ANNUAL ENVIRONMENTAI OPERATING REPORT

VOLUME 2 - RADIOLOGICAL

1/1/78 - 12/31/78

CRYSTAL RIVER - UNIT 3

FLORIDA POWER CORPORATION

FACILITY OPERATING LICENSE NO. DPR-72

DOCKET NO. 50-302

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I. INTRODUCTION

The Radiological Environmental Monitoring Program provides information which can be used to assist in assessing the type and quantity of radiation exposure in unrestricted areas resulting from plant operation. The Program is conducted via a contract with the University of Florida, Department of Environmental Engineering Sciences, Gainesville, Florida and a grant to the State of Florida, Department of Health and Rehabilitative Services, Orlando, Florida. The parts of the Program for which each are responsible are listed in Table I-1. In essence, the Program provdes a continuation of the preoperation program so that any increases of radioactivity in the environment can be detected. No pathway has shown any confirmed increases of radioactivity in the environment due to plant operation during this report period.

The most significant achievement in 1978 was that all but one nuclide in one pathway had an annual average LLD that was equal to or less than that required. This was the result of corrective action started in 1977; but an Enhanced Sampling Program (ESP) was also required for the gamma analyses of several pathways. The Potable Water Pathway required two additional samples subsequent to the fourth quarterly sample in order for the average annual sample LLDs to meet the LLD requirements. The Shoreline External Sediment Pathway needed one additional sample after the second semiannual sample so that the average annual sample LLDs would meet the LLD requirements. The Food Chain (Green Leafy Vegetable) Pathway required five additional samples following the second semiannual sample to bring all annual average sample LLDs (except for I-131) to within the LLD requirements. The I-131 annual average sample LLD could not be brought to within the limits because the second semiannual sample was allowed to sit for approximately thirty days before it was counted. The LLD calculations,which allow for decay, gave an extremely high sample LLD as the half life of I-131 is only eight days. The average I-131 sample LLD for the five additional samples was 5.4 pCi/kg as compared to the 10 pCi/kg requirement. The annual average sample LLDs of all nuclides in 1979 should be within the requirements without an Enhanced Sampling Program.

In the summary analysis tables, two terms are used which need explanation. The term "ND" means that the activity of the nuclide for the samples was non-detectable or less than half of the LLDs for those samples. The term "<LLD" means that the activity of the nuclide for the samples was less than the LLDs for those samples. In this way, an apparent change in activity below the lower limits of detection can be trended without getting bogged down in "actual" activity values.

The statistical evaluation of operational analyses were performed using one-half the LLD value if the activity was non-detectable and using the LLD value if the activity was less than the LLD value. When a non-detectable or less than LLD concentration used in an evaluation, the results are prefaced with a "<" sign to show that the results do not indicate only detected activity.

Finally, the statistical evaluation of the operational concentrations where there are preoperational results includes the median values. This is done solely for comparison to preoperational results.

Table I-1

Radiological Environmental Monitoring Program

RESPONSIBILITY	PATHWAY	SAMPLE STATIONS[1]
University	Air Submersion	C04, C14H*, C14M*, C14G*, C40, C41, C43, C46
State	Air Submersion	C07, C09, C18, C26
University	Air Inhalation	C41*
State	Air Inhalation	C04, C07, C18, C26, C40, C46
State	Precipitation	C04, C26, C40
University	Sea Water	C01, C09, C13, C14H, C14M, C14G*
State	River Water	C15
State	Ground Water	C40
University	Potable Water	C07, C10, C18
University	Shoreline External Sediment	C01, C09, C14H*, C14M*, C14G*
University	Seafood Chain	C29, C30
University	Ingestion Crab	C29*, C30
University	Ingestion Fish (Carnivorous)	C29*, C30
University	Ingestion Fish (Herbivorous)	C29*, C30
University	Ingestion Oysters	C29, C30
University	Ingestion Shrimp	C27
University	Ingestion Milk	C47, C49*
University	Ingestion Animals	C45
University	Food Chain (Grasses)	C05, C40, C41

Table I-1 (Continued)

Radiological Environmental Monitoring Program

RESPONSIBILITY	PATHWAY	SAMPLE STATIONS([1])
State	Ingestion Food Crops (Citrus)	C19
State	Ingestion Food Crops (Watermelon)	C04
University	Food Chain (Soil)	C04, C07, C18, C26, C40, C41, C46
State	Meat	C50
State	Poultry	C51
State	Eggs	C51
University	Food Chain (Vegetables)	C47, C48*

*Critical Pathway Sample Stations

([1]) See ETS Table 3.2-4 and Figures 3.2-2 and 3.2-3 for the description and location of all Sample Stations.

II. MILK AND GREEN LEAFY VEGETABLE CENSUS

Environmental Technical Specification 3.2.1 requires a census of animals producing milk for human consumption to be conducted semiannually. If this census fails to locate any such animals, a census of gardens producing fresh leafy vegetables for human consumption is required annually.

The garden census, required as the result of a lack of findings on the December 12, 1977, milk animal census, was completed on March 3, 1978. The critical garden (Sample Station C48) was found to be in the east sector at 4.5 miles from the plant.

A semiannual milk cow survey was completed on June 5, 1978 again with no milk animals found. The critical station for green leafy vegetables was continued at the garden 4.5 miles from the plant in the east sector.

A seminannual milk cow census was started in December, 1978 but was not completed within the period of this report.

III. MEDIA OTHER THAN EXTERNAL RADIATION

Environmental Technical Specification 3.2.2 requires that samples be taken and analyzed per ETS Table 3.2-2 and that analysis LLDs will be equal to or less than those in ETS Table 3.2-5A and B. Each analysis routine of each pathway in ETS Table 3.2-2 will be summarized, interpreted, and evaluated in the order presented.

AIR INHALATION PATHWAY

The Air Inhalation Pathway is one of two pathways split between the University and the State. In addition to the assigned stations, the University operates a station at C47.

Weekly Gross Beta Analysis

The summary for the gross beta analysis is in Table III-1. Two weekly samples were not collected and analyzed:

C07 for the week of 06-18-78 because of a loose hose

C41 for the week of 03-03-78 because of loss in the U.S. Mail

All other samples were collected and analyzed and all nuclides had LLDs equal to or less than those required.

There are no critical stations for this type of analysis. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-4.

The operational concentrations are similar to the preoperational concentrations and are lower than the 1977 operational concentrations. The 1977 concentrations were artificially elevated due to the Chinese weapons tests and the concentrations returned to preoperational levels.

Weekly I-131 Analysis

The summary for the iodine analysis is in Table III-2. Because of the loss in the U.S. Mail, the sample from Station C41 for the week of 03-03-78 was not collected and analyzed. All other samples were collected and analyzed and all nuclides had LLDs equal to or less than those required. Station C41 is the critical station for this type of analysis and no samples had activity greater than 10 times the control station's 95 percentile values. A statistical evaluation of the operational data is presented in Table III-4. There is no preoperational data.

The statistical analysis of the critical and control stations for the period of this report is as follows:

Critical Station Mean Value	= <.020 pCi/m^3
Critical Station 95 Percentile Value	= <.073 pCi/m^3
Control Stations Mean Value	= <.020 pCi/m^3
Control Stations 95 Percentile Value	= <.027 pCi/M^3

As with the gross beta concentrations, the Iodine-131 concentrations in 1978 were lower than the 1977 concentrations and probably approached the preoperational concentrations. The critical station and control station concentrations are less than their respective 1977 concentrations. Even though all samples at the critical station resulted in non detectable activity, the 95 percentile concentration appears high because of LLD differences in the two contractors collecting the data.

