



Crystal River Nuclear Plant  
Docket No. 50-302  
Operating License No. DPR-72

Ref: ITS 5.7.1.1(b)

April 29, 2010  
3F0410-06

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

Subject: Crystal River Unit 3 – 2009 Annual Radiological Environmental Operating Report

Dear Sir:

Florida Power Corporation (FPC), doing business as Progress Energy Florida, Inc., hereby submits the 2009 Annual Radiological Environmental Operating Report for Crystal River Unit 3 (CR-3) in accordance with the CR-3 Improved Technical Specifications, Section 5.7.1.1(b) and Section 6.6 of the Offsite Dose Calculation Manual (ODCM). The data provided in the attached report is consistent with the objectives outlined in the ODCM, and includes all radiological environmental samples taken during the report period from January 1, 2009 through December 31, 2009.

This letter establishes no new regulatory commitments.

If you have any questions regarding this submittal, please contact Mr. Dan Westcott, Superintendent, Licensing and Regulatory Programs at (352) 563-4796.

Sincerely,

James W. Holt  
Plant General Manager

JWH/ff

Attachment

xc: NRR Project Manager  
Regional Administrator, Region II  
Senior Resident Inspector

A009  
IE25  
NRR

**PROGRESS ENERGY FLORIDA, INC.**  
**CRYSTAL RIVER UNIT 3**  
**DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72**

**ATTACHMENT**

**2009 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING  
REPORT**

# ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

2009



PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

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## TABLE OF CONTENTS

Introduction .....	ii
I. Summary Description of the Radiological Environmental Monitoring Program.....	1
II. Land-Use Census .....	11
III. Interlaboratory Comparison Program.....	12
IV. Analytical Results.....	14
A. Airborne Pathway .....	14
Statistical Summary .....	15
B. Direct Radiation .....	26
Statistical Summary .....	27
C. Waterborne Pathway .....	30
1. Seawater .....	30
Statistical Summary .....	32
2. Ground Water.....	30
Statistical Summary .....	36
3. Site Ground Water .....	30
Statistical Summary .....	39
4. Site Ground Water Non-REMP .....	31
Statistical Summary .....	55
5. Drinking Water .....	31
Statistical Summary .....	60
6. Shoreline Sediment.....	31
Statistical Summary .....	63
D. Ingestion Pathway .....	66
1. Carnivorous Fish .....	66
Statistical Summary .....	67
2. Oysters.....	66
Statistical Summary .....	70
3. Broad Leaf Vegetation .....	66
Statistical Summary .....	73
4. Watermelon and Citrus .....	66
Statistical Summary .....	77

## INTRODUCTION

This report is submitted as required by Technical Specification 5.7.1.1(b) to the Crystal River Facility Operating License No. DPR-72, and Section 6.6 of the Offsite Dose Calculation Manual.

The following information is required to be included in this report:

- Data Summaries
- Interpretations
- Unachievable LLDs
- An analysis of trends
- An assessment of any observed impact of plant operation on the environment

NOTE: If harmful effects or evidence of irreversible damage are detected by the monitoring, the report shall provide an analysis of the problem and a planned course of action to correct it.

- Summarized and tabulated results of all radiological environmental samples taken during the report period, in the format of Radiological Assessment Branch Technical Position, Revision 1, November, 1979.

NOTE: If some results are not available for inclusion, the report shall note and explain the reason for the missing results. The missing results shall be submitted as soon as possible in a supplementary report.

- A summary description of the Radiological Environmental Monitoring Program.
- A map of all sampling locations keyed to a table giving distances and directions from the reactor.
- Land-use census results.
- Interlaboratory Comparison Program results.
- A discussion of airborne sample station availability.
- Results of any unplanned release or spill of radioactive material that could have the potential to contaminate the groundwater as reported to maintain compliance with the groundwater protection initiative (NEI 07-07).

I. SUMMARY DESCRIPTION OF THE RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

The analytical results of the Crystal River Unit 3 (CR-3) operational Radiological Environmental Monitoring Program (REMP) for 2009 are contained in this report. The operational program began on January 1, 1977 just prior to initial criticality, which was achieved on January 14, 1977.

Sampling of the facility environs is performed by the State of Florida Department of Health, Bureau of Radiation Control. The State also performs the required analyses, participates in the Interlaboratory Comparison Program, and performs the annual land-use census. Prior to 1990, the program was split between the Department of Health and the University of Florida. The transition to the State performing all of the program's sampling and analyses in 1990 is evident in several of the trend graphs, most notably oysters and carnivorous fish, and is due to the State using less sensitive measurement techniques for several of the pathways which were formerly evaluated by the University of Florida.

Sample station locations are given in Table I-1 and Figures I-2, I-3, I-4, and I-5. Sample frequency and analysis type may be determined from Table I-2. Figure I-1 illustrates the relevant exposure pathways. Regarding waterborne pathways, the groundwater area of the Crystal River site is too saline to be used as a source of drinking water, hence there is no credible drinking water uptake pathway. Additionally, the Florida aquifer groundwater flows in a west-southwest direction across the site toward the Gulf of Mexico and since the locale of the site is along the coast, there is no downstream public impact regarding groundwater.

Except for air sample gross beta results and direct radiation measurements, most of the analytical results are below the lower limit of detection (LLD) of the sample. Sample LLDs are generally much lower than the required "a priori" LLD. When measurable results are reported, the values are also usually less than the required "a priori" LLD.

The results of the 2009 REMP have been compared to previous years' results. This comparison, in part illustrated by the trend graphs of Section IV, shows no evidence of consistent long-term increasing trends in any of the sample media. However, radioactive material is routinely quantified in sediment samples which are taken in the discharge canal near the liquid release discharge point. In general, these results verify the effectiveness of in-plant measures for controlling radioactive releases.

Trend graphs illustrate the mean measured concentration of a particular radionuclide for the year. When measurable results are not obtained, the highest sample LLD is plotted. LLD and measured values are plotted on the same line to best illustrate any trend. As shown on each graph's legend, any measured value is noted by a text box, unless all values trended are measured values for that particular parameter.

Statistical summary pages are provided for each medium or pathway. Measured values are reported in terms of a mean and range. In addition, the number of measured values versus samples obtained is reported. For example, in the following entry;

15 (249/256)  
(4 - 35)

the "All Indicator Locations" column would be interpreted as indicating a mean measured value of 15, with measured values ranging from 4 to 35. (249/256) means that out of 256 samples, 249 were measured values.

TABLE I-1

## PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

SAMPLE STATION LOCATIONS

SAMPLE MEDIA	STATION ID	DIRECTION	APPROX. DISTANCE (Miles)
TLD – on-site	C60	N	0.88
	C61	NNE	0.92
	C62	NE	1.17
	C63	ENE	0.87
	C64	E	0.80
	C65	ESE	0.33
	C66	SE	0.36
	C67	SSE	0.33
	C68	S	0.27
	C69	SSW	0.31
	C41	SW	0.43
	C70	WSW	0.74
	C71	WNW	0.58
	C72	NW	0.30
	C73	NNW	0.74
	C27	W	0.41
	TLD – off-site	C18	N
C03		NNE	4.89
C04		NE	5.95
C74		ENE	5.13
C75		E	3.99
C76		ESE	5.61
C08		SE	5.66
C77		SSE	3.39
C09		S	3.23
C78		WSW	4.59
C14G		W	2.53
C01		NW	4.8
C79		NNW	4.97
C47-Control		ESE	78
C07*		ESE	7.67
C40*		E	3.48
C46*		N	0.37

\*TLDs not required by ODCM. Deployed at air sample locations.

**TABLE I-1 (CONT'D)**  
**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009**

**SAMPLE STATION LOCATIONS**

SAMPLE MEDIA	STATION ID	DIRECTION	DISTANCE (Miles)
AIR	C07	ESE	7.7
	C18	N	5.3
	C40	E	3.5
	C41	SW	0.4
	C46	N	0.4
	C47-Control	ESE	78
SEAWATER	C14H	NW	0.1
	C14G	W	2.5
	C13-Control	WSW	4.6
GROUND WATER	C40-Control	E	3.6
SITE GROUND WATER	CR3-2	E	0.1
	CR3-4	SSE	0.086
	CR3-5	SSW	0.051
	CR3-6S	W	0.038
	CR3-6D	W	0.038
	CR3-7	WNW	0.060
	CR3-8	WNW	0.073
	CR3-9	NW	0.1
	CR3-10	NNE	0.1
	DRINKING WATER	C07-Control	ESE
C10-Control		ESE	6.0
C18-Control		N	5.3
SHORELINE SEDIMENT	C09-Control	S	3.2
	C14H	NW	0.1
	C14M	W	1.2
	C14G	W	2.5
FISH & OYSTERS	C29	W	2.5
	C30-Control	WSW	3.4
BROAD LEAF VEGETATION	C48A	N	0.4
	C48B	NNE	0.9
	C47-Control	ESE	78
WATERMELON	C04	NE	13
CITRUS	C19	ENE	9.6



**TABLE I-2**  
**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009**  
**SAMPLING AND ANALYSIS PROGRAM**

SAMPLE MEDIA	# OF STATIONS	FREQUENCY	ANALYSIS	LLD <sup>1</sup>	
TLD	33*	Quarterly	γ Dose	---	
Air Iodine	6	Weekly	I-131	0.07 <sup>g</sup> pCi/m <sup>3</sup>	
Air Particulate	6	Weekly	Gross β	0.01	
		Quarterly	γ Spec : Cs-134	0.05 <sup>e</sup>	
			Cs-137	0.06 <sup>e</sup>	
Seawater	3	Monthly	Tritium	2000 <sup>b</sup> pCi/L	
		Monthly	γ Spec :	Mn-54	15
			Fe-59	30	
			Co-58	15	
			Co-60	15	
			Zn-65	30	
			Zr-Nb-95	15 <sup>c</sup>	
			I-131	1 <sup>f</sup>	
			Cs-134	15	
			Cs-137	18	
			Ba-La-140	15 <sup>c</sup>	
Ground Water	1	Semiannual	Tritium	2000 <sup>b</sup> pCi/L	
		Semiannual	γ Spec :	<sup>2</sup>	
Site Ground Water <sup>6</sup>	9	Quarterly	Tritium	2000 <sup>b</sup> pCi/L	
		Quarterly	γ Spec :	<sup>2</sup>	
Drinking Water	3	Quarterly	Tritium	2000 <sup>b</sup> pCi/L	
		Quarterly	γ Spec :	<sup>2</sup>	
Shoreline Sediment	4	Semiannual	γ Spec :	Cs-134	150 pCi/kg
			Cs-137	180	

\*Includes 3 stations which are not required by the ODCM

<sup>1</sup>The maximum "a priori" LLD

<sup>2</sup>Same as Seawater γ Spec

<sup>6</sup>Additional 2 stations reported that are not required by the ODCM

<sup>b</sup>LLD for drinking water. If no drinking water pathway exists, a value of 3000 pCi/L may be used

<sup>c</sup>The specified LLD is for an equilibrium mixture of parent and daughter nuclides which contain 15 pCi/L of the parent nuclide

<sup>e</sup>LLDs apply only to quarterly composite gamma spectral analysis, not to analyses of single particulate filters

<sup>f</sup>LLD for drinking water. If no drinking water pathway exists, the LLD of the gamma isotopic analysis may be used

<sup>g</sup>LLD for I-131 applies to a single weekly filter

**TABLE I-2 (Cont'd)**  
**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009**  
**SAMPLING AND ANALYSIS PROGRAM**

SAMPLE MEDIA	# OF STATIONS	FREQUENCY	ANALYSIS	LLD <sup>1</sup>	
Carnivorous Fish and Oysters	2	Quarterly	γ Spec :	Mn-54	130 pCi/kg
				Fe-59	260
				Co-58	130
				Co-60	130
				Zn-65	260
				Cs-134	130
				Cs-137	150
Broad Leaf Vegetation	3	Monthly <sup>3</sup>	γ Spec :	I-131	60 pCi/kg
				Cs-134	60
				Cs-137	80
Watermelon	1	Annual <sup>4</sup>	γ Spec :	5	5
Citrus	1	Annual <sup>4</sup>	γ Spec :	5	5

<sup>1</sup>The maximum "a priori" LLD

<sup>3</sup>When available

<sup>4</sup>During harvest

<sup>5</sup>Same as broad leaf vegetation

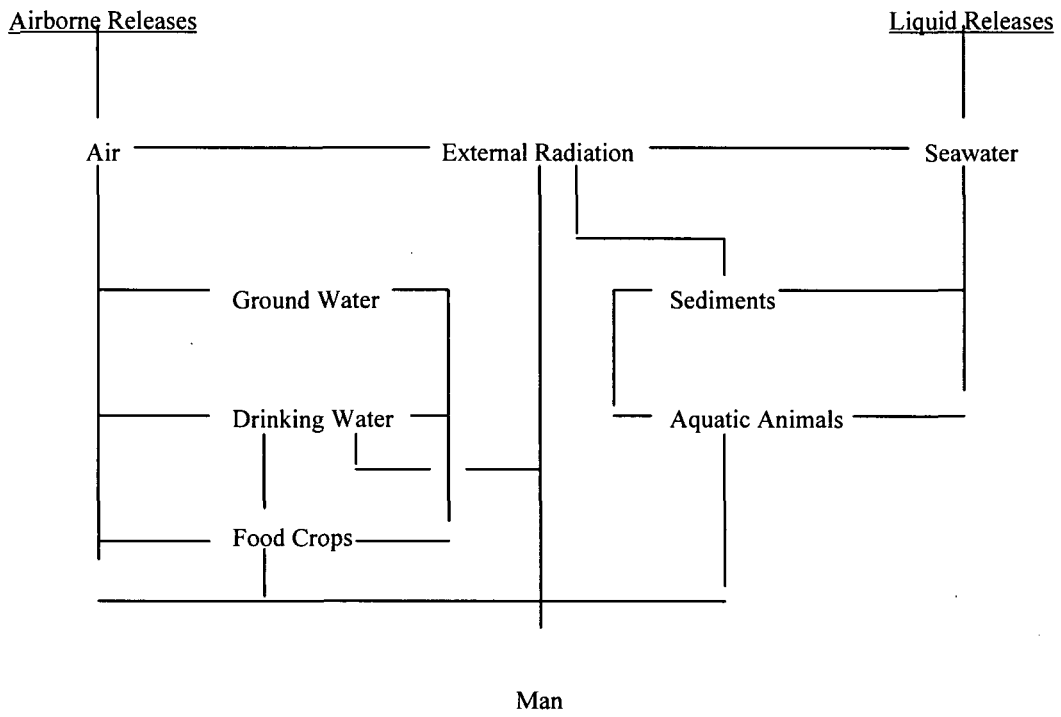


FIGURE I-1: Environmental Media and Exposure Pathways

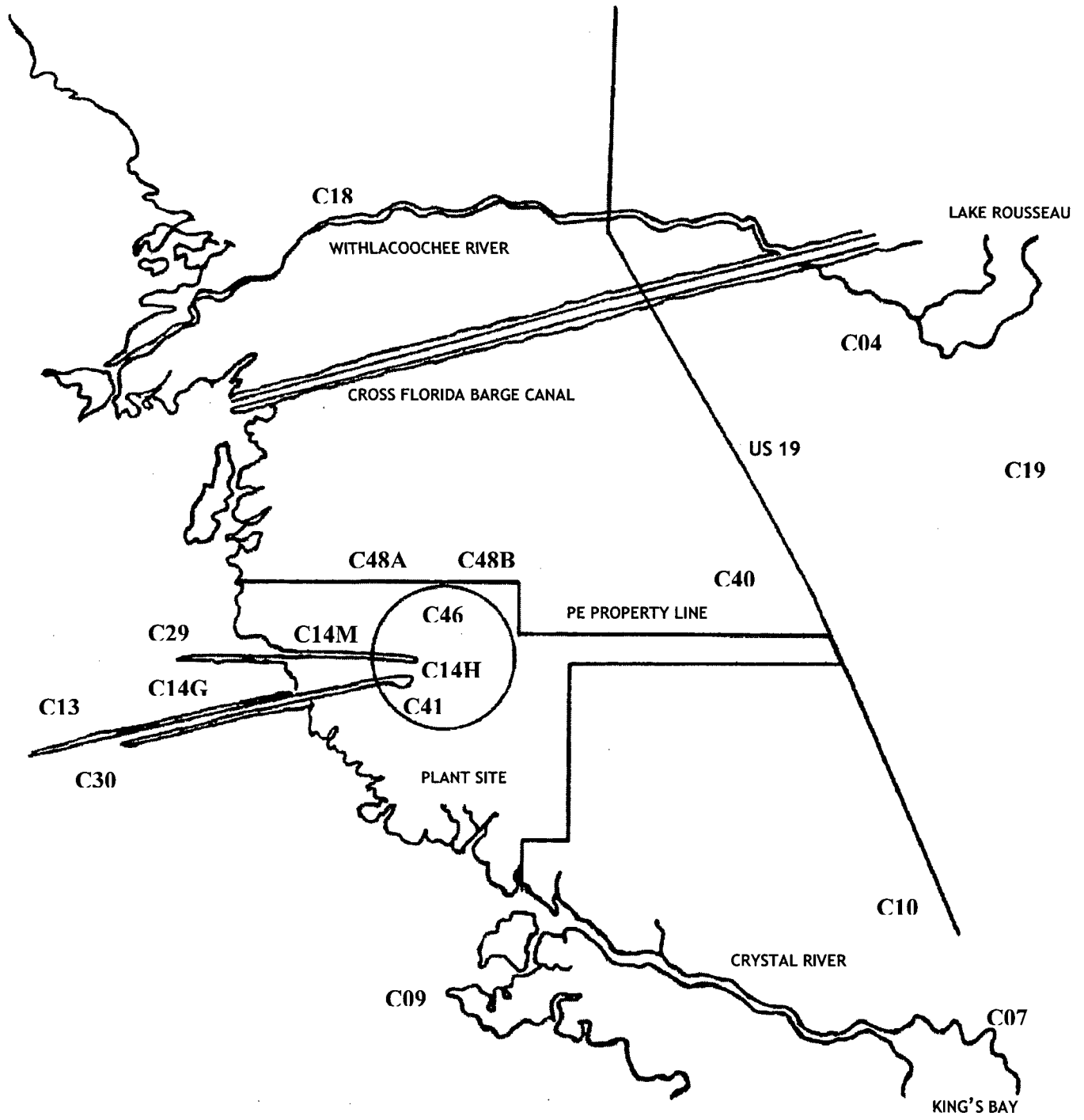
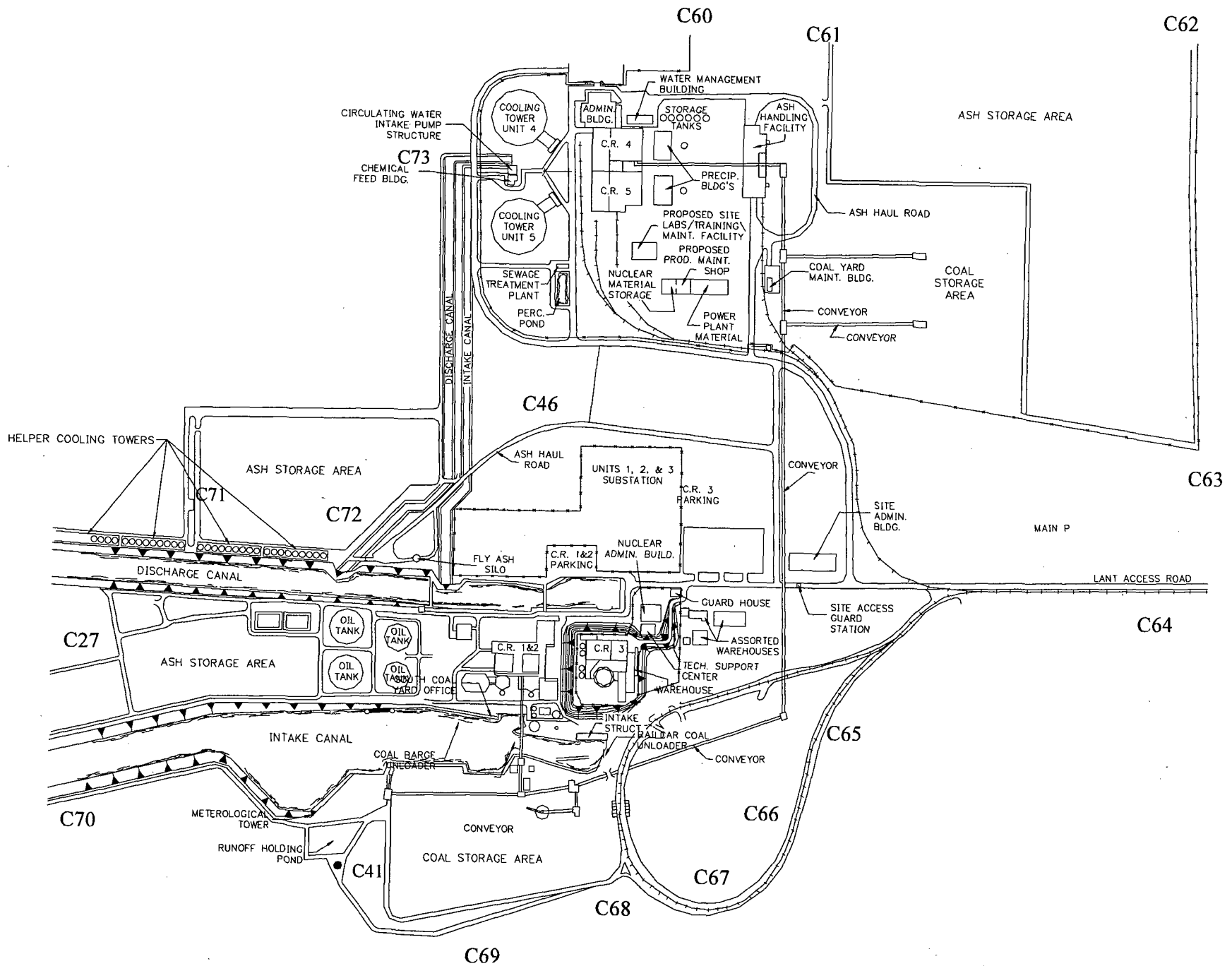


