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SUBJECT: "Semiannual Radioactive Effluent Release Rept for Jul-Dec 1989." W/900301 ltr.

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161-02929-WFC/JRP
March 1, 1990

Docket Nos. STN 50-528/529/530

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Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, and 3
Semi-annual Radioactive Effluent Release Report
File: 90-A-056-026

Pursuant to 10 CFR 50.36a(a)(2), and in accordance with Technical Specification 6.9.1.8, attached please find the Semi-annual 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, 1989.

If you have any questions, please contact Mr. J. R. Provasoli at (602) 340-4160.

Sincerely,

WFConway

WFC/JRP/jle

Attachment

cc: T. L. Chan
S. H. Peterson
D. H. Coe
J. B. Martin

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FOR INFORMATION ONLY

OFFSITE DOSE CALCULATION MANUAL

PALO VERDE NUCLEAR GENERATING STATION

UNITS 1, 2, and 3

REVISION 3

Originator Louis Dunoosky Date 2/13/90

Technical Reviewer K. Kutner K. KUTNER Date 2-15-90

Mgr. Radiation Protection and Chemistry W. Hughes Date 2/20/90

Effective Date 2-21-90

3822E, 3823E/WPVOL

9003080247

OFFSITE DOSE CALCULATION MANUAL

PALO VERDE NUCLEAR GENERATING STATION

UNITS 1, 2 AND 3

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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.

[illegible]

[illegible]

[illegible]

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

[illegible]

[illegible]

[illegible]

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/m^3 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/m^3 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 $\dot{Q}_{SITE}$ is established as follows:

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

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/m^3 weighted by the historical radionuclide distribution.

$(x/Q)_{SBW}$ = $8.91X10^{-6}$, the highest calculated annual average dispersion parameter, in sec/m^3, 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.

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

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.

[illegible]

$(L+1.1M)_{eq}$	=	equivalent skin dose factor, in mrem/yr per uCi/m^3, weighted by the radionuclide distribution.
$(\chi/Q)_{SBW}$	=	$8.91X10^{-6}$, the highest calculated annual average dispersion parameter, in sec/m^3, 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.

$\dot{Q}_{SITE}$ = 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 ($\dot{Q}_{UNIT}$) 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:

$$\text{Monitor Setpoint (uCi/cc)} \leq \frac{(\dot{Q}\text{UNIT})\ (a)}{(471.9)\ (\text{Flow Rate})} \tag{2-6}$$

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

2.4.2 Monitor RU-12

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

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

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.

[illegible]

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.

[illegible]

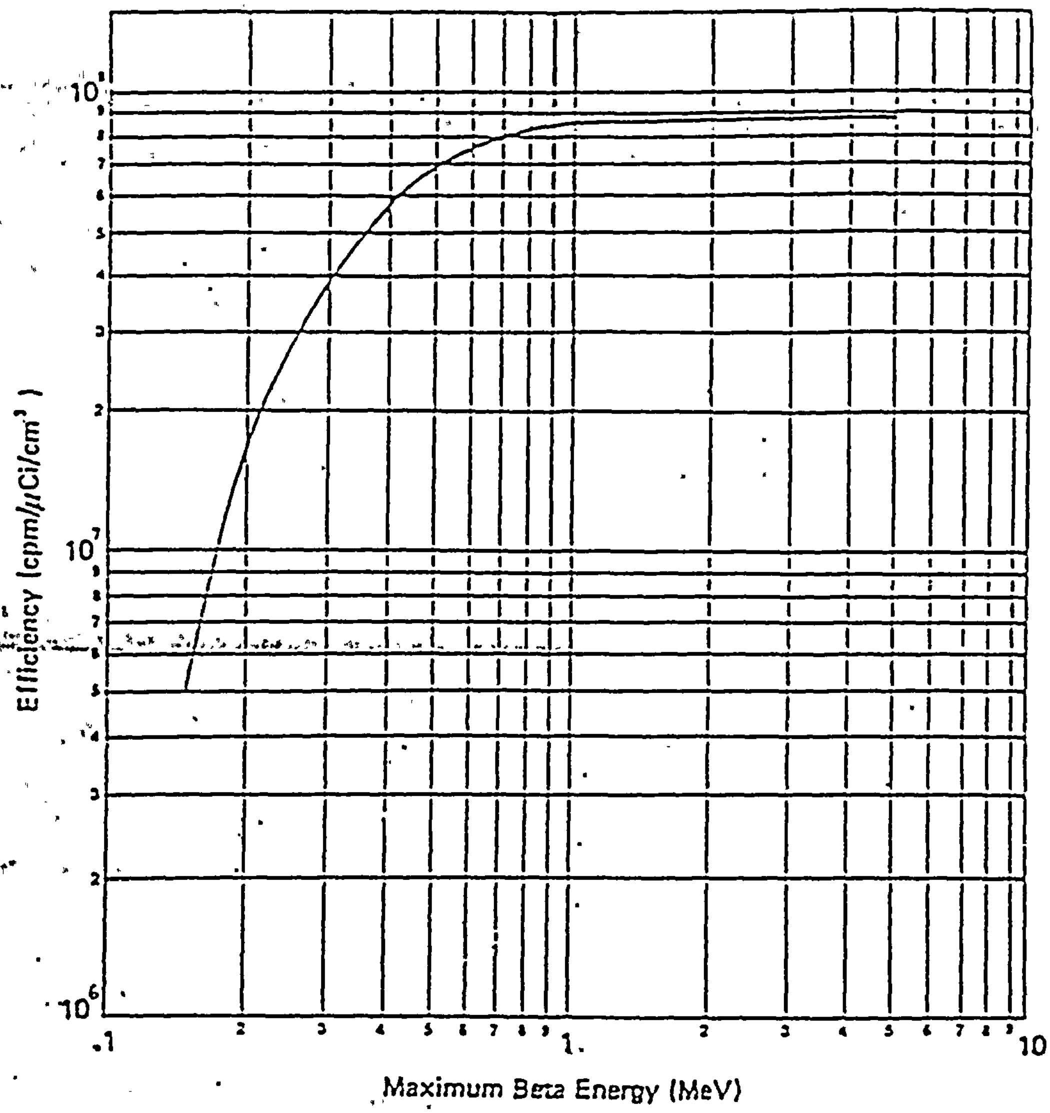

FIGURE 2-1

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)

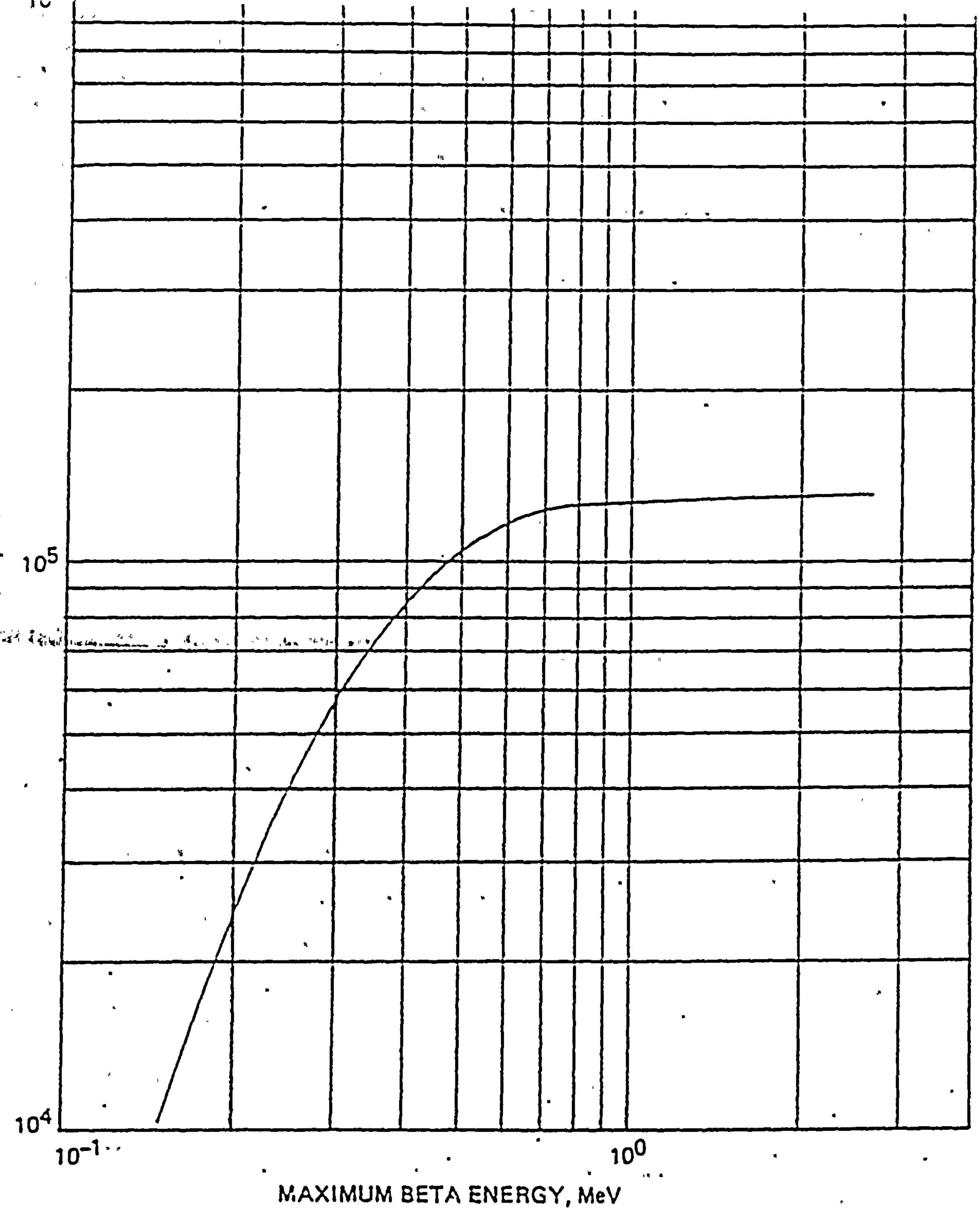

FIGURE 2-2

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:

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

For skin dose rate:

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

Where:

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

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

$(\chi/Q)_{SBW}$ = 8.91×10^{-6}, the highest calculated annual average dispersion parameter, in sec/m^3, 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/m^3 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/m^3 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).

[illegible]

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:

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

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.

$(\chi/Q)_{SBW}$ = 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/m^3)	Skin Dose Factor L_i (mrem/yr per uCi/m^3)	Gamma Air Dose Factor M_i (mrad/yr per uCi/m^3)	Beta Air Dose Factor N_i (mrad/yr per uCi/m^3)
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 X 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)	χ/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)	χ/Q (SEC/m^3)	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) $1.12E+03 = 1.12 \times 10^3$

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.

Rev. 3

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:

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

For beta radiation:

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

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.

[illegible]

[illegible]

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.

$(X/Q)_{SBu}$ = 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.

$D\gamma_u$= 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.

[illegible]

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:

$$D_{ou} = (3.17 \times 10^{-8}) \Sigma_i \quad [\Sigma_k (R_{ik} W_k) (Q_i)] \qquad (4\text{-}3)$$

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.

= $(\chi/Q)_{SBU}$, 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

= $(\chi/Q)_{RU}$, 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 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_1 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.

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:

$D\gamma qtr$ = the total gamma air dose due to noble gases released in gaseous effluents for the current quarter, in mrads, at the site boundary.

$D\beta qtr$ = 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 $D\gamma$ qtr and $D\beta$ qtr were integrated.

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

to noble gases released in gaseous effluents, in mrads, at the site boundary.

31 dayß = the 31 day projected beta air dose due to noble gases released in gaseous effluents, in mrads, at the site boundary.

$CD\gamma$ = 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 γ .

CDß = 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 dayß .

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+08	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	3.76E+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 X 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	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.

[illegible]

[illegible]

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	3.90E+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	1.85E+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 = 1.54×10^3.

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.

[illegible]

[illegible]

[illegible]

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 = 1.26×10^3.

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	3.80E+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 = 1.12×10^3.

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/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	2.92E-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)		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	2.73E-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)	
	χ/Q (Sec/m^3)	D/Q (m^{-2})	χ/Q (Sec/m^3)	D/Q (m^{-2})	χ/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:

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

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.

$(\chi/Q)_{RU}$ = 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.

$= 2.92\times10^{-6}$ from Unit 1
$= 2.19\times10^{-6}$ from Unit 2
$= 2.31\times10^{-6}$ 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:

$$D_o = (3.17 \times 10^{-8}) \Sigma_i \quad [\Sigma_k (R_{ik} W_k)(Q_i)] \qquad (4\text{-}3)$$

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.

= $(\chi/Q)_{RU}$, 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 χ/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.

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*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.

[illegible]

[illegible]

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

SAMPLE SITE	SAMPLE TYPE	NOTE (d)	LOCATION DESIGNATION(a)	LOCATION DESCRIPTION
1	TLD		E30	APS Western Division Office, Goodyear
1	Air		E30	Same as TLD (east of RR tracks)
2	TLD		ENE24	Scott-Libby School, Perryville Rd. and 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 School, Palo Verde Rd.(291st. Ave) and Old Hwy.80
6	TLD(b)	SP	SSE31	APS Gila Bend Substation, service road west of town off I-8
6	Air(b)	Control	SSE31	Same as TLD
7	TLD(b)	SP	SE7	Old US 80 and Arlington School Rd.
7A	Air		SE8	Arlington School, 16351 S. Arlington School Rd.
8	TLD(b)	OR	SSE5	Southern Pacific Pipeline Rd., 1.4 miles SW of 355th. Ave.
9	TLD(b)	OR	S5	Southern Pacific Pipeline Rd., 2.5 miles SW of 355th. Ave.
10	TLD(b)	OR	SE5	SE corner of 355th. Ave and Elliot Rd.
11	TLD(b)	OR	ESE5	NW corner of 339th. Ave. and Dobbins Rd.

SAMPLE SITE	SAMPLE TYPE	NOTE (d)	LOCATION DESIGNATION(a)	LOCATION DESCRIPTION
12	TLD(b)	OR	E5	NE corner of 339th. Ave. and Buckeye-Salome Rd.
13	TLD(b)	IR	N1	N site boundary
14	TLD(b)	IR	NNE2	NNE site boundary
14A	Air(b)		NNE2	SW corner of 371st. Ave. and Buckeye-Salome Rd.
15	TLD(b)	IR	NE2	NE site boundary, on WRF access Rd.
15	Air(b)		NE2	Same as TLD
16	TLD(b)	IR	ENE2	ENE site boundary
17	TLD(b)	IR	E2	E site boundary
17A	Air		E4	351st. Ave., 1 mile south 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 north of Elliot Rd., 3 miles west of Wintersburg Rd.
24	TLD(b)	OR	SW4	Elliot Rd., 2 miles west of Wintersburg Rd. at Desert Farms

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE COLLECTION LOCATIONS

TABLE 6-1

SAMPLE SITE	SAMPLE TYPE	NOTE (d)	LOCATION DESIGNATION(a)	LOCATION DESCRIPTION
25	TLD(b)	OR	WSW5	Elliot Rd., 3 miles west of Wintersburg Rd. at cattle guard
26	TLD(b)	OR	SSW5	Shepard farm, 13202 S. 383rd. Ave.,0.5 miles west of house
27	TLD(b)	IR	SW1	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	NW1	NW site boundary
32	TLD(b)	IR	NNW1	NNW site boundary
33	TLD(b)	OR	NW4	Buckeye Rd., 0.5 miles west of 395th. Ave.
34	TLD(b)	OR	NNW5	SE corner of 395th. Ave. and Van Buren St.
35	TLD(b)	SP	NNW9	Palo Verde Inn Fire Station, 40901 W. Osborn Rd., Tonopah
35	Air		NNW9	Same as TLD
36	TLD(b)	OR	N5	SW corner of Wintersburg Rd. and Van Buren St.
37	TLD(b)	OR	NNE5	SE corner of 363rd. Ave. and Van Buren St.
38	TLD(b)	OR	NE5	SW corner of 355th. Ave. and Buckeye Rd.
39	TLD(b)	OR	ENE5	343rd. Ave., 0.5 miles south of Lower Buckeye Rd.

SAMPLE SITE	SAMPLE TYPE	NOTE (d)	LOCATION DESIGNATION(a)	LOCATION DESCRIPTION
40	TLD(b)	SP	N3	Wintersburg, Transmission Rd. at telephone pole
40	Air(b)		N3	Same as TLD
41	TLD(b)	SP	WNW20	Harquahala Valley School, Van Buren St., 1 mile west of Steve Martori Dr.
42	TLD(b)	SP	N8	Ruth Fisher School, Indian School Rd. and Wintersburg Rd.
43	TLD(b)	SP	N45	Vulture Peak School, 1 mile south of US 60, Wickenburg
44	TLD(b)	Control	ENE35	APS El Mirage Office, 12313 W. Grand Ave.
44	Air		ENE35	Same as TLD
45	TLD(b)	Transit Control	E16	APS Buckeye Office, 615 N. 4th. St., REMP trailer (lead pig)
46	Water (b)	WD	NNW9	McArthur farm, 41701 W. Indian School Rd., Tonopah
46	TLD		ENE30	Litchfield Park School, 13825 W. Indian School Rd.
47	Vegetation(b)		ENE3	Adam's residence, NW corner of 355th. Ave. and Buckeye-Salome Rd.
47	TLD		E35	Littleton School, 115th. Ave. and Hwy. 85, Cashion
48	Water (b)	WD	S5	Shepard farm, 13202 S. 383rd. Ave., at farm house

SAMPLE SITE	SAMPLE TYPE	NOTE (d)	LOCATION DESIGNATION(a)	LOCATION DESCRIPTION
48	TLD		E24	Jackrabbit Trail south of I-10, north of Filmore St.
49	Water (b)	WD	ESE4	Scott residence, 9199 S. 351st. Ave., NE corner of 351st. Ave. and Dobbins Rd.
49	TLD		ENE11	Palo Verde Rd., 0.25 miles south of I-10
50	Milk(b)		ENE12	Crosswinds Dairy, 295th. Ave. and Van Buren St.
50	TLD		WNW5	Olinski Rd., 2 miles south of Buckeye-Salome Rd.
51	Milk(b)		E11	Butler Dairy, Palo Verde Rd. and Southern Ave.
52	Vegetation(b)		N2	DeShazo residence, 0.5 miles south of Buckeye-Salome Rd. on 375th. Ave.
53	Milk(b)		E20	Kerr Dairy, Dean Rd. and Buckeye Rd.
54	Milk		E17	Dickman Dairy, Broadway Rd. and Apache Rd. (Cemetery Rd.)
55	Water		SW3	Gavette residence, 39326 W. Elliot Rd.
56	Milk(b)	Control	E75	Pew Dairy, McQueen Rd. and Ryan Rd., Chandler
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

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE COLLECTION LOCATIONS

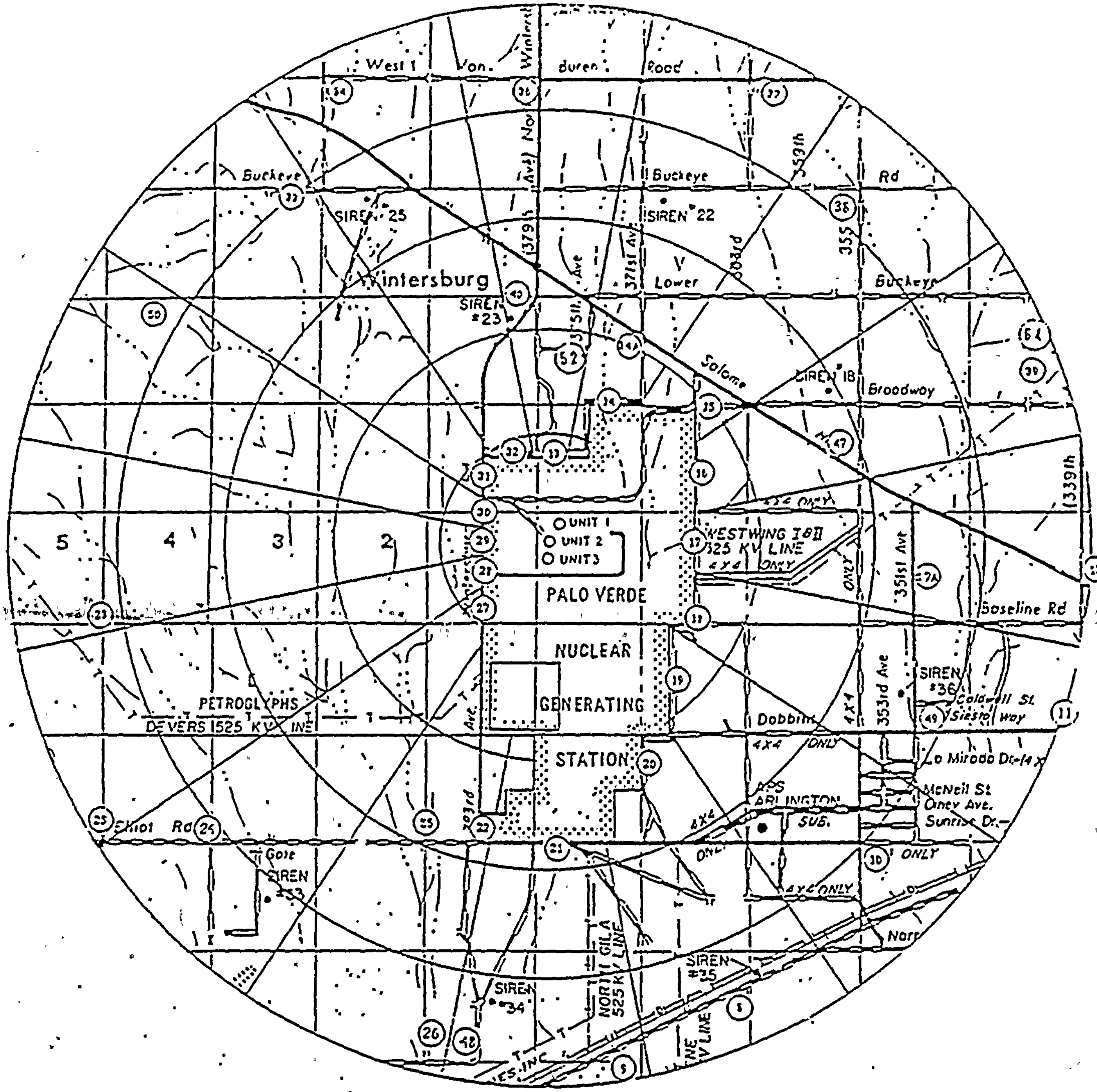
TABLE 6-1

(Page 6 of 6)

SAMPLE SITE	SAMPLE TYPE	NOTE (d)	LOCATION DESIGNATION(a)	LOCATION DESCRIPTION
61	DELETED			
62	Vegetation(b)	Control	ENE75	J.A. Wood Co., N. Alma School Rd.
63	Surface Water(b)	WS	onsite	PVNGS Evaporation Pond #2
64	Milk(b)	Goat	ENE5	Kolb residence, 0.5 miles north of Broadway Rd. and 343rd. Ave.

