

**ANNUAL RADIOACTIVE EFFLUENT  
RELEASE REPORT  
2008**



PROGRESS ENERGY FLORIDA, INC  
CRYSTAL RIVER UNIT 3

Facility Operating License No. DPR-72

Docket No. 50-302

Prepared By: Rudy Pinner  
Sr. Science and Lab Services Specialist

Approved By: J.D. Hyer  
Superintendent Environmental and Chemistry

Date: 3/9/09

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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 - 2008**  
**GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES**

Unit	Quarter 1	Quarter 2	Est. Total Error %
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A. Fission and activation gases

1. Total release	Ci	3.09E+00	0.00E+00	30
2. Average release rate for period	μCi/sec	3.93E-01	0.00E+00	
3. Percent of technical specification limit	%	3.00E-03	0.00E+00	

B. Iodines

1. Total Iodine-131	Ci	1.02E-06	0.00E+00	30
2. Average release rate for period	μCi/sec	1.30E-07	0.00E+00	
3. Percent of technical specification limit	%	2.34E-02	0.00E+00	

C. Particulates\*

1. Particulates with half-lives > 8 days	Ci	1.08E-06	0.00E+00	30
2. Average release rate for period	μCi/sec	1.38E-07	0.00E+00	
3. Percent of technical specification limit	%	2.34E-02	0.00E+00	
4. Gross alpha radioactivity	Ci	5.47E-08	7.91E-09	

D. Tritium

1. Total release	Ci	4.77E+00	4.49E+00	30
2. Average release rate for period	μCi/sec	5.93E-01	5.71E-01	
3. Percent of technical specification limit	%	2.34E-02	1.37E-02	

\* 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 – 2008**  
**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			4.10E-01	
Krypton-85m	Ci				
Krypton-87	Ci				
Krypton-88	Ci				
Xenon-131m	Ci				
Xenon-133	Ci	2.34E+00		2.19E-01	
Xenon-133m	Ci				
Xenon-135	Ci	1.14E-01		6.00E-03	
Xenon-135m	Ci				
Xenon-138	Ci				
Total for period	Ci	2.46E+00	0.00E+00	6.35E-01	0.00E+00

B. Iodines

Iodine-131	Ci	1.02E-06			
Iodine-132	Ci				
Iodine-133	Ci				
Iodine-135	Ci				
Total for period	Ci	1.02E-06	0.00E+00	0.00E+00	0.00E+00

C. Particulates

Zinc-72	Ci				
Cobalt-58*	Ci	6.38E-07		6.08E-08	
Cobalt-60*	Ci				
Strontium-89*	Ci				
Strontium-90*	Ci				
Niobium-95m	Ci				
Technicium-99m	Ci				
Tellurium-132	Ci				
Cesium-134*	Ci				
Cesium-137*	Ci	3.65E-07		1.73E-08	
Cesium-138	Ci				
Barium-139	Ci				
Lanthanum-142	Ci				
Cerium-141*	Ci				
Cerium-143*	Ci				
Rhenium-188	Ci				
Total for period	Ci	1.00E-06	0.00E+00	7.80E-08	0.00E+00

\* > 8 day half-life

**TABLE 3**

**EFFLUENT AND WASTE DISPOSAL REPORT - 2008**

**GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES**

		Unit	Quarter 3	Quarter 4	Est. Total Error %
A. Fission and activation gases					
1.	Total release	Ci	1.78E-01	0.00E+00	30
2.	Average release rate for period	μCi/sec	2.24E-02	0.00E+00	
3.	Percent of technical specification limit	%	2.63E-04	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	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	
4.	Gross alpha radioactivity	Ci	5.60E-09	5.37E-09	

D. Tritium					
1.	Total release	Ci	2.96E+00	3.34E+00	30
2.	Average release rate for period	μCi/sec	3.72E-01	4.21E-01	
3.	Percent of technical specification limit	%	9.47E-03	1.07E-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.

**TABLE 4**  
**EFFLUENT AND WASTE DISPOSAL REPORT - 2008**  
**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			1.61E-01	
Krypton-85m	Ci				
Krypton-87	Ci				
Krypton-88	Ci				
Xenon-131m	Ci				
Xenon-133	Ci			1.65E-02	
Xenon-133m	Ci				
Xenon-135	Ci				
Xenon-135m	Ci				
Xenon-138	Ci				
Total for period	Ci	0.00E+00	0.00E+00	1.78E-01	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

Zinc-72	Ci				
Cobalt-58*	Ci				
Chromium-51*	Ci				
Strontium-89*	Ci				
Strontium-90*	Ci				
Niobium-95*	Ci				
Tin-113*	Ci				
Indium-113m	Ci				
Barium-133m	Ci				
Cesium-137*	Ci				
Cesium-138	Ci				
Barium-139	Ci				
Lanthanum-142	Ci				
Cerium-141	Ci				
Cerium-143	Ci				
Cerium-144*	Ci				
Rhenium-188	Ci				
Total for period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00