FIGURE I-2: Environmental Monitoring Sample Stations (non-TLDs)

FIGURE I-3: Environmental Monitoring TLD Locations (on site)

8



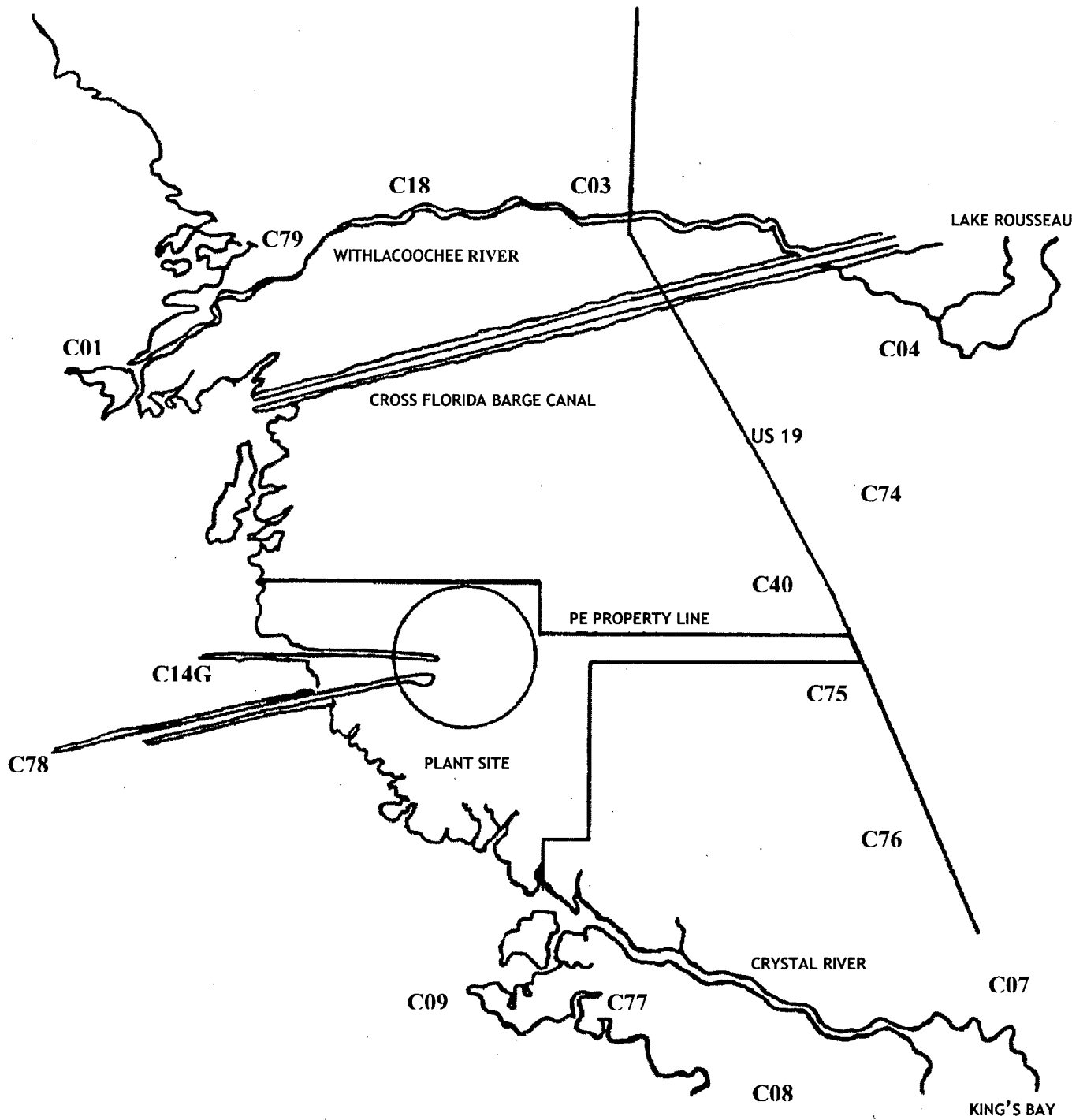
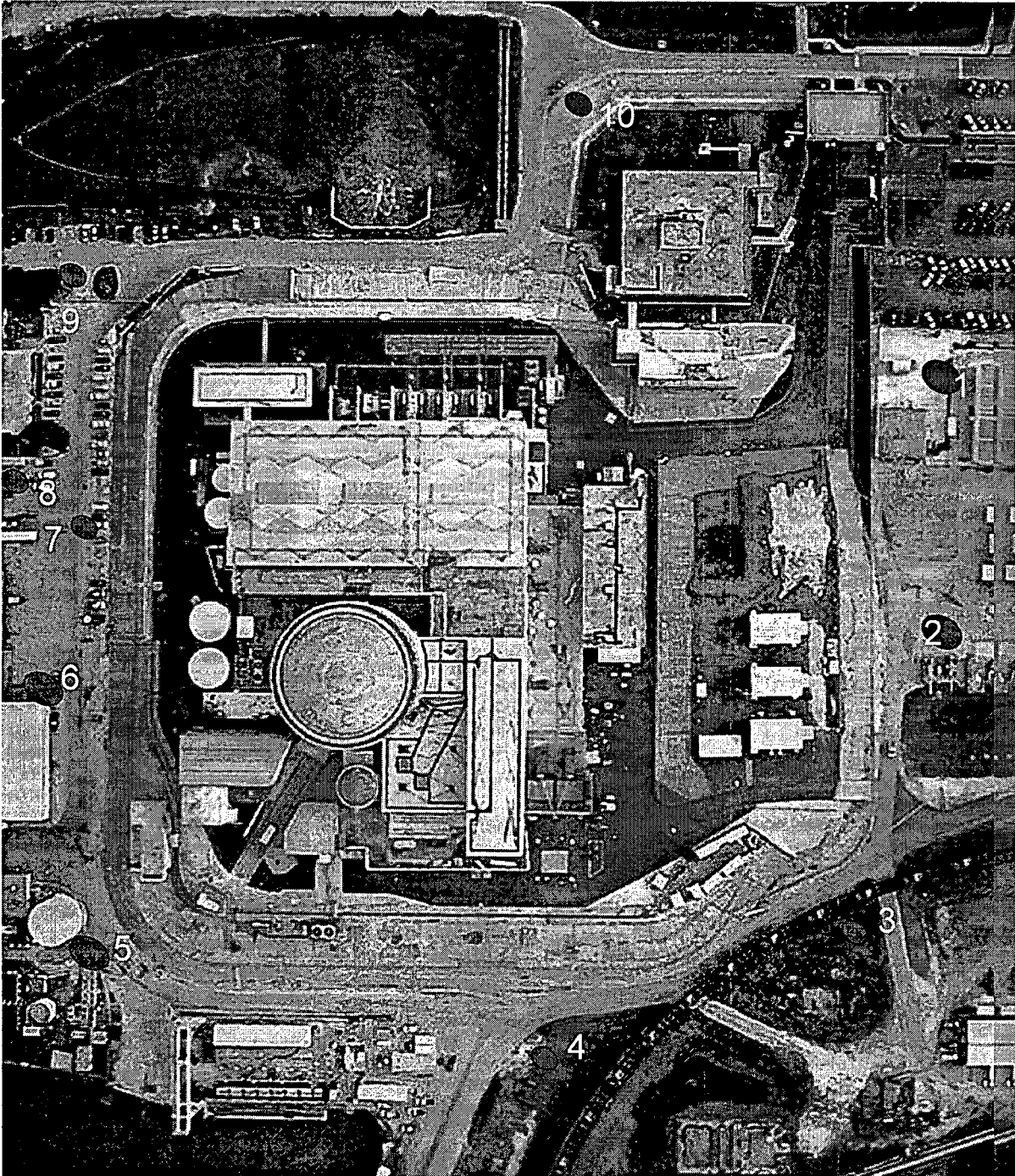


FIGURE I-4: Environmental Monitoring TLD Locations (off site)

Figure I-5: CR3 Groundwater Monitoring Well Locations  
Deep Wells Are Also Installed at #'s 1, 3, 6



Wells # 1 & 3 are not routinely  
sampled by the REMP

## II. LAND-USE CENSUS

A land-use census was conducted during June through August. The purpose of this census is to identify the nearest residences, vegetable gardens, and potential milk-producing animals within a five mile radius of the nuclear plant. The distance in miles and bearing in degrees for each receptor type in each of the sixteen sectors is summarized below.

SECTOR	NEAREST RESIDENCE	NEAREST GARDEN (A)	NEAREST MILK ANIMAL
N	4.46 @ 2°	*	*
NNE	3.95 @ 15°	*	*
NE	3.84 @ 54°	*	*
ENE	3.43 @ 60°	*	*
E	2.40 @ 92°	4.1 @ 93°	*
ESE	4.24 @ 102°	4.7 @ 103°	*
SE	4.90 @ 133°	*	*
SSE	3.53 @ 149°	*	*
S	*	*	*
SSW	*	*	*
SW	*	*	*
WSW	*	*	*
W	*	*	*
WNW	*	*	*
NW	4.77 @ 323°	*	*
NW	4.90 @ 321°	*	*
NNW	4.60 @ 339°	*	*

(A) - Only gardens with an estimated total area of 500 square feet, or more, and producing green leafy vegetables are considered.

\* No suitable sites were located within 5 miles.



### III. FLORIDA DEPARTMENT OF HEALTH - INTERLABORATORY COMPARISON PROGRAM DATA

The EPA crosscheck program ceased operation at the end of 1998. To meet the requirements for a crosscheck program, the Florida Department of Health participates in the Department of Energy's Mixed-Analyte Performance Evaluation Program (MAPEP). The following units are used for each of the four media:

Air Filters: Bq/sample  
 Soil: Bq/Kg  
 Vegetation: Bq/sample  
 Water: Bq/L

Analytical performance is based on historical analytical capabilities for individual analyte/matrix pairs. Acceptable performance is designated by an "A". Acceptable with warning is designated by a "W". Performance which is not acceptable is designated by an "N".

#### Results for February 2009:

Media	Nuclide	Result	% Bias	Acceptance Range	Flag
Air	Co-57	1.15	-11.5	0.91 – 1.69	A
Air	Co-60	1.14	-6.6	0.85 – 1.59	A
Air	Cs-134	2.88	-1.7	2.05 – 3.81	A
Air	Cs-137	1.45	-4.6	1.06 – 1.98	A
Air	Zn-65	1.34	-1.5	0.95 – 1.77	A
Air	Gross Beta	0.335	20.1	0.140 – 0.419	A
Soil	Mn-54	347.54	13.2	215 – 399	A
Soil	Zn-65	278.17	14.9	169 – 315	A
Soil	Cs-134	452.51	-3.1	327 – 607	A
Soil	Cs-137	660.6	9.2	424 – 787	A
Soil	U-238	163.1	5.2	109 – 202	A
Vegetation	Co-57	2.27	-3.8	1.65 – 3.07	A
Vegetation	Zn-65	1.33	-1.8	0.948 – 1.76	A
Vegetation	Cs-134	3.25	-4.4	2.38 – 4.42	A
Vegetation	Cs-137	0.99	-3.2	0.65 – 1.21	A
Vegetation	Mn-54	2.19	-4.8	1.61 – 2.99	A
Water	H-3	344.72	4.2	231.6 – 430.2	A
Water	Mn-54	15.43	5.3	10.26 – 19.06	A
Water	Co-60	17.13	-0.5	12.05 – 22.37	A
Water	Co-57	18.04	-4.6	13.2 – 24.6	A
Water	Cs-134	21.18	-5.9	15.8 – 29.3	A
Water	Zn-65	14.7	8.1	9.5 – 17.7	A

FLORIDA DEPARTMENT OF HEALTH - INTERLABORATORY COMPARISON PROGRAM DATA, cont'd

Results for August 2009:

Media	Nuclide	Result	% Bias	Acceptance Range	Flag
Air	Mn-54	6.31	14.9	3.84 – 7.14	A
Air	Co-57	6.12	-5.6	4.54 – 8.42	A
Air	Co-60	1.05	1.9	0.72 – 1.34	A
Air	Cs-137	1.55	10.7	0.98 – 1.82	A
Air	Zn-65	4.69	19.3	2.75 – 5.11	A
Air	Gross Beta	1.484	12.4	0.66 – 1.98	A
Soil	Mn-54	873.6	9.7	557 – 1035	A
Soil	Co-60	343.7	5.1	229 – 425	A
Soil	Cs-137	712.12	6.4	468 – 870	A
Soil	Co-57	632.79	8.0	410 – 762	A
Soil	Zn-65	1354.41	15.0	825 – 1531	A
Vegetation	Mn-54	7.10	-10.1	5.5 – 10.3	A
Vegetation	Co-60	2.33	-9.3	1.80 – 3.34	A
Vegetation	Cs-137	2.09	-14.0	1.70 – 3.16	A
Vegetation	Co-57	7.39	-7.6	5.6 – 10.4	A
Water	H-3	508.91	-19.7	443.9 – 824.3	A
Water	Co-57	34.53	-5.7	25.6 – 47.6	A
Water	Co-60	15.28	-0.8	10.8 – 20.0	A
Water	Cs-134	29.44	-8.6	22.5 – 41.9	A
Water	Cs-137	41.88	1.7	28.8 – 53.6	A
Water	Zn-65	29.79	10.7	18.8 – 35.0	A

#### IV-A. AIRBORNE PATHWAY

Air samples are taken at five locations in the vicinity of the plant. The control location is 78 miles ESE of the plant, at the Department of Health, State Bureau of Radiation Control in Orlando.

Table IV-A.1 provides a statistical summary of the analytical results for 312 gross beta samples and 312 iodine samples.

Tables IV-A.2 and IV-A.3 provide the results for each weekly air sample.

Three hundred twelve particulate samples were analyzed for gross beta activity, all of which had measurable activity except 8 samples. The average indicator concentration was 17 pCi/1000 m<sup>3</sup> with a range of 8 to 34 pCi/1000 m<sup>3</sup>. The average indicator concentration since 1996 was in the range of 14 to 19 pCi/1000 m<sup>3</sup>. The control location concentration for 2009 averaged 16 pCi/1000 m<sup>3</sup>, with a range of 5 to 27 pCi/1000 m<sup>3</sup>.

Three hundred twelve samples were analyzed for iodine activity, with none having measurable activity. The highest iodine LLD was 0.09 pCi/m<sup>3</sup>. This LLD value was influenced by a partial (minimal) sample run due to a power outage at the sample station. On all other samples that ran the normal amount of time, the highest iodine LLD was 0.03 pCi/m<sup>3</sup>.

Quarterly composite data are summarized in Table IV-A.4. Measurable quantities of cesium were not identified in any particulate filter sample. The highest cesium LLD was 3.6 pCi/1000 m<sup>3</sup> for cesium 134.

There were no instances of non-collected airborne samples for the year 2009, but there were several instances of air sampler partial run times as follows:

1. In February station C-40 was down for 125.4 hours due to a faulty ground fault interrupter (GFI) duplex outlet.
2. In May station C-46 ran intermittently during a period of time between 5-12-09 and 5-26-09 due to an underground power supply line that shorted out and had to be replaced. During this period of time the monitor was down for 384.8 hours.
3. In June station C-40 was down for 142.75 hours due to the power being disconnected by fossil maintenance to install a power transfer switch in the power feed circuit that supplies both a groundwater well pump and the air sample station. Fossil maintenance did not realize at the time that this maintenance was affecting operation of this air sampler. This circuit breaker panel has since been added to the fossil/nuclear interface agreement to prevent reoccurrence.
4. In September station C-40 was down for 123.6 hours due to a lightning strike that hit a groundwater well pump which affected the power supply to the air sample station.

The remaining 4 sample stations were in service 100% of the time, with exception of filter changes and air pump/gas meter replacements. The percentages of down times for the 2 stations are as follows:

C40	4.47%
C46	4.39%

The air sample station's down times are documented in the plant Corrective Action Program (CAP) under NCRs 320964, 335746, 341334, and 353293.

TABLE IV-A.1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA

JANUARY 1 TO DECEMBER 31, 2009

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD) <sup>1</sup>	ALL INDICATOR LOCATIONS	LOCATION WITH HIGHEST MEAN	CONTROL LOCATION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS	
			MEAN RANGE	NAME DISTANCE & BEARING	MEAN RANGE		MEAN RANGE
AIRBORNE IODINE (pCi/m <sup>3</sup> )	γ Spec 312 I-131	0.03	<LLD	--	<LLD	0	
AIRBORNE PARTICULATES (pCi/1000m <sup>3</sup> for Gross β, pCi/1000m <sup>3</sup> for γ Spec)	Gross β 312 γ Spec 24	7.0	17 (304/312) (8-34)	C18 5.2 @ 0°	20 (50/52) (8-29)	16 (50/52) (5-27)	0
	Cs-134	3.6	<LLD	--	<LLD	0	
	Cs-137	2.9	<LLD	--	<LLD	0	

<sup>1</sup>The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

**TABLE IV-A.2**  
**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009**

**pCi/m<sup>3</sup> IODINE - 131 IN AIR**

Collection Date	SAMPLE SITE					
	C07	C18	C40	C41	C46	C47
06-Jan-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
13-Jan-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
20-Jan-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01
26-Jan-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
03-Feb-09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
10-Feb-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
17-Feb-09	<0.01	<0.01	<0.02(A)	<0.01	<0.02	<0.01
24-Feb-09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
03-Mar-09	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
10-Mar-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
16-Mar-09	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
24-Mar-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
31-Mar-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

(A) GFI outlet tripped; pump not running at time of collection. GFI reset. Estimated run time 39.1 out of 164.5 hours.

**TABLE IV-A.2 (Cont'd)**  
**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009**  
**pCi/m<sup>3</sup> IODINE - 131 IN AIR**

Collection Date	SAMPLE SITE					
	C07	C18	C40	C41	C46	C47
07-Apr-09	<0.03	<0.03	<0.03	<0.02	<0.02	<0.02
14-Apr-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
21-Apr-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
28-Apr-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
05-May-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
12-May-09	<0.02	<0.02	<0.02	<0.02	<0.09(A)	<0.02
19-May-09	<0.01	<0.01	<0.01	<0.01	<0.06(B)	<0.01
26-May-09	<0.02	<0.02	<0.02	<0.02	<0.03(C)	<0.02
01-Jun-09	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
09-Jun-09	<0.02	<0.02	<0.03	<0.03	<0.03	<0.02
16-Jun-09	<0.01	<0.01	<0.05(D)	<0.01	<0.01	<0.01
24-Jun-09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
30-Jun-09	<0.02	<0.03	<0.02	<0.02	<0.02	<0.02

- (A) At time of collection vacuum pump not running; able to restart pump. Estimated run time 11.4 out of 166.8 hours.  
(B) No power to hut. Estimated run time 14.2 out of 172.3 hours.  
(C) Power restored on 5/22/09 at 1100. Estimated run time 95.4 out of 162.6 hours.  
(D) No power to hut. Estimated run time 23.5 out of 166.3 hours. Power restored on 6/17/09 at 1700.

TABLE IV-A.2 (Cont'd)  
 PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009  
 pCi/m<sup>3</sup> IODINE - 131 IN AIR

Collection Date	SAMPLE SITE					
	C07	C18	C40	C41	C46	C47
07-Jul-09	<0.03	<0.02	<0.02	<0.02	<0.02	<0.02
14-Jul-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
21-Jul-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
28-Jul-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
04-Aug-09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
11-Aug-09	<0.03	<0.02	<0.02	<0.02	<0.02	<0.03
18-Aug-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
26-Aug-09	<0.01	<0.01	<0.03(A)	<0.01	<0.01	<0.01
01-Sep-09	<0.02	<0.03	<0.02	<0.02	<0.02	<0.02
08-Sep-09	<0.02	<0.02	<0.01	<0.02	<0.01	<0.01
14-Sep-09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
21-Sep-09	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
29-Sep-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

(A) Estimated run time 69.9 out of 193.5 hours; unknown reason for lower run time.

