WNP-2 SEMI-ANNUAL EFFLUENT

REPORT

JANUARY TO JUNE 1986

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

LICENSE NO. NPF-21

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1.0 INTRODUCTION

This report is submitted in compliance with Technical Specification 6.9.1.11. It includes a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from WNP-2 during the previous six months of operation with data summarized on a quarterly basis.

2.0 LIQUID EFFLUENTS

The radwaste liquid effluents were released in a batch mode only during the reporting period. Ten batch releases occurred during the first calendar quarter and 24 batch releases during the second calendar quarter. The total time period for the batch releases was 47.8 hours, with the maximum time period being 1.99 hours for a release, the minimum time period being 0.82 hours for a release and the average time period was 1.4 hours. The volume of dilution water used, is the total volume of recirculating cooling tower blowdown flow for the period. The average flow rate of the Columbia River during January through June 1986 was 1.2E+05 cubic feet per second.

Periodic LADTAP II computer runs were performed to verify compliance with Technical Specification limits. The calculated dose to the maximum individual due to liquid releases for the first quarter was 7.5E-04 mrem whole body and 1.1E-03 mrem for the maximum organ. The second quarter calculated dose was 2.2E-02 mrem whole body and 4.3E-02 mrem for the maximum organ.

The liquid batch releases were recirculated prior to sampling. A representative sample was obtained and analyzed for each batch release. A composite of tank samples for each quarter was analyzed for strontium and irons; however, the second quarter composite analysis was short eight samples for the month of May. The loss of samples and corrective action was incorporated in Non Conformance Report #286-0334. The method for measurement of total radioactivity was by gamma spectroscopy, liquid scintillation and proportional counters.

The percent of MPC limit is based on the total MPC fractions using those nuclides in Table 2-2 and concentrations listed in 10CFR20, Appendix B, Table 2, Column 2.

The percent of estimated total errors are listed in Table 2-1. These estimated errors are based on counting statistics, tank volume, and in obtaining a representative sample prior to discharge.

The estimated total errors were calculated by obtaining the square root of the sum of the squares of the errors of the individual contributors and multiplying by 1.96 for a 95% confidence level.

Table 2-1

WNP-2 LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

January - June 1986

	Unit	1st Quarter	2nd Quarter	Est. Total Error* %
A. Fission and activation products				
1. Total release (not including tritium, gases, alpha)	Ci	5.5E-04	1.8E-02	2.2 E+01
2. Average diluted concentration during period	uCi/ml	2.4E-08	8.5E-08	
3. Percent of MPC limit	%	2.2E-01	5.4E-02	
B. Tritium				
1. Total release	Ci	3.5E-01	2.2E+00	2.2 E+01
2. Average diluted concentration during period	uCi/ml	1.5E-05	1.0E-05	
3. Percent of MPC limit	%	5.2E-01	3.5E-01	
C. Dissolved and entrained gases				
1. Total release	Ci	<6.0E-05	<9.5E-05	2.2 E+01
2. Average diluted concentration during period	uCi/ml	<2.7E-09	<4.5E-10	
3. Percent of MPC limit	%	1.3E-03	2.2E-04	
D. Gross alpha radioactivity				
1. Total release	Ci	<8.6E-07	<2.5E-06	2.3 E+01
E. Volume of waste (prior to dilution)	liters	5.9E+05	1.4E+06	1.5 E+01
F. Volume of dilution water used during period	liters	2.2E+07	2.1E+08	1.5 E+01

*At 95% confidence level

Table 2-2

WNP-2 LIQUID EFFLUENTS - SOURCE TERMS

January - June 1986 BATCH MODE

Nuclides Released	Unit	1st Quarter	2nd Quarter
Strontium-89	Ci	< 1.2 E-05	8.5 E-06
Strontium-90	Ci	< 1.6 E-05	< 1.5 E-05
Cesium-134	Ci	< 1.5 E-05	< 1.8 E-04
Cesium-137	Ci	< 1.4 E-05	< 1.6 E-04
Iodine-131	Ci	< 1.4 E-05	< 1.3 E-04
Cobalt-58	Ci	6.9 E-05	2.0 E-03
Cobalt-60	Ci	4.8 E-05	1.9 E-03
Iron-59	Ci	< 2.3 E-05	2.9 E-05
Zinc-65	Ci	1.7 E-04	1.2 E-02
Manganese-54	Ci	1.9 E-05	5.3 E-04
Chromium-51	Ci	2.1 E-04	1.3 E-03
Niobium-95	Ci	< 1.2 E-05	4.5 E-05
Molybdenum-99	Ci	< 1.0 E-05	6.2 E-05
Technetium-99m	Ci	< 1.3 E-05	7.7 E-05
Barium-lanthanum-140	Ci	< 4.2 E-05	< 4.5 E-04
Cerium-141	Ci	< 1.9 E-05	< 1.6 E-04

TABLE 2-2 (Continued)

Others			
Cerium-144	Ci	< 8.7 E-05	< 7.1 E-04
Iron-55	Ci	2.0 E-05	< 2.3 E-04
Sodium-24	Ci	< 9.3 E-06	2.6 E-05
Copper-64	Ci	< 1.7 E-03	< 1.8 E-03
Arsenic-76	Ci	< 2.3 E-05	< 3.5 E-05
Silver-110m	Ci	< 1.1 E-05	< 1.7 E-05
Zirconium-95	Ci	< 1.9 E-05	3.9 E-05
Total for Period (Above)	Ci	5.5 E-04	1.8 E-02
Xenon-133	Ci	< 4.7 E-05	< 7.5 E-05
Xenon-135	Ci	< 1.3 E-05	< 2.0 E-05
Tritium	Ci	3.5 E-01	2.2 E+00

NOTE: Less than (<) values are not included in the Total For Period values.

