

**Florida  
Power**

CORPORATION

Crystal River Unit 3

Docket No. 50-102

February 28, 1992  
3F0292-14

U.S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, D.C. 20555

Subject: Semiannual Radioactive Effluent Release Report

Dear Sir:

Pursuant to Title 10, Code of Federal Regulations, Part 50.36(a) (2) and Crystal River Unit 3 Technical Specification 6.9.1.5(d), Florida Power Corporation hereby submits the Crystal River Unit 3 Semiannual Radioactive Effluent Release Report for the period July 1, 1991 through December 31, 1991.

Sincerely,

G. L. Boldt  
Vice President  
Nuclear Production

Attachment

GLB/REF:ff

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

000050

SEMIANNUAL RADIOACTIVE EFFLUENT

RELEASE REPORT

July - December 1991

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

Facility Operating License No. DPR-72

Docket No. 50-302

Prepared By Pete F. Ezell  
Radiochemistry & Environmental Specialist

Approved By W. B. Spang  
Manager, Site Nuclear Services

Date 2/25/92

## CONTENTS

	<u>Page</u>
o INTRODUCTION . . . . .	1
o TABULAR DATA SUMMARIES	
GASEOUS EFFLUENTS . . . . .	2
LIQUID EFFLUENTS . . . . .	4
RADWASTE SHIPMENTS . . . . .	7
o GRAPHS	
GASEOUS RELEASES	
FISSION AND ACTIVATION PRODUCTS . . . . .	9
IODINES . . . . .	10
LIQUID RELEASES	
FISSION AND ACTIVATION PRODUCTS . . . . .	11
TRITIUM . . . . .	12
o ANNUAL DOSE SUMMARIES	
INDIVIDUAL DOSES . . . . .	13
POPULATION DOSES . . . . .	14
SITE BOUNDARY AIR DOSES . . . . .	15
o UNPLANNED RELEASES . . . . .	16
o RADIOACTIVE WASTE TREATMENT SYSTEMS . . . . .	16
o ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM . . . . .	16
o EFFLUENT MONITOR OPERABILITY . . . . .	16
o ODCM AND PCP . . . . .	16

## INTRODUCTION

This report is submitted as required by Technical Specification 6.9.1.5.d to Crystal River Facility Operating License No. DPR-72. In accordance with Technical Specifications, the following information must be included in this report:

A summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the plant as outlined in Regulatory Guide 1.21 (Rev. 1, 1974) with data summarized on a quarterly basis following the format of Appendix B thereof.

An annual summary of hourly meteorological data collected over the previous years. (In lieu of submittal, this data is maintained on-site and is available to the NRC upon request.)

An assessment of radiation doses due to the radioactive liquid and gaseous effluents released from the plant during the previous calendar year.

An assessment of radiation doses from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY.

An assessment of radiation doses to the hypothetical worst case individual from reactor releases.

For each type of solid waste shipped off-site:

- Container Volume
- Total Curie Quantity (specified as measured or estimated)
- Principal Radionuclides (specified as measured or estimated)
- Type of Waste (e.g., spent resin, compacted dry waste)
- Type of Container (e.g., LSA, Type A, Type B)
- Solidification Agent (e.g., cement)

A list and description of unplanned releases to unrestricted areas.

A description of any changes to the:

- Process Control Program (PCP)
- Off-Site Dose Calculation Manual (ODCM)
- Radioactive Waste Treatment Systems

A list of new Environmental Radiological Monitoring Program dose calculation location changes identified by the land-use census.

Information relating to effluent monitors being inoperable for 30 or more days.

TABLE 1  
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 1991  
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

	Unit	Quarter 3	Quarter 4	Est.Total Error %
--	------	--------------	--------------	----------------------

A. Fission and Activation Gases

1. Total Release	Ci	8.72E+01	1.03E+03	30
2. Average Release Rate for Period	uCi/sec	1.10E+01	1.30E+02	
3. Percent of Technical Specification Limit	%	1.45E-01	1.72E+00	

B. Iodines

1. Total Iodine - 131	Ci	8.54E-07	1.44E-04	30
2. Average Release Rate for Period	uCi/sec	1.07E-07	1.81E-05	
3. Percent of Technical Specification Limit	%	1.65E-01	1.75E+00	

C. Particulates

1. Particulates with half-lives > 8 days	Ci	7.69E-05	6.44E-05	30
2. Average Release Rate for Period	uCi/sec	9.67E-06	8.10E-06	
3. Percent of Technical Specification Limit	%	1.65E-01	1.75E+00	
4. Gross Alpha Radioactivity	Ci	4.56E-08	4.44E-07	