TABLE IV-A.2 (Cont'd)

PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

pCi/m<sup>3</sup> IODINE - 131 IN AIR

Collection Date	SAMPLE SITE					
	C07	C18	C40	C41	C46	C47
05-Oct-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
13-Oct-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
20-Oct-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
27-Oct-09	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
03-Nov-09	<0.01	<0.02	<0.01	<0.02	<0.02	<0.01
09-Nov-09	<0.03	<0.02	<0.03	<0.03	<0.02	<0.02
16-Nov-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
24-Nov-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
01-Dec-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
08-Dec-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
14-Dec-09	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
21-Dec-09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
29-Dec-09	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02



**TABLE IV-A.3**  
**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009**  
**pCi/1000m<sup>3</sup> GROSS  $\beta$  IN AIR**

Collection Date	SAMPLE SITE					
	C07	C18	C40	C41	C46	C47
06-Jan-09	21	15	17	21	24	21
13-Jan-09	13	23	13	12	11	15
20-Jan-09	20	20	22	12	24	22
26-Jan-09	19	24	27	18	24	15
03-Feb-09	12	18	15	18	16	22
10-Feb-09	21	28	23	21	23	18
17-Feb-09	19	22	20(A)	19	16	19
24-Feb-09	21	24	22	17	26	24
03-Mar-09	24	17	16	23	23	18
10-Mar-09	20	26	<7	26	22	21
16-Mar-09	15	19	6	20	22	14
24-Mar-09	11	16	11	16	13	15
31-Mar-09	17	13	15	16	12	5
Average:	18	20	17	18	20	18

(A) GFI outlet tripped; pump not running at time of collection. GFI reset. Estimated run time 39.1 out of 164.5 hours.

TABLE IV-A.3 (Cont'd)  
 PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009  
 pCi/1000m<sup>3</sup> GROSS  $\beta$  IN AIR

Collection Date	SAMPLE SITE					
	C07	C18	C40	C41	C46	C47
07-Apr-09	12	13	12	11	11	<7
14-Apr-09	21	16	23	21	18	20
21-Apr-09	11	14	<6	<7	17	12
28-Apr-09	21	25	10	6	24	6
05-May-09	18	29	18	4	23	8
12-May-09	13	15	16	12	<99(A)	19
19-May-09	6	8	9	8	<70(B)	8
26-May-09	4	8	6	4	<11(C)	<7
01-Jun-09	18	20	18	16	19	19
09-Jun-09	13	16	23	14	25	20
16-Jun-09	23	25	26(D)	27	21	24
24-Jun-09	30	22	29	23	31	17
30-Jun-09	11	11	11	18	15	10
Average:	15	17	17	14	20	15

(A) At time of collection vacuum pump not running; able to restart pump. Estimated run time 11.4 out of 166.8 hours.

(B) No power to hut. Estimated run time 14.2 out of 172.3 hours.

(C) Power restored on 5/22/09 at 1100. Estimated run time 95.4 out of 162.6 hours.

(D) No power to hut. Estimated run time 23.5 out of 166.3 hours. Power restored on 6/17/09 at 1700.

**TABLE IV-A.3 (Cont'd)**  
**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009**  
**pCi/1000m<sup>3</sup> GROSS β IN AIR**

Collection Date	SAMPLE SITE					
	C07	C18	C40	C41	C46	C47
07-Jul-09	20	15	18	15	19	18
14-Jul-09	13	16	10	17	14	17
21-Jul-09	15	22	21	15	22	16
28-Jul-09	17	23	15	23	17	18
04-Aug-09	12	10	11	10	11	11
11-Aug-09	12	12	14	13	14	13
18-Aug-09	13	21	15	20	18	12
26-Aug-09	14	15	8(A)	14	17	12
01-Sep-09	9	19	14	17	14	16
08-Sep-09	8	9	10	10	10	10
14-Sep-09	16	9	16	16	15	10
21-Sep-09	21	22	21	24	21	22
29-Sep-09	7	13	14	10	11	8
Average:	14	16	14	16	16	14

(A) Estimated run time 69.9 out of 193.5 hours; due to lightning strike.

**TABLE IV-A.3 (Cont'd)**  
**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009**  
**pCi/1000m<sup>3</sup> GROSS β IN AIR**

Collection Date	SAMPLE SITE					
	C07	C18	C40	C41	C46	C47
05-Oct-09	20	24	26	24	20	25
13-Oct-09	10	13	15	11	14	11
20-Oct-09	10	14	12	13	12	12
27-Oct-09	11	21	16	16	15	16
03-Nov-09	13	16	16	16	15	16
09-Nov-09	23	25	34	34	32	21
16-Nov-09	12	11	15	19	12	9
24-Nov-09	24	23	28	21	24	22
01-Dec-09	18	20	24	21	19	27
08-Dec-09	15	14	15	14	15	15
14-Dec-09	14	9	19	12	20	18
21-Dec-09	16	18	13	16	16	15
29-Dec-09	15	17	20	19	19	18
Average:	15	17	20	19	19	18

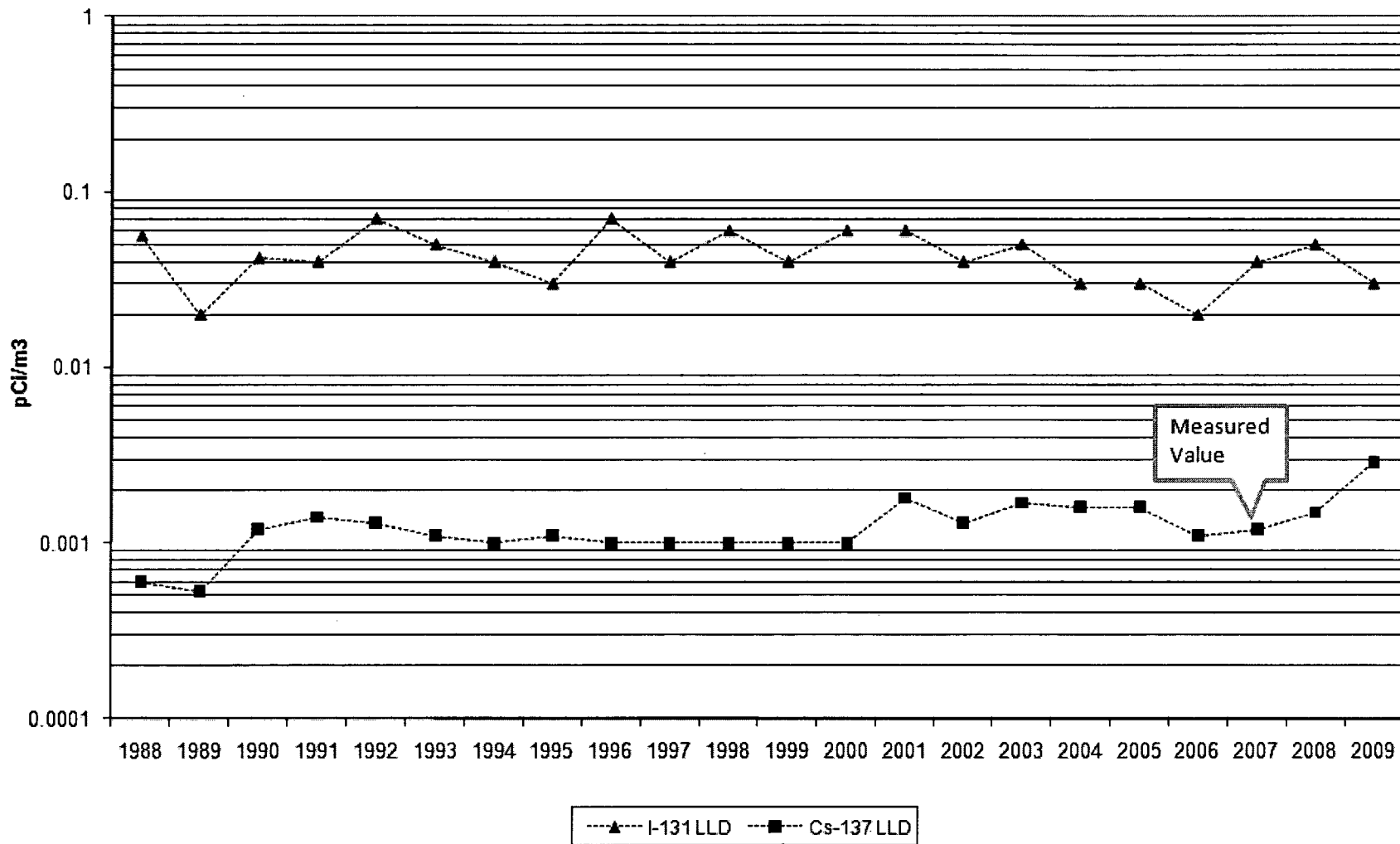
TABLE IV-A.4

## PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

pCi/1000m<sup>3</sup>  $\gamma$  EMITTERS IN QUARTERLY COMPOSITES OF AIR PARTICULATES

STATION	NUCLIDE	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
C07	Be-7	259	137	112	107
	K-40	<19	<34	<39	<30
	Cs-134	<1.1	<2.1	<1.9	<2.1
	Cs-137	<1.0	<1.4	<1.8	<1.7
C18	Be-7	219	112	115	131
	K-40	<23	<30	<19	<30
	Cs-134	<2.0	<2.1	<2.0	<2.1
	Cs-137	<1.6	<1.5	<1.6	<1.4
C40	Be-7	183	117	111	119
	K-40	<6.4	<42	<25	<36
	Cs-134	<0.6	<3.5	<3.4	<3.6
	Cs-137	<0.5	<2.9	<2.6	<2.4
C41	Be-7	268	132	135	124
	K-40	<19	<31	<35	<33
	Cs-134	<1.6	<2.6	<1.8	<2.9
	CS-137	<0.8	<2.3	<1.6	<2.6
C46	Be-7	205	112	135	115
	K-40	<19	<35	<29	<34
	Cs-134	<1.8	<3.0	<2.1	<2.0
	Cs-137	<1.6	<2.6	<1.8	<1.4
C47	Be-7	233	127	104	152
	K-40	<6.2	<35	<33	<28
	Cs-134	<0.4	<2.5	<2.5	<2.0
	Cs-137	<0.3	<1.3	<1.8	<1.0

Airborne (highest values plotted)



#### IV-B. DIRECT RADIATION

Direct radiation measurements (using TLDs) were taken at seventeen locations (stations C60 through C73 and station C27) within one mile of the plant, at fifteen locations ranging from 2.8 to 6.3 miles from the plant, and at one control location 78 miles from the site. One-hundred and thirty-two TLDS were collected during 2009.

Table IV-B provides a statistical summary of the analytical results for 132 TLDs sampled throughout the year.

Table IV-B.1 provides the results of the individual TLD measurements.

The highest on-site dose was 98 mrem/yr at station C71 (WNW at 3600 feet). Station C71 was relocated in 1992 due to construction of the helper cooling towers on the former site. The new location has a higher background radiation level due to being closer to the storage pond for Units 4 & 5 fly ash, which produces a higher external radiation component than normal levels of natural background. The second highest on-site dose was 63 mrem/yr at station C27 (W at 2112 feet). This is a change from the previous year 2<sup>nd</sup> highest location (C65 ESE at 1740 feet) due to nearby construction activities in the area of C27 to install a new cooling tower. New limestone fill is being applied to this area for the tower foundation. Additionally, the settling ponds in this area that receive effluents from the near-by fossil units were de-mucked which also exposed limestone that was previously covered.

The highest off-site dose was 57 mrem/yr at station C40 (east at 3.5 miles). The control station (C47) dose was 52 mrem/yr. The average for all stations (except control) was 51 mrem/yr for 2009, 59 mrem/yr for 2008, and 54 mrem/yr for 2007. Direct radiation results are similar to previous years and show no change of significance.

There were no missing or unanalyzed TLDs during this evaluation period.

TABLE IV-B

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA

JANUARY 1 TO DECEMBER 31, 2009

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)	<u>ALL INDICATOR LOCATIONS</u> MEAN RANGE	<u>LOCATION WITH HIGHEST MEAN</u> NAME DISTANCE & BEARING	MEAN RANGE	CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
DIRECT RADIATION (mrem/yr)	γ DOSE, 132	15	51 (128/128) (36 - 103)	C71 0.6 @ 296°	98 (4/4) (91 - 103)	52 (4/4) (47 - 55)	0



TABLE IV-B.1

## PROGRESS ENERGY FLORIDA, INC. - CR-3 - 2009

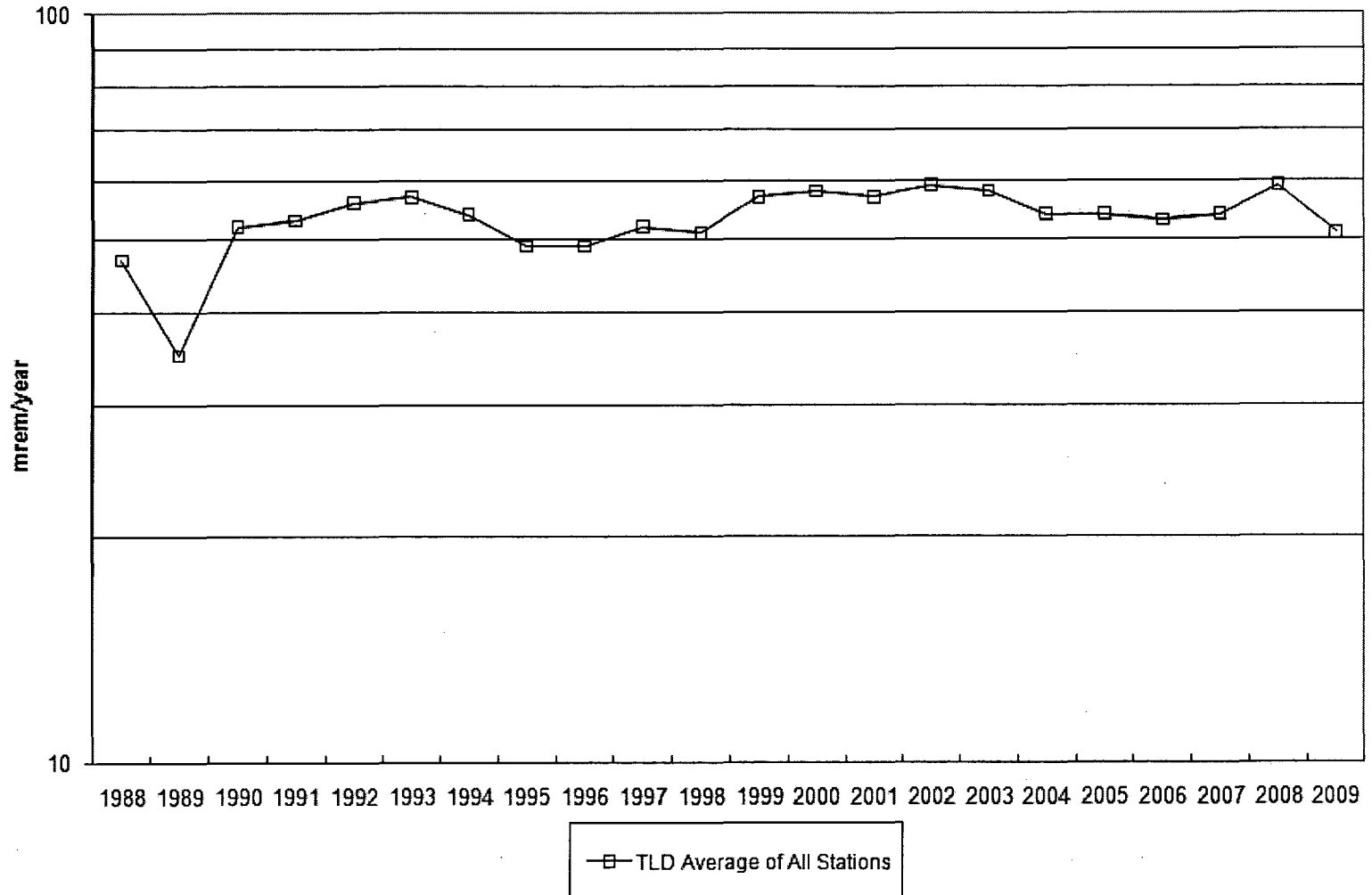
mrem/yr  $\gamma$  Dose

TLD STATION	Quarter	1	2	3	4
CO1		40	36	41	38
CO3		42	39	43	36
CO4		39	38	41	37
CO7*		40	37	42	38
CO8		41	38	39	38
C09		41	38	40	37
C14G		45	48	50	46
C18		44	46	47	42
C27		59	60	61	74
C40*		57	60	55	55
C41		50	54	54	52
C46*		50	52	53	51
C47 (CONTROL)		50	47	55	55
C60		48	50	53	50
C61		53	54	59	53
C62		58	55	64	56
C63		60	56	57	54
C64		52	49	54	50
C65		60	62	66	61
C66		53	51	55	54
C67		54	51	54	51
C68		55	53	59	53
C69		58	56	60	56
C70		52	56	59	57
C71		98	100	103	91
C72		55	52	58	55
C73		49	48	53	49
C74		39	38	39	39
C75		49	51	52	50
C76		47	44	48	47
C77		48	45	46	46
C78		42	39	43	40
C79		45	44	48	44

\*TLDs not required by the ODCM.

Quarterly values are multiplied by 4 to obtain an equivalent yearly dose.

### Direct Radiation



#### IV-C. WATERBORNE PATHWAY

To evaluate the waterborne pathway, samples are taken of seawater, ground water, drinking water, and shoreline sediment.

1. Monthly seawater grab samples are taken at two locations in the discharge canal (C14G and C14H) and at one control location (C13) near the mouth of the intake canal. Of twenty-four indicator samples, sixteen had measurable tritium at an average concentration of 2990 pCi/L, as compared to six measurable samples containing tritium with an average of 103 pCi/L in 2008. The sample with the highest concentration of tritium, 26091 pCi/L, was obtained in November at station C14H near the head of the discharge canal. The seawater tritium activity is consistent with the concentration of tritium in the liquid waste stream and the release times of waste tanks. CR-3 was in Refuel 16 outage at the time of sampling with reduced dilution due to no circulating water pumps running. Plant raw water pumps were providing the dilution flow. This resulted in the concentration of tritium in the discharge canal being elevated. Six control station samples contained tritium at an average concentration of 219 pCi/L. The 2008 control station results averaged 91 pCi/L.

Gamma spectral analysis was performed on thirty-six samples, none of which showed measurable amounts of the gamma emitters of interest.

Table IV-C.1 provides a statistical summary of the seawater tritium and gamma spectroscopy results.

Table IV-C.1.a provides the results of the monthly samples.

2. Semiannual ground water samples are taken at one location, station C40, located approximately 3.5 miles east of CR-3. Gamma spectral and tritium analyses are performed on both samples. All results were less than the detection limits. Since plant startup, all results, except for the results of one 1985 tritium analysis, have been less than LLD. The required sensitivity for measuring tritium in ground water is 2000 pCi/L. Analysis of ground water in the vicinity of CR-3 is done at a sensitivity of approximately 150 pCi/L for tritium and less than 10 pCi/L for select gamma emitters.

Table IV-C.2 provides a statistical summary of the groundwater tritium and gamma spectroscopy results.

Table IV-C.2.a provides the results of the semi-annual samples.

3. Quarterly site ground water samples are taken at nine locations surrounding the perimeter of the CR-3 protected area. Presently five of these ground water wells have shown indications of very low levels of tritium on the west-southwest side of the plant. It is believed that this tritium is the result of a leak in the Station Drain Tank (SDT-1) to the settling pond discharge line that occurred many years ago. This discharge line has recently been leak tested and it is leak free. There are no other known leaking plant components. The five wells that have shown measurable amounts of tritium range from 82 to 1967 pCi/L. These five wells have been sampled additionally on a monthly basis to develop trend data. This information is shown as supplemental data. Along with these wells, two other wells that are not presently part of the REMP have been sampled that are on either side of the plant settling ponds (percolation ponds). These two wells are showing measurable amounts of tritium in the range of 86 to 611 pCi/L, which are a result of plant discharges from the SDT-1. These discharges are being minimized through operational focus. The tritium values are below the reporting criteria of the ODCM or the NEI 07-07 Ground Water Protection Initiative Guidelines. There have been no measurable amounts of gamma emitting radionuclides in any of these wells. There have been no measurable amounts of hard-to-detect (HTD) radionuclides in any of these wells with exception of trace levels of gross alpha, which is expected, given the naturally occurring limestone strata that surrounds the Florida aquifer. It should be noted that site ground water flows in a west-southwest direction toward the Gulf of Mexico. This flow was re-verified in 2006 with a new ground water flow study performed by a certified hydro-geologist as part of the NEI Ground Water Protection Initiative. Additionally, the ground water at the CR-3 site is too saline for use as a potable water source.

Table IV-C.2.b provides a statistical summary of the groundwater tritium and gamma spectroscopy results.

Table IV-C.2.b.1 provides the results of the quarterly samples.

Table IV-C.2.b.2 provides the results of the monthly supplemental samples.

#### IV-C. WATERBORNE PATHWAY Cont'd

4. Monthly non-REMP required well samples were collected as discussed in item #3 above. Two wells were sampled. These two wells are located on either side of the site percolation ponds. The information is discussed above. Both of these wells showed no measurable amounts of any radionuclide of interest. The tritium concentration in these wells have decreased significantly due to a focused reduction in the number of discharges from the station drain tank (SDT-1) to the site percolation ponds.

Table IV-C.2.c provides a statistical summary of the groundwater tritium and gamma spectroscopy results.

Table IV-C.2.c.1 provides the results of the monthly supplemental non-REMP required samples.

5. Quarterly drinking water samples are drawn from three locations: the Crystal River City Hall (C07), the Days Inn Motel (C10), and the Yankeetown City Well (C18). All samples were collected and analyzed for gamma emitters and tritium. None of the samples yielded measurable activities of tritium or the required gamma emitters. The measurement sensitivity for drinking water samples are the same as those for ground water samples.

