



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

Ref: 10 CFR 50.36a(a)(2)  
ITS 5.7.1.1(c)

March 31, 2011  
3F0311-11

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

Subject: Crystal River Unit 3 - 2010 Radioactive Effluent Release Report

Reference: Crystal River Unit 3 - 2009 Radioactive Effluent Release Report (Accession No. ML101250163)

Dear Sir:

Florida Power Corporation (FPC), doing business as Progress Energy Florida, Inc., hereby submits the 2010 Radioactive Effluent Release Report for Crystal River Unit 3 (CR-3) in accordance with 10 CFR 50.36a(a)(2) and the CR-3 Improved Technical Specifications (ITS), Section 5.7.1.1(c). The subject report (Attachment A) includes a summary of the quantities of radioactive liquid and gaseous effluents, and solid waste released from the CR-3 site during 2010. The material provided is consistent with the objectives outlined in the Off-Site Dose Calculation Manual (ODCM) and the Process Control Program (PCP), and is in conformance with 10 CFR 50, Appendix I, Section IV.B.1.

The CR-3 ITS, Section 5.6.2.3, requires submittal of licensee initiated changes to the ODCM as part of the Radioactive Effluent Release Report for the period of the report in which any changes were made. The ODCM and the PCP were not revised in 2010.

Included in this submittal are three amended pages from the above referenced report that corrects a transposition error that discovered after the 2009 Radioactive Effluent Release Report was submitted last year. This error was entered into the CR-3 Corrective Action Program.

This letter establishes no new regulatory commitments.

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

Sincerely,

James W. Holt  
Plant General Manager

JWH/ff

Attachments:

- A. Radioactive Effluent Release Report 2010
- B. Amended Partial Annual Radioactive Effluent Release Report 2009

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

Progress Energy Florida, Inc.  
Crystal River Nuclear Plant  
15760 W. Power Line Street  
Crystal River, FL 34428

IE48

**PROGRESS ENERGY FLORIDA, INC.**

**CRYSTAL RIVER UNIT 3**

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

**ATTACHMENT A**

**RADIOACTIVE EFFLUENT RELEASE REPORT 2010**

**ANNUAL RADIOACTIVE EFFLUENT  
RELEASE REPORT  
2010**



PROGRESS ENERGY FLORIDA, INC  
CRYSTAL RIVER UNIT 3

Facility Operating License No. DPR-72

Docket No. 50-302

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## INTRODUCTION

This report is submitted as required by the Offsite Dose Calculation Manual, section 6.5, and Technical Specifications 5.6.2.3.3 and 5.7.1.1.c.

The scope of this report includes:

- A summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the plant.
- Quarterly and annual dose summaries.
- A list and description of unplanned releases to unrestricted areas.
- A description of any changes to the:  
    Process Control Program (PCP), and  
    Offsite Dose Calculation Manual (ODCM).
- Significant changes to any radioactive waste treatment system.
- A list of new dose calculation location changes identified by the annual land-use census.
- Information relating to effluent monitors or required supporting instrumentation being inoperable for 30 or more days.
- Information required to be included in this report per NEI 07-07 Industry Ground Water Protection Initiative-Final Guidance Document issued in August 2007.

**TABLE 1**

**EFFLUENT AND WASTE DISPOSAL REPORT - 2010**  
**GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES**

Unit	Quarter 1	Quarter 2	Est. Total Error %
------	--------------	--------------	-----------------------

A. Fission and activation gases

1. Total release	Ci	0.00E+00	0.00E+00	30
2. Average release rate for period	μCi/sec	0.00E+00	0.00E+00	
3. Percent of technical specification limit	%	0.00E+00	0.00E+00	

B. Iodines

1. Total Iodine-131	Ci	0.00E+00	0.00E+00	30
2. Average release rate for period	μCi/sec	0.00E+00	0.00E+00	
3. Percent of technical specification limit	%	0.00E+00	0.00E+00	

C. Particulates\*

1. Particulates with half-lives > 8 days	Ci	9.90E-08	9.19E-09	30
2. Average release rate for period	μCi/sec	1.27E-08	1.17E-09	
3. Percent of technical specification limit	%	6.65E-03	7.90E-03	
4. Gross alpha radioactivity	Ci	1.25E-08	7.43E-08	

D. Tritium

1. Total release	Ci	2.08E+00	2.47E+00	30
2. Average release rate for period	μCi/sec	2.67E-01	3.14E-01	
3. Percent of technical specification limit	%	6.65E-03	7.90E-03	

\* The sum of the particulates reported on this page may be less than the sum from Table 2, as Table 2 includes all particulates, while this table includes only those with half-lives greater than 8 days.

