Technical Specification 5.6.2

APS

A subsidiary of Pinnacle West Capital Corporation

Palo Verde Nuclear
Generating Station

Thomas N. Weber
Department Leader
Regulatory Affairs

Tel. 623-393-5764
Fax 623-393-5442

Mail Station 7636
PO Box 52034
Phoenix, Arizona 85072-2034

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May 11, 2010

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Sir:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, and 3
Docket Nos. STN 50-528/529/530
Annual Radiological Environmental Operating Report 2009

In accordance with PVNGS Technical Specification (TS) 5.6.2, enclosed please find the Annual Radiological Environmental Operating Report for 2009.

No commitments are being made to the NRC in this letter. Should you need further information regarding this submittal, please contact Russell A. Stroud, Licensing Section Leader, at (623) 393-5111.

Sincerely,

Thomas N. Weber

TNW/RAS/KAR/gat

Enclosure

cc:	E. E. Collins Jr.	NRC Region IV Regional Administrator
	J. R. Hall	NRC NRR Project Manager
	L. K. Gibson	NRC NRR Project Manager
	R. I. Treadway	NRC Senior Resident Inspector for PVNGS
	A. V. Godwin	Arizona Radiation Regulatory Agency (ARRA)
	T. Morales	Arizona Radiation Regulatory Agency (ARRA)

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NRR

ENCLOSURE

Units 1, 2, and 3

Annual Radiological Environmental Operating Report 2009

NUCLEAR GENERATING STATION

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT 2009

(Reference: RCTSAI 1643, Legacy Item No. 036843.01)

Prepared by: Drinovsky, Louis J(Z33699)
Digitally signed by Drinovsky, Louis J (Z33699)
DN: cn=Drinovsky, Louis J(Z33699)
Reason: I am the author of this document
Date: 2010.04.02 10:24:39 -07'00'

Reviewed by: Bungard, James P(Z18012)
Digitally signed by Bungard, James P(Z18012)
DN: cn=Bungard, James P(Z18012)
Reason: I have reviewed this document
Date: 2010.04.02 12:51:31 -07'00'

Approved by: Gaffney, John P(Z36459)
Digitally signed by Gaffney, John P (Z36459)
DN: cn=Gaffney, John P(Z36459)
Reason: I am approving this document
Date: 2010.04.05 12:38:58 -07'00'

Director, Radiation Protection

TABLE OF CONTENTS

1. INTRODUCTION 2

2. DESCRIPTION OF THE MONITORING PROGRAM 3

2.1. 2009 PVNGS RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM 3
2.2. RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM CHANGES FOR 2009 3
2.3. REMP DEVIATIONS/ABNORMAL EVENTS SUMMARY 4
2.4. SIGNIFICANT INVESTIGATION REGARDING GROUND WATER PROTECTION 4

3. SAMPLE COLLECTION PROGRAM 12

3.1. WATER 12
3.2. VEGETATION 12
3.3. MILK 12
3.4. AIR 12
3.5. SLUDGE AND SEDIMENT 13

4. ANALYTICAL PROCEDURES 13

4.1. AIR PARTICULATE 13
4.2. AIRBORNE RADIOIODINE 13
4.3. MILK 13
4.4. VEGETATION 14
4.5. SLUDGE/SEDIMENT 14
4.6. WATER 14
4.7. SOIL 15

5. NUCLEAR INSTRUMENTATION 15

5.1. GAMMA SPECTROMETER 15
5.2. LIQUID SCINTILLATION SPECTROMETER 15
5.3. GAS FLOW PROPORTIONAL COUNTER 15

6. ISOTOPIC DETECTION LIMITS AND REPORTING CRITERIA 16

6.1. LOWER LIMITS OF DETECTION 16
6.2. DATA REPORTING CRITERIA 16
6.3. LLD AND REPORTING CRITERIA OVERVIEW 17

7. INTERLABORATORY COMPARISON PROGRAM 22

7.1. QUALITY CONTROL PROGRAM 22
7.2. INTERCOMPARISON RESULTS 22

8. DATA INTERPRETATIONS AND CONCLUSIONS 25

8.1. AIR PARTICULATES 25
8.2. AIRBORNE RADIOIODINE 26
8.3. VEGETATION 26
8.4. MILK 26
8.5. DRINKING WATER 26
8.6. GROUND WATER 26

TABLE OF CONTENTS

8.7. SURFACE WATER 26
8.8. SLUDGE AND SEDIMENT 27
8.9. DATA TRENDS 27

9. THERMOLUMINESCENT DOSIMETER (TLD) RESULTS AND DATA 49

10. LAND USE CENSUS 55

10.1. INTRODUCTION 55
10.2. CENSUS RESULTS 55

11. SUMMARY AND CONCLUSIONS 57

12. REFERENCES 62

LIST OF TABLES

TABLE 2.1 SAMPLE COLLECTION LOCATIONS 6

TABLE 2.2 SAMPLE COLLECTION SCHEDULE 7

TABLE 2.3 SUMMARIES OF REMP DEVIATIONS/ABNORMAL EVENTS 8

TABLE 6.1 ODCM REQUIRED LOWER LIMITS OF DETECTION (*A PRIORI*) 19

TABLE 6.2 ODCM REQUIRED REPORTING LEVELS 20

TABLE 6.3 TYPICAL MDA VALUES 21

TABLE 7.1 INTERLABORATORY COMPARISON RESULTS 23

TABLE 8.1 PARTICULATE GROSS BETA IN AIR 1ST - 2ND QUARTER 28

TABLE 8.2 PARTICULATE GROSS BETA IN AIR 3RD - 4TH QUARTER 29

TABLE 8.3 GAMMA IN AIR FILTER COMPOSITES 30

TABLE 8.4 RADIOIODINE IN AIR 1ST - 2ND QUARTER 31

TABLE 8.5 RADIOIODINE IN AIR 3RD - 4TH QUARTER 32

TABLE 8.6 VEGETATION 33

TABLE 8.7 MILK 34

TABLE 8.8 DRINKING WATER 35

TABLE 8.9 GROUND WATER 37

TABLE 8.10 SURFACE WATER 38

TABLE 8.11 SLUDGE/SEDIMENT 42

TABLE 9.1 TLD SITE LOCATIONS 50

TABLE 9.2 2009 ENVIRONMENTAL TLD RESULTS 52

TABLE 10.1 2009 LAND USE CENSUS 56

TABLE 11.1 ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM ANNUAL SUMMARY ... 58

LIST OF FIGURES

FIGURE 2.1 REMP SAMPLE SITES - MAP (0-10 miles) 10
FIGURE 2.2 REMP SAMPLE SITES - MAP (10-35 miles) 11
FIGURE 8.1 HISTORICAL GROSS BETA IN AIR (WEEKLY SYSTEM AVERAGES) 45
FIGURE 8.2 HISTORICAL GROSS BETA IN AIR (ANNUAL SITE TO SITE COMPARISONS) COMPARED TO PRE-OP 46
FIGURE 8.3 GROSS BETA IN DRINKING WATER 47
FIGURE 8.4 EVAPORATION POND TRITIUM ACTIVITY 48
FIGURE 9.1 NETWORK ENVIRONMENTAL TLD EXPOSURE RATES 53
FIGURE 9.2 ENVIRONMENTAL TLD COMPARISON - PRE-OPERATIONAL VS 2009 54

ABSTRACT

The Radiological Environmental Monitoring Program (REMP) is an ongoing program conducted by Arizona Public Service Company (APS) for the Palo Verde Nuclear Generating Station (PVNGS). Various types of environmental samples are collected near PVNGS and analyzed for plant related radionuclide concentrations.

During 2009, the following categories of samples were collected by APS:

- Broad leaf vegetation
- Ground water
- Drinking water
- Surface water
- Airborne particulate and radioiodine
- Goat and cow milk
- Sludge and sediment

Thermoluminescent dosimeters (TLDs) were used to measure environmental gamma radiation. The Environmental TLD program is also conducted by APS.

The Arizona Radiation Regulatory Agency (ARRA) performs radiochemistry analyses on various duplicate samples provided to them by APS. Samples analyzed by ARRA include onsite samples from the Reservoirs, Evaporation Ponds, and two (2) deep wells. Offsite samples analyzed by ARRA include two (2) local resident wells. ARRA also performs air sampling at seven (7) offsite locations identical to APS and maintains approximately fifty (50) environmental TLD monitoring locations, eighteen (18) of which are duplicates of APS locations.

A comparison of pre-operational and operational data indicates no changes to environmental radiation levels.

Low level tritium was discovered in subsurface water onsite (not considered potable) in February 2006 at Units 2 and 3. A significant investigation was initiated to determine the source of the water, the extent of the condition, and corrective actions to protect ground water. See Section 2.4 for further discussion.

(NOTE: Reference to APS throughout this report refers to PVNGS personnel)

OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

1. Introduction

This report presents the results of the operational radiological environmental monitoring program conducted by Arizona Public Service Company (APS). The Radiological Environmental Monitoring Program (REMP) was established for the Palo Verde Nuclear Generating Station (PVNGS) by APS in 1979. The REMP is performed in accordance with the federal requirements to provide a complete environmental monitoring program for nuclear reactors, and with concern for maintaining the quality of the local environment. The program complies with the requirements of 10 CFR 50, Appendix I, PVNGS Technical Specifications, and with the guidance provided by the US Nuclear Regulatory Commission (USNRC) in their Radiological Assessment Branch Technical Position on Environmental Monitoring, Revision 1, November 1979 (incorporated into NUREG 1301).

This report contains the measurements and findings for 2009. All references are specifically identified in Section 12.

The objectives of the REMP are as follows: 1) to determine baseline radiation levels in the environs prior to plant operation and to compare the findings with measurements obtained during reactor operations; 2) to monitor potential radiological exposure pathways to the public; and 3) to determine radiological impacts on the environment caused by the operation of PVNGS.

Results from the REMP help to evaluate sources of elevated levels of radioactivity in the environment (e.g., atmospheric nuclear detonations or abnormal plant releases).

Results of the PVNGS pre-operational environmental monitoring program are presented in Reference 1.

The initial criticality of Unit 1 occurred May 25, 1985. Initial criticality for Units 2 and 3 were April 18, 1986, and October 25, 1987, respectively. PVNGS operational findings (historical) are presented in Reference 2.

2. Description of the Monitoring Program

APS and vendor organizations performed the pre-operational radiological environmental monitoring program, which began in 1979. APS and vendors continued the program into the operational phase.

2.1. 2009 PVNGS Radiological Environmental Monitoring Program

The assessment program consists of routine measurements of environmental gamma radiation and of radionuclide concentrations in media such as air, ground water, drinking water, surface water, vegetation, milk, sludge, and sediment.

Samples were collected by APS at the monitoring sites shown in Figures 2.1 and 2.2. The specific sample types, sampling locations, and sampling frequencies, as set forth in the PVNGS Offsite Dose Calculation Manual (ODCM), Reference 4, are presented in Tables 2.1, 2.2 and 9.1. Additional onsite sampling (outside the scope of the ODCM) is performed to supplement the REMP. All results are included in this report. Sample analyses were performed by APS at the PVNGS Central Chemistry Laboratory. This laboratory is licensed by the Arizona Department of Health Services (ADHS) to perform radiological analyses.

Environmental gamma radiation measurements were performed by APS using TLDs at fifty (50) locations near PVNGS. The PVNGS Dosimetry Department is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) to perform ionizing radiation dosimeter analyses.

In addition to monitoring environmental media, a land use census is performed annually to identify the nearest milk animals, residents, and gardens. This information is used to evaluate the potential dose to members of the public for those exposure pathways that are indicated.

2.2. Radiological Environmental Monitoring Program Changes for 2009

- Annual sampling of Evaporation Pond sediment was discontinued based on historical data and the potential to damage the new liners. This sample was not ODCM required and an evaluation of the risk vs benefit to continued sampling was documented in the Corrective Action Program by CRDR #3363010.
- The Land Use Census identified a new cow milk location within 5 miles and this location was added to the monitoring program.
- Evaporation Pond #3 (divided into sections 3A and 3B) was built and placed into service. Water from Evaporation Pond #2 was pumped into this pond. Evaporation Pond #2 is empty and is undergoing a complete liner replacement.

The following changes implement ODCM Revision 24 and were made as a result of the annual Land Use Census (reference CRDR #3337879);

- 1. Replaced the Lahti (ODCM Site #47), and Wright (ODCM Site #52), vegetation sample locations with the Batdorf location. Designated Batdorf as Site #47.
- 2. Added the Rodriguez (cow and goat) and Davis (goat) milk sample locations. Designated Rodriguez as Site #51 and Davis as Site #52.
- 3. Retained the Hernandez goat milk location as Site #54, but changed status to supplemental.

Refer to Table 2.1 for a description of all current sample locations (except TLDs).

2.3. REMP Deviations/Abnormal Events Summary

During calendar year 2009, there were six (6) deviations/abnormal events with regard to the monitoring program. Refer to Table 2.3 for more detail and any corrective actions taken.

- The air samples at Site #7A were invalid from 9/15 through 9/22
- The air samples at Site #14A were invalid from 11/9 through 11/17
- Evaporation Pond #2 was empty the entire year for liner replacement
- The I-131 concentration in water exceeded the action level in Evaporation Pond #1 and both Reservoirs
- TLDs at Site #36 were missing in the 3rd quarter
- The 4th quarter TLD results were delayed for more than 60 days

2.4. Significant Investigation Regarding Ground Water Protection

(Follow-up from past reports)

NOTE:

Although not part of the REMP, this information is being provided due to the identification of low level tritium in the onsite environs (within the Radiological Controlled Area) and heightened sensitivity to communicate the potential to affect ground water.

On February 15, 2006 Palo Verde personnel observed water leakage into the Unit 2 Essential Pipe Density Tunnel through the 'B' Spray Pond (SP) supply line penetration seal (documented on Significant CRDR No. 2869959). Low level tritium was identified in this water. It has been determined that the water was not the result of leakage from a plant system, but more likely due to previous operating conditions combined with precipitation. The investigation revealed that Unit 3 had a similar situation. PVNGS initiated OE22651 and follow-up OE24237 to describe the incident of low level tritium at Unit 3 since the concentration exceeded a reporting threshold.

Several monitoring wells have been installed to monitor the subsurface water and shallow aquifer at Units 1, 2, and 3. These wells are sampled monthly and quarterly for chemical and radiological parameters. The State of Arizona Aquifer Protection Permit (Area-Wide) No. P-100388 (APP) provides agreed upon monitoring parameters and reporting thresholds. Sample results are reported in the PVNGS Annual Radioactive Effluent Release Report (ARERR).

PVNGS has implemented a ground water protection program initiated by the Nuclear Energy Institute (NEI). This initiative, NEI 07-07 (Industry Ground Water Protection Initiative – Final Guidance Document, August 2007), provides added assurance that ground water will not be adversely affected by PVNGS operations. The State of Arizona APP provides specific regulatory criteria for ground water protection.

