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WASHINGTON PUBLIC POWER SUPPLY SYSTEM

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February 28, 1992
G02-92-053

Docket No. 50-397

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
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Subject: WNP-2, OPERATING LICENSE NPF-21
SEMIANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT
FOR JULY THROUGH DECEMBER, 1991 AND
SUBMITTAL OF OFFSITE DOSE CALCULATION MANUAL

References:

1. Letter, G02-91-124, dated June 28, 1991, GC Sorensen (SS) to NRC, "Request for Amendment to Technical Specifications to Relocate RETS in Accordance with Generic Letter 89-01"

2. Letter, dated December 26, 1991, PL Eng (NRC) to GC Sorensen (SS), "Issuance of Amendment for the Washington Public Power Supply System Nuclear Project No. 2 (TAC No. M80941)"

3. Letter, G02-91-159, dated August 29, 1991, JW Baker (SS) to JB Martin (NRC), "Licensee Event Report 91-013-02"

4. Letter, dated September 23, 1991, PL Eng (NRC) to GC Sorensen (SS), "Evaluation of Offsite Dose Calculation Manual, Revision 8 for the Washington Public Power Supply System Nuclear Project No. 2"

5. Letter, G02-92-041, dated February 14, 1992, GC Sorensen (SS) to NRC, "NRC Evaluation of Offsite Dose Calculation Manual, Revision 8 for the Washington Public Power Supply System Nuclear Project No. 2"

In accordance with 10CFR50.36a(a)(2) and WNP-2 Technical Specification 6.9.1.11, the Semiannual Radioactive Effluent Release Report is submitted as an enclosure to this letter. The report includes a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from WNP-2 during the reporting period as required by this Technical Specification.

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In Reference 1 the Supply System requested an amendment to the Technical Specifications to relocate the Radiological Effluent Technical Specifications (RETS) to the Offsite Dose Calculation Manual (ODCM) as provided for by Generic Letter 89-01. Technical Specification Amendment 98, issued by the NRC on December 26, 1991 (Reference 2) responded to this request. During the time the NRC was reviewing the Technical Specification request of Reference 1, the Supply System processed Amendment 10 to the ODCM which was to be incorporated into the ODCM after the relocation of the RETS to the ODCM was approved by the NRC. The primary purpose of Amendment 10 was to eliminate the unnecessary monitoring discussed in Licensee Event Report 91-013-02, transmitted with Reference 3. In accordance with Technical Specification 6.5.1.6, in 1991 the Plant Operations Committee approved this amendment (see Section 7.3 of the enclosed ODCM). As stated above, the requested amendment was provided by the NRC on December 26, 1991. The ODCM was revised to incorporate Amendment 10 in January 1992. As the POC approval of Amendment 10 and the NRC issuance of Technical Specification Amendment 98 were accomplished within the July through December reporting period for this Semiannual Radioactive Effluent Release Report, a complete copy of the Offsite Dose Calculation Manual with changes noted by revision bars and the approval month and year noted on each changed page is also enclosed with this letter as required by Technical Specification 6.14. Including the ODCM with this Semiannual Radioactive Effluent Release Report may be conservative relative to the reporting requirements of Technical Specification 6.14 as ODCM Amendment 10 was not incorporated into the ODCM until January 1992 (due in part because Technical Specification Amendment 98 was not received at the Supply System until January 1992).

In Reference 4 the NRC commented on the river dilution parameter used in the ODCM. In Reference 5 the Supply System committed to change the near field dilution from 2000 to 500. This change is reflected in Section 6.0 of the attached Semiannual Radioactive Effluent Release Report. Reference 1 also suggested that conservatism in the calculation of the maximum organ dose to an individual due to airborne effluent be noted in the ODCM. This note has been included in Section 6.1 of the report.

Sincerely,

G. C. Sorensen, Manager
Regulatory Programs (Mail Drop 280)

AGH/bk
Enclosures

cc: JB Martin - NRC RV
NS Reynolds - Winston & Strawn
PL Eng - NRC
DL Williams - BPA/399
NRC Site Inspector - 901A

9203060112

REFERENCE:
10CFR50.36a(a)(2)

WNP-2 SEMIANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

JULY THROUGH DECEMBER 1991

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

LICENSE NO. NPF-21

TABLE OF CONTENTS

SECTION

LIST OF TABLES

TABLE

LIST OF TABLES
(Continued)

1.0 INTRODUCTION

This report is submitted in compliance with 10CFR50.36a(a)(2) and Technical Specification 6.9.1.11. It includes a summary of the quantities of radioactive liquid and gaseous effluents and solid radwaste released from WNP-2 during the previous six months of operation. Effluent data is summarized on a quarterly basis.

2.0 LIQUID EFFLUENTS

The radwaste liquid effluents were released in "batch mode" during the reporting period. Ten (10) liquid batch releases occurred during the third calendar quarter and 18 batch releases were performed during the fourth calendar quarter. The total time period for the batch releases was 52.2 hours, with the maximum, minimum and average time periods for a release being 2.5, 1.3, and 1.9 hours, respectively. The volume of dilution water considered is assumed to be the total volume of recirculating cooling tower blowdown flow for the period. The average flow rate of the Columbia River during July through December 1991 was 1.1E+05 cubic feet per second.

Computer runs were performed to verify compliance with Technical Specification limits. The third quarter calculate dose for the maximum individual (adult age group) was 1.5E-04 mrem whole body and 3.3E-04 mrem for the maximum organ. The fourth quarter calculated dose for the maximum individual (adult age group) was 3.9E-04 mrem whole body and 8.3E-04 mrem for the maximum organ. No abnormal liquid releases occurred during this reporting period.

The liquid batch releases were recirculated prior to sampling. A representative sample was obtained and analyzed for each batch release. A composite of the batch samples for each quarter was analyzed for strontium and iron. The methods used for measuring the total radioactivity were gamma spectroscopy, liquid scintillation and proportional counting. Table 2-1 provides a summation of all liquid releases during this reporting period.

The percent of MPC limit in Table 2-1 is based on the total of the MPC fractions using the nuclides in Table 2-2 and the concentrations listed in 10CFR20, Appendix B, Table 2, Column 2.

Estimated total errors are listed in Table 2-1, and are propagated from individual error estimates of sample activity, sample volume, tank volume, and tank homogeneity. The estimated total errors were calculated by obtaining the square root of the sum of the squares of the individual error contributions and multiplying by 1.96 for a 95% confidence level.

Table 2-1

WNP-2 LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

Report Period: July - December 1991

	Unit	3rd Quarter	4th Quarter	Est Total Error* %
A. Fission and activation products				
1. Total release (not including tritium, gases, alpha)	Ci	4.4E-03	5.6E-03	2.2E+01
2. Average diluted concentration during period	uCi/ml	1.6E-08	5.8E-09	
3. Percent of MPC limit	%	2.0E-02	2.5E-02	
B. Tritium				
1. Total release	Ci	1.4E-01	8.2E-01	2.2E+01
2. Average diluted concentration during period	uCi/ml	4.8E-07	8.5E-07	
3. Percent of MPC limit	%	1.6E-02	2.8E-02	
C. Dissolved and entrained gases				
1. Total release	Ci	<1.2E-04	<2.0E-04	2.2E+01
2. Average diluted concentration during period	uCi/ml	NA	NA	
3. Percent of MPC limit	%	NA	NA	
D. Gross alpha radioactivity				
1. Total release	Ci	9.7E-09	2.7E-08	2.3E+01
E.				
Volume of waste (prior to dilution)	liters	5.9E+05	1.0E+06	1.5E+01
F.				
Volume of dilution water used during period	liters	2.8E+08	9.6E+08	1.5E+01

* At 95% confidence level

Table 2-2

WNP-2 LIQUID EFFLUENTS - SOURCE TERMS

Report Period: July - December 1991 BATCH MODE

Nuclides Released	Unit	3rd Quarter	4th Quarter
Strontium-89	Ci	3.5E-05	1.1E-05
Strontium-90	Ci	2.1E-06	5.2E-06
Cesium-134	Ci	<2.1E-05	<3.5E-05
Cesium-137	Ci	<2.3E-05	<3.9E-05
Iodine-131	Ci	<1.4E-05	2.7E-05
Cobalt-58	Ci	1.6E-05	7.5E-05
Cobalt-60	Ci	8.6E-04	3.4E-03
Iron-59	Ci	<3.7E-05	<6.3E-05
Zinc-65	Ci	4.0E-04	1.1E-03
Manganese-54	Ci	6.4E-05	1.6E-04
Chromium-51	Ci	<1.0E-04	5.7E-04
Zirconium-Niobium-95	Ci	<1.8E-05	<3.1E-05
Molybdenum-99	Ci	<1.6E-04	<2.8E-04
Technetium-99m	Ci	<2.2E-05	<3.8E-05
Barium-Lanthanum-140	Ci	<3.3E-05	<5.6E-05
Cerium-141	Ci	<2.2E-05	<3.7E-05
Cerium-144	Ci	<1.1E-04	<1.8E-04
Iron-55	Ci	3.0E-03	2.7E-04

Table 2-2 (continued)

Nuclides Released	Unit	3rd Quarter	4th Quarter
Others			
NONE	Ci		
Total for period (above)	Ci	4.4E-03	5.6E-03

Xenon-133	Ci	< 1.0E-04	< 1.7E-04
Xenon-135	Ci	< 2.0E-05	< 3.4E-05
Tritium	Ci	1.4E-01	8.2E-01

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 from three (3) release points:

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, 3-2, and 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 particulate filters and charcoal cartridges, both are analyzed using gamma spectroscopy.

Total error estimates are propagated from individual error estimates of sample volume, sample activity and effluent flow rate measurements. The overriding uncertainty in all cases is in the measurement of the effluent and sample volumes. The estimated error was determined to be 36% at the 95% confidence level.

The percent of Technical Specification limit for fission and activation gases (air dose) was determined for locations 1 through 7 and were based on quarterly limits of ten (10) millirads for beta and five (5) millirads for gamma. Locations 3 through 7 were used to determine the most restrictive value to be used in Table 3-4, Section A.3.

The percent of Technical Specification limit calculations for iodines, particulates with half-lives greater than eight (8) days and tritium are based on the quarterly limit of 7.5 mrem to any organ. Locations 3 through 7 listed below were used to determine the most restrictive value to be used in Table 3-4 for each quarter.

Calculations were performed for releases using the GASPAR II computer program and parameters as outlined in the ODCM. Quarterly doses were determined at the following locations:

Location 1: Site Boundary; 1.2 miles

Air Dose (mrad)	Beta	% Tech. Spec.	Gamma	% Tech. Spec:
3rd Qtr.	7.9E-05	0.00	4.7E-05	0.00
4th Qtr.	1.5E-01	1.54	1.3E-01	2.58

Highest Organ Dose	mrem	% Tech. Spec.
3rd Qtr.	2.3E-02	0.31
4th Qtr.	6.4E-02	0.85

Location 2: Beyond Site Boundary; 3.3 and 4.0 miles ESE, respectively (ground and inhalation pathways) at the location having the highest X/Q values for mixed mode release.

Air Dose (mrad)	Beta	% Tech. Spec.	Gamma	% Tech. Spec:
3rd Qtr.	1.9E-04	0.00	1.2E-04	0.00
4th Qtr.	4.4E-02	0.44	3.2E-02	0.65

Highest Organ Dose	mrem	% Tech. Spec.
3rd Qtr.	1.9E-03	0.03
4th Qtr.	3.2E-02	0.42

Location 3: 4.8 miles SE (ground, vegetables and inhalation pathways)

Air Dose (mrad)	Beta	% Tech. Spec.	Gamma	% Tech. Spec:
3rd Qtr.	5.4E-05	0.00	3.2E-05	0.00
4th Qtr.	1.7E-02	0.17	1.2E-02	0.24

Highest Organ Dose	mrem	% Tech. Spec.
3rd Qtr.	3.0E-02	0.40
4th Qtr.	4.4E-02	0.59

Location 4: 6.4 miles SE (ground, meat, cow milk, and inhalation pathways)

Air Dose (mrad)	Beta	% Tech. Spec.	Gamma	% Tech. Spec:
3rd Qtr.	3.5E-05	0.00	2.1E-05	0.00
4th Qtr.	1.1E-02	0.11	8.1E-03	0.16

Highest Organ Dose	mrem	% Tech. Spec.
3rd Qtr.	1.7E-02	0.23
4th Qtr.	2.1E-02	0.28

Location 5: 4.2 miles ESE (ground, vegetables and inhalation pathways)

Air Dose (mrad)	Beta	% Tech. Spec.	Gamma	% Tech. Spec:
3rd Qtr.	9.5E-06	0.00	9.0E-06	0.00
4th Qtr.	4.8E-02	0.48	3.7E-02	0.75

Highest Organ Dose	mrem	% Tech. Spec.
3rd Qtr.	3.5E-02	0.47
4th Qtr.	7.9E-02	1.05

Location 6: 4.3 miles NE (ground and inhalation pathways)

Air Dose (mrad)	Beta	% Tech. Spec.	Gamma	% Tech. Spec:
3rd Qtr.	5.2E-06	0.00	3.1E-06	0.00
4th Qtr.	3.0E-03	0.03	2.1E-03	0.04

Highest Organ Dose	mrem	% Tech. Spec.
3rd Qtr.	3.9E-04	0.01
4th Qtr.	1.5E-03	0.02

Location 7: 4.1 miles ENE (ground, vegetables and inhalation pathways)

Air Dose (mrad)	Beta	% Tech. Spec.	Gamma	% Tech. Spec:
3rd Qtr.	1.2E-06	0.00	8.6E-07	0.00
4th Qtr.	2.8E-02	0.28	2.2E-02	0.43

Highest Organ Dose	mrem	% Tech. Spec.
3rd Qtr.	1.5E-02	0.20
4th Qtr.	3.8E-02	0.51

In addition to the reactor facility, WNP-2 has a permanent laundry facility located approximately 0.75 miles from the reactor building. Its ventilation system contains HEPA filters on the discharge and is continuously monitored for particulates. Also, the backup chemistry laboratory within the Emergency Operations Facility (EOF) is located adjacent to the laundry facility. The radiochemical hood within the backup chemistry lab contains HEPA filters and is monitored for radioactive releases when in operation. Gamma spectrometry indicated no radioactive material present other than that attributable to natural background.

There were no abnormal releases of gaseous effluent during the third and fourth quarters of 1991.

Table 3-1

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

Report Period
July - December 1991

CONTINUOUS MODE

Nuclides Released	Unit	3rd Quarter	4th Quarter
1. Fission gases			
Krypton-85	Ci	< 3.9E+01	2.7E-01
Krypton-85m	Ci	< 1.7E-01	5.6E-01
Krypton-87	Ci	3.7E-02	1.5E+00
Krypton-88	Ci	< 3.9E-01	7.7E+00
Xenon-133	Ci	< 3.3E-01	4.8E+01
Xenon-133m	Ci	< 9.2E-01	3.8E+01
Xenon-135	Ci	1.9E-02	2.8E+02
Xenon-135m	Ci	4.1E-02	8.7E+01
Xenon-138	Ci	2.6E-01	9.6E+00
OTHERS			
Xenon-137	Ci	3.0E-01	< 4.4E+00
Argon-41	Ci	< 2.2E-01	5.1E-01
Total for period (above)	Ci	6.6E-01	4.7E+02

Table 3-1 (continued)

2. Iodines

Nuclides Released	Unit	3rd Quarter	4th Quarter
Iodine-131	Ci	< 1.3E-04	1.4E-02
Iodine-132	Ci	< 3.0E-05	2.8E-03
Iodine-133	Ci	< 6.4E-04	6.2E-02
Iodine-134	Ci	< 9.4E-05	1.9E-03
Iodine-135	Ci	< 8.3E-05	8.2E-03
Total for period (above)	Ci	NA	8.9E-02

3. Particulates

Nuclides Released	Unit	3rd Quarter	4th Quarter
Strontium-89	Ci	< 1.0E-03	2.7E-05
Strontium-90	Ci	< 1.6E-05	< 6.0E-06
Cesium-134	Ci	< 1.9E-04	< 7.1E-04
Cesium-137	Ci	< 1.8E-04	< 6.8E-04
Barium-Lanthanum-140	Ci	< 5.0E-04	6.3E-04
Molybdenum-99	Ci	< 2.5E-04	< 7.3E-03
Cerium-141	Ci	< 1.3E-04	< 6.7E-04
Cerium-144	Ci	< 5.0E-04	< 2.3E-03
Cobalt-58	Ci	< 1.6E-04	< 4.6E-03
Cobalt-60	Ci	3.1E-04	3.1E-04
Iron-59	Ci	< 5.2E-04	< 1.7E-03
Manganese-54	Ci	< 1.8E-04	< 6.2E-04
Zinc-65	Ci	< 5.5E-04	< 1.5E-03
Total for period (above)	Ci	3.1E-04	9.7E-04

Table 3-1 (continued)

3. Particulates (continued)

Nuclides Released	Unit	3rd Quarter	4th Quarter
OTHERS with T 1/2 <8 days			
Strontium-91	Ci	< 1.6E-05	2.8E-04
Cesium-138	Ci	4.2E-03	2.5E-02
Barium-139	Ci	1.4E-03	4.1E-02
Bromine-82	Ci	< 2.7E-05	1.7E-06
Total with T 1/2 < 8 days	Ci	5.6E-03	6.6E-02

4. Tritium

Tritium	Ci	4.5E-01	6.6E-01

Total building release	Ci	1.1E+00	4.7E+02

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

Report Period
July - December 1991

CONTINUOUS MODE

Nuclides Released	Unit	3rd Quarter	4th Quarter
1. Fission gases			
Krypton-85	Ci	< 4.9E+02	< 6.1E+02
Krypton-85m	Ci	< 3.3E+00	< 4.0E+00
Krypton-87	Ci	< 2.6E+00	< 6.7E+00
Krypton-88	Ci	< 6.8E+00	< 8.5+00
Xenon-133	Ci	< 1.3E+01	3.3E+01
Xenon-133m	Ci	< 2.1E+01	6.1E+00
Xenon-135	Ci	< 2.7E+00	7.2E+01
Xenon-135m	Ci	< 1.2E+01	4.5E+00
Xenon-138	Ci	< 2.5E+01	< 3.1E+01
OTHERS			
NONE	Ci		
Total for period (above)	Ci	0.0E+00	1.2E+02

Table 3-2 (continued)

2. Iodines

Nuclides Released	Unit	3rd Quarter	4th Quarter
Iodine-131	Ci	< 1.8E-04	1.8E-03
Iodine-132	Ci	< 3.8E-04	8.8E-03
Iodine-133	Ci	< 2.9E-04	1.6E-02
Iodine-134	Ci	< 5.8E-04	2.3E-02
Iodine-135	Ci	< 1.0E-03	1.4E-02
Total for period (above)	Ci	NA	6.4E-02

3. Particulates

Nuclides Released	Unit	3rd Quarter	4th Quarter
Strontium-89	Ci	6.6E-03	2.3E-04
Strontium-90	Ci	5.1E-04	5.5E-06
Cesium-134	Ci	< 2.6E-04	< 1.4E-03
Cesium-137	Ci	< 2.4E-04	< 1.4E-03
Barium-Lanthanum-140	Ci	< 7.5E-04	7.4E-03
Molybdenum-99	Ci	< 3.4E-03	< 1.6E-02
Cerium-141	Ci	< 2.1E-04	< 1.2E-03
Cerium-144	Ci	< 7.4E-04	< 4.6E-03
Cobalt-58	Ci	< 2.1E-04	< 3.0E-03
Cobalt-60	Ci	1.4E-04	2.5E-04
Iron-59	Ci	< 7.0E-04	< 2.5E-03
Manganese-54	Ci	< 2.2E-04	< 1.0E-03
Zinc-65	Ci	< 6.5E-04	< 2.7E-03

Table 3-2 (continued)

3. Particulates (continued)

Nuclides Released	Unit	3rd Quarter	4th Quarter
OTHERS			
Silver-110m	Ci	< 2.6E-04	4.8E-05
Total for period (above)	Ci	7.3E-03	7.9E-03
OTHERS with T 1/2 < 8 days			
Rubidium-89	Ci	< 1.2E-03	9.1E-04
Strontium-91	Ci	< 3.9E-04	1.3E-03
Strontium-92	Ci	< 3.9E-04	3.1E-02
Cesium-138	Ci	1.2E-03	1.3E+00
Barium-139	Ci	8.3E-04	5.7E-01
Total with T 1/2 < 8 days	Ci	2.0E-03	1.9E+00

4. Tritium

Tritium	Ci	2.7E-01	2.0E+00

Total building release	Ci	2.8E-01	1.2E+02

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

Report Period
July - December 1991

CONTINUOUS MODE

Nuclides Released	Unit	3rd Quarter	4th Quarter
1. Fission gases			
Krypton-85	Ci	< 1.3E-02	< 1.2E+02
Krypton-85m	Ci	< 8.3E-01	< 8.1E+02
Krypton-87	Ci	< 1.5E+00	< 1.5E+00
Krypton-88	Ci	< 2.8E+00	< 2.7E+00
Xenon-133	Ci	< 9.2E+00	1.1E+01
Xenon-133m	Ci	< 5.1E+00	< 8.9E+00
Xenon-135	Ci	< 1.6E+01	1.9E+01
Xenon-135m	Ci	< 1.8E+00	5.6E+00
Xenon-138	Ci	< 1.9E+00	< 1.8E+00
OTHERS			
NONE	Ci		
Total for period (above)	Ci	0.0E+00	3.6E+01

Table 3-3 (continued)

2. Iodines

Nuclides Released	Unit	3rd Quarter	4th Quarter
Iodine-131	Ci	< 6.3E-05	2.2E-04
Iodine-132	Ci	< 1.3E-04	2.2E-04
Iodine-133	Ci	< 1.0E-04	9.7E-04
Iodine-134	Ci	< 2.0E-04	2.3E-04
Iodine-135	Ci	< 3.6E-04	2.8E-04
Total for period (above)	Ci	NA	1.9E-03

3. Particulates

Nuclides Released	Unit	3rd Quarter	4th Quarter
Strontium-89	Ci	5.3E-06	3.6E-06
Strontium-90	Ci	< 1.0E-06	< 1.1E-06
Cesium-134	Ci	< 2.8E-05	<7.4E-05
Cesium-137	Ci	<2.7E-05	<8.0E-05
Barium-Lanthanum-140	Ci	<7.5E-05	1.6E-04
Molybdenum-99	Ci	<3.3E-04	<7.2E-04
Cerium-141	Ci	<2.1E-05	<6.9E-05
Cerium-144	Ci	<7.2E-05	<2.6E-04
Cobalt-58	Ci	<2.4E-05	<1.4E-03
Cobalt-60	Ci	<5.4E-05	<1.2E-04
Iron-59	Ci	<8.1E-05	<1.9E-04
Manganese-54	Ci	<2.5E-05	<6.6E-05
Zinc-65	Ci	<7.0E-05	<1.7E-04
Total for period (above)	Ci	5.3E-06	1.6E-04

Table 3-3 (continued)

3. Particulates (continued)

Nuclides Released	Unit	3rd Quarter	4th Quarter
OTHERS			
NONE	Ci		
OTHERS with T 1/2 < 8 days			
NONE	Ci		

4. Tritium

Tritium	Ci	1.9E-01	1.6E-01
Total building release	Ci	1.9E-01	3.6E+01

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

Table 3-4

WNP-2 GASEOUS EFFLUENTS
SUMMATION OF ALL RELEASES

Report Period
July - December 1991

	Unit	3rd Quarter	4th Quarter	Est Total Error %*
A. Fission and activation gases				
1. Total release	Ci	6.6E-01	6.2E+02	3.6E+01
2. Average release rate for period	uCi/sec	8.3E-02	7.9E+01	
3. Percent of Tech. Spec. limit	%	6.4E-04	7.5E-01	
B. Iodines				
1. Total Iodine Release	Ci	NA	1.5E-01	3.6E+01
2. Average release rate for period	uCi/sec	NA	1.9E-02	
3. Percent of Tech. Spec. limit	%	NA	1.0E+00	
C. Particulates				
1. Particulates	Ci	7.6E-03	9.1E-03	3.6E+01
2. Average release rate for period	uCi/sec	9.6E-04	1.1E-03	
3. Percent of Tech. Spec. limit	%	4.7E-01	1.0E+00	
4. Gross alpha radioactivity	Ci	2.1E-04	5.7E-04	
D. Tritium				
1. Total release	Ci	9.2E-01	2.8E+00	3.6E+01
2. Average release rate for period	uCi/sec	1.2E-01	3.5E-01	
3. Percent of Tech. Spec. limit	%	4.7E-01	1.0E+00	

* At 95% confidence level

Table 3-5

WNP-2 GASEOUS EFFLUENTS
BATCH RELEASES

Report Period
July - December 1991

Type	Number	Total Time (hrs)	Maximum Time (hrs)	Minimum Time (hrs)	Mean Time (hrs)
Purge	9	100.3	60.2	1.1	11.1
Vent	42	42.0	2.4	0.3	1.0

4.0 SOLID RADWASTE

A total volume of 9,168.8 ft^3 (259.5 m^3) of solid waste was transported in 29 shipments during the July through December 1991 reporting period. The reported volumes are the disposal volumes of the containers shipped for burial. The total activity of the waste shipped was 367 Ci; 365 Ci contained in dewatered spent resins and 2 Ci contained in DAW.

A. Dewatered Spent Resin

Dewatered resins accounted for 3,818.6 ft^3 (108.1 m^3) of the radioactive wastes shipped during the reporting period. The burial containers were ES-190, EL-142 and EA-142 liners provided by NUPAC Services, Inc. The total activity of the resins shipped during the reporting period was 365 Ci. The principle nuclides and their percent contribution to the total activity are listed in Table 4-3. The solid wastes were shipped to the U S Ecology Hanford burial site using NUPAC lO-142 or NUPAC 14-210 casks.

The counting error associated with the total activity has consistently been found to be less than 3.0% at one standard deviation for previous reporting periods. The statistical counting error is assumed to be 3.0% 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 is approximately 5%. The best estimate of the total error in the activity of spent resin shipped is assumed to be less than or equal to 25%.

B. Dry Active Waste (DAW)

A total of 5,350.2 ft^3 (151.4 m^3) of DAW was shipped in Container Products Corporation B-25 boxes or NUPAC Services ES-190 encapsulation liners. The total activity of the DAW shipped was 1.69 Ci. The value of the activity shipped was determined by using computerized dose rate-to-curie conversion factors. The conversion factors were based on a nuclide distribution taken from analysis of contamination found in the major DAW production areas. This distribution is updated annually in conjunction with offsite analyses of hard-to-measure nuclides. A meaningful counting error cannot be generated for DAW; however, the total error may be assumed to be less than or equal to 25% since DAW would be subjected to similar error contributions as spent resin.

4.1 Scaling Factor Methodology

Scaling factors are based on outside laboratory (SCIENTECH Inc. formerly SAIC) analysis of hard-to-measure nuclides. Scaling factors are updated on an annual basis or when triggered by an order of magnitude change in corrosion to fission product ratios (Co-60/Cs-137) in the resin waste streams as compared to the previous offsite analysis.

C-14, Ni-63, Fe-55

The ratio of each of these nuclides to Co-60 is determined by outside laboratory analysis of each waste stream. The resulting scaling factors are applied to the measured Co-60 concentration for a particular batch or container of radwaste to arrive at the C-14, Ni-63 and Fe-55 concentrations.

H-3, Tc-99, I-129, Sr-90

The ratio of each of these nuclides to Cs-137 is determined by outside laboratory analysis of each waste stream. The resulting scaling factors are applied to the measured Cs-137 concentration for a particular batch or container of radwaste to arrive at the H-3, Tc-99, I-129 and Sr-90 concentrations.

Transuranics

The ratio of hard to measure TRU nuclides to Ce-144 is determined by outside laboratory analysis of each waste stream as recommended by the AIF report, "Methodologies for Classification of Low Level Radioactive Waste for Nuclear Power Plants." These nuclides will be reported if Ce-144 is detected and TRU nuclides have been detected by outside laboratory analyses. TRU nuclides include Pu-239, Pu-238, Pu-241, Am-241, Cm-242 and Cm-244.

Outside laboratory LLD's must be at least 1 nCi/g for TRU, 35 nCi/g for PU-241 or 200 nCi/g for Cf-242.

SCALING FACTORS

TABLE 4-1 - REQUIRED NUCLIDES

RATIO	DAW	RWCU POWDER RESIN	CFD POWDER RESIN	EDF/FDR POWDERED RESIN	EDR/FDR BEAD RESIN
H-3/ CS-137	1.97EO*	1.88E-6*	6.34E-2*	1.07E-4*	1.27E-2*
C-14/ CO-60	2.25E-3*	8.63E-6	1.32EO	2.61E-4	3.20E-3
Tc-99/ Cs-137	3.11E-1*	1.37E-6*	8.76E-3*	9.82E-6*	2.97E-3*
I-129/ Cs-137	4.02E-1*	1.44E-5*	1.24E-2*	8.04E-6*	2.41E-3*

* Scaling factor based on LLD value.

TABLE 4-2 - CONDITIONAL NUCLIDES

Ni-63/Co-60	NOTE 1	5.12E-3	3.32E-2	1.84E-1	NOTE 1
Fe-55/Co-60	2.36E-1	9.83E-2	2.23E-1	2.46E-1	NOTE 1
Sr-90/Cs-137	NOTE 1	1.30E-2	1.92E-1	2.81E-3	4.84E-2
Pu-239,240 /Ce-144	NOTE 1	9.65E-2	NOTE 1	2.60E-3	NOTE 1
Pu-238/Ce-144	NOTE 1	4.70E-2	NOTE 1	7.03E-3	NOTE 1
Pu-241/Ce-144	NOTE 1	5.50E0	NOTE 1	2.14E-1	NOTE 1
Am-241/Ce-144	NOTE 1	8.29E-3	2.56E-4	NOTE 1	NOTE 1
Cm-242/Ce-144	NOTE 1	9.25E-3	7.80E-3	2.75E-2	NOTE 1
Cm-243,244/ Ce-144	NOTE 1	1.13E-2	4.08E-4	NOTE 1	NOTE 1

NOTE 1: Isotope not identified by offsite laboratory analysis.

Table 4-3
WNP-2 SOLID WASTE SHIPMENTS

July - December 1991

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	108.1 365	25
b. Dry active waste, contaminated equip., etc.	m^3 Ci	151.4 1.69	25
c. Irradiated components, control rods, etc.	m^3 Ci	No Shipment	
d. Other, (absorbed aqueous liquid)	m^3 Ci	No Shipment	

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

a. Dewatered Spent Resins

Nuclide	%	Ci
Zn-65	36.5	133
Co-60	30.5	111
Cs-137	7.7	28.1
Cs-134	6.7	24.4
Fe-55*	4.9	18.0
Cr-51	3.2	11.7
Ni-63*	2.4	8.85
Mn-54	1.8	6.65
Sr-89	1.7	6.18
Ce-144	1.5	5.40

b. Dry Active Waste (DAW)

Nuclide	%	Ci
Co-60	72.6	1.23
Fe-55*	17.1	0.290
Zn-65	6.8	0.114
Sb-125	2.3	0.039
Mn-54	1.2	0.020

*Indicates scaled nuclide

c. Irradiated Components - None

d. Other - Absorbed Liquids - None

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
29	10-142 Cask (7) 14-210 Cask (18) Flatbed (4)	US Ecology Richland,WA

5.0 METEOROLOGY

The meteorological data contained in Tables 5-1 through 5-10 were obtained from the WNP-2 meteorological tower located 2500 ft west of WNP-2. Data was recovered from 33 ft and 245 ft levels. The meteorological data is a composite file from both the manual and automated data recovery systems.

The year was drier and the wind calmer than 1990. Precipitation was again below normal for 1991 with the occurrence of fog and haze and blowing dust much less than 1990. There were few arctic outbreaks of cold air with the one significant outbreak causing extensive soft fruit damage in early february 1991. September was very dry with very few haze/fog occurrences as is normal. The extreme periods of high winds and blowing dust which occurred in 1990 did not re-occur in 1991. Snowfall and freezing rain were below normal. In summary, the dispersive environment for WNP-2 for 1991 was better than normal.

The automated data recovery system continued to function at greater than 90% joint data recovery when power was provided by WNP-2 to the meteorological tower system. Power outages contributed to a total data recovery of less than 90% for 1991. All significant outages coincided with scheduled and unscheduled outages at WNP-2. Lightening strikes and thunderstorms were of minor concern and had no significant effect on meteorological tower operations.

Tables 5-1 through 5-8 list the joint frequency distributions at the 33 ft and the 245 ft levels for 1991 by quarter with 5-9 and 5-10 listing the annual joint frequency distributions for 1991. The NRC stability classes A-G and seven wind categories along with the 16 wind sectors were used to prepare each joint frequency table. The annual joint frequency tables should be used to evaluate any vents and purges during 1991 as the releases were random in time.

Calibrations performed in 1991 produced no values exceeding WNP-2 FSAR meteorological equipment tolerances. Therefore, there has been no corrections applied to the raw data.

TABLE 5-1 1ST QTR 1991 33FT JOINT FREQUENCY DISTRIBUTION FOR THE 33 FT LEVEL
CALCULATED FROM HOURLY AVERAGES FROM DISK

EN STABILITY CLASSES ------ MAXIMUM WIND SPEEDS FOR EACH CATEGORY IN MPH ARE:
1 - 0.6 2 - 3.0 3 - 7.0 4 - 12.0 5 - 18.0 6 - 24.0

NUMBERS GIVEN ARE HOURS

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	1.	0.	0.	0.	1.
8.	3.	4.	1.	0.	2.	0.	2.	2.	4.	1.	1.	1.	5.	3.	4.
8.	6.	2.	1.	0.	1.	0.	7.	2.	1.	0.	1.	1.	3.	9.	19.
5.	1.	0.	0.	0.	0.	0.	3.	4.	4.	2.	1.	2.	2.	3.	10.
0.	1.	0.	0.	0.	0.	0.	3.	3.	8.	3.	4.	4.	0.	1.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	4.	0.	2.	0.	1.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	2.	0.	0.	0.	1.	0.	0.
3.	1.	0.	0.	0.	2.	0.	0.	1.	1.	0.	1.	0.	5.	7.	3.
23.	15.	11.	2.	2.	7.	8.	13.	11.	9.	13.	9.	7.	16.	21.	25.
33.	15.	25.	2.	0.	4.	8.	31.	23.	17.	6.	6.	12.	17.	36.	62.
16.	5.	10.	0.	0.	0.	15.	38.	35.	18.	10.	4.	2.	16.	13.	28.
15.	0.	0.	0.	0.	0.	1.	8.	18.	25.	8.	1.	1.	8.	8.	15.
0.	1.	0.	0.	0.	0.	0.	0.	0.	8.	6.	0.	0.	2.	0.	0.
1.	0.	0.	0.	0.	0.	0.	0.	0.	8.	9.	0.	0.	0.	0.	0.
2.	3.	1.	0.	0.	0.	1.	0.	1.	0.	0.	2.	0.	1.	2.	1.
15.	13.	7.	2.	4.	1.	3.	3.	9.	12.	10.	8.	11.	11.	19.	18.
25.	7.	5.	2.	0.	0.	3.	10.	25.	12.	7.	7.	6.	17.	44.	33.
1.	2.	6.	0.	0.	0.	6.	43.	27.	15.	3.	1.	3.	17.	15.	2.
0.	0.	0.	0.	0.	0.	0.	9.	9.	12.	4.	0.	1.	4.	1.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	5.	2.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	1.	0.	0.	0.	0.	0.	0.
0.	2.	0.	1.	1.	0.	0.	0.	0.	2.	0.	0.	1.	1.	1.	3.
18.	15.	9.	3.	2.	1.	2.	8.	14.	9.	8.	10.	5.	8.	19.	18.
31.	22.	6.	3.	0.	0.	2.	16.	15.	11.	1.	3.	1.	2.	43.	51.
[illegible]	1.	1.	1.	0.	0.	2.	18.	16.	3.	0.	1.	0.	2.	4.	2.
[illegible]	0.	0.	0.	0.	0.	0.	5.	3.	4.	0.	0.	1.	0.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.

TOTAL NUMBER OF HOURS
USED = 2036 MISSING = 125 CALM = 53

TABLE 5-2 1ST QTR 1991 245FT JOINT FREQUENCY DISTRIBUTION FOR THE 245 FT LEVEL
CALCULATED FROM HOURLY AVERAGES FROM DISK

EN STABILITY CLASSES ------ MAXIMUM WIND SPEEDS FOR EACH CATEGORY IN MPH ARE:
1 - 0.6 2 - 3.0 3 - 7.0 4 - 12.0 5 - 18.0 6 - 24.0

NUMBERS GIVEN ARE HOURS

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.
0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4.	4.	2.	2.	0.	0.	1.	0.	3.	4.	1.	1.	1.	5.	2.	7.
8.	3.	0.	1.	0.	0.	2.	4.	1.	0.	3.	0.	2.	1.	12.	16.
4.	1.	2.	0.	0.	0.	0.	4.	3.	0.	1.	0.	2.	6.	4.	14.
0.	0.	0.	0.	0.	4.	0.	0.	10.	6.	5.	2.	0.	0.	1.	3.
0.	0.	0.	0.	0.	1.	0.	0.	0.	6.	1.	2.	1.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	2.	1.	0.	0.	2.	0.	0.
0.	4.	0.	1.	0.	0.	0.	0.	0.	4.	2.	1.	0.	0.	2.	1.
16.	10.	6.	5.	2.	5.	4.	8.	9.	8.	9.	6.	9.	10.	9.	29.
27.	19.	11.	6.	0.	3.	8.	23.	27.	13.	3.	5.	10.	17.	24.	43.
25.	15.	10.	0.	0.	0.	10.	29.	27.	10.	5.	3.	3.	9.	31.	36.
8.	2.	2.	0.	0.	1.	2.	12.	24.	21.	8.	3.	7.	20.	11.	12.
10.	1.	0.	0.	0.	1.	2.	3.	11.	18.	13.	1.	0.	6.	4.	9.
1.	0.	0.	0.	0.	0.	0.	0.	0.	9.	26.	0.	0.	3.	1.	0.
1.	2.	0.	0.	1.	0.	1.	0.	0.	0.	0.	0.	0.	0.	1.	0.
7.	8.	9.	2.	6.	3.	5.	7.	3.	4.	8.	3.	2.	5.	8.	6.
24.	13.	5.	8.	0.	3.	5.	8.	13.	5.	7.	2.	4.	6.	15.	28.
7.	10.	4.	1.	0.	2.	4.	20.	23.	8.	6.	3.	6.	8.	23.	27.
1.	4.	0.	0.	0.	2.	1.	20.	16.	13.	13.	0.	1.	14.	9.	8.
0.	0.	1.	0.	0.	4.	0.	5.	8.	10.	9.	0.	0.	6.	0.	0.
0.	0.	0.	0.	0.	1.	0.	1.	0.	5.	10.	0.	0.	3.	1.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4.	3.	5.	7.	4.	9.	6.	5.	2.	6.	4.	2.	4.	3.	2.	4.
23.	17.	11.	5.	1.	0.	9.	6.	17.	12.	3.	4.	3.	5.	13.	24.
[illegible]	5.	2.	5.	0.	3.	9.	14.	16.	4.	0.	2.	2.	2.	36.	31.
[illegible]	0.	1.	0.	0.	0.	2.	7.	8.	5.	5.	0.	0.	2.	14.	14.
[illegible]	0.	0.	0.	0.	1.	0.	3.	2.	1.	1.	0.	0.	1.	1.	0.
0.	0.	0.	0.	0.	0.	0.	0.	2.	3.	0.	0.	0.	0.	0.	0.

TOTAL NUMBER OF HOURS
USED = 2039 MISSING = 122 CALM = 21

TABLE 5-3 2ND QTR 1991 33FT JOINT FREQUENCY DISTRIBUTION FOR THE 33 FT LEVEL
CALCULATED FROM HOURLY AVERAGES FROM DISK

[illegible]EN STABILITY CLASSES ------ MAXIMUM WIND SPEEDS FOR EACH CATEGORY IN MPH ARE:
1 - 0.6 2 - 3.0 3 - 7.0 4 - 12.0 5 - 18.0 6 - 24.0

NUMBERS GIVEN ARE HOURS

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	0.	3.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	1.	0.	0.	0.	0.	2.	1.	0.	1.	2.	0.	0.	0.	0.
1.	0.	0.	0.	1.	0.	0.	1.	0.	0.	0.	0.	1.	0.	1.	0.
0.	0.	1.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	2.	1.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	1.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	1.	1.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.
4.	3.	1.	3.	2.	1.	1.	2.	3.	3.	1.	1.	4.	0.	2.	0.
12.	11.	5.	3.	2.	6.	8.	16.	14.	10.	8.	9.	11.	10.	12.	5.
13.	10.	7.	0.	2.	0.	3.	8.	16.	8.	5.	6.	14.	4.	7.	11.
8.	1.	0.	6.	1.	0.	0.	0.	3.	7.	3.	7.	3.	7.	3.	0.
3.	2.	1.	1.	0.	1.	0.	0.	1.	7.	5.	3.	4.	0.	4.	0.
1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	5.	0.	0.	0.	0.
0.	0.	0.	0.	0.	2.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.
4.	8.	1.	3.	4.	4.	5.	4.	5.	2.	3.	4.	2.	8.	8.	4.
12.	12.	9.	15.	6.	12.	23.	28.	24.	19.	12.	13.	11.	12.	18.	23.
13.	8.	11.	13.	1.	4.	14.	32.	36.	30.	13.	11.	6.	27.	24.	20.
12.	7.	2.	5.	3.	0.	4.	13.	10.	25.	17.	14.	8.	33.	31.	9.
1.	3.	1.	0.	0.	0.	0.	0.	0.	10.	3.	6.	2.	12.	3.	2.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	2.	0.	0.	0.	0.
0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.
8.	4.	3.	4.	5.	2.	5.	9.	7.	4.	4.	4.	4.	4.	8.	8.
3.	6.	10.	5.	2.	8.	15.	24.	24.	12.	13.	6.	10.	14.	14.	11.
1.	3.	1.	0.	1.	3.	5.	19.	13.	7.	3.	4.	8.	20.	14.	3.
1.	2.	0.	1.	0.	0.	0.	0.	2.	7.	1.	0.	1.	0.	2.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	1.	0.	0.	2.	3.	1.	7.	3.	5.	3.	0.	0.	2.	2.	2.
4.	5.	5.	1.	1.	2.	3.	23.	10.	1.	1.	2.	4.	4.	8.	13.
[illegible]	2.	1.	1.	0.	1.	0.	10.	7.	1.	0.	0.	0.	0.	1.	1.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL NUMBER OF HOURS
USED = 1757 MISSING = 428 CALM = 09

TABLE 5-4 2ND QTR 1991 245FT JOINT FREQUENCY DISTRIBUTION FOR THE 245 FT LEVEL CALCULATED FROM HOURLY AVERAGES FROM DISK

VEN STABILITY CLASSES ------ MAXIMUM WIND SPEEDS FOR EACH CATEGORY IN MPH ARE:
1 - 0.6 2 - 3.0 3 - 7.0 4 - 12.0 5 - 18.0 6 - 24.0

NUMBERS GIVEN ARE HOURS

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	0.	0.	1.	0.	0.	0.	0.	1.	0.	0.	0.
0.	1.	0.	2.	0.	1.	0.	0.	1.	0.	0.	0.	1.	0.	0.	0.
1.	0.	0.	0.	1.	0.	0.	1.	0.	0.	1.	0.	1.	0.	0.	0.
0.	1.	0.	0.	1.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	4.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	1.
3.	4.	3.	1.	3.	1.	2.	1.	5.	1.	0.	2.	1.	1.	0.	0.
8.	5.	7.	5.	2.	3.	14.	17.	14.	8.	6.	8.	4.	8.	6.	5.
14.	7.	2.	3.	1.	2.	3.	9.	11.	7.	8.	16.	7.	7.	10.	11.
2.	0.	2.	0.	2.	1.	2.	2.	14.	9.	2.	2.	3.	8.	1.	2.
8.	1.	0.	0.	0.	0.	0.	0.	2.	3.	8.	2.	0.	7.	2.	0.
0.	0.	0.	0.	0.	0.	0.	0.	4.	5.	5.	9.	0.	1.	1.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2.	6.	3.	4.	1.	0.	4.	2.	2.	0.	0.	1.	4.	7.	4.	4.
6.	15.	12.	5.	13.	8.	6.	11.	9.	16.	16.	16.	15.	9.	13.	17.
13.	9.	11.	4.	6.	9.	12.	16.	26.	24.	12.	9.	13.	25.	14.	14.
12.	4.	6.	2.	1.	4.	6.	8.	32.	32.	16.	12.	11.	24.	15.	15.
3.	3.	0.	1.	0.	0.	0.	8.	6.	12.	10.	9.	10.	37.	6.	3.
0.	5.	0.	0.	0.	0.	0.	0.	0.	13.	4.	8.	8.	22.	6.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.
1.	2.	1.	3.	3.	3.	4.	5.	2.	3.	0.	3.	2.	2.	1.	3.
2.	7.	5.	2.	1.	2.	6.	6.	10.	12.	13.	6.	5.	7.	5.	4.
3.	4.	4.	2.	0.	2.	2.	14.	14.	16.	7.	5.	16.	18.	11.	5.
1.	2.	2.	0.	1.	2.	6.	6.	13.	7.	4.	3.	10.	17.	9.	2.
0.	3.	0.	0.	0.	0.	0.	0.	2.	7.	0.	1.	9.	14.	3.	1.
0.	2.	0.	0.	0.	0.	0.	0.	0.	2.	0.	0.	0.	1.	0.	0.
0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	1.	0.	1.	0.	2.	1.	2.	0.	2.	4.	3.	4.	1.	0.	0.
2.	3.	5.	0.	1.	1.	2.	2.	8.	8.	4.	4.	1.	0.	6.	4.
1.	2.	3.	1.	2.	0.	3.	1.	4.	13.	0.	2.	1.	3.	5.	6.
[illegible]	1.	1.	0.	0.	0.	1.	1.	3.	2.	0.	1.	1.	1.	0.	5.
[illegible]	2.	0.	0.	0.	0.	0.	2.	0.	0.	0.	0.	1.	1.	0.	0.
0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL NUMBER OF HOURS
USED = 1756 MISSING = 429 CALM = 4

TABLE 5-5 3RD QTR 1991 33FT JOINT FREQUENCY DISTRIBUTION FOR THE 33 FT LEVEL
CALCULATED FROM HOURLY AVERAGES FROM DISK

EN STABILITY CLASSES ------ MAXIMUM WIND SPEEDS FOR EACH CATEGORY IN MPH ARE:
1 - 0.6 2 - 3.0 3 - 7.0 4 - 12.0 5 - 18.0 6 - 24.0

NUMBERS GIVEN ARE HOURS

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	1.	1.
0.	0.	2.	0.	0.	2.	2.	0.	0.	1.	1.	0.	0.	3.	1.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	1.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	1.	0.	1.	0.	1.	0.	0.	0.	0.	1.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	1.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.
12.	6.	9.	10.	4.	6.	2.	1.	5.	4.	3.	5.	5.	12.	11.	12.
17.	17.	21.	12.	12.	16.	14.	13.	15.	13.	6.	8.	16.	10.	28.	25.
10.	0.	5.	13.	10.	5.	7.	10.	4.	4.	4.	3.	1.	2.	3.	12.
0.	0.	0.	1.	3.	0.	0.	2.	2.	1.	0.	0.	4.	2.	1.	12.
0.	0.	0.	0.	0.	0.	0.	0.	0.	5.	0.	0.	0.	0.	1.	3.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.	2.	0.	0.
0.	0.	3.	2.	0.	0.	1.	1.	0.	0.	0.	0.	2.	0.	0.	0.
6.	6.	3.	4.	6.	2.	3.	8.	5.	3.	3.	4.	4.	7.	6.	7.
11.	16.	16.	14.	15.	20.	16.	17.	8.	11.	10.	9.	11.	10.	15.	17.
4.	3.	7.	14.	16.	15.	11.	5.	15.	2.	4.	3.	7.	15.	17.	25.
0.	0.	2.	1.	2.	1.	0.	1.	1.	10.	2.	1.	8.	4.	12.	7.
0.	0.	0.	0.	0.	0.	0.	0.	1.	17.	0.	2.	8.	6.	0.	4.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.	0.	0.
0.	0.	0.	1.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.
5.	10.	8.	8.	2.	2.	7.	7.	6.	8.	9.	3.	4.	4.	10.	3.
7.	4.	15.	7.	11.	11.	14.	11.	10.	19.	8.	4.	4.	13.	9.	6.
0.	2.	2.	6.	2.	7.	7.	3.	1.	3.	1.	1.	0.	9.	7.	5.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	1.	2.	0.	1.	0.	0.	0.	2.	0.	0.	1.	1.	0.	1.	1.
11.	14.	11.	14.	10.	9.	14.	14.	7.	9.	6.	6.	7.	3.	1.	11.
9.	19.	24.	13.	6.	13.	18.	19.	9.	9.	1.	0.	1.	6.	5.	9.
0.	1.	2.	1.	0.	0.	2.	3.	0.	1.	0.	0.	0.	4.	0.	1.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL NUMBER OF HOURS
USED = 1712 MISSING = 497 CALM = 25

TABLE 5-6 3RD QTR 1991 245FT JOINT FREQUENCY DISTRIBUTION FOR THE 245 FT LEVEL
CALCULATED FROM HOURLY AVERAGES FROM DISK

[illegible]EN STABILITY CLASSES ------ MAXIMUM WIND SPEEDS FOR EACH CATEGORY IN MPH ARE:
1 - 0.6 2 - 3.0 3 - 7.0 4 - 12.0 5 - 18.0 6 - 24.0

NUMBERS GIVEN ARE HOURS

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	1.	0.	1.	1.	0.	0.	2.	0.	0.	0.	0.	0.	0.	1.	2.
1.	1.	0.	2.	0.	0.	0.	1.	1.	0.	0.	0.	0.	0.	1.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	0.	1.	0.	1.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.
1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.
3.	2.	6.	8.	13.	4.	6.	7.	2.	4.	2.	4.	0.	1.	0.	2.
12.	17.	11.	17.	12.	29.	24.	24.	13.	7.	12.	8.	5.	2.	11.	10.
20.	13.	3.	2.	3.	5.	7.	25.	10.	10.	3.	9.	4.	3.	3.	13.
8.	0.	0.	0.	2.	0.	0.	5.	14.	6.	2.	1.	3.	6.	1.	10.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	5.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	10.	1.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	1.	0.	0.
1.	2.	1.	5.	2.	4.	5.	1.	1.	0.	0.	5.	1.	2.	1.	1.
8.	4.	11.	9.	8.	13.	15.	14.	9.	4.	4.	11.	6.	9.	5.	9.
10.	10.	8.	19.	8.	13.	16.	16.	20.	13.	1.	8.	10.	9.	12.	13.
8.	5.	0.	0.	1.	4.	2.	6.	12.	6.	3.	2.	9.	19.	11.	6.
0.	0.	0.	0.	0.	0.	0.	0.	2.	0.	0.	0.	4.	37.	5.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	2.	52.	1.	0.
0.	0.	0.	1.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.
0.	1.	1.	2.	1.	1.	0.	0.	3.	2.	5.	1.	4.	1.	0.	2.
4.	3.	3.	7.	6.	0.	3.	9.	11.	1.	2.	8.	5.	14.	6.	6.
2.	4.	5.	4.	1.	3.	11.	9.	8.	5.	6.	5.	8.	17.	13.	11.
0.	2.	2.	0.	1.	0.	2.	9.	6.	5.	2.	0.	2.	22.	13.	4.
0.	2.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	2.	5.	0.	0.
0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.
3.	3.	0.	2.	8.	6.	4.	5.	7.	8.	2.	2.	2.	0.	1.	1.
4.	10.	11.	8.	7.	8.	19.	16.	13.	11.	8.	5.	12.	4.	7.	12.
[illegible]	5.	7.	2.	2.	2.	2.	16.	7.	9.	0.	2.	1.	4.	22.	12.
[illegible]	2.	3.	0.	0.	0.	0.	1.	2.	2.	0.	0.	1.	4.	7.	4.
[illegible]	0.	2.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL NUMBER OF HOURS
USED = 1712 MISSING = 797 CALM = 4

TABLE 5-7 4ND QTR 1991 33FT JOINT FREQUENCY DISTRIBUTION FOR THE 33 FT LEVEL
CALCULATED FROM HOURLY AVERAGES FROM DISK

[illegible]EN STABILITY CLASSES ------ MAXIMUM WIND SPEEDS FOR EACH CATEGORY IN MPH ARE:
1 - 0.6 2 - 3.0 3 - 7.0 4 - 12.0 5 - 18.0 6 - 24.0

NUMBERS GIVEN ARE HOURS

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	1.	2.	1.	1.
0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	1.	1.
2.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	4.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	2.	0.	2.	0.	0.	1.	1.	0.	1.	0.	0.	1.
14.	13.	7.	2.	5.	1.	2.	4.	4.	5.	3.	7.	3.	10.	16.	12.
12.	8.	3.	0.	0.	2.	7.	6.	4.	5.	4.	3.	8.	21.	19.	22.
10.	1.	0.	0.	0.	2.	6.	6.	8.	4.	0.	5.	7.	28.	15.	17.
1.	0.	0.	0.	0.	0.	4.	8.	7.	0.	0.	0.	2.	7.	8.	3.
0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	1.	1.	0.	0.	4.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	2.	1.	0.	3.	0.	0.
0.	0.	1.	1.	0.	0.	0.	2.	2.	1.	1.	3.	2.	1.	0.	2.
13.	9.	6.	4.	9.	15.	19.	23.	22.	21.	8.	22.	38.	32.	29.	11.
18.	13.	4.	2.	1.	17.	45.	40.	18.	10.	12.	8.	27.	72.	47.	31.
2.	1.	0.	0.	0.	9.	36.	25.	12.	6.	3.	9.	28.	25.	14.	2.
0.	0.	0.	0.	0.	0.	15.	19.	26.	10.	0.	2.	13.	13.	6.	4.
0.	0.	0.	0.	0.	0.	0.	4.	17.	6.	0.	0.	2.	3.	3.	0.
0.	0.	0.	0.	0.	0.	0.	0.	7.	3.	6.	2.	2.	0.	0.	1.
0.	0.	0.	1.	0.	1.	1.	0.	0.	4.	0.	3.	1.	2.	1.	0.
7.	7.	1.	0.	3.	3.	11.	10.	10.	6.	4.	7.	10.	15.	9.	9.
6.	3.	1.	0.	0.	5.	20.	25.	21.	8.	6.	8.	21.	16.	21.	14.
0.	1.	0.	0.	0.	0.	24.	22.	7.	5.	1.	9.	9.	13.	3.	0.
0.	0.	0.	0.	0.	0.	5.	9.	6.	0.	1.	1.	1.	2.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	1.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	2.	0.	1.	0.	1.	1.	1.	1.	0.	0.	1.	1.	1.	0.
21.	12.	5.	3.	3.	1.	10.	5.	4.	5.	2.	9.	7.	6.	20.	21.
11.	7.	0.	1.	0.	2.	9.	6.	5.	4.	4.	0.	4.	16.	9.	12.
0.	0.	0.	0.	0.	0.	9.	10.	1.	0.	0.	3.	2.	2.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TOTAL NUMBER OF HOURS
USED = 2110 MISSING = 98 CALM = 48

TABLE 5-8 4ND QTR 1991 245FT JOINT FREQUENCY DISTRIBUTION FOR THE 245 FT LEVEL
CALCULATED FROM HOURLY AVERAGES FROM DISK

[illegible]VEN STABILITY CLASSES ------ MAXIMUM WIND SPEEDS FOR EACH CATEGORY IN MPH ARE:
1 - 0.6 2 - 3.0 3 - 7.0 4 - 12.0 5 - 18.0 6 - 24.0

NUMBERS GIVEN ARE HOURS

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	0.	1.	0.	1.	0.	0.	1.	0.
0.	0.	1.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	1.	0.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.
2.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.
1.	1.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	2.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	1.	0.	1.	1.	0.	0.	0.	2.	1.	2.	0.	1.	0.	2.	2.
10.	13.	8.	3.	5.	6.	3.	6.	4.	4.	4.	5.	2.	1.	7.	12.
15.	8.	4.	2.	0.	1.	2.	6.	5.	6.	6.	4.	6.	7.	6.	17.
20.	4.	0.	2.	0.	0.	1.	2.	7.	4.	2.	2.	3.	19.	18.	21.
2.	2.	0.	0.	0.	0.	0.	6.	13.	13.	1.	2.	2.	14.	10.	7.
0.	1.	0.	0.	0.	0.	0.	2.	0.	1.	0.	0.	0.	2.	3.	3.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.	3.	1.	3.	0.	4.
19.	14.	8.	8.	6.	13.	13.	25.	23.	9.	6.	3.	2.	29.	46.	32.
10.	5.	1.	5.	1.	5.	5.	13.	18.	12.	6.	10.	11.	15.	19.	7.
14.	5.	1.	4.	1.	3.	17.	22.	11.	16.	12.	6.	5.	20.	23.	13.
8.	7.	4.	1.	0.	1.	9.	21.	15.	10.	3.	11.	4.	20.	22.	18.
2.	1.	0.	0.	0.	0.	4.	13.	19.	21.	4.	8.	8.	27.	9.	8.
2.	0.	0.	0.	0.	0.	0.	5.	15.	18.	10.	1.	4.	17.	6.	3.
0.	0.	0.	0.	0.	0.	0.	0.	5.	24.	7.	0.	4.	9.	5.	2.
1.	2.	2.	3.	3.	0.	1.	6.	8.	0.	0.	4.	3.	2.	11.	0.
1.	0.	3.	2.	0.	4.	6.	3.	8.	7.	2.	6.	7.	7.	8.	5.
7.	7.	3.	6.	3.	1.	4.	10.	5.	13.	8.	7.	12.	5.	11.	6.
2.	1.	2.	0.	0.	0.	7.	14.	14.	12.	2.	2.	2.	6.	6.	2.
0.	0.	0.	0.	0.	0.	1.	17.	10.	9.	4.	2.	7.	19.	4.	8.
0.	0.	0.	0.	0.	0.	0.	3.	14.	5.	0.	1.	3.	10.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	4.	0.	0.	2.	4.	0.	0.
0.	0.	1.	1.	0.	0.	1.	3.	0.	0.	0.	0.	0.	0.	1.	1.
1.	2.	4.	8.	4.	0.	3.	3.	8.	4.	1.	1.	4.	3.	4.	4.
7.	8.	6.	6.	3.	4.	5.	16.	13.	13.	4.	3.	9.	5.	9.	11.
0.	0.	1.	0.	0.	0.	2.	11.	5.	5.	1.	2.	2.	6.	14.	1.
[illegible]	0.	0.	0.	0.	0.	0.	2.	4.	5.	0.	0.	0.	4.	4.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.	6.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.

TOTAL NUMBER OF HOURS
USED = 2098 MISSING = 110 CALM = 324

TABLE 5-9 ANNUAL 1991 33FT JOINT FREQUENCY DISTRIBUTION FOR THE 33 FT LEVEL
CALCULATED FROM HOURLY AVERAGES FROM DISK

GIVEN STABILITY CLASSES ------ MAXIMUM WIND SPEEDS FOR EACH CATEGORY IN MPH ARE:
1 - 0.6 2 - 3.0 3 - 7.0 4 - 12.0 5 - 18.0 6 - 24.0

NUMBERS GIVEN ARE HOURS

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	0.	0.	0.	0.	2.	0.	3.	0.	0.	1.	0.	1.	2.	2.	2.
0.	0.	3.	0.	1.	2.	2.	2.	1.	2.	2.	2.	0.	3.	1.	1.
1.	0.	0.	0.	1.	0.	0.	1.	0.	0.	0.	0.	1.	1.	2.	1.
0.	0.	1.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	2.	1.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2.	0.	0.	0.	1.	0.	0.	0.	1.	0.	0.	0.	1.	0.	1.	1.
2.	1.	0.	1.	1.	1.	0.	1.	0.	0.	0.	0.	2.	0.	1.	0.
0.	0.	0.	0.	0.	0.	0.	1.	1.	0.	0.	0.	0.	0.	5.	1.
0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	1.	1.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	1.	2.	2.	2.	1.	2.	0.	0.	1.	1.	1.	1.	1.	1.	2.
38.	25.	21.	16.	11.	10.	5.	9.	14.	16.	8.	14.	13.	27.	32.	28.
49.	42.	31.	16.	14.	25.	29.	42.	35.	29.	18.	21.	36.	44.	68.	71.
38.	12.	12.	13.	12.	7.	16.	27.	32.	20.	11.	15.	24.	36.	28.	50.
9.	2.	0.	7.	4.	0.	4.	13.	15.	16.	6.	11.	13.	16.	13.	15.
3.	2.	1.	1.	0.	1.	0.	0.	1.	17.	6.	6.	4.	1.	9.	3.
1.	0.	0.	0.	0.	0.	0.	0.	1.	2.	2.	6.	2.	6.	0.	0.
3.	1.	4.	3.	0.	4.	1.	3.	3.	2.	1.	4.	5.	6.	7.	5.
46.	38.	21.	13.	21.	28.	35.	48.	43.	35.	27.	39.	51.	63.	64.	47.
74.	56.	54.	33.	22.	53.	92.	116.	73.	57.	40.	36.	61.	111.	116.	133.
35.	17.	28.	27.	17.	28.	76.	100.	98.	56.	30.	27.	43.	83.	68.	75.
27.	7.	4.	6.	5.	1.	20.	41.	55.	70.	27.	18.	30.	58.	57.	35.
1.	4.	1.	0.	0.	0.	0.	4.	18.	41.	9.	8.	12.	23.	6.	6.
1.	0.	0.	0.	0.	0.	0.	0.	7.	11.	16.	4.	2.	3.	0.	1.
2.	4.	1.	2.	0.	1.	2.	0.	2.	4.	0.	5.	1.	3.	4.	1.
35.	34.	19.	14.	14.	8.	26.	29.	32.	30.	27.	22.	29.	34.	46.	38.
41.	20.	31.	14.	13.	24.	52.	70.	80.	51.	34.	25.	41.	60.	88.	64.
2.	8.	9.	6.	3.	10.	42.	87.	48.	30.	8.	15.	20.	59.	39.	10.
1.	2.	0.	1.	0.	0.	5.	18.	17.	19.	6.	1.	3.	6.	3.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	6.	2.	0.	1.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	1.	1.	0.	0.	0.	0.	0.	0.
1.	3.	3.	1.	3.	0.	1.	1.	3.	3.	0.	1.	3.	2.	3.	4.
51.	42.	25.	20.	17.	14.	27.	34.	28.	28.	19.	25.	19.	19.	42.	52.
55.	53.	35.	18.	7.	17.	32.	63.	39.	25.	7.	5.	10.	28.	65.	85.
[illegible]	4.	4.	3.	0.	1.	13.	41.	24.	5.	0.	4.	2.	8.	5.	4.
[illegible]	0.	0.	0.	0.	0.	0.	5.	4.	4.	0.	0.	1.	0.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	2.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.

TOTAL NUMBER OF HOURS
USED = 7613 MISSING = 1147 CALM = 134

TABLE 5-10 ANNUAL 1991 245FT JOINT FREQUENCY DISTRIBUTION FOR THE 245 FT LEVEL
CALCULATED FROM HOURLY AVERAGES FROM DISK

EN STABILITY CLASSES ------ MAXIMUM WIND SPEEDS FOR EACH CATEGORY IN MPH ARE:
1 - 0.6 2 - 3.0 3 - 7.0 4 - 12.0 5 - 18.0 6 - 24.0

NUMBERS GIVEN ARE HOURS

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	0.	0.	2.	0.	1.	0.	1.	1.	0.	1.	0.
0.	2.	1.	3.	1.	2.	0.	2.	1.	0.	0.	0.	1.	1.	1.	4.
2.	1.	0.	2.	1.	0.	0.	2.	2.	0.	1.	0.	1.	0.	1.	1.
0.	1.	0.	0.	1.	0.	0.	0.	0.	0.	0.	1.	0.	1.	0.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	5.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.
2.	0.	0.	1.	1.	0.	1.	0.	1.	0.	0.	0.	0.	0.	1.	0.
1.	1.	1.	1.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	2.
0.	0.	0.	0.	0.	0.	0.	2.	0.	1.	0.	0.	0.	0.	1.	2.
1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	1.	2.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	1.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	2.	0.	1.	1.	0.	0.	0.	3.	1.	2.	0.	1.	0.	2.	5.
20.	23.	19.	14.	21.	11.	12.	14.	14.	13.	7.	12.	4.	8.	9.	21.
43.	33.	22.	25.	14.	33.	42.	51.	33.	21.	27.	20.	17.	18.	35.	48.
58.	25.	7.	7.	4.	7.	11.	40.	31.	21.	14.	27.	16.	35.	35.	59.
12.	2.	2.	0.	4.	5.	2.	13.	51.	34.	10.	7.	8.	28.	13.	22.
8.	2.	0.	0.	0.	1.	0.	2.	2.	10.	9.	4.	1.	14.	5.	3.
0.	0.	0.	0.	0.	0.	0.	0.	4.	7.	8.	12.	1.	16.	2.	4.
19.	18.	8.	9.	6.	13.	13.	25.	24.	13.	8.	4.	2.	30.	48.	33.
29.	23.	11.	19.	6.	14.	18.	24.	30.	20.	15.	22.	25.	34.	33.	41.
55.	43.	35.	24.	22.	27.	46.	70.	56.	49.	35.	38.	36.	55.	65.	82.
56.	41.	33.	24.	14.	23.	47.	82.	88.	57.	21.	31.	30.	63.	79.	81.
30.	12.	8.	2.	2.	9.	14.	39.	87.	80.	31.	25.	35.	90.	46.	41.
15.	4.	0.	1.	0.	1.	2.	16.	34.	48.	33.	11.	18.	97.	21.	15.
1.	5.	0.	0.	0.	0.	0.	0.	5.	46.	37.	9.	14.	86.	13.	2.
2.	4.	2.	4.	4.	1.	2.	6.	9.	0.	0.	4.	3.	2.	13.	0.
9.	11.	14.	9.	10.	11.	15.	15.	16.	16.	15.	13.	15.	15.	17.	16.
37.	30.	16.	23.	10.	6.	18.	33.	39.	31.	30.	23.	26.	32.	37.	44.
14.	19.	15.	7.	1.	7.	24.	57.	59.	41.	21.	15.	32.	49.	53.	45.
2.	8.	4.	0.	2.	4.	10.	52.	45.	34.	23.	5.	20.	72.	35.	22.
0.	5.	1.	0.	0.	4.	0.	8.	24.	23.	9.	2.	14.	35.	3.	1.
0.	2.	1.	0.	0.	1.	0.	1.	1.	11.	10.	0.	2.	8.	1.	0.
0.	0.	1.	1.	1.	1.	1.	4.	0.	0.	0.	0.	0.	0.	1.	1.
8.	9.	9.	18.	16.	17.	14.	15.	17.	20.	11.	8.	14.	7.	7.	9.
36.	38.	33.	19.	12.	13.	35.	40.	51.	44.	19.	15.	24.	14.	35.	51.
[illegible]	12.	13.	8.	4.	5.	16.	42.	32.	31.	1.	8.	6.	15.	77.	50.
[illegible]	3.	5.	0.	0.	0.	3.	11.	17.	14.	5.	1.	2.	11.	25.	23.
[illegible]	2.	2.	0.	0.	1.	0.	5.	2.	1.	1.	0.	3.	9.	1.	0.
0.	1.	0.	0.	0.	0.	0.	0.	2.	4.	0.	0.	0.	0.	0.	0.

TOTAL NUMBER OF HOURS
USED = 7603 MISSING = 1157 CALM = 359

6.0 DOSE ASSESSMENT IMPACT ON MAN

Liquid Effluents - The doses to the maximum individual from WNP-2 liquid effluents were calculated using the LADTAP II computer code and the site specific input parameters.

Table 6-1 lists the doses to the maximum individual by calendar quarters, respectively. In response to the NRC Consultant's Review Report, the near-field dilution factor was changed from 2000 to 500 and the flow rate was changed from 1.8 to 2.0 cubic feet per second to be consistent with the requirements of NUREG-0133 "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants."

The doses by calendar quarters to the average exposed individual are listed in Table 6-2. The 50-mile population doses by calendar quarters are listed in Table 6-3. Table 6-4 provides annual dosages to the average individual and 50-mile population doses from liquid effluents. All doses were calculated using the LADTAP II computer code.

An evaluation of the nearest orchard (approximately 3 miles downstream) using Columbia River water for its irrigation showed an adult total body dose value of 1.9E-05 mrem/yr, thyroid dose of 2.1E-06 mrem/yr, and an organ dose value of 5.6E-05 mrem/yr. The population doses at this location showed a total body value of 5.6E-05 person-rem, thyroid dose of 4.6E-06 person-rem, and an organ value of 1.3E-04 person-rem.

Gaseous Effluents - The NRC computer code GASPAR II was used to calculate doses at and beyond the site boundary. Table 6-5 furnishes a summary of quarterly air and organ doses. It also provides the annual total body and skin doses at and beyond the site boundary. Table 6-6 lists the annual 50-mile dose using values obtained from the ALARA annual Integrated population dose summary (person-rem). Table 6-6 also provides the annual individual doses associated with each pathway. These values were obtained by dividing the ALARA integrated dose (person-rem) by the 50-mile population (252,356 year 1987) and converting to mrem. The GASPAR II runs utilized quarterly and annual meteorological data and site specific input parameters pertaining to food productions.

6.1 Exposure to "A Member of the Public"

The WNP-2 Visitor Center was evaluated for assessment of radiation doses to "Members of the Public", due to their activities within the site boundary. The ODCM assumes an eight (8) hour per year occupancy by "A Member of the Public" at the Visitor Center. The dose assessment resulted in an annual calculated whole body dose of 4.2E-04 mrem. The annual thyroid dose was 2.8E-03 mrem and the maximum dose to any other organ was 9.1E-04 mrem. The air dose contribution was as follows; Beta air dose was 4.4E-03 mrad and the Gamma air dose was 4.8E-03 mrad. The direct radiation contribution from

TLD results calculated to an average of 1.4E-01 mrem per eight hour period.

The annual assessment of radiation doses to the most likely exposed "Member of the Public" to show conformance with 40CFR Part 190 is assumed to be located in the Taylor Flats vicinity (6.4 miles in a Southeasterly direction). The NRC Gaspar II computer code with annual source terms and XOQDOQ meteorological data was used to obtain the dose assessment from gaseous effluents. It is assumed there is no dose contribution from liquid effluents at this location. The assessment of the maximum age group resulted in annual calculated total body dose of 1.5E-03 mrem. The annual thyroid dose was 6.3E-O2 mrem and the maximum dose to any other organ was 2.9E-03 mrem. Exposure pathways were ground, meat, cow milk and inhalation. The air dose contribution was as follows: Beta air dose was 1.3E-02 mrad/yr and the Gamma air dose was 9.7E-03 mrad/yr.

An annual assessment of radiation doses to a "Member of the Public" was also made at a location in the vicinity of 4.8 miles southeast. This location receives irrigation water from the Columbia River as mentioned in paragraph 6.0 above. The annual GASPAR II computer run resulted in a child total body dose of 4.1E-03 mrem. The annual child age group thyroid dose was 6.0E-O2 mrem and the maximum dose to any other organ for the child age group was 4.6E-02 mrem. The annual Beta air dose was 1.9E-02 mrad and the Gamma air dose was 1.4E-02 mrad. The annual dose contribution due to liquid releases using vegetation from the irrigated food pathway and the child age group of the NRC LADTAP II computer run showed a total body dose of 4.5E-05 mrem. The annual thyroid dose was 4.5E-06 mrem and the maximum dose to any other organ was 7.9E-05 mrem.

The direct radiation contribution showed no significant amount above normal background. The 1991 average TLD summary was 94 mrem per year.

It should be noted that the method for calculating the annual dose to the maximum organ, as detailed in the ODCM, sums the dose from the maximum organ in each calendar quarter for different organs. As a result, the maximum organ dose may not represent the maximum dose to any one particular organ for that particular time period. Actual specific organ doses will be less than or equal to this calculated value.

The alternative; manually summing the doses for each quarter, organ, age group, and designated exposure pathway (as identified in GASPAR II computer output) would require our staff to greatly increase the effort and complexity of this calculation.

Both methods employed for estimating the highest dose to any organ for a particular age group, as detailed above, use conservatism in calculating the maximum organ doses. This conservatism is recognized by the licensee and is intentional.

Table 6-1

MAXIMUM INDIVIDUAL DOSES FROM WNP-2 LIQUID EFFLUENTS

1ST AND 2ND QUARTERS 1991

First Quarter 1991				
Pathway	Total Body (mrem/qtr)	1991 Cumulative Total Body (mrem/yr)	Max. Organ (mrem/qtr)	1991 Cumulative Max. Organ (mrem/yr)
Fishing Drinking Shoreline Swimming Boating Vegetables Leafy Veg. Milk Meat	No Liquid Releases During The 1st Quarter	No Liquid Releases During The 1st Quarter	No Liquid Releases During The 1st Quarter	No Liquid Releases During The 1st Quarter
	=======	=======	=======	=======
Total				

Second Quarter 1991				
Pathway	Total Body (mrem/qtr)	1991 Cumulative Total Body (mrem/yr)	Max. Organ (mrem/qtr)	1991 Cumulative Max. Organ (mrem/yr)
Fishing	4.6E-03	4.6E-03	7.8E-03	7.8E-03
Drinking	1.5E-06	1.5E-06	3.5E-06	3.5E-06
Shoreline	1.1E-05	1.1E-05	1.2E-05	1.2E-05
Swimming	2.1E-08	2.1E-08	2.1E-08	2.1E-08
Boating	2.4E-06	2.4E-06	3.4E-06	3.4E-06
Vegetables	5.8E-06	5.8E-06	1.5E-05	1.5E-05
Leafy Veg.	2.2E-06	2.2E-06	6.4E-06	6.4E-06
Milk	4.6E-06	4.6E-06	6.2E-06	6.2E-06
Meat	9.0E-07	9.0E-07	2.7E-06	2.7E-06
	=======	=======	=======	=======
Total	4.6E-03	4.6E-03	7.8E-03	7.8E-03

Table 6-1

MAXIMUM INDIVIDUAL DOSES FROM WNP-2 LIQUID EFFLUENTS (1)

3RD AND 4TH QUARTERS 1991

Third Quarter 1991				
Pathway	Total Body (mrem/qtr)	1991 Cumulative Total Body (mrem/yr)	Max. Organ (mrem/qtr)	1991 Cumulative Max. Organ (mrem/yr)
Fishing	1.4E-04	4.7E-03	3.1E-04	8.1E-03
Drinking	1.2E-07	1.6E-06	2.9E-07	3.8E-06
Shoreline	7.4E-06	1.8E-05	7.4E-06	1.9E-05
Swimming	1.3E-08	3.4E-08	1.3E-08	3.4E-08
Boating	2.5E-07	2.7E-06	2.5E-07	3.7E-06
Vegetables	4.1E-07	6.2E-06	1.7E-06	1.7E-05
Leafy Veg.	1.5E-07	2.4E-06	7.2E-07	7.1E-06
Milk	5.4E-07	5.1E-06	2.5E-07	6.5E-06
Meat	9.3E-08	9.9E-07	3.3E-07	3.0E-06
Total	1.5E-04	4.8E-03	3.2E-04	8.2E-03

Fourth Quarter 1991				
Pathway	Total Body (mrem/qtr)	1991 Cumulative Total Body (mrem/yr)	Max. Organ (mrem/qtr)	1991 Cumulative Max. Organ (mrem/yr)
Fishing	3.8E-04	5.1E-03	8.1E-04	8.9E-03
Drinking	6.7E-07	2.3E-06	1.7E-06	5.4E-06
Shoreline	5.3E-06	2.4E-05	6.2E-06	2.6E-05
Swimming	8.7E-09	4.3E-08	8.7E-09	4.3E-08
Boating	9.7E-07	3.6E-06	9.7E-07	4.6E-06
Vegetables	1.3E-06	7.5E-06	6.1E-06	2.3E-05
Leafy Veg.	4.5E-07	2.8E-06	2.5E-06	9.6E-06
Milk	7.5E-07	5.9E-06	1.5E-06	7.9E-06
Meat	2.4E-07	1.2E-06	1.0E-06	4.0E-06
Total	3.9E-04	5.2E-03	8.3E-04	9.0E-03

(1) Age Group - Adult: Maximum individual resides at Richland and fishes near the WNP-2 outfall area.

Table 6-2

AVERAGE INDIVIDUAL DOSES FROM WNP-2 LIQUID EFFLUENTS

1ST AND 2ND QUARTERS 1991

	Total per 1st Quarter		Total per 2nd Quarter	
Pathway	Total Body (mrem)	Max. Organ (mrem)	Total Body (mrem)	Max. Organ (mrem)
Fishing	There Were	No Liquid	8.1E-06	2.1E-05
Drinking			1.1E-06	1.7E-06
Shoreline	Releases	During	8.3E-07	8.4E-07
Swimming			4.7E-09	4.7E-09
Boating	The 1st	Quarter	1.2E-09	1.2E-09
Vegetables (a)			4.2E-06	8.3E-06
Leafy Veg. (a)			1.0E-06	2.5E-06
Milk (a)			3.4E-07	3.2E-07
Meat (a)			1.6E-07	3.8E-07
	=======	=======	=======	=======
Total			1.6E-05	3.5E-05

3RD AND 4TH QUARTERS 1991

	Total per 3rd Quarter		Total per 4th Quarter	
Pathway	Total Body (mrem)	Max. Organ (mrem)	Total Body (mrem)	Max. Organ (mrem)
Fishing	4.6E-07	1.0E-06	1.3E-06	2.7E-06
Drinking	7.0E-08	2.2E-07	3.1E-07	8.4E-07
Shoreline	1.0E-07	1.0E-07	4.0E-07	4.7E-07
Swimming	5.1E-10	5.1E-10	1.9E-09	1.9E-09
Boating	1.3E-10	1.3E-10	4.8E-10	4.8E-10
Vegetables (a)	3.9E-09	1.1E-08	1.2E-08	3.9E-08
Leafy Veg. (a)	7.9E-08	3.2E-07	2.3E-07	1.0E-06
Milk (a)	2.3E-08	4.0E-08	6.1E-08	1.1E-07
Meat (a)	1.9E-08	4.6E-08	4.2E-08	1.4E-07
	=======	=======	=======	=======
Total	7.6E-07	1.7E-06	2.3E-06	5.3E-06

(a) Values are obtained by dividing the total population ALARA dose by the total population served from irrigated production and converted to mrem.

Table 6-3

50-MILE POPULATION DOSES FROM WNP-2 LIQUID EFFLUENTS

1ST AND 2ND QUARTERS 1991

	Total per 1st Quarter		Total per 2nd Quarter	
Pathway	Total Body (per-rem)	Max. Organ (per-rem)	Total Body (per-rem)	Max. Organ (per-rem)
Fishing	There Were No		3.2E-05	6.0E-05
Drinking			5.9E-05	1.2E-04
Shoreline	Liquid Batch		1.5E-04	1.7E-04
Swimming			8.3E-07	8.3E-07
Boating	Releases During		2.1E-07	2.1E-07
Vegetables			4.7E-07	9.0E-07
Leafy Veg.	The First		1.0E-05	2.5E-05
Milk			3.2E-06	6.3E-06
Meat	Quarter		1.6E-06	3.8E-06
	=======	=======	=======	=======
Total			2.6E-04	3.9E-04

3RD AND 4TH QUARTERS 1991

	Total per 3rd Quarter		Total per 4th Quarter	
Pathway	Total Body (per-rem)	Max. Organ (per-rem)	Total Body (per-rem)	Max. Organ (per-rem)
Fishing	1.1E-06	2.3E-06	3.0E-06	6.0E-06
Drinking	6.0E-06	1.5E-05	2.5E-05	5.6E-05
Shoreline	1.8E-05	2.1E-05	7.0E-05	8.2E-05
Swimming	8.9E-08	8.9E-08	3.4E-07	3.4E-07
Boating	2.2E-08	2.2E-08	8.5E-08	8.5E-08
Vegetables	3.9E-08	1.1E-07	1.2E-07	3.9E-07
Leafy Veg.	7.9E-07	3.2E-06	2.3E-06	1.0E-05
Milk	2.0E-07	3.8E-07	5.8E-07	1.1E-06
Meat	1.7E-07	4.6E-07	4.2E-07	1.4E-06
	=======	=======	=======	=======
Total	2.6E-05	4.3E-05	1.0E-04	1.6E-04

Table 6-4

ANNUAL LADTAP II RESULTS FOR 1991

A. AVERAGE INDIVIDUAL DOSES FROM WNP-2 LIQUID EFFLUENTS

For Annual of 1991		
Pathway	Total Body (mrem)	Max. Organ (mrem)
Fishing	1.7E-05	3.0E-05
Drinking	1.1E-06	2.8E-06
Shoreline	1.3E-06	1.3E-06
Swimming	7.2E-09	7.2E-09
Boating	1.8E-09	1.8E-09
Vegetables (a)	6.3E-08	1.4E-07
Leafy Veg. (a)	1.4E-06	3.8E-06
Milk (a)	4.2E-07	8.2E-07
Meat (a)	2.2E-07	5.6E-07
	=======	=======
Total	2.2E-05	3.9E-05

B. 50-MILE POPULATION DOSES FROM WNP-2 LIQUID EFFLUENTS

For Annual of 1991		
Pathway	Total Body (Per-Rem)	Max. Organ (Per-Rem)
Fishing	3.6E-05	6.8E-05
Drinking	9.1E-05	1.9E-04
Shoreline	2.3E-04	2.8E-04
Swimming	1.3E-06	1.3E-06
Boating	3.2E-07	3.2E-07
Vegetables	6.3E-07	1.4E-06
Leafy Veg.	1.4E-05	3.8E-05
Milk	4.0E-06	7.8E-06
Meat	2.2E-06	5.7E-06
	=======	=======
Total	3.8E-04	5.9E-04

(a) Values are obtained by dividing the total population ALARA dose by the total population served from irrigated production and converted to mrem.

Table 6-5

SUMMARY OF DOSES FROM WNP-2 GASEOUS EFFLUENTS

1991

(1)
Location: 1.2 miles site boundary
Reporting Period: Calendar Quarters Plus Annual Cumulative, 1991

	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Annual Cumulative
Beta air dose (mrad)*	2.0E-02	3.7E-03	7.9E-05	1.5E-01	1.8E-01
Gamma air dose (mrad)*	1.1E-02	5.1E-03	4.7E-05	1.3E-01	1.5E-01

(2)
Location: Beyond Site Boundary 4.2 miles ESE
Reporting Period: Calendar Quarters Plus Annual Cumulative, 1991

	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Annual Cumulative
Beta air dose (mrad)*	1.4E-03	2.2E-04	9.5E-06	4.8E-02	5.0E-02
Gamma air dose (mrad)*	1.1E-03	2.9E-04	9.0E-06	3.7E-02	3.9E-02

(3)
Location: Site Boundary
Reporting Period: Annual

Annual Total Body Dose (mrem) = 9.8E-03
Annual Skin Dose (mrem) = 1.1E-02

(4)
Location: Beyond Site Boundary
Reporting Period: Annual

Annual Total Body Dose (mrem) = 4.4E-03
Annual Skin Dose (mrem) = 3.1E-03

Table 6-5 (continued)

(5)
Location: The typical sampling location having the highest annual cumulative organ dose based on Land Use Census. 4.2 miles ESE (ground, vegetables, and inhalation pathways).
Reporting Period: Calendar Quarters Plus Annual Cumulative, 1991

	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Annual Cumulative
Maximum organ dose (mrem)**	8.8E-03	7.6E-03	3.5E-02	7.9E-02	1.3E-01

* Technical Specification 3.11.2.2.
** Technical Specification 3.11.2.3.

Table 6-6

A. 50-MILE POPULATION DOSES FROM 1991 GASEOUS EFFLUENTS

Exposure Pathway	Total Body (Person-Rem)	Max. Organ (Person-Rem)
Plume	1.8E-01	1.8E-01
Ground	1.0E-02	1.0E-02
Inhalation	1.1E-02	4.7E-01
Vegetables	1.1E-02	1.4E-02
Milk	3.3E-03	8.4E-02
Meat	1.9E-03	6.3E-03
Total	2.1E-01	7.7E-01

B. AVERAGE INDIVIDUAL DOSES FROM 1991 GASEOUS EFFLUENTS(a)

Population => 2.5E+05

Exposure Pathway	Total Body (mrem)	Max. Organ (mrem)
Plume	7.0E-04	7.2E-04
Ground	4.0E-05	4.0E-05
Inhalation	4.3E-05	1.9E-03
Vegetables	4.5E-05	5.7E-05
Milk	1.3E-05	3.3E-04
Meat	7.5E-06	2.5E-05
Total	8.5E-04	3.0E-03

(a) The 50 mile population doses divided by the population within 50 miles of the Plant by direction and radii interval and converted to mrem.

7.0 REVISIONS TO THE ODCM

During this reporting period Amendment number 10 to the Offsite Dose Calculation Manual (ODCM) was reviewed and approved by the Plant Operations Committee (POC).

7.1 This rationale is intended to provide sufficient information to support the changes made to the WNP-2 Offsite Dose Calculation Manual (ODCM) for Amendment 10.

Description of Change	Reason for Change
1) Page 97: Editorial Changes to Section 5.4.	Clarity of terminology.
2) Page 104: Provide sample types for stations 9A,9B, and 9C.	Provide clarification of sample Types at 9A (air, soil and TLD); 9B (milk); and 9C (produce).
3) Page 105: To correct directional locations for sample stations 31, 32, and 38A.	Stations 31 and 32 are ESE and not E as previously stated. Station 38A is at the Snake river to the E (30 miles).
4) Pages 101, 106, and 107: Change in milk sampling location; removed station 63; inserted station 40. Inserted station 61 for annual cherry collection. Sample station 96 designated as a control station; the distance to sample station 91 was changed.	Milk no longer produced from Station 63. Station 40 is a replacement. Station 61 was added as an additional sampling station to provide consistency with the current monitoring program. Station 96 is being used as a control sampling location. The distance to sample station 91 was changed to reflect its distance from the site more accurately.
5) Pages 109 and 110: Provided updated maps for sample locations.	Due to changes in sampling stations it became necessary to update maps providing locations of such within and beyond 10 mile radius.
6) Page 116: 6.1.1.1 correct typographical error(s)	Typographical error missed in review cycle of RETS submittal.

Description of Change	Reason for Change
7) Page 117: Table 6.1.1.1-1	Typographical error missed in review of RETS.
8) Pages 119, 120, and 127: To revise tables 6.1.1.1.1-1 and 6.1.2.1.1-1 to reflect the actual capabilities of radiological effluent monitoring instruments.	To clarify the capabilities of the radiological effluent monitors as described in the ODCM and discussed in LER 91-013-2. Editorial change due to organization name change.
9) Page 130: Table 6.2.1.1.1-1	Typographical error missed in review cycle of RETS submittal.
10) Page 136: Table 6.2.2.1.2-1 To change the sampling requirement for tritium. (This is currently numbered as 6.2.2.1.1.2-1; which will be corrected)	FSAR section 11.1.3, Tritium states that the prime source of tritium is from activation of deuterium in the reactor core. The activation rate of deuterium is directly related to reactor thermal power and does not show any spiking behavior, as iodine does, when fuel defects are present. The purpose of note b in Table 6.2.2.1.2-1 is to detect changes in effluent activity as a result of startups, shutdowns, and thermal changes of greater than 15% in one hour; that is , changes caused by iodine spiking and associated fission gasses. The current practice of weekly sampling of tritium at the Main Plant Vent is easily adequate to detect changes in effluent tritium concentration in a timely manner.

Description of Change	Reason for Change
11) Page 138: Table 6.2.2.1.2-1	Typographical error missed in review cycle of RETS submittal.
12) Page 152: Table 6.3.1.1-1	Typographical error missed in review cycle of RETS submittal.
13) Page 158: Table 6.3.1.1.1-1	Typographical error missed in review cycle of RETS submittal.
14) Page 172: B6.2.2.3	Typographical error missed in review cycle of RETS submittal.

Note: SCN number 91-109 described changes to the Radiological Environmental Monitoring Program (REMP) pertaining to sample location numbers 59 and 64.

Sample number 59 was to be removed as a milk sampling location and location 64 was to be added, reference Tables 5-1 and 5-2. The current ODCM text does not reflect these locations as such. They were inadvertently omitted in amendment 10. This omission should be corrected in the next amendment to the ODCM.

7.2 A determination has been made that these changes will maintain the level of radioactive effluent control required by 10 CFR 20.106, 40 CFR Part 190, 10 CFR 50.36a, and Appendix I to 10 CFR Part 50 and not adversely impact the accuracy or reliability of effluent, dose or setpoint calculations.

7.3 Amendment 10 to the ODCM consisted of four separate SCNs which were reviewed and approved at the following POC meetings;

SCN Number	POC Meeting Date
91-036	July 24,1991
91-060	October 9, 1991
91-107	November 27,1991
91-109	November 27,1991

7.4 This section consists of a complete revised copy of the WNP-2 "Offsite Dose Calculation Manual" (ODCM) as per Technical Specification 6.14.c. The relocation of the Radiological Effluent Technical Specifications (RETS) into the ODCM as per Generic Letter 89-01, dated January 31, 1989 has been reviewed and approved by NRC. This approval was received during January 1992 and the complete ODCM has been printed. The ODCM is included as an enclosure to the letter transmitting this Semiannual Radioactive Effluent Release Report.

8.0 REVISIONS TO THE PROCESS CONTROL PROGRAM (PCP)

There have been no significant changes to the Process Control Program (PCP) during the reporting period. The PCP implementing procedure (PPM 1.12.2) was revised to provide clarity, but issuance of this revision is currently on hold pending RETS/ODCM upgrades to avoid referencing errors.

9.0 NEW OR DELETED LOCATIONS FOR DOSE ASSESSMENTS AND/OR ENVIRONMENTAL MONITORING LOCATIONS

9.1 Locations where GASPAR II dose calculations were performed for the third and/or fourth quarters of 1991:

9.1.1 4.8 miles southeast (SE) for the highest organ dose using ground, inhalation and vegetation pathways.

9.1.2 6.4 miles southeast (SE) for the highest organ dose using ground, cow milk, inhalation and meat pathways.

9.1.3 4.2 miles east southeast (ESE) for the highest organ dose using ground, inhalation and vegetable pathways.

9.1.4 4.3 miles northeast (NE) for the highest organ dose using ground and inhalation pathways.

9.1.5 4.1 miles east northeast (ENE) for the highest organ dose using ground, inhalation and vegetable pathways.

9.2 In August 1991 milk sampling was discontinued at Station 59 because there is no longer milk production at that location. A new milk sampling location was established at Station 64, 9.9 miles ESE, during the third quarter as a replacement.

9.3 With the exception of milk production at Station 59, no environmental monitoring locations were deleted or changed during this reporting period.

10.0 MAJOR CHANGES TO RADIOACTIVE LIQUID, GASEOUS AND SOLID WASTE TREATMENT SYSTEMS

No major changes were made to the radioactive waste systems (liquid, gaseous, or solid) during this reporting period.

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

WNP-2

OFFSITE DOSE CALCULATION MANUAL

OFFSITE DOSE CALCULATION MANUAL

LIST OF EFFECTIVE PAGES

Page	Amendment	Page	Amendment
i	9	22	9
ii	9	23	9
iii	9	24	9
iv	9	25	9
v	9	26	9
vi	9	27	9
vii	9	28	9
1	9	29	9
2	9	30	9
3	9	31	9
4	9	32	9
5	9	33	9
6	9	34	9
7	9	35	9
8	9	36	9
9	9	37	9
10	9	38	9
11	9	39	9
12	9	40	9
13	9	41	9
14	9	42	9
15	9	43	9
16	9	44	9
17	9	45	9
18	9	46	9
19	9	47	9
20	9	48	9
21	9	49	9

OFFSITE DOSE CALCULATION MANUAL

LIST OF EFFECTIVE PAGES

Page	Amendment	Page	Amendment
50	9	78	9
51	9	79	9
52	9	80	9
53	9	81	9
54	9	82	9
55	9	83	9
56	9	84	9
57	9	85	9
58	9	86	9
59	9	87	9
60	9	88	9
61	9	89	9
62	9	90	9
63	9	91	9
64	9	92	9
65	9	93	9
66	9	94	9
67	9	95	9
68	9	96	9
69	9	97	10
70	9	98	9
71	9	99	9
72	9	100	9
73	9	101	10R
74	9	102	9
75	9	103	9
76	9	104	10
77	9	105	10

OFFSITE DOSE CALCULATION MANUAL

LIST OF EFFECTIVE PAGES

Page	Amendment	Page	Amendment
106	10R	134	9
107	10R	135	9
108	9	136	10
109	10	137	9
110	10	138	10
111	9	139	9
112	9	140	9
113	9	141	9
114	9	142	9
115	9	143	9
116	10	144	9
117	10	145	9
118	9	146	9
119	10	147	9
120	10	148	9
121	9	149	9
122	9	150	9
123	9	151	9
124	9	152	10
125	9	153	9
126	9	154	9
127	10	155	9
128	9	156	9
129	9	157	9
130	10	158	10
131	9	159	9
132	9	160	9
133	9	161	9

OFFSITE DOSE CALCULATION MANUAL

LIST OF EFFECTIVE PAGES

Page	Amendment	Page	Amendment
162	9	170	9
163	9	171	9
164	9	172	10
165	9	173	9
166	9	174	9
167	9	175	9
168	9	176	9
169	9	177	9

OFFSITE DOSE CALCULATION MANUAL

TABLE OF CONTENTS

OFFSITE DOSE CALCULATION MANUAL

TABLE OF CONTENTS

OFFSITE DOSE CALCULATION MANUAL

TABLE OF CONTENTS

OFFSITE DOSE CALCULATION MANUAL

TABLE OF CONTENTS

OFFSITE DOSE CALCULATION MANUAL

LIST OF TABLES

OFFSITE DOSE CALCULATION MANUAL

LIST OF TABLES

OFFSITE DOSE CALCULATION MANUAL

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

The purpose of this manual is to provide the information and methodologies to be used by the Washington Public Power Supply System to satisfy the requirements of 10 CFR 20.106, 40 CFR Part 190, 10 CFR 50.36a, and Appendix I to 10 CFR Part 50.

2.0 LIQUID EFFLUENT DOSE CALCULATION

The U.S. Nuclear Regulatory Commission's computer program LADTAP II can be used for dose analysis for liquid radioactive effluents from WNP-2 into surface waters. The analyses estimate radiation dose to individuals, population groups, and biota from ingestion (aquatic foods, water, and terrestrial irrigated foods) and external exposure (shoreline, swimming, and boating) pathways. The calculated doses provide for determining compliance with Appendix I to 10 CFR Part 50.

2.1 Introduction

Liquid radwaste released from WNP-2 will meet 10 CFR 20 limits at the point of discharge to the Columbia River. This design objective will be kept at all times. Actual discharges of liquid radwaste effluents will only occur on a Batch Basis, and the average concentration at the point of discharge will be only a small percentage of the allowed limits. A simplified block diagram of the liquid waste management system and effluent pathways is contained in Figure 2-1. Solid radioactive wastes are disposed of by way of an approved disposal site. A simplified block diagram of the solid radwaste system is described in Figure 2-2.

The cumulative quarterly dose contributions due to radioactive liquid effluents released to the unrestricted areas will be determined once every 31 days using the LADTAP II computer code. The maximum exposed individual is assumed to be an adult whose exposure pathways include potable water and fish consumption. The choice of an adult as the maximum exposed individual is based on the highest fish and water consumption rates shown by that age group

and the fact that most of the dose from the liquid effluent comes from these two pathways.

The dose contributions will be calculated for all radionuclides identified in the released effluent. The calculations are based on guidelines provided by NUREG-0133 and the LADTAP II computer code.

The methods for calculating the doses are discussed in Section 2.4 of this manual.

2.2 Radwaste Liquid Effluent Radiation Monitoring System

This monitoring subsystem measures the radioactivity in the liquid effluent prior to its entering the cooling tower blowdown line.

All radwaste effluent passes through a four-inch line which has an off-line sodium iodide radiation monitor. The radwaste effluent flow, variable from 0 to 190 gpm, combines with the 36-inch cooling water blowdown line, variable from 0 to 7500 gpm, (average, based on operating data is 808 gpm) and is discharged to the Columbia River with a total flow based on MPC_i total, and cooling water flushing needs.

The radiation monitor has a minimum sensitivity of 10^{-6} μCi/cc of Cs-137, and the radiation indicator has a range of seven decades. The radiation monitor is located on the 437′ level of the Radwaste Building.

2.3 10 CFR 20 Release Rate Limits

The requirements pertaining to discharge of radwaste liquid effluents to the unrestricted area are specified in Requirement for Operability 6.2.1.1 (3.11.1.1):

"The concentration of radioactive material released from the site to unrestricted areas shall be limited to the concentrations specified in 10 CFR 20, Appendix B, Table II, Column 2 for radionuclides other than noble gases, and 2×10^{-4} μCi/ml total activity concentration for all dissolved or entrained noble gases."

In order to comply with the requirements stated above, limits will be set to assure that blowdown line concentrations do not exceed 10 CFR 20, Appendix B, Table II, Column 2 at any time.

2.3.1 Pre-Release Calculation

The activity of the radionuclide mixture will be determined in accordance with Supply System procedure PPM 12.5.3, Liquid Effluent Discharge Determination. Liquid effluent discharge is determined and calculated according to PPM 12.11.1, Radiological Effluent Monitoring Gaseous and Liquid. The effluent concentration is determined by the following equation:

$$Con_{c_i} = \frac{Ci \times fw}{ft} \qquad (1)$$

where:

Con_{c_i} = Concentration of radionuclide i in the effluent at point of discharge - μCi/ml.

C_i = Concentration of radionuclide i in the batch to be released - μCi/ml.

fw = Discharge flow rate from sample tank to the blowdown line - variable from 0 to 190 gpm.

fb = Blowdown flow rate - variable from 0 to 7500 gpm.

ft = Total discharge flow rate - (ft = fb + fw)

The calculated concentration in the blowdown line must be less than the

concentrations listed in 10 CFR 20, Appendix B. Before releasing the batch to the environment, the following equation must hold:

$$\sum_{i=1}^{m} (Con_{C_i}/MPC_i) \leq 1 \qquad (2)$$

where:

Con_{C_i} = The concentration of radionuclide i in the effluent at the point of discharge into the river.

MPC_i = Maximum permissible concentration of nuclide i as listed in 10 CFR 20, Appendix B, Table II.

m = Total number of radionuclides in the batch.

2.3.2 Post-Release Calculation

The concentration of each radionuclide in the restricted area, following the batch release, will be calculated as follows:

The average activity of radionuclide i during the time period of the release is divided by the Plant Discharge Flow/Tank Discharge Flow ratio yielding the concentration at the point of discharge:

$$Con_{C_k} = \frac{C_{ik} \times fw}{ft} \qquad (3)$$

where:

$Con_{C_{ik}}$ = The concentration of radionuclide i in the effluent at the point of discharge during the release period k - (μCi/ml).

C_{ik} = The concentration of radionuclide i in the batch during the release period k - (μCi/ml).

fw = Discharge flow rate from sample tank to the blowdown line - variable from 0 to 190 gpm.

fb = Blowdown flow rate - variable from 0 to 7500 gpm.

ft = Total discharge (ft = fb + fw) flow rate - variable from 0 to 7690 gpm.

To assure compliance with 10 CFR 20, the following relationships must hold:

$$\sum_{i=1}^{m} (Con_{C_k}/MPC_i) \leq 1 \qquad (4)$$

where the terms are as defined in Equation (2).

2.3.3 Continuous Release

Continuous release of liquid radwaste effluent is not planned for WNP-2. However, should it occur, the concentrations of various radionuclides in the unrestricted area would be calculated according to Equation (3) and Equation (4). To show compliance with 10 CFR 20, the two equations must again hold.

2.4 10 CFR 50, Appendix I, Release Rate Limits

Periodic Test and Inspection 6.2.1.2.1 (4.11.1.2) requires that the cumulative dose contributions be determined in accordance with the ODCM at least once per 31 days. Requirement for Operability 6.2.1.2 (3.11.1.2) specifies that the dose to a member of the public from radioactive material in liquid effluents released to the unrestricted area shall be limited to:

≤1.5 mrem/Calendar Quarter - Total Body

and

≤5.0 mrem/Calendar Quarter - Any Organ.

The cumulative dose for the calendar year shall be limited to:

≤3 mrem - Total Body

and

≤10 mrem - Any Organ.

The dose contribution will be calculated for all radionuclides identified in the liquid effluent released to the unrestricted area, using the following equation:

$$D\tau = \sum_i (A_{i_\tau} \sum_{\ell=1}^{m} \Delta t_\ell C_{i\ell} F_\ell) \qquad (5)$$

where:

$D\tau$ = The cumulative dose commitment to the total body or organ, τ, from liquid effluents for the total time period $\sum_{\ell=1}^{m} \Delta t_\ell$, in mrem.

Δt_ℓ = The length of the ℓth time period over which $C_{i\ell}$ and F_ℓ are averaged for all liquid releases, in hours.

m = The number of releases for the time period under consideration.

$C_{i\ell}$ = The average concentration of radionuclide i in undiluted liquid effluent during time period $\Delta t\ell$ from any liquid release, in μCi/ml.

A_{i_τ} = The site-related ingestion dose commitment factor to the total body or any organ τ for each identified principle gamma and beta emitter listed in Table 2-2, in mrem/hr per μCi/ml.

F_ℓ = The near field average dilution factor for $C_{i\ell}$ during any

liquid waste release. Defined as the ratio of the maximum undiluted liquid waste flow during release to the product of the average flow from the site discharge structure to unrestricted receiving waters times 500.

$$\left(F_l = \frac{\text{Liquid Radioactive Waste Flow}}{\text{Discharge Structure Exit Flow x 500}} = \frac{fw}{ft \times 500}\right) \quad (6)$$

The term A_{i_r}, the ingestion dose factors for the total body and critical organs, are tabulated in Table 2-2. It embodies the dose factor, fish bioaccumulation factor, pathway usage factor, and the dilution factor for the plant diffuser pipe to the Richland potable water intake. The following equation was used to calculate the ingestion dose factors:

$$A_{i_r} = K_o \left(\frac{U_w}{D_w} + U_F\, B_{F_i}\right) D_{F_i} \quad (7)$$

where:

A_{i_r} = The composite dose parameter for total body or critical organ of an adult for nuclide i (in mrem/hr per μCi/ml).

K_o = A conversion factor:
1.14E+05 = (10^6 μpCi/Ci) x (10^3 ml/liter) 8760 hr/yr.

U_w = 730 liter/yr - which is the annual water consumption by the maximum adult (Table E-4 of Regulatory Guide 1.109, Revision 1).

B_{F_i} = Bioaccumulation factor for radionuclide i in fish - (pCi/Kg per pci/liter) (Table A-1 of Regulatory Guide 1.109, Revision 1 and NUREG/CR-4013).

D_{F_i} = Adult ingestion dose conversion factor for nuclide i - Total

body or critical organ - (mrem/pCi) (Table E-11 of Regulatory Guide 1.109, Revision 1 and NUREG/CR-4013).

D_w = Dilution factor from near field area (within one-quarter mile of the release point) to the Richland potable water intake - 100.

U_F = Adult fish consumption, 21 kg/yr (Table E-5 of Regulatory Guide 1.109, Revision 1).

The values of BF_i and DF_i are listed in Table 2-1. Dilution assumptions, calculations, and LADTAP II input parameters are provided in Radiological Programs Calculation Log 88-3.

The quarterly limits mentioned before represent one-half of the annual design objective of Section II.A of 10 CFR 50, Appendix I. If any of the limits (either that of the calendar quarter or calendar year) are exceeded, a special report pursuant to Section IV.A of 10 CFR 50, Appendix I, shall be filed with the NRC.

2.4.1 Projection of Doses

The projected doses due to releases of WNP-2 radwaste liquid effluents will be calculated for each batch, using Equation (5). If the sum of the accumulated dose to date for the month and the projected dose for the remainder of the month exceeds the Requirement for Operability 6.2.1.3 (3.11.1.3) limits, then the liquid radwaste treatment system shall be used. This is to ensure compliance with Requirement for Operability 6.2.1.3 (3.11.1.3). This Requirement for Operability states that the liquid radwaste treatment system shall be maintained and the appropriate subsystem shall be used if the radioactive materials in liquid waste, prior to their discharge, when the dose, due to liquid effluent release to unrestricted areas when averaged over the month would exceed 0.06 mrem to total body or 0.2 mrem to any organ.

2.5 Radwaste Liquid Effluent Dilution Ratio and Alarm Setpoints Calculations

2.5.1 Introduction

The dilution alarm ratio and setpoints of the sample liquid effluent monitor are established to ensure that the limits of 10 CFR 20, Appendix B, Table II, Column 2, are not exceeded in the effluent at the discharge point (i.e., compliance with Requirement for Operability 6.2.1.1 (3.11.1.1), as discussed in section 2.3.1 of this manual).

The trip/alarm setpoint for the liquid radwaste effluent monitor is calculated from the results of the radiochemical analysis of the waste solution. The setpoint will be set into the radwaste monitor just prior to the release of each batch of radioactive liquid.

2.5.2 Methodology for Determining the Maximum Permissible Concentration (MPC) Fraction

Radwaste liquid effluents can only be discharged to the environment through the four-inch radwaste line. The maximum radwaste discharge flow rate is 190 gpm. Prior to discharge, the tank is isolated and recirculated for at least thirty minutes, and a representative sample is taken from the tank. An isotopic analysis of the batch will be made to determine the sum of the MPC fraction (MPC_f) based on 10 CFR 20 limits. From the sample analysis and the MPC values in 10 CFR 20, the MPC_f is determined using the following equation.

$$MPC_f = \sum_{i=1}^{m} \frac{C_i}{MPC_i} \qquad (8)$$

where:

MPC_f = Total fraction of the Maximum Permissible Concentrations (MPCs) in the liquid effluent waste sample.

C_i = The concentration of each measured radionuclide i observed by the radiochemical analysis of the liquid waste sample (μCi/ml).

MPC_i = The limiting concentrations of the appropriate radionuclide i from 10 CFR 20, Appendix B, Table II, Column 2. For dissolved or entrained noble gases, the concentration shall be limited to 2.0E-04 μCi/ml total activity.

m = The total number of measured radionuclides in the liquid batch to be released.

If the MCP_f is less than or equal to 0.8, the liquid batch may be released at any radwaste discharge or blowdown rate. If the MPC_f exceeds 0.8, then a dilution factor (Fd) must be determined. The liquid effluent radiation monitor responds proportionally to radioactivity concentrations in the undiluted waste stream. Its setpoint must be determined for diluted releases.

2.5.3 Methodology for the Determination of Liquid Effluent Monitor Setpoint

The measured radionuclide concentrations are used to calculate the dilution factor (Fd), which is the ratio of the total discharge flow rates (fw + fb) to the radwaste tank effluent flow rate (fw) that is required to assure that the limiting concentrations of Requirement for Operability 6.2.1.1 (3.11.1.1) are met at the point of discharge.

The dilution factor (Fd) is determined according to:

$$Fd = \left[\sum_{i=1}^{m} \frac{C_i}{MPC_i} \right] \times Fs \qquad (9)$$

where:

Fd = The dilution factor required for compliance with 10 CFR 20, Appendix B, Table II, Column 2.

C_i = The concentration of each radionuclide i observed by radiochemical analysis of the liquid waste sample (μCi/ml).

MPC_i = The limiting concentration of the appropriate radionuclide i from 10 CFR 20, Appendix B, Table II, Column 2. For dissolved or entrained noble gases, the concentration shall be limited to 2.0E-04 μCi/ml total activity.

Fs = The safety factor; a conservative factor used to compensate for statistical fluctuations and errors in measurements. For example, a safety factor (Fs) of 1.5 corresponds to a fifty (50) percent (%) variation.

m = The total number of measured radionuclides i in the liquid batch to be released.

The dilution which is required to ensure compliance with Requirement for Operability 6.2.1.1 (3.11.1.1) concentration limits will be set such that discharge rates are:

$$Fd \leq \frac{fw+fb}{fw} \tag{10}$$

and follows that:

$$fw \leq \frac{fb}{Fd-1} \tag{10a}$$

or

$$fb \geq fw(Fd-1) \tag{10b}$$

where:

Fd = The dilution factor from Equation (9).

fw = The discharge flow rate from the liquid radwaste tank to the blowdown line - variable from 0 to 190 gpm.

fb = The cooling tower blowdown flow rate - variable from 0 to 7500 gpm.

The liquid effluent radiation monitor response is based on the results of the radiochemical analysis of the waste solution. Therefore the calculation for

the radiation monitor's alarm/trip setpoint is:

$$SP = C + BKg + K\,[C + Bkg]^{1/2} \qquad (11)$$

where:

SP	=	Radiation monitor setpoint (count rate)
C	=	$\sum_{i=1}^{m} (C_i \times E_{fi})$ represents the count rate from the radionuclides in the liquid radwaste.
C_i	=	The concentration of each measured radionuclide i observed by radiochemical analysis of the liquid waste sample (μCi/ml).
m	=	Same as for Equation (9).
E_{fi}	=	The radwaste effluent monitor's response to radionuclide i (count rate per μCi/ml).
BKg	=	Background count rate of the radwaste effluent monitor.
K	=	A constant to compensate for normal expected statistical variations in the liquid effluent radiation monitor count rate to reduce the chance of false alarms/trips; K=3.

2.6 Verification of Compliance with 10 CFR 50, Appendix I, and 10 CFR 20, Appendix B

Verification of compliance with 10 CFR 50, Appendix I, and 10 CFR 20, Appendix B, limits will be achieved by following WNP-2 Plant Procedures for liquid discharge and the periodic application of the LADTAP II computer code.

2.7 Methods for Calculating Doses to Man From Liquid Effluent Pathways

Dose models presented in NRC Regulatory Guide 1.109, Revision 1, as incorporated in the LADTAP II computer code, will be used for offsite dose calculation. The details of the computer code, and user instruction, are included in NUREG/CR-4013, "LADTAP II - Technical Reference and User Guide."

2.7.1 Radiation Doses

Radiation doses from potable water, aquatic food, shoreline deposit, and irrigated food pathways will be calculated by using the following equations:

a. Potable Water

$$R_{apj} = 1100 \frac{U_{ap} M_p}{F} \sum_i Q_i D_{aipj} \exp(-\lambda_i t_p) \tag{13}$$

b. Aquatic Foods

$$R_{apj} = 1100 \frac{U_{ap} M_p}{F} \sum_i Q_i B_{ip} D_{aipj} \exp(-\lambda_i t_p) \tag{14}$$

c. Shoreline Deposits

$$R_{apj} = 110{,}000 \frac{U_{ap} M_p W}{F} \sum_i Q_i T_i D_{aipj} [\exp(-\lambda_i t_p)(1 - \exp(-\lambda_i t_b)] \tag{15}$$

d. Irrigated foods

For all radionuclides except tritium:

$$R_{apj} = U_{ap}^{veg} \sum_i d_i \exp(-\lambda_i t_h) D_{aipj} \left[\frac{r\,[1 - \exp(-\lambda_{Ei} t_e)]}{Y_v \lambda_{Ei}} + \frac{f_1 B_{iv} [1 - \exp(-\lambda_i t_b)]}{P \lambda_i} \right]$$

$$+ U_{ap}^{animal} \sum_i F_{iA} D_{aipj} \left[Q_F d_i \exp(-\lambda_i t_h) \frac{r[1 - \exp(-\lambda_{Ei} t_e)]}{Y_V \lambda_{Ei}} \right.$$

$$\left. + \frac{f_1 B_{iv}\,[1 - \exp(-\lambda_i t_b)]}{P \lambda_i} + C_{iAw} Q_{AW} \right] \qquad (16)$$

For tritium:

$$R_{apj} = U_{ap}^{veg}\, C_v D_{apj} + U_{ap}^{animal}\, D_{apj} F_A (C_v Q_F + C_{Aw} Q_{Aw}) \qquad (17)$$

where:

B_{ip} = The equilibrium bioaccumulation factor for nuclide i in pathway p, expressed as the ratio of the concentration in biota (in pCi/kg) to the radionuclide concentration in water (in pCi/liter), in liters/kg.

B_{iv} = The concentration factor for uptake of radionuclide i from soil by edible parts of crops, in pCi/kg (wet weight) per pCi/kg dry soil.

C_{iAw} = The concentration of radionuclide i in water consumed by animals, in pCi/liter.

C_{iv} = The concentration of radionuclide i in vegetation, in pCi/kg.

D_{aipj} = The dose factor specific to a given age group a, radionuclide i, pathway p, and organ j, which can be used to calculate the radiation dose from an intake of a radionuclide, in mrem/pCi, or from exposure to a given concentration of a radionuclide in sediment, expressed as a ratio of the dose rate (in mrem/hr) and the areal radionuclide concentration (in pCi/m^2).

d_i = The deposition rate of nuclide i in pCi/m^2 per hour.