D. Tritium

1. Total Release	Ci	3.89E+00	3.25E+00	30
2. Average Release Rate for Period	uCi/sec	4.89E-01	4.09E-01	
3. Percent of Technical Specification Limit	%	1.65E-01	1.75E+00	

TABLE 2  
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 1991  
GASEOUS EFFLUENTS - GROUND LEVEL RELEASES

		CONTINUOUS MODE		BATCH MODE	
Nuclides Released	Unit	Quarter 3	Quarter 4	Quarter 3	Quarter 4
1. Fission gases					
argon-41	Ci				
krypton-85	Ci		1.11E+01	1.84E+01	3.32E+01
krypton-85m	Ci				
krypton-87	Ci				
krypton-88	Ci				
xenon-131m	Ci		3.16E+01	8.61E-01	1.06E+00
xenon-133	Ci	2.41E+01	8.95E+02	4.23E+01	4.79E+01
xenon-133m	Ci		7.61E+00	2.22E-01	4.84E-01
xenon-135	Ci	1.29E+00	5.04E+00	1.06E-02	2.04E-01
xenon-135m	Ci				
xenon-138	Ci				
unidentified	Ci				
Total for Period	Ci	2.54E+01	9.50E+02	6.18E+01	8.29E+01

2. Iodines

iodine-131	Ci	7.75E-07	5.62E-05	7.83E-08	8.74E-05
iodine-133	Ci		1.16E-06	1.81E-08	9.30E-09
iodine-135	Ci				
Total for Period	Ci	7.75E-07	5.74E-05	9.64E-08	8.74E-05

3. Particulates

manganese-54	Ci				
cobalt-58	Ci				
iron-59	Ci				
cobalt-60	Ci				
zinc-65	Ci				
strontium-89	Ci	6.29E-05			
strontium-90	Ci				
molybdenum-99	Ci				
tellurium-132	Ci				
cesium-134	Ci				
cesium-137	Ci				
unidentified	Ci				
Total for Period	Ci	6.29E-05			



TABLE 3  
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 1991  
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

	Unit	Quarter 3	Quarter 4	Est. Total Error %
--	------	--------------	--------------	-----------------------

A. Fission and Activation Products

1. Total Release (not including tritium, gases, alpha)	Ci	9.98E-03	4.98E-04	25
2. Average diluted concentration during period	uCi/ml	1.63E-11	9.02E-13	
3. Percent of applicable limit	%	1.27E-01	4.48E-01	

B. Tritium

1. Total Release	Ci	1.21E+02	1.34E+02	30
2. Average diluted concentration during period	uCi/ml	1.98E-07	2.43E-07	
3. Percent of applicable limit	%	6.57E-03	8.10E-03	

C. Dissolved and entrained gases

1. Total release	Ci	6.38E-01	1.58E+00	25
2. Average diluted concentration during period	uCi/ml	1.04E-09	2.86E-09	
3. Percent of applicable limit	%	5.20E-04	1.43E-03	

D. Gross alpha radioactivity

1. Total release	Ci	< LLD	< LLD	30
------------------	----	-------	-------	----

E. Volume of Waste released (prior to dilution)

1. Batch and Continuous Modes	Liters	7.12E+06	2.44E+07	10
-------------------------------	--------	----------	----------	----

F. Volume of dilution water used during period

1. Batch and Continuous Modes	Liters	6.12E+11	5.52E+11	10
-------------------------------	--------	----------	----------	----

