

DOCKET 50-305

KEWAUNEE NUCLEAR POWER PLANT

**SEMIANNUAL RADIOACTIVE
EFFLUENT RELEASE REPORT**

January 1 - June 30, 1993

Wisconsin Public Service Corporation
Green Bay, Wisconsin
September 29, 1993
Rev.A

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2.0 GASEOUS EFFLUENTS

2.1 Lower Limits of Detection (LLD) for Gaseous Effluents

Gaseous radioactive effluents are released in both the continuous mode and the batch mode. The auxiliary building stack is sampled continuously for particulates, halogens and Strontium by an "off-line" sample train. This stack is also grab-sampled daily for gaseous gamma emitters. Batch releases are sampled prior to release for principal gaseous and particulate gamma emitters, halogens and tritium.

The LLD's for gaseous radioanalyses, as listed in Table 8.4 of the Kewaunee Technical Specifications, are:

Analysis	LLD ($\mu\text{Ci/ml}$)
Gaseous Gamma Emitters	1.00 E-04
Iodine 131	3.00 E-12
Particulate Gamma Emitters	1.00 E-11
Particulate Gross Alpha	1.00 E-11
Strontium 89, 90	1.00 E-11
Noble Gases, Gross Beta or Gamma	1.00 E-06

The nominal "a priori" LLD values are shown below.

Isotope	a priori LLD ($\mu\text{Ci/ml}$)
a. Gaseous emissions:	
Kr-87	2.63 E-8
Kr-88	3.49 E-8
Xe-133	3.57 E-8
Xe-133m	5.76 E-8
Xe-135	8.67 E-9
Xe-138	5.38 E-8
b. Particulate emissions:	
Mn-54	3.75 E-14
Fe-59	5.33 E-14
Co-58	4.76 E-14
Co-60	1.08 E-13
Zn-65	8.29 E-14
Mo-99	1.92 E-14
Cs-134	4.08 E-14
Cs-137	4.41 E-14
Ce-141	2.46 E-14
Ce-144	1.36 E-13

3.0 LIQUID EFFLUENTS

3.1 Lower Limits of Detection (LLD) for Liquid Effluents

Liquid radioactive effluents are released as both batch releases and continuous releases. Each batch is sampled prior to release and analyzed for gamma emitters and tritium. A fraction of each sample is retained for a monthly proportional composite which is then analyzed for Gross Alpha, Strontium 89, Strontium 90 and Iron 55.

The LLD's for liquid batch release radioanalyses, as listed in Table 8.3 of the Kewaunee Technical Specifications, are:

Analysis	LLD ($\mu\text{Ci/ml}$)
Principal Gamma Emitters	1.00 E-06
Iodine 131	1.00 E-06
Tritium	1.00 E-05
Gross Alpha	5.00 E-07
Strontium 89, 90	5.00 E-08
Iron 55	1.00 E-06

The actual obtained "a priori" LLD values for batch releases are shown below.

Isotope	1st Qtr	2nd Qtr	Average a priori LLD ($\mu\text{Ci/ml}$)
Mn-54	8.54E-8	3.04E-7	1.95E-7
Fe-59	1.88E-7	4.45E-7	3.17E-7
Co-58	8.39E-8	2.01E-7	1.42E-7
Co-60	2.14E-7	2.64E-7	2.39E-7
Zn-65	2.12E-7	5.00E-7	3.56E-7
Mo-99	8.10E-8	7.93E-8	8.02E-8
Cs-134	9.62E-8	1.89E-7	1.43E-7
Cs-137	1.18E-7	2.01E-7	1.60E-7
Ce-141	1.26E-7	1.55E-7	1.41E-7
Ce-144	3.62E-7	7.12E-7	5.37E-7
I-131	7.75E-8	1.32E-7	1.05E-7
H-3	4.54E-6	6.30E-6	5.42E-6
Sr-89	2.00E-9	2.93E-8	1.57E-8
Sr-90	6.33E-9	1.68E-8	1.16E-8
Gross Alpha	3.00E-9	8.23E-9	5.62E-9
Fe-55	5.70E-7		5.70E-7

Continuous liquid releases are grab sampled weekly and analyzed for principal gamma emitters. A fraction of each weekly sample is retained for a monthly proportional composite which is then analyzed for Tritium, Gross Alpha, Strontium 89, Strontium 90 and Iron 55.