F = The flow rate of the liquid effluent, in ft^3/sec.

f_l = The fraction of the year crops are irrigated, dimensionless.

F_{iA} = The stable element transfer coefficient that relates the daily intake rate by an animal to the concentration in an edible portion of animal product, in pCi/liter (milk) per pCi/day or pCi/kg (animal product) per pCi/day.

M_p = The mixing ratio (reciprocal of the dilution factor) at the point of exposure (or the point of withdrawal of drinking water or point of harvest of aquatic food), dimensionless.

P = The effective "surface density" for soil, in kg (dry soil)/m^2 (Table E-15, Regulatory Guide 1.109, Revision 1).

Q_{Aw} = The consumption rate of contaminated water by an animal, in liters/day.

Q_F = The consumption rate of contaminated feed or forage by an animal, in kg/day (wet weight).

Q_i = The release rate of nuclide i in Ci/yr.

r = The fraction of deposited activity retained on crops, dimensionless (Table E-15, Regulatory Guide 1.109, Revision 1).

R_{apj} = The total annual dose to organ j of individuals of age group a from all of the nuclides i in pathway p, in mrem/yr.

t_b = The period of time for which sediment or soil is exposed to the contaminated water, in hours (Table E-15, Regulatory Guide 1.109, Revision 1).

t_e = The time period that crops are exposed to contamination during the growing season, in hours (Table E-15, Regulatory Guide 1.109, Revision 1).

t_h = A holdup time that represents the time interval between harvest and consumption of the food, in hours (Table E-15, Regulatory Guide 1.109, Revision 1).

T_i = The radioactive half life of nuclide i in days.

t_p = The average transit time required for nuclides to reach the point of exposure. For internal dose, t_p is the total time elapsed between release of the nuclides and ingestion of food or water, in hours (Table E-15, Regulatory Guide 1.109, Revision 1).

U_{ap} = A usage factor that specifies the exposure time or intake rate for an individual of age group a associated with pathway p, in hr/yr, ℓ/yr, or kg/yr (Table E-5, Regulatory Guide 1.109, Revision 1).

W = The shoreline width factor, dimensionless (Table A-2, Regulatory Guide 1.109, Revision 1).

Y_v = The agricultural productivity (yield), in kg (wet weight)/m^2 (Table E-15, Regulatory Guide 1.109, Revision 1).

λ_{Ei} = The effective removal rate constant for radionuclide i from crops, in hr^{-1}, where $\lambda_{Ei} = \lambda_i + \lambda_w$, λ_i is the radioactive decay constant, and λ_w is the removal rate constant for physical loss by weathering (Regulatory Guide 1.109, Revision 1, Table B-15).

λ_i = The radioactive decay constant of nuclide i in hr^{-1}.

1100 = The factor to convert from (Ci/yr)/(ft^3/sec) to pCi/liter.

110,000 = The factor to convert from (Ci/yr)/(ft^3/sec) to pCi/liter and to account for the proportionality constant used in the sediment radioactivity model.

These equations yield the dose rates to various organs of individuals from the exposure pathways mentioned above.

2.7.2 Plant Parameters

WNP-2 is a river shoreline site with a variable effluent discharge flow rate 0 to 7500 gpm. The population center nearest WNP-2 is the city of Richland, where drinking water withdrawal takes place. The applicable dilution factor is 50,000, using average river flow. The time required for released liquids to reach Richland, approximately 12 miles downstream, is estimated at 4.0 hours. Richland is the "realistic case" location, and doses calculated for the Richland location are typically applicable to the population as a whole. Individual and population doses based on Richland parameters are calculated for all exposure pathways.

Only the population downstream of the WNP-2 site is affected by the liquid effluents released. There is no significant commercial fish harvest in the 50-mile radius region around WNP-2. Sportfish harvest is estimated at

14,000 kg/year.

For irrigated foods exposure pathways, it can be assumed that production within the 50-mile radius region around WNP-2 is sufficient to satisfy consumption requirements.

Other relevant parameters relating to the irrigated foods pathways are defined as follows:

Food Type	Irrigation Rate (liter/m^2/mo)	Annual Yield (kg/m^2)	Growing Period (Days)
Vegetation	150	5.0	70
Leafy Vegetation	200	1.5	70
Feed for Milk Cows	200	1.3	30
Feed for Beef Cattle	160	2.0	130

Source terms are measured based on sampled effluent.

Table 2-3 summarizes the LADTAP II input parameters. Documentation and/or calculations of these parameters are discussed in detail in RPI 2.3, and Radiological Programs Calculation Log 88-3.

2.8 Compliance with Technical Specification 3.11.1.4

2.8.1 Maximum Allowable Liquid Radwaste Activity in Temporary Radwaste Hold-Up Tanks

The use of temporary liquid radwaste hold-up tanks is planned for WNP-2. Technical Specification 3.11.1.4 states the quantity of radioactive material contained in any outside temporary tanks shall be limited to the limits calculated in the ODCM such that a complete release of the tank contents would not result in a concentration at the nearest offsite potable water supply that would exceed the limits specified in 10 CFR Part 20 Appendix B, Table II.

Equation (18) will be used to calculate the curie limit for a temporary radwaste hold-up tank. The total tank concentration will be limited to less than or equal to ten (≤10) curies, excluding tritium and dissolved or entrained gases.

Surveillance requirement 4.11.1.4, states that the quantity of radioactive material in the hold-up tanks shall be determined to be within the limit by analyzing a representative sample of the tank's contents at least once per 7 days when radioactive materials are being added to the tank.

$$A_T = \frac{k_d}{\sum_i \frac{fi}{MPC_i\, e^{\lambda_i t}}} \qquad (18)$$

where:

A_T	=	Total allowed activity in tank (curies).
A_i	=	Activity of radioisotope i (curies).
MPC_i	=	Maximum permissible concentration of radionuclide i (10 CFR 20, Appendix B, Table II, Column 2).
λ_i	=	Decay constant (years^{-1}) radioisotope i.
t	=	Transit time of ground water from WNP-2 to WNP-1 well (WNP-2 FSAR Section 2.4) = 67 years.
fi	=	Fraction of radioisotope fi = $\frac{A_i}{\sum A_i}$
i	=	Index for all radioisotopes in tank except tritium and noble gases.
K_d	=	Dispersion constant based on hydrological parameters, (2.4E+05 Ci per μCi/cc.)

The total allowed activity (A_T) is based on limiting WNP-1 well water to less than 1 MPC_i of the entire liquid content of the tank spilled to ground and then migrated via ground water to the WNP-1 well. The WNP-1 well is the location of maximum concentration since it is the nearest source of ground water and conditions are such that no spill of liquid should reach surface water. The 70-85 foot depth of the water table and the low ambient moisture of the soil requires a rather large volume of spillage for the liquid to even reach the water table in less than several hundred years. However, allowed tank activity (A_T) is conservatively based on all liquid radwaste in the tank instantaneously reaching the water table.

The hydrological analysis performed for the WNP-2 FSAR (Section 2.4) determined that the transit time through the ground water from WNP-2 to the WNP-1 well is 67 years for Strontium and 660 years for Cesium. These two radionuclides are representative of the radionuclides found in liquid radwaste. Strontium is a moderate sorber and Cesium strongly sorbs to soil particles. This calculation conservatively treats all radionuclides as moderate sorbers with a transit time of 67 years.

The concentration of each radionuclide in the well (CW_i) is simply the concentration in the tank (CT_i) adjusted for radioactive decay during transit ($e^{-\lambda t}$) and divided by the minimum concentration reduction factor (CRF_{min}). Limiting well concentration to 1 MPC yields:

$$\sum \frac{CW_i}{MPC_i} = 1 = \sum \frac{CT_i \, e^{-\lambda t}}{CRF_{min} \, MPC_i} \qquad (19)$$

(From Section 2.4 of WNP-2 FSAR)

$$CRF_{min} = \frac{(4 \pi L)^{3/2} (a_x a_y a_z)^{1/2}}{2V} \qquad (20)$$

where:

L	=	Migration distance = 1 mile.
V	=	Volume of tank.
α_x, α_y, α_z	=	Dispersion constants.

Combining Equations (19) and (20) yields:

$$1 = \sum \frac{CT_i \, 2V \, e^{-\lambda t}}{(4 \pi L)^{3/2} (\alpha_x \alpha_y \alpha_z)^{1/2} MPC_i} \tag{21}$$

Substituting A_i for CT_i V and reorganizing terms yields:

$$\frac{(4 \pi L)^{3/2} (\alpha_x \alpha_y \alpha_z)^{1/2}}{2} = \sum \frac{A_i}{MPC_i e^{+\lambda t}} \tag{22}$$

Making the following substitutions

$$A_i = f_i A_T$$

$$K_d = \frac{(4 \pi L)^{3/2} (\alpha_x \alpha_y \alpha_z)^{1/2}}{2} \times 10^{-6} \text{ Ci}/\mu\text{Ci} = 2.4 \times 10^5 \text{ Ci per } \mu\frac{\text{Ci}}{\text{cc}} \tag{23}$$

yields:

$$K_d = A_T \sum \frac{f_i}{MPC_i e^{+\lambda t}}$$

or

$$A_T = \frac{K_d}{\sum \frac{f_i}{MPC_i e^{+\lambda t}}} \tag{24}$$

2.8.2 <u>Maximum Allowable Liquid Radwaste in Tanks That Are Not Surrounded by Liners, Dikes, or Walls</u>

Although permanent outside liquid radwaste tanks which are not surrounded by liners, dikes, or walls are not planned for WNP-2, Equation (18) will be used should such tanks become necessary in the future.

2.9 Liquid Process Monitors and Alarm Setpoints Calculations

As mentioned in Section 2.2 of this manual, all liquid radwaste effluent is discharged through a four-inch line that is monitored by an off-line sodium iodide radiation monitor. This monitor is located on the 437′ level of the Radwaste Building. All WNP-2 radwaste liquid effluent is discharged to the Columbia River through the 36-inch Cooling Water Blowdown line. In addition to the liquid effluent discharge monitor there are three liquid streams that are normally nonradioactive but have a finite possibility of having radioactive material injected into them. These liquid streams are:

- Standby Service Water (SW)
- Turbine Building Service Water (TSW)
- Turbine Building Sump Water (FD)

To prevent any discharges of radioactive liquid from these streams, radiation monitoring systems have been installed to detect any increase above the normal background concentration of radioactive material.

Alarm/setpoints are established to prevent any release of radioactive material in concentrations greater than 10 CFR 20 limits. The maximum radiation detector setpoint calculation for the three systems is based on the MPC_i concentration of Cs-137 which is 2.0E-05 μCi/ml. The following equation is used to calculate the maximum setpoint:

$$\text{Setpoint max. (in cpm or cps)} = [(2.0\text{E-05}\ \mu\text{Ci/ml})\ (\text{CF})] \qquad (25)$$

where:

2.0E-05 μCi/ml = MPC limit for Cs-137

CF = Monitor calibration factor - in cpm/ μCi/ml or cps/ μCi/ml

2.9.1 Standby Service Water (SW) Monitor

The Standby Service Water Monitors (SW) are located on the 522′ level of the Reactor Building.

The meter is located in the main control room on panel P-604.

The flow rate through the monitor is variable, from zero (0) to two (2) gpm with a normal flow of 1.0-1.5 gpm.

To ensure 10 CFR 20 limits are never exceeded, the alarm setpoint shall be established at 80% or less of the maximum setpoint plus background.

If the setpoint is exceeded, an alarm will activate in the main control room. The control room operator can then terminate the discharge and mitigate any uncontrolled release of radioactive material.

2.9.2 Turbine Building Service Water (TSW) Monitor

This monitor is located on the 441′ level of the Turbine Building. The readout meter and recorder is located in the main control panel BD-RAD-24.

The flow rate through that monitor is variable, from zero (0) to six (6) gpm with a normal flow of 3-4 gpm.

To ensure 10 CFR 20 limits are never exceeded, the alarm setpoint shall be established at 80% or less of the maximum setpoint plus background.

If the setpoint is exceeded, an alarm will activate in the main control room. The control room operator can then terminate the discharge and mitigate any uncontrolled release of radioactive material.

2.9.3 Turbine Building Sumps Water (FD) Monitor

There are three detectors to measure the activity of each of the three nonradioactive sumps. The monitors are located on the 441′ level of the Turbine Building. The readout meters and recorder are located in the Radwaste Control Room Panel BD-RAD-41.

The Turbine Building Sump Water Effluents are not released to the Columbia River. This effluent is discharged to the Storm Drain System which is an open pond by the WNP-2 Warehouse.

The hydrological analysis performed for the WNP-2 FSAR (Section 2.4) determined that the transmit time through the ground water from WNP-2 to the WNP-1 well is 67 years for strontium and 660 years for cesium.

In the event the setpoint is exceeded, the sump water will be automatically routed to the radioactive waste system.

To prevent the sum of the sump water discharged from the three pumps from exceeding 10 CFR 20 limits, the alarm/setpoint will be established at 80% or less of the maximum setpoint plus background.

Table 2-1 (contd.)

Table 2-1

FISH BIOACCUMULATION FACTORS (BF_i)[1]
AND ADULT INGESTION DOSE CONVERSION FACTORS (DF_i)[2]

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
H-3	9.0E-01	6.0E-08	____(3)	6.0E-08	6.0E-08	6.0E-08
Na-24	1.0E+02	1.7E-06	1.7E-06	1.7E-06	1.7E-06	1.7E-06
P-32	1.0E+05	7.5E-06	1.9E-04	____(3)	1.2E-05	2.2E-05
Cr-51	2.0E+02	2.7E-09	____(3)	1.6E-09	____(3)	6.7E-07
Mn-54	4.0E+02	8.7E-07	____(3)	____(3)	4.6E-06	1.4E-05
Mn-56	4.0E+02	2.0E-08	____(3)	____(3)	1.2E-07	3.7E-06
Fe-55	1.0E+02	4.4E-07	2.8E-06	____(3)	1.9E-06	1.1E-06
Fe-59	1.0E+02	3.9E-06	4.3E-06	____(3)	1.0E-05	3.4E-05
Co-58	5.0E+01	1.7E-06	____(3)	____(3)	7.5E-07	1.5E-05
Co-60	5.0E+01	4.7E-06	____(3)	____(3)	2.1E-06	4.0E-05
Ni-65	1.0E+02	3.1E-08	5.3E-07	____(3)	6.9E-08	1.7E-06
Cu-64	5.0E+01	3.9E-08	____(3)	____(3)	8.3E-08	7.1E-06
Zn-65	2.0E+03	7.0E-06	4.8E-06	____(3)	1.5E-05	9.7E-06
Zn-69m	2.0E+03	3.7E-08	1.7E-07	____(3)	4.1E-07	2.5E-05
As-76	1.0E+02	4.8E-06	____(3)	____(3)	____(3)	4.4E-05
Br-82	4.2E+02	2.3E-06	____(3)	____(3)	____(3)	2.6E-06
Br-83	4.2E+02	4.0E-08	____(3)	____(3)	____(3)	5.8E-08
Br-84	4.2E+02	5.2E-08	____(3)	____(3)	____(3)	4.1E-13
Rb-89	2.0E+03	2.8E-08	____(3)	____(3)	4.0E-08	2.3E-21
Sr-89	3.0E+01	8.8E-06	3.1E-04	____(3)	____(3)	4.9E-05
Sr-90	3.0E+01	1.8E-04	8.7E-03	____(3)	____(3)	2.2E-04
Sr-91	3.0E+01	2.3E-07	5.7E-06	____(3)	____(3)	2.7E-05
Sr-92	3.0E+01	9.3E-08	2.2E-06	____(3)	____(3)	4.3E-05
Y-90	2.5E+01	2.6E-10	9.7E-09	____(3)	____(3)	1.0E-04
Y-91m	2.5E+01	3.5E-12	9.1E-11	____(3)	____(3)	2.7E-10
Y-91	2.5E+01	3.8E-09	1.4E-07	____(3)	____(3)	7.8E-05
Y-92	2.5E+01	2.5E-11	8.5E-10	____(3)	____(3)	1.5E-05

Table 2-1 (contd.)

Nuclide	Fish Bioaccumulation Factor (BF_i) (pCi/kg per pCi/liter)	Dose Conversion Factor (DF_i) Total Body	Bone	Thyroid	Liver	GI Tract
		(mRem per pCi Ingested)				
Y-93	2.5E+01	7.4E-11	2.7E-09	____(3)	____(3)	8.5E-05
Zr-95	3.3E+00	6.6E-09	3.1E-08	____(3)	9.8E-09	3.1E-05
Nb-95	3.0E+04	1.9E-09	6.2E-09	____(3)	3.5E-09	2.1E-05
Zr-97	3.3E+00	1.6E-10	1.7E-09	____(3)	3.4E-10	1.1E-04
Nb-97	3.0E+04	4.8E-12	5.2E-11	____(3)	1.3E-11	4.9E-08
Mo-99	1.0E+01	8.2E-07	____(3)	____(3)	4.3E-06	1.0E-05
Tc-99m	1.5E+01	8.9E-09	2.5E-10	____(3)	7.0E-10	4.1E-07
Tc-101	1.5E+01	3.6E-09	2.5E-10	____(3)	3.7E-10	1.1E-21
Ru-103	1.0E+01	8.0E-08	1.9E-07	____(3)	____(3)	2.2E-05
Ru-105	1.0E+01	6.1E-09	1.5E-08	____(3)	____(3)	9.4E-06
Rh-105	1.0E+01	5.8E-08	1.2E-07	____(3)	8.9E-08	1.4E-05
Ru-106	1.0E+01	3.5E-07	2.8E-06	____(3)	____(3)	1.8E-04
Ag-110m	2.3E+00	8.8E-08	1.6E-07	____(3)	1.5E-07	6.0E-05
Sb-124	1.0E+00	1.1E-06	2.8E-06	6.8E-09	5.3E-08	8.0E-05
Sb-125	1.0E+00	4.3E-07	1.8E-06	1.8E-09	2.0E-08	2.0E-05
Sb-126	1.0E+00	4.2E-07	1.2E-06	7.0E-09	2.3E-08	9.4E-05
Sb-127	1.0E+00	9.9E-08	2.6E-07	3.1E-09	5.7E-09	5.9E-05
Te-127	4.0E+02	2.4E-08	1.1E-07	8.2E-08	4.0E-08	8.7E-06
Te-129m	4.0E+02	1.8E-06	1.2E-05	4.0E-06	4.3E-06	5.8E-05
Te-129	4.0E+02	7.7E-09	3.1E-08	2.4E-08	1.2E-08	2.4E-08
Te-131m	4.0E+02	7.1E-07	1.7E-06	1.3E-06	8.5E-07	8.4E-05
Te-131	4.0E+02	6.2E-09	2.0E-08	1.6E-08	8.2E-09	2.8E-09
Te-132	4.0E+02	1.5E-06	2.5E-06	1.8E-06	1.6E-06	7.7E-05
I-131	1.5E+01	3.4E-06	4.2E-06	2.0E-03	6.0E-06	1.6E-06
I-132	1.5E+01	1.9E-07	2.0E-07	1.9E-05	5.4E-07	1.0E-07
I-133	1.5E+01	7.5E-07	1.4E-06	3.6E-04	2.5E-06	2.2E-06
I-134	1.5E+01	1.0E-07	1.1E-07	5.0E-06	2.9E-07	2.5E-10
I-135	1.5E+01	4.3E-07	4.4E-07	7.7E-05	1.2E-06	1.3E-06
Cs-134	2.0E+03	1.2E-04	6.2E-05	____(3)	1.5E-04	2.6E-06
Cs-136	2.0E+03	1.9E-05	6.5E-06	____(3)	2.6E-05	2.9E-06
Cs-137	2.0E+03	7.1E-05	8.0E-05	____(3)	1.1E-04	2.1E-06

Table 2-1 (contd.)

Nuclide	Fish Bioaccumulation Factor (BF_i) (pCi/kg per pCi/liter)	Dose Conversion Factor (DF_i) Total Body	Bone	Thyroid	Liver	GI Tract
		(mRem per pCi Ingested)				
Cs-138	2.0E+03	5.4E-08	5.5E-08	____(3)	1.1E-07	4.7E-13
Ba-139	4.0E+00	2.8E-09	9.7E-08	____(3)	6.9E-11	1.7E-07
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
Nd-147	2.5E+01	4.4E-10	6.2E-09	____(3)	7.3E-09	3.5E-05
Hf-179m	3.3E+00	4.8E-06	____(3)	____(3)	____(3)	4.1E-05
Hf-181	3.3E+00	4.3E-06	____(3)	____(3)	____(3)	4.1E-05
W-185	1.2E+03	1.4E-08	4.1E-07	____(3)	1.4E-07	1.6E-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 NUREG/CR-4013.

(2) NRC NUREG/CR-4013.

(3) No data listed in NUREG/CR-4013.
(Use total body dose conversion factor as an approximation.)

Table 2-2

INGESTION DOSE FACTORS (A_{ir}) FOR TOTAL BODY AND CRITICAL ORGAN
(in mrem/hr per Ci/ml)

Liquid Effluent

Nuclide	Total Body	Bone	Thyroid	Liver	GI Tract
H-3	1.8E-01	**	1.8E-01	1.8E-01	1.8E-01
Na-24	4.1E+02	4.1E+02	4.1E+02	4.1E+02	4.1E+02
P-32	1.8E+06	4.6E+07	**	2.9E+06	5.3E+06
Cr-51	1.3E+00	**	7.7E-01	**	3.2E+02
Mn-54	8.3E+02	**	**	4.4E+03	1.3E+04
Mn-56	1.9E+01	**	**	1.6E+02	3.6E+03
Fe-55	1.1E+02	6.7E+02	**	4.6E+02	2.6E+02
Fe-59	9.4E+02	1.0E+03	**	2.4E+03	8.2E+03
Co-58	2.1E+02	**	**	9.0E+01	1.8E+03
Co-60	5.7E+02	**	**	2.5E+02	4.8E+03
Ni-65	7.5E+00	1.3E+02	**	1.7E+01	4.1E+02
Cu-64	4.7E+00	**	**	1.0E+01	8.6E+02
Zn-65	3.4E+04	2.3E+04	**	7.2E+04	4.7E+04
Zn-69m	1.8E+02	8.1E+02	**	2.0E+03	1.2E+05
As-76	1.2E+03	**	**	**	1.1E+04
Br-82	2.3E+03	**	**	**	2.6E+03
Br-83	4.0E+01	**	**	**	5.8E+01
Br-84	5.2E+01	**	**	**	4.1E-04
Rb-89	1.3E+02	**	**	1.9E+02	1.1E-11
Sr-89	6.4E+02	2.3E+04	**	**	3.6E+03
Sr-90	1.3E+04	6.3E+05	**	**	1.6E+04
Sr-91	1.7E+01	4.1E+02	**	**	2.0E+03
Sr-92	6.8E+00	1.6E+02	**	**	3.1E+03
Y-90	1.6E-02	5.9E-01	**	**	6.1E+03
Y-91m	2.1E-04	5.5E-03	**	**	1.6E-02
Y-91	2.3E-01	8.5E+00	**	**	4.7E+03
Y-92	1.5E-03	5.2E-02	**	**	9.1E+02
Y-93	4.5E-03	1.6E-01	**	**	5.2E+03

Table 2-2 (contd.)

Nuclide	Total Body	Bone	Thyroid	Liver	GI Tract
Zr-95	5.3E-02	2.5E-01	**	7.9E-02	2.5E+02
Nb-95	1.4E+02	4.5E+02	**	2.5E+02	1.5E+06
Zr-97	1.3E-03	1.4E-02	**	2.7E-03	8.8E+02
Nb-97	3.5E-01	3.7E+00	**	9.3E-01	3.5E+03
Mo-99	2.0E+01	**	**	1.1E+02	2.5E+02
Tc-99m	3.3E-01	9.2E-03	**	2.6E-02	1.5E+01
Tc-101	1.3E-01	9.2E-03	**	1.4E-02	4.0E-14
Ru-103	2.0E+00	4.7E+00	**	**	5.5E+02
Ru-105	1.5E-01	3.7E-01	**	**	2.3E+02
Rh-105	1.4E+00	3.0E+00	**	2.2E+00	3.5E+02
Ru-106	8.7E+00	6.9E+01	**	**	4.5E+03
Ag-110m	5.6E-01	1.0E-00	**	9.5E-01	3.8E+02
Sb-124	3.6E+00	9.0E+00	2.2E-02	1.7E-01	2.6E+02
Sb-125	1.4E+00	5.8E+00	5.8E-03	6.5E-02	6.5E+01
Sb-126	1.4E+00	3.9E+00	2.3E-02	7.4E-02	3.0E+02
Sb-127	3.2E-01	8.4E-01	1.0E-02	1.8E-02	1.9E+02
Te-127	2.3E+01	1.1E+02	7.9E+01	3.8E+01	8.3E+03
Te-129m	1.7E+03	1.2E+04	3.8E+03	4.1E+03	5.6E+04
Te-129	7.4E+00	3.0E+01	2.3E+01	1.2E+01	2.3E+01
Te-131m	6.8E+02	1.6E+03	1.3E+03	8.2E+02	8.1E+04
Te-131	5.9E+00	1.9E+01	1.5E+01	7.9E+00	2.7E+00
Te-132	1.4E+03	2.4E+03	1.7E+03	1.5E+03	7.4E-04
I-131	1.3E+02	1.5E+02	7.4E+04	2.2E+02	5.9E+01
I-132	7.0E+00	7.4E+00	7.0E+02	2.0E+01	3.7E+00
I-133	2.8E+01	5.1E+01	1.3E+04	9.2E+01	8.1E+01
I-134	3.7E+00	4.0E+00	1.8E+02	1.1E+01	9.2E-03
I-135	1.6E+01	1.6E+01	2.8E+03	4.4E+01	4.8E+01
Cs-134	5.8E+05	3.0E+05	**	7.2E+05	1.3E+04
Cs-136	9.1E+04	3.1E+04	**	1.3E+05	1.4E+04
Cs-137	3.4E+05	3.8E+05	**	5.3E+05	1.0E+04
Cs-138	2.6E+02	2.6E+02	**	5.3E+02	2.3E-03

Table 2-2 (contd.)

Nuclide	Total Body	Bone	Thyroid	Liver	GI Tract
Ba-139	2.9E-02	1.0E-00	**	7.2E-04	1.8E+00
Ba-140	1.4E+01	2.1E+02	**	2.7E-01	4.4E+02
La-140	2.0E-02	1.5E-01	**	7.9E-02	5.6E+03
La-141	9.7E-04	1.9E-02	**	6.0E-03	7.3E+02
La-142	9.1E-04	7.9E-03	**	3.5E-03	2.6E+01
Ce-141	2.3E-03	3.0E-02	**	2.0E-02	7.7E+01
Ce-143	4.5E-04	5.5E-03	**	3.9E+00	1.5E+02
Ce-144	8.4E-02	1.6E+00	**	6.5E-01	5.5E+02
Pr-143	2.8E-02	5.6E-01	**	2.3E-01	2.4E+03
Nd-147	2.7E-02	3.8E-01	**	4.4E-01	2.1E+03
Hf-179m	4.2E+01	**	**	**	3.6E+02
Hf-181	3.8E+01	**	**	**	3.6E+02
W-185	4.0E+01	1.2E+03	**	4.0E+02	4.6E+04
W-187	8.6E+01	2.9E+02	**	2.5E+02	8.1E+04
Np-239	1.6E-03	3.0E-02	**	3.0E-03	6.0E+02

**No Ingestion Dose Factor (DF_i) is listed in NUREG/CR-4013. (Total 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:	50,000	
River Transit Time:	4 hours	
Usage Factors:	Adult = 730 l/yr	Teenager = 510 l/yr
	Child = 510 l/yr	Infant = 330 l/yr

Boating and Aquatic Food

River Dilution:	2,000	
Transit Time:	2 hours	
Usage Factors: (Aquatic Food)	Adult = 21 kg/yr	Teenager = 16 kg/yr
	Child = 6.9 kg/yr	Infant = 0
(Boating)	Adult = 100 hr/yr	Teenager = 100 hr/yr
	Child = 85 hr/yr	Infant = 0

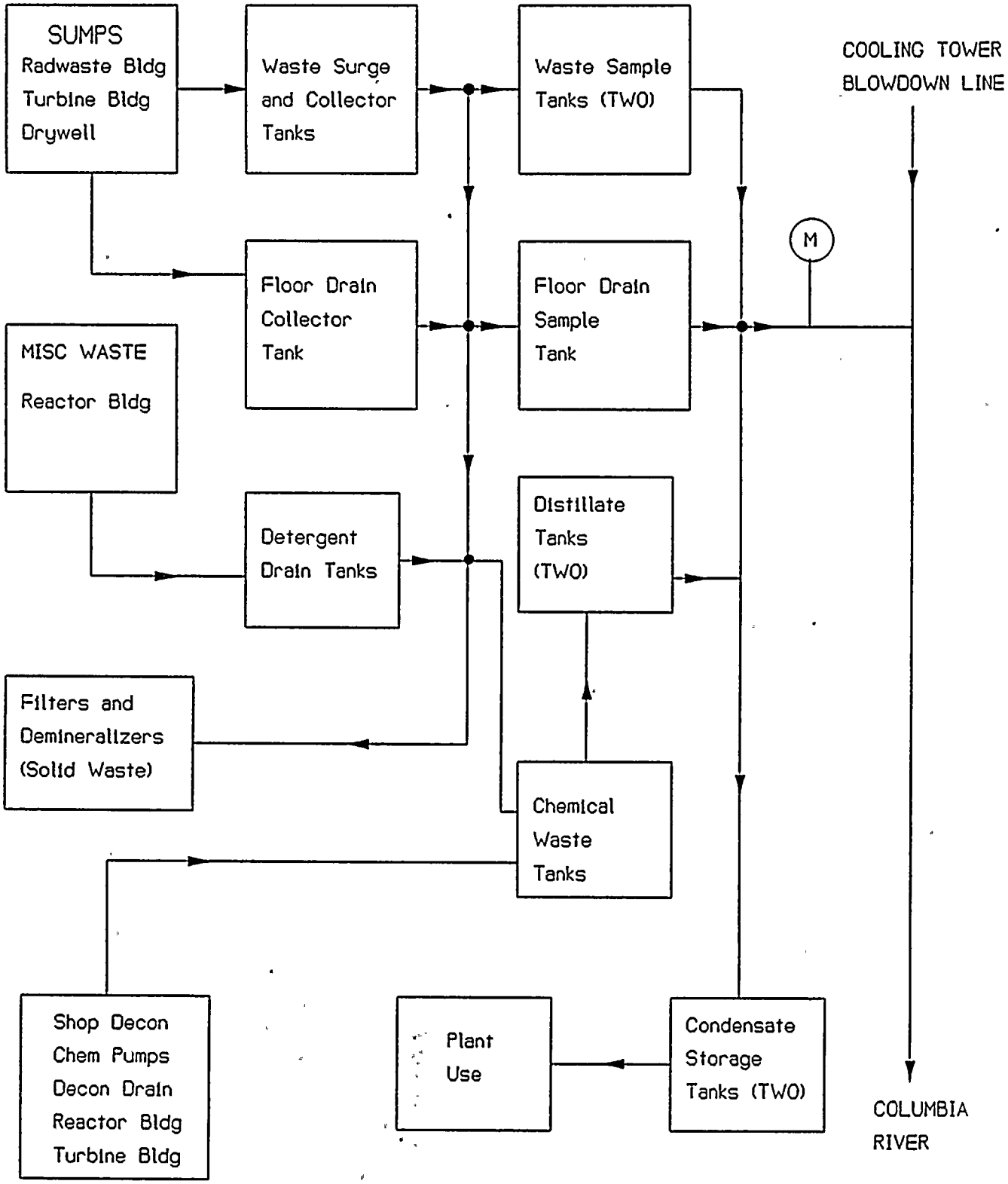
Recreation

River Dilution:	20,000	
Shoreline Width Factor:	0.2	
Usage Factors:	Shoreline Activities:	Adult = 90 hr/yr
		Teenager = 500 hr/yr
		Child = 105 hr/yr
		Infant = 0
	Swimming:	Adult = 18 hr/yr
		Teenager = 100 hr/yr
		Child = 21 hr/yr

Irrigated Foodstuffs

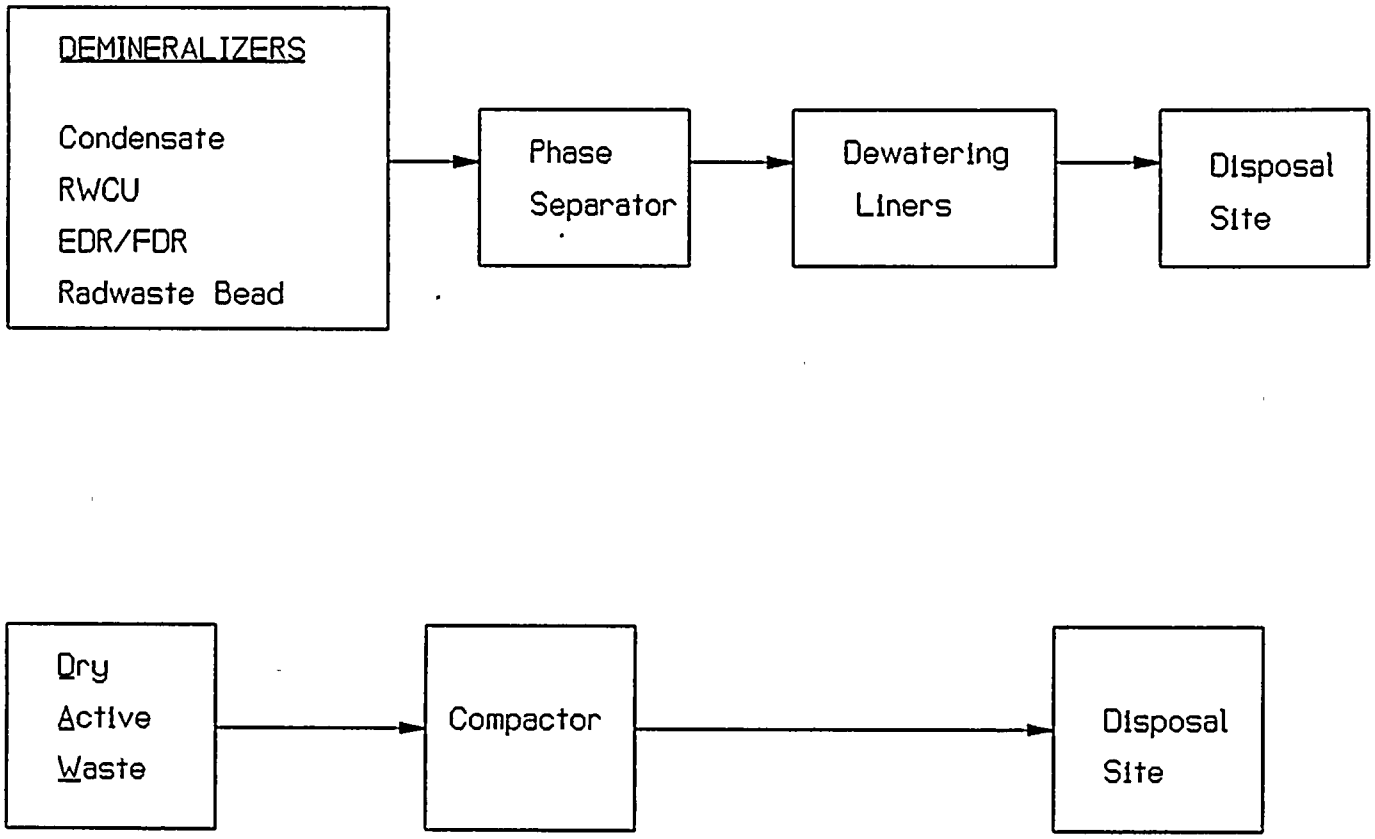
River Dilution:	50,000	
River Transit Time:	4 hours	

	Vegetables	Milk	Meat	Leafy Vegetables
Food Delivery Time:	14 days	48 hours	20 days	24 hours
Usage Factors:				
Adult	520 kg/yr	310 l/yr	110 kg/yr	64 kg/yr
Teenager	630 kg/yr	400 l/yr	65 kg/yr	42 kg/yr
Child	520 kg/yr	330 l/yr	41 kg/yr	26 kg/yr
Monthly Irrigation Rate:	180 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:	3.5E+09 kg	2.8E+08 L	2.3E+07 kg	1.9E+06 kg



SIMPLIFIED BLOCK DIAGRAM OF
LIQUID WASTE SYSTEM

Figure 2-1



SIMPLIFIED BLOCK DIAGRAM OF
SOLID RADWASTE SYSTEM

Figure 2-2

3.0 GASEOUS EFFLUENTS DOSE CALCULATIONS

The U.S. Nuclear Regulatory Commission's computer program GASPAR II can be used to perform environmental dose analyses for releases of radioactive effluents from WNP-2 into the atmosphere. The analyses estimate radiation dose to individuals and population groups from inhalation, ingestion (terrestrial foods), and external exposure (ground and plume) pathways. The calculated doses provide information for determining compliance with Appendix I of 10 CFR Part 50. This computer code has the subroutine "PARTS" which can be used for calculating dose factors.

3.1 Introduction

WNP-2 gaseous effluents are released on a continuous basis; in addition, batch releases also occur when containment and mechanical vacuum pump purges are performed and when the off-gas treatment system operates in the charcoal bypass mode. The gaseous effluents released from WNP-2 will meet Requirement for Operability at the site boundary.

Figure 3-1 delineates the WNP-2 Site boundary, which for dose calculation purposes, is considered circular with a radius of 1.2 miles. There are several low occupancy unrestricted locations within the site boundary. These locations, with the exception of the WNP-2 visitor center, are not continuously controlled by the Supply System. The locations are:

1. Wye burial site - normally controlled by DOE.

2. DOE train - two railroad lines pass through the site (approximately 3 miles of line). According to DOE, the train makes one round trip a day, through the site at an average speed of 20 mph, 5 days a week, 52 weeks/year.

3. BPA Ashe Substation - occupied 2080 hours/year. These people are not normally controlled by the Supply System but are involved in activities directly in support of WNP-2.

4. WNP-2 - Supply System Visitor Center - assumed occupied 8 hrs/yr by non-Supply System individuals.

5. WNP-1 - occupied 2080 hrs/yr. This location is controlled by the Supply System. However, activities are not in direct support of WNP-2.

6. WNP-4 - occupied 2080 hrs/yr. This location is controlled by the Supply System. However, activities are not in direct support of WNP-2.

All other locations listed in Figure 3-1 support WNP-2 activities and are controlled by the Supply System. Figure 3-2 provides a simplified block diagram of the gaseous radwaste system for the reactor, turbine and radwaste buildings. Figure 3-3 provides a simplified block diagram for the off-gas treatment system.

Air doses and doses to individuals at these locations were calculated based on the NRC GALE code design base mixture, location specific estimated occupancy, and X/Qs from XOQDOQ. (Note: Desert Sigmas were used in calculating X/Q and D/Q values, and are listed in Table 3-10 to 3-12). These doses are listed in Tables 3-16 and 3-17 along with the doses to the maximum exposed individual. The most likely exposed member of the public is considered to be residing in Taylor Flats (4.2 miles ESE of WNP-2). This is the closest residential area with the highest X/Q and D/Q values.

3.2 Gaseous Effluent Radiation Monitoring System

3.2.1 Main Plant Release Point

The Main Plant Release is instrument monitored for gaseous radioactivity prior to discharge to the environment via the main plant vent release point. Particulates and iodine activity are accumulated in filters which will be changed and analyzed as per Periodic Test and Inspection 6.2.2.1.2 (4.11.2.1.2) and Table 6.2.2.1.2-1 (4.11-2). The effluent is supplied from: the gland seal

exhauster, mechanical vacuum pumps, treated off gas, standby gas treatment, and exhaust air from the entire reactor building's ventilation.

Two 100-percent capacity vanaxial fans supply 80,000 CFM ventilation air. One is normally operating, the other is in standby. The radiation monitors are located on the ventilation exhaust plenum.

Effluent monitoring consists of a low range beta scintillator, an intermediate range beta scintillator and two ion chamber LOCA monitors. The beta scintillators are mounted in thick lead shielded chambers. The low range beta scintillator has an approximate response of 80 cpm/pCi/cc to Kr-85, and 50 cpm/pCi/cc to Xe-133 and a meter range of 10 - 10^7 cpm. The intermediate range has a response from 10^{-2} - 10^3 μCi/cc Xe-133 equivalent, and reads in panel meter units (PMU) with a meter range of 10^0 - 10^5 PMU.

The readouts and recorder are located in the main control room panel BD-RAD-24. Power is provided from 125 VDC divisional buses. This monitor has no control function but annunciates in the main control room. The alarm will initiate proper action as defined in the WNP-2 plant procedures.

3.2.2 Radwaste Building Ventilation Exhaust Monitor

The radwaste building ventilation exhaust monitoring system monitors the radioactivity in the exhaust air prior to discharge. Radioactivity can originate from: radwaste tank vents, laboratory hoods, and various cubicles housing liquid process treatment equipment and systems.

The radwaste building exhaust system has three 50-percent capacity exhaust filter units of 42,000 cfm capacity. Each exhaust unit has a medium-efficiency prefilter, a high efficiency particulate air filter (HEPA) and two centrifugal fans. Total exhaust flow will vary as the combined exhaust unit maintains a radwaste building differential pressure of -0.25 inches H_2O to the environment.

Particulate and iodine air sample filters are changed weekly for laboratory

analysis. After the particulate and iodine filters, the air sample streams are combined in a manifold prior to being monitored by a beta scintillator.

The beta scintillators, on the 487′ level are mounted in lead shielded chambers. The low range beta scintillator has an approximate response of 80 cpm/pCi/cc to Kr-85, and 50 cpm/pCi/cc to Xe-133 and a meter range of 10 - 10^7 cpm. The intermediate range has a response from 10^{-2} - 10^3 μCi/cc Xe-133 equivalent, and reads in panel meter units (PMU) with a meter range of 10^0 - 10^5 PMU. The readouts and recorder are located in the main control room panel BD-RAD-24. Power is provided from 125 VDC divisional buses. This monitor has no control functions but annunciates in the main control room. The alarm will initiate proper action as defined in the WNP-2 plant procedures.

3.2.3 Turbine Building Ventilation Exhaust Monitor

This monitoring system detects fission and the activation products from the turbine building air which may be present due to leaks from the turbine and other primary components in the building.

The turbine building main exhaust system consists of four roof-mounted centrifugal fans which draw air from a central exhaust plenum. Three fans operate continuously, with one in standby to provide a flow of 260,000 cfm.

A representative sample is extracted from the exhaust vent and passed through a particulate and charcoal filter. The air sample then passes to a beta scintillator.

The beta scintillators are mounted in lead shielded chambers. The low range beta scintillator has an approximate response of 80 cpm/pCi/cc to Kr-85, and 50 cpm/pCi/cc to Xe-133 and a meter range of 10 - 10^7 cpm. The intermediate range has a response from 10^{-2} - 10^3 μCi/cc Xe-133 equivalent, and reads in panel meter units (PMU) with a meter range of 10^0 - 10^5 PMU. The monitors are on the 525′ level of the radwaste building and the readouts and the recorder are located in the main control room panel BD-RAD-24. Power is provided from

the 125 VDC divisional buses. This monitor has no control functions but annunciates in the main control room. The alarm will initiate proper action as defined in the WNP-2 plant procedures.

3.3 10 CFR 20 Release Rate Limits

Limits for release of gaseous effluents from the site to areas at and beyond the site boundary are stated in Requirement for Operability 6.2.2.1 (3.11.2.1). The dose rate at these areas due to radioactive materials released in gaseous effluents from the site shall be limited to the following values:

(a) "The dose rate limit for noble gases shall be ≤500 mrem/yr to the total body and ≤3000 mrem/yr to the skin."

(b) "The dose rate limit for all radioiodines and for all radioactive materials in particulate form and radionuclides other than noble gases with half-lives greater than eight days shall be ≤1500 mrem/yr to any organ."

3.3.1 Noble Gases

In order to comply with Requirement for Operability 6.2.2.1, (3.11.2.1) the following equations must hold:

Whole body:

$$\sum_i Ki \left[(\overline{X/Q})_m \dot{Q}_{im} + (\overline{X/Q})_g \dot{Q}_{ig})\right] \leq 500 \text{ mrem/yr} \qquad (1)$$

Skin:

$$\sum_i \left[(L_i + 1.1M_i) ((\overline{X/Q})_m \dot{Q}_{im} + (\overline{X/Q})_g \dot{Q}_{ig})\right] \leq 3000 \text{ mrem/yr} \qquad (2)$$

3.3.2 Radioiodines and Particulates

Part "b" of Requirement for Operability 6.2.2.1 (3.11.2.1) requires that the release rate limit for all radioiodines and radioactive materials in particulate form and radionuclides other than noble gases must meet the following relationship:

Any organ:

$$\sum_i P_i \left[W_M \dot{Q}_{im} + W_g \dot{Q}_{ig}\right] \leq 1500 \text{ mrem/yr} \qquad (3)$$

The terms used in Equations (1) through (3) are defined as follows:

K_i = The total body dose factor due to gamma emissions for each identified noble gas radionuclide i (mrem/yr per $\mu Ci/m^3$).

L_i = The skin dose factor due to beta emissions for each identified noble gas radionuclide i (mrem/yr per $\mu Ci/m^3$).

M_i = The air dose factor due to gamma emissions for each identified noble gas radionuclide in mrad/yr per $\mu Ci/m^3$ (unit conversion constant of 1.1 mrem/mrad converts air dose to skin dose).

P_i = The dose parameter for all radionuclides other than noble gases for the inhalation pathway, (mrem/yr per $\mu Ci/m^3$) and for food and ground plane pathways, m^2(mrem/yr per μCi/sec). The dose factors are based on the critical individual organ and the most restrictive age group.

$\dot{Q}_{im}$ = The release rate of radionuclide i in gaseous effluent from mixed mode release. The main plant release point is a partially elevated mixed mode release (μCi/sec).

$\dot{Q}_{ig}$ = The release rate of radionuclide i in gaseous effluent from all ground level releases (μCi/sec).

$(\overline{X/Q})_m$ = (sec/m^3). For partially elevated mixed mode releases from the main plant vent release point. The highest calculated partially elevated annual average relative concentration for any area at and beyond the site boundary.

$(\overline{X/Q})_g$ = (sec/m^3). For all Turbine Building and Radwaste releases. The highest calculated ground level annual average relative concentration for any area at and beyond the site boundary.

W_g = The highest calculated annual average dispersion parameter for estimating the dose to an individual at the controlling location due to all ground level releases.

W_g = (sec/m^3). For the inhalation pathway. The location is at and beyond the site boundary in the sector of maximum concentration.

W_g = m^{-2}. For ground plane pathways. The location is at and beyond the site boundary in the sector of maximum concentration.

W_M = The highest calculated annual average dispersion parameter for estimating the dose to an individual at the controlling location due to partially elevated releases:

W_M = sec/m^3. For inhalation pathway. The location is at and beyond the site boundary in the sector of maximum concentration.

W_M = m^{-2}. For ground plane pathways. The location is at and beyond the site boundary in the sector of maximum concentration.

The factors, L_i and M_i, relate the radionuclide airborne concentrations to various dose rates assuming a semi-infinite cloud. These factors are listed in Table B-1 of Regulatory Guide 1.109, Revision 1, and in Table 3-1 of this manual.

The values used in the equations for the implementation of Requirement for Operability 6.2.2.1 (3.11.2.1) are based upon the maximum long-term annual average X/Q at and beyond the site boundary. Atmospheric dispersion factors will be evaluated annually from the WNP-2 meteorological data base and if significantly different than preoperational data as is displayed in Tables 3-10 and 3-11, then the tables will be updated. This comparison began with 1989 data. Table 3-2 provides typical locations based on the current Land Use Census (LUC) with pathways for use in dose determinations. Table 3-3 provides these typical locations with long term X/Q and D/Q values which may be used if current annual averages are not available.

The X/Q and D/Q values listed in Tables 3-10 and 3-11 reflecting correctly acquired meteorological data, January 1, 1984 - January 1, 1990 may be utilized in GASPAR II Computer runs.

3.3.2.1 Dose Parameter for Radionuclide i (P_i)

The dose parameters used in Equation (3) are based on:

1. Inhalation and ground plane. (Note: Food pathway is not applicable to WNP-2 since no food is grown at or near the restricted area boundary.)

2. The annual average continuous release meteorology at the site boundary.

3. The critical organ for each radionuclide (thyroid for radioiodine).

4. The most restrictive age group.

Calculation of P_i^I (Inhalation): The following equation will be used to cal-

culate P_i^I (Inhalation).

$$P_i^I \text{ (Inhalation)} = K^A(BR)\ DFA_i \text{ (mrem/yr per Ci/m}^3\text{)} \quad (5)$$

where:

K^A = A constant of conversion, 10^6 μpCi/Ci.

BR = The breathing rate of the child age group, 3700 m^3/yr.

DFA_i = The critical organ inhalation dose factor for the child age group for the ith radionuclide in mrem/pCi. The total body is considered as an organ in the selection of DFA_i.

The inhalation dose factor for DFA_i for the child age group is listed in Table E-9 of Regulatory Guide 1.109, Revision 1, and Table 3-4 of this manual. Resolving the units yields:

$$P_i^I = \text{(Inhalation)} = (3.7 \times 10^9)\ (DFA_i) \text{ (mrem/yr per } \mu\text{Ci/m}^3\text{)} \quad (6)$$

The P_i^I (Inhalation) values for the child age group are tabulated in Table 3-4 of this manual.

3.4 10 CFR 50 Release Rate Limits

The requirements pertaining to 10 CFR 50 release rate limits are specified in Requirement for Operability 6.2.2.2 (3.11.2.2) and 6.2.2.3 (3.11.2.3).

Requirement for Operability 6.2.2.2 (3.11.2.2) deals with the air dose from noble gases and requires that the air dose at and beyond the site boundary due to noble gases released in gaseous effluents shall be limited to the

following:

(a) "During any calendar quarter, to ≤5 mrad for gamma radiation and to ≤10 mrad for beta radiation."

(b) "During any calendar year, to ≤10 mrad for gamma radiation and ≤20 mrad for beta radiation."

Requirement for Operability 6.2.2.3 (3.11.2.3) deals with radioiodines, tritium, and radioactive materials in particulate form, and requires that the dose to an individual from radioiodines, tritium and radioactive materials in particulate form with half-lives greater than eight days in gaseous effluents released to unrestricted areas shall be limited to the following:

(a) "During any calendar quarter, to ≤7.5 mrem."

(b) "During any calendar year, to ≤15 mrem."

3.4.1 Noble Gases (Requirement for Operability 6.2.2.2 (3.11.2.2))

The air dose at and beyond the site boundary due to noble gases released in the gaseous effluent will be determined by using the following equations.

a. During any calendar quarter, for gamma radiation:

$$3.17 \times 10^{-8} \sum_i \left[M_i (\overline{X/Q})_g Q_{ig} + (X/q)_g q_{ig} + (\overline{X/Q})_m Q_{im} + (X/q)_m q_{im} \right] \leq 5 \text{ mrad} \quad (8)$$

During any calendar quarter, for beta radiation:

$$3.17 \times 10^{-8} \sum_i N_i \left[(\overline{X/Q})_g Q_{ig} + (X/q)_g q_{ig} + (\overline{X/Q})_m Q_{im} + (X/q)_m q_{im} \right] \leq 10 \text{ mrad} \quad (9)$$

b. During any calendar year, for gamma radiation:

$$3.17 \times 10^{-8} \sum_i M_i \left[(\overline{X/Q})_g Q_{ig} + (X/q)_g q_{ig} + (\overline{X/Q})_m Q_{im} + (X/q)_m q_{im} \right] \leq 10 \text{ mrad} \quad (10)$$

During any calendar year, for beta radiation:

$$3.17 \times 10^{-8} \sum_i N_i \left[(\overline{X/Q})_g Q_{ig} + (X/q)_g q_{ig} + (\overline{X/Q})_m Q_{im} + (X/q)_m q_{im} \right] \leq 20 \text{ mrad} \quad (11)$$

where:

M_i = The air dose factor due to gamma emissions for each identified noble gas radionuclide, in mrad/yr per $\mu Ci/m^3$ (M_i values are listed in Table 3-1).

N_i = The air dose factor due to beta emissions for each identified noble gas radionuclide, in mrad/yr per $\mu Ci/m^3$ (N_i values are listed in Table 3-1).

$(\overline{X/Q})_g$ = For ground level release points. The highest calculated annual average relative concentration for area at and beyond the site area boundary for long-term releases (greater than 500 hr/yr). (Sec/m^3)

$(X/q)_g$ = For ground level release points. The relative concentration for areas at and beyond the site area boundary for short-term releases (equal to or less than 500 hr/yr). (Sec/m^3)

$(\overline{X/Q})_m$ = For partially elevated release points. The highest

calculated annual average relative concentration for areas at and beyond the site boundary for long-term releases (greater than 500 hr/yr). (Sec/m^3)

$(X/q)_m$ = For partially elevated release points. The relative concentration for areas at and beyond the site boundary for short-term releases (equal to or less than 500 hr/yr). (Sec/m^3)

q_{im} = The average release of noble gas radionuclides in gaseous effluents, i, for short-term releases (equal to or less than 500 hr/yr) from the main plant release point, in μCi. Releases shall be cumulative over the calendar quarter or year, as appropriate.

q_{ig} = The average release of noble gas radionuclides in gaseous effluents, i, for short-term releases (equal to or less than 500 hr/yr) from Radwaste and Turbine Building, in μCi. Releases shall be cumulative over the calendar quarter or year, as appropriate.

Q_{im} = The average release of noble gas radionuclides in gaseous releases, i, for long-term releases (greater than 500 hr/yr) from the main plant release point, in μCi. Release shall be cumulative over the calendar quarter or year, as appropriate.

Q_{ig} = The average release of noble gas radionuclides in gaseous effluents, i, for long-term releases (greater than 500 hr/yr) from Radwaste and Turbine Building, in μCi. Releases shall be cumulative over the calendar quarter or year, as appropriate.

3.17×10^{-8} = The inverse of the number of seconds in a year.

3.4.2 <u>Radioiodines, Tritium and Particulates Requirement for Operability</u>

6.2.2.3 (3.11.2.3)

The following equation calculates the dose to an individual from radioiodines, tritium, and radioactive material in particulate form with half-lives greater than eight days in gaseous effluents released to the unrestricted areas:

a. During any calendar quarter:

$$3.17 \times 10^{-8} \sum_i R_i \left[W_m Q_{im} + w_m q_{im} + W_g Q_{ig} + w_g q_{ig} \right] \leq 7.5 \text{ mrem} \qquad (12)$$

b. During any calendar year:

$$3.17 \times 10^{-8} \sum_i R_i \left[W_m Q_{im} + w_m q_{im} + W_g Q_{ig} + w_g q_{ig} \right] \leq 15 \text{ mrem} \qquad (13)$$

where:

Q_{im}, Q_{ig} = The releases of radionuclides, radioactive materials in particulate form, and radionuclides other than noble gases in gaseous effluents, i, for long-term releases greater than 500 hr/yr, in μCi. Releases shall be cumulative over the calendar quarter or year, as appropriate (m is for mixed mode releases, g is for ground level releases).

q_{im}, q_{ig} = The releases of radionuclides, radioactive materials in particulate form, and radionuclides other than noble gases in gaseous effluents, i, for short-term releases equal to or less than 500 hr/yr, in μCi. Releases shall be cumulative over the calendar quarter or year as appropriate (m is for mixed mode releases, g is for ground level releases).

W_m, W_g = The dispersion parameter for estimating the dose to an

individual at the controlling location for long-term (greater than 500 hr.) releases (m is for mixed mode releases, g is for ground level releases).

W = $(\overline{X/Q})$ for the inhalation pathway, in sec/m^3.

W = $(\overline{D/Q})$ for the food and ground plane pathways in $meters^{-2}$.

W_m, W_g = The dispersion parameter for estimating the dose to an individual at the controlling location for short-term (less than 500 hr.) releases (m is for mixed mode releases, g is for ground level releases).

w = $(\overline{X/q})$ for the inhalation pathway, in sec/m^3.

w = $(\overline{D/q})$ for the food and ground plane pathways in $meters^{-2}$.

3.17×10^{-8} = The inverse of the number of seconds in a year.

R_i = The dose factor for each identified radionuclide, i, in m^2(mrem/yr per μCi/sec) or mrem/yr per μCi/m^3.

3.4.2.1 Dose Parameter for Radionuclide i (R_i)

The R_i values used in Equations (12) and (13) of this section are calculated separately for each of the following potential exposure pathways:

- Inhalation
- Ground plane contamination
- Grass-cow/goat-milk pathway
- Grass-cow-meat pathway
- Vegetation pathway

Monthly dose assessments for WNP-2 gaseous effluent will be done for all age groups.

Calculation of R_i^I (Inhalation Pathway Factor)

$$R_i^I \text{ (Inhalation)} = K' \, (BR)_a \, (DFA_i)_a \text{ (mrem/yr per } \mu Ci/m^3) \qquad (14)$$

where:

R_i^I = The inhalation pathway factor (mrem/yr per $\mu Ci/m^3$).

K' = A constant of unit conversion, 10^6 pCi/μCi.

$(BR)_a$ = The breathing rate of the receptor of age group (a) in meter^3/yr. (Infant = 1400, child = 3,700, teen = 8,000, adult = 8,000. From P.32 NUREG-0133).

$(DFA_i)_a$ = The maximum organ inhalation dose factor for receptor of age group a for the ith radionuclide (mrem/pCi). The total body is considered as an organ in the selection of $(DFA_i)_a$. $(DFA_i)_a$ values are listed in Tables E-7 through E-10 of Regulatory Guide 1.109 manual, Revision 1 and NUREG/CR-4013. Values of R_i^I are listed in Table 3-5.

Calculation of R_i^G (Ground Plane Pathway Factor)

$$R_i^G \text{ (Ground Plane)} = K^A K^B (SF)(DFG_i)(1-e^{-\lambda_i t})/\lambda_i \text{ (m}^2 \text{ x mrem/yr per } \mu\text{Ci/sec)} \quad (15)$$

where:

R_i^G = Ground plane pathway factor (m^2 x mrem/yr per μCi/sec).

K^A = A conversion constant of (10^6 pCi/μCi).

K^B = A conversion constant - (8760 hr/yr).

λ_i = The decay constant for the ith radionuclide (sec^{-1}).

t = Exposure time, 6.31 x 10^8 sec (20 years).

DFG_i = The ground plane dose conversion factor for the ith radionuclide, as listed in Table E-6 of Regulatory Guide 1.109, Revision 1 and NUREG/CR-4013 (mrem/hr per pCi/m^2).

SF = Shielding Factor (dimensionless)--0.7 if building is present, as suggested in Table E-15 of Regulatory Guide 1.109, Revision 1.

The values of R_i^G are listed in Table 3-5 of this manual.

Calculation of R_i^C (Grass-Cow/Goat-Milk Pathway Factor)

R_i^C (Grass-Cow/Goat-Milk Factor) =

$$K' \frac{Q_F(U_{ap})}{\lambda_i + \lambda_w} F_m(r)(DFL_i)_a \left[\frac{f_p f_s}{Y_p} + \frac{(1-f_p f_s)e^{-\lambda_i t_h}}{Y_s}\right] e^{-\lambda_i t_f} \qquad (16)$$

(m^2 x mrem/yr per μCi/sec)

where:

K'	=	A constant of unit conversion, 10^6 pCi/μCi.
Q_F	=	The cow/goat consumption rate, in kg/day (wet weight).
U_{ap}	=	The receptor's milk consumption rate for age a, in liters/yr.
Y_p	=	The agricultural productivity by unit area of pasture feed grass, in kg/m^2.
Y_s	=	The agricultural productivity by unit area of stored feed, in kg/m^2.
F_m	=	The stable element transfer coefficients, in days/liter.
r	=	Fraction of deposited activity retained on feed grass.
$(DFL_i)_a$	=	The maximum organ ingestion dose factor for the ith radionuclide for the receptor in age group a, in mrem/pCi (Tables E-11 to E-14 of Regulatory Guide 1.109, Revision 1 and NUREG/CR-4013).
λ_i	=	The decay constant for the ith radionuclide, in sec^{-1}.

λ_w = The decay constant for removal of activity on leaf and plant surfaces by weathering, 5.73×10^{-7} sec^{-1} (corresponding to a 14-day half-life).

t_f = The transport time from pasture to animal, to milk, to receptor, in sec.

t_h = The transport time from pasture, to harvest, to animal, to milk, to receptor, in sec.

f_p = Fraction of the year that the cow/goat is on pasture (dimensionless).

f_s = Fraction of the cow/goat feed that is pasture grass while the cow is on pasture (dimensionless).

NOTE: For radioiodines, multiply R_i^C value by 0.5 to account for the fraction of elemental iodine available for deposition.

The input parameters used for calculating R_i^C are listed in Table 3-6 and the R_i^M values are tabulated in Table 3-7.

For Tritium:

In calculating R_T^C pertaining to tritium in milk, the airborne concentration. rather than the deposition will be used:

R_T^C (Grass-Cow/Goat-Milk Factor) =

$$K^A K^C F_m Q_F U_{ap} (DFL_i)_a [0.75(0.5/H)] \text{ (mrem/yr per } \mu Ci/m^3) \quad (17)$$

where:

K^A = A constant unit conversion, 10^6 pCi/μCi.

K^c = A constant of unit conversion, 10^3 gm/kg.

H = Absolute humidity of the atmosphere, in gm/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.

Calculation of R_i^M (Grass-Cow-Meat Pathway Factor)

R_i^M (Grass-Cow-Meat Factor) =

$$K' \frac{Q_F(U_{ap})}{\lambda_i + \lambda_w} F_f(r)(DFL_i)_a \left[\frac{f_p f_s}{Y_p} + \frac{(1-f_p f_s)e^{-\lambda_i t_h}}{Y_s}\right] e^{-\lambda_i t_f} \qquad (18)$$

(m^2 x mrem/yr per μCi/sec)

where:

K' = A constant unit conversion, 10^6pCi/μCi.

F_f = The stable element transfer coefficients, in days/kg.

U_{ap} = The receptor's meat consumption rate for age a, in kg/yr.

t_f = The transport time from pasture to receptor, in sec.

t_h = The transport time from crop field to receptor, in sec.

NOTE: For radioiodines, multiply R_i^M value by 0.5 to account for the fraction of elemental iodine available for deposition.

The input parameters needed for solving Equation (18) are listed in Table 3-7.

For Tritium:

In calculating the R_T^M for tritium in meat, the airborne concentration is used rather than the deposition rate. The following equation is used to calculate the R_T^M values for tritium:

R_T^M (Grass-Cow-Meat Pathway) =

$$K^A K^C \left[F_f Q_F U_{ap} (DFL_i)_a \right] \left[0.75(0.5/H) \right] \text{(mrem/yr per } \mu\text{Ci/m}^3\text{)} \qquad (19)$$

Where the terms are as defined in Equations (16) through (18), R_i^M values for tritium pertaining to the infant age group is zero since there is no meat consumption by this age group.

Calculation of R_i^V (Vegetation Pathway Factor)

R_i^V (Vegetation Pathway Factor) =

$$K' \left[\frac{(r)}{Y_v(\lambda_i + \lambda_w)} (DFL_i)_a \right] \left[U_a^L f_L e^{-\lambda_i t_L} + U_a^S f_g e^{-\lambda_i t_h} \right] \qquad (20)$$

(m^2 x mrem/yr per μCi/sec)

where:

K' = A constant of unit conversion, 10^6pCi/μCi.

U_a^L = The consumption rate of fresh leafy vegetation by the receptor in age group a, in kg/yr.

U_a^S = The consumption rate of stored vegetation by the receptor in age group a, in 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, in seconds.

t_h = The average time between harvest of stored vegetation and its consumption, in seconds.

Y_v = The vegetation area density, in kg/m^2.

NOTE: For radioiodines, multiply R_i^V value by 0.5 to account for the fraction of elemental iodine available for deposition.

All other items are as defined in Equations (16) through (18).

For Tritium:

In calculating the R_T^V for tritium, the concentration of tritium in vegetation is based on airborne concentration rather than the deposition rate. The following equation is used to calculate R_T^V for tritium:

R_T^V (Vegetation Pathway Factor) =

$$K^A K^C \left[(U_a^L f_L + U_a^s f_g) (DFL_i)_a \right] [0.75(0.5/H)] \text{ (mrem/yr per } \mu Ci/m^3) \qquad (21)$$

Where all terms have been defined above and in Equations (16) through (18), the R_T^V value for tritium is zero for the infant age group due to zero vegetation consumption rate by that age group. The input parameters needed for solving Equations (20) and (21) are listed in Table 3-8.

3.4.3 Annual Doses At Special Locations

The Radioactive Effluent Release Report submitted within 60 days after January 1 of each year shall include an assessment of the radiation doses from radioactive gaseous effluents to "Members of the Public," due to their activities inside the site boundary during the report period.

Annual doses within the site boundary have been determined for several locations using the NRC GASPAR computer code and source term data from Table 11.3-7 of the FSAR. These values are listed in Tables 3-16 and 3-17. Of the locations listed within the site boundary, only two, the DOE Train and WNP-2 Visitor Center are considered as being occupied by a "Member of the Public." Annual doses to the maximum exposed "Member of the Public" shall be determined for an individual at the WNP-2 Visitor Center based on occupancy of 8 hours per year due to it being the higher of the two locations.

3.5 Compliance with Requirement for Operability 6.2.2.4 (3.11.2.4)

Requirement for Operability 6.2.2.4 (3.11.2.4) states:

> "The GASEOUS RADWASTE TREATMENT SYSTEM shall be in operation in either the normal or charcoal bypass mode. The charcoal bypass mode shall not be used unless the offgas post-treatment radiation monitor is OPERABLE as specified in Table 6.1.2.1-1 (3.3.7.11-1)."
>
> "RELEVANT CONDITIONS: Whenever the main condenser steam jet air ejector (evacuation) system is in operation."

Prior to placing the gaseous radwaste treatment system in the charcoal bypass mode, the alarm setpoints on the main plant vent release monitor shall be set to account for the increased percentages of short-lived noble gases. Noble gas percentages shall be based either on actual measured values or on primary coolant design base noble gas concentration percentages adjusted for 30-minute decay. Table 3-15 lists the percentage values for 30-minute decay.

3.5.1 Projection of Doses

The projected doses due to WNP-2 gaseous effluent releases will be determined at least once per 31 days as stated in Requirement for Operability 6.2.2.5 (3.11.2.5). The projected dose when averaged over 31 days is not to exceed 0.3 mrem to any organ in a 31 day period to areas at and beyond the site boundary. Dose projection values will be determined by using a previous 31 day "Gaspar Output" (NRC Computer Code) for the site boundary and/or an area beyond the site boundary. Based on operating data, the projected dose should be adjusted accordingly to compensate for those anticipated changes in operations and/or source term values.

3.6 Calculation of Gaseous Effluent Monitor Alarm Setpoints

3.6.1 Introduction

The following procedure is used to ensure that the dose rate in the unrestricted areas due to noble gases in the WNP-2 gaseous effluent do not exceed 500 mrem/yr to the whole body or 3000 mrem/yr to the skin. The initial setpoints determination is calculated using a conservative radionuclide mix obtained from the WNP-2 GALE code. Once the plant is operating and sufficient measurable process fission gases are in the effluent, then the actual radionuclide mix will be used to calculate the alarm setpoint.

3.6.2 Setpoint Determination for all Gaseous Release Paths

The setpoints for gaseous effluent are based on instantaneous noble gas dose rates. Sampling and analysis of radioiodines and radionuclides in particulate form will be performed in accordance with Requirement for Operability to ensure compliance with 10 CFR 20 and 10 CFR 50 Appendix I limits. The three release points will be partitioned such that their sum does not exceed 100 percent of the limit. Originally, the setpoints will be set at 40 percent for the Reactor Building, 40 percent for the Turbine Building and 20 percent for the Radwaste Building. These percentages could vary at the plant discretion, should the operational conditions warrant such change. However, the combined

releases due to variations in the setpoints will not result in doses which exceed the limit stated in Requirement for Operability. Both skin dose and whole body setpoints will be calculated and the lower limit will be used.

3.6.2.1 Setpoints Calculations Based on Whole Body Dose Limits

The fraction (π_i) of the total gaseous radioactivity in each gaseous effluent release path j for each noble gas radionuclide i will be determined by using the following equation:

$$\pi_{ij} = \frac{M_{ij}}{M_{Tj}} \text{ (dimensionless)} \tag{22}$$

where:

M_{ij} = The measured individual concentration of radionuclide i in the gaseous effluent release path j (μCi/cc).

M_{Tj} = The measured total concentration of all noble gases identified in the gaseous effluent release path j (μCi/cc).

Based on Requirement for Operability 6.2.2.1 (3.11.2.1), the maximum acceptable release rate of all noble gases in the gaseous effluent release path j is calculated by using the following equation:

$$Q_{TJ} = \frac{F_j \, 500}{X/Q_j \sum_{i=1}^{m} (K_i)(\pi_{ij})} \text{ (μCi/sec)} \tag{23}$$

where:

Q_{TJ} = The maximum acceptable release rate (μCi/sec) of all noble gases in the gaseous effluent release path j (μCi/cc).

F_j = Fraction of total dose allocated to release path j.

500 = Whole body dose rate limit of 500 mrem/yr as specified in Requirement for Operability 6.2.2.1.a (3.11.2.1.a).

X/Q_j = Maximum normalized diffusion coefficient of effluent release path j at and beyond the site boundary (sec/m^3). Turbine Building and Radwaste Building values are based on average annual ground level values. Main plant vent release values are for mixed mode and may be either short term or average annual value dependent upon type of release.

K_i = The total whole body dose factor due to gamma emission from noble gas nuclide i (mrem/yr per μCi/m^3) (as listed in Table B-1 of Regulatory Guide 1.109, Revision 1).

π_{ij} = As defined in Equation (22).

m = Total number of radionuclides in the gaseous effluent.

j = Different release pathways.

The total maximum acceptable concentration (C_{Tj}) of noble gas radionuclides in the gaseous effluent release path j (μCi/cc) will be calculated by using the following equation:

$$C_{Tj} = \frac{Q_{Tj}}{R_j} \ (\mu\text{Ci/cc}) \qquad (24)$$

where:

C_{Tj} = The total allowed concentration of all noble gas radionuclides in the gaseous effluent release path j (μCi/cc).

Q_{Tj} = The maximum acceptable release rate (μCi/sec) of all noble gases in the gaseous effluent release path j.

R_j = The effluent release rate (cc/sec) at the point of release.

To determine the maximum acceptable concentration (C_{ij}) of noble gas radionuclide i in the gaseous effluent for each individual noble gas in the gaseous effluent (μCi/cc), the following equation will be used:

$$C_{ij} = \pi_{ij} C_{Tj} \ (\mu Ci/cc) \tag{25}$$

where:

π_{ij} and C_{TJ} are as defined in Equations (22) and (24) respectively, the gaseous effluent monitor alarm setpoint will then be calculated as follows:

$$C.R.j. = \sum_{i=1}^{m} C_{ij} E_{ij} (cpm) \tag{26}$$

where:

C.R.j = Count rate above background (cpm) for gaseous release path j.

C_{ij} = The maximum acceptable concentration of noble gas nuclide i in the gaseous effluent release path j μCi/cc.

E_{ij} = Detection efficiency of the gaseous effluent monitor j for noble gas i (cpm/μCi/cc).

3.6.2.2 Setpoints Calculations Based on Skin Dose Limits

The method for calculating the setpoints to ensure compliance with the skin dose limits specified in Requirement for Operability 6.2.2.1.a (3.11.2.1.a) is similar to the one described for whole body dose limits (Section 3.6.2.1 of this manual), except Equation (27) will be used instead of Equation (23) for determining maximum acceptable release rate (Q_{Tj}).

$$Q_{TJ} = \frac{F_j \; 3000}{(X/Q_j) \sum_{i=1}^{m} (L_i + 1.1M_i)(\pi_{ij})} \quad (\mu Ci/sec) \qquad (27)$$

where:

Q_{TJ} = The maximum acceptable release rate of all noble gases in the gaseous effluent release path j in μCi/sec.

X/Q_j = The maximum annual normalized diffusion coefficient for release path j at and beyond the site boundary (sec/m^3).

F_j = Fraction of total allowed dose.

L_i = The skin dose factor due to beta emission for each identified noble gas radionuclide i in mrem/yr per μCi/m^3 (L_i values are listed in Table 3-1).

M_i = The air dose factor due to gamma emissions for each identified noble gas radionuclide, in mrad/yr per μCi/m^3 (M_i values are listed in Table 3-1).

1.1 = A conversion factor to convert dose in mrad to dose

equivalent in mrem.

3000 = Skin dose rate limit of 3000 mrem/yr as specified in Requirement for Operability 6.2.2.1 (3.11.2.1).

Table 3-1

DOSE FACTORS FOR NOBLE GASES AND DAUGHTERS*

Radionuclide	Total Body Dose Factor K_i (mrem/yr per μCi/m3)	Skin Dose Factor L_i (mrem/yr per μCi/m3)	Gamma Air Dose Factor M_i (mrad/yr per μCi/m3)	Beta Air Dose Factor N_i (mrad/yr per μCi/m3)
Kr-85m	1.17E+03**	1.46E+03	1.23E+03	1.97E+03
Kr-85	1.61E+01	1.34E+03	1.72E+01	1.95E+03
Kr-87	5.92E+03	9.73E+03	6.17E+03	1.03E+04
Kr-88	1.47E+04	2.37E+03	1.52E+04	2.93E+03
Kr-89	1.66E+04	1.01E+04	1.73E+04	1.06E+04
Kr-90	1.56E+04	7.29E+03	1.63E+04	7.83E+03
Xe-131m	9.15E+01	4.76E+02	1.56E+02	1.11E+03
Xe-133m	2.51E+02	9.94E+02	3.27E+02	1.48E+03
Xe-133	2.94E+02	3.06E+02	3.53E+02	1.05E+03
Xe-135m	3.12E+03	7.11E+02	3.36E+03	7.39E+02
Xe-135	1.81E+03	1.86E+03	1.92E+03	2.46E+03
Xe-137	1.42E+03	1.22E+04	1.51E+03	1.27E+04
Xe-138	8.83E+03	4.13E+03	9.21E+03	4.75E+03
Ar-41	8.84E+03	2.69E+03	9.30E+03	3.28E+03

*The listed dose factors are for radionuclides that may be detected in gaseous effluents.

**7.56E-02 = 7.56×10^{-2}.

The values listed above were taken from Table B-1 of NRC Regulatory Guide 1.109, Revision 1. The values were multiplied by 10^6 to convert picocuries^{-1} to microcuries^{-1}.

Table 3-2

DISTANCES (MILES) TO TYPICAL CONTROLLING LOCATIONS
AS MEASURED FROM CENTER OF WNP-2 CONTAINMENT BUILDING*

Location	Distance (miles)	Sector	Dose Pathways
Site Boundary	1.2	SE	Air dose measurement
One	4.2	ESE	Ground, vegetables, and inhalation
Two	6.4	SE	Ground, meat, cow milk, and inhalation
Three	4.8	SE	Ground, vegetables, and inhalation
Four	4.1	ENE	Ground, vegetables, and inhalation
Five	4.3	NE	Ground and inhalation

*Typical locations and pathways are based on the current Land Use Census (LUC).

Table 3-3

WNP-2 LONG-TERM AVERAGE DISPERSION (X/Q)
AND DEPOSITION (D/Q) VALUES FOR TYPICAL LOCATIONS

Location	Sector	Distance (miles)	Point of Release	X/Q No Decay No Depletion (sec/m^3)	X/Q 2.3 Days Decay No Depletion (sec/m^3)	X/Q 8.0 Days Decay Depleted (sec/m^3)	D/Q (m^{-2})
Site Boundary	SE	1.2	Reactor Bldg.	2.7E-07	2.7E-07	2.6E-07	2.0E-09
			Turbine Bldg.	1.4E-05	1.3E-05	1.2E-05	1.2E-08
			Radwaste Bldg.	1.4E-05	1.3E-05	1.2E-05	1.2E-08
One	ESE	4.2	Reactor Bldg.	1.5E-06	1.5E-06	1.2E-06	6.0E-10
			Turbine Bldg.	1.1E-06	1.0E-06	8.1E-07	6.0E-10
			Radwaste Bldg.	1.1E-06	1.0E-06	8.1E-07	6.0E-10
Two	SE	6.4	Reactor Bldg.	3.7E-07	3.5E-07	3.4E-07	3.2E-10
			Turbine Bldg.	7.2E-07	6.8E-07	5.1E-07	2.6E-10
			Radwaste Bldg.	7.2E-07	6.8E-07	5.1E-07	2.6E-10
Three	SE	4.8	Reactor Bldg.	5.7E-07	5.5E-07	5.5E-07	5.9E-10
			Turbine Bldg.	1.1E-06	1.1E-06	8.3E-07	4.9E-10
			Radwaste Bldg.	1.1E-06	1.1E-06	8.3E-07	4.9E-10
Four	ENE	4.1	Reactor Bldg.	9.8E-07	9.3E-07	7.7E-07	3.8E-10
			Turbine Bldg.	6.9E-07	6.5E-07	5.2E-07	3.7E-10
			Radwaste Bldg.	6.9E-07	6.5E-07	5.2E-07	3.7E-10
Five	NE	4.3	Reactor Bldg.	6.8E-08	6.6E-08	6.6E-08	1.3E-10
			Turbine Bldg.	6.7E-07	6.3E-07	5.0E-07	3.7E-10
			Radwaste Bldg.	6.7E-07	6.3E-07	5.0E-07	3.7E-10

Table 3-4

DOSE RATE PARAMETERS
IMPLEMENTATION OF 10 CFR 20, AIRBORNE RELEASES

		Child Dose Factor*		P_i^I
Nuclide	$\lambda(sec^{-1})$	DFA_i mrem/pCi	DFG_i mrem/hr / pCi/m^2	Inhalation mrem/yr / μCi/m^3
H-3	1.8E-09	1.7E-07	0.0	6.3E+02
Na-24	1.3E-05	4.4E-06	2.9E-08	1.6E+04
Cr-51	2.9E-07	4.6E-06	2.6E-10	1.7E+04
Mn-54	2.6E-08	4.3E-04	6.8E-09	1.6E+06
Mn-56	7.5E-05	3.3E-05	1.3E-08	1.2E+05
Fe-55	8.5E-09	3.0E-05	0.0	1.1E+05
Fe-59	1.8E-07	3.4E-04	9.4E-09	1.3E+06
Co-58	1.1E-07	3.0E-04	8.2E-09	1.1E+06
Co-60	4.2E-09	1.9E-03	2.0E-08	7.0E+06
Cu-64	1.5E-05	9.9E-06	1.7E-09	3.7E+04
Zn-65	3.3E-08	2.7E-04	4.6E-09	1.0E+06
Zn-69m	1.4E-05	2.7E-05	3.4E-09	1.0E+05
As-76	7.3E-06	1.9E-05	1.7E-07	7.0E+04
Br-82	5.5E-06	5.7E-06	2.2E-08	2.1E+04
Sr-89	1.5E-07	5.8E-04	6.5E-13	2.2E+06
Sr-90	7.9E-10	1.0E-02	2.6E-12**	3.7E+07
Zr-95	1.2E-07	6.0E-04	5.8E-09	2.2E+06
Nb-95	2.3E-07	1.7E-04	6.0E-09	6.3E+05
Zr-97	1.1E-05	9.5E-05	6.4E-09	3.5E+05
Nb-97	1.6E-04	7.5E-06	5.4E-09	2.8E+04
Mo-99	2.9E-06	3.7E-05	2.2E-09	1.4E+05
Tc-99m	3.2E-05	1.3E-06	1.1E-09	4.8E+03
Ru-106	2.2E-08	3.9E-03	1.8E-09	1.4E+07
Ag-110m	3.2E-08	1.5E-03	2.1E-08	5.6E+06
Sb-124	1.3E-07	8.8E-04	1.5E-08	3.3E+06
Sb-125	7.9E-09	6.3E-04	3.5E-09	2.3E+06
Sb-126	6.5E-07	2.9E-04	1.0E-08	1.1E+06
Sb-127	2.1E-06	6.2E-05	6.6E-09	2.3E+05
Te-127	2.1E-05	1.5E-05	1.1E-11	5.6E+04
Te-131m	6.4E-06	8.3E-05	9.9E-09	3.1E+05
I-131	1.0E-06	4.4E-03	3.4E-09	1.6E+07
I-132	8.4E-05	5.2E-05	2.0E-08	1.9E+05
I-133	9.2E-06	1.0E-03	4.5E-09	3.7E+06
I-135	2.9E-05	2.1E-04	1.4E-08	7.8E+05
Cs-134	1.1E-08	2.7E-04	1.4E-08	1.0E+06

Table 3-4

DOSE RATE PARAMETERS
IMPLEMENTATION OF 10 CFR 20, AIRBORNE RELEASES

		Child Dose Factor*		P_i^I
Nuclide	$\lambda(sec^{-1})$	DFA_i mrem/pCi	DFG_i mrem/hr / pCi/m^2	Inhalation mrem/yr / μCi/m^3
Cs-137	7.3E-10	2.5E-04	4.9E-09	9.3E+05
Cs-138	3.6E-04	2.3E-07	2.4E-08	8.5E+02
Ba-140	6.3E-07	4.7E-04	2.4E-09	1.7E+06
La-140	4.8E-06	6.1E-05	1.7E-08	2.3E+05
Ce-141	2.4E-07	1.5E-04	6.2E-10	5.6E+05
Ce-144	2.8E-08	3.2E-03	3.7E-10	1.2E+07
Nd-147	7.2E-07	8.9E-05	1.2E-09	3.3E+05
Hf-179m	3.7E-02	2.0E-05	NO DATA	7.4E+04
Hf-181	1.8E-07	6.0E-05	1.2E-08	2.2E+05
W-185	1.1E-07	1.9E-04	0.0	7.0E+05
Np-239	3.4E-06	1.7E-05	9.5E-10	6.4E+04

* Maximum Organ
**No data is listed for Sr-90 in Table E-6 of Regulatory Guide 1.109, Revision 1. Y-90 values were used for dose conversion factor Sr-90.

Table 3-5a

DOSE PARAMETERS FOR 10 CFR 50 EVALUATIONS, AIRBORNE RELEASES
AGE GROUP: ADULT ORGAN OF REFERENCE: MAXIMUM ORGAN
R(I), INDIVIDUAL PATHWAY DOSE PARAMETERS FOR RADIONUCLIDES OTHER THAN NOBLE GASES

RADIO-NUCLIDE	INHALATION (MREM/YR PER µCI/M3)	GROUND PLANE (M2.MREM/YR PER µCI/SEC)	COW-MILK (M2.MREM/YR PER µCI/SEC)	GOAT-MILK (M2.MREM/YR PER µCI/SEC)	ANIMAL-MEAT (M2.MREM/YR PER µCI/SEC)	VEGETABLES (M2.MREM/YR PER UCI/SEC
H 3	7.2E+02	0.0E-01	5.8E+02	1.2E+03	2.4E+02	1.6E+03
NA 24	1.0E+04	1.2E+07	1.2E+06	2.2E+05	7.2E-04	1.1E+05
CR 51	1.4E+04	4.7E+06	3.3E+06	5.9E+05	8.2E+05	2.3E+07
MN 54	1.4E+06	1.4E+09	1.4E+07	2.1E+06	1.5E+07	9.4E+08
MN 56	2.0E+04	9.0E+05	6.2E-02	1.1E-02	0.0E-01	2.0E+02
FE 55	7.2E+04	0.0E-01	1.4E+07	2.2E+06	1.6E+08	1.9E+08
FE 59	1.0E+06	2.7E+08	1.1E+08	2.0E+07	9.8E+08	1.5E+09
CO 58	9.3E+05	3.8E+08	4.7E+07	7.6E+06	1.8E+08	8.0E+08
CO 60	6.0E+06	2.3E+10	1.7E+08	2.5E+07	8.0E+08	2.9E+09
CU 64	4.9E+04	6.1E+05	1.0E+06	1.7E+05	1.1E-05	3.3E+05
ZN 65	8.6E+05	7.5E+08	2.7E+09	4.0E+08	7.0E+08	1.3E+09
ZN 69M	1.4E+05	1.3E+06	1.3E+07	2.4E+06	1.2E-03	1.4E+06
AS 76	1.5E+05	3.8E+06	2.1E+07	3.8E+06	2.9E+01	8.0E+06
BR 82	1.4E+04	2.1E+07	1.9E+07	3.4E+06	7.0E+02	7.7E+05
SR 89	1.4E+06	2.2E+04	6.9E+08	2.0E+09	1.4E+08	1.5E+10
SR 90	2.9E+07	6.7E+06	3.4E+10	8.3E+10	8.9E+09	7.4E+11
ZR 95	1.8E+06	2.5E+08	4.6E+05	7.6E+04	9.2E+08	1.6E+09
NB 95	5.1E+05	1.4E+08	1.3E+08	2.2E+07	3.6E+09	8.4E+08
ZR 97	5.2E+05	3.0E+06	1.4E+04	2.4E+03	6.4E-01	8.8E+06
NB 97	2.4E+03	1.8E+05	1.6E-09	2.9E-10	0.0E-01	8.1E-04
MO 99	2.5E+05	4.0E+06	2.9E+07	5.2E+06	1.2E+05	9.3E+06
TC 99M	4.2E+03	1.8E+05	2.8E+03	5.0E+02	3.6E-18	2.2E+03
RU106	9.4E+06	4.2E+08	7.3E+05	1.1E+05	1.0E+11	1.2E+10
AG110M	4.6E+06	3.5E+09	1.2E+10	1.8E+09	1.4E+09	4.4E+09
SB124	2.5E+06	6.0E+08	3.5E+08	5.8E+07	2.7E+08	4.0E+09
SB125	1.7E+06	2.4E+09	1.3E+08	1.8E+07	1.2E+08	1.4E+09
SB126	7.7E+05	8.4E+07	2.2E+08	4.0E+07	7.6E+07	1.6E+09
SB127	3.0E+05	1.7E+07	5.2E+07	9.3E+06	1.9E+06	1.2E+08
TE127	5.7E+04	3.0E+03	2.6E+04	4.7E+03	8.4E-09	2.0E+05
TE131M	5.6E+05	8.0E+06	8.9E+06	1.6E+06	1.1E+04	2.0E+07
I 131	1.2E+07	8.6E+06	3.4E+10	6.1E+10	1.2E+09	4.4E+10
I 132	1.1E+05	6.2E+05	3.9E+00	6.9E+00	0.0E-01	1.1E+03
I 133	2.2E+06	1.2E+06	2.5E+08	4.5E+08	2.4E+01	1.1E+08
I 135	4.5E+05	1.3E+06	5.5E+05	9.8E+05	1.7E-15	1.4E+06
CS134	8.5E+05	6.9E+09	7.4E+09	2.7E+10	8.6E+08	1.0E+10
CS136	1.5E+05	1.5E+08	5.0E+08	2.2E+09	2.3E+07	4.6E+08
CS137	6.2E+05	1.3E+10	6.0E+09	2.1E+10	7.1E+08	8.6E+09
CS138	6.2E+02	3.6E+05	1.0E-23	4.6E-23	0.0E-00	3.0E-11
BA140	1.3E+06	2.1E+07	2.7E+07	4.8E+06	2.8E+07	7.3E+08
LA140	4.6E+05	1.9E+07	8.4E+04	1.5E+04	7.0E+02	3.3E+07
CE141	3.6E+05	1.4E+07	5.8E+06	1.0E+06	1.7E+07	9.3E+08
CE144	7.8E+06	7.0E+07	6.4E+07	9.6E+06	2.6E+08	1.1E+10
ND147	2.2E+05	8.5E+06	2.5E+05	4.6E+04	1.9E+07	5.1E+08
HF179M	1.6E+05	0.0E-01	0.0E-01	0.0E-01	0.0E-01	0.0E-01
HF181	4.8E+05	2.1E+08	5.5E+05	9.3E+04	1.2E+10	1.8E+09
W 185	4.5E+05	1.8E+04	2.4E+07	3.9E+06	1.9E+07	8.4E+08
NP239	1.2E+05	1.7E+06	3.7E+04	6.7E+03	2.6E+03	1.6E+07

NOTE: The Y-90 ground plane dose factor was used for Sr-90.
The PARTS subroutine of GASPAR II was used to produce this table.

Table 3-5b

DOSE PARAMETERS FOR 10 CFR 50 EVALUATIONS, AIRBORNE RELEASES
AGE GROUP: TEEN ORGAN OF REFERENCE: MAXIMUM ORGAN
R(I), INDIVIDUAL PATHWAY DOSE PARAMETERS FOR RADIONUCLIDES OTHER THAN NOBLE GASES

RADIO-NUCLIDE	INHALATION (MREM/YR PER µCI/M3)	GROUND PLANE (M2.MREM/YR PER µCI/SEC)	COW-MILK (M2.MREM/YR PER µCI/SEC)	GOAT-MILK (M2.MREM/YR PER µCI/SEC)	ANIMAL-MEAT (M2.MREM/YR PER µCI/SEC)	VEGETABLES (M2.MREM/YR PER µCI/SEC
H 3	7.3E+02	0.0E-01	7.5E+02	1.5E+03	1.5E+02	1.9E+03
NA 24	1.4E+04	1.2E+07	2.1E+06	3.9E+05	5.8E-04	1.0E+05
CR 51	2.1E+04	4.7E+06	3.9E+06	6.8E+05	4.4E+05	2.5E+07
MN 54	2.0E+06	1.4E+09	1.6E+07	2.3E+06	7.8E+06	9.6E+08
MN 56	5.7E+04	9.0E+05	2.3E-01	4.1E-02	0.0E-00	3.7E+02
FE 55	1.2E+05	0.0E-01	2.4E+07	3.8E+06	1.3E+08	3.0E+08
FE 59	1.5E+06	2.7E+08	1.3E+08	2.5E+07	5.5E+08	1.7E+09
CO 58	1.3E+06	3.8E+08	5.3E+07	8.7E+06	9.4E+07	8.3E+08
CO 60	8.7E+06	2.3E+10	2.1E+08	3.0E+07	4.3E+08	3.1E+09
CU 64	6.1E+04	6.1E+05	1.6E+06	2.7E+05	8.0E-06	2.7E+05
ZN 65	1.2E+06	7.5E+08	4.5E+09	6.7E+08	5.4E+08	2.0E+09
ZN 69M	1.7E+05	1.3E+06	2.1E+07	3.8E+06	9.1E-04	1.1E+06
AS 76	1.5E+05	3.8E+06	2.7E+07	4.9E+06	1.7E+01	5.3E+06
BR 82	1.8E+04	2.1E+07	2.8E+07	5.1E+06	4.9E+02	6.1E+05
SR 89	2.4E+06	2.2E+04	1.3E+09	3.7E+09	1.2E+08	2.4E+10
SR 90	3.3E+07	6.7E+06	5.1E+10	1.3E+11	6.2E+09	1.0E+12
ZR 95	2.7E+06	2.5E+08	5.8E+05	9.5E+04	5.3E+08	1.8E+09
NB 95	7.5E+05	1.4E+08	1.6E+08	2.7E+07	2.0E+09	9.1E+08
ZR 97	6.3E+05	3.0E+06	2.1E+04	3.8E+03	4.6E-01	7.0E+06
NB 97	3.9E+03	1.8E+05	1.9E-08	3.3E-09	0.0E-01	4.8E-03
MO 99	2.7E+05	4.0E+06	5.1E+07	9.2E+06	9.4E+04	1.1E+07
TC 99M	6.1E+03	1.8E+05	5.3E+03	9.5E+02	3.2E-18	2.1E+03
RU106	1.6E+07	4.2E+08	9.9E+05	1.5E+05	6.2E+10	1.5E+10
AG110M	6.8E+06	3.5E+09	1.4E+10	2.1E+09	7.6E+08	4.6E+09
SB124	3.8E+06	6.0E+08	4.5E+08	7.3E+07	1.6E+08	4.6E+09
SB125	2.7E+06	2.4E+09	1.6E+08	2.3E+07	6.8E+07	1.6E+09
SB126	1.2E+06	8.4E+07	2.8E+08	5.1E+07	4.5E+07	1.8E+09
SB127	3.2E+05	1.7E+07	6.9E+07	1.2E+07	1.2E+06	1.2E+08
TE127	8.1E+04	3.0E+03	4.8E+04	8.6E+03	7.0E-09	1.8E+05
TE131M	6.2E+05	8.0E+06	1.3E+07	2.3E+06	7.4E+03	1.5E+07
I 131	1.5E+07	8.6E+06	5.4E+10	9.7E+10	9.0E+08	6.1E+10
I 132	1.5E+05	6.2E+05	6.4E+00	1.2E+01	0.0E-00	9.3E+02
I 133	2.9E+06	1.2E+06	4.2E+08	7.5E+08	1.8E+01	9.6E+07
I 135	6.2E+05	1.3E+06	9.3E+05	1.7E+06	1.3E-15	1.2E+06
CS134	1.1E+06	6.9E+09	1.3E+10	4.6E+10	6.8E+08	1.6E+10
CS136	1.9E+05	1.5E+08	8.4E+08	3.8E+09	1.8E+07	7.0E+08
CS137	8.5E+05	1.3E+10	1.1E+10	3.8E+10	5.7E+08	1.4E+10
CS138	8.6E+02	3.6E+05	1.8E-23	8.1E-23	0.0E-00	2.7E-11
BA140	2.0E+06	2.1E+07	3.6E+07	6.4E+06	1.8E+07	8.8E+08
LA140	4.9E+05	1.9E+07	1.1E+05	2.1E+04	4.4E+02	2.4E+07
CE141	6.1E+05	1.4E+07	7.9E+06	1.4E+06	1.0E+07	1.1E+09
CE144	1.3E+07	7.0E+07	8.8E+07	1.3E+07	1.6E+08	1.3E+10
ND147	3.7E+05	8.5E+06	3.5E+05	6.2E+04	1.2E+07	6.1E+08
HF179M	7.1E+04	0.0E-01	0.0E-01	0.0E-01	0.0E-01	0.0E-01
HF181	4.8E+05	2.1E+08	7.1E+05	1.2E+05	7.0E+09	2.1E+09
W 185	7.7E+05	1.8E+04	3.3E+07	5.4E+06	1.2E+07	1.0E+09
NP239	1.3E+05	1.7E+06	5.3E+04	9.6E+03	1.7E+03	1.4E+07

NOTE: The Y-90 ground plane dose factor was used for Sr-90.
The PARTS subroutine of GASPAR II was used to produce this table.

Table 3-5c

DOSE PARAMETERS FOR 10 CFR 50 EVALUATIONS, AIRBORNE RELEASES
AGE GROUP: CHILD ORGAN OF REFERENCE: MAXIMUM ORGAN
R(I), INDIVIDUAL PATHWAY DOSE PARAMETERS FOR RADIONUCLIDES OTHER THAN NOBLE GASES

RADIO-NUCLIDE	INHALATION (MREM/YR PER µCI/M3)	GROUND PLANE (M2.MREM/YR PER µCI/SEC)	COW-MILK (M2.MREM/YR PER µCI/SEC)	GOAT-MILK (M2.MREM/YR PER µCI/SEC)	ANIMAL-MEAT (M2.MREM/YR PER µCI/SEC)	VEGETABLES (M2.MREM/YR PER µCI/SEC
H 3	6.4E+02	0.0E-01	1.2E+03	2.4E+03	1.8E+02	2.9E+03
NA 24	1.6E+04	1.2E+07	4.5E+06	8.0E+05	9.2E-04	1.6E+05
CR 51	1.7E+04	4.7E+06	2.5E+06	4.4E+05	2.2E+05	1.6E+07
MN 54	1.6E+06	1.4E+09	1.1E+07	1.7E+06	4.3E+06	6.9E+08
MN 56	1.2E+05	9.0E+05	8.8E-01	1.6E-01	0.0E-00	1.1E+03
FE 55	1.1E+05	0.0E-01	6.1E+07	9.6E+06	2.5E+08	7.6E+08
FE 59	1.3E+06	2.7E+08	9.5E+07	1.7E+07	3.0E+08	1.2E+09
CO 58	1.1E+06	3.8E+08	3.4E+07	5.6E+06	4.7E+07	5.3E+08
CO 60	7.1E+06	2.3E+10	1.4E+08	2.0E+07	2.2E+08	2.1E+09
CU 64	3.7E+04	6.1E+05	1.7E+06	2.9E+05	6.5E-06	2.2E+05
ZN 65	1.0E+06	7.5E+08	6.8E+09	1.0E+09	6.2E+08	3.0E+09
ZN 69M	1.0E+05	1.3E+06	2.2E+07	4.0E+06	7.2E-04	9.0E+05
AS 76	7.0E+04	3.8E+06	2.2E+07	4.0E+06	1.1E+01	3.3E+06
BR 82	2.1E+04	2.1E+07	5.8E+07	1.0E+07	7.6E+02	9.5E+05
SR 89	2.2E+06	2.2E+04	3.1E+09	9.2E+09	2.3E+08	6.0E+10
SR 90	3.8E+07	6.7E+06	1.0E+11	2.6E+11	9.8E+09	2.1E+12
ZR 95	2.2E+06	2.5E+08	4.2E+05	7.0E+04	3.0E+08	1.3E+09
NB 95	6.1E+05	1.4E+08	1.1E+08	1.8E+07	1.0E+09	6.2E+08
ZR 97	3.5E+05	3.0E+06	2.1E+04	3.8E+03	3.5E-01	5.2E+06
NB 97	2.8E+04	1.8E+05	4.2E-07	7.6E-08	0.0E-01	8.2E-02
MO 99	1.3E+05	4.0E+06	8.7E+07	1.6E+07	1.2E+05	1.6E+07
TC 99M	4.8E+03	1.8E+05	7.4E+03	1.3E+03	3.4E-18	2.2E+03
RU106	1.4E+07	4.2E+08	7.9E+05	1.2E+05	3.8E+10	1.2E+10
AG110M	5.5E+06	3.5E+09	9.4E+09	1.4E+09	3.8E+08	3.0E+09
SB124	3.2E+06	6.0E+08	3.3E+08	5.4E+07	8.8E+07	3.3E+09
SB125	2.3E+06	2.4E+09	1.2E+08	1.7E+07	3.8E+07	1.2E+09
SB126	1.1E+06	8.4E+07	2.2E+08	4.0E+07	2.7E+07	1.4E+09
SB127	2.3E+05	1.7E+07	5.5E+07	1.0E+07	7.2E+05	9.2E+07
TE127	5.6E+04	3.0E+03	5.9E+04	1.1E+04	6.7E-09	1.7E+05
TE131M	3.1E+05	8.0E+06	1.1E+07	2.1E+06	5.0E+03	9.9E+06
I 131	1.6E+07	8.6E+06	1.1E+11	1.9E+11	1.4E+09	1.2E+11
I 132	1.9E+05	6.2E+05	1.5E+01	2.7E+01	0.0E-00	1.6E+03
I 133	3.8E+06	1.2E+06	9.9E+08	1.8E+09	3.3E+01	1.7E+08
I 135	7.9E+05	1.3E+06	2.1E+06	3.8E+06	2.3E-15	2.1E+06
CS134	1.0E+06	6.9E+09	2.0E+10	7.5E+10	8.3E+08	2.6E+10
CS136	1.7E+05	1.5E+08	1.3E+09	6.0E+09	2.1E+07	1.1E+09
CS137	9.1E+05	1.3E+10	1.9E+10	6.8E+10	7.9E+08	2.5E+10
CS138	8.4E+02	3.6E+05	3.2E-23	1.4E-22	0.0E-00	3.6E-11
BA140	1.7E+06	2.1E+07	5.6E+07	1.0E+07	2.1E+07	1.4E+09
LA140	2.3E+05	1.9E+07	9.5E+04	1.7E+04	2.8E+02	1.6E+07
CE141	5.4E+05	1.4E+07	6.3E+06	1.1E+06	6.4E+06	9.0E+08
CE144	1.2E+07	7.0E+07	7.0E+07	1.1E+07	1.0E+08	1.1E+10
ND147	3.3E+05	8.5E+06	2.8E+05	5.0E+04	7.4E+06	4.8E+08
HF179M	7.4E+04	0.0E-01	0.0E-01	0.0E-01	0.0E-01	0.0E-01
HF181	2.2E+05	2.1E+08	5.9E+05	9.9E+04	4.4E+09	1.8E+09
W 185	6.9E+05	1.8E+04	2.7E+07	4.3E+06	7.3E+06	8.3E+08
NP239	6.4E+04	1.7E+06	4.6E+04	8.3E+03	1.1E+03	1.0E+07

NOTE: The Y-90 ground plane dose factor was used for Sr-90.
The PARTS subroutine of GASPAR II was used to produce this table.

Table 3-5d

DOSE PARAMETERS FOR 10 CFR 50 EVALUATIONS, AIRBORNE RELEASES
AGE GROUP: INFANT ORGAN OF REFERENCE: MAXIMUM ORGAN
R(I), INDIVIDUAL PATHWAY DOSE PARAMETERS FOR RADIONUCLIDES OTHER THAN NOBLE GASES

RADIO-NUCLIDE	INHALATION (MREM/YR PER µCI/M3)	GROUND PLANE (M2.MREM/YR PER µCI/SEC)	COW-MILK (M2.MREM/YR PER µCI/SEC)	GOAT-MILK (M2.MREM/YR PER µCI/SEC)	ANIMAL-MEAT (M2.MREM/YR PER µCI/SEC)	VEGETABLES (M2.MREM/YR PER µCI/SEC
H 3	3.7E+02	0.0E-01	1.8E+03	3.7E+03	0.0E-01	0.0E-01
NA 24	1.1E+04	1.2E+07	7.8E+06	1.4E+06	0.0E-01	0.0E-01
CR 51	1.3E+04	4.7E+06	2.2E+06	3.8E+05	0.0E-01	0.0E-01
MN 54	1.0E+06	1.4E+09	2.1E+07	3.1E+06	0.0E-01	0.0E-01
MN 56	7.2E+04	9.0E+05	1.3E+00	2.4E-01	0.0E-01	0.0E-01
FE 55	8.7E+04	0.0E-01	7.4E+07	1.2E+07	0.0E-01	0.0E-01
FE 59	1.0E+06	2.7E+08	1.8E+08	3.4E+07	0.0E-01	0.0E-01
CO 58	7.8E+05	3.8E+08	2.9E+07	4.8E+06	0.0E-01	0.0E-01
CO 60	4.5E+06	2.3E+10	1.2E+08	1.7E+07	0.0E-01	0.0E-01
CU 64	1.5E+04	6.1E+05	1.9E+06	3.2E+05	0.0E-01	0.0E-01
ZN 65	6.5E+05	7.5E+08	1.2E+10	1.7E+09	0.0E-01	0.0E-01
ZN 69M	4.1E+04	1.3E+06	2.4E+07	4.3E+06	0.0E-01	0.0E-01
AS 76	2.7E+04	3.8E+06	2.2E+07	4.0E+06	0.0E-01	0.0E-01
BR 82	1.3E+04	2.1E+07	9.8E+07	1.8E+07	0.0E-01	0.0E-01
SR 89	2.0E+06	2.2E+04	6.0E+09	1.8E+10	0.0E-01	0.0E-01
SR 90	1.6E+07	6.7E+06	1.2E+11	2.9E+11	0.0E-01	0.0E-01
ZR 95	1.8E+06	2.5E+08	4.0E+05	6.5E+04	0.0E-01	0.0E-01
NB 95	4.8E+05	1.4E+08	9.6E+07	1.7E+07	0.0E-01	0.0E-01
ZR 97	1.4E+05	3.0E+06	2.2E+04	4.0E+03	0.0E-01	0.0E-01
NB 97	2.7E+04	1.8E+05	1.1E-06	1.9E-07	0.0E-01	0.0E-01
MO 99	1.3E+05	4.0E+06	1.6E+08	2.8E+07	0.0E-01	0.0E-01
TC 99M	2.0E+03	1.8E+05	8.2E+03	1.5E+03	0.0E-01	0.0E-01
RU106	1.2E+07	4.2E+08	8.0E+05	1.2E+05	0.0E-01	0.0E-01
AG110M	3.7E+06	3.5E+09	8.2E+09	1.2E+09	0.0E-01	0.0E-01
SB124	2.6E+06	6.0E+08	3.1E+08	5.1E+07	0.0E-01	0.0E-01
SB125	1.6E+06	2.4E+09	1.1E+08	1.6E+07	0.0E-01	0.0E-01
SB126	9.6E+05	8.4E+07	2.1E+08	3.7E+07	0.0E-01	0.0E-01
SB127	2.2E+05	1.7E+07	5.5E+07	9.9E+06	0.0E-01	0.0E-01
TE127	2.4E+04	3.0E+03	6.8E+04	1.2E+04	0.0E-01	0.0E-01
TE131M	2.0E+05	8.0E+06	1.2E+07	2.1E+06	0.0E-01	0.0E-01
I 131	1.5E+07	8.6E+06	2.6E+11	4.7E+11	0.0E-01	0.0E-01
I 132	1.7E+05	6.2E+05	3.4E+01	6.1E+01	0.0E-01	0.0E-01
I 133	3.6E+06	1.2E+06	2.4E+09	4.3E+09	0.0E-01	0.0E-01
I 135	7.0E+05	1.3E+06	4.9E+06	8.9E+06	0.0E-01	0.0E-01
CS134	7.0E+05	6.9E+09	3.7E+10	1.4E+11	0.0E-01	0.0E-01
CS136	1.3E+05	1.5E+08	2.8E+09	1.2E+10	0.0E-01	0.0E-01
CS137	6.1E+05	1.3E+10	3.6E+10	1.3E+11	0.0E-01	0.0E-01
CS138	8.8E+02	3.6E+05	1.2E-22	5.6E-22	0.0E-01	0.0E-01
BA140	1.6E+06	2.1E+07	1.2E+08	2.1E+07	0.0E-01	0.0E-01
LA140	1.7E+05	1.9E+07	9.4E+04	1.7E+04	0.0E-01	0.0E-01
CE141	5.2E+05	1.4E+07	6.4E+06	1.1E+06	0.0E-01	0.0E-01
CE144	9.8E+06	7.0E+07	7.1E+07	1.1E+07	0.0E-01	0.0E-01
ND147	3.2E+05	8.5E+06	2.8E+05	5.0E+04	0.0E-01	0.0E-01
HF179M	2.8E+04	0.0E-01	0.0E-01	0.0E-01	0.0E-01	0.0E-01
HF181	8.4E+04	2.1E+08	5.9E+05	9.9E+04	0.0E-01	0.0E-01
W 185	6.3E+05	1.8E+04	2.7E+07	4.4E+06	0.0E-01	0.0E-01
NP239	6.0E+04	1.7E+06	4.7E+04	8.5E+03	0.0E-01	0.0E-01

NOTE: The Y-90 ground plane dose factor was used for Sr-90.
The PARTS subroutine of GASPAR II was used to produce this table.

Table 3-6

INPUT PARAMETERS FOR CALCULATING R_i^c

Parameter	Value	Table*
r (dimensionless)	1.0 for radioiodine	E-15
	0.2 for particulates	E-15
F_m (days/liter)	Each stable element	E-1
U_{ap} (liters/yr) --Infant	330	E-5
--Child	330	E-5
--Teen	400	E-5
--Adult	310	E-5
$(DFL_i)_a$ (mrem/pCi)	Each radionuclide	E-11 to E-14
Y_p (kg/m^2)	0.7	E-15
Y_s (kg/m^2)	2.0	E-15
t_f (seconds)	1.73×10^5 (2 days)	E-15
t_h (seconds)	7.78×10^6 (90 days)	E-15
Q_F (kg/day)	50 for cow	E-3
	6 for goat	E-3
fs (dimensionless)	1.0	NUREG-0133
fp (dimensionless)	0.5 for cow	Site specific
	0.75 for goat	Site specific

*Of Regulatory Guide 1.109, Revision 1 unless stated otherwise.

Table 3-7

INPUT PARAMETERS FOR CALCULATING R_i^M

Parameter	Value	Table*
r (dimensionless)	1.0 for radioiodine	E-15
	0.2 for particulates	E-15
F_f (days/kg)	Each stable element	E-1
U_{ap} (kg/yr) --Infant	0	E-5
--Child	41	E-5
--Teen	65	E-5
--Adult	110	E-5
$(DFL_i)_a$ (mrem/pCi)	Each radionuclide	E-11 to E-14
Y_p (kg/m^2)	0.7	E-15
Y_s (kg/m^2)	2.0	E-15
t_f (seconds)	1.73×10^6 (20 days)	E-15
t_h (seconds)	7.78×10^6 (90 days)	E-15
Q_F (kg/day)	50	E-3

*Of Regulatory Guide 1.109, Revision 1.

Table 3-8

INPUT PARAMETERS FOR CALCULATING R_i^V

Parameter	Value	Table*
r (dimensionless)	1.0 for radioiodine	E-1
	0.2 for particulates	E-1
$(DFL_i)_a$ (mrem/pCi)	Each radionuclide	E-11 to E-14
U_a^L (kg/yr)--Infant	0	E-5
--Child	26	E-5
--Teen	42	E-5
--Adult	64	E-5
U_a^S (kg/yr)--Infant	0	E-5
--Child	520	E-5
--Teen	630	E-5
--Adult	520	E-5
f_L (dimensionless)	1.0	E-15
f_g (dimensionless)	0.76	E-15
t_L (seconds)	8.6×10^4 (1 day)	E-15
t_h (seconds)	5.18×10^6 (60 days)	E-15
Y_v (kg/m^2)	2.0	E-15

*Of Regulatory Guide 1.109, Revision 1.

Table 3-9

INPUT PARAMETERS NEEDED FOR CALCULATING DOSE SUMMARIES TO THE MAXIMUM INDIVIDUAL AND THE POPULATION WITHIN 50 MILES FROM WNP-2 GASEOUS EFFLUENT

Input Parameter	Value	Reference*
Distance to Maine (miles)	3000	Ref 1
Fraction of year leafy vegetables are grown	0.42	Ref 2
Fraction of year cows are on pasture	0.5	Ref 2
Fraction of crop from garden	0.76	Ref 3
Fraction of daily intake of cows derived from pasture while on pasture	1.0	Ref 2
Annual average relative humidity (%)	53.8	Ref 4
Annual average temperature (F°)	53.0	Ref 5
Fraction of year goats are on pasture	0.75	Ref 2
Fraction of daily intake of goats derived from pasture while on pasture	1.0	Ref 2
Fraction of year beef cattle are on pasture	0.5	Ref 2
Fraction of daily intake of beef cattle derived from pasture while on pasture	1.0	Ref 2
Population within 50 miles of plant by direction and radii interval in miles.	252,356	Ref 6
Annual 50-mile milk production (liters/yr)	2.8E+08	Refs 7 & 9
Annual 50-mile meat production (kg/yr)	2.3E+07	Refs 7 & 9
Annual 50-mile vegetable production (kg/yr)	3.5E+09	Refs 7 & 9
Source terms		Ref 8

Table 3-9 (contd.)

Input Parameter	Value	Reference*
X/Q values by sector for each distance (recirculation, no decay) (sec/m^3)	See Tables 3-11 through 3-12	Ref 10
X/Q values by sector for each distance (recirculation, 2.26 days decay, undepleted) (sec/m^3)	See Tables 3-11 through 3-12	Ref 10
X/Q values by sector for each distance (recirculation, 8.0 days decay, depleted) (sec/m^3)	See Table 3-11 through 3-12	Ref 10
D/Q values by sector for each distance (1/m^2)	See Table 3-11 through 3-12	Ref 10

*References are listed in Table 3-14.

