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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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 2008

In accordance with PVNGS Technical Specification (TS) 5.6.2, enclosed please find the Annual Radiological Environmental Operating Report for 2008.

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
R. I. Treadway NRC Senior Resident Inspector for PVNGS
A. V. Godwin Arizona Radiation Regulatory Agency (ARRA)
T. Morales Arizona Radiation Regulatory Agency (ARRA)

IE25
NRR

ENCLOSURE

Units 1, 2, and 3

Annual Radiological Environmental Operating Report 2008

NUCLEAR GENERATING STATION

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT 2008

(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)
Date: 2009.03.25 13:22:40 -07'00'

Reviewed by: Gray, Thomas S(Z99610)
Digitally signed by Gray, Thomas S (Z99610)
DN: cn=Gray, Thomas S(Z99610)
Reason: I have reviewed this document
Date: 2009.03.25 13:38:59 -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: 2009.04.10 10:57:44 -07'00'

Director, Radiation Protection

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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 2008, the following categories of samples were collected by APS:

- Broad leaf vegetation
- Ground water
- 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 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 2008. 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. 2008 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 2008

NOTE: All changes listed below were implemented by ODCM Rev. 23, effective 7-11-08.

- The vegetation sample location at Site #47 (Garden of Eatin', NNE3) became permanently unavailable and was replaced in July (Lahti residence, N3). This was documented in the Corrective Action Program by CRDR #3133845 and CRAI #3136750.
- The goat milk sample location at Site #51 (Painter residence, NE4) became permanently unavailable and was deleted. No replacement location was identified. This was documented in the Corrective Action Program by CRDR #3161377 and CRAI #3161378.

- The sample and analysis frequencies for all Evaporation Ponds and Reservoirs were changed from weekly/monthly/quarterly to quarterly. This change was processed after a review of more than 20 years of historical data and implements ODCM Revision 23.
- Added new Evaporation Pond #3 to the REMP.
- Added sample Site #43, Winters Well School TLD, to the REMP (ACT #3119292).

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 2008, there were eight (8) deviations/abnormal events with regard to the monitoring program. Refer to Table 2.3 for more detail and any corrective actions taken.

- The vegetation sample location at Site #47 (Garden of Eatin', NNE3) became permanently unavailable
- The goat milk sample location at Site #51 (Painter residence, NE4) became permanently unavailable.
- The air samples at Site #15 were invalid from 8/20 through 9/2
- The air samples at Site #4 were invalid from 9/23 through 9/30
- The air samples at Site #35 were invalid from 10/21 through 10/28
- Evaporation Pond #2 was emptied for liner replacement
- TLDs at Site #2 were missing in the 4th quarter
- TLDs at Site #36 were missing in the 1st and 2nd quarter

2.4. Significant Investigation Regarding Ground Water Protection

(Follow-Up from 2007 AREOR)

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.

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 Area-Wide Aquifer Protection Permit 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	N3 **(b)**	**Lahti residence (new, replaced Garden of Eatin' as of July)**
48	drinking water	SW1	Berryman residence
49	drinking water	N2	Sandoval residence
51	milk	NE4 **(b)**	**Deleted as of July**
52	vegetation	ENE3	Wright residence
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 **(b)**	Evaporation Pond #3 **(new)**

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 DELETED 7-08		M/AA					
52				M/AA			
53		M/AA					
54		M/AA					
55						W	
57					Q		
58					Q		
59							W/Q
60							W/Q
61							W/Q
62				M/AA			
63							W/Q
64							NEW

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

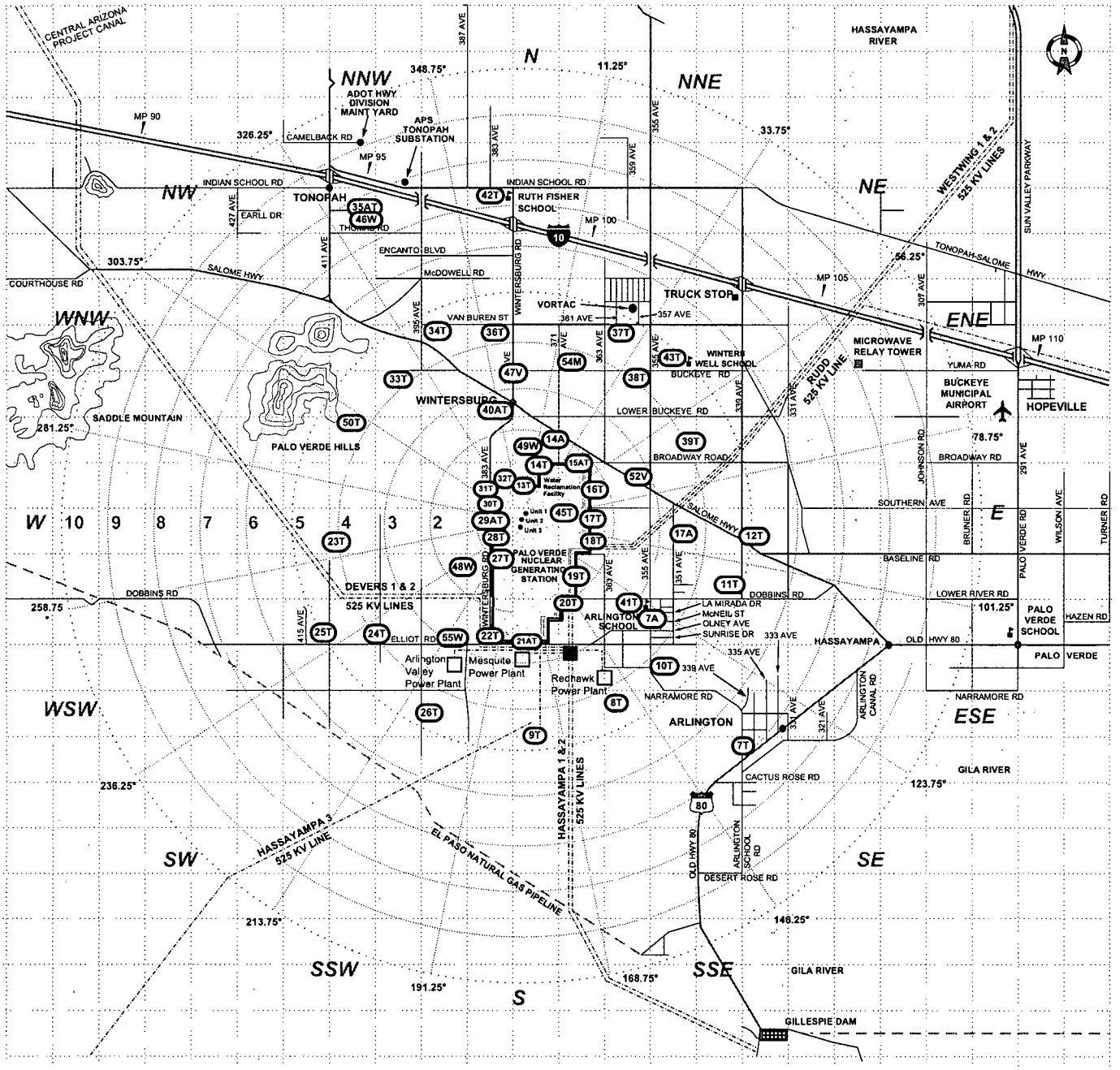
TABLE 2.3 SUMMARIES OF REMP DEVIATIONS/ABNORMAL EVENTS

Deviation/Abnormal Event	Actions taken
1. The vegetation sample location at Site #47 (Garden of Eatin', NNE3) became permanently unavailable.	1. Site #47 became permanently unavailable and was replaced in July (Lahti residence, N3). This was documented in the Corrective Action Program by CRDR #3133845 and CRAI #3136750. No further actions are needed.
2. The goat milk sample location at Site #51 (Painter residence, NE4) became permanently unavailable.	2. The goat milk sample location at Site #51 (Painter residence, NE4) became permanently unavailable and was deleted. No replacement location was identified. The 30 day sample location replacement criterion from ODCM requirement 6.1, Action c., was not met since the Land Use Census was used to determine the best possible replacement sample location. The Land Use Census was completed beyond 30 days from the time the current sample location became unavailable. This was documented in the Corrective Action Program by CRDRs #3133845 and #3161377, and CRAIs #3136750, #3137782, and #3161378. No further actions are needed.
3. The air samples at Site #15 were invalid from 8/20/08 through 9/2/08.	3. Site #15 was not accessible for the two week period due to insect infestation. This was a one time situation at this one location. No further actions are needed.
4. The air samples at Site #4 were invalid from 9/23/08 through 9/30/08.	4. Power was out at the sample location. The samples were invalidated as the sample volume was indeterminate. Subsequent sample results the following week were acceptable. No further actions are needed.
5. The air samples at Site #35 were invalid from 10/21/08 through 10/28/08.	5. The air sample pump was seized. The samples were invalidated as the sample volume was indeterminate. Subsequent sample results the following week were acceptable. No further actions are needed.
6. Evaporation Pond #2 was emptied for liner replacement.	6. The liner in Evaporation Pond #2 has deteriorated to the point that it needs repair/replacement. Evaporation Pond #2 was pumped dry to allow for liner repair/replacement. The normal sampling regimen will start after it is placed back in service.

TABLE 2.3 SUMMARIES OF REMP DEVIATIONS/ABNORMAL EVENTS

Deviation/Abnormal Event (continued)	Actions taken (continued)
7. The TLDs at Site #2 were missing in the 4th quarter.	7. Historically, there has not been a recurring issue with TLDs missing at this location. TLDs were placed at Site #2 for monitoring the 1st quarter 2009 period. If TLDs are missing when they are changed out for the 1st quarter, consideration will be given to relocation. No other actions are needed.
8. TLDs at Site #36 were missing in the 1st and 2nd quarter.	8. Since these TLDs were missing in two consecutive quarters, they were relocated across the road from their original location. The TLDs were retrievable in the 3rd and 4th quarters. No further actions are needed 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