(a) Distance and direction are from the centerline of the 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) NOTE:

IR- inner ring
OR- outer ring
SP- school or population center
WS- waterborne surface
WG- waterborne ground
WD- waterborne drinking



Palo Verde Nuclear Generating Station

Radiological Environmental

Monitoring Program

Sample Sites
0 to 5 miles

N

Figure 6-1
Rev. 12/89

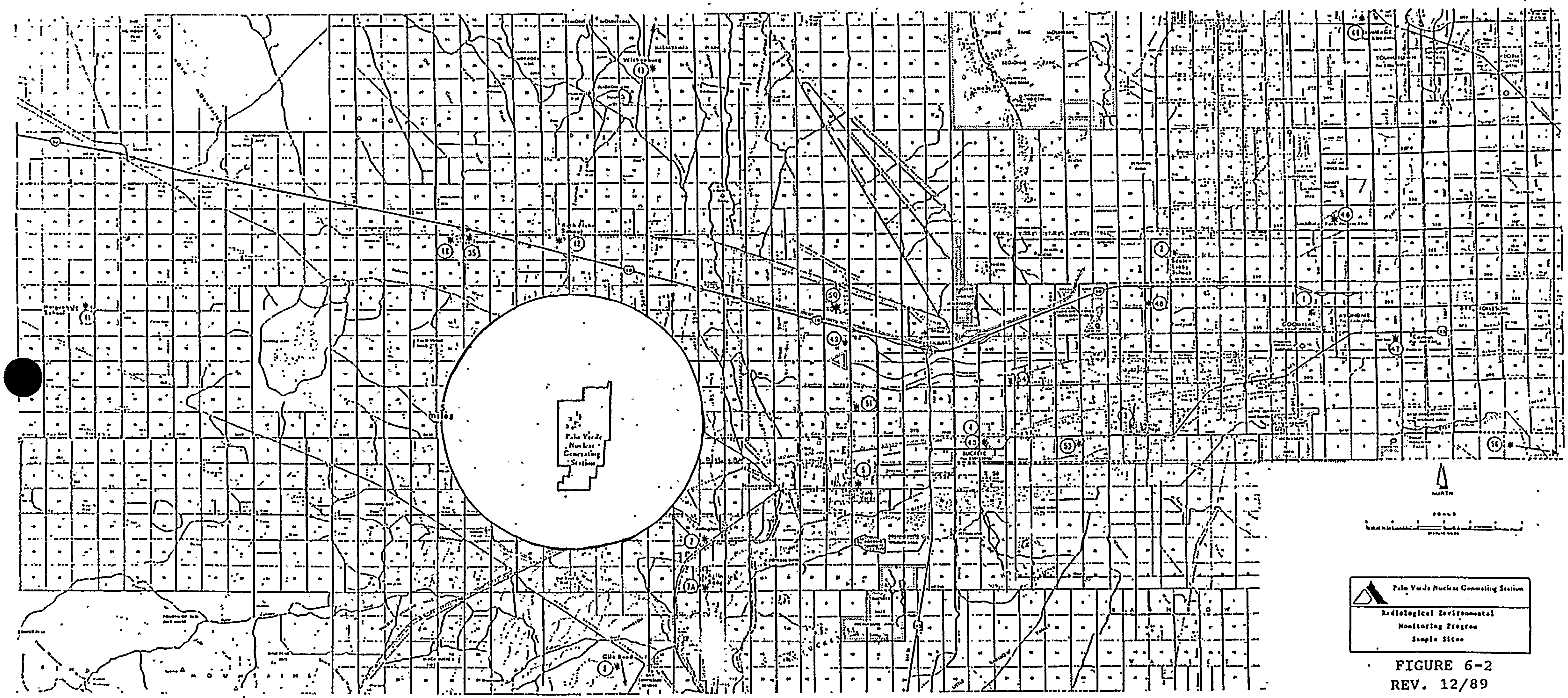


FIGURE 6-2
REV. 12/89

[illegible]

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.

REVISION REQUEST FORM

DATE: 12/11/89

ORIGINATOR: Louis Drinovsky EXT: 3895 PAGE 1 OF 5

Description and Justification of Revision:

Table 6-1, Radiological Environmental Monitoring Sample Collection Locations, is in need of a revision to reflect changes in the sample locations since ODCM Revision 2. Additionally, Figures 6-1 and 6-2 will be revised to more accurately depict sample locations. The changes to be made are explained in detail on pages ~~2 and 3~~ LSD 12/13/89 3, 4, 5, ~~and 6~~ of this submittal. The changes made will not reduce the accuracy or reliability of previous dose calculations and setpoint determinations. Upon completion of 75ST-9ZZ04, Land Use Census, which is in process as of this date, any changes in dose or dose commitment will be identified and reported. Note that per Technical Specification 3.12.1 action c, sample site #50 (milk) and #52 (vegetation) are required to be reported as revised sample locations in the next Semi-Annual Radioactive Effluent Release Report. Sample site #64 (goat milk) also falls within this reporting criteria.

Approved By: J.B. Cederquist Date: 30 JAN 90
Chemistry Standards Supervisor

Use additional pages as required.

REVIEW AND CONTROL OF THE OFFSITE DOSE CALCULATION MANUAL	75AC-9RP18	Revision 1
	Appendix B Page 1 of 1	

TECHNICAL SPECIFICATION REFERENCE

A. Periodic Review and/or Revision Requirements:

Technical Specification Surveillance requirements and/or limiting conditions for operation have been reviewed. This review/revision of the ODCM includes verification that the methods and procedures, methodology and parameters, locations, and figures and tables referenced in the following Tech Specs are included in this revision of the ODCM;

(NOTE: Signature below denotes the review of all Tech Specs referenced)

Tech Spec -	4.11.1.2	Methodology and Parameters (M&P)
	4.11.2.1.1	Methods and Procedures
	4.11.2.1.2	Methods and Procedures
	4.11.2.2	M&P
	4.11.2.3	M&P
	4.11.2.4	M&P
	4.11.4.1	M&P
	4.11.4.2	M&P
	4.12.1	Locations
LCO -	3.12.2.b	Figures and Tables
	4.12.3	M&P

ODCM Revision No. 3

Initiator Name (printed) Louis Drinovsky

Signature Louis Drinovsky Date 12/11/89

Technical Reviewer K W [illegible] Date 2-15-90

B. Additional Revision Requirements:

Does the ODCM revision submittal contain;

1. Sufficiently detailed information to totally support the rationale for the change without benefit of additioanal or supplemental information? Yes ✓ No ___ (Information submitted should consist of those pages of the ODCM to be changed with each page numbered and provided with an approval and date box, together with appropriate analyses or evaluations justifying the change(s)) (RCTS011072) and;

2. A determination that the change will not reduce the accuracy or reliability of dose calculations or setpoint determinations? (RCTS 011050). Yes ✓ No ___

Initiator Louis Drinovsky Date 12/11/89

Technical Reviewer K W [illegible] K KUTHER Date 2-15-90

PV216-00NI (8-88)

[illegible]

ODCM revision 2, section 4.2, page 4-5, states in part;

" Residences, vegetable gardens and meat and milk animals located within 5 miles of the site will be identified during the annual land use census. "

ODCM revision 3, section 4.2, page 4-5, (referenced above) was changed to read ;

" Residences, vegetable gardens, and milk animals located within 5 miles of the site will be identified during the annual land use census. "

EXPLANATION OF CHANGE:

The technical specifications (3/4.12.2) do not require that meat animals be identified in the annual land use census. In addition, the 1985 Annual Radiological Environmental Operating Report identifies that in February of 1984 meat was deleted from the sampling program.

ODCM revision 2, Table 6-1 was revised to more accurately identify existing sample locations and change sample locations which are no longer applicable. Below is listed the changes made and the explanations for changes:

Sample Site	Change(s)	Reason for change(s)
1	location description	more accurate description
7	location description	corrected typo
8	location description	more accurate description
9	location description	more accurate description
10	location description	more accurate description
11	location description	more accurate description
12	location description	more accurate description
14A	location description	more accurate description
15	location description	more accurate description
24	location description	more accurate description
25	location description	more accurate description
26	location description	more accurate description

Sample Site	Change(s)	Reason for change(s)
27	SW2 to SW1	correct distance error
31	NW2 to NW1	correct distance error
34	location description	more accurate description
35	location description	more accurate description
36	location description	more accurate description
37	location description	more accurate description
38	location description	more accurate description
40	location description	more accurate description
44(TLD)	added 'control' notation	correct error in table
44(Air)	deleted note (b) and 'control'	correct error in table
45	'control' to 'transit control'	more accurate description of sample purpose
46	location description	more accurate description
47	location description	more accurate description
48(water)	SSW5 to S5, location description	well is actually located in the S sector at house
48	location description	more accurate description
49(water)	location description	new resident at location
49(TLD)	location description	more accurate description
50(milk)	replaced Lueck Dairy with Cross-winds Dairy	previous dairy went out of business in December, 1988
51	deleted vegetation sample	citrus is no longer collected
52	replaced the Schroeder Farm with the DeShazo residence	the Schroeder family no longer gardens, DeShazo's are a nearest resident with a garden in the N sector per the most recent land use census

Sample Site	Change(s)	Reason for change(s)
54	replaced the Smart Dairy with the Dickman Dairy	the Smart Dairy went out of business
56	location description	new dairy owner
61	deleted this sample point	citrus samples are no longer collected
64	added goat milk sample point	goat milk was identified as being within the 5 mile zone by land use census

Additional change:
Note (b) identified that the location designations were based on Table J-1 of NUREG-0654. This format of reporting locations was deleted since it is more accurate to identify locations by actual distance and direction. Also, the Technical Specification Table 3.12-1, Table Notations, note (a), states in part, "Actual locations (distance and direction) from the site shall be provided ..."

ODCM Rev. 3 also includes revised Figures 6-1 and 6-2 to reflect the sample location changes made on Table 6-1. These figures are nothing more than maps showing relative sample locations.

SUMMARY

The changes made to the ODCM per this submital will not reduce the accuracy or reliability of dose calculations or setpoint determinations. These changes only update the REMP sample locations and delete the identification of meat animals as part of the land use census.

Summary of PCN01 to 76PR-9RW01

Table of Content: added page 8A.

Step 1.1.3; New material dealing with "Dewatering and Drying Resins" and Packaging Class B & C Waste in High Integrity Containers.

Step 1.2.1; Changed:

Did read: This program applies to operation of plant installed and vendor provided portable solidification systems at PVNGS and provides reasonable assurance of compliance with Low Level Radioactive Waste Regulations.

Now reads: This program applies to operation of plant installed and plant portable processing systems and vendor provided portable processing systems at PVNGS. It provides reasonable assurance of compliance with Low Level Radioactive Waste Regulations.

Page 5 & 6: No change to text. Moved step 2.2 from p4 to p5 and step 2.3 from p5 to p6.

Step 3.4.1; Line 2, removed comma following the word "Class".

Step 3.4.2; Line 1, removed the dash (-) following the word "Class". Line 3, removed the word "or" following "Revision 4".

Step 3.4.3; Line 5, removed the word "or" following the word "corporation".

Step 3.4.4; Added the following sentence to the end of step 3.4.4.

Class A ion exchange resins may be dewatered in an appropriate container in accordance with approved operating procedure.

Step 3.4.5: Line 5 & 6: Changed "with the vendors operating procedures" to "with approved operating procedures".

Note: Changed wording to avoid excluding PVNGS from using a house owned portable solidification system.

Step 3.4.7 through 3.4.7.2; New material to provide for packaging of Class B & C Radioactive waste in High Integrity Containers. (per ref. 5.2.21).

Step 4.1.4: Added definition of "High Integrity Container".

Step 4.2.2; Verbalized acronym "HIC".

Step 5.2.21: New reference: NRC Technical Position on Waste Form, Rev. 0, May 1983.

Appendix A; Added "R.W. Truckbay" and "Portable R.W. System" connections to schematic drawing.

CONTROLLED DOCUMENT

PROCEDURE CHANGE NOTICE

PROCEDURE NO.:	REV. NO.:	PCN NO.: (OBTAIN FROM DDC ONLY)
76PR-9RW01	0	01

TITLE:	DDC CONTACT:
Solid Radwaste Process Control Program	Lori
	EXT.: 6633

ORIGINATOR: (PLEASE PRINT)	EXT.:	UNIT(S) AFFECTED.
F. M. Petty	3718	All

REASON FOR THIS PCN:

Add provisions for Dewatering and Drying Resins and Packaging Class B & Class C Waste in High Integrity Containers. Add new reference "NRC Technical Position on Waste Form, Rev. 0, May 1983". Revisie Appendix A, schematic drawing to show Radwaste truckbay connection and Portable Radwaste System connection. Make several editorial corrections.

EXPIRATION: ~~Indefinite~~ Permanent GS 12-95

PAGE NUMBERS AFFECTED BY THIS PCN:	TOTAL NUMBER OF PAGES ATTACHED:
2, 4, 5, 6, 7, 8, 8A, 11, 12, 13, 14, 15, 16.	16

Does PCN require a 50.59 review?	☐ NO	☒ YES
Does PCN affect activities in the RCA	☐ NO	☒ YES *(Copy to ALARA)*
Does PCN affect the non-radiological environment of any offsite or previously undisturbed onsite area?	☒ NO	☐ YES *(Refer to Environmental Review & Evaluation)*
Does PCN pertain to an AC, Program, Emergency Plan or Security Program, Phase I-IV Test, or a ST?	☐ NO	☒ YES *(PRB/PRG/TRRG Review Required)*

APPROVALS

[signature]	7 Nov., 1989
TECHNICAL REVIEWER *(Supervisory Level)*	Date
[signature]	11/15/89
PRB/PRG/TRRG CHAIRMAN (If required)	Date
[signature]	11/15/89
FINAL APPROVAL	DATE

EFFECTIVE DATE: *(DDC ONLY)*	ASSIGNED COPY NUMBER: *(DDC ONLY)*
11/28/89	

PV216-03ND (6-88)

PALO VERDE NUCLEAR GENERATING STATION
UNITS 1, 2 AND 3

SEMIANNUAL RADIOACTIVE
EFFLUENT RELEASE REPORT

JULY 1, 1989 THROUGH DECEMBER 31, 1989

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

Table of Contents

List of Tables

[illegible]

INTRODUCTION

This report summarizes meteorological data and doses from radioactive effluents for the Palo Verde Nuclear Generating Station (PVNGS) for the period of July through December 1989. The data presented meets the reporting requirements of Regulatory Guide 1.21 (Revision 1, June 1974) of the U.S. Nuclear Regulatory Commission and the PVNGS Technical Specifications.

The report is organized into five 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 contains the revised Solid Radwaste Process Control Program (PCP). Appendix E contains the revised Offsite Dose Calculation Manual (ODCM).

BIBLIOGRAPHY

Palo Verde Nuclear Generating Station Units 1, 2, and 3, Semiannual Radioactive Effluent Release Report, January 1, 1989 through June 30, 1989. USNRC Dockets STN-50-528, STN-50-529, STN-50-530.

U.S. Nuclear Regulatory Commission, Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents form Light-Water-Cooled Nuclear Power Plants", Revision 1, 1974.

U.S. Nuclear Regulatory Commission, Regulatory Guide 1.23 (Safety Guide 23), "Onsite Meteorological Programs", 1972.

U.S. Nuclear Regulatory Commission, NUREG/CR-2919, "XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations", 1982.

U.S. Nuclear Regulatory Commission, NUREG-0579, "Users Guide to GASPAR Code", June 1980.

U.S. Nuclear Regulatory Commission, Regulatory Guide 1.109, "Calculations of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I", Revision 1, 1977.

U.S. Nuclear Regulatory Commission, NUREG-0172, "Age-specific Radiation Dose Commitment Factors for a One-Year Chronic Intake", 1977.

U.S. Nuclear Regulatory Commission, NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants", 1978.

U.S. Nuclear Regulatory Commission, NUREG-1133, "Technical Specifications, Palo Verde Nuclear Generating Station, Unit No. 1, Docket No. 50-528, Appendix "A" to License No. NPF-41", 1985.

U.S. Nuclear Regulatory Commission, NUREG-1181, "Technical Specifications, Palo Verde Nuclear Generating Station, Unit No. 2, Docket No. 50-529, Appendix "A" to License No. NPF-51", 1986.

U.S. Nuclear Regulatory Commission, NUREG-1287, "Technical Specifications, Palo Verde Nuclear Generating Station, Unit No. 3, Docket No. 50-530, Appendix "A" to License No. NPF-74", 1987.

APPENDIX A

SOURCE TERMS

AND

EFFLUENT AND WASTE DISPOSAL REPORTS

[illegible]

1.0 REGULATORY LIMITS

1.1 Liquid Releases

a. PVNGS Technical Specification 3.11.1.1

The concentration of radioactive material discharged from the secondary system liquid waste to the onsite evaporation ponds shall be limited to the Lower Limit of Detectability (LLD) defined as 5×10^{-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:

1 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

2 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:

1 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

2 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:

1 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,

2 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:

1 During any calendar quarter: Less than or equal to 7.5 mrems to any organ and,

2 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, form 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 section 1.2.a of this report.

3.0 AVERAGE ENERGY

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

4.0 MEASUREMENTS AND APPROXIMATIONS OF TOTAL RADIOACTIVITY IN GASEOUS EFFLUENTS

For continuous releases, sampling is in accordance with PVNGS 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

All times are in hours

5.1 Gaseous

	Unit 1	Unit 2	Unit 3
Number of batch releases:	47	39	29
Total time period for batch releases:	2749.21	1794.17	2686.36
Maximum time period for a batch release:	168.00	167.25	168.00
Average time period for a batch release:	58.49	46.00	92.63
Minimum time period for a batch release:	0.53	1.88	0.20

5.2 Liquid

None.

6.0 ABNORMAL RELEASES

None.

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

There were revisions to both the PCP and the ODCM. These changes are included in appendices D and E.

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 A10. Included in these tables are summaries of the effluents and estimated total error.

8.2 Liquid Effluents

There were no liquid effluents from the PVNGS site

8.3 Solid Waste

Solid waste shipments are summarized in Table A12.

9.0 MISCELLANEOUS INFORMATION

Releases made to the Evaporation Ponds have been limited, at the Chemical Waste Neutralizer tank, to the concentrations specified in PVNGS Technical Specification 3.11.1.1. In addition, PVNGS has imposed a limit of 3.00E-03 μCi/ml for tritium in tanks released to the Evaporation Ponds. This is the maximum permissible concentration for unrestricted areas for tritium in water from 10 CFR 20 Appendix B. The Evaporation Ponds were monitored in accordance with PVNGS Technical Specification 3.12.1. During this report period, the analyses indicated tritium concentrations in the Evaporation Ponds to be a maximum of 1.02E-06 μCi/ml.

The results of the second quarter 1989 Strontium-89 and Strontium-90 analysis for continuous releases, which were not available at the time the January-June 1989 Semiannual Report was written, were less than the Lower Limit of Detection. The gaseous effluent and dose summaries are therefore correct as reported in the January-June 1989 Semiannual Report.

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).

In January of 1989, the Lueck Dairy (ODCM Rev. 2, location #50) closed. The Crosswinds Dairy (ODCM Rev. 3, location #50) replaces the Lueck Dairy as the Technical Specification sample location.

Revised ODCM figures and tables are included as part of the ODCM Rev. 3, which is included in Appendix E of this report.

Table A1

UNITS 1, 2 AND 3

GASEOUS EFFLUENTS - AVERAGE LOWER LIMIT OF DETECTION

μCi/cc

NUCLIDE	CONTINUOUS	BATCH
Argon-41	1.70E-08	1.70E-08
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-131m	3.90E-07	3.90E-07
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-132	2.20E-14	1.60E-12
Iodine-133	2.60E-14	1.00E-11
Iodine-134	3.80E-14	3.20E-12
Iodine-135	9.60E-14	3.80E-11
Antimony-122	3.50E-14	1.40E-12
Antimony-124	7.70E-14	3.60E-12
Barium-140	1.10E-13	4.30E-11
Bromine-82	1.90E-14	9.60E-13
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
Cesium-138	1.20E-13	3.80E-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
Niobium-95	2.40E-14	9.80E-13
Rubidium-88	1.20E-12	3.00E-11
Ruthenium-103	2.20E-14	1.50E-12
Strontium-89	2.15E-15	(1)
Strontium-90	5.60E-16	(1)
Tritium	5.00E-07	5.00E-07
Zinc-65	5.90E-14	2.30E-11
Gross Alpha	6.00E-15	(1)

(1) Not required for batch releases.

Table A2
UNIT 1 1989
GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

	UNIT	QUARTER #3	QUARTER #4	EST. TOTAL ERROR % (1)
A. Fission & activation gases				
1. Total release	Ci	4.25E+01	1.39E+01	3.97E+01
2. Average release rate for period	µCi/sec	5.36E+01	1.75E+00	
3. Percent of technical specification limit	%	NA (2)	NA (2)	
B. Iodine 131				
1. Total Iodine 131	Ci	< LLD	< LLD	2.93E+01
2. Average release rate for period	µCi/sec	< LLD	< LLD	
3. Percent of technical specification limit	%	NA (2)	NA (2)	
C. Particulates				
1. Particulates with half-lives > 8 days	Ci	4.81E-05	1.52E-05	2.93E+01
2. Average release rate for period	µCi/sec	6.05E-06	1.91E-06	
3. Percent of technical specification limit	%	NA (2)	NA (2)	
4. Gross Alpha radio-activity	Ci	< LLD	< LLD	
D. Tritium				
1. Total release	Ci	2.66E+00	1.41E+01	4.22E+01
2. Average release rate for period	µCi/sec	3.35E-01	1.77E+00	
3. Percent of technical specification limit	%	NA (2)	NA (2)	

(1) Estimated total error methodology is presented in Table A11.
(2) See Table A4 for percent of technical specification limits.

[illegible]

Table A3

UNIT 1
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	< LLD	< LLD	< LLD	< LLD
Krypton-85	Ci	1.92E+01	1.39E+01	2.33E+01	< LLD
Krypton-85m	Ci	< LLD	< LLD	< LLD	< LLD
Krypton-87	Ci	< LLD	< LLD	< LLD	< LLD
Krypton-88	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-131m	Ci	< LLD	< LLD	3.23E-02	< LLD
Xenon-133	Ci	2.68E-02	< LLD	< LLD	< LLD
Xenon-133m	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-135	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-135m	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-138	Ci	< LLD	< LLD	< LLD	< LLD
Total for period	Ci	1.92E+01	1.39E+01	2.33E+01	< LLD
2. Iodines					
Iodine-131	Ci	< LLD	< LLD	< LLD	< LLD
Iodine-132	Ci	< LLD	< LLD	< LLD	< LLD
Iodine-133	Ci	< LLD	< LLD	< LLD	< LLD
Iodine-134	Ci	< LLD	< LLD	< LLD	< LLD
Iodine-135	Ci	< LLD	< LLD	< LLD	< LLD
Total for period	Ci	< LLD	< LLD	< LLD	< LLD

Table A3 (Continued)

UNIT 1
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					
Antimony-124	Ci	4.96E-06	< LLD	3.95E-06	< LLD
Barium-140	Ci	< LLD	< LLD	< LLD	< LLD
Bromine-82	Ci	< LLD	< LLD	< LLD	< LLD
Cerium-141	Ci	< LLD	< LLD	< LLD	< LLD
Cerium-144	Ci	< LLD	< LLD	< LLD	< LLD
Cesium-134	Ci	< LLD	< LLD	< LLD	< LLD
Cesium-137	Ci	< LLD	< LLD	6.33E-07	< LLD
Cesium-138	Ci	< LLD	< LLD	< LLD	< LLD
Cobalt-58	Ci	2.35E-06	1.72E-06	7.29E-06	1.27E-06
Cobalt-60	Ci	5.03E-06	6.81E-06	2.06E-05	5.41E-06
Iron-59	Ci	< LLD	< LLD	< LLD	< LLD
Lanthanum-140	Ci	< LLD	< LLD	< LLD	< LLD
Manganese-54	Ci	< LLD	< LLD	2.06E-06	< LLD
Molybdenum-99	Ci	< LLD	< LLD	< LLD	< LLD
Rubidium-88	Ci	< LLD	< LLD	< LLD	< LLD
Ruthenium-103	Ci	1.26E-06	< LLD	< LLD	< LLD
Strontium-89	Ci	< LLD	(1)	(2)	(2)
Strontium-90	Ci	< LLD	(1)	(2)	(2)
Tritium	Ci	< LLD	< LLD	2.66E+00	1.41E+01
Zinc-65	Ci	< LLD	< LLD	< LLD	< LLD
Total for period	Ci	1.36E-05	8.53E-06	2.66E+00	1.41E+01

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

(2) Not required for batch releases.

