APS

A subsidiary of Pinnacle West Capital Corporation

Palo Verde Nuclear
Generating Station

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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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 2006

In accordance with PVNGS Technical Specification (TS) 5.6.2, enclosed please find the Annual Radiological Environmental Operating Report for 2006.

No commitments are being made to the NRC in this letter. If you have any questions, please contact Daniel G. Marks at (623) 393-6492.

Sincerely,

Thomas N. Weber

TNW/DGM/CJJ/gat

Enclosure

cc: B. S. Mallett
M. T. Markley
G. G. Warnick
A. V. Godwin

IE25

PALO VERDE

NUCLEAR GENERATING STATION

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT 2006

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

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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 2006, the following categories of samples were collected by APS:

- Broad leaf vegetation
- Groundwater
- Drinking water
- Surface water
- Airborne particulate and radioiodine
- Goat 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 Reservoir, two (2) 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 Unit 3. A significant investigation was initiated to determine the source of the water, the extent of the condition, and corrective actions to protect groundwater. See Section 2.4 for a detailed description of this event.

(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.

This report contains the measurements and findings for 2006. 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 critical pathways of radio-effluent 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. 2006 PVNGS Radiological Environmental Monitoring Program

The assessment program consists of routine measurements of background gamma radiation and of radionuclide concentrations in media such as air, groundwater, 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.

Background gamma radiation measurements were performed by APS using TLDs at forty-nine (49) locations near PVNGS.

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 2006

- Site #46 (drinking water) was changed from McArthur (NW9) to Wirth (NNW8) in September as the property was sold and access to the sample was no longer available

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 2006, there were three (3) deviations/abnormal events with regard to the monitoring program. Refer to Table 2.3 for more detail and any corrective actions taken.

- Monthly goat milk samples were obtained as required in May. During the sample analysis, the equipment shutdown. The samples could not be re-analyzed due to the short half-life of I-131.
- Air samples were invalidated from Site #21 for gross beta and radioiodine the week of 7/3-7/11.
- One interlaboratory crosscheck sample, gross beta in water, failed the acceptance criteria.

2.4. Significant Investigation Regarding Groundwater Protection

NOTE: Although not part of the REMP, this information is being provided due to the identification of measurable licensed radioactive material in the onsite environs (within the Radiological Controlled Area) and heightened sensitivity to communicate the potential to affect groundwater.

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). The seal and wall below the seal were observed to be wet, with a water puddle on the pipe chase floor. Unit 2 placed the 'B' Spray Pond pump into service for a scheduled pump run on February 16. Personnel observed that water accumulation at the penetration increased while the pump was operating. In response to the observed in-leakage, station management decided to excavate the Unit 2 SP 'B' supply and return lines immediately west of the Essential Pipe Density Tunnel to inspect for leakage. Maintenance excavated lines 2PSPBL030 and 2PSPBL025 to look for leaks, but none were found. Additionally, the penetration seal around SPBL030 was removed to look for leaks, none were found, and the area was restored.

A subsequent inspection in the Unit 3 Essential Pipe Density Tunnel identified similar leakage at the penetration for the SP 'A' return line (3PSPAL079) and SP 'B' return line (3PSPBL025) penetration seals. The seals for the return line penetrations were observed to be dripping while the SPA/B pumps were in operation. The wall below the SP 'A' supply line (3PSPAL068) and SP 'B' supply line (3PSPBL030) penetration seals showed dampness, but no visible water drops. Maintenance excavated the return line and the supply line to the 4'-4" top of pipe level. The excavation revealed no visible leaks and Maintenance restored the area.

Process piping in Unit 3 associated with the Charging system (CH), Liquid Radwaste system (LR) and Fire Protection system (FP) were partially excavated in the area of the pipe chase penetrations. The elimination of SP system piping leaks left these pipes suspect. No leaks were identified by excavation.

In addition to the major excavation detailed above, a test hole, approximately 13 feet deep, was dug in the radiological controlled area yard to determine the extent of condition. Water was subsequently discovered in the test hole and a sample was obtained in order to characterize the water and identify its source. Initial results from the unit laboratory (March 1, 2006 sample) indicated the presence of tritium. A confirmatory sample was collected and analyzed by the State certified laboratory at Palo Verde that confirmed the presence of tritium at a concentration of approximately 7.14E-05 µCi/ml. The Aquifer Protection Permit, Aquifer Quality Limit for tritium is 2.00E-05 µCi/ml. The Palo Verde Environmental Control department notified the Arizona Department of Environmental Quality (ADEQ) of the possibility of a discharge of non-hazardous material that has the potential to cause groundwater limits to be exceeded. The station also notified the Nuclear Regulatory Commission pursuant to 10CFR50.72 (b) (2) (xi); specifically of a situation related to the protection of the environment, for which a notification to another government agency has been or will be made. Public meetings with local residents were held to inform the public and answer concerns.

The direct root cause of the elevated levels of tritium in subsurface water samples from Unit 3 cannot be identified. The sources of the tritium come from washout and localized small volume spills. There is no evidence at this time that supports the presence of a system leak.

The washout described in the preceding paragraph is historical. It is due to past operations of the Boric Acid Concentrator (BAC) during rain and wash down of roofs or washout from rain during times when tritium condensation from the ventilation system was present.

Atmospheric modeling, conducted as part of the investigation, does not support that rain washout of tritium is the source of the subsurface tritiated water accumulation at identified concentrations, with current operating conditions (not allowing BAC operations during periods of rain).

Contributing causes of the condition in Unit 3 are the composition of the backfill and above ground grading and paving of the Unit 3 RCA yard.

There is no indication that tritiated water has reached any aquifer. No Technical Specification effluent limits have been exceeded nor have any Offsite Dose Calculation Manual (ODCM) effluent limits been exceeded. Federal effluent limits have not been exceeded. Palo Verde has not identified any increased health or safety risk to the public or onsite personnel due to this condition. The condition report is classified as significant by management direction due to recent industry events and public trust issues.

Corrective actions are ongoing and include the installation of several monitoring wells in the RCA at all three Units. These monitoring wells will be routinely sampled for radiological analyses and results will be reported in the PVNGS Annual Radioactive Effluent Release Report (ARERR). This reporting protocol was agreed upon by industry leaders via the NEI Industry Ground Water Protection Voluntary Communication Protocol Interim Guidance Document (June 2006) for non-REMP well samples (with additional direction via a position paper developed during the industry RETS-REMP workshop).

Table 2.2 SAMPLE COLLECTION SCHEDULE

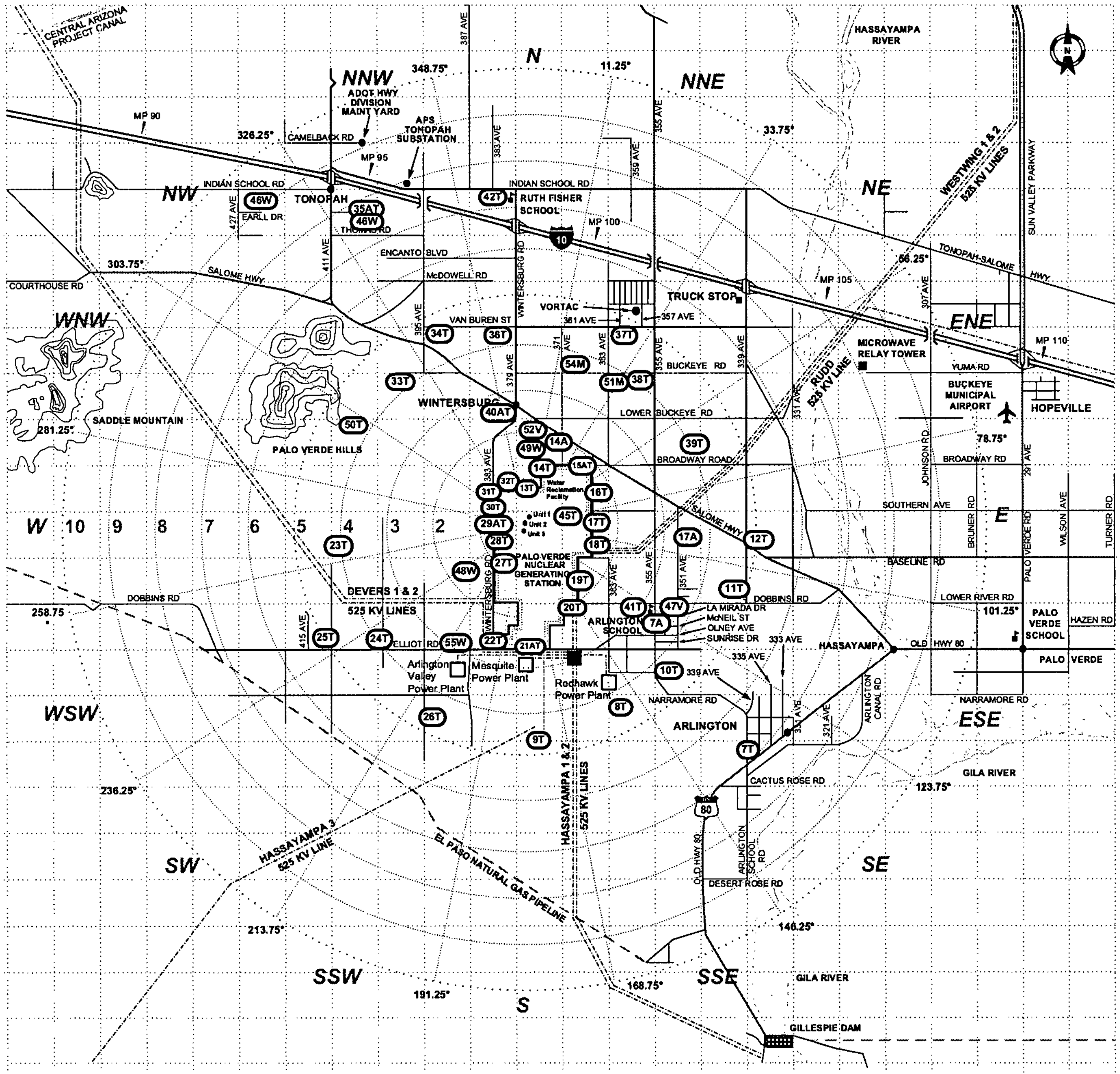
SAMPLE SITE #	*AIR PARTICULATE*	*MILK*	*AIRBORNE RADIOIODINE*	*VEGETATION*	*GROUND WATER*	*DRINKING WATER*	*SURFACE WATER*
4	W		W				
6A	W		W				
7A	W		W				
14A	W		W				
15	W		W				
17A	W		W				
21	W		W				
29	W		W				
35	W		W				
40	W		W				
46						W	
47				M/AA			
48						W	
49						W	
51		M/AA	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

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

TABLE 2.3 SUMMARIES OF REMP DEVIATIONS/ABNORMAL EVENTS

Deviation/Abnormal Event	Actions taken
1. Monthly goat milk samples were obtained as required in May. During the sample analysis, the equipment shutdown. The samples could not be re-analyzed due to the short half-life of I-131.	1. This event was documented on corrective action document CRDR 2894572 due to the missed sample analysis frequency requirements of the ODCM. The cause of the equipment shutdown was the elevated temperature of the countroom due to the building A/C unit failure. The A/C unit was repaired to correct the condition and no further actions were required.
2. Air sample results from Site #21 for gross beta and radioiodine were invalidated due to pump inoperability the week of 7-11-06.	2. The air sample pump was not running when the technician arrived at the sample location, although the ETM had power. The actual sample volume could not be determined. Equipment was replaced and subsequent samples were valid. No additional actions are necessary.
3. One interlaboratory crosscheck sample, gross beta in water, failed the acceptance criteria.	3. The crosscheck sample was re-analyzed and again failed the acceptance criteria. CRDR #2975606 was initiated, as part of the Corrective Action Program, due to the failure. Actions in progress include the purchase of a new calibration source and replacement of an EPROM. Corrective actions are not complete at this time.