Table IV-C.3 provides a statistical summary of the drinking water tritium and gamma spectroscopy results.

Table IV-C.3.a provides the results of the quarterly samples.

6. Semiannual shoreline sediment samples are taken at three indicator locations in the discharge canal (C14H, C14M, C14G) and one control location (C09) at Fort Island Gulf Beach. The plant discharge canal is the primary liquid effluent release pathway from CR-3. Of the six indicator samples, four had measurable amounts of cesium-137 and three had measurable amounts of cobalt-60. In 2008 there were no measurable amounts of cobalt-60. The average cobalt-60 concentration at the indicator locations ranged from 30 to 389 pCi/L from 1998 through 2007. In 2008 the average cesium-137 concentration at the indicator locations was 25 pCi/L. The average cesium-137 concentration in 2007 was 23 pCi/L. The 2009 results are similar to previous years' results. None of the samples taken at Fort Island Gulf Beach, the control location station C09, indicated measurable amounts of cobalt or cesium.

Table IV-C.4 provides a statistical summary of the shoreline sediment gamma spectroscopy results.

Table IV-C.4.a provides the results of the semi-annual samples.

7. There were no unmonitored spills or releases of radioactive material in 2009 that could have the potential to contaminate the ground water per the guidelines of the Nuclear Energy Institute Ground Water Protection Initiative – Final Guidance Document 07-07. As such, there were no communiqués issued to state, local, or regulatory agencies.

TABLE IV-C.1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA

JANUARY 1 TO DECEMBER 31, 2009

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD) <sup>1</sup>	ALL INDICATOR LOCATIONS MEAN RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING	MEAN RANGE	CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
SEAWATER (pCi/L)	<u>Tritium, 36</u>	139	2990 (16/24) (94-26091)	C14H 0.1 @ 0°	4092 (9/12) (94-26091)	219 (6/12) (83-395)	0
	<u>γ Spec, 36</u>						
	Mn-54	5	<LLD	--	--	<LLD	0
	Fe-59	11	<LLD	--	--	<LLD	0
	Co-58	6	<LLD	--	--	<LLD	0
	Co-60	7	<LLD	--	--	<LLD	0
	Zn-65	12	<LLD	--	--	<LLD	0
	Zr-Nb-95	6	<LLD	--	--	<LLD	0
	I-131	8	<LLD	--	--	<LLD	0
	Cs-134	6	<LLD	--	--	<LLD	0
	Cs-137	7	<LLD	--	--	<LLD	0
	Ba-La-140	15	<LLD	--	--	<LLD	0

<sup>1</sup>The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

**TABLE IV-C.1.a**  
**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009**  
**pCi/L  $\gamma$  EMITTERS AND TRITIUM IN SEAWATER**

STATION	MONTH	H-3	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Zr-Nb-95	I-131	Cs-134	Cs-137	Ba-La-140
C13	JAN	146±27	377±31	<3	<4	<9	<4	<8	<7	<5	<5	<4	<8
	FEB	<142	277±32	<3	<2	<7	<3	<5	<5	<5	<3	<3	<4
	MAR	395±50	190±68	<3	<3	<6	<4	<8	<5	<4	<3	<3	<8
	APR	<139	309±42	<4	<4	<9	<6	<9	<7	<5	<5	<5	<9
	MAY	<154	303±16	<2	<1	<3	<2	<4	<3	<2	<2	<2	<3
	JUN	147±45	227±32	<4	<4	<9	<5	<8	<6	<5	<4	<4	<10
	JUL	<143	246±10	<1	<1	<3	<2	<3	<2	<2	<1	<2	<4
	AUG	<159	278±31	<3	<4	<7	<3	<7	<7	<4	<4	<4	<13
	SEP	394±62	286±32	<4	<4	<8	<4	<8	<8	<6	<4	<4	<5
	OCT	<165	339±20	<2	<2	<5	<3	<5	<4	<3	<3	<3	<4
	NOV	151±48	223±18	<3	<3	<7	<4	<7	<5	<4	<3	<3	<12
	DEC	83±26	336±33	<4	<4	<9	<4	<8	<7	<5	<5	<4	<13
C14G	JAN	<143	301±44	<4	<4	<10	<7	<12	<8	<5	<6	<7	<10
	FEB	<142	251±31	<2	<2	<5	<3	<6	<4	<3	<3	<3	<8
	MAR	562±54	283±32	<3	<3	<7	<4	<7	<6	<4	<4	<3	<7
	APR	<139	321±32	<3	<3	<8	<4	<8	<6	<5	<4	<4	<8
	MAY	8928±157	249±28	<3	<3	<6	<4	<8	<6	<5	<4	<5	<6
	JUN	128±45	203±18	<3	<3	<6	<4	<9	<5	<4	<4	<4	<8
	JUL	<143	207±18	<3	<3	<6	<3	<7	<6	<4	<4	<3	<9
	AUG	<159	198±17	<3	<3	<6	<3	<8	<6	<4	<4	<3	<11
	SEP	882±73	275±45	<4	<5	<11	<7	<12	<9	<7	<6	<6	<9
	OCT	133±53	281±36	<4	<3	<8	<4	<7	<7	<6	<4	<3	<4
	NOV	285±51	282±22	<3	<3	<7	<3	<6	<5	<4	<3	<3	<11
	DEC	98±26	229±31	<4	<4	<9	<4	<9	<8	<4	<4	<4	<15

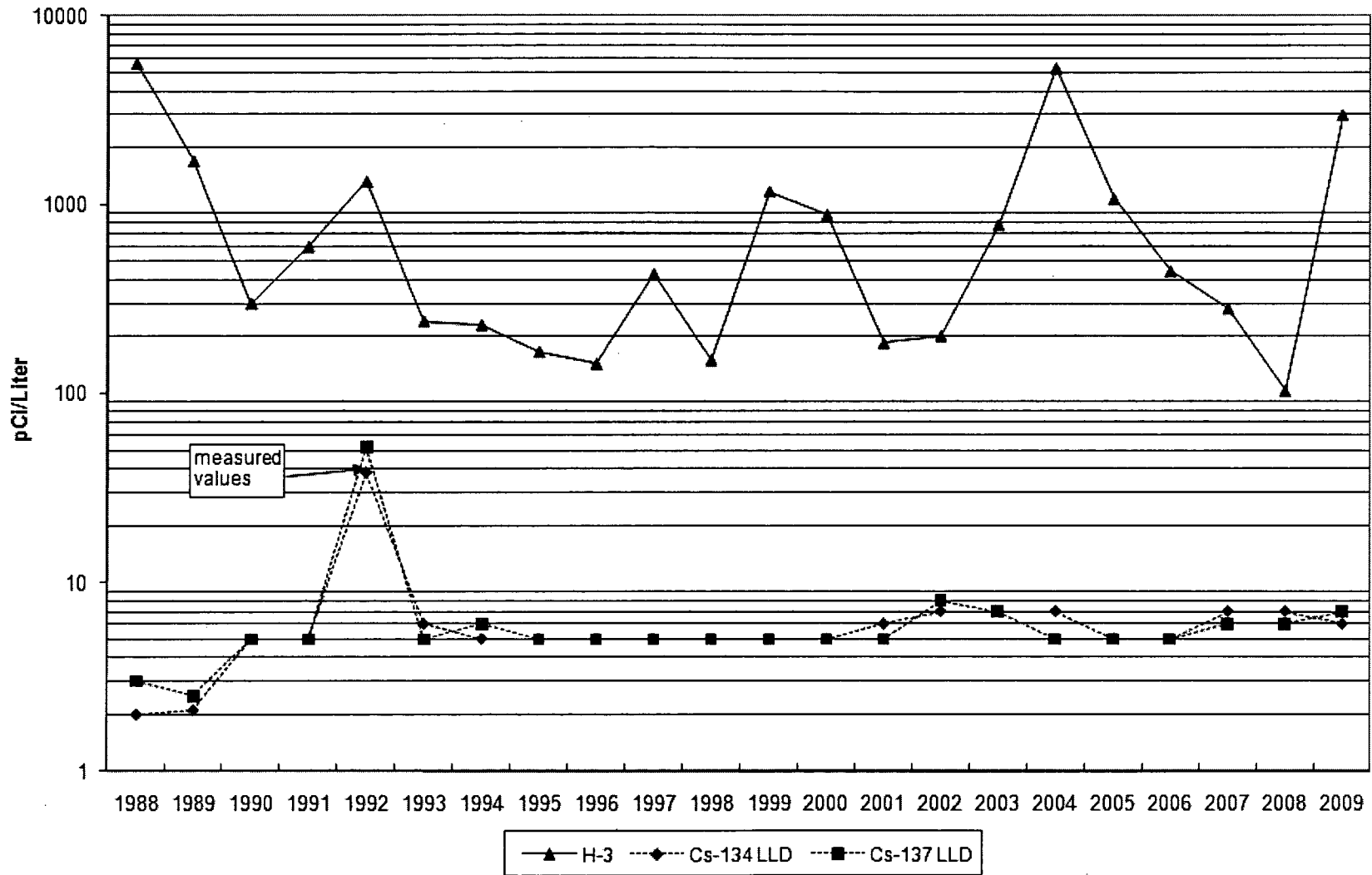
TABLE IV-C.1a (CONT'D)

## PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

pCi/L  $\gamma$  EMITTERS AND TRITIUM IN SEAWATER

STATION	MONTH	H-3	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Zr-Nb-95	I-131	Cs-134	Cs-137	Ba-La-140
C14H	JAN	<143	199±44	<5	<5	<9	<6	<12	<8	<5	<5	<6	<10
	FEB	94±26	310±30	<3	<3	<7	<4	<8	<5	<4	<3	<4	<10
	MAR	474±52	222±18	<1	<1	<3	<2	<3	<2	<2	<1	<2	<4
	APR	<139	211±18	<4	<3	<7	<4	<9	<6	<4	<4	<3	<8
	MAY	155±51	297±25	<3	<2	<5	<3	<6	<5	<4	<3	<3	<4
	JUN	212±47	251±20	<3	<3	<7	<4	<8	<6	<4	<4	<3	<9
	JUL	<143	224±18	<4	<3	<7	<4	<8	<5	<4	<3	<4	<7
	AUG	9421±171	212±18	<3	<3	<6	<4	<9	<6	<3	<3	<3	<11
	SEP	119±31	283±40	<5	<6	<10	<6	<11	<9	<8	<6	<4	<8
	OCT	158±54	250±11	<1	<1	<3	<2	<3	<2	<2	<1	<2	<2
	NOV	26091±257	235±19	<3	<3	<7	<4	<8	<5	<4	<4	<3	<13
	DEC	108±445	267±30	<4	<3	<7	<4	<10	<7	<5	<4	<4	<4

# Seawater





**TABLE IV-C.2**  
**RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY**  
**CRYSTAL RIVER UNIT 3** **DOCKET NO. 50-302**  
**CITRUS COUNTY, FLORIDA** **JANUARY 1 TO DECEMBER 31, 2009**

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD) <sup>1</sup>	ALL INDICATOR LOCATIONS	LOCATION WITH HIGHEST MEAN		CONTROL LOCATION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
			MEAN RANGE	NAME	MEAN RANGE	MEAN RANGE	
				DISTANCE & BEARING			
GROUND WATER (pCi/L)	<u>Tritium_2</u>	159	<LLD	--	--	<LLD	0
	<u>γ Spec. 2</u>						
	Mn-54	3	<LLD	--	--	<LLD	0
	Fe-59	6	<LLD	--	--	<LLD	0
	Co-58	3	<LLD	--	--	<LLD	0
	Co-60	3	<LLD	--	--	<LLD	0
	Zn-65	7	<LLD	--	--	<LLD	0
	Zr-Nb-95	4	<LLD	--	--	<LLD	0
	I-131	3	<LLD	--	--	<LLD	0
	Cs-134	3	<LLD	--	--	<LLD	0
	Cs-137	3	<LLD	--	--	<LLD	0
Ba-La-140	7	<LLD	--	--	<LLD	0	

<sup>1</sup>The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

TABLE IV-C.2.a

PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

pCi/L  $\gamma$  EMITTERS AND TRITIUM IN GROUND WATER

STATION	NUCLIDE	FIRST HALF	SECOND HALF
C40	H-3	<138	<159
	Mn-54	<3	<2
	Fe-59	<6	<3
	Co-58	<3	<2
	Co-60	<3	<2
	Zn-65	<7	<4
	Zr-Nb-95	<4	<3
	I-131	<3	<2
	Cs-134	<3	<2
	Cs-137	<3	<2
	Ba-La-140	<7	<5
	K-40	<32	<29

Ground Water

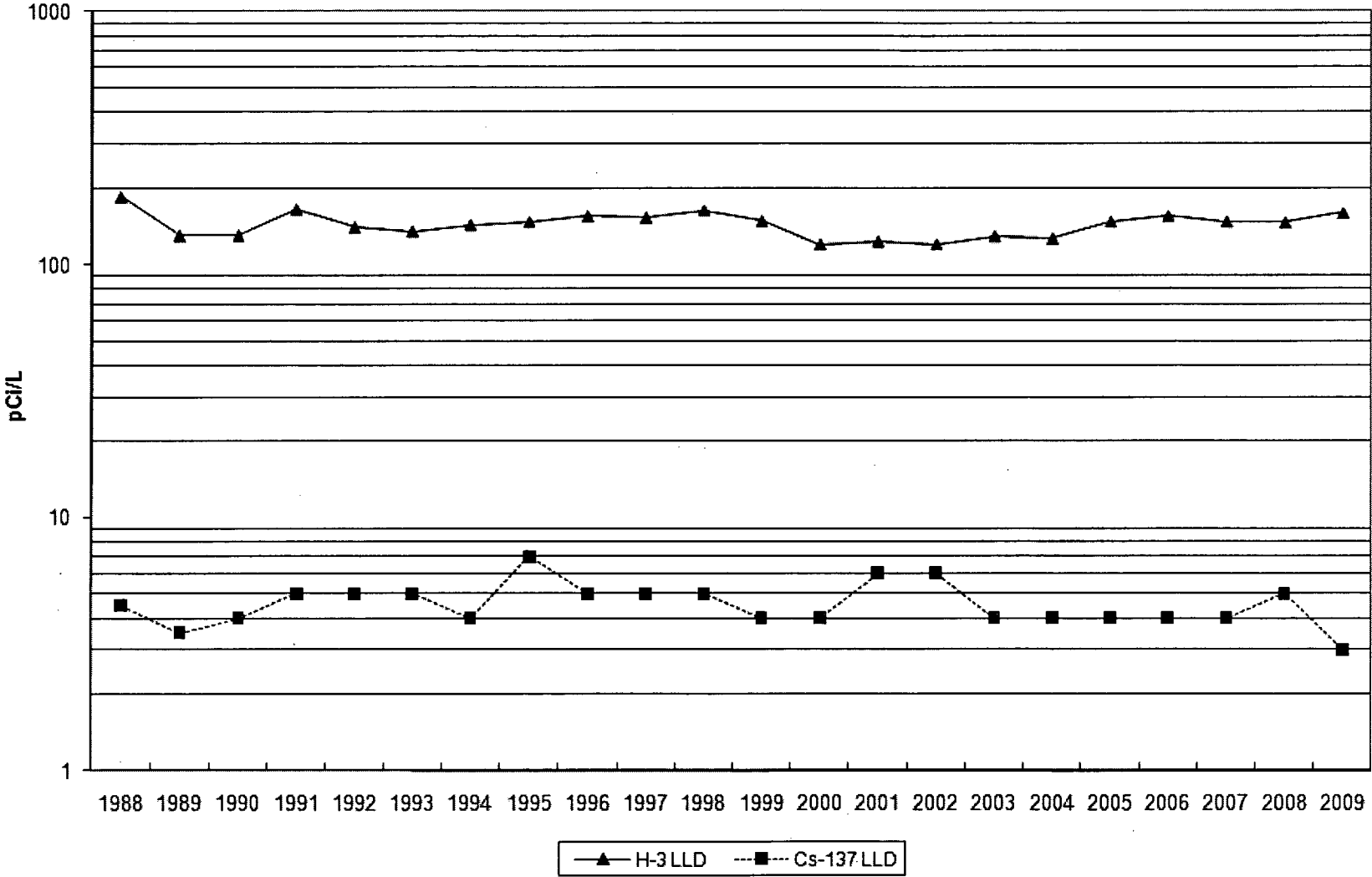


TABLE IV-C.2.b

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA

JANUARY 1 TO DECEMBER 31, 2009

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL (NUMBER) <sup>2</sup> OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD) <sup>1</sup>	ALL INDICATOR LOCATIONS	LOCATION WITH HIGHEST MEAN		CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
			MEAN RANGE	NAME	MEAN RANGE		
CR3 SITE GROUND WATER (pCi/L)	Tritium 76	165	504(47/76) (82-1967)	C3-5 0.051 mi. @225°	1490(12/12) (327-1967)	C3-2 86(1/4) (86-150)	0
	γ Spec 76						
	Mn-54	6	<LLD	--	--	<LLD	0
	Fe-59	13	<LLD	--	--	<LLD	0
	Co-58	7	<LLD	--	--	<LLD	0
	Co-60	8	<LLD	--	--	<LLD	0
	Zn-65	19	<LLD	--	--	<LLD	0
	Zr-Nb-95	11	<LLD	--	--	<LLD	0
	I-131	13	<LLD	--	--	<LLD	0
	Cs-134	8	<LLD	--	--	<LLD	0
	Cs-137	7	<LLD	--	--	<LLD	0
Ba-La-140	15	<LLD	--	--	<LLD	0	

<sup>1</sup>The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

<sup>2</sup>Includes extra samples collected for data trending.

TABLE IV-C.2.b.1

PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

pCi/L  $\gamma$  EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER

STATION	DATE	H-3	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Zn-Nb-95	I-131	Cs-134	Cs-137	Ba-La-140
C3-2	01-06	<143	<52	<4	<4	<10	<5	<9	<7	<6	<5	<5	<8
	04-07	<139	<71	<5	<5	<10	<5	<10	<9	<7	<6	<6	<10
	07-07	<143	<31	<2	<2	<4	<2	<5	<4	<3	<3	<2	<7
	10-13	86±27	<36	<3	<3	<6	<3	<9	<5	<5	<3	<3	<5
C3-4	01-06	<143	<41	<3	<3	<7	<4	<11	<5	<4	<4	<4	<7
	04-07	<139	<69	<4	<4	<7	<4	<10	<8	<6	<5	<5	<10
	07-07	<143	<69	<4	<5	<8	<5	<9	<9	<6	<6	<4	<14
	10-13	<150	<46	<3	<3	<5	<3	<6	<6	<6	<3	<3	<15
C3-5	01-06	327±51	<80	<4	<5	<10	<6	<9	<7	<5	<5	<6	<10
	04-07	1843±78	71±14	<3	<2	<5	<3	<5	<5	<4	<3	<3	<5
	07-07	1670±77	40±16	<4	<4	<8	<4	<8	<7	<6	<4	<4	<7
	10-05	1454±80	58±5	<2	<2	<3	<2	<5	<3	<2	<2	<2	<3

TABLE IV-C.2.b.1(cont'd)

PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

pCi/L  $\gamma$  EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER

STATION	DATE	H-3	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Zn-Nb-95	I-131	Cs-134	Cs-137	Ba-La-140
C3-6S	01-06	90±26	<73	<5	<5	<9	<7	<12	<7	<6	<6	<6	<14
	04-07	<139	40±13	<2	<2	<3	<2	<4	<3	<3	<2	<2	<3
	07-07	137±47	40±11	<2	<2	<3	<2	<3	<3	<3	<2	<2	<2
	10-05	<165	24±8	<4	<4	<7	<3	<13	<6	<5	<4	<4	<7
C3-6D	01-06	143	<67	<5	<5	<9	<5	<10	<7	<6	<6	<6	<14
	04-07	139	35±11	<4	<5	<9	<6	<10	<8	<5	<5	<5	<8
	07-07	143	223±18	<3	<3	<6	<4	<8	<5	<5	<4	<5	<8
	10-13	108±28	<81	<2	<2	<6	<3	<5	<4	<4	<3	<2	<11
C3-7	01-06	<143	<46	<4	<4	<8	<4	<16	<7	<5	<4	<4	<7
	04-07	156±47	16±4	<13	<2	<2	<4	<2	<6	<3	<3	<2	<2
	07-07	518±57	37±9	<18	<3	<4	<7	<4	<14	<6	<4	<4	<4
	10-05	193±55	72±13	<21	<2	<2	<4	<2	<4	<4	<3	<2	<2

TABLE IV-C.2.b.1(cont'd)

PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

pCi/L  $\gamma$  EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER

STATION	DATE	H-3	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Zn-Nb-95	I-131	Cs-134	Cs-137	Ba-La-140
C3-8	01-06	115±46	<74	<3	<3	<7	<4	<7	<7	<5	<5	<4	<9
	04-07	155±46	44±13	<2	<2	<4	<2	<4	<4	<3	<2	<2	<5
	07-07	142±47	27±8	<4	<4	<8	<4	<16	<7	<5	<4	<5	<8
	10-05	157±23	<81	<5	<4	<10	<5	<9	<9	<7	<5	<5	<8
C3-9	01-06	<143	<47	<3	<3	<6	<3	<9	<5	<4	<3	<4	<7
	04-07	<147	<52	<4	<4	<8	<4	<15	<7	<5	<4	<4	<10
	07-07	82±28	<45	<4	<4	<7	<4	<12	<6	<5	<4	<4	<7
	10-05	<165	79±27	<4	<4	<7	<5	<9	<7	<6	<4	<4	<7
C3-10	01-06	<143	<39	<3	<3	<6	<4	<7	<6	<4	<3	<3	<6
	04-07	<139	10±4	<3	<3	<5	<2	<9	<4	<3	<3	<3	<4
	07-07	<143	<68	<5	<5	<9	<5	<10	<8	<7	<6	<5	<11
	10-13	<150	11±3	<2	<2	<3	<2	<6	<3	<3	<2	<2	<3