**TABLE 2**  
**EFFLUENT AND WASTE DISPOSAL REPORT – 2010**  
**GASEOUS EFFLUENTS - GROUND LEVEL RELEASES**

Nuclides Released	Unit	CONTINUOUS MODE		BATCH MODE	
		Quarter 1	Quarter 2	Quarter 1	Quarter 2

A. Fission gases

Argon-41	Ci				
Krypton-85	Ci				
Krypton-85m	Ci				
Krypton-87	Ci				
Krypton-88	Ci				
Xenon-131m	Ci				
Xenon-133	Ci				
Xenon-133m	Ci				
Xenon-135	Ci				
Xenon-135m	Ci				
Xenon-138	Ci				
Total for period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00

B. Iodines

Iodine-131	Ci				
Iodine-132	Ci				
Iodine-133	Ci				
Iodine-135	Ci				
Total for period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00

C. Particulates

Manganese-54*	Ci				
Zinc-72	Ci		2.07E-07		
Cobalt-58*	Ci	9.90E-08	9.19E-09		
Cobalt-60*	Ci				
Strontium-89*	Ci				
Strontium-90*	Ci				
Niobium-95m	Ci				
Technicium-99m	Ci				
Tellurium-132	Ci				
Cesium-134*	Ci				
Cesium-137*	Ci				
Cesium-138	Ci				
Barium-139	Ci				
Lanthanum-142	Ci				
Cerium-141*	Ci				
Cerium-143	Ci	6.17E-07			
Rhenium-188	Ci				
Total for period	Ci	7.16E-07	2.16E-07	0.00E+00	0.00E+00

\* > 8 day half-life

**TABLE 3**

**EFFLUENT AND WASTE DISPOSAL REPORT - 2010**

**GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES**

	Unit	Quarter 3	Quarter 4	Est. Total Error %
A. Fission and activation gases				
1. Total release	Ci	0.00E+00	0.00E+00	30
2. Average release rate for period	μCi/sec	0.00E+00	0.00E+00	
3. Percent of technical specification limit	%	0.00E+00	0.00E+00	
B. Iodines				
1. Total Iodine-131	Ci	0.00E+00	0.00E+00	30
2. Average release rate for period	μCi/sec	0.00E+00	0.00E+00	
3. Percent of technical specification limit	%	0.00E+00	0.00E+00	
C. Particulates*				
1. Particulates with half-lives > 8 days	Ci	1.68E-07	1.83E-07	30
2. Average release rate for period	μCi/sec	2.11E-08	2.29E-08	
3. Percent of technical specification limit	%	8.28E-03	8.33E-03	
4. Gross alpha radioactivity	Ci	0.00E+00	0.00E+00	
D. Tritium				
1. Total release	Ci	2.56E+00	2.57E+00	30
2. Average release rate for period	μCi/sec	3.22E-01	3.24E-01	
3. Percent of technical specification limit	%	8.28E-03	8.33E-03	

\* The sum of the particulates reported on this page may be less than the sum from Table 4, as Table 4 includes all particulates, while this table includes only those with half-lives greater than 8 days.

TABLE 4

EFFLUENT AND WASTE DISPOSAL REPORT - 2010

GASEOUS EFFLUENTS - GROUND LEVEL RELEASES

Nuclides Released	Unit	CONTINUOUS MODE		BATCH MODE	
		Quarter 3	Quarter 4	Quarter 3	Quarter 4

A. Fission gases

Argon-41	Ci				
Krypton-85	Ci				
Krypton-85m	Ci				
Krypton-87	Ci				
Krypton-88	Ci				
Xenon-131m	Ci				
Xenon-133	Ci				
Xenon-133m	Ci				
Xenon-135	Ci				
Xenon-135m	Ci				
Xenon-138	Ci				
Total for period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00

B. Iodines

Iodine-131	Ci				
Iodine-132	Ci				
Iodine-133	Ci				
Iodine-135	Ci				
Total for period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00

C. Particulates

Manganese-54*	Ci				
Zinc-72	Ci				
Cobalt-58*	Ci				
Cobalt-60*	Ci				
Chromium-51*	Ci				
Strontium-89*	Ci				
Strontium-90*	Ci				
Niobium-95*	Ci				
Tin-113*	Ci				
Zirconium-95*	Ci				
Barium-133m	Ci				
Cesium-137*	Ci	1.68E-07	1.32E-07		5.05E-08
Barium-139	Ci				
Cerium-141	Ci				
Cerium-143	Ci	9.09E-07			
Cerium-144*	Ci				
Ruthenium-103	Ci				
Total for period	Ci	1.08E-06	1.32E-07	0.00E+00	5.05E-08