Table 2.1 SAMPLE COLLECTION LOCATIONS

SAMPLE SITE #	*SAMPLE TYPE*	*LOCATION (a)*	*LOCATION DESCRIPTION*
4	air	E16	APS Office
6A*	air	SSE13	Old US 80
7A	air	ESE3	Arlington School
14A	air	NNE2	371st Ave. and Buckeye-Salome Rd.
15	air	NE2	NE Site Boundary
17A	air	E3	351st Ave.
21	air	S3	S Site Boundary
29	air	W1	W Site Boundary
35	air	NNW8	Tonopah
40	air	N2	Transmission Rd
46	drinking water	NNW8	Wirth residence
47	vegetation	NNE2 **(b)**	**Batdorf residence**
48	drinking water	SW1	Berryman residence
49	drinking water	N2	Sandoval residence
51	milk	ESE2 **(b)**	**Rodriguez residence- goats and cows**
52	milk	ENE3 **(b)**	**Davis residence- goats**
53*	milk	NE30	Martin residence- goats
54	milk	NNE4	Hernandez residence-goats
55	drinking water (supplemental)	SW3	Gavette residence
57	ground water	ONSITE	Well 27ddc
58	ground water	ONSITE	Well 34abb
59	surface water	ONSITE	Evaporation Pond #1
60	surface water	ONSITE	85 acre Reservoir
61	surface water	ONSITE	45 acre Reservoir
62*	vegetation	ENE26	Duncan Family Farms
63	surface water	ONSITE	Evaporation Pond #2
64	surface water	ONSITE	Evaporation Pond #3

NOTES:

* Designates a control site

(a) Distances and direction are from the center-line of Unit 2 containment and rounded to the nearest mile

(b) Denotes a change in location or a new sample location

Air sample sites designated with the letter 'A' are sites that have the same site number as a TLD location, but are not in the same location (e.g. site **#6** TLD location is different from site **#6A** air sample location; site **#4** TLD location is the same as site **#4** air sample location)

Table 2.2 SAMPLE COLLECTION SCHEDULE

SAMPLE SITE #	*AIR PARTICULATE*	*MILK*	*AIRBORNE RADIOIODINE*	*VEGETATION*	*GROUND WATER*	*DRINKING WATER*	*SURFACE WATER*
4	W		W				
6A	W		W				
7A	W		W				
14A	W		W				
15	W		W				
17A	W		W				
21	W		W				
29	W		W				
35	W		W				
40	W		W				
46						W	
47				M/AA			
48						W	
49						W	
51		M/AA					
52		M/AA					
53		M/AA					
54		M/AA					
55						W	
57					Q		
58					Q		
59							Q
60							Q
61							Q
62				M/AA			
63							Q
64							Q

W = WEEKLY M/AA = MONTHLY AS AVAILABLE Q = QUARTERLY

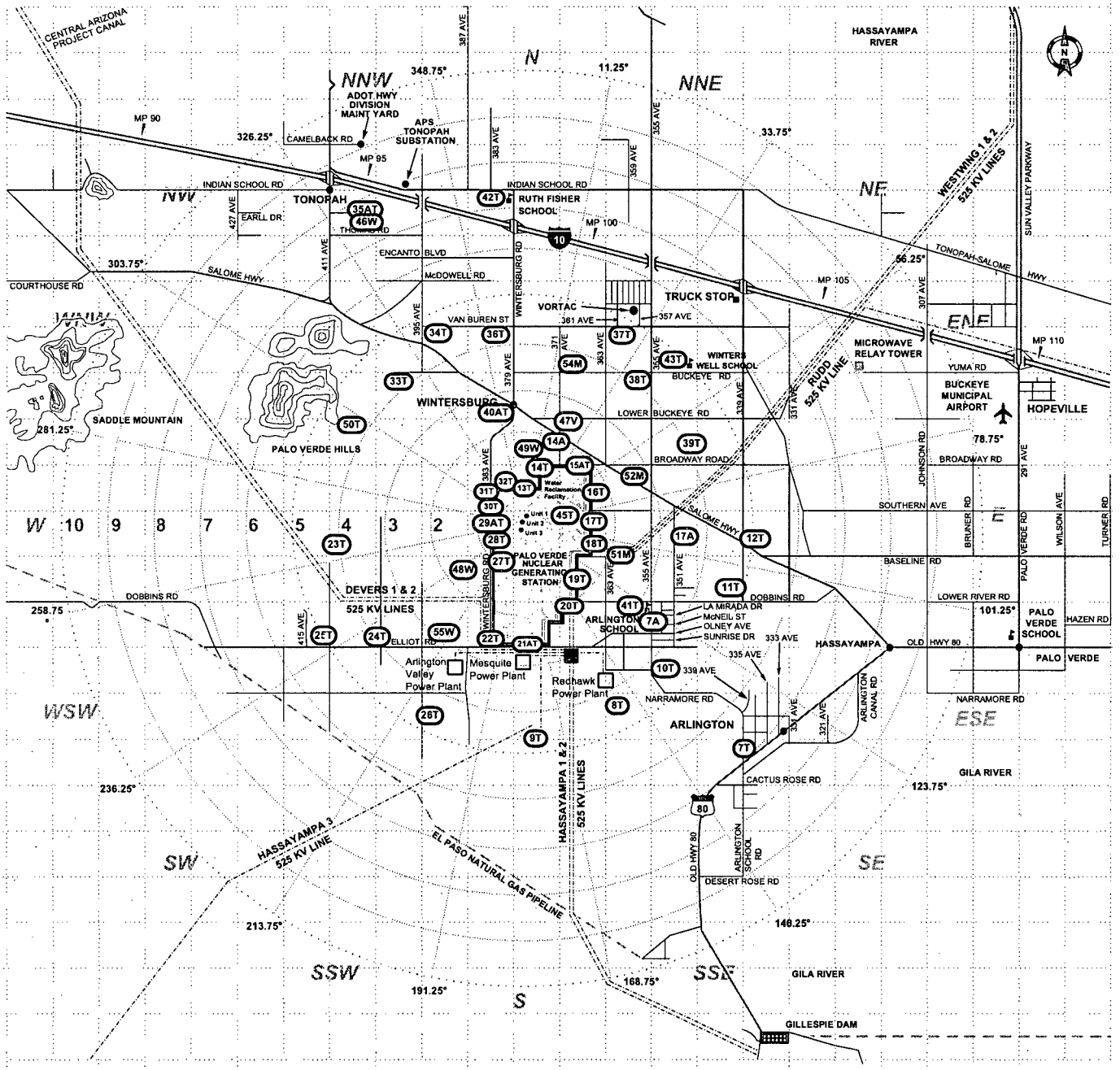
TABLE 2.3 SUMMARIES OF REMP DEVIATIONS/ABNORMAL EVENTS

Deviation/Abnormal Event	Actions taken
1. The air samples at Site #7A were invalid from 9/15 through 9/22	1. The air sample pump failed during the sample period, resulting in the inability to determine the actual sample volume. The pump was replaced and the sample for the next week was valid. No further actions required.
2. The air samples at Site #14A were invalid from 11/9 through 11/17	2. The air sample pump failed during the sample period, resulting in the inability to determine the actual sample volume. The pump was replaced and the sample for the next week was valid. No further actions required.
3. Evaporation Pond #2 was empty the entire year for liner replacement	3. The liner is being replaced. Evaporation Pond #2 was empty all year. When water is added to the pond routine sampling will start. No action required.
4. The I-131 concentration in water exceeded the action level in Evaporation Pond #1 and both Reservoirs	4. Corrective Action Program document CRDR #3309449 provides the evaluation conclusion that radiopharmaceutical I-131 is the cause of the elevated I-131 concentrations. Because the I-131 is not the result of plant effluents, no Special Reporting was required. Providing the information in this report meets the requirements of ODCM Section 6.1, Action b. and CRAI #3312804. No further actions are required.
5. TLDs at Site #36 were missing in the 3rd quarter	5. The TLDs at this location were moved across the road as it was determined a school bus stop was now at this location. The TLDs were not missing in the 4th quarter. Therefore, moving them across the road has corrected the problem. Relocation of these TLDs will be considered if the problem recurs. No further actions are required at this time.

TABLE 2.3 SUMMARIES OF REMP DEVIATIONS/ABNORMAL EVENTS

Deviation/Abnormal Event (continued)	Actions taken (continued)
6. The 4th quarter TLD results were delayed for more than 60 days	6. The environmental TLD results showed a low bias in the 4th quarter and an investigation into the cause was conducted. Corrective Action Program document CRDR #3439215 was initiated to document and correct the issue.

FIGURE 2.1



KEY TO MAP

Sample Site (1)
A Air
V Vegetation
W Water
T TLD
M Milk

School
Airstrip

REMP SAMPLE SITES
0-10 MILES

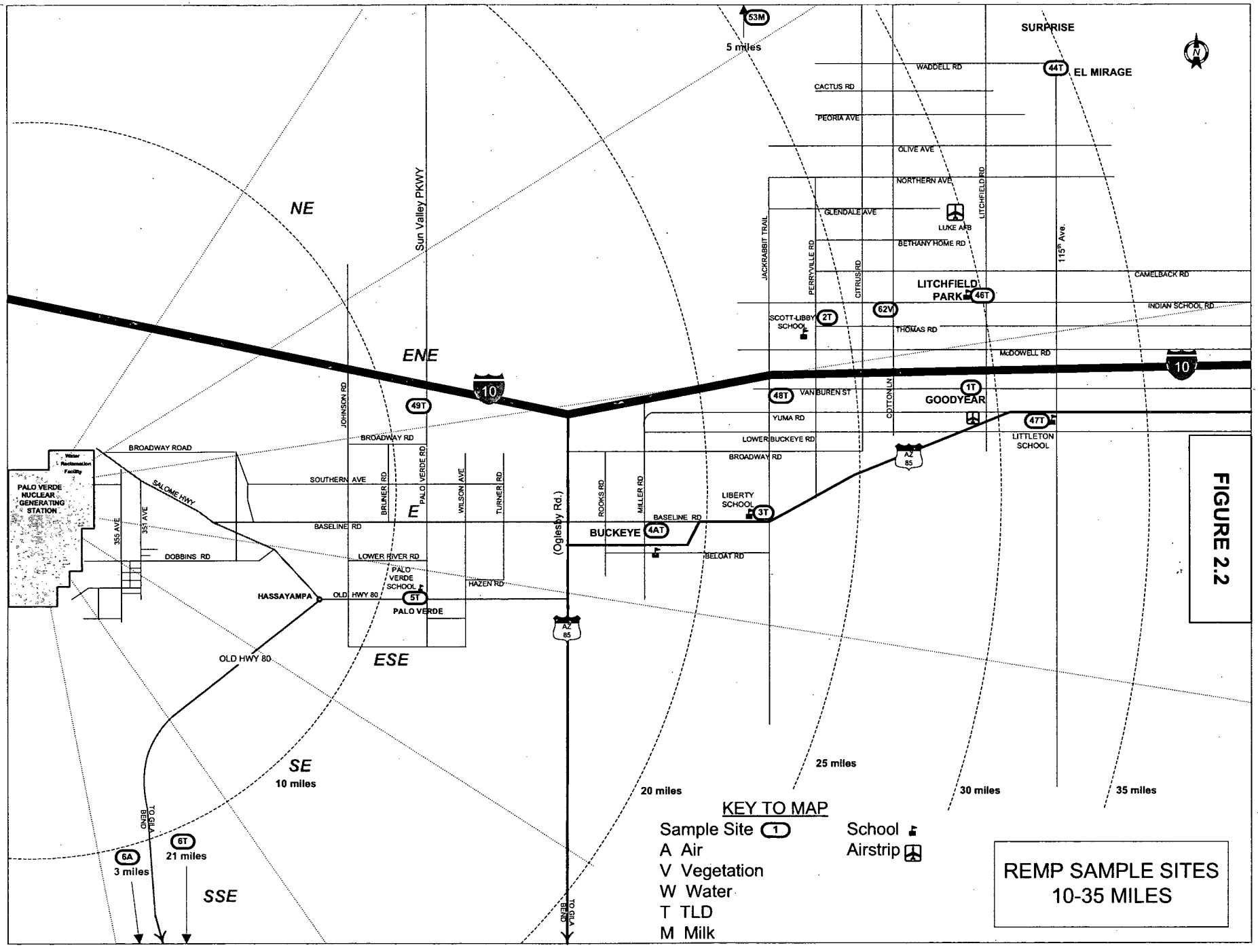


FIGURE 2.2

REMP SAMPLE SITES
10-35 MILES

KEY TO MAP

Sample Site (1)
A Air
V Vegetation
W Water
T TLD
M Milk

School
Airstrip

3. Sample Collection Program

APS personnel using PVNGS procedures collected all samples.

3.1. Water

Weekly samples were collected from four (4) residence wells for monthly and quarterly composites. Samples were collected in one-gallon containers and 500 ml glass bottles. The samples were analyzed for gross beta, gamma emitting radionuclides and tritium.

Quarterly grab samples were collected from the (45 and 85 acre) Reservoirs, Evaporation Pond #1, Evaporation Pond #3A/3B, and onsite wells 34abb and 27ddc. Evaporation Pond #2 was empty for liner replacement. Samples were collected in one-gallon containers and 500 ml glass bottles. Samples were analyzed for gamma emitting radionuclides and tritium.

Treated sewage effluent from the City of Phoenix was sampled as a weekly composite at the onsite Water Reclamation Facility (WRF), and analyzed for gamma emitting radionuclides. A monthly composite was analyzed for tritium.

3.2. Vegetation

Vegetation samples were collected monthly, as available, and were analyzed for gamma emitting radionuclides.

3.3. Milk

Goat and cow milk samples were collected monthly, as available, and were analyzed for gamma emitting radionuclides, including low level I-131.

3.4. Air

Air particulate filters and charcoal cartridges were collected at ten (10) sites on a weekly basis. Particulate filters were analyzed for gross beta. Charcoal cartridges were analyzed for I-131. Particulate filters were composited quarterly, by location, and analyzed for gamma emitting radionuclides.

3.5. Sludge and Sediment

Sludge samples were obtained weekly from the WRF waste centrifuge (whenever the plant was operational) and analyzed for gamma emitting radionuclides.

Cooling tower sludge was analyzed for gamma emitting radionuclides prior to disposal in the WRF sludge landfill.

4. Analytical Procedures

The procedures described in this report are those used by APS to routinely analyze samples.

4.1. Air Particulate

4.1.1. Gross Beta

A glass fiber filter sample is placed in a stainless steel planchet and counted for gross beta activity utilizing a low background gas flow proportional counter.

4.1.2. Gamma Spectroscopy

The glass fiber filters are counted on a multichannel analyzer equipped with an HPGe detector. The resulting spectrum is analyzed by a computer for specific radionuclides.

4.2. Airborne Radioiodine

The charcoal cartridge is counted on a multichannel analyzer equipped with an HPGe detector. The resulting spectrum is analyzed by a computer for I-131.

4.3. Milk

4.3.1. Gamma Spectroscopy

The sample is placed in a plastic marinelli beaker and counted on a multichannel analyzer equipped with an HPGe detector. The resulting spectrum is analyzed by a computer for specific radionuclides.

4.4. Vegetation

4.4.1. Gamma Spectroscopy

The sample is pureed in a food processor, placed in a one liter plastic marinelli beaker, weighed, and counted on a multichannel analyzer equipped with an HPGe detector. The resulting spectrum is analyzed by a computer for specific radionuclides.

4.5. Sludge/Sediment

4.5.1. Gamma Spectroscopy

The wet sample is placed in a one-liter plastic marinelli beaker, weighed, and counted on a multichannel analyzer equipped with an HPGe detector. The resulting spectrum is analyzed by a computer for specific radionuclides.

4.6. Water

4.6.1. Gamma Spectroscopy

The sample is placed in a one-liter plastic marinelli beaker and counted on a multichannel analyzer equipped with an HPGe detector. The resulting spectrum is analyzed by a computer for specific radionuclides.

4.6.2. Tritium

The sample is evaluated to determine the appropriate method of preparation prior to counting. If the sample contains suspended solids or is turbid, it may be filtered, distilled, and/or de-ionized, as appropriate. Eight (8) milliliters of sample are mixed with fifteen (15) milliliters of liquid scintillation cocktail. The mixture is dark adapted and counted for tritium activity using a liquid scintillation counting system.

4.6.3. Gross Beta

A 200-250 milliliter sample is placed in a beaker. Five (5) milliliters of concentrated nitric (HNO_3) acid is added and the sample is evaporated down to about twenty (20) milliliters. The remaining sample is transferred to a stainless steel planchet. The sample is heated to dryness and counted for gross beta in a gas flow proportional counter.

4.7. Soil

4.7.1. Gamma Spectroscopy

The samples are sieved, placed in a one-liter plastic marinelli beaker, and weighed. The samples are then counted on a multichannel analyzer equipped with an HPGe detector. The resulting spectrum is analyzed by a computer for specific radionuclides.

5. Nuclear Instrumentation

5.1. Gamma Spectrometer

The Canberra Gamma Spectrometer consists of a Canberra System equipped with HPGe detectors having resolutions of 1.73 keV and 1.88 keV (as determined by full width half max with an energy of 0.5 keV per channel) and respective efficiencies of 21.5% and 38.4% (as determined by the manufacturer with Co-60). The Canberra System is used for all gamma counting. The system uses Canberra developed software to search, identify, and quantify the peaks of interest.

5.2. Liquid Scintillation Spectrometer

A Beckman LS-6500 Liquid Scintillation Counter is used for tritium determinations. The system background averages approximately 15-17 cpm with a counting efficiency of approximately 40% using a quenched standard.

5.3. Gas Flow Proportional Counter

The Tennelec S5E is a low background gas flow proportional counter for gross beta analysis. The system contains an automatic sample changer capable of counting 50 samples in succession. Average beta background count rate is about 1-2 cpm with a beta efficiency of approximately 30% for Cs-137.

6. Isotopic Detection Limits and Reporting Criteria

6.1. Lower Limits of Detection

The lower limits of detection (LLD) and the method for calculation are specified in the PVNGS ODCM, Reference 4. The ODCM required *a priori* LLDs are presented in Table 6.1. For reference, *a priori* LLDs are indicated at the top of data tables for samples having required LLD values.

6.2. Data Reporting Criteria

All results that are greater than the Minimum Detectable Activity (MDA) (a posteriori LLD) are reported as positive activity with its associated 2σ counting error. All results that are less than the MDA are reported as less than values at the associated MDA. For example, if the MDA is 12 pCi/liter, the value is reported as <12.

Typical MDA values are presented in Table 6.3.

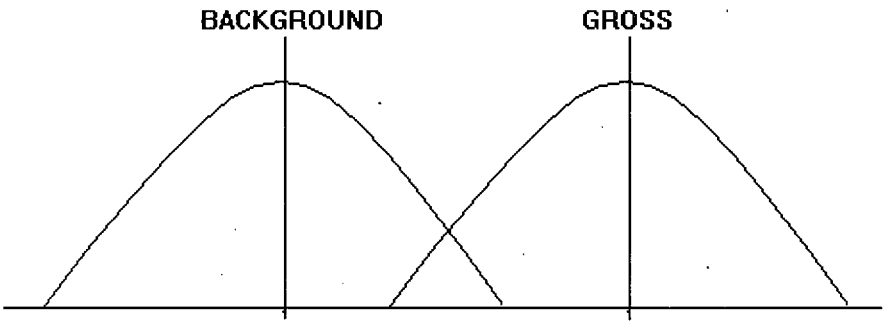
Occasionally, the PVNGS ODCM *a priori* LLDs may not be achieved as a result of:

- Background fluctuations
- Unavoidably small sample sizes
- The presence of interfering radionuclides
- Self absorption corrections
- Decay corrections for short half-life radionuclides
- Other uncontrollable circumstances

In these instances, the contributing factors will be noted in the table where the data are presented. A summary of deviations/abnormal events is presented in Table 2.3 and includes a description of any sample results that did not meet *a priori* LLD requirements.