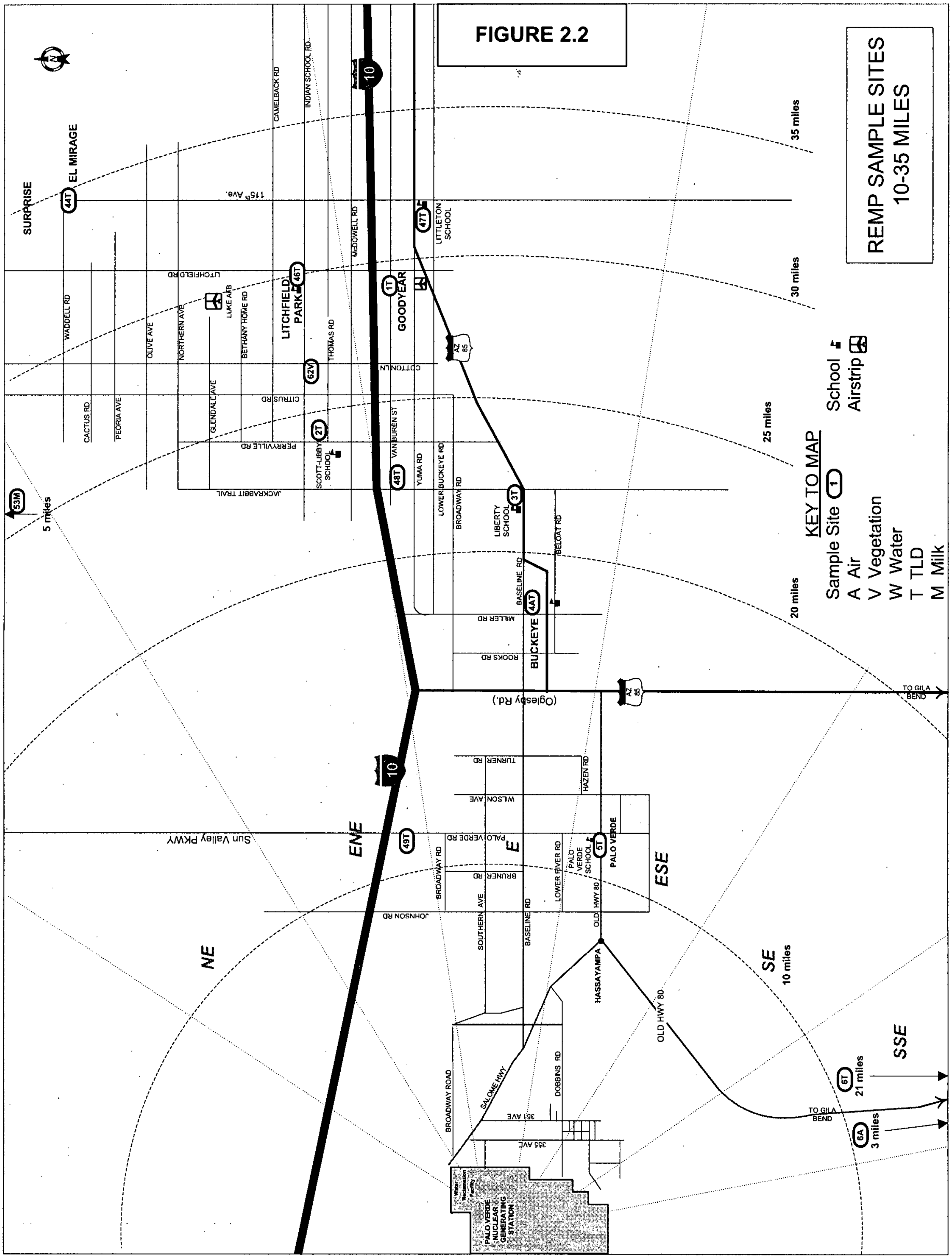


FIGURE 2.2
REMP SAMPLE SITES
10-35 MILES
KEY TO MAP
Sample Site
A Air
V Vegetation
W Water
T TLD
M Milk
School
Airstrip
5 miles
10 miles
20 miles
25 miles
30 miles
35 miles
NE
ENE
E
ESE
SE
SSE
SURPRISE
EL MIRAGE
LITCHFIELD PARK
GOODYEAR
BUCKEYE
PALO VERDE
HASSAYAMPA
LUKE AFB
LITTLETON SCHOOL
SCOTT-LIBBY SCHOOL
LIBERTY SCHOOL
PALO VERDE SCHOOL
PALO VERDE NUCLEAR GENERATING STATION
44T
46T
47T
1T
62V
2T
48T
3T
4AT
53M
49T
5T
6T
6A
21 miles
3 miles
TO GILA BEND
WADDELL RD
CACTUS RD
PEORIA AVE
OLIVE AVE
NORTHERN AVE
GLENDALE AVE
BETHANY HOME RD
CAMELBACK RD
INDIAN SCHOOL RD
THOMAS RD
McDOWELL RD
VAN BUREN ST
YUMA RD
LOWER BUCKEYE RD
BROADWAY RD
BASELINE RD
BELOAT RD
115th Ave.
LITCHFIELD RD
COTTON LN
CITRUS RD
PERRYVILLE RD
JACKRABBIT TRAIL
MILLER RD
ROOKS RD
(Oglesby Rd.)
TURNER RD
WILSON AVE
HAZEN RD
PALO VERDE RD
BRUNER RD
JOHNSON RD
Sun Valley PKWY
SOUTHERN AVE
LOWER RIVER RD
OLD HWY 80
SALOME HWY
DOBBINS RD
BROADWAY ROAD
351 AVE
355 AVE
AZ 85
10

3. Sample Collection Program

APS personnel using PVNGS procedures collected all samples.

3.1. Water

Weekly/Monthly/Quarterly samples were collected from the (45 and 85 acre) Reservoirs, Evaporation Pond #1, Evaporation Pond #2, and four (4) residence wells. Samples were collected in one-gallon containers and 500 ml glass bottles. The samples were analyzed for gamma emitting radionuclides and tritium. Resident wells were also analyzed for gross beta.

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.

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.

Bottom sediment samples were obtained from Sedimentation Basin #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.

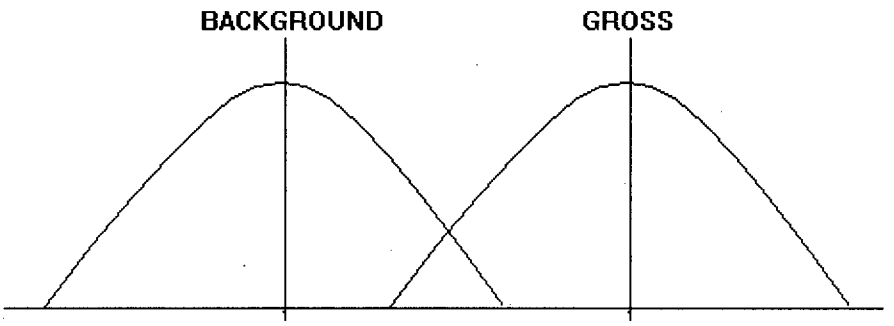
Occasionally, the PVNGS ODCM *a priori* LLDs may not be achieved as a result of:

- 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	2.4		0.003	
H-3	268			
Mn-54	12			
Fe-59	24			
Co-58	11			
Co-60	13			
Zn-65	25			
Zr-95	20			
Nb-95	12			
I-131	11 [a]	1	0.06 [b]	32
Cs-134	12	1	0.04 [b]	34
Cs-137	13	1	0.05 [b]	39
Ba-140	39	4		
La-140	13	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 2008, 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	Known Value	PVNGS Value	1 sigma Error	Resolution *	Ratio	Accept/Reject
Water	Mixed Gamma E6372-111	Ce-141	224	222	12	19	0.99	Accept
		Cr-51	288	334	44	8	1.16	Accept
		Cs-134	157	140	8	18	0.89	Accept
		Cs-137	140	135	8	17	0.96	Accept
		Co-58	122	115	8	14	0.94	Accept
		Mn-54	178	176	10	18	0.99	Accept
		Fe-59	117	127	12	11	1.08	Accept
		Zn-65	214	208	14	15	0.97	Accept
		Co-60	156	161	9	18	1.03	Accept
		I-131	64.1	86	15	6	1.34	Accept
	Tritium E6429-111	H-3	11300	9277	140	66	0.82	Accept
	Gross Beta E6430-111	gbeta	130	137	2	69	1.05	Accept
Air	Gross Beta E6336-111	gbeta	182	218	2	109	1.20	Accept
	Iodine Cart E6373-111	I-131	53.4	46	5	9	0.86	Accept
	Iodine Cart E6338-111	I-131	93.8	95	6	16	1.01	Accept
	Mixed Gamma E6339-111	Ce-141	76.5	79	4	20	1.03	Accept
		Cr-51	200	200	17	12	1.00	Accept
		Cs-134	110	105	7	15	0.95	Accept
		Cs-137	76.9	85	6	14	1.11	Accept
		Co-58	84.7	92	6	15	1.09	Accept
		Mn-54	78.8	92	6	15	1.17	Accept
		Fe-59	68.5	76	7	11	1.11	Accept
		Zn-65	151	168	11	15	1.11	Accept
		Co-60	111	122	6	20	1.10	Accept

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 E6337-111	I-131	67.9	69	4	17	1.02	Accept
		Ce-141	161	165	8	21	1.02	Accept
		Cr-51	421	413	26	16	0.98	Accept
		Cs-134	232	218	12	18	0.94	Accept
		Cs-137	162	167	9	19	1.03	Accept
		Co-58	179	183	10	18	1.03	Accept
		Mn-54	166	178	10	18	1.07	Accept
		Fe-59	144	142	9	16	0.98	Accept
		Zn-65	319	321	17	19	1.01	Accept
		Co-60	234	233	11	21	0.99	Accept

* calculated from PVNGS value/1 sigma error value

Acceptance Criteria **

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

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

Sample Type	Analysis Type	Nuclide	PVNGS Value	Certified Value [1]	PT Acceptance Limit [2]	Results
Water	Gamma	I-131	25.5	28.1	23.4-33.0	Accept
	Tritium	H-3	1938	2220	1830-2460	Accept
	Gross Beta		39.4	38.0	25.1-45.5	Accept
ERA RAD-75 PT Study Results						
Filter	Gross Beta		44.8	36.2	22.3-52.9	Accept
	Gamma	Am-241	71.8	67.3	39.4-92.3	Accept
		Cs-134	633.5	623	406-771	Accept
		Cs-137	858.8	761	572-1000	Accept
		Co-60	479.6	425	329-531	Accept
		Zn-65	538.6	452	313-626	Accept
ERA MRAD-009 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).

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 2008 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 2008 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 0.016 to 0.067 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 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 7.8 pCi/liter (Gavette residence, December composite).

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 is being pumped into Evaporation Pond #3 and will be relined first. Results are presented in Table 8.10. I-131 was observed in the Evaporation Ponds in three (3) of the monthly composite samples (11-19 pCi/liter) and four (4) of the Reservoir monthly composite samples (13 to 31 pCi/liter). I-131 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 1111 pCi/liter and the highest concentration in Evaporation Pond #2 was 1028 pCi/liter. Tritium was not identified 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 86 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 gamma emitting radionuclides were observed in any of the samples. Tritium was detected at very low concentrations in 3 of 7 samples, within the range of 319 to 577 pCi/liter. These values are consistent with historical tritium data and are attributed to plant vent releases during precipitation.

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 fifty-one (51) samples ranging from 180 to 2249 pCi/kg. The highest value corresponded to the dates associated with the highest weekly I-131 activity in the source water supply (WRF Influent).

In-111 was also identified in the sludge in 12 of the 51 samples. The highest concentration was 91 pCi/kg. It was previously established that In-111 is also used in the Phoenix area as a radiopharmaceutical. The frequency of In-111 detection has increased from the 2007 calendar year, when only 4 samples indicated In-111 activity.

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 seven (7) Evaporation Pond sediment samples indicated low levels of Cs-137 ranging from <MDA to 79 pCi/kg. One sample from Evaporation Pond #1 indicated I-131 (non-licensed radioactive material) at a concentration of 18 pCi/kg. These results are consistent with previous samples. Sample results can be found in Table 8.11.

8.8.3. 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 2008. Sample results can be found in Table 8.11.

8.8.4. Sedimentation Basin #2 sediment

Sedimentation Basin #2 receives storm runoff and provides an onsite collection area. Two (2) bottom sediment samples were collected and analyzed for gamma emitting radionuclides. Cs-137 was detected in both samples at 45 and 47 pCi/kg. This is below the pre-operational onsite average soil Cs-137 concentration of 238 pCi/kg and consistent with historical data. Refer to 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	26-Dec-07	2-Jan-08	0.023	0.026	0.026	0.026	0.025	0.025	0.024	0.025	0.023	0.024	0.025	4.7
2	2-Jan-08	8-Jan-08	0.025	0.026	0.024	0.025	0.028	0.026	0.025	0.027	0.026	0.026	0.026	4.4
3	8-Jan-08	15-Jan-08	0.025	0.030	0.027	0.025	0.027	0.025	0.026	0.026	0.024	0.025	0.026	6.5
4	15-Jan-08	22-Jan-08	0.033	0.039	0.036	0.033	0.035	0.032	0.034	0.032	0.033	0.034	0.034	6.3
5	22-Jan-08	29-Jan-08	0.023	0.026	0.025	0.023	0.025	0.026	0.026	0.026	0.024	0.024	0.025	5.0
6	29-Jan-08	5-Feb-08	0.018	0.020	0.018	0.018	0.019	0.018	0.018	0.017	0.018	0.018	0.018	4.3
7	5-Feb-08	12-Feb-08	0.029	0.033	0.030	0.027	0.030	0.027	0.029	0.031	0.029	0.028	0.029	6.2
8	12-Feb-08	20-Feb-08	0.031	0.035	0.031	0.030	0.034	0.030	0.030	0.033	0.032	0.033	0.032	5.6
9	20-Feb-08	26-Feb-08	0.017	0.020	0.021	0.017	0.018	0.018	0.017	0.017	0.019	0.017	0.018	8.0
10	26-Feb-08	4-Mar-08	0.026	0.027	0.027	0.024	0.025	0.024	0.021	0.026	0.022	0.023	0.025	8.4
11	4-Mar-08	11-Mar-08	0.029	0.032	0.029	0.027	0.032	0.025	0.027	0.028	0.026	0.027	0.028	8.3
12	11-Mar-08	18-Mar-08	0.031	0.031	0.029	0.028	0.032	0.030	0.028	0.029	0.029	0.031	0.030	4.7
13	18-Mar-08	24-Mar-08	0.036	0.038	0.035	0.033	0.037	0.033	0.033	0.033	0.030	0.033	0.034	7.0
Mean			0.027	0.029	0.028	0.026	0.028	0.026	0.026	0.027	0.026	0.026	0.027	4.5

