



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

ODCM

April 7, 2020  
3F0420-02

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

Subject: Crystal River Unit 3 – 2019 Annual Radiological Environmental Operating Report

Dear Sir:

Duke Energy Florida, LLC (DEF), hereby provides the 2019 Annual Radiological Environmental Operating Report for Crystal River Unit 3 in accordance with 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, 2019 through December 31, 2019.

This letter contains no new regulatory commitments.

If you have any questions regarding this submittal, please contact Mr. Mark Van Sicklen, Licensing Lead, Nuclear Regulatory Affairs, at (352) 501-3045.

Sincerely,

A handwritten signature in blue ink, appearing to read "Terry D. Hobbs", written over a horizontal line.

Terry D. Hobbs  
General Manager, Decommissioning - SAFSTOR

TDH/mvs

Attachment 1: 2019 Annual Radiological Environmental Operating Report

xc: NMSS Project Manager  
Regional Administrator, Region I

**DUKE ENERGY FLORIDA, LLC**

**DOCKET NUMBER 50 - 302 / 72-1035  
LICENSE NUMBER DPR - 72**

**ATTACHMENT 1**

**2019 ANNUAL RADIOLOGICAL ENVIRONMENTAL  
OPERATING REPORT**

# **ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT**

**2019**



**DUKE ENERGY FLORIDA, LLC**

**CRYSTAL RIVER UNIT 3**

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## INTRODUCTION

This report is submitted as required by procedure CP-500: Special Actions and Reporting Requirements, Section 4.4.1.1, and the Offsite Dose Calculation Manual (ODCM).

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.
- Inter-laboratory 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 decided 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 has placed the facility in a SAFSTOR condition with plans to begin decommissioning, using a vendor who will assume the NRC license, starting in 2020. The plant staff (called SAFSTOR organization) is now mainly working to maintain the plant in its SAFSTOR "cold and dark" condition. All spent nuclear fuel was transferred from the spent fuel pool to the onsite Independent Spent Fuel Storage Installation (ISFSI) for dry storage in January 2018 and most plant systems have been abandoned.

## 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 2019 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.

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 is shown on 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 intake pathway. Additionally, the Florida aquifer groundwater flows in a west-southwest direction across the site toward the Gulf of Mexico, and since the location 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.

Trace levels of Cs-137 are still occasionally seen in vegetation samples due to past global fallout. 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 2019 REMP samples 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, CR3 plant related radioactive material is occasionally 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, unless all values trended are measured values for that 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 - 2019**

**SAMPLE STATION LOCATIONS**

| SAMPLE MEDIA  | STATION ID     | DIRECTION | APPROX. DISTANCE<br>(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                        |
| C14G          |                | W         | 2.0                         |
| 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 - 2019

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           | 2.0              |
|                       | 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           | 2.0              |
| 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 - 2019**  
**SAMPLING AND ANALYSIS PROGRAM**

| SAMPLE MEDIA                   | # OF STATIONS | FREQUENCY  | ANALYSIS | LLD <sup>1</sup>        |                   |
|--------------------------------|---------------|------------|----------|-------------------------|-------------------|
| TLD                            | 32*           | Quarterly  | γ Dose   | ---                     |                   |
| Air Particulate                | 6             | Weekly     | Gross β  | 0.01 pCi/m <sup>3</sup> |                   |
|                                |               | 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>   |
|                                |               |            |          | 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 : | 2                       | 2                 |
| Site Ground Water <sup>6</sup> | 9             | Quarterly  | Tritium  | 2000 <sup>b</sup> pCi/L |                   |
|                                |               | Quarterly  | γ Spec : | 2                       | 2                 |
| Drinking Water                 | 3             | Quarterly  | Tritium  | 2000 <sup>b</sup> 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

<sup>1</sup> The maximum "a priori" LLD listed in the ODCM

<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

**TABLE I-2 (Cont'd)**  
**DUKE ENERGY FLORIDA, LLC- CR3 - 2019**  
**SAMPLING AND ANALYSIS PROGRAM**

| SAMPLE MEDIA                    | # OF STATIONS | FREQUENCY            | ANALYSIS | LLD <sup>1</sup> |            |
|---------------------------------|---------------|----------------------|----------|------------------|------------|
| Carnivorous Fish<br>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<br>Vegetation        | 3             | Monthly <sup>3</sup> | γ Spec : | 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

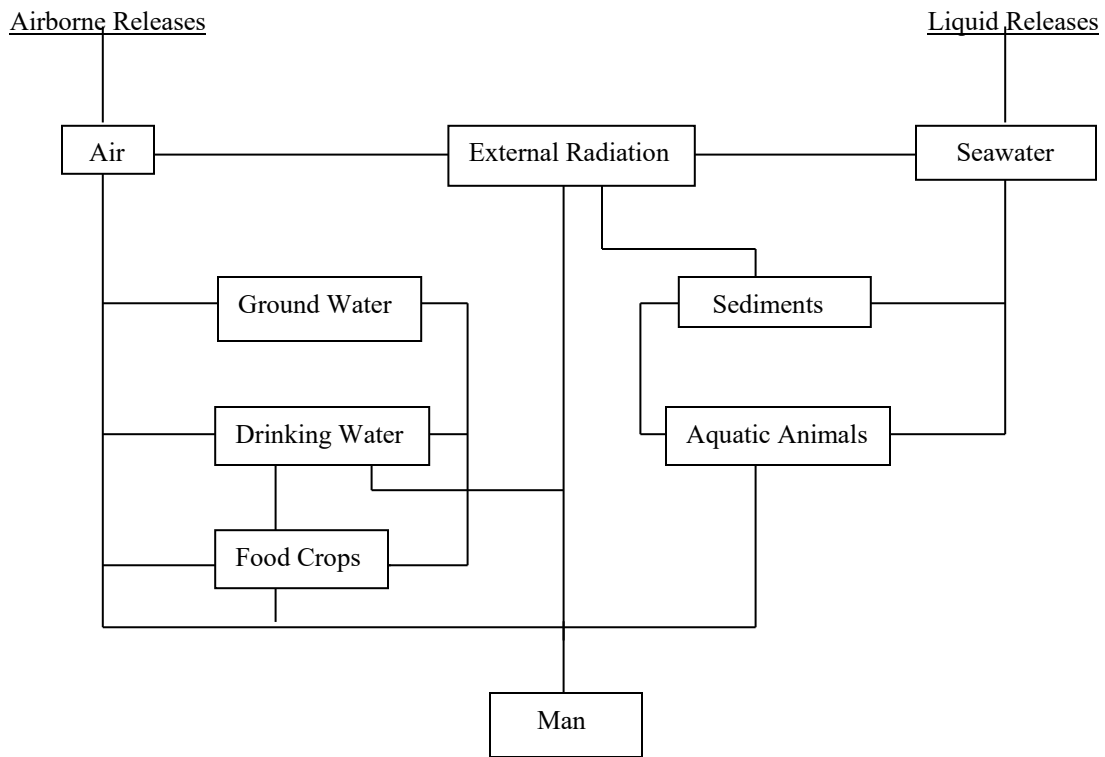


FIGURE I-1: Environmental Media and Exposure Pathways

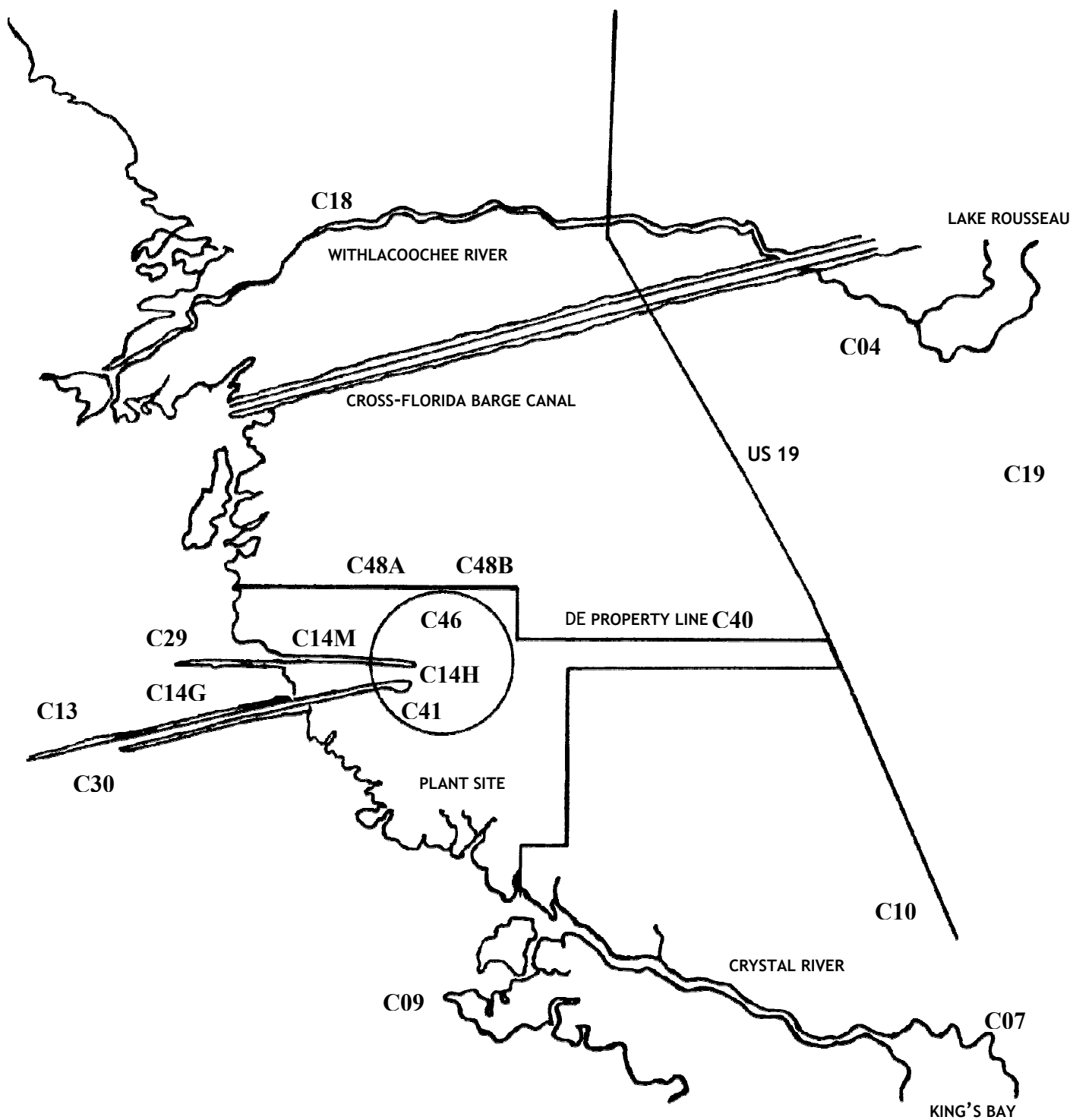
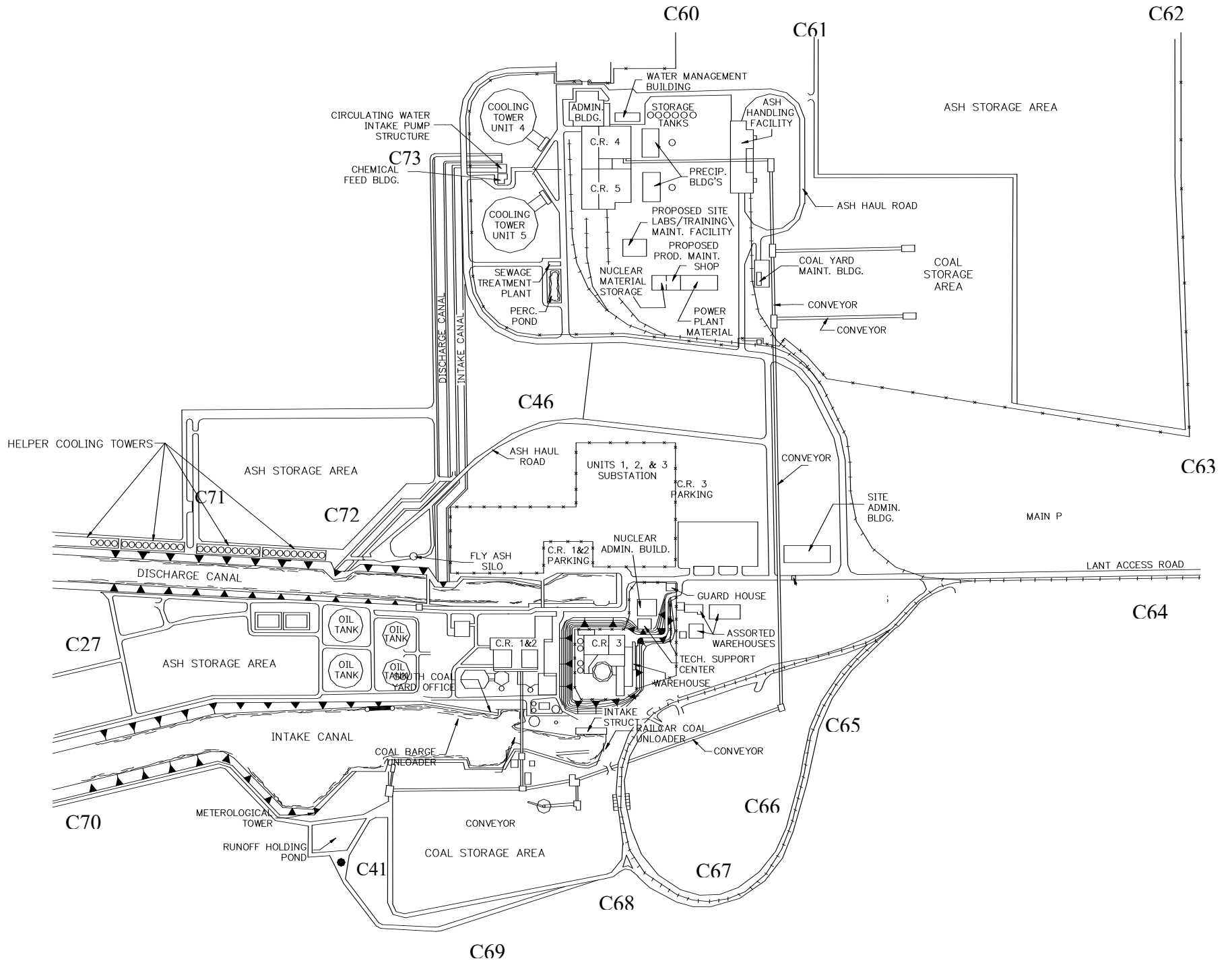


FIGURE I-2: Environmental Monitoring Sample Stations (non-TLDs)

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



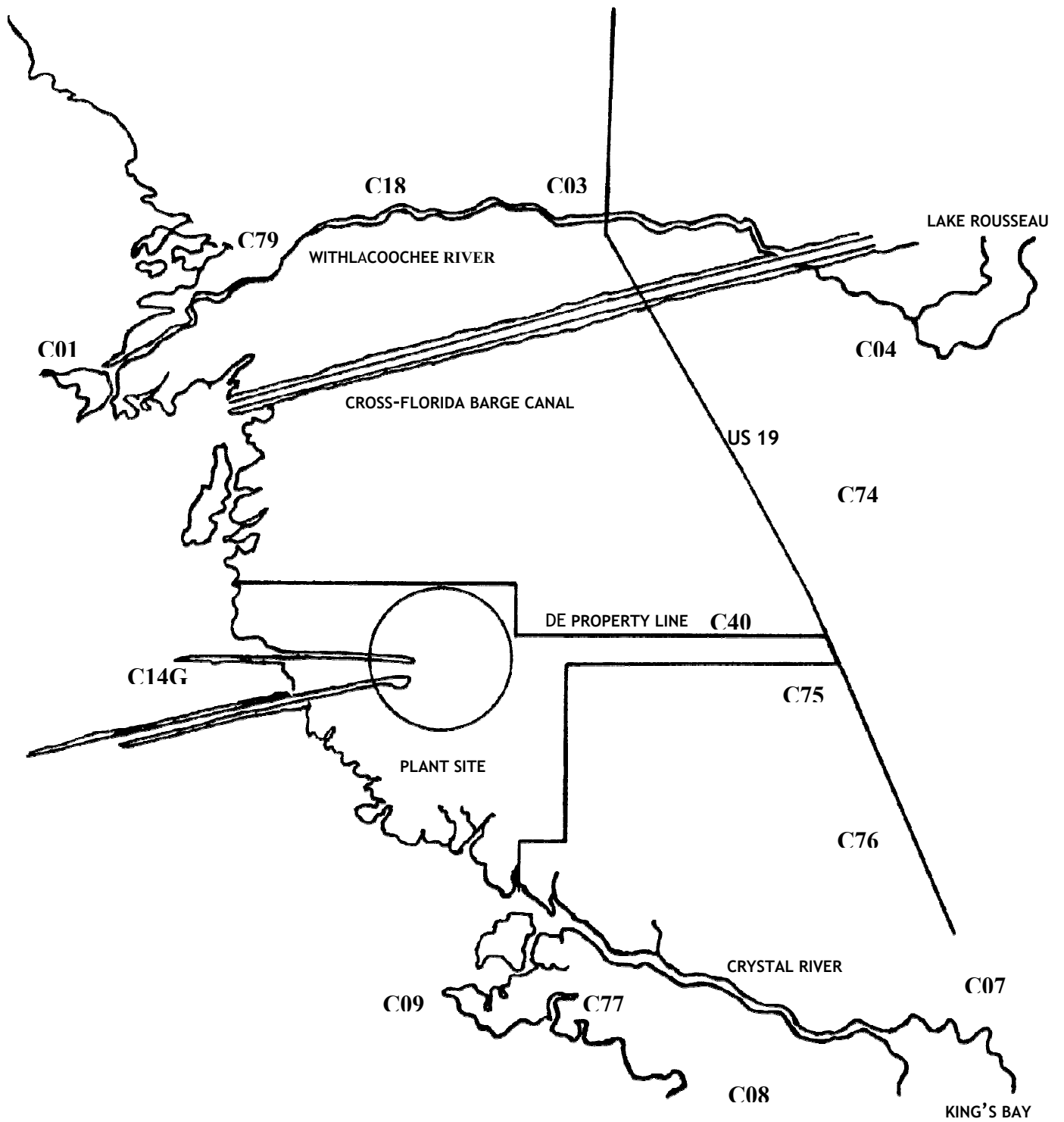
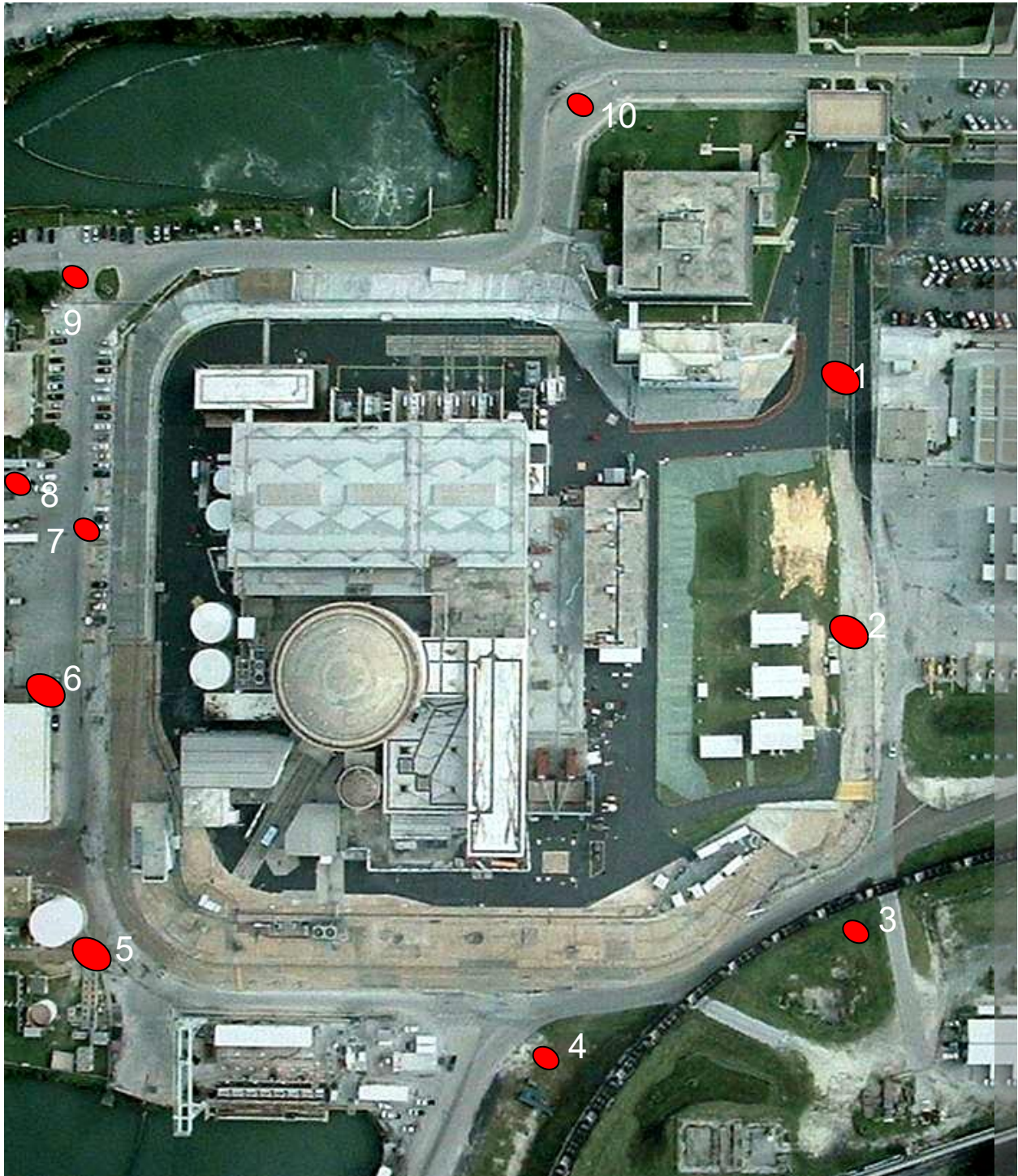


FIGURE I-4: Environmental Monitoring TLD Locations (off site)

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



## II. LAND-USE CENSUS

A 2019 land-use census was conducted in May and June. The purpose of the 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 changes from the prior August 2018 land-use census.

| SECTOR | NEAREST RESIDENCE | NEAREST GARDEN (A) | NEAREST MILK ANIMAL |
|--------|-------------------|--------------------|---------------------|
| N      | 4.5 @ 2°          | *                  | *                   |
| NNE    | 4.6 @ 15°         | *                  | *                   |
| NE     | 3.8 @ 54°         | *                  | *                   |
| ENE    | 3.4 @ 57°         | 4.4 miles @76 °    | *                   |
| E      | 2.4 @ 92°         | *                  | *                   |
| ESE    | 4.2 @ 102°        | *                  | *                   |
| SE     | 4.8 @ 133°        | *                  | *                   |
| SSE    | 3.5 @ 149°        | *                  | *                   |
| S      | *                 | *                  | *                   |
| SSW    | *                 | *                  | *                   |
| SW     | *                 | *                  | *                   |
| WSW    | *                 | *                  | *                   |
| W      | *                 | *                  | *                   |
| WNW    | *                 | *                  | *                   |
| NW     | 4.8 @ 321°        | *                  | *                   |
| NNW    | 4.6 @ 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). For 2019, all results were within the indicated Acceptance Ranges, as shown below.