Quarterly Gamma Analysis

The summary for gamma analysis of quarterly composites is in Table III-3. All samples were collected and analyzed and all had LLDs equal to or less than those required. There are no critical stations for this type of analysis.

The statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-4.

The concentrations of the nuclides, as determined by gamma analysis are similar to the preoperational and the 1977 operational concentrations. The only exceptions are Zr-95 and K-40 whose concentrations returned to preoperational levels after being elevated during 1977.

Quarterly Sr-89 and 90 Analysis

The summary for the Strontium analysis of quarterly composites is in Table III-5. All samples were collected and analyzed and all had LLDs equal to or less than those required. There are no critical stations for this type of analysis.

A statistical evaluation of the operational data is presented in Table III-4. There is no preoperational data.

The strontium-89 concentrations in 1978 were lower than the 1977 concentrations while the strontium-90 concentrations were similar during both years.

Table III-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	HBR
AIR INHALATION (PCI/M3)	GROSS B 416	0.008	0.059 (412/ 415) (0.002-0.310)	C26 0.071 (52/ 52) (0.010-0.310)	SEE COLUMN 4	

Table III-2

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	HIGH
AIR INHALATION (PCI/M3)	IODINE 416	+0.039	+0.050 (2/ 416)	C47 +0.033 (5/ 5) (0.009-0.053)	SEE COLUMN 4	
			(0.048-0.023)			

Table III-3

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
AIR INHALATION (PCI/M3)	GAMMA ANALYSIS QUARTERLY COMPOSITE 32					
	CE-144	0.055	0.189 (5/ 32) (0.086-0.245)	0.000 (0/ 0)	SEE COLUMN 4	
	RA-226	0.030	0.004 (8/ 32) (0.002-0.008)	0.000 (0/ 0)	SEE COLUMN 4	
	TH-232	0.015	0.002 (8/ 32) (0.002-0.003)	0.000 (0/ 0)	SEE COLUMN 4	
	I-131	0.008	ND			
	BA-140	0.008	ND			
	RU-106	0.039	0.009 (5/ 32) (0.005-0.014)	0.000 (0/ 0)	SEE COLUMN 4	
	CS-137	0.008	0.003 (7/ 32) (0.001-0.004)	0.000 (0/ 0)	SEE COLUMN 4	
	ZR-95	0.008	0.007 (5/ 32) (0.001-0.020)	0.000 (0/ 0)	SEE COLUMN 4	
	MN-54	0.008	ND			
	ZN-65	0.015	ND			
	K-40	0.084	0.018 (8/ 32) (0.010-0.022)	0.000 (0/ 0)	SEE COLUMN 4	

Table III-4

AIR INHALATION PATHWAY

STATISTICAL EVALUATION OF ANALYSES (pCi/m^3)

Nuclide	Preoperational Values		Operational Values		
	Median	95 Percentile	Median	Mean	95 Percentile
Gross Beta Analysis					
Gross β	.029	.12	.044	.059	.153
Iodine Analysis					
I-131*	--	--	--	<.020	<.033
Gamma Analysis					
Ce-144	.003	.172	<.030	<.051	<.165
Ra-226	<.2	.241	<.020	<.016	<.030
Th-232	<.01	.008	<.010	<.008	<.015
I-131	<.07	.004	<.005	<.004	<.008
Ba-140	<.01	.016	<.005	<.004	<.007
Ru-106	.025	.216	<.025	<.021	<.036
Cs-137	<.01	.013	<.005	<.004	<.007
Zr-95	.003	.043	<.005	<.005	<.011
Mn-54	<.01	<.01	<.005	<.004	<.008
Zn-65	<.01	<.01	<.010	<.008	<.016
K-40	<16.8	<16.8	<.055	<.055	<.122
Strontium Analysis					
Sr-89	--	--	--	<.001	<.002
Sr-90	--	--	--	<.004	<.008

*Critical nuclide for critical station

Table III-5

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
AIR INHALATION (PCI/M3)	SR 89-90 ANALYSIS 32					
	SR-89	0.002	0.002 (4/ 32) (0.001-0.003)	C41 0.002 (2/ 4) (0.002-0.002)	SEE COLUMN 4	
	SR-90	0.001	0.001 (2/ 32) (0.001-0.001)	C41 0.001 (1/ 4)	SEE COLUMN 4	

PRECIPITATION PATHWAY

The State has the responsibility to collect and analyze precipitation samples. There are no additional stations for the pathway.

Monthly Gamma Analysis

The summary for the gamma analysis of the monthly samples is in Table III-6. All monthly samples except Station C40 for November were collected and analyzed and all had LLDs equal to or less than those required. There are no critical stations in this pathway. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-6a. No operational sample had any detectable activity and the preoperational analyses also had no detectable activity.

The 1978 operational activity of the nuclides determined by gamma analysis are non detectable as were the preoperational and 1977 operational concentrations.

Monthly Tritium Analysis

The summary for the tritium analysis of the monthly precipitation sample is in Table III-7. Due to insufficient rainfall, the sample for Station C40 in November could not be collected. All other samples were collected and analyzed and all had LLDs equal to or less than those required. There are no critical stations in this pathway. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-6a.

The 1978 operational activity of tritium was non detectable as was the preoperational and 1977 operational activities.

Table III-6

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
PRECIPITATION (PCI/L)	GAMMA ANALYSIS 36					0
	I -131	17	ND			
	BA-140	17	ND			
	CS-137	17	ND			
	CS-134	17	ND			
	CO-58	17	ND			
	MN-54	15	ND			
	ZN-65	30	ND			
	CO-60	17	ND			

Table III-6a

PRECIPITATION PATHWAY

STATISTICAL EVALUATION OF ANALYSES (pCi/ℓ)

Nuclide	Preoperational Values		Operational Values		
	Median	95 Percentile	Median	Mean	95 Percentile
Gamma Analysis					
I-131	<.4	<.4	<8.5	<8.5	<8.5
Ba-140	<10	<10	<8.5	<8.5	<8.5
Cs-137	<10	<10	<8.5	<8.5	<8.5
Cs-134	<10	<10	<8.5	<8.5	<8.5
Co-58	<10	<10	<8.5	<8.5	<8.5
Mn-54	<10	<10	<7.5	<7.5	<7.5
Zn-65	<20	<20	<15.0	<15.0	<15.0
Co-60	<10	<10	<8.5	<8.5	<8.5
Tritium Analysis					
H-3	<320	<320	<100	<100	<100

Table III-7

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
PRECIP (PCI/L)	TRITIUM ANALYSIS 36					0
	H-3	200	ND			

SEA WATER PATHWAY

The University has the responsibility to collect and analyze sea water samples. There are no additional stations for this pathway.

Monthly Gamma Analysis

The summary for the gamma analysis of monthly samples is in Table III-8. All samples were collected and analyzed and all nuclides had annual average LLDs equal to or less than those required. Sample Station C14G is the critical station in this pathway and no sample had activity greater than 10 times the control station value. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-9.

The concentrations of nuclides by gamma analysis during 1978 was less than the concentrations during 1977 and similar to the preoperational concentrations. The critical stations and the control stations concentration were almost identical and both were less than the respective concentrations during 1977.

Quarterly Sr-89 and 90 Analysis

The summary for the Sr-89 and 90 analysis of quarterly composites is in Table III-10. All quarterly composites were collected and analyzed and all LLDs were equal to or less than those required. There are no critical stations for this type of analysis.