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	24-Mar-08	1-Apr-08	0.025	0.030	0.026	0.027	0.028	0.029	0.026	0.027	0.028	0.028	0.027	5.5
15	1-Apr-08	8-Apr-08	0.026	0.028	0.030	0.028	0.030	0.028	0.029	0.030	0.030	0.028	0.029	4.7
16	8-Apr-08	15-Apr-08	0.027	0.028	0.028	0.027	0.027	0.027	0.025	0.028	0.029	0.026	0.027	4.2
17	15-Apr-08	22-Apr-08	0.036	0.038	0.037	0.037	0.037	0.037	0.035	0.036	0.038	0.038	0.037	2.7
18	22-Apr-08	29-Apr-08	0.038	0.038	0.039	0.036	0.039	0.038	0.036	0.041	0.040	0.036	0.038	4.5
19	29-Apr-08	6-May-08	0.030	0.034	0.034	0.032	0.032	0.029	0.030	0.032	0.032	0.031	0.032	5.2
20	6-May-08	13-May-08	0.037	0.039	0.040	0.037	0.040	0.037	0.040	0.036	0.037	0.038	0.038	4.0
21	13-May-08	20-May-08	0.028	0.032	0.029	0.025	0.028	0.028	0.029	0.027	0.028	0.026	0.028	6.7
22	20-May-08	27-May-08	0.025	0.028	0.021	0.023	0.024	0.022	0.021	0.022	0.025	0.023	0.023	9.3
23	27-May-08	4-Jun-08	0.032	0.039	0.036	0.032	0.034	0.034	0.034	0.034	0.033	0.035	0.034	6.0
24	4-Jun-08	10-Jun-08	0.031	0.029	0.030	0.030	0.033	0.032	0.031	0.029	0.030	0.031	0.031	4.1
25	10-Jun-08	17-Jun-08	0.037	0.040	0.040	0.037	0.039	0.037	0.037	0.039	0.040	0.039	0.039	3.5
26	17-Jun-08	24-Jun-08	0.037	0.042	0.039	0.038	0.041	0.039	0.041	0.039	0.042	0.039	0.040	4.3
Mean			0.031	0.034	0.033	0.031	0.033	0.032	0.032	0.032	0.033	0.032	0.033	2.8

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	24-Jun-08	1-Jul-08	0.038	0.041	0.039	0.038	0.043	0.038	0.039	0.039	0.039	0.037	0.039	4.4
28	1-Jul-08	8-Jul-08	0.032	0.034	0.034	0.035	0.036	0.035	0.034	0.033	0.036	0.036	0.035	3.9
29	8-Jul-08	16-Jul-08	0.029	0.028	0.027	0.027	0.029	0.027	0.027	0.025	0.029	0.031	0.028	6.0
30	16-Jul-08	22-Jul-08	0.037	0.037	0.037	0.036	0.036	0.038	0.033	0.037	0.039	0.037	0.037	4.3
31	22-Jul-08	29-Jul-08	0.033	0.034	0.029	0.031	0.034	0.035	0.031	0.035	0.038	0.034	0.033	7.6
32	29-Jul-08	5-Aug-08	0.033	0.031	0.034	0.032	0.033	0.034	0.032	0.033	0.036	0.033	0.033	4.1
33	5-Aug-08	12-Aug-08	0.040	0.044	0.036	0.037	0.039	0.037	0.036	0.035	0.042	0.041	0.039	7.7
34	12-Aug-08	20-Aug-08	0.037	0.040	0.036	0.039	0.039	0.035	0.037	0.036	0.042	0.035	0.038	6.2
35	20-Aug-08	26-Aug-08	0.034	0.035	0.035	0.031	invalid [a]	0.034	0.035	0.035	0.034	0.035	0.034	3.8
36	26-Aug-08	2-Sep-08	0.023	0.022	0.021	0.023	invalid [a]	0.020	0.018	0.021	0.024	0.023	0.022	8.6
37	2-Sep-08	9-Sep-08	0.045	0.046	0.046	0.046	0.046	0.046	0.043	0.041	0.046	0.043	0.045	4.0
38	9-Sep-08	17-Sep-08	0.031	0.038	0.035	0.034	0.031	0.035	0.031	0.030	0.033	0.036	0.033	7.9
39	17-Sep-08	23-Sep-08	0.040	0.040	0.039	0.042	0.041	0.040	0.039	0.041	0.041	0.042	0.041	2.7
Mean			0.035	0.036	0.034	0.035	0.037	0.035	0.033	0.034	0.037	0.036	0.035	3.4

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	23-Sep-08	30-Sep-08	invalid [b]	0.042	0.040	0.040	0.041	0.039	0.040	0.042	0.040	0.033	0.040	6.8
41	30-Sep-08	7-Oct-08	0.040	0.040	0.040	0.039	0.039	0.039	0.037	0.041	0.039	0.042	0.040	3.4
42	7-Oct-08	14-Oct-08	0.030	0.041	0.041	0.036	0.039	0.041	0.039	0.043	0.042	0.038	0.039	9.7
43	14-Oct-08	21-Oct-08	0.048	0.049	0.052	0.049	0.046	0.048	0.051	0.051	0.048	0.048	0.049	3.7
44	21-Oct-08	28-Oct-08	0.044	0.047	0.045	0.039	0.044	0.042	0.043	0.043	invalid [c]	0.042	0.043	5.1
45	28-Oct-08	4-Nov-08	0.055	0.057	0.058	0.054	0.063	0.057	0.058	0.061	0.055	0.059	0.058	4.8
46	4-Nov-08	12-Nov-08	0.024	0.027	0.023	0.023	0.024	0.022	0.023	0.023	0.023	0.022	0.023	6.1
47	12-Nov-08	18-Nov-08	0.038	0.041	0.035	0.035	0.038	0.035	0.035	0.035	0.036	0.037	0.037	5.5
48	18-Nov-08	24-Nov-08	0.065	0.073	0.067	0.063	0.062	0.065	0.060	0.056	0.066	0.052	0.063	9.4
49	24-Nov-08	2-Dec-08	0.052	0.052	0.046	0.042	0.049	0.046	0.047	0.045	0.048	0.044	0.047	6.9
50	2-Dec-08	10-Dec-08	0.053	0.053	0.049	0.041	0.046	0.046	0.049	0.047	0.046	0.048	0.048	7.4
51	10-Dec-08	16-Dec-08	0.037	0.037	0.033	0.031	0.033	0.034	0.035	0.034	0.034	0.034	0.034	5.3
52	16-Dec-08	22-Dec-08	0.021	0.022	0.019	0.016	0.019	0.020	0.016	0.019	0.018	0.017	0.019	10.7
53	22-Dec-08	29-Dec-08	0.020	0.023	0.021	0.020	0.020	0.023	0.019	0.019	0.019	0.020	0.020	7.4
Mean			0.041	0.043	0.041	0.038	0.040	0.040	0.039	0.040	0.040	0.038	0.040	3.7
Annual Average			***0.033***	***0.036***	***0.034***	***0.033***	***0.035***	***0.033***	***0.033***	***0.033***	***0.034***	***0.033***	***0.034***	***2.9***

[a] Sample not accessible due to insect infestation. [b] Power was out at sample location, sample invalid. [c] Sample pump was seized, sample invalid.

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*
24-Mar-08	Cs-134	<0.0009	<0.0029	<0.0009	<0.0034	<0.0038	<0.0045	<0.0042	<0.0029	<0.0029	<0.0029
	Cs-137	<0.0037	<0.0052	<0.0051	<0.0041	<0.0043	<0.0039	<0.0047	<0.0044	<0.0044	<0.0049
24-Jun-08	Cs-134	<0.0039	<0.0035	<0.0029	<0.0030	<0.0024	<0.0041	<0.0040	<0.0035	<0.0038	<0.0029
	Cs-137	<0.0029	<0.0011	<0.0042	<0.0042	<0.0048	<0.0036	<0.0041	<0.0037	<0.0053	<0.0042
30-Sep-08	Cs-134	<0.0042	<0.0023	<0.0032	<0.0038	<0.0024	<0.0035	<0.0035	<0.0022	<0.0032	<0.0022
	Cs-137	<0.0048	<0.0045	<0.0036	<0.0037	<0.0044	<0.0034	<0.0031	<0.0039	<0.0039	<0.0039
29-Dec-08	Cs-134	<0.0046	<0.0042	<0.0029	<0.0034	<0.0015	<0.0030	<0.0024	<0.0038	<0.0050	<0.0038
	Cs-137	<0.0011	<0.0039	<0.0036	<0.0029	<0.0011	<0.0043	<0.0042	<0.0038	<0.0040	<0.0053

TABLE 8.4 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	Site 6A*	Site 7A	Site 14A*	Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*
1	26-Dec-07	2-Jan-08	<0.068	<0.065	<0.047	<0.060	<0.045	<0.052	<0.043	**<0.014**	<0.030	<0.047
2	2-Jan-08	8-Jan-08	<0.050	<0.068	<0.066	<0.048	<0.051	<0.056	<0.060	<0.041	<0.068	<0.047
3	8-Jan-08	15-Jan-08	<0.044	<0.038	<0.040	<0.042	<0.049	<0.040	<0.038	<0.035	<0.043	<0.042
4	15-Jan-08	22-Jan-08	<0.054	<0.050	<0.059	<0.050	<0.036	<0.047	<0.055	<0.040	<0.052	<0.052
5	22-Jan-08	29-Jan-08	<0.042	<0.069	<0.069	<0.039	<0.064	<0.054	<0.064	<0.047	<0.049	<0.042
6	29-Jan-08	5-Feb-08	<0.049	<0.035	<0.045	<0.038	<0.051	<0.048	<0.048	<0.042	<0.045	<0.046
7	5-Feb-08	12-Feb-08	<0.032	<0.038	<0.051	<0.042	<0.038	<0.047	<0.042	<0.042	<0.048	<0.052
8	12-Feb-08	20-Feb-08	<0.052	<0.059	<0.062	<0.040	<0.052	<0.052	<0.068	<0.051	<0.040	<0.061
9	20-Feb-08	26-Feb-08	<0.070	<0.068	<0.068	<0.069	<0.068	<0.069	<0.069	<0.068	<0.069	<0.069
10	26-Feb-08	4-Mar-08	<0.037	<0.059	<0.065	<0.045	<0.045	<0.034	<0.067	<0.053	<0.065	<0.041
11	4-Mar-08	11-Mar-08	<0.037	<0.066	<0.066	<0.035	<0.038	<0.039	<0.060	<0.035	<0.047	<0.043
12	11-Mar-08	18-Mar-08	<0.068	<0.048	<0.048	<0.056	<0.063	<0.068	<0.070	<0.063	<0.063	<0.048
13	18-Mar-08	24-Mar-08	<0.068	<0.039	<0.063	<0.057	<0.062	<0.066	<0.050	<0.052	<0.053	<0.053
			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	24-Mar-08	1-Apr-08	<0.044	<0.049	<0.030	<0.038	<0.030	<0.047	<0.061	<0.040	<0.042	<0.057
15	1-Apr-08	8-Apr-08	<0.062	<0.014	<0.053	<0.036	<0.069	<0.046	<0.060	<0.046	<0.054	<0.054
16	8-Apr-08	15-Apr-08	<0.055	<0.062	<0.049	<0.034	<0.049	<0.034	<0.034	<0.056	<0.043	<0.054
17	15-Apr-08	22-Apr-08	<0.047	<0.067	<0.047	<0.036	<0.066	<0.047	<0.045	<0.055	<0.055	<0.048
18	22-Apr-08	29-Apr-08	<0.064	<0.056	<0.066	<0.055	<0.047	<0.055	<0.068	<0.068	<0.039	<0.070
19	29-Apr-08	6-May-08	<0.049	<0.059	<0.049	<0.055	<0.055	<0.060	<0.050	<0.034	<0.050	<0.052
20	6-May-08	13-May-08	<0.043	<0.059	<0.057	<0.062	<0.066	<0.060	<0.045	<0.045	<0.053	<0.066
21	13-May-08	20-May-08	<0.066	<0.063	<0.069	<0.054	<0.060	<0.047	<0.059	<0.037	<0.048	<0.055
22	20-May-08	27-May-08	<0.039	<0.063	<0.058	<0.063	<0.057	<0.039	<0.057	<0.057	<0.063	<0.057
23	27-May-08	4-Jun-08	<0.058	<0.058	<0.030	<0.049	<0.038	<0.053	<0.040	<0.062	<0.049	<0.054
24	4-Jun-08	10-Jun-08	<0.052	<0.054	<0.067	<0.064	<0.067	<0.065	<0.063	<0.044	<0.061	<0.066
25	10-Jun-08	17-Jun-08	<0.048	<0.063	<0.065	<0.053	<0.053	<0.067	<0.014	<0.047	<0.069	<0.047
26	17-Jun-08	24-Jun-08	<0.042	<0.058	<0.049	<0.015	<0.060	<0.066	<0.039	<0.059	<0.060	<0.067