The LLD's for liquid continuous release radioanalyses, as listed in Table 8.3 of the Kewaunee Technical Specifications, are:

Analysis	LLD ($\mu\text{Ci/ml}$)
Principal Gamma Emitters	5.00 E-07
Iodine 131	1.00 E-06
Tritium	1.00 E-05
Gross Alpha	5.00 E-07
Strontium 89, 90	5.00 E-08
Iron 55	1.00 E-06

The actual obtained "a priori" LLD values for continuous releases are shown below.

Isotope	1st Qtr	2nd Qtr	Average a priori LLD ($\mu\text{Ci/ml}$)
Mn-54	1.42E-8	6.36E-8	3.89E-8
F-59	7.01E-8	8.57E-8	7.79E-8
Co-58	3.42E-8	4.98E-8	4.20E-8
Co-60	3.73E-8	8.75E-8	6.24E-8
Zn-65	7.89E-8	8.77E-8	8.33E-8
Mo-99	2.14E-8	2.94E-8	2.54E-8
Cs-134	3.59E-8	5.10E-8	4.35E-8
Cs-137	4.17E-8	6.27E-8	5.22E-8
Ce-141	3.86E-8	2.87E-8	3.37E-8
Ce-144	1.65E-7	2.95E-7	2.30E-7
I-131	2.89E-8	4.10E-8	3.50E-8
H-3	4.54E-6	6.30E-6	5.42E-6
Sr-89	8.83E-9	1.23E-8	1.06E-8
Sr-90	3.53E-9	5.98E-9	4.76E-9
Gross Alpha	3.03E-9	6.02E-9	4.53E-9
Fe-55	1.88E-7	5.58E-7	3.73E-7

TABLE 3.1
Semiannual Radioactive Effluent Release Report 1993
Liquid Effluents - Summation of all Releases

	1st Quarter	2nd Quarter	Total
Fission and Activation Products			
Total Release Excluding H3 and Dissolved Gases (Ci)			
	9.704E-003	8.178E-002	9.148E-002
Average Concentration (μCi/ml)			
	9.938E-011	6.086E-010	
Tritium			
Total Release (Ci)			
	6.092E+001	3.871E+001	9.963E+001
Average Concentration (μCi/ml)			
	6.239E-007	2.880E-007	
% of Tech. Spec. Limit(3.0E-3 μCi/ml)			
	2.080E-002	9.602E-003	
Dissolved Gases			
Total Release (Ci)			
	2.325E-004	2.870E-003	3.102E-003
Average Concentration (μCi/ml)			
	2.381E-012	2.135E-011	
% of Tech. Spec. Limit(2.0E-4 μCi/ml)			
	1.190E-006	1.068E-005	
Gross Alpha Activity			
Total Release (Ci)			
	0.000E+000	0.000E+000	0.000E+000
Volume of Waste Released			
Batch (liters)	2.165E+006	9.785E+005	3.143E+006
Continuous (liters)	3.242E+007	4.201E+007	7.443E+007
Total (liters)	3.458E+007	4.299E+007	7.757E+007
Volume of Dilution Water			
Batch (liters)	1.289E+010	8.483E+009	2.137E+010
Continuous (liters)	8.476E+010	1.259E+011	2.107E+011
Total (liters)	9.765E+010	1.344E+011	2.320E+011

TABLE 3.2B
Semiannual Radioactive Effluent Release Report 1993
Liquid Effluents - Batch Releases

