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161-01722-DBK/GEC
March 1, 1989

Docket Nos. STN 50-528/529/530

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
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Washington, DC 20555

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, and 3
Semiannual Radioactive Effluent Release Report
File: 89-A-056-026

Pursuant to 10CFR50.36a(a)(2), and in accordance with Technical Specification 6.9.1.8, attached please find the Semiannual Radioactive Effluent Release Report for the Palo Verde Nuclear Generating Station Units No. 1, 2, and 3 for the six month period ending December 31, 1988.

If you have any questions, please contact Mr. A. C. Rogers at (602) 371-4041.

Very truly yours,

DBKarner

D. B. Karner
Executive Vice President

DBK/GEC/vlb
Attachment

cc: G. W. Knighton (all w/a)
M. J. Davis
T. L. Chan
J. B. Martin
T. J. Polich

IE48
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PALO VERDE NUCLEAR GENERATING STATION
UNITS 1, 2 AND 3

SEMI-ANNUAL RADIOACTIVE
EFFLUENT RELEASE REPORT
JULY 1, 1988 THROUGH DECEMBER 31, 1988

USNRC Dockets STN-50-528, STN-50-529 and STN-50-530

8903090387 881231
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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 July through December 1988. The data presented meet the reporting requirements of Regulatory Guide 1.21 of the U.S. Nuclear Regulatory Commission (Revision 1, June 1974) as well as the PVNGS Radiological Environmental Technical Specifications (RETS).

The report is organized into four 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. Appendix D presents the change pages to the effluent release report for the period January through June 1988. Appendix E presents the entire revised offsite Dose Calculation Manual (ODCM). Appendix F presents changes made to the ODCM and their explanations.

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APPENDIX A

SOURCE TERMS AND

EFFLUENT AND WASTE DISPOSAL REPORTS

Supplemental Information

1.0 Regulatory Limits

1.1 Liquid Releases

a. PVNGS Technical Specification 3.11.1.1

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

b. PVNGS Technical Specification 3.11.1.2

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:

- 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
- 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.

1.2 Gaseous Releases

a. PVNGS Technical Specification 3.11.2.1

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

- 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
- 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 mrems/yr to any organ.

b. PVNGS Technical Specification 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 shall be limited to the following:

- 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,

- 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.

c. PVNGS Technical Specification 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 shall be limited to the following:

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

d. PVNGS Technical Specification 3.11.2.4

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

a. PVNGS Technical Specification 3.11.4

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 mrems to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems.

2.0 Maximum Permissible Concentrations

Air: Release Concentrations are limited to dose rate limits described in 1.2.a of this report.

3.0 Average Energy

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

4.0 Measurement and Approximations of Total Radioactivity in Gaseous Effluents.

For continuous releases, sampling is in accordance with PVNGS Technical Specification Table 4.11-2 (Units 1, 2 and 3). 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 Technical Specification Table 4.11-2 (Units 1, 2 and 3). 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 4.11-2 of the PVNGS Technical Specifications (Units 1, 2 and 3). An average LLD for each radionuclide is provided in Table A1.

5.0 Batch Releases

5.1 Gaseous

	Unit 1*	Unit 2*	Unit 3*
• Number of batch releases:	52	33	50
• Total time period for batch releases:	2188.04	1455.24	2332.72
• Maximum time period for a batch release:	168.00	168.00	151.38
• Average time period for a batch release:	42.08	44.10	46.65
• Minimum time period for a batch release:	2.34	0.88	1.03

* All times are in hours

5.2 Liquid

None

6.0 Abnormal Releases

None

7.0 Offsite Dose Calculation Manual (ODCM) and, Process Control Program (PCP) Revisions

There were no revisions to the PCP. There were no major changes to the radwaste systems.

The ODCM was revised and is included in Appendix E. The justification for a revision of the ODCM is presented in Appendix F.

8.0 Effluents and Solid Wastes

8.1 Gaseous Effluents

The gaseous effluents for the third and fourth quarters are included in Tables A2 through A7. 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 A9.

9.0 Miscellaneous Information

Releases made to the evaporation pond have been limited at the tank to the concentrations specified in PVNGS Technical Specification 3.11.1.1. In addition, PVNGS has imposed a limit of 3×10^{-3} µCi/ml for tritium in tanks released to the evaporation pond. This is the maximum permissible concentration for unrestricted areas for tritium in water from 10CFR20 Appendix B. The evaporation pond was monitored in accordance with PVNGS Technical Specification 3.12.1 (Units 1, 2 and 3). During this report period, the analyses showed tritium concentrations in water to be less than or equal to 1.49E-06 µCi/ml.

The results of the second quarter 1988 Strontium-89 and Strontium-90 analyses for continuous mode releases, which were not available at the time the January-June, 1988 Semi-Annual Report was written, were determined to be less than the Lower Limit of Detection.

An error was discovered in the January-June 1988 Report. The tritium total curies released for Unit 1, second quarter, continuous mode (Table A3) was 9.60E+01 curies versus 4.19E+01 as reported. Revised Tables A2, A3, C1 and C3 are included in Appendix D. The population doses for the first semi-annual period presented in Table C2 of the January-June 1988 Report were recalculated and are presented in Appendix C (Table C2).

Technical Specification 3.12.1 ACTION c. requires, in part, to 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).

On July 1, 1987, the Baisley Dairy, ODCM location #50, closed. The Lueck Dairy, (ODCM Rev. 1 location #55) ODCM Rev. 2 location #50, replaced the Baisley Dairy as the Technical Specification sample location.

Revised ODCM figures and tables are included as part of the ODCM Rev. 2, which is included in Appendix E of this report.

Table A1

PVNGS UNITS 1, 2, AND 3

GASEOUS EFFLUENTS - AVERAGE LOWER LIMIT OF DETECTION

µCi/cc

NUCLIDE	CONTINUOUS	BATCH
KRYPTON 85	5.50E-06	5.50E-06
KRYPTON 85m	2.10E-08	2.10E-08
KRYPTON 87	4.90E-08	4.90E-08
KRYPTON 88	9.10E-08	9.10E-08
XENON 133	6.00E-08	6.00E-08
XENON 133m	1.10E-07	1.10E-07
XENON 135	2.40E-08	2.40E-08
XENON 135m	5.10E-07	5.10E-07
XENON 138	2.30E-06	2.30E-06
IODINE 131	3.70E-14	1.50E-11
IODINE 133	2.60E-14	1.00E-11
IODINE 135	9.60E-14	3.80E-11
BARIUM 140	1.10E-13	4.30E-11
CERIUM 141	3.30E-14	1.30E-11
CERIUM 144	1.40E-13	5.80E-11
CESIUM 134	1.60E-14	6.30E-12
CESIUM 137	2.40E-14	9.60E-12
COBALT 58	2.60E-14	1.00E-11
COBALT 60	3.00E-14	1.20E-11
IRON 59	3.50E-14	1.40E-11
LANTHANUM 140	3.00E-14	1.20E-11
MANGANESE 54	2.70E-14	1.10E-11
MOLYBDENUM 99	2.30E-13	9.20E-11
STRONTIUM 89	5.00E-16	*
STRONTIUM 90	5.00E-16	*
TRITIUM	5.00E-07	5.00E-07
ZINC 65	5.90E-14	2.30E-11
GROSS ALPHA	6.00E-15	*

*Not required for batch releases.

Table A2
PVNGS UNIT 1 1988
GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

	Unit	Quarter #3	Quarter #4	Est. Total Error%*
A. Fission & activation gases				
1. Total release	Ci	7.94E+02	3.99E+02	3.97E+01
2. Average release rate for period	µCi/sec	9.99E+01	5.02E+01	
3. Percent of technical specification limit	%	NA**	NA**	
B. Iodines				
1. Total Iodine-131	Ci	4.30E-04	1.66E-04	2.93E+01
2. Average release rate for period	µCi/sec	5.41E-05	2.09E-05	
3. Percent of technical specification limit	%	NA**	NA**	
C. Particulates				
1. Particulates with half-lives >8 days	Ci	1.28E-05	<LLD	2.93E+01
2. Average release rate for period	µCi/sec	1.62E-06	<LLD	
3. Percent of technical specification limit	%	NA**	NA**	
4. Gross Alpha radioactivity	Ci	<LLD	<LLD	
D. Tritium				
1. Total release	Ci	1.51E+02	5.40E+01	4.22E+01
2. Average release rate for period	µCi/sec	1.90E+01	6.79E+00	
3. Percent of technical specification limit	%	NA**	NA**	

*Estimated total error methodology is presented in Table A8.
**See Table C3 for percent of technical specification limits.

Table A3
PVNGS UNIT 1 1988
GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

		CONTINUOUS MODE		BATCH MODE	
Nuclides Released	Unit	Quarter #3	Quarter #4	Quarter #3	Quarter #4
1. Fission gases					
Argon 41	Ci	*	*	8.47E-02	2.26E-01
Krypton-85	Ci	<LLD	<LLD	1.98E+01	2.63E+00
Kypton-85m	Ci	<LLD	<LLD	2.81E-03	3.20E-03
Krypton-87	Ci	<LLD	<LLD	<LLD	<LLD
Krypton-88	Ci	<LLD	<LLD	<LLD	<LLD
Xenon-131m	Ci	*	*	4.60E+00	2.40E-01
Xenon-133	Ci	2.22E+02	3.49E+02	3.78E+02	1.98E+01
Xenon-133m	Ci	2.40E+00	<LLD	1.22E+00	1.31E-01
Xenon-135	Ci	6.53E+00	2.65E+01	1.04E-01	1.08E-01
Xenon-135m	Ci	<LLD	<LLD	<LLD	<LLD
Xenon-138	Ci	1.59E+02	<LLD	<LLD	<LLD
Unidentified	Ci	**	**	**	**
Total for period	Ci	3.90E+02	3.76E+02	4.04E+02	2.31E+01
2. Iodines					
Iodine-131	Ci	3.66E-04	1.30E-04	6.37E-05	3.63E-05
Iodine-133	Ci	1.89E-04	1.45E-05	4.64E-06	1.02E-05
Iodine-135	Ci	<LLD	<LLD	3.39E-04	3.58E-04
Total for period	Ci	5.55E-04	1.45E-04	4.07E-04	4.05E.04
3. Particulates					
Antimony-124	Ci	4.98E-06	*	*	*
Barium-140	Ci	<LLD	<LLD	<LLD	<LLD
Bromine-82	Ci	*	*	7.18E-06	1.95E-05
Cerium-141	Ci	<LLD	<LLD	<LLD	<LLD
Cerium-144	Ci	<LLD	<LLD	<LLD	<LLD

Table A3 (Continued)
PVNGS UNIT 1 1988
GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

		CONTINUOUS MODE		BATCH MODE	
Nuclides Released	Unit	Quarter #3	Quarter #4	Quarter #3	Quarter #4
3. Particulates (continued)					
Cesium-134	Ci	2.98E-06	<LLD	<LLD	<LLD
Cesium-137	Ci	3.99E-06	<LLD	<LLD	<LLD
Cesium-138	Ci	*	*	3.98E-04	1.93E-03
Cobalt-58	Ci	<LLD	<LLD	<LLD	<LLD
Cobalt-60	Ci	8.92E-07	<LLD	<LLD	<LLD
Iron-59	Ci	<LLD	<LLD	<LLD	<LLD
Lanthanum-140	Ci	<LLD	<LLD	<LLD	<LLD
Manganese-54	Ci	<LLD	<LLD	<LLD	<LLD
Molybdenum-99	Ci	<LLD	<LLD	<LLD	<LLD
Rubidium-88	Ci	*	*	2.82E-04	6.18E-04
Strontium-89	Ci	<LLD	***	**	**
Strontium-90	Ci	<LLD	***	**	**
Tritium	Ci	6.19E+01	<LLD	8.95E+01	5.40E+01
Zinc-65	Ci	<LLD	<LLD	<LLD	<LLD
Unidentified	Ci	**	**	**	**
Total for period	Ci	6.19E+01	<LLD	8.95E+01	5.40E+01

*Not detected
**Not applicable
***Analysis not yet completed. Additional information will be included in the next Semi-Annual report.

Table A4
PVNGS UNIT 2 1988
GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

	Unit	Quarter #3	Quarter #4	Est. Total Error%*
A. Fission & activation gases				
1. Total release	Ci	4.13E+01	1.04E+02	3.97E+01
2. Average release rate for period	µCi/sec	5.20E+00	1.31E+01	
3. Percent of technical specification limit	%	NA**	NA**	
B. Iodines				
1. Total Iodine-131	Ci	1.33E-04	1.77E-03	2.93E+01
2. Average release rate for period	µCi/sec	1.67E-05	2.23E-04	
3. Percent of technical specification limit	%	NA**	NA**	
C. Particulates				
1. Particulates with half-lives >8 days	Ci	1.54E-05	<LLD	2.93E+01
2. Average release rate for period	µCi/sec	1.94E-06	<LLD	
3. Percent of technical specification limit	%	NA**	NA**	
4. Gross Alpha radioactivity	Ci	<LLD	<LLD	
D. Tritium				
1. Total release	Ci	5.33E+01	1.25E+02	4.22E+01
2. Average release rate for period	µCi/sec	6.71E+00	1.57E+01	
3. Percent of technical specification limit	%	NA***	NA***	

*Estimated total error methodology is presented in Table A8.
**See Table C3 for percent of technical specification limits.

Table A5
PVNGS UNIT 2 1988
GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

Nuclides Released	Unit	CONTINUOUS MODE Quarter #3	CONTINUOUS MODE Quarter #4	BATCH MODE Quarter #3	BATCH MODE Quarter #4
1. Fission gases					
Argon 41	Ci	*	*	8.61E-02	8.16E-02
Krypton-85	Ci	<LLD	<LLD	<LLD	<LLD
Kypton-85m	Ci	<LLD	<LLD	<LLD	1.97E-04
Krypton-87	Ci	<LLD	<LLD	<LLD	<LLD
Krypton-88	Ci	<LLD	<LLD	<LLD	<LLD
Xenon-131m	Ci	*	*	*	1.50E-02
Xenon-133	Ci	3.69E+01	7.58E+01	2.32E+00	2.56E+01
Xenon-133m	Ci	<LLD	<LLD	1.30E-02	2.72E-02
Xenon-135	Ci	1.95E+00	2.51E+00	1.27E-02	4.09E-02
Xenon-135m	Ci	<LLD	<LLD	<LLD	<LLD
Xenon-138	Ci	<LLD	<LLD	<LLD	<LLD
Unidentified	Ci	**	**	**	**
Total for period	Ci	3.89E+01	7.83E+01	2.43E+00	2.58E+01
2. Iodines					
Iodine-131	Ci	1.21E-04	1.21E-03	1.20E-05	5.60E-04
Iodine-132	Ci	*	*	*	2.76E-06
Iodine-133	Ci	<LLD	<LLD	5.27E-06	7.37E-05
Iodine-135	Ci	<LLD	<LLD	5.07E-07	1.09E-05
Total for period	Ci	1.21E-04	1.21E-03	1.78E-05	6.47E-04
3. Particulates					
Antimony-124	Ci	1.54E-05	*	*	*
Barium-139	Ci	*	*	*	1.95E-06
Barium-140	Ci	<LLD	<LLD	<LLD	<LLD
Bromine-82	Ci	*	*	7.20E-06	6.10E-06
Cerium-141	Ci	<LLD	<LLD	<LLD	<LLD
Cerium-144	Ci	<LLD	<LLD	<LLD	<LLD

Table A5 (Continued)
PVNGS UNIT 2 1988
GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

		CONTINUOUS MODE		BATCH MODE	
Nuclides Released	Unit	Quarter #3	Quarter #4	Quarter #3	Quarter #4
3. Particulates (continued)					
Cesium-134	Ci	<LLD	<LLD	<LLD	<LLD
Cesium-137	Ci	<LLD	<LLD	<LLD	<LLD
Cesium-138	Ci	*	*	*	3.11E-05
Cobalt-58	Ci	<LLD	<LLD	<LLD	<LLD
Cobalt-60	Ci	<LLD	<LLD	<LLD	<LLD
Iron-59	Ci	<LLD	<LLD	<LLD	<LLD
Lanthanum-140	Ci	<LLD	<LLD	<LLD	<LLD
Manganese-54	Ci	<LLD	<LLD	<LLD	<LLD
Molybdenum-99	Ci	<LLD	<LLD	<LLD	<LLD
Rubidium-88	Ci	*	*	*	2.37E-04
Strontium-89	Ci	<LLD	***	**	**
Strontium-90	Ci	<LLD	***	**	**
Tritium	Ci	<LLD	<LLD	5.33E+01	1.25E+02
Zinc-65	Ci	<LLD	<LLD	<LLD	<LLD
Unidentified	Ci	**	**	**	**
Total for period	Ci	1.54E-05	<LLD	5.33E+01	1.25E+02

*Not detected
**Not applicable
***Analysis not yet completed. Additional information will be included in the next Semi-annual Report.

Table A6
PVNGS UNIT 3 1988
GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

	Unit	Quarter #3	Quarter #4	Est. Total Error%*
A. Fission & activation gases				
1. Total release	Ci	5.48E+01	7.33E+01	3.97E+01
2. Average release rate for period	µCi/sec	6.89E+00	9.22E+00	
3. Percent of technical specification limit	%	NA**	NA**	
B. Iodines				
1. Total Iodine-131	Ci	1.66E-05	1.05E-04	2.93E+01
2. Average release rate for period	µCi/sec	2.09E-06	1.32E-05	
3. Percent of technical specification limit	%	NA**	NA**	
C. Particulates				
1. Particulates with half-lives >8 days	Ci	<LLD	<LLD	2.93E+01
2. Average release rate for period	µCi/sec	<LLD	<LLD	
3. Percent of technical specification limit	%	NA**	NA**	
4. Gross Alpha radioactivity	Ci	2.97E-11	3.58E-11	
D. Tritium				
1. Total release	Ci	2.00E+02	1.24E+02	4.22E+01
2. Average release rate for period	µCi/sec	2.51E+01	1.55E+01	
3. Percent of technical specification limit	%	NA**	NA**	

*Estimated total error methodology is presented in Table A8.
**See Table C3 for percent of technical specification limits.

[illegible]

Table A7
PVNGS UNIT 3 1988
GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

Nuclides Released	Unit	CONTINUOUS MODE Quarter #3	CONTINUOUS MODE Quarter #4	BATCH MODE Quarter #3	BATCH MODE Quarter #4
1. Fission gases					
Argon 41	Ci	9.86E-03	3.85E-01	8.79E-02	1.56E-01
Krypton-85	Ci	<LLD	<LLD	7.82E-05	6.59E-02
Kypton-85m	Ci	4.49E-05	1.09E-01	2.38E-04	<LLD
Krypton-87	Ci	<LLD	<LLD	<LLD	<LLD
Krypton-88	Ci	<LLD	3.08E-02	<LLD	<LLD
Xenon-131m	Ci	**	**	1.12E-01	1.31E-01
Xenon-133	Ci	4.55E+01	6.37E+01	8.00E+00	6.10E+00
Xenon-133m	Ci	<LLD	<LLD	7.29E-02	3.75E-02
Xenon-135	Ci	9.61E-01	2.57E+00	3.04E-02	1.88E-02
Xenon-135m	Ci	<LLD	<LLD	<LLD	<LLD
Xenon-138	Ci	<LLD	<LLD	1.82E-04	<LLD
Unidentified	Ci	*	*	*	*
Total for period	Ci	4.65E+01	6.68E+01	8.30E+00	6.51E+00
2. Iodines					
Iodine-131	Ci	1.64E-05	1.05E-04	1.66E-07	4.13E-07
Iodine-132	Ci	**	6.81E-06	**	**
Iodine-133	Ci	8.72E-06	1.19E-04	<LLD	<LLD
Iodine-135	Ci	<LLD	1.11E-05	<LLD	<LLD
Total for period	Ci	2.51E-05	2.42E-04	1.66E-07	4.13E-07
3. Particulates					
Barium-140	Ci	<LLD	<LLD	<LLD	<LLD
Bromine-82	Ci	**	**	1.68E-05	2.42E-05
Cerium-141	Ci	<LLD	<LLD	<LLD	<LLD
Cerium-144	Ci	<LLD	<LLD	<LLD	<LLD

Table A7 (Continued)
PVNGS UNIT 3 1988
GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

Nuclides Released	Unit	CONTINUOUS MODE Quarter #3	CONTINUOUS MODE Quarter #4	BATCH MODE Quarter #3	BATCH MODE Quarter #4
3. Particulates (continued)					
Cesium-134	Ci	<LLD	<LLD	<LLD	<LLD
Cesium-137	Ci	<LLD	<LLD	<LLD	<LLD
Cesium-138	Ci	**	2.55E-03	**	**
Cobalt-58	Ci	<LLD	<LLD	<LLD	<LLD
Cobalt-60	Ci	<LLD	<LLD	<LLD	<LLD
Iron-59	Ci	<LLD	<LLD	<LLD	<LLD
Lanthanum-140	Ci	<LLD	<LLD	<LLD	<LLD
Manganese-54	Ci	<LLD	<LLD	<LLD	<LLD
Molybdenum-99	Ci	<LLD	<LLD	<LLD	<LLD
Rubidium-88	Ci	**	2.19E-02	2.42E-05	4.25E-05
Strontium-89	Ci	<LLD	***	*	*
Strontium-90	Ci	<LLD	***	*	*
Tritium	Ci	6.66E-01	5.54E-01	1.99E+02	1.23E+02
Zinc-65	Ci	<LLD	<LLD	<LLD	<LLD
Unidentified	CI	*	*	*	*
Total for period	Ci	6.66E-01	5.78E-01	1.99E+02	1.23E+02

*Not applicable
**Not detected
***Analysis not yet completed. Additional information will be included in the next Semi-annual Report.

Table A8
ESTIMATION METHODOLOGY OF TOTAL PERCENT ERROR

The estimated total errors is calculated as follows:

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

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.

Table A9

SOLID WASTE SUMMARY FOR JULY 1988 - DECEMBER 1988

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

1. Type of Waste	Unit	6-Month Period	Estimated Total Error %
a. Spent resin, filter sludges, evaporator bottoms, etc.	M^3	1.96E+02	
	Ci	2.34E+02	+/-2.50E+01
b. Dry compressible waste, contaminated equipment, etc.	M^3	1.61E+02	
	Ci	6.63E-01	+/-2.50E+01
c. Irradiated components, fuel rods, etc.	M^3	0.00E+00	
	Ci	0.00E+00	NA
d. Other	M^3	0.00E+00	
	Ci	0.00E+00	NA

2.a. Estimate of Major Nuclide Composition for Spent Resins, Filter Sludges, Evaporator Bottoms, Etc., as Determined by Measurement.

Waste Class	Nuclide Name	Percent Abundance	Curies
A	*Fe-55	58.836	4.05E+01
A	Co-60	22.953	1.58E+01
A	Sb-124	6.479	4.46E+00
A	Co-58	3.864	2.66E+00
A	Cs-137	3.065	2.11E+00
A	*Ni-63	1.554	1.07E+00
A	Cs-134	1.467	1.01E+00
A	*H-3	0.986	6.79E-01
A	Mn-54	0.649	4.47E-01
A	Nb-95	0.061	4.17E-02
A	*C-14	0.042	2.90E-02
A	Ag-110M	0.021	1.47E-02
A	Sb-125	0.017	1.19E-02
A	*Pu-241	0.001	8.69E-04
A	Ce-144	0.001	4.08E-04
A	*Tc-99	0.000	2.55E-04
A	*Pu-239/40	0.000	1.81E-05
A	Be-7	0.000	1.43E-05

*Scaled Nuclide based on 10CFR61.55.

Table A9 (Continued)

SOLID WASTE SUMMARY FOR JULY 1988 - DECEMBER 1988

Estimates of Major Nuclide Composition for Spent Resins, Filter Sludges, Evaporator Bottoms, Etc., as Determined by Measurement.

Waste Class	Nuclide Name	Percent Abundance	Curies
B	Cs-137	25.275	4.16E+01
B	Co-60	22.541	3.71E+01
B	*Fe-55	22.116	3.64E+01
B	Cs-134	12.941	2.13E+01
B	Sb-124	8.628	1.42E+01
B	Co-58	3.718	6.12E+00
B	Mn-54	2.515	4.14E+00
B	*Ni-63	1.634	2.69E+00
B	Ce-144	0.430	7.07E-01
B	*C-14	0.112	1.85E-01
B	*Sr-90	0.064	1.06E-01
B	*H-3	0.019	3.19E-02
B	*Pu-241	0.005	8.11E-03
B	*Tc-99	0.000	5.34E-04
B	*Pu-239/40	0.000	3.27E-04

*Scaled Nuclide based on 10CFR61.55.

Table A9 (Continued)

SOLID WASTE SUMMARY FOR JULY 1988 - DECEMBER 1988

2.b. Estimates of Major Nuclide Composition for Dry Compressible Waste, Contaminated Equipment, Etc., as Determined by Measurement.

Waste Class	Nuclide Name	Percent Abundance	Curies
A	*Fe-55	25.955	1.72E-01
A	Sb-124	17.354	1.15E-01
A	Cs-137	16.750	1.11E-01
A	Co-60	8.511	5.64E-02
A	Co-58	7.952	5.27E-02
A	Cr-51	6.926	4.59E-02
A	Cs-134	5.131	3.40E-02
A	Nb-95	2.475	1.64E-02
A	Zr-95	1.660	1.10E-02
A	Ce-144	1.569	1.04E-02
A	Mn-54	1.539	1.02E-02
A	Fe-59	1.133	7.51E-03
A	Ru-103	1.032	6.84E-03
A	*C-14	0.767	5.08E-03
A	Ce-141	0.549	3.64E-03
A	*Ni-63	0.264	1.75E-03
A	I-131	0.249	1.65E-03
A	*H-3	0.183	1.21E-03
A	*Tc-99	0.001	8.90E-06

*Scaled Nuclide based on 10CFR61.55.

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
30	Exclusive use truck	Hanford

Table A9 (Continued)

SOLID WASTE SUMMARY FOR JULY 1988 - DECEMBER 1988

B. IRRADIATED FUEL SHIPMENTS

Number of Shipments	Mode of Transportation	Destination
0	N/A	N/A

C. ADDITIONAL INFORMATION

Thirty Shipments:

1.	88-RW-46	1 - 199.4 ft^3 steel liner containing evaporator bottoms solidified with Envirostone.
2.	88-RW-44	2 - 199.4 ft^3 steel liners containing evaporator bottoms solidified with Envirostone.
3.	88-RW-47	2 - 199.4 ft^3 steel liners containing evaporator bottoms solidified with Envirostone.
4.	88-RW-48	1 - 199.4 ft^3 steel liner containing evaporator bottoms solidified with Envirostone.
5.	88-RW-49	3 - 199.4 ft^3 steel liners containing dewatered resin.
6.	88-RW-50	1 - 199.4 ft^3 steel liner containing dewatered resin. 1 - 199.4 ft^3 steel liner containing evaporator bottoms solidified with Envirostone.
7.	88-RW-51	1 - 199.4 ft^3 steel liner containing evaporator bottoms solidified with Envirostone.
8.	88-RW-52	2 - 199.4 ft^3 steel liners containing evaporator bottoms solidified with Envirostone.
9.	88-RW-53	1 - 130.8 ft^3 high integrity container containing dewatered resin.
10.	88-RW-54	1 - 49.9 ft^3 high integrity container containing filters.
11.	88-RW-55	2 - 199.4 ft^3 steel liners containing evaporator bottoms solidified with Envirostone.
12.	88-RW-56	1 - 130.8 ft^3 high integrity container containing dewatered resin.
13.	88-RW-57	1 - 130.8 ft^3 high integrity container containing dewatered resin.

Table A9 (Continued)

SOLID WASTE SUMMARY FOR JULY 1988 - DECEMBER 1988

14.	88-RW-58	2 - 199.4 ft^3 steel liners containing evaporator bottoms solidified with Envirostone.
15.	88-RW-59	1 - 130.8 ft^3 high integrity container containing dewatered resin.
16.	88-RW-60	11 - 107.5 ft^3 boxes containing dry compressible waste.
17.	88-RW-61	1 - 130.8 ft^3 high integrity container containing dewatered resin.
18.	88-RW-62	2 - 206.1 ft^3 steel liners containing sump water.
19.	88-RW-63	2 - 199.4 ft^3 steel liners containing evaporator bottoms solidified with Envirostone.
20.	88-RW-64	1 - 130.8 ft^3 high integrity container containing dewatered resin.
21.	88-RW-65	7 - 107.5 ft^3 boxes containing dry compressible waste. 6 - 54.3 ft^3 boxes containing dry compressible waste.
22.	88-RW-66	84 - 7.5 ft^3 drums containing dry compressible waste.
23.	88-RW-67	2 - 199.4 ft^3 steel liners containing evaporator bottoms solidified with Envirostone.
24.	88-RW-68	This shipment number was never used.
25.	88-RW-69	1 - 206.1 ft^3 steel liner containing sump water. 1 - 199.4 ft^3 steel liner containing dry compressible waste.
26.	88-RW-70	12 - 107.5 ft^3 boxes containing dry compressible waste.
27.	88-RW-71	12 - 107.5 ft^3 boxes containing dry compressible waste.
28.	88-RW-72	1 - 49.9 ft^3 high integrity container containing dewatered resin.
29.	88-RW-73	2 - 170.2 ft^3 steel liners containing dewatered resin. 1 - 199.4 ft^3 steel liner containing dewatered resin.
30.	88-RW-74	1 - 170.2 ft^3 steel liner containing dewatered resin. 1 - 206.1 ft^3 steel liner containing solidified evaporator bottoms.
31.	88-RW-75	1 - 130.8 ft^3 high integrity container containing dewatered resin.

Table A9 (Continued)

SOLID WASTE SUMMARY FOR JULY 1988 - DECEMBER 1988

D. Changes to processes and/or equipment.

D.1 No changes were made to the Solid Radwaste Process Control Program.

D.2 No major changes were made to installed plant equipment.

D.3 No major changes were made to installed plant equipment. Therefore, predicted release or quantity of solid waste generated, remain unchanged as addressed in the UFSAR.

D.4 No major changes were made to installed plant equipment. Therefore, predicted exposures to the public and general population, remain unchanged as addressed in the UFSAR.

Table A10
PVNGS UNITS 1, 2 and 3
EFFLUENT MONITORING INSTRUMENTATION OUT OF SERVICE GREATER THAN 30 DAYS

Instrument	Inoperability Dates	Inoperability Cause	Explanation
None	N/A	N/A	N/A

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 1988. 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 and semi-annual basis, the JFDs were 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 (delta T).