\* > 8 day half-life

**TABLE 5**

**EFFLUENT AND WASTE DISPOSAL REPORT - 2010**

**LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES**

	Unit	Quarter 1	Quarter 2	Est. Total Error %
<b>A. Fission and activation products</b>				
1. Total release (not including tritium, gases, alpha)	Ci	7.84E-03	2.09E-03	25
2. Average diluted concentration during period	µCi/ml	2.48E-11	6.57E-12	
3. Percent of applicable limit	%	3.12E-04	1.30E-04	
<b>B. Tritium</b>				
1. Total release	Ci	1.94E+00	2.00E+00	30
2. Average diluted concentration during period	µCi/ml	6.12E-09	6.29E-09	
3. Percent of applicable limit	%	6.12E-04	6.29E-04	
<b>C. Dissolved and entrained gases</b>				
1. Total release	Ci	0.00E+00	0.00E+00	25
2. Average diluted concentration during period	µCi/ml	0.00E+00	0.00E+00	
3. Percent of applicable limit	%	0.00E+00	0.00E+00	
<b>D. Gross alpha radioactivity</b>				
1. Total release	Ci	2.31E-04	5.73E-04	30
<b>E. Volume of waste released (prior to dilution)</b>				
1. Batch and continuous modes	Liters	9.98E+06	4.86E+06	10
<b>F. Volume of dilution water used during period</b>				
1. Batch and continuous modes	Liters	3.17E+11	3.18E+11	10

**TABLE 6**  
**EFFLUENT AND WASTE DISPOSAL REPORT - 2010**  
**LIQUID EFFLUENTS**

Fission and activation products	Unit	CONTINUOUS MODE		BATCH MODE	
		Quarter 1	Quarter 2	Quarter 1	Quarter 2
Sodium-24	Ci				
Chromium-51	Ci			5.21E-05	
Manganese-54	Ci				
Manganese-56	Ci				
Iron-55	Ci				
Iron-59	Ci				
Cobalt-57	Ci				
Cobalt-58	Ci			1.05E-04	1.98E-05
Cobalt-60	Ci			2.99E-05	2.33E-04
Zinc-69	Ci				
Strontium-85	Ci				
Strontium-89	Ci				
Strontium-90	Ci				
Yttrium-91m	Ci				
Yttrium-92	Ci				
Yttrium-93	Ci				
Niobium-95	Ci			9.05E-07	
Niobium-95m	Ci				
Niobium-97	Ci				
Zirconium-95	Ci				
Zirconium-97	Ci				
Molybdenum-99	Ci				
Technetium-99m	Ci				
Technetium-101	Ci				
Ruthenium-103	Ci				
Ruthenium-106	Ci				
Silver-110m	Ci				
Tin-113	Ci				
Indium-113m	Ci				
Antimony-122	Ci				
Antimony-124	Ci				
Antimony-125	Ci			7.50E-03	1.64E-03
Tellurium-129	Ci				
Tellurium-132	Ci				
Iodine-131	Ci				
Iodine-133	Ci				
Iodine-135	Ci				
Cesium-134	Ci				
Cesium-137	Ci	1.96E-05		7.14E-05	1.23E-04
Cesium-138	Ci				
Barium-133m	Ci				
Barium-140	Ci				
Lanthanum-140	Ci				
Cerium-141	Ci				
Cerium-143	Ci				
Neodymium-147	Ci				
Tungsten-187	Ci				
Neptunium--239	Ci				
Nickle-63	Ci			6.31E-05	7.25E-05
Total for period	Ci	1.96E-05	0.00E+00	7.82E-03	2.09E-03

**TABLE 6 (CONTINUED)**

**EFFLUENT AND WASTE DISPOSAL REPORT - 2010**

**LIQUID EFFLUENTS**

Dissolved and entrained gases	Unit	CONTINUOUS MODE		BATCH MODE	
		Quarter 1	Quarter 2	Quarter 1	Quarter 2
Argon-41	Ci				
Krypton-85	Ci				
Krypton-85m	Ci				
Krypton-87	Ci				
Krypton-88	Ci				
Xenon-131m	Ci				
Xenon-133	Ci				
Xenon-133m	Ci				
Xenon-135	Ci				
Xenon-135m	Ci				
Total for period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium	Ci	3.65E-03	0.00E+00	1.93E+00	2.00E+00

**TABLE 7**

**EFFLUENT AND WASTE DISPOSAL REPORT - 2010**

**LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES**

Unit	Quarter 3	Quarter 4	Est. Total Error %
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A. Fission and activation products

1. Total release (not including tritium, gases, alpha)	Ci	5.78E-04	3.65E-03	25
2. Average diluted concentration during period	μCi/ml	1.73E-12	1.40E-11	
3. Percent of applicable limit	%	7.36E-05	3.46E-03	

B. Tritium

1. Total release	Ci	1.93E+00	1.53E+01	30
2. Average diluted concentration during period	μCi/ml	5.79E-09	5.89E-08	
3. Percent of applicable limit	%	5.79E-04	5.89E-03	

C. Dissolved and entrained gases

1. Total release	Ci	0.00E+00	0.00E+00	25
2. Average diluted concentration during period	μCi/ml	0.00E+00	0.00E+00	
3. Percent of applicable limit	%	0.00E+00	0.00E+00	

