Progress Energy

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

Ref: ITS 5.7.1.1(b)

April 28, 2011
3F0411-03

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

Subject: Crystal River Unit 3 – 2010 Annual Radiological Environmental Operating Report

Dear Sir:

Florida Power Corporation (FPC), doing business as Progress Energy Florida, Inc., hereby submits the 2010 Annual Radiological Environmental Operating Report for Crystal River Unit 3 (CR-3) in accordance with the CR-3 Improved Technical Specifications, Section 5.7.1.1(b) and Section 6.6 of the Offsite Dose Calculation Manual (ODCM). The data provided in the attached report is consistent with the objectives outlined in the ODCM, and includes all radiological environmental samples taken during the report period from January 1, 2010 through December 31, 2010.

This letter establishes no new regulatory commitments.

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

Sincerely,

W. Holt

James W. Holt
Plant General Manager

JWH/ff

Attachment

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

A009
IE25
NRR

**Progress Energy Florida, Inc.**
Crystal River Nuclear Plant
15760 W. Powerline Street
Crystal River, FL 34428

# PROGRESS ENERGY FLORIDA, INC.

# CRYSTAL RIVER UNIT 3

# DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

# ATTACHMENT

# 2010 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

# ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

# 2010


## PROGRESS ENERGY FLORIDA, INC.

## CRYSTAL RIVER UNIT 3

Prepared By: Rudy Pinner 4/12/2011

Sr. Nuclear Plant Chemistry Specialist

# TABLE OF CONTENTS

## INTRODUCTION

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

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

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

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

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

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

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

## I. SUMMARY DESCRIPTION OF THE RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

The analytical results of the Crystal River Unit 3 (CR-3) operational Radiological Environmental Monitoring Program (REMP) for 2010 are contained in this report. The operational program began on January 1, 1977 just prior to initial criticality, which was achieved on January 14, 1977.

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

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

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

The results of the 2010 REMP have been compared to previous years' results. This comparison, in part illustrated by the trend graphs of Section IV, shows no evidence of consistent long-term increasing trends in any of the sample media. However, radioactive material is routinely quantified in sediment samples which are taken in the discharge canal near the liquid release discharge point. In general, these results verify the effectiveness of in-plant measures for controlling radioactive releases.

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

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

15 (249/256)
(4 - 35)

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

## TABLE I-1

## PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010

## SAMPLE STATION LOCATIONS

| SAMPLE MEDIA | STATION ID | DIRECTION | APPROX. DISTANCE (Miles) |
|---|---|---|---|
| TLD – on-site | C60 | N | 0.88 |
| | C61 | NNE | 0.92 |
| | C62 | NE | 1.17 |
| | C63 | ENE | 0.87 |
| | C64 | E | 0.80 |
| | C65 | ESE | 0.33 |
| | C66 | SE | 0.36 |
| | C67 | SSE | 0.33 |
| | C68 | S | 0.27 |
| | C69 | SSW | 0.31 |
| | C41 | SW | 0.43 |
| | C70 | WSW | 0.74 |
| | C71 | WNW | 0.58 |
| | C72 | NW | 0.30 |
| | C73 | NNW | 0.74 |
| | C27 | W | 0.41 |
| TLD – off-site | C18 | N | 5.3 |
| | C03 | NNE | 4.89 |
| | C04 | NE | 5.95 |
| | C74 | ENE | 5.13 |
| | C75 | E | 3.99 |
| | C76 | ESE | 5.61 |
| | C08 | SE | 5.66 |
| | C77 | SSE | 3.39 |
| | C09 | S | 3.23 |
| | C78 | WSW | 4.59 |
| | C14G | W | 2.53 |
| | C01 | NW | 4.8 |
| | C79 | NNW | 4.97 |
| | C47-Control | ESE | 78 |
| | C07* | ESE | 7.67 |
| | C40* | E | 3.48 |
| | C46* | N | 0.37 |

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

## TABLE I-1 (CONT'D)

## PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010

## SAMPLE STATION LOCATIONS

| SAMPLE MEDIA | STATION ID | DIRECTION | DISTANCE (Miles) |
|---|---|---|---|
| AIR | C07 | ESE | 7.7 |
| | C18 | N | 5.3 |
| | C40 | E | 3.5 |
| | C41 | SW | 0.4 |
| | C46 | N | 0.4 |
| | C47-Control | ESE | 78 |
| SEAWATER | C14H | NW | 0.1 |
| | C14G | W | 2.5 |
| | C13-Control | WSW | 4.6 |
| GROUND WATER | C40-Control | E | 3.6 |
| SITE GROUND WATER | CR3-2 | E | 0.1 |
| | CR3-4 | SSE | 0.086 |
| | CR3-5 | SSW | 0.051 |
| | CR3-6S | W | 0.038 |
| | CR3-6D | W | 0.038 |
| | CR3-7 | WNW | 0.060 |
| | CR3-8 | WNW | 0.073 |
| | CR3-9 | NW | 0.1 |
| | CR3-10 | NNE | 0.1 |
| DRINKING WATER | C07-Control | ESE | 7.4 |
| | C10-Control | ESE | 6.0 |
| | C18-Control | N | 5.3 |
| SHORELINE SEDIMENT | C09-Control | S | 3.2 |
| | C14H | NW | 0.1 |
| | C14M | W | 1.2 |
| | C14G | W | 2.5 |
| FISH & OYSTERS | C29 | W | 2.5 |
| | C30-Control | WSW | 3.4 |
| BROAD LEAF VEGETATION | C48A | N | 0.4 |
| | C48B | ENE | 0.9 |
| | C47-Control | ESE | 78 |
| WATERMELON | C04 | NE | 13 |
| CITRUS | C19 | ENE | 9.6 |

## TABLE I-2

## PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010

## SAMPLING AND ANALYSIS PROGRAM

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

*Includes 3 stations which are not required by the ODCM
[1]The maximum "a priori" LLD
[2]Same as Seawater γ Spec
[6]Additional 2 stations reported that are not required by the ODCM
[b]LLD for drinking water. If no drinking water pathway exists, a value of 3000 pCi/L may be used
[c]The specified LLD is for an equilibrium mixture of parent and daughter nuclides which contain 15 pCi/L of the parent nuclide
[e]LLDs apply only to quarterly composite gamma spectral analysis, not to analyses of single particulate filters
[f]LLD for drinking water. If no drinking water pathway exists, the LLD of the gamma isotopic analysis may be used
[g]LLD for I-131 applies to a single weekly filter

**TABLE I-2 (Cont'd)**

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**SAMPLING AND ANALYSIS PROGRAM**

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

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

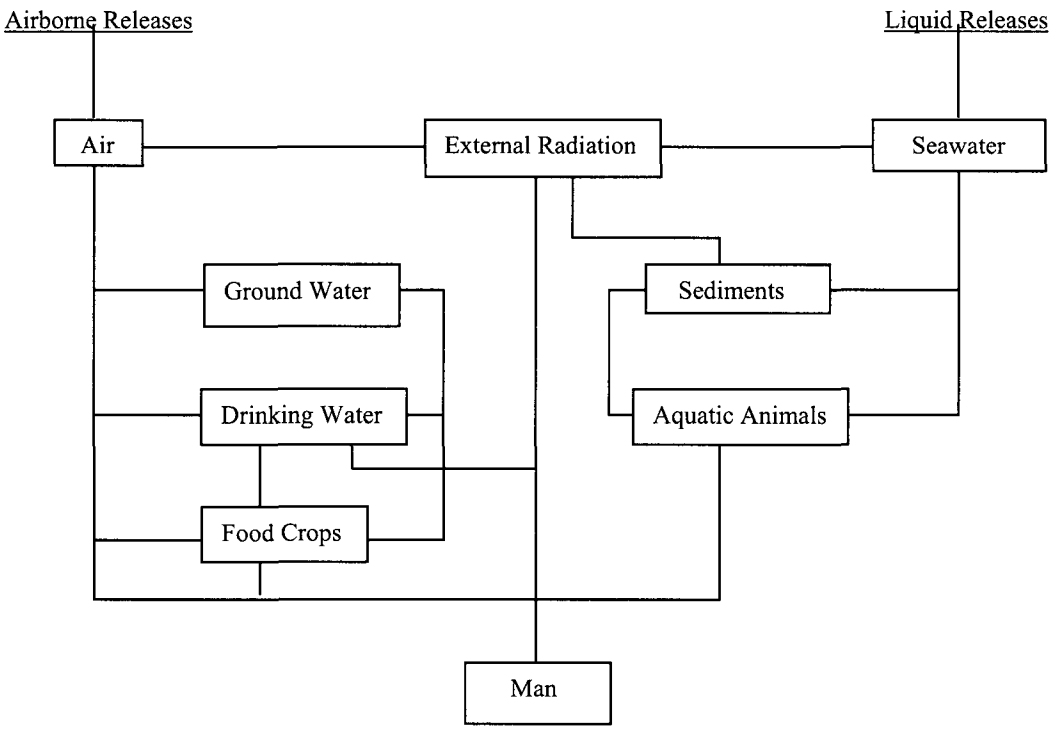



FIGURE I-1: Environmental Media and Exposure Pathways

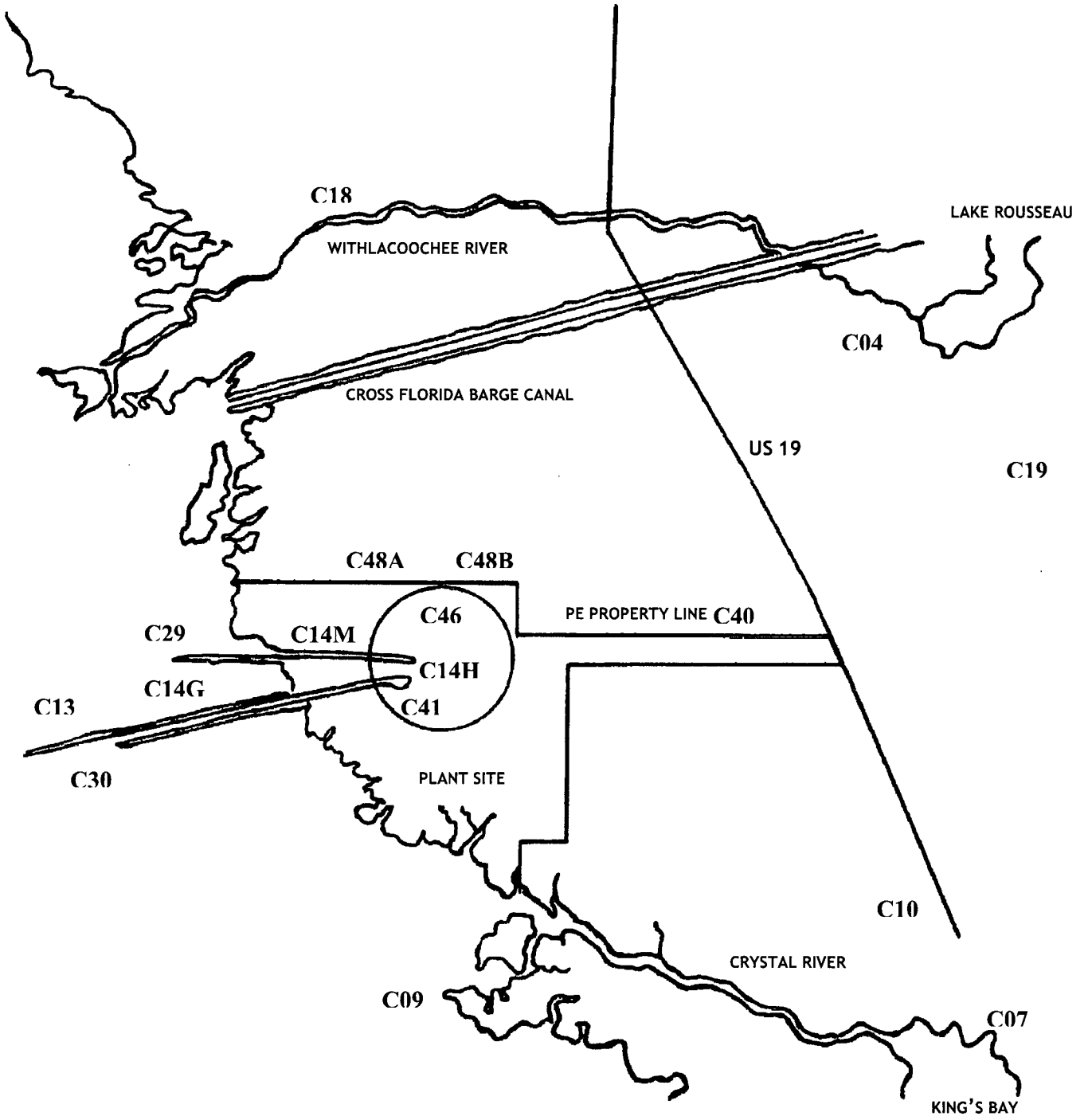



FIGURE I-2: Environmental Monitoring Sample Stations (non-TLDs)

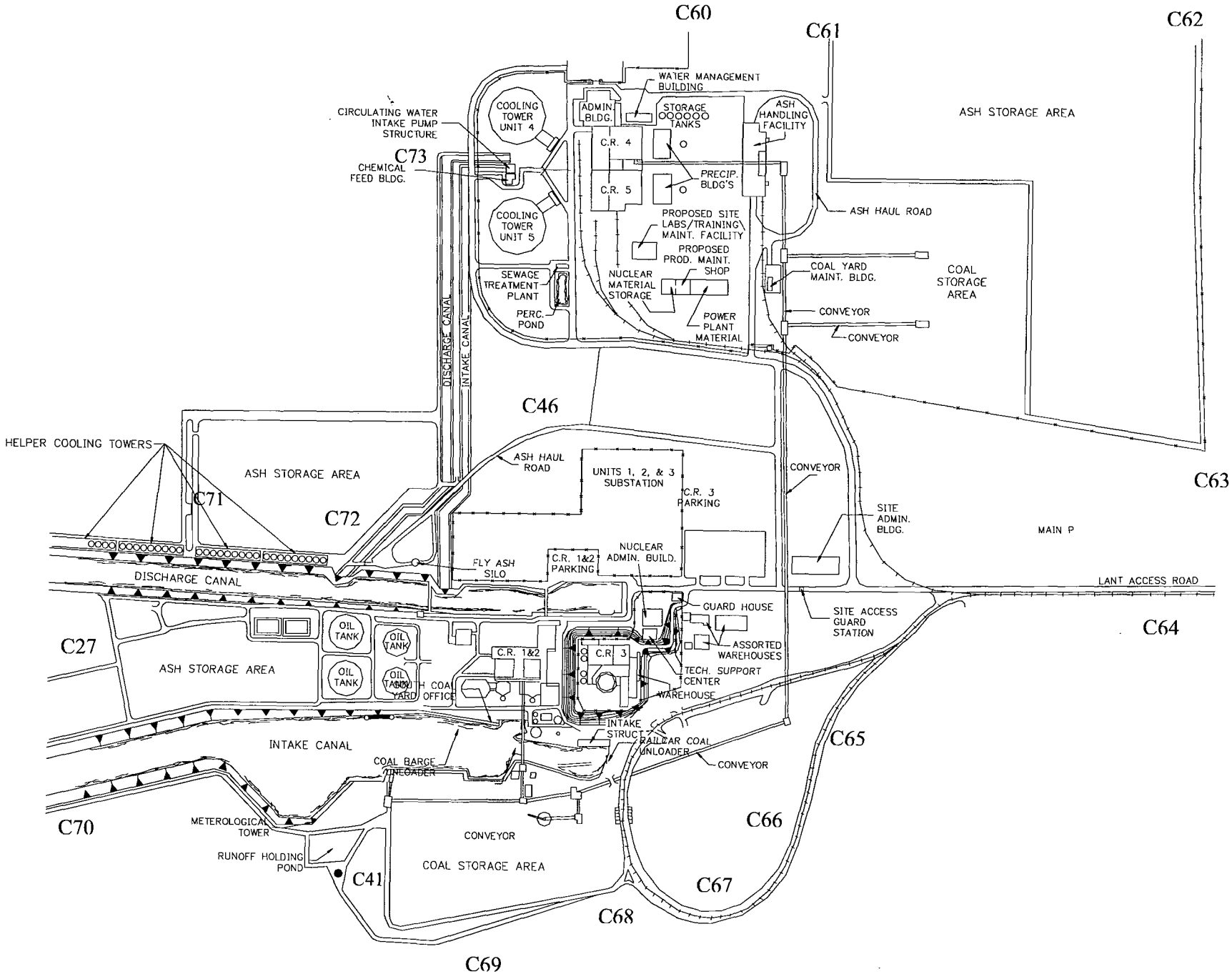



FIGURE I-3: Environmental Monitoring TLD Locations (on site)



8

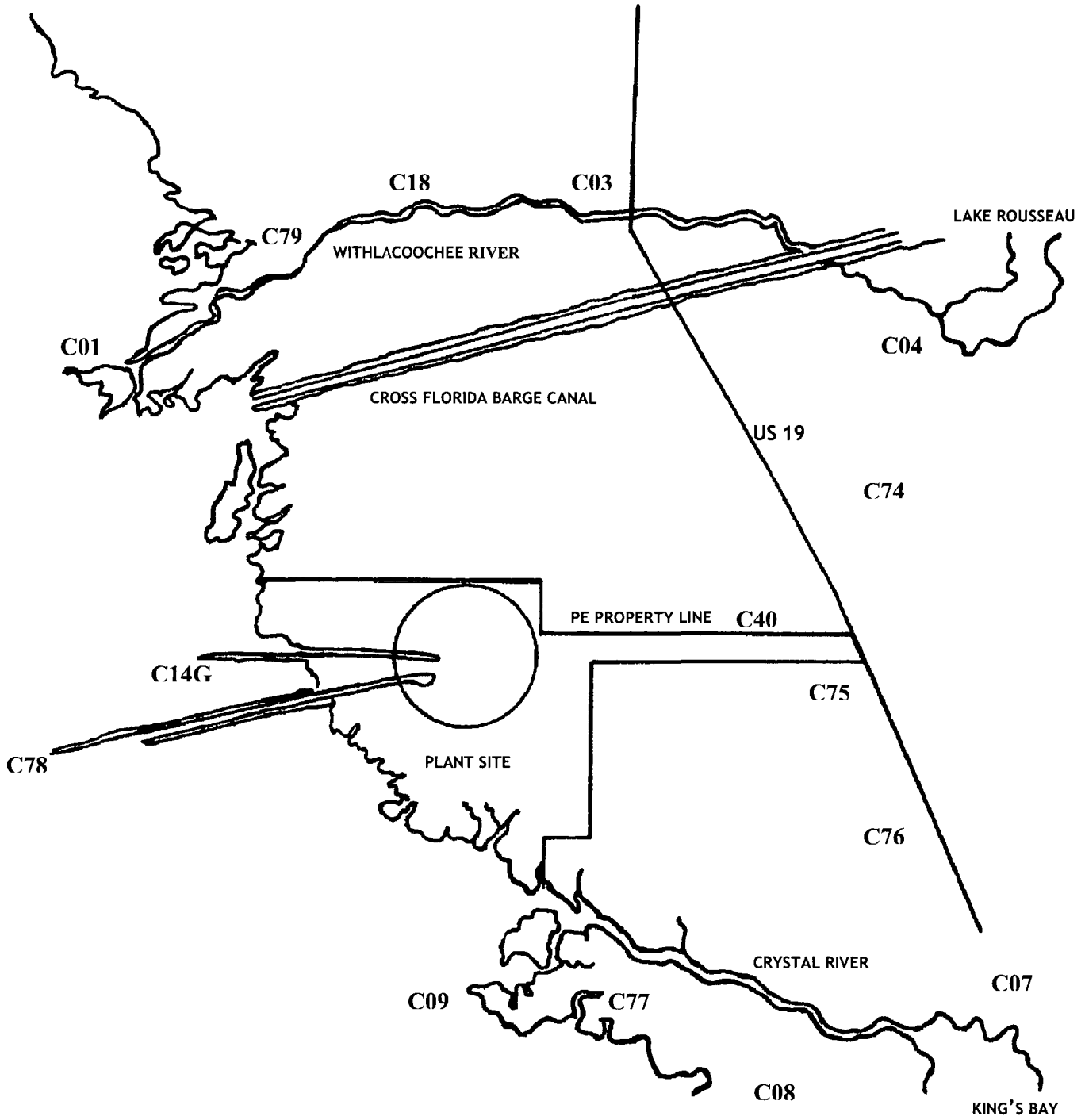
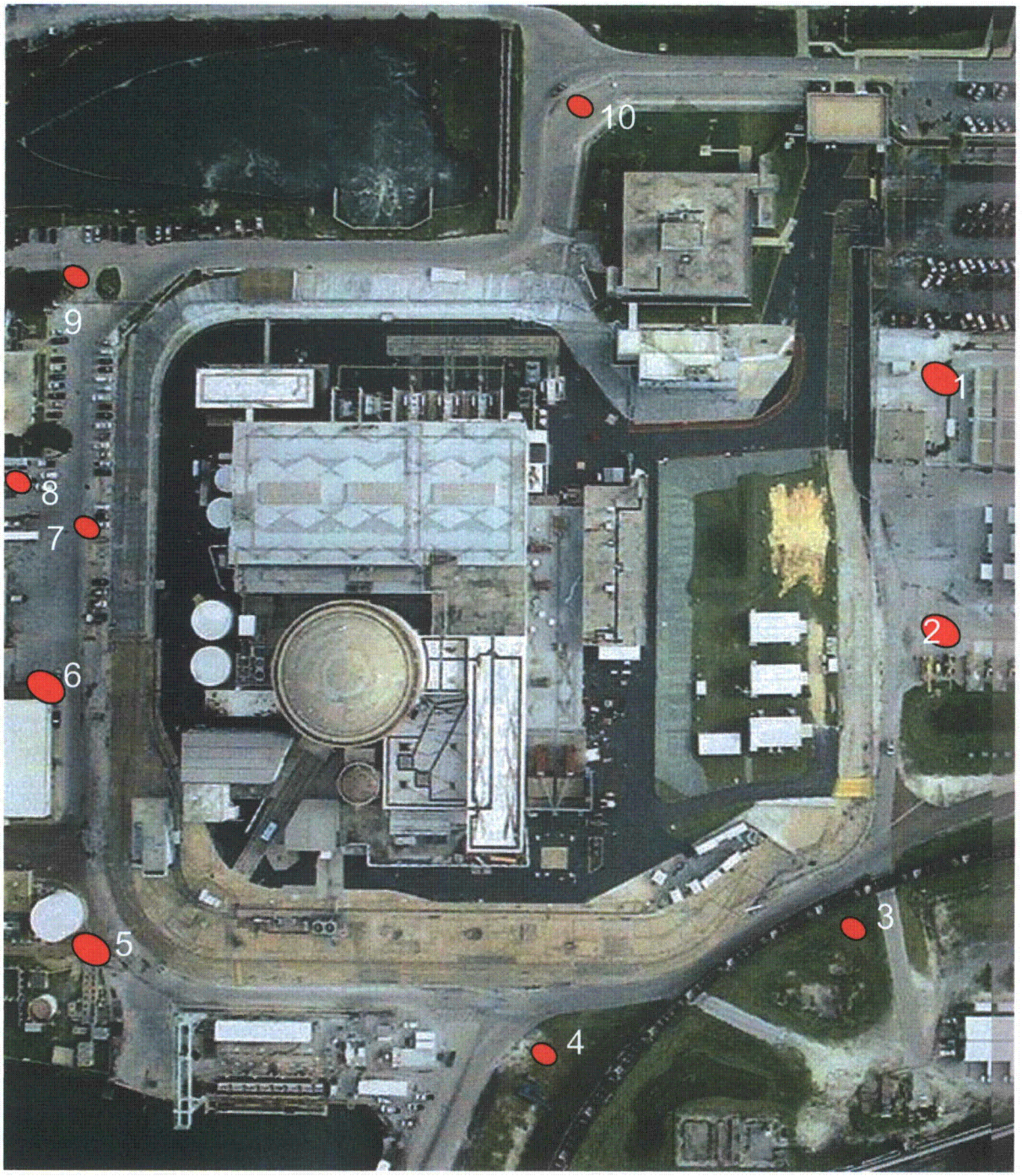