TABLE 3-10

REACTOR BUILDING STACK X/Q AND D/Q VALUES

A) NO DECAY, UNDEPLETED
CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

SEGMENT BOUNDARIES IN MILES FROM THE SITE

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	3.899E-07	1.486E-07	6.171E-08	3.982E-08	3.093E-08	2.000E-08	2.118E-07	1.769E-07	1.196E-07	8.944E-08
SSW	2.557E-07	9.471E-08	3.914E-08	2.553E-08	2.000E-08	1.411E-08	1.702E-07	1.431E-07	9.698E-08	7.264E-08
SW	1.635E-07	6.378E-08	3.299E-08	2.517E-08	1.999E-08	3.647E-08	1.045E-07	7.704E-08	5.209E-08	3.894E-08
WSW	6.676E-08	2.927E-08	1.506E-08	1.122E-08	8.872E-09	1.668E-08	5.532E-08	4.156E-08	2.808E-08	2.098E-08
W	6.588E-08	2.996E-08	1.509E-08	1.090E-08	8.368E-09	4.928E-09	2.837E-08	2.330E-08	1.569E-08	1.170E-08
WNW	1.279E-07	5.746E-08	3.018E-08	2.258E-08	1.781E-08	1.324E-08	5.160E-08	4.103E-08	2.750E-08	2.044E-08
NW	2.294E-07	8.625E-08	3.624E-08	2.423E-08	1.934E-08	1.543E-08	9.519E-08	7.785E-08	5.228E-08	3.891E-08
NNW	5.137E-07	1.770E-07	6.982E-08	4.507E-08	4.224E-08	2.976E-08	1.801E-07	1.479E-07	9.945E-08	7.407E-08
N	6.024E-07	2.016E-07	8.063E-08	5.264E-08	4.120E-08	2.146E-07	2.652E-07	1.430E-07	9.579E-08	7.115E-08
NNE	4.988E-07	1.690E-07	6.861E-08	4.526E-08	4.339E-08	2.904E-07	1.966E-07	1.057E-07	7.066E-08	5.243E-08
NE	3.347E-07	1.195E-07	4.965E-08	4.175E-08	1.400E-07	3.198E-07	1.723E-07	9.247E-08	6.174E-08	4.576E-08
ENE	4.184E-07	3.067E-07	4.347E-07	9.267E-07	8.436E-07	4.052E-07	1.641E-07	8.817E-08	5.893E-08	4.371E-08
E	4.207E-07	3.460E-07	4.968E-07	1.027E-06	8.714E-07	4.159E-07	1.669E-07	8.906E-08	5.928E-08	4.385E-08
ESE	6.224E-07	5.205E-07	7.813E-07	1.572E-06	1.364E-06	5.365E-07	2.045E-07	1.403E-07	9.350E-08	6.922E-08
SE	5.045E-07	2.156E-07	1.174E-07	3.944E-07	6.347E-07	3.083E-07	2.738E-07	1.923E-07	1.289E-07	9.576E-08
SSE	4.591E-07	1.855E-07	7.985E-08	5.319E-08	4.237E-08	3.085E-08	2.635E-07	2.188E-07	1.475E-07	1.100E-07

TABLE 3-10 (CONTD)

B) 2.260 DAY DECAY, UNDEPLETED
CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

SEGMENT BOUNDARIES IN MILES FROM THE SITE

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	3.887E-07	1.477E-07	6.094E-08	3.904E-08	3.008E-08	1.898E-08	1.813E-07	1.424E-07	8.918E-08	6.201E-08
SSW	2.550E-07	9.411E-08	3.866E-08	2.504E-08	1.947E-08	1.341E-08	1.493E-07	1.190E-07	7.530E-08	5.275E-08
SW	1.630E-07	6.338E-08	3.255E-08	2.463E-08	1.939E-08	3.438E-08	9.132E-08	6.300E-08	3.969E-08	2.776E-08
WSW	6.657E-08	2.909E-08	1.484E-08	1.093E-08	8.533E-09	1.521E-08	4.618E-08	3.210E-08	1.995E-08	1.381E-08
W	6.563E-08	2.972E-08	1.488E-08	1.069E-08	8.157E-09	4.721E-09	2.319E-08	1.757E-08	1.077E-08	7.365E-09
WNW	1.275E-07	5.702E-08	2.970E-08	2.201E-08	1.717E-08	1.226E-08	4.063E-08	2.933E-08	1.765E-08	1.194E-08
NW	2.287E-07	8.575E-08	3.584E-08	2.381E-08	1.888E-08	1.470E-08	8.026E-08	6.139E-08	3.811E-08	2.642E-08
NNW	5.125E-07	1.760E-07	6.913E-08	4.439E-08	4.130E-08	2.853E-08	1.614E-07	1.269E-07	8.077E-08	5.711E-08
N	6.011E-07	2.006E-07	7.988E-08	5.189E-08	4.040E-08	2.000E-07	2.381E-07	1.202E-07	7.574E-08	5.313E-08
NNE	4.978E-07	1.682E-07	6.795E-08	4.456E-08	4.236E-08	2.707E-07	1.714E-07	8.475E-08	5.256E-08	3.639E-08
NE	3.339E-07	1.188E-07	4.909E-08	4.089E-08	1.348E-07	2.908E-07	1.447E-07	7.008E-08	4.277E-08	2.924E-08
ENE	4.172E-07	3.040E-07	4.272E-07	8.948E-07	7.996E-07	3.720E-07	1.390E-07	6.706E-08	4.134E-08	2.827E-08
E	4.194E-07	3.430E-07	4.885E-07	9.909E-07	8.315E-07	3.861E-07	1.445E-07	7.067E-08	4.346E-08	2.986E-08
ESE	6.207E-07	5.158E-07	7.670E-07	1.523E-06	1.306E-06	5.046E-07	1.776E-07	1.132E-07	7.012E-08	4.846E-08
SE	5.030E-07	2.142E-07	1.159E-07	3.850E-07	6.171E-07	2.946E-07	2.383E-07	1.554E-07	9.668E-08	6.701E-08
SSE	4.577E-07	1.843E-07	7.887E-08	5.214E-08	4.117E-08	2.911E-08	2.219E-07	1.724E-07	1.072E-07	7.416E-08

TABLE 3-10 (CONTD)

C) 8.000 DAY DECAY, UNDEPLETED
CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

SEGMENT BOUNDARIES IN MILES FROM THE SITE

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	3.793E-07	1.434E-07	5.872E-08	3.765E-08	2.919E-08	1.879E-08	1.925E-07	1.497E-07	9.326E-08	6.496E-08
SSW	2.479E-07	9.089E-08	3.705E-08	2.403E-08	1.880E-08	1.325E-08	1.561E-07	1.226E-07	7.691E-08	5.388E-08
SW	1.572E-07	6.070E-08	3.115E-08	2.387E-08	1.896E-08	3.473E-08	9.189E-08	6.223E-08	3.871E-08	2.694E-08
WSW	6.375E-08	2.776E-08	1.416E-08	1.057E-08	8.356E-09	1.572E-08	4.792E-08	3.295E-08	2.035E-08	1.407E-08
W	6.471E-08	2.914E-08	1.449E-08	1.047E-08	8.037E-09	4.713E-09	2.534E-08	1.922E-08	1.182E-08	8.138E-09
WNW	1.255E-07	5.587E-08	2.901E-08	2.171E-08	1.709E-08	1.261E-08	4.452E-08	3.233E-08	1.960E-08	1.335E-08
NW	2.228E-07	8.309E-08	3.451E-08	2.300E-08	1.837E-08	1.471E-08	8.579E-08	6.505E-08	4.009E-08	2.769E-08
NNW	4.947E-07	1.686E-07	6.558E-08	4.219E-08	3.996E-08	2.820E-08	1.654E-07	1.272E-07	7.938E-08	5.547E-08
N	5.785E-07	1.917E-07	7.566E-08	4.927E-08	3.863E-08	2.032E-07	2.372E-07	1.154E-07	7.127E-08	4.939E-08
NNE	4.769E-07	1.602E-07	6.423E-08	4.232E-08	4.105E-08	2.728E-07	1.696E-07	8.150E-08	4.985E-08	3.425E-08
NE	3.220E-07	1.141E-07	4.688E-08	3.977E-08	1.366E-07	2.947E-07	1.433E-07	6.805E-08	4.121E-08	2.806E-08
ENE	4.056E-07	2.988E-07	3.849E-07	7.340E-07	6.588E-07	2.951E-07	1.033E-07	4.759E-08	2.806E-08	1.864E-08
E	4.072E-07	3.375E-07	4.406E-07	8.152E-07	6.738E-07	3.000E-07	1.042E-07	4.785E-08	2.822E-08	1.877E-08
ESE	5.997E-07	5.068E-07	6.926E-07	1.240E-06	1.053E-06	3.916E-07	1.247E-07	7.545E-08	4.463E-08	2.978E-08
SE	4.883E-07	2.075E-07	1.122E-07	3.874E-07	6.185E-07	2.852E-07	2.217E-07	1.413E-07	8.648E-08	5.940E-08
SSE	4.476E-07	1.796E-07	7.640E-08	5.064E-08	4.029E-08	2.929E-08	2.179E-07	1.669E-07	1.027E-07	7.085E-08

TABLE 3-10 (CONTD)

D) REACTOR BUILDING D/Q

RELATIVE DEPOSITION PER UNIT AREA (M**-2) BY DOWNWIND SECTORS

SEGMENT BOUNDARIES IN MILES

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	4.044E-09	1.146E-09	3.717E-10	1.874E-10	1.127E-10	4.635E-11	3.868E-11	2.283E-11	1.219E-11	7.548E-12
SSW	2.643E-09	7.296E-10	2.324E-10	1.165E-10	7.000E-11	2.916E-11	2.663E-11	1.596E-11	8.526E-12	5.278E-12
SW	1.429E-09	4.068E-10	1.407E-10	6.799E-11	4.016E-11	3.192E-11	2.386E-11	9.555E-12	5.104E-12	3.160E-12
WSW	4.407E-10	1.347E-10	4.908E-11	2.400E-11	1.423E-11	1.224E-11	9.617E-12	3.865E-12	2.064E-12	1.278E-12
W	5.587E-10	1.780E-10	6.665E-11	3.253E-11	1.929E-11	7.707E-12	6.116E-12	3.617E-12	1.932E-12	1.196E-12
WNW	1.110E-09	3.459E-10	1.262E-10	6.186E-11	3.674E-11	2.357E-11	1.640E-11	6.963E-12	3.719E-12	2.302E-12
NW	2.199E-09	6.289E-10	2.051E-10	1.036E-10	6.242E-11	2.625E-11	2.528E-11	1.520E-11	8.117E-12	5.025E-12
NNW	5.161E-09	1.411E-09	4.463E-10	2.231E-10	1.382E-10	5.828E-11	5.329E-11	3.186E-11	1.702E-11	1.053E-11
N	7.312E-09	1.932E-09	6.001E-10	2.970E-10	1.774E-10	1.307E-10	8.654E-11	3.430E-11	1.832E-11	1.134E-11
NNE	6.688E-09	1.751E-09	5.437E-10	2.675E-10	1.637E-10	1.566E-10	6.754E-11	2.677E-11	4.430E-11	8.851E-12
NE	4.654E-09	1.223E-09	3.808E-10	1.931E-10	2.225E-10	1.592E-10	4.683E-11	1.873E-11	1.000E-11	6.191E-12
ENE	4.842E-09	1.277E-09	6.137E-10	5.265E-10	3.056E-10	1.189E-10	3.440E-11	1.364E-11	7.286E-12	4.511E-12
E	4.004E-09	1.121E-09	6.044E-10	5.617E-10	3.268E-10	1.248E-10	3.590E-11	1.441E-11	7.695E-12	4.763E-12
ESE	6.270E-09	1.764E-09	9.704E-10	9.016E-10	5.207E-10	2.008E-10	5.788E-11	2.316E-11	1.237E-11	7.659E-12
SE	5.027E-09	1.477E-09	5.218E-10	5.481E-10	6.894E-10	2.662E-10	7.839E-11	3.142E-11	1.678E-11	1.039E-11
SSE	4.426E-09	1.321E-09	4.452E-10	2.267E-10	1.366E-10	5.692E-11	4.873E-11	2.896E-11	1.547E-11	9.573E-12

TABLE 3-11

TURBINE OR RADWASTE BUILDING X/Q AND D/Q VALUES

A) NO DECAY, UNDEPLETED
CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

SEGMENT BOUNDARIES IN MILES FROM THE SITE

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	2.782E-05	7.806E-06	2.832E-06	1.567E-06	1.037E-06	5.081E-07	2.113E-07	1.153E-07	7.771E-08	5.794E-08
SSW	2.117E-05	6.000E-06	2.195E-06	1.220E-06	8.099E-07	3.989E-07	1.671E-07	9.172E-08	6.199E-08	4.631E-08
SW	1.211E-05	3.404E-06	1.236E-06	6.834E-07	4.521E-07	2.214E-07	9.199E-08	5.019E-08	3.381E-08	2.520E-08
WSW	6.468E-06	1.831E-06	6.680E-07	3.702E-07	2.451E-07	1.202E-07	5.001E-08	2.729E-08	1.837E-08	1.369E-08
W	4.034E-06	1.113E-06	3.982E-07	2.186E-07	1.439E-07	6.994E-08	2.873E-08	1.555E-08	1.043E-08	7.751E-09
WNW	7.812E-06	2.127E-06	7.518E-07	4.096E-07	2.682E-07	1.292E-07	5.239E-08	2.809E-08	1.873E-08	1.387E-08
NW	1.386E-05	3.830E-06	1.370E-06	7.517E-07	4.944E-07	2.397E-07	9.809E-08	5.290E-08	3.538E-08	2.624E-08
NNW	2.549E-05	7.081E-06	2.548E-06	1.402E-06	9.242E-07	4.498E-07	1.849E-07	1.001E-07	6.703E-08	4.976E-08
N	2.640E-05	7.275E-06	2.599E-06	1.424E-06	9.356E-07	4.528E-07	1.845E-07	9.915E-08	6.615E-08	4.897E-08
NNE	2.061E-05	5.617E-06	1.986E-06	1.082E-06	7.085E-07	3.410E-07	1.379E-07	7.372E-08	4.906E-08	3.626E-08
NE	1.800E-05	4.929E-06	1.749E-06	9.543E-07	6.251E-07	3.009E-07	1.217E-07	6.502E-08	4.323E-08	3.193E-08
ENE	1.715E-05	4.677E-06	1.656E-06	9.030E-07	5.914E-07	2.848E-07	1.152E-07	6.164E-08	4.103E-08	3.032E-08
E	1.821E-05	4.961E-06	1.751E-06	9.521E-07	6.221E-07	2.982E-07	1.198E-07	6.368E-08	4.221E-08	3.111E-08
ESE	2.834E-05	7.730E-06	2.730E-06	1.484E-06	9.699E-07	4.651E-07	1.870E-07	9.951E-08	6.602E-08	4.868E-08
SE	3.509E-05	9.697E-06	3.466E-06	1.899E-06	1.247E-06	6.035E-07	2.459E-07	1.322E-07	8.823E-08	6.534E-08
SSE	3.628E-05	1.013E-05	3.656E-06	2.015E-06	1.330E-06	6.485E-07	2.677E-07	1.453E-07	9.755E-08	7.255E-08

TABLE 3-11 (CONTD)

B) 2.260 DAY DECAY, UNDEPLETED
CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

SEGMENT BOUNDARIES IN MILES FROM THE SITE

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	2.763E-05	7.701E-06	2.766E-06	1.515E-06	9.933E-07	4.745E-07	1.848E-07	9.291E-08	5.799E-08	4.022E-08
SSW	2.104E-05	5.933E-06	2.152E-06	1.186E-06	7.812E-07	3.766E-07	1.492E-07	7.615E-08	4.802E-08	3.355E-08
SW	1.203E-05	3.361E-06	1.208E-06	6.623E-07	4.343E-07	2.077E-07	8.127E-08	4.111E-08	2.581E-08	1.801E-08
WSW	6.405E-06	1.797E-06	6.466E-07	3.537E-07	2.313E-07	1.098E-07	4.210E-08	2.083E-08	1.286E-08	8.865E-09
W	4.001E-06	1.095E-06	3.867E-07	2.097E-07	1.363E-07	6.412E-08	2.424E-08	1.183E-08	7.228E-09	4.937E-09
WNW	7.732E-06	2.084E-06	7.250E-07	3.891E-07	2.510E-07	1.163E-07	4.274E-08	2.033E-08	1.222E-08	8.256E-09
NW	1.376E-05	3.776E-06	1.337E-06	7.256E-07	4.724E-07	2.229E-07	8.513E-08	4.216E-08	2.614E-08	1.810E-08
NNW	2.537E-05	7.013E-06	2.506E-06	1.369E-06	8.966E-07	4.286E-07	1.683E-07	8.590E-08	5.449E-08	3.842E-08
N	2.626E-05	7.199E-06	2.551E-06	1.387E-06	9.044E-07	4.289E-07	1.659E-07	8.349E-08	5.244E-08	3.668E-08
NNE	2.047E-05	5.544E-06	1.941E-06	1.047E-06	6.792E-07	3.187E-07	1.208E-07	5.960E-08	3.687E-08	2.548E-08
NE	1.784E-05	4.844E-06	1.696E-06	9.137E-07	5.910E-07	2.753E-07	1.025E-07	4.952E-08	3.013E-08	2.055E-08
ENE	1.701E-05	4.603E-06	1.610E-06	8.673E-07	5.613E-07	2.621E-07	9.803E-08	4.756E-08	2.901E-08	1.980E-08
E	1.808E-05	4.891E-06	1.707E-06	9.184E-07	5.938E-07	2.769E-07	1.037E-07	5.047E-08	3.090E-08	2.115E-08
ESE	2.813E-05	7.623E-06	2.663E-06	1.434E-06	9.278E-07	4.336E-07	1.634E-07	8.016E-08	4.941E-08	3.402E-08
SE	3.486E-05	9.574E-06	3.389E-06	1.840E-06	1.197E-06	5.654E-07	2.165E-07	1.075E-07	6.672E-08	4.615E-08
SSE	3.600E-05	9.979E-06	3.562E-06	1.942E-06	1.268E-06	6.016E-07	2.313E-07	1.150E-07	7.125E-08	4.919E-08

TABLE 3-11 (CONTD)

C) 8.000 DAY DECAY, DEPLETED
CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

SEGMENT BOUNDARIES IN MILES FROM THE SITE

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	2.487E-05	6.658E-06	2.286E-06	1.213E-06	7.751E-07	3.540E-07	1.275E-07	5.998E-08	3.588E-08	2.411E-08
SSW	1.892E-05	5.121E-06	1.774E-06	9.460E-07	6.067E-07	2.788E-07	1.015E-07	4.823E-08	2.906E-08	1.964E-08
SW	1.082E-05	2.904E-06	9.977E-07	5.294E-07	3.382E-07	1.545E-07	5.566E-08	2.623E-08	1.571E-08	1.058E-08
WSW	5.777E-06	1.559E-06	5.378E-07	2.856E-07	1.824E-07	8.320E-08	2.980E-08	1.391E-08	8.267E-09	5.523E-09
W	3.605E-06	9.486E-07	3.209E-07	1.688E-07	1.072E-07	4.847E-08	1.714E-08	7.924E-09	4.679E-09	3.111E-09
WNW	6.978E-06	1.811E-06	6.046E-07	3.155E-07	1.992E-07	8.908E-08	3.092E-08	1.406E-08	8.205E-09	5.403E-09
NW	1.239E-05	3.267E-06	1.106E-06	5.816E-07	3.693E-07	1.668E-07	5.900E-08	2.734E-08	1.619E-08	1.080E-08
NNW	2.280E-05	6.047E-06	2.061E-06	1.089E-06	6.935E-07	3.153E-07	1.129E-07	5.307E-08	3.181E-08	2.145E-08
N	2.362E-05	6.211E-06	2.101E-06	1.105E-06	7.013E-07	3.169E-07	1.123E-07	5.225E-08	3.110E-08	2.086E-08
NNE	1.843E-05	4.793E-06	1.604E-06	8.381E-07	5.298E-07	2.377E-07	8.323E-08	3.832E-08	2.263E-08	1.507E-08
NE	1.608E-05	4.201E-06	1.409E-06	7.367E-07	4.655E-07	2.085E-07	7.255E-08	3.311E-08	1.939E-08	1.282E-08
ENE	1.532E-05	3.988E-06	1.335E-06	6.977E-07	4.409E-07	1.976E-07	6.893E-08	3.155E-08	1.853E-08	1.227E-08
E	1.628E-05	4.232E-06	1.413E-06	7.366E-07	4.646E-07	2.075E-07	7.206E-08	3.291E-08	1.932E-08	1.281E-08
ESE	2.534E-05	6.595E-06	2.203E-06	1.149E-06	7.248E-07	3.241E-07	1.128E-07	5.170E-08	3.045E-08	2.024E-08
SE	3.137E-05	8.274E-06	2.799E-06	1.471E-06	9.331E-07	4.210E-07	1.487E-07	6.892E-08	4.086E-08	2.729E-08
SSE	3.242E-05	8.636E-06	2.949E-06	1.558E-06	9.928E-07	4.510E-07	1.609E-07	7.503E-08	4.461E-08	2.984E-08

TABLE 3-11 (CONTD)

D) TURBINE OR RADWASTE DEPOSITION, D/Q.
RELATIVE DEPOSITION PER UNIT AREA (M**-2) BY DOWNWIND SECTORS

DIRECTION FROM SITE	SEGMENT BOUNDARIES IN MILES .5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	2.664E-08	5.457E-09	1.425E-09	6.398E-10	3.620E-10	1.392E-10	4.027E-11	1.596E-11	8.523E-12	5.275E-12
SSW	1.853E-08	3.796E-09	9.909E-10	4.450E-10	2.518E-10	9.682E-11	2.801E-11	1.110E-11	5.928E-12	3.669E-12
SW	1.160E-08	2.375E-09	6.201E-10	2.785E-10	1.575E-10	6.058E-11	1.753E-11	6.947E-12	3.710E-12	2.296E-12
WSW	4.652E-09	9.529E-10	2.488E-10	1.117E-10	6.321E-11	2.431E-11	7.032E-12	2.787E-12	1.488E-12	9.212E-13
W	4.254E-09	8.714E-10	2.275E-10	1.022E-10	5.780E-11	2.223E-11	6.430E-12	2.549E-12	1.361E-12	8.424E-13
WNW	8.379E-09	1.716E-09	4.481E-10	2.012E-10	1.138E-10	4.378E-11	1.266E-11	5.020E-12	2.681E-12	1.659E-12
NW	1.761E-08	3.608E-09	9.419E-10	4.230E-10	2.393E-10	9.203E-11	2.662E-11	1.055E-11	5.635E-12	3.488E-12
NNW	3.707E-08	7.593E-09	1.982E-09	8.903E-10	5.036E-10	1.937E-10	5.603E-11	2.221E-11	1.186E-11	7.340E-12
N	4.270E-08	8.746E-09	2.283E-09	1.025E-09	5.801E-10	2.231E-10	6.454E-11	2.558E-11	1.366E-11	8.455E-12
NNE	3.448E-08	7.062E-09	1.844E-09	8.280E-10	4.684E-10	1.801E-10	5.211E-11	2.065E-11	1.103E-11	6.827E-12
NE	2.465E-08	5.050E-09	1.318E-09	5.921E-10	3.349E-10	1.288E-10	3.726E-11	1.477E-11	7.887E-12	4.881E-12
ENE	2.235E-08	4.579E-09	1.195E-09	5.368E-10	3.037E-10	1.168E-10	3.379E-11	1.339E-11	7.151E-12	4.426E-12
E	2.363E-08	4.841E-09	1.264E-09	5.676E-10	3.211E-10	1.235E-10	3.572E-11	1.416E-11	7.560E-12	4.679E-12
ESE	3.810E-08	7.804E-09	2.037E-09	9.150E-10	5.176E-10	1.991E-10	5.759E-11	2.282E-11	1.219E-11	7.544E-12
SE	4.168E-08	8.537E-09	2.229E-09	1.001E-09	5.663E-10	2.178E-10	6.300E-11	2.497E-11	1.333E-11	8.253E-12
SSE	3.672E-08	7.521E-09	1.963E-09	8.818E-10	4.988E-10	1.918E-10	5.550E-11	2.200E-11	1.175E-11	7.270E-12

Table 3-13

CHARACTERISTICS OF WNP-2 GASEOUS EFFLUENT RELEASE POINTS

	Reactor Building	Radwaste Building	Turbine Building
Height of release point above ground level (m)	70.6m	31.1	27.7
Annual average rate of air flow from release point (m^3/sec)	44.8	38.7	125.6
Annual average heat flow from release point (cal/sec)	1.06×10^6	2.9×10^6	9.1×10^5
Type and size of release point (m)	Duct 1.14 x 3.05	3 Louver houses 1.4 x 2.4 x 0.8 Each	4 Exhaust fans 1.45 x 2.01 Each
Effective vent area (m^2)	3.48	2 x 2.7	3 x 2.91
Vent velocity (m/sec)*	12.9	2 x 525 cfm**	14.4
Effective diameter (m) (πr^2 = area)	1.1	--	1.0
Building height (m)	70.1	70.1	70.1

*Reactor Building exhaust in vertical direction. Radwaste and Turbine Building exhaust in horizontal plane.
**FSAR Drawing 6-41, 525 cfm x 2 out of 3, will run at any one time.

Table 3-14

REFERENCES FOR VALUES LISTED IN TABLE 3-9

Reference 1	U.S. Map
Reference 2	Site Specific
Reference 3	Regulatory Guide 1.109, Revision 1, Table E-15
Reference 4	Section 2.3, WNP-2 FSAR, Table 2.3-1
Reference 5	Section 2.3, WNP-2 FSAR, page 2.3-3
Reference 6	WNP-1 & WNP-2 Emergency Preparedness Plan Table 12.1, Permanent Population Distribution, Rev 5, Feb. 88
Reference 7	1986 50-Mile Land Use Census, WPPSS REMP
Reference 8	WNP-2 Effluent Analysis for Applicable Time Period
Reference 9	Radiological Programs Calculation Log No. 88-3
Reference 10	NUREG/CR-2919 XOQDOQ: Computer Program For The Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations, September 1982.

Table 3-15

DESIGN BASE PERCENT NOBLE GAS (30-MINUTE DECAY)*

Isotope	Percent of Total Activity
Kr-83M	2.9
Kr-85M	5.6
Kr-85	0
Kr-87	15
Kr-88	18
Kr-89	0.2
Xe-131M	0.02
Xe-133M	0.3
Xe-133	8.2
Xe-135M	6.9
Xe-135	22
Xe-137	0.7
Xe-138	21

*From Table 11.3-1 WNP-2 FSAR

TABLE 3-16

ANNUAL DOSES AT TYPICAL LOCATIONS

Source: WNP-2 Gaseous Effluent

Location	Distance (Miles)	Occupancy (hrs/yr)	Whole Body Dose (mrem/yr)	Thyroid Dose (mrem/yr)
BPA Ashe Substation	0.5 N	2080	1.1E+00	1.7E+00
DOE Train	0.5 SE*	78	6.7E-02	1.0E-01
Wye Burial Site	0.5 WNW	8	4.1E-03	6.5E-03
WNP-1	1.2 ESE	2080	3.8E-02	1.3E-01
WNP-4	1.0 ENE	2080	7.0E-02	1.1E-01
WNP-2 Visitor Center	0.08 ESE	8	8.6E-02	1.3E-01
Taylor Flats**	4.2 ESE	8760	3.1E-02	5.2E+00
Site Boundary***	1.2 SE	8760	1.1E+00	1.7E+00

*The sector with the highest X/Q values (within 0-0.5 mile radius) was used.

**Closest residential area representative of maximum individual dose from plume, ground, ingestion, and inhalation exposure pathways. Included for comparison.

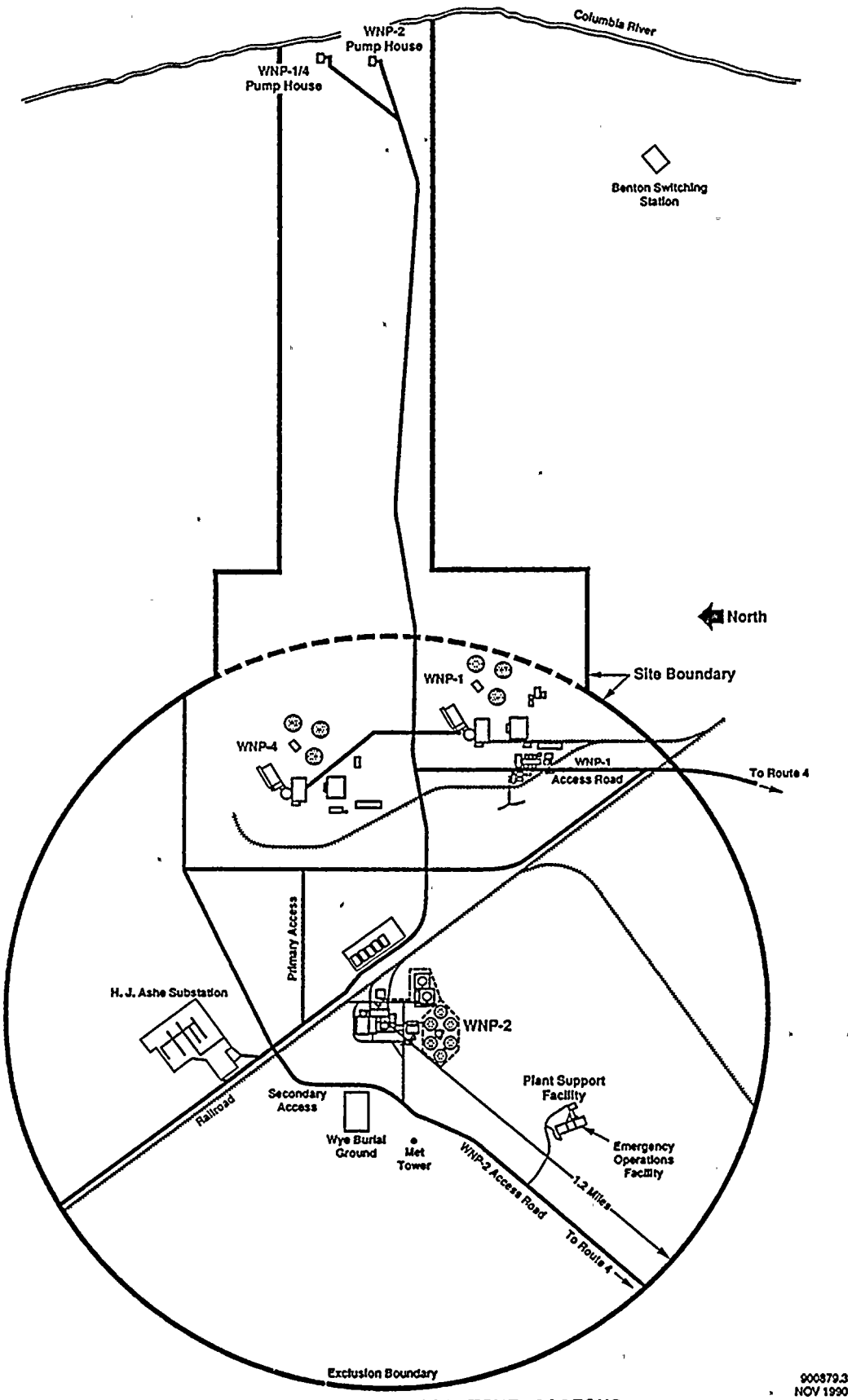
***Assumed continuously occupied. Actual occupancy is very low. Doses from Inhalation and Ground Exposure pathways. No food crops.

TABLE 3-17

ANNUAL OCCUPIED AIR DOSE AT TYPICAL LOCATIONS

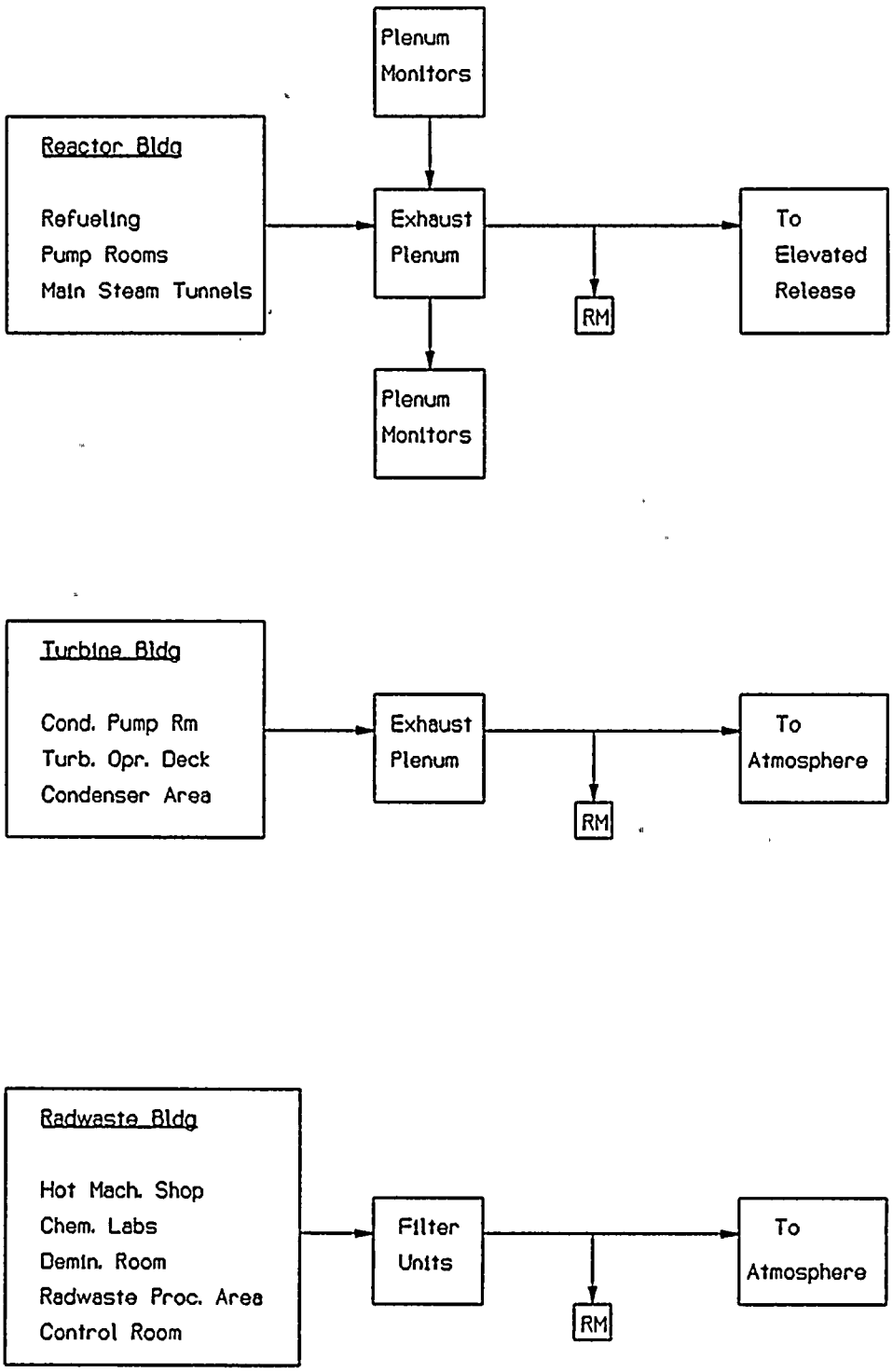
Location	Annual Beta Air dose (mrad)	Annual Gamma Air Dose (mrad)
BPA Ashe Substation	8.9E-01	1.5E+00
DOE Train	5.3E-02	9.2E-02
Wye Burial Site	3.2E-03	5.7E-03
WNP-1	3.3E-02	2.8E-02
WNP-4	5.3E-02	8.5E-02
WNP-2 Visitor Center	7.0E-02	1.2E-01
Taylor Flats*	2.3E-02	1.4E-02
Site Boundary	8.7E-01	1.5E+00

*Closest residential area.



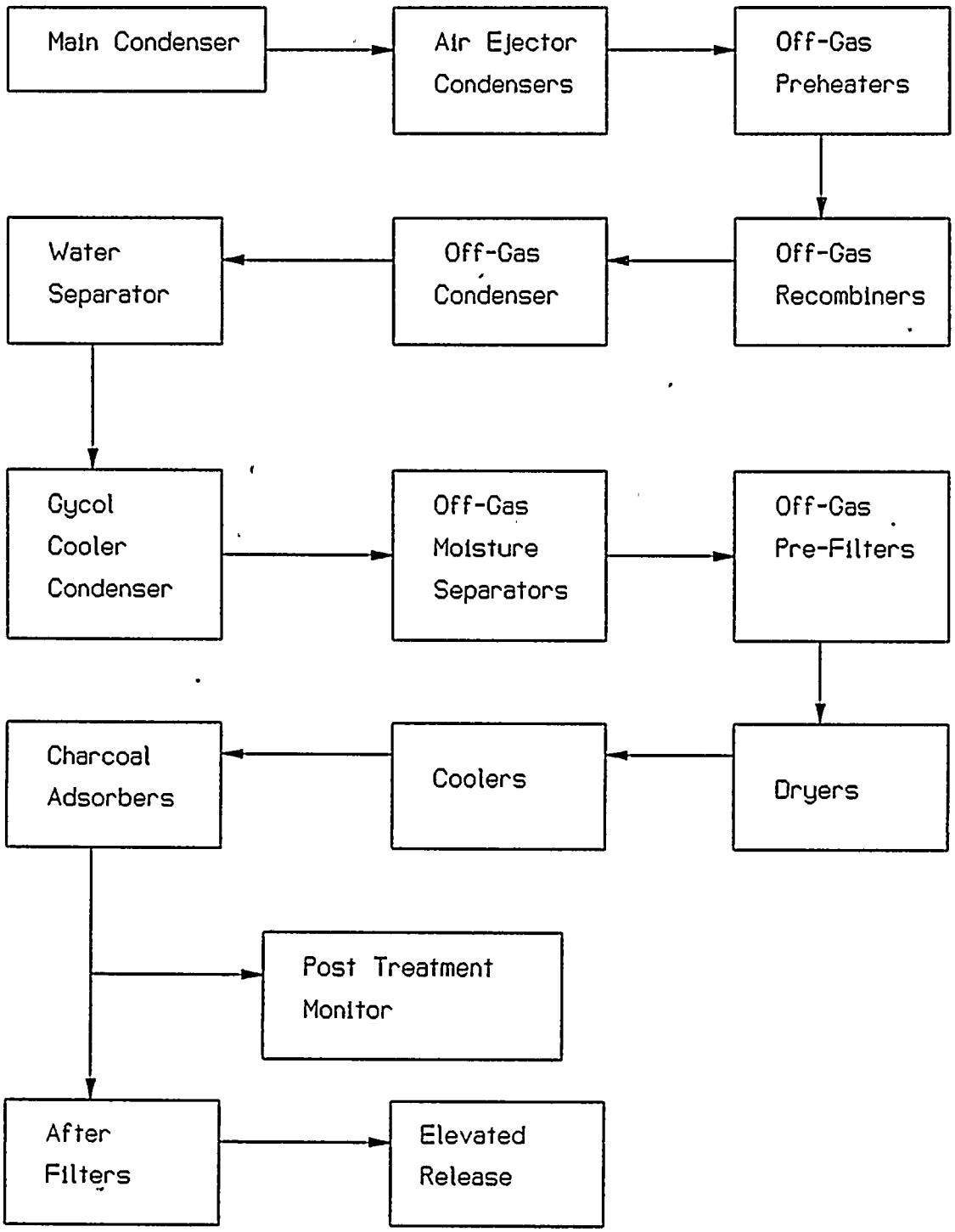
SITE BOUNDARY FOR RADIOACTIVE GASEOUS
AND LIQUID EFFLUENTS

Figure 3-1



SIMPLIFIED BLOCK DIAGRAM OF
GASEOUS WASTE SYSTEM

Figure 3-2



SIMPLIFIED BLOCK DIAGRAM OF
OFF-GAS TREATMENT SYSTEM

Figure 3-3

4.0 COMPLIANCE WITH 40 CFR 190

4.1 Requirement For Operability

Requirement for Operability 6.2.4.1 (3.11.4) states, "The annual (calendar year) dose or dose commitment to any Member of the Public, due to release of radioactivity and radiation, from uranium fuel cycle sources shall be limited to less than or equal to 25 mrems to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems."

4.2 ODCM Methodology for Determining Dose and Dose Commitment from Uranium Fuel Cycle Sources

The annual dose or dose commitment to a Member of the Public for the uranium fuel cycle sources is determined as:

a) Dose to the total body due to the release of radioactive materials in liquid effluents.

b) Dose to any organ due to the release of radioactive materials in liquid effluents.

c) Air doses due to noble gases released in gaseous effluents.

d) Dose to any organ due to the release of radioiodines, tritium and radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents.

e) Dose due to direct radiation from the plant.

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 Requirement for Operability 6.2.1.2.a, 6.2.1.2.b, 6.2.2.2.a, 6.2.2.2.b, 6.2.2.3.a, or 6.2.2.3.b (3.11.1.2.a, 3.11.1.2.b, 3.11.2.2.a, 3.11.2.2.b, 3.11.2.3.a, or 3.11.2.3.b). Direct radiation measurements will also be made to determine if the limits of Requirement for Operability 6.2.4.1 (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.

5.0 RADIOLOGICAL ENVIRONMENTAL MONITORING

Radiological environmental monitoring is intended to supplement radiological effluent monitoring by verifying that measurable concentrations of radioactive materials and levels of radiation in the environment are not greater than expected based on effluent measurement and dose modeling of environmental exposure pathways. The Radiological Environmental Monitoring Program (REMP) for WNP-2 provides for measurements of radiation and radioactive materials in those exposure pathways and for those radionuclides for which the highest potential dose commitment to a Member of the Public would result due to plant operations.

The WNP-2 REMP is designed to conform to regulatory guidance provided by Regulatory Guide 4.1, 4.8 and the Radiological Assessment Branch Technical Position (BTP), taking into consideration certain site specific characteristics. The unique nature of the WNP-2 site on Federally owned and administered land (Hanford Reservation) dedicated to energy facilities, research, waste management and as a natural reserve, forms the basis for many of the site specific parameters. Amongst the many site specific parameters considered is demographic data such as:

1) No significant clusters of population including schools, hospitals, business facilities or primary public transportation routes are located within 8 km (5 mile) radius of the plant.

2) No private residences are located on the Hanford Reservation.

3) The closest resident is east of the Columbia River at a distance of approximately 4 miles.

Additional site information is available in the WNP-2 Environmental Report, Operating License Stage.

Radiological environmental monitoring activities implemented by PPM 1.11.1 "Radiological Environmental Monitoring Program (REMP) Implementation Procedure", as detailed in the following sections, meet or exceed the criteria of the REMP plan as specified by Requirement for Operability, 6.3.1.1 (3.12.1).

5.1 Radiological Environmental Monitoring Program (REMP)

Environmental samples for the REMP are collected in accordance with Table 5-1. This table provides a detailed outline of the environmental sampling plan including both Requirement for Operability and non Requirement for Operability items by sample type, sample location code, sampling and collection frequency, and type and frequency of analysis of samples collected within exposure pathway. Deviations from the sampling frequency detailed in Table 5-1 may occur due to circumstances such as hazardous conditions, malfunction of automatic sampling equipment, seasonal unavailability, or other legitimate reasons. When sample media is unobtainable due to equipment malfunction,

special actions per program instruction shall be taken to ensure that corrective action is implemented prior to the end of the next sampling period. In some cases, alternate sample collection may be substituted for the missing specimen. All deviations from the sampling plan Requirement for Operability items detailed in the sampling plan, Table 5-1, shall be documented and reported in the Annual Radiological Environmental Operating Report in accordance with PPM 1.10.2, "Routine or Periodic Reports Required by Regulatory Agencies", Regulatory Guide 4.8 and BTP.

In the event that it becomes impossible or impractical to continue sampling a media of choice at currently established location(s) or time, an evaluation shall be made to determine a suitable alternative media and/or location to provide appropriate exposure pathway evaluations. The evaluation and any substitution made shall be implemented in the sampling program within 30 days of identification of the problem. All changes implemented in the sampling program due to unavailability of samples shall be fully documented in the next Semiannual Radioactive Effluent Release Report and ODCM per PPM 1.10.1, "Reportable Events and Occurrences Required by Regulatory Agencies". Revised sampling plan table(s) and figure(s) reflecting the new locations and/or media shall be included with the documentation.

WNP-2 sampling stations are described in Table 5-2. Each station is identified by an assigned number or alphanumeric designation, meteorological sector (16 different, 22-1/2° compass sections) in which the station is located, and radial distance from WNP-2 containment as estimated from map positions. Also included in Table 5-2 is information identifying the type(s) of samples collected at each station and whether or not the specific sample type satisfies a Requirement for Operability criteria. Figures 5-1 and 5-2 depict the geographical locations of each of the sample stations listed in Table 5-2.

5.2 Land Use Census

A Land Use Census shall be conducted in accordance with the requirements of Requirement for Operability 6.3.2.1 (3.12.2). It shall identify within a distance of 8 km (5 miles) in each of the 16 meteorological sectors, the location of the nearest milk animal, the nearest residence and the nearest

garden of greater than $150m^2$ ($500\ ft^2$) producing broad leaf vegetation. Field activities pertaining to the Land Use Census (LUC) will be initiated during the growing season and completed no later than September 30 each year. The information obtained during the field survey is used along with other demographic data to assess population changes in the unrestricted area that might require modifications in the sampling plan to ensure adequate evaluation of dose or dose commitment.

The results of the Land Use Census will be submitted no later than October 31 of each year for evaluation of maximum individual doses or dose commitment. All changes, such as a location yielding a greater estimated dose or dose commitment or different location with a 20 percent greater estimated dose or dose commitment than a currently sampled location, will be reported in the next Semiannual Radioactive Effluent Report in accordance with PPM 1.10.2 and Requirement for Operability 6.3.2.1 (3.12.2). The REMP plan, ODCM, will be changed to reflect new sampling location(s). The new sampling location(s) will be added to the REMP within 30 days.

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 Census and the census results shall be 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 Requirement for Operability 6.3.3.1 (3.12.3).

Besides the vendor's required participation in the EPA's Crosscheck Program, the Department of Health (DOH) 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/DOH 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 monitoring 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, DOH, 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 anomalous 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 5-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM PLAN

Sample Type[11]	Sample Location Code*	Sampling and Collection Frequency[1]	Type and Frequency of Analysis[1]
1. AIRBORNE			
a. Particulates and radioiodine (5/12)	1, 4-9A, 21, 23, 40, 48 and 57	Continuous sampling Weekly collection	Particulate: Gross beta[2], weekly; gamma isotopic[3], quarterly composite (by location) Radioiodine: I-131 analysis, weekly
b. Soil[10] (0/5)	9A, 1, 7, 21, and 23	Annually	Gamma isotopic[3], annually strontium-90 when requested[10]
2. DIRECT RADIATION			
TLD[4] (34/57)	1-9A, 10-25, 40-47, 49-51, 53-56, 61, 1S-16S	Quarterly, annually	TLD converted to exposure quarterly, annual processing
3. WATERBORNE			
a. Surface/ Drinking[6] (3/4)	26, 27, 28 and 29	Composite aliquots[5], monthly	Gamma isotopic[3], gross beta, monthly; tritium, quarterly composite strontium-90, iodine-131, when requested[6]
b. Ground water (2/3)	31, 32, and 52	Quarterly	Gamma isotopic[3] and tritium, quarterly

TABLE 5-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM PLAN

Sample Type[11]	Sample Location Code*	Sampling and Collection Frequency[1]	Type and Frequency of Analysis[1]
c. Sediment from shoreline (1/2)	33 and 34	Semiannually	Gamma and isotopic[3], semiannually
4. INGESTION			
a. Milk[7] (4/6)	9B, 36, 40, 62, 64 and 96	Semimonthly during grazing season, monthly at other times	Gamma isotopic[3] and iodine-131, monthly/ semimonthly strontium-90, when requested[7]
b. Fish[8] (2/2)	30, 38, or 39	Seasonal or Semiannually	Gamma isotopic[3], when sampled
c. Garden produce[9] (2/4)	9C, 37, 61 and 91	Monthly during growing season in the Riverview area of Pasco and a control near Grandview. Annually for the apple sample collection at Station 91 and cherry sample collection at Station 61.	Gamma isotopic[3], when sampled

*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 yearly mean of the control sample, gamma isotopic analysis shall be performed on the individual sample.

TABLE 5-1 (contd.)

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

[4]TLD refers to thermoluminescent dosimeter. For purposes of WNP-2 REMP, a TLD is a phosphor card (32mm x 45mm x 0.5mm) with eight individual read-out areas (four main dosimeter areas and four back-up dosimeter areas) in each badge case. TLDs used in REMP meet the requirements of Regulatory Guide 4.13 (ANSI N545-1975), except for specified energy-dependence response. Correction factors are available for energy ranges with response outside of the specified tolerances. TLD stations 1S-16S and 61 are special interest stations and are not included amongst the 34 routine TLD stations required by Requirement for Operability, Table 7.3.1.1-1 (3.12-1).

[5]Composite samples will be collected with equipment which is capable of collecting an aliquot at time intervals which are short relative to the compositing period. A composite sample is also one in which the quantity (aliquot) of liquid sampled is proportional to the quantity of flowing liquid and in which the method of sampling employed results in a specimen that is representative of the liquid flow.

[6]Station 26, WNP-2 makeup water intake from the Columbia River, satisfies the Requirement for Operability criteria for upstream surface water and drinking water control samples. The discharge water (Station 27) samples are used to fulfill the Requirement for Operability criteria for a downstream sample. However, they provide very conservative estimates of downstream concentrations. Drinking water samples are not routinely analyzed for I-131 from two week composite, but I-131 analysis will be performed when the calculated dose for the consumption of water is greater than 1 mrem per year to the maximum organ. When the gross beta result in drinking water is greater than ten times the mean of the previous month's data for the control location or greater than 8 pCi/liter, Sr-90 analysis shall be performed.

[7]Milk samples will be obtained from farms or individual milk animals which are located in sectors with high calculated annual average ground-level D/Qs and high dose potential. There are no milk animals located within 5 km of WNP-2. If cesium-134 or cesium-137 is measured in an individual milk sample in excess of 30 pCi/l, then strontium-90 analysis shall be performed.

[8]There are no commercially important species in the Hanford reach of the Columbia River. Most recreationally important species in the area are anadromous, primarily salminoids. Four fish specimen will normally be collected by electroshock technique in the vicinity of the plant discharge (Station 30). If electroshocking produces insufficient fish samples, anadromous species may be obtained from Ringold Fish Hatchery (Station 39). Control samples are normally collected in the vicinity of Ice Harbor Dam (salminoids may be obtained through the National Marine Fisheries Service at Lower Granite Dam).

TABLE 5-1 (contd.)

[9]Garden produce will routinely be obtained from farms or gardens using Columbia River water for irrigation. One sample of a root crop, leafy vegetable, and a fruit should be collected each sample period if available. The variety of the produce sample will be dependent on seasonal availability.

[10]Soil samples are collected to satisfy the requirements of the Site Certification Agreement (SCA), WNP-2. If gamma isotopic results for an indicator sample are greater than ten times the mean of the control station (station 9) data, the sample shall be analyzed for Sr-90.

[11]The fraction in parenthesis under each sample type gives the ratio of the number of Requirement for Operability sample locations to the total number of sample locations for the sample type that is currently included in the overall WNP-2 radiological environmental monitoring program.

TABLE 5-2

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	4.5	0	0								
9A*	WSW	30.0	0	0								
9B*	WSW	35.0							X			X
9C	WSW	33.0									0	
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									

TABLE 5-2

(Continued)

Station	Sector	Radial Miles[a]	TLD	AP/AI	SW	DW	GW	SE	MI	FI	GP	SO_b
18	N	1.1	0									
19	NE	1.8	0									
20	ENE	1.9	0									
21	ENE	1.5	X	X								X
22	E	2.1	0									
23	ESE	3.0	X	X								X
24	SE	1.9	0									
25	SSE	1.6	0									
26*	E	3.2			0	0						
27	E	3.2			X							
28	SSE	7.4			0	0						
29	SSE	11.0				0						
30	E	3.3								0		
31	ESE	1.1					0					
32	ESE	1.2					X					
33*	ENE	3.6						X				
34	ESE	3.5						0				
36	ESE	7.2							0			
37A	SSE	17.0									0	
37B	SSE	16.0									X	
38*	E	26.5								0		
38A	E	30.0								X		

TABLE 5-2

(Continued)

Station	Sector	Radial Miles[a]	TLD	AP/AI	SW	DW	GW	SE	MI	FI	GP	SO_b
39	NE	4.4								X		
40	SE	6.4	0	0					0			
41	SE	5.8	0									
42	ESE	5.6	0									
43	E	5.8	0									
44	ENE	5.8	0									
45	ENE	4.3	0									
46	NE	5.0	0									
47	N	0.5	X									
48	NE	4.5		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	0.8		0								
61	SE	6.5	X									

TABLE 5-2

(Continued)

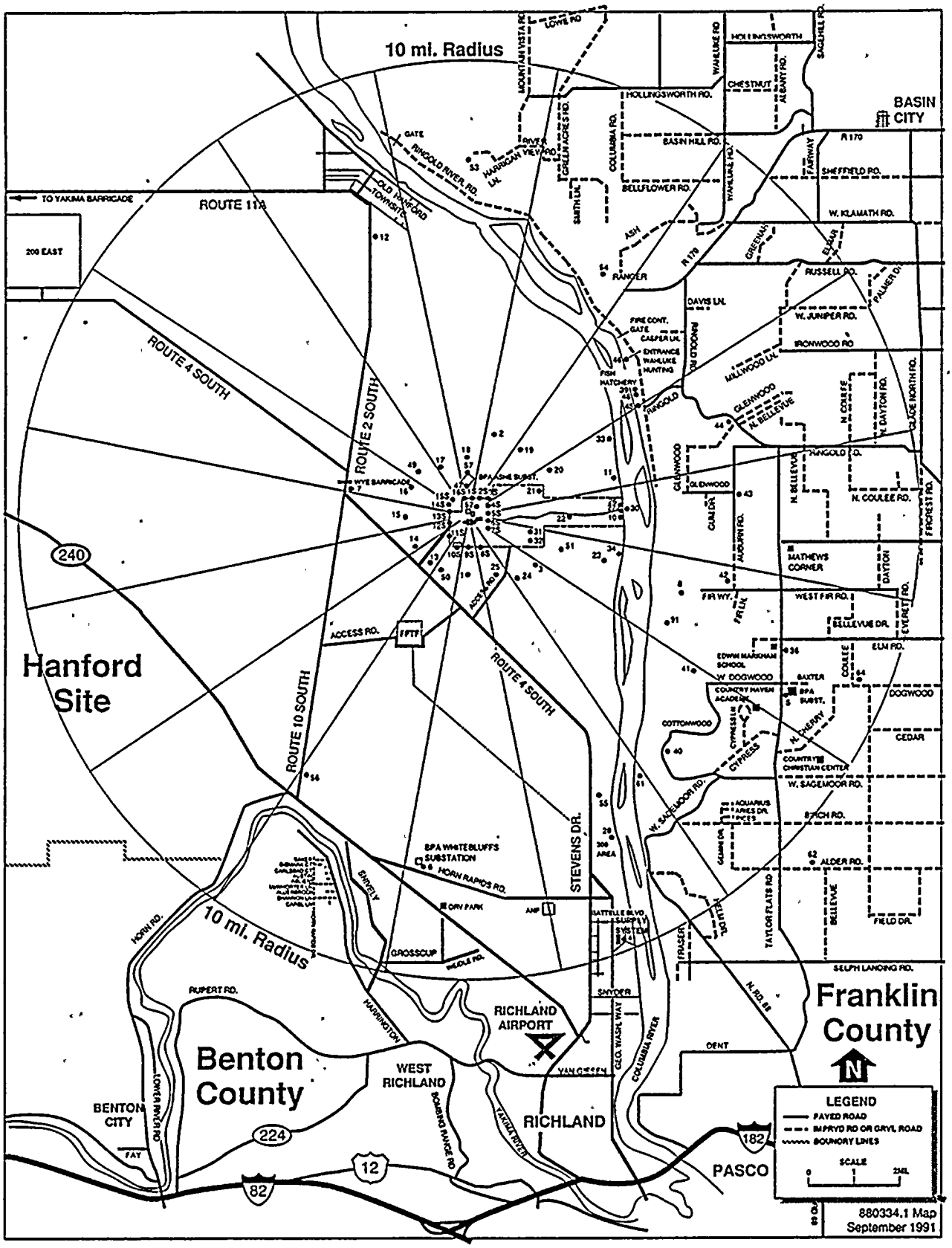
Station	Sector	Radial Miles[a]	TLD	AP/AI	SW	DW	GW	SE	MI	FI	GP	SO_b
62	SE	10.9							X			
64	ESE	9.9							0			
91	ESE	4.4									X	
96*	WSW	36.0							0			
1S(71)	N	0.3	X									
2S(72)	NNE	0.4	X									
3S(73)	NE	0.5	X									
4S(74)	ENE	0.4	X									
5S(75)	E	0.4	X									
6S(76)	ESE	0.4	X									
7S(77)	SE	0.5	X									
8S(78)	SSE	0.7	X									
9S(79)	S	0.7	X									

TABLE 5-2

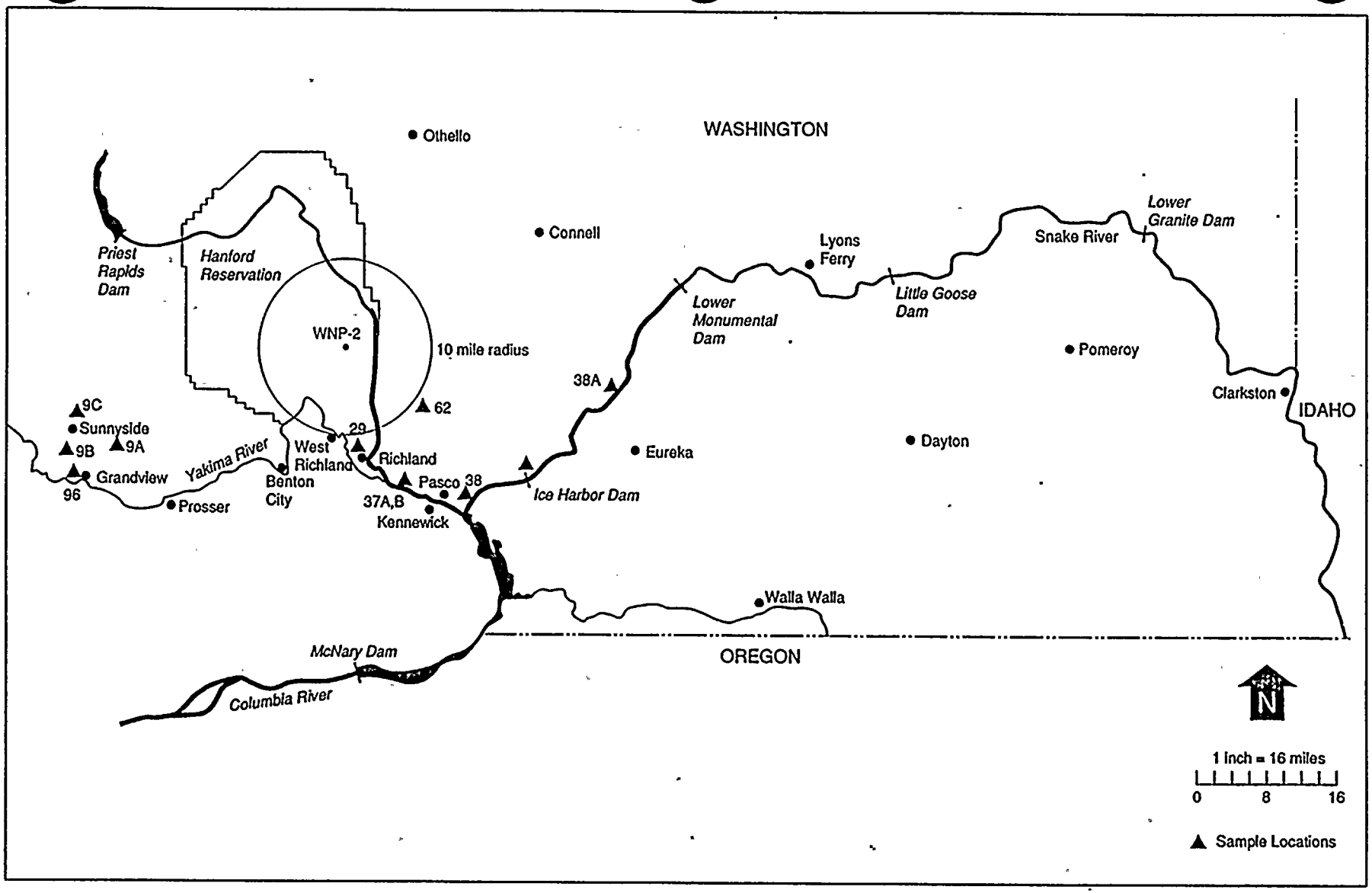
(Continued)

Station	Sector	Radial Miles[a]	TLD	AP/AI	SW	DW	GW	SE	MI	FI	GP	SO[b]
10S(80)	SSW	0.8	X									
11S(81)	SW	0.7	X									
12S(82)	WSW	0.5	X									
13S(83)	W	0.5	X									
14S(84)	WNW	0.5	X									
15S(85)	NW	0.5	X									
16S(86)	NNW	0.4	X									

*Control location.
X - Sample collected at station that is not included in the Requirement for Operability (non-RETS)
O - Radiological Environmental Requirement for Operability sample collected at station.
a - Estimated from center of WNP-2 Containment from map positions.
b - Included in sampling program to satisfy requirements for Site Certification Agreement with the State of Washington.
AP/AI = Air Particulate and Iodine
SW = Surface Water (River Water)
DW = Drinking Water
GW = Ground Water
SE = Shoreline Sediment
MI = Milk
FI = Fish
GP = Garden Produce
SO = Soil



RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE
LOCATIONS INSIDE OF 10 MILE RADIUS
Figure 5-1



900286A
April 1991

Radiological Environmental Monitoring Sampling Locations Outside 10 Mile Radius

Figure 5-2

TABLE 5-3

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM ANNUAL SUMMARY[a]

Name of Facility _____ Docket No. _____

Location of Facility _____ Reporting Period _____
(County, State)

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (f)[c] Range	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (f)[c], Range	Control Locations Mean (f)[c] Range	Number of Nonroutine Reported Measurements
Air particulates (pCi/m^3)	Gross 416	0.01	0.08 (200/312) (0.05-2.0)	Middletown 5 mi. 340°	0.10 (5/52) (0.08-2.0)	0.08 (8/104) (1.05-1.40)	1
	-Spec 32						
	^{137}Cs	0.01	0.05 (4/24) (0.03-0.13)	Smithville 2.5 mi. 160°	0.08 (2/4) (0.03-2.0)	LLD	4
	^{131}I	0.07	0.12 (2/24) (0.09-0.18)	Podunk 4.0 mi. 270°	0.20 (2/4) (0.10-0.31)	0.02 (2/4)	1
Fish (pCi/kg) (wet weight)	-Spec. 8						
	^{137}Cs	130	LLD		LLD	90 (1/4)	0
	^{134}Cs	130	LLD		LLD	LLD	0
	^{60}Co	130	180 (3/4) (150-225)	River Mile 35	See Column 4	LLD	0

[a]Summary Table is taken from the NRC's Branch Technical Position, Rev. 1, Nov. 1979, and provided for illustrative purposes only.

[c]Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (f).

TABLE 5-4

REPORTING LEVELS FOR NONROUTINE OPERATING REPORTS

Reporting Level (RL)

Analysis	Water (pCi/l)	Airborne Particulate or Gases (pCi/M^3)	Fish (pCi/kg, wet)	Milk (pCi/l)	Broad Leaf Vegetation (pCi/Kg, wet)
H-3	2×10^4*				
Mn-54	1×10^3		3×10^4		
Fe-59	4×10^2		1×10^4		
Co-58	1×10^3		3×10^4		
Co-60	3×10^2		1×10^4		
Zn-65	3×10^2		2×10^4		
Zr-Nb-95	4×10^2				
I-131	2	0.9		3	1×10^2
Cs-134	30	10	1×10^3	60	1×10^3
Cs-137	50	20	2×10^3	70	2×10^3
Ba-La-140	2×10^2			3×10^2	

*For drinking water samples. This is 40 CFR Part 141 value.

6.0 CONDUCT OF TESTS AND INSPECTIONS

IN SUPPORT OF

WNP-2

RADIOACTIVE EFFLUENT AND RADIOLOGICAL

ENVIRONMENTAL MONITORING PROGRAMS

6.0 INTRODUCTION

NOTE: In accordance with Generic Letter 89-01, the following Limiting Conditions for Operations (LCO) have been relocated from the WNP-2 Technical Specifications to the ODCM. To differentiate between Technical Specifications and ODCM programs, the following title changes have been made:

Limiting Condition for Operation	-	Requirement for Operability
Applicability	-	Relevant Conditions
Action	-	Compensatory Measures
Surveillance, Surveillance Requirements	-	Periodic Tests and Inspections

The following, Requirement for Operability are numbered sequentially as part of Section 6.0. The Technical Specification numbering has been retained in parenthesis to promote traceability. The above changes will conform to plant practices being developed with the WNP-2 Improved Technical Specifications Program. Further sections 1.0 and 4.0 of the WNP-2 Technical Specifications are to be followed in conforming to this section and applicability statements 3.0.1, 3.0.2, 3.0.3 and 3.0.4 of the WNP-2 Technical Specifications are to be followed as applied in the text of the Requirement for Operability.

6.1 INSTRUMENTATION

IN SUPPORT OF

WNP-2

RADIOACTIVE EFFLUENT MONITORING

REQUIREMENT FOR OPERABILITY

6.1 (3/4.3) INSTRUMENTATION

6.1.1 (3/4.3.7.11) RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

CONTROLS

6.1.1.1 (3.3.7.11) The radioactive liquid effluent monitoring instrumentation channels shown in Table 6.1.1.1-1 (3.3.7.11-1) shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Requirement for Operability 6.2.1.1 (3.11.1.1) are not exceeded. The alarm/trip setpoints of these channels shall be determined and adjusted in accordance with the methodology and parameters described in the OFFSITE DOSE CALCULATION MANUAL (ODCM).

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With a radioactive liquid effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required by the above specification, immediately suspend the release of radioactive liquid effluents monitored by the affected channel or declare the channel inoperable.

b. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels OPERABLE, take the COMPENSATORY MEASURES shown in Table 6.1.1.1-1 (3.3.7.11-1). Restore the inoperable instrumentation to OPERABLE status within the time specified in the COMPENSATORY MEASURES or, in lieu of a Licensee Event Report, explain why this inoperability was not corrected within the time specified in the next Radioactive Effluent Release Report.

c. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS and INSPECTIONS

6.1.1.1.1 (4.3.7.11) Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL FUNCTIONAL TEST operations at the frequencies shown in Table 6.1.1.1.1-1 (4.3.7.11-1).

TABLE 6.1.1.1-1 (3.3.7.11-1)

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	COMPENSATORY MEASURES
1. GROSS RADIOACTIVITY MONITORS PROVIDING ALARM AND AUTOMATIC TERMINATION OF RELEASE		
a. Liquid Radwaste Effluent Line	1	100
b. Turbine Building Sump	1/Sump	101
2. GROSS RADIOACTIVITY MONITORS PROVIDING ALARM BUT NOT PROVIDING AUTOMOTIVE TERMINATION OF RELEASE		
a. Service Water System Effluent Line	1	101
b. RHR Service Water System Effluent Line	1/Loop	101
3. FLOW RATE MEASUREMENT DEVICES		
a. Liquid Radwaste Effluent Line	1	102
b. Plant Discharge-Blowdown Line	1	102

TABLE 6.1.1.1-1 (3.3.7.11-1) (Continued)

COMPENSATORY MEASURES

COMPENSATORY MEASURE 100 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirements, effluent releases via this pathway may continue for up to 30 days provided that prior to initiating a release:

a. At least two independent samples of the batch are analyzed in accordance with Periodic Tests and Inspections 6.2.1.1.1 (4.11.1.1.1) and 6.2.1.1.2 (4.11.1.1.2) and

b. At least two technically qualified members of the facility staff independently verify the release rate calculations and the discharge valve lineup;

Otherwise, suspend release of radioactive effluents via this pathway.

COMPENSATORY MEASURE 101 - With the number of channels OPERABLE less than required by the Minimum Channel OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided that, at least once per 12 hours, grab samples are collected and are analyzed for gross radioactivity (beta or gamma) at a limit of detection of at least 10^{-7} microcurie/mL.

COMPENSATORY MEASURE 102 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided that the flow rate is estimated at least once per 4 hours during actual releases. Pump performance curves generated in place may be used to estimate flow.

TABLE 6.1.1.1.1-1 (4.3.7.11-1)

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION PERIODIC TESTS AND INSPECTIONS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
1. GROSS RADIOACTIVITY MONITORS PROVIDING ALARM AND AUTOMATIC TERMINATION OF RELEASE				
a. Liquid Radwaste Effluent Line	D	P	R(3)	Q(1,2)
b. Turbine Building Sump	D	M	R(3)	Q(1,5)
2. GROSS RADIOACTIVITY MONITORS PROVIDING ALARM BUT NOT PROVIDING AUTOMATIC TERMINATION OF RELEASE				
a. Service Water System Effluent Line	D	M	R(3)	Q(5)
b. RHR Service Water System Effluent Line	D	M	R(3)	Q(2)
3. FLOW RATE MEASUREMENT DEVICES				
a. Liquid Radwaste Effluent Line	D(4)	N.A.	R	Q
b. Plant Discharge-Blowdown Line	D(4)	N.A.	R	Q

TABLE 6.1.1.1.1-1 (4.3.7.11-1) (Continued)

TABLE NOTATIONS

(1) The CHANNEL FUNCTIONAL TEST shall also demonstrate that automatic isolation of this pathway occurs if the:

Instrument indicates measured levels above the alarm setpoint.

(2) The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exists:

1. Instrument indicates measured levels above the alarm setpoint.

2. High voltage abnormally low.

3. Instrument indicates a downscale failure.

4. Instrument controls not set in operate mode.

(3) The initial CHANNEL CALIBRATION shall be performed using one or more reference standards certified by the National Institute of Science and Technology (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used.

(4) CHANNEL CHECK shall consist of verifying indication of flow during periods of release. CHANNEL CHECK shall be made at least once per 24 hours when continuous, periodic, or batch releases are made.

(5) The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exists:

1. Instrument indicates measured levels above the alarm setpoint.

2. High voltage abnormally low.

3. Instrument indicates a downscale failure.

6.1 (3/4.3) INSTRUMENTATION

6.1.2 (3/4.3.7.12) RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

CONTROLS

6.1.2.1 (3.3.7.12) The radioactive gaseous effluent monitoring instrumentation channels shown in Table 6.1.2.1-1 (3.3.7.12-1) shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Requirements for Operability 6.2.2.1 (3.11.2.1) are not exceeded. The alarm/trip setpoint of these channels shall be determined in accordance with the methodology and parameters described in the ODCM.

RELEVANT CONDITION: As shown in Table 6.1.2.1-1 (3.3.7.12-1).

COMPENSATORY MEASURES:

a. With a radioactive gaseous effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required by the above specification, immediately initiate action to suspend the release of radioactive gaseous effluents monitored by the affected channel or change the setpoint so it is acceptably conservative or declare the channel inoperable.

b. With less than the minimum number of radioactive gaseous effluent monitoring instrumentation channels OPERABLE, take the COMPENSATORY MEASURES shown in Table 6.1.2.1-1 (3.3.7.12-1). Restore the inoperable instrumentation to OPERABLE status within the time specified in the COMPENSATORY MEASURES or, in lieu of a Licensee Event Report, explain why this inoperability was not corrected within the time specified in the next Semiannual Radioactive Effluent Release Report.

c. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.1.2.1.1 (4.3.7.12) Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL FUNCTIONAL TEST operations at the frequencies shown in Table 6.1.2.1.1-1 (4.3.7.12-1).

TABLE 6.1.2.1-1 (3.3.7.12-1)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	RELEVANT CONDITIONS	COMPENSATORY MEASURES
1. Main Condenser Offgas Post-Treatment Radiation Monitor			
a. Gross Gamma Detection Alarm and Automatic Isolation of the Offgas System Outlet and Drain Valves	1	**	110
2. Main Condenser Offgas Pre-Treatment Radiation Monitor			
a. Gamma Sensitive Ion-Chamber Located Upstream of Holdup Line	1	**	114
3. Main Plant Vent Release Monitor			
a. Noble Gas Activity Monitor			
1) Low Range	1	*	110
2) Intermediate Range	1	*	110
b. Iodine Sampler	1	*	112
c. Particulate Sampler	1	*	112
d. Effluent System Flow Rate Monitor	1	*	113
e. Sampler Flow Rate Monitor	1	*	113

TABLE 6.1.2.1-1 (3.3.7.12-1) (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	RELEVANT CONDITIONS	COMPENSATORY MEASURES
4. Turbine Building Ventilation Exhaust Monitor			
a. Noble Gas Activity Monitor			
1) Low Range	1	*	110
2) Intermediate Range	1	*	110
b. Iodine Sampler	1	*	112
c. Particulate Sampler	1	*	112
d. Effluent System Flow Rate Monitor	1	*	113
e. Sampler Flow Rate Monitor	1	*	113
5. Radwaste Building Ventilation Exhaust			
a. Noble Gas Activity Monitor			
1) Low Range	1	*	110
2) Intermediate Range	1	*	110
b. Iodine Sampler	1	*	112
c. Particulate Sampler	1	*	112
d. Effluent System Flow Rate Measurement Device #	1	*	115
e. Sampler Flow Rate Monitor	1	*	113

TABLE 6.1.2.1-1 (3.3.7.12-1) (Continued)

TABLE NOTATIONS

* At all times.
** During main condenser offgas treatment system operation.
\# Radwaste Building ventilation exhaust fan. There are 3 fans; WEA-FN-1A, WEA-FN-1B and WEA-FN-1C.

COMPENSATORY MEASURES

COMPENSATORY MEASURE 110 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided that grab samples are taken at least once per 8 hours and analyzed for noble gas gamma emitters within 24 hours.

COMPENSATORY MEASURE 112 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided that within 4 hours after the channel has been declared inoperable samples are continuously collected with auxiliary sampling equipment as required in Table 6.2.2.1.2-1 (4.11-2).

COMPENSATORY MEASURE 113 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided that the flow rate is estimated at least once per 4 hours.

COMPENSATORY MEASURE 114 - With the number of channels operable less than required by the Minimum Channels OPERABLE requirement, gases from the main condenser offgas treatment system may be released to the environment for up to 72 hours provided:

a. The offgas treatment system is not bypassed, and

b. The offgas post-treatment monitor used in a pretreatment function shall be OPERABLE.*

COMPENSATORY MEASURE 115 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway shall be terminated.

*With the offgas post-treatment monitor in a pretreatment function unavailable or inoperable, install a temporary replacement ionization chamber for the pre-treatment monitor or be in HOT STANDBY within the following 12 hours.

TABLE 6.1.2.1.1-1 (4.3.7.12-1)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION PERIODIC TESTS AND INSPECTIONS REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES IN WHICH PERIODIC TESTS AND INSPECTIONS ARE REQUIRED
1. Main Condenser Offgas Post-Treatment Radiation Monitor					
a. Gross gamma detector alarm and automatic isolation of the offgas system outlet and drain valves	D	D	R(2)	Q(1)	**
2. Main Condenser Offgas Pre-Treatment Radiation Monitor					
a. Gamma sensitive ion chamber located upstream of holdup line	D	M	R(2)	Q(1)	**
3. Main Plant Release Monitor					
a. Noble Gas Activity Monitor					
1) Low Range	D	M	R(2)	Q(1)	*
2) Intermediate Range	D	M	R(2)	Q(6)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Effluent System Flow Rate Monitor	D	N.A.	R	Q	*
e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*

TABLE 6.1.2.1.1-1 (4.3.7.12-1) (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION PERIODIC TESTS AND INSPECTIONS REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES IN WHICH PERIODIC TESTS AND INSPECTIONS ARE REQUIRED
4. Turbine Building Ventilation Exhaust Monitor					
a. Noble Gas Activity Monitor					
1) Low Range	D	M	R(2)	Q(1)	*
2) Intermediate Range	D	M	R(2)	Q(6)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Effluent System Flow Rate Monitor	D	N.A.	R	Q	*
e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*
5. Radwaste Building Ventilation Exhaust					
a. Noble Gas Activity Monitor					
1) Low Range	D	M	R(2)	Q(1)	*
2) Intermediate Range	D	M	R(2)	Q(6)	*
b. Iodine Sampler	W	N.A.	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Effluent System Flow Rate Monitor	D(3)	N.A.	R(5)	Q(4)	*
e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*

TABLE 6.1.2.1.1-1 (4.3.7.12-1) (Continued)

TABLE NOTATIONS

* At all times.
** During main condenser offgas treatment system operation

(1) The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exist:

a. Instrument indicates measured levels above the alarm setpoint.

b. Circuit failure.

(2) The initial CHANNEL CALIBRATION shall be performed using one or more reference radioactive standards traceable to the NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system over its intended range of energy and measurement range. Subsequent CHANNEL CALIBRATION shall be performed using the initial radioactive standards or other standards of equivalent quality or radioactive sources that have been related to the initial calibration.

(3) The CHANNEL CHECK shall be performed by comparing a computer reading or power signal comparing each fan's local amperage reading with preestablished baseline values.

(4) The CHANNEL FUNCTIONAL TEST shall be performed by measurement of the phase currents for each fan.

(5) The CHANNEL CALIBRATION shall be performed by using a flow measurement device to determine the fan current to flow relationship.

(6) For the CHANNEL FUNCTIONAL TEST on the intermediate range noble gas activity monitors, demonstrate that circuit failures or instrument controls when set in the OFF position produce control room alarm annunciation.

6.2 REQUIREMENT FOR OPERABILITY IN SUPPORT OF RADIOACTIVE EFFLUENT MONITORING PROGRAMS

6.2 (3/4.11) RADIOACTIVE EFFLUENTS

6.2.1 (3/4.11.1) LIQUID EFFLUENTS

6.2.1.1 CONCENTRATION

REQUIREMENTS FOR OPERABILITY

6.2.1.1 (3.11.1.1) The concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS (see ODCM Figure 3-1) shall be limited to the concentrations specified in 10 CFR Part 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2×10^{-4} microcurie/ml total activity.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

With the concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS exceeding the above limits, immediately restore the concentration to the above limits.

PERIODIC TESTS AND INSPECTIONS

6.2.1.1.1 (4.11.1.1.1) Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program of Table 6.2.1.1.1-1 (4.11-1).

6.2.1.1.2 (4.11.1.1.2) The results of the radioactivity analyses shall be used in accordance with the methodology and parameters in the ODCM to assure that the concentrations at the point of release are maintained within the limits of Requirement for Operability 6.2.1.1 (3.11.1.1).

TABLE 6.2.1.1.1-1 (4.11-1)

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

LIQUID RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD)[a] (μCi/ml)
A. Batch Waste Release Tanks[b]	P Each Batch	P Each Batch	Principal Gamma Emitters[c]	$5x10^{-7}$
			I-131	$1x10^{-6}$
	P One Batch/M	M	Dissolved and Entrained Gases (Gamma Emitters)	$1x10^{-5}$
	P Each Batch	M Composite[d]	H-3	$1x10^{-5}$
			Gross Alpha	$1x10^{-7}$
	P Each Batch	Q Composite[d]	Sr-89, Sr-90	$5x10^{-8}$
			Fe-55	$1x10^{-6}$

TABLE 6.2.1.1.1-1 (4.11-1) (Continued)

TABLE NOTATIONS

[a] The LLD is defined, for purposes of these specifications, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66\ s_b}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot \exp(-\lambda \Delta \tau)}$$

Where:

LLD is the "a priori" lower limit of detection as defined above, as microcuries per unit mass or volume,

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate, as counts per minute,

E is the counting efficiency as counts per disintegration,

V is the sample size in units of mass or volume,

2.22×10^6 is the number of disintegrations per minute per microcurie,

Y is the fractional radiochemical yield, when applicable,

λ is the radioactive decay constant for the particular radionuclide, and

$\Delta\tau$ for plant effluents is the elapsed time between the midpoint of sample collection and time of counting.

Typical values of E, V, Y, and $\Delta\tau$ should be used in the calculation.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

TABLE 6.2.1.1.1-1 (4.11-1) (Continued)

TABLE NOTATIONS

[b] A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analyses, each batch shall be isolated, and then thoroughly mixed by a method described in the ODCM to assure representative sampling.

[c] The principal gamma emitters for which the LLD specification applies include the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Radioactive Effluent Release Report pursuant to Technical Specification 6.9.1.11.

[d] A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen that is representative of the liquids released. This may be accomplished through composites of grab samples obtained prior to discharge after the tanks have been recirculated.

6.2 (3/4.11) RADIOACTIVE EFFLUENTS

6.2.1 (3/4.11.1) LIQUID EFFLUENTS

6.2.1.2 DOSE

REQUIREMENT FOR OPERABILITY

6.2.1.2 (3.11.1.2) The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released to UNRESTRICTED AREAS (see ODCM Figure 3-1) shall be limited:

a. During any calendar quarter to less than or equal to 1.5 mrems to the total body and to less than or equal to 5 mrems to any organ, and

b. During any calendar year to less than or equal to 3 mrems to the total body and to less than or equal to 10 mrems to any organ.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective action to be taken to assure that subsequent releases will be in compliance with the above limits. This Special Report shall also include (1) the results of radiological analyses of the drinking water source and (2) the radiological impact on finished drinking water supplies with regard to the requirements of 40 CFR Part 141.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.2.1.2.1 (4.11.1.2) Cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year shall be determined in accordance with the methodology and parameters in the ODCM at least once per 31 days.

6.2 (3/4.11) RADIOACTIVE EFFLUENTS

6.2.1 (3/4.11.1) LIQUID EFFLUENTS

6.2.1.3 (3:11.1.3) LIQUID RADWASTE TREATMENT SYSTEM

REQUIREMENT FOR OPERABILITY

6.2.1.3 (3.11.1.3) The liquid radwaste treatment system shall be OPERABLE. The appropriate portions of the system shall be used to reduce the releases of radioactivity when the projected doses due to the liquid effluent, from each reactor unit, to UNRESTRICTED AREAS (see ODCM Figure 3-1) would exceed 0.06 mrem to the total body or 0.2 mrem to any organ in a 31-day period.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With radioactive liquid waste being discharged without treatment and in excess of the above limits and any portion of the liquid radwaste treatment system not in operation, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days pursuant to Technical Specification 6.9.2 a Special Report that includes the following information:

   1. Explanation of why liquid radwaste was being discharged without treatment, identification of any inoperable equipment or subsystems, and the reason for the inoperability,

   2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

   3. Summary description of actions(s) taken to prevent a recurrence.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.2.1.3.1 (4.11.1.3.1) Doses due to liquid releases from each reactor unit to UNRESTRICTED AREAS shall be projected at least once per 31 days in accordance with the methodology and parameters in the ODCM.

6.2.1.3.2 (4.11.1.3.2) The installed liquid radwaste treatment system shall be demonstrated OPERABLE by meeting Requirement for Operability 6.2.1.1 (3.11.1.1) and 6.2.1.2 (3.11.1.2).

6.2 (3/4.11) RADIOACTIVE EFFLUENTS

6.2.2 (3/4.11.2) GASEOUS EFFLUENTS

6.2.2.1 (3.11.2.1) DOSE RATE

REQUIREMENT FOR OPERABILITY

6.2.2.1 (3.11.2.1) The dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY (see ODCM Figure 3-1) shall be limited to the following:

a. For noble gases: Less than or equal to 500 mrems/yr to the total body and less than or equal to 3000 mrems/yr to the skin, and

b. For iodine-131, for iodine-133, for tritium, and for all radionuclides in particulate form with half-lives greater than 8 days: Less than or equal to 1500 mrems/yr to any organ.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

With the dose rate exceeding the above limits, immediately restore the release rate to within the above limit(s).

PERIODIC TESTS AND INSPECTIONS

6.2.2.1.1 (4.11.2.1.1) The dose rate due to noble gases in gaseous effluents shall be determined to be within the above limits in accordance with the methodology and parameters in the ODCM.

6.2.2.1.2 (4.11.2.1.2) The dose rate due to iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents shall be determined to be within the above limits in accordance with the methodology and parameters in the ODCM by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Table 6.2.2.1.2-1 (4.11-2).

TABLE 6.2.2.1.1.2-1 (4.11-2)

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

GASEOUS RELEASE TYPE		SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD)[a] (μCi/mL)
A.	Primary Containment PURGE and VENT	P Each PURGE[b] and VENT Grab Sample	P Each PURGE[b] and VENT	Principal Gamma Emitters[f]	$1x10^{-4}$
			M	H-3	$1x10^{-6}$
B.	Main Plant Vent	M[b,d] Grab Sample	M[b]	Principal Gamma Emitters[f]	$1x10^{-4}$
			W	H-3	$1x10^{-6}$
C.	Turbine Building Vents and Radwaste Building Vents	M Grab Sample	M	Principal Gamma Emitters[f]	$1x10^{-4}$
				H-3	$1x10^{-6}$
D.	All Release Types as listed in A, B, and C above	Continuous[e]	W[c] Charcoal Sample	I-131 I-133	$1x10^{-12}$ $1x10^{-10}$
		Continuous[e]	W[c] Particulate Sample	Principal Gamma Emitters[f]	$1x10^{-11}$
		Continuous[e]	M Composite Particulate Sample	Gross Alpha	$1x10^{-11}$
		Continuous[e]	Q Composite Particulate Sample	Sr-89, Sr-90	$1x10^{-11}$
		Continuous[e]	Noble Gas Monitor	Noble Gases Gross Beta or Gamma	$1x10^{-6}$ (Xe-133 equivalent)

TABLE 6.2.2.1.2-1 (4.11-2) (Continued)

TABLE NOTATIONS

[a] The LLD is defined, for purposes of these specifications, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66 s_b}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot \exp(-\lambda \Delta t)}$$

Where:

LLD is the "a priori" lower limit of detection as defined above, as microcuries per unit mass or volume,

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate, as counts per minute,

E is the counting efficiency, as counts per disintegration,

V is the sample size in units of mass or volume,

2.22×10^6 is the number of disintegrations per minute per microcurie,

Y is the fractional radiochemical yield, when applicable,

λ is the radioactive decay constant for the particular radionuclide, and

Δt for plant effluents is the elapsed time between the midpoint of sample collection and time of counting.

Typical values of E, V, Y, and Δt should be used in the calculation.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

TABLE 6.2.2.1.2-1 (4.11-2) (Continued)

TABLE NOTATIONS

[b] Sampling and analysis shall also be performed following shutdown, startup, or a THERMAL POWER change exceeding 15% of RATED THERMAL POWER within a 1-hour period.

[c] Samples shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing, or after removal from sampler. Sampling shall also be performed at least once per 24 hours for at least 7 days following each shutdown, startup, or THERMAL POWER change exceeding 15% of RATED THERMAL POWER in 1 hour and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10. This requirement does not apply if (1) analysis shows that the DOSE EQUIVALENT I-131 concentration in the primary coolant has not increased more than a factor of 3; and (2) the noble gas monitor shows that effluent activity has not increased more than a factor of 3.

[d] Tritium grab samples shall be taken at least once per 7 days from the main plant vent stack to determine tritium releases in the ventilation exhaust from the spent fuel pool area whenever spent fuel is in the spent fuel pool.

[e] The ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with Requirement for Operability 6.2.2.1, 6.2.2.2 and 6.2.2.3 (3.11.2.1, 3.11.2.2, and 3.11.2.3).

[f] The principal gamma emitters for which the LLD specification applies include the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 in noble gas releases and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, I-131, Cs-134, Cs-137, Ce-141 and Ce-144 in iodine and particulate releases. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Radioactive Effluent Release Report.

6.2 (3/4.11) RADIOACTIVE EFFLUENTS

6.2.2 (3/4.11.2) GASEOUS EFFLUENTS

6.2.2.2 (3.11.2.2) DOSE - NOBLE GASES

REQUIREMENT FOR OPERABILITY

6.2.2.2 (3.11.2.2) The air dose due to noble gases released in gaseous effluents, from each reactor unit, to areas at and beyond the SITE BOUNDARY (see ODCM Figure 3-1) shall be limited to the following:

a. During any calendar quarter: Less than or equal to 5 mrads for gamma radiation and less than or equal to 10 mrads for beta radiation and,

b. During any calendar year: Less than or equal to 10 mrads for gamma radiation and less than or equal to 20 mrads for beta radiation.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.2.2.2.1 (4.11.2.2) Cumulative dose contributions for the current calendar quarter and current calendar year for noble gases shall be determined in accordance with the methodology and parameters in the ODCM at least once per 31 days.

6.2 (3/4.11) RADIOACTIVE EFFLUENTS

6.2.2 (3/4.11.2) GASEOUS EFFLUENTS

6.2.2.3 (3.11.2.3) DOSE - IODINE-131, IODINE-133, TRITIUM, AND RADIONUCLIDES IN PARTICULATE FORM

REQUIREMENT FOR OPERABILITY

6.2.2.3 (3.11.2.3) The dose to a MEMBER OF THE PUBLIC from iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released, from each reactor unit, to areas at and beyond the SITE BOUNDARY (see ODCM Figure 3-1) shall be limited to the following:

a. During any calendar quarter: Less than or equal to 7.5 mrems to any organ and,

b. During any calendar year: Less than or equal to 15 mrems to any organ.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With the calculated dose from the release of iodine-131, iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents exceeding any of the above limits, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2, a Special Report that identifies the cause(s) for exceeding the limit and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.2.2.3.1 (4.11.2.3) Cumulative dose contributions for the current calendar quarter and current calendar year for iodine-131, iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days shall be determined in accordance with the methodology and parameters in the ODCM at least once per 31 days.

6.2 (3/4.11) RADIOACTIVE EFFLUENTS

6.2.2 (3/4.11.2) GASEOUS EFFLUENT

6.2.2.4 (3.11.2.4) GASEOUS OFFGAS RADWASTE TREATMENT SYSTEM

REQUIREMENT FOR OPERABILITY

6.2.2.4 (3.11.2.4) The GASEOUS OFFGAS RADWASTE TREATMENT SYSTEM* shall be in operation in either the normal or charcoal bypass mode. The charcoal bypass mode shall not be used unless the offgas post-treatment radiation monitor is OPERABLE as specified in Table 6.1.2.1-1 (3.3.7.12-1).

RELEVANT CONDITIONS: Whenever the main condenser steam jet air ejector (evacuation) system is in operation.

COMPENSATORY MEASURES:

a. With the GASEOUS OFFGAS RADWASTE TREATMENT SYSTEM not used in the normal mode for more than 7 days, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2, a Special Report which includes the following information:

   1. Identification of the inoperable equipment or subsystems and the reason for inoperability,

   2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

   3. Summary description of action(s) taken to prevent a recurrence.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.2.2.4.1 (4.11.2.4) The GASEOUS OFFGAS RADWASTE TREATMENT SYSTEM shall be verified to be in operation in either the normal or charcoal bypass mode at least once per 7 days whenever the main condenser steam jet air ejector (evacuation) system is in operation.

* A GASEOUS OFFGAS RADWASTE TREATMENT SYSTEM shall be any system designed and installed to reduce radioactive gaseous effluents by collecting primary coolant system offgases from the primary system and providing for delay or holdup for the purpose of reducing the total radioactivity prior to release to the environment.

6.2 (3/4.11) RADIOACTIVE EFFLUENTS

6.2.2 (3/4.11.2) GASEOUS EFFLUENTS

6.2.2.5 (3.11.2.5) VENTILATION EXHAUST TREATMENT SYSTEM

REQUIREMENT FOR OPERABILITY

6.2.2.5 (3.11.2.5) The appropriate portions of the VENTILATION EXHAUST TREATMENT SYSTEM shall be OPERABLE and shall be used to reduce radioactive materials in gaseous waste prior to their discharge when the projected doses due to gaseous effluent releases from each reactor unit to areas at and beyond the SITE BOUNDARY (see ODCM Figure 3-1) when averaged over 31 days would exceed 0.3 mrem to any organ in a 31-day period.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With the VENTILATION EXHAUST TREATMENT SYSTEM inoperable for more than 31 days, or with gaseous waste being discharged without treatment and in excess of the above limits, in lieu of a Licensee Event Report, prepare and submit to the Commission within 10 days, pursuant to Technical Specification 6.9.2, a Special Report which includes the following information:

   1. Identification of the inoperable equipment or subsystems, and the reason for the inoperability,

   2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

   3. Summary description of action(s) taken to prevent a recurrence.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.2.2.5.1 (4.11.2.5.1) Doses due to gaseous release to areas at and beyond the SITE BOUNDARY shall be projected at least once per 31 days in accordance with the methodology and parameters in the ODCM.

6.2.2.5.2 (4.11.2.5.2) The VENTILATION EXHAUST TREATMENT SYSTEM shall be demonstrated OPERABLE by operating the VENTILATION EXHAUST TREATMENT SYSTEM equipment for at least 10 minutes, at least once per 92 days unless the appropriate system has been utilized to process radioactive gaseous effluents during the previous 92 days.

6.2.2 (3/4.11) RADIOACTIVE EFFLUENTS

6.2.2 (3/4.11.2) GASEOUS EFFLUENTS

6.2.2.6 (3.11.2.8) VENTING OR PURGING

REQUIREMENT FOR OPERABILITY

6.2.2.6 (3.11.2.8) VENTING or PURGING of the Mark II containment drywell shall be through the standby gas treatment system or the primary containment vent and purge system. The first 24 hours of any vent or purge operation shall be through one standby gas treatment system.

RELEVANT CONDITIONS: Whenever the drywell is vented or purged.

COMPENSATORY MEASURES:

a. With the requirements of the above specification not satisfied, suspend all VENTING and PURGING of the drywell.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.2.2.6.1 (4.11.2.8.1) The containment drywell shall be determined to be aligned for VENTING or PURGING through the standby gas treatment system or the primary containment vent and purge system within 4 hours prior to start of and at least once per 12 hours during VENTING or PURGING of the drywell.

6.2.2.6.2 (4.11.2.8.2) Prior to use of the purge system through the standby gas treatment system assure that:

a. Both standby gas treatment system trains are OPERABLE whenever the purge system is in use, and

b. Whenever the purge system is in use during OPERATIONAL CONDITION 1 or 2 or 3, only one of the standby gas treatment system trains may be used.

6.2.2.6.3 (4.11.2.8.3) The containment drywell shall be sampled and analyzed per Table 6.2.2.1.2-1 (4.11-2) of Requirements for Operability 6.2.2.1 (3.11.2.1) within 8 hours prior to the start of and at least once per 12 hours during VENTING and PURGING of the drywell through other than the standby gas treatment system.

6.2 (3/4.11) RADIOACTIVE EFFLUENTS

6.2.3 (3/4.11.3) SOLID RADIOACTIVE WASTE

6.2.3.1 (3.11.3) SOLID RADIOACTIVE WASTE

REQUIREMENT FOR OPERABILITY

6.2.3.1 (3.11.3) Radioactive wastes shall be SOLIDIFIED or dewatered in accordance with the PROCESS CONTROL PROGRAM to meet shipping and transportation requirements during transit, and disposal site requirements when received at the disposal site.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With SOLIDIFICATION* or dewatering not meeting disposal site and shipping and transportation requirements, suspend shipment of the inadequately processed wastes and correct the PROCESS CONTROL PROGRAM, the procedures and/or the solid waste system as necessary to prevent recurrence.

b. With SOLIDIFICATION or dewatering not performed in accordance with the PROCESS CONTROL PROGRAM, (1) test the improperly processed waste in each container to ensure that it meets burial ground and shipping requirements and (2) take appropriate administrative action to prevent recurrence.

c. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.2.3.1.1 (4.11.3) SOLIDIFICATION of at least one representative test specimen from at least every tenth batch of each type of wet radioactive wastes (e.g., filter sludges, spent resins, evaporator bottoms, boric acid solutions, and sodium sulfate solutions) shall be verified in accordance with the PROCESS CONTROL PROGRAM.

a. If any test specimen fails to verify SOLIDIFICATION, the SOLIDIFICATION of the batch under test shall be suspended until such time as additional test specimens can be obtained, alternative SOLIDIFICATION parameters can be determined in accordance with the PROCESS CONTROL PROGRAM, and a subsequent test verifies SOLIDIFICATION. SOLIDIFICATION of the batch may then be resumed using the alternative SOLIDIFICATION parameters determined by the PROCESS CONTROL PROGRAM.

* SOLIDIFICATION shall be the conversion of radioactive wastes from liquid systems to a homogeneous (uniformly distributed), monolithic, immobilized solid with definite volume and shape, bounded by a stable surface of distinct outline on all sides (free-standing).

PERIODIC TESTS AND INSPECTIONS (Continued)

b. If the initial test specimen from a batch of waste fails to verify SOLIDIFICATION, the PROCESS CONTROL PROGRAM shall provide for the collection and testing of representative test specimens from each consecutive batch of the same type of wet waste until at least three consecutive initial test specimens demonstrate SOLIDIFICATION. The PROCESS CONTROL PROGRAM shall be modified as required, as provided in Technical Specification 6.13, to assure SOLIDIFICATION of subsequent batches of waste.

c. With the installed equipment incapable of meeting Requirement for Operability 6.2.3.1 (3.11.3) or declared inoperable, restore the equipment to OPERABLE status or provide for contract capability to process wastes as necessary to satisfy all applicable transportation and disposal requirements.

6.2 (3/4.11) RADIOACTIVE EFFLUENTS

6.2.4 (3/4.11.4) TOTAL DOSE

REQUIREMENT FOR OPERABILITY

6.2.4.1 (3.11.4) The annual (calendar year) dose or dose commitment to any MEMBER OF THE PUBLIC, due to releases of radioactivity and radiation, from uranium fuel cycle sources shall be limited to less than or equal to 25 mrems to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Requirement for Operability 6.2.1.2.a, 6.2.1.2.b, 6.2.2.2.a, 6.2.2.2.b, 6.2.2.3.a, or 6.2.2.3.b (3.11.1.2.a, 3.11.1.2.b, 3.11.2.2.a, 3.11.2.2.b, 3.11.2.3.a, or 3.11.2.3.b), calculations shall be made including direct radiation contributions from the reactor units and from outside storage tanks to determine whether the above limits of Requirement for Operability 6.2.4.1 (3.11.4) have been exceeded. If such is the case, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2, a Special Report that defines the corrective action to be taken to reduce subsequent releases to prevent recurrence of exceeding the above limits and includes the schedule for achieving conformance with the above limits. This Special Report, as defined in 10 CFR 20.405c, shall include an analysis that estimates the radiation exposure (dose) to a MEMBER OF THE PUBLIC from uranium fuel cycle sources, including all effluent pathways and direct radiation, for the calendar year that includes the release(s) covered by this report. It shall also describe levels of radiation and concentrations of radioactive material involved, and the cause of the exposure levels or concentrations. If the estimated dose(s) exceeds the above limits, and if the release condition resulting in violation of 40 CFR Part 190 has not already been corrected, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR Part 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

6.2 (3/4.11) RADIOACTIVE EFFLUENTS

6.2.4 (3/4.11.4) TOTAL DOSE (Continued)

PERIODIC TESTS AND INSPECTIONS

6.2.4.1.1 (4.11.4.1) Cumulative dose contributions from liquid and gaseous effluents shall be determined in accordance with PERIODIC TESTS AND INSPECTIONS 6.2.1.2.1, 6.2.2.2.1, and 6.2.2.3.1 (4.11.1.2, 4.11.2.2, and 4.11.2.3), and in accordance with the methodology and parameters in the ODCM.

6.2.4.1.2 (4.11.4.2) Cumulative dose contributions from direct radiation from unit operation shall be determined in accordance with the methodology and parameters in the ODCM.

6.3 REQUIREMENT FOR OPERABILITY

IN

SUPPORT

OF THE

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

6.3 (3/4.12) RADIOLOGICAL ENVIRONMENTAL MONITORING

6.3.1 (3/4.12.1) MONITORING PROGRAM

REQUIREMENT FOR OPERABILITY

6.3.1.1 (3.12.1) The radiological environmental monitoring program shall be conducted as specified in Table 6.3.1.1-1 (3.12-1).

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With the radiological environmental monitoring program not being conducted as specified in Table 6.3.1.1-1 (3.12-1), in lieu of a Licensee Event Report, prepare and submit to the Commission, in the Annual Radiological Environmental Operating Report, a description of the reasons for not conducting the program as required and the plans for preventing a recurrence.

b. With the level of radioactivity as the result of plant effluents in an environmental sampling medium at a specified location exceeding the reporting levels of Table 6.3.1.1-2 (3.12-2) when averaged over any calendar quarter, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce radioactive effluents so that the potential annual dose* to A MEMBER OF THE PUBLIC is less than the calendar year limits of Requirement for Operability 6.2.1.2, 6.2.2.2 and 6.2.2.3 (3.11.1.2, 3.11.2.2, and 3.11.2.3). When more than one of the radionuclides in Table 6.3.1.1-2 (3.12-2) are detected in the sampling medium, this report shall be submitted if:

$$\frac{\text{concentration (1)}}{\text{reporting level (1)}} + \frac{\text{concentration (2)}}{\text{reporting level (2)}} \pm \ldots \geq 1.0$$

When radionuclides other than those in Table 6.3.1.1-2 (3.12-2) are detected and are the result of plant effluents, this report shall be submitted if the potential annual dose* to A MEMBER OF THE PUBLIC is equal to or greater than the calendar year limits of Requirement for Operability 6.2.1.2, 6.2.2.2 and 6.2.2.3 (3.11.1.2, 3.11.2.2 and 3.11.2.3). This report is not required if the measured level of radioactivity was not the result of plant effluents; however, in such an event, the condition shall be reported and described in the Annual Radiological Environmental Operating Report.

c. With milk or fresh leafy vegetable samples unavailable from one or more of the sample locations required by Table 6.3.1.1-1 (3.12-1), identify locations for obtaining replacement samples and add them to the radiological environmental monitoring program within 30 days.

*The methodology and parameters used to estimate the potential annual dose to a MEMBER OF THE PUBLIC shall be indicated in this report.

RADIOLOGICAL ENVIRONMENTAL MONITORING

REQUIREMENT FOR OPERABILITY (Continued)

COMPENSATORY MEASURES: (Continued)

The specific locations from which samples were unavailable may then be deleted from the monitoring program. In lieu of a Licensee Event Report and pursuant to Technical Specification 6.9.1.11, identify the cause of the unavailability of samples and identify the new location(s) for obtaining replacement samples in the next Semiannual Radioactive Effluent Release Report and also include in the report a revised figure(s) and table for the ODCM reflecting the new location(s).

d. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.3.1.1.1 (4.12.1) The radiological environmental monitoring samples shall be collected pursuant to Table 6.3.1.1-1 (3.12-1) from the specific locations given in the table and figure(s) in the ODCM,, and shall be analyzed pursuant to the requirements of Table 6.3.1.1-1 (3.12-1) and the detection capabilities required by Table 6.3.1.1.1-1 (4.12-1).

TABLE 6.3.1.[illegible] (3.12-1)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM*

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS[a]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
1. DIRECT RADIATION[b]	34 routine monitoring stations either with two or more dosimeters or with one instrument for measuring and recording dose rate continuously, placed as follows: An inner ring of stations, one in each meteorological sector in the general area of the SITE BOUNDARY. An outer ring of stations, one in each of the meteorological sectors of NE, ENE, E, ESE, SE in the 6- to 9-km range from the site, and one in each of the meteorological sectors of N, NNE, SSE, S, SSW in the 9- to 12-km range from the site. The balance of the stations to be placed in special interest areas such as population centers, nearby residences, schools, and 1 or 2 areas to serve as control stations.	Quarterly.	Gamma dose quarterly.

* The number, media, frequency, and location of samples may vary from site to site. This table presents an acceptable minimum program for a site at which each entry is applicable. Local site characteristics must be examined to determine if pathways not covered by this table may significantly contribute to an individual's dose and should be included in the sampling program.

TABLE 6.3.1.1.-1 (6.12-1) (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM*

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS[a]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
2. AIRBORNE			
Radioiodine and Particulates	Samples from 5 locations: 1 sample from close to the 1 SITE BOUNDARY location, having a high calculated annual average ground-level D/Q. Three samples from close to the 3 Columbia River locations having the highest calculated D/Q. One sample from the vicinity of a community having the highest calculated annual average ground-level D/Q. One sample from a control location, as for example 30-50 km distant and in the least prevalent wind direction.	Continuous sampler operation with sample collection weekly, or more frequently if required by dust loading.	Radioiodine Canister: I-131 analysis weekly. Particulate Sampler: Gross beta radioactivity analysis following filter change;[c] Gamma isotopic analysis[d] of composite (by location) quarterly.
3. WATERBORNE			
a. Surface[e]	1 sample upstream 1 sample downstream	Composite sample over 1-month period.[f]	Gamma isotopic analysis[d] monthly. Composite for tritium analysis quarterly.
b. Ground	Samples from 1 or 2 sources only if likely to be affected.[g]	Quarterly.	Gamma isotopic[d] and tritium analysis quarterly.

TABLE 6.3.1.1.-1 (5.12-1) (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM*

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS[a]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
3. WATERBORNE (Continued)			
c. Drinking	One sample of each of 1 to 3 of the nearest water supplies that could be affected by its discharge.	Composite sample over 2-week period[f] when I-131 analysis is performed, monthly composite otherwise.	I-131 analysis on each composite when the dose calculated for the consumption of the water is greater than 1 mrem per year.[h]
	One sample from a control location.		Composite for gross beta and gamma isotopic analysis[d] monthly. Composite for tritium analysis quarterly.
d. Sediment from shoreline	One sample from downstream area with existing or potential recreational value.	Semiannually.	Gamma isotopic analysis[d] semiannually.
4. INGESTION			
a. Milk	Samples from milking animals in 3 locations within 5 km distance having the highest dose potential. If there are none, then 1 sample from milking animals in each of 3 areas between 5-16 km distant where doses are calculated to be greater than 1 mrem per year.[h]	Semimonthly when animals are on pasture, monthly at other times.	Gamma isotopic[d] and I-131 analysis semi-monthly when animals are on pasture; monthly at other times.
	1 sample from milking animals at a control location, 30-50 km distant and in the least prevalent wind direction.		

TABLE 6.3.1.1.-1 (3.12-1) (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM*

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS[a]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
4. INGESTION (Continued)			
b. Fish and Invertebrates	1 sample of each recreationally important species in vicinity of plant discharge area.	Sample in season, or semiannually if they are not seasonal.	Gamma isotopic analysis[d] on edible portions.
	1 sample of same species in areas not influenced by plant discharge.		
c. Food Products	1 sample of each principal class of food products from any area that is irrigated by water in which liquid plant wastes have been discharged.	At time of harvest.[i]	Gamma isotopic analyses[d] on edible portion.
	Samples of 3 different kinds of broad leaf vegetation grown nearest each of two different offsite locations of highest predicted annual average ground-level D/Q if milk sampling is not performed.	Monthly during growing season.	Gamma isotopic[d] and I-131 analysis.
	1 sample of each of the similar broad leaf vegetation grown 30-50 km distant in the least prevalent wind direction if milk sampling is not performed.	Monthly during growing season.	Gamma isotopic[d] and I-131 analysis.

TABLE 6.3.1.1-1 (3.12-1) (Continued)

TABLE NOTATIONS

[a] Specific parameters of distance and direction sector from the centerline of one reactor, and additional description where pertinent, shall be provided for each and every sample location in Table 6.3.1.1-1 (3.12-1) in a table and figure(s) in the ODCM. Refer to NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," October 1978, and to Radiological Assessment Branch Technical Position, Revision 1, November 1979. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to circumstances such as hazardous conditions, seasonal unavailability, and malfunction of automatic sampling equipment. If specimens are unobtainable due to sampling equipment malfunction, effort shall be made to complete corrective action prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented in the Annual Radiological Environmental Operating Report. It is recognized that, at times, it may not be possible or practicable to continue to obtain samples of the media of choice at the most desired location or time. In these instances suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the radiological environmental monitoring program. In lieu of a Licensee Event Report, identify the cause of the unavailability of samples for that pathway and identify the new location(s) for obtaining replacement samples in the next Semiannual Radioactive Effluent Release Report and also include in the report a revised figure(s) and table for the ODCM reflecting the new location(s).

[b] One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. For the purposes of this table, a thermoluminescent dosimeter (TLD) is considered to be one phosphor card with multiple readout areas; a phosphor card in a packet is considered to be equivalent to two or more dosimeters. Film badges shall not be used as dosimeters for measuring direct radiation. (The number of direct radiation monitoring stations may be reduced according to geographical limitations. The frequency of analysis or readout for TLD systems will depend upon the characteristics of the specific system used and should be selected to obtain optimum dose information with minimal fading.)

[c] Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than 10 times the yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples.

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

[e] The "upstream sample" shall be taken at a distance beyond significant influence of the discharge. The "downstream" sample shall be taken in an area beyond but near the mixing zone.

TABLE 6.3.1.1-1 (3.12-1) (Continued)

TABLE NOTATIONS

[f] A composite sample is one in which the quantity (aliquot) of liquid is proportional to the quantity of flowing liquid and in which the method of sampling employed results in a specimen that is representative of the liquid flow. In this program composite sample aliquots shall be collected at time intervals that are very short (e.g., hourly) relative to the compositing period (e.g., monthly) in order to assure obtaining a representative sample.

[g] Groundwater samples shall be taken when this source is tapped for drinking or irrigation purposes in areas where the hydraulic gradient or recharge properties are suitable for contamination.

[h] The dose shall be calculated for the maximum organ and age group, using the methodology and parameters in the ODCM.

[i] If harvest occurs more than once a year, sampling shall be performed during each discrete harvest. If harvest occurs continuously, sampling shall be monthly. Attention shall be paid to including samples of tuberous and root food products.

TABLE 6.3.1.1-2 (3.12-2)

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

ANALYSIS	WATER (pCi/L)	AIRBORNE PARTICULATE OR GASES (pCi/m^3)	FISH (pCi/kg, wet)	MILK (pCi/L)	FOOD PRODUCTS (pCi/kg, wet)
H-3[1]	2×10^4				
Mn-54	1×10^3		3×10^4		
Fe-59	4×10^2		1×10^4		
Co-58	1×10^3		3×10^4		
Co-60	3×10^2		1×10^4		
Zn-65	3×10^2		2×10^4		
Zr-Nb-95	4×10^2				
I-131	2	0.9		3	1×10^2
Cs-134	30	10	1×10^3	60	1×10^3
Cs-137	50	20	2×10^3	70	2×10^3
Ba-La-140	2×10^2			3×10^2	

(1) For drinking water samples. The value given is the 40 CFR Part 141 value. If no drinking water pathway exists, a value of 30,000 pCi/L may be used.

TABLE 6.3.1.1.1-1 (4.12-1)

DETECTION CAPABILITIES OR ENVIRONMENTAL SAMPLE ANALYSIS[a]

LOWER LIMIT OF DETECTION (LLD)[b]

ANALYSIS	WATER (pCi/L)	AIRBORNE PARTICULATE OR GASES (pCi/m^3)	FISH (pCi/kg, wet)	MILK (pCi/L)	FOOD PRODUCTS (pCi/kg, wet)	SEDIMENT (pCi/kg, dry)
Gross beta	4	1×10^{-2}				
H-3	2000*					
Mn-54	15		130			
Fe-59	30		260			
Co-58,60	15		130			
Zn-65	30		260			
Zr-95	30					
Nb-95	15					
I-131		7×10^{-2}		1	60	
Cs-134	15	5×10^{-2}	130	15	60	150
Cs-137	18	6×10^{-2}	150	18	80	180
Ba-140	60			60		
La-140	15			15		

(*) If no drinking water pathway exists, a value of 3,000 pCi/L may be used.

TABLE 6.3.1.1.1-1 (4.12-1) (Continued)

TABLE NOTATIONS

[a] This list does not mean that only these nuclides are to be considered. Other peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Annual Radiological Environmental Operating Report.

[b] Required detection capabilities for thermoluminescent dosimeters used for environmental measurements shall be in accordance with the recommendations of Regulatory Guide 4.13, except for specification regarding energy dependence. Correction factors shall be provided for energy ranges not meeting the energy dependence specification.

[c] The LLD is defined for purposes of these specifications, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66 s_b}{E \cdot V \cdot 2.22 \cdot Y \cdot \exp(-\lambda \Delta t)}$$

Where:

LLD is the "a priori" lower limit of detection as defined above, as picocuries per unit mass or volume,

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate, as counts per minute,

E is the counting efficiency, as counts per disintegration,

V is the sample size in units of mass or volume,

2.22 is the number of disintegrations per minute per picocurie,

Y is the fractional radiochemical yield, when applicable,

λ is the radioactive decay constant for the particular radionuclide, and

Δt for environmental samples is the elapsed time between sample collection, or end of the sample collection period, and time of counting.

Typical values of E, V, Y, and Δt should be used in the calculation.

TABLE 6.3.1.1.1-1 (4.12-1) (Continued)

TABLE NOTATIONS

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement. Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidable small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors shall be identified and described in the Annual Radiological Environmental Operating Report.

[d] LLD for drinking water samples. If no drinking water pathway exists, the LLD of gamma isotopic analysis may be used.

6.3 (3/4.12) RADIOLOGICAL ENVIRONMENTAL MONITORING

6.3.2 (3/4.12.2) LAND USE CENSUS

REQUIREMENT FOR OPERABILITY

6.3.2.1 (3.12.2) A Land Use Census shall be conducted and shall identify within a distance of 8 km (5 miles) the location in each of the 16 meteorological sectors of the nearest milk animal, the nearest residence and the nearest garden* of greater than 50 m^2 (500 ft^2) producing broad leaf vegetation.

