.2.2.3.1, and in accordance with the methodology and parameters in the ODCM.

6.2.4.1.2 Cumulative dose contributions from direct radiation from unit operation shall be determined in accordance with the methodology and parameters in the ODCM.

6.3 REQUIREMENT FOR OPERABILITY

IN

SUPPORT

OF THE

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

6.3 RADIOLOGICAL ENVIRONMENTAL MONITORING

6.3.1 MONITORING PROGRAM

REQUIREMENT FOR OPERABILITY

6.3.1.1 The radiological environmental monitoring program shall be conducted as specified in Table 6.3.1.1-1.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With the radiological environmental monitoring program not being conducted as specified in Table 6.3.1.1-1, in lieu of a Licensee Event Report, prepare and submit to the Commission, in the Annual Radiological Environmental Operating Report, a description of the reasons for not conducting the program as required and the plans for preventing a recurrence.

b. With the level of radioactivity as the result of plant effluents in an environmental sampling medium at a specified location exceeding the reporting levels of Table 6.3.1.1-2 when averaged over any calendar quarter, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days, pursuant to 10 CFR 50, Appendix I, Section IV.A, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce radioactive effluents so that the potential annual dose* to A MEMBER 0F THE PUBLIC is less than the calendar year limits of Requirement for Operability 6.2.1.2, 6.2.2.2 and 6.2.2.3. When more than one of the radionuclides in Table 6.3.1.1-2 are detected in the sampling medium, this report shall be submitted if:

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

When radionuclides other than those in Table 6.3.1.1-2 are detected and are the result of plant effluents, this report shall be submitted if the potential annual dose* to A MEMBER OF THE PUBLIC is equal to or greater than the calendar year limits of Requirement for Operability 6.2.1.2, 6.2.2.2 and 6.2.2.3. This report is not required if the measured level of radioactivity was not the result of plant effluents; however, in such an event, the condition shall be reported and described in the Annual Radiological Environmental Operating Report.

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

RADIOLOGICAL ENVIRONMENTAL MONITORING

REQUIREMENT FOR OPERABILITY

COMPENSATORY MEASURES: (Continued)

c. With milk or fresh leafy vegetable samples unavailable from one or more of the sample locations required by Table 6.3.1.1-1, identify locations for obtaining replacement samples and add them to the radiological environmental monitoring program within 30 days.

The specific locations from which samples were unavailable may then be deleted from the monitoring program. In lieu of a Licensee Event Report and in accordance with ODCM 6.4.1, identify the cause of the unavailability of samples and identify the new location(s) for obtaining replacement samples in the next Radioactive Effluent Release Report and also include in the report a revised figure(s) and table for the ODCM reflecting the new location(s).

d. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.3.1.1.1 The radiological environmental monitoring samples shall be collected pursuant to Table 6.3.1.1-1 from the specific locations given in the table and figure(s) in the ODCM, and shall be analyzed pursuant to the requirements of Table 6.3.1.1-1 and the detection capabilities required by Table 6.3.1.1.1-1.

TABLE 6.3.1.1-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM*

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS[a]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
1. DIRECT RADIATION[b]	34 routine monitoring stations either with two or more dosimeters or with one instrument for measuring and recording dose rate continuously, placed as follows: An inner ring of stations, one in each meteorological sector in the general area of the SITE BOUNDARY. An outer ring of stations, one in each of the meteorological sectors of NE, ENE, E, ESE, SE in the 6- to 9-km range from the site, and one in each of the meteorological sectors of N, NNE, SSE, S, SSW in the 9- to 12-km range from the site. The balance of the stations to be placed in special interest areas such as population centers, nearby residences, schools, and 1 or 2 areas to serve as control stations.	Quarterly.	Gamma dose quarterly.

* The number, media, frequency, and location of samples may vary from site to site. This table presents an acceptable minimum program for a site at which each entry is applicable. Local site characteristics must be examined to determine if pathways not covered by this table may significantly contribute to an individual's dose and should be included in the sampling program.

