TABLE D 3-6
DOSE AND DOSE RATE
R_i VALUES - INHALATION - TEEN
mrem/yr
uCi/m³

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3*	--	1.27E3	1.27E3	1.27E3	1.27E3	1.27E3	1.27E3
C 14*	2.60E4	4.87E3	4.87E3	4.87E3	4.87E3	4.87E3	4.87E3
Cr 51	--	--	1.35E2	7.50E1	3.07E1	2.10E4	3.00E3
Mn 54	--	5.11E4	8.40E3	--	1.27E4	1.98E6	6.68E4
Fe 55	3.34E4	2.38E4	5.54E3	--	--	1.24E5	6.39E3
Fe 59	1.59E4	3.70E4	1.43E4	--	--	1.53E6	1.78E5
Co 58	--	2.07E3	2.78E3	--	--	1.34E6	9.52E4
Co 60	--	1.51E4	1.98E4	--	--	8.72E6	2.59E5
Zn 65	3.86E4	1.34E5	6.24E4	--	8.64E4	1.24E6	4.66E4
Sr 89	4.34E5	--	1.25E4	--	--	2.42E6	3.71E5
Sr 90	1.08E8	--	6.68E6	--	--	1.65E7	7.65E5
Zr 95	1.46E5	4.58E4	3.15E4	--	6.74E4	2.69E6	1.49E5
Nb 95	1.86E4	1.03E4	5.66E3	--	1.00E4	7.51E5	9.68E4
Mo 99	--	1.69E2	3.22E1	--	4.11E2	1.54E5	2.69E5
I 131	3.54E4	4.91E4	2.64E4	1.46E7	8.40E4	--	6.49E3
I 133	1.22E4	2.05E4	6.22E3	2.92E6	3.59E4	--	1.03E4
Cs 134	5.02E5	1.13E6	5.49E5	--	3.75E5	1.46E5	9.76E3
Cs 137	6.70E5	8.48E5	3.11E5	--	3.04E5	1.21E5	8.48E3
Ba 140	5.47E4	6.70E1	3.52E3	--	2.28E1	2.03E6	2.29E5
La 140	4.79E2	2.36E2	6.26E1	--	--	2.14E5	4.87E5
Ce 141	2.84E4	1.90E4	2.17E3	--	8.88E3	6.14E5	1.26E5
Ce 144	4.89E6	2.02E6	2.62E5	--	1.21E6	1.34E7	8.64E5
Nd 147	7.86E3	8.56E3	5.13E2		5.02E3	3.72E5	1.82E5
Ag 110m	1.38E4	1.31E4	7.99E3	--	2.50E4	6.75E6	2.73E5

* mrem/yr per μCi/m³

TABLE D 3-7
DOSE AND DOSE RATE
R_i VALUES - INHALATION - ADULT
$\frac{mrem/yr}{uCi/m^3}$

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3*	--	1.26E3	1.26E3	1.26E3	1.26E3	1.26E3	1.26E3
C 14*	1.82E4	3.41E3	3.41E3	3.41E3	3.41E3	3.41E3	3.41E3
Cr 51	--	--	1.00E2	5.95E1	2.28E1	1.44E4	3.32E3
Mn 54	--	3.96E4	6.30E3	--	9.84E3	1.40E6	7.74E4
Fe 55	2.46E4	1.70E4	3.94E3	--	--	7.21E4	6.03E3
Fe 59	1.18E4	2.78E4	1.06E4	--	--	1.02E6	1.88E5
Co 58	--	1.58E3	2.07E3	--	--	9.28E5	1.06E5
Co 60	--	1.15E4	1.48E4	--	--	5.97E6	2.85E5
Zn 65	3.24E4	1.03E5	4.66E4	--	6.90E4	8.64E5	5.34E4
Sr 89	3.04E5	--	8.72E3	--	--	1.40E6	3.50E5
Sr 90	9.92E7	--	6.10E6	--	--	9.60E6	7.22E5
Zr 95	1.07E5	3.44E4	2.33E4	--	5.42E4	1.77E6	1.50E5
Nb 95	1.41E4	7.82E3	4.21E3	--	7.74E3	5.05E5	1.04E5
Mo 99	--	1.21E2	2.30E1	--	2.91E2	9.12E4	2.48E5
I 131	2.52E4	3.58E4	2.05E4	1.19E7	6.13E4	--	6.28E3
I 133	8.64E3	1.48E4	4.52E3	2.15E6	2.58E4	--	8.88E3
Cs 134	3.73E5	8.48E5	7.28E5	--	2.87E5	9.76E4	1.04E4
Cs 137	4.78E5	6.21E5	4.28E5	--	2.22E5	7.52E4	8.40E3
Ba 140	3.90E4	4.90E1	2.57E3	--	1.67E1	1.27E6	2.18E5
La 140	3.44E2	1.74E2	4.58E1	--	--	1.36E5	4.58E5
Ce 141	1.99E4	1.35E4	1.53E3	--	6.26E3	3.62E5	1.20E5
Ce 144	3.43E6	1.43E6	1.84E5	--	8.48E5	7.78E6	8.16E5
Nd 147	5.27E3	6.10E3	3.65E2	--	3.56E3	2.21E5	1.73E5
Ag 110m	1.08E4	1.00E4	5.94E3	--	1.97E4	4.63E6	3.02E5

* mrem/yr per $\mu Ci/m^3$

TABLE D 3-8
DOSE AND DOSE RATE
R_i VALUES - GROUND PLANE
ALL AGE GROUPS
$\frac{m^2\text{-mrem/yr}}{\text{uCi/sec}}$

NUCLIDE	TOTAL BODY	SKIN
H 3	--	--
C 14	--	--
Cr 51	4.65E6	5.50E6
Mn 54	1.40E9	1.64E9
Fe 55	--	--
Fe 59	2.73E8	3.20E8
Co 58	3.80E8	4.45E8
Co 60	2.15E10	2.53E10
Zn 65	7.46E8	8.57E8
Sr 89	2.16E4	2.51E4
Sr 90	--	--
Zr 95	2.45E8	2.85E8
Nb 95	1.36E8	1.61E8
Mo 99	3.99E6	4.63E6
I 131	1.72E7	2.09E7
I 133	2.39E6	2.91E6
Cs 134	6.83E9	7.97E9
Cs 137	1.03E10	1.20E10
Ba 140	2.05E7	2.35E7
La 140	1.92E7	2.18E7
Ce 141	1.37E7	1.54E7
Ce 144	6.96E7	8.07E7
Nd 147	8.46E6	1.01E7
Ag 110m	3.44E9	4.01E9

TABLE D 3-9
DOSE AND DOSE RATE
R_i VALUES - COW MILK - INFANT
$\frac{m^2\text{-mrem/yr}}{\text{uCi/sec}}$

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3*	--	2.38E3	2.38E3	2.38E3	2.38E3	2.38E3	2.38E3
C 14*	3.23E6	6.89E5	6.89E5	6.89E5	6.89E5	6.89E5	6.89E5
Cr 51	--	--	8.35E4	5.45E4	1.19E4	1.06E5	2.43E6
Mn 54	--	2.51E7	5.68E6	--	5.56E6	--	9.21E6
Fe 55	8.43E7	5.44E7	1.45E7	--	--	2.66E7	6.91E6
Fe 59	1.22E8	2.13E8	8.38E7	--	--	6.29E7	1.02E8
Co 58	--	1.39E7	3.46E7	--	--	--	3.46E7
Co 60	--	5.90E7	1.39E8	--	--	--	1.40E8
Zn 65	3.53E9	1.21E10	5.58E9	--	5.87E9	--	1.02E10
Sr 89	6.93E9	--	1.99E8	--	--	--	1.42E8
Sr 90	8.19E10	--	2.09E10	--	--	--	1.02E9
Zr 95	3.85E3	9.39E2	6.66E2	--	1.01E3	--	4.68E5
Nb 95	4.21E5	1.64E5	1.17E5	--	1.54E5	--	3.03E8
Mo 99	--	1.04E8	2.03E7	--	1.55E8	--	3.43E7
I 131	6.81E8	8.02E8	3.53E8	2.64E11	9.37E8	--	2.86E7
I 133	8.52E6	1.24E7	3.63E6	2.26E9	1.46E7	--	2.10E6
Cs 134	2.41E10	4.49E10	4.54E9	--	1.16E10	4.74E9	1.22E8
Cs 137	3.47E10	4.06E10	2.88E9	--	1.09E10	4.41E9	1.27E8
Ba 140	1.21E8	1.21E5	6.22E6	--	2.87E4	7.42E4	2.97E7
La 140	2.03E1	7.99	2.06	--	--	--	9.39E4
Ce 141	2.28E4	1.39E4	1.64E3	--	4.28E3	--	7.18E6
Ce 144	1.49E6	6.10E5	8.34E4	--	2.46E5	--	8.54E7
Nd 147	4.43E2	4.55E2	2.79E1	--	1.76E2	--	2.89E5
Ag 110m	2.46E8	1.79E8	1.19E8	--	2.56E8	--	9.29E9

*mrem/yr per μCi/m^3.

TABLE D 3-10
DOSE AND DOSE RATE
R_i VALUES - COW MILK - CHILD
$\frac{m^2\text{-mrem/yr}}{\text{uCi/sec}}$

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3*	--	1.57E3	1.57E3	1.57E3	1.57E3	1.57E3	1.57E3
C 14*	1.65E6	3.29E5	3.29E5	3.29E5	3.29E5	3.29E5	3.29E5
Cr 51	--	--	5.27E4	2.93E4	7.99E3	5.34E4	2.80E6
Mn 54	--	1.35E7	3.59E6	--	3.78E6	--	1.13E7
Fe 55	6.97E7	3.07E7	1.15E7	--	--	2.09E7	6.85E6
Fe 59	6.52E7	1.06E8	5.26E7	--	--	3.06E7	1.10E8
Co 58	--	6.94E6	2.13E7	--	--	--	4.05E7
Co 60	--	2.89E7	8.52E7	--	--	--	1.60E8
Zn 65	2.63E9	7.00E9	4.35E9	--	4.41E9	--	1.23E9
Sr 89	3.64E9	--	1.04E8	--	--	--	1.41E8
Sr 90	7.53E10	--	1.91E10	--	--	--	1.01E9
Zr 95	2.17E3	4.77E2	4.25E2	--	6.83E2	--	4.98E5
Nb 95	1.86E5	1.03E4	5.69E4	--	1.00E5	--	4.42E8
Mo 99	--	4.07E7	1.01E7	--	8.69E7	--	3.37E7
I 131	3.26E8	3.28E8	1.86E8	1.08E11	5.39E8	--	2.92E7
I 133	4.04E6	4.99E6	1.89E6	9.27E8	8.32E6	--	2.01E6
Cs 134	1.50E10	2.45E10	5.18E9	--	7.61E9	2.73E9	1.32E8
Cs 137	2.17E10	2.08E10	3.07E9	--	6.78E9	2.44E9	1.30E8
Ba 140	5.87E7	5.14E4	3.43E6	--	1.67E4	3.07E4	2.97E7
La 140	9.70	3.39	1.14	--	--	--	9.45E4
Ce 141	1.15E4	5.73E3	8.51E2	--	2.51E3	--	7.15E6
Ce 144	1.04E6	3.26E5	5.55E4	--	1.80E5	--	8.49E7
Nd 147	2.24E2	1.81E2	1.40E1	--	9.94E1	--	2.87E5
Ag 110m	1.33E8	8.97E7	7.17E7	--	1.67E8	--	1.07E10

*mrem/yr per μCi/m^3.

TABLE D 3-11
DOSE AND DOSE RATE
R_i VALUES - COW MILK - TEEN
$\frac{m^2\text{-mrem/yr}}{\text{uCi/sec}}$

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3*	--	9.94E2	9.94E2	9.94E2	9.94E2	9.94E2	9.94E2
C 14*	6.70E5	1.34E5	1.34E5	1.34E5	1.34E5	1.35E5	1.34E5
Cr 51	--	--	2.58E4	1.44E4	5.66E3	3.69E4	4.34E6
Mn 54	--	9.01E6	1.79E6	--	2.69E6	--	1.85E7
Fe 55	2.78E7	1.97E7	4.59E6	--	--	1.25E7	8.52E6
Fe 59	2.81E7	6.57E7	2.54E7	--	--	2.07E7	1.55E8
Co 58	--	4.55E6	1.05E7	--	--	--	6.27E7
Co 60	--	1.86E7	4.19E7	--	--	--	2.42E8
Zn 65	1.34E9	4.65E9	2.17E9	--	2.97E9	--	1.97E9
Sr 89	1.47E9	--	4.21E7	--	--	--	1.75E8
Sr 90	4.45E10	--	1.10E10	--	--	--	1.25E9
Zr 95	9.34E2	2.95E2	2.03E2	--	4.33E2	--	6.80E5
Nb 95	1.86E5	1.03E5	5.69E4	--	1.00E5	--	4.42E8
Mo 99	--	2.24E7	4.27E6	--	5.12E7	--	4.01E7
I 131	1.34E8	1.88E8	1.01E8	5.49E10	3.24E8	--	3.72E7
I 133	1.66E6	2.82E6	8.59E5	3.93E8	4.94E6	--	2.13E6
Cs 134	6.49E9	1.53E10	7.08E9	--	4.85E9	1.85E9	1.90E8
Cs 137	9.02E9	1.20E10	4.18E9	--	4.08E9	1.59E9	1.71E8
Ba 140	2.43E7	2.98E4	1.57E6	--	1.01E4	2.00E4	3.75E7
La 140	4.05	1.99	5.30E-1	--	--	--	1.14E5
Ce 141	4.67E3	3.12E3	3.58E2	--	1.47E3	--	8.91E6
Ce 144	4.22E5	1.74E5	2.27E4	--	1.04E5	--	1.06E8
Nd 147	9.12E1	9.91E1	5.94E0	--	5.82E1	--	3.58E5
Ag 110m	6.13E7	5.80E7	3.53E7	--	1.11E8	--	1.63E10

*mrem/yr per μCi/m^3.

TABLE D 3-12
DOSE AND DOSE RATE
R_i VALUES - COW MILK - ADULT
$\frac{m^2\text{-mrem/yr}}{\text{uCi/sec}}$

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3*	--	7.63E2	7.63E2	7.63E2	7.63E2	7.63E2	7.63E2
*C 14	3.63E5	7.26E4	7.26E4	7.26E4	7.26E4	7.26E4	7.26E4
Cr 51	--	--	1.48E4	8.85E3	3.26E3	1.96E4	3.72E6
Mn 54	--	5.41E6	1.03E6	--	1.61E6	--	1.66E7
Fe 55	1.57E7	1.08E7	2.52E6	--	--	6.04E6	6.21E6
Fe 59	1.61E7	3.79E7	1.45E7	--	--	1.06E7	1.26E8
Co 58	--	2.70E6	6.05E6	--	--	--	5.47E7
Co 60	--	1.10E7	2.42E7	--	--	--	2.06E8
Zn 65	8.71E8	2.77E9	1.25E9	--	1.85E9	--	1.75E9
Sr 89	7.99E8	--	2.29E7	--	--	--	1.28E8
Sr 90	3.15E10	--	7.74E9	--	--	--	9.11E8
Zr 95	5.34E2	1.71E2	1.16E2	--	2.69E2	--	5.43E5
Nb 95	1.09E5	6.07E4	3.27E4	--	6.00E4	--	3.69E8
Mo 99	--	1.24E7	2.36E6	--	2.81E7	--	2.87E7
I 131	7.41E7	1.06E8	6.08E7	3.47E10	1.82E8	--	2.80E7
I 133	9.09E5	1.58E6	4.82E5	2.32E8	2.76E6	--	1.42E6
Cs 134	3.74E9	8.89E9	7.27E9	--	2.88E9	9.55E8	1.56E8
Cs 137	4.97E9	6.80E9	4.46E9	--	2.31E9	7.68E8	1.32E8
Ba 140	1.35E7	1.69E4	8.83E5	--	5.75E3	9.69E3	2.77E7
La 140	2.26	1.14	3.01E-1	--	--	--	8.35E4
Ce 141	2.54E3	1.72E3	1.95E2	--	7.99E2	--	6.58E6
Ce 144	2.29E5	9.58E4	1.23E4	--	5.68E4	--	7.74E7
Nd 147	4.74E1	5.48E1	3.28E0	--	3.20E1	--	2.63E5
Ag 110m	3.71E7	3.43E7	2.04E7	--	6.74E7	--	1.40E10

*mrem/yr per μCi/m^3.

TABLE D 3-13
DOSE AND DOSE RATE
R_i VALUES - GOAT MILK - INFANT
$\frac{m^2\text{-mrem/yr}}{\text{uCi/sec}}$

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3*	--	6.33E3	6.33E3	6.33E3	6.33E3	6.33E3	6.33E3
C 14*	3.23E6	6.89E5	6.89E5	6.89E5	6.89E5	6.89E5	6.89E5
Cr 51	--	--	1.00E4	6.56E3	1.43E3	1.28E4	2.93E5
Mn 54	--	3.01E6	6.82E5	--	6.67E5	--	1.11E6
Fe 55	1.10E6	7.08E5	1.89E5	--	--	3.46E5	8.98E4
Fe 59	1.59E6	2.78E6	1.09E6	--	--	8.21E5	1.33E6
Co 58	--	1.67E6	4.16E6	--	--	--	4.16E6
Co 60	--	7.08E6	1.67E7	--	--	--	1.68E7
Zn 65	4.24E8	1.45E9	6.70E8	--	7.04E8	--	1.23E9
Sr 89	1.48E10	--	4.24E8	--	--	--	3.04E8
Sr 90	1.72E11	--	4.38E10	--	--	--	2.15E9
Zr 95	4.66E2	1.13E2	8.04E1	--	1.22E2	--	5.65E4
Nb 95	9.42E4	3.88E4	2.24E4	--	2.78E4	--	3.27E7
Mo 99	--	1.27E7	2.47E6	--	1.89E7	--	4.17E6
I 131	8.17E8	9.63E8	4.23E8	3.16E11	1.12E9	--	3.44E7
I 133	1.02E7	1.49E7	4.36E6	2.71E9	1.75E7	--	2.52E6
Cs 134	7.23E10	1.35E11	1.36E10	--	3.47E10	1.42E10	3.66E8
Cs 137	1.04E11	1.22E11	8.63E9	--	3.27E10	1.32E10	3.81E8
Ba 140	1.45E7	1.45E4	7.48E5	--	3.44E3	8.91E3	3.56E6
La 140	2.430	9.59E-1	2.47E-1	--	--	--	1.13E4
Ce 141	2.74E3	1.67E3	1.96E2	--	5.14E2	--	8.62E5
Ce 144	1.79E5	7.32E4	1.00E4	--	2.96E4	--	1.03E7
Nd 147	5.32E1	5.47E1	3.35E0	--	2.11E1	--	3.46E4
Ag 110m	2.95E7	2.15E7	1.43E7	--	3.07E7	--	1.11E9

*mrem/yr per μCi/m^3.

TABLE D 3-14
DOSE AND DOSE RATE
R_i VALUES - GOAT MILK - CHILD
$\frac{m^2\text{-mrem/yr}}{\text{uCi/sec}}$

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3*	--	4.17E3	4.17E3	4.17E3	4.17E3	4.17E3	4.17E3
C 14*	1.65E6	3.29E5	3.29E5	3.29E5	3.29E5	3.29E5	3.29E5
Cr 51	--	--	6.34E3	3.52E3	9.62E2	6.43E3	3.36E5
Mn 54	--	1.62E6	4.31E5	--	4.54E5	--	1.36E6
Fe 55	9.06E5	4.81E5	1.49E5	--	--	2.72E5	8.91E4
Fe 59	8.52E5	1.38E6	6.86E5	--	--	3.99E5	1.43E6
Co 58	--	8.35E5	2.56E6	--	--	--	4.87E6
Co 60	--	3.47E6	1.02E7	--	--	--	1.92E7
Zn 65	3.15E8	8.40E8	5.23E8	--	5.29E8	--	1.48E8
Sr 89	7.77E9	--	2.22E8	--	--	--	3.01E8
Sr 90	1.58E11	--	4.01E10	--	--	--	2.13E9
Zr 95	2.62E2	5.76E1	5.13E1	--	8.25E1	--	6.01E4
Nb 95	5.05E4	1.96E4	1.40E4	--	1.85E4	--	3.63E7
Mo 99	--	4.95E6	1.22E6	--	1.06E7	--	4.09E6
I 131	3.91E8	3.94E8	2.24E8	1.30E11	6.46E8	--	3.50E7
I 133	4.84E6	5.99E6	2.27E6	1.11E9	9.98E6	--	2.41E6
Cs 134	4.49E10	7.37E10	1.55E10	--	2.28E10	8.19E9	3.97E8
Cs 137	6.52E10	6.24E10	9.21E9	--	2.03E10	7.32E9	3.91E8
Ba 140	7.05E6	6.18E3	4.12E5	--	2.01E3	3.68E3	3.57E6
La 140	1.16	4.07E-1	1.37E-1	--	--	--	1.13E4
Ce 141	1.38E3	6.88E2	1.02E2	--	3.02E2	--	8.59E5
Ce 144	1.25E5	3.91E4	6.66E3	--	2.16E4	--	1.02E7
Nd 147	2.68E1	2.17E1	1.68E0	--	1.19E1	--	3.44E4
Ag 110m	1.60E7	1.08E7	8.60E6	--	2.00E7	--	1.28E9

*mrem/yr per μCi/m^3.

TABLE D 3-15
DOSE AND DOSE RATE
R_i VALUES - GOAT MILK - TEEN
$\frac{m^2\text{-mrem/yr}}{\text{uCi/sec}}$

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3*	--	2.64E3	2.64E3	2.64E3	2.64E3	2.64E3	2.64E3
C 14*	6.70E5	1.34E5	1.34E5	1.34E5	1.34E5	1.35E5	1.34E5
Cr 51	--	--	3.11E3	1.73E3	6.82E2	4.44E3	5.23E5
Mn 54	--	1.08E6	2.15E5	--	3.23E5	--	2.22E6
Fe 55	3.61E5	2.56E5	5.97E4	--	--	1.62E5	1.11E5
Fe 59	3.67E5	8.57E5	3.31E5	--	--	2.70E5	2.03E6
Co 58	--	5.46E5	1.26E6	--	--	--	7.53E6
Co 60	--	2.23E6	5.03E6	--	--	--	2.91E7
Zn 65	1.61E8	5.58E8	2.60E8	--	3.57E8	--	2.36E8
Sr 89	3.14E9	--	8.99E7	--	--	--	3.74E8
Sr 90	9.36E10	--	2.31E10	--	--	--	2.63E9
Zr 95	1.13E2	3.56E1	2.45E1	--	5.23E1	--	8.22E4
Nb 95	2.23E4	1.24E4	6.82E3	--	1.20E4	--	5.30E7
Mo 99	--	2.72E6	5.19E5	--	6.23E6	--	4.87E6
I 131	1.61E8	2.26E8	1.21E8	6.59E10	3.89E8	--	4.47E7
I 133	1.99E6	3.38E6	1.03E6	4.72E8	5.93E6	--	2.56E6
Cs 134	1.95E10	4.58E10	2.13E10	--	1.46E10	5.56E9	5.70E8
Cs 137	2.71E10	3.60E10	1.25E10	--	1.23E10	4.76E9	5.12E8
Ba 140	2.92E6	3.58E3	1.88E5	--	1.21E3	2.41E3	4.50E6
La 140	4.86E-1	2.39E-1	6.36E-2	--	--	--	1.37E4
Ce 141	5.60E2	3.74E2	4.30E1	--	1.76E2	--	1.07E6
Ce 144	5.06E4	2.09E4	2.72E3	--	1.25E4	--	1.27E7
Nd 147	1.09E1	1.19E1	7.13E-1	--	6.99E0	--	4.29E4
Ag 110m	7.36E6	6.96E6	4.24E6	--	1.33E7	--	1.96E9

*mrem/yr per μCi/m^3.

