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Arizona Public Service Company

PALO VERDE NUCLEAR GENERATING STATION
P.O. BOX 52034 • PHOENIX, ARIZONA 85072-2034

102-02845-AKK/JRP
February 28, 1994

U. S. Nuclear Regulatory Commission
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Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, and 3
Docket Nos. STN 50-528/529/530
Semiannual Radioactive Effluent Release Report
File: 94-056-026

Pursuant to 10 CFR Part 50.36a(a)(2), and in accordance with Technical Specification 6.9.1.8, enclosed please find the Semiannual Radioactive Effluent Release Report for PVNGS Units 1, 2, and 3 for the six-month period ending December 31, 1993.

If you have any questions, please contact Richard A. Bernier of my staff at (602) 393-5882.

Sincerely,



Angela K. Krainik, Manager
Nuclear Licensing

AKK/JRP/dld

Enclosure

cc: W. F. Conway
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STORY

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UNITS 1, 2, AND 3
SEMIANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

JULY 1, 1993 THROUGH DECEMBER 31, 1993

USNRC Docket No. STN 50-528/529/530

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INTRODUCTION

This report summarizes meteorological data and doses from radioactive effluents for the Palo Verde Nuclear Generating Station (PVNGS) for the period of July through December 1993. The data presented meets the reporting requirements of Regulatory Guide 1.21 (Revision 1, June 1974) of the U.S. Nuclear Regulatory Commission and the PVNGS Technical Specifications.

The report is organized into three parts. Appendix A presents the effluent and waste disposal source term data. Appendix B presents a summary of onsite meteorological data for the report period. Appendix C presents the radiological doses from gaseous radioactive effluents.

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APPENDIX A
SOURCE TERMS
AND
EFFLUENT AND WASTE DISPOSAL REPORTS



Supplemental Information

1.0 REGULATORY LIMITS

1.1 Liquid Releases

1.1.1 PVNGS ODCM Requirement 3.2

The concentration of radioactive material discharged from the secondary system liquid waste to the onsite evaporation ponds shall be limited to the Lower Limit of Detectability (LLD) defined as $5 \times 10^{-7} \mu\text{Ci/ml}$ for the principal gamma emitters or $1 \times 10^{-6} \mu\text{Ci/ml}$ for I-131.

1.1.2 PVNGS ODCM Requirement 4.4

The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released, from each reactor unit, to areas at and beyond the SITE BOUNDARY shall be limited:

- a. During any calendar quarter to less than or equal to 1.5 mrem to the total body and to less than or equal to 5 mrem to any organ, and
- b. During any calendar year to less than or equal to 3 mrem to the total body and to less than or equal to 10 mrem to any organ.

1.2 Gaseous Releases

1.2.1 PVNGS ODCM Requirement 3.1

The dose rate due to radioactive materials released in gaseous effluents from the site shall be limited to the following:

- a. For noble gases: Less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin, and
- b. For I-131 and I-133, for tritium, and for all radionuclides in particulate form with half-lives greater than 8 days: Less than or equal to 1500 mrem/yr to any organ.



1.2.2 PVNGS ODCM Requirement 4.1

The air dose due to noble gases released in gaseous effluents, from each reactor unit, to areas at and beyond the SITE BOUNDARY shall be limited to the following:

- a. During any calendar quarter: Less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation and,
- b. During any calendar year: Less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation.

1.2.3 PVNGS ODCM Requirement 4.2

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 shall be limited to the following:

- a. During any calendar quarter: Less than or equal to 7.5 mrem to any organ and,
- b. During any calendar year: Less than or equal to 15 mrem to any organ.

1.2.4 PVNGS ODCM Requirement 4.3

The GASEOUS RADWASTE SYSTEM and the VENTILATION EXHAUST TREATMENT SYSTEM shall be used to reduce radioactive materials in gaseous waste prior to their discharge when the projected gaseous effluent air doses due to gaseous effluent releases, from each reactor unit, from the site, when averaged over 31 days, would exceed 0.2 mrad for gamma radiation and 0.4 mrad for beta radiation. The VENTILATION EXHAUST TREATMENT SYSTEM 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 when averaged over 31 days, would exceed 0.3 mrem to any organ of a MEMBER OF THE PUBLIC.

1.3 Total Dose

1.3.1 PVNGS ODCM Requirement 5.1

The annual (calendar year) dose or dose commitment to any MEMBER OF THE PUBLIC due to releases of radioactivity and to radiation from uranium fuel cycle sources shall be limited to less than or equal to 25 mrem to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrem.



2.0 MAXIMUM PERMISSIBLE CONCENTRATIONS

Air: Release Concentrations are limited to dose rate limits described in section 1.2.1 of this report.

3.0 AVERAGE ENERGY

The average energy (\bar{E}) of the radionuclide mixture in releases of fission and activation gases is not applicable to PVNGS.

4.0 MEASUREMENTS AND APPROXIMATIONS OF TOTAL RADIOACTIVITY IN GASEOUS EFFLUENTS

For continuous releases, sampling is in accordance with PVNGS ODCM Table 3-1. Particulate and iodine radionuclides are sampled continuously at the three exhaust points. The particulate filters and charcoal cartridges are exchanged for analysis four times per month. Noble gas and tritium are sampled at least once per 31 days. The hourly average Radiation Monitoring System (RMS) effluent monitor readings are used, when available, to account for increases and decreases in noble gas concentrations between noble gas grab samples. The tritium concentration is assumed constant between sampling periods.

For batch releases, sampling is also in accordance with PVNGS ODCM Table 3-1. For containment purges, the noble gas concentration is adjusted to account for decreases or increases in concentration during the purge using RMS readings. The volume of air released during the purge is determined using the exhaust fan rated flow rate. For Waste Gas Decay Tank releases, the volume released is corrected to standard pressure.

The Lower Limit of Detection (LLD) of a measurement system is defined in Table 3-1 of the PVNGS ODCM. An average LLD for each radionuclide is provided in Table A1.

5.0 BATCH RELEASES

5.1 Gaseous

All times are in hours

	Unit 1	Unit 2	Unit 3
Number of batch releases	45	76	52
Total time period for batch releases	2115.18	5414.57	1734.85
Maximum time period for a batch release	168.00	168.00	168.00
Average time period for a batch release	47.00	71.24	33.36
Minimum time period for a batch release	0.02	0.02	0.04

5.2 Liquid

None.



6.0 ABNORMAL RELEASES

An abnormal release occurred in Unit Two on July 21, 1993, when approximately 25 gallons of water escaped from the CST transfer pump seal water line. $1.55\text{E-}06$ curies were released. Individual isotopic information is included in Table A6. Specific release information is documented in Permit # 932144. For a detailed description of this event, refer to CRDR 2-3-0456.

7.0 OFFSITE DOSE CALCULATION MANUAL (ODCM) AND PROCESS CONTROL PROGRAM (PCP) REVISIONS

None.

8.0 EFFLUENTS AND SOLID WASTES

8.1 Gaseous Effluents

Gaseous effluent information is presented in Tables A2 through A10. Included in these tables are summaries of the effluents and estimated total error.

8.2 Liquid Effluents

There were no liquid effluents from the PVNGS site.

8.3 Solid Waste

Solid waste shipments are summarized in Table A12.

9.0 MISCELLANEOUS INFORMATION

Releases made to the Evaporation Ponds have been limited, at the Chemical Waste Neutralizer tank, to the concentrations specified in PVNGS ODCM Requirement 3.2. In addition, PVNGS has imposed a limit of $3.00\text{E-}03$ $\mu\text{Ci/ml}$ for tritium in tanks released to the Evaporation Ponds. This was the maximum permissible concentration for unrestricted areas for tritium in water from 10 CFR 20.1-20.601, Appendix B, Table II, Column 2. The Evaporation Ponds were monitored in accordance with PVNGS ODCM Requirement 6.1.

The average historical evaporation is approximately 12 inches, per pond, for each of the first and fourth quarters, and 33 inches, per pond, for each of the second and third quarters. This equates to $3.09\text{E+}11$ cc evaporated from Pond 1 for each of the first and fourth quarters and $8.50\text{E+}11$ cc evaporated from Pond 1 for each of the second and third quarters. The amount evaporated from Pond 2 is $2.89\text{E+}11$ cc for each of the first and fourth quarters and $7.96\text{E+}11$ cc for each of the second and third quarters. Using a site boundary X/Q of $5.0\text{E-}05$ sec/m^3 for the evaporation ponds and equation 4-3 from the ODCM, the dose from the evaporation ponds to a hypothetical individual at the site boundary, for all pathways, is summarized below.



1993 Evaporation Pond Data					
Evaporation Pond 1	Quarter 1	Quarter 2	Quarter 3	Quarter 4	
Historical volume of water evaporated (ml)	3.09E+11	8.50E+11	8.50E+11	3.09E+11	
Tritium Concentration ($\mu\text{Ci/cc}$)	< LLD	5.52E-07	< LLD	6.21E-07	
Tritium Curies	< LLD	4.69E-01	< LLD	1.92E-01	
Evaporation Pond 2	Quarter 1	Quarter 2	Quarter 3	Quarter 4	
Historical volume of water evaporated (ml)	2.89E+11	7.96E+11	7.96E+11	2.89E+11	
Tritium Concentration ($\mu\text{Ci/cc}$)	9.59E-07	1.62E-06	1.64E-06	2.29E-06	
Tritium curies	2.77E-01	1.29E+00	1.31E+00	6.62E-01	
Dose (mRem)	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Year
Pond 1	0.00E+00	6.51E-03	0.00E+00	2.66E-03	9.17E-03
Pond 2	3.84E-03	1.79E-02	1.82E-02	9.18E-03	4.91E-02
Total	3.84E-03	2.44E-02	1.82E-02	1.18E-02	5.83E-02

The results of the second quarter 1993 Strontium-89 and Strontium-90 analysis for continuous releases, which were not available at the time the January - June 1993 Semiannual Report was written, are summarized below. This additional data does not affect doses reported previously in Appendix C.

	Curies	
	Sr-89	Sr-90
Unit 1	1.93E-07	5.54E-08
Unit 2	< LLD	2.53E-08
Unit 3	4.08E-08	1.22E-07

Table A1

UNITS 1, 2 AND 3

GASEOUS EFFLUENTS - AVERAGE LOWER LIMIT OF DETECTION

 $\mu\text{Ci/cc}$

<u>NUCLIDE</u>	<u>CONTINUOUS</u>	<u>BATCH</u>
Argon-41	4.50E-08	4.50E-08
Krypton-85	7.40E-06	7.40E-06
Krypton-85m	2.20E-08	2.20E-08
Krypton-87	5.70E-08	5.70E-08
Krypton-88	7.40E-08	7.40E-08
Xenon-131m	9.10E-07	9.10E-07
Xenon-133	6.30E-08	6.30E-08
Xenon-133m	1.90E-07	1.90E-07
Xenon-135	2.00E-08	2.00E-08
Xenon-135m	8.90E-08	8.90E-08
Xenon-138	2.00E-07	2.00E-07
Iodine-131	8.00E-14	7.00E-12
Iodine-132	6.60E-12	1.90E-11
Iodine-133	4.70E-13	1.10E-11
Iodine-134	5.90E-11	8.20E-11
Iodine-135	7.00E-12	5.50E-11
Antimony-122	2.20E-13	1.90E-11
Antimony-124	8.40E-14	1.70E-11
Barium-140	3.40E-13	5.70E-11
Bromine-82	3.30E-13	1.40E-11
Cerium-141	8.70E-14	3.10E-11
Cerium-144	3.60E-13	6.50E-11
Cesium-134	1.00E-13	2.60E-11
Cesium-137	8.10E-14	1.70E-11
Cesium-138	5.20E-10	7.30E-10
Chromium-51	6.90E-13	1.40E-10
Cobalt-58	8.50E-14	1.70E-11
Cobalt-60	1.00E-13	1.90E-11
Iron-59	1.70E-13	3.20E-11
Lanthanum-140	2.80E-13	2.10E-11
Manganese-54	8.30E-14	1.70E-11
Molybdenum-99	2.40E-13	2.80E-11
Niobium-95	8.70E-14	1.80E-11
Rubidium-88	1.90E-08	1.90E-08
Ruthenium-103	7.40E-14	1.50E-11
Strontium-89	2.15E-15	(1)
Strontium-90	5.60E-16	(1)
Tellurium-123m	6.60E-14	1.50E-11
Tritium	3.80E-07	3.80E-07
Zinc-65	1.90E-13	3.80E-11
Zirconium-95	1.80E-13	4.10E-11
Gross Alpha	3.60E-15	(1)

(1) Not required for batch releases.