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

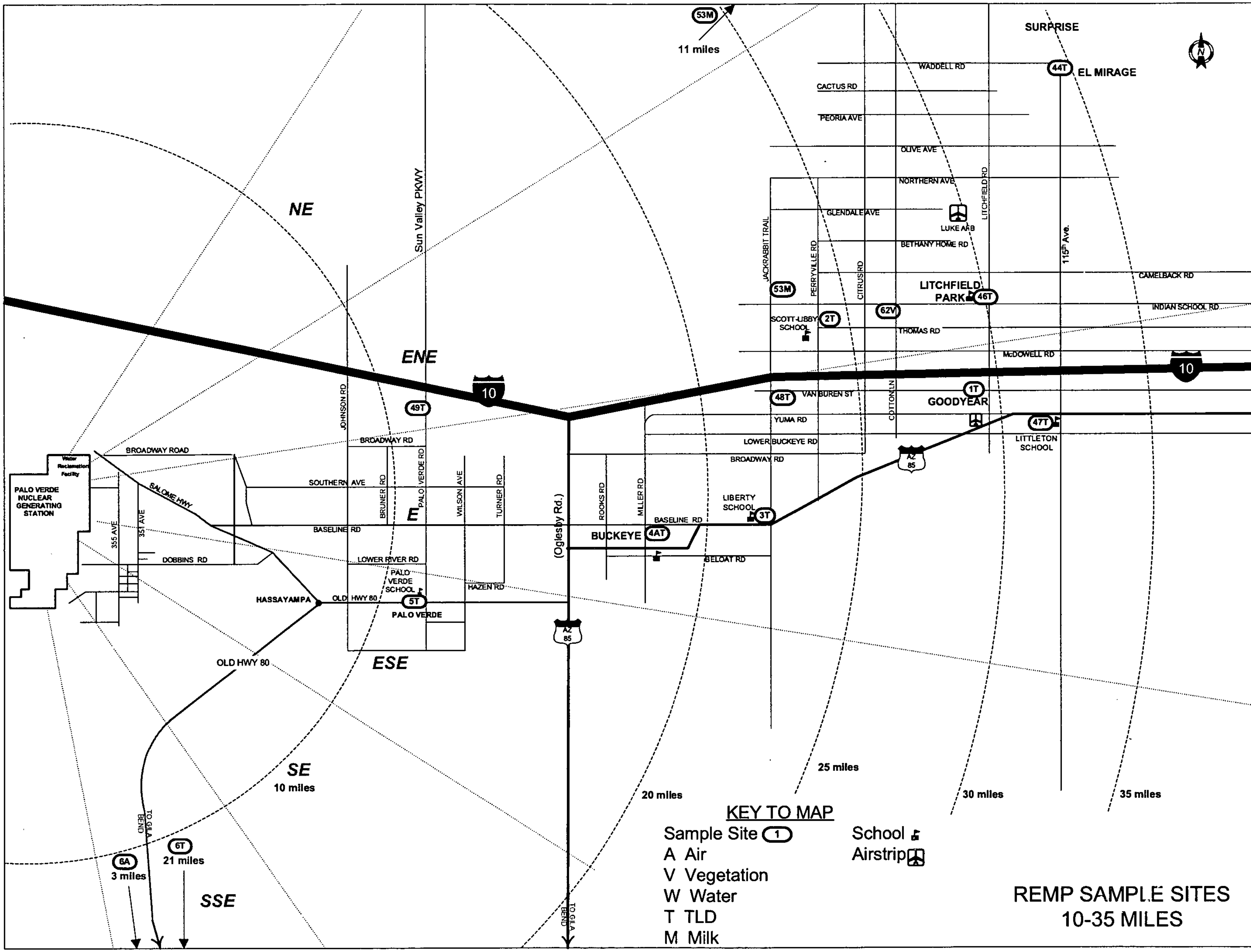

53M
11 miles
SURPRISE
WADDELL RD
44T
EL MIRAGE
CACTUS RD
PEORIA AVE
OLIVE AVE
NORTHERN AVE
GLENDALE AVE
LUKE AFB
LITCHFIELD RD
BETHANY HOME RD
115th Ave.
CAMELBACK RD
JACKRABBIT TRAIL
PERRYVILLE RD
CITRUS RD
53M
LITCHFIELD PARK
46T
INDIAN SCHOOL RD
62V
SCOTT-LIBBY SCHOOL
2T
THOMAS RD
MCDOWELL RD
NE
Sun Valley PKWY
ENE
10
1T
48T
VAN BUREN ST
GOODYEAR
COTTON LN
YUMA RD
47T
LITTLETON SCHOOL
49T
JOHNSON RD
BROADWAY RD
LOWER BUCKEYE RD
BROADWAY RD
AZ 85
BROADWAY ROAD
Water Reclamation Facility
PALO VERDE NUCLEAR GENERATING STATION
SALOME HWY
SOUTHERN AVE
BRUNER RD
PALO VERDE RD
WILSON AVE
TURNER RD
(Oglesby Rd.)
ROOKS RD
MILLER RD
LIBERTY SCHOOL
3T
BASELINE RD
E
BASELINE RD
BUCKEYE
4AT
355 AVE
351 AVE
DOBBINS RD
LOWER RIVER RD
BELOAT RD
PALO VERDE SCHOOL
HAZEN RD
HASSAYAMPA
OLD HWY 80
5T
PALO VERDE
AZ 85
OLD HWY 80
ESE
25 miles
SE
10 miles
20 miles
30 miles
35 miles
TO GILA BEND
6T
21 miles
6A
3 miles
SSE
TO GILA BEND
KEY TO MAP
Sample Site 1
A Air
V Vegetation
W Water
T TLD
M Milk
School
Airstrip
REMP SAMPLE SITES
10-35 MILES

FIGURE 2.2

3. Sample Collection Program

APS personnel using PVNGS procedures collected all samples.

3.1. Water

Weekly samples were collected from the Reservoir, Evaporation Pond #1, Evaporation Pond #2, and four (4) residence wells. Samples were collected in one-gallon containers and 500 ml glass bottles. One liter from each weekly one-gallon sample was added to a monthly composite, which is preserved with nitric acid (HNO_3). The composite samples were then analyzed for gamma emitting radionuclides. Residence wells were also analyzed for gross beta activity. Weekly grab samples in glass bottles were composited quarterly and analyzed for tritium.

Quarterly grab samples were collected from onsite wells 34abb and 27ddc. 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 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. Samples were collected using 1 liter containers.

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

Bottom sediment/sludge samples were obtained from Evaporation Pond #1 and Evaporation Pond #2 and analyzed for gamma emitting radionuclides.

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.

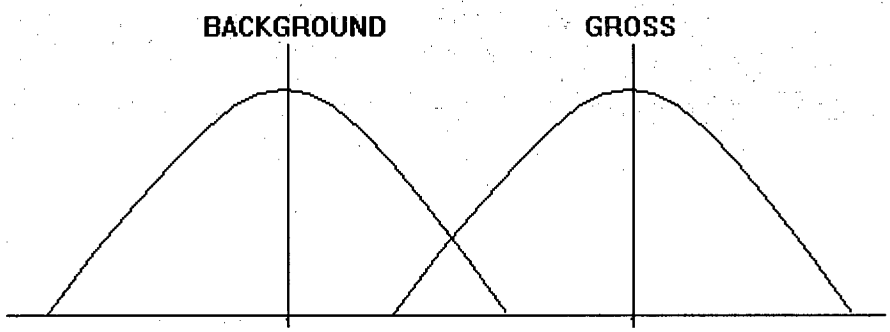
Occasionally, the PVNGS ODCM *a priori* LLDs may not be achieved as a result of:

- 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 (calendar) 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	3		0.003	
H-3	273			
Mn-54	12			
Fe-59	19			
Co-58	11			
Co-60	12			
Zn-65	26			
Zr-95	17			
Nb-95	11			
I-131	8 [a]	1	0.05	50
Cs-134	10	1	0.02 [b]	55
Cs-137	13	1	0.02 [b]	60
Ba-140	38	3		
La-140	12	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 2006, 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.

One crosscheck result in 2006, gross beta in water, did not pass the established acceptance criteria. This failure was documented in the PVNGS Corrective Action Program via CRDR #2975606. See Table 2.3 for additional information.

TABLE 7.1 INTERLABORATORY COMPARISON RESULTS

Sample Type	Analysis Type	Nuclide	Known Value	PVNGS Value	1 sigma Error	Resolution *	Ratio	Accept/Reject
Water	Mixed Gamma	I-131	75.7	82	11	7	1.08	Accept
	E5062-111	Ce-141	57	66	9	7	1.16	Accept
		Cr-51	68.1	58	33	2	0.85	Accept
		Cs-134	98.3	86	11	8	0.87	Accept
		Cs-137	94.8	97	12	8	1.02	Accept
		Co-58	52.3	53	8	7	1.01	Accept
		Mn-54	107	110	14	8	1.03	Accept
		Fe-59	37.6	31	11	3	0.82	Accept
		Zn-65	132	139	19	7	1.05	Accept
		Co-60	103	106	12	9	1.03	Accept
	Tritium	H-3	5960	5130	233	22	0.86	Accept
	E5060-111							
	Gross Beta	gbeta	198	225	5.5	41	1.14	Accept
	E5061-111							
Air	Gross Beta	gbeta	65.1	78.4	1.5	52	1.20	Accept
	E5063-111							
	Iodine Cart	I-131	68.1	67	8	8	0.98	Accept
	E5064-111							
	Mixed Gamma	Ce-141	59.7	72	8	9	1.21	Accept
	E5065-111	Cr-51	71.4	81	19	4	1.13	Accept
		Cs-134	103	84	10	8	0.82	Accept
		Cs-137	99.4	111	13	9	1.12	Accept
		Co-58	54.9	63	9	7	1.15	Accept
		Mn-54	113	129	17	8	1.14	Accept
		Fe-59	39.5	48	8	6	1.22	Accept
		Zn-65	139	174	21	8	1.25	Accept
		Co-60	108	116	13	9	1.07	Accept
Milk	Mixed Gamma	I-131	54.6	50	3	17	0.92	Accept
	E5236-111	Ce-141	53.8	54	3	18	1.00	Accept
		Cr-51	77.2	80	9	9	1.04	Accept
		Cs-134	31.0	28	2	14	0.90	Accept
		Cs-137	50.3	51	3	17	1.01	Accept
		Co-58	16.6	16	2	8	0.96	Accept
		Mn-54	23.2	26	2	13	1.12	Accept
		Fe-59	15.2	13	2	7	0.86	Accept
		Zn-65	34.1	38	3	13	1.11	Accept
		Co-60	59.4	59	3	20	0.99	Accept

TABLE 7.1 INTERLABORATORY COMPARISON RESULTS

Sample Type	Analysis Type	Nuclide	Known Value	PVNGS Value	1 sigma Error	Resolution *	Ratio	Accept/Reject
Water	Mixed Gamma	I-131	70.2	75	7	11	1.07	Accept
	E5230-111	Ce-141	286	283	15	19	0.99	Accept
		Cr-51	421	397	38	10	0.94	Accept
		Cs-134	143	132	8	17	0.92	Accept
		Cs-137	230	229	13	18	1.0	Accept
		Co-58	81.4	84	7	12	1.03	Accept
		Mn-54	108	111	14	8	1.03	Accept
		Fe-59	77.4	90	11	8	1.16	Accept
		Zn-65	159	174	14	12	1.09	Accept
		Co-60	273	282	15	19	1.03	Accept
	Tritium	H-3	1.48E04	1.20E04	154	78	0.81	Accept
	E5234-111							
	Gross Beta	**gbeta**	**249**	**340**	**3.5**	**97**	**1.37**	**REJECT**
	E5229-111	**gbeta**	**249**	**321**	**3.5**	**92**	**1.29**	**REJECT**
Air	Gross Beta	gbeta	86.6	111	2.4	46	1.28	Accept
	E5231-111							
	Iodine Cart	I-131	86.2	89	7	13	1.03	Accept
	E5232-111							
	Mixed Gamma	Ce-141	226	224	11	20	1.09	Accept
	E5233-111	Cr-51	332	330	29	11	1.08	Accept
		Cs-134	113	103	7	15	0.85	Accept
		Cs-137	182	188	13	15	1.13	Accept
		Co-58	64.3	70	6	12	1.10	Accept
		Mn-54	85.1	97	7	14	1.19	Accept
		Fe-59	61.1	73	8	9	1.28	Accept
		Zn-65	126	147	12	12	1.18	Accept
		Co-60	215	224	12	19	1.10	Accept

* calculated from PVNGS value/1 sigma error value

Acceptance Criteria [1]

Resolution	Ratio
<4	
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

[1] 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 2006 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 2006 was the low level tritium discovered in subsurface water onsite in the RCA. 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 0.010 to 0.070 pCi/m^3. The associated counting error ranged from 0.001 to 0.004 pCi/m^3. Mean quarterly activity is 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 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 6.2 pCi/liter (Gavette residence, April composite).

8.6. Groundwater

Groundwater 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 Reservoir and Evaporation Ponds were analyzed for tritium and gamma emitting radionuclides. The Reservoir contains processed sewage water from the City of Phoenix and is approximately 80 acres in size. A 45 acre Reservoir was constructed to allow for re-lining of the 80 acre Reservoir. The two Evaporation Ponds receive mostly circulating water from main turbine condenser cooling and are about 250 acres each. Results are presented in Table 8.10. I-131 was observed in Evaporation Pond # 2 in one (1) monthly composite sample (15 pCi/liter) and six (6) of the Reservoir monthly composite samples (7 to 23 pCi/liter). I-131 is a result of radiopharmaceutical I-131 in the Phoenix sewage effluent.

Tritium was routinely observed in Evaporation Ponds 1 and 2. The highest concentration in Evaporation Pond #1 was 2142 pCi/liter and the highest concentration in Evaporation Pond #2 was also 2142 pCi/liter. Tritium was not identified in the

Reservoir. The tritium identified in the Evaporation Ponds has been attributed to plant gaseous effluent releases and secondary plant liquid releases.