TABLE 6.3.1.1.-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM*

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS[a]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
2. AIRBORNE			
Radioiodine and Particulates	Samples from 5 locations: 1 sample from close to the 1 SITE BOUNDARY location, having a high calculated annual average ground-level D/Q. Three samples from close to the 3 Columbia River locations having the highest calculated D/Q. One sample from the vicinity of a community having the highest calculated annual average ground-level D/Q. One sample from a control location, as for example 30-50 km distant and in the least prevalent wind direction.	Continuous sampler operation with sample collection weekly, or more frequently if required by dust loading.	Radioiodine Canister: I-131 analysis weekly. Particulate Sampler: Gross beta radioactivity analysis following filter change;[c] Gamma isotopic analysis[d] of composite (by location) quarterly.
3. WATERBORNE			
a. Surface[e]	1 sample upstream 1 sample downstream	Composite sample over 1-month period.[f]	Gamma isotopic analysis[d] monthly. Composite for tritium analysis quarterly.
b. Ground	Samples from 1 or 2 sources only if likely to be affected.[g]	Quarterly.	Gamma isotopic[d] and tritium analysis quarterly.

TABLE 6.3.1.1.-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM*

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS[a]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
3. WATERBORNE (Continued)			
c. Drinking	One sample of each of 1 to 3 of the nearest water supplies that could be affected by its discharge.	Composite sample over 2-week period[f] when I-131 analysis is performed, monthly composite otherwise.	I-131 analysis on each composite when the dose calculated for the consumption of the water is greater than 1 mrem per year.[h]
	One sample from a control location.		Composite for gross beta and gamma isotopic analysis[d] monthly. Composite for tritium analysis quarterly.
d. Sediment from shoreline	One sample from downstream area with existing or potential recreational value.	Semiannually.	Gamma isotopic analysis[d] semiannually.
4. INGESTION			
a. Milk	Samples from milking animals in 3 locations within 5 km distance having the highest dose poten-tial. If there are none, then 1 sample from milking animals in each of 3 areas between 5-16 km distant where doses are calculated to be greater than 1 mrem per year.[h]	Semimonthly when animals are on pasture, monthly at other times.	Gamma isotopic[d] and I-131 analysis semi-monthly when animals are on pasture; monthly at other times.
	1 sample from milking animals at a control location, 30-50 km distant and in the least prevalent wind direction.		

TABLE 6.3.1-2 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM*

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS[a]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
4. INGESTION (Continued)			
b. Fish and Invertebrates	1 sample of each of three recreationally important species (one anadromous and two resident) in vicinity of plant discharge area.	Sample annually, unless an impact is indicated, then semiannually.[i]	Gamma isotopic analysis[d] on edible portions.
	1 sample of same species in areas not influenced by plant discharge.		
c. Food Products	1 sample of each principal class of food products from any area that is irrigated by water in which liquid plant wastes have been discharged.	At time of harvest.[j]	Gamma isotopic analyses[d] on edible portion.
	Samples of 3 different kinds of broad leaf vegetation grown nearest each of two different offsite locations of highest predicted annual average ground-level D/Q if milk sampling is not performed.	Monthly during growing season.	Gamma isotopic[d] and I-131 analysis.
	1 sample of each of the similar broad leaf vegetation grown 30-50 km distant in the least prevalent wind direction if milk sampling is not performed.	Monthly during growing season.	Gamma isotopic[d] and I-131 analysis.

TABLE 6.3.1.1-1 (Continued)

TABLE NOTATIONS

[a] Specific parameters of distance and direction sector from the centerline of one reactor, and additional description where pertinent, shall be provided for each and every sample location in Table 6.3.1.1-1 in a table and figure(s) in the ODCM. Refer to NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," October 1978, and to Radiological Assessment Branch Technical Position, Revision 1, November 1979. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to circumstances such as hazardous conditions, seasonal unavailability, and malfunction of automatic sampling equipment. If specimens are unobtainable due to sampling equipment malfunction, effort shall be made to complete corrective action prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented in the Annual Radiological Environmental Operating Report. It is recognized that, at times, it may not be possible or practicable to continue to obtain samples of the media of choice at the most desired location or time. In these instances suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the radiological environmental monitoring program. In lieu of a Licensee Event Report, identify the cause of the unavailability of samples for that pathway and identify the new location(s) for obtaining replacement samples in the next Radioactive Effluent Release Report and also include in the report a revised figure(s) and table for the ODCM reflecting the new location(s).