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With a Land Use Census identifying a location(s) that yields a calculated dose or dose commitment greater than the values currently being calculated in Requirement for Operability 6.2.2.3.1 (4.11.2.3), in lieu of a Licensee Event Report, identify the new location(s) in the next Semiannual Radioactive Effluent Release Report.

b. With a Land Use Census identifying a location(s) that yields a calculated dose or dose commitment (via the same exposure pathway) 20% greater than at a location from which samples are currently being obtained in accordance with Requirement for Operability 6.3.1.1 (3.12.1), add the new location(s) to the radiological environmental monitoring program within 30 days. The sampling location(s), excluding the control station location having the lowest calculated dose or dose commitment(s), via the same exposure pathway, may be deleted from this monitoring program after October 31 of the year in which this Land Use Census was conducted. In lieu of a Licensee Event Report, identify the new location(s) in the next Semiannual Radioactive Effluent Release Report and also include in the report a revised figure(s) and table for the ODCM reflecting the new location(s).

c. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.3.2.1.1 (4.12.2) The Land Use Census shall be conducted during the growing season at least once per calendar year using that information that will provide the best results, such as by a door-to-door survey, aerial survey, or by consulting local agriculture authorities. The results of the Land Use Census shall be included in the Annual Radiological Environmental Operating Report.

*Broad leaf vegetation sampling of at least three different kinds of vegetation may be performed at the SITE BOUNDARY in each of two different direction sectors with the highest predicted D/Qs in lieu of the garden census. Specifications for broad leaf vegetation sampling in Table 6.3.1.1-1 (3.12-1) shall be followed, including analysis of control samples.

6.3 (3/4.12) RADIOLOGICAL ENVIRONMENTAL MONITORING

6.3.3 (3/4.12.3) INTERLABORATORY COMPARISON PROGRAM

REQUIREMENT FOR OPERABILITY

6.3.3.1 (3.12.3) Analyses shall be performed on all radioactive materials, supplied as part of an Interlaboratory Comparison Program that has been approved by the Commission, that correspond to samples required by Table 6.3.1.1-1 (3.12-1).

RELEVANT CONDITIONS: At all times.

COMPENSATORY MEASURES:

a. With analyses not being performed as required above, report the corrective actions taken to prevent a recurrence to the Commission in the Annual Radiological Environmental Operating Report.

b. The provisions of Technical Specifications 3.0.3 and 3.0.4 are not applicable.

PERIODIC TESTS AND INSPECTIONS

6.3.3.1.1 (4.12.3) The Interlaboratory Comparison Program shall be described in the ODCM. A summary of the results obtained as part of the above required Interlaboratory Comparison Program shall be included in the Annual Radiological Environmental Operating Report.

6.4 RADIOLOGICAL ENVIRONMENTAL OPERATING/RADIOACTIVE EFFLUENT RELEASE REPORT REQUIREMENTS

CONTROL OF CHANGES TO THE:

RADIOACTIVE LIQUID, GASEOUS, AND SOLID WASTE TREATMENT SYSTEMS

6.4.1 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

Routine Radiological Environmental Operating Reports covering the operation of the unit during the previous calendar year shall be submitted prior to May 1 of each year.

The Annual Radiological Environmental Operating Reports shall include summaries, interpretations, and an analysis of trends of the results of the radiological environmental surveillance activities for the report period, including a comparison with preoperational studies, with operational controls as appropriate, and with previous environmental surveillance reports, and an assessment of the observed impacts of the plant operation of the environment. The reports shall also include the results of Land Use Censuses required by Requirement for Operability 6.3.2.1 (3.12.2).

The Annual Radiological Environmental Operating Reports shall include the results of analysis of all radiological environmental samples and of all environmental radiation measurements taken during the period pursuant to the locations specified in the table and figures in the ODCM, as well as summarized and tabulated results of these analyses and measurements in the format of the table in the Radiological Assessment Branch Technical Position, Revision 1, November 1979. In the event that some individual results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted as soon as possible in a supplementary report.

The reports shall also include the following: a summary description of the radiological environmental monitoring program, at least two legible maps* covering all sampling locations keyed to a table giving distances and directions from the centerline of the reactor; the results of license participation in the Interlaboratory Comparison Program, required by Requirement for Operability 6.3.3.1 (3.12.3); discussion of all deviations from the sampling schedule of Table 6.3.1.1-1 (3.12-1); and discussion of all analyses in which the LLD required by Table 6.3.1.1.1-1 (4.12-1) was not achievable.

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* One map shall cover stations near the SITE BOUNDARY; a second shall include the more distant stations.

6.4.2 RADIOACTIVE EFFLUENT RELEASE REPORT

The Routine Radioactive Effluent Release Report covering the operation of the unit shall be submitted in accordance with 10 CFR 50.36a(a)(2).

The Radioactive Effluent Release Report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit as outlined in Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," Revision 1, June 1974, with data summarized on a quarterly basis following the format of Appendix B thereof.

The Radioactive Effluent Release Report to be submitted within 60 days after January 1 of each year shall include an annual summary of hourly meteorological data collected over the previous year. This annual summary may be either in the form of an hour-by-hour listing on magnetic tape of wind speed, wind direction, atmospheric stability, and precipitation (if measured), or in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability.* This same report shall include an assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from the unit or station during the previous calendar year. This same report shall also include an assessment of the radiation doses from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY (ODCM Figure 3-1) during the report period. All assumptions used in making these assessments, i.e., specific activity, exposure time and location, shall be included in these reports. The meteorological conditions concurrent with the time of release of radioactive materials in gaseous effluents, as determined by sampling frequency and measurement, shall be used for determining the gaseous pathway doses. The assessment of radiation doses shall be performed in accordance with the methodology and parameters in the OFFSITE DOSE CALCULATION MANUAL (ODCM).

The Radioactive Effluent Release Report shall also include once a year an assessment of radiation doses to the likely most exposed MEMBER OF THE PUBLIC from reactor releases and other nearby uranium fuel cycle sources, including doses from primary effluent pathways and direct radiation, for the previous calendar year to show conformance with 40 CFR Part 190, Environmental Radiation Protection Standards for Nuclear Power Operation. Acceptable methods for calculating the dose contribution from liquid and gaseous effluents are given in Regulatory Guide 1.109, Rev. 1, October 1977.

*In lieu of submission with the first half year Radioactive Effluent Release Report, the licensee has the option of retaining this summary of required meteorological data on site in a file that shall be provided to the NRC upon request.

6.4.2 RADIOACTIVE EFFLUENT RELEASE REPORT (Continued)

The Radioactive Effluent Release Report shall include the following information for each class of solid waste (as defined by 10 CFR Part 61) shipped offsite during the report period:

a. Container volume,

b. Total curie quantity (specify whether determined by measurement or estimate),

c. Principal radionuclides (specify whether determined by measurement or estimate),

d. Source of waste and processing employed (e.g., dewatered spent resin, compacted dry waste, evaporator bottoms),

e. Type of container (e.g., LSA, Type A, Type B, Large Quantity), and

f. Solidification agent or absorbent (e.g., cement, urea formaldehyde).

The Radioactive Effluent Release Reports shall include a list and description of unplanned releases from the site to UNRESTRICTED AREAS of radioactive materials in gaseous and liquid effluents made during the reporting period.

The Radioactive Effluent Release Reports shall include any changes made during the reporting period to the PROCESS CONTROL PROGRAM (PCP) and to the OFFSITE DOSE CALCULATION MANUAL (ODCM), as well as a listing of new locations for dose calculations and/or environmental monitoring identified by the Land Use Census pursuant to Requirement for Operability 6.3.2.1 (3.12.2).

6.4.3 MAJOR CHANGES TO RADIOACTIVE LIQUID, GASEOUS, AND SOLID WASTE TREATMENT SYSTEMS*

Licensee initiated major changes to the radioactive waste systems (liquid, gaseous, and solid):

a. Shall be reported to the Commission in the Semiannual Radioactive Effluent Release Report for the period in which the evaluation was reviewed by the POC. The discussion of each change shall contain:

1. A summary of the evaluation that led to the determination that the change could be made in accordance with 10 CFR 50.59;

2. Sufficient detailed information to totally support the reason for the change without benefit of additional or supplemental information;

* Licensees may choose to submit the information called for in this specification as part of the annual FSAR update.

3. A detailed description of the equipment, components, and processes involved and the interface with other plant systems;

4. An evaluation of the change, which shows the predicted releases of radioactive materials in liquid and gaseous effluents and/or quantity of solid waste that differ from those previously predicted in the license application and amendments thereto;

5. An evaluation of the change, which shows the expected maximum exposures to a MEMBER OF THE PUBLIC in the UNRESTRICTED AREA and to the general population that differ from those previously estimated in the license application and amendments thereto;

6. A comparison of the predicted releases of radioactive materials, in liquid and gaseous effluents and in solid waste, to the actual releases for the period prior to when the changes are to be made;

7. An estimate of the exposure to plant operating personnel as a result of the change; and

8. Documentation of the fact that the change was reviewed and found acceptable by the POC.

b. Shall become effective upon review and acceptance by the POC.

* Licensees may choose to submit the information called for in this specification as part of the annual FSAR update.

6.5 BASES

FOR

RADIOACTIVE EFFLUENTS MONITORING

REQUIREMENT FOR OPERABILITY

B6.1 INSTRUMENTATION

BASES

MONITORING INSTRUMENTATION

B6.1.1 (3/4.3.7.11) RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The alarm/trip setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50. The purpose of tank level indicating devices is to assure the detection and control of leaks that if not controlled could potentially result in the transport of radioactive materials to UNRESTRICTED AREAS.

B6.1.2 (3/4.3.7.12) RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The alarm/trip setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. This instrumentation also includes provisions for monitoring the concentrations of potentially explosive gas mixtures in the WASTE GAS HOLDUP SYSTEM. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

B6.2 (3/4.11) RADIOACTIVE EFFLUENTS

BASES

B6.2.1 (3/4.11) LIQUID EFFLUENTS

B6.2.1.1 (3/4.1.1.1) CONCENTRATION

This Requirement for Operability is provided to ensure that the concentration of radioactive materials released in liquid waste effluents to UNRESTRICTED AREAS will be less than the concentration levels specified in 10 CFR Part 20, Appendix B, Table II, Column 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water in UNRESTRICTED AREAS will result in exposures within (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a MEMBER OF THE PUBLIC and (2) the limits of 10 CFR 20.106(e) to the population. The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

This Requirement for Operability applies to the release of radioactive materials in liquid effluents from all reactor units at the site.

The required detection capabilities for radioactive materials in liquid waste samples are tabulated in terms of the lower limits of detection (LLDs). Detailed discussion of the LLD, and other detection limits can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, L. A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem. 40, 586-93 (1968), and Hartwell, J. K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

B6.2.1.2 (3/4.11.1.2) DOSE

This Requirement for Operability is provided to implement the requirements of Sections II.A, III.A, and IV.A of Appendix I, 10 CFR Part 50. The Requirement for Operability implements the guides set forth in Section II.A of Appendix I. The COMPENSATORY MEASURES statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." Also, for fresh water sites with drinking water supplies that can be potentially affected by plant operations, there is reasonable assurance that the operation of the facility will not result in radionuclide concentrations in the finished drinking water that are in excess of the requirements of 40 CFR Part 141. The dose calculation methodology and parameters in the ODCM implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials

B6.2.1.2 (3/4.11.1.2) DOSE (Continued)

in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

This Requirement for Operability applies to the release of radioactive materials in liquid effluents from each reactor unit at the site.

B6.2.1.3 (3/4.11.1.3) LIQUID RADWASTE TREATMENT SYSTEM

The OPERABILITY of the liquid radwaste treatment system ensures that this system will be available for use whenever liquid effluents require treatment prior to release to the environment. The requirement that the appropriate portions of this system be used, when specified, provides assurance that the releases of radioactive materials in liquid effluent will be kept "as low as is reasonably achievable." This Requirement for Operability implements the requirements of 10 CFR 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50 and the design objective given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the liquid radwaste treatment system were specified as a suitable fraction of the dose design objectives set forth in Section II.A of Appendix I, 10 CFR Part 50, for liquid effluents.

This Requirement for Operability applies to the release of radioactive materials in liquid effluents from each reactor unit at the site.

B6.2.2 (3/4.11.2) GASEOUS EFFLUENTS

B6.2.2.1 (3/4.11.2.1) DOSE RATE

This Requirement for Operability is provided to ensure that the dose at any time at and beyond the SITE BOUNDARY from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 to UNRESTRICTED AREAS. The annual dose limits are the doses associated with the concentrations of 10 CFR Part 20, Appendix B, Table II, Column 1. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of a MEMBER OF THE PUBLIC in an UNRESTRICTED AREA, either within or outside the SITE BOUNDARY, to annual average concentrations exceeding the limits specified in Appendix B, Table II of 10 CFR Part 20 (10 CFR 20. 106(b)). For MEMBERS OF THE PUBLIC who may at times be within the SITE BOUNDARY, the occupancy of that MEMBER OF THE PUBLIC will usually be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the SITE BOUNDARY. Examples of calculations for such MEMBERS OF THE PUBLIC, with the appropriate occupancy factors, is provided in the ODCM. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to a MEMBER OF THE PUBLIC at or beyond the SITE BOUNDARY to less than or equal to 500 mrems/year to the total body or to less than or equal to 3000 mrems/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrems/year.

B6.2.2.1 (3/4.11.2.1) DOSE RATE (Continued)

This Requirement for Operability applies to the release of radioactive materials in gaseous effluents from all reactor units at the site.

The required detection capabilities for radioactive materials in gaseous waste samples are tabulated in terms of the lower limits of detection (LLDs). Detailed discussion of the LLD and other detection limits can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, L. A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem. 40, 586-93 (1968), and Hartwell, J. K. , "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

B6.2.2.2 (3/4.11.2.2) DOSE - NOBLE GASES

This Requirement for Operability is provided to implement the requirements of Sections II.B, III.A, and IV.A of Appendix I, 10 CFR Part 50. The Requirement for Operability implements the guides set forth in Section II.B of Appendix I. The COMPENSATORY MEASURES statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The PERIODIC TESTS AND INSPECTIONS requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The dose calculation methodology and parameters established in the ODCM for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors," Revision 1, July 1977. The ODCM equations provided for determining the air doses at and beyond the SITE BOUNDARY are based upon the historical average atmospheric conditions.

This Requirement for Operability applies to the release of radioactive materials in gaseous effluents from each reactor unit at the site.

B6.2.2.3 (3/4.11.2.3) DOSE - IODINE- 131, IODINE- 133, TRITIUM, AND RADIONUCLIDES IN PARTICULATE FORM

This Requirement for Operability is provided to implement the requirements of Sections II.C, III.A, and IV.A of Appendix I, 10 CFR Part 50. The Requirement for Operability are the guides set forth in Section II.C of Appendix I. The COMPENSATORY MEASURES statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The ODCM calculational methods specified in the Requirement for Operability implement the requirements in Section III.A of Appendix I that

B6.2.2.3 (3/4.11.2.3) DOSE - IODINE-131, IODINE-133, TRITIUM, AND RADIONUCLIDES IN PARTICULATE FORM (Continued)

conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The ODCM calculational methodology and parameters for calculating the doses due to the actual release rates of the subject materials are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors," Revision 1, July 1977. These equations also provide for determining the actual doses based upon the historical average atmospheric conditions or concurrent meteorology. The release rate specifications for iodine-131, iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days are dependent upon the existing radionuclide pathways to man, in the areas at and beyond the SITE BOUNDARY. The pathways that were examined in the development of these calculations were: (1) individual inhalation of airborne radionuclides, (2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, (3) deposition onto grassy areas where milk animals and meat-producing animals graze with consumption of the milk and meat by man, and (4) deposition on the ground with subsequent exposure of man.

This Requirement for Operability applies to the release of radioactive materials in gaseous effluents from each reactor unit at the site.

B6.2 RADIOACTIVE EFFLUENTS

BASES

B6.2.2.4 and 6.2.2.5 (3/4.11.2.4 and 3/4.11.2.5) GASEOUS OFFGAS RADWASTE TREATMENT SYSTEM and VENTILATION EXHAUST TREATMENT SYSTEM

The OPERABILITY of the GASEOUS OFFGAS RADWASTE TREATMENT SYSTEM and the VENTILATION EXHAUST TREATMENT SYSTEM ensures that the systems will be available for use whenever gaseous effluents require treatment prior to release to the environment. The requirement that the appropriate portions of these systems be used, when specified, provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." This Requirement for Operability implements the requirements of 10 CFR 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and the design objectives given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the dose design objectives set forth in Sections II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents.

B6.2.2.6 (3/4.11.2.8) VENTING OR PURGING

This Requirement for Operability provides reasonable assurance that releases from drywell purging operations will not exceed the annual dose limits of 10 CFR Part 20 for unrestricted areas.

B6.2.3.1 (3/4.11.3) SOLID RADIOACTIVE WASTE

This Requirement for Operability implements the requirements of 10 CFR 50.36a and General Design Criterion 60 of Appendix A to 10 CFR Part 50. The process parameters included in establishing the PROCESS CONTROL PROGRAM may include, but are not limited to, waste type, waste pH, waste/liquid/solidification agent/catalyst ratios, waste oil content, waste principal chemical constituents, mixing and curing times.

B6.2 RADIOACTIVE EFFLUENTS

BASES

B6.2.4.1 (3/4.11.4) TOTAL DOSE

This Requirement for Operability is provided to meet the dose limitations of 40 CFR Part 190 that have been incorporated into 10 CFR Part 20 by 46 FR 18525. The Requirement for Operability requires the preparation and submittal of a Special Report whenever the calculated doses from plant generated radioactive effluents and direct radiation exceed 25 mrems to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems. For sites containing up to four reactors, it is highly unlikely that the resultant dose to a MEMBER OF THE PUBLIC will exceed the dose limits of 40 CFR Part 190 if the individual reactors remain within twice the dose design objectives of Appendix I, and if direct radiation doses from the reactor units and outside storage tanks are kept small. The Special Report will describe a course of action that should result in the limitation of the annual dose to a MEMBER OF THE PUBLIC to within the 40 CFR Part 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to the MEMBER OF THE PUBLIC from other uranium fuel cycle sources is negligible with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 8 km must be considered. If the dose to any MEMBER OF THE PUBLIC is estimated to exceed the requirements of 40 CFR Part 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR Part 190 have not already been corrected), in accordance with the provisions of 40 CFR 190.11 and 10 CFR 20.405c, is considered to be a timely request and fulfills the requirements of 40 CFR Part 190 until NRC staff action is completed. The variance only relates to the limits of 40 CFR Part 190, and does not apply in any way to the other requirements for dose limitation of 10 CFR Part 20, as addressed in Requirement for Operability 6.2.1.1 (3.11.1.)1 and 6.2.2.1 (3.11.2.1). An individual is not considered a MEMBER OF THE PUBLIC during any period in which he/she is engaged in carrying out any operation that is part of the nuclear fuel cycle.

B6.3 (3/4.12) RADIOLOGICAL ENVIRONMENTAL MONITORING

BASES

B6.3.1.1 (3/4.12.1) MONITORING PROGRAM

The radiological environmental monitoring program required by this Requirement for Operability provides representative measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposures of MEMBERS OF THE PUBLIC resulting from the plant operation. This monitoring program implements Section IV.B.2 of Appendix I to 10 CFR Part 50 and thereby supplements the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and the modeling of the environmental exposure pathways. Guidance for this monitoring program is provided by the Radiological Assessment Branch Technical Position on Environmental Monitoring. The initially specified monitoring program will be effective for at least the first 3 years of commercial operation. Following this period, program changes may be initiated on operational experience.

The required detection capabilities for environmental sample analyses are tabulated in terms of the lower limits of detection (LLDs). The LLDs required by Table 6.3.1.1.1-1 (4.12-1) are considered optimum for routine environmental measurements in industrial laboratories. It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

Detailed discussion on the LLD, and other detection limits, can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, L. A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem. 40, 586-93 (1968), and Hartwell, J. K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

B6.3.2.1 (3/4.12.2) LAND USE CENSUS

This Requirement for Operability is provided to ensure that changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the radiological environmental monitoring program are made if required by the results of this census. The best information from the door-to-door survey, from aerial survey or from consulting with local agricultural authorities shall be used. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50. Restricting the census to gardens of greater than 50 m^2 provides assurance that significant exposure pathways via leafy vegetables will be identified and monitored since a garden of this size is the minimum required to produce the quantity (26 kg/year) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption by a child. To determine this minimum garden size, the following assumptions were made: (1) 20% of the garden was used for growing broad leaf vegetation (i.e., similar to lettuce and cabbage), and (2) a vegetation yield of 2 kg/m^2.

B6.3 (3/4.12) RADIOLOGICAL ENVIRONMENTAL MONITORING

BASES

B6.3.3.1 (3/4.12.3) INTERLABORATORY COMPARISON PROGRAM

The requirement for participation in an approved Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring in order to demonstrate that the results are valid for the purposes of Section IV.B.2 of Appendix I to 10 CFR Part 50.

Radiological Environmental Monitoring Program

1991 Annual Report For Nuclear Plant 2

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM

NUCLEAR PLANT NUMBER 2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

1991 ANNUAL REPORT

April 1992

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM

NUCLEAR PLANT NUMBER 2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

1991 ANNUAL REPORT

April 1992

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WNP-2 Licensing Manager	A.G. Hosler	4/23/92 Date
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TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

LIST OF TABLES

LIST OF TABLES (Cont.)

LIST OF FIGURES

LIST OF FIGURES
(Continued)

1.0 EXECUTIVE SUMMARY

The Washington Public Power Supply System Radiological Environmental Monitoring Program (REMP) activities during 1991 are discussed in this report. The objective of the REMP is to determine the radiological impact, if any, of Plant 2 operations on the environment. To accomplish that objective, air, water, milk, soil, sediment, fish and garden produce samples were collected on a regular basis from the region surrounding the plant. In addition, direct radiation from the plant and plant effluents was measured using thermoluminescent dosimeters (TLDs).

Determining whether plant operations significantly affected the environment involved comparison of samples taken in areas near the plant and in other regions which could be potentially impacted by Plant 2 effluents to samples taken in areas that are highly unlikely to be affected. In addition, a comparison of the samples taken during 1991 at locations of potential impact to samples taken at the same location prior to plant operation and during previous periods of operation provided another mechanism for detecting any changes in the environmental radioactivity attributable to Plant 2 operations. Other methods used to evaluate the REMP results and to bring the results into perspective included comparison of the 1991 results to the lower limits of detection (LLDs) determined for each radionuclide, to the preoperational averages and to the applicable State of Washington or U.S. Nuclear Regulatory Commission investigation or reporting levels or standards.

Intercomparison programs or studies through which the accuracy of the REMP analytical results and TLD results are demonstrated were an important part of the quality assurance activities during 1991. Such intercomparisons tested the performance of the Supply System monitoring program against other monitoring programs and also against known values. The Supply System REMP performed well in the Environmental Measurements Laboratory and Environmental Protection Agency Intercomparison Studies and the Hanford TLD Intercomparison Study conducted during 1991.

The 1991 results were generally consistent with the environmental results for previous years. Most of the results were below detection levels. Some analyses, such as the determination of gross (total) beta, generated detectable results for nearly all samples of air and water, because of the low detection limit for the gross beta analysis and the abundance of naturally-occurring beta-emitting radionuclides in the environment. Other results above detection levels, such as cesium-137 in soil and sediment, reflected the effect of past Hanford activities or fallout from past nuclear weapons testing. Direct radiation measurements made in the region around Plant 2 using thermoluminescent dosimeters (TLDs) also were consistent with previous measurements. No significant trends were observed in the 1991 data. Based on the extensive comparisons and evaluations performed on the data, no radiological impacts of Plant 2 operations on the environment around the plant were detected by the REMP during 1991.

2.0 TERMINOLOGY

Becquerel (Bq): One disintegration per second. One picocurie (pCi) equals 0.037 becquerel.

Blank Sample: A sample of the same media as the field sample being analyzed but without the radionuclide(s) being measured. It enables correction for the inherent sample background.

Composite Sample: A series of single collected portions (aliquots) analyzed as one sample. The aliquots making up the sample are collected at time intervals that are very short compared to the composite period.

Control Station: A background sampling location, i.e., a location not likely to be affected by plant effluents due to its distance and/or direction from Plant 2.

Cumulative Probability Plotting: A technique used to determine whether a set of data conforms to a particular type of distribution; in the case of REMP environmental data, the distribution is log normal.

Curie (Ci): 3.7×10^{10} disintegrations per second.

DOH: Washington State Department of Health.

Grab Sample: A single discrete sample drawn at one point in time.

Indicator Station: A sampling location that could be affected by plant effluents due to its proximity and/or direction from Plant 2.

Lower Limit of Detection (LLD): Detection capability. The smallest concentration of radioactive material in a sample that will yield a net count (above system background) that will be detected with 95% probability and a 5% probability of a false conclusion that a blank observation represents a "real" signal.

Mean: The average, i.e., the sum of results divided by the number of results.

Milliroentgen (mR): 1/1000 Roentgen; a unit of exposure to X or gamma radiation.

NRC: U.S. Nuclear Regulatory Commission.

ODCM: Offsite Dose Calculation Manual.

Picocurie (pCi): 1×10^{-12} Curie or 2.22 disintegrations per minute.

REMP: Radiological Environmental Monitoring Program.

Range: The difference between the smallest and largest results.

Roentgen: Unit of exposure to X or gamma radiation in air.

Site Certification Agreement (SCA): The Plant 2 licensing agreement with the State of Washington.

Spike Sample: A sample containing a known concentration of the radionuclide(s) being measured.

Standard Deviation: A measure of the scatter of a set of observations (or samples) around their mean value.

Standard Error: An estimate of the uncertainty associated with the mean of observation (or sample) averages.

TLD: Thermoluminescent dosimeter; a TLD contains a phosphor which stores energy from exposure to radiation and emits that energy in the form of light when heated.

TL: Thermoluminescence.

3.0 INTRODUCTION

The Radiological Environmental Monitoring Program (REMP) for Washington Public Power Supply System Plant 2 provides for the collection and analysis of samples of various environmental media, in order to assess the radiological impact of plant operations. The environmental media routinely sampled by the REMP include air, water, milk, soil, river sediment, fish, vegetables, fruits, and root crops. Other sample media, such as vegetation and animal products (for example, eggs and meat) are also sampled under special circumstances when additional information about particular radionuclides is needed. The direct radiation near the plant and at various distances from the plant is assessed through the use of thermoluminescent dosimeters.

This annual report is written to satisfy the requirements of Plant 2 Technical Specification 6.9.1.10. The results of environmental measurements made during CY 1991 are presented in the report. The results are discussed and interpreted by comparing them to similar measurements made during the preoperational and previous operational periods and to the detection capabilities associated with the current methods of analysis. The quality assurance and quality control aspects of the program are also discussed in this report.

3.1 Site Description

Washington Public Power Supply System Plant 2 is located in a sparsely populated shrub-steppe region within the Department of Energy-operated Hanford Site in southeastern Washington. The plant is approximately three miles west of the Columbia River and is surrounded on all sides by uninhabited desert land. The nearest population centers are Richland, Kennewick and Pasco, which are 12 miles south, 21 miles southeast, and 18 miles southeast, respectively. The nearest privately-owned lands are located approximately four miles ENE of the plant, across the Columbia River. Given the prevailing wind directions, shown in the 1991 wind frequency distribution in Figure 3-1, the focus of REMP sampling is this farming region across the river.

Because Plant 2 is located on the Hanford Site, other sources of radioactive effluents are in relatively close proximity to Plant 2. For this reason, sampling locations near the plant (near-plant locations) provide useful information for separating the potential environmental effects of Plant 2 from the effects of the other effluent sources on the Hanford Site.

3.2 Program Background

The REMP is designed to conform to the regulatory guidance provided by Regulatory Guides 4.1[1] and 4.8[2], including the Radiological Assessment Branch Technical Position (BTP)[3], while taking into account site specific characteristics. The quality assurance aspects of the program and the thermoluminescent dosimetry are conducted in accordance with Regulatory Guides 4.15[4] and 4.13[5]. The REMP also must adhere to the requirements of the Site Certification Agreement (SCA)[10] with the State of Washington and the Plant 2 Technical Specifications[9]. These requirements cover not only the environmental sampling and sample analysis aspects of the program, but also the reporting and quality assurance aspects of the program.

The preoperational phase of the program, which extended from March 1978 to January 19, 1984, the date of initial criticality, provided a baseline of environmental data. Variability in the background levels of radioactivity due to differences in geologic composition, nuclear weapons test fallout, meteorological conditions and seasonal changes is reflected in that preoperational data.

REMP environmental samples have always been analyzed by a contract analytical laboratory. Since June 1986, Teledyne Isotopes, Inc. in Westwood, New Jersey, has performed the analysis of REMP samples. The thermoluminescent dosimeters used in the REMP to assess the direct radiation are processed by the Supply System External Dosimetry Laboratory under the Plant Services Department.

3.3 Program Objectives

The REMP is the final stage in a series of monitoring programs that characterize and analyze the liquid and gaseous effluents from Plant 2. Figure 3-2 presents this monitoring hierarchy from the generation of the waste liquids and gases to the calculation of doses from these effluents and the measurement of radioactivity in the environment.

The REMP provides a mechanism for determining whether the levels of radioactivity in the plant environs are within established limits and for ensuring that the accumulation of radionuclides in the environment will not become significant as a result of plant operations. While in-plant monitoring programs are used to ensure that 10CFR20[7] and 10CFR50[8] criteria for releases of radioactive effluents are met, the REMP provides supplemental verification that the concentrations of radionuclides in the environment are not greater than anticipated.

Any radiological effect of Plant 2 on the environment must be distinguished from the normal variation in background radiation levels and from the effects of other sources of radioactive effluents in the area. The monitoring results obtained during each year of the plant's operation are compared to the preoperational data and to data from previous operating years, in order to determine whether a significant accumulation of plant-produced radionuclides has occurred in the environment. Should a significant accumulation be observed and be attributed to plant operation, steps would be taken to locate the release pathway and to prevent further releases.

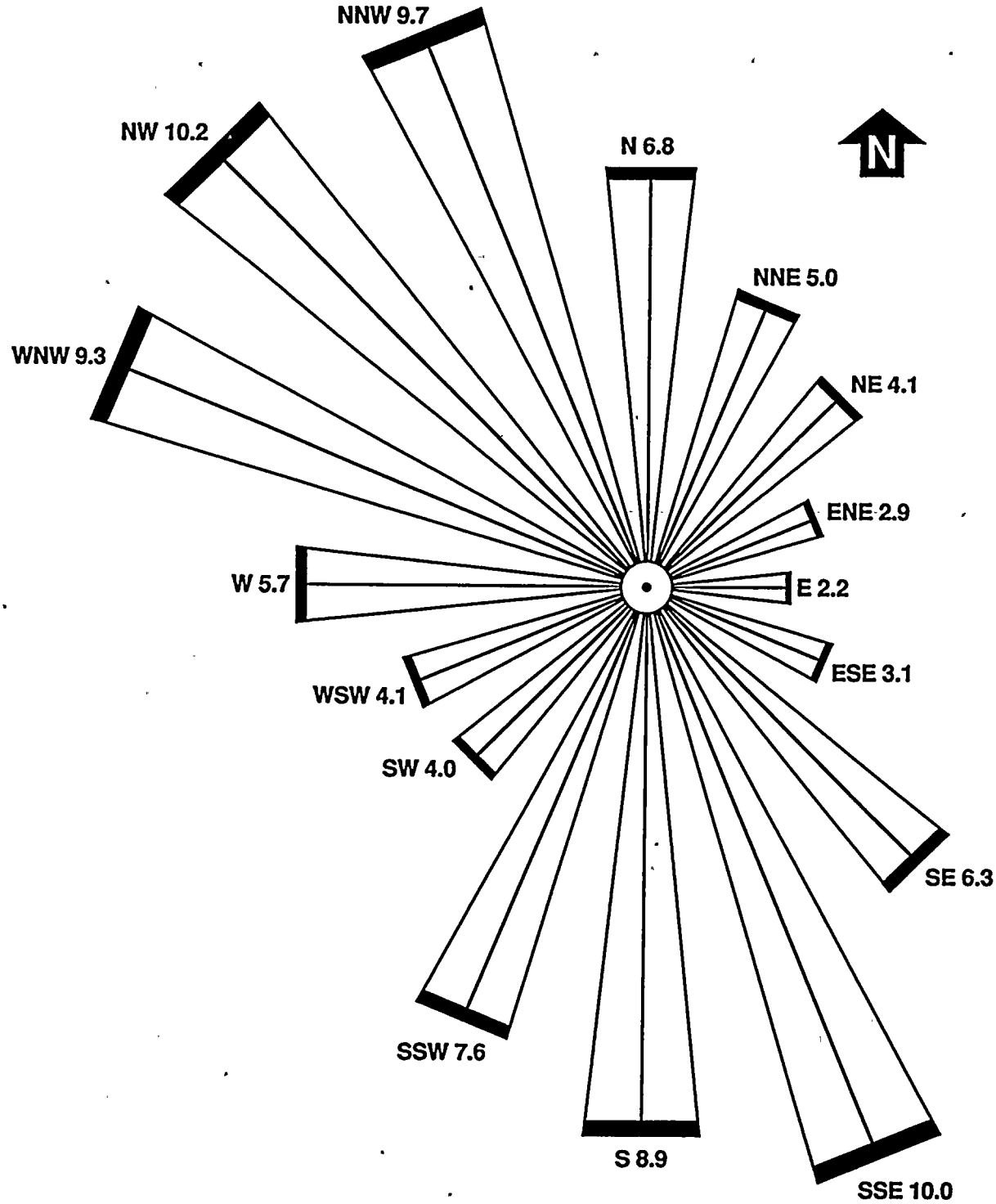

FIGURE 3-1
1991 WIND FREQUENCY DISTRIBUTION IN PERCENT FROM EACH DIRECTION
RELATIVE TO PLANT 2

Monitoring Hierarchy

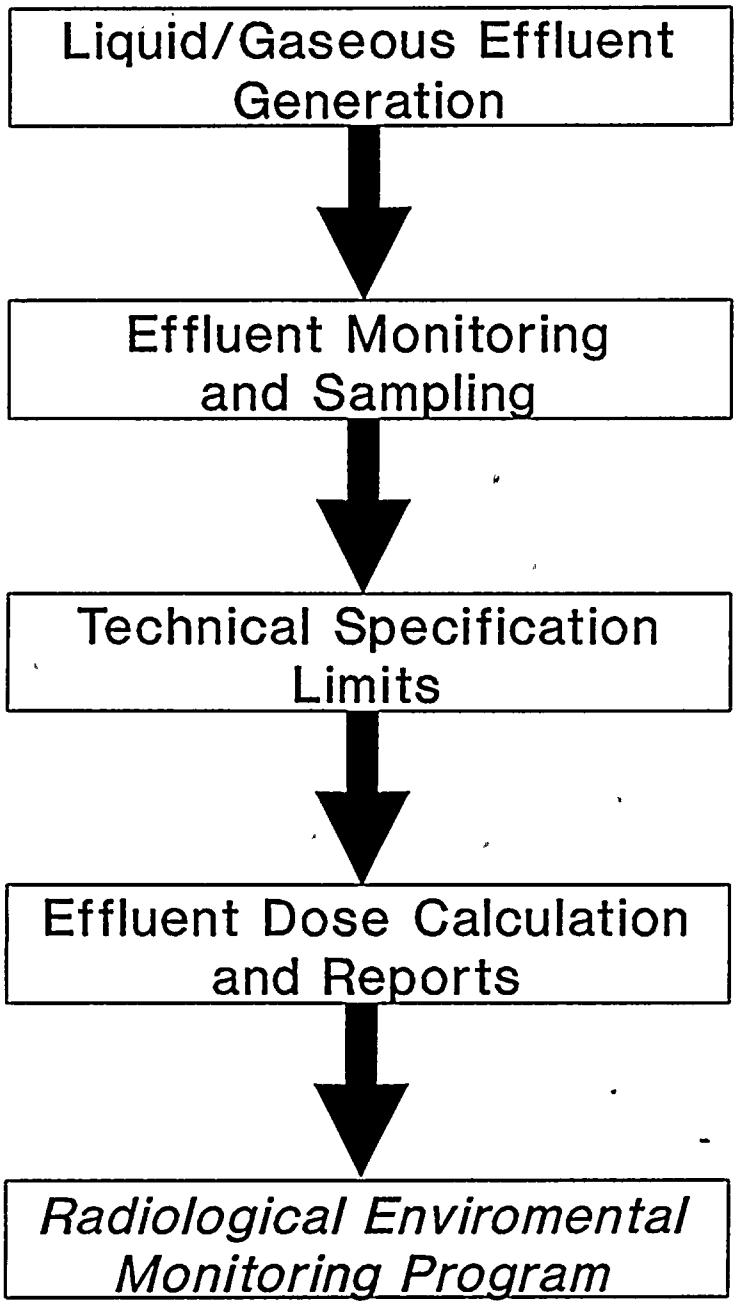

FIGURE 3-2
THE MONITORING HIERARCHY FROM THE GENERATION OF LIQUID AND GASEOUS EFFLUENTS TO THE MEASUREMENT OF RADIOACTIVITY TO THE ENVIRONMENT

4.0 PROGRAM DESCRIPTION

The REMP plan for Plant 2 is presented in Table 4-1. It summarizes the sample locations, collection frequency and types of analysis performed on the sample media. The methods of sampling and sampling frequencies utilized in the program have been determined by such factors as the half-lives and major exposure pathways for the radionuclides potentially released from the plant to the surrounding environment.

4.1 Sample Locations

Seventy-seven sample locations were included in the 1991 monitoring program. Seventy indicator and two control, i.e. background, locations were within 10 miles (16 kilometers) of the Plant 2 containment. Three additional control stations and two indicator stations were outside the 10-mile radius from the plant. Sample stations are listed in Table 4-2 by meteorological sector, sample media and approximate distance from the plant. The numbers and locations of sample stations are based not only on factors such as population distribution and meteorological conditions, but also on station accessibility, security throughout the year and the requirements of applicable regulations.

Maps of the REMP sampling locations described in Tables 4-1 and 4-2 are presented in Figure 4-1 for sampling locations within the 10-mile radius and Figure 4-2 for sampling locations outside the 10-mile radius. A more detailed presentation of sampling locations in the Sunnyside/Grandview area is given in Figure 4-3. Maps indicating the sampling locations for each specific type of sample media are presented in Section 4.3 as Figures 4-4 through 4-12.

4.2 Land Use Census

In August the annual land use census was performed, as required by the Plant 2 Technical Specifications.[9] One objective of the land use census is to identify the locations of the nearest milk animal, residence and garden greater than 50 m^2 (500 ft^2) producing broadleaf vegetation within a distance of 5 miles from the plant. Another objective is to determine whether any site located during the census has a calculated dose or dose commitment greater than the sites currently monitored for the same exposure pathway. If so, routine sampling of that dose pathway would be initiated at that new site.

The results of the 1991 land use census within 5 miles are given in Table 4-3. No milk animals are located within the 5-mile radius. The closest milk locations are at 6.4 miles SE and 7.2 miles ESE. Two small gardens containing broadleaf vegetation were located within 5 miles of the plant during the 1991 land use census. Samples were not obtained at these locations due to the small amounts grown.

4.3 Sampling Methods

The collection of environmental samples for the REMP was performed according to the schedule in Table 4-1. All samples were collected by Supply System personnel. Documented procedures contained in the Environmental Program Instruction Manual were used for sample collection and preparation. The following sections describe the Supply System's sampling and preparation methods.

4.3.1 Direct Radiation

During 1991, thermoluminescent dosimeters (TLDs) were used to determine the direct radiation levels at the fifty-seven (57) monitoring locations shown in Figures 4-4, 4-5 and 4-6. No new TLD locations were added to the program this year. The TLD located at Station 9A in Sunnyside served as the control, or background, TLD. The other 56 TLDs served as indicator TLDs.

The environmental dosimeter consists of a card containing $CaSO_4$:Dy (25%) phosphor in a Teflon matrix. Following oven annealing at 250°C for 2 hours, the 31.75 mm x 44.75 mm x 0.4 mm thick card was loaded into a plastic case (Teledyne Model EB-2) lined with 0.58 mm copper (520 mg/cm^2) to lessen the TLD's over-response to low energy photons.[11] The TLD was prepared for the field by first wrapping the case with aluminum foil, sealing it in two plastic bags and finally placing it in a cotton bag, which was hung from a metal post at each site. The TLDs were hung approximately three feet above the ground.

Two sets of TLDs were employed at each location. One set was exchanged on a quarterly basis and the other exchanged on an annual basis. Exposure of the field TLDs during transport to the TLD sites was monitored by a set of field control, or trip control, dosimeters that accompanied the field dosimeters to and from the field locations. Another set of TLDs was used as building control TLDs which were used to determine the exposure of the TLDs if they remained in the lead cave during the entire quarter. The TLD exposure during transport to and from the field was determined by subtracting the difference between the building control results and the trip control results.

The environmental dosimeters were processed on a Teledyne Isotopes Model 9100 Automatic Reader. Following the initial processing, the field dosimeters were annealed and given a calibration exposure of 100 mR of cesium-137 gamma, in order to determine response (i.e, calibration) factors for each dosimeter. The calibration factors were then used to determine the total exposure received by each TLD.

The exposure values determined for calibration exposures, as well as the exposures of the QA dosimeters (processing control dosimeters) and audit dosimeters (spiked dosimeters), were based on the calculated field strength of the encapsulated cesium-137 source. The calculated field strength of the source was determined from National Institute of Standards and Technology (NIST)-traceable ionization chamber measurements made over a period of several years during the routine use and calibration of the source. Ionization chamber measurements made during TLD calibration were used to confirm the calculated exposure. If the calculated exposure and the ionization chamber reading differed by 5% or more, an investigation was performed into the calibration exposure.

Three Reuter Stokes pressurized ionization chambers (PICs) provide an additional capability for measuring direct radiation exposure. These units are no longer part of the routine monitoring program, but they are used in special monitoring situations and maintained as back-up monitoring systems. Solar panels provide the power sources for the units in order to prevent equipment problems and damage caused by power surges and lightning.

4.3.2 Airborne Particulate/Iodine

Air particulate and air iodine (I-131) samples were obtained through the use of portable, low volume (1.5 cfm) constant flow-rate sampling units at each of twelve locations. The samples drawn at Station 9A (Figure 4-3) were considered control samples; the ones drawn at the other locations (Figure 4-7) were indicator samples. Air particulates were collected by drawing air through a 47mm-diameter glass fiber filter. Air iodine was collected by drawing air through a 57mm-diameter TEDA*-impregnated charcoal cartridge. The particulate air filter and charcoal cartridge were placed in tandem, particulate filter first, in a holder that attached to the air inlet of the sampler unit. The sampler units were placed in ventilated metal weatherproof housings mounted on elevated platforms at each air sample location.

The air sampler units were run continuously, with the filter and charcoal cartridge exchanged weekly for analysis. The total sample time for each filter and cartridge was recorded from the elapsed time indicator and the sample volume was calculated and recorded. The filters and cartridges were shipped or delivered to the analytical contractor within one or two days of collection.

4.3.3 Water

The water sampling network consisted of seven sampling locations: three for the evaluation of river/drinking water, one for the evaluation of discharge water and three for the evaluation of ground water. The locations of these sampling sites are shown in Figures 4-2 and 4-8. One river/drinking water location, Station 26, was used for evaluation of the plant intake water, i.e., the river water taken upstream of the plant discharge point. This Station 26 sample can be considered a drinking water sample since the site draws its drinking water from the intake water. It is considered the river/drinking water control sample because of its upstream location. Two additional locations, Stations 28 and 29, were used to evaluate the water at the two nearest drinking water locations, the Department of Energy 300 Area and the Richland Water Treatment Plant. These two stations were considered indicator stations.

The Technical Specification requirement for a downstream water sample "near but beyond the mixing zone" was met by sampling water from Station 27, the plant discharge line to the Columbia River. This sample reflects the radioactivity present in the plant discharge prior to any river dilution, rather than the concentrations that would be found after dilution in the mixing zone. Water is drawn at this location because it was not feasible to perform flow-proportional composite sampling in the mixing zone area of the river downstream from the plant discharge point. This Station 27 sample is also considered an indicator sample.

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*TEDA: Triethylene diamine

Collins Model 42 composite samplers are installed at the two drinking water locations (Stations 28 and 29) and the control location (Station 26) to periodically collect 25-ml aliquots of water at a regular time interval. These aliquots are added to large collection bottles. At the prescribed intervals, the sampler collects, alternately, an aliquot for the sample designated for gross beta and gamma isotopic analyses and an aliquot for the sample designated for tritium analysis. Two Collins Model 58-P6W composite samplers draw samples from the discharge line (Station 27). They operate in a flow-proportional mode through a complex system that adjusts the sampling frequency relative to the flow rate in the discharge line. Only one of the samplers operates at any given time, while the other sampler is maintained ready to use when needed.

Prior to the start of each monthly sampling period, concentrated nitric acid was added to the large collection bottles receiving the gross beta and gamma isotopic water samples to inhibit biological growth and plateout of dissolved ions on the bottle wall. Acid was not added to the collection bottles receiving the water samples for tritium analysis. One gallon of each of the gross beta samples was poured into a clean plastic cubitainer each month. A 250-ml cubitainer was used to hold the monthly sample submitted for the quarterly tritium composite.

Nonroutine analyses on the water samples include strontium-90 analysis, when the gross beta activity in the drinking water exceeds 8 pCi/liter or ten times the mean of the previous three months' activity for a specific location, and iodine-131 analysis, when the dose calculated for the consumption of water exceeds one mrem per year. Neither of these analyses were required during 1991.

The three groundwater stations are located on Supply System property: one well on the Plant 2 site (0.1 mile north of the Reactor Building) and two wells on the WNP-1 site (1.2 miles downgradient from Plant 2). These locations are shown in Figure 4-9. Water from the Plant 2 well can be used as a backup source for drinking and fire protection. Water from the WNP-1 wells supplies the drinking and fire protection water for the WNP-1 site. All three groundwater samples are considered indicator samples.

Quarterly grab samples were taken from each of these wells. One gallon was collected from each well for gamma analysis and 250 ml was drawn for tritium analysis. The gamma analysis samples were acidified with nitric acid. The tritium samples were left unacidified.

4.3.4 Soil

Soil samples were collected once during 1991, as required by the Site Certification Agreement. Samples were taken from the four indicator locations (Stations 1, 7, 21 and 23) shown in Figure 4-10. One sample was taken at the control location, Station 9A (Figure 4-3). Each sample was taken from an area of approximately one square foot and a depth of approximately one inch. Approximately two kilograms of soil were used in each sample. Soil samples were shipped to the analytical contractor within ten working days after collection and analyzed for gamma activity.

If the gamma isotopic analysis indicated that cesium levels in any of the indicator samples exceeded ten (10) times the level in the control sample, a strontium analysis was performed on the sample(s). During 1991, strontium analyses were required for the Station 1 and Station 23 soil samples.

4.3.5 Shoreline Sediment

Shoreline sediment samples were collected twice during 1991 from two sampling locations. The upstream sediment sample (Station 33) was collected from a location approximately two miles up the Columbia River from the plant discharge point. The downstream sample location (Station 34) was collected from a location approximately one mile downstream of the discharge point (Figure 4-11). Samples were scooped from under water near the river shoreline. Each sample consisted of approximately two kilograms of the shallow surface sediment. The samples were placed in clean plastic bags and shipped to the analytical contractor within a day or two of collection.

4.3.6 Fish

Fish sampling was performed during May and October, when the likelihood of obtaining anadromous** species was high. Fish samples collected from the Columbia River (Station 30 in Figure 4-1) were indicator samples, while the fish collected on the Snake River (Stations 38 and 38A in Figure 4-2) were control samples.

Four separate fish samples, consisting of an anadromous species and three other species generally considered edible or potentially edible (such as carp, catfish and whitefish), were collected at each location. Most of the fish were collected through the use of electro-shock, but samples of the anadromous species were also collected from the Lyons Ferry Fish Hatchery on the Snake River. The fish were filleted to obtain one kilogram of edible flesh per sample. The fillets were placed in clean plastic bags and frozen until shipment to the analytical contractor. Fish samples were shipped within 14 days of collection.

4.3.7 Milk

Milk samples were collected monthly during January, February, March, October, November and December and semimonthly during the remaining six months when the cows were likely to be grazing. One gallon of raw milk was collected from each sampling location. The milk samples were chilled thoroughly and shipped to the analytical contractor within a day of collection.

Routine samples were collected from five indicator locations (Stations 36, 40, 59, 62 and 64) across the Columbia River in Franklin County, as shown in Figure 4-12. Milk samples were taken from Stations 59 and 64 during only a part of 1991. Station 59 discontinued milk production in August, so Station 64, the Van Batavia farm, (9.7 miles ESE), was added. Addition of this sample was necessary to meet Technical Specification requirements for three milk sampling locations within 5 kilometers (9.9 miles) from the plant.

**Fish, such as salmonids, which ascend rivers from the sea for breeding.

Samples were also collected at one indicator station (Station 9B) and one control location (Station 96) in the Sunnyside/Grandview area (in Figure 3-3). Station 9B in Grandview continued to serve as an indicator station in 1991 because a portion of the feed for the cows at that location is hay from the north Pasco area of Franklin County. That factor makes it unsuitable for use as a control location.

4.3.8 Garden Produce

Samples of local garden produce were collected monthly from April to September, when the produce was readily available. When possible, three types of produce samples--a root crop, fruit and a leafy vegetable--were collected at each location. The indicator samples were collected from a region in a predominant downwind direction (Station 37 in Figure 4-2) where crops are irrigated with Columbia River water. The control samples were obtained from produce stands in the Sunnyside area (Station 9C in Figure 4-3), the direction least likely to be affected by plant effluents. In addition, apples were collected in August from Station 91, the Rio Vista Farms orchard, which is irrigated with Columbia River water and cherries were collected in June from Station 61, the Haymaker farm. These produce samples were shipped to the analytical contractor within one to two days of collection.

4.4 Analytical Procedures

The analytical procedures used for the 1991 REMP samples are described below. Teledyne Isotopes performed all analyses of REMP samples during 1991.

4.4.1 Gross Beta Activity on Particulate Filters

The particulate filters were counted in a gas-flow proportional counter after a delay of five or more days to allow for the radon-222 and radon-220 (thoron) daughter products to decay. An unused air particulate filter was counted as the blank with each weekly set of filters.

4.4.2 Measurement of Gamma Emitters

Milk and Water

A 1-liter Marinelli beaker was filled with a representative aliquot of the sample. The sample was then counted for at least 1000 minutes (16.7 hours) with a shielded Ge(Li) detector.

Foodstuff

As much of the edible portion of the sample as possible was loaded into a tared Marinelli beaker and weighed. The sample was then counted for at least 1000 minutes (16.7 hours) with a shielded Ge(Li) detector.

Soils and Sediments

A large quantity of the sample was dried at a temperature below 100°C. As much sample as possible was loaded into a tared 1-liter Marinelli beaker and weighed. The sample was then counted for at least 360 minutes (6 hours) with a shielded Ge(Li) detector.

Charcoal Cartridges (Air Iodine)
Charcoal filters were counted up to five at a time, with one positioned on the face of a Ge(Li) detector and up to four on the side of the Ge(Li) detector. Each Ge(Li) detector was calibrated for both positions. The detection limit for iodine-131 on each charcoal cartridge was determined (assuming no positive iodine-131) uniquely from the volume of air which passed through it. In the event that iodine-131 would have been observed in the initial counting of a set, each charcoal cartridge in the set was then positioned separately on the face of the detector and counted.

Air Particulate Filters
Four air particulate filters for a quarterly composite for each field station were aligned one in front of another and then counted for at least 360 minutes (6 hours) with a shielded Ge(Li) detector.

The shielded Ge(Li) detector was coupled to a mini-computer-based data acquisition system which performed pulse height analysis. A mini-computer software program defined peaks by certain changes in the slope of the spectrum. The program also compared the energy of each peak with a library of peaks for isotope identification and then performed the radioactivity calculation using the appropriate fractional gamma ray abundance, half-life, detector efficiency, and net counts in the peak region.

4.4.3 Gross Beta Activity in Water

One liter of each sample was evaporated to a small volume and transferred to a stainless steel planchet. The sample was dried under heat lamps, cooled, then counted on an automatic beta proportional counter. The results were calculated using empirical self-absorption curves which enabled the correction of effective counting efficiency, based on the sample residue mass.

4.4.4 Iodine-131 in Water

Two liters of sample were first equilibrated with stable iodide carrier. A batch treatment with anion exchange resin was used to remove iodine from the sample. The iodine was then stripped from the resin with sodium hypo-chlorite solution, reduced with hydroxylamine hydrochloride and extracted into carbon tetrachloride as free iodine. It was then back-extracted as iodide into sodium bisulfite solution and precipitated as palladium iodide. The precipitate was weighed for chemical yield and mounted on a nylon planchet for low level beta counting. The chemical yield was corrected by measuring the stable iodide content of the water with a specific ion electrode. During 1991, this procedure was used only on intercomparison samples, since the doses calculated via ODCM methodology for the consumption of drinking water did not exceed 1 mrem per year (Table 4-1, footnote n).

4.4.5 Tritium in Water

Approximately two milliliters of water were converted to hydrogen by passing the water, heated to its vapor state, over a granular zinc conversion column heated to 400°C. The hydrogen was loaded into a one-liter proportional detector and the volume was determined by recording the pressure. The proportional detector was passively shielded by lead and steel and an electronic, anti-coincidence system provided additional shielding from cosmic rays.

4.4.6 Strontium-89 and 90 in Water, Milk and Soil

During 1991, strontium analyses were not required for any routine REMP water or milk samples. Strontium analysis was required for two routine soil samples (Station 1 and Station 23) which had cesium-137 levels ten times greater than those measured for Station 9A, the control location. The techniques used to analyze for strontium in the various media are described below.

Water

Stable strontium carrier was added to one liter of sample and the volume was reduced by evaporation. Strontium was precipitated as $Sr(NO_3)_2$ using fuming (90%) nitric acid.

Milk

Stable strontium carrier was added to one liter of sample. The sample was then evaporated and ashed in a muffle furnace. The ash was dissolved and strontium was precipitated as a phosphate. It was then redissolved and strontium was precipitated as $Sr(NO_3)_2$ using fuming (90%) nitric acid.

Soil and Sediment

The sample was first dried under heat lamps and a 10-gram aliquot was taken. Stable strontium carrier was added and the sample was leached in hydrochloric acid. The mixture was filtered. Phosphates were then precipitated, collected by filtration and dissolved in nitric acid. Strontium was precipitated as $Sr(NO_3)_2$ using fuming (90%) nitric acid. A barium chromate scavenge and an iron (ferric hydroxide) scavenge were then performed. Stable yttrium carrier was added and the sample was allowed to stand for 5 days or more for yttrium ingrowth. Yttrium was then precipitated as hydroxide, dissolved and reprecipitated as oxalate. The yttrium oxalate was mounted on a nylon planchet and counted in a low-level beta counter to infer strontium-90 activity. Strontium-89 activity was determined by precipitating $SrCO_3$ from the sample after yttrium separation. This precipitate was mounted on a nylon planchet and covered with an 80 mg/cm^2 aluminum absorber for low-level beta counting.

4.4.7 Iodine-131 in Milk

Two liters of sample were first equilibrated with stable iodide carrier. A batch treatment with anion exchange resin was used to remove iodine from the sample. The iodine was then stripped from the resin with sodium hypochlorite solution, reduced with hydroxylamine hydrochloride and extracted into carbon tetrachloride as free iodine. It was then back-extracted as iodide into sodium bisulfite solution and precipitated as palladium iodide. The precipitate was weighed for chemical yield and mounted on a nylon planchet for low-level beta counting. The chemical yield was corrected by measuring the stable iodide content of the milk with a specific ion electrode.

4.5 Data Analysis Methods

Since mid-1984, the results of the REMP analyses have been given as net results calculated from the gross or total counts determined for each radionuclide minus the background counts of the counting or detection instrument. Consequently, for several sample types, the results range from negative to positive numbers. This manner of presenting environmental data prevents the bias

and loss of individual results inherent in the use of "less than" (<) values, where the "less than" numbers can have a variety of meanings, such as "less than the lower limit of detection (LLD)" or "less than the two sigma uncertainty."

The net results for REMP samples are presented with an asterisk (*) in front, if the results are less than the LLD. A listing of the LLDs determined for each analysis is provided in Section 5.0 as a reference when reviewing the sample results.

Plots of the sample results versus time are used to represent the results for analyses such as gross beta on air particulate filters, where the results are normally above the lower limits of detection. In such cases, the indicator station results are plotted with the control station results for easy comparison. Other data analysis techniques, such as cumulative probability plotting and control charting, are also used to represent the data and to determine whether trends that could be attributed to Plant 2 operations are evident.

Thermoluminescent dosimeter (TLD) data is presented in terms of the net mR/day exposure rate. These results are determined from the total mR exposure calculated for each TLD from its total thermoluminescent output minus the TLD background, minus any transit (or trip) exposure received during distribution and retrieval, and divided by the number of days the TLD was in the field. Cumulative probability plots and graphs of TLD data by meteorological sector and distance from the plant are used to interpret trends in the results.

TLD data summaries include the term "standard error," along with "standard deviation." The standard error, which is the estimate of the precision of the mean, is used for mean annual summaries of mean quarterly data. The standard deviation is used for the TLD data involving a single dosimeter result that has been determined from the four reader areas of the TLD. Both terms simply provide an indicator of the uncertainty associated with the results.

TABLE 4-1

REMP SAMPLE LOCATIONS BY SECTOR

SAMPLE TYPE[a]	SAMPLE STATION [b] NUMBER	SAMPLING AND COLLECTION FREQUENCY[c]	TYPE AND FREQUENCY OF ANALYSIS
1. AIRBORNE			
Particulates and radioiodine (6/12)	1, 4-9A, 21, 23, 40, 48, and 57	Continuous sampling; weekly collection	Particulate: Weekly gross beta[d]; gamma isotopic[e] of quarterly composite (by location) Iodine: Weekly gamma analysis.
Soil[f](0/5)	9A, 1,7,21 and 23	Annually	Gamma isotopic[e]; strontium-90[g]
2. DIRECT RADIATION			
TLD[h](34/57)	1-9A, 10-25, 40-47, 49-51, 53-56, 61, 71-86 (1S-16S)[i]	Quarterly, annually	Thermoluminescent output; quarterly and annual processing.
PIC (0/3)	(j)	Continuous recording, as needed	Exposure rate accumulated on mag card and in internal memory
3. WATERBORNE			
Surface/Drinking Water[k] (3/4)	26, 27, 28 and 29	Composite aliquots[l]; monthly collection	Gamma isotopic[e], gross beta, quarterly; tritium composite; strontium-90[m]: iodine-131[n]
Ground Water (2/3)	31, 32, and 52	Quarterly	Gamma isotopic[e]; quarterly tritium grab sample
Sediment from shoreline (1/2)	33 and 34	Semiannually	Gamma isotopic[e]

TABLE 4-1 (Cont.)

REMP SAMPLE LOCATIONS BY SECTOR

SAMPLE TYPE[a]	SAMPLE STATION[b] NUMBER	SAMPLING AND COLLECTION FREQUENCY[c]	TYPE AND FREQUENCY OF ANALYSIS
4. INGESTION			
Milk[o] (4/6)	9B, 36, 40, 59, 62, 64 and 96[p]	Semimonthly during grazing season, monthly at other times	Gamma isotopic[e]; iodine-131; strontium-90[q]
Fish[r] (2/2)	30 and 38	Semiannually	Gamma isotopic[e]
Garden Produce[s](1/3)	9C, 61[t], 91[t] and 37	Monthly during growing season in the Riverview area of Pasco and a control near Grandview; annual collection at Station 91.	Gamma isotopic[e]

(a) The fraction in parentheses for each sample type indicates the ratio of Technical Specification-required sample locations to the total number of sample locations currently being monitored in the surveillance program.

(b) The underlined sample location designates a control station.

(c) Deviations are permitted if samples are unobtainable due to hazardous conditions, seasonal availability, malfunction of automatic sampling equipment, or other legitimate reasons. Such deviations are documented in Appendix D.

(d) Particulate sample filters will be analyzed for gross beta after at least 24 to 48 hours to allow for the decay of radon daughter products. If gross beta activity is greater than 10 times the mean of the result for the control, Station 9A, gamma isotopic analysis shall be performed on the individual sample.

TABLE 4-1 (Cont.)

(e) Gamma isotopic means identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents of Plant 2.

(f) Soil samples are collected to satisfy the requirements of the Site Certification Agreement (SCA)[10] for Plant 2.

(g) Strontium-90 analysis shall be performed on any indicator soil sample having cesium results greater than ten times the results for the control location.

(h) TLD refers to thermoluminescent dosimeter. For purposes of the REMP, a TLD is a phosphor card (31.75mm x 44.75mm x 0.4mm) with eight individual read-out areas (four main dosimeter areas and four back-up dosimeter areas) in each badge case. TLDs used in the REMP meet the requirements of Regulator Guide 4.13[5] and ANSI N545-1975[6], except for specified energy-dependence response. Correlation factors are available for energy ranges with response outside of specified tolerances.

(i) TLD Stations 71-86 are special interest stations and are not included among the 34 routine TLD stations required by the Plant Technical Specification Table 3.12-1. Their alternate designations are 1S-16S. Station 61 is also a special interest location. It was added to the program during the third quarter of 1989.

(j) Pressurized ion chambers (PICs) are no longer required as part of the routine monitoring program. They are used only for special monitoring situations, but are maintained as a supplemental or backup system. PICs are used at various locations, depending on the need.

(k) The term "river/drinking water," instead of "surface/drinking water", is used throughout this report because the surface water is taken from the Columbia River. Station 26, Plant 2 makeup water intake from the Columbia River is both an upstream surface, or river, water sample and the drinking water control sample location. Station 28 (300 Area) and Station 29 samples are drinking water samples. The Station 27 sample, which is drawn from the plant discharge line, is taken in place of a "downstream" water sample near but beyond the mixing zone. It reflects the radioactivity present in the plant discharge prior to any river dilution.

(l) Composite (integrated grab) samples are collected with equipment which collects an aliquot at time intervals that are short relative to the compositing period.

(m) When the gross beta activity in drinking water exceeds 8 pCi/liter, a strontium-90 analysis is performed.

TABLE 4-1 (Cont.)

(n) When the dose calculated via ODCM methodology for consumption of water exceeds 1 mrem per year, iodine-131 analyses are performed on the drinking water samples.

(o) Milk samples will be obtained from farms or individual milk animals which are located in the most prevalent wind directions from Plant 2. Routine milk samples are collected in areas of high dose potential instead of within 5 kilometers, due to the locations of milk animals.

(p) Station 96 is the control station for milk samples because it was determined that the cows at Station 9B in Sunnyside were given feed grown in the Franklin County area across the Columbia River from Plant 2. Station 64, at 9.7 miles ESE of the plant, was added during 1991 due to the unavailability of milk from Station 59 for part of the year.

(q) If cesium-134 or cesium-137 is measured in an individual milk sample in excess of 30 pCi/1, then the strontium-90 analysis will be performed.

(r) There are no commercially important species in the Hanford Reach of the Columbia River. Most recreationally important species in the area are anadromous (primarily salmonids), which ascend rivers from the sea for breeding. Four fish specimen will normally be collected by electroshock technique in the vicinity of the plant discharge (Station 30) and from the Snake River (Station 38). If electroshocking produces insufficient anadromous fish samples from the Snake River, samples may be obtained from the fish trap at Ice Harbor Dam, Lyons Ferry Fish Hatchery, or other similar facility (Station 38A). If insufficient anadromous fish samples are produced through electroshocking on the Columbia River, samples may be obtained at the Ringold Fish Hatchery (Station 39).

(s) Garden produce will routinely be obtained from farms or gardens using Columbia River water for irrigation. One sample of a root crop, leafy vegetable, and a fruit is collected each sample period, if available. The variety of the produce obtained will be dependent on seasonal availability.

(t) Station 61 is the Haymaker farm, which has a large cherry orchard. A cherry sample is collected in June each year. Station 91 is an apple orchard irrigated by the Columbia River. The apple crop from Station 91 is sampled annually.

TABLE 4-2

REMP SAMPLE LOCATIONS BY SECTOR

SECTOR[a]	STATION[b] NUMBER	ESTIMATED MILES	DISTANCE[c] METERS	SAMPLE TYPE[d]
N (1)	52	0.1	161	GW
	71(1S)	0.3	483	TLD
	47	0.5	805	TLD
	57	0.8	1201	AP/AI
	18	1.1	1770	TLD
	53	7.5	12068	TLD
NNE (2)	72(2S)[e]	0.4	644	TLD
	2	1.8	2896	TLD
	54	6.5	10459	TLD
NE (3)	73(3S)	0.5	805	TLD
	19	1.8	2896	TLD
	48	4.5	7241	AP/AI
	39	4.4	7084	FI
	46	5.0	8045	TLD
ENE (4)	74(4s)	0.4	644	TLD
	21	1.5	2414	AP/AI/SO/TLD
	20	1.9	3057	TLD
	11	3.1	4988	TLD
	33	3.6	5792	SE
	45	4.3	6919	TLD
	44	5.8	9332	TLD

TABLE 4-2 (Cont.)

REMP SAMPLE LOCATIONS BY SECTOR

SECTOR[a]		STATION[b] NUMBER	ESTIMATED MILES	DISTANCE[c] METERS	SAMPLE TYPE[d]
E	(5)	75(5S)	0.4	644	TLD
		22	2.1	3379	TLD
		10	3.1	4988	TLD
		26	3.2	5149	PW
		27[e]	3.2	5149	DW
		30	3.3	5311	FI
		43	5.8	9332	TLD
ESE	(6)	76(6S)	0.4	644	TLD
		31	1.1	1770	GW
		32	1.2	1931	GW
		51	2.1	3379	TLD
		23	3.0	4827	AP/AI/TLD
		34	3.5	5632	SE
		8	4.5	7241	AP/AI/TLD
		42	5.6	9010	TLD
		36[e]	7.2	11585	MI
		5	7.7	12389	AP/AI/TLD
		38	26.5	42639	FI
		91	4.4	7079	FR
		64	9.7	15610	MI
SE	(7)	77(7S)	0.5	805	TLD
		24	1.9	3057	TLD
		3	2.0	3218	TLD

TABLE 4-2 (Cont.)

REMP SAMPLE LOCATIONS BY SECTOR

SECTOR[a]	STATION[b] NUMBER	ESTIMATED MILES	DISTANCE[c] METERS	SAMPLE TYPE[d]
SE (7)	41	5.8	9332	TLD
Cont.	40	6.4	10298	AP/AI/MI/TLD
	59	9.6	15443	MI
	61	6.5	10456	TLD
	62	10.9	16730	MI
SSE (8)	78(8S)	0.7	1126	TLD
	25	1.6	2574	TLD
	55	7.0	11263	TLD
	28	7.4	11907	PW
	4	9.3	14964	AI/AP/TLD
	29	11.0	17699	PW
	37[e]	16.0	25744	GP
S (9)	79(9S)	0.7	1126	TLD
	1	1.3	2092	AP/AI/SO/TLD
	6	7.7	12389	AP/AI/TLD
SSW (10)	80(10S)	0.8	1287	TLD
	50	1.2	1931	TLD
	56	7.0	11263	TLD
SW (11)	81(11S)	0.7	1126	TLD
	13	1.4	2253	TLD
	96	36.0	49250	MI

TABLE 4-2 (Cont.)

REMP SAMPLE LOCATIONS BY SECTOR

SECTOR[a]	STATION[b] NUMBER	ESTIMATED MILES	DISTANCE[c] METERS	SAMPLE TYPE[d]
WSW (12)	82(12S)	0.5	805	TLD
	14	1.4	2253	TLD
	9A, 9B, 9C[e]	30.0	48270	AP/AI/MI/GP/ TLD/SO
W (13)	83(13S)	0.5	805	TLD
	15	1.4	2253	TLD
WNW (14)	84(14S)	0.5	805	TLD
	16	1.4	2253	TLD
	7	2.7	4344	AP/AI/SO/TLD
NW (15)	85(15S)	0.5	805	TLD
	49	1.2	1931	TLD
NNW (16)	86(16S)	0.4	644	TLD
	17	1.2	1931	TLD
	12	3.1	9815	TLD

(a) The area in the vicinity of Plant 2 is separated into 16 separate sectors for reporting purposes. The 16 sectors cover 360 degrees in equal 22.5 degree sections, beginning with Sector 1 (N) at 348.75 to 11.25 degrees and continuing clockwise through Sector 16 (NNW).

(b) The alternate designations for TLD Stations 71-86 are given in parentheses, i.e., 1S-16S.

(c) Distances are estimated from map positions for each location as a radial distance from Plant 2 containment.

TABLE 4-2 (Cont.)

(d) Sample Type Key:

TLD	Thermoluminescent Dosimeter	MI	Milk
AP	Air Particulate	PW	Surface (River)/ Drinking Water
AI	Air Iodine	GW	Ground Water
SE	Sediment	DW	Discharge Water
FI	Fish	GP	Garden Produce
SO	Soil	FR	Fruit

Station 9 designates the Sunnyside-Grandview control area. It is actually three separate stations (Stations 9A for TLD, AI/AP and SO, 9B for milk, and 9C for GP) within a few miles of each other and all within 30-35 miles of Plant 2. Station 96, which is the control station for milk, is also located within the control area. It is 36 miles from Plant 2. Station 9B, which was the control location for milk until 1986, is now an indicator milk location.

(e) Duplicate samples, i.e., samples drawn at the same time as the routine samples and submitted for analysis as a quality assurance check, are collected at this location. The station designation for the duplicate of Station 27 is Station 72. The station designation for the duplicate of Station 36 is Station 37.

TABLE 4-3

DISTANCES[a] IN MILES TO NEAREST POINTS OF INTEREST WITHIN FIVE MILES OF PLANT 2 CONTAINMENT

SECTOR[b] PARAMETER	NEAREST RESIDENT	GARDEN (>50M^2)	DAIRY[c] ANIMALS	LIVESTOCK
NE	4.3	0	0	0
ENE	4.1	4.1[d]	0	4.7
E	4.5	4.9[d]	0	0
ESE	4.1	0	0	0

(a) These are estimated distances; slight variations occur when the map used for the land use census is changed.

(b) Eleven of the sixteen meteorological sectors within the five-mile radius of Plant 2 are on the federally-owned Hanford Site; the remaining land is comprised of 4.48 sq. miles of privately-owned farm land. Only those sectors containing points of interest are presented here.

(c) The closest dairy animal locations are at 6.4, 8.3, 9.6 (discontinued in August) and 10.9 miles SE and 7.2 and 9.7 miles ESE. The dairy at 8.3 miles SE is not used for milk sample collection due to the owner's reluctance to participate in the sampling program.

(d) Small garden with broadleaf; samples were not available due to the small amounts grown.

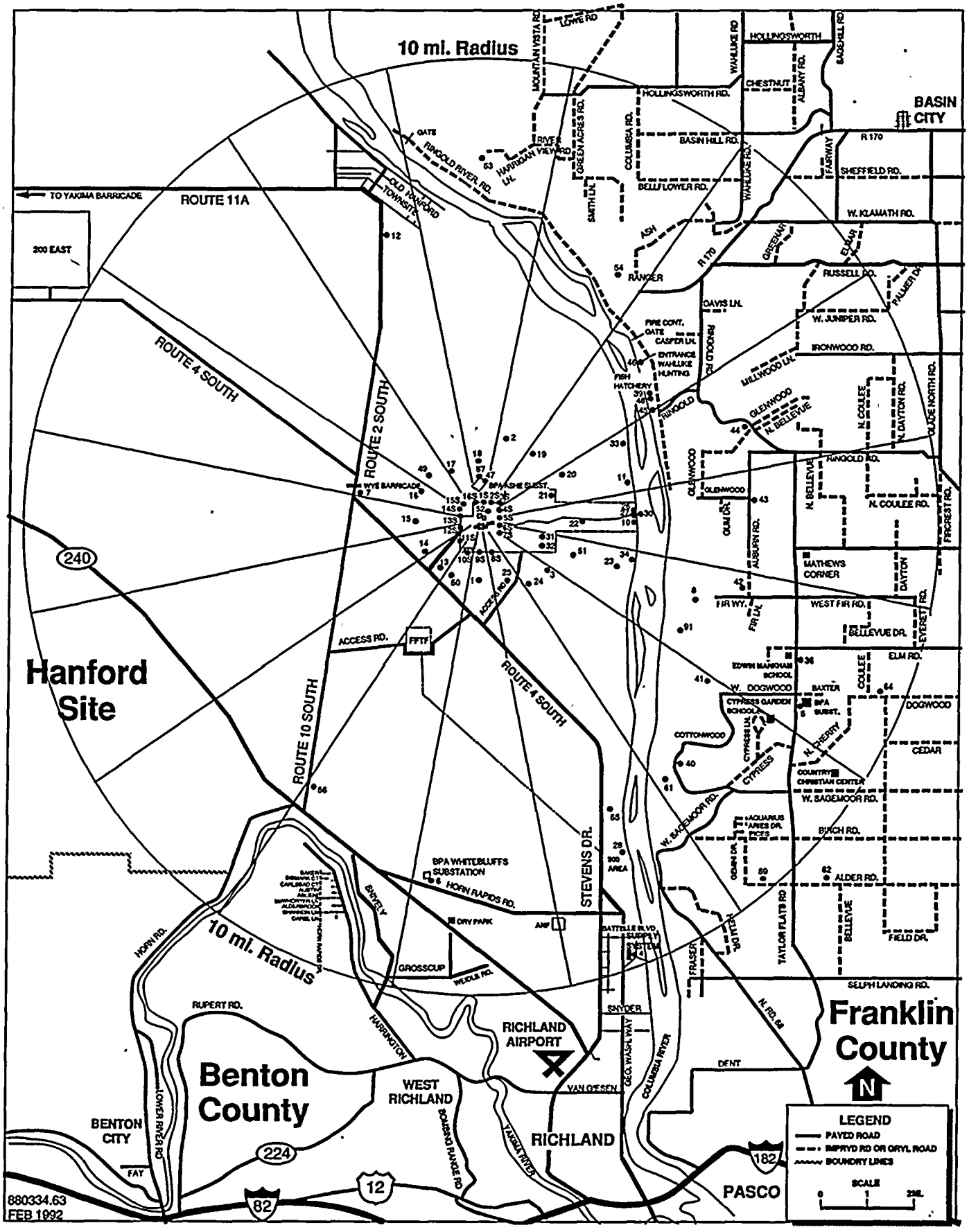
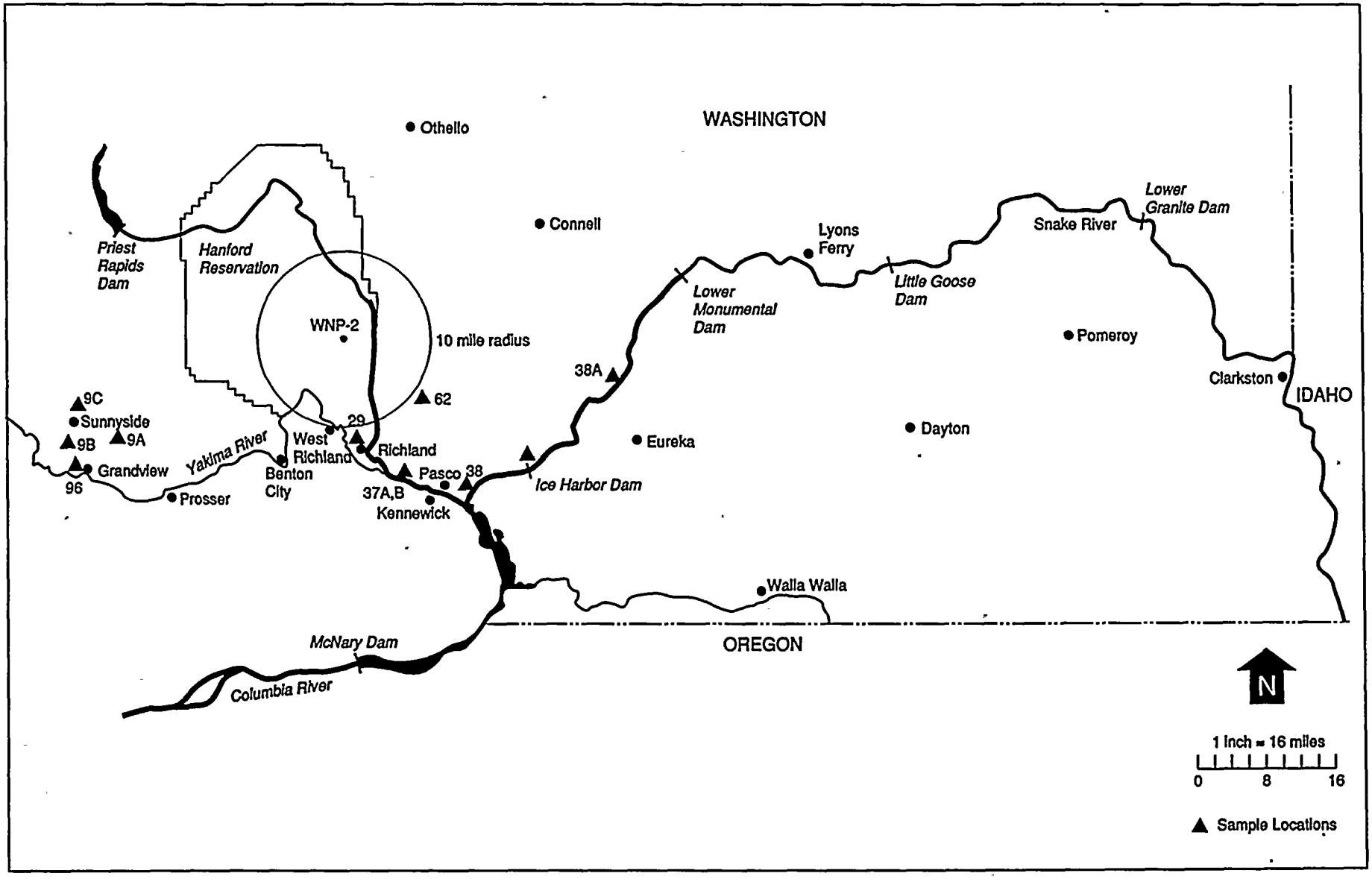
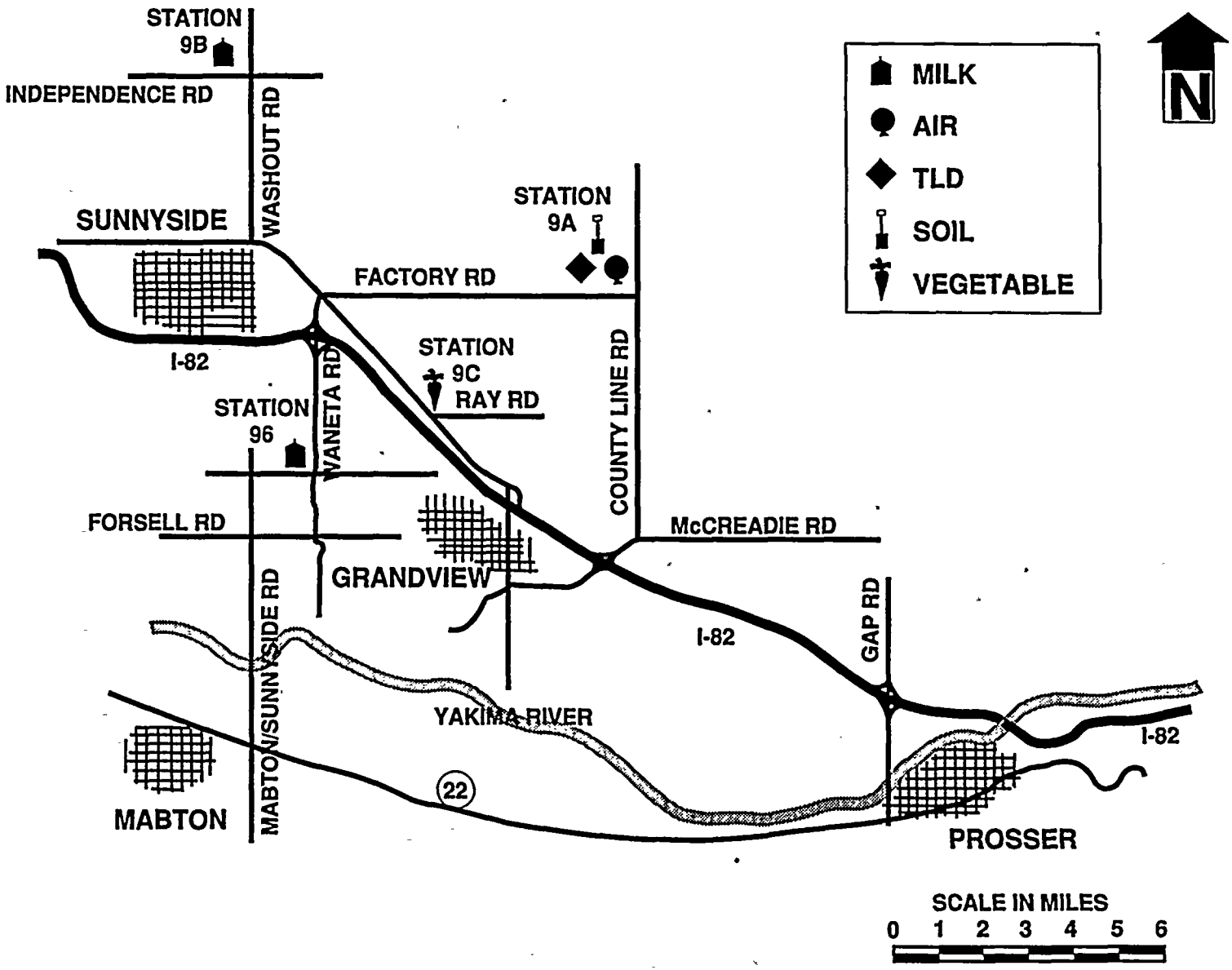


FIGURE 4-1
REMP SAMPLING LOCATIONS WITHIN THE 10-MILE RADIUS



900286A1
Jan 1992

FIGURE 4-2
REMP SAMPLING LOCATIONS OUTSIDE THE 10-MILE RADIUS



880138M

FIGURE 4-3
REMP SAMPLING LOCATIONS SUNNYSIDE/GRANDVIEW AREA

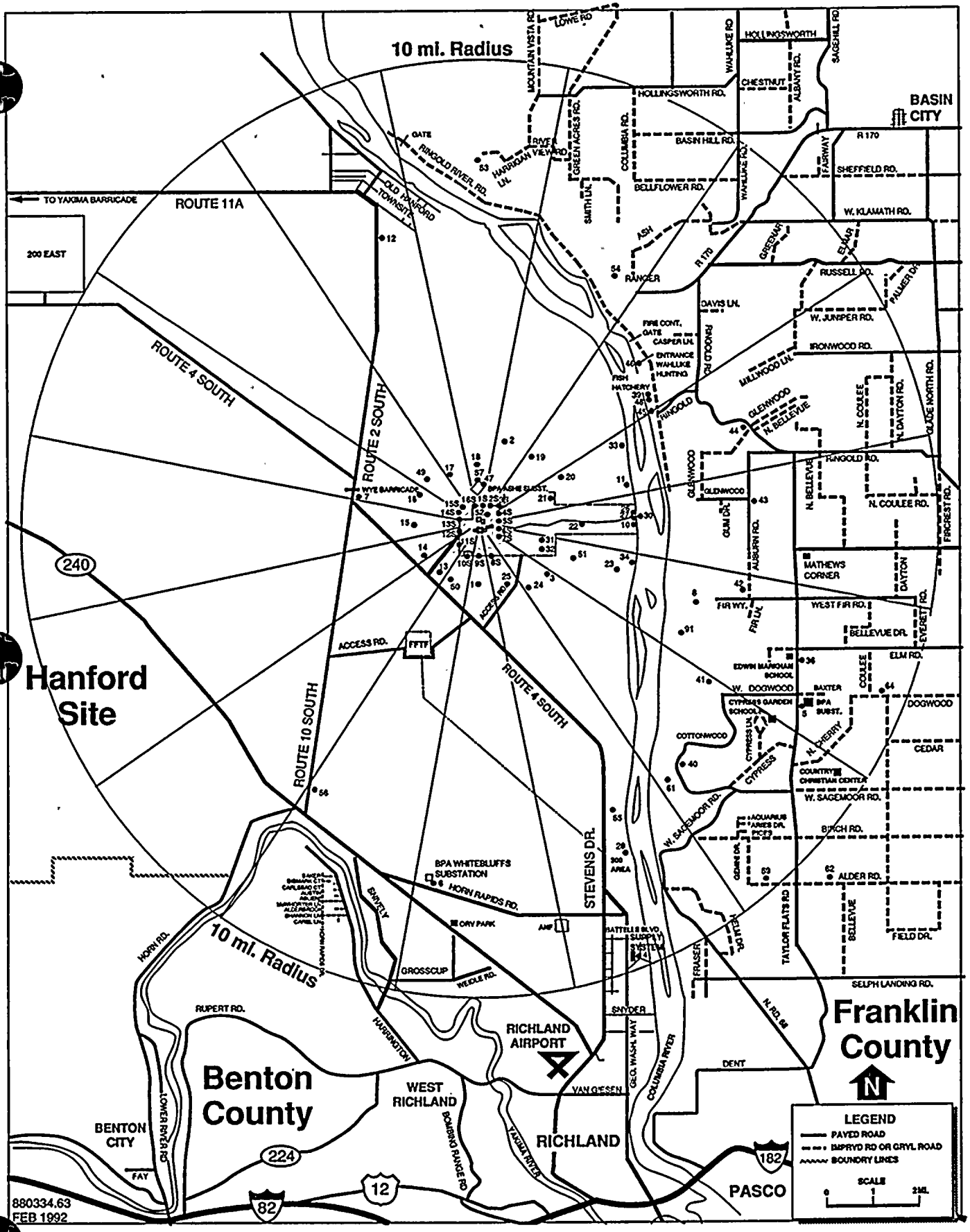


FIGURE 4-4
INNER CIRCLE TLD LOCATIONS

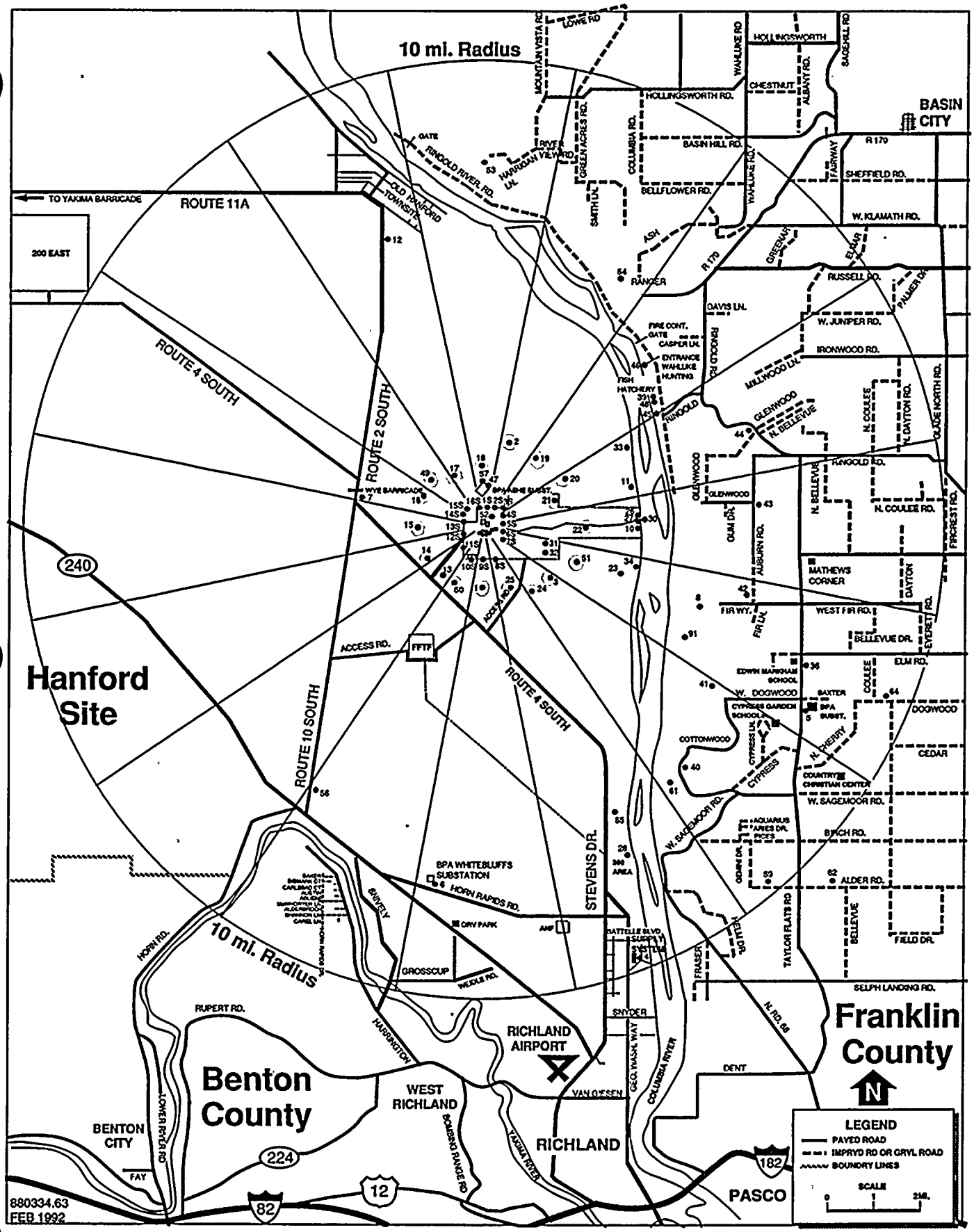


FIGURE 4-5
NEAR-PLANT TLD LOCATIONS

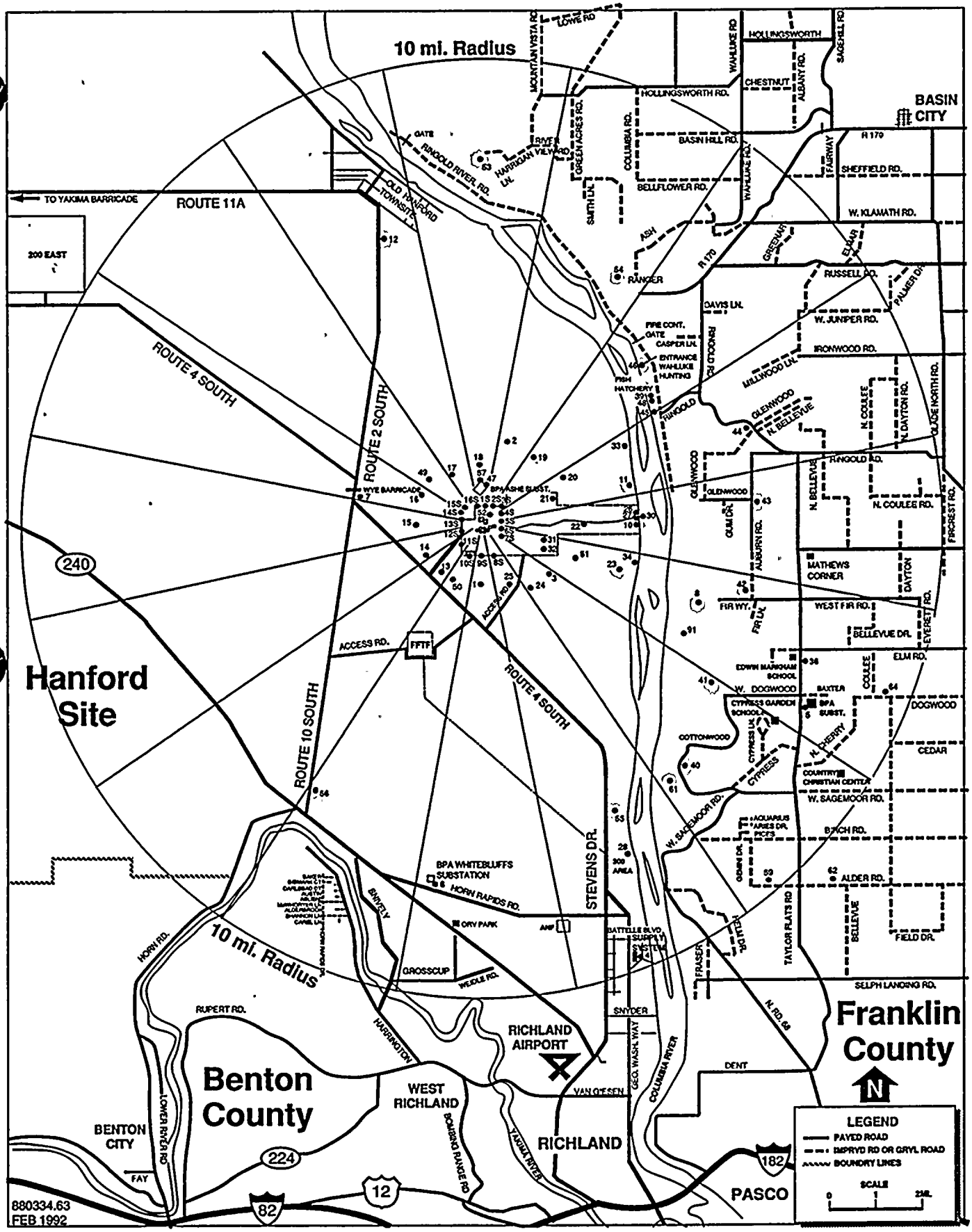


FIGURE 4-6
OUTLYING TLD LOCATIONS WITHIN THE 10-MILE RADIUS

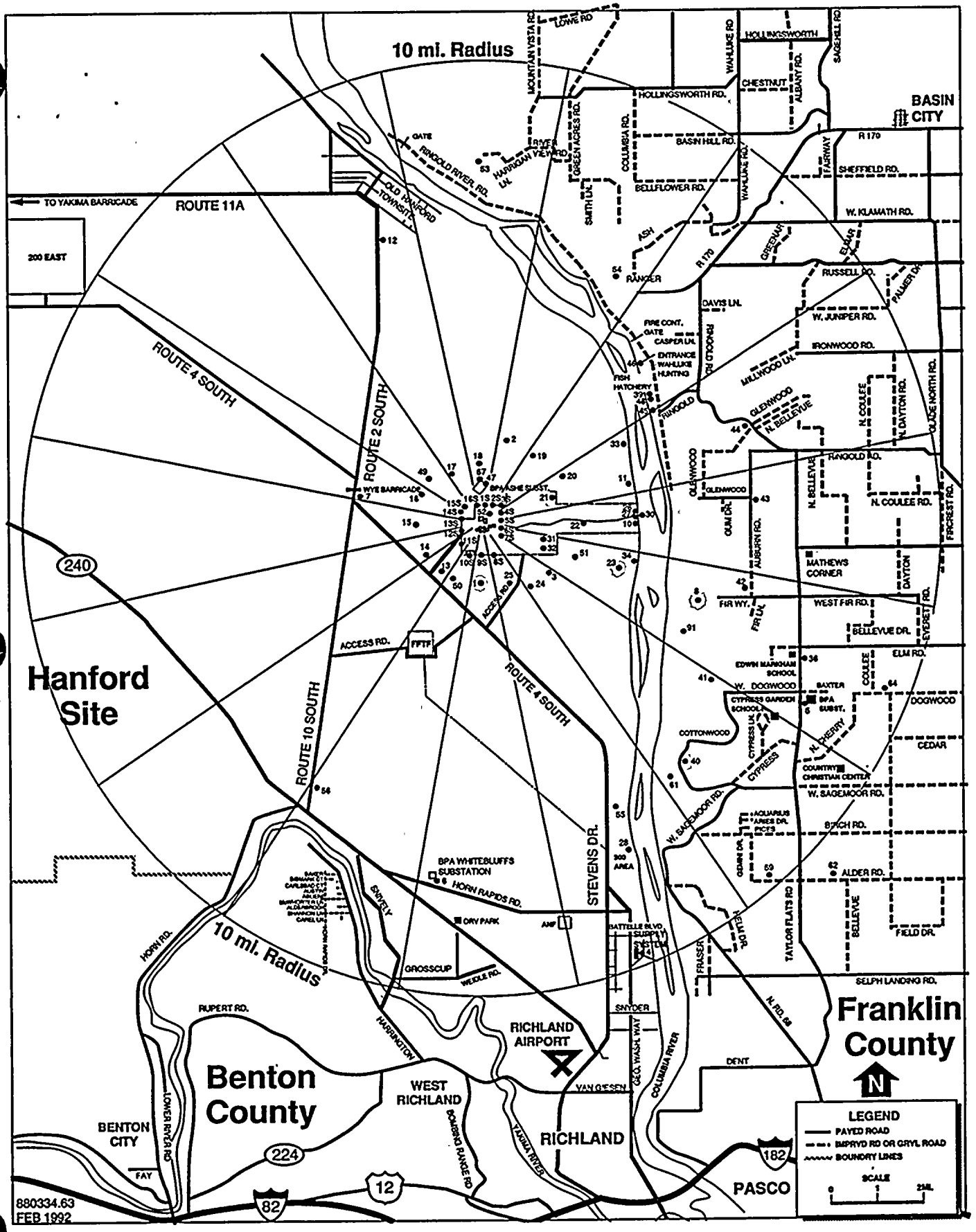


FIGURE 4-7
AIR SAMPLING LOCATIONS WITHIN THE 10-MILE RADIUS

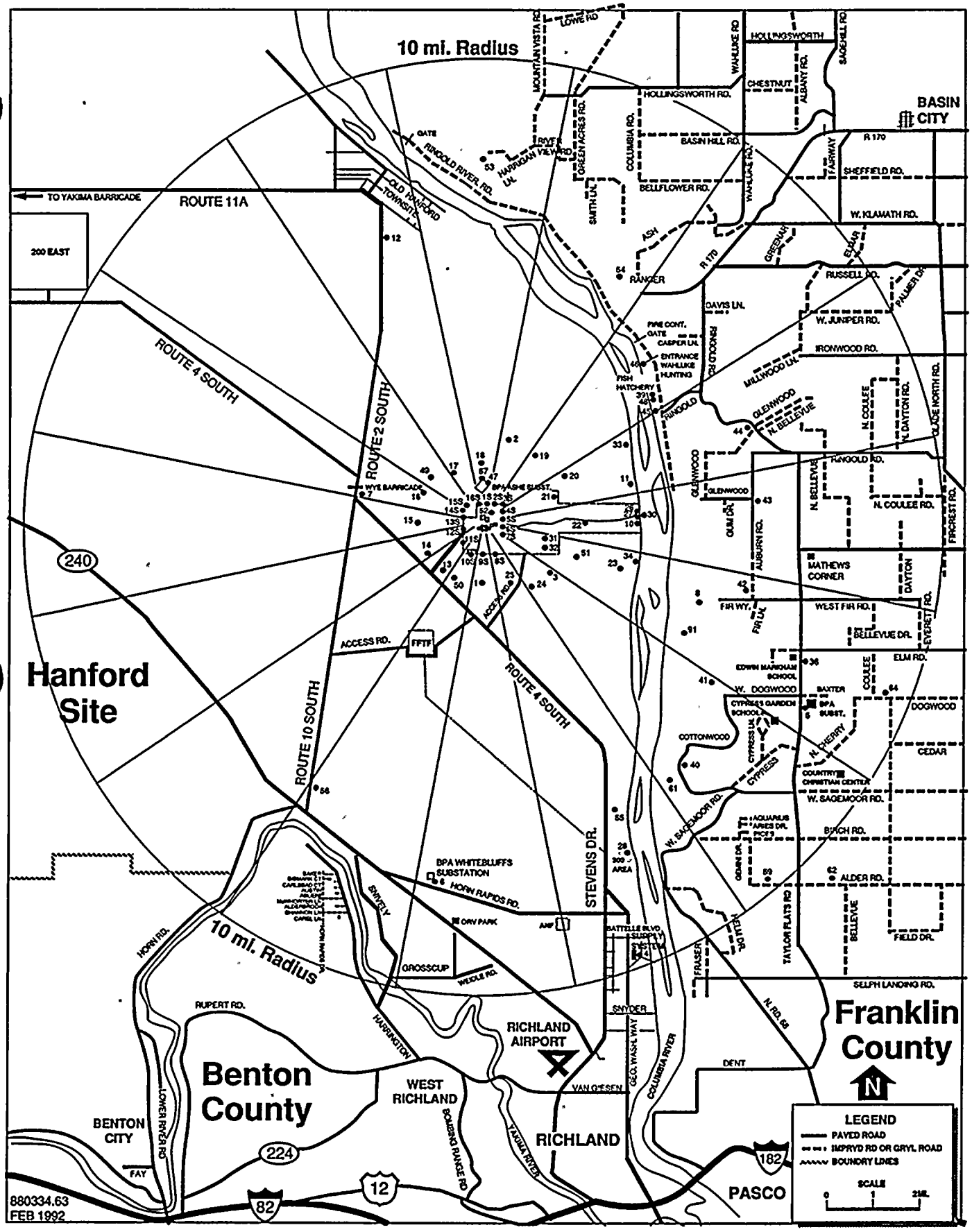


FIGURE 4-8
RIVER/DRINKING AND DISCHARGE WATER SAMPLING LOCATIONS
WITHIN THE 10-MILE RADIUS

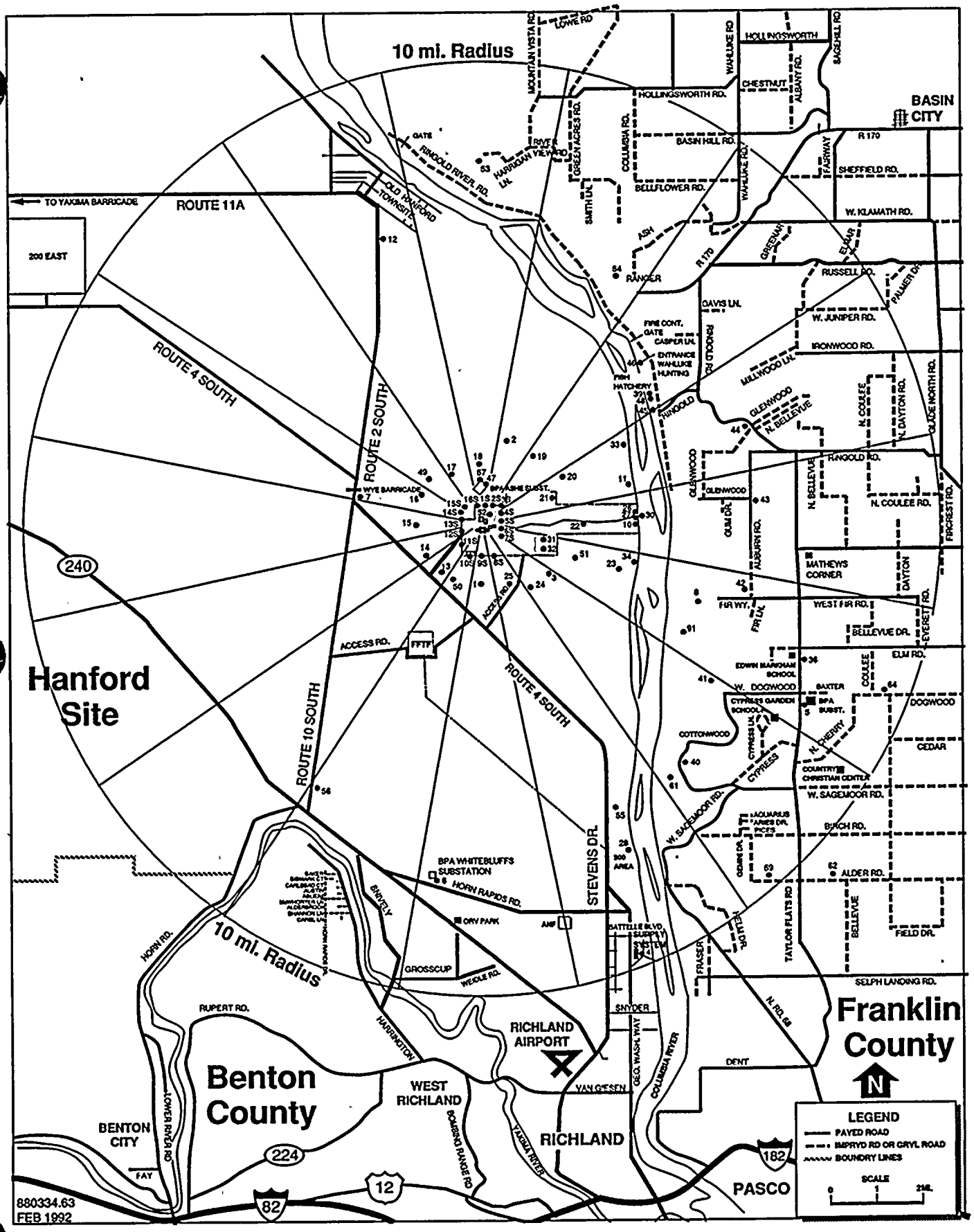


FIGURE 4-9
GROUNDWATER SAMPLING LOCATIONS

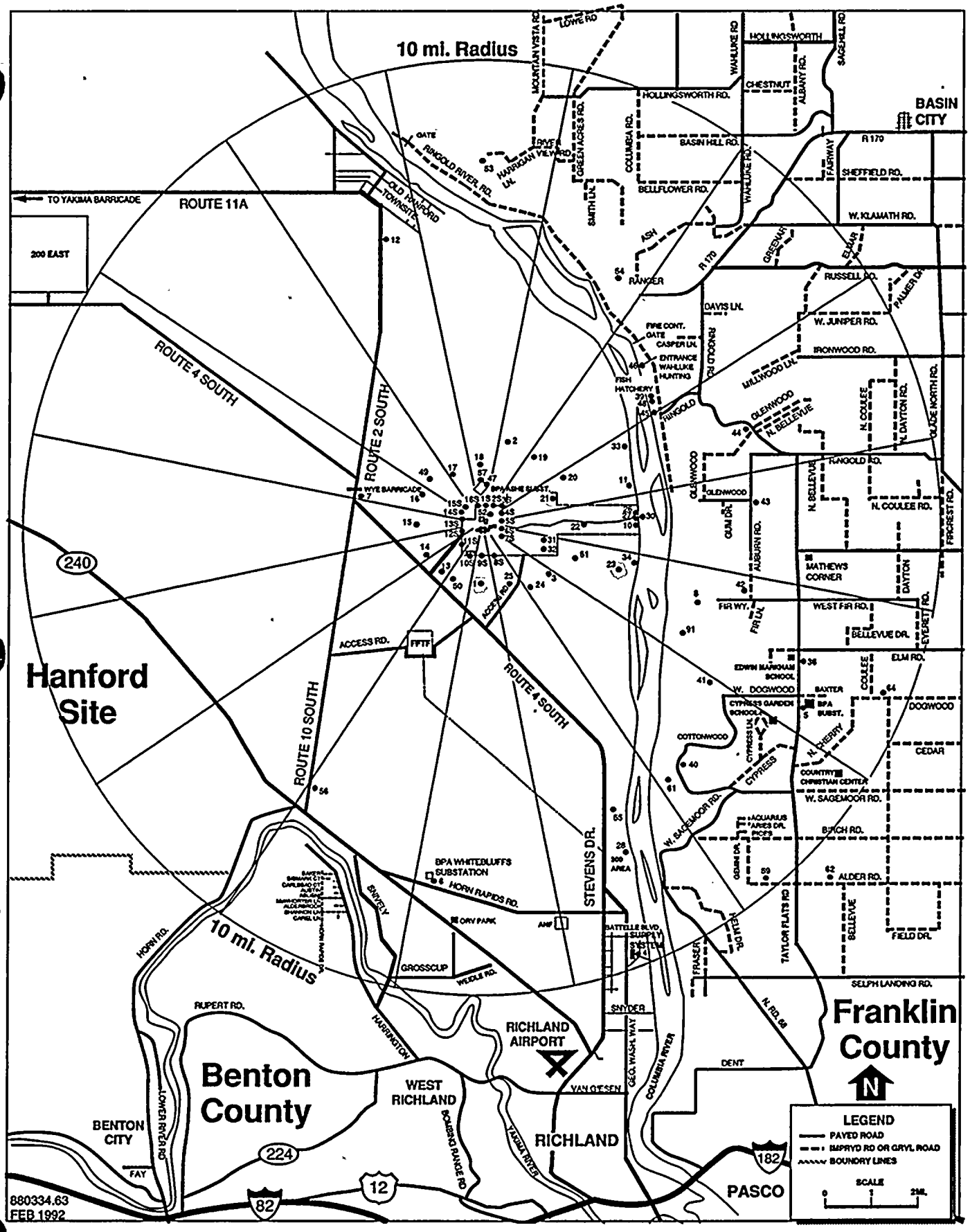


FIGURE 4-10
SOIL SAMPLING LOCATIONS WITHIN THE 10-MILE RADIUS

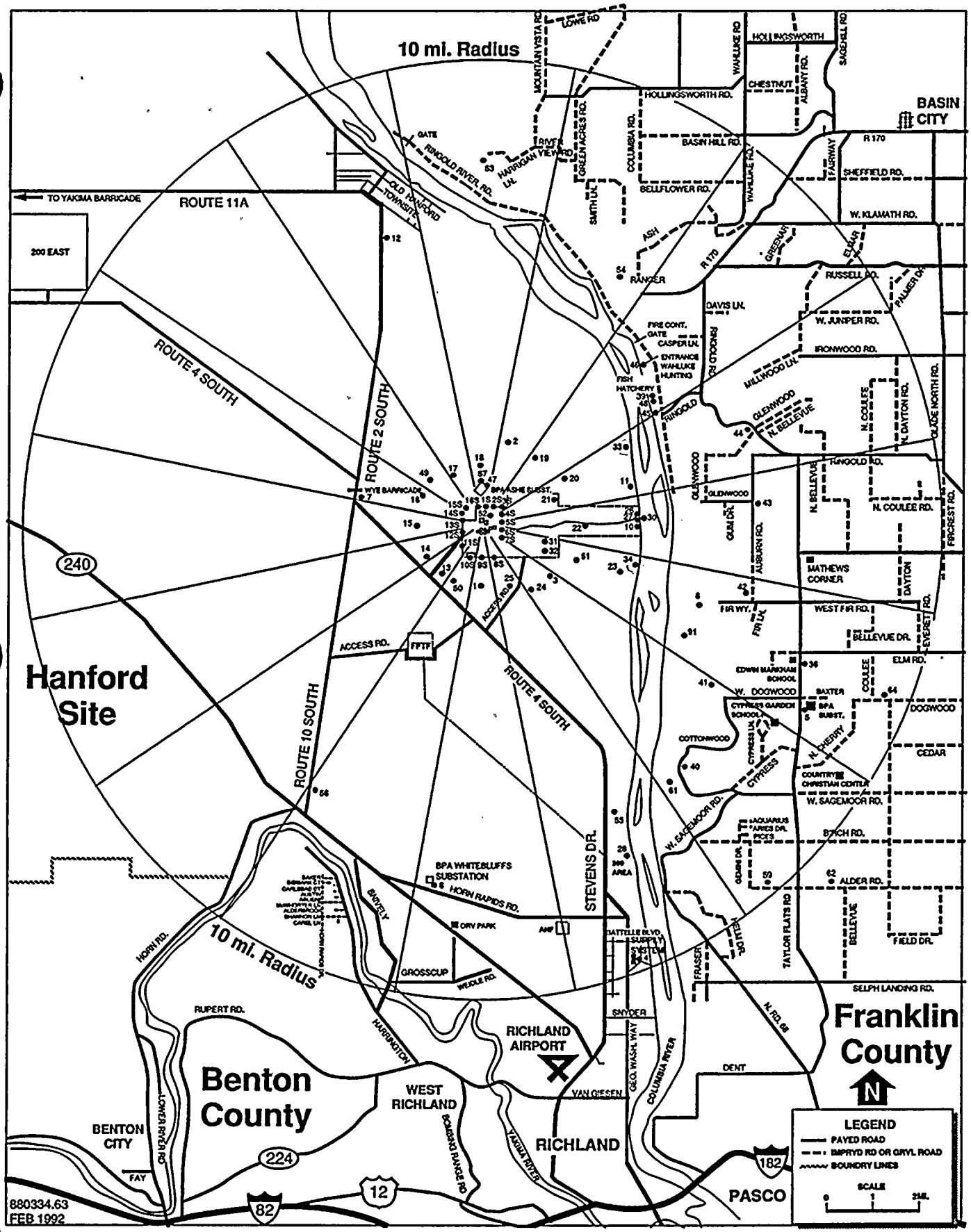


FIGURE 4-11
SEDIMENT SAMPLING LOCATIONS

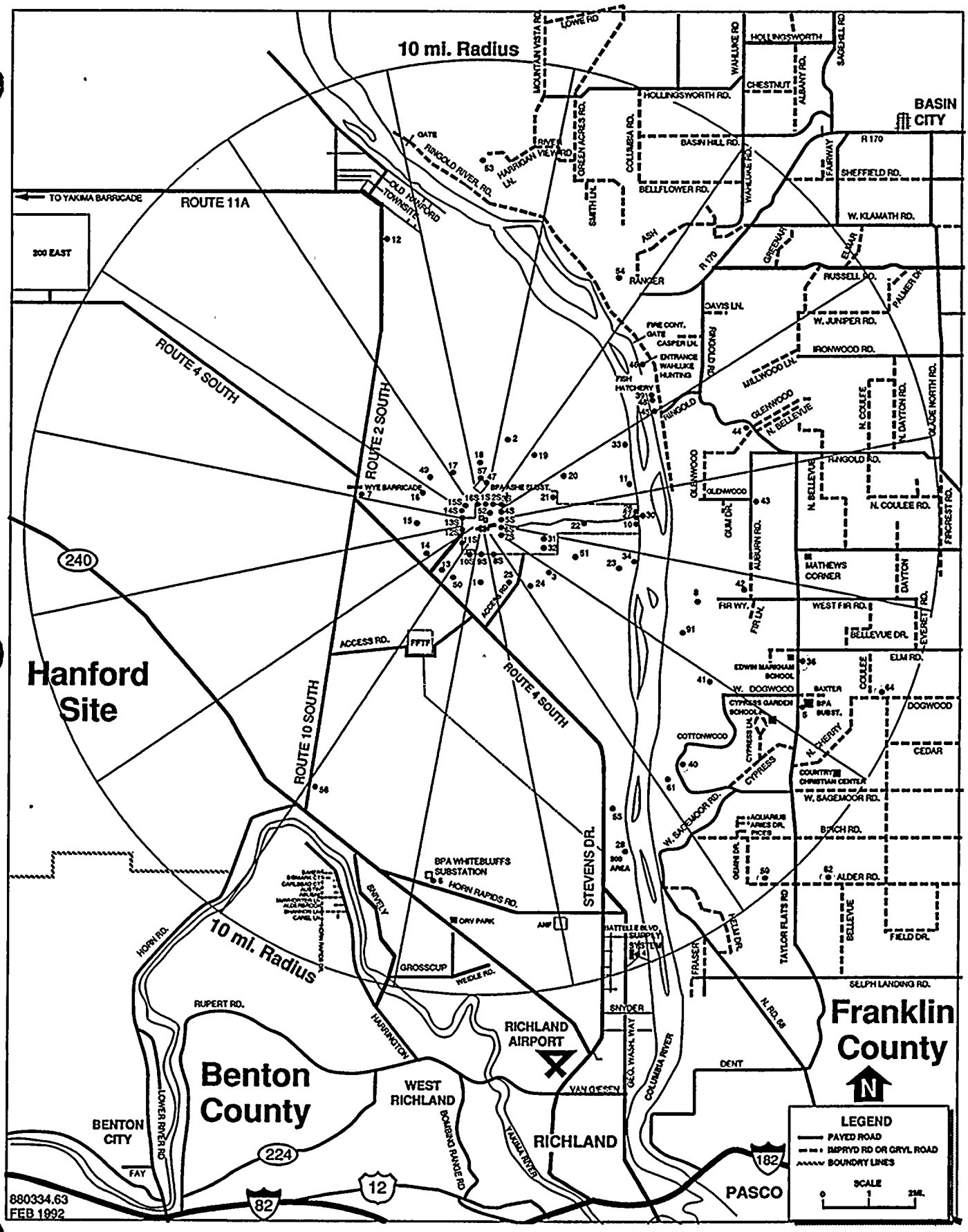


FIGURE 4-12
MILK SAMPLING LOCATIONS WITHIN THE 10-MILE RADIUS

5.0 RESULTS AND DISCUSSION

During 1991 the analyses of REMP samples were performed by Teledyne Isotopes in Westwood, New Jersey. The thermoluminescent dosimeters were processed by the Supply System External Dosimetry Laboratory. Table 5-1 presents the means and ranges of the 1991 results for each type of sample collected. The means and ranges of the preoperational and the previous operational data from 1984 to 1990 are also included in the table for comparison.

