

KEWAUNEE NUCLEAR POWER PLANT
SEMIANNUAL RADIOACTIVE
EFFLUENT RELEASE REPORT
JANUARY - JUNE 1991

WISCONSIN PUBLIC SERVICE CORPORATION
GREEN BAY, WISCONSIN
SEPTEMBER 1991

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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:

| <u>Analysis</u> | <u>LLD (uCi/ml)</u> |
|----------------------------------|---------------------|
| 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.

| <u>Isotope</u> | <u>a priori LLD (uCi/ml)</u> |
|---------------------------|------------------------------|
| a. Gaseous emissions: | |
| Kr-87 | 2.39 E-8 |
| Kr-88 | 3.48 E-8 |
| Xe-133 | 3.39 E-8 |
| Xe-133m | 7.95 E-8 |
| Xe-135 | 1.10 E-8 |
| Xe-138 | 4.14 E-8 |
| b. Particulate emissions: | |
| Mn-54 | 5.52 E-14 |
| Fe-59 | 1.01 E-13 |
| Co-58 | 5.79 E-14 |
| Co-60 | 1.16 E-13 |
| Zn-65 | 1.01 E-13 |
| Mo-99 | 2.92 E-14 |
| Cs-134 | 4.62 E-14 |
| Cs-137 | 7.07 E-14 |
| Ce-141 | 3.79 E-14 |
| Ce-144 | 1.56 E-13 |

TABLE 2.1
Semiannual Radioactive Effluent Report 1991
Gaseous Effluents-Summation of all Releases

| | <u>1st Quarter</u> | <u>2nd Quarter</u> |
|-------------------------------------|--------------------|--------------------|
| <u>Fission and Activation Gases</u> | | |
| Total Activity Released (Ci) | 1.67 E+0 | 1.40 E-1 |
| Average Release Rate (uCi/Sec) | 2.06 E-1 | 1.78 E-2 |
| <u>Iodines</u> | | |
| Total Activity Released (Ci) | 2.90 E-7 | -0- |
| Average Release Rate (uCi/Sec) | 3.73 E-8 | -0- |
| <u>Particulates</u> | | |
| Total Activity Released (Ci) | 1.40 E-3 | 5.24 E-4 |
| Average Release Rate (uCi/Sec) | 1.80 E-4 | 6.67 E-5 |
| Gross Alpha Released (Ci) | 6.54 E-4 | 2.83 E-4 |
| <u>Tritium</u> | | |
| Total Activity Released (Ci) | 3.71 E+0 | 2.69 E+0 |
| Average Release Rate (uCi/Sec) | 4.77 E-1 | 3.42 E-1 |

TABLE 2.2
Semiannual Radioactive Effluent Report 1991
Gaseous Effluents

| <u>Nuclides Released (Ci)</u> | <u>Continuous Mode</u> | | <u>Batch Mode</u> | |
|-------------------------------|------------------------|----------------|-------------------|----------------|
| | <u>1st Qtr</u> | <u>2nd Qtr</u> | <u>1st Qtr</u> | <u>2nd Qtr</u> |
| <u>Fission Gases</u> | | | | |
| Ar-41 | - | - | 8.18 E-1 | - |
| Kr-85 | - | - | 1.69 E-2 | 9.96 E-3 |
| Xe-131m | - | - | 2.00 E-4 | - |
| Xe-133 | 6.50 E-2 | 1.30 E-1 | 5.45 E-1 | 4.00 E-5 |
| Xe-133m | 1.96 E-1 | - | 4.00 E-4 | - |
| Xe-135 | - | - | 2.82 E-2 | - |
| Unidentified | - | - | - | - |
| Total for Period | 2.61 E-1 | 1.30 E-1 | 1.41 E+0 | 1.00 E-2 |
| <u>Particulates</u> | | | | |
| Co-58 | - | 1.64 E-6 | 1.11 E-5 | 2.14 E-8 |
| Co-60 | 3.72 E-6 | 1.30 E-6 | 2.95 E-5 | - |
| Sr-89 | - | - | - | - |
| Sr-90 | - | - | - | - |
| Nb-95 | - | 8.32 E-7 | - | - |
| Cs-137 | 3.76 E-7 | 1.68 E-7 | 1.46 E-6 | - |
| Ce-144 | - | 1.30 E-7 | - | - |
| Unidentified | 2.55 E-6 | 9.30 E-6 | 1.35 E-3 | 5.11 E-4 |
| Total for Period | 6.65 E-6 | 1.34 E-5 | 1.39 E-3 | 5.11 E-4 |
| <u>Iodines</u> | | | | |
| I-131 | 2.77 E-7 | - | 1.13 E-8 | - |
| I-133 | - | - | 2.48 E-9 | - |
| Total for Period | 2.77 E-7 | - | 1.38 E-8 | - |
| H-3 | 3.54 E+0 | 2.69 E+0 | 1.61 E-1 | 5.47 E-3 |