There were no reported preoperational results and a statistical evaluation of the operational data is presented in Table III-9.

The 1978 operational concentrations are similar to the 1977 operational concentrations and probably are close to preoperational levels.

Quarterly Tritium Analysis

The summary for the tritium analysis of quarterly composites is in Table III-11. All quarterly composites were collected and analyzed and all had LLDs that were equal to or less than those required. There are no critical stations for this type of analysis.

A comparison of the preoperational and operational analyses in Table III-9. The operational concentrations in 1978 were less than those in 1977 but did not approach preoperational levels. Some preoperational activities that were reported were less than the minimal detectable activities and this skewed the statistics downward.

Table III-8

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	INDR
SEA WATER (PCI/KG)	GAMMA ANALYSIS 72					0
	RA-226	18	37(65/ 72)C09	58(9/ 12)	37(53/ 60)	
			(13- 154)	(19- 154)	(13- 154)	
	TH-232	15	21(50/ 72)C14C	24(10/ 12)	21(40/ 60)	
			(12- 39)	(14- 38)	(12- 37)	
	I -131	9	13(2/ 72)C14B	13(1/ 12)	15(2/ 60)	
			(12- 13)		(12- 13)	
	BA-140	29	25(1/ 72)C01	25(1/ 12)	25(1/ 60)	
	RU-106	40	52(2/ 72)C14B	56(1/ 12)	52(2/ 60)	
			(47- 56)		(47- 52)	
	CS-137	8	6(1/ 72)C01	6(1/ 12)	6(1/ 60)	
	ZR -95	11	15(1/ 72)C14B	15(1/ 12)	15(1/ 60)	
	CS-134	7	9(4/ 72)C01	12(1/ 12)	10(3/ 60)	
			(6- 12)		(7- 12)	
	MN -54	7	8(1/ 72)C13	0(1/ 12)	6(1/ 60)	
	ZN -65	14	ND			
	K -40	81	257(72/ 72)C14B	316(12/ 12)	251(58/ 60)	
			(67- 390)	(255- 390)	(67- 390)	

Table III-9

SEA WATER PATHWAY

STATISTICAL EVALUATION OF ANALYSES (pCi/kg)

Nuclide	Preoperational Values		Operational Values						
	Median	95 Percentile	Median	Mean	95 Percentile	Control Stations		Critical Stations	
						Mean	95 Percentile	Mean	95 Percentile
Gamma Analysis									
Ra-226	--	600	<30.5	<34.9	<77.6	<34.4	<79.5	<37.1	<66.4
Th-232	--	7	<18.5	<18.2	<32.9	<17.6	<31.6	<20.8	<38.8
I-131*	<.4	<.4	<4.5	<4.9	<9.6	<4.9	<9.9	<4.5	<8.2
Ba-140	<10	11	<14.5	<14.4	<24.3	<14.4	<24.5	<14.3	<23.7
Ru-106	--	--	<33.5	<30.9	<49.9	<30.9	<50.4	<31.2	<48.2
Cs-137*	<10	10	<4.5	<4.0	<6.4	<4.0	<6.5	<4.0	<5.9
Zr-95	<10	<10	<6.5	<5.9	<10.1	<5.9	<10.2	<6.2	<10.0
Cs-134*	<10	<10	<4.0	<4.1	<7.6	<4.1	<7.9	<4.0	<6.0
Mn-54	<10	<10	<3.5	<3.4	<5.8	<3.4	<5.9	<3.5	<5.4
Zn-65	<20	7	<7.5	<7.2	<11.7	<7.2	<11.8	<7.3	<10.8
K-40	150.8	368.7	<249.5	<232.4	<410.1	<221.0	<405.4	<289.8	<358.7
Strontium Analysis									
Sr-89	--	--	--	<2.4	<10.7	--	--	--	--
Sr-90	--	--	--	<0.5	<1.7	--	--	--	--
Tritium Analysis									
H-3	71	87	<349.5	<359.4	<623.3	--	--	--	--

*Critical nuclides for critical station.

Table III-10

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
SEA WATER (PCI/KG)	SR 8/7/90					
	ANALYSIS 24					0
	SR-89	1	1(12/ 24)*C14H*	1(3/ 4)*	SEE COLUMN 4	
			(0- 20)*	(5- 20)*		
	SR-90	0	1(12/ 24)*C14H*	1(3/ 4)*	SEE COLUMN 4	
			(0- 2)*	(1- 2)*		

Table III-11

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NPR
SEA WATER (PCI/KG)	TRITIUM ANALYSIS 24					0
	R-3	450	519(4/ 24)|C01	829(1/ 4)|	SEE COLUMN 4	
			(416- 829)|		

RIVER WATER PATHWAY

The State has the responsibility to collect and analyze river water samples. There are no additional stations for this pathway.

Quarterly Gamma Analysis

The summary for the gamma analysis of quarterly samples is in Table III-12. All samples were collected and analyzed and all had LLDs equal to or less than those required. There are no critical stations in this pathway. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-12a. All operational samples had no detectable activity and all preoperational samples also had no detectable activity.

Quarterly Tritium Analysis

The summary for the tritium analysis of quarterly samples is in Table III-13. All samples were collected and analyzed and all had LLDs equal to or less than those required. There are no critical stations in this pathway. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-12a. All operational samples had no detectable activity and all preoperational samples also had no detectable activity.

Table II'-12

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
RIVER WATER (PCI/KG)	GAMMA ANALYSIS 4					0
	I- 131	17	ND			
	BA-140	17	ND			
	CO- 58	17	ND			
	CS-137	17	ND			
	CS-134	17	ND			
	MN-54	15	ND			
	ZN-65	30	ND			
	CO- 60	17	ND			

Table III-12a

RIVER WATER PATHWAY

STATISTICAL EVALUATION OF ANALYSES (pCi/kg)

Nuclide	Preoperational Values		Operational Values		
	Median	95 Percentile	Median	Mean	95 Percentile
Gamma Analysis					
I-131	<.4	<.4	<8.5	<8.5	<8.5
Ba-140	<10	<10	<8.5	<8.5	<8.5
Co-58	<10	<10	<8.5	<8.5	<8.5
Cs-137	<10	<10	<8.5	<8.5	<8.5
Cs-134	<10	<10	<8.5	<8.5	<8.5
Mn-54	<10	<10	<7.5	<7.5	<7.5
Zn-55	<20	<20	<15.0	<15.0	<15.0
Co-60	<10	<10	<8.5	<8.5	<8.5
Tritium Analysis					
H-3	<320	<320	<100	<100	<100

Table III-13

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
RIVER WATER (PCI/KG)	TRITIUM ANALYSIS 4					0
	H-3	200	ND			

GROUND WATER PATHWAY

The State has the responsibility to collect and analyze ground water samples. There are no additional stations for this pathway.

Semiannual Gamma Analysis

The summary for the gamma analysis of semiannual samples is in Table III-14. All samples were collected and analyzed and all had LLDs equal to or less than those required. There are no critical stations in this pathway. A statistical evaluation of the operational data is presented in Table III-14a. All operational samples had no detectable activity and there is no preoperational data.

Semiannual Tritium Analysis

The summary for the tritium analysis of semiannual samples is in Table III-15. All samples were collected and analyzed and all had LLDs equal to or less than those required. There are no critical stations in this pathway. A statistical evaluation of the operational data is presented in Table III-14a. All operational samples had no detectable activity and there is no preoperational data.