The data for the preoperational period and the first six months of 1984 included "less than" (<) designations for results below the actual LLD, the contractual LLD or the two sigma error, depending upon the convention employed by the analytical contractor. Consequently, the data averages using "less than" values are biased high. The use of the "less than" values was discontinued in mid 1984. Since then, REMP data have been reported as net results, i.e., total (gross) results minus the detector counting background.

Since the primary focus of the REMP is to determine whether Plant 2 operations have impacted the environment, the 1991 results are compared in this report to the results during the preoperational period and the results obtained during the previous years of Plant 2 operation. Because of the use of "less than" values, rather than net results, during the preoperational period and during the first year of operation and because of the impact of the Chernobyl accident in 1986 on environmental radiation measurements, the interpretation of the 1991 measurements relative to previous measurements must be done carefully. Some of the parameters considered in the evaluations discussed in this report are the means, ranges and standard deviations or standard errors of the results. Comparative plots, cumulative probability plots, and control charts of the data based on the means or ranges of results are some of the tools that have been employed in the interpretation of the 1991 REMP data.

The 1991 REMP analytical results compare well to the results during previous periods. The quarterly TLD results for 1991 were also very close to the previous results. The slight differences observed among the TLD results are within the normal range of uncertainty expected on TLD systems.

The LLDs generally determined by Teledyne Isotopes for each analysis performed and each radionuclide of interest are listed in Table 5-2. Presented alongside the Teledyne LLDs are the LLDs required by the NRC Branch Technical Position (BTP).[3] The LLDs determined for analyses at Teledyne Isotopes have met the NRC requirements in all cases.

A summary of the REMP results relative to detection limits is presented in Table 5-3. If a particular radionuclide of interest was not detected in the 1991 samples, the term "LLD" is noted in the data mean and range columns. Aside from some naturally-occurring radionuclides, the radionuclides detected in the 1991 samples included cesium-137 in fish, soil and sediment, and cobalt-60 and zinc-65 in the discharge water and tritium in some water river/drinking and discharge samples. Gross beta results in air and water were nearly all above the detection limits due to the low detection limit for the analysis and the abundance of naturally-occurring beta-emitters in the environment.

The positive, or detected, 1991 results compare well with the results from previous years. Any observed differences or increases in the 1991 results are discussed in the following subsections.

5.1 Direct Radiation

Summaries of the environmental radiation exposure rates, determined by thermoluminescent dosimeters (TLDs) are presented in Tables 5-4 and 5-5. The individual quarterly and annual results for each TLD station are given in Tables A-1.1 and A-1.2 of Appendix A. Figures 5-1 and 5-2 show the mean quarterly results for near-plant and remote TLD locations for the preoperational period, 1984-1990 and 1991. Figures 5-3 and 5-4 show the annual TLD results for near-plant and remote locations for the same periods. The quarterly and annual results for the control location (Station 9A) show similar fluctuations over time as the indicator locations and the relationships between the different locations remain very consistent over the three periods.

Figure 5-5 presents a circular plot of the mean 1991 quarterly TLD results for each of the sixteen meteorological sectors, compared to the sector means for the preoperational and previous operational periods. The relationship of the mean 1991 results to the results for the preoperational and previous operational periods is very similar for each sector. This indicates that there were no significant directional effects observed in the 1991 TLD results. The apparent increase in the mean 1991 TLD results over the means of the preoperational and previous operational periods is due to the effect of averaging only the four quarters of 1991 data, versus averaging numerous quarters for the other two sets of results. The differences between the data sets are generally within 10%, which is within the range of variation normally expected for TLD systems. The annual TLD results for each sector also follow the same pattern as the mean quarterly results, except they are approximately 5% lower.

Station 46 in the Wahluke Reserve remained the location with the highest mean exposure rate, 0.31 mR/day. This is the same mean exposure rate determined for that station for 1989 and 1990. Since the preoperational measurement phase, the results for this location have exceeded the results for all other locations. Variations in the ambient background due to differences in the soil and underlying rock composition account for such local differences in the TLD results.

A comparison of the 1991 annual and mean quarterly TLD results is presented in Table 5-6. The 1991 annual TLD results are generally 5-10% lower than the mean quarterly results because of the signal fading characteristics of $CaSo_4$. This difference is not significant, in light of the variability commonly observed in TLD results. In most cases, the annual result is within the uncertainty associated with the quarterly TLD results.

The cumulative probability plots of the 1991 and previous operational (1984-1990) quarterly TLD results are presented in Figure 5-6. The "slopes" of the lines in both plots are nearly the same, indicating that both sets of data are part of the same distribution. Control charts of the mean TLD results for TLD Stations 71, 72, 73, and 86 on the north side of the plant, Stations 77, 78, 79 and 80 on the south side and Station 9A at the control location are presented in Figure 5-7. These charts clearly show the effect of the increase in environmental exposure rate observed in 1986 for all TLD locations. That increase was discussed in the 1986 annual report[15] and determined to be unrelated to Plant 2 operations or TLD system changes. The effect of improvements in the way that the TLDs are calibrated is also evident in the consistency of results from the latter part of 1988 on.

Figure 5-8 presents a cumulative probability plot of the results for all TLD indicator stations, except those closest to the plant (ie, the inner ring) and a plot of the results for the inner ring TLDs. The similarity of the plots indicates that these two sets of data are from the same distribution. No plant effect is apparent, therefore, from this data.

The 1991 annual TLD results are also consistent with results observed for the past monitoring periods. This is evident in the cumulative probability plots of the annual TLD results from 1984 to 1990 and the results for 1991 presented in Figure 5-9.

The above comparisons of 1991 TLD results to preoperational and previous operational data and the analysis of results by meteorological sector and distance from the plant demonstrate that Plant 2 operations have not impacted the direct radiation levels in the environment around the plant.

5.2 Airborne Particulate/Iodine

The results of the 1991 gross beta in air analyses are presented in Tables A-2.1 and A-2.2 of Appendix A. The 1991 mean weekly results of all indicator stations are plotted in Figure 5-10. The gross beta in air results for 1991 were within the ranges observed during the preoperational period and during previous operational periods, as shown in Table 5-1. In Figure 5-11 the similarity between results from near-plant locations and those from remote locations can be seen. The control location (Station 9A) results follow a very similar pattern to the remote and near-plant indicator locations.

As observed previously, gross beta levels increased during periods of inversion occurring in the fall and winter months. In fact, the gross beta results plotted over a period of several years show a cyclic pattern of fall and winter increases. The increase, which was evident in the results of all the air sampling locations is due to an increase in radon and radon daughter concentrations during the inversions.

The quarterly gamma analyses of the particulate filter composites indicated only the presence of two naturally-occurring radionuclides, beryllium-7 and potassium-40, at levels above detection limits at indicator locations and the control location. The results of the gamma analysis of particulate filter composites are presented in Table A-3.1 and A-3.2 of Appendix A. The results of the gamma analyses of charcoal cartridges for iodine-131 are presented in Table A-4.1. All iodine-131 in air results for 1991 were less than the 0.01 pCi/cubic meter LLD.

No evidence of any impact of plant operations on the environment was apparent in the particulate filter and charcoal cartridge results for 1991.

5.3 Water

During May and June 1991, two new flow-proportional composite water samplers, which do not rely on an external pump to supply sample water, were installed in the river pumphouses at Station 27. Both samplers are connected to the same sampling line, so that if one sampler does not operate properly, the other sampler can be activated to continue sampling. Since their installation, the samplers have been far more reliable than previous samplers used at that station. Two operational problems did, however, develop with this sampling system within a few months of sampler

installation. These problems were resolved and sampling has continued without significant interruptions. The operational problems and the periods when the sampling system has not operated or not operated properly are discussed in Appendix D, Sample Deviations.

The gross beta in river/drinking (including intake) and discharge water results are given in Tables A-5.1 and A-5.2 of Appendix A. All river/drinking water results were within the ranges normally observed and less than 8 pCi/liter, the level at which a strontium analysis is performed to verify compliance with the Washington State drinking water standard for strontium-90*. *Strontium-90 is assumed to account for the gross beta result. The 1991 gross beta in river/drinking water results, relative to the State Annual Average Concentration Limit, are presented in Figure 5-12. The mean gross beta results in river/drinking water for the period of 1984-1989, 1990 and 1991 are compared in Figure 5-13. The higher mean observed in the Richland water results for the 1984-1989 period is due to the use of well water, instead of river water, during the maintenance outages of the Richland Water Treatment Plant.

The 1991 gross beta results for discharge water are shown in Figure 5-14. The State Annual Average Concentration limit of 50 pCi/liter and the State Department of Health Interim Investigation Level of 75 pCi/liter are given for comparison. The 1991 results were well below both levels.

The mean 1991 gross beta levels in the discharge water were slightly lower than the previous levels observed during the period of 1984-1989 and 1990, as shown in Figure 5-15. This lower gross beta level resulted from the current mode of plant operations using less concentrated circulating water, i.e., lower cycles of concentration. The gross beta levels in the discharge sample reflect the concentrations of naturally-occurring radionuclides, principally potassium-40, and any radionuclides from upstream sources or past Hanford activities present in the makeup water, in addition to radionuclides from Plant 2 discharges. The discharge sample results are representative of the radioactivity present in plant discharges before any mixing with river water occurs. Therefore, the sample is not indicative of the actual radionuclide concentrations in the river water downstream from Plant 2. Flow-proportional composite sampling from the discharge line was considered to be the most feasible option for meeting the Technical Specification requirement for sampling from the river near the downstream edge of the mixing zone. However, careful interpretation of the results from this sampling point is necessary, since they do not represent a true environmental sample.

The 1991 mean gross beta results ($\pm$ 3 sigma) for the river/drinking and discharge samples are compared to the mean results for previous operational years in Figure 5-16. The "3 sigma" bars provide an indication of the variability among sample results for each year.

The tritium results for river/drinking water, discharge water and groundwater are presented in Tables A-6.1 and A-6.2 of Appendix A. The tritium levels in the river/drinking water were all below the LLD for that analysis except one result which was at the detection level. The mean results for 1991 are compared to previous periods in Figure 5-17.

The tritium levels in the discharge water were higher than the levels observed for the river/drinking water samples because of plant releases and because discharge water samples are taken prior to the water reaching the river and becoming diluted. As shown in Figure 5-18, the mean result was slightly higher than the levels observed for 1990. The difference between the means for the 1984-1989 period and 1991 reflects the 1986 change in the way the plant discharges water. The removal

of a crosstie line between the intake and discharge lines resulted in the start of intermittent discharges rather than the continual discharge made up, to a large extent, of diverted intake water.

The 1991 tritium levels were reasonable for samples taken directly from the discharge line prior to any river dilution. Compared to the annual average concentration of less than 20,000 pCi/liter of tritium for drinking water to be in compliance with the state dose limitation, the results were low.[16]

All the tritium results for the quarterly groundwater samples were below the LLD, except one, which was at the LLD. They are presented in Table A-6.1 of Appendix A.

Cobalt-60 and zinc-65 were detected in some discharge samples during and following the plant outage and cesium-137 was detected in one sample during the outage. The cobalt-60 results ranged from 12.3 to 57.6 pCi/liter, the zinc-65 results ranged from 17.3 to 28.5 pCi/liter, and the cesium-137 result was 6.87 pCi/liter. Although above detection levels, these results were low and did not exceed any reporting levels.

5.4 Soil

Gamma spectrometry was performed on five soil samples collected in May. The cesium-137 levels in the samples ranged from -7.3 pCi/kilogram to 590 pCi/kilogram. As shown in Table 5-1, the cesium-137 levels in the soil samples were well within the range observed during preoperational and previous operational sampling. However, the cesium-137 levels measured in two of the soil samples, Station 1 and Station 23, exceeded the cesium-137 measured in the control sample, Station 9A, by more than a factor of 10. Strontium analyses were, therefore, performed on those samples, as required by the Site Certification Agreement. The results of the strontium analyses were 160.0 and 190.0 pCi/kilogram for Station 23 and Station 1, respectively. These levels are below the range previously observed, as shown in Table 5-1. Aside from cesium-137, the only radionuclides detected in the samples were potassium-40, radium-226 and thorium-228. These are part of the natural radioactivity typically found in soils.

The gamma spectrometry results for the soil samples are given in Tables A-8.1 and A-8.2 in Appendix A. No indication of impact of Plant 2 operations on the environment was evident in these results.

5.5 Shoreline Sediment

The results of gamma spectrometry of shoreline sediment are presented in Tables A-9.1 and A-9.2 in Appendix A. Aside from the naturally-occurring radionuclides (potassium-40, radium-226 and thorium-228), only cesium-137 was detected downstream of the plant (Station 34). Cesium-137 was also detected in the control location (Station 33) sample. The cesium-137 concentrations upstream from the plant discharge point were 96.1 and 118.0 pCi/kilogram; the concentrations downstream from the discharge point were 329.0 and 345.0 pCi/kilogram. These are consistent with the concentrations observed previously, as shown in Figure 5-19.

Cesium-137 has been detected in preoperational samples and in samples taken since plant operation began. It has also been previously identified as a component of the Columbia River sediment originating from the operation of the old Hanford Reservation reactors.[17]

5.6 Fish

The gamma spectrometry results of fish samples collected in the vicinity of the Plant 2 discharge and at the control location on the Snake River are presented in Tables A-10.1 and A-10.2 of Appendix A. All results were below detection limits, except for potassium-40, a naturally-occurring radionuclide, and cesium-137. The detectable cesium-137 levels for the fish taken from the Columbia River were within the range observed during the preoperational and previous operational periods.

5.7 Milk

All the results of iodine-131 analyses of milk samples collected during 1991 were less than detection limits. The routine iodine-131 in milk results are listed in Tables A-11.1 and A-11.2 of Appendix A. The gamma spectrometry results for the same milk samples are listed in Tables A-12.1 and A-12.2. All results for the indicator and control locations were less than the detection limits, except for potassium-40, which is naturally-occurring.

5.8 Garden Produce

The gamma isotopic analysis results for all root, fruit and leafy vegetables were below detection limits. The results of all produce samples, including the apples collected from Station 91 and the cherries collected from Station 61, are listed in Tables A-13.1 through A-15.2 of Appendix A.

TABLE 5-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM COMPARATIVE SUMMARY

MEDIA/ ANALYSIS	PREOPERATIONAL[a]		PREVIOUS OPERATIONAL[b][c]		1991[d]	
	MEAN	(RANGE)	MEAN	(RANGE)	MEAN	(RANGE)
Air: pCi/m^3						
Gross Beta	<0.02	(<0.003 - 0.130)	0.02	(0.00 - 0.74)	0.02	(0.00 - 0.07)
I-131[e]	<0.05	(<0.01 - 0.11)	0.00	(-0.07 - 0.82)	0.00	(-0.02 - 0.02)
Gamma						
Cs-134	<0.01	(<0.001 - 0.040)	0.001	(-0.002 - 0.015)	-0.0000	(-0.003 - 0.0002)
Cs-137	<0.01	(<0.001 - 0.040)	0.001	(-0.001 - 0.036)	0.0001	(-0.0003 - 0.0003)
Ru-103	Not Reported		0.001	(-0.001 - 0.019)	-0.0000	(-0.0008 - 0.0007)
River/Drinking Water: pCi/l						
Gross Beta	<3.0	(<1.0 - <6.0)	2.0	(-0.2 - 9.1)	1.7	(0.7 - 2.9)
Gamma						
Cs-134	<3.8	(<1.0 - <12.0)	0.4	(-5.4 - 5.2)	0.3	(-2.3 - 2.8)
Cs-137	<4.1	(<1.0 - <13.0)	1.1	(-5.7 - 5.7)	1.6	(-4.8 - 6.2)
Co-58	<5.1	(<1.0 - <25.0)	0.0	(-3.3 - 2.9)	-0.3	(-2.0 - 2.0)
Co-60	<4.7	(<1.0 - <13.0)	1.1	(-4.9 - 7.1)	0.9	(-2.8 - 5.3)
Fe-59	<13.3	(<2.0 - <93.0)	0.7	(-8.9 - 6.6)	1.1	(-3.7 - 6.9)
Zn-65	<8.3	(<2.0 - <27.0)	-2.1	(-16.2 - 8.2)	-1.0	(-8.1 - 6.1)
H-3	<481.7	(220 - <820)	166.3	(-52.0 - 596.0)	73.9	(-6.7 - 160.0)
Sr-90	<2.0		0.4	(0.3 - 0.7)	Not analyzed	
Groundwater: pCi/1						
Gamma						
Cs-134	<4.0	(<1.0 - <12.0)	0.5	(-4.1 - 5.4)	0.8	(-2.0 - 3.8)
Cs-137	<3.8	(0.8 - <8.0)	1.0	(-3.1 - 4.9)	1.5	(-2.7 - 4.7)
Co-58	<4.7	(<1.0 - <12.0)	-0.1	(-2.8 - 1.9)	-0.5	(-1.5 - 0.5)
Co-60	<4.1	(0.1 - <9.0)	1.2	(-2.4 - 8.4)	1.5	(0.0 - 3.5)
Fe-59	<11.6	(<2.0 - <33.0)	0.7	(-4.5 - 5.7)	0.4	(-3.5 - 4.8)
Zn-65	<8.6	(<2.0 - 17.0)	-2.4	(-46.8 - 4.4)	0.8	(-17.0 - 5.5)
H-3	<467.8	(<10.0 - 2600.0)	67.8	(-516.0 - 470.0)	8.1	(-93.0 - 110.0)
Sr-90	<0.4	(<0.1 - 0.7)	Not analyzed		Not analyzed	

(a) All stations, all years.
(b) Indicator stations only for the years 1984 to 1990. Some of the data means and ranges are biased high due to the effects of the Chernobyl accident in 1986.
(c) The data used for these averages does not include the "less than" values reported in 1984.
(d) Indicator stations only.
(e) Charcoal cartridge results.

TABLE 5-1 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM COMPARATIVE SUMMARY

MEDIA/ ANALYSIS	PREOPERATIONAL[a]		PREVIOUS OPERATIONAL[b][c]		1991[d]	
	MEAN	(RANGE)	MEAN	(RANGE)	MEAN	(RANGE)
Discharge Water: pCi/l						
Gross Beta	<2.8	(<1.9 - 4.0)	17.8	(0.6 - 48.0)	14.1	(4.8 - 28.0)
Gamma						
Cs-134	<3.7	(<1.0 - <8.0)	0.5	(-3.0 - 5.4)	0.9	(-3.9 - 3.6)
Cs-137	<4.7	(<1.0 - 16.0)	1.5	(-2.0 - 7.9)	1.8	(-3.3 - 6.9)
Co-58	<1.4	(1.0 - 13.0)	0.0	(-2.6 - 4.6)	0.2	(-1.3 - 2.1)
Co-60	<5.0	(<1.9 - <13.0)	2.3	(-8.7 - 28.2)	12.4	(-1.7 - 57.6)
Fe-59	<11.9	(<3.0 - <38.0)	0.7	(-4.1 - 6.0)	1.1	(-2.1 - 3.4)
Zn-65	<8.6	(<2.0 - 27.0)	2.6	(-7.5 - 86.7)	6.0	(-8.2 - 28.5)
H-3	<420.0	(<80.0 - 700.0)	1090.9	(55.0 - 4400.0)	1600.5	(62.0 -
Sr-90	<3.0		0.8	(0.5 - 1.1)	Not analyzed	
Sediment: pCi/kg						
Gamma						
Cs-134	<112.5	(<50.0 - <150.0)	58.2	(7.0 - 172.0)	36.0	(15.6 - 55.8)
Cs-137	<287.0	(<50.0 - <560.0)	353.4	(153.0 - 1890.0)	337.0	(329.0 -
Co-60	<254.6	(130.0 - 610.0)	49.5	(14.8 - 129.0)	32.5	(21.0 - 44.0)
Co-57	Not Reported		29.7	(-11.6 - 54.0)	39.0	(33.0 - 45.0)
Eu-152	Not Reported		101.0	(5.6 - 166.0)	245.0	(210.0 -
Soil: pCi/kg						
Gamma						
Cs-134	<65.3	(<20.0 - <150.0)	27.7	(7.1 - 53.2)	25.5	(1.0 - 47.0)
Cs-137	364.3	(<20.0 - <1880.0)	308.6	(9.6 - 735.0)	278.7	(-7.3 - 590.0)
Sr-90	Analysis Not Performed		351.5	(260.0 - 455.0)	175.0	(160.0 -
Milk: pCi/l						
Gamma						
Cs-134	<3.7	(<0.9 - <14.0)	1.1	(-7.4 - 22.6)	0.4	(-2.0 - 4.0)
Cs-137	<3.8	(<1.0 - <12.0)	3.5	(-7.4 - 47.3)	1.0	(-3.3 - 4.3)
Ba-140	<72.1	(<6.0 - <2000.0)	0.3	(-44.3 - 55.0)	0.0	(-8.4 - 8.7)
La-140	<33.3	(<5.0 - 1000.0)	-0.6	(-24.2 - 9.7)	-0.1	(-4.3 - 4.6)
I-131[e]	<0.5	(<0.1 - <1.0)	1.4	(-0.8 - 143.6)	0.0	(-0.1 - 0.3)
Sr-90	Not Reported		1.9	(1.3 - 3.9)	Not Reported	

(a) All stations, all years.
(b) Indicator stations only for the years 1984 to 1990. Some of the data means and ranges are biased high due to the effects of the Chernobyl accident in 1986.
(c) The data used for these averages does not include the "less than" values reported in 1984.
(d) Indicator stations only.
(e) Resin recovery method.

TABLE 5-1 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM COMPARATIVE SUMMARY

MEDIA/ ANALYSIS	PREOPERATIONAL[a]		PREVIOUS OPERATIONAL[b][c]		1991[d]	
	MEAN	(RANGE)	MEAN	(RANGE)	MEAN	(RANGE)
Fish: pCi/kg						
Gamma						
Cs-134	<61.2	(<6.0 - <130.0)	2.4	(-20.4 - 24.0)	0.5	(-11.0 - 14.0)
Cs-137	<88.8	(<10.0 - <130.0)	13.4	(-35.1 - 54.9)	26.7	(-0.4 - 57.0)
Co-58	<87.7	(<9.0 - <130.0)	1.3	(-16.8 - 25.8)	-3.2	(-15.0 - 1.5)
Co-60	<80.6	(<9.0 - <130.0)	0.3	(-18.4 - 19.1)	3.2	(-9.6 - 21.0)
Fe-59	<130.0	(<30.0 - <260.0)	-0.5	(-34.2 - 30.0)	-4.4	(-23.0 - 18.0)
Mn-54	<88.3	(<8.0 - <130.0)	1.9	(-10.3 - 30.9)	-3.1	(-20.0 - 6.5)
Produce: pCi/kg						
Gamma						
Cs-134	<49.1	(<10.0 - < 140.0)	1.5	(-24.8 - 19.8)	1.9	(-2.3 - 6.0)
Cs-137	<69.8	(<10.0 - < 140.0)	4.5	(-9.8 - 20.9)	2.1	(-5.1 - 9.5)
I-131	<105.6	(<10.0 - <1000.0)	0.2	(-21.3 - 59.0)	-3.3	(-26.0 - 16.0)
TLD: mR/day						
Quarterly	0.24	(0.11 - 0.32)	0.25	(0.16 - 0.35)	0.26	(0.23 - 0.33)
Annual	0.23	(0.20 - 0.31)	0.23	(0.18 - 0.32)	0.24	(0.21 - 0.29)

(a) All stations, all years.
(b) Indicator stations only for the years 1984 to 1990. Some of the data means and ranges are biased high due to the effects of the Chernobyl accident in 1986.
(c) The data used for these averages does not include the "less than" values reported in 1984.
(d) Indicator stations only.

TABLE 5-2

COMPARISON OF TELEDYNE NOMINAL LOWER LIMITS OF DETECTION WITH BRANCH TECHNICAL POSITION REQUIREMENTS

MEDIA (UNITS)	ANALYSIS	TELEDYNE LLDs	BTP REQUIRED LLDs
Air Particulates: (pCi/m^3)	Gross Beta	0.003	0.01
	Gamma Spectrometry		
	Cs-134	0.001	0.05
	Cs-137	0.001	0.06
Air Iodine: (pCi/m^3)	I-131	0.01	0.07
Water: (pCi/1)	Gross Beta	4	4
	Tritium	100-200	2000
	I-131	1	1
	Sr-90	1	---
	Gamma Spectrometry		
	Mn-54	10	15
	Fe-59	20	30
	Co-58	10	15
	Co-60	10	15
	Zn-65	20	30
	Zr-95	20	30
	Nb-95	10	15
	Cs-134	10	15
	Cs-137	10	18
	Ba-140	20	60
	La-140	10	15
Soil/Sediment: (pCi/kg)	Gamma Spectrometry		
	Co-57	120	---
	Co-60	30	---
	Cs-134	30	150
	Cs-137	40	180
	Sr-90	10	---
Fish: (pCi/kg)	Gamma Spectrometry		
	Mn-54	20	130
	Fe-59	30	260
	Co-58	20	130
	Co-60	20	130
	Zn-65	30	260
	Cs-134	20	130
	Cs-137	20	150

TABLE 5-2 (Cont.)

COMPARISON OF TELEDYNE NOMINAL LOWER LIMITS OF DETECTION WITH BRANCH TECHNICAL POSITION REQUIREMENTS

MEDIA (UNITS)	ANALYSIS	TELEDYNE LLDs	BTP REQUIRED LLDs
Milk:	I-131	0.5	1
(pCi/1)	Gamma Spectrometry		
	Cs-134	10	15
	Cs-137	10	18
	Ba-140	20	60
	La-140	10	15
	Sr-90	1	---
Garden Produce:	Gamma Spectrometry.		
(pCi/kg)	Cs-134	20	60
	Cs-137	20	80
	I-131	30	60

TABLE 5-3

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1991

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)	ALL INDICATOR LOCATIONS MEAN (RATIO). [a] (RANGE)	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (RATIO)[a] (RANGE)	CONTROL LOCATION MEAN (RATIO) [a] (RANGE)	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
AIR PARTICULATES (pCi/m^3)	Gross Beta 634	0.003	0.0158(580/581) (0.003-0.073)	48 4.5 mi NE	0.017(53/53) (0.004-0.060)	0.015(53/53) (0.003-0.065)	0
	Gamma (Quarterly) 48						
	Be-7	0.01	(0.089(44/44) (0.063-0.129)	7 2.7 mi WNW	0.101(4/4) (0.082-0.129)	0.085(4/4) (0.068-0.104)	0
	K-40	0.01	0.006(2/44) (0.004-0.007)	8 4.5 mi ESE	0.007(1/4)	0.007(1/4)	0
	Cs-137	0.01	LLD			LLD	0
	Cs-134	0.001	LLD			LLD	0
AIR IODINE (pCi/m^3)	I-131 634	0.01	LLD			LLD	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-3 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1991

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)	ALL INDICATOR LOCATIONS MEAN (RATIO) [a] (RANGE)	LOCATION WITH HIGHEST MEAN NAME	DISTANCE AND DIRECTION	MEAN (RATIO)[a] (RANGE)	CONTROL LOCATION MEAN (RATIO) [a] (RANGE)	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
SOIL (pCi/kg dry)	Gamma 5							
	K-40	700	14075(4/4) (13700-14500)	23	3.0 mi ESE	14500(1/1)	13500(1/1)	0
	Cs-134	30	LLD				LLD	0
	Cs-137	40	557(2/4) (524-590)	23	3.0 mi ESE	590(1/1)	-(0/1)	0
	Ra-226	400	1070(2/4) (1010-1130)	9A	30 mi WSW	1320(1/1)	1320(1/1)	0
	Th-228	50	620(4/4) (491-748)	1	1.3 mi S	748(1/1)	769(1/1)	0
	Sr-90	2	0.18(2/2) (0.16-0.19)	1	1.3 mi S	0.19(1/1)	-(0/0)	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-3 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1991

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED		LOWER LIMIT OF DETECTION (LLD)	ALL INDICATOR LOCATIONS MEAN (RATIO) (a) (RANGE)	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION			MEAN (RATIO)(a) (RANGE)	CONTROL LOCATION MEAN (RATIO) (a) (RANGE)	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
WATER (River/Drinking) (pCi/liter)	Gross Beta	36	4	1.78(22/24) (1.0-2.9)	28	7.4 mi	SSE	1.92(11/12) (1.1-2.9)	1.69(10/12) (1.2-2.5)	0
	Tritium	12	200	-(0/8)	26	3.2 mi	E	110(1/4)	110(1/4)	0
	Gamma	36								
	K-40		200	-(0/24)	26	3.2 mi	E	80.4(1/12)	80.4(1/12)	0
	Mn-54		10	LLD					LLD	0
	Fe-59		20	LLD					LLD	0
	Co-58		10	LLD					LLD	0
	Co-60		10	LLD					LLD	0
	Zn-65		20	LLD					LLD	0
	Zr-95		20	LLD					LLD	0
	Nb-95		10	LLD					LLD	0
	Cs-134		10	LLD					LLD	0
	Cs-137		10	LLD					LLD	0
	Ba-140		20	LLD					LLD	0
	La-140		10	LLD					LLD	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-3 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1991

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)	ALL INDICATOR LOCATIONS MEAN (RATIO) (a) (RANGE)	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (RATIO)(a) (RANGE)	CONTROL LOCATION MEAN (RATIO) (a) (RANGE)	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
WATER (Discharge) (pCi/liter)	Gross Beta 36	12	14.1(11/11) (4.8-28)	27 3.2 mi E	14.1(11/11) (4.8-28)	None	0
	Tritium 4	200	2113(3/4) (840-3700)	27 3.2 mi E	2113(3/4) (840-3700)	None	0
	Mn-54	10	LLD			LLD	0
	Fe-59	20	LLD			LLD	0
	Co-58	10	LLD			LLD	0
	Co-60	10	25.4(5/11) (12.3-57.6)	27 3.2 mi E	25.4(5/11) (12.3-57.6)	None	0
	Zn-65	10	22.1(3/11) (17.3-28.5)	27 3.2 mi E	22.1(3/11) (17.3-28.5)	None	0
	Zr-95	20	LLD			LLD	0
	Nb-95	10	LLD			LLD	0
	Cs-134	10	LLD			LLD	0
	Cs-137	10	6.87(1/11)	27 3.2 mi E	6.87(1/11)	None	0
	Ba-140	20	LLD			LLD	0
	La-140	10	LLD			LLD	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-3 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1991

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED		LOWER LIMIT OF DETECTION (LLD)	ALL INDICATOR LOCATIONS MEAN (RATIO) [a] (RANGE)	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (RATIO) [a] (RANGE)	CONTROL LOCATION MEAN (RATIO) [a] (RANGE)	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
WATER (Ground) (pCi/liter)	Tritium	12	200	110(1/12)	52 0.1 mi N	110(1/4)	None	0
	Gamma	12						
	Mn-54		10	LLD			LLD	0
	Fe-59		20	LLD			LLD	0
	Co-58		10	LLD			LLD	0
	Co-60		10	LLD			LLD	0
	Zn-65		20	LLD			LLD	0
	Zr-95		20	LLD			LLD	0
	Nb-95		10	LLD			LLD	0
	Cs-134		10	LLD			LLD	0
	Cs-137		10	LLD			LLD	0
	Ba-140		20	LLD			LLD	0
	La-140		10	LLD			LLD	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-3 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1991

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)	ALL INDICATOR LOCATIONS MEAN (RATIO) [a] (RANGE)	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (RATIO)[a] (RANGE)	CONTROL LOCATION MEAN (RATIO) [a] (RANGE)	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
SEDIMENT (pCi/kg dry)	Gamma 4						
	K-40	700	14650(2/2) (14100-15200)	33 3.6 mi ENE	16150(2/2) (15400-16900)	16150(2/2) (15400-16900)	0
	Co-60	30	LLD			LLD	0
	Cs-134	30	LLD			LLD	0
	Cs-137	40	337(2/2) (329-345)	34 3.5 mi ESE	337(2/2) (329-345)	107(2/2) (96.1-118)	0
	Ra-226	400	1350(2/2) (1190-1510)	34 3.5 mi ESE	1350(2/2) (1190-1510)	1175(2/2) (1090-1260)	0
	Th-228	50	980(2/2) (750-1210)	34 3.5 mi ESE	980(2/2) (750-1210)	812(2/2) (738-886)	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-3 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1991

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)	ALL INDICATOR LOCATIONS MEAN (RATIO) [a] (RANGE)	LOCATION WITH HIGHEST MEAN NAME	DISTANCE AND DIRECTION	MEAN (RATIO)[a] (RANGE)	CONTROL LOCATION MEAN (RATIO) [a] (RANGE)	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
FISH (pCi/kg wet)	Gamma 16							
	K-40	1000	3039(8/8) (2340-3460)	38	26.5 mi ESE	3104(8/8) (2050-3680)	3104(8/8) (2050-3680)	0
	Mn-54	20	LLD				LLD	0
	Fe-59	30	LLD				LLD	0
	Co-58	20	LLD				LLD	0
	Co-60	20	LLD				LLD	0
	Zn-65	30	LLD				LLD	0
	Cs-134	20	LLD				LLD	0
	Cs-137	20	47.7(2/8) (38.4-57.0)	30	3.3 mi E	47.7(2/8) (38.4-57.0)	-(0/8)	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-3 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1991

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED		LOWER LIMIT OF DETECTION (LLD)	ALL INDICATOR LOCATIONS MEAN (RATIO) [a] (RANGE)	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (RATIO)[a] (RANGE)	CONTROL LOCATION MEAN (RATIO) [a] (RANGE)	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
MILK (pCi/liter)	I-131	107	1	LLD			LLD	0
	Gamma	107						
	K-40	107	200	1320(89/89) (1080-1660)	40 6.4 mi SE	1445(18/18) (1160-1660)	1351(18/18) (1130-1430)	0
	Cs-134	107	10	LLD			LLD	0
	Cs-137	107	10	LLD			LLD	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-3 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1991

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)	ALL INDICATOR LOCATIONS MEAN (RATIO) [a] (RANGE)	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (RATIO)[a] (RANGE)	CONTROL LOCATION MEAN (RATIO) [a] (RANGE)	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
ROOTS (pCi/kg wet)	Gamma 8						
	I-131	50	LLD			LLD	0
	Cs-134	50	LLD			LLD	0
	Cs-137	50	LLD			LLD	0
FRUITS (pCi/kg wet)	Gamma 10						
	I-131	50	LLD			LLD	0
	Cs-134	50	LLD			LLD	0
	Cs-137	50	LLD			LLD	0
VEGETABLES (pCi/kg wet)	Gamma 12						
	I-131	50	LLD			LLD	0
	Cs-134	50	LLD			LLD	0
	Cs-137	50	LLD			LLD	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-3 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1991

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED		LOWER LIMIT OF DETECTION (LLD)	ALL INDICATOR LOCATIONS MEAN (RATIO) [a] (RANGE)	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION			MEAN (RATIO) [a] (RANGE)	CONTROL LOCATION MEAN (RATIO) [a] (RANGE)	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
DIRECT RADIATION Quarterly TLD's (mR/day)	TLD	228	-	0.26(224/224) (0.23-0.33)	46	4.7 mi	NE	0.31(4/4) (0.30-0.33)	0.24(4/4) (0.23-0.24)	0
DIRECT RADIATION Annual TLD's (mR/day)	TLD	57	-	0.24(56/56) (0.21 -0.29)	46	4.7 mi	NE	0.29(1/1) -	0.22(1/1) -	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-4

MEAN QUARTERLY TLD DATA SUMMARY FOR THE PREOPERATIONAL AND OPERATIONAL PERIODS

Results in mR/day

	PREOPERATIONAL		1984 - 1990 OPERATIONAL		1991 OPERATIONAL	
STATION	MEAN[a]	STANDARD ERROR	MEAN	STANDARD ERROR	MEAN	STANDARD ERROR
1	0.24	0.02	0.25	0.01	0.26	0.01
2	0.23	0.02	0.24	0.00	0.25	0.01
3	0.22	0.01	0.24	0.01	0.25	0.01
4	0.22	0.02	0.22	0.01	0.24	0.01
5	0.23	0.01	0.23	0.01	0.24	0.01
6	0.22	0.01	0.23	0.01	0.24	0.01
7	0.23	0.01	0.24	0.01	0.25	0.01
8	0.26	0.01	0.26	0.01	0.28	0.01
9	0.22	0.01	0.22	0.01	0.24	0.01
10	0.23	0.01	0.24	0.01	0.25	0.01
11	0.24	0.01	0.24	0.01	0.25	0.00
12	0.25	0.01	0.26	0.01	0.27	0.01
13	0.24	0.01	0.24	0.01	0.25	0.01
14	0.24	0.02	0.24	0.01	0.25	0.00
15	0.25	0.01	0.26	0.01	0.27	0.01
16	0.24	0.01	0.25	0.01	0.26	0.01
17	0.25	0.01	0.25	0.01	0.26	0.01
18	0.24	0.01	0.25	0.01	0.26	0.01
19	0.24	0.01	0.25	0.01	0.26	0.01
20	0.24	0.01	0.24	0.01	0.25	0.01
21	0.23	0.01	0.23	0.01	0.24	0.01
22	0.24	0.01	0.24	0.01	0.25	0.01
23	0.24	0.01	0.24	0.01	0.25	0.01
24	0.24	0.01	0.25	0.01	0.26	0.01
25	0.25	0.01	0.26	0.01	0.27	0.01
40	0.22	0.01	0.24	0.01	0.24	0.01
41	0.26	0.02	0.26	0.01	0.27	0.01
42	0.25	0.01	0.25	0.01	0.27	0.01
43	0.25	0.01	0.26	0.01	0.27	0.01
44	0.23	0.01	0.24	0.01	0.25	0.01
45	0.23	0.01	0.24	0.01	0.25	0.01
46	0.28	0.02	0.30	0.02	0.31	0.01
47	0.22	0.02	0.23	0.01	0.24	0.01
49	0.24	0.00	0.24	0.01	0.25	0.01
50	0.22	0.00	0.25	0.01	0.25	0.01
51	0.23	0.01	0.24	0.01	0.25	0.01
53	0.27	0.00	0.27	0.01	0.28	0.01
54	0.26	0.00	0.26	0.01	0.26	0.01
55	0.23	0.00	0.24	0.01	0.25	0.01
56	0.24	0.00	0.24	0.01	0.26	0.01

[a] This preoperational mean is for the 1982-1983 data only.

TABLE 5-4 (Cont.)

MEAN QUARTERLY TLD DATA SUMMARY FOR THE PREOPERATIONAL AND OPERATIONAL PERIODS

Results in mR/day

	PREOPERATIONAL		1984 - 1990 OPERATIONAL		1991 OPERATIONAL	
STATION	MEAN[a]	STANDARD ERROR	MEAN	STANDARD ERROR	MEAN	STANDARD ERROR
61	(b)		0.28	0.01	0.28	0.01
71(1S)	0.24	0.02	0.27	0.01	0.28	0.03
72(2S)	0.25	0.01	0.27	0.01	0.27	0.01
73(3S)	0.23	0.01	0.24	0.01	0.25	0.01
74(4S)	0.26	0.01	0.26	0.01	0.28	0.01
75(5S)	0.22	0.02	0.24	0.01	0.26	0.01
76(6S)	0.24	0.01	0.25	0.01	0.25	0.01
77(7S)	0.25	0.01	0.25	0.01	0.26	0.01
78(8S)	0.25	0.01	0.24	0.01	0.25	0.01
79(9S)	0.25	0.01	0.25	0.01	0.26	0.01
80(10S)	0.24	0.01	0.24	0.01	0.25	0.01
81(11S)	0.24	0.02	0.25	0.01	0.25	0.01
82(12S)	0.25	0.02	0.27	0.01	0.27	0.01
83(13S)	0.25	0.01	0.26	0.01	0.26	0.01
84(14S)	0.24	0.01	0.26	0.01	0.26	0.01
85(15S)	0.26	0.01	0.27	0.01	0.27	0.01
86(16S)	0.25	0.01	0.28	0.01	0.28	0.02
All	0.24	0.00	0.26	0.00	0.26	0.02

(a) This preoperational mean is for 1982-1983 data only.
(b) Station 61 was added in 1989.

TABLE 5-5

ANNUAL TLD DATA SUMMARY FOR THE PREOPERATIONAL AND OPERATIONAL PERIODS

Results in mR/day

	PREOPERATIONAL		1984 - 1990 OPERATIONAL		1991 OPERATIONAL	
STATION	MEAN[a]	STANDARD ERROR	MEAN	STANDARD ERROR	MEAN	STANDARD DEVIATION(2σ)
1	0.23	0.04	0.23	0.02	0.24	0.02
2	0.22	0.04	0.22	0.02	0.23	0.01
3	0.21	0.04	0.21	0.02	0.23	0.02
4	0.22	0.06	0.20	0.02	0.21	0.01
5	0.22	0.04	0.21	0.02	0.22	0.02
6	0.21	0.04	0.21	0.02	0.22	0.02
7	0.22	0.02	0.23(b)	0.02	0.23	0.02
8	0.25	0.04	0.25(b)	0.02	0.26	0.01
9	0.20	0.02	0.21	0.02	0.22	0.02
10	0.22	0.04	0.22	0.02	0.23	0.02
11	0.22	0.04	0.22	0.02	0.23	0.02
12	0.24	0.04	0.24	0.02	0.25	0.02
13	0.22	0.04	0.23	0.02	0.23	0.02
14	0.22	0.04	0.22	0.02	0.23	0.02
15	0.23	0.06	0.24	0.02	0.25	0.02
16	0.23	0.04	0.23	0.02	0.24	0.02
17	0.23	0.02	0.23(b)	0.02	0.24	0.02
18	0.25	0.02	0.23	0.02	0.24	0.01
19	0.22	0.04	0.23	0.02	0.23	0.02
20	0.23	0.04	0.23	0.02	0.24	0.02
21	0.23	0.02	0.21	0.02	0.22	0.02
22	0.22	0.02	0.22	0.02	0.24	0.02
23	0.24	0.02	0.22	0.02	0.23	0.02
24	0.22	0.02	0.23	0.02	0.24	0.02
25	0.24	0.02	0.24	0.02	0.26	0.02
40	0.21(c)	0.02	0.22	0.02	0.22	0.02
41	0.26(c)	0.04	0.24	0.02	0.26	0.02
42	0.24(c)	0.02	0.23	0.02	0.24	0.02
43	0.24(c)	0.02	0.24	0.02	0.25	0.02
44	0.24	0.02	0.22	0.02	0.23	0.02
45	0.24	0.01	0.22	0.02	0.23	0.02
46	0.29	0.01	0.28	0.02	0.29	0.02
47	0.22(c)	0.03	0.21	0.02	0.22	0.02
49	(d)		0.22	0.02	0.24	0.02

(a) This preoperational mean is for 1982 - 1983 data only.
(b) 1985 TLD missing
(c) There was only one annual exchange during the preoperational period.
(d) Stations 49-56 were first monitored during Fourth Quarter 1983. Station 61 was added in 1989.

TABLE 5-5 (Cont.)

ANNUAL TLD DATA SUMMARY FOR THE PREOPERATIONAL AND OPERATIONAL PERIODS

Results in mR/day

	PREOPERATIONAL		1984 - 1990 OPERATIONAL		1991 OPERATIONAL	
STATION	MEAN[a]	STANDARD ERROR	MEAN	STANDARD ERROR	MEAN	STANDARD DEVIATION(2σ)
50	(d)		0.23	0.02	0.22	0.02
51	(d)		0.22	0.02	0.23	0.02
53	(d)		0.25	0.02	0.26	0.02
54	(d)		0.24	0.01	0.24	0.02
55	(d)		0.22	0.01	0.23	0.02
56	(d)		0.22	0.01	0.24	0.02
61	(d)		0.27(d)	0.00	0.26	0.02
71	0.24(c)	0.02	0.25	0.02	0.26	0.02
72	0.25(c)	0.02	0.25	0.02	0.26	0.02
73	0.23(c)	0.01	0.22	0.02	0.22	0.01
74	0.24(c)	0.01	0.24	0.02	0.25	0.02
75	0.24(c)	0.01	0.22	0.02	0.24	0.02
76	0.24(c)	0.02	0.23	0.01	0.24	0.02
77	0.25(c)	0.02	0.23	0.01	0.24	0.02
78	0.25(c)	0.04	0.23	0.02	0.23	0.02
79	0.25(c)	0.02	0.23	0.01	0.24	0.02
80	0.23(c)	0.05	0.22	0.02	0.24	0.02
81	0.23(c)	0.02	0.22	0.02	0.23	0.02
82	0.25(c)	0.03	0.24	0.01	0.25	0.02
83	0.25(c)	0.02	0.24	0.02	0.25	0.02
84	0.23(c)	0.02	0.23	0.02	0.24	0.02
85	0.26(c)	0.02	0.24	0.02	0.25	0.02
86	0.24	0.02	0.26	0.02	0.26	0.02
All	0.23	0.02	0.24	0.00	0.24	0.02

(a) This preoperational mean is for 1982 - 1983 data only.
(b) 1985 TLD missing
(c) There was only one annual exchange during the preoperational period.
(d) Stations 49-56 were first monitored during Fourth Quarter 1983. Station 61 was added in 1989.

TABLE 5-6

1991 MEAN QUARTERLY VERSUS ANNUAL TLD DATA
Results in mR/day

	QUARTERLY TLDS		ANNUAL TLDS	
STATION	MEAN*	STANDARD ERROR	MEAN**	STANDARD DEVIATION(2σ)
1	0.26	0.01	0.24	0.02
2	0.25	0.01	0.23	0.01
3	0.25	0.01	0.23	0.02
4	0.24	0.01	0.21	0.01
5	0.24	0.01	0.22	0.02
6	0.24	0.01	0.22	0.02
7	0.25	0.01	0.23	0.02
8	0.28	0.01	0.26	0.01
9	0.24	0.01	0.22	0.02
10	0.25	0.01	0.23	0.02
11	0.25	0.00	0.23	0.02
12	0.27	0.01	0.25	0.02
13	0.25	0.01	0.23	0.02
14	0.25	0.00	0.23	0.02
15	0.27	0.01	0.25	0.02
16	0.26	0.01	0.24	0.02
17	0.26	0.01	0.24	0.02
18	0.26	0.01	0.24	0.01
19	0.26	0.01	0.23	0.02
20	0.25	0.01	0.24	0.02
21	0.24	0.01	0.22	0.02
22	0.25	0.01	0.24	0.02
23	0.25	0.01	0.23	0.02
24	0.26	0.01	0.24	0.02
25	0.27	0.01	0.26	0.02
40	0.24	0.01	0.22	0.02
41	0.27	0.01	0.26	0.02
42	0.27	0.01	0.24	0.02
43	0.27	0.01	0.25	0.02
44	0.25	0.01	0.23	0.02
45	0.25	0.01	0.23	0.02
46	0.31	0.01	0.29	0.02
47	0.24	0.01	0.22	0.02
49	0.25	0.01	0.24	0.02
50	0.25	0.01	0.22	0.02

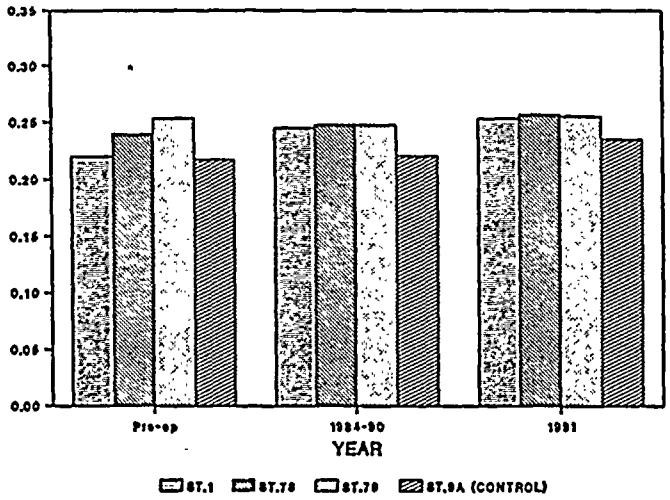
* Mean of the quarterly results.
**Mean of four readout areas on each TLD.

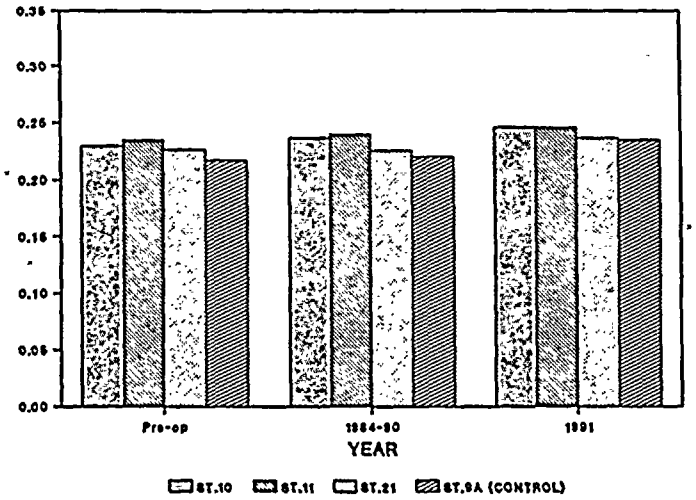
TABLE 5-6 (Cont.)

1991 MEAN QUARTERLY VERSUS ANNUAL TLD DATA
Results in mR/day

	QUARTERLY TLDS		ANNUAL TLDS	
STATION	MEAN*	STANDARD ERROR	MEAN**	STANDARD DEVIATION(2σ)
51	0.25	0.01	0.23	0.02
53	0.28	0.01	0.26	0.02
54	0.26	0.01	0.25	0.02
55	0.25	0.01	0.23	0.02
56	0.26	0.01	0.24	0.02
61	0.28	0.01	0.26	0.02
71 (1S)	0.28	0.03	0.26	0.02
72 (2S)	0.27	0.01	0.26	0.02
73 (3S)	0.25	0.01	0.22	0.01
74 (4S)	0.28	0.01	0.25	0.02
75 (5S)	0.26	0.01	0.24	0.02
76 (6S)	0.25	0.01	0.24	0.02
77 (7S)	0.26	0.01	0.24	0.02
78 (8S)	0.25	0.01	0.23	0.02
79 (9S)	0.26	0.01	0.24	0.02
80 (10S)	0.25	0.01	0.24	0.02
81 (11S)	0.25	0.01	0.23	0.02
82 (12S)	0.27	0.01	0.25	0.02
83 (13S)	0.26	0.01	0.25	0.02
84 (14S)	0.26	0.01	0.24	0.02
85 (15S)	0.27	0.01	0.25	0.02
86 (16S)	0.28	0.02	0.26	0.02

* Mean of the quarterly mean results.
**Mean of four readout areas on each TLD.





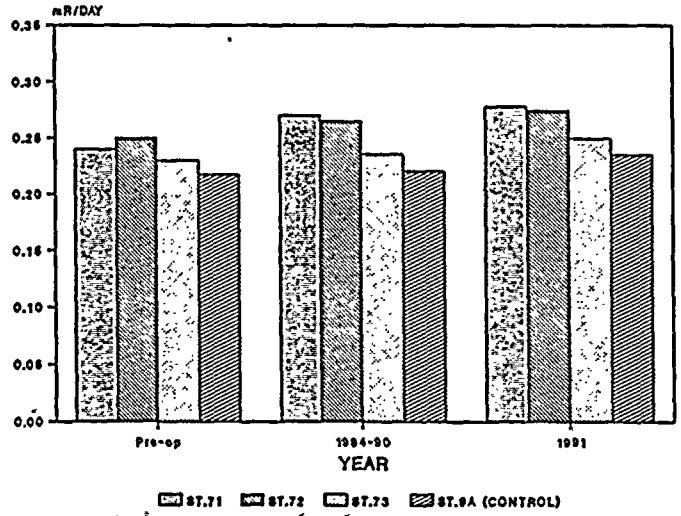
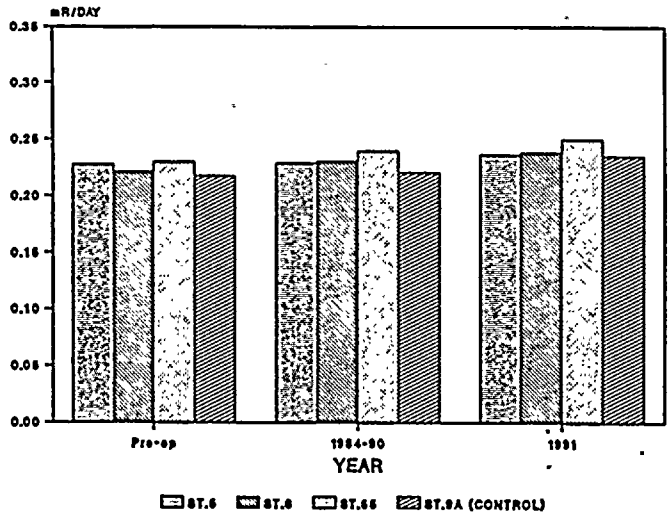
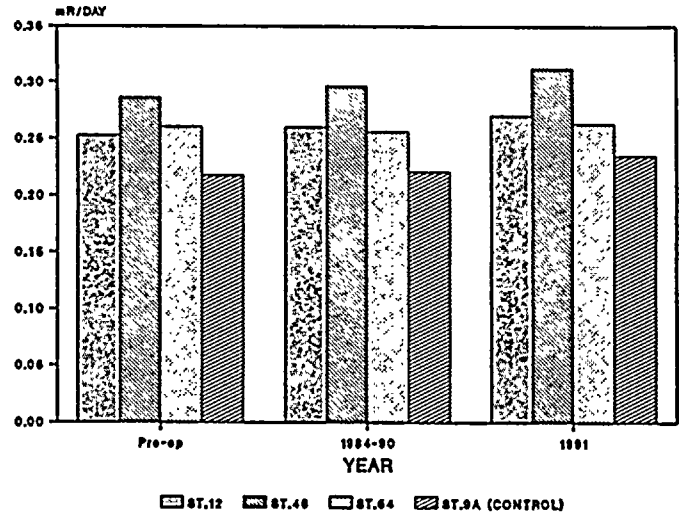


FIGURE 5-1
MEAN QUARTERLY TLD RESULTS FOR NEAR-PLANT LOCATIONS
AND THE CONTROL LOCATION (STATION 9A) FOR THE PREOPERATIONAL PERIOD, 1984-1990, AND 1991





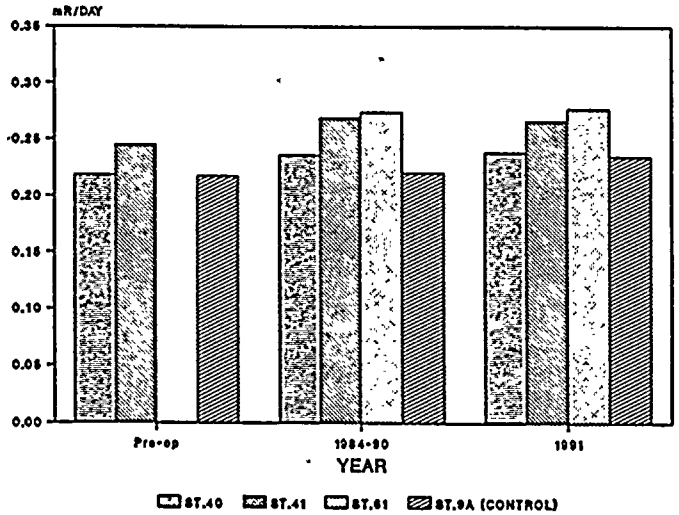
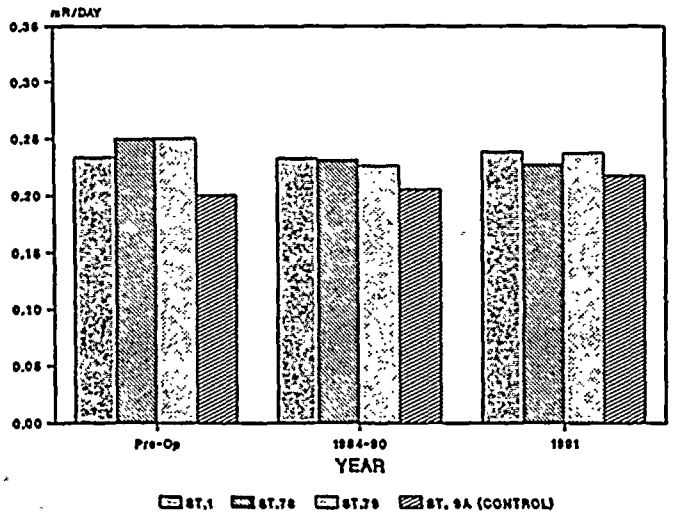


FIGURE 5-2
MEAN QUARTERLY TLD RESULTS FOR REMOTE LOCATIONS
AND THE CONTROL LOCATION (STATION 9A) FOR THE PREOPERATIONAL PERIOD, 1984-1990, AND 1991



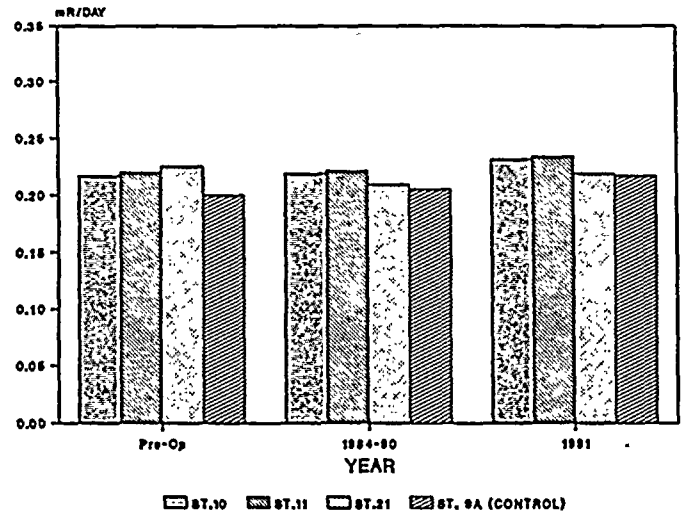


FIGURE 5-3
ANNUAL TLD RESULTS FOR NEAR-PLANT LOCATIONS
AND THE CONTROL LOCATION (STATION 9A) FOR THE PREOPERATIONAL PERIOD, 1984-1990, AND 1991

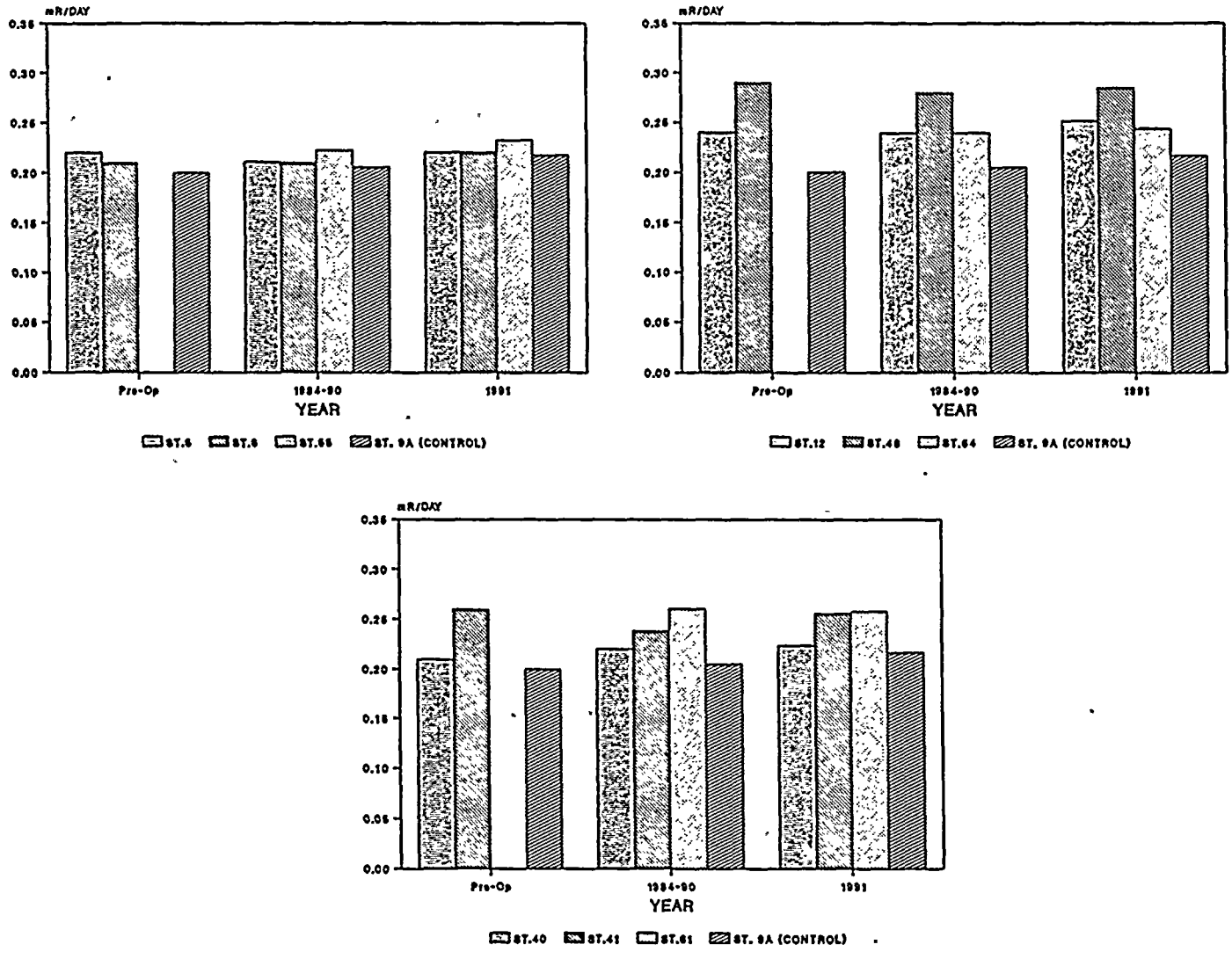


FIGURE 5-4
ANNUAL TLD RESULTS FOR REMOTE LOCATIONS
AND THE CONTROL LOCATION (STATION 9A) FOR THE PREOPERATIONAL PERIOD, 1984-1990, AND 1991

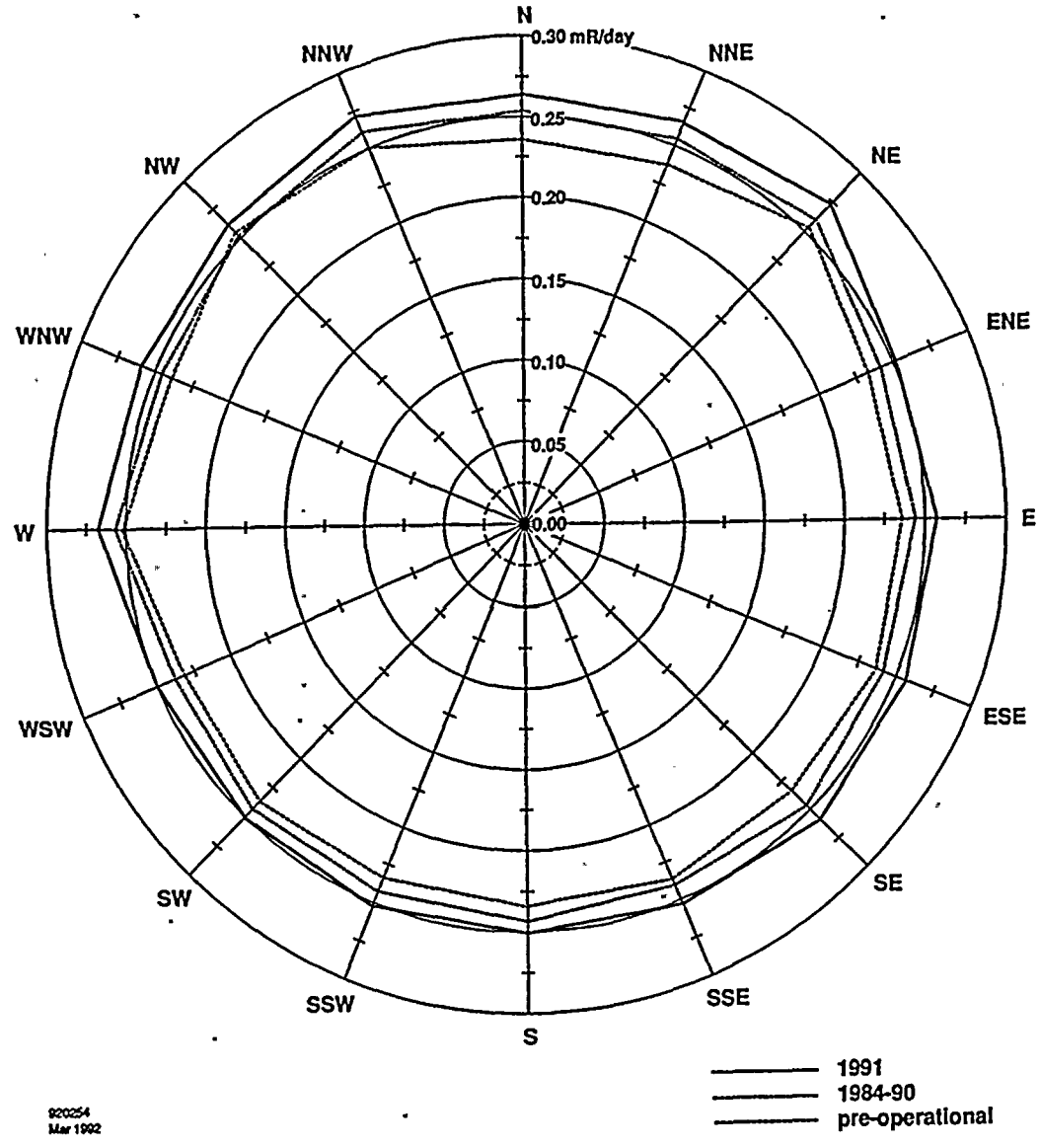
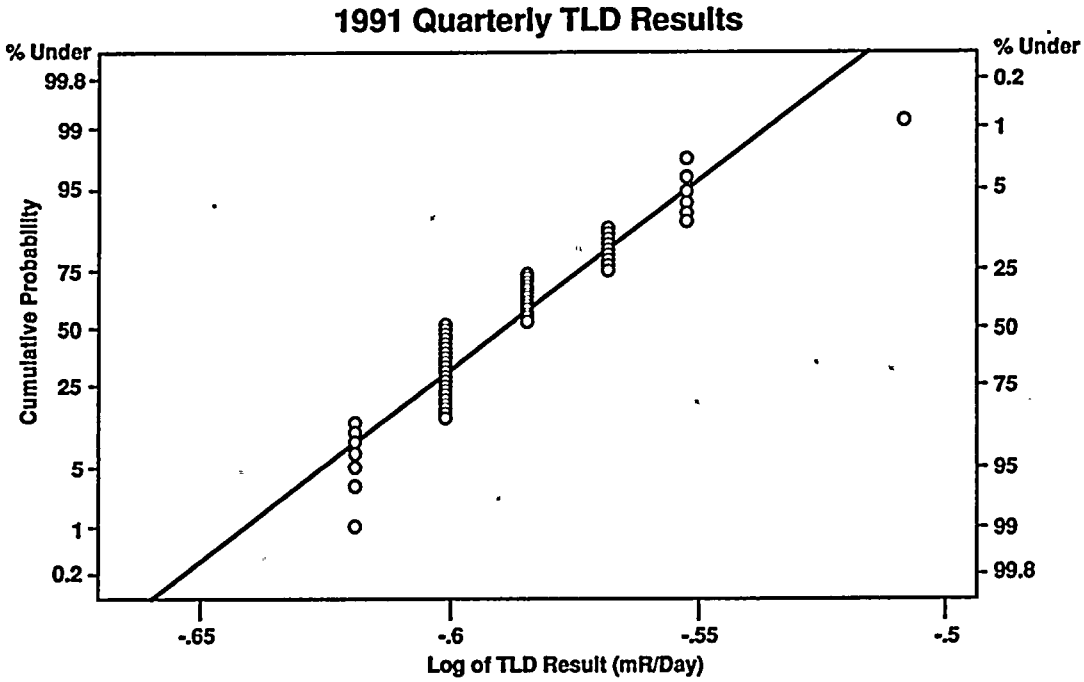


FIGURE 5-5
MEAN 1991 QUARTERLY TLD RESULTS FOR LOCATIONS IN EACH METEOROLOGICAL SECTOR COMPARED TO THE MEAN PREOPERATIONAL AND PREVIOUS OPERATIONAL RESULTS



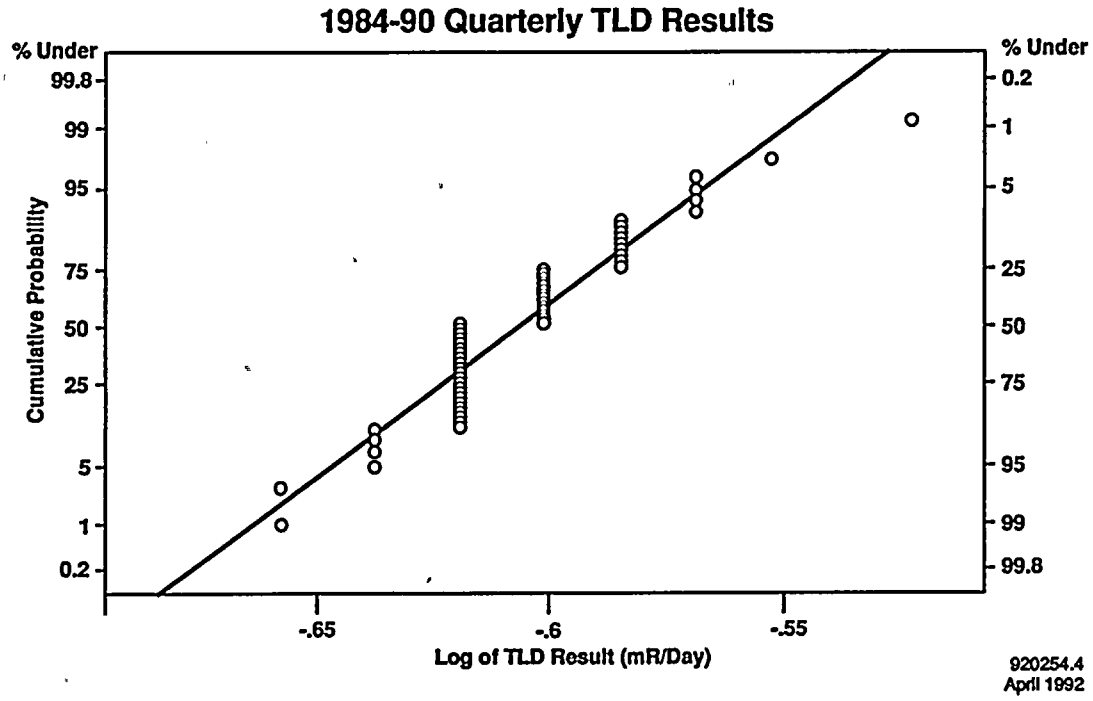


FIGURE 5-6
CUMULATIVE PROBABILITY PLOTS OF THE 1991 AND 1984-1990 QUARTERLY TLD RESULTS

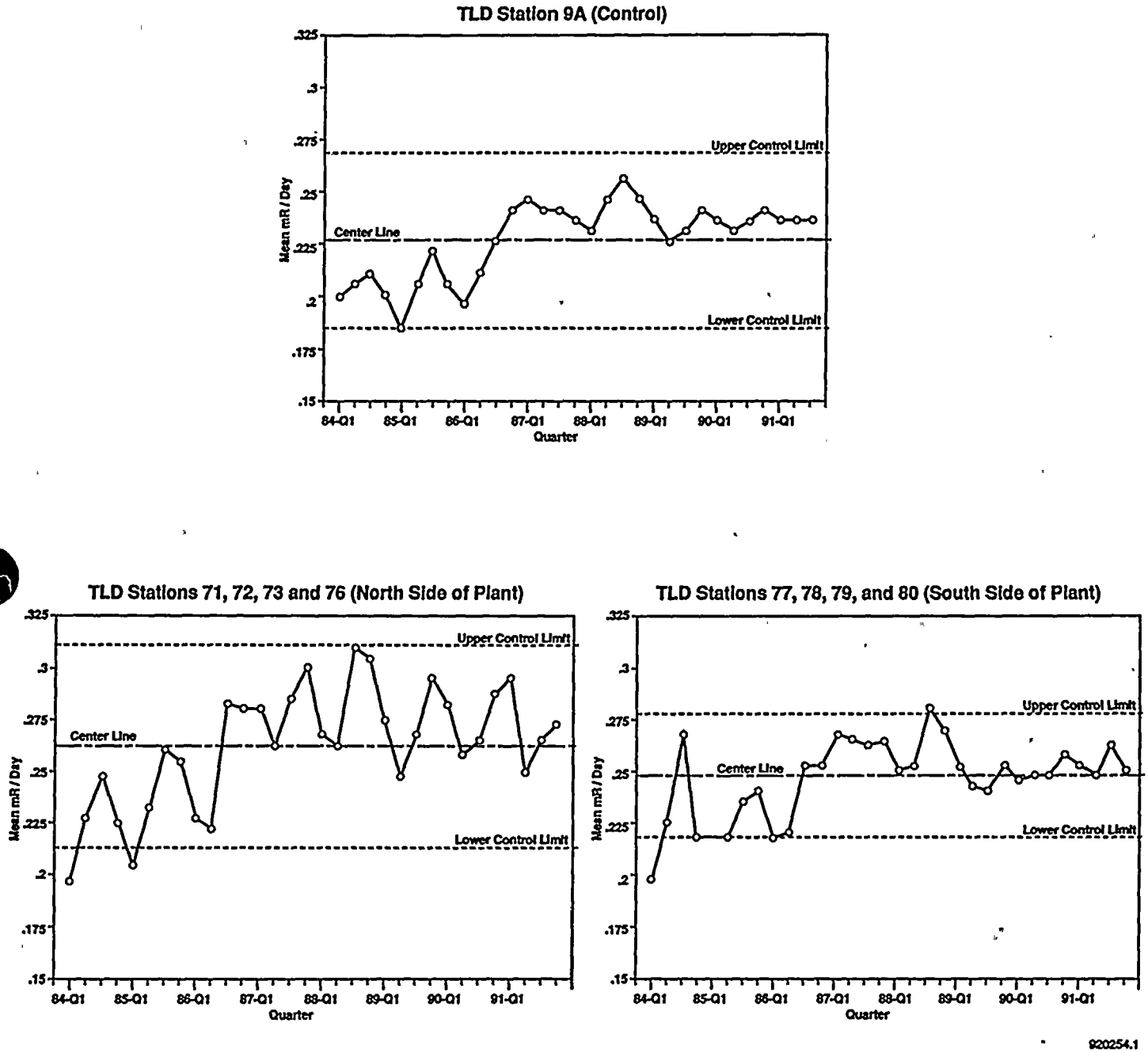
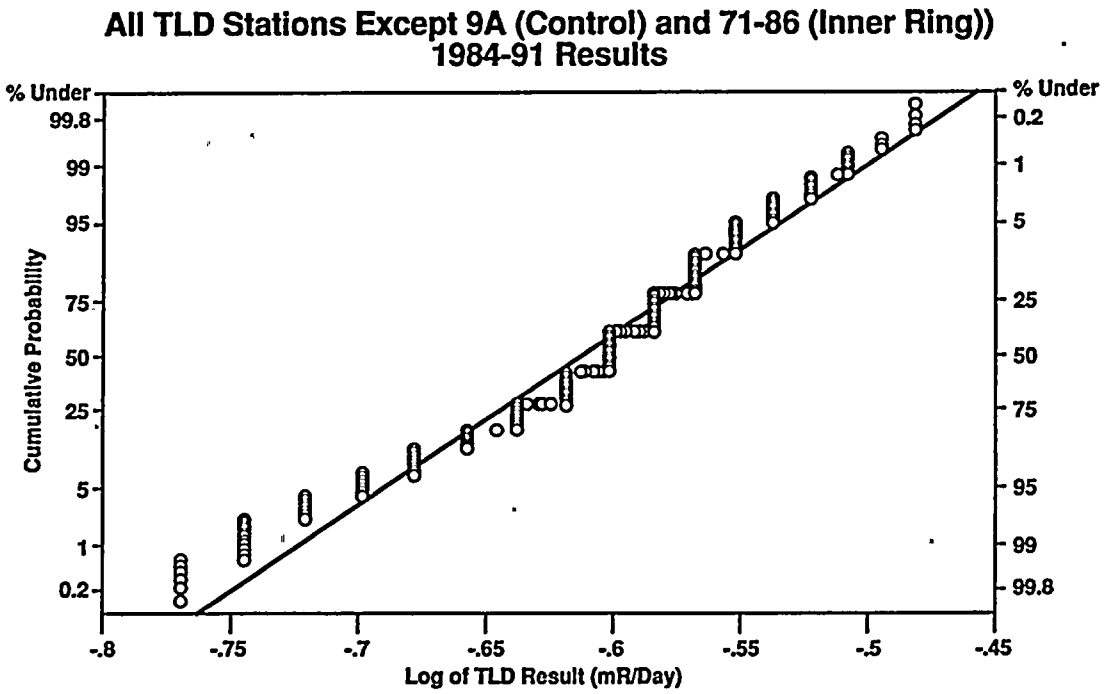


FIGURE 5-7
CONTROL CHARTS OF MEAN TLD RESULTS FOR NEAR-PLANT STATIONS
AND FOR THE CONTROL LOCATION (STATION 9A) FROM 1984-1991



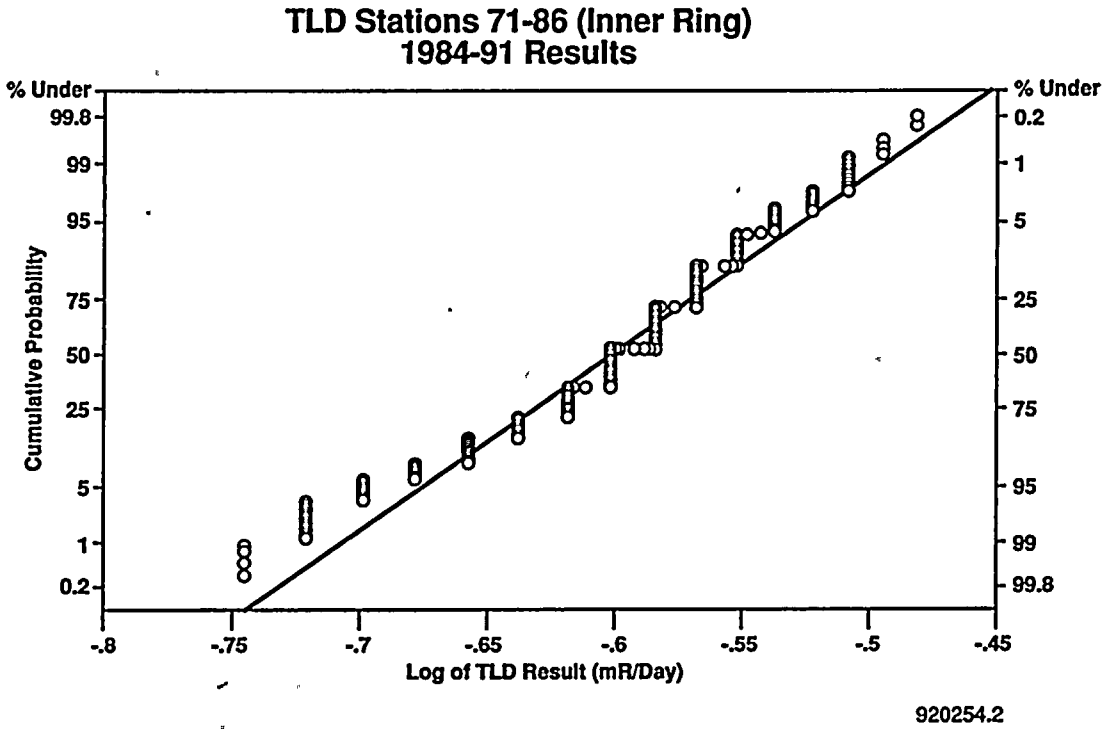
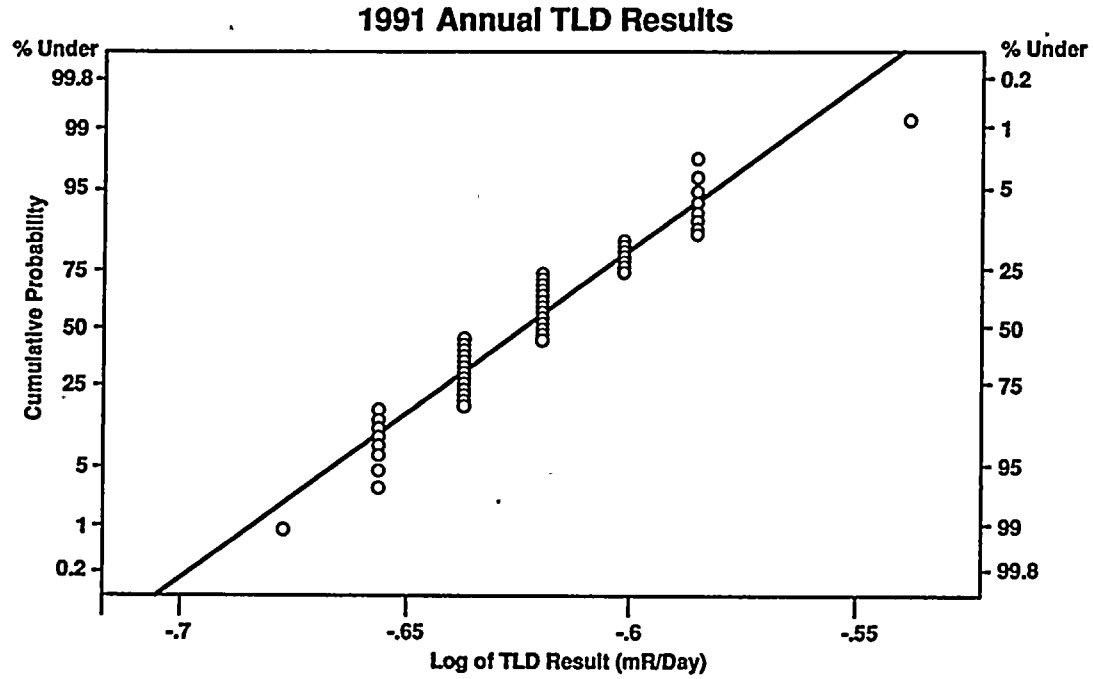


FIGURE 5-8
CUMULATIVE PROBABILITY PLOTS COMPARING THE INNER RING TLD RESULTS WITH THE RESULTS OF ALL OTHER INDICATOR STATIONS



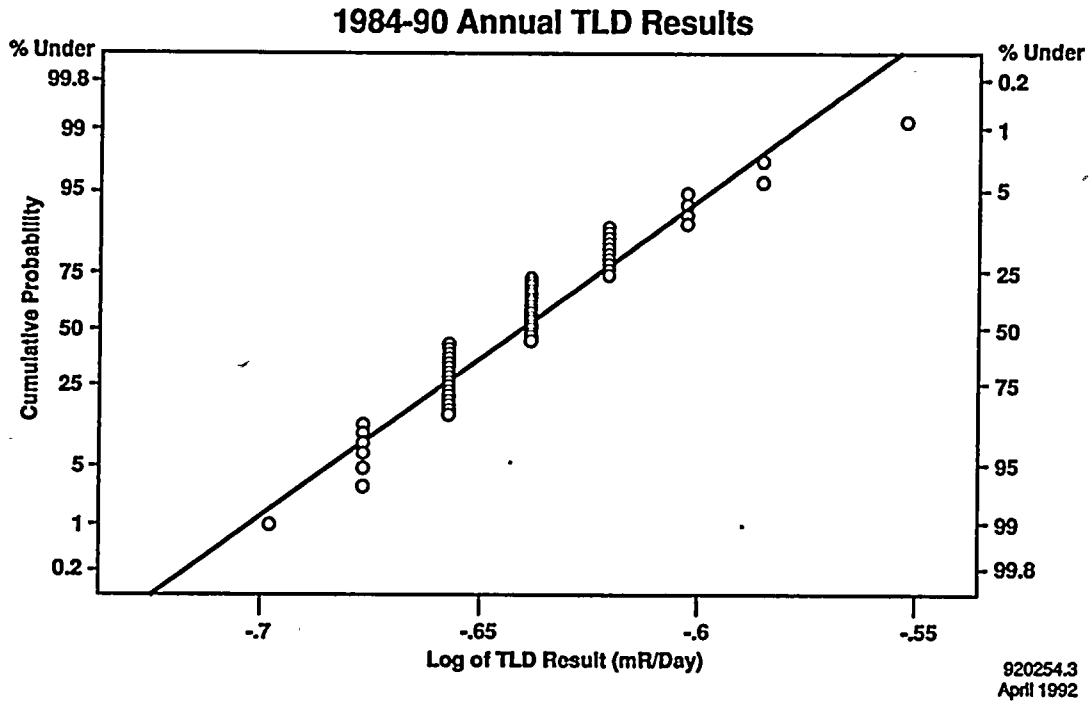


FIGURE 5-9
CUMULATIVE PROBABILITY PLOTS OF THE 1991 AND 1984-1990 ANNUAL TLD RESULTS

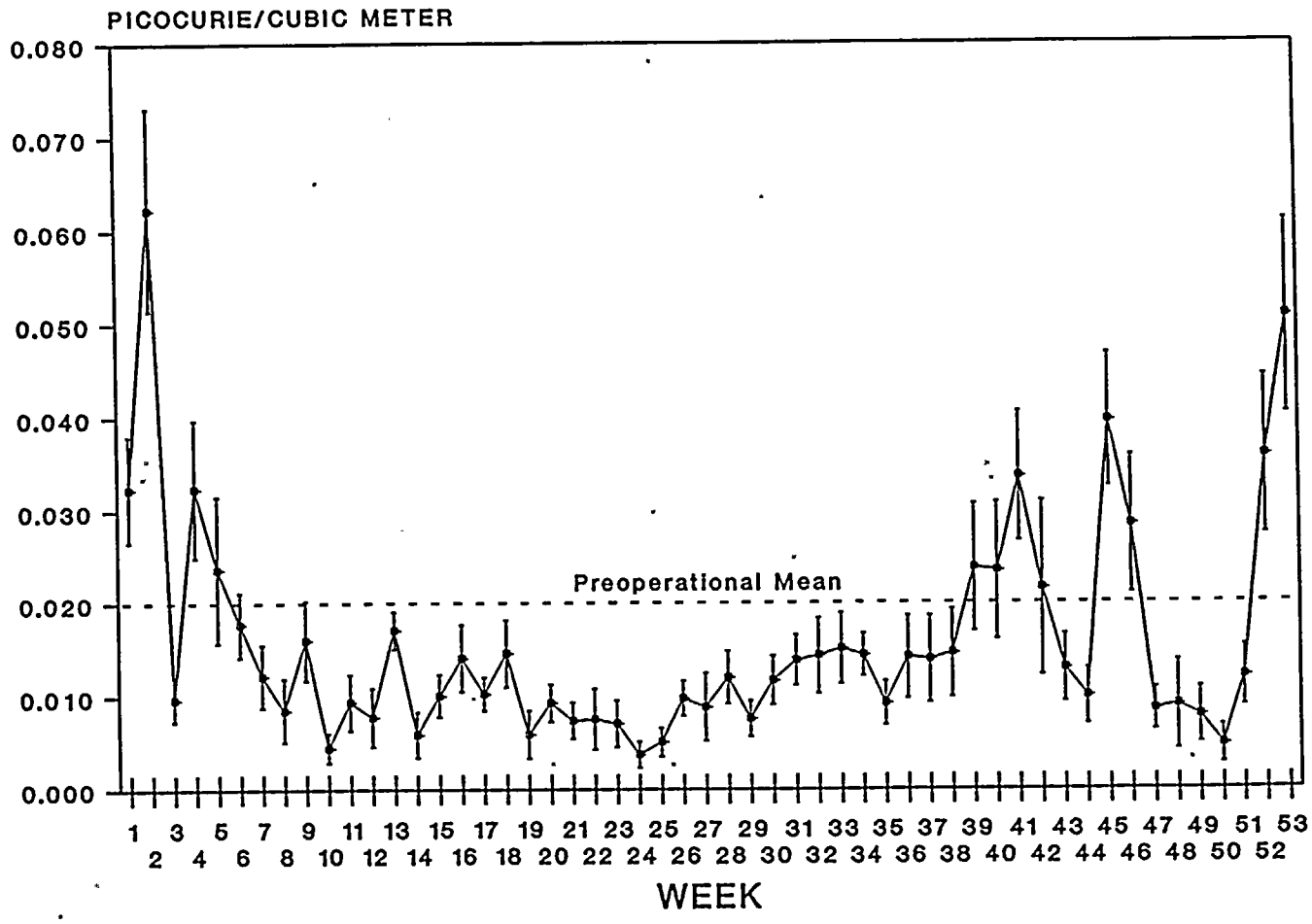
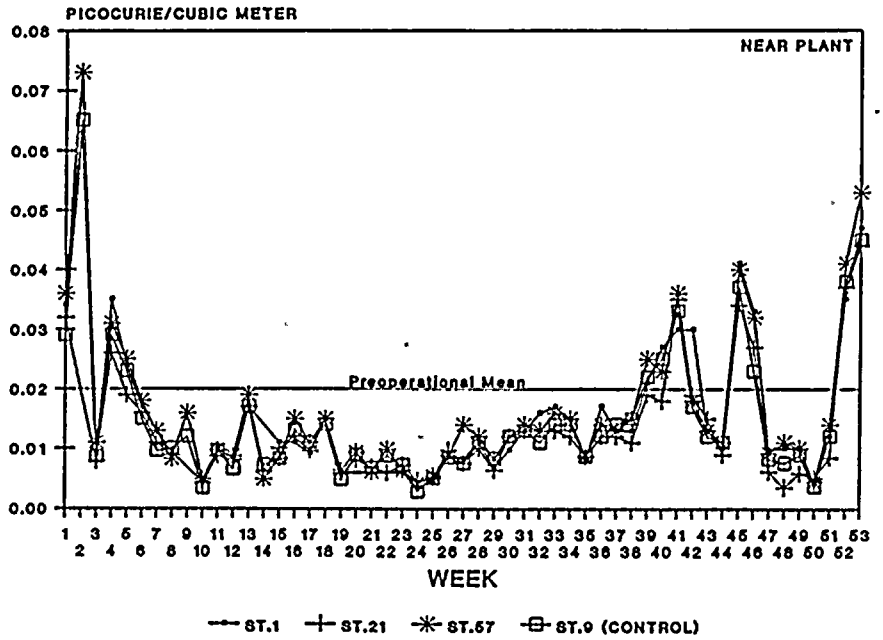


FIGURE 5-10
MEAN WEEKLY 1991 GROSS BETA IN AIR RESULTS



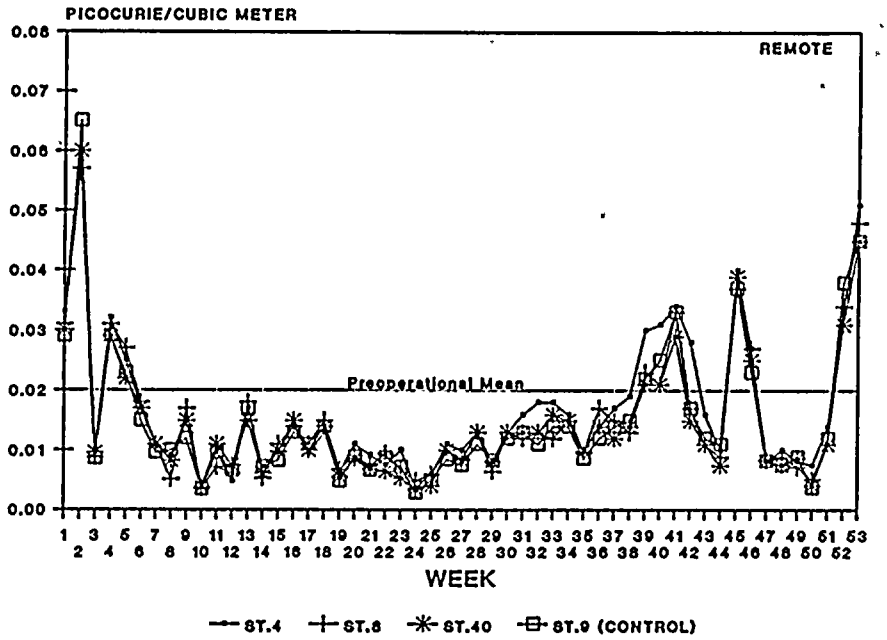
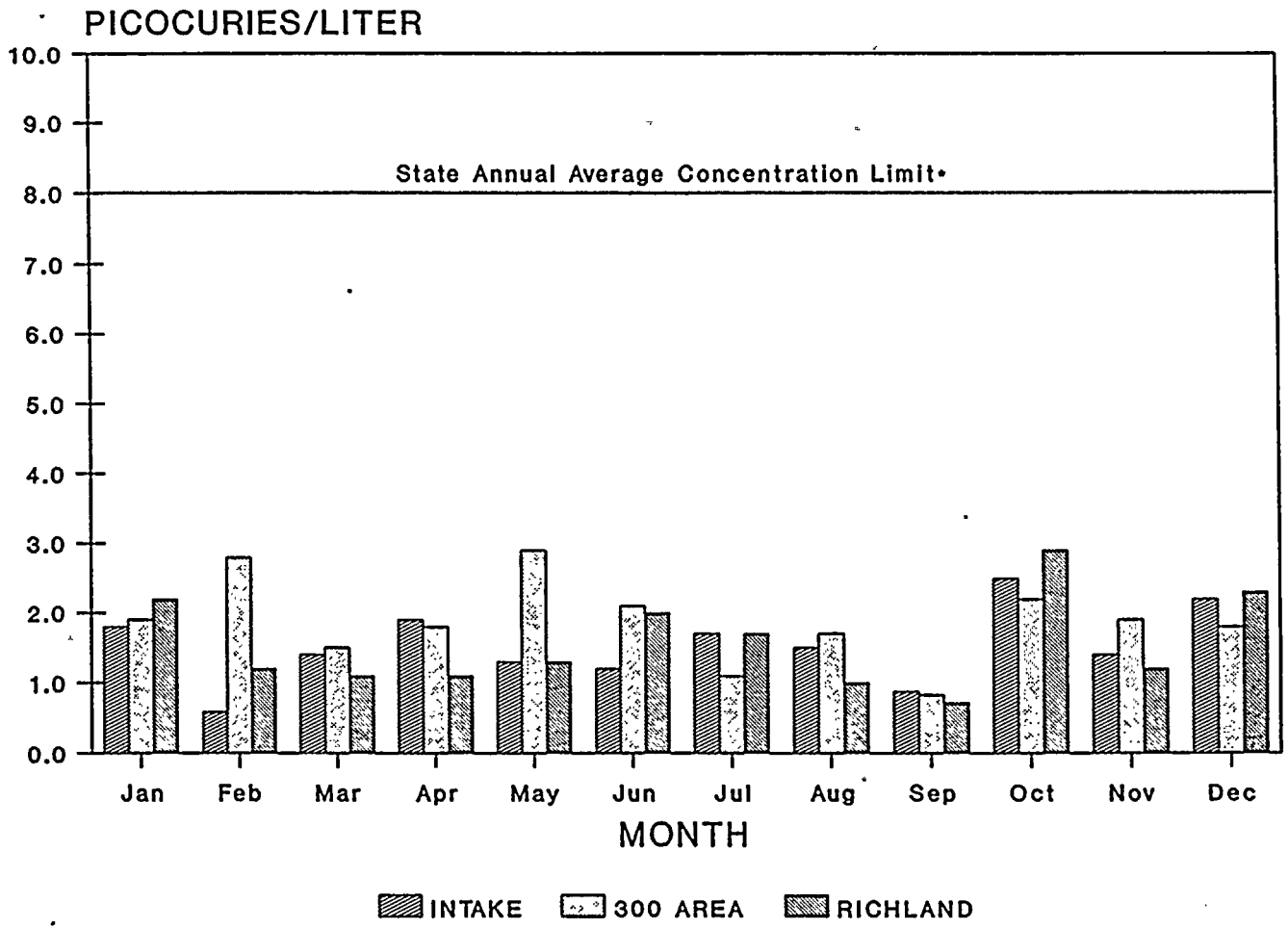
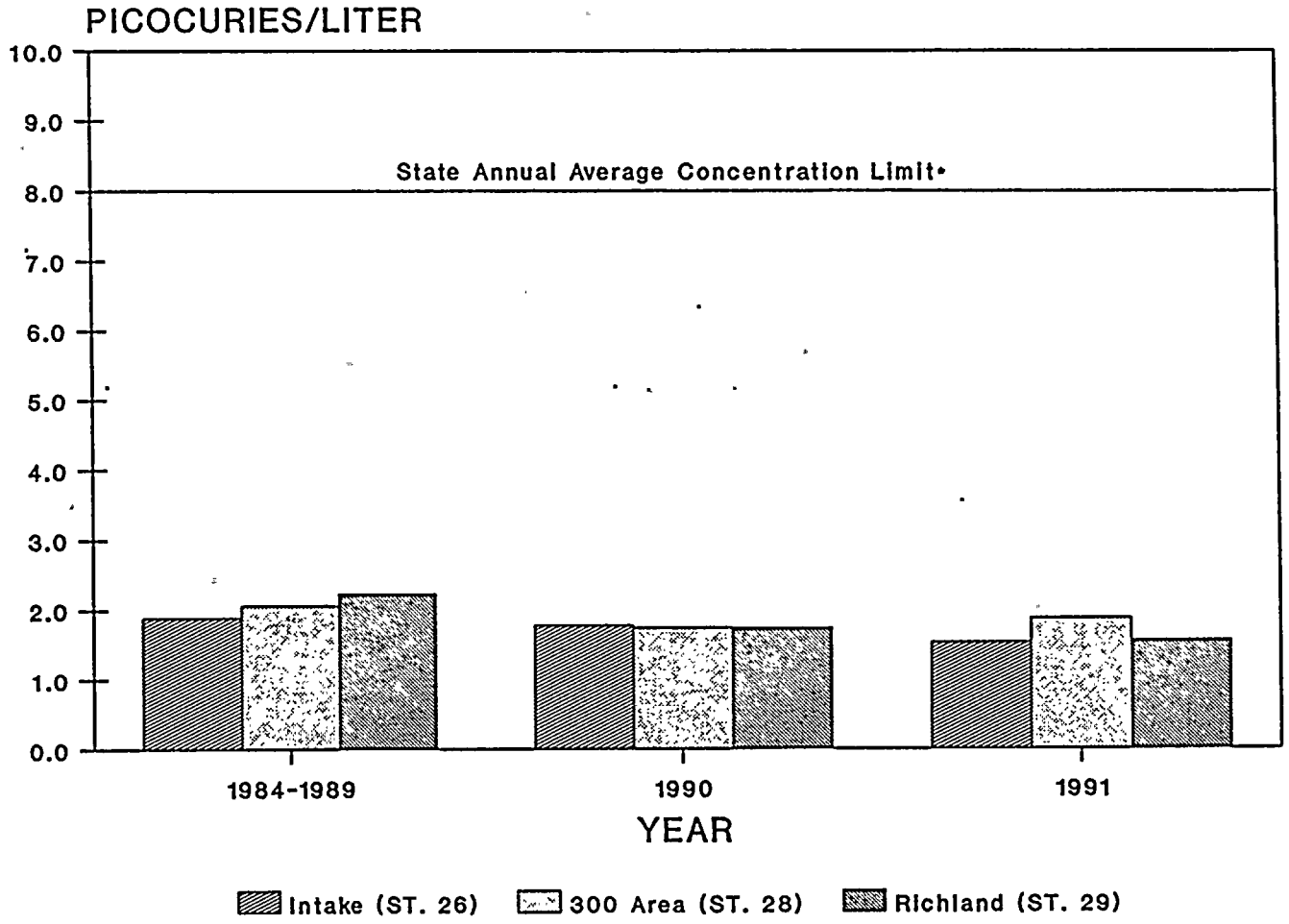


FIGURE 5-11
WEEKLY GROSS BETA IN AIR RESULTS FOR NEAR-PLANT AND REMOTE SAMPLING LOCATIONS VERSUS THE RESULTS FOR THE CONTROL LOCATION (STATION 9A)



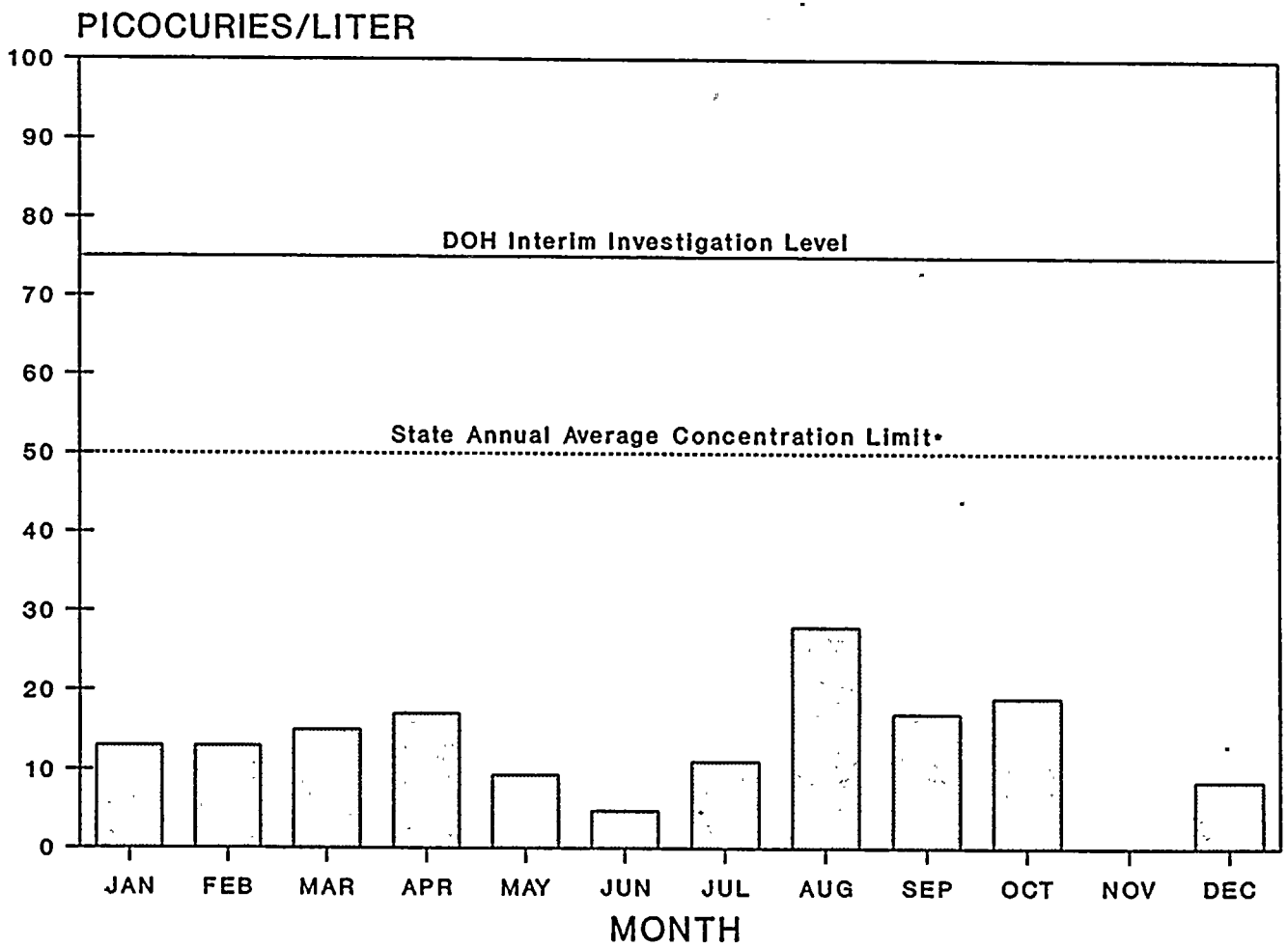
*NOTE: The maximum average annual concentration of strontium-90 for compliance to the 4 mrem/year dose limitation for drinking water is 8 pCi/liter.

FIGURE 5-12
1991 GROSS BETA IN RIVER/DRINKING WATER RESULTS



* Assuming strontium-90, the maximum average concentration for compliance to state dose limitations is 8 pCi/liter.

FIGURE 5-13
MEAN GROSS BETA IN RIVER/DRINKING WATER RESULTS FOR 1984 - 1989, 1990 AND 1991



*NOTE: For compliance to the 4 mrem/year state dose limitation, the annual average concentration of gross beta in drinking water is 50 pCi/liter.

