DUKE ENERGY®

Crystal River Nuclear Plant
15760 W. Power Line Street
Crystal River, FL 34428
Docket 50-302
Docket 72-1035
Operating License No. DPR-72

PDTS 5.7.1.1(b)
ODCM 6.5

April 4, 2016
3F0416-02

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

Subject: Crystal River Unit 3 – 2015 Annual Radiological Environmental Operating Report

Dear Sir:

Duke Energy Florida, LLC, previously known as Duke Energy Florida, Inc. (DEF), hereby provides the 2015 Annual Radiological Environmental Operating Report for Crystal River Unit 3 (CR-3) in accordance with the CR-3 Permanently Defueled Technical Specifications (PDTS), Section 5.7.1.1(b) and Section 6.5 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, 2015 through December 31, 2015.

No new regulatory commitments are made in this letter.

If you have any questions regarding this submittal, please contact Mr. Mark Van Sicklen, Licensing Lead, Nuclear Regulatory Affairs, at (352) 563-4795.

Sincerely,

Terry D. Hobbs
General Manager, Decommissioning

TDH/mvs

Attachment 1: 2015 Annual Radiological Environmental Operating Report

xc: NMSS Project Manager
Regional Administrator, Region I

DUKE ENERGY FLORIDA, LLC

DOCKET NUMBER 50 - 302 / LICENSE NUMBER DPR - 72

ATTACHMENT1

2015 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

2015

DUKE ENERGY FLORIDA, LLC

CRYSTAL RIVER UNIT 3

Prepared By: Chuck Burtoff 03/01/2016
Lead Scientist

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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).

Additional Information

On February 5, 2013, Duke Energy announced that a decision had been made to permanently retire Crystal River Unit 3. The decision was made due to the risk associated with repairing the containment building's delaminated concrete wall. The company intends to place the facility in SAFSTOR for the immediate future until eventual decommissioning. The plant staff (called SAFSTOR organization) is now mainly working to abandon unneeded plant systems and transfer the spent fuel into dry storage to an Independent Spent Fuel Storage Installation (ISFSI) that is currently being built on site.

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 2015 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 listed in the ODCM. When measurable results are reported, the values are also usually less than the required "a priori" LLD.

In 2011 there were positively measured results of iodine and cesium airborne concentrations during the period of March 22 through April 12th for almost all sampling stations including the control station. These measurements are a direct result of the earthquake and tsunami event at the Dai-Ichi, Fukushima nuclear plants following the March 11, 2011 Tohoku event in Japan. These measurements are not related to Crystal River Unit 3 activities. The Japanese event also affected broad leaf vegetation sample media throughout the year as long-lived radionuclides (Cs-137) were released at Fukushima multiple times. The vegetation measurements in 2015 are still affected by the Fukushima event due to the long-lived radionuclides deposited. The vegetation control sample station located in Orlando, Fl. is also experiencing similar Cs-137 deposition on the broad leaf sample media.

The results of the 2015 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

DUKE ENERGY FLORIDA, LLC - CR3 - 2015

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	5.3
	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)

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

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	7.4
	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	ENE	0.9
	C47-Control	ESE	78
WATERMELON	C04	NE	6.0
CITRUS	C19	ENE	9.6

TABLE I-2

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

SAMPLING AND ANALYSIS PROGRAM

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

*Includes 3 stations which are not required by the ODCM
[1]The maximum "a priori" LLD

[2]Same as Seawater γ Spec
[6]Additional 2 stations reported that are not required by the ODCM
[b]LLD for drinking water. If no drinking water pathway exists, a value of 3000 pCi/L may be used
[c]The specified LLD is for an equilibrium mixture of parent and daughter nuclides which contain 15 pCi/L of the parent nuclide
[e]LLDs apply only to quarterly composite gamma spectral analysis, not to analyses of single particulate filters
[f]LLD for drinking water. If no drinking water pathway exists, the LLD of the gamma isotopic analysis may be used

TABLE I-2 (Cont'd)

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

SAMPLING AND ANALYSIS PROGRAM

SAMPLE MEDIA	# OF STATIONS	FREQUENCY	ANALYSIS		LLD[1]
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[3]	γ Spec :	I-131	60 pCi/kg
				Cs-134	60
				Cs-137	80
Watermelon	1	Annual[4]	γ Spec :	[5]	[5]
Citrus	1	Annual[4]	γ Spec :	[5]	[5]

[1]The maximum "a priori" LLD
[3]When available
[4]During harvest
[5]Same as broad leaf vegetation

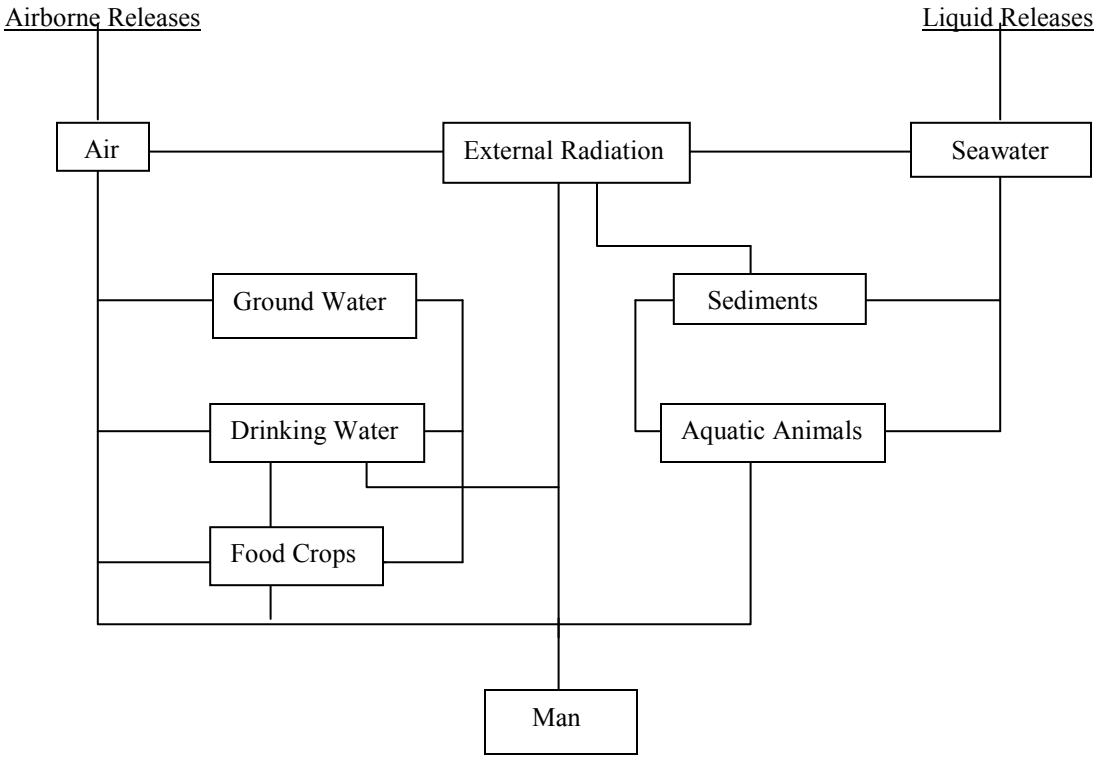


FIGURE I-1: Environmental Media and Exposure Pathways

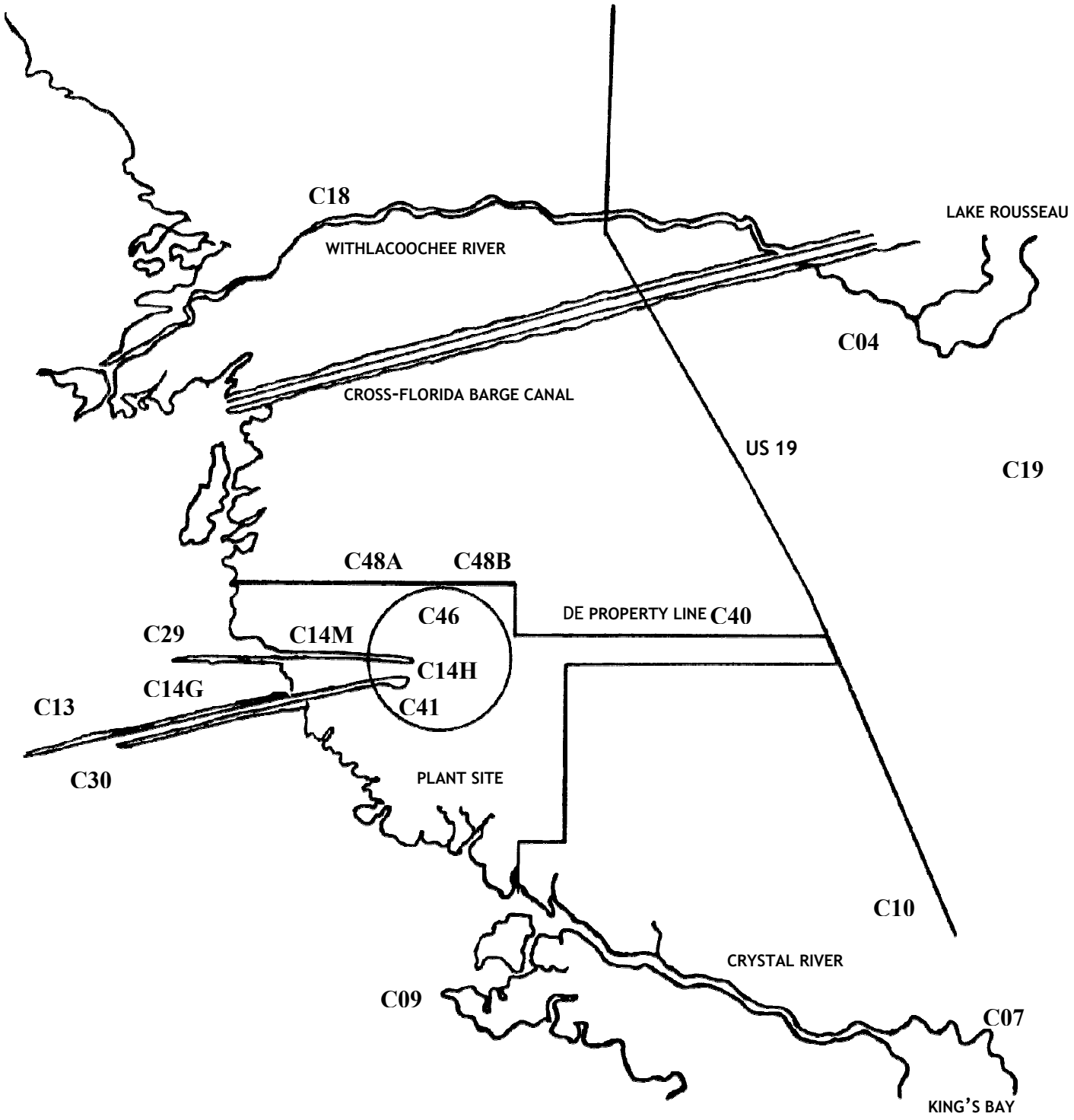


FIGURE I-2: Environmental Monitoring Sample Stations (non-TLDs)

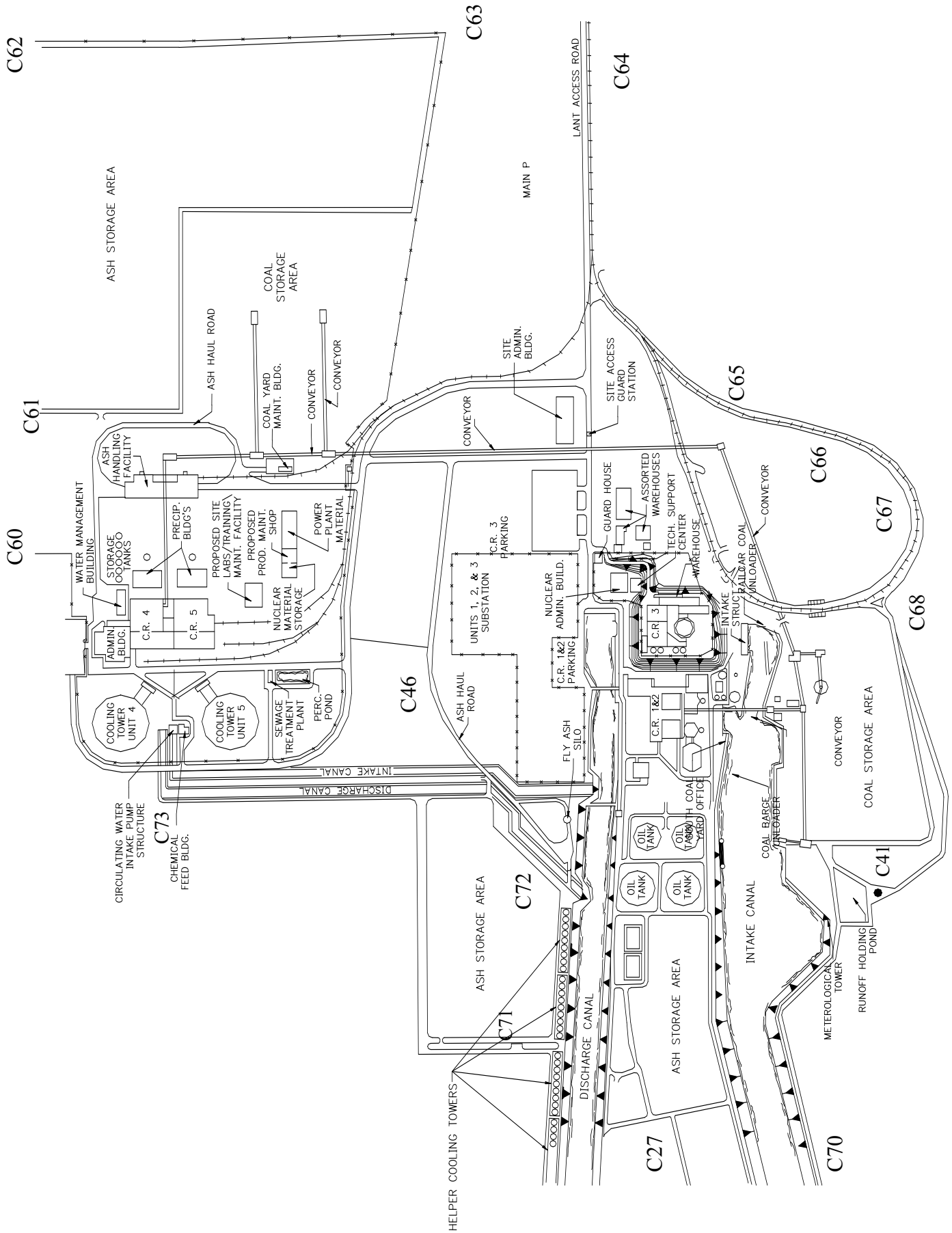


FIGURE I-3: Environmental Monitoring TLD Locations (on site)

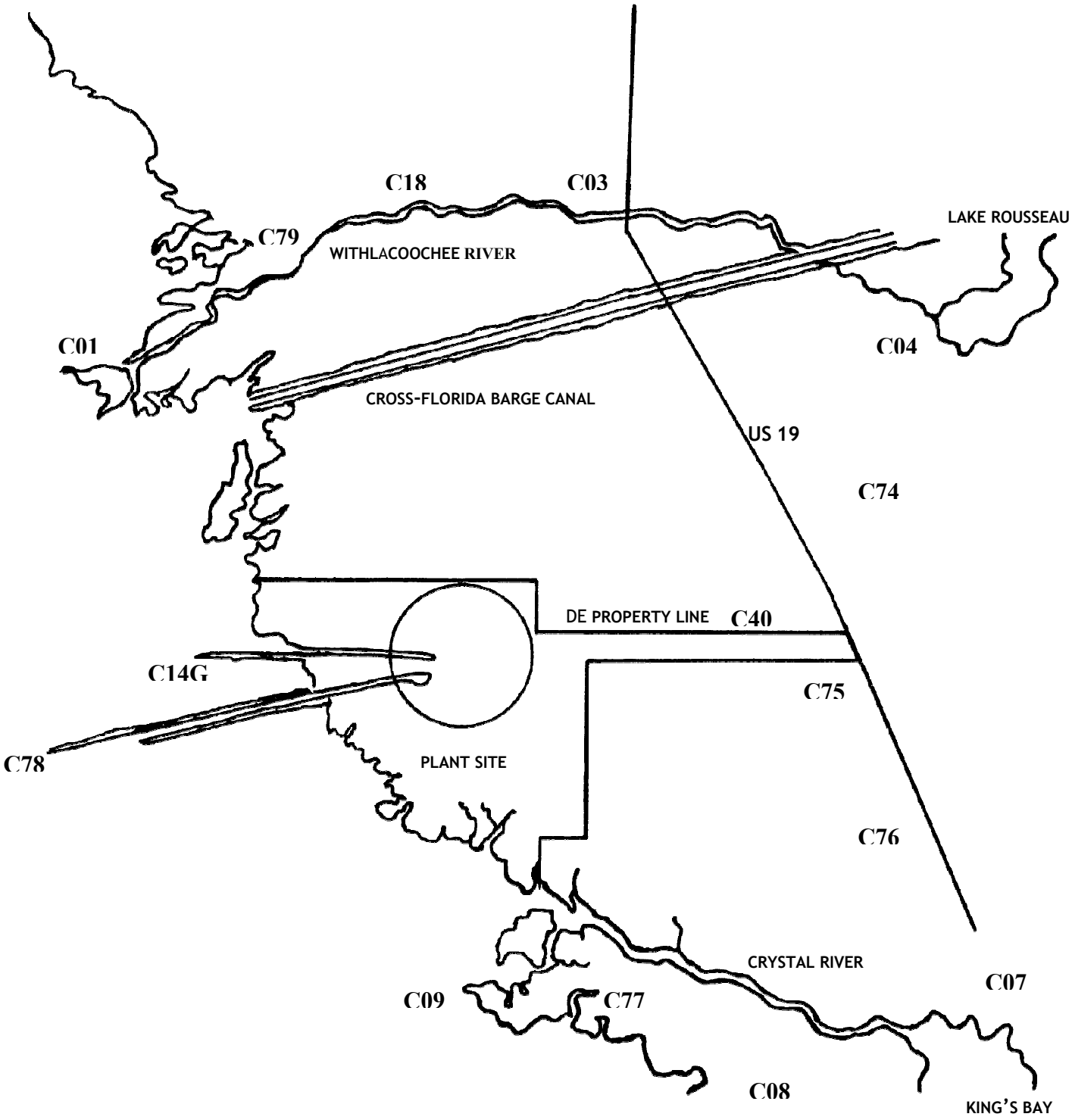
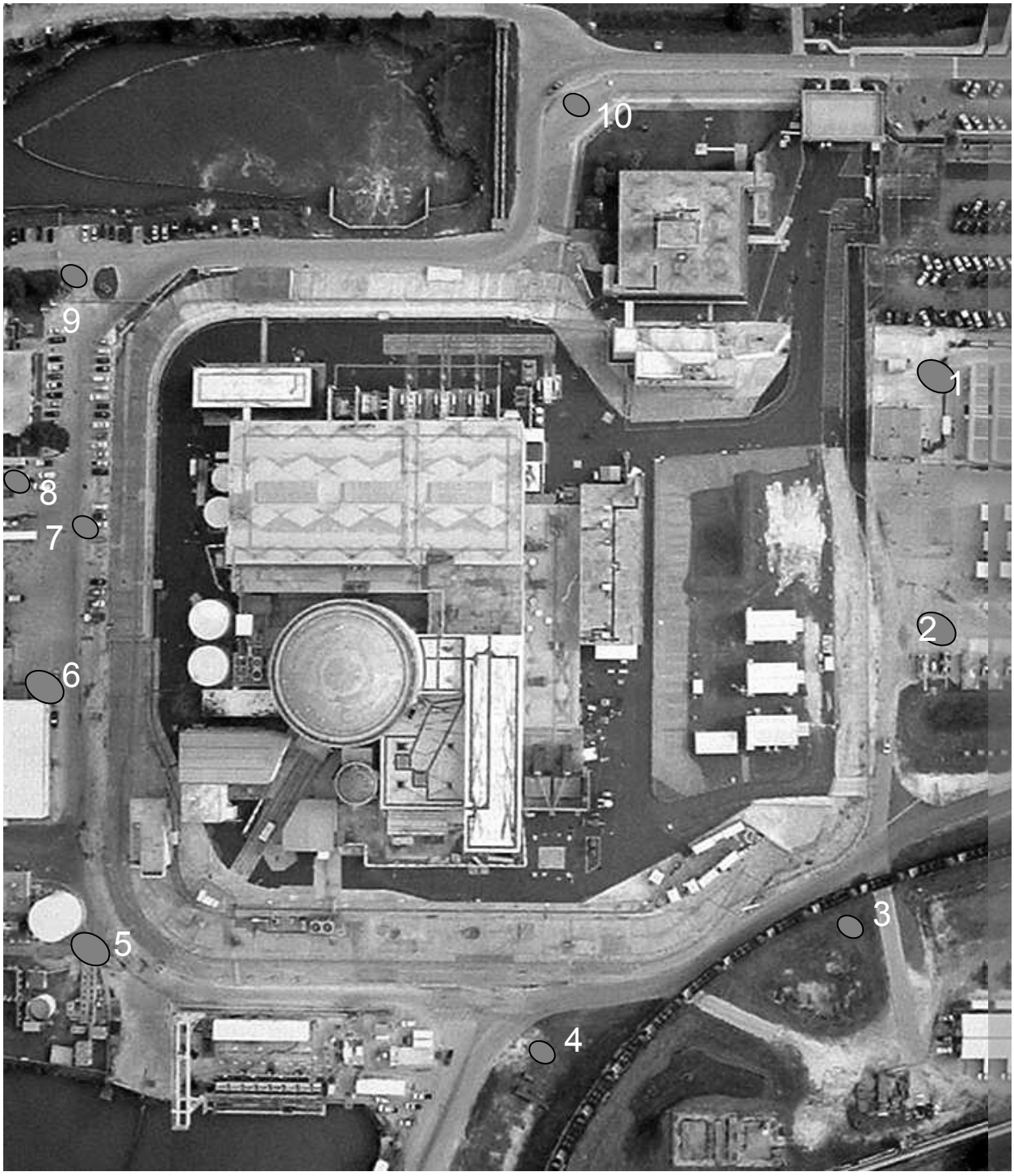


FIGURE I-4: Environmental Monitoring TLD Locations (off site)

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



II. LAND-USE CENSUS

A 2015 land-use census was conducted during June through July. 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. There were no significant changes compared to 2014.