TABLE D 3-16
DOSE AND DOSE RATE
R_i VALUES - GOAT MILK - ADULT
$\frac{m^2\text{-mrem/yr}}{\text{uCi/sec}}$

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3*	--	2.03E3	2.03E3	2.03E3	2.03E3	2.03E3	2.03E3
C 14*	3.63E5	7.26E4	7.26E4	7.26E4	7.26E4	7.26E4	7.26E4
Cr 51	--	--	1.78E3	1.06E3	3.92E2	2.36E3	4.48E5
Mn 54	--	6.50E5	1.24E5	--	1.93E5	--	1.99E6
Fe 55	2.04E5	1.41E5	3.28E4	--	--	7.85E4	8.07E4
Fe 59	2.10E5	4.95E5	1.90E5	--	--	1.38E5	1.65E6
Co 58	--	3.25E5	7.27E5	--	--	--	6.58E6
Co 60	--	1.32E6	2.91E6	--	--	--	2.48E7
Zn 65	1.05E8	3.33E8	1.51E8	--	2.23E8	--	2.10E8
Sr 89	1.70E9	--	4.89E7	--	--	--	2.73E8
Sr 90	6.62E10	--	1.63E10	--	--	--	1.91E9
Zr 95	6.45E1	2.07E1	1.40E1	--	3.25E1	--	6.56E4
Nb 95	1.31E4	7.29E3	3.92E3	--	7.21E3	--	4.42E7
Mo 99	--	1.51E6	2.87E5	--	3.41E6	--	3.49E6
I 131	8.89E7	1.27E8	7.29E7	4.17E10	2.18E8	--	3.36E7
I 133	1.09E6	1.90E6	5.79E5	2.79E8	3.31E6	--	1.71E6
Cs 134	1.12E10	2.67E10	2.18E10	--	8.63E9	2.86E9	4.67E8
Cs 137	1.49E10	2.04E10	1.34E10	--	6.93E9	2.30E9	3.95E8
Ba 140	1.62E6	2.03E3	1.06E5	--	6.91E2	1.16E3	3.33E6
La 140	2.71E-1	1.36E-1	3.61E-2	--	--	--	1.00E4
Ce 141	3.06E2	2.07E2	2.34E1	--	9.60E1	--	7.90E5
Ce 144	2.75E4	1.15E4	1.48E3	--	6.82E3	--	9.30E6
Nd 147	5.69E0	6.57E0	3.93E-1	--	3.84E0	--	3.15E4
Ag 110m	4.45E6	4.12E6	2.45E6	--	8.09E6	--	1.68E9

*mrem/yr per μCi/m^3.

TABLE D 3-17
DOSE AND DOSE RATE
R_i VALUES - COW MEAT - CHILD
$\frac{m^2\text{-mrem/yr}}{\text{uCi/sec}}$

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3*	--	2.34E2	2.34E2	2.34E2	2.34E2	2.34E2	2.34E2
C 14*	5.29E5	1.06E5	1.06E5	1.06E5	1.06E5	1.06E5	1.06E5
Cr 51	--	--	4.55E3	2.52E3	6.90E2	4.61E3	2.41E5
Mn 54	--	5.15E6	1.37E6	--	1.44E6	--	4.32E6
Fe 55	2.89E8	1.53E8	4.74E7	--	--	8.66E7	2.84E7
Fe 59	2.04E8	3.30E8	1.65E8	--	--	9.58E7	3.44E8
Co 58	--	9.41E6	2.88E7	--	--	--	5.49E7
Co 60	--	4.64E7	1.37E8	--	--	--	2.57E8
Zn 65	2.38E8	6.35E8	3.95E8	--	4.00E8	--	1.12E8
Sr 89	2.65E8	--	7.57E6	--	--	--	1.03E7
Sr 90	7.01E9	--	1.78E9	--	--	--	9.44E7
Zr 95	1.51E6	3.32E5	2.95E5	--	4.75E5	--	3.46E8
Nb 95	4.10E6	1.59E6	1.14E6	--	1.50E6	--	2.95E9
Mo 99	--	5.42E4	1.34E4	--	1.16E5	--	4.48E4
I 131	4.15E6	4.18E6	2.37E6	1.38E9	6.86E6	--	3.72E5
I 133	9.38E-2	1.16E-1	4.39E-2	2.15E1	1.93E-1	--	4.67E-2
Cs 134	6.09E8	1.00E9	2.11E8	--	3.10E8	1.11E8	5.39E6
Cs 137	8.99E8	8.60E8	1.27E8	--	2.80E8	1.01E8	5.39E6
Ba 140	2.20E7	1.93E4	1.28E6	--	6.27E3	1.15E4	1.11E7
La 140	2.80E-2	9.78E-3	3.30E-3	--	--	--	2.73E2
Ce 141	1.17E4	5.82E3	8.64E2	--	2.55E3	--	7.26E6
Ce 144	1.48E6	4.65E5	7.91E4	--	2.57E5	--	1.21E8
Nd 147	5.93E3	4.80E3	3.72E2	--	2.64E3	--	7.61E6
Ag 110m	5.62E6	3.79E6	3.03E6	--	7.05E6	--	4.52E8

*mrem/yr per μCi/m^3.

TABLE D 3-18
DOSE AND DOSE RATE
R_i VALUES - COW MEAT - TEEN
$\frac{m^2\text{-mrem/yr}}{\text{uCi/sec}}$

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3*	--	1.94E2	1.94E2	1.94E2	1.94E2	1.94E2	1.94E2
C 14*	2.81E5	5.62E4	5.62E4	5.62E4	5.62E4	5.62E4	5.62E4
Cr 51	--	--	2.93E3	1.62E3	6.39E2	4.16E3	4.90E5
Mn 54	--	4.50E6	8.93E5	--	1.34E6	--	9.24E6
Fe 55	1.50E8	1.07E8	2.49E7	--	--	6.77E7	4.62E7
Fe 59	1.15E8	2.69E8	1.04E8	--	--	8.47E7	6.36E8
Co 58	--	8.05E6	1.86E7	--	--	--	1.11E8
Co 60	--	3.90E7	8.80E7	--	--	--	5.09E8
Zn 65	1.59E8	5.52E8	2.57E8	--	3.53E8	--	2.34E8
Sr 89	1.40E8	--	4.01E6	--	--	--	1.67E7
Sr 90	5.42E9	--	1.34E9	--	--	--	1.52E8
Zr 95	8.50E5	2.68E5	1.84E5	--	3.94E5	--	6.19E8
Nb 95	2.37E6	1.32E6	7.24E5	--	1.28E6	--	5.63E9
Mo 99	--	3.90E4	7.43E3	--	8.92E4	--	6.98E4
I 131	2.24E6	3.13E6	1.68E6	9.15E8	5.40E6	--	6.20E5
I 133	5.05E-2	8.57E-2	2.61E-2	1.20E1	1.50E-1	--	6.48E-2
Cs 134	3.46E8	8.13E8	3.77E8	--	2.58E8	9.87E7	1.01E7
Cs 137	4.88E8	6.49E8	2.26E8	--	2.21E8	8.58E7	9.24E6
Ba 140	1.19E7	1.46E4	7.68E5	--	4.95E3	9.81E3	1.84E7
La 140	1.53E-2	7.51E-3	2.00E-3	--	--	--	4.31E2
Ce 141	6.19E3	4.14E3	4.75E2	--	1.95E3	--	1.18E7
Ce 144	7.87E5	3.26E5	4.23E4	--	1.94E5	--	1.98E8
Nd 147	3.16E3	3.44E3	2.06E2	--	2.02E3	--	1.24E7
Ag 110m	3.39E6	3.20E6	1.95E7	--	6.13E6	--	9.01E8

*mrem/yr per μCi/m^3.

TABLE D 3-19
DOSE AND DOSE RATE
R_i VALUES - COW MEAT - ADULT
$\frac{m^2\text{-mrem/yr}}{\text{uCi/sec}}$

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3*	--	3.25E2	3.25E2	3.25E2	3.25E2	3.25E2	3.25E2
C 14*	3.33E5	6.66E4	6.66E4	6.66E4	6.66E4	6.66E4	6.66E4
Cr 51	--	--	3.65E3	2.18E3	8.03E2	4.84E3	9.17E5
Mn 54	--	5.90E6	1.13E6	--	1.76E6	--	1.81E7
Fe 55	1.85E8	1.28E8	2.98E7	--	--	7.14E7	7.34E7
Fe 59	1.44E8	3.39E8	1.30E8	--	--	9.46E7	1.13E9
Co 58	--	1.04E7	2.34E7	--	--	--	2.12E8
Co 60	--	5.03E7	1.11E8	--	--	--	9.45E8
Zn 65	2.26E8	7.19E8	3.25E8	--	4.81E8	--	4.53E8
Sr 89	1.66E8	--	4.76E6	--	--	--	2.66E7
Sr 90	8.38E9	--	2.06E9	--	--	--	2.42E8
Zr 95	1.06E6	3.40E5	2.30E5	--	5.34E5	--	1.08E9
Nb 95	3.04E6	1.69E6	9.08E5	--	1.67E6	--	1.03E10
Mo 99	--	4.71E4	8.97E3	--	1.07E5	--	1.09E5
I 131	2.69E6	3.85E6	2.21E6	1.26E9	6.61E6	--	1.02E6
I 133	6.04E-2	1.05E-1	3.20E-2	1.54E1	1.83E-1	--	9.44E-2
Cs 134	4.35E8	1.03E9	8.45E8	--	3.35E8	1.11E8	1.81E7
Cs 137	5.88E8	8.04E8	5.26E8	--	2.73E8	9.07E7	1.56E7
Ba 140	1.44E7	1.81E4	9.44E5	--	6.15E3	1.04E4	2.97E7
La 140	1.86E-2	9.37E-3	2.48E-3	--	--	--	6.88E2
Ce 141	7.38E3	4.99E3	5.66E2	--	2.32E3	--	1.91E7
Ce 144	9.33E5	3.90E5	5.01E4	--	2.31E5	--	3.16E8
Nd 147	3.59E3	4.15E3	2.48E2	--	2.42E3	--	1.99E7
Ag 110m	4.48E6	4.14E6	2.46E6	--	8.13E6	--	1.69E9

*mrem/yr per μCi/m^3.

TABLE D 3-20
DOSE AND DOSE RATE
R_i VALUES - VEGETATION - CHILD
$\frac{m^2\text{-mrem/yr}}{\text{uCi/sec}}$

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3*	--	4.01E3	4.01E3	4.01E3	4.01E3	4.01E3	4.01E3
C 14*	3.50E6	7.01E5	7.01E5	7.01E5	7.01E5	7.01E5	7.01E5
Cr 51	--	--	1.17E5	6.49E4	1.77E4	1.18E5	6.20E6
Mn 54	--	6.65E8	1.77E8	--	1.86E8	--	5.58E8
Fe 55	7.63E8	4.05E8	1.25E8	--	--	2.29E8	7.50E7
Fe 59	3.97E8	6.42E8	3.20E8	--	--	1.86E8	6.69E8
Co 58	--	6.45E7	1.97E8	--	--	--	3.76E8
Co 60	--	3.78E8	1.12E9	--	--	--	2.10E9
Zn 65	8.12E8	2.16E9	1.35E9	--	1.36E9	--	3.80E8
Sr 89	3.59E10	--	1.03E9	--	--	--	1.39E9
Sr 90	1.24E12	--	3.15E11	--	--	--	1.67E10
Zr 95	3.86E6	8.50E5	7.56E5	--	1.22E6	--	8.86E8
Nb 95	1.02E6	3.99E5	2.85E5	--	3.75E5	--	7.37E8
Mo 99	--	7.70E6	1.91E6	--	1.65E7	--	6.37E6
I 131	7.16E7	7.20E7	4.09E7	2.38E10	1.18E8	--	6.41E6
I 133	1.69E6	2.09E6	7.92E5	3.89E8	3.49E6	--	8.44E5
Cs 134	1.60E10	2.63E10	5.55E9	--	8.15E9	2.93E9	1.42E8
Cs 137	2.39E10	2.29E10	3.38E9	--	7.46E9	2.68E9	1.43E8
Ba 140	2.77E8	2.43E5	1.62E7	--	7.90E4	1.45E5	1.40E8
La 140	3.25E3	1.13E3	3.83E2	--	--	--	3.16E7
Ce 141	6.56E5	3.27E5	4.85E4	--	1.43E5	--	4.08E8
Ce 144	1.27E8	3.98E7	6.78E6	--	2.21E7	--	1.04E10
Nd 147	7.23E4	5.86E4	4.54E3	--	3.22E4	--	9.28E7
Ag 110m	3.21E7	2.17E7	1.73E7	--	4.04E7	--	2.58E9

*mrem/yr per $\mu Ci/m^3$.

TABLE D 3-21
DOSE AND DOSE RATE
R_i VALUES - VEGETATION - TEEN
$\frac{m^2\text{-mrem/yr}}{\text{uCi/sec}}$

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3*	--	2.59E3	2.59E3	2.59E3	2.59E3	2.59E3	2.59E3
C 14*	1.45E6	2.91E5	2.91E5	2.91E5	2.91E5	2.91E5	2.91E5
Cr 51	--	--	6.16E4	3.42E4	1.35E4	8.79E4	1.03E7
Mn 54	--	4.54E8	9.01E7	--	1.36E8	--	9.32E8
Fe 55	3.10E8	2.20E8	5.13E7	--	--	1.40E8	9.53E7
Fe 59	1.79E8	4.18E8	1.61E8	--	--	1.32E8	9.89E8
Co 58	--	4.37E7	1.01E8	--	--	--	6.02E8
Co 60	--	2.49E8	5.60E8	--	--	--	3.24E9
Zn 65	4.24E8	1.47E9	6.86E8	--	9.41E8	--	6.23E8
Sr 89	1.51E10	--	4.33E8	--	--	--	1.80E9
Sr 90	7.51E11	--	1.85E11	--	--	--	2.11E10
Zr 95	1.72E6	5.44E5	3.74E5	--	7.99E5	--	1.26E9
Nb 95	4.80E5	2.66E5	1.46E5	--	2.58E5	--	1.14E9
Mo 99	--	5.64E6	1.08E6	--	1.29E7	--	1.01E7
I 131	3.85E7	5.39E7	2.89E7	1.57E10	9.28E7	--	1.07E7
I 133	9.29E5	1.58E6	4.80E5	2.20E8	2.76E6	--	1.19E6
Cs 134	7.10E9	1.67E10	7.75E9	--	5.31E9	2.03E9	2.08E8
Cs 137	1.01E10	1.35E10	4.69E9	--	4.59E9	1.78E9	1.92E8
Ba 140	1.38E8	1.69E5	8.91E6	--	5.74E4	1.14E5	2.13E8
La 140	1.81E3	8.88E2	2.36E2	--	--	--	5.10E7
Ce 141	2.83E5	1.89E5	2.17E4	--	8.89E4	--	5.40E8
Ce 144	5.27E7	2.18E7	2.83E6	--	1.30E7	--	1.33E10
Nd 147	3.66E4	3.98E4	2.3863	--	2.34E4	--	1.44E8
Ag 110m	1.51E7	1.43E7	8.72E6	--	2.74E7	--	4.03E9

*mrem/yr per μCi/m^3

TABLE D 3-22
DOSE AND DOSE RATE
R_i VALUES - VEGETATION - ADULT
$\frac{m^2\text{-mrem/yr}}{\text{uCi/sec}}$

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3*	--	2.26E3	2.26E3	2.26E3	2.26E3	2.26E3	2.26E3
C 14*	8.97E5	1.79E5	1.79E5	1.79E5	1.79E5	1.79E5	1.79E5
Cr 51	--	--	4.64E4	2.77E4	1.02E4	6.15E4	1.17E7
Mn 54	--	3.13E8	5.97E7	--	9.31E7	--	9.58E8
Fe 55	2.00E8	1.38E8	3.22E7	--	--	7.69E7	7.91E7
Fe 59	1.26E8	2.96E8	1.13E8	--	--	8.27E7	1.02E9
Co 58	--	3.08E7	6.90E7	--	--	--	6.24E8
Co 60	--	1.67E8	3.69E8	--	--	--	3.14E9
Zn 65	3.17E8	1.01E9	4.56E8	--	6.75E8	--	6.36E8
Sr 89	9.96E9	--	2.86E8	--	--	--	1.60E9
Sr 90	6.05E11	--	1.48E11	--	--	--	1.75E10
Zr 95	1.18E6	3.77E5	2.55E5	--	5.92E5	--	1.20E9
Nb 95	3.55E5	1.98E5	1.06E5	--	1.95E5	--	1.20E9
Mo 99	--	6.14E6	1.17E6	--	1.39E7	--	1.42E7
I 131	4.04E7	5.78E7	3.31E7	1.90E10	9.91E7	--	1.53E7
I 133	1.00E6	1.74E6	5.30E5	2.56E8	3.03E6	--	1.56E6
Cs 134	4.67E9	1.11E10	9.08E9	--	3.59E9	1.19E9	1.94E8
Cs 137	6.36E9	8.70E9	5.70E9	--	2.95E9	9.81E8	1.68E8
Ba 140	1.29E8	1.61E5	8.42E6	--	5.49E4	9.25E4	2.65E8
La 140	1.98E3	9.97E2	2.63E2	--	--	--	7.32E7
Ce 141	1.97E5	1.33E5	1.51E4	--	6.19E4	--	5.09E8
Ce 144	3.29E7	1.38E7	1.77E6	--	8.16E6	--	1.11E10
Nd 147	3.36E4	3.88E4	2.32E3	--	2.27E4	--	1.86E8
Ag 110m	1.05E7	9.75E6	5.79E6	--	1.92E7	--	3.98E9

*mrem/yr per μCi/m^3

TABLE D 3-23
DISPERSION PARAMETERS AT CONTROLLING LOCATIONS[1]
X/Q, W_v and W_s VALUES

VENT	DIRECTION	DISTANCE (m)	X/Q (sec/m³)	D/Q (m⁻²)
Site Boundary[2]	E	1,600	2.00 E-6	2.10E-9
Inhalation and Ground Plane	E (104°)	1,800	1.42E-7	2.90E-9
Cow Milk	ESE (130°)	4,300	4.11E-8	4.73E-10
Goat Milk[3]	SE (140°)	4,800	3.56E-08	5.32E-10
Meat Animal	E (114°)	2,600	1.17E-7	1.86E-9
Vegetation	E (96°)	2,900	1.04E-7	1.50E-9
STACK				
Site Boundary[2]	E	1,600	4.50E-8	6.00E-9
Inhalation and Ground Plane	E (109°)	1,700	8.48E-9	1.34E-9
Cow Milk	ESE (135°)	4,200	1.05E-8	3.64E-10
Goat Milk[3]	SE (140°)	4,800	2.90E-08	5.71E-10
Meat Animal	E (114°)	2,500	1.13E-8	1.15E-9
Vegetation	E (96°)	2,800	1.38E-8	9.42E-10

NOTE: Inhalation and Ground Plane are annual average values. Others are grazing season only.

1 X/Q and D/Q values from NMP-2 ER-OLS.
2 X/Q and D/Q from NMP-2 FES, NUREG-1085, May 1985, Table D-2.
3 X/Q and D/Q from C.T. Main Data Report dated November 1985.

TABLE D 3-24
PARAMETERS FOR THE EVALUATION OF DOSES TO REAL MEMBERS OF THE PUBLIC FROM GASEOUS AND LIQUID EFFLUENTS

Pathway	Parameter	Value	Reference
Fish	U (kg/yr) - adult	21	Reg. Guide 1.109 Table E-5
Fish	D_{aipj} (mrem/pCi)	Each Radionuclide	Reg. Guide 1.109 Table E-11
Shoreline	U (hr/yr) - adult - teen	 67 67	Reg. Guide 1.109 Assumed to be Same as Adult
Shoreline	D_{aipj} (mrem/hr per pCi/m^2)	Each Radionuclide	Reg. Guide 1.109 Table E-6
Inhalation	DFA_{ija}	Each Radionuclide	Reg. Guide 1.109 Table E-7

TABLE D 5.1
NINE MILE POINT NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
SAMPLING LOCATIONS

Type of Sample	* Map Location	Collection Site (Env. Program No.)	Location
Radioiodine and Particulates (air)	1	Nine Mile Point Road North (R-1)	1.8 mi @ 88° E
Radioiodine and Particulates (air)	2	County Route 29 & Lake Road (R-2)	1.1 mi @ 104° ESE
Radioiodine and Particulates (air)	3	County Route 29 (R-3)	1.5 mi @ 132° SE
Radioiodine and Particulates (air)	4	Village of Lycoming, NY (R-4)	1.8 mi @ 143° SE
Radioiodine and Particulates (air)	5	Montario Point Road (R-5)	16.4 mi @ 42° NE
Direct Radiation (TLD)	6	North Shoreline Area (75)	0.1 mi @ 5° N
Direct Radiation (TLD)	7	North Shoreline Area (76)	0.1 mi @ 25° NNE
Direct Radiation (TLD)	8	North Shoreline Area (77)	0.2 mi @ 45° NE
Direct Radiation (TLD)	9	North Shoreline Area (23)	0.8 mi @ 70° ENE
Direct Radiation (TLD)	10	JAF East Boundary (78)	1.0 mi @ 90° E
Direct Radiation (TLD)	11	Route 29 (79)	1.1 mi @ 115° SE
Direct Radiation (TLD)	12	Route 29 (80)	1.4 mi @ 133° SE
Direct Radiation (TLD)	13	Miner Road (81)	1.6 mi @ 159° SSE
Direct Radiation (TLD)	14	Miner Road (82)	1.6 mi @ 181° S
Direct Radiation (TLD)	15	Lakeview Road (83)	1.2 mi @ 200° SSW
Direct Radiation (TLD)	16	Lakeview Road (84)	1.1 mi @ 225° SW
Direct Radiation (TLD)	17	Site Meteorological Tower (7)	0.7 mi @ 250° WSW
Direct Radiation (TLD)	18	Energy Information Center (18)	0.4 mi @ 265° W
Direct Radiation (TLD)	19	North Shoreline (85)	0.2 mi @ 294° WNW

* Map = See Figures D 5.1-1 and D 5.1-2.