D. Gross alpha radioactivity

1. Total release	Ci	0.00E+00	0.00E+00	30
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E. Volume of waste released (prior to dilution)

1. Batch and continuous modes	Liters	5.26E+06	6.06E+06	10
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F. Volume of dilution water used during period

1. Batch and continuous modes	Liters	3.33E+11	2.60E+11	10
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**TABLE 8**  
**EFFLUENT AND WASTE DISPOSAL REPORT - 2010**  
**LIQUID EFFLUENTS**

Fission and activation products	Unit	CONTINUOUS MODE		BATCH MODE	
		Quarter 3	Quarter 4	Quarter 3	Quarter 4
Sodium-24	Ci				
Chromium-51	Ci				
Manganese-54	Ci			4.87E-06	2.06E-04
Manganese-56	Ci				
Iron-55	Ci				
Iron-59	Ci				
Cobalt-57	Ci				
Cobalt-58	Ci			8.47E-06	1.19E-04
Cobalt-60	Ci			7.33E-05	2.18E-03
Zinc-69	Ci				
Zinc-72	Ci				
Strontium-85	Ci				
Strontium-89	Ci				
Strontium-90	Ci				
Strontium-92	Ci				
Yttrium-91	Ci				
Yttrium-92	Ci				
Yttrium-93	Ci				
Rubidium-88	Ci				
Niobium-95	Ci				
Niobium-95m	Ci				
Zirconium-95	Ci				2.97E-05
Zirconium-97	Ci				9.50E-07
Molybdenum-99	Ci				
Technetium-99m	Ci				
Technetium-101	Ci				
Ruthenium-106	Ci				
Silver-110m	Ci			1.29E-05	7.23E-04
Tin-113	Ci				
Indium-113m	Ci				
Antimony-122	Ci				
Antimony-124	Ci				
Antimony-125	Ci			2.23E-04	1.82E-04
Tellurium-129	Ci				
Tellurium-132	Ci				
Iodine-131	Ci				
Iodine-133	Ci				
Iodine-135	Ci				
Cesium-134	Ci			1.14E-05	3.94E-06
Cesium-137	Ci			1.52E-04	1.03E-04
Barium-133m	Ci				
Barium-139	Ci				
Barium-140	Ci				
Lanthanum-140	Ci				
Cerium-141	Ci				
Cerium-143	Ci				
Praseodymium-144	Ci				
Neodymium-147	Ci				
Neptunium-239	Ci				
Nickel-63	Ci			9.17E-05	1.02E-04
Rhenium-188	Ci				
Total for period	Ci	0.00E+00	0.00E+00	5.78E-04	3.65E-03

**TABLE 8 (CONTINUED)**

**EFFLUENT AND WASTE DISPOSAL REPORT - 2010**

**LIQUID EFFLUENTS**

Dissolved and entrained gases	Unit	CONTINUOUS MODE		BATCH MODE	
		Quarter 3	Quarter 4	Quarter 3	Quarter 4
Argon-41	Ci				
Krypton-85	Ci				
Krypton-85m	Ci				
Krypton-87	Ci				
Krypton-88	Ci				
Xenon-131m	Ci				
Xenon-133	Ci				
Xenon-133m	Ci				
Xenon-135	Ci				
Xenon-135m	Ci				
Total for period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium	Ci	0.00E+00	0.00E+00	1.93E+00	1.53E+01

**TABLE 9**

**EFFLUENT AND WASTE DISPOSAL REPORT - 2010**

**SOLID WASTE AND IRRADIATED FUEL SHIPMENTS**

**A. SOLID WASTE SHIPPED OFFSITE FOR PROCESSING OR BURIAL (Non-irradiated fuel)**

1. Type of waste	Unit	12 month period	Est. Total Error %
a. Spent resins, filter sludges, evaporator bottoms, etc.	m3 Ci	4.38E+01 7.96E+01	25
b. Dry compressible waste, contaminated equipment, etc.	m3 Ci	6.48E+02 8.04E-01	25
c. Irradiated components, control rods, etc.	m3 Ci	0.00E+00 0.00E+00	25
d. Other (describe): Combined DAW package	m3 Ci	3.00E+01 1.72E+00	25
<b>2. Estimate of major nuclide composition (by type of waste in %)*</b>			
a.	Fe-55 9.55 Sb-125 0.25 Mn-54 0.46	Co-58 0.18 Co-60 6.68 Ni-63 49.13	Cs-134 5.23 Cs-137 27.93
b.	C-14 0.23 Fe-55 37.23 Co-60 20.77 Nb-95 1.95	Ni-63 19.29 Mn-54 3.94 Cs-137 2.50	Co-58 9.97 Ce-144 2.28 Cs-134 0.87
c.	N/A	N/A	N/A
d.	Fe-55 29.36 Co-60 13.68 Ni-63 29.83 Co-58 2.28	Sb-125 3.33 Cs-134 1.81 Cs-137 9.40 Ce-144 1.29	Mn-54 1.49 H-3 5.98 C-14 0.42 Ag-110m 0.70

\* Curie values and principle radionuclides are estimates based on a combination of direct and indirect methods.