WRF Influent (Phoenix sewage effluent) 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 96 pCi/liter (week of Dec. 19th). 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. Neither gamma emitting radionuclides nor tritium were detected in any of the five (5) samples taken in 2006.

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 in the WRF waste centrifuge sludge is consistent with historical values and, as previously discussed, is due to radiopharmaceuticals in the WRF influent. I-131 was present in all fifty-one (51) samples ranging from 351 to 2460 pCi/kg.

In-111 was also identified in the sludge in twelve (12) samples. The highest concentration was 181 pCi/kg. It was previously established that In-111 is in use in the Phoenix area as a radiopharmaceutical.

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

8.8.2. Evaporation Ponds #1 and #2 sediment

A set of ten (10) Evaporation Pond sediment samples indicated all gamma emitting radionuclides to be <MDA. Sample results can be found in Table 8.11.

8.8.3. Cooling Tower sludge

Sludge originating from the Unit 1 and Unit 3 Cooling Towers and/or Circulating Water canals was disposed of in the WRF sludge landfill during 2006. 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	(control) Site 6A*	Site 7A	Site 14A*	Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*	Mean	RSD (%)
1	27-Dec-05	3-Jan-06	0.036	0.031	0.030	0.027	0.028	0.030	0.029	0.030	0.028	0.029	0.030	8.3
2	3-Jan-06	10-Jan-06	0.031	0.029	0.026	0.026	0.024	0.023	0.023	0.026	0.024	0.025	0.026	10.1
3	10-Jan-06	17-Jan-06	0.039	0.039	0.035	0.034	0.033	0.034	0.036	0.036	0.031	0.034	0.035	7.2
4	17-Jan-06	24-Jan-06	0.024	0.026	0.022	0.026	0.023	0.024	0.020	0.021	0.019	0.018	0.022	12.5
5	24-Jan-06	31-Jan-06	0.043	0.045	0.044	0.042	0.044	0.040	0.042	0.043	0.039	0.043	0.043	4.3
6	31-Jan-06	7-Feb-06	0.030	0.034	0.029	0.027	0.030	0.031	0.027	0.028	0.027	0.023	0.029	10.3
7	7-Feb-06	14-Feb-06	0.033	0.039	0.034	0.031	0.033	0.032	0.029	0.033	0.033	0.031	0.033	8.0
8	14-Feb-06	21-Feb-06	0.025	0.024	0.023	0.022	0.022	0.023	0.020	0.023	0.020	0.021	0.022	7.3
9	21-Feb-06	28-Feb-06	0.047	0.049	0.048	0.043	0.045	0.041	0.045	0.042	0.043	0.038	0.044	7.7
10	28-Feb-06	7-Mar-06	0.027	0.029	0.025	0.024	0.024	0.026	0.025	0.027	0.025	0.024	0.026	6.4
11	7-Mar-06	14-Mar-06	0.016	0.012	0.012	0.012	0.011	0.012	0.010	0.011	0.014	0.011	0.012	14.3
12	14-Mar-06	21-Mar-06	0.021	0.019	0.019	0.020	0.019	0.019	0.019	0.020	0.018	0.017	0.019	5.8
13	21-Mar-06	28-Mar-06	0.024	0.027	0.027	0.025	0.026	0.025	0.026	0.028	0.024	0.025	0.026	5.2
Mean			0.030	0.031	0.029	0.028	0.028	0.028	0.027	0.028	0.027	0.026	0.028	5.6

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	28-Mar-06	4-Apr-06	0.018	0.018	0.019	0.019	0.018	0.019	0.018	0.017	0.019	0.017	0.018	4.3
15	4-Apr-06	10-Apr-06	0.017	0.019	0.018	0.017	0.018	0.016	0.018	0.017	0.020	0.016	0.018	7.2
16	10-Apr-06	18-Apr-06	0.022	0.022	0.021	0.021	0.021	0.021	0.019	0.020	0.021	0.019	0.021	5.1
17	18-Apr-06	25-Apr-06	0.028	0.029	0.028	0.025	0.027	0.025	0.025	0.027	0.027	0.026	0.027	5.3
18	25-Apr-06	2-May-06	0.027	0.026	0.026	0.026	0.026	0.028	0.026	0.027	0.031	0.025	0.027	6.3
19	2-May-06	9-May-06	0.033	0.030	0.033	0.030	0.035	0.035	0.029	0.034	0.036	0.035	0.033	7.6
20	9-May-06	16-May-06	0.047	0.046	0.048	0.043	0.048	0.047	0.043	0.046	0.046	0.045	0.046	3.9
21	16-May-06	23-May-06	0.034	0.028	0.034	0.031	0.034	0.032	0.028	0.033	0.034	0.030	0.032	7.7
22	23-May-06	30-May-06	0.028	0.024	0.025	0.023	0.025	0.028	0.024	0.023	0.025	0.026	0.025	7.1
23	30-May-06	5-Jun-06	0.041	0.039	0.039	0.037	0.041	0.042	0.037	0.041	0.039	0.035	0.039	5.7
24	5-Jun-06	13-Jun-06	0.035	0.042	0.038	0.037	0.036	0.036	0.035	0.038	0.037	0.040	0.037	5.9
25	13-Jun-06	21-Jun-06	0.040	0.038	0.038	0.034	0.038	0.036	0.032	0.039	0.035	0.033	0.036	7.5
26	21-Jun-06	27-Jun-06	0.039	0.039	0.039	0.036	0.038	0.037	0.036	0.036	0.038	0.032	0.037	5.8
Mean			0.031	0.031	0.031	0.029	0.031	0.031	0.028	0.031	0.031	0.029	0.030	3.6

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	(control) Site 6A*	Site 7A	Site 14A*	Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*	Mean	RSD (%)
27	27-Jun-06	3-Jul-06	0.042	0.044	0.040	0.039	0.039	0.043	0.032	0.040	0.041	0.036	0.040	8.8
28	3-Jul-06	11-Jul-06	0.036	0.040	0.036	0.036	0.035	0.037	Invalid[a]	0.037	0.036	0.038	0.037	4.0
29	11-Jul-06	18-Jul-06	0.037	0.036	0.036	0.034	0.036	0.035	0.035	0.035	0.034	0.034	0.035	2.9
30	18-Jul-06	25-Jul-06	0.037	0.041	0.039	0.037	0.038	0.039	0.038	0.040	0.038	0.036	0.038	3.9
31	25-Jul-06	1-Aug-06	0.027	0.030	0.027	0.027	0.029	0.029	0.026	0.028	0.027	0.026	0.028	4.9
32	1-Aug-06	8-Aug-06	0.035	0.037	0.034	0.033	0.034	0.033	0.032	0.037	0.033	0.034	0.034	4.9
33	8-Aug-06	15-Aug-06	0.030	0.028	0.027	0.028	0.028	0.028	0.025	0.029	0.028	0.026	0.028	5.1
34	15-Aug-06	22-Aug-06	0.028	0.029	0.028	0.026	0.028	0.026	0.026	0.029	0.029	0.026	0.028	4.9
35	22-Aug-06	29-Aug-06	0.033	0.033	0.036	0.033	0.035	0.036	0.034	0.032	0.033	0.032	0.034	4.4
36	29-Aug-06	5-Sep-06	0.029	0.029	0.029	0.026	0.026	0.028	0.027	0.028	0.030	0.026	0.028	5.3
37	5-Sep-06	12-Sep-06	0.024	0.027	0.025	0.023	0.025	0.025	0.025	0.026	0.026	0.026	0.025	4.5
38	12-Sep-06	19-Sep-06	0.034	0.038	0.035	0.031	0.034	0.034	0.032	0.036	0.035	0.034	0.034	5.7
39	19-Sep-06	26-Sep-06	0.031	0.032	0.035	0.031	0.035	0.034	0.032	0.035	0.033	0.030	0.033	5.7
Mean			0.033	0.034	0.033	0.031	0.032	0.033	0.030	0.033	0.033	0.031	0.032	3.6

4th Quarter

Week #	START DATE	STOP DATE	Site 4	(control) Site 6A*	Site 7A	Site 14A*	Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*	Mean	RSD (%)
40	29-Sep-06	3-Oct-06	0.040	0.045	0.041	0.038	0.038	0.040	0.035	0.039	0.036	0.036	0.039	7.6
41	3-Oct-06	10-Oct-06	0.034	0.032	0.030	0.028	0.031	0.031	0.031	0.031	0.031	0.027	0.031	6.4
42	10-Oct-06	17-Oct-06	0.031	0.034	0.035	0.034	0.034	0.032	0.031	0.033	0.035	0.032	0.033	4.6
43	17-Oct-06	24-Oct-06	0.035	0.037	0.038	0.033	0.037	0.035	0.034	0.035	0.033	0.034	0.035	4.9
44	24-Oct-06	31-Oct-06	0.034	0.038	0.038	0.034	0.035	0.040	0.033	0.039	0.038	0.036	0.037	6.6
45	31-Oct-06	7-Nov-06	0.052	0.060	0.054	0.049	0.054	0.053	0.056	0.059	0.055	0.052	0.054	6.1
46	7-Nov-06	14-Nov-06	0.043	0.045	0.042	0.040	0.041	0.039	0.037	0.041	0.043	0.036	0.041	6.9
47	14-Nov-06	21-Nov-06	0.047	0.047	0.044	0.039	0.042	0.041	0.041	0.045	0.039	0.041	0.043	7.0
48	21-Nov-06	28-Nov-06	0.065	0.074	0.070	0.059	0.065	0.065	0.063	0.070	0.067	0.064	0.066	6.4
49	28-Nov-06	5-Dec-06	0.036	0.035	0.032	0.032	0.031	0.034	0.028	0.032	0.033	0.030	0.032	7.3
50	5-Dec-06	12-Dec-06	0.049	0.049	0.046	0.044	0.046	0.045	0.041	0.047	0.042	0.038	0.045	7.9
51	12-Dec-06	19-Dec-06	0.041	0.038	0.035	0.031	0.034	0.033	0.030	0.034	0.030	0.030	0.034	11.0
52	19-Dec-06	26-Dec-06	0.049	0.049	0.043	0.035	0.040	0.043	0.039	0.041	0.041	0.042	0.042	10.1
Mean			0.043	0.045	0.042	0.038	0.041	0.041	0.038	0.042	0.040	0.038	0.041	5.3
Annual Average			***0.034***	***0.035***	***0.034***	***0.032***	***0.033***	***0.033***	***0.031***	***0.034***	***0.033***	***0.031***	***0.033***	***4.2***

a Pump was off with power to the ETM. Unable to determine sample volume so sample was invalidated.

TABLE 8.3 GAMMA IN AIR FILTER COMPOSITES

ODCM required samples denoted by *
units are pCi/m^3

QUARTER ENDPOINT	NUCLIDE	Site 4	(control) Site 6A*	Site 7A	Site 14A*	Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*
28-Mar-06	Cs-134	<0.0024	<0.0024	<0.0018	<0.0023	<0.0023	<0.0037	<0.0021	<0.0034	<0.0026	<0.0029
	Cs-137	<0.0018	<0.0025	<0.0021	<0.0042	<0.0027	<0.0038	<0.0024	<0.0029	<0.0031	<0.0028
27-Jun-06	Cs-134	<0.0020	<0.0034	<0.0008	<0.0022	<0.0029	<0.0034	<0.0024	<0.0033	<0.0012	<0.0034
	Cs-137	<0.0023	<0.0038	<0.0021	<0.0018	<0.0047	<0.0045	<0.0026	<0.0036	<0.0029	<0.0047
26-Sep-06	Cs-134	<0.0017	<0.0039	<0.0023	<0.0018	<0.0033	<0.0022	<0.0036	<0.0019	<0.0038	<0.0019
	Cs-137	<0.0021	<0.0011	<0.0054	<0.0027	<0.0039	<0.0027	<0.0042	<0.0025	<0.0049	<0.0025
26-Dec-06	Cs-134	<0.0021	<0.0029	<0.0044	<0.0022	<0.0041	<0.0024	<0.0028	<0.0018	<0.0035	<0.0024
	Cs-137	<0.0026	<0.0038	<0.0043	<0.0023	<0.0033	<0.0026	<0.0028	<0.0034	<0.0052	<0.0027