In accordance with NUREG-0133, the batch releases for the third and fourth quarters for 1988 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 1988

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR 3RD QTR88
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/88 - 9/30/88

*** 3RD QUARTER 1988 ***

STABILITY CLASS A

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
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	1	0	0	0	0	0	0	0	0	0	0	0	1
6.51- 8.50	0	0	0	0	1	2	1	0	0	2	4	4	0	1	0	0	15
8.51-11.50	0	0	0	0	4	1	0	1	3	6	25	17	6	0	0	0	63
11.51-14.50	0	1	0	0	1	0	0	0	0	4	5	2	0	0	0	0	13
14.51-20.50	0	0	0	3	3	0	0	0	2	2	3	1	0	0	0	0	14
>20.50	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	3
TOTAL	0	1	0	3	10	3	1	1	7	15	37	24	6	1	0	0	109

STABILITY CLASS B

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
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	1	0	0	0	0	0	0	0	0	0	1	0	0	0	2
4.51- 5.50	0	0	0	0	0	0	1	1	0	1	0	1	0	1	1	0	6
5.51- 6.50	0	1	1	0	0	0	0	2	1	1	3	0	0	1	0	0	10
6.51- 8.50	0	0	0	2	5	6	7	2	9	11	16	13	10	1	0	0	82
8.51-11.50	0	0	1	2	10	1	1	0	2	6	20	13	5	1	1	0	63
11.51-14.50	0	0	0	2	3	0	0	0	0	2	7	1	0	1	0	0	16
14.51-20.50	0	0	0	4	5	0	0	0	0	0	1	0	0	0	0	0	10
>20.50	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
TOTAL	0	1	3	10	23	7	9	5	12	22	47	28	16	5	2	0	190

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR 3RD QTR88
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/88 - 9/30/88

*** 3RD QUARTER 1988 ***

STABILITY CLASS C

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
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	1	0	0	0	0	0	0	0	1	2
3.51- 4.50	0	1	0	0	0	0	1	3	1	2	0	0	0	0	0	0	8
4.51- 5.50	1	0	3	0	1	2	5	2	10	12	5	6	1	0	1	1	50
5.51- 6.50	1	0	0	4	0	2	1	7	10	14	8	3	0	1	0	1	52
6.51- 8.50	0	0	1	2	5	3	4	2	7	11	18	6	4	2	1	1	67
8.51-11.50	0	0	1	1	9	0	0	0	1	2	8	5	1	1	0	0	29
11.51-14.50	0	0	0	0	3	0	0	0	0	0	4	2	0	0	0	0	9
14.51-20.50	0	0	0	4	5	0	0	0	0	2	1	0	0	1	0	0	13
>20.50	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL	2	1	5	11	24	7	11	15	29	43	44	22	6	5	2	4	231

STABILITY CLASS D

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
0.76- 1.50	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
1.51- 2.50	1	1	1	1	0	1	0	3	0	1	1	0	0	1	4	1	16
2.51- 3.50	2	3	2	2	1	4	5	1	6	5	7	1	4	4	1	3	51
3.51- 4.50	2	2	4	1	3	4	1	6	19	12	11	7	3	1	4	3	83
4.51- 5.50	1	5	1	5	2	2	1	7	17	16	16	7	3	6	2	0	91
5.51- 6.50	2	0	2	3	3	5	0	3	10	14	15	3	5	3	0	2	70
6.51- 8.50	1	3	3	1	1	5	3	4	7	11	21	8	5	1	1	4	79
8.51-11.50	3	2	4	7	3	8	1	0	3	5	16	17	2	1	0	1	73
11.51-14.50	2	1	0	6	5	3	0	0	1	1	11	4	0	0	0	1	35
14.51-20.50	0	3	1	7	2	0	1	2	2	4	7	1	0	1	0	1	32
>20.50	0	0	0	1	3	0	0	0	0	2	0	0	0	0	0	0	6
TOTAL	14	21	18	34	23	32	12	26	65	71	105	48	22	18	13	16	538

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR 3RD QTR88
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/88 - 9/30/88

*** 3RD QUARTER 1988 ***

STABILITY CLASS E

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
0.76- 1.50	0	1	1	0	0	0	0	0	0	2	0	0	0	0	0	0	4
1.51- 2.50	5	3	2	1	1	1	1	0	2	0	2	3	9	5	2	4	41
2.51- 3.50	5	4	1	2	1	2	2	0	4	3	6	6	3	4	8	3	54
3.51- 4.50	7	2	2	2	1	2	1	0	0	4	11	10	8	3	2	10	65
4.51- 5.50	4	2	6	3	2	1	1	2	3	3	12	3	1	4	1	3	51
5.51- 6.50	4	5	0	1	2	3	2	1	1	4	7	7	4	4	1	2	48
6.51- 8.50	5	5	7	5	2	3	4	1	3	13	26	15	5	4	0	2	100
8.51-11.50	0	2	5	7	6	6	3	5	4	15	36	22	4	2	1	1	119
11.51-14.50	0	0	0	4	8	3	1	0	1	2	14	3	0	3	0	0	39
14.51-20.50	0	0	0	3	1	1	0	0	2	5	1	2	0	0	0	1	16
>20.50	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
TOTAL	30	24	24	28	24	22	16	9	20	51	115	71	34	29	15	26	538

STABILITY CLASS F

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
0.76- 1.50	1	0	0	1	0	0	0	0	0	0	0	2	0	1	2	0	7
1.51- 2.50	4	1	1	1	0	1	0	1	2	0	1	1	1	2	7	4	27
2.51- 3.50	7	1	1	0	2	1	1	0	1	3	4	3	5	7	8	11	55
3.51- 4.50	12	4	2	2	0	0	2	0	3	4	4	6	2	3	2	9	55
4.51- 5.50	4	6	2	1	1	0	0	2	0	2	5	3	3	3	1	3	36
5.51- 6.50	0	2	1	3	0	0	0	0	1	3	8	4	0	4	1	0	27
6.51- 8.50	1	4	5	2	1	0	0	0	0	5	21	6	3	0	2	0	50
8.51-11.50	0	0	4	3	3	0	0	1	3	4	10	1	0	0	1	0	30
11.51-14.50	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	3
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	29	18	17	14	7	2	3	4	10	21	53	26	14	20	25	27	290

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR 3RD QTR88
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/88 - 9/30/88

*** 3RD QUARTER 1988 ***

STABILITY CLASS G

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
0.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	3
1.51- 2.50	11	2	1	0	0	0	0	1	0	0	2	4	4	1	6	3	35
2.51- 3.50	15	5	3	3	0	2	0	0	0	1	1	3	7	2	11	15	68
3.51- 4.50	35	10	7	0	1	0	0	0	1	2	1	1	6	1	9	15	89
4.51- 5.50	21	7	2	0	0	0	0	0	0	1	2	1	0	1	6	6	47
5.51- 6.50	9	11	2	0	1	0	0	0	0	0	1	1	0	1	0	3	29
6.51- 8.50	2	7	1	1	0	0	0	0	0	0	3	0	0	0	0	2	16
8.51-11.50	0	3	5	1	0	0	0	0	0	0	0	0	0	0	0	0	9
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	93	45	21	5	2	2	0	1	1	4	10	10	17	7	32	46	296

STABILITY CLASS ALL

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
0.76- 1.50	1	2	1	1	0	0	0	0	0	2	0	2	0	2	3	2	16
1.51- 2.50	21	7	5	3	1	3	1	5	4	1	6	8	14	9	19	12	119
2.51- 3.50	29	13	7	7	4	9	8	2	11	12	18	13	19	17	28	33	230
3.51- 4.50	56	19	16	5	5	6	5	9	24	24	27	24	20	8	17	37	302
4.51- 5.50	31	20	14	9	6	5	8	14	30	35	40	21	8	15	12	13	281
5.51- 6.50	16	19	6	11	7	10	3	13	23	36	42	18	9	14	2	8	237
6.51- 8.50	9	19	17	13	15	19	19	9	26	53	109	52	27	9	4	9	409
8.51-11.50	3	7	20	21	35	16	5	7	16	38	115	75	18	5	3	2	386
11.51-14.50	2	2	1	13	20	6	1	0	2	9	41	12	0	4	1	1	115
14.51-20.50	0	3	1	21	16	1	1	2	6	13	13	4	0	2	0	2	85
>20.50	0	0	0	1	4	0	1	0	2	4	0	0	0	0	0	0	12
TOTAL	168	111	88	105	113	75	52	61	144	227	411	229	115	85	89	119	2192

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR 3RD QTR88
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/88 - 9/30/88

*** 3RD QUARTER 1988 ***

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 MPH

TOTAL NUMBER OF OBSERVATIONS: 2208
TOTAL NUMBER OF VALID OBSERVATIONS: 2192
TOTAL NUMBER OF MISSING OBSERVATIONS: 16
PERCENT DATA RECOVERY FOR THIS PERIOD: 99.3 %
MEAN WIND SPEED FOR THIS PERIOD: 6.9 MPH
TOTAL NUMBER OF OBSERVATIONS WITH BACKUP DATA: 0

PERCENTAGE OCCURRENCE OF STABILITY CLASSES

A	B	C	D	E	F	G
4.97	8.67	10.54	24.54	24.54	13.23	13.50

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	3	10	3	1	1	7	15	37	24	6	1	0	0	0
B	0	1	3	10	23	7	9	5	12	22	47	28	16	5	2	0	0
C	2	1	5	11	24	7	11	15	29	43	44	22	6	5	2	4	0
D	14	21	18	34	23	32	12	26	65	71	105	48	22	18	13	16	0
E	30	24	24	28	24	22	16	9	20	51	115	71	34	29	15	26	0
F	29	18	17	14	7	2	3	4	10	21	53	26	14	20	25	27	0
G	93	45	21	5	2	2	0	1	1	4	10	10	17	7	32	46	0
TOTAL	168	111	88	105	113	75	52	61	144	227	411	229	115	85	89	119	0

Table B2

JFDs of 35-Foot Wind Versus Delta T

October - December 1988

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR 4TH QTR88
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 10/ 1/88 - 12/31/88

*** 4TH QUARTER 1988 ***

STABILITY CLASS A

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
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	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
6.51- 8.50	0	0	2	0	0	1	0	0	0	0	0	1	0	0	0	0	4
8.51-11.50	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	4
11.51-14.50	0	0	0	0	1	0	0	0	0	2	2	0	2	0	0	0	7
14.51-20.50	0	0	0	1	0	0	0	0	1	2	0	0	0	0	0	0	4
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	1	3	2	1	2	0	0	1	5	2	2	2	0	0	0	21

STABILITY CLASS B

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
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	1	0	0	0	0	0	0	0	0	0	0	0	0	1
3.51- 4.50	0	0	2	2	1	0	0	1	0	0	0	0	0	0	0	0	6
4.51- 5.50	0	0	1	0	1	0	0	0	0	0	1	2	0	0	0	0	5
5.51- 6.50	0	0	0	3	1	2	2	0	3	1	3	0	0	0	0	0	15
6.51- 8.50	0	0	4	12	5	6	0	1	2	1	2	0	1	0	0	0	34
8.51-11.50	0	0	3	3	4	2	0	2	0	3	2	1	3	1	0	0	24
11.51-14.50	0	0	0	0	3	0	0	0	0	0	1	0	0	2	1	0	7
14.51-20.50	0	0	0	1	0	0	0	0	1	1	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	0	0	10	22	15	10	2	4	6	6	9	3	4	3	1	0	95

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR 4TH QTR88
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 10/ 1/88 - 12/31/88

*** 4TH QUARTER 1988 ***

STABILITY CLASS C

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
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	1	1	1	1	1	1	0	0	0	1	1	1	1	1	2	13
3.51- 4.50	3	1	3	1	1	0	0	3	1	2	3	0	0	1	2	1	22
4.51- 5.50	0	1	5	1	1	1	1	1	4	5	5	5	0	1	1	1	33
5.51- 6.50	2	3	6	3	0	3	1	2	13	8	3	2	0	2	0	0	48
6.51- 8.50	0	1	4	3	6	6	4	2	4	1	7	3	0	1	0	0	42
8.51-11.50	0	1	1	3	4	2	1	1	1	2	3	2	3	0	0	0	24
11.51-14.50	0	0	0	1	2	3	0	0	0	0	1	1	0	1	0	0	9
14.51-20.50	0	0	0	6	2	0	0	0	0	0	0	1	0	0	0	0	9
>20.50	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
TOTAL	5	8	20	20	18	16	8	9	23	18	23	15	4	7	4	4	202

STABILITY CLASS D

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
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	2	2	0	1	3	1	1	1	5	2	7	1	5	2	1	1	35
2.51- 3.50	3	4	8	4	3	1	2	5	9	9	12	10	7	5	1	7	90
3.51- 4.50	1	3	6	3	3	1	1	3	5	11	11	3	5	1	3	2	62
4.51- 5.50	2	1	1	2	3	1	1	0	5	13	5	2	0	4	2	3	45
5.51- 6.50	1	0	9	2	1	0	2	3	6	2	1	0	2	3	1	1	34
6.51- 8.50	1	1	3	3	1	5	2	2	3	6	9	3	1	1	1	2	44
8.51-11.50	0	0	1	5	6	7	2	0	0	3	6	3	3	4	2	0	42
11.51-14.50	0	0	0	5	9	3	0	0	0	3	4	1	0	2	0	0	27
14.51-20.50	0	0	2	6	10	0	0	0	0	1	1	1	1	0	0	0	22
>20.50	0	0	0	0	3	0	0	0	0	0	0	0	2	1	0	0	6
TOTAL	10	11	30	31	42	19	11	14	33	50	56	24	26	23	11	16	407

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR 4TH QTR88
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 10/ 1/88 - 12/31/88

*** 4TH QUARTER 1988 ***

STABILITY CLASS E

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
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	2	1	3	1	0	0	2	1	3	2	3	2	2	3	3	2	30
2.51- 3.50	3	2	1	1	1	1	1	1	1	5	4	2	7	9	6	4	49
3.51- 4.50	2	4	3	0	1	1	0	1	1	8	4	1	5	2	4	2	39
4.51- 5.50	4	5	0	0	1	0	0	1	2	4	5	5	1	1	2	0	31
5.51- 6.50	1	2	2	1	1	0	0	1	0	8	9	3	2	1	2	0	33
6.51- 8.50	0	1	5	0	0	2	2	2	0	4	10	4	3	2	0	0	35
8.51-11.50	0	4	8	3	3	1	4	1	1	4	7	3	2	7	2	0	50
11.51-14.50	0	0	5	5	9	3	2	1	0	1	1	0	2	2	3	0	34
14.51-20.50	0	0	5	7	4	0	0	2	0	0	0	1	2	2	0	0	23
>20.50	0	0	0	0	5	0	0	0	0	0	0	0	0	1	0	0	6
TOTAL	12	19	32	18	25	8	11	11	8	36	44	21	26	30	23	8	332

STABILITY CLASS F

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
0.76- 1.50	0	0	1	0	0	1	1	0	0	0	1	0	0	0	0	0	4
1.51- 2.50	1	2	2	0	2	0	0	0	1	1	0	3	2	11	3	6	34
2.51- 3.50	8	1	0	2	1	1	0	1	1	2	5	6	8	9	8	12	65
3.51- 4.50	5	5	3	0	1	0	0	1	1	3	7	4	7	7	3	9	56
4.51- 5.50	9	5	1	1	0	1	0	1	0	2	7	10	1	3	3	9	53
5.51- 6.50	4	4	2	1	0	0	0	0	1	3	6	1	3	0	8	1	34
6.51- 8.50	3	7	0	1	1	0	0	0	0	10	9	2	2	3	3	2	43
8.51-11.50	0	1	1	3	0	0	0	1	1	1	2	1	0	0	0	1	12
11.51-14.50	0	0	4	1	1	0	0	0	0	0	0	0	0	1	0	0	7
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	30	25	14	10	6	3	1	4	5	22	37	27	23	34	28	40	309

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR 4TH QTR88
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 10/ 1/88 - 12/31/88

*** 4TH QUARTER 1988 ***

STABILITY CLASS G

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
0.76- 1.50	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	1	4
1.51- 2.50	13	6	1	0	1	0	1	0	0	3	3	4	12	15	19	19	97
2.51- 3.50	46	19	12	6	3	1	0	1	0	4	11	9	13	19	34	69	247
3.51- 4.50	77	30	5	6	0	0	0	0	1	2	3	4	3	8	27	72	238
4.51- 5.50	51	24	8	3	0	0	1	0	0	2	2	3	2	3	12	29	140
5.51- 6.50	28	19	3	0	0	0	0	0	1	0	1	0	0	1	1	13	67
6.51- 8.50	13	12	1	1	0	0	0	0	0	0	0	0	0	0	1	4	32
8.51-11.50	6	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	10
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	234	113	31	17	4	1	2	1	2	11	21	20	30	47	94	207	835

STABILITY CLASS ALL

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
0.76- 1.50	0	0	1	1	0	1	1	0	0	0	3	0	0	1	1	1	10
1.51- 2.50	18	11	6	2	6	1	4	2	9	8	13	10	21	31	26	28	196
2.51- 3.50	60	27	22	15	9	5	4	8	11	20	33	28	36	43	50	94	465
3.51- 4.50	88	43	22	12	7	2	1	9	9	26	28	12	20	19	39	86	423
4.51- 5.50	66	36	16	7	6	3	3	3	11	26	25	27	4	12	20	42	307
5.51- 6.50	36	29	23	10	3	5	5	6	24	22	23	6	7	7	12	15	233
6.51- 8.50	17	22	19	20	13	20	8	7	9	22	37	13	7	7	5	8	234
8.51-11.50	6	9	15	18	17	13	7	5	3	14	20	11	11	12	4	1	166
11.51-14.50	0	0	9	12	25	9	2	1	0	6	9	2	4	8	4	0	91
14.51-20.50	0	0	7	22	16	0	0	2	2	4	1	3	3	2	0	0	62
>20.50	0	0	0	1	9	0	0	0	0	0	0	0	2	2	0	0	14
TOTAL	291	177	140	120	111	59	35	43	78	148	192	112	115	144	161	275	2201

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR 4TH QTR88
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 10/ 1/88 - 12/31/88

*** 4TH QUARTER 1988 ***

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 MPH

TOTAL NUMBER OF OBSERVATIONS: 2208
TOTAL NUMBER OF VALID OBSERVATIONS: 2201
TOTAL NUMBER OF MISSING OBSERVATIONS: 7
PERCENT DATA RECOVERY FOR THIS PERIOD: 99.7 %
MEAN WIND SPEED FOR THIS PERIOD: 5.7 MPH
TOTAL NUMBER OF OBSERVATIONS WITH BACKUP DATA: 0

PERCENTAGE OCCURRENCE OF STABILITY CLASSES

A	B	C	D	E	F	G
0.95	4.32	9.18	18.49	15.08	14.04	37.94

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	3	2	1	2	0	0	1	5	2	2	2	0	0	0	0
B	0	0	10	22	15	10	2	4	6	6	9	3	4	3	1	0	0
C	5	8	20	20	18	16	8	9	23	18	23	15	4	7	4	4	0
D	10	11	30	31	42	19	11	14	33	50	56	24	26	23	11	16	0
E	12	19	32	18	25	8	11	11	8	36	44	21	26	30	23	8	0
F	30	25	14	10	6	3	1	4	5	22	37	27	23	34	28	40	0
G	234	113	31	17	4	1	2	1	2	11	21	20	30	47	94	207	0
TOTAL	291	177	140	120	111	59	35	43	78	148	192	112	115	144	161	275	0

Table B3

JFDs of 35-Foot Wind Versus Delta T

July - December 1988

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR QTRS3&4 OF 1988
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/88 - 12/31/88

*** 3RD & 4TH QTRS 1988 ***

STABILITY CLASS A

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
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	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	3
6.51- 8.50	0	0	2	0	1	3	1	0	0	2	4	5	0	1	0	0	19
8.51-11.50	0	0	0	1	4	2	0	1	3	7	25	18	6	0	0	0	67
11.51-14.50	0	1	0	0	2	0	0	0	0	6	7	2	2	0	0	0	20
14.51-20.50	0	0	0	4	3	0	0	0	3	4	3	1	0	0	0	0	18
>20.50	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	3
TOTAL	0	2	3	5	11	5	1	1	8	20	39	26	8	1	0	0	130

STABILITY CLASS B

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
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	1	0	0	0	0	0	0	0	0	0	0	0	0	1
3.51- 4.50	0	0	3	2	1	0	0	1	0	0	0	0	1	0	0	0	8
4.51- 5.50	0	0	1	0	1	0	1	1	0	1	1	3	0	1	1	0	11
5.51- 6.50	0	1	1	3	1	2	2	2	4	2	6	0	0	1	0	0	25
6.51- 8.50	0	0	4	14	10	12	7	3	11	12	18	13	11	1	0	0	116
8.51-11.50	0	0	4	5	14	3	1	2	2	9	22	14	8	2	1	0	87
11.51-14.50	0	0	0	2	6	0	0	0	0	2	8	1	0	3	1	0	23
14.51-20.50	0	0	0	5	5	0	0	0	1	1	1	0	0	0	0	0	13
>20.50	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
TOTAL	0	1	13	32	38	17	11	9	18	28	56	31	20	8	.3	0	285

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR QTRS3&4 OF 1988
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/88 - 12/31/88

*** 3RD & 4TH QTRS 1988 ***

STABILITY CLASS C

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
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	1	1	1	1	1	1	1	0	0	1	1	1	1	1	3	15
3.51- 4.50	3	2	3	1	1	0	1	6	2	4	3	0	0	1	2	1	30
4.51- 5.50	1	1	8	1	2	3	6	3	14	17	10	11	1	1	2	2	83
5.51- 6.50	3	3	6	7	0	5	2	9	23	22	11	5	0	3	0	1	100
6.51- 8.50	0	1	5	5	11	9	8	4	11	12	25	9	4	3	1	1	109
8.51-11.50	0	1	2	4	13	2	1	1	2	4	11	7	4	1	0	0	53
11.51-14.50	0	0	0	1	5	3	0	0	0	0	5	3	0	1	0	0	18
14.51-20.50	0	0	0	10	7	0	0	0	0	2	1	1	0	1	0	0	22
>20.50	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	3
TOTAL	7	9	25	31	42	23	19	24	52	61	67	37	10	12	6	8	433

STABILITY CLASS D

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
0.76- 1.50	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
1.51- 2.50	3	3	1	2	3	2	1	4	5	3	8	1	5	3	5	2	51
2.51- 3.50	5	7	10	6	4	5	7	6	15	14	19	11	11	9	2	10	141
3.51- 4.50	3	5	10	4	6	5	2	9	24	23	22	10	8	2	7	5	145
4.51- 5.50	3	6	2	7	5	3	2	7	22	29	21	9	3	10	4	3	136
5.51- 6.50	3	0	11	5	4	5	2	6	16	16	16	3	7	6	1	3	104
6.51- 8.50	2	4	6	4	2	10	5	6	10	17	30	11	6	2	2	6	123
8.51-11.50	3	2	5	12	9	15	3	0	3	8	22	20	5	5	2	1	115
11.51-14.50	2	1	0	11	14	6	0	0	1	4	15	5	0	2	0	1	62
14.51-20.50	0	3	3	13	12	0	1	2	2	5	8	2	1	1	0	1	54
>20.50	0	0	0	1	6	0	0	0	0	2	0	0	2	1	0	0	12
TOTAL	24	32	48	65	65	51	23	40	98	121	161	72	48	41	24	32	945

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR QTRS3&4 OF 1988
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/88 - 12/31/88

*** 3RD & 4TH QTRS 1988 ***

STABILITY CLASS E

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
0.76- 1.50	0	1	1	0	0	0	0	0	0	2	1	0	0	0	1	0	6
1.51- 2.50	7	4	5	2	1	1	3	1	5	2	5	5	11	8	5	6	71
2.51- 3.50	8	6	2	3	2	3	3	1	5	8	10	8	10	13	14	7	103
3.51- 4.50	9	6	5	2	2	3	1	1	1	12	15	11	13	5	6	12	104
4.51- 5.50	8	7	6	3	3	1	1	3	5	7	17	8	2	5	3	3	82
5.51- 6.50	5	7	2	2	3	3	2	2	1	12	16	10	6	5	3	2	81
6.51- 8.50	5	6	12	5	2	5	6	3	3	17	36	19	8	6	0	2	135
8.51-11.50	0	6	13	10	9	7	7	6	5	19	43	25	6	9	3	1	169
11.51-14.50	0	0	5	9	17	6	3	1	1	3	15	3	2	5	3	0	73
14.51-20.50	0	0	5	10	5	1	0	2	2	5	1	3	2	2	0	1	39
>20.50	0	0	0	0	5	0	1	0	0	0	0	0	0	1	0	0	7
TOTAL	42	43	56	46	49	30	27	20	28	87	159	92	60	59	38	34	870

STABILITY CLASS F

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
0.76- 1.50	1	0	1	1	0	1	1	0	0	0	1	2	0	1	2	0	11
1.51- 2.50	5	3	3	1	2	1	0	1	3	1	1	4	3	13	10	10	61
2.51- 3.50	15	2	1	2	3	2	1	1	2	5	9	9	13	16	16	23	120
3.51- 4.50	17	9	5	2	1	0	2	1	4	7	11	10	9	10	5	18	111
4.51- 5.50	13	11	3	2	1	1	0	3	0	4	12	13	4	6	4	12	89
5.51- 6.50	4	6	3	4	0	0	0	0	2	6	14	5	3	4	9	1	61
6.51- 8.50	4	11	5	3	2	0	0	0	0	15	30	8	5	3	5	2	93
8.51-11.50	0	1	5	6	3	0	0	2	4	5	12	2	0	0	1	1	42
11.51-14.50	0	0	5	2	1	0	0	0	0	0	0	0	0	1	1	0	10
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	59	43	31	24	13	5	4	8	15	43	90	53	37	54	53	67	599

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR QTRS3&4 OF 1988
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/88 - 12/31/88

*** 3RD & 4TH QTRS 1988 ***

STABILITY CLASS G

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
0.76- 1.50	0	0	0	1	0	0	0	0	0	0	1	0	0	2	0	3	7
1.51- 2.50	24	8	2	0	1	0	1	1	0	3	5	8	16	16	25	22	132
2.51- 3.50	61	24	15	9	3	3	0	1	0	5	12	12	20	21	45	84	315
3.51- 4.50	112	40	12	6	1	0	0	0	2	4	4	5	9	9	36	87	327
4.51- 5.50	72	31	10	3	0	0	1	0	0	3	4	4	2	4	18	35	187
5.51- 6.50	37	30	5	0	1	0	0	0	1	0	2	1	0	2	1	16	96
6.51- 8.50	15	19	2	2	0	0	0	0	0	0	3	0	0	0	1	6	48
8.51-11.50	6	6	6	1	0	0	0	0	0	0	0	0	0	0	0	0	19
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	327	158	52	22	6	3	2	2	3	15	31	30	47	54	126	253	1131

STABILITY CLASS ALL

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
0.76- 1.50	1	2	2	2	0	1	1	0	0	2	3	2	0	3	4	3	26
1.51- 2.50	39	18	11	5	7	4	5	7	13	9	19	18	35	40	45	40	315
2.51- 3.50	89	40	29	22	13	14	12	10	22	32	51	41	55	60	78	127	695
3.51- 4.50	144	62	38	17	12	8	6	18	33	50	55	36	40	27	56	123	725
4.51- 5.50	97	56	30	16	12	8	11	17	41	61	65	48	12	27	32	55	588
5.51- 6.50	52	48	29	21	10	15	8	19	47	58	65	24	16	21	14	23	470
6.51- 8.50	26	41	36	33	28	39	27	16	35	75	146	65	34	16	9	17	643
8.51-11.50	9	16	35	39	52	29	12	12	19	52	135	86	29	17	7	3	552
11.51-14.50	2	2	10	25	45	15	3	1	2	15	50	14	4	12	5	1	206
14.51-20.50	0	3	8	43	32	1	1	4	8	17	14	7	3	4	0	2	147
>20.50	0	0	0	2	13	0	1	0	2	4	0	0	2	2	0	0	26
TOTAL	459	288	228	225	224	134	87	104	222	375	603	341	230	229	250	394	4393

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR QTRS3&4 OF 1988
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/88 - 12/31/88

*** 3RD & 4TH QTRS 1988 ***

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 MPH

TOTAL NUMBER OF OBSERVATIONS: 4416
TOTAL NUMBER OF VALID OBSERVATIONS: 4393
TOTAL NUMBER OF MISSING OBSERVATIONS: 23
PERCENT DATA RECOVERY FOR THIS PERIOD: 99.5 %
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
2.96	6.49	9.86	21.51	19.80	13.64	25.75

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	2	3	5	11	5	1	1	8	20	39	26	8	1	0	0	0
B	0	1	13	32	38	17	11	9	18	28	56	31	20	8	3	0	0
C	7	9	25	31	42	23	19	24	52	61	67	37	10	12	6	8	0
D	24	32	48	65	65	51	23	40	98	121	161	72	48	41	24	32	0
E	42	43	56	46	49	30	27	20	28	87	159	92	60	59	38	34	0
F	59	43	31	24	13	5	4	8	15	43	90	53	37	54	53	67	0
G	327	158	52	22	6	3	2	2	3	15	31	30	47	54	126	253	0
TOTAL	459	288	228	225	224	134	87	104	222	375	603	341	230	229	250	394	0

Table B4

JFDs of 35-Foot Wind Versus Delta T

January - December 1988

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR 1988 ANNUAL PERIOD
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 1/ 1/88 - 12/31/88

*** 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: 0.75 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
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	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	3
6.51- 8.50	0	0	2	0	1	3	2	0	0	2	6	6	0	1	0	0	23
8.51-11.50	0	1	1	2	8	2	0	2	6	15	39	21	9	2	1	0	109
11.51-14.50	0	1	0	0	2	0	1	0	2	17	28	7	4	4	2	5	73
14.51-20.50	0	0	0	4	6	0	0	0	3	16	26	2	2	14	4	5	82
>20.50	0	0	0	0	0	0	0	0	3	2	4	2	3	0	0	1	15
TOTAL	0	3	4	6	18	5	3	2	14	52	103	38	18	21	7	11	305

STABILITY CLASS B

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
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	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
3.51- 4.50	0	0	3	2	1	0	0	1	0	0	0	0	1	0	0	0	8
4.51- 5.50	0	0	2	1	1	0	1	1	2	4	1	3	0	2	1	0	19
5.51- 6.50	0	5	2	3	1	5	4	3	8	3	10	1	0	1	1	1	48
6.51- 8.50	2	3	6	16	16	16	8	3	18	27	31	17	14	3	0	1	181
8.51-11.50	1	1	6	5	20	8	3	2	7	27	40	21	12	2	3	0	158
11.51-14.50	0	3	0	3	9	0	0	0	4	6	11	5	0	4	5	0	50
14.51-20.50	0	0	0	5	8	0	0	0	1	6	6	1	0	3	0	3	33
>20.50	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	3
TOTAL	3	13	19	36	56	29	16	10	40	74	100	48	28	15	10	5	502

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR 1988 ANNUAL PERIOD
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 1/ 1/88 - 12/31/88

*** 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: 0.75 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
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	1	0	0	0	0	0	0	0	0	0	0	0	0	1
2.51- 3.50	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	3	16
3.51- 4.50	3	3	3	1	3	0	3	7	5	6	6	1	2	2	2	1	48
4.51- 5.50	2	2	10	4	4	7	9	5	23	22	18	12	3	2	3	4	130
5.51- 6.50	5	4	9	10	6	8	4	17	33	34	22	17	2	3	2	1	177
6.51- 8.50	4	3	6	10	19	15	10	9	23	27	47	20	10	4	1	2	210
8.51-11.50	0	4	4	6	14	7	1	2	5	7	26	15	5	2	0	2	100
11.51-14.50	0	2	0	3	9	3	0	0	1	3	12	7	0	1	1	0	42
14.51-20.50	1	0	0	12	11	0	0	0	0	3	8	1	4	1	0	1	42
>20.50	0	0	0	1	2	0	0	0	0	1	0	0	0	0	0	0	4
TOTAL	15	19	33	49	69	41	28	41	91	103	140	74	27	16	10	14	770