**3. Solid Waste Disposition**

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
12	Highway	EnergySolutions-Bear Creek
02	Highway	EnergySolutions-LLC.
11	Highway	IMPACT Services, Inc.
01	Highway	IMPACT Services, Inc.
05	Highway	Studsvik Processing Facility, LLC

**B. IRRADIATED FUEL SHIPMENTS (Disposition)**

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
0	N/A	N/A

## Unplanned Releases

There were no unplanned releases in 2010.

## Radioactive Waste Treatment Systems

There were no significant changes to the radioactive waste treatment systems in 2010. A different mixed bed resin with 1:1 cation to anion ratio was added to two of the five waste processing demineralizers to provide added capacity to target removal of Sb-125 in support of plant start up activities.

## Annual Land Use Census

The 2010 land-use census did not identify any new dose calculation locations.

## Effluent Monitor Instrument Operability

During 2010, WD-19-FQI, waste gas effluent flow element, was declared inoperable on 3-4-10 due to improper flow indication. This instrumentation is used to measure flow during release of Waste Gas Decay Tanks. During the course of the extended refuel 16 outage at Crystal River Unit 3, the waste gas system is presently aligned to the auxiliary building ventilation. The waste gas decay tanks are not in service and are empty. A post maintenance test cannot be performed until the waste gas system is realigned to service with the waste gas decay tanks, therefore this instrumentation remains inoperable. This instrumentation will be tested and verified satisfactory prior to the plant heat up, which remains on hold due to the reactor building containment wall repair. Nuclear Condition Report 391053 and Work Request 422663 are tracking the repair and return to service of this instrument. There have been no waste gas decay tank releases performed that require use of this instrument during this time period.

## ODCM & PCP Changes

The ODCM was not revised in 2010. Revision 32, performed in 2009, incorporated the following changes:

1. The replacement of the CR-3 steam generators in refuel 16 outage require cutting a sizeable hole in the reactor building wall to facilitate removal and installation of these large components. Verbiage was added to page 97 under the section for representative sampling method 3.1-5 dealing with the reactor building equipment hatch and personnel hatch being in the open position to also include the steam generator replacement access hole.  
  
Under certain wind flow conditions outside air might flow into the reactor building through one open hatch and out the other open hatch. ODCM sampling specification 3.1-5 was established to provide guidance for controlling these hatches (personal and equipment hatches) to minimize the chances of releasing airborne radioactive material. This guidance is not a commitment and is not a required part of the ODCM.  
  
The SG replacement project requires an opening in the Reactor Building that is equivalent to having another hatch opening. This new opening is not practical to control in the same way the personnel and equipment hatches have been controlled in the past. Consequently, the sampling specification is being revised to recognize this new opening and to provide for flexibility in the application of the guideline.
2. Also on page 97 under the section for representative sampling method 3.1-6 dealing with sampling to support the reactor building integrated leak rate test, verbiage was added that describes use of RM-A6 samples prior to pressurizing the RB or use of RM-A1 samples from the previous RB purge permit as long as the source term has not changed.
3. On page 11 the footnote of table 2-3 for requirements of when the RM-A1 automatic isolation function is required was updated to state that this function is not required during periods of "no mode" due to no gas source term being located in the RB during the "no mode" plant condition.
4. On page 140, the direction for station C14H was changed from NW to N as we moved the collection of surface water slightly east to eliminate dilution effects of units CR 1&2. Also footnote 1 was added to the vegetation collection areas to provide an alternate means of collecting required media if adequate vegetation is not available.

The PCP was not revised in 2010.

### Emergency Feed Pump 2 & Steam Releases

Emergency Feed Pump 2 (EFP-2) over-speed testing is performed quarterly using steam from CR-3's steam generators. Due to a historical small primary to secondary leak, an evaluation is normally performed to estimate the quantity of radioactive material which would be released during 2010 due to operation of this pump. In addition, radioactive releases due to other steam releases are normally estimated and included. These values normally include any plant trips with associated secondary plant atmosphere steam relief valve initiation. The results are given below in units of Curies/year.

Due to the extended plant shutdown for refueling outage 16, which began in September of 2009, the plant is still shutdown for the containment building wall repair. The emergency feed pump 2 has not operated and there were no secondary plant steam releases during 2010.

Xe-133	0.00E+00	I-131	0.00E+00	Cs-137	0.00E+00
Xe-135	0.00E+00	I-133	0.00E+00		
H-3	0.00E+00				

These values are not included in Tables 1 through 4.