TABLE 2.3A (con't)
 Semiannual Radioactive Effluent Report 1991
 2nd Quarter Gaseous Release
 Total of all Releases

Noble Gases (Curies)

| <u>Isotope</u> | <u>April</u> | <u>May</u> | <u>June</u> | <u>Total</u> |
|----------------|--------------|------------|-------------|--------------|
| Kr-85 | 2.58 E-3 | 1.99 E-3 | 5.39 E-3 | 9.96 E-3 |
| Xe-133 | 3.34 E-5 | 6.64 E-6 | 1.30 E-1 | 1.30 E-1 |
| Unidentified | - | - | - | - |
| Total | 2.61 E-3 | 2.00 E-3 | 1.35 E-1 | 1.40 E-1 |

Particulates (Curies)

| <u>Isotope</u> | <u>April</u> | <u>May</u> | <u>June</u> | <u>Total</u> |
|----------------|--------------|------------|-------------|--------------|
| Co-58 | 2.03 E-7 | 2.14 E-8 | 1.44 E-6 | 1.66 E-6 |
| Co-60 | 1.25 E-7 | - | 1.17 E-6 | 1.30 E-6 |
| Sr-89 | - | - | - | - |
| Sr-90 | - | - | - | - |
| Nb-95 | 6.40 E-7 | - | 1.92 E-7 | 8.32 E-7 |
| Cs-137 | 5.90 E-8 | - | 1.09 E-7 | 1.68 E-7 |
| Ce-144 | 1.30 E-7 | - | - | 1.30 E-7 |
| Unidentified | 7.77 E-6 | 6.51 E-6 | 5.06 E-4 | 5.20 E-4 |
| Total | 8.93 E-6 | 6.53 E-6 | 5.09 E-4 | 5.24 E-4 |

Halogens (Curies)

| <u>Isotope</u> | <u>April</u> | <u>May</u> | <u>June</u> | <u>Total</u> |
|----------------|--------------|------------|-------------|--------------|
| Total | - | - | - | - |

TABLE 2.3A (con't)
 Semiannual Radioactive Effluent Report 1991
 2nd Quarter Gaseous Release
 Total of all Releases

Summary

| | <u>April</u> | <u>May</u> | <u>June</u> | <u>Total</u> |
|------------------------------------------------------------|--------------|------------|-------------|--------------|
| Total Noble Gases (Ci) | 2.61 E-3 | 2.00 E-3 | 1.35 E-1 | 1.40 E-1 |
| Total Halogens (Ci) | - | - | - | - |
| Total Particulate Gross Beta-Gamma (Ci) | 8.93 E-6 | 6.53 E-6 | 5.09 E-4 | 5.24 E-4 |
| Total Particulate Gross Beta-Gamma Half-Lives >8 Days (Ci) | 1.16 E-6 | 2.14 E-8 | 2.91 E-6 | 4.09 E-6 |
| Total Tritium (Ci) | 2.17 E+0 | 1.85 E-1 | 3.36 E-1 | 2.69 E+0 |
| Total Particulate Gross Alpha (Ci) | 4.65 E-6 | 4.43 E-6 | 2.74 E-4 | 2.83 E-4 |
| Maximum Noble Gas Release Rate (uCi/Sec) | 1.08 E+0 | 2.74 E+0 | 4.40 E+0 | - |