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	Site 6A*	Site 7A	Site 14A*	Site 15*	Site 17A	Site 21	Site 29*	Site 35	Site 40*
27	24-Jun-08	1-Jul-08	<0.064	<0.063	<0.047	<0.037	<0.068	<0.055	<0.067	<0.055	<0.064	<0.066
28	1-Jul-08	8-Jul-08	<0.050	<0.034	<0.043	<0.044	<0.057	<0.035	<0.051	<0.044	<0.051	<0.063
29	8-Jul-08	16-Jul-08	<0.043	<0.048	<0.043	<0.036	<0.064	<0.049	<0.031	<0.065	<0.046	<0.068
30	16-Jul-08	22-Jul-08	<0.068	<0.069	<0.069	<0.070	<0.038	<0.064	<0.067	<0.060	<0.066	<0.059
31	22-Jul-08	29-Jul-08	<0.065	<0.065	<0.064	<0.050	<0.069	<0.065	<0.039	<0.058	<0.051	<0.040
32	29-Jul-08	5-Aug-08	<0.064	<0.070	<0.014	<0.049	<0.039	<0.050	<0.070	<0.065	<0.040	<0.052
33	5-Aug-08	12-Aug-08	<0.063	<0.069	<0.045	<0.054	<0.037	<0.054	<0.065	<0.068	<0.041	<0.057
34	12-Aug-08	20-Aug-08	<0.046	<0.039	<0.049	<0.029	<0.056	<0.053	<0.029	<0.030	<0.041	<0.047
35	20-Aug-08	26-Aug-08	<0.060	<0.066	<0.050	<0.069	invalid [a]	<0.062	<0.069	<0.067	<0.067	<0.068
36	26-Aug-08	2-Sep-08	<0.037	<0.068	<0.036	<0.063	invalid [a]	<0.060	<0.070	<0.065	<0.047	<0.061
37	2-Sep-08	9-Sep-08	<0.052	<0.034	<0.063	<0.060	<0.056	<0.043	<0.042	<0.043	<0.049	<0.013
38	9-Sep-08	17-Sep-08	<0.053	<0.068	<0.032	<0.057	<0.051	<0.054	<0.039	<0.047	<0.036	<0.048
39	17-Sep-08	23-Sep-08	<0.015	<0.062	<0.060	<0.053	<0.062	<0.063	<0.061	<0.070	<0.069	<0.068
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	23-Sep-08	30-Sep-08	invalid [b]	<0.037	<0.060	<0.047	<0.060	<0.037	<0.037	<0.063	<0.056	<0.037
41	30-Sep-08	7-Oct-08	<0.038	<0.038	<0.065	<0.038	<0.055	<0.062	<0.054	<0.054	<0.069	<0.065
42	7-Oct-08	14-Oct-08	<0.035	<0.068	<0.045	<0.064	<0.052	<0.045	<0.063	<0.053	<0.046	<0.070
43	14-Oct-08	21-Oct-08	<0.070	<0.064	<0.061	<0.058	<0.051	<0.049	<0.054	<0.055	<0.038	<0.056
44	21-Oct-08	28-Oct-08	<0.070	<0.066	<0.065	<0.052	<0.051	<0.050	<0.060	<0.061	invalid [c]	<0.063
45	28-Oct-08	4-Nov-08	<0.048	<0.066	<0.046	<0.066	<0.037	<0.038	<0.060	<0.065	<0.069	<0.067
46	4-Nov-08	12-Nov-08	<0.058	<0.052	<0.046	<0.032	<0.040	<0.052	<0.040	<0.032	<0.032	<0.047
47	12-Nov-08	18-Nov-08	<0.043	<0.066	<0.063	<0.066	<0.070	<0.043	<0.069	<0.016	<0.062	<0.067
48	18-Nov-08	24-Nov-08	<0.065	<0.063	<0.067	<0.068	<0.054	<0.065	<0.063	<0.068	<0.047	<0.067
49	24-Nov-08	2-Dec-08	<0.011	<0.064	<0.046	<0.055	<0.066	<0.039	<0.051	<0.061	<0.012	<0.052
50	2-Dec-08	10-Dec-08	<0.052	<0.040	<0.051	<0.046	<0.032	<0.061	<0.046	<0.039	<0.052	<0.039
51	10-Dec-08	16-Dec-08	<0.067	<0.066	<0.065	<0.065	<0.046	<0.046	<0.070	<0.060	<0.069	<0.060
52	16-Dec-08	22-Dec-08	<0.069	<0.068	<0.051	<0.060	<0.068	<0.066	<0.060	<0.062	<0.066	<0.041
53	22-Dec-08	29-Dec-08	<0.052	<0.034	<0.052	<0.043	<0.052	<0.034	<0.051	<0.029	<0.068	<0.033

[a] Sample not accessible due to insect infestation. [b] Power was out at sample location, sample invalid. [c] Sample pump was seized, sample invalid.

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
WRIGHT RESIDENCE (Site #52)*	NO SAMPLES AVAILABLE				
DUNCAN FAMILY FARMS (Site #62)*	green cabbage	11-Jan-08	<58	<56	<79
	red cabbage	11-Jan-08	<60	<54	<69
	green cabbage	15-Feb-08	<53	<47	<63
	red cabbage	15-Feb-08	<55	<46	<67
	savoy cabbage	15-Feb-08	<54	<57	<57
	green cabbage	14-Mar-08	<38	<45	<64
	green cabbage	11-Apr-08	<37	<49	<60
	green cabbage	16-May-08	<41	<38	<45
	green cabbage	17-Oct-08	<30	<30	<44
	green cabbage	14-Nov-08	<29	<36	<36
	green cabbage	12-Dec-08	<33	<43	<30
	red cabbage	12-Dec-08	<38	<26	<44
GARDEN OF EATIN' RESIDENCE (Site #47)* LAHTI RESIDENCE	NO SAMPLES AVAILABLE (Lahti replaced Garden of Eatin' in July)				

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					
MARTIN GOATS (Site #53)*	26-Feb-08	<1	<1	<1	<3	<1
	21-Mar-08	<1	<1	<1	<3	<1
	18-Apr-08	<1	<1	<1	<3	<1
	23-May-08	<1	<1	<1	<3	<1
	20-Jun-08	<1	<1	<1	<3	<1
	25-Jul-08	<1	<1	<1	<3	<1
	22-Aug-08	<1	<1	<1	<3	<1
	26-Sep-08	<1	<1	<1	<3	<1
	24-Oct-08	<1	<1	<1	<3	<1
	21-Nov-08	<1	<1	<1	<3	<1
	18-Dec-08	<1	<1	<1	<3	<1
HERNANDEZ GOATS (Site #54)	11-Jan-08	<1	<1	<1	<3	<1
	15-Feb-08	<1	<1	<1	<3	<1
	14-Mar-08	<1	<1	<1	<3	<1
	11-Apr-08	<1	<1	<1	<3	<1
	16-May-08	<1	<1	<1	<3	<1
	11-Jul-08	<1	<1	<1	<3	<1
	15-Aug-08	<1	<1	<1	<3	<1
	19-Sep-08	<1	<1	<1	<3	<1
	14-Nov-08	<1	<1	<1	<3	<1
	12-Dec-08	<1	<1	<1	<3	<1

Site #51 was no longer available as of March. The Land Use Census did not identify a replacement, so the location was deleted effective 7-11-08.

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)*	29-Jan-08	<13	<13	<24	<13	<30	<12	<23	<12	<12	<14	<41	<13		4.5 ± 1.7
	26-Feb-08	<14	<14	<30	<14	<27	<15	<22	<13	<13	<13	<46	<14		<3.3
	24-Mar-08	<12	<12	<20	<13	<28	<11	<21	<9	<10	<11	<37	<13	<275	<3.1
	29-Apr-08	<13	<11	<25	<14	<30	<11	<22	<11	<11	<10	<36	<12		4.0 ± 1.9
	27-May-08	<13	<12	<27	<13	<29	<14	<21	<13	<12	<14	<47	<13		4.4 ± 1.8
	24-Jun-08	<10	<9	<17	<10	<21	<9	<16	<8	<9	<10	<32	<15	<282	<3.0
	29-Jul-08	<13	<13	<25	<14	<27	<13	<22	<12	<11	<14	<37	<13		<2.9
	26-Aug-08	<10	<12	<30	<15	<29	<13	<20	<12	<11	<13	<47	<9		4.5 ± 2.0
	30-Sep-08	<9	<10	<21	<11	<26	<12	<21	<12	<9	<11	<39	<13	<275	6.4 ± 1.5
	28-Oct-08	<13	<15	<25	<15	<26	<10	<24	<13	<12	<14	<44	<15		3.0 ± 1.8
	24-Nov-08	<11	<10	<17	<12	<23	<12	<18	<9	<9	<10	<37	<15		3.6 ± 1.9
	29-Dec-08	<11	<9	<22	<11	<25	<9	<18	<9	<9	<11	<36	<14	<273	7.1 ± 1.8
GAVETTE RESIDENCE (SITE #55)	29-Jan-08	<12	<14	<28	<15	<28	<13	<27	<11	<12	<14	<42	<15		5.3 ± 1.5
	26-Feb-08	<13	<14	<27	<13	<29	<13	<23	<12	<12	<15	<45	<15		<2.5
	24-Mar-08	<12	<9	<25	<12	<26	<11	<21	<10	<8	<11	<32	<15	<285	<2.5
	29-Apr-08	<13	<12	<23	<15	<27	<13	<24	<13	<11	<13	<37	<11		3.9 ± 1.6
	27-May-08	<10	<11	<24	<15	<26	<12	<20	<12	<11	<13	<41	<12		3.8 ± 1.5
	24-Jun-08	<13	<14	<22	<12	<27	<14	<21	<13	<13	<14	<50	<14	<279	<2.4
	29-Jul-08	<14	<15	<28	<15	<29	<13	<22	<14	<10	<13	<43	<13		4.4 ± 1.5
	26-Aug-08	<10	<12	<16	<13	<25	<11	<17	<10	<10	<10	<34	<14		4.7 ± 1.5
	30-Sep-08	<12	<13	<25	<12	<30	<13	<18	<12	<11	<14	<47	<12	<272	5.8 ± 1.2
	28-Oct-08	<12	<13	<25	<15	<29	<13	<25	<10	<10	<14	<45	<15		3.6 ± 1.6
	24-Nov-08	<10	<10	<22	<10	<22	<10	<17	<9	<8	<10	<37	<15		3.5 ± 1.6
	29-Dec-08	<13	<12	<21	<12	<23	<12	<22	<11	<12	<12	<41	<15	<273	7.8 ± 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
WIRTH RESIDENCE (SITE #46)*	29-Jan-08	<12	<13	<28	<14	<30	<13	<24	<13	<12	<13	<46	<13		3.6 ± 1.4
	26-Feb-08	<11	<11	<20	<12	<30	<14	<24	<13	<13	<13	<52	<14		2.6 ± 1.6
	24-Mar-08	<13	<12	<25	<15	<30	<13	<25	<13	<10	<12	<40	<14	<285	<2.6
	29-Apr-08	<11	<14	<21	<13	<30	<14	<16	<13	<12	<14	<44	<13		2.5 ± 1.5
	27-May-08	<13	<11	<25	<14	<29	<13	<24	<13	<10	<11	<45	<15		3.0 ± 1.4
	24-Jun-08	<12	<10	<25	<14	<30	<12	<22	<13	<10	<14	<40	<13	<281	3.4 ± 1.6
	29-Jul-08	<12	<11	<24	<13	<27	<12	<21	<10	<11	<13	<38	<15		3.6 ± 1.5
	26-Aug-08	<13	<13	<27	<12	<29	<15	<21	<12	<12	<15	<43	<12		4.7 ± 1.5
	30-Sep-08	<11	<11	<23	<12	<23	<13	<21	<12	<9	<11	<42	<15	<274	5.6 ± 1.3
	28-Oct-08	<13	<12	<22	<14	<29	<14	<23	<11	<13	<15	<47	<14		4.6 ± 1.6
	24-Nov-08	<13	<13	<24	<14	<27	<13	<21	<15	<13	<12	<58	<13		<2.4
	29-Dec-08	<15	<14	<23	<11	<28	<10	<20	<13	<13	<12	<43	<13	<274	4.8 ± 1.4
SANDOVAL RESIDENCE (SITE #49) *	29-Jan-08	<12	<11	<24	<14	<20	<11	<20	<11	<11	<12	<33	<15		<1.9
	26-Feb-08	<11	<10	<24	<11	<27	<12	<22	<12	<11	<12	<44	<15		<2.4
	24-Mar-08	<12	<13	<27	<13	<30	<13	<19	<12	<11	<14	<49	<13	<284	<2.4
	29-Apr-08	<9	<10	<19	<13	<20	<10	<19	<9	<9	<11	<29	<15		<2.1
	27-May-08	<13	<14	<28	<13	<30	<15	<24	<15	<13	<14	<51	<14		<2.0
	24-Jun-08	<11	<11	<22	<15	<22	<12	<19	<12	<9	<12	<40	<13	<279	<2.3
	29-Jul-08	<14	<14	<30	<14	<25	<15	<23	<14	<12	<14	<48	<13		<2.1
	26-Aug-08	<12	<11	<30	<13	<24	<12	<20	<13	<12	<13	<39	<12		<2.0
	30-Sep-08	<10	<11	<17	<14	<21	<12	<16	<9	<8	<11	<39	<15	<271	4.7 ± 1.1
	28-Oct-08	<13	<13	<29	<15	<29	<15	<26	<13	<11	<15	<44	<14		<2.2
	24-Nov-08	<13	<13	<29	<15	<26	<14	<21	<15	<12	<14	<50	<12		<2.2
	29-Dec-08	<11	<11	<21	<15	<26	<12	<19	<11	<9	<10	<35	<12	<272	3.6 ± 1.3