6.3. LLD and Reporting Criteria Overview

Making a reasonable estimate of the limits of detection for a counting procedure or a radiochemical method is usually complicated by the presence of significant background. It must be considered that the background or blank is not a fixed value but that a series of replicates would be normally distributed. The desired net activity is the difference between the gross and background activity distributions. The interpretation of this difference becomes a problem if the two distributions intersect as indicated in the diagram.



If a sufficient number of replicate analyses are run, it is expected that the results would fall in a normal Gaussian distribution. Standard statistics allow an estimate of the probability of any particular deviation from the mean value. It is common practice to report the mean ± one or two standard deviations as the result. In routine analysis, such replication is not carried out, and it is not possible to report a Gaussian standard deviation. With counting procedures, however, it is possible to estimate a Poisson standard deviation directly from the count. Data are commonly reported as the measured value ± one or two Poisson standard deviations. The reported values are then considered to give some indication of the range in which the true value might be expected to occur.

A LLD is the smallest amount of sample activity that will yield a net count for which there is confidence at a predetermined level that activity is present. LLDs are calculated values for individual radionuclides based on a number of different factors including sample size, counting efficiency and background count rate of the instrument, the background and sample counting time, the decay time, and the chemical recovery of the analytical procedures. A minimum detectable activity value (MDA) is the smallest amount of activity that can be detected in an actual sample and uses the values obtained from the instrument and outcome of the analytical process. Therefore, the MDA values may differ from the calculated LLD values if the sample size and chemical recovery, decay values, or the instrument efficiency, background, or count time differed from those used in the LLD calculation.

The factors governing the calculation of the LLD and MDA values are discussed below:

1. Sample Size

2. Counting Efficiency

The fundamental quantity in the measurement of a radioactive substance is the number of disintegrations per unit time. As with most physical measurements in analytical chemistry, an absolute measurement of the disintegration rate is seldom possible, rather it is necessary to compare the sample with one or more standards. The standards determine the counter efficiency that may then be used to convert sample counts per minute (cpm) to disintegrations per minute (dpm).

3. Background Count Rate

Any counter will show a certain counting rate without a sample in position. This background counting rate comes from several sources: 1) natural environmental radiation from the surrounding materials, 2) cosmic radiation, and 3) the natural radioactivity in the counter material itself. The background counting rate will depend on the amounts of these types of radiation and the sensitivity of the counter to the radiation.

4. Background and Sample Counting Time

The amount of time devoted to the counting of the background depends on the level of activity being measured. In general, with low level samples, this time should be about equal to that devoted to counting a sample.

5. Time Interval between Sample Collection and Counting

Decay measurements are useful in identifying certain short-lived nuclides. The disintegration constant is one of the basic characteristics of a specific radionuclide and is readily determined, if the half-life is sufficiently short. To ensure the required LLDs are achieved, appropriate decay correction values are used to account for radioactive decay during transit time and sample processing.

Table 6.1 ODCM REQUIRED LOWER LIMITS OF DETECTION (*a priori*)

ANALYSIS/ NUCLIDE	WATER (pCi/liter)	AIRBORNE PARTICULATE or GAS (pCi/m^3)	MILK (pCi/liter)	VEGETATION (pCi/kg, wet)
Gross Beta	4	0.01		
H-3	2000*			
Mn-54	15			
Fe-59	30			
Co-58, 60	15			
Zn-65	30			
Zr-95	30			
Nb-95	15			
I-131	1**	0.07	1	60
Cs-134	15	0.05	15	60
Cs-137	18	0.06	18	80
Ba-140	60		60	
La-140	15		15	

NOTES:

* If no drinking water pathway exists, a value of 3000 pCi/liter may be used.
** If no drinking water pathway exists, a value of 15 pCi/liter may be used.

This list does not mean that only these nuclides are to be detected and reported. Other peaks that are measurable and identifiable, together with the above nuclides, shall also be identified and reported.

Table 6.2 ODCM REQUIRED REPORTING LEVELS

ANALYSIS/ NUCLIDE	WATER (pCi/liter)	AIRBORNE PARTICULATE or GAS (pCi/m^3)	MILK (pCi/liter)	VEGETATION (pCi/kg, wet)
H-3	20,000*			
Mn-54	1,000			
Fe-59	400			
Co-58	1,000			
Co-60	300			
Zn-65	300			
Zr/Nb-95	400			
I-131	2**	0.9	3	100
Cs-134	30	10	60	1,000
Cs-137	50	20	70	2,000
Ba/La-140	200		300	

NOTES:

* For drinking water samples. This is a 40CFR141 value. If no drinking water pathway exists, a value of 30,000 pCi/liter may be used.

** If no drinking water pathway exists, a reporting level of 20 pCi/liter may be used.

The values in this table are quarterly average values, as stated in the ODCM.

Table 6.3 TYPICAL MDA VALUES

ANALYSIS/ NUCLIDE	WATER (pCi/liter)	MILK (pCi/liter)	AIRBORNE PARTICULATE or GAS (pCi/m^3)	VEGETATION (pCi/kg, wet)
Gross Beta	2.8		0.003	
H-3	295			
Mn-54	12			
Fe-59	25			
Co-58	12			
Co-60	13			
Zn-65	26			
Zr-95	22			
Nb-95	13			
I-131	10 [a]	1	0.04 [b]	49
Cs-134	12	1	0.04 [b]	47
Cs-137	13	1	0.05 [b]	51
Ba-140	40	3		
La-140	14	1		

NOTES:

a - low level I-131 is not required since there is no drinking water pathway
b - Based on 433 m^3 volume

7. Interlaboratory Comparison Program

7.1. Quality Control Program

APS maintains an extensive QA/QC Program to provide assurance that samples are collected, handled, tracked, and analyzed to specified requirements. This program includes appropriate elements of USNRC Regulatory Guide 4.15, Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment, Rev. 1. Included in the program are procedures for sample collection, preparation and tracking, sample analysis, equipment calibration and checks, and ongoing participation in an interlaboratory comparison program. Duplicate/replicate samples are analyzed to verify analytical precision and sample methodology. Comprehensive data reviews are performed including trending of data where appropriate.

During 2009, APS analyzed the following sample types under the interlaboratory comparison program;

- Beta/Gamma/ in Air Filter
- I-131 in Air
- Beta in Water
- Gamma in Water
- Tritium in Water
- Gamma in Milk

7.2. Intercomparison Results

APS participates in a crosscheck program using vendor supplied blind radionuclide samples. Results for the interlaboratory comparison program are presented in Table 7.1.

TABLE 7.1 INTERLABORATORY COMPARISON RESULTS

Sample Type	Analysis Type	Nuclide	PVNGS Value	Certified Value [1]	PT Acceptance Limit [2]	Results
	Gamma	Ba-133	88	94.2	79.4 - 104	Accept
		Cs-134	82	88.6	72.7 - 97.5	Accept
		Cs-137	63	70	63 - 79.7	Accept
WATER		Co-60	108	110	99 - 123	Accept
		Zn-65	122	114	103 - 136	Accept
	Tritium	H-3	3831	4230	3610 - 4660	Accept
	Gross Beta		37	46.1	31.0 - 53.3	Accept
ERA RAD-76 PT Study Results						
	Gamma	Am-241	133	132	90.4 - 178	Accept
		Cs-134	713	790	584 - 907	Accept
		Cs-137	876	913	776 - 1090	Accept
WATER		Co-60	1240	1230	1070 - 1450	Accept
		Zn-65	623	631	535 - 786	Accept
	Tritium	H-3	9695	11800	7680 - 17400	Accept
FILTER	Gamma	Am-241	74.3	55.4	32.4 - 76.0	Accept
		Cs-134	766	865	563 - 1070	Accept
		Cs-137	793	724	544 - 951	Accept
		Co-60	540	490	379 - 612	Accept
		Zn-65	229	185	128 - 256	Accept
	Gross Beta		89	80.7	49.7 - 118	Accept
ERA MRAD-010 PT Study Results						
	Gamma	Ba-133	87	92.9	78.3 - 102	Accept
WATER		Cs-134	74	79.4	65.0 - 87.3	Accept
		Cs-137	52	54.6	49.1 - 62.9	Accept
		Co-60	115	117	105 - 131	Accept
		Zn-65	92	99.5	89.6 - 119	Accept
	Gross Beta		23.25	26.0	16.2 - 33.9	Accept
ERA RAD-79 PT Study Results						
FILTER	Gross Beta		83.8	62.5	38.5 - 91.3	Accept
	Gross Beta		74.7	67.4	39.4 - 98.9	Accept
ERA MRAD-011 PT Study Results						

[1] The certified values are verified to meet criteria as established by NIST NVLAP in Handbooks 150 and 150-19 and the USEPA in National Standards for Water Proficiency Testing Studies Criteria Document (December 30, 1998).

[2] "Acceptance Limits" have been calculated per the requirements of the USEPA in National Standards for Water Proficiency Testing Studies Criteria Document (December 30, 1998).

TABLE 7.1 INTERLABORATORY COMPARISON RESULTS

Sample Type	Analysis Type	Nuclide	Known Value	PVNGS Value	1 sigma Error	Resolution *	Ratio	Accept/Reject
Milk	Mixed Gamma	I-131	39.9	38.5	1.8	21	0.97	Accept
	E6683-111	Ce-141	15.1	17	1.7	10	1.12	Accept
		Cr-51	45.6	45.5	6.7	7	1.00	Accept
		Cs-134	21.6	20.8	1.2	17	0.96	Accept
		Cs-137	26.1	28	1.4	20	1.07	Accept
		Co-58	23.4	24.6	1.3	19	1.05	Accept
		Mn-54	28.8	32.8	1.6	21	1.14	Accept
		Fe-59	17.7	23.1	2.3	10	1.31	Accept
		Zn-65	34.7	36.0	2.6	14	1.04	Accept
		Co-60	33.2	35.9	1.6	22	1.08	Accept
Air	Iodine Cart.	I-131	95.7	101	7.3	14	1.06	Accept
	E6684-111							

* calculated from PVNGS value/1 sigma error value

Acceptance Criteria **

Resolution	Ratio
4-7	0.5-2.0
8-15	0.6-1.66
16-50	0.75-1.33
51-200	0.80-1.25
>200	0.85-1.18

**From NRC Inspection Manual, Inspection Procedure 84750, "Radioactive Waste Treatment, And Effluent And Environmental Monitoring"

8. Data Interpretations and Conclusions

Associated with the analytical process are potential random and systematic errors. Systematic errors can be caused by instrument malfunctions, incomplete precipitation, back scattering, and self-absorption. Random errors are beyond the control of the analyst.

Efforts are made to minimize both systematic and random errors in the data reported. Systematic errors are minimized by performing reviews throughout the analysis. For example, instruments are checked routinely with radioactive sources, and recovery and self-absorption factors based on individual sample analyses are incorporated into the calculation equations where necessary. Random errors are reduced by comparing all data to historical data for the same site and performing comparisons between analytical results when available. In addition, when data do not appear to match historical results, analyses may be rerun on a separate aliquot of the sample to verify the presence of the activity. The acceptance of data is dependent upon the results of quality control samples and is part of the data review process for all analytical results.

The "plus or minus value" reported with each analytical result represents the counting error associated with the result and gives the 95% confidence (2σ) interval around the data.

Most samples contain radioactivity associated with natural background/cosmic radioactivity (e.g. K-40, Th-234, and Be-7). Gross beta results for drinking water and air are due to natural background. Gamma emitting radionuclides, which can be attributed to natural background sources, are not indicated in this report.

Results and interpretation of the data for all of the samples analyzed during 2009 are presented in the following sections. Assessment of pre-operational and operational data revealed no changes to environmental radiation levels. ***The only measurable impact on the environment in 2009 was the low level tritium discovered in subsurface water onsite in the RCA in 2006. See Section 2.4 for specific information.***

8.1. Air Particulates

Weekly gross beta results, in quarterly format, are presented in Tables 8.1 and 8.2. Gross beta activity at indicator locations ranged from 0.013 to 0.080 pCi/m^3. The associated counting error ranged from 0.001 to 0.004 pCi/m^3. Mean quarterly activity is normally calculated using weekly activity over a thirteen (13) week period. Also presented in the tables are the weekly mean values of all the sites as well as the percent relative standard deviation (RSD %) for the data. The gross beta activity is attributable to natural (background) radioactive materials. The findings are consistent with pre-operational baseline and previous operational results. The results are summarized in Table 11.1.

Table 8.3 displays the results of gamma spectroscopy on the quarterly composites. No Cs-134 or Cs-137 was observed.

8.2. Airborne Radioiodine

Tables 8.4 and 8.5 present the quarterly radioiodine results. No airborne radioiodine was observed in any of the samples.

8.3. Vegetation

Table 8.6 presents gamma isotopic data for the vegetation samples. No gamma emitting radionuclides were observed in any of the samples.

8.4. Milk

Table 8.7 presents gamma isotopic data for the goat milk samples. No gamma emitting radionuclides were observed in any of the samples.

8.5. Drinking Water

Samples were analyzed for gross beta, tritium, and gamma emitting radionuclides. Results of these analyses are presented in Table 8.8. No tritium or gamma emitting radionuclides were detected in any samples. Gross beta activity ranged from less than detectable to a high of 5.5 pCi/liter (Gavette residence, August composite). The gross beta activity is attributable to natural (background) radioactive materials.

8.6. Ground Water

Ground water samples were analyzed for tritium and gamma emitting radionuclides. Results obtained from the analysis of the samples are presented in Table 8.9.

No tritium or gamma emitting radionuclides were observed in any of the samples.

8.7. Surface Water

Surface water samples from the Reservoirs and Evaporation Ponds were analyzed for tritium and gamma emitting radionuclides. The two Reservoirs contain processed sewage water from the City of Phoenix and are approximately 45 and 85 acres in size. The three Evaporation Ponds receive mostly circulating water from main turbine condenser cooling and are about 200-250 acres each. Evaporation Pond #3 was constructed in 2008 to allow for re-lining of the older ponds. Evaporation Pond #2 was pumped into Evaporation Pond #3 (sections 3A and 3B) and will be relined first. Results are presented in Table 8.10. I-131 was observed in the Evaporation Ponds in two (2) samples (15 to 20 pCi/liter) and four (4) of the Reservoir samples (13 to 32 pCi/liter). I-131 in these surface water locations is a result of radiopharmaceutical I-131 in the Phoenix sewage effluent.

Tritium was routinely observed in the Evaporation Ponds. The highest concentration in Evaporation Pond #1 was 1224 pCi/liter and the highest concentration in Evaporation

Pond #3 was 991 pCi/liter. Evaporation Pond #2 was empty the entire year due to liner replacement. Tritium was not detected in the Reservoirs. The tritium identified in the Evaporation Ponds has been attributed to permitted plant gaseous effluent releases and secondary plant liquid discharges.

WRF Influent (Phoenix sewage effluent containing radiopharmaceutical I-131) samples collected by the WRF were analyzed for gamma emitting radionuclides and tritium. The results, presented in Table 8.10, demonstrate that I-131 was observed routinely. The highest I-131 concentration was 74 pCi/liter. None of the samples analyzed indicated the presence of tritium.

Table 8.10 also presents gamma spectroscopy and tritium measurements of samples collected from Sedimentation Basin #2. This basin collects rain water from site runoff and was dry for most of the year. No tritium or gamma emitting radionuclides were observed in the samples.

8.8. Sludge and Sediment

8.8.1. WRF Centrifuge waste sludge

Sludge samples were obtained from the WRF centrifuge and analyzed by gamma spectroscopy. I-131 activity in the sludge is consistent with historical values and, as previously discussed, is due to radiopharmaceuticals in the WRF Influent. I-131 was present in all forty-nine (49) samples ranging from 387 to 1670 pCi/kg.

In-111 was also identified in the sludge in 3 of the 49 samples. The highest concentration was 97 pCi/kg. It was previously established that In-111 is also used in the Phoenix area as a radiopharmaceutical.

Results for WRF centrifuge waste sludge can be found in Table 8.11.

8.8.2. Cooling Tower sludge

Sludge/sediment originating from the Unit 3 Cooling Towers and/or Circulating Water canals was disposed of in the WRF sludge landfill during 2009. Sample results can be found in Table 8.11.

8.9. Data Trends

Figures 8.1-8.5 present data in graphical format. Historical data are displayed for comparison where practical.