TABLE 2.3B (con't)
 Semiannual Radioactive Effluent Report 1991
 2nd Quarter Gaseous Release
 Continuous Mode Only

Noble Gases (Curies)

| <u>Isotope</u> | <u>April</u> | <u>May</u> | <u>June</u> | <u>Total</u> |
|----------------|--------------|------------|-------------|--------------|
| Xe-133 | - | - | 1.30 E-1 | 1.30 E-1 |
| Unidentified | - | - | - | - |
| Total | - | - | 1.30 E-1 | 1.30 E-1 |

Particulates (Curies)

| <u>Isotope</u> | <u>April</u> | <u>May</u> | <u>June</u> | <u>Total</u> |
|----------------|--------------|------------|-------------|--------------|
| Co-58 | 2.03 E-7 | - | 1.44 E-6 | 1.64 E-6 |
| Co-60 | 1.25 E-7 | - | 1.17 E-6 | 1.30 E-6 |
| Sr-89 | - | - | - | - |
| Sr-90 | - | - | - | - |
| Nb-95 | 6.40 E-7 | - | 1.92 E-7 | 8.32 E-7 |
| Cs-137 | 5.90 E-8 | - | 1.09 E-7 | 1.68 E-7 |
| Ce-144 | 1.30 E-7 | - | - | 1.30 E-7 |
| Unidentified | 7.77 E-6 | 1.33 E-6 | 1.97 E-7 | 9.30 E-6 |
| Total | 8.93 E-6 | 1.33 E-6 | 3.11 E-6 | 1.34 E-5 |

Halogens (Curies)

| <u>Isotope</u> | <u>April</u> | <u>May</u> | <u>June</u> | <u>Total</u> |
|----------------|--------------|------------|-------------|--------------|
| Total | - | - | - | - |

TABLE 2.3B (con't)
 Semiannual Radioactive Effluent Report 1991
 2nd Quarter Gaseous Release
 Continuous Mode Only

Summary

| | <u>April</u> | <u>May</u> | <u>June</u> | <u>Total</u> |
|------------------------------------------------------------|---------------------|---------------------|-------------|--------------|
| Total Noble Gases (Ci) | - | - | 1.30 E-1 | 1.30 E-1 |
| Total Halogens (Ci) | - | - | - | - |
| Total Particulate Gross Beta-Gamma (Ci) | 8.93 E-6 | 1.33 E-6 | 3.11 E-6 | 1.34 E-5 |
| Total Particulate Gross Beta-Gamma Half-Lives >8 Days (Ci) | 1.16 E-6 | - | 2.91 E-6 | 4.07 E-6 |
| Total Tritium (Ci) | 2.17 E+0 | 1.80 E-1 | 3.36 E-1 | 2.69 E+0 |
| Total Particulate Gross Alpha (Ci) | 4.65 E-6 | 8.26 E-7 | 2.06 E-7 | 5.68 E-6 |
| Maximum Noble Gas Release Rate (uCi/Sec) | <u><1.01 E+0</u> | <u><9.84 E-1</u> | 1.50 E+0 | - |

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 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:

| <u>Analysis</u> | <u>LLD (uCi/ml)</u> |
|--------------------------|---------------------|
| 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.

| <u>Isotope</u> | <u>a priori LLD (uCi/ml)</u> |
|----------------|------------------------------|
| Mn-54 | 8.26 E-8 |
| Fe-59 | 2.20 E-7 |
| Co-58 | 8.11 E-8 |
| Co-60 | 1.20 E-7 |
| Zn-65 | 2.05 E-7 |
| Mo-99 | 5.42 E-8 |
| Cs-134 | 1.12 E-7 |
| Cs-137 | 1.21 E-7 |
| Ce-141 | 1.03 E-7 |
| Ce-144 | 4.49 E-7 |
| I-131 | 6.39 E-8 |
| H-3 | 3.98 E-6 |
| Sr-89 | 1 E-8 |
| Sr-90 | 1 E-8 |
| Gross Alpha | 6 E-9 |
| Fe-55 | 5 E-8 |