TABLE 8.9 GROUND WATER

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	29-Jan-08	<12	<13	<25	<13	<29	<15	<20	<14	<12	<12	<45	<15	<230
27ddc	29-Apr-08	<14	<12	<26	<14	<27	<15	<22	<13	<11	<14	<43	<14	<277
(Site #57)*	30-Jul-08	<14	<15	<23	<14	<26	<13	<19	<11	<10	<14	<42	<11	<283
	28-Oct-08	<9	<10	<25	<13	<28	<11	<19	<10	<10	<12	<51	<15	<282
WELL	29-Jan-08	<10	<10	<19	<12	<26	<11	<16	<9	<9	<10	<36	<15	<281
34abb	29-Apr-08	<11	<11	<26	<15	<29	<14	<22	<14	<11	<13	<44	<13	<282
(Site #58)*	30-Jul-08	<13	<11	<23	<13	<28	<14	<25	<13	<12	<12	<42	<15	<283
	28-Oct-08	<9	<10	<21	<10	<28	<11	<18	<11	<10	<10	<39	<15	<279

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) *	29-Jan-08	<8	<11	<20	<11	<21	<9	<16	13 ± 8	<9	<13	<36	<15	
	26-Feb-08	<14	<12	<23	<14	<27	<13	<23	31 ± 14	<11	<12	<41	<13	
	24-Mar-08	<15	<12	<26	<8	<30	<12	<24	14 ± 10	<12	<15	<45	<13	<279
	29-Apr-08	<12	<11	<23	<13	<26	<12	<20	<14	<11	<12	<33	<15	
	27-May-08	<13	<11	<23	<13	<25	<13	<23	15 ± 14	<12	<15	<46	<14	
	24-Jun-08	<11	<10	<23	<11	<25	<11	<20	<14	<9	<12	<38	<15	<283
	22-Jul-08	<12	<11	<27	<12	<26	<12	<18	<15	<12	<12	<39	<14	<279
	28-Oct-08	<11	<12	<18	<13	<18	<9	<17	<10	<10	<8	<33	<15	<282
85 ACRE RESERVOIR (Site #60) *	29-Apr-08	<8	<9	<17	<8	<15	<8	<13	<9	<7	<7	<27	<11	
	27-May-08	<14	<12	<24	<14	<30	<11	<24	<12	<11	<13	<42	<11	
	24-Jun-08	<12	<11	<22	<14	<23	<12	<17	<11	<11	<13	<33	<15	<283
	22-Jul-08	<12	<11	<21	<12	<30	<10	<20	<12	<11	<12	<32	<10	<279
	28-Oct-08	<12	<10	<21	<12	<25	<10	<19	<12	<9	<12	<40	<15	<282
EVAP POND 1 (Site #59) *	29-Jan-08	<11	<11	<22	<11	<30	<10	<20	<10	<9	<11	<34	<12	
	26-Feb-08	<14	<12	<29	<14	<30	<13	<22	15 ± 11	<11	<15	<45	<11	
	24-Mar-08	<12	<12	<29	<15	<26	<12	<20	19 ± 10	<8	<13	<38	<13	913 ± 184
	29-Apr-08	<12	<13	<26	<15	<28	<12	<22	<15	<12	<15	<44	<13	
	27-May-08	<11	<13	<21	<15	<26	<11	<20	<12	<10	<12	<39	<14	
	24-Jun-08	<12	<13	<25	<11	<30	<11	<21	<13	<10	<14	<32	<14	1107 ± 186
	29-Jul-08	<12	<11	<26	<14	<30	<11	<19	<13	<11	<13	<40	<13	
	26-Aug-08	<11	<10	<29	<12	<29	<12	<22	<10	<11	<14	<37	<14	
	30-Sep-08	<9	<10	<23	<14	<30	<11	<16	<10	<10	<12	<31	<11	948 ± 174
	28-Oct-08	<9	<10	<24	<11	<29	<10	<21	<9	<9	<12	<32	<10	
	24-Nov-08	<12	<11	<29	<11	<30	<12	<21	11 ± 11	<12	<14	<36	<11	
	29-Dec-08	<13	<11	<26	<13	<28	<13	<21	<15	<11	<14	<43	<12	1111 ± 168
EVAP POND 2 (Site #63) *	29-Jan-08	<14	<12	<30	<15	<30	<13	<24	<13	<12	<16	<47	<11	
	26-Feb-08	<12	<12	<28	<12	<29	<12	<22	<13	<10	<13	<46	<15	
	24-Mar-08	<11	<10	<24	<12	<30	<11	<21	<11	<10	<12	<45	<10	1028 ± 188
	29-Apr-08	<12	<11	<30	<14	<27	<12	<19	<12	<11	<15	<41	<13	
	27-May-08	<13	<12	<28	<13	<30	<12	<23	<12	<11	<14	<48	<14	
	24-Jun-08	<12	<10	<26	<14	<30	<11	<20	<11	<11	<14	<38	<10	785 ± 182
	29-Jul-08	<12	<12	<27	<13	<30	<11	<21	<12	<11	<13	<41	<14	
	26-Aug-08	<13	<10	<27	<12	<17	<12	<20	<13	<10	<13	<41	<12	
	30-Sep-08	<12	<14	<30	<12	<30	<12	<18	<12	<10	<16	<43	<13	783 ± 173
	28-Oct-08	<12	<11	<26	<13	<30	<11	<21	<10	<10	<14	<42	<8	903 ± 179
	empty for re-lining													

The 85 acre Reservoir was out of service for re-lining from July 2007 to April 2008. Reservoir and Evap Pond sample frequency was changed to quarterly in August. Evap Ponds were still sampled and analyzed more frequently to meet Aquifer Protection Permit requirements.

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	1-Jan-08	<11	<12	<22	<13	<25	<11	<20	43 ± 12	<10	<11	<36	<13	
	8-Jan-08	<11	<12	<23	<13	<27	<11	<21	18 ± 11	<12	<12	<37	<13	
	15-Jan-08	<13	<12	<24	<12	<30	<13	<22	38 ± 13	<11	<14	<44	<13	
	22-Jan-08	<11	<11	<22	<13	<22	<12	<19	41 ± 14	<11	<12	<38	<12	
	29-Jan-08	<11	<9	<23	<14	<21	<11	<18	38 ± 11	<10	<12	<33	<15	<229
	4-Feb-08	<12	<9	<21	<14	<27	<12	<20	50 ± 13	<10	<11	<37	<14	
	12-Feb-08	<13	<12	<25	<14	<27	<14	<23	11 ± 11	<14	<14	<43	<15	
	17-Feb-08	<12	<9	<21	<12	<20	<12	<21	41 ± 12	<10	<13	<47	<15	
	26-Feb-08	<13	<11	<28	<14	<30	<13	<20	37 ± 13	<10	<13	<45	<12	<285
	2-Mar-08	<13	<10	<23	<13	<24	<11	<21	12 ± 12	<8	<10	<38	<15	
	11-Mar-08	<13	<12	<25	<12	<30	<13	<22	6 ± 15	<12	<14	<47	<14	
	17-Mar-08	<8	<9	<24	<9	<20	<9	<15	34 ± 11	<8	<10	<31	<12	
	25-Mar-08	<11	<10	<26	<13	<24	<11	<17	26 ± 10	<11	<10	<32	<11	<294
	1-Apr-08	<13	<13	<30	<13	<28	<13	<20	34 ± 12	<9	<14	<41	<12	
	8-Apr-08	<13	<10	<29	<14	<28	<13	<23	20 ± 14	<11	<15	<41	<15	
	14-Apr-08	<12	<12	<25	<12	<28	<10	<18	29 ± 12	<10	<12	<39	<13	
	WRF down for maintenance													
	29-Apr-08	<15	<14	<29	<15	<29	<14	<25	75 ± 20	<12	<15	<46	<12	<286
	6-May-08	<11	<12	<27	<13	<30	<13	<22	71 ± 20	<13	<13	<44	<15	
	13-May-08	<12	<12	<25	<13	<27	<11	<20	68 ± 19	<11	<12	<42	<15	
	20-May-08	<10	<8	<19	<9	<19	<9	<19	33 ± 11	<10	<10	<32	<15	
	27-May-08	<11	<10	<20	<11	<30	<11	<18	44 ± 13	<10	<12	<39	<10	<291
	3-Jun-08	<13	<11	<27	<15	<26	<13	<21	57 ± 19	<11	<12	<41	<13	
	10-Jun-08	<11	<13	<26	<15	<26	<11	<19	23 ± 12	<12	<14	<40	<13	
	17-Jun-08	<13	<13	<25	<15	<30	<14	<23	30 ± 14	<11	<14	<46	<14	
	24-Jun-08	<11	<14	<27	<14	<30	<11	<25	35 ± 13	<10	<11	<39	<9	<290
	1-Jul-08	<12	<12	<25	<14	<28	<12	<21	23 ± 13	<13	<14	<41	<12	
	8-Jul-08	<12	<11	<24	<13	<29	<11	<19	34 ± 10	<10	<11	<35	<15	
	16-Jul-08	<13	<9	<22	<15	<25	<14	<21	17 ± 8	<11	<14	<44	<14	

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	22-Jul-08	<10	<11	<21	<12	<24	<10	<17	<13	<10	<10	<35	<14	
	29-Jul-08	<10	<9	<19	<12	<15	<8	<14	<10	<9	<10	<30	<11	<287
	5-Aug-08	<11	<11	<23	<13	<26	<11	<18	21 ± 12	<11	<11	<44	<15	
	12-Aug-08	<13	<9	<20	<15	<22	<13	<21	<11	<10	<11	<39	<11	
	19-Aug-08	<12	<10	<20	<13	<24	<10	<19	<15	<10	<13	<41	<12	
	26-Aug-08	<12	<9	<28	<12	<27	<10	<22	26 ± 10	<9	<15	<39	<15	<281
	2-Sep-08	<10	<14	<29	<12	<21	<15	<21	<13	<11	<16	<44	<14	
	9-Sep-08	<10	<11	<28	<15	<29	<13	<21	<15	<13	<15	<49	<13	
	16-Sep-08	<13	<12	<27	<14	<30	<13	<19	25 ± 15	<10	<12	<43	<14	
	23-Sep-08	<14	<12	<24	<12	<29	<13	<28	23 ± 12	<10	<13	<48	<15	
	30-Sep-08	<13	<14	<24	<12	<30	<12	<25	55 ± 14	<13	<15	<34	<14	<268
	7-Oct-08	<12	<10	<27	<14	<30	<15	<22	25 ± 15	<14	<16	<46	<14	
	14-Oct-08	<15	<12	<30	<13	<30	<13	<23	27 ± 15	<15	<15	<47	<12	<272
	WRF down for maintenance													
	4-Nov-08	<12	<11	<23	<13	<25	<12	<21	22 ± 10	<10	<12	<41	<13	
	12-Nov-08	<12	<13	<30	<11	<27	<15	<22	54 ± 19	<13	<13	<48	<14	
	18-Nov-08	<11	<9	<28	<12	<25	<11	<15	86 ± 16	<8	<12	<32	<11	
	24-Nov-08	<14	<12	<21	<14	<29	<12	<25	56 ± 15	<11	<13	<37	<14	<280
	2-Dec-08	<13	<12	<25	<15	<26	<12	<21	29 ± 12	<10	<12	<44	<14	
	9-Dec-08	<11	<12	<24	<13	<27	<12	<17	16 ± 11	<8	<12	<41	<15	
	16-Dec-08	<11	<10	<16	<14	<23	<11	<19	23 ± 10	<10	<11	<31	<13	
	22-Dec-08	<13	<13	<24	<15	<29	<13	<21	29 ± 14	<12	<15	<44	<13	
	29-Dec-08	<11	<13	<25	<13	<29	<11	<20	75 ± 21	<11	<11	<41	<11	<280

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-Jan-08	<10	<13	<22	<14	<25	<12	<19	<8	<11	<12	<42	<15	577 ± 178
	29-Jan-08	<14	<10	<23	<15	<27	<12	<22	<11	<12	<13	<43	<13	319 ± 145
	5-Feb-08	<14	<14	<26	<10	<28	<14	<25	<13	<10	<14	<42	<15	<237
	12-Feb-08	<12	<11	<22	<11	<24	<10	<17	<10	<10	<13	<30	<13	<241
	20-Feb-08	<12	<12	<26	<15	<29	<14	<21	<12	<13	<15	<44	<13	319 ± 147
	26-Feb-08	<11	<10	<17	<11	<24	<11	<19	<10	<10	<10	<34	<15	<283
	26-Aug-08	<7	<11	<23	<13	<19	<10	<16	<9	<9	<11	<32	<14	<292