TABLE 8.1 PARTICULATE GROSS BETA IN AIR 1st - 2nd QUARTER

ODCM required samples denoted by *

units are pCi/m^3

1st Quarter

Week #	START DATE	STOP DATE	Site 4	Site 6A*	Site 7A	Site 14A*	Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*	Mean	RSD (%)
1	29-Dec-08	6-Jan-09	0.046	0.044	0.044	0.037	0.045	0.040	0.044	0.045	0.045	0.039	0.043	7.2
2	6-Jan-09	13-Jan-09	0.029	0.034	0.031	0.027	0.031	0.033	0.031	0.034	0.029	0.031	0.031	7.3
3	13-Jan-09	20-Jan-09	0.032	0.033	0.031	0.029	0.030	0.026	0.030	0.031	0.031	0.028	0.030	6.7
4	20-Jan-09	26-Jan-09	0.039	0.040	0.038	0.033	0.037	0.039	0.036	0.035	0.039	0.033	0.037	6.9
5	26-Jan-09	3-Feb-09	0.025	0.025	0.025	0.023	0.025	0.022	0.027	0.026	0.023	0.023	0.024	6.5
6	3-Feb-09	10-Feb-09	0.016	0.019	0.021	0.019	0.020	0.019	0.018	0.020	0.018	0.020	0.019	7.4
7	10-Feb-09	18-Feb-09	0.014	0.015	0.014	0.013	0.014	0.014	0.015	0.014	0.014	0.014	0.014	4.0
8	18-Feb-09	24-Feb-09	0.027	0.026	0.028	0.024	0.028	0.027	0.025	0.027	0.026	0.026	0.026	4.8
9	24-Feb-09	3-Mar-09	0.026	0.031	0.028	0.026	0.027	0.027	0.026	0.025	0.028	0.028	0.027	6.2
10	3-Mar-09	10-Mar-09	0.026	0.026	0.026	0.025	0.028	0.027	0.023	0.024	0.022	0.026	0.025	7.2
11	10-Mar-09	17-Mar-09	0.034	0.037	0.036	0.033	0.037	0.034	0.033	0.037	0.036	0.033	0.035	5.0
12	17-Mar-09	24-Mar-09	0.025	0.026	0.027	0.025	0.026	0.026	0.024	0.025	0.024	0.023	0.025	4.8
13	24-Mar-09	31-Mar-09	0.025	0.023	0.022	0.022	0.022	0.023	0.019	0.021	0.023	0.020	0.022	7.7
Mean			0.028	0.029	0.029	0.026	0.028	0.027	0.027	0.028	0.028	0.026	0.028	3.6

2nd Quarter

Week #	START DATE	STOP DATE	Site 4	Site 6A*	Site 7A	Site 14A*	Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*	Mean	RSD (%)
14	31-Mar-09	7-Apr-09	0.029	0.031	0.028	0.026	0.030	0.030	0.026	0.028	0.031	0.028	0.029	6.4
15	7-Apr-09	14-Apr-09	0.025	0.028	0.024	0.022	0.023	0.022	0.020	0.022	0.025	0.023	0.023	9.5
16	14-Apr-09	21-Apr-09	0.028	0.030	0.026	0.025	0.028	0.027	0.027	0.028	0.029	0.028	0.028	5.2
17	21-Apr-09	28-Apr-09	0.034	0.037	0.038	0.037	0.040	0.039	0.036	0.037	0.039	0.036	0.037	4.7
18	28-Apr-09	5-May-09	0.031	0.033	0.032	0.027	0.032	0.031	0.031	0.034	0.028	0.030	0.031	6.9
19	5-May-09	12-May-09	0.033	0.032	0.034	0.030	0.034	0.034	0.032	0.032	0.032	0.031	0.032	4.2
20	12-May-09	20-May-09	0.037	0.040	0.037	0.035	0.037	0.038	0.036	0.036	0.039	0.036	0.037	4.1
21	20-May-09	26-May-09	0.039	0.038	0.037	0.033	0.036	0.041	0.037	0.037	0.040	0.035	0.037	6.3
22	26-May-09	2-Jun-09	0.037	0.036	0.034	0.033	0.032	0.032	0.035	0.035	0.039	0.033	0.035	6.6
23	2-Jun-09	10-Jun-09	0.025	0.024	0.026	0.026	0.027	0.028	0.023	0.028	0.028	0.024	0.026	7.2
24	10-Jun-09	17-Jun-09	0.030	0.027	0.029	0.026	0.027	0.030	0.025	0.029	0.028	0.029	0.028	6.1
25	17-Jun-09	23-Jun-09	0.033	0.036	0.031	0.030	0.031	0.032	0.029	0.033	0.034	0.032	0.032	6.3
26	23-Jun-09	29-Jun-09	0.036	0.034	0.035	0.035	0.036	0.037	0.033	0.031	0.033	0.033	0.034	5.3
Mean			0.032	0.033	0.032	0.030	0.032	0.032	0.030	0.032	0.033	0.031	0.032	3.5

TABLE 8.2 PARTICULATE GROSS BETA IN AIR 3rd - 4th QUARTER

ODCM required samples denoted by *

units are pCi/m^3

3rd Quarter

Week #	START DATE	STOP DATE	Site 4	Site 6A*	Site 7A	Site 14A*	Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*	Mean	RSD (%)
27	29-Jun-09	7-Jul-09	0.032	0.038	0.036	0.032	0.033	0.035	0.031	0.032	0.038	0.033	0.034	7.6
28	7-Jul-09	14-Jul-09	0.032	0.036	0.034	0.033	0.032	0.035	0.034	0.035	0.035	0.034	0.034	3.9
29	14-Jul-09	21-Jul-09	0.035	0.036	0.041	0.037	0.038	0.038	0.036	0.035	0.036	0.031	0.036	7.1
30	21-Jul-09	28-Jul-09	0.043	0.043	0.040	0.040	0.043	0.038	0.038	0.043	0.045	0.040	0.041	5.8
31	28-Jul-09	4-Aug-09	0.037	0.041	0.044	0.042	0.043	0.044	0.038	0.041	0.039	0.040	0.041	5.9
32	4-Aug-09	11-Aug-09	0.039	0.038	0.036	0.033	0.036	0.033	0.038	0.038	0.038	0.037	0.037	5.8
33	11-Aug-09	18-Aug-09	0.035	0.037	0.037	0.032	0.036	0.032	0.030	0.033	0.035	0.035	0.034	6.9
34	18-Aug-09	25-Aug-09	0.038	0.038	0.037	0.035	0.038	0.034	0.034	0.036	0.036	0.035	0.036	4.4
35	25-Aug-09	1-Sep-09	0.044	0.040	0.046	0.037	0.039	0.040	0.034	0.040	0.042	0.036	0.040	9.1
36	1-Sep-09	7-Sep-09	0.038	0.037	0.038	0.031	0.038	0.035	0.036	0.035	0.040	0.035	0.036	6.9
37	7-Sep-09	15-Sep-09	0.035	0.038	0.036	0.035	0.035	0.035	0.033	0.034	0.035	0.032	0.035	4.7
38	15-Sep-09	22-Sep-09	0.039	0.031	Invalid [a]	0.034	0.034	0.033	0.034	0.037	0.040	0.035	0.035	8.3
39	22-Sep-09	29-Sep-09	0.046	0.052	0.049	0.042	0.045	0.039	0.042	0.044	0.046	0.040	0.045	9.0
Mean			0.038	0.039	0.040	0.036	0.038	0.036	0.035	0.037	0.039	0.036	0.037	4.1

4th Quarter

Week #	START DATE	STOP DATE	Site 4	Site 6A*	Site 7A	Site 14A*	Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*	Mean	RSD (%)
40	29-Sep-09	6-Oct-09	0.040	0.037	0.037	0.032	0.034	0.035	0.031	0.038	0.037	0.033	0.035	8.1
41	6-Oct-09	13-Oct-09	0.057	0.059	0.056	0.053	0.058	0.051	0.055	0.058	0.056	0.052	0.056	4.9
42	13-Oct-09	20-Oct-09	0.039	0.039	0.037	0.032	0.033	0.030	0.033	0.031	0.033	0.033	0.034	9.4
43	20-Oct-09	27-Oct-09	0.039	0.039	0.036	0.033	0.035	0.033	0.036	0.035	0.038	0.034	0.036	6.3
44	27-Oct-09	3-Nov-09	0.031	0.033	0.031	0.029	0.027	0.027	0.024	0.025	0.021	0.024	0.027	14.0
45	3-Nov-09	9-Nov-09	0.062	0.070	0.064	0.046	0.051	0.057	0.055	0.055	0.052	0.048	0.056	13.4
46	9-Nov-09	17-Nov-09	0.046	0.048	0.054	Invalid [a]	0.047	0.046	0.047	0.048	0.053	0.039	0.048	9.1
47	17-Nov-09	23-Nov-09	0.080	0.081	0.075	0.075	0.070	0.069	0.069	0.070	0.069	0.068	0.073	6.7
48	23-Nov-09	1-Dec-09	0.042	0.038	0.041	0.038	0.041	0.038	0.039	0.042	0.039	0.037	0.040	4.7
49	1-Dec-09	8-Dec-09	0.047	0.057	0.045	0.046	0.044	0.052	0.047	0.046	0.052	0.046	0.048	8.5
50	8-Dec-09	15-Dec-09	0.038	0.051	0.038	0.035	0.035	0.038	0.038	0.043	0.037	0.038	0.039	12.1
51	15-Dec-09	21-Dec-09	0.047	0.043	0.044	0.044	0.045	0.044	0.045	0.042	0.039	0.043	0.044	4.9
52	21-Dec-09	28-Dec-09	0.049	0.050	0.047	0.044	0.047	0.047	0.050	0.045	0.047	0.044	0.047	4.7
Mean			0.047	0.050	0.047	0.042	0.044	0.044	0.044	0.044	0.044	0.041	0.045	5.5
Annual Average			***0.036***	***0.038***	***0.036***	***0.033***	***0.035***	***0.035***	***0.034***	***0.035***	***0.036***	***0.034***	***0.035***	***4.0***

a Sample invalidated due to failure of air sample pump some time during the sample period. Unable to determine actual sample volume.

TABLE 8.3 GAMMA IN AIR FILTER COMPOSITES

ODCM required samples denoted by *

units are pCi/m^3

QUARTER ENDPOINT	NUCLIDE	Site 4	Site 6A*	Site 7A	Site 14A*	Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*
31-Mar-09	Cs-134	<0.0047	<0.0024	<0.0033	<0.0037	<0.0029	<0.0041	<0.0012	<0.0037	<0.0023	<0.0029
	Cs-137	<0.0037	<0.0050	<0.0037	<0.0041	<0.0032	<0.0036	<0.0010	<0.0010	<0.0041	<0.0028
29-Jun-09	Cs-134	<0.0039	<0.0030	<0.0034	<0.0037	<0.0038	<0.0035	<0.0038	<0.0038	<0.0042	<0.0039
	Cs-137	<0.0054	<0.0043	<0.0011	<0.0046	<0.0029	<0.0011	<0.0047	<0.0048	<0.0030	<0.0037
29-Sep-09	Cs-134	<0.0014	<0.0024	<0.0026	<0.0029	<0.0023	<0.0035	<0.0033	<0.0024	<0.0023	<0.0034
	Cs-137	<0.0021	<0.0042	<0.0051	<0.0037	<0.0036	<0.0017	<0.0041	<0.0041	<0.0029	<0.0042
28-Dec-09	Cs-134	<0.0039	<0.0046	<0.0035	<0.0046	<0.0044	<0.0042	<0.0024	<0.0030	<0.0043	<0.0023
	Cs-137	<0.0042	<0.0045	<0.0010	<0.0058	<0.0037	<0.0056	<0.0039	<0.0037	<0.0048	<0.0037

TABLE 8.4 RADIOIODINE IN AIR 1st - 2nd QUARTER

ODCM required samples denoted by *

units are pCi/m^3

Week #	START DATE	STOP DATE	Site 4	Site 6A*	Site 7A	Site 14A*	Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*
1st Quarter												
1	29-Dec-08	6-Jan-09	<0.033	<0.036	<0.034	<0.038	<0.035	<0.036	<0.033	<0.030	<0.023	<0.030
2	6-Jan-09	13-Jan-09	<0.054	<0.056	<0.057	<0.032	<0.066	<0.054	<0.057	<0.050	<0.065	<0.040
3	13-Jan-09	20-Jan-09	<0.059	<0.069	<0.045	<0.050	<0.046	<0.068	<0.035	<0.058	<0.035	<0.043
4	20-Jan-09	26-Jan-09	<0.069	<0.069	<0.065	<0.051	<0.050	<0.040	<0.049	<0.050	<0.066	<0.065
5	26-Jan-09	3-Feb-09	<0.025	<0.050	<0.050	<0.028	<0.051	<0.036	<0.067	<0.038	<0.067	<0.034
6	3-Feb-09	10-Feb-09	<0.043	<0.036	<0.052	<0.032	<0.064	<0.033	<0.067	<0.047	<0.058	<0.035
7	10-Feb-09	18-Feb-09	<0.038	<0.024	<0.029	<0.051	<0.026	<0.052	<0.037	<0.045	<0.032	<0.031
8	18-Feb-09	24-Feb-09	<0.050	<0.064	<0.063	<0.054	<0.016	<0.041	<0.032	<0.041	<0.035	<0.065
9	24-Feb-09	3-Mar-09	<0.036	<0.067	<0.067	<0.066	<0.042	<0.056	<0.040	<0.051	<0.038	<0.060
10	3-Mar-09	10-Mar-09	<0.040	<0.044	<0.029	<0.032	<0.033	<0.032	<0.051	<0.040	<0.034	<0.044
11	10-Mar-09	17-Mar-09	<0.042	<0.043	<0.048	<0.043	<0.050	<0.032	<0.059	<0.040	<0.069	<0.048
12	17-Mar-09	24-Mar-09	<0.045	<0.037	<0.059	<0.040	<0.053	<0.044	<0.065	<0.036	<0.062	<0.046
13	24-Mar-09	31-Mar-09	<0.064	<0.068	<0.055	<0.060	<0.049	<0.028	<0.066	<0.037	<0.062	<0.046
2nd Quarter												
Week #	START DATE	STOP DATE	Site 4	Site 6A*	Site 7A	Site 14A*	Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*
14	31-Mar-09	7-Apr-09	<0.046	<0.026	<0.044	<0.036	<0.036	<0.032	<0.044	<0.041	<0.034	<0.046
15	7-Apr-09	14-Apr-09	<0.058	<0.058	<0.064	<0.058	<0.064	<0.065	<0.046	<0.046	<0.061	<0.053
16	14-Apr-09	21-Apr-09	<0.031	<0.040	<0.043	<0.039	<0.041	<0.033	<0.033	<0.036	<0.027	<0.046
17	21-Apr-09	28-Apr-09	<0.038	<0.058	<0.040	<0.045	<0.040	<0.044	<0.059	<0.042	<0.051	<0.041
18	28-Apr-09	5-May-09	<0.042	<0.053	<0.052	<0.042	<0.064	<0.037	<0.053	<0.033	<0.061	<0.038
19	5-May-09	12-May-09	<0.036	<0.065	<0.069	<0.043	<0.067	<0.047	<0.052	<0.033	<0.062	<0.045
20	12-May-09	20-May-09	<0.047	<0.038	<0.031	<0.026	<0.030	<0.033	<0.054	<0.038	<0.011	<0.027
21	20-May-09	26-May-09	<0.056	<0.037	<0.039	<0.037	<0.055	<0.067	<0.058	<0.066	<0.052	<0.041
22	26-May-09	2-Jun-09	<0.025	<0.035	<0.026	<0.032	<0.038	<0.053	<0.036	<0.013	<0.042	<0.056
23	2-Jun-09	10-Jun-09	<0.036	<0.029	<0.036	<0.031	<0.043	<0.037	<0.043	<0.025	<0.044	<0.040
24	10-Jun-09	17-Jun-09	<0.035	<0.042	<0.042	<0.035	<0.055	<0.033	<0.042	<0.034	<0.056	<0.042
25	17-Jun-09	23-Jun-09	<0.048	<0.051	<0.070	<0.047	<0.066	<0.048	<0.050	<0.046	<0.069	<0.039
26	23-Jun-09	29-Jun-09	<0.055	<0.069	<0.042	<0.060	<0.069	<0.055	<0.069	<0.054	<0.055	<0.068

TABLE 8.5 RADIOIODINE IN AIR 3rd - 4th QUARTER

ODCM required samples denoted by *

units are pCi/m^3

Week #	START DATE	STOP DATE	Site 4	Site 6A*	Site 7A	Site 14A*	Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*
3rd Quarter												
27	29-Jun-09	7-Jul-09	<0.022	<0.059	<0.046	<0.035	<0.031	<0.029	<0.039	<0.033	<0.047	<0.036
28	7-Jul-09	14-Jul-09	<0.064	<0.028	<0.057	<0.036	<0.060	<0.040	<0.042	<0.050	<0.045	<0.034
29	14-Jul-09	21-Jul-09	<0.034	<0.066	<0.055	<0.043	<0.057	<0.042	<0.036	<0.035	<0.055	<0.040
30	21-Jul-09	28-Jul-09	<0.044	<0.068	<0.064	<0.034	<0.064	<0.069	<0.066	<0.044	<0.070	<0.039
31	28-Jul-09	4-Aug-09	<0.041	<0.026	<0.034	<0.041	<0.038	<0.034	<0.045	<0.030	<0.047	<0.031
32	4-Aug-09	11-Aug-09	<0.047	<0.066	<0.066	<0.035	<0.042	<0.030	<0.033	<0.060	<0.046	<0.056
33	11-Aug-09	18-Aug-09	<0.029	<0.060	<0.058	<0.046	<0.036	<0.028	<0.045	<0.043	<0.066	<0.037
34	18-Aug-09	25-Aug-09	<0.034	<0.060	<0.043	<0.044	<0.056	<0.044	<0.064	<0.044	<0.040	<0.054
35	25-Aug-09	1-Sep-09	<0.046	<0.043	<0.064	<0.043	<0.038	<0.048	<0.034	<0.064	<0.042	<0.034
36	1-Sep-09	7-Sep-09	<0.051	<0.063	<0.067	<0.052	<0.059	<0.054	<0.068	<0.039	<0.064	<0.050
37	7-Sep-09	15-Sep-09	<0.036	<0.066	<0.032	<0.040	<0.039	<0.028	<0.060	<0.019	<0.062	<0.029
38	15-Sep-09	22-Sep-09	<0.058	<0.034	Invalid [a]	<0.031	<0.060	<0.038	<0.042	<0.032	<0.059	<0.045
39	22-Sep-09	29-Sep-09	<0.051	<0.066	<0.030	<0.048	<0.042	<0.069	<0.044	<0.054	<0.039	<0.057
4th Quarter												
Week #	START DATE	STOP DATE	Site 4	Site 6A*	Site 7A	Site 14A*	Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*
40	29-Sep-09	6-Oct-09	<0.031	<0.068	<0.042	<0.040	<0.043	<0.031	<0.042	<0.037	<0.056	<0.036
41	6-Oct-09	13-Oct-09	<0.048	<0.057	<0.052	<0.040	<0.046	<0.035	<0.053	<0.037	<0.046	<0.027
42	13-Oct-09	20-Oct-09	<0.049	<0.050	<0.065	<0.040	<0.051	<0.033	<0.035	<0.025	<0.068	<0.039
43	20-Oct-09	27-Oct-09	<0.024	<0.043	<0.043	<0.042	<0.038	<0.045	<0.040	<0.027	<0.035	<0.034
44	27-Oct-09	3-Nov-09	<0.045	<0.045	<0.051	<0.036	<0.056	<0.026	<0.050	<0.016	<0.067	<0.029
45	3-Nov-09	9-Nov-09	<0.067	<0.043	<0.054	<0.043	<0.044	<0.065	<0.051	<0.068	<0.064	<0.068
46	9-Nov-09	17-Nov-09	<0.034	<0.051	<0.056	Invalid [a]	<0.034	<0.012	<0.044	<0.052	<0.035	<0.047
47	17-Nov-09	23-Nov-09	<0.048	<0.067	<0.063	<0.046	<0.069	<0.052	<0.063	<0.050	<0.044	<0.051
48	23-Nov-09	1-Dec-09	<0.044	<0.056	<0.054	<0.050	<0.050	<0.066	<0.068	<0.046	<0.050	<0.063
49	1-Dec-09	8-Dec-09	<0.047	<0.047	<0.062	<0.038	<0.049	<0.037	<0.043	<0.039	<0.055	<0.030
50	8-Dec-09	15-Dec-09	<0.042	<0.045	<0.034	<0.040	<0.032	<0.055	<0.046	<0.058	<0.043	<0.046
51	15-Dec-09	21-Dec-09	<0.065	<0.058	<0.069	<0.048	<0.065	<0.051	<0.057	<0.058	<0.050	<0.032
52	21-Dec-09	28-Dec-09	<0.036	<0.052	<0.057	<0.043	<0.064	<0.039	<0.052	<0.037	<0.058	<0.042

a Sample invalidated due to failure of air sample pump some time during the sample period. Unable to determine actual sample volume.