TABLE 8.4 RADIOIODINE IN AIR 1st - 2nd QUARTER

RADIOIODINE IN AIR 1st - 2nd QUARTER

ODCM required samples denoted by *

units are pCi/m^3

1st Quarter

Week #	START DATE	STOP DATE	Site 4	(control) Site 6A*	Site 7A	Site 14A*	0.07 Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*
1	27-Dec-05	3-Jan-06	<0.029	<0.060	<0.068	<0.012	<0.031	<0.049	<0.031	<0.050	<0.037	<0.058
2	3-Jan-06	10-Jan-06	<0.041	<0.070	<0.058	<0.031	<0.046	<0.041	<0.059	<0.035	<0.047	<0.042
3	10-Jan-06	17-Jan-06	<0.032	<0.049	<0.036	<0.045	<0.041	<0.057	<0.028	<0.035	<0.041	<0.052
4	17-Jan-06	24-Jan-06	<0.043	<0.043	<0.064	<0.034	<0.055	<0.049	<0.042	<0.065	<0.045	<0.042
5	24-Jan-06	31-Jan-06	<0.043	<0.034	<0.066	<0.036	<0.060	<0.039	<0.069	<0.020	<0.051	<0.035
6	31-Jan-06	7-Feb-06	<0.035	<0.028	<0.042	<0.035	<0.054	<0.029	<0.012	<0.038	<0.069	<0.039
7	7-Feb-06	14-Feb-06	<0.053	<0.035	<0.020	<0.060	<0.033	<0.050	<0.033	<0.043	<0.032	<0.038
8	14-Feb-06	21-Feb-06	<0.034	<0.033	<0.032	<0.034	<0.033	<0.033	<0.042	<0.065	<0.035	<0.037
9	21-Feb-06	28-Feb-06	<0.043	<0.038	<0.040	<0.028	<0.038	<0.039	<0.070	<0.047	<0.040	<0.068
10	28-Feb-06	7-Mar-06	<0.039	<0.038	<0.032	<0.033	<0.027	<0.042	<0.027	<0.028	<0.040	<0.037
11	7-Mar-06	14-Mar-06	<0.038	<0.052	<0.054	<0.036	<0.066	<0.041	<0.054	<0.047	<0.047	<0.034
12	14-Mar-06	21-Mar-06	<0.031	<0.033	<0.036	<0.036	<0.031	<0.058	<0.046	<0.053	<0.036	<0.036
13	21-Mar-06	28-Mar-06	<0.036	<0.044	<0.050	<0.037	<0.035	<0.069	<0.032	<0.013	<0.039	<0.067

2nd Quarter

Week #	START DATE	STOP DATE	Site 4	(control) Site 6A*	Site 7A	Site 14A*	Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*
14	28-Mar-06	4-Apr-06	<0.033	<0.043	<0.049	<0.032	<0.059	<0.037	<0.059	<0.036	<0.034	<0.024
15	4-Apr-06	10-Apr-06	<0.048	<0.061	<0.055	<0.062	<0.052	<0.014	<0.055	<0.048	<0.049	<0.068
16	10-Apr-06	18-Apr-06	<0.028	<0.026	<0.033	<0.023	<0.029	<0.039	<0.029	<0.026	<0.036	<0.029
17	18-Apr-06	25-Apr-06	<0.056	<0.031	<0.034	<0.033	<0.043	<0.039	<0.065	<0.033	<0.044	<0.033
18	25-Apr-06	2-May-06	<0.032	<0.049	<0.033	<0.026	<0.055	<0.042	<0.042	<0.031	<0.043	<0.039
19	2-May-06	9-May-06	<0.042	<0.049	<0.041	<0.036	<0.060	<0.037	<0.012	<0.034	<0.046	<0.032
20	9-May-06	16-May-06	<0.046	<0.048	<0.053	<0.032	<0.059	<0.026	<0.037	<0.041	<0.048	<0.040
21	16-May-06	23-May-06	<0.039	<0.047	<0.034	<0.037	<0.050	<0.032	<0.054	<0.029	<0.013	<0.035
22	23-May-06	30-May-06	<0.038	<0.034	<0.021	<0.049	<0.032	<0.060	<0.034	<0.060	<0.051	<0.056
23	30-May-06	5-Jun-06	<0.043	<0.055	<0.069	<0.040	<0.044	<0.046	<0.016	<0.042	<0.067	<0.046
24	5-Jun-06	13-Jun-06	<0.032	<0.048	<0.052	<0.030	<0.052	<0.032	<0.043	<0.027	<0.033	<0.032
25	13-Jun-06	21-Jun-06	<0.064	<0.027	<0.037	<0.024	<0.043	<0.023	<0.037	<0.028	<0.042	<0.025
26	21-Jun-06	27-Jun-06	<0.042	<0.057	<0.058	<0.015	<0.057	<0.051	<0.050	<0.058	<0.062	<0.058

TABLE 8.5 RADIOIODINE IN AIR 3rd - 4th QUARTER

ODCM required samples denoted by *

units are pCi/m^3

3rd Quarter

Week #	START DATE	STOP DATE	Site 4	(control) Site 6A*	Site 7A	Site 14A*	0.070 Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*
27	27-Jun-06	3-Jul-06	<0.068	<0.033	<0.050	<0.037	<0.069	<0.042	<0.056	<0.047	<0.063	<0.037
28	3-Jul-06	11-Jul-06	<0.022	<0.056	<0.048	<0.035	<0.037	<0.027	Invalid [a]	<0.052	<0.023	<0.048
29	11-Jul-06	18-Jul-06	<0.038	<0.033	<0.043	<0.049	<0.031	<0.057	<0.032	<0.050	<0.066	<0.036
30	18-Jul-06	25-Jul-06	<0.059	<0.029	<0.068	<0.035	<0.059	<0.039	<0.049	<0.029	<0.056	<0.036
31	25-Jul-06	1-Aug-06	<0.040	<0.049	<0.033	<0.060	<0.028	<0.057	<0.030	<0.012	<0.025	<0.060
32	1-Aug-06	8-Aug-06	<0.032	<0.033	<0.049	<0.029	<0.042	<0.030	<0.048	<0.031	<0.062	<0.032
33	8-Aug-06	15-Aug-06	<0.025	<0.053	<0.029	<0.034	<0.062	<0.042	<0.055	<0.045	<0.067	<0.053
34	15-Aug-06	22-Aug-06	<0.038	<0.054	<0.059	<0.033	<0.066	<0.032	<0.051	<0.037	<0.058	<0.031
35	22-Aug-06	29-Aug-06	<0.032	<0.058	<0.064	<0.039	<0.065	<0.031	<0.043	<0.028	<0.056	<0.044
36	29-Aug-06	5-Sep-06	<0.027	<0.062	<0.042	<0.032	<0.064	<0.037	<0.012	<0.039	<0.059	<0.038
37	5-Sep-06	12-Sep-06	<0.053	<0.042	<0.036	<0.069	<0.036	<0.042	<0.029	<0.059	<0.036	<0.030
38	12-Sep-06	19-Sep-06	<0.029	<0.067	<0.053	<0.035	<0.041	<0.031	<0.048	<0.033	<0.056	<0.030
39	19-Sep-06	26-Sep-06	<0.041	<0.054	<0.060	<0.044	<0.050	<0.034	<0.055	<0.034	<0.057	<0.034

4th Quarter

Week #	START DATE	STOP DATE	Site 4	(control) Site 6A*	Site 7A	Site 14A*	0.070 Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*
40	26-Sep-06	3-Oct-06	<0.060	<0.032	<0.056	<0.033	<0.050	<0.028	<0.034	<0.035	<0.058	<0.033
41	3-Oct-06	10-Oct-06	<0.040	<0.048	<0.054	<0.030	<0.041	<0.035	<0.042	<0.026	<0.056	<0.029
42	10-Oct-06	17-Oct-06	<0.061	<0.054	<0.033	<0.064	<0.027	<0.012	<0.037	<0.033	<0.030	<0.049
43	17-Oct-06	24-Oct-06	<0.041	<0.033	<0.054	<0.024	<0.033	<0.038	<0.055	<0.033	<0.050	<0.031
44	24-Oct-06	31-Oct-06	<0.051	<0.028	<0.049	<0.045	<0.054	<0.041	<0.058	<0.037	<0.044	<0.037
45	31-Oct-06	7-Nov-06	<0.031	<0.044	<0.067	<0.038	<0.043	<0.029	<0.055	<0.029	<0.036	<0.024
46	7-Nov-06	14-Nov-06	<0.070	<0.045	<0.055	<0.039	<0.054	<0.026	<0.055	<0.025	<0.064	<0.036
47	14-Nov-06	21-Nov-06	<0.035	<0.066	<0.061	<0.029	<0.037	<0.034	<0.013	<0.041	<0.040	<0.042
48	21-Nov-06	28-Nov-06	<0.046	<0.049	<0.069	<0.030	<0.040	<0.038	<0.057	<0.031	<0.041	<0.036
49	28-Nov-06	5-Dec-06	<0.043	<0.062	<0.056	<0.033	<0.034	<0.032	<0.049	<0.038	<0.035	<0.035
50	5-Dec-06	12-Dec-06	<0.053	<0.049	<0.035	<0.031	<0.035	<0.033	<0.034	<0.036	<0.051	<0.037
51	12-Dec-06	19-Dec-06	<0.040	<0.034	<0.043	<0.055	<0.039	<0.049	<0.038	<0.056	<0.028	<0.034
52	19-Dec-06	26-Dec-06	<0.031	<0.042	<0.048	<0.031	<0.059	<0.031	<0.066	<0.036	<0.042	<0.037

a Pump was off with power to the ETM. Unable to determine sample volume so sample was invalidated.

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
BRANCH RESIDENCE (Site #52)*		NO SAMPLES AVAILABLE			
DUNCAN FAMILY FARMS (Site #62)*	Green cabbage	19-Jan-06	<51	<57	<41
	Red cabbage	19-Jan-06	<44	<53	<71
	Savoy cabbage	19-Jan-06	<58	<27	<33
	Green cabbage	16-Feb-06	<36	<44	<43
	Red cabbage	16-Feb-06	<40	<38	<71
	Savoy cabbage	16-Feb-06	<49	<57	<66
	Green cabbage	16-Mar-06	<45	<45	<66
	Red cabbage	16-Mar-06	<41	<48	<44
	Savoy cabbage	16-Mar-06	<41	<57	<54
	Green cabbage	11-Apr-06	<46	<33	<37
	Red cabbage	11-Apr-06	<38	<59	<32
	Savoy cabbage	11-Apr-06	<37	<57	<63
	Red cabbage	11-May-06	<46	<43	<54
	Green cabbage	11-May-06	<40	<51	<48
	Savoy cabbage	11-May-06	<49	<13	<47
	Green cabbage	13-Oct-06	<47	<49	<44
	Red cabbage	16-Nov-06	<40	<56	<76
	Green cabbage	16-Nov-06	<45	<58	<48
	Savoy cabbage	15-Dec-06	<56	<51	<50
	Red cabbage	15-Dec-06	<55	<59	<61
	Green cabbage	15-Dec-06	<51	<59	<41
MCCOY RESIDENCE (Site #47)*		NO SAMPLES AVAILABLE			

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
PAINTER GOATS (Site #51)*	NO SAMPLES AVAILABLE					
ADAMS GOATS (Site #53)*	20-Jan-06	<1	<1	<1	<3	<1
	17-Feb-06	<1	<1	<1	<3	<1
	17-Mar-06	<1	<1	<1	<3	<1
	14-Apr-06	<1	<1	<1	<3	<1
	16-Jun-06	<1	<1	<1	<3	<1
	14-Jul-06	<1	<1	<1	<4	<1
	11-Aug-06	<1	<1	<1	<3	<1
	13-Oct-06	<1	<1	<1	<3	<1
	16-Nov-06	<1	<1	<1	<3	<1
	15-Dec-06	<1	<1	<1	<3	<1
HERNANDEZ GOATS (Site #54)	20-Jan-06	<1	<1	<1	<3	<1
	17-Feb-06	<1	<1	<1	<3	<1
	17-Mar-06	<1	<1	<1	<3	<1
	16-Jun-06	<1	<1	<1	<3	<1
	11-Aug-06	<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)*	31-Jan-06	<14	<11	<27	<11	<30	<12	<23	<12	<12	<14	<49	<13		<3.0
	28-Feb-06	<13	<12	<23	<14	<30	<13	<20	<12	<12	<14	<45	<14		<3.3
	28-Mar-06	<9	<10	<19	<13	<23	<10	<19	<10	<9	<10	<33	<15	<282	<2.7
	25-Apr-06	<11	<11	<24	<15	<25	<12	<21	<11	<11	<12	<41	<13		<2.7
	30-May-06	<7	<11	<17	<12	<24	<11	<19	<9	<9	<9	<35	<15		<2.9
	27-Jun-06	<11	<12	<22	<10	<24	<13	<22	<11	<12	<14	<43	<14	<277	<3.1
	25-Jul-06	<13	<10	<28	<15	<30	<11	<22	<12	<11	<13	<34	<14		3.6 ± 1.8
	29-Aug-06	<9	<10	<19	<9	<26	<10	<15	<10	<10	<10	<33	<15		3.8 ± 1.8
	26-Sep-06	<13	<13	<29	<14	<23	<13	<21	<10	<13	<15	<41	<12	<282	<2.9
	31-Oct-06	<9	<12	<19	<15	<27	<14	<21	<10	<10	<10	<37	<15		<3.2
	28-Nov-06	<13	<15	<26	<14	<28	<14	<24	<13	<11	<13	<48	<14		3.7 ± 1.9
	26-Dec-06	<11	<11	<23	<14	<30	<12	<21	<11	<11	<13	<38	<14	<273	<3.1
GAVETTE RESIDENCE (SITE #55)	31-Jan-06	<13	<12	<25	<14	<27	<12	<21	<10	<10	<11	<41	<12		4.3 ± 1.6
	28-Feb-06	<10	<8	<24	<15	<22	<11	<16	<10	<9	<11	<33	<10		<2.6
	28-Mar-06	<13	<13	<29	<10	<30	<14	<20	<11	<11	<12	<41	<14	<285	4.1 ± 1.5
	25-Apr-06	<12	<11	<26	<11	<21	<11	<20	<10	<10	<10	<38	<12		6.2 ± 1.6
	30-May-06	<13	<12	<25	<14	<23	<11	<20	<12	<11	<13	<37	<15		3.2 ± 1.5
	27-Jun-06	<14	<8	<21	<12	<21	<15	<19	<9	<10	<12	<44	<15	<276	2.8 ± 1.6
	25-Jul-06	<12	<12	<25	<13	<30	<13	<20	<11	<10	<10	<41	<13		4.8 ± 1.5
	29-Aug-06	<13	<12	<21	<15	<27	<13	<19	<13	<12	<12	<46	<15		3.4 ± 1.4
	26-Sep-06	<11	<11	<21	<11	<20	<11	<12	<8	<9	<11	<29	<15	<282	4.5 ± 1.6
	31-Oct-06	<14	<13	<29	<15	<30	<14	<25	<13	<13	<17	<42	<13		<2.6
	28-Nov-06	<12	<12	<17	<12	<30	<12	<19	<10	<12	<12	<38	<6		3.8 ± 1.5
	26-Dec-06	<10	<12	<26	<12	<29	<13	<21	<10	<12	<12	<37	<13	<272	2.9 ± 1.6