[illegible] [illegible]

Table A4

PVNGS UNIT 1
RADIATION DOSES AT AND BEYOND THE SITE BOUNDARY(1) FOR 1989

	Unit	Quarter #1	Quarter #2	Quarter #3	Quarter #4	Total for 1989
Gamma Air Dose T.S. 3.11.2.2 Limit % T.S. Limit	mrad mrad %	1.29E-01 5.00E+00 2.58E+00	1.94E-04 5.00E+00 3.88E-03	2.10E-04 5.00E+00 4.20E-03	6.77E-05 5.00E+00 1.35E-03	1.30E-01 1.00E+01 1.30E+00
Beta Air Dose T.S. 3.11.2.2 Limit % T.S. Limit	mrad mrad %	2.05E-01 1.00E+01 2.05E+00	7.73E-03 1.00E+01 7.73E-02	2.34E-02 1.00E+01 2.34E-01	7.67E-03 1.00E+01 7.67E-02	2.44E-01 2.00E+01 1.22E+00
Maximum Organ Dose (excluding skin) T.S. 3.11.2.3 Limit % T.S. Limit	 mrem mrem %	(3) 4.23E-01 7.50E+00 5.64E+00	(3) 8.99E-02 7.50E+00 1.20E+00	(3) 9.66E-03 7.50E+00 1.29E-01	(2)(3) 5.03E-02 7.50E+00 6.71E-01	(2)(3) 5.73E-01 1.50E+01 3.82E+00

(1) Calculations are based on parameters and methodologies of the ODCM using historical meteorology.

(2) Does not include 4th quarter Sr-89, 90 results.

(3) The highest organ dose is child's thyroid.

[illegible]

[illegible]

Table A5
UNIT 2 1989
GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

	UNIT	QUARTER #3	QUARTER #4	EST. TOTAL ERROR % (1)
A. Fission & activation gases				
1. Total release	Ci	2.44E+02	9.60E+01	3.97E+01
2. Average release rate for period	µCi/sec	3.07E+01	1.21E+01	
3. Percent of technical specification limit	%	NA (2)	NA (2)	
B. Iodine 131				
1. Total Iodine 131	Ci	9.83E-04	1.63E-04	2.93E+01
2. Average release rate for period	µCi/sec	1.24E-04	2.05E-05	
3. Percent of technical specification limit	%	NA (2)	NA (2)	
C. Particulates				
1. Particulates with half-lives > 8 days	Ci	2.28E-05	2.04E-05	2.93E+01
2. Average release rate for period	µCi/sec	2.87E-06	2.57E-06	
3. Percent of technical specification limit	%	NA (2)	NA (2)	
4. Gross Alpha radio-activity	Ci	< LLD	< LLD	
D. Tritium				
1. Total release	Ci	7.45E+01	7.32E+01	4.22E+01
2. Average release rate for period	µCi/sec	9.37E+00	9.21E+00	
3. Percent of technical specification limit	%	NA (2)	NA (2)	

(1) Estimated total error methodology is presented in Table A11.
(2) See Table A4 for percent of technical specification limits.

Table A6

UNIT 2
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	< LLD	< LLD	7.45E-02	4.04E-02
Krypton-85	Ci	< LLD	< LLD	8.82E-01	< LLD
Krypton-85m	Ci	1.20E+00	4.84E-01	2.50E-04	3.70E-04
Krypton-87	Ci	6.74E-01	4.32E-02	< LLD	< LLD
Krypton-88	Ci	1.86E+00	1.66E-01	< LLD	< LLD
Xenon-131m	Ci	< LLD	< LLD	3.75E-01	2.50E-01
Xenon-133	Ci	1.82E+02	6.77E+01	3.73E+01	2.15E+01
Xenon-133m	Ci	2.44E+00	2.40E-01	1.56E-01	1.78E-01
Xenon-135	Ci	1.71E+01	5.93E+00	2.75E-02	3.39E-02
Xenon-135m	Ci	6.14E-01	< LLD	< LLD	< LLD
Xenon-138	Ci	< LLD	< LLD	< LLD	< LLD
Total for period	Ci	2.06E+02	7.40E+01	3.88E+01	2.20E+01
2. Iodines					
Iodine-131	Ci	7.64E-04	5.39E-05	2.19E-04	1.09E-04
Iodine-132	Ci	< LLD	< LLD	< LLD	< LLD
Iodine-133	Ci	< LLD	2.56E-06	3.42E-07	2.48E-05
Iodine-134	Ci	< LLD	< LLD	< LLD	< LLD
Iodine-135	Ci	< LLD	< LLD	< LLD	< LLD
Total for period	Ci	7.64E-04	5.65E-05	2.19E-04	1.34E-04

Table A6 (Continued)

UNIT 2
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					
Antimony-124	Ci	< LLD	1.96E-06	< LLD	< LLD
Barium-140	Ci	< LLD	< LLD	< LLD	< LLD
Bromine-82	Ci	< LLD	< LLD	3.73E-05	3.29E-06
Cerium-141	Ci	5.08E-07	< LLD	< LLD	< LLD
Cerium-144	Ci	< LLD	< LLD	< LLD	< LLD
Cesium-134	Ci	< LLD	< LLD	< LLD	< LLD
Cesium-137	Ci	< LLD	< LLD	< LLD	< LLD
Cesium-138	Ci	< LLD	< LLD	4.44E-07	1.04E-06
Cobalt-58	Ci	1.83E-05	1.84E-05	< LLD	< LLD
Cobalt-60	Ci	4.04E-06	< 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	< LLD	< LLD	6.41E-05	5.79E-05
Ruthenium-103	Ci	< LLD	< LLD	< LLD	< LLD
Strontium-89	Ci	< LLD	(1)	(2)	(2)
Strontium-90	Ci	< LLD	< LLD	< LLD	< LLD
Tritium	Ci	< LLD	< LLD	7.45E+01	7.32E+01
Zinc-65	Ci	< LLD	< LLD	< LLD	< LLD
Total for period	Ci	2.28E-05	2.04E-05	7.45E+01	7.32E+01

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

(2) Not required for batch releases.

[illegible] [illegible]

[illegible]

Table A7

PVNGS UNIT 2
RADIATION DOSES AT AND BEYOND THE SITE BOUNDARY(1) FOR 1989

	Unit	Quarter #1	Quarter #2	Quarter #3	Quarter #4	Total for 1989
Gamma Air Dose T.S. 3.11.2.2 Limit % T.S. Limit	mrad mrad %	1.20E-02 5.00E+00 2.40E-01	2.01E-04 5.00E+00 4.02E-03	4.17E-02 5.00E+00 8.34E-01	1.30E-02 5.00E+00 2.60E-01	6.69E-02 1.00E+01 6.69E-01
Beta Air Dose T.S. 3.11.2.2 Limit % T.S. Limit	mrad mrad %	2.78E-02 1.00E+01 2.78E-01	2.26E-03 1.00E+01 2.26E-02	8.29E-02 1.00E+01 8.29E-01	3.11E-02 1.00E+01 3.11E-01	1.44E-01 2.00E+01 7.20E-01
Maximum Organ Dose (excluding skin) T.S. 3.11.2.3 Limit % T.S. Limit	 mrem mrem %	(3) 2.89E-01 7.50E+00 3.85E+00	(3) 5.02E-01 7.50E+00 6.69E+00	(3) 2.86E-01 7.50E+00 3.81E+00	(2)(3) 2.65E-01 7.50E+00 3.53E+00	(2)(3) 1.34E+00 1.50E+01 8.93E+00

(1) Calculations are based on parameters and methodologies of the ODCM using historical meteorology.

(2) Does not include 4th quarter Sr-89, 90 results.

(3) The highest organ dose is child's thyroid.

Table A8
UNIT 3 1989
GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

	UNIT	QUARTER #3	QUARTER #4	EST. TOTAL ERROR % (1)
A. Fission & activation gases				
1. Total release	Ci	7.65E-01	1.73E+02	3.97E+01
2. Average release rate for period	µCi/sec	9.62E-02	2.18E+01	
3. Percent of technical specification limit	%	NA (2)	NA (2)	
B. Iodine 131				
1. Total Iodine 131	Ci	< LLD	< LLD	2.93E+01
2. Average release rate for period	µCi/sec	< LLD	< LLD	
3. Percent of technical specification limit	%	NA (2)	NA (2)	
C. Particulates				
1. Particulates with half-lives > 8 days	Ci	5.87E-06	3.46E-04	2.93E+01
2. Average release rate for period	µCi/sec	7.38E-07	4.35E-05	
3. Percent of technical specification limit	%	NA (2)	NA (2)	
4. Gross Alpha radio-activity	Ci	< LLD	6.91E-12	
D. Tritium				
1. Total release	Ci	2.88E+01	1.29E+01	4.22E+01
2. Average release rate for period	µCi/sec	3.62E+00	1.62E+00	
3. Percent of technical specification limit	%	NA (2)	NA (2)	

(1) Estimated total error methodology is presented in Table A11.
(2) See Table A4 for percent of technical specification limits.

Table A9

UNIT 3
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	< LLD	< LLD	< LLD	< LLD
Krypton-85	Ci	< LLD	1.73E+02	7.64E-01	< LLD
Krypton-85m	Ci	< LLD	< LLD	< LLD	< LLD
Krypton-87	Ci	< LLD	< LLD	< LLD	< LLD
Krypton-88	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-131m	Ci	< LLD	< LLD	1.24E-03	< LLD
Xenon-133	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-133m	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-135	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-135m	Ci	< LLD	< LLD	< LLD	< LLD
Xenon-138	Ci	< LLD	3.28E-03	< LLD	< LLD
Total for period	Ci	< LLD	1.73E+02	7.65E-01	< LLD
2. Iodines					
Iodine-131	Ci	< LLD	< LLD	< LLD	< LLD
Iodine-132	Ci	< LLD	< LLD	< LLD	< LLD
Iodine-133	Ci	< LLD	< LLD	< LLD	< LLD
Iodine-134	Ci	< LLD	< LLD	< LLD	< LLD
Iodine-135	Ci	< LLD	< LLD	< LLD	< LLD
Total for period	Ci	< LLD	< LLD	< LLD	< LLD

[illegible]

[illegible]

[illegible]

[illegible]

Table A9 (Continued)

UNIT 3
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					
Antimony-124	Ci	< LLD	< LLD	< LLD	3.44E-04
Barium-140	Ci	< LLD	< LLD	< LLD	< LLD
Bromine-82	Ci	< LLD	< LLD	< LLD	< LLD
Cerium-141	Ci	< LLD	< LLD	< LLD	< LLD
Cerium-144	Ci	< LLD	< LLD	< LLD	< LLD
Cesium-134	Ci	< LLD	< LLD	< LLD	< LLD
Cesium-137	Ci	< LLD	1.77E-06	< LLD	< LLD
Cesium-138	Ci	< LLD	< LLD	< LLD	< LLD
Cobalt-58	Ci	< LLD	< LLD	< LLD	< LLD
Cobalt-60	Ci	5.87E-06	< 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	< LLD	< LLD	< LLD	< LLD
Ruthenium-103	Ci	< LLD	< LLD	< LLD	< LLD
Strontium-89	Ci	< LLD	(1)	(2)	(2)
Strontium-90	Ci	< LLD	< LLD	< LLD	< LLD
Tritium	Ci	< LLD	< LLD	2.88E+01	1.29E+01
Zinc-65	Ci	< LLD	< LLD	< LLD	< LLD
Total for period	Ci	5.87E-06	1.77E-06	2.88E+01	1.29E+01

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

(2) Not required for batch releases.

[illegible] [illegible]

Table A10

PVNGS UNIT 3
RADIATION DOSES AT AND BEYOND THE SITE BOUNDARY(1) FOR 1989

	Unit	Quarter #1	Quarter #2	Quarter #3	Quarter #4	Total for 1989
Gamma Air Dose T.S. 3.11.2.2 Limit % T.S. Limit	mrad mrad %	7.28E-02 5.00E+00 1.46E+00	0.00E+00 5.00E+00 0.00E+00	3.77E-06 5.00E+00 7.54E-05	8.48E-04 5.00E+00 1.70E-02	7.36E-02 1.00E+01 7.36E-01
Beta Air Dose T.S. 3.11.2.2 Limit % T.S. Limit	mrad mrad %	2.02E-01 1.00E+01 2.02E+00	0.00E+00 1.00E+01 0.00E+00	4.21E-04 1.00E+01 4.21E-03	9.51E-02 1.00E+01 9.51E-01	2.97E-01 2.00E+01 1.49E+00
Maximum Organ Dose (excluding skin) T.S. 3.11.2.3 Limit % T.S. Limit	 mrem mrem %	(3) 4.00E-01 7.50E+00 5.33E+00	(3) 2.24E-01 7.50E+00 2.99E+00	(4) 1.03E-01 7.50E+00 1.37E+00	(2)(4) 4.65E-02 7.50E+00 6.20E-01	(2)(3) 7.74E-01 1.50E+01 5.16E+00

(1) Calculations are based on parameters and methodologies of the ODCM using historical meteorology.

(2) Does not include 4th quarter Sr-89, 90 results.

(3) The highest organ dose is child's thyroid.

(4) The highest organ dose is child's lung.

Table A11

Estimation of Total Percent Error

The estimated total error is calculated as follows:

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

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.

[illegible]

Table A12

SOLID WASTE SUMMARY FOR PERIOD JULY 1989 - DECEMBER 1989

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL

1. Type of Waste	Unit	6-month period	estimated total error %
a) spent resin, filters, sludges, evaporator bottoms, etc.	M3	1.80E+02	
	Ci	2.54E+02	± 2.50E+01
b) dry compressible waste, contaminated equipment etc.	M3	2.62E+02	
	Ci	1.29E+01	± 2.50E+01
c) irradiated components fuel rods etc.	M3	0.00E+00	N/A
	Ci	0.00E+00	N/A
d) other	M3	0.00E+00	N/A
	Ci	0.00E+00	N/A

2. Estimate of major nuclide concentration for spent resins, filter sludges, evaporator bottoms, etc., as determined by measurement. (** indicates scaled nuclides)

WASTE CLASS	NUCLIDE NAME	PERCENT ABUNDANCE	CURIES
A	H-3 **	27.296%	2.13E+00
A	CS-137	23.244%	1.81E+00
A	CS-134	13.553%	1.06E+00
A	C0-58	12.249%	9.54E-01
A	SB-124	11.959%	9.31E-01
A	CO-60	5.022%	3.91E-01
A	FE-55 **	3.468%	2.70E-01
A	NI-63 **	1.451%	1.13E-01
A	SB-125	1.160%	9.03E-02
A	C-14 **	0.313%	2.44E-02
A	NB-95	0.122%	9.50E-03
A	PU-241**	0.066%	5.16E-03
A	MN-54	0.042%	3.28E-03
A	SR-90 **	0.032%	2.52E-03
A	CE-144	0.017%	1.30E-03
A	TC-99 **	0.003%	2.34E-04
A	PU-239/40 **	0.001%	1.08E-04

[illegible]

Table A12 (Continued)

WASTE CLASS	NUCLIDE NAME	PERCENT ABUNDANCE	CURIES
B	FE-55 **	43.229%	2.76E+01
B	CO-60	21.458%	1.37E+01
B	CO-58	19.579%	1.25E+01
B	NB-95	4.323%	2.76E+00
B	ZR-95	2.804%	1.79E+00
B	MN-54	2.725%	1.74E+00
B	NI-63 **	2.553%	1.63E+00
B	CR-51	1.927%	1.23E+00
B	FE-59	1.303%	8.32E-01
B	C-14 **	0.099%	6.34E-02

WASTE CLASS	NUCLIDE NAME	PERCENT ABUNDANCE	CURIES
C	CO-58	32.879%	5.98E+01
C	CS-137	21.443%	3.90E+01
C	CS-134	15.285%	2.78E+01
C	CO-60	12.041%	2.19E+01
C	FE-55 **	6.158%	1.12E+01
C	NI-63	4.860%	8.84E+00
C	MN-54	3.249%	5.91E+00
C	SB-124	2.111%	3.84E+00
C	C-14 **	1.935%	3.52E+00
C	H-3 **	0.034%	6.24E-02
C	SR-90 **	0.002%	4.45E-03

Table A12 (Continued)

<u>NOTE</u> Volume and curies for dry compressible waste, contaminated equipment, include PVNGS waste shipped after being processed by a volume reduction facility.

Estimate of major nuclide concentration for dry commpressible waste, contaminated equipment, etc., as determined by measurement. (** indicates scaled nuclides)

WASTE CLASS	NUCLIDE NAME	PERCENT ABUNDANCE	CURIES
A	CS-137	23.154%	2.98E+00
A	CS-134	9.100%	1.17E+00
A	SB-124	24.686%	3.18E+00
A	CO-58	7.953%	1.02E+00
A	CO-60	4.498%	5.79E-01
A	FE-55 **	14.703%	1.89E+00
A	MN-54	0.405%	5.21E-02
A	NI-63 **	4.277%	5.50E-01
A	CE-144	0.536%	6.89E-02
A	NB-95	3.364%	4.33E-01
A	TC-99 **	0.001%	9.38E-05
A	H-3 **	1.097%	1.41E-01
A	SR-90 **	0.015%	1.89E-03
A	C-14 **	0.729%	9.39E-02
A	AG-110m	0.887%	1.14E-01
A	RU-103	0.268%	3.44E-02
A	FE-59	0.531%	6.84E-02
A	CE-141	0.027%	3.51E-03
A	CR-51	2.086%	2.68E-01
A	I-131	1.036%	1.33E-01
A	ZR-95	0.648%	8.34E-02

3. <u>Solid Waste Disposition</u>

Shipments	TYPE OF SHIPMENT	TYPE OF CONTAINER	MODE OF TRANSPORTATION	DESTINATION
28	LSA	STRONG TIGHT	TRUCK	HANFORD
1	TYPE B	TYPE B	TRUCK	HANFORD

B. **Irradiated Fuel Shipments:** None

[illegible]

C. Additional Information

89-RW-38	12 - 107.5 ft^3 boxes containing dry compressible waste.
89-RW-39	2 - 170.2 ft^3 steel liners containing evaporator bottoms solidified with portland cement.
89-RW-40	14 - 7.5 ft^3 drums containing dry compressible waste.
89-RW-41	1 - 170.2 ft^3 steel liner containing evaporator bottoms solidified with portland cement. 1 - 199.4 ft^3 steel liner containing evaporator bottoms solidified with portland cement.
89-RW-42	14 - 7.5 ft^3 drums containing dry compressible waste.
89-RW-43	2 - 170.2 ft^3 steel liners containing evaporator bottoms solidified with portland cement.
89-RW-44	12 - 107.5 ft^3 boxes containing dry compressible waste.
89-RW-45	2 - 170.2 ft^3 steel liners containing evaporator bottoms solidified with portland cement.
89-RW-46	2 - 170.2 ft^3 steel liners containing evaporator bottoms solidified with portland cement.
89-RW-47	1 - 199.4 ft^3 steel liner containing dry compressible waste.
89-RW-48	3 - 199.4 ft^3 steel liner containing dewatered resin.
89-RW-49	12 - 107.5 ft^3 boxes containing dry compressible waste.
89-RW-50	2 - 199.4 ft^3 steel liner containing evaporator bottoms solidified with portland cement.
89-RW-51	1 - 49.9 ft^3 high integrity container containing dewatered filters.
89-RW-52	12 - 107.5 ft^3 boxes containing dry compressible waste.
89-RW-53	14 - 7.5 ft^3 drums containing dry compressible waste.
89-RW-54	2 - 199.4 ft^3 steel liner containing evaporator bottoms solidified with portland cement.
89-RW-55	1 - 170.2 ft^3 steel liner containing evaporator bottoms solidified with portland cement. 1 - 199.4 ft^3 steel liner containing evaporator bottoms solidified with portland cement.

Table A12 (Continued)

89-RW-56	2 - 199.4 ft^3 steel liner containing evaporator bottoms solidified with portland cement.
89-RW-57	1 - 199.4 ft^3 steel liner containing dry compressible waste.
89-RW-58	14 - 7.5 ft^3 drums containing dry compressible waste.
89-RW-59	12 - 54.3 ft^3 box containing dry compressible waste. 6 - 107.5 ft^3 box containing dry compressible waste.
89-RW-60	1 - 199.4 ft^3 steel liner containing evaporator bottoms solidified with portland cement. 1 - 199.4 ft^3 steel liner containing dewatered resin.
89-RW-61	68 - 10.0 ft^3 drums containing dry compressible waste.
89-RW-62	2 - 199.4 ft^3 steel liner containing evaporator bottoms solidified with portland cement.
89-RW-63	2 - 199.4 ft^3 steel liner containing evaporator bottoms solidified with portland cement.
89-RW-64	14 - 7.5 ft^3 drums containing dry compressible waste.
9-RW-65	14 - 7.5 ft^3 drums containing dry compressible waste.
89-RW-66	1 - 130.8 ft^3 high integrity containers containing dewatered resin.

Table A12 (Continued)

D. Changes to Processes and/or Equipment

D.1 The PVNGS Solid Radwaste Process Control Program (PCP) was revised to place the program into Nuclear Administrative and Technical Manual (NATM) format in September of 1989, it was further updated by means of a procedure change in November 1989.

All existing PCP (pre-change) references remain in effect, (e.g. 10CFR61, 10CFR71) and NRC Technical Position on Waste Form, Rev. 0. May 1983 was added to the references, information contained therein was added to the PCP. There is no reduction in conformance of the solidified waste product to existing criteria for Solid Wastes.

The following is the basis for the change:

The September revision was implemented to place the PCP into NATM format in accordance with 01AC-0AP01, Format and Content of Nuclear Administrative and Technical Manual Procedures. Prior to the revision, the PCP was a "stand alone" document with limited distribution.

There is no intent change associated with the revision. Several areas of the program have been enhanced and some new material has been added.

A change to the purpose was initiated to include Arizona State Regulations which were previously excluded as a regulatory agency. This change was made in view of the recent publication of the "Revised Arizona Administrative Code" which does contain regulations applicable to PVNGS.

A new section titled "Scope" was added to the program. The purpose of the Scope section is to include Vendor Portable Solidification systems in the program and provide a statement dealing with "Reasonable" assurance of PVNGS commitment to compliance with Low Level Radioactive Waste Regulations. Additionally, "Scope" maintains compliance with the format requirements of 01AC-0AP01.

Incorporated additional program sections dealing with "Responsibilities" and "Prerequisites". The responsibilities section places emphasis on the requirements of the Technical Specification as they regard reporting and review of the program. It further delineates in broad term language the responsibilities of the Radwaste Support Department Manager.

[illegible]

The section dealing with "Prerequisites" is intended to place additional emphasis on adherence to procedures and to include "Vendor Procedures" in the body of the program.

There was a significant change in section 3 of the program as it pertains to "Topical Reports". The phrase "Approved by the NRC" was deleted and the phrase "Approved by or Under Review by the NRC" was added in keeping with information available in IEN 89-27.