TABLE 8.6 VEGETATION

ODCM required samples denoted by *
units are pCi/kg, wet

LOCATION	TYPE	DATE COLLECTED	<60 I-131	<60 Cs-134	<80 Cs-137
BATDORF RESIDENCE (Site #47)*	NO SAMPLES AVAILABLE				
DUNCAN FAMILY FARMS (Site #62)*	green cabbage	16-Jan-09	<60	<54	<67
	red cabbage	16-Jan-09	<47	<58	<69
	savoy cabbage	16-Jan-09	<46	<57	<45
	green cabbage	13-Feb-09	<56	<34	<73
	red cabbage	13-Feb-09	<52	<41	<67
	savoy cabbage	13-Feb-09	<56	<41	<49
	savoy cabbage	13-Mar-09	<41	<55	<61
	red cabbage	13-Mar-09	<43	<58	<74
	green cabbage	13-Mar-09	<46	<49	<54
	red cabbage	16-Apr-09	<58	<59	<69
	savoy cabbage	16-Apr-09	<56	<56	<63
	green cabbage	16-Apr-09	<56	<49	<14

TABLE 8.7 MILK

ODCM required samples denoted by *
units are pCi/liter

SAMPLE LOCATION	DATE COLLECTED	<1 I-131	<15 Cs-134	<18 Cs-137	<60 Ba-140	<15 La-140
RODRIGUEZ COWS	23-Oct-09	<1	<1	<1	<3	<1
	12-Nov-09	<1	<1	<1	<3	<1
	10-Dec-09	<1	<1	<1	<3	<1
GOATS (Site #51)*	NO SAMPLES AVAILABLE					
DAVIS GOATS (Site #52)*	NO SAMPLES AVAILABLE					
MARTIN GOATS (Site #53)*	23-Jan-09	<1	<1	<1	<3	<1
	27-Feb-09	<1	<1	<1	<3	<1
	20-Mar-09	<1	<1	<1	<3	<1
	24-Apr-09	<1	<1	<1	<3	<1
	22-May-09	<1	<1	<1	<3	<1
	26-Jun-09	<1	<1	<1	<3	<1
	24-Jul-09	<1	<1	<1	<3	<1
	21-Aug-09	<1	<1	<1	<3	<1
	18-Sep-09	<1	<1	<1	<3	<1
	16-Oct-09	<1	<1	<1	<3	<1
	12-Nov-09	<1	<1	<1	<3	<1
	11-Dec-09	<1	<1	<1	<3	<1
HERNANDEZ GOATS (Site #54)	13-Feb-09	<1	<1	<1	<3	<1
	27-Feb-09	<1	<1	<1	<3	<1
	16-Apr-09	<1	<1	<1	<3	<1
	15-Oct-09	<1	<1	<1	<3	<1
	06-Nov-09	<1	<1	<1	<3	<1

TABLE 8.8 DRINKING WATER

ODCM required samples denoted by *
units are pCi/liter

SAMPLE LOCATION	MONTH ENDPOINT	<15 Mn-54	<15 Co-58	<30 Fe-59	<15 Co-60	<30 Zn-65	<15 Nb-95	<30 Zr-95	<15 I-131	<15 Cs-134	<18 Cs-137	<60 Ba-140	<15 La-140	<2000 QTRLY H-3	<4.0 Gross Beta
BERRYMAN RESIDENCE (SITE #48)*	26-Jan-09	<12	<11	<25	<11	<28	<13	<20	<11	<10	<10	<46	<15		<3.0
	24-Feb-09	<14	<13	<25	<11	<25	<13	<23	<11	<12	<13	<36	<15		3.7 ± 1.9
	31-Mar-09	<12	<12	<29	<14	<30	<13	<21	<11	<12	<15	<41	<15	<268	4.8 ± 1.9
	28-Apr-09	<14	<14	<24	<15	<26	<13	<25	<13	<13	<15	<55	<14		<3.7
	26-May-09	<9	<11	<24	<13	<29	<12	<15	<10	<10	<12	<38	<15		<3.5
	29-Jun-09	<10	<10	<23	<10	<23	<10	<19	<10	<9	<10	<31	<15	<277	<3.3
	28-Jul-09	<12	<12	<23	<12	<29	<15	<17	<12	<12	<14	<46	<15		<3.8
	25-Aug-09	<14	<15	<27	<15	<29	<14	<20	<15	<14	<16	<52	<15		3.6 ± 2.0
	29-Sep-09	<9	<9	<21	<10	<23	<9	<15	<8	<9	<9	<30	<10	<275	<3.5
	27-Oct-09	<14	<13	<28	<13	<28	<10	<18	<12	<11	<14	<44	<15		<3.8
	23-Nov-09	<9	<9	<17	<10	<22	<10	<16	<8	<7	<8	<31	<13		<3.8
	28-Dec-09	<12	<11	<24	<10	<20	<11	<18	<7	<8	<9	<34	<15	<293	<3.5
GAVETTE RESIDENCE (SITE #55)	26-Jan-09	<11	<10	<21	<10	<23	<11	<19	<10	<9	<9	<30	<14		3.6 ± 1.6
	24-Feb-09	<13	<14	<27	<13	<29	<14	<21	<14	<13	<14	<50	<12		4.2 ± 1.6
	31-Mar-09	<11	<12	<23	<13	<25	<12	<18	<9	<10	<12	<37	<15	<266	3.9 ± 1.5
	28-Apr-09	<11	<11	<23	<13	<30	<13	<20	<12	<10	<12	<42	<11		2.9 ± 1.6
	26-May-09	<14	<12	<21	<13	<30	<12	<21	<13	<11	<14	<45	<13		2.5 ± 1.5
	29-Jun-09	<10	<12	<21	<15	<24	<10	<19	<13	<10	<12	<38	<12	<278	3.5 ± 1.5
	28-Jul-09	<11	<13	<24	<14	<25	<11	<19	<11	<11	<12	<38	<15		4.2 ± 1.6
	25-Aug-09	<14	<15	<28	<12	<28	<12	<22	<13	<11	<17	<54	<12		5.5 ± 1.5
	29-Sep-09	<11	<12	<21	<13	<25	<15	<19	<9	<8	<11	<32	<15	<277	5.4 ± 1.7
	27-Oct-09	<12	<12	<25	<15	<29	<11	<23	<14	<11	<14	<51	<14		3.4 ± 1.6
	23-Nov-09	<11	<10	<24	<13	<21	<10	<18	<9	<9	<10	<36	<13		<2.6
	28-Dec-09	<10	<11	<24	<11	<21	<9	<15	<9	<9	<11	<29	<14	<294	4.3 ± 1.6

ODCM required samples denoted by *
units are pCi/liter

SAMPLE LOCATION	MONTH ENDPOINT	<15 Mn-54	<15 Co-58	<30 Fe-59	<15 Co-60	<30 Zn-65	<15 Nb-95	<30 Zr-95	<15 I-131	<15 Cs-134	<18 Cs-137	<60 Ba-140	<15 La-140	<2000 QTRLY H-3	<4.0 Gross Beta
WIRTH RESIDENCE (SITE #46)*	26-Jan-09	<13	<12	<30	<14	<30	<12	<24	<14	<10	<13	<43	<12		<2.4
	24-Feb-09	<13	<12	<23	<15	<24	<11	<21	<12	<12	<14	<44	<13		3.2 ± 1.6
	31-Mar-09	<11	<14	<22	<13	<29	<11	<19	<10	<10	<13	<35	<12	<266	3.7 ± 1.5
	28-Apr-09	<13	<10	<24	<14	<24	<11	<19	<10	<9	<11	<43	<15		3.4 ± 1.7
	26-May-09	<11	<10	<21	<13	<26	<11	<20	<10	<8	<13	<36	<15		2.7 ± 1.6
	29-Jun-09	<10	<11	<24	<10	<29	<14	<23	<12	<11	<12	<40	<14	<275	<2.3
	28-Jul-09	<12	<9	<23	<15	<24	<11	<20	<12	<11	<11	<34	<11		<2.4
	25-Aug-09	<15	<14	<27	<15	<25	<14	<21	<12	<13	<15	<46	<11		4.6 ± 1.5
	29-Sep-09	<13	<10	<21	<15	<29	<12	<21	<13	<11	<13	<43	<12	<274	3.9 ± 1.6
	27-Oct-09	<14	<11	<24	<15	<30	<12	<20	<14	<12	<13	<44	<13		2.5 ± 1.6
	23-Nov-09	<13	<12	<26	<12	<29	<15	<21	<13	<12	<13	<42	<11		<2.5
	28-Dec-09	<15	<12	<24	<14	<26	<15	<20	<12	<12	<14	<49	<11	<293	<2.3
SANDOVAL RESIDENCE (SITE #49) *	26-Jan-09	<8	<10	<18	<10	<20	<10	<17	<9	<9	<10	<37	<11		<2.3
	24-Feb-09	<10	<9	<20	<11	<23	<10	<18	<9	<10	<10	<35	<15		<2.3
	31-Mar-09	<13	<11	<26	<15	<29	<14	<19	<13	<12	<12	<45	<12	<272	2.4 ± 1.4
	28-Apr-09	<11	<10	<23	<9	<21	<9	<18	<12	<9	<11	<38	<15		<2.5
	26-May-09	<10	<13	<22	<15	<25	<13	<22	<13	<11	<12	<41	<13		<2.3
	29-Jun-09	<11	<11	<23	<13	<24	<12	<19	<14	<10	<12	<44	<14	<277	<2.2
	28-Jul-09	<13	<11	<29	<14	<28	<13	<17	<10	<10	<13	<35	<14		<2.2
	25-Aug-09	<15	<11	<25	<13	<15	<14	<19	<10	<11	<14	<46	<14	<277 [a]	3.0 ± 1.3
		temporarily unavailable as of 8-25-09													
	23-Nov-09	<12	<12	<21	<13	<27	<11	<20	<10	<11	<12	<44	<15		<2.4
	28-Dec-09	<11	<12	<26	<15	<26	<13	<18	<14	<11	<11	<44	<14	<300 [a]	<2.2

a This composite sample only included two months of weekly samples (instead of the normal three months) due to temporary unavailability of sample.

ODCM required samples denoted by *
units are pCi/liter

SAMPLE LOCATION	DATE COLLECTED	<15 Mn-54	<15 Co-58	<30 Fe-59	<15 Co-60	<30 Zn-65	<15 Nb-95	<30 Zr-95	<15 I-131	<15 Cs-134	<18 Cs-137	<60 Ba-140	<15 La-140	<2000 H-3
WELL	26-Jan-09	<9	<9	<21	<10	<18	<10	<15	<10	<8	<8	<31	<10	<283
27ddc	28-Apr-09	<15	<13	<27	<13	<28	<15	<19	<13	<13	<13	<47	<12	<267
(Site #57)*	28-Jul-09	<11	<11	<25	<12	<27	<14	<18	<11	<11	<11	<38	<15	<287
	27-Oct-09	<12	<10	<22	<11	<24	<11	<20	<11	<11	<11	<39	<15	<287
WELL	26-Jan-09	<11	<12	<25	<14	<25	<13	<21	<15	<11	<13	<41	<14	<280
34abb	28-Apr-09	<11	<10	<23	<13	<22	<11	<21	<11	<10	<10	<37	<15	<266
(Site #58)*	28-Jul-09	<14	<13	<28	<14	<27	<14	<22	<15	<10	<14	<47	<14	<288
	27-Oct-09	<10	<11	<23	<10	<20	<11	<18	<10	<10	<11	<33	<15	<287

TABLE 8.10 SURFACE WATER

ODCM required samples denoted by *
units are pCi/liter

SAMPLE LOCATION	MONTH ENDPOINT	<15 Mn-54	<15 Co-58	<30 Fe-59	<15 Co-60	<30 Zn-65	<15 Nb-95	<30 Zr-95	<15 I-131	<15 Cs-134	<18 Cs-137	<60 Ba-140	<15 La-140	<3000 H-3
45 ACRE RESERVOIR (Site #61) *	26-Jan-09	<11	<10	<30	<15	<26	<14	<23	32 ± 13 [b]	<10	<11	<47	<12	<281
	28-Apr-09	<14	<10	<22	<15	<24	<12	<20	17 ± 11 [d]	<10	<14	<42	<14	<268
	28-Jul-09	<11	<11	<27	<15	<27	<11	<22	<15	<12	<14	<44	<12	<291
	27-Oct-09	<11	<11	<20	<15	<26	<12	<20	<11	<12	<10	<37	<10	<287
85 ACRE RESERVOIR (Site #60) *	26-Jan-09	<11	<12	<24	<13	<26	<12	<20	<14	<10	<10	<43	<15	<287
	28-Apr-09	<13	<14	<26	<12	<30	<13	<22	25 ± 14 [c]	<12	<14	<44	<12	<269
	28-Jul-09	<12	<9	<22	<13	<30	<11	<19	13 ± 10	<8	<11	<37	<14	<290
	27-Oct-09	<13	<12	<26	<15	<29	<14	<17	<14	<12	<13	<46	<12	<290
EVAP POND 1 (Site #59) *	26-Jan-09	<12	<11	<26	<15	<28	<12	<18	15 ± 11 [a]	<10	<12	<44	<14	825 ± 256
	28-Apr-09	<14	<13	<27	<13	<28	<15	<23	<15	<12	<17	<47	<12	957 ± 257
	28-Jul-09	<12	<13	<30	<14	<29	<14	<24	20 ± 13 [e]	<13	<15	<44	<13	1224 ± 188
	27-Oct-09	<13	<12	<25	<11	<30	<13	<17	<14	<11	<14	<45	<12	697 ± 177
EVAP POND 2 (Site #63) *	Empty for re-lining													
EVAP POND 3 (Site #64)* 3A	2-Mar-09	<11	<12	<28	<15	<25	<12	<19	<10	<10	<13	<40	<15	991 ± 175
	28-Apr-09	<12	<12	<30	<13	<30	<11	<21	<10	<11	<12	<40	<13	989 ± 256
	28-Jul-09	<12	<13	<29	<13	<30	<9	<20	<11	<10	<14	<41	<14	786 ± 182
	27-Oct-09	<12	<11	<28	<13	<30	<11	<21	<11	<10	<13	<39	<15	628 ± 176
3B	28-Jul-09	<12	<13	<29	<14	<30	<11	<19	<13	<12	<13	<42	<12	707 ± 181
	27-Oct-09	<12	<12	<28	<15	<30	<12	<21	<12	<12	<13	<44	<12	778 ± 180

a Recount indicated an I-131 concentration of 30 ± 13 pCi/liter. See CRDR #3309449. b Recount indicated an I-131 concentration of 33 ± 13 pCi/liter. See CRDR #3309449. c Recount indicated an I-131 concentration of 39 ± 16 pCi/liter. See CRDR #3309449. d Recount indicated an I-131 concentration of 20 ± 12 pCi/liter. See CRDR #3309449. e Recount indicated an I-131 concentration of 15 ± 11 pCi/liter. See CRDR #3309449.