[b] One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. For the purposes of this table, a thermoluminescent dosimeter (TLD) is considered to be one phosphor card with multiple readout areas; a phosphor card in a packet is considered to be equivalent to two or more dosimeters. Film badges shall not be used as dosimeters for measuring direct radiation. (The number of direct radiation monitoring stations may be reduced according to geographical limitations. The frequency of analysis or readout for TLD systems will depend upon the characteristics of the specific system used and should be selected to obtain optimum dose information with minimal fading.)

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

[d] Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.

[e] The "upstream sample" shall be taken at a distance beyond significant influence of the discharge. The "downstream" sample shall be taken in an area beyond but near the mixing zone.

TABLE 6.3.1.1-1 (Continued)

TABLE NOTATIONS

[f] A composite sample is one in which the quantity (aliquot) of liquid is proportional to the quantity of flowing liquid and in which the method of sampling employed results in a specimen that is representative of the liquid flow. In this program composite sample aliquots shall be collected at time intervals that are very short (e.g., hourly) relative to the compositing period (e.g., monthly) in order to assure obtaining a representative sample.

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

[h] The dose shall be calculated for the maximum organ and age group, using the methodology and parameters in the ODCM.

[i] If any of the analytical results for Columbia River fish samples are significantly higher than the results of the Snake River samples or the results of previous fish samples, sampling will be conducted semiannually.

[j] If harvest occurs more than once a year, sampling shall be performed during each discrete harvest. If harvest occurs continuously, sampling shall be monthly. Attention shall be paid to including samples of tuberous and root food products.

TABLE 6.3.1.1-2

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

ANALYSIS	WATER (pCi/L)	AIRBORNE PARTICULATE OR GASES (pCi/m^3)	FISH (pCi/kg, wet)	MILK (pCi/L)	FOOD PRODUCTS (pCi/kg, wet)
H-3[1]	2×10^4				
Mn-54	1×10^3		3×10^4		
Fe-59	4×10^2		1×10^4		
Co-58	1×10^3		3×10^4		
Co-60	3×10^2		1×10^4		
Zn-65	3×10^2		2×10^4		
Zr-Nb-95	4×10^2				
I-131	2	0.9		3	1×10^2
Cs-134	30	10	1×10^3	60	1×10^3
Cs-137	50	20	2×10^3	70	2×10^3
Ba-La-140	2×10^2			3×10^2	

(1) For drinking water samples. The value given is the 40 CFR Part 141 value. If no drinking water pathway exists, a value of 30,000 pCi/L may be used.

TABLE 6.3.1.1.1-1

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS[a]

LOWER LIMIT OF DETECTION (LLD)[b]

ANALYSIS	WATER (pCi/L)	AIRBORNE PARTICULATE OR GASES (pCi/m^3)	FISH (pCi/kg, wet)	MILK (pCi/L)	FOOD PRODUCTS (pCi/kg, wet)	SEDIMENT (pCi/kg, dry)
Gross beta	4	1×10^{-2}				
H-3	2000*					
Mn-54	15		130			
Fe-59	30		260			
Co-58,60	15		130			
Zn-65	30		260			
Zr-95	30					
Nb-95	15					
I-131		7×10^{-2}		1	60	
Cs-134	15	5×10^{-2}	130	15	60	150
Cs-137	18	6×10^{-2}	150	18	80	180
Ba-140	60			60		
La-140	15			15		

(*) If no drinking water pathway exists, a value of 3,000 pCi/L may be used.

TABLE 6.3.1.1.1-1 (Continued)

TABLE NOTATIONS

[a] This list does not mean that only these nuclides are to be considered. Other peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Annual Radiological Environmental Operating Report.

[b] Required detection capabilities for thermoluminescent dosimeters used for environmental measurements shall be in accordance with the recommendations of Regulatory Guide 4.13, except for specification regarding energy dependence. Correction factors shall be provided for energy ranges not meeting the energy dependence specification.

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

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66 s_b}{E \cdot V \cdot 2.22 \cdot Y \cdot \exp(-\lambda \Delta \tau)}$$

Where:

LLD is the "a priori" lower limit of detection as defined above, as picocuries per unit mass or volume,

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

E is the counting efficiency, as counts per disintegration,

V is the sample size in units of mass or volume,

2.22 is the number of disintegrations per minute per picocurie,

Y is the fractional radiochemical yield, when applicable,

λ is the radioactive decay constant for the particular radionuclide, and

Δt for environmental samples is the elapsed time between sample collection, or end of the sample collection period, and time of counting.