Referenced documents within the body of the program were updated to show current and correct references (e.g. step 3.8 did reference "The Solidification Proces Control Procedure" and was changed to "Classification of Radioactive Waste" to insure stability specifications set forth in 10 CFR 61.56 are identified.).

Several new definition were added to the program to enhance the readers understanding of text.

Added provisions for Dewatering and Drying of Resin and Packaging various class B and class C waste in High Integrity Containers to meet waste form stability requirements and included NRC Technical Position on Waste Form, Rev.0, May 1983 to section 5 reference list.

Revised Appendix A, schematic drawing to show Radwaste truckbay connection and Portable Radwaste System connection.

Made several editorial corrections.

D.2 A design change was made to the gaseous Radwaste processing/monitoring system. The change is described below.

1. The existing H_2O_2 analyzer was replaced at the 140' elevation of the radwaste building with an O_2 analyzer system comprised of orbispheres for continuous on-line monitoring of oxygen in the surge tanks and waste gas surge header.

D.3 Although changes were made to installed plant equipment, the predicted release or quantity of solid waste generated, remains unchanged as addressed in the UFSAR.

[illegible]

Table A12 (Continued)

D.4 Although changes were made to installed plant equipment, the predicted exposures to plant operating personnel, the public, and general population, remain unchanged as addressed in the UFSAR.

D.5 The revised PCP is included in Appendix D.

Table A13

Units 1, 2 and 3
EFFLUENT MONITORING INSTRUMENTATION OUT OF SERVICE GREATER THAN 30 DAYS

Instrument	Inoperability Dates	Inoperability Cause	Explanation[1]
RU-145/146 (Unit 1)	07/15/89-09/26/89	Torn bellows in sample flow control valve (Ref 1-SR-89-007)	
RU-143/144 (Unit 1)	07/21/89-09/02/89	Temporary power outage while changing power supply (Ref 1-SR-89-007)	
RU-143/444 (Unit 1)	09/07/89-10/13/89	SMIC on RU-143 inop (Ref 1-SR-89-009)	
RU-145/146 (Unit 2)	09/29/89- Present	Low flow limit switch drifting from its desired position (Ref 2-SR-89-007)	
RU-141/142 (Unit 3)	07/01/89- Present	Damaged detector due to water vapor (Ref 3-SR-89-003)	
RU-145 (Unit 3)	08/09/89-09/09/89	Low power supply voltage to flow transmitter (Ref 3-SR-89-006)	
RU-146 (Unit 3)	08/09/89-10/04/89	Low power supply voltage to flow transmitter (Ref 3-SR-89-006)	

Note 1 - See page A30 for explanation

TABLE A13
SECOND HALF 1990
EXPLANATIONS FOR EFFLUENT MONITORING INSTRUMENTATION OUT OF SERVICE GREATER THAN 30 DAYS

RU-145/146 (UNIT 1) 7/15-9/26	MONITOR WAS INOPERABLE DURING THIS TIME TO IMPLEMENT A PLANT CHANGE REQUEST
RU-143/144 (UNIT 1) 7/21-9/02	OUTAGE ON ELECTRICAL BUS PBB-S04 WHICH REMOVED CLASS 1 POWER FROM THE MONITORS. TEMPORARY NON-CLASS POWER WAS PULLED, BUT MONITORS WERE STILL DECLARED INOPERABLE.
RU-143/144 (UNIT 1) 9/07-10/13	MONITOR WAS DECLARED INOPERABLE DUE TO A SMIC FAILURE, EER 89-SQ-126 RESOLVED THAT SMIC WAS NOT REQUIRED FOR MONITOR OPERABILITY
RU-145/146 (UNIT 2) 9/29-12/31	EXCESSIVE LOW FLOW ALARMS DUE TO FLOW CONTROL VALVE FOLLOWING AN ERRONEOUS VENT FLOW SIGNAL WHEN VENT FLOW WAS AT A REDUCED FLOW CONDITION DUE TO REDUCED NUMBER OF FANS IN SERVICE
RU-141/142 (UNIT 3) 7/01-12/31	IMPLEMENTATION OF A SITE MODIFICATION TO PREVENT WATER CONDENSATION AND NUMEROUS UNRELATED PROBLEMS WHEN ATTEMPTING TO RETURN THE MONITORS TO SERVICE.
RU-145 (UNIT 3) 8/09-9/09	MONITOR WAS INOPERABLE DURING INVESTIGATION OF CAUSE OF LOW POWER SUPPLY VOLTAGE
RU-146 (UNIT 3) 8/09-10/04	MONITOR WAS INOPERABLE DURING INVESTIGATION OF CAUSE OF LOW POWER SUPPLY VOLTAGE AND DURING RESULTANT MODIFICATIONS TO POWER SUPPLY

APPENDIX B

METEOROLOGY

[illegible]

[illegible]

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 1989. 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, semi-annual and 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 1989 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 1989

JOINT FREQUENCY DISTRIBUTION ANALYSIS FOR QUARTER-THREE 1989
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/89 - 9/30/89

*** 3RD QUARTER 1989 ***

STABILITY CLASS A

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.51- 4.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.51- 5.50	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
5.51- 6.50	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	3
6.51- 8.50	0	0	1	1	0	1	1	1	1	6	8	8	3	1	0	0	32
8.51-11.50	0	0	0	0	1	1	3	2	5	13	21	8	4	1	0	0	59
11.51-14.50	0	0	0	0	2	0	2	0	0	4	17	4	1	0	0	0	30
14.51-20.50	0	0	0	0	1	0	0	0	2	3	5	5	0	0	0	0	16
>20.50	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
TOTAL	0	0	1	1	4	3	7	4	8	26	52	26	8	2	0	0	142

STABILITY CLASS B

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.51- 4.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.51- 5.50	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	0	4
5.51- 6.50	0	1	0	0	0	1	2	7	2	4	4	1	1	0	1	0	24
6.51- 8.50	0	0	0	1	4	2	4	6	12	18	27	10	6	1	0	0	91
8.51-11.50	1	0	0	1	8	5	11	9	12	12	21	11	3	0	1	0	95
11.51-14.50	1	0	0	0	3	2	1	0	3	3	8	2	0	0	0	0	23
14.51-20.50	0	0	0	0	2	1	1	0	0	1	1	0	0	0	0	0	6
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	1	0	2	17	12	19	22	29	39	62	25	10	1	2	0	243

JOINT FREQUENCY DISTRIBUTION ANALYSIS FOR QUARTER-THREE 1989
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/89 - 9/30/89

*** 3RD QUARTER 1989 ***

STABILITY CLASS C

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.51- 4.50	1	0	0	1	0	0	0	1	1	1	0	2	0	0	0	0	7
4.51- 5.50	1	0	1	0	1	6	5	5	9	2	2	1	1	0	0	1	35
5.51- 6.50	0	0	1	1	7	4	9	12	13	8	3	1	3	1	0	0	63
6.51- 8.50	0	0	1	5	1	3	4	12	10	13	9	5	4	0	1	0	68
8.51-11.50	0	0	0	0	4	1	2	5	3	4	8	8	4	0	0	0	39
11.51-14.50	0	0	0	0	1	0	0	1	0	1	4	2	1	0	0	1	11
14.51-20.50	0	0	0	0	4	1	0	0	0	0	1	0	0	0	0	0	6
>20.50	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
TOTAL	2	0	3	7	20	15	20	36	36	29	27	19	13	1	1	2	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: .75 MPH
JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS AT 35.00 FEET

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	1	0	3	0	2	2	1	0	1	2	3	0	1	0	0	16
2.51- 3.50	1	1	1	0	1	4	5	6	8	5	5	5	1	0	2	0	45
3.51- 4.50	1	2	4	4	8	6	10	11	9	13	6	4	0	2	1	2	83
4.51- 5.50	2	2	2	4	3	8	7	15	17	7	6	1	2	3	1	1	81
5.51- 6.50	0	1	2	3	1	3	8	7	7	3	7	3	0	0	1	0	46
6.51- 8.50	0	0	3	3	1	2	4	5	4	7	17	9	2	2	0	1	60
8.51-11.50	1	0	1	6	4	1	4	2	2	10	25	10	6	0	0	0	72
11.51-14.50	0	0	1	2	8	1	1	1	2	8	32	11	1	0	0	0	68
14.51-20.50	0	0	1	0	10	1	1	3	2	5	9	2	1	0	0	0	35
>20.50	0	0	0	0	3	0	0	2	0	0	2	0	0	0	0	0	7
TOTAL	5	7	15	25	39	28	42	53	51	59	111	48	13	8	5	4	513

JOINT FREQUENCY DISTRIBUTION ANALYSIS FOR QUARTER-THREE 1989
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/89 - 9/30/89

*** 3RD QUARTER 1989 ***

STABILITY CLASS E

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	1	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	4
1.51- 2.50	1	4	1	3	1	0	1	2	0	2	1	1	1	2	2	2	24
2.51- 3.50	3	3	3	0	1	0	1	2	4	2	3	1	3	2	5	2	35
3.51- 4.50	0	3	3	1	3	0	2	0	6	6	8	1	1	0	2	2	38
4.51- 5.50	2	2	4	2	1	0	2	2	3	8	6	3	2	0	1	2	40
5.51- 6.50	1	1	1	0	0	0	0	1	1	10	8	6	2	1	2	0	34
6.51- 8.50	0	1	1	14	4	2	1	7	4	22	26	18	7	1	0	0	108
8.51-11.50	0	0	3	7	10	4	3	1	3	14	51	18	5	1	2	0	122
11.51-14.50	1	0	1	1	9	5	0	0	7	9	32	5	5	0	1	0	76
14.51-20.50	0	1	0	1	6	0	0	0	0	4	4	1	0	0	0	0	17
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	9	15	18	29	35	11	10	16	28	77	139	54	26	8	15	8	498

STABILITY CLASS F

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	1	4
1.51- 2.50	3	3	4	4	0	2	1	0	1	0	0	0	2	2	1	2	25
2.51- 3.50	6	5	3	0	1	1	0	1	2	3	2	1	4	2	2	6	39
3.51- 4.50	3	1	1	3	1	0	1	1	1	4	2	3	3	4	5	1	34
4.51- 5.50	0	2	1	3	3	0	0	1	2	2	3	3	1	4	1	1	27
5.51- 6.50	1	1	1	1	0	0	0	0	2	5	6	8	2	0	2	0	29
6.51- 8.50	0	1	4	3	1	0	3	1	2	6	20	14	5	0	0	0	60
8.51-11.50	0	0	1	2	1	0	5	0	0	3	5	4	2	0	1	1	25
11.51-14.50	1	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	4
14.51-20.50	0	0	0	0	1	0	0	0	1	0	1	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	14	13	15	17	10	3	11	4	11	23	39	34	19	12	13	12	250

JOINT FREQUENCY DISTRIBUTION ANALYSIS FOR QUARTER-THREE 1989
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/89 - 9/30/89

*** 3RD QUARTER 1989 ***

STABILITY CLASS G

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	2
.76- 1.50	1	1	1	0	0	0	0	0	1	0	0	0	0	2	0	0	6
1.51- 2.50	7	5	4	1	0	1	2	3	2	1	0	4	3	7	5	9	54
2.51- 3.50	22	20	7	2	1	0	2	2	0	0	2	5	3	1	7	12	86
3.51- 4.50	26	22	12	4	2	1	1	0	0	0	1	0	0	2	4	11	86
4.51- 5.50	19	16	9	4	1	0	0	0	1	0	1	0	1	2	1	4	59
5.51- 6.50	2	7	2	1	0	0	1	0	0	0	0	1	0	1	0	2	17
6.51- 8.50	1	1	5	0	1	0	0	1	1	1	2	0	0	0	0	0	13
8.51-11.50	0	1	0	2	0	0	1	0	0	1	0	0	0	0	0	0	5
11.51-14.50	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
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	78	73	40	15	5	2	7	6	5	3	6	10	7	15	17	38	329

STABILITY CLASS ALL

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	2
.76- 1.50	2	1	2	1	0	0	0	1	1	0	0	1	0	3	1	1	14
1.51- 2.50	11	13	9	11	1	5	6	6	3	4	3	8	6	12	8	13	119
2.51- 3.50	32	29	14	2	4	5	8	11	14	10	12	12	11	5	16	20	205
3.51- 4.50	31	28	20	13	14	7	14	13	17	24	17	10	4	8	12	16	248
4.51- 5.50	24	22	17	13	9	15	15	23	32	20	19	9	7	9	4	9	247
5.51- 6.50	4	11	7	6	8	9	20	28	25	30	28	21	8	3	6	2	216
6.51- 8.50	1	3	15	27	12	10	17	33	34	73	109	64	27	5	1	1	432
8.51-11.50	2	1	5	18	28	12	29	19	25	57	131	59	24	2	4	1	417
11.51-14.50	3	0	2	4	25	8	5	2	12	25	93	24	8	0	1	1	213
14.51-20.50	0	1	1	1	24	3	2	3	5	13	21	8	1	0	0	0	83
>20.50	0	0	0	0	5	0	0	2	0	0	3	0	0	0	0	0	10
TOTAL	110	109	92	96	130	74	116	141	168	256	436	216	96	47	53	64	2206

[illegible]

JOINT FREQUENCY DISTRIBUTION ANALYSIS FOR QUARTER-THREE 1989
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/89 - 9/30/89

*** 3RD QUARTER 1989 ***

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

TOTAL NUMBER OF OBSERVATIONS: 2208
TOTAL NUMBER OF VALID OBSERVATIONS: 2206
TOTAL NUMBER OF MISSING OBSERVATIONS: 2
PERCENT DATA RECOVERY FOR THIS PERIOD: 99.9 %
MEAN WIND SPEED FOR THIS PERIOD: 7.3 MPH
TOTAL NUMBER OF OBSERVATIONS WITH BACKUP DATA: 0

PERCENTAGE OCCURRENCE OF STABILITY CLASSES

A	B	C	D	E	F	G
6.44	11.02	10.47	23.25	22.57	11.33	14.91

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	0	1	1	4	3	7	4	8	26	52	26	8	2	0	0	0
B	2	1	0	2	17	12	19	22	29	39	62	25	10	1	2	0	0
C	2	0	3	7	20	15	20	36	36	29	27	19	13	1	1	2	0
D	5	7	15	25	39	28	42	53	51	59	111	48	13	8	5	4	0
E	9	15	18	29	35	11	10	16	28	77	139	54	26	8	15	8	0
[illegible]	14	13	15	17	10	3	11	4	11	23	39	34	19	12	13	12	0
[illegible]	78	73	40	15	5	2	7	6	5	3	6	10	7	15	17	38	2
[illegible]	110	109	92	96	130	74	116	141	168	256	436	216	96	47	53	64	2

Table B2

JFDs of 35-Foot Wind Versus Delta T

October - December 1989

FREQUENCY DISTRIBUTION ANALYSIS FOR QUARTER-FOUR 1989
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 10/ 1/89 - 12/31/89

*** FOURTH QUARTER 1989 ***

STABILITY CLASS A

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

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

STABILITY CLASS B

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.51- 4.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.51- 5.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.51- 6.50	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	3
6.51- 8.50	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3
8.51-11.50	0	0	0	1	2	2	1	1	2	0	0	0	0	0	0	0	9
11.51-14.50	0	1	0	0	2	0	0	0	0	1	0	0	0	0	0	0	4
14.51-20.50	0	0	2	2	3	0	0	0	1	0	0	0	0	0	0	0	8
>20.50	0	0	2	0	1	0	0	0	0	1	0	0	0	0	0	0	4
TOTAL	0	1	4	3	13	3	1	1	3	2	0	0	0	0	0	0	31

FREQUENCY DISTRIBUTION ANALYSIS FOR QUARTER-FOUR 1989
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 10/ 1/89 - 12/31/89

*** FOURTH QUARTER 1989 ***

STABILITY CLASS C

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.51- 4.50	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3
4.51- 5.50	0	4	1	3	1	2	2	0	0	0	0	0	0	0	0	0	13
5.51- 6.50	0	0	0	0	0	0	0	1	3	1	0	0	0	0	0	0	5
6.51- 8.50	0	1	1	3	2	3	2	3	3	1	4	0	0	0	0	0	23
8.51-11.50	0	0	0	3	2	0	0	3	2	0	0	1	0	0	0	1	12
11.51-14.50	0	0	0	3	5	0	0	0	0	0	1	0	0	0	0	0	9
14.51-20.50	1	0	1	1	2	0	0	0	2	1	2	0	0	0	0	0	10
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	3	5	3	13	13	5	4	7	10	3	7	1	0	0	0	1	75

STABILITY CLASS D

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	1	0	0	0	0	0	1	2	1	0	5
1.51- 2.50	2	1	4	3	3	6	8	4	6	2	2	8	4	4	1	5	63
2.51- 3.50	8	5	7	11	11	11	20	17	22	19	14	9	5	4	5	1	169
3.51- 4.50	3	5	7	7	11	15	8	12	16	12	14	6	3	1	0	2	122
4.51- 5.50	4	2	3	15	8	5	7	8	14	5	2	1	0	1	1	1	77
5.51- 6.50	1	0	2	5	4	5	2	6	6	1	2	3	1	0	0	3	41
6.51- 8.50	1	1	1	4	7	2	4	3	1	2	1	1	0	0	1	1	30
8.51-11.50	1	1	3	4	7	6	2	2	1	0	3	2	3	0	0	2	37
11.51-14.50	0	0	2	4	13	0	2	1	0	1	2	0	0	0	0	0	25
14.51-20.50	0	0	2	1	15	2	1	0	2	3	1	0	1	0	0	2	30
>20.50	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL	20	15	31	54	80	52	55	53	68	45	41	30	18	12	9	17	600

FREQUENCY DISTRIBUTION ANALYSIS FOR QUARTER-FOUR 1989
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 10/ 1/89 - 12/31/89

*** FOURTH QUARTER 1989 ***

STABILITY CLASS E

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	1
.76- 1.50	1	0	1	0	0	1	1	0	0	0	2	0	0	2	0	0	8
1.51- 2.50	5	5	3	2	2	2	4	2	6	5	9	3	3	2	0	4	57
2.51- 3.50	0	0	2	1	0	1	2	8	6	3	1	2	0	1	2	5	34
3.51- 4.50	1	2	1	1	1	0	1	3	3	4	6	1	0	1	0	2	27
4.51- 5.50	1	3	3	0	2	0	2	2	2	1	1	0	1	1	1	1	21
5.51- 6.50	1	1	0	2	2	0	0	0	1	1	1	0	3	1	0	0	13
6.51- 8.50	2	1	3	2	3	3	0	1	0	2	2	1	1	1	1	2	25
8.51-11.50	1	0	0	5	9	1	5	1	0	6	1	1	3	0	2	1	36
11.51-14.50	0	0	1	8	3	0	0	0	1	2	1	1	0	0	1	0	18
14.51-20.50	0	0	2	0	2	0	0	0	0	2	1	1	0	0	0	3	11
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	12	12	16	21	24	8	15	17	19	26	25	10	11	9	7	18	251

STABILITY CLASS F

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	2	0	1	1	0	0	0	0	0	0	0	0	0	3	1	1	9
1.51- 2.50	4	2	4	3	1	1	2	2	4	3	4	3	5	3	6	3	50
2.51- 3.50	6	5	10	1	3	1	0	2	1	3	1	4	5	3	3	8	56
3.51- 4.50	4	6	7	1	0	0	0	1	2	6	2	2	2	1	4	6	44
4.51- 5.50	5	6	4	2	0	1	0	0	0	2	1	4	3	2	5	3	38
5.51- 6.50	1	2	3	2	0	0	1	1	0	2	1	1	0	1	4	4	23
6.51- 8.50	4	1	0	3	1	0	0	1	0	4	1	1	0	2	9	6	33
8.51-11.50	5	1	1	2	0	0	1	0	0	1	0	0	1	1	1	1	15
11.51-14.50	0	2	1	1	0	0	0	0	0	1	0	0	0	0	2	0	7
14.51-20.50	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	31	25	32	16	5	3	4	7	7	22	10	15	16	16	35	33	277

FREQUENCY DISTRIBUTION ANALYSIS FOR QUARTER-FOUR 1989
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 10/ 1/89 - 12/31/89

*** FOURTH QUARTER 1989 ***

STABILITY CLASS G

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	6	2	0	0	2	0	0	1	0	1	0	0	3	0	3	0	18
1.51- 2.50	30	21	22	11	4	2	4	2	1	5	6	9	0	13	19	21	170
2.51- 3.50	79	56	26	11	5	3	1	1	3	4	4	3	11	13	20	53	293
3.51- 4.50	78	61	28	7	0	1	3	1	3	2	2	0	5	2	11	25	229
4.51- 5.50	33	49	12	3	1	0	0	0	1	0	0	1	1	0	7	16	124
5.51- 6.50	23	13	3	2	1	0	0	0	0	1	0	0	0	4	2	7	56
6.51- 8.50	19	12	1	4	0	0	0	0	0	0	0	0	0	0	2	4	42
8.51-11.50	6	3	3	1	0	0	0	0	0	0	0	0	0	0	0	1	14
11.51-14.50	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	5
14.51-20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	276	218	96	39	13	6	8	5	8	13	12	13	20	32	64	128	951

STABILITY CLASS ALL

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	1
.76- 1.50	9	2	2	1	2	1	2	1	0	1	2	0	4	7	5	1	40
1.51- 2.50	41	29	33	19	10	11	18	10	17	15	21	23	12	22	26	33	340
2.51- 3.50	93	66	45	24	19	16	23	28	32	29	20	18	21	21	30	67	552
3.51- 4.50	88	74	43	16	13	16	12	17	24	24	24	9	10	5	15	35	425
4.51- 5.50	43	64	23	23	12	8	11	10	17	8	4	6	5	4	14	21	273
5.51- 6.50	26	16	8	11	9	6	3	8	10	6	4	4	4	6	6	14	141
6.51- 8.50	26	16	6	16	17	8	6	8	4	9	8	3	1	3	13	13	157
8.51-11.50	13	5	7	16	21	9	9	7	5	7	4	4	7	1	3	6	124
11.51-14.50	2	4	5	16	23	0	2	2	2	6	4	1	0	0	3	1	71
14.51-20.50	1	2	11	5	24	2	1	1	5	8	4	1	1	0	0	6	72
>20.50	0	0	3	1	2	0	0	0	2	1	0	0	0	0	0	0	9
TOTAL	342	278	186	148	152	77	87	92	118	114	95	69	65	69	115	197	2205

[illegible]

FREQUENCY DISTRIBUTION ANALYSIS FOR QUARTER-FOUR 1989
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 10/ 1/89 - 12/31/89

*** FOURTH QUARTER 1989 ***

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

TOTAL NUMBER OF OBSERVATIONS: 2208
TOTAL NUMBER OF VALID OBSERVATIONS: 2205
TOTAL NUMBER OF MISSING OBSERVATIONS: 3
PERCENT DATA RECOVERY FOR THIS PERIOD: 99.9 %
MEAN WIND SPEED FOR THIS PERIOD: 5.0 MPH
TOTAL NUMBER OF OBSERVATIONS WITH BACKUP DATA: 0

PERCENTAGE OCCURRENCE OF STABILITY CLASSES

A	B	C	D	E	F	G
.91	1.41	3.40	27.21	11.38	12.56	43.13

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	4	2	4	0	0	2	3	3	0	0	0	0	0	0	0
B	0	1	4	3	13	3	1	1	3	2	0	0	0	0	0	0	0
C	3	5	3	13	13	5	4	7	10	3	7	1	0	0	0	1	0
D	20	15	31	54	80	52	55	53	68	45	41	30	18	12	9	17	0
E	12	12	16	21	24	8	15	17	19	26	25	10	11	9	7	18	1
F	31	25	32	16	5	3	4	7	7	22	10	15	16	16	35	33	0
[illegible]	276	218	96	39	13	6	8	5	8	13	12	13	20	32	64	128	0
[illegible]	342	278	186	148	152	77	87	92	118	114	95	69	65	69	115	197	1