TABLE 8.10 SURFACE WATER

ODCM required samples denoted by *

units are pCi/liter

SAMPLE LOCATION	DATE COLLECTED	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140	Tritium
WRF INFLUENT	6-Jan-09	<14	<14	<28	<14	<27	<15	<24	19 ± 23	<12	<12	<42	<14	
	13-Jan-09	<12	<12	<19	<13	<27	<12	<20	31 ± 19	<11	<12	<36	<10	
	20-Jan-09	<12	<9	<25	<15	<30	<14	<21	35 ± 12	<9	<13	<32	<14	
	26-Jan-09	<11	<10	<24	<14	<26	<12	<20	44 ± 15	<10	<13	<35	<14	<285
	3-Feb-09	<11	<10	<17	<14	<25	<11	<19	36 ± 15	<9	<13	<29	<15	
	10-Feb-09	<14	<13	<24	<15	<25	<12	<25	33 ± 12	<11	<13	<39	<13	
	17-Feb-09	<10	<10	<23	<14	<19	<13	<20	38 ± 13	<11	<13	<37	<12	
	24-Feb-09	<11	<13	<24	<10	<27	<9	<19	64 ± 15	<15	<14	<35	<10	<273
	3-Mar-09	<14	<10	<22	<13	<29	<12	<21	72 ± 19	<12	<13	<41	<10	
	10-Mar-09	<11	<12	<22	<15	<28	<12	<21	74 ± 22	<12	<14	<45	<12	
	17-Mar-09	<11	<12	<25	<13	<30	<13	<19	48 ± 16	<11	<13	<40	<15	
	24-Mar-09	<11	<11	<20	<13	<23	<9	<20	32 ± 9	<9	<12	<37	<15	
	31-Mar-09	<9	<11	<21	<14	<29	<10	<19	20 ± 12	<10	<11	<33	<12	<275
	7-Apr-09	<11	<12	<29	<9	<30	<12	<22	40 ± 14	<12	<12	<44	<15	
	14-Apr-09	<12	<9	<25	<13	<25	<12	<17	32 ± 12	<9	<13	<35	<14	
	28-Apr-09	<10	<11	<22	<15	<26	<11	<19	37 ± 10	<10	<12	<37	<12	<271
	5-May-09	<11	<11	<15	<12	<25	<12	<18	32 ± 10	<10	<12	<36	<15	
	12-May-09	<15	<13	<29	<14	<27	<13	<21	15 ± 12	<13	<14	<42	<15	
	19-May-09	<9	<9	<23	<15	<24	<11	<19	24 ± 12	<9	<10	<32	<9	
	26-May-09	<14	<13	<24	<14	<30	<15	<25	25 ± 13	<12	<14	<47	<11	<287
	2-Jun-09	<15	<11	<20	<12	<29	<13	<24	22 ± 11	<11	<12	<36	<14	
	9-Jun-09	<10	<9	<21	<12	<20	<10	<19	22 ± 9	<10	<10	<34	<15	
	16-Jun-09	<10	<10	<21	<12	<23	<10	<18	14 ± 8	<10	<13	<38	<15	
	23-Jun-09	<10	<10	<21	<12	<20	<9	<16	24 ± 9	<9	<11	<36	<12	
	29-Jun-09	<13	<13	<26	<10	<28	<9	<19	31 ± 13	<11	<11	<41	<15	<285
	7-Jul-09	<12	<12	<27	<11	<25	<12	<19	20 ± 11	<10	<13	<40	<10	
	14-Jul-09	<13	<13	<24	<15	<28	<11	<21	22 ± 14	<12	<14	<46	<14	
	21-Jul-09	<12	<11	<19	<13	<26	<12	<17	22 ± 11	<9	<12	<36	<12	
	28-Jul-09	<14	<13	<26	<13	<30	<13	<26	13 ± 10	<13	<16	<47	<14	<294

TABLE 8.10 SURFACE WATER

ODCM required samples denoted by *

units are pCi/liter

SAMPLE LOCATION	DATE COLLECTED	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140	Tritium
WRF INFLUENT	4-Aug-09	<10	<10	<25	<10	<21	<9	<18	9 ± 9	<10	<10	<27	<15	
	11-Aug-09	<9	<8	<21	<12	<24	<10	<19	<10	<10	<9	<31	<14	
	18-Aug-09	<11	<13	<23	<13	<20	<12	<19	18 ± 10	<13	<13	<39	<15	
	25-Aug-09	<9	<9	<21	<12	<28	<9	<19	25 ± 9	<10	<9	<35	<15	<280
	1-Sep-09	<13	<14	<30	<14	<25	<12	<21	26 ± 15	<13	<17	<49	<12	
	7-Sep-09	<11	<11	<23	<14	<27	<13	<28	11 ± 15	<14	<14	<48	<9	
	15-Sep-09	<13	<13	<24	<15	<28	<13	<24	15 ± 16	<13	<13	<47	<13	
	22-Sep-09	<12	<13	<27	<13	<30	<12	<25	<13	<13	<13	<41	<11	
	29-Sep-09	<12	<13	<28	<14	<29	<12	<22	<15	<12	<12	<44	<14	<283
	6-Oct-09	<13	<13	<27	<14	<27	<13	<23	8 ± 10	<14	<15	<47	<15	
	13-Oct-09	<12	<9	<22	<13	<30	<12	<22	<14	<10	<13	<40	<11	
	20-Oct-09	<11	<12	<28	<14	<22	<11	<17	21 ± 8	<11	<12	<37	<15	
	27-Oct-09	<14	<15	<24	<13	<29	<14	<25	12 ± 17	<12	<14	<41	<15	
	3-Nov-09	<11	<12	<26	<15	<24	<10	<20	8 ± 10	<13	<13	<38	<12	
		WRF shutdown for maintenance												
	17-Nov-09	<13	<11	<22	<15	<22	<11	<23	15 ± 13	<11	<13	<38	<12	
	23-Nov-09	<12	<11	<21	<11	<23	<11	<19	32 ± 11	<10	<12	<34	<15	<274
	1-Dec-09	<9	<10	<20	<11	<22	<9	<19	13 ± 7	<9	<11	<35	<15	
	8-Dec-09	<12	<10	<22	<15	<26	<10	<16	44 ± 11	<11	<12	<39	<15	
	15-Dec-09	<11	<12	<23	<9	<28	<11	<21	42 ± 15	<10	<12	<42	<15	
	21-Dec-09	<13	<10	<27	<15	<27	<13	<23	41 ± 17	<12	<12	<48	<12	
	28-Dec-09	<14	<10	<26	<12	<25	<12	<20	<15	<11	<12	<44	<14	<305

TABLE 8.10 SURFACE WATER

ODCM required samples denoted by *
units are pCi/liter

SAMPLE LOCATION	DATE COLLECTED	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140	Tritium
SEDIMENT. BASIN #2	8-Dec-09	<11	<15	<25	<10	<29	<11	<24	<14	<12	<13	<41	<14	<282

TABLE 8.11 SLUDGE/SEDIMENT

ODCM required samples denoted by *
units are pCi/kg, wet

SAMPLE LOCATION	DATE COLLECTED	I-131	Cs-134	Cs-137	In-111
WRF CENTRIFUGE WASTE SLUDGE	6-Jan-09	1372 ± 171	<15	<30	
	13-Jan-09	1670 ± 344	<21	<27	
	20-Jan-09	1404 ± 181	<31	<9	
	26-Jan-09	651 ± 100	<24	<26	
	3-Feb-09	404 ± 91	<15	<24	
	10-Feb-09	1051± 143	<25	<27	82 ± 40
	17-Feb-09	1122 ± 143	<25	<19	97 ± 43
	24-Feb-09	1079 ± 227	<18	<26	38 ± 31
	3-Mar-09	866 ± 215	<144	<177	
	10-Mar-09	714 ± 174	<111	<177	
	17-Mar-09	1301 ± 259	<141	<148	
	24-Mar-09	1312 ± 249	<122	<175	
	31-Mar-09	895 ± 220	<143	<179	
	7-Apr-09	833 ± 213	<146	<132	
	14-Apr-09	1201 ± 238	<130	<169	
	28-Apr-09	464 ± 160	<149	<114	
	5-May-09	664 ± 186	<134	<176	
	12-May-09	1303 ± 219	<110	<166	
	19-May-09	831 ± 253	<135	<144	
	26-May-09	612 ± 178	<143	<148	
	1-Jun-09	499 ± 214	<101	<134	
	9-Jun-09	777 ± 170	<128	<176	
	16-Jun-09	912 ± 242	<138	<163	
	22-Jun-09	1006 ± 201	<115	<148	
	29-Jun-09	1028 ± 222	<137	<169	
	6-Jul-09	1377 ± 278	<135	<153	
	13-Jul-09	835 ± 230	<146	<111	
	20-Jul-09	1122 ± 239	<135	<151	
	28-Jul-09	722 ± 221	<93	<168	
	3-Aug-09	909 ± 216	<96	<135	
	10-Aug-09	1631 ± 242	<111	<112	
	17-Aug-09	1003 ± 229	<146	<98	
	24-Aug-09	1636 ± 316	<146	<166	

Note: The sample volume was lowered to 250 ml in March and the MDAs increased due to the smaller volume.

TABLE 8.11 SLUDGE/SEDIMENT

ODCM required samples denoted by *
units are pCi/kg, wet

SAMPLE LOCATION	DATE COLLECTED	I-131	Cs-134	Cs-137	In-111
WRF CENTRIFUGE WASTE SLUDGE	1-Sep-09	1457 ± 296	<121	<172	
	7-Sep-09	876 ± 217	<142	<135	
	15-Sep-09	791 ± 222	<140	<106	
	22-Sep-09	829 ± 184	<142	<113	
	29-Sep-09	953 ± 287	<142	<176	
	6-Oct-09	1032 ± 214	<145	<156	
	13-Oct-09	700 ± 197	<146	<174	
	20-Oct-09	961 ± 214	<142	<163	
	27-Oct-09	1109 ± 241	<86	<134	
	WRF shutdown for maintenance				
	17-Nov-09	387 ± 124	<115	<168	
	23-Nov-09	553 ± 197	<149	<166	
	1-Dec-09	469 ± 167	<96	<108	
	8-Dec-09	648 ± 172	<148	<133	
	15-Dec-09	741 ± 167	<127	<161	
	21-Dec-09	861 ± 183	<105	<130	
	28-Dec-09	1372 ± 327	<122	<151	

ODCM required samples denoted by *
Units are pCi/kg, wet

COOLING TOWER SLUDGE

UNIT CYCLE	APPROXIMATE VOLUME (yd^3)	ISOTOPE	ACTIVITY RANGE (uCi/ml)	SAMPLE TYPE	FRACTION OF SAMPLES ABOVE MDA
U1R14	216	Cs-137	<MDA to 1.32E-07	tower/canal sludge	19 of 32
U3R14	326	Cs-137	<MDA to 7.45E-08	tower/canal sludge	1 of 4

FIGURE 8.1 HISTORICAL GROSS BETA IN AIR (WEEKLY SYSTEM AVERAGES)

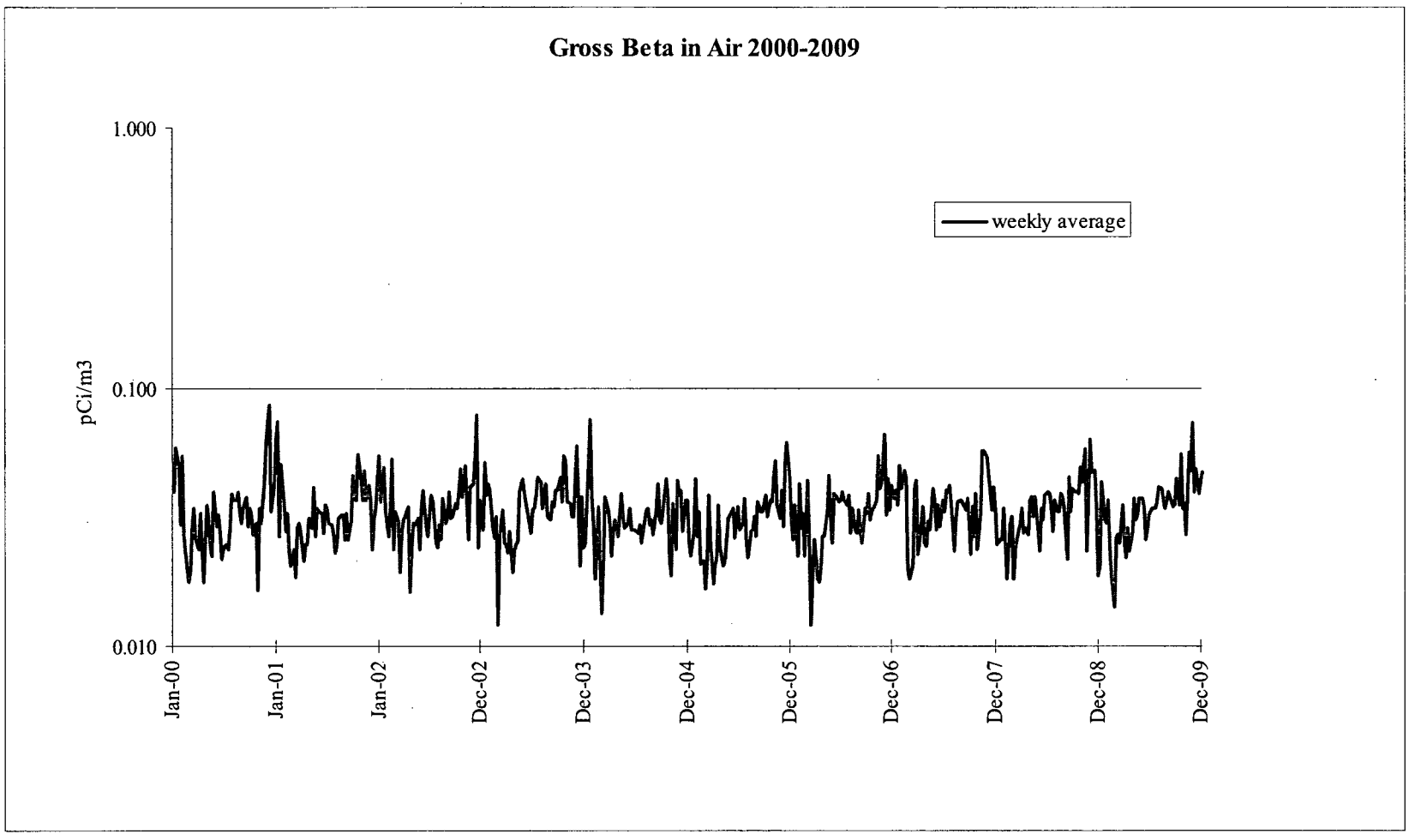
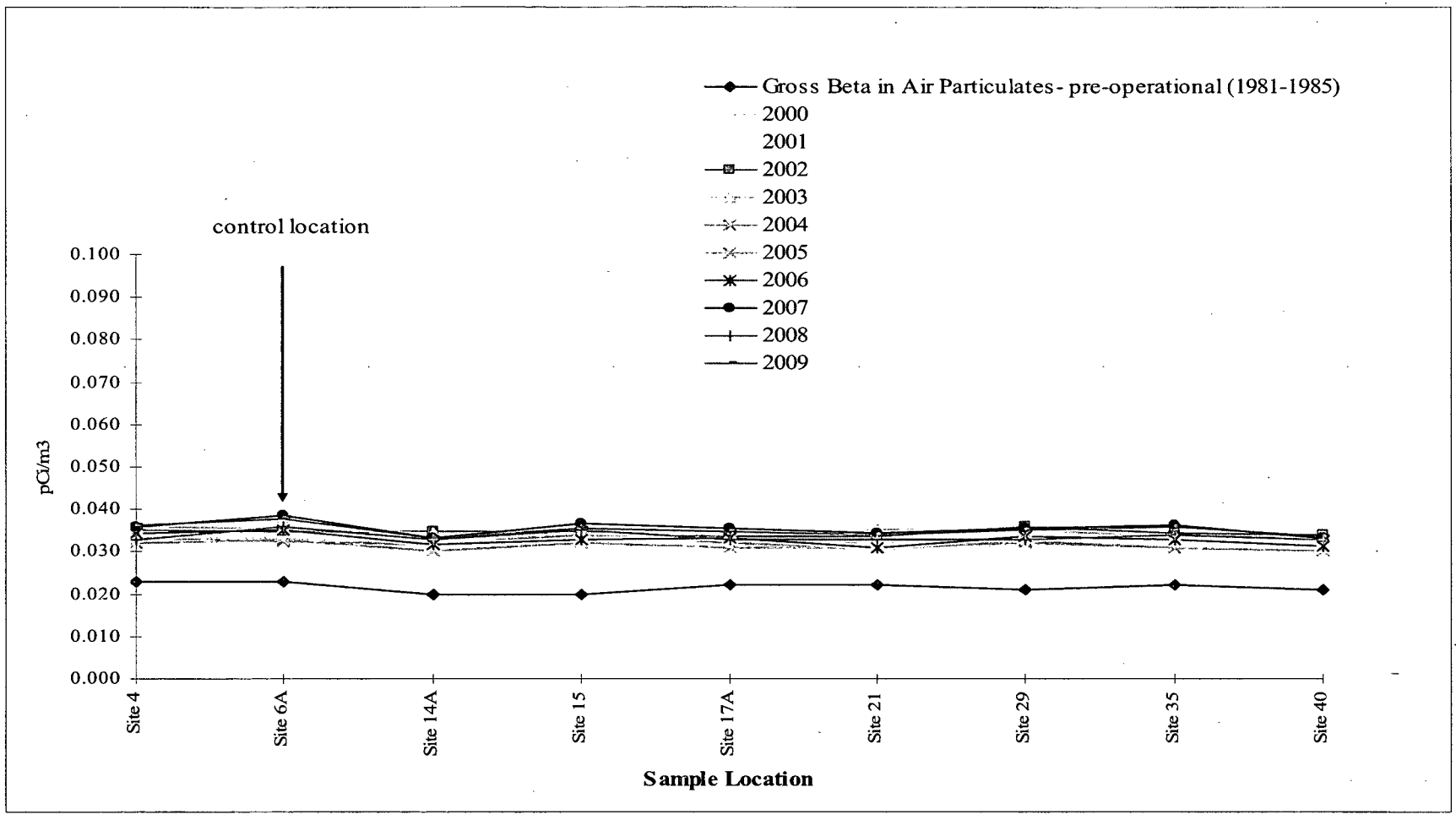
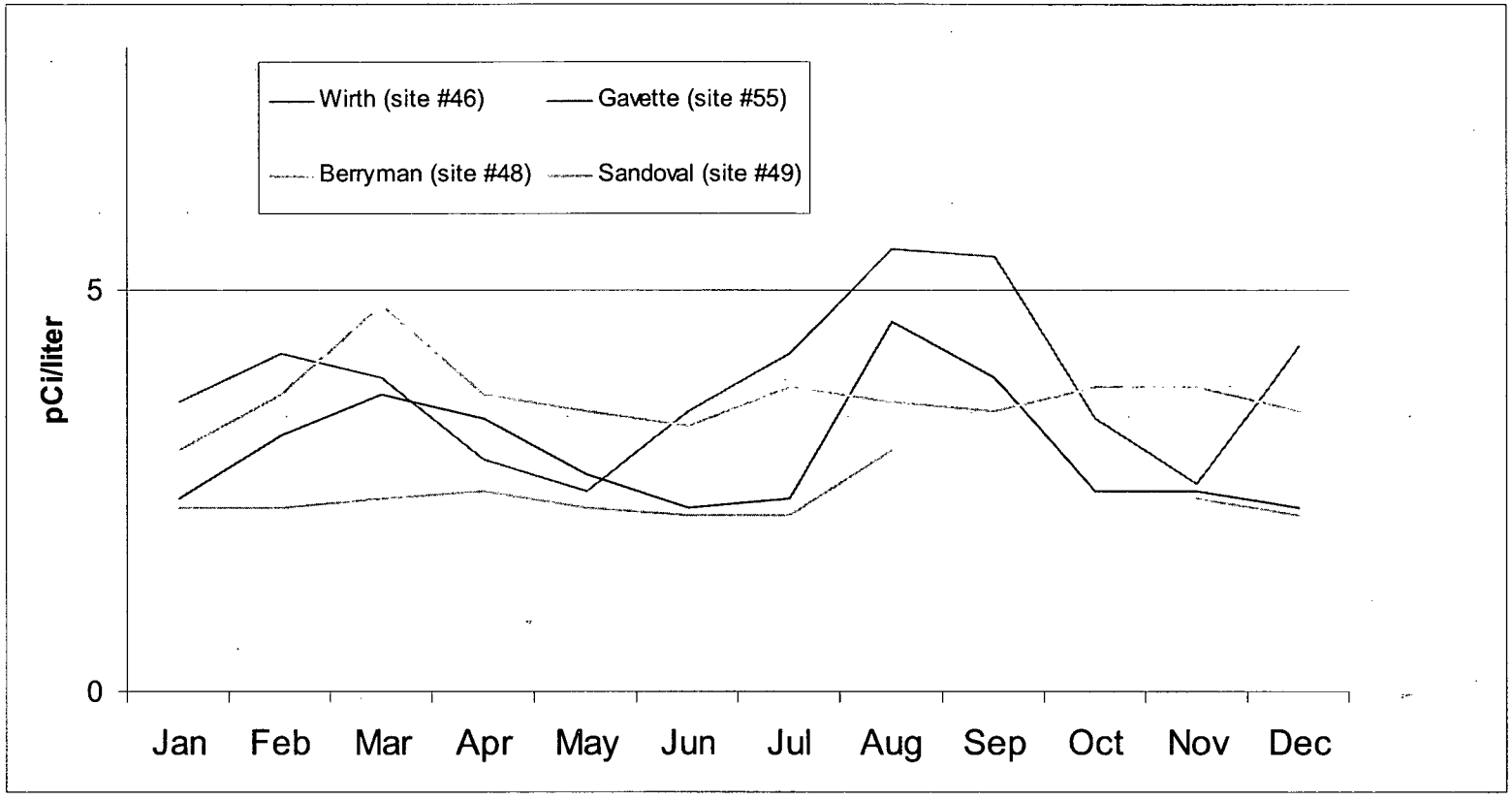