TABLE D 5.1 (Cont'd)
NINE MILE POINT NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
SAMPLING LOCATIONS

Type of Sample	* Map Location	Collection Site (Env. Program No.)	Location
Direct Radiation (TLD)	20	North Shoreline (86)	0.1 mi @ 315° NW
Direct Radiation (TLD)	21	North Shoreline (87)	0.1 mi @ 341° NNW
Direct Radiation (TLD)	22	Hickory Grove (88)	4.5 mi @ 97° E
Direct Radiation (TLD)	23	Leavitt Road (89)	4.1 mi @ 111° ESE
Direct Radiation (TLD)	24	Route 104 (90)	4.2 mi @ 135° SE
Direct Radiation (TLD)	25	Route 51A (91)	4.8 mi @ 156° SSE
Direct Radiation (TLD)	26	Maiden Lane Road (92)	4.4 mi @ 183° S
Direct Radiation (TLD)	27	County Route 53 (93)	4.4 mi @ 205° SSW
Direct Radiation (TLD)	28	County Route 1 (94)	4.7 mi @ 223° SW
Direct Radiation (TLD)	29	Lake Shoreline (95)	4.1 mi @ 237° WSW
Direct Radiation (TLD)	30	Phoenix, NY Control (49)	19.8 mi @ 163° S
Direct Radiation (TLD)	31	S. W. Oswego, Control (14)	12.6 mi @ 226° SW
Direct Radiation (TLD)	32	Scriba, NY (96)	3.6 mi @ 199° SSW
Direct Radiation (TLD)	33	Alcan Aluminum, Route 1A (58)	3.1 mi @ 220° SW
Direct Radiation (TLD)	34	Lycoming, NY (97)	1.8 mi @ 143° SE
Direct Radiation (TLD)	35	New Haven, NY (56)	5.3 mi @ 123° ESE
Direct Radiation (TLD)	36	W. Boundary, Bible Camp (15)	0.9 mi @ 237° WSW
Direct Radiation (TLD)	37	Lake Road (98)	1.2 mi @ 101° E

* Map = See Figures D 5.1-1 and D 5.1-2.

TABLE D 5.1 (Cont'd)
NINE MILE POINT NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
SAMPLING LOCATIONS

Type of Sample	* Map Location	Collection Site (Env. Program No.)	Location
Surface Water	38	OSS Inlet Canal (NA)	7.6 mi @ 235° SW
Surface Water	39	JAFNPP Inlet Canal (NA)	0.5 mi @ 70° ENE
Shoreline Sediment	40	Sunset Bay Shoreline (NA)	1.5 mi @ 80° E
Fish	41	NMP Site Discharge Area (NA)	0.3 mi @ 315° NW (and/or)
Fish	42	NMP Site Discharge Area (NA)	0.6 mi @ 55° NE
Fish	43	Oswego Harbor Area (NA)	6.2 mi @ 235° SW
Milk	44	Milk Location #50	8.2 mi @ 93° E
Milk	64	Milk Location #55	9.0 mi @ 95° E
Milk	65	Milk Location #60	9.5 mi @ 90° E
Milk	66	Milk Location #4	7.8 mi @ 113° ESE
Milk (CR)	77	Milk Location (Summerville)	13.9 mi @ 191° SSW
Food Product	48	Produce Location #6** (Bergenstock) (NA)	1.9 mi @ 141° SE
Food Product	49	Produce Location #1** (Culeton) (NA)	1.7 mi @ 96° E
Food Product	50	Produce Location #2** (Vitullo) (NA)	1.9 mi @ 101° E
Food Product	51	Produce Location #5** (C.S. Parkhurst) (NA)	1.5 mi @ 114° ESE
Food Product	52	Produce Location #3** (C. Narewski) (NA)	1.6 mi @ 84° E

* Map = See Figures D 5.1-1 and D 5.1-2.
** = Food Product Samples need not necessarily be collected from all listed locations. Collected samples will be of the highest calculated site average D/Q.
(NA) = Not applicable.
CR = Control Result (location).

TABLE D 5.1 (Cont'd)
NINE MILE POINT NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
SAMPLING LOCATIONS

Type of Sample	* Map Location	Collection Site (Env. Program No.)	Location
Food Product	53	Produce Location #4** (P. Parkhurst) (NA)	2.1 mi @ 110° ESE
Food Product (CR)	54	Produce Location #7** (Mc Millen) (NA)	15.0 mi @ 223° SW
Food Product (CR)	55	Produce Location #8** (Denman) (NA)	12.6 mi @ 225° SW
Food Product	56	Produce Location #9** (O'Connor) (NA)	1.6 mi @ 171° S
Food Product	57	Produce Location #10** (C. Lawton) (NA)	2.2 mi @ 123° ESE
Food Product	58	Produce Location #11** (C. R. Parkhurst) (NA)	2.0 mi @ 112° ESE
Food Product	59	Produce Location #12** (Barton) (NA)	1.9 mi @ 115° ESE
Food Product (CR)	60	Produce Location #13** (Flack) (NA)	15.6 mi @ 225° W
Food Product	61	Produce Location #14** (Koeneke) (NA)	1.9 mi @ 95° E
Food Product	62	Produce Location #15** (Whaley) (NA)	1.7 mi @ 136° SE
Food Product	63	Produce Location #16** (Murray) (NA)	1.2 mi @ 207° SSW
Food Product	67	Produce Location #17** (Battles) (NA)	1.76 mi @ 97° E

* Map = See Figures D 5.1-1 and D 5.1-2.
** = Food Product Samples need not necessarily be collected from all listed locations. Collected samples will be of the highest calculated site average D/Q.
(NA) = Not applicable.
CR = Control Result (location).

APPENDIX A

LIQUID DOSE FACTOR DERIVATION

Appendix A

Liquid Effluent Dose Factor Derivation, A_{iat}

A_{iat} (mrem/hr per uCi/ml) which embodies the dose conversion factors, pathway transfer factors (e.g., bioaccumulation factors), pathway usage factors, and dilution factors for the points of pathway origin takes into account the dose from ingestion of fish and drinking water and the sediment. The total body and organ dose conversion factors for each radionuclide will be used from Table E-11 of Regulatory Guide 1.109. To expedite time, the dose is calculated for a maximum individual instead of each age group. The maximum individual dose factor is a composite of the highest dose factor A_{iat} of each nuclide i age group a, and organ t, hence A_{1at}. It should be noted that the fish ingestion pathway is the most significant pathway for dose from liquid effluents. The water consumption pathway is included for consistency with NUREG 0133.

The equation for calculating dose contributions given in section 1.3 requires the use of the composite dose factor A_{it} for each nuclide, i. The dose factor equation for a fresh water site is:

$$A_{iat} = K_o \left[\left(\frac{U_w e^{-\lambda_i t_{pw}}}{D_w} + U_f BF_i e^{-\lambda_i t_{pf}} \right) DFL_{iat} + \frac{69.3 U_s W e^{-\lambda_i t_{ps}}}{D_s \lambda_i} \left(1 - e^{-\lambda_i t_b}\right) DFS_i \right]$$

Where:

A_{iat} = Is the dose factor for nuclide i, age group a, total body or organ t, for all appropriate pathways, (mrem/hr per uCi/ml)

K_o = Is the unit conversion factor, 1.14E5=1E6pCi/uCi x 1E3 ml/liter -:- 8760 hr/yr

U_w = Water consumption (liters/yr); from Table E-5 of Reg. Guide 1.109

U_f = Fish consumption (kg/yr); from Table E-5 of Reg. Guide 1.109

U_s = Sediment Shoreline Usage (hr/yr); from Table E-5 of Reg. Guide 1.109

BF_i = Bioaccumulation factor for nuclide, i, in fish, (pCi/kg per pCi/liter), from Table A-1 of Reg. Guide 1.109

DFL_{iat} = Dose conversion factor for age, nuclide, i, group a, total body or organ t, (mrem/pCi); from Table E-11 of Reg. Guide 1.109

DFS_i = Dose conversion factor for nuclide i and total body, from standing on contaminated ground (mrem/hr per pCi/m^2); from Table E-6 of Reg. Guide 1.109

D_w	=	Dilution factor from the near field area within one-quarter mile of the release point to the potable water intake for the adult water consumption. This is the Metropolitan Water Board, Onondaga County intake structure located west of the City of Oswego. (Unitless)
D_s	=	Dilution factor from the near field area within one quarter mile of the release point to the shoreline deposit (taken at the same point where we take environmental samples 1.5 miles; unitless)
69.3	=	conversion factor .693 x 100, 100 = K_c (liters/kg-hr)*40 kg/m^2*24 hr/day/.693 in liters/m^2-d, and K_c = transfer coefficient from water to sediment in liters/kg per hour.
t_{pw}, t_{pf}, t_{ps}	=	Average transit time required for each nuclide to reach the point of exposure for internal dose, it is the total time elapsed from release of the nuclides to either ingestion for water (w) and fish (f) or shoreline deposit (s), (hr)
t_b	=	Length of time the sediment is exposed to the contaminated water, nominally 15 yrs (approximate midpoint of facility operating life), (hrs).
λ_i	=	decay constant for nuclide i (hr^{-1})
W	=	Shore width factor (unitless) from Table A-2 of Reg. Guide 1.109

Example Calculation
For I-131 Thyroid Dose Factor for an Adult from a Radwaste liquid effluents release:

$(DFS)_i$	= 2.80E-9 mrem/hr per pCi/m^2				
$(DFL)_{iat}$	= 1.95E-3 mrem/pCi		t_{pw}	=	40 hrs. (w = water)
BF_i	= 15	pCi/kg per pCi/liter	t_{pf}	=	24 hrs. (f = fish)
U_f	= 21	kg/yr	t_b	=	1.314E5 hr (5.48E3 days)
D_w	= 62	unitless	U_w	=	730 liters/yr
D_s	= 17.8	unitless	K_o	=	1.14E5 (pCi/uCi)(ml/kg) / (hr/yr)
U_s	= 12	hr/yr			
W	= 0.3		λ_i	=	3.61E-3hr^{-1}
t_{ps}	= 7.3	hrs (s=Shoreline Sediment)			

These values will yield an A_{iat} Factor of 6.65E4 mrem-ml per uCi-hr as listed in Table D 2-2. It should be noted that only a limited number of nuclides are listed on Tables D 2-2 to D 2-5. These are the most common nuclides encountered in effluents. If a nuclide is detected for which a factor is not listed, then it will be calculated and included in a revision to the ODCM.

In addition, not all dose factors are used for the dose calculations. A maximum individual is used, which is a composite of the maximum dose factor of each age group for each organ as reflected in the applicable chemistry procedures.

APPENDIX B

PLUME SHINE DOSE FACTOR DERIVATION

Appendix B

For elevated releases the plume shine dose factors for gamma air (B_i) and whole body (V_i), are calculated using the finite plume model with an elevation above ground equal to the stack height. To calculate the plume shine factor for gamma whole body doses, the gamma air dose factor is adjusted for the attenuation of tissue, and the ratio of mass absorption coefficients between tissue and air. The equations are as follows:

Gamma Air

$$B_i = \sum_s \frac{K \mu_a E \; I_s}{R \Theta \; V_s}$$

Where:

K^1 = conversion factor (see below for actual value).

μ_a = mass absorption coefficient (cm^2/g; air for B_i, tissue for V_i)

E = Energy of gamma ray per disintegration (Mev)

V_s = average wind speed for each stability class (s), $^{m/s}$

R = downwind distance (site boundary, m)

Θ = sector width (radians)

s = subscript for stability class

I_s = I function = $I_1 + kI_2$ for each stability class. (unitless, see Regulatory Guide 1.109)

k^2 = Fraction of the attenuated energy that is actually absorbed in air (see Regulatory Guide 1.109, see below for equation)

Whole Body

$$V_i = 1.11 S_F B_i e^{-\mu_a t_d}$$

Where:

t_d = tissue depth (g/cm^2)

S_F = shielding factor from structures (unitless)

1.11 = Ratio of mass absorption coefficients between tissue and air.

Where all other parameters are defined above.

---

[1]K = conversion factor = $\dfrac{3.7\text{ E10 } \frac{\text{dis}}{\text{Ci-sec}} \quad 1.6\text{ E-6 } \frac{\text{erg}}{\text{Mev}}}{1293 \frac{\text{g}}{\text{m}^3} \quad 100 \frac{\text{erg}}{\text{g-rad}}}$ = .46

[2]$k = \dfrac{\mu - \mu_a}{\mu_a}$

Where: μ = mass attenuation coefficient (cm^2/g; air for B_i, tissue for V_i)

μ_a = defined above

There are seven stability classes, A thru F. The percentage of the year that each stability class is taken from the U-2 FSAR. From this data, a plume shine dose factor is calculated for each stability class and each nuclide, multiplied by its respective fraction and then summed.

The wind speeds corresponding to each stability class are, also, taken from the Unit 2 FSAR. To confirm the accuracy of these values, an average of the 12 month wind speeds for 1985, 1986, 1987 and 1988 was compared to the average of the FSAR values. The average wind speed of
the actual data is equal to 6.78 m/s, which compared favorably to the FSAR average wind speed equal to 6.77 m/s.

The average gamma energies were calculated using a weighted average of all gamma energies emitted from the nuclide. These energies were taken from the handbook "Radioactive Decay Data Tables", David C. Kocher.

The mass absorption (μ_a) and attenuation (μ) coefficients were calculated by multiplying the mass absorption (μ_a/ρ) and mass attenuation (μ/ρ) coefficients given in the Radiation Health Handbook by the air density equal to 1.293 E-3 g/cc or the tissue density of 1 g/cc where applicable. The tissue depth is 5g/cm^2 for the whole body.

The downwind distance is the site boundary.

SAMPLE CALCULATION

Ex. Kr-89 F STABILITY CLASS ONLY - Gamma Air

-DATA

E = 2.22MeV $k = \dfrac{\mu - \mu_a}{\mu_a}$ = .871 K = .46

μ_a = 2.943 E-3m^{-1} V_F = 5.55 m/sec

μ = 5.5064E-3m^{-1} R = 1600m

θ = .39

σ_z = 19m vertical plume spread taken from "Introduction to Nuclear Engineering", John R. LaMarsh

-I Function

$U\sigma_z$ = .11

I_1 = .3

I_2 = .4

I = $I_1 + kI_2 = .3 + (.871)(.4) = .65$

$$B_i = \frac{0.46}{(\pi^{1/2}} \left[\frac{\frac{\text{dis.}}{\text{Ci-sec}}(\text{Mev/ergs})}{(\text{g/m}^3) \quad \frac{(\text{ergs})}{(\text{g-rad})}}\right] \frac{(2.943E\text{-}3m^{-1})(2.22\text{Mev})(.65)}{(5.55\ m/s)\quad(.39)\quad(1600m)}$$

$$= 3.18(-7)\ \frac{\text{rad/s}}{\text{Ci/s}} \frac{(3600\ s/hr)\ (24\ h/d)\ (365\ d/y)\ (1E3mrad/rad)}{\frac{(1E6uCi)}{Ci}}$$

$$= 1.00(-2)\ \frac{\text{mrad/yr}}{\text{uCi/sec}}$$

$$V_i = 1.11\ (.7)\ (1E\text{-}2) \left[\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right] [e^{-(.0253\ cm^2/g)(5g/cm^2)}]$$

$$= 6.85(-3)\ \frac{\text{mrad/yr}}{\mu\text{Ci/sec}}$$

Note: The above calculation is for the F stability class only. For Table D 3-2 and procedure values, a weighted fraction of each stability class was used to determine the B_i and V_i values.

APPENDIX C

DOSE PARAMETERS FOR IODINE 131 and 133, PARTICULATES AND TRITIUM

Appendix C

DOSE PARAMETERS FOR IODINE - 131 AND - 133, PARTICULATES AND TRITIUM

This appendix contains the methodology which was used to calculate the organ dose factors for I-131, I-133, particulates, and tritium. The dose factor, R_i, was calculated using the methodology outlined in NUREG-0133. The radioiodine and particulate DLCO 3.2.1 is applicable to the location in the unrestricted area where the combination of existing pathways and receptor age groups indicates the maximum potential exposure occurs, i.e., the critical receptor. Washout was calculated and determined to be negligible. R_i values have been calculated for the adult, teen, child and infant age groups for all pathways. However, for dose compliance calculations, a maximum individual is assumed that is a composite of highest dose factor of each age group for each organ and pathway. The methodology used to calculate these values follows:

C.1 Inhalation Pathway

$$R_i(I) = K'(BR)_a(DFA)_{ija}$$

where:

$R_i(I)$ = dose factor for each identified radionuclide i of the organ of interest (units = mrem/yr per uCi/m^3);

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

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

$(DFA)_{ija}$ = The inhalation dose factor for nuclide i, organ j and age group a, and organ t (units = mrem/pCi).

The breathing rates $(BR)_a$ for the various age groups, as given in Table E-5 of Regulatory Guide 1.109 Revision 1, are tabulated below.

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

Inhalation dose factors $(DFA)_{ija}$ for the various age groups are given in Tables E-7 through E-10 of Regulatory Guide 1.109 Revision 1.

C.2 Ground Plane Pathway

$$R_i(G) = \frac{K'K''(SF)(DFG)_i \quad (1-e^{-\lambda_i t})}{\lambda_i}$$

Where:

$R_i(G)$	=	Dose factor for the ground plane pathway for each identified radionuclide i for the organ of interest (units = m^2-mrem/yr per uCi/sec)
K'	=	A constant of unit conversion, 1E6 pCi/uCi
K''	=	A constant of unit conversion, 8760 hr/year
λ_i	=	The radiological decay constant for radionuclide i, (units = sec^{-1})
t	=	The exposure time, sec, 4.73E8 sec (15 years)
$(DFG)_i$	=	The ground plane dose conversion factor for radionuclide i; (units = mrem/hr per pCi/m^2)
SF	=	The shielding factor (dimensionless)

A shielding factor of 0.7 is discussed in Table E-15 of Regulatory Guide 1.109 Revision 1. A tabulation of DFG_i values is presented in Table E-6 of Regulatory Guide 1.109 Revision 1.

C.3 Grass-(Cow or Goat)-Milk Pathway

$$R_i(C) = \frac{K'Q_f(U_{ap})\ F_m(r)(DFL)_{iat}}{(\lambda_i + \lambda_w)\ Y_p}\left[f_pf_s + \frac{(1-f_pf_s)\ (e^{-\lambda_i t_h})}{Y_s}\right]e^{-\lambda_i t_f}$$

Where:

$R_i(C)$	=	Dose factor for the cow milk or goat milk pathway, for each identified radionuclide i for the organ of interest, (units = m2-mrem/yr per uCi/sec)
K'	=	A constant of unit conversion, 1E6 pCi/μCi
Q_f	=	The cow's or goat's feed consumption rate, (units = kg/day-wet weight)
U_{ap}	=	The receptor's milk consumption rate for age group a, (units = liters/yr)
Y_p	=	The agricultural productivity by unit area of pasture feed grass, (units = kg/m2)
Y_s	=	The agricultural productivity by unit area of stored feed, (units = kg/m2)
F_m	=	The stable element transfer coefficients, (units = pCi/liter per pCi/day)
r	=	Fraction of deposited activity retained on cow's feed grass
$(DFL)_{iat}$	=	The ingestion dose factor for nuclide i, age group a, and total body or organ t (units = mrem/pCi)
λ_i	=	The radiological decay constant for radionuclide i, (units=sec -1)
λ_w	=	The decay constant for removal of activity on leaf and plant surfaces by weathering equal to 5.73E-7 sec -1 (corresponding to a 14 day half-life)
t_f	=	The transport time from pasture to cow or goat, to milk, to receptor, (units = sec)
t_h	=	The transport time from pasture, to harvest, to cow or goat, to milk, to receptor (units = sec)
f_p	=	Fraction of the year that the cow or goat is on pasture (dimensionless)
f_s	=	Fraction of the cow feed that is pasture grass while the cow is on pasture (dimensionless)

Milk cattle and goats are considered to be fed from two potential sources, pasture grass and stored feeds. Following the development in Regulatory Guide 1.109 Revision 1, the value of f_s is considered unity in lieu of site specific information. The value of f_p is 0.5 based on 6 month grazing period. This value for f_p was obtained from the environmental group.

Table C-1 contains the appropriate values and their source in Regulatory Guide 1.109 Revision 1.

The concentration of tritium in milk is based on the airborne concentration rather than the deposition. Therefore, the $R_T(C)$ is based on X/Q:

$$R_T(C) = K'K''' F_m Q_f U_{ap} (DFL)_{iat}\ 0.75(0.5/H)$$

Where:

$R_T(C)$	=	Dose factor for the cow or goat milk pathway for tritium for the organ of interest, (units = mrem/yr per μCi/m^3)
K'''	=	A constant of unit conversion, 1E3 g/kg
H	=	Absolute humidity of the atmosphere, (units = g/m^3)
0.75	=	The fraction of total feed that is water
0.5	=	The ratio of the specific activity of the feed grass water to the atmospheric water

Other values are given previously. A site specific value of H equal to 6.14 g/m^3 is used. This value was obtained from the environmental group using actual site data.

C.4 Grass-Cow-Meat Pathway

$$R_i(C) = \frac{K'Q_f U_{ap} F_f(r) DFL_{iat}}{(\lambda_i + \lambda_w)} \left[\frac{f_p f_s}{Y_p} + \frac{(1 - f_p f_s) e^{-\lambda_i t_h}}{Y_s} \right] e^{-\lambda_i t_f}$$

$R_i(M)$ = Dose factor for the meat ingestion pathway for radionuclide i for any organ of interest, (units = m^2-mrem/yr per μCi/sec)

F_f = The stable element transfer coefficients, (units = pCi/kg per pCi/day)

U_{ap} = The receptor's meat consumption rate for age group a, (units = kg/year)

t_h = The transport time from harvest, to cow, to receptor, (units = sec)

t_f = The transport time from pasture, to cow, to receptor, (units = sec)

All other terms remain the same as defined for the milk pathway. Table C-2 contains the values which were used in calculating $R_i(M)$.

The concentration of tritium in meat is based on airborne concentration rather than deposition. Therefore, the $R_T(M)$ is based on X/Q.

$$R_T(M) = K'K'''F_f Q_f U_{ap} (DFL)_{iat} [0.75(0.5/H)]$$

Where:

$R_T(M)$ = Dose factor for the meat ingestion pathway for tritium for any organ of interest, (units = mrem/yr per $\mu Ci/m^3$)

All other terms are defined above.