TABLE 4

## EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 1991

## LIQUID EFFLUENTS

Nuclides Released	Unit	CONTINUOUS MODE		BATCH MODE	
		Quarter 3	Quarter 4	Quarter 3	Quarter 4
sodium-24	Ci				1.44E-04
chromium-51	Ci				3.67E-03
manganese-54	Ci				3.47E-04
iron-55	Ci			8.35E-03	6.76E-03
cobalt-58	Ci			6.02E-03	5.53E-02
iron-59	Ci				
cobalt-60	Ci			2.54E-04	3.87E-03
zinc-65	Ci				
rubidium-88	Ci				
strontium-89	Ci			6.03E-05	2.79E-04
strontium-90	Ci	8.53E-05			9.58E-06
strontium-92	Ci			9.97E-07	9.54E-04
yttrium-91m	Ci				
yttrium-92	Ci				
niobium-95	Ci				1.13E-03
zirconium-95	Ci				5.25E-04
zirconium-97	Ci				1.07E-04
molybdenum-99	Ci				
technetium-99m	Ci			2.88E-05	3.47E-04
ruthenium-103	Ci				1.81E-04
ruthenium-106	Ci				4.21E-04
silver-110m	Ci				2.62E-03
iodine-131	Ci			6.70E-05	7.07E-04
iodine-133	Ci			8.46E-06	4.38E-05
tellurium-132	Ci				
iodine-133	Ci				
cesium-134	Ci			3.64E-04	1.92E-02
cesium-136	Ci				
cesium-137	Ci			6.64E-04	2.91E-02
barium-139	Ci			3.38E-05	
lanthanum-140	Ci				2.14E-03
cerium-141	Ci				
cerium-144	Ci				
protactinium-144	Ci				6.97E-03
unidentified	Ci				
Total for period	Ci	8.53E-05		9.89E-03	4.98E-04



TABLE 4 (CONTINUED)

## EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 1991

## LIQUID EFFLUENTS

Dissolved & Entrained Gases	Unit	CONTINUOUS MODE		BATCH MODE	
		Quarter 3	Quarter 4	Quarter 3	Quarter 4
argon-41	Ci				
krypton-85	Ci			4.16E-02	3.78E-02
krypton-85m	Ci				
krypton-88	Ci				
xenon-131m	Ci			1.04E-02	2.85E-02
xenon-133	Ci		9.61E-04	5.82E-01	1.49E+00
xenon-133m	Ci			3.94E-03	1.52E-02
xenon-135	Ci				1.03E-02
xenon-135m	Ci				
tritium	Ci		1.14E-01	1.21E+02	1.34E+02

TABLE 5

## EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 1991

## SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

## A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Non irradiated fuel)

1. Type of waste	Unit	Second 6-month period	Est. Total Error, %
a. Spent resins, filter sludges, evaporator bottoms, etc.	m <sup>3</sup> Ci	9.21E+01* 2.80E+00	20
b. Dry compressible waste, contaminated equip, etc.	m <sup>3</sup> Ci	3.73E+02* 1.11E+01	50
c. Irradiated components, control rods, etc.	m <sup>3</sup> Ci		
d. Other (describe) Solidified phosphoric acid and sludge	m <sup>3</sup> Ci		

2. Estimate of major nuclide composition (by type of waste in %) **						
a.	Cs-137	27.3	Co-60	10.1	C-14	4.3
	Fe-55	20.2	H-3	5.9	Ni-63	3.0
	Cs-134	18.5	Sr-89	5.7	Co-58	2.5
b.	Fe-55	42.7	C-14	8.5	Cs-137	1.8
	Co-60	19.4	Ni-63	7.1		
	Co-58	12.7	Mn-54	2.5		
c.						
d.						

## 3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
4	Exclusive Use Vehicle	Barnwell, SC (CNSI)
12	Exclusive Use Vehicle	Oak Ridge, TN (SEG)**
2	Exclusive Use Vehicle	Wampum, PA (Aloron)

## B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
0	N/A	N/A

\* Scientific Ecology Group (SEG) repacks secondary plant resin and non-compacted dry waste in order to reduce burial volume. Type A burial volume was 23.2 m<sup>3</sup>, while Type B burial volume was 71.3 m<sup>3</sup>.