\* > 8 day half-life

**TABLE 5**

**EFFLUENT AND WASTE DISPOSAL REPORT - 2008**

**LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES**

	Unit	Quarter 1	Quarter 2	Est. Total Error %
A. Fission and activation products				
1. Total release (not including tritium, gases, alpha)	Ci	2.77E-03	2.60E-03	25
2. Average diluted concentration during period	μCi/ml	5.38E-12	4.39E-12	
3. Percent of applicable limit	%	6.81E-04	4.00E-04	
B. Tritium				
1. Total release	Ci	1.27E+02	6.95E+01	30
2. Average diluted concentration during period	μCi/ml	2.47E-07	1.17E-07	
3. Percent of applicable limit	%	1.89E-01	1.21E-01	
C. Dissolved and entrained gases				
1. Total release	Ci	7.12E-03	8.11E-04	25
2. Average diluted concentration during period	μCi/ml	1.38E-11	1.37E-12	
3. Percent of applicable limit	%	5.30E-04	7.07E-05	
D. Gross alpha radioactivity				
1. Total release	Ci	2.44E-05	5.56E-05	30
E. Volume of waste released (prior to dilution)				
1. Batch and continuous modes	Liters	1.21E+07	7.81E+06	10
F. Volume of dilution water used during period				
1. Batch and continuous modes	Liters	5.14E+11	5.92E+11	10



**TABLE 6**  
**EFFLUENT AND WASTE DISPOSAL REPORT - 2008**  
**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			4.09E-05	6.18E-05
Manganese-56	Ci				
Iron-55	Ci			2.41E-04	1.74E-04
Iron-59	Ci				
Cobalt-57	Ci				
Cobalt-58	Ci			5.71E-04	8.35E-04
Cobalt-60	Ci			1.41E-03	1.28E-03
Zinc-69	Ci				
Strontium-85	Ci				
Strontium-89	Ci				
Strontium-90	Ci				
Yttrium-91m	Ci				
Yttrium-92	Ci				
Yttrium-93	Ci				
Niobium-95	Ci			4.42E-06	9.23E-05
Niobium-95m	Ci				
Niobium-97	Ci				
Zirconium-95	Ci				1.56E-05
Zirconium-97	Ci				
Molybdenum-99	Ci				
Technetium-99m	Ci				
Technetium-101	Ci				
Ruthenium-103	Ci				
Ruthenium-106	Ci				
Silver-110m	Ci			1.49E-04	5.64E-05
Tin-113	Ci				
Indium-113m	Ci				
Antimony-122	Ci				
Antimony-124	Ci				
Antimony-125	Ci			2.59E-04	5.96E-05
Tellurium-129	Ci				
Tellurium-132	Ci				
Iodine-131	Ci				
Iodine-133	Ci				
Iodine-135	Ci				
Cesium-134	Ci				
Cesium-137	Ci			7.02E-05	2.39E-05
Cesium-138	Ci				
Barium-133m	Ci			2.61E-05	
Barium-140	Ci				
Lanthanum-140	Ci				
Cerium-141	Ci				
Cerium-143	Ci				
Neodymium-147	Ci				
Tungsten-187	Ci				
Neptunium--239	Ci				
Nickle-63	Ci				
Total for period	Ci	0.00E+00	0.00E+00	2.77E-03	2.60E-03

TABLE 6 (CONTINUED)

EFFLUENT AND WASTE DISPOSAL REPORT - 2008

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			7.00E-04	
Krypton-85m	Ci				
Krypton-87	Ci				
Krypton-88	Ci				
Xenon-131m	Ci				
Xenon-133	Ci			6.12E-03	8.00E-04
Xenon-133m	Ci			2.78E-05	
Xenon-135	Ci			2.71E-04	1.10E-05
Xenon-135m	Ci				
Total for period	Ci	0.00E+00	0.00E+00	7.12E-03	8.11E-04

Tritium	Ci	1.82E-01	0.00E+00	1.27E+02	6.95E+01
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TABLE 7

EFFLUENT AND WASTE DISPOSAL REPORT - 2008

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	1.07E-03	9.28E-04	25
2. Average diluted concentration during period	μCi/ml	1.99E-12	1.75E-12	
3. Percent of applicable limit	%	3.59E-04	1.59E-04	

B. Tritium

1. Total release	Ci	5.81E+01	9.29E+01	30
2. Average diluted concentration during period	μCi/ml	1.08E-07	1.75E-07	
3. Percent of applicable limit	%	9.98E-02	1.52E-01	