	April	May	June	<u>Total</u>
Gross Radioactivity				
Total Release				
Excluding H3 and Dissolved Gases (Ci)	1.062E-002	1.305E-002	9.070E-003	3.275E-002
Avg. Conc. (μ Ci/ml)	5.021E-009	7.960E-009	1.919E-009	
Tritium				
Total Release				
(Ci)	5.869E+000	2.841E+000	2.992E+001	3.863E+001
Avg. Conc. (μ Ci/ml)	2.774E-006	1.732E-006	6.329E-006	
Dissolved Gases				
Total Release				
(Ci)	0.000E+000	0.000E+000	0.000E+000	0.000E+000
Avg. Conc. (μ Ci/ml)	0.000E+000	0.000E+000	0.000E+000	
Gross Alpha Activity				
Total Release				
(Ci)	0.000E+000	0.000E+000	0.000E+000	0.000E+000
Avg. Conc. (μ Ci/ml)	0.000E+000	0.000E+000	0.000E+000	
Volume of Waste Released				
(liters)	3.753E+005	1.659E+005	4.373E+005	9.785E+005
Volume of Dilution Water				
(liters)	2.116E+009	1.640E+009	4.727E+009	8.483E+009

TABLE 3.2B (Ccn't)
Semiannual Radioactive Effluent Release Report 1993
Liquid Effluents - Batch Releases

Isotope (Ci)	April	May	June	<u>Total</u>
H-3	5.869E+000	2.841E+000	2.992E+001	3.863E+001
Cr-51	4.338E-004	4.524E-004	6.267E-004	1.513E-003
Mn-54	1.465E-005	8.719E-005	0.000E+000	1.018E-004
Fe-55	3.003E-003	3.484E-003	2.011E-003	8.498E-003
Co-57	6.598E-007	0.000E+000	0.000E+000	6.598E-007
Co-58	5.199E-003	2.531E-003	2.469E-003	1.020E-002
Fe-59	1.504E-004	2.000E-004	6.968E-005	4.200E-004
Co-60	3.280E-004	8.075E-004	5.032E-004	1.639E-003
Zr-95	1.007E-004	1.397E-004	0.000E+000	2.404E-004
Nb-95	1.046E-004	1.609E-004	9.880E-005	3.643E-004
Ag-110m	2.010E-004	4.478E-003	3.291E-003	7.969E-003
Sn-113	3.629E-005	6.166E-005	0.000E+000	9.796E-005
Sb-124	4.304E-004	2.572E-004	0.000E+000	6.876E-004
Sb-125	6.204E-004	3.941E-004	0.000E+000	1.015E-003
Cs-137	2.649E-006	0.000E+000	0.000E+000	2.649E-006
Total	5.880E+000	2.854E+000	2.993E+001	3.867E+001

TABLE 3.3B
Semiannual Radicactive Effluent Release Report 1993
Liquid Effluents - Ccntinuous Releases

	April	May	June	<u>Total</u>
Gross Radioactivity				
Total Release				
Excluding H3 and Dissolved Gases (Ci)	9.849E-003	3.266E-002	6.527E-003	4.903E-002
Avg. Conc. (μ Ci/ml)	3.545E-010	6.966E-010	1.274E-011	
Tritium				
Total Release				
(Ci)	3.830E-004	0.000E+000	8.036E-002	8.075E-002
Avg. Conc. (μ Ci/ml)	1.379E-011	0.000E+000	1.568E-009	
Dissolved Gases				
Total Release				
(Ci)	2.144E-004	6.061E-004	2.049E-003	2.870E-003
Avg. Conc. (μ Ci/ml)	7.718E-012	1.293E-011	3.999E-011	
Gross Alpha Activity				
Total Release				
(Ci)	0.000E+000	0.000E+000	0.000E+000	0.000E+000
Avg. Conc. (μ Ci/ml)	0.000E+000	0.000E+000	0.000E+000	
Volume of Waste Released				
(liters)	1.175E+007	1.759E+007	1.267E+007	4.201E+007
Volume of Dilution Water				
(liters)	2.778E+010	4.688E+010	5.124E+010	1.259E+011

TABLE 3.3B (Con't)
Semiannual Radioactive Effluent Release Report 1993
Liquid Effluents - Continuous Releases