TABLE 3.1
Semiannual Radioactive Effluent Report 1991
Liquid Effluents - Summation of all Releases

| | <u>1st Qtr</u> | <u>2nd Qtr</u> | <u>Total</u> |
|-------------------------------------------------------|---------------------|---------------------|---------------------|
| <u>Fission and Activation Products</u> | | | |
| Total Release (Excluding H3 and Dissolved Gases) (Ci) | 3.29 E-2 | 1.60 E-1 | 1.93 E-1 |
| Average Concentration (uCi/ml) | 3.70 E-9 | 1.18 E-8 | |
| <u>Tritium</u> | | | |
| Total Release (Ci) | 1.65 E+2 | 2.73 E+1 | 1.92 E+2 |
| Average Concentration (uCi/ml) | 1.86 E-5 | 2.08 E-6 | |
| Percent of Tech Spec Limit (3.0 E-3 uCi/ml) (%) | 6.20 E-1 | 6.93 E-2 | |
| <u>Dissolved Gases</u> | | | |
| Total Release (Ci) | - | - | - |
| Average Concentration (uCi/ml) | - | - | |
| Percent of Tech Spec Limit (2.0 E-4 uCi/ml) (%) | - | - | |
| <u>Gross Alpha Activity</u> | | | |
| Total Release (Ci) | <u><6.85 E-5</u> | <u><5.66 E-5</u> | <u><1.25 E-4</u> |
| <u>Volume of Waste Released</u> (Batch Releases) | | | |
| (Liters) | 1.33 E+6 | 1.13 E+6 | 2.46 E+6 |
| <u>Volume of Dilution Water</u> (Batch Releases) | | | |
| (Liters) | 8.89 E+9 | 1.31 E+10 | 2.20 E+10 |

TABLE 3.2B
Semiannual Radioactive Effluent Report 1991
Liquid Effluents - Batch Releases

| <u>Liquid Releases</u> | <u>April</u> | <u>May</u> | <u>June</u> | <u>Total</u> |
|------------------------------------------------------------|--------------------------|--------------------------|--------------------------|-------------------------|
| <u>Gross Radioactivity</u> | | | | |
| Total Release (Excluding Tritium and Dissolved Gases) (Ci) | 5.22 E-2 | 4.11 E-2 | 6.06 E-2 | 1.54 E-1 |
| Average Concentration (uCi/ml) | 1.72 E-8 | 7.98 E-9 | 1.23 E-8 | |
| <u>Tritium</u> | | | | |
| Total Release (Ci) | 2.54 E+0 | 1.78 E+1 | 6.81 E+0 | 2.72 E+1 |
| Average Concentration (uCi/ml) | 8.38 E-7 | 3.46 E-6 | 1.38 E-6 | |
| <u>Dissolved Noble Gases</u> | | | | |
| Total Release (Ci) | - | - | - | - |
| Average Concentration (uCi/ml) | - | - | - | - |
| <u>Gross Alpha Activity</u> | | | | |
| Total Release (Ci) | $\leq 3.18 \text{ E-6}$ | $\leq 8.74 \text{ E-7}$ | $\leq 6.56 \text{ E-7}$ | $\leq 4.71 \text{ E-6}$ |
| Average Concentration (uCi/ml) | $\leq 1.05 \text{ E-12}$ | $\leq 1.70 \text{ E-13}$ | $\leq 1.33 \text{ E-13}$ | |
| <u>Volume of Waste Released</u> | | | | |
| (Liters) | 5.30 E+5 | 4.37 E+5 | 1.64 E+5 | 1.13 E+6 |
| <u>Volume of Dilution Water</u> | | | | |
| (Liters) | 3.03 E+9 | 5.15 E+9 | 4.92 E+9 | 1.31 E+10 |