C.5 Vegetation Pathway

The integrated concentration in vegetation consumed by man follows the expression developed for milk. Man is considered to consume two types of vegetation (fresh and stored) that differ only in the time period between harvest and consumption, therefore:

$$R_i(V) = K' \frac{r}{Y_v(\lambda_i + \lambda_w)} (DFL)_{iat} \left[U^L{}_a F_L e^{-\lambda_i t_L} + U^S{}_a F_g e^{-\lambda_i t_h} \right]$$

Where:

$R_i(V)$	=	Dose factor for vegetable pathway for radionuclide i for the organ of interest, (units = m^2-mrem/yr per μCi/sec)
K'	=	A constant of unit conversion, 1E6 pCi/μCi
U^L_a	=	The consumption rate of fresh leafy vegetation by the receptor in age group a, (units = kg/yr)
U^S_a	=	The consumption rate of stored vegetation by the receptor in age group a (units = kg/yr)
F_L	=	The fraction of the annual intake of fresh leafy vegetation grown locally
F_g	=	The fraction of the annual intake of stored vegetation grown locally
t_L	=	The average time between harvest of leafy vegetation and its consumption, (units = sec)
t_h	=	The average time between harvest of stored vegetation and its consumption, (units = sec)
Y_v	=	The vegetation areal P density, (units = kg/m^2)

All other factors have been defined previously.

Table C-3 presents the appropriate parameter values and their source in Regulatory Guide 1.109 Revision 1.

In lieu of site-specific data, values for F_L and F_g of, 1.0 and 0.76, respectively, were used in the calculation. These values were obtained from Table E-15 of Regulatory Guide 1.109 Revision 1.

The concentration of tritium in vegetation is based on the airborne concentration rather than the deposition. Therefore, the $R_T(V)$ is based on X/Q:

$$R_T(V) = K'K''' [U^L_a f_L + U^s_a f_g](DFL)_{iat} 0.75(0.5/H)$$

Where:

$R_T(V)$	=	dose factor for the vegetable pathway for tritium for any organ of interest, (units = mrem/yr per $\mu Ci/m^3$).

All other terms are defined in preceeding sections.

TABLE C-1

Parameters for Grass - (Cow or Goat) - Milk Pathways

Parameter	Value	Reference (Reg. Guide 1.109 Rev. 1)
Q_f (kg/day)	50 (cow) 6 (goat)	Table E-3 Table E-3
r	1.0 (radioiodines) 0.2 (particulates)	Table E-15 Table E-15
$(DFL)_{ija}$ (mrem/pCi)	Each radionuclide	Tables E-11 to E-14
F_m (pCi/liter per pCi/day)	Each stable element	Table E-1 (cow) Table E-2 (goat)
Y_s (kg/m^2)	2.0	Table E-15
Y_p (kg/m^2)	0.7	Table E-15
t_h (seconds)	7.78 x 10^6 (90 days)	Table E-15
t_f (seconds)	1.73 x 10^5 (2 days)	Table E-15
U_{ap} (liters/yr)	330 infant 330 child 400 teen 310 adult	Table E-5 Table E-5 Table E-5 Table E-5

TABLE C-2

Parameters for the Grass-Cow-Meat Pathway

Parameter	Value	Reference (Reg. Guide 1.109 Rev. 1)
r	1.0 (radioiodines) 0.2 (particulates)	Table E-15 Table E-15
F_f (pCi/kg per pCi/day)	Each stable element	Table E-1
U_{ap} (kg/yr)	0 infant 41 child 65 teen 110 adult	Table E-5 Table E-5 Table E-5 Table E-5
$(DFL)_{ija}$ (mrem/pCi)	Each radionuclide	Tables E-11 to E-14
Y_p (kg/m^2)	0.7	Table E-15
Y_s (kg/m^2)	2.0	Table E-15
t_h (seconds)	7.78E6 (90 days)	Table E-15
t_f (seconds)	1.73E6 (20 days)	Table E-15
Q_f (kg/day)	50	Table E-3

TABLE C-3

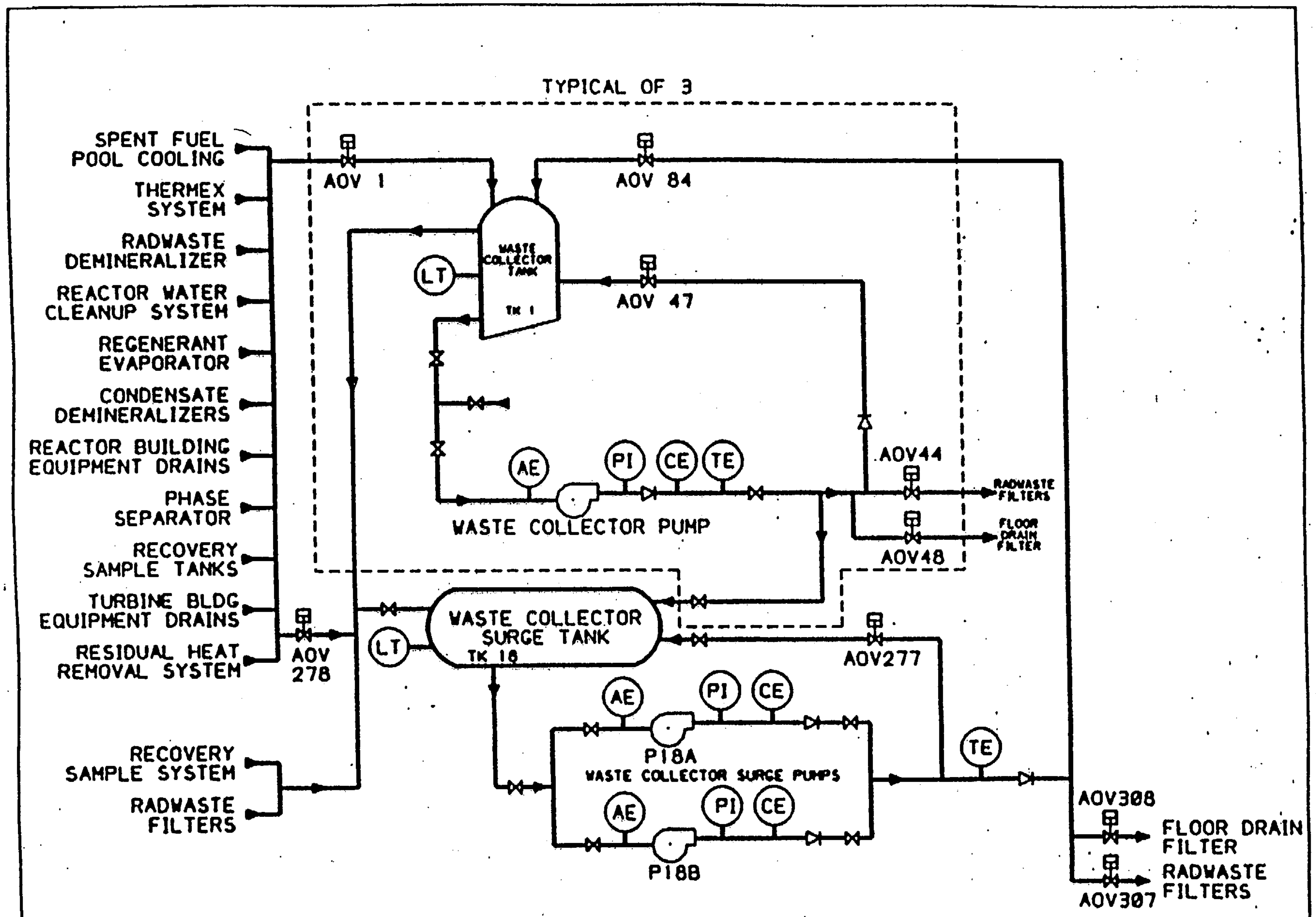
Parameters for the Vegetable Pathway

Parameter	Value	Reference (Reg. Guide 1.109 Rev. 1)
r (dimensionless)	1.0 (radioiodines)	Table E-1
	0.2 (particulates)	Table E-1
$(DFL)_{ija}$ (mrem/pCi)	Each radionuclide	Tables E-11 to E-14
$U^{L})_{a}$ (kg/yr) - infant	0	Table E-5
- child	26	Table E-5
- teen	42	Table E-5
- adult	64	Table E-5
$U^{s})_{a}$ (kg/yr) - infant	0	Table E-5
- child	520	Table E-5
- teen	630	Table E-5
- adult	520	Table E-5
t_L (seconds)	8.6E4 (1 day)	Table E-15
t_h (seconds)	5.18E6 (60 days)	Table E-15
Y_v (kg/m^2)	2.0	Table E-15

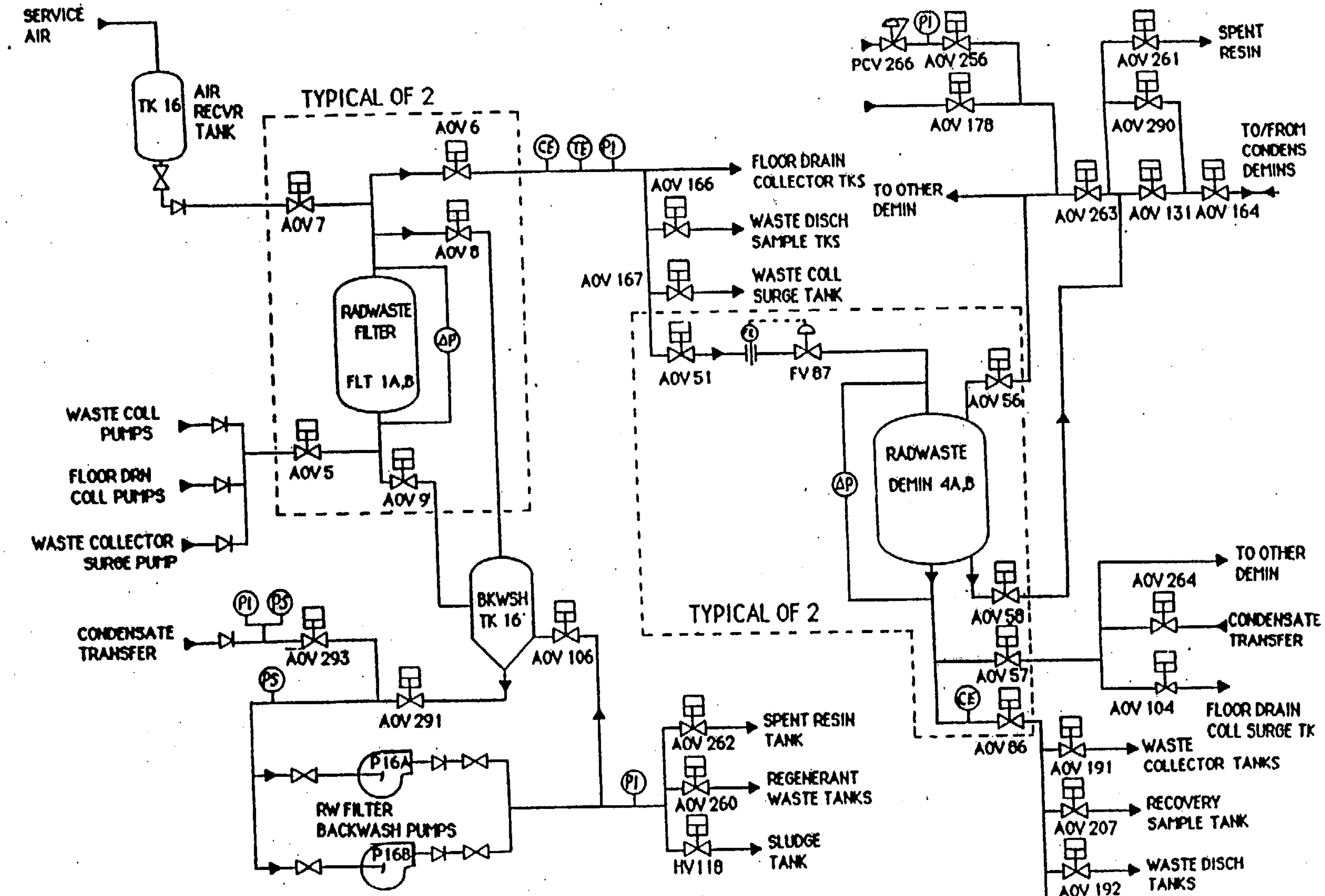
APPENDIX D

DIAGRAMS OF LIQUID AND GASEOUS TREATMENT SYSTEMS AND MONITORING SYSTEMS

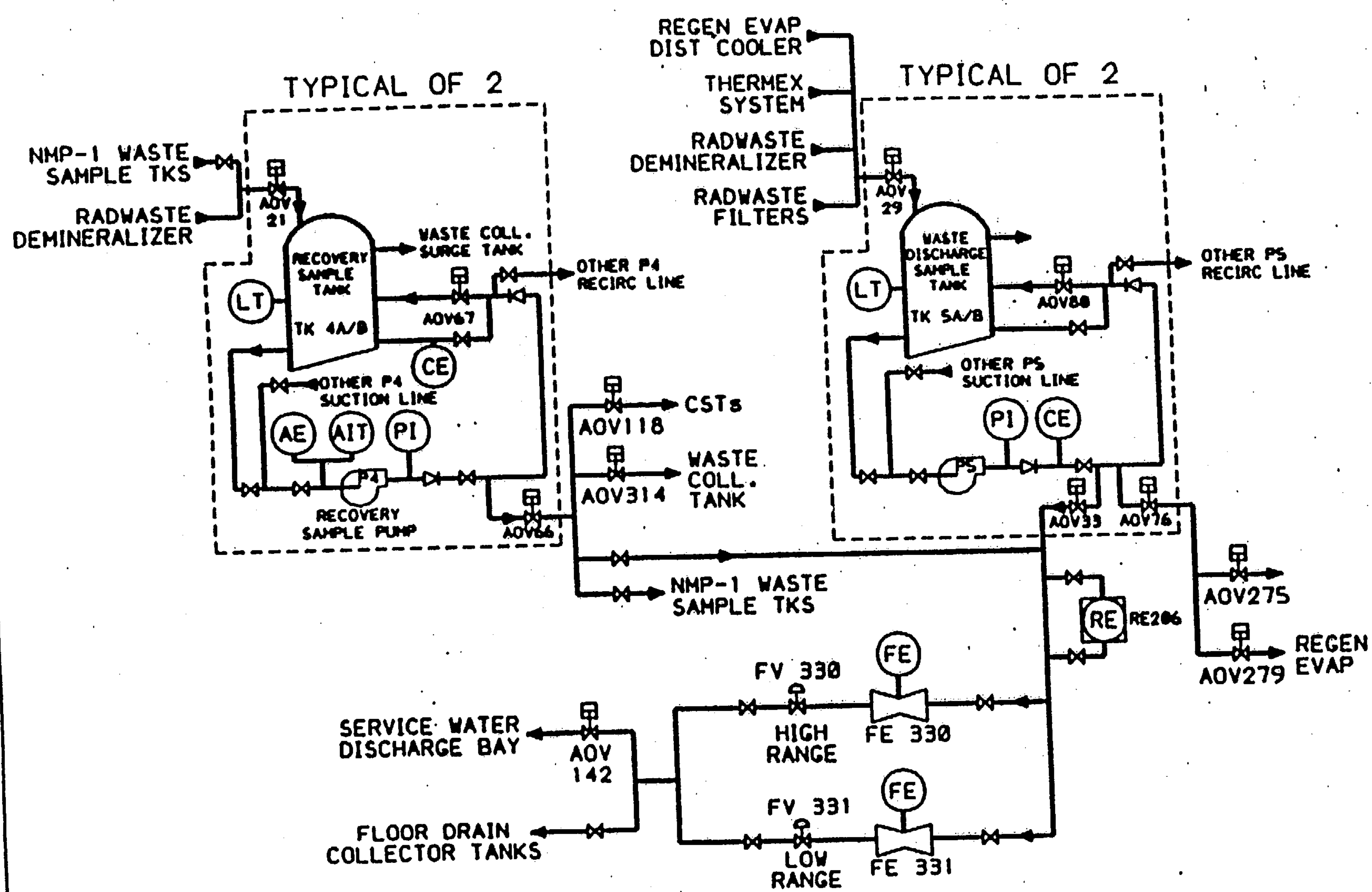
Liquid Radwaste Treatment System Diagrams