Table III-14

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NBR
GROUND WATER (PCI/KG)	GAMMA ANALYSIS 2					0
	I- 131	17	ND			
	BA-140	17	ND			
	CO- 58	17	ND			
	CS-137	17	ND			
	CS-134	17	ND			
	MN-54	15	ND			
	ZN-65	30	ND			
	CO- 60	17	ND			

Table III-14a

GROUND WATER PATHWAY

STATISTICAL EVALUATION OF ANALYSES (pCi/kg)

Nuclide	Operational Values	
	Mean	95 Percentile
Gamma Analysis		
I-131	<8.5	<8.5
Ba-140	<8.5	<8.5
Co-58	<8.5	<8.5
Cs-137	<8.5	<8.5
Cs-134	<8.5	<8.5
Mn-54	<7.5	<7.5
Zn-65	<15.0	<15.0
Co-60	<8.5	<8.5
Tritium Analysis		
H-3	<100	<100

Table III-15

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRO
GROUND WATER (PCI/KG)	TRITIUM ANALYSIS 2					0
	H-3	200	ND			

POTABLE WATER PATHWAY

The University has the responsibility to collect and analyze potable water samples. There are no additional stations for this pathway. Two additional samples were collected at each station as part of the Enhanced Sampling Program for the gamma analysis.

Quarterly Gamma Analysis

The summary for the gamma analysis of quarterly samples is in Table III-16. All samples were collected and analyzed and all nuclides had annual average LLDs equal to or less than those required. There are no critical stations in this pathway. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-16a. The 1978 operational activity was similar to the 1977 operational concentrations and was less than the preoperational activity levels except for Ba-140. Activity for Ba-140 was only found in two samples, one of which was at the LLD level. This activity is thought to be spurious.

Quarterly Tritium Analysis

The summary for the tritium analysis of the quarterly samples is in Table III-17. All samples were collected and analyzed and all had LLDs equal to or less than those required. There are no critical stations in this pathway and all samples had activity that was less than the sample LLD. All preoperational samples had an average activity of less than 320 pCi/ℓ. There was, therefore, probably no increase in activity over the preoperational levels and the 1977 operational levels.

Table III-16

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRE
POT. WATER (PCI/KG) INGESTION	GAMMA ANALYSIS 36					0
	I -131	9	ND			
	BA-140	27	30(2/ 18)(C10	50(2/ 6)(	SEE COLUMN 4	
			(13- 47)(	(13- 47)(		
	CS-137	7	0(1/ 18)(C10	8(1/ 6)(	SEE COLUMN 4	
	CS-134	7	<LLD(1/ 18)(			
	CO -58	6	3(1/ 18)(C07	3(1/ 6)(	SEE COLUMN 4	
	MN -54	6	ND			
	ZN -65	12	ND			
	CO -60	6	<LLD(1/ 18)(			

Table III-16a

POTABLE WATER PATHWAY

STATISTICAL EVALUATION OF ANALYSES (pCi/kg)

Nuclide	Preoperational Values		Operational Values		
	Median	95 Percentile	Median	Mean	95 Percentile
Gamma Analysis					
I-131	<.4	<.4	<6.5	<4.6	<11.3
Ba-140	<10	<10	<22.5	<15.6	<37.1
Cs-137	<10	<10	<3.0	<3.8	<7.9
Cs-134	<10	<10	<3.0	<3.7	<8.1
Co-58	<10	<10	<2.8	<3.1	<6.0
Mn-54	<10	<10	<2.8	<3.0	<5.7
Zn-65	<20	<20	<5.0	<6.2	<12.0
Co-60	<10	<10	<2.5	<5.0	<19.3
Tritium Analysis					
H-3	<320	<320	<349.5	<305.5	<533.7

Table III-17

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
POT. WATER (PCI/KG)	TRITIUM ANALYSIS 12					0
	H-3	488	(LLD) (4/ 12)			

SHORELINE EXTERNAL SEDIMENT PATHWAY

The University has the responsibility to collect and analyze shoreline external sediment samples. There are no additional stations for this pathway. One additional sample was collected at each station as part of the Enhanced Sampline Program for the gamma analysis.

Semiannual Gamma Analysis

The summary for the gamma analysis of the semiannual samples is in Table III-18. Samples were not reported for the first half at Sample Station C14H because of excessive LLDs due to naturally occurring nuclides. All other samples were collected and analyzed and the annual average LLDs for all nuclides were equal to or less than those required. The critical stations for this analysis are Sample Stations C14H, C14M, and C14G and no sample had activity greater than 10 times the control station value. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-19.

The 1978 operational data is equal to or less than the preoperational data and similar to the 1977 operational data for almost every nuclide. The lack of more operational data prevents a more thorough comparison. Also, the control station data is very similar to the critical station data.

Semiannual Sr-90 Analysis

The summary for the strontium analysis of the semiannual samples is in Table III-20. Due to a laboratory accident, the sample for the first half from Station C09 was lost. All other samples were collected and analyzed and all LLDs for all nuclides were equal to or less than those required. There are no critical stations for this analysis. A statistical evaluation of the operational data is presented in Table III-20. There is no preoperational data.

The operational concentrations in 1978 are similar to the 1977 operational concentrations.

Table III-18

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NR
BOT. SED. PCI/KG SHORELINE EXT	GAMMA ANALYSIS 10					0
	RA-226	21	377(14/ 14) (165- 809)	C14M 521(3/ 3) (189- 809)	245(6/ 6) (165- 325)	
	TH-232	17	68(11/ 14) (37- 104)	C09 76(3/ 3) (52- 104)	73(6/ 6) (52- 104)	
	I -131	9	ND			
	BA-140	25	ND			
	RU-106	48	74(2/ 14) (38- 109)	C14M 109(1/ 3)	ND	
	CS-137	7	24(10/ 14) (0- 47)	C09 47(1/ 3)	27(4/ 6) (12- 47)	
	ZR- 95	10	ND			
	CS-134	6	6(7/ 14) (3- 14)	C14G 9(2/ 3) (4- 14)	5(3/ 6) (3- 6)	
	MN- 54	5	ND			
	ZN- 65	12	ND			
	K - 40	69	300(14/ 14) (147- 470)	C14M 371(3/ 3) (273- 452)	265(6/ 6) (147- 415)	

Table III-19

SHORELINE EXTERNAL SEDIMENT PATHWAY

STATISTICAL EVALUATION OF ANALYSES (pCi/kg)

Nuclide	Preoperational Values		Operational Values						
						Control Stations		Critical Stations	
	Median	95 Percentile	Median	Mean	95 Percentile	Mean	95 Percentile	Mean	95 Percentile
Gamma Analysis									
Ra-226	2900	10,000	324.5	372.3	750.8	244.8	391.5	476.2	854.3
Th-232	90	300	<59.5	<56.8	<111.2	72.7	110.5	<44.9	<99.8
I-131	<.4	34	<4.3	<4.4	<9.2	<4.8	<10.0	<4.0	<8.8
Ba-140	<10	<10	<10.8	<12.6	<26.0	<12.8	<25.5	<12.4	<27.1
Ru-106	190	690	<15.3	<29.8	<84.8	<23.9	<62.1	<34.2	<100.3
Cs-137*	<10	250	<10.5	<14.3	<42.8	<11.9	<35.8	<16.0	<48.7
Zr-95	12	40	<3.0	<4.9	<12.4	<4.7	<11.1	<5.1	<13.7
Cs-134*	<10	<10	<4.5	<5.0	<11.3	<4.8	<8.4	<5.1	<13.2
Mn-54	<10	19	<1.5	<2.7	<6.6	<2.6	<6.3	<2.8	<7.1
Zn-65	--	--	<3.5	<6.0	<15.9	<5.3	<12.7	<6.6	<18.4
K-40	259.8	1,006	270.5	252.9	519.3	154.7	379.8	326.5	526.8
Strontium Analysis									
Sr-90	--	--	--	<12.2	<24.9	--	--	--	--

*Critical nuclides for critical station

Table III-20

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NUMBER
BOT. SED (PCI/KG) SHORELINE EXT	SR-90 ANALYSIS 10					0
	SR-90	16	22(27 9)KC09	26(1/ 1)	26(1/ 5)	
			(17- 28)			

SEA FOOD CHAIN PATHWAY

The University has the responsibility to collect and analyze marine plants in the sea food chain. There are no additional stations for this pathway.