Table B3

JFDs of 35-Foot Wind Versus Delta T

July - December 1989

FREQUENCY DISTRIBUTION ANALYSIS FOR 3RD & 4TH QTRS 1989
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/89 - 12/31/89

*** 3RD & 4TH QTRS 1989 ***

STABILITY CLASS A

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.51- 4.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.51- 5.50	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
5.51- 6.50	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	3
6.51- 8.50	0	0	1	1	1	1	1	1	1	6	8	8	3	1	0	0	33
8.51-11.50	0	0	0	0	2	1	3	2	5	13	21	8	4	1	0	0	60
11.51-14.50	0	0	0	0	2	0	2	1	1	5	17	4	1	0	0	0	33
14.51-20.50	0	2	3	1	3	0	0	1	2	5	5	5	0	0	0	0	27
>20.50	0	0	1	1	0	0	0	0	2	0	1	0	0	0	0	0	5
TOTAL	0	2	5	3	8	3	7	6	11	29	52	26	8	2	0	0	162

STABILITY CLASS B

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.51- 4.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.51- 5.50	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	0	4
5.51- 6.50	0	1	0	0	2	2	2	7	2	4	4	1	1	0	1	0	27
6.51- 8.50	0	0	0	1	7	2	4	6	12	18	27	10	6	1	0	0	94
8.51-11.50	1	0	0	2	10	7	12	10	14	12	21	11	3	0	1	0	104
11.51-14.50	1	1	0	0	5	2	1	0	3	4	8	2	0	0	0	0	27
14.51-20.50	0	0	2	2	5	1	1	0	1	1	1	0	0	0	0	0	14
>20.50	0	0	2	0	1	0	0	0	0	1	0	0	0	0	0	0	4
TOTAL	2	2	4	5	30	15	20	23	32	41	62	25	10	1	2	0	274

FREQUENCY DISTRIBUTION ANALYSIS FOR 3RD & 4TH QTRS 1989
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/89 - 12/31/89

*** 3RD & 4TH QTRS 1989 ***

STABILITY CLASS C

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.51- 4.50	3	0	0	1	1	0	0	1	1	1	0	2	0	0	0	0	10
4.51- 5.50	1	4	2	3	2	8	7	5	9	2	2	1	1	0	0	1	48
5.51- 6.50	0	0	1	1	7	4	9	13	16	9	3	1	3	1	0	0	68
6.51- 8.50	0	1	2	8	3	6	6	15	13	14	13	5	4	0	1	0	91
8.51-11.50	0	0	0	3	6	1	2	8	5	4	8	9	4	0	0	1	51
11.51-14.50	0	0	0	3	6	0	0	1	0	1	5	2	1	0	0	1	20
14.51-20.50	1	0	1	1	6	1	0	0	2	1	3	0	0	0	0	0	16
>20.50	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
TOTAL	5	5	6	20	33	20	24	43	46	32	34	20	13	1	1	3	306

STABILITY CLASS D

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	1	0	0	0	0	0	1	2	1	0	5
1.51- 2.50	2	2	4	6	3	8	10	5	6	3	4	11	4	5	1	5	79
2.51- 3.50	9	6	8	11	12	15	25	23	30	24	19	14	6	4	7	1	214
3.51- 4.50	4	7	11	11	19	21	18	23	25	25	20	10	3	3	1	4	205
4.51- 5.50	6	4	5	19	11	13	14	23	31	12	8	2	2	4	2	2	158
5.51- 6.50	1	1	4	8	5	8	10	13	13	4	9	6	1	0	1	3	87
6.51- 8.50	1	1	4	7	8	4	8	8	5	9	18	10	2	2	1	2	90
8.51-11.50	2	1	4	10	11	7	6	4	3	10	28	12	9	0	0	2	109
11.51-14.50	0	0	3	6	21	1	3	2	2	9	34	11	1	0	0	0	93
14.51-20.50	0	0	3	1	25	3	2	3	4	8	10	2	2	0	0	2	65
>20.50	0	0	0	0	4	0	0	2	0	0	2	0	0	0	0	0	8
TOTAL	25	22	46	79	119	80	97	106	119	104	152	78	31	20	14	21	1113

FREQUENCY DISTRIBUTION ANALYSIS FOR 3RD & 4TH QTRS 1989
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/89 - 12/31/89

*** 3RD & 4TH QTRS 1989 ***

STABILITY CLASS E

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	1
.76- 1.50	2	0	2	0	0	1	1	1	0	0	2	0	0	3	0	0	12
1.51- 2.50	6	9	4	5	3	2	5	4	6	7	10	4	4	4	2	6	81
2.51- 3.50	3	3	5	1	1	1	3	10	10	5	4	3	3	3	7	7	69
3.51- 4.50	1	5	4	2	4	0	3	3	9	10	14	2	1	1	2	4	65
4.51- 5.50	3	5	7	2	3	0	4	4	5	9	7	3	3	1	2	3	61
5.51- 6.50	2	2	1	2	2	0	0	1	2	11	9	6	5	2	2	0	47
6.51- 8.50	2	2	4	16	7	5	1	8	4	24	28	19	8	2	1	2	133
8.51-11.50	1	0	3	12	19	5	8	2	3	20	52	19	8	1	4	1	158
11.51-14.50	1	0	2	9	12	5	0	0	8	11	33	6	5	0	2	0	94
14.51-20.50	0	1	2	1	8	0	0	0	0	6	5	2	0	0	0	3	28
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	21	27	34	50	59	19	25	33	47	103	164	64	37	17	22	26	749

STABILITY CLASS F

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	2	0	1	2	0	0	0	0	0	0	0	1	0	3	2	2	13
1.51- 2.50	7	5	8	7	1	3	3	2	5	3	4	3	7	5	7	5	75
2.51- 3.50	12	10	13	1	4	2	0	3	3	6	3	5	9	5	5	14	95
3.51- 4.50	7	7	8	4	1	0	1	2	3	10	4	5	5	5	9	7	78
4.51- 5.50	5	8	5	5	3	1	0	1	2	4	4	7	4	6	6	4	65
5.51- 6.50	2	3	4	3	0	0	1	1	2	7	7	9	2	1	6	4	52
6.51- 8.50	4	2	4	6	2	0	3	2	2	10	21	15	5	2	9	6	93
8.51-11.50	5	1	2	4	1	0	6	0	0	4	5	4	3	1	2	2	40
11.51-14.50	1	2	1	1	2	0	1	0	0	1	0	0	0	0	2	0	11
14.51-20.50	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	1	5
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	45	38	47	33	15	6	15	11	18	45	49	49	35	28	48	45	527

FREQUENCY DISTRIBUTION ANALYSIS FOR 3RD & 4TH QTRS 1989
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/ 1/89 - 12/31/89

*** 3RD & 4TH QTRS 1989 ***

STABILITY CLASS G

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	2
.76- 1.50	7	3	1	0	2	0	0	1	1	1	0	0	3	2	3	0	24
1.51- 2.50	37	26	26	12	4	3	6	5	3	6	6	13	3	20	24	30	224
2.51- 3.50	101	76	33	13	6	3	3	3	3	4	6	8	14	14	27	65	379
3.51- 4.50	104	83	40	11	2	2	4	1	3	2	3	0	5	4	15	36	315
4.51- 5.50	52	65	21	7	2	0	0	0	2	0	1	1	2	2	8	20	183
5.51- 6.50	25	20	5	3	1	0	1	0	0	1	0	1	0	5	2	9	73
6.51- 8.50	20	13	6	4	1	0	0	1	1	1	2	0	0	0	2	4	55
8.51-11.50	6	4	3	3	0	0	1	0	0	1	0	0	0	0	0	1	19
11.51-14.50	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	6
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	354	291	136	54	18	8	15	11	13	16	18	23	27	47	81	166	1280

STABILITY CLASS ALL

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	3
.76- 1.50	11	3	4	2	2	1	2	2	1	1	2	1	4	10	6	2	54
1.51- 2.50	52	42	42	30	11	16	24	16	20	19	24	31	18	34	34	46	459
2.51- 3.50	125	95	59	26	23	21	31	39	46	39	32	30	32	26	46	87	757
3.51- 4.50	119	102	63	29	27	23	26	30	41	48	41	19	14	13	27	51	673
4.51- 5.50	67	86	40	36	21	23	26	33	49	28	23	15	12	13	18	30	520
5.51- 6.50	30	27	15	17	17	15	23	36	35	36	32	25	12	9	12	16	357
6.51- 8.50	27	19	21	43	29	18	23	41	38	82	117	67	28	8	14	14	589
8.51-11.50	15	6	12	34	49	21	38	26	30	64	135	63	31	3	7	7	541
11.51-14.50	5	4	7	20	48	8	7	4	14	31	97	25	8	0	4	2	284
14.51-20.50	1	3	12	6	48	5	3	4	10	21	25	9	2	0	0	6	155
>20.50	0	0	3	1	7	0	0	2	2	1	3	0	0	0	0	0	19
TOTAL	452	387	278	244	282	151	203	233	286	370	531	285	161	116	168	261	4411

[illegible]

[illegible]

[illegible]

FREQUENCY DISTRIBUTION ANALYSIS FOR 3RD & 4TH QTRS 1989
SITE IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 7/1/89 - 12/31/89

*** 3RD & 4TH QTRS 1989 ***

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

TOTAL NUMBER OF OBSERVATIONS: 4416
TOTAL NUMBER OF VALID OBSERVATIONS: 4411
TOTAL NUMBER OF MISSING OBSERVATIONS: 5
PERCENT DATA RECOVERY FOR THIS PERIOD: 99.9 %
MEAN WIND SPEED FOR THIS PERIOD: 6.2 MPH
TOTAL NUMBER OF OBSERVATIONS WITH BACKUP DATA: 0

PERCENTAGE OCCURRENCE OF STABILITY CLASSES

A	B	C	D	E	F	G
3.67	6.21	6.94	25.23	16.98	11.95	29.02

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	5	3	8	3	7	6	11	29	52	26	8	2	0	0	0
B	2	2	4	5	30	15	20	23	32	41	62	25	10	1	2	0	0
C	5	5	6	20	33	20	24	43	46	32	34	20	13	1	1	3	0
D	25	22	46	79	119	80	97	106	119	104	152	78	31	20	14	21	0
E	21	27	34	50	59	19	25	33	47	103	164	64	37	17	22	26	1
F	45	38	47	33	15	6	15	11	18	45	49	49	35	28	48	45	0
	354	291	136	54	18	8	15	11	13	16	18	23	27	47	81	166	2
	452	387	278	244	282	151	203	233	286	370	531	285	161	116	168	261	3

Table B4

JFDs of 35-Foot Wind Versus Delta T

January - December 1989

FREQUENCY DISTRIBUTION ANALYSIS FOR ANNUAL 1989
DENTIFIER: PVNGS
DATA PERIOD EXAMINED: 1/ 1/89 - 12/31/89

*** ANNUAL ***

STABILITY CLASS A

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.51- 4.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.51- 5.50	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
5.51- 6.50	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	3
6.51- 8.50	0	0	2	1	1	2	1	1	3	9	17	11	4	1	0	0	53
8.51-11.50	0	0	0	0	3	1	3	2	7	29	58	27	13	4	0	1	148
11.51-14.50	0	0	0	0	2	0	2	1	3	21	53	11	4	1	0	1	99
14.51-20.50	2	2	3	1	3	0	0	1	3	15	26	11	2	1	0	5	75
>20.50	0	0	1	1	0	0	0	0	2	0	3	1	1	3	0	0	12
TOTAL	2	2	6	3	9	4	7	6	18	74	157	62	24	10	0	7	391

STABILITY CLASS B

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

ED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.51- 4.50	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
4.51- 5.50	0	0	0	0	0	1	0	3	0	1	3	2	0	1	0	0	11
5.51- 6.50	0	3	0	1	3	3	2	7	5	4	10	1	3	1	1	0	44
6.51- 8.50	0	0	1	5	9	4	4	6	17	39	49	26	12	2	1	0	175
8.51-11.50	1	0	0	3	13	8	12	11	18	20	51	24	10	0	4	0	175
11.51-14.50	1	1	0	1	6	2	1	0	3	6	16	6	0	2	1	1	47
14.51-20.50	0	1	3	2	5	1	1	0	1	5	8	2	1	2	0	0	32
>20.50	0	0	2	0	1	0	0	0	0	1	2	0	0	1	0	0	7
TOTAL	2	5	6	12	37	19	21	27	44	76	139	61	26	9	7	1	492

FREQUENCY DISTRIBUTION ANALYSIS FOR ANNUAL 1989
DENTIFIER: PVNGS
DA PERIOD EXAMINED: 1/ 1/89 - 12/31/89

*** ANNUAL ***

STABILITY CLASS C

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.51- 2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.51- 3.50	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2
3.51- 4.50	3	0	1	2	2	2	2	2	3	3	1	2	0	0	0	0	23
4.51- 5.50	2	4	5	4	4	10	10	12	13	8	8	6	1	0	0	1	88
5.51- 6.50	1	1	2	2	12	11	12	26	25	20	18	5	3	2	0	0	140
6.51- 8.50	0	3	4	14	9	12	10	22	16	32	35	19	9	2	4	0	191
8.51-11.50	1	0	0	6	8	1	3	9	5	8	26	25	8	2	2	2	106
11.51-14.50	0	0	1	4	8	1	0	1	0	2	18	2	3	4	0	1	45
14.51-20.50	1	0	4	1	6	1	0	0	2	1	5	2	0	3	0	0	26
>20.50	0	0	0	0	2	0	0	0	0	1	0	1	0	0	0	0	4
TOTAL	8	8	17	33	51	39	38	72	64	75	111	62	24	13	6	4	625

STABILITY CLASS D

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

ED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.76- 1.50	1	0	0	1	0	0	1	0	0	1	0	0	1	2	1	0	8
1.51- 2.50	6	4	8	8	9	11	17	11	13	11	9	17	9	8	6	6	153
2.51- 3.50	16	10	18	18	19	38	39	55	54	42	34	26	15	12	11	9	416
3.51- 4.50	9	15	17	16	39	32	37	47	65	51	46	19	11	14	7	12	437
4.51- 5.50	10	5	7	24	18	20	25	49	53	32	33	9	8	5	3	4	305
5.51- 6.50	5	2	9	10	9	14	13	20	19	16	19	15	6	2	1	6	166
6.51- 8.50	1	5	9	11	14	6	10	13	8	22	39	19	7	4	4	2	174
8.51-11.50	3	1	4	10	19	8	9	5	6	18	60	32	14	6	3	3	201
11.51-14.50	0	2	3	8	27	1	3	2	3	14	57	20	4	5	3	0	152
14.51-20.50	0	0	4	3	32	3	2	3	4	16	27	7	4	7	4	3	119
>20.50	0	0	0	0	7	0	0	2	0	3	5	0	1	1	0	0	19
TOTAL	51	44	79	109	193	133	156	207	225	226	329	164	80	66	43	45	2150

FREQUENCY DISTRIBUTION ANALYSIS FOR ANNUAL 1989
DENTIFIER: PVNGS
DATA PERIOD EXAMINED: 1/ 1/89 - 12/31/89

*** ANNUAL ***

STABILITY CLASS E

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	1
.76- 1.50	3	0	2	0	2	2	1	1	1	1	2	1	0	4	0	0	20
1.51- 2.50	11	15	8	5	5	3	6	6	9	9	13	10	6	5	7	10	128
2.51- 3.50	8	8	8	6	5	4	4	12	15	7	9	9	8	7	13	13	136
3.51- 4.50	3	9	8	5	4	1	4	4	15	17	18	11	6	2	5	5	117
4.51- 5.50	8	6	10	3	3	0	4	4	8	27	23	8	6	2	5	5	122
5.51- 6.50	8	3	3	3	2	0	0	2	5	24	19	13	11	5	6	2	106
6.51- 8.50	4	3	5	18	8	6	2	10	7	45	65	38	12	4	6	2	235
8.51-11.50	2	1	3	14	19	5	8	3	7	37	107	50	16	5	14	3	294
11.51-14.50	1	1	2	12	17	6	1	0	10	28	74	21	12	4	8	1	198
14.51-20.50	0	1	3	1	13	0	0	0	0	9	16	4	1	2	3	5	58
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	48	47	52	67	78	27	30	42	77	204	346	165	78	40	67	46	1415

STABILITY CLASS F

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

ED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	1
.76- 1.50	3	0	1	2	0	0	1	1	0	0	0	1	0	4	3	2	18
1.51- 2.50	10	10	11	8	1	4	4	5	6	6	13	4	16	10	13	14	135
2.51- 3.50	21	21	24	6	9	6	1	9	9	11	11	17	17	17	24	28	231
3.51- 4.50	18	13	14	7	3	3	2	9	7	15	16	21	11	14	15	19	187
4.51- 5.50	11	12	5	7	4	2	2	1	3	10	13	14	12	11	12	16	135
5.51- 6.50	6	6	4	3	0	0	2	2	3	14	39	15	8	10	11	9	132
6.51- 8.50	8	2	7	7	3	0	3	2	4	37	68	38	17	11	20	12	239
8.51-11.50	7	2	3	4	1	0	6	0	0	20	50	21	12	5	5	12	148
11.51-14.50	2	2	3	3	2	0	1	0	0	1	3	0	0	0	2	0	19
14.51-20.50	0	0	1	0	1	0	0	0	1	0	3	0	0	0	0	1	7
>20.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	86	68	73	47	24	15	22	29	33	114	216	131	93	82	105	113	1252

FREQUENCY DISTRIBUTION ANALYSIS FOR ANNUAL 1989
DENTIFIER: PVNGS
DA PERIOD EXAMINED: 1/ 1/89 - 12/31/89

*** ANNUAL ***

STABILITY CLASS G

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

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	2
.76- 1.50	11	4	2	0	2	0	1	1	1	1	0	0	4	2	4	2	35
1.51- 2.50	62	52	37	18	5	6	9	6	6	8	11	19	11	33	40	52	375
2.51- 3.50	174	138	51	25	10	4	6	4	4	8	12	21	24	31	79	121	712
3.51- 4.50	180	164	65	21	6	3	6	2	4	6	9	6	14	12	44	76	618
4.51- 5.50	92	111	41	12	3	1	0	2	3	5	5	7	7	3	14	37	343
5.51- 6.50	44	42	10	5	2	0	1	0	0	2	5	3	4	10	6	22	156
6.51- 8.50	32	29	10	6	1	0	0	1	1	3	5	6	4	4	5	16	123
8.51-11.50	11	13	3	3	0	0	1	0	0	5	7	1	1	0	0	5	50
11.51-14.50	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	6
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	608	554	220	91	29	14	24	16	19	38	54	63	69	95	192	332	2420

STABILITY CLASS ALL

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

ED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	4
.76- 1.50	18	4	5	3	4	2	4	3	2	3	2	2	5	12	8	4	81
1.51- 2.50	89	81	64	39	20	24	36	28	34	34	46	50	42	56	66	82	791
2.51- 3.50	219	177	101	55	43	53	51	80	82	68	66	73	64	67	127	171	1497
3.51- 4.50	213	201	105	51	54	41	52	64	94	92	90	59	42	42	71	112	1383
4.51- 5.50	123	138	68	50	32	34	42	71	80	83	85	46	34	22	34	63	1005
5.51- 6.50	64	57	28	24	28	29	30	58	57	80	110	53	35	30	25	39	747
6.51- 8.50	45	42	38	62	45	30	30	55	56	187	278	157	65	28	40	32	1190
8.51-11.50	25	17	13	40	63	23	42	30	43	137	359	180	74	22	28	26	1122
11.51-14.50	6	7	10	29	62	10	8	4	19	72	221	60	23	16	14	5	566
14.51-20.50	3	4	18	8	60	5	3	4	11	46	85	26	8	15	7	14	317
>20.50	0	0	3	1	10	0	0	2	2	5	10	2	2	5	0	0	42
TOTAL	805	728	453	362	421	251	298	399	480	807	1352	708	394	315	420	548	8745

[illegible]

FREQUENCY DISTRIBUTION ANALYSIS FOR ANNUAL 1989
IDENTIFIER: PVNGS
DATA PERIOD EXAMINED: 1/ 1/89 - 12/31/89

*** ANNUAL ***

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

TOTAL NUMBER OF OBSERVATIONS: 8760
TOTAL NUMBER OF VALID OBSERVATIONS: 8745
TOTAL NUMBER OF MISSING OBSERVATIONS: 15
PERCENT DATA RECOVERY FOR THIS PERIOD: 99.8 %
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
4.47	5.63	7.15	24.59	16.18	14.32	27.67

DISTRIBUTION OF WIND DIRECTION VS STABILITY

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	CALM
A	2	2	6	3	9	4	7	6	18	74	157	62	24	10	0	7	0
B	2	5	6	12	37	19	21	27	44	76	139	61	26	9	7	1	0
C	8	8	17	33	51	39	38	72	64	75	111	62	24	13	6	4	0
D	51	44	79	109	193	133	156	207	225	226	329	164	80	66	43	45	0
E	48	47	52	67	78	27	30	42	77	204	346	165	78	40	67	46	1
F	86	68	73	47	24	15	22	29	33	114	216	131	93	82	105	113	1
G	608	554	220	91	29	14	24	16	19	38	54	63	69	95	192	332	2
TOTAL	805	728	453	362	421	251	298	399	480	807	1352	708	394	315	420	548	4

APPENDIX C

DOSE CALCULATIONS

GASEOUS EFFLUENT* DOSE CALCULATIONS

Doses to the maximum individual and the surrounding population resulting from the release of radioactive material in gaseous effluents from the Palo Verde Nuclear Generating Station were calculated using the GASPAR computer program. Gaseous effluents were released from Units 1, 2 and 3 during the year 1989. 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 only through the third quarter 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 on a quarterly, semi-annual and annual basis for the period 1989 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 1989. 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 1989

SITE BOUNDARY 1.40 MILES SSW FROM UNIT 1, 1.14 MILES SSW FROM UNIT 2 AND 1.00 MILES SSW FROM UNIT 3

AIR DOSES(MRAD)	BETA	GAMMA
1ST QUARTER	4.16E-01	1.93E-01
2ND QUARTER	7.33E-03	3.06E-04
1ST SEMI-ANNUAL	4.24E-01	1.94E-01
3RD QUARTER	5.52E-02	2.19E-02
4TH QUARTER	2.17E-01	2.07E-02
2ND SEMI-ANNUAL	2.72E-01	4.26E-02
ANNUAL	6.96E-01	2.36E-01

MAXIMUM INDIVIDUAL(MREM)	T. BODY	SKIN
1ST QUARTER	1.19E-01	3.01E-01
2ND QUARTER	1.81E-04	4.98E-03
1ST SEMI-ANNUAL	1.19E-01	3.06E-01
3RD QUARTER	1.36E-02	4.18E-02
4TH QUARTER	1.27E-02	1.50E-01
2ND SEMI-ANNUAL	2.63E-02	1.92E-01
ANNUAL	1.45E-01	4.98E-01

MAXIMUM INDIVIDUAL IN GENERAL PUBLIC LOCATED AT A RESIDENCE 4.55 MILES SSW FROM UNIT 1, 4.37 MILES S FROM UNIT 2 AND 4.22 MILES S FROM UNIT 3