STABILITY CLASS D

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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																	1
0.76- 1.50	0	1	0	0	1	0	1	0	0	0	0	0	0	0	2	0	5
1.51- 2.50	3	4	8	5	6	5	9	8	7	7	13	7	9	4	6	6	107
2.51- 3.50	12	20	19	17	20	16	15	19	37	40	32	20	22	13	14	23	339
3.51- 4.50	13	14	18	17	15	15	10	22	50	44	43	23	12	7	16	16	335
4.51- 5.50	9	11	12	26	14	12	13	15	49	61	42	20	8	14	9	11	326
5.51- 6.50	6	14	20	9	13	8	2	10	30	25	37	14	12	9	5	6	220
6.51- 8.50	7	11	14	9	12	13	7	6	16	26	49	21	12	6	5	10	224
8.51-11.50	5	4	8	21	18	19	4	0	4	16	36	35	11	7	4	2	194
11.51-14.50	2	2	1	15	29	11	0	1	4	9	24	12	3	7	2	4	126
14.51-20.50	1	3	4	15	18	0	2	2	5	13	23	7	6	10	1	4	114
>20.50	0	0	0	1	7	0	0	0	2	3	0	1	2	3	0	0	19
TOTAL	58	84	104	135	153	99	63	83	204	244	299	160	97	80	64	82	2010

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR 1988 ANNUAL PERIOD
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 1/ 1/88 - 12/31/88

*** 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: 0.75 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																	1
0.76- 1.50	1	1	1	0	0	0	0	0	0	6	1	0	2	0	1	2	15
1.51- 2.50	12	6	7	3	2	4	3	1	7	3	6	8	19	14	10	9	114
2.51- 3.50	20	20	10	6	2	3	6	2	8	13	12	13	12	24	26	17	194
3.51- 4.50	16	10	9	3	4	6	2	3	6	19	20	16	19	9	10	14	166
4.51- 5.50	14	9	7	4	5	3	3	5	12	18	28	17	8	6	7	8	154
5.51- 6.50	8	9	7	3	4	3	2	2	5	22	31	22	12	6	7	6	149
6.51- 8.50	11	7	17	11	3	5	8	9	9	38	51	30	13	9	2	6	229
8.51-11.50	0	6	16	14	11	10	8	9	7	36	70	60	21	15	9	6	298
11.51-14.50	2	2	7	10	21	7	4	1	12	12	39	7	6	14	9	2	155
14.51-20.50	2	1	5	10	7	1	0	2	6	13	10	6	3	17	4	2	89
>20.50	0	0	1	0	5	0	1	0	2	0	0	0	0	1	0	2	12
TOTAL	86	71	87	64	64	42	37	34	74	180	268	179	115	115	85	74	1576

STABILITY CLASS F

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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
0.76- 1.50	2	0	1	1	0	2	1	0	0	0	2	2	0	1	3	0	15
1.51- 2.50	12	7	7	2	2	3	2	1	3	2	2	13	6	20	18	14	114
2.51- 3.50	23	10	6	3	4	3	3	2	4	14	19	20	19	24	26	30	210
3.51- 4.50	31	23	6	4	2	0	2	4	10	12	22	16	15	22	19	37	225
4.51- 5.50	24	13	5	3	1	2	2	4	2	11	23	22	7	16	7	27	169
5.51- 6.50	13	9	7	5	0	0	0	0	4	11	24	12	11	13	13	11	133
6.51- 8.50	9	13	6	5	3	1	0	0	2	29	51	25	23	13	15	17	212
8.51-11.50	4	6	10	9	3	0	0	2	4	13	30	12	6	2	5	10	116
11.51-14.50	0	4	5	4	1	0	0	0	0	1	2	0	0	1	5	1	24
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	118	85	53	37	16	11	10	13	29	93	175	122	87	112	111	147	1219

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR 1988 ANNUAL PERIOD
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 1/ 1/88 - 12/31/88

*** 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: 0.75 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																	1
0.76- 1.50	1	2	0	2	0	0	0	0	1	1	1	0	3	5	2	6	24
1.51- 2.50	48	25	14	3	3	2	3	2	4	6	12	11	22	23	41	48	267
2.51- 3.50	152	74	31	18	9	10	3	2	4	12	17	22	29	35	80	149	647
3.51- 4.50	209	113	30	11	3	2	0	1	3	6	12	10	15	26	55	150	646
4.51- 5.50	130	101	24	8	2	0	2	1	0	5	9	6	6	5	29	64	392
5.51- 6.50	75	64	14	0	1	0	1	0	2	1	5	3	1	4	3	35	209
6.51- 8.50	39	38	11	2	0	0	0	0	0	3	4	0	0	0	5	18	120
8.51-11.50	11	21	7	2	0	0	0	0	0	0	6	0	0	0	0	4	51
11.51-14.50	1	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
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	666	446	131	46	18	14	9	6	14	34	66	52	76	98	215	474	2366

STABILITY CLASS ALL

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 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																	3
0.76- 1.50	4	4	2	3	1	2	2	0	1	7	4	2	5	6	8	8	59
1.51- 2.50	75	42	36	14	13	14	17	12	21	18	33	39	56	61	75	77	603
2.51- 3.50	207	126	67	46	36	33	28	26	54	79	81	76	83	97	147	222	1408
3.51- 4.50	272	163	69	38	28	23	17	38	74	87	103	66	64	66	102	218	1428
4.51- 5.50	179	136	60	46	27	24	30	31	88	121	121	80	32	45	56	114	1190
5.51- 6.50	107	106	60	30	26	24	13	32	82	96	129	69	38	36	31	60	939
6.51- 8.50	72	75	62	53	54	53	35	27	68	152	239	119	72	36	28	54	1199
8.51-11.50	21	43	52	59	74	46	16	17	33	114	247	164	64	30	22	24	1026
11.51-14.50	5	22	13	35	71	21	5	2	23	48	116	38	13	31	24	12	479
14.51-20.50	4	4	9	47	50	1	2	4	15	51	73	17	15	45	9	15	361
>20.50	0	0	1	2	14	0	1	0	7	7	5	3	6	4	0	3	53
TOTAL	946	721	431	373	394	241	166	189	466	780	1151	673	448	457	502	807	8748

PVNGS JFD: 35FT WIND VS DELTA T (200'-35') FOR 1988 ANNUAL PERIOD
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 1/ 1/88 - 12/31/88

*** ANNUAL ***

STABILITY BASED ON: DELTA T BETWEEN 200.0 AND 35.0 FEET
WIND MEASURED AT: 35.0 FEET
WIND THRESHOLD AT: 0.75 MPH

TOTAL NUMBER OF OBSERVATIONS: 8784
TOTAL NUMBER OF VALID OBSERVATIONS: 8748
TOTAL NUMBER OF MISSING OBSERVATIONS: 36
PERCENT DATA RECOVERY FOR THIS PERIOD: 99.6 %
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
3.49	5.74	8.80	22.98	18.02	13.93	27.05

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	3	4	6	18	5	3	2	14	52	103	38	18	21	7	11	0
B	3	13	19	36	56	29	16	10	40	74	100	48	28	15	10	5	0
C	15	19	33	49	69	41	28	41	91	103	140	74	27	16	10	14	0
D	58	84	104	135	153	99	63	83	204	244	299	160	97	80	64	82	1
E	86	71	87	64	64	42	37	34	74	180	268	179	115	115	85	74	1
F	118	85	53	37	16	11	10	13	29	93	175	122	87	112	111	147	0
G	666	446	131	46	18	14	9	6	14	34	66	52	76	98	215	474	1
TOTAL	946	721	431	373	394	241	166	189	466	780	1151	673	448	457	502	807	3

APPENDIX C

DOSE CALCULATIONS

GASEOUS EFFLUENT* DOSE CALCULATION

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 GASPAR computer program. Gaseous effluents were released from Units 1, 2 and 3 during the year 1988. 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. Strontium-89 and Strontium-90 were considered for the third quarter only since the fourth quarter results were not available. 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. GASPAR 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. The ingestion pathways considered were cow milk, goat milk, meat, and vegetables. 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 GASPAR code are described on page C8.

Table C1 presents the doses for the first two quarters and the first semi-annual period of 1988 for the highest exposed location on the site boundary, the maximum individual in the general public and the Visitor Center. The site boundary and residence locations for which data are presented represent the highest annual doses. An occupancy factor of 1.0 (implying continuous occupancy over the entire year) was considered for the Visitor Center and the exposure pathways considered to calculate its doses were plume, ground deposition, and inhalation.

Table C2 presents the population doses for the year 1988. Table C3 summarizes the individual doses and compares the result to PVNGS Technical Specification limits.

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 1988

SITE BOUNDARY 1.40 MILES SSW FROM UNIT 1, 1.14 MILES SSW FROM UNIT 2 AND 1.10 MILES SSW FROM UNIT 3

AIR DOSES(MRAD)	BETA	GAMMA
1ST QUARTER	1.05E+00	3.73E-01
2ND QUARTER	1.13E-01	5.05E-02
1ST SEMI-ANNUAL	1.17E+00	4.23E-01
3RD QUARTER	7.65E-02	5.38E-02
4TH QUARTER	1.16E-01	4.58E-02
2ND SEMI-ANNUAL	1.92E-01	9.95E-02
ANNUAL	1.36E+00	5.23E-01

MAXIMUM INDIVIDUAL(MREM)	T. BODY	SKIN
1ST QUARTER	2.20E-01	6.28E-01
2ND QUARTER	3.10E-02	8.16E-02
1ST SEMI-ANNUAL	2.51E-01	7.10E-01
3RD QUARTER	3.44E-02	7.64E-02
4TH QUARTER	2.76E-02	7.60E-02
2ND SEMI-ANNUAL	6.20E-02	1.52E-01
ANNUAL	3.13E-01	8.62E-01

MAXIMUM INDIVIDUAL IN GENERAL PUBLIC LOCATED AT A RESIDENCE 4.60 MILES S FROM UNIT 1, 4.50 MILES S FROM UNIT 2 AND 4.23 MILES S FROM UNIT 3

(MREM)	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
1ST QUARTER								
ADULT	1.05E-01	1.05E-01	9.16E-02	1.06E-01	1.06E-01	1.68E-01	1.05E-01	2.76E-01
TEEN	1.06E-01	1.06E-01	9.17E-02	1.06E-01	1.06E-01	1.82E-01	1.06E-01	2.76E-01
CHILD	1.04E-01	1.04E-01	9.18E-02	1.04E-01	1.04E-01	1.89E-01	1.04E-01	2.74E-01
INFANT	9.87E-02	9.86E-02	9.17E-02	9.88E-02	9.89E-02	1.76E-01	9.87E-02	2.69E-01
2ND QUARTER								
ADULT	4.12E-02	4.12E-02	1.35E-02	4.12E-02	4.12E-02	4.40E-02	4.13E-02	6.45E-02
TEEN	4.14E-02	4.14E-02	1.35E-02	4.14E-02	4.14E-02	4.48E-02	4.16E-02	6.47E-02
CHILD	3.81E-02	3.81E-02	1.35E-02	3.81E-02	3.81E-02	4.20E-02	3.83E-02	6.14E-02
INFANT	2.77E-02	2.77E-02	1.35E-02	2.77E-02	2.77E-02	3.12E-02	2.78E-02	5.10E-02
1ST SEMI-ANNUAL								
ADULT	1.47E-01	1.47E-01	1.05E-01	1.47E-01	1.47E-01	2.12E-01	1.47E-01	3.40E-01
TEEN	1.47E-01	1.47E-01	1.05E-01	1.47E-01	1.47E-01	2.27E-01	1.47E-01	3.41E-01
CHILD	1.42E-01	1.42E-01	1.05E-01	1.42E-01	1.42E-01	2.31E-01	1.42E-01	3.36E-01
INFANT	1.26E-01	1.26E-01	1.05E-01	1.27E-01	1.27E-01	2.08E-01	1.26E-01	3.20E-01
3RD QUARTER								
ADULT	4.45E-02	4.45E-02	1.10E-02	4.45E-02	4.45E-02	4.50E-02	4.45E-02	6.53E-02
TEEN	4.48E-02	4.48E-02	1.10E-02	4.48E-02	4.48E-02	4.54E-02	4.48E-02	6.56E-02
CHILD	4.09E-02	4.09E-02	1.10E-02	4.09E-02	4.09E-02	4.15E-02	4.09E-02	6.17E-02
INFANT	2.82E-02	2.82E-02	1.10E-02	2.82E-02	2.82E-02	2.87E-02	2.82E-02	4.89E-02
4TH QUARTER								
ADULT	7.35E-02	7.35E-02	2.06E-02	7.35E-02	7.35E-02	7.66E-02	7.35E-02	1.10E-01
TEEN	7.40E-02	7.39E-02	2.06E-02	7.40E-02	7.40E-02	7.76E-02	7.39E-02	1.10E-01
CHILD	6.77E-02	6.77E-02	2.06E-02	6.77E-02	6.77E-02	7.18E-02	6.77E-02	1.04E-01
INFANT	4.77E-02	4.77E-02	2.06E-02	4.77E-02	4.77E-02	5.14E-02	4.77E-02	8.40E-02
2ND SEMI-ANNUAL								
ADULT	1.18E-01	1.18E-01	3.15E-02	1.18E-01	1.18E-01	1.22E-01	1.18E-01	1.75E-01
TEEN	1.19E-01	1.19E-01	3.15E-02	1.19E-01	1.19E-01	1.23E-01	1.19E-01	1.76E-01
CHILD	1.09E-01	1.09E-01	3.15E-02	1.09E-01	1.09E-01	1.13E-01	1.09E-01	1.66E-01
INFANT	7.58E-02	7.58E-02	3.15E-02	7.59E-02	7.59E-02	8.01E-02	7.58E-02	1.33E-01
ANNUAL								
ADULT	2.65E-01	2.65E-01	1.37E-01	2.65E-01	2.65E-01	3.33E-01	2.65E-01	5.16E-01
TEEN	2.66E-01	2.66E-01	1.37E-01	2.66E-01	2.66E-01	3.50E-01	2.66E-01	5.16E-01
CHILD	2.51E-01	2.51E-01	1.37E-01	2.51E-01	2.51E-01	3.44E-01	2.51E-01	5.01E-01
INFANT	2.02E-01	2.02E-01	1.37E-01	2.02E-01	2.02E-01	2.88E-01	2.02E-01	4.53E-01

TABLE C1 (CONTINUED)

VISITOR'S CENTER LOCATED ONSITE 0.45 MILES WNW FROM UNIT 1, 0.42 MILES NW FROM UNIT2 AND 0.58 MILES NW FROM UNIT 3

(MREM)	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
1ST QUARTER								
ADULT	3.40E-02	3.40E-02	2.98E-02	3.40E-02	3.41E-02	5.54E-02	3.40E-02	8.82E-02
TEEN	3.40E-02	3.40E-02	2.98E-02	3.41E-02	3.42E-02	6.04E-02	3.41E-02	8.83E-02
CHILD	3.36E-02	3.35E-02	2.98E-02	3.36E-02	3.36E-02	6.28E-02	3.36E-02	8.78E-02
INFANT	3.19E-02	3.19E-02	2.98E-02	3.20E-02	3.20E-02	5.86E-02	3.19E-02	8.61E-02
2ND QUARTER								
ADULT	3.26E-02	3.26E-02	1.20E-02	3.26E-02	3.26E-02	3.48E-02	3.27E-02	5.17E-02
TEEN	3.28E-02	3.28E-02	1.20E-02	3.28E-02	3.28E-02	3.54E-02	3.29E-02	5.19E-02
CHILD	3.04E-02	3.04E-02	1.20E-02	3.04E-02	3.04E-02	3.33E-02	3.05E-02	4.94E-02
INFANT	2.26E-02	2.25E-02	1.20E-02	2.26E-02	2.26E-02	2.52E-02	2.26E-02	4.16E-02
1ST SEMI-ANNUAL								
ADULT	6.66E-02	6.66E-02	4.17E-02	6.67E-02	6.67E-02	9.03E-02	6.67E-02	1.40E-01
TEEN	6.68E-02	6.68E-02	4.17E-02	6.69E-02	6.69E-02	9.58E-02	6.70E-02	1.40E-01
CHILD	6.39E-02	6.39E-02	4.18E-02	6.40E-02	6.40E-02	9.61E-02	6.41E-02	1.37E-01
INFANT	5.45E-02	5.44E-02	4.17E-02	5.45E-02	5.45E-02	8.38E-02	5.46E-02	1.28E-01
3RD QUARTER								
ADULT	6.33E-02	6.33E-02	4.36E-02	6.33E-02	6.33E-02	6.37E-02	6.33E-02	1.09E-01
TEEN	6.35E-02	6.35E-02	4.36E-02	6.35E-02	6.35E-02	6.40E-02	6.35E-02	1.09E-01
CHILD	6.12E-02	6.12E-02	4.36E-02	6.12E-02	6.12E-02	6.17E-02	6.12E-02	1.07E-01
INFANT	5.37E-02	5.37E-02	4.36E-02	5.37E-02	5.37E-02	5.42E-02	5.37E-02	9.91E-02
4TH QUARTER								
ADULT	2.06E-02	2.06E-02	6.06E-03	2.06E-02	2.06E-02	2.16E-02	2.06E-02	3.12E-02
TEEN	2.07E-02	2.07E-02	6.06E-03	2.07E-02	2.07E-02	2.20E-02	2.07E-02	3.13E-02
CHILD	1.90E-02	1.90E-02	6.06E-03	1.90E-02	1.90E-02	2.04E-02	1.90E-02	2.96E-02
INFANT	1.35E-02	1.35E-02	6.06E-03	1.35E-02	1.35E-02	1.48E-02	1.35E-02	2.41E-02
2ND SEMI-ANNUAL								
ADULT	8.39E-02	8.39E-02	4.97E-02	8.39E-02	8.39E-02	8.53E-02	8.39E-02	1.40E-01
TEEN	8.41E-02	8.41E-02	4.97E-02	8.42E-02	8.42E-02	8.59E-02	8.41E-02	1.40E-01
CHILD	8.02E-02	8.02E-02	4.97E-02	8.02E-02	8.02E-02	8.21E-02	8.02E-02	1.36E-01
INFANT	6.72E-02	6.72E-02	4.97E-02	6.72E-02	6.72E-02	6.90E-02	6.72E-02	1.23E-01
ANNUAL								
ADULT	1.51E-01	1.51E-01	9.14E-02	1.51E-01	1.51E-01	1.76E-01	1.51E-01	2.80E-01
TEEN	1.51E-01	1.51E-01	9.14E-02	1.51E-01	1.51E-01	1.82E-01	1.51E-01	2.80E-01
CHILD	1.44E-01	1.44E-01	9.15E-02	1.44E-01	1.44E-01	1.78E-01	1.44E-01	2.73E-01
INFANT	1.22E-01	1.22E-01	9.14E-02	1.22E-01	1.22E-01	1.53E-01	1.22E-01	2.51E-01

TABLE C2

INTEGRATED POPULATION DOSES FOR JANUARY - DECEMBER 1988

PERSONREM

JANUARY 1 - JUNE 30 1988

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	6.34E-01	6.34E-01	6.34E-01	6.34E-01	6.34E-01	6.34E-01	6.34E-01	2.29E+00
GROUND	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.92E-03
INHAL	7.33E-01	7.32E-01	1.37E-03	7.34E-01	7.35E-01	1.27E+00	7.34E-01	7.32E-01
VEGET	2.21E+00	2.21E+00	3.25E-03	2.21E+00	2.22E+00	3.26E+00	2.21E+00	2.21E+00
COW MILK	3.03E-01	3.03E-01	4.25E-04	3.03E-01	3.03E-01	4.13E-01	3.03E-01	3.03E-01
MEAT	9.34E-02	9.34E-02	7.54E-06	9.34E-02	9.34E-02	9.36E-02	9.34E-02	9.34E-02
TOTAL	3.98E+00	3.98E+00	6.41E-01	3.98E+00	3.98E+00	5.67E+00	3.98E+00	5.63E+00
(a) PER CAPITA DOSE (REM)	2.21E-06	2.21E-06	3.57E-07	2.21E-06	2.21E-06	3.16E-06	2.21E-06	3.13E-06

JULY 1 - SEPTEMBER 30 1988

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.42E-01	1.42E-01	1.42E-01	1.42E-01	1.42E-01	1.42E-01	1.42E-01	5.28E-01
GROUND	2.77E-05	2.77E-05	2.77E-05	2.77E-05	2.77E-05	2.77E-05	2.77E-05	3.23E-05
INHAL	7.30E-01	7.30E-01	2.27E-05	7.30E-01	7.30E-01	7.38E-01	7.30E-01	7.30E-01
VEGET	1.73E+00	1.73E+00	6.13E-05	1.73E+00	1.73E+00	1.75E+00	1.73E+00	1.73E+00
COW MILK	3.03E-01	3.03E-01	1.24E-05	3.03E-01	3.03E-01	3.05E-01	3.03E-01	3.03E-01
MEAT	7.03E-02	7.03E-02	2.80E-07	7.03E-02	7.03E-02	7.03E-02	7.03E-02	7.03E-02
TOTAL	2.98E+00	2.98E+00	1.42E-01	2.98E+00	2.98E+00	3.00E+00	2.98E+00	3.37E+00
(a) PER CAPITA DOSE (REM)	1.66E-06	1.66E-06	7.91E-08	1.66E-06	1.66E-06	1.67E-06	1.66E-06	1.88E-06

OCTOBER 1 - DECEMBER 31 1988

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.05E-01	2.05E-01	2.05E-01	2.05E-01	2.05E-01	2.05E-01	2.05E-01	7.05E-01
GROUND	3.56E-06	3.56E-06	3.56E-06	3.56E-06	3.56E-06	3.56E-06	3.56E-06	4.32E-06
INHAL	9.47E-01	9.47E-01	1.12E-04	9.47E-01	9.47E-01	9.94E-01	9.46E-01	9.46E-01
VEGET	2.98E+00	2.98E+00	1.29E-04	2.98E+00	2.98E+00	3.03E+00	2.98E+00	2.98E+00
COW MILK	3.95E-01	3.95E-01	1.65E-05	3.95E-01	3.95E-01	4.01E-01	3.95E-01	3.95E-01
MEAT	1.49E-01	1.49E-01	2.49E-08	1.49E-01	1.49E-01	1.49E-01	1.49E-01	1.49E-01
TOTAL	4.67E+00	4.67E+00	2.05E-01	4.67E+00	4.67E+00	4.78E+00	4.67E+00	5.17E+00
(a) PER CAPITA DOSE (REM)	2.60E-06	2.60E-06	1.14E-07	2.60E-06	2.60E-06	2.66E-06	2.60E-06	2.88E-06

(a) Personrem divided by 50-mile population of 1,796,000

TABLE C2 (CONTINUED)

PERSONREM

JULY 1 - DECEMBER 31 1988

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.47E-01	3.47E-01	3.47E-01	3.47E-01	3.47E-01	3.47E-01	3.47E-01	1.23E+00
GROUND	3.12E-05	3.12E-05	3.12E-05	3.12E-05	3.12E-05	3.12E-05	3.12E-05	3.67E-05
INHAL	1.68E+00	1.68E+00	1.35E-04	1.68E+00	1.68E+00	1.73E+00	1.68E+00	1.68E+00
VEGET	4.71E+00	4.71E+00	1.90E-04	4.71E+00	4.71E+00	4.78E+00	4.71E+00	4.71E+00
COW MILK	6.98E-01	6.98E-01	2.88E-05	6.98E-01	6.98E-01	7.07E-01	6.98E-01	6.98E-01
MEAT	2.19E-01	2.19E-01	3.05E-07	2.19E-01	2.19E-01	2.19E-01	2.19E-01	2.19E-01
TOTAL	7.65E+00	7.65E+00	3.48E-01	7.65E+00	7.65E+00	7.78E+00	7.65E+00	8.54E+00
(a) PER CAPITA DOSE (REM)	4.26E-06	4.26E-06	1.94E-07	4.26E-06	4.26E-06	4.33E-06	4.26E-06	4.76E-06

JANUARY 1 - DECEMBER 31 1988

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	9.81E-01	9.81E-01	9.81E-01	9.81E-01	9.81E-01	9.81E-01	9.81E-01	3.52E+00
GROUND	1.67E-03	1.67E-03	1.67E-03	1.67E-03	1.67E-03	1.67E-03	1.67E-03	1.96E-03
INHAL	2.41E+00	2.41E+00	1.51E-03	2.41E+00	2.42E+00	3.00E+00	2.41E+00	2.41E+00
VEGET	6.92E+00	6.92E+00	3.44E-03	6.92E+00	6.93E+00	8.04E+00	6.92E+00	6.92E+00
COW MILK	1.00E+00	1.00E+00	4.54E-04	1.00E+00	1.00E+00	1.12E+00	1.00E+00	1.00E+00
MEAT	3.12E-01	3.12E-01	7.85E-06	3.12E-01	3.12E-01	3.13E-01	3.12E-01	3.12E-01
TOTAL	1.16E+01	1.16E+01	9.89E-01	1.16E+01	1.16E+01	1.35E+01	1.16E+01	1.42E+01
(a) PER CAPITA DOSE (REM)	6.46E-06	6.46E-06	5.51E-07	6.46E-06	6.46E-06	7.52E-06	6.46E-06	7.91E-06

(a) Personrem divided by 50-mile population of 1,796,000

Table C3
SUMMARY OF INDIVIDUAL DOSES FOR JANUARY - DECEMBER 1988*

	Unit	Quarter #1	Quarter #2
Gamma Air Dose T.S. 3.11.2.2 Limit % T.S. Limit	mrad mrad %	3.73E-01 5.00E+00 7.46E+00	5.05E-02 5.00E+00 1.01E+00
Beta Air Dose T.S. 3.11.2.2 Limit % T.S. Limit	mrad mrad %	1.05E+00 1.00E+01 1.05E+01	1.13E-01 1.00E+01 1.13E+00
Maximum Organ Dose (neglecting skin) T.S. 3.11.2.3 Limit % T.S. Limit	 mrem mrem %	 1.82E-01** 7.50E+00 2.43E+00	 4.48E-02** 7.50E+00 5.97E-01

	Unit	Quarter #3	Quarter #4	Total for 1988
Gamma Air Dose T.S. 3.11.2.2 Limit % T.S. Limit	mrad mrad %	5.38E-02 5.00E+00 1.08E+00	4.58E-02 5.00E+00 9.16E-01	5.23E-01 1.00E+01 5.23E+00
Beta Air Dose T.S. 3.11.2.2 Limit % T.S. Limit	mrad mrad %	7.65E-02 1.00E+01 7.65E-01	1.16E-01 1.00E+01 1.16E+00	1.36E+00 2.00E+01 6.80E+00
Maximum Organ Dose (neglecting skin) T.S. 3.11.2.3 Limit % T.S. Limit	 mrem mrem %	 4.54E-02** 7.50E+00 6.05E-01	 7.76E-02** 7.50E+00 1.03E+00	 3.50E-01 1.50E+01 2.33E+00

*From Table C1.

**These control location doses are imparted via three principal atmospheric pathways: plume,ground exposure and inhalation. The highest organ dose is to the teenager's thyroid resulting from exposure in the South Sector at 4.60, 4.50 and 4.23 miles from Units 1, 2, and 3, respectively. Technical Specification 3.11.4 has higher limits than Technical Specification 3.11.2.3 and therefore the percent of limits are more conservative based on Technical Specification 3.11.2.3 than on Technical Specification 3.11.4.

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 semi-annual period are the summation of the quarterly doses. Additional input to GASPAR includes the following site-specific data:

- 0 to 5 mile land use census conducted in December 1988. The following changes in land use were identified between December 1987 and December 1988: addition of three gardens, the first located in the east-northeast sector at 2.7 miles from Unit 2, the second in the north sector at 1.7 miles from Unit 2 and the third in the northeast sector at 5.0 miles from Unit 2; deletion of a residence in the south sector at 2.8 miles from Unit 2 and one in the south-southeast sector at 4.5 miles from Unit 2.

- 0 to 5 mile population distribution based on the land use census conducted June-August, 1984.

- 5 to 50 mile population distribution from PVNGS ER-OL Figure 2.1-6.

- The population distribution of metropolitan Phoenix greater than 50 miles from PVNGS, based on the 1980 census results, was conservatively included in the 40 to 50 mile sectors.

- Absolute humidity of 6.0 g/m^3 from PVNGS ER-OL Table 2.3-34.

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

- The fraction of daily feed derived from pasture while on pasture and length of grazing season for milk animals beyond 5 miles (0.35 and 0.75) from PVNGS ER-OL Section 2.1.3.4.

- The only milk animal (goats) located within 5 miles from PVNGS was fed fifty percent on stored feed and the other fifty percent on pasture grass during 1988, based on the land use census conducted in December 1988.

- The fraction of daily feed derived from pasture while on pasture and length of grazing season for meat animals (0.05 and 0.25) from PVNGS ER-OL Section 2.1.3.4.

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

APPENDIX D

CHANGE PAGES TO PALO VERDE NUCLEAR GENERATING STATION, UNITS 1, 2 AND 3. SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT, JANUARY 1, 1988 THROUGH JUNE 30, 1988

This Appendix contains the revised portions of the first semi-annual effluent release report for 1988 that were affected by a change in the release amount of tritium from Unit 1 during the second quarter. Tables D1 and D2 reflect the corrected release amount and correspond to Tables A2 and A3, respectively of the first semi-annual report for 1988. Tables D3 and D4 present the corrected doses and correspond to Tables C1 and C3, respectively of the first semi-annual report for 1988. The corrected population doses for the first semi-annual period are presented in Table C2 in Appendix C of this report.

Table D1
PVNGS UNIT 1 1988
REVISED GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

	Unit	Quarter #1	Quarter #2	Est. Total Error%*
A. Fission & activation gases				
1. Total release	Ci	2.72E+01	6.16E+02	3.97E+01
2. Average release rate for period	µCi/sec	3.46E+00	7.84E+01	
3. Percent of technical specification limit	%	NA**	NA**	
B. Iodines				
1. Total Iodine-131	Ci	1.33E-04	8.29E-04	2.93E+01
2. Average release rate for period	µCi/sec	1.69E-05	1.05E-04	
3. Percent of technical specification limit	%	NA**	NA**	
C. Particulates				
1. Particulates with half-lives >8 days	Ci	1.75E-04	7.03E-05	2.93E+01
2. Average release rate for period	µCi/sec	2.23E-05	8.94E-06	
3. Percent of technical specification limit	%	NA**	NA**	
4. Gross Alpha radioactivity	Ci	<LLD	<LLD	
D. Tritium				
1. Total release	Ci	5.43E+00	2.13E+02	4.22E+01
2. Average release rate for period	µCi/sec	6.91E-01	2.71E+01	
3. Percent of technical specification limit	%	NA**	NA**	

*Estimated total error methodology is presented in Table A8.
**See Table C3 for percent of technical specification limits.