TABLE IV-C.2.b.2

PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

pCi/L  $\gamma$  EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER (SUPPLEMENTAL DATA)

STATION	DATE	H-3	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Zn-Nb-95	I-131	Cs-134	Cs-137	Ba-La-140
C3-5	02-05	1364±72	91±16	<4	<4	<9	<5	<8	<6	<7	<5	<4	<6
	03-03	1683±76	113±23	<5	<4	<8	<4	<9	<8	<5	<5	<5	<10
	05-05	1967±84	71±20	<3	<5	<9	<4	<10	<8	<6	<6	<4	<13
	06-01	1622±76	<79	<4	<4	<10	<5	<9	<8	<6	<5	<4	<11
	08-04	1892±88	33±9	<4	<4	<8	<4	<16	<7	<4	<5	<5	<13
	09-01	1389±79	101±23	<4	<4	<7	<5	<9	<8	<7	<5	<4	<10
	11-02	1392±73	72±18	<2	<2	<6	<3	<6	<5	<3	<3	<3	<5
	12-01	1275±69	39±8	<4	<4	<7	<4	<13	<5	<4	<4	<4	<14
C3-6S	02-05	<142	<44	<3	<3	<5	<3	<6	<5	<3	<3	<3	<6
	03-03	173±44	<63	<3	<4	<6	<5	<9	<7	<6	<5	<4	<9
	05-05	188±52	<70	<4	<5	<7	<4	<7	<6	<5	<6	<4	<11
	06-01	180±46	<49	<4	<4	<8	<4	<15	<7	<5	<5	<4	<9
	08-04	103±51	30±4	<2	<2	<4	<2	<7	<3	<2	<2	<2	<5
	09-01	<165	<74	<4	<5	<9	<4	<11	<7	<7	<5	<5	<13
	11-02	117±47	24±8	<1	<1	<3	<1	<6	<2	<1	<1	<1	<5
	12-01	127±45	160±16	<3	<3	<7	<4	<8	<6	<4	<4	<4	<13



TABLE IV-C.2.b.2(cont'd)

## PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

pCi/L  $\gamma$  EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER (SUPPLEMENTAL DATA)

STATION	DATE	H-3	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Zn-Nb-95	I-131	Cs-134	Cs-137	Ba-La-140
C3-7	02-05	210±27	<100	<6	<7	<12	<8	<11	<11	<8	<8	<7	<9
	03-03	301±51	<45	<4	<4	<8	<3	<12	<6	<4	<4	<4	<8
	05-05	145±50	<50	<3	<4	<8	<4	<14	<6	<5	<4	<4	<8
	06-01	279±49	22±8	<4	<4	<8	<4	<13	<6	<5	<4	<4	<9
	08-04	243±55	<73	<4	<4	<8	<4	<9	<7	<5	<5	<4	<13
	09-01	208±56	<36	<2	<2	<4	<2	<3	<3	<3	<2	<2	<5
	11-02	239±50	<48	<4	<4	<8	<4	<13	<6	<5	<4	<4	<15
	12-01	311±50	<46	<4	<4	<8	<4	<13	<6	<5	<4	<4	<15
C3-8	02-05	222±49	<113	<6	<6	<13	<7	<13	<9	<10	<7	<8	<12
	03-03	129±47	<61	<4	<4	<7	<3	<8	<7	<6	<5	<5	<7
	05-05	<154	23±8	<4	<4	<8	<4	<17	<7	<5	<4	<5	<9
	06-01	200±47	<53	<4	<4	<9	<5	<17	<7	<5	<5	<5	<9
	08-04	157±53	28±9	<4	<4	<8	<5	<19	<7	<5	<5	<5	<11
	09-01	170±55	<38	<2	<2	<4	<2	<4	<4	<4	<2	<2	<5
	11-02	112±47	10±3	<2	<2	<3	<1	<6	<2	<2	<2	<1	<5
	12-01	147±46	<50	<4	<4	<7	<4	<15	<7	<5	<4	<4	<15

TABLE IV-C.2.b.2(cont'd)

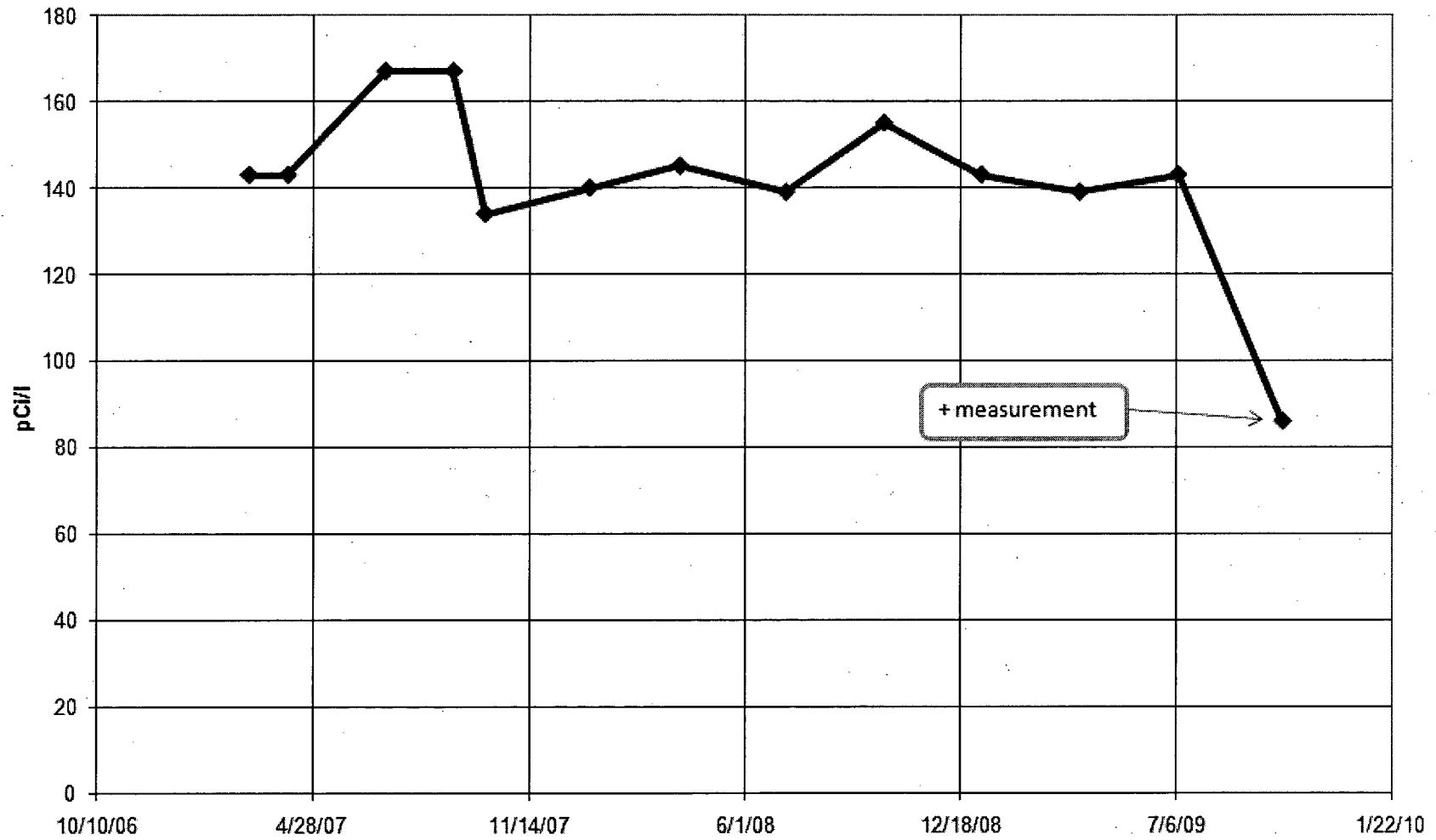
PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

pCi/L  $\gamma$  EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER (SUPPLEMENTAL DATA)

STATION	DATE	H-3	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Zn-Nb-95	I-131	Cs-134	Cs-137	Ba-La-140
C3-9	02-05	<138	<71	<4	<4	<8	<4	<9	<7	<6	<4	<4	<7
	03-03	<144	32±3	<1	<1	<3	<1	<2	<2	<13	<1	<1	<5
	05-05	<154	<52	<3	<4	<7	<4	<8	<6	<6	<4	<4	<10
	06-01	<136	69±22	<4	<4	<8	<5	<8	<8	<6	<5	<4	<8
	08-04	151±52	32±9	<4	<4	<8	<4	<13	<7	<5	<4	<4	<9
	09-01	<165	<40	<2	<2	<4	<3	<5	<4	<3	<2	<2	<7
	11-02	<145	12±3	<1	<1	<3	<1	<5	<2	<1	<1	<1	<5
	12-01	90±36	<64	<4	<4	<8	<3	<7	<5	<5	<4	<4	<15