TABLE 3.2B (con't)
Semiannual Radioactive Effluent Report 1991
Liquid Effluents - Batch Releases

| <u>Isotopes Released</u> | <u>April</u> | <u>May</u> | <u>June</u> | <u>Total</u> |
|--------------------------|--------------|------------|-------------|--------------|
| (Curies) | | | | |
| Sr-89 | 2.12 E-6 | - | - | 2.12 E-6 |
| Sr-90 | - | - | - | - |
| Fe-55 | 2.83 E-3 | 6.90 E-3 | 2.03 E-2 | 3.00 E-2 |
| Fe-59 | 1.28 E-3 | 4.79 E-4 | 1.34 E-3 | 3.10 E-3 |
| Co-57 | 2.68 E-5 | 4.19 E-5 | 7.15 E-5 | 1.40 E-4 |
| Co-58 | 2.57 E-2 | 2.19 E-2 | 1.93 E-2 | 6.69 E-2 |
| Co-60 | 9.40 E-3 | 4.49 E-3 | 8.12 E-3 | 2.20 E-2 |
| Mn-54 | 6.84 E-4 | 4.43 E-4 | 5.81 E-4 | 1.71 E-3 |
| Cs-134 | - | 1.24 E-4 | - | 1.24 E-4 |
| Cs-137 | - | 1.60 E-4 | - | 1.60 E-4 |
| Ag-110m | 1.93 E-3 | 5.08 E-4 | 5.33 E-3 | 7.77 E-3 |
| Sb-124 | 3.11 E-4 | 9.56 E-4 | 1.06 E-4 | 1.37 E-3 |
| Sb-125 | 2.72 E-4 | 9.49 E-4 | 4.27 E-4 | 1.65 E-3 |
| Nb-95 | 1.72 E-3 | 9.24 E-4 | 1.25 E-3 | 3.89 E-3 |
| Cr-51 | 6.33 E-3 | 2.25 E-3 | 2.38 E-3 | 1.10 E-2 |
| Na-24 | - | 2.38 E-5 | - | 2.38 E-5 |
| Sn-113 | 4.93 E-4 | 4.74 E-4 | 6.14 E-4 | 1.58 E-3 |
| Zr-95 | 1.18 E-3 | 4.98 E-4 | 7.26 E-4 | 2.40 E-3 |
| Zr-97 | - | - | 5.02 E-5 | 5.02 E-5 |
| Sn-117m | 3.89 E-5 | - | - | 3.89 E-5 |

TABLE 3.3B
Semiannual Radioactive Effluent Report 1991
Liquid Effluents - Continuous Releases

| <u>Liquid Releases</u> | <u>April</u> | <u>May</u> | <u>June</u> | <u>Total</u> |
|------------------------------------------------------------|--------------|------------|-------------|--------------|
| <u>Gross Radioactivity</u> | | | | |
| Total Release (Excluding Tritium and Dissolved Gases) (Ci) | 1.63 E-5 | 2.26 E-3 | 3.99 E-3 | 6.27 E-3 |
| Average Concentration (uCi/ml) | 4.98 E-13 | 4.72 E-11 | 6.11 E-11 | |
| <u>Tritium</u> | | | | |
| Total Release (Ci) | - | - | 8.72 E-2 | 8.72 E-2 |
| <u>Gross Alpha Activity</u> | | | | |
| Total Release (Ci) | <2.33 E-6 | <3.94 E-5 | <1.02 E-5 | <5.19 E-5 |
| <u>Volume of Continuous Release</u> | | | | |
| (Liters) | 2.34 E+6 | 1.38 E+7 | 1.03 E+7 | 2.64 E+7 |
| <u>Volume of Dilution Flow</u> | | | | |
| (Liters) | 3.27 E+10 | 4.79 E+10 | 6.53 E+10 | 1.46 E+11 |
| <u>Isotopes Released</u> | | | | |
| (Curies) | | | | |
| Sr-89 | 1.63 E-5 | 1.49 E-3 | - | 1.51 E-3 |
| Sr-90 | - | - | 2.37 E-5 | 2.37 E-5 |
| Fe-55 | - | 3.24 E-4 | 3.97 E-3 | 4.29 E-3 |
| Co-58 | - | 1.66 E-5 | - | 1.66 E-5 |
| Co-60 | - | 3.12 E-4 | - | 3.12 E-4 |
| Sb-125 | - | 7.09 E-5 | - | 7.09 E-5 |
| Na-24 | - | 5.00 E-5 | - | 5.00 E-5 |

NOTE: May's volume of liquid waste released includes the gallonage from the condenser hotwell discharges released after the refueling outage.