FIGURE I-4: Environmental Monitoring TLD Locations (off site)

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




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

II. LAND-USE CENSUS

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

| SECTOR | NEAREST RESIDENCE | NEAREST GARDEN (A) | NEAREST MILK ANIMAL |
|---|---|---|---|
| N | 4.5 @ 2° | * | * |
| NNE | 4.6 @ 15° | * | * |
| NE | 3.8 @ 54° | * | * |
| ENE | 3.4 @ 60° | * | * |
| E | 2.4 @ 92° | * | * |
| ESE | 4.2 @ 102° | 4.7 @ 103° | * |
| SE | 4.9 @ 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). The following units are used for each of the four media:

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

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

**Results for March 2010:**

| Media | Nuclide | Result | % Bias | Acceptance Range | Flag |
|---|---|---|---|---|---|
| Air | Co-60 | 2.62 | 5.9 | 1.731 – 3.215 | A |
| Air | Cs-134 | 2.33 | 9.4 | 1.49 – 2.77 | A |
| Air | Cs-137 | 1.74 | 13.7 | 1.07 – 1.99 | A |
| Air | Mn-54 | 3.75 | -1.5 | 2.11 – 3.93 | A |
| Air | Gross Beta | 1.45 | 12.4 | 0.65 – 1.94 | A |
| Soil | Mn-54 | 915.25 | 7.8 | 594 – 1104 | A |
| Soil | Co-60 | 647.25 | 4.1 | 435 – 809 | A |
| Soil | Cs-134 | 704.01 | -4.0 | 513 – 953 | A |
| Soil | Cs-137 | 816.78 | 4.9 | 545 – 1013 | A |
| Soil | Co-57 | 560.22 | 7.3 | 365 – 679 | A |
| Vegetation | Co-60 | 3.01 | -8.0 | 2.29 – 4.25 | A |
| Vegetation | Zn-65 | 6.88 | -3.1 | 4.97 – 9.23 | A |
| Vegetation | Cs-134 | 3.93 | -10.5 | 3.07 – 5.71 | A |
| Vegetation | Cs-137 | 2.78 | -9.2 | 2.14 – 3.98 | A |
| Water | H-3 | 94.61 | 4.2 | 63.6 – 118.0 | A |
| Water | Mn-54 | 28.38 | 5.5 | 18.8 – 35.0 | A |
| Water | Co-57 | 27.1 | -4.2 | 19.8 – 36.8 | A |
| Water | Cs-137 | 61.96 | 2.2 | 42.4 – 78.8 | A |
| Water | Ni-63 | 62.4 | 4.2 | 41.9 – 77.9 | A |

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

**Results for September 2010:**

| Media | Nuclide | Result | % Bias | Acceptance Range | Flag |
|---|---|---|---|---|---|
| Air | Mn-54 | 3.56 | 12.0 | 2.23 – 4.13 | A |
| Air | Co-57 | 3.78 | -7.4 | 2.86 – 5.30 | A |
| Air | Co-60 | 2.86 | -2.1 | 2.04 – 3.80 | A |
| Air | Cs-134 | 2.85 | -4.4 | 2.09 – 3.87 | A |
| Air | Am-241 | 0.11 | -4.3 | 0.081 – 0.15 | A |
| Air | Gross Beta | 0.498 | -0.4 | 0.25 – 0.75 | A |
| Soil | Mn-54 | 874.59 | 6.7 | 574 – 1066 | A |
| Soil | Co-60 | 345.98 | 0.9 | 240 – 446 | A |
| Soil | Cs-137 | 694.27 | 3.6 | 469 – 871 | A |
| Soil | Cs-134 | 952.61 | 1.3 | 658 – 1222 | A |
| Soil | Am-241 | 95.14 | 9.4 | 61 – 113 | A |
| Vegetation | Mn-54 | 5.76 | -8.4 | 4.401 – 8.173 | A |
| Vegetation | Co-57 | 7.41 | -10.4 | 5.79 – 10.75 | A |
| Vegetation | Cs-137 | 5.32 | -9.5 | 4.12 – 7.64 | A |
| Vegetation | Cs-134 | 4.56 | -4.8 | 3.35 – 6.23 | A |
| Vegetation | Zn-65 | 5.14 | -4.6 | 3.77 – 7.01 | |
| Water | H-3 | 471.58 | 4.0 | 317.4 – 589.4 | A |
| Water | Co-57 | 36.04 | 0.1 | 25.2 – 46.8 | A |
| Water | Co-60 | 27.15 | -4.1 | 19.8 – 36.8 | A |
| Water | Cs-134 | 30.98 | -1.3 | 22.0 – 40.8 | A |
| Water | Cs-137 | 44.26 | 1.7 | 30.9 – 57.5 | A |
| Water | Sr-90 | 7.66 | -7.7 | 5.8 – 10.8 | A |

## IV-A. AIRBORNE PATHWAY

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

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

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

Three hundred twelve particulate samples were analyzed for gross beta activity, all of which had measurable activity except 1 sample. The average indicator concentration was 20 pCi/1000 $m^3$ with a range of 15 to 29 pCi/1000 $m^3$. The average indicator concentration since 1996 was in the range of 14 to 20 pCi/1000 $m^3$. The control location concentration for 2010 averaged 18 pCi/1000 $m^3$, with a range of 14 to 23 pCi/1000 $m^3$.

Three hundred twelve samples were analyzed for iodine activity, with none having measurable activity. The highest iodine LLD was 0.15 pCi/$m^3$. This LLD value was influenced by a partial (minimal) sample run due to a power outage at the sample station. On all other samples that ran the normal amount of time, the highest iodine LLD was 0.03 pCi/$m^3$.

Quarterly composite data are summarized in Table IV-A.4. Measurable quantities of cesium were not identified in any particulate filter sample. The highest cesium LLD was 3.4 pCi/1000 $m^3$ for cesium 134.

There were no instances of non-collected airborne samples for the year 2010, but there were several instances of air sampler partial run times as follows:

1. In February station C-40 was down for 42.75 hours due to a grounded underground power feed cable.
2. In May station C-46 was down for 138.65 hours due to a failed vacuum pump.
3. In June station C-40 was down for 151.2 hours due to the power being disconnected by fossil maintenance to perform maintenance on a nearby well supply pump. Fossil maintenance did not realize at the time that this maintenance was affecting operation of this air sampler. The model work order for this fossil maintenance activity has been revised to eliminate the electrical tagout problems and loss of power to the air sampler.

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

| | |
|---|---|
| C40 | 2.22% |
| C46 | 1.59% |

The air sample station's down times are documented in the plant Corrective Action Program (CAP) under Nuclear Condition Reports (NCRs) 379191, 400306, and 402868.

## 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, 2010**

| MEDIUM OR PATHWAY SAMPLED (UNITS) | ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED | LOWER LIMIT OF DETECTION (LLD)[1] | ALL INDICATOR LOCATIONS MEAN RANGE | LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING | MEAN RANGE | CONTROL LOCATION MEAN RANGE | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |
|---|---|---|---|---|---|---|---|
| AIRBORNE IODINE ($pCi/m^3$) | γ Spec 312 | | | | | | |
| | I-131 | 0.03 | <LLD | -- | -- | <LLD | 0 |
| AIRBORNE PARTICULATES ($pCi/1000m^3$ for Gross ß, $pCi/1000m^3$ for γ Spec) | Gross ß 312 | 7.0 | 20 (311/312) (15–29) | C40 3.4 @ 60° | 21 (51/52) (8–39) | 18 (52/52) (8–38) | 0 |
| | γ Spec 24 | | | | | | |
| | Cs-134 | 3.4 | <LLD | -- | -- | <LLD | 0 |
| | Cs-137 | 2.5 | <LLD | -- | -- | <LLD | 0 |

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

**TABLE IV-A.2**

**PROGRESS ENERGY FLORIDA, INC. - CR3 – 2010**

**pCi/m$^3$ IODINE - 131 IN AIR**

| | SAMPLE SITE | | | | | |
|---|---|---|---|---|---|---|
| Collection Date | C07 | C18 | C40 | C41 | C46 | C47 |
| 05-Jan-10 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 |
| 12-Jan-10 | <0.03 | <0.03 | <0.03 | <0.03 | <0.02 | <0.03 |
| 19-Jan-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 25-Jan-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 02-Feb-10 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 |
| 09-Feb-10 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 |
| 16-Feb-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 23-Feb-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 02-Mar-10 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 |
| 09-Mar-10 | <0.03 | <0.03 | <0.03 | <0.03 | <0.02 | <0.02 |
| 16-Mar-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 23-Mar-10 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 |
| 30-Mar-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |

**TABLE IV-A.2 (Cont'd)**

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/m$^3$ IODINE - 131 IN AIR**

| | SAMPLE SITE | | | | | |
|---|---|---|---|---|---|---|
| Collection Date | C07 | C18 | C40 | C41 | C46 | C47 |
| 06-Apr-10 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 |
| 13-Apr-10 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 |
| 20-Apr-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 27-Apr-10 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 |
| 04-May-10 | <0.02 | <0.03 | <0.03 | <0.03 | <0.03 | <0.02 |
| 11-May-10 | <0.03 | <0.02 | <0.03 | <0.02 | <0.02 | <0.03 |
| 18-May-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.15(A) | <0.03 |
| 25-May-10 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 |
| 01-Jun-10 | <0.01 | <0.01 | <0.06(B) | <0.01 | <0.01 | <0.01 |
| 08-Jun-10 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 |
| 15-Jun-10 | <0.03 | <0.03 | <0.03(C) | <0.03 | <0.03 | <0.03 |
| 21-Jun-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 29-Jun-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |

(A) At time of collection vacuum pump not running; pump failed and was replaced. Estimated run time 25.6 out of 164.3 hours.
(B) Power out to hut due to work on nearby well pump station; power restored at 1800 on this date. Estimated run time 16.8 out of 168 hours.
(C) Power out to hut; power restored at 1400 on this date. Estimated run time 145 out of 168 hours.

**TABLE IV-A.2 (Cont'd)**

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/m$^3$ IODINE - 131 IN AIR**

| | SAMPLE SITE | | | | | |
|---|---|---|---|---|---|---|
| Collection Date | C07 | C18 | C40 | C41 | C46 | C47 |
| 06-Jul-10 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 |
| 13-Jul-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 20-Jul-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 27-Jul-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 02-Aug-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 10-Aug-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 17-Aug-10 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 |
| 24-Aug-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 31-Aug-10 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 |
| 07-Sep-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 14-Sep-10 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 |
| 21-Sep-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 28-Sep-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |

**TABLE IV-A.2 (Cont'd)**

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/m$^3$ IODINE - 131 IN AIR**

| | SAMPLE SITE | | | | | |
|---|---|---|---|---|---|---|
| Collection Date | C07 | C18 | C40 | C41 | C46 | C47 |
| 05-Oct-10 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 |
| 12-Oct-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 19-Oct-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 26-Oct-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 02-Nov-10 | <0.03 | <0.02 | <0.03 | <0.02 | <0.03 | <0.02 |
| 09-Nov-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 16-Nov-10 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 |
| 23-Nov-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 30-Nov-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 07-Dec-10 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 |
| 15-Dec-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 21-Dec-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 |
| 28-Dec-10 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |

**TABLE IV-A.3**

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/1000m$^3$ GROSS ß IN AIR**

| | SAMPLE SITE | | | | | |
|---|---|---|---|---|---|---|
| Collection Date | C07 | C18 | C40 | C41 | C46 | C47 |
| 05-Jan-10 | 20 | 30 | 28 | 25 | 22 | 28 |
| 12-Jan-10 | 19 | 28 | 16 | 25 | 30 | 23 |
| 19-Jan-10 | 19 | 20 | 25 | 18 | 21 | 12 |
| 25-Jan-10 | 13 | 17 | 16 | 15 | 12 | 10 |
| 02-Feb-10 | 17 | 16 | 22(A) | 18 | 16 | 20 |
| 09-Feb-10 | 10 | 13 | 13(B) | 12 | 11 | 11 |
| 16-Feb-10 | 17 | 22 | 24 | 19 | 23 | 20 |
| 23-Feb-10 | 15 | 14 | 16 | 18 | 14 | 10 |
| 02-Mar-10 | 29 | 25 | 29 | 26 | 27 | 29 |
| 09-Mar-10 | 15 | 19 | 21 | 24 | 17 | 18 |
| 16-Mar-10 | 14 | 14 | 17 | 17 | 16 | 16 |
| 23-Mar-10 | 13 | 10 | 11 | 10 | 15 | 11 |
| 30-Mar-10 | 11 | 15 | 11 | 15 | 15 | 18 |
| Average: | 16 | 19 | 19 | 19 | 18 | 17 |

(A) No power at time of collection; reported out at 2200 on 01-Feb-10. Estimated run time 177.5 out of 187 hours.
(B) Power restored at 1645 on 03-Feb-10

**TABLE IV-A.3 (Cont'd)**

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/1000m$^3$ GROSS ß IN AIR**

| | SAMPLE SITE | | | | | |
|---|---|---|---|---|---|---|
| Collection Date | C07 | C18 | C40 | C41 | C46 | C47 |
| 06-Apr-10 | 20 | 23 | 25 | 19 | 21 | 22 |
| 13-Apr-10 | 13 | 22 | 20 | 20 | 18 | 16 |
| 20-Apr-10 | 9 | 20 | 18 | 17 | 20 | 15 |
| 27-Apr-10 | 20 | 23 | 25 | 25 | 22 | 26 |
| 04-May-10 | 16 | 20 | 19 | 23 | 21 | 23 |
| 11-May-10 | 17 | 22 | 21 | 19 | 19 | 18 |
| 18-May-10 | 13 | 18 | 21 | 19 | 29(A) | 14 |
| 25-May-10 | 15 | 16 | 19 | 11 | 14 | 17 |
| 01-Jun-10 | 13 | 16 | <60(B) | 8 | 12 | 12 |
| 08-Jun-10 | 12 | 18 | 19 | 16 | 15 | 14 |
| 15-Jun-10 | 19 | 19 | 20(C) | 24 | 22 | 20 |
| 21-Jun-10 | 17 | 17 | 17 | 13 | 17 | 15 |
| 29-Jun-10 | 9 | 10 | 12 | 10 | 11 | 12 |
| Average: | 15 | 19 | 20 | 17 | 19 | 17 |

(A) Pump not running at time of collection; pump failed and was replaced. Estimated run time 25.6 out of 164.3 hours.
(B) Power out to hut due to work on nearby well pump station; power restored at 1800 on this date. Estimated run time 16.8 out of 168 hours.
(C) Power out to hut; unknown reason why; power restored at 1400 on this date. Estimated run time 145 out of 168 hours.

**TABLE IV-A.3 (Cont'd)**

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/1000m$^3$ GROSS ß IN AIR**

| | SAMPLE SITE | | | | | |
|---|---|---|---|---|---|---|
| Collection Date | C07 | C18 | C40 | C41 | C46 | C47 |
| 06-Jul-10 | 8 | 12 | 11 | 9 | 9 | 9 |
| 13-Jul-10 | 19 | 23 | 20 | 13 | 15 | 18 |
| 20-Jul-10 | 19 | 20 | 15 | 19 | 15 | 15 |
| 27-Jul-10 | 14 | 21 | 17 | 18 | 19 | 20 |
| 02-Aug-10 | 15 | 10 | 11 | 9 | 12 | 5 |
| 10-Aug-10 | 12 | 13 | 12 | 15 | 14 | 11 |
| 17-Aug-10 | 12 | 15 | 11 | 17 | 13 | 13 |
| 24-Aug-10 | 7 | 6 | 8 | 6 | 7 | 8 |
| 31-Aug-10 | 8 | 8 | 12 | 9 | 10 | 9 |
| 07-Sep-10 | 27 | 23 | 28 | 24 | 32 | 24 |
| 14-Sep-10 | 13 | 13 | 13 | 16 | 12 | 13 |
| 21-Sep-10 | 30 | 33 | 35 | 29 | 35 | 25 |
| 28-Sep-10 | 19 | 23 | 24 | 21 | 22 | 18 |
| Average: | 16 | 17 | 17 | 16 | 16 | 14 |

**TABLE IV-A.3 (Cont'd)**

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/1000m$^3$ GROSS ß IN AIR**

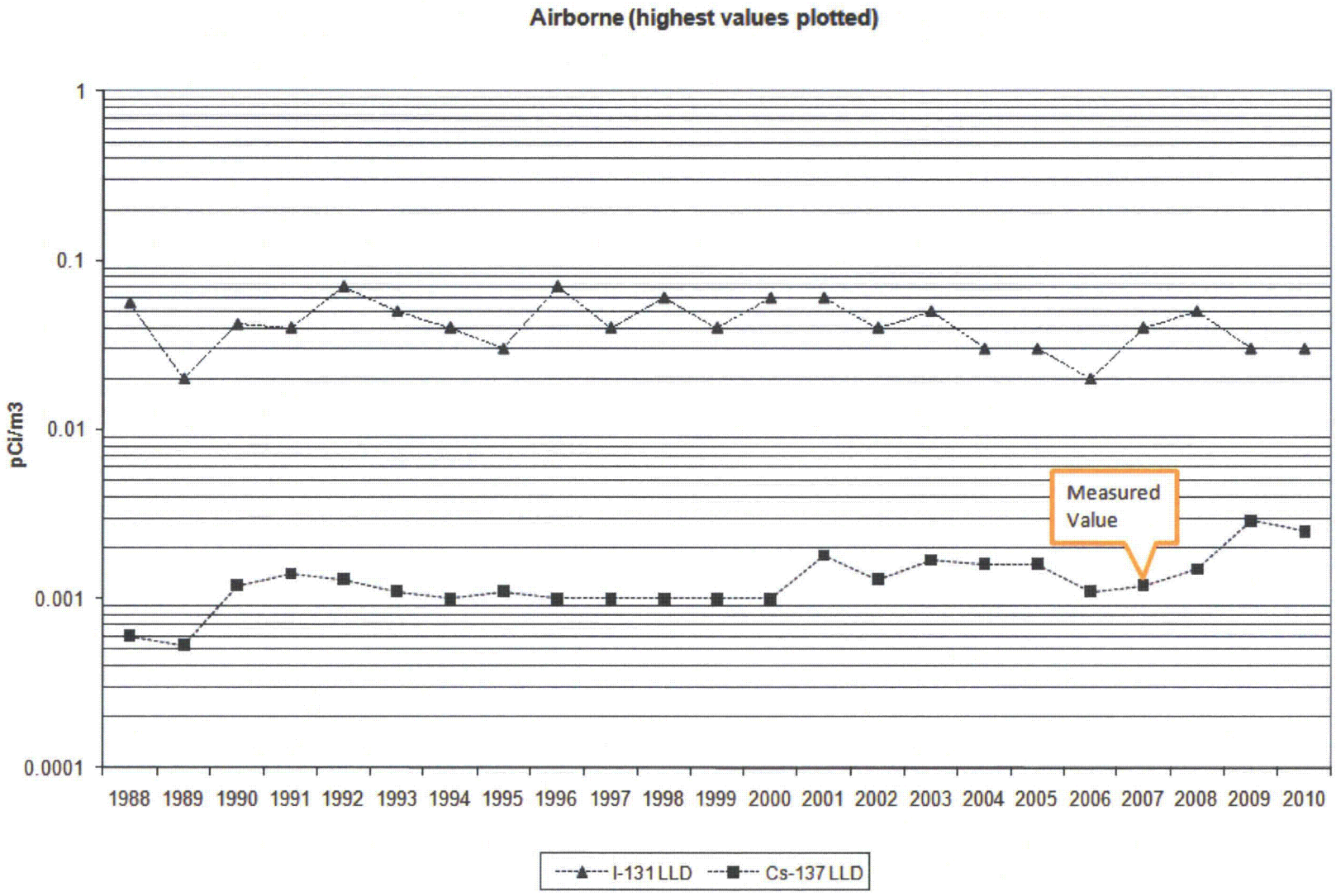
| | SAMPLE SITE | | | | | |
|---|---|---|---|---|---|---|
| Collection Date | C07 | C18 | C40 | C41 | C46 | C47 |
| 05-Oct-10 | 22 | 22 | 21 | 19 | 17 | 21 |
| 12-Oct-10 | 31 | 48 | 39 | 41 | 39 | 33 |
| 19-Oct-10 | 28 | 38 | 32 | 38 | 42 | 30 |
| 26-Oct-10 | 38 | 46 | 46 | 43 | 43 | 38 |
| 02-Nov-10 | 11 | 14 | 17 | 20 | 21 | 10 |
| 09-Nov-10 | 18 | 18 | 19 | 17 | 23 | 17 |
| 16-Nov-10 | 28 | 31 | 34 | 29 | 29 | 24 |
| 23-Nov-10 | 20 | 25 | 21 | 17 | 22 | 22 |
| 30-Nov-10 | 13 | 20 | 17 | 20 | 18 | 12 |
| 07-Dec-10 | 36 | 29 | 35 | 21 | 33 | 25 |
| 15-Dec-10 | 26 | 24 | 26 | 23 | 23 | 25 |
| 21-Dec-10 | 17 | 21 | 27 | 24 | 21 | 16 |
| 28-Dec-10 | 23 | 32 | 27 | 26 | 30 | 28 |
| Average | 24 | 28 | 28 | 26 | 28 | 23 |

**TABLE IV-A.4**

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

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

| STATION | NUCLIDE | FIRST QUARTER | SECOND QUARTER | THIRD QUARTER | FOURTH QUARTER |
|---|---|---|---|---|---|
| C07 | Be-7 | 124 | 112 | 112 | 119 |
| | K-40 | <33 | <34 | <33 | <31 |
| | Cs-134 | <3.0 | <2.8 | <2.8 | <3.4 |
| | Cs-137 | <2.0 | <1.5 | <2.4 | <2.5 |
| C18 | Be-7 | 137 | 136 | 143 | 170 |
| | K-40 | <36 | <5.0 | <29 | <23 |
| | Cs-134 | <3.0 | <0.6 | <2.1 | <1.8 |
| | Cs-137 | <1.1 | <0.4 | <1.4 | <1.3 |
| C40 | Be-7 | 159 | 176 | 153 | 205 |
| | K-40 | <20 | <19 | <21 | <26 |
| | Cs-134 | <1.7 | <2.4 | <1.6 | <1.6 |
| | Cs-137 | <1.7 | <1.3 | <1.5 | <1.3 |
| C41 | Be-7 | 145 | 130 | 151 | 119 |
| | K-40 | <22 | <18 | <23 | <20 |
| | Cs-134 | <1.1 | <1.8 | <1.6 | <1.7 |
| | CS-137 | <0.9 | <1.5 | <1.3 | <1.5 |
| C46 | Be-7 | 113 | 128 | 162 | 153 |
| | K-40 | <24 | <26 | <4.0 | <13 |
| | Cs-134 | <1.2 | <1.4 | <1.9 | <1.2 |
| | Cs-137 | <1.1 | <1.0 | <0.9 | <0.9 |
| C47 | Be-7 | 139 | 156 | 170 | 175 |
| | K-40 | <21 | <20 | <16 | <20 |
| | Cs-134 | <2.1 | <1.9 | <1.7 | <2.0 |
| | Cs-137 | <1.4 | <1.4 | <1.4 | <1.6 |


Airborne (highest values plotted)
pCi/m3
1
0.1
0.01
0.001
0.0001
1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Measured Value
I-131 LLD
Cs-137 LLD

## IV-B. DIRECT RADIATION

Direct radiation measurements (using TLDs) were taken at seventeen locations (stations C60 through C73 and station C27) within one mile of the plant, at fifteen locations ranging from 2.8 to 6.3 miles from the plant, and at one control location 78 miles from the site. One-hundred and thirty-one TLDs were collected during 2010.