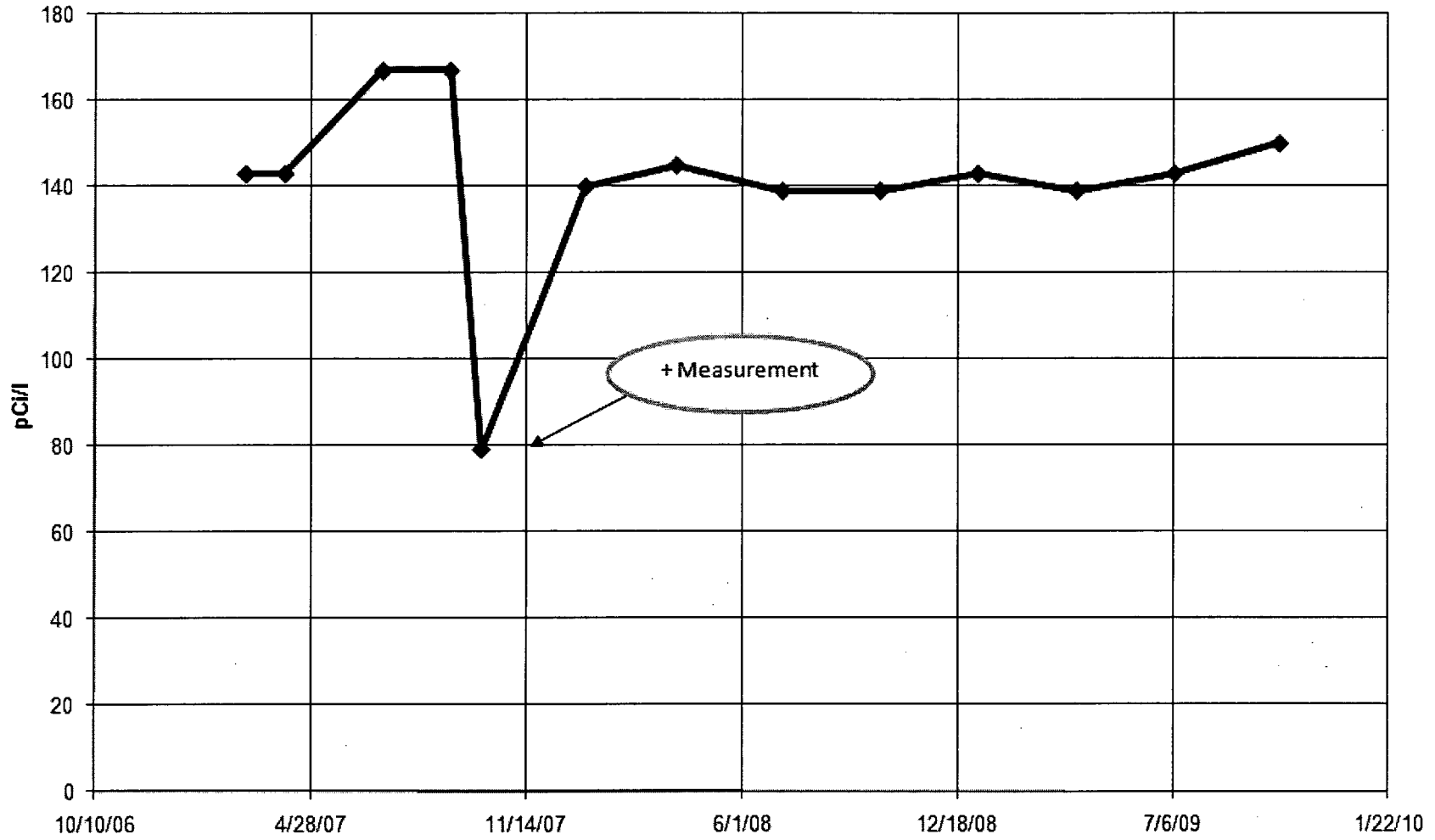
### Tritium Measurement GW Well # CR3-2

All results are < LLD unless noted

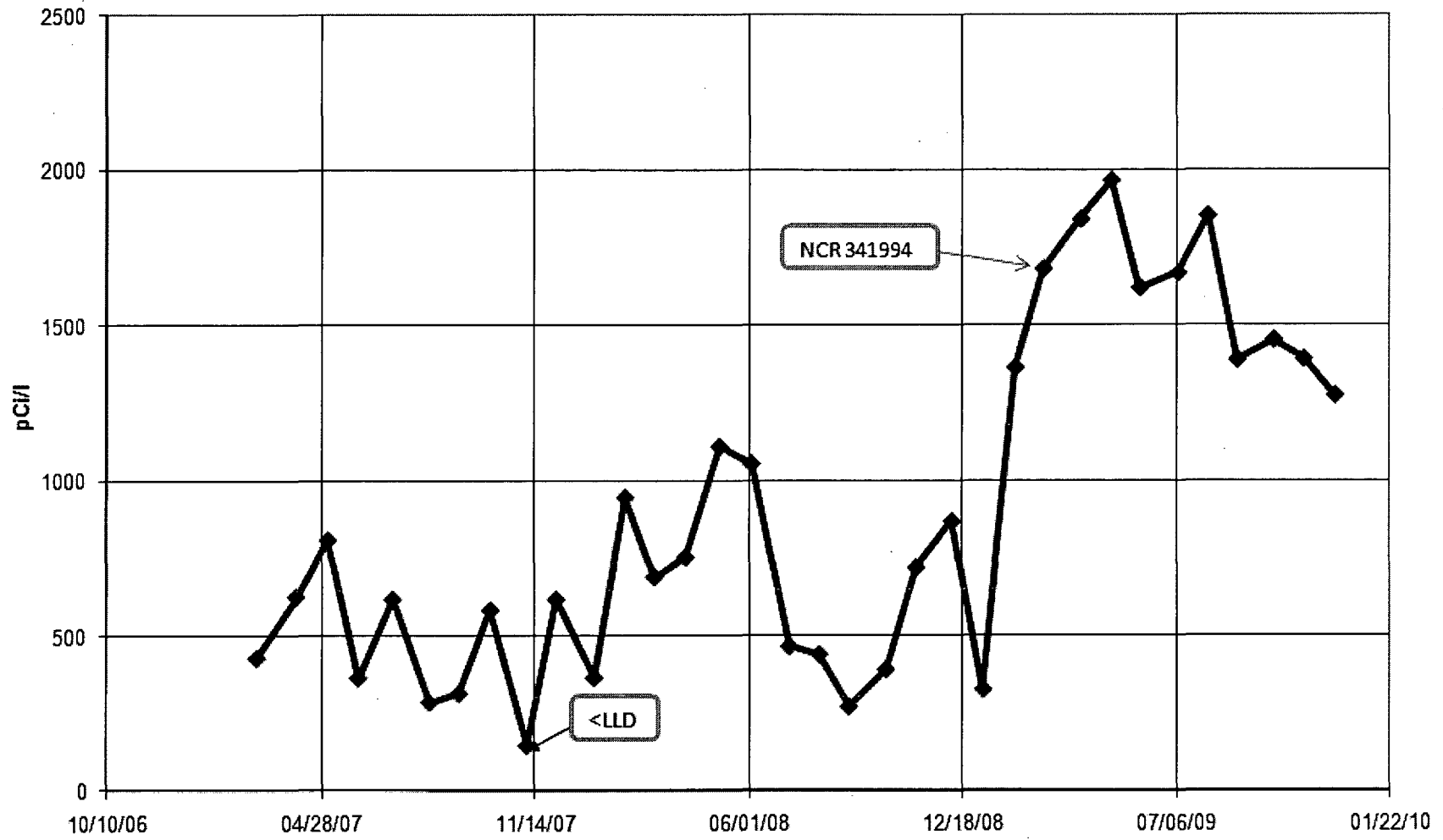


### Tritium Measurement GW Well # CR3-4

All results are < LLD unless noted

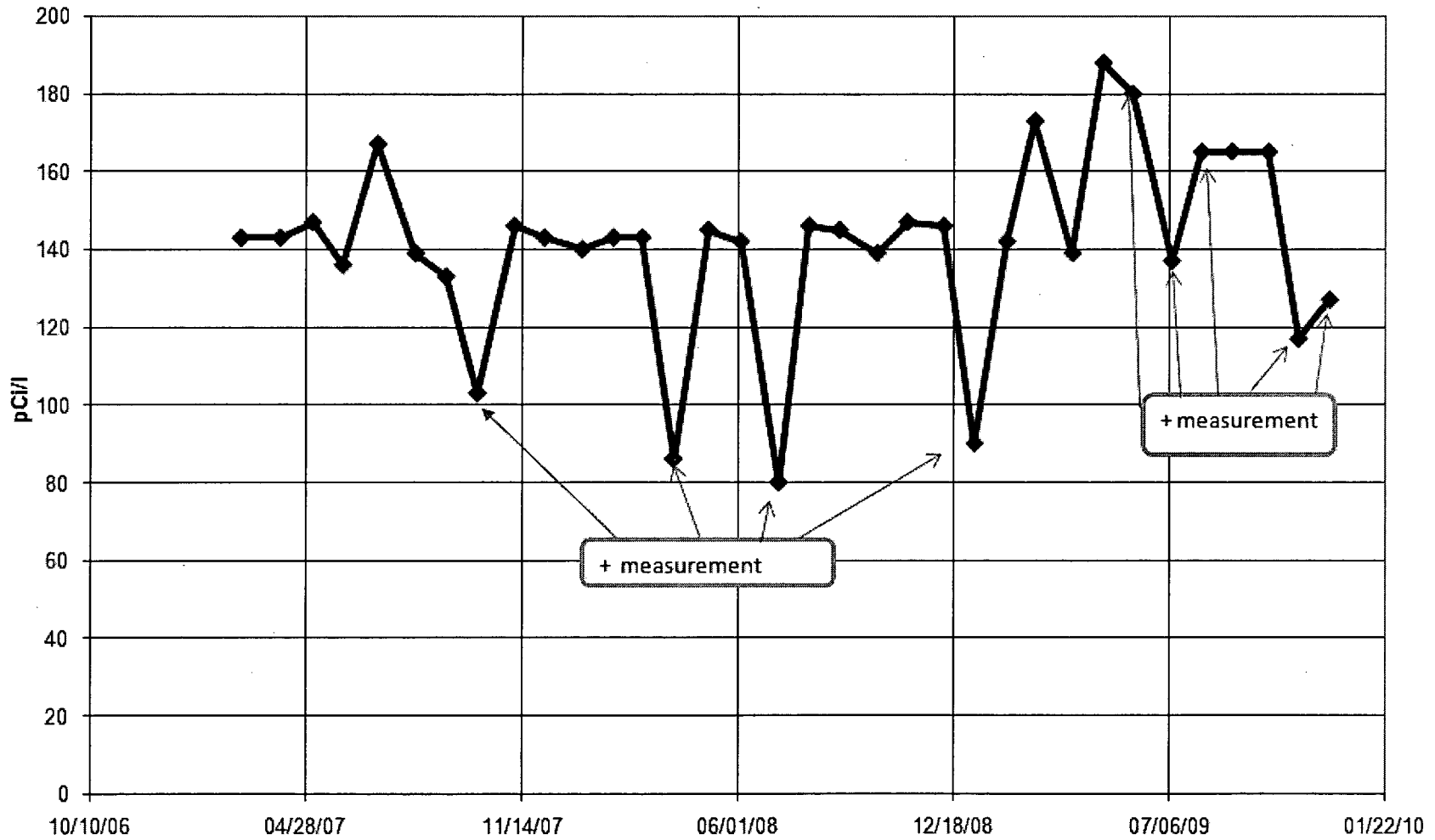


### Tritium Measurement GW Well # CR3-5



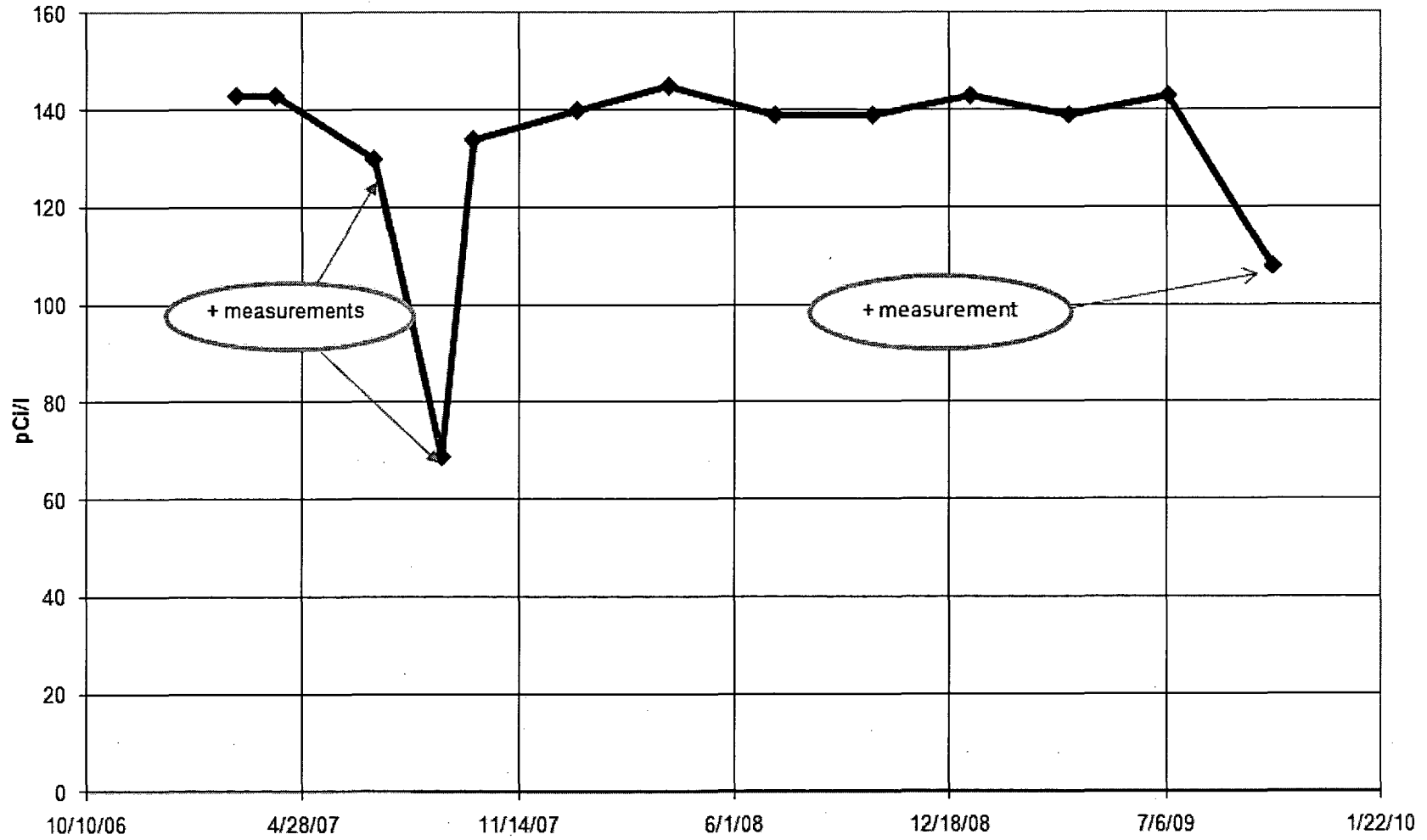
### Tritium Measurement GW Well # CR3-6S

All results are < LLD unless noted

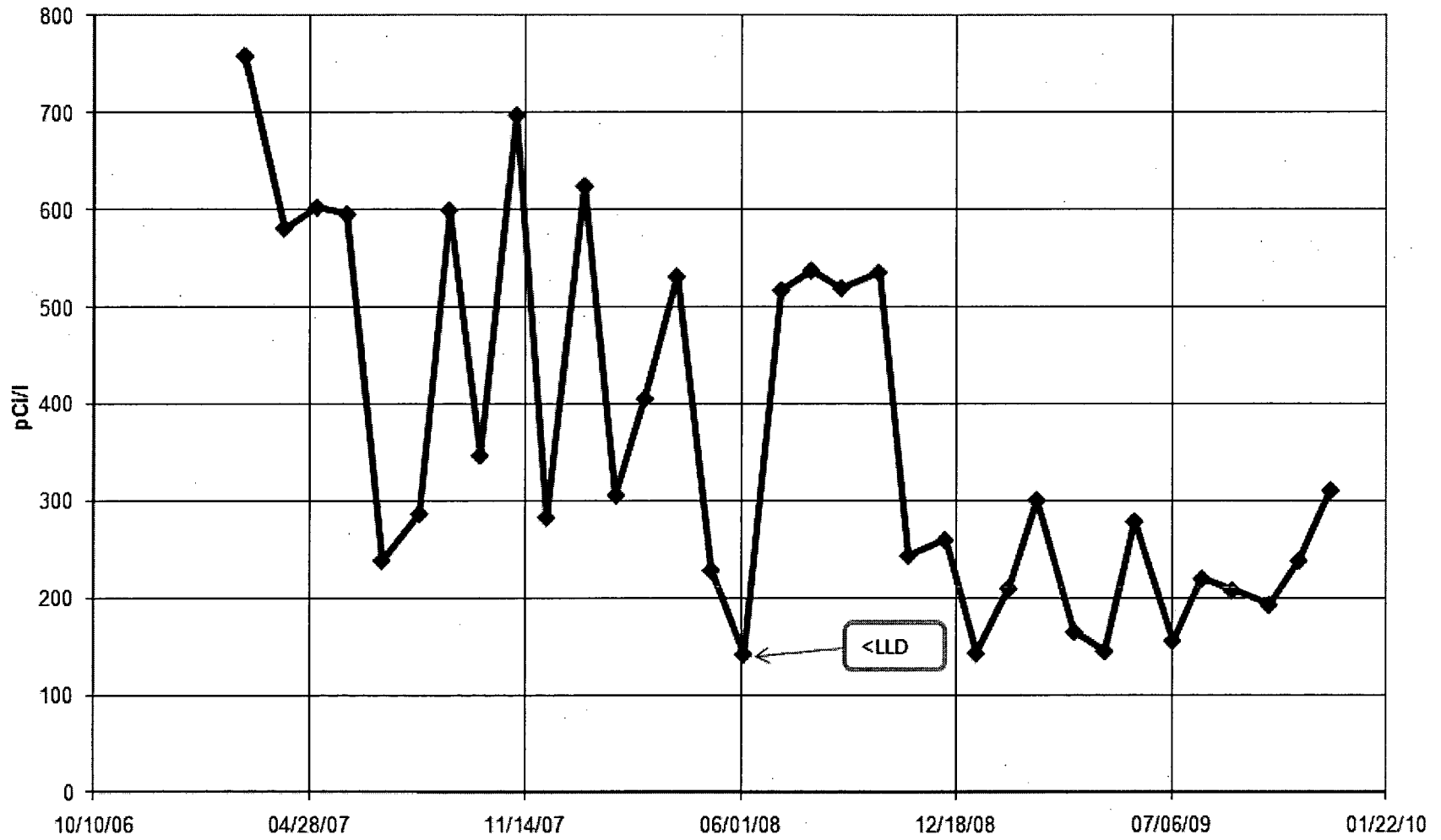


### Tritium Measurements GW Well # CR3-6D

All results are < LLD unless noted

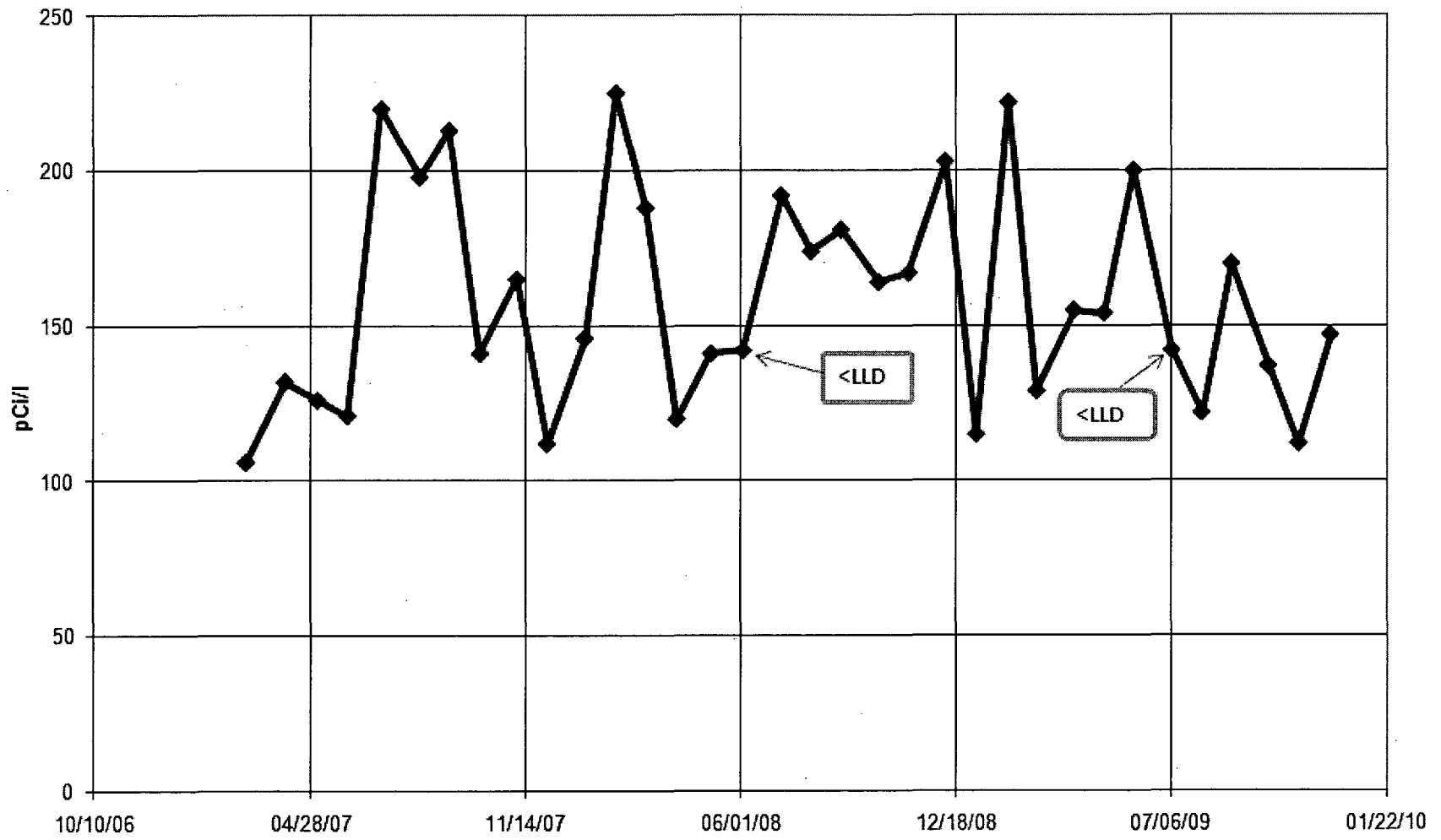


Tritium Measurements GW Well # CR3-7



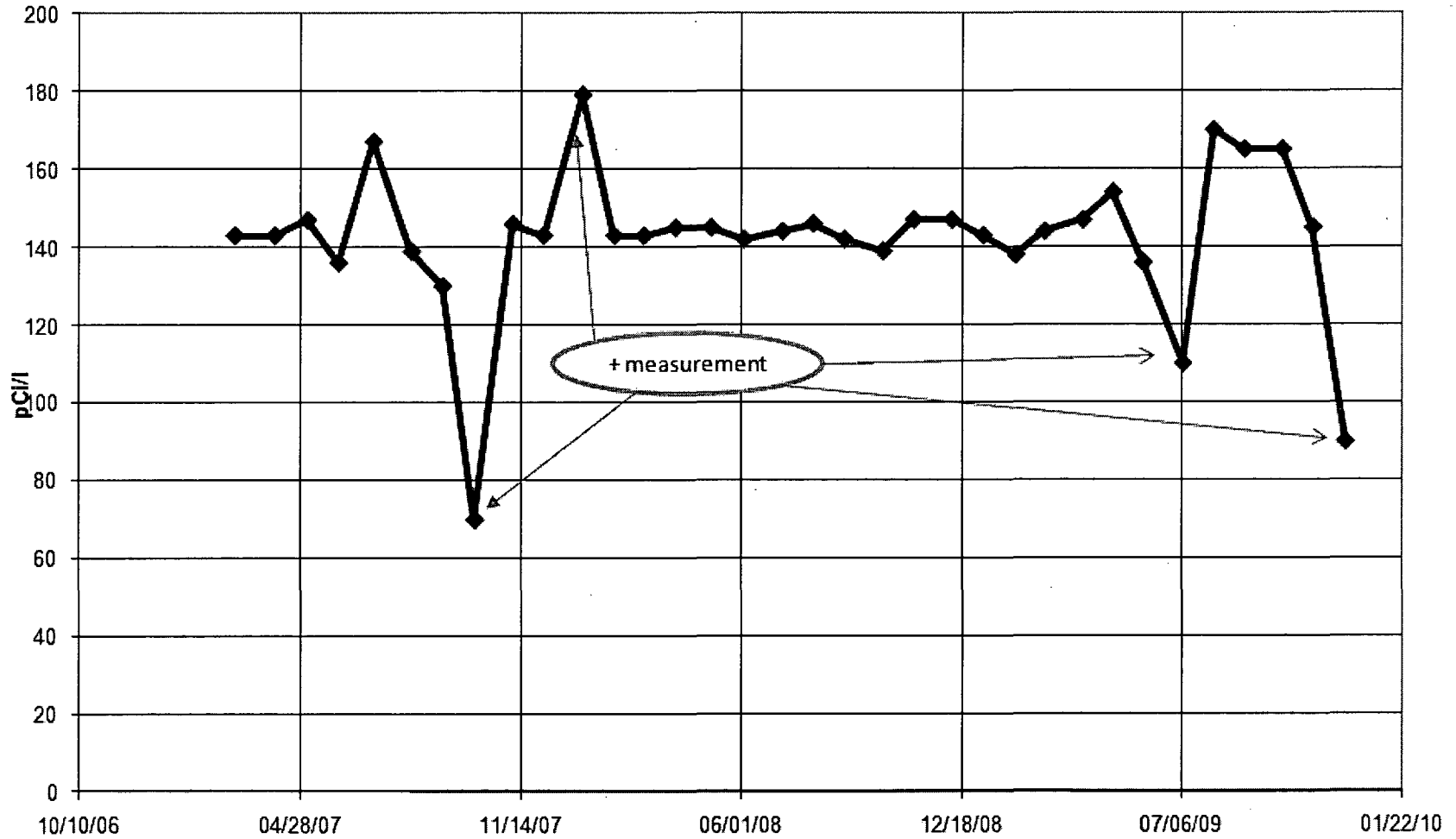


### Tritium Measurements GW Well # CR3-8



### Tritium Measurements GW Well # CR3-9

All results are < LLD unless noted



### Tritium Measurements GW Well # CR3-10

All results are < LLD unless noted

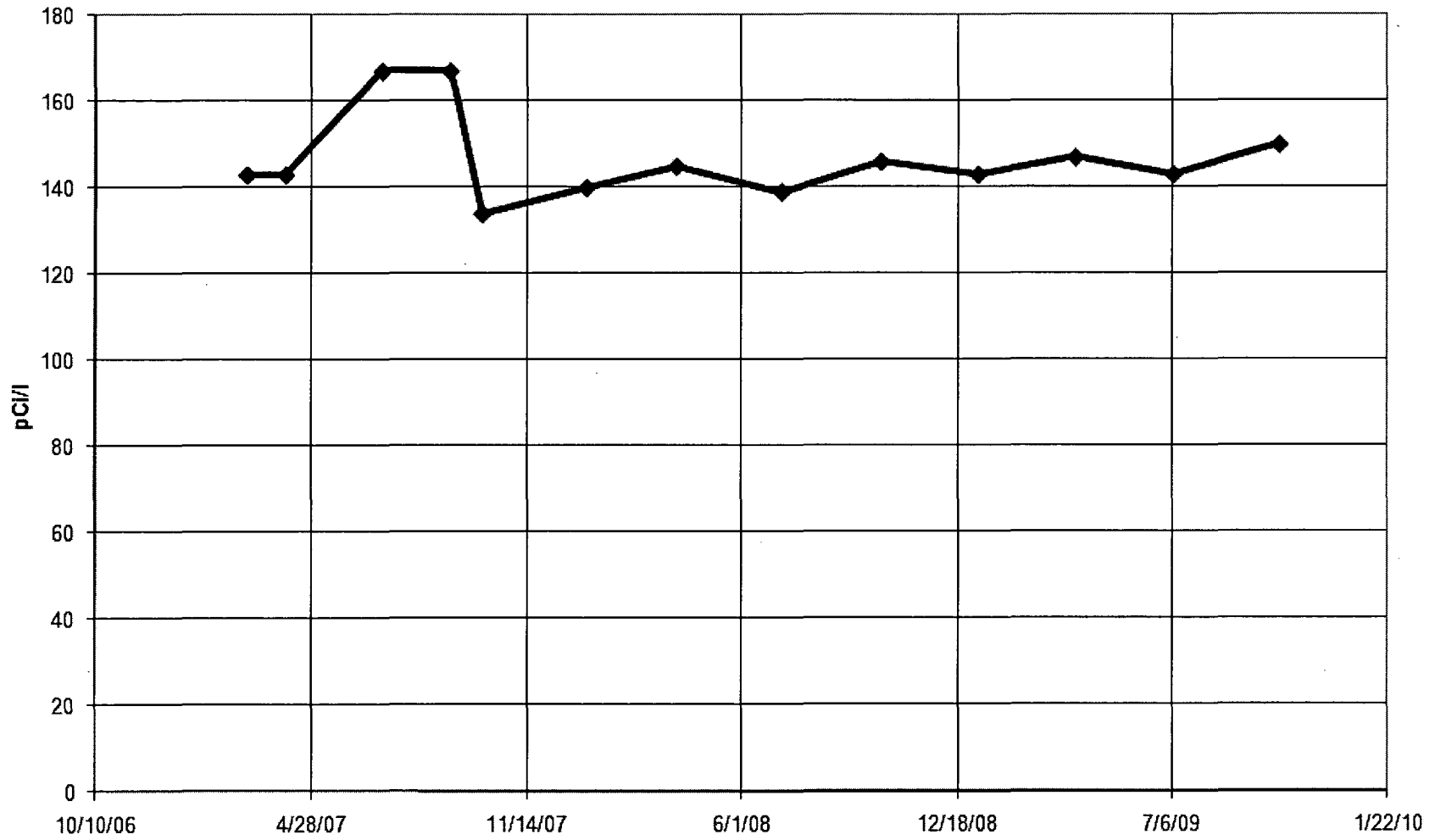


TABLE IV-C.2.c

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA

JANUARY 1 TO DECEMBER 31, 2009

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD) <sup>1</sup>	ALL INDICATOR LOCATIONS	LOCATION WITH HIGHEST MEAN		CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
			MEAN RANGE	NAME	MEAN RANGE		
*CR3 SITE GROUND WATER (pCi/L) *	Tritium 24	159	217(21/24) (86-611)	M27 0.42 mi.@285°	232(9/12) (104-611)	CR3-2 86(1/4) (86-150)	0
	γ Spec 24						
	Mn-54	6	<LLD	-	-	<LLD	0
	Fe-59	15	<LLD	-	-	<LLD	0
	Co-58	6	<LLD	-	-	<LLD	0
	Co-60	9	<LLD	-	-	<LLD	0
	Zn-65	17	<LLD	-	-	<LLD	0
	Zr-Nb-95	11	<LLD	-	-	<LLD	0
	I-131	8	<LLD	-	-	<LLD	0
	Cs-134	7	<LLD	-	-	<LLD	0
	Cs-137	6	<LLD	-	-	<LLD	0
	Ba-La-140	14	<LLD	-	-	<LLD	0

<sup>1</sup>The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

\*Non-REMP required samples

TABLE IV-C.2.c.1

PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

pCi/L  $\gamma$  EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER (SUPPLEMENTAL DATA)

STATION	DATE	H-3	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Zn-Nb-95	I-131	Cs-134	Cs-137	Ba-La-140
MWC-27*	01-06	139±27	<45	<4	<4	<7	<4	<14	<6	<5	<4	<4	<8
	02-05	<138	<92	<6	<6	<15	<9	<16	<11	<8	<7	<6	<10
	03-03	134±47	<43	<4	<4	<6	<4	<12	<6	<4	<4	<4	<6
	04-07	104±45	<12	<2	<2	<4	<2	<8	<3	<2	<2	<2	<4
	05-05	109±50	<64	<5	<4	<9	<4	<11	<7	<6	<5	<5	<10
	06-01	<146	<69	<4	<5	<7	<5	<9	<7	<6	<5	<5	<8
	07-07	134±47	<45	<4	<4	<8	<4	<13	<6	<5	<4	<4	<7
	08-04	<159	<48	<4	<3	<6	<4	<7	<6	<4	<4	<4	<13
	09-01	156±54	96±16	<4	<4	<7	<3	<8	<7	<6	<5	<4	<11
	10-05	611±36	<46	<4	<4	<8	<4	<15	<7	<6	<4	<4	<6
	11-02	469±55	<41	<3	<3	<6	<3	<6	<5	<5	<3	<3	<13
	12-01	236±48	27±10	<2	<1	<3	<2	<3	<3	<2	<2	<2	<3

\*= These wells are not officially included in the REMP and are located on either side of the site percolation ponds.