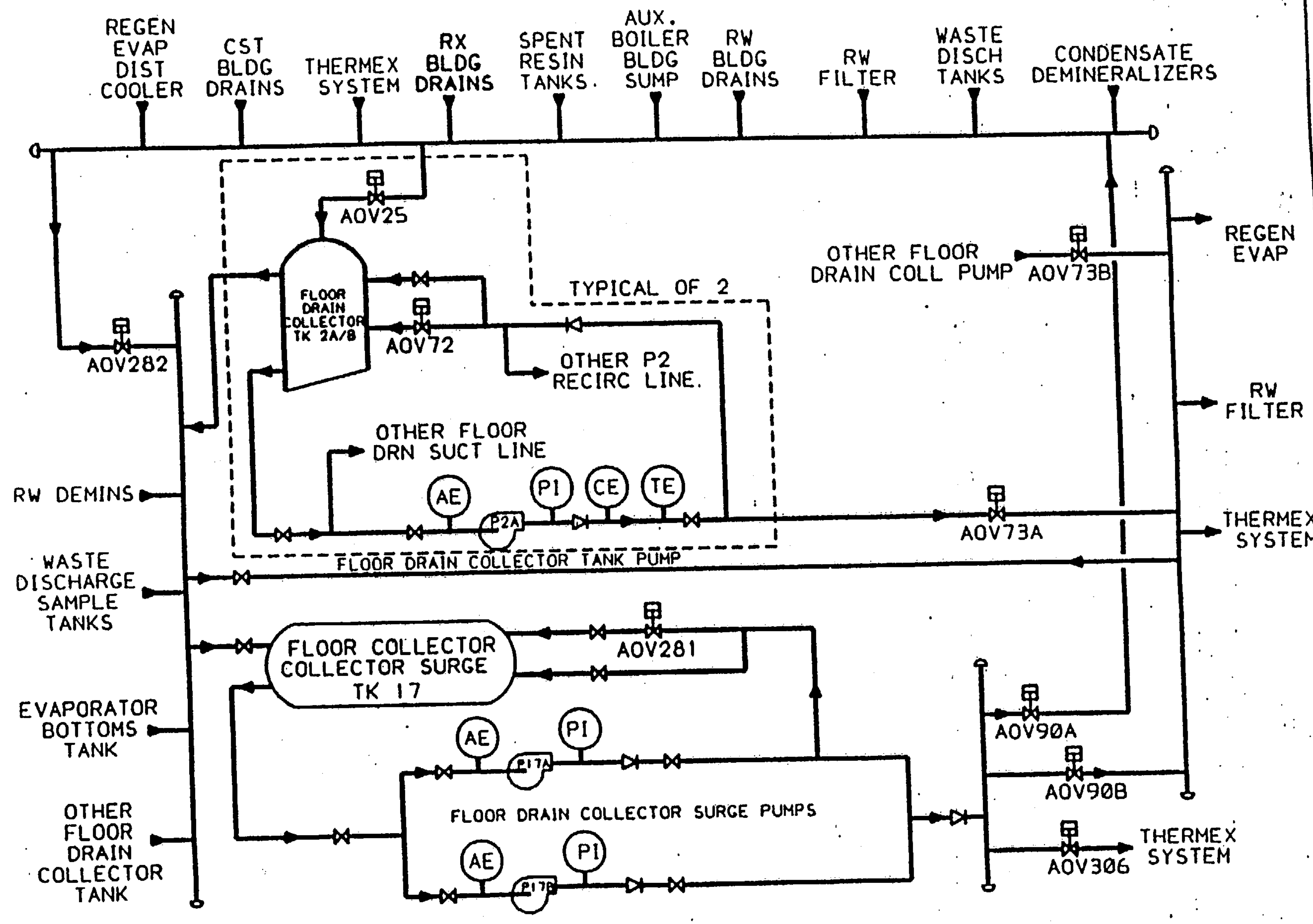
WASTE COLLECTION



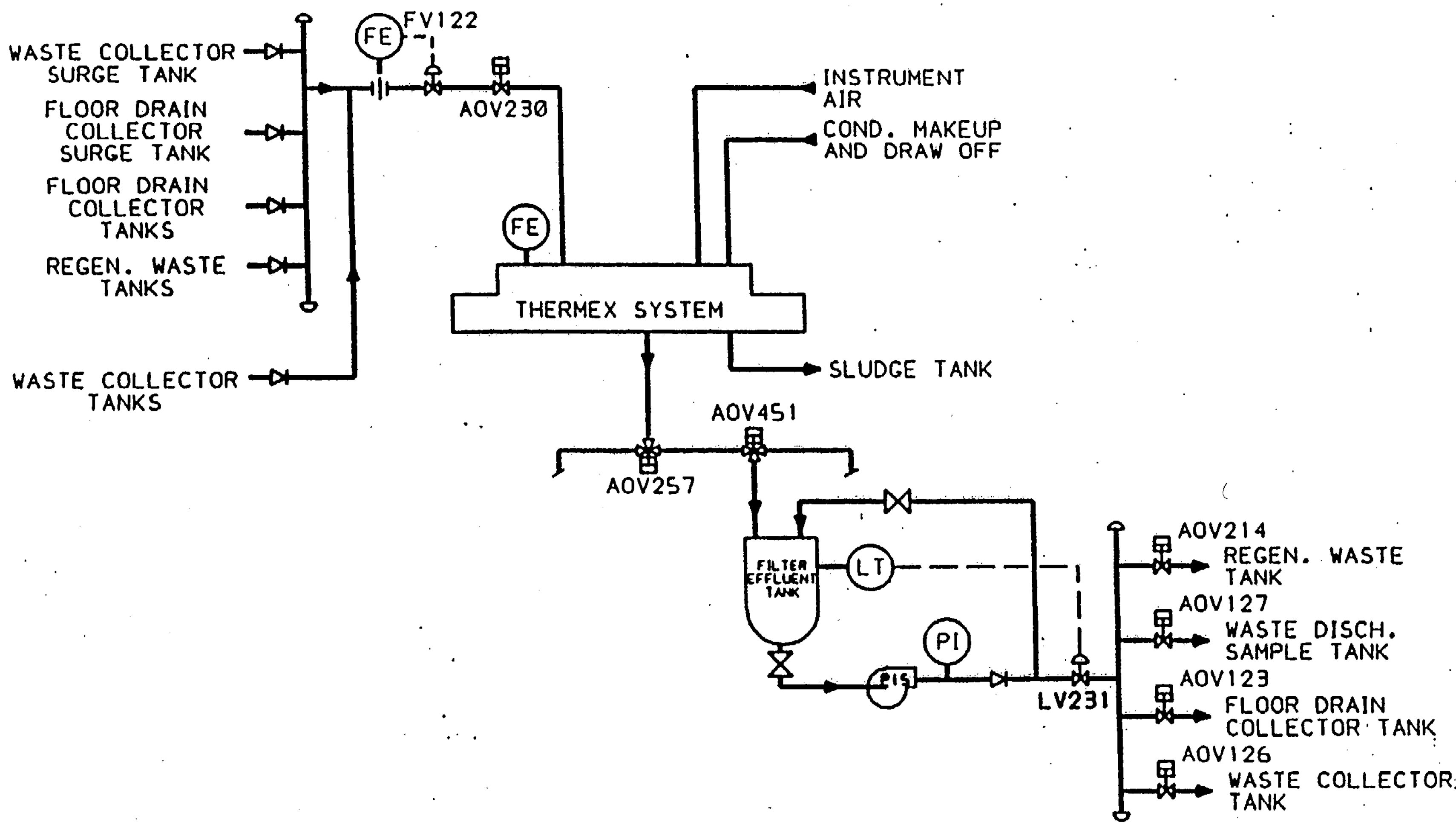
WASTE COLLECTOR TREATMENT SYSTEM



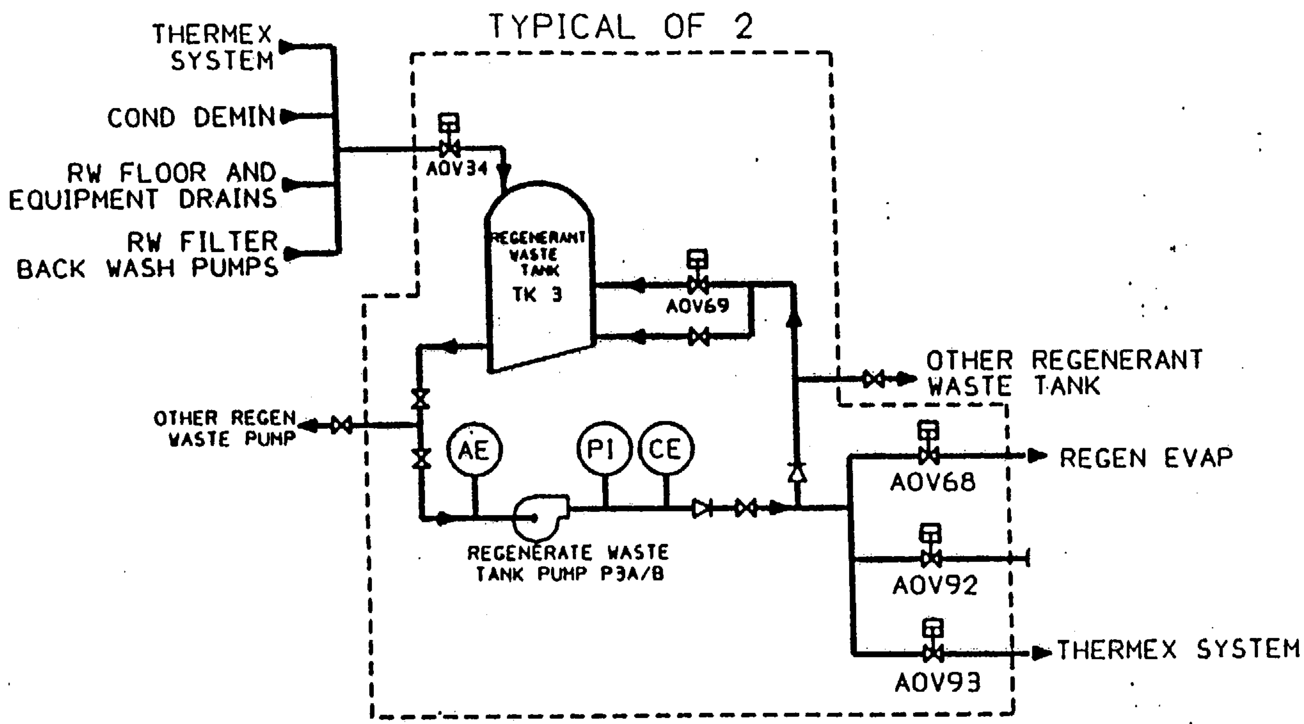
RECOVERY SAMPLE SYSTEM and
WASTE DISCHARGE SAMPLE SYSTEM