Table IV-B provides a statistical summary of the analytical results for 131 TLDs sampled throughout the year.

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

The highest on-site dose was 92 mrem/yr at station C71 (WNW at 3600 feet). Station C71 was relocated in 1992 due to construction of the helper cooling towers on the former site. The new location has a higher background radiation level due to being closer to the storage pond for Units 4 & 5 fly ash, which produces a higher external radiation component than normal levels of natural background. The second highest on-site dose was 63 mrem/yr at station C65 (ESE at 1584 feet).

The highest off-site dose was 55 mrem/yr at station C40 (east at 3.5 miles). The control station (C47) dose was 53 mrem/yr. The average for all stations (except control) was 49 mrem/yr for 2010, 51 mrem/yr for 2009, and 59 mrem/yr for 2008. Direct radiation results are similar to previous years and show no change of significance.

There was one missing or unanalyzed TLD during this evaluation period that was lost at location C09 (S @ 3.2 miles) for the 3$^{rd}$ quarter deployment period. The missing TLD event is documented in the plant corrective action program (CAP) under nuclear condition report (NCR) 417964.

**TABLE IV-B**

**RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY**

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

**CITRUS COUNTY, FLORIDA** **JANUARY 1 TO DECEMBER 31, 2010**

| MEDIUM OR PATHWAY SAMPLED (UNITS) | ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED | LOWER LIMIT OF DETECTION (LLD) | ALL INDICATOR LOCATIONS MEAN RANGE | LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING | MEAN RANGE | CONTROL LOCATION MEAN RANGE | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |
|---|---|---|---|---|---|---|---|
| DIRECT RADIATION (mrem/yr) | $\gamma$ DOSE, 131 | 15 | 49 (127/127) (34 - 92) | C71 0.6 @ 296° | 83 (4/4) (80 - 92) | 53 (4/4) (46 - 57) | 0 |

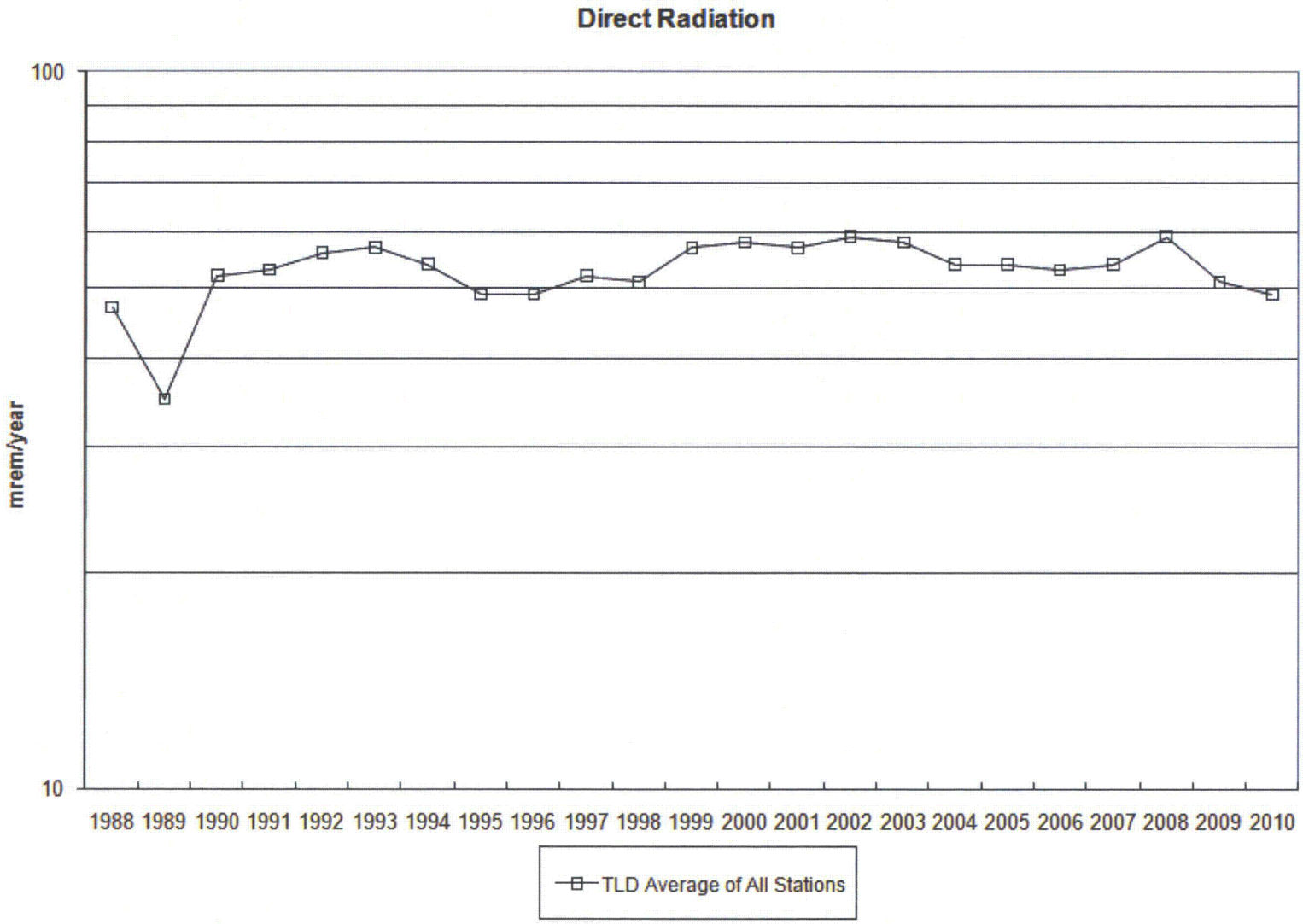
**TABLE IV-B.1**

**PROGRESS ENERGY FLORIDA, INC. - CR-3 - 2010**

**mrem/yr γ Dose**

| TLD STATION | Quarter | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| CO1 | | 37 | 40 | 41 | 34 |
| CO3 | | 36 | 39 | 40 | 34 |
| CO4 | | 38 | 39 | 38 | 36 |
| CO7* | | 39 | 36 | 38 | 34 |
| CO8 | | 39 | 35 | 39 | 35 |
| C09 | | 39 | 37 | Lost | 36 |
| C14G | | 47 | 46 | 47 | 45 |
| C18 | | 45 | 42 | 41 | 42 |
| C27 | | 57 | 55 | 55 | 54 |
| C40* | | 56 | 54 | 53 | 55 |
| C41 | | 54 | 52 | 49 | 51 |
| C46* | | 51 | 50 | 51 | 52 |
| C47 (CONTROL) | | 57 | 46 | 53 | 55 |
| C60 | | 48 | 45 | 46 | 46 |
| C61 | | 54 | 53 | 51 | 53 |
| C62 | | 55 | 56 | 56 | 54 |
| C63 | | 53 | 53 | 52 | 53 |
| C64 | | 51 | 51 | 48 | 48 |
| C65 | | 63 | 59 | 60 | 59 |
| C66 | | 53 | 53 | 54 | 51 |
| C67 | | 50 | 51 | 56 | 55 |
| C68 | | 56 | 52 | 51 | 51 |
| C69 | | 58 | 55 | 56 | 54 |
| C70 | | 57 | 56 | 57 | 56 |
| C71 | | 92 | 82 | 80 | 80 |
| C72 | | 54 | 54 | 50 | 49 |
| C73 | | 50 | 48 | 48 | 46 |
| C74 | | 39 | 39 | 36 | 36 |
| C75 | | 51 | 48 | 48 | 47 |
| C76 | | 46 | 44 | 43 | 42 |
| C77 | | 47 | 45 | 44 | 43 |
| C78 | | 41 | 40 | 38 | 40 |
| C79 | | 46 | 44 | 44 | 41 |

*TLDs not required by the ODCM.


Direct Radiation
100
10
mrem/year
1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
TLD Average of All Stations

## IV-C. WATERBORNE PATHWAY

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

1. Monthly seawater grab samples are taken at two locations in the discharge canal (C14G and C14H) and at one control location (C13) near the mouth of the intake canal. In 2010, of twenty-four indicator samples, one had measurable tritium at a concentration of 1774 pCi/L, as compared to sixteen measurable samples containing tritium with an average of 2990 pCi/L in 2009. The sample with the highest concentration of tritium, 1774 pCi/L, was obtained in November at station C14H near the head of the discharge canal. The seawater tritium activity is consistent with the concentration of tritium in the liquid waste stream and the release times of waste tanks. CR-3 was in Refuel 16 outage at the time of sampling with reduced dilution due to no circulating water pumps running. Plant raw water pumps were providing the dilution flow. This resulted in the concentration of tritium in the discharge canal being elevated. In 2010 all control station samples' tritium concentrations were <LLD. The 2009 control station results averaged 219 pCi/L.

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

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

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

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

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

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

3. Quarterly site ground water samples are taken at nine locations surrounding the perimeter of the CR-3 protected area. Presently five of these ground water wells have shown indications of very low levels of tritium on the west-southwest side of the plant. It is believed that this tritium is the result of a leak in the Station Drain Tank (SDT-1) to the settling pond discharge line that occurred many years ago. This discharge line has recently been leak tested and it is leak free. There are no other know leaking plant components. In 2010 the five wells that have shown measurable amounts of tritium range from 76 to 1213 pCi/L. These five wells have been sampled additionally on a monthly basis to develop trend data. This information is shown as supplemental data. Along with these wells, two other wells that are not presently part of the REMP have been sampled that are on either side of the plant settling ponds (percolation ponds). In 2010 these two wells are showing measurable amounts of tritium in the range of 104 to 183 pCi/L, which are a result of plant discharges from the SDT-1. These discharges are being minimized through operational focus. The positively measured tritium values are below the reporting criteria of the ODCM and the NEI 07-07 Ground Water Protection Initiative Guidelines. There have been no measurable amounts of gamma emitting radionuclides in any of these wells. There have been no measurable amounts of hard-to-detect (HTD) radionuclides in any of these wells with exception of trace levels of gross alpha, which is expected, given the naturally occurring limestone strata that surrounds the Florida aquifier. It should be noted that site ground water flows in a west-southwest direction toward the Gulf of Mexico. This flow was re-verified in 2006 with a new ground water flow study performed by a certified hydro-geologist as part of the NEI Ground Water Protection Initiative. Additionally, the ground water at the CR-3 site is too saline for use as a potable water source, hence there is no drinking water uptake pathway at the Crystal River site.

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

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

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

4. Monthly non-REMP required well samples were collected as discussed in item #3 above. Two wells were sampled. These two wells are located on 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 percolation ponds.

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

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

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

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

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

6. Semiannual shoreline sediment samples are taken at three indicator locations in the discharge canal (C14H, C14M, C14G) and one control location (C09) at Fort Island Gulf Beach. The plant discharge canal is the primary liquid effluent release pathway from CR-3. Of the six indicator samples, four had measurable amounts of cesium-137 and two had measurable amounts of cobalt-60. In 2009 there were three samples with measurable amounts of cobalt-60. The average cobalt-60 concentration at the indicator locations ranged from 30 to 389 pCi/L from 1998 through 2007. In 2009 the average cesium-137 concentration at the indicator locations was 24 pCi/L. The average cesium-137 concentration in 2008 was 25 pCi/L. The 2010 results are similar to previous years' results. None of the samples taken at Fort Island Gulf Beach, the control location station C09, indicated measurable amounts of cobalt or cesium.

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

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

7. There were no unmonitored spills or releases of radioactive material in 2010 that could have the potential to contaminate the ground water per the guidelines of the Nuclear Energy Institute Ground Water Protection Initiative – Final Guidance Document 07-07. As such, there were no communiqués issued to state, local, or regulatory agencies.

8. Additional samples taken in 2010 but not required by the ODCM:

   Annual sediment samples were collected at four locations in the site settling ponds. Cs-137 was detected in two of the four samples in concentrations ranging from 20 to137 pCi/kg. There were no measurable amounts of Co-60 or Cs-134 in any of the samples.

   Annual surface water samples were collected at two locations in the site settling ponds. The tritium concentration was < LLD of 140 pCi/L in both samples. Both of these samples showed no measurable amounts of any other radionuclides of interest.

## 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, 2010**

| MEDIUM OR PATHWAY SAMPLED (UNITS) | ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED | LOWER LIMIT OF DETECTION (LLD)[1] | ALL INDICATOR LOCATIONS MEAN RANGE | LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING | MEAN RANGE | CONTROL LOCATION MEAN RANGE | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |
|---|---|---|---|---|---|---|---|
| SEAWATER (pCi/L) | Tritium, 36 | 155 | 1774 (1/36) (<LLD-1774) | C14H 0.1 @ 0° | 1774 (1/12) (<LLD-1774) | <LLD | 0 |
| | γ Spec, 36 | | | | | | |
| | Mn-54 | 6 | <LLD | -- | -- | <LLD | 0 |
| | Fe-59 | 10 | <LLD | -- | -- | <LLD | 0 |
| | Co-58 | 5 | <LLD | -- | -- | <LLD | 0 |
| | Co-60 | 6 | <LLD | -- | -- | <LLD | 0 |
| | Zn-65 | 12 | <LLD | -- | -- | <LLD | 0 |
| | Zr-Nb-95 | 10 | <LLD | -- | -- | <LLD | 0 |
| | I-131 | 7 | <LLD | -- | -- | <LLD | 0 |
| | Cs-134 | 5 | <LLD | -- | -- | <LLD | 0 |
| | Cs-137 | 6 | <LLD | -- | -- | <LLD | 0 |
| | Ba-La-140 | 14 | <LLD | -- | -- | <LLD | 0 |

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

**TABLE IV-C.1.a**
**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**
**pCi/L γ EMITTERS AND TRITIUM IN SEAWATER**

| STATION | MONTH | H-3 | K-40 | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Zr-Nb-95 | I-131 | Cs-134 | Cs-137 | Ba-La-140 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C13 | JAN | <142 | 249±35 | <4 | <3 | <7 | <4 | <9 | <6 | <5 | <5 | <4 | <10 |
| | FEB | <151 | 223±19 | <2 | <2 | <5 | <3 | <5 | <4 | <2 | <2 | <2 | <4 |
| | MAR | <148 | 145±21 | <3 | <3 | <7 | <4 | <9 | <5 | <4 | <4 | <3 | <7 |
| | APR | <147 | 141±73 | <3 | <3 | <7 | <3 | <8 | <5 | <4 | <4 | <3 | <6 |
| | MAY | <155 | 112±13 | <3 | <3 | <6 | <3 | <8 | <5 | <3 | <4 | <3 | <9 |
| | JUN | <147 | 289±32 | <3 | <3 | <7 | <4 | <7 | <7 | <3 | <4 | <4 | <14 |
| | JUL | <145 | 213±18 | <3 | <3 | <6 | <4 | <8 | <5 | <4 | <3 | <3 | <5 |
| | AUG | <159 | 293±39 | <6 | <5 | <10 | <4 | <11 | <10 | <5 | <6 | <5 | <11 |
| | SEP | <145 | 317±35 | <5 | <5 | <9 | <6 | <8 | <7 | <5 | <6 | <6 | <13 |
| | OCT | <138 | 338±34 | <4 | <4 | <8 | <4 | <10 | <8 | <7 | <5 | <5 | <6 |
| | NOV | <140 | 237±20 | <4 | <4 | <7 | <4 | <12 | <7 | <4 | <4 | <4 | <14 |
| | DEC | <140 | 278±34 | <4 | <4 | <10 | <5 | <10 | <7 | <4 | <4 | <5 | <10 |
| C14G | JAN | <142 | 216±18 | <3 | <3 | <7 | <4 | <9 | <6 | <4 | <4 | <4 | <13 |
| | FEB | <151 | 266±26 | <4 | <3 | <6 | <4 | <7 | <6 | <4 | <4 | <4 | <7 |
| | MAR | <148 | 201±28 | <4 | <3 | <6 | <4 | <7 | <6 | <5 | <4 | <4 | <6 |
| | APR | <147 | 90±48 | <3 | <3 | <6 | <4 | <7 | <6 | <4 | <4 | <3 | <6 |
| | MAY | <155 | 135±14 | <3 | <3 | <6 | <4 | <8 | <6 | <4 | <3 | <3 | <7 |
| | JUN | <147 | 283±33 | <4 | <4 | <7 | <5 | <9 | <6 | <4 | <5 | <4 | <12 |
| | JUL | <145 | 264±14 | <3 | <3 | <6 | <4 | <8 | <5 | <4 | <4 | <3 | <7 |
| | AUG | <145 | 196±17 | <3 | <3 | <7 | <4 | <7 | <6 | <3 | <3 | <3 | <8 |
| | SEP | <145 | 308±31 | <3 | <3 | <8 | <5 | <7 | <6 | <4 | <5 | <5 | <10 |
| | OCT | <138 | 267±15 | <2 | <2 | <3 | <2 | <3 | <3 | <2 | <2 | <2 | <3 |
| | NOV | <140 | 290±30 | <4 | <3 | <8 | <4 | <9 | <7 | <4 | <5 | <3 | <9 |
| | DEC | <140 | 241±32 | <4 | <4 | <7 | <3 | <8 | <7 | <5 | <5 | <5 | <10 |

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

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/L γ EMITTERS AND TRITIUM IN SEAWATER**

| STATION | MONTH | H-3 | K-40 | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Zr-Nb-95 | I-131 | Cs-134 | Cs-137 | Ba-La-140 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C14H | JAN | <142 | 179±17 | <4 | <4 | <8 | <4 | <11 | <6 | <4 | <4 | <4 | <14 |
| | FEB | <151 | 169±16 | <3 | <3 | <7 | <4 | <7 | <5 | <4 | <4 | <4 | <12 |
| | MAR | <148 | 157±63 | <3 | <3 | <7 | <4 | <8 | <5 | <4 | <4 | <4 | <7 |
| | APR | <147 | 119±13 | <3 | <3 | <7 | <4 | <9 | <6 | <4 | <4 | <4 | <6 |
| | MAY | <155 | 153±63 | <3 | <3 | <7 | <4 | <8 | <6 | <4 | <3 | <3 | <7 |
| | JUN | <147 | 174±16 | <3 | <3 | <7 | <4 | <8 | <5 | <3 | <4 | <3 | <10 |
| | JUL | <145 | 232±10 | <1 | <1 | <3 | <2 | <3 | <2 | <2 | <1 | <1 | <3 |
| | AUG | <145 | 237±19 | <3 | <3 | <6 | <4 | <6 | <6 | <3 | <3 | <3 | <9 |
| | SEP | <145 | 299±32 | <4 | <3 | <8 | <5 | <9 | <6 | <4 | <4 | <4 | <11 |
| | OCT | <138 | 308±31 | <4 | <3 | <7 | <4 | <10 | <7 | <4 | <4 | <4 | <6 |
| | NOV | 1774±76 | 271±33 | <4 | <4 | <7 | <3 | <7 | <6 | <5 | <4 | <4 | <7 |
| | DEC | <140 | 413±31 | <4 | <4 | <8 | <4 | <9 | <6 | <4 | <4 | <4 | <9 |

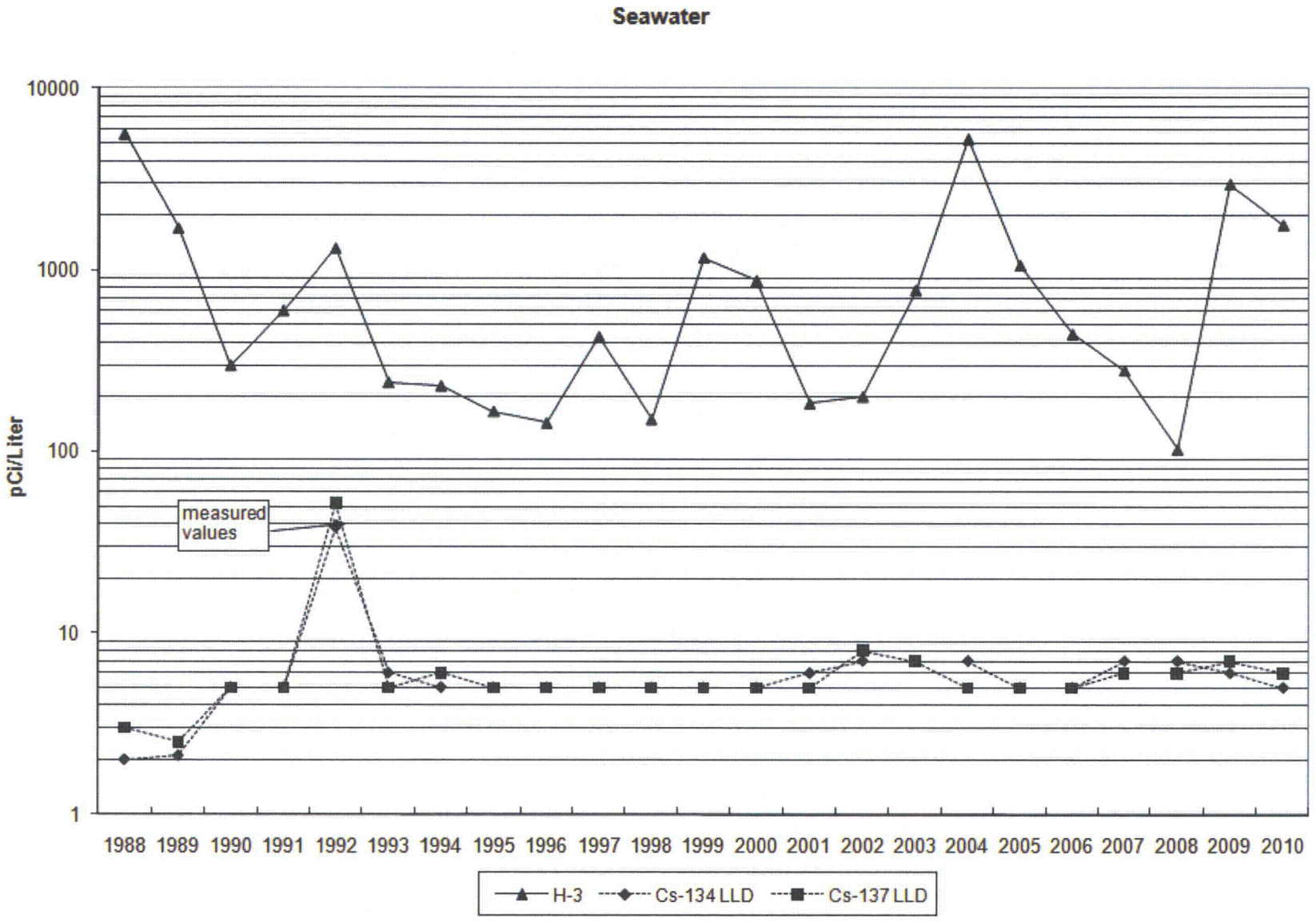

Seawater
10000
1000
100
10
1
pCi/Liter
measured values
1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
H-3
Cs-134 LLD
Cs-137 LLD

