MONTICELLO NUCLEAR GENERATING PLANT
NORTHERN STATES POWER COMPANY

Period: Jul - Dec 1981
License No. DPR-22

# EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT

## Supplemental Information

1. Regulatory Limits - Qtrly Levels Requiring Report to NRC

   A. Noble Gases:

   $50*(QTV*NBARV+QTS*NBARS) = 1$ AND
   $25*(QTV*MBARV+QTS*MBARS) = 1$

   QTV = Noble Gas Release Rate from Bldg Vents (Ci/sec)
   QTS = Noble Gas Release Rate from Plant Stack (Ci/sec)
   NBARV = Vent Avg Gamma Air Dose Factor (Rad/yr per Ci/sec)
   NBARS = Stack Avg Gamma Air Dose Factor (Rad/yr per Ci/sec)
   MBARV = Vent Avg Beta Air Dose Factor (Rad/yr per Ci/sec)
   MBARS = Stack Avg Beta Air Dose Factor (Rad/yr per Ci/sec)

   B. Iodines and Particulates:

   $50*(3.7E05*QV+2.5E04*QS) = 1$

   QV = Building Vent Release Rate of Iodines and Particulates with Half-Lives Greater than 8 Days (Ci/sec)

   QS = Plant Stack Release Rate of Iodines and Particulates with Half-Lives Greater than 8 Days (Ci/sec)

   C. Liquid Effluents:

   Concentration - 10CFR20, App B, Table II, Col 2, and notes thereto

   Total Quantity - 2.5 Ci/Quarter

2. Average Dose Factors for Noble Gases (Rem/yr per Ci/sec and Rad/yr per Ci/sec:

| | Vent Releases | | Stack Releases | |
|---|---|---|---|---|
| | 1ST Qtr | 2ND Qtr | 1ST Qtr | 2ND Qtr |
| KBAR (Boby Gamma) | 6.03E 00 | 1.47E 00 | 1.40E 00 | 1.30E 00 |
| LBAR (Skin Beta) | 4.74E 01 | 1.23E 01 | 1.55E 00 | 1.45E 00 |
| MBAR (Air Beta) | 5.01E 01 | 1.60E 01 | 1.66E 00 | 1.55E 00 |
| NBAR (Air Gamma) | 6.37E 00 | 1.62E 00 | 1.45E 00 | 1.36E 00 |

3. Average Energy:

(Not Applicable)

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## Supplemental Information (continued)

4. Measurements and Approximations of Total Radioactivity:

A. Noble Gases:
Continuous gross activity monitors in Reactor Building Vent and plant stack exhaust streams. Weekly isotopic analysis of steam jet air ejector stream. Monthly analysis of storage tank contents.

B. Iodines in Gaseous Effluent:
Continuous monitoring with charcoal cartridges in Reactor Building vent and plant stack exhaust streams with weekly analysis.

C. Particulates in Gaseous Effluent:
Continuous monitoring with particulate filters in Reactor Building vent and plant stack exhaust streams with weekly analysis.

D. Tritium in Gaseous Effluent:
Continuous monitoring with silica gel cartridges in Reactor Building vent and plant stack exhaust streams with biweekly analysis.

E. Liquid Effluents:
Tank sample analyzed prior to each planned release and continuous monitoring of gross activity during planned release.

5. Batch Releases:

A. Liquid:

| | | |
|---|---|---|
| 1. Number of Batch Releases | 1 | |
| 2. Total Time Period For Batch Releases | 3.50E 01 | Min |
| 3. Maximum Time Period for a Batch Release | 3.50E 01 | Min |
| 4. Average Time Period for a Batch Release | 3.50E 01 | Min |
| 5. Minimum Time Period for a Batch Release | 3.50E 01 | Min |
| 6. Average River Flow During Releases | 3.95E 03 | Cf/sec |

B. Gaseous:

| | | |
|---|---|---|
| 1. Number of Batch Releases | 0 | |
| 2. Total Time Period for Batch Releases | NA | Min |
| 3. Maximum Time Period for a Batch Release | NA | Min |
| 4. Average Time Period for a Batch Release | NA | Min |
| 5. Minimum Time Period for a Batch Release | NA | Min |

6. Abnormal Releases:

A. Liquid:

| | | |
|---|---|---|
| 1. Number of Releases | 1 | |
| 2. Total Activity Released | 4.17E-03 | Ci |

B. Gaseous:

| | | |
|---|---|---|
| 1. Number of Releases | 0 | |
| 2. Total Activity Released | 0.0 | Ci |