Table D2
PVNGS UNIT 1 1988
REVISED GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

Nuclides Released	Unit	CONTINUOUS MODE Quarter #1	CONTINUOUS MODE Quarter #2	BATCH MODE Quarter #1	BATCH MODE Quarter #2
1. Fission gases					
Argon 41	Ci	*	*	3.88E-02	2.13E-01
Krypton-85	Ci	<LLD	<LLD	8.52E-02	3.30E+00
Krypton-85m	Ci	<LLD	3.59E-01	1.03E-02	5.02E-02
Krypton-87	Ci	<LLD	<LLD	<LLD	7.21E-04
Krypton-88	Ci	<LLD	<LLD	7.20E-03	2.77E-02
Xenon-131m	Ci	*	*	*	2.15E+00
Xenon-133	Ci	2.28E+00	2.54E+02	1.81E+01	3.25E+02
Xenon-133m	Ci	<LLD	<LLD	2.74E-01	2.19E+00
Xenon-135	Ci	6.17E+00	2.78E+01	2.47E-01	1.24E+00
Xenon-135m	Ci	<LLD	<LLD	<LLD	<LLD
Xenon-138	Ci	<LLD	<LLD	<LLD	<LLD
Unidentified	Ci	**	**	**	**
Total for period	Ci	8.45E+00	2.82E+02	1.88E+01	3.34E+02
2. Iodines					
Iodine-131	Ci	1.29E-04	7.73E-04	3.67E-06	5.57E-05
Iodine-133	Ci	2.68E-04	7.82E-06	2.02E-06	1.07E-05
Iodine-135	Ci	<LLD	<LLD	<LLD	<LLD
Total for period	Ci	3.97E-04	7.81E-04	5.69E-06	6.64E-05
3. Particulates					
Antimony-124	Ci	5.83E-06	1.37E-06	1.19E-05	*
Barium-140	Ci	<LLD	5.31E-06	2.32E-07	<LLD
Bromine-82	Ci	*	*	3.15E-06	2.18E-05
Cerium-141	Ci	<LLD	<LLD	<LLD	<LLD
Cerium-144	Ci	8.50E-06	<LLD	<LLD	<LLD

Table D2 (Continued)
PVNGS UNIT 1 1988
REVISED GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

Nuclides Released	Unit	CONTINUOUS MODE Quarter #1	CONTINUOUS MODE Quarter #2	BATCH MODE Quarter #1	BATCH MODE Quarter #2
3. Particulates (continued)					
Cesium-134	Ci	<LLD	1.57E-05	4.37E-06	2.00E-09
Cesium-137	Ci	<LLD	3.13E-05	6.92E-06	1.28E-07
Cobalt-58	Ci	3.32E-05	4.77E-06	8.32E-06	1.28E-08
Cobalt-60	Ci	4.19E-05	4.60E-06	4.01E-05	1.41E-08
Iron-59	Ci	2.01E-06	<LLD	<LLD	2.51E-08
Lanthanum-140	Ci	<LLD	<LLD	<LLD	<LLD
Manganese-54	Ci	3.33E-06	6.64E-07	3.65E-06	<LLD
Molybdenum-99	Ci	<LLD	<LLD	<LLD	<LLD
Niobium-95	Ci	3.46E-06	3.87E-06	*	*
Rubidium-88	Ci	*	*	1.32E-04	3.18E-03
Ruthenium-103	Ci	1.15E-06	*	*	*
Strontium-89	Ci	<LLD	<LLD	**	**
Strontium-90	Ci	<LLD	<LLD	**	**
Tin-117m	Ci	5.61E-07	6.65E-07	*	*
Tritium	Ci	<LLD	9.60E+01	5.43E+00	1.17E+02
Zinc-65	Ci	<LLD	<LLD	<LLD	<LLD
Zirconium-95	Ci	*	1.82E-06	*	*
Unidentified	Ci	**	**	**	**
Total for period	Ci	9.99E-05	9.60E+01	5.43E+00	1.17E+02

*Not detected
**Not applicable

TABLE D3

REVISED DOSES TO SPECIAL LOCATIONS FOR JANUARY-JUNE 1988

SITE BOUNDARY 1.40 MILES SSW FROM UNIT 1, 1.14 MILES SSW FROM UNIT 2 AND 1.10 MILES SSW FROM UNIT 3

	BETA	GAMMA
AIR DOSES(MRAD)		
1ST QUARTER	1.05E+00	3.73E-01
2ND QUARTER	1.13E-01	5.05E-02
1ST SEMI-ANNUAL	1.17E+00	4.23E-01

	T. BODY	SKIN
MAXIMUM INDIVIDUAL(MREM)		
1ST QUARTER	2.20E-01	6.28E-01
2ND QUARTER	3.10E-02	8.16E-02
1ST SEMI-ANNUAL	2.51E-01	7.10E-01

MAXIMUM INDIVIDUAL IN GENERAL PUBLIC LOCATED AT A RESIDENCE 2.96 MILES S FROM UNIT 1, 2.80 MILES S FROM UNIT 2 AND 2.64 MILES S FROM UNIT 3

(MREM)	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
1ST QUARTER								
ADULT	1.59E-01	1.59E-01	1.38E-01	1.59E-01	1.59E-01	2.54E-01	1.59E-01	4.15E-01
TEEN	1.59E-01	1.59E-01	1.38E-01	1.59E-01	1.60E-01	2.76E-01	1.59E-01	4.15E-01
CHILD	1.57E-01	1.56E-01	1.39E-01	1.57E-01	1.57E-01	2.87E-01	1.57E-01	4.13E-01
INFANT	1.49E-01	1.49E-01	1.38E-01	1.49E-01	1.49E-01	2.68E-01	1.49E-01	4.05E-01
2ND QUARTER								
ADULT	6.05E-02	6.06E-02	2.03E-02	6.05E-02	6.06E-02	6.48E-02	6.07E-02	9.49E-02
TEEN	6.07E-02	6.07E-02	2.03E-02	6.07E-02	6.07E-02	6.60E-02	6.10E-02	9.51E-02
CHILD	5.61E-02	5.61E-02	2.04E-02	5.61E-02	5.61E-02	6.19E-02	5.63E-02	9.05E-02
INFANT	4.09E-02	4.09E-02	2.03E-02	4.09E-02	4.09E-02	4.62E-02	4.11E-02	7.53E-02
1ST SEMI-ANNUAL								
ADULT	2.19E-01	2.19E-01	1.59E-01	2.20E-01	2.20E-01	3.19E-01	2.20E-01	5.10E-01
TEEN	2.20E-01	2.20E-01	1.59E-01	2.20E-01	2.20E-01	3.42E-01	2.20E-01	5.10E-01
CHILD	2.13E-01	2.13E-01	1.59E-01	2.13E-01	2.13E-01	3.49E-01	2.13E-01	5.03E-01
INFANT	1.90E-01	1.90E-01	1.59E-01	1.90E-01	1.90E-01	3.14E-01	1.90E-01	4.80E-01

Table D4
REVISED SUMMARY OF INDIVIDUAL DOSES FOR JANUARY - JUNE 1988*

	Unit	Quarter #1	Quarter #2	Year to Date
Gamma Air Dose	mrad	3.73E-01	5.05E-02	4.23E-01
T.S. 3.11.2.2 Limit	mrad	5.00E+00	5.00E+00	1.00E+01
% T.S. Limit	%	7.46E+00	1.01E+00	4.23E+00
Beta Air Dose	mrad	1.05E+00	1.13E-01	1.17E+00
T.S. 3.11.2.2 Limit	mrad	1.00E+01	1.00E+01	2.00E+01
% T.S. Limit	%	1.05E+01	1.13E+00	5.85E+00
Maximum Organ Dose (neglecting skin)	mrem	2.87E-01**	6.19E-02**	3.49E-01**
T.S. 3.11.2.3 Limit	mrem	7.50E+00	7.50E+00	1.50E+01
% T.S. Limit	%	3.83E+00	8.25E-01	2.33E+00

*From Table D3.

**These control location doses are imparted via three principal atmospheric pathways: plume,ground exposure and inhalation. The highest organ dose is to the child's thyroid resulting from exposure in the South Sector at 2.96, 2.80 and 2.64 miles from Units 1, 2, and 3, respectively. Technical Specification 3.11.4 has higher limits than Technical Specification 3.11.2.3 and therefore the percent of limits are more conservative based on Technical Specification 3.11.2.3 than on Technical Specification 3.11.4.

APPENDIX E

REVISED OFFSITE DOSE CALCULATION MANUAL (ODCM)

CONTROLLED BY USER

OFFSITE DOSE CALCULATION MANUAL
PALO VERDE NUCLEAR GENERATING STATION
UNITS 1, 2 AND 3

Originator PAUL GENOA Date 10-20-88

Tech. Reviewer KEVIN KUTNER Date 12-22-88

Mgr. Radiation Protection & Chemistry Date 28 Dec 88

Effective Date 01-01-89

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PVNGS #________

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OFFSITE DOSE CALCULATION MANUAL

PALO VERDE NUCLEAR GENERATING STATION

UNITS 1, 2 AND 3

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OFFSITE DOSE CALCULATION MANUAL

PALO VERDE NUCLEAR GENERATING STATION

UNITS 1, 2 AND 3

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1.0 INTRODUCTION

The purpose of the Offsite Dose Calculation Manual (ODCM) is to provide the parameters and methodology to be used in calculating offsite doses and effluent monitor setpoints at the Palo Verde Nuclear Generating Station (PVNGS) for Unit 1, Unit 2, and Unit 3. Included are methods for determining air dose from beta and gamma radiation, and organ dose at the controlling location due to plant effluents, to assure compliance with the dose limitations in the Technical Specifications. Methods are included for performing dose projections to assure compliance with the gaseous treatment system operability sections of the Technical Specifications. This manual, in addition to Regulatory Guide 1.109, includes the methods used for determining quarterly individual doses for inclusion in Semiannual Radioactive Effluent Release Reports.

1.1 Liquid Effluent Pathways

Dose calculation methodology for liquid effluents is not included in this manual because of the desert location of the plant and the hydrology of the area. PVNGS is located in the drainage basin of the Centennial Wash, which flows southeasterly into the Gila River. Surface water flows near the site area are intermittent and of short duration because the flows are caused by storm runoff, usually occurring in August and September and from December to April. Surface water bodies, such as ponds, lakes, and marshes, are not present in the area offsite because of the arid climate, the geological character of surficial materials, and the high potential evaporation rate.

The groundwater in the site area consists of an extensive regional aquifer and a local perched-water zone. The regional aquifer extends to over 400 square miles. The primary recharge source to the regional aquifer is underflow from the Upper Hassayampa Valley to the north. The general flow direction is

north to south. Infiltration of precipitation, surface runoff, and return flow from irrigation constitute a small portion of the total recharge of the aquifer. Discharge of the aquifer occurs as underflow to Arlington Valley to the south and pumpage from irrigation wells (the major use of groundwater in the area).

Contaminated water, if accidentally spilled during plant operation, may seep through the ground surface. For this postulated occurrence, the contaminated water will infiltrate downward through the unsaturated soil and reach the perched water table about 40 feet below the land surface. It will then disperse into the perched groundwater. Further downward movement of water from the base of the perched water zone is restricted due to the presence of the Palo Verde Clay layer about 200 feet below the ground surface. Two aquifer systems have been analyzed for the possible effect of a contaminated water spill: the perched water zone and the underlying regional aquifer. The impact of such postulated accidental seepages on the groundwater system, and in particular on the existing wells located in the 5-mile zone around the site area has been calculated and analyzed in Section 2.4.13.3 of the PVNGS FSAR. It is shown that the resultant concentrations of the refueling water tank source-term radionuclides are well below the MPC_w values listed in 10 CFR 20, Appendix B, Table II. Therefore, no methods for calculating doses due to the liquid have been included.

If geological conditions, surface, or groundwater sources change in the future, or if plant operating conditions become such that the likelihood of a liquid effluent pathway increases, then dose calculation methodology for this pathway will be added to this manual.

1.2 Gaseous Effluent Pathways

All gaseous effluents are treated as ground level releases and are considered to be "long-term" as discussed in NUREG-0133, Section 3.3, page 8. This includes the containment purge and gaseous decay tank releases as well as the normal ventilation system and condenser vacuum exhaust releases. All releases are either greater than 500 hours in duration or are made at random, not depending upon atmospheric conditions or time of day. The releases are lumped together and calculated as an entity. The historical annual average X/Q is therefore used throughout this manual for all gaseous effluent set-point and dose calculations. Airborne releases are further subdivided into two subclasses:

1.2.1 Iodine - 131, Iodine - 133, Tritium and Radionuclides in Particulate Form with Half-lives Greater than Eight Days

In this model, a controlling location is identified for assessing the maximum exposure to a MEMBER OF THE PUBLIC for the various pathways and to critical organs. Infant exposure occurs through inhalation and any actual milk pathway. Child, teenager and adult exposure derives from inhalation, consumed vegetation pathways, and any actual milk and meat pathways. Dose to each of the seven organs listed in Regulatory Guide 1.109 (bone, liver, total body, thyroid, kidney, lung and GI-LLI) are computed from individual nuclide contributions in each sector. The largest of the organ doses in any sector is compared to 10 CFR 50, Appendix I design objectives. This dose calculation is performed monthly for all age groups. The release rates of these nuclides will be converted to instantaneous dose rates for comparison to the limits of 10 CFR 20.

1.2.2 Noble Gases

The air dose from both the beta and gamma radiation component of the noble gases will be assessed and compared to the 10 CFR 50, Appendix I design objectives. The noble gas release rate will be converted to instantaneous dose rates for comparison to the limits of 10 CFR 20.

This manual discusses the methodology to be used in determining effluent monitor alarm/trip setpoints to be used to assure compliance with the instantaneous release rate limits of Technical Specification 3.11.2.1. Methods are described for determining the annual cumulative dose to a MEMBER OF THE PUBLIC, from gaseous effluents and direct radiation for critical organs, to assure compliance with Technical Specification 3.11.4.

The Radiological Environmental Monitoring Program is described in this manual; also included is the Annual Land Use Census Survey.

The ODCM will be maintained for use as a document of acceptable methodologies and calculations to be used in implementing the Technical Specifications. Changes will be incorporated into the ODCM in accordance with Technical Specification 6.14.

1.3 Nuisance Pathways

This section addresses the potential release pathways which should not contribute more than 10% of the doses evaluated in this manual. Table 1-1 lists examples of potential release pathways. The doses from these nuisance pathways will periodically be evaluated to ensure that they do not contribute more than 10% of the doses evaluated in this manual. If any nuisance pathway exceeds this limit then the ODCM methodology for calculation of doses will be applied to each applicable release pathway.

TABLE 1-1

NUISANCE PATHWAYS
(EXAMPLES)

Evaporation Pond
Cooling Towers
Laundry/Decon Building Exhaust
Unmonitored Secondary System Steam Vents/Reliefs
Turbine Building Ventilation Exhaust
Unmonitored Tank Atmospheric Vents
Dry Active Waste Processing and Storage (DAWPS) Building
Respirator Cleaning Facility
Secondary Side Decontamination Equipment

2.0 GASEOUS EFFLUENT MONITOR SETPOINTS

Technical Specification 3.3.3.8 - The radioactive gaseous effluent monitoring instrumentation channels shown in Table 3.3-12 [of the Technical Specifications] shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Specification 3.11.2.1 are not exceeded. The alarm/trip setpoints of these channels shall be determined and adjusted in accordance with the methodology and parameters in the ODCM.

The general methodology for establishing low range gaseous effluent monitor setpoints is based upon a site release rate limit in uCi/sec derived from site specific meteorological dispersion conditions, radioisotopic distribution, and whole body and skin dose factors. The high alarm of the low range monitors will alarm/trip when the release rate from an individual vent will result in exceeding Technical Specification 3.11.2.1. 80% of Technical Specification 3.11.2.1 limits is considered to be the site release rate limit. The site release rate limit will be allocated among the licensed units' release points. The unit release rate limit will then be utilized for the determination of gaseous effluent monitor setpoints. A fraction of the unit release rate limit is then allotted to each release point and its monitor alert setpoint (uCi/cc) is derived using actual or fan design flow rates.

Administrative values are used to reduce each setpoint to account for the potential activity in other releases. These administrative values shall be reviewed based on actual release data.

For the purpose of implementation of Technical Specification 3.3.3.8, the alarm setpoint levels for low range effluent noble gas monitors are established to ensure that personnel are alerted when the noble gas releases approach the total body dose rate of 500 mrem/yr and 3000 mrem/yr skin dose (Technical Specification 3.11.2.1). The equations in Section 3.0 of this manual provide the methodology for calculating the gaseous effluent dose rate.

The evaluation of doses due to releases of radioactive material can be simplified by the use of equivalent dose factors as defined in Section 2.1.

The equivalent dose factors will be evaluated periodically to assure that the best information on isotopic distribution is being used for the dose equivalent value.

2.1 Equivalent Dose Factor Determination

The equivalent whole body dose factor is calculated as follows:

$$K_{eq} = \Sigma_i \; [(K_i)(f_i)] \qquad (2\text{-}1)$$

Where:

K_{eq} = the equivalent whole body dose factor weighted by historical radionuclide distribution in releases.

K_i = the whole body dose factor due to gamma emissions for each identified noble gas radionuclide i, in mrem/yr per uCi/m^3 from Table 3-1.

f_i = the fraction of noble gas radionuclide i in the total noble gas radionuclide mix.

The equivalent skin dose factor is calculated as follows:

$$(L+1.1M)_{eq} = \Sigma_i [(L_i + 1.1M_i)(f_i)] \qquad (2\text{-}2)$$

Where:

$(L+1.1M)_{eq}$ = the equivalent skin dose factor due to beta and gamma emissions from all noble gases released, weighted by the historical radionuclide distribution in releases.

L_i = the skin dose factor due to the beta emissions for each identified noble gas radionuclide i, in mrem/yr per uCi/m³ from Table 3-1.

M_i = the air dose factor due to gamma emissions for each identified noble gas radionuclide i, in mrad/yr per uCi/m³ from Table 3-1.

f_i = the fraction of noble gas radionuclide i in the total noble gas radionuclide mix.

2.2 Site Release Rate Limit ($\dot{Q}_{SITE}$)

The release rates corresponding to 80% of the whole body (Q_{WB}) and skin (Q_{SK}) dose rate limits are calculated using the equivalent dose factors defined in Section 2.1. The site release rate limit ($\dot{Q}_{SITE}$) is the lower of Q_{WB} or Q_{SK}, thus assuring that the more restrictive dose rate limit will not be exceeded.

The Q_{SITE} is established as follows:

$$\dot{Q}_{SITE}, WB = \frac{(\dot{D}_{WB})}{(K_{eq})} \frac{(0.8)}{(X/Q)_{SBW}} \quad (2\text{-}3)$$

Where:

$\dot{Q}_{SITE,WB}$ = the site release rate, in uCi/sec, that would deliver a dose rate 80% of the whole body dose rate limit, $\dot{D}_{WB}$.

$\dot{D}_{WB}$ = whole body dose rate limit of 500 mrem/yr.

K_{eq} = equivalent whole body dose factor, in mrem/yr per uCi/m³ weighted by the historical radionuclide distribution.

$(X/Q)_{SBW}$ = $8.91X10^{-6}$, the highest calculated annual average dispersion parameter, in sec/m³, at the Site Boundary for any of the 3 units, from Table 3-2.

0.8 = administrative factor to provide conservatism to compensate for any unexpected variability in the radionuclide mix and to ensure that Site Boundary dose rate limits will not be exceeded.

$$\dot{Q}_{SITE,SK} = \frac{(\dot{D}_{SK})}{(L+1.1M)_{eq}} \; \frac{(0.8)}{(X/Q)_{SBW}} \qquad (2\text{-}4)$$

Where:

$\dot{Q}_{SITE,SK}$ = the site release rate limit, in uCi/sec, that would deliver a dose rate 80% of the skin dose rate limit, $\dot{D}_{SK}$.

$\dot{D}_{SK}$ = skin dose rate limit of 3000 mrem/yr.

$(L+1.1M)_{eq}$	=	equivalent skin dose factor, in mrem/yr per uCi/m³, weighted by the radionuclide distribution.
$(X/Q)_{SBW}$	=	$8.91X10^{-6}$, the highest calculated annual average dispersion parameter, in sec/m³, at the Site Boundary for any of the three units, from Table 3-2.
0.8	=	administrative factor to provide conservatism to compensate for any unexpected variability in the radionuclide mix and to ensure that Site Boundary dose rate limits will not be exceeded.

After determination of the $\dot{Q}_{SITE}$ whole body and skin dose rates (equations 2-3 and 2-4, respectively), the most conservative result will be used as $\dot{Q}_{SITE}$, the site release rate limit.

2.3 Unit Release Rate Limits ($\dot{Q}_{UNIT}$)

Typically $\dot{Q}_{SITE}$ will be divided equally among operating units. If operational history dictates a larger fraction of the $\dot{Q}_{SITE}$ be assigned to a specific unit then a weighted average of each unit's contribution to the $\dot{Q}_{SITE}$ will be utilized to determine the $\dot{Q}_{UNIT}$.

$$\dot{Q}_{UNIT} = (f_{UNIT})\ (\dot{Q}_{SITE}) \qquad (2\text{-}5)$$

where:

$\dot{Q}_{UNIT}$ = unit release rate limit, in uCi/sec.

f_{UNIT} = the fraction ($\leq$ 1) of noble gas historically released from a specific operating unit to the total of all noble gas released from the site.

Q_{SITE} = the site release rate limit, in uCi/sec determined in section 2.2 of this manual.

2.4 Setpoint Determination

To comply with Technical Specification 3.3.3.8, the alarm/trip setpoints can now be established using the unit release rate limit (Q_{UNIT}) to ensure that the noble gas releases do not exceed the dose rate limits.

To allow for multiple sources of releases from different or common release points, the effluent monitor setpoint includes an administrative factor which allocates a percentage of the unit release rate limit to each of the release sources. Monitor setpoints will also be adjusted in accordance with Station Manual Procedures to account for monitor-specific characteristics.

2.4.1 Monitors RU-141, RU-143, and RU-145

The alarm/trip setpoint for Monitors RU-141, RU-143, and RU-145 is calculated as follows:

$$\text{Monitor Setpoint (uCi/cc)} \leq \frac{(\text{QUNIT})\ (a)}{(471.9)\ (\text{Flow Rate})} \qquad (2\text{-}6)$$

Where:

Monitor Setpoint = the setpoint for the effluent monitor, in uCi/cc, which provides a safe margin of assurance that the allowable dose rate limits will not be exceeded.

$\dot{Q}_{UNIT}$ = unit release rate limit, in uCi/sec, as determined in Section 2.3.

Flow Rate = the flow rate, in cfm, from flow rate monitors or the fan design flow rate for the release source under consideration.

471.9 = conversion factor, cubic centimeter/second per cubic feet/minute.

a = fraction of Q_{UNIT} allocated for a specific release point. The sum of these administrative values will be less than or equal to one.

2.4.2 <u>Monitor RU-12</u>

The alarm/trip setpoint for Monitor RU-12, the Waste Gas Decay Tank Monitor, is calculated as follows:

$$\text{Monitor Setpoint} \quad (\text{uCi/cc}) \leq \frac{[(\dot{Q}_{UNIT})(a)(0.9)] - [(H)(PF)(471.9)]}{(\text{Flow Rate})(471.9)} \qquad (2\text{-}7)$$

where:

Monitor Setpoint = the setpoint for the monitor, in uCi/cc at STP, which provides a safe margin of assurance that the allowable dose rate limits will not be exceeded.

$\dot{Q}_{UNIT}$ = unit release rate limit, in uCi/sec, as determined in Section 2.3.

Flow Rate = flow rate, in cfm at STP at which the tank will be released.

PF = the current process flow of the plant vent in CFM.

H = the current plant vent monitor concentration in uCi/cc.

a = fraction of $\dot{Q}_{UNIT}$ allocated for a specific release point. This administrative value should be equal to or less than the administrative value used for the Plant Vent.

0.9 = an administrative value to account for potential increases in activity from other contributors to the same release point.

471.9 = conversion factor, cubic centimeter/second per cubic feet/minute.

If there is no release associated with this monitor, the monitor setpoint should be established as close as practical to background to prevent spurious alarms, and yet assure an alarm should an inadvertent release occur.

2.5 Monitor Calibration

The calibration factor for each monitor is entered into the Radiation Monitoring System Database and may change whenever the monitor is calibrated. Calibration is performed in accordance with Station Manual Procedures. The calibration factor may vary with detector age and equipment changes.

The typical calibration conversion factor for the Plant Vent Airborne Monitor (RU-143), Condenser Evacuation Monitor (RU-141), and Fuel Building Vent Exhaust (RU-145) is based on the detector energy response curve (Figure 2-1) and the FSAR source term.

The typical calibration conversion factor for the Waste Gas Decay Tank Monitor (RU-12) is based on the detector energy response curve (Figure 2-2) and the FSAR source term decayed for forty five (45) days.

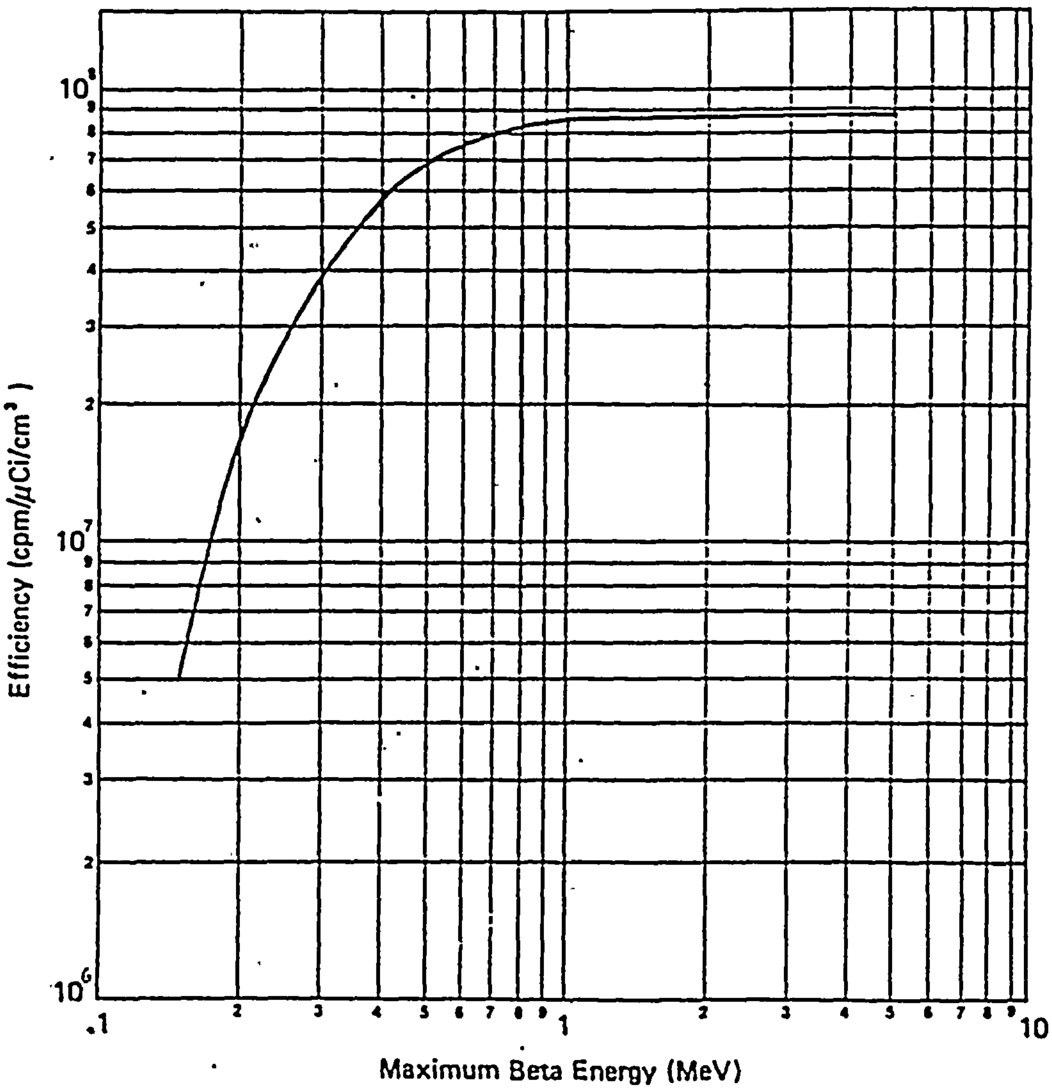


FIGURE 2-1

CALIBRATION CURVE FOR PVNGS EFFLUENT MONITORS RU-141, RU-143, AND RU-145. RESPONSE TO NOBLE GAS

Reference: Kaman Instrumentation Corporation Calibration Report K-82-50-U(R)

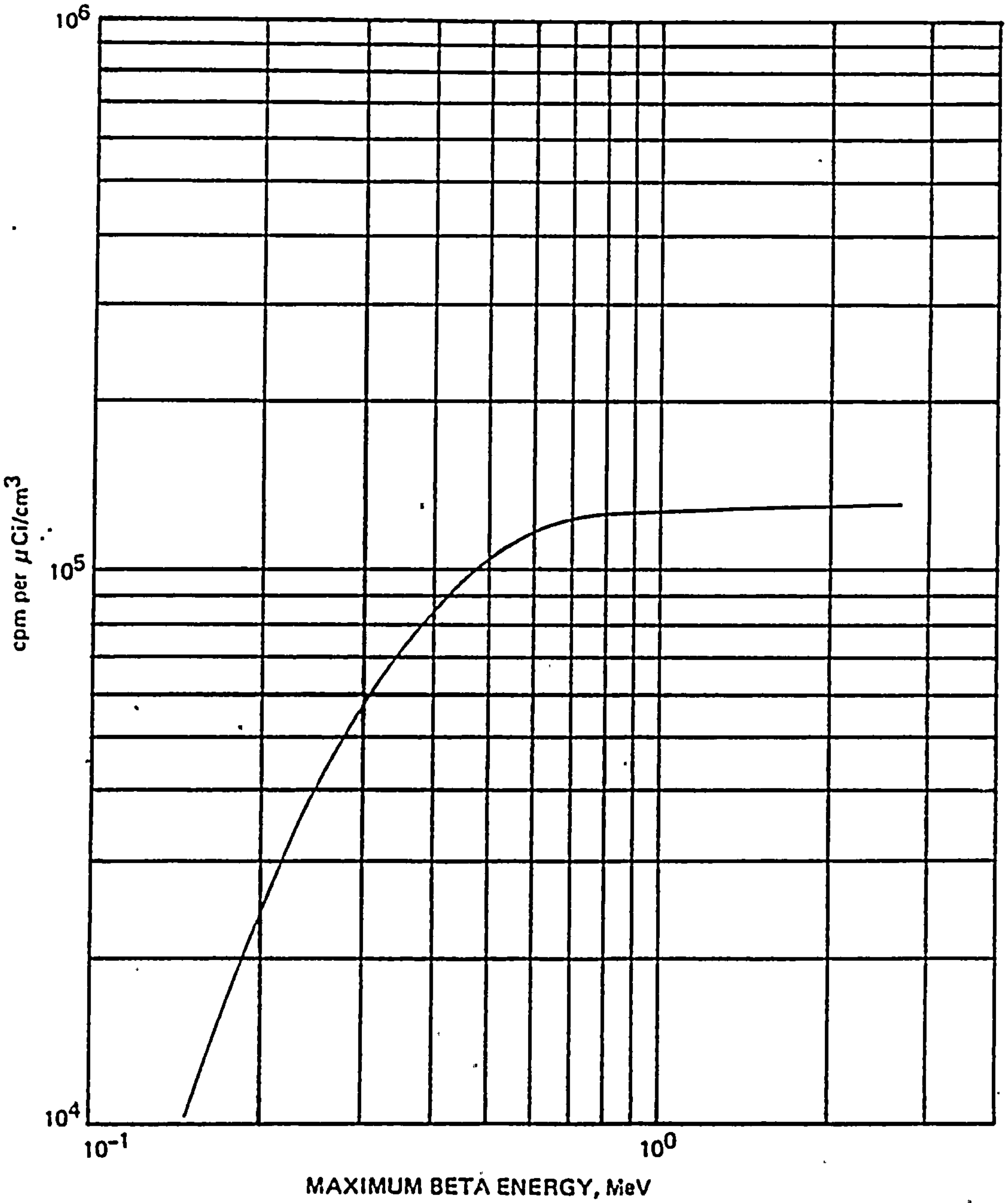


FIGURE 2-2

CALIBRATION CURVE FOR PVNGS MONITOR RU-12.
RESPONSE to NOBLE GAS

Reference: Kaman Instrumentation Corporation Calibration Report K-83-30-U(R)

3.0 GASEOUS EFFLUENT DOSE RATE

Technical Specification 3.11.2.1 - The dose rate due to radioactive materials released in gaseous effluents from the site (see [Technical Specification] Figures 5.1-1 and 5.1-3) 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 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 mrems/yr to any organ.