Semiannual Gamma Analysis

The summary for the gamma analysis of the semiannual samples is in Table III-21. All samples were collected and analyzed and all nuclides had LLDs equal to or less than those required. There are no critical stations in this pathway. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-22.

The 1978 operational concentrations are less than both the 1977 operational and the preoperational concentrations.

Semiannual Sr-89 and 90 Analysis

The summary for the strontium analysis of the semiannual samples is in Table III-23. All samples were collected and analyzed and all nuclides had annual average LLDs equal to or less than those required. There are no critical stations in this pathway. A statistical evaluation of the operational data is presented in Table III-22. There is no preoperational data.

The 1977 and 1978 operational concentrations are very similar.

Table III-21

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
MARINE PLANT PCI/KG SEAFOOD CHAIN	GAMMA ANALYSIS 4					O
	RA-226	10	34(4/ 4)*C29 (22- 45)*	34(2/ 2)* (28- 39)*	SEE COLUMN 4	
	TH-232	9	29(4/ 4)*C29 (11- 42)*	31(2/ 2)* (29- 32)*	SEE COLUMN 4	
	I-131	5	ND			
	BA-140	18	ND			
	RU-106	44	52(1/ 4)*C30	52(1/ 2)*	SEE COLUMN 4	
	CS-137	5	9(3/ 4)*C29 (7- 11)*	9(2/ 2)* (7- 11)*	SEE COLUMN 4	
	ZR- 95	9	11(1/ 4)*C30	11(1/ 2)*	SEE COLUMN 4	
	NN- 54	5	5(2/ 4)*C30 (3- 7)*	5(2/ 2)* (3- 7)*	SEE COLUMN 4	
	ZN- 65	13	ND			
	K - 40	91	3301(4/ 4)*C30 (875- 5200)*	3624(2/ 2)* (3560- 3687)*	SEE COLUMN 4	

Table III-22

SEA FOOD CHAIN PATHWAY

STATISTICAL EVALUATION OF ANALYSES (pCi/kg)

Nuclide	Preoperational Values		Operational Values		
	Median	95 Percentile	Median	Mean	95 Percentile
Gamma Analysis					
Ra-226	624	3300	33.5	33.5	53.9
Th-232	--	280	30.5	28.5	41.4
I-131	<10	37	<2.5	<2.5	<4.1
Ba-140	<10	75	<9.5	<9.0	<14.8
Ru-106	--	360	<27.8	<31.6	<59.8
Cs-137	<10	181	<8.0	<7.3	<11.1
Zr-95	18	157	<5.3	<6.4	<12.5
Mn-54	--	43	<2.8	<3.8	<8.0
Zn-65	--	156	<6.0	<6.38	<10.1
K-40	1508.4	12570	3623.5	3330.5	6855.6
Strontium Analysis					
Sr-89	--	--	--	<4.1	<13.2
Sr-90	--	--	--	<1.3	<3.1

Table III-23

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-362

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NUMBER
MAR. PLANT (PCI/KG) SEAFOOD CH	SRD9/90 ANALYSIS 4					0
	SR-89	5	<LLD(1/ 4)			
	SR-90	0	2(3/ 4)*C29	2(2/ 2)	SEE COLUMN 4	
			(1- 2)	(2- 2)		

INGESTION CRAB PATHWAY

The University has the responsibility to collect and analyze crabs. There are no additional stations for this pathway.

Semiannual Gamma Analysis

The summary for the gamma analysis of the edible portion of semiannual samples is in Table III-24. The sample for the first half at C30 was not collected due to the unsuccessful attempts at entrapment. All other samples were collected and analyzed and all nuclides had LLDs equal to or less than those required. Sample Station C29 is the critical station in this pathway and no sample had activity greater than 10 times the control station value. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-25.

The 1978 operational concentrations are less than both the 1977 operational and preoperational concentrations except for naturally occurring K-40 which has similar concentrations for the three periods. The concentrations of the critical and control stations during 1978 were in close agreement.

Table III-24

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	ERR
CRABS (PCI/KG) INGESTION	GAMMA ANALYSIS 4					0
	RA-226	15	65(3/ 3)+C30 (52- 82)+	82(1/ 1)+	82(1/ 1)+	
	TH-232	12	25(2/ 3)+C29 (12- 37)+	37(1/ 2)+	12(1/ 1)+	
	I -131	7	ND			
	BA-140	25	ND			
	RU-106	50	ND			
	CS-137	7	ND			
	ZR- 95	10	ND			
	CS-134	7	ND			
	MN -54	4	ND			
	ZN -65	14	ND			
	K - 40	93	1560(3/ 3)+C30 (1140- 1960)+	1790(1/ 1)+	1790(1/ 1)+	

Table III-25

INGESTION CRAB PATHWAY

SEMI-ANNUAL GAMMA ANALYSIS (pCi/kg)

Nuclide	Preoperational Values		Operational Values						
						Control Stations		Critical Stations	
	Median	95 Percentile	Median	Mean	95 Percentile	Mean	95 Percentile	Mean	95 Percentile
Ra-226	1325	3600	63.0	65.7	95.4	82.0	-	57.5	72.8
Th-232	92	170	<12.0	<18.3	<24.2	12.0	-	<21.5	<64.5
I-131*	<10	<10	<4.0	<3.5	<5.2	<4.0	-	<3.3	<5.3
Ba-140	<10	55	<9.5	<12.3	<17.4	<13.0	-	<12.0	<18.9
Ru-106	--	--	<21.5	<21.8	<23.0	<22.5	-	<21.5	<21.5
Cs-137*	<10	75	<3.5	<3.5	<4.5	<3.0	-	<3.8	<4.4
Zr-95	<10	13	<4.5	<5.2	<7.4	<4.5	-	<5.5	<8.3
Cs-134*	<10	<10	<3.5	<3.5	<4.5	<3.0	-	<3.8	<4.4
Mn-54	<80	24	<3.0	<3.0	<4.0	<2.5	-	<3.3	<3.9
Zn-65	<160	127	<7.0	<7.2	<9.6	<7.0	-	<7.3	<10.7
K-40	1424.6	2011.2	1790.0	1630.0	2478.3	1790.0	-	1550.0	2686.5

*Critical nuclides for critical station

INGESTION CARNIVOROUS FISH PATHWAY

The University has the responsibility to collect and analyze carnivorous fish. There are no additional stations for this pathway.

Semiannual Gamma Analysis

The summary for the gamma analysis of the edible portion of semiannual samples is in Table III-26. The samples for the first half at C30 were not collected due to the unsuccessful attempts at capture. All other samples were collected and analyzed and all nuclides had LLDs equal to or less than those required. Sample Station C29 is the critical station in this pathway and no sample had activity greater than 10 times the control station value. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-27.