FIGURE 5-14
1991 GROSS BETA IN DISCHARGE WATER RESULTS

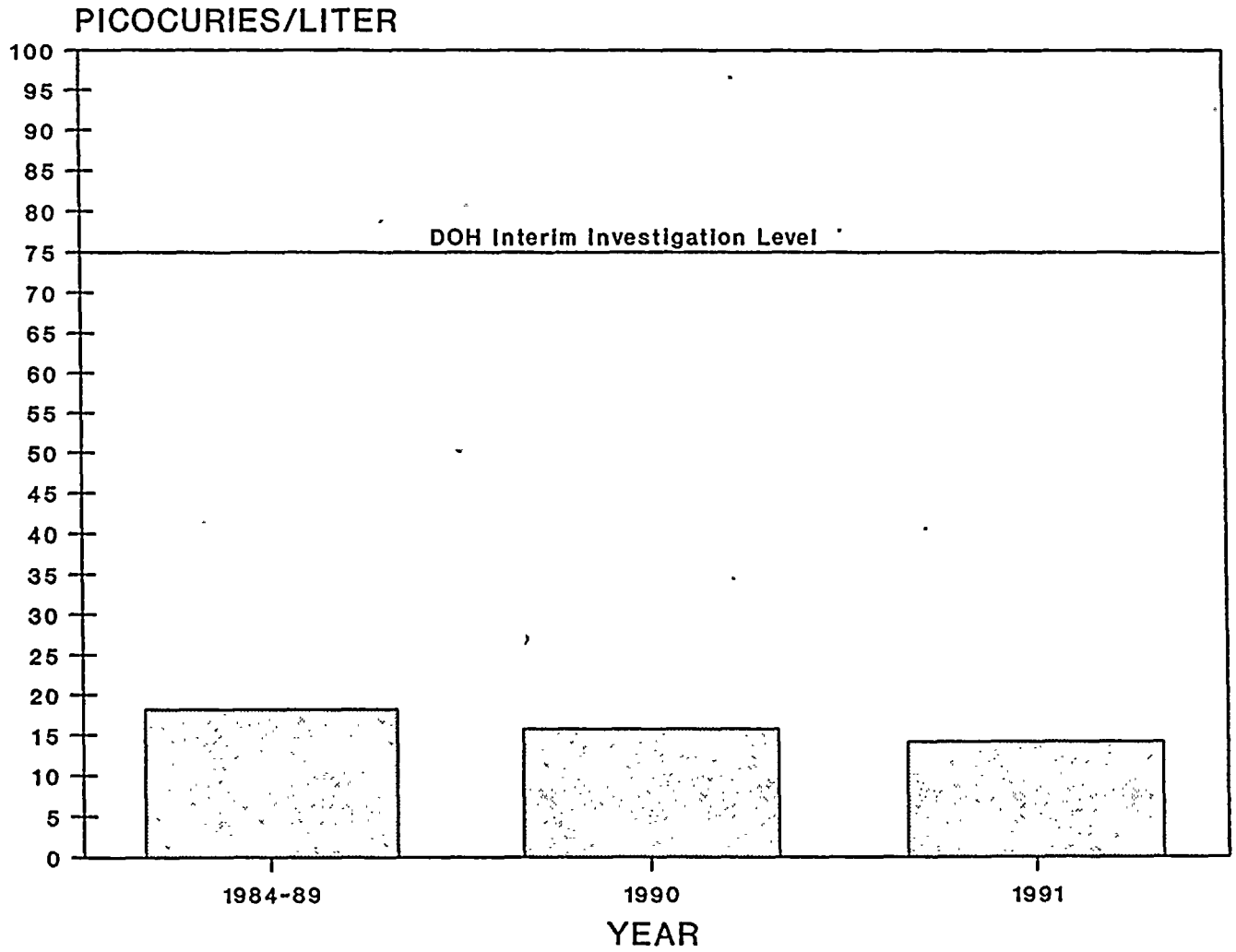


FIGURE 5-15
MEAN GROSS BETA IN DISCHARGE WATER RESULTS FOR 1984 - 1989, 1990 AND 1991

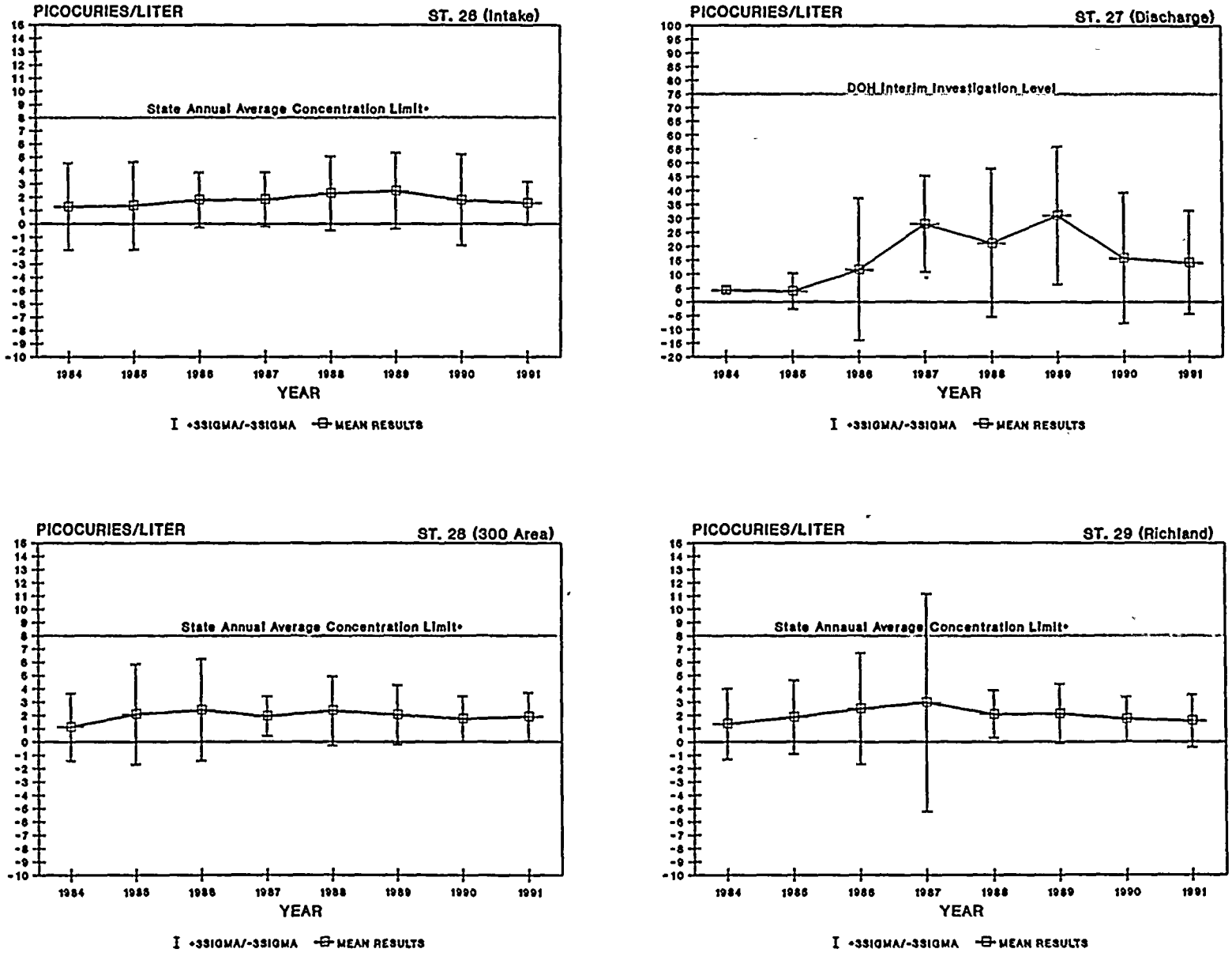


FIGURE 5-16
MEAN GROSS BETA RESULTS (±3 SIGMA) FOR RIVER/DRINKING AND DISCHARGE WATER SAMPLES FROM 1984 TO 1991

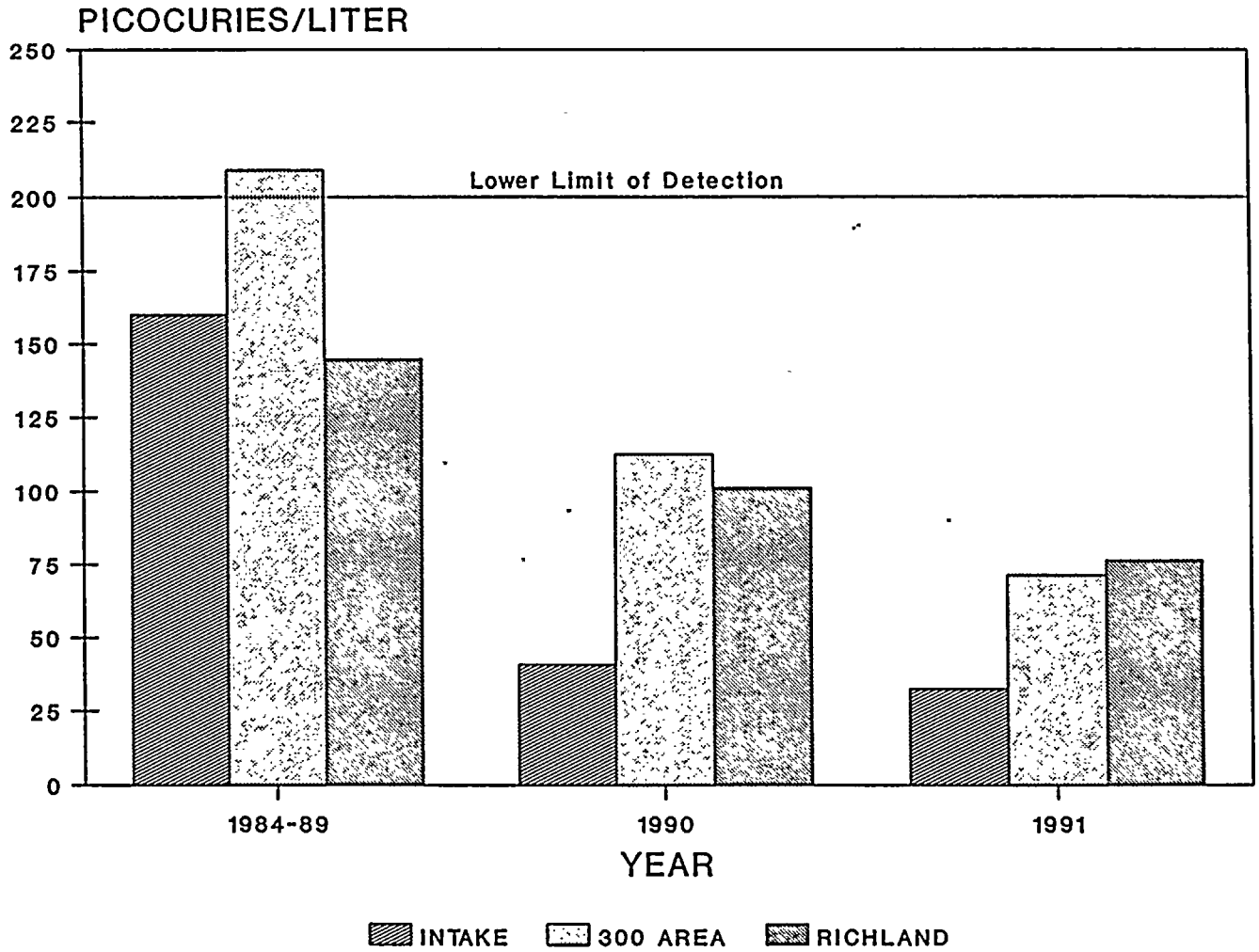


FIGURE 5-17
1991 MEAN TRITIUM IN RIVER/DRINKING WATER RESULTS FOR 1984-1989, 1990, AND 1991

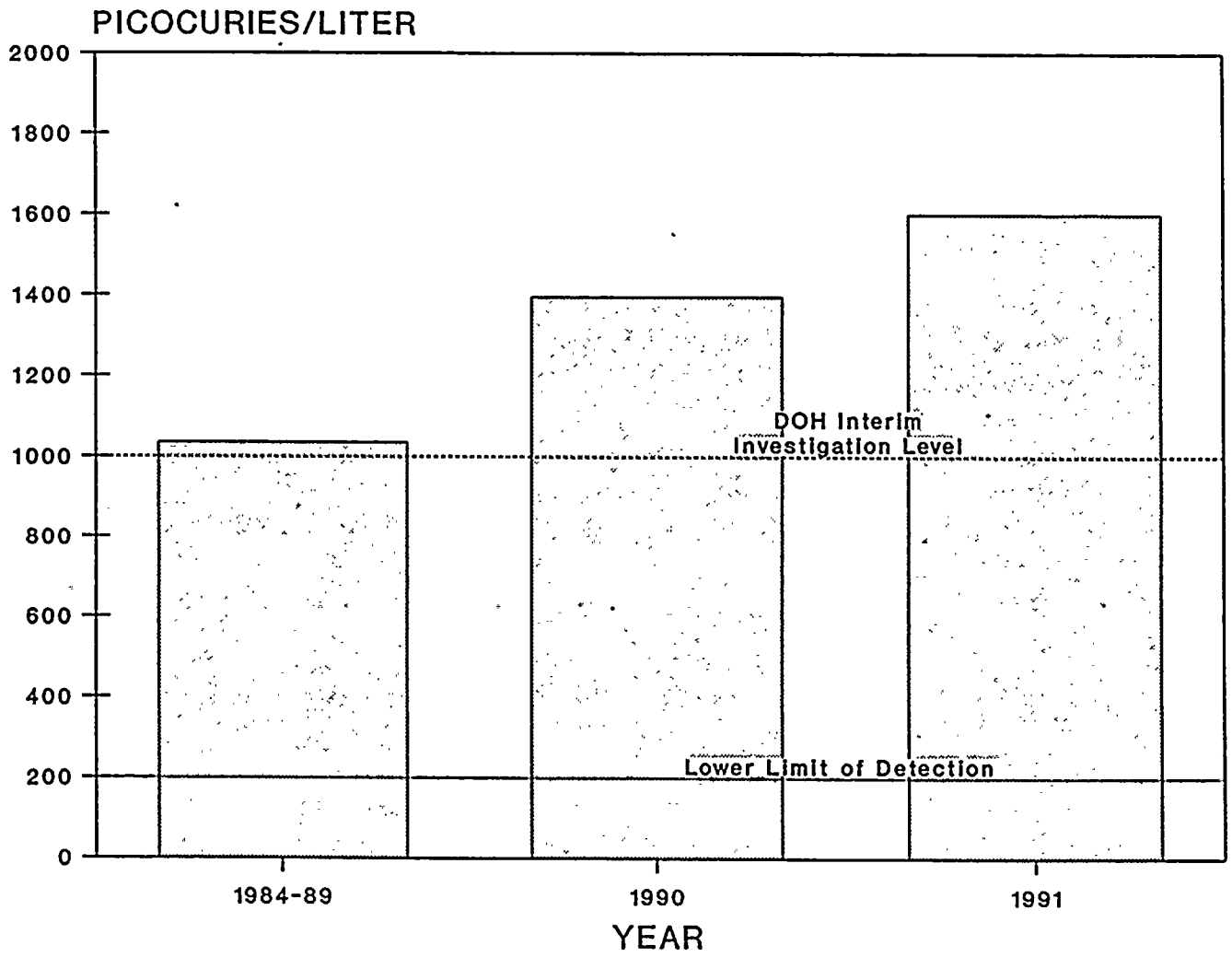


FIGURE 5-18
MEAN TRITIUM IN DISCHARGE WATER RESULTS FROM 1984-1989, 1990 AND 1991

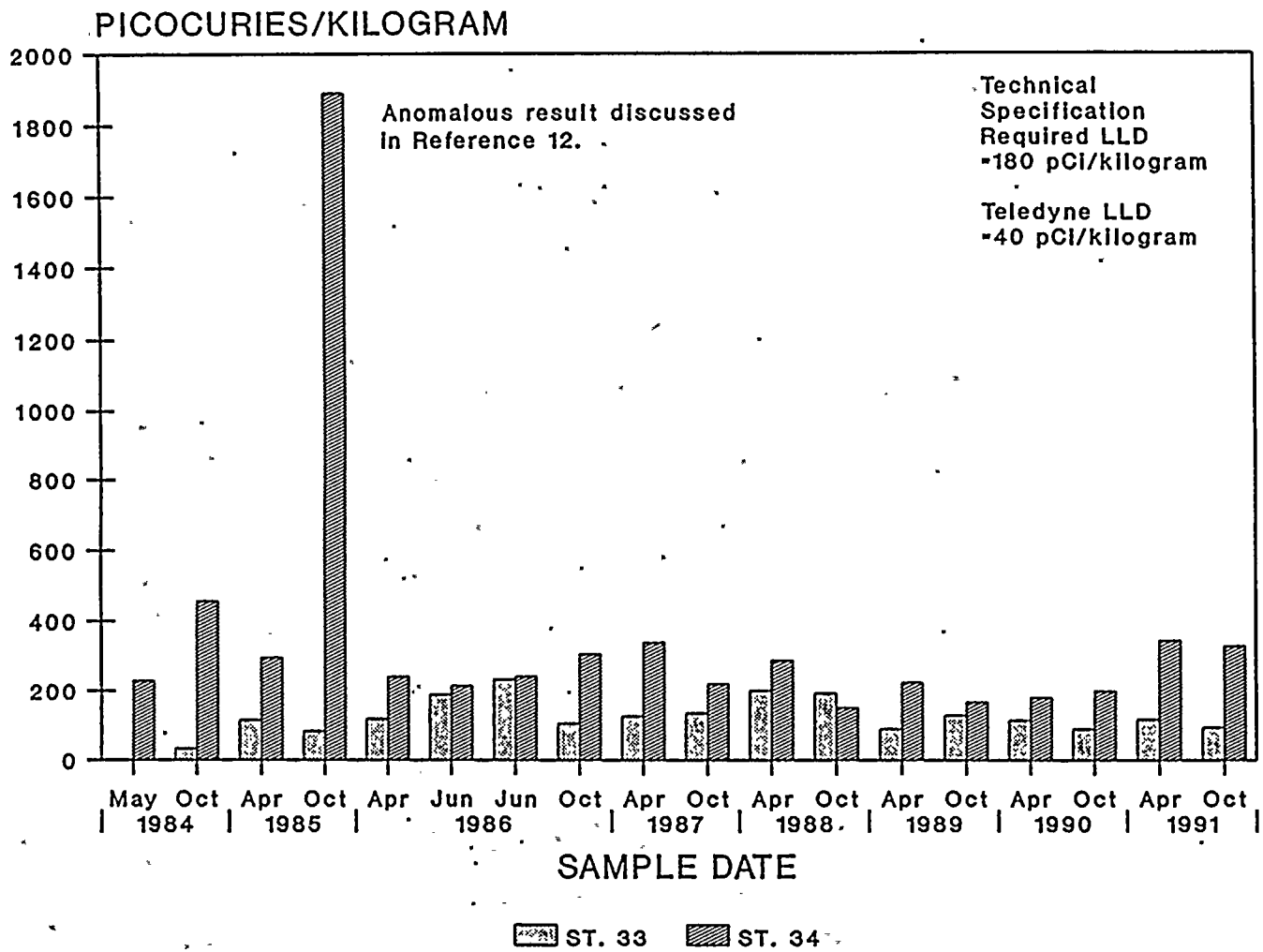


FIGURE 5-19
CESIUM-137 IN SEDIMENT RESULTS FROM 1984 TO 1991

6.0 QUALITY ASSURANCE AND QUALITY CONTROL

The REMP is designed to meet the quality assurance and quality control criteria of Regulatory Guide 4.15. To accomplish this, the REMP requires that its analytical contractors meet these criteria also. In-depth audits are performed of the REMP records and activities and the records and activities of its support organizations at least annually by the Supply System Corporate Licensing and Assurance group.

Quality assurance and technical audits of the analytical contractor, Teledyne Isotopes, are also conducted annually to verify their compliance to regulatory and contractual requirements. The adequacy of their quality assurance program is also assessed during the audits.

Intercomparison programs, which involve the comparison of Supply System analytical results for samples containing known concentrations of various radionuclides with the known values and with the results reported by other monitoring programs, are also a major component of the quality assurance activities of the REMP. The program participates in the Environmental Protection Agency (EPA) and Environmental Measurements Laboratory (EML) intercomparison programs. It also participates in local and regional intercomparison studies. The following sections summarize the quality assurance and quality control aspects of the TLD and analytical components of the REMP.

6.1 Quality Control For the Supply System Environmental TLD Program

The Quality Control Program for the environmental TLD preparation, processing and evaluation is described in Figures 6-1 and 6-2. QA dosimeters, which are annealed just prior to being given a known exposure to 100 mR of cesium-137 gamma radiation and processed among the field dosimeters, serve as indicators that the readout, calibration and evaluation of the field dosimeters were properly performed. The number of QA dosimeters used during each processing is generally 10% of the number of field dosimeters. Since 1987 the same QA dosimeters have been used repeatedly throughout the year in order to track their sensitivity and to provide consistency from run to run.

If the mean QA dosimeter results are greater than $\pm$ 5% (or 5 mR) of the given exposure, an investigation into the source of the discrepancy is initiated. Evaluation of the 1991 QA dosimeter results indicated only small biases for the four quarters.

Control dosimeters (trip controls) are used for each set of field dosimeters to monitor the contribution of the exposure received by the field TLDs while in transit. The radiation background in the storage area is also monitored by a separate set of control dosimeters (building controls). If the trip control results are significantly greater than the building control results, the difference between the two is subtracted from the field dosimeters.

Spiked dosimeters, which are exposed to known levels of radiation below the 100 mR given to the QA dosimeters, were processed with the field dosimeters during each run to verify the accuracy of the environmental TLD evaluations. The results of these audit dosimeters processed during 1991

are presented in Table 6-1. Except for the third quarter spiked TLDs, all results were well within ±5% of the given exposure. The third quarter results indicate more variability than normally observed; however, that variability is still within the range expected for TLD systems.

During each environmental TLD processing, individual calibration factors are determined for each TLD by exposing the TLDs to 100 mR from an encapsulated cesium-137 source. The calibration exposure is determined from the exposure duration and the assessed source strength at 55 centimeters. As a quality control check for each calibration exposure, an NIST-traceable ionization chamber is also used to determine the calibration exposure. If the ionization chamber measurement does not agree with the calibration exposure to within ± 5% of the calculated value, an investigation is performed into the discrepancy and the TLD calibration is repeated, if necessary.

An additional aspect of the Quality Control Program for the TLDs is participation in intercomparison studies. The Supply System participated in the last International Intercomparison of Environmental Dosimeters, which was held in 1986, and in regional TLD intercomparisons in 1988 and 1991. The results of the 1991 intercomparison are contained in Table 6-2. Participating in this study were the U.S. Nuclear Regulatory Commission (NRC), the Oregon State Health Division (OHD), the Department of Energy contractor Battelle Pacific Northwest Laboratory (DOE/PNL), Portland General Electric Company's Trojan Nuclear Plant (PGE) and the Supply System (WPPSS). Each participant had a different TLD system and different methods of determining the exposure rate from the TLDs. One participant, in addition to a TLD system, used electrets, which measure using changes in electrical charge. The participating TLDs were exposed to an elevated environmental location (N8T), a low level environmental location (WPPSS#4), a low and higher level of cesium-137 and a low and a higher level of radium-226. The environmental exposures took place over the entire fourth quarter of 1991. The laboratory exposures were given at the middle of that quarter. TLDs given the laboratory exposures to cesium-137 and radium-226 were kept in lead caves before and after exposure. The Supply System environmental TLD performed well in this intercomparison.

6.2 Quality Control For the Analytical Program

Quality control for the analytical program involves two components: the quality control activities performed by the Supply System and the quality control program of the analytical contractor, Teledyne Isotopes. Both of these components are described in the following sections.

6.2.1 Supply System Quality Control Activities

The Supply System has participated in the U.S. Department of Energy Environmental Measurements Laboratory (EML) Quality Assessment Program since 1987. The Supply System results for the samples sent out in March and September of 1991 are listed on Table 6-3. The 25-30% difference observed previously between the cesium-137 results determined at Teledyne and the EML value was again evident in some of the 1991 intercomparison results. This appears to be due to a slight difference in the calibration of the gamma detectors at the two facilities. In addition, a cerium-144 result in water was high due to interference from cobalt-57. Otherwise, Supply System results agreed well with the EML expected values.

6.2.2 Teledyne Isotopes Quality Control Program

The goal of the quality control program at Teledyne Isotopes is to produce analytical results which are accurate, precise and supported by adequate documentation. The program is based on the requirements of 10CFR50, Appendix B, Regulatory Guide 4.15 and the program, as described in Quality Assurance Manual IWL-0032-395 and Quality Control Manual IWL-0032-365.

All measuring equipment is calibrated for efficiency at least annually using standard reference material traceable to the National Institute of Standards and Technology (NIST), formerly the National Bureau of Standards (NBS). For alpha and beta counting, check sources are prepared and counted every week day except holidays. Control charts are maintained with three-sigma limits specified. Backgrounds are usually measured at least once per week.

The efficiency of the gamma spectrometers is calibrated annually with a NIST traceable standard reference material selected to cover the energy range of the nuclides to be monitored and to include all of the geometries measured. Backgrounds are determined every other week and check sources are counted weekly. The energy resolution and efficiency are plotted at two energy levels (125.1 and 1274.4 Kev) on charts and held within three-sigma control limits.

The efficiency calibration factors of the tritium gas counters are determined annually by counting a NIST standard. This data is plotted on control charts with three-sigma limits. A background measurement is performed daily.

Control of sample identity is maintained by the assignment of a unique five-digit number which is maintained throughout the sample's history from sample receipt, log-in number assignment and designation of analysis to reporting the final analytical result. Besides ensuring sample accountability, Teledyne procedures also ensure the maintenance of sample integrity by controlling sample storage and taking steps to prevent contamination of samples.

Results are reviewed for reasonableness before being entered into the data system. Any results which are suspect, i.e., which are higher or lower than results in the past, are returned to the laboratory for recount. If a longer count, decay check, recount on another system or recalculation does not give acceptable results based on experience, a new aliquot is analyzed. The complete information about the sample is contained on the worksheets accompanying the sample results.

No deviations from written procedures occurred during 1991. Summaries of the results of internal blanks and spiked samples used for quality control are presented in Tables 6-4 and 6-5. A summary of the EPA cross-check sample results is presented in Table B-1 of Appendix B.

<u>Iodine-131 Cartridges</u>

One blank charcoal cartridge was analyzed with each set of cartridges, for a total of fifty-one blanks. The average result was -1.3±9.8E-01 pCi per cartridge. This was calculated from the results of quality control samples without considering detection limits.

Gross-Beta - Filters

One blank filter was measured with each set of filters except the set for May 28, 1991. A blank was not sent with that set of samples. Fifty-one blanks were counted. The average activity in total pCi was -1.0±0.2E+00, which indicated a relatively stable background for the filters, including the background of the gross beta proportional counters.

I-131 - Milk

A blank milk was analyzed with each group of samples assayed. The results showed that there was no contamination in the laboratory or counting area. The measurements of the blank samples (Table 6-4) indicated that there was no bias on the low background counters. The average activity for seventeen samples was -2.1±7.1E-02 pCi/liter. This was calculated from quality control samples, without considering detection limits. A total of fifty-two in-house blank milk samples were processed throughout 1991. The average result was 2.2±14.7E-02 pCi/liter.

Sr-90 - Milk and Water

Blank water samples were analyzed on a weekly basis. The average result of the blank water samples was 8.1±9.0E-02 pCi/liter. Fifty-two spiked water samples were analyzed. The average result was 3.8±0.4E+01 pCi/liter, compared with a spike level of 4.0±0.6E+01 pCi/liter. A total of twenty-five milk samples were spiked to a level of 4.0±0.6E+01 pCi/liter. The average activity determined for the spikes was 3.8±0.4E+01 pCi/liter, which was within the limits specified by the EPA Intercomparison Studies Program. A total of twenty-six blank milk samples were analyzed, with an average activity of 7.0±3.8E-01 pCi/liter of strontium-90.

Gross Beta - Water

Fifty-two blanks were prepared from distilled water. The average result, without considering detection limits, was 2.3±1.8E-01 pCi/liter. No contamination was indicated and the background level was low and stable. During 1991 fifty-two gross beta spike samples were analyzed, nine with a spike level of 2.1±0.5E+01 pCi/liter and forty-three with a spike level of 2.2±0.5E+01 pCi/liter. The average results were 1.8±0.2E+01 and 1.9±0.2E+01 pCi/liter. This was well within the guidelines of the EPA Intercomparison Studies Program.

Tritium in Water

Fifty-two blank samples were analyzed by gas counting. The average result was -4.9±38.9E+00 pCi/liter. During 1991 a total of fifty-two spiked tritium samples were analyzed, with seventeen having a spike level of 2.6±0.3E+03 pCi/liter and thirty-five having a spike level of 4.5±0.5E+03 pCi/liter. The average results were 2.5±0.1E+03 and 4.5±0.1E+03 pCi/liter respectively.

Gamma Spectroscopy

A blank water sample was analyzed on a weekly basis in the gamma spectroscopy laboratory. All nuclides were less than the normal level of detection, indicating no contamination. Spike samples were measured weekly using the Eu-154 peak at 1274.5 KeV. The average activity of fifty-two measurements was 1.42±0.02E+05 pCi/liter, compared with a spike level of 1.40±0.2E+05 pCi/liter.

TABLE 6-1

1991 ENVIRONMENTAL SPIKED DOSIMETER RESULTS

TLD DISTRIBUTION	GIVEN EXPOSURE (mR)	REPORTED EXPOSURE (mR)	BIAS (%)
First Quarter	20.0	20.3	1.5
		20.6	3.0
		20.6	3.0
Second Quarter	30.0	30.6	2.0
		29.3	-2.3
		30.3	1.0
Third Quarter	30.0	32.7	9.0
		31.7	5.6
		30.7	2.3
Fourth Quarter	20.0	20.6	3.0
		20.9	4.5
		20.3	1.5
Annual	60.0	60.7	1.1
		59.1	-1.5
		60.4	0.6

TABLE 6-2

1991 HANFORD TLD INTERCOMPARISON RESULTS

	Participants' Results ± 2σ						
EXPOSURE TYPE	WPPSS	PGE	OHD	OHD-Electret	NRC	DOE/PNL	GIVEN EXPOSURE
Environmental							
N8T (mR/day)	0.96±0.01	0.62±0.12	0.76±0.01	0.87[a]	(b)	0.75±0.03	---
WPPSS#4 (mR/day)	0.25±0.02	0.27±0.03	0.16±0.01	0.28[a]	0.21±0.02	0.24±0.02	---
Control-Field (mR/day)	0.09±0.00	0.13±0.01	0.08±0.01	0.07[a]	0.09±0.00	0.09±0.03	---
Laboratory							
Cesium-137-1 (mR)	29.2±0.8	36.9 ± 4.4	26.0±0.4	(c)	28.9±2.2	(d)	30.2
Cesium-137-2 (mR)	103.6±1.8	93.5 ±12.0	79.8±0.6	(c)	106.0±6.8	(d)	105.5
Control-Cesium-137(mR)	7.9±0.2	11.5 ± 1.4	7.1±0.1	(c)	8.1±0.4	(d)	---
Radium-226-1 (mR)	105.4±4.9	97.0 ±11.8	80.1±0.7	(c)	96.3±6.4	(d)	95.9
Radium-226-2 (mR)	18.8±0.3	30.6 ± 4.2	20.9±0.4	(c)	19.6±1.8	(d)	18.7
Control-Radium-226 (mR)	10.6±0.4	18.9 ± 2.0	10.4±0.1	(c)	9.7±0.6	(d)	---

(a) No standard deviation given.
(b) TLD damaged; no result received.
(c) No result received.
(d) Final results not received by publication.

TABLE 6-3

1991 ENVIRONMENTAL MEASUREMENTS LABORATORY (EML)
QUALITY ASSESSMENT PROGRAM RESULTS

Date	Sample Type	Nuclide	Teledyne Reported Result	Percent Error (2σ)	EML Value	Ratio Reported/EML
9103	Particulate Filter (total Bq)[1]	Be-7	5.83E+01	9	5.30E+01	1.10
		Mn-54	5.50E+00	10	4.80E+00	1.15
		Co-57	6.90E+00	10	5.82E+00	1.19
		Co-60	5.80E+00	10	5.14E+00	1.13
		Cs-137	5.70E+00	10	4.53E+00	1.26[2]
		Ce-144	6.10E+01	10	5.22E+01	1.17
9103	Soil (Bq/kg)	K-40	3.20E+02	6	3.74E+02	0.86
		Cs-137	1.95E+02	10	1.50E+02	1.30[2]
		Sr-90	1.07E+01	24	9.20E+00	1.16
9103	Vegetation (Bq/kg)	K-40	1.37E+03	10	1.15E+03	1.19
		Cs-137	8.47E+01	3	6.76E+01	1.25
9103	Water (Bq/l)	H-3	3.44E+02	29	3.61E+02	0.95
		Mn-54	2.08E+02	9	2.13E+02	0.98
		Co-57	2.07E+02	10	2.30E+02	0.90
		Co-60	1.85E+02	10	2.01E+03	0.92
		Sr-90	8.90E+00	4	8.63E+00	1.03
		Cs-137	1.74E+02	10	1.69E+02	1.03
		Ce-144	2.31E+02	2	3.51E+01	6.58[3]
9109	Particulate Filter (total Bq)	Be-7	5.18E+01	10	5.38E+01	0.96
		Mn-54	2.35E+01	10	2.43E+01	0.97
		Co-57	1.72E+01	9	1.66E+01	1.04
		Co-60	2.13E+01	9	2.30E+01	0.93
		Cs-137	2.75E+01	9	2.80E+01	0.98
		Ce-144	4.63E+01	10	5.08E+01	0.91
9109	Soil (Bq/kg)	K-40	4.37E+02	10	4.30E+02	1.02
		Sr-90	4.80E+00	39	3.78E+00	1.27
		Cs-137	3.84E+02	9	3.12E+02	1.23[2]
9109	Vegetation (Bq/kg)	K-40	1.10E+03	10	9.92E+02	1.11
		Cs-137	3.17E+01	10	2.71E+01	1.17
9109	Water (Bq/l)	H-3	9.99E+01	3	1.00E+02	1.00
		Mn-54	1.06E+02	10	1.03E+02	1.03
		Co-57	1.78E+02	9	1.66E+02	1.07
		Co-60	2.91E+02	10	2.91E+02	1.00
		Sr-90	8.50E+00	4	1.01E+01	0.84
		Cs-137	4.63E+01	12	4.60E+01	1.01
		Ce-144	3.26E+02	7	2.26E+03	1.44

(1) Bq = becquerel; the EML results are now reported in becquerels instead of picocuries. One picocurie equals 0.037 becquerel.

(2) This difference between the cesium-137 concentrations determined by Teledyne Isotopes and the EML lab appears to be a slight difference in calibration of the gamma detectors.

(3) The Ce-144 reported included a contribution from cobalt 57. Hand integration gave a result of 32.6 Bq/kg, which would have resulted in a ratio of 0.93.

TABLE 6-4

SUMMARY OF 1991 QUALITY CONTROL DATA: BLANKS

NUCLIDE	MEDIUM	BLANKS NUMBER		AVERAGE BLANK	UNITS
I-131	Milk	17	(a)	2.1± 7.1E-02	pCi/l
		52	(a)	2.2±14.7E-02	pCi/l
Sr-90	Milk	26	(d)	7.0± 3.8E-01	pCi/l
Sr-90	Water	52	(a)	8.1± 8.9E-02	pCi/l
H-3 (Gas Counting)	Water	52	(a)	-4.9±38.9E+00	pCi/l
Gross Beta	Water	52	(a)	2.3± 1.8E-01	pCi/l
Gamma	Water	52		*	pCi/l
Gross Beta	AP Filter	51	(c)	1.0± 0.2E+00	Total pCi
I-131	Charcoal	52	(a)	-1.3± 9.8E-01	Total pCi

*All nuclides less than minimum detection level.

(a) This average is calculated from the Supply System quality control samples, without considering detection limits.

(b) The in-house weekly quality control blanks for AP filters and charcoals are calculated in total pCi.

(c) This average includes only the blank AP filters analyzed for the Supply System. A blank planchet (counter background) and a blank filter are counted with each set of filters analyzed (approximately 10 sets per week).

(d) The highest detection level was used as the average of these samples.

TABLE 6-5

SUMMARY OF 1991 QUALITY CONTROL DATA: SPIKES

NUCLIDE	MEDIUM	SPIKED SAMPLES NUMBER	AVERAGE RESULT (pCi/l)	SPIKE LEVEL (pCi/l)
Gross Beta	Water	59	1.8±0.4E+01	2.1±0.5E+01
		43	1.9±0.2E+01	2.2±0.5E+01
H-3 (Gas Counting)	Water	17	2.5±0.1E+03	2.6±0.3E+03
		35	4.5±0.1E+03	4.5±0.5E+03
Sr-90	Water	52	3.8±0.2E+01	4.0±0.6E+01
Sr-90	Milk	52	3.8±0.4E+01	4.0±0.6E+01
Gamma (Eu-154)	Water	52	1.4±0.2E+05	1.4±0.2E+05

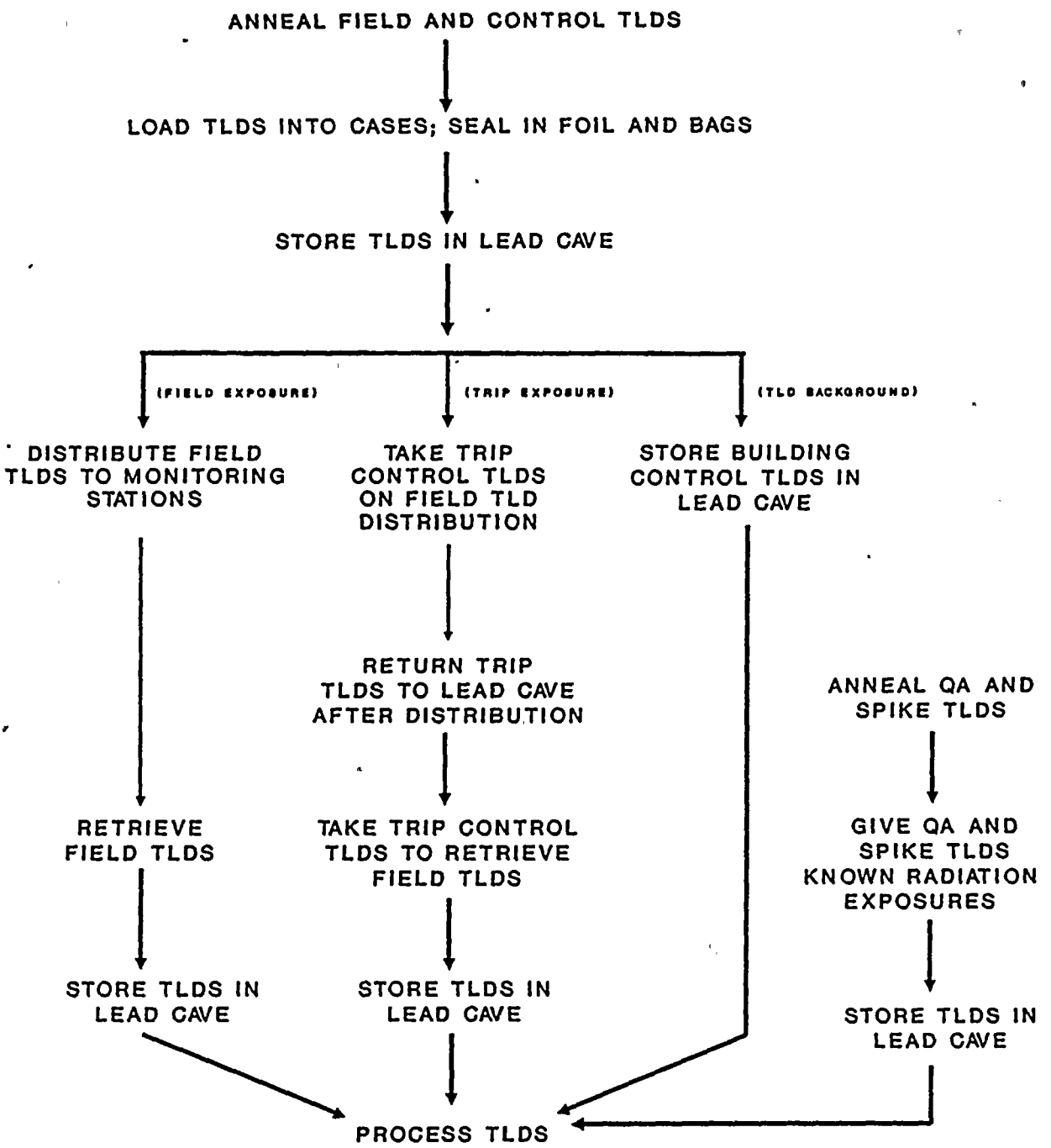


FIGURE 6-1
SUPPLY SYSTEM ENVIRONMENTAL TLD PREPARATION - USE CYCLE

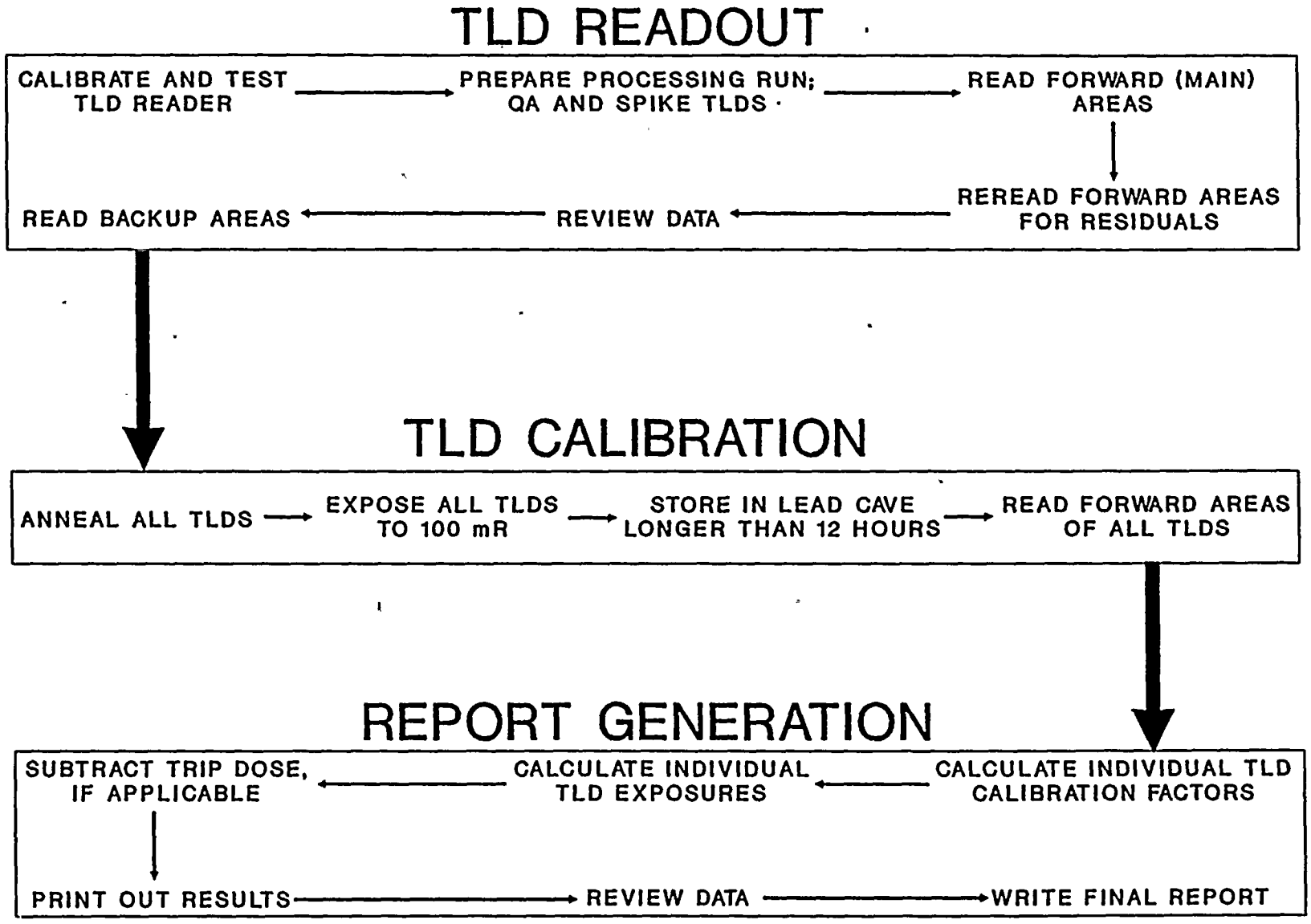


FIGURE 6-2
SUPPLY SYSTEM TLD EVALUATION

7.0 REFERENCES

1. U.S. Nuclear Regulatory Commission, "Programs For Monitoring Radioactivity in the Environs of Nuclear Power Plants," Regulatory Guide 4.1, Revision 1, April 1975.

2. U.S. Nuclear Regulatory Commission, "Environmental Technical Specifications For Nuclear Power Plants," Regulatory Guide 4.8, December 1975.

3. U.S. Nuclear Regulatory Commission, "An Acceptable Radiological Environmental Monitoring Program," Assessment Branch Technical Position; Revision 1, November 1979.

4. U.S. Nuclear Regulatory Commission, "Quality Assurance For Radiological Environmental Monitoring Program (Normal Operations), Effluent Streams and the Environment," Regulatory Guide 4.15, Revision 1, February 1979.

5. U.S. Nuclear Regulatory Commission, "Performance, Testing and Procedural Specifications For Thermoluminescence Dosimetry-Environmental Applications," Regulatory Guide 4.13, Revision 1, July 1977.

6. American National Standard: ANSI N545-1975, "Performance Testing and Procedural Specifications for Thermoluminescent Dosimetry (Environmental Applications)."

7. Code of Federal Regulations, Title 10 Part 20, Standards For Protection Against Radiation.

8. Code of Federal Regulations, Title 10 Part 50, Domestic Licensing of Production and Utilization Facilities.

9. Washington Public Power Supply System Nuclear Plant No. 2, Operating License NSF-21, Technical Specifications 3/4.12.1, Table 3.13.1.

10. Attachment I to the Site Certification Agreement Between the State of Washington and the Washington Public Power Supply System, May 17, 1972 (with revision dated January 1978).

11. "Teledyne Isotopes TLD System For Personnel and Environmental Monitoring," Teledyne Isotopes, Westwood, New Jersey, February 2, 1981.

12. Washington Public Power Supply System, Radiological Environmental Monitoring Program Annual Report Plant 2, 1985, April 1986.

13. Washington Public Power Supply System, Radiological Environmental Monitoring Program Annual Report Plant 2, 1986, April 1987.

14. Washington Public Power Supply System, Radiological Environmental Monitoring Program Annual Report Plant 2, 1987, April 1988.

15. Washington Public Power Supply System, Radiological Environmental Monitoring Program Annual Report Plant 2, 1988, April 1989.

16. Washington State Department of Health, Rules and Regulations of the State Board of Health Regarding Public Drinking Water Systems, Chapter 246-290, Washington Administrative Code, April 1991.

17. Robertson, D. E., and J. J. Fix, Association of Hanford Origin Radionuclides With Columbia River Sediment, BNWL-2305, August 1977.

APPENDIX A: 1991 ROUTINE RESULTS

TABLE A-1.1

1991 QUARTERLY TLD RESULTS

Results in mR/day

LOCATION	COLLECTION PERIOD	RESULT	UNCERTAINTY 2σ
1	901227 to 910328	0.26	0.01
	910328 to 910627	0.25	0.00
	910627 to 910926	0.27	0.02
	910926 to 911226	0.25	0.01
2	901227 to 910328	0.25	0.01
	910328 to 910627	0.24	0.01
	910627 to 910926	0.26	0.01
	910926 to 911226	0.25	0.00
3	901227 to 910328	0.24	0.01
	910328 to 910627	0.25	0.01
	910627 to 910926	0.26	0.01
	910926 to 911226	0.25	0.01
4	901227 to 910328	0.24	0.00
	910328 to 910627	0.23	0.00
	910627 to 910926	0.24	0.01
	910926 to 911226	0.24	0.01
5	901227 to 910328	0.24	0.00
	910328 to 910627	0.23	0.01
	910627 to 910926	0.24	0.01
	910926 to 911226	0.24	0.00
6	901227 to 910328	0.24	0.00
	910328 to 910627	0.23	0.01
	910627 to 910926	0.25	0.01
	910926 to 911226	0.24	0.01
7	901227 to 910328	0.25	0.01
	910328 to 910627	0.24	0.01
	910627 to 910926	0.26	0.01
	910926 to 911226	0.25	0.01
8	901227 to 910328	0.28	0.01
	910328 to 910627	0.27	0.01
	910627 to 910926	0.29	0.01
	910926 to 911226	0.28	0.01

TABLE A-1.1 (Cont.)

1991 QUARTERLY TLD RESULTS

Results in mR/day

LOCATION	COLLECTION PERIOD	RESULT	UNCERTAINTY 2σ
9A	901227 to 910328	0.24	0.00
	910328 to 910627	0.23	0.00
	910627 to 910926	0.24	0.01
	910926 to 911226	0.23	0.01
10	901227 to 910328	0.25	0.01
	910328 to 910627	0.23	0.01
	910627 to 910926	0.26	0.01
	910926 to 911226	0.25	0.01
11	901227 to 910328	0.25	0.01
	910328 to 910627	0.24	0.01
	910627 to 910926	0.25	0.01
	910926 to 911226	0.25	0.01
12	901227 to 910328	0.27	0.01
	910328 to 910627	0.26	0.01
	910627 to 910926	0.28	0.02
	910926 to 911226	0.27	0.01
13	901227 to 910328	0.25	0.01
	910328 to 910627	0.25	0.01
	910627 to 910926	0.26	0.02
	910926 to 911226	0.26	0.01
14	901227 to 910328	0.25	0.01
	910328 to 910627	0.25	0.01
	910627 to 910926	0.25	0.01
	910926 to 911226	0.25	0.01
15	901227 to 910328	0.27	0.01
	910328 to 910627	0.27	0.01
	910627 to 910926	0.28	0.01
	910926 to 911226	0.27	0.00
16	901227 to 910328	0.26	0.01
	910328 to 910627	0.26	0.01
	910627 to 910926	0.27	0.01
	910926 to 911226	0.26	0.01

TABLE A-1.1 (Cont.)

1991 QUARTERLY TLD RESULTS

Results in mR/day

LOCATION	COLLECTION PERIOD	RESULT	UNCERTAINTY 2σ
17	901227 to 910328	0.26	0.01
	910328 to 910627	0.25	0.01
	910627 to 910926	0.28	0.01
	910926 to 911226	0.27	0.03
18	901227 to 910328	0.26	0.01
	910328 to 910627	0.25	0.00
	910627 to 910926	0.26	0.01
	910926 to 911226	0.26	0.00
19	901227 to 910328	0.25	0.00
	910328 to 910627	0.25	0.01
	910627 to 910926	0.27	0.02
	910926 to 911226	0.26	0.00
20	901227 to 910328	0.25	0.02
	910328 to 910627	0.25	0.01
	910627 to 910926	0.26	0.00
	910926 to 911226	0.26	0.01
21	901227 to 910328	0.24	0.02
	910328 to 910627	0.23	0.01
	910627 to 910926	0.24	0.01
	910926 to 911226	0.24	0.01
22	901227 to 910328	0.25	0.01
	910328 to 910627	0.25	0.01
	910627 to 910926	0.26	0.01
	910926 to 911226	0.26	0.01
23	901227 to 910328	0.25	0.00
	910328 to 910627	0.24	0.01
	910627 to 910926	0.26	0.01
	910926 to 911226	0.25	0.01
24	901227 to 910328	0.26	0.01
	910328 to 910627	0.25	0.01
	910627 to 910926	0.27	0.01
	910926 to 911226	0.26	0.01

TABLE A-1.1 (Cont.)

1991 QUARTERLY TLD RESULTS

Results in mR/day

LOCATION	COLLECTION PERIOD	RESULT	UNCERTAINTY 2σ
25	901227 to 910328	0.27	0.01
	910328 to 910627	0.27	0.01
	910627 to 910926	0.28	0.01
	910926 to 911226	0.27	0.02
40	901227 to 910328	0.24	0.01
	910328 to 910627	0.23	0.01
	910627 to 910926	0.25	0.01
	910926 to 911226	0.23	0.01
41	901227 to 910328	0.26	0.01
	910328 to 910627	0.26	0.01
	910627 to 910926	0.27	0.01
	910926 to 911226	0.27	0.01
42	901227 to 910328	0.26	0.01
	910328 to 910627	0.26	0.01
	910627 to 910926	0.28	0.01
	910926 to 911226	0.26	0.01
43	901227 to 910328	0.27	0.00
	910328 to 910627	0.26	0.01
	910627 to 910926	0.28	0.01
	910926 to 911226	0.27	0.01
44	901227 to 910328	0.24	0.01
	910328 to 910627	0.24	0.00
	910627 to 910926	0.26	0.01
	910926 to 911226	0.24	0.01
45	901227 to 910328	0.25	0.01
	910328 to 910627	0.24	0.01
	910627 to 910926	0.27	0.01
	910926 to 911226	0.25	0.01
46	901227 to 910328	0.30	0.01
	910328 to 910627	0.31	0.01
	910627 to 910926	0.33	0.02
	910926 to 911226	0.31	0.01

TABLE A-1.1 (Cont.)

1991 QUARTERLY TLD RESULTS

Results in mR/day

LOCATION	COLLECTION PERIOD	RESULT	UNCERTAINTY 2σ
47	901227 to 910328	0.24	0.00
	910328 to 910627	0.23	0.01
	910627 to 910926	0.24	0.01
	910926 to 911226	0.24	0.01
49	901227 to 910328	0.25	0.01
	910328 to 910627	0.25	0.01
	910627 to 910926	0.26	0.01
	910926 to 911226	0.25	0.01
50	901227 to 910328	0.25	0.01
	910328 to 910627	0.25	0.01
	910627 to 910926	0.26	0.01
	910926 to 911226	0.26	0.01
51	901227 to 910328	0.25	0.02
	910328 to 910627	0.24	0.01
	910627 to 910926	0.26	0.01
	910926 to 911226	0.25	0.00
53	901227 to 910328	0.28	0.01
	910328 to 910627	0.28	0.00
	910627 to 910926	0.29	0.01
	910926 to 911226	0.26	0.01
54	901227 to 910328	0.27	0.01
	910328 to 910627	0.25	0.01
	910627 to 910926	0.27	0.01
	910926 to 911226	0.26	0.01
55	901227 to 910328	0.25	0.01
	910328 to 910627	0.24	0.01
	910627 to 910926	0.26	0.02
	910926 to 911226	0.25	0.01
56	901227 to 910328	0.25	0.01
	910328 to 910627	0.25	0.02
	910627 to 910926	0.27	0.01
	910926 to 911226	0.25	0.02

TABLE A-1.1 (Cont.)

1991 QUARTERLY TLD RESULTS

Results in mR/day

LOCATION	COLLECTION PERIOD	RESULT	UNCERTAINTY 2σ
61	901227 to 910328	0.27	0.01
	910328 to 910627	0.27	0.01
	910627 to 910926	0.29	0.01
	910926 to 911226	0.27	0.01
71	901227 to 910328	0.31	0.01
	910328 to 910627	0.25	0.01
	910627 to 910926	0.27	0.01
	910926 to 911226	0.28	0.01
72	901227 to 910328	0.29	0.02
	910328 to 910627	0.26	0.01
	910627 to 910926	0.27	0.02
	910926 to 911226	0.28	0.01
73	901227 to 910328	0.27	0.01
	910328 to 910627	0.24	0.01
	910627 to 910926	0.25	0.01
	910926 to 911226	0.24	0.01
74	901227 to 910328	0.28	0.01
	910328 to 910627	0.27	0.05
	910627 to 910926	0.28	0.01
	910926 to 911226	0.28	0.01
75	901227 to 910328	0.27	0.01
	910328 to 910627	0.24	0.01
	910627 to 910926	0.26	0.01
	910926 to 911226	0.26	0.01
76	901227 to 910328	0.26	0.01
	910328 to 910627	0.24	0.01
	910627 to 910926	0.26	0.01
	910926 to 911226	0.24	0.01
77	901227 to 910328	0.25	0.01
	910328 to 910627	0.25	0.01
	910627 to 910926	0.27	0.01
	910926 to 911226	0.26	0.01

TABLE A-1.1 (Cont.)

1991 QUARTERLY TLD RESULTS

Results in mR/day

LOCATION	COLLECTION PERIOD	RESULT	UNCERTAINTY 2σ
78	901227 to 910328	0.25	0.01
	910328 to 910627	0.25	0.01
	910627 to 910926	0.26	0.02
	910926 to 911226	0.25	0.01
79	901227 to 910328	0.26	0.01
	910328 to 910627	0.25	0.01
	910627 to 910926	0.26	0.01
	910926 to 911226	0.25	0.01
80	901227 to 910328	0.25	0.01
	910328 to 910627	0.24	0.00
	910627 to 910926	0.26	0.01
	910926 to 911226	0.24	0.01
81	901227 to 910328	0.25	0.01
	910328 to 910627	0.24	0.01
	910627 to 910926	0.26	0.01
	910926 to 911226	0.24	0.01
82	901227 to 910328	0.26	0.01
	910328 to 910627	0.26	0.01
	910627 to 910926	0.27	0.02
	910926 to 911226	0.27	0.02
83	901227 to 910328	0.27	0.01
	910328 to 910627	0.26	0.01
	910627 to 910926	0.26	0.01
	910926 to 911226	0.26	0.01
84	901227 to 910328	0.26	0.01
	910328 to 910627	0.25	0.02
	910627 to 910926	0.27	0.01
	910926 to 911226	0.26	0.01
85	901227 to 910328	0.27	0.00
	910328 to 910627	0.26	0.01
	910627 to 910926	0.28	0.01
	910926 to 911226	0.26	0.01

TABLE A-1.1 (Cont.)

1991 QUARTERLY TLD RESULTS

Results in mR/day

LOCATION	COLLECTION PERIOD	RESULT	UNCERTAINTY 2σ
86	901227 to 910328	0.31	0.01
	910328 to 910627	0.26	0.01
	910627 to 910926	0.27	0.00
	910926 to 911226	0.29	0.01

TABLE A-1.2

1991 ANNUAL TLD RESULTS

Results in mR/day

LOCATION	COLLECTION PERIOD	RESULT	UNCERTAINTY 2s
1	901227 to 911226	0.24	0.01
2	901227 to 911226	0.23	0.00
3	901227 to 911226	0.23	0.01
4	901227 to 911226	0.21	0.00
5	901227 to 911226	0.22	0.01
6	901227 to 911226	0.22	0.01
7	901227 to 911226	0.23	0.01
8	901227 to 911226	0.26	0.00
9A	901227 to 911226	0.22	0.01
10	901227 to 911226	0.23	0.01
11	901227 to 911226	0.23	0.01
12	901227 to 911226	0.25	0.01
13	901227 to 911226	0.23	0.01
14	901227 to 911226	0.23	0.01
15	901227 to 911226	0.25	0.01
16	901227 to 911226	0.24	0.01
17	901227 to 911226	0.24	0.01
18	901227 to 911226	0.24	0.00
19	901227 to 911226	0.23	0.01
20	901227 to 911226	0.24	0.01
21	901227 to 911226	0.22	0.01
22	901227 to 911226	0.24	0.01
23	901227 to 911226	0.23	0.01
24	901227 to 911226	0.24	0.01
25	901227 to 911226	0.26	0.01
40	901227 to 911226	0.22	0.01
41	901227 to 911226	0.26	0.01
42	901227 to 911226	0.24	0.01
43	901227 to 911226	0.25	0.01

TABLE A-1.2

1991 ANNUAL TLD RESULTS

Results in mR/day

LOCATION	COLLECTION PERIOD	RESULT	UNCERTAINTY 2s
44	901227 to 911226	0.23	0.00
45	901227 to 911226	0.23	0.01
46	901227 to 911226	0.29	0.01
47	901227 to 911226	0.22	0.01
49	901227 to 911226	0.24	0.01
50	901227 to 911226	0.22	0.01
51	901227 to 911226	0.23	0.01
53	901227 to 911226	0.26	0.01
54	901227 to 911226	0.24	0.01
55	901227 to 911226	0.23	0.01
56	901227 to 911226	0.24	0.01
61	901227 to 911226	0.26	0.01
71	901227 to 911226	0.26	0.01
72	901227 to 911226	0.26	0.01
73	901227 to 911226	0.22	0.01
74	901227 to 911226	0.25	0.01
75	901227 to 911226	0.24	0.01
76	901227 to 911226	0.24	0.01
77	901227 to 911226	0.24	0.01
78	901227 to 911226	0.23	0.01
79	901227 to 911226	0.24	0.00
80	901227 to 911226	0.24	0.01
81	901227 to 911226	0.23	0.01
82	901227 to 911226	0.25	0.01
83	901227 to 911226	0.25	0.02
84	901227 to 911226	0.24	0.01
85	901227 to 911226	0.25	0.00
86	901227 to 911226	0.26	0.01

TABLE A-1.3

1991 TLD RESULTS - SUMMARY

Results in mR/day

NUCLIDE		AVERAGE	LOW	HIGH	NUMBER SAMPLES	NUMBER POSITIVE
			QUARTERLY TLD RESULTS			
TLD	(I)	0.26	0.23	0.33	224	224
TLD	(C)	0.24	0.23	0.24	4	4
			ANNUAL TLD RESULTS			
TLD	(I)	0.24	0.21	0.29	56	56
TLD	(C)	0.22	0.22	0.22	1	1

(I) Indicator Stations
(C) Control Station

TABLE A-2.1

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
1	911231 to 910107	3.4 E-02	3.0 E-03
	910107 to 910114	6.3 E-02	4.0 E-03
	910114 to 910121	9.1 E-03	1.8 E-03
	910121 to 910128	3.5 E-02	3.0 E-03
	910128 to 910204	2.4 E-02	3.0 E-03
	910204 to 910211	1.7 E-02	2.0 E-03
	910211 to 910219	1.3 E-02	2.0 E-03
	910219 to 910225	9.4 E-03	2.2 E-03
	910225 to 910304 (a)	1.7 E-02	4.0 E-03
	910305 to 910311 (b)	4.4 E-03	1.9 E-03
	910311 to 910318	9.9 E-03	1.9 E-03
	910318 to 910325	8.4 E-03	1.8 E-03
	910325 to 910401	1.7 E-02	2.0 E-03
	910401 to 910408 (a)	* 4.7 E-02	5.7 E-02
	910408 to 910415 (c)	1.1 E-02	2.0 E-03
	910415 to 910422 (c)	1.1 E-02	2.0 E-02
	910422 to 910429 (c)	9.2 E-03	2.1 E-03
	910429 to 910506	1.5 E-02	2.0 E-03
	910506 to 910513 (c)	6.0 E-03	2.8 E-03
	910513 to 910520 (d)		
	910520 to 910528 (d)		
	910528 to 910603 (a)	9.1 E-03	4.2 E-03
	910603 to 910610	6.0 E-03	1.7 E-03
	910610 to 910617	3.4 E-03	1.7 E-03
	910617 to 910624	4.4 E-03	1.7 E-03
	910624 to 910701	8.6 E-03	1.9 E-03
	910701 to 910708	8.3 E-03	1.9 E-03
	910708 to 910715	1.1 E-02	2.0 E-03
	910715 to 910722	6.8 E-03	1.8 E-03
	910722 to 910729	9.8 E-03	2.0 E-03
	910729 to 910805	1.3 E-02	2.0 E-03
	910805 to 910812	1.6 E-02	2.0 E-03
	910812 to 910819	1.7 E-02	2.0 E-03
	910819 to 910826	1.5 E-02	2.0 E-03
	910826 to 910903	8.0 E-03	1.6 E-03
	910903 to 910909	1.7 E-02	3.0 E-03
	910909 to 910916	1.3 E-02	2.0 E-03
	910916 to 910923	1.3 E-02	2.0 E-03
	910923 to 910930	2.1 E-02	3.0 E-03

(a) Power outage; low sample volume. Not included in summary.
(b) Power cable breakdown; reduced sample volume.
(c) Power outage; reduced sample volume.
(d) Sample not collected; power outage.
* Denotes a result less than the detection limit.

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
1	910930 to 911007	2.7 E-02	3.0 E-03
	911007 to 911014	3.0 E-02	3.0 E-03
	911014 to 911017	3.0 E-02	5.0 E-03
	911017 to 911021	1.3 E-02	3.0 E-03
	911021 to 911028	1.0 E-02	2.0 E-03
	911028 to 911104	4.1 E-02	3.0 E-03
	911104 to 911111	3.3 E-02	3.0 E-03
	911111 to 911118	9.8 E-03	2.0 E-03
	911118 to 911125	1.0 E-02	2.0 E-03
	911125 to 911202	1.0 E-02	2.0 E-03
	911202 to 911209	4.2 E-03	1.8 E-03
	911209 to 911216	1.2 E-02	2.0 E-03
	911216 to 911223	3.5 E-02	3.0 E-03
	911223 to 911230	4.7 E-02	4.0 E-03

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
4	901231 to 910107	3.3 E-02	3.0 E-03
	910107 to 910114	6.0 E-02	4.0 E-03
	910114 to 910121	1.0 E-02	2.0 E-03
	910121 to 910128	3.2 E-02	3.0 E-03
	910128 to 910204	2.5 E-02	3.0 E-03
	910204 to 910211	1.7 E-02	2.0 E-03
	910211 to 910219	1.1 E-02	2.0 E-03
	910219 to 910225	9.2 E-03	2.2 E-03
	910225 to 910304	1.5 E-02	2.0 E-03
	910304 to 910311	4.3 E-03	1.7 E-03
	910311 to 910318	1.0 E-02	2.0 E-03
	910318 to 910325	4.8 E-03	1.6 E-03
	910325 to 910401	1.7 E-02	2.0 E-03
	910401 to 910408	7.2 E-03	1.8 E-03
	910408 to 910415	9.7 E-03	1.8 E-03
	910415 to 910422	1.4 E-02	2.0 E-03
	910422 to 910429	9.5 E-03	1.9 E-03
	910429 to 910506	1.3 E-02	2.0 E-03
	910506 to 910513	6.3 E-03	1.8 E-03
	910513 to 910520	1.1 E-02	2.0 E-03
	910520 to 910528	9.2 E-03	1.8 E-03
	910528 to 910603	7.6 E-03	2.2 E-03
	910603 to 910610	1.0 E-02	2.0 E-03
	910610 to 910617	3.7 E-03	1.7 E-03
	910617 to 910624	6.0 E-03	1.8 E-03
	910624 to 910701	1.1 E-02	2.0 E-03
	910701 to 910708	1.0 E-02	2.0 E-03
	910708 to 910715	1.3 E-02	2.0 E-03
	910715 to 910722	8.1 E-03	1.9 E-03
	910722 to 910729	1.3 E-02	2.0 E-03
	910729 to 910805	1.6 E-02	2.0 E-03
	910805 to 910812	1.8 E-02	2.0 E-03
	910812 to 910819	1.8 E-02	2.0 E-03
	910819 to 910826	1.6 E-02	2.0 E-03
	910826 to 910903	9.9 E-03	1.8 E-03
	910903 to 910909	1.4 E-02	2.0 E-03
	910909 to 910916	1.7 E-02	2.0 E-03
	910916 to 910923	1.9 E-02	3.0 E-03
	910923 to 910930	3.0 E-02	3.0 E-03

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
4	910930 to 911007	3.1 E-02	3.0 E-03
	911007 to 911014	3.4 E-02	3.0 E-03
	911014 to 911017	2.8 E-02	5.0 E-03
	911017 to 911021	1.6 E-02	4.0 E-03
	911021 to 911028	1.0 E-02	2.0 E-03
	911028 to 911104	4.0 E-02	3.0 E-03
	911104 to 911111	2.7 E-02	3.0 E-03
	911111 to 911118	8.1 E-03	1.9 E-03
	911118 to 911125	1.0 E-02	2.0 E-03
	911125 to 911202	8.4 E-03	1.9 E-03
	911202 to 911209	7.5 E-03	2.0 E-03
	911209 to 911216	1.4 E-02	2.0 E-03
	911216 to 911223	3.3 E-02	3.0 E-03
	911223 to 911230	5.1 E-02	4.0 E-03

A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
5	901231 to 910107	3.4 E-02	3.0 E-03
	910107 to 910114	5.3 E-02	4.0 E-03
	910114 to 910121	1.0 E-02	2.0 E-03
	910121 to 910128	3.5 E-02	3.0 E-03
	910128 to 910204	1.5 E-02	2.0 E-03
	910204 to 910211	1.9 E-02	2.0 E-03
	910211 to 910219	1.3 E-02	2.0 E-03
	910219 to 910225	7.6 E-03	2.1 E-03
	910225 to 910304	1.8 E-02	2.0 E-03
	910304 to 910311	4.5 E-03	1.7 E-03
	910311 to 910318	1.0 E-02	2.0 E-03
	910318 to 910325	7.8 E-03	1.8 E-03
	910325 to 910401	1.8 E-02	2.0 E-03
	910401 to 910408	7.6 E-03	1.8 E-03
	910408 to 910415	9.7 E-03	1.8 E-03
	910415 to 910422	1.5 E-02	2.0 E-03
	910422 to 910429	1.2 E-02	2.0 E-03
	910429 to 910506	1.7 E-02	2.0 E-03
	910506 to 910513	4.7 E-03	1.7 E-03
	910513 to 910520	8.6 E-03	2.0 E-03
	910520 to 910528	8.3 E-03	1.8 E-03
	910528 to 910603	7.2 E-03	2.2 E-03
	910603 to 910610	7.6 E-03	1.8 E-03
	910610 to 910617	3.0 E-03	1.7 E-03
	910617 to 910624	4.9 E-03	1.7 E-03
	910624 to 910701	1.1 E-02	2.0 E-03
	910701 to 910708	9.3 E-03	2.0 E-03
	910708 to 910715	1.2 E-02	2.0 E-03
	910715 to 910722	8.9 E-03	1.9 E-03
	910722 to 910729	1.3 E-02	2.0 E-03
	910729 to 910805	1.5 E-02	2.0 E-03
	910805 to 910812 (a)	1.5 E-02	3.0 E-03
	910812 to 910819	1.3 E-02	2.0 E-03
	910819 to 910826	1.2 E-02	2.0 E-03
	910826 to 910903	7.3 E-03	1.6 E-03
	910903 to 910909	9.9 E-03	2.2 E-03
	910909 to 910916	1.1 E-02	2.0 E-03
	910916 to 910923	1.1 E-02	2.0 E-03
	910923 to 910930	2.0 E-02	3.0 E-03

(a) Blown fuse; reduced sample volume.

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
5	910930 to 911007	2.0 E-02	2.0 E-03
	911007 to 911014	3.0 E-02	3.0 E-03
	911014 to 911017	2.0 E-02	5.0 E-03
	911017 to 911021	9.8 E-03	3.2 E-03
	911021 to 911028	1.0 E-02	2.0 E-03
	911028 to 911104	3.6 E-02	3.0 E-03
	911104 to 911111	2.5 E-02	3.0 E-03
	911111 to 911118	7.1 E-03	1.8 E-03
	911118 to 911125	7.9 E-03	2.1 E-03
	911125 to 911202	5.3 E-03	1.7 E-03
	911202 to 911209	4.5 E-03	1.8 E-03
	911209 to 911216	1.1 E-02	2.0 E-03
	911216 to 911223	2.9 E-02	3.0 E-03
	911223 to 911230	4.9 E-02	4.0 E-03

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
6	901231 to 910107	3.2 E-02	3.0 E-03
	910107 to 910114	6.5 E-02	4.0 E-03
	910114 to 910121	1.2 E-02	2.0 E-03
	910121 to 910128	3.2 E-02	3.0 E-03
	910128 to 910204	2.6 E-02	3.0 E-03
	910204 to 910211	1.8 E-02	2.0 E-03
	910211 to 910219	1.3 E-02	2.0 E-03
	910219 to 910225	7.0 E-03	2.1 E-03
	910225 to 910304	1.7 E-02	2.0 E-03
	910304 to 910311	3.8 E-03	1.7 E-03
	910311 to 910318	1.2 E-02	2.0 E-03
	910318 to 910325	8.2 E-03	1.8 E-03
	910325 to 910401	1.7 E-02	2.0 E-03
	910401 to 910408	4.4 E-03	1.7 E-03
	910408 to 910415	1.1 E-02	2.0 E-03
	910415 to 910422	1.5 E-02	2.0 E-03
	910422 to 910429	9.3 E-03	1.9 E-03
	910429 to 910506	1.4 E-02	2.0 E-03
	910506 to 910513	6.3 E-03	1.8 E-03
	910513 to 910520	1.0 E-02	2.0 E-03
	910520 to 910528	7.1 E-03	1.7 E-03
	910528 to 910603	7.2 E-03	2.2 E-03
	910603 to 910610	7.1 E-03	1.8 E-03
	910610 to 910617	4.7 E-03	1.8 E-03
	910617 to 910624	3.9 E-03	1.7 E-03
	910624 to 910701	9.6 E-03	2.0 E-03
	910701 to 910708	8.9 E-03	2.0 E-03
	910708 to 910715	1.5 E-02	2.0 E-03
	910715 to 910722	7.9 E-03	1.9 E-03
	910722 to 910729	9.8 E-03	2.0 E-03
	910729 to 910805	1.5 E-02	2.0 E-03
	910805 to 910812	1.5 E-02	2.0 E-03
	910812 to 910819	1.4 E-02	2.0 E-03
	910819 to 910826	1.4 E-02	2.0 E-03
	910826 to 910903	7.6 E-03	1.6 E-03
	910903 to 910909	1.5 E-02	2.0 E-03
	910909 to 910916	1.2 E-02	2.0 E-03
	910916 to 910923	1.6 E-02	2.0 E-03
	910923 to 910930	2.3 E-02	3.0 E-03

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
6	910930 to 911007	2.2 E-02	3.0 E-03
	911007 to 911014	3.5 E-02	3.0 E-03
	911014 to 911017	2.4 E-02	5.0 E-03
	911017 to 911021	1.4 E-02	3.0 E-03
	911021 to 911028	1.2 E-02	2.0 E-03
	911028 to 911104	3.8 E-02	3.0 E-03
	911104 to 911111	2.8 E-02	3.0 E-03
	911111 to 911118	8.9 E-03	2.0 E-03
	911118 to 911125	1.2 E-02	2.0 E-03
	911125 to 911202	6.5 E-03	1.8 E-03
	911202 to 911209	3.7 E-03	1.7 E-03
	911209 to 911216	1.3 E-02	2.0 E-03
	911216 to 911223	3.3 E-02	3.0 E-03
	911223 to 911230	5.6 E-02	4.0 E-03

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
7	901231 to 910107	3.8 E-02	3.0 E-03
	910107 to 910114	6.8 E-02	4.0 E-03
	910114 to 910121	1.1 E-02	2.0 E-03
	910121 to 910128	3.6 E-02	3.0 E-03
	910128 to 910204	2.8 E-02	3.0 E-03
	910204 to 910211	2.0 E-02	2.0 E-03
	910211 to 910219	1.6 E-02	2.0 E-03
	910219 to 910225	9.1 E-03	2.2 E-03
	910225 to 910304	1.9 E-02	2.0 E-03
	910304 to 910311	5.1 E-03	1.8 E-03
	910311 to 910318	9.7 E-03	1.9 E-03
	910318 to 910325	9.1 E-03	1.8 E-03
	910325 to 910401	1.7 E-02	2.0 E-03
	910401 to 910408	4.6 E-03	1.7 E-03
	910408 to 910415	9.4 E-03	1.8 E-03
	910415 to 910422	1.4 E-02	2.0 E-03
	910422 to 910429	9.8 E-03	1.9 E-03
	910429 to 910506	1.1 E-02	2.0 E-03
	910506 to 910513	6.1 E-03	1.8 E-03
	910513 to 910520	8.8 E-03	2.0 E-03
	910520 to 910528	8.2 E-03	1.7 E-03
	910528 to 910603	6.5 E-03	2.1 E-03
	910603 to 910610	7.0 E-03	1.8 E-03
	910610 to 910617	3.5 E-03	1.7 E-03
	910617 to 910624	4.8 E-03	1.7 E-03
	910624 to 910701	1.1 E-02	2.0 E-03
	910701 to 910708	7.3 E-03	1.9 E-03
	910708 to 910715	1.2 E-02	2.0 E-03
	910715 to 910722	7.4 E-03	1.8 E-03
	910722 to 910729	9.8 E-03	2.0 E-03
	910729 to 910805	1.2 E-02	2.0 E-03
	910805 to 910812	1.3 E-02	2.0 E-03
	910812 to 910819	1.5 E-02	2.0 E-03
	910819 to 910826	1.4 E-02	2.0 E-03
	910826 to 910903	9.2 E-03	1.7 E-03
	910903 to 910909	1.6 E-02	3.0 E-03
	910909 to 910916	1.9 E-02	2.0 E-03
	910916 to 910923	1.7 E-02	2.0 E-03
	910923 to 910930	2.8 E-02	3.0 E-03

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
7	910930 to 911007	2.7 E-02	3.0 E-03
	911007 to 911014	4.2 E-02	3.0 E-03
	911014 to 911017	2.3 E-02	5.0 E-03
	911017 to 911021	1.3 E-02	3.0 E-03
	911021 to 911028	1.2 E-02	2.0 E-03
	911028 to 911104	4.5 E-02	3.0 E-03
	911104 to 911111	3.6 E-02	3.0 E-03
	911111 to 911118	9.8 E-03	2.0 E-03
	911118 to 911125	1.0 E-02	2.0 E-03
	911125 to 911202	8.0 E-03	1.9 E-03
	911202 to 911209	4.9 E-03	1.8 E-03
	911209 to 911216	1.4 E-02	2.0 E-03
	911216 to 911223	4.4 E-02	3.0 E-03
	911223 to 911230	5.8 E-02	4.0 E-03

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
8	901231 to 910107	3.1 E-02	3.0 E-03
	910107 to 910114	5.7 E-02	4.0 E-03
	910114 to 910121	8.8 E-03	1.8 E-03
	910121 to 910128	3.1 E-02	3.0 E-03
	910128 to 910204	2.7 E-02	3.0 E-03
	910204 to 910211	1.8 E-02	2.0 E-03
	910211 to 910219	1.1 E-02	2.0 E-03
	910219 to 910225	5.2 E-03	2.0 E-03
	910225 to 910304	1.7 E-02	2.0 E-03
	910304 to 910311	3.6 E-03	1.7 E-03
	910311 to 910318	7.2 E-03	1.7 E-03
	910318 to 910325	6.2 E-03	1.7 E-03
	910325 to 910401	1.8 E-02	2.0 E-03
	910401 to 910408	5.3 E-03	1.7 E-03
	910408 to 910415	1.1 E-02	2.0 E-03
	910415 to 910422	1.4 E-02	2.0 E-03
	910422 to 910429	1.1 E-02	2.0 E-03
	910429 to 910506	1.5 E-02	2.0 E-03
	910506 to 910513	6.8 E-03	1.8 E-03
	910513 to 910520	9.1 E-03	2.0 E-03
	910520 to 910528	7.5 E-03	1.7 E-03
	910528 to 910603	9.4 E-03	2.3 E-03
	910603 to 910610	6.9 E-03	1.8 E-03
	910610 to 910617	4.8 E-03	1.8 E-03
	910617 to 910624	6.0 E-03	1.8 E-03
	910624 to 910701	1.0 E-02	2.0 E-03
	910701 to 910708	8.6 E-03	2.0 E-03
	910708 to 910715	1.3 E-02	2.0 E-03
	910715 to 910722	6.5 E-03	1.8 E-03
	910722 to 910729	1.3 E-02	2.0 E-03
	910729 to 910805	1.2 E-02	2.0 E-03
	910805 to 910812	1.3 E-02	2.0 E-03
	910812 to 910819	1.2 E-02	2.0 E-03
	910819 to 910826 (a)	1.5 E-02	2.0 E-03
	910826 to 910903	9.6 E-03	1.7 E-03
	910903 to 910909	1.7 E-02	3.0 E-03
	910909 to 910916	1.5 E-02	2.0 E-03
	910916 to 910923	1.3 E-02	2.0 E-03
	910923 to 910930	2.3 E-02	3.0 E-03

(a) Blown fuse; reduced sample volume.

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
8	910930 to 911007 (a)	2.1 E-02	3.0 E-03
	911007 to 911014	3.3 E-02	3.0 E-03
	911014 to 911017	1.7 E-02	5.0 E-03
	911017 to 911021	1.1 E-02	3.0 E-03
	911021 to 911028	8.9 E-03	1.9 E-03
	911028 to 911104	3.7 E-02	3.0 E-03
	911104 to 911111	2.7 E-02	3.0 E-03
	911111 to 911118	8.4 E-03	1.9 E-03
	911118 to 911125	9.0 E-03	2.1 E-03
	911125 to 911202	7.2 E-03	1.8 E-03
	911202 to 911209	5.2 E-03	1.8 E-03
	911209 to 911216	1.1 E-02	2.0 E-03
	911216 to 911223	3.4 E-02	3.0 E-03
	911223 to 911230	4.8 E-02	4.0 E-03

(a) Sampler malfunction; reduced sample volume.

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
9A	901231 to 910107	2.9 E-02	3.0 E-03
	910107 to 910114	6.5 E-02	4.0 E-03
	910114 to 910121	8.6 E-03	1.8 E-03
	910121 to 910128	2.9 E-02	3.0 E-03
	910128 to 910204	2.3 E-02	2.0 E-03
	910204 to 910211	1.5 E-02	2.0 E-03
	910211 to 910219	9.6 E-03	1.8 E-03
	910219 to 910225	1.0 E-02	2.0 E-03
	910225 to 910304	1.2 E-02	2.0 E-03
	910304 to 910311	3.4 E-03	1.7 E-03
	910311 to 910318	9.6 E-03	1.9 E-03
	910318 to 910325	6.6 E-03	1.7 E-03
	910325 to 910401	1.7 E-02	2.0 E-03
	910401 to 910408	7.2 E-03	1.8 E-03
	910408 to 910415	8.3 E-03	1.7 E-03
	910415 to 910422	1.3 E-02	2.0 E-03
	910422 to 910429	1.1 E-02	2.0 E-03
	910429 to 910506 (a)	1.4 E-02	3.0 E-03
	910506 to 910513	4.8 E-03	1.7 E-03
	910513 to 910520 (b)	9.0 E-03	2.6 E-03
	910520 to 910528	6.7 E-03	1.7 E-03
	910528 to 910603	8.8 E-03	2.3 E-03
	910603 to 910610	7.2 E-03	1.8 E-03
	910610 to 910617	2.9 E-03	1.7 E-03
	910617 to 910624	5.0 E-03	1.7 E-03
	910624 to 910701	8.5 E-03	1.9 E-03
	910701 to 910708	7.6 E-03	1.9 E-03
	910708 to 910715	1.1 E-02	2.0 E-03
	910715 to 910722	8.4 E-03	1.9 E-03
	910722 to 910729	1.2 E-02	2.0 E-03
	910729 to 910805	1.3 E-02	2.0 E-03
	910805 to 910812	1.1 E-02	2.0 E-03
	910812 to 910819	1.4 E-02	2.0 E-03
	910819 to 910826	1.4 E-02	2.0 E-03
	910826 to 910903	8.6 E-03	1.7 E-03
	910903 to 910909	1.2 E-02	2.0 E-03
	910909 to 910916	1.4 E-02	2.0 E-03
	910916 to 910923	1.5 E-02	2.0 E-03
	910923 to 910930	2.2 E-02	3.0 E-03

(a) Power off; reduced sample volume.
(b) Sampler malfunction; reduced sample volume.

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
9A	910930 to 911007	2.5 E-02	3.0 E-03
	911007 to 911014	3.3 E-02	3.0 E-03
	911014 to 911017	1.7 E-02	5.0 E-03
	911017 to 911021	1.2 E-02	3.0 E-03
	911021 to 911028	1.1 E-02	2.0 E-03
	911028 to 911104	3.7 E-02	3.0 E-03
	911104 to 911111	2.3 E-02	3.0 E-03
	911111 to 911118	8.2 E-03	1.9 E-03
	911118 to 911125	7.6 E-03	2.1 E-03
	911125 to 911202	8.9 E-03	1.9 E-03
	911202 to 911209	3.7 E-03	1.7 E-03
	911209 to 911216	1.2 E-02	2.0 E-03
	911216 to 911223	3.8 E-02	3.0 E-03
	911223 to 911230	4.5 E-02	3.0 E-03

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
21	901231 to 910107	3.2 E-02	3.0 E-03
	910107 to 910114 (a)	6.1 E-02	7.0 E-03
	910114 to 910121	7.9 E-03	1.7 E-03
	910121 to 910128	2.6 E-02	3.0 E-03
	910128 to 910204	1.9 E-02	2.0 E-03
	910204 to 910211	1.6 E-02	2.0 E-03
	910211 to 910219 (b)	1.1 E-02	2.0 E-03
	910219 to 910225	8.9 E-03	2.2 E-03
	910225 to 910304	1.6 E-02	2.0 E-03
	910304 to 910311	4.3 E-03	1.7 E-03
	910311 to 910318	8.7 E-03	1.8 E-03
	910318 to 910325	8.1 E-03	1.8 E-03
	910325 to 910401	1.7 E-02	2.0 E-03
	910401 to 910408	6.2 E-03	1.8 E-03
	910408 to 910415	1.0 E-02	2.0 E-03
	910415 to 910422	1.2 E-02	2.0 E-03
	910422 to 910429	9.6 E-03	1.9 E-03
	910429 to 910506	1.5 E-02	2.0 E-03
	910506 to 910513	5.8 E-03	1.7 E-03
	910513 to 910520	8.1 E-03	1.9 E-03
	910520 to 910528	6.9 E-03	1.7 E-03
	910528 to 910603	6.0 E-03	2.1 E-03
	910603 to 910610	7.2 E-03	1.8 E-03
	910610 to 910617	4.7 E-03	1.8 E-03
	910617 to 910624	5.1 E-03	1.7 E-03
	910624 to 910701	9.7 E-03	2.0 E-03
	910701 to 910708	7.6 E-03	1.9 E-03
	910708 to 910715	1.0 E-02	2.0 E-03
	910715 to 910722	6.4 E-03	1.8 E-03
	910722 to 910729	1.2 E-02	2.0 E-03
	910729 to 910805	1.3 E-02	2.0 E-03
	910805 to 910812	1.3 E-02	2.0 E-03
	910812 to 910819	1.3 E-02	2.0 E-03
	910819 to 910826	1.2 E-02	2.0 E-03
	910826 to 910903	8.6 E-03	1.7 E-03
	910903 to 910909	1.2 E-02	2.0 E-03
	910909 to 910916	1.2 E-02	2.0 E-03
	910916 to 910923	1.1 E-02	2.0 E-03
	910923 to 910930	1.9 E-02	3.0 E-03

(a) Blown fuse; low sample volume. Not included in summary table.
(b) Power outage; reduced sample volume.

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
21	910930 to 911007	1.8 E-02	2.0 E-03
	911007 to 911014	3.5 E-02	3.0 E-03
	811014 to 911017	1.9 E-02	5.0 E-03
	911017 to 911021	1.5 E-02	3.0 E-03
	911021 to 911028	9.0 E-03	1.9 E-03
	911028 to 911104	3.4 E-02	3.0 E-03
	911104 to 911111	2.7 E-02	3.0 E-03
	911111 to 911118 (a)	6.2 E-03	2.0 E-03
	911118 to 911125 (b)	1.1 E-02	2.0 E-03
	911125 to 911202 (b)	5.9 E-03	1.8 E-03
	911202 to 911209	5.1 E-03	1.8 E-03
	911209 to 911216	8.5 E-03	2.0 E-03
	911216 to 911223	3.7 E-02	3.0 E-03
	911223 to 911230	4.4 E-02	3.0 E-03

(a) Power outage; reduced sample volume.
(b) Broken receptacle; reduced sample volume.

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
23	901231 to 910107	2.8 E-02	3.0 E-03
	910107 to 910114	6.1 E-02	4.0 E-03
	910114 to 910121	9.1 E-03	1.8 E-03
	910121 to 910128	3.2 E-02	3.0 E-03
	910128 to 910204	2.4 E-02	3.0 E-03
	910204 to 910211	1.6 E-02	2.0 E-03
	910211 to 910219	1.2 E-02	2.0 E-03
	910219 to 910225	7.3 E-03	2.1 E-03
	910225 to 910304 (a)	1.3 E-02	2.0 E-03
	910304 to 910311	5.6 E-03	1.8 E-03
	910311 to 910318	7.8 E-03	1.8 E-03
	910318 to 910325	6.9 E-03	1.7 E-03
	910325 to 910401	1.6 E-02	2.0 E-03
	910401 to 910408	4.5 E-03	1.7 E-03
	910408 to 910415	1.1 E-02	2.0 E-03
	910415 to 910422	1.3 E-02	2.0 E-03
	910422 to 910429	1.0 E-02	2.0 E-03
	910429 to 910506	1.4 E-02	2.0 E-03
	910506 to 910513	3.6 E-03	1.6 E-03
	910513 to 910520	8.4 E-03	1.9 E-03
	910520 to 910528	6.1 E-03	1.6 E-03
	910528 to 910603	5.3 E-03	2.0 E-03
	910603 to 910610	5.8 E-03	1.7 E-03
	910610 to 910617	3.0 E-03	1.7 E-03
	910617 to 910624	6.3 E-03	1.8 E-03
	910624 to 910701	8.8 E-03	1.9 E-03
	910701 to 910708	7.4 E-03	1.9 E-03
	910708 to 910715	1.0 E-02	2.0 E-03
	910715 to 910722	5.8 E-03	1.7 E-03
	910722 to 910729	1.2 E-02	2.0 E-03
	910729 to 910805	1.5 E-02	2.0 E-03
	910805 to 910812	1.5 E-02	2.0 E-03
	910812 to 910819	1.6 E-02	2.0 E-03
	910819 to 910826	1.5 E-02	2.0 E-03
	910826 to 910903	1.2 E-02	2.0 E-03
	910903 to 910909	1.6 E-02	3.0 E-03
	910909 to 910916	1.4 E-02	2.0 E-03
	910916 to 910923	1.5 E-02	2.0 E-03
	910923 to 910930	2.6 E-02	3.0 E-03

(a) Sampler malfunction; reduced sample volume.

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
23	910930 to 911007	2.5 E-02	3.0 E-03
	911007 to 911014	3.4 E-02	3.0 E-03
	911014 to 911017	2.4 E-02	5.0 E-03
	911017 to 911021	1.4 E-02	3.0 E-03
	911021 to 911028	1.1 E-02	2.0 E-03
	911028 to 911104	4.6 E-02	3.0 E-03
	911104 to 911111	2.9 E-02	3.0 E-03
	911111 to 911118	1.0 E-02	2.0 E-03
	911118 to 911125	7.7 E-03	2.1 E-03
	911125 to 911202	8.6 E-03	1.9 E-03
	911202 to 911209	5.2 E-03	1.8 E-03
	911209 to 911216	1.2 E-02	2.0 E-03
	911216 to 911223	3.8 E-02	3.0 E-03
	911223 to 911230	5.3 E-02	4.0 E-03

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
40	901231 to 910107	3.0 E-02	3.0 E-03
	910107 to 910114	6.0 E-02	4.0 E-03
	910114 to 910121	9.5 E-03	1.8 E-03
	910121 to 910128	2.9 E-02	3.0 E-03
	910128 to 910204	2.2 E-02	2.0 E-03
	910204 to 910211	1.7 E-02	2.0 E-03
	910211 to 910219	1.1 E-02	2.0 E-03
	910219 to 910225	8.3 E-03	2.2 E-03
	910225 to 910304	1.5 E-02	2.0 E-03
	910304 to 910311	3.8 E-03	1.7 E-03
	910311 to 910318	1.1 E-02	2.0 E-03
	910318 to 910325	7.5 E-03	1.7 E-03
	910325 to 910401	1.5 E-02	2.0 E-03
	910401 to 910408	6.2 E-03	1.8 E-03
	910408 to 910415	9.8 E-03	1.8 E-03
	910415 to 910422	1.5 E-02	2.0 E-03
	910422 to 910429	1.0 E-02	2.0 E-03
	910429 to 910506	1.4 E-02	2.0 E-03
	910506 to 910513	5.5 E-03	1.7 E-03
	910513 to 910520	8.6 E-03	2.0 E-03
	910520 to 910528	6.9 E-03	1.7 E-03
	910528 to 910603	6.5 E-03	2.1 E-03
	910603 to 910610	5.3 E-03	1.7 E-03
	910610 to 910617	3.4 E-03	1.7 E-03
	910617 to 910624	4.0 E-03	1.7 E-03
	910624 to 910701	1.0 E-02	2.0 E-03
	910701 to 910708	8.3 E-03	1.9 E-03
	910708 to 910715	1.3 E-02	2.0 E-03
	910715 to 910722	8.1 E-03	1.9 E-03
	910722 to 910729	1.3 E-02	2.0 E-03
	910729 to 910805	1.3 E-02	2.0 E-03
	910805 to 910812	1.3 E-02	2.0 E-03
	910812 to 910819	1.6 E-02	2.0 E-03
	910819 to 910826	1.5 E-02	2.0 E-03
	910826 to 910903	9.9 E-03	1.7 E-03
	910903 to 910909	1.4 E-02	2.0 E-03
	910909 to 910916	1.2 E-02	2.0 E-03
	910916 to 910923	1.4 E-02	2.0 E-03
	910923 to 910930	2.1 E-02	3.0 E-03

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
40	910930 to 911007	2.1 E-02	2.0 E-03
	911007 to 911014	2.9 E-02	3.0 E-03
	911014 to 911017	1.5 E-02	5.0 E-03
	911017 to 911021	1.1 E-02	3.0 E-03
	911021 to 911028	7.5 E-03	1.8 E-03
	911028 to 911104	3.9 E-02	3.0 E-03
	911104 to 911111	2.5 E-02	3.0 E-03
	911111 to 911118	8.3 E-03	1.9 E-03
	911118 to 911125	7.6 E-03	2.1 E-03
	911125 to 911202	8.6 E-03	1.9 E-03
	911202 to 911209	4.1 E-03	1.8 E-03
	911209 to 911216	1.1 E-02	2.0 E-03
	911216 to 911223	3.1 E-02	3.0 E-03
	911223 to 911230	4.5 E-02	3.0 E-03

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
48	901231 to 910107	3.1 E-02	3.0 E-03
	910107 to 910114	6.0 E-02	4.0 E-03
	910114 to 910121	9.6 E-03	1.8 E-03
	910121 to 910128	3.9 E-02	3.0 E-03
	910128 to 910204	2.9 E-02	3.0 E-03
	910204 to 910211	2.1 E-02	2.0 E-03
	910211 to 910219	1.3 E-02	2.0 E-03
	910219 to 910225	1.2 E-02	2.0 E-03
	910225 to 910304	1.8 E-02	2.0 E-03
	910304 to 910311	6.0 E-03	1.8 E-03
	910311 to 910318	6.9 E-03	1.7 E-03
	910318 to 910325	1.1 E-02	2.0 E-03
	910325 to 910401	1.7 E-02	2.0 E-03
	910401 to 910408	7.0 E-03	1.8 E-03
	910408 to 910415	1.2 E-02	2.0 E-03
	910415 to 910422	1.8 E-02	2.0 E-03
	910422 to 910429	1.1 E-02	2.0 E-03
	910429 to 910506	1.8 E-02	2.0 E-03
	910506 to 910513	8.8 E-03	1.9 E-03
	910513 to 910520	1.1 E-02	2.0 E-03
	910520 to 910528	8.2 E-03	1.8 E-03
	910528 to 910603	9.8 E-03	2.3 E-03
	910603 to 910610	8.4 E-03	1.9 E-03
	910610 to 910617	3.5 E-03	1.7 E-03
	910617 to 910624	5.1 E-03	1.7 E-03
	910624 to 910701	1.0 E-02	2.0 E-03
	910701 to 910708	8.4 E-03	2.0 E-03
	910708 to 910715	1.2 E-02	2.0 E-03
	910715 to 910722	8.2 E-03	1.9 E-03
	910722 to 910729	1.1 E-02	2.0 E-03
	910729 to 910805	1.5 E-02	2.0 E-03
	910805 to 910812	1.7 E-02	2.0 E-03
	910812 to 910819	1.7 E-02	2.0 E-03
	910819 to 910826	1.6 E-02	2.0 E-03
	910826 to 910903	9.5 E-03	1.7 E-03
	910903 to 910909	1.3 E-02	2.0 E-03
	910909 to 910916	1.5 E-02	2.0 E-03
	910916 to 910923	1.6 E-02	2.0 E-03
	910923 to 910930	2.7 E-02	3.0 E-03

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
48	910930 to 911007	2.1 E-02	2.0 E-03
	911007 to 911014	3.2 E-02	3.0 E-03
	911014 to 911017	2.4 E-02	5.0 E-03
	911017 to 911021	1.4 E-02	3.0 E-03
	911021 to 911028	7.7 E-03	1.9 E-03
	911028 to 911104	4.2 E-02	3.0 E-03
	911104 to 911111	2.9 E-02	3.0 E-03
	911111 to 911118	9.0 E-03	2.0 E-03
	911118 to 911125	1.2 E-02	2.0 E-03
	911125 to 911202	7.3 E-03	1.8 E-03
	911202 to 911209	4.7 E-03	1.8 E-03
	911209 to 911216	1.3 E-02	2.0 E-03
	911216 to 911223	3.7 E-02	3.0 E-03
	911223 to 911230	5.9 E-02	4.0 E-03

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
57	901231 to 910107	3.6 E-02	3.0 E-03
	910107 to 910114	7.3 E-02	4.0 E-03
	910114 to 910121	1.1 E-02	2.0 E-03
	910121 to 910128	3.1 E-02	3.0 E-03
	910128 to 910204	2.5 E-02	3.0 E-03
	910204 to 910211	1.8 E-02	2.0 E-03
	910211 to 910219	1.3 E-02	2.0 E-03
	910219 to 910225	8.3 E-03	2.2 E-03
	910225 to 910304	1.6 E-02	2.0 E-03
	910304 to 910311	4.9 E-03	1.7 E-03
	910311 to 910318	9.7 E-03	1.9 E-03
	910318 to 910325	8.7 E-03	1.8 E-03
	910325 to 910401	1.9 E-02	2.0 E-03
	910401 to 910408	4.9 E-03	1.7 E-03
	910408 to 910415	8.3 E-03	1.7 E-03
	910415 to 910422	1.5 E-02	2.0 E-03
	910422 to 910429	1.1 E-02	2.0 E-03
	910429 to 910506	1.5 E-02	2.0 E-03
	910506 to 910513	6.4 E-03	1.8 E-03
	910513 to 910520	9.4 E-03	2.0 E-03
	910520 to 910528	6.2 E-03	1.6 E-03
	910528 to 910603	9.9 E-03	2.3 E-03
	910603 to 910610 (a)	6.4 E-03	2.0 E-03
	910610 to 910617	4.3 E-03	1.7 E-03
	910617 to 910624	5.4 E-03	1.8 E-03
	910624 to 910701	8.8 E-03	1.9 E-03
	910701 to 910708	1.4 E-02	2.0 E-03
	910708 to 910715	1.2 E-02	2.0 E-03
	910715 to 910722	8.2 E-03	1.9 E-03
	910722 to 910729	1.2 E-02	2.0 E-03
	910729 to 910805	1.4 E-02	2.0 E-03
	910805 to 910812	1.3 E-02	2.0 E-03
	910812 to 910819	1.6 E-02	2.0 E-03
	910819 to 910826	1.5 E-02	2.0 E-03
	910826 to 910903	8.8 E-03	1.7 E-03
	910903 to 910909	1.4 E-02	2.0 E-03
	910909 to 910916	1.3 E-02	2.0 E-03
	910916 to 910923	1.5 E-02	2.0 E-03
	910923 to 910930	2.5 E-02	3.0 E-03

(a) Sampler malfunction; reduced sample volume.

TABLE A-2.1 (Cont.)

GROSS BETA ON AIR PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
57	910930 to 911007	2.3 E-02	3.0 E-03
	911007 to 911014	3.6 E-02	3.0 E-03
	911014 to 911017	1.8 E-02	5.0 E-03
	911017 to 911021	1.3 E-02	3.0 E-03
	911021 to 911028	1.1 E-02	2.0 E-03
	911028 to 911104	4.0 E-02	3.0 E-03
	911104 to 911111	3.2 E-02	2.3 E-02
	911111 to 911118	9.2 E-03	2.0 E-03
	911118 to 911125	1.1 E-02	2.0 E-03
	911125 to 911202	1.0 E-02	2.0 E-03
	911202 to 911209	4.5 E-03	1.8 E-03
	911209 to 911216	1.4 E-02	2.0 E-03
	911216 to 911223	4.1 E-02	3.0 E-03
	911223 to 911230	5.3 E-02	4.0 E-03

TABLE A-2.2

GROSS BETA ON AIR PARTICULATE FILTERS - SUMMARY

Results in pCi/cubic meter

NUCLIDE	AVERAGE	LOW	HIGH	NUMBER SAMPLES	NUMBER POSITIVE
Gr-Beta (I)	1.58E-02	3.00E-03	7.30E-02	581	580
Gr-Beta (C)	1.49E-02	2.90E-03	6.50E-02	53	53

(I) Indicator Station
(C) Control Station

TABLE A-3.1

GAMMA SPECTROMETRY OF PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
1	901231 to 910401 (a)	Be-7	7.92 E-02	8.60 E-03
		K-40	*-3.93 E-04	2.74 E-03
		Ru-103	* 1.64 E-04	5.45 E-04
		Ru-106	* 1.65 E-04	1.92 E-03
		Cs-134	*-3.36 E-05	2.02 E-04
		Cs-137	*-1.08 E-04	2.07 E-04
		Ra-226	* 1.14 E-03	3.73 E-03
		Th-228	*-2.63 E-05	3.25 E-04
	910401 to 910701 (a)	Be-7	6.29 E-02	9.89 E-03
		K-40	* 9.08 E-03	4.29 E-03
		Ru-103	* 8.99 E-05	6.69 E-04
		Ru-106	* 2.56 E-04	2.17 E-03
		Cs-134	*-5.28 E-05	2.49 E-04
		Cs-137	* 0.00 E+00	2.68 E-04
		Ra-226	* 9.69 E-04	4.83 E-03
		Th-228	* 3.42 E-04	4.01 E-04
	910701 to 910930	Be-7	1.09 E-01	8.95 E-03
		K-40	* 2.04 E-03	2.96 E-03
		Ru-103	*-1.52 E-04	5.29 E-04
		Ru-106	* 1.68 E-03	2.04 E-03
		Cs-134	* 3.82 E-05	2.28 E-04
		Cs-137	* 1.54 E-04	2.26 E-04
		Ra-226	* 1.21 E-03	4.02 E-03
		Th-228	* 3.41 E-04	3.37 E-04
	910930 to 911230	Be-7	7.32 E-02	7.00 E-03
		K-40	* 1.36 E-04	5.70 E-03
		Ru-103	*-1.82 E-04	5.77 E-04
		Ru-106	*-4.97 E-04	2.13 E-03
		Cs-134	*-3.35 E-05	2.50 E-04
		Cs-137	* 1.65 E-04	2.41 E-04
		Ra-226	*-3.58 E-04	3.12 E-03
		Th-228	* 1.86 E-05	2.98 E-04

(a) Sampler outages during this period; reduced sample volume.
* Denotes a result less than the detection limit.

TABLE A-3.1 (Cont.)

GAMMA SPECTROMETRY OF PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
4	901231 to 910401	Be-7	8.00 E-02	8.23 E-03
		K-40	* 5.26 E-03	3.41 E-03
		Ru-103	* 4.19 E-05	5.68 E-04
		Ru-106	* 1.27 E-03	1.83 E-03
		Cs-134	* 9.14 E-05	2.12 E-04
		Cs-137	* 3.69 E-05	1.98 E-04
		Ra-226	* 3.72 E-04	3.05 E-03
		Th-228	*-2.75 E-04	3.32 E-04
	910401 to 910701	Be-7	8.21 E-02	1.03 E-02
		K-40	* 1.92 E-03	3.55 E-03
		Ru-103	*-3.92 E-04	6.16 E-04
		Ru-106	* 0.00 E+00	2.06 E-03
		Cs-134	* 0.00 E+00	2.37 E-04
		Cs-137	* 4.44 E-05	2.34 E-04
		Ra-226	*-2.51 E-03	5.30 E-03
		Th-228	* 4.39 E-05	4.48 E-04
	910701 to 910930	Be-7	1.20 E-01	8.72 E-03
		K-40	*-1.01 E-02	5.20 E-03
		Ru-103	* 1.47 E-04	5.44 E-04
		Ru-106	*-9.07 E-04	2.09 E-03
		Cs-134	*-9.48 E-05	2.51 E-04
		Cs-137	* 2.61 E-04	2.32 E-04
		Ra-226	*-3.27 E-03	3.50 E-03
		Th-228	*-2.36 E-04	2.93 E-04
	910930 to 911230	Be-7	7.26 E-02	9.70 E-03
		K-40	* 3.68 E-04	2.56 E-03
		Ru-103	* 4.13 E-04	4.70 E-04
		Ru-106	* 8.72 E-05	1.75 E-03
		Cs-134	* 1.41 E-04	1.75 E-04
		Cs-137	* 1.35 E-04	1.70 E-04
		Ra-226	*-4.99 E-04	3.15 E-03
		Th-228	* 3.55 E-05	3.27 E-04

* Denotes a result less than the detection limit.

TABLE A-3.1 (Cont.)

GAMMA SPECTROMETRY OF PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
5	901231 to 910401	Be-7	9.91 E-02	9.09 E-03
		K-40	* 7.76 E-04	3.55 E-03
		Ru-103	*-1.25 E-04	7.36 E-04
		Ru-106	* 0.00 E+00	2.31 E-03
		Cs-134	* 1.89 E-04	2.62 E-04
		Cs-137	* 1.62 E-04	2.54 E-04
		Ra-226	* 3.59 E-03	4.00 E-03
		Th-228	*-6.41 E-04	4.38 E-04
	910401 to 910701	Be-7	6.74 E-02	8.10 E-03
		K-40	*-3.66 E-03	4.90 E-03
		Ru-103	*-7.56 E-05	6.35 E-04
		Ru-106	*-1.10 E-03	2.04 E-03
		Cs-134	* 1.58 E-04	2.70 E-04
		Cs-137	*-1.45 E-04	2.37 E-04
		Ra-226	* 1.15 E-03	3.02 E-03
		Th-228	* 2.64 E-04	3.20 E-04
	910701 to 910930 (a)	Be-7	1.07 E-01	9.08 E-03
		K-40	*-3.80 E-03	6.34 E-03
		Ru-103	* 3.60 E-05	6.63 E-04
		Ru-106	* 1.22 E-03	2.36 E-03
		Cs-134	*-2.57 E-04	2.77 E-04
		Cs-137	* 1.51 E-04	2.56 E-04
		Ra-226	* 1.23 E-03	3.56 E-03
		Th-228	*-1.60 E-04	3.47 E-04
	910930 to 911230	Be-7	6.88 E-02	7.77 E-03
		K-40	* 2.20 E-03	4.49 E-03
		Ru-103	*-1.47 E-05	5.28 E-04
		Ru-106	*-1.95 E-04	1.98 E-03
		Cs-134	*-6.98 E-05	2.31 E-04
		Cs-137	* 1.07 E-04	2.14 E-04
		Ra-226	*-3.43 E-04	2.76 E-03
		Th-228	*-1.41 E-04	2.87 E-04

(a) Sampler outage during this period; slightly reduced sample volume.
* Denotes a result less than the detection limit.

TABLE A-3.1 (Cont.)

GAMMA SPECTROMETRY OF PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
6	901231 to 910401	Be-7	8.41 E-02	7.73 E-03
		K-40	*-1.63 E-02	5.18 E-03
		Ru-103	*-1.11 E-04	6.42 E-04
		Ru-106	* 8.82 E-04	2.13 E-03
		Cs-134	*-3.38 E-05	2.33 E-04
		Cs-137	*-8.24 E-05	2.20 E-04
		Ra-226	*-9.96 E-04	3.01 E-03
		Th-228	* 2.76 E-04	3.02 E-04
	910401 to 910701	Be-7	7.62 E-02	8.60 E-03
		K-40	* 1.03 E-03	3.53 E-03
		Ru-103	* 3.03 E-04	5.83 E-04
		Ru-106	*-7.17 E-04	2.05 E-03
		Cs-134	*-2.39 E-05	2.46 E-04
		Cs-137	* 1.43 E-04	2.62 E-04
		Ra-226	* 2.39 E-03	3.60 E-03
		Th-228	*-1.81 E-04	3.48 E-04
	910701 to 910930	Be-7	1.28 E-01	1.00 E-02
		K-40	4.28 E-03	2.18 E-03
		Ru-103	* 0.00 E+00	5.02 E-04
		Ru-106	* 6.30 E-04	1.90 E-03
		Cs-134	* 0.00 E+00	2.07 E-04
		Cs-137	* 9.21 E-05	1.83 E-04
		Ra-226	* 2.37 E-03	3.38 E-03
		Th-228	* 8.23 E-05	3.69 E-04
	910930 to 911230	Be-7	8.00 E-02	7.53 E-03
		K-40	* 3.48 E-03	3.24 E-03
		Ru-103	*-5.64 E-05	4.84 E-04
		Ru-106	* 5.07 E-04	1.72 E-03
		Cs-134	*-2.30 E-05	2.17 E-04
		Cs-137	* 2.06 E-04	2.06 E-04
		Ra-226	* 9.26 E-04	3.44 E-03
		Th-228	* 3.17 E-04	3.14 E-04

* Denotes a result less than the detection limit.

TABLE A-3.1 (Cont.)

GAMMA SPECTROMETRY OF PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
7	901231 to 910401	Be-7	1.05 E-01	8.92 E-03
		K-40	*-1.65 E-03	2.36 E-03
		Ru-103	*-6.68 E-05	5.08 E-04
		Ru-106	*-9.73 E-04	1.49 E-03
		Cs-134	*-3.54 E-05	1.88 E-04
		Cs-137	* 4.82 E-05	1.67 E-04
		Ra-226	*-4.27 E-03	3.12 E-03
		Th-228	*-3.60 E-04	3.14 E-04
	910401 to 910701	Be-7	8.15 E-02	9.41 E-03
		K-40	* 1.97 E-03	3.86 E-03
		Ru-103	* 4.00 E-04	6.36 E-04
		Ru-106	*-2.22 E-04	2.27 E-03
		Cs-134	*-3.31 E-05	2.72 E-04
		Cs-137	*-6.32 E-05	2.59 E-04
		Ra-226	*-7.43 E-04	3.72 E-03
		Th-228	*-1.56 E-03	4.38 E-04
	910701 to 910930	Be-7	1.29 E-01	1.04 E-02
		K-40	*-6.45 E-03	7.55 E-03
		Ru-103	*-4.08 E-04	7.29 E-04
		Ru-106	* 3.92 E-04	2.65 E-03
		Cs-134	*-2.81 E-04	3.07 E-04
		Cs-137	* 6.19 E-05	2.74 E-04
		Ra-226	* 1.09 E-03	4.87 E-03
		Th-228	*-3.03 E-04	4.55 E-04
	910930 to 911230	Be-7	8.93 E-02	8.51 E-03
		K-40	* 2.99 E-03	6.36 E-03
		Ru-103	* 3.43 E-05	6.51 E-04
		Ru-106	* 7.63 E-05	2.59 E-03
		Cs-134	* 1.75 E-04	3.13 E-04
		Cs-137	* 1.01 E-04	2.56 E-04
		Ra-226	*-1.29 E-03	3.59 E-03
		Th-228	* 6.57 E-04	3.64 E-04

* Denotes a result less than the detection limit.

TABLE A-3.1 (Cont.)

GAMMA SPECTROMETRY OF PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
8	901231 to 910401	Be-7	9.03 E-02	8.47 E-03
		K-40	7.35 E-03	3.27 E-03
		Ru-103	*-4.64 E-04	7.60 E-04
		Ru-106	*-4.61 E-04	2.42 E-03
		Cs-134	* 3.88 E-05	2.83 E-04
		Cs-137	* 9.31 E-05	2.55 E-04
		Ra-226	* 3.53 E-03	4.54 E-03
		Th-228	* 3.37 E-04	4.38 E-04
	910401 to 910701	Be-7	8.17 E-02	9.62 E-03
		K-40	*-2.76 E-02	6.70 E-03
		Ru-103	*-6.31 E-05	8.18 E-04
		Ru-106	* 0.00 E+00	2.79 E-03
		Cs-134	* 4.64 E-05	3.14 E-04
		Cs-137	* 1.43 E-04	2.97 E-04
		Ra-226	*-3.01 E-03	4.19 E-03
		Th-228	*-2.77 E-04	4.41 E-04
	910701 to 910930 (a)	Be-7	1.28 E-01	1.09 E-02
		K-40	* 2.35 E-03	3.20 E-03
		Ru-103	* 7.24 E-05	5.77 E-04
		Ru-106	* 5.17 E-04	2.01 E-03
		Cs-134	*-1.13 E-04	2.16 E-04
		Cs-137	*-2.67 E-04	2.12 E-04
		Ra-226	*-1.51 E-04	3.92 E-03
		Th-228	* 7.69 E-05	3.52 E-04
	910930 to 911230 (a)	Be-7	7.27 E-02	8.45 E-03
		K-40	* 1.23 E-03	3.19 E-03
		Ru-103	*-9.68 E-05	4.93 E-04
		Ru-106	*-1.66 E-03	1.82 E-03
		Cs-134	* 1.67 E-04	2.19 E-04
		Cs-137	* 2.22 E-04	2.03 E-04
		Ra-226	*-2.51 E-03	3.86 E-03
		Th-228	*-3.05 E-04	3.23 E-04

(a) Sampler outage during this period; slightly reduced sample volume.
* Denotes a result less than the detection limit.

TABLE A-3.1 (Cont.)

GAMMA SPECTROMETRY OF PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
9A	901231 to 910401	Be-7	9.84 E-02	8.96 E-03
		K-40	7.24 E-03	3.47 E-03
		Ru-103	* 2.55 E-04	5.80 E-04
		Ru-106	* 1.54 E-03	1.95 E-03
		Cs-134	*-9.30 E-05	2.23 E-04
		Cs-137	* 7.50 E-05	1.95 E-04
		Ra-226	*-7.58 E-03	3.57 E-03
		Th-228	* 1.92 E-04	3.24 E-04
	910401 to 910701 (a)	Be-7	6.78 E-02	9.65 E-03
		K-40	*-4.57 E-03	7.39 E-03
		Ru-103	*-4.14 E-04	7.94 E-04
		Ru-106	* 9.61 E-05	2.61 E-03
		Cs-134	* 2.07 E-04	3.12 E-04
		Cs-137	* 2.63 E-04	2.91 E-04
		Ra-226	*-4.36 E-03	4.14 E-03
		Th-228	*-2.24 E-04	3.94 E-04
	910701 to 910930	Be-7	1.04 E-01	9.29 E-03
		K-40	* 1.25 E-03	2.71 E-03
		Ru-103	*-2.29 E-04	4.42 E-04
		Ru-106	* 8.27 E-05	1.60 E-03
		Cs-134	*-3.41 E-05	1.69 E-04
		Cs-137	* 1.64 E-04	1.75 E-04
		Ra-226	*-1.45 E-04	3.22 E-03
		Th-228	*-5.74 E-05	2.74 E-04
	910930 to 911230	Be-7	6.93 E-02	7.60 E-03
		K-40	* 2.40 E-03	4.19 E-03
		Ru-103	*-2.88 E-04	5.29 E-04
		Ru-106	* 8.64 E-04	2.00 E-03
		Cs-134	* 3.53 E-05	2.25 E-04
		Cs-137	*-1.77 E-05	2.02 E-04
		Ra-226	* 7.23 E-04	2.73 E-03
		Th-228	*-1.76 E-04	2.76 E-04

(a) Sampler outage during this period; slightly reduced sample volume.
* Denotes a result less than the detection limit.

TABLE A-3.1 (Cont.)

GAMMA SPECTROMETRY OF PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
21	901231 to 910401 (a)	Be-7	7.46 E-02	7.84 E-03
		K-40	* 2.03 E-03	2.58 E-03
		Ru-103	*-9.16 E-05	4.84 E-04
		Ru-106	*-1.49 E-04	1.62 E-03
		Cs-134	*-7.16 E-05	1.71 E-04
		Cs-137	* 4.09 E-05	1.76 E-04
		Ra-226	*-4.78 E-04	3.12 E-03
		Th-228	* 8.91 E-05	2.64 E-04
	910401 to 910701	Be-7	6.58 E-02	8.17 E-03
		K-40	* 2.53 E-03	3.70 E-03
		Ru-103	*-1.69 E-04	5.46 E-04
		Ru-106	*-1.13 E-03	1.96 E-03
		Cs-134	* 1.53 E-04	2.02 E-04
		Cs-137	* 1.91 E-04	2.09 E-04
		Ra-226	*-8.17 E-04	3.96 E-03
		Th-228	* 2.83 E-04	3.45 E-04
	910701 to 910930	Be-7	1.22 E-01	1.16 E-02
		K-40	* 2.93 E-03	3.78 E-03
		Ru-103	* 4.19 E-04	6.48 E-04
		Ru-106	*-5.43 E-04	2.28 E-03
		Cs-134	* 3.61 E-05	1.97 E-04
		Cs-137	* 1.78 E-04	2.28 E-04
		Ra-226	*-3.39 E-03	5.20 E-03
		Th-228	*-6.59 E-04	4.62 E-04
	910930 to 911230 (a)	Be-7	6.69 E-02	8.27 E-03
		K-40	* 8.68 E-04	2.76 E-03
		Ru-103	* 2.49 E-04	5.11 E-04
		Ru-106	*-9.30 E-05	1.70 E-03
		Cs-134	* 1.90 E-04	1.84 E-04
		Cs-137	*-1.34 E-04	1.96 E-04
		Ra-226	* 7.29 E-04	3.39 E-03
		Th-228	* 2.90 E-04	3.24 E-04

(a) Sampler outage during this period; slightly reduced sample volume.
* Denotes a result less than the detection limit.