FIGURE 8.2 HISTORICAL GROSS BETA IN AIR (ANNUAL SITE TO SITE COMPARISONS) COMPARED TO PRE-OP



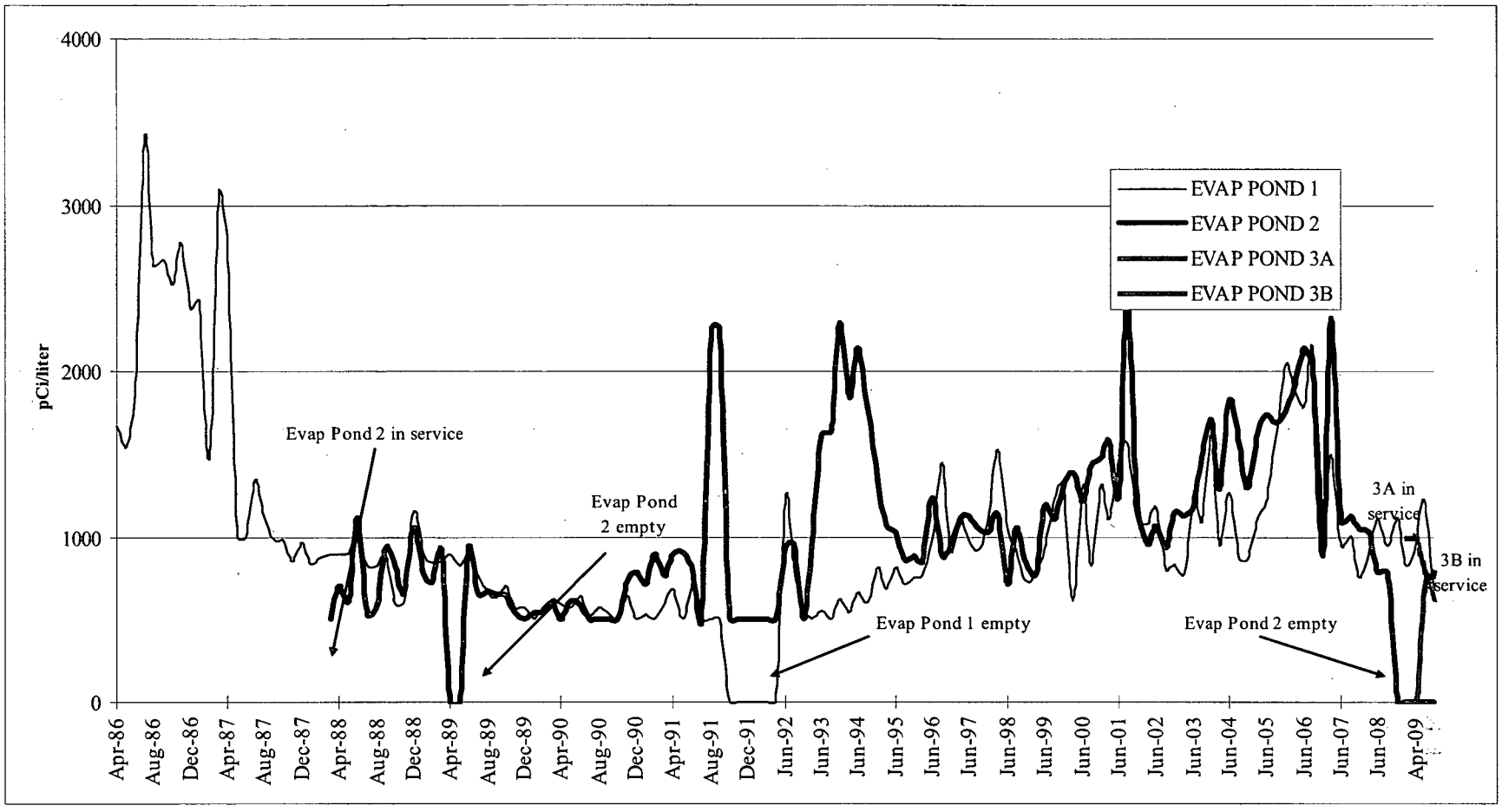
Site 7A is not included since the location changed since the pre-operational period
A known high bias has occurred in gross beta data since the onsite laboratory began analysis in 1994

FIGURE 8.3 GROSS BETA IN DRINKING WATER



NOTES: MDA values plotted as activity (e.g. <2.3 is plotted as 2.3)

FIGURE 8.4 EVAPORATION POND TRITIUM ACTIVITY



Evaporation Pond #3 was constructed with two sections designated as 3A and 3B. Evaporation Pond #2 was pumped into sections 3A and 3B and is in process of liner replacement.

9. Thermoluminescent Dosimeter (TLD) Results and Data

The environmental TLD used at PVNGS is the Panasonic Model 812 Dosimeter. The Model 812 is a multi-element dosimeter combining two elements of lithium borate and two elements of calcium sulfate under various filters.

TLDs were placed in forty-nine locations from one to thirty-five miles from the PVNGS. TLD locations are shown in Figures 2.1 and 2.2 and are described in Table 9.1. TLD results for 2009 are presented in Table 9.2. Historical environmental gamma radiation results for 1985 through 2009 are presented in graphical form on Figure 9.1 (excluding transit control TLD #45).

Figure 9.2 depicts the environmental TLD results from 2009 as compared to the pre-operational TLD results (excluding sites #41, #43, and #46-50 as they were deleted (and later assigned to a new location) or had no pre-op TLD at the location for comparison). The site to site comparisons indicate a direct correlation with respect to pre-operational results. It is evident that the offsite dose, as measured by TLDs, has not changed since Palo Verde became operational.

TABLE 9.1 TLD SITE LOCATIONS

(distances and directions are relative to Unit 2 in miles)

TLD SITE	LOCATION	LOCATION DESCRIPTION
1	E30	Goodyear
2	ENE24	Scott-Libby School
3	E21	Liberty School
4	E16	Buckeye
5	ESE11	Palo Verde School
6*	SSE31	APS Gila Bend substation
7	SE7	Old US 80 and Arlington School Rd
8	SSE4	Southern Pacific Pipeline Rd.
9	S5	Southern Pacific Pipeline Rd.
10	SE5	355th Ave. and Elliot Rd.
11	ESE5	339th Ave. and Dobbins Rd.
12	E5	339th Ave. and Buckeye-Salome Rd.
13	N1	N site boundary
14	NNE2	NNE site boundary
15	NE2	NE site boundary, WRF access road
16	ENE2	ENE site boundary
17	E2	E site boundary
18	ESE2	ESE site boundary
19	SE2	SE site boundary
20	SSE2	SSE site boundary
21	S3	S site boundary
22	SSW3	SSW site boundary
23	W5	N of Elliot Rd
24	SW4	N of Elliot Rd
25	WSW5	N of Elliot Rd
26	SSW4	S of Elliot Rd
27	SW1	SW site boundary
28	WSW1	WSW site boundary
29	W1	W site boundary
30	WNW1	WNW site boundary
31	NW1	NW site boundary
32	NNW1	NNW site boundary
33	NW4	S of Buckeye Rd
34	NNW5	395th Ave. and Van Buren St.
35	NNW8	Tonopah
36	N5	Wintersburg Rd. and Van Buren St.
37	NNE5	363rd Ave. and Van Buren St.
38	NE5	355th Ave. and Buckeye Rd.
39	ENE5	343rd Ave. N of Broadway Rd.
40	N2	Wintersburg
41	ESE3	Arlington School
42	N8	Ruth Fisher School

TABLE 9.1 TLD SITE LOCATIONS

(distances and directions are relative to Unit 2 in miles)

TLD SITE	LOCATION	LOCATION DESCRIPTION
43	NE5	Winters Well School
44*	ENE35	El Mirage
45**	Onsite	Central Laboratory (lead pig)
46	ENE30	Litchfield Park School
47	E35	Littleton School
48	E24	Jackrabbit Trail
49	ENE11	Palo Verde Rd.
50	WNW5	S of Buckeye-Salome Rd.

* Site #6 and site #44 are the control locations.

** Site #45 is the transit control TLD (stored in lead pig).

TABLE 9.2 2009 ENVIRONMENTAL TLD RESULTS

Units are mrem/std qtr

TLD Site #	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Average
1	23.6	23.4	21.3	23.0	22.8
2	21.8	22.1	20.4	20.6	21.2
3	22.9	22.5	21.2	21.8	22.1
4	21.8	22.7	21.8	22.3	22.2
5	22.0	22.9	21.3	20.9	21.8
6 (control)	26.2	26.4	24.4	25.8	25.7
7	24.8	25.1	23.0	24.6	24.4
8	23.1	22.9	21.7	22.0	22.4
9	27.1	26.5	26.2	27.0	26.7
10	22.4	23.4	22.5	22.9	22.8
11	23.1	25.4	22.7	23.0	23.6
12	22.7	23.2	22.3	22.1	22.6
13	23.7	26.0	24.2	24.2	24.5
14	24.7	24.2	23.6	24.2	24.2
15	23.3	23.6	22.4	22.8	23.0
16	21.1	21.3	20.8	21.5	21.2
17	23.4	24.3	23.1	24.0	23.7
18	23.1	22.8	22.1	22.5	22.6
19	24.5	24.6	23.4	24.8	24.3
20	23.8	24.1	22.7	23.3	23.5
21	24.8	24.9	24.3	24.8	24.7
22	25.3	25.1	25.5	25.6	25.4
23	22.1	22.7	20.5	21.9	21.8
24	20.3	21.5	21.2	21.3	21.1
25	22.0	21.9	21.2	22.1	21.8
26	25.4	28.0	25.1	25.8	26.1
27	25.7	26.9	25.1	26.1	26.0
28	24.4	26.6	23.7	25.3	25.0
29	23.8	24.7	22.2	23.6	23.6
30	24.7	25.7	23.3	24.1	24.5
31	22.2	22.9	22.3	22.4	22.5
32	23.9	24.7	24.1	24.4	24.3
33	25.8	26.0	24.0	25.1	25.2
34	27.0	27.5	25.2	25.9	26.4
35	29.6	31.0	29.2	29.5	29.8
36	24.6	25.0	missing	23.5	24.4
37	23.9	23.1	22.5	23.7	23.3
38	26.7	27.5	26.0	26.0	26.6
39	23.8	24.0	22.1	21.7	22.9
40	24.8	24.8	23.4	22.8	24.0
41	27.0	25.7	26.6	25.8	26.3
42	29.6	28.3	29.2	28.7	29.0
43	28.2	27.7	26.5	25.8	27.1
44 (control)	19.7	20.6	19.4	20.1	20.0
45 (transit control)	6.2	5.8	5.5	5.6	5.8
46	26.8	26.5	24.7	25.6	25.9
47	22.5	23.8	21.5	23.5	22.8
48	24.9	24.1	22.5	22.8	23.6
49	22.5	24.0	21.4	21.7	22.4
50	19.2	18.5	18.6	18.2	18.6

NOTE: The 4th quarter TLD results were delayed due to an identified bias with results. Refer to corrective action document CRDR #3439215.