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

TABLE 6.3.1.1.1-1 (Continued)

TABLE NOTATIONS

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement. Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidable small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors shall be identified and described in the Annual Radiological Environmental Operating Report.

[d] LLD for drinking water samples. If no drinking water pathway exists, the LLD of gamma isotopic analysis may be used.

6.3 RADIOLOGICAL ENVIRONMENTAL MONITORING

6.3.2 LAND USE CENSUS

REQUIREMENT FOR OPERABILITY

6.3.2.1 A Land Use Census shall be conducted and shall identify within a distance of 8 km (5 miles) the location in each of the 16 meteorological sectors of the nearest milk animal, the nearest residence and the nearest garden* of greater than 50 m^2 (500 ft^2) producing broad leaf vegetation.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With a Land Use Census identifying a location(s) that yields a calculated dose or dose commitment greater than the values currently being calculated in Requirement for Operability 6.2.2.3.1, in lieu of a Licensee Event Report, identify the new location(s) in the next Radioactive Effluent Release Report.

b. With a Land Use Census identifying a location(s) that yields a calculated dose or dose commitment (via the same exposure pathway) 20% greater than at a location from which samples are currently being obtained in accordance with Requirement for Operability 6.3.1.1, add the new location(s) to the radiological environmental monitoring program within 30 days. The sampling location(s), excluding the control station location having the lowest calculated dose or dose commitment(s), via the same exposure pathway, may be deleted from this monitoring program after October 31 of the year in which this Land Use Census was conducted. In lieu of a Licensee Event Report, identify the new location(s) in the next Radioactive Effluent Release Report and also include in the report a revised figure(s) and table for the ODCM reflecting the new location(s).

c. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.3.2.1.1 The Land Use Census shall be conducted during the growing season at least once per calendar year using that information that will provide the best results, such as by a door-to-door survey, aerial survey, or by consulting local agriculture authorities. The results of the Land Use Census shall be included in the Annual Radiological Environmental Operating Report.

*Broad leaf vegetation sampling of at least three different kinds of vegetation may be performed at the SITE BOUNDARY in each of two different direction sectors with the highest predicted D/Qs in lieu of the garden census. Specifications for broad leaf vegetation sampling in Table 6.3.1.1-1 shall be followed, including analysis of control samples.

6.3 RADIOLOGICAL ENVIRONMENTAL MONITORING

6.3.3 INTERLABORATORY COMPARISON PROGRAM

REQUIREMENT FOR OPERABILITY

6.3.3.1 Analyses shall be performed on all radioactive materials, supplied as part of an Interlaboratory Comparison Program that has been approved by the Commission, that correspond to samples required by Table 6.3.1.1-1.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

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

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.3.3.1.1 The Interlaboratory Comparison Program shall be described in the ODCM. A summary of the results obtained as part of the above required Interlaboratory Comparison Program shall be included in the Annual Radiological Environmental Operating Report.

6.4 RADIOLOGICAL ENVIRONMENTAL OPERATING/RADIOACTIVE EFFLUENT RELEASE REPORT REQUIREMENTS

CONTROL OF CHANGES TO THE:

RADIOACTIVE LIQUID, GASEOUS, AND SOLID WASTE TREATMENT SYSTEMS

6.4.1 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

Routine Radiological Environmental Operating Reports covering the operation of the unit during the previous calendar year shall be submitted prior to May 15 of each year.

The Annual Radiological Environmental Operating Reports shall include summaries, interpretations, and an analysis of trends of the results of the radiological environmental surveillance activities for the report period, including a comparison with preoperational studies, with operational controls as appropriate, and with previous environmental surveillance reports, and an assessment of the observed impacts of the plant operation of the environment. The reports shall also include the results of Land Use Censuses required by Requirement for Operability 6.3.2.1.

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

The reports shall also include the following: a summary description of the radiological environmental monitoring program, at least two legible maps* covering all sampling locations keyed to a table giving distances and directions from the centerline of the reactor; the results of license participation in the Interlaboratory Comparison Program, required by Requirement for Operability 6.3.3.1; discussion of all deviations from the sampling schedule of Table 6.3.1.1-1; and discussion of all analyses in which the LLD required by Table 6.3.1.1.1-1 was not achievable.