The operational concentrations for 1978 are less than both the 1977 operational and the preoperational concentrations except for naturally occurring K-40 where the concentrations were similar.

Table III-26

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
C. FISH (PCI/KG) INGESTION	GAMMA ANALYSIS 4					0
	RA-226	12	43(3/ 3) (21- 61)	*C30 61(1/ 1)	61(1/ 1)	
	TH-232	11	21(2/ 3) (19- 22)	*C30 22(1/ 1)	22(1/ 1)	
	I- 131	5	6(1/ 3)	*C30 6(1/ 1)	6(1/ 1)	
	BA-140	19	ND			
	RU-106	47	14(1/ 3)	*C29 14(1/ 2)	0(0/ 1)	
	CS-137	6	13(3/ 3) (5- 20)	*C30 15(1/ 1)	15(1/ 1)	
	ZR- 95	9	ND			
	CS-134	6	ND			
	MN- 54	6	ND			
	ZN- 65	13	7(1/ 3)	*C29 7(1/ 2)	0(0/ 1)	
	K - 40	97	1517(3/ 3) (242- 2290)	*C30 2020(1/ 1)	2020(1/ 1)	

Table III-27

INGESTION CARNIVOROUS FISH PATHWAY

SEMIANNUAL GAMMA ANALYSIS (pCi/kg)

Nuclide	Preoperational Values		Operational Values						
						Control Stations		Critical Stations	
	Median	95 Percentile	Median	Mean	95 Percentile	Mean	95 Percentile	Mean	95 Percentile
Ra-226	335	2400	47.0	43.0	82.8	61.0	-	34.0	70.0
Th-232	--	92	<19.0	<16.2	<31.2	22.0	-	<13.3	<17.2
I-131*	<10	<10	<3.5	<3.8	<7.8	<6.0	-	<2.8	<4.8
Ba-140	<10	72	<8.5	<9.7	<14.5	<8.5	-	<10.3	<16.5
Ru-106	--	--	<19.0	<17.3	<23.0	<19.0	-	<16.5	<23.4
Cs-137*	<10	43	15.0	13.3	28.3	15.0	-	12.5	33.3
Zr-95	<10	12	<4.0	<4.7	<6.9	<4.0	-	<5.0	<7.8
Cs-134*	<10	<10	<2.5	<13.3	<28.3	<2.5	-	<12.5	<33.3
Mn-54	<80	<80	<2.5	<2.8	<4.9	<2.0	-	<3.3	<5.3
Zn-65	<160	99	<5.5	<5.3	<7.9	<5.0	-	<6.3	<8.3
K-40	2346.4	3854.8	2020.0	1517.3	3698.2	2020.0	-	1266.0	4104.4

*Critical nuclides for critical station

INGESTION HERBIVOROUS FISH PATHWAY

The University has the responsibility to collect and analyze herbivorous fish. There are no additional stations for this pathway.

Semiannual Gamma Analysis

The summary for the gamma analysis of the edible portion of semiannual samples is in Table III-28. The samples for the first half at C29 and C30 and for the second half at C29 were not collected due to the unsuccessful attempts at capture. All other samples were collected and analyzed and all nuclides had LLDs equal to or less than those required. Sample Station C29 is the critical station in this pathway and no sample had activity greater than 10 times the control station value. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-29.

The 1978 operational concentrations are lower than both the 1977 operational and the preoperational concentrations.

Table III-28

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
M.FISH (PCI/KG) INJESTION	GAMMA ANALYSIS 4					0
	RA-226	16	34(1/ 1)	*C30 34(1/ 1)	34(1/ 1)	
	TH-232	13	36(1/ 1)	*C30 36(1/ 1)	36(1/ 1)	
	I- 131	8	ND			
	BA-140	28	ND			
	RU-106	62	ND			
	CS-137	7	12(1/ 1)	*C30 12(1/ 1)	12(1/ 1)	
	ZR- 95	11	ND			
	CS-134	8	ND			
	MN- 54	7	ND			
	ZN- 65	15	ND			
	K - 40	75	1220(1/ 1)	*C30 1220(1/ 1)	1220(1/ 1)	

Table III-29

INGESTION HERBIVOROUS FISH PATHWAY

SEMIANNUAL GAMMA ANALYSIS (pCi/kg)

Nuclide	Preoperational Values		Operational Values						
						Control Stations		Critical Stations	
	Median	95 Percentile	Median	Mean	95 Percentile	Mean	95 Percentile	Mean	95 Percentile
Ra-226	960	3100	34.0	34.0	-	34.0	-	NC/M	NC/M
Th-232	--	84	36.0	36.0	-	36.0	-	NC/M	NC/M
I-131*	<10	<10	<4.0	<4.0	-	<4.0	-	NC/M	NC/M
Ba-140	<10	50	<14.0	<14.0	-	<14.0	-	NC/M	NC/M
Ru-106	--	90	<31.0	<31.0	-	<31.0	-	NC/M	NC/M
Cs-137*	<10	110	12.0	12.0	-	12.0	-	NC/M	NC/M
Zr-95	<10	9	<5.5	<5.5	-	<5.5	-	NC/M	NC/M
Cs-134*	<10	<10	<4.0	<4.0	-	<4.0	-	NC/M	NC/M
Mn-54	<80	<80	<3.5	<3.5	-	<3.5	-	NC/M	NC/M
Zn-65	<160	63	<7.5	<7.5	-	<7.5	-	NC/M	NC/M
K-40	2178.8	3100.6	1220.0	1220.0	-	1220.0	-	NC/M	NC/M

*Critical nuclides for critical station

INGESTION OYSTERS PATHWAY

The University has the responsibility to collect and analyze oysters. There are no additional stations for this pathway.

Semiannual Gamma Analysis

The summary for the gamma analysis of the edible portion of semiannual samples is in Table III-30. All samples were collected and analyzed and all nuclides had LLDs equal to or less than those required. There are no critical stations in this pathway. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-31.

The 1978 operational concentrations are lower than both the 1977 operational and preopoerational concentrations except for Ru-106 which is probably the result of including concentrations that were less than the minimum detectable activities in the statistics.

Table III-30

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
OYSTERS (PCI/KG) INGESTION	GAMMA ANALYSIS 4					0
	RA-226	12	46(4/ 4)*C30 (39- 62)	51(2/ 2)* (39- 62)	SEE COLUMN 4	
	TH-232	11	31(4/ 4)*C30 (19- 47)	38(2/ 2)* (28- 47)	SEE COLUMN 4	
	I -131	6	ND			
	BA-140	20	ND			
	RU-106	48	89(2/ 4)*C29 (82- 96)	96(1/ 2)*	SEE COLUMN 4	
	CS-137	7	11(1/ 4)*C29	11(1/ 2)*	SEE COLUMN 4	
	ZR -95	9	ND			
	MN -54	5	ND			
	ZN -65	13	ND			
	K - 40	98	1229(4/ 4)*C30 (994- 1440)	1355(2/ 2)* (1270- 1440)	SEE COLUMN 4	

Table III-31

INGESTION OYSTERS PATHWAY

SEMIANNUAL GAMMA ANALYSIS (pCi/kg)

Nuclide	Preoperational Values		Operational Values		
	Median	95 Percentile	Median	Mean	95 Percentile
Ra-226	--	534	40.5	45.5	67.1
Th-232	--	--	29.0	31.0	53.9
I-131	<10	<10	<2.5	<2.8	<3.7
Ba-140	<10	<10	<10.3	<10.0	<12.9
Ru-106	--	82	<53.3	<55.3	<132.6
Cs-137	<10	<10	<5.8	<6.3	<14.0
Zr-95	<10	<10	<5.0	<4.6	<6.8
Mn-54	<80	<80	<2.8	<2.6	<3.6
Zn-65	<160	33	<6.8	<7.0	<8.4
K-40	--	1843.6	1240.0	1228.5	1589.5

INGESTION SHRIMP PATHWAY

The University has the responsibility to collect and analyze shrimp. There are no additional stations for this pathway.