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".

**MAPEP Results for June 2019:**

| Media      | Nuclide | Result  | % Bias | Acceptance Range    | Flag |
|------------|---------|---------|--------|---------------------|------|
| Air Filter | Cs-134  | 0.213   | -1.4   | 0.151-0.281         | A    |
| Air Filter | Cs-137  | 0.307   | 5.9    | 0.203-0.377         | A    |
| Air Filter | Zn-65   | 0.010   | -      | False Positive Test | A    |
| Air Filter | Co-60   | 0.357   | 5.0    | 0.238-0.442         | A    |
| Air Filter | Mn-54   | 0.596   | 9.0    | 0.383-0.711         | A    |
| Soil       | Cs-134  | 0.29    | -      | False Positive Test | A    |
| Soil       | Cs-137  | 1137.78 | -2.3   | 815-1513            | A    |
| Soil       | Co-57   | 0.35    | -      | False Positive Test | A    |
| Soil       | Co-60   | 822.15  | -3.8   | 599-1112            | A    |
| Soil       | Mn-54   | 1016.57 | -1.0   | 719-1335            | A    |
| Soil       | Zn-65   | 697.73  | 4.5    | 468-868             | A    |
| Vegetation | Cs-134  | 2.446   | 0.2    | 1.71-3.17           | A    |
| Vegetation | Cs-137  | 2.522   | 9.7    | 1.61-2.99           | A    |
| Vegetation | Co-57   | 2.359   | 14.0   | 1.45-2.69           | A    |
| Vegetation | Co-60   | 0.062   | -      | False Positive Test | A    |
| Vegetation | Mn-54   | 0.020   | -      | False Positive Test | A    |
| Vegetation | Zn-65   | 1.795   | 5.0    | 1.20-2.22           | A    |
| Water      | Cs-134  | 5.412   | -9.6   | 4.19-7.79           | A    |
| Water      | Cs-137  | 0.108   | -      | False Positive Test | A    |
| Water      | Co-60   | 6.360   | -5.1   | 4.7-8.7             | A    |
| Water      | Mn-54   | 8.262   | -1.6   | 5.9-10.9            | A    |
| Water      | Zn-65   | 0.136   | -      | False Positive Test | A    |
| *Water     | H-3     | 23,978  | NA     | 20,500-25,700       | A    |

\* Separate study performed using ERA RadChem™ Proficiency Testing (RAD-119). Study date 10/4/19. Results in units of pCi/liter.

#### IV-A. AIRBORNE PATHWAY

Air samples are taken at five locations near 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 318 gross beta samples.

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

In 2019, 318 particulate samples were analyzed for gross beta activity, and 317 had measurable activity above LLD. Location C07 showed less than MDA for the August 26<sup>th</sup> sample. The average indicator concentration was 18 pCi/1000 m<sup>3</sup> with a range of 7 to 50 pCi/1000 m<sup>3</sup>. In 2018 the average value was also 18 pCi/1000 m<sup>3</sup>. The average indicator concentration since 1996 has been in the range of 14 to 24 pCi/1000 m<sup>3</sup>. The control location concentration for 2019 averaged 17 pCi/1000 m<sup>3</sup>, with a range of 7 to 46 pCi/1000 m<sup>3</sup>. The control location in 2018 averaged 18 pCi/1000 m<sup>3</sup>. In 2019, location C18 (along with C7 and C41) had the highest yearly indicator concentration at 18 pCi/1000 m<sup>3</sup>. C40 was the highest location in 2018, with an average of 20 pCi/1000 m<sup>3</sup>.

Quarterly composite data are summarized in Table IV-A.3. In 2019, measurable quantities of cesium were not identified in any particulate filter sample. The highest cesium LLD was 1.1 pCi/1000 m<sup>3</sup> for Cs-137, versus 1.5 pCi/1000 m<sup>3</sup> in 2018.

The 2019 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 were five instances of an air sampler partial run time. They were identified during the routine weekly sample change-outs.

1. C46: 08-Jan-19 – No power. Estimated run time 113.5 out of 140.6 hours. Power restored later the same day. (Documented in CR3 NCR 2251529)
2. C41: 18-Feb-19 – No power. Power restored later the same day. Normal flow rate and run time.
3. C47: 22-Jul-19 – No power. Estimated run time 122.6 out of 144 hours. GFI breaker was tripped. Power restored.
4. C41: 09-Dec-19 – No power. Normal flow rate and run time.
5. C41: 16-Dec-19 – No power. Estimated run time 100.3 out of 169 hours.

The yearly percentages of missed (zero) or partial air samples (five) was less than 2% of the total indicator samples (265) collected.

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, 2019

| 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 |
|---|---|---|------------------------------------|--|-------------------|-----------------------------|--|
| AIRBORNE PARTICULATES (pCi/1000m <sup>3</sup> for Gross β, pCi/1000m <sup>3</sup> for γ Spec) | Gross β 318<br>γ Spec 24                        | 4.0   | 18 (265/265) (<1-50)               | *C18<br>5.3 miles North                            | 18 (53/53) (7-50) | 18 (53/53) (7-46)           | 0  |
|   | Cs-134  | 1.7   | <LLD                               | --   | --                | <LLD                        | 0  |
|   | Cs-137  | 1.5   | <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.

\*Locations C7 and C18 also had a mean of 20 pCi/m<sup>3</sup>.

**TABLE IV-A.2**  
**DUKE ENERGY FLORIDA, LLC- CR3 - 2019**  
**pCi/1000m<sup>3</sup> GROSS  $\beta$  IN AIR**

| Collection Date | SAMPLE SITE |     |     |     |     |     |
|-----------------|-------------|-----|-----|-----|-----|-----|
|                 | C07         | C18 | C40 | C41 | C46 | C47 |
| 02-Jan-19       | 16          | 13  | 13  | 9   | 13  | 13  |
| 08-Jan-19       | 19          | 15  | 12  | 17  | 17  | 16  |
| 15-Jan-19       | 19          | 21  | 18  | 21  | 17  | 22  |
| 22-Jan-19       | 21          | 17  | 19  | 17  | 17  | 19  |
| 28-Jan-19       | 17          | 17  | 20  | 17  | 16  | 14  |
| 05-Feb-19       | 19          | 15  | 15  | 11  | 14  | 12  |
| 11-Feb-19       | 20          | 22  | 20  | 25  | 19  | 16  |
| 18-Feb-19       | 15          | 19  | 16  | 19  | 14  | 14  |
| 25-Feb-19       | 10          | 10  | 12  | 12  | 12  | 12  |
| 05-Mar-19       | 12          | 13  | 12  | 15  | 13  | 13  |
| 13-Mar-19       | 23          | 22  | 22  | 15  | 17  | 18  |
| 19-Mar-19       | 31          | 17  | 23  | 26  | 28  | 25  |
| 26-Mar-19       | 26          | 26  | 27  | 28  | 31  | 27  |
| Average:        | 18          | 17  | 17  | 17  | 17  | 16  |

**TABLE IV-A.2 (Cont'd)**  
**DUKE ENERGY FLORIDA, LLC- CR3 - 2019**  
**pCi/1000m<sup>3</sup> GROSS β IN AIR**

| Collection Date | SAMPLE SITE |           |           |           |           |           |
|-----------------|-------------|-----------|-----------|-----------|-----------|-----------|
|                 | C07         | C18       | C40       | C41       | C46       | C47       |
| 02-Apr-19       | 14          | 14        | 12        | 14        | 12        | 13        |
| 09-Apr-19       | 20          | 16        | 15        | 14        | 20        | 16        |
| 16-Apr-19       | 13          | 12        | 10        | 13        | 12        | 15        |
| 23-Apr-19       | 16          | 14        | 12        | 17        | 17        | 17        |
| 30-Apr-19       | 21          | 23        | 20        | 15        | 19        | 19        |
| 07-May-19       | 14          | 7         | 10        | 13        | 12        | 12        |
| 15-May-19       | 15          | 14        | 13        | 15        | 11        | 16        |
| 21-May-19       | 29          | 25        | 25        | 37        | 30        | 24        |
| 28-May-19       | 28          | 23        | 27        | 26        | 28        | 27        |
| 04-Jun-19       | 16          | 19        | 18        | 17        | 19        | 17        |
| 11-Jun-19       | 12          | 11        | 12        | 13        | 15        | 12        |
| 18-Jun-19       | 11          | 9         | 14        | 11        | 12        | 12        |
| 25-Jun-19       | 29          | 23        | 22        | 27        | 26        | 25        |
| Average         | <b>17</b>   | <b>15</b> | <b>16</b> | <b>17</b> | <b>17</b> | <b>17</b> |

**TABLE IV-A.2 (Cont'd)**  
**DUKE ENERGY FLORIDA, LLC- CR3 - 2019**  
**pCi/1000m<sup>3</sup> GROSS  $\beta$  IN AIR**

| Collection Date | SAMPLE SITE |           |           |           |           |           |
|-----------------|-------------|-----------|-----------|-----------|-----------|-----------|
|                 | C07         | C18       | C40       | C41       | C46       | C47       |
| 02-Jul-19       | 22          | 21        | 20        | 27        | 15        | 21        |
| 8-Jul-19        | 19          | 20        | 16        | 15        | 19        | 17        |
| 16-Jul-19       | 20          | 18        | 17        | 22        | 20        | 16        |
| 22-Jul-19       | 15          | 13        | 15        | 12        | 12        | 11        |
| 29-Jul-19       | 6           | 8         | 7         | 8         | 7         | 8         |
| 06-Aug-19       | 11          | 11        | 11        | 10        | 10        | 9         |
| 12-Aug-19       | 15          | 13        | 14        | 21        | 15        | 15        |
| 20-Aug-19       | 13          | 14        | 9         | 13        | 13        | 15        |
| 26-Aug-19       | 0           | 12        | 9         | 9         | 9         | 7         |
| 05-Sep-19       | 17          | 11        | 13        | 13        | 10        | 13        |
| 11-Sep-19       | 47          | 50        | 37        | 45        | 41        | 46        |
| 17-Sep-19       | 26          | 30        | 31        | 34        | 25        | 27        |
| 24-Sep-19       | 25          | 22        | 18        | 26        | 24        | 19        |
| Average         | <b>18</b>   | <b>19</b> | <b>17</b> | <b>20</b> | <b>17</b> | <b>17</b> |

**TABLE IV-A.2 (Cont'd)**  
**DUKE ENERGY FLORIDA, LLC- CR3 - 2019**  
**pCi/1000m<sup>3</sup> GROSS  $\beta$  IN AIR**

| Collection Date | SAMPLE SITE |           |           |           |           |           |
|-----------------|-------------|-----------|-----------|-----------|-----------|-----------|
|                 | C07         | C18       | C40       | C41       | C46       | C47       |
| 01-Oct-19       | 30          | 33        | 31        | 31        | 31        | 33        |
| 08-Oct-19       | 18          | 20        | 14        | 21        | 16        | 15        |
| 15-Oct-19       | 17          | 14        | 16        | 15        | 11        | 12        |
| 22-Oct-19       | 19          | 17        | 18        | 17        | 17        | 19        |
| 29-Oct-19       | 12          | 12        | 17        | 15        | 14        | 12        |
| 04-Nov-19       | 23          | 15        | 16        | 18        | 22        | 20        |
| 12-Nov-19       | 21          | 19        | 16        | 18        | 16        | 13        |
| 19-Nov-19       | 14          | 17        | 16        | 20        | 16        | 17        |
| 25-Nov-19       | 28          | 27        | 26        | 26        | 28        | 26        |
| 03-Dec-19       | 20          | 24        | 24        | 21        | 21        | 23        |
| 09-Dec-19       | 22          | 24        | 19        | 20        | 19        | 22        |
| 16-Dec-19       | 14          | 16        | 8         | 28        | 16        | 10        |
| 23-Dec-19       | 16          | 16        | 13        | 13        | 11        | 10        |
| 30-Dec-19       | 12          | 13        | 8         | 11        | 12        | 8         |
| Average         | <b>19</b>   | <b>19</b> | <b>17</b> | <b>19</b> | <b>18</b> | <b>17</b> |

TABLE IV-A.3

DUKE ENERGY FLORIDA, LLC- CR3 - 2019

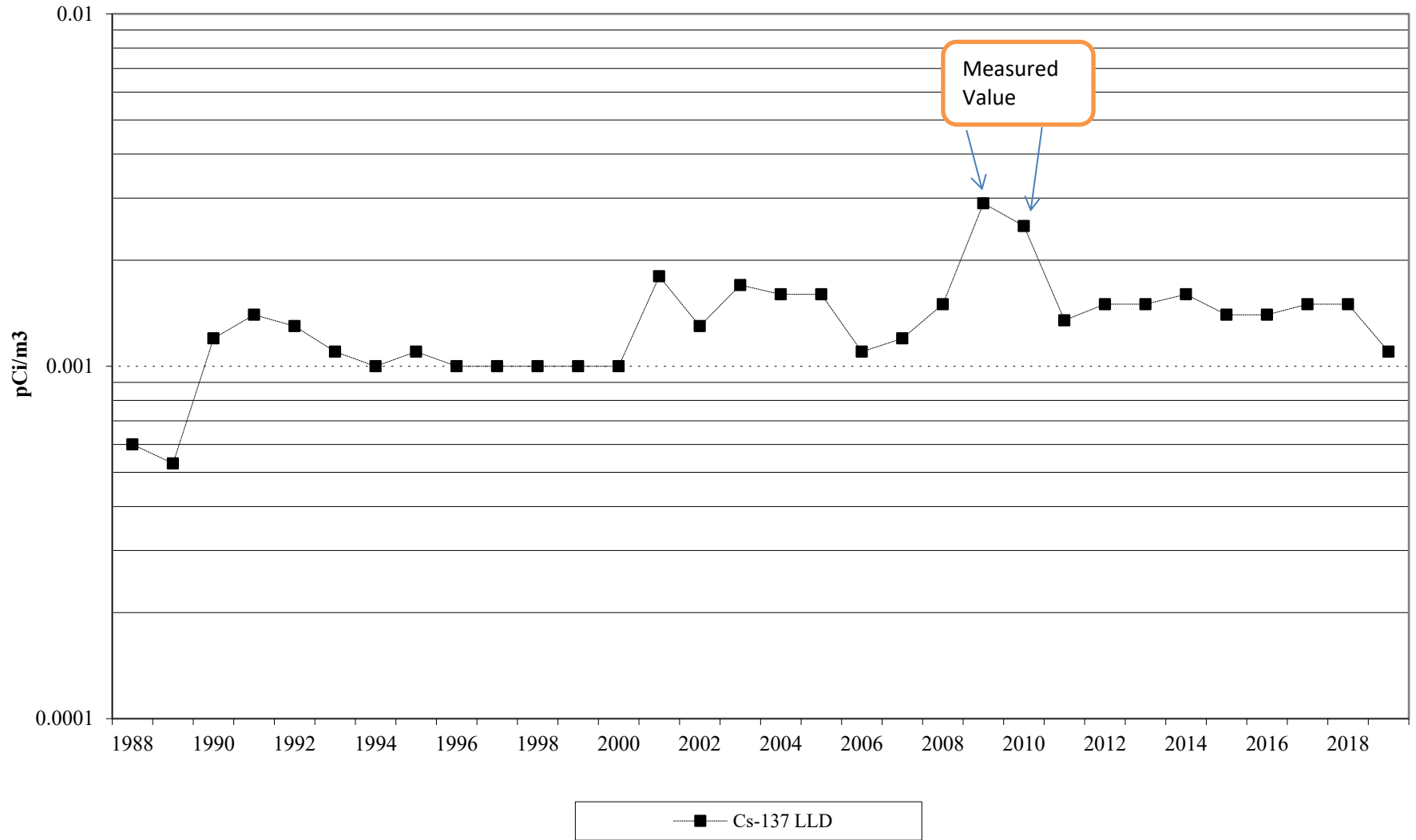
pCi/1000m<sup>3</sup> γ EMITTERS IN QUARTERLY COMPOSITES OF AIR PARTICULATES

| STATION | NUCLIDE | FIRST QUARTER | SECOND QUARTER | THIRD QUARTER | FOURTH QUARTER |
|---------|---------|---------------|----------------|---------------|----------------|
| C07     | Be-7    | 152           | 136            | 107           | 143            |
|         | K-40    | <16           | <15            | <19           | <13            |
|         | Cs-134  | <0.8          | <1             | <0.8          | <0.9           |
|         | Cs-137  | <1            | <1             | <1.1          | <1             |
| C18     | Be-7    | 139           | 170            | 112           | 129            |
|         | K-40    | <15           | <22            | <13           | <18            |
|         | Cs-134  | <0.9          | <0.9           | <0.9          | <0.8           |
|         | Cs-137  | <0.9          | <1.1           | <1.1          | <0.8           |
| C40     | Be-7    | 155           | 147            | 117           | 150            |
|         | K-40    | <15           | <12            | <18           | <15            |
|         | Cs-134  | <1            | <1             | <0.8          | <0.8           |
|         | Cs-137  | <1.1          | <1             | <1            | <0.8           |
| C41     | Be-7    | 161           | 193            | 120           | 140            |
|         | K-40    | <22           | <23            | <14           | <22            |
|         | Cs-134  | <0.9          | <1.1           | <0.9          | <0.9           |
|         | Cs-137  | <1            | <1.1           | <1            | <1             |
| C46     | Be-7    | 126           | 167            | 95            | 126            |
|         | K-40    | <21           | <15            | <22           | <13            |
|         | Cs-134  | <0.9          | <1             | <0.8          | <0.8           |
|         | Cs-137  | <1.1          | <1             | <0.8          | <0.8           |
| C47     | Be-7    | 150           | 58             | 118           | 149            |
|         | K-40    | <11           | <22            | <14           | <19            |
|         | Cs-134  | <1            | <1.1           | <1.1          | <0.6           |
|         | Cs-137  | <0.9          | <1.1           | <1            | <1             |



**Airborne (highest values plotted)**

2011 Measured Values due to Fukushima Event



## IV-B. DIRECT RADIATION

Direct radiation measurements (using TLDs) were taken at 31 locations surrounding the plant, and at one control location 78 miles from the site (C47). Of the 124 non-control quarterly TLDs, 122 were collected. Location C77 could not be collected during the 4th quarter as the siren pole was found removed during routine changeout (NCR 2309368). A new TLD was placed on an adjacent pole. The TLD at Location C70 was not collected during the 3<sup>rd</sup> quarter as it was found missing. It is noted that location C78 has been abandoned and a TLD is no longer being monitored here. This location is on the far west end of the canal road leading out in the Gulf of Mexico and is no longer readily accessible as its access road is not being maintained.

Table IV-B provides a statistical summary of the analytical results for 124 non-control TLDs sampled throughout the year.

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

In 2019, the highest annual average on-site dose was 56 mrem at station C71 (WNW at 3600 feet). It was also the highest in 2018 at 55 mrem and in 2017 at 51 mrem. 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 42 mrem at station C65 (ESE at 1743 feet southeast of the coal rail loop). These were the same two locations with the highest onsite dose as in 2018.

The highest annual average off-site dose was 38 mrem at station C40 (east at 3.5 miles). This was also the same location which the highest recorded dose in 2018 also at 38 mrem. The control station (C47) average annual dose was 33 mrem in 2019 versus 35 mrem in 2018. The average for all stations (except control) was 35 mrem for 2019 versus 36 mrem for 2018. Direct radiation results in 2019 are similar to previous results and do not show any indication of a trend.