Isotope (Ci)	April	May	June	<u>Total</u>
H-3	3.830E-004	0.000E+000	8.036E-002	8.075E-002
Na-24	1.224E-003	4.582E-003	6.182E-004	6.424E-003
Ar-41	1.225E-004	7.900E-005	2.023E-003	2.225E-003
Fe-55	0.000E+000	5.330E-004	3.398E-003	3.931E-003
Mn-54	5.087E-005	7.446E-005	7.434E-006	1.328E-004
Mn-56	0.000E+000	5.941E-004	0.000E+000	5.941E-004
Cc-58	4.379E-003	6.768E-003	2.518E-004	1.140E-002
Fe-59	6.347E-005	0.000E+000	0.000E+000	6.347E-005
Co-60	1.359E-004	2.536E-004	9.095E-005	4.805E-004
Br-82	0.000E+000	2.875E-004	4.252E-005	3.300E-004
Sr-89	2.447E-004	1.250E-005	0.000E+000	2.572E-004
Zr-95	3.245E-006	2.368E-004	2.709E-005	2.671E-004
Nb-95	8.274E-006	1.383E-004	2.297E-005	1.695E-004
Zr-97	9.455E-005	5.794E-005	1.014E-005	1.626E-004
Ag-110m	7.063E-005	0.000E+000	0.000E+000	7.063E-005
I-131	0.000E+000	0.000E+000	3.043E-005	3.043E-005
I-132	2.804E-004	3.057E-003	3.214E-004	3.659E-003
I-133	1.151E-003	5.904E-003	7.180E-004	7.772E-003
I-134	6.792E-004	1.602E-003	3.082E-004	2.589E-003
I-135	1.464E-003	8.190E-003	6.796E-004	1.033E-002
Xe-135	9.195E-005	5.271E-004	2.585E-005	6.449E-004
Cs-138	0.000E+000	3.667E-004	0.000E+000	3.667E-004
Total	1.045E-002	3.273E-002	8.554E-002	1.287E-001

Table 3.4
Semiannual Radioactive Effluent Report 1993
Dose From Liquid Effluents

The dose to a member of the public from total liquid radioactive release for each quarter was well below the Technical specification limits of 1.5 mRem to the body and less than or equal to 5 mRem to any organ.

Instantaneous release concentrations are limited by the individual radionuclide concentrations established in 10 CFR 20, Appendix B, for unrestricted areas. During the report period, none of the isotopes released exceed the concentrations specified in Appendix B. The following offsite doses were calculated using equation 1.5 from the Kewaunee ODCM.

Organ 1st Qtr Dose	Dose Total mRem	Quarterly Limit mRem	Percent of Limit
Total Body	1.608E-003	1.5	0.11
Bone	3.880E-003	5.0	0.08
Liver	8.665E-004	5.0	0.02
Thyroid	6.529E-004	5.0	0.01
Kidney	6.790E-004	5.0	0.01
Lung	6.823E-004	5.0	0.01
GI-LLI	3.622E-002	5.0	0.72

Organ 2nd Qtr Dose	Dose Total mRem	Quarterly Limit mRem	Percent of Limit
Total Body	5.428E-004	1.5	0.04
Bone	5.186E-004	5.0	0.01
Liver	6.814E-004	5.0	0.01
Thyroid	2.802E-003	5.0	0.06
Kidney	3.822E-004	5.0	0.01
Lung	4.430E-004	5.0	0.01
GI-LLI	2.081E-002	5.0	0.42

Calculated Dose This Year			
Organ	Dose Total mRem	Quarterly Limit mRem	Percent of Limit
Total Body	2.150E-003	3.0	0.07
Bone	4.399E-003	10.0	0.04
Liver	1.548E-003	10.0	0.02
Thyroid	3.455E-003	10.0	0.03
Kidney	1.061E-003	10.0	0.01
Lung	1.125E-003	10.0	0.01
GI-LLI	5.704E-002	10.0	0.57