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

**TABLE 6**  
**EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 1991**

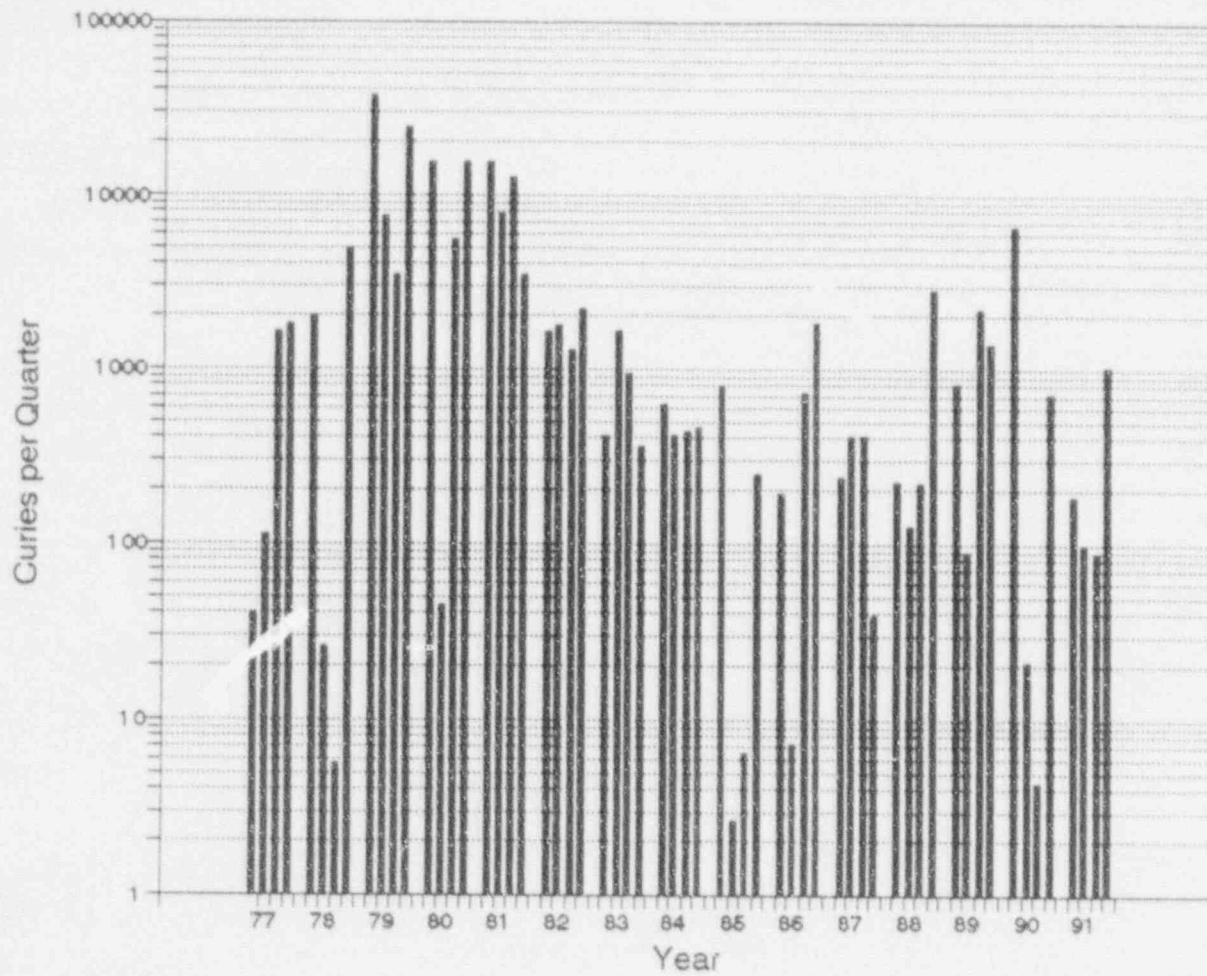
DATE AND SHIPMENT #	CONTAINER VOLUME *	TOTAL CURIES	PRINCIPLE RADIONUCLIDES	WASTE TYPE	CONTAINER TYPE	SOLIDIF. AGENT
7-15-91 91-33	1 @ 380	2.3E-03	Cs-137, Cs-134, H-3, Sr-89, Sb-122	SC	ST	N/A
7-18-91 91-34	1 @ 380	2.2E-03	Cs-137, Cs-134, H-3, Sr-89, Sb-122	SC	ST	N/A
7-22-91 91-35	1 @ 380	2.2E-03	Cs-137, Cs-134, H-3, Sr-89, Sb-122	SC	ST	N/A
7-25-91 91-36	1 @ 385	5.1E-03	Cs-137, Cs-134, Sr-89, H-3, Sb-122	SC	ST	N/A
7-29-91 91-37	1 @ 380	5.7E-03	Cs-137, Cs-134, Sr-89, H-3, Sb-122	SC	ST	N/A
10-10-91 91-46	1 @ 385	1.6E-03	Cs-137, H-3, Cs-134, Sr-89, Sb-122	SC	ST	N/A
8-30-91 91-41	1 @ 205.8	2.4E-01	H-3, Co-60, Cs-137, Co-58, Cs-134, Ni-63, Fe-55, Mn-54	SR	HIC	N/A
11-29-91 91-58	1 @ 205.8	2.6E+00	Cs-137, Fe-55, Cs-134, Co-60, Sr-89, C-14, H-3, Ni-63	SR	HIC	N/A