Semiannual Gamma Analysis

The summary for the gamma analysis of the semiannual samples is in Table III-32. The sample for the second half at C27 was not available from the Ralston Purina Research Facility. The other sample was collected and analyzed and all nuclides had LLDs equal to or less than those required. There are no critical stations in this pathway. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-32a.

One sample lacks the statistics for an evaluation of the operational data or a rigorous comparison with the preoperational data. The activity found in the shrimp does, however, correspond to that found in the preoperational and the 1977 operational shrimp. It should be noted that discharge canal water was not used for shrimp raising in 1978.

Table III-32

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
SHRIMP (PCI/KG) INGESTION	GAMMA ANALYSIS 2					0
	RA-226	19	171(1/ 1)	C27 171(1/ 1)	SEE COLUMN 4	
	TH-232	17	50(1/ 1)	C27 50(1/ 1)	SEE COLUMN 4	
	I -131	10	ND			
	BA-140	31	39(1/ 1)	C27 39(1/ 1)	SEE COLUMN 4	
	RU-106	71	ND			
	CS-137	9	ND			
	ZR-95	14	ND			
	MN-54	8	ND			
	ZN-65	18	ND			
	K - 40	72	1240(1/ 1)	C27 1240(1/ 1)	SEE COLUMN 4	

Table III-32a

INGESTION SHRIMP PATHWAY

SEMIANNUAL GAMMA ANALYSES (pCi/kg)

Nuclide	Preoperational Values		Operational Values		
	Median	95 Percentile	Median	Mean	95 Percentile
Ra-226	--	--	85.5	85.5	--
Th-232	--	36	25.0	25.0	--
I-131	<10	<10	<5.0	<5.0	--
Ba-140	<10	<10	19.5	19.5	--
Ru-106	--	--	<35.5	<35.5	--
Cs-137	<10	37	<4.5	<4.5	--
Zr-95	<10	<10	<7.0	<7.0	--
Mn-54	<80	<80	<4.0	<4.0	--
Zn-65	<160	<160	<9.0	<9.0	--
K-40	921.8	2514	<36.0	<36.0	--

INGESTION MILK PATHWAY

The University has the responsibility to collect and analyze milk. There are no additional stations for this pathway.

Monthly Gamma Analysis

The summary for the gamma analysis of the monthly samples is in Table III-33. The samples at Sample Station C49 were not collected due to the unavailability of milk. All other samples were collected and analyzed and all nuclides had annual average LLDs equal to or less than those required. Sample Station C49 is the critical station for this type of analysis. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-34.

The 1978 operational concentrations are similar to both the 1977 operational and the preoperational concentrations including Cs-137 which was elevated in 1977 due to the Chinese weapons tests fallout.

Monthly Sr-89 and 90 Analysis

The summary for the strontium analysis of the monthly samples is in Table III-35. The samples at Sample Station C49 were not collected due to the unavailablity of milk. All other samples were collected and analyzed and all nuclides had LLDs equal to or less than those required. Sample There is no critical station for this type of analysis. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-34.

The 1978 operational concentrations are similar to both the 1977 operational and the preoperational concentrations.

Table III-33

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
MILK (PCI/L) INGESTION	GAMMA ANALYSIS 24					0
	I -131	8	ND			
	BA-140	25	ND			
	CS-137	7	13(11/ 12)*C47 (8- 19)*	13(11/ 12)* (8- 19)*	13(11/ 12)* (8- 19)*	
	ZR- 95	10	ND			
	CS-134	7	6(1/ 12)*C47	6(1/ 12)*	6(1/ 12)*	
	CO-58	6	10(1/ 12)*C47	10(1/ 12)*	10(1/ 12)*	
	MN- 54	6	ND			
	CO- 60	6	5(1/ 12)*C47	5(1/ 12)*	5(1/ 12)*	

Table III-34

INGESTION MILK PATHWAY

STATISTICAL EVALUATION OF ANALYSES (pCi/kg)

Nuclide	Preoperational Values		Operational Values						
						Control Stations		Critical Stations	
	Median	95 Percentile	Median	Mean	95 Percentile	Mean	95 Percentile	Mean	95 Percentile
Gamma Analysis									
I-131*	<10	<10	<3.5	<3.9	<7.4	<3.9	<7.4	NC/M	NC/M
Ba-140	<30	<30	<12.3	<12.5	<21.1	<12.5	<21.1	NC/M	NC/M
Cs-137	16	22	<12.5	<12.2	<19.4	<12.2	<19.4	NC/M	NC/M
Zr-95	<20	<20	<5.5	<4.5	<8.5	<4.5	<8.5	NC/M	NC/M
Cs-134	<10	<10	<4.0	<3.5	<6.0	<3.5	<6.0	NC/M	NC/M
Mn-54	<10	<10	<2.8	<2.9	<5.4	<2.9	<5.4	NC/M	NC/M
Co-58	<10	<10	<3.0	<3.4	<7.8	<3.4	<7.8	NC/M	NC/M
Co-60	<10	<10	<3.0	<4.1	<8.5	<4.1	<8.5	NC/M	NC/M
Strontium Analysis									
Sr-89	--	--	<4.0	<4.1	<8.4	--	--	--	--
Sr-90	4.0	6.0	<2.0	<2.5	<6.2	--	--	--	--

*Critical nuclides for critical station

Table III-35

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
MILK (PCI/L) INGESTION	SR 89/90 ANALYSIS 24					0
	SR-90	0	3(11/ 12)*C47 (1- 7)	3(11/ 12) (1- 7)	3(11/ 12) (1- 7)	
	SR-89	6	6(3/ 12)*C47 (3- 10)	6(3/ 12) (3- 10)	6(3/ 12) (3- 10)	

INGESTION ANIMAL PATHWAY

The University has the responsibility to collect and analyze small terrestrial animals. There are no additional stations for this pathway.

Semiannual Gamma Analysis

The summary for the gamma analysis of the semiannual samples is in Table III-36. All samples were collected and analyzed and all nuclides had LLDs equal to or less than those required. There are no critical sample stations in this pathway. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-37.

The operational concentrations for 1978 are lower than both the 1977 operational and the preoperational concentrations. Cesium-137 is the exception with the 1978 concentration approaching preoperational levels after being elevated in 1977 due to the Chinese weapons test fallout.