3.1 Noble Gases

Noble gas activity monitor setpoints are established at release rates which permit some margin for corrective action to be taken before exceeding offsite dose rates corresponding to the 10 CFR 20 annual dose limits as described in Section 2.0. The methods for sampling and analysis of continuous and batch effluent releases are given in the Station Manual Procedures. The dose rate in unrestricted areas shall be determined using the following equations.

For whole body dose rate:

$$\dot{D}_{WB} = \Sigma_i \left[(K_i) \, (X/Q)_{SBW} \, (\dot{Q}_i) \right] \qquad (3\text{-}1)$$

For skin dose rate:

$$\dot{D}_{SK} = \Sigma_i \left[(L_i + 1.1 M_i) \, (X/Q)_{SBW} \, (\dot{Q}_i) \right] \qquad (3\text{-}2)$$

Where:

K_i	=	the whole body dose factor due to gamma emissions for each identified noble gas radionuclide i, in mrem/yr per uCi/m³ from Table 3-1.
$\dot{Q}_i$	=	the release rate of radionuclide i, in uCi/sec.
$(X/Q)_{SBW}$	=	8.91×10^{-6}, the highest calculated annual average dispersion parameter, in sec/m³, for any of the three units, from Table 3-2.
$\dot{D}_{WB}$	=	the annual whole body dose rate (mrem/yr.).
L_i	=	the skin dose factor due to the beta emissions for each identified noble gas radionuclide i, in mrem/yr per uCi/m³ from Table 3-1.
M_i	=	the air dose factor due to gamma emissions for each identified noble gas radionuclide i, in mrad/yr per uCi/m³ from Table 3-1 (conversion constant of 1.1 converts air dose-mrad to skin dose-mrem).
$\dot{D}_{SK}$	=	the annual skin dose rate (mrem/yr).

3.2 Radionuclides Other Than Noble Gases

The methods for sampling and analysis of continuous and batch releases for I-131, I-133, tritium and radionuclides in particulate form with half-lives greater than 8 days, are given in the applicable plant procedures. Additional monthly and quarterly analyses shall be performed in accordance with Table 4.11-2 of the PVNGS Technical Specifications. The total organ dose rate in unrestricted areas shall be determined by the following equation:

$$\dot{D}_o = \Sigma_i \, [(P_i)(X/Q)_{SBW} \, (\dot{Q}_i)] \qquad (3\text{-}3)$$

Where:

P_i = the dose factor, in mrem/yr per uCi/m^3, for radionuclide i, for the child inhalation pathway, from Table 3-3.

$(X/Q)_{SBW}$ = 8.91×10^{-6}, the highest calculated annual average dispersion parameter, in sec/m^3, at the Site Boundary, for any of the three units,

$\dot{Q}_i$ = the release rate of radionuclide i, in uCi/sec

$\dot{D}_o$ = the total organ dose rate (mrem/yr).

TABLE 3-1

DOSE FACTORS FOR NOBLE GASES AND DAUGHTERS[a]

Radionuclide	Whole Body Dose Factor K_i (mrem/yr per uCi/m³)	Skin Dose Factor L_i (mrem/yr per uCi/m³)	Gamma Air Dose Factor M_i (mrad/yr per uCi/m³)	Beta Air Dose Factor N_i (mrad/yr per uCi/m³)
Kr-83m	7.56E-02[b]	---	1.93E+01	2.88E+02
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

[a] The listed dose factors are for noble gases that may be detected in gaseous effluents.

[b] 7.56E-02 = 7.56×10^{-2}.

Reference: Regulatory Guide 1.109, Table B-1.

TABLE 3-2
(Sheet 1 of 3)

PALO VERDE NUCLEAR GENERATING STATION DISPERSION AND DEPOSITION PARAMETERS FOR LONG TERM RELEASES AT THE SITE BOUNDARY CENTERED ON UNIT 1

DIRECTION	DISTANCE (METERS)	X/Q (SEC/m^3)	D/Q (m^{-2})
N	1037	4.93 E-06[a]	9.24 E-09
NNE	1057	4.14 E-06	1.19 E-08
NE	2206	2.84 E-06	6.84 E-09
ENE	1967	2.51 E-06	4.43 E-09
E	1927	2.56 E-06	3.24 E-09
ESE	1967	2.61 E-06	2.46 E-09
SE	2049	3.56 E-06	2.36 E-09
SSE	2730	3.80 E-06	1.58 E-09
S	3006	5.07 E-06	1.78 E-09
SSW	2258	6.52 E-06	3.20 E-09
SW	1487	7.47 E-06	5.65 E-09
WSW	1251	4.52 E-06	5.93 E-09
W	1225	4.73 E-06	9.49 E-09
WNW	1244	3.76 E-06	6.76 E-09
NW	1254	3.43 E-06	5.87 E-09
NNW	1069	3.70 E-06	7.26 E-09

(a) 4.93 E-06 = 4.93×10^{-6}

Reference: Distances are from the PVNGS ER-OL, Table 2.3-33. Dispersion and Deposition parameters are from a September, 1985, calculation by NUS Corporation based on 9 years of meteorological data; NUS Corporation letter NUS-ANPP-1386, dated October 4, 1985.

TABLE 3-2
(Sheet 2 of 3)

PALO VERDE NUCLEAR GENERATING STATION DISPERSION AND DEPOSITION PARAMETERS FOR LONG TERM RELEASES AT THE SITE BOUNDARY CENTERED ON UNIT 2

DIRECTION	DISTANCE (METERS)	X/Q (SEC/m^3)	D/Q (m^{-2})
N	1318	3.85 E-06	6.17 E-09
NNE	1342	3.18 E-06	7.93 E-09
NE	2545	2.42 E-06	5.34 E-09
ENE	2206	2.22 E-06	3.64 E-09
E	2163	2.27 E-06	2.66 E-09
ESE	2067	2.32 E-06	2.11 E-09
SE	2101	3.47 E-06	2.26 E-09
SSE	3026	3.43 E-06	1.32 E-09
S	2699	5.16 E-06	1.97 E-09
SSW	1836	7.90 E-06	4.56 E-09
SW	1208	7.72 E-06	6.88 E-09
WSW	1014	5.55 E-06	8.44 E-09
W	993	5.86 E-06	1.34 E-08
WNW	1010	4.67 E-06	9.60 E-09
NW	1191	3.62 E-06	6.40 E-09
NNW	1342	2.85 E-06	4.87 E-09

Reference: Distances are from the PVNGS ER-OL, Table 2.3-33. Dispersion and Deposition parameters are from a September, 1985, calculation by NUS Corporation based on 9 years of meteorological data; NUS Corporation letter NUS-ANPP-1386, dated October 4, 1985.

TABLE 3-2
(Sheet 3 of 3)

PALO VERDE NUCLEAR GENERATING STATION DISPERSION AND DEPOSITION PARAMETERS FOR LONG TERM RELEASES AT THE SITE BOUNDARY CENTERED ON UNIT 3

DIRECTION	DISTANCE (METERS)	X /Q (SEC/m³)	D/Q (m⁻²)
N	1661	3.54 E-06	4.86 E-09
NNE	1693	2.86 E-06	6.23 E-09
NE	2756	2.21 E-06	4.65 E-09
ENE	2337	2.08 E-06	3.30 E-09
E	2290	2.14 E-06	2.41 E-09
ESE	2023	2.37 E-06	2.10 E-09
SE	2256	3.24 E-06	2.00 E-09
SSE	2786	3.72 E-06	1.52 E-09
S	2346	5.90 E-06	2.51 E-09
SSW	1607	8.91 E-06	5.73 E-09
SW	1057	8.68 E-06	8.61 E-09
WSW	889	5.34 E-06	8.83 E-09
W	871	6.72 E-06	1.67 E-08
WNW	885	5.37 E-06	1.19 E-08
NW	1045	4.17 E-06	7.98 E-09
NNW	1561	2.93 E-06	4.58 E-09

Reference: Distances are from the PVNGS ER-OL, Table 2.3-33. Dispersion and Deposition parameters are from a September, 1985, calculation by NUS Corporation based on 9 years of meteorological data; NUS Corporation letter NUS-ANPP-1386, dated October 4, 1985.

TABLE 3-3

P_i Values for the

Palo Verde Nuclear Generating Station

Isotope	Inhalation Pathway [a] (mrem/yr/uCi/m^3)
H 3	1.12E+03[b]
Cr 51	1.70E+04
Mn 54	1.57E+06
Fe 59	1.27E+06
Co 58	1.10E+06
Co 60	7.06E+06
Zn 65	9.94E+05
Sr 89	2.15E+06
Sr 90	1.01E+08
Zr 95	2.23E+06
Sb 124	3.24E+06
I 131	1.62E+07
I 133	3.84E+06
Cs 134	1.01E+06
Cs 137	8.24E+05
Ba 140	1.74E+06
Ce 141	5.43E+05
Ce 144	1.19E+07

[a] Child receptor

[b] 1.12E+03 = 1.12 x 10^3

References: NUREG-0133, Section 5.2.1.1 (Calculation of P_i (inhalation))
Regulatory Guide 1.109, Table E-5, Table E-9.
NUS Corporation letter NUS-ANPP-1385, dated 9/26/85.

4.0 DOSE DUE TO GASEOUS EFFLUENT

4.1 Noble Gases

Technical Specification 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 [Technical Specification] Figures 5.1-1 and 5.1-3) 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.

The air dose in unrestricted areas beyond the site boundary due to noble gases released in gaseous effluents from each unit during any specified time period shall be determined by the following equations:

For gamma radiation:

$$D_{\gamma u} = (3.17 \times 10^{-8}) \cdot \Sigma_i \left[(M_i)(\chi/Q)_{SBu}(Q_i)\right] \qquad (4\text{-}1)$$

For beta radiation:

$$D_{\beta u} = (3.17 \times 10^{-8}) \, \Sigma_i \left[(N_i)(\chi/Q)_{SBu}(Q_i)\right] \qquad (4\text{-}2)$$

Where:

M_i = the air dose factor due to gamma emissions for each identified noble gas radionuclide i, in mrad/yr per uCi/m^3 from Table 3-1.

N_i = the air dose factor due to beta emissions for each identified noble gas radionuclide i, in mrad/yr per uCi/m^3 from Table 3-1.

$(\chi/Q)_{SBu}$ = the highest calculated annual average dispersion parameter, in sec/m^3, at the site boundary for the particular unit, from Table 3-2.

= $7.47X10^{-6}$ from Unit 1
= $7.90X10^{-6}$ from Unit 2
= $8.91X10^{-6}$ from Unit 3

$D_{\gamma u}$ = the total gamma air dose, for the particular unit, in mrad, due to noble gases released in gaseous effluents for a specified time period at the SITE BOUNDARY.

$D_{\beta u}$ = the total beta air dose, for the particular unit, in mrad, due to noble gases released in gaseous effluents for a specified time period at the SITE BOUNDARY.

Q_i = the integrated release, from the particular unit, in uCi, of each identified noble gas radionuclide i, in gaseous effluents for a specified time period.

3.17×10^{-8} = the inverse of seconds in a year (yr/sec).

The cumulative gamma air dose and beta air dose for a quarterly or annual evaluation shall be based on the calculated dose contribution from each specified time period occurring during the reporting time period.

4.2 Iodine - 131, Iodine-133, Tritium, and All Radionuclides in Particulate Form With Half-Lives Greater Than 8 Days

Technical Specification 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 [Technical Specification] Figures 5.1-1 and 5.1-3) 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.

The organ dose to an individual from I-131, I-133, tritium, and all radionuclides in particulate form, with half-lives greater than eight days, in gaseous effluents released to unrestricted areas from each reactor unit is calculated using the following expressions:

$$D_{ou} = (3.17 \times 10^{-8}) \sum_i \left[\sum_k (R_{ik} W_k) (Q_i) \right] \tag{4-3}$$

Where:

D_{ou} = the total accumulated organ dose from gaseous effluents for a particular unit, to a MEMBER OF THE PUBLIC, in mrem, at the SITE BOUNDARY or at the controlling location.

Q_i = the quantity of radionuclide i, in uCi, released in gaseous effluents from a particular unit.

R_{ik} = the dose factor for each identified radionuclide i, for pathway k (for the inhalation pathway in mrem/yr per uCi/m^3 and for the food and ground plane pathways in m^2 - mrem/yr per uCi/sec) at the controlling location. The R_{ik}'s for each age group are given in Tables 4-1 through 4-15.

$3.17X10^{-8}$ = the inverse of seconds per year (yr/sec).

W_k = the highest annual average dispersion or deposition parameter for the particular unit, used for estimating the dose at the site boundary or to a MEMBER OF THE PUBLIC at the controlling location for the particular unit.

= $(X/Q)_{SBU}$, in sec/m^3 for the inhalation pathway and for all tritium calculations, for organ dose at the site boundary, from Table 3-2.

= $7.47X10^{-6}$ from Unit 1
= $7.90X10^{-6}$ from Unit 2
= $8.91X10^{-6}$ from Unit 3

= $(X/Q)_{RU}$, in sec/m^3 for the inhalation pathway and for all tritium calculations, for organ dose at the controlling location, from Table 4-16.

= $2.92X10^{-6}$ from Unit 1
= $2.19X10^{-6}$ from Unit 2
= $2.31X10^{-6}$ from Unit 3

= ($D/Q)_{SBU}$, in m^{-2}, for the food and ground plane pathways, for organ dose at the site boundary, from Table 3-2.

= $1.19X10^{-8}$ from Unit 1
= $1.34X10^{-8}$ from Unit 2
= $1.67X10^{-8}$ from Unit 3

= ($D/Q)_{RU}$, in m^{-2}, for the food and ground plane pathways, for organ dose at the controlling location, from Table 4-16.

= $3.25X10^{-9}$ from Unit 1
= $3.88X10^{-10}$ from Unit 2
= $4.21X10^{-10}$ from Unit 3

Residences, vegetable gardens and meat and milk animals located within 5 miles of the site will be identified during the annual land use census. The controlling pathway and location will be identified and will be used for all MEMBER OF THE PUBLIC dose evaluations.

The R_i values were calculated in accordance with the methodologies in NUREG-0133 and generated using the GASPAR code. The following site specific information was used to calculate R_i:

	Value
fraction of year milk animals and beef animals are on pasture, f_p	0.75
fraction of the feed that is pasture grass while the milk and beef animals are on pasture, f_s	0.35

fraction of year vegetables are grown, f_L approximation   0.667

the annual absolute humidity (g/m^3), H   6

These site specific values are from the PVNGS Environmental Report, Section 2 and Appendix 5-B.

4.3 Dose Projection

Technical Specification 3.11.2.4 - 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 (see [Technical Specification] Figures 5.1-1 and 5.1-3) 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 (see [Technical Specification] Figures 5.1-1 and 5.1-3) when averaged over 31 days would exceed 0.3 mrem to any organ of a MEMBER OF THE PUBLIC.

Where possible, consideration for expected operational evolutions (i.e., outages, etc.) should be taken in the dose projections.

4.3.1 Noble Gas Dose Projection

For the purpose of satisfying requirements of Technical Specification 3.11.2.4, the air dose at the site boundary due to noble gases released in gaseous effluents from a particular unit is projected at least once per 31 days.

The air dose, in mrads for the current quarter is determined using the methodology described in Section 4.1 of this manual. This information is used to determine an air dose projection for the next 31 days using the following equations:

For gamma radiation:

$$31\ day_{\gamma} = (D_{\gamma}\ qtr/Tqtr)\ 31 + CD_{\gamma} \qquad (4\text{-}4)$$

For beta radiation:

$$31\ day_{\beta} = (D_{\beta}\ qtr/Tqtr)\ 31 + CD_{\beta} \qquad (4\text{-}5)$$

where:

D_{γ} qtr = the total gamma air dose due to noble gases released in gaseous effluents for the current quarter, in mrads, at the site boundary.

D_{β} qtr = the total beta air dose due to noble gases released in gaseous effluents for the current quarter, in mrads, at the site boundary.

Tqtr = the time period, in days, over which D_{γ} qtr and D_{β} qtr were integrated.

31 = the number of days over which the dose projections are made.

$31\ day_{\gamma}$ = the 31 day projected gamma air dose due to noble gases released in gaseous effluents, in mrads, at the site boundary.

$31\ day_{\beta}$ = the 31 day projected beta air dose due to noble gases released in gaseous effluents, in mrads, at the site boundary.

CD_{γ} = any current or projected gamma air dose, in mrads, due to noble gases released in gaseous effluents, which could have a significant impact on $31\ day_{\gamma}$.

CD_{β} = any current or projected beta air dose, in mrads, due to noble gases released in gaseous effluents, which could have a significant impact on $31\ day_{\beta}$.

4.3.2 <u>Organ Dose Projection</u>

For the purpose of satisfying requirements of Technical Specification 3.11.2.4 for a particular unit, the organ dose, in mrem, for the current quarter is determined using the methodology described in Section 4.2 of this manual. This information is used to determine an organ dose projection for the next 31 days using the following equation:

$$31day_o = (D_o\ qtr/Tqtr)31 + CD_o \qquad (4\text{-}6)$$

where:

D_o qtr	=	the total organ dose from a particular unit due to I-131, I-133, tritium, and all radionuclides in particulate form with half-lives greater than eight days, released in gaseous effluents for the current quarter, in mrem.
Tqtr	=	the time period, in days, over which $D_o$qtr was integrated.
31	=	the number of days over which the dose projections are made.
31 day_o	=	the 31 day projected organ dose, in mrem, from a particular unit.
CD_o	=	any current or projected organ dose for a particular unit, in mrem, which could have a significant impact on 31 day_o.

TABLE 4-1 R VALUES FOR THE PALO VERDE NUCLEAR GENERATING STATION[a]

PATHWAY = GROUND

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
Mn 54	1.38E+09[b]	1.38E+09	1.38E+09	1.38E+09	1.38E+09	1.38E+09	1.38E+09	1.62E+09
Cr 51	4.65E+06	4.65E+06	4.65E+06	4.65E+06	4.65E+06	4.65E+06	4.65E+06	5.49E+06
Fe 59	2.72E+08	2.72E+08	2.72E+08	2.72E+08	2.72E+08	2.72E+08	2.72E+08	3.20E+08
Co 58	3.79E+08	3.79E+08	3.79E+08	3.79E+08	3.79E+08	3.79E+08	3.79E+08	4.44E+08
Co 60	2.15E+10	2.15E+10	2.15E+10	2.15E+10	2.15E+10	2.15E+10	2.15E+10	2.52E+10
Zn 65	7.44E+08	7.44E+08	7.44E+08	7.44E+08	7.44E+08	7.44E+08	7.44E+08	8.56E+08
Sr 89	2.16E+04	2.16E+04	2.16E+04	2.16E+04	2.16E+04	2.16E+04	2.16E+04	2.50E+04
Zr 95	2.45E+08	2.45E+08	2.45E+08	2.45E+08	2.45E+08	2.45E+08	2.45E+08	2.84E+08
Sb124	5.98E+08	5.98E+08	5.98E+08	5.98E+08	5.98E+08	5.98E+08	5.98E+08	6.91E+08
I 131	1.72E+07	1.72E+07	1.72E+07	1.72E+07	1.72E+07	1.72E+07	1.72E+07	2.09E+07
I 133	2.45E+06	2.45E+06	2.45E+06	2.45E+06	2.45E+06	2.45E+06	2.45E+06	2.98E+06
Cs134	6.82E+09	6.82E+09	6.82E+09	6.82E+09	6.82E+09	6.82E+09	6.82E+09	7.96E+09
Cs137	1.03E+10	1.03E+10	1.03E+10	1.03E+10	1.03E+10	1.03E+10	1.03E+10	1.20E+10
Ba140	2.05E+07	2.05E+07	2.05E+07	2.05E+07	2.05E+07	2.05E+07	2.05E+07	2.34E+07
Ce141	1.36E+07	1.36E+07	1.36E+07	1.36E+07	1.36E+07	1.36E+07	1.36E+07	1.54E+07
Ce144	6.95E+07	6.95E+07	6.95E+07	6.95E+07	6.95E+07	6.95E+07	6.95E+07	8.03E+07

(a) R values are in units of m^2-mrem/yr per uCi/sec.

(b) 1.38E+09 = 1.38×10^9.

Reference: NUREG-0133; NUS Corporation letter NUS-ANPP-1385, dated 9/26/85.

TABLE 4-2 R VALUES FOR THE PALO VERDE NUCLEAR GENERATING STATION[a]

PATHWAY = VEGET

AGE GROUP = ADULT

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	4.34E+03[b]	4.34E+03	0.00E-01	4.34E+03	4.34E+03	4.34E+03	4.34E+03	4.34E+03
Mn 54	5.65E+07	9.07E+08	0.00E-01	2.96E+08	8.81E+07	0.00E-01	0.00E-01	0.00E-01
Cr 51	3.99E+04	1.00E+07	0.00E-01	0.00E-01	8.79E+03	2.38E+04	5.29E+04	0.00E-01
Fe 59	1.02E+08	8.91E+08	1.14E+06	2.67E+08	0.00E-01	0.00E-01	7.47E+07	0.00E-01
Co 58	6.38E+07	5.77E+08	0.00E-01	2.85E+07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Co 60	3.51E+08	2.99E+09	0.00E-01	1.59E+08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zn 65	4.31E+08	6.01E+08	3.00E+08	9.54E+08	6.38E+08	0.00E-01	0.00E-01	0.00E-01
Sr 89	2.60E+08	1.45E+09	9.06E+09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Sr 90	1.41E+11	1.66E+10	5.76E+11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zr 95	2.35E+05	1.10E+09	1.08E+06	3.47E+05	5.45E+05	0.00E-01	0.00E-01	0.00E-01
Sb124	3.78E+07	2.71E+09	9.53E+07	1.80E+06	0.00E-01	2.31E+05	7.42E+07	0.00E-01
I 131	4.49E+07	2.07E+07	5.47E+07	7.83E+07	1.34E+08	2.57E+10	0.00E-01	0.00E-01
I 133	7.35E+05	2.17E+06	1.39E+06	2.41E+06	4.21E+06	3.54E+08	0.00E-01	0.00E-01
Cs134	8.62E+09	1.85E+08	4.43E+09	1.05E+10	3.41E+09	0.00E-01	1.13E+09	0.00E-01
Cs137	5.42E+09	1.60E+08	6.05E+09	8.28E+09	2.81E+09	0.00E-01	9.34E+08	0.00E-01
Ba140	6.17E+06	1.94E+08	9.42E+07	1.18E+05	4.03E+04	0.00E-01	6.78E+04	0.00E-01
Ce141	1.33E+04	4.47E+08	1.73E+05	1.17E+05	5.43E+04	0.00E-01	0.00E-01	0.00E-01
Ce144	1.67E+06	1.05E+10	3.11E+07	1.30E+07	7.72E+06	0.00E-01	0.00E-01	0.00E-01

(a) R values are in units of mrem/yr per uCi/m^3 for tritium, and in units of m^2-mrem/yr per uCi/sec for all others.

(b) 4.34E+03 = 4.34×10^3.

TABLE 4-3 R VALUES FOR THE PALO VERDE NUCLEAR GENERATING STATION[a]

PATHWAY = VEGET

AGE GROUP = TEEN

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	5.08E+03[b]	5.08E+03	0.00E-01	5.08E+03	5.08E+03	5.08E+03	5.08E+03	5.08E+03
Mn 54	8.72E+07	9.02E+08	0.00E-01	4.40E+08	1.31E+08	0.00E-01	0.00E-01	0.00E-01
Cr 51	5.58E+04	9.37E+06	0.00E-01	0.00E-01	1.22E+04	3.10E+04	7.96E+04	0.00E-01
Fe 59	1.52E+08	9.28E+08	1.68E+08	3.92E+08	0.00E-01	0.00E-01	1.24E+08	0.00E-01
Co 58	9.60E+07	5.74E+08	0.00E-01	4.17E+07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Co 60	5.44E+08	3.14E+09	0.00E-01	2.41E+08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zn 65	6.64E+08	6.03E+08	4.10E+08	1.42E+09	9.11E+08	0.00E-01	0.00E-01	0.00E-01
Sr 89	4.09E+08	1.70E+09	1.43E+10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Sr 90	1.80E+11	2.05E+10	7.29E+11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zr 95	3.56E+05	1.19E+09	1.64E+06	5.18E+05	7.60E+05	0.00E-01	0.00E-01	0.00E-01
Sb124	5.73E+07	2.96E+09	1.47E+08	2.70E+06	0.00E-01	3.33E+05	1.28E+08	0.00E-01
I 131	3.97E+07	1.46E+07	5.28E+07	7.40E+07	1.27E+08	2.16E+10	0.00E-01	0.00E-01
I 133	6.66E+05	1.65E+06	1.29E+06	2.18E+06	3.83E+06	3.05E+08	0.00E-01	0.00E-01
Cs134	7.52E+09	2.02E+08	6.89E+09	1.62E+10	5.15E+09	0.00E-01	1.97E+09	0.00E-01
Cs137	4.56E+09	1.86E+08	9.84E+09	1.31E+10	4.46E+09	0.00E-01	1.73E+09	0.00E-01
Ba140	6.87E+06	1.65E+08	1.07E+08	1.31E+05	4.43E+04	0.00E-01	8.79E+04	0.00E-01
Ce141	2.00E+04	4.97E+08	2.60E+05	1.74E+05	8.18E+04	0.00E-01	0.00E-01	0.00E-01
Ce144	2.74E+06	1.28E+10	5.11E+07	2.11E+07	1.26E+07	0.00E-01	0.00E-01	0.00E-01

(a) R values are in units of mrem/yr per uCi/m^3 for tritium, and in units of m^2-mrem/yr per uCi/sec for all others.

(b) 5.08E+03 = 5.08 X 10^3.

TABLE 4-4 R VALUES FOR THE PALO VERDE NUCLEAR GENERATING STATION[a]

PATHWAY = VEGET

AGE GROUP = CHILD

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	7.91E+03[b]	7.91E+03	0.00E-01	7.91E+03	7.91E+03	7.91E+03	7.91E+03	7.91E+03
Mn 54	1.73E+08	5.44E+08	0.00E-01	6.48E+08	1.82E+08	0.00E-01	0.00E-01	0.00E-01
Cr 51	1.08E+05	5.73E+06	0.00E-01	0.00E-01	1.64E+04	6.00E+04	1.09E+05	0.00E-01
Fe 59	3.04E+08	6.36E+08	3.78E+08	6.11E+08	0.00E-01	0.00E-01	1.77E+08	0.00E-01
Co 58	1.90E+08	3.63E+08	0.00E-01	6.22E+07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Co 60	1.09E+09	2.05E+09	0.00E-01	3.70E+08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zn 65	1.31E+09	3.70E+08	7.92E+08	2.11E+09	1.33E+09	0.00E-01	0.00E-01	0.00E-01
Sr 89	9.80E+08	1.33E+09	3.43E+10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Sr 90	3.08E+11	1.64E+10	1.22E+12	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zr 95	7.27E+05	8.52E+08	3.72E+06	8.17E+05	1.17E+06	0.00E-01	0.00E-01	0.00E-01
Sb124	1.19E+08	2.12E+09	3.38E+08	4.39E+06	0.00E-01	7.47E+05	1.88E+08	0.00E-01
I 131	5.67E+07	8.89E+06	9.92E+07	9.98E+07	1.64E+08	3.30E+10	0.00E-01	0.00E-01
I 133	1.10E+06	1.17E+06	2.35E+06	2.90E+06	4.84E+06	5.39E+08	0.00E-01	0.00E-01
Cs134	5.42E+09	1.39E+08	1.57E+10	2.57E+10	7.96E+09	0.00E-01	2.86E+09	0.00E-01
Cs137	3.31E+09	1.40E+08	2.34E+10	2.24E+10	7.30E+09	0.00E-01	2.63E+09	0.00E-01
Ba140	1.28E+07	1.11E+08	2.20E+08	1.93E+05	6.27E+04	0.00E-01	1.15E+05	0.00E-01
Ce141	4.54E+04	3.82E+08	6.14E+05	3.06E+05	1.34E+05	0.00E-01	0.00E-01	0.00E-01
Ce144	6.61E+06	1.01E+10	1.24E+08	3.89E+07	2.15E+07	0.00E-01	0.00E-01	0.00E-01

(a) R values are in units of mrem/yr per uCi/m^3 for tritium, and in units of m^2-mrem/yr per uCi/sec for all others.

(b) 7.91E+03 = 7.91 X 10^3.