The Independent Spent Fuel Storage Installation (ISFSI) pad was loaded with the final fuel cask in January 2018. Calculation N16-0003, performed prior to fuel movement into dry storage, documents a conservative annual dose estimate at 700 meters from the ISFSI pad of about 0.06 mrem. A distance of 700 meters is well within the site boundary owner controlled area in all directions. This small dose is not distinguishable from normal background fluctuations of several mrem per year as measured by the REMP TLDs. These TLDs are deployed in the controlled area, at locations adjacent to the site boundary, and at offsite locations. REMP TLD results for 2019 show no detectable changes in dose beyond the expected fluctuations. Based on this, and also including the dose contributions from effluent releases, the 40 CFR 190 dose limit was not exceeded in 2019.

TABLE IV-B

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA

JANUARY 1 TO DECEMBER 31, 2019

| 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<br>DISTANCE & BEARING | MEAN RANGE            | CONTROL LOCATION MEAN RANGE | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |
|-----------------------------------|---|--------------------------------|---|--|-----------------------|-----------------------------|--|
| DIRECT RADIATION (mrem/yr)        | $\gamma$ DOSE, 124                              | 15                             | 35 (122/124)<br>(27 - 57)                 | C71<br>0.6 @ 296°  | 56 (4/4)<br>(52 - 57) | 33 (4/4)<br>(31 - 36)       | 0  |

TABLE IV-B.1

## DUKE ENERGY FLORIDA, LLC- CR-3 - 2019

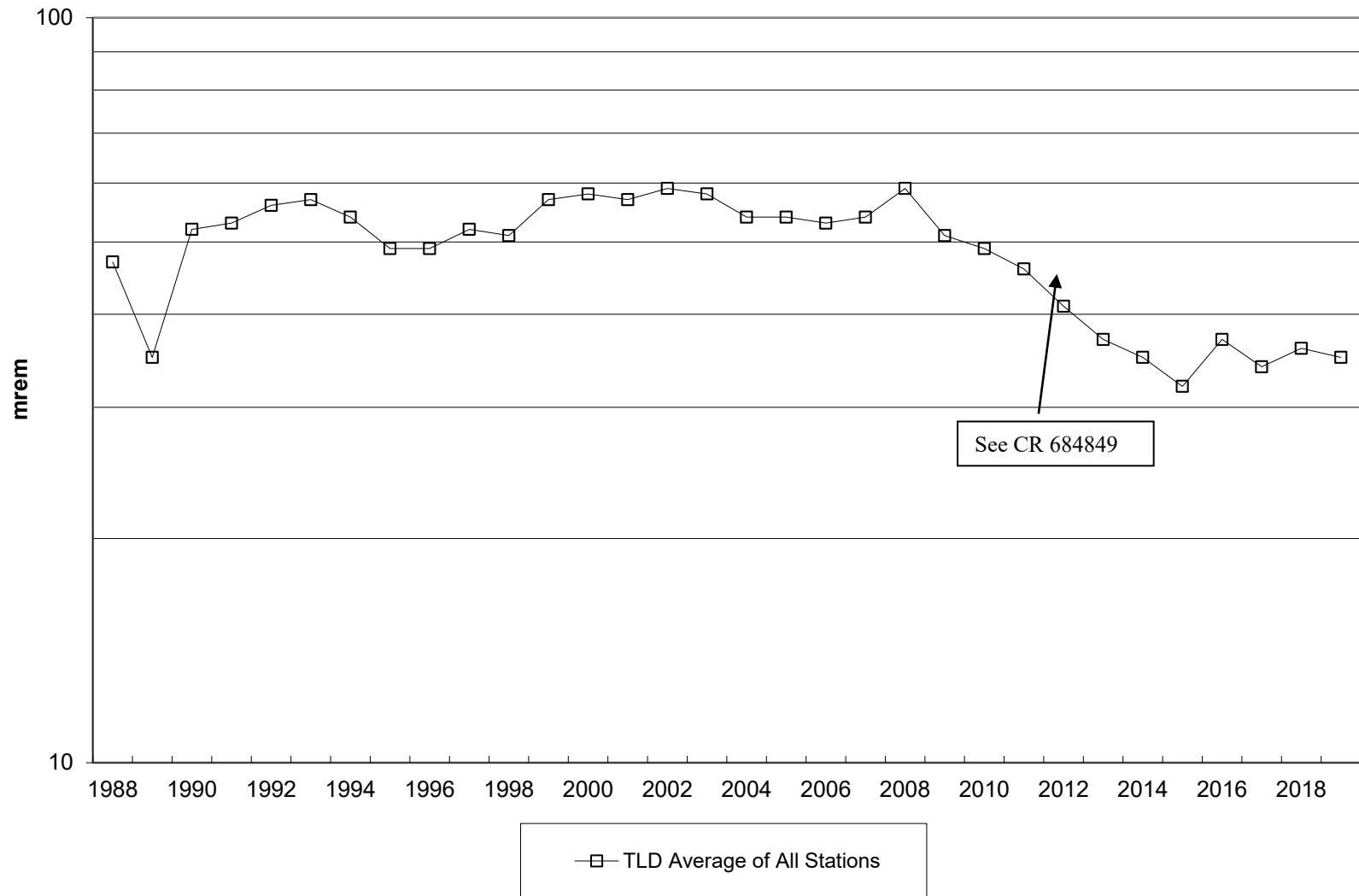
Annual gamma ( $\gamma$ ) Dose (mrem)

| TLD STATION   | Quarter | 1         | 2         | 3         | 4         |
|---------------|---------|-----------|-----------|-----------|-----------|
| C01           |         | 27        | 29        | 27        | 28        |
| C03           |         | 28        | 29        | 28        | 30        |
| C04           |         | 27        | 28        | 29        | 29        |
| C07*          |         | 28        | 28        | 29        | 29        |
| C08           |         | 28        | 27        | 27        | 29        |
| C09           |         | 27        | 27        | 28        | 28        |
| C14G          |         | 32        | 35        | 33        | 34        |
| C18           |         | 30        | 32        | 30        | 33        |
| C27           |         | 38        | 42        | 39        | 41        |
| C40*          |         | 37        | 40        | 38        | 39        |
| C41           |         | 34        | 33        | 34        | 35        |
| C46*          |         | 34        | 37        | 37        | 39        |
| C47 (CONTROL) |         | 34        | 36        | 31        | 31        |
| C60           |         | 35        | 34        | 35        | 34        |
| C61           |         | 35        | 38        | 36        | 37        |
| C62           |         | 36        | 39        | 38        | 39        |
| C63           |         | 38        | 39        | 37        | 38        |
| C64           |         | 35        | 37        | 34        | 34        |
| C65           |         | 40        | 42        | 41        | 43        |
| C66           |         | 37        | 39        | 37        | 39        |
| C67           |         | 39        | 42        | 38        | 40        |
| C68           |         | 36        | 38        | 36        | 38        |
| C69           |         | 38        | 41        | 38        | 40        |
| C70           |         | 38        | 39        |           | 46        |
| C71           |         | <b>57</b> | <b>57</b> | <b>52</b> | <b>56</b> |
| C72           |         | 37        | 39        | 36        | 38        |
| C73           |         | 33        | 34        | 33        | 35        |
| C74           |         | 27        | 27        | 27        | 28        |
| C75           |         | 33        | 34        | 35        | 34        |
| C76           |         | 31        | 31        | 30        | 33        |
| C77           |         | 32        | 36        | 32        |           |
| C79           |         | 30        | 33        | 30        | 32        |

\*TLDs not required by the ODCM.

\*\*C78 has been removed and will not be reported going forward.

### 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. In 2019, of twenty-four indicator samples, none had measurable tritium.

Gamma spectral analysis was performed on all thirty-six samples, (including the 12 control samples at C13) and none of them 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. In 2019, 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 ODCM 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. The C40 groundwater sample used to taken from pump #5. However, this pump was retired in 2019 so the second sample (August) was obtained from pump #12 which is close to pump #5. The first sample (February) was obtained from pump #5.

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 (See Figure 1-5). 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 known leaking plant components.
4. In 2019, one groundwater well - CR3-5 - continued to show tritium at very low concentrations above LLD, same as in 2018. No other well showed tritium concentrations positively greater than LLD levels in 2019. Well CR3-5 had an average tritium concentration of 240 pCi/L with a range of 188 to 305 pCi/L based on all four quarterly samples. This compares to an average value of 440 pCi/l in 2018 and thus represents a slight decrease.

Along with these wells, two other wells that are not presently part of the REMP program were 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 wells did not show tritium concentrations above LLD levels in 2019, same as in 2018.

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

There have 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. As already noted, site ground water flows in a west-southwest direction toward the Gulf of Mexico. This flow was re-verified in 2016, after the ISFSI pad sub-surface construction was completed, with a new ground water flow study performed by a certified hydro-geologist as part of the NEI Ground Water Protection Initiative. In 2012 a previous 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 studies 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 or the ISFSI pad.

It is noted that 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.

5. Monthly non-REMP required well samples were collected as discussed in item #4 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, 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 2019, none of the samples yielded measurable activities of tritium or the required gamma emitters. The measurement sensitivity for drinking water samples is 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. Higher than usual Co-60 was detected in the three February 2019 samples – 67, 29 and 394 pCi/kg, for locations C14H, C14M and C14G, respectively. These locations all showed less than LLD when resampled in August 2019. Cs-137 results showed two of the three locations (C14M and C14G) with positive results in February (17 and 64 pCi/kg, respectively). For the August set of samples, only C14M showed Cs-137 above LLD at 13 pCi/Kg.

In 2018, one of the six samples showed Cs-137 above LLD levels (location C14M had  $6\pm 2$  pCi/kg in the Aug 2018 sample). This is very close to the LLD value.

In 2017, one of the six samples showed Cs-137 above LLD levels (location C14M had 23 pCi/kg Cs-137 in the Aug 2017 sample). None of the other samples showed CR3 licensed activity above LLD values. In 2016, one of the six

samples had measurable amounts of Cs-137, at the same C14M location with a value of 21 pCi/kg. In 2015, three samples showed small concentrations of Cs-137.

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

The 2019 shoreline sediment results from the February samples were higher in Co-60 and Cs-137 than 2018 but the August set of samples were similar to 2018 results. There is not trend present. 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. There were no unmonitored spills or releases of radioactive material in 2019 that had 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, 2019

| 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 |                             |  |
| SEAWATER (pCi/L)                  | <u>Tritium, 36</u>                              | 157   | <LLD                    |                            |            | <LLD                        | 0  |
|                                   | <u>γ Spec, 36</u>                               |   |                         |                            |            |                             |  |
|                                   | 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   | 15  | <LLD                    | --                         | --         | <LLD                        | 0  |
|                                   | Zr-Nb-95  | 10  | <LLD                    | --                         | --         | <LLD                        | 0  |
|                                   | Cs-134  | 6   | <LLD                    | --                         | --         | <LLD                        | 0  |
|                                   | Cs-137  | 7   | <LLD                    | --                         | --         | <LLD                        | 0  |
| Ba-La-140                         | 21  | <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**  
**DUKE ENERGY FLORIDA, LLC- CR3 - 2019**  
**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 | Cs-134 | Cs-137 | Ba-La-140 |
|---------|-------|------|--------|-------|-------|-------|-------|-------|----------|--------|--------|-----------|
| C13     | JAN   | <145 | 180±18 | <3    | <3    | <6    | <3    | <8    | <5       | <3     | <3     | <8        |
|         | FEB   | <142 | 178±18 | <3    | <3    | <7    | <3    | <9    | <5       | <3     | <3     | <8        |
|         | MAR   | <141 | 231±20 | <3    | <3    | <6    | <4    | <7    | <5       | <3     | <3     | <6        |
|         | APR   | <141 | 247±21 | <4    | <3    | <7    | <3    | <7    | <6       | <3     | <3     | <5        |
|         | MAY   | <134 | 175±36 | <6    | <6    | <10   | <7    | <15   | <9       | <6     | <5     | <11       |
|         | JUN   | <141 | 230±20 | <3    | <3    | <6    | <3    | <8    | <5       | <3     | <3     | <7        |
|         | JUL   | <135 | 199±19 | <3    | <3    | <7    | <3    | <7    | <5       | <3     | <4     | <10       |
|         | AUG   | <138 | 240±30 | <6    | <6    | <13   | <7    | <12   | <9       | <5     | <7     | <21       |
|         | SEP   | <142 | 213±30 | <6    | <5    | <12   | <5    | <11   | <9       | <5     | <6     | <11       |
|         | OCT   | <143 | 241±21 | <3    | <3    | <7    | <3    | <4    | <6       | <3     | <4     | <6        |
|         | NOV   | <142 | 281±22 | <3    | <3    | <6    | <4    | <7    | <5       | <3     | <3     | <7        |
|         | DEC   | <138 | 191±19 | <3    | <3    | <7    | <3    | <7    | <5       | <3     | <3     | <11       |
| C14G    | JAN   | <145 | 185±19 | <3    | <3    | <6    | <3    | <7    | <5       | <3     | <3     | <11       |
|         | FEB   | <142 | 192±18 | <3    | <3    | <7    | <3    | <7    | <6       | <3     | <4     | <6        |
|         | MAR   | <141 | 120±15 | <3    | <3    | <6    | <3    | <6    | <5       | <3     | <3     | <7        |
|         | APR   | <141 | 241±37 | <6    | <5    | <11   | <6    | <11   | <11      | <4     | <6     | <14       |
|         | MAY   | <134 | 165±19 | <3    | <3    | <7    | <3    | <8    | <6       | <3     | <4     | <6        |
|         | JUN   | <141 | 272±22 | <3    | <3    | <6    | <3    | <8    | <5       | <3     | <3     | <7        |
|         | JUL   | <135 | 206±18 | <4    | <3    | <7    | <4    | <7    | <6       | <3     | <3     | <13       |
|         | AUG   | <136 | 143±16 | <4    | <3    | <7    | <3    | <8    | <6       | <3     | <4     | <11       |
|         | SEP   | <142 | 190±19 | <3    | <3    | <6    | <4    | <7    | <6       | <3     | <3     | <5        |
|         | OCT   | <143 | 281±32 | <5    | <6    | <11   | <6    | <14   | <10      | <5     | <6     | <9        |
|         | NOV   | <142 | 277±22 | <3    | <3    | <7    | <3    | <7    | <6       | <3     | <3     | <8        |
|         | DEC   | <138 | 219±20 | <4    | <3    | <8    | <4    | <8    | <5       | <3     | <4     | <11       |

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

DUKE ENERGY FLORIDA, LLC- CR3 - 2019

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 | Cs-134 | Cs-137 | Ba-La-140 |
|---------|-------|------|--------|-------|-------|-------|-------|-------|----------|--------|--------|-----------|
| C14H    | JAN   | <145 | 220±20 | <3    | <4    | <7    | <4    | <7    | <5       | <3     | <3     | <8        |
|         | FEB   | <142 | 290±22 | <3    | <3    | <8    | <4    | <7    | <6       | <3     | <4     | <4        |
|         | MAR   | <141 | 267±22 | <3    | <4    | <7    | <3    | <8    | <6       | <3     | <3     | <7        |
|         | APR   | <141 | 312±23 | <3    | <3    | <6    | <3    | <8    | <5       | <3     | <3     | <5        |
|         | MAY   | <134 | 236±36 | <5    | <6    | <12   | <5    | <12   | <10      | <5     | <6     | <6        |
|         | JUN   | <141 | 281±40 | <5    | <6    | <13   | <6    | <15   | <9       | <5     | <7     | <14       |
|         | JUL   | <135 | 148±34 | <6    | <6    | <10   | <7    | <13   | <10      | <5     | <6     | <21       |
|         | AUG   | <136 | 251±21 | <3    | <3    | <6    | <3    | <7    | <5       | <3     | <3     | <10       |
|         | SEP   | <142 | 292±36 | <6    | <6    | <11   | <6    | <11   | <10      | <6     | <7     | <10       |
|         | OCT   | <143 | 261±21 | <3    | <3    | <7    | <3    | <7    | <5       | <3     | <3     | <6        |
|         | NOV   | <140 | 258±22 | <3    | <2    | <6    | <4    | <8    | <6       | <3     | <3     | <7        |
|         | DEC   | <139 | 208±19 | <3    | <3    | <6    | <3    | <9    | <5       | <3     | <4     | <10       |

# Seawater

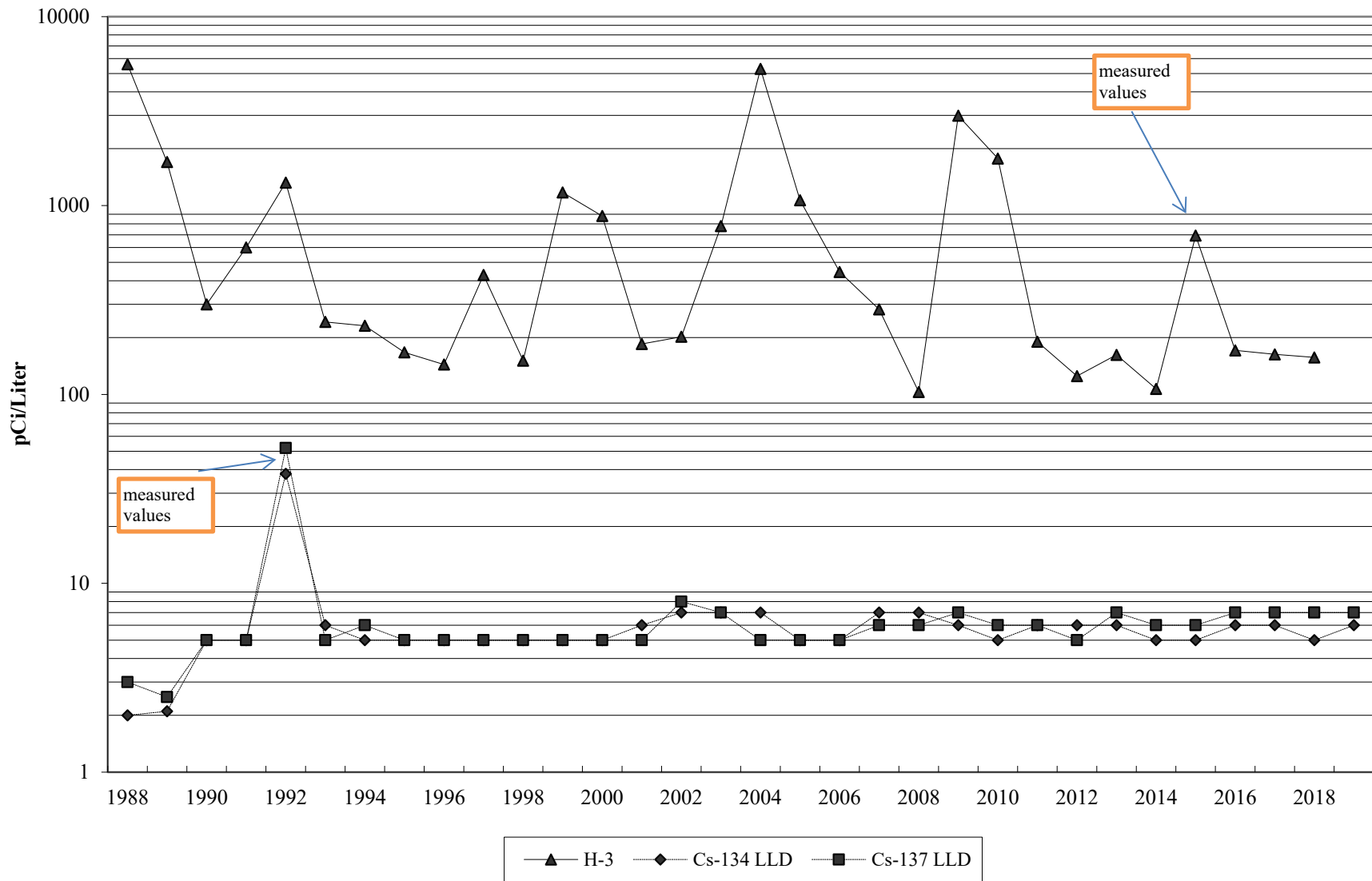


TABLE IV-C.2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA

JANUARY 1 TO DECEMBER 31, 2019

| 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 |                             |  |
| GROUND WATER <sup>2</sup><br>(pCi/L) | <u>Tritium, 2</u>                               | 143   | <LLD                    | --                         | --         | <LLD                        | 0  |
|                                      | <u>γ Spec, 2</u>                                |   |                         |                            |            |                             |  |
|                                      | Mn-54   | 7   | <LLD                    | --                         | --         | <LLD                        | 0  |
|                                      | Fe-59   | 13  | <LLD                    | --                         | --         | <LLD                        | 0  |
|                                      | Co-58   | 7   | <LLD                    | --                         | --         | <LLD                        | 0  |
|                                      | Co-60   | 7   | <LLD                    | --                         | --         | <LLD                        | 0  |
|                                      | Zn-65   | 16  | <LLD                    | --                         | --         | <LLD                        | 0  |
|                                      | Zr-Nb-95  | 12  | <LLD                    | --                         | --         | <LLD                        | 0  |
|                                      | Cs-134  | 7   | <LLD                    | --                         | --         | <LLD                        | 0  |
|                                      | Cs-137  | 8   | <LLD                    | --                         | --         | <LLD                        | 0  |
| Ba-La-140                            | 27  | <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> There is no drinking water uptake pathway at the Crystal River site.