### Carbon-14 Evaluation

During the entire year of 2010, Crystal River Unit 3 has been in a cold shutdown mode. The plant was taken off line in September of 2009 for refueling outage 16. The plant was degassed, the reactor building was purged of radioactivity, waste gas decay tanks were released, a construction opening was made in the side of the reactor building containment wall, and both once through steam generators were replaced. All of these activities were completed in 2009. Since the plant has been in cold shutdown for the entire year of 2010, there is no source term generation for carbon-14 production in 2010. Once the plant restarts, C-14 source term and resultant dose will be estimated and reported utilizing the EPRI (or similar methodology) model for B&W reactors as discussed in the 2010 C-14 workshop sponsored by EPRI in February of 2011.

**2010 Appendix I Dose Summary**  
**Maximum Hypothetical Individual**

**Liquid Effluent Dose Limits**

Total Body: 1.5 mrem/quarter, 3 mrem/year  
 Any Organ: 5 mrem/quarter, 10 mrem/year

**Liquid Effluent Dose Summary**

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual Total
Total Body Dose (mrem)	3.06E-04	1.42E-04	1.88E-04	4.64E-04	1.10E-03
Maximum Organ Dose (mrem)	3.68E-04	5.13E-04	3.35E-04	1.36E-02	1.47E-02
Maximum Organ was GI					

**Gaseous Effluent Dose Limits**

Gamma Air Dose: 5 mrad/quarter, 10 mrad/year  
 Beta Air Dose: 10 mrad/quarter, 20 mrad/year  
  
 Any Organ: 7.5 mrem/quarter, 15 mrem/year

**Gaseous Release Dose Summary**

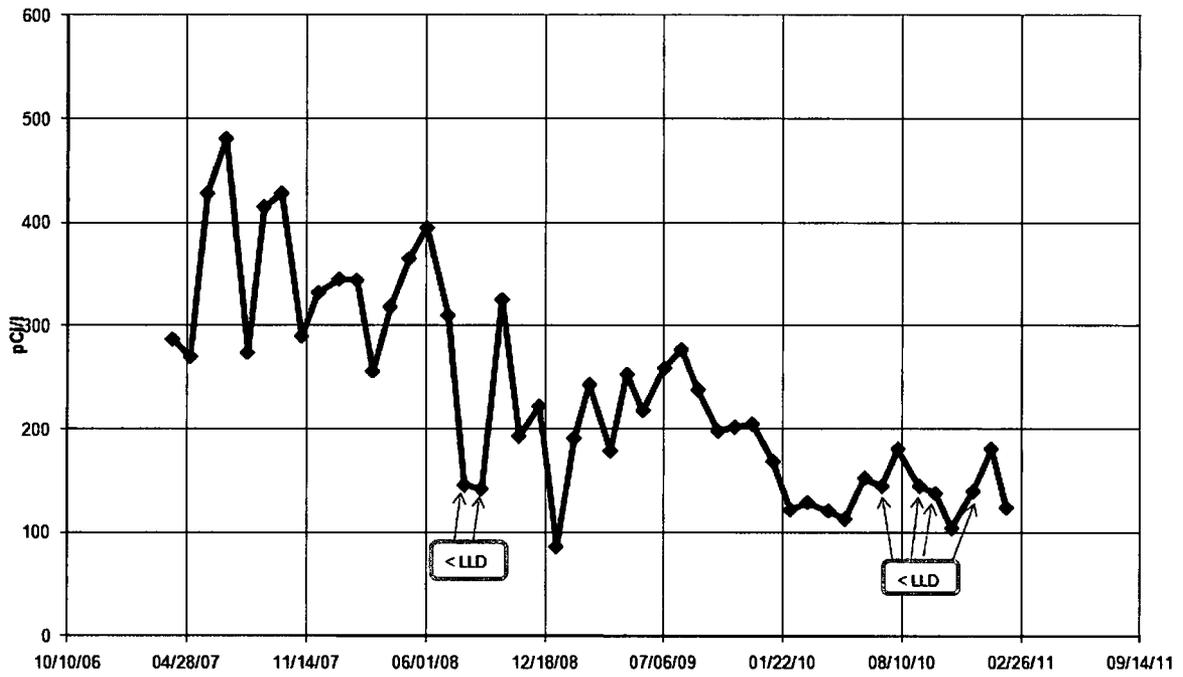
**Note: There were no noble gases released in 2010 due to the extended plant shutdown from refueling outage 16 that began in September 2009. The plant is still shutdown in mode 5 in 2011 due to reactor building containment wall repairs.**

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual Total
Gamma Air Dose (mrad)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Beta Air Dose (mrad)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Body Dose (mrem)	4.99E-04	5.93E-04	6.16E-04	6.18E-04	2.33E-03
Maximum Organ Dose (mrem)	4.99E-04	5.93E-03	6.21E-04	6.25E-04	2.34E-03
Maximum Organ was Liver					