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## Table 1A Gaseous Effluents - Summation of all Releases

| | Units | 1st Qtr | 2nd Qtr | Pcnt Est Error |
|---|---|---|---|---|
| A. Noble Gases: | | | | |
| 1. Total Release: | | | | |
| A. Elevated Release | Ci | 6.90E 02 | 3.50E 02 | |
| B. Building Vent Release | Ci | 4.24E 02 | 6.08E 02 | |
| C. Total | Ci | 1.11E 03 | 9.58E 02 | 5.00E 01 |
| 2. Average Release Rate: | | | | |
| A. Elevated Release | uCi/sec | 8.69E 01 | 4.41E 01 | |
| B. Building Vent Release | uCi/sec | 5.34E 01 | 7.65E 01 | |
| C. Total | uCi/sec | 1.40E 02 | 1.21E 02 | 5.00E 01 |
| 3. Percent Tech Spec Qtrly Reporting Level | | 7.04E 00 | 3.22E 00 | |
| B. Iodines: | | | | |
| 1. Total I-131: | | | | |
| A. Elevated Release | Ci | 2.34E-03 | 1.18E-03 | |
| B. Building Vent Release | Ci | 1.27E-03 | 1.17E-03 | |
| C. Total | Ci | 3.61E-03 | 2.36E-03 | 5.00E 01 |
| 2. Average I-131 Release Rate: | | | | |
| A. Elevated Release | uCi/sec | 2.94E-04 | 1.49E-04 | |
| B. Building Vent Release | uCi/sec | 1.60E-04 | 1.48E-04 | |
| C. Total | uCi/sec | 4.54E-04 | 2.97E-04 | 5.00E 01 |
| C. Long Lived Particulates and Gross Alpha Releases: | | | | |
| 1. Total Particulates: | | | | |
| A. Elevated Release | Ci | 2.37E-03 | 1.16E-03 | |
| B. Building Vent Release | Ci | 2.12E-03 | 2.97E-03 | |
| C. Total | Ci | 4.49E-03 | 4.13E-03 | 5.00E 01 |
| 2. Average Release Rate: | | | | |
| A. Elevated Release | uCi/sec | 2.98E-04 | 1.46E-04 | |
| B. Building Vent Release | uCi/sec | 2.67E-04 | 3.73E-04 | |
| C. Total | uCi/sec | 5.65E-04 | 5.20E-04 | 5.00E 01 |
| 3. Percent Tech Spec Qtrly Reporting Level for Long-Lived Iodines and Particulates | | 8.63E-01 | 1.00E 00 | |

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Table 1A Gaseous Effluents - Summation of All Releases (Continued)

| | Units | 1st Qtr | 2nd Qtr | Pcnt Est Error |
|---|---|---|---|---|
| 4. Gross Alpha Radioactivity: | | | | |
| A. Elevated Release | Ci | 2.29E-04 | 2.49E-06 | |
| B. Building Vent Release | Ci | 1.98E-04 | 1.52E-04 | |
| C. Total | Ci | 4.27E-04 | 1.54E-04 | 1.00E 02 |
| D. Tritium: | | | | |
| 1. Total Release: | | | | |
| A. Elevated Release | Ci | 4.93E-01 | 2.72E-01 | |
| B. Building Vent Release | Ci | 4.31E 00 | 4.91E 01 | |
| C. Total | CI | 4.80E 00 | 4.94E 01 | 5.00E 01 |
| 2. Average Release Rate: | | | | |
| A. Elevated Release | uCi/sec | 6.20E-02 | 3.42E-02 | |
| B. Building Vent Release | uCi/sec | 5.42E-01 | 6.18E 00 | |
| C. Total | uCi/sec | 6.04E-01 | 6.21E 00 | 5.00E 01 |

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EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT

Table 1B Gaseous Effluents - Elevated Release

| Nuclides Released | Units | Continuous Mode 1st Qtr | Continuous Mode 2nd Qtr | Batch Mode 1st Qtr | Batch Mode 2nd Qtr |
|---|---|---|---|---|---|
| 1. Noble Gases: | | | | | |
| Xe133 | Ci | 9.94E 01 | 6.35E 01 | 0.0 | 0.0 |
| Xe135 | Ci | 7.78E 00 | 3.63E 00 | 0.0 | 0.0 |
| Kr85M | Ci | 1.48E 00 | 6.75E-01 | 0.0 | 0.0 |
| Kr88 | Ci | 4.57E 00 | 2.09E 00 | 0.0 | 0.0 |
| Kr87 | Ci | 8.67E 00 | 4.01E 00 | 0.0 | 0.0 |
| Xe138 | Ci | 1.62E 02 | 7.70E 01 | 0.0 | 0.0 |
| Kr90 | Ci | 5.29E 00 | 2.47E 00 | 0.0 | 0.0 |
| Xe139 | Ci | 1.57E 01 | 7.35E 00 | 0.0 | 0.0 |
| Kr89 | Ci | 1.55E 02 | 7.26E 01 | 0.0 | 0.0 |
| Xe137 | Ci | 2.03E 02 | 9.46E 01 | 0.0 | 0.0 |
| Xe135M | Ci | 1.18E 01 | 5.50E 00 | 0.0 | 0.0 |
| Kr83M | Ci | 1.57E 00 | 7.24E-01 | 0.0 | 0.0 |
| Xe133M | Ci | 2.88E-01 | 2.85E-01 | 0.0 | 0.0 |
| Xe131M | Ci | 6.25E-01 | 4.41E-01 | 0.0 | 0.0 |
| Kr85 | Ci | 1.31E 01 | 1.53E 01 | 0.0 | 0.0 |
| Total for Period | Ci | 6.90E 02 | 3.50E 02 | 0.0 | 0.0 |
| 2. Iodines: | | | | | |
| I-131 | Ci | 2.34E-03 | 1.18E-03 | 0.0 | 0.0 |
| I-133 | Ci | 1.17E-02 | 4.24E-03 | 0.0 | 0.0 |
| I-135 | Ci | 8.51E-03 | 1.77E-03 | 0.0 | 0.0 |
| Total | Ci | 2.26E-02 | 7.19E-03 | 0.0 | 0.0 |

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Table 1B Gaseous Effluents - Elevated Release (Continued)

| Nuclides Released | Units | Continuous Mode 1st Qtr | Continuous Mode 2nd Qtr | Batch Mode 1st Qtr | Batch Mode 2nd Qtr |
|---|---|---|---|---|---|
| 3. Particulates: | | | | | |
| Ce144 | Ci | 0.0 | 1.38E-06 | 0.0 | 0.0 |
| Ce141 | Ci | 2.14E-06 | 1.95E-06 | 0.0 | 0.0 |
| Ba140 | Ci | 1.63E-03 | 5.46E-04 | 0.0 | 0.0 |
| Cs137 | Ci | 1.39E-05 | 6.67E-06 | 0.0 | 0.0 |
| Cs134 | Ci | 0.0 | 8.81E-08 | 0.0 | 0.0 |
| Ru103 | Ci | 0.0 | 3.63E-08 | 0.0 | 0.0 |
| Nb95 | Ci | 0.0 | 5.18E-08 | 0.0 | 0.0 |
| Sr90 | Ci | 8.14E-06 | 1.01E-04 | 0.0 | 0.0 |
| Sr89 | Ci | 7.08E-04 | 5.00E-04 | 0.0 | 0.0 |
| Zn65 | Ci | 0.0 | 2.79E-06 | 0.0 | 0.0 |
| Co60 | Ci | 1.51E-06 | 3.53E-06 | 0.0 | 0.0 |
| Mn54 | Ci | 3.34E-07 | 7.38E-07 | 0.0 | 0.0 |
| Total | Ci | 2.37E-03 | 1.16E-03 | 0.0 | 0.0 |

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Table 1C Gaseous Effluents - Building Vent Release