C. Dissolved and entrained gases

1. Total release	Ci	9.19E-04	1.18E-03	25
2. Average diluted concentration during period	μCi/ml	1.71E-12	2.22E-12	
3. Percent of applicable limit	%	7.89E-05	9.64E-05	

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	1.07E+07	8.14E+06	10
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F. Volume of dilution water used during period

1. Batch and continuous modes	Liters	5.37E+11	5.31E+11	10
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**TABLE 8**  
**EFFLUENT AND WASTE DISPOSAL REPORT - 2008**  
**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			1.82E-05	9.93E-07
Manganese-56	Ci				
Iron-55	Ci			1.56E-04	2.68E-04
Iron-59	Ci				
Cobalt-57	Ci				
Cobalt-58	Ci			9.31E-05	2.98E-06
Cobalt-60	Ci			3.56E-04	4.13E-05
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			2.63E-05	
Niobium-95m	Ci				
Zirconium-95	Ci				
Molybdenum-99	Ci				
Technetium-99m	Ci				
Technetium-101	Ci				
Ruthenium-106	Ci				
Silver-110m	Ci			1.99E-05	
Tin-113	Ci				
Indium-113m	Ci				
Antimony-122	Ci				
Antimony-124	Ci				
Antimony-125	Ci			1.11E-05	5.34E-06
Tellurium-129	Ci				
Tellurium-132	Ci				
Iodine-131	Ci				
Iodine-133	Ci				
Iodine-135	Ci				
Cesium-134	Ci				
Cesium-137	Ci			4.15E-05	1.38E-05
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			3.46E-04	5.95E-04
Rhenium-188	Ci				
Total for period	Ci	0.00E+00	0.00E+00	1.07E-03	9.28E-04

TABLE 8 (CONTINUED)

EFFLUENT AND WASTE DISPOSAL REPORT - 2008

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			8.96E-04	1.16E-03
Xenon-133m	Ci				
Xenon-135	Ci			2.31E-05	2.83E-05
Xenon-135m	Ci				
Total for period	Ci	0.00E+00	0.00E+00	9.19E-04	1.19E-03
Tritium	Ci	1.68E-01	0.00E+00	5.79E+01	9.29E+01

**TABLE 9**

**EFFLUENT AND WASTE DISPOSAL REPORT - 2008**

**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	6.04E+01	25		
		Ci	3.43E+02			
b.	Dry compressible waste, contaminated equipment, etc.	m3	2.00E+02	25		
		Ci	3.60E-01			
c.	Irradiated components, control rods, etc.	m3	0.00E+00	25		
		Ci	0.00E+00			
d.	Other (describe): Combined DAW package	m3	3.63E+01	25		
		Ci	8.86E+00			
2. Estimate of major nuclide composition (by type of waste in %)*						
a.	Mn-54	1.1	Co-60	7.4	Cs-134	14.5
	Fe-55	11.5	Ni-63	31.2	Cs-137	34.0
b.	Ce-144	0.25	Ni-63	45.4	Co-58	2.8
	Fe-55	32.0	Mn-54	0.34	C-14	4.8
	Co-60	11.9	Cs-137	1.4	Pu-241	0.82
	N/A		N/A		N/A	
d.	Fe-55	6.3	Ce-144	0.6	Zr-95	1.2
	Co-58	18.1	Cs-134	22.6	H-3	1.8
	Co-60	3.6	Cs-137	24.5	C-14	1.0
	Ni-63	4.5	Nb-95	15.1		

\* 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>
5	Hittman Transport Services	Clive Disposal Facility
1	Hittman Transport Services	DURATEK
5	Hittman Transport Services.	DURATEK - Bear Creek
6	Hittman Transportation	Studs vik 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 2008.

### Radioactive Waste Treatment Systems

There were no significant changes to the radioactive waste treatment systems.

### Annual Land Use Census

The 2008 land-use census did not identify any new dose calculation locations.

### Effluent Monitor Instrument Operability

Required effluent monitor instrumentation was not out of service for more than 30 days during 2008.

### ODCM & PCP Changes

The ODCM was revised once in 2008. Revision 31 incorporated an updated protocol for voluntary communication regarding leaks or spills of radioactive material that could potentially reach groundwater, per the guidance in the final version of NEI 07-07, Industry Groundwater Protection Initiative Guidance Document. The remainder of changes are enhancements that include: labeling of dose table names at the top of each table, correction of an equation that was missing a division sign on page 110, added Appendix I dose calculation exemption criteria associated with settling pond releases to document that liquid releases to the settling ponds are insignificant in relationship to the other liquid effluent pathways, added a summary table of unrestricted and controlled area dose limits for members of the public to provide a composite collection of the various limits into one discussion for ease of understanding. On pages 11 and 16, added guidance for RM-A1 (RB Purge Exhaust monitor) trip function requirements when moving fuel (from ITS 3.3.15) for clarity. On page 140, modified the location descriptor for environmental air sample station C40, as this station was relocated from underneath the dense tree canopy area just north of the plant access road, to along the power line corridor, adjacent to the plant access road, keeping within the same sector locale.