SECTOR	NEAREST RESIDENCE	NEAREST GARDEN (A)	NEAREST MILK ANIMAL
N	4.5 @ 2º	*	*
NNE	4.6 @ 15º	*	*
NE	3.8 @ 54º	*	*
ENE	3.4 @ 57º	*	*
E	2.4 @ 92º	*	*
ESE	4.2 @ 102º	*	*
SE	4.9 @ 133º	*	*
SSE	3.5 @ 149º	*	*
S	*	*	*
SSW	*	*	*
SW	*	*	*
WSW	*	*	*
W	*	*	*
WNW	*	*	*
NW	4.8 @ 321°	*	*
NNW	4.6 @ 339º	*	*

(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). Overall performance in 2015 was acceptable. 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 March 2015:

Media	Nuclide	Result	% Bias	Acceptance Range	Flag
Air	Cs-134	1.089	-5.3	0.81 – 1.50	A
Air	Co-57	1.508	-0.1	1.06 – 1.96	A
Air	Zn-65	0.983	18.4	0.58 – 1.08	A
Soil	Cs-134	624	-8.0	475 – 881	A
Soil	Mn-54	1264	5.5	839 – 1557	A
Soil	Zn-65	1178	10.7	745 – 1383	A
Vegetation	Co-60	5.58	0.6	3.89 – 7.22	A
Vegetation	Cs-137	10.22	11.3	6.43 – 11.93	A
Vegetation	Cs-134	7.252	-0.9	5.12 – 9.52	A
Water	H-3	589	4.6	394 - 732	A
Water	Zn-65	21.5	17.5	12.8 – 23.8	A
Water	Cs-137	21	9.9	13.4 - 24.8	A
Water	Co-57	30.95	3.5	20.9 - 38.9	A
Water	Cs-134	24.6	4.7	16.5 – 30.6	A

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

Results for August 2015:

Media	Nuclide	Result	% Bias	Acceptance Range	Flag
Air	Cs-134	2.5	2.0	1.72 – 3.19	A
Air	Cs-137	2.02	3.1	1.37 – 2.55	A
Air	Mn-54	2.26	7.1	1.48 – 2.74	A
Air	Co-57	2.65	-3.3	1.92 – 3.56	A
Air	Co-60	1.76	2.9	1.20 – 2.22	A
Air	Zn-65	1.45	9.8	0.92 – 1.72	A
Soil	Mn-54	1395	41	938 - 1742	A
Soil	Co-57	1203.33	2.0	826 - 1534	A
Soil	Zn-65	709.5	7.2	463 - 861	A
Soil	Cs-134	994.21	-1.6	707 - 1313	A
Soil	Cs-137	850.00	5.1	566 – 1052	A
Vegetation	Co-57	6.89	4.1	4.63 – 8.61	A
Vegetation	Mn-54	8.376	9.1	5.38 – 9.98	A
Vegetation	Zn-65	5.896	8.0	3.82 – 7.10	A
Vegetation	Cs-134	5.947	2.5	4.06 – 7.54	A
Vegetation	Co-60	4.568	0.2	3.19 – 5.93	A
Water	Co-60	21.7	4.3	14.6 – 27.0	A
Water	Mn-54	17.011	9.0	10.9 – 20.3	A
Water	Cs-134	23.069	-0.1	16.2 – 30.0	A
Water	Zn-65	16.122	16.0	9.7 – 18.1	A
Water	H-3	220.17	1.9	151 - 281	A

IV-A. AIRBORNE PATHWAY

Air samples are taken at five locations in the vicinity of the plant. The control location (station C-47) 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.

In 2015, 312 particulate samples were analyzed for gross beta activity, 311 had measurable activity. The average indicator concentration was 15 pCi/1000 m^3 with a range of 4 to 35 pCi/1000 m^3. The average indicator concentration since 1996 was in the range of 14 to 20 pCi/1000 m^3. The control location concentration for 2015 averaged 13 pCi/1000 m^3, with a range of 4 to 32 pCi/1000 m^3.

In 2015, 312 samples were analyzed for iodine activity, with none having measurable activity. The highest iodine LLD was 0.04 pCi/m^3. There were no anomalies with the iodine samples for the year. Note that given the long shut down time since CR3 has operated (>5 years) there is no longer an iodine source term due to radioactive decay. Iodine air sampling will no longer be required in 2016 due to decay of the short lived iodine beta-gamma emitting radionuclides.

Quarterly composite data are summarized in Table IV-A.4. In 2015, measurable quantities of cesium were not identified in any particulate filter sample. The highest cesium LLD was 1.4 pCi/1000 m^3 for cesium 137.

The 2015 airborne sample data is comparable with previous year's sample data with exception of samples collected in 2011 during the March and April time frame where airborne particulate and iodine samples were affected by the Fukushima earthquake and tsunami event that occurred on March 11, 2011. Those sample data were thoroughly discussed in the 2011 Annual Radiological Environmental Operating Report submitted for Crystal River Unit 3.

There was four instances of air sampler partial run times as follows. Each was identified during weekly sample changes.

1. In August, station C47 (the background station in Orlando) only ran for 153.1 hours out of 192.7 hours due to a failed air sample pump.
2. In October, station C40 ran for only 1.5 hours out of 167.5 hours due to a failed pump.
3. In February, station C41 ran for 71.8 hours out of 168.5 hours due to a failed vacuum pump.
4. In May, station C18 ran for 78.5 hours out of 143.5 hours due to a failed vacuum pump.

The remaining 2 sample stations were in service 100% of the time, with exception of filter changes and air pump/gas meter replacements. The yearly percentages of down times for these 4 stations were each less than 2%.

The air sample station's down times are documented in the plant Corrective Action Program (CAP) under Condition Reports (CRs) 1962047 (C40), 1941935 (C47) and 00697914 (C41).

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, 2015

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)[1]	ALL INDICATOR LOCATIONS MEAN RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING	LOCATION WITH HIGHEST MEAN MEAN RANGE	CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
AIRBORNE IODINE	γ Spec 312						
(pCi/m^3)	I-131	0.04	<LLD	--	<LLD	<LLD	0
AIRBORNE PARTICULATES	Gross ß 312	4.0	15 (258/259) (4–35)	C40 3.6 @ 90°	16 (51/52) (8–31)	13 (52/52) (4–32)	0
(pCi/1000m^3 for Gross ß,	γ Spec 24						
pCi/1000m^3 for γ Spec)	Cs-134	1.3	<LLD	--	--	<LLD	0
	Cs-137	1.4	<LLD	--	--	<LLD	0

[1]The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

TABLE IV-A.2

DUKE ENERGY FLORIDA, LLC- CR3 – 2015

pCi/m^3 IODINE - 131 IN AIR

	SAMPLE SITE					
Collection Date	C07	C18	C40	C41	C46	C47
05-Jan-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
12-JAN-15	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
20-JAN-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
26-JAN-15	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
02-Feb-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
09-Feb-15	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
16-Feb-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
23-Feb-15	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
02-Mar-15	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
09-Mar-15	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
16-Mar-15	<0.03	<0.04	<0.03	<0.03	<0.03	<0.04
23-Mar-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

TABLE IV-A.2 (Cont'd)

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/m^3 IODINE - 131 IN AIR

	SAMPLE SITE					
Collection Date	C07	C18	C40	C41	C46	C47
30-Mar-15	<0.04	<0.03	<0.03	<0.03	<0.03	<0.03
06-Apr-15	<0.04	<0.04	<0.03	<0.03	<0.03	<0.03
13-Apr-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
21-Apr-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
28-Apr-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
05-May-15	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
11-May-15	<0.03	<0.02	<0.03	<0.03	<0.03	<0.03
19-May-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
26-May-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
02-Jun-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
08-Jun-15	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
15-Jun-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.04
23-Jun-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

TABLE IV-A.2 (Cont'd)

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/m^3 IODINE - 131 IN AIR

	SAMPLE SITE					
Collection Date	C07	C18	C40	C41	C46	C47
29-Jun-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
06-Jul-15	<0.03	<0.04	<0.04	<0.03	<0.03	<0.04
13-Jul-15	<0.03	<0.03	<0.04	<0.04	<0.04	<0.03
21-Jul-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
27-Jul-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
04-Aug-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.04
10-Aug-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
18-Aug-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
24-Aug-15	<0.03	<0.04	<0.03	<0.03	<0.03	<0.03
01-Sep-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
08-Sep-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
14-Sep-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
21-Sep-15	<0.03	<0.03	<0.04	<0.04	<0.04	<0.03

TABLE IV-A.2 (Cont'd)

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/m^3 IODINE - 131 IN AIR

	SAMPLE SITE					
Collection Date	C07	C18	C40	C41	C46	C47
28-Sep-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
05-Oct-15	<0.03	<0.03	<1.48*	<0.03	<0.03	<0.04
12-Oct-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
19-Oct-15	<0.03	<0.04	<0.03	<0.04	<0.04	<0.03
26-Oct-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
02-Nov-15	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
09-Nov-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
17-Nov-15	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
23-Nov-15	<0.03	<0.02	<0.02	<0.03	<0.03	<0.02
01-Dec-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
07-Dec-15	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
14-Dec-15	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
21-Dec-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
28-Dec-15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.04

*Station partially out of service due to failed pump. See site CR #1962047.

TABLE IV-A.3

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/1000m^3 GROSS ß IN AIR

	SAMPLE SITE					
Collection Date	C07	C18	C40	C41	C46	C47
05-Jan-15	16	13	10	12	9	11
12-Jan-15	22	29	22	14	24	32
20-Jan-15	13	18	22	15	19	17
26-Jan-15	16	16	20	19	23	17
02-Feb-15	16	13	17	13	13	11
09-Feb-15	12	18	21	23	21	20
16-Feb-15	25	25	24	19	20	26
23-Feb-15	22	20	16	21	17	17
02-Mar-15	14	12	11	14	13	7
09-Mar-15	13	11	8	14	9	9
16-Mar-15	9	11	12	9	9	5
23-Mar-15	23	15	19	17	18	15
Average:	17	17	17	16	16	16

TABLE IV-A.3 (Cont'd)

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/1000m^3 GROSS ß IN AIR

	SAMPLE SITE					
Collection Date	C07	C18	C40	C41	C46	C47
30-Mar-15	10	11	14	14	13	15
06-Apr-15	9	12	11	10	11	7
13-Apr-15	11	14	11	13	21	12
21-Apr-15	7	11	12	10	9	5
28-Apr-15	23	21	24	26	24	20
05-May-15	16	14	20	16	25	8
11-May-15	24	10	25	22	18	18
19-May-15	14	18	23	22	17	11
26-May-15	14	16	12	15	15	18
02-Jun-15	12	13	15	13	11	7
08-Jun-15	9	11	10	9	9	4
15-Jun-15	18	20	21	20	16	14
23-Jun-15	18	22	17	15	18	10
Average	14	15	17	16	16	11

TABLE IV-A.3 (Cont'd)

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/1000m^3 GROSS ß IN AIR

	SAMPLE SITE					
Collection Date	C07	C18	C40	C41	C46	C47
29-Jun-15	10	16	10	11	11	6
06-Jul-15	17	20	17	15	17	23
13-Jul-15	17	20	19	19	16	15
21-Jul-15	14	16	16	16	16	15
27-Jul-15	14	12	14	14	13	11
04-Aug-15	14	14	11	13	14	4
10-Aug-15	20	20	15	22	17	13
18-Aug-15	13	14	13	14	17	13
24-Aug-15	7	9	18	6	13	8
01-Sep-15	10	13	15	12	12	13
08-Sep-15	19	17	23	17	14	16
14-Sep-15	12	11	12	15	12	13
21-Sep-15	11	15	13	9	8	7
28-Sep-15	13	16	16	12	13	8
Average	14	15	15	14	14	12

TABLE IV-A.3 (Cont'd)

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/1000m^3 GROSS ß IN AIR

	SAMPLE SITE					
Collection Date	C07	C18	C40	C41	C46	C47
05-Oct-15	6	8	*	6	7	4
12-Oct-15	10	9	11	11	9	9
19-Oct-15	30	35	31	30	26	19
26-Oct-15	16	16	13	14	14	13
02-Nov-15	20	22	19	19	17	5
09-Nov-15	8	11	12	10	10	8
17-Nov-15	19	21	21	17	20	15
23-Nov-15	14	13	17	18	15	12
01-Dec-15	16	16	12	12	9	17
07-Dec-15	15	23	19	20	19	14
14-Dec-15	21	27	26	20	23	21
21-Dec-15	13	13	16	13	18	9
28-Dec-15	8	5	11	6	4	7
Average	15	17	17	15	15	12

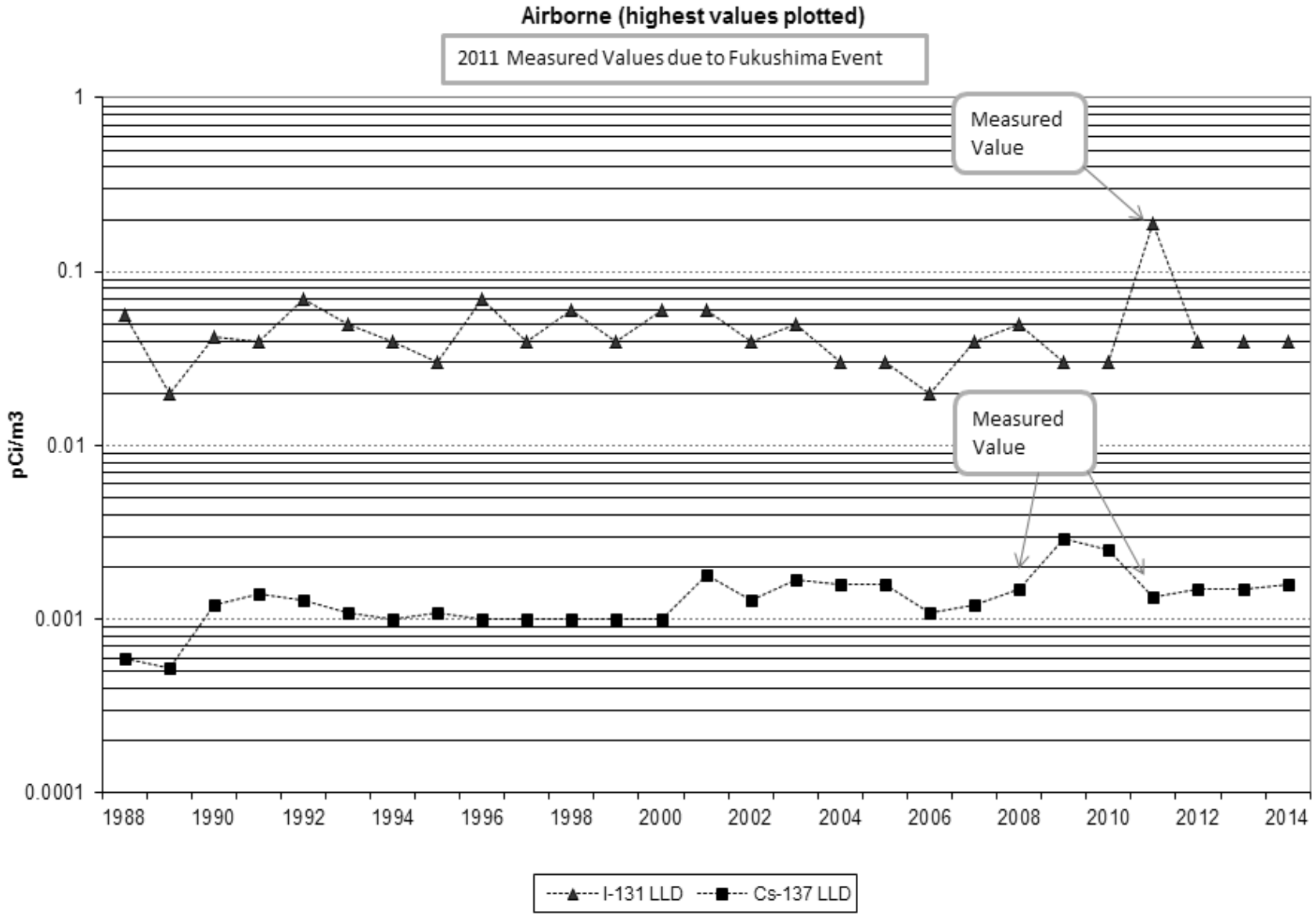
* Pump out of service and the sample was not taken. See CR #1962047.

TABLE IV-A.4

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/1000m^3 γ EMITTERS IN QUARTERLY COMPOSITES OF AIR PARTICULATES

STATION	NUCLIDE	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
C07	Be-7	98	126	106	150
	K-40	<20	<25	<28	<26
	Cs-134	<1.3	<1.1	<1.0	<1.2
	Cs-137	<1.1	<1.1	<1.3	<1.2
C18	Be-7	114	129	102	138
	K-40	<16	<16	<11	<23
	Cs-134	<1.0	<1.1	<1.0	<1.0
	Cs-137	<0.9	<1.1	<1.1	<1.1
C40	Be-7	113	120	113	123
	K-40	<15	<15	<17	<17
	Cs-134	<1.1	<1.2	<1.2	<1.2
	Cs-137	<1.2	<0.9	<1.1	<1.2
C41	Be-7	89	144	108	145
	K-40	<15	<23	<29	<27
	Cs-134	<1.2	<0.9	<1.2	<1.1
	Cs-137	<1.2	<1.3	<1.4	<1.0
C46	Be-7	118	141	115	125
	K-40	<16	<22	<19	<24
	Cs-134	<1.1	<1.2	<1.0	<1.0
	Cs-137	<1.0	<1.1	<1.0	<0.9
C47	Be-7	123	117	82	115
	K-40	<14	<14	<14	<19
	Cs-134	<0.9	<1.0	<1.1	<1.1
	Cs-137	<0.9	<1.0	<0.9	<1.2


Airborne (highest values plotted)
2011 Measured Values due to Fukushima Event
Measured Value
Measured Value
pCi/m3
1
0.1
0.01
0.001
0.0001
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
I-131 LLD
Cs-137 LLD

IV-B. DIRECT RADIATION

Direct radiation measurements (using TLDs) were taken at thirty-three locations surrounding the plant, including one control location 78 miles from the site. One-hundred and thirty-two TLDs were collected during 2015.

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 annual average on-site dose was 50 mrem 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 average on-site dose was 39 mrem at station C65 (ESE at 1743 feet southeast of the coal rail loop).

The highest annual average off-site dose was 38 mrem at station C40 (east at 3.5 miles). The control station (C47) average annual dose was 31 mrem. The average for all stations (except control) was 32 mrem for 2015, 35 mrem for 2014, and 37 mrem for 2013. Direct radiation results in 2015 are similar to previous year's; however, there is a slight decreasing trend of the average dose for all stations combined (except control) as seen by the trend chart at the end of this section. The state TLD lab has performed a comprehensive investigation to look for the cause. Preliminary results indicate that the TLD's may be experiencing age related degradation. The current TLD inventory used at CR3 is around 20 years old. As a corrective action, the state lab will replace the CR3 TLD inventory with new TLD's in 2016.

This TLD decreasing trend has been documented in the CR3 corrective action program under condition report 684849.

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, 2015**

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)	ALL INDICATOR LOCATIONS MEAN RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING	MEAN RANGE	CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
DIRECT RADIATION (mrem/yr)	γ DOSE, 132	15	32 (128/128) (20 - 57)	C71 0.6 @ 296°	50 (4/4) (41 - 57)	31 (4/4) (26 - 34)	0

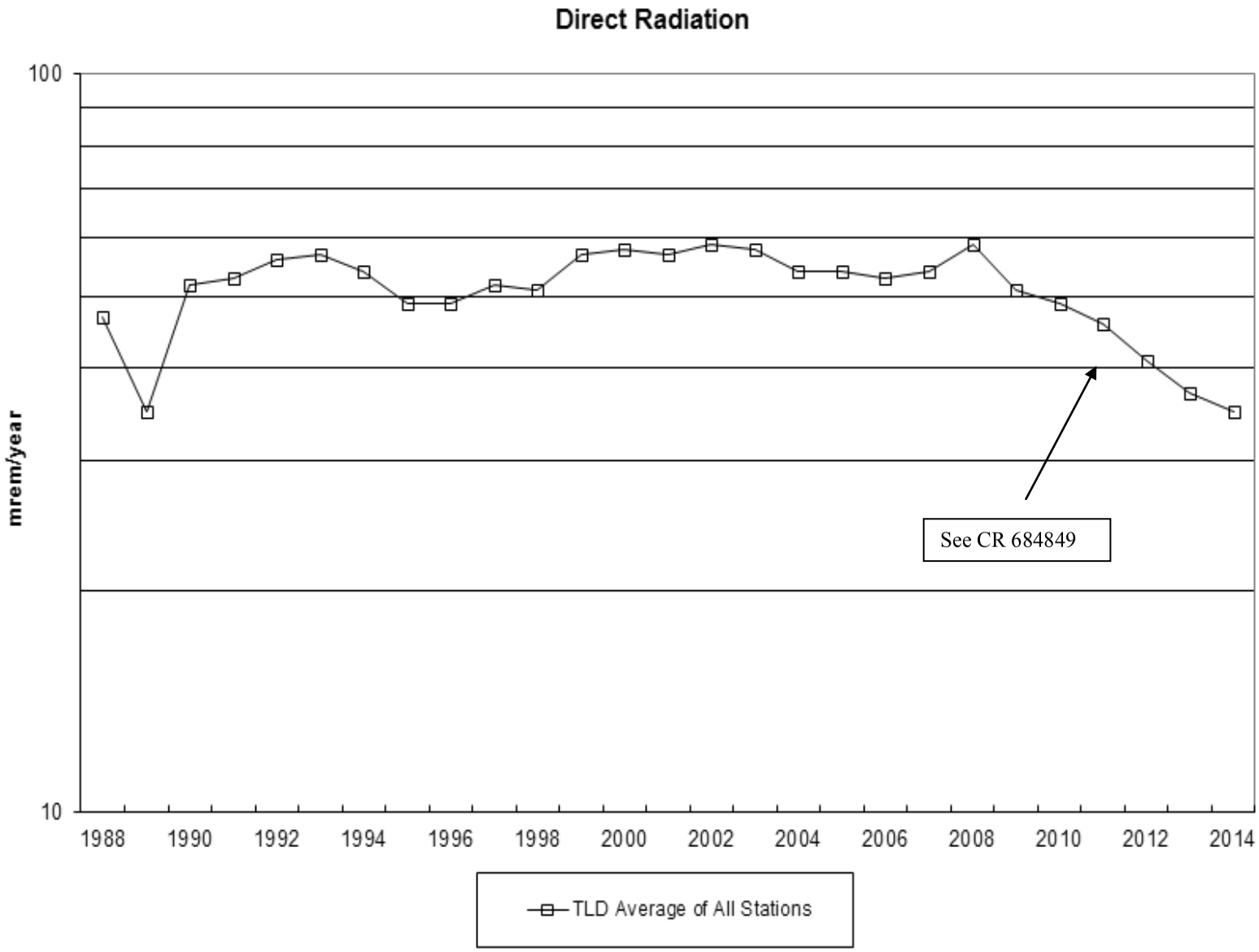
TABLE IV-B.1

DUKE ENERGY FLORIDA, LLC- CR-3 - 2015

Annual gamma (γ) Dose (mrem)

TLD STATION	Quarter	1	2	3	4
CO1		31	21	26	24
CO3		31	27	27	26
CO4		31	26	26	25
CO7*		30	20	25	25
CO8		31	25	26	26
C09		31	26	27	25
C14G		32	31	31	30
C18		30	22	29	27
C27		41	36	37	36
C40*		38	41	39	35
C41		37	28	34	31
C46*		35	32	33	31
C47 (CONTROL)		34	26	33	31
C60		33	32	33	29
C61		35	36	37	33
C62		37	37	40	33
C63		38	35	37	31
C64		36	32	33	31
C65		41	39	39	36
C66		37	34	34	32
C67		41	37	39	34
C68		40	28	36	33
C69		38	36	39	33
C70		38	36	38	32
C71		57	41	53	47
C72		40	34	37	33
C73		33	26	33	29
C74		27	24	26	24
C75		38	26	33	29
C76		32	29	31	25
C77		33	30	31	28
C78		28	25	27	24
C79		33	23	30	25

*TLDs not required by the ODCM.