**TABLE IV-C.2**

**RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY**

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

**CITRUS COUNTY, FLORIDA** **JANUARY 1 TO DECEMBER 31, 2010**

| MEDIUM OR PATHWAY SAMPLED (UNITS) | ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED | LOWER LIMIT OF DETECTION (LLD)[1] | ALL INDICATOR LOCATIONS MEAN RANGE | LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING | MEAN RANGE | CONTROL LOCATION MEAN RANGE | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |
|---|---|---|---|---|---|---|---|
| GROUND WATER[2] (pCi/L) | Tritium, 2 | 151 | <LLD | -- | -- | <LLD | 0 |
| | γ Spec, 2 | | | | | | |
| | Mn-54 | 3 | <LLD | -- | -- | <LLD | 0 |
| | Fe-59 | 3 | <LLD | -- | -- | <LLD | 0 |
| | Co-58 | 6 | <LLD | -- | -- | <LLD | 0 |
| | Co-60 | 3 | <LLD | -- | -- | <LLD | 0 |
| | Zn-65 | 7 | <LLD | -- | -- | <LLD | 0 |
| | Zr-Nb-95 | 6 | <LLD | -- | -- | <LLD | 0 |
| | I-131 | 4 | <LLD | -- | -- | <LLD | 0 |
| | Cs-134 | 4 | <LLD | -- | -- | <LLD | 0 |
| | Cs-137 | 4 | <LLD | -- | -- | <LLD | 0 |
| | Ba-La-140 | 12 | <LLD | -- | -- | <LLD | 0 |

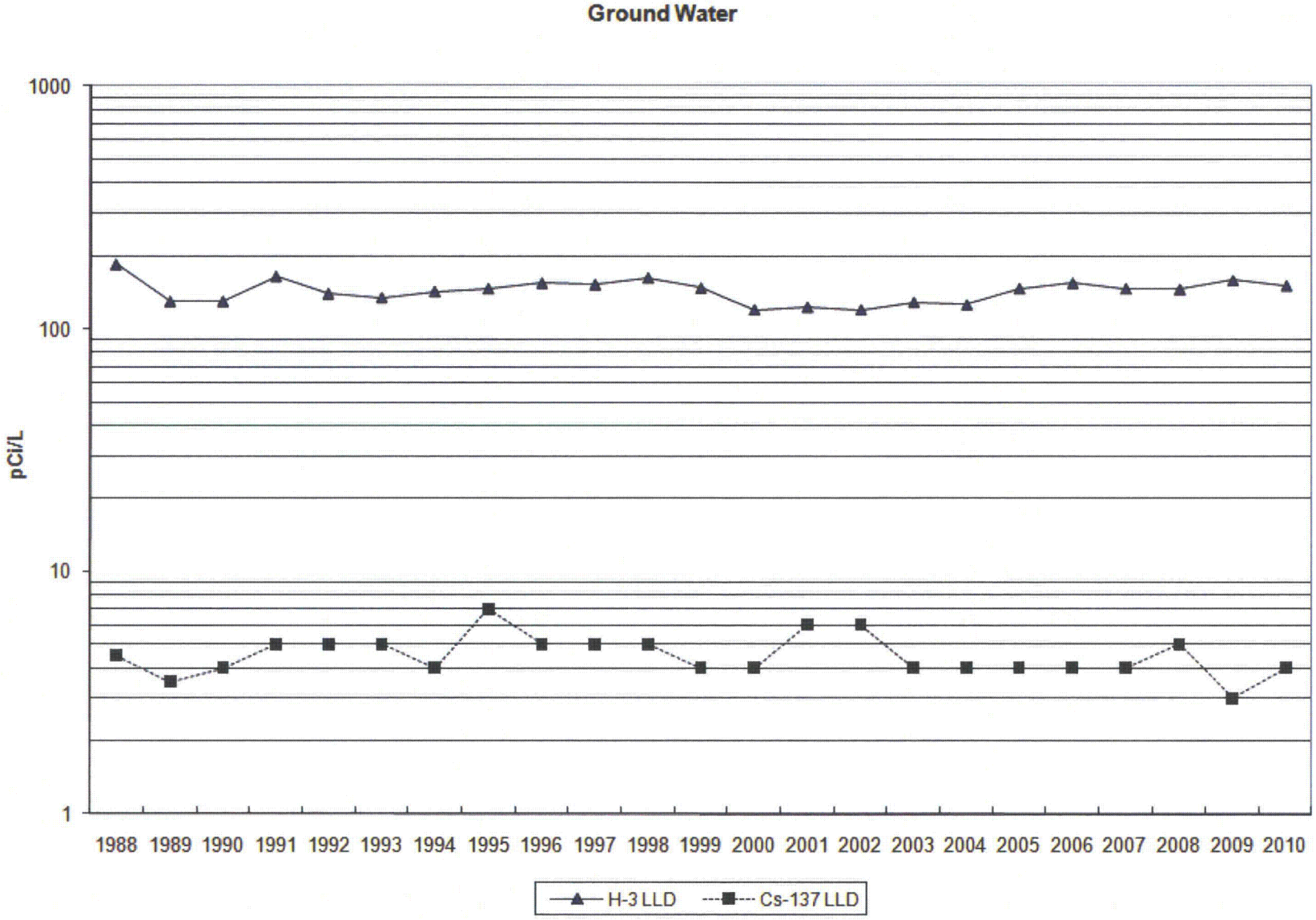
[1]The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.
[2]There is no drinking water uptake pathway at the Crystal River site.

**TABLE IV-C.2.a**

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/L γ EMITTERS AND TRITIUM IN GROUND WATER**

| STATION | NUCLIDE | FIRST HALF | SECOND HALF |
|---|---|---|---|
| C40 | H-3 | <151 | <145 |
| | Mn-54 | <3 | <5 |
| | Fe-59 | <3 | <4 |
| | Co-58 | <6 | <8 |
| | Co-60 | <3 | <4 |
| | Zn-65 | <7 | <11 |
| | Zr-Nb-95 | <6 | <8 |
| | I-131 | <4 | <5 |
| | Cs-134 | <4 | <5 |
| | Cs-137 | <4 | <5 |
| | Ba-La-140 | <12 | <7 |
| | K-40 | <43 | <70 |


Ground Water
1000
100
10
1
pCi/L
1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
H-3 LLD
Cs-137 LLD

## TABLE IV-C.2.b

## RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

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

**CITRUS COUNTY, FLORIDA** **JANUARY 1 TO DECEMBER 31, 2010**

| MEDIUM OR PATHWAY SAMPLED (UNITS) | ANALYSIS AND TOTAL (NUMBER)[2] OF ANALYSES PERFORMED | LOWER LIMIT OF DETECTION (LLD)[1] | ALL INDICATOR LOCATIONS MEAN RANGE | LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING | LOCATION WITH HIGHEST MEAN MEAN RANGE | CONTROL LOCATION MEAN RANGE | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |
|---|---|---|---|---|---|---|---|
| CR3 SITE GROUND WATER (pCi/L) | Tritium 76 | 165 | 454 (33/76) (76-1213) | C3-5 0.051 mi.@225° | 981 (12/12) (718-1213) | C3-2 <LLD | 0 |
| | γ Spec 76 | | | | | | |
| | 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 | 27 | <LLD | -- | -- | <LLD | 0 |
| | Zr-Nb-95 | 12 | <LLD | -- | -- | <LLD | 0 |
| | I-131 | 8 | <LLD | -- | -- | <LLD | 0 |
| | Cs-134 | 7 | <LLD | -- | -- | <LLD | 0 |
| | Cs-137 | 8 | <LLD | -- | -- | <LLD | 0 |
| | Ba-La-140 | 15 | <LLD | -- | -- | <LLD | 0 |

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

**TABLE IV-C.2.b.1**

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

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

| STATION | DATE | H-3 | K-40 | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Zn-Nb-95 | I-131 | Cs-134 | Cs-137 | Ba-La-140 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C3-2 | 01-08 | <142 | <46 | <5 | <5 | <8 | <4 | <9 | <8 | <6 | <5 | <4 | <7 |
| | 04-08 | <147 | <41 | <4 | <4 | <7 | <4 | <15 | <7 | <6 | <4 | <4 | <7 |
| | 07-07 | <145 | <50 | <5 | <5 | <10 | <5 | <22 | <8 | <6 | <5 | <6 | <11 |
| | 10-05 | <138 | <68 | <5 | <4 | <9 | <4 | <11 | <8 | <7 | <6 | <5 | <9 |
| C3-4 | 01-08 | <142 | <46 | <4 | <4 | <8 | <4 | <14 | <7 | <6 | <4 | <4 | <6 |
| | 04-08 | <147 | <37 | <3 | <3 | <5 | <3 | <5 | <5 | <3 | <3 | <3 | <6 |
| | 07-07 | <145 | <9 | <1 | <2 | <3 | <2 | <5 | <3 | <2 | <2 | <2 | <3 |
| | 10-05 | <138 | <53 | <4 | <4 | <8 | <4 | <14 | <6 | <5 | <4 | <4 | <6 |
| C3-5 | 01-08 | 1092±67 | 101±21 | <5 | <3 | <9 | <5 | <9 | <7 | <6 | <6 | <5 | <11 |
| | 04-08 | 1161±69 | 48±2 | <2 | <2 | <4 | <2 | <8 | <4 | <3 | <3 | <2 | <4 |
| | 07-07 | 1053±67 | 106±18 | <2 | <2 | <5 | <3 | <5 | <4 | <4 | <3 | <3 | <5 |
| | 10-05 | 792±60 | 82±16 | <2 | <2 | <4 | <2 | <4 | <3 | <2 | <2 | <2 | <3 |

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

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

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

| STATION | DATE | H-3 | K-40 | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Zn-Nb-95 | I-131 | Cs-134 | Cs-137 | Ba-La-140 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C3-6S | 01-05 | <142 | 96±12 | <2 | <2 | <4 | <2 | <4 | <3 | <3 | <2 | <2 | <4 |
| | 04-08 | <147 | 15±4 | <3 | <3 | <5 | <3 | <8 | <4 | <3 | <3 | <3 | <4 |
| | 07-07 | <145 | <48 | <4 | <4 | <8 | <4 | <11 | <6 | <5 | <4 | <4 | <5 |
| | 10-05 | 159±46 | <53 | <4 | <4 | <8 | <4 | <16 | <6 | <5 | <4 | <4 | <10 |
| C3-6D | 01-08 | <142 | 191±25 | <3 | <4 | <9 | <4 | <7 | <5 | <6 | <4 | <4 | <5 |
| | 04-08 | <147 | 270±20 | <2 | <2 | <5 | <2 | <5 | <4 | <3 | <3 | <3 | <4 |
| | 07-07 | 145 | 153±15 | <3 | <3 | <6 | <4 | <9 | <6 | <5 | <4 | <3 | <5 |
| | 10-05 | 94±26 | 155±17 | <4 | <3 | <6 | <4 | <11 | <7 | <4 | <4 | <4 | <8 |
| C3-7 | 01-05 | 243±39 | <50 | <4 | <4 | <7 | <4 | <13 | <6 | <4 | <4 | <4 | <15 |
| | 04-20 | 190±52 | <46 | <4 | <4 | <8 | <4 | <14 | <6 | <4 | <4 | <4 | <12 |
| | 07-07 | 146±48 | 20±6 | <3 | <3 | <6 | <3 | <9 | <5 | <4 | <3 | <3 | <5 |
| | 10-05 | 229±48 | <50 | <4 | <4 | <8 | <4 | <15 | <7 | <5 | <4 | <4 | <8 |

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

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

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

| STATION | DATE | H-3 | K-40 | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Zn-Nb-95 | I-131 | Cs-134 | Cs-137 | Ba-La-140 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C3-8 | 01-05 | <142 | 27±4 | <2 | <2 | <4 | <2 | <8 | <3 | <2 | <2 | <2 | <8 |
| | 04-08 | 126±48 | 124±27 | <5 | <6 | <9 | <5 | <12 | <9 | <7 | <7 | <6 | <13 |
| | 07-07 | <145 | 92±17 | <3 | <3 | <6 | <3 | <6 | <4 | <4 | <3 | <3 | <4 |
| | 10-05 | 142±46 | <80 | <5 | <5 | <10 | <5 | <10 | <8 | <7 | <6 | <5 | <10 |
| C3-9 | 01-05 | <142 | <73 | <5 | <4 | <9 | <4 | <8 | <7 | <5 | <4 | <4 | <9 |
| | 04-08 | <147 | 19±3 | <1 | <2 | <3 | <1 | <4 | <2 | <2 | <2 | <2 | <2 |
| | 07-07 | <145 | 32±8 | <3 | <3 | <8 | <3 | <10 | <7 | <6 | <4 | <4 | <6 |
| | 10-05 | <138 | 25±8 | <4 | <4 | <7 | <4 | <12 | <6 | <5 | <4 | <4 | <7 |
| C3-10 | 01-05 | <142 | <21 | <5 | <5 | <9 | <5 | <18 | <8 | <7 | <5 | <4 | <7 |
| | 04-08 | <147 | 270±20 | <2 | <3 | <5 | <3 | <6 | <4 | <4 | <3 | <3 | <4 |
| | 07-07 | <145 | 10±3 | <2 | <2 | <4 | <2 | <7 | <3 | <2 | <2 | <2 | <4 |
| | 10-05 | 76±26 | <21 | <2 | <2 | <4 | <2 | <7 | <3 | <2 | <2 | <2 | <4 |

## TABLE IV-C.2.b.2

## PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010

## pCi/L γ EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER (SUPPLEMENTAL DATA)

| STATION | DATE | H-3 | K-40 | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Zn-Nb-95 | I-131 | Cs-134 | Cs-137 | Ba-La-140 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C3-5 | 02-03 | 1159±70 | 101±21 | <2 | <2 | <4 | <2 | <4 | <3 | <3 | <2 | <2 | <5 |
| | 03-04 | 1213±70 | 59±4 | <2 | <2 | <3 | <2 | <7 | <3 | <2 | <2 | <2 | <2 |
| | 05-06 | 1172±72 | 23±7 | <4 | <4 | <7 | <4 | <17 | <6 | <5 | <4 | <5 | <14 |
| | 06-08 | 956±65 | <60 | <4 | <4 | <8 | <4 | <15 | <7 | <5 | <4 | <4 | <13 |
| | 08-03 | 876±64 | 113±18 | <3 | <3 | <5 | <3 | <7 | <5 | <4 | <4 | <3 | <10 |
| | 09-08 | 718±60 | 101±21 | <3 | <3 | <5 | <3 | <6 | <4 | <3 | <3 | <3 | <8 |
| | 11-01 | 836±61 | 40±9 | <4 | <5 | <8 | <4 | <16 | <7 | <5 | <5 | <5 | <10 |
| | 12-07 | 745±59 | <68 | <6 | <6 | <10 | <5 | <21 | <9 | <7 | <5 | <6 | <13 |
| C3-6S | 02-05 | <151 | 72±23 | <4 | <3 | <8 | <4 | <9 | <7 | <6 | <5 | <5 | <12 |
| | 03-03 | <148 | 61±17 | <3 | <3 | <6 | <3 | <6 | <5 | <3 | <3 | <3 | <8 |
| | 05-05 | <155 | 70±29 | <6 | <6 | <12 | <6 | <13 | <9 | <7 | <7 | <5 | <15 |
| | 06-01 | <147 | <57 | <4 | <3 | <8 | <4 | <8 | <6 | <4 | <4 | <4 | <12 |
| | 08-04 | <145 | <65 | <4 | <4 | <7 | <4 | <8 | <8 | <4 | <4 | <4 | <12 |
| | 09-01 | <145 | <68 | <3 | <4 | <8 | <4 | <6 | <5 | <5 | <4 | <4 | <13 |
| | 11-02 | 107±45 | <67 | <4 | <4 | <7 | <4 | <8 | <7 | <6 | <5 | <4 | <8 |
| | 12-01 | <140 | 65±21 | <3 | <5 | <9 | <5 | <10 | <6 | <6 | <5 | <5 | <10 |

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

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/L γ EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER (SUPPLEMENTAL DATA)**

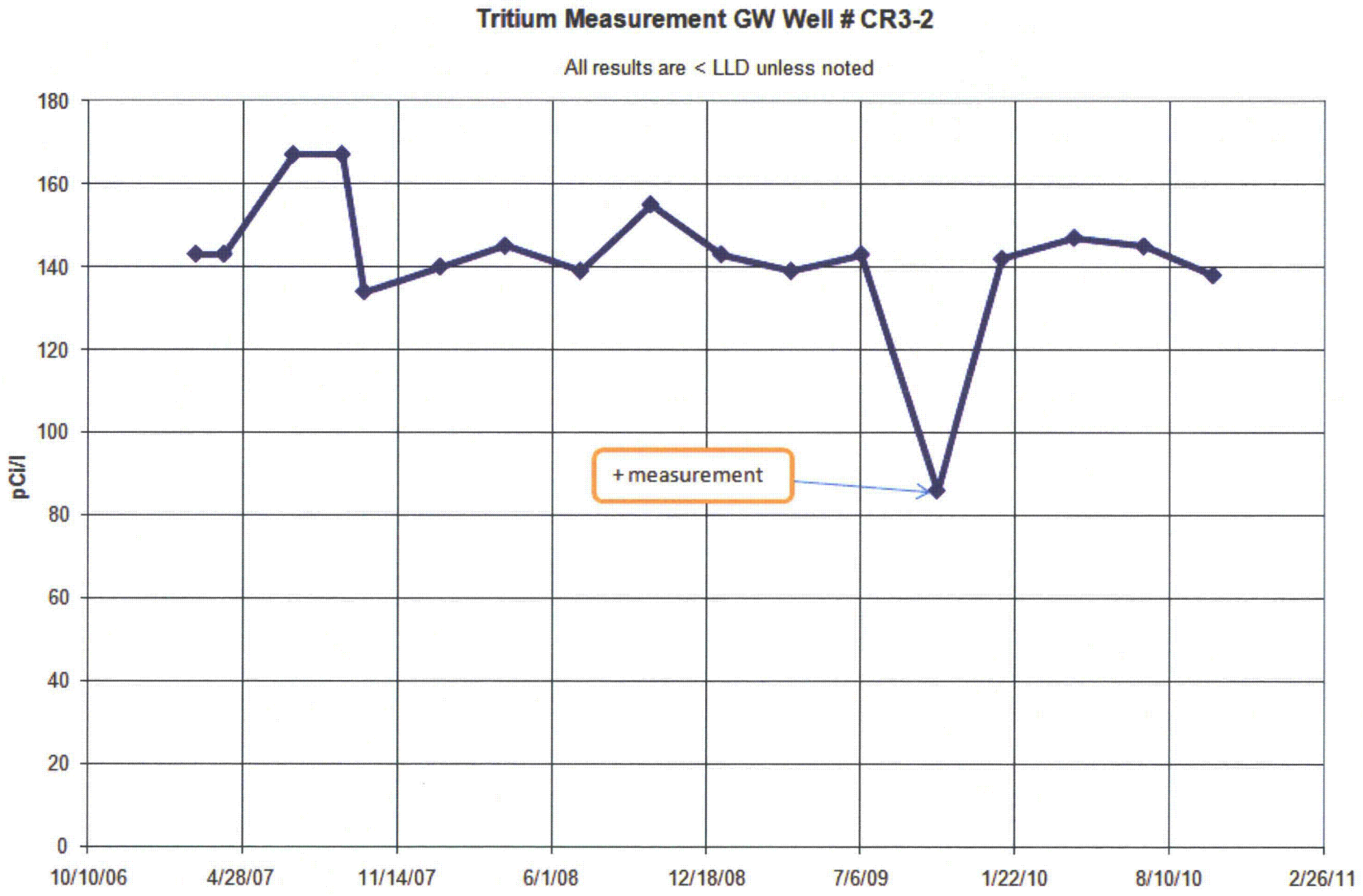
| STATION | DATE | H-3 | K-40 | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Zn-Nb-95 | I-131 | Cs-134 | Cs-137 | Ba-La-140 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C3-7 | 02-03 | 211±51 | <50 | <2 | <2 | <3 | <2 | <6 | <2 | <2 | <2 | <2 | <6 |
| | 03-04 | 155±49 | <34 | <2 | <2 | <4 | <2 | <4 | <3 | <2 | <2 | <2 | <4 |
| | 05-05 | <155 | <92 | <6 | <5 | <13 | <5 | <12 | <9 | <8 | <6 | <6 | <13 |
| | 06-08 | <147 | <53 | <4 | <4 | <9 | <4 | <16 | <7 | <5 | <5 | <5 | <13 |
| | 08-04 | 152±48 | 145±32 | <2 | <2 | <3 | <2 | <5 | <3 | <2 | <2 | <2 | <5 |
| | 09-08 | 188±49 | <76 | <5 | <4 | <8 | <4 | <7 | <7 | <5 | <5 | <4 | <14 |
| | 11-01 | 223±48 | <71 | <3 | <5 | <8 | <4 | <12 | <7 | <6 | <5 | <4 | <7 |
| | 12-07 | 205±48 | <62 | <6 | <6 | <11 | <5 | <20 | <11 | <6 | <6 | <6 | <13 |
| C3-8 | 02-03 | <151 | <51 | <4 | <5 | <9 | <4 | <19 | <8 | <5 | <5 | <5 | <9 |
| | 03-04 | <148 | <47 | <4 | <4 | <8 | <4 | <14 | <6 | <6 | <4 | <4 | <6 |
| | 05-05 | 118±50 | <62 | <4 | <5 | <9 | <5 | <20 | <7 | <5 | <5 | <5 | <15 |
| | 06-08 | 110±47 | <68 | <4 | <4 | <8 | <4 | <9 | <7 | <5 | <4 | <4 | <13 |
| | 08-04 | 113±47 | <78 | <4 | <4 | <8 | <6 | <10 | <6 | <6 | <4 | <5 | <11 |
| | 09-08 | 103±47 | <75 | <4 | <5 | <11 | <4 | <11 | <8 | <7 | <6 | <5 | <12 |
| | 11-01 | <140 | <84 | <5 | <5 | <9 | <5 | <12 | <8 | <6 | <6 | <5 | <12 |
| | 12-07 | 126±46 | <84 | <7 | <7 | <12 | <7 | <27 | <12 | <8 | <7 | <8 | <14 |