12-20-91 91-63	1 @ 170 2 @ 190	1.4E-03	Cs-137, Cs-134, H-3, Sr-89, Fe-55, Sb-122, Co-60, C-14	SC	ST	N/A
7-30-91 91-38	1 @ 2080.0	5.0E-01	Fe-55, Co-60, Ni-63, Cs-137, C-14	NW	ST	N/A
9-4-91 91-42	14 @ 7.5	9.1E+00	Fe-55, Co-60, Co-58, C-14, Ni-63, Mn-54, Cr-51	NW	ST	N/A
10-18-91 91-49	1 @ 2080.0	1.1E-01	Fe-55, Co-60, Cs-137, Ni-63, Cs-134, Tc-99, C-14	NW	ST	N/A
10-29-91 91-52	1 @ 2080.0	1.2E-01	Fe-55, Cs-137, Co-60, Co-58, Ni-63, Cs-134, Tc-99, C-14	NW	ST	N/A
11-14-91 91-55	1 @ 2080.0	1.7E-01	Fe-55, Cs-137, Co-60, Ni-63, Co-58, Cs-134, Tc-99, Mn-54	NW	ST	N/A
11-26-91 91-56	7 @ 96.0 1 @ 98.0 3 @ 11.6	1.7E-01	Fe-55, Co-60, Ni-63, Cs-137, Tc-99, C-14, Cs-134	NW	ST	N/A
11-26-92 91-57	3 @ 11.6 3 @ 96.0 1 @ 72.0 1 @ 92.0 1 @ 102.0 1 @ 103.0 1 @ 107.0	1.4E-01	Fe-55, Co-60, Ni-63, Cs-137, Tc-99, C-14, Cs-134	NW	ST	N/A
12-6-91 91-59	10 @ 96.0 1 @ 102.0	6.7E-01	Fe-55, Co-60, Ni-63, Cs-137, C-14, Tc-99	NW	ST	N/A
12-20-91 91-64	1 @ 2080.0	1.4E-01	Co-58, Cs-137, Fe-55, Cs-134, Co-60, Ni-63, Tc-99, C-14	NW	ST	N/A