Direct Radiation
100
10
mrem/year
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
See CR 684849
TLD Average of All Stations

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. In 2015, of twenty-four indicator samples, one had measurable tritium. This sample was taken at location C14H at the head of the discharge canal while an approved plant liquid effluent release was in progress. Tritium was measured at a concentration of 694 pCi/L. No other samples showed tritium above MDA levels. 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 the SAFSTOR organization configuration at the time of sampling with reduced dilution due to no circulating water pumps running. Plant raw water pumps were providing the dilution flow. In 2015 there were no control station samples with measurable tritium concentrations (location C13).

   In 2014, six of twenty four indicator samples contained measurable tritium with an average concentration of 107 pCi/L. The 2014 control station samples had no samples with measurable tritium concentrations.

   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.
   In 2015, 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 thirteen locations surrounding the perimeter of the CR-3 protected area. (Note: Monthly samples were taken at several locations but were stopped after February and all locations are now sampled on a quarterly frequency.) Periodically 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 in 1998. This discharge line has recently been leak tested and it is leak free. There are no other know leaking plant components.

4. In 2015, only three wells continue to show tritium concentrations above MDA, the other well which showed measureable tritium in 2014 now shows less then detectable amounts. Well #5 had the highest tritium concentrations which ranged from 184 to 299 pCi/L based on five samples.

   Along with these wells, two other wells that are not presently part of the REMP program have been sampled. They are on either side (north and south) of the plant settling ponds (percolation ponds) and are referred to as MWC-27 and MWC-IF2. Both of these wells did not show tritium concentrations above MDA levels in 2015. This is a decrease from 2014 when these two wells showed measurable amounts of tritium in the range of 87 to 144 pCi/L. The detectable tritium in these two wells from 2014 was a result of plant discharges from the SDT-1. These discharges are being minimized through operational focus and due fewer liquid releases as a result of plant shutdown.

There has been no measurable amounts of gamma emitting radionuclides in any of these wells. There have also 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. In 2012 another groundwater flow study was performed to evaluate groundwater flow post installation of CR Units 4 & 5 clean air scrubber system. This scrubber system utilizes significant groundwater from the Florida aquifer. The flow study confirmed that the groundwater flow, and direction of flow, has not been altered due to the installation and operation of the clean air scrubber system.

Additionally, the groundwater at the CR3 site is too saline for use as a potable water source, hence there is no drinking water uptake pathway at the Crystal River site.

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

Table IV-C.3.a.1 provides the results of the quarterly samples and additional monthly samples when taken.

5. Monthly non-REMP required well samples were collected as discussed in item #3 above. Two wells were sampled. These two wells are located on the north side and the south side of the site percolation ponds. The information is discussed above. Both of these wells showed no measurable amounts of any other radionuclides of interest. The tritium concentration in these wells, discussed in item #3 above, have decreased significantly due to a focused reduction in the number of discharges from the station drain tank (SDT-1) to the site settling ponds (percolation ponds) and are now less than the minimum detectable.

   Table IV-C.4 provides a statistical summary of the groundwater tritium and gamma spectroscopy results.

   Table IV-C.4.a. provides the results of the monthly supplemental non-REMP required samples.

6. 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.

   In 2015, 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.

   Since the beginning of sampling, the drinking water samples have not had any other positive-measured radionuclides of interest detected.

   Table IV-C.5 provides a statistical summary of the drinking water tritium and gamma spectroscopy results.

   Table IV-C.5.a provides the results of the quarterly samples.

7. 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.

   In 2015, of the six indicator samples, three had measurable amounts of cesium-137 with an average concentration of 24 pCi/kg and a range of 17 to 39 pCi/kg. There were three shoreline sediment samples with measurable amounts of cobalt-60 with a concentration range of 35 to 109 pCi/kg.

   In 2014, of the six indicator samples, four had measurable amounts of cesium-137 with an average concentration of 23 pCi/kg and a range of 11 to 57 pCi/kg. There were five shoreline sediment samples with measurable amounts of cobalt-60 with a concentration range of 7 to 47 pCi/kg.

In 2013 two samples had measurable amounts of cesium-137 with an average of 8.5 pCi/kg and a range of 8 to 9 pCi/kg. There were no samples with measurable amounts of cobalt-60 in any of the shoreline sediment samples.

In 2012 three samples had measurable amounts of cesium-137 with an average of 28 pCi/kg and a range of 19 to 35 pCi/kg. Also there were three samples with measurable amounts of cobalt-60 with a concentration range of 14 to 24 pCi/kg.

In 2011 the average cesium-137 concentration at the indicator locations was 28 pCi/kg.

In 2010, the average cesium-137 concentration at the indicator locations was 19 pCi/kg.

The average cobalt-60 concentration at the indicator locations ranged from 24 to 389 pCi/kg from 1998 through 2008.

The 2015 shoreline sediment results are similar to previous years' results with exception of there being a slight decrease in the number of samples with measurable Cs-137 and Co-60 in the sediment samples. The decrease in the number of samples containing Cs-137 and Co-60 may be related to fewer liquid plant releases during 2015. 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.6 provides a statistical summary of the shoreline sediment gamma spectroscopy results.

Table IV-C.6.a provides the results of the semi-annual samples.

8. Additional samples taken in 2015 but not required by the ODCM: Site Settling Ponds

   Annual sediment samples were collected at four locations in the site settling ponds. There were no measurable amounts of Cs-137, Cs-134 or Co-60 in any of the samples.

   Annual surface water samples were collected at two locations in the site settling ponds. The tritium concentration was < LLD in both samples. All of the pond surface water samples showed no measurable amounts of any other radionuclides of interest.

   Table IV-C.7 provides the results of the settling pond samples.

9. There were no unmonitored spills or releases of radioactive material in 2015 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.

   State and local governmental officials have been updated regarding the status of the groundwater monitoring program at the Crystal River site per the requirements of the NEI 07-07 Guidelines.

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, 2015**

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)[1]	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)	Tritium, 36	172	694(1/24) (172-694)	C14H 0.1 @ 0º	694 (1/12) (694-694)	<LLD	0
	γ Spec, 36						
	Mn-54	4	<LLD	--	--	<LLD	0
	Fe-59	7	<LLD	--	--	<LLD	0
	Co-58	3	<LLD	--	--	<LLD	0
	Co-60	4	<LLD	--	--	<LLD	0
	Zn-65	8	<LLD	--	--	<LLD	0
	Zr-Nb-95	6	<LLD	--	--	<LLD	0
	I-131	6	<LLD	--	--	<LLD	0
	Cs-134	3	<LLD	--	--	<LLD	0
	Cs-137	4	<LLD	--	--	<LLD	0
	Ba-La-140	7	<LLD	--	--	<LLD	0

[1]The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

TABLE IV-C.1.a
DUKE ENERGY FLORIDA, LLC- CR3 - 2015
pCi/L γ 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	<151	262±29	<4	<5	<8	<7	<11	<9	<8	<5	<5	<8
	FEB	<172	201±26	<4	<4	<9	<6	<12	<7	<7	<5	<5	<8
	MAR	<151	197±19	<3	<3	<6	<4	<6	<6	<3	<3	<3	<6
	APR	<153	192±12	<2	<2	<4	<2	<4	<3	<2	<2	<2	<5
	MAY	<138	208±14	<2	<2	<4	<3	<4	<4	<3	<2	<3	<5
	JUN	<144	277±16	<2	<2	<4	<3	<5	<4	<2	<2	<2	<6
	JUL	<145	236±21	<3	<3	<7	<3	<7	<6	<4	<2	<3	<5
	AUG	<150	164±17	<3	<3	<6	<3	<7	<6	<4	<3	<4	<7
	SEP	<140	237±21	<3	<3	<6	<3	<8	<5	<3	<3	<3	<6
	OCT	<144	284±31	<5	<4	<9	<5	<10	<8	<7	<4	<5	<7
	NOV	<149	241±22	<3	<3	<5	<3	<7	<5	<5	<3	<4	<4
	DEC	<152	348±26	<4	<4	<6	<4	<7	<6	<4	<4	<3	<10
C14G	JAN	<151	219±26	<5	<5	<11	<6	<11	<8	<9	<5	<6	<7
	FEB	<172	199±25	<5	<5	<10	<6	<10	<8	<6	<4	<6	<9
	MAR	<151	170±18	<3	<3	<6	<4	<7	<5	<3	<3	<3	<6
	APR	<153	112±15	<3	<3	<5	<3	<6	<5	<3	<3	<3	<8
	MAY	<145	195±19	<3	<3	<6	<3	<6	<5	<5	<3	<3	<5
	JUN	<144	241±13	<2	<2	<3	<3	<4	<3	<2	<2	<1	<4
	JUL	<145	256±21	<4	<3	<5	<3	<7	<5	<4	<3	<3	<5
	AUG	<150	208±16	<2	<3	<5	<3	<6	<4	<3	<2	<3	<5
	SEP	<140	221±20	<3	<3	<7	<3	<7	<5	<3	<3	<4	<10
	OCT	<146	206±20	<3	<3	<6	<3	<8	<6	<6	<3	<3	<3
	NOV	<149	285±24	<4	<3	<8	<4	<8	<6	<5	<3	<4	<6
	DEC	<148	277±21	<3	<3	<6	<3	<6	<6	<4	<3	<4	<10

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

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/L γ 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	<151	175±18	<3	<3	<6	<3	<7	<6	<5	<3	<3	<5
	FEB	<150	215±27	<5	<5	<9	<6	<10	<9	<6	<5	<5	<9
	MAR	<151	203±16	<3	<2	<5	<4	<6	<4	<3	<2	<3	<5
	APR	<153	165±11	<2	<2	<4	<3	<5	<4	<3	<2	<3	<5
	MAY	<145	261±26	<2	<2	<4	<2	<4	<3	<2	<2	<2	<5
	JUN	<144	288±21	<3	<3	<6	<3	<6	<5	<3	<3	<3	<7
	JUL	<145	238±30	<4	<5	<9	<5	<8	<9	<4	<4	<5	<9
	AUG	<150	78±12	<3	<3	<6	<3	<7	<6	<4	<3	<3	<6
	SEP	<140	136±16	<3	<3	<6	<3	<7	<4	<4	<3	<4	<12
	OCT	694	208±23	<4	<3	<7	<4	<8	<6	<6	<3	<4	<7
	NOV	<155	182±19	<3	<3	<6	<3	<7	<5	<5	<3	<3	<5
	DEC	<152	247±15	<2	<2	<4	<2	<4	<3	<2	<2	<2	<6

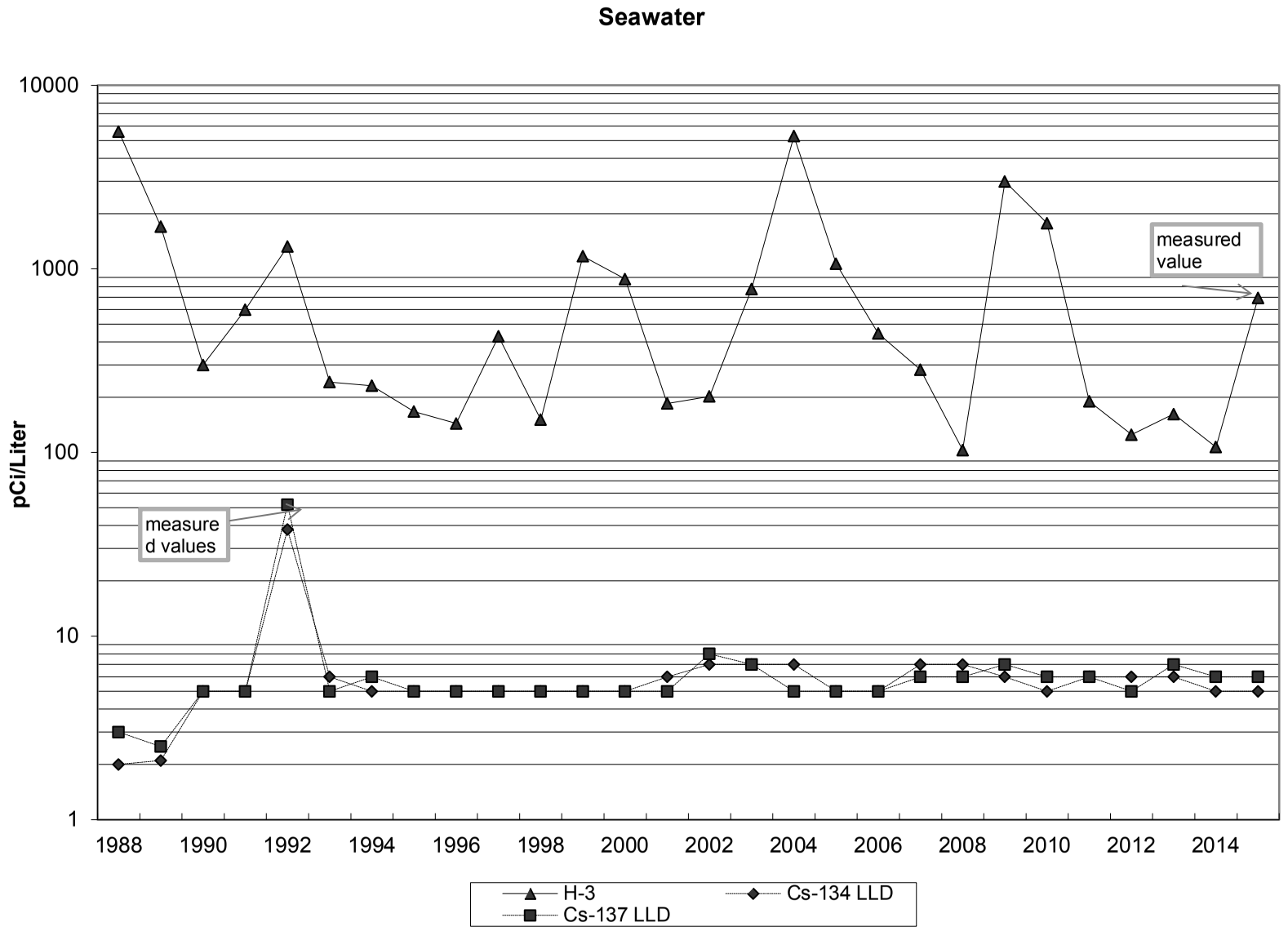

Seawater
10000
1000
100
10
1
pCi/Liter
measured value
measure d values
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
H-3
Cs-134 LLD
Cs-137 LLD

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, 2015**

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)[1]	ALL INDICATOR LOCATIONS MEAN RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING	MEAN RANGE	CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROUND WATER[2] (pCi/L)	Tritium, 2	147	<LLD	--	--	<LLD	0
	γ Spec, 2						
	Mn-54	4	<LLD	--	--	<LLD	0
	Fe-59	8	<LLD	--	--	<LLD	0
	Co-58	4	<LLD	--	--	<LLD	0
	Co-60	4	<LLD	--	--	<LLD	0
	Zn-65	11	<LLD	--	--	<LLD	0
	Zr-Nb-95	7	<LLD	--	--	<LLD	0
	I-131	5	<LLD	--	--	<LLD	0
	Cs-134	4	<LLD	--	--	<LLD	0
	Cs-137	4	<LLD	--	--	<LLD	0
	Ba-La-140	13	<LLD	--	--	<LLD	0

[1]The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.
[2]There is no drinking water uptake pathway at the Crystal River site.

TABLE IV-C.2.a

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/L γ EMITTERS AND TRITIUM IN GROUND WATER

STATION	NUCLIDE	FIRST HALF	SECOND HALF
C40	H-3	<150	<147
	Mn-54	<4	<4
	Fe-59	<7	<8
	Co-58	<4	<4
	Co-60	<4	<4
	Zn-65	<9	<11
	Zr-Nb-95	<6	<7
	I-131	<5	<5
	Cs-134	<4	<4
	Cs-137	<4	<4
	Ba-La-140	<9	<13
	K-40	<43	<48

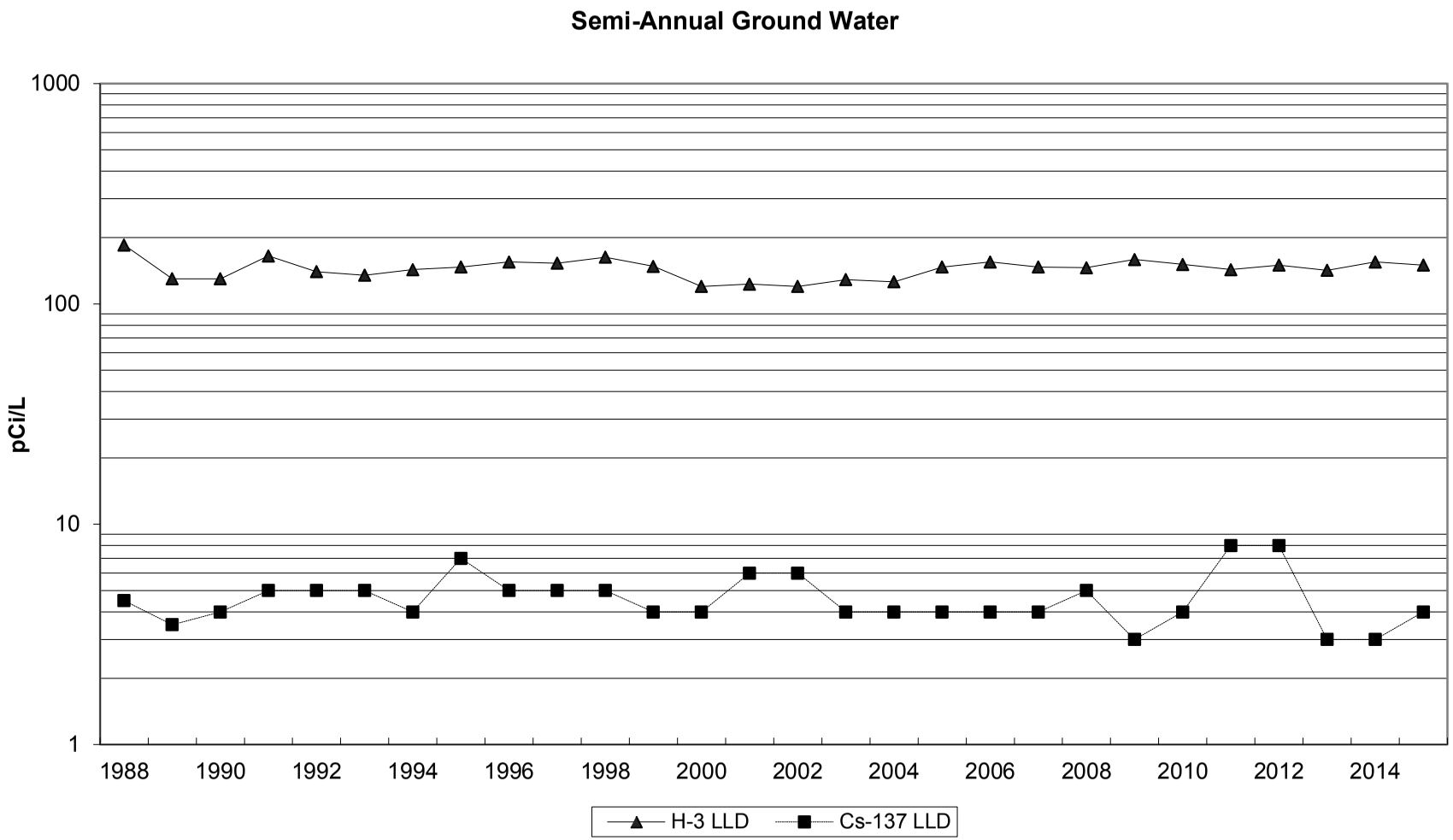

Semi-Annual Ground Water
1000
100
10
1
pCi/L
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
H-3 LLD
Cs-137 LLD

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, 2015**

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL (NUMBER)[2] OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)[1]	ALL INDICATOR LOCATIONS MEAN RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING	LOCATION WITH HIGHEST MEAN MEAN RANGE	CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
CR3 SITE GROUND WATER (pCi/L)	Tritium 63	153	265 (5/63) (184-298)	CR3-5 0.051 mi.@225°	265(5/5) (184-298)	CR3-2 145(0/4) (LLD)	0
	γ Spec 63						
	Mn-54	6	<LLD	--	--	<LLD	0
	Fe-59	13	<LLD	--	--	<LLD	0
	Co-58	6	<LLD	--	--	<LLD	0
	Co-60	7	<LLD	--	--	<LLD	0
	Zn-65	14	<LLD	--	--	<LLD	0
	Zr-Nb-95	14	<LLD	--	--	<LLD	0
	I-131	10	<LLD	--	--	<LLD	0
	Cs-134	5	<LLD	--	--	<LLD	0
	Cs-137	7	<LLD	--	--	<LLD	0
	Ba-La-140	14	<LLD	--	--	<LLD	0

[1]The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.
[2]Includes extra samples collected for data trending.