| Nuclides Released | Units | Continuous Mode 1st Qtr | Continuous Mode 2nd Qtr | Batch Mode 1st Qtr | Batch Mode 2nd Qtr |
|---|---|---|---|---|---|
| 1. Noble Gases: | | | | | |
| Xe133 | Ci | 5.19E-01 | 2.91E 02 | 0.0 | 0.0 |
| Xe135 | Ci | 5.87E 00 | 1.60E 00 | 0.0 | 0.0 |
| Kr85M | Ci | 1.12E 00 | 2.97E-01 | 0.0 | 0.0 |
| Kr88 | Ci | 3.44E 00 | 9.17E-01 | 0.0 | 0.0 |
| Kr87 | Ci | 6.53E 00 | 1.76E 00 | 0.0 | 0.0 |
| Xe138 | Ci | 1.22E 02 | 3.43E 01 | 0.0 | 0.0 |
| Kr90 | Ci | 3.99E 00 | 1.09E 00 | 0.0 | 0.0 |
| Xe139 | Ci | 1.19E-02 | 3.25E-03 | 0.0 | 0.0 |
| Kr89 | Ci | 1.17E 02 | 3.20E 01 | 0.0 | 0.0 |
| Xe137 | Ci | 1.53E 02 | 4.18E 01 | 0.0 | 0.0 |
| Xe135M | Ci | 8.93E 00 | 2.43E 00 | 0.0 | 0.0 |
| Kr83M | Ci | 1.18E 00 | 3.18E-01 | 0.0 | 0.0 |
| Xe133M | Ci | 2.18E-02 | 1.14E 00 | 0.0 | 0.0 |
| Xe131M | Ci | 9.77E-04 | 2.49E 00 | 0.0 | 0.0 |
| Kr85 | Ci | 7.63E-03 | 1.97E 02 | 0.0 | 0.0 |
| Total for Period | Ci | 4.24E 02 | 6.08E 02 | 0.0 | 0.0 |
| 2. Iodines: | | | | | |
| I-131 | Ci | 1.27E-03 | 1.17E-03 | 0.0 | 0.0 |
| I-133 | Ci | 1.01E-02 | 3.42E-03 | 0.0 | 0.0 |
| I-135 | Ci | 4.59E-03 | 3.62E-03 | 0.0 | 0.0 |
| Total | Ci | 1.60E-02 | 8.22E-03 | 0.0 | 0.0 |

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Table 1C Gaseous Effluents - Building Vent Releases (Continued)

| Nuclides Released | Units | Continuous Mode 1st Qtr | Continuous Mode 2nd Qtr | Batch Mode 1st Qtr | Batch Mode 2nd Qtr |
|---|---|---|---|---|---|
| 3. Particulates: | | | | | |
| Ce144 | Ci | 0.0 | 8.93E-06 | 0.0 | 0.0 |
| Ce141 | Ci | 0.0 | 4.84E-05 | 0.0 | 0.0 |
| Ba140 | Ci | 1.13E-03 | 4.92E-04 | 0.0 | 0.0 |
| Cs137 | Ci | 1.59E-04 | 2.18E-04 | 0.0 | 0.0 |
| Cs136 | Ci | 0.0 | 1.51E-06 | 0.0 | 0.0 |
| Cs134 | Ci | 1.67E-05 | 2.00E-05 | 0.0 | 0.0 |
| Ru103 | Ci | 0.0 | 3.09E-05 | 0.0 | 0.0 |
| Zr95 | Ci | 0.0 | 1.45E-05 | 0.0 | 0.0 |
| Nb95 | Ci | 0.0 | 3.22E-05 | 0.0 | 0.0 |
| Sr90 | Ci | 1.37E-05 | 3.27E-05 | 0.0 | 0.0 |
| Sr89 | Ci | 2.01E-04 | 9.74E-05 | 0.0 | 0.0 |
| Zn65 | Ci | 2.30E-04 | 4.58E-04 | 0.0 | 0.0 |
| Co60 | Ci | 2.17E-04 | 1.14E-03 | 0.0 | 0.0 |
| Fe59 | Ci | 9.51E-07 | 4.58E-05 | 0.0 | 0.0 |
| Co58 | Ci | 0.0 | 2.19E-05 | 0.0 | 0.0 |
| Mn54 | Ci | 2.40E-05 | 1.47E-04 | 0.0 | 0.0 |
| Cr51 | Ci | 1.24E-04 | 1.60E-04 | 0.0 | 0.0 |
| Total | Ci | 2.12E-03 | 2.97E-03 | 0.0 | 0.0 |

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Table 2A Liquid Effluents - Summation of All Releases

| | Units | 1st Qtr | 2nd Qtr | Pcnt Est Error |
|---|---|---|---|---|
| A. Fission and Activation Products: | | | | |
| 1. Total Release (Except H-3, Gases, and Alpha) | Ci | 3.11E-06 | 0.0 | 5.00E 01 |
| 2. Avg Diluted Concentration | uCi/ml | 8.21E-06 | 0.0 | |
| 3. Percent Qtrly Tech Spec Reporting Level | | 1.24E-04 | 0.0 | |
| B. Tritium: | | | | |
| 1. Total Release | Ci | 4.17E-03 | 0.0 | 2.50E 01 |
| 2. Avg Diluted Concentration | uCi/ml | 1.10E-02 | 0.0 | |
| 3. Percent Qtrly Tech Spec Reporting Level | | NA | NA | |
| C. Dissolved and Entrained Gases: | | | | |
| 1. Total Release | Ci | 0.0 | 0.0 | 0.0 |
| 2. Avg Diluted Concentration | uCi/ml | 0.0 | 0.0 | |
| 3. Percent Qtrly Tech Spec Reporting Level | | NA | NA | |
| D. Gross Alpha Radioactivity: | | | | |
| 1. Total Release | Ci | 0.0 | 0.0 | 0.0 |
| E. Volume of Waste Released | Liters | 3.79E 02 | 0.0 | 2.50E 01 |
| F. Volume of Dilution Water Used | Liters | 0.0 | 0.0 | 0.0 |