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-Jan-08	1658 ± 231	<34	<33	
	8-Jan-08	1120 ± 144	<17	<33	40 ± 31
	15-Jan-08	686 ± 117	<30	<37	
	22-Jan-08	930 ± 124	<26	<33	21 ± 19
	29-Jan-08	1071 ± 140	<23	<30	
	4-Feb-08	1098 ± 163	<33	<31	
	12-Feb-08	905 ± 139	<35	<46	
	18-Feb-08	683 ± 101	<22	<35	
	25-Feb-08	979 ± 155	<22	<47	
	3-Mar-08	863 ± 134	<22	<35	
	10-Mar-08	602 ± 94	<24	<20	
	17-Mar-08	578 ± 92	<17	<26	
	25-Mar-08	701 ± 103	<28	<26	25 ± 28
	1-Apr-08	471 ± 110	<26	<22	
	8-Apr-08	528 ± 110	<25	<32	
	15-Apr-08	428 ± 71	<29	<25	
	16-Apr-08	557 ± 114	<32	<30	
	WRF down for maintenance				
	29-Apr-08	180 ± 41	<24	<20	
	6-May-08	591 ± 131	<18	<23	
	13-May-08	609 ± 92	<20	<36	
	20-May-08	907 ± 119	<19	<21	40 ± 24
	27-May-08	849 ± 126	<17	<32	91 ± 44
	3-Jun-08	797 ± 109	<34	<23	37 ± 22
	10-Jun-08	932 ± 124	<22	<28	
	17-Jun-08	695 ± 105	<21	<37	
	24-Jun-08	825 ± 112	<15	<38	
	1-Jul-08	1054 ± 221	<24	<29	71 ± 42
	8-Jul-08	1061 ± 223	<19	<26	
	16-Jul-08	921 ± 194	<24	<22	
	22-Jul-08	784 ± 169	<22	<21	35 ± 25
	29-Jul-08	705 ± 102	<30	<25	
	5-Aug-08	1288 ± 270	<23	<19	

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	12-Aug-08	887 ± 119	<30	<19	
	19-Aug-08	573 ± 88	<26	<33	30 ± 23
	26-Aug-08	646 ± 98	<29	<30	
	2-Sep-08	1057 ± 221	<22	<21	35 ± 19
	9-Sep-08	693 ± 97	<25	<11	
	16-Sep-08	760 ± 165	<15	<29	
	23-Sep-08	968 ± 128	<26	<20	
	30-Sep-08	1378 ± 168	<31	<31	
	7-Oct-08	1245 ± 156	<29	<27	
	14-Oct-08	1321 ± 165	<27	<33	
	WRF down for maintenance				
	4-Nov-08	314 ± 75	<19	<22	
	12-Nov-08	661 ± 145	<23	<25	
	18-Nov-08	2099 ± 244	<29	<31	60 ± 34
	24-Nov-08	2249 ± 262	<29	<20	83 ± 42
	2-Dec-08	1490 ± 186	<18	<21	
	9-Dec-08	1137 ± 240	<24	<29	
	16-Dec-08	864 ± 186	<32	<30	
	22-Dec-08	1337 ± 169	<24	<8	
	29-Dec-08	1758 ± 351	<28	<31	

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
(N)	20-Nov-08	18 ± 9	<10	13 ± 8
(E)	20-Nov-08	<13	<11	<17
EVAP POND 1 (W)	20-Nov-08	<13	<13	<16
(N)	7-Nov-08	<9	<11	15 ± 13
(E)	7-Nov-08	<11	<12	20 ± 13
EVAP POND 2 (W)	7-Nov-08	<12	<11	35 ± 15
(S)	7-Nov-08	<10	<10	79 ± 15
SED. BASIN #2 (N)	20-Nov-08	<12	<11	47 ± 11
SED. BASIN #2 (S)	20-Nov-08	<11	<11	45 ± 12

COOLING TOWER SLUDGE

UNIT CYCLE	APPROXIMATE VOLUME (yd^3)	ISOTOPE	ACTIVITY RANGE (uCi/ml)	SAMPLE TYPE	FRACTION OF SAMPLES ABOVE MDA
U3R13	290	Co-60 Cs-137	<MDA to 3.54E-07 <MDA to 1.49E-07	tower/canal sludge	26 of 32 16 of 32
U2R14	234	Co-60 Cs-137	<MDA to 1.60E-07 <MDA to 1.40E-07	tower/canal sludge	29 of 32 32 of 32

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

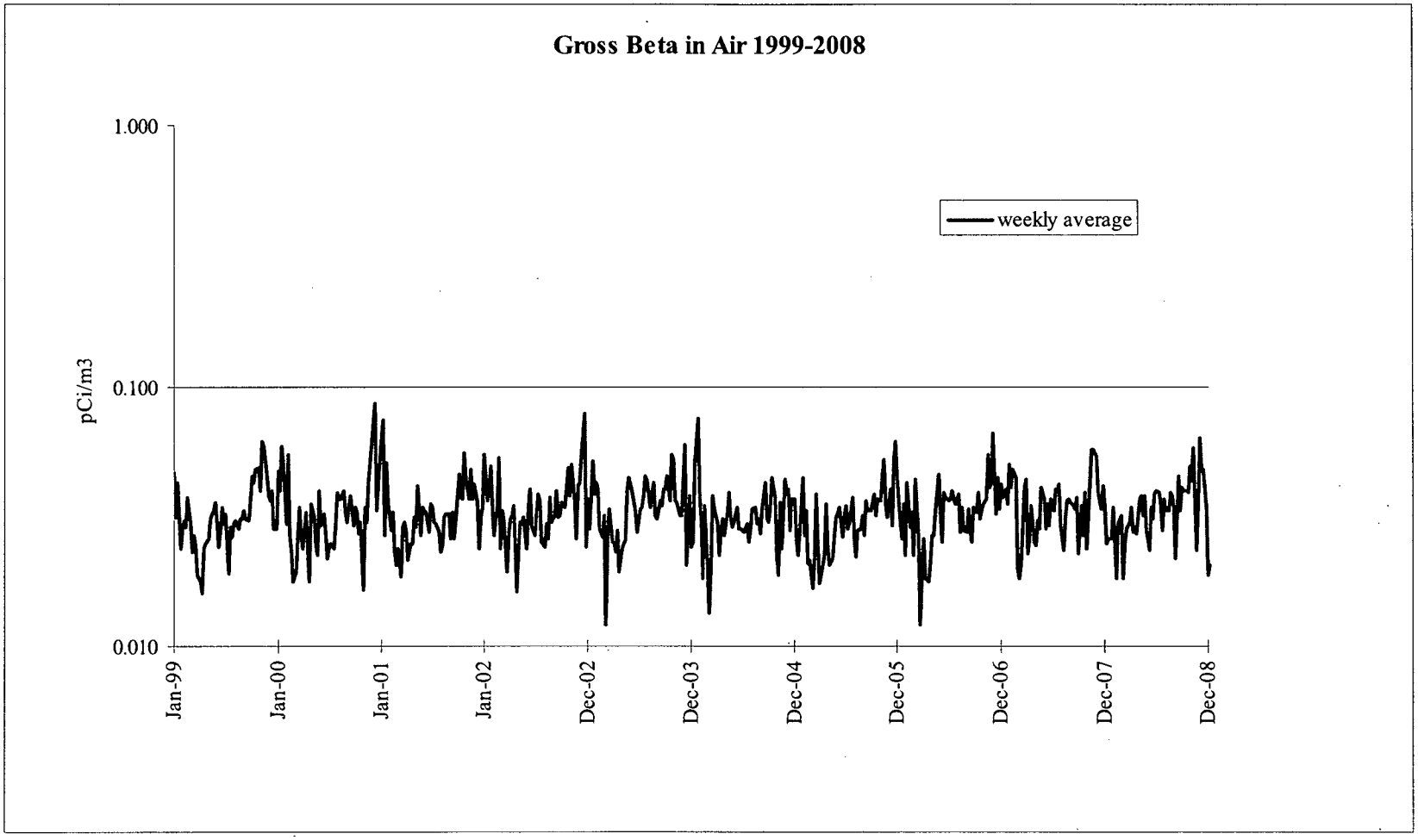
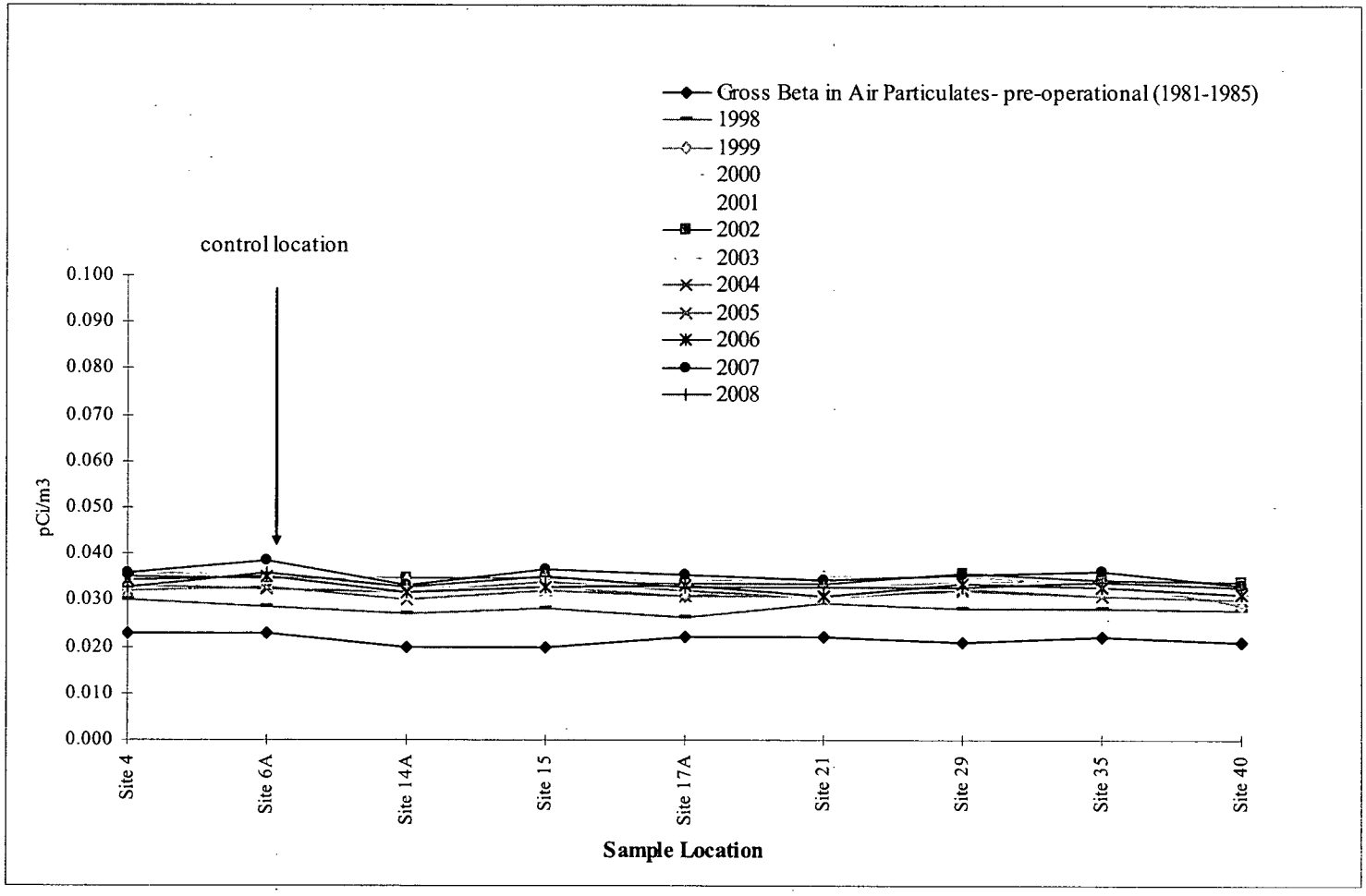
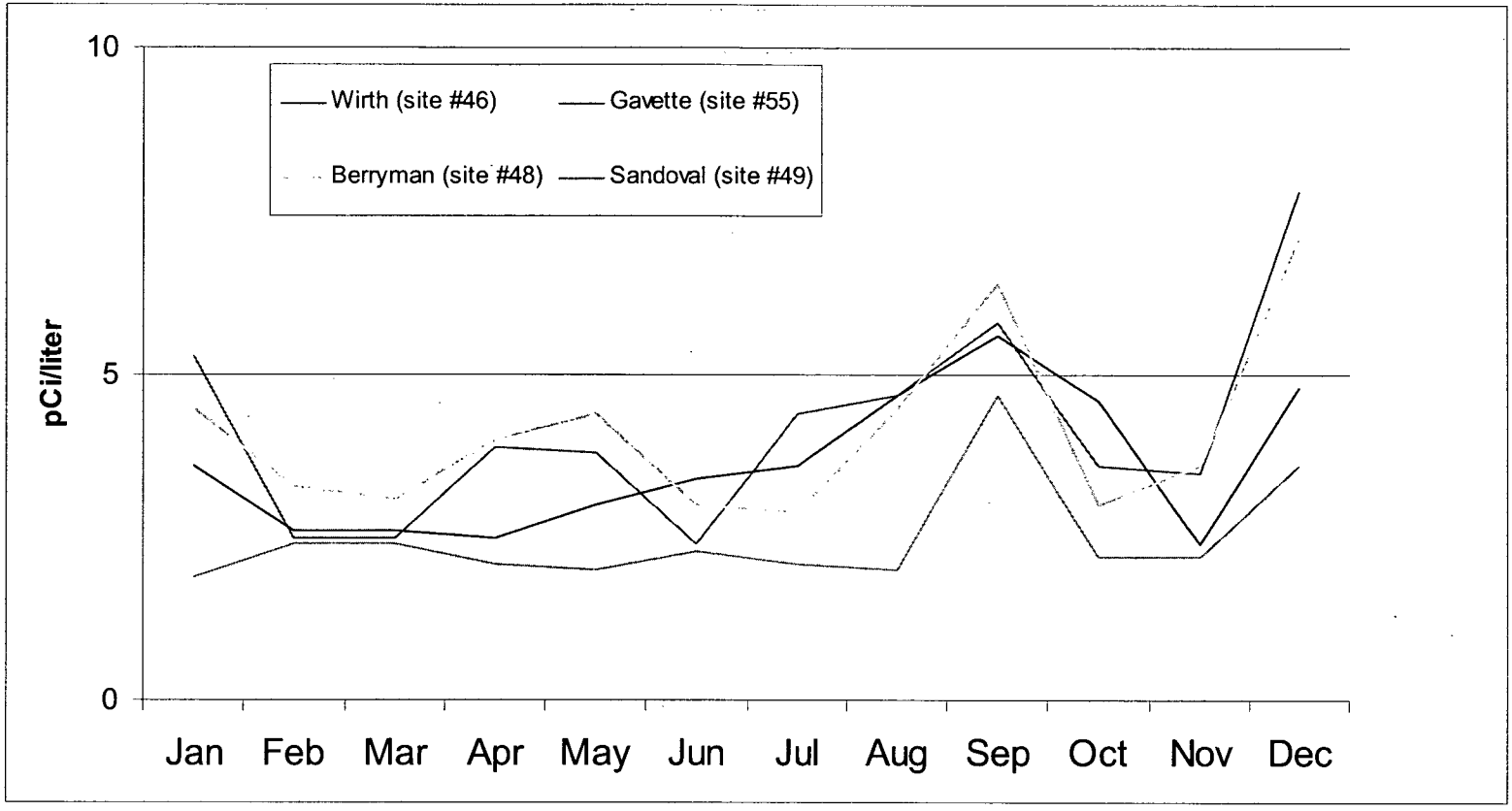