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Table A2
UNIT 1 1993
GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

	UNIT	QUARTER #3	QUARTER #4	EST. TOTAL ERROR % (1)
--	------	---------------	---------------	---------------------------

A. Fission & activation gases

1. Total release	Ci	2.25E+02	7.65E+00	3.54E+01
2. Average release rate for period	μCi/sec	2.83E+01	9.62E-01	
3. Percent of ODCM Requirement limit	%	NA (2)	NA (2)	

B. Iodine 131

1. Total Iodine 131	Ci	3.66E-03	2.54E-04	3.32E+01
2. Average release rate for period	μCi/sec	4.60E-04	3.20E-05	
3. Percent of ODCM Requirement limit	%	NA (2)	NA (2)	

C. Particulates

1. Particulates with half-lives > 8 days	Ci	6.84E-04	5.32E-04	3.43E+01
2. Average release rate for period	μCi/sec	8.59E-05	6.69E-05	
3. Percent of ODCM Requirement limit	%	NA (2)	NA (2)	
4. Gross Alpha radio-activity	Ci	< LLD	< LLD	

D. Tritium

1. Total release	Ci	7.02E+01	1.80E+01	3.85E+01
2. Average release rate for period	μCi/sec	8.84E+00	2.26E+00	
3. Percent of ODCM Requirement limit	%	NA (2)	NA (2)	

(1) Estimated total error methodology is presented in Table A11.

(2) See Table A4 for percent of ODCM Requirement limits.

Table A3

UNIT 1 1993

GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

Nuclides Released	Unit	Continuous Mode		Batch Mode	
		Quarter #3	Quarter #4	Quarter #3	Quarter #4
1. Fission gases					
Argon-41	Ci	< LLD	< LLD	1.49E-01	5.17E-02
Krypton-83m	Ci	< LLD	< LLD	< LLD	< LLD
Krypton-85	Ci	1.08E-01	< LLD	6.88E+00	4.66E+00
Krypton-85m	Ci	1.48E-01	< LLD	5.58E-03	< LLD
Krypton-87	Ci	< LLD	< LLD	< LLD	< LLD
Krypton-88	Ci	1.15E-01	< LLD	6.73E-03	< LLD
Krypton-89	Ci	< LLD	< LLD	< LLD	< LLD
Krypton-90	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-131m	Ci	4.65E-03	< LLD	2.47E-01	8.77E-02
Xenon-133	Ci	1.10E+02	< LLD	9.49E+01	2.47E-01
Xenon-133m	Ci	< LLD	< LLD	2.36E-02	9.22E-04
Xenon-135	Ci	1.16E+01	2.59E+00	6.80E-01	9.33E-03
Xenon-135m	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-137	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-138	Ci	< LLD	< LLD	< LLD	< LLD
Total for period	Ci	1.22E+02	2.59E+00	1.03E+02	5.06E+00
2. Iodines					
Iodine-131	Ci	1.58E-03	2.53E-04	2.09E-03	2.94E-07
Iodine-132	Ci	7.15E-03	3.88E-04	2.81E-03	< LLD
Iodine-133	Ci	4.22E-05	1.67E-05	6.21E-04	< LLD
Iodine-134	Ci	1.38E-06	< LLD	< LLD	< LLD
Iodine-135	Ci	1.38E-06	< LLD	< LLD	< LLD
Total for period	Ci	8.77E-03	6.58E-04	5.52E-03	2.94E-07



Table A3 (Continued)

UNIT 1 1993

GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

Nuclides Released	Unit	Continuous Mode		Batch Mode	
		Quarter #3	Quarter #4	Quarter #3	Quarter #4
3. Particulates					
Antimony-122	Ci	7.69E-06	< LLD	< LLD	< LLD
Antimony-124	Ci	2.33E-06	6.03E-06	< LLD	8.79E-06
Barium-140	Ci	< LLD	< LLD	< LLD	< LLD
Bromine-82	Ci	< LLD	< LLD	5.02E-04	3.89E-06
Cerium-141	Ci	< LLD	< LLD	6.63E-05	< LLD
Cerium-144	Ci	< LLD	< LLD	< LLD	< LLD
Cesium-134	Ci	5.50E-05	2.21E-05	< LLD	4.57E-08
Cesium-137	Ci	6.94E-05	3.07E-05	< LLD	4.17E-06
Cesium-138	Ci	1.09E-03	< LLD	< LLD	< LLD
Chromium-51	Ci	< LLD	< LLD	< LLD	< LLD
Cobalt-58	Ci	1.46E-05	2.35E-05	< LLD	3.97E-05
Cobalt-60	Ci	1.31E-06	3.69E-06	< LLD	< LLD
Iron-59	Ci	< LLD	< LLD	< LLD	< LLD
Lanthanum-140	Ci	< LLD	< LLD	< LLD	< LLD
Manganese-54	Ci	< LLD	< LLD	< LLD	1.17E-05
Molybdenum-99	Ci	< LLD	< LLD	< LLD	1.17E-05
Niobium-95	Ci	5.03E-06	3.76E-06	< LLD	1.36E-07
Osmium-191	Ci	1.82E-05	8.29E-06	< LLD	< LLD
Rubidium-88	Ci	2.20E-03	< LLD	2.13E-03	6.31E-06
Ruthenium-103	Ci	2.55E-04	2.42E-04	< LLD	< LLD
Ruthenium-106	Ci	1.86E-04	1.13E-04	< LLD	< LLD
Selenium-75	Ci	7.44E-06	1.25E-05	< LLD	< LLD
Silver-110m	Ci	1.05E-06	< LLD	< LLD	6.66E-09
Strontium-89	Ci	< LLD	(1)	(2)	(2)
Strontium-90	Ci	2.87E-07	(1)	(2)	(2)
Tellurium-123m	Ci	< LLD	6.38E-07	< LLD	< LLD
Tritium	Ci	4.83E+00	< LLD	6.54E+01	1.80E+01
Zinc-65	Ci	< LLD	< LLD	< LLD	< LLD
Zirconium-95	Ci	1.57E-06	1.28E-06	< LLD	< LLD
Total for period	Ci	4.83E+00	4.68E-04	6.54E+01	1.80E+01

(1) Analysis not yet completed. Additional information will be included in the next Semiannual Report.

(2) Not required for batch releases.



Table A4

PVNGS UNIT 1
RADIATION DOSES AT AND BEYOND THE SITE BOUNDARY⁽¹⁾ FOR 1993

	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for 1993
Gamma Air Dose	mrad	2.26E-02	2.42E-02	2.81E-02	1.59E-03	7.65E-02
ODCM Req 4.1 Limit	mrad	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
% ODCM Limit	%	4.52E-01	4.84E-01	5.62E-01	3.18E-02	7.65E-01
Beta Air Dose	mrad	5.37E-02	6.20E-02	7.35E-02	4.52E-03	1.94E-01
ODCM Req 4.1 Limit	mrad	1.00E+01	1.00E+01	1.00E+01	1.00E+01	2.00E+01
% ODCM Limit	%	5.37E-01	6.20E-01	7.35E-01	4.52E-02	9.70E-01
Maximum Organ Dose		Child	Child	Child	Child (2)	Child (2)
(excluding skin)		Thyroid	Thyroid	Thyroid	Thyroid	Thyroid
ODCM Req. 4.2 Limit	mrem	4.12E-01	7.14E-01	2.47E-01	4.96E-02	1.42E+00
% ODCM Limit	mrem	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
	%	5.49E+00	9.52E+00	3.29E+00	6.61E-01	9.47E+00

- (1) Calculations are based on parameters and methodologies of the ODCM using historical meteorology. Dose is calculated to a hypothetical individual at the site boundary for all pathways. In contrast, Appendix C dose calculations are based on concurrent meteorology, a real individual, and only the actual pathways present.
- (2) Does not include 4th quarter Sr-89, 90 results.



Table A5
UNIT 2 1993
GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

	UNIT	QUARTER #3	QUARTER #4	EST. TOTAL ERROR % (1)
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A. Fission & activation gases

1. Total release	Ci	6.36E+00	1.42E+01	3.54E+01
2. Average release rate for period	μCi/sec	8.00E-01	1.79E+00	
3. Percent of ODCM Requirement limit	%	NA (2)	NA (2)	

B. Iodine 131

1. Total Iodine 131	Ci	< LLD	8.39E-06	3.32E+01
2. Average release rate for period	μCi/sec	< LLD	1.06E-06	
3. Percent of ODCM Requirement limit	%	NA (2)	NA (2)	

C. Particulates

1. Particulates with half-lives > 8 days	Ci	3.71E-03	7.53E-05	3.43E+01
2. Average release rate for period	μCi/sec	4.67E-04	9.47E-06	
3. Percent of ODCM Requirement limit	%	NA (2)	NA (2)	
4. Gross Alpha radio-activity	Ci	< LLD	< LLD	

D. Tritium

1. Total release	Ci	5.12E+01	1.12E+02	3.85E+01
2. Average release rate for period	μCi/sec	6.44E+00	1.41E+01	
3. Percent of ODCM Requirement limit	%	NA (2)	NA (2)	

(1) Estimated total error methodology is presented in Table A11.

(2) See Table A7 for percent of ODCM Requirement limits.



Table A6

UNIT 2. 1993

GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

Nuclides Released	Unit	Continuous Mode		Batch Mode	
		Quarter #3	Quarter #4	Quarter #3	Quarter #4
1. Fission gases					
Argon-41	Ci	< LLD	< LLD	1.99E-02	7.96E-02
Krypton-83m	Ci	< LLD	< LLD	< LLD	< LLD
Krypton-85	Ci	< LLD	< LLD	6.21E+00	< LLD
Krypton-85m	Ci	< LLD	< LLD	< LLD	< LLD
Krypton-87	Ci	< LLD	< LLD	< LLD	9.82E-07
Krypton-88	Ci	< LLD	< LLD	< LLD	< LLD
Krypton-89	Ci	< LLD	< LLD	< LLD	< LLD
Krypton-90	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-131m	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-133	Ci	< LLD	1.36E+01	1.15E-01	5.28E-01
Xenon-133m	Ci	< LLD	< LLD	2.57E-03	1.64E-03
Xenon-135	Ci	< LLD	< LLD	5.38E-03	1.48E-03
Xenon-135m	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-137	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-138	Ci	< LLD	< LLD	< LLD	< LLD
Total for period	Ci	< LLD	1.36E+01	6.36E+00	6.11E-01
2. Iodines					
Iodine-131	Ci	< LLD	8.15E-06	< LLD	2.41E-07
Iodine-132	Ci	< LLD	< LLD	< LLD	< LLD
Iodine-133	Ci	< LLD	< LLD	< LLD	< LLD
Iodine-134	Ci	< LLD	< LLD	< LLD	< LLD
Iodine-135	Ci	< LLD	< LLD	< LLD	< LLD
Total for period	Ci	< LLD	8.15E-06	< LLD	2.41E-07

Table A6 (Continued)

UNIT 2 1993

GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

Nuclides Released	Unit	Continuous Mode		Batch Mode	
		Quarter #3	Quarter #4	Quarter #3	Quarter #4
3. Particulates					
Antimony-124	Ci	2.91E-06	1.32E-05	2.78E-04	1.26E-07
Antimony-125	Ci	< LLD	< LLD	3.94E-06	< LLD
Barium-140	Ci	< LLD	< LLD	< LLD	< LLD
Bromine-82	Ci	< LLD	< LLD	1.46E-06	9.75E-06
Cerium-141	Ci	< LLD	< LLD	< LLD	< LLD
Cerium-144	Ci	< LLD	< LLD	< LLD	< LLD
Cesium-134	Ci	1.09E-06	< LLD	1.90E-03	9.06E-09
Cesium-137	Ci	2.45E-06	< LLD	1.47E-03	6.30E-08
Cesium-138	Ci	< LLD	< LLD	< LLD	< LLD
Chromium-51	Ci	< LLD	< LLD	< LLD	4.95E-09
Cobalt-57	Ci	< LLD	< LLD	1.11E-07	< LLD
Cobalt-58	Ci	< LLD	3.91E-05	2.25E-05	1.65E-08
Cobalt-60	Ci	< LLD	1.85E-05	6.23E-06	4.31E-08
Iron-59	Ci	< LLD	< LLD	< LLD	< LLD
Lanthanum-140	Ci	< LLD	< LLD	< LLD	< LLD
Manganese-54	Ci	< LLD	< LLD	3.18E-06	4.77E-09
Molybdenum-99	Ci	< LLD	< LLD	< LLD	< LLD
Niobium-95	Ci	< LLD	< LLD	8.62E-06	1.79E-09
Rubidium-88	Ci	< LLD	< LLD	< LLD	< LLD
Ruthenium-103	Ci	< LLD	< LLD	< LLD	< LLD
Silver-110m	Ci	< LLD	2.26E-06	< LLD	< LLD
Strontium-89	Ci	< LLD	(1)	(2)	(2)
Strontium-90	Ci	< LLD	(1)	(2)	(2)
Tellurium-123m	Ci	3.92E-06	1.97E-06	< LLD	< LLD
Tin-113m	Ci	< LLD	< LLD	2.87E-07	< LLD
Tritium	Ci	< LLD	< LLD	5.12E+01	1.12E+02
Zinc-65	Ci	< LLD	< LLD	< LLD	< LLD
Zirconium-95	Ci	< LLD	< LLD	4.76E-06	< LLD
Total for period	Ci	1.04E-05	7.50E-05	5.12E+01	1.12E+02

(1) Analysis not yet completed. Additional information will be included in the next Semiannual Report.

(2) Not required for batch releases.