The PCP was not revised in 2008.

### 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 small primary to secondary leak, an evaluation was performed to estimate the quantity of radioactive material which was released during 2008 due to operation of this pump. In addition, radioactive releases due to other steam releases have been estimated and included. These values include any plant trips with associated secondary plant atmosphere steam relief valve initiation. The results are given below in units of Curies/year.

Xe-133	1.80E-07	I-131	4.50E-09	Cs-134	7.50E-11
Xe-135	1.95E-07	I-133	5.25E-08	Cs-137	2.25E-10
H-3	1.35E-05				

These values are not included in Tables 1 through 4.

## 2008 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)	1.02E-05	2.86E-06	5.38E-06	2.38E-06	2.08E-05
Maximum Organ Dose (mrem)	3.10E-05	2.00E-05	9.05E-06	7.56E-06	6.76E-05
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

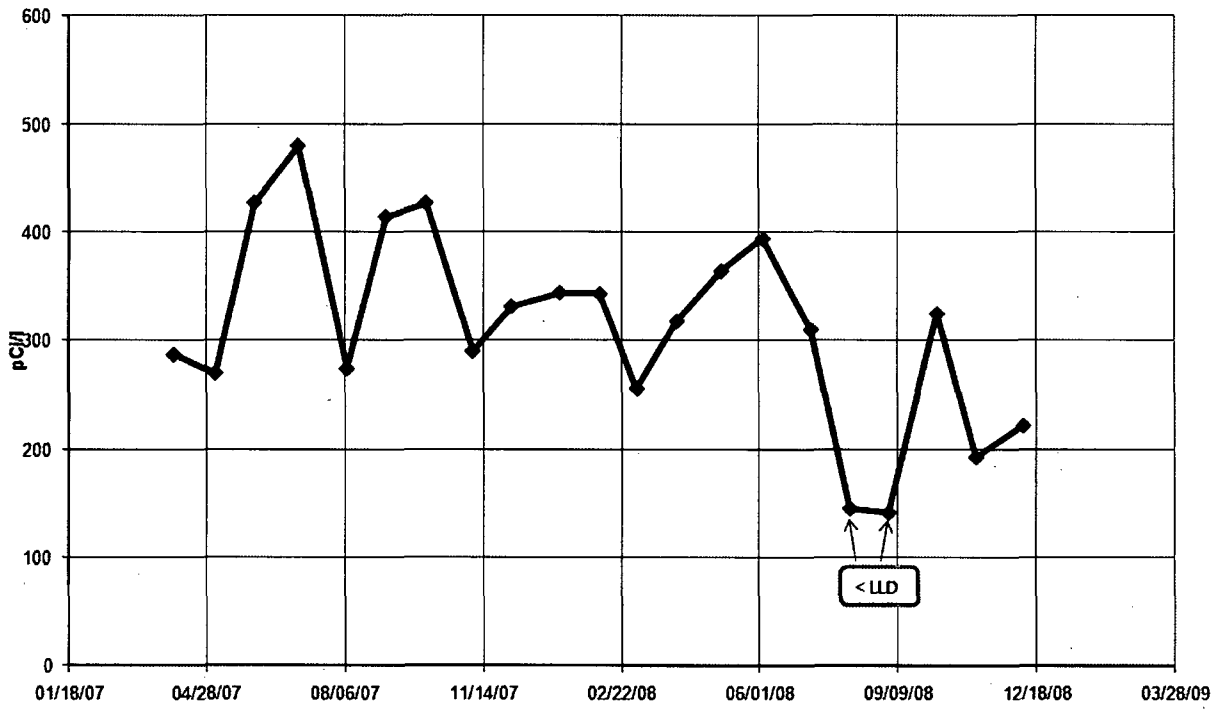
	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual Total
Gamma Air Dose (mrad)	9.04E-05	0.00E+00	6.81E-07	0.00E+00	9.11E-05
Beta Air Dose (mrad)	2.99E-05	0.00E+00	2.63E-04	0.00E+00	3.26E-04
Total Body Dose (mrem)	1.11E-03	1.03E-03	7.10E-04	8.02E-04	3.65E-03
Maximum Organ Dose (mrem)	1.76E-04	1.03E-04	7.09E-04	8.03E-04	1.79E-03
Maximum Organ was Thyroid					



## **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