TABLE IV-C.2.c.1(cont'd)

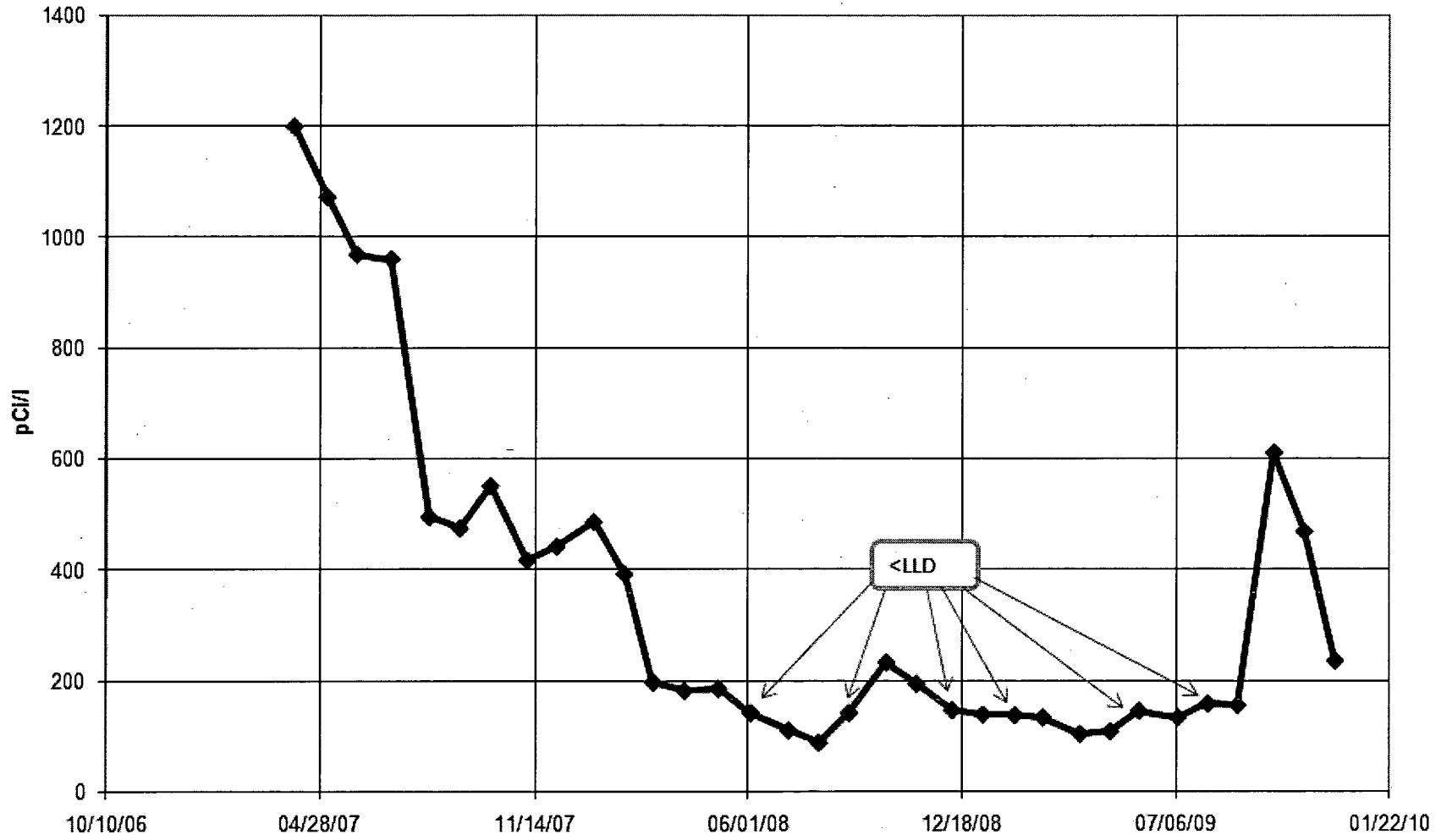
## PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

pCi/L  $\gamma$  EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER (SUPPLEMENTAL DATA)

STATION	DATE	H-3	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Zn-Nb-95	I-131	Cs-134	Cs-137	Ba-La-140
MWC-IF2*	01-06	81±26	<41	<4	<4	<7	<3	<13	<7	<4	<4	<4	<8
	02-05	191±48	<39	<3	<3	<6	<3	<6	<4	<4	<3	<3	<4
	03-03	243±50	<46	<4	<4	<8	<4	<17	<7	<5	<5	<4	<12
	04-07	179±47	<39	<3	<3	<6	<3	<8	<5	<5	<3	<3	<5
	05-05	253±53	<34	<3	<3	<6	<3	<11	<5	<4	<3	<3	<6
	06-01	218±50	13±3	<2	<2	<3	<2	<6	<3	<2	<2	<2	<4
	07-07	259±50	12±3	<2	<2	<3	<2	<5	<3	<2	<2	<2	<3
	08-04	194±54	<46	<4	<4	<8	<4	<15	<6	<4	<4	<4	<9
	09-01	238±56	<28	<2	<2	<4	<2	<3	<4	<3	<2	<2	<5
	10-05	198±55	<45	<4	<4	<7	<4	<13	<6	<5	<4	<4	<6
	11-02	202±49	<3	<1	<1	<1	<1	<2	<1	<1	<1	<1	<2
	12-01	205±47	61±13	<3	<3	<6	<4	<7	<7	<5	<4	<3	<14

\*= These wells are not officially included in the REMP and are located on either side of the site percolation ponds.

### Tritium Measurements GW Well # MWC-27



### Tritium Measurements GW Well # MWC-IF2

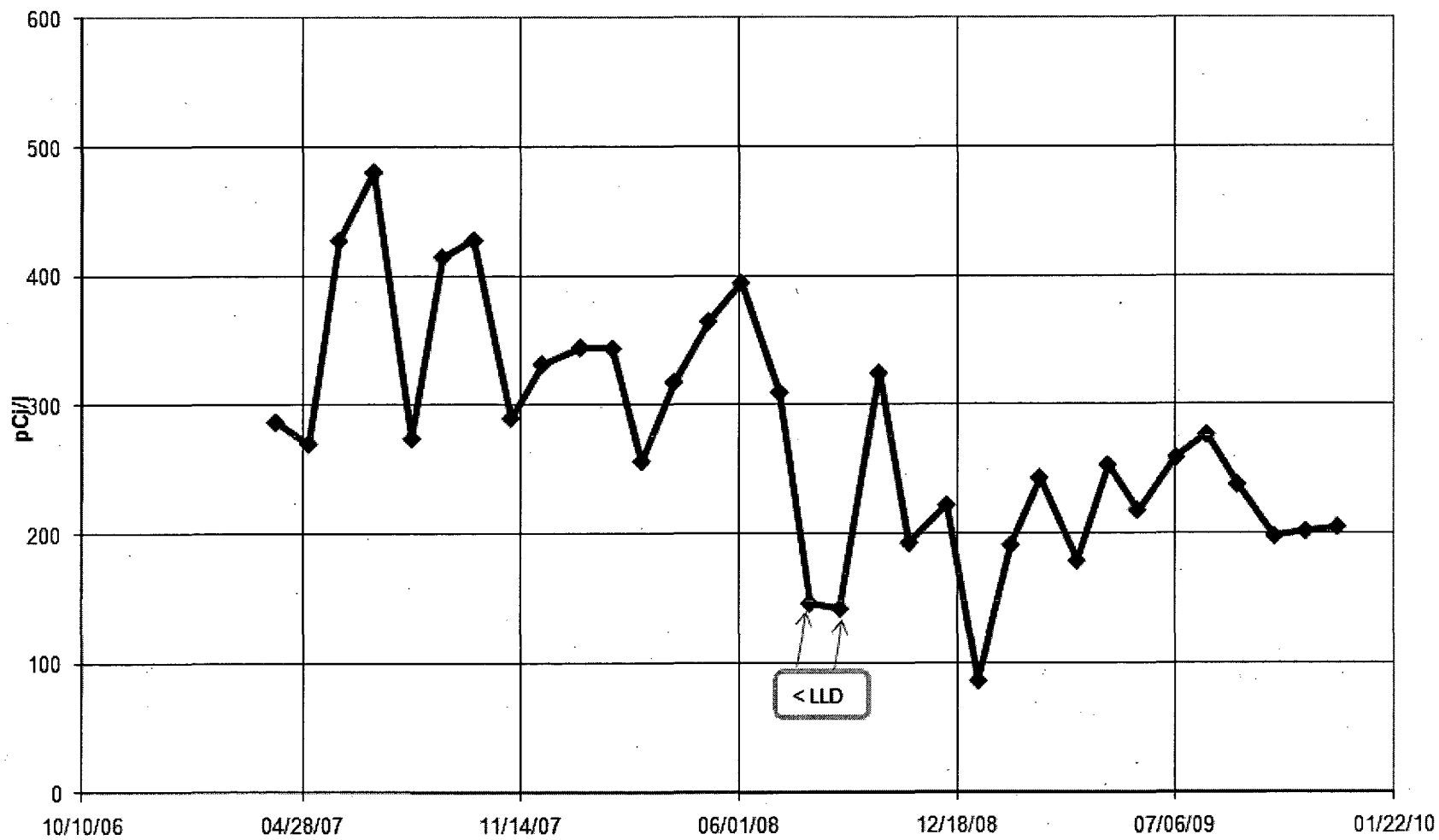




TABLE IV-C.3

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA

JANUARY 1 TO DECEMBER 31, 2009

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD) <sup>1</sup>	ALL INDICATOR LOCATIONS	LOCATION WITH HIGHEST MEAN		CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
			MEAN RANGE	NAME	MEAN RANGE		
DRINKING WATER (pCi/L)	Tritium 12	145	<LLD	-	-	<LLD	0
	γ Spec 12						
	Mn-54	5	<LLD	-	-	<LLD	0
	Fe-59	8	<LLD	-	-	<LLD	0
	Co-58	4	<LLD	-	-	<LLD	0
	Co-60	5	<LLD	-	-	<LLD	0
	Zn-65	9	<LLD	-	-	<LLD	0
	Zr-Nb-95	7	<LLD	-	-	<LLD	0
	I-131	6	<LLD	-	-	<LLD	0
	Cs-134	5	<LLD	-	-	<LLD	0
	Cs-137	6	<LLD	-	-	<LLD	0
Ba-La-140	15	<LLD	-	-	<LLD	0	

<sup>1</sup>The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

TABLE IV-C.3.a

PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

pCi/L  $\gamma$  EMITTERS AND TRITIUM IN DRINKING WATER

STATION	DATE	H-3	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Zn-Nb-95	I-131	Cs-134	Cs-137	Ba-La-140
C07	01-13	<143	<31	<2	<2	<4	<3	<5	<3	<2	<3	<3	<6
	04-07	<139	<71	<4	<4	<8	<5	<9	<7	<5	<5	<6	<12
	07-07	<143	<40	<3	<3	<6	<3	<9	<5	<4	<3	<3	<9
	10-13	<150	<45	<3	<3	<7	<3	<6	<5	<6	<3	<2	<15
C10	01-13	<143	<8	<1	<1	<2	<1	<2	<2	<1	<1	<1	<3
	04-07	<139	<43	<3	<3	<7	<4	<9	<6	<4	<4	<3	<7
	07-07	<14	<59	<4	<4	<7	<3	<9	<7	<4	<3	<3	<14
	10-13	<150	<32	<3	<3	<7	<3	<7	<5	<5	<3	<3	<5
C18	01-13	<143	<15	<1	<1	<2	<2	<3	<2	<2	<2	<1	<4
	04-07	<139	<51	<4	<3	<7	<3	<8	<6	<5	<4	<4	<8
	07-07	<143	<69	<4	<4	<6	<3	<9	<6	<6	<4	<4	<7
	10-13	<164	<80	<5	<4	<8	<5	<9	<6	<4	<5	<4	<14

### Drinking Water

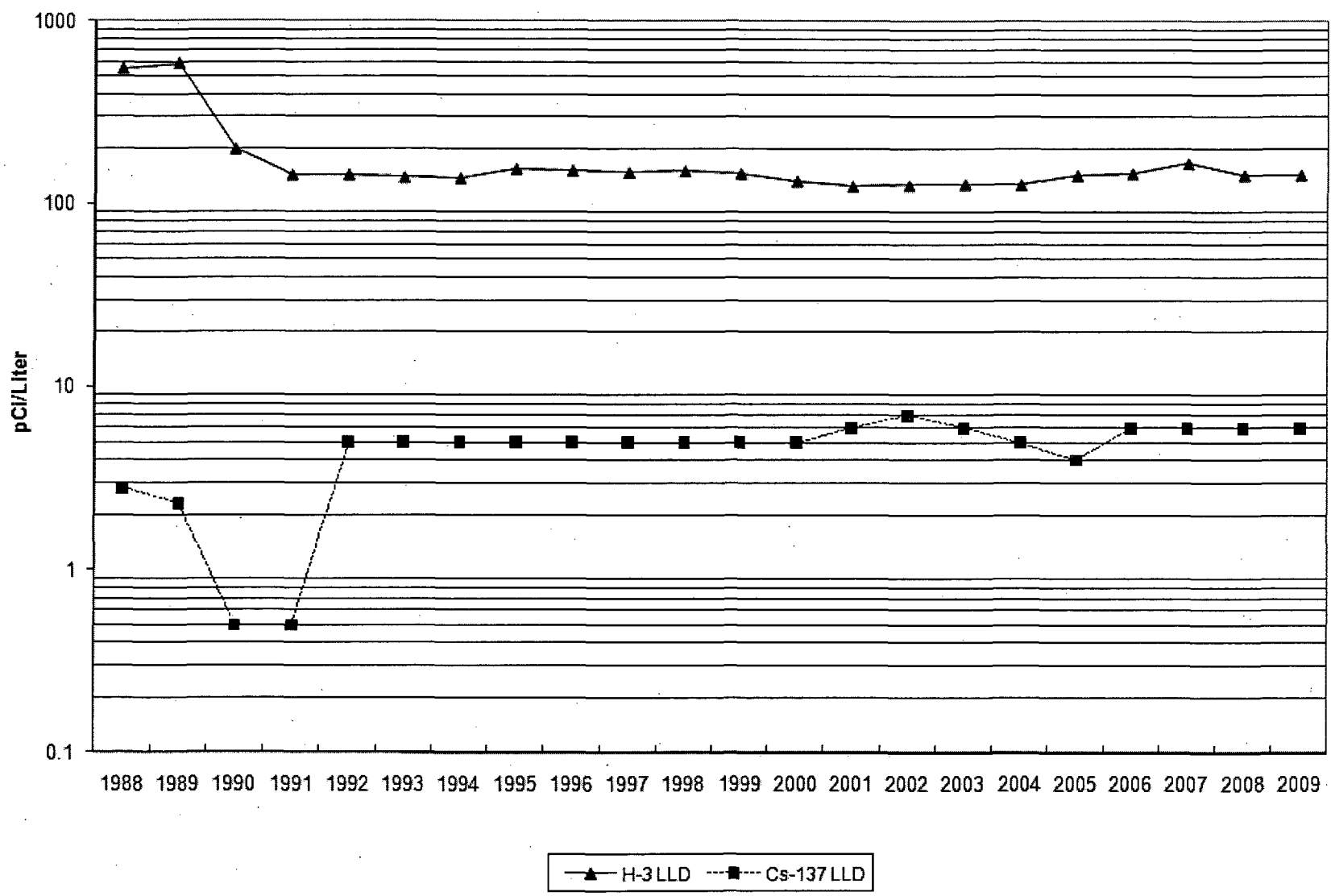


TABLE IV-C.4

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA

JANUARY 1 TO DECEMBER 31, 2009

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD) <sup>1</sup>	<u>ALL INDICATOR LOCATIONS</u>	<u>LOCATION WITH HIGHEST MEAN</u>		CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
			MEAN RANGE	NAME	MEAN RANGE		
SHORELINE SEDIMENT (pCi/kg)	γ Spec 8						
	Cs-134	15	<LLD	—	—	<LLD	0
	Cs-137	13	24 (4/6) (17-30)	C14H 0.1 @ 0°	29 (2/2) (28-30)	<LLD	0

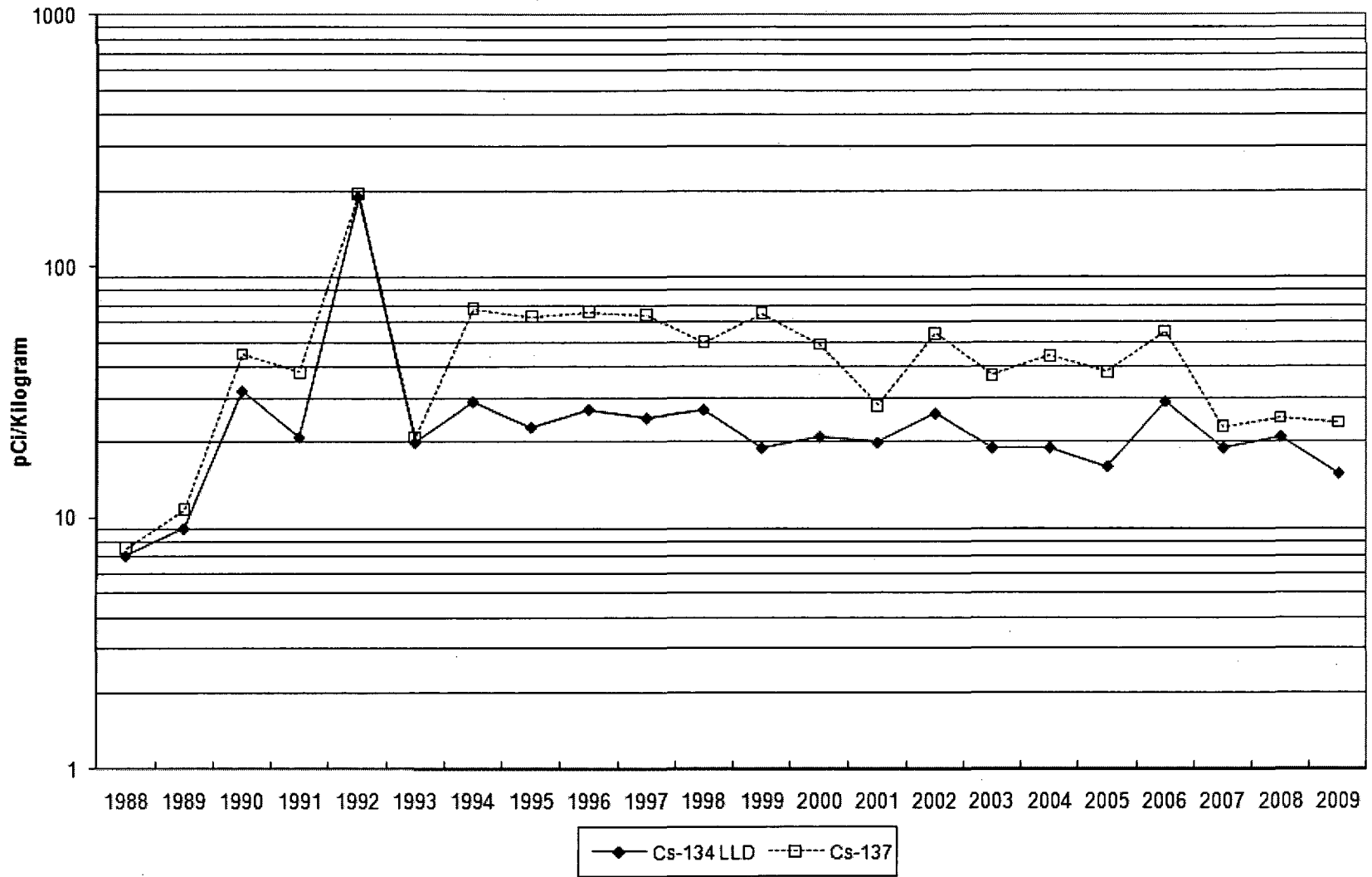
<sup>1</sup>The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

**TABLE IV-C.4.a**  
**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009**  
**pCi/kg  $\gamma$  EMITTERS IN SHORELINE SEDIMENT**

STATION	PERIOD	Co-58	Co-60	Cs-134	Cs-137	K-40	Ra-226
C09	First Half	<9	<10	<14	<11	354±55	408±150
	Second Half	<8	<8	<10	<9	456±52	1062±126
C14H	First Half	<14	9±1	<15	30±3	1608±76	1464±193
	Second Half	<14	<15	<15	28±3	1657±77	655±220
C14M	First Half	<12	24±4	<15	21±6	631±93	1342±155
	Second Half	<11	21±2	<12	17±2	672±42	763±201
C14G	First Half	<10	<12	<14	<13	250±59	905±163
	Second Half	<11	<11	<12	<13	322±30	1056±155

C09 is the control station at Ft. Island Beach. C14H, C14M, & C14G are discharge canal stations.

### Shoreline Sediment



#### IV-D. INGESTION PATHWAY

To evaluate the ingestion pathway, samples are taken of fish, oysters, broad leaf vegetation, citrus, and watermelon.