FIGURE 9.1 NETWORK ENVIRONMENTAL TLD EXPOSURE RATES

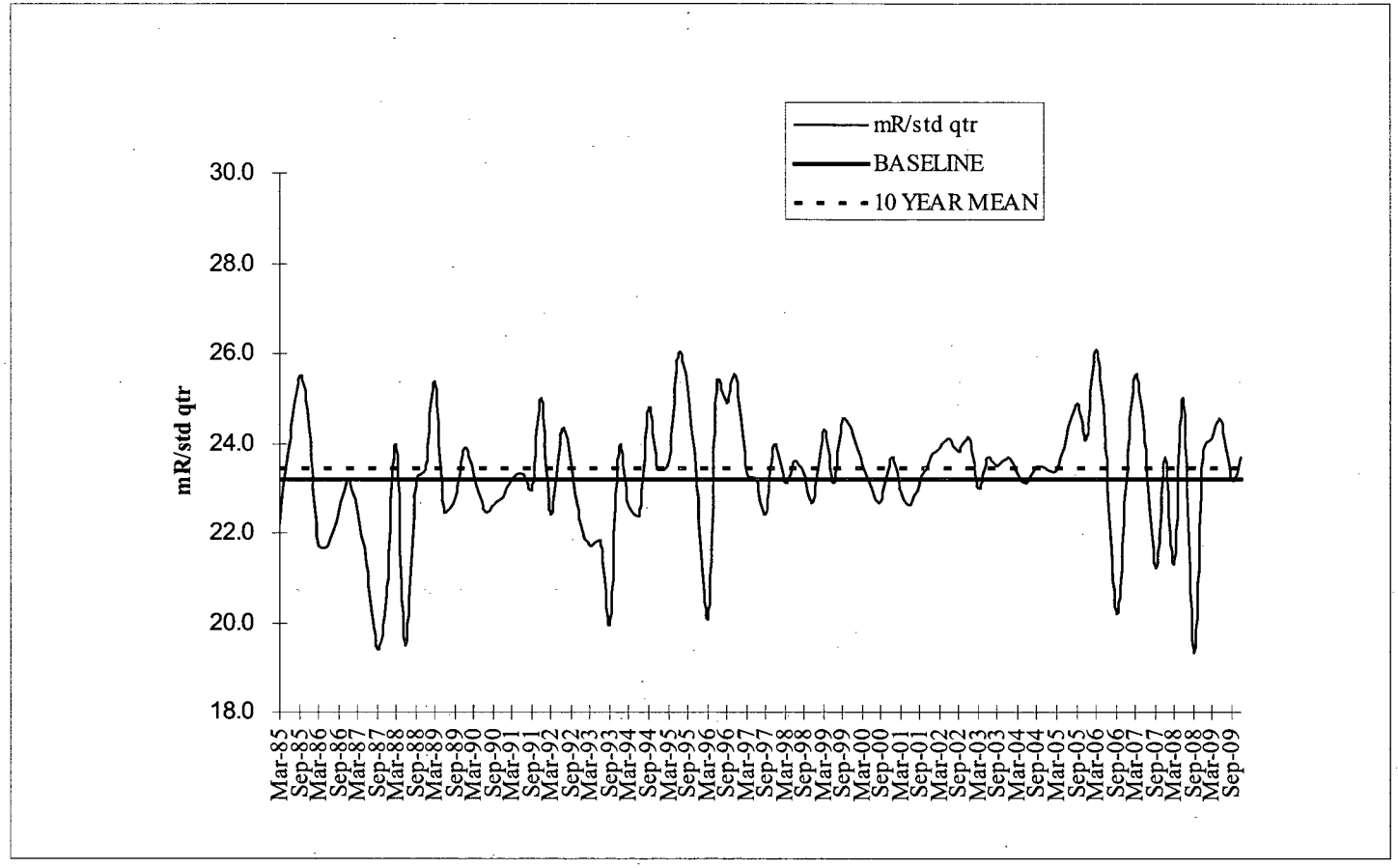
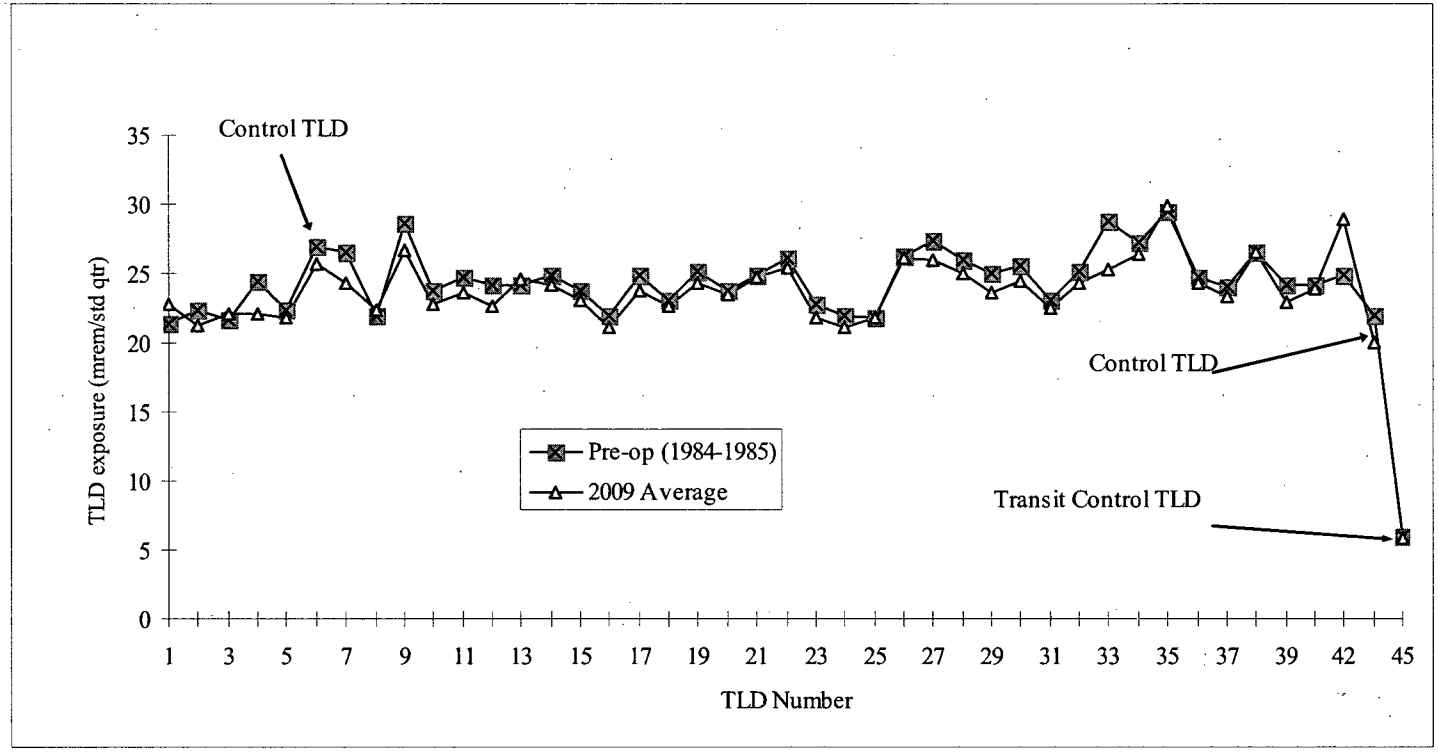


FIGURE 9.2 ENVIRONMENTAL TLD COMPARISON - PRE-OPERATIONAL VS 2009



The following TLDs are not included on this graph;
TLD #41 monitoring location was deleted in June, 2000 due to school closing (this TLD was placed at new school in 2004)
TLD #43 monitoring location was deleted in 1994 due to school closing (this TLD was placed at a new school in 2007)
TLDs #46-50 are not included since they were not included in the pre-op monitoring program

10. Land Use Census

10.1. Introduction

In accordance with the PVNGS ODCM, Section 6.2, the annual Land Use Census was performed within five miles of Unit 2 containment in April 2009.

Observations were made in each of the 16 meteorological sectors to determine the nearest milking animals, residences, and gardens of greater than 500 square feet. This census was completed by driving the roads and speaking with residents.

The results of the Land Use Census are presented in Table 10.1 and discussed below. The directions and distances listed are in sectors and miles from the Unit 2 containment.

10.2. Census Results

Nearest Resident

There were two (2) changes in nearest resident status. Dose calculations indicated the highest dose to be 0.229 mrem.

Milk Animal

There were five (5) changes in milk animal status. Dose calculations indicated the highest dose to be 0.872 mrem.

Vegetable Gardens

There were four (4) changes in nearest garden status. Dose calculations indicated the highest dose to be 0.332 mrem.

See Table 10.1 for a summary of the specific results and Table 2.1 for current sample locations.

TABLE 10.1 2009 LAND USE CENSUS

(Distances and directions are relative to Unit 2 in miles)

SECTOR	NEAREST RESIDENT	NEAREST GARDEN	NEAREST MILK ANIMAL (COW/GOAT)	CALCULATED DOSE (mrem)		CHANGE FROM 2008
N	1.55	**NONE**	**2.69**	Resident Milk	3.92E-02 3.50E-01	**GARDEN MILK**
NNE	1.52	**2.23**	**2.05**	Resident Garden Milk	7.86E-02 3.32E-01 7.60E-01	**GARDEN MILK**
NE	2.16	NONE	3.91	Resident Milk	1.14E-01 5.41E-01	
ENE	**2.05**	**4.72**	**2.52**	Resident Garden Milk	8.09E-02 1.00E-01 5.91E-01	**RESIDENT GARDEN MILK**
E	2.81	NONE	NONE	Resident	5.23E-02	
ESE	1.89	NONE	**1.95**	Resident Milk	1.32E-01 8.72E-01	**MILK**
SE	3.36	NONE	**3.40**	Resident Milk	8.80E-02 5.30E-01	**MILK**
SSE	NONE	NONE	NONE	NA		
S	**4.67**	NONE	NONE	Resident	2.29E-01	**RESIDENT**
SSW	NONE	NONE	NONE	NA		
SW	1.39	NONE	NONE	Resident	1.41E-01	
WSW	0.75	NONE	NONE	Resident	1.08E-01	
W	0.70	NONE	NONE	Resident	5.02E-02	
WNW	2.67	NONE	NONE	Resident	1.05E-02	
NW	0.93	NONE	NONE	Resident	3.71E-02	
NNW	1.30	**4.34**	NONE	Resident Garden	2.91E-02 4.70E-02	**GARDEN**

COMMENTS:

Dose calculations were performed using the GASPAR code and 2008 meteorological data and source term. Dose reported for each location is the total for all three PVNGS Units and is the highest individual dose identified (organ, bone, total body, or skin).

11. Summary and Conclusions

The conclusions are based on a review of the radio assay results and environmental gamma radiation measurements for the 2009 calendar year. Where possible, the data were compared to pre-operational sample data.

All sample results for 2009 are presented in Tables 8.1-8.11 and do not include observations of naturally occurring radionuclides, with the exception of gross beta in air and gross beta in drinking water. Table 11.1 summarizes the ODCM required samples and is in the format required by the NRC BTP on Environmental Monitoring.

I-131 concentrations identified on occasion in the Evaporation Ponds, WRF Influent, WRF Centrifuge sludge, and Reservoirs is the result of offsite sources and appears in the effluent sewage from Phoenix. The levels of I-131 detected in these locations are consistent with levels identified in previous years.

Tritium concentrations identified in surface water onsite have been attributed to PVNGS permitted gaseous effluent releases and secondary plant releases. These concentrations are consistent with historical values.

Environmental radiation levels are consistent with measurements reported in previous Pre-operational and Operational Radiological Environmental annual reports, References 1 and 2.

The only measurable impact on the environment in 2009 was the low level tritium discovered in subsurface water onsite in the Radiological Controlled Area in 2006. See Section 2.4 for specific information.

TABLE 11.1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM ANNUAL SUMMARY

Palo Verde Nuclear Generating Station
Maricopa County, Arizona

Docket Nos. STN 50-528/529/530
Calendar Year 2009

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD) (from Table 6.1)	All Indicator Locations Mean (f)[a] Range	Location with Highest Annual Mean: Name Distance and Direction	Location with Highest Annual Mean: Mean (f)[a] Range	Control Locations Mean (f)[a] Range	Number of Nonroutine Reported Measurements
Direct Radiation (mrem/std. qtr.)	TLD – 199	NA	23.9 (187/187) 18.2 – 31.0	Site #35 8 miles 330°	29.8 (4/4) 29.2 – 31.0	22.8 (8/8) 19.4 - 26.4	0
Air Particulates (pCi/m^3)	Gross Beta – 518	0.010	0.035 (466/466) 0.013 - 0.080	Site #7A 3 miles 125°	0.036 (51/51) 0.014 - 0.075	0.038 (52/52) 0.015 - 0.081	0
	Gamma Spec. Composite - 40						
	Cs-134	0.05	<LLD	NA	<LLD	<LLD	0
	Cs-137	0.06	<LLD	NA	<LLD	<LLD	0
Air Radioiodine (pCi/m^3)	Gamma Spec. - 518 I-131	0.07	<LLD	NA	<LLD	<LLD	0
Broadleaf Vegetation (pCi/Kg-wet)	Gamma Spec. - 12						
	I-131	60	<LLD	NA	<LLD	<LLD	0
	Cs-134	60	<LLD	NA	<LLD	<LLD	0
	Cs-137	80	<LLD	NA	<LLD	<LLD	0
Ground Water (pCi/liter)	H-3 – 8	2000	<LLD	NA	<LLD	NA	0
	Gamma Spec. - 8						
	Mn-54	15	<LLD	NA	<LLD	NA	0
	Fe-59	30	<LLD	NA	<LLD	NA	0
	Co-58	15	<LLD	NA	<LLD	NA	0
	Co-60	15	<LLD	NA	<LLD	NA	0
	Zn-65	30	<LLD	NA	<LLD	NA	0
	Zr-95	30	<LLD	NA	<LLD	NA	0

TABLE 11.1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM ANNUAL SUMMARY

Palo Verde Nuclear Generating Station
Maricopa County, Arizona

Docket Nos. STN 50-528/529/530
Calendar Year 2009

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD) (from Table 6.1)	All Indicator Locations Mean (f)[a] Range	Location with Highest Annual Mean: Name Distance and Direction	Location with Highest Annual Mean: Mean (f)[a] Range	Control Locations Mean (f)[a] Range	Number of Nonroutine Reported Measurements
Ground Water (pCi/liter) -continued-	Nb-95	15	<LLD	NA	<LLD	NA	0
	I-131	15	<LLD	NA	<LLD	NA	0
	Cs-134	15	<LLD	NA	<LLD	NA	0
	Cs-137	18	<LLD	NA	<LLD	NA	0
	Ba-140	60	<LLD	NA	<LLD	NA	0
	La-140	15	<LLD	NA	<LLD	NA	0
Drinking Water (pCi/liter)	Gross Beta – 46	4.0	3.7 (23/46) 2.4 – 5.5	Site #48 1 mile 236°	4.0 (3/12) 3.6 – 4.8	NA	0
	H-3 – 16	2000	<LLD	NA	<LLD	NA	0
	Gamma Spec. – 46						
	Mn-54	15	<LLD	NA	<LLD	NA	0
	Fe-59	30	<LLD	NA	<LLD	NA	0
	Co-58	15	<LLD	NA	<LLD	NA	0
	Co-60	15	<LLD	NA	<LLD	NA	0
	Zn-65	30	<LLD	NA	<LLD	NA	0
	Zr-95	30	<LLD	NA	<LLD	NA	0
	Nb-95	15	<LLD	NA	<LLD	NA	0
	I-131	15	<LLD	NA	<LLD	NA	0
	Cs-134	15	<LLD	NA	<LLD	NA	0
	Cs-137	18	<LLD	NA	<LLD	NA	0
	Ba-140	60	<LLD	NA	<LLD	NA	0
	La-140	15	<LLD	NA	<LLD	NA	0

TABLE 11.1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM ANNUAL SUMMARY

Palo Verde Nuclear Generating Station
Maricopa County, Arizona

Docket Nos. STN 50-528/529/530
Calendar Year 2009

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD) (from Table 6.1)	All Indicator Locations Mean (f)[a] Range	Location with Highest Annual Mean: Name Distance and Direction	Location with Highest Annual Mean: Mean (f)[a] Range	Control Locations Mean (f)[a] Range	Number of Nonroutine Reported Measurements
	Gamma Spec. – 8						
	I-131	1.0	<LLD	NA	<LLD	<LLD	0
Milk	Cs-134	15	<LLD	NA	<LLD	<LLD	0
(pCi/liter)	Cs-137	18	<LLD	NA	<LLD	<LLD	0
	Ba-140	60	<LLD	NA	<LLD	<LLD	0
	La-140	15	<LLD	NA	<LLD	<LLD	0
	Gamma Spec. - 18						
	Mn-54	15	<LLD	NA	<LLD	NA	0
	Fe-59	30	<LLD	NA	<LLD	NA	0
	Co-58	15	<LLD	NA	<LLD	NA	0
	Co-60	15	<LLD	NA	<LLD	NA	0
	Zn-65	30	<LLD	NA	<LLD	NA	0
	Zr-95	30	<LLD	NA	<LLD	NA	0
	Nb-95	15	<LLD	NA	<LLD	NA	0
Surface Water (pCi/liter)	I-131	15	20 (6/18) 13 - 32	Site #61 Onsite 67°	25 (2/4) 17 - 32	NA	0
	Cs-134	15	<LLD	NA	<LLD	NA	0
	Cs-137	18	<LLD	NA	<LLD	NA	0
	Ba-140	60	<LLD	NA	<LLD	NA	0
	La-140	15	<LLD	NA	<LLD	NA	0

TABLE 11.1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM ANNUAL SUMMARY

Palo Verde Nuclear Generating Station
Maricopa County, Arizona

Docket Nos. STN 50-528/529/530
Calendar Year 2009

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD) (from Table 6.1)	All Indicator Locations Mean (f)[a] Range	Location with Highest Annual Mean: Name Distance and Direction	Location with Highest Annual Mean: Mean (f)[a] Range	Control Locations Mean (f)[a] Range	Number of Nonroutine Reported Measurements
Surface Water (pCi/liter) -continued-	H-3 - 18	3000	841 (10/18) 628 - 1224	Site #59 Onsite 180°	926 (4/4) 697 - 1224	NA	0

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

NOTE: Miscellaneous samples that are not listed on Tables 2.1 and 9.1 (not ODCM required) are not included on this table.

12. References

1. Pre-Operational Radiological Monitoring Program, Summary Report 1979-1985
2. 1985-2008 Annual Radiological Environmental Operating Reports, Palo Verde Nuclear Generating Station
3. Palo Verde Nuclear Generating Station Technical Specifications and Technical Reference Manual
4. Offsite Dose Calculation Manual, PVNGS Units 1, 2, and 3
5. Regulatory Guide 4.1, Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants
6. Regulatory Guide 4.8, Environmental Technical Specifications for Nuclear Power Plants
7. NRC Radiological Assessment Branch Technical Position on Environmental Monitoring, Revision 1, November 1979 (Incorporated into NUREG-1301)
8. NEI 07-07, Nuclear Energy Institute, Industry Ground Water Protection Initiative – Final Guidance Document, August 2007