(MREM)	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
1ST QUARTER								
ADULT	7.97E-02	7.97E-02	4.34E-02	7.97E-02	7.97E-02	9.01E-02	7.97E-02	1.48E-01
TEEN	7.99E-02	7.98E-02	4.34E-02	7.99E-02	8.00E-02	9.29E-02	7.98E-02	1.48E-01
CHILD	7.58E-02	7.57E-02	4.34E-02	7.58E-02	7.58E-02	9.01E-02	7.58E-02	1.44E-01
INFANT	6.20E-02	6.19E-02	4.34E-02	6.20E-02	6.20E-02	7.51E-02	6.20E-02	1.31E-01
2ND QUARTER								
ADULT	1.80E-02	1.80E-02	7.09E-05	1.80E-02	1.80E-02	1.81E-02	1.80E-02	1.97E-02
TEEN	1.81E-02	1.81E-02	7.11E-05	1.81E-02	1.81E-02	1.83E-02	1.82E-02	1.99E-02
CHILD	1.60E-02	1.60E-02	7.13E-05	1.60E-02	1.60E-02	1.62E-02	1.60E-02	1.78E-02
INFANT	9.24E-03	9.24E-03	7.11E-05	9.24E-03	9.24E-03	9.43E-03	9.25E-03	1.10E-02
1ST SEMI-ANNUAL								
ADULT	9.77E-02	9.77E-02	4.34E-02	9.77E-02	9.77E-02	1.08E-01	9.77E-02	1.68E-01
TEEN	9.81E-02	9.80E-02	4.35E-02	9.81E-02	9.82E-02	1.11E-01	9.80E-02	1.68E-01
CHILD	9.18E-02	9.17E-02	4.35E-02	9.18E-02	9.18E-02	1.06E-01	9.18E-02	1.62E-01
INFANT	7.12E-02	7.12E-02	4.35E-02	7.12E-02	7.12E-02	8.45E-02	7.12E-02	1.42E-01
3RD QUARTER								
ADULT	1.21E-02	1.21E-02	4.60E-03	1.21E-02	1.21E-02	1.27E-02	1.21E-02	2.22E-02
TEEN	1.22E-02	1.22E-02	4.61E-03	1.22E-02	1.22E-02	1.29E-02	1.22E-02	2.23E-02
CHILD	1.13E-02	1.13E-02	4.61E-03	1.13E-02	1.13E-02	1.21E-02	1.13E-02	2.14E-02
INFANT	8.46E-03	8.46E-03	4.61E-03	8.46E-03	8.46E-03	9.18E-03	8.46E-03	1.86E-02
4TH QUARTER								
ADULT	2.92E-02	2.92E-02	5.51E-03	2.92E-02	2.92E-02	2.95E-02	2.93E-02	8.49E-02
TEEN	2.94E-02	2.94E-02	5.51E-03	2.94E-02	2.94E-02	2.98E-02	2.96E-02	8.50E-02
CHILD	2.66E-02	2.66E-02	5.51E-03	2.66E-02	2.66E-02	2.71E-02	2.68E-02	8.22E-02
INFANT	1.76E-02	1.76E-02	5.51E-03	1.76E-02	1.76E-02	1.81E-02	1.78E-02	7.33E-02
2ND SEMI-ANNUAL								
ADULT	4.14E-02	4.14E-02	1.01E-02	4.14E-02	4.14E-02	4.22E-02	4.15E-02	1.07E-01
TEEN	4.15E-02	4.16E-02	1.01E-02	4.15E-02	4.15E-02	4.27E-02	4.18E-02	1.07E-01
CHILD	3.79E-02	3.79E-02	1.01E-02	3.79E-02	3.79E-02	3.92E-02	3.81E-02	1.04E-01
INFANT	2.61E-02	2.61E-02	1.01E-02	2.61E-02	2.61E-02	2.72E-02	2.62E-02	9.18E-02
ANNUAL								
ADULT	1.39E-01	1.39E-01	5.36E-02	1.39E-01	1.39E-01	1.50E-01	1.39E-01	2.75E-01
TEEN	1.40E-01	1.40E-01	5.36E-02	1.40E-01	1.40E-01	1.54E-01	1.40E-01	2.76E-01
CHILD	1.30E-01	1.30E-01	5.36E-02	1.30E-01	1.30E-01	1.46E-01	1.30E-01	2.66E-01
INFANT	9.73E-02	9.73E-02	5.36E-02	9.73E-02	9.73E-02	1.12E-01	9.74E-02	2.33E-01

[illegible]

TABLE C1(CONT.)

VISITORS CENTER LOCATED ONSITE 0.45 MILES WNW FROM UNIT 1, 0.44 MILES NW FROM UNIT 2 AND 0.60 MILES NNW FROM UNIT 3

(MREM)	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
1ST QUARTER								
ADULT	3.93E-02	3.93E-02	2.14E-02	3.94E-02	3.94E-02	4.36E-02	3.93E-02	7.05E-02
TEEN	3.95E-02	3.95E-02	2.14E-02	3.95E-02	3.95E-02	4.47E-02	3.95E-02	7.06E-02
CHILD	3.74E-02	3.74E-02	2.14E-02	3.74E-02	3.74E-02	4.32E-02	3.74E-02	6.85E-02
INFANT	3.06E-02	3.06E-02	2.14E-02	3.06E-02	3.06E-02	3.59E-02	3.06E-02	6.17E-02
2ND QUARTER								
ADULT	2.11E-02	2.11E-02	3.30E-04	2.11E-02	2.11E-02	2.14E-02	2.12E-02	2.30E-02
TEEN	2.13E-02	2.13E-02	3.31E-04	2.13E-02	2.13E-02	2.15E-02	2.13E-02	2.31E-02
CHILD	1.89E-02	1.89E-02	3.31E-04	1.89E-02	1.89E-02	1.91E-02	1.89E-02	2.07E-02
INFANT	1.10E-02	1.10E-02	3.31E-04	1.10E-02	1.10E-02	1.12E-02	1.10E-02	1.28E-02
1ST SEMI-ANNUAL								
ADULT	6.05E-02	6.05E-02	2.17E-02	6.05E-02	6.05E-02	6.50E-02	6.05E-02	9.35E-02
TEEN	6.08E-02	6.08E-02	2.17E-02	6.08E-02	6.08E-02	6.62E-02	6.08E-02	9.38E-02
CHILD	5.63E-02	5.63E-02	2.17E-02	5.63E-02	5.63E-02	6.24E-02	5.63E-02	8.93E-02
INFANT	4.16E-02	4.16E-02	2.17E-02	4.16E-02	4.16E-02	4.72E-02	4.16E-02	7.46E-02
3RD QUARTER								
ADULT	2.16E-02	2.16E-02	9.37E-03	2.16E-02	2.16E-02	2.26E-02	2.16E-02	3.87E-02
TEEN	2.16E-02	2.16E-02	9.37E-03	2.16E-02	2.16E-02	2.31E-02	2.17E-02	3.87E-02
CHILD	2.02E-02	2.02E-02	9.37E-03	2.02E-02	2.02E-02	2.18E-02	2.02E-02	3.73E-02
INFANT	1.56E-02	1.56E-02	9.37E-03	1.56E-02	1.56E-02	1.70E-02	1.56E-02	3.27E-02
4TH QUARTER								
ADULT	1.94E-02	1.94E-02	3.99E-03	1.94E-02	1.94E-02	1.97E-02	1.94E-02	4.65E-02
TEEN	1.95E-02	1.95E-02	3.99E-03	1.95E-02	1.95E-02	1.98E-02	1.96E-02	4.66E-02
CHILD	1.76E-02	1.76E-02	3.99E-03	1.76E-02	1.76E-02	1.80E-02	1.77E-02	4.48E-02
INFANT	1.19E-02	1.19E-02	3.99E-03	1.19E-02	1.19E-02	1.22E-02	1.19E-02	3.83E-02
2ND SEMI-ANNUAL								
ADULT	4.09E-02	4.09E-02	1.34E-02	4.09E-02	4.09E-02	4.23E-02	4.10E-02	8.52E-02
TEEN	4.11E-02	4.11E-02	1.34E-02	4.11E-02	4.11E-02	4.28E-02	4.13E-02	8.54E-02
CHILD	3.79E-02	3.78E-02	1.34E-02	3.79E-02	3.79E-02	3.98E-02	3.80E-02	8.21E-02
INFANT	2.75E-02	2.75E-02	1.34E-02	2.75E-02	2.75E-02	2.92E-02	2.75E-02	7.10E-02
ANNUAL								
ADULT	1.01E-01	1.01E-01	3.51E-02	1.01E-01	1.01E-01	1.07E-01	1.02E-01	1.79E-01
TEEN	1.02E-01	1.02E-01	3.51E-02	1.02E-01	1.02E-01	1.09E-01	1.02E-01	1.79E-01
CHILD	9.41E-02	9.41E-02	3.51E-02	9.41E-02	9.42E-02	1.02E-01	9.43E-02	1.71E-01
INFANT	6.90E-02	6.90E-02	3.51E-02	6.91E-02	6.91E-02	7.64E-02	6.91E-02	1.46E-01

TABLE C2

INTEGRATED POPULATION DOSES FOR JANUARY - DECEMBER 1989 (PERSONREM)

JANUARY 1 - JUNE 30 1989

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.80E-01	3.80E-01	3.80E-01	3.80E-01	3.80E-01	3.80E-01	3.80E-01	1.34E+00
GROUND	3.81E-04	3.81E-04	3.81E-04	3.81E-04	3.81E-04	3.81E-04	3.81E-04	4.48E-04
INHAL	1.10E+00	1.10E+00	4.00E-04	1.10E+00	1.10E+00	1.26E+00	1.10E+00	1.10E+00
VEGET	3.21E+00	3.21E+00	5.72E-04	3.21E+00	3.21E+00	3.41E+00	3.20E+00	3.20E+00
COW MILK	4.44E-01	4.44E-01	8.23E-05	4.45E-01	4.45E-01	4.72E-01	4.44E-01	4.44E-01
MEAT	1.29E-01	1.29E-01	7.97E-07	1.29E-01	1.29E-01	1.29E-01	1.29E-01	1.29E-01
TOTAL	5.26E+00	5.26E+00	3.82E-01	5.26E+00	5.26E+00	5.65E+00	5.26E+00	6.22E+00
(a) PER CAPITA DOSE (REM)	2.93E-06	2.93E-06	2.13E-07	2.93E-06	2.93E-06	3.15E-06	2.93E-06	3.46E-06

JULY 1 - SEPTEMBER 30 1989

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.58E-02	3.58E-02	3.58E-02	3.58E-02	3.58E-02	3.58E-02	3.58E-02	1.80E-01
GROUND	2.04E-04	2.04E-04	2.04E-04	2.04E-04	2.04E-04	2.04E-04	2.04E-04	2.41E-04
INHAL	1.30E-01	1.30E-01	2.12E-05	1.30E-01	1.30E-01	1.39E-01	1.31E-01	1.30E-01
VEGET	4.13E-01	4.13E-01	5.65E-05	4.13E-01	4.13E-01	4.34E-01	4.13E-01	4.13E-01
COW MILK	5.04E-02	5.04E-02	8.75E-06	5.05E-02	5.05E-02	5.36E-02	5.04E-02	5.04E-02
MEAT	1.51E-02	1.51E-02	3.13E-08	1.51E-02	1.51E-02	1.51E-02	1.51E-02	1.51E-02
TOTAL	6.45E-01	6.45E-01	3.61E-02	6.45E-01	6.45E-01	6.78E-01	6.45E-01	7.89E-01
(a) PER CAPITA DOSE (REM)	3.59E-07	3.59E-07	2.01E-08	3.59E-07	3.59E-07	3.78E-07	3.59E-07	4.39E-07

OCTOBER 1 - DECEMBER 31 1989

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.69E-02	2.69E-02	2.69E-02	2.69E-02	2.69E-02	2.69E-02	2.69E-02	5.46E-01
GROUND	6.54E-05	6.54E-05	6.54E-05	6.54E-05	6.54E-05	6.54E-05	6.54E-05	7.63E-05
INHAL	2.29E-01	2.29E-01	1.87E-05	2.29E-01	2.29E-01	2.31E-01	2.29E-01	2.29E-01
VEGET	9.76E-01	9.76E-01	4.94E-05	9.76E-01	9.76E-01	9.79E-01	9.76E-01	9.76E-01
COW MILK	9.23E-02	9.23E-02	2.13E-06	9.23E-02	9.23E-02	9.26E-02	9.23E-02	9.23E-02
MEAT	3.69E-02	3.69E-02	2.01E-07	3.69E-02	3.69E-02	3.69E-02	3.69E-02	3.69E-02
TOTAL	1.36E+00	1.36E+00	2.70E-02	1.36E+00	1.36E+00	1.37E+00	1.36E+00	1.88E+00
(a) PER CAPITA DOSE (REM)	7.57E-07	7.57E-07	1.50E-08	7.57E-07	7.57E-07	7.63E-07	7.57E-07	1.05E-06

(a) PERSONREM DIVIDED BY 50-MILE POPULATION OF 1,796,000

TABLE C2 (CONTINUED)

PERSONREM

JULY 1 - DECEMBER 31 1989

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	6.27E-02	6.27E-02	6.27E-02	6.27E-02	6.27E-02	6.27E-02	6.27E-02	7.26E-01
GROUND	2.70E-04	2.70E-04	2.70E-04	2.70E-04	2.70E-04	2.70E-04	2.70E-04	3.17E-04
INHAL	3.59E-01	3.59E-01	4.00E-05	3.59E-01	3.59E-01	3.71E-01	3.60E-01	3.59E-01
VEGET	1.39E+00	1.39E+00	1.06E-04	1.39E+00	1.39E+00	1.41E+00	1.39E+00	1.39E+00
COW MILK	1.43E-01	1.43E-01	1.09E-05	1.43E-01	1.43E-01	1.46E-01	1.43E-01	1.43E-01
MEAT	5.20E-02	5.20E-02	2.32E-07	5.20E-02	5.20E-02	5.20E-02	5.20E-02	5.20E-02
TOTAL	2.01E+00	2.01E+00	6.31E-02	2.01E+00	2.01E+00	2.05E+00	2.01E+00	2.67E+00
(a) PER CAPITA DOSE (REM)	1.12E-06	1.12E-06	3.51E-08	1.12E-06	1.12E-06	1.14E-06	1.12E-06	1.49E-06

JANUARY 1 - DECEMBER 31 1989

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	4.43E-01	4.43E-01	4.43E-01	4.43E-01	4.43E-01	4.43E-01	4.43E-01	2.07E+00
GROUND	6.51E-04	6.51E-04	6.51E-04	6.51E-04	6.51E-04	6.51E-04	6.51E-04	7.65E-04
INHAL	1.46E+00	1.46E+00	4.40E-04	1.46E+00	1.46E+00	1.64E+00	1.46E+00	1.46E+00
VEGET	4.59E+00	4.59E+00	6.77E-04	4.59E+00	4.59E+00	4.82E+00	4.59E+00	4.59E+00
COW MILK	5.87E-01	5.87E-01	9.32E-05	5.87E-01	5.87E-01	6.18E-01	5.87E-01	5.87E-01
MEAT	1.81E-01	1.81E-01	1.03E-06	1.81E-01	1.81E-01	1.81E-01	1.81E-01	1.81E-01
TOTAL	7.26E+00	7.26E+00	4.45E-01	7.26E+00	7.27E+00	7.70E+00	7.26E+00	8.89E+00
(a) PER CAPITA DOSE (REM)	4.04E-06	4.04E-06	2.48E-07	4.04E-06	4.05E-06	4.29E-06	4.04E-06	4.95E-06

(a) PERSONREM DIVIDED BY 50-MILE POPULATION OF 1,796,000

Table C3

SUMMARY OF INDIVIDUAL DOSES FOR JANUARY - DECEMBER 1989 [1]

	Unit	Quarter #1	Quarter #2	Quarter #3	Quarter #4	Total for 1989
Gamma Air Dose	mrad	1.93E-01	3.06E-04	2.19E-02	2.07E-02	2.36E-01
T.S. 3.11.2.2 Limit	mrad	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
% T.S. Limit	%	3.86E+00	6.12E-03	4.38E-01	4.14E-01	2.36E+00
Beta Air Dose	mrad	4.16E-01	7.33E-03	5.52E-02	2.17E-01	6.96E-01
T.S. 3.11.2.2 Limit	mrad	1.00E+01	1.00E+01	1.00E+01	1.00E+01	2.00E+01
% T.S. Limit	%	4.16E+00	7.33E-02	5.52E-01	2.17E+00	3.48E+00
Maximum Organ Dose		(2)	(2)	(2)	(2)	(2)
(excluding skin)	mrem	9.29E-02	1.83E-02	1.29E-02	2.98E-02	1.54E-01
T.S. 3.11.2.3 Limit	mrem	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
% T.S. Limit	%	1.24E+00	2.44E-01	1.72E-01	3.97E-01	1.03E-02

Note 1 : From Table C1.

Note 2 : These control location doses are imparted via three principal atmospheric pathways: plume, ground exposure and inhalation. The highest organ dose is to the teen thyroid resulting from exposure at a residence 4.55 miles SSW from Unit 1, 4.37 miles S from Unit 2, and 4.22 miles S from Unit 3. Technical Specification 3.11.4 has higher limits than Technical Specification 3.11.2.3, therefore the percent of limits are more conservative based on Technical Specification 3.11.2.3 than on Technical Specification 3.11.4.

[illegible]

DOSE CALCULATION MODELS

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

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

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

> 0 to 5 mile nearest residence, milk animal and garden in each of the 16 compass sectors, based on the 1988 Land Use Census.
>
> 0 to 5 mile population distribution based on the Land Use Census conducted during June-August, 1984.
>
> The population distribution from the PVNGS UFSAR, Figure 2.1-8.
>
> The population distribution of metropolitan Phoenix greater than 50 miles from PVNGS, based on the 1980 federal census results, is conservatively included in the 40 to 50 mile sectors (NE=123; ENE=140,097; E=621,130; ESE=8,392)
>
> Absolute humidity of 6.0 g/m^3 from the PVNGS UFSAR, Table 2.3-16.
>
> The fraction of the year that vegetables are grown (0.667) from the PVNGS ER-OL, Section 2.1.3.4, Table 2.1-8.
>
> The fraction of daily feed derived from pasture while on pasture (0.35) and length of grazing season for milk animals beyond 5 miles (0.75) from the PVNGS ER-OL, Section 2.1.3.4.3.
>
> The fraction of daily feed derived from pasture while on pasture (0.05) and length of grazing season for meat animals (0.25) from the PVNGS ER-OL, Section 2.1.3.4.4.
>
> The only milk animal (goats) located within 5 miles from the PVNGS was fed on stored feed 100% of the time. For calculational purposes these milk animals are assumed to be fed 50% on stored feed and 50% on pasture grass during 1989.

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

APPENDIX D

REVISED SOLID RADWASTE PROCESS CONTROL PROGRAM (PCP)

PCP revision is in response to CAR 89-0017 dtd 4/20/89. There is no intent change in this revision. Changes made to the PCP are editorial in nature and geared toward putting the document in proper format according to 01AC-OAP01 "Format & Content of Nuclear Administrative and Technical Procedures".

The list of changes and notes are intended for use in formulation of the notice of change to the PCP submitted to the NRC in the semi-annual Radioactive Effluent Release Report.

Before revision Step #	Revised Step #:	Change:
1.0	1.0	Note 1
	1.2	New: Scope Note 2.
N.A.	2.0	New: Responsibilities. Note 2.
3.1(C)	3.1.1	Text enhanced Note 5.
3.9	3.1.2	Added RCTS ref.
N.A.	3.1.3	New material. Note 3.
N.A.	3.2	Added Prerequisites.
3.1(b)	3.2.1	Note 7.
N.A.	3.2.2 & 3.2.3	Added language to address vendor operations. Note 4.
3.1	3.3	No change in text.
3.2	3.4	Added RCTS ref. to step 3.4.2 & 3.4.3.
3.2(a)	3.4.1	No change to text.
3.2(b)	3.4.2	" " " "
3.2(c)	3.4.3	" " " "
3.2(d)	3.4.4	Note 10.
3.2(e)	3.4.5	Note 11.
3.2(f)	3.4.6	Note 8.
3.3	3.5	No change to text.
3.3(a)	3.5.1	Updated ref. procedure.

3.3(b)	3.5.2	No change to text.
3.3(c)	3.5.3	" " " "
3.4	3.6	No change to text.
3.4(a)	3.6.1	added RCTS ref.
3.4(b)	3.6.2	No change to text.
3.4(c)	3.6.3	" " " "
3.5	3.7	No change to text.
3.5(a)	3.7.1	" " " "
3.5(a) 1)	3.7.1.1	" " " "
3.5(a) 2)	3.7.1.2	Note 11.
3.5(a) 3)	3.7.1.3	" " " "
3.5(a) 3) i	3.7.1.3 i	" " " "
3.5(a) 3) ii	3.7.1.3 ii	" " " "
3.5(a) 4)	3.7.1.4	" " " "
3.5(a) 5)	3.7.1.5	" " " "
3.5(a) 6)	3.7.1.6	" " " "
3.5(a) 7)	3.7.1.7	" " " "
3.5(b)	3.7.2 & 3.7.2.1	Note 11.
3.5(c)	3.7.2.2	No change to text.
3.6	3.8	Note 9.
3.7	3.9	Added RCTS ref.
3.7(a)	3.9.1	No change to text.
3.7(b)	3.9.2	Added RCTS ref.
3.7(c)	3.9.3	No change to text.
3.7(d)	3.9.4	Updated reference.
3.8	3.10	No change to text.
2.0	4.0	No change to text.
	4.1	New: Definitions.
2.0(b)	4.1.1	Enhanced definition.
2,0(c)	4.1.2	" "
		Note 6.
	4.1.3	New definition.
	4.1.4	" "
2.0(e)	4.1.5	No change to text
	4.1.6	New definition.
2.0(f)	4.1.7	No change to text.
2.0(g)	deleted	Designation no longer used at PVNGS.
	4.1.8	New definition.
	4.1.9	" "
	4.1.10	" "
	4.1.11	" "
	4.1.12	" "

2.0(d)	4.1.13	Enhanced.
	4.2	Added: Abbreviations. Note 2.
2.0(a)	4.2.1	No change to text.
	4.2.2	New.
	4.2.3	New.
4.0	5.0	No change to text.
	5.1	New: Implementing. Note 2.
4.0(d)	5.1.1	No change to text.
	5.2	New: Developmental Note 2.
4.0(a)	5.2.1	No change to text.
4.0(b)	5.2.2	Enhanced reference.
4.0(c)	5.2.3	" "
4.0(e)	5.2.4	" "
4.0(f)	5.2.5	Add RCTS REF.
4.0(G)	5.2.6	Update reference. Add RCTS ref.
4.0(h)	5.2.7	No change to text.
4.0(i)	5.2.8	Update reference
4.0(j)	5.2.9	" "
4.0(k)	5.2.10	" "
4.0(l)	5.2.11	" "
4.0(m)	5.2.12	" "
4.0(n)	5.2.13	Enhanced reference.
4.0(o)	5.2.14	" "
4.0(p)	5.2.15	Update reference.
4.0(q)	5.2.16	No change to text.
4.0(r)	5.2.17	" " " "
4.0(s)	5.2.18	Update reference.
4.0(t)	5.2.19	" "
	5.2.20	Added.
	5.2.21	Added.
	5.2.22	New. Note 2.
	5.2.23	New. Note 2.
	6.0	New. Note 2.

Note 1. First paragraph, last line. Deleted the sentence "There are no Arizona State Regulations applicable to PVNGS. Inserted "Arizona State Regulations" into body of first paragraph as a regulating agency.
This action taken because the state of Arizona is currently revising the state Administrative Code as it applies to radioactive waste.