3.0 GASEOUS EFFLUENTS

The gaseous radwaste effluents from WNP-2 were released in a continuous mode. There are three (3) release points at WNP-2:

1. Main Plant Vent - mixed mode release
2. Turbine Building - ground level release
3. Radwaste Building - ground level release

The gaseous source terms from each release point are listed in Tables 3-1 to 3-3. Table 3-4 provides a summation of the total activity released, the average release rate, the percent of Technical Specification limit, gross alpha radioactivity and the estimated total error associated with the measurements of radioactivity in the gaseous effluents.

Radioactivity measurements for gaseous effluent releases are performed for fission and activation gases by collecting the samples on charcoal traps and analyzing them using gamma spectroscopy. Tritium is sampled by freeze trapping and analyzed by liquid scintillation counting. Particulates and iodines are sampled using charcoal cartridges and particulate filters and analyzed using gamma spectroscopy.

The "Percent of Technical Specification Limit" calculations were based on exposure at specified locations. Air dose due to noble gases was determined at the site boundary with the quarterly limit of 5 mrads for gamma being the more restrictive for each time period. The gamma air dose from noble gases for the first quarter was 5.7E-02 mrads and 3.7E-03 mrad for the second quarter. Iodines, particulates and tritium calculations were determined at Taylor Flats, located 4.2 miles southeast. A limit of 7.5 mrems per quarter to any organ was used in these calculations. The maximum organ dose to a "Member of the Public" was 3.5E-03 mrem for the first quarter and 3.9E-03 mrem for the second quarter.

To verify compliance with Technical Specification limits, calculations were performed for each month's releases using the GASPAR computer program and parameters as outlined in the ODCM. Doses were determined at two special locations.

1. The Site Boundary at 1.2 miles from the plant and for the sector with the maximum X/Q value.

2. Taylor Flats - at 4.2 miles SE.

There were no abnormal releases of gaseous effluent during the first and second quarters of 1986. Sampling and monitoring of the gaseous effluents were performed in accordance with Technical Specifications and Plant Procedures.

Total error estimates are based on grab samples, gamma spectrometry, analyzer detectors, and beta scintillation readings. The overriding uncertainty in all cases is the measurement of the effluent and sample volumes. The estimated error was determined to be 36% at the 95% confidence level.

In addition to the reactor site, WNP-2 has a permanent laundry facility located approximately 0.75 miles from the site. Its ventilation system contains HEPA filters on the discharge and is continuously monitored for particulates and radioiodines. Also at this location is a backup chemistry lab within the EOF. The radiochemical hood containing HEPA filters is monitored for radioactive releases when in operation. Gamma spectrometry indicated no isotopes present other than those attributable to natural background.

Table 3-1

WNP-2 GASEOUS EFFLUENTS
SOURCE TERMS - MIXED MODE RELEASES
MAIN PLANT VENT

January - June 1986

CONTINUOUS MODE

Nuclides Released	Unit	1st Quarter	2nd Quarter
1. Fission gases			
Krypton-85	Ci	1.4 E+01	< 1.5 E+01
Krypton-85m	Ci	1.1 E+00	< 3.0 E-02
Krypton-87	Ci	2.9 E-01	2.1 E-01
Krypton-88	Ci	5.4 E-01	2.9 E-01
Xenon-133	Ci	1.1 E+00	3.1 E-01
Xenon-135	Ci	1.2 E-01	1.1 E-01
Xenon-135m	Ci	< 1.9 E-01	1.7 E-02
Xenon-138	Ci	1.6 E+00	1.9 E+00
Xenon-133m	Ci	1.1 E+00	6.8 E-01
Total for period	Ci	2.0 E+01	3.5 E+00
2. Iodines			
Iodine-131	Ci	3.8 E-04	2.3 E-04
Iodine-133	Ci	2.7 E-03	1.6 E-04
Iodine-135	Ci	< 5.0 E-03	< 5.0 E-03
Total for period	Ci	3.1 E-03	3.9 E-04

Table 3-1 (Continued)

3. Particulates

Strontium-89	Ci	8.2 E-06	5.1 E-07
Strontium-90	Ci	9.9 E-06	< 2.4 E-07
Cesium-134	Ci	< 1.3 E-04	< 2.2 E-04
Cesium-137	Ci	< 1.1 E-04	4.1 E-05
Barium-lanthanum-140	Ci	< 4.2 E-04	< 6.0 E-04
Molybdenum-99	Ci	1.9 E-03	2.6 E-04
Cerium-141	Ci	< 1.1 E-04	< 1.5 E-04
Cerium-144	Ci	< 4.4 E-04	6.4 E-05
Cobalt-58	Ci	1.7 E-03	7.3 E-04
Cobalt-60	Ci	5.4 E-04	1.2 E-03
Iron-59	Ci	< 2.0 E-04	2.1 E-04
Manganese-54	Ci	1.5 E-04	2.9 E-04
Zinc-65	Ci	3.8 E-03	3.4 E-03
Others			
Chromium-51	Ci	2.6 E-03	1.4 E-03
Zirconium-95	Ci	< 1.9 E-04	6.2 E-04
Total for period	Ci	1.1 E-02	8.2 E-03

4. Tritium	Ci	1.5 E-01	1.0 E-01

Total building release	Ci	2.0 E+01	3.6 E+00

NOTE: Less than (<) values are not included in the Total For Period values.