FIGURE 8.2 HISTORICAL GROSS BETA IN AIR (ANNUAL SITE TO SITE COMPARISONS) COMPARED TO PRE-OP



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

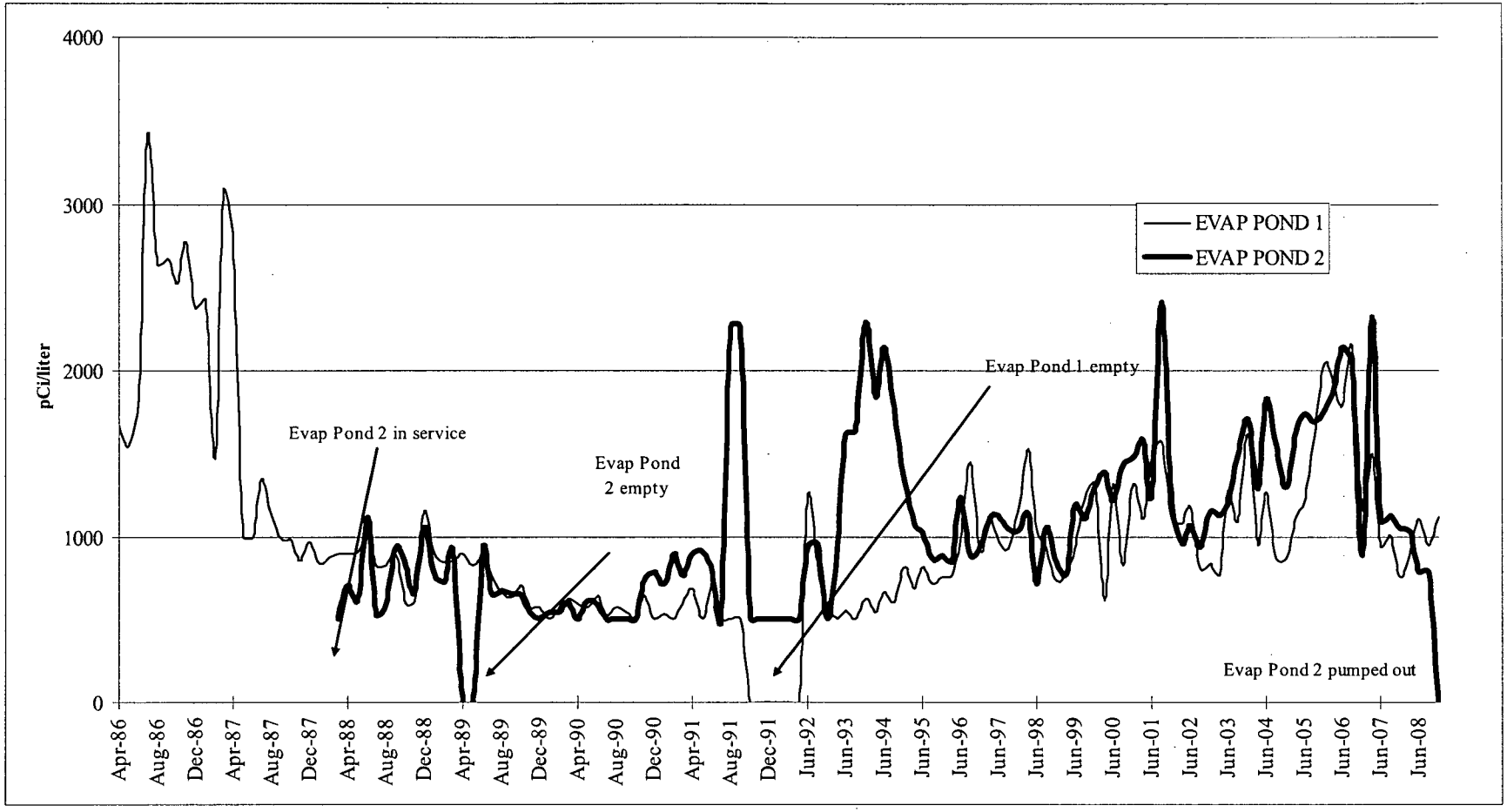
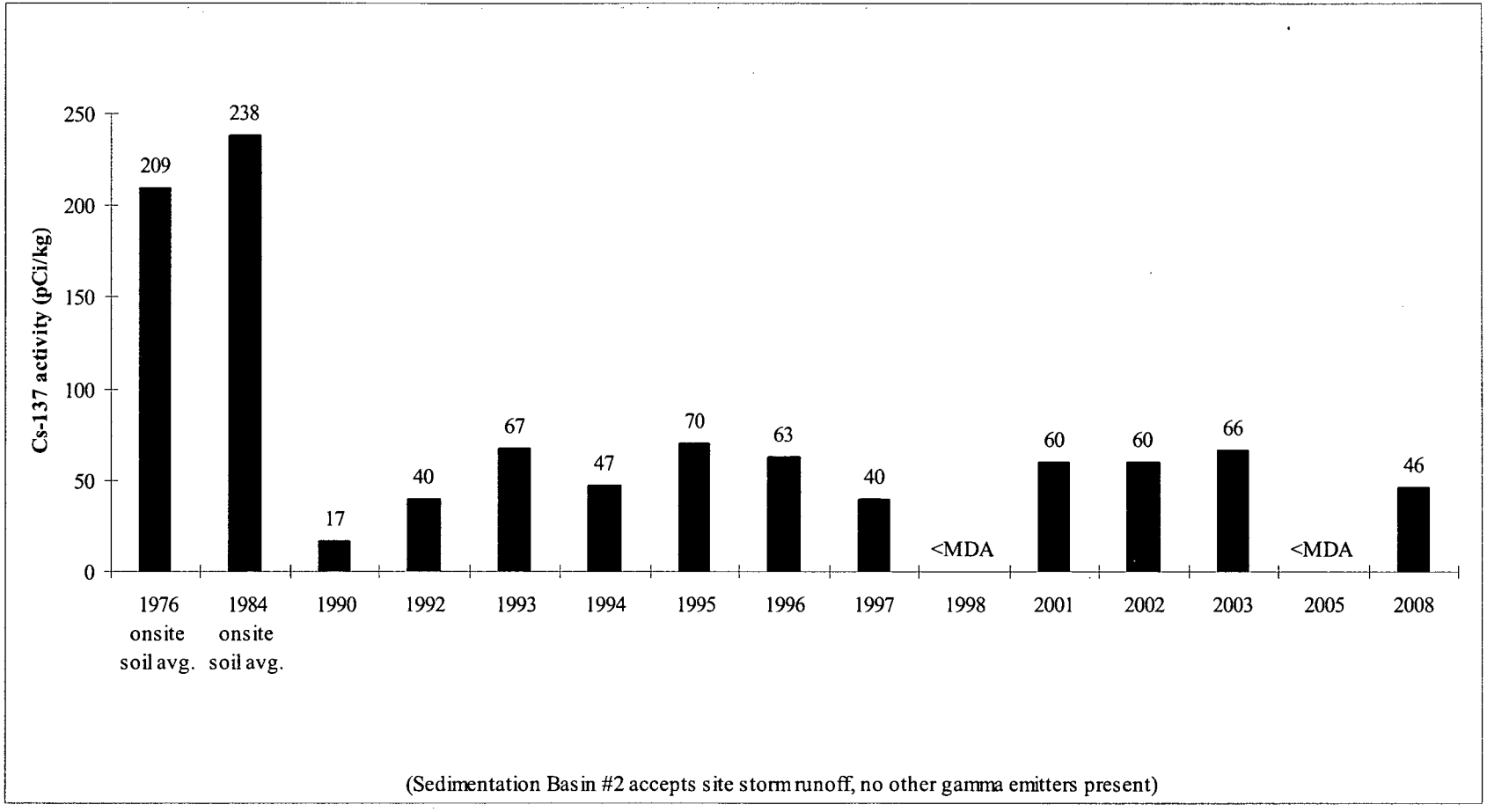


FIGURE 8.5 SEDIMENTATION BASIN #2 Cs-137



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 2008 are presented in Table 9.2. Historical environmental gamma radiation results for 1985 through 2008 are presented in graphical form on Figure 9.1 (excluding transit control TLD #45).