Table A7

PVNGS UNIT 2
RADIATION DOSES AT AND BEYOND THE SITE BOUNDARY⁽¹⁾ FOR 1993

	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for 1993
Gamma Air Dose	mrad	6.78E-02	3.84E-04	9.72E-05	1.61E-03	6.99E-02
ODCM Req 4.1 Limit	mrad	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
% ODCM Limit	%	1.36E+00	7.68E-03	1.94E-03	3.22E-02	6.99E-01
Beta Air Dose	mrad	8.69E-02	9.71E-03	3.48E-03	4.25E-03	1.04E-01
ODCM Req 4.1 Limit	mrad	1.00E+01	1.00E+01	1.00E+01	1.00E+01	2.00E+01
% ODCM Limit	%	8.69E-01	9.71E-02	3.48E-02	4.25E-02	5.20E-01
Maximum Organ Dose		Child	Child	Child	Child (2)	Child (2)
(excluding skin)		Thyroid	Thyroid	Liver	Thyroid	Thyroid
ODCM Req. 4.2 Limit	mrem	1.83E-01	2.21E-01	1.45E-01	2.78E-01	8.12E-01
% ODCM Limit	mrem	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
	%	2.44E+00	2.95E+00	1.93E+00	3.71E+00	5.41E+00

- (1) Calculations are based on parameters and methodologies of the ODCM using historical meteorology. Dose is calculated to a hypothetical individual at the site boundary for all pathways. In contrast, Appendix C dose calculations are based on concurrent meteorology, a real individual, and only the actual pathways present.
- (2) Does not include 4th quarter Sr-89, 90 results.



Table A8
UNIT 3 1993
GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

	UNIT	QUARTER #3	QUARTER #4	EST. TOTAL ERROR % (1)
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A. Fission & activation gases

1. Total release	Ci	8.34E+00	1.57E+02	3.54E+01
2. Average release rate for period	μCi/sec	1.05E+00	1.98E+01	
3. Percent of ODCM Requirement limit	%	NA (2)	NA (2)	

B. Iodine 131

1. Total Iodine 131	Ci	3.27E-06	1.42E-03	3.32E+01
2. Average release rate for period	μCi/sec	4.11E-07	1.79E-04	
3. Percent of ODCM Requirement limit	%	NA (2)	NA (2)	

C. Particulates

1. Particulates with half-lives > 8 days	Ci	1.38E-07	1.57E-04	3.43E+01
2. Average release rate for period	μCi/sec	1.74E-08	1.98E-05	
3. Percent of ODCM Requirement limit	%	NA (2)	NA (2)	
4. Gross Alpha radio-activity	Ci	< LLD	4.65E-08	

D. Tritium

1. Total release	Ci	1.81E+02	1.06E+02	3.85E+01
2. Average release rate for period	μCi/sec	2.28E+01	1.33E+01	
3. Percent of ODCM Requirement limit	%	NA (2)	NA (2)	

(1) Estimated total error methodology is presented in Table A11.

(2) See Table A10 for percent of ODCM Requirement limits.



Table A9

UNIT 3 1993

GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

Nuclides Released	Unit	Continuous Mode		Batch Mode	
		Quarter #3	Quarter #4	Quarter #3	Quarter #4
1. Fission gases					
Argon-41	Ci	< LLD	< LLD	9.89E-02	1.46E+00
Krypton-83m	Ci	< LLD	< LLD	< LLD	< LLD
Krypton-85	Ci	< LLD	< LLD	7.43E-01	3.37E+00
Krypton-85m	Ci	< LLD	< LLD	< LLD	2.60E-03
Krypton-87	Ci	< LLD	< LLD	< LLD	< LLD
Krypton-88	Ci	< LLD	< LLD	< LLD	< LLD
Krypton-89	Ci	< LLD	< LLD	< LLD	< LLD
Krypton-90	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-131m	Ci	< LLD	< LLD	< LLD	1.15E+00
Xenon-133	Ci	6.25E+00	6.37E+01	5.45E-02	8.53E+01
Xenon-133m	Ci	< LLD	< LLD	< LLD	2.75E-01
Xenon-135	Ci	1.19E+00	1.25E+00	4.52E-05	7.90E-02
Xenon-135m	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-137	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-138	Ci	< LLD	< LLD	< LLD	< LLD
Total for period	Ci	7.44E+00	6.50E+01	8.96E-01	9.16E+01
2. Iodines					
Iodine-131	Ci	2.72E-06	2.12E-04	5.48E-07	1.21E-03
Iodine-132	Ci	< LLD	< LLD	< LLD	2.69E-03
Iodine-133	Ci	2.18E-06	9.59E-06	2.80E-07	5.28E-05
Iodine-134	Ci	< LLD	< LLD	< LLD	< LLD
Iodine-135	Ci	< LLD	< LLD	< LLD	< LLD
Total for period	Ci	4.90E-06	2.22E-04	8.28E-07	3.95E-03

Table A9 (Continued)

UNIT 3 1993

GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

Nuclides Released	Unit	Continuous Mode		Batch Mode	
		Quarter #3	Quarter #4	Quarter #3	Quarter #4
3. Particulates					
Antimony-122	Ci	< LLD	< LLD	< LLD	1.53E-05
Antimony-124	Ci	< LLD	< LLD	< LLD	7.17E-06
Barium-140	Ci	< LLD	< LLD	< LLD	< LLD
Bromine-82	Ci	< LLD	< LLD	1.39E-05	1.95E-04
Cerium-141	Ci	< LLD	< LLD	< LLD	< LLD
Cerium-144	Ci	< LLD	< LLD	< LLD	< LLD
Cesium-134	Ci	< LLD	< LLD	< LLD	1.40E-08
Cesium-137	Ci	< LLD	< LLD	< LLD	1.11E-08
Cesium-138	Ci	< LLD	< LLD	< LLD	< LLD
Chromium-51	Ci	< LLD	< LLD	< LLD	3.55E-05
Cobalt-58	Ci	< LLD	6.97E-06	< LLD	8.62E-05
Cobalt-60	Ci	< LLD	4.45E-06	< LLD	1.62E-05
Iron-59	Ci	< LLD	< LLD	< LLD	< LLD
Lanthanum-140	Ci	< LLD	< LLD	< LLD	< LLD
Manganese-54	Ci	< LLD	5.96E-07	< LLD	< LLD
Molybdenum-99	Ci	< LLD	< LLD	< LLD	3.92E-06
Niobium-95	Ci	< LLD	< LLD	< LLD	< LLD
Rubidium-88	Ci	< LLD	< LLD	< LLD	6.53E-04
Ruthenium-103	Ci	< LLD	< LLD	< LLD	< LLD
Strontium-89	Ci	9.18E-08	(1)	(2)	(2)
Strontium-90	Ci	4.57E-08	(1)	(2)	(2)
Technicium-99m	Ci	< LLD	< LLD	< LLD	3.80E-06
Tritium	Ci	< LLD	< LLD	1.81E+02	1.06E+02
Zinc-65	Ci	< LLD	< LLD	< LLD	< LLD
Zirconium-95	Ci	< LLD	< LLD	< LLD	< LLD
Total for period	Ci	1.38E-07	1.20E-05	1.81E+02	1.06E+02

(1) Analysis not yet completed. Additional information will be included in the next Semiannual Report.

(2) Not required for batch releases.



Table A10

PVNGS UNIT 3
RADIATION DOSES AT AND BEYOND THE SITE BOUNDARY⁽¹⁾ FOR 1993

	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for 1993
Gamma Air Dose	mrad	2.41E-03	2.64E-03	1.54E-03	1.95E-02	2.61E-02
ODCM Req 4.1 Limit	mrad	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
% ODCM Limit	%	4.82E-02	5.28E-02	3.08E-02	3.90E-01	2.61E-01
Beta Air Dose	mrad	4.89E-03	6.16E-03	3.20E-03	4.88E-02	6.30E-02
ODCM Req 4.1 Limit	mrad	1.00E+01	1.00E+01	1.00E+01	1.00E+01	2.00E+01
% ODCM Limit	%	4.89E-02	6.16E-02	3.20E-02	4.88E-01	3.15E-01
Maximum Organ Dose		Child	Child	Child	Child (2)	Child (2)
(excluding skin)		Thyroid	Thyroid	Thyroid	Thyroid	Thyroid
ODCM Req. 4.2 Limit	mrem	2.24E-01	1.80E-01	4.47E-01	2.91E-01	1.14E+00
% ODCM Limit	mrem	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
	%	2.99E+00	2.40E+00	5.96E+00	3.88E+00	7.60E+00

- (1) Calculations are based on parameters and methodologies of the ODCM using historical meteorology. Dose is calculated to a hypothetical individual at the site boundary for all pathways. In contrast, Appendix C dose calculations are based on concurrent meteorology, a real individual, and only the actual pathways present.
- (2) Does not include 4th quarter Sr-89, 90 results.

Table A11

Estimation of Total Percent Error

The estimated total error is calculated as follows:

$$\text{Total Percent Error} = (E_1^2 + E_2^2 + E_3^2 + \dots + E_n^2)^{1/2}$$

Where E_n = Percent error associated with each contributing parameter.

Parameters contributing to errors in the measurement of gaseous effluents are; process flow rates, sample collection, analytical counting and tank volumes.

The following values (%) were used for error calculations.

Fission & Act. gases	I-131	Partic- ulates	Tritium	
25	25	25	25	Sample counting error
10	10	10	10	Counting system calibration error
5	5	5	5	Counting system source error
20	N/A	N/A	N/A	Temperature/volume correction error
10	10	10	10	Process flow measuring device
N/A	15	15	15	Sample flow measuring device
N/A	5	N/A	N/A	Iodine collection efficiency error
N/A	N/A	10	N/A	Plateout error
N/A	N/A	N/A	20	Bubbler collection efficiency error
N/A	N/A	N/A	2	Sample volume transfer error (pipette)
N/A	N/A	N/A	2	Sample volume error (graduate)



TABLE A12

SOLID WASTE SUMMARY FOR PERIOD JULY 1, 1993 - DECEMBER 31, 1993

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (not irradiated fuel)

1.0 Type of Waste	Unit	6-month period	estimated total error %
1.a) spent resin, filters, sludges, evaporator bottoms, etc.	M ³ Ci	1.04E+02 6.33E+02	N/A ± 2.50E+01
1.b) dry compressible waste, contaminated equipment, etc.	M ³ Ci	6.93E+01 2.35E+00	N/A ± 2.50E+01
1.c) irradiated components, fuel rods, etc.	M ³ Ci	0.00E+00 0.00E+00	N/A N/A
1.d) other (Incinerator Ash)	M ³ Ci	2.85E+00 2.42E-01	N/A N/A

NOTE

Volume and activity for dry compressible waste, contaminated equipment, etc., include PVNGS waste disposed of after being processed by a volume reduction facility.

2.0 Principal Radionuclides

2.a) Estimate a major nuclide concentration for spent resins, filter sludges, evaporator bottoms, etc.

WASTE CLASS	NUCLIDE NAME	PERCENT ABUNDANCE	CURIES
A	Fe-55	2.94E+01%	3.82E+00
A	Cs-134	1.99E+01%	2.58E+00
A	Cs-137	1.94E+01%	2.52E+00
A	Co-60	1.58E+01%	2.05E+00
A	Ni-63	9.90E+00%	1.29E+00
A	Sb-124	4.67E+00%	6.10E-01
A	H-3	2.62E+00%	3.40E-01
A	C-14	1.91E+00%	2.48E-01
A	Sr-90	1.00E-01%	1.30E-02
Total			1.35E+01



TABLE A12

2.b) Estimate a major nuclide concentration for spent resins, filter sludges, evaporator bottoms, etc.

WASTE CLASS	NUCLIDE NAME	PERCENT ABUNDANCE	CURIES
B	Cs-137	2.60E+01%	5.49E+01
B	Cs-134	2.00E+01%	4.23E+01
B	Fe-55	1.86E+01%	3.93E+01
B	Co-60	9.82E+00%	2.07E+01
B	Ni-63	9.03E+00%	1.91E+01
B	Co-58	7.10E+00%	1.50E+01
B	C-14	9.30E-01%	1.96E+00
B	Sr-90	2.10E-01%	4.44E-01
B	H-3	1.90E-01%	4.01E-01
B	Pu-241	1.10E-01%	2.32E-01
B	Cm-242	1.00E-03%	2.11E-02
Total			1.94E+02

2.c) Estimate a major nuclide concentration for spent resins, filter sludges, evaporator bottoms, etc.

WASTE CLASS	NUCLIDE NAME	PERCENT ABUNDANCE	CURIES
C	Cs-137	3.87E+01%	1.58E+02
C	Cs-134	2.90E+01%	1.19E+02
C	Fe-55	2.25E+01%	9.20E+01
C	Co-60	5.58E+00%	2.28E+01
C	Ni-63	3.79E+00%	1.55E+01
C	C-14	8.26E-01%	3.38E+00
C	Sr-90	2.79E-01%	1.14E+00
C	Pu-241	1.41E-01%	5.77E-01
C	H-3	2.90E-02%	1.19E-01
C	Cm-242	3.00E-03%	1.23E-02
Total			4.13E+02



TABLE A12

2.d) Estimate a major nuclide concentration for dry compressible waste, contaminated equipment, etc.