Table 3-2

WNP-2 GASEOUS EFFLUENTS
SOURCE TERMS GROUND LEVEL RELEASES
TURBINE BUILDING

January - June 1986

CONTINUOUS MODE

Nuclides Released	Unit	1st Quarter	2nd Quarter
1. Fission gases			
Krypton-85	Ci	< 8.9 E+01	< 3.1 E+01
Krypton-85m	Ci	< 1.7 E-01	< 6.1 E-02
Krypton-87	Ci	1.2 E+00	4.7 E-01
Krypton-88	Ci	1.7 E+00	6.0 E-01
Xenon-133	Ci	2.0 E+00	8.8 E-01
Xenon-135	Ci	4.5 E-01	1.6 E-01
Xenon-135m	Ci	1.3 E+00	< 1.5 E+00
Xenon-138	Ci	7.1 E+00	1.8 E+00
Xenon-133m	Ci	4.4 E+00	1.5 E+00
Total for period	Ci	1.8 E+01	5.4 E+00
2. Iodines			
Iodine-131	Ci	1.4 E-04	9.8 E-05
Iodine-133	Ci	1.1 E-03	1.1 E-04
Iodine-135	Ci	< 3.0 E-03	< 2.1 E-03
Total for period	Ci	1.2 E-03	2.1 E-04

Table 3-2 (Continued)

3. Particulates

Strontium-89	Ci	3.4 E-05	2.7 E-07
Strontium-90	Ci	2.6 E-05	1.4 E-06
Cesium-134	Ci	< 1.3 E-04	3.5 E-05
Cesium-137	Ci	< 1.2 E-04	3.7 E-05
Barium-lanthanum-140	Ci	4.7 E-04	< 5.5 E-04
Molybdenum-99	Ci	5.0 E-05	7.2 E-05
Cerium-141	Ci	< 1.3 E-04	< 1.8 E-04
Cerium-144	Ci	< 5.3 E-04	< 7.3 E-04
Cobalt-58	Ci	< 1.2 E-04	< 1.5 E-04
Cobalt-60	Ci	< 1.5 E-04	< 2.0 E-04
Iron-59	Ci	< 3.3 E-04	< 3.8 E-04
Manganese-54	Ci	< 1.2 E-04	< 1.7 E-04
Zinc-65	Ci	1.3 E-04	8.9 E-04
Others			
Chromium-51	Ci	< 1.0 E-03	< 1.3 E-03
Zirconium-95	Ci	< 2.4 E-04	1.6 E-04
Total for period	Ci	7.1 E-04	1.2 E-03

4. Tritium	Ci	1.2 E+00	2.9 E-01

Total building release	Ci	1.9 E+01	5.7 E+00

NOTE: Less than (<) values are not included in the Total For Period values.

Table 3-3

WNP-2 GASEOUS EFFLUENTS
SOURCE TERMS GROUND LEVEL RELEASES
RADWASTE BUILDING

January - June 1986

CONTINUOUS MODE

Nuclides Released	Unit	1st Quarter	2nd Quarter
1. Fission gases			
Krypton-85	Ci	< 2.6 E+01	< 5.2 E+00
Krypton-85m	Ci	< 5.0 E-02	< 1.0 E-02
Krypton-87	Ci	4.9 E-01	1.0 E-01
Krypton-88	Ci	5.7 E-01	1.6 E-01
Xenon-133	Ci	6.8 E-01	2.2 E-01
Xenon-135	Ci	9.6 E-01	4.8 E-02
Xenon-135m	Ci	2.4 E+00	< 3.8 E-01
Xenon-138	Ci	2.4 E+00	3.1 E-01
Xenon-133m	Ci	1.4 E+00	4.2 E-01
Total for period	Ci	8.9 E+00	1.3 E+00
2. Iodines			
Iodine-131	Ci	2.7 E-05	4.2 E-05
Iodine-133	Ci	8.1 E-05	2.0 E-05
Iodine-135	Ci	< 5.9 E-04	< 9.1 E-04
Total for period	Ci	1.1 E-04	6.2 E-05

Table 3-3 (Continued)

3. Particulates

Strontium-89	Ci	6.5 E-07	6.6 E-07
Strontium-90	Ci	2.8 E-06	1.7 E-07
Cesium-134	Ci	< 1.3 E-05	< 3.0 E-05
Cesium-137	Ci	< 1.1 E-05	< 2.5 E-05
Barium-Lanthanum-140	Ci	< 3.9 E-05	< 8.8 E-05
Molybdenum-99	Ci	< 1.1 E-05	< 2.2 E-05
Cerium-141	Ci	< 1.3 E-05	< 2.8 E-05
Cerium-144	Ci	< 4.7 E-05	< 1.2 E-04
Cobalt-58	Ci	< 1.2 E-05	< 2.7 E-05
Cobalt-60	Ci	< 1.6 E-05	< 3.4 E-05
Iron-59	Ci	< 4.0 E-05	< 6.7 E-05
Manganese-54	Ci	< 2.3 E-05	< 2.7 E-05
Zinc-65	Ci	< 2.7 E-05	< 7.0 E-05
Others			
Chronium-51	Ci	< 8.8 E-05	< 1.9 E-04
Zirconium-95	Ci	< 2.0 E-05	< 4.4 E-05
Total for period	Ci	3.5 E-06	8.3 E-07

4. Tritium	Ci	6.4 E-02	8.0 E-03

Total building release	Ci	9.0 E+00	1.3 E+00

NOTE: Less than (<) values are not included in the Total For Period values.