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* One map shall cover stations near the SITE BOUNDARY; a second shall include the more distant stations.

6.4.2 RADIOACTIVE EFFLUENT RELEASE REPORT

The routine Radioactive Effluent Release Report covering the operation of the unit shall be submitted in accordance with 10 CFR 50.36a(a)(2).

The Radioactive Effluent Release Report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit as outlined in Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," Revision 1, June 1974, with data summarized on a quarterly basis following the format of Appendix B thereof.

The Radioactive Effluent Release Report to be submitted within 60 days after January 1 of each year shall include an annual summary of hourly meteorological data collected over the previous year. This annual summary may be either in the form of an hour-by-hour listing on magnetic tape of wind speed, wind direction, atmospheric stability, and precipitation (if measured), or in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability. This same report shall include an assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from the unit or station during the previous calendar year. This same report shall also include an assessment of the radiation doses from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY (ODCM Figure 3-1) during the report period. All assumptions used in making these assessments, i.e., specific activity, exposure time and location, shall be included in these reports. The meteorological conditions concurrent with the time of release of radioactive materials in gaseous effluents, as determined by sampling frequency and measurement, shall be used for determining the gaseous pathway doses. The assessment of radiation doses shall be performed in accordance with the methodology and parameters in the OFFSITE DOSE CALCULATION MANUAL (ODCM).

6.4.2 RADIOACTIVE EFFLUENT RELEASE REPORT (Continued)

The Radioactive Effluent Release Report shall also include once a year an assessment of radiation doses to the likely most exposed MEMBER OF THE PUBLIC from reactor releases and other nearby uranium fuel cycle sources, including doses from primary effluent pathways and direct radiation, for the previous calendar year to show conformance with 40 CFR Part 190, Environmental Radiation Protection Standards for Nuclear Power Operation. Acceptable methods for calculating the dose contribution from liquid and gaseous effluents are given in Regulatory Guide 1.109, Rev. 1, October 1977.

The Radioactive Effluent Release Report shall include the following information for each class of solid waste (as defined by 10 CFR Part 61) shipped offsite during the report period:

a. Container volume,

b. Total curie quantity (specify whether determined by measurement or estimate),

c. Principal radionuclides (specify whether determined by measurement or estimate),

d. Source of waste and processing employed (e.g., dewatered spent resin, compacted dry waste, evaporator bottoms),

e. Type of container (e.g., LSA, Type A, Type B, Large Quantity), and

f. Solidification agent or absorbent (e.g., cement, urea formaldehyde).

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

The Radioactive Effluent Release Reports shall include any changes made during the reporting period to the PROCESS CONTROL PROGRAM (PCP) and to the OFFSITE DOSE CALCULATION MANUAL (ODCM), as well as a listing of new locations for dose calculations and/or environmental monitoring identified by the Land Use Census pursuant to Requirement for Operability 6.3.2.1.

6.4.3 MAJOR CHANGES TO RADIOACTIVE LIQUID, GASEOUS, AND SOLID WASTE TREATMENT SYSTEMS*

Licensee initiated major changes to the radioactive waste systems (liquid, gaseous, and solid):

a. Shall be reported to the Commission in the Radioactive Effluent Release Report for the period in which the evaluation was reviewed by the POC. The discussion of each change shall contain:

1. A summary of the evaluation that led to the determination that the change could be made without prior NRC approval;

2. Sufficient detailed information to totally support the reason for the change without benefit of additional or supplemental information;

3. A detailed description of the equipment, components, and processes involved and the interface with other plant systems;

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

5. An evaluation of the change, which shows the expected maximum exposures to a MEMBER OF THE PUBLIC in the UNRESTRICTED AREA and to the general population that differ from those previously estimated in the license application and amendments thereto;

6. A comparison of the predicted releases of radioactive materials, in liquid and gaseous effluents and in solid waste, to the actual releases for the period prior to when the changes are to be made;

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

8. Documentation of the fact that the change was reviewed and found acceptable by the POC.

b. Shall become effective upon review and acceptance by the POC.

* Licensees may choose to submit the information called for in this specification as part of the annual FSAR update.