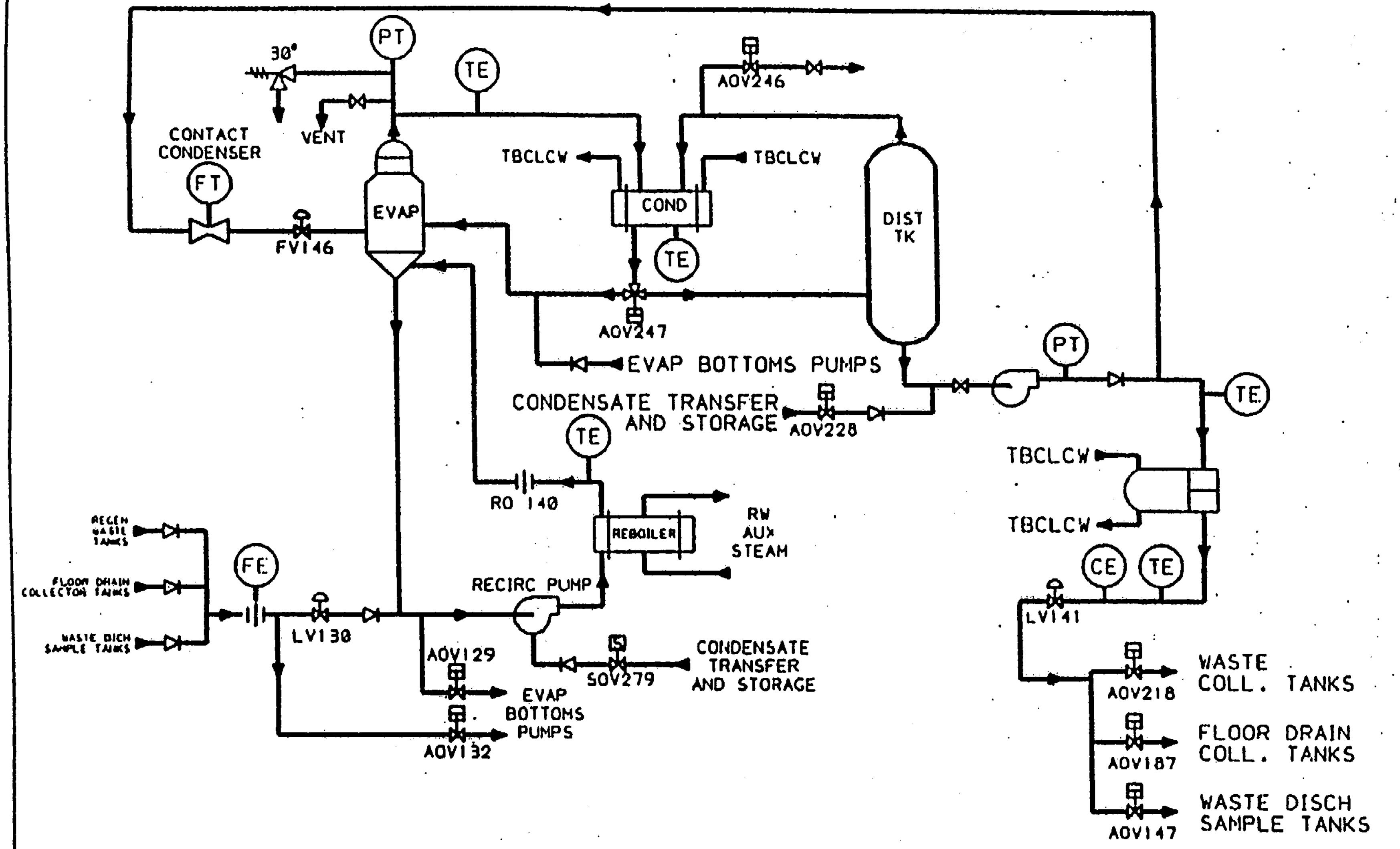
FLOOR DRAIN COLLECTION SYSTEM



FLOOR DRAIN FILTER SYSTEM

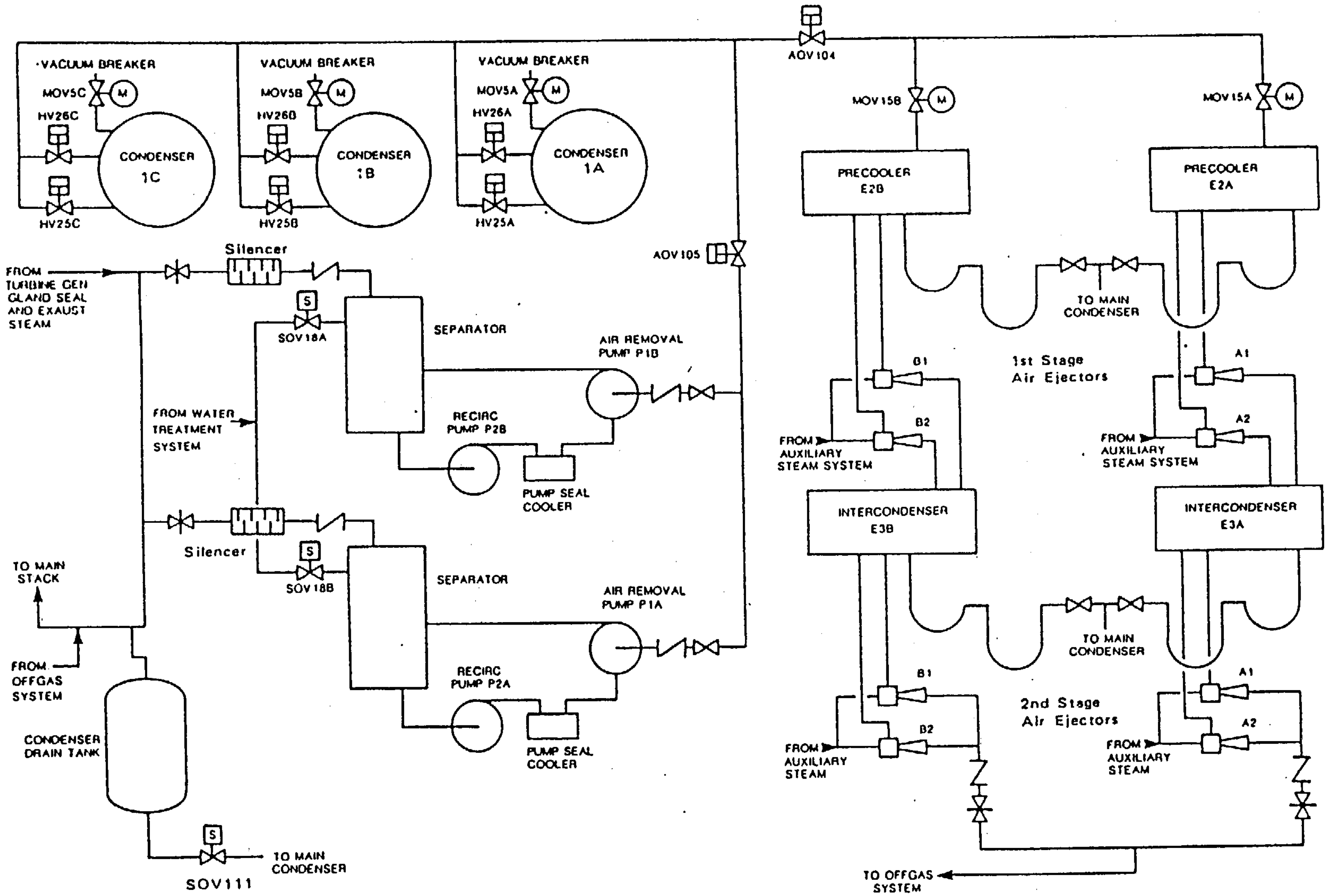


REGENERANT WASTE SYSTEM

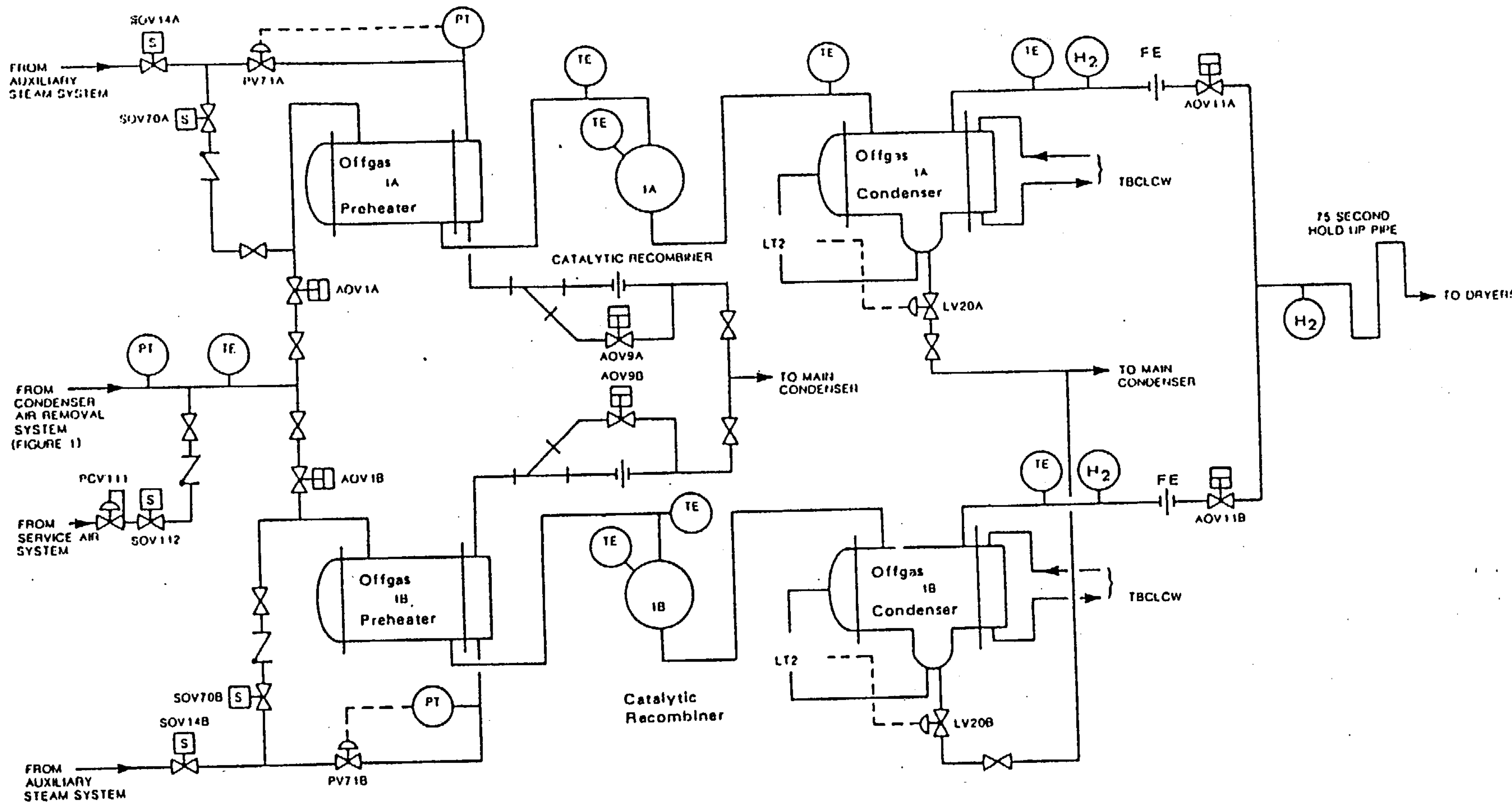


REGENERANT
EVAPORATOR SYSTEM

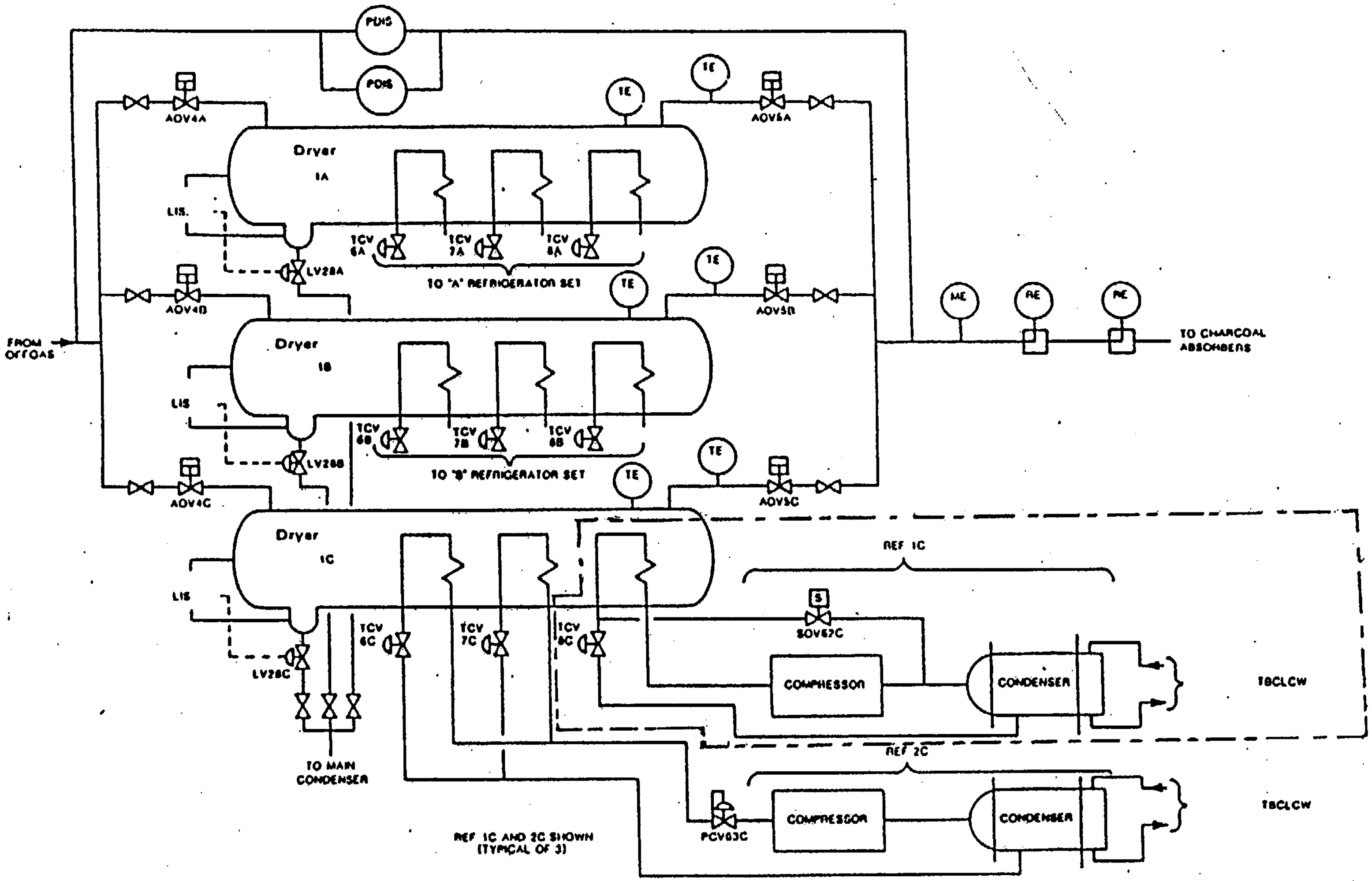
Gaseous Treatment System Diagrams



Title: CONDENSER AIR REMOVAL SYSTEM



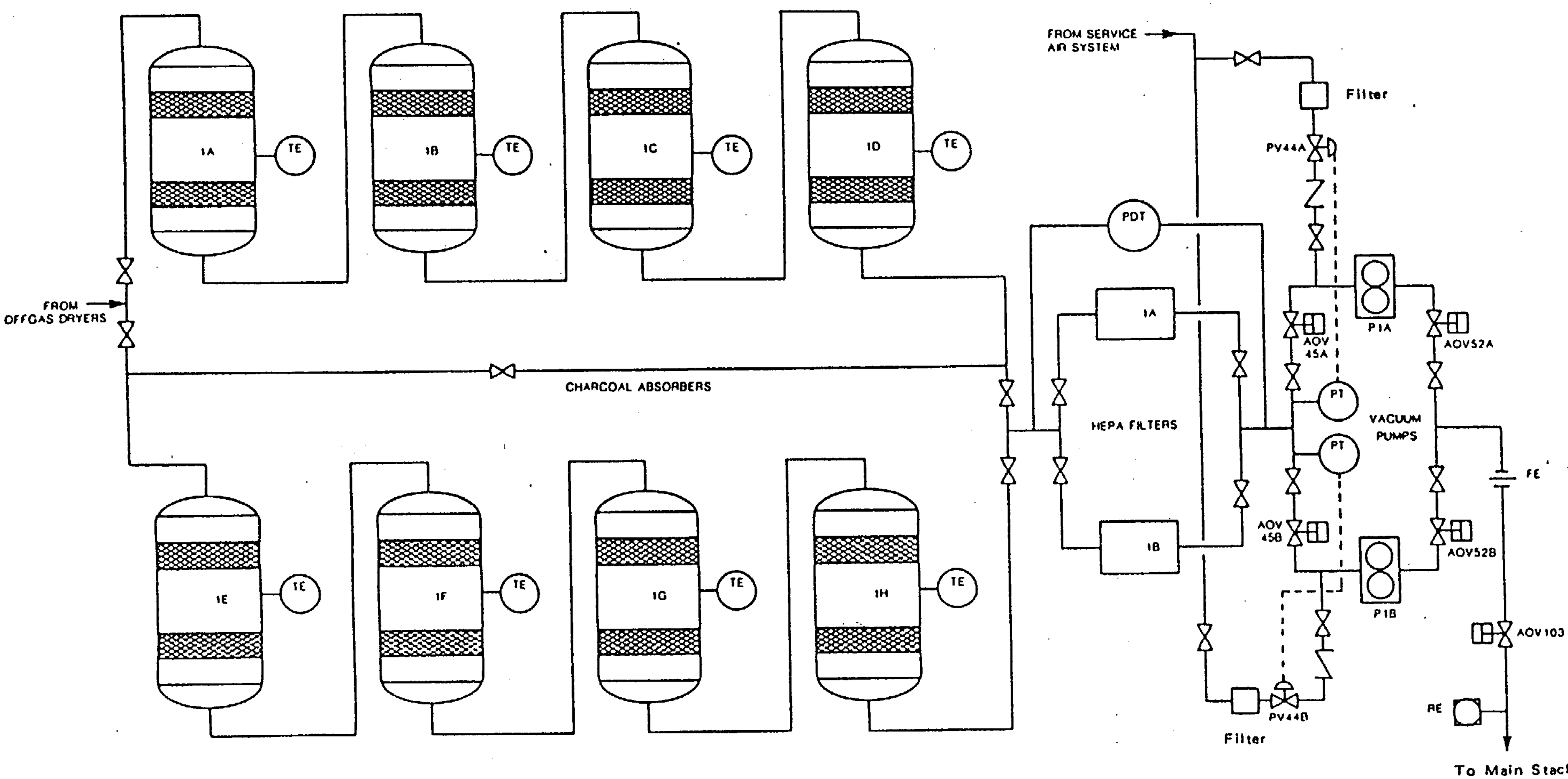
Title:
OFFGAS RECOMBINERS



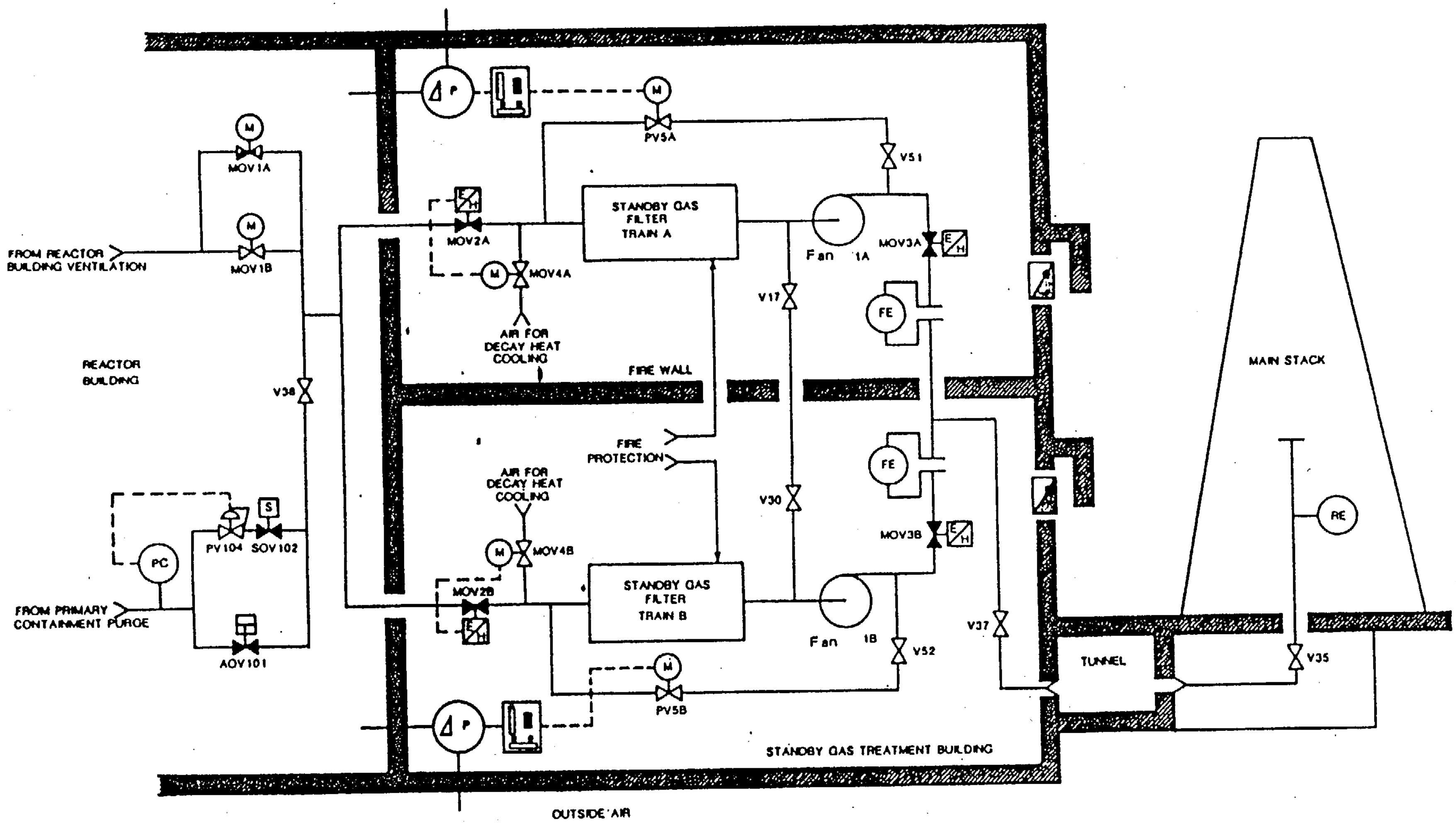
ALL LINES AND EQUIPMENT LOCATED INSIDE THIS BOUNDARY TO BE ABANDONED IN PLACE

Title:

OFFGAS DRYERS

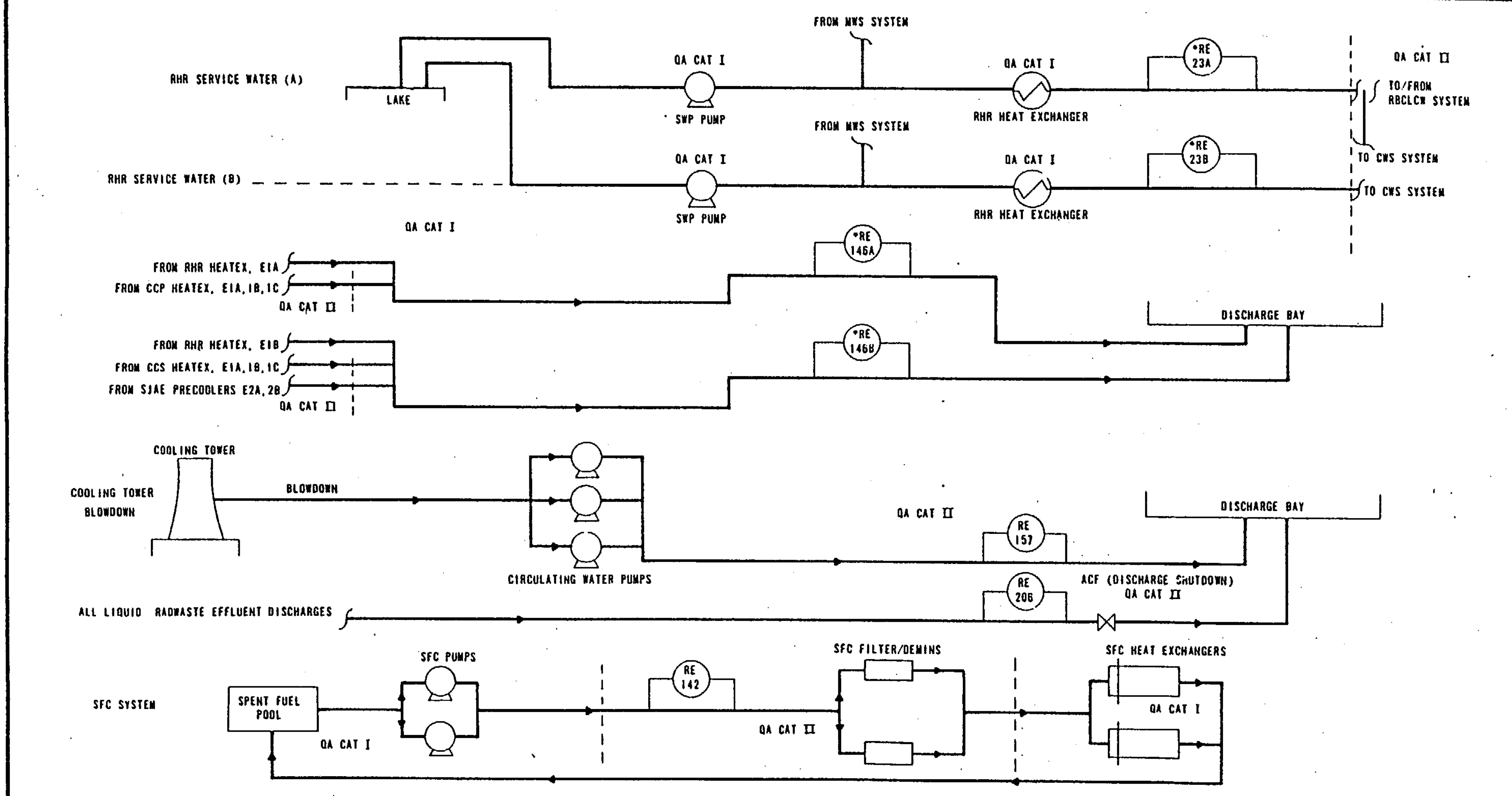


Title: OFFGAS SYSTEM CHARCOAL ABSORBERS



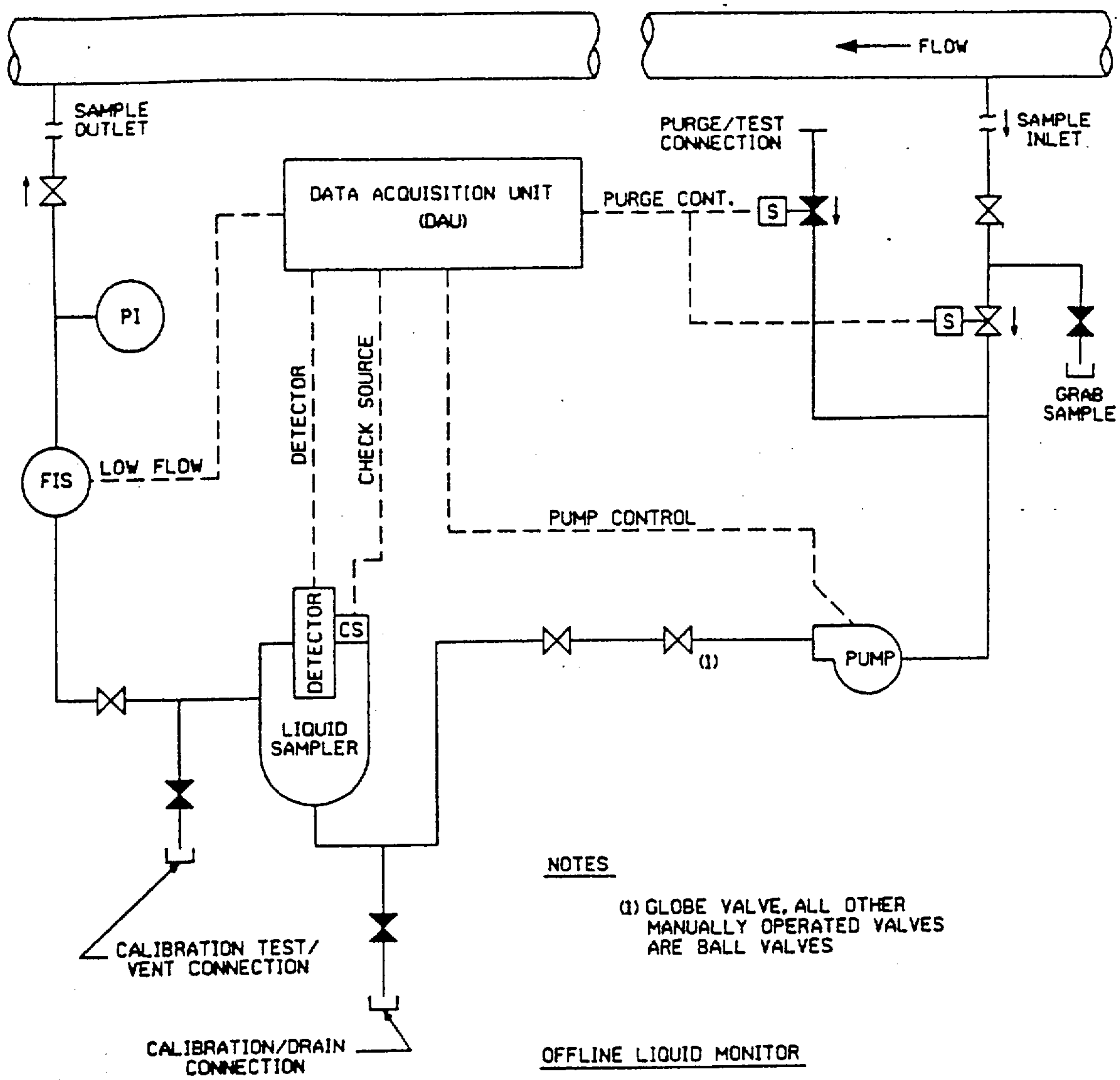
Title: STANDBY GAS TREATMENT SYSTEM

Liquid Radiation Monitoring Diagrams



LIQUID RADIATION MONITORING
SHEET 2 OF 2

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
FINAL SAFETY ANALYSIS REPORT



NOTES

(1) GLOBE VALVE, ALL OTHER MANUALLY OPERATED VALVES ARE BALL VALVES

OFFLINE LIQUID MONITOR

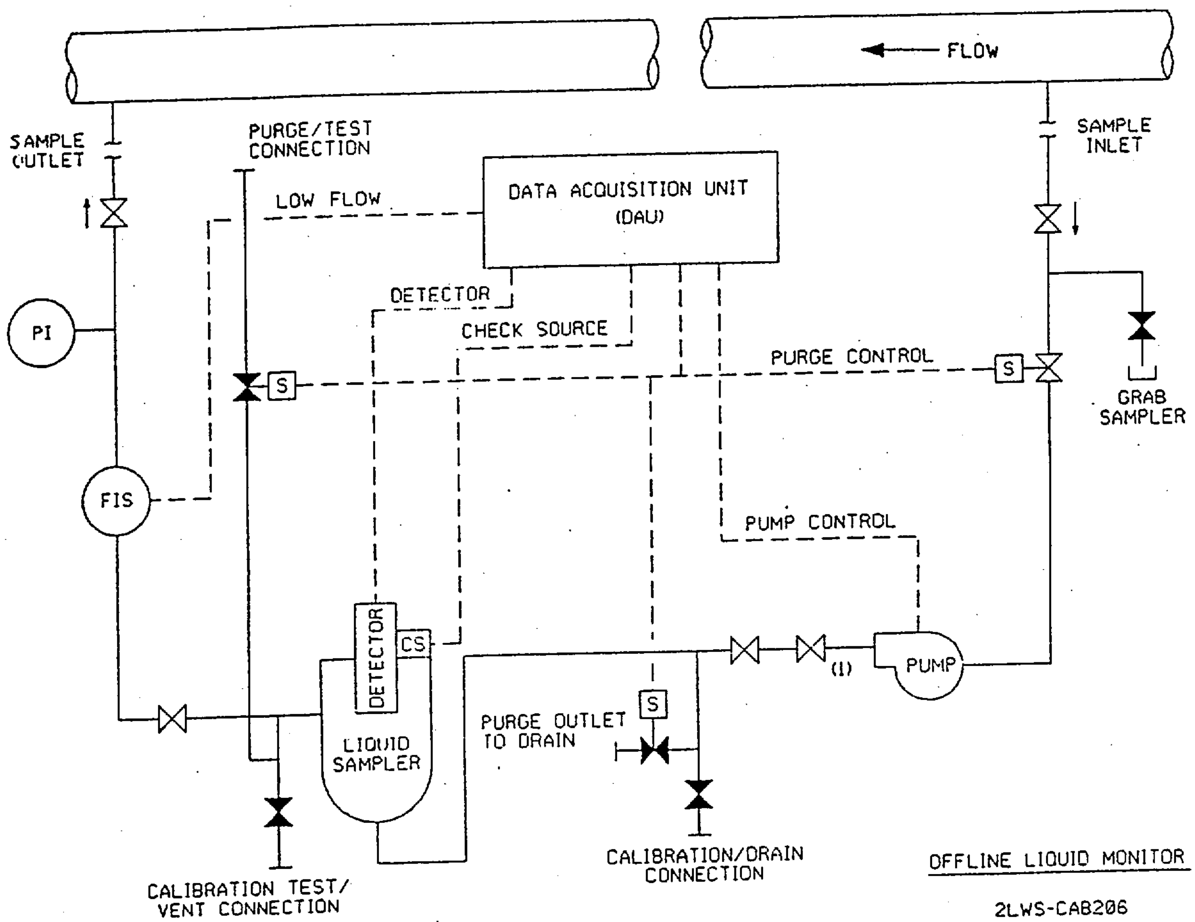
2CCP-CAB115
2CCS-CAB152
2CWS-CAB157

LEGEND

- PI — PRESSURE INDICATOR
- FIS — FLOW INDICATING SW.
- S — SOLENOID OPERATED SW.
- NORMALLY CLOSED VALVE
- NORMALLY OPEN VALVE

OFF-LINE LIQUID MONITOR

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
UPDATED SAFETY ANALYSIS REPORT



LEGEND

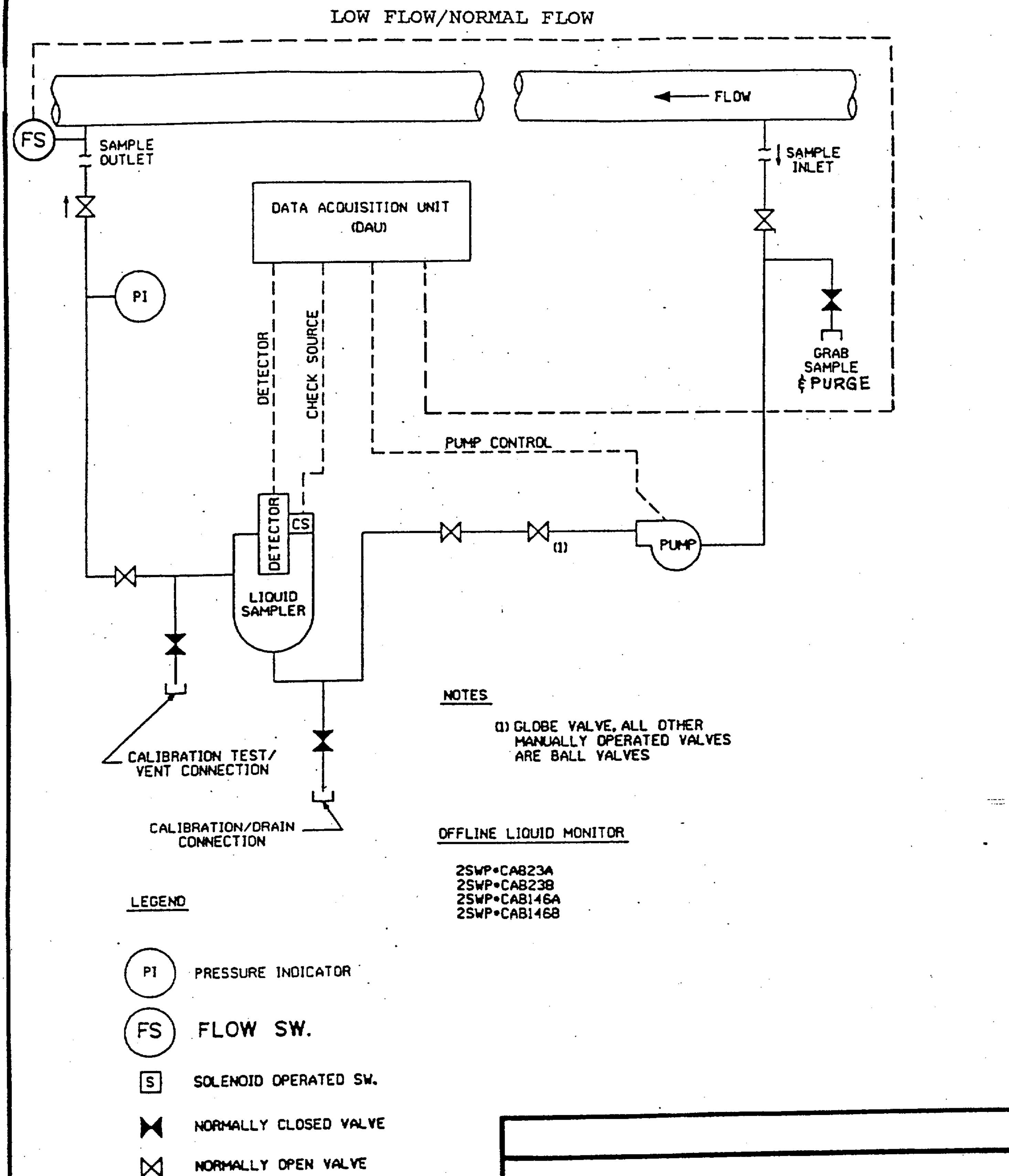
PI	PRESSURE INDICATOR
FIS	FLOW INDICATING SW.
S	SOLENOID OPERATED SW.
⧓ (filled)	NORMALLY CLOSED VALVE
⋈ (open)	NORMALLY OPEN VALVE

NOTES

(1) GLOBE VALVE, ALL OTHER MANUALLY OPERATED VALVES ARE BALL VALVES

OFF-LINE LIQUID MONITOR

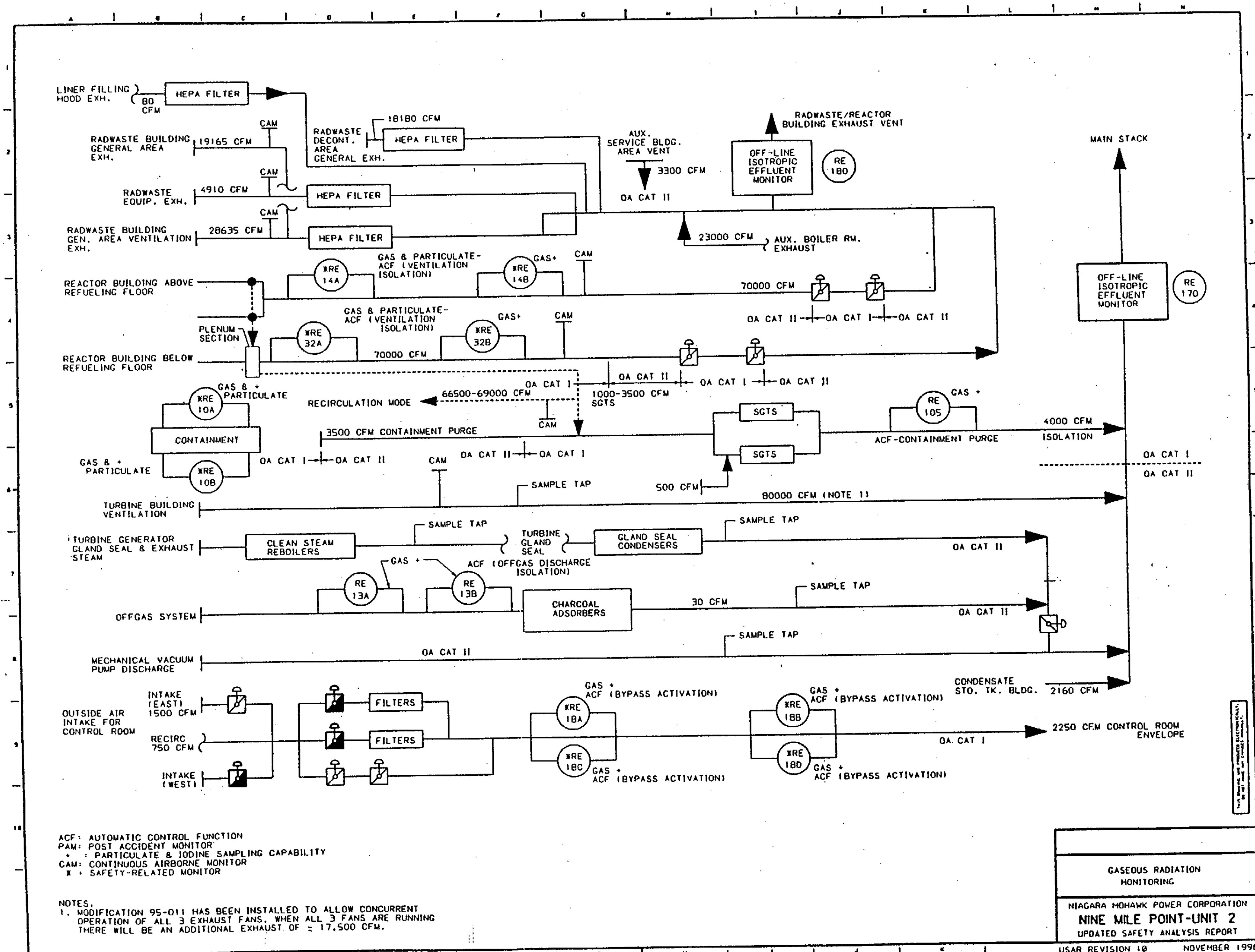
NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
UPDATED SAFETY ANALYSIS REPORT