Table 3-4

WNP-2 GASEOUS EFFLUENTS
SUMMATION OF ALL RELEASES

January - June 1986

	Unit	1st Quarter	2nd Quarter	Est. Total Error %*
A. Fission & activation gases				
1. Total release	Ci	4.7 E+01	1.0 E+01	3.6 E+01
2. Average release rate for period	uCi/sec	6.0 E+00	1.3 E+00	
3. Percent of Tech. Spec. limit	%	1.1 E+00	7.4 E-02	
B. Iodines				
1. Total iodine (131, 133)	Ci	4.4 E-03	6.6 E-04	3.6 E+01
2. Average release rate for period	uCi/sec	5.7 E-04	8.4 E-05	
3. Percent of Tech. Spec. limit	%	4.7 E-02	5.2 E-02	
C. Particulates				
1. Particulates with half-lives 8 days	Ci	1.2 E-02	9.4 E-03	3.6 E+01
2. Average release rate for period	uCi/sec	1.5 E-03	1.2 E-03	
3. Percent of Tech. Spec. limit	%	4.7 E-02	5.2 E-02	
4. Gross alpha radioactivity	Ci	4.3 E-05	1.7 E-05	
D. Tritium				
1. Total releases	Ci	1.4 E+00	4.0 E-01	3.6 E+01
2. Average release rate for period	uCi/sec	1.8 E-01	5.1 E-02	
3. Percent of Tech. Spec. limit	%	4.7 E-02	5.2 E-02	

* At 95% confidence level

Table 3-5

WNP-2 GASEOUS EFFLUENTS
BATCH RELEASES

January - June 1986

Type	Number	Total Time (hrs)	Maximum Time (hrs)	Minimum Time (hrs)	Mean Time (hrs)
Purge	3	8.9	6.8	1.0	3.0
Vent	80	149.2	4.1	0.5	1.86

4.0 SOLID WASTE

A total volume of 5047 ft^3 (142.9 m^3) of solid waste was transported in 15 shipments during the January 1 through June 30, 1986 reporting period. The total activity of the waste shipped was 98.73 Ci; 97.89 Ci contained in dewatered spent resins, 0.3716 Ci in Dry Active Waste (DAW) and 0.4650 Ci in absorbed liquid.

A. Dewatered Spent Resin

Dewatered resins accounted for 2244 ft^3 (63.55 m^3) of the radioactive wastes shipped during the reporting period. The burial containers were CNS 14-195 steel liners provided by Chem-Nuclear Systems, Inc. or LSA-190 liners provided by NUPAC, Inc. The total activity of the resins shipped during the reporting period was 97.89 Ci. The principle nuclides and their percent contribution to the total activity are listed in Table 4-2. The solid wastes were shipped to the U.S. Ecology, Hanford burial site using flat bed trailers, NUPAC LSA-190 or NUPAC 14-210H casks as appropriate.

The counting error associated with the total activity has been found to be less than 1.0% at one standard deviation in previous effluent reports and to decrease with increasing activity. The statistical counting error is assumed to be 1% for the purpose of this error evaluation.

Other parameters considered in estimating the total error of the activity shipped included the error in measuring the absolute volume, the weight of the waste in the liners, the representativeness of the sample taken, the homogeneity of the nuclide distribution within a batch or liner and the geometry error in the gamma spectroscopy analysis. The gamma spectroscopy calibration error was approximately 5%. The best estimate of the total error in the activity of spent resin shipped was assumed to be less than or equal to 20%.

B. Dry Active Waste (DAW)

A total of 2700 ft^3 (76.46 m^3) of DAW was shipped in 30 Container Products Corporation, B-25 steel boxes. The total activity of the DAW shipped was 0.3716 Ci. The values for the activities shipped were determined by using dose rate-to-curie conversion factors. The conversion factors were based on a nuclide distribution taken from reactor coolant sample analyses which are representative for the time period in which the waste was generated. Short lived nuclides were eliminated based on decay of the DAW prior to shipment. A meaningful counting error cannot be generated for the DAW, however, the total error may be assumed to be less than or equal to 20% since DAW would be subjected to similar error contributions as the spent resins.

C. Absorbed Liquids

A total of 102.9 ft^3 (2.914 m^3) of absorbed aqueous liquid containing a total of 0.4650 Ci was shipped during the reporting period. The drums were of either a 17C, 17H or 17E/H designation to meet burial ground requirements but were shipped only as strong tight containers (STCs) per DOT LSA requirements.

The values for the activities shipped were based on using dose rate-to-curie conversion factors and sample analysis. As with the DAW, the total error is assumed to be less than or equal to 20% due to the likelihood of similar contributing errors to those associated with the resins.

4.1 Scaling Factor Methodology

H-3

In accordance with the procedure outlined in the AIF report "Methodologies for Classification of Low Level Radioactive Waste from Nuclear Power Plants" and the final EPRI report, "Radionuclide Correlations in Low-Level Radwaste", EPRI NP-4037 June 1985, the amount of H-3 in solid radwaste shipments was determined by estimating or measuring the amount of water present and multiplying by the average H-3 concentration in the coolant for the time period associated with the waste generation. In accordance with the final EPRI report a water percentage of 55% was used for powdered resin, 50% for bead resin and 25% (very conservative) was used for DAW.

C-14

The generic scaling factor (C-14 to Co-60, 1.0 E-4) from the EPRI report was used unless the result was less than 5.0E-8 uCi/g (typical MDA), in which case the MDA was used.

I-129

The I-129 concentration was determined by scaling to Cs-137. The Cs-137 MDA was used since Cs-137 was not detected, and the resulting value, if less than a typical I-129 MDA of 3.0E-8 uCi/cc was reported as less than the MDA value. The scaling factor taken from the EPRI report is 2.0E-5.

Tc-99

The Tc-99 concentration was determined by scaling to Cs-137. The Cs-137 MDA was used since Cs-137 was not detected, and the resulting value, if less than a typical Tc-99 MDA of 2.0E-8 uCi/cc was reported as less than the MDA value. The scaling factor taken from the final EPRI report is 3.0E-5.

TRU, Sr-90, Ni-63

TRU nuclides would be scaled to Ce-144. As recommended in the AIF report, these nuclides are not considered to be present if the scaled values are less than: 1 nCi/g for TRU, 35 nCi/g for Pu-241 or 200 nCi/g for Cm-242. TRU nuclides will be reported if the scaling nuclide (Ce-144) is reliably detected and Cs-137 is also present.

Sr-90 is scaled to Cs-137 and Ni-63 is scaled to Co-60. The following table contains the scaling factors, required LLD's and reporting thresholds.