WASTE CLASS	NUCLIDE NAME	PERCENT ABUNDANCE	CURIES
A	Fe-55	4.19E+01%	9.93E-01
A	Co-60	1.24E+01%	2.94E-01
A	Co-58	9.60E+00%	2.28E-01
A	Cs-137	7.04E+00%	1.67E-01
A	Ni-63	6.14E+00%	1.46E-01
A	Ag-110m	4.20E+00%	9.95E-02
A	Cs-134	2.60E+00%	6.16E-02
A	Pu-241	2.27E+00%	5.38E-02
A	C-14	2.22E+00%	5.26E-02
A	Mn-54	1.70E+00%	4.03E-02
A	Sb-124	1.60E+00%	3.79E-02
A	Ru-106	1.55E+00%	3.67E-02
A	Ce-144	1.55E+00%	3.67E-02
A	Nb-95	1.30E+00%	3.08E-02
A	H-3	1.13E+00%	2.68E-02
A	Sb-125	1.00E+00%	2.37E-02
A	Zr-95	7.00E-01%	1.66E-02
Total			2.35E+00



TABLE A12

2.e) Estimate a major nuclide concentration for Incinerator ash.

WASTE CLASS	NUCLIDE NAME	PERCENT ABUNDANCE	CURIES
A	Fe-55	2.74E+01%	6.66E-02
A	H-3	1.58E+01%	3.84E-02
A	C-14	1.51E+01%	3.66E-02
A	Co-60	9.70E+00%	2.35E-02
A	Co-58	6.00E+00%	1.45E-02
A	Cs-137	5.50E+00%	1.33E-02
A	Ni-63	4.30E+00%	1.04E-02
A	Ce-144	2.80E+00%	6.77E-03
A	Ag-110m	2.10E+00%	5.15E-03
A	Zr-95	2.10E+00%	5.04E-03
A	Sb-124	2.10E+00%	5.02E-03
A	Cs-134	1.80E+00%	4.38E-03
A	Ru-106	1.40E+00%	3.50E-03
A	Nb-95	1.40E+00%	3.47E-03
A	Mn-54	1.10E+00%	2.60E-03
A	Pu-241	7.00E-01%	1.66E-03
A	Sb-125	6.00E-01%	1.50E-03
Total			2.42E-01



TABLE A12

3.0 Solid Waste Disposition

3.a)

SHIPMENTS	SHIPPER	MODE OF TRANSPORTATION	DESTINATION
24	CHEM-NUCLEAR	TRUCK	BARNWELL, SC
2	KENDRICK	TRUCK	BARNWELL, SC
3	TRI-STATE	TRUCK	BARNWELL, SC
71	HITTMAN	TRUCK	BARNWELL, SC

3.b) Irradiated Fuel Shipments: None

3.c) Supplemental Information - This section includes PVNGS and vendor provided containers.

NUMBER OF CONTAINERS	CONTAINER VOLUME FT ³	TYPE OF WASTE	CONTAINER TYPE	SOLIDIFICATION AGENT
4	132.4	RESIN	EL-142	NONE
2	202.1	DAW	EL-210	NONE
1	49.9	FILTERS	EA-50	NONE
3	130.8	RESIN	EA-142	NONE
3	199.4	RESIN	ES-210	NONE
4	11.6	EVAP BOTTOMS	80 GAL DRUMS	NONE
243	7.5	EVAP BOTTOMS	55 GAL DRUMS	NONE
50	7.5	DAW	55 GAL DRUMS	NONE
20	46	ASH	LSA BOX	NONE
1	53.7	ASH	LSA BOX	NONE
93	46	DAW	LSA BOX	NONE
5	10.8	DAW	DRUM	NONE
6	11.6	DAW	DRUM	NONE
19	12.1	DAW	DRUM	NONE



TABLE A12

4.0 Changes to Processes and/or Equipment

- 4.a) The Process Control Program has not been revised this report period.
- 4.b) No major changes were made to installed plant equipment.
- 4.c) No major changes were made to installed plant equipment. Therefore, predicted release or quantity of solid waste generated, remain unchanged as addressed in the FSAR.
- 4.d) No major changes were made to installed plant equipment. Therefore, predicted exposure to the public and general population, remain unchanged as addressed in the FSAR.



Table A13

Units 1, 2 and 3

EFFLUENT MONITORING INSTRUMENTATION OUT OF SERVICE GREATER THAN
30 DAYS

Instrument	Date Span of Inoperability	Cause of Inoperability	Explanation
1JGRNFIT0033 WGDT flow rate monitor	07/22/93 - 11/13/93	Test equipment used in calibration was out of tolerance.	With the monitor inoperable, a decision was made to implement DCP 1XJ-GR-046



APPENDIX B
METEOROLOGY

JOINT FREQUENCY DISTRIBUTION TABLES

The tables presented in this section are results obtained from processing the hourly meteorological data collected at the Palo Verde Nuclear Generating Station for 1993. The joint frequency distribution (JFD) tables represent the frequency, in terms of the number of observations, that a particular wind speed, wind direction, and stability category occurred simultaneously. On a quarterly, semiannual and annual basis, the JFDs are produced for 35-foot wind speed and wind direction by atmospheric stability class corresponding to the seven Pasquill stability categories, and for wind speed and wind direction for all stability classes combined. Atmospheric stability was classified per Regulatory Guide 1.23, using the 200-foot to 35-foot temperature difference (ΔT).

In accordance with NUREG-0133, the batch releases for the third and fourth quarters for 1993 were considered as "long term," since for each quarter, the sum of the batch release periods for each unit exceeded 150 hours. Consequently, the JFDs for the batch releases for both quarters are the same as for the continuous releases.



Table B1
JFDs of 35-Foot Wind Versus Delta T
July - September 1993



JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 7/ 1/93 - 9/30/93

3RD-QTR-93

STABILITY CLASS: A
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH
 JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.51- 4.50	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	2
4.51- 5.50	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	3
5.51- 6.50	0	1	0	1	0	1	2	2	1	2	2	3	2	0	1	0	18
6.51- 8.50	0	0	0	2	4	1	5	7	11	22	16	6	0	0	0	0	74
8.51-11.50	0	0	0	2	7	1	2	5	15	36	29	16	1	2	0	0	116
11.51-14.50	0	0	0	0	3	0	0	0	8	18	24	5	0	0	0	0	58
14.51-20.50	0	0	0	0	0	0	0	0	4	8	18	0	0	0	0	0	30
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	1	0	5	14	3	10	15	40	87	89	30	3	3	1	0	301

STABILITY CLASS: B
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH
 JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	2
3.51- 4.50	0	0	0	2	0	1	2	1	0	0	1	0	0	0	0	1	8
4.51- 5.50	2	0	2	0	2	2	2	6	9	5	4	4	2	2	0	1	43
5.51- 6.50	0	1	0	0	1	5	2	7	10	7	4	5	1	0	0	1	44
6.51- 8.50	0	0	0	3	6	7	3	9	20	13	4	4	1	3	1	0	74
8.51-11.50	0	0	1	3	9	6	0	2	3	7	6	5	2	0	0	0	44
11.51-14.50	0	0	0	0	3	1	1	2	0	3	8	0	0	1	0	0	19
14.51-20.50	0	0	0	0	1	0	0	0	0	3	2	0	0	0	0	0	6
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	1	3	8	22	22	10	27	43	38	29	19	6	6	1	3	240



JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 7/ 1/93 - 9/30/93

3RD-QTR-93

STABILITY CLASS C
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	1	1	1	0	1	1	0	1	0	0	0	6
3.51- 4.50	1	0	0	1	2	0	2	1	4	2	2	0	2	0	0	1	18
4.51- 5.50	0	0	0	1	0	3	3	7	10	9	3	0	0	1	0	0	37
5.51- 6.50	0	0	1	4	2	6	2	0	10	7	1	3	0	1	1	0	38
6.51- 8.50	0	0	0	3	4	6	1	4	7	5	3	7	1	1	0	0	42
8.51-11.50	0	0	0	0	2	8	0	0	1	3	6	3	1	0	0	0	24
11.51-14.50	0	0	0	0	3	0	0	0	0	1	7	2	0	0	0	0	13
14.51-20.50	0	0	0	0	2	1	0	0	0	1	3	1	0	0	0	0	8
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	0	1	9	15	25	9	13	32	29	26	16	5	3	1	1	186

STABILITY CLASS D
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	1	0	1	1	0	1	0	1	0	4	0	1	1	3	14
2.51- 3.50	0	4	2	5	3	6	6	3	5	2	3	2	1	7	2	0	51
3.51- 4.50	3	1	0	5	5	5	1	12	5	4	7	3	3	1	0	0	55
4.51- 5.50	0	1	1	2	1	2	0	2	3	3	6	3	0	0	0	0	24
5.51- 6.50	0	0	1	5	3	4	1	2	4	2	8	0	3	1	1	0	35
6.51- 8.50	0	1	3	1	2	9	3	0	2	6	10	9	4	1	2	0	53
8.51-11.50	1	0	0	3	7	16	2	0	4	8	14	7	3	4	0	0	69
11.51-14.50	0	0	0	0	10	5	1	1	3	3	18	4	0	0	0	0	45
14.51-20.50	0	2	0	0	3	0	0	1	1	9	18	0	0	0	0	0	34
>20.50	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	3
TOTAL	4	9	8	21	35	48	14	22	28	38	86	32	14	15	6	3	383



JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 7/ 1/93 - 9/30/93

3RD-QTR-93

STABILITY CLASS E
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	2
1.51- 2.50	4	1	2	1	0	0	0	0	1	0	1	2	3	2	3	2	22
2.51- 3.50	5	6	4	0	0	0	0	0	1	3	2	0	0	1	3	6	31
3.51- 4.50	4	3	2	3	1	0	2	2	0	3	7	1	2	3	0	2	35
4.51- 5.50	1	4	5	3	1	2	2	1	3	5	9	4	0	1	1	0	42
5.51- 6.50	1	2	1	0	0	0	0	1	2	2	10	9	1	1	1	0	31
6.51- 8.50	1	3	5	6	6	3	0	1	3	11	26	12	2	1	1	0	81
8.51-11.50	0	0	3	1	5	10	0	0	1	24	52	20	2	3	1	0	122
11.51-14.50	0	0	0	0	4	3	1	2	0	11	24	2	0	0	0	0	47
14.51-20.50	0	0	0	0	3	2	1	1	0	4	2	0	0	0	0	0	13
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	16	19	22	14	21	20	6	8	11	63	134	50	10	12	10	10	426

STABILITY CLASS F
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1.51- 2.50	4	1	0	0	0	0	0	0	1	0	0	0	1	2	3	2	14
2.51- 3.50	10	1	1	1	3	0	0	1	0	1	1	3	4	2	4	2	34
3.51- 4.50	9	8	3	3	0	1	0	1	1	4	6	5	7	6	2	3	59
4.51- 5.50	3	4	4	0	0	0	0	1	1	4	6	7	8	1	3	3	45
5.51- 6.50	2	2	1	1	1	0	0	0	0	3	6	3	2	2	0	0	23
6.51- 8.50	0	0	5	1	0	0	0	1	3	10	12	6	3	4	0	1	46
8.51-11.50	0	0	0	2	0	2	1	0	2	10	25	3	1	0	0	1	47
11.51-14.50	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
14.51-20.50	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	28	18	14	8	4	3	2	5	8	32	56	27	26	17	12	12	272

JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 7/ 1/93 - 9/30/93

3RD-QTR-93

STABILITY CLASS G
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH
 JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	3	4	1	0	0	0	0	0	0	1	0	0	2	2	4	9	26
2.51- 3.50	15	10	3	2	1	0	0	0	1	1	3	3	3	3	12	17	74
3.51- 4.50	40	19	5	3	0	1	0	0	0	6	2	2	6	4	2	22	112
4.51- 5.50	32	27	7	0	0	0	0	0	0	2	1	4	3	3	4	13	96
5.51- 6.50	9	13	10	0	0	0	0	0	0	0	1	1	1	0	3	5	43
6.51- 8.50	2	11	4	1	1	0	0	0	0	0	1	0	0	0	0	1	21
8.51-11.50	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0	0	5
11.51-14.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14.51-20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	101	84	30	6	2	1	0	0	1	12	11	10	15	12	25	67	377

STABILITY CLASS ALL
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH
 JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	3
1.51- 2.50	11	6	4	1	1	1	0	1	2	2	1	6	6	7	11	16	76
2.51- 3.50	30	21	10	8	7	7	7	5	8	8	10	9	9	13	21	25	198
3.51- 4.50	57	31	10	17	8	8	7	17	10	20	25	11	20	15	4	29	289
4.51- 5.50	38	36	19	6	4	9	8	18	27	28	29	22	13	8	8	17	290
5.51- 6.50	12	19	14	11	7	16	7	12	27	23	32	24	10	5	7	6	232
6.51- 8.50	3	15	17	17	23	26	12	22	46	67	72	44	11	10	4	2	391
8.51-11.50	1	0	4	11	30	43	5	7	26	90	135	54	10	9	1	1	427
11.51-14.50	0	0	0	0	23	9	3	6	11	36	81	13	0	1	0	0	183
14.51-20.50	0	3	0	0	9	3	2	2	5	25	43	1	0	0	0	0	93
>20.50	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	3
TOTAL	152	132	78	71	113	122	51	90	163	299	431	184	79	68	56	96	2185



JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 7/ 1/93 - 9/30/93

3RD-QTR-93

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH

TOTAL NUMBER OF OBSERVATIONS: 2208
 TOTAL NUMBER OF VALID OBSERVATIONS: 2185
 TOTAL NUMBER OF MISSING OBSERVATIONS: 23
 PERCENT DATA RECOVERY FOR THIS PERIOD: 99.0 %
 MEAN WIND SPEED FOR THIS PERIOD: 7.3 MPH
 TOTAL NUMBER OF OBSERVATIONS WITH BACKUP DATA: 0

PERCENTAGE OCCURRENCE OF STABILITY CLASSES
 A 13.78 B 10.98 C 8.51 D 17.53 E 19.50 F 12.45 G 17.25

	DISTRIBUTION OF WIND DIRECTION VS STABILITY																
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	CALM
A	0	1	0	5	14	3	10	15	40	87	89	30	3	3	1	0	0
B	2	1	3	8	22	22	10	27	43	38	29	19	6	6	1	3	0
C	1	0	1	9	15	25	9	13	32	29	26	16	5	3	1	1	0
D	4	9	8	21	35	48	14	22	28	38	86	32	14	15	6	3	0
E	16	19	22	14	21	20	6	8	11	63	134	50	10	12	10	10	0
F	28	18	14	8	4	3	2	5	8	32	56	27	26	17	12	12	0
G	101	84	30	6	2	1	0	0	1	12	11	10	15	12	25	67	0
TOTAL	152	132	78	71	113	122	51	90	163	299	431	184	79	68	56	96	0

Table B2
JFDs of 35-Foot Wind Versus Delta T
October - December 1993



JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 10/ 1/93 - 12/31/93

4TH-QTR-93

STABILITY CLASS A
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH
 JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.51- 4.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.51- 5.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.51- 6.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.51- 8.50	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	2
8.51-11.50	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	2
11.51-14.50	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	3
14.51-20.50	0	0	0	4	0	0	0	0	0	0	0	0	0	1	0	1	6
>20.50	3	0	0	2	0	0	0	0	0	0	0	1	1	0	0	0	7
TOTAL	3	0	0	7	2	1	0	0	1	0	0	1	2	2	0	1	20

STABILITY CLASS B
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH
 JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.51- 4.50	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
4.51- 5.50	0	1	0	1	1	0	1	0	0	1	1	0	0	0	0	0	6
5.51- 6.50	0	0	1	1	3	0	0	0	0	1	1	1	0	0	0	0	8
6.51- 8.50	0	5	2	4	0	1	0	3	0	3	3	2	0	1	0	0	24
8.51-11.50	0	0	0	5	7	1	0	0	0	1	3	1	1	1	0	0	20
11.51-14.50	0	0	1	3	2	0	0	0	0	1	1	1	1	1	0	0	11
14.51-20.50	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
>20.50	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL	0	6	5	15	14	2	1	3	0	8	9	5	2	3	0	0	73



JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 10/ 1/93 - 12/31/93

4TH-QTR-93

STABILITY CLASS C
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH
 JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
2.51- 3.50	0	0	0	0	0	0	0	0	1	0	0	1	0	2	1	0	5
3.51- 4.50	1	0	2	4	1	0	0	0	0	1	1	5	0	0	0	2	17
4.51- 5.50	0	2	3	1	0	1	0	2	3	4	2	0	2	0	1	1	22
5.51- 6.50	1	4	7	6	3	1	1	1	0	0	4	2	0	1	0	0	31
6.51- 8.50	0	2	6	7	3	2	2	1	0	2	1	1	2	0	0	1	30
8.51-11.50	1	2	1	2	3	2	1	0	1	1	2	1	1	0	0	0	18
11.51-14.50	0	1	0	3	2	0	0	0	0	0	1	0	0	1	0	0	8
14.51-20.50	0	0	0	1	5	0	0	0	0	0	0	1	0	0	0	0	7
>20.50	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	3
TOTAL	4	11	21	24	17	6	4	4	5	8	11	12	6	4	2	4	143

STABILITY CLASS D
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH
 JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	4	3	5	5	2	0	1	2	5	3	1	6	1	2	5	4	49
2.51- 3.50	6	6	10	5	3	3	10	12	18	7	17	9	5	0	8	3	122
3.51- 4.50	1	10	6	11	3	4	5	5	8	14	7	6	2	5	4	2	93
4.51- 5.50	2	7	5	8	3	2	1	5	9	11	10	3	0	1	2	0	69
5.51- 6.50	1	5	10	5	2	3	3	1	2	5	4	1	0	0	1	1	44
6.51- 8.50	1	3	7	5	3	3	0	2	2	7	5	1	3	0	3	2	47
8.51-11.50	1	5	1	15	3	1	1	2	0	1	0	3	3	1	1	0	38
11.51-14.50	0	1	1	10	3	0	0	1	0	1	2	0	1	3	0	0	23
14.51-20.50	0	0	0	8	3	0	0	0	0	2	0	1	0	2	0	0	16
>20.50	0	1	2	0	0	0	0	0	0	0	0	1	0	0	0	0	4
TOTAL	16	41	47	72	25	16	21	30	44	51	46	31	15	14	24	12	505

JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 10/ 1/93 - 12/31/93

4TH-QTR-93

STABILITY CLASS E
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET

WIND MEASURED AT: 35.0 FEET

WIND THRESHOLD AT: .75 MPH

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	1	4
1.51- 2.50	2	2	2	1	2	1	1	1	1	2	2	1	5	3	5	1	32
2.51- 3.50	3	1	2	1	0	0	1	3	1	4	2	1	1	5	5	3	33
3.51- 4.50	2	6	3	3	1	2	0	1	3	0	4	5	3	3	1	3	40
4.51- 5.50	3	7	1	4	1	1	1	1	2	1	3	1	0	3	0	0	29
5.51- 6.50	4	5	1	2	2	0	0	1	3	4	2	1	1	0	0	0	26
6.51- 8.50	0	5	4	4	1	1	0	3	0	3	2	1	0	4	2	0	30
8.51-11.50	1	4	1	3	1	2	1	1	0	2	3	3	4	1	1	1	29
11.51-14.50	1	2	0	1	2	1	2	0	0	1	0	1	4	1	1	1	18
14.51-20.50	2	4	1	0	2	0	0	0	0	0	0	0	0	1	0	2	12
>20.50	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
TOTAL	19	36	16	20	12	9	6	11	10	17	18	14	19	21	15	12	255

STABILITY CLASS F
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET

WIND MEASURED AT: 35.0 FEET

WIND THRESHOLD AT: .75 MPH

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2
1.51- 2.50	6	4	1	1	0	0	1	1	1	0	2	2	2	2	4	7	34
2.51- 3.50	7	4	3	0	0	2	1	2	2	3	3	4	5	5	12	12	65
3.51- 4.50	10	9	4	0	2	0	0	2	1	2	5	3	1	1	7	8	55
4.51- 5.50	9	3	1	1	0	0	0	0	4	3	6	4	3	3	2	7	46
5.51- 6.50	3	2	2	1	1	0	1	0	0	2	3	1	1	2	5	0	24
6.51- 8.50	3	3	4	1	1	1	1	0	2	5	6	2	2	8	4	3	46
8.51-11.50	1	3	4	0	0	0	0	1	0	2	2	0	1	0	0	0	14
11.51-14.50	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
14.51-20.50	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	39	29	19	6	4	3	4	6	10	17	28	16	15	21	35	37	289



JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 10/ 1/93 - 12/31/93

4TH-QTR-93

STABILITY CLASS G
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET

WIND MEASURED AT: 35.0 FEET

WIND THRESHOLD AT: .75 MPH

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	1	1	1	0	0	0	0	0	3	0	0	1	0	1	0	0	8
1.51- 2.50	17	13	5	1	2	2	2	1	0	2	2	4	1	6	23	16	97
2.51- 3.50	57	31	11	5	5	2	0	0	1	7	3	3	8	16	28	44	221
3.51- 4.50	102	51	7	3	0	2	0	1	0	0	3	5	4	4	22	55	259
4.51- 5.50	72	41	5	0	1	0	0	0	1	1	1	1	1	2	6	30	162
5.51- 6.50	32	31	11	1	0	0	0	0	0	0	0	0	1	0	5	7	88
6.51- 8.50	26	25	6	0	0	0	0	0	0	0	0	0	2	0	1	5	65
8.51-11.50	9	7	0	2	0	0	0	0	0	0	0	0	0	0	0	0	18
11.51-14.50	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
14.51-20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	316	202	46	12	8	6	2	2	5	10	9	14	17	29	85	157	920

STABILITY CLASS ALL
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET

WIND MEASURED AT: 35.0 FEET

WIND THRESHOLD AT: .75 MPH

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	1	1	1	1	0	1	0	0	3	0	1	1	1	1	1	1	14
1.51- 2.50	29	22	15	8	6	3	5	5	7	7	7	13	9	13	37	28	214
2.51- 3.50	73	42	26	11	8	7	12	17	23	21	25	18	19	28	54	62	446
3.51- 4.50	116	76	22	21	7	8	5	9	12	18	20	24	10	13	34	70	465
4.51- 5.50	86	61	15	15	6	4	3	8	19	21	23	9	6	9	11	38	334
5.51- 6.50	41	47	32	16	11	4	5	3	5	12	14	6	3	3	11	8	221
6.51- 8.50	30	43	29	21	8	9	3	9	4	20	17	7	10	13	10	11	244
8.51-11.50	13	21	7	28	14	6	3	4	2	7	10	8	10	3	2	1	139
11.51-14.50	1	7	2	18	11	1	2	1	0	3	4	2	6	7	1	1	67
14.51-20.50	2	4	1	15	11	0	0	0	0	2	0	2	0	4	0	3	44
>20.50	5	1	4	2	0	0	0	0	0	0	0	3	2	0	0	0	17
TOTAL	397	325	154	156	82	43	38	56	75	111	121	93	76	94	161	223	2205



JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 10/1/93 - 12/31/93

4TH-QTR-93

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH

TOTAL NUMBER OF OBSERVATIONS: 2208
 TOTAL NUMBER OF VALID OBSERVATIONS: 2205
 TOTAL NUMBER OF MISSING OBSERVATIONS: 3
 PERCENT DATA RECOVERY FOR THIS PERIOD: 99.9 %
 MEAN WIND SPEED FOR THIS PERIOD: 5.4 MPH
 TOTAL NUMBER OF OBSERVATIONS WITH BACKUP DATA: 0

PERCENTAGE OCCURRENCE OF STABILITY CLASSES

A	B	C	D	E	F	G
.91	3.31	6.49	22.90	11.56	13.11	41.72

DISTRIBUTION OF WIND DIRECTION VS STABILITY

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	CALM
A	3	0	0	7	2	1	0	0	1	0	0	1	2	2	0	1	0
B	0	6	5	15	14	2	1	3	0	8	9	5	2	3	0	0	0
C	4	11	21	24	17	6	4	4	5	8	11	12	6	4	2	4	0
D	16	41	47	72	25	16	21	30	44	51	46	31	15	14	24	12	0
E	19	36	16	20	12	9	6	11	10	17	18	14	19	21	15	12	0
F	39	29	19	6	4	3	4	6	10	17	28	16	15	21	35	37	0
G	316	202	46	12	8	6	2	2	5	10	9	14	17	29	85	157	0
TOTAL	397	325	154	156	82	43	38	56	75	111	121	93	76	94	161	223	0

Table B3
JFDs of 35-Foot Wind Versus Delta T
July - December 1993

JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 7/ 1/93 - 12/31/93

2ND SEMIANNUAL

STABILITY CLASS A
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.51- 4.50	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	2
4.51- 5.50	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	3
5.51- 6.50	0	1	0	1	0	1	2	2	1	2	2	3	2	0	1	0	18
6.51- 8.50	0	0	0	2	4	2	5	7	11	22	16	6	1	0	0	0	76
8.51-11.50	0	0	0	3	7	1	2	5	16	36	29	16	1	2	0	0	118
11.51-14.50	0	0	0	0	5	0	0	0	8	18	24	5	0	1	0	0	61
14.51-20.50	0	0	0	4	0	0	0	0	4	8	18	0	0	1	0	1	36
>20.50	3	0	0	2	0	0	0	0	0	0	0	1	1	0	0	0	7
TOTAL	3	1	0	12	16	4	10	15	41	87	89	31	5	5	1	1	321

STABILITY CLASS B
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH
 JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	2
3.51- 4.50	0	0	0	2	0	1	2	1	0	1	1	0	0	0	0	1	9
4.51- 5.50	2	1	2	1	3	2	3	6	9	6	5	4	2	2	0	1	49
5.51- 6.50	0	1	1	1	4	5	2	7	10	8	5	6	1	0	0	1	52
6.51- 8.50	0	5	2	7	6	8	3	12	20	16	7	6	1	4	1	0	98
8.51-11.50	0	0	1	8	16	7	0	2	3	8	9	6	3	1	0	0	64
11.51-14.50	0	0	1	3	5	1	1	2	0	4	9	1	1	2	0	0	30
14.51-20.50	0	0	0	1	2	0	0	0	0	3	2	0	0	0	0	0	8
>20.50	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL	2	7	8	23	36	24	11	30	43	46	38	24	8	9	1	3	313



JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 7/ 1/93 - 12/31/93

2ND SEMIANNUAL

STABILITY CLASS C
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH
 JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
2.51- 3.50	0	0	0	0	0	1	1	1	1	1	1	1	1	2	1	0	11
3.51- 4.50	2	0	2	5	3	0	2	1	4	3	3	5	2	0	0	3	35
4.51- 5.50	0	2	3	2	0	4	3	9	13	13	5	0	2	1	1	1	59
5.51- 6.50	1	4	8	10	5	7	3	1	10	7	5	5	0	2	1	0	69
6.51- 8.50	0	2	6	10	7	8	3	5	7	7	4	8	3	1	0	1	72
8.51-11.50	1	2	1	2	5	10	1	0	2	4	8	4	2	0	0	0	42
11.51-14.50	0	1	0	3	5	0	0	0	0	1	8	2	0	1	0	0	21
14.51-20.50	0	0	0	1	7	1	0	0	0	1	3	2	0	0	0	0	15
>20.50	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	3
TOTAL	5	11	22	33	32	31	13	17	37	37	37	28	11	7	3	5	329

STABILITY CLASS D
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH
 JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	4	3	6	5	3	1	1	3	5	4	1	10	1	3	6	7	63
2.51- 3.50	6	10	12	10	6	9	16	15	23	9	20	11	6	7	10	3	173
3.51- 4.50	4	11	6	16	8	9	6	17	13	18	14	9	5	6	4	2	148
4.51- 5.50	2	8	6	10	4	4	1	7	12	14	16	6	0	1	2	0	93
5.51- 6.50	1	5	11	10	5	7	4	3	6	7	12	1	3	1	2	1	79
6.51- 8.50	1	4	10	6	5	12	3	2	4	13	15	10	7	1	5	2	100
8.51-11.50	2	5	1	18	10	17	3	2	4	9	14	10	6	5	1	0	107
11.51-14.50	0	1	1	10	13	5	1	2	3	4	20	4	1	3	0	0	68
14.51-20.50	0	2	0	8	6	0	0	1	1	11	18	1	0	2	0	0	50
>20.50	0	1	2	0	0	0	0	0	1	0	2	1	0	0	0	0	7
TOTAL	20	50	55	93	60	64	35	52	72	89	132	63	29	29	30	15	888



JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS.
 DATA PERIOD EXAMINED: 7/ 1/93 - 12/31/93

2ND SEMIANNUAL

STABILITY CLASS E
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH
 JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	1	1	1	0	0	0	0	1	0	1	0	0	1	6
1.51- 2.50	6	3	4	2	2	1	1	1	2	2	3	3	8	5	8	3	54
2.51- 3.50	8	7	6	1	0	0	1	3	2	7	4	1	1	6	8	9	64
3.51- 4.50	6	9	5	6	2	2	2	3	3	3	11	6	5	6	1	5	75
4.51- 5.50	4	11	6	7	2	3	3	2	5	6	12	5	0	4	1	0	71
5.51- 6.50	5	7	2	2	2	0	0	2	5	6	12	10	2	1	1	0	57
6.51- 8.50	1	8	9	10	7	4	0	4	3	14	28	13	2	5	3	0	111
8.51-11.50	1	4	4	4	6	12	1	1	1	26	55	23	6	4	2	1	151
11.51-14.50	1	2	0	1	6	4	3	2	0	12	24	3	4	1	1	1	65
14.51-20.50	2	4	1	0	5	2	1	1	0	4	2	0	0	1	0	2	25
>20.50	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
TOTAL	35	55	38	34	33	29	12	19	21	80	152	64	29	33	25	22	681

STABILITY CLASS F
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH
 JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	3
1.51- 2.50	10	5	1	1	0	0	1	1	2	0	2	2	3	4	7	9	48
2.51- 3.50	17	5	4	1	3	2	1	3	2	4	4	7	9	7	16	14	99
3.51- 4.50	19	17	7	3	2	1	0	3	2	6	11	8	8	7	9	11	114
4.51- 5.50	12	7	5	1	0	0	0	1	5	7	12	11	11	4	5	10	91
5.51- 6.50	5	4	3	2	2	0	1	0	0	5	9	4	3	4	5	0	47
6.51- 8.50	3	3	9	2	1	1	1	1	5	15	18	8	5	12	4	4	92
8.51-11.50	1	3	4	2	0	2	1	1	2	12	27	3	2	0	0	1	61
11.51-14.50	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	3
14.51-20.50	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	3
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	67	47	33	14	8	6	6	11	18	49	84	43	41	38	47	49	561



JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 7/ 1/93 - 12/31/93

2ND SEMIANNUAL

STABILITY CLASS G
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	1	1	1	0	0	0	0	0	3	0	0	1	0	1	0	0	8
1.51- 2.50	20	17	6	1	2	2	2	1	0	3	2	4	3	8	27	25	123
2.51- 3.50	72	41	14	7	6	2	0	0	2	8	6	6	11	19	40	61	295
3.51- 4.50	142	70	12	6	0	3	0	1	0	6	5	7	10	8	24	77	371
4.51- 5.50	104	68	12	0	1	0	0	0	1	3	2	5	4	5	10	43	258
5.51- 6.50	41	44	21	1	0	0	0	0	0	0	1	1	2	0	8	12	131
6.51- 8.50	28	36	10	1	1	0	0	0	0	0	1	0	2	0	1	6	86
8.51-11.50	9	7	0	2	0	0	0	0	0	2	3	0	0	0	0	0	23
11.51-14.50	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
14.51-20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	417	286	76	18	10	7	2	2	6	22	20	24	32	41	110	224	1297

STABILITY CLASS ALL
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	1	2	1	1	1	1	0	0	3	0	2	1	1	1	1	1	17
1.51- 2.50	40	28	19	9	7	4	5	6	9	9	8	19	15	20	48	44	290
2.51- 3.50	103	63	36	19	15	14	19	22	31	29	35	27	28	41	75	87	644
3.51- 4.50	173	107	32	38	15	16	12	26	22	38	45	35	30	28	38	99	754
4.51- 5.50	124	97	34	21	10	13	11	26	46	49	52	31	19	17	19	55	624
5.51- 6.50	53	66	46	27	18	20	12	15	32	35	46	30	13	8	18	14	453
6.51- 8.50	33	58	46	38	31	35	15	31	50	87	89	51	21	23	14	13	635
8.51-11.50	14	21	11	39	44	49	8	11	28	97	145	62	20	12	3	2	566
11.51-14.50	1	7	2	18	34	10	5	7	11	39	85	15	6	8	1	1	250
14.51-20.50	2	7	1	15	20	3	2	2	5	27	43	3	0	4	0	3	137
>20.50	5	1	4	2	0	0	0	0	1	0	2	3	2	0	0	0	20
TOTAL	549	457	232	227	195	165	89	146	238	410	552	277	155	162	217	319	4390

JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 7/ 1/93 - 12/31/93

2ND SEMIANNUAL

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH

TOTAL NUMBER OF OBSERVATIONS: 4416
 TOTAL NUMBER OF VALID OBSERVATIONS: 4390
 TOTAL NUMBER OF MISSING OBSERVATIONS: 26
 PERCENT DATA RECOVERY FOR THIS PERIOD: 99.4 %
 MEAN WIND SPEED FOR THIS PERIOD: 6.3 MPH
 TOTAL NUMBER OF OBSERVATIONS WITH BACKUP DATA: 0

PERCENTAGE OCCURRENCE OF STABILITY CLASSES

A	B	C	D	E	F	G
7.31	7.13	7.49	20.23	15.51	12.78	29.54

DISTRIBUTION OF WIND DIRECTION VS STABILITY

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	CALM
A	3	1	0	12	16	4	10	15	41	87	89	31	5	5	1	1	0
B	2	7	8	23	36	24	11	30	43	46	38	24	8	9	1	3	0
C	5	11	22	33	32	31	13	17	37	37	37	28	11	7	3	5	0
D	20	50	55	93	60	64	35	52	72	89	132	63	29	29	30	15	0
E	35	55	38	34	33	29	12	19	21	80	152	64	29	33	25	22	0
F	67	47	33	14	8	6	6	11	18	49	84	43	41	38	47	49	0
G	417	286	76	18	10	7	2	2	6	22	20	24	32	41	110	224	0
TOTAL	549	457	232	227	195	165	89	146	238	410	552	277	155	162	217	319	0



Table B4
JFDs of 35-Foot Wind Versus Delta T
January - December 1993

JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 1/ 1/93 - 12/31/93

*** ANNUAL ***

STABILITY CLASS A
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.51- 4.50	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	2
4.51- 5.50	0	1	1	0	0	1	2	3	1	0	3	2	2	0	0	0	16
5.51- 6.50	0	1	0	1	0	2	3	4	5	4	11	8	6	0	1	2	48
6.51- 8.50	0	0	1	3	5	4	6	9	23	36	36	15	3	2	1	0	144
8.51-11.50	1	0	0	4	10	4	2	6	27	62	73	35	8	6	1	3	242
11.51-14.50	1	0	0	0	7	0	0	0	10	36	56	12	11	7	3	1	144
14.51-20.50	0	0	0	4	0	0	0	0	4	11	31	4	3	10	1	4	72
>20.50	3	0	0	2	0	0	0	0	0	2	0	4	1	0	0	1	13
TOTAL	5	2	2	14	22	11	13	22	70	152	210	80	34	26	7	11	681

STABILITY CLASS B
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	2
3.51- 4.50	0	0	0	2	0	2	3	1	0	2	2	1	0	0	0	1	14
4.51- 5.50	2	3	2	1	4	2	4	8	18	10	8	9	3	2	0	1	77
5.51- 6.50	0	1	2	2	6	10	2	10	24	23	9	9	5	2	0	2	107
6.51- 8.50	0	5	3	7	7	12	5	16	28	27	16	13	6	4	2	0	151
8.51-11.50	0	1	2	8	18	10	0	2	6	12	19	17	6	4	3	1	109
11.51-14.50	0	0	1	3	6	2	1	2	0	8	18	6	1	2	0	0	50
14.51-20.50	0	0	0	1	3	0	0	0	0	5	8	1	3	0	1	1	23
>20.50	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	2
TOTAL	2	10	11	24	44	38	15	39	77	88	80	57	24	14	6	6	535



JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 1/ 1/93 - 12/31/93

*** ANNUAL ***

STABILITY CLASS: C
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET

WIND MEASURED AT: 35.0 FEET

WIND THRESHOLD AT: .75 MPH

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	3
2.51- 3.50	0	0	0	0	0	1	1	1	1	1	3	3	3	2	2	1	19
3.51- 4.50	3	1	2	6	5	3	4	2	9	10	5	8	3	1	1	4	67
4.51- 5.50	1	8	6	3	4	10	6	19	25	22	15	3	4	1	2	2	131
5.51- 6.50	1	5	9	14	10	11	6	7	15	15	7	7	1	3	1	0	112
6.51- 8.50	0	3	9	12	10	17	4	7	13	15	19	19	7	2	1	1	139
8.51-11.50	3	3	5	3	6	15	1	1	2	4	20	17	9	4	1	1	95
11.51-14.50	0	1	0	3	6	0	0	0	0	5	21	7	0	3	1	0	47
14.51-20.50	0	0	0	1	7	1	0	0	1	1	6	2	0	2	1	0	22
>20.50	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	3
TOTAL	9	21	33	42	48	58	22	37	66	73	96	68	28	18	10	9	638

STABILITY CLASS: D
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET

WIND MEASURED AT: 35.0 FEET

WIND THRESHOLD AT: .75 MPH

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	1	4
1.51- 2.50	4	6	9	7	5	2	5	5	7	9	9	18	5	13	10	11	125
2.51- 3.50	11	20	20	13	12	14	22	20	29	23	36	30	22	16	16	11	315
3.51- 4.50	20	22	10	29	17	14	9	24	27	34	34	31	19	19	11	9	329
4.51- 5.50	3	11	13	17	10	9	6	13	24	25	31	14	3	4	4	1	188
5.51- 6.50	2	13	18	13	10	10	6	5	13	13	22	9	7	5	3	2	151
6.51- 8.50	3	9	17	14	10	17	5	5	18	24	38	20	11	5	7	3	206
8.51-11.50	3	6	2	21	15	40	11	4	9	18	29	28	16	14	4	1	221
11.51-14.50	1	1	1	10	19	5	1	2	6	9	41	19	5	6	2	1	129
14.51-20.50	0	2	0	10	13	0	0	3	3	18	34	13	3	7	1	0	107
>20.50	0	1	2	0	1	0	0	0	1	1	3	3	1	0	0	0	13
TOTAL	47	91	92	134	112	111	65	81	137	176	277	186	92	89	58	40	1788



JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 1/ 1/93 - 12/31/93

*** ANNUAL ***

STABILITY CLASS E
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH
 JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	1	0	0	1	1	1	0	0	0	1	1	0	1	0	0	3	10
1.51- 2.50	10	4	10	3	3	2	1	1	2	5	9	8	17	8	17	10	110
2.51- 3.50	17	15	11	2	1	0	3	3	5	16	9	7	12	13	20	17	151
3.51- 4.50	16	18	12	10	3	2	3	8	6	11	21	13	14	16	10	11	174
4.51- 5.50	6	17	8	10	2	3	4	3	11	18	29	9	7	7	7	5	146
5.51- 6.50	8	12	6	5	3	0	2	5	13	15	28	21	6	2	7	0	133
6.51- 8.50	2	13	11	14	8	7	3	11	13	34	44	35	16	9	8	4	232
8.51-11.50	3	7	7	7	12	16	6	3	6	38	98	54	24	15	11	6	313
11.51-14.50	1	2	0	3	19	21	15	3	4	25	52	16	6	8	3	2	180
14.51-20.50	2	4	1	0	18	5	3	3	3	5	9	0	1	4	4	3	65
>20.50	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
TOTAL	67	92	67	55	70	57	40	40	63	168	300	163	104	82	87	61	1516

STABILITY CLASS F
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH
 JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	2	1	0	0	0	0	0	0	0	0	1	1	0	1	3	0	9
1.51- 2.50	17	11	2	2	2	0	3	2	3	3	6	8	6	16	18	15	114
2.51- 3.50	30	11	11	3	6	3	3	4	9	9	13	19	24	22	34	44	245
3.51- 4.50	40	30	12	5	4	1	1	3	5	9	24	19	18	13	16	32	232
4.51- 5.50	22	15	10	1	2	0	0	1	5	13	22	17	21	9	11	19	168
5.51- 6.50	7	7	6	4	2	1	1	0	2	8	21	9	8	10	11	4	101
6.51- 8.50	9	6	11	3	1	1	1	2	10	31	57	26	24	24	9	6	221
8.51-11.50	4	5	8	2	0	2	2	3	3	29	54	19	6	9	2	6	154
11.51-14.50	1	1	0	1	0	0	0	1	0	0	1	0	0	0	2	6	13
14.51-20.50	0	1	1	1	0	0	1	0	0	1	0	0	0	0	0	0	5
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	132	88	61	22	17	8	12	16	37	103	199	118	107	104	106	132	1262



JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 1/ 1/93 - 12/31/93

*** ANNUAL ***

STABILITY CLASS G
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH
 JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	1	1	1	0	0	0	0	0	4	0	0	1	0	2	0	3	13
1.51- 2.50	32	27	11	3	2	2	2	2	0	4	6	7	7	19	42	43	209
2.51- 3.50	141	72	21	11	9	4	1	2	3	9	10	11	19	40	73	115	541
3.51- 4.50	236	109	18	13	2	5	2	1	1	7	11	10	20	13	49	134	631
4.51- 5.50	195	113	20	3	2	0	1	0	1	3	5	11	10	8	27	75	474
5.51- 6.50	71	64	25	4	1	0	0	0	1	2	7	3	5	5	13	25	226
6.51- 8.50	55	53	15	2	1	0	0	0	1	2	4	6	5	1	1	15	161
8.51-11.50	19	11	2	2	0	0	0	0	0	2	5	2	0	1	2	8	54
11.51-14.50	1	2	0	0	0	0	0	0	0	0	0	1	0	0	0	1	5
14.51-20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	751	452	113	38	17	11	6	5	11	29	48	52	66	89	207	419	2314

STABILITY CLASS ALL
 STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH
 JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	4	2	1	1	1	1	0	0	4	3	2	3	1	3	3	7	36
1.51- 2.50	63	48	34	15	12	6	11	10	12	21	30	42	35	56	87	79	561
2.51- 3.50	199	118	63	29	28	22	30	30	48	58	71	71	80	93	145	188	1273
3.51- 4.50	315	180	54	65	31	27	22	39	48	74	97	82	74	63	87	191	1449
4.51- 5.50	229	168	60	35	24	25	23	47	85	91	113	65	50	31	51	103	1200
5.51- 6.50	89	103	66	43	32	34	20	31	73	80	105	66	38	27	36	35	878
6.51- 8.50	69	89	67	55	42	58	24	50	106	169	214	134	72	47	29	29	1254
8.51-11.50	33	33	26	47	61	87	22	19	53	165	298	172	69	53	24	26	1188
11.51-14.50	5	7	2	20	57	28	17	8	20	83	189	61	23	26	11	11	568
14.51-20.50	2	7	2	17	41	6	4	6	11	41	88	20	10	23	8	8	294
>20.50	5	1	4	2	1	0	0	0	1	4	3	8	3	0	0	1	33
TOTAL	1013	756	379	329	330	294	173	240	461	789	1210	724	455	422	481	678	8734

JOINT FREQUENCY DISTRIBUTION ANALYSIS
 SITE IDENTIFIER: PVNGS
 DATA PERIOD EXAMINED: 1/ 1/93 - 12/31/93.

*** ANNUAL ***

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
 WIND MEASURED AT: 35.0 FEET
 WIND THRESHOLD AT: .75 MPH

TOTAL NUMBER OF OBSERVATIONS: 8760
 TOTAL NUMBER OF VALID OBSERVATIONS: 8734
 TOTAL NUMBER OF MISSING OBSERVATIONS: 26
 PERCENT DATA RECOVERY FOR THIS PERIOD: 99.7 %
 MEAN WIND SPEED FOR THIS PERIOD: 6.4 MPH
 TOTAL NUMBER OF OBSERVATIONS WITH BACKUP DATA: 0

PERCENTAGE OCCURRENCE OF STABILITY CLASSES

A	B	C	D	E	F	G
7.80	6.13	7.30	20.47	17.36	14.45	26.49

DISTRIBUTION OF WIND DIRECTION VS STABILITY

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	CALM
A	5	2	2	14	22	11	13	22	70	152	210	80	34	26	7	11	0
B	2	10	11	24	44	38	15	39	77	88	80	57	24	14	6	6	0
C	9	21	33	42	48	58	22	37	66	73	96	68	28	18	10	9	0
D	47	91	92	134	112	111	65	81	137	176	277	186	92	89	58	40	0
	67	92	67	55	70	57	40	40	63	168	300	163	104	82	87	61	0
	132	88	61	22	17	8	12	16	37	103	199	118	107	104	106	132	0
	751	452	113	38	17	11	6	5	11	29	48	52	66	89	207	419	0
TOTAL	1013	756	379	329	330	294	173	240	461	789	1210	724	455	422	481	678	0

APPENDIX C
DOSE CALCULATIONS



GASEOUS EFFLUENT DOSE CALCULATIONS

Doses to the maximum individual and the surrounding population resulting from the release of radioactive material in gaseous effluents from the Palo Verde Nuclear Generating Station were calculated using the GASPARD computer program. The radionuclides considered in the dose calculations were Tritium, Iodine-131, Iodine-132, Iodine-133, Iodine-135, all noble gases, and particulates having a half-life greater than eight days and for which dose factors are contained in NUREG-0172. Locations selected for individual dose calculations included for each sector, the site boundary, and within five miles, if present, the nearest residence, the nearest garden, and the nearest milk animal. GASPARD implements the radiological dose models of Regulatory Guide 1.109 to determine the radiation exposure to man from four principal atmospheric exposure pathways: plume, ground deposition, inhalation, and ingestion. Doses to the maximum individual and the population were calculated as a function of age group and pathway for significant body organs. Assumptions and data sources used for input to the GASPARD code are described on page C8.

Table C1 presents the doses on a quarterly, semiannual and annual basis for the Energy Information Center. An occupancy factor of 1.0 (implying continuous occupancy over the entire year) was considered for the Energy Information Center and the exposure pathways considered to calculate its doses were plume, ground deposition, and inhalation.

Table C2 presents the population doses.

Table C3 summarizes the individual doses and compares the result to PVNGS ODCM Requirement limits. The site boundary and residence locations for which data are presented represent the highest annual doses.

Based on results obtained by placing TLDs on the site boundary in each sector, the net annual dose from direct-radiation, plume and ground deposition from all three units was determined to be zero.

There were no liquid effluents associated with the operation of this facility.

TABLE C1

DOSES TO SPECIAL LOCATIONS: FOR JANUARY - DECEMBER 1993

ENERGY INFORMATION CENTER LOCATED ONSITE 0.44 MILE S FROM UNIT 1, 0.29 MILE SSE FROM UNIT 2 AND 0.20 MILE ESE FROM UNIT 3

(HREM)	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
1ST QUARTER								
ADULT	4.74E-01	4.74E-01	1.78E-01	4.74E-01	4.74E-01	4.88E-01	4.75E-01	7.06E-01
TEEN	4.76E-01	4.76E-01	1.78E-01	4.76E-01	4.76E-01	4.92E-01	4.77E-01	7.08E-01
CHILD	4.42E-01	4.42E-01	1.78E-01	4.42E-01	4.42E-01	4.60E-01	4.42E-01	6.73E-01
INFANT	3.29E-01	3.29E-01	1.78E-01	3.29E-01	3.29E-01	3.47E-01	3.30E-01	5.61E-01
2ND QUARTER								
ADULT	2.71E-01	2.71E-01	3.42E-02	2.71E-01	2.71E-01	2.98E-01	2.72E-01	3.35E-01
TEEN	2.73E-01	2.73E-01	3.43E-02	2.73E-01	2.73E-01	3.05E-01	2.74E-01	3.36E-01
CHILD	2.45E-01	2.45E-01	3.43E-02	2.46E-01	2.46E-01	2.82E-01	2.46E-01	3.08E-01
INFANT	1.55E-01	1.55E-01	3.43E-02	1.56E-01	1.55E-01	1.89E-01	1.56E-01	2.19E-01
1ST SEMI-ANNUAL								
ADULT	7.46E-01	7.46E-01	2.12E-01	7.46E-01	7.46E-01	7.86E-01	7.47E-01	1.04E+00
TEEN	7.49E-01	7.49E-01	2.12E-01	7.49E-01	7.49E-01	7.98E-01	7.51E-01	1.04E+00
CHILD	6.86E-01	6.86E-01	2.12E-01	6.87E-01	6.87E-01	7.42E-01	6.88E-01	9.81E-01
INFANT	4.85E-01	4.85E-01	2.12E-01	4.85E-01	4.85E-01	5.35E-01	4.86E-01	7.80E-01
3RD QUARTER								
ADULT	1.59E-01	1.59E-01	4.72E-02	1.59E-01	1.59E-01	1.77E-01	1.60E-01	2.14E-01
TEEN	1.60E-01	1.59E-01	4.74E-02	1.60E-01	1.60E-01	1.82E-01	1.61E-01	2.15E-01
CHILD	1.46E-01	1.46E-01	4.77E-02	1.47E-01	1.47E-01	1.72E-01	1.48E-01	2.02E-01
INFANT	1.04E-01	1.04E-01	4.73E-02	1.05E-01	1.04E-01	1.27E-01	1.05E-01	1.59E-01
4TH QUARTER								
ADULT	2.28E-01	2.28E-01	2.53E-02	2.28E-01	2.28E-01	2.37E-01	2.29E-01	2.72E-01
TEEN	2.29E-01	2.29E-01	2.53E-02	2.29E-01	2.29E-01	2.41E-01	2.31E-01	2.73E-01
CHILD	2.05E-01	2.05E-01	2.53E-02	2.05E-01	2.05E-01	2.18E-01	2.07E-01	2.49E-01
INFANT	1.29E-01	1.29E-01	2.53E-02	1.29E-01	1.29E-01	1.41E-01	1.31E-01	1.47E-01
2ND SEMI-ANNUAL								
ADULT	3.87E-01	3.86E-01	7.25E-02	3.87E-01	3.86E-01	4.14E-01	3.89E-01	4.85E-01
TEEN	3.89E-01	3.88E-01	7.27E-02	3.90E-01	3.89E-01	4.23E-01	3.92E-01	4.88E-01
CHILD	3.52E-01	3.51E-01	7.30E-02	3.53E-01	3.52E-01	3.90E-01	3.55E-01	4.51E-01
INFANT	2.33E-01	2.33E-01	7.26E-02	2.34E-01	2.33E-01	2.68E-01	2.36E-01	3.06E-01
ANNUAL								
ADULT	1.13E+00	1.13E+00	2.85E-01	1.13E+00	1.13E+00	1.20E+00	1.14E+00	1.53E+00
TEEN	1.14E+00	1.14E+00	2.85E-01	1.14E+00	1.14E+00	1.22E+00	1.14E+00	1.53E+00
CHILD	1.04E+00	1.04E+00	2.85E-01	1.04E+00	1.04E+00	1.13E+00	1.04E+00	1.43E+00
INFANT	7.18E-01	7.17E-01	2.85E-01	7.19E-01	7.18E-01	8.04E-01	7.22E-01	1.09E+00