SR - Spent Resin  
SC - Secondary Resin  
F - Filters  
ST - Strong Tight

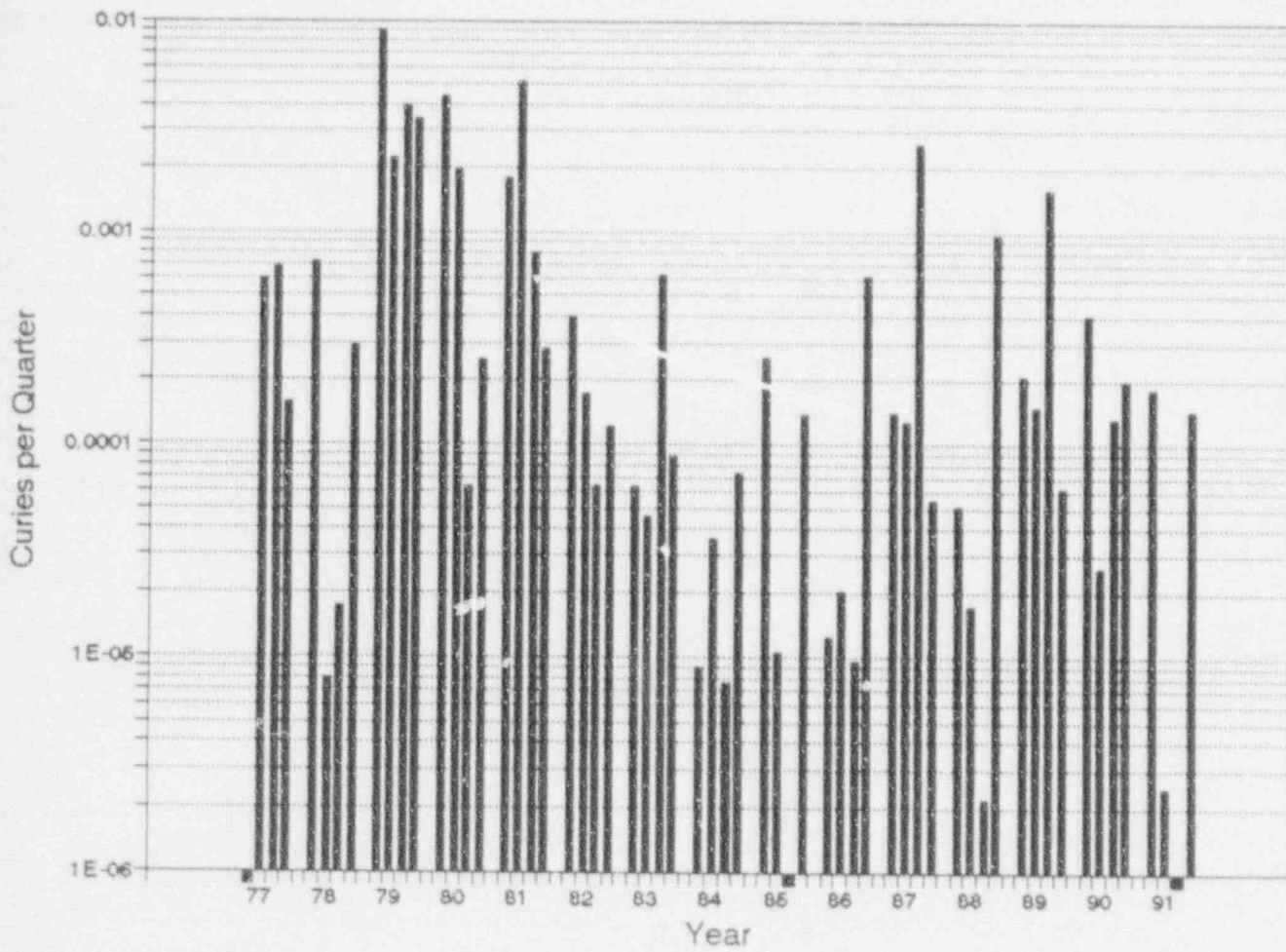
NW - Non-Compacted Waste  
CW - Compacted Waste  
EB - Evaporator Bottoms  
HIC - High Integrity Container