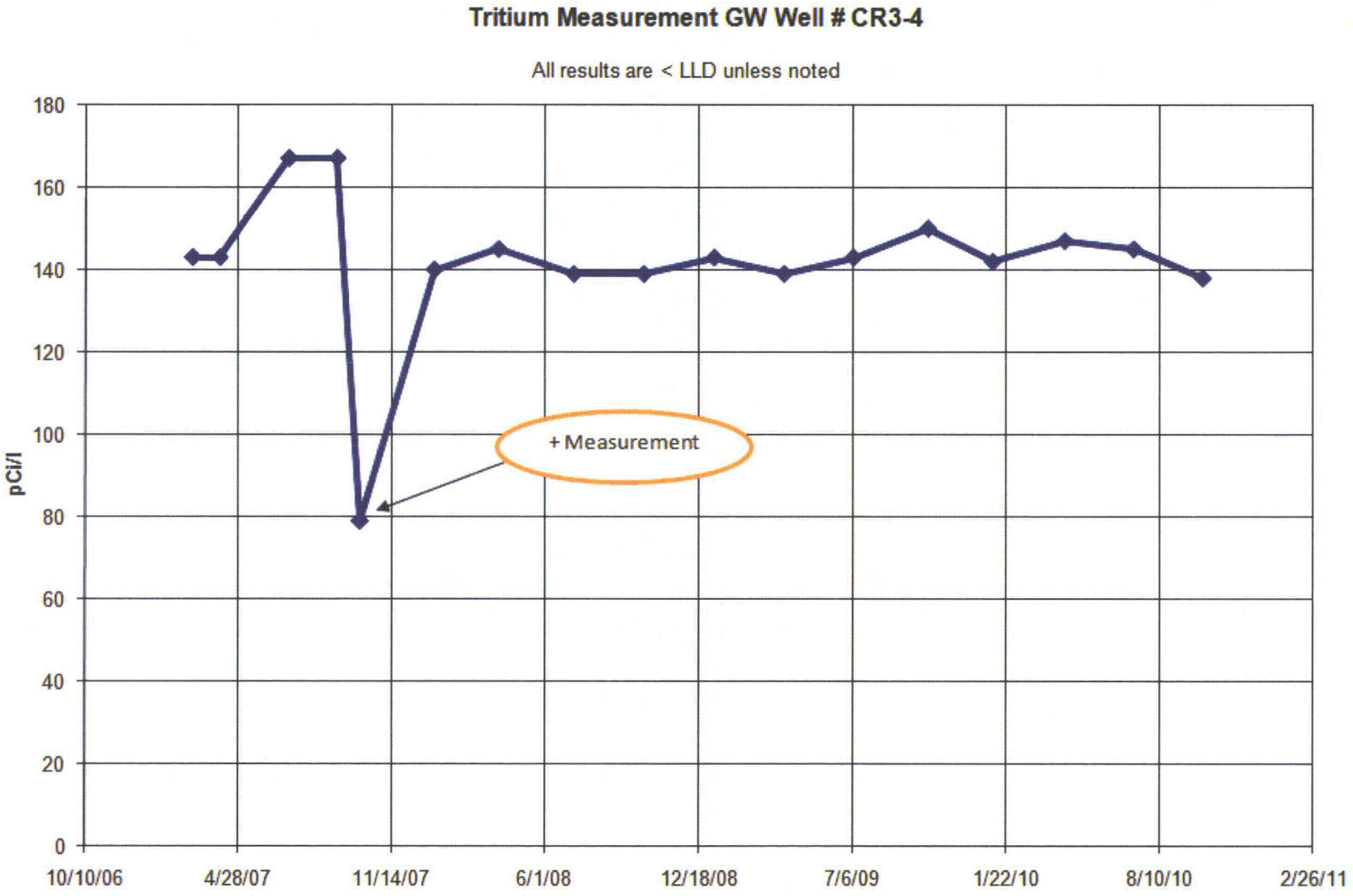
**TABLE IV-C.2.b.2(cont'd)**

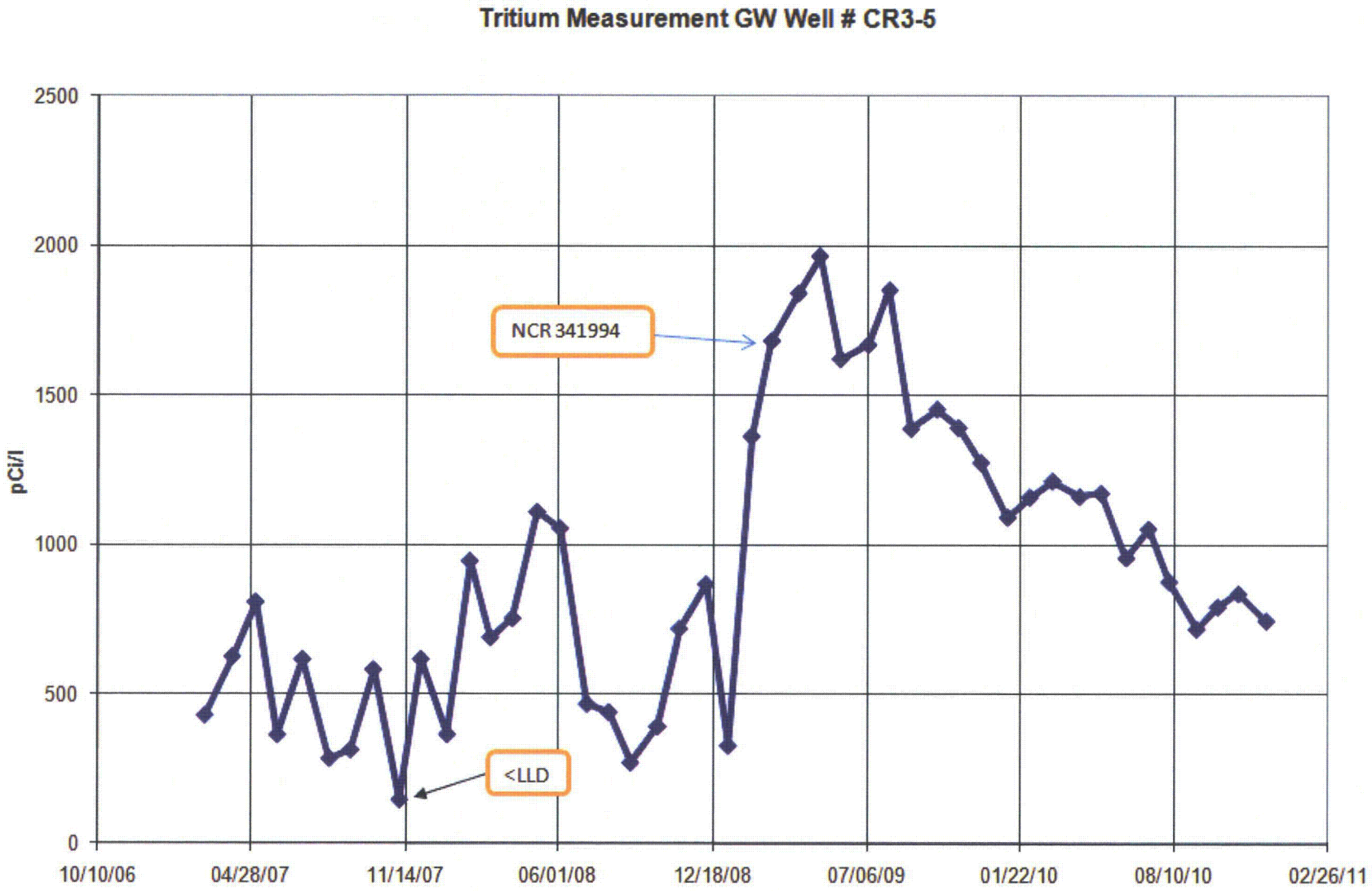
**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

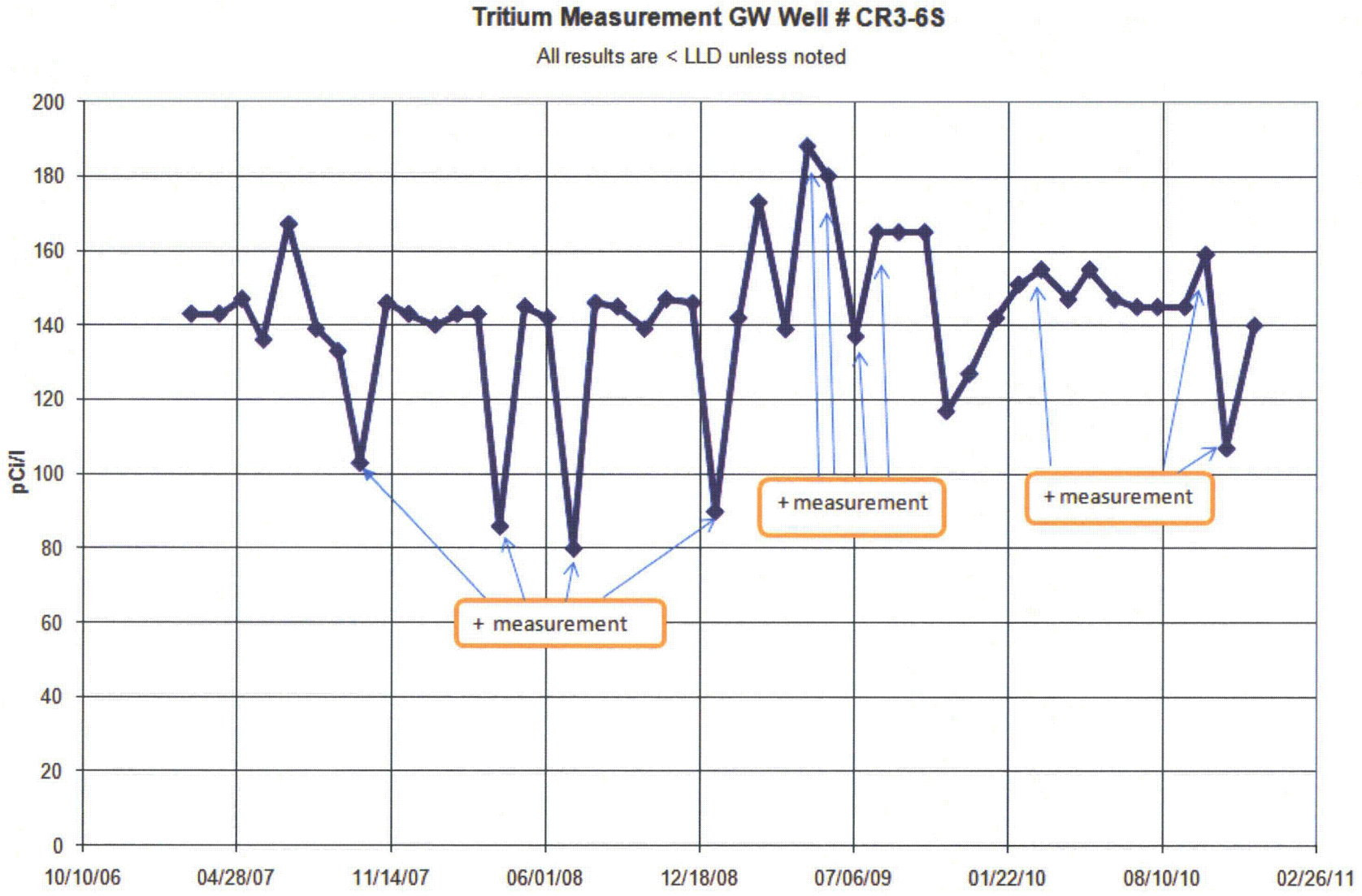
**pCi/L γ EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER (SUPPLEMENTAL DATA)**

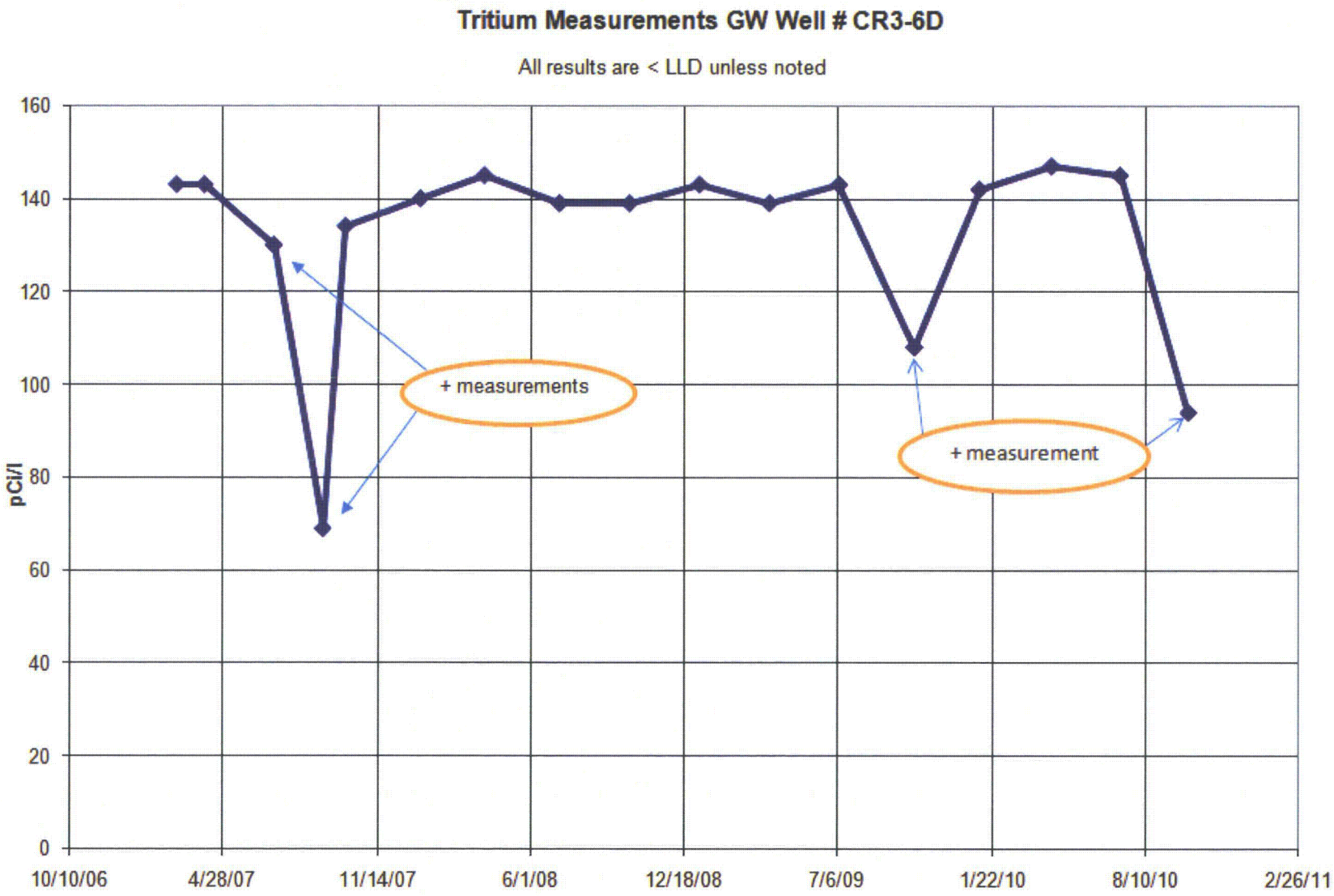
| STATION | DATE | H-3 | K-40 | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Zn-Nb-95 | I-131 | Cs-134 | Cs-137 | Ba-La-140 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C3-9 | 02-03 | <151 | 63±22 | <5 | <4 | <8 | <5 | <10 | <8 | <7 | <6 | <5 | <12 |
| | 03-04 | <148 | 99±22 | <5 | <4 | <11 | <6 | <11 | <9 | <7 | <6 | <6 | <6 |
| | 05-06 | <155 | <53 | <4 | <4 | <8 | <4 | <16 | <7 | <4 | <4 | <4 | <14 |
| | 06-08 | <147 | <48 | <4 | <4 | <7 | <4 | <15 | <6 | <4 | <4 | <5 | <14 |
| | 08-03 | <145 | 30±8 | <4 | <4 | <8 | <4 | <13 | <6 | <4 | <4 | <4 | <9 |
| | 09-08 | <145 | 57±24 | <4 | <3 | <8 | <4 | <11 | <7 | <6 | <5 | <5 | <10 |
| | 11-02 | <140 | <54 | <5 | <5 | <9 | <5 | <16 | <8 | <5 | <4 | <5 | <10 |
| | 12-07 | <140 | <75 | <7 | <6 | <12 | <6 | <23 | <11 | <8 | <6 | <7 | <14 |

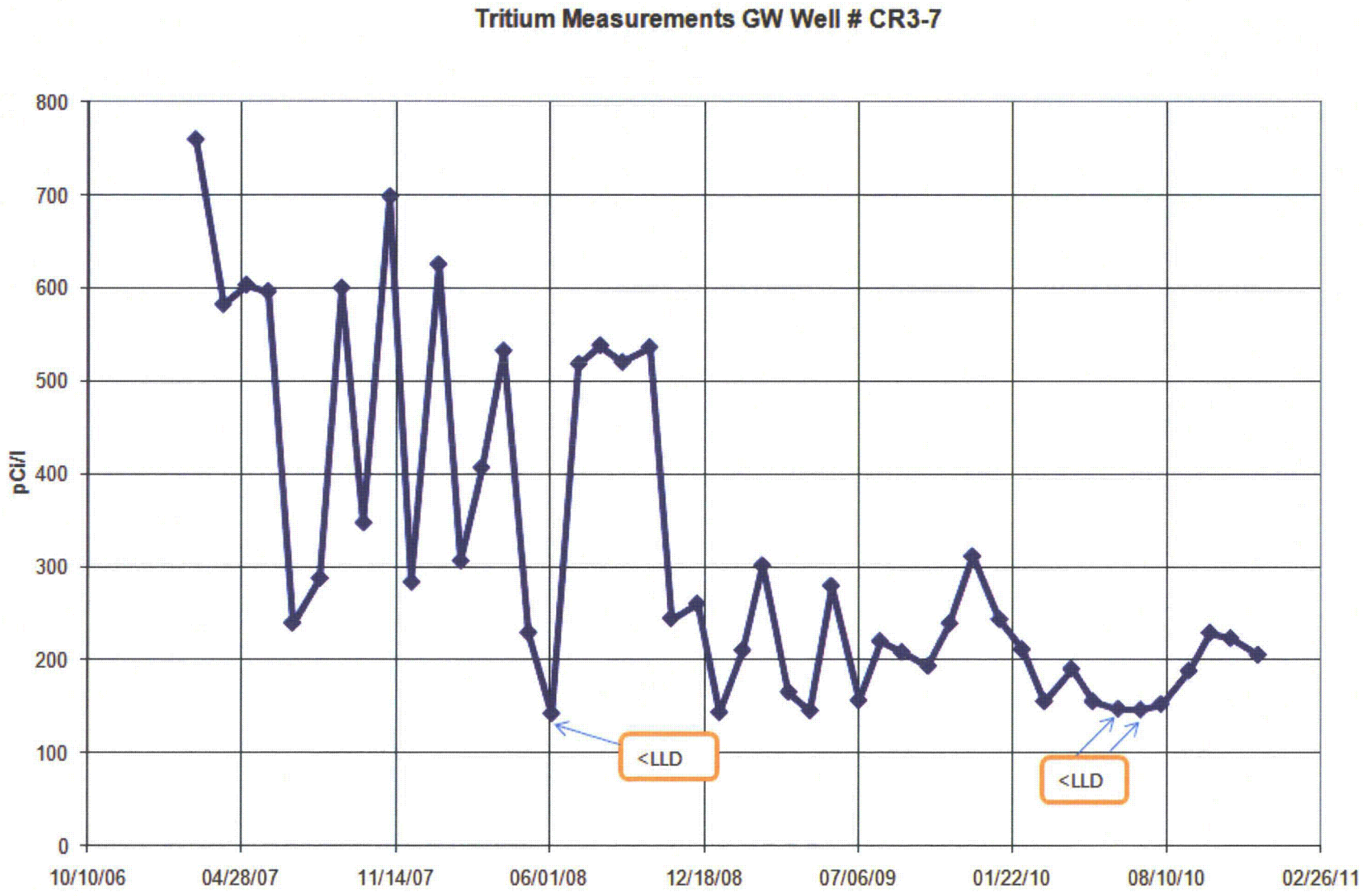

Tritium Measurement GW Well # CR3-2
All results are < LLD unless noted
pCi/l
180
160
140
120
100
80
60
40
20
0
10/10/06
4/28/07
11/14/07
6/1/08
12/18/08
7/6/09
1/22/10
8/10/10
2/26/11
+ measurement