**TABLE IV-C.2.a**  
**DUKE ENERGY FLORIDA, LLC- CR3 - 2019**  
**pCi/L  $\gamma$  EMITTERS AND TRITIUM IN GROUND WATER**

| STATION | NUCLIDE   | FIRST HALF | SECOND HALF |
|---------|-----------|------------|-------------|
| C40     | H-3       | <159       | <143        |
|         | Mn-54     | <5         | <4          |
|         | Fe-59     | <8         | <8          |
|         | Co-58     | <4         | <3          |
|         | Co-60     | <4         | <3          |
|         | Zn-65     | <11        | <9          |
|         | Zr-Nb-95  | <7         | <5          |
|         | Cs-134    | <4         | <4          |
|         | Cs-137    | <5         | <4          |
|         | Ba-La-140 | <16        | <8          |
|         | K-40      | <43        | <42         |

### Semi-Annual Ground Water

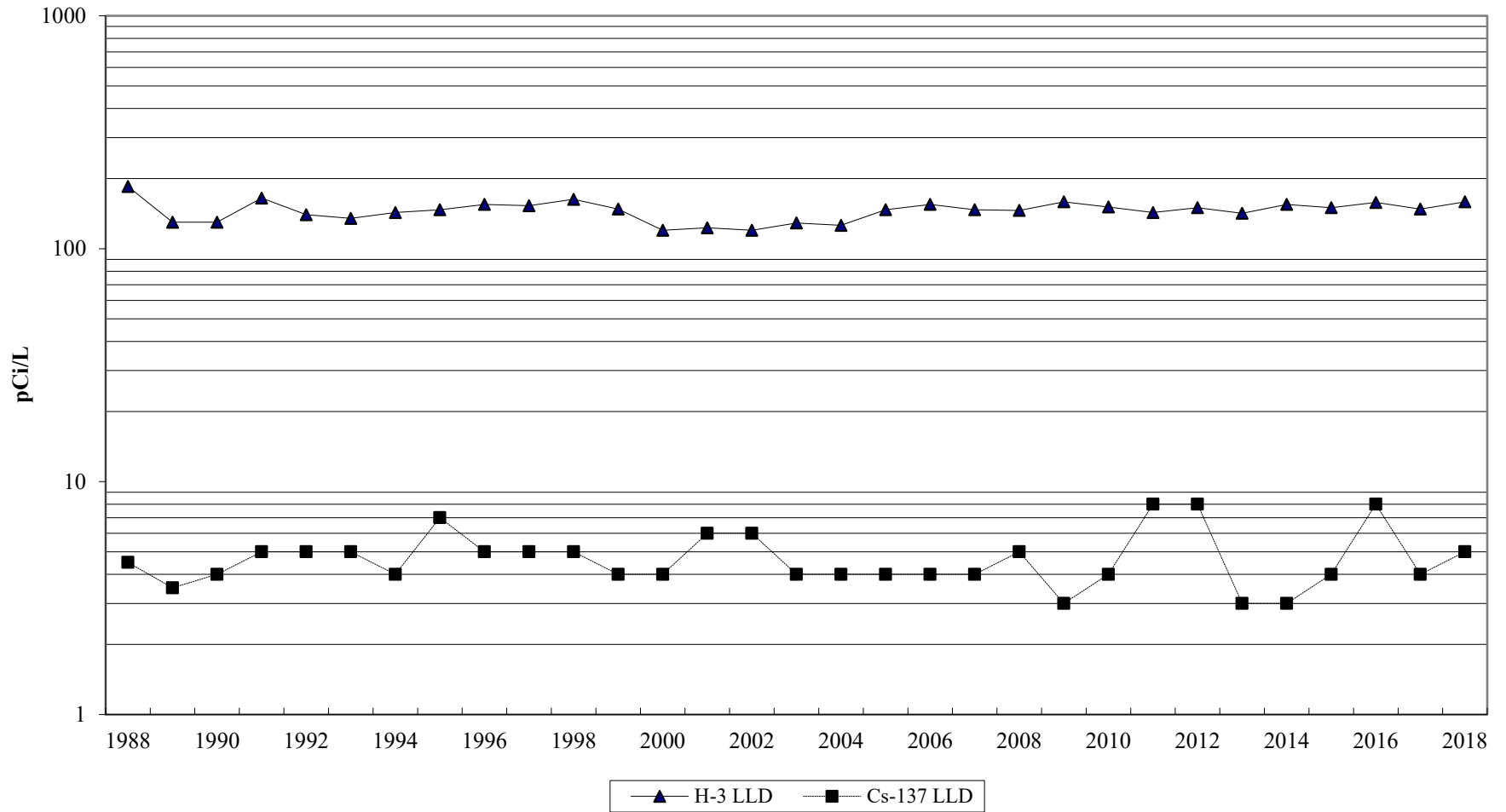


TABLE IV-C.3

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA

JANUARY 1 TO DECEMBER 31, 2019

| 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 52   | 146   | 240(4/52)<br>(188-305)  | CR3-5<br>0.051 mi.@225°    | 240(4/4)<br>(188-305) | CR3-2<br>160(0/4)<br>(LLD)  | 0  |
|                                   | $\gamma$ Spec 52   |   |                         |                            |                       |                             |  |
|                                   | Mn-54  | 7   | <LLD                    | --                         | --                    | <LLD                        | 0  |
|                                   | Fe-59  | 14  | <LLD                    | --                         | --                    | <LLD                        | 0  |
|                                   | Co-58  | 7   | <LLD                    | --                         | --                    | <LLD                        | 0  |
|                                   | Co-60  | 7   | <LLD                    | --                         | --                    | <LLD                        | 0  |
|                                   | Zn-65  | 15  | <LLD                    | --                         | --                    | <LLD                        | 0  |
|                                   | Zr-Nb-95   | 12  | <LLD                    | --                         | --                    | <LLD                        | 0  |
|                                   | Cs-134   | 6   | <LLD                    | --                         | --                    | <LLD                        | 0  |
|                                   | Cs-137   | 7   | <LLD                    | --                         | --                    | <LLD                        | 0  |
| Ba-La-140                         | 17   | <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.3.a.1

DUKE ENERGY FLORIDA, LLC- CR3 - 2019

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 | Cs-134 | Cs-137 | Ba-La-140 |
|---------|-------|------|------|-------|-------|-------|-------|-------|----------|--------|--------|-----------|
| CR3-1D  | 01-17 | <145 | <48  | <3    | <3    | <6    | <3    | <7    | <6       | <3     | <4     | <11       |
|         | 04-17 | <139 | <57  | <6    | <5    | <10   | <6    | <9    | <9       | <6     | <6     | <19       |
|         | 07-17 | <136 | <109 | <6    | <6    | <11   | <7    | <14   | <8       | <6     | <7     | <14       |
|         | 10-14 | <141 | <25  | <3    | <3    | <7    | <3    | <8    | <6       | <3     | <3     | <7        |
| CR3-1S  | 01-17 | <145 | <47  | <3    | <4    | <7    | <4    | <8    | <6       | <4     | <4     | <11       |
|         | 04-17 | <139 | <40  | <3    | <3    | <7    | <4    | <8    | <5       | <4     | <4     | <7        |
|         | 07-17 | <136 | <39  | <3    | <3    | <7    | <3    | <8    | <6       | <3     | <4     | <8        |
|         | 10-14 | <141 | <93  | <5    | <6    | <9    | <6    | <13   | <9       | <5     | <6     | <13       |
| CR3-2   | 01-17 | <146 | <44  | <4    | <4    | <7    | <3    | <9    | <6       | <4     | <4     | <12       |
|         | 04-17 | <139 | <61  | <6    | <7    | <9    | <7    | <17   | <11      | <6     | <6     | <18       |
|         | 07-17 | <136 | <43  | <4    | <4    | <7    | <4    | <8    | <6       | <4     | <4     | <9        |
|         | 10-14 | <141 | <65  | <5    | <6    | <9    | <6    | <12   | <10      | <5     | <6     | <13       |

TABLE IV-C.3.a.1

DUKE ENERGY FLORIDA, LLC- CR3 – 2019

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 | Cs-134 | Cs-137 | Ba-La-140 |
|---------|-------|------|------|-------|-------|-------|-------|-------|----------|--------|--------|-----------|
| CR3-3D  | 01-17 | <146 | <29  | <3    | <3    | <7    | <3    | <7    | <5       | <3     | <4     | <11       |
|         | 04-17 | <139 | <47  | <3    | <3    | <7    | <3    | <6    | <6       | <3     | <4     | <7        |
|         | 07-17 | <136 | <98  | <5    | <6    | <11   | <6    | <13   | <8       | <5     | <6     | <16       |
|         | 10-14 | <141 | <51  | <3    | <3    | <6    | <3    | <6    | <5       | <3     | <4     | <6        |
| CR3-3S  | 01-17 | <146 | <37  | <3    | <3    | <7    | <3    | <7    | <6       | <3     | <3     | <5        |
|         | 04-17 | <139 | <107 | <7    | <6    | <12   | <7    | <14   | <11      | <6     | <7     | <13       |
|         | 07-17 | <136 | <47  | <3    | <3    | <7    | <3    | <7    | <6       | <4     | <3     | <8        |
|         | 10-14 | <141 | <78  | <6    | <5    | <12   | <5    | <12   | <10      | <6     | <6     | <12       |
| CR3-4   | 01-17 | <146 | <107 | <7    | <5    | <14   | <6    | <15   | <12      | <6     | <6     | <10       |
|         | 04-17 | <139 | <32  | <4    | <4    | <8    | <4    | <10   | <7       | <4     | <4     | <8        |
|         | 07-17 | <136 | <94  | <7    | <6    | <12   | <7    | <14   | <11      | <5     | <7     | <14       |
|         | 10-14 | <141 | <47  | <4    | <4    | <6    | <3    | <8    | <6       | <4     | <4     | <9        |

**TABLE IV-C.3.a.1**

**DUKE ENERGY FLORIDA, LLC- CR3 - 2019**

**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 | Cs-134 | Cs-137 | Ba-La-140 |
|---------|-------|------|------|-------|-------|-------|-------|-------|----------|--------|--------|-----------|
| CR3-5   | 01-17 | 305  | <28  | <3    | <3    | <7    | <3    | <8    | <6       | <3     | <3     | <6        |
|         | 04-17 | 231  | <88  | <5    | <7    | <13   | <7    | <15   | <11      | <6     | <7     | <17       |
|         | 07-17 | 188  | <99  | <6    | <6    | <14   | <7    | <12   | <11      | <6     | <7     | <17       |
|         | 10-14 | 236  | <56  | <6    | <6    | <13   | <6    | <13   | <11      | <5     | <6     | <11       |
| CR3-6S  | 01-17 | <141 | <52  | <3    | <3    | <7    | <3    | <8    | <6       | <3     | <4     | <6        |
|         | 04-17 | <139 | <51  | <4    | <4    | <7    | <4    | <8    | <7       | <4     | <4     | <8        |
|         | 07-17 | <136 | <51  | <3    | <3    | <7    | <4    | <9    | <6       | <4     | <4     | <8        |
|         | 10-14 | <141 | <52  | <3    | <3    | <8    | <4    | <9    | <6       | <4     | <4     | <6        |
| CR3-6D  | 01-17 | <141 | <82  | <5    | <6    | <12   | <6    | <12   | <10      | <6     | <7     | <10       |
|         | 04-17 | <139 | <93  | <6    | <5    | <13   | <6    | <13   | <10      | <6     | <6     | <17       |
|         | 07-17 | <135 | <27  | <3    | <3    | <7    | <3    | <6    | <5       | <3     | <3     | <8        |
|         | 10-14 | <141 | <29  | <4    | <3    | <8    | <3    | <8    | <5       | <3     | <3     | <6        |

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

DUKE ENERGY FLORIDA, LLC- CR3 - 2019

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 | Cs-134 | Cs-137 | Ba-La-140 |
|---------|-------|------|------|-------|-------|-------|-------|-------|----------|--------|--------|-----------|
| CR3-7   | 01-17 | <141 | <38  | <5    | <6    | <12   | <7    | <10   | <9       | <5     | <5     | <10       |
|         | 04-17 | <139 | <53  | <7    | <5    | <10   | <7    | <11   | <10      | <5     | <6     | <15       |
|         | 07-17 | <136 | <86  | <6    | <6    | <12   | <6    | <13   | <10      | <5     | <7     | <15       |
|         | 10-14 | <141 | <27  | <4    | <4    | <7    | <4    | <9    | <6       | <4     | <4     | <9        |
| CR3-8   | 01-17 | <141 | <97  | <6    | <7    | <12   | <6    | <15   | <11      | <6     | <6     | <10       |
|         | 04-17 | <139 | <51  | <4    | <4    | <7    | <3    | <10   | <7       | <4     | <4     | <7        |
|         | 07-17 | <139 | <95  | <6    | <5    | <13   | <7    | <13   | <11      | <5     | <7     | <11       |
|         | 10-14 | <141 | <106 | <7    | <7    | <13   | <7    | <15   | <11      | <7     | <7     | <12       |
| CR3-9   | 01-17 | <141 | <37  | <6    | <6    | <13   | <6    | <14   | <12      | <5     | <7     | <10       |
|         | 04-17 | <139 | <99  | <5    | <5    | <12   | <5    | <12   | <10      | <6     | <7     | <10       |
|         | 07-17 | <136 | <54  | <3    | <4    | <7    | <3    | <7    | <6       | <3     | <3     | <5        |
|         | 10-14 | <141 | <57  | <3    | <3    | <8    | <3    | <8    | <6       | <4     | <4     | <6        |

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

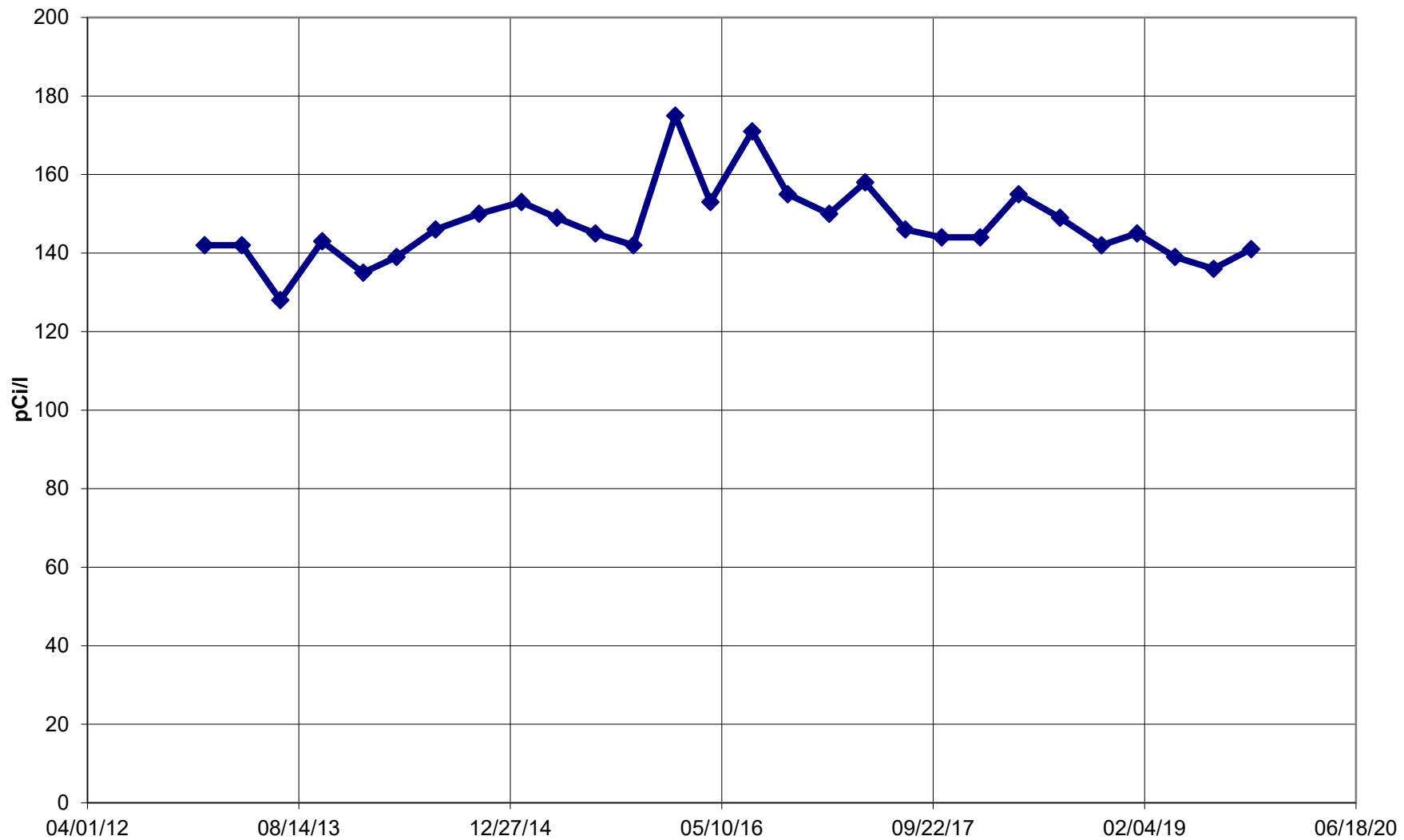
**DUKE ENERGY FLORIDA, LLC- CR3 - 2019**

**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 | Cs-134 | Cs-137 | Ba-La-140 |
|---------|-------|------|------|-------|-------|-------|-------|-------|----------|--------|--------|-----------|
| CR3-10  | 01-17 | <141 | <38  | <3    | <4    | <8    | <4    | <9    | <6       | <4     | <3     | <6        |
|         | 04-17 | <139 | <49  | <5    | <4    | <7    | <4    | <11   | <7       | <5     | <4     | <13       |
|         | 07-17 | <139 | <96  | <6    | <6    | <12   | <6    | <13   | <11      | <6     | <6     | <10       |
|         | 10-14 | <141 | <93  | <6    | <7    | <13   | <7    | <16   | <12      | <6     | <6     | <14       |

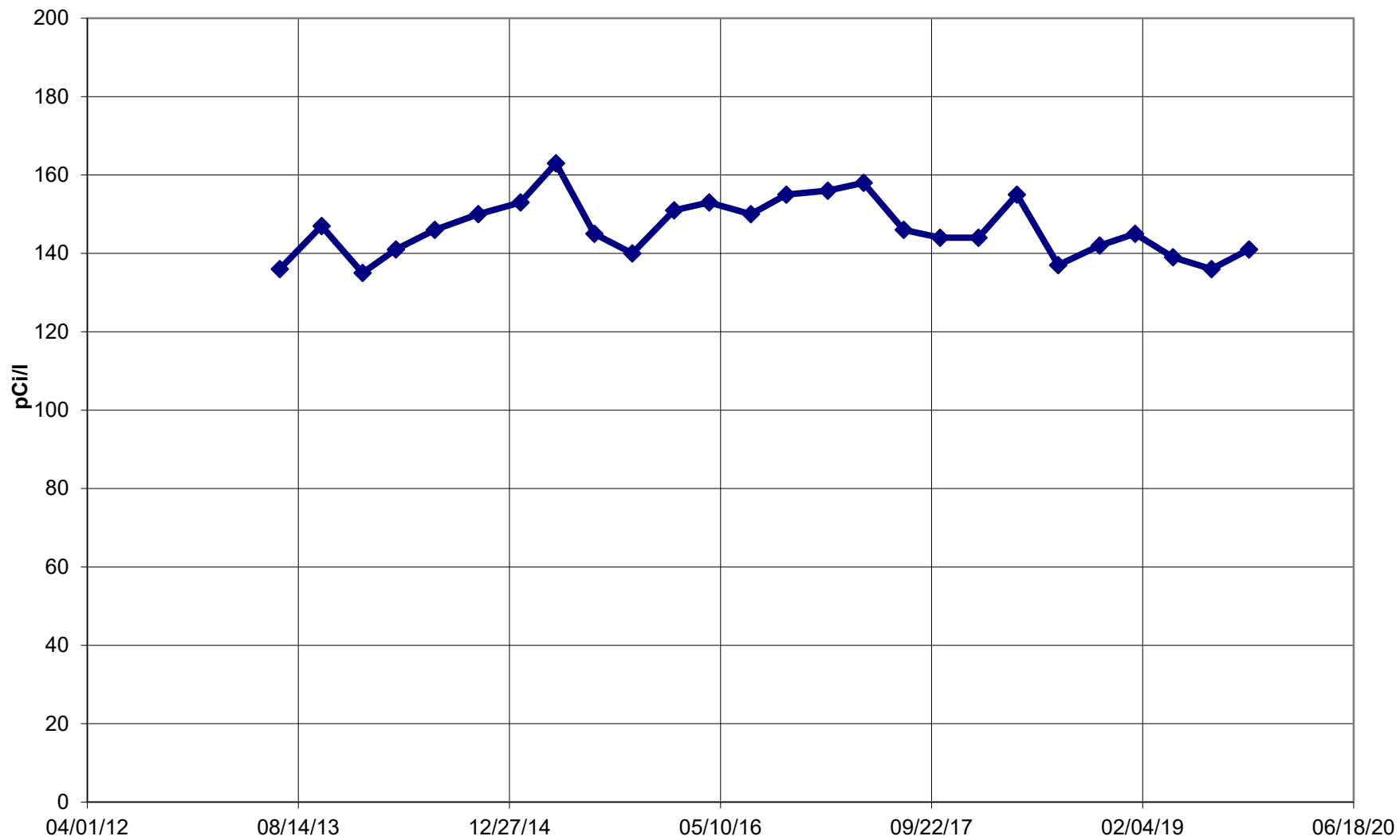
### Tritium Measurement GW Well # CR3-1S