CE - Contaminated Equipment  
IC - Irradiated Components  
SW - Solidified Wastes  
\* Cubic Feet

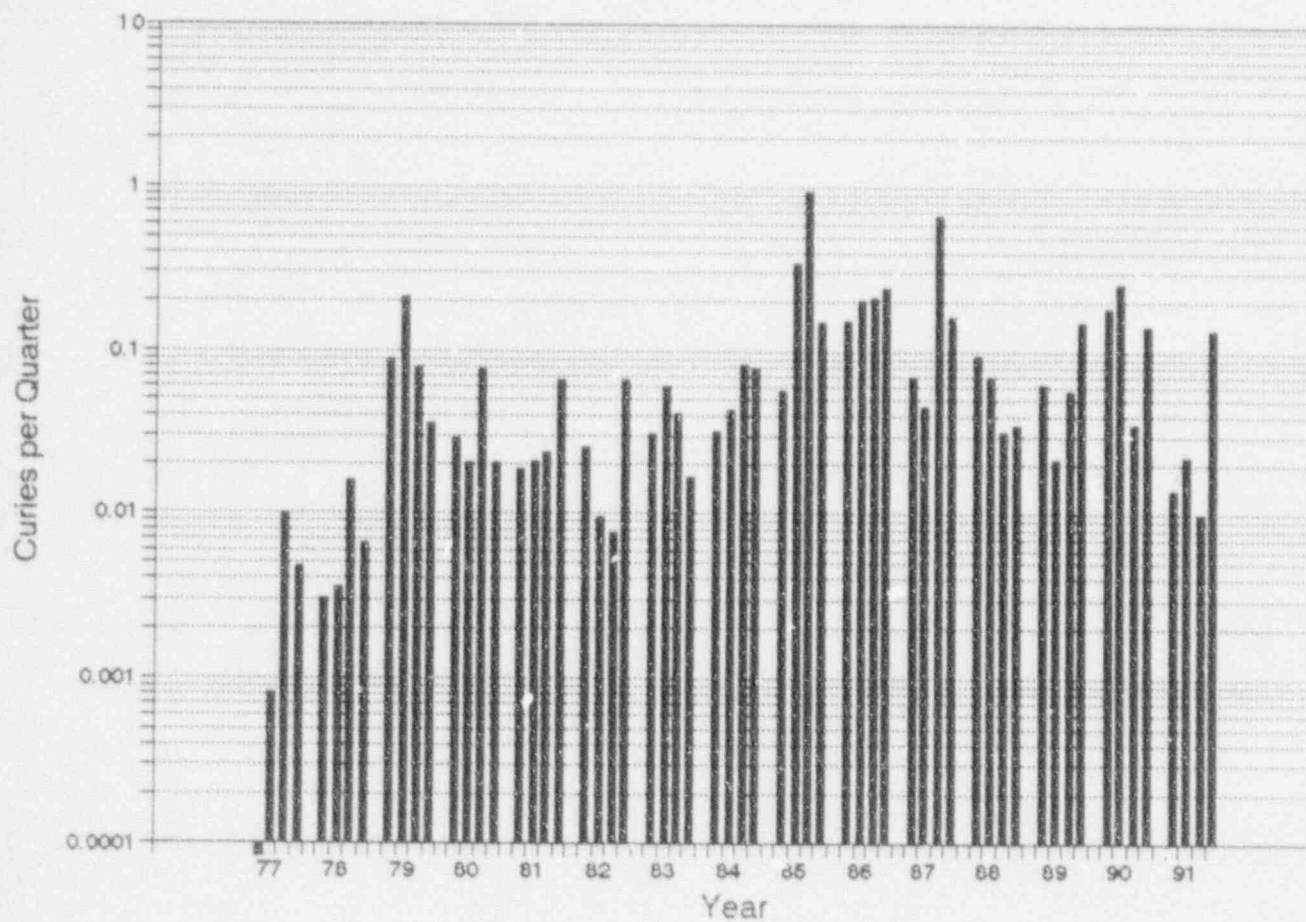
## Airborne Releases - Noble Gases



## Airborne Releases - Iodines



## Liquid Releases - Fission & Activation Products





## Liquid Releases - Tritium

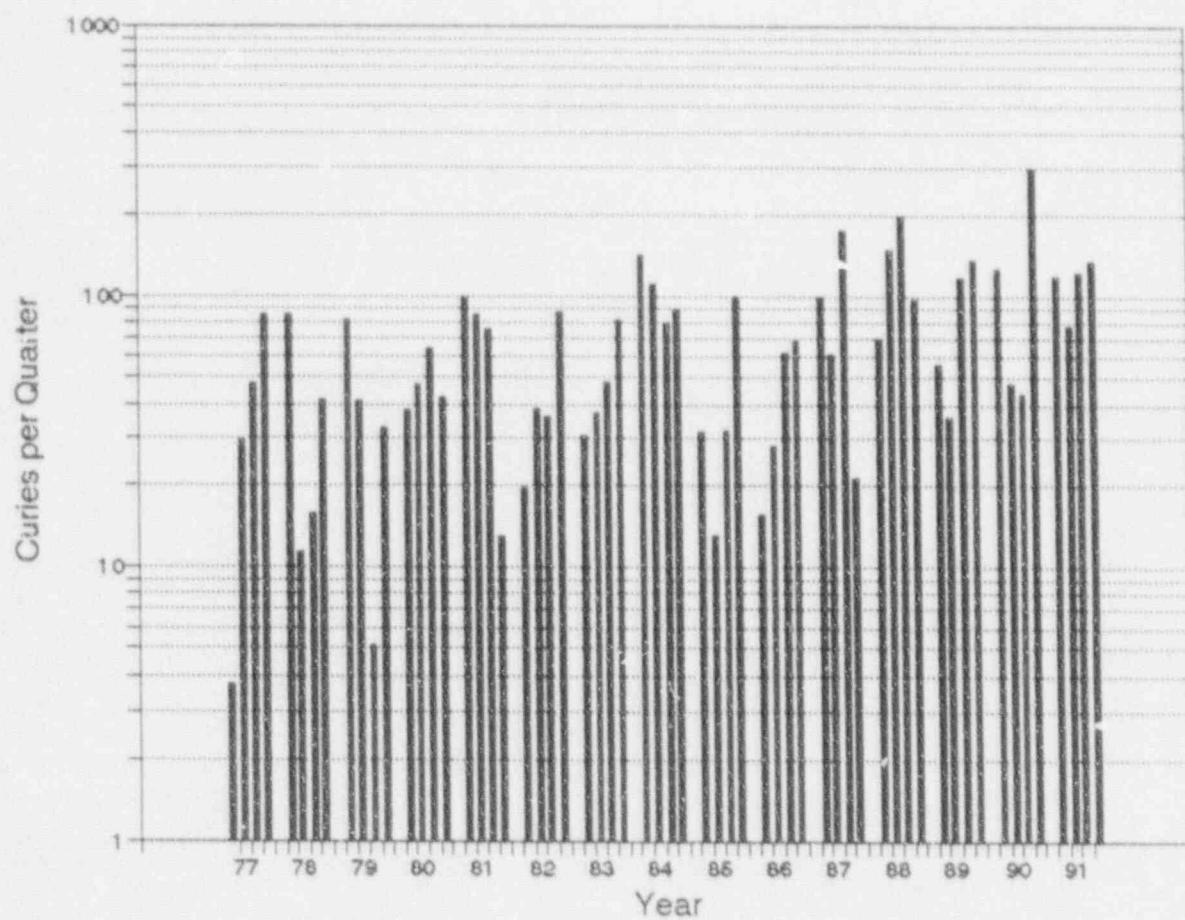


TABLE 7

## DOSES TO INDIVIDUALS FROM CASEOUS AND LIQUID EFFLUENTS - 1991

Doses due to gaseous and liquid releases were calculated using the methods derived from Regulatory Guide 1.109 and NUREG-0472. Gaseous effluent doses are based on the highest site boundary dispersion (X/Q) and deposition (D/Q) factors. Liquid effluent doses were calculated using dilution provided by Units 1, 2, and 3 cooling water.

<u>Quarter</u>	<u>Effluent Type</u>	<u>Whole Body Dose</u> (mrem)	<u>Organ Dose</u> (mrem)
1	Gas	8.09E-03	4.81E-02
	Liquid	6.04E-04	4.80E-03
2	Gas	1.50E-02	2.94E-02
	Liquid	5.92E-02	1.09E-02
3	Gas	5.51E-03	1.24E-02
	Liquid	4.55E-04	6.36E-03
4	Gas	3.42E-02	1.31E-01
	Liquid	2.92E-03	2.24E-02
	Annual Total (Gases)	6.28E-02	2.21E-01
	Annual Total (Liquids)	6.32E-02	4.45E-02
	ANNUAL TOTAL	1.26E-01	2.65E-01
	ANNUAL LIMIT	25	25
	Per Cent of Limit	0.5	1.1

TABLE 8

## DOSES TO THE POPULATION FROM GASEOUS AND LIQUID EFFLUENTS - 1991

Doses due to gaseous and liquid releases were calculated using methods derived from Regulatory Guide 1.109 and NUREG-0472 and an estimated population of 502,000 within a 50 mile radius of CR-3. Liquid effluent doses were calculated using dilution provided by Units 1, 2, and 3 cooling water, and a Gulf of Mexico dilution factor of 10.