TABLE IV-C.3.a.1

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/L γ 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
CR3-1D	01-22	<153	<47	<3	<3	<6	<4	<7	<6	<5	<3	<3	<6
	04-16	<163	<80	<4	<6	<10	<7	<11	<10	<10	<5	<6	<9
	07-16	<145	<59	<5	<5	<10	<5	<10	<9	<9	<4	<5	<7
	10-14	<140	<53	<4	<3	<8	<4	<8	<6	<6	<3	<4	<6
CR3-1S	01-22	<153	<63	<6	<5	<9	<7	<11	<9	<8	<5	<6	<7
	04-16	<149	<31	<3	<3	<6	<3	<6	<6	<5	<3	<3	<5
	07-16	<145	<35	<3	<3	<7	<3	<6	<5	<5	<3	<3	<5
	10-14	<142	<41	<3	<3	<7	<4	<7	<5	<4	<3	<4	<7
CR3-2	01-22	<153	<65	<6	<5	<10	<6	<11	<10	<9	<5	<6	<10
	04-16	<149	<75	<5	<5	<7	<6	<10	<8	<8	<5	<6	<9
	07-16	<145	<33	<4	<3	<7	<3	<8	<5	<6	<3	<4	<5
	10-14	<146	<42	<3	<3	<7	<3	<8	<5	<4	<4	<3	<10

TABLE IV-C.3.a.1

DUKE ENERGY FLORIDA, LLC- CR3 – 2015

pCi/L γ 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
CR3-3D	01-22	<148	<48	<3	<3	<7	<3	<6	<6	<5	<3	<4	<5
	04-16	<163	<23	<4	<3	<6	<3	<7	<6	<6	<3	<4	<5
	07-16	<145	<53	<4	<5	<9	<5	<10	<8	<8	<4	<5	<7
	10-14	<140	<30	<4	<4	<8	<5	<11	<7	<5	<5	<5	<14
CR3-3S	01-22	<148	<43	<3	<3	<6	<3	<6	<5	<4	<3	<3	<6
	04-16	<149	<42	<3	<3	<5	<3	<6	<4	<5	<3	<3	<4
	07-16	<145	<42	<3	<3	<7	<4	<7	<6	<6	<3	<4	<6
	10-14	<149	<40	<4	<4	<6	<3	<7	<5	<4	<4	<4	<12
CR3-4	01-22	<148	<45	<3	<3	<6	<3	<7	<6	<6	<3	<4	<6
	04-16	<160	<64	<5	<5	<11	<7	<10	<10	<9	<5	<6	<8
	07-16	<145	<55	<5	<5	<9	<5	<10	<9	<8	<4	<5	<7
	10-14	<154	<53	<4	<4	<7	<4	<9	<6	<5	<4	<4	<9

TABLE IV-C.3.a.1

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/L γ 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
CR3-5	01-08	299	<56	<5	<5	<11	<7	<12	<9	<9	<6	<7	<8
	02-03	184	<52	<3	<3	<6	<3	<7	<6	<4	<3	<3	<8
	04-16	260	<15	<2	<2	<4	<2	<4	<3	<3	<2	<2	<3
	07-16	298	<58	<5	<4	<8	<4	<10	<8	<5	<4	<5	<10
	10-14	285	<31	<3	<3	<6	<3	<7	<5	<5	<3	<3	<4
CR3-6S	01-08	<151	<77	<5	<5	<10	<7	<13	<9	<9	<5	<6	<6
	02-03	<150	<36	<3	<4	<7	<3	<7	<6	<4	<3	<4	<13
	04-16	<149	<41	<4	<3	<6	<3	<7	<6	<5	<3	<3	<4
	07-16	<141	<37	<3	<3	<5	<3	<6	<5	<3	<2	<3	<8
	10-14	<142	<100	<5	<6	<13	<7	<13	<10	<10	<5	<6	<9
CR3-6D	01-22	<153	<65	<5	<5	<9	<6	<9	<9	<9	<5	<6	<7
	04-16	<163	<28	<3	<3	<7	<3	<7	<6	<5	<3	<3	<5
	07-16	<145	<26	<3	<3	<5	<3	<6	<5	<3	<3	<3	<8
	10-14	<149	<32	<3	<3	<6	<4	<6	<6	<6	<3	<4	<5

TABLE IV-C.3.a.1 (cont'd)

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/L γ EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER

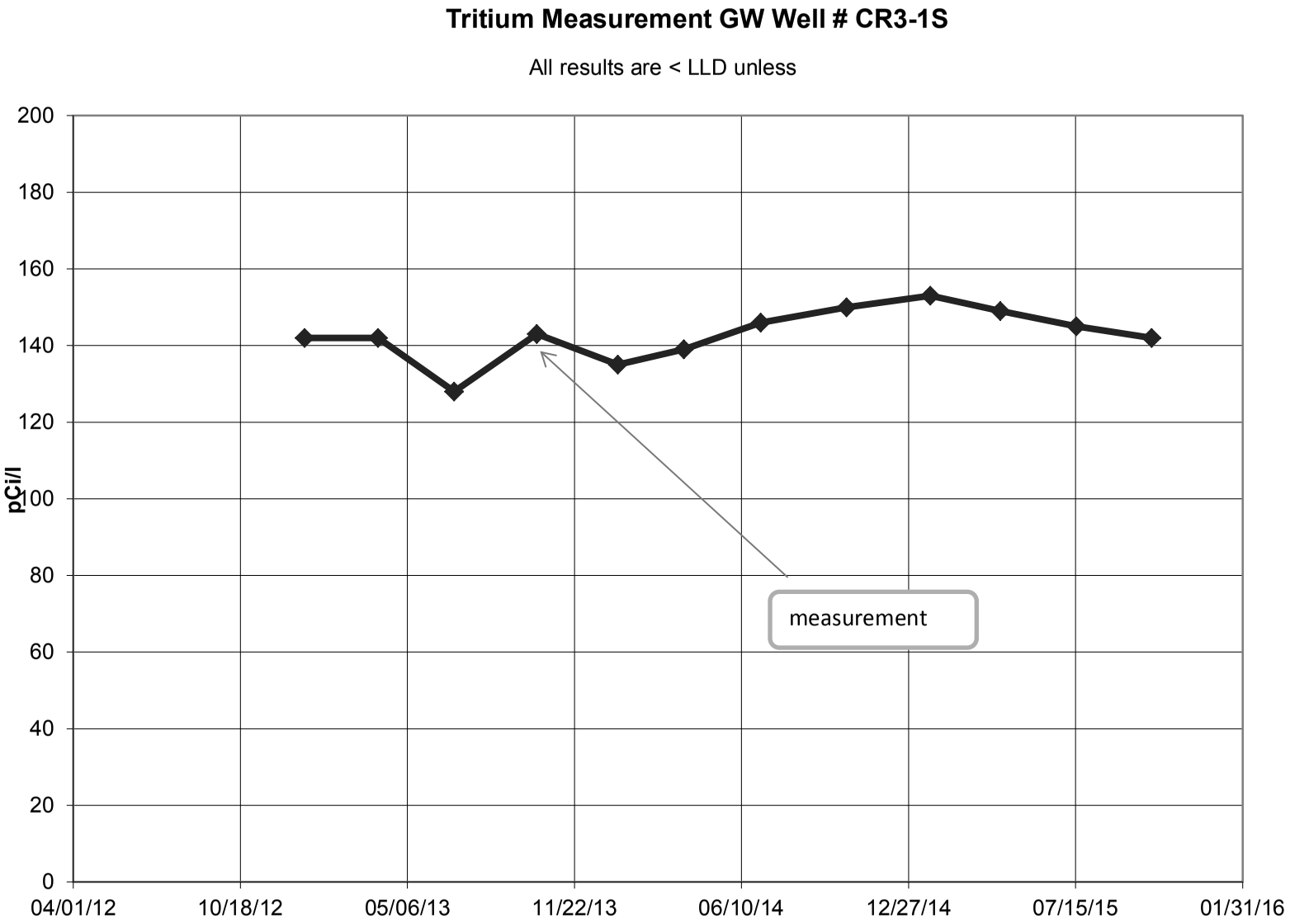
STATION	DATE	H-3	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Zn-Nb-95	I-131	Cs-134	Cs-137	Ba-La-140
CR3-7	01-08	<155	<77	<4	<5	<10	<6	<10	<10	<10	<4	<6	<8
	02-03	<153	<38	<3	<3	<6	<3	<6	<5	<4	<3	<4	<12
	04-16	<163	<73	<5	<5	<9	<7	<11	<10	<8	<5	<6	<7
	07-16	<142	<45	<3	<3	<7	<4	<7	<6	<4	<3	<4	<8
	10-14	<142	<47	<4	<3	<6	<3	<8	<5	<4	<3	<4	<7
CR3-8	01-08	<151	<42	<3	<3	<7	<3	<8	<5	<7	<3	<3	<6
	02-03	<172	<45	<3	<3	<7	<4	<7	<6	<4	<3	<4	<8
	04-16	<163	<57	<5	<5	<11	<7	<14	<10	<9	<5	<7	<8
	07-16	<141	<57	<5	<5	<9	<5	<11	<9	<6	<5	<5	<12
	10-14	<140	<40	<3	<3	<7	<3	<7	<5	<6	<3	<4	<6
CR3-9	01-08	<151	<50	<3	<3	<6	<3	<7	<5	<5	<3	<4	<4
	02-03	<150	<48	<4	<4	<7	<4	<8	<7	<4	<3	<4	<12
	04-16	<150	<36	<3	<3	<6	<4	<7	<6	<5	<3	<3	<4
	07-16	<142	<30	<3	<3	<8	<3	<8	<6	<5	<3	<4	<7
	10-14	<142	<46	<3	<3	<6	<4	<9	<6	<5	<3	<4	<7

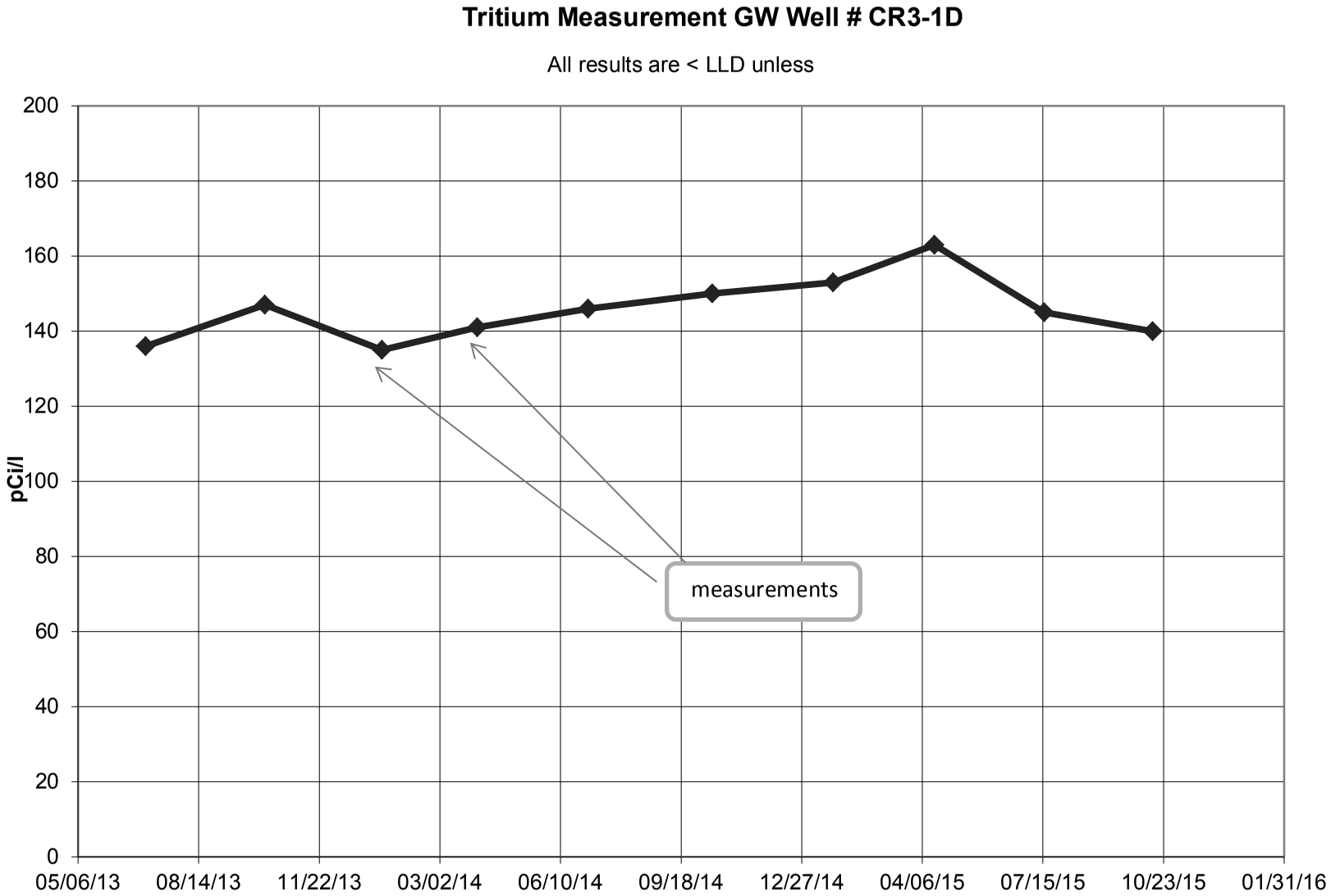
TABLE IV-C.3.a.1 (cont'd)

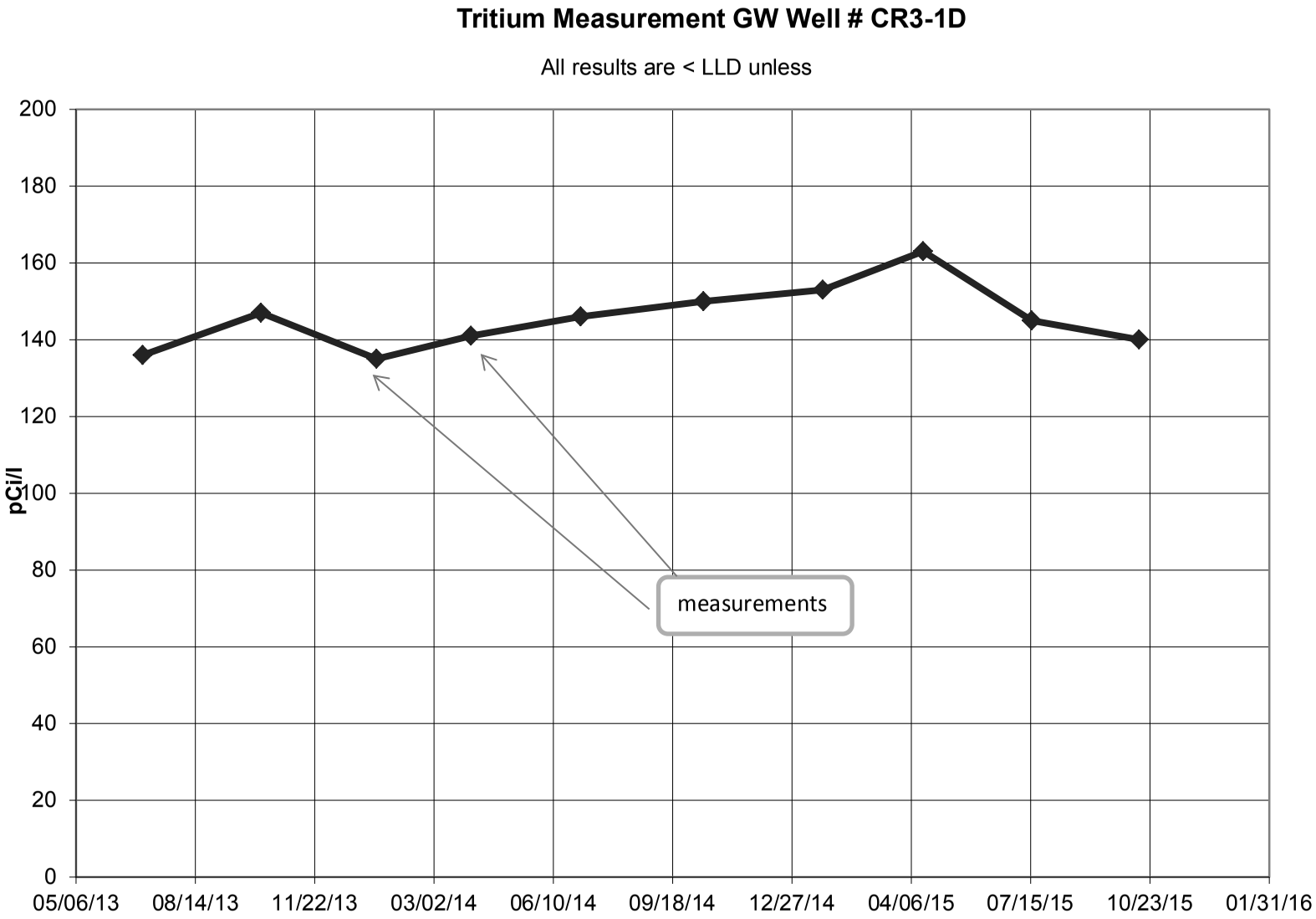
DUKE ENERGY FLORIDA, LLC- CR3 - 2015

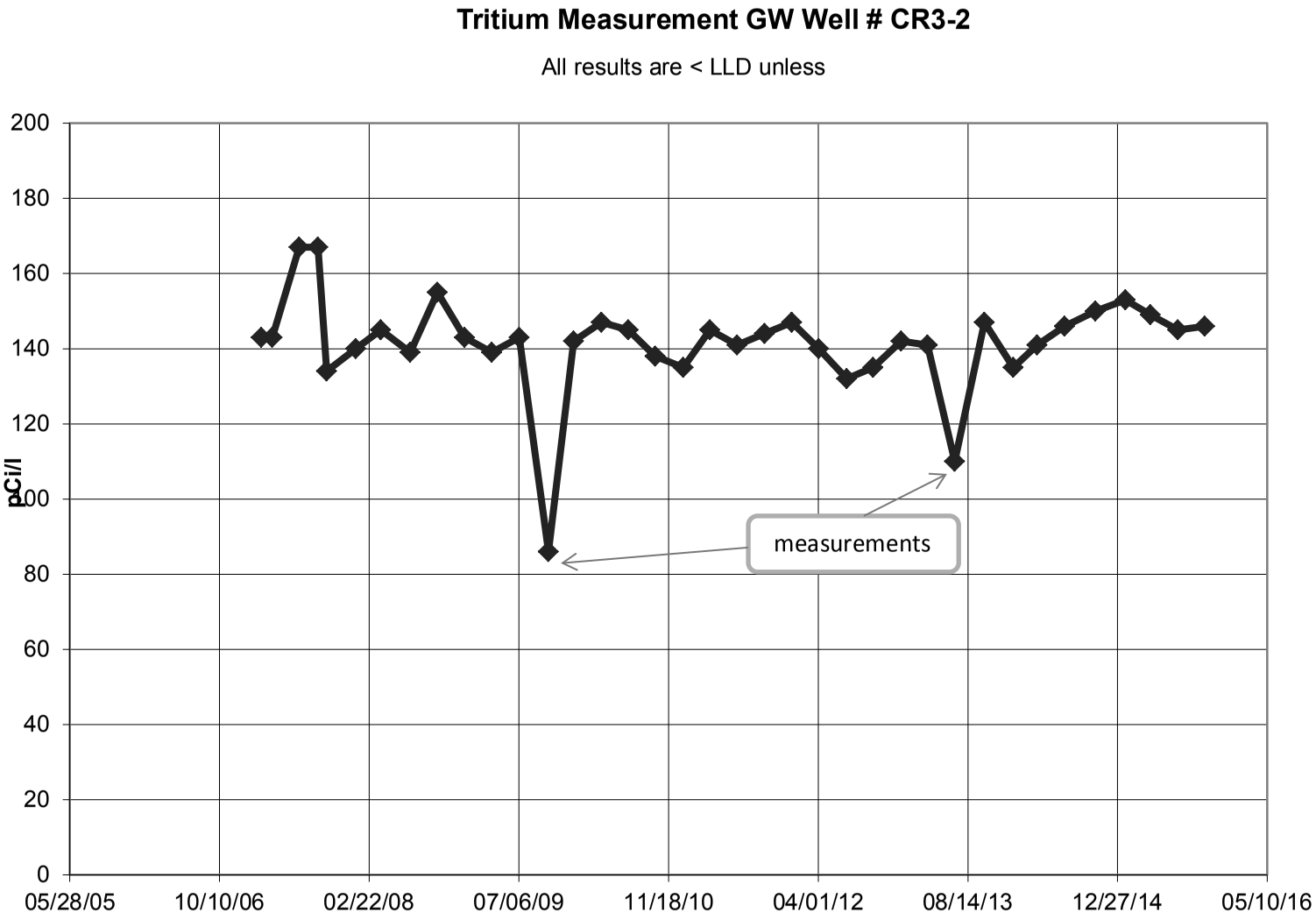
pCi/L γ EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER

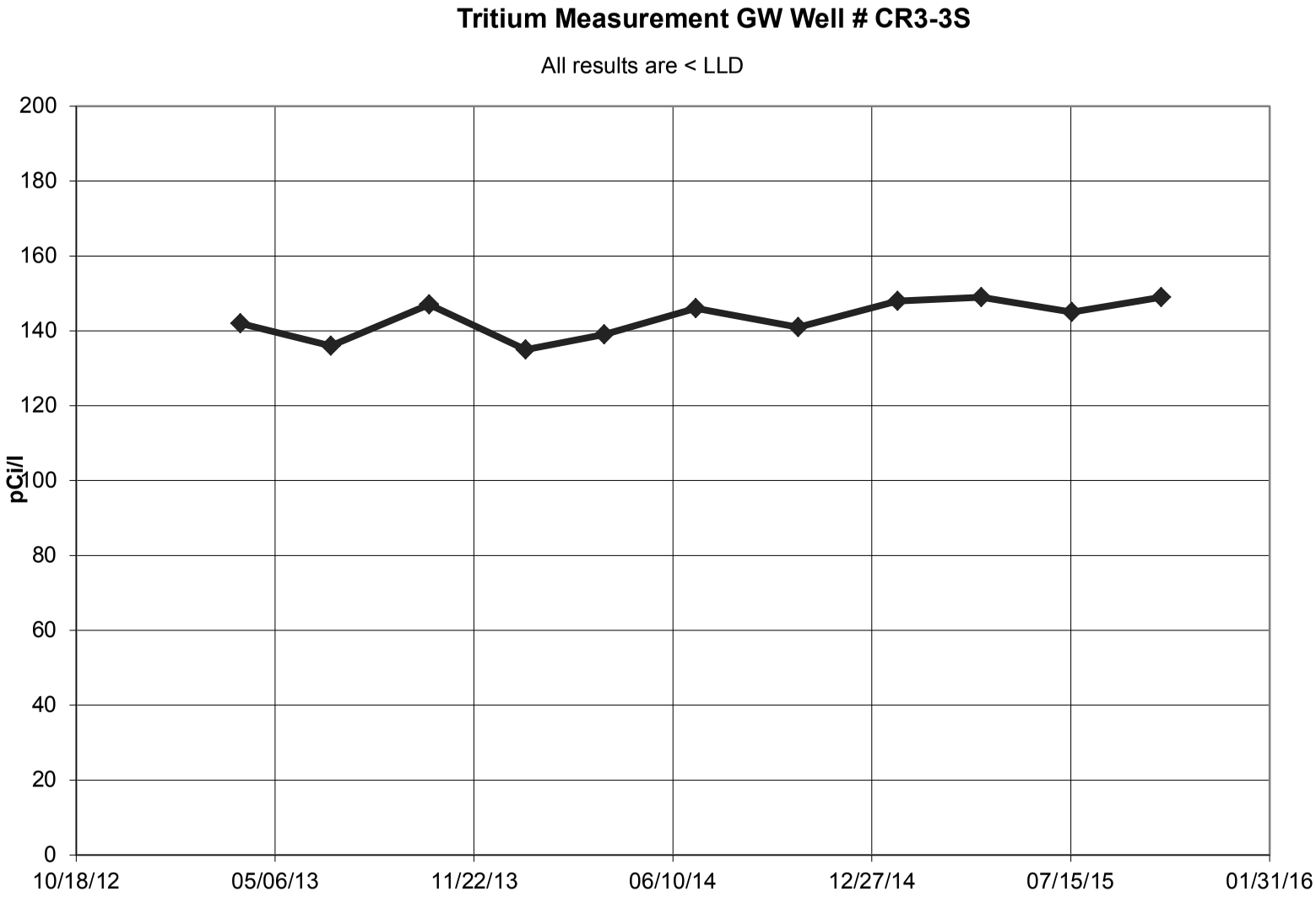
STATION	DATE	H-3	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Zn-Nb-95	I-131	Cs-134	Cs-137	Ba-La-140
CR3-10	01-22	<153	<66	<5	<5	<9	<7	<11	<10	<8	<5	<6	<7
	04-16	<149	<56	<5	<6	<10	<6	<11	<9	<9	<5	<5	<9
	07-16	<142	<40	<4	<3	<8	<4	<9	<6	<5	<4	<4	<8
	10-14	<149	<48	<3	<4	<6	<3	<7	<5	<6	<3	<3	<5


Tritium Measurement GW Well # CR3-1S
All results are < LLD unless
200
180
160
140
120
100
80
60
40
20
0
pCi/l
04/01/12
10/18/12
05/06/13
11/22/13
06/10/14
12/27/14
07/15/15
01/31/16
measurement


Tritium Measurement GW Well # CR3-1D
All results are < LLD unless
pCi/l
200
180
160
140
120
100
80
60
40
20
0
05/06/13
08/14/13
11/22/13
03/02/14
06/10/14
09/18/14
12/27/14
04/06/15
07/15/15
10/23/15
01/31/16
measurements

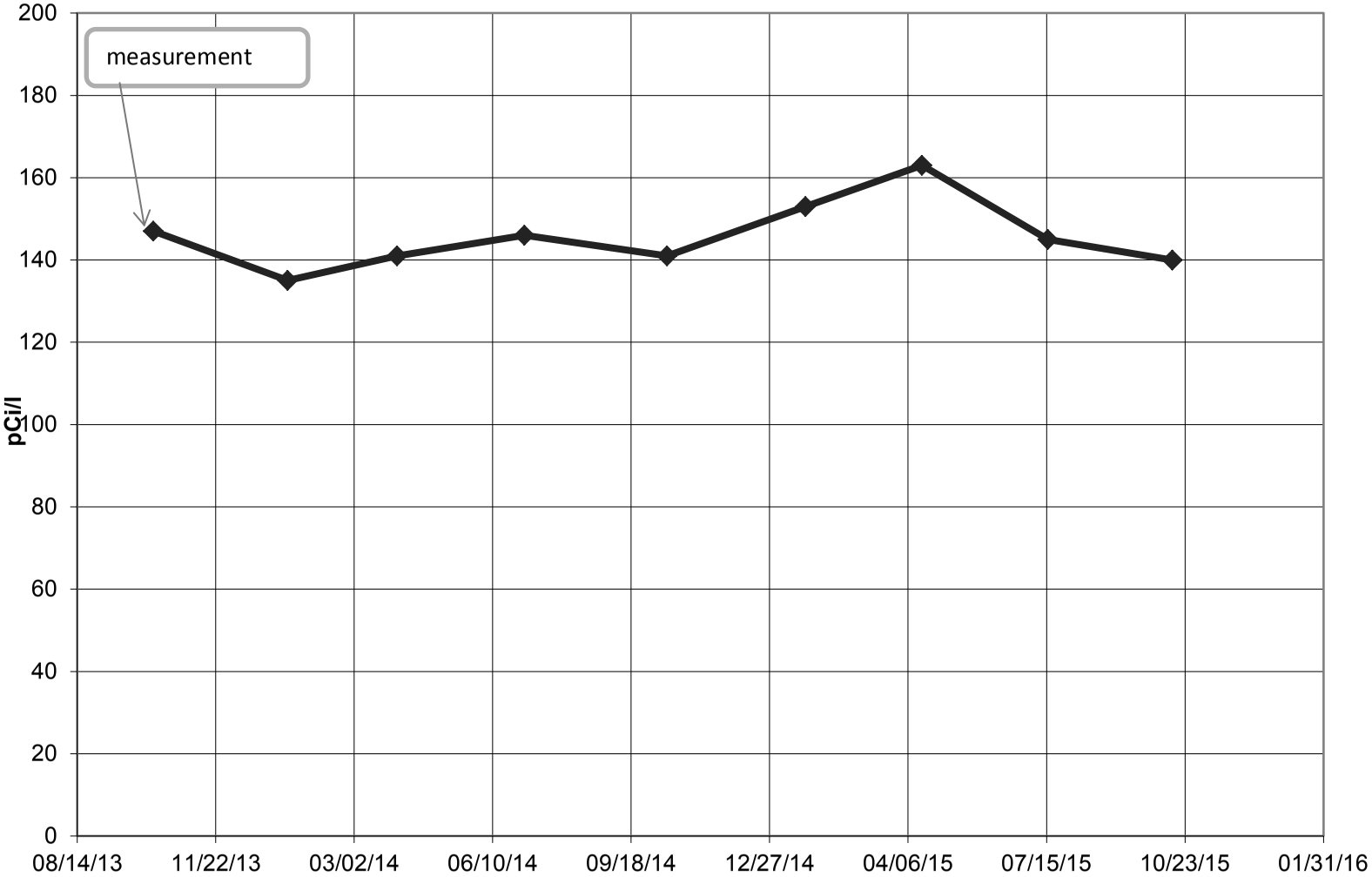

Tritium Measurement GW Well # CR3-1D
All results are < LLD unless
pCi/l
200
180
160
140
120
100
80
60
40
20
0
05/06/13
08/14/13
11/22/13
03/02/14
06/10/14
09/18/14
12/27/14
04/06/15
07/15/15
10/23/15
01/31/16
measurements

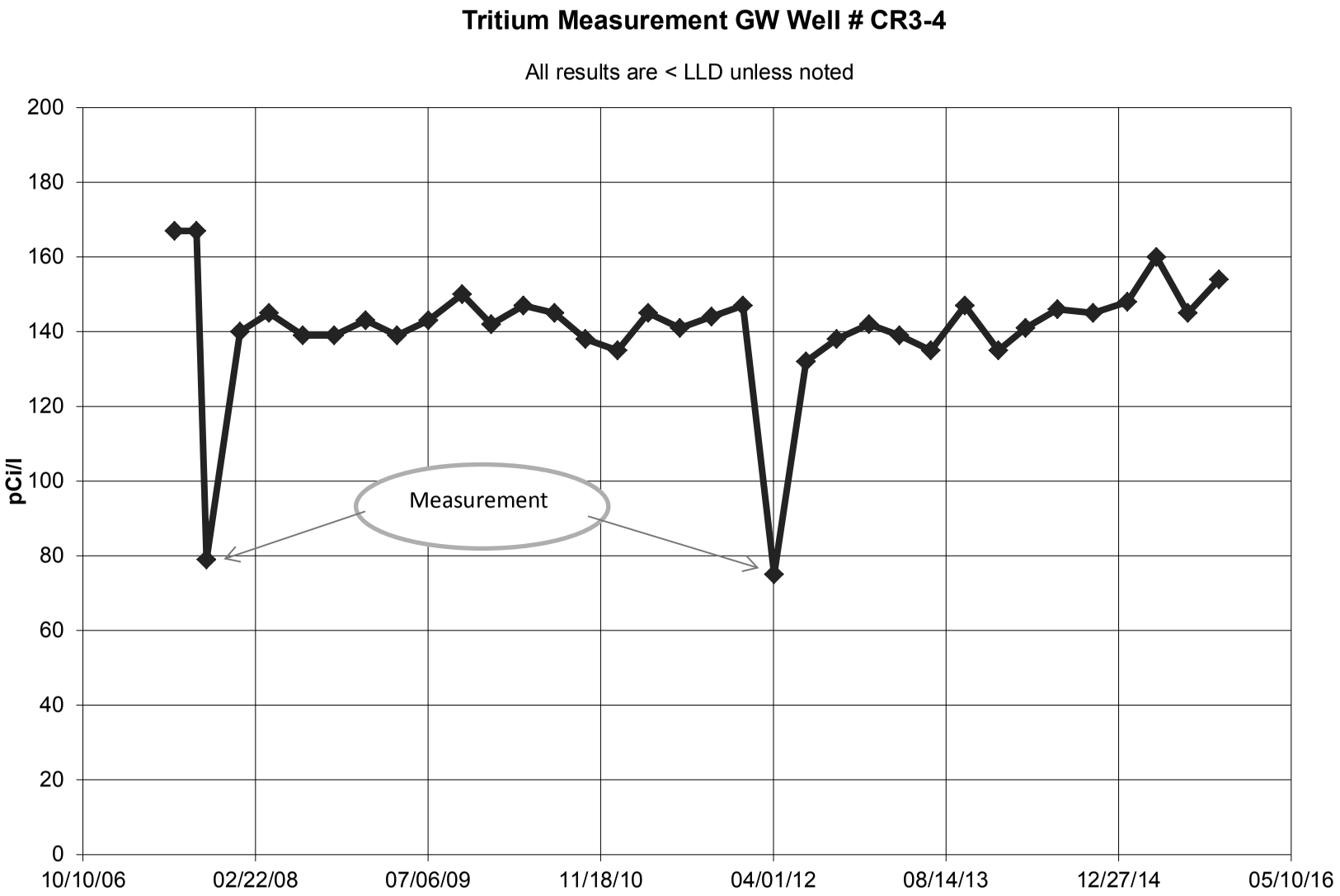

Tritium Measurement GW Well # CR3-2
All results are < LLD unless
pCi/l
200
180
160
140
120
100
80
60
40
20
0
05/28/05
10/10/06
02/22/08
07/06/09
11/18/10
04/01/12
08/14/13
12/27/14
05/10/16
measurements

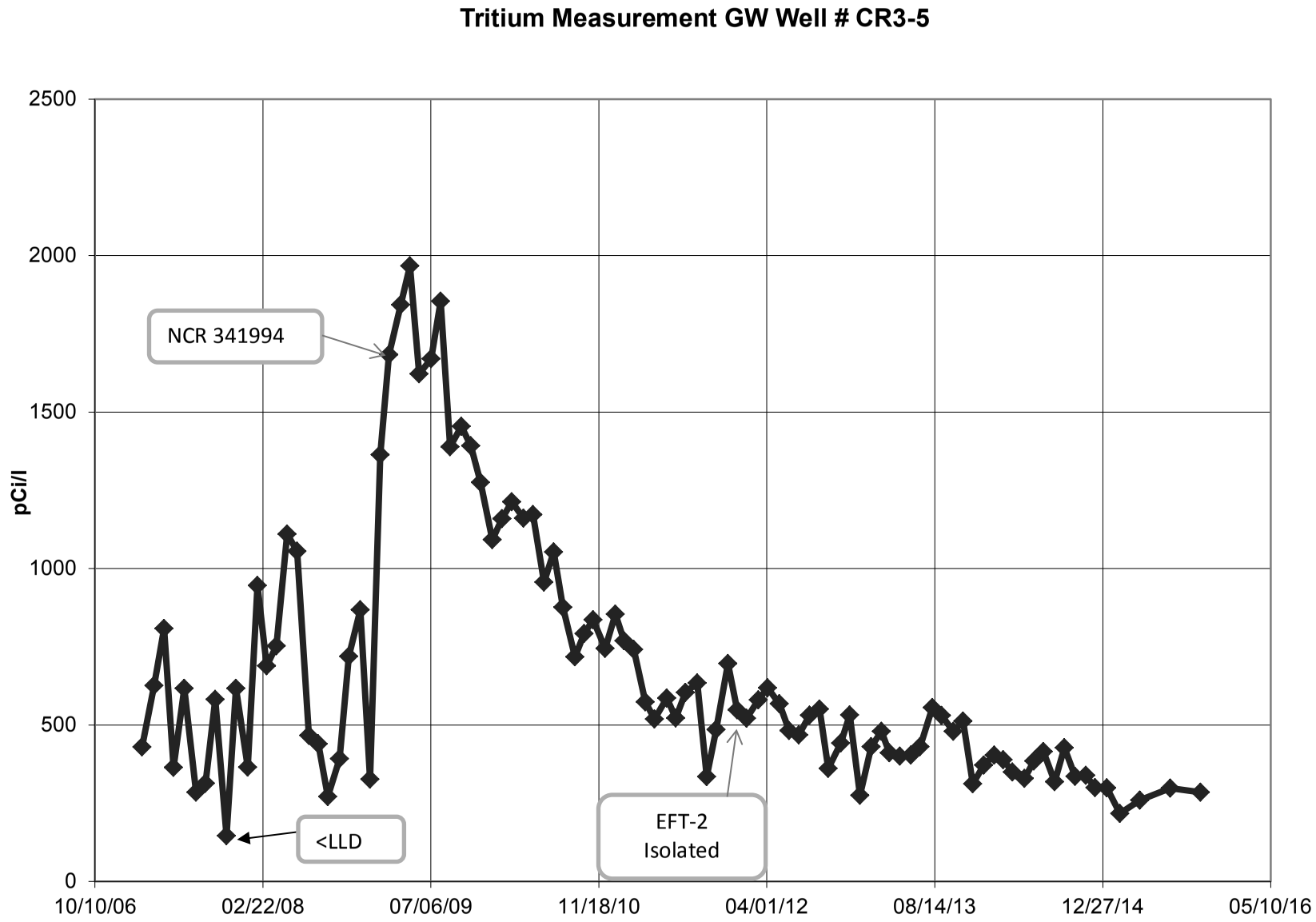

Tritium Measurement GW Well # CR3-3S
All results are < LLD
pCi/l
200
180
160
140
120
100
80
60
40
20
0
10/18/12
05/06/13
11/22/13
06/10/14
12/27/14
07/15/15
01/31/16