All results are < LLD since 2010



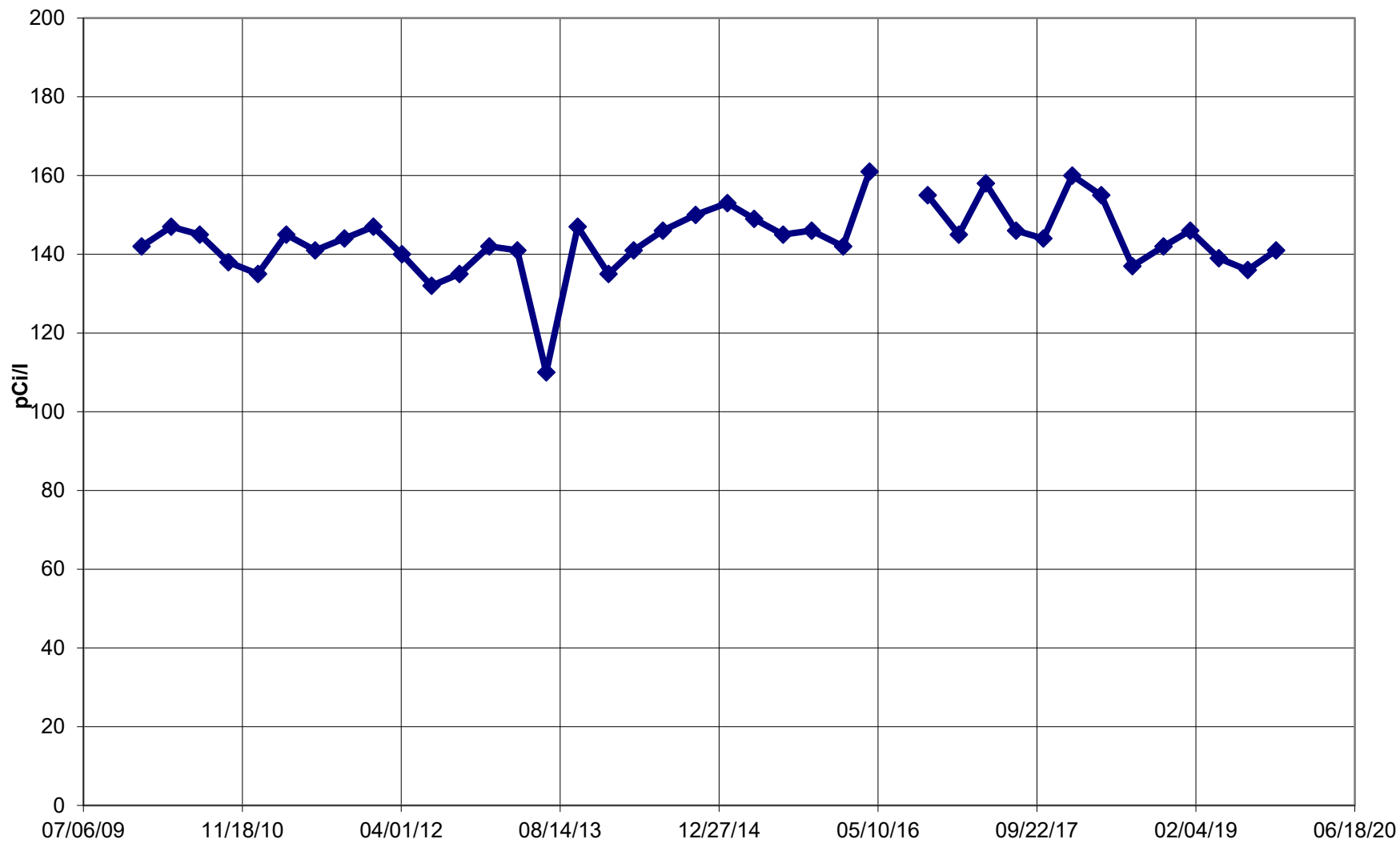
### Tritium Measurement GW Well # CR3-1D

All results are < LLD



### Tritium Measurement GW Well # CR3-2

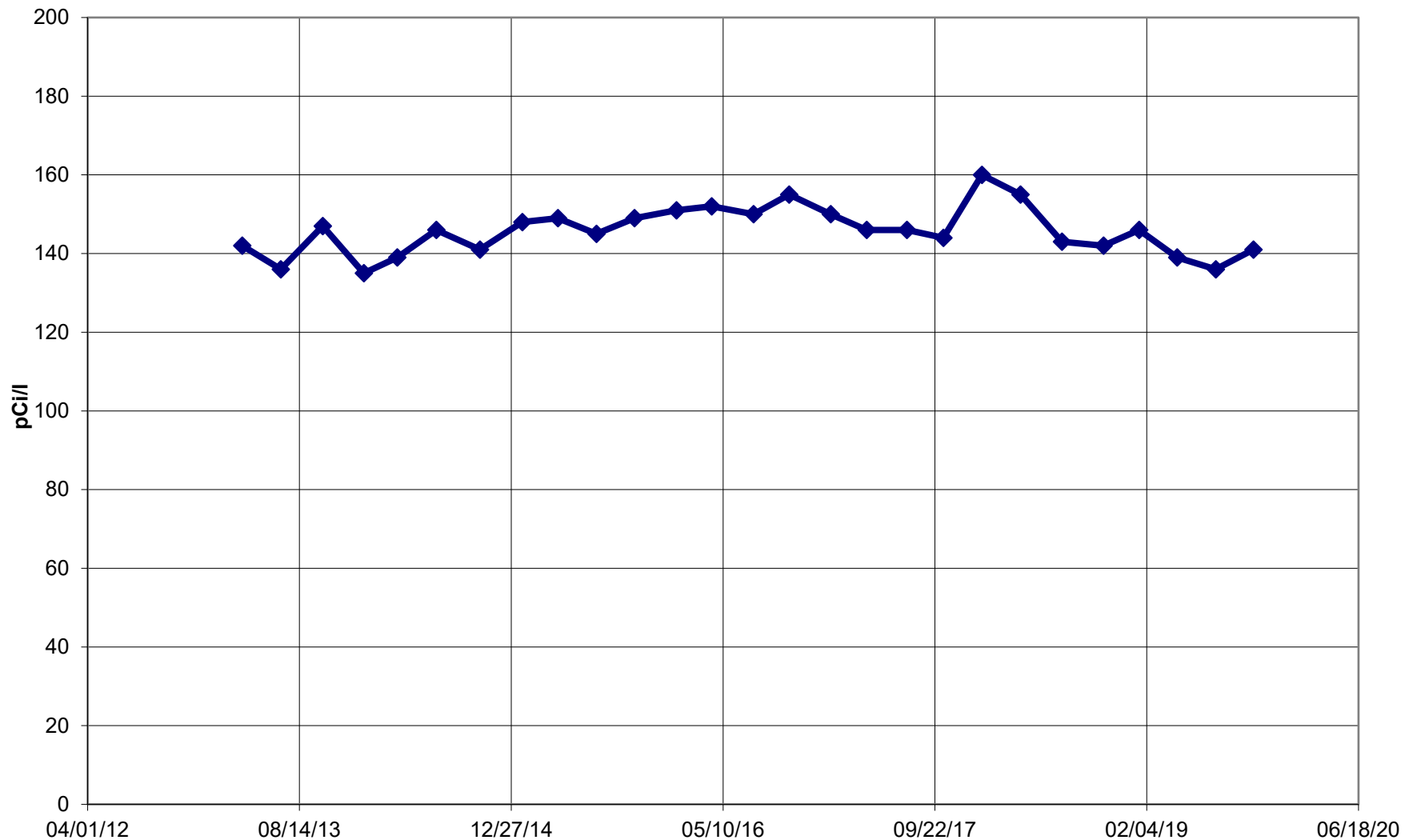
All results are < LLD





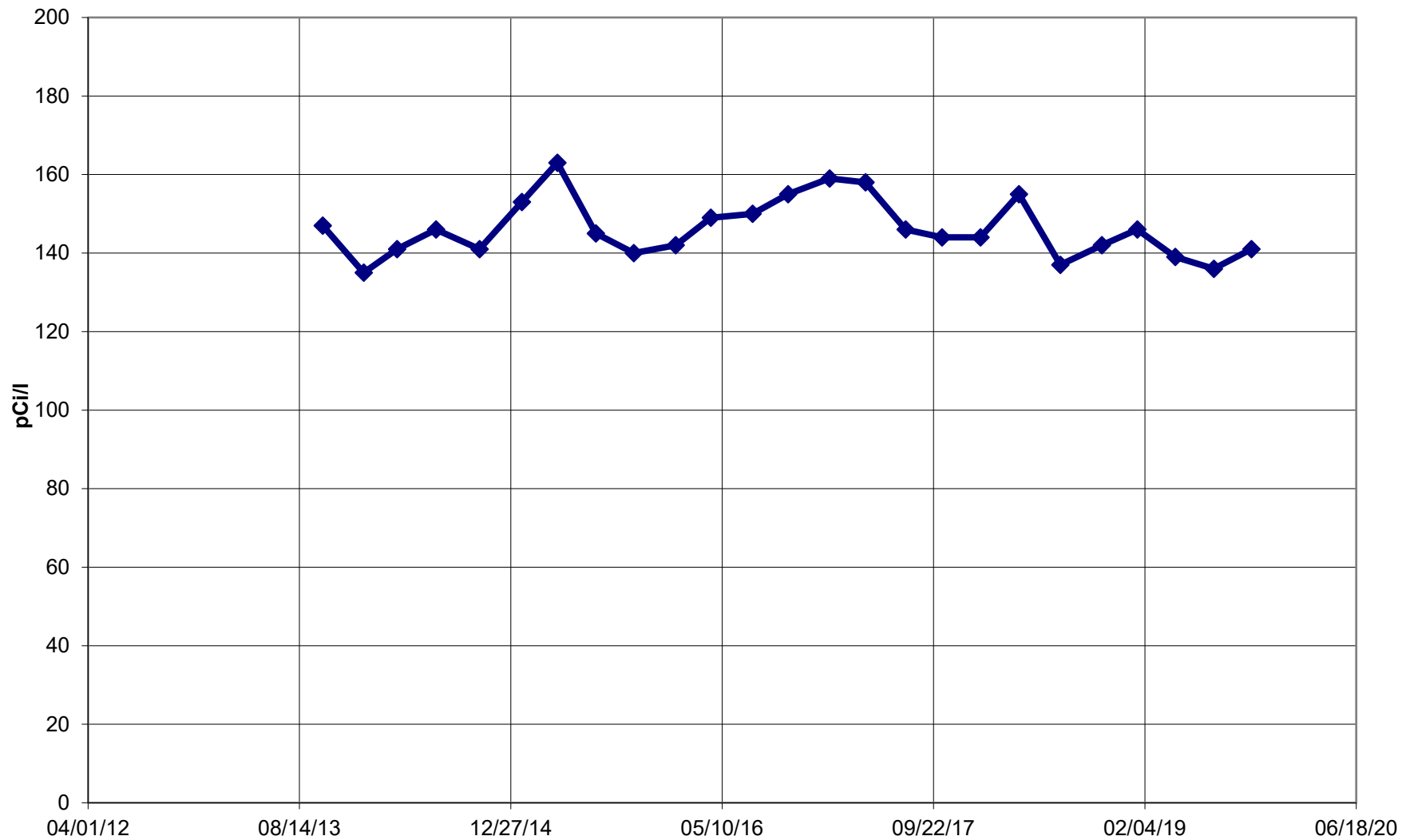
### Tritium Measurement GW Well # CR3-3S

All results are < LLD



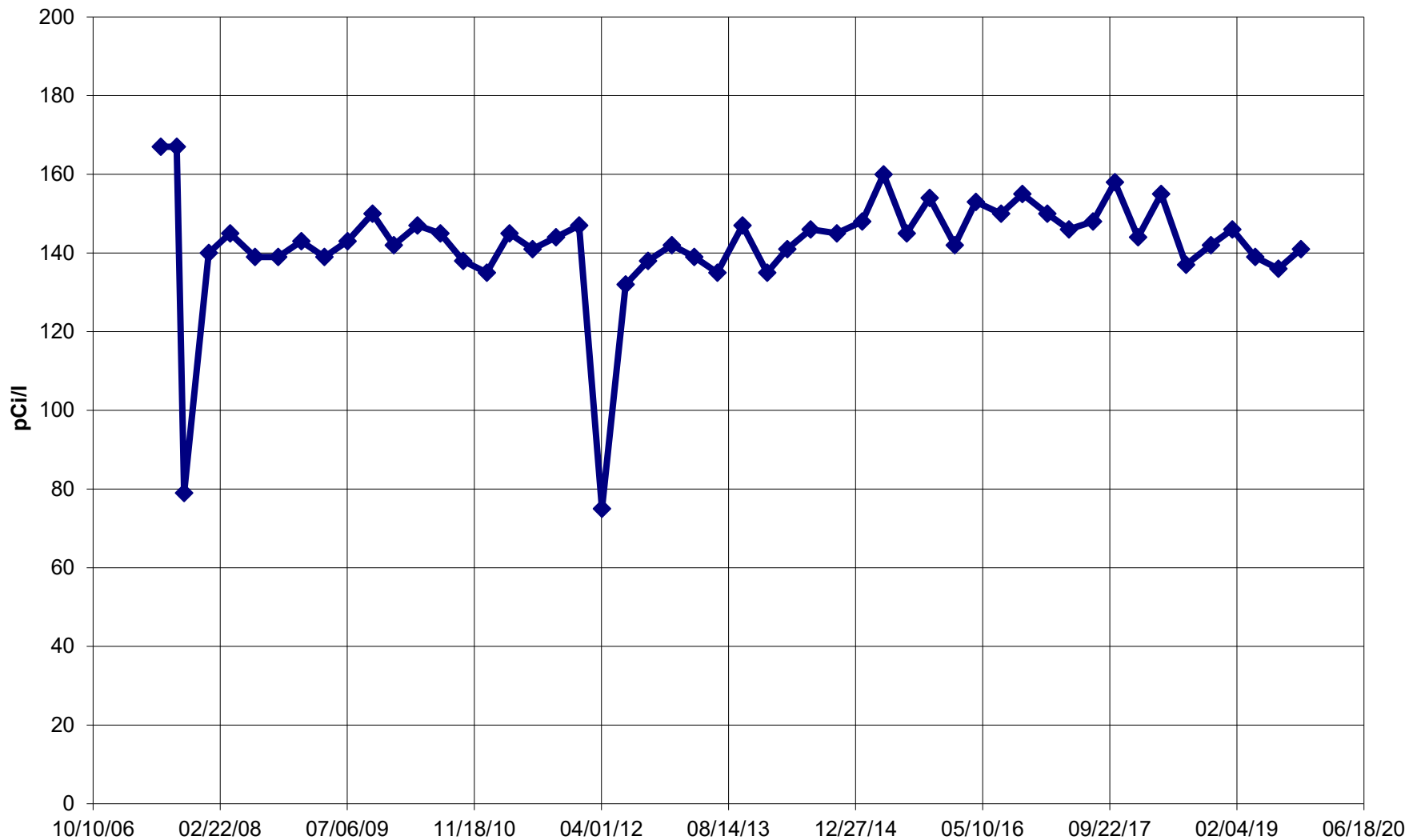
### Tritium Measurement GW Well # CR3-3D