6.5 BASES

FOR

RADIOACTIVE EFFLUENTS MONITORING

REQUIREMENT FOR OPERABILITY

B6.1 INSTRUMENTATION

BASES

MONITORING INSTRUMENTATION

B6.1.1 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, releases of radioactive materials in liquid effluents during actual radioactive releases or potentially radioactive releases of liquid effluents. The alarm/trip setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50. The purpose of tank level indicating devices is to assure the detection and control of leaks that if not controlled could potentially result in the transport of radioactive materials to UNRESTRICTED AREAS.

B6.1.2 RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, releases of radioactive materials in gaseous effluents during actual radioactive releases or potentially radioactive releases of gaseous effluents. The alarm/trip setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. This instrumentation also includes provisions for monitoring the concentrations of potentially explosive gas mixtures in the WASTE GAS HOLDUP SYSTEM. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

B6.2 RADIOACTIVE EFFLUENTS

BASES

B6.2.1 LIQUID EFFLUENTS

B6.2.1.1 CONCENTRATION

This Requirement for Operability is provided to ensure that the concentration of radioactive materials released in liquid waste effluents to UNRESTRICTED AREAS will be less than the concentration levels specified in 10 CFR Part 20, Appendix B, Table II, Column 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water in UNRESTRICTED AREAS will result in exposures within (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a MEMBER OF THE PUBLIC and (2) the limits of 10 CFR 20.106(e) to the population. The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-135 is the con-trolling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

This Requirement for Operability applies to the release of radioactive materials in liquid effluents from all reactor units at the site.

The required detection capabilities for radioactive materials in liquid waste samples are tabulated in terms of the lower limits of detection (LLDs). Detailed discussion of the LLD, and other detection limits can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, L. A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem. 40, 586-93 (1968), and Hartwell, J. K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

B6.2.1.2 DOSE

This Requirement for Operability is provided to implement the requirements of Sections II.A, III.A, and IV.A of Appendix I, 10 CFR Part 50. The Requirement for Operability implements the guides set forth in Section II.A of Appendix I. The COMPENSATORY MEASURES statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." Also, for fresh water sites with drinking water supplies that can be potentially affected by plant operations, there is reasonable assurance that the operation of the facility will not result in radionuclide concentrations in the finished drinking water that are in excess of the requirements of 40 CFR Part 141. The dose calculation methodology and parameters in the ODCM implement the requirements in Section III.A of Appendix I that conformance with the guides of

B6.2.1.2 DOSE (Continued)

Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

This Requirement for Operability applies to the release of radioactive materials in liquid effluents from each reactor unit at the site.

B6.2.1.3 LIQUID RADWASTE TREATMENT SYSTEM

The OPERABILITY of the liquid radwaste treatment system ensures that this system will be available for use whenever liquid effluents require treatment prior to release to the environment. The requirement that the appropriate portions of this system be used, when specified, provides assurance that the releases of radioactive materials in liquid effluent will be kept "as low as is reasonably achievable." This Requirement for Operability implements the requirements of 10 CFR 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50 and the design objective given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the liquid radwaste treatment system were specified as a suitable fraction of the dose design objectives set forth in Section II.A of Appendix I, 10 CFR Part 50, for liquid effluents.

This Requirement for Operability applies to the release of radioactive materials in liquid effluents from each reactor unit at the site.

B6.2.2 GASEOUS EFFLUENTS

B6.2.2.1 DOSE RATE

This Requirement for Operability is provided to ensure that the dose at any time at and beyond the SITE BOUNDARY from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 to UNRESTRICTED AREAS. The annual dose limits are the doses associated with the concentrations of 10 CFR Part 20, Appendix B, Table II, Column 1. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of a MEMBER OF THE PUBLIC in an UNRESTRICTED AREA, either within or outside the SITE BOUNDARY, to annual average concentrations exceeding the limits specified in Appendix B, Table II of 10 CFR Part 20 (10 CFR 20.1302(b)). For MEMBERS OF THE PUBLIC who may at times be within the SITE

B6.2.2.1 DOSE RATE (Continued)

BOUNDARY, the occupancy of that MEMBER OF THE PUBLIC will usually be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the SITE BOUNDARY. Examples of calculations for such MEMBERS OF THE PUBLIC, with the appropriate occupancy factors, is provided in the ODCM. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to a MEMBER OF THE PUBLIC at or beyond the SITE BOUNDARY to less than or equal to 500 mrems/year to the total body or to less than or equal to 3000 mrems/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrems/year.