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
McARTHUR [a]/ WIRTH RESIDENCE (SITE #46)*	31-Jan-06	<12	<13	<25	<13	<24	<12	<22	<11	<9	<13	<42	<13		3.2 ± 1.5
	28-Feb-06	<12	<12	<27	<15	<28	<13	<24	<14	<12	<15	<46	<13		<2.5
	28-Mar-06	<15	<11	<24	<15	<26	<11	<20	<12	<10	<13	<48	<14	<283	2.7 ± 1.4
	25-Apr-06	<11	<11	<23	<15	<25	<11	<19	<11	<10	<11	<45	<12		4.1 ± 1.4
	23-May-06	<9	<10	<19	<9	<19	<10	<16	<15	<9	<9	<43	<11	<280	3.5 ± 1.5
	27-Jun-06	<12	<11	<26	<15	<30	<13	<21	<12	<12	<11	<45	<14	<279	<2.6
	25-Jul-06	<11	<13	<29	<10	<28	<14	<23	<12	<13	<15	<46	<13		2.6 ± 1.4
	29-Aug-06	<11	<14	<25	<11	<20	<11	<17	<11	<11	<13	<37	<15		4.1 ± 1.5
	26-Sep-06	<13	<13	<24	<11	<30	<14	<22	<12	<11	<12	<47	<12	<272	2.8 ± 1.6
	31-Oct-06	<15	<12	<28	<12	<24	<13	<25	<12	<12	<13	<41	<15		<2.6
	28-Nov-06	<13	<14	<20	<13	<30	<13	<21	<12	<10	<12	<44	<13		2.8 ± 1.5
	26-Dec-06	<9	<9	<19	<9	<19	<10	<15	<8	<8	<9	<28	<12	<272	3.1 ± 1.7
CHOWANEC[b]/ SANDOVAL RESIDENCE (SITE #49) *	31-Jan-06	<11	<12	<26	<9	<28	<12	<19	<11	<11	<14	<39	<14		2.3 ± 1.5
	28-Feb-06	<13	<12	<25	<15	<28	<13	<22	<12	<11	<14	<43	<14		<2.4
	28-Mar-06	<11	<12	<24	<14	<26	<11	<18	<11	<11	<13	<44	<14	<284	<2.1
	25-Apr-06	<10	<8	<21	<14	<25	<11	<20	<8	<10	<10	<32	<9		2.5 ± 1.4
	30-May-06	<12	<11	<23	<12	<27	<14	<21	<13	<11	<13	<47	<15		<2.2
	27-Jun-06	<13	<13	<29	<14	<29	<15	<23	<14	<13	<13	<53	<12	<277	<2.4
	25-Jul-06	<10	<12	<26	<11	<27	<12	<20	<11	<11	<12	<40	<15		<2.0
	29-Aug-06	<13	<12	<21	<13	<30	<13	<20	<10	<11	<13	<37	<12		<2.0
	26-Sep-06	<12	<11	<21	<14	<25	<13	<20	<11	<11	<12	<40	<15	<279	<2.3
	31-Oct-06	<12	<10	<21	<12	<21	<13	<16	<11	<11	<11	<41	<15		<2.5
	28-Nov-06	<11	<12	<24	<13	<30	<13	<19	<11	<12	<13	<37	<13		<2.2
	26-Dec-06	<14	<15	<29	<14	<29	<15	<24	<12	<13	<14	<45	<13	<274	<2.4

a Sample location changed in September due to sale of property. New sample location is the Wirth residence.

b Property ownership changed to Sandoval in July.

TABLE 8.9 GROUNDWATER

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	31-Jan-06	<12	<12	<25	<15	<28	<14	<19	<12	<11	<12	<40	<13	<273
27ddc	24-Apr-06	<11	<10	<20	<14	<23	<13	<20	<10	<10	<10	<38	<15	<272
(Site #57)*	25-Jul-06	<10	<10	<24	<14	<30	<12	<20	<11	<11	<12	<38	<13	<264
	31-Oct-06	<10	<11	<21	<15	<30	<13	<21	<11	<11	<13	<39	<11	<277
WELL	31-Jan-06	<14	<12	<27	<13	<25	<15	<21	<11	<11	<12	<45	<13	<269
34abb	24-Apr-06	<11	<11	<22	<14	<29	<15	<21	<10	<11	<11	<38	<13	<282
(Site #58)*	25-Jul-06	<11	<10	<22	<14	<30	<14	<19	<11	<10	<12	<44	<15	<262
	31-Oct-06	<12	<12	<21	<11	<26	<15	<19	<12	<10	<12	<40	<14	<272

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
RESERVOIR (Site #60) *	31-Jan-06	<9	<9	<19	<9	<18	<9	<17	11 ± 8	<9	<10	<29	<15	
	28-Feb-06	<12	<11	<26	<15	<27	<11	<20	20 ± 10	<10	<12	<36	<12	
	28-Mar-06	<14	<13	<26	<12	<29	<12	<21	<15	<10	<14	<44	<13	<285
	25-Apr-06	<12	<11	<21	<13	<22	<10	<20	<11	<11	<10	<35	<12	
	30-May-06	<13	<10	<24	<11	<30	<11	<17	<14	<11	<13	<47	<15	
	27-Jun-06	<10	<11	<18	<12	<30	<12	<20	18 ± 11	<10	<10	<31	<14	<278
	25-Jul-06	<14	<11	<30	<14	<29	<13	<20	7 ± 9	<12	<14	<48	<14	
	29-Aug-06	<13	<11	<18	<9	<25	<11	<22	8 ± 10	<9	<11	<38	<15	
	26-Sep-06	<11	<12	<24	<13	<26	<13	<20	<11	<10	<12	<39	<14	<277
	31-Oct-06	<11	<14	<26	<12	<29	<14	<23	<15	<11	<13	<44	<15	
	28-Nov-06	<15	<10	<27	<10	<27	<11	<23	<12	<12	<13	<41	<15	
	26-Dec-06	<11	<9	<22	<15	<26	<13	<16	23 ± 11	<10	<12	<40	<14	<274
EVAP POND 1 (Site #59) *	31-Jan-06	<13	<12	<25	<13	<30	<10	<23	<11	<10	<13	<40	<13	
	28-Feb-06	<13	<13	<26	<13	<30	<15	<22	<13	<10	<14	<51	<13	
	28-Mar-06	<11	<11	<29	<10	<30	<12	<18	<12	<10	<13	<38	<11	1912 ± 168
	25-Apr-06	<10	<11	<22	<13	<30	<10	<19	<10	<9	<13	<35	<15	
	30-May-06	<11	<13	<25	<15	<30	<10	<17	<10	<10	<13	<37	<11	
	27-Jun-06	<12	<11	<23	<11	<30	<12	<21	<10	<11	<14	<41	<11	1787 ± 161
	25-Jul-06	<12	<13	<29	<15	<30	<11	<22	<13	<11	<16	<45	<11	
	29-Aug-06	<12	<14	<28	<15	<30	<14	<21	<13	<12	<14	<44	<13	
	26-Sep-06	<9	<9	<23	<11	<24	<10	<19	<10	<8	<10	<30	<12	2142 ± 167
	31-Oct-06	<11	<11	<30	<13	<25	<12	<19	<12	<10	<13	<41	<12	
	28-Nov-06	<15	<12	<26	<13	<30	<11	<24	<13	<12	<15	<41	<14	
	26-Dec-06	<13	<12	<26	<13	<30	<14	<19	<15	<11	<13	<41	<12	1168 ± 187
EVAP POND 2 (Site #63) *	31-Jan-06	<12	<11	<20	<15	<29	<12	<19	<10	<11	<13	<36	<12	
	28-Feb-06	<13	<12	<26	<15	<25	<14	<21	<11	<10	<15	<36	<13	
	28-Mar-06	<10	<13	<21	<15	<30	<12	<19	15 ± 10	<9	<12	<36	<8	1904 ± 169
	25-Apr-06	<12	<11	<24	<12	<30	<13	<22	<13	<11	<14	<44	<10	
	30-May-06	<13	<13	<28	<12	<29	<13	<24	<14	<12	<14	<42	<9	
	27-Jun-06	<12	<12	<29	<14	<29	<12	<20	<15	<11	<14	<43	<14	2142 ± 173
	25-Jul-06	<11	<11	<23	<13	<30	<11	<18	<11	<9	<14	<33	<11	
	29-Aug-06	<11	<10	<26	<10	<30	<10	<18	<14	<12	<15	<40	<9	
	26-Sep-06	<12	<13	<25	<15	<24	<13	<22	<13	<11	<14	<43	<11	2044 ± 167
	31-Oct-06	<13	<13	<25	<14	<30	<11	<19	<10	<11	<14	<39	<8	
	28-Nov-06	<11	<8	<23	<11	<29	<10	<16	<9	<8	<12	<31	<11	
	26-Dec-06	<11	<11	<24	<11	<30	<13	<20	<12	<12	<15	<41	<12	883 ± 182

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	H-3
WRF INFLUENT	3-Jan-06	<13	<13	<23	<15	<24	<13	<22	22 ± 13	<12	<13	<46	<13	
	10-Jan-06	<9	<11	<24	<13	<23	<11	<18	40 ± 12	<10	<11	<41	<15	
	17-Jan-06	<11	<10	<17	<11	<17	<11	<17	37 ± 10	<11	<10	<28	<15	
	24-Jan-06	<11	<12	<17	<11	<22	<11	<17	64 ± 14	<10	<14	<32	<15	<278
	31-Jan-06	<10	<10	<17	<15	<19	<11	<17	33 ± 10	<10	<11	<31	<11	
	7-Feb-06	<13	<14	<28	<13	<30	<15	<25	59 ± 19	<15	<13	<48	<15	
	14-Feb-06	<14	<15	<22	<13	<29	<14	<20	81 ± 19	<13	<13	<43	<15	
	21-Feb-06	<12	<12	<24	<14	<26	<14	<18	55 ± 15	<10	<12	<34	<15	
	28-Feb-06	<12	<11	<17	<11	<22	<13	<17	41 ± 11	<11	<10	<41	<15	<272
	7-Mar-06	<12	<13	<30	<12	<29	<10	<18	25 ± 9	<13	<13	<40	<13	
	14-Mar-06	<12	<10	<27	<10	<19	<11	<18	18 ± 9	<11	<10	<39	<15	
	21-Mar-06	<11	<11	<19	<15	<23	<12	<21	73 ± 15	<11	<12	<40	<13	
	28-Mar-06	<13	<12	<27	<12	<30	<13	<25	28 ± 16	<12	<12	<41	<12	<296
	4-Apr-06	<10	<10	<22	<11	<29	<13	<20	19 ± 9	<10	<14	<38	<15	
	11-Apr-06	<12	<11	<24	<15	<25	<12	<21	13 ± 7	<13	<12	<37	<13	<285
	2-May-06	<14	<14	<25	<13	<24	<11	<16	16 ± 16	<11	<14	<32	<13	
	9-May-06	<15	<13	<22	<12	<29	<15	<24	25 ± 10	<13	<15	<42	<14	
	16-May-06	<11	<12	<29	<13	<29	<15	<24	38 ± 12	<14	<12	<44	<11	
	23-May-06	<13	<11	<26	<14	<26	<13	<24	76 ± 17	<11	<14	<52	<15	
	30-May-06	<12	<11	<23	<15	<20	<8	<18	30 ± 10	<12	<10	<35	<15	<277
	6-Jun-06	<10	<9	<20	<14	<22	<10	<15	44 ± 14	<9	<10	<38	<15	
	13-Jun-06	<8	<7	<18	<9	<22	<9	<15	28 ± 11	<8	<7	<27	<15	
	20-Jun-06	<15	<13	<26	<8	<26	<14	<23	84 ± 22	<11	<15	<51	<13	
	27-Jun-06	<14	<11	<26	<11	<29	<14	<23	35 ± 13	<11	<14	<41	<11	<282
	4-Jul-06	<14	<12	<23	<13	<29	<14	<21	27 ± 13	<12	<15	<45	<12	
	11-Jul-06	<10	<12	<28	<15	<30	<14	<21	<13	<11	<13	<43	<13	
	18-Jul-06	<9	<9	<21	<11	<23	<10	<18	11 ± 6	<9	<9	<33	<15	
	25-Jul-06	<11	<10	<19	<13	<20	<12	<16	19 ± 10	<8	<12	<39	<13	<272
	1-Aug-06	<10	<9	<23	<14	<23	<9	<16	19 ± 9	<10	<11	<33	<13	
	8-Aug-06	<7	<10	<20	<11	<17	<11	<17	24 ± 8	<10	<11	<31	<15	