TABLE 4-1

Scaling Factors for TRU, Sr-90 and Ni-63

Scaled Nuclide	Scaling Nuclide	Scaling Factor	Required LLD (uCi/cc)	Reporting Threshold (uCi/g)
Pu-238	Ce-144	8.0 E-3	1.0 E-5	Ce-144 detected
Pu-239	Ce-144	5.0 E-3	1.0 E-5	Ce-144 detected
Pu-241	Ce-144	5.5 E-1	3.5 E-4	Ce-144 detected
Am-241	Ce-144	3.0 E-3	1.0 E-5	Ce-144 detected
Cm-242	Ce-144	1.5 E-2	2.0 E-3	Ce-144 detected
Cm-244	Ce-144	3.5 E-3	1.0 E-5	Ce-144 detected
Ni-63	Co-60	2.0 E-2	3.5 E-2	Co-60 detected
Sr-90	Cs-137	6.3 E-3	4.0 E-4	Cs-137 detected

4.2 Process Control Program

The Process Control Program (PCP) used to control solidification at WNP-2 will be provided by the vendor waste processor, Pacific Nuclear Inc. in accordance with Contract C-20452, and will be subjected to POC review prior to any solidification of radwaste. Two Pacific Nuclear generic solidification PCP's, TP-04, "Portable Solidification System and TP-05, "Radwaste Solidification System" are currently under NRC review. As an alternative, approved High Integrity Containers (HIC's) could be used for the transport of wastes requiring stabilization. Other portions of the radwaste program are controlled by the WNP-2 procedures PPM 1.12.1, "Radwaste Management Program", PPM 1.12.2, "Radwaste Process Control Program", and 1.12.3, "Contract (Vendor) Waste Processing". No significant changes have occurred in these procedures during this reporting period other than those associated with changing of the radwaste processing contractor.

Table 4-2
WNP-2 SOLID WASTE SHIPMENTS

January - June 1986

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL

1. Type of Waste

Waste Stream	Unit	6-month Period	Est. Total Error, %
a. Spent resins, filter sludges, evaporator bottoms, etc.	m^3 Ci	63.55 97.89	20
b. Dry active waste, contaminated equip., etc.	m^3 Ci	76.46 0.3716	20
c. Irradiated components, control rods, etc.	m^3 Ci	No Shipment	
d. Other, (absorbed aqueous liquid)	m^3 Ci	2.914 0.4650	20

2. Estimate of major nuclide composition (by type of waste):

a. Dewatered Spent Resins

Nuclide		%	Ci
1	Zn-65	60.49	59.22
2	Co-58	13.31	13.03
3	Co-60	10.73	10.50
4	Cr-51	5.592	5.474
5	Nb-95	3.603	3.527
6	Zr-95	2.910	2.849
7	Mn-54	2.180	2.134
8	Ag-110m	0.2794	0.2735
9	Cd-109	0.2448	0.2396
10	Ni-63*	0.2147	0.2102

*Indicates scaled nuclide

b. Dry Active Wastes (DAW)

Nuclide		%	Ci
1	Zn-65	49.01	0.1626
2	Cr-51	15.00	0.04975
3	Co-60	14.57	0.04833
4	Co-58	5.926	0.01966
5	Nb-95	5.628	0.01867
6	Zr-95	3.656	0.01213
7	Mn-54	2.943	9.764E-3
8	Fe-59	1.752	5.813E-3
9	H-3*	0.9905	3.286E-3
10	Ni-63*	0.2913	9.663E-4

c. Irradiated Components - None

d. Other - Absorbed Liquids (oil)

Nuclide		%	Ci
1	Zn-65	47.5	0.221
2	Co-60	28.4	0.132
3	Co-58	12.9	0.0601
4	Mn-54	5.23	0.0243
5	Cr-51	4.28	0.0199
6	Ni-63*	0.568	2.64E-3
7	Nb-95	0.378	1.76E-3
8	Fe-59	0.273	1.27E-3
9	H-3*	0.219	1.02E-3
10	Co-57	0.130	6.03E-4

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
15	Flat bed trailer (3) 14-210H Cask (7) LSA-190 Cask (5)	US Ecology Richland, WA

B. IRRADIATED FUEL SHIPMENTS (Disposition)

None

*Indicates scaled nuclide

5.0 METEOROLOGY

The meteorological data for the first half of calendar year 1986 will be included in the Semi-Annual Effluent Report due 60 days after January 1, 1987 and will include data covering the full calendar year 1986.

6.0 DOSE ASSESSMENT - IMPACT ON MAN

The dose impact on man for the calendar year 1986 will be included in the Semi-Annual Effluent Report due 60 days after January 1, 1987.

7.0 REVISIONS TO THE ODCM

During the semi-annual reporting period, revisions were made to the Offsite Dose Calculation Manual (ODCM), which are included under this section.

Table 2-1 (contd.)

Nuclide	Fish Bioaccumulation Factor (BF_i) (pCi/kg per pCi/liter)	Dose Conversion Factor (DF_i) (mRem per pCi Ingested) Total Body	Bone	Thyroid	Liver	GI Tract
Ba-140	4.0E+00	1.3E-06	2.0E-05	____(3)	2.6E-08	4.2E-05
La-140	2.5E+01	3.3E-10	2.5E-09	____(3)	1.3E-09	9.3E-05
La-141	2.5E+01	1.6E-11	3.2E-10	____(3)	9.9E-11	1.2E-05
La-142	2.5E+01	1.5E-11	1.3E-10	____(3)	5.8E-11	4.3E-07
Ce-141	1.0E+00	7.2E-10	9.4E-09	____(3)	6.3E-09	2.4E-05
Ce-143	1.0E+00	1.4E-10	1.7E-09	____(3)	1.2E-06	4.6E-05
Ce-144	1.0E+00	2.6E-08	4.9E-07	____(3)	2.0E-07	1.7E-04
Pr-143	2.5E+01	4.6E-10	9.2E-09	____(3)	3.7E-09	4.0E-05
W-187	1.2E+03	3.0E-08	1.0E-07	____(3)	8.6E-08	2.8E-05
Np-239	1.0E+01	6.5E-11	1.2E-09	____(3)	1.2E-10	2.4E-05

(1) NRC Regulatory Guide 1.109, Revision 1, Table A-1.