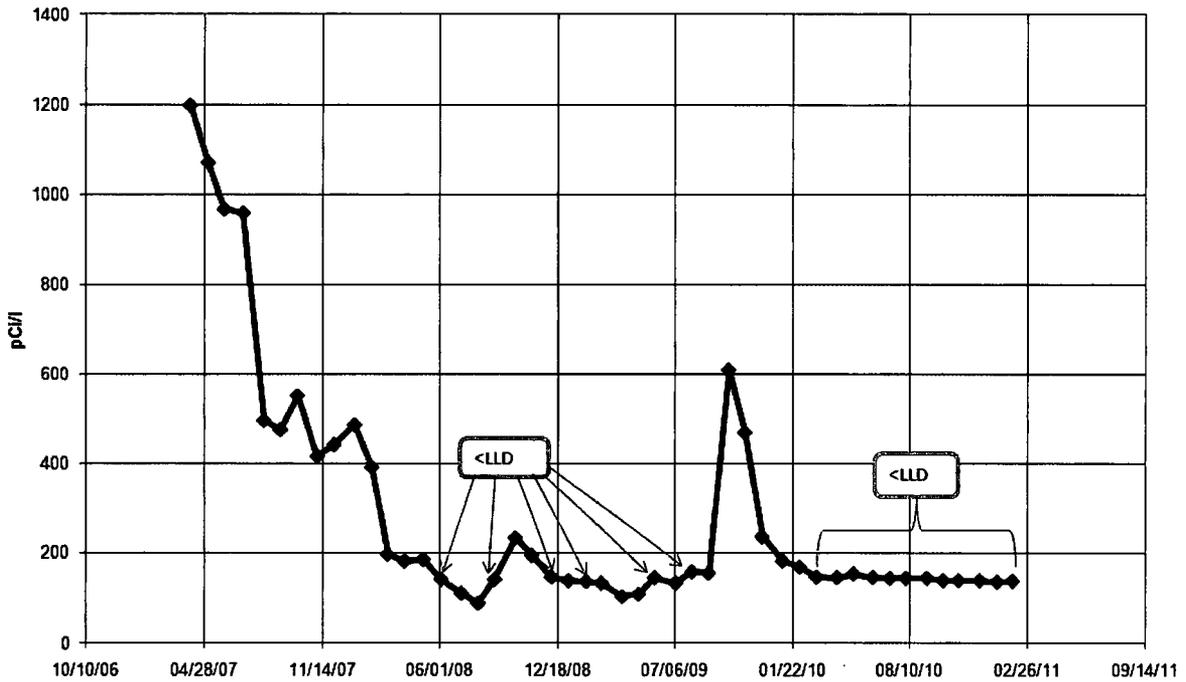
### **Nuclear Electric Institute (NEI) Required Information**

The following environmental data is being included in this report per objective 2.4.b.i and 2.4.b.ii of NEI 07-07 Industry Ground Water Protection Initiative, as this groundwater well data is used to evaluate groundwater at the site, but is not officially included in the Radiological Environmental Monitoring Program (REMP) or the Offsite Dose Calculation Manual (ODCM). These 2 graphs are of tritium measurements in units of pCi/l, taken from groundwater monitoring wells located west of CR-3 on either side of the settling ponds. There are many other groundwater monitoring wells included in the REMP that are used for evaluating the groundwater in the vicinity of the CR-3 site. These 2 wells are providing supplemental information. The LLD for tritium measurement of these environmental well samples is ~150 pCi/l.

Tritium Measurements GW Well # MWC-IF2



Tritium Measurements GW Well # MWC-27



**PROGRESS ENERGY FLORIDA, INC.**

**CRYSTAL RIVER UNIT 3**

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

**ATTACHMENT B**

**AMENDED PARTIAL ANNUAL RADIOACTIVE  
EFFLUENT RELEASE REPORT  
2009**

**AMENDED PARTIAL  
ANNUAL RADIOACTIVE EFFLUENT  
RELEASE REPORT  
2009**



**PROGRESS ENERGY FLORIDA, INC  
CRYSTAL RIVER UNIT 3**

Facility Operating License No. DPR-72

Docket No. 50-302

Corrections Prepared as a Supplement to the 2010 Report

TABLE 3

EFFLUENT AND WASTE DISPOSAL REPORT - 2009

GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

Unit	Quarter 3	Quarter 4	Est. Total Error %
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C. Fission and activation gases

4. Total release	Ci	8.38E-02	0.00E+00	30
5. Average release rate for period	μCi/sec	1.05E-02	0.00E+00	
6. Percent of technical specification limit	%	6.97E-05	0.00E+00	