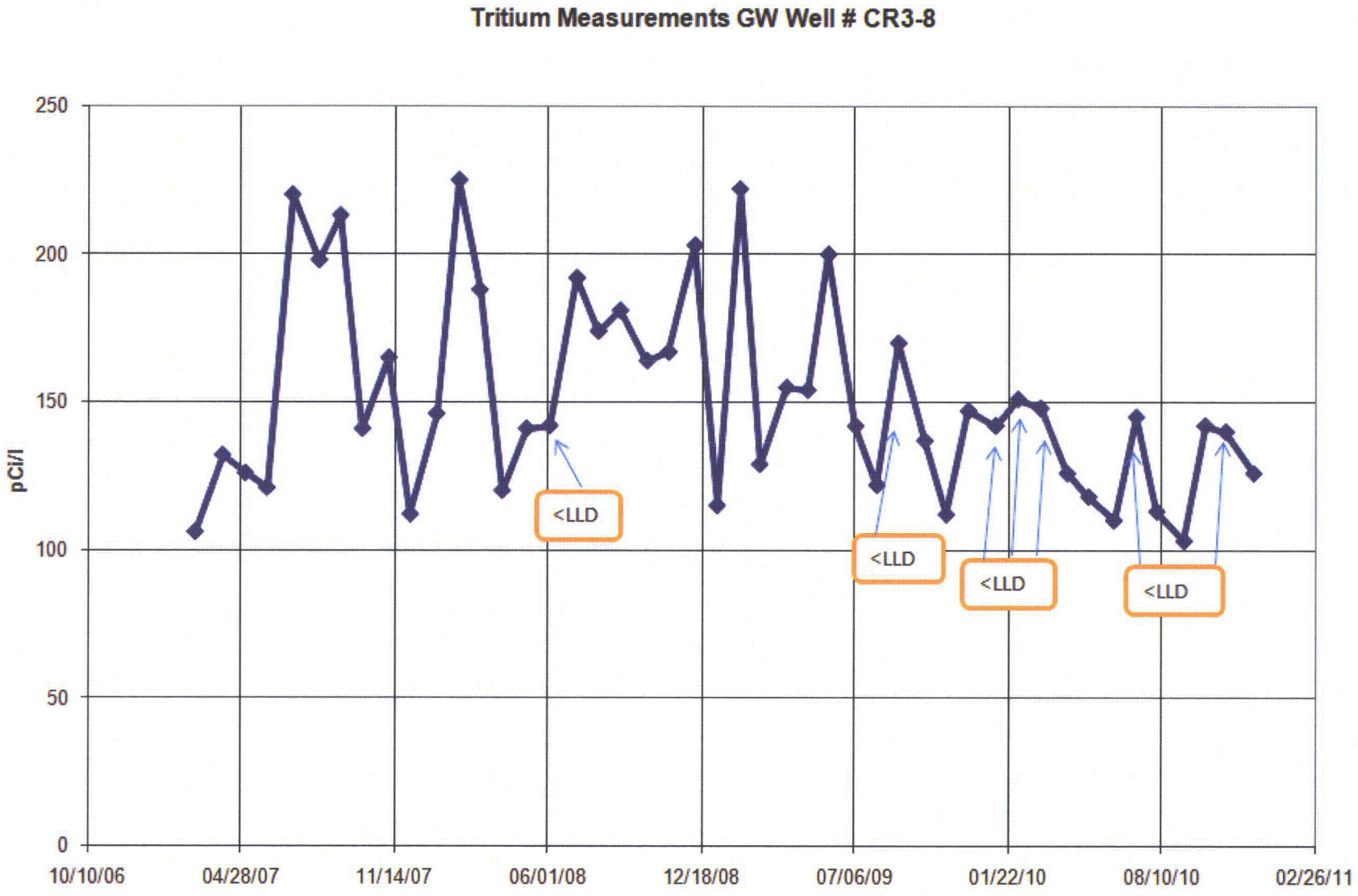

Tritium Measurement GW Well # CR3-4
All results are < LLD unless noted
pCi/l
180
160
140
120
100
80
60
40
20
0
10/10/06
4/28/07
11/14/07
6/1/08
12/18/08
7/6/09
1/22/10
8/10/10
2/26/11
+ Measurement

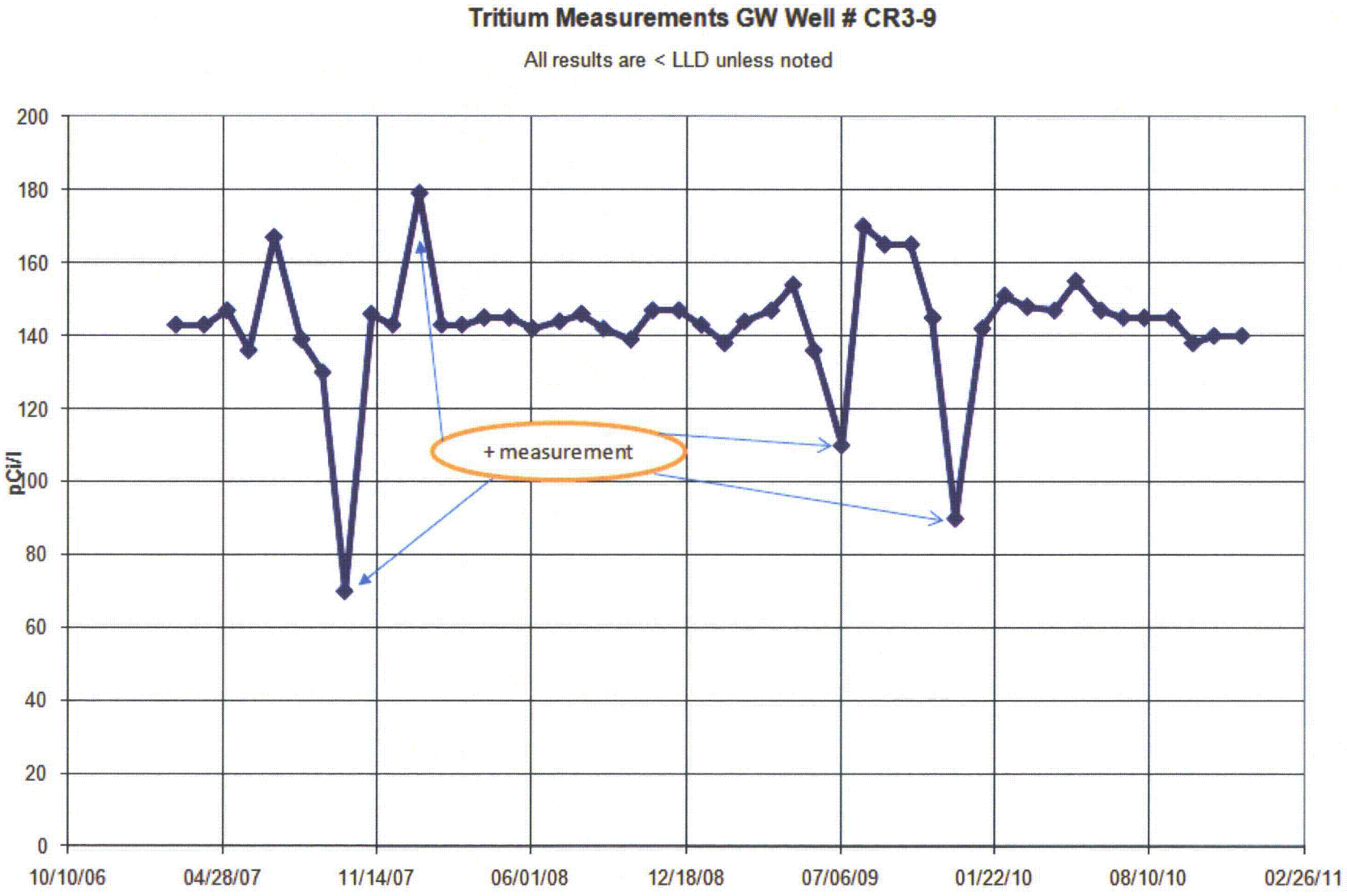

Tritium Measurement GW Well # CR3-5
2500
2000
1500
1000
500
0
pCi/l
NCR 341994
<LLD
10/10/06
04/28/07
11/14/07
06/01/08
12/18/08
07/06/09
01/22/10
08/10/10
02/26/11


Tritium Measurement GW Well # CR3-6S
All results are < LLD unless noted
pCi/l
200
180
160
140
120
100
80
60
40
20
0
10/10/06
04/28/07
11/14/07
06/01/08
12/18/08
07/06/09
01/22/10
08/10/10
02/26/11
+ measurement
+ measurement
+ measurement


Tritium Measurements GW Well # CR3-6D
All results are < LLD unless noted
pCi/l
160
140
120
100
80
60
40
20
0
10/10/06
4/28/07
11/14/07
6/1/08
12/18/08
7/6/09
1/22/10
8/10/10
2/26/11
+ measurements
+ measurement


Tritium Measurements GW Well # CR3-7
pCi/l
800
700
600
500
400
300
200
100
0
10/10/06
04/28/07
11/14/07
06/01/08
12/18/08
07/06/09
01/22/10
08/10/10
02/26/11
<LLD
<LLD


Tritium Measurements GW Well # CR3-8
pCi/l
250
200
150
100
50
0
10/10/06
04/28/07
11/14/07
06/01/08
12/18/08
07/06/09
01/22/10
08/10/10
02/26/11
<LLD
<LLD
<LLD
<LLD


Tritium Measurements GW Well # CR3-9
All results are < LLD unless noted
pCi/l
200
180
160
140
120
100
80
60
40
20
0
+ measurement
10/10/06
04/28/07
11/14/07
06/01/08
12/18/08
07/06/09
01/22/10
08/10/10
02/26/11

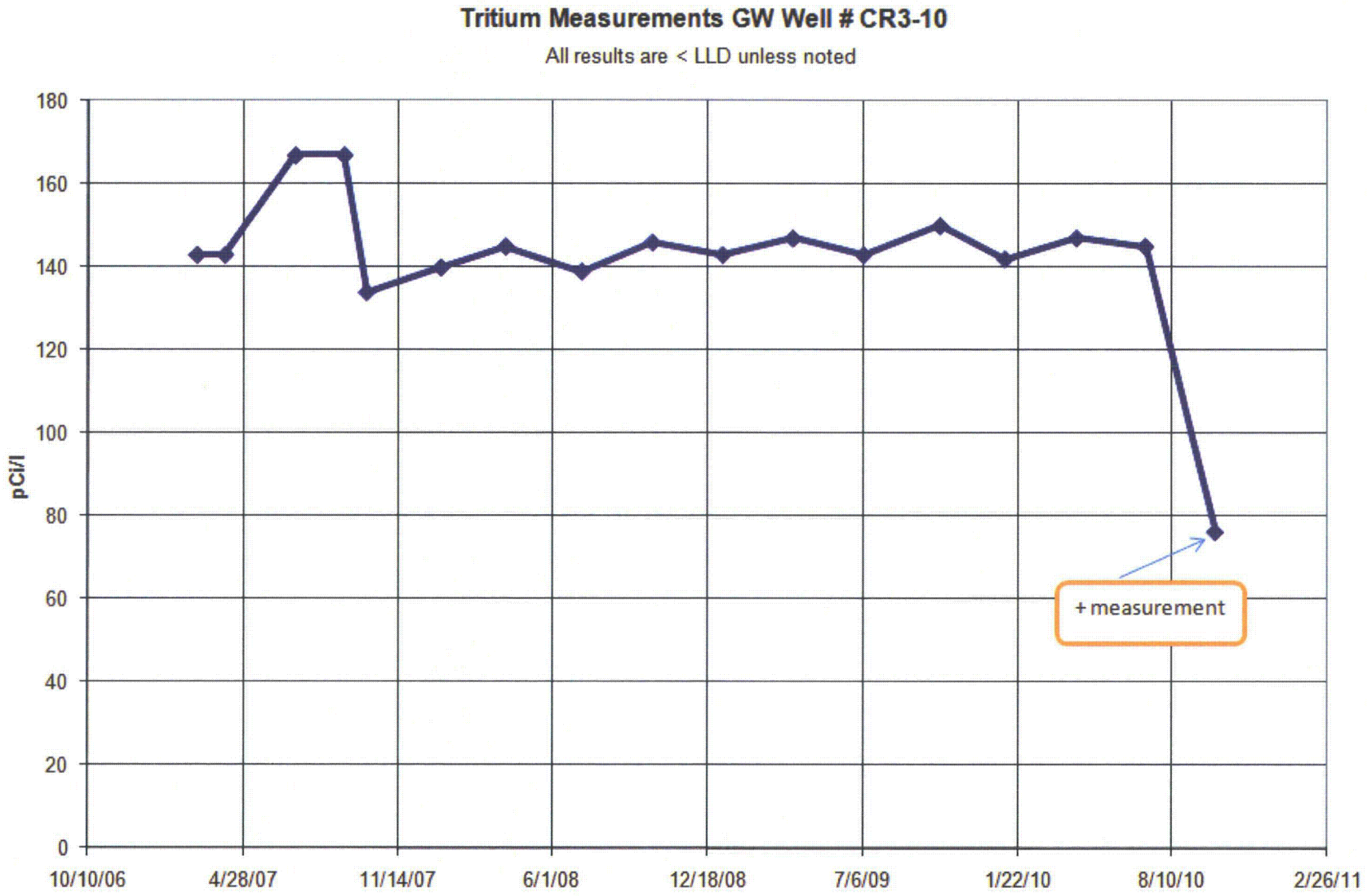

Tritium Measurements GW Well # CR3-10
All results are < LLD unless noted
pCi/l
180
160
140
120
100
80
60
40
20
0
10/10/06
4/28/07
11/14/07
6/1/08
12/18/08
7/6/09
1/22/10
8/10/10
2/26/11
+ measurement

**TABLE IV-C.2.c**

**RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY**

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

**CITRUS COUNTY, FLORIDA** **JANUARY 1 TO DECEMBER 31, 2010**

| MEDIUM OR PATHWAY SAMPLED (UNITS) | ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED | LOWER LIMIT OF DETECTION (LLD)[1] | ALL INDICATOR LOCATIONS MEAN RANGE | LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING | MEAN RANGE | CONTROL LOCATION MEAN RANGE | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |
|---|---|---|---|---|---|---|---|
| *CR3 SITE GROUND WATER (pCi/L) * | Tritium 24 | 155 | 145 (10/24) (104-183) | M27 0.42 mi.@285° | 177 (2/12) (170-183) | CR3-2 <LLD | 0 |
| | γ Spec 24 | | | | | | |
| | Mn-54 | 5 | <LLD | - | - | <LLD | 0 |
| | Fe-59 | 12 | <LLD | - | - | <LLD | 0 |
| | Co-58 | 5 | <LLD | - | - | <LLD | 0 |
| | Co-60 | 5 | <LLD | - | - | <LLD | 0 |
| | Zn-65 | 21 | <LLD | - | - | <LLD | 0 |
| | Zr-Nb-95 | 9 | <LLD | - | - | <LLD | 0 |
| | I-131 | 8 | <LLD | - | - | <LLD | 0 |
| | Cs-134 | 6 | <LLD | - | - | <LLD | 0 |
| | Cs-137 | 6 | <LLD | - | - | <LLD | 0 |
| | Ba-La-140 | 15 | <LLD | - | - | <LLD | 0 |

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

**TABLE IV-C.2.c.1**

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/L γ EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER (SUPPLEMENTAL DATA)**

| STATION | DATE | H-3 | K-40 | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Zn-Nb-95 | I-131 | Cs-134 | Cs-137 | Ba-La-140 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MWC-27* | 01-05 | 183±48 | <58 | <5 | <4 | <9 | <5 | <10 | <7 | <7 | <6 | <5 | <9 |
| | 02-03 | 170±50 | 45±50 | <4 | <3 | <9 | <4 | <9 | <7 | <5 | <5 | <4 | <8 |
| | 03-04 | <148 | <67 | <4 | <4 | <8 | <4 | <8 | <6 | <7 | <4 | <4 | <7 |
| | 04-08 | <147 | <80 | <5 | <5 | <12 | <5 | <10 | <9 | <8 | <6 | <6 | <10 |
| | 05-06 | <155 | <50 | <4 | <4 | <7 | <4 | <18 | <7 | <5 | <5 | <5 | <15 |
| | 06-08 | <147 | <43 | <4 | <4 | <7 | <4 | <15 | <6 | <4 | <4 | <4 | <13 |
| | 07-07 | <145 | <55 | <3 | <4 | <8 | <4 | <8 | <7 | <6 | <4 | <4 | <6 |
| | 08-03 | <145 | <71 | <4 | <4 | <7 | <5 | <11 | <7 | <6 | <5 | <5 | <10 |
| | 09-08 | <145 | <55 | <5 | <5 | <9 | <4 | <21 | <8 | <5 | <5 | <5 | <11 |
| | 10-05 | <140 | <45 | <4 | <4 | <7 | <4 | <14 | <7 | <5 | <4 | <4 | <7 |
| | 11-01 | <140 | 63±19 | <4 | <3 | <8 | <4 | <7 | <7 | <4 | <4 | <4 | <8 |
| | 12-07 | <140 | <56 | <5 | <5 | <9 | <5 | <19 | <8 | <6 | <5 | <6 | <11 |

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

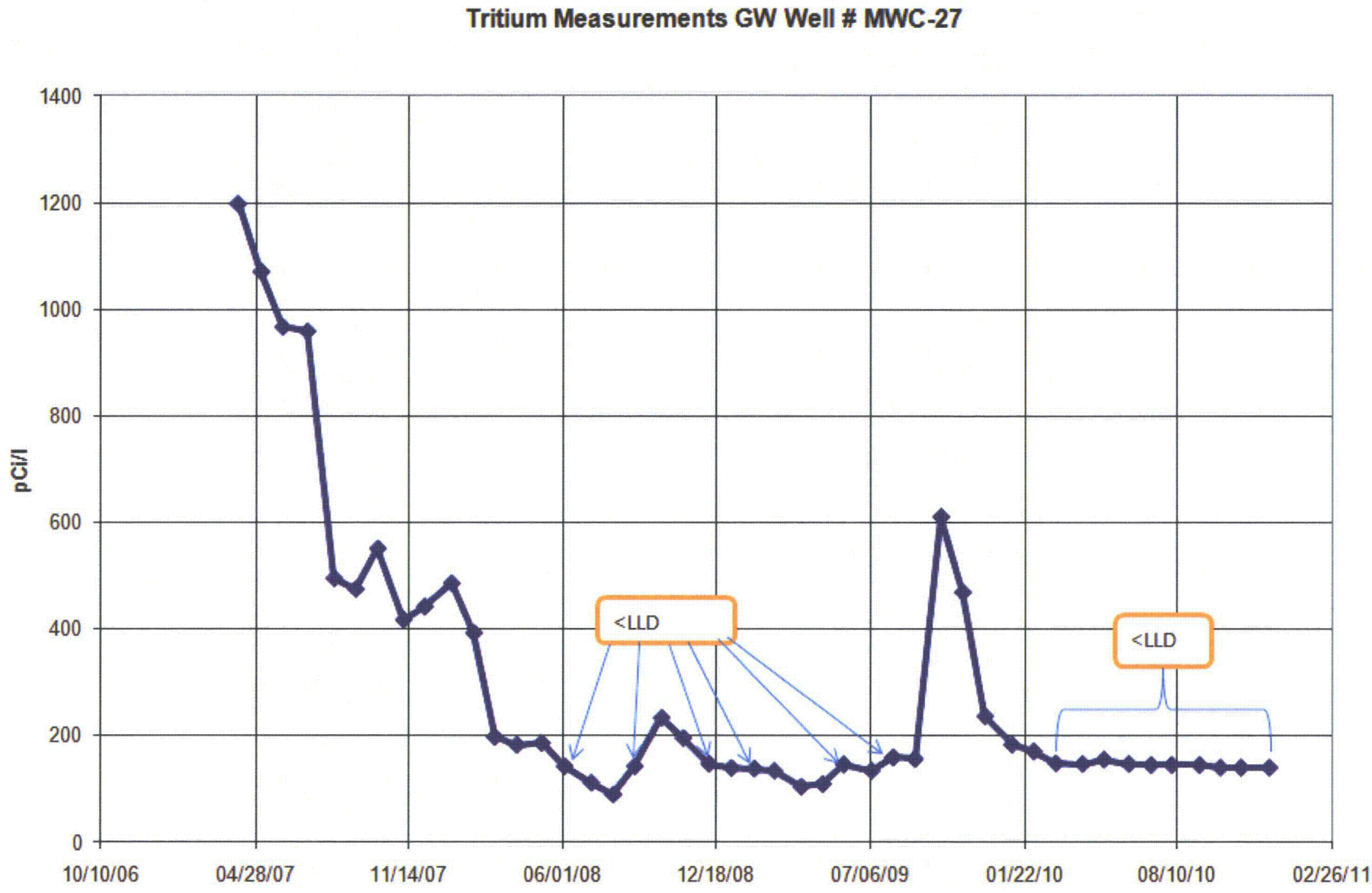
**TABLE IV-C.2.c.1(cont'd)**

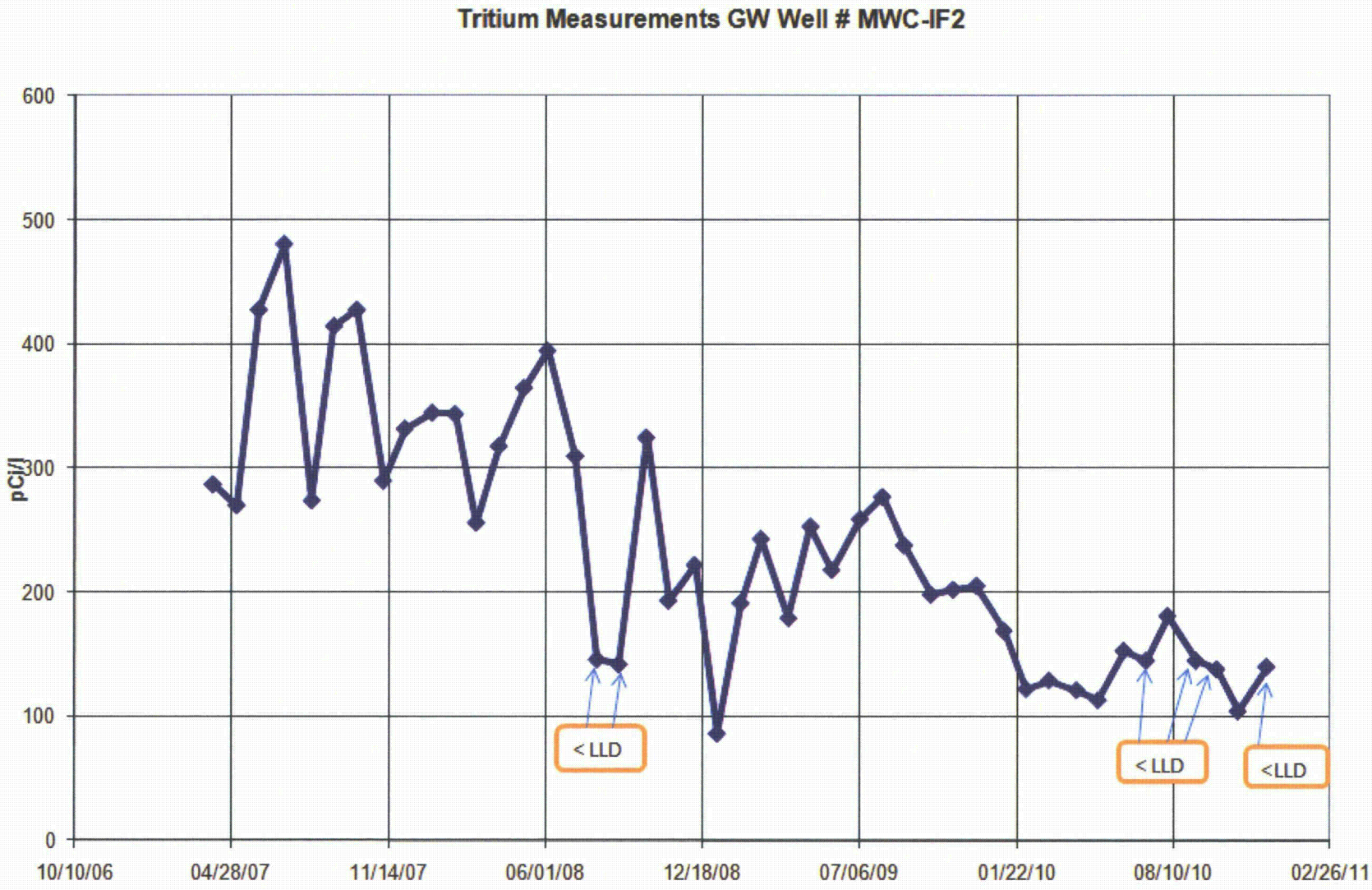
**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/L γ EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER (SUPPLEMENTAL DATA)**

| STATION | DATE | H-3 | K-40 | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Zn-Nb-95 | I-131 | Cs-134 | Cs-137 | Ba-La-140 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MWC-IF2* | 01-05 | 169±48 | <72 | <4 | <4 | <8 | <5 | <7 | <6 | <6 | <5 | <4 | <8 |
| | 02-03 | 122±49 | <54 | <4 | <4 | <7 | <4 | <16 | <7 | <5 | <4 | <4 | <15 |
| | 03-04 | 129±48 | <44 | <4 | <4 | <7 | <4 | <12 | <6 | <5 | <4 | <4 | <7 |
| | 04-08 | 121±48 | <40 | <4 | <4 | <8 | <4 | <12 | <6 | <5 | <4 | <4 | <6 |
| | 05-06 | 113±50 | 46±19 | <4 | <4 | <7 | <4 | <8 | <6 | <4 | <5 | <3 | <14 |
| | 06-08 | 153±49 | <41 | <2 | <2 | <6 | <3 | <6 | <4 | <3 | <3 | <3 | <7 |
| | 07-07 | <145 | <68 | <4 | <3 | <9 | <4 | <7 | <7 | <5 | <4 | <4 | <6 |
| | 08-03 | 181±49 | <63 | <4 | <5 | <8 | <5 | <10 | <7 | <5 | <5 | <5 | <10 |
| | 09-08 | <145 | 54±24 | <4 | <4 | <7 | <3 | <7 | <8 | <4 | <5 | <4 | <10 |
| | 10-05 | <138 | <50 | <4 | <4 | <8 | <4 | <12 | <6 | <4 | <4 | <3 | <7 |
| | 11-01 | 104±45 | <53 | <3 | <3 | <6 | <4 | <7 | <6 | <5 | <4 | <4 | <9 |
| | 12-07 | <140 | <70 | <4 | <4 | <9 | <4 | <8 | <8 | <6 | <4 | <5 | <7 |