(2) NRC Regulatory Guide 1.109, Revision 1, Table E-11.

(3) No data listed in Regulatory Guide 1.109, Revision 1, Table E-11. (Use whole body dose conversion factor as an approximation.)

Table 2-2 (contd.)

Nuclide	Total Body	Bone	Thyroid	Liver	Gi Tract
Ce-143	3.9E-04	4.8E-03	**	3.4E+00	1.3E+02
Ce-144	7.3E-02	1.4E+00	**	5.6E-01	4.8E-02
Pr-143	2.8E-02	5.5E-01	**	2.2E-01	2.4E+03
W-187	8.6E+01	2.9E+02	**	2.5E+02	8.0E+04
Np-239	1.6E-03	2.9E-02	**	2.9E-03	5.8E+02

*Based on conservative radionuclide mix obtained from GALE Liquid Code. Equation (7) was used to calculate the ingestion dose factors (A_{ij}).

**No Ingestion Dose Factor (DF_i) is listed in Table E-11 of Regulatory Guide 1.109, Revision 1. (Whole body dose factor value will be used as an approximation.)

TABLE 2-3
INPUT PARAMETERS USED TO CALCULATE MAXIMUM INDIVIDUAL DOSE FROM LIQUID EFFLUENTS

Drinking Water

River Dilution:	20,000	
River Transit Time:	12 hours	
Water Treatment and Delivery Time:	24 hours	
Usage Factors:	Adult = 814 l/yr	Teenager = 567 l/yr
	Child = 567 l/yr	Infant = 567 l/yr

Fish

River Dilution:	20,000 for Richland	2,000 for WNP-2 Slough
Time To Consumption:	24 hours	2 hours
Usage Factors:	Adult = 48 kg/yr	Teenager = 36 kg/yr
	Child = 15 kg/yr	Infant = 0

Recreation

River Dilution:	20,000	
Shoreline Width Factor:	0.2	
Usage Factors:	Shoreline Activities:	Adult = 298 hr/yr
		Teenager = 1665 hr/yr
		Child = 349 hr/yr
		Infant = 0
	Swimming:	Adult = 59 hr/yr
		Teenager = 336 hr/yr
		Child = 68 hr/yr
	Boating:	Adult = 145 hr/yr
		Teenager = 31 hr/yr
		Child = 0 hr/yr
		Infant = 0

Irrigated Foodstuffs

River Dilution:	20,000	
River Transit Time:	12 hours	

	Vegetables	Milk	Meat	Leafy Vegetables
Food Delivery Time:	60 days	48 hours	20 days	24 hours
Usage Factors:				
Adult	529 kg/yr	224 l/yr	119 kg/yr	29 kg/yr
Teenager	670 kg/yr	408 l/yr	74 kg/yr	36 kg/yr
Child	559 kg/yr	346 l/yr	46 kg/yr	29 kg/yr
Infant	0	346 l/yr	0	0
Monthly Irrigation Rate:	150 l/m^2	200 l/m^2	160 l/m^2	200 l/m^2
Annual Yield:	5.0 kg/m^2	1.3 l/m^2	2.0 kg/m^2	1.5 kg/m^2
Annual Growing Period:	70 days	30 days	130 days	70 days
Annual 50-Mile Production:	2.0E+07 kg	9.9E+06 L	3.5E+06 kg	1.1E+06 kg

The annual dose or dose commitment to a Member of the Public from the uranium fuel cycle sources is determined whenever the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceed twice the limits in Technical Specification 3.11.1.2a, 3.11.1.2b, 3.11.2.2a, 3.11.2.2b, 3.11.2.3a, or 3.11.2.3b. Direct radiation measurements will also be made to determine if the limits of Specification 3.11.4 have been exceeded.

4.2.1 Total Dose from Liquid Effluents

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

4.2.2 Total Dose from Gaseous Effluents

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

4.2.3 Direct Radiation Contribution

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

TLD stations 1S-16S are special interest stations and will not be used for direct radiation dose determinations to a Member of the Public.

will be reported in the next Semiannual Radiological Effluent Report in accordance with PPM 1.10.2 and Technical Specification. The REMP plan, ODCM, will be changed to reflect new sampling locations.

The best available census information, whether obtained by aerial survey, door-to-door survey, or consultation with local authorities, shall be used to complete the Land Use Survey and the results reported in the Annual Radiological Environmental Operating Report in accordance with PPM 1.10.2 and Technical Specification requirements.

5.3 Laboratory Intercomparison Program

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

The results of the contractor's analysis of Crosscheck samples shall be included in the Annual Radiological Environmental Operating Report in accordance with PPM 1.10.2 and Technical Specification.

Besides the vendor's required participation in the EPA's Crosscheck Program, the Department of Social and Health Services (DSHS) of the State of Washington oversees an analytical program for the Energy Facility Site Evaluation Council (EFSEC) to provide an independent test of WNP-2 REMP sample analyses. The WNP-2/DSHS split samples are analyzed by Washington State's Office of Public Health Laboratories and Epidemiology, Environmental Radiation Laboratory (ERL). The State's ERL participates in the EPA Crosscheck Program, as well as

other federal participatory analytical quality assurance programs. The results of the ERL analysis and EPA Crosscheck data are included in an annual report, "Environmental Radiation Program, Environmental Health Surveillance, State of Washington" and is available for comparison with the WNP-2 data.