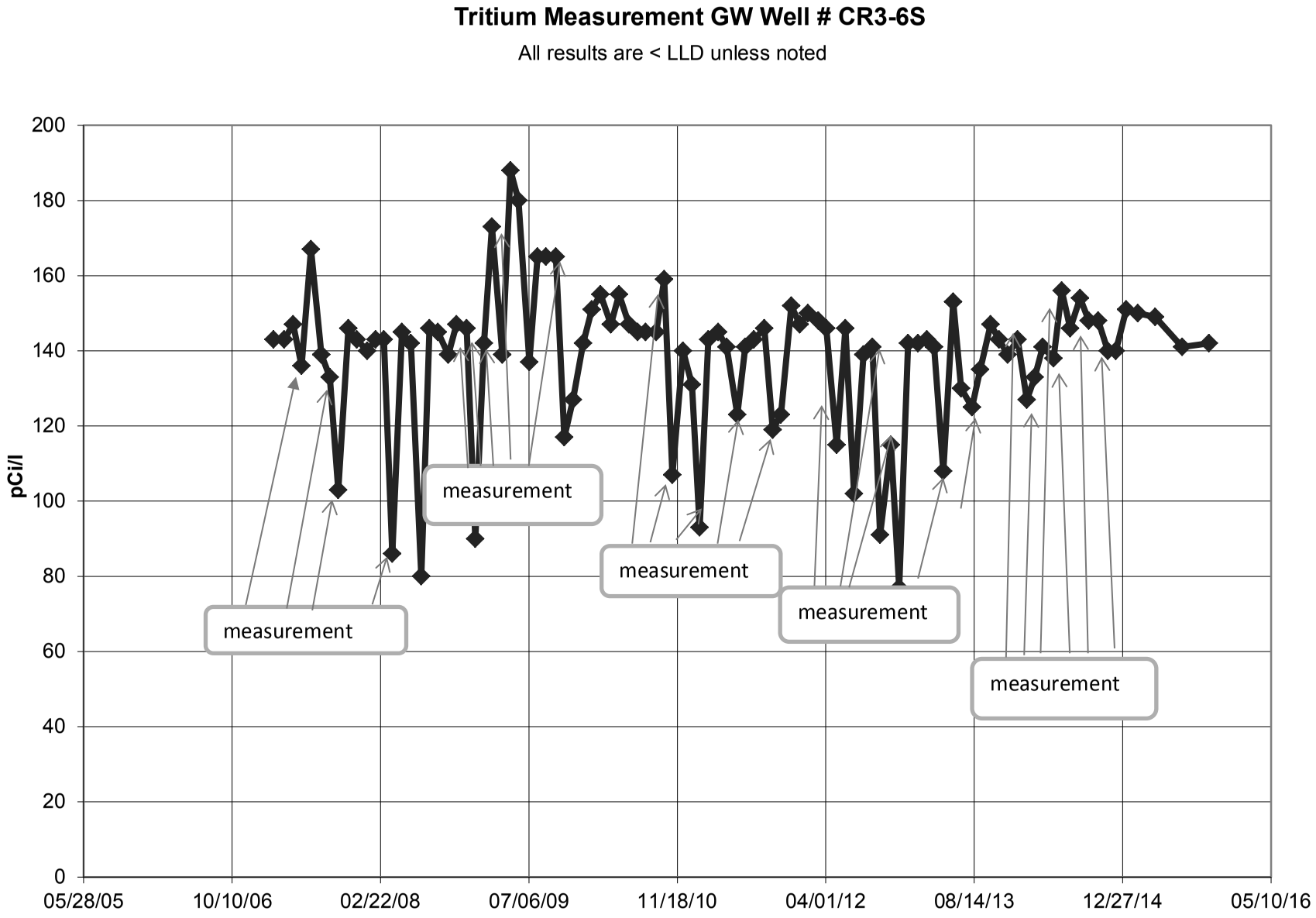
Tritium Measurement GW Well # CR3-3D

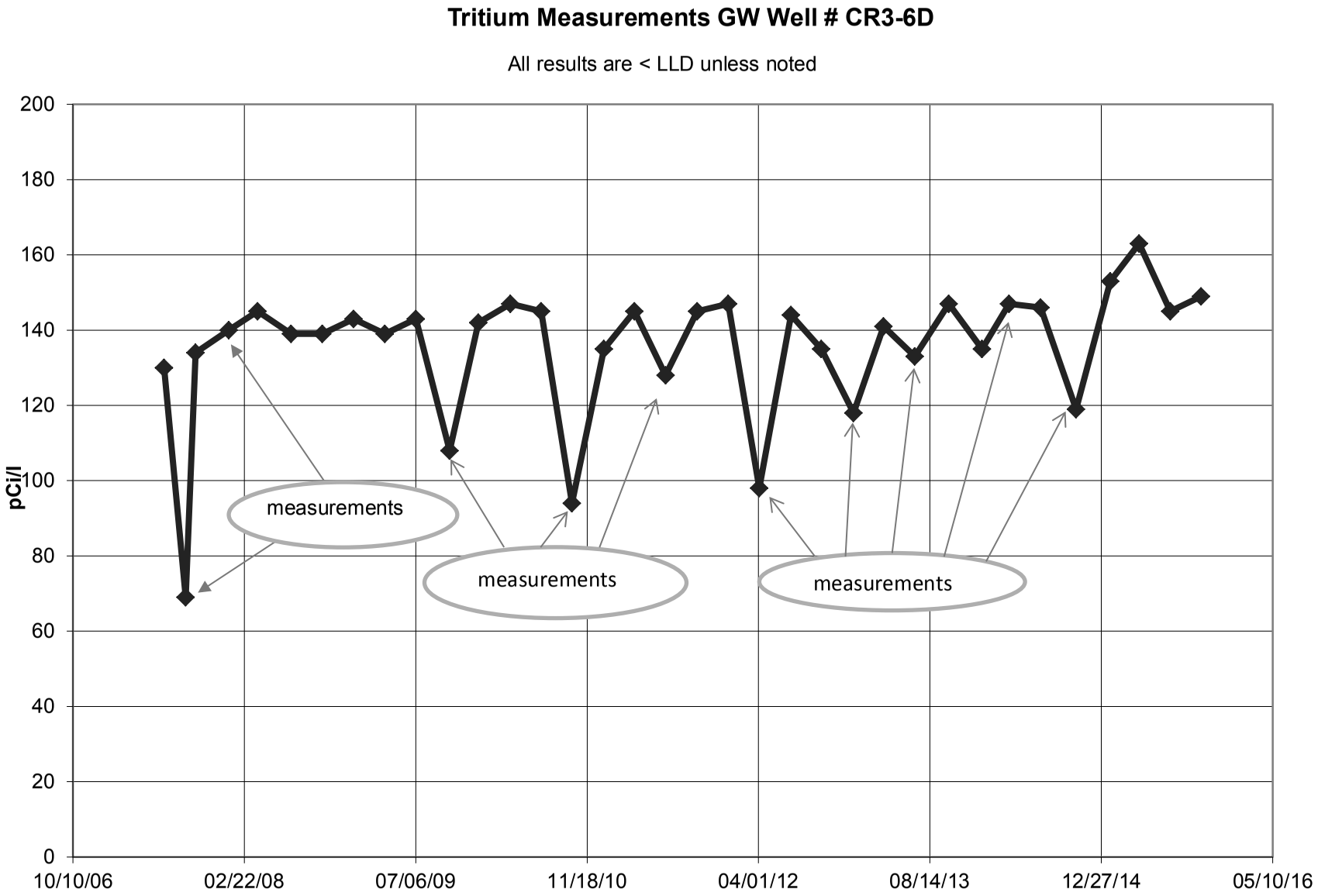
All results are < LLD unless noted



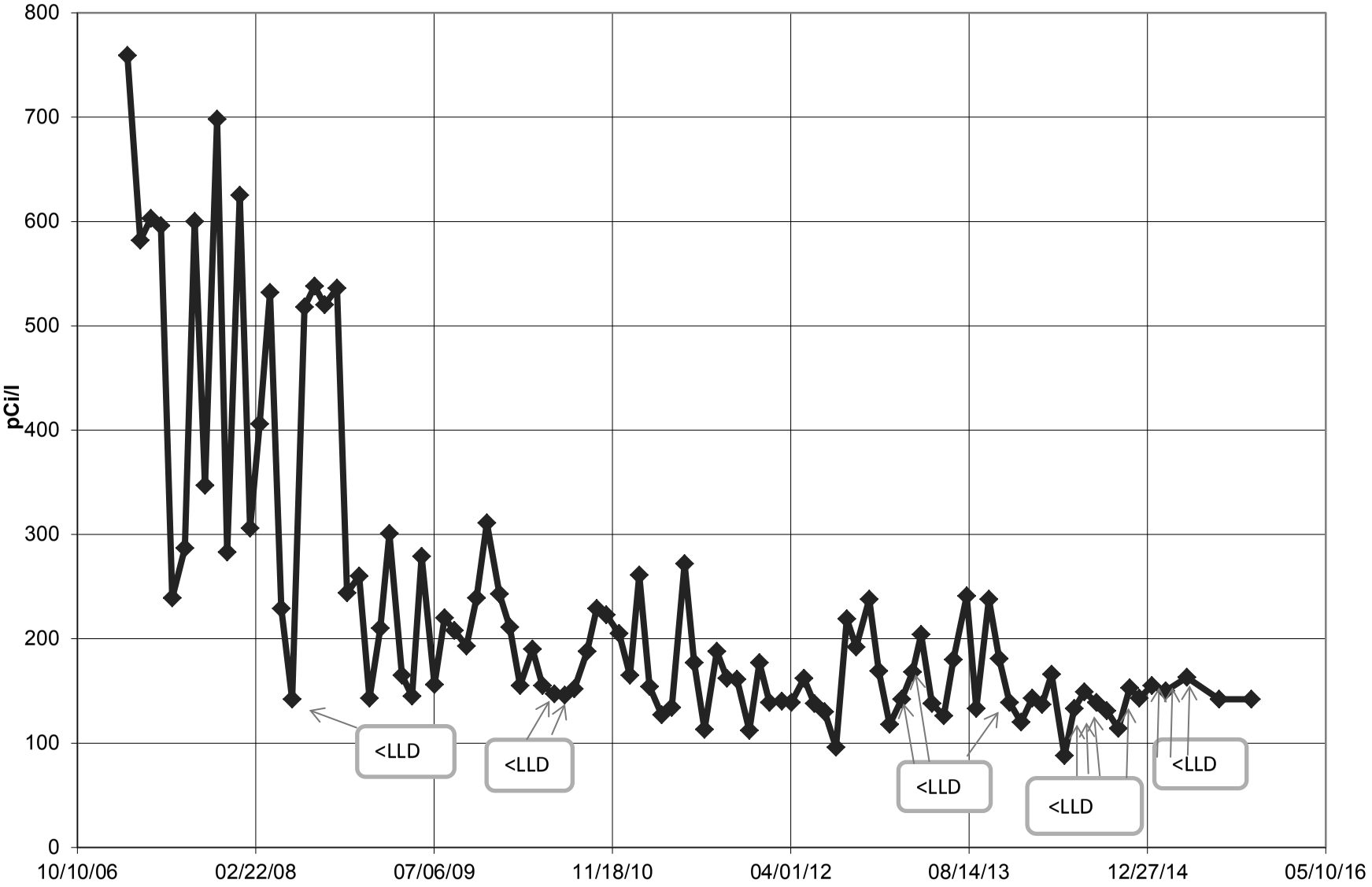

Tritium Measurement GW Well # CR3-4
All results are < LLD unless noted
pCi/l
200
180
160
140
120
100
80
60
40
20
0
Measurement
10/10/06
02/22/08
07/06/09
11/18/10
04/01/12
08/14/13
12/27/14
05/10/16


Tritium Measurement GW Well # CR3-5
pCi/l
2500
2000
1500
1000
500
0
10/10/06
02/22/08
07/06/09
11/18/10
04/01/12
08/14/13
12/27/14
05/10/16
NCR 341994
<LLD
EFT-2
Isolated

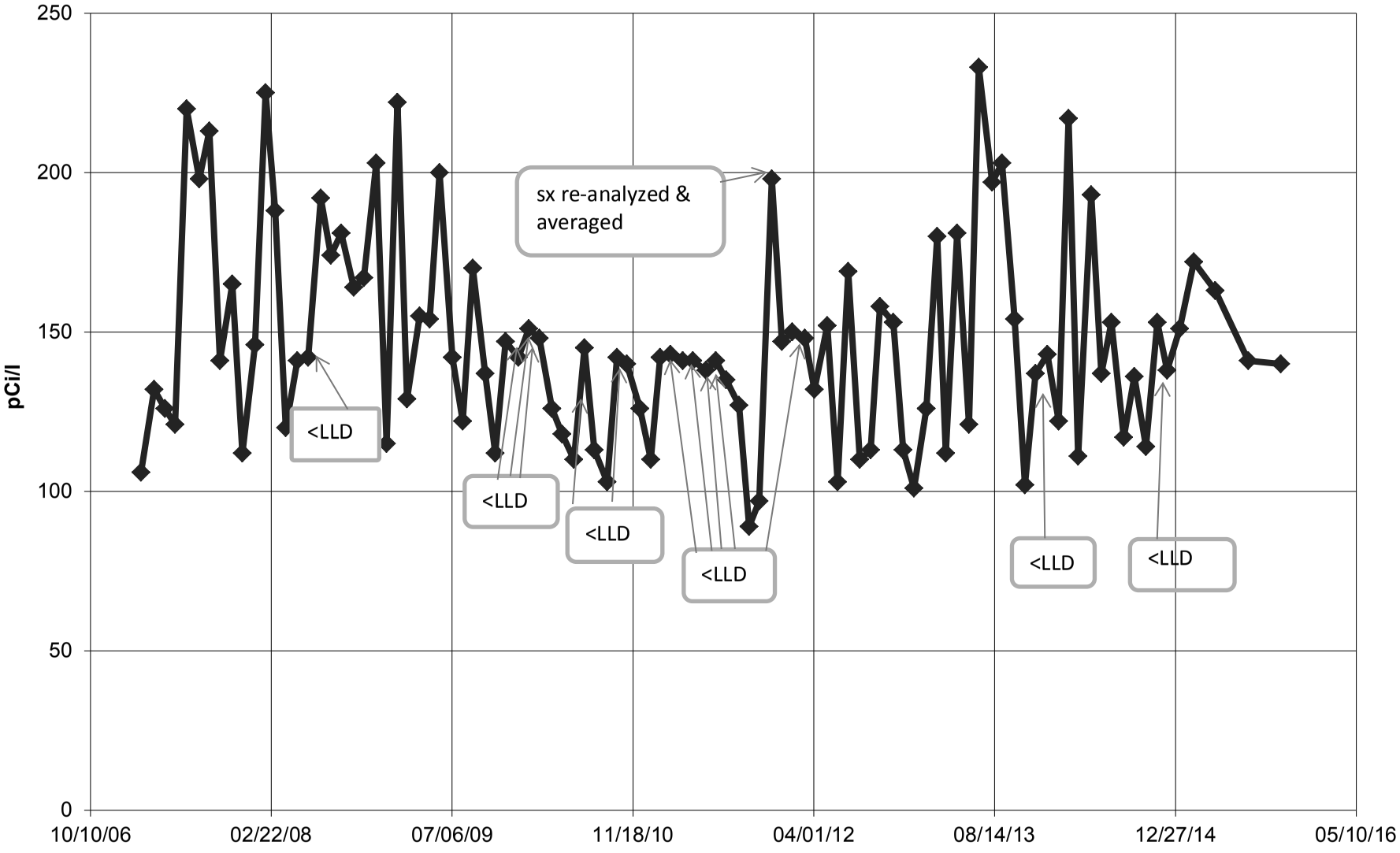

Tritium Measurement GW Well # CR3-6S
All results are < LLD unless noted
pCi/l
200
180
160
140
120
100
80
60
40
20
0
05/28/05
10/10/06
02/22/08
07/06/09
11/18/10
04/01/12
08/14/13
12/27/14
05/10/16
measurement
measurement
measurement
measurement
measurement


Tritium Measurements GW Well # CR3-6D
All results are < LLD unless noted
pCi/l
200
180
160
140
120
100
80
60
40
20
0
10/10/06
02/22/08
07/06/09
11/18/10
04/01/12
08/14/13
12/27/14
05/10/16
measurements
measurements
measurements

Tritium Measurements GW Well # CR3-7

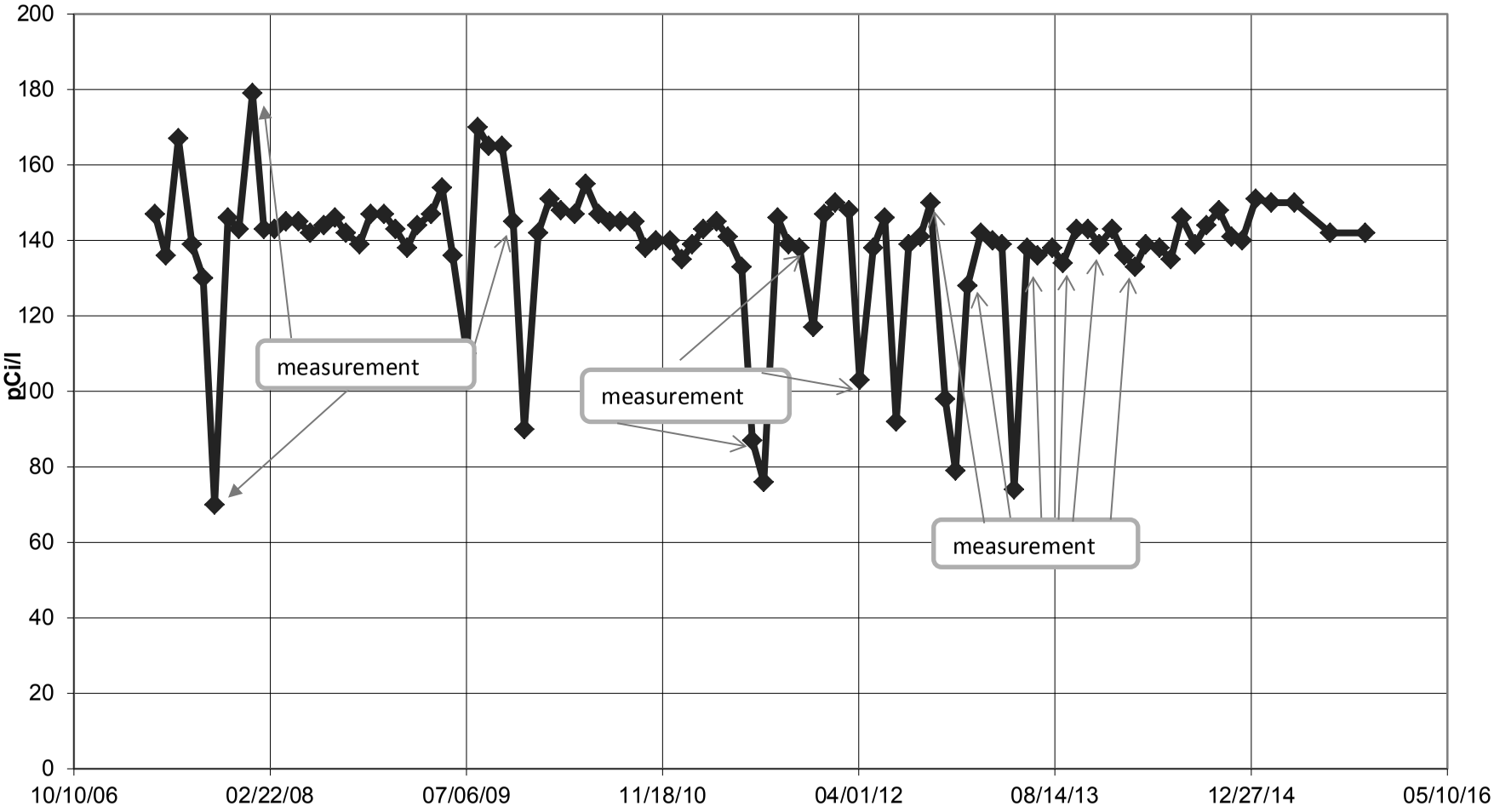


Tritium Measurements GW Well # CR3-8



Tritium Measurements GW Well # CR3-9

All results are < LLD unless noted



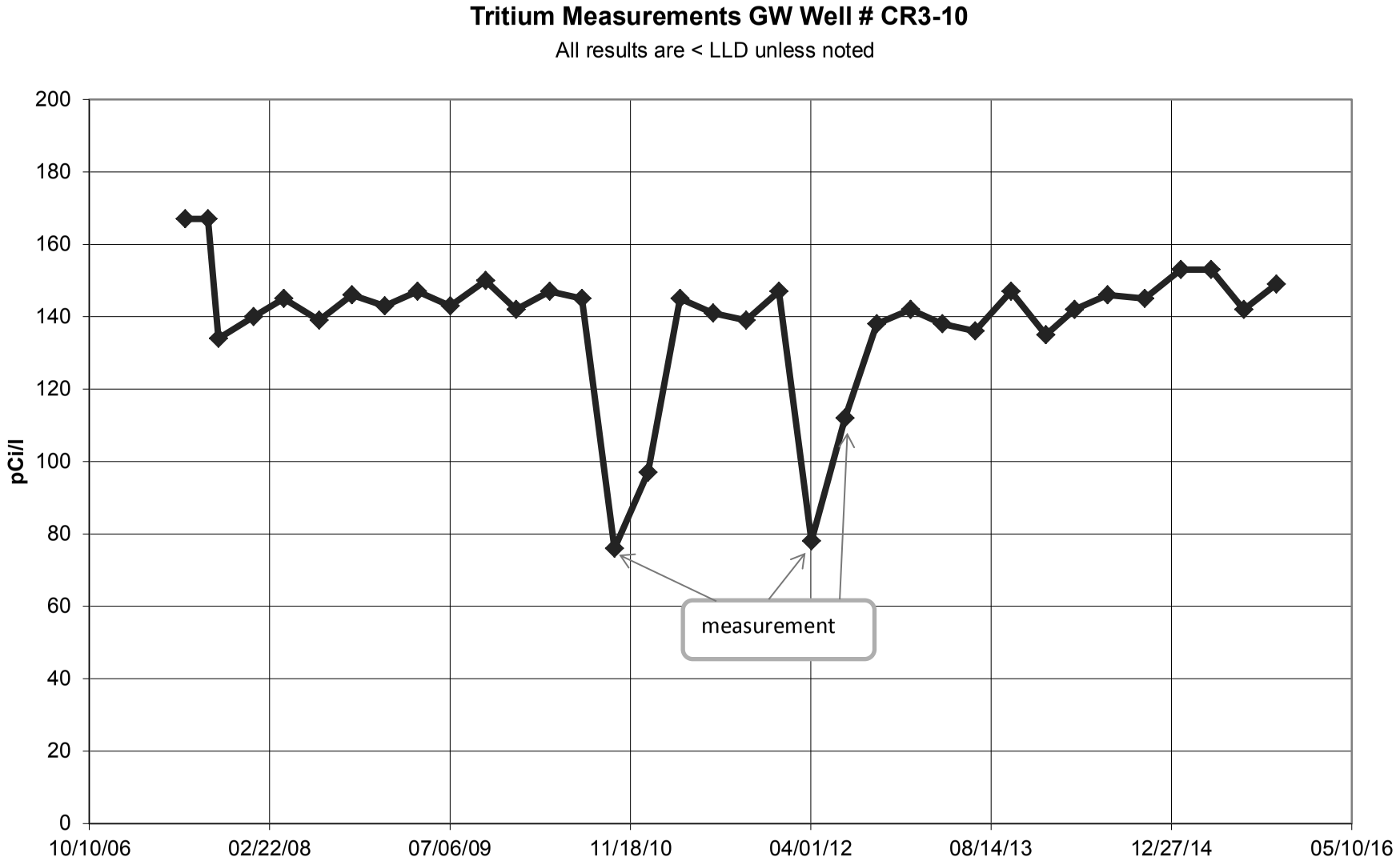

Tritium Measurements GW Well # CR3-10
All results are < LLD unless noted
pCi/l
200
180
160
140
120
100
80
60
40
20
0
10/10/06
02/22/08
07/06/09
11/18/10
04/01/12
08/14/13
12/27/14
05/10/16
measurement

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, 2015**

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)[1]	ALL INDICATOR LOCATIONS MEAN RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING	LOCATION WITH HIGHEST MEAN MEAN RANGE	CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
*CR3 SITE GROUND WATER (pCi/L) *	Tritium 10	151	<LLD (0/10)	MWC-27 0.30 mi.@266°	(0/5) (<LLD)	CR3-2 (<LLD)	0
	γ Spec 4						
	Mn-54	5	<LLD	-	-	<LLD	0
	Fe-59	11	<LLD	-	-	<LLD	0
	Co-58	5	<LLD	-	-	<LLD	0
	Co-60	7	<LLD	-	-	<LLD	0
	Zn-65	11	<LLD	-	-	<LLD	0
	Zr-Nb-95	8	<LLD	-	-	<LLD	0
	I-131	10	<LLD	-	-	<LLD	0
	Cs-134	5	<LLD	-	-	<LLD	0
	Cs-137	5	<LLD	-	-	<LLD	0
	Ba-La-140	7	<LLD	-	-	<LLD	0

[1]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.4.a

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/L γ 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*	01-08	<151	<76	<5	<5	<11	<7	<11	<8	<10	<5	<5	<7
	02-03	<172	<51	<3	<3	<7	<3	<9	<5	<5	<4	<4	<7
	04-17	<150	<68	<6	<5	<9	<7	<11	<9	<8	<5	<6	<8
	07-14	<142	<20	<2	<2	<5	<3	<6	<4	<3	<2	<3	<5
	10-14	<142	<45	<3	<3	<7	<4	<7	<6	<6	<3	<3	<6

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

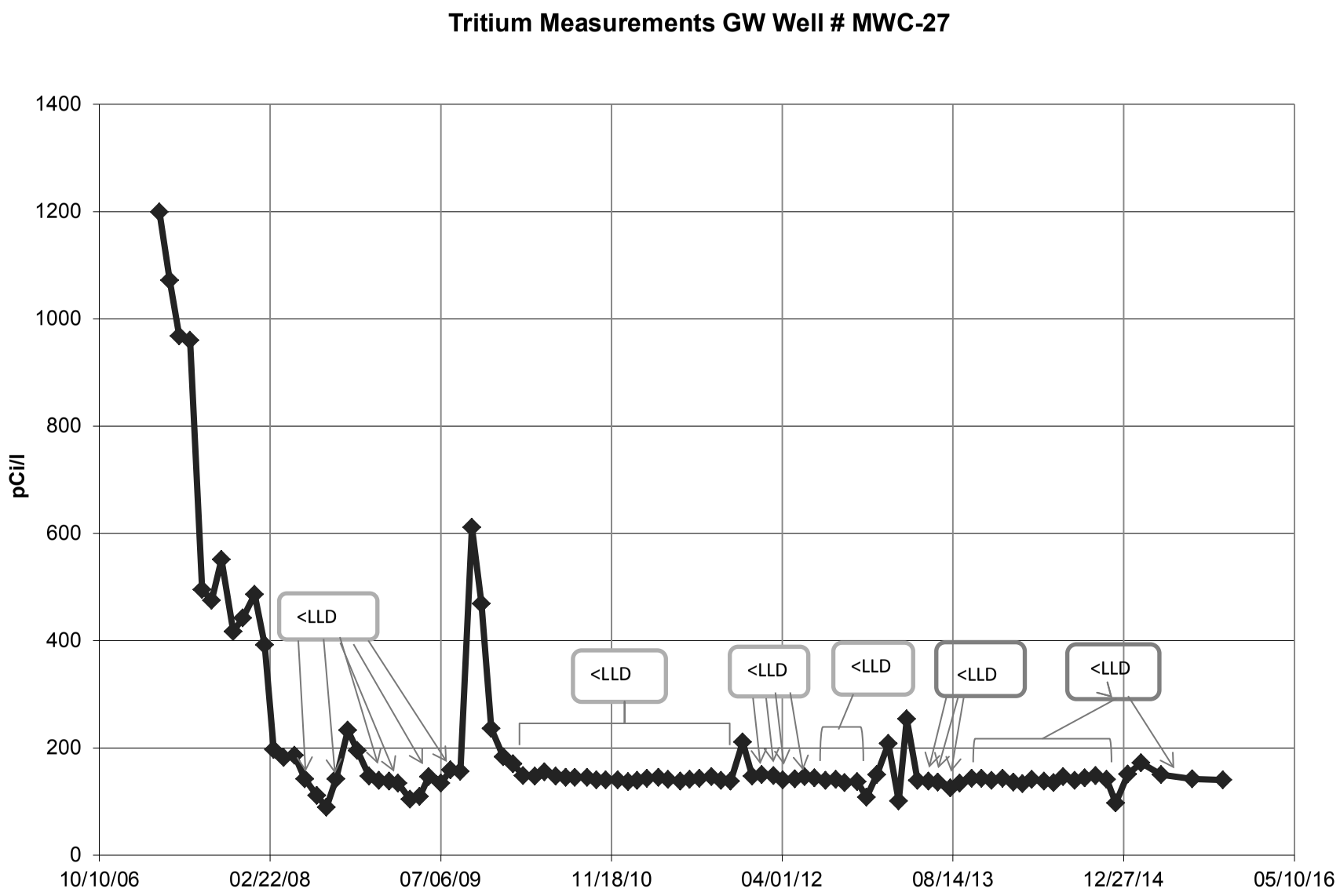
TABLE IV-C.4.a (cont'd)