Note 2. As directed by reference 5.2.22, "Format and Content of Nuclear Administrative and Technical Procedure".

Note 3. As discussed in reference 5.2.20, "NRC IEN 89-27".

Note 4. Language added to PCP to further emphasize the requirement of operating equipment/processes under the direction of approved procedures.

Note 5. Did read "a waste substitute shall be prepared in accordance with the 'Solidification Process Control'.

Now reads "a waste substitute shall be prepared and used for performance of the prequalification bench test in accordance with the 'Solidification Process Control procedure'".

Note 6. Definition "Bench Test".

Did read "Laboratory testing of the solidification process on a reduced scale with representative mixing ratios and similar operational techniques".

Now reads "A prequalification program of the solidification process, performed on a reduced scale with representative mixing ratios, implemented to demonstrate that the proposed method of wet waste processing will result in a waste form acceptable to the land disposal facility".

Note 7. Added "or appropriate vendor procedure" to text.

Note 8. Added "or the vendors operating proceudre" to text.

Note 9. Did Read:

"The 'Solidification Process Control' procedure shall indentify the stability specifications as set forth in 10CFR 61.56, 'Waste Characteristics,' and Branch Technical Position ETSB 11-3, Revision 2, July 1981, 'Design Guidance for Solid Radioactive Waste Management Systems Installed in Light-Water-Cooled Nuclear Power Reactor Plants.'"

Now Reads:

Wet radioactive waste shall be classified in accordance with "Classification of Radioactive Waste" procedure prior to solidifictaion to assure stability specification set forth in 10CFR61.56 "Waste Characteristics," and branch technical position ETSB 11-3, Revision 2, July 1981, "Design Guidance For Solid Radioactive Waste Management Systems Installed in Light-Watercooled Nuclear Power Reactor Plants" are identified.

Note 10. Deleted last sentence of Step 3.4.4: "Class B & C wa will be ...." Language is redundant & is stated in step 3.4.5.

Note 11. Steps 3.4.5, 3.7.2 and 3.7.2.1 changed wording from "Approved by the NRC" to "Approved by or under revie by the NRC" per IEN 89-27.

		Revision
SOLID RADWASTE PROCESS CONTROL PROGRAM	76PR-9RW01	0

RECORD OF REVISIONS

REVISION	DATE	REASON
0	08/23/89	New Issue

31 Aug., 1989
TECHNICAL REVIEW SIGNATURE — DATE

8/31/89
LEAD MANAGER REVIEW — DATE

9/9/89
PRB REVIEW SIGNATURE, IF REQUIRED — DATE

APPROVED BY:

9/9/89
SIGNATURE — DATE

Effective Date: 9-9-89

DDC ONLY
ASSIGNED COPY NUMBER

TABLE OF CONTENTS

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TABLE OF CONTENTS (con't)

1.0 PURPOSE AND SCOPE

1.1 Purpose

1.1.1 The purpose of the Process Control Program (PCP) for the Palo Verde Nuclear Generating Station (PVNGS), Units 1, 2, and 3 is to establish a set of process parameters which will provide reasonable assurance of complete solidification of various liquid radioactive "wet wastes" including resin slurries, evaporator bottoms, filter sludges, and chemical drains in accordance with the requirements of applicable portions of the PVNGS Quality Assurance Program, PVNGS Technical Specifications, PVNGS Final Safety Analysis Report, Department of Transportation (DOT) regulations, Arizona State Regulations, Nuclear Regulator Commission (NRC) regulations, and licensed burial facilities acceptance criteria for solidification, packaging and shipment to an approved offsite burial site.

1.1.2 Toward this purpose, the PCP ensures that the solidified substance is a monolith having no freestanding liquid and is within the limits as set forth in the above mentioned regulations and acceptance criteria. This PCP will also ensure that solidification will be performed to maintain any potential radiation exposure to plant personnel to "as low as is reasonably achievable" (ALARA) levels, in accordance with the "ALARA Program" procedure. (RCTS 032630, 032639)

1.2 Scope

1.2.1 This program applies to operation of plant installed and vendor provided portable solidification systems at PVNGS and provides reasonable assurance of compliance with Low Level Radioactive Waste Regulations.

2.0 RESPONSIBILITIES

2.1 The Director, Standards and Technical Support shall assure the performance of a review by a qualified individual/organization of changes to the PROCESS CONTROL PROGRAM in accordance with this document.

2.2 The Radiation Protection and Chemistry Manager shall:

2.2.1 Ensure a periodic review of the Process Control Program (PCP) is completed at a minimum of every two years subsequent to the latest revision to maintain compliance with applicable State and Federal Regulations, licensing commitments, and burial facility requirements in accordance with 75AC-0RP01, "Review of Radiological Protection and Chemistry Program Performance".

2.2.2 Ensure that the Periodic Review Control Form is forwarded to NRM-DDC and copies are distributed to the following:

1) Vice President, Nuclear Production and,
2) Director of Standards and Technical Support and,
3) Nuclear Safety Group.

2.2.3 Initiate any required changes to the Process Control Program identified during the review.

2.2.4 Report changes to the Process Control Program to the NRC in the Semi-annual Radioactive Effluent Release Report for the period in which the change(s) was made. This submittal shall contain:

2.2.4.1 Sufficiently detailed information to totally support the rationale for the change without benefit of additional or supplemental information; and

2.2.4.2 A determination that the change did not reduce the overall conformance of the solidified waste product to existing criteria for solid wastes.

2.2.5 Provide an independent review of Process Control Program related "Instruction Change Request" received to evaluate the impact of the proposed change upon the program. Make changes to the program as necessary to maintain compliance with applicable state and federal regulation.

2.2.6 Develop Station procedures or make necessary changes to existing procedures to maintain compliance with the Process Control Program subsequent to any change to the program.

2.2.7 Review and process Vendor solidification procedures through the PVNGS procedure approval process.

2.3 The Radwaste Support Department Manager is responsible for:

2.3.1 Implementation of the Solid Radwaste Process Control Program.

2.3.2 Assuring that personnel under his control are fully aware of, and operate equipment in compliance with the Process Control Program.

2.3.3 Monitoring the activities of Vendor personnel to assure Vendor compliance with the Process Control Program.

2.3.4 Communicating to the appropriate department, any apparent need for change to the PCP to maintain compliance with State and Federal Regulations, Licensing commitments and burial site requirements.

2.3.5 Communicating, to the appropriate department, the need for procedure changes, or new procedures to maintain compliance with the Process Control Program.

3.0 PROGRAM

3.1 Precautions

3.1.1 When the radiation level of a waste batch is determined to be excessive by ALARA standards, a waste substitute shall be prepared and used for performance of the prequalification bench test in accordance with 76RW-9SR01, "Solidification Process Control procedure".

3.1.2 Radiological Precautions

The radiological precautions necessary for implementing the Process Control Program shall be followed and are covered in the "Radiation Protection Program". (RCTS 032648)

3.1.3 Sited State Acceptance;

Waste generators are allowed to stabilize class B & C waste utilizing topical reports "Approved by" or "Under Review" by the NRC provided the burial site State agrees to accept the waste so stabilized.

3.2 Prerequisites

3.2.1 Typical and atypical wet waste types shall be identified by the "Solidification Process Control" procedure, or appropriate vendor procedure which shall provide a record of waste formulations.

3.2.2 All Radioactive wet waste processing will be accomplished in accordance with an approved procedure.

3.2.3 Vendor operating procedures will undergo the same review process as PVNGS procedures.

3.3 Waste Types

3.3.1 Appendix A, "Schematic Flow Diagram," and Appendix B, "Radwaste Cement Solidification System Diagram," illustrate the different waste types to be processed by the solidification system. They are listed as follows:

3.3.2 Chemical regenerative and decontamination waste - evaporator concentrates - from a forced recirculation evaporator.

3.3.3 Boric acid waste from the Boric Acid Concentrator.

3.3.4 Bead resin waste as a slurry from the Spent Resin Tanks.

3.3.5 Chemical Drain Tank waste

3.3.6 Spent filter cartridges.

3.4 Process Parameters

3.4.1 An acceptable waste product for transfer and disposal in accordance with 10 CFR 20.311 for class, A, B, and C waste shall be provided by compliance with the "Solidification Process Control" procedure and 76DP-0RW03, "Classification of Radioactive Waste" procedure.

3.4.2 The process parameter for various class-A wastes shall be based on the Hittman Radwaste Solidification System (Cement) Topical Report, HN-R1109, Revision 4 or U.S. Gypsum Envirostone Topical Report 5/84, or Chem-Nuclear Systems, CNSI-WF-C-02-P, (or a vendor process control program) and the "Solidification Process Control" procedure. These documents establish boundary conditions to provide reasonable assurance that solidification will be complete. (RCTS 032631)

3.4.3 For class-A waste types containing concentrations of chemical that do not fall within the bound of chemical concentrations for which preoperational solidification tests have been performed by Hittman Nuclear and Development Corporation, or U.S. Gypsum, or Chem-Nuclear Systems acceptable base data for test solidification shall be developed in accordance with the "Solidification Process Control" procedure. (RCTS 032646, 032647)

3.4.4 As plant conditions dictate, including ALARA considerations as well as inplant system inoperability due to maintenance, repairs, or modifications a portable solidification system will be used to process class A waste in accordance with the vendor's operating procedures.

3.4.5 For class-B and class-C waste types, a 10 CFR 61 qualified solidification process will be used on the installed solid radwaste system in accordance with the "Solidification Process Control" procedure or a portable solidification system will be used in accordance with the vendor's operating procedures and a 10 CFR 61 Topical Report approved by, or under review by the NRC.

3.4.6 Process mixing ratios for class-A, B, and C waste types shall be determined for each waste batch in accordance with the "Solidification Process Control" procedure or the vendors operating procedure.

3.5 Waste Classification

3.5.1 The Classification of Radioactive Waste procedure provides for the use of PWR scaling factors for identifying specific radionuclides as required by 10 CFR 61.55, "Waste Classification".

3.5.2 Scaling factors shall be verified or updated as required in 10 CFR Part 61 by waste stream analysis to ensure acceptable standards are maintained for waste classification.

3.5.3 During incident conditions where the use of the existing scaling factors is questionable, the waste shall be classified by correlation factors or actual sample analysis in accordance with the "Classification of Radioactive Waste" procedure.

3.6 Waste Preconditioning

3.6.1 The "Operation of Solidification System" procedure shall designate the required mixing/recirculation times and system operations to ensure a representative sample is obtained after chemical addition and prior to process initiation. (RCIS 032643, 032645)

[illegible]

[illegible]

3.6.2 Adjustment of the waste solution pH shall be in accordance with the "Operation of Solidification System" procedure.

3.6.3 The "Operation of Solidification System" procedure shall designate when heat tracing is required to ensure chemical suspension.

3.7 Verification of Solidification

3.7.1 Solid Radwaste System

3.7.1.1 The solidification bench tests, in accordance with the Hittman Topical Report, Radwaste Solidification System (Cement), HN-R1109, Revision 4, or U.S. Gypsum Envirostone Topical Report 5/84, or Chem-Nuclear Systems (CNSI-WF-C-02-P) provide the solidification bench testing base data for the "Solidification Process Control" procedure for use with class-A type waste.

3.7.1.2 The solidification bench tests in accordance with a vendor's 10 CFR 61 Topical Report approved by, or under review by the NRC will provide the bench testing base data for the "Solidification Process Control" procedure for use with class-B and C type waste.

3.7.1.3 During solidification system operations, additions to the waste feed tank, waste feed pump operation, and process mixing ratio adjustments shall be in accordance with the "Operation of Solidification System" procedure.

No additions will be made to the waste feed tank while the tank is being recirculated for sampling or processing. (RCTS 032644)

The waste feed pump will not be stopped during sampling.

3.7.1.4 A periodic solidification bench test shall be performed as specified by and in accordance with the "Solidification Process Control" procedure for verification of an acceptable solidification process.

3.7.1.5 If any solidification bench test is found to be not acceptable, subsequent operations and testing shall be in accordance with the "Solidification Process Control" procedure.

3.7.1.6 The solidification bench test acceptance criteria shall be in accordance with the "Solidification Process Control" procedure.

3.7.1.7 Solidification product quality is controlled by the performance of the "Operation of Solidification System" procedure.

3.7.2 Portable Solidification System

3.7.2.1 The portable solidification vendor will verify proper solidification of the waste product in accordance with the vendor's operating procedure and a 10 CFR 61 Topical Report approved by or under review by the NRC.

3.7.2.2 Handling of containers of unacceptable solidified waste shall be in accordance with the "Operation of Solidification System" procedure.

3.8 Stability Requirements

Wet radioactive waste shall be classified in accordance with "Classification of Radioactive Waste" procedure prior to solidification to assure stability specification set forth in 10CFR61.56 "Waste Characteristics," and branch technical position ETSB 11-3, Revision 2, July 1981, "Design Guidance For Solid Radioactive Waste Management Systems Installed in Light-Water-cooled Nuclear Power Reactor Plants".

3.9 Data Sheets (RCTS 032649)

3.9.1 For each solidification bench test actually used for waste processing, a test data record shall be maintained in accordance with the "Solidification Process Control" procedure.

3.9.2 For each batch solidification process, a feed rate determination shall be completed in accordance with the "Solidification Process Control" procedure. (RCTS 032650)

3.9.3 For each batch solidification process, records shall be maintained of the unique batch information in accordance with the "Solidification Process Control" procedure.

3.9.4 For each batch solidification process, a waste classification record shall be completed in accordance with the "Classification of Radioactive Waste" procedure.

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3.10 Record Retention

For each batch solidification process, all records generated shall be maintained in accordance with 84AC-0RM05, "Document/Record Turnover Control" procedure.

4.0 DEFINITIONS AND ABBREVIATIONS

4.1 Definitions

4.1.1 Batch - An isolated quantity of waste feed to be processed having essentially constant physical and chemical characteristics, or

A quantity of wet waste type(s) prepared in the waste feed tank for solidification.

4.1.2 Bench test - A prequalification program of the solidification process, performed on a reduced scale with representative mixing ratios, implemented to demonstrate that the proposed method of wet waste processing will result in a waste form acceptable to the land disposal facility.

4.1.3 Chelating Agent - For the purpose of this document chelating agents are amine polycarboxylic acids (e.g., EDTA, DTPA), hydroxy-carboxylic acids, and polycarboxylic acids (e.g., citric acid, carbolic acid, picolanic acid and glucinic acid) as defined in 10 CFR Part 61.2.

4.1.4 Low level radioactive waste (LLW)

4.1.4.1 Those low-level radioactive wastes containing source, special nuclear, or by-product material that are acceptable for disposal in a near surface land disposal facility.

4.1.4.2 Radioactive waste that contains no hazardous materials as defined in RCRA.

4.1.4.3 Radioactive waste not classified as high-level radioactive waste, transuranic waste or spent nuclear fuel.

4.1.5 Monolith - A freestanding, solid object.

4.1.6 Operable - A system, subsystem, train, component or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified function(s), and when all necessary attendant instrumentation, control, electrical power, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its function(s) are also capable of performing their related support function(s).

4.1.7 Procedure - A document that specifies or prescribes how an activity is to be performed. Procedures shall be approved for use in accordance with the PVNGS Procedure "Review and Approval of Nuclear Administrative and Technical Procedures".

4.1.8 Process(ing) - Changing, modifying, and/or packaging the commercial nuclear power plant generated wet radioactive waste into a form that is acceptable to a disposal facility.

4.1.9 Quality Assurance/Quality Control - As used in this document, "quality assurance" comprises all those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service. Quality assurance includes quality control, which comprises those quality assurance actions related to the physical characteristics of a material, structure, component, or system which provide a means to control the quality of the material, structure, component, or system to predetermined requirements.

4.1.10 Stability - As used in this document, "stability" means structural stability. Stability requires that the waste form maintain its structural integrity under the expected disposal conditions.

4.1.11 Waste Container - An approved vessel of any shape, size, and composition used to contain the final processed waste.

4.1.12 Waste Form: Waste in a waste container acceptable for disposal at a licensed near-surface disposal facility.

4.1.13 Wet Waste Types - Liquid radioactive wastes, sludges, spent filter cartridges, and ion exchanger resins.

4.2 Abbreviations

4.2.1 ALARA - As Low As Reasonably Achievable

4.2.2 PCP - Process Control Program

4.2.3 RCRA - Resource Conservation and Recovery Act

5.0 <u>REFERENCES</u>

5.1 Implementing

5.1.1 Palo Verde Nuclear Generating Station Technical Specifications.

5.2 Developmental

5.2.1 10 CFR 20, Amendment Series No: 6-8, Current through November 15, 1988 - January 15, 1989, "Standards for Protection Against Radiation".

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5.2.4 49 CFR Subchapter C, Amendment Series No: 8, Current through March 1, 1989 - "Hazardous Materials Regulations".

5.2.5 NUREG-0472, Rev 2, July 1979, "Radiological Effluent Technical Specification for PWRS".

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5.2.9 75PR-0RP01, Rev 0, "Radiation Protection Program".

5.2.10 75PR-ORP03, Rev 0, "ALARA Program". (RCTS 032633)

5.2.11 01AC-0AP01, Rev 0, "Format & Content of Nuclear Administrative And Technical Procedures".

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5.2.13 84AC-ORM05, Rev 1, "Document/Record Turnover Control".

5.2.14 76RW (1,2,3)SR01, Rev 0, "Operation of Solidification

5.2.15 76RW-9SR01, Rev 0, "Solidification Process Control". System".

5.2.16 76DP-0AP02, "Review of Radwaste and Radwaste Process Control Program".

5.2.17 76DP-ORW01, Rev 0, "Waste Stream Sampling and Data Base Maintenance".

5.2.18 76DP-ORW03, Rev 0, "Classification of Radioactive Waste".

5.2.19 76DP-9RW01, Rev 0 "Aquaset, Aquaset II, Petroset, and Petroset II Solidification Process".

5.2.20 USNRC Branch Technical Position ETSB 11-3, Rev 2, July 1981 "Design Guidance for Solid Radioactive Waste Management Systems Installed in Light-Water-Cooled Nuclear Power Reactor Plants.." (RCTS 032636)

5.2.21 Chem-Nuclear Systems (CNSI-WF-C-02-P), "Development and Testing of Waste Solidification Formulas to meet Title 10 CFR Part 61 Waste Form Criteria".

5.2.22 U.S. NRC Standard Review Plan 11.4, Rev 2, July 1981 "Solid Waste Management Systems" (RCTS 032635).

5.2.23 U.S. Gypsum Envirostone Topical Report 5/84.

5.2.24 NRC Information Notice 89-27

5.2.25 Regulatory Commitment Tracking System

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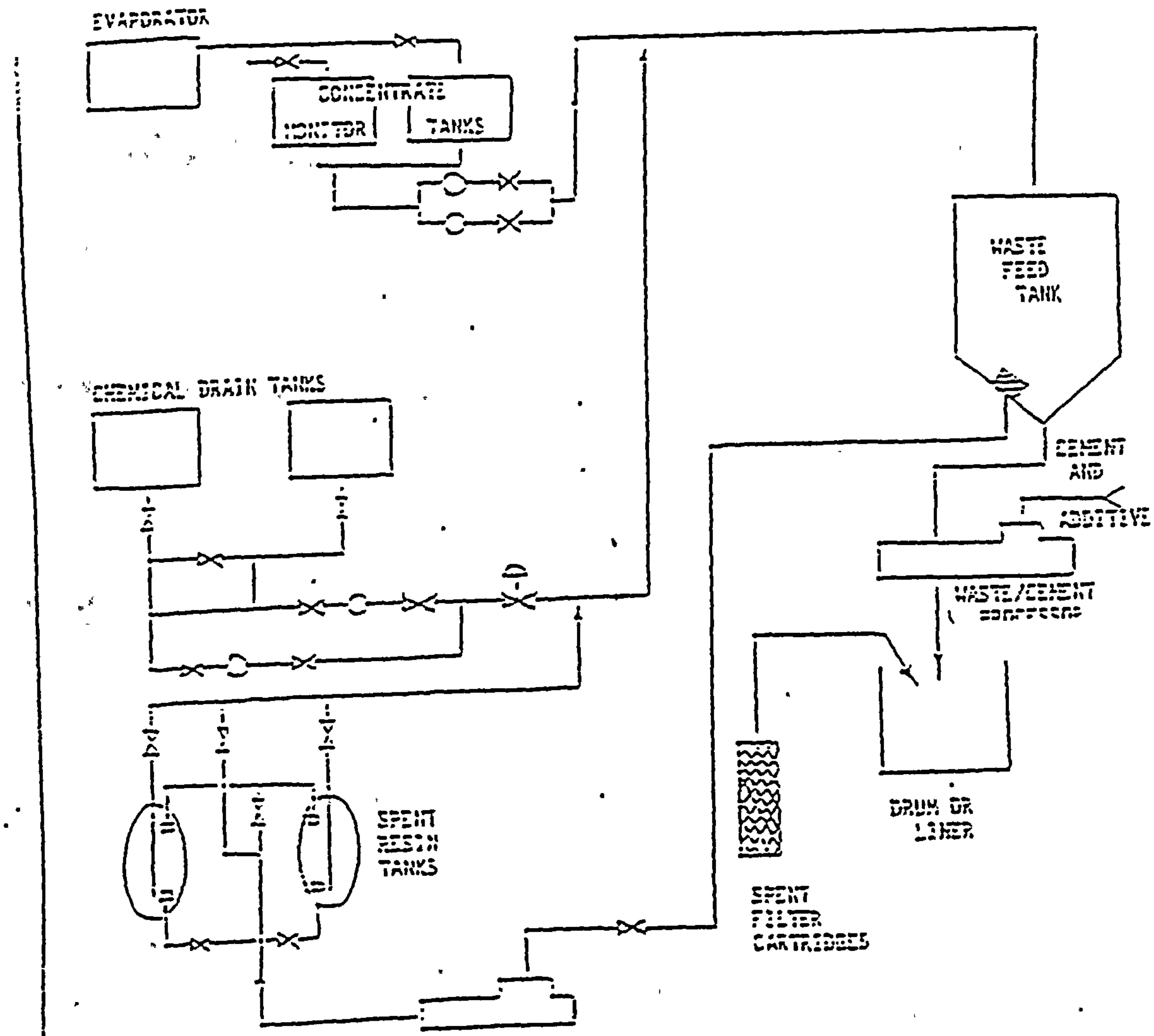
6.0 APPENDICES

Appendix A - Schematic Flow Diagram

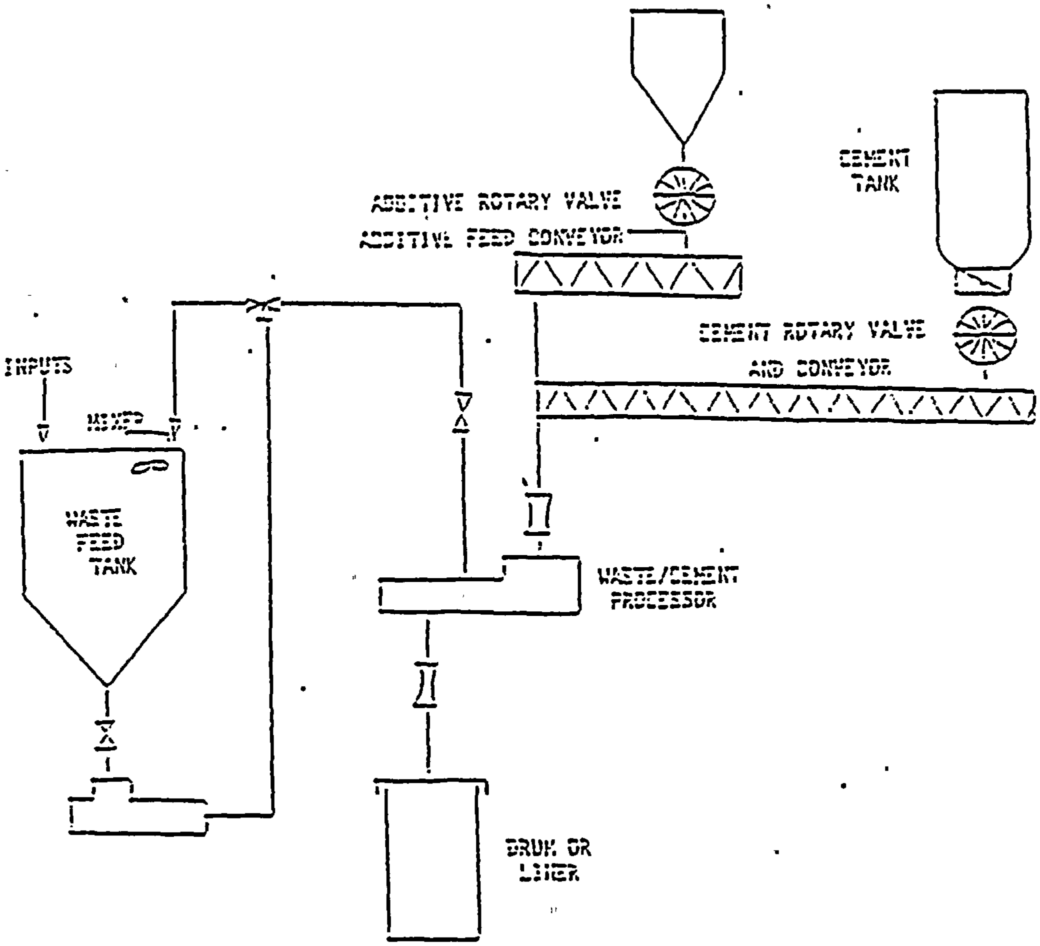
Appendix B - Radwaste Cement Solidification System Diagram

APPENDIX A



SCHEMATIC FLOW DIAGRAM

APPENDIX B



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RECORD OF REVISIONS

REVISION	DATE	REASON
0	08/23/89	New Issue

31 Aug., 1989
TECHNICAL REVIEW SIGNATURE — DATE

8/31/89
LEAD MANAGER REVIEW — DATE

9/9/89
PRB REVIEW SIGNATURE, IF REQUIRED — DATE

APPROVED BY:

9/9/89
SIGNATURE — DATE

Effective Date: 9-9-89

DDC ONLY
ASSIGNED COPY NUMBER:

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1.0 PURPOSE AND SCOPE

1.1 Purpose

1.1.1 The purpose of the Process Control Program (PCP) for the Palo Verde Nuclear Generating Station (PVNGS), Units 1, 2, and 3 is to establish a set of process parameters which will provide reasonable assurance of complete solidification of various liquid radioactive "wet wastes" including resin slurries, evaporator bottoms, filter sludges, and chemical drains in accordance with the requirements of applicable portions of the PVNGS Quality Assurance Program, PVNGS Technical Specifications, PVNGS Final Safety Analysis Report, Department of Transportation (DOT) regulations, Arizona State Regulations, Nuclear Regulator Commission (NRC) regulations, and licensed burial facilities acceptance criteria for solidification, packaging and shipment to an approved offsite burial site.