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


Tritium Measurements GW Well # MWC-27
pCi/l
1400
1200
1000
800
600
400
200
0
10/10/06
04/28/07
11/14/07
06/01/08
12/18/08
07/06/09
01/22/10
08/10/10
02/26/11
<LLD
<LLD


Tritium Measurements GW Well # MWC-IF2
600
500
400
300
200
100
0
pCi/l
10/10/06
04/28/07
11/14/07
06/01/08
12/18/08
07/06/09
01/22/10
08/10/10
02/26/11
< LLD
< LLD
<LLD

## TABLE IV-C.3

## RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

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

**CITRUS COUNTY, FLORIDA** **JANUARY 1 TO DECEMBER 31, 2010**

| MEDIUM OR PATHWAY SAMPLED (UNITS) | ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED | LOWER LIMIT OF DETECTION (LLD)[1] | ALL INDICATOR LOCATIONS MEAN RANGE | LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING | MEAN RANGE | CONTROL LOCATION MEAN RANGE | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |
|---|---|---|---|---|---|---|---|
| DRINKING WATER (pCi/L) | Tritium 12 | 147 | <LLD | - | - | <LLD | 0 |
| | γ Spec 12 | | | | | | |
| | Mn-54 | 5 | <LLD | - | - | <LLD | 0 |
| | Fe-59 | 9 | <LLD | - | - | <LLD | 0 |
| | Co-58 | 4 | <LLD | - | - | <LLD | 0 |
| | Co-60 | 5 | <LLD | - | - | <LLD | 0 |
| | Zn-65 | 10 | <LLD | - | - | <LLD | 0 |
| | Zr-Nb-95 | 9 | <LLD | - | - | <LLD | 0 |
| | I-131 | 7 | <LLD | - | - | <LLD | 0 |
| | Cs-134 | 5 | <LLD | - | - | <LLD | 0 |
| | Cs-137 | 5 | <LLD | - | - | <LLD | 0 |
| | Ba-La-140 | 8 | <LLD | - | - | <LLD | 0 |

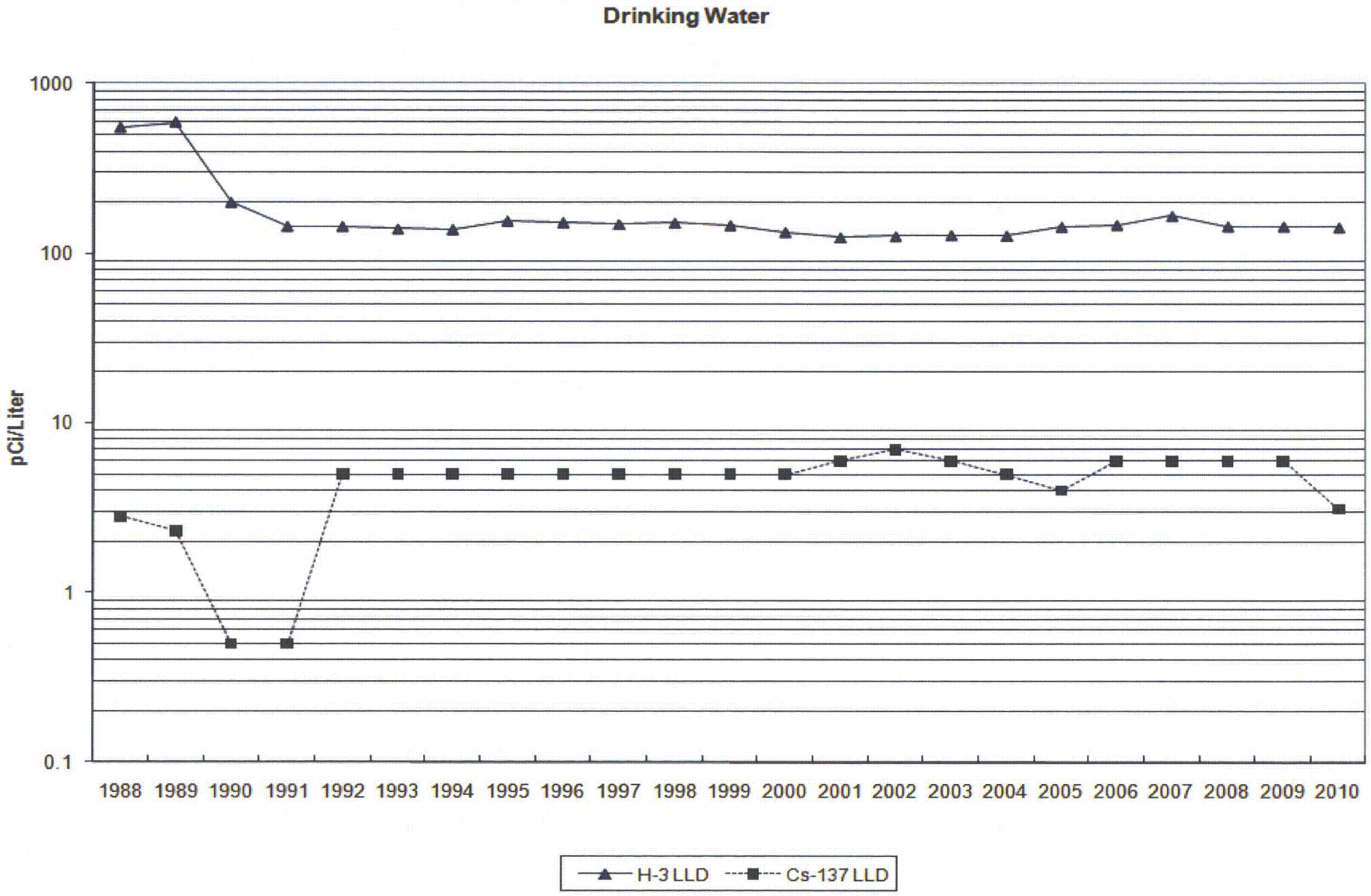
[1]The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

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

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/L γ EMITTERS AND TRITIUM IN DRINKING WATER**

| STATION | DATE | H-3 | K-40 | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Zn-Nb-95 | I-131 | Cs-134 | Cs-137 | Ba-La-140 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C07 | 01-08 | <142 | 70±12 | <1 | <2 | <3 | <2 | <4 | <3 | <3 | <2 | <2 | <2 |
| | 04-06 | <147 | <18 | <1 | <1 | <3 | <1 | <4 | <2 | <2 | <1 | <1 | <3 |
| | 07-06 | <145 | <65 | <5 | <4 | <9 | <3 | <10 | <9 | <7 | <5 | <5 | <5 |
| | 10-05 | <138 | <68 | <4 | <4 | <8 | <5 | <6 | <7 | <6 | <5 | <5 | <7 |
| C10 | 01-08 | <142 | <16 | <1 | <1 | <3 | <1 | <3 | <2 | <2 | <1 | <1 | <6 |
| | 04-06 | <147 | <33 | <3 | <3 | <6 | <3 | <8 | <6 | <4 | <3 | <3 | <7 |
| | 07-06 | <145 | <60 | <3 | <3 | <6 | <3 | <7 | <5 | <4 | <4 | <4 | <6 |
| | 10-05 | <138 | <71 | <4 | <4 | <9 | <4 | <8 | <6 | <6 | <5 | <5 | <8 |
| C18 | 01-08 | <142 | <38 | <2 | <2 | <5 | <3 | <5 | <4 | <3 | <3 | <2 | <4 |
| | 04-06 | <147 | <37 | <3 | <3 | <7 | <3 | <7 | <5 | <4 | <4 | <3 | <6 |
| | 07-06 | <145 | <64 | <2 | <2 | <4 | <2 | <5 | <4 | <3 | <3 | <2 | <5 |
| | 10-05 | <138 | <59 | <4 | <3 | <9 | <4 | <9 | <7 | <5 | <3 | <4 | <8 |


Drinking Water
1000
100
10
1
0.1
pCi/Liter
1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
H-3 LLD
Cs-137 LLD

## TABLE IV-C.4

## RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

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

**CITRUS COUNTY, FLORIDA** **JANUARY 1 TO DECEMBER 31, 2010**

| MEDIUM OR PATHWAY SAMPLED (UNITS) | ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED | LOWER LIMIT OF DETECTION (LLD)[1] | ALL INDICATOR LOCATIONS MEAN RANGE | LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING | MEAN RANGE | CONTROL LOCATION MEAN RANGE | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |
|---|---|---|---|---|---|---|---|
| SHORELINE SEDIMENT | $\gamma$ Spec 8 | | | | | | |
| (pCi/kg) | Cs-134 | 34 | <LLD | — | — | <LLD | 0 |
| | Cs-137 | 36 | 19 (4/6) (10-29) | C14H 0.1 @ 0° | 20 (2/2) (10-29) | <LLD | 0 |

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

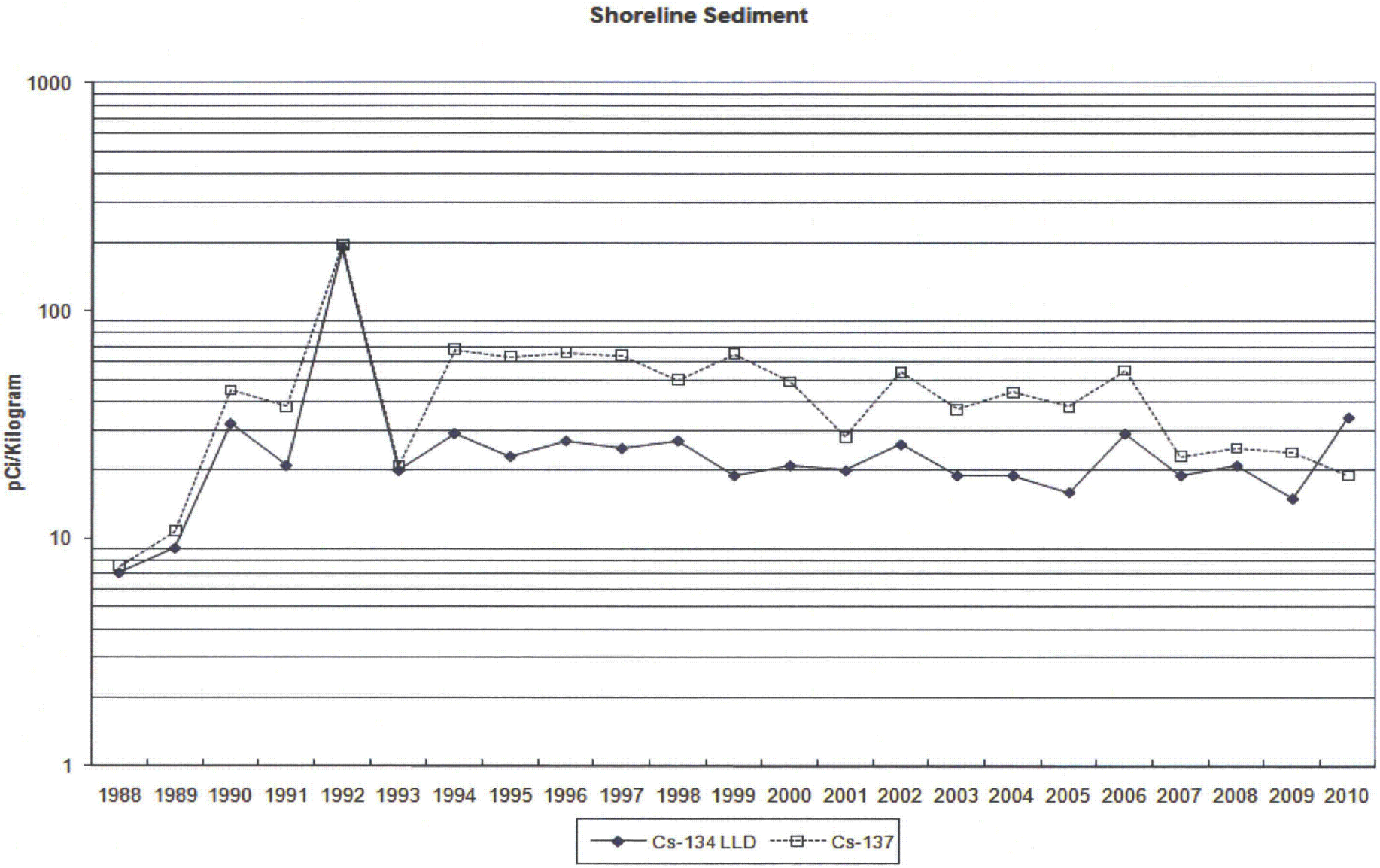
**TABLE IV-C.4.a**

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/kg γ EMITTERS IN SHORELINE SEDIMENT**

| STATION | PERIOD | Co-58 | Co-60 | Cs-134 | Cs-137 | K-40 | Ra-226 |
|---|---|---|---|---|---|---|---|
| C09 | First Half | <10 | <12 | <14 | <13 | 482±80 | 1001±129 |
| | Second Half | <9 | <7 | <9 | <8 | 241±24 | 384±35 |
| C14H | First Half | <13 | <13 | <14 | 29±3 | 1507±73 | 1313±177 |
| | Second Half | <11 | <11 | <16 | 10±4 | 591±77 | 2179±106 |
| C14M | First Half | <11 | 26±4 | <15 | 21±6 | 631±93 | 1342±155 |
| | Second Half | <17 | 53±8 | <12 | 17±2 | 672±42 | 763±201 |
| C14G | First Half | <10 | <10 | <11 | <11 | 167±22 | 1297±114 |
| | Second Half | <11 | <33 | <34 | <36 | 833±141 | 1115±306 |

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


Shoreline Sediment
1000
100
10
1
pCi/Kilogram
1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Cs-134 LLD
Cs-137

## IV-D. INGESTION PATHWAY

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

1. Quarterly carnivorous fish samples were taken at two locations: C29 at the end of the discharge canal, and C30, the control location, near the mouth of the intake canal. None of the required radionuclides were found in measurable quantities. The highest cesium-137 LLD for station C29 was 28 pCi/kg. Naturally occurring potassium-40 was quantified in all eight samples at an average concentration of 2822 pCi/kg.

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

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

2. Quarterly oyster samples were taken at the same locations as fish samples, C29 and C30. Of the isotopes required to be evaluated, none indicated measurable amounts of radioactivity. In 2009, silver-110m was quantified in one sample at location C29 near the end of the discharge canal, at a concentration of 20 pCi/kg. Silver-110m was not quantified in any oyster samples collected in 2010 or 2008. In 2007, silver-110m was quantified in three samples at C29 with an average concentration of 85 pCi/kg and a range of 58 to 118 pCi/kg.

   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. Five of twenty-four indicator samples had measurable amounts of cesium-137 with an average concentration of 66 pCi/kg and a range of 9 to 153 pCi/kg. This is higher than the levels found in 2009, but lower than in 2007 and 2008. It is believed the 2007 and 2008 spike was due to possible collection of wire grass mixed into the sample, which has a greater uptake rate of cesium as compared to other broad-leafed media. In 2010, eight of twelve control station samples had measurable amounts of cesium-137 with an average concentration of 21 pCi/kg and a range of 9 to 31 pCi/kg. During 2009 due to construction activities at the Crystal River Unit 4 & 5 site, the area where broad leaf vegetation was being collected at station C48A was removed. A new location in the same north sector was located near the air sample station C46. During 2010, also due to construction activities at the Crystal River Units 4 & 5 site, the area where broadleaf vegetation was being collected at station C48B became inaccessible. A new location in the ENE sector was located near the transmission power line corridor right of way, just NE of the mariculture center. This sector has the same D/Q value as the N and NNE sectors and is allowed by the ODCM.

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

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

4. In 2010 watermelon samples were collected at station C04. None of the required radionuclides were found in measurable quantities. In 2008 and again in 2009, there were no watermelon samples available at station C04. In these 2 years, due to crop rotation, there were no locally grown watermelons found in any areas nearby the facility and no local commercial harvest performed. Citrus samples were taken at station C19. None of the required radionuclides were found in measurable quantities in the citrus samples with exception of Cs-137 at a concentration of 71 pCi/kg.

   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, 2010**

| MEDIUM OR PATHWAY SAMPLED (UNITS) | ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED | LOWER LIMIT OF DETECTION (LLD)[1] | ALL INDICATOR LOCATIONS MEAN RANGE | LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING | LOCATION WITH HIGHEST MEAN MEAN RANGE | CONTROL LOCATION MEAN RANGE | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |
|---|---|---|---|---|---|---|---|
| CARNIVOROUS FISH | γ Spec 8 | | | | | | |
| (pCi/kg) | Mn-54 | 33 | <LLD | - | - | <LLD | 0 |
| | Fe-59 | 67 | <LLD | - | - | <LLD | 0 |
| | Co-58 | 28 | <LLD | - | - | <LLD | 0 |
| | Co-60 | 29 | <LLD | - | - | <LLD | 0 |
| | Zn-65 | 69 | <LLD | - | - | <LLD | 0 |
| | Cs-134 | 35 | <LLD | - | - | <LLD | 0 |
| | Cs-137 | 30 | <LLD | - | - | <LLD | 0 |

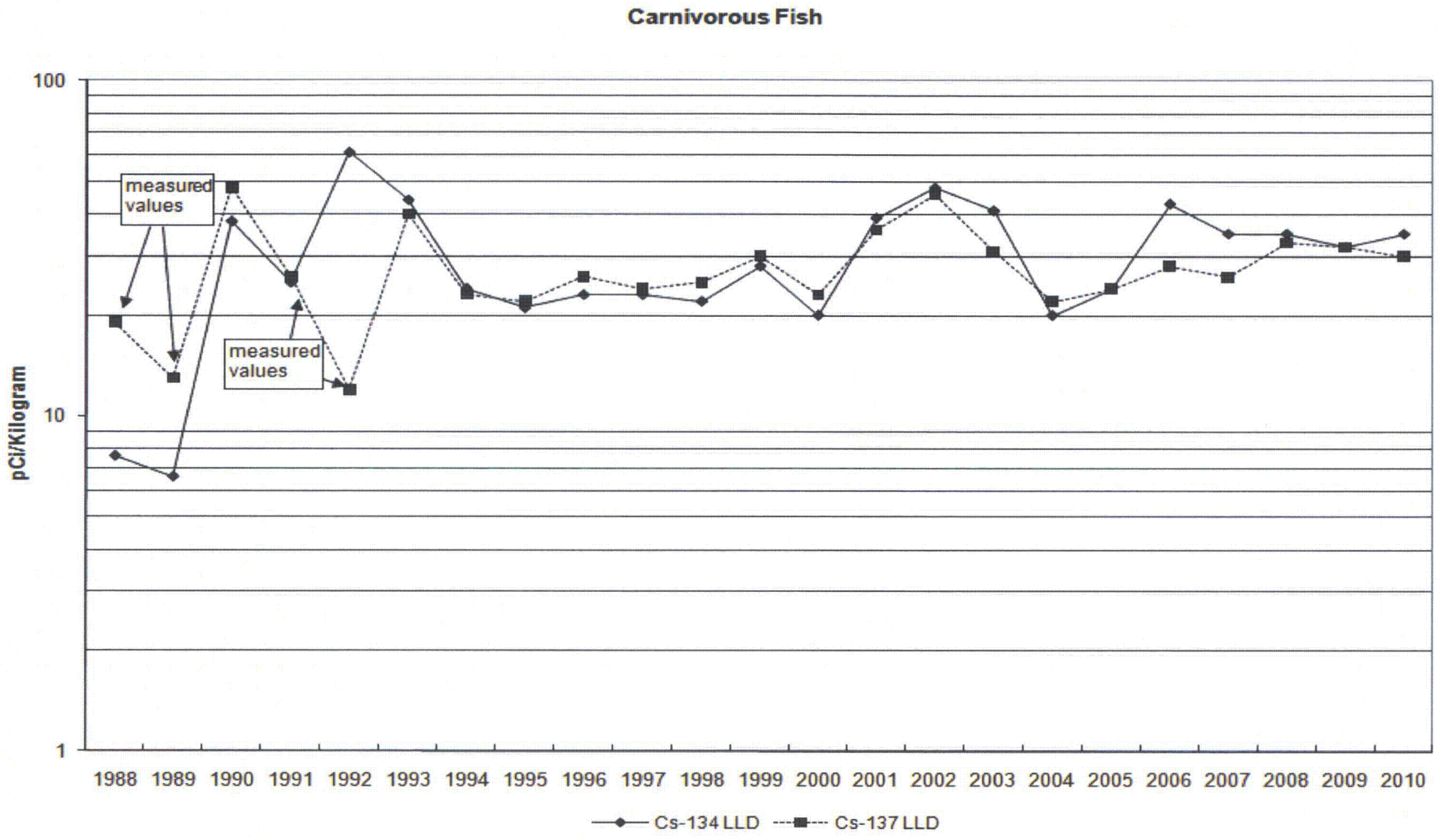
[1]The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