Figure 9.2 depicts the environmental TLD results from 2008 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 2008 ENVIRONMENTAL TLD RESULTS

Units are mrem/std qtr

TLD Site #	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Average
1	19.9	25.3	18.0	21.9	21.3
2	18.4	22.6	16.6	missing	19.2
3	18.7	21.8	16.9	21.5	19.7
4	20.0	24.0	18.1	21.0	20.8
5	18.5	23.4	16.7	20.9	19.9
6 (control)	22.8	27.5	20.7	25.1	24.0
7	22.0	25.8	20.0	23.3	22.8
8	20.2	25.0	18.3	22.7	21.6
9	24.6	28.9	22.4	25.7	25.4
10	20.9	24.8	19.0	22.3	21.8
11	21.4	26.1	19.4	23.4	22.6
12	19.3	24.2	17.5	22.6	20.9
13	21.8	26.4	19.9	24.3	23.1
14	21.8	26.3	19.8	23.9	23.0
15	20.3	24.7	18.4	22.2	21.4
16	18.5	23.2	16.7	21.0	19.9
17	21.4	26.1	19.5	23.9	22.7
18	20.8	24.4	18.9	21.8	21.5
19	21.3	26.5	19.4	24.3	22.9
20	21.7	25.6	19.7	23.3	22.6
21	22.0	27.1	20.0	23.6	23.2
22	22.8	27.3	20.8	24.4	23.8
23	19.8	23.8	17.9	21.4	20.7
24	19.3	22.6	17.5	21.3	20.2
25	20.1	24.9	18.2	22.6	21.5
26	23.4	26.9	21.3	27.7	24.8
27	24.0	27.2	21.9	27.5	25.2
28	23.4	25.4	21.3	25.4	23.9
29	21.2	23.9	19.3	24.1	22.1
30	22.0	25.3	20.0	24.6	23.0
31	20.7	23.4	18.8	22.5	21.4
32	22.1	24.9	20.1	24.4	22.9
33	22.1	25.2	20.1	24.7	23.0
34	24.2	27.7	22.1	26.3	25.1
35	27.2	29.9	24.9	29.1	27.8
36	missing	missing	19.4	23.5	21.5
37	20.5	23.9	18.6	23.0	21.5
38	24.0	27.5	21.8	27.0	25.1
39	21.2	23.6	19.2	23.6	21.9
40	21.9	24.5	19.9	24.5	22.7
41	20.3	22.3	18.4	25.1	21.5
42	24.8	29.2	22.6	28.8	26.4
43	23.6	26.8	21.5	26.8	24.7
44 (control)	17.4	19.7	15.7	19.8	18.2
45 (transit control)	5.2	6.1	4.4	5.3	5.3
46	22.4	26.1	20.4	25.4	23.6
47	19.9	21.8	18.0	22.4	20.5
48	20.2	23.8	18.3	22.5	21.2
49	19.9	21.9	18.1	20.4	20.1
50	17.0	19.2	15.9	23.8	19.0

FIGURE 9.1 NETWORK ENVIRONMENTAL TLD EXPOSURE RATES

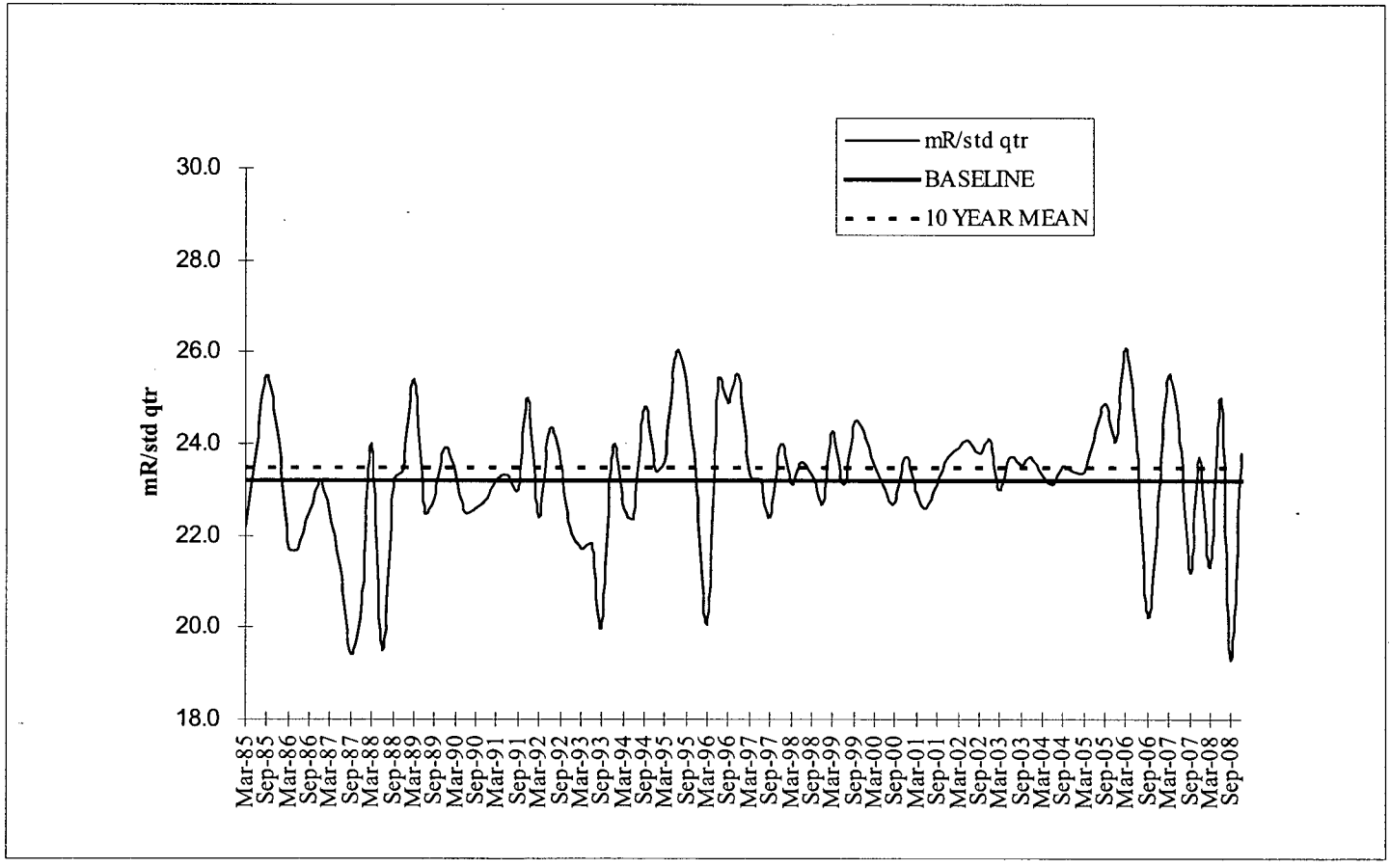
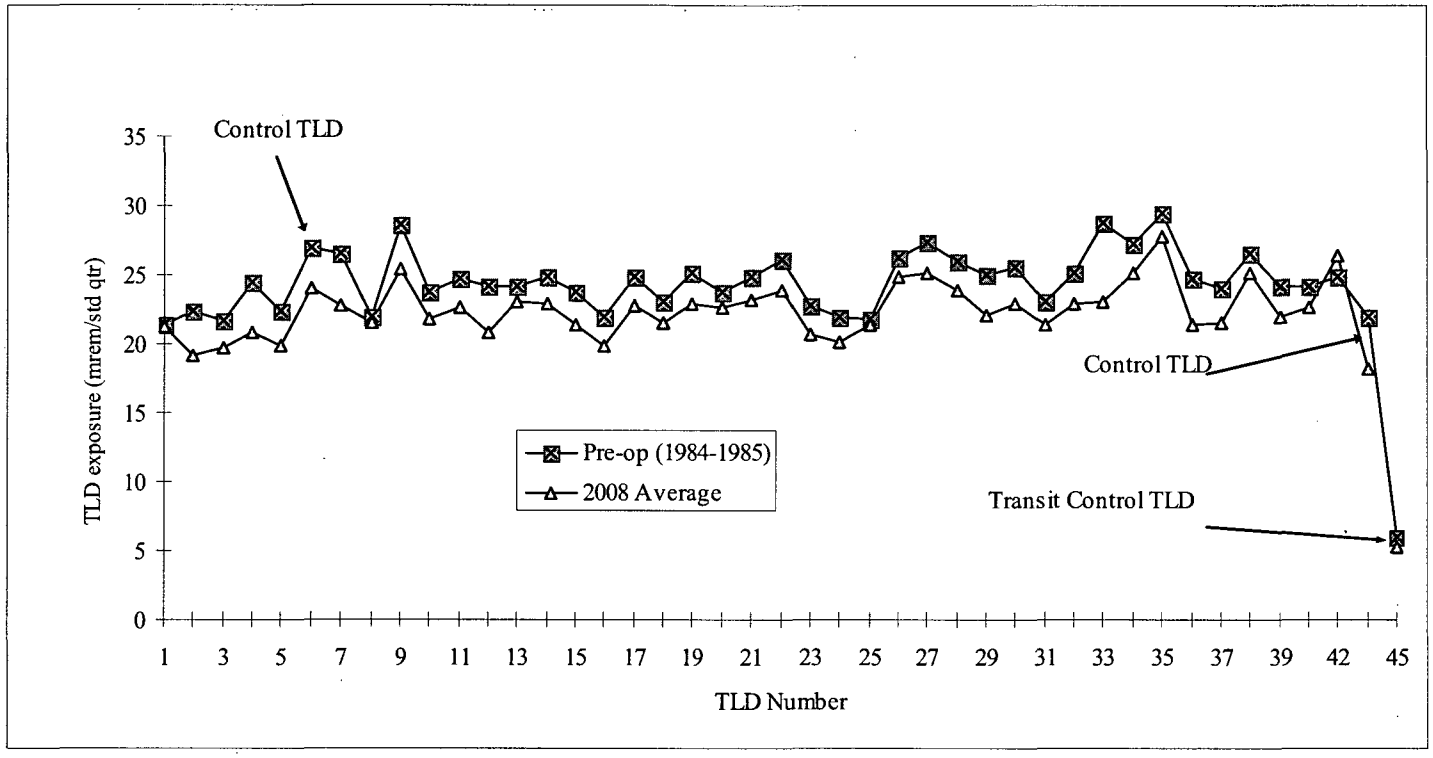


FIGURE 9.2 ENVIRONMENTAL TLD COMPARISON - PRE-OPERATIONAL VS 2008



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 March-April 2008.

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 no changes in nearest resident status. Dose calculations indicated the highest dose to be 0.167 mrem.

Milk Animal

There was one (1) change in milk animal status. Dose calculations indicated the highest dose to be 0.337 mrem.

Vegetable Gardens

There were no changes in nearest garden status. Dose calculations indicated the highest dose to be 0.323 mrem.

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

TABLE 10.1 2008 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 2007
N	1.55	3.10	NONE	Resident Garden	4.50E-02 9.41E-02	
NNE	1.52	3.30	**3.85**	Resident Garden Milk	7.13E-02 1.77E-01 1.61E-01	**MILK**
NE	2.16	NONE	3.91	Resident Milk	1.27E-01 3.37E-01	
ENE	2.16	2.63	4.84	Resident Garden Milk	8.98E-02 3.23E-01 1.35E-01	
E	2.81	NONE	NONE	Resident	6.84E-02	
ESE	1.89	NONE	NONE	Resident	1.24E-01	
SE	3.36	NONE	NONE	Resident	8.80E-02	
SSE	NONE	NONE	NONE	NA		
S	NONE	NONE	NONE	NA		
SSW	NONE	NONE	NONE	NA		
SW	1.39	NONE	NONE	Resident	1.67E-01	
WSW	0.75	NONE	NONE	Resident	1.02E-01	
W	0.70	NONE	NONE	Resident	6.56E-02	
WNW	2.67	NONE	NONE	Resident	1.36E-02	
NW	0.93	NONE	NONE	Resident	5.14E-02	
NNW	1.30	NONE	NONE	Resident	4.57E-02	

COMMENTS:

Dose calculations were performed using the GASPAR code and 2007 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 2008 calendar year. Where possible, the data were compared to pre-operational sample data.

All sample results for 2008 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 2008 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 2008

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	Mean (f)[a] Range	Control Locations Mean (f)[a] Range	Number of Nonroutine Reported Measurements
Direct Radiation (mrem/std. qtr.)	TLD - 197	NA	22.4 (185/185) 15.9 – 29.9	Site #35 8 miles 330°	27.8 (4/4) 24.9 – 29.9	21.1 (8/8) 15.7 - 27.5	0
Air Particulates (pCi/m^3)	Gross Beta – 526	0.010	0.033 (473/473) 0.016 - 0.067	Site #15 2 miles 55°	0.035 (51/51) 0.018 - 0.063	0.036 (53/53) 0.020 - 0.073	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. - 526 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 2008

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	Mean (f)[a] Range	Control Locations Mean (f)[a] Range	Number of Nonroutine Reported Measurements
	Nb-95	15	<LLD	NA	<LLD	NA	0
Ground Water	I-131	15	<LLD	NA	<LLD	NA	0
(pCi/liter)	Cs-134	15	<LLD	NA	<LLD	NA	0
-continued-	Cs-137	18	<LLD	NA	<LLD	NA	0
	Ba-140	60	<LLD	NA	<LLD	NA	0
	La-140	15	<LLD	NA	<LLD	NA	0
	Gross Beta – 48	4.0	4.4 (29/48) 2.5 – 7.8	Site #55 3 miles 210°	4.8 (9/12) 3.5 – 7.8	NA	0
	H-3 – 16	2000	<LLD	NA	<LLD	NA	0
	Gamma Spec. – 48						
Drinking Water	Mn-54	15	<LLD	NA	<LLD	NA	0
(pCi/liter)	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 2008

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	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. - 35						
	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	17 (7/35) 11 - 31	Site #61 Onsite 67°	18 (4/8) 14 - 31	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 2008

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	Mean (f)[a] Range	Control Locations Mean (f)[a] Range	Number of Nonroutine Reported Measurements
Surface Water (pCi/liter) -continued-	H-3 - 15	3000	947 (8/15) 783 - 1111	Site #59 Onsite 180°	1020 (4/4) 913 - 1111	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. 1985-2007 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