<u>Quarter</u>	<u>Effluent Type</u>	<u>Whole Body Dose</u> (Rem)	<u>Organ Dose</u> (Rem)
1	Gas	3.53E-03	1.19E-02
	Liquid	6.36E-03	4.18E-02
2	Gas	3.38E-02	9.50E-02
	Liquid	4.32E-03	1.53E-01
3	Gas	1.07E-03	4.00E-03
	Liquid	4.73E-03	5.43E-02
4	Gas	2.06E-02	8.02E-02
	Liquid	3.31E-02	2.39E-01
	Annual Total (Gases)	5.90E-02	1.91E-01
	Annual Total (Liquids)	4.85E-02	4.88E-01
	ANNUAL TOTAL	1.67E-01	6.79E-01

TABLE 9  
SITE BOUNDARY AIP DOSE SUMMARY - 1991

<u>Quarter</u>	<u>Sector</u>	<u>Distance</u> (Miles)	<u>Beta Dose</u> (mrads)	<u>Gamma Dose</u> (mrads)
1	NW	1.01	2.69E-02	1.04E-02
2	NW	1.01	3.18E-02	1.16E-02
3	WSW	1.41	1.45E-02	3.44E-03
4	SW	1.39	1.72E-01	5.29E-02
ANNUAL TOTALS			2.45E-01	7.83E-02
ANNUAL LIMITS			20	10
Per Cent of Limit			1.2	0.8

#### UNPLANNED RELEASES

There were no unplanned liquid or gaseous releases for the period of this report.

#### RADIOACTIVE WASTE TREATMENT SYSTEMS

There were no significant changes to the radioactive waste treatment systems for the period of this report.

#### ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM

The June 1991 land-use census did not identify any new dose calculation locations.

#### EFFLUENT MONITOR INSTRUMENTATION OPERABILITY

No effluent monitor was inoperable for a period of 30 days or more for the period of this report.

#### ODCM AND PCP

There were no changes to the Off-Site Dose Calculation Manual or the Process Control Program for the period of this report.