**TABLE IV-D.1.a**

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/kg γ EMITTERS IN CARNIVOROUS FISH**

| STATION | QUARTER | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Cs-134 | Cs-137 | K-40 |
|---|---|---|---|---|---|---|---|---|---|
| C29 | 1 | <18 | <18 | <36 | <21 | <45 | <23 | <20 | 2231±120 |
| | 2 | <24 | <23 | <54 | <27 | <60 | <34 | <28 | 2312±170 |
| | 3 | <23 | <20 | <39 | <24 | <49 | <29 | <24 | 3215±237 |
| | 4 | <21 | <23 | <49 | <27 | <51 | <25 | <24 | 2809±239 |
| C30 | 1 | <24 | <26 | <52 | <28 | <59 | <33 | <28 | 1775±137 |
| | 2 | <11 | <11 | <22 | <12 | <27 | <13 | <12 | 2682±107 |
| | 3 | <33 | <28 | <67 | <29 | <69 | <35 | <30 | 4420±306 |
| | 4 | <27 | <24 | <61 | <29 | <61 | <32 | <26 | 3132±202 |


Carnivorous Fish
100
10
1
pCi/Kilogram
measured values
measured values
1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Cs-134 LLD
Cs-137 LLD

## TABLE IV-D.2

## RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

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

**CITRUS COUNTY, FLORIDA** **JANUARY 1 TO DECEMBER 31, 2010**

| MEDIUM OR PATHWAY SAMPLED (UNITS) | ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED | LOWER LIMIT OF DETECTION (LLD)[1] | ALL INDICATOR LOCATIONS MEAN RANGE | LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING | MEAN RANGE | CONTROL LOCATION MEAN RANGE | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |
|---|---|---|---|---|---|---|---|
| OYSTERS (pCi/kg) | γ Spec 8 | | | | | | |
| | Mn-54 | 27 | <LLD | - | - | <LLD | 0 |
| | Fe-59 | 74 | <LLD | - | - | <LLD | 0 |
| | Co-58 | 28 | <LLD | - | - | <LLD | 0 |
| | Co-60 | 28 | <LLD | - | - | <LLD | 0 |
| | Zn-65 | 63 | <LLD | - | - | <LLD | 0 |
| | Cs-134 | 39 | <LLD | - | - | <LLD | 0 |
| | Cs-137 | 28 | <LLD | - | - | <LLD | 0 |

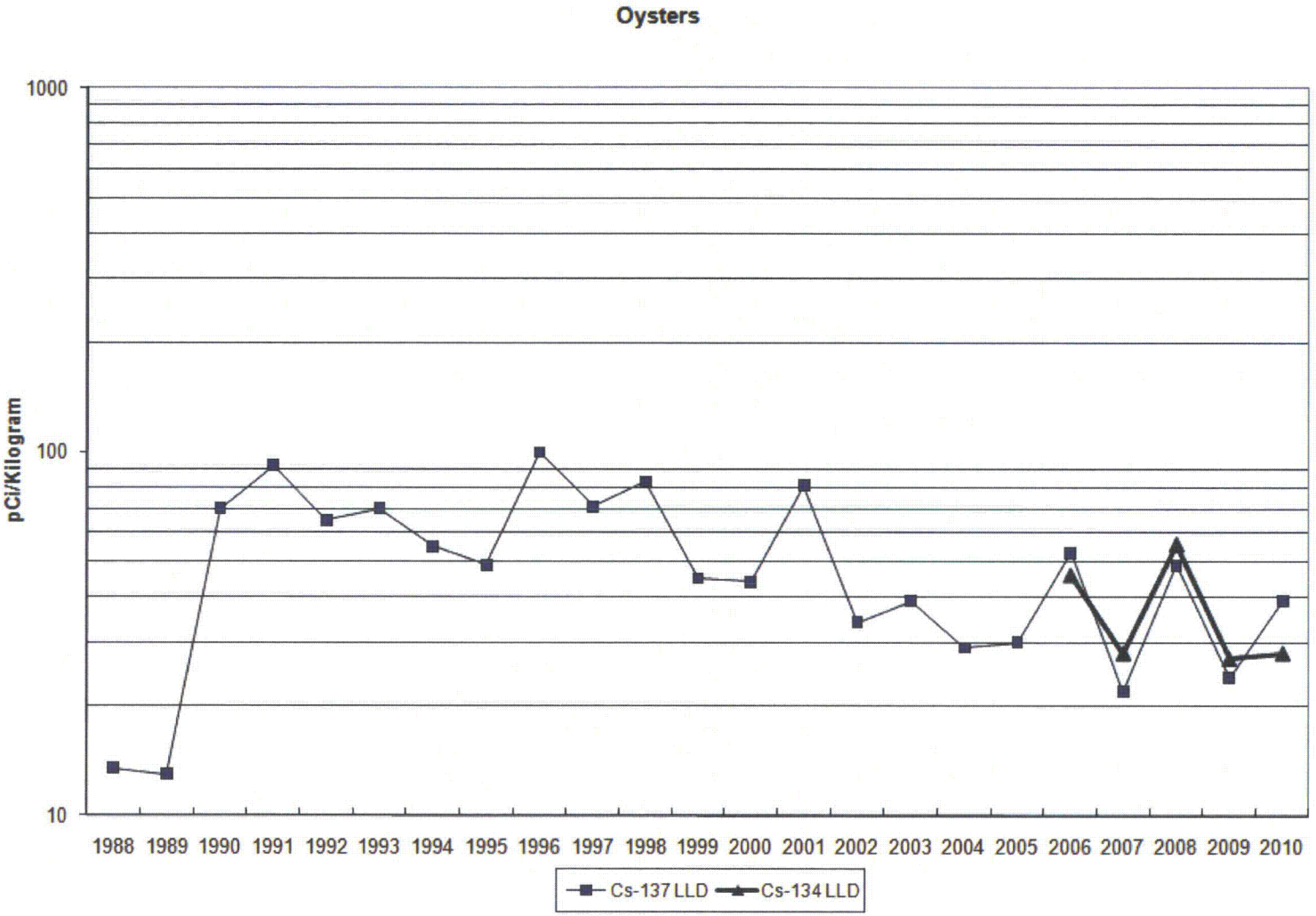
[1]The "a priori" LLD which meets or exceeds the requirements of Table 2-9 of the CR-3 ODCM.

**TABLE IV-D.2.a**

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/kg γ EMITTERS IN OYSTERS**

| STATION | QUARTER | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Cs-134 | Cs-137 | K-40 |
|---|---|---|---|---|---|---|---|---|---|
| C29 | 1 | <19 | <18 | <41 | <18 | <48 | <22 | <22 | 1386±165 |
| | 2 | <26 | <28 | <58 | <27 | <57 | <29 | <26 | 890±109 |
| | 3 | <12 | <11 | <23 | <13 | <23 | <14 | <13 | 1176±63 |
| | 4 | <23 | <23 | <74 | <28 | <63 | <39 | <26 | 775±212 |
| C30 | 1 | <25 | <26 | <54 | <23 | <55 | <32 | <28 | 1444±132 |
| | 2 | <27 | <16 | <51 | <25 | <53 | <33 | <26 | 1261±229 |
| | 3 | <20 | <14 | <46 | <21 | <42 | <20 | <22 | 1885±177 |
| | 4 | <21 | <20 | <37 | <21 | <48 | <24 | <21 | 782±83 |


Oysters
1000
100
10
pCi/Kilogram
1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Cs-137 LLD
Cs-134 LLD

## TABLE IV-D.3

## RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

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

**CITRUS COUNTY, FLORIDA** **JANUARY 1 TO DECEMBER 31, 2010**

| MEDIUM OR PATHWAY SAMPLED (UNITS) | ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED | LOWER LIMIT OF DETECTION (LLD)[1] | ALL INDICATOR LOCATIONS MEAN RANGE | LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING | MEAN RANGE | CONTROL LOCATION MEAN RANGE | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |
|---|---|---|---|---|---|---|---|
| BROAD LEAF VEGETATION (pCi/kg) | γ Spec 36 | | | | | | |
| | I-131 | 25 | <LLD | - | - | <LLD | 0 |
| | Cs-134 | 22 | <LLD | - | - | <LLD | 0 |
| | Cs-137 | 24 | 66 (5/24) (9-153) | C48B 0.9 @ 73° | 81 (4/12) (22-153) | 21 (8/12) (9-31) | 0 |

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

**TABLE IV-D.3.a**

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/kg OF γ EMITTERS IN BROAD LEAF VEGETATION**

| STATION | MONTH | I-131 | Cs-134 | Cs-137 | K-40 |
|---|---|---|---|---|---|
| C47 | JAN | <12 | <14 | 28±3 | 3962±157 |
| | FEB | <17 | <19 | 31±8 | 2906±177 |
| | MAR | <12 | <13 | 11±5 | 2713±213 |
| | APR | <24 | <17 | 27±6 | 3990±195 |
| | MAY | <13 | <20 | <21 | 5225±240 |
| | JUN | <15 | <20 | 26±9 | 4329±228 |
| | JUL | <25 | <20 | <19 | 4375±211 |
| | AUG | <7 | <7 | 15±3 | 2824±76 |
| | SEP | <4 | <4 | 9±1 | 3938±153 |
| | OCT | <21 | <21 | <21 | 4855±240 |
| | NOV | <24 | <19 | <15 | 3274±183 |
| | DEC | <14 | <21 | 22±6 | 3761±211 |
| C48A | JAN | <19 | <21 | <19 | 3413±213 |
| | FEB | <11 | <11 | <10 | 1617±84 |
| | MAR | <15 | <17 | <18 | 2080±149 |
| | APR | <17 | <18 | <15 | 3548±190 |
| | MAY | <18 | <17 | <22 | 3554±196 |
| | JUN | <10 | <11 | 9±2 | 2897±123 |
| | JUL | <16 | <15 | <18 | 2975±190 |
| | AUG | <16 | <14 | <14 | 2690±169 |
| | SEP | <12 | <10 | <12 | 3583±146 |
| | OCT | <17 | <22 | <16 | 5028±236 |
| | NOV | <23 | <19 | <16 | 3699±193 |
| | DEC | <18 | <12 | <17 | 2996±180 |

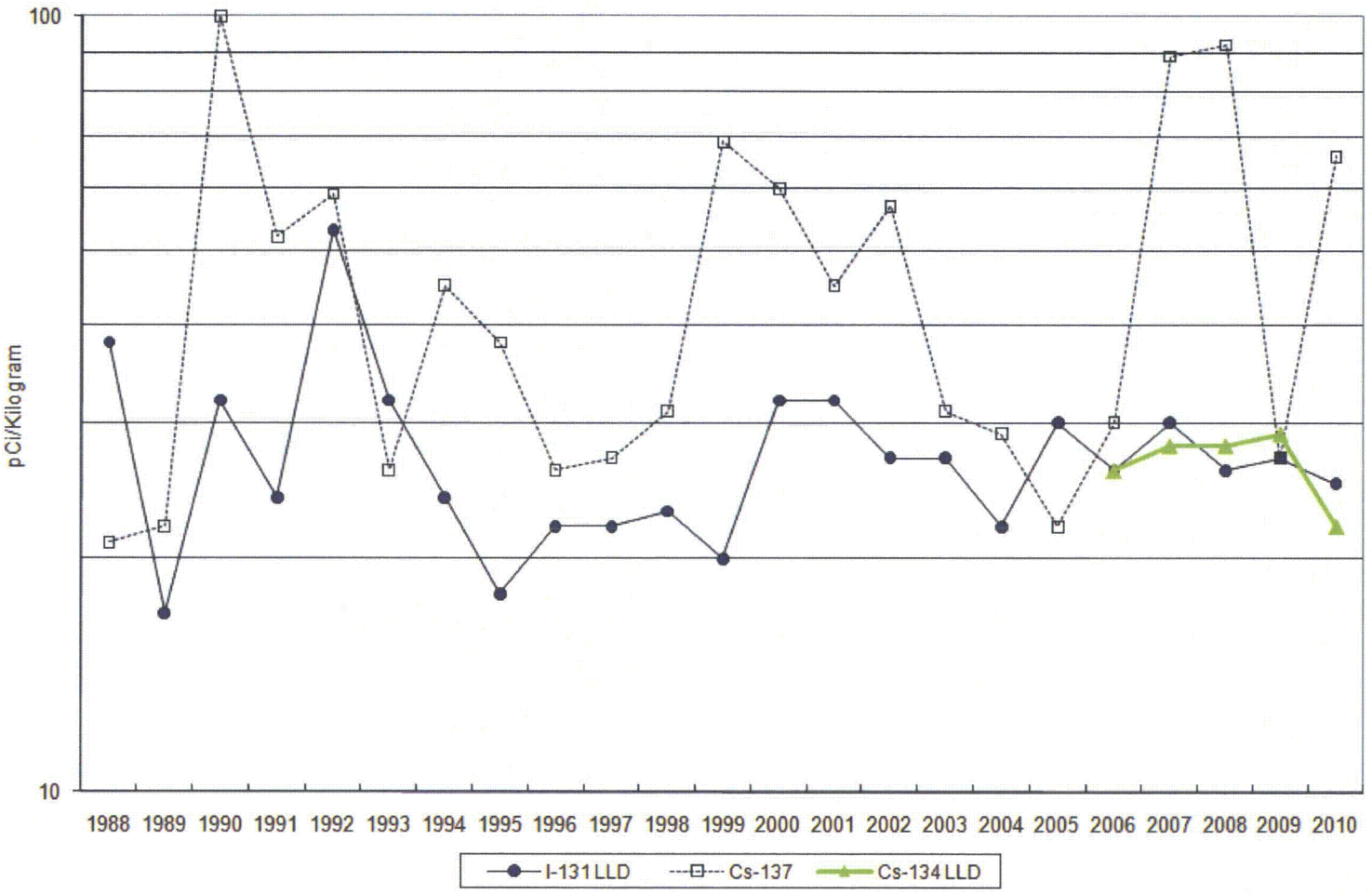
**TABLE IV-D.3.a (CONT'D)**

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/kg OF γ EMITTERS IN BROAD LEAF VEGETATION**

| STATION | MONTH | I-131 | Cs-134 | Cs-137 | K-40 |
|---|---|---|---|---|---|
| C48B | JAN | <17 | <20 | <24 | 5519±253 |
| | FEB | <17 | <19 | 22±9 | 4195±199 |
| | MAR | <16 | <18 | <15 | 4556±206 |
| | APR | <16 | <15 | <16 | 4588±211 |
| | MAY | <10 | <12 | <10 | 5040±264 |
| | JUN | <13 | <18 | <16 | 6232±233 |
| | JUL | <20 | <17 | <21 | 6381±259 |
| | AUG | <16 | <17 | 34±7 | 4542±218 |
| | SEP | <10 | <11 | <11 | 4511±187 |
| | OCT | <17 | <19 | <20 | 4493±228 |
| | NOV | <22 | <12 | 113±8 | 3560±148 |
| | DEC | <16 | <22 | 153±17 | 2849±206 |

## 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, 2010**

| MEDIUM OR PATHWAY SAMPLED (UNITS) | ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED | LOWER LIMIT OF DETECTION (LLD)[1] | ALL INDICATOR LOCATIONS MEAN RANGE | LOCATION WITH HIGHEST MEAN NAME DISTANCE & BEARING | LOCATION WITH HIGHEST MEAN MEAN RANGE | CONTROL LOCATION MEAN RANGE | NUMBER OF NONROUTINE REPORTED MEASUREMENTS |
|---|---|---|---|---|---|---|---|
| WATERMELON (pCi/kg) | γ Spec 1 | | | | | | |
| | I-131 | 7 | < LLD | - | - | None | 0 |
| | Cs-134 | 10 | < LLD | - | - | None | 0 |
| | Cs-137 | 9 | < LLD | - | - | None | 0 |
| CITRUS (pCi/kg) | γ Spec 1 | | | | | | |
| | I-131 | 7 | <LLD | - | - | None | 0 |
| | Cs-134 | 8 | <LLD | - | - | None | 0 |
| | Cs-137 | 9 | 71(1/1) | - | - | None | 0 |

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

**TABLE IV-D.4.a**

**PROGRESS ENERGY FLORIDA, INC. - CR3 - 2010**

**pCi/kg OF γ EMITTERS IN WATERMELON AND CITRUS**

| STATION | MONTH | I-131 | Cs-134 | Cs-137 | K-40 |
|---|---|---|---|---|---|
| C04 – Watermelon | May | <7 | <10 | <9 | 1209±80 |
| C19 – Citrus | January | <7 | <8 | 71±5 | 1921±86 |

# AMENDED
# ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

# 2009


## PROGRESS ENERGY FLORIDA, INC.

## CRYSTAL RIVER UNIT 3

REVISED TABLES SUBMITTED DUE TO CUT AND PASTE ERRORS ON ORIGINAL REPORT
Documented on Nuclear Condition Report (NCR) 423136

## REVISED TABLE IV-C.2.b

## RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

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

**CITRUS COUNTY, FLORIDA** **JANUARY 1 TO DECEMBER 31, 2009**

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

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

Note: underlined values were changed.

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

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

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

| STATION | DATE | H-3 | K-40 | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Zn-Nb-95 | I-131 | Cs-134 | Cs-137 | Ba-La-140 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C3-6S | 01-06 | 90±26 | <73 | <5 | <5 | <9 | <7 | <12 | <7 | <6 | <6 | <6 | <14 |
| | 04-07 | <139 | 40±13 | <2 | <2 | <3 | <2 | <4 | <3 | <3 | <2 | <2 | <3 |
| | 07-07 | 137±47 | 40±11 | <2 | <2 | <3 | <2 | <3 | <3 | <3 | <2 | <2 | <2 |
| | 10-05 | <165 | 24±8 | <4 | <4 | <7 | <3 | <13 | <6 | <5 | <4 | <4 | <7 |
| C3-6D | 01-06 | 143 | <67 | <5 | <5 | <9 | <5 | <10 | <7 | <6 | <6 | <6 | <14 |
| | 04-07 | 139 | **229±27** | <4 | <5 | <9 | <6 | <10 | <8 | <5 | <5 | <5 | <8 |
| | 07-07 | 143 | **191±29** | <3 | <3 | <6 | <4 | <8 | <5 | <5 | <4 | <5 | <8 |
| | 10-13 | 108±28 | **191±22** | <2 | <2 | <6 | <3 | <5 | <4 | <4 | <3 | <2 | <11 |
| C3-7 | 01-06 | <143 | <46 | <4 | <4 | <8 | <4 | <16 | <7 | <5 | <4 | <4 | <7 |
| | 04-07 | **165±46** | 16±4 | **<2** | **<2** | **<4** | **<2** | **<6** | **<3** | **<3** | **<2** | **<2** | **<4** |
| | 07-07 | **156±47** | 37±9 | **<3** | **<4** | **<7** | **<4** | **<14** | **<6** | **<4** | **<4** | **<4** | **<10** |
| | 10-05 | 193±55 | 72±13 | **<2** | **<2** | **<4** | **<2** | **<4** | **<4** | **<3** | **<2** | **<2** | **<3** |

Note: Underlined values were changed.

**REVISED TABLE IV-C.2.b.2**

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

**pCi/L γ EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER (SUPPLEMENTAL DATA)**

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

Note: Underlined values were changed.

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

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

**pCi/L γ EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER (SUPPLEMENTAL DATA)**

| STATION | DATE | H-3 | K-40 | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Zn-Nb-95 | I-131 | Cs-134 | Cs-137 | Ba-La-140 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C3-9 | 02-05 | <138 | <71 | <4 | <4 | <8 | <4 | <9 | <7 | <6 | <4 | <4 | <7 |
| | 03-03 | <144 | 32±3 | <1 | <1 | <3 | <1 | <2 | <2 | <13 | <1 | <1 | <5 |
| | 05-05 | <154 | **47±24** | <3 | <4 | <7 | <4 | <8 | <6 | <6 | <4 | <4 | <10 |
| | 06-01 | <136 | 69±22 | <4 | <4 | <8 | <5 | <8 | <8 | <6 | <5 | <4 | <8 |
| | 08-04 | 151±52 | 32±9 | <4 | <4 | <8 | <4 | <13 | <7 | <5 | <4 | <4 | <9 |
| | 09-01 | <165 | <40 | <2 | <2 | <4 | <3 | <5 | <4 | <3 | <2 | <2 | <7 |
| | 11-02 | <145 | 12±3 | <1 | <1 | <3 | <1 | <5 | <2 | <1 | <1 | <1 | <5 |
| | 12-01 | **90±26** | <64 | <4 | <4 | <8 | <3 | <7 | <5 | <5 | <4 | <4 | <15 |

Note: Underlined values were changed.

**REVISED TABLE IV-C.2.c.1**

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

**pCi/L γ EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER (SUPPLEMENTAL DATA)**

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

*= These wells are not officially included in the REMP and are located on either side of the site percolation ponds.
Note: Underlined values are changed.

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

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

**pCi/L γ EMITTERS AND TRITIUM IN CR3 SITE GROUND WATER (SUPPLEMENTAL DATA)**

| STATION | DATE | H-3 | K-40 | Mn-54 | Co-58 | Fe-59 | Co-60 | Zn-65 | Zn-Nb-95 | I-131 | Cs-134 | Cs-137 | Ba-La-140 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MWC-IF2* | 01-06 | **86±26** | <41 | <4 | <4 | <7 | <3 | <13 | <7 | <4 | <4 | <4 | <8 |
| | 02-05 | 191±48 | <39 | <3 | <3 | <6 | <3 | <6 | <4 | <4 | <3 | <3 | <4 |
| | 03-03 | 243±50 | <46 | <4 | <4 | <8 | <4 | <17 | <7 | <5 | <5 | <4 | <12 |
| | 04-07 | 179±47 | <39 | <3 | <3 | <6 | <3 | <8 | <5 | <5 | <3 | <3 | <5 |
| | 05-05 | 253±53 | <34 | <3 | <3 | <6 | <3 | <11 | <5 | <4 | <3 | <3 | <6 |
| | 06-01 | 218±50 | 13±3 | <2 | <2 | <3 | <2 | <6 | <3 | <2 | <2 | <2 | <4 |
| | 07-07 | 259±50 | 12±3 | <2 | <2 | <3 | <2 | <5 | <3 | <2 | <2 | <2 | <3 |
| | 08-04 | 194±54 | <46 | <4 | <4 | <8 | <4 | <15 | <6 | <4 | <4 | <4 | <9 |
| | 09-01 | 238±56 | <28 | <2 | <2 | <4 | <2 | <3 | <4 | <3 | <2 | <2 | <5 |
| | 10-05 | 198±55 | <45 | <4 | <4 | <7 | <4 | <13 | <6 | <5 | <4 | <4 | <6 |
| | 11-02 | 202±49 | **8±1** | <1 | <1 | <1 | <1 | <2 | <1 | <1 | <1 | <1 | <2 |
| | 12-01 | 205±47 | 61±13 | <3 | <3 | <6 | <4 | <7 | <7 | <5 | <4 | <3 | <14 |

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

Note: Underlined values were changed.