All results are < LLD

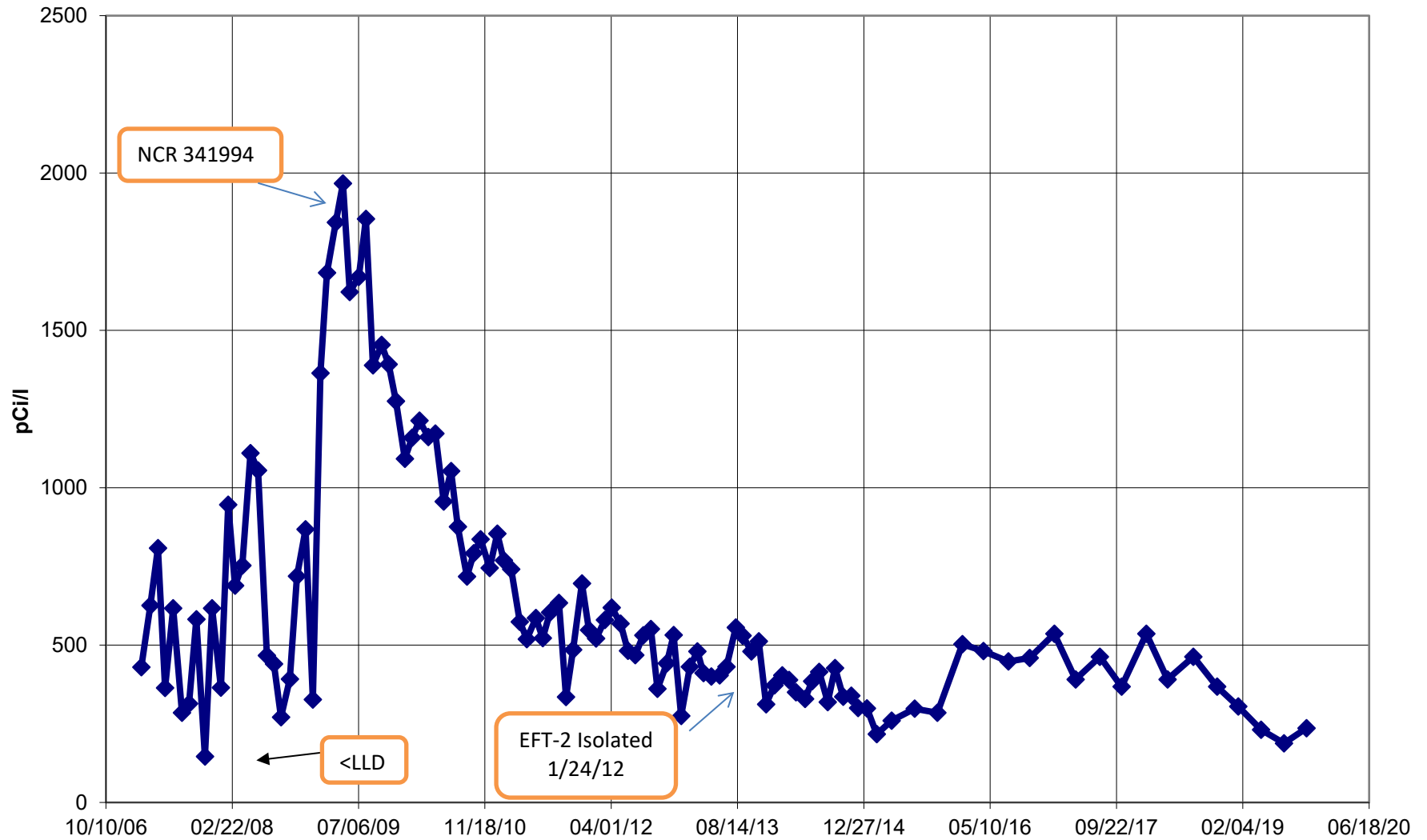


### Tritium Measurement GW Well # CR3-4

All results are < LLD since 2013

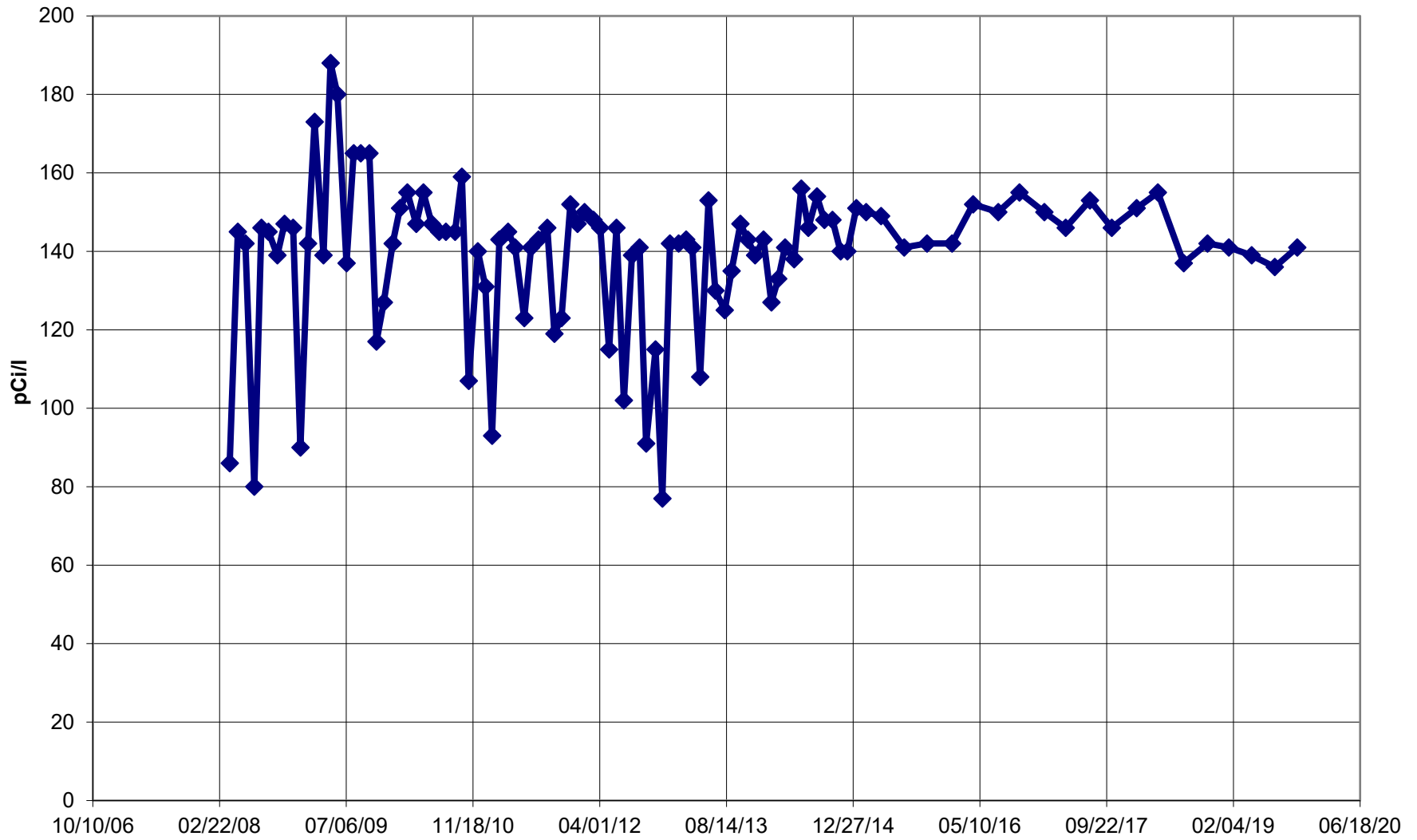


**Tritium Measurement GW Well # CR3-5**  
All results greater than LLD



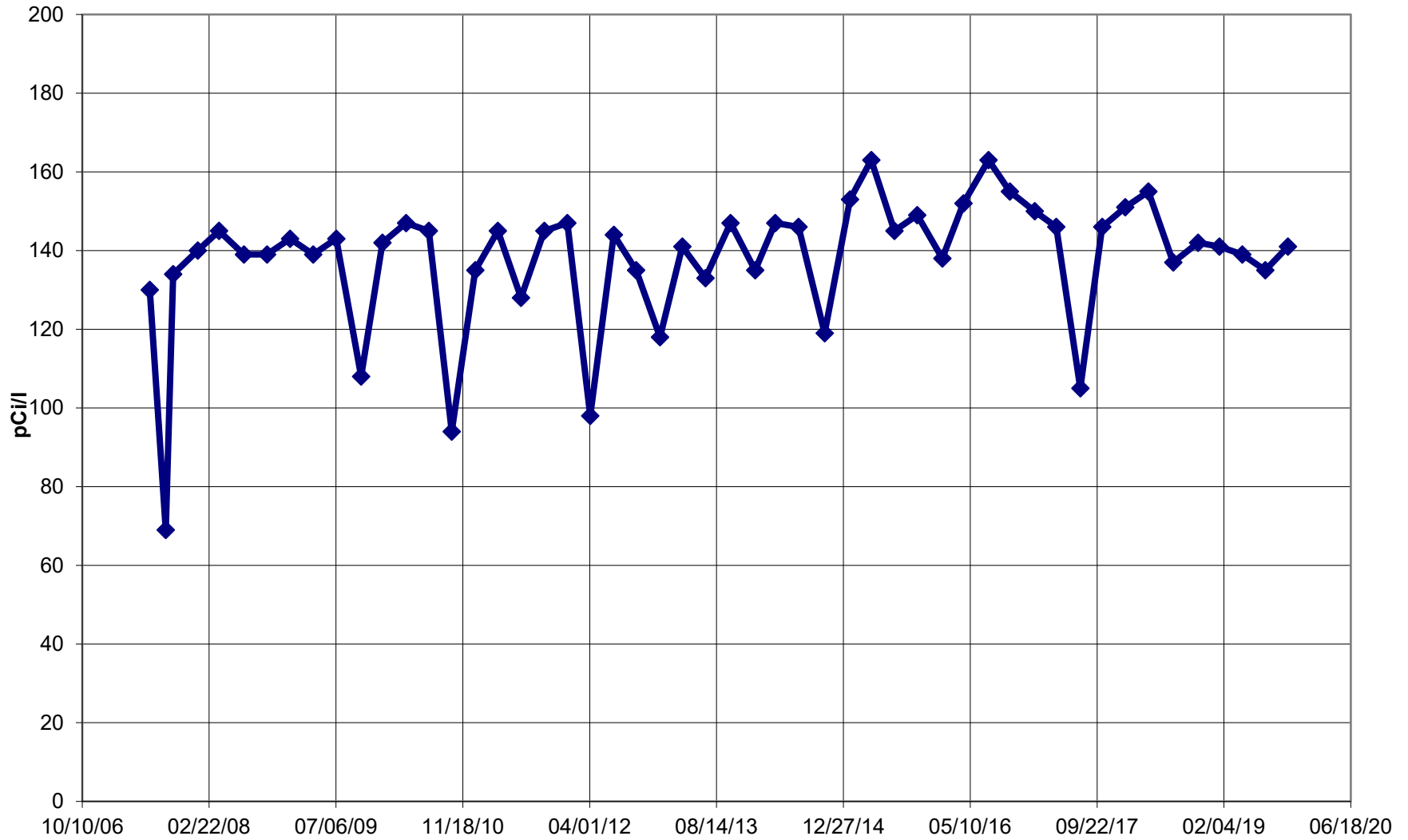
### Tritium Measurement GW Well # CR3-6S

Results after 2014 are < LLD

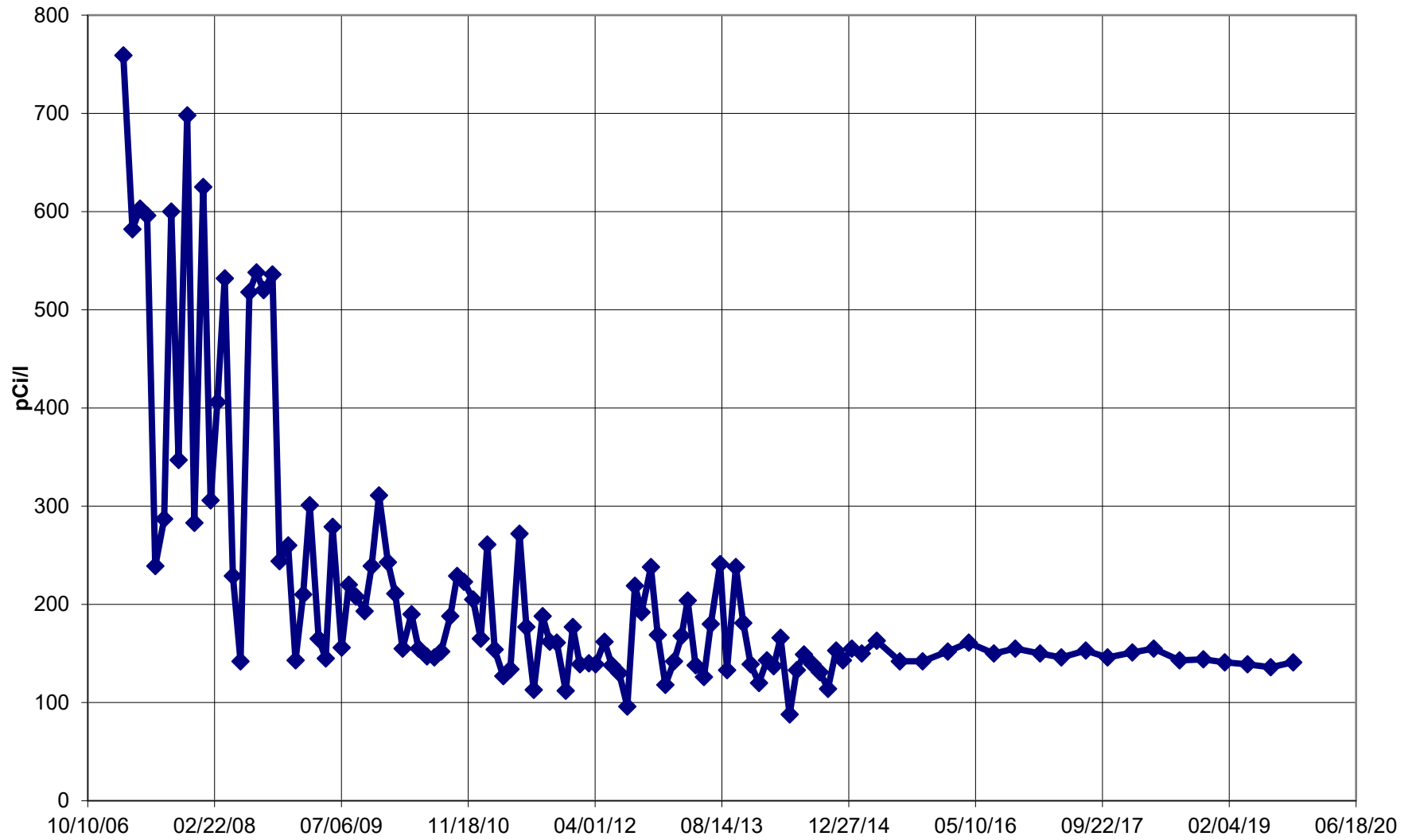


### Tritium Measurements GW Well # CR3-6D

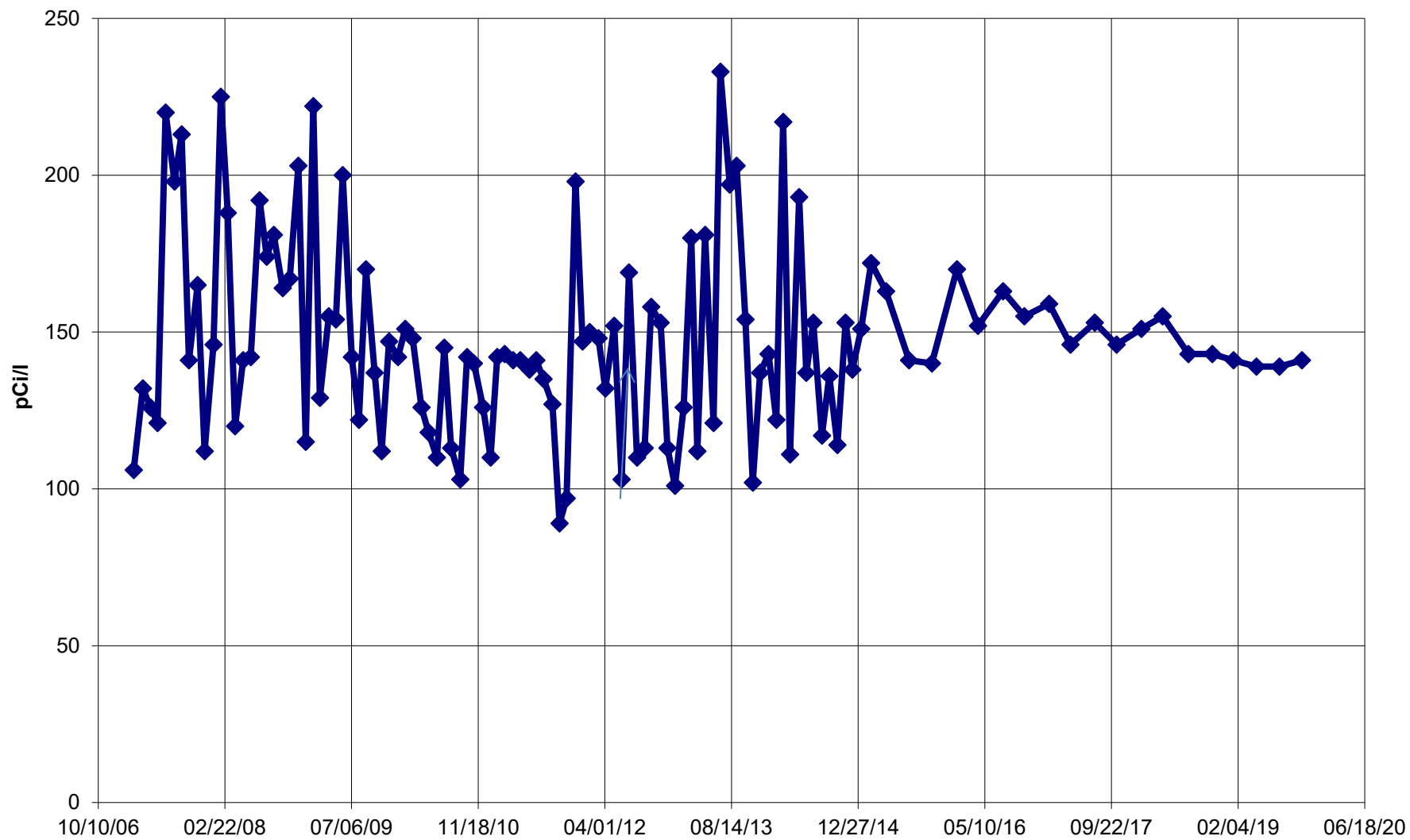
All results are < LLD after 2010



**Tritium Measurements GW Well # CR3-7**  
All measurements LLD after 2015



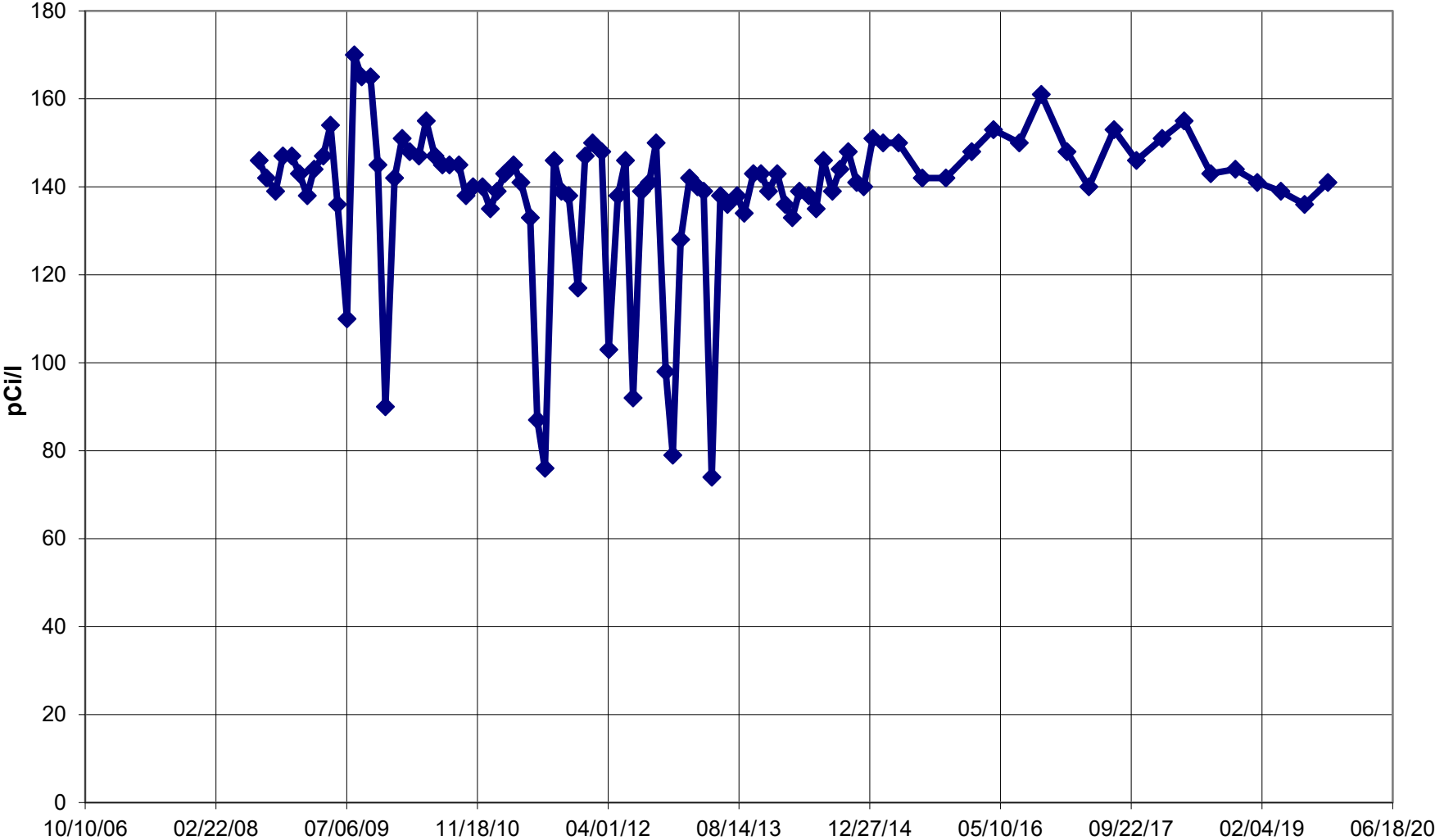
**Tritium Measurements GW Well # CR3-8**  
All measurements LLD after 2016





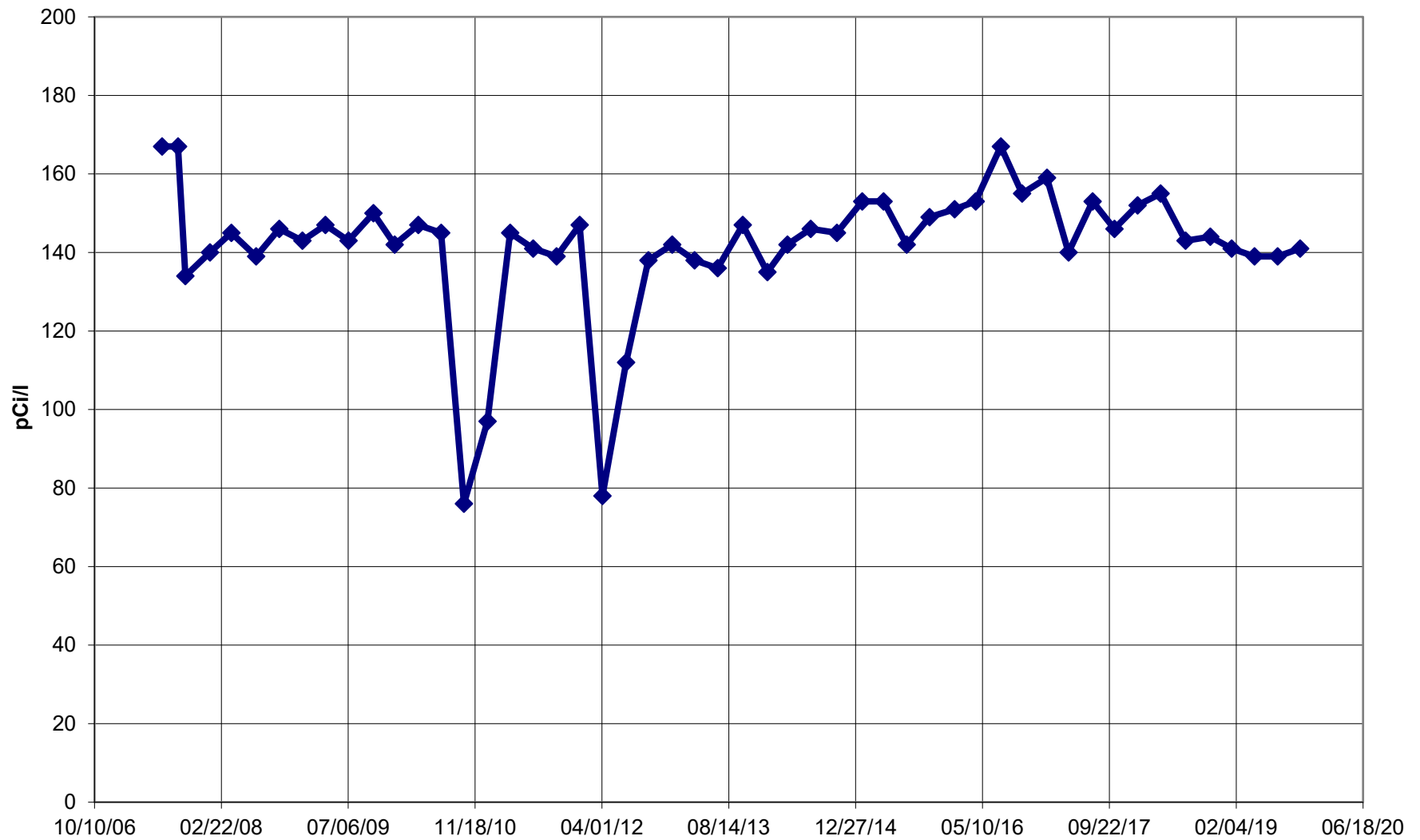
### Tritium Measurements GW Well # CR3-9

All measurements <LLD after 2013



### Tritium Measurements GW Well # CR3-10

All measurements LLD after 2012





**TABLE IV-C.4.a**

**DUKE ENERGY FLORIDA, LLC- CR3 - 2019**

**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 | Cs-134 | Cs-137 | Ba-La-140 |
|---------|-------|------|------|-------|-------|-------|-------|-------|----------|--------|--------|-----------|
| MWC-27* | 01-11 | <152 | <76  | <5    | <6    | <13   | <6    | <13   | <9       | <6     | <7     | <11       |
|         | 04-12 | <154 | <48  | <6    | <7    | <13   | <7    | <13   | <10      | <6     | <6     | <12       |
|         | 07-23 | <143 | <93  | <6    | <7    | <13   | <7    | <14   | <12      | <6     | <7     | <16       |
|         | 10-25 | <144 | <64  | <6    | <6    | <14   | <6    | <14   | <9       | <6     | <7     | <10       |