D. Iodines

4. Total Iodine-131	Ci	0.00E+00	0.00E+00	30
5. Average release rate for period	μCi/sec	0.00E+00	0.00E+00	
6. Percent of technical specification limit	%	0.00E+00	0.00E+00	

D. Particulates\*

5. Particulates with half-lives > 8 days	Ci	1.10E-06	1.04E-05 <sup>A</sup>	30
6. Average release rate for period	μCi/sec	1.38E-07	1.30E-06 <sup>A</sup>	
7. Percent of technical specification limit	%	8.40E-03	1.15E-02	
8. Gross alpha radioactivity	Ci	2.31E-09	1.48E-07	

E. Tritium

4. Total release	Ci	2.48E+00	3.25E+00	30
5. Average release rate for period	μCi/sec	3.13E-01	4.09E-01	
6. Percent of technical specification limit	%	8.40E-03	1.15E-02	

\* The sum of the particulates reported on this page may be less than the sum from Table 4, as Table 4 includes all particulates, while this table includes only those with half-lives greater than 8 days.

<sup>A</sup> Corrected value.

**TABLE 5**

**EFFLUENT AND WASTE DISPOSAL REPORT - 2009**

**LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES**

	<b>Unit</b>	<b>Quarter 1</b>	<b>Quarter 2</b>	<b>Est. Total Error %</b>
<b>B. Fission and activation products</b>				
4. Total release (not including tritium, gases, alpha)	Ci	<b>8.81E-04<sup>A</sup></b>	3.73E-04	25
5. Average diluted concentration during period	μCi/ml	1.66E-12	6.54E-13	
6. Percent of applicable limit	%	9.98E-04	4.66E-04	
<b>C. Tritium</b>				
4. Total release	Ci	1.87E+02	1.91E+02	30
5. Average diluted concentration during period	μCi/ml	3.52E-07	3.35E-07	
6. Percent of applicable limit	%	2.99E-01	3.35E-01	
<b>D. Dissolved and entrained gases</b>				
4. Total release	Ci	2.83E-03	2.19E-03	25
5. Average diluted concentration during period	μCi/ml	5.33E-12	3.84E-12	
6. Percent of applicable limit	%	2.26E-04	1.92E-04	
<b>E. Gross alpha radioactivity</b>				
2. Total release	Ci	0.00E+00	0.00E+00	30
<b>F. Volume of waste released (prior to dilution)</b>				
2. Batch and continuous modes	Liters	9.58E+06	1.00E+07	10
<b>G. Volume of dilution water used during period</b>				
2. Batch and continuous modes	Liters	5.31E+11	5.70E+11	10

<sup>A</sup> Corrected Value

**TABLE 6**  
**EFFLUENT AND WASTE DISPOSAL REPORT - 2009**  
**LIQUID EFFLUENTS**

Fission and activation products	Unit	CONTINUOUS MODE		BATCH MODE	
		Quarter 1	Quarter 2	Quarter 1	Quarter 2
Sodium-24	Ci				
Chromium-51	Ci				
Manganese-54	Ci				
Manganese-56	Ci				
Iron-55	Ci			2.33E-04	
Iron-59	Ci				
Cobalt-57	Ci				
Cobalt-58	Ci			9.47E-07	7.22E-07
Cobalt-60	Ci			1.05E-05	2.10E-05
Zinc-69	Ci				
Strontium-85	Ci				
Strontium-89	Ci				
Strontium-90	Ci				
Yttrium-91m	Ci				
Yttrium-92	Ci				
Yttrium-93	Ci				
Niobium-95	Ci				
Niobium-95m	Ci				
Niobium-97	Ci				
Zirconium-95	Ci				
Zirconium-97	Ci				
Molybdenum-99	Ci				
Technetium-99m	Ci				
Technetium-101	Ci				
Ruthenium-103	Ci				
Ruthenium-106	Ci				
Silver-110m	Ci				
Tin-113	Ci				
Indium-113m	Ci				
Antimony-122	Ci				
Antimony-124	Ci				
Antimony-125	Ci			7.04E-06	3.11E-04
Tellurium-129	Ci				
Tellurium-132	Ci				
Iodine-131	Ci				
Iodine-133	Ci				
Iodine-135	Ci				
Cesium-134	Ci				
Cesium-137	Ci	4.49E-05		6.79E-05	3.47E-05
Cesium-138	Ci				
Barium-133m	Ci				1.67E-06
Barium-140	Ci				
Lanthanum-140	Ci				
Cerium-141	Ci				
Cerium-143	Ci				
Neodymium-147	Ci				
Tungsten-187	Ci				
Neptunium-239	Ci				
Nickle-63	Ci			5.17E-04	4.42E-06
<b>Total for period</b>	Ci	4.49E-05	0.00E+00	<b>8.36E-04<sup>A</sup></b>	3.73E-04

<sup>A</sup> Corrected value.