TABLE A-3.1 (Cont.)

GAMMA SPECTROMETRY OF PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
23	901231 to 910401 (a)	Be-7	9.23 E-02	1.01 E-03
		K-40	* 4.02 E-03	3.82 E-03
		Ru-103	*-3.18 E-04	6.31 E-04
		Ru-106	* 9.15 E-04	1.96 E-03
		Cs-134	* 1.52 E-05	2.03 E-04
		Cs-137	* 9.94 E-05	2.01 E-04
		Ra-226	* 5.65 E-03	5.09 E-03
		Th-228	* 6.10 E-04	4.36 E-04
	910401 to 910701	Be-7	7.73 E-02	8.87 E-03
		K-40	* 1.97 E-03	3.69 E-03
		Ru-103	* 0.00 E+00	6.41 E-04
		Ru-106	* 1.11 E-04	2.24 E-03
		Cs-134	*-1.07 E-04	2.61 E-04
		Cs-137	*-6.32 E-05	2.79 E-04
		Ra-226	*-2.44 E-03	3.79 E-03
		Th-228	*-1.57 E-03	4.45 E-04
	910701 to 910930	Be-7	9.48 E-02	8.33 E-03
		K-40	*-5.86 E-03	5.41 E-03
		Ru-103	* 1.86 E-04	6.36 E-04
		Ru-106	*-7.85 E-04	2.31 E-03
		Cs-134	* 9.47 E-05	2.70 E-04
		Cs-137	* 1.29 E-04	2.61 E-04
		Ra-226	*-1.04 E-03	3.09 E-03
		Th-228	*-9.73 E-06	3.24 E-04
	910930 to 911230	Be-7	8.63 E-02	7.91 E-03
		K-40	* 3.36 E-03	2.85 E-03
		Ru-103	*-3.82 E-05	4.99 E-04
		Ru-106	*-6.76 E-04	1.81 E-03
		Cs-134	* 0.00 E+00	2.00 E-04
		Cs-137	* 6.52 E-05	1.83 E-04
		Ra-226	*-3.92 E-03	2.95 E-03
		Th-228	*-5.12 E-04	3.35 E-04

(a) Sampler outage during this period; slightly reduced sample volume.
* Denotes a result less than the detection limit.

TABLE A-3.1 (Cont.)

GAMMA SPECTROMETRY OF PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
40	901231 to 910401	Be-7	7.58 E-02	9.37 E-03
		K-40	*-1.20 E-03	3.15 E-03
		Ru-103	*-4.18 E-04	6.02 E-04
		Ru-106	*-8.27 E-04	1.91 E-03
		Cs-134	* 0.00 E+00	2.30 E-04
		Cs-137	*-6.95 E-05	2.51 E-04
		Ra-226	*-2.88 E-04	3.43 E-03
		Th-228	* 4.20 E-04	3.61 E-04
	910401 to 910701	Be-7	7.40 E-02	9.83 E-03
		K-40	*-2.76 E-02	6.58 E-03
		Ru-103	*-1.71 E-04	8.13 E-04
		Ru-106	* 5.24 E-04	2.79 E-03
		Cs-134	*-1.63 E-04	3.02 E-04
		Cs-137	* 2.86 E-04	3.15 E-04
		Ra-226	*-2.53 E-03	4.44 E-03
		Th-228	*-2.17 E-04	4.59 E-04
	910701 to 910930	Be-7	1.04 E-01	1.06 E-02
		K-40	*-8.25 E-05	3.46 E-03
		Ru-103	*-2.98 E-04	6.05 E-04
		Ru-106	* 4.48 E-04	2.12 E-03
		Cs-134	* 4.77 E-05	2.04 E-04
		Cs-137	* 1.94 E-04	2.63 E-04
		Ra-226	*-4.73 E-04	3.58 E-03
		Th-228	* 2.26 E-04	3.65 E-04
	910930 to 911230	Be-7	6.61 E-02	6.48 E-03
		K-40	* 1.36 E-03	2.23 E-03
		Ru-103	* 2.93 E-05	3.79 E-04
		Ru-106	* 0.00 E+00	1.49 E-03
		Cs-134	*-1.34 E-04	1.67 E-04
		Cs-137	*-5.80 E-05	1.51 E-04
		Ra-226	*-1.43 E-03	1.99 E-03
		Th-228	* 2.71 E-04	2.15 E-04

* Denotes a result less than the detection limit.

TABLE A-3.1 (Cont.)

GAMMA SPECTROMETRY OF PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
48	901231 to 910401	Be-7	1.09 E-01	9.54 E-03
		K-40	* 3.83 E-03	3.87 E-03
		Ru-103	*-9.37 E-05	6.19 E-04
		Ru-106	* 1.12 E-03	2.16 E-03
		Cs-134	*-2.57 E-04	2.37 E-04
		Cs-137	* 2.10 E-04	2.66 E-04
		Ra-226	*-3.56 E-03	3.39 E-03
		Th-228	*-2.76 E-03	3.65 E-04
	910401 to 910701	Be-7	9.70 E-02	7.99 E-03
		K-40	* 2.80 E-03	3.16 E-03
		Ru-103	* 2.70 E-04	5.71 E-04
		Ru-106	*-6.13 E-04	1.85 E-03
		Cs-134	* 0.00 E+00	2.22 E-04
		Cs-137	* 5.59 E-05	2.15 E-04
		Ra-226	*-1.86 E-03	3.21 E-03
		Th-228	*-5.01 E-04	3.58 E-04
	910701 to 910930	Be-7	1.28 E-01	1.21 E-02
		K-40	*-8.36 E-03	7.35 E-03
		Ru-103	*-7.45 E-04	7.85 E-04
		Ru-106	* 6.09 E-04	2.91 E-03
		Cs-134	* 1.74 E-04	3.23 E-04
		Cs-137	* 1.05 E-04	3.25 E-04
		Ra-226	*-2.92 E-03	4.32 E-03
		Th-228	*-1.22 E-03	4.30 E-04
	910930 to 911230	Be-7	6.96 E-02	5.49 E-03
		K-40	* 5.02 E-03	2.18 E-03
		Ru-103	* 2.47 E-05	3.57 E-04
		Ru-106	* 4.41 E-04	1.31 E-03
		Cs-134	*-1.04 E-04	1.52 E-04
		Cs-137	* 1.22 E-04	1.48 E-04
		Ra-226	*-8.93 E-04	2.55 E-03
		Th-228	* 1.08 E-04	2.41 E-04

* Denotes a result less than the detection limit.

TABLE A-3.1 (Cont.)

GAMMA SPECTROMETRY OF PARTICULATE FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
57	901231 to 910401	Be-7	1.03 E-01	9.96 E-03
		K-40	*-2.48 E-03	6.93 E-03
		Ru-103	* 1.11 E-04	8.23 E-04
		Ru-106	* 1.90 E-03	2.71 E-03
		Cs-134	* 5.82 E-05	3.16 E-04
		Cs-137	* 3.02 E-04	2.87 E-04
		Ra-226	*-5.68 E-03	4.14 E-03
		Th-228	*-1.64 E-04	4.23 E-04
	910401 to 910701 (a)	Be-7	7.16 E-02	1.07 E-02
		K-40	* 1.52 E-03	7.37 E-03
		Ru-103	*-2.96 E-04	7.85 E-04
		Ru-106	* 7.49 E-04	2.78 E-03
		Cs-134	*-5.03 E-05	3.11 E-04
		Cs-137	*-3.07 E-05	2.85 E-04
		Ra-226	*-2.44 E-03	4.04 E-03
		Th-228	* 4.53 E-06	3.97 E-04
	910701 to 910930	Be-7	1.09 E-01	9.93 E-03
		K-40	*-8.14 E-03	6.88 E-03
		Ru-103	* 6.52 E-04	7.84 E-04
		Ru-106	*-1.11 E-03	2.76 E-03
		Cs-134	*-2.23 E-04	3.07 E-04
		Cs-137	* 1.01 E-04	3.00 E-04
		Ra-226	*-3.34 E-03	4.07 E-03
		Th-228	* 3.11 E-04	4.05 E-04
	910930 to 911230	Be-7	7.78 E-02	7.34 E-03
		K-40	* 4.39 E-03	5.22 E-03
		Ru-103	* 1.00 E-04	5.64 E-04
		Ru-106	*-1.89 E-04	2.11 E-03
		Cs-134	* 3.37 E-05	2.44 E-04
		Cs-137	*-8.66 E-05	2.26 E-04
		Ra-226	* 1.04 E-03	2.68 E-03
		Th-228	* 1.78 E-04	2.98 E-04

(a) Sampler outage during this period; slightly reduced sample volume.
* Denotes a result less than the detection limit.

TABLE A-3.2

GAMMA SPECTROMETRY OF PARTICULATE FILTERS - SUMMARY

Results in pCi/cubic meter

NUCLIDE	AVERAGE	LOW	HIGH	NUMBER SAMPLES	NUMBER POSITIVE
Ru-103 (I)	-2.51E-05	-7.45E-04	6.52E-04	44	0
Ru-103 (C)	-1.69E-04	-4.14E-04	2.55E-04	4	0
Ru-106 (I)	3.76E-05	-1.66E-03	1.90E-03	44	0
Ru-106 (C)	6.46E-04	8.27E-05	1.54E-03	4	0
Cs-134 (I)	-7.89E-06	-2.81E-04	1.90E-04	44	0
Cs-134 (C)	2.88E-05	-9.30E-05	2.07E-04	4	0
Cs-137 (I)	7.50E-05	-2.67E-04	3.02E-04	44	0
Cs-137 (C)	1.21E-04	-1.77E-05	2.63E-04	4	0
Be-7 (I)	8.94E-02	6.29E-02	1.29E-01	44	44
Be-7 (C)	8.49E-02	6.78E-02	1.04E-01	4	4
K-40 (I)	-9.46E-04	-2.76E-02	9.08E-03	44	2
K-40 (C)	1.58E-03	-4.57E-03	7.24E-03	4	1

(I) Indicator Stations
(C) Control Station

TABLE A-4.1

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
1	901231 to 910107	*-1.07 E-02	1.59 E-02
	910107 to 910114	*-1.56 E-03	1.36 E-02
	910114 to 910121	* 8.07 E-03	1.83 E-02
	910121 to 910128	* 5.47 E-03	1.29 E-02
	910128 to 910204	* 5.57 E-03	1.63 E-02
	910204 to 910211	* 4.90 E-03	1.26 E-02
	910211 to 910219	*-6.17 E-03	8.75 E-03
	910219 to 910225	* 7.61 E-03	1.60 E-02
	910225 to 910304 (a)	*-7.85 E-03	1.89 E-02
	910305 to 910311 (b)	*-6.58 E-03	1.09 E-02
	910311 to 910318	* 8.91 E-03	1.36 E-02
	910318 to 910325	* 6.33 E-03	1.35 E-02
	910325 to 910401	* 1.46 E-04	8.95 E-03
	910401 to 910408 (a)	*-1.01 E-01	3.47 E-01
	910408 to 910415 (c)	*-2.20 E-03	1.89 E-02
	910415 to 910422 (c)	* 6.12 E-03	1.38 E-02
	910422 to 910429 (c)	*-4.87 E-03	1.38 E-02
	910429 to 910506	* 1.83 E-03	1.14 E-02
	910506 to 910513 (c)	*-2.01 E-02	1.89 E-02
	910513 to 910520 (d)		
	910520 to 910528 (d)		
	910528 to 910603 (a)	*-1.49 E-03	3.17 E-02
	910603 to 910610	*-2.65 E-03	1.12 E-02
	910610 to 910617	*-3.07 E-03	8.88 E-03
	910617 to 910624	* 4.42 E-03	1.23 E-02
	910624 to 910701	*-1.33 E-03	1.05 E-02
	910701 to 910708	*-9.18 E-04	1.29 E-02
	910708 to 910715	* 7.47 E-03	1.44 E-02
	910715 to 910722	* 1.52 E-04	9.05 E-03
	910722 to 910729	*-6.39 E-03	1.26 E-02
	910729 to 910805	* 5.36 E-03	1.28 E-02
	910805 to 910812	* 1.09 E-03	1.38 E-02
	910812 to 910819	*-1.55 E-03	8.89 E-03
	910819 to 910826	*-2.28 E-03	9.49 E-03
	910826 to 910903	*-4.64 E-03	1.89 E-02
	910903 to 910909	* 0.00 E+00	9.35 E-03
	910909 to 910916	*-3.65 E-03	1.16 E-02
	910916 to 910923	* 2.60 E-03	1.21 E-02

(a) Power outage; low sample volume. Not included in summary.
(b) Power cable breakdown; reduced sample volume.
(c) Power outage; reduced sample volume.
(d) Sample not collected; power outage.
* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
1	910930 to 911007	*-6.00 E-03	1.04 E-02
	911007 to 911014	* 4.18 E-03	9.06 E-03
	911014 to 911017	*-1.32 E-02	2.84 E-02
	911017 to 911021	* 4.48 E-03	1.43 E-02
	911021 to 911028	*-4.92 E-03	1.04 E-02
	911028 to 911104	* 3.17 E-03	1.20 E-02
	911104 to 911111	*-5.10 E-03	1.25 E-02
	911111 to 911118	*-1.02 E-02	1.14 E-02
	911118 to 911125	* 2.12 E-03	2.09 E-02
	911125 to 911202	* 0.00 E+00	1.29 E-02
	911202 to 911209	*-2.87 E-03	1.33 E-02
	911209 to 911216	*-5.68 E-03	1.27 E-02
	911216 to 911223	* 6.45 E-03	1.86 E-02
	911223 to 911230	* 6.37 E-03	1.26 E-02

* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
4	901231 to 910107	*-1.05 E-02	1.55 E-02
	910107 to 910114	*-1.54 E-03	1.34 E-02
	910114 to 910121	* 8.01 E-03	1.81 E-02
	910121 to 910128	* 5.33 E-03	1.26 E-02
	910128 to 910204	* 5.46 E-03	1.60 E-02
	910204 to 910211	* 4.80 E-03	1.23 E-02
	910211 to 910219	*-6.06 E-03	8.58 E-03
	910219 to 910225	* 7.49 E-03	1.57 E-02
	910225 to 910304	*-3.66 E-03	8.80 E-03
	910304 to 910311	*-5.88 E-03	9.77 E-03
	910311 to 910318	* 8.76 E-03	1.34 E-02
	910318 to 910325	* 6.20 E-03	1.33 E-02
	910325 to 910401	* 1.43 E-04	8.80 E-03
	910401 to 910408	*-2.58 E-03	8.86 E-03
	910408 to 910415	*-1.52 E-03	1.30 E-02
	910415 to 910422	* 4.90 E-03	1.10 E-02
	910422 to 910429	*-4.32 E-03	1.23 E-02
	910429 to 910506	* 1.80 E-03	1.12 E-02
	910506 to 910513	*-1.10 E-02	1.03 E-02
	910513 to 910520	* 2.05 E-04	1.20 E-02
	910520 to 910528	* 2.86 E-04	9.95 E-03
	910528 to 910603	*-6.84 E-04	1.46 E-02
	910603 to 910610	*-2.61 E-03	1.10 E-02
	910610 to 910617	*-3.00 E-03	8.68 E-03
	910617 to 910624	* 4.35 E-03	1.21 E-02
	910624 to 910701	*-1.31 E-03	1.03 E-02
	910701 to 910708	*-8.97 E-04	1.26 E-02
	910708 to 910715	* 7.32 E-03	1.41 E-02
	910715 to 910722	* 1.50 E-04	8.91 E-03
	910722 to 910729	*-6.21 E-03	1.23 E-02
	910729 to 910805	* 5.29 E-03	1.26 E-02
	910805 to 910812	* 1.06 E-03	1.35 E-02
	910812 to 910819	*-1.53 E-03	8.75 E-03
	910819 to 910826	*-2.22 E-03	9.27 E-03
	910826 to 910903	*-3.67 E-03	1.49 E-02
	910903 to 910909	* 0.00 E+00	9.11 E-03
	910909 to 910916	*-3.58 E-03	1.14 E-02
	910916 to 910923	* 2.57 E-03	1.20 E-02
	910923 to 910930	*-4.23 E-03	9.10 E-03

* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
4	910930 to 911007	*-5.87 E-03	1.02 E-02
	911007 to 911014	* 4.11 E-03	8.92 E-03
	911014 to 911017	*-1.28 E-02	2.76 E-02
	911017 to 911021	* 4.46 E-03	1.43 E-02
	911021 to 911028	*-4.82 E-03	1.02 E-02
	911028 to 911104	* 3.12 E-03	1.18 E-02
	911104 to 911111	*-5.00 E-03	1.22 E-02
	911111 to 911118	*-9.94 E-03	1.11 E-02
	911118 to 911125	* 2.09 E-03	2.06 E-02
	911125 to 911202	* 0.00 E+00	1.26 E-02
	911202 to 911209	*-2.81 E-03	1.30 E-02
	911209 to 911216	*-5.59 E-03	1.25 E-02
	911216 to 911223	* 6.33 E-03	1.82 E-02
	911223 to 911230	* 6.26 E-03	1.23 E-02

* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
5	901231 to 910107	*-1.15 E-02	1.70 E-02
	910107 to 910114	*-1.54 E-03	1.34 E-02
	910114 to 910121	* 8.04 E-03	1.82 E-02
	910121 to 910128	* 5.38 E-03	1.27 E-02
	910128 to 910204	* 5.50 E-03	1.61 E-02
	910204 to 910211	* 4.84 E-03	1.25 E-02
	910211 to 910219	*-6.09 E-03	8.63 E-03
	910219 to 910225	* 7.51 E-03	1.58 E-02
	910225 to 910304	*-3.68 E-03	8.86 E-03
	910304 to 910311	*-5.90 E-03	9.80 E-03
	910311 to 910318	* 8.79 E-03	1.35 E-02
	910318 to 910325	* 6.24 E-03	1.33 E-02
	910325 to 910401	* 1.44 E-04	8.86 E-03
	910401 to 910408	*-2.59 E-03	8.92 E-03
	910408 to 910415	*-1.40 E-03	1.21 E-02
	910415 to 910422	* 4.93 E-03	1.11 E-02
	910422 to 910429	*-4.35 E-03	1.23 E-02
	910429 to 910506	* 1.81 E-03	1.13 E-02
	910506 to 910513	*-1.10 E-02	1.03 E-02
	910513 to 910520	* 2.07 E-04	1.21 E-02
	910520 to 910528	* 2.87 E-04	9.97 E-03
	910528 to 910603	*-6.88 E-04	1.47 E-02
	910603 to 910610	*-2.63 E-03	1.11 E-02
	910610 to 910617	*-3.03 E-03	8.76 E-03
	910617 to 910624	* 4.36 E-03	1.21 E-02
	910624 to 910701	*-1.31 E-03	1.04 E-02
	910701 to 910708	*-9.02 E-04	1.27 E-02
	910708 to 910715	* 8.00 E-03	1.54 E-02
	910715 to 910722	* 1.51 E-04	8.96 E-03
	910722 to 910729	*-6.26 E-03	1.24 E-02
	910729 to 910805	* 5.30 E-03	1.26 E-02
	910805 to 910812 (a)	* 1.31 E-03	1.65 E-02
	910812 to 910819	*-1.54 E-03	8.80 E-03
	910819 to 910826	*-2.23 E-03	9.29 E-03
	910826 to 910903	*-3.69 E-03	1.50 E-02
	910903 to 910909	* 0.00 E+00	9.29 E-03
	910909 to 910916	*-3.60 E-03	1.15 E-02
	910916 to 910923	* 2.57 E-03	1.20 E-02
	910923 to 910930	*-4.25 E-03	9.15 E-03

(a) Blown fuse; reduced sample volume.
* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
5	910930 to 911007	*-5.91 E-03	1.02 E-02
	911007 to 911014	* 4.13 E-03	8.96 E-03
	911014 to 911017	*-1.28 E-02	2.76 E-02
	911017 to 911021	* 4.49 E-03	1.43 E-02
	911021 to 911028	*-4.85 E-03	1.03 E-02
	911028 to 911104	* 3.14 E-03	1.18 E-02
	911104 to 911111	*-5.04 E-03	1.24 E-02
	911111 to 911118	*-9.97 E-03	1.12 E-02
	911118 to 911125	* 2.10 E-03	2.07 E-02
	911125 to 911202	* 0.00 E+00	1.27 E-02
	911202 to 911209	*-2.83 E-03	1.31 E-02
	911209 to 911226	*-5.61 E-03	1.26 E-02
	911216 to 911223	* 6.36 E-03	1.83 E-02
	911223 to 911230	* 6.30 E-03	1.24 E-02

* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
6	901231 to 910107	*-1.06 E-02	1.58 E-02
	910107 to 910114	*-1.56 E-03	1.36 E-02
	910114 to 910121	* 7.41 E-03	1.68 E-02
	910121 to 910128	* 5.46 E-03	1.29 E-02
	910128 to 910204	* 5.58 E-03	1.63 E-02
	910204 to 910211	* 4.88 E-03	1.26 E-02
	910211 to 910219	*-6.15 E-03	8.72 E-03
	910219 to 910225	* 7.59 E-03	1.59 E-02
	910225 to 910304	*-3.74 E-03	8.98 E-03
	910304 to 910311	*-5.97 E-03	9.92 E-03
	910311 to 910318	* 8.88 E-03	1.36 E-02
	910318 to 910325	* 6.32 E-03	1.35 E-02
	910325 to 910401	* 1.45 E-04	8.93 E-03
	910401 to 910408	*-2.61 E-03	8.97 E-03
	910408 to 910415	*-1.54 E-03	1.33 E-02
	910415 to 910422	* 5.01 E-03	1.13 E-02
	910422 to 910429	*-4.40 E-03	1.25 E-02
	910429 to 910506	* 1.83 E-03	1.14 E-02
	910506 to 910513	*-1.12 E-02	1.04 E-02
	910513 to 910520	* 2.10 E-04	1.23 E-02
	910520 to 910528	* 2.89 E-04	1.01 E-02
	910528 to 910603	*-7.00 E-04	1.49 E-02
	910603 to 910610	*-2.43 E-03	1.02 E-02
	910610 to 910617	*-3.07 E-03	8.87 E-03
	910617 to 910624	* 4.40 E-03	1.22 E-02
	910624 to 910701	*-1.33 E-03	1.05 E-02
	910701 to 910708	*-9.19 E-04	1.29 E-02
	910708 to 910715	* 7.44 E-03	1.44 E-02
	910715 to 910722	* 1.52 E-04	9.04 E-03
	910722 to 910729	*-6.35 E-03	1.25 E-02
	910729 to 910805	* 5.35 E-03	1.27 E-02
	910805 to 910812	* 1.08 E-03	1.37 E-02
	910812 to 910819	*-1.55 E-03	8.87 E-03
	910819 to 910826	*-2.08 E-03	8.68 E-03
	910826 to 910903	*-3.68 E-03	1.50 E-02
	910903 to 910909	* 0.00 E+00	9.27 E-03
	910909 to 910916	*-3.64 E-03	1.16 E-02
	910916 to 910923	* 2.59 E-03	1.21 E-02
	910923 to 910930	*-4.31 E-03	9.28 E-03

* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
6	910930 to 911007	*-5.97 E-03	1.03 E-02
	911007 to 911014	* 4.17 E-03	9.03 E-02
	911014 to 911017	*-1.30 E-02	2.81 E-02
	911017 to 911021	* 4.48 E-03	1.43 E-02
	911021 to 911028	*-4.89 E-03	1.04 E-02
	911028 to 911104	* 3.18 E-03	1.20 E-02
	911104 to 911111	*-4.66 E-03	1.14 E-02
	911111 to 911118	*-1.01 E-02	1.13 E-02
	911118 to 911125	* 1.94 E-03	1.92 E-02
	911125 to 911202	* 0.00 E+00	1.29 E-02
	911202 to 911209	*-2.86 E-03	1.32 E-02
	911209 to 911216	*-5.67 E-03	1.27 E-02
	911216 to 911223	* 6.43 E-03	1.85 E-02
	911223 to 911230	* 6.33 E-03	1.25 E-02

* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
7	901231 to 910107	*-7.75 E-03	1.15 E-02
	910107 to 910114	*-1.02 E-03	8.86 E-03
	910114 to 910121	* 5.39 E-03	1.22 E-02
	910121 to 910128	* 4.47 E-03	1.05 E-02
	910128 to 910204	* 4.69 E-03	1.37 E-02
	910204 to 910211	* 3.19 E-03	8.20 E-03
	910211 to 910219	*-4.86 E-03	6.88 E-03
	910219 to 910225	* 5.02 E-03	1.05 E-02
	910225 to 910304	*-2.11 E-03	5.06 E-03
	910304 to 910311	*-4.72 E-03	7.84 E-03
	910311 to 910318	* 5.80 E-03	8.88 E-03
	910318 to 910325	* 4.13 E-03	8.83 E-03
	910325 to 910401	* 8.75 E-05	5.38 E-03
	910401 to 910408	*-1.47 E-03	5.06 E-03
	910408 to 910415	*-1.01 E-03	8.66 E-03
	910415 to 910422	* 2.71 E-03	6.09 E-03
	910422 to 910429	*-2.36 E-03	6.69 E-03
	910429 to 910506	* 1.43 E-03	8.92 E-03
	910506 to 910513	*-8.77 E-03	8.21 E-03
	910513 to 910520	* 2.10 E-04	1.23 E-02
	910520 to 910528	* 2.89 E-04	1.01 E-02
	910528 to 910603	*-4.57 E-04	9.74 E-03
	910603 to 910610	*-9.49 E-04	4.00 E-03
	910610 to 910617	*-1.73 E-03	5.01 E-03
	910617 to 910624	* 1.72 E-03	4.77 E-03
	910624 to 910701	*-5.18 E-04	4.10 E-03
	910701 to 910708	*-6.00 E-04	8.45 E-03
	910708 to 910715	* 4.85 E-03	9.37 E-03
	910715 to 910722	* 9.12 E-05	5.43 E-03
	910722 to 910729	*-2.48 E-03	4.90 E-03
	910729 to 910805	* 2.09 E-03	4.97 E-03
	910805 to 910812	* 7.07 E-04	8.95 E-03
	910812 to 910819	*-8.73 E-04	5.00 E-03
	910819 to 910826	*-1.25 E-03	5.22 E-03
	910826 to 910903	*-1.45 E-03	5.91 E-03
	910903 to 910909	* 0.00 E+00	5.24 E-03
	910909 to 910916	*-1.42 E-03	4.54 E-03
	910916 to 910923	* 1.01 E-03	4.71 E-03
	910923 to 910930	*-2.59 E-03	5.57 E-03

* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
7	910930 to 911007	*-4.71 E-03	8.15 E-03
	911007 to 911014	* 2.35 E-03	5.09 E-03
	911014 to 911017	*-8.51 E-03	1.83 E-02
	911017 to 911021	* 2.70 E-03	8.62 E-03
	911021 to 911028	*-3.87 E-03	8.19 E-03
	911028 to 911104	* 1.24 E-03	4.68 E-03
	911104 to 911111	*-3.04 E-03	7.45 E-03
	911111 to 911118	*-6.59 E-03	7.38 E-03
	911118 to 911125	* 7.59 E-04	7.48 E-03
	911125 to 911202	* 0.00 E+00	5.01 E-03
	911202 to 911209	*-1.72 E-03	7.95 E-03
	911209 to 911216	*-3.70 E-03	8.29 E-03
	911216 to 911223	* 3.86 E-03	1.11 E-02
	911223 to 911230	* 2.47 E-03	4.87 E-03

* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
8	901231 to 910107	*-1.81 E-04	1.48 E-02
	910107 to 910114	* 6.86 E-03	1.48 E-02
	910114 to 910121	*-8.35 E-04	1.33 E-02
	910121 to 910128	* 1.02 E-02	1.46 E-02
	910128 to 910204	*-6.83 E-03	1.17 E-02
	910204 to 910211	*-1.52 E-03	1.39 E-02
	910211 to 910219	*-5.96 E-03	1.58 E-02
	910219 to 910225	*-2.66 E-03	1.71 E-02
	910225 to 910304	* 5.82 E-03	1.03 E-02
	910304 to 910311	*-8.60 E-03	1.27 E-02
	910311 to 910318	*-2.54 E-03	1.18 E-02
	910318 to 910325	*-2.73 E-03	1.02 E-02
	910325 to 910401	*-2.70 E-03	1.23 E-02
	910401 to 910408	*-4.68 E-03	1.04 E-02
	910408 to 910415	* 3.04 E-03	1.17 E-02
	910415 to 910422	*-3.39 E-04	1.16 E-02
	910422 to 910429	* 1.11 E-02	1.33 E-02
	910429 to 910506	* 8.05 E-03	1.36 E-02
	910506 to 910513	*-3.08 E-04	1.13 E-02
	910513 to 910520	* 8.07 E-05	4.73 E-03
	910520 to 910528	* 1.87 E-04	6.50 E-03
	910528 to 910603	*-3.30 E-04	9.57 E-03
	910603 to 910610	* 5.79 E-03	1.19 E-02
	910610 to 910617	*-6.17 E-03	1.03 E-02
	910617 to 910624	* 1.55 E-03	1.39 E-02
	910624 to 910701	*-1.16 E-04	7.36 E-03
	910701 to 910708	*-6.12 E-03	8.71 E-03
	910708 to 910715	*-1.12 E-03	9.39 E-03
	910715 to 910722	* 0.00 E+00	4.53 E-03
	910722 to 910729	*-2.09 E-04	1.12 E-02
	910729 to 910805	*-6.69 E-03	1.38 E-02
	910805 to 910812	*-7.37 E-04	9.20 E-03
	910812 to 910819	* 1.48 E-03	9.00 E-03
	910819 to 910826 (a)	*-4.07 E-03	1.09 E-02
	910826 to 910903	*-7.74 E-03	1.25 E-02
	910903 to 910909	*-2.74 E-04	1.07 E-02
	910909 to 910916	* 3.61 E-03	9.35 E-03
	910916 to 910923	*-2.34 E-04	1.23 E-02
	910923 to 910930	* 2.71 E-04	7.67 E-04

(a) Blown fuse; reduced sample volume.
* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
8	910930 to 911007 (a)	* 1.10 E-02	2.15 E-02
	911007 to 911014	*-4.23 E-03	9.70 E-03
	911014 to 911017	* 9.57 E-04	2.91 E-02
	911017 to 911021	* 1.12 E-02	1.63 E-02
	911021 to 911028	* 3.39 E-03	8.43 E-03
	911028 to 911104	* 6.40 E-04	1.29 E-02
	911104 to 911111	* 1.01 E-02	9.45 E-03
	911111 to 911118	*-1.79 E-03	8.91 E-03
	911118 to 911125	*-3.34 E-03	2.21 E-02
	911125 to 911202	* 0.00 E+00	9.32 E-03
	911202 to 911209	* 1.58 E-03	9.13 E-03
	911209 to 911216	* 3.70 E-04	1.30 E-02
	911216 to 911223	*-1.39 E-03	1.30 E-02
	911223 to 911230	*-1.58 E-03	1.29 E-02

(a) Sampler malfunction; reduced sample volume.
* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
9A	901231 to 910107	*-1.82 E-04	1.49 E-02
	910107 to 910114	* 6.93 E-03	1.50 E-02
	910114 to 910121	*-8.38 E-04	1.34 E-02
	910121 to 910128	* 1.03 E-02	1.47 E-02
	910128 to 910204	*-6.90 E-03	1.18 E-02
	910204 to 910211	*-1.53 E-03	1.39 E-02
	910211 to 910219	*-5.99 E-03	1.59 E-02
	910219 to 910225	*-2.67 E-03	1.72 E-02
	910225 to 910304	* 5.88 E-03	1.04 E-02
	910304 to 910311	*-8.67 E-03	1.28 E-02
	910311 to 910318	*-2.55 E-03	1.18 E-02
	910318 to 910325	*-2.76 E-03	1.03 E-02
	910325 to 910401	*-2.71 E-03	1.23 E-02
	910401 to 910408	*-4.70 E-03	1.05 E-02
	910408 to 910415	* 3.06 E-03	1.18 E-02
	910415 to 910422	*-3.42 E-04	1.18 E-02
	910422 to 910429	* 1.11 E-02	1.33 E-02
	910429 to 910506 (a)	* 1.05 E-02	1.77 E-02
	910506 to 910513	*-3.11 E-04	1.14 E-02
	910513 to 910520 (b)	* 4.74 E-03	1.86 E-02
	910520 to 910528	* 3.85 E-03	6.77 E-03
	910528 to 910603	*-3.33 E-04	9.64 E-03
	910603 to 910610	* 5.80 E-03	1.20 E-02
	910610 to 910617	*-6.21 E-03	1.04 E-02
	910617 to 910624	* 1.56 E-03	1.40 E-02
	910624 to 910701	*-1.17 E-04	7.40 E-03
	910701 to 910708	*-6.18 E-03	8.81 E-03
	910708 to 910715	*-1.13 E-03	9.46 E-03
	910715 to 910722	* 0.00 E+00	1.08 E-02
	910722 to 910729	*-2.11 E-04	1.14 E-02
	910729 to 910805	*-6.71 E-03	1.38 E-02
	910805 to 910812	*-7.48 E-04	9.35 E-03
	910812 to 910819	* 1.49 E-03	9.06 E-03
	910819 to 910826	*-3.41 E-03	9.12 E-03
	910826 to 910903	*-7.76 E-03	1.25 E-02
	910903 to 910909	*-2.76 E-04	1.08 E-02
	910909 to 910916	* 3.63 E-03	9.40 E-03
	910916 to 910923	*-2.35 E-04	1.23 E-02
	910923 to 910930	* 3.60 E-03	1.02 E-02

(a) Power off; reduced sample volume.
(b) Sampler malfunction; reduced sample volume.
* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
9A	910930 to 911007	* 6.92 E-03	1.34 E-02
	911007 to 911014	*-4.24 E-03	9.73 E-03
	911014 to 911017	* 9.63 E-04	2.92 E-02
	911017 to 911021	* 1.12 E-02	1.64 E-02
	911021 to 911028	* 3.42 E-03	8.48 E-03
	911028 to 911104	* 6.44 E-04	1.30 E-02
	911104 to 911111	* 1.02 E-02	9.60 E-03
	911111 to 911118	*-1.80 E-03	8.95 E-03
	911118 to 911125	*-3.37 E-03	2.23 E-02
	911125 to 911202	* 0.00 E+00	9.35 E-03
	911202 to 911209	* 1.59 E-03	9.19 E-03
	911209 to 911216	* 3.71 E-04	1.30 E-02
	911216 to 911223	*-1.40 E-03	1.31 E-02
	911223 to 911230	*-1.59 E-03	1.29 E-02

* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
21	901231 to 910107	*-1.85 E-04	1.52 E-02
	910107 to 910114 (a)	* 1.96 E-02	4.22 E-02
	910114 to 910121	*-8.40 E-04	1.34 E-02
	910121 to 910128	* 1.04 E-02	1.49 E-02
	910128 to 910204	*-6.94 E-03	1.19 E-02
	910204 to 910211	*-1.54 E-03	1.41 E-02
	910211 to 910219 (b)	*-7.94 E-03	2.11 E-02
	910219 to 910225	*-2.69 E-03	1.73 E-02
	910225 to 910304	* 5.96 E-03	1.06 E-02
	910304 to 910311	*-8.75 E-03	1.29 E-02
	910311 to 910318	*-2.57 E-03	1.20 E-02
	910318 to 910325	*-2.78 E-03	1.04 E-02
	910325 to 910401	*-2.73 E-03	1.25 E-02
	910401 to 910408	*-4.79 E-03	1.07 E-02
	910408 to 910415	* 3.08 E-03	1.19 E-02
	910415 to 910422	*-3.47 E-04	1.19 E-02
	910422 to 910429	* 1.13 E-02	1.35 E-02
	910429 to 910506	* 8.18 E-03	1.38 E-02
	910506 to 910513	*-3.14 E-04	1.15 E-02
	910513 to 910520	* 3.40 E-03	1.33 E-02
	910520 to 910528	* 3.89 E-03	6.83 E-03
	910528 to 910603	*-3.36 E-04	9.73 E-03
	910603 to 910610	* 5.86 E-03	1.21 E-02
	910610 to 910617	*-6.29 E-03	1.05 E-02
	910617 to 910624	* 1.59 E-03	1.43 E-02
	910624 to 910701	*-1.18 E-04	7.48 E-03
	910701 to 910708	*-6.25 E-03	8.89 E-03
	910708 to 910715	*-1.14 E-03	9.58 E-03
	910715 to 910722	* 0.00 E+00	1.09 E-02
	910722 to 910729	*-2.13 E-04	1.15 E-02
	910729 to 910805	*-7.18 E-03	1.48 E-02
	910805 to 910812	*-7.51 E-04	9.38 E-03
	910812 to 910819	* 1.50 E-03	9.13 E-03
	910819 to 910826	*-3.46 E-03	9.25 E-03
	910826 to 910903	*-7.82 E-03	1.26 E-02
	910903 to 910909	*-2.80 E-04	1.09 E-02
	910909 to 910916	* 3.67 E-03	9.51 E-03
	910916 to 910923	*-2.38 E-04	1.24 E-02
	910923 to 910930	* 3.60 E-03	1.02 E-02

(a) Low time; not included in summary table.
(b) Power outage; reduced sample volume.
* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
21	910930 to 911007	* 6.98 E-03	1.36 E-02
	911007 to 911014	*-4.24 E-03	9.73 E-03
	911014 to 911017	* 9.85 E-04	2.99 E-02
	911017 to 911021	* 1.12 E-02	1.63 E-02
	911021 to 911028	* 3.45 E-03	8.58 E-03
	911028 to 911104	* 6.49 E-04	1.31 E-02
	911104 to 911111	* 1.03 E-02	9.62 E-03
	911111 to 911118 (a)	*-2.05 E-03	1.02 E-02
	911118 to 911125 (b)	*-4.52 E-03	3.00 E-02
	911125 to 911202 (b)	* 0.00 E+00	9.82 E-03
	911202 to 911209	* 1.61 E-03	9.29 E-03
	911209 to 911216	* 3.75 E-04	1.31 E-02
	911216 to 911223	*-1.42 E-03	1.32 E-02
	911223 to 911230	*-1.61 E-03	1.31 E-02

(a) Power outage; reduced sample volume.
(b) Broken receptacle: reduced sample volume.
* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
23	901231 to 910107	*-1.84 E-04	1.51 E-02
	910107 to 910114	* 6.94 E-03	1.50 E-02
	910114 to 910121	*-8.40 E-04	1.34 E-02
	910121 to 910128	* 1.04 E-02	1.49 E-02
	910128 to 910204	*-6.94 E-03	1.19 E-02
	910204 to 910211	*-1.54 E-03	1.41 E-02
	910211 to 910219	*-6.05 E-03	1.61 E-02
	910219 to 910225	*-2.69 E-03	1.73 E-02
	910225 to 910304 (a)	* 6.68 E-03	1.19 E-02
	910304 to 910311	*-8.74 E-03	1.29 E-02
	910311 to 910318	*-2.57 E-03	1.20 E-02
	910318 to 910325	*-2.79 E-03	1.04 E-02
	910325 to 910401	*-2.73 E-03	1.24 E-02
	910401 to 910408	*-4.78 E-03	1.07 E-02
	910408 to 910415	* 3.08 E-03	1.19 E-02
	910415 to 910422	*-3.47 E-04	1.19 E-02
	910422 to 910429	* 1.12 E-02	1.35 E-02
	910429 to 910506	* 8.16 E-03	1.37 E-02
	910506 to 910513	*-3.14 E-04	1.15 E-02
	910513 to 910520	* 3.40 E-03	1.33 E-02
	910520 to 910528	* 3.89 E-03	6.83 E-03
	910528 to 910603	*-3.36 E-04	9.73 E-03
	910603 to 910610	* 5.86 E-03	1.21 E-02
	910610 to 910617	*-6.28 E-03	1.05 E-02
	910617 to 910624	* 1.58 E-03	1.42 E-02
	910624 to 910701	*-1.18 E-04	7.47 E-03
	910701 to 910708	*-6.24 E-03	8.88 E-03
	910708 to 910715	*-1.14 E-03	9.58 E-03
	910715 to 910722	* 0.00 E+00	1.09 E-02
	910722 to 910729	*-2.13 E-04	1.15 E-02
	910729 to 910805	*-6.79 E-03	1.40 E-02
	910805 to 910812	*-7.50 E-04	9.37 E-03
	910812 to 910819	* 1.56 E-03	9.45 E-03
	910819 to 910826	*-3.45 E-03	9.24 E-03
	910826 to 910903	*-7.82 E-03	1.26 E-02
	910903 to 910909	*-2.80 E-04	1.09 E-02
	910909 to 910916	* 3.67 E-03	9.51 E-03
	910916 to 910923	*-2.37 E-04	1.24 E-02
	910923 to 910930	* 3.64 E-03	1.03 E-02

(a) Sampler malfunction; reduced sample volume.
* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
23	910930 to 911007	* 6.97 E-03	1.36 E-02
	911007 to 911014	*-4.28 E-03	9.82 E-03
	911014 to 911017	* 9.85 E-04	2.99 E-02
	911017 to 911021	* 1.12 E-02	1.63 E-02
	911021 to 911028	* 3.45 E-03	8.57 E-03
	911028 to 911104	* 6.49 E-04	1.31 E-02
	911104 to 911111	* 1.02 E-02	9.60 E-03
	911111 to 911118	*-1.83 E-03	9.08 E-03
	911118 to 911125	*-3.38 E-03	2.24 E-02
	911125 to 911202	* 0.00 E+00	9.49 E-03
	911202 to 911209	* 1.61 E-03	9.28 E-03
	911209 to 911216	* 3.75 E-04	1.31 E-02
	911216 to 911223	*-1.41 E-03	1.32 E-02
	911223 to 911230	*-1.60 E-03	1.31 E-02

* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
40	901231 to 910107	*-1.52 E-04	1.25 E-02
	910107 to 910114	* 5.80 E-03	1.25 E-02
	910114 to 910121	*-6.82 E-04	1.09 E-02
	910121 to 910128	* 8.58 E-03	1.23 E-02
	910128 to 910204	*-4.80 E-03	8.23 E-03
	910204 to 910211	*-1.11 E-03	1.01 E-02
	910211 to 910219	*-3.90 E-03	1.04 E-02
	910219 to 910225	*-2.24 E-03	1.44 E-02
	910225 to 910304	* 4.60 E-03	8.17 E-03
	910304 to 910311	*-5.63 E-03	8.31 E-03
	910311 to 910318	*-1.98 E-03	9.20 E-03
	910318 to 910325	*-2.16 E-03	8.08 E-03
	910325 to 910401	*-1.46 E-03	6.66 E-03
	910401 to 910408	*-3.69 E-03	8.22 E-03
	910408 to 910415	* 1.64 E-03	6.35 E-03
	910415 to 910422	*-2.21 E-04	7.61 E-03
	910422 to 910429	* 7.24 E-03	8.68 E-03
	910429 to 910506	* 5.28 E-03	8.89 E-03
	910506 to 910513	*-1.21 E-04	4.41 E-03
	910513 to 910520	* 3.35 E-03	1.31 E-02
	910520 to 910528	* 3.82 E-03	6.72 E-03
	910528 to 910603	*-1.99 E-04	5.75 E-03
	910603 to 910610	* 3.79 E-03	7.80 E-03
	910610 to 910617	*-4.88 E-03	8.15 E-03
	910617 to 910624	* 1.02 E-03	9.11 E-03
	910624 to 910701	*-6.99 E-05	4.42 E-03
	910701 to 910708	*-3.69 E-03	5.25 E-03
	910708 to 910715	*-6.33 E-04	5.31 E-03
	910715 to 910722	* 0.00 E+00	8.44 E-03
	910722 to 910729	*-1.36 E-04	7.35 E-03
	910729 to 910805	*-4.37 E-03	8.99 E-03
	910805 to 910812	*-4.43 E-04	5.54 E-03
	910812 to 910819	* 8.92 E-04	5.42 E-03
	910819 to 910826	*-1.91 E-03	5.11 E-03
	910826 to 910903	*-6.09 E-03	9.82 E-03
	910903 to 910909	*-2.17 E-04	8.47 E-03
	910909 to 910916	* 2.86 E-03	7.40 E-03
	910916 to 910923	*-1.53 E-04	8.00 E-03
	910923 to 910930	* 3.63 E-03	1.03 E-02

* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
40	910930 to 911007	* 2.68 E-03	5.20 E-03
	911007 to 911014	*-3.33 E-03	7.65 E-03
	911014 to 911017	* 4.72 E-04	1.43 E-02
	911017 to 911021	* 8.83 E-03	1.28 E-02
	911021 to 911028	* 4.02 E-03	8.31 E-03
	911028 to 911104	* 2.50 E-04	5.04 E-03
	911104 to 911111	* 7.98 E-03	7.48 E-03
	911111 to 911118	*-1.07 E-03	5.35 E-03
	911118 to 911125	*-2.18 E-03	1.45 E-02
	911125 to 911202	* 0.00 E+00	6.09 E-03
	911202 to 911209	* 8.93 E-04	5.15 E-03
	911209 to 911216	* 2.22 E-04	7.77 E-03
	911216 to 911223	*-7.85 E-04	7.33 E-03
	911223 to 911230	*-1.03 E-03	8.43 E-03

* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
48	901231 to 910107	* 0.00 E+00	1.85 E-02
	910107 to 910114	*-8.41 E-03	1.68 E-02
	910114 to 910121	*-2.62 E-03	1.52 E-02
	910121 to 910128	* 9.74 E-03	1.07 E-02
	910128 to 910204	*-9.70 E-03	1.63 E-02
	910204 to 910211	*-7.11 E-03	1.48 E-02
	910211 to 910219	*-7.84 E-03	8.72 E-03
	910219 to 910225	*-2.46 E-03	8.51 E-03
	910225 to 910304	*-3.44 E-03	1.15 E-02
	910304 to 910311	*-6.44 E-03	1.15 E-02
	910311 to 910318	*-5.07 E-03	1.02 E-02
	910318 to 910325	* 1.23 E-02	1.17 E-02
	910325 to 910401	*-1.03 E-03	1.08 E-02
	910401 to 910408	* 5.72 E-03	1.07 E-02
	910408 to 910415	* 7.03 E-03	1.11 E-02
	910415 to 910422	*-2.10 E-03	1.03 E-02
	910422 to 910429	* 7.45 E-03	7.98 E-03
	910429 to 910506	* 4.16 E-03	8.84 E-03
	910506 to 910513	* 5.36 E-03	7.87 E-03
	910513 to 910520	* 2.18 E-03	8.52 E-03
	910520 to 910528	* 2.14 E-03	3.77 E-03
	910528 to 910603	*-5.61 E-03	8.75 E-03
	910603 to 910610	* 2.30 E-03	7.85 E-03
	910610 to 910617	*-2.06 E-03	8.54 E-03
	910617 to 910624	* 1.58 E-03	8.35 E-03
	910624 to 910701	*-6.01 E-04	7.23 E-03
	910701 to 910708	*-1.81 E-03	8.43 E-03
	910708 to 910715	* 7.60 E-03	1.07 E-02
	910715 to 910722	*-9.02 E-03	9.18 E-03
	910722 to 910729	* 1.11 E-03	8.99 E-03
	910729 to 910805	* 1.50 E-03	8.83 E-03
	910805 to 910812	*-3.12 E-03	1.30 E-02
	910812 to 910819	*-6.37 E-03	1.03 E-02
	910819 to 910826	*-2.64 E-03	1.02 E-02
	910826 to 910903	*-4.59 E-03	1.16 E-02
	910903 to 910909	* 9.03 E-03	1.37 E-02
	910909 to 910916	*-1.03 E-03	1.19 E-02
	910916 to 910923	* 3.18 E-03	8.16 E-03
	910923 to 910930	* 5.93 E-03	8.73 E-03

* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
48	910930 to 911007	* 6.29 E-03	8.56 E-03
	911007 to 911014	*-7.37 E-03	1.24 E-02
	911014 to 911017	* 1.93 E-02	3.10 E-02
	911017 to 911021	*-2.53 E-03	1.98 E-02
	911021 to 911028	* 3.99 E-03	8.26 E-03
	911028 to 911104	* 3.63 E-03	8.97 E-03
	911104 to 911111	*-3.58 E-03	1.25 E-02
	911111 to 911118	* 7.17 E-04	1.62 E-02
	911118 to 911125	*-5.73 E-03	2.12 E-02
	911125 to 911202	* 1.73 E-03	1.04 E-02
	911202 to 911209	*-2.84 E-03	4.78 E-03
	911209 to 911216	*-8.91 E-04	8.72 E-03
	911216 to 911223	*-1.25 E-02	1.89 E-02
	911223 to 911230	*-1.88 E-03	1.08 E-02

* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
57	901231 to 910107	* 0.00 E+00	1.90 E-02
	910107 to 910114	*-7.80 E-03	1.56 E-02
	910114 to 910121	*-2.64 E-03	1.53 E-02
	910121 to 910128	* 9.97 E-03	1.10 E-02
	910128 to 910204	*-9.89 E-03	1.66 E-02
	910204 to 910211	*-7.24 E-03	1.50 E-02
	910211 to 910219	*-8.01 E-03	8.91 E-03
	910219 to 910225	*-2.49 E-03	8.63 E-03
	910225 to 910304	*-3.53 E-03	1.18 E-02
	910304 to 910311	*-6.55 E-03	1.17 E-02
	910311 to 910318	*-5.15 E-03	1.03 E-02
	910318 to 910325	* 1.25 E-02	1.19 E-02
	910325 to 910401	*-1.05 E-03	1.10 E-02
	910401 to 910408	* 5.38 E-03	1.01 E-02
	910408 to 910415	* 7.14 E-03	1.12 E-02
	910415 to 910422	*-2.15 E-03	1.06 E-02
	910422 to 910429	* 7.56 E-03	8.10 E-03
	910429 to 910506	* 4.21 E-03	8.95 E-03
	910506 to 910513	* 5.45 E-03	8.01 E-03
	910513 to 910520	*-3.16 E-03	8.11 E-03
	910520 to 910528	* 0.00 E+00	4.59 E-03
	910528 to 910603	*-5.74 E-03	8.94 E-03
	910603 to 910610	* 2.49 E-03	8.51 E-03
	910610 to 910617	*-2.10 E-03	8.73 E-03
	910617 to 910624	* 1.61 E-03	8.52 E-03
	910624 to 910701	*-6.11 E-04	7.35 E-03
	910701 to 910708	*-1.84 E-03	8.56 E-03
	910708 to 910715	* 7.78 E-03	1.10 E-02
	910715 to 910722	*-9.14 E-03	9.31 E-03
	910722 to 910729	* 1.14 E-03	9.20 E-03
	910729 to 910805	* 1.53 E-03	9.00 E-03
	910805 to 910812	*-3.19 E-03	1.33 E-02
	910812 to 910819	*-5.94 E-03	9.61 E-03
	910819 to 910826	*-2.70 E-03	1.05 E-02
	910826 to 910903	*-4.66 E-03	1.17 E-02
	910903 to 910909	* 9.22 E-03	1.40 E-02
	910909 to 910916	*-1.05 E-03	1.21 E-02
	910916 to 910923	* 3.23 E-03	8.28 E-03
	910923 to 910930	* 6.03 E-03	8.89 E-03

* Denotes a result less than the detection limit.

TABLE A-4.1 (Cont.)

I-131 IN CHARCOAL FILTERS

Results in pCi/cubic meter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
57	910930 to 911007	* 6.43 E-03	8.74 E-03
	911007 to 911014	*-7.48 E-03	1.26 E-02
	911014 to 911017	* 1.99 E-02	3.20 E-02
	911017 to 911021	*-2.54 E-03	1.98 E-02
	911021 to 911028	* 4.09 E-03	8.45 E-03
	911028 to 911104	* 3.68 E-03	9.10 E-03
	911104 to 911111	*-3.66 E-03	1.28 E-02
	911111 to 911118	* 7.34 E-04	1.66 E-02
	911118 to 911125	*-5.84 E-03	2.16 E-02
	911125 to 911202	* 1.76 E-03	1.06 E-02
	911202 to 911209	*-1.67 E-03	1.63 E-02
	911209 to 911216	*-9.07 E-04	8.88 E-03
	911216 to 911223	*-1.27 E-02	1.93 E-02
	911223 to 911230	*-1.91 E-03	1.10 E-02

* Denotes a result less than the detection limit.

TABLE A-4.2

I-131 IN CHARCOAL FILTERS FILTERS - SUMMARY

Results in pCi/cubic meter

NUCLIDE		AVERAGE	LOW	HIGH	NUMBER SAMPLES	NUMBER POSITIVE
I-131	(I)	-1.38E-04	-2.01E-02	1.99E-02	581	0
I-131	(C)	4.13E-04	-8.67E-03	1.12E-02	53	0

(I) Indicator Station
(C) Control Station

TABLE A-5.1

GROSS BETA IN WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
		River/Drinking	
26	901205 to 910109	1.8 E+00	7.0 E-01
	910109 to 910212	* 5.9 E-01	6.7 E-01
	910212 to 910313	1.4 E+00	7.0 E-01
	910313 to 910409	1.9 E+00	7.0 E-01
	910409 to 910508	1.3 E+00	7.0 E-01
	910508 to 910611	1.2 E+00	6.0 E-01
	910611 to 910709	1.7 E+00	7.0 E-01
	910709 to 910813	1.5 E+00	3.9 E-01
	910813 to 910904	* 8.8 E-01	7.8 E-01
	910904 to 911009	2.5 E+00	8.0 E-01
	911009 to 911108	1.4 E+00	7.0 E-01
	911108 to 911203 (a)	2.2 E+00	7.0 E-01
28	901205 to 910109	1.9 E+00	7.0 E-01
	910109 to 910212	2.8 E+00	8.0 E-01
	910212 to 910313	1.5 E+00	7.0 E-01
	910313 to 910409	1.8 E+00	7.0 E-01
	910409 to 910508	2.9 E+00	8.0 E-01
	910508 to 910611	2.1 E+00	7.0 E-01
	910611 to 910709	1.1 E+00	6.0 E-01
	910709 to 910813	1.7 E+00	8.0 E-01
	910813 to 910904 (a)	* 8.3 E-01	7.8 E-01
	910904 to 911009	2.2 E+00	8.0 E-01
	911009 to 911108	1.9 E+00	7.0 E-01
	911108 to 911203	1.8 E+00	6.0 E-01
29	901205 to 910109	2.2 E+00	7.0 E-01
	910109 to 910212	1.2 E+00	7.0 E-01
	910212 to 910313	1.1 E+00	7.0 E-01
	910313 to 910409	1.1 E+00	7.0 E-01
	910409 to 910508	1.3 E+00	7.0 E-01
	910508 to 910611	2.0 E+00	7.0 E-01
	910611 to 910709	1.7 E+00	7.0 E-01
	910709 to 910813	1.0 E+00	4.0 E-01
	910813 to 910904	* 7.2 E-01	7.6 E-01
	910904 to 911009	2.9 E+00	8.0 E-01
	911009 to 911108	1.2 E+00	7.0 E-01
	911108 to 911203	2.3 E+00	7.0 E-01

(a) Sampler or equipment malfunction during part of this period.
* Denotes a result less than the detection limit.

TABLE A-5.1 (Cont.)

GROSS BETA IN WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
		Discharge	
27	901205 to 910109	1.3 E+01	2.0 E+00
	910109 to 910212	1.3 E+01	2.0 E+00
	910212 to 910313	1.5 E+01	2.0 E+00
	910313 to 910409	1.7 E+01	2.0 E+00
	910409 to 910508 (a)	9.3 E+00	1.4 E+00
	910508 to 910517 (a)	4.8 E+00	8.0 E-01
	910612 to 910709 (a)	1.1 E+01	1.0 E+00
	910709 to 910813	2.8 E+01	5.2 E-01
	910813 to 910904	1.7 E+01	2.0 E+00
	910904 to 911009	1.9 E+01	2.0 E+00
	911009 to 911108 (b)		
	911107 to 911203 (a)	8.5 E+00	1.4 E+00

(a) Sampler or other equipment malfunction during part of this period.
(b) Sampler failure: sample not collected.
* Denotes a result less than the detection limit.

TABLE A-5.2

GROSS BETA IN WATER - SUMMARY

Results in pCi/liter

NUCLIDE	AVERAGE	LOW	HIGH	NUMBER SAMPLES	NUMBER POSITIVE
		River/Drinking			
Gr-Beta (I)	1.7E+00	7.2E-01	2.9E+00	24	22
Gr-Beta (C)	1.5E+00	5.9E-01	2.5E+00	12	10
		Discharge			
Gr-Beta (I)	1.4E+01	4.8E+00	2.8E+01	11	11

(I) Indicator Station
(C) Control Station

TABLE A-6.1

TRITIUM IN WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
		River/Drinking	
26	901205 to 910313	* 8.3 E-01	7.5 E-01
	910313 to 910611	* 5.8 E+01	4.7 E+01
	910611 to 911009	1.1 E+02	6.0 E+01
	911009 to 920107	*-3.8 E+01	8.0 E+01
28	901205 to 910313	* 9.7 E+01	1.3 E+01
	910313 to 910611	* 3.5 E+01	7.7 E+01
	910611 to 911009	*-6.7 E+00	5.6 E+01
	911009 to 920107	* 1.6 E+02	1.0 E+02
29	901205 to 910313	* 1.2 E+02	8.0 E+01
	910313 to 910611	* 6.8 E+01	9.0 E+01
	910611 to 911009	* 4.0 E+01	6.8 E+01
	911009 to 920107	* 7.8 E+01	5.3 E+01
		Discharge	
27	901205 to 910313	* 6.2 E+01	1.2 E+01
	910313 to 910517	3.7 E+03	1.0 E+02
	910611 to 911009	8.4 E+02	8.0 E+01
	911009 to 920107	1.8 E+03	1.0 E+02

* Denotes a result less than the detection limit.

TABLE A-6.1 (Cont.)

TRITIUM IN WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	RESULT	OVERALL UNCERTAINTY
		Ground	
31	910313	* 5.9 E-01	7.2 E+01
(Well 1)	910616	*-2.9 E+01	8.2 E+01
	910904	*-1.4 E+00	9.5 E+01
	911203	*-8.0 E+00	9.4 E+01
32	910313	*-9.3 E+01	7.6 E+01
(Well 2)	910611	* 7.9 E+00	1.1 E+02
	910904	*-3.4 E+00	7.9 E+01
	911203	*-3.6 E+01	9.3 E+01
33	910313	* 8.1 E+01	7.1 E+01
(Well 3)	910611	1.1 E+02	7.0 E+01
	910904	* 8.6 E+01	7.6 E+01
	911203	*-1.7 E+01	9.8 E+01

* Denotes a result less than the detection limit.

TABLE A-6.2

TRITIUM IN WATER - SUMMARY

Results in pCi/liter

NUCLIDE		AVERAGE	LOW	HIGH	NUMBER SAMPLES	NUMBER POSITIVE
			River/Drinking			
H-3	(I)	7.39E+01	-6.70E+00	1.60E+02	8	0
H-3	(C)	3.27E+01	-3.80E+01	1.10E+02	4	1
			Discharge			
H-3	(I)	1.60E+03	6.20E+01	3.70E+03	4	3
			Ground			
H-3	(I)	8.14E+00	-9.30E+01	1.10E+02	12	1

(I) Indicator Station
(C) Control Station

TABLE A-7.1

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		River/Drinking		
26	901205 TO 910109	Be-7	* 6.84 E+00	2.34 E+01
		K-40	*-8.94 E-01	6.88 E+01
		Mn-54	* 2.35 E+00	2.47 E+00
		Co-58	* 1.51 E-01	2.43 E+00
		Fe-59	* 3.58 E-01	5.21 E+00
		Co-60	* 8.69 E-01	2.77 E+00
		Zn-65	*-7.97 E+00	6.11 E+00
		Zr-95	* 5.45 E+00	5.40 E+00
		Nb-95	* 2.85 E+00	2.65 E+00
		Cs-134	*-2.87 E+00	2.75 E+00
		Cs-137	*-5.32 E-01	2.85 E+00
		Ba-140	* 1.32 E-01	8.98 E+00
		La-140	*-3.83 E+00	3.22 E+00
		Ra-226	* 6.60 E+00	6.22 E+01
		Th-228	*-6.47 E+00	5.13 E+00
	910109 to 910212	Be-7	* 9.80 E+00	1.38 E+01
		K-40	*-1.91 E+01	2.26 E+01
		Mn-54	* 6.47 E-01	1.48 E+00
		Co-58	*-4.83 E-01	1.48 E+00
		Fe-59	*-1.58 E+00	3.08 E+00
		Co-60	* 1.11 E+00	1.83 E+00
		Zn-65	* 5.56 E-01	3.56 E+00
		Zr-95	* 9.64 E-01	3.01 E+00
		Nb-95	* 0.00 E+00	1.50 E+00
		Cs-134	*-8.39 E-01	1.64 E+00
		Cs-137	* 8.15 E-01	1.61 E+00
		Ba-140	*-1.08 E-01	5.06 E+00
		La-140	*-1.03 E+00	2.42 E+00
		Ra-226	*-5.27 E+01	3.88 E+01
		Th-228	*-3.83 E+00	2.96 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		River/Drinking		
26	910212 to 910313	Be-7	* 1.35 E+01	1.62 E+01
		K-40	* 3.97 E-01	2.50 E+01
		Mn-54	* 2.01 E-01	1.48 E+00
		Co-58	* 4.29 E-01	1.63 E+00
		Fe-59	* 2.92 E+00	3.35 E+00
		Co-60	* 2.72 E+00	1.65 E+00
		Zn-65	* 1.04 E+00	3.72 E+00
		Zr-95	* 1.88 E+00	3.26 E+00
		Nb-95	* 5.09 E-01	1.70 E+00
		Cs-134	* 1.40 E+00	1.73 E+00
		Cs-137	* 1.55 E+00	1.77 E+00
		Ba-140	* 3.63 E+00	7.32 E+00
		La-140	* 2.97 E+00	3.26 E+00
		Ra-226	* 4.53 E+01	4.22 E+01
		Th-228	* 2.89 E+00	3.20 E+00
	910313 TO 910409	Be-7	* 1.49 E+01	2.15 E+01
		K-40	*-1.86 E+02	4.79 E+01
		Mn-54	* 9.09 E-01	2.13 E+00
		Co-58	*-6.38 E-01	2.18 E+00
		Fe-59	* 2.74 E-01	4.67 E+00
		Co-60	* 1.62 E+00	2.11 E+00
		Zn-65	*-1.18 E+01	4.98 E+00
		Zr-95	*-4.01 E+00	4.54 E+00
		Nb-95	* 2.04 E+00	2.32 E+00
		Cs-134	* 6.01 E-01	2.41 E+00
		Cs-137	* 5.53 E+00	2.40 E+00
		Ba-140	*-4.65 E+00	1.02 E+01
		La-140	*-1.02 E+00	4.08 E+00
		Ra-226	*-8.17 E+01	4.60 E+01
		Th-228	*-2.44 E+01	3.75 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		River/Drinking		
26	910409 to 910508	Be-7	* 2.79 E+00	2.79 E+01
		K-40	*-1.46 E+02	5.90 E+01
		Mn-54	*-1.65 E+00	2.48 E+00
		Co-58	*-5.49 E-01	2.75 E+00
		Fe-59	* 4.39 E+00	6.54 E+00
		Co-60	*-3.93 E-01	2.69 E+00
		Zn-65	*-5.72 E+00	6.06 E+00
		Zr-95	*-4.67 E+00	5.58 E+00
		Nb-95	* 2.40 E+00	3.00 E+00
		Cs-134	*-4.71 E-01	2.91 E+00
		Cs-137	* 3.31 E+00	2.87 E+00
		Ba-140	*-9.10 E+00	1.59 E+01
		La-140	*-1.54 E+00	6.00 E+00
		Ra-226	* 2.33 E+00	5.10 E+01
		Th-228	*-3.34 E+00	4.52 E+00
	910508 to 910611	Be-7	*-1.20 E+01	2.90 E+01
		K-40	*-1.81 E+01	6.68 E+01
		Mn-54	* 1.27 E-01	2.73 E+00
		Co-58	*-1.38 E-01	3.00 E+00
		Fe-59	* 5.12 E+00	6.84 E+00
		Co-60	*-1.47 E+00	2.86 E+00
		Zn-65	* 3.71 E+00	6.35 E+00
		Zr-95	* 3.34 E+00	6.38 E+00
		Nb-95	* 1.52 E+00	3.10 E+00
		Cs-134	* 4.01 E+00	3.10 E+00
		Cs-137	* 4.41 E+00	3.10 E+00
		Ba-140	* 4.15 E+00	1.53 E+01
		La-140	* 0.00 E+00	5.85 E+00
		Ra-226	* 4.69 E+01	5.89 E+01
		Th-228	*-6.92 E+00	4.99 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		River/Drinking		
26	910611 to 910709	Be-7	*-8.85 E+00	2.34 E+01
		K-40	*-2.47 E+01	5.43 E+01
		Mn-54	*-1.41 E+00	2.22 E+00
		Co-58	*-3.66 E-01	2.43 E+00
		Fe-59	* 1.11 E-01	5.54 E+00
		Co-60	* 6.14 E-01	2.28 E+00
		Zn-65	*-1.08 E-01	5.20 E+00
		Zr-95	*-1.53 E+00	4.98 E+00
		Nb-95	* 2.18 E+00	2.53 E+00
		Cs-134	*-3.67 E-01	2.62 E+00
		Cs-137	* 1.86 E+00	2.55 E+00
		Ba-140	* 1.10 E+00	1.15 E+01
		La-140	*-1.37 E-01	4.21 E+00
		Ra-226	*-5.22 E+01	4.52 E+01
		Th-228	*-1.26 E+00	4.05 E+00
	910709 to 910813	Be-7	* 0.00 E+00	2.02 E+01
		K-40	*-5.86 E+02	4.02 E+01
		Mn-54	*-5.69 E-01	1.91 E+00
		Co-58	* 6.46 E-01	2.07 E+00
		Fe-59	* 2.07 E+00	4.54 E+00
		Co-60	* 3.20 E-01	1.98 E+00
		Zn-65	*-2.40 E-01	4.26 E+00
		Zr-95	*-6.32 E-02	4.32 E+00
		Nb-95	*-3.19 E+00	2.04 E+00
		Cs-134	*-3.30 E+00	2.17 E+00
		Cs-137	* 5.53 E+00	2.27 E+00
		Ba-140	* 5.32 E+00	9.68 E+00
		La-140	* 6.88 E+00	3.90 E+00
		Ra-226	*-1.97 E+01	4.41 E+01
		Th-228	*-6.15 E+00	3.60 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		River/Drinking		
26	910813 to 910904	Be-7	*-6.81 E+00	2.54 E+01
		K-40	*-2.80 E+02	6.51 E+01
		Mn-54	* 2.07 E+00	2.41 E+00
		Co-58	*-1.29 E+00	2.64 E+00
		Fe-59	*-4.01 E-01	5.72 E+00
		Co-60	* 1.23 E+00	2.60 E+00
		Zn-65	*-2.15 E+00	5.59 E+00
		Zr-95	*-1.10 E+01	5.52 E+00
		Nb-95	*-5.11 E-02	2.70 E+00
		Cs-134	*-2.34 E+00	2.66 E+00
		Cs-137	* 3.91 E-01	2.68 E+00
		Ba-140	* 6.00 E-01	1.33 E+01
		La-140	*-4.89 E+00	5.28 E+00
		Ra-226	* 1.16 E+00	5.97 E+01
		Th-228	*-1.68 E+01	4.77 E+00
	910904 to 911009	Be-7	* 3.19 E+00	1.63 E+01
		K-40	*-8.11 E+00	2.29 E+01
		Mn-54	* 7.51 E-01	1.47 E+00
		Co-58	*-3.55 E-01	1.65 E+00
		Fe-59	* 2.51 E-01	3.53 E+00
		Co-60	* 1.04 E+00	1.68 E+00
		Zn-65	* 0.00 E+00	3.32 E+00
		Zr-95	* 1.59 E+00	3.43 E+00
		Nb-95	* 7.25 E-01	1.76 E+00
		Cs-134	*-7.54 E-01	1.74 E+00
		Cs-137	* 1.10 E+00	1.75 E+00
		Ba-140	*-4.47 E+00	7.97 E+00
		La-140	* 2.64 E+00	3.62 E+00
		Ra-226	* 1.45 E+01	3.80 E+01
		Th-228	*-8.26 E+00	3.15 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		River/Drinking		
26	911009 to 911108	Be-7	* 5.68 E+00	2.18 E+01
		K-40	8.04 E+01	3.09 E+01
		Mn-54	* 9.61 E-02	2.17 E+00
		Co-58	*-1.04 E+00	2.27 E+00
		Fe-59	*-3.83 E-01	5.01 E+00
		Co-60	* 2.78 E-01	2.13 E+00
		Zn-65	* 3.66 E+00	5.11 E+00
		Zr-95	* 5.71 E+00	4.92 E+00
		Nb-95	* 8.45 E-01	2.37 E+00
		Cs-134	* 8.77 E-01	2.34 E+00
		Cs-137	*-9.07 E-02	2.40 E+00
		Ba-140	*-2.82 E+00	1.07 E+01
		La-140	*-4.66 E+00	4.32 E+00
		Ra-226	*-4.94 E+01	4.39 E+01
		Th-228	*-2.08 E+01	3.70 E+00
	911108 to 911203 (a)	Be-7	* 3.31 E+00	1.69 E+01
		K-40	*-2.23 E+01	2.68 E+01
		Mn-54	* 1.55 E-01	1.76 E+00
		Co-58	*-5.87 E-01	1.80 E+00
		Fe-59	*-1.66 E+00	3.99 E+00
		Co-60	*-3.06 E-01	1.95 E+00
		Zn-65	*-2.50 E+00	3.91 E+00
		Zr-95	*-3.93 E-01	3.68 E+00
		Nb-95	* 5.56 E-01	1.91 E+00
		Cs-134	*-1.50 E+00	1.95 E+00
		Cs-137	*-3.69 E-01	2.42 E+00
		Ba-140	* 1.46 E+00	6.62 E+00
		La-140	*-1.20 E+00	3.22 E+00
		Ra-226	*-2.45 E+00	3.90 E+01
		Th-228	* 5.28 E-02	3.35 E+00

(a) Sampler or equipment malfunction during part of this period.
* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		River/Drinking		
28	901205 TO 910109	Be-7	*-1.68 E+00	2.47 E+01
		K-40	*-8.86 E+01	6.08 E+01
		Mn-54	* 2.70 E+00	2.55 E+00
		Co-58	* 1.98 E+00	2.74 E+00
		Fe-59	*-8.79 E-01	5.40 E+00
		Co-60	* 1.52 E+00	2.75 E+00
		Zn-65	*-8.13 E+00	5.99 E+00
		Zr-95	*-2.77 E+00	5.39 E+00
		Nb-95	* 2.58 E+00	2.69 E+00
		Cs-134	* 5.63 E-02	2.85 E+00
		Cs-137	* 4.62 E-01	2.83 E+00
		Ba-140	* 2.13 E+00	9.22 E+00
		La-140	*-2.37 E+00	3.61 E+00
		Ra-226	*-9.65 E+01	5.80 E+01
		Th-228	*-2.83 E+01	4.71 E+00
	910109 to 910212	Be-7	*-5.68 E+00	1.50 E+01
		K-40	*-5.55 E+00	2.19 E+01
		Mn-54	* 1.30 E+00	1.57 E+00
		Co-58	*-1.96 E+00	1.49 E+00
		Fe-59	* 4.95 E-01	3.19 E+00
		Co-60	* 1.12 E+00	1.70 E+00
		Zn-65	*-1.93 E+00	3.66 E+00
		Zr-95	* 8.52 E-01	3.09 E+00
		Nb-95	* 0.00 E+00	1.55 E+00
		Cs-134	* 1.57 E+00	1.72 E+00
		Cs-137	*-1.09 E+00	1.66 E+00
		Ba-140	* 0.00 E+00	5.46 E+00
		La-140	* 1.66 E+00	2.44 E+00
		Ra-226	*-3.34 E-01	3.46 E+01
		Th-228	*-4.14 E+00	3.08 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		River/Drinking		
28	910212 to 910313	Be-7	*-3.04 E+00	2.75 E+01
		K-40	*-5.22 E+01	6.66 E+01
		Mn-54	* 1.07 E+00	2.70 E+00
		Co-58	*-1.97 E+00	2.88 E+00
		Fe-59	*-1.00 E+00	6.44 E+00
		Co-60	*-1.82 E-01	2.88 E+00
		Zn-65	*-1.12 E+00	6.72 E+00
		Zr-95	* 3.28 E+00	6.24 E+00
		Nb-95	* 6.48 E-02	3.01 E+00
		Cs-134	* 1.21 E+00	3.01 E+00
		Cs-137	* 2.89 E+00	2.97 E+00
		Ba-140	*-4.14 E+00	1.43 E+01
		La-140	*-3.92 E+00	5.54 E+00
		Ra-226	*-2.46 E+01	5.39 E+01
		Th-228	*-1.67 E+00	4.70 E+00
	910313 to 910409	Be-7	* 1.68 E+01	2.86 E+01
		K-40	*-1.45 E+02	6.36 E+01
		Mn-54	* 2.01 E+00	2.75 E+00
		Co-58	* 1.38 E-01	3.02 E+00
		Fe-59	*-1.88 E+00	6.64 E+00
		Co-60	* 1.82 E+00	2.78 E+00
		Zn-65	*-2.88 E+00	6.27 E+00
		Zr-95	*-1.67 E+00	6.30 E+00
		Nb-95	*-2.64 E-01	3.09 E+00
		Cs-134	* 2.42 E+00	3.02 E+00
		Cs-137	* 3.24 E+00	3.01 E+00
		Ba-140	* 1.18 E+01	1.55 E+01
		La-140	*-3.13 E+00	6.59 E+00
		Ra-226	*-3.98 E+01	5.35 E+01
		Th-228	* 2.22 E+00	4.60 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		River/Drinking		
28	910409 to 910508	Be-7	* 5.11 E+00	2.33 E+01
		K-40	* 9.97 E+00	4.70 E+01
		Mn-54	* 4.54 E-01	2.19 E+00
		Co-58	*-1.29 E+00	2.52 E+00
		Fe-59	* 3.74 E+00	5.41 E+00
		Co-60	* 5.05 E-01	2.24 E+00
		Zn-65	* 1.28 E-01	4.98 E+00
		Zr-95	* 1.77 E+00	5.11 E+00
		Nb-95	* 1.87 E+00	2.50 E+00
		Cs-134	*-4.86 E-01	2.52 E+00
		Cs-137	*-4.77 E+00	2.58 E+00
		Ba-140	* 1.39 E+00	1.31 E+01
		La-140	*-4.83 E+00	5.38 E+00
		Ra-226	* 1.40 E+01	4.60 E+01
		Th-228	*-3.59 E-01	3.92 E+00
	910508 to 910611	Be-7	* 8.81 E+00	1.92 E+01
		K-40	*-2.00 E+01	2.84 E+01
		Mn-54	* 1.43 E+00	1.79 E+00
		Co-58	*-2.13 E-01	1.83 E+00
		Fe-59	* 2.14 E+00	3.84 E+00
		Co-60	*-3.89 E-01	1.95 E+00
		Zn-65	*-2.20 E+00	3.81 E+00
		Zr-95	* 3.14 E+00	3.85 E+00
		Nb-95	* 2.84 E+00	1.98 E+00
		Cs-134	* 1.95 E+00	1.98 E+00
		Cs-137	* 2.42 E+00	2.05 E+00
		Ba-140	* 4.41 E+00	9.62 E+00
		La-140	* 1.24 E+00	4.43 E+00
		Ra-226	* 1.34 E+01	4.74 E+01
		Th-228	*-1.36 E+00	3.57 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		River/Drinking		
28	910611 to 910709	Be-7	* 4.74 E+00	2.29 E+01
		K-40	*-2.47 E+02	5.85 E+01
		Mn-54	* 1.28 E+00	2.31 E+00
		Co-58	*-1.21 E+00	2.30 E+00
		Fe-59	* 5.15 E-01	5.19 E+00
		Co-60	* 5.15 E-01	2.37 E+00
		Zn-65	*-4.29 E+00	4.97 E+00
		Zr-95	* 3.95 E+00	4.83 E+00
		Nb-95	* 2.39 E-01	2.43 E+00
		Cs-134	* 2.76 E+00	2.52 E+00
		Cs-137	* 1.82 E+00	2.49 E+00
		Ba-140	* 6.00 E+00	1.12 E+01
		La-140	*-7.96 E+00	4.56 E+00
		Ra-226	*-3.34 E+01	5.62 E+01
		Th-228	*-7.49 E+00	4.51 E+00
	910709 to 910813	Be-7	* 3.42 E+00	1.41 E+01
		K-40	* 3.44 E+00	2.19 E+01
		Mn-54	* 1.19 E-01	1.35 E+00
		Co-58	*-7.66 E-01	1.42 E+00
		Fe-59	* 1.06 E+00	3.21 E+00
		Co-60	* 1.78 E-01	1.48 E+00
		Zn-65	* 1.95 E+00	3.15 E+00
		Zr-95	* 9.41 E-01	3.06 E+00
		Nb-95	* 4.45 E-01	1.47 E+00
		Cs-134	* 4.25 E-02	1.51 E+00
		Cs-137	* 1.33 E+00	1.51 E+00
		Ba-140	* 0.00 E+00	6.90 E+00
		La-140	* 9.57 E-01	3.29 E+00
		Ra-226	*-7.27 E+01	3.56 E+01
		Th-228	* 1.21 E+00	2.70 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		River/Drinking		
28	910813 to 910904 (a)	Be-7	* 7.68 E+00	2.74 E+01
		K-40	* 4.00 E+02	6.24 E+01
		Mn-54	* 1.59 E+00	2.70 E+00
		Co-58	* 2.66 E-01	2.94 E+00
		Fe-59	* 6.91 E+00	6.84 E+00
		Co-60	* 1.68 E+00	2.75 E+00
		Zn-65	*-3.42 E+00	6.21 E+00
		Zr-95	*-2.60 E+00	5.86 E+00
		Nb-95	* 1.34 E+00	2.97 E+00
		Cs-134	*-4.58 E-01	2.96 E+00
		Cs-137	* 2.64 E+00	2.92 E+00
		Ba-140	* 1.54 E+01	1.46 E+01
		La-140	*-1.11 E+00	5.98 E+00
		Ra-226	*-3.74 E+01	5.28 E+01
		Th-228	* 5.76 E+00	4.59 E+00
	910904 to 911009	Be-7	*-1.50 E+01	1.81 E+01
		K-40	*-1.43 E+02	3.70 E+01
		Mn-54	*-2.71 E-01	1.79 E+00
		Co-58	*-8.45 E-01	1.93 E+00
		Fe-59	* 1.52 E+00	4.20 E+00
		Co-60	* 1.22 E+00	1.79 E+00
		Zn-65	*-3.26 E+00	3.93 E+00
		Zr-95	*-2.74 E+00	3.89 E+00
		Nb-95	*-8.78 E-01	1.93 E+00
		Cs-134	*-2.33 E+00	1.98 E+00
		Cs-137	* 3.18 E+00	1.99 E+00
		Ba-140	* 4.01 E+00	9.13 E+00
		La-140	*-3.73 E+00	3.85 E+00
		Ra-226	*-1.89 E+01	3.74 E+01
		Th-228	* 4.86 E-01	3.13 E+00

(a) Sampler or equipment malfunction during part of this period.
* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		River/Drinking		
29	911009 to 911108	Be-7	*-2.16 E+01	2.37 E+01
		K-40	*-1.24 E+02	4.05 E+01
		Mn-54	* 9.65 E-02	2.12 E+00
		Co-58	* 3.68 E-01	2.35 E+00
		Fe-59	* 9.74 E-01	4.91 E+00
		Co-60	* 1.30 E-02	1.98 E+00
		Zn-65	*-3.25 E+00	4.72 E+00
		Zr-95	*-1.78 E+00	5.35 E+00
		Nb-95	* 2.69 E+00	2.48 E+00
		Cs-134	* 0.00 E+00	2.48 E+00
		Cs-137	* 4.89 E+00	2.68 E+00
		Ba-140	*-2.25 E+00	1.22 E+01
		La-140	*-1.33 E+00	3.96 E+00
		Ra-226	* 9.54 E+00	4.90 E+01
		Th-228	*-3.90 E+00	4.68 E+00
	911108 to 911203	Be-7	*-9.28 E+00	1.77 E+01
		K-40	*-3.97 E+01	2.82 E+01
		Mn-54	* 9.00 E-01	1.91 E+00
		Co-58	*-9.96 E-01	1.91 E+00
		Fe-59	* 1.12 E+00	3.79 E+00
		Co-60	* 1.26 E+00	2.08 E+00
		Zn-65	* 6.14 E+00	4.00 E+00
		Zr-95	* 2.56 E+00	3.81 E+00
		Nb-95	* 1.63 E+00	1.91 E+00
		Cs-134	* 1.46 E+00	1.97 E+00
		Cs-137	* 1.82 E-01	2.02 E+00
		Ba-140	*-3.56 E-01	6.80 E+00
		La-140	* 1.53 E+00	3.12 E+00
		Ra-226	*-4.86 E+01	4.78 E+01
		Th-228	* 1.15 E+00	3.58 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		River/Drinking		
29	901205 TO 910109	Be-7	*-8.32 E+00	2.57 E+01
		K-40	* 6.54 E+00	6.87 E+01
		Mn-54	* 2.96 E+00	2.84 E+00
		Co-58	* 1.14 E+00	2.94 E+00
		Fe-59	*-3.15 E+00	5.79 E+00
		Co-60	*-1.00 E+00	2.79 E+00
		Zn-65	*-6.74 E+00	6.80 E+00
		Zr-95	*-1.05 E+00	5.72 E+00
		Nb-95	*-6.02 E-02	2.75 E+00
		Cs-134	* 2.01 E+00	3.00 E+00
		Cs-137	* 7.67 E-01	3.05 E+00
		Ba-140	* 3.85 E+00	9.80 E+00
		La-140	*-1.35 E+00	4.15 E+00
		Ra-226	* 1.14 E+02	5.59 E+01
		Th-228	*-2.64 E+00	4.67 E+00
	910109 to 910212	Be-7	* 2.75 E-01	1.49 E+01
		K-40	*-3.44 E+00	1.95 E+01
		Mn-54	* 0.00 E+00	1.60 E+00
		Co-58	*-1.72 E-01	1.57 E+00
		Fe-59	*-4.02 E-01	3.22 E+00
		Co-60	* 5.33 E+00	1.91 E+00
		Zn-65	*-1.04 E+00	3.55 E+00
		Zr-95	* 3.98 E-01	3.24 E+00
		Nb-95	* 2.04 E+00	1.57 E+00
		Cs-134	*-1.71 E+00	1.79 E+00
		Cs-137	* 9.63 E-01	1.72 E+00
		Ba-140	*-6.44 E+00	5.69 E+00
		La-140	*-1.10 E+00	2.67 E+00
		Ra-226	*-4.71 E+01	3.04 E+01
		Th-228	*-3.48 E+00	2.61 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		River/Drinking		
29	910409 to 910508	Be-7	* 1.61 E+01	2.60 E+01
		K-40	*-3.24 E+02	5.49 E+01
		Mn-54	* 2.61 E-01	2.46 E+00
		Co-58	*-1.27 E+00	2.77 E+00
		Fe-59	*-3.74 E+00	5.96 E+00
		Co-60	*-7.49 E-02	2.67 E+00
		Zn-65	*-9.28 E-01	5.47 E+00
		Zr-95	* 2.37 E+00	5.75 E+00
		Nb-95	* 2.99 E+00	2.85 E+00
		Cs-134	* 1.67 E-01	2.69 E+00
		Cs-137	* 4.94 E+00	2.82 E+00
		Ba-140	* 5.47 E+00	1.51 E+01
		La-140	*-6.53 E+00	6.07 E+00
		Ra-226	*-8.07 E+01	5.49 E+01
		Th-228	*-2.19 E+01	4.59 E+00
	910508 to 910611	Be-7	*-1.39 E+01	1.86 E+01
		K-40	*-3.98 E+00	2.47 E+01
		Mn-54	* 1.82 E+00	1.91 E+00
		Co-58	*-4.10 E-01	1.95 E+00
		Fe-59	* 2.33 E+00	4.37 E+00
		Co-60	* 2.14 E+00	2.07 E+00
		Zn-65	*-1.58 E-01	3.85 E+00
		Zr-95	*-8.94 E-01	4.08 E+00
		Nb-95	* 1.96 E-01	2.02 E+00
		Cs-134	*-1.68 E+00	2.06 E+00
		Cs-137	* 7.73 E-01	2.01 E+00
		Ba-140	* 6.00 E+00	9.96 E+00
		La-140	*-2.22 E+00	4.49 E+00
		Ra-226	*-1.12 E+01	3.70 E+01
		Th-228	*-2.17 E+00	3.21 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		River/Drinking		
29	910611 to 910709	Be-7	*-7.57 E+00	1.84 E+01
		K-40	* 8.41 E-01	2.77 E+01
		Mn-54	*-1.14 E-01	1.73 E+00
		Co-58	* 0.00 E+00	1.90 E+00
		Fe-59	* 2.29 E+00	4.06 E+00
		Co-60	* 4.28 E-01	1.96 E+00
		Zn-65	* 2.96 E-01	4.13 E+00
		Zr-95	* 2.60 E+00	3.75 E+00
		Nb-95	* 6.42 E-01	2.01 E+00
		Cs-134	*-1.84 E-01	1.86 E+00
		Cs-137	* 2.29 E+00	1.92 E+00
		Ba-140	* 5.16 E+00	8.71 E+00
		La-140	* 0.00 E+00	4.05 E+00
		Ra-226	*-8.50 E+00	3.91 E+01
		Th-228	*-4.90 E+00	3.40 E+00
	910709 to 910813	Be-7	* 1.10 E+01	1.44 E+01
		K-40	* 1.66 E+01	2.17 E+01
		Mn-54	* 1.42 E+00	1.40 E+00
		Co-58	*-4.92 E-02	1.44 E+00
		Fe-59	* 2.32 E+00	3.20 E+00
		Co-60	* 4.08 E-01	1.56 E+00
		Zn-65	* 5.90 E-01	2.99 E+00
		Zr-95	* 1.64 E+00	3.13 E+00
		Nb-95	*-4.40 E+00	1.54 E+00
		Cs-134	* 1.47 E-01	1.55 E+00
		Cs-137	* 1.28 E+00	1.63 E+00
		Ba-140	*-1.00 E+00	6.80 E+00
		La-140	*-3.12 E-01	3.16 E+00
		Ra-226	*-1.36 E+01	3.30 E+01
		Th-228	* 1.44 E+00	2.88 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		River/Drinking		
29	910813 TO 910904	Be-7	* 2.06 E+01	2.59 E+01
		K-40	* 4.83 E+01	4.41 E+01
		Mn-54	*-3.26 E-01	2.30 E+00
		Co-58	* 9.17 E-01	2.44 E+00
		Fe-59	*-2.97 E+00	4.98 E+00
		Co-60	* 1.97 E+00	2.33 E+00
		Zn-65	* 4.03 E+00	4.62 E+00
		Zr-95	* 1.50 E+00	5.58 E+00
		Nb-95	* 8.24 E-01	2.55 E+00
		Cs-134	* 0.00 E+00	2.55 E+00
		Cs-137	* 6.21 E+00	2.74 E+00
		Ba-140	* 4.11 E-01	1.32 E+01
		La-140	*-2.09 E+00	4.34 E+00
		Ra-226	*-1.06 E+00	5.21 E+01
		Th-228	* 1.03 E+01	4.92 E+00
	910904 to 911009	Be-7	*-1.50 E+01	1.47 E+01
		K-40	*-5.17 E+01	2.16 E+01
		Mn-54	* 4.25 E-01	1.43 E+00
		Co-58	*-6.89 E-01	1.57 E+00
		Fe-59	*-1.51 E+00	3.41 E+00
		Co-60	* 2.23 E+00	1.61 E+00
		Zn-65	* 1.99 E+00	3.40 E+00
		Zr-95	* 1.21 E+00	3.20 E+00
		Nb-95	* 1.61 E+00	1.59 E+00
		Cs-134	*-7.59 E-01	1.67 E+00
		Cs-137	*-3.19 E+00	1.88 E+00
		Ba-140	*-7.08 E+00	7.22 E+00
		La-140	*-2.98 E+00	3.57 E+00
		Ra-226	*-1.97 E+01	3.15 E+01
		Th-228	* 4.06 E+00	2.81 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		River/Drinking		
29	911009 to 911108	Be-7	*-2.16 E+01	2.37 E+01
		K-40	*-1.24 E+02	4.05 E+01
		Mn-54	* 9.65 E-02	2.12 E+00
		Co-58	* 3.68 E-01	2.35 E+00
		Fe-59	* 9.74 E-01	4.91 E+00
		Co-60	* 1.30 E-02	1.98 E+00
		Zn-65	*-3.25 E+00	4.72 E+00
		Zr-95	*-1.78 E+00	5.35 E+00
		Nb-95	* 2.69 E+00	2.48 E+00
		Cs-134	* 0.00 E+00	2.48 E+00
		Cs-137	* 4.89 E+00	2.68 E+00
		Ba-140	*-2.25 E+00	1.22 E+01
		La-140	*-1.33 E+00	3.96 E+00
		Ra-226	* 9.54 E+00	4.90 E+01
		Th-228	*-3.90 E+00	4.68 E+00
	911107 to 911203	Be-7	*-9.28 E+00	1.77 E+01
		K-40	*-3.97 E+01	2.82 E+01
		Mn-54	* 9.00 E-01	1.91 E+00
		Co-58	*-9.96 E-01	1.91 E+00
		Fe-59	* 1.12 E+00	3.79 E+00
		Co-60	* 1.26 E+00	2.08 E+00
		Zn-65	* 6.14 E+00	4.00 E+00
		Zr-95	* 2.56 E+00	3.81 E+00
		Nb-95	* 1.63 E+00	1.91 E+00
		Cs-134	* 1.46 E+00	1.97 E+00
		Cs-137	* 1.82 E-01	2.02 E+00
		Ba-140	*-3.56 E-01	6.80 E+00
		La-140	* 1.53 E+00	3.12 E+00
		Ra-226	*-4.86 E+01	4.78 E+01
		Th-228	* 1.15 E+00	3.58 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		Discharge		
27	901205 TO 910109	Be-7	* 1.50 E+01	1.80 E+01
		K-40	* 3.04 E-01	2.66 E+01
		Mn-54	* 1.04 E-01	1.81 E+00
		Co-58	*-8.54 E-01	1.77 E+00
		Fe-59	*-3.79 E-01	3.84 E+00
		Co-60	* 2.76 E+00	2.12 E+00
		Zn-65	*-8.18 E+00	4.21 E+00
		Zr-95	* 2.17 E+00	3.75 E+00
		Nb-95	* 3.24 E+00	1.96 E+00
		Cs-134	* 1.28 E+00	2.03 E+00
		Cs-137	*-3.33 E+00	2.37 E+00
		Ba-140	*-5.63 E-01	6.61 E+00
		La-140	*-2.40 E+00	3.21 E+00
		Ra-226	*-6.38 E+00	4.34 E+01
		Th-228	* 2.31 E-01	3.63 E+00
	910109 to 910212	Be-7	* 3.09 E-01	1.52 E+01
		K-40	*-1.88 E+01	2.25 E+01
		Mn-54	* 1.20 E+00	1.51 E+00
		Co-58	* 1.02 E-01	1.57 E+00
		Fe-59	* 2.29 E+00	3.30 E+00
		Co-60	* 9.74 E-01	1.76 E+00
		Zn-65	*-4.22 E+00	3.33 E+00
		Zr-95	*-1.86 E-01	3.05 E+00
		Nb-95	* 1.44 E+00	1.59 E+00
		Cs-134	* 1.46 E+00	1.63 E+00
		Cs-137	* 6.62 E-01	1.68 E+00
		Ba-140	* 1.63 E+00	5.32 E+00
		La-140	* 5.87 E-01	2.47 E+00
		Ra-226	*-8.01 E+00	3.50 E+01
		Th-228	*-3.18 E+00	3.17 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		Discharge		
27	910212 to 910313	Be-7	* 3.47 E+00	1.67 E+01
		K-40	*-1.35 E+01	2.27 E+01
		Mn-54	*-8.15 E-01	1.50 E+00
		Co-58	*-6.82 E-01	1.69 E+00
		Fe-59	* 3.06 E-01	3.74 E+00
		Co-60	* 9.51 E-01	1.79 E+00
		Zn-65	*-1.65 E+00	3.66 E+00
		Zr-95	* 3.09 E+00	3.54 E+00
		Nb-95	* 2.48 E+00	1.71 E+00
		Cs-134	* 1.75 E+00	1.83 E+00
		Cs-137	* 1.31 E+00	1.87 E+00
		Ba-140	*-2.82 E+00	7.35 E+00
		La-140	* 7.53 E-01	3.53 E+00
		Ra-226	*-4.82 E+01	3.67 E+01
		Th-228	* 4.65 E+00	3.33 E+00
	910313 to 910409	Be-7	* 1.73 E+01	2.74 E+01
		K-40	* 5.21 E+00	3.72 E+01
		Mn-54	* 5.07 E-01	2.68 E+00
		Co-58	* 7.42 E-01	2.80 E+00
		Fe-59	*-2.07 E+00	6.01 E+00
		Co-60	*-1.70 E+00	2.65 E+00
		Zn-65	* 4.29 E-01	5.59 E+00
		Zr-95	* 1.90 E+00	6.46 E+00
		Nb-95	* 1.77 E-01	2.88 E+00
		Cs-134	* 3.61 E+00	3.00 E+00
		Cs-137	*-2.03 E-01	3.25 E+00
		Ba-140	* 2.18 E+00	1.50 E+01
		La-140	*-7.10 E+00	7.13 E+00
		Ra-226	*-4.39 E+01	5.30 E+01
		Th-228	*-7.34 E+01	5.02 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		Discharge		
27	910409 to 910508	Be-7	* 2.83 E+00	2.66 E+01
		K-40	*-1.21 E+02	6.76 E+01
		Mn-54	* 2.81 E+00	2.50 E+00
		Co-58	*-1.28 E+00	2.72 E+00
		Fe-59	* 1.26 E+00	6.18 E+00
		Co-60	* 5.35 E+00	2.66 E+00
		Zn-65	* 3.09 E+00	5.66 E+00
		Zr-95	* 1.65 E+00	5.64 E+00
		Nb-95	*-3.72 E-01	2.79 E+00
		Cs-134	* 1.55 E+00	2.96 E+00
		Cs-137	* 3.15 E+00	2.92 E+00
		Ba-140	*-1.88 E+01	1.54 E+01
		La-140	*-1.16 E+01	6.42 E+00
		Ra-226	* 1.19 E+01	6.20 E+01
		Th-228	*-1.50 E+00	5.01 E+00
	910508 to 910517(a)	Be-7	* 0.00 E+00	2.85 E+01
		K-40	*-1.45 E+01	4.78 E+01
		Mn-54	* 2.43 E+00	2.56 E+00
		Co-58	* 6.02 E-01	2.92 E+00
		Fe-59	* 2.49 E+00	7.00 E+00
		Co-60	2.14 E+01	4.06 E+00
		Zn-65	1.73 E+01	4.93 E+00
		Zr-95	*-2.02 E+00	5.88 E+00
		Nb-95	* 2.66 E+00	2.96 E+00
		Cs-134	* 6.40 E-01	2.66 E+00
		Cs-137	6.87 E+00	3.48 E+00
		Ba-140	*-2.51 E+01	2.64 E+01
		La-140	*-1.65 E+00	1.09 E+01
		Ra-226	* 1.30 E+01	4.88 E+01
		Th-228	* 2.23 E+00	4.22 E+00

(a) Sample taken during plant outage; low sample volume.
* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		Discharge		
27	910612 to 910709	Be-7	* 1.19 E+00	1.77 E+01
		K-40	* 1.71 E+01	2.36 E+01
		Mn-54	* 2.45 E+00	1.93 E+00
		Co-58	* 2.13 E+00	1.96 E+00
		Fe-59	* 1.07 E+00	3.99 E+00
		Co-60	2.18 E+01	4.32 E+00
		Zn-65	2.85 E+01	7.73 E+00
		Zr-95	*-2.32 E-01	3.75 E+00
		Nb-95	* 7.75 E-01	1.91 E+00
		Cs-134	*-6.25 E-02	2.02 E+00
		Cs-137	* 2.19 E+00	2.07 E+00
		Ba-140	* 4.31 E-01	8.26 E+00
		La-140	* 7.78 E-01	3.56 E+00
		Ra-226	*-2.52 E+01	3.75 E+01
		Th-228	*-6.20 E+00	3.30 E+00
	910709 to 910813	Be-7	* 7.59 E+00	2.22 E+01
		K-40	*-6.32 E+01	5.17 E+01
		Mn-54	* 3.32 E+00	2.42 E+00
		Co-58	* 1.73 E+00	2.55 E+00
		Fe-59	* 2.11 E+00	5.65 E+00
		Co-60	5.76 E+01	5.18 E+00
		Zn-65	2.06 E+01	5.07 E+00
		Zr-95	* 3.81 E+00	5.01 E+00
		Nb-95	* 1.53 E+00	2.40 E+00
		Cs-134	* 3.04 E+00	2.53 E+00
		Cs-137	* 5.98 E+00	2.62 E+00
		Ba-140	*-8.81 E+00	1.10 E+01
		La-140	*-2.54 E-01	4.24 E+00
		Ra-226	*-5.95 E+01	4.27 E+01
		Th-228	*-5.62 E+00	3.67 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		Discharge		
27	910813 to 910904	Be-7	* 4.63 E+00	2.52 E+01
		K-40	*-5.39 E+02	5.07 E+01
		Mn-54	* 1.01 E-01	2.32 E+00
		Co-58	*-4.97 E-01	2.62 E+00
		Fe-59	* 3.40 E+00	6.07 E+00
		Co-60	1.23 E+01	2.56 E+00
		Zn-65	* 3.60 E+00	5.79 E+00
		Zr-95	* 1.75 E+00	5.36 E+00
		Nb-95	*-3.06 E+00	2.71 E+00
		Cs-134	*-3.96 E+00	2.71 E+00
		Cs-137	* 5.62 E+00	2.89 E+00
		Ba-140	*-1.04 E+00	1.33 E+01
		La-140	*-1.65 E+00	5.45 E+00
		Ra-226	*-9.20 E+01	5.14 E+01
		Th-228	*-1.73 E+01	4.20 E+00
	911004 to 911009	Be-7	* 1.96 E+00	1.83 E+01
		K-40	* 2.03 E+00	2.42 E+01
		Mn-54	* 9.57 E-01	1.68 E+00
		Co-58	* 9.13 E-01	1.81 E+00
		Fe-59	* 8.92 E-01	3.98 E+00
		Co-60	1.40 E+01	3.24 E+00
		Zn-65	* 4.99 E+00	3.85 E+00
		Zr-95	*-1.36 E+00	3.58 E+00
		Nb-95	* 1.11 E+00	1.87 E+00
		Cs-134	* 1.09 E+00	1.87 E+00
		Cs-137	* 4.79 E-01	1.94 E+00
		Ba-140	*-1.53 E+00	8.57 E+00
		La-140	* 1.72 E+00	3.81 E+00
		Ra-226	* 1.24 E+01	4.82 E+01
		Th-228	*-1.39 E+01	3.77 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		Discharge		
27	911008 to 911203 (a)			
	911107 to 911203	Be-7	* 7.00 E+00	1.72 E+01
		K-40	* 1.62 E+00	2.55 E+01
		Mn-54	* 2.25 E+00	1.81 E+00
		Co-58	*-6.34 E-01	1.83 E+00
		Fe-59	* 8.75 E-01	3.88 E+00
		Co-60	* 1.19 E+00	2.06 E+00
		Zn-65	* 1.55 E+00	4.17 E+00
		Zr-95	*-4.88 E-01	3.76 E+00
		Nb-95	* 2.46 E+00	1.96 E+00
		Cs-134	*-4.97 E-01	2.00 E+00
		Cs-137	*-2.45 E+00	2.34 E+00
		Ba-140	* 4.24 E+00	6.77 E+00
		La-140	*-5.15 E-01	2.80 E+00
		Ra-226	*-4.60 E+01	4.17 E+01
		Th-228	*-6.05 E+00	3.30 E+00

(a) Sampler not operational; no sample collected.
* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		Ground		
31	910313	Be-7	* 1.98 E+01	1.86 E+01
		K-40	* 1.59 E+01	2.45 E+00
		Mn-54	* 2.20 E-01	1.84 E+00
		Co-58	* 5.38 E-01	1.93 E+00
		Fe-59	* 0.00 E+00	4.03 E+00
		Co-60	* 8.62 E-01	2.13 E+00
		Zn-65	* 2.80 E+00	4.23 E+00
		Zr-95	* 0.00 E+00	3.78 E+00
		Nb-95	*-4.39 E-01	2.02 E+00
		Cs-134	* 1.26 E+00	2.08 E+00
		Cs-137	* 6.25 E-01	2.03 E+00
		Ba-140	*-3.91 E+00	7.75 E+00
		La-140	*-2.29 E+00	3.10 E+00
		Ra-226	*-2.17 E+01	4.09 E+01
		Th-228	*-1.95 E+00	3.70 E+00
	910611	Be-7	* 4.70 E+00	2.78 E+01
		K-40	*-7.68 E+01	6.12 E+01
		Mn-54	*-8.87 E-01	2.63 E+00
		Co-58	*-1.51 E+00	2.89 E+00
		Fe-59	* 4.75 E+00	6.37 E+00
		Co-60	* 3.18 E-01	2.79 E+00
		Zn-65	*-4.21 E-01	5.87 E+00
		Zr-95	* 2.25 E-01	5.99 E+00
		Nb-95	* 1.85 E+00	2.92 E+00
		Cs-134	* 7.13 E-01	2.98 E+00
		Cs-137	* 3.61 E+00	3.06 E+00
		Ba-140	*-5.93 E+00	1.47 E+01
		La-140	*-8.32 E-01	5.55 E+00
		Ra-226	* 4.21 E+01	5.27 E+01
		Th-228	* 7.29 E+00	4.66 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		Ground		
32	910904	Be-7	* 4.67 E+00	2.71 E+01
		K-40	*-1.18 E+02	6.26 E+01
		Mn-54	* 6.70 E-01	2.57 E+00
		Co-58	*-7.25 E-01	2.70 E+00
		Fe-59	* 1.78 E+00	6.14 E+00
		Co-60	* 2.83 E+00	2.95 E+00
		Zn-65	* 3.92 E+00	6.07 E+00
		Zr-95	* 2.28 E+00	5.88 E+00
		Nb-95	*-3.35 E+00	2.89 E+00
		Cs-134	*-9.13 E-01	2.98 E+00
		Cs-137	* 3.16 E+00	2.97 E+00
		Ba-140	*-2.02 E+00	1.36 E+01
		La-140	*-1.78 E-01	5.29 E+00
		Ra-226	*-6.26 E+01	5.77 E+01
		Th-228	*-1.41 E+01	4.74 E+00
	911203	Be-7	*-2.01 E+01	2.32 E+01
		K-40	* 3.52 E+01	4.41 E+01
		Mn-54	* 0.00 E+00	2.25 E+00
		Co-58	*-8.36 E-01	2.31 E+00
		Fe-59	*-3.53 E+00	4.47 E+00
		Co-60	* 0.00 E+00	2.18 E+00
		Zn-65	* 7.93 E-01	4.91 E+00
		Zr-95	* 1.29 E+00	5.17 E+00
		Nb-95	* 1.84 E+00	2.46 E+00
		Cs-134	* 1.13 E+00	2.51 E+00
		Cs-137	* 1.98 E+00	2.62 E+00
		Ba-140	* 5.58 E+00	9.16 E+00
		La-140	* 1.49 E+00	2.90 E+00
		Ra-226	* 1.56 E+01	5.17 E+01
		Th-228	* 1.27 E+01	4.94 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		Ground		
52	910313	Be-7	* 4.61 E+00	1.99 E+01
		K-40	*-2.23 E+01	2.73 E+01
		Mn-54	* 2.59 E+00	2.07 E+00
		Co-58	* 3.02 E-01	2.15 E+00
		Fe-59	* 0.00 E+00	4.21 E+00
		Co-60	* 2.60 E+00	2.37 E+00
		Zn-65	* 4.65 E+00	4.80 E+00
		Zr-95	* 2.91 E+00	4.43 E+00
		Nb-95	* 1.65 E+00	2.15 E+00
		Cs-134	* 3.79 E+00	2.40 E+00
		Cs-137	* 1.62 E+00	2.26 E+00
		Ba-140	*-1.55 E+00	8.56 E+00
		La-140	*-8.48 E-01	3.89 E+00
		Ra-226	*-4.53 E+01	4.44 E+01
		Th-228	*-6.88 E-02	3.84 E+00
	910611	Be-7	* 1.63 E+01	2.71 E+01
		K-40	*-2.55 E+02	5.96 E+01
		Mn-54	*-5.77 E-01	2.58 E+00
		Co-58	*-8.59 E-01	2.68 E+00
		Fe-59	* 1.69 E+00	6.14 E+00
		Co-60	* 7.56 E-01	2.54 E+00
		Zn-65	* 1.20 E+00	5.84 E+00
		Zr-95	*-3.73 E+00	5.63 E+00
		Nb-95	*-4.93 E-01	2.79 E+00
		Cs-134	* 6.19 E-01	2.88 E+00
		Cs-137	*-2.74 E+00	2.89 E+00
		Ba-140	* 3.90 E+00	1.42 E+01
		La-140	* 7.26 E+00	5.92 E+00
		Ra-226	*-2.06 E+01	5.82 E+01
		Th-228	*-1.36 E+01	4.83 E+00

* Denotes a result less than the detection limit.

TABLE A-7.1 (Cont.)

GAMMA SPECTROMETRY OF WATER

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
		Ground		
52	910904	Be-7	* 1.06 E+01	2.30 E+01
		K-40	* 5.06 E+02	5.48 E+01
		Mn-54	* 2.57 E+00	2.25 E+00
		Co-58	* 9.02 E-02	2.39 E+00
		Fe-59	* 2.20 E-01	5.17 E+00
		Co-60	* 1.72 E+00	2.41 E+00
		Zn-65	*-3.22 E-01	5.03 E+00
		Zr-95	* 3.01 E+00	4.92 E+00
		Nb-95	* 2.80 E+00	2.44 E+00
		Cs-134	*-2.04 E+00	2.48 E+00
		Cs-137	* 1.40 E+00	2.56 E+00
		Ba-140	* 1.36 E+00	1.08 E+01
		La-140	*-4.05 E-01	4.26 E+00
		Ra-226	*-1.10 E+00	4.49 E+01
		Th-228	* 2.04 E+00	3.85 E+00
	911203	Be-7	*-4.47 E+00	1.78 E+01
		K-40	*-6.16 E+01	4.07 E+01
		Mn-54	* 2.49 E-01	1.74 E+00
		Co-58	*-9.99 E-01	1.84 E+00
		Fe-59	*-1.95 E+00	3.69 E+00
		Co-60	* 1.43 E+00	1.86 E+00
		Zn-65	* 1.91 E+00	3.99 E+00
		Zr-95	* 4.71 E+00	4.04 E+00
		Nb-95	* 4.06 E-01	1.89 E+00
		Cs-134	* 3.87 E-01	2.08 E+00
		Cs-137	*-2.45 E-01	2.03 E+00
		Ba-140	*-2.48 E+00	7.17 E+00
		La-140	*-2.59 E+00	2.59 E+00
		Ra-226	* 3.82 E+00	3.02 E+01
		Th-228	*-3.68 E+00	3.29 E+00

* Denotes a result less than the detection limit.

TABLE A-7.2

GAMMA SPECTROMETRY OF WATER - SUMMARY

Results in pCi/liter

NUCLIDE		AVERAGE	LOW	HIGH	NUMBER SAMPLES	NUMBER POSITIVE
			River/Drinking			
Co-60	(I)	9.07E-01	-2.81E+00	5.33E+00	24	0
Co-60	(C)	6.36E-01	-1.47E+00	2.72E+00	12	0
Co-58	(I)	-3.27E-01	-1.97E+00	1.98E+00	24	0
Co-58	(C)	-3.52E-01	-1.29E+00	6.46E-01	12	0
Cs-134	(I)	3.32E-01	-2.33E+00	2.76E+00	24	0
Cs-134	(C)	-4.63E-01	-3.30E+00	4.01E+00	12	0
Cs-137	(I)	1.56E+00	-4.77E+00	6.21E+00	24	0
Cs-137	(C)	1.96E+00	-5.32E-01	5.53E+00	12	0
Nb-95	(I)	9.17E-01	-4.40E+00	4.30E+00	24	0
Nb-95	(C)	8.65E-01	-3.19E+00	2.85E+00	12	0
Zr-95	(I)	3.32E-01	-2.77E+00	3.95E+00	24	0
Zr-95	(C)	-2.28E-01	-1.10E+01	5.71E+00	12	0
Zn-65	(I)	-9.94E-01	-8.13E+00	6.14E+00	24	0
Zn-65	(C)	-1.79E+00	-1.18E+01	3.71E+00	12	0

(I) Indicator Station
(C) Control Station

TABLE A-7.2 (Cont.)

GAMMA SPECTROMETRY OF WATER - SUMMARY

Results in pCi/liter

NUCLIDE	AVERAGE	LOW	HIGH	NUMBER SAMPLES	NUMBER POSITIVE
		River/Drinking			
Fe-59 (I)	1.12E+00	-3.74E+00	6.91E+00	24	0
Fe-59 (C)	9.56E-01	-1.66E+00	5.12E+00	12	0
Ba-140 (I)	2.27E+00	-7.08E+00	1.54E+01	24	0
Ba-140 (C)	-3.96E-01	-9.10E+00	5.32E+00	12	0
La-140 (I)	-1.85E+00	-7.96E+00	1.66E+00	24	0
La-140 (C)	-4.85E-01	-4.89E+00	6.88E+00	12	0

(I) Indicator Station
(C) Control Station

TABLE A-7.2 (Cont.)

GAMMA SPECTROMETRY OF WATER - SUMMARY

Results in pCi/liter

NUCLIDE	AVERAGE	LOW	HIGH	NUMBER SAMPLES	NUMBER POSITIVE
		Discharge			
Co-60 (I)	1.24E+01	-1.70E+00	5.76E+01	11	5
Co-58 (I)	2.07E-01	-1.28E+00	2.13E+00	11	0
Cs-134 (I)	9.00E-01	-3.96E+00	3.61E+00	11	0
Cs-137 (I)	1.84E+00	-3.33E+00	6.87E+00	11	1
Nb-95 (I)	1.13E+00	-3.06E+00	3.24E+00	11	0
Zr-95 (I)	9.17E-01	-2.02E+00	3.81E+00	11	0
Zn-65 (I)	6.00E+00	-8.18E+00	2.85E+01	11	3
Fe-59 (I)	1.11E+00	-2.07E+00	3.40E+00	11	0
Ba-140 (I)	-4.56E+00	-2.51E+01	4.24E+00	11	0
La-140 (I)	-1.94E+00	-1.16E+01	1.72E+00	11	0

(I) Indicator Stations only.

TABLE A-7.2 (Cont.)

GAMMA SPECTROMETRY OF WATER - SUMMARY

Results in pCi/liter

NUCLIDE	AVERAGE	LOW	HIGH	NUMBER SAMPLES	NUMBER POSITIVE
		Ground			
Co-60 (I)	1.48E+00	0.00E+00	3.48E+00	12	0
Co-58 (I)	-4.45E-01	-1.51E+00	5.38E-01	12	0
Cs-134 (I)	7.60E-01	-2.04E+00	3.79E+00	12	0
Cs-137 (I)	1.53E+00	-2.74E+00	4.68E+00	12	0
Nb-95 (I)	1.20E+00	-3.35E+00	3.76E+00	12	0
Zr-95 (I)	1.12E+00	-5.36E+00	4.71E+00	12	0
Zn-65 (I)	7.43E-01	-1.71E+01	5.53E+00	12	0
Fe-59 (I)	3.93E-01	-3.53E+00	4.75E+00	12	0
Ba-140 (I)	4.14E-01	-5.93E+00	6.73E+00	12	0
La-140 (I)	2.50E-01	-2.59E+00	7.26E+00	12	0

(I) Indicator Stations only.