TABLE 4-5 R VALUES FOR THE PALO VERDE NUCLEAR GENERATING STATION[a]

PATHWAY = MEAT

AGE GROUP = ADULT

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	6.55E+02[b]	6.55E+02	0.00E-01	6.55E+02	6.55E+02	6.55E+02	6.55E+02	6.55E+02
Mn 54	8.29E+05	1.33E+07	0.00E-01	4.34E+06	1.29E+06	0.00E-01	0.00E-01	0.00E-01
Cr 51	2.04E+03	5.12E+05	0.00E-01	0.00E-01	4.48E+02	1.22E+03	2.70E+03	0.00E-01
Fe 59	7.78E+07	6.77E+08	8.64E+07	2.03E+08	0.00E-01	0.00E-01	5.67E+07	0.00E-01
Co 58	1.51E+07	1.37E+08	0.00E-01	6.74E+06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Co 60	8.49E+07	7.23E+08	0.00E-01	3.85E+07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zn 65	2.36E+08	3.29E+08	1.64E+08	5.23E+08	3.50E+08	0.00E-01	0.00E-01	0.00E-01
Sr 89	2.91E+06	1.63E+07	1.02E+08	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Sr 90	1.58E+09	1.86E+08	6.45E+09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zr 95	1.46E+05	6.85E+08	6.74E+05	2.16E+05	3.39E+05	0.00E-01	0.00E-01	0.00E-01
Sb124	2.78E+06	1.99E+08	7.01E+06	1.32E+05	0.00E-01	1.70E+04	5.45E+06	0.00E-01
I 131	2.31E+06	1.06E+06	2.81E+06	4.03E+06	6.90E+06	1.32E+09	0.00E-01	0.00E-01
I 133	5.14E-02	1.52E-01	9.69E-02	1.69E-01	2.94E-01	2.48E+01	0.00E-01	0.00E-01
Cs134	6.39E+08	1.37E+07	3.28E+08	7.81E+08	2.53E+08	0.00E-01	8.39E+07	0.00E-01
Cs137	4.05E+08	1.20E+07	4.52E+08	6.18E+08	2.10E+08	0.00E-01	6.98E+07	0.00E-01
Ba140	4.97E+05	1.56E+07	7.59E+06	9.54E+03	3.24E+03	0.00E-01	5.46E+03	0.00E-01
Ce141	3.23E+02	1.09E+07	4.21E+03	2.85E+03	1.32E+03	0.00E-01	0.00E-01	0.00E-01
Ce144	3.67E+04	2.31E+08	6.84E+05	2.86E+05	1.70E+05	0.00E-01	0.00E-01	0.00E-01

(a) R values are in units of mrem/yr per uCi/m^3 for tritium, and in units of m^2-mrem/yr per uCi/sec for all others.

(b) 6.55E+02 = 6.55 X 10^2.

TABLE 4-6 R VALUES FOR THE PALO VERDE NUCLEAR GENERATING STATION[a]

PATHWAY = MEAT

AGE GROUP = TEEN

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	3.91E+02[b]	3.91E+02	0.00E-01	3.91E+02	3.91E+02	3.91E+02	3.91E+02	3.91E+02
Mn 54	6.57E+05	6.79E+06	0.00E-01	3.31E+06	9.88E+05	0.00E-01	0.00E-01	0.00E-01
Cr 51	1.63E+03	2.74E+05	0.00E-01	0.00E-01	3.57E+02	9.04E+02	2.32E+03	0.00E-01
Fe 59	6.22E+07	3.81E+08	6.91E+07	1.61E+08	0.00E-01	0.00E-01	5.08E+07	0.00E-01
Co 58	1.20E+07	7.16E+07	0.00E-01	5.19E+06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Co 60	6.72E+07	3.89E+08	0.00E-01	2.99E+07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zn 65	1.87E+08	1.70E+08	1.15E+08	4.01E+08	2.57E+08	0.00E-01	0.00E-01	0.00E-01
Sr 89	2.45E+06	1.02E+07	8.57E+07	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Sr 90	1.03E+09	1.17E+08	4.17E+09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zr 95	1.17E+05	3.93E+08	5.40E+05	1.70E+05	2.50E+05	0.00E-01	0.00E-01	0.00E-01
Sb124	2.23E+06	1.15E+08	5.72E+06	1.05E+05	0.00E-01	1.30E+04	5.00E+06	0.00E-01
I 131	1.76E+06	6.48E+05	2.34E+06	3.27E+06	5.64E+06	9.56E+08	0.00E-01	0.00E-01
I 133	4.19E-02	1.04E-01	8.11E-02	1.38E-01	2.41E-01	1.92E+01	0.00E-01	0.00E-01
Cs134	2.85E+08	7.64E+06	2.61E+08	6.14E+08	1.95E+08	0.00E-01	7.45E+07	0.00E-01
Cs137	1.74E+08	7.11E+06	3.75E+08	4.99E+08	1.70E+08	0.00E-01	6.60E+07	0.00E-01
Ba140	4.04E+05	9.68E+06	6.28E+06	7.69E+03	2.61E+03	0.00E-01	5.17E+03	0.00E-01
Ce141	2.71E+02	6.75E+06	3.53E+03	2.36E+03	1.11E+03	0.00E-01	0.00E-01	0.00E-01
Ce144	3.10E+04	1.45E+08	5.76E+05	2.38E+05	1.42E+05	0.00E-01	0.00E-01	0.00E-01

(a) R values are in units of mrem/yr per uCi/m^3 for tritium, and in units of m^2-mrem/yr per uCi/sec for all others.

(b) 3.91E+02 = 3.91 X 10^2.

TABLE 4-7 R VALUES FOR THE PALO VERDE NUCLEAR GENERATING STATION[a]

PATHWAY = MEAT

AGE GROUP = CHILD

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	4.72E+02[b]	4.72E+02	0.00E-01	4.72E+02	4.72E+02	4.72E+02	4.72E+02	4.72E+02
Mn 54	1.01E+06	3.18E+06	0.00E-01	3.79E+06	1.06E+06	0.00E-01	0.00E-01	0.00E-01
Cr 51	2.54E+03	1.35E+05	0.00E-01	0.00E-01	3.85E+02	1.41E+03	2.57E+03	0.00E-01
Fe 59	9.87E+07	2.06E+08	1.22E+08	1.98E+08	0.00E-01	0.00E-01	5.74E+07	0.00E-01
Co 58	1.86E+07	3.54E+07	0.00E-01	6.07E+06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Co 60	1.05E+08	1.96E+08	0.00E-01	3.54E+07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zn 65	2.87E+08	8.11E+07	1.73E+08	4.62E+08	2.91E+08	0.00E-01	0.00E-01	0.00E-01
Sr 89	4.63E+06	6.28E+06	1.62E+08	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Sr 90	1.37E+09	7.26E+07	5.39E+09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zr 95	1.88E+05	2.20E+08	9.59E+05	2.11E+05	3.02E+05	0.00E-01	0.00E-01	0.00E-01
Sb124	3.63E+06	6.47E+07	1.04E+07	1.34E+05	0.00E-01	2.28E+04	5.74E+06	0.00E-01
I 131	2.48E+06	3.88E+05	4.34E+06	4.36E+06	7.16E+06	1.44E+09	0.00E-01	0.00E-01
I 133	7.05E-02	7.50E-02	1.51E-01	1.86E-01	3.10E-01	3.46E+01	0.00E-01	0.00E-01
Cs134	1.59E+08	4.07E+06	4.60E+08	7.55E+08	2.34E+08	0.00E-01	8.40E+07	0.00E-01
Cs137	9.77E+07	4.14E+06	6.91E+08	6.62E+08	2.16E+08	0.00E-01	7.76E+07	0.00E-01
Ba140	6.76E+05	5.87E+06	1.16E+07	1.01E+04	3.30E+03	0.00E-01	6.05E+03	0.00E-01
Ce141	4.93E+02	4.14E+06	6.66E+03	3.32E+03	1.46E+03	0.00E-01	0.00E-01	0.00E-01
Ce144	5.80E+04	8.88E+07	1.09E+06	3.41E+05	1.89E+05	0.00E-01	0.00E-01	0.00E-01

(a) R values are in units of mrem/yr per uCi/m^3 for tritium, and in units of m^2-mrem/yr per uCi/sec for all others.

(b) 4.72E+02 = 4.72 X 10^2.

TABLE 4-8 R VALUES FOR THE PALO VERDE NUCLEAR GENERATING STATION[a]

PATHWAY = COW MILK

AGE GROUP = ADULT

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	1.54E+03[b]	1.54E+03	0.00E-01	1.54E+03	1.54E+03	1.54E+03	1.54E+03	1.54E+03
Mn 54	7.60E+05	1.22E+07	0.00E-01	3.98E+06	1.18E+06	0.00E-01	0.00E-01	0.00E-01
Cr 51	8.26E+03	2.08E+06	0.00E-01	0.00E-01	1.82E+03	4.94E+03	1.10E+04	0.00E-01
Fe 59	8.71E+06	7.57E+07	9.67E+06	2.27E+07	0.00E-01	0.00E-01	6.35E+06	0.00E-01
Co 58	3.90E+06	3.53E+07	0.00E-01	1.74E+06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Co 60	1.65E+07	1.58E+08	0.00E-01	8.39E+06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zn 65	9.11E+08	1.27E+09	6.33E+08	2.02E+09	1.35E+09	0.00E-01	0.00E-01	0.00E-01
Sr 89	1.40E+07	7.84E+07	4.89E+08	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Sr 90	5.95E+09	7.01E+08	2.43E+10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zr 95	7.37E+01	3.45E+05	3.39E+02	1.09E+02	1.71E+02	0.00E-01	0.00E-01	0.00E-01
Sb124	3.61E+06	2.59E+08	9.11E+06	1.72E+05	0.00E-01	2.21E+04	7.09E+06	0.00E-01
I 131	6.36E+07	2.93E+07	7.76E+07	1.11E+08	1.90E+08	3.64E+10	0.00E-01	0.00E-01
I 133	5.39E+05	1.59E+06	1.02E+06	1.77E+06	3.08E+06	2.60E+08	0.00E-01	0.00E-01
Cs134	5.49E+09	1.18E+08	2.82E+09	6.72E+09	2.17E+09	0.00E-01	7.21E+08	0.00E-01
Cs137	3.43E+09	1.01E+08	3.83E+09	5.23E+09	1.78E+09	0.00E-01	5.91E+08	0.00E-01
Ba140	4.65E+05	1.46E+07	7.10E+06	8.92E+03	3.03E+03	0.00E-01	5.11E+03	0.00E-01
Ce141	6.68E+02	2.25E+07	8.71E+03	5.89E+03	2.74E+03	0.00E-01	0.00E-01	0.00E-01
Ce144	5.41E+04	3.40E+08	1.01E+06	4.21E+05	2.50E+05	0.00E-01	0.00E-01	0.00E-01

(a) R values are in units of mrem/yr per uCi/m^3 for tritium, and in units of m^2-mrem/yr per uCi/sec for all others.

(b) 1.54E+03 = 1.54 X 10^3.

TABLE 4-9 R VALUES FOR THE PALO VERDE NUCLEAR GENERATING STATION[a]

PATHWAY = COW MILK

AGE GROUP = TEEN

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	2.00E+03[b]	2.00E+03	0.00E-01	2.00E+03	2.00E+03	2.00E+03	2.00E+03	2.00E+03
Mn 54	1.32E+06	1.36E+07	0.00E-01	6.63E+06	1.98E+06	0.00E-01	0.00E-01	0.00E-01
Cr 51	1.44E+04	2.42E+06	0.00E-01	0.00E-01	3.16E+03	8.01E+03	2.06E+04	0.00E-01
Fe 59	1.52E+07	9.31E+07	1.69E+07	3.94E+07	0.00E-01	0.00E-01	1.24E+07	0.00E-01
Co 58	6.75E+06	4.04E+07	0.00E-01	2.93E+06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Co 60	3.20E+07	1.85E+08	0.00E-01	1.42E+07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zn 65	1.58E+09	1.43E+09	9.73E+08	3.38E+09	2.16E+09	0.00E-01	0.00E-01	0.00E-01
Sr 89	2.58E+07	1.07E+08	9.01E+08	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Sr 90	8.46E+09	9.62E+08	3.43E+10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zr 95	1.29E+02	4.32E+05	5.93E+02	1.87E+02	2.75E+02	0.00E-01	0.00E-01	0.00E-01
Sb124	6.34E+06	3.27E+08	1.62E+07	2.99E+05	0.00E-01	3.68E+04	1.42E+07	0.00E-01
I 131	1.06E+08	3.90E+07	1.41E+08	1.97E+08	3.39E+08	5.75E+10	0.00E-01	0.00E-01
I 133	9.60E+05	2.38E+06	1.86E+06	3.15E+06	5.52E+06	4.40E+08	0.00E-01	0.00E-01
Cs134	5.35E+09	1.43E+08	4.90E+09	1.15E+10	3.66E+09	0.00E-01	1.40E+09	0.00E-01
Cs137	3.22E+09	1.31E+08	6.94E+09	9.23E+09	3.14E+09	0.00E-01	1.22E+09	0.00E-01
Ba140	8.26E+05	1.98E+07	1.28E+07	1.57E+04	5.33E+03	0.00E-01	1.06E+04	0.00E-01
Ce141	1.23E+03	3.05E+07	1.60E+04	1.07E+04	5.02E+03	0.00E-01	0.00E-01	0.00E-01
Ce144	9.96E+04	4.66E+08	1.85E+06	7.67E+05	4.58E+05	0.00E-01	0.00E-01	0.00E-01

(a) R values are in units of mrem/yr per uCi/m^3 for tritium, and in units of m^2-mrem/yr per uCi/sec for all others.

(b) 2.00E+03 = 2.00 X 10^3.

TABLE 4-10 R VALUES FOR THE PALO VERDE NUCLEAR GENERATING STATION[a]

PATHWAY = COW MILK

AGE GROUP = CHILD

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	3.17E+03[b]	3.17E+03	0.00E-01	3.17E+03	3.17E+03	3.17E+03	3.17E+03	3.17E+03
Mn 54	2.64E+06	8.33E+06	0.00E-01	9.92E+06	2.78E+06	0.00E-01	0.00E-01	0.00E-01
Cr 51	2.94E+04	1.56E+06	0.00E-01	0.00E-01	4.46E+03	1.63E+04	2.98E+04	0.00E-01
Fe 59	3.15E+07	6.59E+07	3.91E+07	6.33E+07	0.00E-01	0.00E-01	1.84E+07	0.00E-01
Co 58	1.37E+07	2.61E+07	0.00E-01	4.48E+06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Co 60	6.51E+07	1.22E+08	0.00E-01	2.21E+07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zn 65	3.16E+09	8.93E+08	1.91E+09	5.08E+09	3.20E+09	0.00E-01	0.00E-01	0.00E-01
Sr 89	6.37E+07	8.63E+07	2.23E+09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Sr 90	1.47E+10	7.80E+08	5.79E+10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zr 95	2.70E+02	3.16E+05	1.38E+03	3.03E+02	4.34E+02	0.00E-01	0.00E-01	0.00E-01
Sb124	1.35E+07	2.40E+08	3.84E+07	4.99E+05	0.00E-01	8.48E+04	2.13E+07	0.00E-01
I 131	1.95E+08	3.06E+07	3.42E+08	3.44E+08	5.64E+08	1.14E+11	0.00E-01	0.00E-01
I 133	2.11E+06	2.25E+06	4.51E+06	5.58E+06	9.29E+06	1.04E+09	0.00E-01	0.00E-01
Cs134	3.91E+09	1.00E+08	1.13E+10	1.85E+10	5.75E+09	0.00E-01	2.06E+09	0.00E-01
Cs137	2.36E+09	1.00E+08	1.67E+10	1.60E+10	5.21E+09	0.00E-01	1.88E+09	0.00E-01
Ba140	1.81E+06	1.57E+07	3.09E+07	2.71E+04	8.82E+03	0.00E-01	1.62E+04	0.00E-01
Ce141	2.91E+03	2.45E+07	3.93E+04	1.96E+04	8.60E+03	0.00E-01	0.00E-01	0.00E-01
Ce144	2.44E+05	3.73E+08	4.57E+06	1.43E+06	7.93E+05	0.00E-01	0.00E-01	0.00E-01

(a) R values are in units of mrem/yr per uCi/m^3 for tritium, and in units of m^2-mrem/yr per uCi/sec for all others.

(b) 3.17E+03 = 3.17 X 10^3.

TABLE 4-11 R VALUES FOR THE PALO VERDE NUCLEAR GENERATING STATION[a]

PATHWAY = COW MILK

AGE GROUP = INFANT

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	4.80E+03[b]	4.80E+03	0.00E-01	4.80E+03	4.80E+03	4.80E+03	4.80E+03	4.80E+03
Mn 54	4.18E+06	6.78E+06	0.00E-01	1.85E+07	4.09E+06	0.00E-01	0.00E-01	0.00E-01
Cr 51	4.66E+04	1.36E+06	0.00E-01	0.00E-01	6.64E+03	3.04E+04	5.92E+04	0.00E-01
Fe 59	5.03E+07	6.09E+07	7.30E+07	1.28E+08	0.00E-01	0.00E-01	3.77E+07	0.00E-01
Co 58	2.23E+07	2.23E+07	0.00E-01	8.96E+06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Co 60	1.06E+08	1.07E+08	0.00E-01	4.51E+07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zn 65	4.05E+09	7.42E+09	2.56E+09	8.79E+09	4.26E+09	0.00E-01	0.00E-01	0.00E-01
Sr 89	1.22E+08	8.71E+07	4.24E+09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Sr 90	1.60E+10	7.87E+08	6.30E+10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Zr 95	4.23E+02	2.97E+05	2.45E+03	5.97E+02	6.43E+02	0.00E-01	0.00E-01	0.00E-01
Sb124	2.30E+07	2.29E+08	7.41E+07	1.09E+06	0.00E-01	1.97E+05	4.64E+07	0.00E-01
I 131	3.69E+08	3.00E+07	7.13E+08	8.40E+08	9.81E+08	2.76E+11	0.00E-01	0.00E-01
I 133	4.06E+06	2.35E+06	9.52E+06	1.39E+07	1.63E+07	2.52E+09	0.00E-01	0.00E-01
Cs134	3.43E+09	9.23E+07	1.82E+10	3.40E+10	8.74E+09	0.00E-01	3.58E+09	0.00E-01
Cs137	2.21E+09	9.76E+07	2.67E+10	3.12E+10	8.38E+09	0.00E-01	3.39E+09	0.00E-01
Ba140	3.28E+06	1.56E+07	6.37E+07	6.37E+04	1.51E+04	0.00E-01	3.91E+04	0.00E-01
Ce141	5.60E+03	2.46E+07	7.80E+04	4.76E+04	1.47E+04	0.00E-01	0.00E-01	0.00E-01
Ce144	3.67E+05	3.76E+08	6.54E+06	2.68E+06	1.08E+06	0.00E-01	0.00E-01	0.00E-01

(a) R values are in units of mrem/yr per uCi/m^3 for tritium, and in units of m^2-mrem/yr per uCi/sec for all others.

(b) 4.80E+03 = 4.80 X 10^3.

TABLE 4-12 R VALUES FOR THE PALO VERDE NUCLEAR GENERATING STATION[a]

PATHWAY = INHAL

AGE GROUP = ADULT

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	1.26E+03[b]	1.26E+03	0.00E-01	1.26E+03	1.26E+03	1.26E+03	1.26E+03	1.26E+03
Mn 54	6.29E+03	7.72E+04	0.00E-01	3.95E+04	9.83E+03	0.00E-01	1.40E+06	0.00E-01
Cr 51	9.99E+01	3.32E+03	0.00E-01	0.00E-01	2.28E+01	5.94E+01	1.44E+04	0.00E-01
Fe 59	1.05E+04	1.88E+05	1.17E+04	2.77E+04	0.00E-01	0.00E-01	1.01E+06	0.00E-01
Co 58	2.07E+03	1.06E+05	0.00E-01	1.58E+03	0.00E-01	0.00E-01	9.27E+05	0.00E-01
Co 60	1.48E+04	2.84E+05	0.00E-01	1.15E+04	0.00E-01	0.00E-01	5.96E+06	0.00E-01
Zn 65	4.65E+04	5.34E+04	3.24E+04	1.03E+05	6.89E+04	0.00E-01	8.63E+05	0.00E-01
Sr 89	8.71E+03	3.49E+05	3.04E+05	0.00E-01	0.00E-01	0.00E-01	1.40E+06	0.00E-01
Sr 90	6.09E+06	7.21E+05	9.91E+07	0.00E-01	0.00E-01	0.00E-01	9.59E+06	0.00E-01
Zr 95	2.32E+04	1.50E+05	1.07E+05	3.44E+04	5.41E+04	0.00E-01	1.77E+06	0.00E-01
Sb124	1.24E+04	4.06E+05	3.12E+04	5.88E+02	0.00E-01	7.54E+01	2.48E+06	0.00E-01
I 131	2.05E+04	6.27E+03	2.52E+04	3.57E+04	6.12E+04	1.19E+07	0.00E-01	0.00E-01
I 133	4.51E+03	8.87E+03	8.63E+03	1.48E+04	2.58E+04	2.15E+06	0.00E-01	0.00E-01
Cs134	7.27E+05	1.04E+04	3.72E+05	8.47E+05	2.87E+05	0.00E-01	9.75E+04	0.00E-01
Cs137	4.27E+05	8.39E+03	4.78E+05	6.20E+05	2.22E+05	0.00E-01	7.51E+04	0.00E-01
Ba140	2.56E+03	2.18E+05	3.90E+04	4.90E+01	1.67E+01	0.00E-01	1.27E+06	0.00E-01
Ce141	1.53E+03	1.20E+05	1.99E+04	1.35E+04	6.25E+03	0.00E-01	3.61E+05	0.00E-01
Ce144	1.84E+05	8.15E+05	3.43E+06	1.43E+06	8.47E+05	0.00E-01	7.76E+06	0.00E-01

(a) R values are in units of mrem/yr per uCi/m^3.

(b) $1.26E+03 = 1.26 \times 10^3$.

TABLE 4-13 R VALUES FOR THE PALO VERDE NUCLEAR GENERATING STATION[a]

PATHWAY = INHAL

AGE GROUP = TEEN

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	1.27E+03[b]	1.27E+03	0.00E-01	1.27E+03	1.27E+03	1.27E+03	1.27E+03	1.27E+03
Mn 54	8.39E+03	6.67E+04	0.00E-01	5.10E+04	1.27E+04	0.00E-01	1.98E+06	0.00E-01
Cr 51	1.35E+02	3.00E+03	0.00E-01	0.00E-01	3.07E+01	7.49E+01	2.09E+04	0.00E-01
Fe 59	1.43E+04	1.78E+05	1.59E+04	3.69E+04	0.00E-01	0.00E-01	1.53E+06	0.00E-01
Co 58	2.77E+03	9.51E+04	0.00E-01	2.07E+03	0.00E-01	0.00E-01	1.34E+06	0.00E-01
Co 60	1.98E+04	2.59E+05	0.00E-01	1.51E+04	0.00E-01	0.00E-01	8.71E+06	0.00E-01
Zn 65	6.23E+04	4.66E+04	3.85E+04	1.33E+05	8.63E+04	0.00E-01	1.24E+06	0.00E-01
Sr 89	1.25E+04	3.71E+05	4.34E+05	0.00E-01	0.00E-01	0.00E-01	2.41E+06	0.00E-01
Sr 90	6.67E+06	7.64E+05	1.08E+08	0.00E-01	0.00E-01	0.00E-01	1.65E+07	0.00E-01
Zr 95	3.15E+04	1.49E+05	1.45E+05	4.58E+04	6.73E+04	0.00E-01	2.68E+06	0.00E-01
Sb124	1.68E+04	3.98E+05	4.30E+04	7.92E+02	0.00E-01	9.75E+01	3.84E+06	0.00E-01
I 131	2.64E+04	6.48E+03	3.54E+04	4.90E+04	8.39E+04	1.46E+07	0.00E-01	0.00E-01
I 133	6.21E+03	1.03E+04	1.21E+04	2.05E+04	3.59E+04	2.92E+06	0.00E-01	0.00E-01
Cs134	5.48E+05	9.75E+03	5.02E+05	1.13E+06	3.75E+05	0.00E-01	1.46E+05	0.00E-01
Cs137	3.11E+05	8.47E+03	6.69E+05	8.47E+05	3.04E+05	0.00E-01	1.21E+05	0.00E-01
Ba140	3.51E+03	2.28E+05	5.46E+04	6.69E+01	2.28E+01	0.00E-01	2.03E+06	0.00E-01
Ce141	2.16E+03	1.26E+05	2.84E+04	1.89E+04	8.87E+03	0.00E-01	6.13E+05	0.00E-01
Ce144	2.62E+05	8.63E+05	4.88E+06	2.02E+06	1.21E+06	0.00E-01	1.33E+07	0.00E-01

(a) R values are in units of mrem/yr per uCi/m^3.

(b) 1.27E+03 = 1.27 X 10^3.

TABLE 4-14 R VALUES FOR THE PALO VERDE NUCLEAR GENERATING STATION[a]

PATHWAY = INHAL

AGE GROUP = CHILD

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	1.12E+03[b]	1.12E+03	0.00E-01	1.12E+03	1.12E+03	1.12E+03	1.12E+03	1.12E+03
Mn 54	9.50E+03	2.29E+04	0.00E-01	4.29E+04	1.00E+04	0.00E-01	1.57E+06	0.00E-01
Cr 51	1.54E+02	1.08E+03	0.00E-01	0.00E-01	2.43E+01	8.53E+01	1.70E+04	0.00E-01
Fe 59	1.67E+04	7.06E+04	2.07E+04	3.34E+04	0.00E-01	0.00E-01	1.27E+06	0.00E-01
Co 58	3.16E+03	3.43E+04	0.00E-01	1.77E+03	0.00E-01	0.00E-01	1.10E+06	0.00E-01
Co 60	2.26E+04	9.61E+04	0.00E-01	1.31E+04	0.00E-01	0.00E-01	7.06E+06	0.00E-01
Zn 65	7.02E+04	1.63E+04	4.25E+04	1.13E+05	7.13E+04	0.00E-01	9.94E+05	0.00E-01
Sr 89	1.72E+04	1.67E+05	5.99E+05	0.00E-01	0.00E-01	0.00E-01	2.15E+06	0.00E-01
Sr 90	6.43E+06	3.43E+05	1.01E+08	0.00E-01	0.00E-01	0.00E-01	1.47E+07	0.00E-01
Zr 95	3.69E+04	6.10E+04	1.90E+05	4.17E+04	5.95E+04	0.00E-01	2.23E+06	0.00E-01
Sb124	2.00E+04	1.64E+05	5.73E+04	7.39E+02	0.00E-01	1.26E+02	3.24E+06	0.00E-01
I 131	2.72E+04	2.84E+03	4.80E+04	4.80E+04	7.87E+04	1.62E+07	0.00E-01	0.00E-01
I 133	7.68E+03	5.47E+03	1.66E+04	2.03E+04	3.37E+04	3.84E+06	0.00E-01	0.00E-01
Cs134	2.24E+05	3.84E+03	6.50E+05	1.01E+06	3.30E+05	0.00E-01	1.21E+05	0.00E-01
Cs137	1.28E+05	3.61E+03	9.05E+05	8.24E+05	2.82E+05	0.00E-01	1.04E+05	0.00E-01
Ba140	4.32E+03	1.02E+05	7.39E+04	6.47E+01	2.11E+01	0.00E-01	1.74E+06	0.00E-01
Ce141	2.89E+03	5.65E+04	3.92E+04	1.95E+04	8.53E+03	0.00E-01	5.43E+05	0.00E-01
Ce144	3.61E+05	3.88E+05	6.76E+06	2.11E+06	1.17E+06	0.00E-01	1.19E+07	0.00E-01

(a) R values are in units of mrem/yr per uCi/m^3.

(b) 1.12E+03 = 1.12 X 10^3.

TABLE 4-15 R VALUES FOR THE PALO VERDE NUCLEAR GENERATING STATION[a]

PATHWAY = INHAL

AGE GROUP = INFANT

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	6.46E+02[b]	6.46E+02	0.00E-01	6.46E+02	6.46E+02	6.46E+02	6.46E+02	6.46E+02
Mn 54	4.98E+03	7.05E+03	0.00E-01	2.53E+04	4.98E+03	0.00E-01	9.98E+05	0.00E-01
Cr 51	8.93E+01	3.56E+02	0.00E-01	0.00E-01	1.32E+01	5.75E+01	1.28E+04	0.00E-01
Fe 59	9.46E+03	2.47E+04	1.35E+04	2.35E+04	0.00E-01	0.00E-01	1.01E+06	0.00E-01
Co 58	1.82E+03	1.11E+04	0.00E-01	1.22E+03	0.00E-01	0.00E-01	7.76E+05	0.00E-01
Co 60	1.18E+04	3.19E+04	0.00E-01	8.01E+03	0.00E-01	0.00E-01	4.50E+06	0.00E-01
Zn 65	3.10E+04	5.13E+04	1.93E+04	6.25E+04	3.24E+04	0.00E-01	6.46E+05	0.00E-01
Sr 89	1.14E+04	6.39E+04	3.97E+05	0.00E-01	0.00E-01	0.00E-01	2.03E+06	0.00E-01
Sr 90	2.59E+06	1.31E+05	4.08E+07	0.00E-01	0.00E-01	0.00E-01	1.12E+07	0.00E-01
Zr 95	2.03E+04	2.17E+04	1.15E+05	2.78E+04	3.10E+04	0.00E-01	1.75E+06	0.00E-01
Sb124	1.20E+04	5.90E+04	3.79E+04	5.55E+02	0.00E-01	1.00E+02	2.64E+06	0.00E-01
I 131	1.96E+04	1.06E+03	3.79E+04	4.43E+04	5.17E+04	1.48E+07	0.00E-01	0.00E-01
I 133	5.59E+03	2.15E+03	1.32E+04	1.92E+04	2.24E+04	3.55E+06	0.00E-01	0.00E-01
Cs134	7.44E+04	1.33E+03	3.96E+05	7.02E+05	1.90E+05	0.00E-01	7.95E+04	0.00E-01
Cs137	4.54E+04	1.33E+03	5.48E+05	6.11E+05	1.72E+05	0.00E-01	7.12E+04	0.00E-01
Ba140	2.89E+03	3.83E+04	5.59E+04	5.59E+01	1.34E+01	0.00E-01	1.59E+06	0.00E-01
Ce141	1.99E+03	2.15E+04	2.77E+04	1.66E+04	5.24E+03	0.00E-01	5.16E+05	0.00E-01
Ce144	1.76E+05	1.48E+05	3.19E+06	1.21E+06	5.37E+05	0.00E-01	9.83E+06	0.00E-01

(a) R values are in units of mrem/yr per uCi/m^3.

(b) 6.46E+02 = 6.46 X 10^2.