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

5.4 Reporting Requirements

WNP-2 radiological environmental surveillance program activities are presented annually per PPM 1.10.2 in the Annual Radiological Environmental Operating Report (AREOR). The approved report is submitted to the Administrator, Region V Office of Inspection and Enforcement, with copies to the Director, Office of Nuclear Reactor Regulation, and the State of Washington Energy Facility Site Evaluation Council (EFSEC) and Radiation Control Section, DSHS, by May 1 of each year for program activities conducted the previous calendar year. The period of the first operational report begins with the date of initial criticality.

The annual report is to include the following types of information: a tabulated summary; interpretations and analyses of trends for results of radiological environmental surveillance activities for the report period, including comparisons with operational controls, preoperational studies, and previous environmental surveillance reports as appropriate; an assessment of the observed impacts of plant operation on the environment; a brief description of the radiological environmental monitoring program; maps representing sampling station locations, keyed to tables of distance and direction from reactor containment; results of the land use census; and the results of analytical laboratory participation in the EPA's Crosscheck Program. The tabulated summary shall be presented in a format represented in Table 5-3. A supplementary report is required if all analytical results are not available for

inclusion in the annual report within the specified time frame. The missing data shall be submitted as soon as possible upon receipt of the results. Along with the missing data, the supplementary report shall include an explanation as to the cause for the delay in completion of the analysis within the report period.

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

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

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

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

TABLE (contd.)

Sample Type[11]	Sample Location Code[1]	Sampling and Collection Frequency[1]	Type and Frequency of Analysis[1]
WATERBORNE (contd.)			
c. Sediment from shoreline (1/2)	33 and 34	Semiannually	Gamma isotopic[3]
4. INGESTION			
a. Milk[7] (4/5)	9, 36, 40, 58 and 96	Semimonthly during grazing season, monthly at other times	Gamma isotopic[3] Iodine-131
b. Fish[8] (2/2)	30, 38, or 39	Seasonal or Semiannually	Gamma isotopic[3]
c. Garden produce[9] (2/2)	37 and 9	Monthly during growing season in the Riverview area of Pasco and a control near Grandview	Gamma isotopic[3]

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

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

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

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

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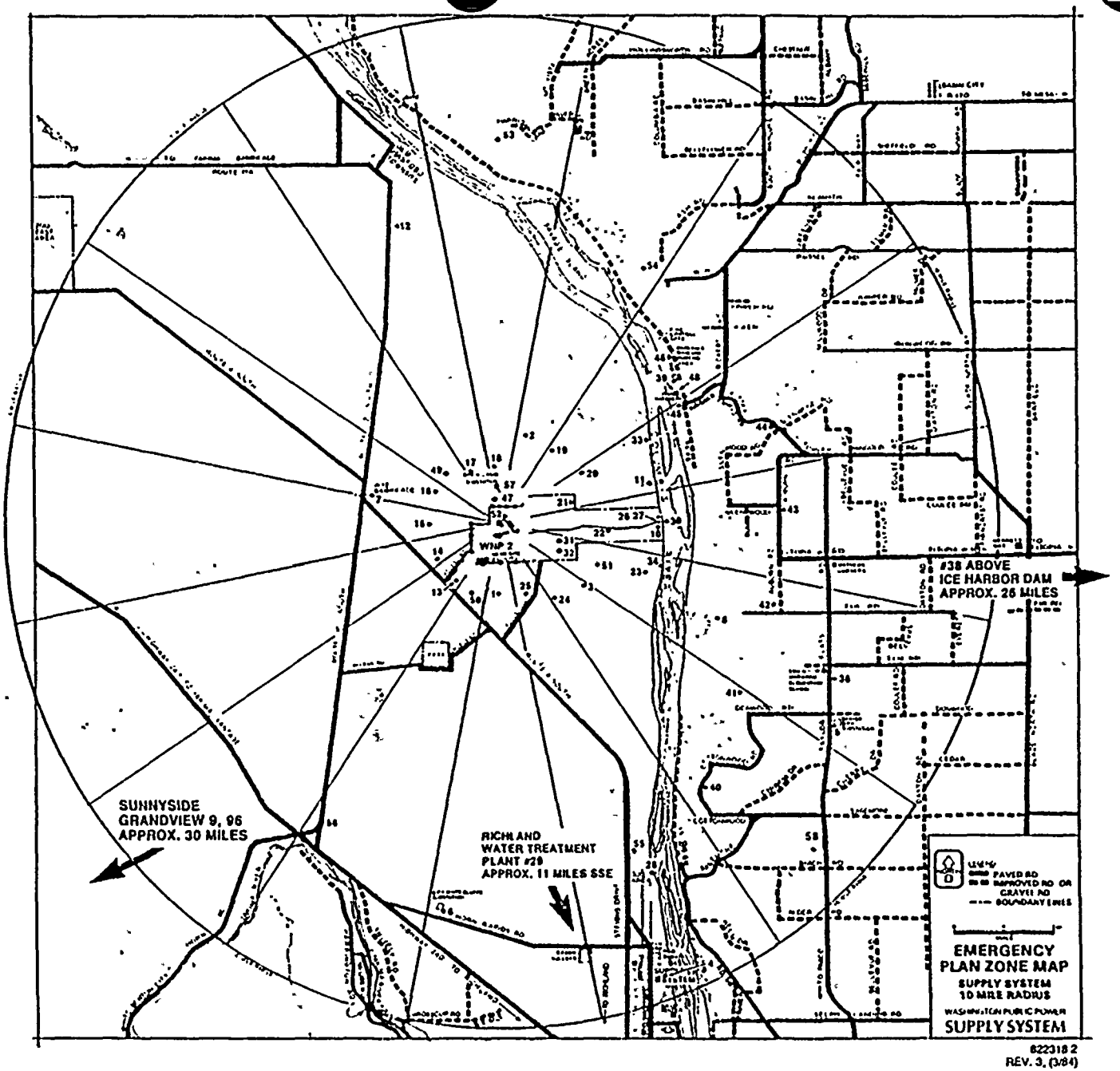
WNP-2 REMP LOCATIONS