TABLE A-8.1

GAMMA SPECTROMETRY OF SOIL

Results in pCi/kilogram

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
1	910516	K-40	1.40 E+04	8.10 E+02
		Cs-134	* 4.70 E+01	2.28 E+01
		Cs-137	5.24 E+02	4.90 E+01
		Ra-226	1.13 E+03	5.16 E+02
		Th-228	7.48 E+02	6.50 E+01
7	910516	K-40	1.41 E+04	7.04 E+02
		Cs-134	* 2.70 E+01	1.82 E+01
		Cs-137	*-7.33 E+00	1.87 E+01
		Ra-226	* 5.68 E+02	3.24 E+02
		Th-228	5.89 E+02	3.52 E+01
9A	910516	K-40	1.35 E+04	9.29 E+02
		Cs-134	* 3.01 E+01	2.82 E+01
		Cs-137	* 4.26 E+01	2.99 E+01
		Ra-226	1.32 E+03	6.74 E+02
		Th-228	7.69 E+02	7.66 E+01
21	910516	K-40	1.37 E+04	8.52 E+02
		Cs-134	* 9.55 E-01	2.29 E+01
		Cs-137	* 8.10 E+00	2.41 E+01
		Ra-226	* 8.22 E+02	4.62 E+02
		Th-228	4.91 E+02	4.77 E+01
23	910516	K-40	1.45 E+04	7.19 E+02
		Cs-134	* 2.65 E+01	2.12 E+01
		Cs-137	5.90 E+02	4.65 E+01
		Ra-226	1.01 E+03	4.69 E+02
		Th-228	6.53 E+02	3.99 E+01

* Denotes a result less than the detection limit.

TABLE A-8.2

GAMMA SPECTROMETRY OF SOIL - SUMMARY

Results in pCi/kilogram

NUCLIDE		AVERAGE	LOW	HIGH	NUMBER SAMPLES	NUMBER POSITIVE
K-40	(I)	1.41E+04	1.37E+04	1.45E+04	4	4
K-40	(C)	1.35E+04	1.35E+04	1.35E+04	1	1
Cs-134	(I)	2.54E+01	9.55E-01	4.70E+01	4	0
Cs-134	(C)	3.01E+01	3.01E+01	3.01E+01	1	0
Cs-137	(I)	2.79E+02	-7.33E+00	5.90E+02	4	2
Cs-137	(C)	4.26E+01	4.26E+01	4.26E+01	1	0
Ra-226	(I)	8.83E+02	5.68E+02	1.13E+03	4	2
Ra-226	(C)	1.32E+03	1.32E+03	1.32E+03	1	1
Th-228	(I)	6.20E+02	4.91E+02	7.48E+02	4	4
Th-228	(C)	7.69E+02	7.69E+02	7.69E+02	1	1

(I) Indicator Station
(C) Control Station

TABLE A-9.1

GAMMA SPECTROMETRY OF SEDIMENT

Results in pCi/kilogram

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
33 (Upstream)	910410	K-40	1.69 E+04	6.62 E+02
		Co-57	* 5.01 E+00	1.33 E+01
		Co-60	* 9.54 E+00	1.56 E+01
		Cs-134	* 3.76 E+01	1.69 E+01
		Cs-137	1.18 E+02	1.98 E+01
		Ra-226	1.26 E+03	4.33 E+02
		Eu-152	* 4.71 E+01	7.44 E+01
		Th-228	7.38 E+02	3.54 E+01
34 (Downstream)	910410	K-40	1.52 E+04	6.87 E+02
		Co-57	* 4.50 E+01	1.41 E+01
		Co-60	* 2.05 E+01	1.90 E+01
		Cs-134	* 1.56 E+01	1.92 E+01
		Cs-137	3.45 E+02	4.02 E+01
		Ra-226	1.19 E+03	4.54 E+02
		Eu-152	* 2.79 E+02	1.04 E+02
		Th-228	7.50 E+02	3.97 E+01
33 (Upstream)	911031	K-40	1.54 E+04	5.17 E+02
		Co-57	*-5.95 E+00	1.35 E+01
		Co-60	*-1.24 E+00	1.42 E+01
		Cs-134	* 5.61 E+01	1.65 E+01
		Cs-137	9.61 E+01	2.44 E+01
		Ra-226	1.09 E+03	3.93 E+02
		Eu-152	* 4.32 E+01	6.68 E+01
		Th-228	8.86 E+02	3.65 E+01
34 (Downstream)	911031	K-40	1.41 E+04	7.78 E+02
		Co-57	* 3.28 E+01	2.34 E+01
		Co-60	* 4.42 E+01	2.33 E+01
		Cs-134	* 5.58 E+01	2.51 E+01
		Cs-137	3.29 E+02	4.68 E+01
		Ra-226	1.51 E+03	6.05 E+02
		Eu-152	* 2.10 E+02	1.25 E+02
		Th-228	1.21 E+03	5.58 E+01

* Denotes a result less than the detection limit.

TABLE A-9.2

GAMMA SPECTROMETRY OF SEDIMENT - SUMMARY

Results in pCi/kilogram

NUCLIDE		AVERAGE	LOW	HIGH	NUMBER SAMPLES	NUMBER POSITIVE
K-40	(I)	1.47E+04	1.41E+04	1.52E+04	2	2
K-40	(C)	1.62E+04	1.54E+04	1.69E+04	2	2
Co-57	(I)	3.89E+01	3.28E-01	4.50E+01	2	0
Co-57	(C)	-4.70E-01	-5.95E+00	5.01E+00	2	0
Co-60	(I)	3.24E+01	2.05E+01	4.42E+01	2	0
Co-60	(C)	4.15E+00	-1.24E+00	9.54E+00	2	0
Cs-134	(I)	3.57E+01	1.56E+01	5.58E+01	2	0
Cs-134	(C)	4.69E+01	3.76E+01	5.61E+01	2	0
Cs-137	(I)	3.37E+02	3.29E+02	3.45E+02	2	2
Cs-137	(C)	1.07E+02	9.61E+01	1.18E+02	2	2
Ra-226	(I)	1.35E+03	1.19E+03	1.51E+03	2	2
Ra-226	(C)	1.18E+03	1.09E+03	1.26E+03	2	2
Eu-152	(I)	2.45E+02	2.10E+02	2.79E+02	2	0
Eu-152	(C)	4.52E+01	4.32E+01	4.71E+01	2	0
Th-228	(I)	9.80E+02	7.50E+02	1.21E+03	2	2
Th-228	(C)	8.12E+02	7.38E+02	8.86E+02	2	2

(I) Indicator Station
(C) Control Station

TABLE A-10.1

GAMMA SPECTROMETRY OF FISH

Results in pCi/kilogram

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
30 Carp	910429	K-40	2.92 E+03	4.22 E+02
		Mn-54	*-2.00 E+01	1.45 E+01
		Co-58	* 0.00 E+00	1.89 E+01
		Fe-59	* 0.00 E+00	4.78 E+01
		Co-60	*-9.61 E+00	1.73 E+01
		Zn-65	* 2.79 E+01	3.96 E+01
		Cs-134	*-9.61 E+00	1.62 E+01
		Cs-137	5.70 E+01	2.64 E+01
		Ra-226	* 3.00 E+01	3.18 E+02
		Th-228	*-2.12 E+01	2.87 E+01
Salmon	910429	K-40	2.74 E+03	3.45 E+02
		Mn-54	*-4.92 E+00	1.65 E+01
		Co-58	* 0.00 E+00	1.84 E+01
		Fe-59	*-8.51 E+00	4.92 E+01
		Co-60	* 7.07 E+00	1.69 E+01
		Zn-65	* 1.13 E+01	3.74 E+01
		Cs-134	* 7.49 E+00	1.73 E+01
		Cs-137	* 2.94 E+01	1.69 E+01
		Ra-226	*-1.22 E+02	2.74 E+02
		Th-228	*-7.71 E+00	2.40 E+01
Sucker	910429	K-40	2.34 E+03	3.35 E+02
		Mn-54	* 6.53 E+00	1.07 E+01
		Co-58	* 1.54 E+00	1.28 E+01
		Fe-59	*-1.23 E+01	3.13 E+01
		Co-60	* 7.61 E+00	1.23 E+01
		Zn-65	* 1.19 E+01	2.65 E+01
		Cs-134	*-4.12 E+00	9.95 E+00
		Cs-137	* 2.13 E+01	1.31 E+01
		Ra-226	* 1.68 E+02	2.09 E+02
		Th-228	* 1.82 E+01	1.95 E+01
Squaw	910429	K-40	3.19 E+03	4.15 E+02
		Mn-54	*-2.24 E+00	1.83 E+01
		Co-58	*-3.97 E+00	2.04 E+01
		Fe-59	* 5.25 E+00	4.76 E+01
		Co-60	* 2.10 E+01	1.84 E+01
		Zn-65	* 1.45 E+01	3.97 E+01
		Cs-134	*-1.64 E+00	1.88 E+01
		Cs-137	* 4.42 E+01	2.08 E+01
		Ra-226	*-2.77 E+01	3.93 E+02
		Th-228	*-1.97 E+01	3.25 E+01

* Denotes a result less than the detection limit.

TABLE A-10.1 (Cont.)

GAMMA SPECTROMETRY OF FISH

Results in pCi/kilogram

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
38 Carp	910429	K-40	3.01 E+03	3.97 E+02
		Mn-54	* 3.89 E+00	1.36 E+01
		Co-58	* 1.83 E+01	1.52 E+01
		Fe-59	*-4.89 E+00	3.93 E+01
		Co-60	* 6.82 E+00	1.53 E+01
		Zn-65	* 1.22 E+01	3.07 E+01
		Cs-134	* 6.55 E+00	1.48 E+01
		Cs-137	* 5.63 E+00	1.50 E+01
		Ra-226	*-2.59 E+02	2.85 E+02
		Th-228	* 1.96 E+01	2.49 E+01
Salmon	910429	K-40	3.21 E+03	3.93 E+02
		Mn-54	*-1.75 E+01	1.40 E+01
		Co-58	*-5.29 E+00	1.52 E+01
		Fe-59	*-3.97 E+01	4.01 E+01
		Co-60	*-1.08 E+01	1.34 E+01
		Zn-65	*-9.68 E+00	3.44 E+01
		Cs-134	*-1.11 E+01	1.38 E+01
		Cs-137	* 1.23 E+01	1.44 E+01
		Ra-226	* 1.53 E+02	2.91 E+02
		Th-228	* 1.56 E+01	2.57 E+01
Sucker	910429	K-40	3.08 E+03	4.88 E+02
		Mn-54	*-4.37 E+00	1.75 E+01
		Co-58	*-7.74 E+00	1.91 E+01
		Fe-59	*-3.33 E+01	4.10 E+01
		Co-60	*-6.05 E+00	1.66 E+01
		Zn-65	*-2.48 E+01	4.46 E+01
		Cs-134	* 1.39 E+01	1.75 E+01
		Cs-137	* 1.52 E+01	1.73 E+01
		Ra-226	* 3.99 E+02	4.61 E+02
		Th-228	*-1.16 E+01	3.80 E+01
Bass (a)	910429	K-40	3.49 E+03	4.41 E+02
		Mn-54	* 4.81 E+00	1.78 E+01
		Co-58	*-8.11 E-01	2.22 E+01
		Fe-59	* 8.28 E+00	5.13 E+01
		Co-60	*-9.35 E-01	1.79 E+01
		Zn-65	* 2.57 E+01	4.37 E+01
		Cs-134	*-9.47 E+00	2.02 E+01
		Cs-137	*-3.55 E+00	2.10 E+01
		Ra-226	* 1.18 E+02	3.02 E+02
		Th-228	* 9.92 E+00	3.02 E+01

(a) Bass fish sample 1.5 lbs. instead of the 2.2 lbs required by procedure.
* Denotes a result less than the detection limit.

TABLE A-10.1 (Cont.)

GAMMA SPECTROMETRY OF FISH

Results in pCi/kilogram

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
38 Steelhead	910924	K-40	2.05 E+03	3.06 E+02
		Mn-54	* 1.72 E+00	1.71 E+01
		Co-58	* 2.00 E+01	2.28 E+01
		Fe-59	*-3.29 E+01	5.77 E+01
		Co-60	* 1.57 E+01	1.74 E+01
		Zn-65	* 1.03 E+01	4.35 E+01
		Cs-134	* 5.98 E-01	1.78 E+01
		Cs-137	* 2.43 E+01	1.88 E+01
		Ra-226	*-1.62 E+02	3.10 E+02
		Th-228	*-9.90 E+01	2.86 E+01
Carp	910924	K-40	3.24 E+03	4.24 E+02
		Mn-54	*-4.99 E+00	1.80 E+01
		Co-58	* 2.66 E+01	2.59 E+01
		Fe-59	* 2.07 E+01	6.36 E+01
		Co-60	* 5.96 E+00	1.92 E+01
		Zn-65	* 4.05 E+01	4.88 E+01
		Cs-134	*-7.40 E-01	1.99 E+01
		Cs-137	* 8.89 E+00	2.03 E+01
		Ra-226	* 5.17 E+01	3.26 E+02
		Th-228	* 1.71 E+01	3.01 E+01
Sucker	910924	K-40	3.68 E+03	3.87 E+02
		Mn-54	*-9.22 E+00	1.33 E+01
		Co-58	* 5.09 E+00	1.52 E+01
		Fe-59	*-9.59 E+00	4.29 E+01
		Co-60	* 7.38 E+00	1.51 E+01
		Zn-65	*-1.71 E+01	3.28 E+01
		Cs-134	* 0.00 E+00	1.48 E+01
		Cs-137	* 1.23 E+01	1.34 E+01
		Ra-226	* 1.13 E+02	1.96 E+02
		Th-228	* 8.62 E+00	1.83 E+01
Bass	910924	K-40	3.07 E+03	3.54 E+02
		Mn-54	* 0.00 E+00	1.08 E+01
		Co-58	* 2.25 E+00	1.52 E+01
		Fe-59	* 0.00 E+00	3.91 E+01
		Co-60	*-1.26 E+01	1.20 E+01
		Zn-65	* 1.04 E+01	2.84 E+01
		Cs-134	*-2.42 E+00	1.27 E+01
		Cs-137	* 5.22 E+00	1.22 E+01
		Ra-226	*-3.58 E+02	2.69 E+02
		Th-228	* 6.57 E+00	2.21 E+01

* Denotes a result less than the detection limit.

TABLE A-10.2

GAMMA SPECTROMETRY OF FISH- SUMMARY

Results in pCi/kilogram

NUCLIDE		AVERAGE	LOW	HIGH	NUMBER SAMPLES	NUMBER POSITIVE
K-40	(I)	3.04E+03	2.34E+03	3.46E+03	8	8
K-40	(C)	3.11E+03	2.05E+03	3.68E+03	8	8
Co-60	(I)	3.23E+00	-9.61E+00	2.10E+01	8	0
Co-60	(C)	6.84E-01	-1.26E+01	1.57E+01	8	0
Fe-59	(I)	-4.50E+00	-2.27E+01	1.77E+01	8	0
Fe-59	(C)	-1.14E+01	-3.97E+01	2.07E+01	8	0
Zn-65	(I)	1.00E+01	-5.78E+00	2.79E+01	8	0
Zn-65	(C)	5.94E+00	-2.48E+01	4.05E+01	8	0
Co-58	(I)	-3.18E+00	-1.52E+01	1.54E+00	8	0
Co-58	(C)	7.30E+00	-7.74E+00	2.66E+01	8	0
Cs-134	(I)	5.29E-01	-1.05E+01	1.43E+01	8	0
Cs-134	(C)	-3.35E-01	-1.11E+01	1.39E+01	8	0
Cs-137	(I)	2.69E+01	-3.79E-01	5.70E+01	8	2
Cs-137	(C)	1.00E+01	-3.55E+00	2.43E+01	8	0
Mn-54	(I)	-3.05E+00	-2.00E+01	6.53E+00	8	0
Mn-54	(C)	-3.21E+00	-1.75E+01	4.81E+00	8	0

(I) Indicator Station
(C) Control Station

TABLE A-11.1

I-131 IN MILK

Results in pCi/liter

LOCATION	COLLECTION DATE	RESULT	OVERALL UNCERTAINTY
9B	910109	* 2.1 E-01	1.61 E-01
	910205	* 4.5 E-02	1.94 E-01
	910305	*-7.7 E-02	1.24 E-01
	910402	* 1.9 E-02	1.48 E-01
	910416	*-8.7 E-02	1.12 E-01
	910507	* 1.5 E-01	1.08 E-01
	910521	*-9.8 E-02	1.07 E-01
	910604	* 2.6 E-03	8.44 E-02
	910618	*-4.5 E-02	8.69 E-02
	910702	*-1.0 E-01	1.10 E-01
	910716	*-4.0 E-02	7.00 E-02
	910806	* 5.4 E-02	1.72 E-01
	910827	*-8.2 E-02	1.12 E-01
	910910	*-4.5 E-03	7.66 E-02
	910924	*-1.9 E-02	6.46 E-02
	911015	* 2.9 E-02	8.20 E-02
	911119	*-1.2 E-01	1.62 E-01
	911210	*-1.7 E-02	8.86 E-02
36	910108	*-5.0 E-02	1.15 E-01
	910205	* 6.2 E-02	1.23 E-01
	910305	* 0.0 E+00	1.15 E-01
	910402	*-2.6 E-02	1.00 E-01
	910416	* 3.0 E-01	3.50 E-01
	910507	* 7.1 E-02	1.25 E-01
	910521	* 4.8 E-02	1.14 E-01
	910604	*-9.7 E-02	9.33 E-02
	910618	*-1.2 E-02	9.91 E-02
	910702	* 1.3 E-01	1.70 E-01
	910716	* 4.6 E-02	7.20 E-02
	910806	* 8.1 E-02	1.42 E-01
	910827	* 4.7 E-02	8.07 E-02
	910910	* 0.0 E+00	1.00 E-01
	910924	* 1.1 E-02	6.77 E-02
	911015	*-7.8 E-02	8.62 E-02
	911119	*-9.4 E-02	9.00 E-02
	911210	* 1.9 E-02	1.11 E-01

* Denotes a result less than the detection limit.

TABLE A-11.1 (Cont.)

I-131 IN MILK

Results in pCi/liter

LOCATION	COLLECTION DATE	RESULT	OVERALL UNCERTAINTY
40	910108 (a)		
	910205	*-7.3 E-02	7.49 E-02
	910305	*-1.3 E-01	1.25 E-01
	910402	*-5.6 E-02	9.77 E-02
	910416	* 6.3 E-02	1.25 E-01
	910507	* 7.8 E-02	1.28 E-01
	910521	*-1.3 E-02	1.18 E-01
	910604	*-4.2 E-02	8.20 E-02
	910618	* 0.0 E+00	1.00 E-01
	910702	* 2.5 E-02	8.90 E-02
	910716	*-8.7 E-02	8.20 E-02
	910806	* 2.3 E-02	8.96 E-02
	910827	* 3.8 E-02	8.36 E-02
	910910	* 2.9 E-02	8.92 E-02
	910924	* 2.6 E-02	6.78 E-02
	911015	* 7.4 E-02	1.19 E-01
	911119	* 1.1 E-01	1.17 E-01
	911210	* 5.1 E-02	9.86 E-02
59	910108	*-1.5 E-02	1.30 E-01
	910205	* 1.2 E-01	1.23 E-01
	910305	* 1.1 E-01	1.11 E-01
	910402	* 3.3 E-02	8.60 E-02
	910416	* 1.9 E-02	1.84 E-01
	910507	* 1.6 E-01	1.28 E-01
	910521	*-5.2 E-02	9.65 E-02
	910604	*-5.1 E-02	1.08 E-01
	910618	*-7.2 E-02	8.37 E-02
	910702	* 3.7 E-02	1.38 E-01
	910716	* 1.9 E-02	6.90 E-02
	(b)		

(a) The Herr farm (Station 63) discontinued milk production early January; collection at Station 40 not begun until February.
(b) The Johnson farm (Station 59) discontinued milk production in August.
* Denotes a result less than the detection limit.

TABLE A-11.1 (Cont.)

I-131 IN MILK

Results in pCi/liter

LOCATION	COLLECTION DATE	RESULT	OVERALL UNCERTAINTY
62	910108	* 8.5 E-02	1.60 E-01
	910205	* 3.8 E-02	8.77 E-02
	910305	*-3.0 E-02	9.42 E-02
	910402	* 0.0 E+00	1.07 E-01
	910416	*-1.1 E-01	1.80 E-01
	910507	* 3.4 E-02	1.00 E-01
	910521	* 3.9 E-02	7.40 E-02
	910604	*-5.1 E-02	9.70 E-02
	910618	*-1.3 E-02	1.04 E-01
	910702	* 1.3 E-02	7.00 E-02
	910716	* 4.5 E-03	7.07 E-02
	910806	* 4.3 E-02	1.78 E-01
	910827	* 8.8 E-03	9.13 E-02
	910910	*-2.3 E-02	8.19 E-02
	910924	*-2.0 E-02	7.24 E-02
	911015	* 2.7 E-02	1.06 E-01
	911119	*-9.7 E-02	8.70 E-02
	911210	*-2.3 E-02	8.99 E-02
64	910827	* 3.5 E-02	9.30 E-02
	910910	* 5.7 E-02	9.10 E-02
	910924	* 4.6 E-02	7.61 E-02
	911015	* 2.1 E-02	1.02 E-01
	911119	*-1.3 E-02	8.48 E-02
	911210	* 1.0 E-01	1.84 E-01

* Denotes a result less than the detection limit.

TABLE A-11.1 (Cont.)

I-131 IN MILK

Results in pCi/liter

LOCATION	COLLECTION DATE	RESULT	OVERALL UNCERTAINTY
96	910109	* 2.0 E-01	1.80 E-01
	910205	*-4.1 E-02	1.14 E-01
	910305	*-2.2 E-02	1.20 E-01
	910402	* 1.2 E-02	9.49 E-02
	910416	* 0.0 E+00	1.66 E-01
	910507	*-2.8 E-02	1.02 E-01
	910521	*-6.2 E-02	1.05 E-01
	910604	* 6.7 E-02	9.90 E-02
	910618	* 6.8 E-02	1.55 E-01
	910702	* 1.1 E-01	1.10 E-01
	910716	* 1.6 E-02	8.00 E-02
	910806	* 6.6 E-02	2.14 E-01
	910827	* 9.8 E-02	8.86 E-02
	910910	* 5.5 E-03	9.78 E-02
	910924	*-3.4 E-02	6.57 E-02
	911015	* 4.6 E-03	9.96 E-02
	911119	*-4.7 E-02	1.01 E-01
	911210	* 2.4 E-02	1.07 E-01

* Denotes a result less than the detection limit.

TABLE A 11.2 (Cont.)

I-131 IN MILK - SUMMARY

Results in pCi/liter

NUCLIDE		AVERAGE	LOW	HIGH	NUMBER SAMPLES	NUMBER POSITIVE
I-131	(I)	9.84E-03	-1.30E-01	3.00E-01	89	0
I-131	(C)	2.43E-02	-6.20E-02	2.00E-01	18	0

(I) Indicator Station
(C) Control Station

TABLE A-12.1

GAMMA SPECTROMETRY OF MILK

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
9B	910109	K-40	1.31 E+03	8.40 E+01
		Cs-134	*-1.49 E-01	2.47 E+00
		Cs-137	*-5.24 E-01	2.41 E+00
		Ba-140	* 1.94 E-01	7.81 E+00
		La-140	* 3.70 E+00	3.16 E+00
	910205	K-40	1.32 E+03	8.05 E+01
		Cs-134	* 2.43 E+00	2.57 E+00
		Cs-137	* 1.23 E+00	2.49 E+00
		Ba-140	* 8.67 E+00	9.13 E+00
		La-140	*-3.35 E+00	3.62 E+00
	910305	K-40	1.16 E+03	7.91 E+01
		Cs-134	*-6.26 E-01	2.49 E+00
		Cs-137	* 3.34 E+00	2.53 E+00
		Ba-140	*-3.80 E+00	8.51 E+00
		La-140	* 6.05 E-01	3.53 E+00
	910402	K-40	1.31 E+03	8.89 E+01
		Cs-134	*-2.99 E-01	2.29 E+00
		Cs-137	*-6.56 E-02	2.36 E+00
		Ba-140	* 2.45 E+00	8.34 E+00
		La-140	* 1.51 E+00	3.62 E+00
	910416	K-40	1.21 E+03	7.71 E+01
		Cs-134	* 7.36 E-01	2.46 E+00
		Cs-137	* 1.55 E+00	2.19 E+00
		Ba-140	* 8.94 E-01	8.98 E+00
		La-140	* 3.30 E+00	3.91 E+00
	910507	K-40	1.22 E+03	8.80 E+01
		Cs-134	* 2.43 E+00	3.22 E+00
		Cs-137	* 1.71 E-01	2.97 E+00
		Ba-140	*-5.92 E+00	1.12 E+01
		La-140	* 3.06 E+00	4.83 E+00

* Denotes a result less than the detection limit.

TABLE A-12.1

GAMMA SPECTROMETRY OF MILK

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
9B	910521	K-40	1.28 E+03	8.77 E+01
		Cs-134	* 3.93 E+00	3.04 E+00
		Cs-137	* 2.60 E+00	2.94 E+00
		Ba-140	*-6.13 E+00	1.56 E+01
		La-140	* 2.77 E+00	6.26 E+00
	910604	K-40	1.29 E+03	7.52 E+01
		Cs-134	*-9.55 E-01	2.14 E+00
		Cs-137	* 1.54 E+00	2.17 E+00
		Ba-140	*-3.00 E+00	7.89 E+00
		La-140	* 4.17 E-01	2.93 E+00
	910618	K-40	1.33 E+03	8.05 E+01
		Cs-134	*-6.69 E-01	2.33 E+00
		Cs-137	* 1.43 E+00	2.33 E+00
		Ba-140	*-6.77 E-01	9.25 E+00
		La-140	* 1.46 E+00	3.54 E+00
	910702	K-40	1.37 E+03	8.10 E+01
		Cs-134	* 1.47 E-01	2.46 E+00
		Cs-137	* 1.03 E+00	2.32 E+00
		Ba-140	* 6.48 E+00	9.09 E+00
		La-140	*-2.48 E+00	3.84 E+00
	910716	K-40	1.37 E+03	8.20 E+01
		Cs-134	*-6.00 E-01	2.38 E+00
		Cs-137	* 2.62 E-01	2.29 E+00
		Ba-140	* 4.58 E-01	9.10 E+00
		La-140	* 6.34 E-01	3.98 E+00
	910806	K-40	1.32 E+03	8.42 E+01
		Cs-134	* 8.38 E-01	2.45 E+00
		Cs-137	* 6.64 E-01	2.39 E+00
		Ba-140	* 0.00 E+00	1.23 E+01
		La-140	* 1.67 E+00	4.71 E+00

* Denotes a result less than the detection limit.

TABLE A-12.1

GAMMA SPECTROMETRY OF MILK

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
9B	910827	K-40	1.34 E+03	6.88 E+01
		Cs-134	* 4.20 E-01	2.03 E+00
		Cs-137	* 3.62 E+00	2.14 E+00
		Ba-140	*-1.68 E-01	8.25 E+00
		La-140	*-7.88 E-01	3.87 E+00
	910910	K-40	1.29 E+03	7.04 E+01
		Cs-134	* 1.25 E+00	2.28 E+00
		Cs-137	*-1.80 E+00	2.50 E+00
		Ba-140	*-5.66 E+00	1.08 E+01
		La-140	*-4.34 E+00	4.70 E+00
	910924	K-40	1.25 E+03	7.96 E+01
		Cs-134	* 6.18 E-01	2.43 E+00
		Cs-137	*-2.69 E-01	2.48 E+00
		Ba-140	* 3.08 E+00	9.14 E+00
		La-140	*-8.40 E-01	3.67 E+00
	911015	K-40	1.33 E+03	8.50 E+01
		Cs-134	* 2.07 E+00	2.51 E+00
		Cs-137	* 1.66 E+00	2.42 E+00
		Ba-140	* 0.00 E+00	1.24 E+01
		La-140	* 0.00 E+00	5.29 E+00
	911119	K-40	1.33 E+03	5.72 E+01
		Cs-134	*-3.78 E-02	1.81 E+00
		Cs-137	*-1.81 E+00	1.96 E+00
		Ba-140	* 5.82 E+00	6.40 E+00
		La-140	* 4.01 E-01	2.84 E+00
	911210	K-40	1.23 E+03	6.59 E+01
		Cs-134	* 9.48 E-01	1.99 E+00
		Cs-137	*-6.06 E-01	2.31 E+00
		Ba-140	*-1.44 E+00	5.75 E+00
		La-140	* 1.42 E+00	2.57 E+00

* Denotes a result less than the detection limit.

TABLE A-12.1 (Cont.)

GAMMA SPECTROMETRY OF MILK

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
36	910108	K-40	1.34 E+03	7.88 E+01
		Cs-134	* 2.07 E-01	2.39 E+00
		Cs-137	* 2.22 E+00	2.42 E+00
		Ba-140	* 3.51 E-01	7.48 E+00
		La-140	* 5.09 E-01	3.26 E+00
	910205	K-40	1.27 E+03	7.56 E+01
		Cs-134	* 7.57 E-01	2.34 E+00
		Cs-137	* 3.85 E+00	2.36 E+00
		Ba-140	* 3.74 E-01	7.85 E+00
		La-140	* 1.05 E+00	3.24 E+00
	910305	K-40	1.35 E+03	7.94 E+01
		Cs-134	* 1.65 E+00	2.45 E+00
		Cs-137	*-4.98 E-01	2.42 E+00
		Ba-140	* 5.60 E-01	8.03 E+00
		La-140	* 1.75 E-01	3.21 E+00
	910402	K-40	1.31 E+03	7.62 E+01
		Cs-134	* 1.96 E+00	2.37 E+00
		Cs-137	* 2.26 E+00	2.48 E+00
		Ba-140	*-6.62 E+00	7.58 E+00
		La-140	*-3.27 E-01	2.85 E+00
	910416	K-40	1.36 E+03	7.71 E+01
		Cs-134	*-6.12 E-01	2.21 E+00
		Cs-137	* 2.61 E+00	2.41 E+00
		Ba-140	*-8.42 E+00	8.71 E+00
		La-140	*-3.46 E+00	3.32 E+00
	910507	K-40	1.27 E+03	8.87 E+01
		Cs-134	*-1.60 E-01	2.42 E+00
		Cs-137	* 9.12 E-01	2.47 E+00
		Ba-140	* 4.80 E+00	8.45 E+00
		La-140	* 2.62 E+00	3.34 E+00

* Denotes a result less than the detection limit.

TABLE A-12.1 (Cont.)

GAMMA SPECTROMETRY OF MILK

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
36	910521	K-40	1.24 E+03	7.66 E+01
		Cs-134	* 0.00 E+00	2.41 E+00
		Cs-137	*-1.41 E-01	2.27 E+00
		Ba-140	* 2.74 E+00	1.05 E+01
		La-140	*-5.49 E-01	4.40 E+00
	910604	K-40	1.28 E+03	7.77 E+01
		Cs-134	* 3.43 E-01	2.24 E+00
		Cs-137	* 4.25 E+00	2.27 E+00
		Ba-140	* 3.33 E+00	7.67 E+00
		La-140	* 7.06 E-01	3.18 E+00
	910618	K-40	1.24 E+03	7.89 E+01
		Cs-134	*-2.06 E-01	2.30 E+00
		Cs-137	* 1.38 E+00	2.32 E+00
		Ba-140	* 5.81 E+00	8.86 E+00
		La-140	*-5.83 E-01	3.64 E+00
	910702	K-40	1.30 E+03	7.69 E+01
		Cs-134	* 1.63 E+00	2.22 E+00
		Cs-137	* 2.67 E+00	2.31 E+00
		Ba-140	* 6.16 E+00	8.88 E+00
		La-140	* 9.62 E-01	3.50 E+00
	910716	K-40	1.27 E+03	8.43 E+01
		Cs-134	* 8.34 E-01	2.24 E+00
		Cs-137	* 2.43 E+00	2.40 E+00
		Ba-140	*-5.51 E+00	8.93 E+00
		La-140	*-5.96 E-01	3.59 E+00
	910806	K-40	1.44 E+03	8.49 E+01
		Cs-134	*-4.14 E-01	2.29 E+00
		Cs-137	* 2.24 E+00	2.44 E+00
		Ba-140	* 5.63 E+00	1.13 E+01
		La-140	*-5.98 E-01	4.58 E+00

* Denotes a result less than the detection limit.

TABLE A-12.1 (Cont.)

GAMMA SPECTROMETRY OF MILK

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
36	910827	K-40	1.36 E+03	8.23 E+01
		Cs-134	* 1.62 E+00	2.42 E+00
		Cs-137	* 1.63 E+00	2.33 E+00
		Ba-140	* 5.20 E+00	8.50 E+00
		La-140	*-2.24 E-01	3.51 E+00
	910910	K-40	1.29 E+03	8.10 E+01
		Cs-134	* 1.13 E+00	2.43 E+00
		Cs-137	* 0.00 E+00	2.33 E+00
		Ba-140	*-2.39 E+00	1.27 E+01
		La-140	* 0.00 E+00	4.98 E+00
	910924	K-40	1.30 E+03	7.81 E+01
		Cs-134	* 2.38 E+00	2.37 E+00
		Cs-137	* 5.93 E-01	2.34 E+00
		Ba-140	*-5.84 E+00	8.53 E+00
		La-140	* 3.65 E+00	3.21 E+00
	911015	K-40	1.25 E+03	7.60 E+01
		Cs-134	* 9.09 E-01	2.24 E+00
		Cs-137	* 2.55 E+00	2.26 E+00
		Ba-140	*-3.04 E+00	1.12 E+01
		La-140	*-3.36 E+00	4.90 E+00
	911119	K-40	1.26 E+03	6.78 E+01
		Cs-134	*-5.51 E-01	1.96 E+00
		Cs-137	* 2.19 E-01	1.93 E+00
		Ba-140	*-1.45 E-01	7.33 E+00
		La-140	*-9.36 E-01	3.18 E+00
	911210	K-40	1.33 E+03	7.58 E+01
		Cs-134	* 5.29 E-01	2.23 E+00
		Cs-137	* 1.45 E+00	2.17 E+00
		Ba-140	*-1.46 E+00	5.86 E+00
		La-140	*-5.40 E-01	2.54 E+00

* Denotes a result less than the detection limit.

TABLE A-12.1 (Cont.)

GAMMA SPECTROMETRY OF MILK

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
40	910108 (a)			
	910205	K-40	1.34 E+03	8.34 E+01
		Cs-134	* 6.25 E-01	2.56 E+00
		Cs-137	* 3.63 E+00	2.67 E+00
		Ba-140	* 4.47 E+00	9.02 E+00
		La-140	*-8.70 E-01	3.59 E+00
	910305	K-40	1.42 E+03	1.05 E+02
		Cs-134	* 2.80 E+00	3.51 E+00
		Cs-137	* 2.70 E+00	3.47 E+00
		Ba-140	* 8.22 E+00	1.33 E+01
		La-140	*-3.27 E-01	5.51 E+00
	910402	K-40	1.44 E+03	7.20 E+01
		Cs-134	* 8.47 E-01	2.31 E+00
		Cs-137	*-1.56 E+00	2.51 E+00
		Ba-140	*-1.55 E+00	7.59 E+00
		La-140	*-2.12 E+00	3.34 E+00
	910416	K-40	1.59 E+03	7.27 E+01
		Cs-134	* 1.67 E-01	2.20 E+00
		Cs-137	* 1.83 E-01	2.49 E+00
		Ba-140	*-2.37 E+00	8.37 E+00
		La-140	* 6.19 E-01	3.75 E+00
	910507	K-40	1.27 E+03	8.78 E+01
		Cs-134	* 2.38 E-01	2.39 E+00
		Cs-137	* 0.00 E+00	2.55 E+00
		Ba-140	*-2.03 E+00	9.08 E+00
		La-140	*-2.80 E+00	4.12 E+00
	910521	K-40	1.58 E+03	9.82 E+01
		Cs-134	* 1.63 E+00	3.09 E+00
		Cs-137	*-5.03 E-01	2.95 E+00
		Ba-140	* 1.92 E+00	1.61 E+01
		La-140	*-2.08 E+00	6.37 E+00

(a) The Herr farm (Station 63) discontinued milk production in early January; sampling began at Station 40 in February.

* Denotes a result less than the detection limit.

TABLE A-12.1 (Cont.)

GAMMA SPECTROMETRY OF MILK

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
40	910604	K-40	1.36 E+03	8.17 E+01
		Cs-134	*-1.40 E+00	2.29 E+00
		Cs-137	* 1.36 E+00	2.33 E+00
		Ba-140	* 8.51 E-01	8.74 E+00
		La-140	* 7.85 E-01	3.42 E+00
	910618	K-40	1.36 E+03	6.98 E+01
		Cs-134	* 1.35 E+00	2.20 E+00
		Cs-137	*-2.96 E-01	2.46 E+00
		Ba-140	*-5.81 E+00	8.45 E+00
		La-140	* 1.25 E+00	3.56 E+00
	910702	K-40	1.45 E+03	7.07 E+01
		Cs-134	* 1.11 E-01	2.17 E+00
		Cs-137	*-3.31 E+00	2.39 E+00
		Ba-140	* 5.08 E+00	8.27 E+00
		La-140	* 0.00 E+00	3.47 E+00
	910716	K-40	1.41 E+03	7.18 E+01
		Cs-134	* 1.13 E-01	2.25 E+00
		Cs-137	* 8.75 E-01	2.49 E+00
		Ba-140	*-6.97 E-01	8.26 E+00
		La-140	* 9.54 E-01	3.70 E+00
	910806	K-40	1.16 E+03	6.33 E+01
		Cs-134	* 3.45 E-01	2.13 E+00
		Cs-137	*-1.33 E+00	2.46 E+00
		Ba-140	*-3.67 E+00	1.08 E+01
		La-140	*-2.72 E+00	5.25 E+00
	910827	K-40	1.52 E+03	7.99 E+01
		Cs-134	*-9.48 E-01	2.25 E+00
		Cs-137	* 1.43 E+00	2.22 E+00
		Ba-140	*-5.56 E+00	9.31 E+00
		La-140	* 7.78 E-01	3.24 E+00

* Denotes a result less than the detection limit.

TABLE A-12.1 (Cont.)

GAMMA SPECTROMETRY OF MILK

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
40	910910	K-40	1.47 E+03	8.57 E+01
		Cs-134	*-8.14 E-01	2.33 E+00
		Cs-137	*-7.08 E-01	2.28 E+00
		Ba-140	* 1.29 E+00	1.17 E+01
		La-140	* 1.20 E+00	4.80 E+00
	910924	K-40	1.56 E+03	9.43 E+01
		Cs-134	* 1.85 E+00	2.60 E+00
		Cs-137	* 1.95 E+00	2.78 E+00
		Ba-140	*-5.18 E-01	9.46 E+00
		La-140	* 2.27 E-01	3.41 E+00
	911015	K-40	1.57 E+03	9.13 E+01
		Cs-134	* 1.63 E+00	2.40 E+00
		Cs-137	* 2.15 E+00	2.62 E+00
		Ba-140	*-4.76 E+00	1.29 E+01
		La-140	* 0.00 E+00	5.07 E+00
	911119	K-40	1.66 E+03	9.16 E+01
		Cs-134	* 3.61 E+00	2.64 E+00
		Cs-137	* 3.48 E+00	2.62 E+00
		Ba-140	*-3.95 E+00	1.24 E+01
		La-140	*-2.31 E+00	4.42 E+00
	911210	K-40	1.41 E+03	7.46 E+01
		Cs-134	* 4.32 E-01	1.91 E+00
		Cs-137	* 3.24 E+00	2.11 E+00
		Ba-140	* 2.70 E-01	5.82 E+00
		La-140	*-1.16 E+00	2.56 E+00

* Denotes a result less than the detection limit.

TABLE A-12.1 (Cont.)

GAMMA SPECTROMETRY OF MILK

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
59	910108	K-40	1.31 E+03	8.46 E+01
		Cs-134	* 1.10 E+00	2.35 E+00
		Cs-137	* 1.10 E+00	2.32 E+00
		Ba-140	* 2.81 E+00	7.21 E+00
		La-140	* 1.75 E+00	3.20 E+00
	910205	K-40	1.28 E+03	9.03 E+01
		Cs-134	*-1.85 E+00	3.17 E+00
		Cs-137	*-8.44 E-01	3.11 E+00
		Ba-140	* 2.64 E+00	1.06 E+01
		La-140	*-1.19 E+00	4.96 E+00
	910305	K-40	1.31 E+03	8.72 E+01
		Cs-134	* 1.34 E+00	3.25 E+00
		Cs-137	* 2.36 E+00	3.12 E+00
		Ba-140	*-2.11 E+00	1.08 E+01
		La-140	*-1.43 E+00	4.11 E+00
	910402	K-40	1.22 E+03	8.64 E+01
		Cs-134	* 3.93 E-01	2.36 E+00
		Cs-137	* 1.45 E+00	2.33 E+00
		Ba-140	* 1.23 E+00	7.50 E+00
		La-140	*-1.48 E+00	2.74 E+00
	910416	K-40	1.25 E+03	7.72 E+01
		Cs-134	*-7.89 E-02	2.26 E+00
		Cs-137	* 2.43 E+00	2.24 E+00
		Ba-140	*-3.62 E+00	8.40 E+00
		La-140	*-2.18 E-01	3.54 E+00
	910507	K-40	1.30 E+03	7.38 E+01
		Cs-134	*-1.15 E+00	2.25 E+00
		Cs-137	*-9.22 E-01	2.58 E+00
		Ba-140	*-9.92 E-01	7.95 E+00
		La-140	* 1.96 E+00	3.29 E+00

* Denotes a result less than the detection limit.

TABLE A-12.1 (Cont.)

GAMMA SPECTROMETRY OF MILK

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
59	910521	K-40	1.18 E+03	7.94 E+01
		Cs-134	* 1.18 E+00	2.61 E+00
		Cs-137	*-4.09 E-01	2.41 E+00
		Ba-140	* 7.60 E+00	1.20 E+01
		La-140	* 2.79 E-01	5.12 E+00
	910604	K-40	1.33 E+03	8.11 E+01
		Cs-134	* 1.59 E-01	2.42 E+00
		Cs-137	* 9.03 E-01	2.33 E+00
		Ba-140	*-5.61 E+00	7.56 E+00
		La-140	* 8.07 E-01	3.23 E+00
	910618	K-40	1.26 E+03	8.05 E+01
		Cs-134	* 1.44 E+00	2.34 E+00
		Cs-137	* 1.75 E+00	2.16 E+00
		Ba-140	*-3.66 E+00	8.92 E+00
		La-140	*-1.99 E+00	3.40 E+00
	910702	K-40	1.39 E+03	9.23 E+01
		Cs-134	* 7.89 E-02	2.28 E+00
		Cs-137	* 3.12 E+00	2.30 E+00
		Ba-140	*-1.69 E+00	8.41 E+00
		La-140	* 4.36 E-01	3.37 E+00
	910716	K-40	1.43 E+03	8.41 E+01
		Cs-134	*-3.23 E-01	2.32 E+00
		Cs-137	* 1.98 E+00	2.44 E+00
		Ba-140	* 9.99 E-01	8.95 E+00
		La-140	*-1.35 E+00	3.26 E+00
	(a)			

(a) The Johnson farm discontinued milk production in August.
* Denotes a result less than the detection limit.

TABLE A-12.1 (Cont.)

GAMMA SPECTROMETRY OF MILK

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
62	910108	K-40	1.29 E+03	8.14 E+01
		Cs-134	* 2.28 E+00	2.58 E+00
		Cs-137	* 2.06 E-01	2.51 E+00
		Ba-140	* 2.63 E+00	8.11 E+00
		La-140	* 1.91 E+00	3.33 E+00
	910205	K-40	1.08 E+03	8.06 E+01
		Cs-134	*-1.12 E+00	2.33 E+00
		Cs-137	* 1.05 E+00	2.32 E+00
		Ba-140	*-5.50 E+00	7.81 E+00
		La-140	* 4.57 E+00	3.75 E+00
	910305	K-40	1.42 E+03	9.25 E+01
		Cs-134	* 9.98 E-01	2.75 E+00
		Cs-137	* 2.11 E+00	2.84 E+00
		Ba-140	* 3.02 E+00	9.53 E+00
		La-140	* 1.49 E+00	4.03 E+00
	910402	K-40	1.17 E+03	7.93 E+01
		Cs-134	* 1.85 E+00	2.52 E+00
		Cs-137	* 5.38 E-01	2.54 E+00
		Ba-140	* 1.97 E+00	7.78 E+00
		La-140	* 3.76 E-01	3.31 E+00
	910416	K-40	1.24 E+03	8.06 E+01
		Cs-134	* 4.64 E-01	2.55 E+00
		Cs-137	* 2.56 E+00	2.51 E+00
		Ba-140	* 1.16 E+00	9.61 E+00
		La-140	*-3.77 E+00	4.42 E+00
	910507	K-40	1.20 E+03	7.20 E+01
		Cs-134	* 6.97 E-02	2.38 E+00
		Cs-137	* 3.38 E-01	2.38 E+00
		Ba-140	* 2.80 E+00	8.22 E+00
		La-140	* 2.06 E+00	3.93 E+00

* Denotes a result less than the detection limit.

TABLE A-12.1 (Cont.)

GAMMA SPECTROMETRY OF MILK

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
62	910521	K-40	1.20 E+03	7.67 E+01
		Cs-134	* 1.24 E+00	2.27 E+00
		Cs-137	*-8.83 E-01	2.25 E+00
		Ba-140	* 2.71 E+00	1.14 E+01
		La-140	* 4.32 E+00	5.00 E+00
	910604	K-40	1.26 E+03	7.40 E+01
		Cs-134	* 1.23 E+00	2.37 E+00
		Cs-137	*-1.30 E+00	2.21 E+00
		Ba-140	* 6.87 E+00	8.27 E+00
		La-140	*-2.39 E+00	3.19 E+00
	910618	K-40	1.25 E+03	7.86 E+01
		Cs-134	*-7.82 E-01	2.52 E+00
		Cs-137	* 1.43 E+00	2.47 E+00
		Ba-140	* 3.99 E+00	9.47 E+00
		La-140	*-8.96 E-01	3.35 E+00
	910702	K-40	1.29 E+03	8.09 E+01
		Cs-134	* 2.40 E+00	2.51 E+00
		Cs-137	* 2.15 E+00	2.47 E+00
		Ba-140	* 6.96 E-01	9.01 E+00
		La-140	*-6.65 E-01	3.84 E+00
	910716	K-40	1.24 E+03	8.16 E+01
		Cs-134	* 1.74 E+00	2.47 E+00
		Cs-137	* 6.19 E-01	2.48 E+00
		Ba-140	*-2.16 E+00	1.00 E+01
		La-140	* 9.16 E-01	3.66 E+00
	910806	K-40	1.13 E+03	7.94 E+01
		Cs-134	* 1.79 E+00	2.47 E+00
		Cs-137	* 4.22 E-01	2.42 E+00
		Ba-140	* 2.86 E+00	1.27 E+01
		La-140	* 2.73 E+00	5.11 E+00

* Denotes a result less than the detection limit.

TABLE A-12.1 (Cont.)

GAMMA SPECTROMETRY OF MILK

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
62	910827	K-40	1.22 E+03	8.24 E+01
		Cs-134	* 1.35 E+00	2.47 E+00
		Cs-137	* 1.31 E+00	2.48 E+00
		Ba-140	*-7.14 E+00	9.29 E+00
		La-140	*-2.95 E+00	4.49 E+00
	910910	K-40	1.39 E+03	8.76 E+01
		Cs-134	* 1.81 E+00	2.55 E+00
		Cs-137	* 2.79 E+00	2.57 E+00
		Ba-140	* 3.66 E-01	1.31 E+01
		La-140	*-1.60 E+00	4.86 E+00
	910924	K-40	1.24 E+03	7.70 E+01
		Cs-134	*-7.89 E-01	2.29 E+00
		Cs-137	* 6.93 E-01	2.34 E+00
		Ba-140	* 0.00 E+00	8.01 E+00
		La-140	*-8.27 E-01	3.00 E+00
	991015	K-40	1.41 E+03	8.26 E+01
		Cs-134	* 2.44 E-01	2.34 E+00
		Cs-137	* 2.06 E+00	2.20 E+00
		Ba-140	* 0.00 E+00	1.11 E+01
		La-140	* 0.00 E+00	5.01 E+00
	911119	K-40	1.24 E+03	6.90 E+01
		Cs-134	* 1.93 E+00	2.15 E+00
		Cs-137	* 5.32 E-01	2.02 E+00
		Ba-140	*-1.77 E+00	7.50 E+00
		La-140	* 1.86 E+00	2.83 E+00
	911210	K-40	1.29 E+03	7.74 E+01
		Cs-134	* 3.02 E+00	2.38 E+00
		Cs-137	* 2.47 E+00	2.45 E+00
		Ba-140	* 8.96 E-01	6.79 E+00
		La-140	*-7.84 E-01	2.57 E+00

* Denotes a result less than the detection limit.

TABLE A-12.1 (Cont.)

GAMMA SPECTROMETRY OF MILK

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
64	910827 (a)	K-40	1.43 E+03	6.43 E+01
		Cs-134	*-1.28 E-01	1.92 E+00
		Cs-137	*-2.54 E+00	2.15 E+00
		Ba-140	* 5.50 E-01	7.75 E+00
		La-140	* 2.13 E+00	3.41 E+00
	910910	K-40	1.35 E+03	8.05 E+01
		Cs-134	* 1.42 E+00	2.40 E+00
		Cs-137	* 2.33 E+00	2.37 E+00
		Ba-140	* 4.60 E+00	1.20 E+01
		La-140	*-3.07 E-01	5.41 E+00
	910924	K-40	1.33 E+03	7.05 E+01
		Cs-134	* 8.30 E-01	2.14 E+00
		Cs-137	*-1.71 E+00	2.45 E+00
		Ba-140	* 2.40 E+00	7.69 E+00
		La-140	*-1.61 E+00	3.40 E+00
	911015	K-40	1.39 E+03	7.18 E+01
		Cs-134	*-1.71 E+00	2.20 E+00
		Cs-137	*-2.63 E+00	2.41 E+00
		Ba-140	*-1.13 E+00	1.05 E+01
		La-140	* 1.24 E+00	4.76 E+00
	911119	K-40	1.26 E+03	6.66 E+01
		Cs-134	* 1.51 E+00	2.16 E+00
		Cs-137	*-4.23 E-01	2.45 E+00
		Ba-140	*-6.93 E+00	9.78 E+00
		La-140	* 3.16 E+00	4.38 E+00
	911210	K-40	1.30 E+03	8.06 E+01
		Cs-134	*-5.00 E-01	2.15 E+00
		Cs-137	* 5.64 E-01	2.07 E+00
		Ba-140	*-6.92 E+00	5.92 E+00
		La-140	*-1.03 E+00	2.38 E+00

(a) The station replaced the Johnson farm, Station 59.
* Denotes a result less than the detection limit.

TABLE A-12.1 (Cont.)

GAMMA SPECTROMETRY OF MILK

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
96	910109	K-40	1.40 E+03	8.79 E+01
		Cs-134	*-1.81 E-01	2.38 E+00
		Cs-137	* 2.55 E+00	2.61 E+00
		Ba-140	* 4.96 E+00	8.35 E+00
		La-140	* 2.55 E+00	3.34 E+00
	910205	K-40	1.32 E+03	7.81 E+01
		Cs-134	*-1.78 E+00	2.43 E+00
		Cs-137	*-8.46 E-01	2.36 E+00
		Ba-140	* 5.47 E+00	8.43 E+00
		La-140	* 1.12 E+00	3.53 E+00
	910305	K-40	1.31 E+03	8.01 E+01
		Cs-134	* 8.90 E-01	2.45 E+00
		Cs-137	* 6.49 E-02	2.42 E+00
		Ba-140	* 2.14 E+00	9.05 E+00
		La-140	* 1.97 E-01	3.54 E+00
	910402	K-40	1.13 E+03	7.72 E+01
		Cs-134	* 8.10 E-01	2.46 E+00
		Cs-137	* 6.37 E-01	2.44 E+00
		Ba-140	* 0.00 E+00	8.92 E+00
		La-140	* 0.00 E+00	3.42 E+00
	910416	K-40	1.36 E+03	8.41 E+01
		Cs-134	*-8.85 E-02	2.53 E+00
		Cs-137	*-7.81 E-02	2.55 E+00
		Ba-140	* 0.00 E+00	9.60 E+00
		La-140	*-9.59 E-01	3.80 E+00
	910507	K-40	1.43 E+03	8.54 E+01
		Cs-134	*-7.29 E-01	2.44 E+00
		Cs-137	* 4.70 E+00	2.40 E+00
		Ba-140	*-1.18 E+00	8.30 E+00
		La-140	* 8.49 E-01	3.16 E+00

* Denotes a result less than the detection limit.

TABLE A-12.1 (Cont.)

GAMMA SPECTROMETRY OF MILK

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
96	910521	K-40	1.42 E+03	8.31 E+01
		Cs-134	* 7.19 E-01	2.22 E+00
		Cs-137	*-1.40 E-01	2.26 E+00
		Ba-140	*-9.58 E+00	1.13 E+01
		La-140	*-5.77 E-01	4.76 E+00
	910604	K-40	1.33 E+03	8.35 E+01
		Cs-134	*-3.90 E-01	2.49 E+00
		Cs-137	* 2.24 E+00	2.40 E+00
		Ba-140	*-5.33 E+00	8.80 E+00
		La-140	*-1.91 E+00	3.43 E+00
	910618	K-40	1.40 E+03	8.58 E+01
		Cs-134	* 2.05 E+00	2.44 E+00
		Cs-137	* 3.08 E+00	2.64 E+00
		Ba-140	* 1.66 E+00	9.83 E+00
		La-140	* 1.45 E+00	3.53 E+00
	910702	K-40	1.26 E+03	8.46 E+01
		Cs-134	*-2.04 E+00	2.38 E+00
		Cs-137	* 3.20 E+00	2.52 E+00
		Ba-140	* 1.37 E+00	9.41 E+00
		La-140	*-9.59 E-01	3.95 E+00
	910716	K-40	1.33 E+03	8.37 E+01
		Cs-134	*-8.11 E-01	2.41 E+00
		Cs-137	* 2.71 E-01	2.45 E+00
		Ba-140	* 1.40 E+00	9.95 E+00
		La-140	*-1.47 E+00	3.94 E+00
	910806	K-40	1.38 E+03	8.51 E+01
		Cs-134	* 2.11 E+00	2.41 E+00
		Cs-137	* 7.25 E-01	2.61 E+00
		Ba-140	* 0.00 E+00	1.26 E+01
		La-140	*-3.24 E-01	5.01 E+00

* Denotes a result less than the detection limit.

TABLE A-12.1 (Cont.)

GAMMA SPECTROMETRY OF MILK

Results in pCi/liter

LOCATION	COLLECTION PERIOD	NUCLIDE	RESULT	OVERALL UNCERTAINTY
96	910827	K-40	1.36 E+03	6.87 E+01
		Cs-134	* 2.25 E-01	2.03 E+00
		Cs-137	* 6.90 E-01	2.03 E+00
		Ba-140	* 5.81 E+00	8.37 E+00
		La-140	* 0.00 E+00	3.42 E+00
	910910	K-40	1.34 E+03	8.40 E+01
		Cs-134	* 1.43 E+00	2.31 E+00
		Cs-137	* 4.35 E-01	2.25 E+00
		Ba-140	*-2.53 E+00	1.10 E+01
		La-140	*-2.68 E-01	4.70 E+00
	910924	K-40	1.43 E+03	8.25 E+01
		Cs-134	* 4.03 E+00	2.61 E+00
		Cs-137	* 1.54 E+00	2.27 E+00
		Ba-140	*-5.07 E+00	8.75 E+00
		La-140	* 0.00 E+00	3.48 E+00
	911015	K-40	1.39 E+03	8.81 E+01
		Cs-134	* 6.03 E-01	2.41 E+00
		Cs-137	* 1.77 E+00	2.36 E+00
		Ba-140	*-1.20 E+00	1.17 E+01
		La-140	* 0.00 E+00	4.68 E+00
	911119	K-40	1.32 E+03	7.79 E+01
		Cs-134	*-4.29 E-01	2.38 E+00
		Cs-137	* 2.25 E+00	2.44 E+00
		Ba-140	*-4.03 E+00	1.11 E+01
		La-140	*-9.92 E-01	4.82 E+00
	911210	K-40	1.40 E+03	6.74 E+01
		Cs-134	* 7.42 E-01	2.05 E+00
		Cs-137	*-2.24 E+00	2.32 E+00
		Ba-140	* 1.67 E+00	5.83 E+00
		La-140	*-7.84 E-01	2.43 E+00

* Denotes a result less than the detection limit.

TABLE A-12.2 (Cont.)

GAMMA SPECTROMETRY OF MILK - SUMMARY

Results in pCi/liter

NUCLIDE	AVERAGE	LOW	HIGH	NUMBER SAMPLES	NUMBER POSITIVE
K-40 (I)	1.32E+03	1.08E+03	1.66E+03	88	88
K-40 (C)	1.35E+03	1.13E+03	1.43E+03	18	18
Cs-134 (I)	6.88E-01	-1.85E+00	3.93E+00	88	0
Cs-134 (C)	3.98E-01	-2.04E+00	4.03E+00	18	0
Cs-137 (I)	9.72E-01	-3.31E+00	4.25E+00	88	0
Cs-137 (C)	1.16E+00	-2.24E+00	4.70E+00	18	0
Ba-140 (I)	-2.80E-02	-8.42E+00	8.67E+00	88	0
Ba-140 (C)	-2.47E-01	-9.58E+00	5.81E+00	18	0
La-140 (I)	7.48E-02	-4.34E+00	4.57E+00	88	0
La-140 (C)	-1.15E-01	-1.91E+00	2.55E+00	18	0

(I) Indicator Station
(C) Control Station

TABLE A-13.1

GAMMA SPECTROMETRY OF ROOT

Results in pCi/kilogram (wet)

LOCATION	COLLECTION DATE	NUCLIDE	RESULT	OVERALL UNCERTAINTY
9C Beet	910618	Cs-134	* 2.04 E+00	4.55 E+00
		Cs-137	*-3.77 E-01	4.99 E+00
		I-131	* 8.44 E+00	1.11 E+01
37 Beet	910618	Cs-134	* 4.34 E+00	4.53 E+00
		Cs-137	* 0.00 E+00	4.41 E+00
		I-131	*-1.88 E+00	1.19 E+01
37 Potatoes	910716	Cs-134	*-2.31 E+00	4.34 E+00
		Cs-137	* 7.39 E+00	4.27 E+00
		I-131	*-1.13 E+01	9.86 E+00
9C Potatoes	910716	Cs-134	*-6.06 E-02	4.02 E+00
		Cs-137	* 7.10 E+00	4.05 E+00
		I-131	*-1.62 E+00	1.00 E+01
37 Onions	910827	Cs-134	* 2.27 E+00	4.25 E+00
		Cs-137	* 3.50 E+00	4.21 E+00
		I-131	*-2.58 E+01	2.69 E+01
9C Onions	910827	Cs-134	* 4.46 E-01	2.41 E+00
		Cs-137	* 1.01 E+00	2.20 E+00
		I-131	*-8.97 E+00	1.78 E+01
9C Onions	910924	Cs-134	*-3.50 E+00	4.57 E+00
		Cs-137	* 2.73 E+00	4.66 E+00
		I-131	*-6.67 E+00	2.43 E+01
37 Potatoes	910924	Cs-134	*-2.29 E+00	4.38 E+00
		Cs-137	* 1.77 E+00	4.24 E+00
		I-131	*-6.28 E+00	2.24 E+01

* Denotes a result less than the detection limit.

TABLE A-13.2

GAMMA SPECTROMETRY OF ROOT- SUMMARY

Results in pCi/kilogram (wet)

NUCLIDE	AVERAGE	LOW	HIGH	NUMBER SAMPLES	NUMBER POSITIVE
Cs-134 (I)	5.03E-01	-2.31E+00	4.34E+00	4	0
Cs-134 (C)	-2.69E-01	-3.50E+00	2.04E+00	4	0
Cs-137 (I)	3.17E+00	0.00E+00	7.39E+00	4	0
Cs-137 (C)	2.62E+00	-3.77E-01	7.10E+00	4	0
I-131 (I)	-1.13E+01	-2.58E+01	-1.88E+00	4	0
I-131 (C)	-2.21E+00	-8.97E+00	8.44E+00	4	0

(I) Indicator Station
(C) Control Station

TABLE A-14.1

GAMMA SPECTROMETRY OF FRUIT

Results in pCi/kilogram (wet)

LOCATION	COLLECTION DATE	NUCLIDE	RESULT	OVERALL UNCERTAINTY
9C Cherries	910618	Cs-134	*-3.82 E+00	7.77 E+00
		Cs-137	*-2.26 E+00	7.85 E+00
		I-131	*-3.40 E+00	1.45 E+01
37 Cherries	910618	Cs-134	* 1.55 E+00	1.03 E+01
		Cs-137	* 2.19 E+00	9.79 E+00
		I-131	* 5.22 E+00	1.89 E+01
61 Cherries	910622	Cs-134	* 1.29 E+00	5.95 E+00
		Cs-137	* 1.96 E+00	6.56 E+00
		I-131	*-7.29 E+00	1.47 E+01
37 Raspberries	910716	Cs-134	* 9.30 E-01	3.34 E+00
		Cs-137	* 1.51 E+00	3.36 E+00
		I-131	* 1.18 E+00	7.86 E+00
9C Apricots	910716	Cs-134	* 5.65 E-01	2.98 E+00
		Cs-137	* 2.08 E+00	3.00 E+00
		I-131	*-2.65 E+00	7.38 E+00
37 Cantaloupe	910827	Cs-134	*-1.04 E+00	2.82 E+00
		Cs-137	*-1.94 E+00	2.95 E+00
		I-131	* 9.50 E+00	1.69 E+01
9C Pears	910827	Cs-134	*-7.18 E-01	4.35 E+00
		Cs-137	* 3.35 E+00	4.32 E+00
		I-131	*-5.79 E-01	3.30 E+01
37 Apples	910924	Cs-134	* 2.48 E+00	6.12 E+00
		Cs-137	* 9.45 E+00	6.07 E+00
		I-131	*-1.26 E+01	3.45 E+01
9C Plums	910924	Cs-134	*-4.86 E-01	3.06 E+00
		Cs-137	* 3.07 E+00	3.15 E+00
		I-131	* 0.00 E+00	1.91 E+01
91 Apples	910927	Cs-134	* 5.53 E+00	7.93 E+00
		Cs-137	* 3.11 E+00	7.54 E+00
		I-131	* 1.64 E+01	3.19 E+01

* Denotes a result less than the detection limit.

TABLE A-14.2

GAMMA SPECTROMETRY OF FRUIT- SUMMARY

Results in pCi/kilogram (wet)

NUCLIDE	AVERAGE	LOW	HIGH	NUMBER SAMPLES	NUMBER POSITIVE
Cs-134 (I)	1.79E+00	-1.04E+00	5.53E+00	6	0
Cs-134 (C)	-1.11E+00	-3.82E+00	5.65E-01	4	0
Cs-137 (I)	2.71E+00	-1.94E+00	9.45E+00	6	0
Cs-137 (C)	1.56E+00	-2.26E+00	3.35E+00	4	0
I-131 (I)	2.07E+00	-1.26E+01	1.64E+01	6	0
I-131 (C)	-1.66E+00	-3.40E+00	0.00E+00	4	0

(I) Indicator Stations
(C) Control Station

TABLE A-15.1

GAMMA SPECTROMETRY OF VEGETABLES

Results in pCi/kilogram (wet)

LOCATION	COLLECTION DATE	NUCLIDE	RESULT	OVERALL UNCERTAINTY
9 Asparagus	910424	Cs-134	* 2.20 E+00	4.99 E+00
		Cs-137	* 6.00 E+00	5.15 E+00
		I-131	*-1.17 E+01	1.05 E+01
37 Asparagus	910424	Cs-134	* 4.24 E+00	5.05 E+00
		Cs-137	* 1.00 E+00	5.06 E+00
		I-131	*-6.23 E+00	1.04 E+01
9 Asparagus	910521	Cs-134	* 5.98 E-01	6.87 E+00
		Cs-137	* 6.98 E+00	6.96 E+00
		I-131	*-9.79 E+00	1.31 E+01
37 Asparagus	910521	Cs-134	* 5.99 E+00	4.64 E+00
		Cs-137	* 9.36 E-01	4.82 E+00
		I-131	* 1.36 E+00	9.55 E+00
9C Beet Top	910618	Cs-134	* 2.39 E+00	4.92 E+00
		Cs-137	* 5.13 E+00	4.81 E+00
		I-131	* 3.25 E+00	1.20 E+01
37 Cabbage	910618	Cs-134	* 4.03 E+00	4.99 E+00
		Cs-137	* 2.16 E+00	5.02 E+00
		I-131	*-1.31 E+01	1.34 E+01
9C Beet Top	910716	Cs-134	* 1.14 E+00	8.00 E+00
		Cs-137	* 9.28 E+00	8.17 E+00
		I-131	* 3.54 E+00	1.83 E+01
37 Cabbage	910716	Cs-134	* 3.58 E-01	6.53 E+00
		Cs-137	* 4.83 E+00	6.54 E+00
		I-131	* 3.14 E+00	1.52 E+01
37 Tomatoes	910827	Cs-134	* 1.89 E+00	2.79 E+00
		Cs-137	*-1.42 E-01	2.71 E+00
		I-131	*-1.84 E+00	1.79 E+01

* Denotes a result less than the detection limit.

TABLE A-15.1 (Cont.)

GAMMA SPECTROMETRY OF VEGETABLES

Results in pCi/kilogram (wet)

LOCATION	COLLECTION DATE	NUCLIDE	RESULT	OVERALL UNCERTAINTY
9C Tomatoes	910827	Cs-134	* 1.17 E+00	3.57 E+00
		Cs-137	* 1.33 E+00	3.29 E+00
		I-131	*-7.19 E+00	2.29 E+01
37 Tomatoes	9109024	Cs-134	* 1.42 E+00	2.90 E+00
		Cs-137	*-5.12 E+00	2.96 E+00
		I-131	*-9.68 E-01	1.11 E+01
9C Greenpeppers	910924	Cs-134	*-4.56 E+00	5.78 E+00
		Cs-137	* 2.16 E+00	5.57 E+00
		I-131	*-2.50 E+01	2.95 E+01

* Denotes a result less than the detection limit.

TABLE A-15.2

GAMMA SPECTROMETRY OF VEGETABLES- SUMMARY

Results in pCi/kilogram (wet)

NUCLIDE	AVERAGE	LOW	HIGH	NUMBER SAMPLES	NUMBER POSITIVE
Cs-134 (I)	2.99E+00	3.58E-01	5.99E+00	6	0
Cs-134 (C)	4.90E-01	-4.56E+00	2.39E+00	6	0
Cs-137 (I)	6.11E-01	-5.12E+00	4.83E+00	6	0
Cs-137 (C)	5.15E+00	1.33E+00	9.28E+00	6	0
I-131 (I)	-2.94E+00	-1.31E+01	3.14E+00	6	0
I-131 (C)	-7.82E+00	-2.50E+01	3.54E+00	6	0

(I) Indicator Stations
(C) Control Station

APPENDIX B: TELEDYNE ISOTOPES 1991 EPA INTERCOMPARISON RESULTS

EPA INTERCOMPARISON RESULTS

A summary of the results of EPA Intercomparison Program samples analyzed during 1991 is given in Table B-1. Graphs of the results of selected analyses performed by Teledyne Isotopes on EPA Intercomparison samples during 1991 and previous years are presented in Figures B-1 through B-8.

TABLE B-1

1991 EPA INTERCOMPARISON PROGRAM RESULTS

ISOTOPE	COLLECTION DATE	TI RESULTS (a)	EPA RESULTS (b)	OTHER LABS (c)
		MEDIUM - WATER (pCi/liter)		
Sr-89	910111	5.00 ± 0.00	5.0 ± 5.0	5.23 ± 1.59
Sr-90	"	5.00 ± 0.00	5.0 ± 5.0	4.85 ± 1.01
Sr-89	910416	31.00 ± 1.00	28.0 ± 5.0	25.74 ± 6.45
Sr-90	"	21.00 ± 0.00	26.0 ± 5.0	23.61 ± 3.27
Sr-89	910510	38.67 ± 4.51	39.0 ± 5.0	37.43 ± 8.27
Sr-90	"	22.00 ± 1.73	24.0 ± 5.0	23.85 ± 3.02
Sr-89	910913	50.67 ± 2.89	49.0 ± 5.0	49.57 ± 9.08
Sr-90	"	26.00 ± 1.00	25.0 ± 5.0	24.72 ± 2.91
Sr-89	911022	10.67 ± 2.08	10.0 ± 5.0	9.79 ± 2.49
Sr-90	"	9.33 ± 0.58	10.0 ± 5.0	10.09 ± 2.02
Gr-Beta	910125	7.00 ± 0.00	5.0 ± 5.0	6.30 ± 1.51
Gr-Beta	910517	50.33 ± 1.53	46.0 ± 5.0	44.73 ± 7.73
Gr-Beta	910416	110.00 ± 0.00	115.0 ± 17.0	108.60 ± 13.87
Gr-Beta	910920	21.00 ± 0.00	20.0 ± 5.0	20.30 ± 3.68
Gr-Beta	911022	56.00 ± 1.00	65.0 ± 1.00	55.53 ± 7.72
Co-60	910208	39.33 ± 3.06	40.0 ± 5.0	40.04 ± 2.87
Zn-65	"	147.00 ± 1.00	149.0 ± 15.0	149.71 ± 10.68
Ru-106	"	176.67 ± 17.56	186.0 ± 19.0	191.83 ± 19.93
Cs-134	"	7.33 ± 0.58	8.0 ± 5.0	8.09 ± 1.98
Cs-137	"	7.67 ± 3.21	8.0 ± 5.0	9.06 ± 1.59
Ba-133	"	75.67 ± 5.51	75.0 ± 8.0	74.14 ± 5.68
I-131	910215	80.00 ± 5.29	75.0 ± 8.0	77.00 ± 5.89
H-3	910222	4500 ±173.21	4418.0 ± 442.0	4437.54 ± 332.79
Ra-226	910308	28.33 ± 4.73	31.8 ± 4.8	29.45 ± 4.28
Ra-228	"	16.67 ± 2.08	21.1 ± 5.3	19.14 ± 4.16
Ra-226	910416	7.33 ± 0.81	8.0 ± 1.2	7.72 ± 0.69
Ra-228	"	10.00 ± 0.00	15.2 ± 3.8	14.01 ± 3.24 (d)
Cs-134	910416	25.00 ± 1.00	24.0 ± 5.0	22.96 ± 2.06
Cs-137	"	24.00 ± 1.73	25.0 ± 5.0	25.49 ± 2.41
Co-60	910607	10.33 ± 0.58	10.0 ± 5.0	10.69 ± 2.32
Zn-65	"	106.00 ± 2.65	108.0 ± 11.0	109.54 ± 8.13
Ru-106	"	136.67 ± 3.79	149.0 ± 15.0	141.48 ± 14.08
Cs-134	"	13.67 ± 1.53	15.0 ± 5.0	14.20 ± 2.02
Cs-137	"	13.67 ± 1.53	14.0 ± 5.0	15.37 ± 1.96
Ba-133	"	56.33 ± 1.53	62.0 ± 6.0	61.37 ± 5.48
H-3	910621	12833.33 ±115.50	12480. ± 1248.0	12434.92 ± 940.81
Ra-226	910712	15.0 ± 1.00	15.9 ± 2.4	15.34 ± 1.22
Ra-228	"	14.33 ± 2.31	16.7 ± 4.2	15.63 ± 3.11
I-131	910809	19.33 ± 0.58	20.0 ± 6.0	20.96 ± 3.02

TABLE B-1 (Cont.)

1991 EPA INTERCOMPARISON PROGRAM RESULTS

ISOTOPE	COLLECTION DATE	TI RESULTS (a)	EPA RESULTS (b)	OTHER LABS (c)
		MEDIUM - WATER (pCi/liter)		
Co-60	911004	30.33 ± 2.08	29.0 ± 5.0	29.83 ± 3.00
Zn-65	"	72.67 ± 7.09	73.0 ± 7.0	74.57 ± 6.64
Ru-106	"	197.67 ± 7.51	199.0 ± 20.0	194.21 ± 20.92
Cs-134	"	10.33 ± 0.58	10.0 ± 5.0	9.93 ± 1.82
Cs-137	"	11.33 ± 0.58	10.0 ± 5.0	10.86 ± 1.81
Ba-133	"	97.00 ± 8.72	98.0 ± 10.0	95.56 ± 7.44
H-3	911018	2333.33 ± 57.74	2454.0 ± 353.0	2531.91 ± 338.52
Ra-226	911022	21.00 ± 2.65	22.0 ± 3.3	21.57 ± 2.58
Ra-228	"	18.00 ± 1.00	22.2 ± 5.6	21.12 ± 3.55
Co-60	"	19.67 ± 0.58	20.0 ± 5.0	20.22 ± 2.13
Cs-134	"	10.33 ± 2.08	10.0 ± 5.0	9.58 ± 1.22
Cs-137	"	13.67 ± 0.58	11.0 ± 5.0	12.45 ± 1.55
Ra-226	911108	5.37 ± 0.32	6.5 ± 1.0	6.38 ± 0.71
Ra-228	"	7.90 ± 1.20	8.1 ± 2.0	8.19 ± 2.02
		MEDIUM - AIR FILTERS (pCi/cubic meter)		
Gr-Beta	910329	126.67 ± 5.77	124.0 ± 6.0	130.11 ± 13.60
Sr-90		37.00 ± 1.00	40.0 ± 5.0	39.30 ± 5.21
Cs-137		43.00 ± 5.29	40.0 ± 5.0	44.61 ± 7.62
Gr-Beta	910830	100.00 ± 0.00	92.0 ± 10.0	95.54 ± 9.04
Sr-90	"	27.67 ± 2.89	30.0 ± 5.0	29.11 ± 3.92
Cs-137	"	33.33 ± 3.21	30.0 ± 5.0	32.48 ± 5.38

TABLE B-1 (Cont.)

1991 EPA INTERCOMPARISON PROGRAM RESULTS

ISOTOPE	COLLECTION DATE	TI RESULTS (a)	EPA RESULTS (b)	OTHER LABS (c)
		MEDIUM - MILK (pCi/liter)		
Sr-89	910426	24.00 ± 3.00	32.0 ± 5.0	27.07 ± 7.53 (e)
Sr-90	"	26.33 ± 2.08	32.0 ± 5.0	28.02 ± 5.14
I-131	"	53.33 ± 2.31	60.0 ± 6.0	61.17 ± 5.79
Cs-137	"	52.67 ± 1.53	49.0 ± 5.0	51.35 ± 3.73
K	"	1590.00 ± 81.85	1650.0 ± 83.0	1653.09 ± 162.22
Sr-89	910927	21.00 ± 2.65	25.0 ± 5.0	20.95 ± 5.18
Sr-90	"	19.00 ± 0.00	25.0 ± 5.0	21.09 ± 4.20 (e)
I-131	"	113.33 ± 5.77	108.0 ± 11.0	108.56 ± 8.34
Cs-137	"	29.00 ± 3.61	30.0 ± 5.0	31.35 ± 2.34
K	"	1503.33 ± 75.06	1740.0 ± 87.0	1667.46 ± 120.79 (f)

(a) Teledyne Results - Average ± one sigma. Units are pCi/liter for water and milk except K is in mg/liter. Units are total pCi for air particulate filters

(b) EPA Results - Expected laboratory precision (1 sigma). Units are pCi/liter for water and milk except K is in mg/liter. Units are total pCi for air particulate filters

(c) Average concentration plus or minus one sigma, based on range of values encountered.

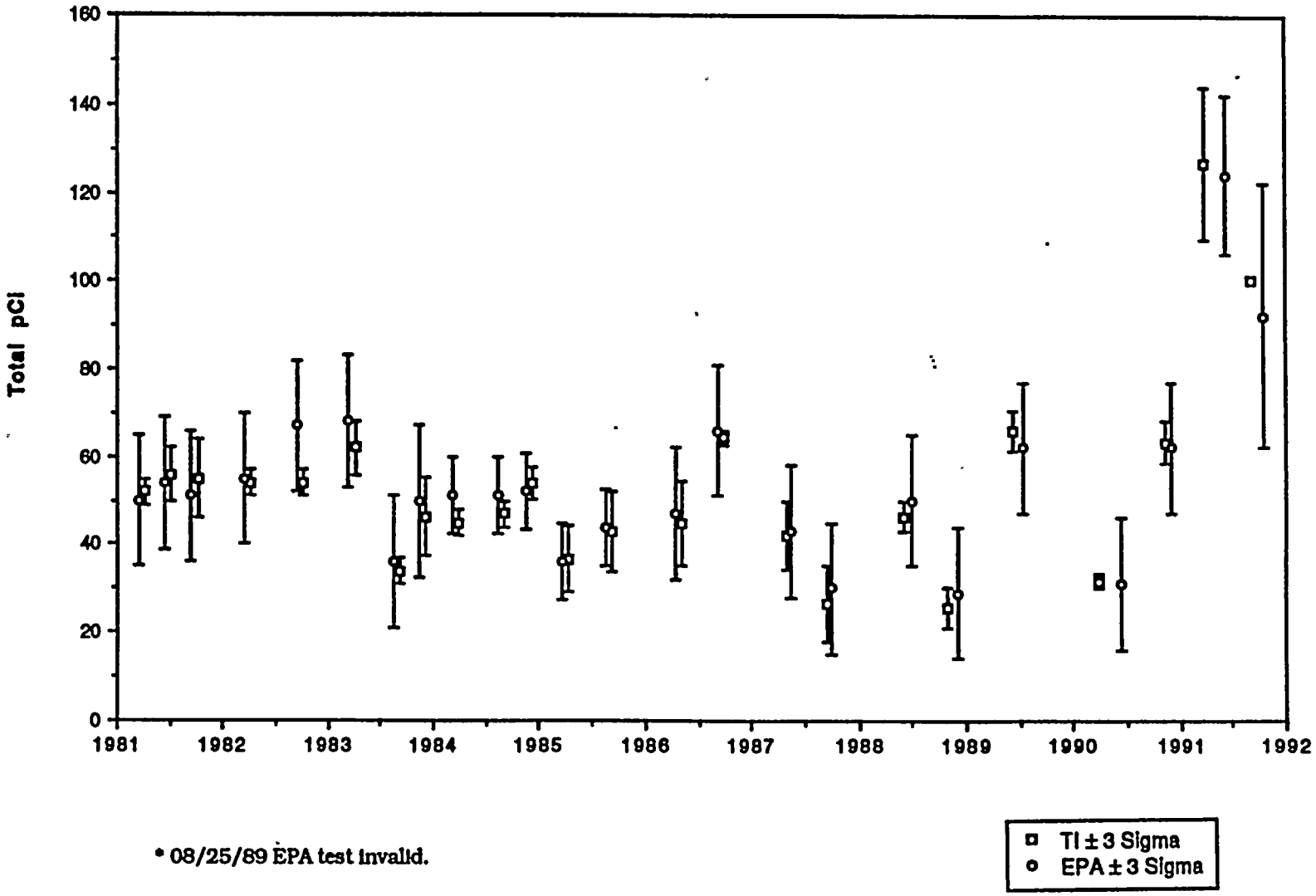
(d) The lowest three results out of nine analyses were chosen. Other results in the group were close to the given value. Subsequent EPA analyses were accepted without selection, leading to acceptable results.

(e) The cause for the deviation is believed to be erroneously high strontium yields, probably caused by incomplete separation of calcium. The laboratory has investigated carrier concentrations and pipeting techniques and have found them to be correct. Further aspects of analysts' techniques are being tested. The laboratory has received a new strontium extraction material developed at Argonne National Laboratory. Experiments with this method to achieve better separation of calcium were completed and procedure PRO-032-105 was implemented on 2/1/92.

(f) There is no apparent cause for the low K-40 results. Two other isotopes spiked in the sample were in good agreement with EPA values. Unit conversions were reviewed and found to be correctly applied. Possible background errors in geometry were investigated and found to have an insignificant effect.

US EPA CROSS CHECK PROGRAM

GROSS BETA IN AIR PARTICULATES



* 08/25/89 EPA test invalid.

FIGURE B-1

US EPA CROSS CHECK PROGRAM

CESIUM-137 IN AIR PARTICULATES

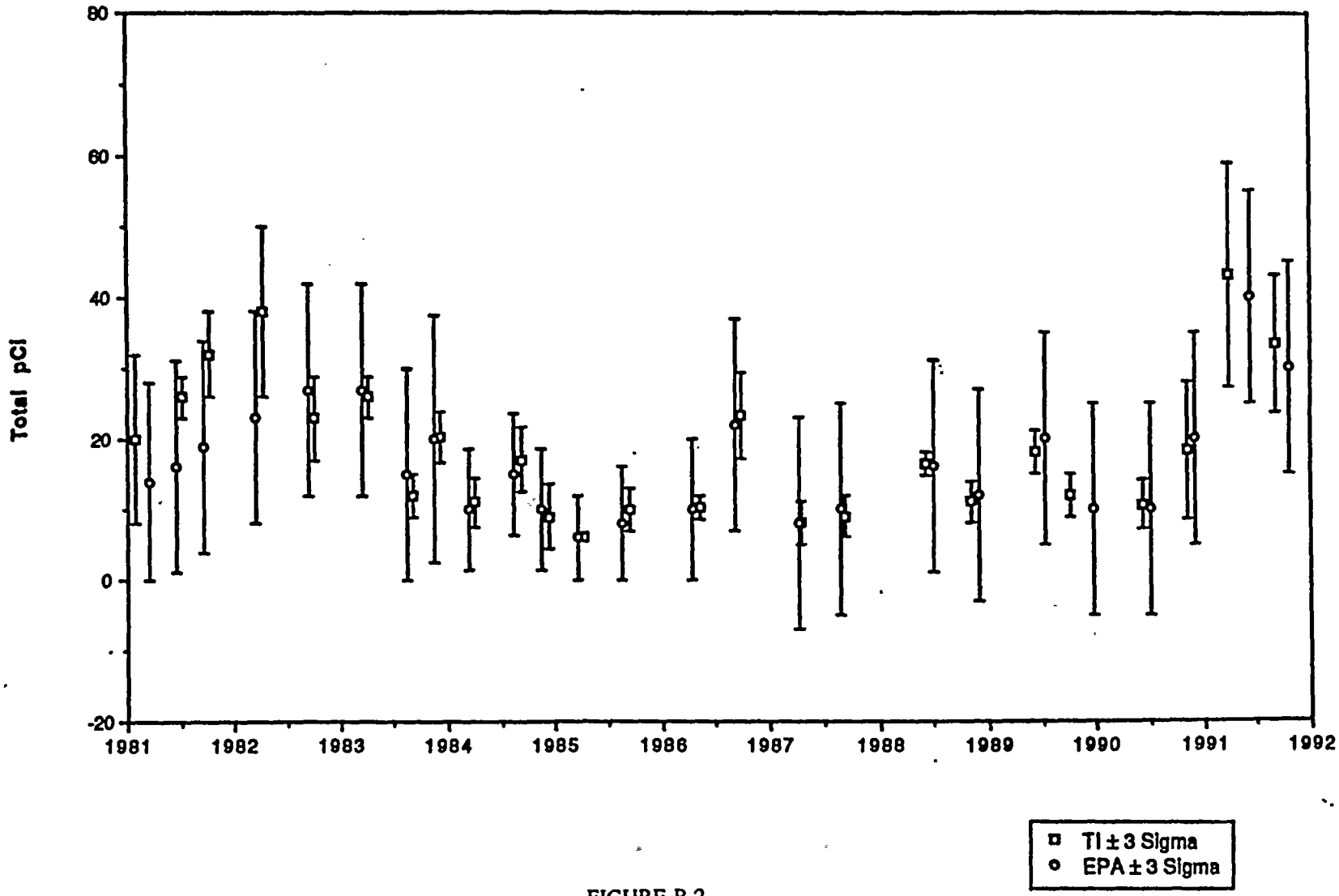


FIGURE B-2

US EPA CROSS CHECK PROGRAM

GROSS BETA IN WATER

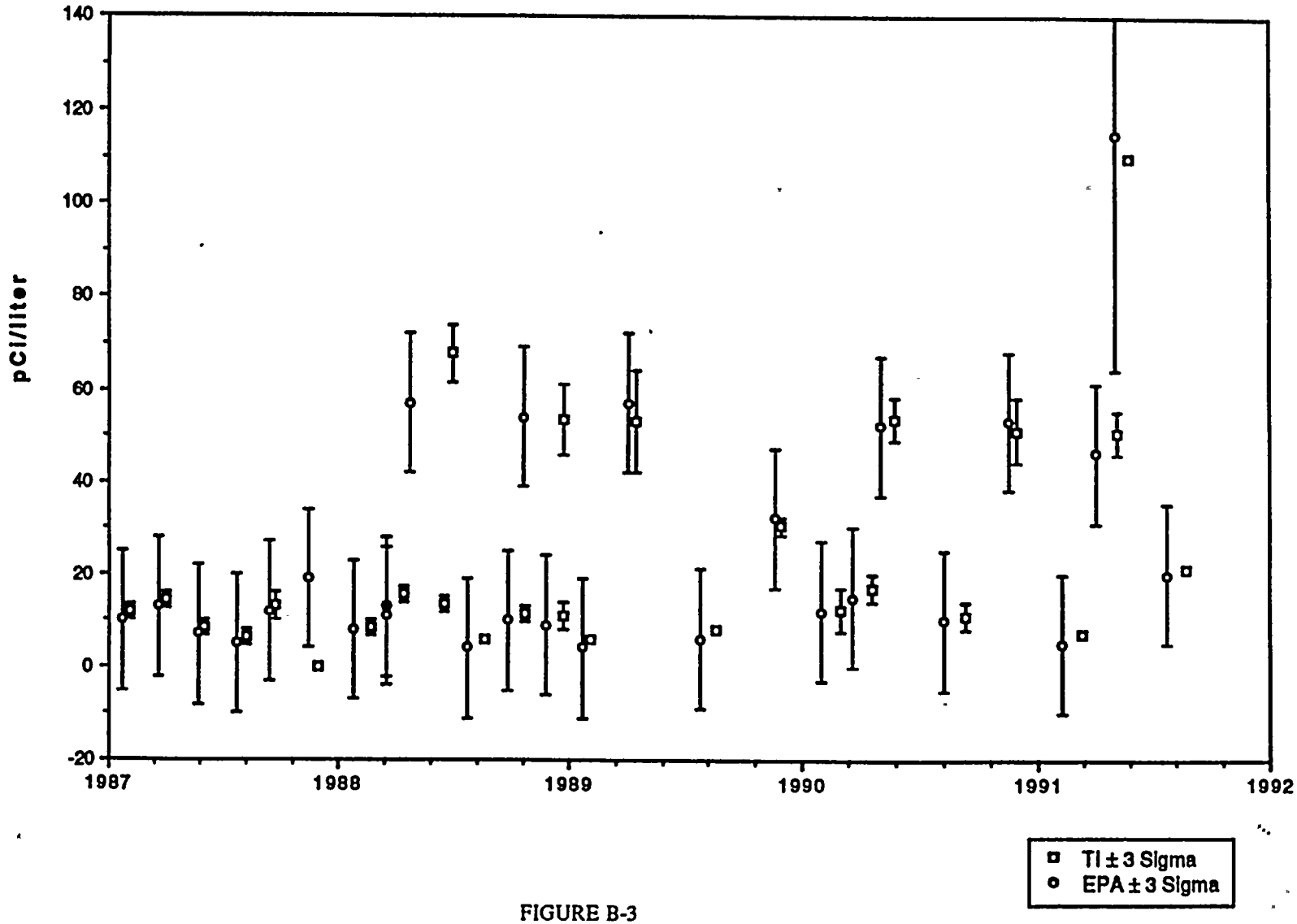


FIGURE B-3

US EPA CROSS CHECK PROGRAM

TRITIUM IN WATER

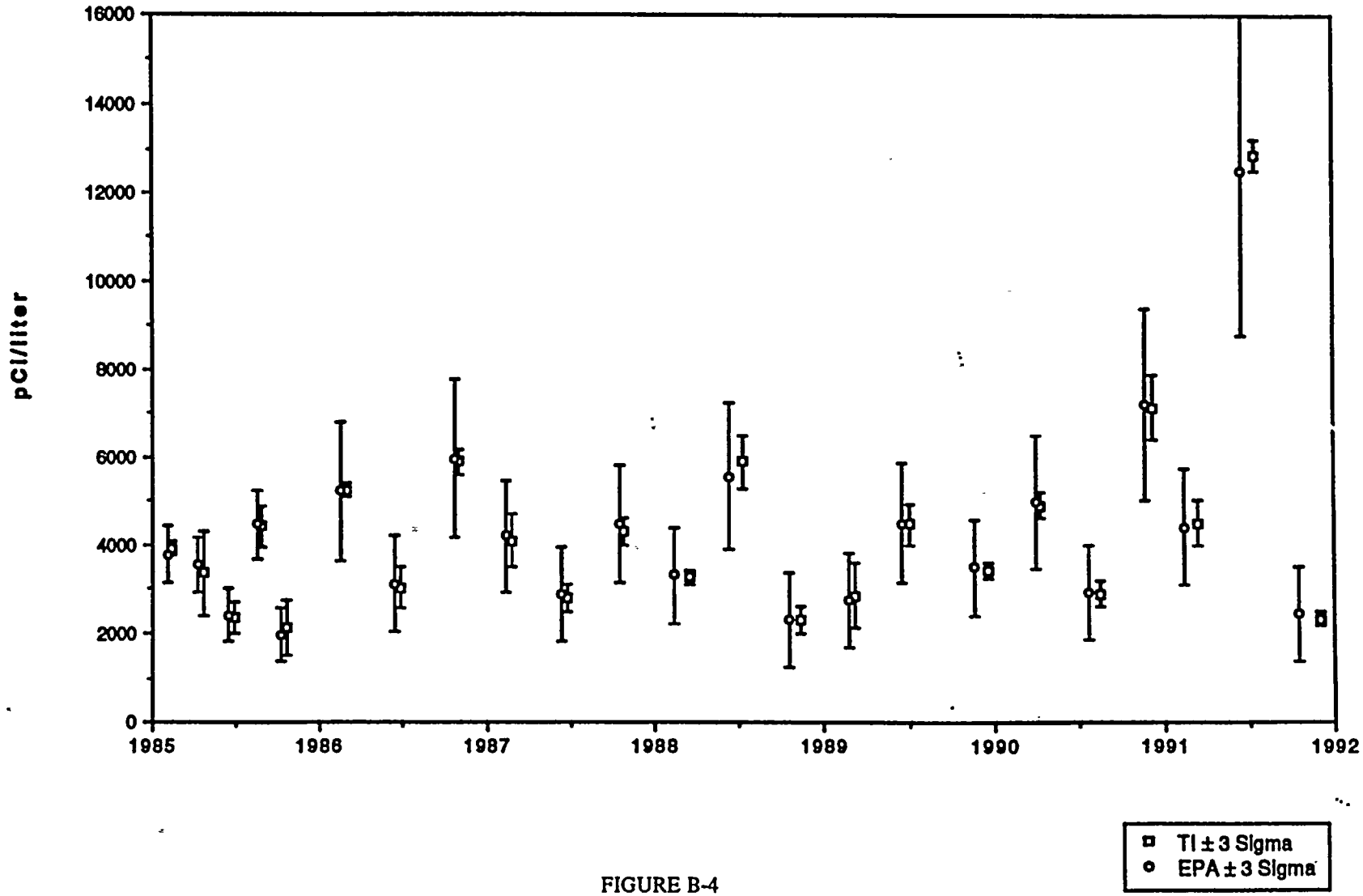


FIGURE B-4

US EPA CROSS CHECK PROGRAM

STRONTIUM-90 IN WATER

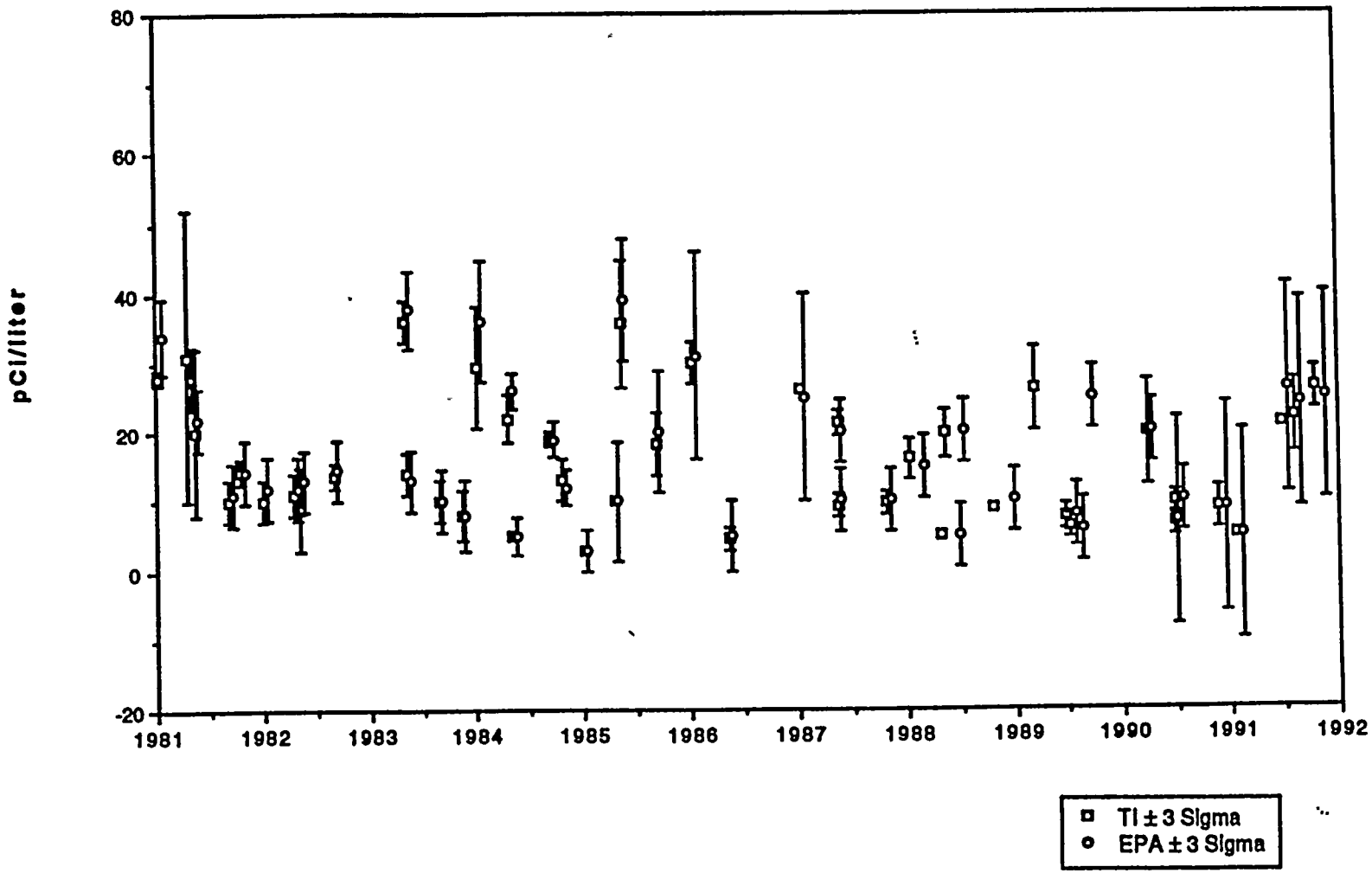


FIGURE B-5

US EPA CROSS CHECK PROGRAM

IODINE-131 IN WATER

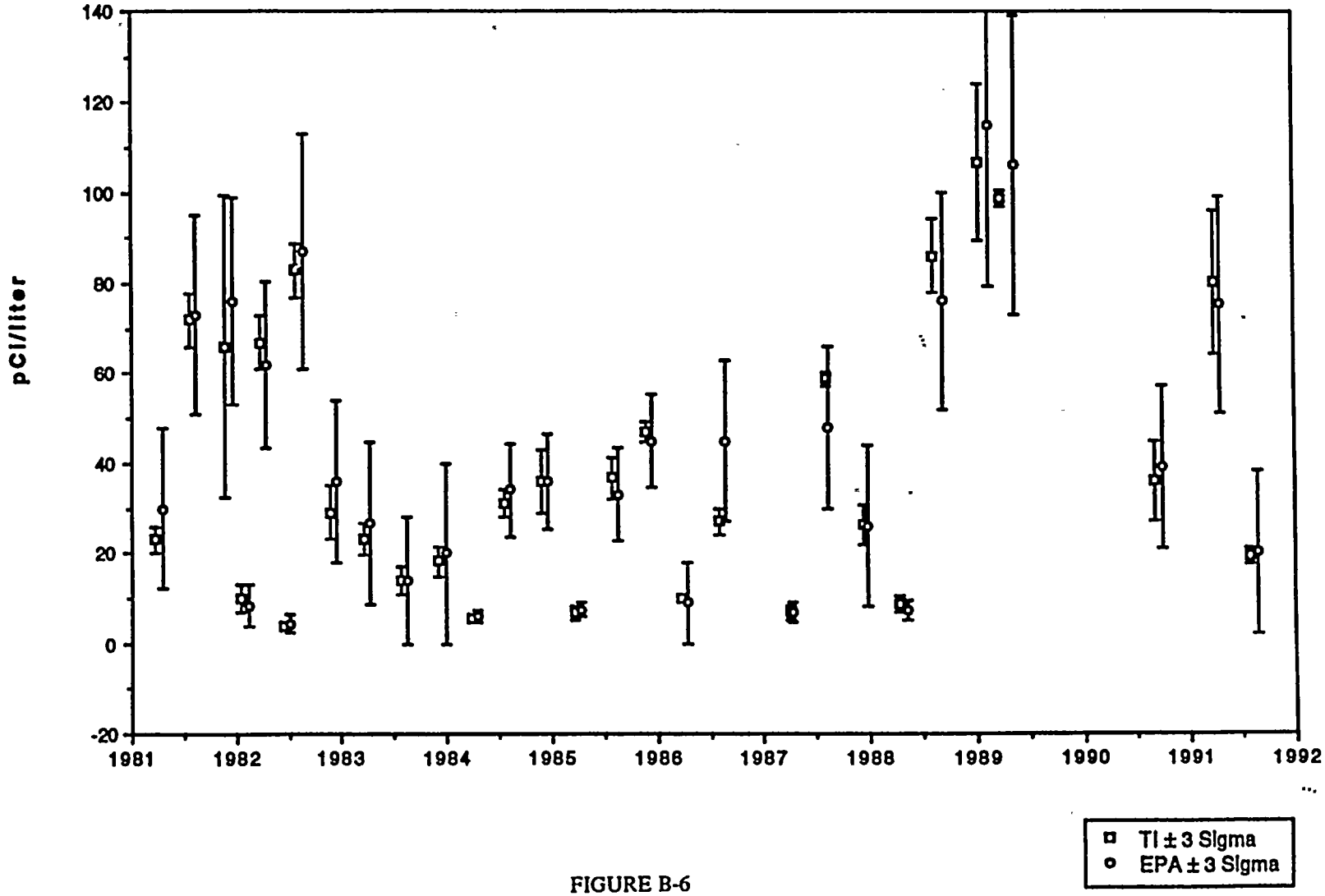


FIGURE B-6

US EPA CROSS CHECK PROGRAM

IODINE-131 IN MILK

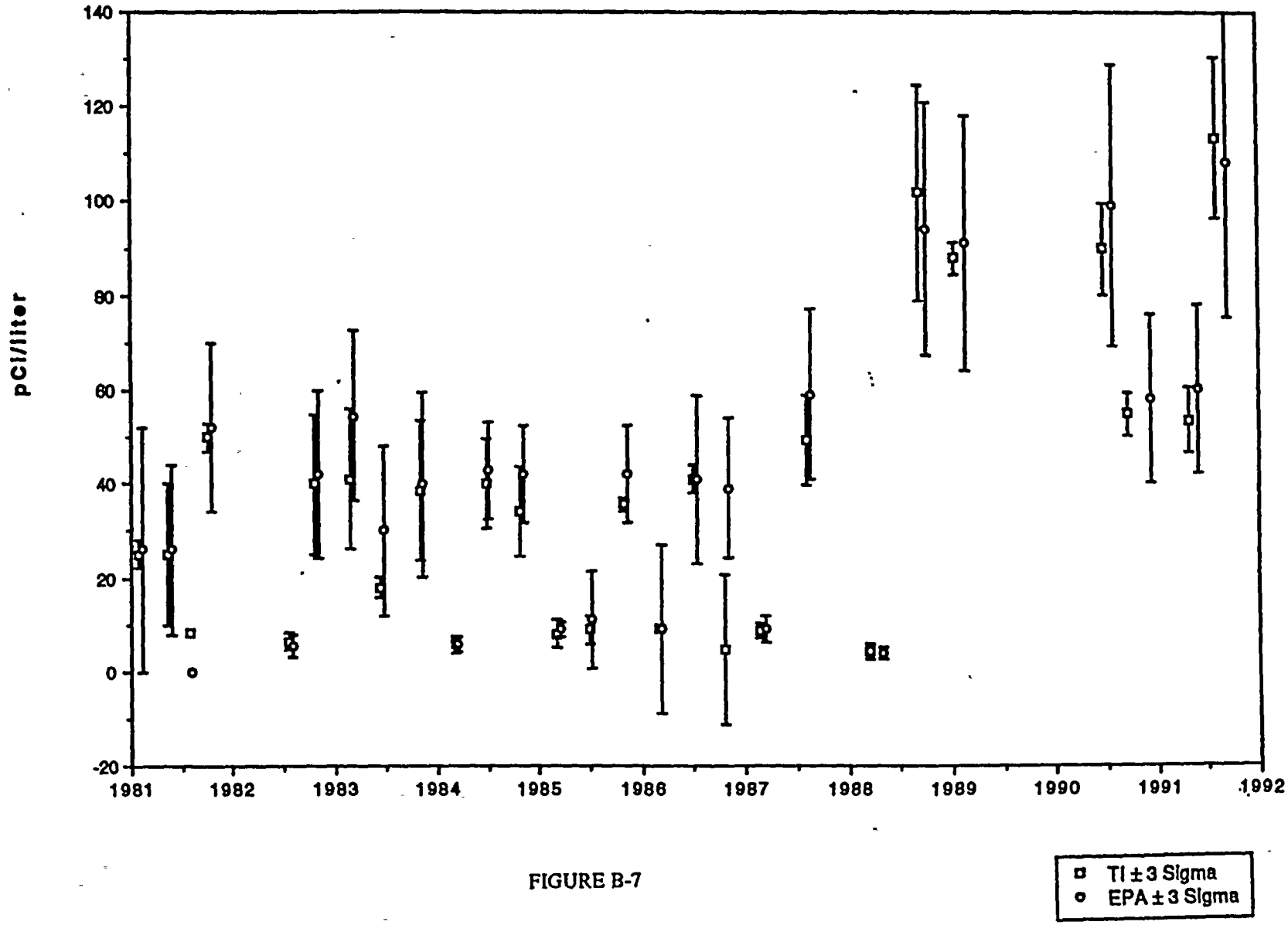


FIGURE B-7

US EPA CROSS CHECK PROGRAM

STRONTIUM-90 IN MILK

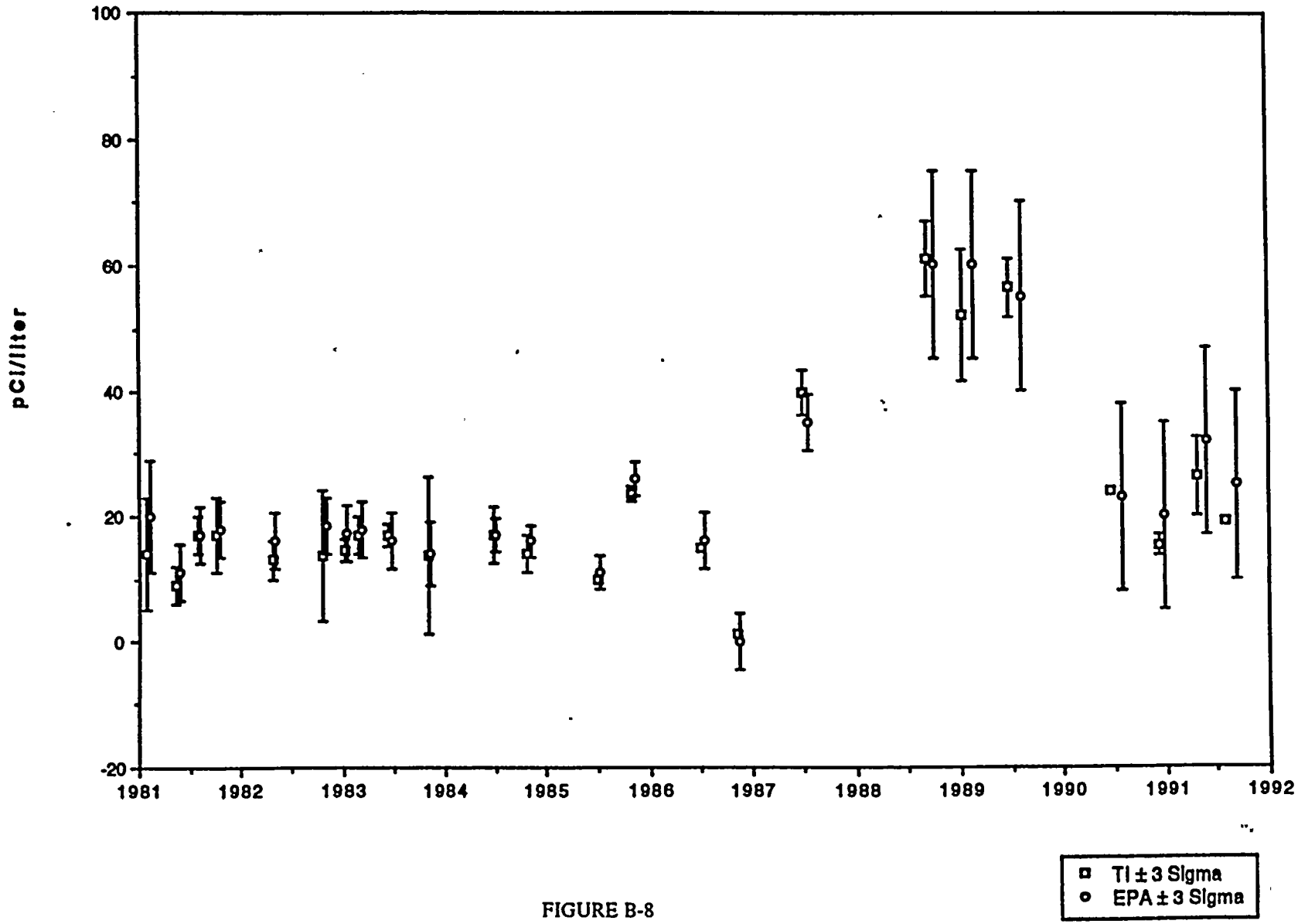


FIGURE B-8

APPENDIX C: 1991 SAMPLE DEVIATIONS

Sample Deviations

Deviations in air sampling during 1991 were fairly typical in the number and types of problems encountered, except in the case of Station 1. In April the installation of a sewer pipe from the US Department of Energy test reactor, the Fast Flux Test Facility (FFTF), to the Supply System sanitary waste facility resulted in the intermittent loss of power to the Station 1 air sampler. Plant 2 outage work during May also resulted in the intermittent loss of power to the Station 1 sampler. Alternate sampling at another location in the same direction from the plant was not feasible due to the loss of power to all the near-plant facilities. During these times, sampling was maintained at Station 6, which is also located directly south of the plant and at a distance of 7.7 miles.

During May and June, 1991, two new flow-proportional composite water samplers were installed to collect samples from the discharge line. These samplers do not require the use of an external pump to draw water from the discharge pipe into the sampling line. They were expected, therefore, to be much more reliable and to provide much more consistent sampling. The samplers have, in fact, operated much more reliably. They were installed so that one sampler operates, while the other serves as a backup, to be activated if a problem arises with the operational sampler.

Two problems accounted for most of the sample deviations for water samples: (1) a pinch valve in the samplers leaked when blowdown reached 1000 gpm or greater; (2) blowdown flows greater than 4000 gpm exceeded the range of the flow meter used to determine the flow-proportional sampling. A new valve, which is effective at higher water pressures, was installed in the samplers to remedy the first problem. To alleviate the second problem, blowdown flows have been limited to 4000 gpm or less until a flow meter with an expanded scale can be installed.

Two milk sampling locations, Station 63 and Station 59, discontinued milk production during 1991. The Pettet farm, Station 40, began milk production again so it replaced the Herr farm, Station 63. The Johnson farm, Station 59, was replaced by the Van Batavia farm, Station 64.

All the deviations from the 1991 sampling schedule or sampling requirements are listed in Table C-1.

TABLE C-1

1991 SAMPLE DEVIATIONS

SAMPLE MEDIA	DATE	LOCATION	PROBLEM
Air Particulate/ Iodine	01/07 to 01/14	Station 21	Blown fuse; reduced hours.
	01/28 to 02/04	Station 21	Debris in gas flow indicator chamber.
	02/25 to 03/04	Station 1	Blown fuse; reduced hours.
	03/05 to 03/11	Station 1	Replacement unit unavailable for one day; reduced hours.
	02/11 to 02/19	Station 21	Power turned off accidentally; reduced hours.
	02/25 to 03/04	Station 23	Pump out; reduced hours.
	04/01 to 04/08	Station 1	Power off due to outage work; reduced hours.
	04/08 to 04/15	Station 1	Power off due to outage work; reduced hours.
	04/15 to 04/22	Station 1	Power off due to outage work; reduced hours.
	04/22 to 04/29	Station 1	Power off due to outage work; reduced hours.
	04/29 to 05/06	Station 9	Power off due to insulator repair; reduced hours.
	05/06 to 05/13	Station 1	Power off due to transformer outage; reduced hours.
	05/13 to 05/20	Station 1	Power off; no sample.
	05/13 to 05/20	Station 9	Sampler malfunction; reduced hours.
	05/20 to 05/28	Station 1	Power off; no sample.
	05/28 to 06/03	Station 1	Power off; reduced hours.
	06/03 to 06/10	Station 57	Sampler malfunction; reduced hours.
	07/29 to 08/05	Station 21	Power off; reduced hours.
	08/05 to 08/12	Station 5	Blown fuse; reduced hours.
	08/19 to 08/26	Station 8	Blown fuse; reduced hours.
	09/30 to 10/07	Station 8	Blown fuse; reduced hours.
	10/14 to 10/17	Station 40	Power off; reduced hours.
	11/11 to 11/18	Station 21	Power off; reduced hours.
	11/18 to 11/25	Station 21	Broken receptacle; reduced hours.
	11/25 to 12/02	Station 21	Broken receptacle; reduced hours.
Water	04/13 to 04/17	Station 27	Sampler pump not operational; Part of sampling period missed. Flow indicator not permitting flow proportionality. due to high flow rate.
	05/02 to 05/06	Station 27	Sampler not operational due to power outage.
	05/17 to 06/14	Station 27	Sampler not operational due to installation of new sampler.

TABLE C-1 (Cont.)
1991 SAMPLE DEVIATIONS

SAMPLE MEDIA	DATE	LOCATION	PROBLEM
Water (Cont.)	08/29	Station 28	Intake line plugged.
	10/01 to 10/07	Station 27	Sampler pressurized due to 3000 gpm flow; could not handle flows above 1000 gpm; flows kept to 1000 gpm or less per written 10/02.
	10/07 to 11/11	Station 27	Sampler could not sample flow proportionally due to over-pressure when blowdown greater than 1000 gpm; blowdown exceeded 1000 gpm numerous times during this period; sampler repaired; valve causing the problem was replaced and sampler became operational on 11/11;
	11/11	Station 27	Blowdown greater than 4000 gpm, so not sampled flow - proportionally; see December 19 entry.
	11/17 to 11/19	Station 27	Blowdown greater than 4000 gpm so not sampled flow - proportionally; see December 19 entry.
	11/12 to 11/26	Station 26	Sampler not operational.
	12/17	Station 27	Blowdown greater than 4000 gpm so not sampled flow - proportionally; see December 19 entry. flow indicator not accurate; not registering flow;
	12/19	Station 27	Flow indicator found to not function flow-proportionally during portions of April, November and December; see earlier entries. Blowdown procedure modified to limit blowdown flow to 4000 gallons per minute.
	12/20	Station 27	Blowdown greater than 4000 gpm, so not sampled flow - proportionally; see December 19 entry.
Milk	01/15	Station 63	Discontinued milk production; replaced by Station 40.
	08/01	Station 59	Discontinued milk production; replaced by Station 64.
Fish	05/02	Station 39	One resident species less than 2.2. lbs.

DISTRIBUTION

Supply System:

J.W. Baker
WNP-2 Plant Manager
Mail Drop 927M

J.C. Bell, Manager
Plant Services
Mail Drop 1025

T.E. Chapman
Principal Health Physicist
Mail Drop 1020

J.P. Chasse
Senior Env. Licensing Engineer
Mail Drop 280

A.I. Davis
Principal Health Physicist
Mail Drop 927K

Environmental Programs Library
Mail Drop 1020

R.F. Haight
Corporate Radiological Health Officer
Mail Drop PE12

A.G. Hosler, Manager
WNP-2 Plant Licensing
Mail Drop PE21

W.A. Kiel
Senior State Liaison
Mail Drop 280

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