TABLE 4-16
(Sheet 1 of 3)

PALO VERDE NUCLEAR GENERATING STATION DISPERSION
AND DEPOSITION PARAMETERS FOR LONG TERM RELEASES
AT THE NEAREST PATHWAY LOCATIONS CENTERED ON UNIT 1

DIRECTION	RESIDENCE(c) X/Q (Sec/m³)	RESIDENCE(c) D/Q (m⁻²)	GARDEN(c) X/Q (Sec/m³)	GARDEN(c) D/Q (m⁻²)	MILK(c) X/Q (Sec/m³)	MILK(c) D/Q (m⁻²)
N	2.92E-06(b)	3.25E-09	2.92E-06	3.25E-09	7.03E-07(a)	3.48E-10(a)
NNE	1.81E-06	2.88E-09	4.70E-07(a)	4.04E-10(a)	4.70E-07(a)	4.04E-10(a)
NE	1.95E-06	3.85E-09	1.76E-06	3.29E-09	5.77E-07(a)	6.51E-10(a)
ENE	1.03E-06	1.08E-09	1.03E-06	1.08E-09	3.86E-07(a)	2.86E-10(a)
E	9.39E-07	6.68E-10	3.71E-07(a)	1.87E-10(a)	3.71E-07(a)	1.87E-10(a)
ESE	6.37E-07	2.84E-10	4.12E-07	1.60E-10	4.12E-07	1.60E-10
SE	8.83E-07	2.61E-10	8.83E-07	2.61E-10	5.84E-07(a)	1.52E-10(a)
SSE	1.27E-06	2.61E-10	1.09E-06(a)	2.15E-10(a)	1.09E-06(a)	2.15E-10(a)
S	2.58E-06	4.85E-10	2.09E-06	3.59E-10	2.13E-06	3.71E-10
SSW	3.26E-06	8.26E-10	2.28E-06(a)	4.53E-10(a)	2.28E-06(a)	4.53E-10(a)
SW	2.80E-06	9.10E-10	1.58E-06(a)	3.56E-10(a)	1.58E-06(a)	3.56E-10(a)
WSW	1.95E-06	1.09E-09	8.55E-07(a)	3.18E-10(a)	8.55E-07(a)	3.18E-10(a)
W	7.54E-07(a)	4.44E-10(a)	7.54E-07(a)	4.44E-10(a)	7.54E-07(a)	4.44E-10(a)
WNW	6.03E-07(a)	3.25E-10(a)	6.03E-07(a)	3.25E-10(a)	6.03E-07(a)	3.25E-10(a)
NW	8.24E-07	5.25E-10	7.55E-07	4.61E-10	6.02E-07(a)	3.27E-10(a)
NNW	1.46E-06	1.47E-09	5.20E-07(a)	3.04E-10(a)	5.20E-07(a)	3.04E-10(a)

(a) 5-mile value used since there is no pathway located within the sector up to five miles.

(b) 2.92E-06 = 2.92×10^{-6}

(c) Locations of these residences, gardens and milk animals are given in Table A-1, sheet 1. Controlling locations are discussed in Appendix A.

References: 1984 Land Use Census (letter ANPM-21221-JRM/LEB).
NUS Corporation letters NUS-ANPP-1385 and NUS-ANPP-1386.

TABLE 4-16
(Sheet 2 of 3)

PALO VERDE NUCLEAR GENERATING STATION DISPERSION
AND DEPOSITION PARAMETERS FOR LONG TERM RELEASES
AT THE NEAREST PATHWAY LOCATIONS CENTERED ON UNIT 2

DIRECTION	RESIDENCE(c) X/Q (Sec/m^3)	RESIDENCE(c) D/Q (m^{-2})	GARDEN(c) X/Q (Sec/m^3)	GARDEN(c) D/Q (m^{-2})	MILK(c) X/Q (Sec/m^3)	MILK(c) D/Q (m^{-2})
N	2.73E-06[b]	2.92E-09	2.39E-06	2.35E-09	7.03E-07[a]	3.48E-10[a]
NNE	2.20E-06	3.87E-09	2.20E-06	3.87E-09	4.70E-07[a]	4.04E-10[a]
NE	1.85E-06	3.55E-09	1.57E-06	2.78E-09	5.77E-07[a]	6.51E-10[a]
ENE	1.03E-06	1.08E-09	1.03E-06	1.08E-09	3.86E-07[a]	2.86E-10[a]
E	8.80E-07	6.06E-10	3.71E-07[a]	1.87E-10[a]	3.71E-07[a]	1.87E-10[a]
ESE	6.25E-07	2.76E-10	3.96E-07	1.51E-10	3.96E-07	1.51E-10
SE	9.06E-07	2.72E-10	9.06E-07	2.72E-10	5.84E-07[a]	1.52E-10[a]
SSE	1.34E-06	2.81E-10	1.09E-06[a]	2.15E-10[a]	1.09E-06[a]	2.15E-10[a]
S	2.63E-06	5.01E-10	2.19E-06	3.88E-10	2.19E-06	3.88E-10
SSW	3.48E-06	9.19E-10	2.28E-06[a]	4.53E-10[a]	2.28E-06[a]	4.53E-10[a]
SW	2.93E-06	9.75E-10	1.58E-06(a)	3.56E-10(a)	1.58E-06(a)	3.56E-10(a)
WSW	2.01E-06	1.16E-09	8.55E-07(a)	3.18E-10(a)	8.55E-07(a)	3.18E-10(a)
W	7.54E-07[a]	4.44E-10[a]	7.54E-07[a]	4.44E-10[a]	7.54E-07[a]	4.44E-10[a]
WNW	6.03E-07[a]	3.25E-10[a]	6.03E-07[a]	3.25E-10[a]	6.03E-07[a]	3.25E-10[a]
NW	7.84E-07	4.88E-10	7.84E-07	4.88E-10	6.02E-07[a]	3.27E-10[a]
NNW	1.46E-06	1.47E-09	5.20E-07	3.04E-10	5.20E-07[a]	3.04E-10[a]

[a] 5-mile value used since there is no pathway located within the sector up to five miles.

[b] 2.73E-06 = 2.73×10^{-6}

[c] Locations of these residences, gardens and milk animals are given in Table A-1, sheet 2. Controlling locations are discussed in Appendix A.

References: 1984 Land Use Census (letter ANPM-21221-JRM/LEB).
NUS Corporation letters NUS-ANPP-1385 and NUS-ANPP-1386.

TABLE 4-16
(Sheet 3 of 3)

PALO VERDE NUCLEAR GENERATING STATION DISPERSION
AND DEPOSITION PARAMETERS FOR LONG TERM RELEASES
AT THE NEAREST PATHWAY LOCATIONS CENTERED ON UNIT 3

DIRECTION	RESIDENCE(c)		GARDEN(c)		MILK(c)	
	X/Q (Sec/m^3)	D/Q (m^{-2})	X/Q (Sec/m^3)	D/Q (m^{-2})	X/Q (Sec/m^3)	D/Q (m^{-2})
N	2.58E-06[b]	2.47E-09	2.42E-06	2.22E-09	7.03E-07[a]	3.48E-10[a]
NNE	1.85E-06	2.97E-09	1.85E-06	2.97E-09	4.70E-07[a]	4.04E-10[a]
NE	1.66E-06	3.00E-09	1.48E-06	2.54E-09	5.77E-07[a]	6.51E-10[a]
ENE	8.75E-07	8.86E-10	8.75E-07	8.86E-10	3.86E-07[a]	2.86E-10[a]
E	8.90E-07	6.17E-10	4.06E-07	2.15E-10	4.25E-07	2.31E-10
ESE	6.37E-07	2.84E-10	5.80E-07	2.46E-10	3.73E-07[a]	1.37E-10[a]
SE	5.84E-07[a]	1.52E-10[a]	5.84E-07[a]	1.52E-10[a]	5.84E-07[a]	1.52E-10[a]
SSE	1.36E-06	2.88E-10	1.09E-06[a]	2.15E-10[a]	1.09E-06[a]	2.15E-10[a]
S	2.65E-06	5.25E-10	2.25E-06	4.06E-10	2.31E-06	4.21E-10
SSW	3.64E-06	9.82E-10	2.28E-06[a]	4.53E-10[a]	2.28E-06[a]	4.53E-10[a]
SW	3.19E-06	1.11E-09	1.58E-06(a)	3.56E-10(a)	1.58E-06(a)	3.56E-10(a)
WSW	2.12E-06	1.26E-09	8.55E-07(a)	3.18E-10(a)	8.55E-07(a)	3.18E-10(a)
W	7.54E-07[a]	4.44E-10[a]	7.54E-07[a]	4.44E-10[a]	7.54E-10[a]	4.44E-10[a]
WNW	6.03E-07[a]	3.25E-10[a]	6.03E-07[a]	3.25E-10[a]	6.03E-07[a]	3.25E-10[a]
NW	6.83E-07	4.05E-10	6.82E-07	4.05E-10	6.02E-07[a]	3.27E-10[a]
NNW	1.34E-06	1.26E-09	5.16E-07	3.01E-10	5.20E-07[a]	3.04E-10[a]

(a) 5-mile value used since there is no pathway located within the sector up to five miles.

(b) 2.58E-06 = 2.58×10^{-6}

(c) Locations of these residences, gardens and milk animals are given in Table A-1, sheet 3. Controlling locations are discussed in Appendix A.

References: 1984 Land Use Census (letter ANPM-21221-JRM/LEB).
NUS Corporation letters NUS-ANPP-1385 and NUS-ANPP-1386.

5.0 TOTAL DOSE AND DOSE TO PUBLIC ONSITE

5.1 Technical Specification 3.11.4 - 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 mrems to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems.

Since all other uranium fuel cycle sources are greater than 20 miles away, only the PVNGS site need be considered.

The total dose to any MEMBER OF THE PUBLIC will be determined based on a sum of the doses from all three units' releases and doses from direct radiation from PVNGS.

This dose evaluation is done annually and submitted with the Semiannual Radioactive Effluent Release Report for July through December to assure compliance with 40CFR Part 190, Environmental Radiation Protection Standards for Nuclear Power Operation. This dose evaluation will also be performed whenever calculated doses associated with effluent releases exceed twice the limits of any one of the Technical Specifications 3.11.2.2 or 3.11.2.3.

5.1.1 Doses from Releases

The annual whole body dose accumulated by a MEMBER OF THE PUBLIC for the noble gases released in gaseous effluents is determined by using the following equation:

$$D_{WB} = (3.17 \times 10^{-8}) \quad \Sigma_i \; [(K_i) \; (\chi/Q)_{RU} \quad (Q_i)] \qquad (5\text{-}1)$$

Where:

K_i = the whole body dose factor due to gamma emissions for each identified noble gas radionuclide i, in mrem/yr per uCi/m^3 from Table 3-1.

Q_i = the integrated release of radionuclide i, in uCi for the previous calendar year.

$(X/Q)_{RU}$ = the highest calculated annual average dispersion parameter, in sec/m^3, for a particular unit, at the controlling location, from Table 4-16, or concurrent meteorological data if available.

= 2.92×10^{-6} from Unit 1
= 2.19×10^{-6} from Unit 2
= 2.31×10^{-6} from Unit 3

D_{WB} = the annual whole body dose in mrem to a MEMBER OF THE PUBLIC at the controlling location due to noble gases released in gaseous effluents.

The annual dose to any organ accumulated by a MEMBER OF THE PUBLIC for iodine-131, iodine-133, tritium and all radionuclides in particulate form with half-lives greater than 8 days released in gaseous effluents is determined by using the following equation:

$$D_o = (3.17 \times 10^{-8}) \sum_i \left[\sum_k (R_{ik} W_k)(Q_i) \right] \quad (4\text{-}3)$$

Where:

D_o = the total annual organ dose from gaseous effluents to a MEMBER OF THE PUBLIC, in mrem, at the controlling location.

Q_i = the integrated release of radionuclide i, in uCi, for the previous calendar year.

R_{ik} = the dose factor for each identified radionuclide i, for pathway k (for the inhalation pathway in mrem/yr per uCi/m^3 and for the food and ground plane pathways in m^2-mrem/yr per uCi/sec) at the controlling location. The R_{ik}'s for each age group are given in Tables 4-1 through 4-15.

W_K = the highest annual average dispersion or deposition parameter for the particular unit, used for estimating the total annual organ dose to a MEMBER OF THE PUBLIC at the controlling location for the particular unit.

= $(X/Q)_{RU}$, in sec/m^3 for the inhalation pathway and for all tritium calculations, for organ dose at the controlling location, from Table 4-16 or concurrent meteorological data if available.

= 2.92×10^{-6} from Unit 1
= 2.19×10^{-6} from Unit 2
= 2.31×10^{-6} from Unit 3

= $(D/Q)_{RU}$, in m^{-2}, for the food and ground plane pathways, for organ dose at the controlling location, from Table 4-16 or concurrent meteorological data if available.

= 3.25×10^{-9} from Unit 1
= 3.88×10^{-10} from Unit 2
= 4.21×10^{-10} from Unit 3

5.1.2 Dose Due to Direct Radiation

The component of dose to a MEMBER OF THE PUBLIC due to direct radiation will be evaluated by first determining the direct radiation dose at the site boundary in each sector, and then extrapolating the site boundary dose to the controlling location by the inverse square law of distance.

5.2 Dose to Public Onsite

Technical Specification 6.9.1.8 - For the purpose of evaluating the dose to MEMBERS OF THE PUBLIC due to their activities within the SITE BOUNDARY the following methodology will be used. These activities have been determined to be limited to the vicinity of the Visitor Center located inside the SITE BOUNDARY west of Unit 1. An assumption was made that no MEMBER OF THE PUBLIC would spend more than eight hours per year at this location.

A X/Q, determined for the Visitor Center, will be used for this assessment.

Equations 5-1 and 4-3 in Sections 5.1.1 and 5.1.2 should be used for this assessment. Q_i should be the integrated release of radionuclide i, in uCi, for 8 hours (determined from the yearly Q_i).

6.0 RADIOLOGICAL ENVIRONMENTAL PROGRAM

6.1 Radiological Environmental Monitoring Program

Technical Specification 3.12.1 - The radiological environmental monitoring program shall be conducted as specified in Table 3.12-1 [of the Technical Specifications].

Samples shall be collected as specified in Table 3.12-1 [of the Technical Specifications] and from the specific locations given in Table 6-1 and Figures 6-1 and 6-2 of the ODCM, and shall be analyzed pursuant to the requirements of Table 3.12-1 [of the Technical Specifications], and the detection capabilities required by Table 4.12-1 [of the Technical Specifications].

The results of the radiological environmental monitoring program are intended to supplement the results of the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected based on the effluent measurements and modeling of the environmental exposure pathways. Thus, the specified environmental monitoring program provides measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides which lead to the highest potential radiation exposures to individuals resulting from station operation.

If the analysis of an environmental sampling medium at a specified location exceeds the reporting level of Table 3.12-2 [of the technical specifications] when averaged over any calendar quarter, an investigation shall be conducted. If the radioactivity is determined to be the result of plant effluents a Special Report is submitted to the NRC, within 30 days, which identifies the cause(s) for exceeding the limit(s) and corrective actions to be taken. If the radioactivity is determined not to be the result of plant effluents, the condition is reported and described in the Annual Radiological Environmental Operating Report.

The initial radiological environmental monitoring program will be conducted for the first three years of commercial operation of Unit 1. With the radiological environmental monitoring program not being conducted as specified in Table 3.12-1, [of the Technical Specifications] 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.

6.2 Land Use Census

Technical Specification 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.

A land use census is conducted in accordance with Technical Specification 3.12.2. When a land use census identifies a location(s) which yields a calculated dose or dose commitment greater than the values calculated in Technical Specification 4.11.2.3, identify the new location(s) in the next Semiannual Radioactive Effluent Release 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 3.12-1 shall be followed, including analysis of control samples.

When a land use census identifies a location(s) which 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, the new location(s) is added to the Radiological Environmental Monitoring Program within 30 days.

An equivalent sampling location(s), excluding the control location, having the lowest calculated dose or dose commitment(s), via the same exposure pathway, may be deleted from the Radiological Environmental Monitoring Program after October 31 of the year in which this land use census was conducted.

New sampling location(s) are identified in the next Semiannual Radioactive Effluent Report along with revised ODCM figure(s) and table(s) which reflect the new location(s).

A land use census is conducted during the growing season at least once per 12 months by a door-to-door or aerial survey, by consulting local agricultural authorities, or by any combination of these methods. The results of the land use census are reported in the Annual Radiological Environmental Operating Report.

6.3 Interlaboratory Comparison Program

Technical Specification 3.12.3 - Analyses shall be performed on radioactive materials supplied as part of an Interlaboratory Comparison Program that has been approved by the Commission that correspond to samples required by [Technical Specification] Table 3.12-1.

PVNGS laboratories or contract laboratories which perform analyses for the Radiological Environmental Monitoring Program (REMP) participate in the Environmental Protection Agency's (EPA's) Environmental Radioactivity Laboratory Intercomparisons Studies (crosscheck) Program. The participation includes all of the determinations (sample medium-radionuclide combinations) that are offered by the EPA and that are also included in the monitoring program.

The sample handling, preparation and analysis procedures approved for use on routine REMP samples, at the time the crosscheck samples are received from the EPA, are used to implement the program. The results of the crosscheck sample analyses are reviewed, at minimum on an annual basis, to ensure that the control limits established by the EPA are not exceeded.

If deviation from these specified limits is identified an investigation is made to determine the reason for the deviation and corrective actions are taken as necessary. The results of all analyses made under this program are included in the Annual Radiological Environmental Operating Report.

TABLE 6-1
(Sheet 1 of 4)

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE COLLECTION LOCATIONS

SAMPLE SITE	SAMPLE TYPE	NOTATION[d]	LOCATION DESIGNATION[a]	LOCATION DESCRIPTION
1	TLD		E30	APS Goodyear Office
1	Air		E30	Air East of RR Tracks
2	TLD		ENE24	Scott-Libby School, Perryville Rd. & Thomas Rd.
3	TLD		E21	Liberty School, 19800 W. Hwy. 85
4	TLD		E16	APS Buckeye Office, 615 N. 4th St, Buckeye
4	Air		E16	Same as TLD
5	TLD		ESE11	Palo Verde Rd. (291st Ave.) & Old Hwy. 80
6	TLD[b]	SP	SSE31	APS Gila Bend Substation, Service Rd. West Of Town, Off I-8
6	Air [b]	Control	SSE31	Same as TLD
7	TLD,[b]	SP	SE7	Old U.S. 85 and Arlington School Road
7A	Air		SE8	Arlington School, 16351 S. Arlington School Rd.
8	TLD[b]	OR	SSE5	Corner of 363rd Ave. & Southern Pacific Pipeline Rd.
9	TLD[b]	OR	S5	Corner of 371st Ave. & Southern Pacific Pipeline Rd.
10	TLD[b]	OR	SE5	Corner of 355th Ave. & Elliot Rd.
11	TLD[b]	OR	ESE5	Corner of 339th Ave. & Dobbins Rd.
12	TLD[b]	OR	E5	Corner of 339th Ave. & Buckeye-Salome Rd.
13	TLD[b]	IR	N1	N Site Boundary
14	TLD[b]	IR	NNE2	NNE Site Boundary
14A	Air[b]		NNE2	Buckeye-Salome Rd. & 371st Ave.
15	TLD[b]	IR	NE2	NE Site Boundary
15	Air [b]		NE2	Same as TLD
16	TLD[b]	IR	ENE2	ENE Site Boundary
17	TLD[b]	IR	E2	E Site Boundary

TABLE 6-1
(Sheet 2 of 4)

SAMPLE SITE	SAMPLE TYPE	NOTATION[d]	LOCATION DESIGNATION [a]	LOCATION DESCRIPTION
17A	Air		E4	351st Ave., 1 mi. S of Buckeye Salome Rd.
18	TLD[b]	IR	ESE2	ESE Site Boundary
19	TLD[b]	IR	SE2	SE Site Boundary
20	TLD[b]	IR	SSE2	SSE Site Boundary
21	TLD[b]	IR	S3	S Site Boundary
21	Air [b]		S3	Same as TLD
22	TLD[b]	IR	SSW3	SSW Site Boundary
23	TLD[b]	OR	W5	2 miles N. of Elliot Rd., 3 miles W. of Wintersburg Rd.
24	TLD[b]	OR	SW4	Elliot Rd. at Desert Farms
25	TLD[b]	OR	WSW5	Elliot Rd. at Cattle Guard
26	TLD[b]	OR	SSW5	Shepard Farm, 13202 S. 383rd Ave.
27	TLD[b]	IR	SW2	SW Site Boundary
28	TLD[b]	IR	WSW1	WSW Site Boundary
29	TLD[b]	IR	W1	W Site Boundary
29	Air [b]		W1	Same as TLD
30	TLD[b]	IR	WNW1	WNW Site Boundary
31	TLD[b]	IR	NW2	NW Site Boundary
32	TLD[b]	IR	NNW1	NNW Site Boundary
33	TLD[b]	OR	NW4	Buckeye Rd., 1/2 mile West of 395th Ave.
34	TLD[b]	OR	NNW5	Corner of 395th & Van Buren Rd.
35	TLD[b]	SP	NNW9	Tonopah, Palo Verde Inn Fire Station, 40901 W. Osborn Rd.
35	Air		NNW9	Same as TLD
36	TLD[b]	OR	N5	Corner of Wintersburg Rd. & Van Buren Rd.
37	TLD[b]	OR	NNE5	Corner of 363rd Ave. & Van Buren Rd.

TABLE 6-1
(Sheet 3 of 4)

SAMPLE SITE	SAMPLE TYPE	NOTATION[d]	LOCATION DESIGNATION [a]	LOCATION DESCRIPTION
38	TLD[b]	OR	NE5	Corner of 355th Ave. & Buckeye Rd.
39	TLD[b]	OR	ENE5	343rd Ave., 1/2 mi. South of Lower Buckeye Rd.
40	TLD[b]	SP	N3	Wintersburg, End of Transmission Rd.
40	Air[b]		N3	Same as TLD
41	TLD[b]	SP	WNW20	Harquahala Valley School, Van Buren St., 1 mi W. of Steve Martori Dr.
42	TLD[b]	SP	N8	Ruth Fisher School, Indian School Rd. & Wintersburg Rd.
43	TLD[b]	SP	N45	Vulture Peak Sch., Wickenburg, 1 mi S. of US 60
44	TLD[b]		ENE35	APS El Mirage Office, 12313 W. Grand Ave.
44	Air [b]	Control	ENE35	Same as TLD
45	TLD[b]	Control	E20	REMP Lab. (Lead PIG), 615 N. 4th St, Buckeye
46	Water[b]	WD	NNW9	McArthur's Farm, 41701 W. Indian School Rd.
46	TLD		ENE30	Litchfield Park Sch, 13825 W. Indian School Rd.
47	Vegetation[b]		ENE3	Adams Residence, Buckeye-Salome Rd.
47	TLD		E35	Littleton School, 115th Ave. & Hwy 85
48	Water[b]	WD	SSW5	Shepard Farms, 13202 S. 383rd Ave.
48	TLD		E24	Perryville, Jackrabbit Trail, S. of Circle K
49	Water[b]	WD	ESE4	Glover Residence, 9199 S. 351st Ave.
49	TLD		ENE11	Hopeville, Palo Verde Rd, 1/2 mi S. of I-10
50	Milk[b]		E28	Lueck Dairy, Jackrabbit Trail & Elliot Rd.
50	TLD		WNW5	Olinski Road, 2 mi. S. of Buckeye-Salome Rd.
51	Milk[b], Vegetation		E11	Butler Dairy, Palo Verde Rd. & Southern Ave.
52	Vegetation[b]		E15	Schroeder Farm, Miller Rd. & Broadway Rd.
53	Milk[b]		E26	Kerr Dairy, Dean Rd. & Buckeye Rd.

TABLE 6-1
(Sheet 4 of 4)

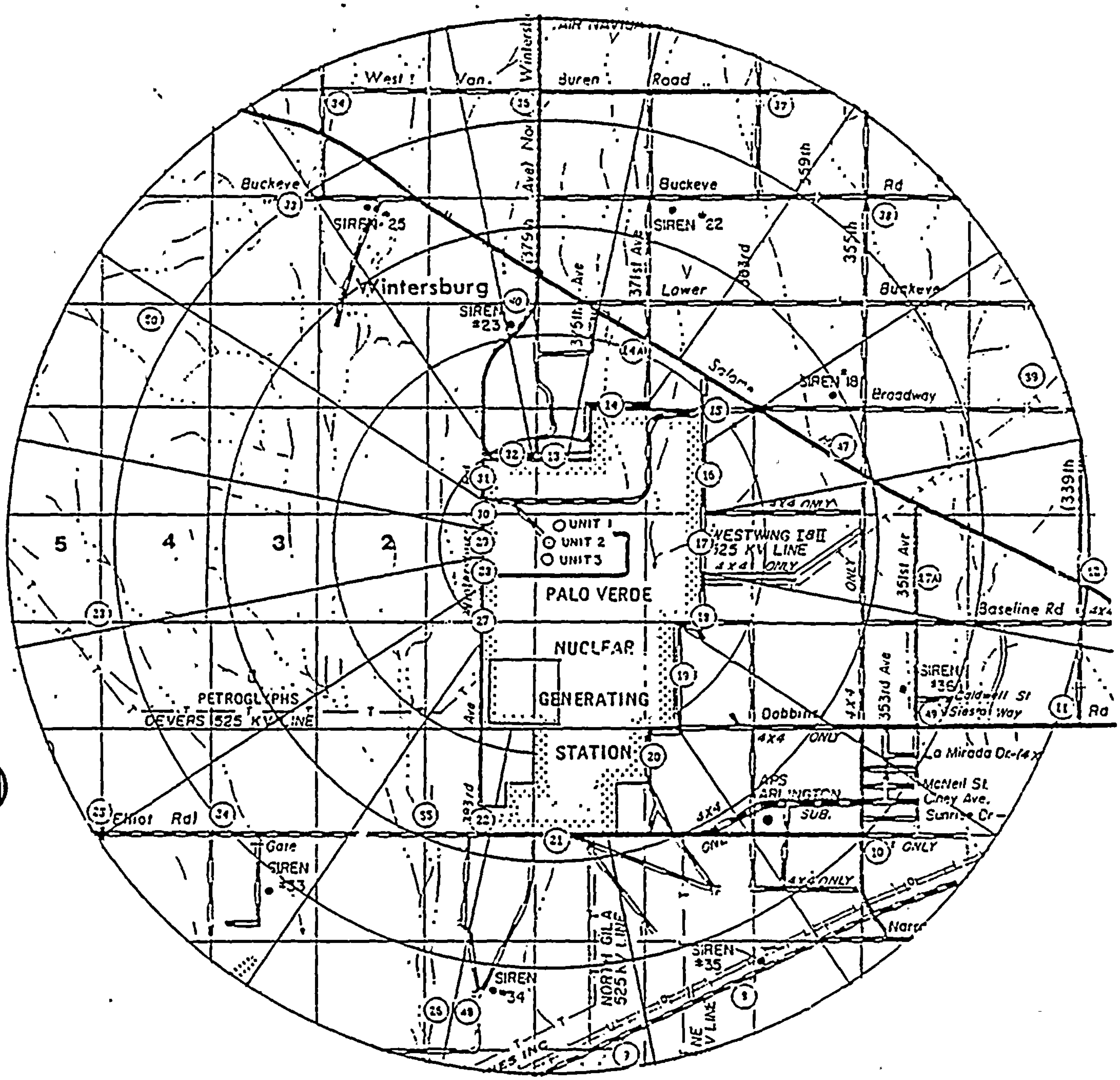
SAMPLE SITE	SAMPLE TYPE	NOTATION[d]	LOCATION DESIGNATION[a]	LOCATION DESCRIPTION
54	Milk		E27	Smart Dairy, Airport Rd. & Dobbins Rd.
55	Water		SW3	GaVette Residence, 39326 W. Elliot Rd.
56	Milk[b]	Control	E75	Hamstra Dairy #2, McQueen Rd. & Ryan Rd.
57	Water[b]	WG	Onsite	Well 27ddc
58	Water[b]	WG	Onsite	Well 34abb
59	Surface Water[b]	WS	Onsite	PVNGS Evaporation Pond #1
60	Surface Water[b]	WS	Onsite	PVNGS Reservoir
61	Citrus	Control	E80	Cooley Farms, Inc. (Higley, Arizona), 643 S. Sierra
62	Vegetation[b]	Control	ENE75	J.A. Wood Co., N. Alma School Rd.
63	Surface Water[b]	WS	Onsite	PVNGS Evaporation Pond #2

(a) Location Designation based on Sector and Zone Nomenclature from Table J-1, NUREG-0654. Distances are from the centerline of Unit 2 containment.

(b) These samples fulfill the requirements of the PVNGS Technical Specifications.

(c) Refer to Figures 6-1 and 6-2 for relative locations of Sample sites.

(d) IR - Inner Ring
OR - Outer Ring
SP - School or Population Center
WS - Waterborne Surface
WG - Waterborne Ground
WD - Waterborne Drinking



N

Palo Verde Nuclear Generating Station

Radiological Environmental

Monitoring Program

Sample Sites
0 to 5 miles

Figure 6-1

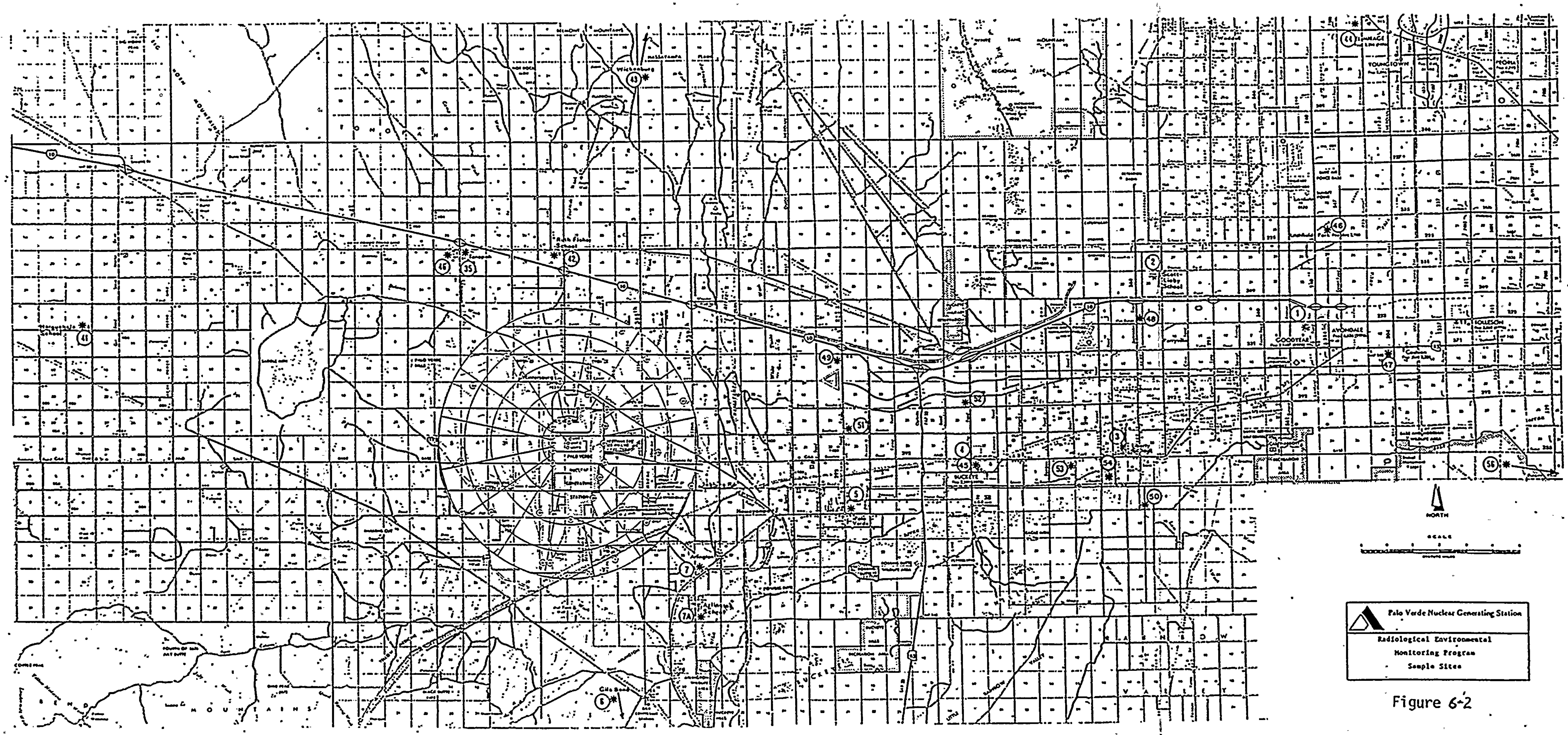


Figure 6-2

SI APERTURE CARD

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APPENDIX A

DETERMINATION OF CONTROLLING LOCATION

The controlling location is the location of the MEMBER OF THE PUBLIC who receives the highest doses.