This Requirement for Operability applies to the release of radioactive materials in gaseous effluents from all reactor units at the site.

The required detection capabilities for radioactive materials in gaseous waste samples are tabulated in terms of the lower limits of detection (LLDs). Detailed discussion of the LLD and other detection limits can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, L. A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radio- chemistry," Anal. Chem. 40, 586-93 (1968), and Hartwell, J. K. , "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

B6.2.2.2 DOSE - NOBLE GASES

This Requirement for Operability is provided to implement the requirements of Sections II.B, III.A, and IV.A of Appendix I, 10 CFR Part 50. The Requirement for Operability implements the guides set forth in Section II.B of Appendix I. The COMPENSATORY MEASURES statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The PERIODIC TESTS AND INSPECTIONS requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The dose calculation methodology and parameters established in the ODCM for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors," Revision 1, July 1977. The ODCM equations provided for determining the air doses at and beyond the SITE BOUNDARY are based upon the historical average atmospheric conditions.

B6.2.2.2 DOSE - NOBLE GASES (Continued)

This Requirement for Operability applies to the release of radioactive materials in gaseous effluents from each reactor unit at the site.

B6.2.2.3 DOSE - IODINE- 131, IODINE- 133, TRITIUM, AND RADIONUCLIDES IN PARTICULATE FORM

This Requirement for Operability is provided to implement the requirements of Sections II.C, III.A, and IV.A of Appendix I, 10 CFR Part 50. The Requirement for Operability are the guides set forth in Section II.C of Appendix I. The COMPENSATORY MEASURES statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The ODCM calculational methods specified in the Requirement for Operability implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The ODCM calculational methodology and parameters for calculating the doses due to the actual release rates of the subject materials are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors," Revision 1, July 1977. These equations also provide for determining the actual doses based upon the historical average atmospheric conditions or concurrent meteorology. The release rate specifications for iodine-131, iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days are dependent upon the existing radionuclide pathways to man, in the areas at and beyond the SITE BOUNDARY. The pathways that were examined in the development of these calculations were: (1) individual inhalation of airborne radionuclides, (2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, (3) deposition onto grassy areas where milk animals and meat-producing animals graze with consumption of the milk and meat by man, and (4) deposition on the ground with subsequent exposure of man.

This Requirement for Operability applies to the release of radioactive materials in gaseous effluents from each reactor unit at the site.

B6.2 RADIOACTIVE EFFLUENTS

BASES

B6.2.2.4 and 6.2.2.5 GASEOUS OFFGAS RADWASTE TREATMENT SYSTEM and VENTILATION EXHAUST TREATMENT SYSTEM

The OPERABILITY of the GASEOUS OFFGAS RADWASTE TREATMENT SYSTEM and the VENTILATION EXHAUST TREATMENT SYSTEM ensures that the systems will be available for use whenever gaseous effluents require treatment prior to release to the environment. The requirement that the appropriate portions of these systems be used, when specified, provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." This Requirement for Operability implements the requirements of 10 CFR 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and the design objectives given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the dose design objectives set forth in Sections II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents.

B6.2.2.6 VENTING OR PURGING

This Requirement for Operability provides reasonable assurance that releases from containment VENTING or PURGING operations will not exceed the annual dose limits of 10 CFR Part 20 for unrestricted areas.

In Modes 1, 2, or 3, the requirement to have one OPERABLE standby gas treatment system train, in addition to one functional train for VENTING or PURGING when using the 24-inch or 30-inch exhaust valves, provides assurance that the gases exhausted from primary containment are properly filtered prior to release. Standby gas treatment system train functionality shall include the ability to accept the exhaust gases from primary containment, process the gases through the filtration unit, and discharge the gases to either the reactor building stack or the reactor building. The requirement to have an additional OPERABLE standby gas treatment system train addresses the fact that when the 24-inch or 30-inch exhaust valves are used, the in-service standby gas treatment system train used for filtration of the exhaust gases is INOPERABLE due to the potential for post-LOCA overpressurization of that train. The overpressurization is caused by the postulated rapid pressurization of containment during a LOCA which occurs before the qualified containment isolation valves close in 4-5 seconds from receipt of a high drywell pressure signal.