1.1.2 Toward this purpose, the PCP ensures that the solidified substance is a monolith having no freestanding liquid and is within the limits as set forth in the above mentioned regulations and acceptance criteria. This PCP will also ensure that solidification will be performed to maintain any potential radiation exposure to plant personnel to "as low as is reasonably achievable" (ALARA) levels, in accordance with the "ALARA Program" procedure. (RCTS 032630, 032639)

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1.1.3. The program addresses dewatering and drying of resin in conformance with 10 CFR 61 and packaging of various class B and class C waste in High Integrity Containers to meet waste form stability requirements.

1.2 Scope.

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1.2.1 This program applies to operation of plant installed and plant portable processing systems and vendor provided portable processing systems at PVNGS. It provides reasonable assurance of compliance with Low Level Radioactive Waste Regulations.

2.0 RESPONSIBILITIES

2.1 The Director, Standards and Technical Support shall assure the performance of a review by a qualified individual/organization of changes to the PROCESS CONTROL PROGRAM in accordance with this document.

2.2 The Radiation Protection and Chemistry Manager shall:

2.2.1 Ensure a periodic review of the Process Control Program (PCP) is completed at a minimum of every two years subsequent to the latest revision to maintain compliance with applicable State and Federal Regulations, licensing commitments, and burial facility requirements in accordance with 75AC-0RP01, "Review of Radiological Protection and Chemistry Program Performance".

2.2.2 Ensure that the Periodic Review Control Form is forwarded to NRM-DDC and copies are distributed to the following:

1) Vice President, Nuclear Production and,
2) Director of Standards and Technical Support and,
3) Nuclear Safety Group.

2.2.3 Initiate any required changes to the Process Control Program identified during the review.

2.2.4 Report changes to the Process Control Program to the NRC in the Semi-annual Radioactive Effluent Release Report for the period in which the change(s) was made. This submittal shall contain:

2.2.4.1 Sufficiently detailed information to totally support the rationale for the change without benefit of additional or supplemental information; and

2.2.4.2 A determination that the change did not reduce the overall conformance of the solidified waste product to existing criteria for solid wastes.

2.2.5 Provide an independent review of Process Control Program related "Instruction Change Request" received to evaluate the impact of the proposed change upon the program. Make changes to the program as necessary to maintain compliance with applicable state and federal regulation.

2.2.6 Develop Station procedures or make necessary changes to existing procedures to maintain compliance with the Process Control Program subsequent to any change to the program.

2.2.7 Review and process Vendor solidification procedures through the PVNGS procedure approval process.

2.3 The Radwaste Support Department Manager is responsible for:

2.3.1 Implementation of the Solid Radwaste Process Control Program.

2.3.2 Assuring that personnel under his control are fully aware of, and operate equipment in compliance with the Process Control Program.

2.3.3 Monitoring the activities of Vendor personnel to assure Vendor compliance with the Process Control Program.

2.3.4 Communicating to the appropriate department, any apparent need for change to the PCP to maintain compliance with State and Federal Regulations, Licensing commitments and burial site requirements.

2.3.5 Communicating, to the appropriate department, the need for procedure changes, or new procedures to maintain compliance with the Process Control Program.

3.0 PROGRAM

3.1 Precautions

3.1.1 When the radiation level of a waste batch is determined to be excessive by ALARA standards, a waste substitute shall be prepared and used for performance of the prequalification bench test in accordance with 76RW-9SR01, "Solidification Process Control procedure".

3.1.2 Radiological Precautions

The radiological precautions necessary for implementing the Process Control Program shall be followed and are covered in the "Radiation Protection Program". (RCTS 032648)

3.1.3 Sited State Acceptance;

Waste generators are allowed to stabilize class B & C waste utilizing topical reports "Approved by" or "Under Review" by the NRC provided the burial site State agrees to accept the waste so stabilized.

3.2 Prerequisites

3.2.1 Typical and atypical wet waste types shall be identified by the "Solidification Process Control" procedure, or appropriate vendor procedure which shall provide a record of waste formulations.

3.2.2 All Radioactive wet waste processing will be accomplished in accordance with an approved procedure.

3.2.3 Vendor operating procedures will undergo the same review process as PVNGS procedures.

3.3 Waste Types

3.3.1 Appendix A, "Schematic Flow Diagram," and Appendix B, "Radwaste Cement Solidification System Diagram," illustrate the different waste types to be processed by the solidification system. They are listed as follows:

3.3.2 Chemical regenerative and decontamination waste - evaporator concentrates - from a forced recirculation evaporator.

3.3.3 Boric acid waste from the Boric Acid Concentrator.

3.3.4 Bead resin waste as a slurry from the Spent Resin Tanks.

3.3.5 Chemical Drain Tank waste

3.3.6 Spent filter cartridges.

3.4 Process Parameters

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3.4.1 An acceptable waste product for transfer and disposal in accordance with 10 CFR 20.311 for class A, B, and C waste shall be provided by compliance with the "Solidification Process Control" procedure and 76DP-0RW03, "Classification of Radioactive Waste" procedure.

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3.4.2 The process parameter for various class A wastes shall be based on the Hittman Radwaste Solidification System (Cement) Topical Report, HN-R1109, Revision 4, U.S. Gypsum Envirostone Topical Report 5/84, or Chem-Nuclear Systems, CNSI-WF-C-02-P, (or a vendor process control program) and the "Solidification Process Control" procedure. These documents establish boundary conditions to provide reasonable assurance that solidification will be complete.
(RCTS 032631)

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3.4.3 For class-A waste types containing concentrations of chemical that do not fall within the bound of chemical concentrations for which preoperational solidification tests have been performed by Hittman Nuclear and Development Corporation, U.S. Gypsum, or Chem-Nuclear Systems acceptable base data for test solidification shall be developed in accordance with the "Solidification Process Control" procedure. (RCIS 032646, 032647)

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3.4.4 As plant conditions dictate, including ALARA considerations as well as inplant system inoperability due to maintenance, repairs, or modifications a portable solidification system will be used to process class A waste in accordance with approved operating procedures. Class A ion exchange resins may be dewatered in an appropriate container in accordance with approved operating procedure.

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3.4.5 For class-B and class-C waste types, a 10 CFR 61 qualified solidification process will be used on the installed solid radwaste system in accordance with the "Solidification Process Control" procedure or a portable solidification system will be used in accordance with approved operating procedures and a 10 CFR 61 Topical Report approved by, or under review by the NRC.

3.4.6 Process mixing ratios for class A, B, and C waste types shall be determined for each waste batch in accordance with the "Solidification Process Control" procedure or the vendors operating procedure.

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3.4.7 Packaging Class B and class C Radioactive waste in High Integrity Containers.

3.4.7.1 Class B and Class C ion exchange resins may be dewatered in an approved High Integrity Container in accordance with a Process Control Program and a 10 CFR 61 Topical Report approved by or under review by the NRC.

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3.4.7.2 Class B and Class C spent filters and other appropriately sized Radioactive material may be placed in an approved High Integrity Container for disposal, in accordance with approved procedures, provided all the requirements of 10 CFR 61 are ensured.

3.5 Waste Classification

3.5.1 The Classification of Radioactive Waste procedure provides for the use of PWR scaling factors for identifying specific radionuclides as required by 10 CFR 61.55, "Waste Classification".

3.5.2 Scaling factors shall be verified or updated as required in 10 CFR Part 61 by waste stream analysis to ensure acceptable standards are maintained for waste classification.

3.5.3 During incident conditions where the use of the existing scaling factors is questionable, the waste shall be classified by correlation factors or actual sample analysis in accordance with the "Classification of Radioactive Waste" procedure.

3.6 Waste Preconditioning

3.6.1 The "Operation of Solidification System" procedure shall designate the required mixing/recirculation times and system operations to ensure a representative sample is obtained after chemical addition and prior to process initiation. (RCTS 032643, 032645)

3.6.2 Adjustment of the waste solution pH shall be in accordance with the "Operation of Solidification System" procedure.

3.6.3 The "Operation of Solidification System" procedure shall designate when heat tracing is required to ensure chemical suspension.

3.7 Verification of Solidification

3.7.1 Solid Radwaste System

3.7.1.1 The solidification bench tests, in accordance with the Hittman Topical Report, Radwaste Solidification System (Cement), HN-R1109, Revision 4, or U.S. Gypsum Envirostone Topical Report 5/84, or Chem-Nuclear Systems (CNSI-WF-C-02-P) provide the solidification bench testing base data for the "Solidification Process Control" procedure for use with class-A type waste.

3.7.1.2 The solidification bench tests in accordance with a vendor's 10 CFR 61 Topical Report approved by, or under review by the NRC will provide the bench testing base data for the "Solidification Process Control" procedure for use with class-B and C type waste.

3.7.1.3 During solidification system operations, additions to the waste feed tank, waste feed pump operation, and process mixing ratio adjustments shall be in accordance with the "Operation of Solidification System" procedure.

No additions will be made to the waste feed tank while the tank is being recirculated for sampling or processing. (RCIS 032644)

The waste feed pump will not be stopped during sampling.

3.7.1.4 A periodic solidification bench test shall be performed as specified by and in accordance with the "Solidification Process Control" procedure for verification of an acceptable solidification process.

3.7.1.5 If any solidification bench test is found to be not acceptable, subsequent operations and testing shall be in accordance with the "Solidification Process Control" procedure.

3.7.1.6 The solidification bench test acceptance criteria shall be in accordance with the "Solidification Process Control" procedure.

3.7.1.7 Solidification product quality is controlled by the performance of the "Operation of Solidification System" procedure.

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3.7.2.1 The portable solidification vendor will verify proper solidification of the waste product in accordance with the vendor's operating procedure and a 10 CFR 61 Topical Report approved by or under review by the NRC.

3.7.2.2 Handling of containers of unacceptable solidified waste shall be in accordance with the "Operation of Solidification System" procedure.

3.8 Stability Requirements

Wet radioactive waste shall be classified in accordance with "Classification of Radioactive Waste" procedure prior to solidification to assure stability specification set forth in 10CFR61.56 "Waste Characteristics," and branch technical position ETSB 11-3, Revision 2, July 1981, "Design Guidance For Solid Radioactive Waste Management Systems Installed in Light-Water-cooled Nuclear Power Reactor Plants".

3.9 Data Sheets (RCIS 032649)

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For each batch solidification process, all records generated shall be maintained in accordance with 84AC-0RM05, "Document/Record Turnover Control" procedure.

4.0 <u>DEFINITIONS AND ABBREVIATIONS</u>

4.1 Definitions

4.1.1 Batch - An isolated quantity of waste feed to be processed having essentially constant physical and chemical characteristics, or

A quantity of wet waste type(s) prepared in the waste feed tank for solidification.

4.1.2 Bench test - A prequalification program of the solidification process, performed on a reduced scale with representative mixing ratios, implemented to demonstrate that the proposed method of wet waste processing will result in a waste form acceptable to the land disposal facility.

4.1.3 Chelating Agent - For the purpose of this document chelating agents are amine polycarboxylic acids (e.g., EDTA, DTPA), hydroxy-carboxylic acids, and polycarboxylic acids (e.g., citric acid, carbolic acid, picolanic acid and glucinic acid) as defined in 10 CFR Part 61.2.

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4.1.4 Approved High Integrity Container: A container used to provide the long term stability requirement of 10 CFR 61. Approval to be evidenced by a copy of the 10 CFR 61 "Certificate of Compliance" being reviewed prior to the containers use and maintained in station file during and subsequent to the containers use.

4.1.5 Low level radioactive waste (LLW)

4.1.5.1 Those low-level radioactive wastes containing source, special nuclear, or by-product material that are acceptable for disposal in a near surface land disposal facility.

4.1.5.2 Radioactive waste that contains no hazardous materials as defined in RCRA.

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4.1.14 Wet Waste Types - Liquid radioactive wastes, sludges, spent filter cartridges, and ion exchanger resins.

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4.2 Abbreviations

4.2.1 ALARA - As Low As Reasonably Achievable

4.2.2 HIC - High Integrity Container

4.2.3 PCP - Process Control Program

4.2.4 RCRA - Resource Conservation and Recovery Act

5.0 <u>REFERENCES</u>

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5.2.21 NRC Technical Position on Waste Form, Rev 0, May 1983

5.2.22 Chem-Nuclear Systems (CNSI-WF-C-02-P), "Development and Testing of Waste Solidification Formulas to meet Title 10 CFR Part 61 Waste Form Criteria".

5.2.23 U.S. NRC Standard Review Plan 11.4, Rev 2, July 1981 "Solid Waste Management Systems" (RCTS 032635).

5.2.24 U.S. Gypsum Envirostone Topical Report 5/84.

5.2.25 NRC Information Notice 89-27

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5.2.26 Regulatory Commitment Tracking System

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032632	5.2.5
032633	5.2.6
032634	5.2.8
032635	5.2.21
032636	5.2.13
032637	5.2.14
032638	The PCP
032639	1.1.2
032641	Appendix A
032643	3.6.1
032644	3.7.1.3
032645	3.6.1
032646	3.4.3
032647	3.4.3
032648	3.1.2
032649	3.9
032650	3.9.2

6.0 APPENDICES

Appendix A - Schematic Flow Diagram

Appendix B - Radwaste Cement Solidification System Diagram

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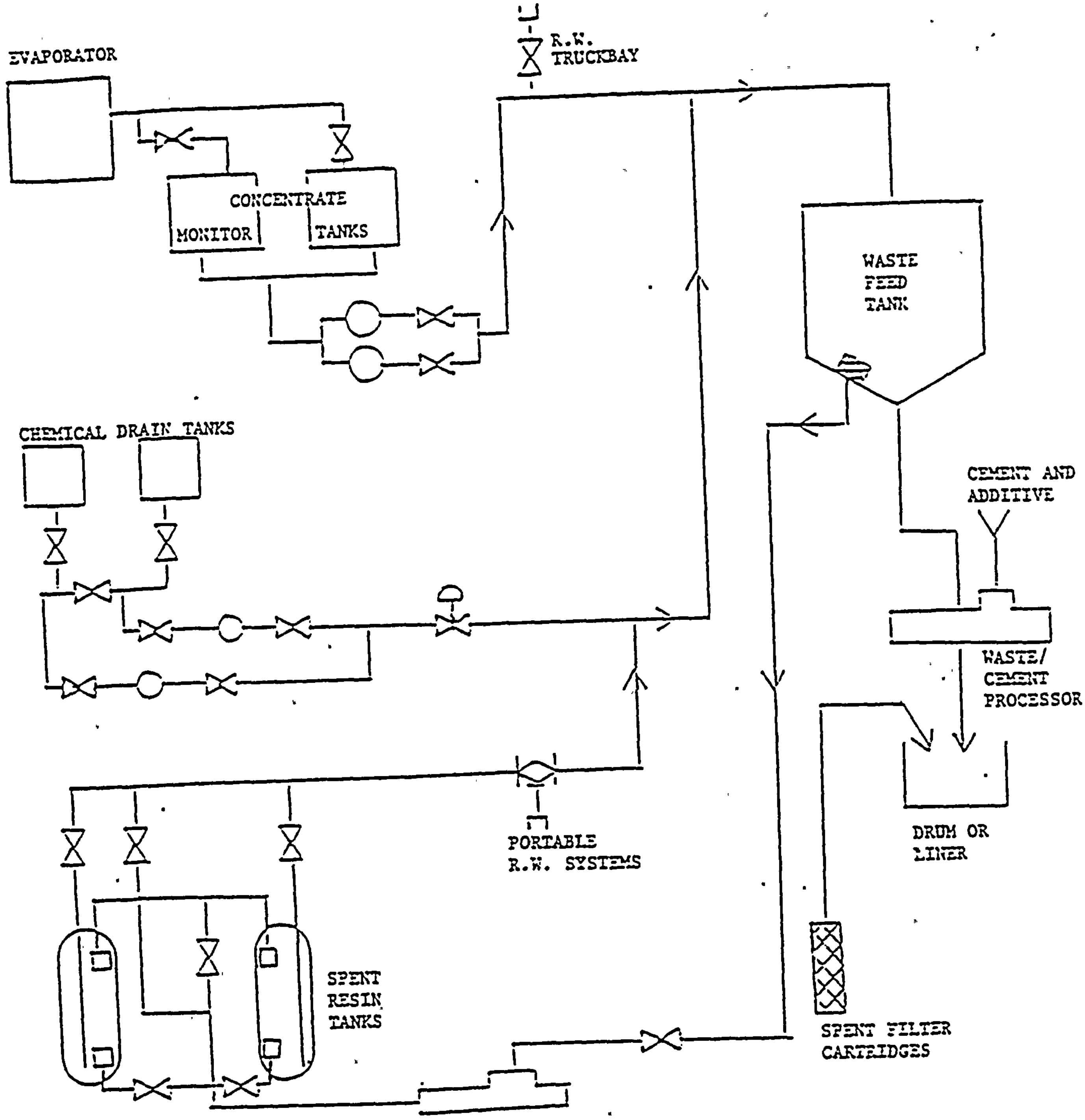
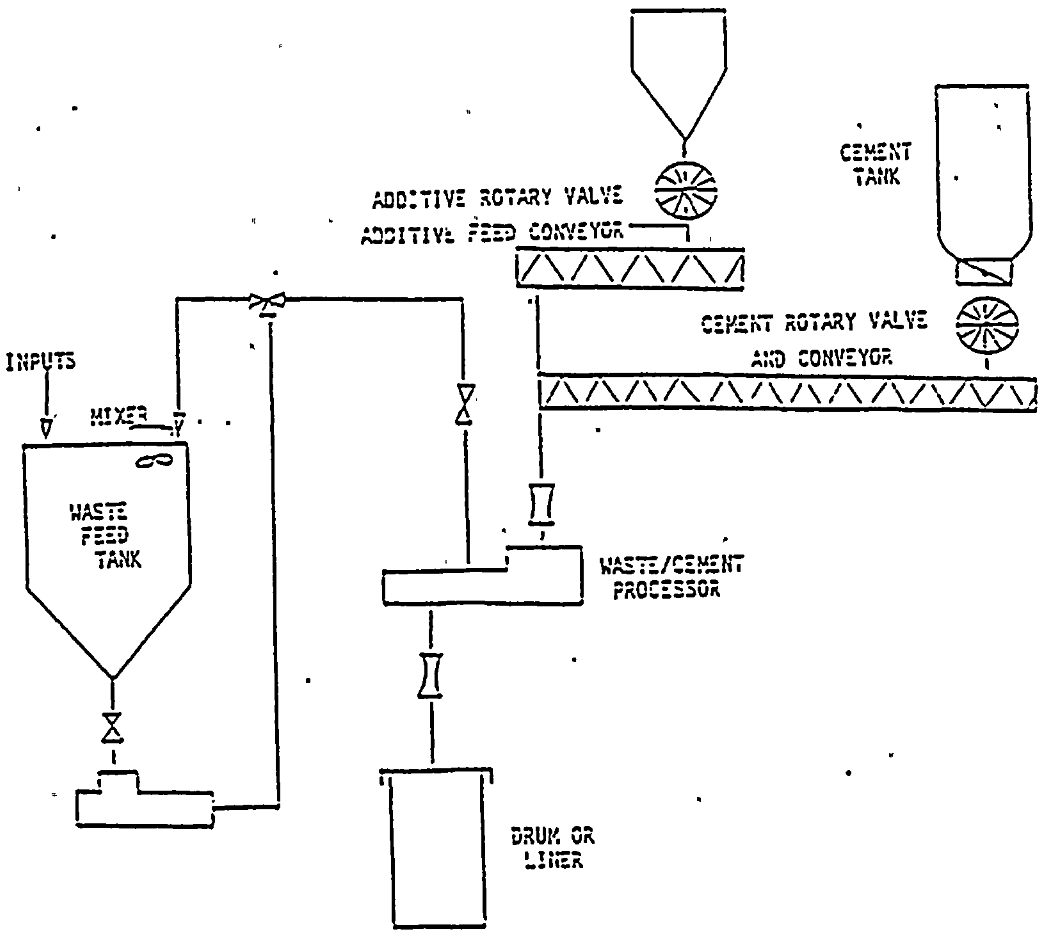
PCN 01



PCN 01

SCHEMATIC FLOW DIAGRAM

APPENDIX B



RADWASTE CEMENT SOLIDIFICATION SYSTEM

APPENDIX E

REVISED OFFSITE DOSE CALCULATION MANUAL (ODCM)