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Table 2B Liquid Effluents

| Nuclides Released | Units | Continuous Mode 1st Qtr | Continuous Mode 2nd Qtr | Batch Mode 1st Qtr | Batch Mode 2nd Qtr |
|---|---|---|---|---|---|
| I-131 | Ci | 0.0 | 0.0 | 2.48E-07 | 0.0 |
| I-133 | Ci | 0.0 | 0.0 | 1.03E-06 | 0.0 |
| Cs137 | Ci | 0.0 | 0.0 | 1.99E-07 | 0.0 |
| Co60 | Ci | 0.0 | 0.0 | 1.63E-06 | 0.0 |

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## Table 3 Solid Waste and Irradiated Fuel Shipments

A. Solid Waste Shipped Offsite For Burial or Disposal:

1. Type of Waste:

| | Units | Total | Pcnt Est Error |
|---|---|---|---|
| A. Spent Resins, Filter Sludges, Evaporator Bottoms, Ect. | Cu Meter | 5.24E 01 | |
| | Ci | 1.65E 02 | 5.00E 01 |
| B. Dry Compressible Waste, Contaminated Equip, Ect. | Cu Meter | 3.01E 02 | |
| | Ci | 8.68E 00 | 5.00E 01 |
| C. Irradiated Components, Control Rods, Ect. | Cu Meter | 0.0 | |
| | Ci | 0.0 | 0.0 |

D. Other (described below):

None

2. Estimate of Major Nuclide Composition by Type of Waste:

| TYPE | Nuclide | Percent |
|---|---|---|
| A | Ba140 | 4.45E 00 |
| | Cs137 | 4.20E 01 |
| | Cs134 | 5.05E 00 |
| | Zn65 | 1.51E 01 |
| | Co60 | 1.84E 01 |
| | Mn54 | 2.04E 00 |
| | Cr51 | 2.14E 00 |
| | La140 | 4.49E 00 |
| | I 131 | 4.44E 00 |
| B | Ce141 | 1.54E 00 |
| | Ba140 | 3.17E-01 |
| | Cs137 | 2.37E 01 |
| | Cs134 | 2.28E 00 |
| | Ru103 | 1.45E-02 |
| | Sr90 | 1.42E-01 |
| | Zn65 | 1.27E 01 |
| | Co60 | 5.06E 01 |
| | Mn54 | 7.89E-01 |
| | Cr51 | 2.83E 00 |
| | La140 | 2.89E-01 |
| | I 131 | 1.06E 00 |

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Table 3 Solid Waste and Irradiated Fuel Shipments (Continued)

3. Solid Waste Disposition:

| Number of Shipments | Mode | Destination |
|---|---|---|
| 10 | Truck | Chem-Nuc Inc., Barnwell, SC |
| 14 | Truck | US Ecology, Richland, WA |

B. Irradiated Fuel Shipments:

| Number of Shipments | Mode | Destination |
|---|---|---|
| None | | |

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Notes:

1. Release of individual noble gas isotopes from the plant stack was determined using an isotopic analysis at the steam jet air ejector. Xe133, Xe135, Kr85M, Kr88, Kr87, AND Xe138 were measured and used to characterize the mode of gas release from the fuel. Other significant noble gases were determined using known ratios, the measured total offgas holdup system delay time, and the known fraction of the offgas stream released via the gland exhauster.

2. An isotopic analysis for noble gases is normally not possible at the building vents. Individual isotopes are generally below their lower limit of detection (LLD). Therefore, for reactor building vent releases, the noble gas isotopic mixture is assumed to be the same as the mixture determined at the steam jet air ejector.

3. Information specified in Regulatory Guide 1.21 which is not applicable to the Monticello plant is indicated by 'NA'.

4. Nuclides not detected in plant effluents (those below the LLD of the analysis) are not included in the quantities reported released. LLD values are recorded and must be less than the minimum LLD values stated in the Monticello Technical Specifications.