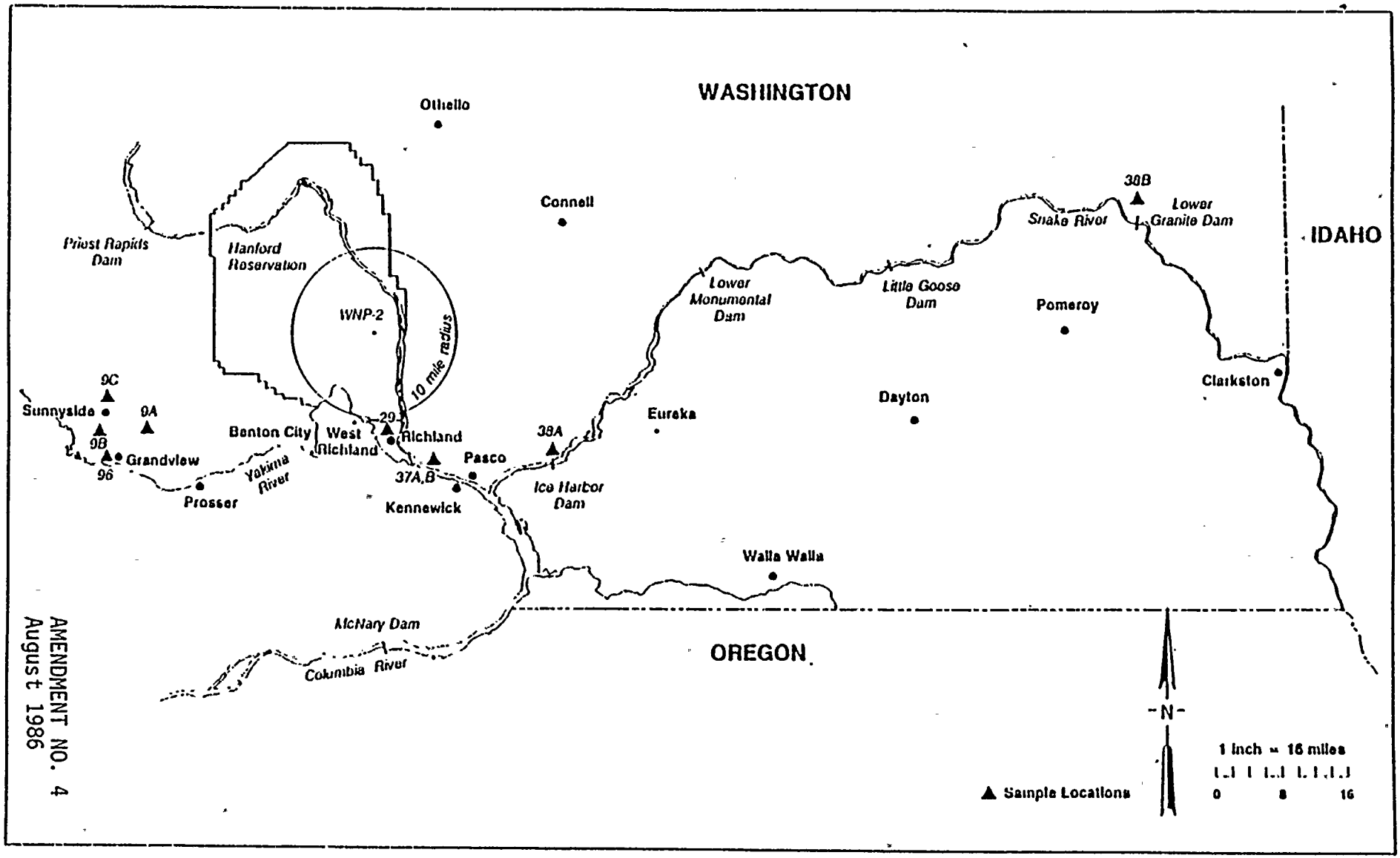
Station	Sector	Radial Miles[a]	TLD	AP/AI	SW	DW	GW	SE	MI	FI	GP	SO_b
1	S	1.3	0	X								X
2	NNE	1.8	0									
3	SE	2.0	X									
4	SSE	9.3	0	0								
5	ESE	7.7	0	X								
6	S	7.7	0	X								
7	WNW	2.7	0	X								X
8	ESE	4.7	0	0								
9A*	WSW	30.0	0	0								
9B*	WSW	35.0									0	
9C	WSW	33.0							0			X
10	E	3.1	0									
11	ENE	3.1	X									
12	NNW	6.1	X									
13	SW	1.4	0									
14	WSW	1.4	0									
15	W	1.4	0									
16	WNW	1.4	0									
17	NNW	1.2	0									

Station	Sector	Radial Miles[a]	TLD	AP/AI	SW	DW	GW	SE	MI	FI	GP	SO_b
39	NE	4.3								X		
40	SE	6.4	0	0					0			
41	SE	5.8	0									
42	ESE	5.6	0									
43	E	5.7	0									
44	ENE	5.7	0									
45	ENE	4.2	0									
46	NE	4.7	0									
47	N	0.5	X									
48	NE	4.3		0								
49	NW	1.2	0									
50	SSW	1.2	0									
51	ESE	2.1	0									
52	N	0.1					0					
53	N	7.5	0									
54	NNE	6.5	0									
55	SSE	7.0	0									
56	SSW	7.0	0									
57	N	0.7		0								
58	SE	8.6							0			
96	WSW	36.0							0			



RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS INSIDE OF 10 MILE RADIUS

Figure 5-1



Radiological Environmental Monitoring Sample Locations Outside of 10-Mile Radius

Figure 5-2

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