\*= 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)**

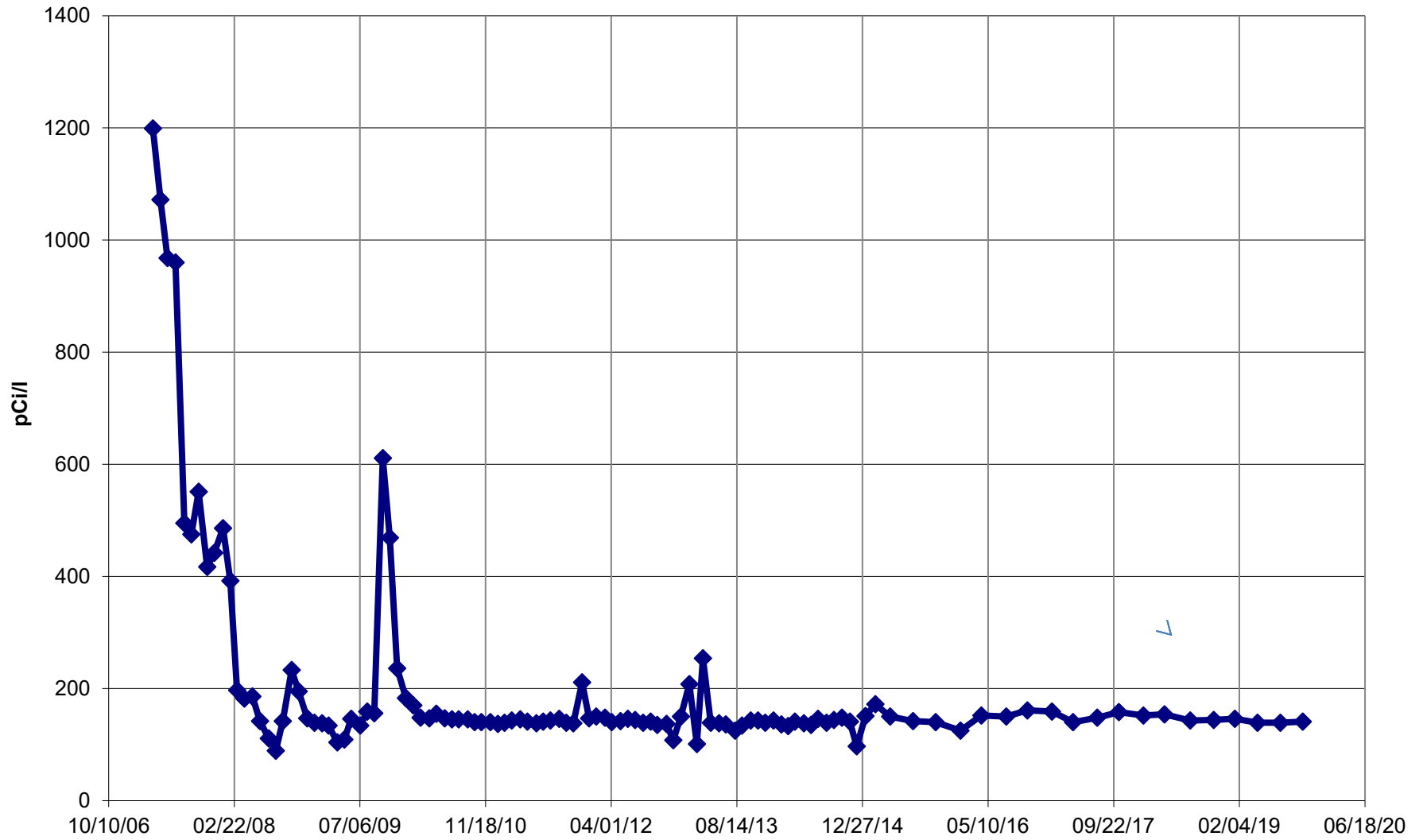
**DUKE ENERGY FLORIDA, LLC- CR3 - 2019**

**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 | Cs-134 | Cs-137 | Ba-La-140 |
|----------|-------|------|------|-------|-------|-------|-------|-------|----------|--------|--------|-----------|
| MWC-IF2* | 01-11 | <152 | <46  | <3    | <3    | <7    | <3    | <7    | <6       | <3     | <3     | <5        |
|          | 04-12 | <155 | <53  | <3    | <3    | <7    | <4    | <8    | <6       | <4     | <4     | <6        |
|          | 07-23 | <143 | <78  | <6    | <6    | <12   | <7    | <10   | <9       | <5     | <6     | <11       |
|          | 10-25 | <144 | <94  | <6    | <6    | <13   | <7    | <15   | <11      | <6     | <6     | <10       |

\* 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**  
All measurements LLD after 2010



**Tritium Measurements GW Well # MWC-IF2**  
All measurements LLD after 2012

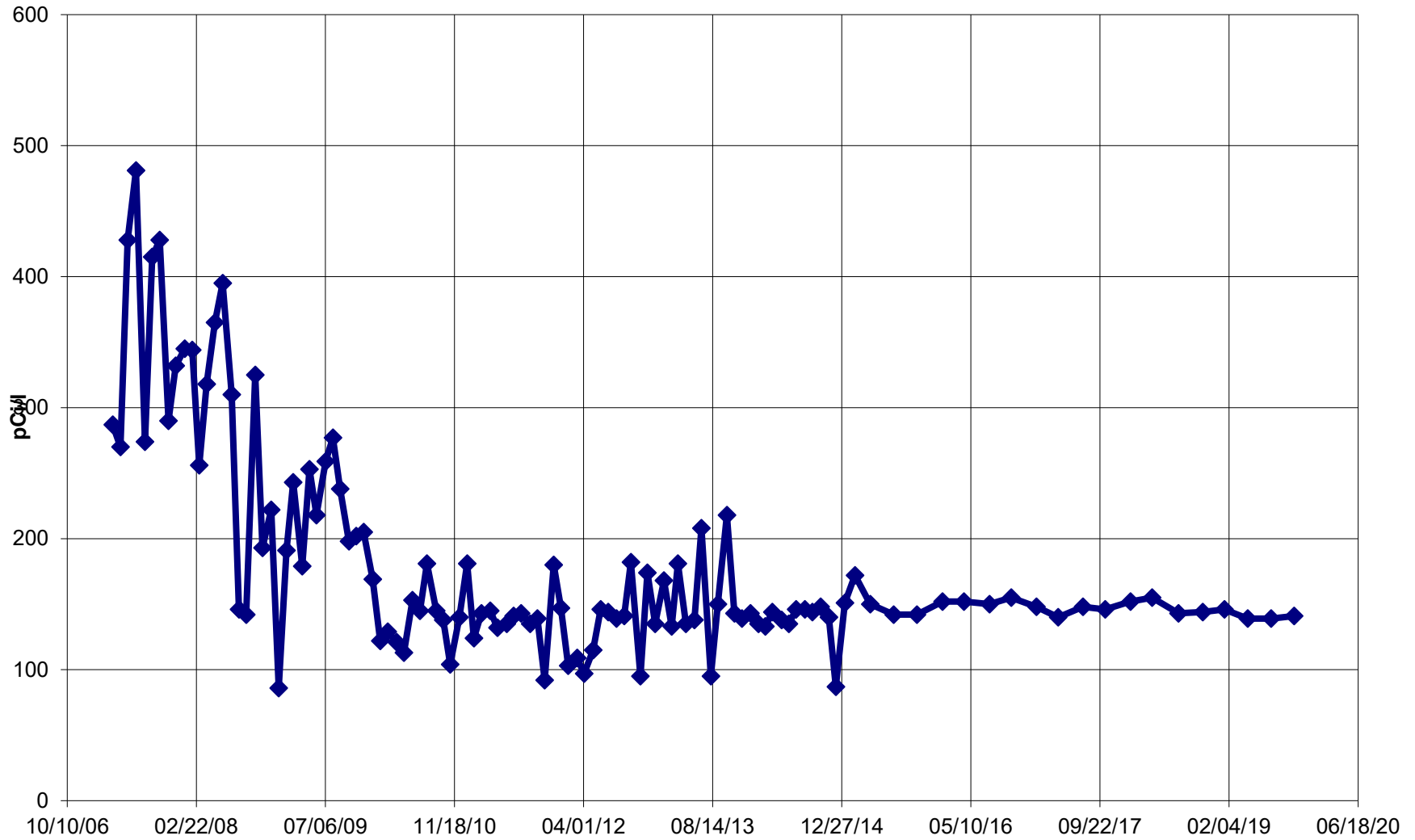






TABLE IV-C.5.a

DUKE ENERGY FLORIDA, LLC- CR3 - 2019

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 | Cs-134 | Cs-137 | Ba-La-140 |
|---------|-------|------|------|-------|-------|-------|-------|-------|----------|--------|--------|-----------|
| C07     | 01-15 | <145 | <40  | <3    | <3    | <7    | <3    | <8    | <5       | <3     | <3     | <8        |
|         | 04-09 | <140 | <35  | <3    | <3    | <7    | <3    | <7    | <5       | <3     | <3     | <11       |
|         | 07-02 | <135 | <39  | <3    | <3    | <6    | <3    | <6    | <5       | <3     | <3     | <6        |
|         | 10-15 | <143 | <58  | <6    | <5    | <8    | <5    | <13   | <10      | <5     | <6     | <11       |
| C10     | 01-15 | <145 | <38  | <3    | <3    | <7    | <4    | <8    | <6       | <3     | <3     | <8        |
|         | 04-09 | <140 | <100 | <4    | <5    | <11   | <6    | <13   | <10      | <5     | <7     | <15       |
|         | 07-02 | <135 | <77  | <6    | <6    | <10   | <5    | <11   | <9       | <6     | <6     | <10       |
|         | 10-15 | <143 | <38  | <4    | <3    | <7    | <3    | <7    | <5       | <3     | <3     | <6        |
| C18     | 01-15 | <145 | <92  | <5    | <5    | <10   | <6    | <14   | <10      | <5     | <6     | <10       |
|         | 04-09 | <140 | <83  | <5    | <6    | <10   | <6    | <10   | <10      | <5     | <6     | <13       |
|         | 07-02 | <135 | <91  | <6    | <6    | <11   | <7    | <11   | <11      | <5     | <6     | <7        |
|         | 10-15 | <143 | <89  | <6    | <5    | <11   | <5    | <12   | <9       | <5     | <7     | <12       |

### Quarterly Drinking Water

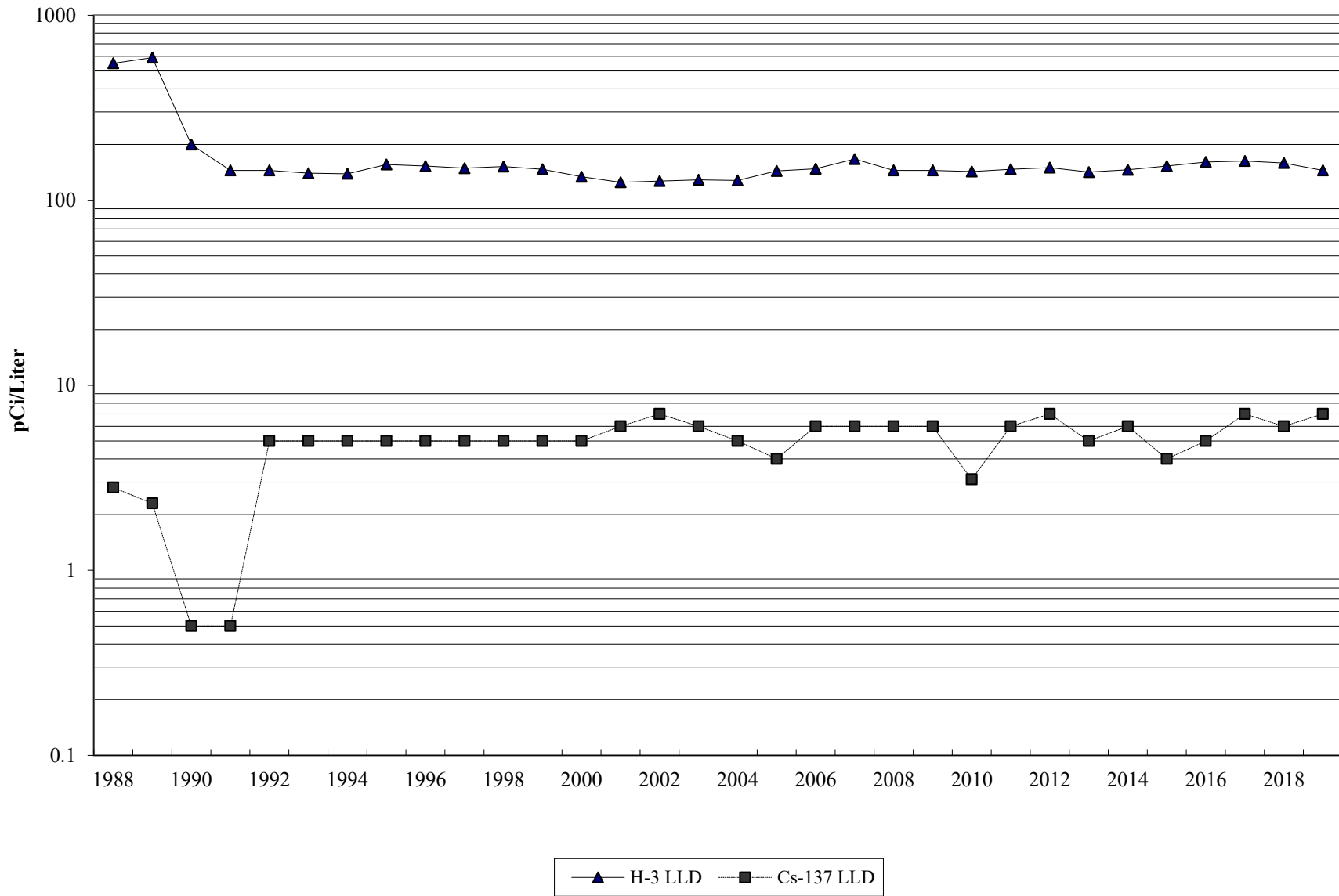


TABLE IV-C.6

**RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY**  
**CRYSTAL RIVER UNIT 3** **DOCKET NO. 50-302**  
**CITRUS COUNTY, FLORIDA** **JANUARY 1 TO DECEMBER 31, 2019**

| 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> MEAN RANGE | <u>LOCATION WITH HIGHEST MEAN</u> NAME<br>DISTANCE & BEARING | MEAN RANGE           | CONTROL LOCATION MEAN RANGE | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |
|-----------------------------------|---|---|---|--|----------------------|-----------------------------|--|
| SHORELINE SEDIMENT                | γ Spec 8  |   |   |  |                      |                             |  |
| (pCi/kg)                          | Cs-134  | 22  | Co-60                                     | —  | —                    | <LLD                        | 0  |
|                                   | Cs-137  | 18  | 163 (3/6)<br>(LLD-394)                    | C14G<br>2.0 mi. @ 270°                                       | 6 (1/2)<br>(LLD-360) | <LLD                        | 0  |
|                                   |   |   | Cs-137                                    | C14G   | 64 (1/2)             | <LLD                        | 0  |
|                                   |   |   | 41 (2/6)<br>(LLD-64)                      | 2.0 mi. @ 270°   | (LLD-64)             | <LLD                        | 0  |

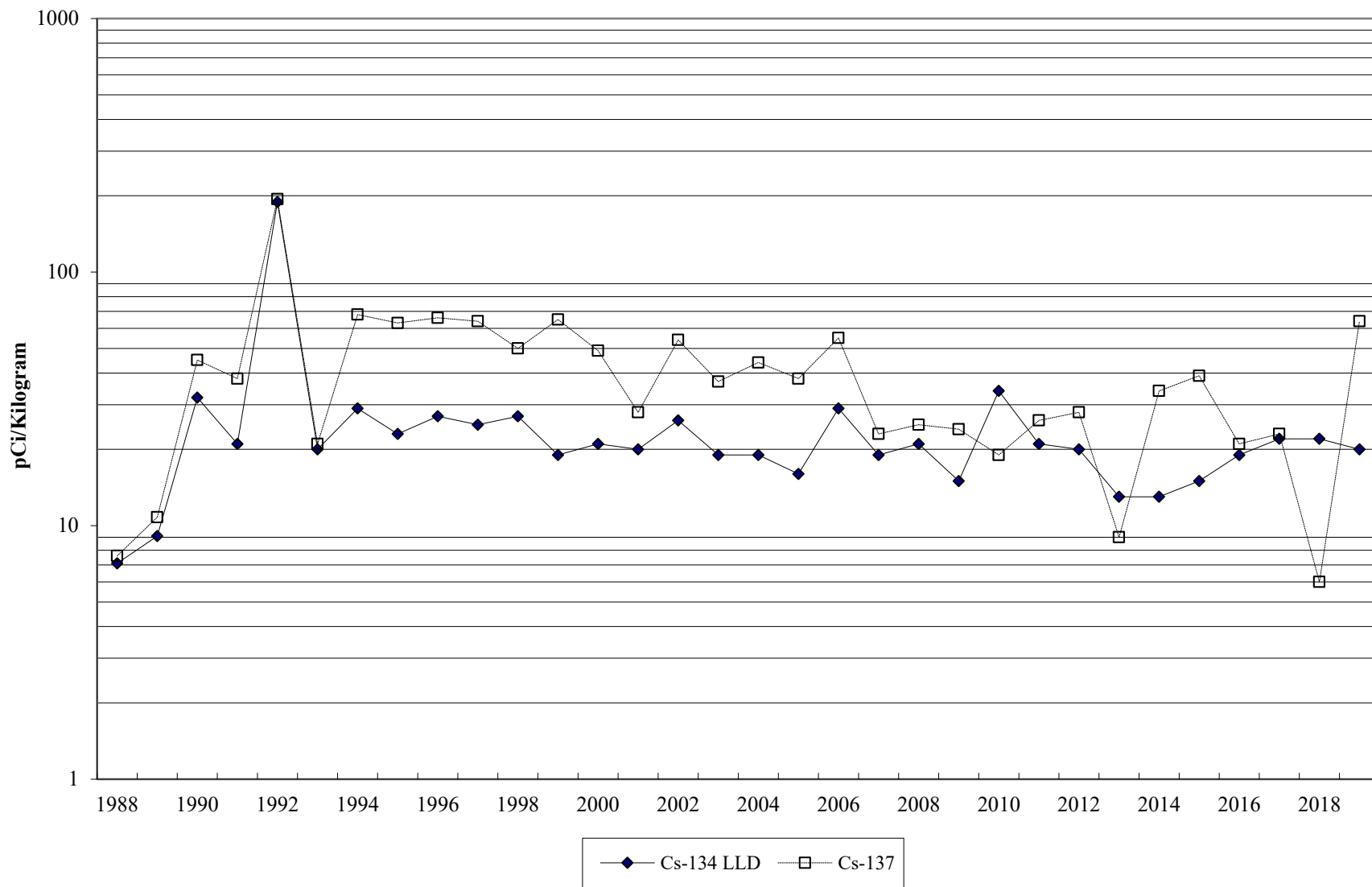
<sup>1</sup>The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

**TABLE IV-C.6.a**  
**DUKE ENERGY FLORIDA, LLC- CR3 - 2019**  
**pCi/kg  $\gamma$  EMITTERS IN SHORELINE SEDIMENT**

| STATION | PERIOD      | Co-58 | Co-60  | Cs-134 | Cs-137 | K-40     | Ra-226   |
|---------|-------------|-------|--------|--------|--------|----------|----------|
| C09     | First Half  | <11   | <9     | <11    | <11    | 375±48   | 320±12   |
|         | Second Half | <9    | <10    | <9     | <11    | 127±37   | 214±38   |
| C14H    | First Half  | <18   | 67±6   | <15    | <15    | 1212±104 | 1292±32  |
|         | Second Half | <20   | <18    | <19    | <20    | <212     | 2800±185 |
| C14M    | First Half  | <11   | 29±2   | <13    | 17±2   | 621±51   | 939±20   |
|         | Second Half | <11   | <11    | <11    | 13±2   | 330±35   | 923±90   |
| C14G    | First Half  | <18   | 394±11 | <18    | <6     | 2182±110 | 1125±25  |
|         | Second Half | <14   | <11    | <10    | 64±6   | 265±47   | 919±107  |

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.

In 2019, none of the required radionuclides were found in measurable quantities. The highest Cs-137 LLD for stations C29 and C30 was 22 pCi/kg. Naturally occurring K-40 was quantified in all eight samples at an average concentration of 2,311 pCi/kg.

In 2018, none of the required radionuclides were found in measurable quantities.

In 2017, none of the required radionuclides were found in measurable quantities.

In 2016, none of the required radionuclides were found in measurable quantities.

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

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.

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 2019, none of the required radionuclides were found in measurable quantities.

In 2018, none of the required radionuclides were found in measurable quantities.

In 2017, none of the required radionuclides were found in measurable quantities.

In 2016, none of the required radionuclides were found in measurable quantities.

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.

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 2019, 11 out of the 24 indicator locations (C48A and C48B) had measurable amounts of Cs-137 with an average concentration of 52 pCi/kg and a range of 6 to 329 pCi/kg. The control station (C47) located in Orlando, FL also had measurable amounts of Cs-137 in 7 of 12 samples ranging from 13 to 154 pCi/kg. These results are similar to those in 2018.

In 2018, 13 out of 24 indicator locations (C48A and C48B) had measurable amounts of Cs-137 with an average concentration of 27 pCi/kg and a range of 13 to 48 pCi/kg. The control station (C47) located in Orlando, FL also had measurable amounts of Cs-137. In 12 of 12 control station samples there were measurable amounts of Cs-137 with an average concentration of 111 pCi/kg and a range of 38 to 184 pCi/kg. These results are similar to those in 2017.

In 2017, 12 out of 24 indicator locations (C48A and C48B) had measurable amounts of Cs-137 with an average concentration of 30 pCi/kg and a range of 17 to 66 pCi/kg. The control station (C47) located in Orlando, FL also had measurable amounts of Cs-137. In 10 of 12 control station samples there were measurable amounts of Cs-137 with an average concentration of 99 pCi/kg and a range of 19 to 186 pCi/kg. These results are similar to those in 2016.