The determination of a controlling location for implementation of 10CFR50 for radioiodines and particulates is known to be a function of:

(1) Isotopic release rates

(2) Meteorology

(3) Exposure pathway

(4) Receptor's age

The incorporation of these parameters into Equation 4-3 results in the respective equations at the controlling location. The isotopic release rates are based upon the source terms calculated using the PVNGS Environmental Report, Operating License Stage, Table 3.5-12, without carbon.

All of the locations and exposure pathways, identified in the 1984 Land Use Census, have been evaluated. These include cow milk ingestion, goat milk ingestion, vegetable ingestion, inhalation, and ground plane exposure. An infant is assumed to be present at all milk pathway locations. A child is assumed to be present at all vegetable garden locations. The ground plane exposure pathway is only considered to be present where an infant is not present. Naturally, inhalation is present everywhere an individual is present.

For the determination of the controlling locations, the highest X/Q and D/Q values, based on the 9 year meteorological data base, for the vegetable garden, cow milk, and goat milk pathways, are selected for each unit. The receptor organ doses have been calculated at each of these locations. Based upon these calculations, it is determined that the controlling receptor pathway is a function of unit location. For Unit 1, the controlling receptor is a garden-child pathway; for releases from Unit 2 and Unit 3 the controlling receptor is a cow milk-infant pathway. These determinations are based upon Table 4-16 which, in turn, is based upon the 1984 Land Use Census. Locations of the nearest residences, gardens and milk animals, as determined in the 1984 Land Use Census, are given in Table A-1.

TABLE A-1
(Sheet 1 of 3)
EXPOSURE PATHWAY LOCATIONS NEAREST TO PVNGS UNIT 1

Sector Designator(a)	Nearest Residence Distance Miles(a)	Location Designator (b)	Nearest Garden Distance Miles(a)	Location Designator (b)	Nearest Milk Animal Distance Miles(a)	Location Designator (b)	Animal Type
N	1.4	3	1.4	3	(c)		
NNE	1.8	20	(c)		(c)		
NE	1.9	4	2.1	5	(c)		
ENE	2.7	6	2.7	6	(c)		
E	2.8	9	(c)		(c)		
ESE	3.7	8	4.6	9	4.6	9	Goat
SE	4.1	10	4.1	10	(c)		
SSE	4.7	11	(c)		(c)		
S	4.6	19	5.2	12	5.1	12	Cow
SSW	3.5	13	(c)		(c)		
SW	2.9	14	(c)		(c)		
WSW	2.6	15	(c)		(c)		
W	(c)		(c)		(c)		
WNW	(c)		(c)		(c)		
NW	3.8	21	4.1	16	(c)		
NNW	2.0	17	(c)		(c)		

(a) Sector designators and distances derive from the 1984 Land Use Census (letter ANPM-21221-JRM/LEB), and are specific to the subject PVNGS unit.

(b) Location designators, and animal types at locations indicated, are from the 1984 Land Use Census (letter ANPM-21221-JRM/LEB).

(c) Postulated to be at 5 mile distance since the 1984 Land Use Census identified no pathway (residence, garden or milk animal as appropriate) within the sector and within 5 miles.

TABLE A-1
(Sheet 2 of 3)
EXPOSURE PATHWAY LOCATIONS NEAREST TO PVNGS UNIT 2

Sector Designator(a)	Nearest Residence Distance Miles(a)	Location Designator (b)	Nearest Garden Distance Miles(a)	Location Designator (b)	Nearest Milk Animal Distance Miles(a)	Location Designator (b)	Animal Type
N	1.5	1	1.7	2	(c)		
NNE	1.5	3	1.5	3	(c)		
NE	2.0	4	2.3	5	(c)		
ENE	2.7	6	2.7	6	(c)		
E	3.0	7	(c)		(c)		
ESE	3.7	8	4.7	9	4.7	9	Goat
SE	4.0	10	4.0	10	(c)		
SSE	4.5	11	(c)		(c)		
S	4.5	19	5.0	12	5.0	12	Cow
SSW	3.2	13	(c)		(c)		
SW	2.7	14	(c)		(c)		
WSW	2.5	15	(c)		(c)		
W	(c)		(c)		(c)		
WNW	(c)		(c)		(c)		
NW	4.0	16	4.0	16	(c)		
NNW	2.0	17	5.0	18	(c)		

(a) Sector designators and distances derive from the 1984 Land Use Census (letter ANPM-21221-JRM/LEB), and are specific to the subject PVNGS unit.

(b) Location designators, and animal types at locations indicated, are from the 1984 Land Use Census (letter ANPM-21221-JRM/LEB).

(c) Postulated to be at 5 mile distance since the 1984 Land Use Census identified no pathway (residence, garden or milk animal as appropriate) within the sector and within 5 miles.

TABLE A-1
(Sheet 3 of 3)
EXPOSURE PATHWAY LOCATIONS NEAREST TO PVNGS UNIT 3

Sector Designator(a)	Nearest Residence Distance Miles(a)	Location Designator (b)	Nearest Garden Distance Miles(a)	Location Designator (b)	Nearest Milk Animal Distance Miles(a)	Location Designator (b)	Animal Type
N	1.8	1	1.9	2	(c)		
NNE	1.7	3	1.7	3	(c)		
NE	2.2	4	2.4	5	(c)		
ENE	2.9	6	2.9	6	(c)		
E	3.0	7	4.6	9	4.5	9	Goat
ESE	3.7	8	4.0	10	(c)		
SE	(c)		(c)		(c)		
SSE	4.4	11	(c)		(c)		
S	4.2	19	4.9	12	4.8	12	Cow
SSW	3.1	13	(c)		(c)		
SW	2.5	14	(c)		(c)		
WSW	2.4	15	(c)		(c)		
W	(c)		(c)		(c)		
WNW	(c)		(c)		(c)		
NW	4.3	16	4.3	16	(c)		
NNW	2.2	17	5.0	18	(c)		

(a) Sector designators and distances derive from the 1984 Land Use Census (letter ANPM-21221-JRM/LEB), and are specific to the subject PVNGS unit.

(b) Location designators, and animal types at locations indicated, are from the 1984 Land Use Census (letter ANPM-21221-JRM/LEB).

(c) Postulated to be at 5 mile distance since the 1984 Land Use Census identified no pathway (residence, garden or milk animal as appropriate) within the sector and within 5 miles.

APPENDIX F

CHANGES TO OFFSITE DOSE CALCULATION MANUAL (ODCM)

REVISION REQUEST FORM

DATE: 10/14/88

ORIGINATOR: PAUL GENOA EXT: 1966

Description and Justification of Revision:

Licensee initiated changes to the ODCM must be made in accordance with PVNGS Technical Specification 6.14.2. This report contains sufficiently detailed information to support the rationale for the changes to the ODCM and hereby determines that the changes will not reduce the accuracy or reliability of dose calculations or set point determinations.

The major technical changes made in the revision are:

1. Use of a new ODCM review and approval process.
2. Additional potential nuisance release pathways.
3. Revised calibration curve for the Waste Gas Decay Tank Monitor.
4. Revised setpoint calculation for the Waste Gas Decay Tank Monitor.
5. Deletion of Section 6.0, "Operability of Equipment."
6. With reference to the Land Use Census, replacement of the concept of increase in D/Q with increase in dose.

A detailed discussion of the changes appears in this report. The evaluations are organized by Section of the ODCM (i.e., change 1.1 is the first change in ODCM Section 1, change 5.7 is the seventh change in ODCM Section 5, etc., zero is used to designate changes which occur in the document prior to Section 1).

Page 1 of 20

Approved By: [signature] Date: 22 Dec 88
Chemistry Standards Supervisor

Use additional pages as required.

[illegible]

Cover Page:

Change 0.1:

Revision 1 has signatures of (a) department head, (b) the Plant Review Board Chairman and (c) the Plant Manager.

Revision 2 will bear signatures of (a) originator, (b) technical reviewer and (c) the Manager, Radiation Protection and Chemistry, (d) PRG Chairman.

Explanation 0.1:

The review and control of revisions to the ODCM are now subject to the requirements of an Administrative Control procedure in the PVNGS Station Manual, in order to provide a formal and documented means of complying with PVNGS' Technical Specification 6.5.2.9 in lieu of the previous review process.

TABLE OF CONTENTS:

Change 0.2:

Section 1.1 "Liquid Effluents" was changed to "Liquid Effluent Pathways"
Section 1.2 "Gaseous Effluents" was changed to "Gaseous Effluent Pathways"

Explanation 0.2:

Editorial

Change 0.3:

Section 6.0, "Operability of Equipment", was deleted, and Section 7.0, "Radiological Environmental Program", its page numbers, table numbers and figure numbers were redesignated for new section 6.0, "Radiological Environmental Program."

Explanation 0.3:

Section 6.0 of Rev. 1 of the ODCM consisted simply of flow diagrams of the radioactive waste systems. These are deleted as not required and of no apparent value in the ODCM.

Section 7.0 of Rev. 1 is renumbered to Section 6.0 of Rev. 2, to conform.

Change 0.4:

Figure 2-2 (Rev. 1) has title: "Initial Calibration Curve for PVNGS Monitor RU-12. Response to Kr-85 Gas."

Explanation 0.4:

Figure 2-2 and its title have been revised to reflect the same units on the X and Y axis as Figure 2-1.

Change 0.5:

Tables 6-2 and 6-3 were deleted.

Explanation 0.5:

These tables are copies of tables in the Technical Specification. Section 6 was revised to reference the Technical Specification Tables.

<u>INTRODUCTION:</u>

Change 1.1:

Rev. 1 heading for Section 1.1 reads: "Liquid Effluents".

Rev. 2 heading for Section 1.1 reads: "Liquid Effluent Pathways".

Explanation 1.1:

Editorial change only.

Change 1.2:

Rev. 1 heading for Section 1.2 reads: "Gaseous Effluents".

Rev. 2 heading for Section 1.2 reads: "Gaseous Effluent Pathways".

Explanation 1.2:

Editorial change only.

Change 1.3:

Rev. 1 states:

"1.3 <u>Nuisance Pathways</u>

This section addresses the potential release pathways which should not contribute more than 10% of the doses evaluated in this manual. Table 1-1 identifies these potential release pathways which would occur primarily due to operation with primary to secondary leakage.---".

Rev. 2 states:

"1.3 <u>Nuisance Pathways</u>

This section addresses the potential release pathways which should not contribute more than 10% of the doses evaluated in this manual. Table 1-1 lists examples of potential release pathways.---".

Explanation 1.3:

Table 1-1 is now characterized as listing examples of pathways, rather than identifying all potential pathways, due to an intent to not mislead the reader to accept the listing as exhaustive for all time. New pathways for potential release have been added to PVNGS since Rev. 1 was issued, and it is recognized that this process can continue. The reference to primary to secondary leakage has been deleted due to recognition of potential release pathways not associated with primary to secondary leakage.

<u>Table 1-1</u>:

Change 1.4:

Rev. 1 lists Laundry Building Exhaust

Rev. 2 lists Laundry/Decontamination Building Exhaust

Explanation 1.4:

This potential pathway is better-characterized as the Laundry/<u>Decontamination</u> Building Exhaust.

Change 1.5:

Rev. 2 adds:

> "Dry Active Waste Processing and Storage (DAWPS) Building Respirator Cleaning Facility Secondary Side decontamination equipment."

Explanation 1.5:

These items have been added to PVNGS and are recognized to be potential release pathways.

<u>2.0 GASEOUS EFFLUENT MONITOR SETPOINTS</u>:

Change 2.1:

All Rev. 1 references to Technical Specification 3.3.3.9 have been changed to Technical Specification 3.3.3.8 in Rev. 2.

Explanation 2.1:

The cited Technical Specification has been renumbered in the Operating Licenses for the 3 units.

Change 2.2:

All Rev. 1 references to Technical Specification Table 3.3-13 have been changed to Table 3.3-12 in Rev. 2.

Explanation 2.2:

The cited Table has been renumbered in the Operating Licenses for the 3 units.

2.4.1 Monitors Ru-141, Ru-143, and Ru-145

Change 2.3:

Rev. 1 states:

"The alarm/trip setpoint for Monitors Ru-141, Ru-143, and Ru-145 is calculated as follows:

$$\text{Monitor Setpoint } (\mu Ci/cc) \leq \frac{(\dot{Q}_{UNIT})(2.12\times10^{-3}\ \frac{CFM}{cc/sec})}{(\text{Flow Rate})}(a) \qquad (2\text{-}6)$$

where:

Monitor Setpoint = the setpoint for the effluent monitor, in µCi/cc, which provides a safe margin of assurance that the allowable dose rate limits will not be exceeded.

$\dot{Q}_{UNIT}$ = unit release rate limit, in µCi/sec, as determined in Section 2.3.

Flow Rate = the flow rate, in cfm, from flow rate monitors or the fan design flow rate for the release source under consideration.

2.12×10^{-3} = conversion factor, cubic feet/minute per cubic centimeter/second.

a = fraction of $\dot{Q}_{UNIT}$ allocated for a specific release point. The sum of these administrative values will be less than or equal to one."

Rev. 2 states:

"The alarm/trip setpoint for Monitors Ru-141, Ru-143, and Ru-145 is calculated as follows:

$$\text{Monitor Setpoint } (\mu Ci/cc) \leq \frac{(\dot{Q}_{UNIT})\ (a)}{(471.9)(\text{Flow Rate})} \qquad (2\text{-}6)$$

where:

Monitor Setpoint = the setpoint for the effluent monitor, in $\mu Ci/cc$, which provides a safe margin of assurance that the allowable dose rate limits will not be exceeded.

$\dot{Q}_{UNIT}$ = unit release rate limit, in $\mu Ci/sec$, as determined in Section 2.3.

Flow Rate = the flow rate, in cfm, from flow rate monitors or the fan design flow rate for the release source under consideration.

471.9 = conversion factor, cubic centimeter/second per cubic feet/minute.

a = fraction of $\dot{Q}_{UNIT}$ allocated for a specific release point. The sum of these administrative values will be less than or equal to one."

Explanation 2.3:

The Rev. 2 conversion factor of 471.9 is the reciprocal of the Rev. 1 conversion factor of 2.12E-3.

<u>2.4.2 Monitor RU-12</u>:

Change 2.4:

Rev. 1 states:

"The alarm/trip setpoint for Monitor RU-12, the Waste Gas Decay Tank Monitor, is calculated as follows:

$$\text{Monitor Setpoint } (\mu Ci/cc) \leq \frac{[(\dot{Q}_{UNIT})\ (2.12\times10^{-3}\ \frac{CFM}{cc/sec})\ (0.9)(a)]}{(\text{Flow Rate})} \qquad (2\text{-}7)$$

where:

Monitor Setpoint = the setpoint for the monitor, in µCi/cc at STP, which provides a safe margin of assurance that the allowable dose rate limits will not be exceeded.

$\dot{Q}_{UNIT}$ = unit release rate limit, in µCi/sec, as determined in Section 2.3.

Flow Rate = flow rate, in cfm at STP at which the tank will be released.

a = fraction of $\dot{Q}_{UNIT}$ allocated for a specific release point. This administrative value should be equal to or less than the administrative value used for the Plant Vent.

0.9 = an administrative value to account for potential increases in activity from other contributors to the same release point.

2.12×10^{-3} = conversion factor, cubic feet/minute per cubic centimeter/second."

Rev. 2 states:

"The alarm/trip setpoint for Monitor RU-12, the Waste Gas Decay Tank Monitor, is calculated as follows:

$$\text{Monitor Setpoint } (\mu Ci/cc) \leq \frac{[(\dot{Q}_{UNIT})(a)(0.9)] - [(H)(PF)(471.9)]}{(\text{Flow Rate})\ (471.9)} \qquad (2\text{-}7)$$

where:

Monitor Setpoint = the setpoint for the monitor, in µCi/cc at STP, which provides a safe margin of assurance that the allowable dose rate limits will not be exceeded.

$\dot{Q}_{UNIT}$ = unit release rate limit, in µCi/sec, as determined in Section 2.3.

Flow Rate = flow rate, in cfm at STP at which the tank will be released.

PF = the current process flow of the plan vent in CFM.

H = the current plant vent monitor concentration in μCi/cc.

a = fraction of Q_{UNIT} allocated for a specific release point. This administrative value should be equal to or less than the administrative value used for the Plant Vent.

0.9 = an administrative value to account for potential increases in activity from other contributors to the same release point.

471.9 = conversion factor, cubic centimeter/second per cubic feet/minute."

Explanation 2.4:

Waste Gas Decay Tank (WGDT) discharges are to the atmosphere via the Plant Vent. Equation (2-7) of Rev. 1 does not account for the existing release via the Plant Vent -- for sources other than WGDT -- in the determination of a setpoint for the WGDT monitor when developing a release permit for a planned WGDT discharge. Any existing release is indeed accounted for in the setpoint procedure, and Equation (2-7) of Rev. 2 reflects this. The change in conservative. Variables H and PF, added to Equation (2-7) of Rev. 2 provide the parameters needed to account for existing release via the Plant Vent.

The Rev. 2 conversion factor of 471.9 is the reciprocal of the Rev. 1 conversion factor of $2.12X10^{-3}$; the reciprocal, Rev. 2, value is mathematically required by the form of the equation.

2.5 Monitor Calibration:

Change 2.5:

The third paragraph in Rev. 1 reads:

"The typical calibration conversion factor for the Waste Gas Decay Tank Monitor (RU-12) is based on Kr-85 calibration as indicated on Figure 2-2."

The third paragraph in Rev. 2 reads:

"The typical calibration conversion factor for the Waste Gas Decay Tank Monitor (RU-12) is based on the detector energy response curve (Figure 2-2) and the FSAR source term decayed for forty five (45) days."

Explanation 2.5:

Same as explanation 0.3.

<u>Figure 2-2</u>:

Change 2.6:

Figure 2-2 and its title have been revised to reflect the same units on the X and Y axis as Figure 2-1. A different curve is presented.

Explanation 2.6:

Same as explanation 0.4.

4.2 <u>Iodine - 131, Iodine - 133, Tritium , and All Radionuclides in Particulate Form With Half-Lives Greater Than 8 Days Technical Specification 3.11.2.3</u>:

Change 4.1:

Rev. 1 states:

"The R_i values were calculated in accordance with the methodologies in NUREG-0133 and generated using the GASPAR code. The following site specific information was used to calculate R_i:

	Value
fraction of year milch animals and beef animals are on pasture, f_p	0.75
fraction of daily intake of milch animals and beef animals derived from pasture while on pasture, f_s	0.35
fraction of year vegetables are grown, f_l approximation	0.667
absolute humidity (g/m^3) over the growing season, H	4

These site specific values are from the PVNGS Environmental Report, Section 2 and Appendix 5-B."

Rev. 2 states:

"The R_i values were calculated in accordance with the methodologies in NUREG-0133 and generated using the GASPAR code. The following site specific information was used to calculate R_i:

	Value
fraction of year milk animals and beef animals are on pasture, f_p	0.75
fraction of the feed that is pasture grass while the milk and beef animals are on pasture, f_s	0.35
fraction of year vegetables are grown, f_l approximation	0.667
the annual absolute humidity (g/m^3), H	6

These site specific values are from the PVNGS Environmental Report, Section 2 and Appendix 5-B."

Explanation 4.1:

The term "Milch" while technically correct tended to confuse some readers. The term "Milk" has been substituted in this revision to avoid this problem in the future. In addition, the ER-OL lists 2 values for H over the growing season (4 and 6). To avoid confusion the annual value of 6 will be used. The definition of H reflects this change.

6.0 OPERABILITY OF EQUIPMENT:

Change 6.1:

Section 6.0 is deleted from Rev. 2.

Explanation 6.1:

Same as explanation 0.2.

7.0 RADIOLOGICAL ENVIRONMENTAL PROGRAM (Rev. 1 title)

Change 6.2:

All page numbers, section numbers, table numbers and figure numbers have been changed to reflect the renumbering of Section 7.0 in Rev. 1 to Section 6.0 in Rev. 2.

Explanation 6.2:

Consistency with change 6.1.

6.1 Radiological Environmental Monitoring Program. Technical Specification 3.12.1:

Change 6.3:

Rev. 1 states:

"Samples shall be collected as specified in Table 3.12-1 [of the Technical Specifications] and from the specific locations given in the table and figure(s) in the ODCM, and shall be analyzed pursuant to the requirements of Table 3.12-1, and the detection capabilities required by Table 4.12-1 [of the Technical Specifications].

Environmental samples are collected at locations shown in Figures 7-1 and 7-2 and described in Table 7-1. Analytical techniques used ensure that the detection capabilities in Table 7-2 are achieved. Environmental samples are collected and analyzed according to Table 7-3."

Rev. 2 states:

Samples shall be collected as specified in Table 3.12-1 [of the Technical Specifications] and from the specific locations given in Table 6-1 and Figures 6-1 and 6-2 (of the ODCM), and shall be analyzed pursuant to the requirements of Table 3.12-1, [of the Technical Specifications] and the detection capabilities required by Table 4.12-1 [of the Technical Specifications].

Explanation 6.3:

The sampling and analysis requirements are controlled by the Technical Specifications, not the ODCM. Only the table and figures of the specific locations are required in the ODCM.

Change 6.4:

Add paragraph:

"If the analysis of an environmental sampling medium at a specified location exceeds the reporting level of Table 3.12-2 [of the technical specifications] when averaged over any calendar quarter, an investigation shall be conducted. If the radioactivity is determined to be the result of plant effluents a Special Report is submitted to the NRC, within 30 days, which identifies the cause(s) for exceeding the limit(s) and corrective actions to be taken. If the radioactivity is determined not to be the result of plant effluents, the condition is reported and described in the Annual Radiological Environmental Operating Report."

Explanation 6.4

This is additional program information describing the activities which would be conducted for the contingency mentioned; this is derived from Action Statement 3.12.1b of the PVNGS Technical Specifications.

Change 6.5

Rev. 1 states:

"Following this period, program changes may be proposed based on operational experience. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment, and other legitimate reasons.

If specimens are unobtainable due to sampling equipment malfunction, an effort is made to complete corrective action prior to the end of the next sampling period. All deviations from the sampling schedule are documented in the annual report."

Rev. 2 states:

"With the radiological environmental monitoring program not being conducted as specified in Table 3.12-1, [of the Technical Specifications] 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."

Explanation 6.5:

This change clearly states the Technical Specification Action Statement.

6.2 LAND USE CENSUS:

Change 6.6:

Rev. 2 adds the footnote of PVNGS Technical Specification 3.12.2: "*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 3.12-1 shall be followed, including analysis of control samples."

Explanation 6.6:

Editorial change; previous quotation of the Technical Specification was less complete.

Change 6.7:

Rev. 1 states:

"A land use census is conducted in accordance with Technical Specification 3.12.2. When a land use census identifies a location(s) which yields a calculated dose or dose commitment greater than the values calculated from current sample locations, appropriate changes in the sample locations are made."

Rev. 2 states:

"A land use census is conducted in accordance with Technical Specification 3.12.2. When a land use census identifies a location(s) which yields a calculated dose or dose commitment greater than the values calculated in Technical Specifications 4.11.2.3, identify the new location(s) in the next Semiannual Radioactive Effluent Release Report."

Explanation 6.7:

This is additional program information describing the activities which would be conducted for the contingency mentioned; this is derived from Action Statement 3.12.2a of the PVNGS Technical Specifications.

Change 6.8:

Rev. 1 states:

"If a land use census identifies a location(s) with a higher average annual disposition rate (D/Q) than a current indicator location, the following applies:

1. If the D/Q is at least 20% greater than a previously high D/Q, one of the existing sample locations may be replaced after and evaluation with a new one within 30 days. The evaluation is based on past history of the location, availability of sample, milk production history, and other environmental conditions.

2. If the D/Q is not 20% greater than the previously highest D/Q, distance and D/Q are considered in deciding whether to replace one of the existing sample locations. If applicable, replacement is made within 30 days."

Rev. 2 states:

"When a land use census identifies a location(s) which 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, the new location(s) is added to the Radiological Environmental Monitoring Program within 30 days.

An equivalent sampling location(s), excluding the control location, having the lowest calculated dose or dose commitment(s), via the same exposure pathway, may be deleted from the Radiological Environmental Monitoring Program after October 31 of the year in which this land use census was conducted.

New sampling location(s) are identified in the next Semiannual Radioactive Effluent Report along with revised ODCM figure(s) and table(s) which reflect the new location(s)."

Explanation 6.8:

This is additional program information describing the activities which would be conducted for the contingency mentioned; this is derived from Action Statement 3.12.2b of the PVNGS Technical Specification. In addition, the action specified is based on an increase of 20% or greater of the calculated dose or dose commitment rather than an increase in the D/Q as in Revision 1. This methodology more closely implements the referenced Technical Specification.

Change 6.9:

Rev. 1 states:

"A land use census is conducted at least one per calendar year by a door-to-door or aerial survey, by consulting local agricultural authorities, or by any combination of these methods."

Rev. 2 states:

"A land use census is conducted during the growing season at least once per 12 months by a door-to-door or aerial survey, by consulting local agricultural authorities, or by any combination of these methods. The results of the land use census are reported in the Annual Radiological Environmental Operating Report."

Explanation 6.9:

This change clarifies that the census is conducted during the growing season, and that results are reported.

6.3 INTERLABORATORY COMPARISON PROGRAM:

Change 6.10

Rev. 1 states:

"The results of analyses of these crosscheck samples are included in the annual report."

Rev. 2 states:

"The results of all analyses made under this program are included in the Annual Radiological Environmental Operating Report."

Explanation 6.10:

Editorial change: The statement was combined with material added; see change 6.11, following.

Change 6.11:

Rev. 2 has additional text:

"The sample handling, preparation and analysis procedures approved for use on routine REMP samples, at the time the crosscheck samples are received from the EPA, are used to implement the program. The results of the crosscheck sample analyses are reviewed, at minimum on an annual basis, to ensure that the control limits established by the EPA are not exceeded.

If deviation from these specified limits is identified an investigation is made to determine the reason for the deviation and corrective actions are taken as necessary. The results of all analyses made under this program are included in the Annual Radiological Environmental Operating Report."

Explanation 6.11:

Paragraph one above identifies the specific review areas and schedule that will be performed with regard to the EPA crosscheck sample analysis results as recommended by Reg Guide 4.15, Section 6.3.2.

Paragraphs one and two above identify the "Methodology and Parameters (acceptance criteria or actions based on non-acceptance)" as required by section 4.12.3 of PVNGS Technical Specification.

<u>Table 6-1</u>:

Change 6.12:

Changes occurred at the sample sites listed, for the following reasons:

Sample Site	Change	Reason
1	Add: Air, East of RR Tracks	TLD and Air not together
2	Add: Perryville Rd & Thomas Rd	Specify address
3	E25 to E21, Add: 19800 W. Hwy. 85	Distance wrong in Rev. 1, Specify address
4	E20 to E16 Add: 615 N. 4th St. Buckeye	Distance wrong in Rev. 1, Specify address
5	ESE 15 to ESE 11 Add: (291st Ave) & Old Hwy 80	Distance wrong in Rev. 1, Specify address

Explanation 6.12 (cont'd):

Sample Site	Change	Reason
6	SSE 35 to SSE 31 Add: Service Rd W. of Town, off I-8	Distance wrong in Rev. 1, Specify address
7A	Add: 16351 S. Arlington School Rd	Specify address
10	Ward Rd to Elliot Rd	New Rd. Name
14A	NNE 3 to NNE 2	Distance wrong in Rev. 1
23	Ward Rd to Elliot Rd	New Road Name
24	" " " " "	" " "
25	" " " " "	" " "
26	Add: 13202 S. 383rd Ave	Specify Address
33	NNW 5 to NNW 4	New location SE corner of 395th and Buckeye Rd.
34	Belmont Rd to 395th	Rd. Marked 395th
35	Add: 40901 W. Osburn Rd	Specify Address
38	Yuma Rd to Buckeye Rd	New Road Name
40	TLD Add: End of Transmission Rd	Specify address
41	Add: Van Buren St., 1 mi W. of Steve Martori Dr.	Specify address
42	Add: Indian School Rd. & Wintersburg Rd.	Specify address
43	Add: 1 mi. S. of US 60	Specify address
44	TLD Add: 12313 W. Grand Ave.	Specify address
45	Add: 615 N. 4th St, Buckeye	Specify address
46	Water Add: 41701 W. Indian School Rd.	Specify address
46	TLD ENE 30 Litchfield Pk Sch., 13825 W. Indian School Rd.	New TLD Site

Explanation 6.12 (cont'd):

Sample Site	Change	Reason
46	Water Add: 41701 W. Indian School Rd.	Specify address
47	Vegetation NE3 to ENE3	Direction wrong in Rev. 1
47	Vegetation Add: Buckeye-Salome Rd.	Specify Address
47	TLD E35 Littleton School, 115th Ave & Hwy 85	New TLD site
48	Water(b) SSW 5 Shepard Farms, 13202 S. 383rd Ave	New Water Site
48	TLD E24 Perryville, Jackrabbit Trail, S. of Circle K	New TLD Site
49	Wedgeworth to Glover, Add: 9199 S 351st Ave.	New Property Owner
49	TLD ENE11 Hopeville, Palo Verde Rd. 1/2 mi. S. of I-10	New TLD Site
50	E 28 Leuck Dairy, Jackrabbit Trail & Elliot Rd	New Site Number (Baisley Dairy gone)
50	TLD WNW5 Olinski Rd 2 mi. S. of Buckeye-Salome Rd.	New TLD Site
52	Cambron to Schroeder	New Resident
54	Skousen to Smart	New Resident
55	Water SW3 Gavette Residence, 39326 W. Elliot Rd	New Water Site
59	Add: #1	There are 2 Evap Ponds
61	Add: 643 S. Sierra	Specify Address
62	AJM Farms to J.A. Wood Co.	New Name of Site
63	Surface Water(b) PVNGS Evap Pond #2	New Location

Figures 6-1 and 6-2:

Change 6.13:

A column "NOTATION" was added to Table 6-1. This clarifies the locations stated in Technical Specifications Table 3.12-1.

Change 6.14:

Sample locations are updated.

Explanation 6.14:

Changes required for consistency with change 6.12.

Appendix A:

Change A.1:

Rev. 1 uses "milch animal".

Rev. 2 uses "milk animal".

Explanation A.1:

Editorial; delete German and use English consistently.