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/L γ 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*	01-08	<151	<43	<3	<3	<7	<3	<7	<6	<6	<3	<3	<6
	02-03	<172	<45	<3	<3	<7	<4	<8	<5	<4	<3	<4	<7
	04-17	<142	<53	<4	<4	<6	<4	<7	<6	<4	<3	<4	<8
	07-14	<140	<48	<4	<3	<7	<3	<8	<6	<4	<4	<4	<9
	10-14	<163	<100	<6	<6	<13	<7	<14	<10	<10	<5	<7	<14

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


Tritium Measurements GW Well # MWC-27
pCi/l
1400
1200
1000
800
600
400
200
0
10/10/06
02/22/08
07/06/09
11/18/10
04/01/12
08/14/13
12/27/14
05/10/16
<LLD
<LLD
<LLD
<LLD
<LLD
<LLD

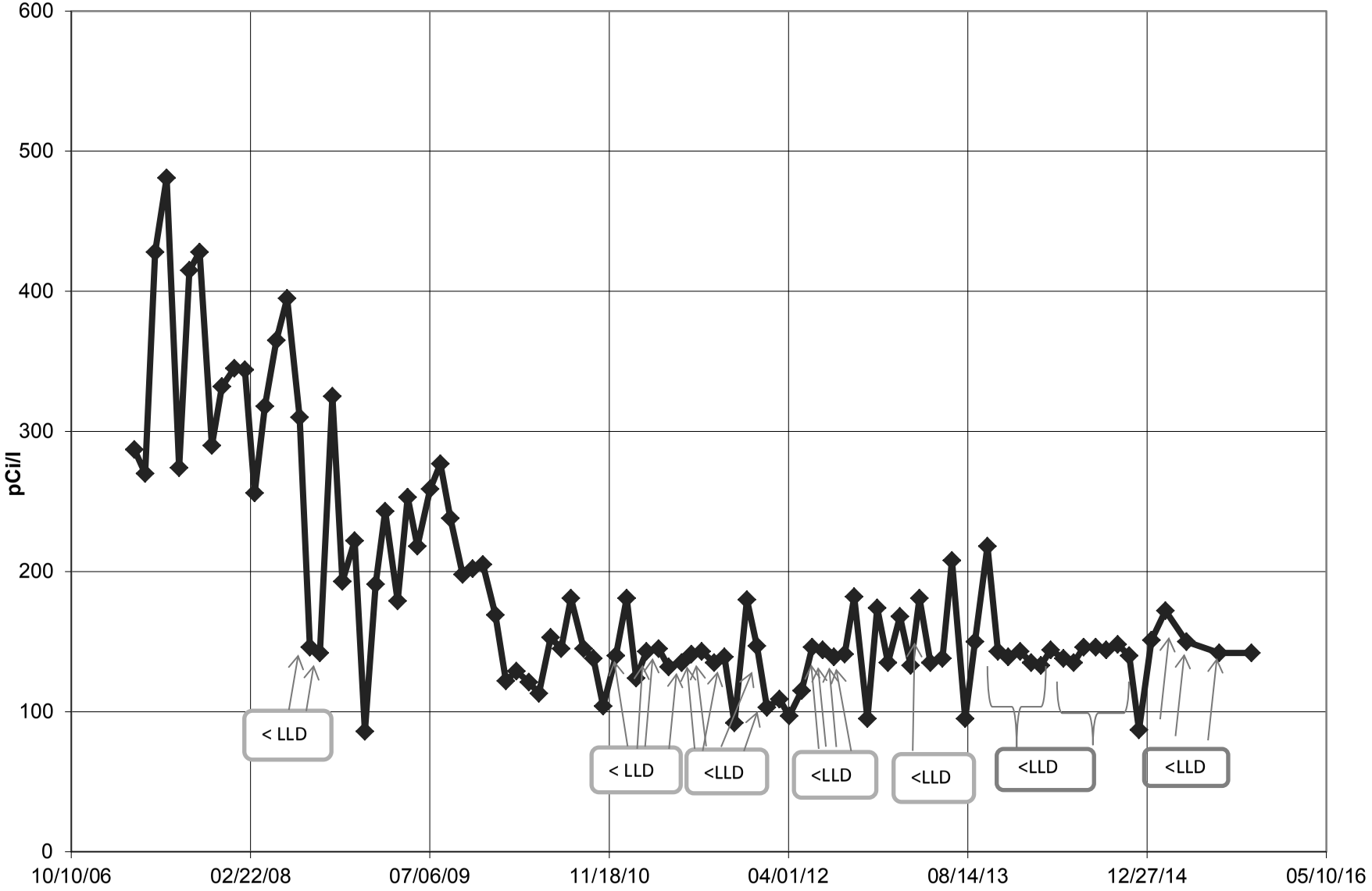

Tritium Measurements GW Well # MWC-IF2
pCi/l
600
500
400
300
200
100
0
10/10/06
02/22/08
07/06/09
11/18/10
04/01/12
08/14/13
12/27/14
05/10/16
< LLD
< LLD
<LLD
<LLD
<LLD
<LLD
<LLD

TABLE IV-C.5

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA JANUARY 1 TO DECEMBER 31, 2015

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)[1]	ALL INDICATOR LOCATIONS MEAN RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING	MEAN RANGE	CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
DRINKING WATER (pCi/L)	Tritium 12	153	<LLD	-	-	<LLD	0
	γ Spec 12						
	Mn-54	3	<LLD	-	-	<LLD	0
	Fe-59	6	<LLD	-	-	<LLD	0
	Co-58	3	<LLD	-	-	<LLD	0
	Co-60	4	<LLD	-	-	<LLD	0
	Zn-65	7	<LLD	-	-	<LLD	0
	Zr-Nb-95	5	<LLD	-	-	<LLD	0
	I-131	4	<LLD	-	-	<LLD	0
	Cs-134	3	<LLD	-	-	<LLD	0
	Cs-137	4	<LLD	-	-	<LLD	0
	Ba-La-140	11	<LLD	-	-	<LLD	0

[1]The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

TABLE IV-C.5.a

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/L γ 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	01-22	<153	<33	<3	<3	<6	<3	<5	<5	<3	<3	<3	<153
	04-13	<153	<41	<2	<2	<6	<3	<5	<5	<3	<3	<3	<153
	07-21	<144	<44	<2	<3	<5	<3	<7	<5	<4	<3	<3	<144
	10-05	<152	<30	<2	<2	<4	<2	<4	<3	<2	<2	<2	<152
C10	01-22	<148	<33	<3	<3	<5	<3	<6	<5	<3	<3	<3	<148
	04-13	<153	<40	<3	<3	<6	<4	<7	<5	<4	<3	<4	<153
	07-21	<144	<42	<3	<2	<5	<3	<6	<5	<4	<3	<3	<144
	10-05	<152	<43	<3	<3	<6	<3	<7	<5	<4	<3	<3	<152
C18	<153	<33	<3	<3	<5	<3	<6	<5	<3	<3	<3	<153	<33
	<153	<34	<3	<3	<6	<3	<5	<5	<3	<2	<3	<153	<34
	<144	<22	<2	<2	<4	<2	<4	<3	<2	<2	<2	<144	<22
	<152	<38	<3	<3	<5	<3	<6	<5	<4	<3	<3	<152	<38

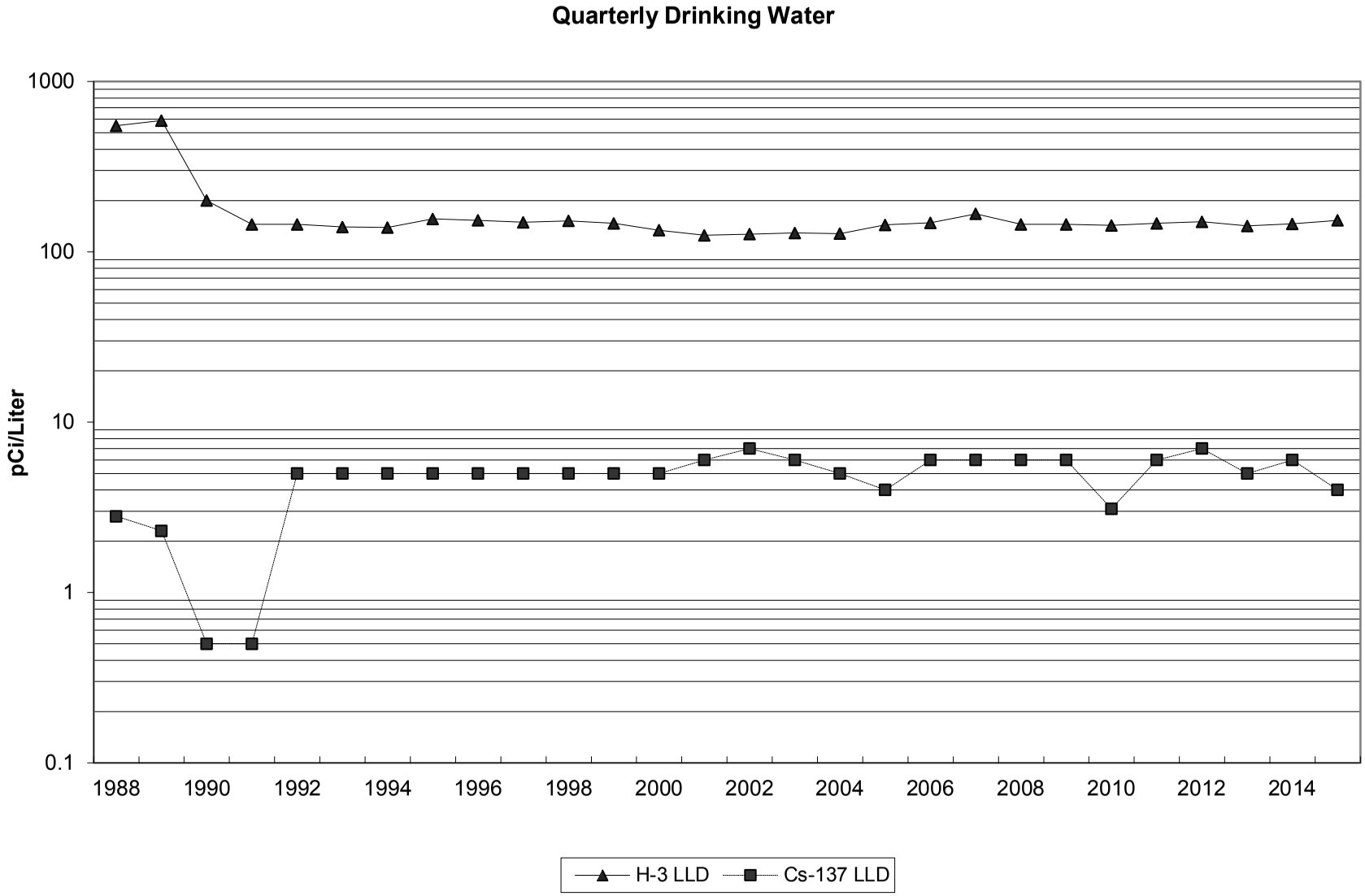

Quarterly Drinking Water
1000
100
10
1
0.1
pCi/Liter
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
H-3 LLD
Cs-137 LLD

TABLE IV-C.6

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 **DOCKET NO. 50-302**

CITRUS COUNTY, FLORIDA **JANUARY 1 TO DECEMBER 31, 2015**

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)[1]	ALL INDICATOR LOCATIONS MEAN RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING	MEAN RANGE	CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
SHORELINE SEDIMENT	γ Spec 8						
(pCi/kg)	Cs-134	15	<LLD	—	—	<LLD	0
	Cs-137	15	24 (3/6) (17-39)	C14M 1.2 mi. @ 270°	17 (2/2) (17-17)	<LLD	0

[1]The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

TABLE IV-C.6.a

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/kg γ EMITTERS IN SHORELINE SEDIMENT

STATION	PERIOD	Co-58	Co-60	Cs-134	Cs-137	K-40	Ra-226
C09	First Half	<8	<11	<8	<9	171±31	231±43
	Second Half	<8	<10	<9	<10	93±33	512±84
C14H	First Half	<16	109±5	<15	39±4	2192±109	2388±121
	Second Half	<16	<15	<14	<16	743±83	2185±190
C14M	First Half	<12	52±3	<11	17±2	519±47	1644±86
	Second Half	<13	35±4	<14	17±5	1230±97	1943±153
C14G	First Half	<15	<15	<11	<16	249±40	1594±98
	Second Half	<12	<16	<12	<15	232±57	1180±123

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

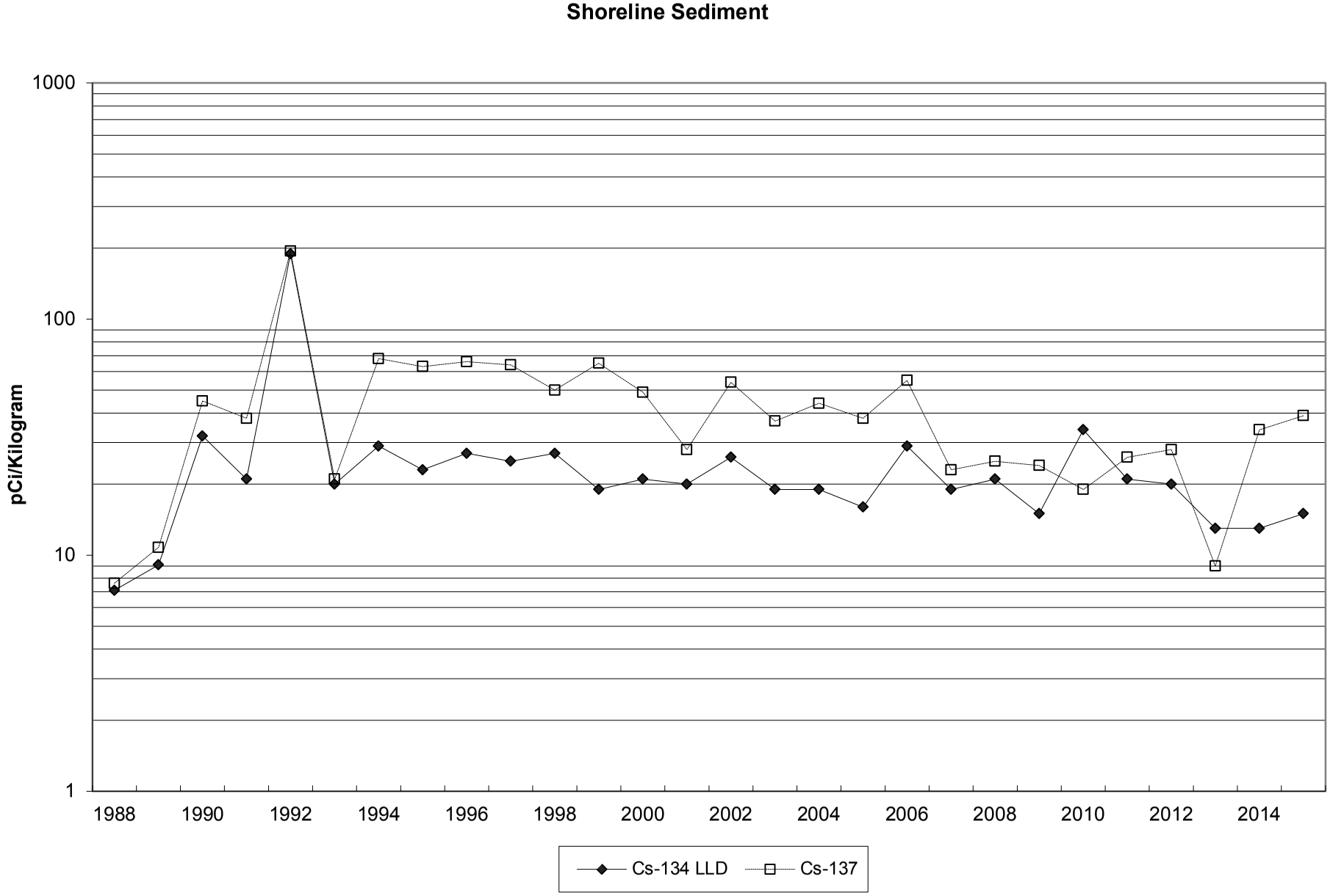

Shoreline Sediment
1000
100
10
1
pCi/Kilogram
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Cs-134 LLD
Cs-137

TABLE IV-C.7 SUPPLEMENTAL DATA

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/L γ EMITTERS AND TRITIUM IN SITE SETTLING PONDS SURFACE WATER

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
31NE	DEC	<148	<22	<2	<2	<4	<2	<4	<3	<2	<2	<2	<6
32NE	DEC	<152	<27	<2	<2	<5	<2	<6	<4	<3	<3	<3	<5

pCi/kg γ EMITTERS IN SITE SETTLING PONDS SEDIMENT

STATION	MONTH	Co-58	Co-60	Cs-134	Cs-137	K-40	Ra-226
31NE	DEC	<8	<9	<8	<6	826 ± 53	985 ± 227
31NW	DEC	<9	<9	<10	<12	921 ± 59	2038 ± 125
32NE	DEC	<6	<7	<7	<5	152 ± 23	624 ± 66
32NW	DEC	<6	<7	<7	<5	144 ± 25	631 ± 64

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.

   In 2015, none of the required radionuclides were found in measurable quantities. The highest cesium-137 LLD for stations C29 and C30 was 31 pCi/kg. Naturally occurring potassium-40 was quantified in all eight samples at an average concentration of 2,592 pCi/kg.

   In 2014, none of the required radionuclides were found in measurable quantities.

   In 2013, none of the radionuclides of interest were identified in measurable quantities.

   In 2012, none of the radionuclides of interest were identified in measurable quantities.

   In 2011, none of the radionuclides of interest were identified in measurable quantities.

   In 2010, none of the radionuclides of interest were identified in measurable quantities.

   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.

   In 2015, none of the required radionuclides were found in measurable quantities.

   In 2014, none of the required radionuclides were found in measurable quantities. Additionally, silver-110m was found in one sample at location C29 with a concentration of 35 pCi/kg.

   In 2013, none of the required radionuclides were found in measurable quantities. Additionally, silver-110m was not quantified in any sample.

   In 2012, of the isotopes required to be evaluated, one sample from station C29 indicated measurable amounts of cesium-137 at a concentration of 22 pCi/L. This value was statistically positive, but is in the range of the analytical LLD. Also, silver-110m was not quantified in any sample.

   In 2011, silver-110m was quantified in two samples at C29 with an average concentration of 19 pCi/kg and a range of 14 to 23 pCi/kg. There were no other radionuclides of interest identified in any oyster samples in 2011.

   In 2010, silver-110m was not quantified in any oyster samples collected. There were no other radionuclides of interest identified in any oyster samples in 2010.

   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.

   In 2015, fourteen of twenty four indicator samples had measurable amounts of cesium-137 with an average concentration of 50 pCi/kg and a range of 12 to 105 pCi/kg. The control station (C47) located in Orlando, Fl. also had measurable amounts of cesium-137. In 11 of 12 control station samples there were measurable amounts of cesium-137 with an average concentration of 67 pCi/kg and a range of 15 to 150 pCi/kg. The cesium-137 values are similar in concentration as compared to samples collected in 2014 which experienced radionuclide deposition as a result of the Fukushima earthquake event in 2011 and are not a result of the operation of CR3

   In 2014, sixteen of twenty four indicator samples had measurable amounts of cesium-137 with an average concentration of 53 pCi/kg and a range of 4 to 159 pCi/kg. The control station (C47) located in Orlando, Fl. also had measurable amounts of cesium-137. In 10 of 12 control station samples there were measurable amounts of cesium-137 with an average concentration of 43 pCi/kg and a range of 17 to 71 pCi/kg. The cesium-137 values are similar in concentration as compared to samples collected in 2013 which experienced radionuclide deposition as a result of the Fukushima earthquake event in 2011 and are not a result of the operation of CR3.

   In 2013, fifteen of twenty four indicator samples had measurable amounts of cesium-137 with an average concentration of 75 pCi/kg and a range of 5 to 147 pCi/kg. The control station (C47) located in Orlando, Fl. also had measurable amounts of cesium-137. In twelve of twelve control station samples there were measurable amounts of cesium-137 at an average concentration of 86 pCi/kg and a range of 14 to 258 pCi/kg. The cesium-137 values are similar in concentration as compared to samples collected in 2012 which experienced radionuclide deposition as a result of the Fukushima earthquake event and are not a result of the operation of CR3.

   In 2012, thirteen of twenty four indicator samples had measurable amounts of cesium-137 with an average concentration of 86 pCi/kg and a range of 18 to 172 pCi/kg. The control station (C47) located in Orlando, Fl. also had measurable amounts of cesium-137. In eight of twelve control station samples there were measurable amounts of cesium-137 at an average concentration of 57 pCi/kg and a range of 16 to 201 pCi/kg. The cesium-137 values are similar in concentration as compared to samples collected in 2011 which experienced radionuclide deposition as a result of the Fukushima earthquake event and are not a result of the operation of CR3.