1. Quarterly carnivorous fish samples were taken at two locations: C29 at the end of the discharge canal, and C30, the control location, near the mouth of the intake canal. None of the required radionuclides were found in measurable quantities. The highest cesium-137 LLD for station C29 was 32 pCi/kg. Naturally occurring potassium-40 was quantified in all eight samples at an average concentration of 2449 pCi/kg.

Table IV-D.1 provides a statistical summary of the carnivorous fish gamma spectroscopy results.

Table IV-D.1.a provides the results of the quarterly samples.

2. Quarterly oyster samples were taken at the same locations as fish samples, C29 and C30. Of the isotopes required to be evaluated, none indicated measurable amounts of radioactivity. In 2009, silver-110m was quantified in one sample at location C29 near the end of the discharge canal, at a concentration of 20 pCi/kg. Silver-110m was not quantified in any oyster samples collected in 2008. In 2007, silver-110m was quantified in three samples at C29 with an average concentration of 85 pCi/kg and a range of 58 to 118 pCi/kg. In 2006, silver-110m was quantified in four samples at C29 and one sample at C30 with an average concentration of 350 pCi/kg and a range of 38 to 845 pCi/kg.

Table IV-D.2 provides a statistical summary of the oyster gamma spectroscopy results.

Table IV-D.2.a provides the results of the quarterly samples.

3. Monthly broad leaf vegetation samples were taken at two indicator locations, C48A and C48B, and one control location, C47. Nine of twenty-four indicator samples had measurable amounts of cesium-137 with an average concentration of 14 pCi/kg and a range of 5 to 27 pCi/kg. This is lower than the levels found in 2007 and 2008, and also is lower than the previous four years. It is believed the 2007 and 2008 spike was due to possible collection of wire grass mixed into the sample, which has a greater uptake rate of cesium as compared to other broad-leafed media. In 2009, six of twelve control station samples had measurable amounts of cesium-137 with an average concentration of 40 pCi/kg and a range of 7 to 106 pCi/kg. During 2009 due to construction activities at the Crystal River Unit 4 & 5 site, the area where broad leaf vegetation was being collected at station C48A was removed. A new location in the same north sector was located near the air sample station C46.

Table IV-D.3 provides a statistical summary of the broad leaf vegetation gamma spectroscopy results.

Table IV-D.3.a provides the results of the monthly samples.

4. Citrus samples are taken at station C19. In 2008 and again in 2009, there were no watermelon samples available at station C04. Due to crop rotation there were no locally grown watermelons found in any areas nearby the facility and no local commercial harvest performed. None of the required radionuclides were found in measurable quantities in the citrus samples with exception of Cs-137 at a concentration of 13 pCi/kg.

Table IV-D.4 provides a statistical summary of the watermelon and citrus gamma spectroscopy results.

Table IV-D.4.a provides the results of the semi-annual samples.

TABLE IV-D.1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA

JANUARY 1 TO DECEMBER 31, 2009

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD) <sup>1</sup>	ALL INDICATOR LOCATIONS	LOCATION WITH HIGHEST MEAN	CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
			MEAN RANGE	NAME DISTANCE & BEARING		
CARNIVOROUS	γ Spec 8					
FISH						
(pCi/kg)	Mn-54	25	<LLD	-	<LLD	0
	Fe-59	52	<LLD	-	<LLD	0
	Co-58	25	<LLD	-	<LLD	0
	Co-60	30	<LLD	-	<LLD	0
	Zn-65	65	<LLD	-	<LLD	0
	Cs-134	32	<LLD	-	<LLD	0
	Cs-137	32	<LLD	-	<LLD	0

<sup>1</sup>The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.



TABLE IV-D.1.a

## PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

pCi/kg  $\gamma$  EMITTERS IN CARNIVOROUS FISH

STATION	QUARTER	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137	K-40
C29	1	<25	<25	<52	<30	<65	<32	<28	1579±682
	2	<24	<24	<50	<30	<56	<29	<32	2582±185
	3	<23	<21	<43	<20	<50	<24	<23	2489±215
	4	<14	<17	<37	<14	<34	<16	<13	2600±137
C30	1	<19	<17	<41	<23	<40	<21	<20	3146±207
	2	<21	<20	<41	<24	<48	<24	<21	1953±413
	3	<20	<18	<36	<26	<53	<27	<19	2704±211
	4	<13	<15	<35	<13	<33	<15	<13	2542±99

### Carnivorous Fish

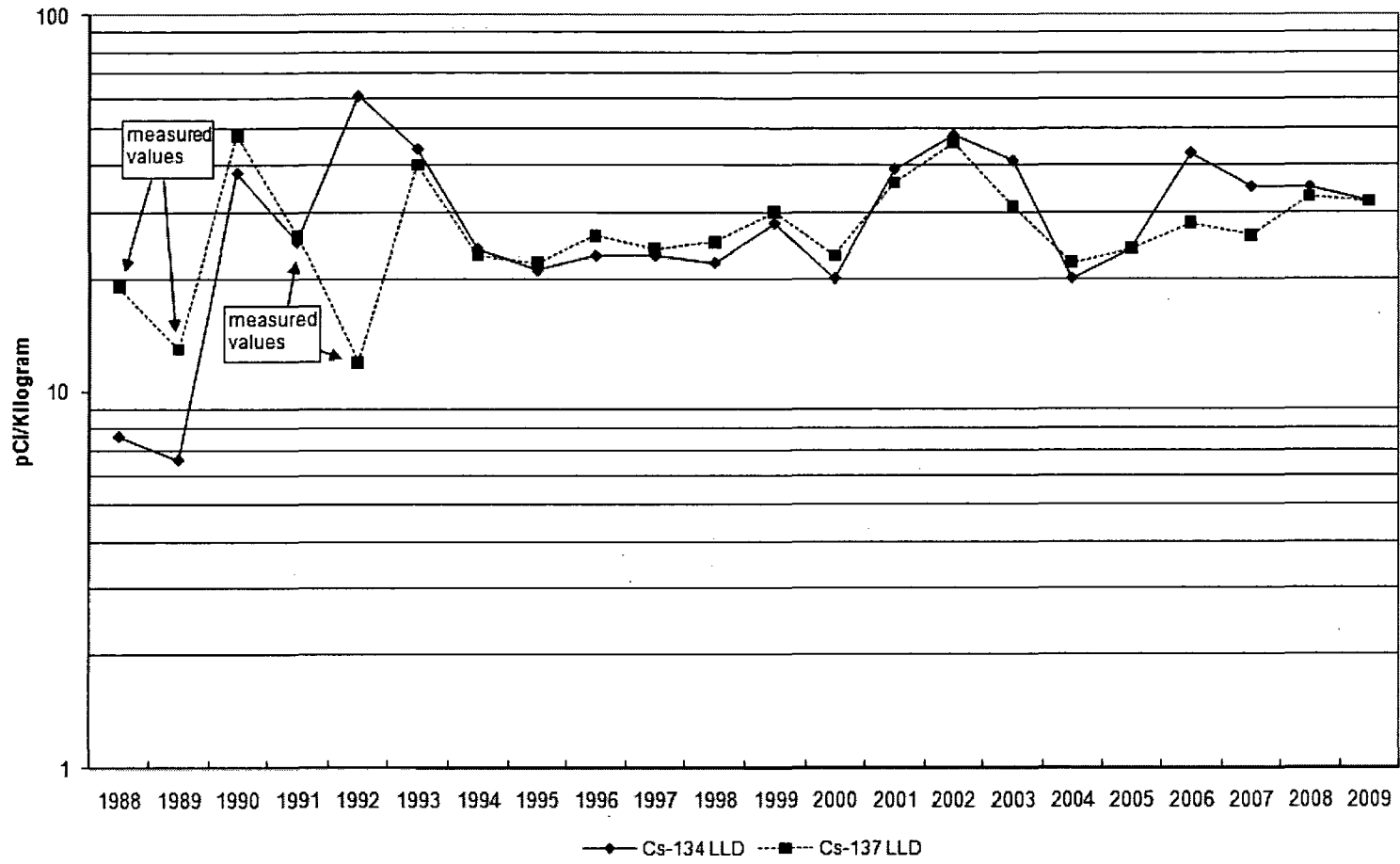


TABLE IV-D.2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA

JANUARY 1 TO DECEMBER 31, 2009

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD) <sup>1</sup>	ALL INDICATOR LOCATIONS	LOCATION WITH HIGHEST MEAN		CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
			MEAN RANGE	NAME	MEAN RANGE		
OYSTERS (pCi/kg)	γ Spec 8						
	Mn-54	24	<LLD	-	-	<LLD	0
	Fe-59	59	<LLD	-	-	<LLD	0
	Co-58	23	<LLD	-	-	<LLD	0
	Co-60	22	<LLD	-	-	<LLD	0
	Zn-65	39	<LLD	-	-	<LLD	0
	Cs-134	27	<LLD	-	-	<LLD	0
	Cs-137	24	<LLD	-	-	<LLD	0

<sup>1</sup>The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

TABLE IV-D.2.a

PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

pCi/kg  $\gamma$  EMITTERS IN OYSTERS

STATION	QUARTER	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137	K-40
C29	1	<9	<9	<17	<10	<20	<11	<11	1181±98
	2	<15	<15	<32	<16	<38	<21	<16	1300±136
	3	<18	<18	<35	<17	<38	<21	<19	434±59
	4	<24	<23	<55	<22	<52	<27	<24	1223±110
C30	1	<17	<14	<36	<21	<33	<19	<18	1467±150
	2	<15	<16	<35	<17	<39	<19	<17	1354±87
	3	<9	<10	<21	<10	<23	<11	<10	779±95
	4	<22	<23	<59	<22	<55	<26	<23	956±99

# Oysters

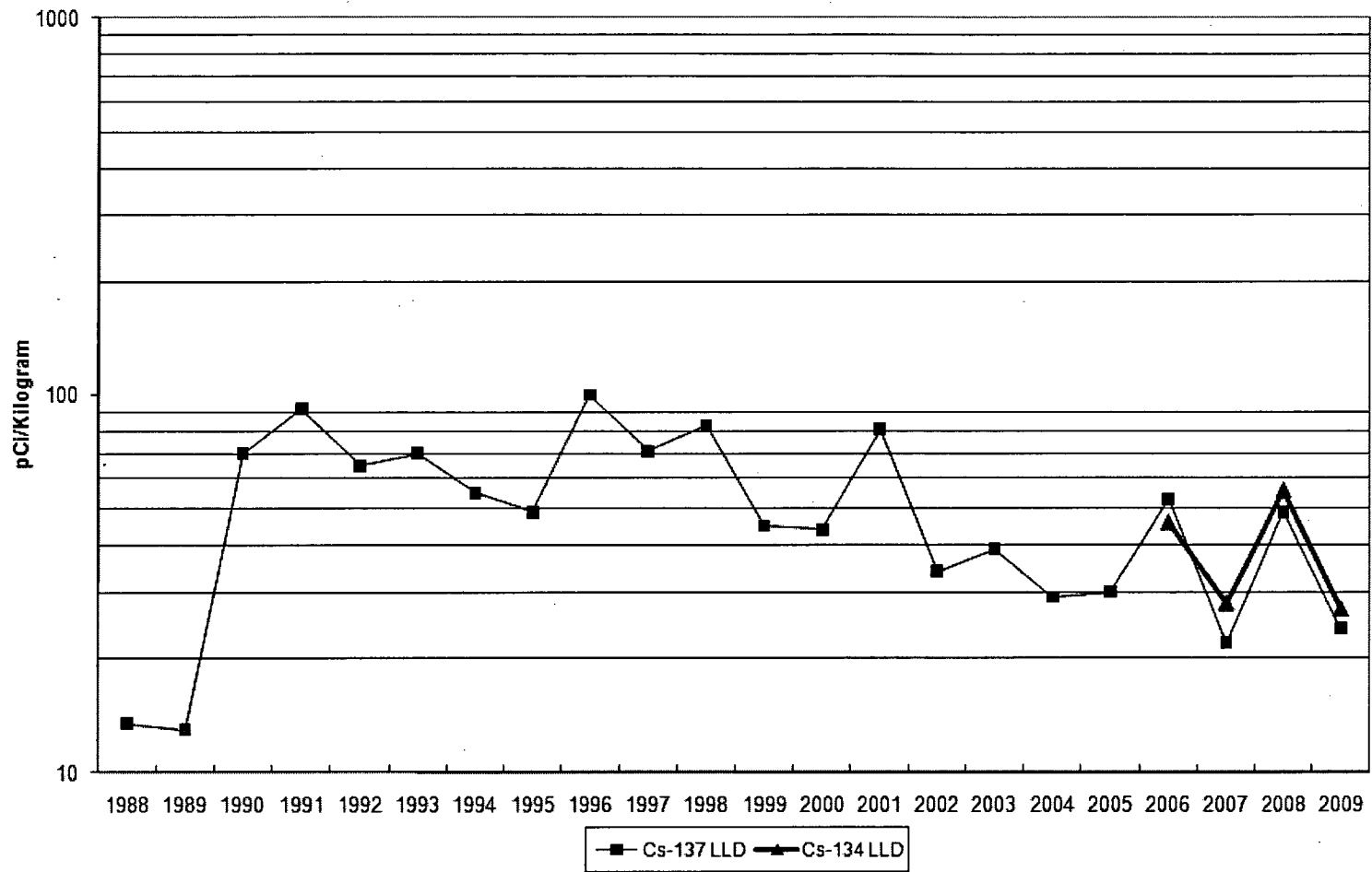


TABLE IV-D.3

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA

JANUARY 1 TO DECEMBER 31, 2009

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD) <sup>1</sup>	ALL INDICATOR LOCATIONS MEAN RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING	MEAN RANGE	CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
BROAD LEAF VEGETATION (pCi/kg)	γ Spec 36						
	I-131	27	<LLD	-	-	<LLD	0
	Cs-134	29	<LLD	-	-	<LLD	0
	Cs-137	27	14 (9/24) (5-27)	C48B 0.9 @ 45°	18 (5/12) (5-29)	40 (6/12) (7-106)	0

<sup>1</sup>The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

TABLE IV-D.3.a

## PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

pCi/kg OF  $\gamma$  EMITTERS IN BROAD LEAF VEGETATION

STATION	MONTH	I-131	Cs-134	Cs-137	K-40
C47	JAN	<25	<15	27±7	3877±162
	FEB	<15	<19	64±9	2614±170
	MAR	<14	<16	106±8	3303±179
	APR	<4	<5	13±1	3191±109
	MAY	<16	<19	<24	3477±211
	JUN	<10	<11	7±2	3582±144
	JUL	<12	<12	22±6	4325±154
	AUG	<14	<12	<15	3613±152
	SEP	<13	<14	<14	3181±142
	OCT	<27	<24	<20	4044±212
	NOV	<17	<18	<18	2665±162
	DEC	<17	<19	<22	3595±212
C48A	JAN	<5	<5	6±2	3676±135
	FEB	<15	<20	<20	6714±214
	MAR	<19	<29	<25	6977±285
	APR	<15	<22	<19	5609±241
	MAY	<17	<18	<25	6583±251
	JUN	<11	<13	<13	5564±208
	JUL	<16	<16	<16	7298±214
	AUG	<11	<11	8±2	3427±137
	SEP	<12	<11	9±2	3549±153
	OCT	<17	<17	18±5	2288±175
	NOV	<19	<16	<14	1963±169
	DEC	<11	<10	<10	2040±97

TABLE IV-D.3.a (CONT'D)

PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

pCi/kg OF  $\gamma$  EMITTERS IN BROAD LEAF VEGETATION

STATION	MONTH	I-131	Cs-134	Cs-137	K-40
C48B	JAN	<24	<13	<16	3099±153
	FEB	<15	<20	29±7	4429±234
	MAR	<15	<16	<19	4120±201
	APR	<10	<13	<15	4396±159
	MAY	<9	<10	13±5	6917±133
	JUN	<12	<15	<14	7079±205
	JUL	<10	<13	14±2	4956±183
	AUG	<11	<13	5±2	5545±201
	SEP	<17	<13	<16	5763±196
	OCT	<20	<19	<21	5902±241
	NOV	<20	<21	<21	4643±235
	DEC	<16	<17	27±7	5857±257



### Broad Leaf Vegetation

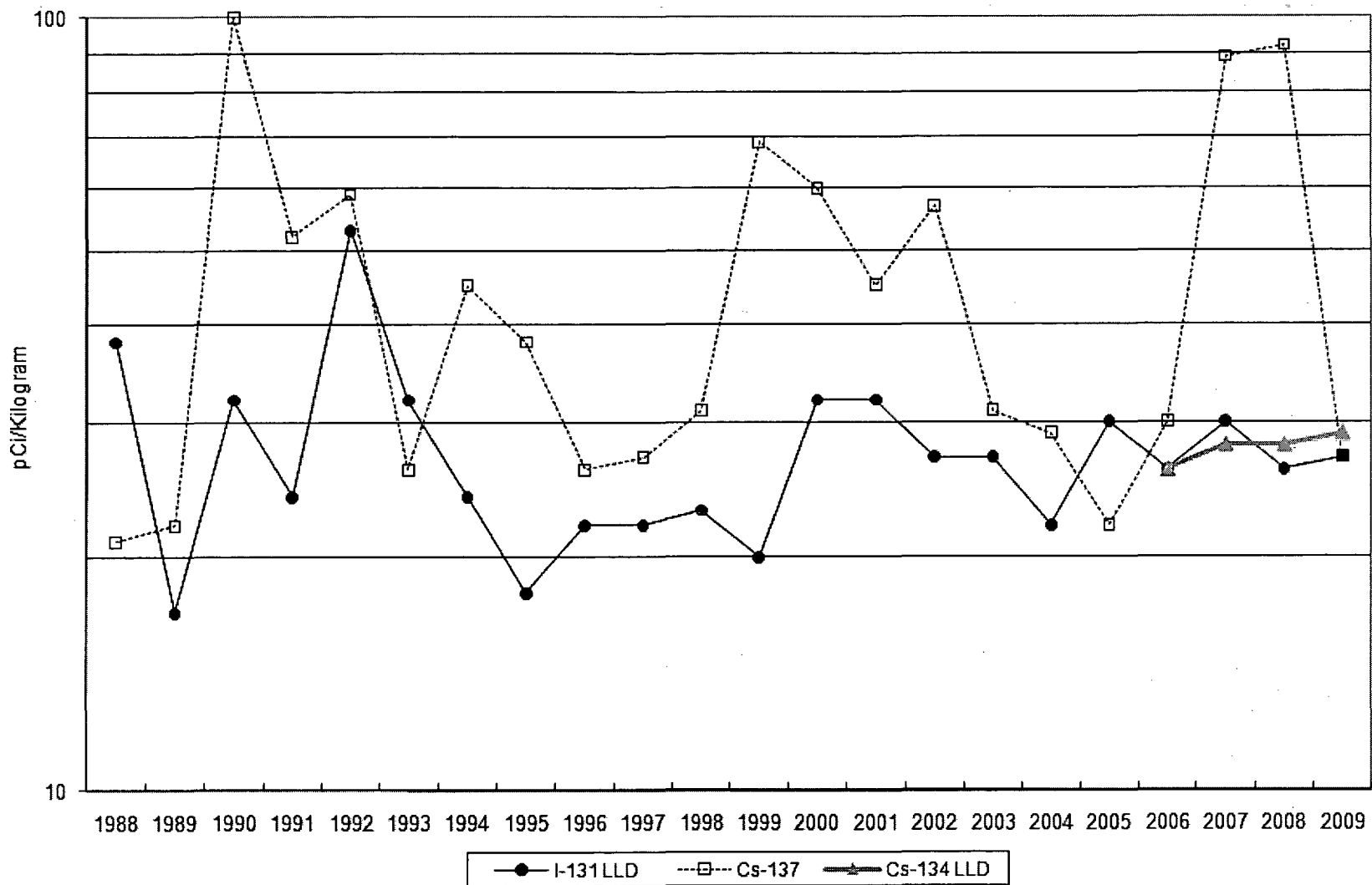


TABLE IV-D.4

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA

JANUARY 1 TO DECEMBER 31, 2009

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD) <sup>1</sup>	ALL INDICATOR LOCATIONS		LOCATION WITH HIGHEST MEAN		CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
			MEAN RANGE	NAME DISTANCE & BEARING	MEAN RANGE			
(WATERMELON) <sup>2</sup> (pCi/kg)	γ Spec 0							
	I-131	5	-	-	-	None	0	
	Cs-134	4	-	-	-	None	0	
	Cs-137	8	-	-	-	None	0	
CITRUS (pCi/kg)	γ Spec 1							
	I-131	6	<LLD	-	-	None	0	
	Cs-134	4	<LLD	-	-	None	0	
	Cs-137	9	13(1/1)	-	-	None	0	

<sup>1</sup>The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

<sup>2</sup>Watermelon, no harvest during the year-samples not available due to crop rotation in the area.

TABLE IV-D.4.a

PROGRESS ENERGY FLORIDA, INC. - CR3 - 2009

pCi/kg OF  $\gamma$  EMITTERS IN WATERMELON AND CITRUS

STATION	MONTH	I-131	Cs-134	Cs-137	K-40
C04 – (Watermelon) <sup>1</sup>	June	-	-	-	-
C19 – Citrus	January	<6	<4	13±3	1655 ± 48

<sup>1</sup>Watermelon, no harvest during the year-samples not available due to crop rotation in the area.