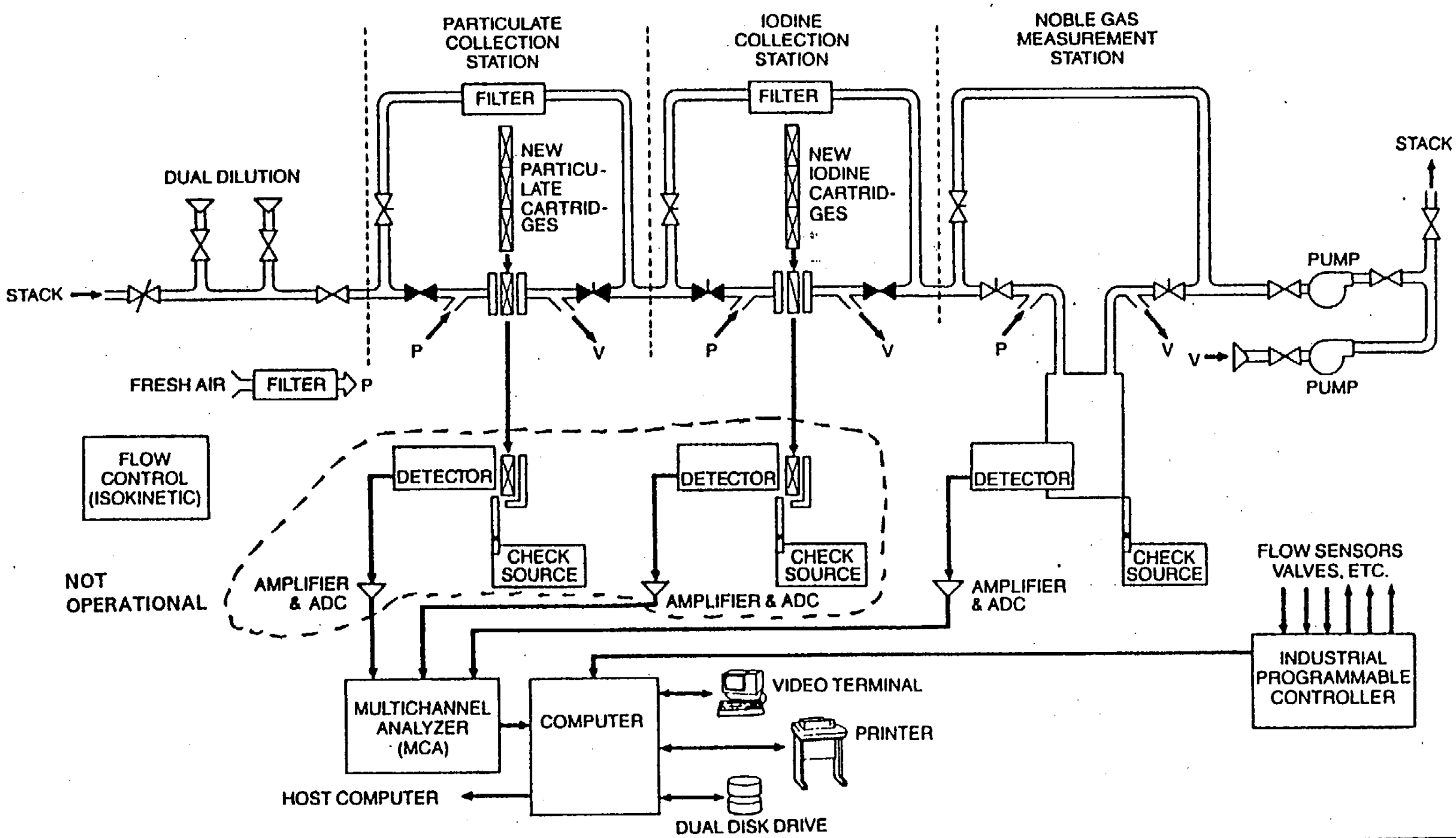
OFF-LINE LIQUID MONITOR

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
UPDATED SAFETY ANALYSIS REPORT

Gaseous Effluent Monitoring System Diagrams



LINER FILLING HOOD EXH.
80 CFM
HEPA FILTER
RADWASTE BUILDING GENERAL AREA EXH.
CAM
19165 CFM
RADWASTE DECONT. AREA GENERAL EXH.
18180 CFM
HEPA FILTER
AUX. SERVICE BLDG. AREA VENT
3300 CFM
OA CAT II
RADWASTE/REACTOR BUILDING EXHAUST VENT
OFF-LINE ISOTROPIC EFFLUENT MONITOR
RE 180
MAIN STACK
RADWASTE EQUIP. EXH.
4910 CFM
HEPA FILTER
RADWASTE BUILDING GEN. AREA VENTILATION EXH.
28635 CFM
HEPA FILTER
23000 CFM
AUX. BOILER RM. EXHAUST
REACTOR BUILDING ABOVE REFUELING FLOOR
*RE 14A
GAS & PARTICULATE-ACF (VENTILATION ISOLATION)
*RE 14B
GAS+
70000 CFM
OA CAT II
OA CAT I
OA CAT II
OFF-LINE ISOTROPIC EFFLUENT MONITOR
RE 170
PLENUM SECTION
*RE 32A
GAS & PARTICULATE-ACF (VENTILATION ISOLATION)
*RE 32B
REACTOR BUILDING BELOW REFUELING FLOOR
70000 CFM
OA CAT I
OA CAT II
OA CAT I
OA CAT II
1000-3500 CFM SGTS
*RE 10A
GAS & + PARTICULATE
RECIRCULATION MODE
66500-69000 CFM
CONTAINMENT
3500 CFM CONTAINMENT PURGE
SGTS
SGTS
RE 105
GAS +
4000 CFM
ISOLATION
ACF-CONTAINMENT PURGE
*RE 10B
GAS & + PARTICULATE
OA CAT I
OA CAT II
OA CAT II
OA CAT I
OA CAT I
OA CAT II
SAMPLE TAP
500 CFM
TURBINE BUILDING VENTILATION
80000 CFM (NOTE 1)
TURBINE GENERATOR GLAND SEAL & EXHAUST STEAM
CLEAN STEAM REBOILERS
SAMPLE TAP
TURBINE GLAND SEAL
GLAND SEAL CONDENSERS
SAMPLE TAP
OA CAT II
GAS +
RE 13A
RE 13B
ACF (OFFGAS DISCHARGE ISOLATION)
OFFGAS SYSTEM
CHARCOAL ADSORBERS
30 CFM
SAMPLE TAP
OA CAT II
MECHANICAL VACUUM PUMP DISCHARGE
OA CAT II
SAMPLE TAP
CONDENSATE STO. TK. BLDG.
2160 CFM
OUTSIDE AIR INTAKE FOR CONTROL ROOM
INTAKE (EAST) 1500 CFM
RECIRC 750 CFM
INTAKE (WEST)
FILTERS
FILTERS
GAS + ACF (BYPASS ACTIVATION)
*RE 18A
*RE 18C
GAS + ACF (BYPASS ACTIVATION)
GAS + ACF (BYPASS ACTIVATION)
*RE 18B
*RE 18D
GAS + ACF (BYPASS ACTIVATION)
OA CAT I
2250 CFM CONTROL ROOM ENVELOPE
ACF: AUTOMATIC CONTROL FUNCTION
PAM: POST ACCIDENT MONITOR
+ : PARTICULATE & IODINE SAMPLING CAPABILITY
CAM: CONTINUOUS AIRBORNE MONITOR
* : SAFETY-RELATED MONITOR
NOTES.
1. MODIFICATION 95-011 HAS BEEN INSTALLED TO ALLOW CONCURRENT OPERATION OF ALL 3 EXHAUST FANS. WHEN ALL 3 FANS ARE RUNNING THERE WILL BE AN ADDITIONAL EXHAUST OF ≈ 17,500 CFM.
GASEOUS RADIATION MONITORING
NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
UPDATED SAFETY ANALYSIS REPORT
USAR REVISION 10
NOVEMBER 1998



BLOCK DIAGRAM
TYPICAL GASEOUS EFFLUENT
MONITORING SYSTEM

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
UPDATED SAFETY ANALYSIS REPORT

APPENDIX E
NINE MILE POINT ON-SITE AND OFF-SITE MAPS

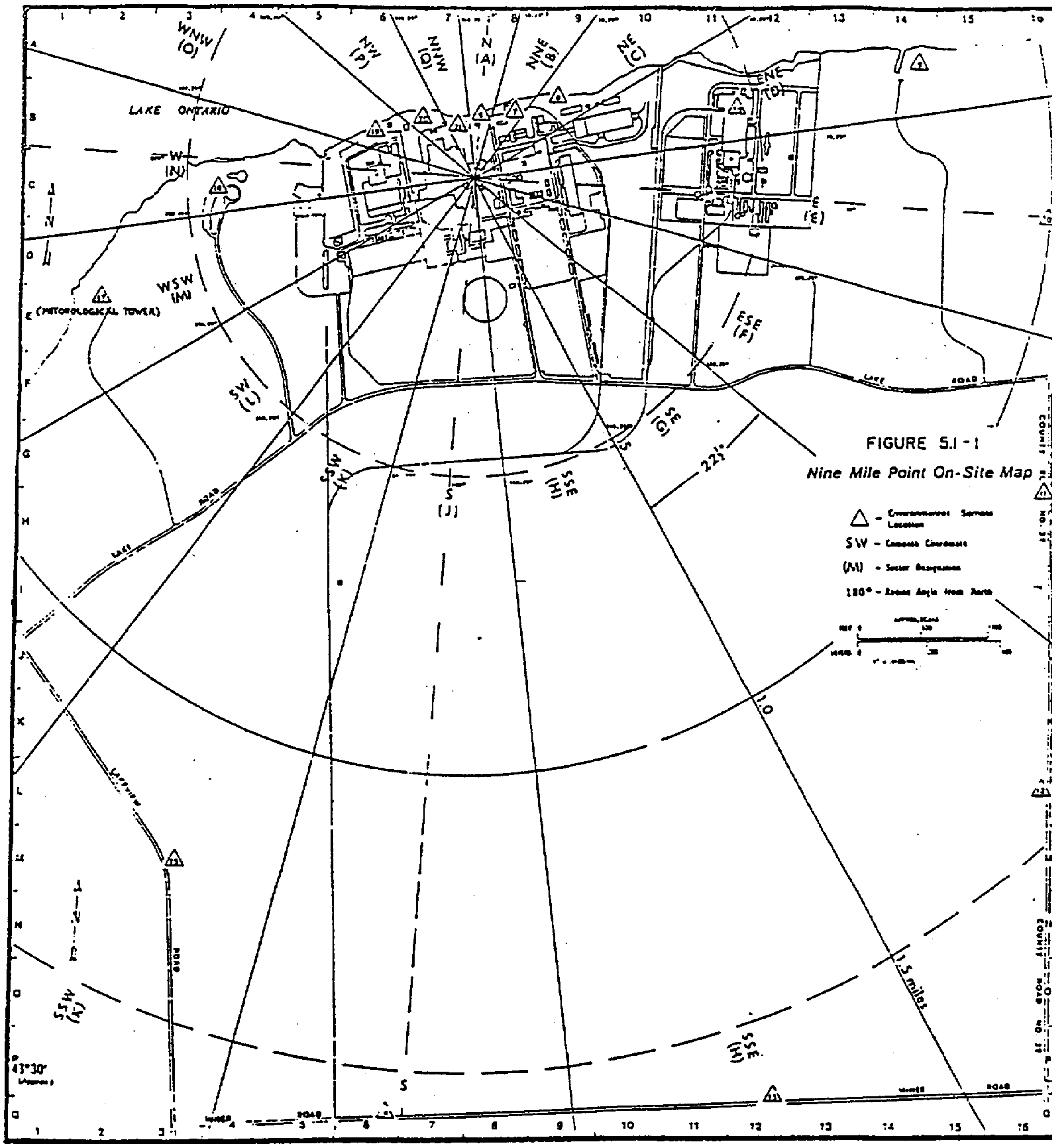


FIGURE 5.1-1

Nine Mile Point On-Site Map

FIGURE D 5.1-2
NINE MILE POINT OFF-SITE MAP (10/2001)

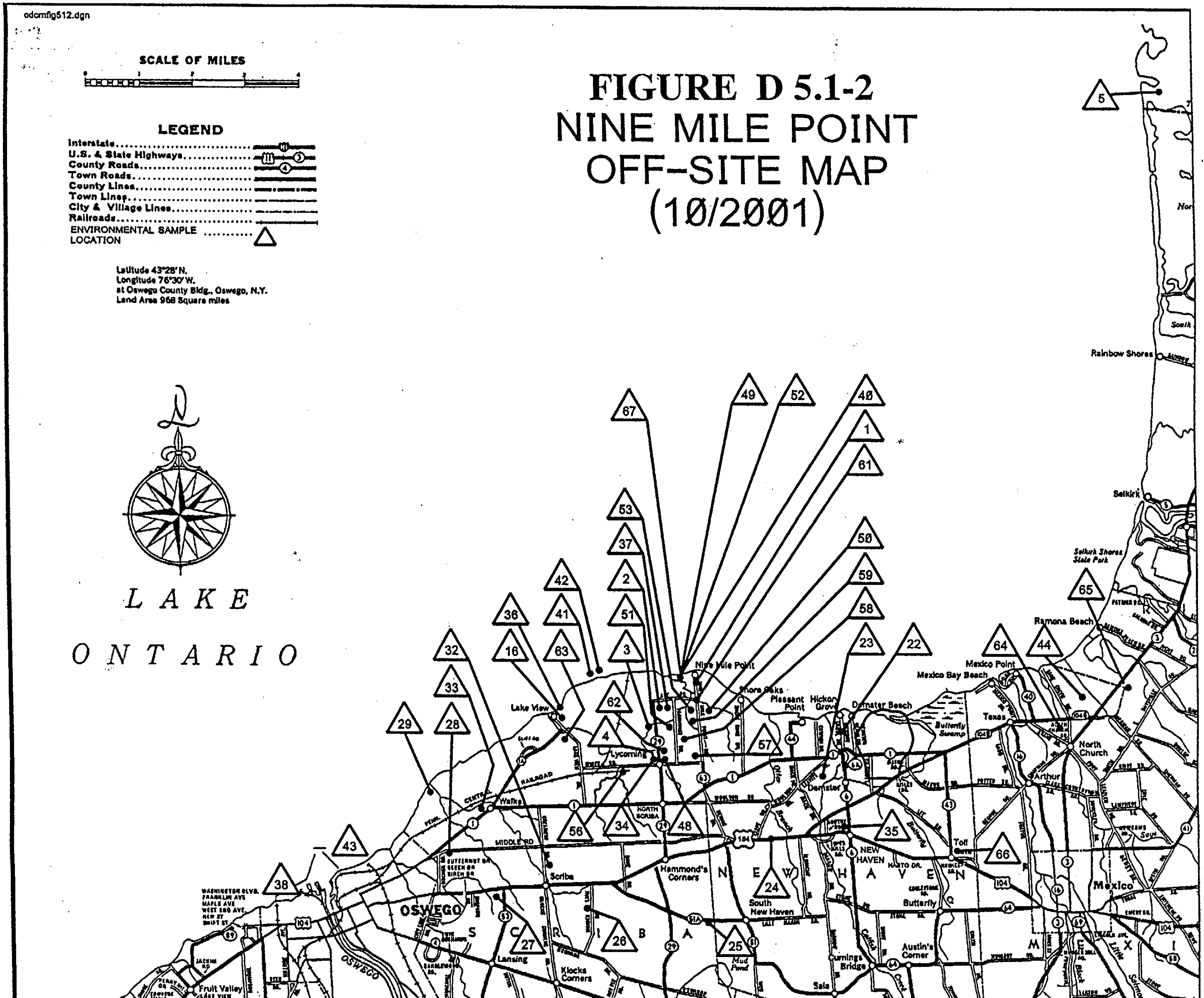


FIGURE D 5.1-2a

20 M 79

ATTACHMENT 15

Radwaste Process Control Program (RPCP)

ORIGINAL CONTROLLED

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION

UNIT 2 RADWASTE PROCESS CONTROL PROGRAM

REVISION 05

TECHNICAL SPECIFICATION REQUIRED

Approved By: M. F. Peckham — Plant Manager - Unit 2 — 2/9/01 Date

THIS IS A FULL REVISION

Effective Date: 02/13/2001

LIST OF EFFECTIVE PAGES

Page No.	Change No.	Page No.	Change No.	Page No.	Change No.
Coversheet .					
i					
ii					
1					
2					
3					
4					
5					
6					
7					
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9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

TABLE OF CONTENTS

1.0 PURPOSE

1.0.1 To describe the methods for processing, packaging and transportation of low-level radioactive waste and provide assurance of complete stabilization of various radioactive "wet wastes" in accordance with applicable NRC regulations and guidelines.

1.0.2 To satisfy the Nuclear Regulatory Commission's Low-Level Waste and Uranium Recovery Projects Branch (WMLU) requirement and establish process parameters within which the Chem-Nuclear Rapid Dewatering System (RDS-1000) must be operated to meet current disposal criteria at low-level waste disposal facilities.

NOTE: Conformance with WMLU requirements provides assurance that the requirements identified in 10CFR61, Sub Part D, Technical Requirements for Land Disposal Facilities and Final Waste Classification are satisfied.

2.0 RESPONSIBILITIES

2.1 The Plant Manager is responsible for:

2.1.1 Ensuring the Unit 2 Radwaste Process Control Program provides for the health and safety of the general public as it applies to Radwaste Management.

2.1.2 Reviewing and approving changes to the Unit 2 Radwaste Process Control Program in accordance with the Quality Assurance program.

2.2 The Manager Radiation Protection is responsible for the content and maintenance of this procedure.

2.3 The General Supervisor Radwaste is responsible for overall implementation of the Radwaste Process Control Program.

3.0 PROGRAM

3.1 System Description

3.1.1 General

a. The Solid Waste Management System (SWMS), implemented by the procedures identified in the Unit 2 Radwaste Process Control Program Implementing Procedures (Attachment 1) collects, reduces the volume, dewaters or solidifies and packages wet and dry types of radioactive waste in preparation for shipment off-site for further processing or disposal at a licensed burial site. The processing and storage methods used for interim storage are consistent with the present waste form stability requirements.

3.1.1 (Cont)

b. Types of solid waste sources are identified in Solid Waste Sources (Attachment 2).

c. The Solid Waste Management System accepts dry solid trash which is then compacted with a trash compactor (when physically possible) or sent off site for separation and processing.

NOTE: When required, Unit 2 will use the services of a vendor to solidify, dewater, separate, recover, or incinerate waste.

d. Bead resins, powdered resins and charcoal are dewatered using RDS-1000 in:

1. Vendor Certified Polyethylene containers, or
2. Carbon steel liners, or
3. High Integrity Container (HIC)

e. Bead resins, powdered resins and charcoal are solidified by cement solidification using an approved vendor.

f. Concentrated wastes are processed offsite to dryness by an approved vendor.

3.1.2 Evaporator Bottoms Tank

a. The evaporator bottoms tank and lines are electrically heat traced to prevent crystallization of waste salts.

b. Contents of the tank are transferred to a liner in the Radwaste Truckbay, via the concentrated waste transfer pump/for offsite processing.

3.1.3 Waste Sludge Tank

a. The waste sludge tank is supplied with waste from the following sources:

1. Radwaste filters,
2. The Thermex System, and
3. The spent resin tank

b. The waste sludge tank has the ability for decantation. A decant pump takes a suction off the sludge tank and discharges to the spent resin tank.

3.1.3 (Cont)

c. Contents of the waste sludge tank are fed by one of two redundant waste sludge pumps, to the Radwaste Truckbay for dewatering by the RDS 1000 or cement solidification by an approved vendor.

3.1.4 Ventilation System

The Radwaste Building Ventilation System (HVW) provides filtered, conditioned outside air to various areas of the Radwaste Building and exhaust the air to the atmosphere through the Reactor Building Vent. The HVW system maintains the building at a pressure below atmospheric to help prevent any unmonitored air leakage to the environment.

3.1.5 Liners

a. The RDS-1000 system is compatible with Chem-Nuclear System Incorporated (CNSI) dewatering waste containers.

b. These containers and their dewatering internals are designed to ensure uniform dewatering of waste slurries. They are fabricated and inspected in accordance with CNSI Quality Assurance Program.

c. Waste classification requirements will enter into selection of liner type.

d. Liners used to transport concentrated waste are fabricated and inspected in accordance with CNSI Quality Assurance Program and are compatible with Liquid Waste.

3.1.6 Crane

a. All liners movements are completed using a radio controlled/operated crane.

b. Liners are moved if required by crane to the Radwaste Building storage area using a ceiling grid coordinated system for placement of the liner.

c. When liners stored in the Radwaste Building storage area are to be shipped, the liners scheduled for shipment are moved, capped just before shipment, and then loaded for transportation to the burial location.

3.2 Radioactive Waste Dewatering System (RDS 1000)

3.2.1 Rapid Dewatering System (RDS-1000)

a. The rapid dewatering system is a self-contained, free-standing portable system for dewatering radioactive spent resins and filter sludges in a variety of liners to meet current disposal criteria at low-level waste disposal facilities. The system is comprised of:

   1. A dewatering skid

   2. A plant connection skid

   3. A control console

   4. A container fillhead

   5. A waste container complete with interconnecting hoses and cables

b. The radioactive waste slurry is transferred by waste transfer pumps to the RDS 1000, which includes a waste inlet automatic control valve.

c. The water removed from the radioactive waste is pumped from the waste liner by a dewatering pump through a media-specific filtering device and returned to the plant through a floor drain.

d. Fill operation is controlled remotely and viewed with a video monitor on the control panel. A remote level-control system detects and monitors waste level in the liner. Overfill protection is provided through this system and an independent level control in the fillhead, either of which will automatically close the waste inlet valve.

e. Upon completion of dewatering, warm air between 160-180 deg. F is recirculated through the liner and moisture separator until water content of the waste is within the low-level burial site Acceptance Criteria.