   In 2011, eighteen of twenty four indicator samples had measurable amounts of cesium-137 with an average concentration of 76 pCi/kg and a range of 6 to 233 pCi/kg. Two of twenty four indicator samples also had measurable amounts of iodine-131 with an average of 232 pCi/kg and a range of 195-269 pCi/kg. The control station also had measurable amounts of iodine-131 and cesium-137. In seven of twenty one control station samples, there was measurable I-131 at an average concentration of 324 pCi/kg and a range of 13-1397 pCi/kg. In seventeen of twenty one control station samples there was measurable cesium-137 at an average concentration of 61 pCi/kg and a range of 7 to 182 pCi/kg. Nine extra control samples were collected at the Orlando station location. These positive-measured radionuclides were a result of the Fukushima earthquake and tsunami event that occurred in 2011 and were not from the operation of CR3.

   In 2010, five of twenty-four indicator samples had measurable amounts of cesium-137 with an average concentration of 66 pCi/kg and a range of 9 to 153 pCi/kg. This is higher than the levels found in 2009, but lower than in 2007 and 2008. 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. Additionally in 2010, eight of twelve control station samples had measurable amounts of cesium-137 with an average concentration of 21 pCi/kg and a range of 9 to 31 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. During 2010, also due to construction activities at the Crystal River Units 4 & 5 site, the area where broadleaf vegetation was being collected at station C48B became inaccessible. A new location in the ENE sector was located near the transmission power line corridor right of way, just NE of the mariculture center. This sector has the same D/Q value as the N and NNE sectors and is allowed by the ODCM.

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. In 2015 one watermelon sample was collected at station C04. None of the required radionuclides were found in measurable quantities. One citrus sample (oranges and grapefruit) was collected at station C19. None of the required radionuclides were found in measurable quantities in the citrus samples with exception of Cs-137 at a concentration of 9 pCi/kg. It is not unusual to periodically see Cs-137 in citrus samples due to widespread deposition of Cs-137 from fallout due to past weapons testing and more recent from the Fukushima earthquake and tsunami event that occurred in 2011

   In 2014 watermelon samples were collected at station C04. None of the required radionuclides were found in measurable quantities. Citrus samples (oranges and grapefruit) were collected at station C19. None of the required radionuclides were found in measurable quantities in the citrus samples with exception of Cs-137 (in grapefruit) at a concentration of 4 pCi/kg. It is not unusual to periodically see Cs-137 in citrus samples due to widespread deposition of Cs-137 from fallout due to past weapons testing and more recent from the Fukushima earthquake and tsunami event that occurred in 2011.

   In 2013 watermelon samples were collected at station C04. None of the required radionuclides were found in measurable quantities. Citrus samples were taken at station C19. None of the required radionuclides were found in measurable quantities in the citrus samples with exception of Cs-137 at a concentration of 86 pCi/kg. It is not unusual to periodically see Cs-137 in citrus samples due to widespread deposition of Cs-137 from fallout due to past weapons testing.

   In 2012 one watermelon sample was collected at station C04. This sample had no measurable quantities of radionuclides of interest. Citrus samples were taken at station C19. There were no measurable quantities of radionuclides of interest in the citrus samples.

   In 2011 two watermelon samples were collected at station C04. One sample had a measurable amount of cesium-137 at a concentration of 14 pCi/kg. All other radionuclides of interest were < LLD. Citrus samples were taken at station C19. There were no measurable quantities of radionuclides of interest in the citrus samples.

   In 2010 watermelon samples were collected at station C04. None of the required radionuclides were found in measurable quantities. Citrus samples were taken at station C19. None of the required radionuclides were found in measurable quantities in the citrus samples with exception of Cs-137 at a concentration of 71 pCi/kg.

   In 2008 and again in 2009, there were no watermelon samples available at station C04. In these 2 years, due to crop rotation, there were no locally grown watermelons found in any areas nearby the facility and no local commercial harvest performed.

   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, 2015**

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)[1]	ALL INDICATOR LOCATIONS MEAN RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING	MEAN RANGE	CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
CARNIVOROUS FISH	γ Spec 8						
(pCi/kg)	Mn-54	29	<LLD	-	-	<LLD	0
	Fe-59	59	<LLD	-	-	<LLD	0
	Co-58	27	<LLD	-	-	<LLD	0
	Co-60	36	<LLD	-	-	<LLD	0
	Zn-65	66	<LLD	-	-	<LLD	0
	Cs-134	29	<LLD	-	-	<LLD	0
	Cs-137	31	<LLD	-	-	<LLD	0

[1]The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

TABLE IV-D.1.a

DUKE ENERGY FLORIDA, LLC- CR3 - 2014

pCi/kg γ EMITTERS IN CARNIVOROUS FISH

STATION	QUARTER	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137	K-40
C29	1	<27	<27	<59	<36	<48	<29	<30	2113±192
	2	<17	<18	<38	<21	<42	<21	<24	2600±175
	3	<29	<26	<50	<24	<59	<234	<29	2546±222
	4	<24	<23	<45	<34	<66	<21	<31	3250±247
C30	1	<20	<19	<48	<28	<51	<22	<21	2489±165
	2	<23	<22	<47	<34	<52	<24	<31	2680±217
	3	<20	<18	<41	<16	<44	<19	<21	2357±160
	4	<18	<21	<36	<29	<44	<22	<20	2700±180

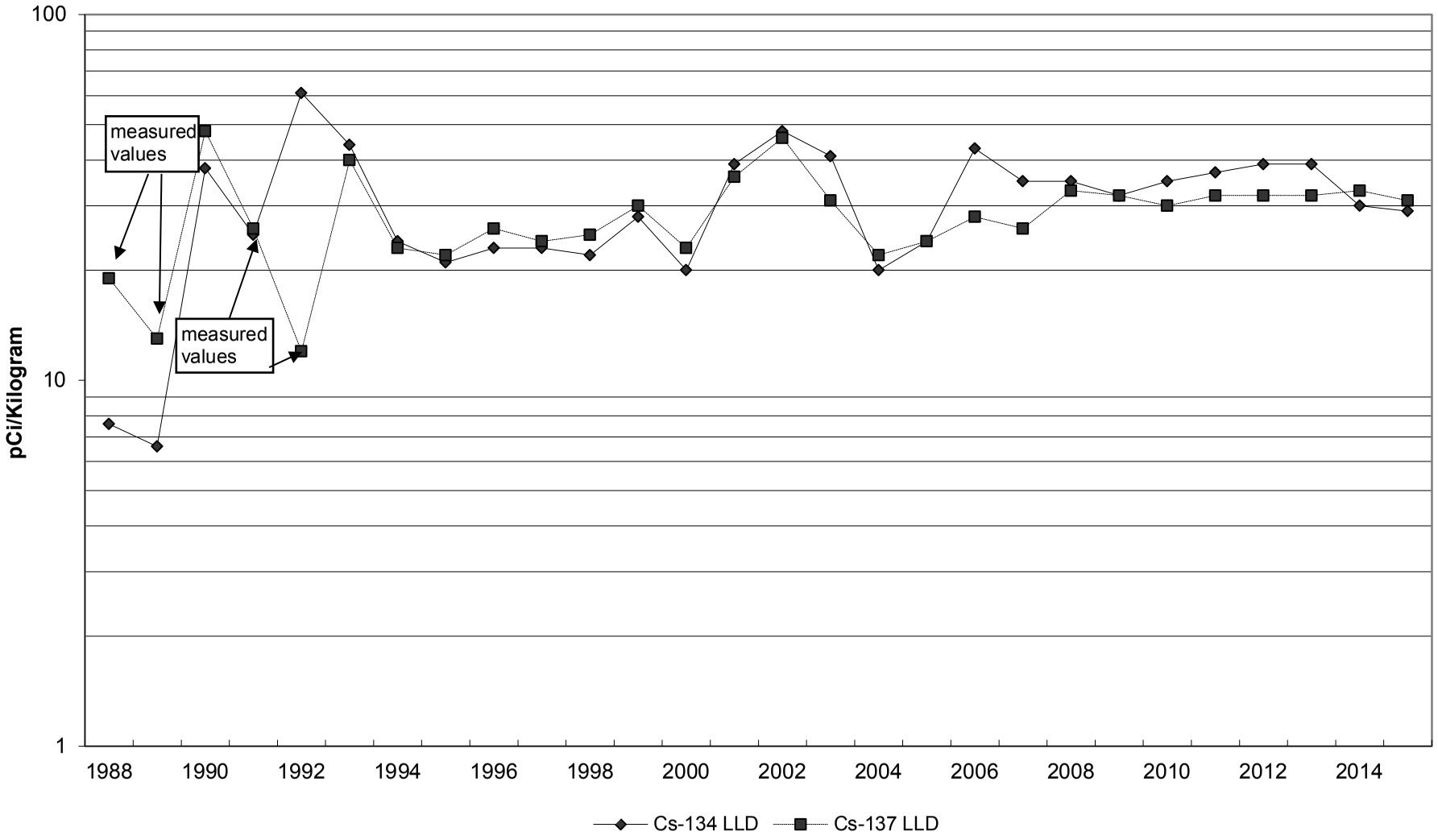

Carnivorous Fish
100
10
1
pCi/Kilogram
measured values
measured values
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Cs-134 LLD
Cs-137 LLD

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, 2015

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)[1]	ALL INDICATOR LOCATIONS MEAN RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING	MEAN RANGE	CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
OYSTERS (pCi/kg)	γ Spec 8						
	Mn-54	27	<LLD	-	-	<LLD	0
	Fe-59	64	<LLD	-	-	<LLD	0
	Co-58	32	<LLD	-	-	<LLD	0
	Co-60	39	<LLD	-	-	<LLD	0
	Zn-65	60	<LLD	-	-	<LLD	0
	Cs-134	32	<LLD	-	-	<LLD	0
	Cs-137	34	<LLD	-	-	<LLD	0

[1]The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

TABLE IV-D.2.a

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/kg γ EMITTERS IN OYSTERS

STATION	QUARTER	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137	K-40
C29	1	<20	<20	<54	<32	<49	<23	<27	603±109
	2	<27	<25	<53	<26	<54	<21	<24	845±144
	3	<20	<21	<32	<19	<36	<20	<20	676±88
	4	<24	<24	<59	<23	<48	<17	<23	796±133
C30	1	<25	<32	<64	<39	<59	<32	<34	1716±181
	2	<21	<22	<54	<34	<60	<25	<29	1310±155
	3	<18	<18	<35	<16	<33	<18	<21	870±100
	4	<20	<25	<56	<20	<46	<17	<20	1050±134

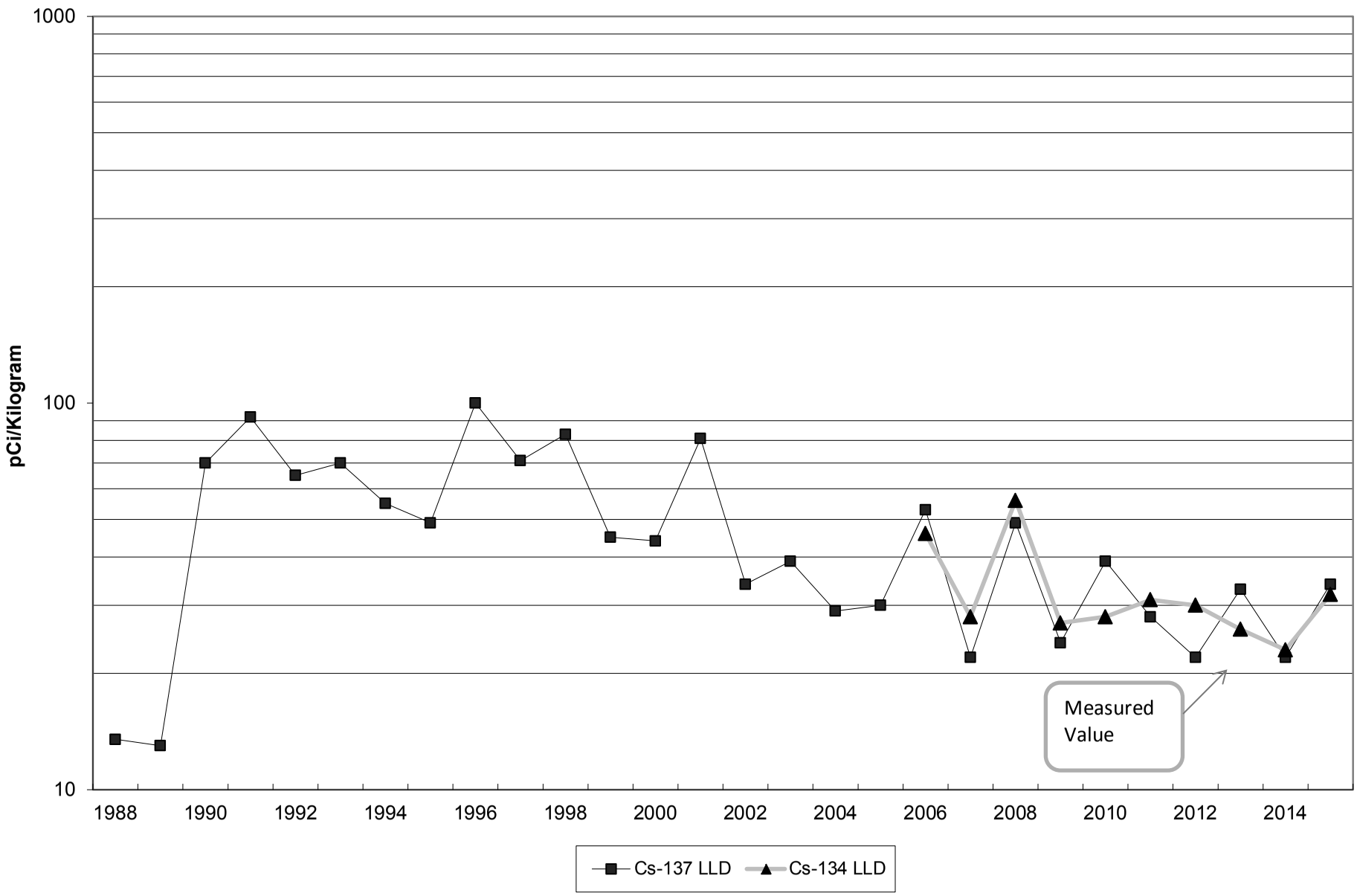

Oysters
1000
100
10
pCi/Kilogram
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Measured Value
Cs-137 LLD
Cs-134 LLD

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, 2015

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)[1]	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	22	<LLD	_	_	<LLD	0
	Cs-134	15	<LLD	_	_	<LLD	0
	Cs-137[2]	20	50 (14/24) (12-105)	C48B 0.9 @ 73º	57(12/12) (24-105)	467 (11/12) (15-150)	0

[1]The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

[2]The elevated Cs-137 values are not associated with the operation of CR3 and are a direct result of the Fukushima earthquake and tsunami event that occurred in 2011.

TABLE IV-D.3.a

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/kg OF γ EMITTERS IN BROAD LEAF VEGETATION

STATION	MONTH	I-131	Cs-134	Cs-137	K-40
C47	JAN	<22	<12	150±0	1954±119
	FEB	<16	<13	15±3	3344±166
	MAR	<15	<12	16±4	2168±128
	APR	<9	<7	21±2	2240±106
	MAY	<16	<12	122±9	2290±139
	JUN	<17	<12	57±7	1510±110
	JUL	<20	<12	87±8	1484±120
	AUG	<12	<9	87±6	2288±113
	SEP	<15	<10	60±7	2211±143
	OCT	<22	<13	<17	2953±169
	NOV	<13	<8	52±4	2505±115
	DEC	<12	<9	68±5	2994±131
C48A	JAN	<14	<7	<8	2955±133
	FEB	<10	<8	<9	1511±87
	MAR	<16	<13	<17	2450±137
	APR	<10	<9	<10	2822±137
	MAY	<18	<15	<20	2840±162
	JUN	<18	<14	<18	3430±171
	JUL	<19	<12	<15	3135±182
	AUG	<17	<12	<16	3383±182
	SEP	<15	<13	<18	2732±165
	OCT	<15	<9	12±2	2998±132
	NOV	<16	<13	<17	2573±154
	DEC	<13	<8	<12	2840±126

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

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/kg OF γ EMITTERS IN BROAD LEAF VEGETATION

STATION	MONTH	I-131	Cs-134	Cs-137	K-40
C48B	JAN	<15	<9	105±6	1888±103
	FEB	<10	<7	44±3	1627±92
	MAR	<18	<14	52±5	2233±135
	APR	<11	<9	54±4	2950±140
	MAY	<14	<13	48±6	2830±152
	JUN	<18	<13	39±5	2690±153
	JUL	<7	<5	82±4	2792±98
	AUG	<14	<9	24±3	1709±98
	SEP	<16	<14	47±7	2351±156
	OCT	<14	<8	71±5	1706±94
	NOV	<19	<13	31±5	1839±133
	DEC	<20	<13	82±8	1806±129

The elevated Cs-137 values are a direct result of the Fukushima earthquake and tsunami event that occurred in 2011 and are not associated with CR-3 operation.

Broad Leaf Vegetation

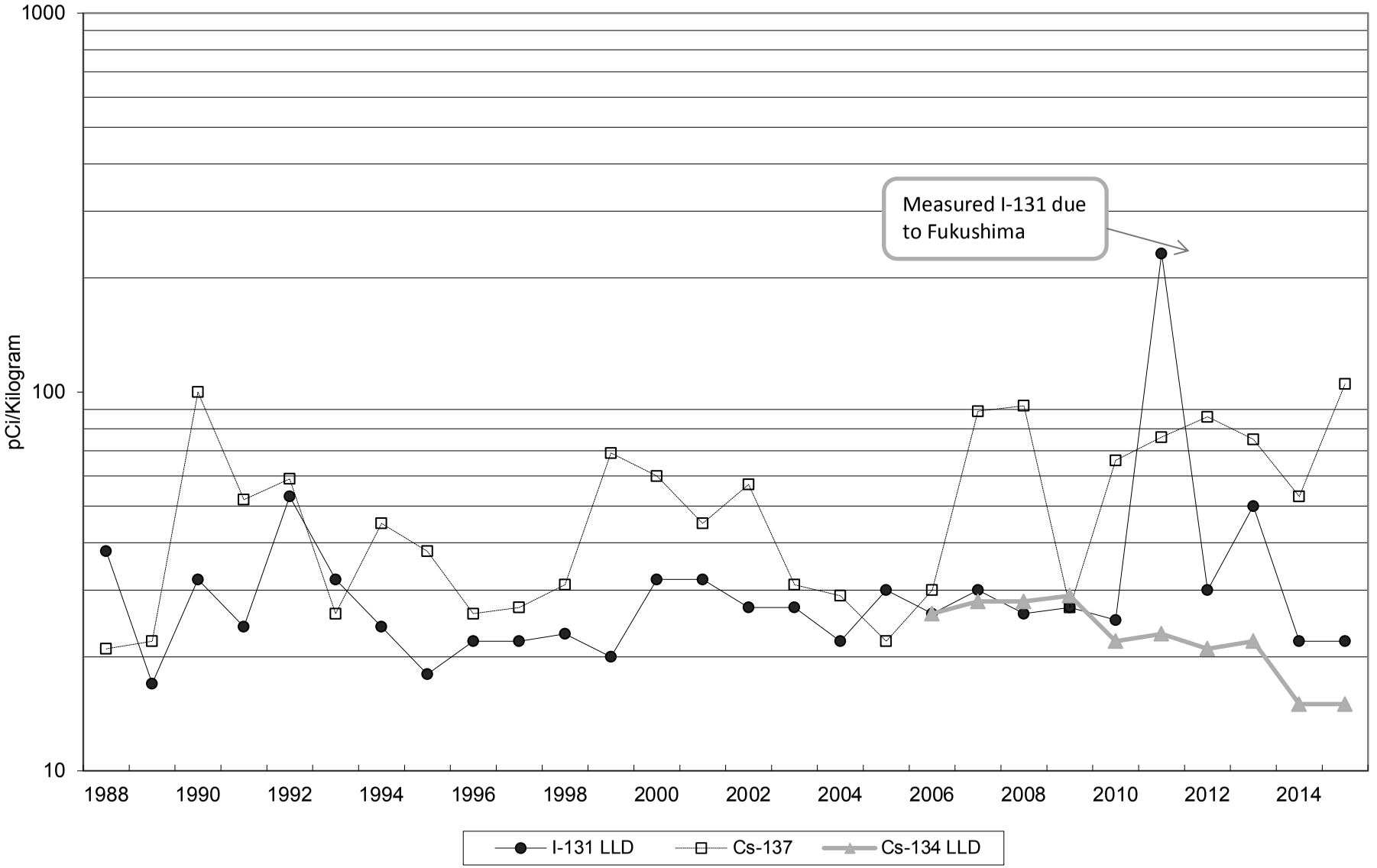


TABLE IV-D.4

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA JANUARY 1 TO DECEMBER 31, 2015

MEDIUM OR PATHWAY SAMPLED (UNITS)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)[1]	ALL INDICATOR LOCATIONS MEAN RANGE	LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING	LOCATION WITH HIGHEST MEAN MEAN RANGE	CONTROL LOCATION MEAN RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
WATERMELON (pCi/kg)	γ Spec 1						
	I-131	6	< LLD	_	_	None	0
	Cs-134	5	< LLD	_	_	None	0
	Cs-137	8	< LLD	_	_	None	0
CITRUS (pCi/kg)	γ Spec 2						
	I-131	7	<LLD	_	_	None	0
	Cs-134	6	<LLD	_	_	None	0
	Cs-137	4	9(1/2) (9)	C19 9.6 mi. @ 30°	9(1/2) (9)	None	0

[1]The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

TABLE IV-D.4.a

DUKE ENERGY FLORIDA, LLC- CR3 - 2015

pCi/kg OF γ EMITTERS IN WATERMELON AND CITRUS

STATION	MONTH	I-131	Cs-134	Cs-137	K-40
C04 – Watermelon	June	<6	<5	<8	1050±67
C19 – Citrus	February	<7	<6	9	864±53