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	H-3
WRF INFLUENT (continued)	15-Aug-06	<11	<13	<23	<11	<30	<12	<21	37 ± 15	<12	<13	<45	<10	
	22-Aug-06	<9	<11	<22	<12	<23	<10	<18	28 ± 10	<9	<12	<31	<15	
	29-Aug-06	<13	<11	<21	<11	<30	<11	<22	23 ± 9	<11	<10	<38	<11	<270
	5-Sep-06	<11	<10	<22	<12	<23	<12	<21	26 ± 12	<11	<14	<41	<13	
	12-Sep-06	<14	<14	<26	<13	<27	<14	<24	23 ± 14	<12	<13	<44	<15	
	19-Sep-06	<11	<11	<19	<11	<29	<9	<17	14 ± 9	<11	<10	<38	<15	
	26-Sep-06	<15	<15	<29	<15	<29	<14	<23	31 ± 13	<13	<12	<50	<14	<293
	3-Oct-06	<14	<12	<23	<14	<29	<13	<20	29 ± 10	<10	<10	<39	<15	
	10-Oct-06	<14	<12	<29	<12	<29	<13	<24	29 ± 13	<12	<13	<39	<13	
	17-Oct-06	<10	<11	<20	<14	<30	<11	<19	<11	<12	<12	<35	<10	
	24-Oct-06	<12	<11	<25	<13	<29	<15	<20	<14	<11	<13	<42	<14	
	31-Oct-06	<13	<13	<25	<13	<27	<15	<22	38 ± 13	<13	<14	<43	<13	<282
	7-Nov-06	<11	<10	<26	<13	<23	<13	<18	12 ± 9	<11	<14	<40	<15	
	14-Nov-06	<13	<13	<29	<15	<30	<14	<22	32 ± 15	<12	<13	<39	<13	
	21-Nov-06 [a]	<12	<13	<18	<12	<25	<11	<15	55 ± 13	<12	<13	<42	<15	
	28-Nov-06	<12	<11	<26	<15	<28	<13	<23	20 ± 12	<11	<14	<46	<13	<280
	5-Dec-06	<11	<10	<27	<13	<30	<12	<21	22 ± 12	<11	<11	<42	<12	
	12-Dec-06	<10	<9	<20	<11	<25	<12	<17	15 ± 7	<9	<9	<31	<15	
	19-Dec-06	<12	<10	<23	<13	<29	<10	<24	96 ± 19	<11	<10	<34	<6	
	27-Dec-06	<9	<11	<23	<12	<24	<9	<19	35 ± 10	<9	<12	<36	<15	<279
SEDIMENT. BASIN #2	1-Aug-06	<12	<11	<27	<9	<30	<12	<24	<11	<11	<11	<41	<15	<280
	15-Aug-06	<13	<14	<30	<12	<27	<12	<17	<12	<13	<15	<51	<12	<289
	5-Sep-06	<10	<9	<21	<13	<21	<10	<17	<9	<10	<12	<37	<14	<277
	12-Sep-06	<12	<12	<25	<14	<30	<12	<22	<12	<12	<14	<40	<13	<280
	19-Sep-06	<13	<12	<24	<12	<30	<12	<23	<9	<11	<13	<38	<14	<269

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	3-Jan-06	794 ± 115	<25	<8	35 ± 27
	10-Jan-06	591 ± 92	<28	<40	
	17-Jan-06	620 ± 92	<24	<30	
	24-Jan-06	679 ± 97	<29	<33	
	31-Jan-06	756 ± 106	<27	<30	
	12-Feb-06	978 ± 122	<22	<33	
	21-Feb-06	1704 ± 202	<23	<19	
	28-Feb-06	1195 ± 149	<28	<28	
	7-Mar-06	1082 ± 131	<17	<21	
	14-Mar-06	753 ± 107	<28	<31	
	21-Mar-06	546 ± 89	<30	<32	
	28-Mar-06	904 ± 114	<22	<24	
	4-Apr-06	891 ± 119	<34	<41	
	11-Apr-06	762 ± 107	<30	<34	
	18-Apr-06	584± 85	<33	<28	
	25-Apr-06	360± 70	<20	<39	
	2-May-06	838 ± 108	<25	<17	
	9-May-06	780 ± 114	<23	<40	
	16-May-06	879 ± 119	<11	<19	
	23-May-06	1219 ± 150	<18	<67	
	30-May-06	1240 ± 143	<23	<11	
	6-Jun-06	977 ± 120	<21	<24	59 ± 31
	13-Jun-06	690 ± 99	<20	<25	
	20-Jun-06	818 ± 111	<20	<17	
	27-Jun-06	1503 ± 180	<31	<19	
	4-Jul-06	1203 ± 154	<22	<13	81 ± 27
	11-Jul-06	787 ± 99	<25	<24	
	18-Jul-06	481 ± 76	<22	<32	
	25-Jul-06	468 ± 74	<27	<19	
	1-Aug-06	759 ± 104	<21	<23	
	8-Aug-06	882 ± 118	<19	<25	
	15-Aug-06	1035 ± 126	<21	<28	27 ± 21
	22-Aug-06	1380 ± 169	<31	<28	
	29-Aug-06	1947 ± 232	<19	<25	27 ± 35
	5-Sep-06	1162 ± 145	<21	<30	35 ± 31
	12-Sep-06	921 ± 120	<28	<28	22 ± 18
	19-Sep-06	595 ± 79	<17	<24	
	26-Sep-06	721 ± 100	<26	<24	
	3-Oct-06	1204 ± 129	<22	<25	
	10-Oct-06	1086 ± 129	<23	<27	
	17-Oct-06	351 ± 62	<24	<27	
	24-Oct-06	406 ± 58	<21	<15	
	31-Oct-06	371 ± 63	<27	<28	
	7-Nov-06	467 ± 73	<21	<26	
	14-Nov-06	591 ± 79	<21	<17	
	21-Nov-06	605 ± 79	<26	<29	
	28-Nov-06	1113 ± 132	<19	<30	78 ± 38
	5-Dec-06	847 ± 114	<20	<20	62 ± 22
	12-Dec-06	881 ± 123	<24	<27	181 ± 42
	19-Dec-06	1134 ± 145	<29	<25	64 ± 24
	27-Dec-06	2460 ± 269	<23	<19	94 ± 40

TABLE 8.11 SLUDGE/SEDIMENT

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

SAMPLE LOCATION	DATE COLLECTED	Cs-134	Cs-137
(N)	7-Dec-06	<13	<18
(E)	7-Dec-06	<15	<17
EVAP POND 1 (S)	7-Dec-06	<14	<18
(W)	7-Dec-06	<13	<18
(C)	7-Dec-06	<13	<18
(N)	7-Dec-06	<15	<17
(E)	7-Dec-06	<13	<15
EVAP POND 2 (S)	7-Dec-06	<12	<18
(W)	7-Dec-06	<15	<17
(C)	7-Dec-06	<13	<17

COOLING TOWER SLUDGE

UNIT CYCLE	APPROXIMATE VOLUME (yd^3)	ISOTOPE	ACTIVITY RANGE (uCi/ml)	SAMPLE TYPE	FRACTION OF SAMPLES ABOVE MDA
U1R12	453	Co-60 Cs-137	<MDA to 8.25E-08 <MDA to 6.16E-08	tower/canal sludge	4 of 32 8 of 32
U3R12	276	Co-60	2.95E-09 to 6.81E-07	tower/canal sludge	32 of 32