In 2016, 13 out of 24 indicator locations (C48A and C48B) had measurable amounts of Cs-137 with an average concentration of 46 pCi/kg and a range of 11 to 179 pCi/kg. The control station (C47) located in Orlando, FL also had measurable amounts of Cs-137. In 10 of 12 control station samples there were measurable amounts of Cs-137 with an average concentration of 73 pCi/kg and a range of 10 to 174 pCi/kg. These results are similar to those in 2015.

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 Cs-137. In 11 of 12 control station samples there were measurable amounts of Cs-137 with an average concentration of 67 pCi/kg and a range of 15 to 150 pCi/kg. The Cs-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 Cs-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 Cs-137. In 10 of 12 control station samples there were measurable amounts of Cs-137 with an average concentration of 43 pCi/kg and a range of 17 to 71 pCi/kg. The Cs-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 Cs-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 Cs-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 Cs-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 Cs-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 Cs-137. In eight of twelve control station samples there were measurable amounts of Cs-137 at an average concentration of 57 pCi/kg and a range of 16 to 201 pCi/kg. The Cs-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.

4. In 2019 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 sample. There were also three milk samples collected in 2019, all at location C28. Location C28 is about 20 miles SSE of the plant. All showed less than LLD for Cs-134 and Cs-137. Milk samples are not required per the ODCM.

In 2018 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 sample.

In 2017 the State was unable to locate a watermelon field at location C04 or anywhere in the vicinity of C04. This is documented in plant condition report 2192486. Also, only one citrus sample was collected versus the usual two samples. It showed above MDA levels of Cs-137 at 9 pCi/kg with an uncertainty of 2 pCi/kg. It was collected at location C19 which is 9.6 miles ENE of CR3. This reported value is less than the MDA of 11 pCi/kg reported in 2016 and is likely due to natural background.

In 2016 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 sample.

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.

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, 2019

| 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><br>MEAN RANGE | <u>LOCATION WITH HIGHEST MEAN</u><br>NAME<br>DISTANCE & BEARING | CONTROL LOCATION<br>MEAN RANGE | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |   |
|-----------------------------------|---|---|--|---|--------------------------------|--|---|
| CARNIVOROUS FISH<br>(pCi/kg)      | γ Spec 8  |   |  |   |                                |  |   |
|                                   | Mn-54   | 21  | <LLD   | -   | -                              | <LLD                                       | 0 |
|                                   | Fe-59   | 42  | <LLD   | -   | -                              | <LLD                                       | 0 |
|                                   | Co-58   | 20  | <LLD   | -   | -                              | <LLD                                       | 0 |
|                                   | Co-60   | 22  | <LLD   | -   | -                              | <LLD                                       | 0 |
|                                   | Zn-65   | 46  | <LLD   | -   | -                              | <LLD                                       | 0 |
|                                   | Cs-134  | 20  | <LLD   | -   | -                              | <LLD                                       | 0 |
|                                   | Cs-137  | 22  | <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

DUKE ENERGY FLORIDA, LLC- CR3 - 2019

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       | <19   | <15   | <38   | <19   | <42   | <19    | <21    | 2246±156 |
|         | 2       | <18   | <16   | <33   | <17   | <34   | <18    | <18    | 2390±151 |
|         | 3       | <21   | <18   | <42   | <19   | <36   | <20    | <22    | 2380±162 |
|         | 4       | <16   | <16   | <32   | <18   | <33   | <17    | <19    | 2320±148 |
| C30     | 1       | <21   | <20   | <37   | <22   | <46   | <18    | <22    | 2633±192 |
|         | 2       | <20   | <18   | <38   | <20   | <37   | <16    | <18    | 2480±176 |
|         | 3       | <14   | <15   | <32   | <15   | <31   | <15    | <15    | 1590±94  |
|         | 4       | <16   | <16   | <35   | <18   | <40   | <19    | <18    | 2450±157 |

### Carnivorous Fish

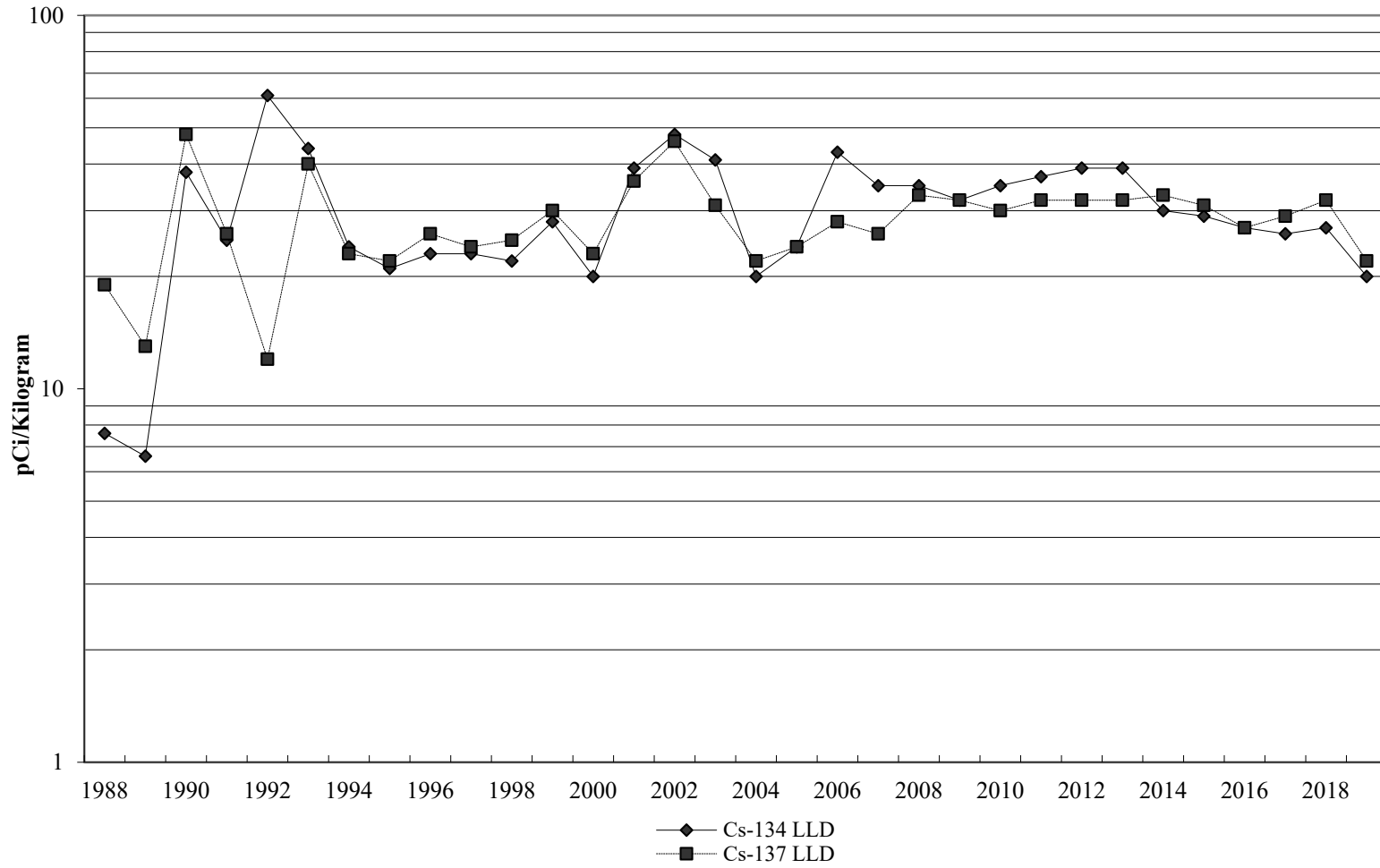


TABLE IV-D.2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA

JANUARY 1 TO DECEMBER 31, 2019

| 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 |                             |  |
| OYSTERS<br>(pCi/kg)               | γ Spec 8  |   |                                |                                   |            |                             |  |
|                                   | Mn-54   | 23  | <LLD                           | -                                 | -          | <LLD                        | 0  |
|                                   | Fe-59   | 78  | <LLD                           | -                                 | -          | <LLD                        | 0  |
|                                   | Co-58   | 32  | <LLD                           | -                                 | -          | <LLD                        | 0  |
|                                   | Co-60   | 26  | <LLD                           | -                                 | -          | <LLD                        | 0  |
|                                   | Zn-65   | 58  | <LLD                           | -                                 | -          | <LLD                        | 0  |
|                                   | Cs-134  | 20  | <LLD                           | -                                 | -          | <LLD                        | 0  |
|                                   | Cs-137  | 23  | <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**  
**DUKE ENERGY FLORIDA, LLC- CR3 - 2019**

**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       | <20   | <32   | <72   | <15   | <47   | <17    | <18    | 823±145  |
|         | 2       | <21   | <24   | <60   | <21   | <50   | <16    | <22    | 1340±132 |
|         | 3       | <22   | <29   | <62   | <26   | <58   | <19    | <22    | 837±124  |
|         | 4       | <19   | <24   | <47   | <17   | <44   | <19    | <20    | 772±87   |
| C30     | 1       | <20   | <28   | <76   | <21   | <53   | <18    | <18    | 778±144  |
|         | 2       | <19   | <29   | <63   | <23   | <53   | <18    | <23    | 1120±127 |
|         | 3       | <20   | <23   | <56   | <20   | <39   | <19    | <21    | 772±93   |
|         | 4       | <23   | <29   | <78   | <23   | <52   | <20    | <22    | 830±117  |

# Oysters

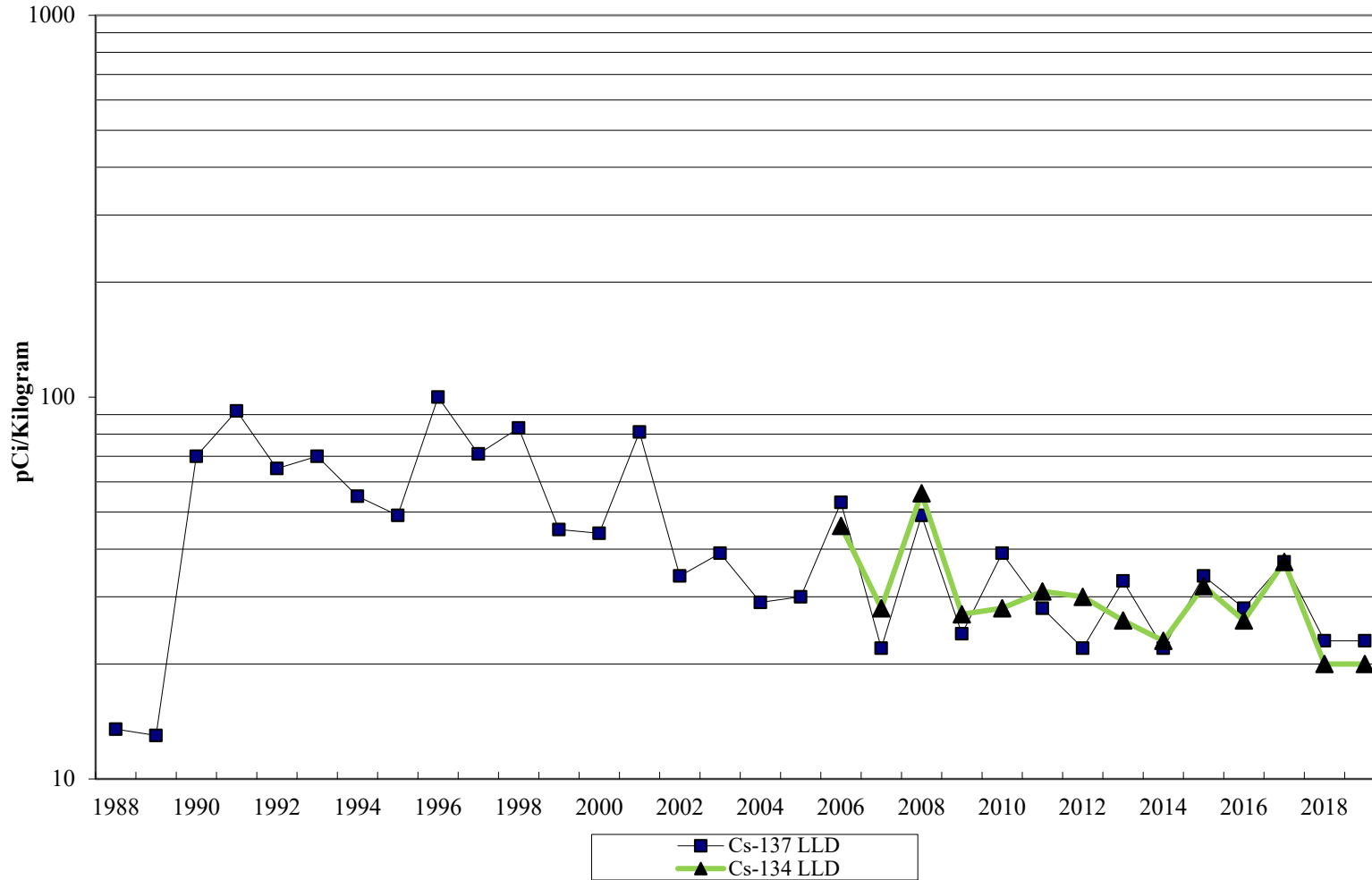


TABLE IV-D.3

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA

JANUARY 1 TO DECEMBER 31, 2019

| 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            |                             |  |
| BROAD LEAF VEGETATION (pCi/kg)    | γ Spec 36                                       |   |                                |                                   |                       |                             |  |
|                                   | Cs-134  | 16  | <LLD                           | -                                 | -                     | <LLD                        | 0  |
|                                   | Cs-137 <sup>2</sup>                             | 19  | 52 (11/24)<br>(6-329)          | C48B<br>0.9 @ 73°                 | 88(11/12)<br>(21-329) | 47 (7/12)<br>(13-154)       | 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> 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 - 2019

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

| STATION | MONTH | Cs-134 | Cs-137 | K-40     |
|---------|-------|--------|--------|----------|
| C47     | JAN   | <15    | <19    | 4945±239 |
|         | FEB   | <12    | <15    | 3808±165 |
|         | MAR   | <8     | 13±7   | 3334±140 |
|         | APR   | <8     | 154±8  | 2569±114 |
|         | MAY   | <12    | <15    | 4160±175 |
|         | JUN   | <9     | 20±6   | 3130±140 |
|         | JUL   | <8     | 22±6   | 3380±138 |
|         | AUG   | <8     | 127±6  | 2010±98  |
|         | SEP   | <10    | 18±8   | 3810±161 |
|         | OCT   | <9     | 120±10 | 2080±103 |
|         | NOV   | <14    | <19    | 3560±183 |
|         | DEC   | <13    | <20    | 3500±187 |
| C48A    | JAN   | <15    | <20    | 2682±173 |
|         | FEB   | <15    | <18    | 4524±233 |
|         | MAR   | <9     | <10    | 2612±120 |
|         | APR   | <12    | <17    | 2912±172 |
|         | MAY   | <9     | <6     | 2400±115 |
|         | JUN   | <10    | <10    | 2290±112 |
|         | JUL   | <12    | <16    | 2700±160 |
|         | AUG   | <14    | <17    | 2640±158 |
|         | SEP   | <9     | <10    | 2720±123 |
|         | OCT   | <13    | <17    | 2840±161 |
|         | NOV   | <12    | <18    | 1990±145 |
|         | DEC   | <14    | <20    | 2110±151 |



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

**DUKE ENERGY FLORIDA, LLC- CR3 - 2019**

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

| STATION | MONTH | Cs-134 | Cs-137 | K-40     |
|---------|-------|--------|--------|----------|
| C48B    | JAN   | <10    | 28±7   | 2323±114 |
|         | FEB   | <14    | 24±17  | 2014±144 |
|         | MAR   | <13    | <21    | 2767±174 |
|         | APR   | <8     | 20±5   | 2597±112 |
|         | MAY   | <9     | 14±5   | 2820±127 |
|         | JUN   | <12    | 151±17 | 1990±148 |
|         | JUL   | <7     | 15±7   | 2060±99  |
|         | AUG   | <9     | 329±11 | 2160±108 |
|         | SEP   | <14    | 168±16 | 1710±125 |
|         | OCT   | <13    | 139±20 | 1300±114 |
|         | NOV   | <14    | 108±18 | 1800±136 |
|         | DEC   | <15    | 43±21  | 2650±175 |

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

### Broad Leaf Vegetation

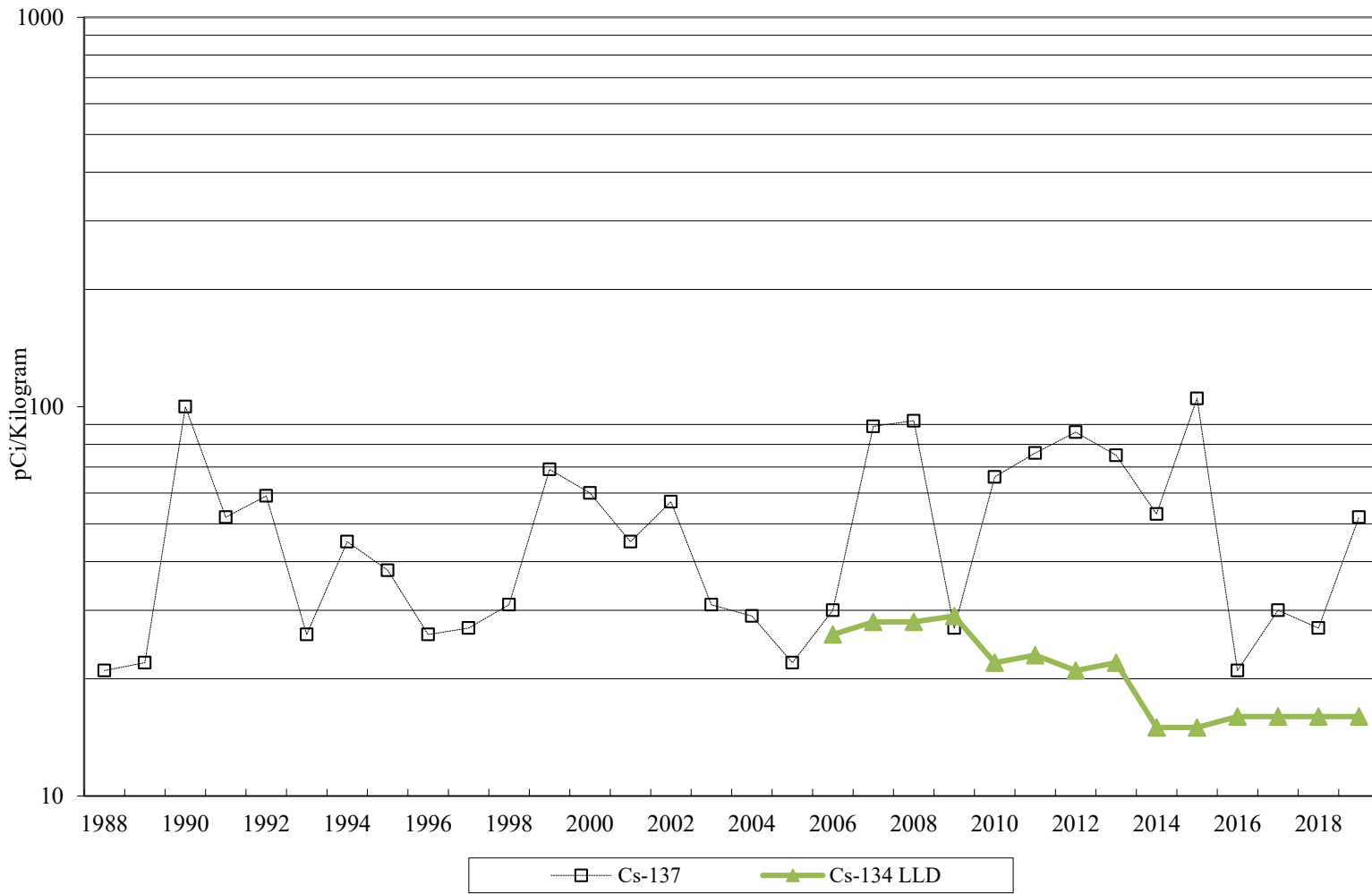


TABLE IV-D.4

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3

DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA

JANUARY 1 TO DECEMBER 31, 2019

| 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              | MEAN RANGE | NAME DISTANCE & BEARING    | MEAN RANGE          |                             |  |
| WATERMELON<br>(pCi/kg)            | γ Spec 1  |   |                         |            |                            |                     |                             |  |
|                                   |   | Cs-134                                      | 6                       | <LLD       |                            |                     | None                        | 0  |
|                                   |   | Cs-137                                      | 6                       | <LLD       |                            | C04 NE (6.0 miles)  | None                        | 0  |
| CITRUS<br>(pCi/kg)                | γ Spec 1  |   |                         |            |                            |                     |                             |  |
|                                   |   | Cs-134                                      | 8                       | <LLD       |                            | — —                 | None                        | 0  |
|                                   |   | Cs-137                                      | 11                      | <LLD       |                            | C19 ENE (9.6 miles) | None                        | 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.4.a

DUKE ENERGY FLORIDA, LLC- CR3 - 2019

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

| STATION          | MONTH   | Cs-134 | Cs-137 | K-40    |
|------------------|---------|--------|--------|---------|
| C04 – Watermelon | June    | <6     | <6     | 1140±72 |
| C19 – Citrus     | January | <8     | <11    | 1417±89 |