   NOTE: The limiting factor on air temperature recirculated through the liner is based on maximum allowable temperature of a HIC. The maximum measured acceptable temperature is 200 deg. F.

f. The type of media which can be dewatered by the RDS-1000 is divided into two categories:

   1. Granular media which includes bead resin, charcoal, and zeolites

   2. Filter precoat media which includes ecodex, powdex, ecosorb, ecocoat, and diatomateous earth.

3.2.1 (Cont)

g. All discharge air is passed through HEPA filtration units contained within the RDS-1000 Skid before passing to permanent plant vent.

3.2.2 Acceptance Criteria

Acceptance Criteria for process completion is established by a minimum dewatering time and a maximum water collection rate. The resultant waste form meets the requirements of 10 CFR 61 "Licensing Requirements for Land Disposal of Radioactive Waste" and NRC Branch Technical Position on Waste Form (May, 1983 Rev 0).

a. Bead Resin

1. The dewatering pump has run for one hour after the final waste transfer.

2. The RDS-1000 has been run for a minimum of four hours.

3. The moisture separator sight glass does not increase more than 1/2 inch during a thirty minute period.

b. Precoat Media

1. The dewatering pump has run, after the final waste transfer for a minimum of one hour and dewatering pump suction is equal to or less than 16" of mercury with all lateral suction valves opened.

2. The RDS-1000 has been run for a minimum of eleven hours.

3. The moisture separator sight glass does not increase more than 1 inch during a thirty minute period.

3.2.3 Plant Connection Stand

The plant connection stand, consists of the following:

a. A remotely operated waste inlet valve to control influent to the processing liner. This valve is interlocked to close on High Level, High High Level (mechanical float inside fillhead), and decreasing air pressure or loss of electrical power.

b. A diaphragm pump with connections to the fillhead for gross initial dewatering.

c. Manifold for air and water supplies to control elements and flush components.

3.2.4 Fillhead

a. Camera and light provides remote visual observation of the container level during the resin transfer and dewatering.

b. Connections on the underside of the fillhead can connect to break away fittings in order to facilitate remote removal from the container for ALARA.

c. The external connections on the fillhead are camlock except the waste inlet.

d. A float switch inside the fillhead is a high high level backup to the level detection system (FAVA) installed inside the liner for automatic closure of the waste isolation valve.

3.2.5 RDS Dewatering Skid

The RDS Skid consists of a vacuum pump, moisture separator, air conditioning unit, and piping interface to the plant connection stand. Pressures and temperatures are monitored at various points on this component to safeguard mechanical operations. A HEPA filter is installed downstream of the safety relief valve and manual valve bypass.

3.2.6 Control Panel

A control panel containing electrical and pneumatic controls to allow remote operation of all components and monitoring of individual parameters. A video monitor of the liner is provided as well as temperature and pressure indications of primary components. Audible and visual alarms to indicate off-normal conditions are also found on the control panel.

3.2.7 Level Detection System (FAVA)

The term FAVA is the manufacturers designation for a level detection system which is installed in the liner with a remote readout display on the control console. There are four probes inserted to different levels in the liner. The level detection system works on the conduction principle. It is used in the process to indicate the level of the liquid in the container.

3.2.8 Radwaste Operators

Radwaste Operators shall ensure proper equipment is available before beginning radwaste processing. Radwaste Operators may process wastes when the following equipment is operable:

a. Closed circuit television system stations

b. Radwaste Building Ventilation

3.2.8 (Cont)

c. Radwaste Building Floor Drain System

d. Radwaste Building CNS System

e. Service Air System

3.2.9 Vendor Operators

All operations of RDS-1000 shall be performed by technicians that have successfully completed the CNSI technicians training program. Initial indoctrination training includes approximately 30 days of general knowledge examinations, health physics instructions, and equipment operation. The operator shall have practical experience, certification on the RDS-1000 system and is subjected to recertification every two years. Each phase of the training is monitored by the use of qualification cards, on the job training reports, written tests and certificates of completion.

3.2.10 Quality Assurance

Chem-Nuclear's Quality Assurance Program, CNSI Procedure, QA-AD-001, shall be employed to control the design, fabrication, inspection, testing, operation, and record keeping for the RDS-1000.

3.2.11 Records

CNSI maintains records of the design, fabrication and testing of each RDS-1000 system. The setup and operation of the system is maintained in accordance with CNSI Procedures, FO-OP-032, Setup and Operating Procedure for RDS-1000 unit and FO-OP-035, Setup and Operating Procedure for Dewatering Precoat Media in a 21-300 Liner Using the RDS-1000.

3.2.12 Waste Containers

The General Supervisor Radwaste shall ensure:

a. Waste Containers are used for dewatering to satisfy the stability requirements.

   1. Polyethylene container may be used as the disposal package for NRC Class "A" waste.

   2. Polyethylene container may also be used for NRC CLASS "B" and "C" waste, but enhanced structural stability is required for burial at the Barnwell site.

3.2.12 (Cont)

NOTE: This structural stability to meet requirements of 10CFR61.56 and the State of South Carolina is accomplished by the use of DHEC approved concrete overpack structures at the Barnwell burial site.

b. Each Waste Container is accompanied by a certificate of compliance.

c. Dewatering procedures based on an NRC approved vendor process control program or "Topical Report" are part of FO-OP-032, RDS-1000 Dewatering Procedure.

d. Documentation of adherence to procedures are maintained as records.

e. No polyethylene container is stored in direct sunlight for a period greater than one year.

f. Waste containers used to transport concentrated waste are compatible with this type of waste.

3.3 Disposition of other Radioactive Material

3.3.1 Contaminated Oils

The General Supervisor Radwaste shall ensure:

a. Contaminated oils are stored in containers at designated areas within the plant.

b. A vendor with an approved process control program acceptable at the selected burial site is used to solidify the oil.

c. A vendor may also be used to incinerate the oils.

3.3.2 Temporary Radwaste Processing

The General Supervisor Radwaste shall ensure:

a. The vendor is NRC approved and has demonstrated a commitment to 10CFR61, Sub Part D, Technical Requirements for Land Disposal Facilities and Final Waste Classification and Waste Form Technical Position Papers stability requirements.

b. The vendor has completed Class B and C waste testing or has provided a schedule of completion.

c. The vendor has an approved procedure to process Class A waste (Dewatering, Evaporation, Solidification).

3.3.2 (Cont)

d. Vendor procedures are acceptable as follows:

1. Vendor procedures are reviewed and approved in accordance with NIP-PRO-03, Preparation and Review of Technical Procedures.

2. A production sample level process control procedure is implemented.

3. The vendor provides samples in accordance with N2-WHP-4, Waste Transfer Procedure, for N2-CSP-WSS-@406, Dewatered Waste Sludge surveillance at Unit 2.

3.3.3 <u>Dry Active Waste (DAW)</u>

The General Supervisor Radwaste shall ensure:

a. The proper and safe steps are performed to collect and prepare low specific activity (LSA) DAW in accordance with N2-WHP-12, Solid Dry Waste Collection and Compaction.

b. DAW is examined for liquids or items that would compromise the integrity of the package or violate the burial site license and/or criteria before compacting. These items are removed or separated.

c. DAW is shipped in containers meeting the transport requirements of 49CFR173.427, Transport Requirements for Low Specific Activity (LSA) Radioactive Materials.

d. Waste precluded from disposal in LSA boxes or drums due to radiation limits is disposed of in liners in accordance with N2-WHP-4, Waste Transfer Procedure.

e. DAW shipped off-site for vendor processing meets 49CFR173.427, Transport Requirements for LSA, and any additional vendor requirements, if specified.

3.4 <u>Sampling</u>

Radwaste Operators or the Chemistry Branch shall ensure:

a. The Evaporator Bottoms Tank (TK10), the Waste Sludge Tank (TK8), or the Spent Resin Tank (TK7) are isolated from further input when preparing to process waste and a batch number is assigned.

b. The Evaporator Bottoms Tank (TK10) is recirculated to ensure a homogeneous mixture.

c. The Waste Sludge Tank (TK8) is agitated and the Spent Resin Tank (TK7) is recirculated to ensure a homogeneous mixture.

3.4 (Cont)

d. A sample is obtained from the tank(s) to be processed in accordance with N2-WHP-4, Waste Transfer Procedure, for N2-CSP-WSS-@406, Dewatered Waste Surveillance at Unit 2.

e. The sample from the tank(s) to be processed is analyzed and the sample data sheet form in N2-CSP-WSS-@406, Dewatered Waste Surveillance at Unit 2, is completed.

f. The Chemistry Branch shall determine the radionuclide content of each sample.

3.5 Waste Classification

a. The Unit 2 Radwaste Process Control Program, procedure assures that wastes determined acceptable for near surface disposal are properly classified.

b. Waste classification is performed consistent with the guidance provided in the Branch Technical Position pertaining to Waste Classification and is based upon the concentration of certain radionuclides in the waste form as given in 10CFR61.55, Waste Classification, and 10CFR61.56, Waste Characteristics.

NOTE: The methods used and the frequency for determining the radionuclide concentration of the final waste form are conducted in accordance with N2-CSP-WSS-@406, Dewatered Waste Surveillance at Unit 2.

c. The General Supervisor Radwaste shall ensure:

1. The minimum waste characteristic requirements identified in 10CFR61.56, Waste Characteristics, are satisfied by implementation of applicable S-RPIPs for the packaging and transportation of radioactive material.

2. The radionuclide concentration determination methods and frequency are conducted in accordance with N2-CSP-WSS-@406, Dewatered Waste Surveillance at Unit 2 and N2-CSP-WSS-@403.

d. The Manager Radiation Protection shall ensure classification of waste is performed in accordance with S-WHP-03, Classification and Shipment of Radioactive Material, using the RADMAN computer code or S-WHP-04, Classification and Shipment of Radioactive Material, using the RAMSHP computer program.

3.6 Administrative Controls

NOTE: The Manager, Nuclear QA, Operations has the authority to stop work when significant conditions adverse to quality exist and require corrective action.

3.6.1 Quality Assurance (QA) procedures and the Nuclear QA Program require:

a. Ongoing review, monitoring, and audit functions.

b. Performance of audits, under the cognizance of the SRAB, of the Process Control Program and implementing procedures for processing and packaging of radioactive waste at least once every 24 months.

c. Compliance with the waste classification and characterization requirements of 10CFR61.55, Waste Classification and 10CFR61.56, Waste Characteristics.

d. Quality Assurance Inspectors performing radwaste inspections have documented training in Department of Transportation and NRC radwaste regulatory requirements.

e. Quality Assurance review of vendor programs to ensure compliance with 10CFR71, Packaging and Transportation of Radioactive Materials, Quality Assurance requirements.

3.6.2 Training Procedures and Training Programs require:

a. Radwaste Operator qualification by completion of the Radwaste Operations Unit 2 Plant Training Program with:

1. An average grade of 80 percent or above.

2. On-the-job training in conjunction with classroom instruction to ensure each radwaste operator maintains an acceptable level of skill and familiarity associated with radwaste controls and operational procedures.

3. Training in accordance with approved training procedures.

b. Training of Radwaste Operators to include, but <u>NOT</u> be limited to, familiarity with the following radwaste components or related systems:

1. Liquid-drains, collection tanks with subsystems, waste and regeneration evaporators, and seal water

2. Solid Waste and associated support systems

3. LWS-Computer operation and interfaces

3.6.2.b (Cont)

4. Waste handling procedures for packaging and shipping of radioactive materials

5. Condensate demineralizer system

6. Spent fuel and phase separators subsystem

7. Steam supplies

8. The Thermex System

9. Rapid Dewatering System (RDS-1000)

c. Chemistry Technician and Radiation Protection Technician training in accordance with approved training procedures.

d. A formal classroom Radwaste Training Program schedule based on the needs of Radwaste Operations personnel.

NOTE: This training may be covered in a continuous cycle or as part of the normal rotating shift schedule.

e. Continuing Training of Radwaste Operator personnel on a cyclic basis (i.e. every 4 yrs.) to identify individual needs for retraining.

1. Personnel demonstrating a significant deficiency in a given area of knowledge and proficiency are placed in a remedial training program as directed by the General Supervisor Radwaste.

2. Successful completion of the accelerated training program is evaluated by a written and/or oral examination as directed by the General Supervisor Radwaste.

NOTE: The Requalification Training Program covers a fundamental review of system modifications, revisions or changes to procedures, and changes or experiences in the nuclear industry.

f. Training records to:

1. Be maintained for audit and inspection purposes.

2. Be considered permanent records.

3.6.2.f (Cont)

3. Meet the applicable requirements of QATR-1, Quality Assurance Program Topical Report for Nine Mile Point Nuclear Station Operations, Section 17.0, Quality Assurance Records, NIP-TQS-01, Qualification and Certification, and NIP-RMG-01, Identification, Maintenance, Storage and Transfer of Nuclear Division Records

3.6.3 Documentation Control and Record Retention

a. Station management shall evaluate QA program audits of waste classification records to satisfy the requirements of 10CFR20.2006.d, Transfer for Disposal and Manifests.

b. Personnel shall forward changes affecting operating procedures to Nuclear-QA for review in parallel with the NMPC Operations review as required.

c. Site Records Management shall maintain waste management records in accordance with the appropriate administrative procedures.

3.6.4 Licensee-initiated changes to the Unit 2 Radwaste Process Control Program:

a. Are submitted to the Commission in the Radioactive Effluent Release Report for the period in which the change(s) was made, and contain the information required by USAR Section 11.4.7, Process Control Program.

b. Become effective upon review and acceptance by the SORC.

3.6.5 The General Supervisor Radwaste shall ensure:

a. Shipping manifests are completed and tracked to satisfy the requirements of 10CFR20.2006.d. Transfer for Disposal and Manifests, in accordance with Waste Handling Procedures.

b. Radwaste Management monitors the status of the manifests in accordance with N2-WHP-7, Cask/Van/Flatbed/Seavan Departure.

c. Temporary storage of solid radioactive material awaiting shipment in an area other than a designated area is done in accordance with GAP-INV-02, Control of Material Storage Areas.

3.6.6 Solid Radioactive Wastes Specification

a. Technical Requirements Manual (TRM) Specification 3.11.1 contains requirements for solidification and dewatering of radioactive wastes.

b. Although the specification is housed in the TRM, TRM 3.11.1 is a part of the Process Control Program and is subject to the controls and change processes of this document.

4.0 DEFINITIONS

4.1 Class "A" Waste

Waste usually segregated from other waste classes at the disposal site. The physical form and characteristics shall meet the minimum requirements of 10CFR61.56, Waste Characteristics.

4.2 Class "B" Waste

Waste meeting more rigorous waste form requirements to ensure stability after disposal. Class B waste form shall meet both the minimum and stability requirements of 10CFR61.56, Waste Characteristics.

4.3 Class "C" Waste

Waste meeting Class B standards and requiring additional measures at the disposal facility to prevent inadvertent intrusion.

4.4 Homogeneous

Of the same kind or nature; essentially alike. Most waste streams are considered homogeneous for purposes of waste classification.

4.5 Batch

An isolated quantity of feed waste to be processed having essentially constant physical and chemical characteristics.

4.6 Dewatered Waste

Refers to waste that has been processed by means other than solidification, encapsulation, or absorption to meet the free standing liquid requirements of 10 CFR 61.56 (a)(3) and (b)(2).

4.7 Concentrated Waste

Liquid waste that has a high level of dissolved and/or particulate solid content.

4.8 Dried Waste

Solid waste that has been processed by evaporation to dryness.

5.0 REFERENCES

5.1 Licensee Documentation

5.1.1 QATR-1, Quality Assurance Program Topical Report for Nine Mile Point Nuclear Station Operations, Section 17.0, Quality Assurance Records

5.1.2 Unit 2 Technical Specifications Section 5.6.3, Radioactive Effluent Release Report

5.1.3 Nuclear Quality Assurance Program

5.1.4 Unit 2 Updated Safety Analysis Report Section 11.4.7, Process Control Program

5.1.5 Unit 2 Technical Requirements Manual Specification 3.11.1, Solid Radioactive Wastes

5.2 Standards, Regulations, and Codes

5.2.1 ANSI/ANS 55.1, 1979, American National Standard for Solid Radioactive Waste Processing System for Light Water Cooled Reactor Plants

5.2.2 10CFR20.2006.d, Transfer for Disposal and Manifest

5.2.3 10CFR20 App G, Requirements for Transfers of Low Level Radioactive Waste intended for Disposal at Licensed Land Disposal Facilities and Manifests

5.2.4 10CFR61, Sub Part D, Technical Requirements for Land Disposal Facilities and Final Waste Classification and Waste Form Technical Position Papers

5.2.5 10CFR61.55, Waste Classification

5.2.6 10CFR61.56, Waste Characteristics

5.2.7 10CFR71, Packaging and Transportation of Radioactive Material

5.2.8 49CFR173.1.b, Transportation

5.2.9 49CFR173.427, Transport Requirements for Low Specific Activity (LSA) Radioactive Materials

5.2.10 NUREG-0123, Standard Radiological Effluent Technical Specifications for Boiling Water Reactors

5.2.11 NUREG-0800,

a. Section 11.2, Standard Review Plan for Liquid Waste Management Systems

b. Section 11.4, Standard Review Plan for Solid Waste Management Systems

5.2.12 Resource Conservation and Recovery Act (RCRA) of 1976 (Ref. Corporate Guide to Hazardous Waste Disposal and Spill Reporting)

5.2.13 Regulatory Guide 1.143, Rev. 0, Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light Water Cooled Nuclear Power Plants

5.3 Supplemental References

5.3.1 South Carolina Department of Health and Environmental Control, Radioactive Material License 097, as amended

5.3.2 State of Washington Radioactive Material License No. WN-I019-2, as amended

5.3.3 NRC Special Nuclear Material License No. 12-13536-02, as amended, for Barnwell, SC

5.3.4 NRC Special Nuclear Material License No. 16-19204-01, as amended, for Richland, WA

5.3.5 Nuclear Regulatory Commission Branch Technical Position on Waste Classification and Waste Form, May 1983

5.3.6 CNSI Proprietary Topical Report
No. RDS-25506-01-NP-A, Rev. 1- March 1988.
Appendix A,B,C,D and Material Safety Data Sheets

5.3.7 SE 92-049, Interim On-Site Storage of Low Level Radioactive Waste (LLRW) in the Radwaste Solidification and Storage Building (RSSB) at Unit 1.

5.3.8 SE 92-061, Upgrade Radwaste 245' Elevation Storage, at Unit 2.

5.3.9 N2-WHP-25, Thermex Operating Procedure

5.3.10 Safety Evaluation 94-074, Installation of the Thermex System

ATTACHMENT 1: UNIT 2 RADWASTE PROCESS CONTROL PROGRAM REFERENCE AND IMPLEMENTING PROCEDURES

Waste Handling Procedures (WHPs)

Radiation Protection Procedures (S-RPIPs)

Chemistry Procedures (CSPs)

Quality Assurance Procedures (QAPs)

Operating Procedures (OPs)

Generation Administrative Procedures (GAP/APs)

Nuclear Division Interfacing Procedures (NIPs)

ATTACHMENT 2: SOLID WASTE SOURCES

(Sheet 1 of 3)

1.0 RADWASTE FILTERS

1.1 Mechanical radwaste filters filter resin and crud (backwash material) from the waste collector sub-system.

1.2 When a filter reaches a pre-determined differential pressure, the filter backwashes the material into the backwash tank, which is then pumped to the spent resin tank.

2.0 RADWASTE DEMINERALIZERS

2.1 The radwaste demineralizers are used as an ionic exchange media for processing high quality water from the waste collector tanks.

2.2 When determined the resin can NO longer be used, the depleted resin is pumped to the spent resin tank.

3.0 CONDENSATE DEMINERALIZER

3.1 The condensate demineralizers remove soluble and insoluble impurities from the condensate water to maintain reactor feedwater purity.

3.2 After it is determined these resins can NO longer be used, the depleted resins are pumped to the Radwaste Demineralizer or spent resin tank.

4.0 THERMEX SYSTEM

4.1 Concentrated waste will be pumped to the regen waste tank for further concentration by an evaporator or stored in a liner and eventually pumped to a transport liner in the Radwaste Truckbay for offsite processing.

4.2 Exhausted resin and charcoal are sluiced to the filter sludge tank. This waste is transferred to the Spent Resin tank mixed to a homogenous mixture and then transferred to a liner in the truckbay for dewatering.

4.3 Exhausted reverse osmosis membranes will be processed as DAW.

5.0 SPENT FUEL PHASE SEPARATOR

These tanks receive the exhausted powdered filter media (resins) from the fuel pool cleanup system which is subsequently pumped to the spent resin tank or directly to a liner in the Radwaste Truckbay for processing.

6.0 RWCU PHASE SEPARATOR

These separator tanks receive exhausted powdered filter media (resins) from the water cleanup system which is subsequently pumped to the spent resin tank or directly to a liner in the Radwaste Truckbay for processing.

7.0 CONTAMINATED OIL

Oil from sources within Unit 2 that become contaminated is either stored in containers (to be solidified by a vendor with an approved procedure) or shipped off-site for incineration.

8.0 COMPACTIBLE SOLIDS

8.1 Compactible low level trash is either processed and compacted in a hydraulically operated box compactor, or shipped off-site for vendor separation and processing.

8.2 Shoe covers, trash, contaminated paper from the chemistry lab, and similar materials are included in this category.

9.0 FILTERS AND MISCELLANEOUS ITEMS

Solid items with high dose rates are handled on a case-by-case basis, being disposed of by methods acceptable to the burial site or shipped off-site for vendor recovery or disposal.

10.0 WASTE EVAPORATOR

10.1 The waste evaporator processes low quality waste from the floor drain collector system, Regeneration Waste Tanks and, as an option, waste from the Waste Discharge Tanks.

10.2 The waste evaporator is designed to concentrate waste to a 25% solid concentration which may then be discharged to the evaporator bottoms tank for transfer to the Radwaste Truckbay for vendor processing.

11.0 REGENERANT EVAPORATOR

11.1 The Regenerant Waste Evaporator may receive concentrated waste from the Thermex System, regeneration solutions from the Condensate Demineralizer System, the Radwaste Demineralizer Resin Regeneration System, and the radwaste regeneration sump. It can also process waste from the Floor Drain Collector System and the Waste Discharge Tanks.

11.2 The Regenerant Waste Evaporator is designed to concentrate to a 25% by weight solid concentration of sodium sulfate.

11.3 The concentrates are then discharged to the Evaporator Bottoms Tank for transfer to the Radwaste Truckbay for vendor processing.

12.0 SPENT RESIN STORAGE TANK

12.1 Exhausted resin from the condensate demineralizer, the Radwaste Demineralizer, RWCU phase separator, the Spent Fuel Pool Phase Separator, and the Radwaste Filter Backwash Tanks are sluiced to the Spent Resin Storage Tank.

12.2 The waste from the Spent Resin Storage Tank is pumped to the Waste Sludge Tank for processing by the RDS 1000 in the Radwaste Truckbay.