TABLE C2
INTEGRATED POPULATION DOSES FOR JANUARY - DECEMBER 1993
PERSONREM

JANUARY 1 - JUNE 30, 1993

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.38E-01 2.11%	1.38E-01 2.11%	1.38E-01 97.04%	1.38E-01 2.11%	1.38E-01 2.11%	1.38E-01 2.03%	1.38E-01 2.11%	5.15E-01 7.45%
GROUND	2.36E-03 .04%	2.36E-03 .04%	2.36E-03 1.66%	2.36E-03 .04%	2.36E-03 .04%	2.36E-03 .03%	2.36E-03 .04%	2.77E-03 .04%
INHAL	1.43E+00 21.85%	1.43E+00 21.85%	3.39E-04 .24%	1.43E+00 21.85%	1.43E+00 21.85%	1.52E+00 22.31%	1.43E+00 21.89%	1.43E+00 20.66%
VEGET	4.23E+00 64.82%	4.24E+00 64.83%	1.25E-03 .88%	4.24E+00 64.82%	4.24E+00 64.82%	4.38E+00 64.48%	4.23E+00 64.79%	4.23E+00 61.28%
COW MILK	5.42E-01 8.29%	5.42E-01 8.29%	2.56E-04 .18%	5.42E-01 8.30%	5.42E-01 8.29%	5.69E-01 8.37%	5.42E-01 8.29%	5.42E-01 7.84%
MEAT	1.89E-01 2.89%	1.89E-01 2.89%	7.86E-06 .01%	1.89E-01 2.89%	1.89E-01 2.89%	1.89E-01 2.77%	1.89E-01 2.89%	1.89E-01 2.73%
TOTAL	6.53E+00	6.53E+00	1.42E-01	6.53E+00	6.53E+00	6.80E+00	6.54E+00	6.91E+00
(a) PER CAPITA DOSE (REM)	3.33E-06	3.33E-06	7.25E-08	3.33E-06	3.33E-06	3.47E-06	3.34E-06	3.53E-06

JULY 1 - SEPTEMBER 30, 1993

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	4.24E-02 2.15%	4.24E-02 2.16%	4.24E-02 66.17%	4.24E-02 2.14%	4.24E-02 2.16%	4.24E-02 2.03%	4.24E-02 2.16%	1.66E-01 7.99%
GROUND	6.78E-03 .34%	6.78E-03 .35%	6.78E-03 10.57%	6.78E-03 .34%	6.78E-03 .34%	6.78E-03 .32%	6.78E-03 .35%	7.91E-03 .38%
INHAL	4.66E-01 23.63%	4.65E-01 23.69%	1.17E-03 1.83%	4.66E-01 23.53%	4.65E-01 23.66%	5.07E-01 24.32%	4.67E-01 23.77%	4.65E-01 22.29%
VEGET	1.22E+00 62.11%	1.22E+00 62.02%	1.13E-02 17.59%	1.23E+00 62.19%	1.22E+00 62.08%	1.29E+00 61.83%	1.22E+00 61.99%	1.21E+00 58.30%
COW MILK	1.79E-01 9.07%	1.77E-01 9.03%	2.34E-03 3.65%	1.81E-01 9.11%	1.78E-01 9.06%	1.87E-01 8.96%	1.77E-01 9.04%	1.77E-01 8.49%
MEAT	5.31E-02 2.70%	5.39E-02 2.75%	1.18E-04 .18%	5.32E-02 2.68%	5.31E-02 2.70%	5.30E-02 2.54%	5.30E-02 2.70%	5.30E-02 2.54%
TOTAL	1.97E+00	1.96E+00	6.41E-02	1.98E+00	1.97E+00	2.09E+00	1.96E+00	2.08E+00
(a) PER CAPITA DOSE (REM)	1.01E-06	1.00E-06	3.27E-08	1.01E-06	1.01E-06	1.07E-06	1.00E-06	1.06E-06

TABLE C2 (CONTINUED)

PERSONREM

OCTOBER 1 - DECEMBER 31, 1993

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.50E-02 1.28%	3.50E-02 1.28%	3.50E-02 97.94%	3.50E-02 1.28%	3.50E-02 1.28%	3.50E-02 1.25%	3.50E-02 1.28%	1.36E-01 4.79%
GROUND	2.64E-04 .01%	2.64E-04 .01%	2.64E-04 .74%	2.64E-04 .01%	2.64E-04 .01%	2.64E-04 .01%	2.64E-04 .01%	3.10E-04 .01%
INHAL	4.34E-01 15.91%	4.34E-01 15.91%	8.36E-05 .23%	4.34E-01 15.91%	4.34E-01 15.91%	4.57E-01 16.36%	4.35E-01 15.95%	4.34E-01 15.34%
VEGET	2.02E+00 73.91%	2.02E+00 73.90%	3.28E-04 .92%	2.02E+00 73.91%	2.02E+00 73.91%	2.05E+00 73.57%	2.02E+00 73.87%	2.02E+00 71.28%
COW MILK	1.56E-01 5.73%	1.56E-01 5.73%	4.20E-05 .12%	1.56E-01 5.73%	1.56E-01 5.73%	1.60E-01 5.73%	1.56E-01 5.73%	1.56E-01 5.53%
MEAT	8.59E-02 3.15%	8.67E-02 3.18%	1.80E-05 .05%	8.59E-02 3.15%	8.60E-02 3.15%	8.60E-02 3.08%	8.59E-02 3.15%	8.59E-02 3.04%
TOTAL	2.73E+00	2.73E+00	3.57E-02	2.73E+00	2.73E+00	2.79E+00	2.73E+00	2.83E+00
(a) PER CAPITA DOSE (REM)	1.39E-06	1.39E-06	1.82E-08	1.39E-06	1.39E-06	1.42E-06	1.39E-06	1.44E-06

JULY 1 - DECEMBER 31, 1993

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	7.74E-02 1.65%	7.74E-02 1.65%	7.74E-02 77.55%	7.74E-02 1.64%	7.74E-02 1.65%	7.74E-02 1.59%	7.74E-02 1.65%	3.02E-01 6.15%
GROUND	7.04E-03 .15%	7.04E-03 .15%	7.04E-03 7.05%	7.04E-03 .15%	7.04E-03 .15%	7.04E-03 .14%	7.04E-03 .15%	8.22E-03 .17%
INHAL	9.00E-01 19.16%	8.99E-01 19.14%	1.25E-03 1.25%	9.00E-01 19.11%	8.99E-01 19.14%	9.64E-01 19.78%	9.02E-01 19.20%	8.99E-01 18.31%
VEGET	3.24E+00 68.96%	3.24E+00 68.97%	1.16E-02 11.62%	3.25E+00 69.00%	3.24E+00 68.99%	3.34E+00 68.52%	3.24E+00 68.96%	3.23E+00 65.77%
COW MILK	3.35E-01 7.13%	3.33E-01 7.09%	2.38E-03 2.38%	3.37E-01 7.15%	3.34E-01 7.11%	3.47E-01 7.12%	3.33E-01 7.09%	3.33E-01 6.78%
MEAT	1.39E-01 2.96%	1.41E-01 3.00%	1.36E-04 .14%	1.39E-01 2.95%	1.39E-01 2.96%	1.39E-01 2.85%	1.39E-01 2.96%	1.39E-01 2.83%
TOTAL	4.70E+00	4.69E+00	9.98E-02	4.71E+00	4.70E+00	4.88E+00	4.69E+00	4.91E+00
(a) PER CAPITA DOSE (REM)	2.40E-06	2.40E-06	5.09E-08	2.40E-06	2.40E-06	2.49E-06	2.39E-06	2.50E-06

TABLE C2 (CONTINUED)

PERSONREM

JANUARY 1 - DECEMBER 31, 1993

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.15E-01 1.91%	2.15E-01 1.91%	2.15E-01 88.96%	2.15E-01 1.91%	2.15E-01 1.91%	2.15E-01 1.84%	2.15E-01 1.91%	8.17E-01 6.91%
GROUND	9.40E-03 .08%	9.40E-03 .08%	9.40E-03 3.89%	9.40E-03 .08%	9.40E-03 .08%	9.40E-03 .08%	9.40E-03 .08%	1.10E-02 .09%
INHAL	2.33E+00 20.75%	2.33E+00 20.73%	1.59E-03 .66%	2.33E+00 20.71%	2.33E+00 20.73%	2.48E+00 21.25%	2.33E+00 20.75%	2.33E+00 19.71%
VEGET	7.47E+00 66.52%	7.48E+00 66.55%	1.29E-02 5.34%	7.49E+00 66.57%	7.48E+00 66.56%	7.72E+00 66.16%	7.47E+00 66.53%	7.46E+00 63.11%
COW MILK	8.77E-01 7.81%	8.75E-01 7.79%	2.64E-03 1.09%	8.79E-01 7.81%	8.76E-01 7.79%	9.16E-01 7.85%	8.75E-01 7.79%	8.75E-01 7.40%
MEAT	3.28E-01 2.92%	3.30E-01 2.94%	1.44E-04 .06%	3.28E-01 2.92%	3.28E-01 2.92%	3.28E-01 2.81%	3.28E-01 2.92%	3.28E-01 2.77%
TOTAL	1.12E+01	1.12E+01	2.42E-01	1.13E+01	1.12E+01	1.17E+01	1.12E+01	1.18E+01
(a) PER CAPITA DOSE (REM)	5.73E-06	5.74E-06	1.23E-07	5.74E-06	5.74E-06	5.96E-06	5.73E-06	6.03E-06

(a) PERSONREM TOTAL DIVIDED BY 50-MILE POPULATION OF 1,959,000

SUMMARY OF INDIVIDUAL DOSES FOR JANUARY - DECEMBER 1993

	Unit	Quarter #1	Quarter #2	Quarter #3	Quarter #4	Total for 1993
Gamma Air Dose	mrad	6.76E-02	1.59E-02	1.32E-02	3.13E-02	1.28E-01
ODCM Req. 4.1 Limit	mrad	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
% ODCM Limit	%	1.35E+00	3.18E-01	2.64E-01	6.26E-01	1.28E+00
Beta Air Dose	mrad	1.12E-01	4.59E-02	3.60E-02	8.13E-02	2.75E-01
ODCM Req. 4.1 Limit	mrad	1.00E+01	1.00E+01	1.00E+01	1.00E+01	2.00E+01
% ODCM Limit	%	1.12E+00	4.59E-01	3.60E-01	8.13E-01	1.38E+00
Maximum Individual Total Body	mrem	4.29E-02	9.66E-03	7.98E-03	1.88E-02	7.92E-02
Skin	mrem	1.01E-01	3.14E-02	2.42E-02	5.31E-02	2.10E-01
Location						
Unit 1	miles	1.87 S	1.87 S	1.40 SSW	1.87 S	1.87 S
Unit 2	miles	1.68 S	1.68 S	1.14 SSW	1.68 S	1.68 S
Unit 3	miles	1.46 S	1.46 S	1.00 SSW	1.46 S	1.46
Maximum Organ Dose (excluding skin)	mrem	Teen Thyroid	Child Thyroid	Child Thyroid	Child(1) Thyroid	Child (1) Thyroid
ODCM Req. 4.2 Limit	mrem	5.86E-02	7.59E-02	6.04E-02	8.48E-02	2.63E-01
% ODCM Limit (2)	%	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
		7.81E-01	1.01E+00	8.05E-01	1.13E+00	1.75E+00
Location						
Unit 1	miles	5.05 S	3.36 SW	3.36 SW	3.36 SW	3.36 SW
Unit 2	miles	4.88 S	3.14 SW	3.14 SW	3.14 SW	3.14 SW
Unit 3	miles	4.67 S	2.92 SW	2.92 SW	2.92 SW	2.92 SW

Note 1 : Does not include fourth quarter Sr-89,90 results.

Note 2 : These control location doses are imparted via three principal atmospheric pathways: plume, ground exposure and inhalation. ODCM Requirement 5.1 has higher limits than ODCM Requirement 4.2, therefore the percent of limits are more conservative based on ODCM Requirement 4.2 than on ODCM Requirement 5.1.

DOSE CALCULATION MODELS

The GASPAR computer code was used to evaluate the radiological consequences of the routine release of gaseous effluents. GASPAR implements the dose calculational methodologies of Regulatory Guide 1.109, Revision 1.

Source terms for each quarter are combined with station-specific demographic data and each quarter's atmospheric diffusion estimates for gaseous dose calculations.

Atmospheric diffusion estimates are generated by the XOQDOQ computer code using onsite meteorological data as input. Doses for the semiannual period are the summation for the quarterly doses. Additional input to GASPAR includes the following site-specific data:

- 0 to 5 mile nearest residence, milk animal and garden in each of the 16 compass sectors, based on the 1992 Land Use Census.

- 0 to 10 mile population distribution based on the Maricopa County Department of Emergency Management, Emergency Response Manual, Annex B - PVNGS Emergency Procedures, Appendix 13, page 133, March 1993.

- The 10 to 50 mile population distribution from the PVNGS UFSAR, Figure 2.1-10.

- The population distribution of metropolitan Phoenix greater than 50 miles from PVNGS, based on the 1980 federal census results, is conservatively included in the 40 to 50 mile sectors (NE=123; ENE=140,097; E=621,130; ESE=8,392).

- Absolute humidity of 6.0 g/m^3 from the PVNGS UFSAR, Table 2.3-16.

- The fraction of the year that vegetables are grown (0.667) from the PVNGS ER-OL, Section 2.1.3.4, Table 2.1-8.

- The fraction of daily feed derived from pasture while on pasture (0.35) and length of grazing season for milk animals beyond 5 miles (0.75) from the PVNGS ER-OL, Section 2.1.3.4.3.

- The fraction of daily feed derived from pasture while on pasture (0.05) and length of grazing season for meat animals (0.25) from the PVNGS ER-OL, Section 2.1.3.4.4.

- There were no milk animals located within 5 miles.

Other values used for input to GASPAR are default values from Regulatory Guide 1.109; Revision 1.



10-10-68