In Mode 4 when VENTING or PURGING through the 24-inch or 30-inch exhaust lines, it is acceptable to have only one functional standby gas treatment system train, and to have that train in service supporting the VENTING or PURGING. This functional filtration will assure the requirements of 10 CFR 20 are met. In Mode 4 there are no postulated accidents that could result in overpressurization of the standby gas treatment system train.

B6.2.2.6 VENTING OR PURGING (Continued)

The requirements associated with VENTING or PURGING through the 2-inch lines ensure that primary containment gases are exhausted through a standby gas treatment system train capable of providing the necessary filtration to meet 10 CFR 20 requirements for unrestricted areas. Additional restrictions on standby gas treatment system OPERABILITY are not required in the ODCM since the flow through the 2-inch lines will not overpressurize the train, and these 2-inch lines are automatically isolated during a LOCA by primary containment isolation valves.

Additional requirements for standby gas treatment system OPERABILITY are found in the Technical Specifications.

B6.2.3.1 SOLID RADIOACTIVE WASTE

This Requirement for Operability implements the requirements of 10 CFR 50.36a and General Design Criterion 60 of Appendix A to 10 CFR Part 50. The process parameters included in establishing the PROCESS CONTROL PROGRAM may include, but are not limited to, waste type, waste pH, waste/liquid/solidification agent/catalyst ratios, waste oil content, waste principal chemical constituents, mixing and curing times.

B6.2 RADIOACTIVE EFFLUENTS

BASES

B6.2.4.1 TOTAL DOSE

This Requirement for Operability is provided to meet the dose limitations of 40 CFR Part 190 that have been incorporated into 10 CFR Part 20 by 46 FR 18525. The Requirement for Operability requires the preparation and submittal of a Special Report whenever the calculated doses from plant generated radioactive effluents and direct radiation exceed 25 mrems to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems. For sites containing up to four reactors, it is highly unlikely that the resultant dose to a MEMBER OF THE PUBLIC will exceed the dose limits of 40 CFR Part 190 if the individual reactors remain within twice the dose design objectives of Appendix I, and if direct radiation doses from the reactor units and outside storage tanks are kept small. The Special Report will describe a course of action that should result in the limitation of the annual dose to a MEMBER OF THE PUBLIC to within the 40 CFR Part 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to the MEMBER OF THE PUBLIC from other uranium fuel cycle sources is negligible with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 8 km must be considered. If the dose to any MEMBER OF THE PUBLIC is estimated to exceed the requirements of 40 CFR Part 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR Part 190 have not already been corrected), in accordance with the provisions of 40 CFR 190.11 and 10 CFR 20.405c, is considered to be a timely request and fulfills the requirements of 40 CFR Part 190 until NRC staff action is completed. The variance only relates to the limits of 40 CFR Part 190, and does not apply in any way to the other requirements for dose limitation of 10 CFR Part 20, as addressed in Requirement for Operability 6.2.1.1 and 6.2.2.1. An individual is not considered a MEMBER OF THE PUBLIC during any period in which he/she is engaged in carrying out any operation that is part of the nuclear fuel cycle.

B6.3 RADIOLOGICAL ENVIRONMENTAL MONITORING

BASES

B6.3.1.1 MONITORING PROGRAM

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

The required detection capabilities for environmental sample analyses are tabulated in terms of the lower limits of detection (LLDs). The LLDs required by Table 6.3.1.1.1-1 are considered optimum for routine environmental measurements in industrial laboratories. It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

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

B6.3.2.1 LAND USE CENSUS

This Requirement for Operability is provided to ensure that changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the radiological environmental monitoring program are made if required by the results of this census. The best information from the door-to-door survey, from aerial survey or from consulting with local agricultural authorities shall be used. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50. Restricting the census to gardens of greater than 50 m^2 provides assurance that significant exposure pathways via leafy vegetables will be identified and

B6.3.2.1 LAND USE CENSUS (continued)

monitored since a garden of this size is the minimum required to produce the quantity (26 kg/year) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption by a child. To determine this minimum garden size, the following assumptions were made: (1) 20% of the garden was used for growing broad leaf vegetation (i.e., similar to lettuce and cabbage), and (2) a vegetation yield of 2 kg/m^2.

B6.3.3.1 INTERLABORATORY COMPARISON PROGRAM

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