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

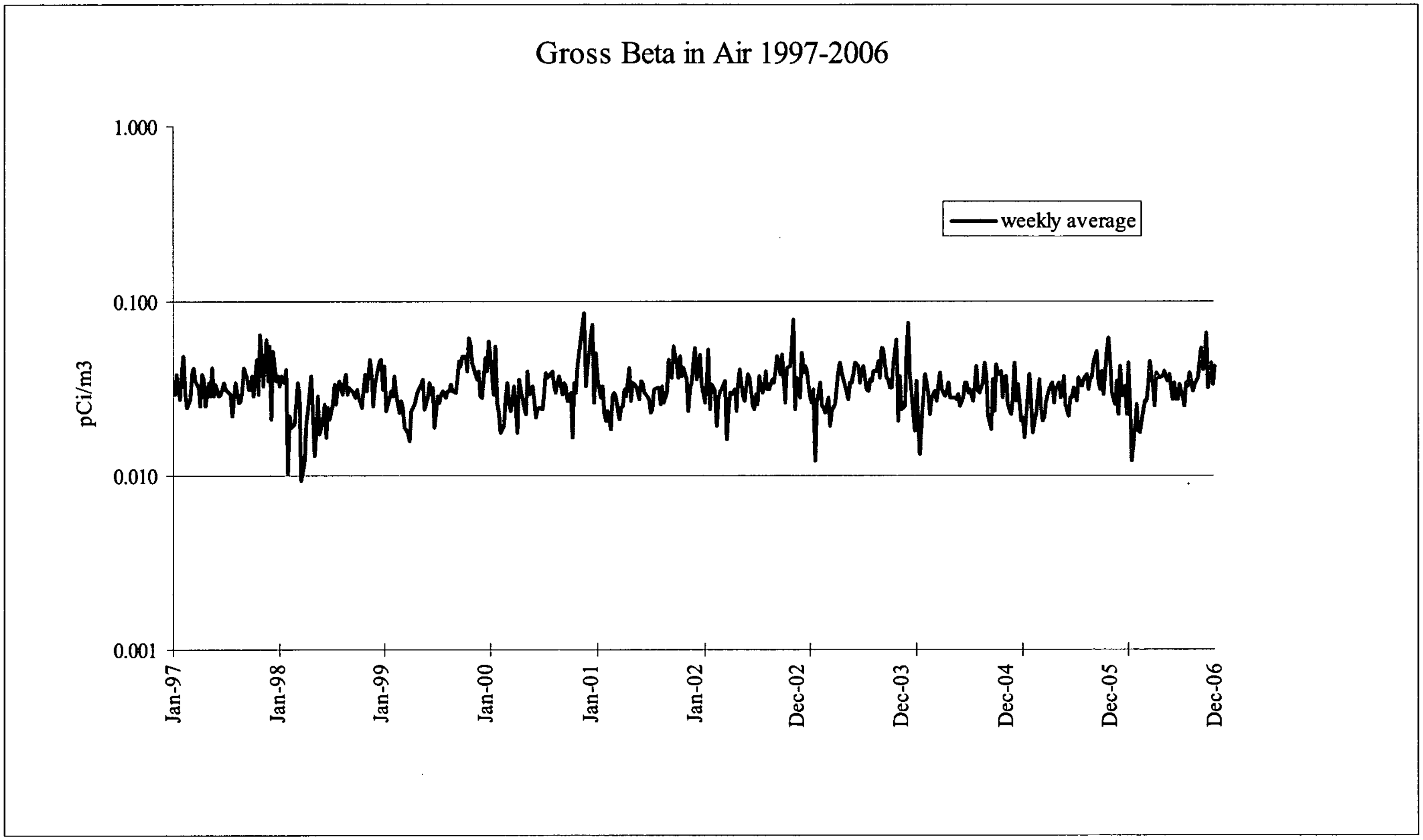


FIGURE 8.2 HISTORICAL GROSS BETA IN AIR (ANNUAL SITE TO SITE COMPARISONS) COMPARED TO PRE-OP

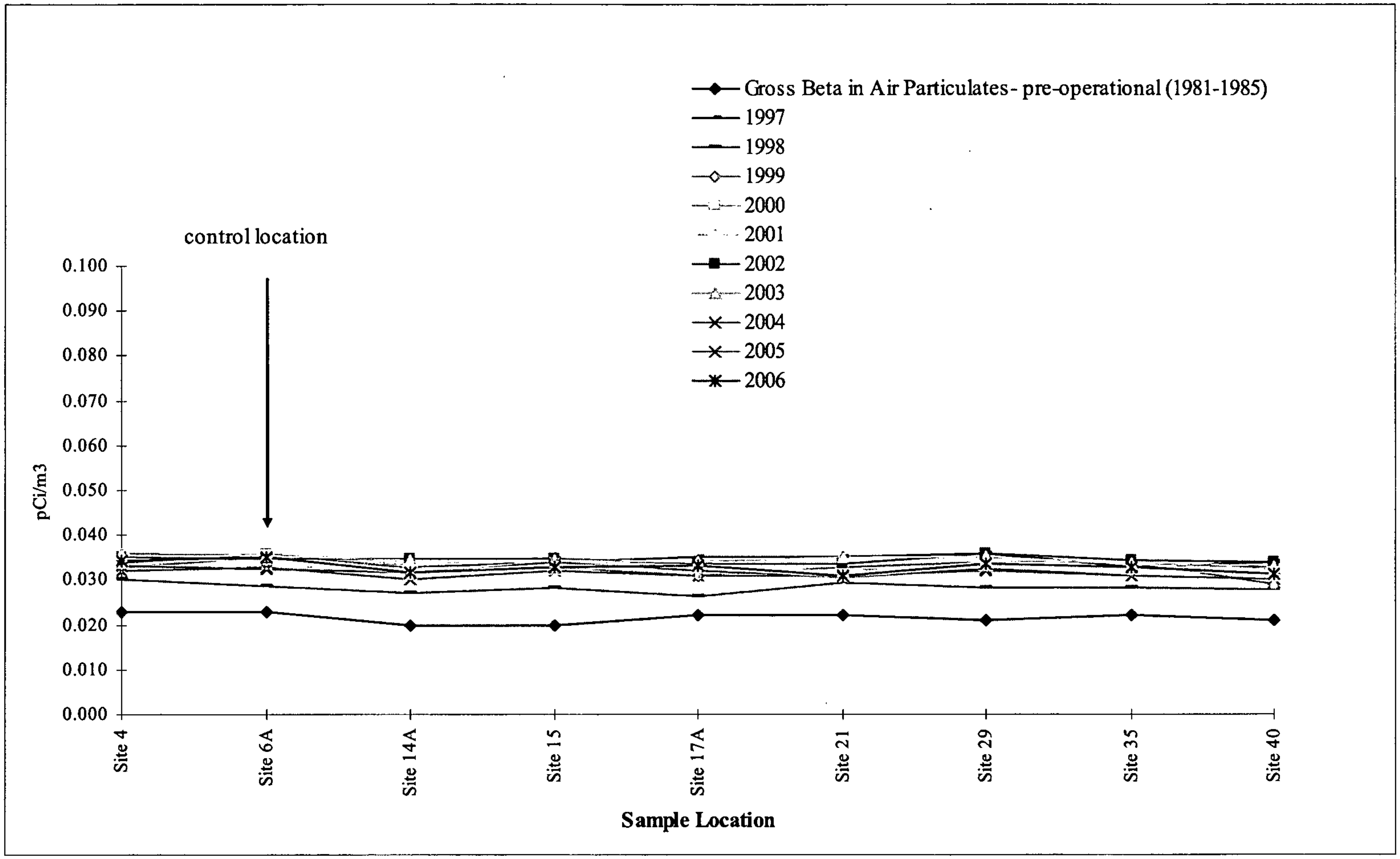
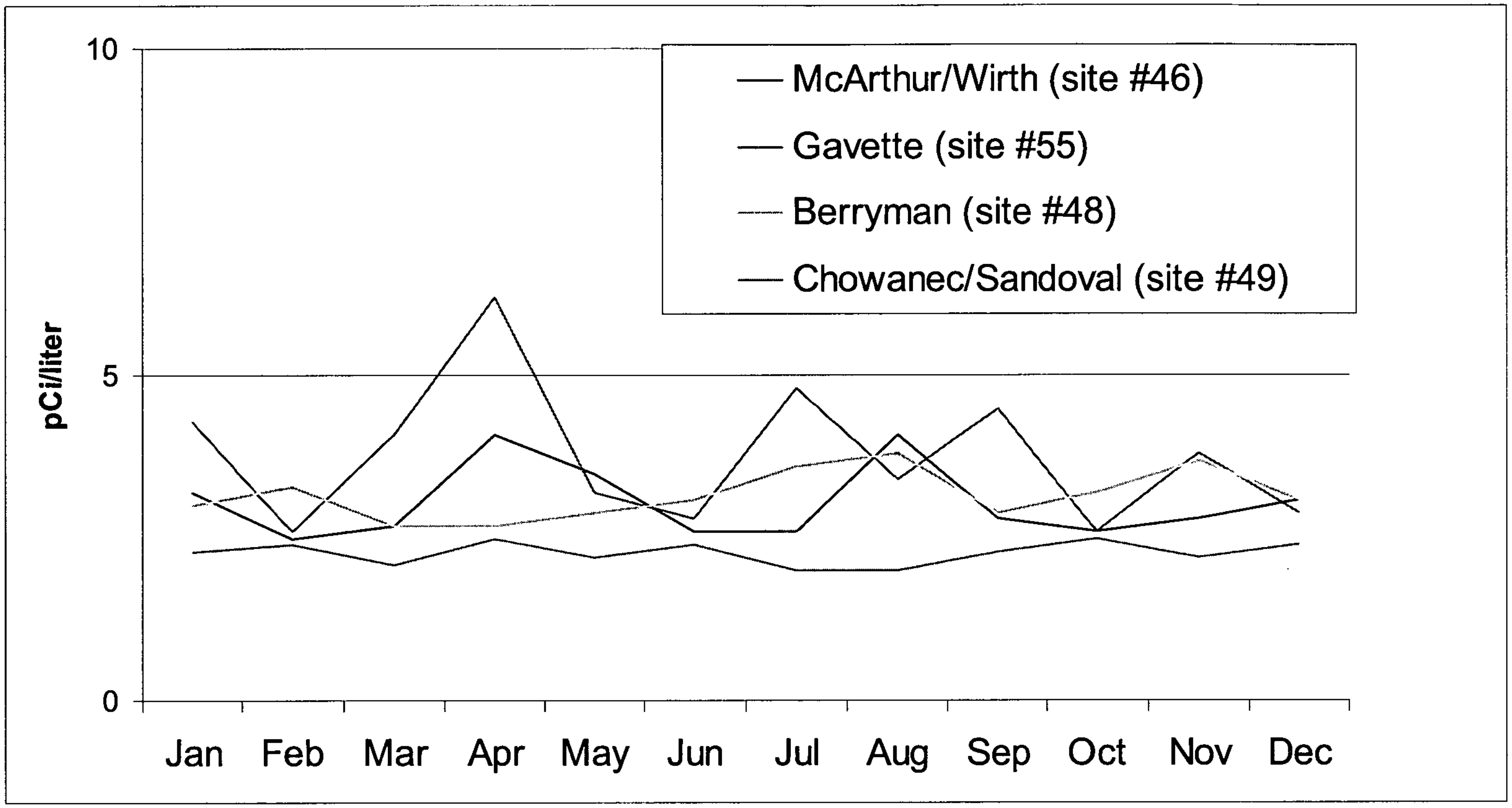
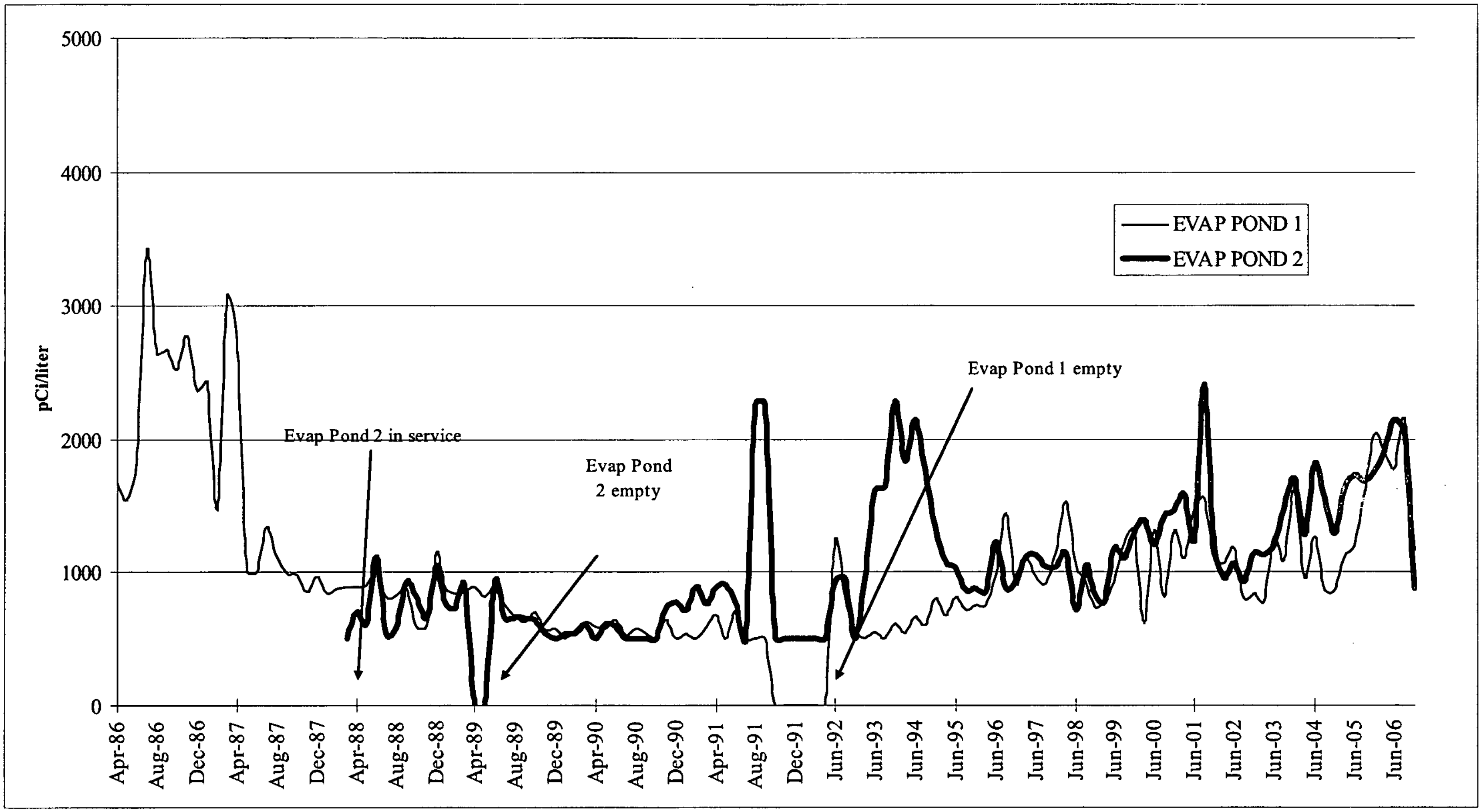


FIGURE 8.3 GROSS BETA IN DRINKING WATER



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

FIGURE 8.4 EVAPORATION POND TRITIUM ACTIVITY



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 2006 are presented in Table 9.2. Historical environmental gamma radiation results for 1985 through 2006 are presented in graphical form on Figure 9.1 (excluding transit control TLD #45).

Figure 9.2 depicts the environmental TLD results from 2006 as compared to the pre-operational TLD results (excluding sites #41, #43, and #46-50 as they were either deleted or had no pre-op TLD at these locations 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
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 2006 ENVIRONMENTAL TLD RESULTS

Units are mrem/std qtr

TLD Site #	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Average
1	25.5	24.2	21.4	23.8	23.7
2	22.6	21.3	18.0	20.8	20.7
3	24.2	22.5	17.4	20.5	21.2
4	23.4	21.6	18.8	20.2	21.0
5	22.3	22.6	18.8	19.7	20.9
6 (control)	27.2	26.9	21.7	24.9	25.2
7	26.3	24.3	20.6	23.3	23.6
8	24.2	23.7	18.7	22.4	22.3
9	29.8	24.6	21.2	24.3	25.0
10	25.0	22.6	19.3	22.6	22.4
11	26.5	23.5	19.7	23.7	23.4
12	24.2	22.5	18.3	21.5	21.6
13	25.8	25.1	21.3	23.7	24.0
14	25.8	22.8	19.1	21.9	22.4
15	24.5	22.6	19.8	21.7	22.2
16	23.3	21.9	18.6	20.4	21.1
17	26.0	24.1	19.4	23.6	23.3
18	25.2	22.7	19.0	21.9	22.2
19	26.5	24.8	20.6	23.7	23.9
20	25.7	23.5	19.4	23.2	23.0
21	27.4	25.2	21.4	24.3	24.6
22	27.9	27.8	21.5	25.3	25.6
23	23.7	21.7	18.5	22.4	21.6
24	24.3	20.3	18.4	20.3	20.8
25	25.3	22.4	18.5	21.5	21.9
26	29.0	26.8	23.3	25.6	26.2
27	30.1	27.5	22.1	25.4	26.3
28	27.9	26.6	21.3	24.0	25.0
29	27.1	23.9	19.2	23.5	23.4
30	27.7	25.2	21.8	24.8	24.9
31	25.1	22.9	19.1	21.0	22.0
32	26.7	25.0	20.3	23.3	23.8
33	27.9	26.6	21.6	23.2	24.8
34	30.2	26.5	23.5	25.1	26.3
35	missing	29.1	26.1	28.5	27.9
36	28.0	25.6	20.9	23.0	24.4
37	26.0	22.3	19.1	21.1	22.1
38	29.8	27.0	22.9	26.1	26.5
39	26.0	24.3	20.3	22.4	23.3
40	27.2	24.9	20.1	22.5	23.7
41	25.4	23.1	20.0	20.9	22.4
42	32.8	30.7	25.3	27.6	29.1
44 (control)	21.5	19.2	16.8	19.4	19.2
45 (transit control)	6.2	5.6	4.3	4.7	5.2
46	28.6	26.3	21.9	23.3	25.0
47	24.8	23.3	19.2	21.1	22.1
48	26.7	24.7	20.0	24.0	23.9
49	24.0	22.4	18.8	20.5	21.4
50	21.0	18.8	16.5	23.4	19.9

FIGURE 9.1 NETWORK ENVIRONMENTAL TLD EXPOSURE RATES

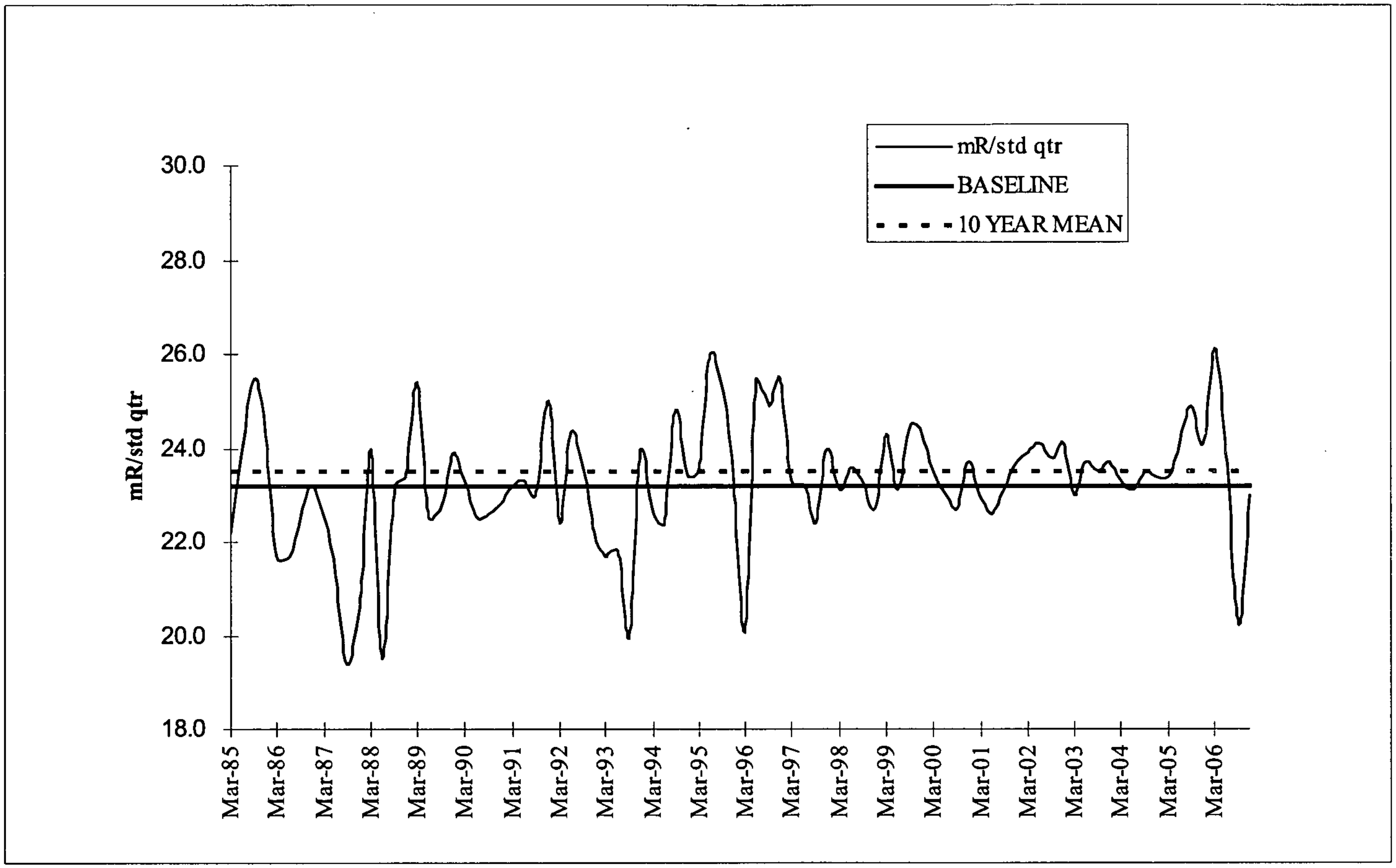
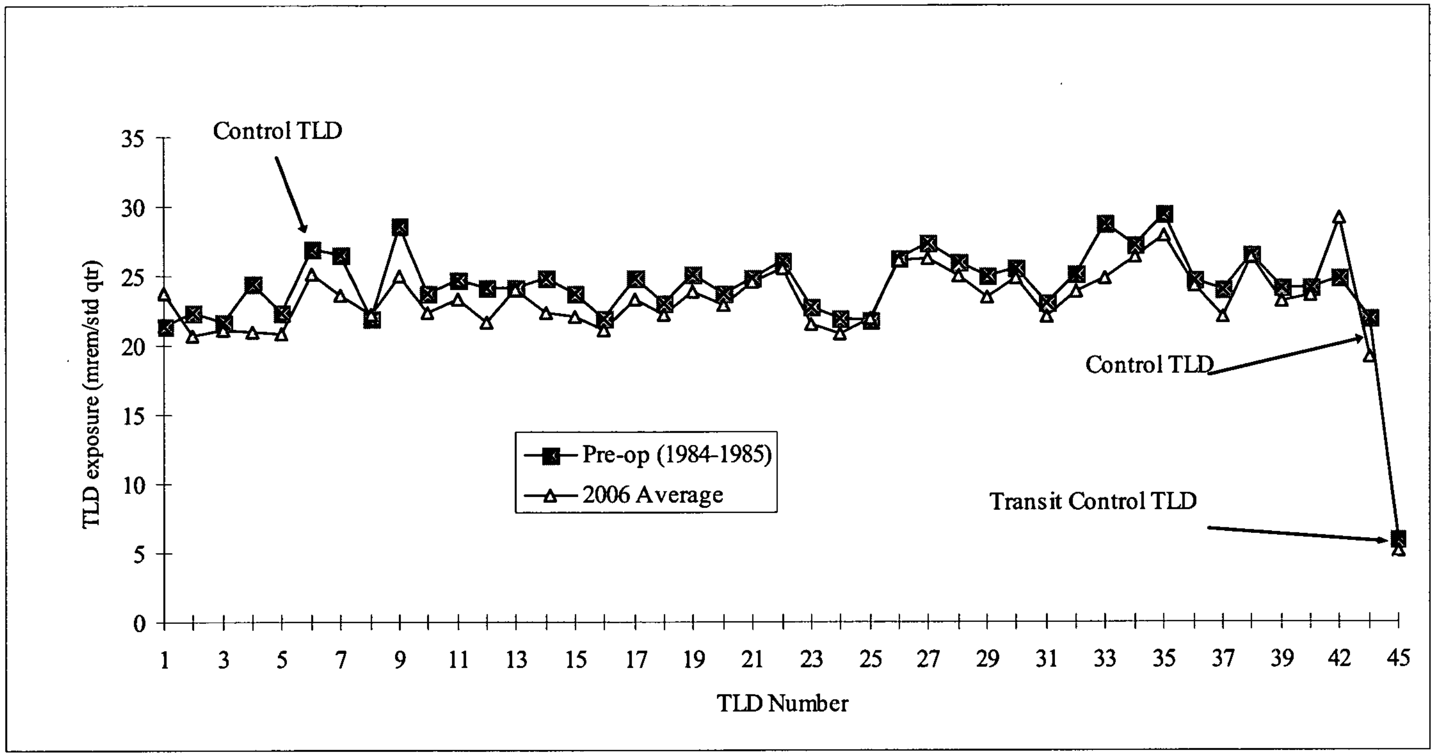


FIGURE 9.2 ENVIRONMENTAL TLD COMPARISON - PRE-OPERATIONAL VS 2006



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
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 May-June 2006.

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 0.158 mrem.

Milk Animal

There were no changes in nearest milk animal (goat) status. Dose calculations indicated the highest dose to be 0.327 mrem.

Vegetable Gardens

There were three (3) changes in nearest garden status (two former gardens are no longer there, one new garden was identified). Dose calculations indicated the highest dose to be 0.251 mrem.

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

TABLE 10.1 2006 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 2005
N	1.55	**3.10**	NONE	Resident 4.50E-02 Garden 1.23E-01	**Garden**
NNE	1.52	**NONE**	2.05	Resident 8.00E-02 Milk 3.27E-01	**Garden**
NE	2.16	NONE	3.91	Resident 1.12E-01 Milk 2.99E-01	
ENE	**2.44**	**NONE**	4.84	Resident 6.58E-02 Milk 1.17E-01	**Resident** **Garden**
E	2.81	NONE	NONE	Resident 6.75E-02	
ESE	**1.89**	3.85	NONE	Resident 1.35E-01 Garden 2.51E-01	**Resident**
SE	4.10	NONE	NONE	Resident 8.59E-02	
SSE	NONE	NONE	NONE	NA	
S	NONE	NONE	NONE	NA	
SSW	NONE	NONE	NONE	NA	
SW	1.39	NONE	NONE	Resident 1.58E-01	
WSW	0.75	NONE	NONE	Resident 1.28E-01	
W	0.70	NONE	NONE	Resident 9.54E-02	
WNW	2.67	NONE	NONE	Resident 2.31E-02	
NW	0.93	NONE	NONE	Resident 7.00E-02	
NNW	1.30	NONE	NONE	Resident 4.81E-02	

COMMENTS:

Dose calculations were performed using the GASPAR code and 2005 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 background gamma radiation measurements for the 2006 calendar year. Where possible, the data were compared to pre-operational sample data.

All sample results for 2006 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 Reservoir 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 gaseous effluent releases and secondary plant releases. These concentrations are consistent with historical values.

Natural background 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 2006 was the low level tritium discovered in subsurface water onsite in the RCA. 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 2006

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 - 195	NA	23.4 (183/183) 16.5 – 32.8	Site #42 8 miles 0°	29.1 (4/4) 25.3 – 32.8	20.0 (8/8) 16.8 - 27.2	0
Air Particulates (pCi/m^3)	Gross Beta – 519	0.010	0.033 (467/467) 0.010 - 0.070	Site #4 16 miles 90°	0.034 (52/52) 0.016 - 0.065	0.035 (52/52) 0.012 - 0.074	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. - 519						
	I-131	0.07	<LLD	NA	<LLD	<LLD	0
Broadleaf Vegetation (pCi/Kg-wet)	Gamma Spec. - 21						
	I-131	60	<LLD	NA	<LLD	<LLD	0
	Cs-134	60	<LLD	NA	<LLD	<LLD	0
	Cs-137	80	<LLD	NA	<LLD	<LLD	0
Groundwater (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 2006

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
Groundwater (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 – 48	4.0	3.3 (24/48) 2.3 – 6.2	Site #55 3 miles 220°	4.0 (10/12) 2.8 – 6.2	NA	0
	H-3 – 16	2000	<LLD	NA	<LLD	NA	0
	Gamma Spec. – 48						
	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 2006

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. – 15						
	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. - 36						
	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	15 (7/36) 7 - 23	Site #60 Onsite 67°	15 (6/12) 7 - 23	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 2006

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 - 12	3000	1748 (8/12) 883 - 2142	Site #59 Onsite 180°	1752 (4/4) 1168 - 2142	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. 1985-2005 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 4.8, Environmental Technical Specifications for Nuclear Power Plants
6. NRC Radiological Assessment Branch Technical Position on Environmental Monitoring, Revision 1, November 1979