Table III-36

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
ANIMALS (PCI/KG) INGESTION	GAMMA ANALYSIS 2					0
	RA-226	15	59(2/ 2)*C45 (45- 73)	59(2/ 2) (45- 73)	SEE COLUMN 4	
	TH-232	13	33(2/ 2)*C45 (15- 51)	33(2/ 2) (15- 51)	SEE COLUMN 4	
	I -131	8	ND			
	BA-140	24	ND			
	RU-106	56	ND			
	CS-137	12	144(2/ 2)*C45 (93- 194)	144(2/ 2) (93- 194)	SEE COLUMN 4	
	ZR -95	11	ND			
	MN -54	6	ND			
	ZN -65	14	ND			
	K - 40	139	2090(2/ 2)*C45 (1760- 2420)	2090(2/ 2) (1760- 2420)	SEE COLUMN 4	

Table III-37

INGESTION ANIMALS PATHWAY

SEMIANNUAL GAMMA ANALYSIS (pCi/kg)

Nuclide	Preoperational Values		Operational Values		
	Median	95 Percentile	Median	Mean	95 Percentile
Ra-226	--	720	59.0	59.0	97.8
Th-232	--	--	33.0	33.0	82.9
I-131	<10	100	<3.8	<3.8	<4.4
Ba-140	<10	<10	<23.5	<23.5	<33.2
Ru-106	--	--	<55.5	<55.5	<101.2
Cs-137	<10	80	143.5	143.5	283.5
Zr-95	<10	70	<5.3	<5.3	<10.1
Mn-54	<80	<80	<3.0	<3.0	<5.8
Zn-65	<160	160	<6.8	<6.8	<10.2
K-40	1656.5	3586.6	2090.0	2090.0	3004.7

FOOD CHAIN (GRASSES) PATHWAY

The University has the responsibility to collect and analyze grass samples. There are no additional stations for this pathway.

Semiannual Gamma Analysis

The summary for the gamma analysis of the semiannual samples is in Table III-38. Results for Stations C05 and C40 for the first half are not reported due to contamination by fallout from a Chinese weapons test. All other samples were collected and analyzed and all nuclides had annual average LLDs equal to or less than those required. There are no critical stations in this pathway. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-39.

The 1978 operational concentrations are similar to the 1977 operational and preoperational concentrations.

Table III-38

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
GRASS (PCI/KG) FOOD CHAIN	GAMMA ANALYSIS 6					0
	RA-226	17	52(4/ 4) (29- 89)	C40 59(1/ 1)	SEE COLUMN 4	
	TH-232	14	121(4/ 4) (20- 357)	C40 357(1/ 1)	SEE COLUMN 4	
	I -131	8	92(1/ 4)	C41 92(1/ 2)	SEE COLUMN 4	
	BA-140	26	ND			
	RU-106	67	<LLD(1/ 4)			
	CS-137	10	136(4/ 4) (36- 251)	C05 251(1/ 1)	SEE COLUMN 4	
	ZR- 95	13	ND			
	MN- 54	7	5(1/ 4)	C40 5(1/ 1)	SEE COLUMN 4	
	ZN- 65	15	ND			
	K - 40	157	2070(4/ 4) (440- 6320)	C41 3516(2/ 2) (711- 6320)	SEE COLUMN 4	

Table III-39

FOOD CHAIN (GRASSES) PATHWAY

SEMIANNUAL GAMMA ANALYSIS (pCi/kg)

Nuclide	Preoperational Values		Operational Values		
	Median	95 Percentile	Median	Mean	95 Percentile
Ra-226	--	2363	44.5	51.8	107.5
Th-232	--	120	52.5	120.5	432.7
I-131	<10	<10	<2.5	<24.8	<112.6
Ba-140	26	253	<7.5	<13.1	<35.9
Ru-106	--	--	<18.3	<53.0	<191.5
Cs-137	1363	5416	128.5	136.0	314.4
Zr-95	<10	31	<3.0	<6.3	<19.0
Mn-54	--	--	<3.3	<4.5	<11.7
Zn-65	--	589	<4.0	<7.5	<21.9
K-40	578.2	2430.2	759.5	2069.8	7631.8

INGESTION FOOD CROPS (CITRUS) PATHWAY

The State has the responsibility to collect and analyze citrus samples. There are no additional stations in this pathway.

Annual Gamma Analysis

The summary for the gamma analysis of the annual samples is in Table III-40. All samples were collected and analyzed and all nuclides had LLDs equal to or less than those required. There is no critical sample stations in this pathway. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-40a.

The 1978 operational concentrations were non detectable as were the 1977 operational and the preoperational concentrations except for Cs-137. Because this is an annual sample and Cs-137 was not found in 1977 or the preoperational data, this positive indication is considered to be spurious.

Table III-40

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	N
CITRUS (PCI/KG) INGESTION	GAMMA ANALYSIS 1					
	I- 131	24	ND			
	BA-140	24	ND			
	CO- 58	24	ND			
	CS-137	24	70(1/ 1)	C19 70(1/ 1)	SEE COLUMN 4	
	CS-134	24	ND			
	MN- 54	21	ND			
	ZN- 65	42	ND			
	CO- 60	24	ND			

Table III-40a

INGESTION FOOD CROPS (CITRUS) PATHWAY

ANNUAL GAMMA ANALYSIS (pCi/kg)

Nuclide	Preoperational Values		Operational Values		
	Median	95 Percentile	Median	Mean	95 Percentile
I-131	<10	<10	<12.0	<12.0	--
Ba-140	<10	<10	<12.0	<12.0	--
Co-58	<10	<10	<12.0	<12.0	--
Cs-137	<10	<10	70.0	70.0	--
Cs-134	<10	<10	<12.0	<12.0	--
Mn-54	<10	<10	<10.5	<10.5	--
Zn-65	--	--	<21.0	<21.0	--
Co-60	<10	<10	<12.0	<12.0	--

INGESTION FOOD CROPS (WATERMELON) PATHWAY

The State has the responsibility to collect and analyze watermelon samples. There are no additional stations in this pathway.

Annual Gamma Analysis

The summary for the gamma analysis of the annual samples is in Table III-41. All samples were collected and analyzed and all had LLDs equal to or less than those required. There is no critical sample station in this pathway. A statistical evaluation of the operational data is presented in Table III-41a. There was no preoperational data for this pathway and all 1978 operational analyses resulted in nondetectable activity as did the 1977 operational analyses.

Table III-41

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	N
WATERMELON (PCI/KG) INGESTION	GAMMA ANALYSIS 1					
	I- 131	24	ND			
	BA-140	24	ND			
	CO- 58	24	ND			
	CS-137	24	ND			
	CS-134	24	ND			
	MN- 54	21	ND			
	ZN- 65	42	ND			
	CO- 60	24	ND			

Table III-41a

INGESTION FOOD CROPS (WATERMELON) PATHWAY

ANNUAL GAMMA ANALYSIS (pCi/kg)

Nuclide	Operational Values	
	Mean	95 Percentile
I-131	<12.0	--
Ba-140	<12.0	--
Co-58	<12.0	--
Cs-137	<12.0	--
Cs-134	<12.0	--
Mn-54	<12.0	--
Zn-65	<12.0	--
Co-60	<12.0	--

FOOD CHAIN (SOIL) PATHWAY

The University has the responsibility to collect and analyze soil samples. There are no additional stations in this pathway. This pathway was sampled in 1978, even though it was not required, to show that sample LLDs could be met by improved techniques.

Gamma Analysis

The summary for the gamma analysis of the annual samples is in Table III-42. All samples were collected and analyzed and all nuclides had LLDs equal to or less than those required. There is no critical sample station in this pathway. A statistical evaluation of the operational data and a comparison with the preoperational data is presented in Table III-43.

The 1978 operational results are almost identical to the 1977 operational and the preoperational results.

Table III-42

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
SOIL (PCI/KG) FOOD CHAIN	GAMMA ANALYSIS 7					
	RA-226	9	372(7/ 7) (88- 784)	C41 784(1/ 1)	SEE COLUMN 4	
	TH-232	9	102(7/ 7) (41- 373)	C40 373(1/ 1)	SEE COLUMN 4	
	I -131	4	ND			
	BA-140	14	ND			
	RU-106	29	35(4/ 7) (29- 41)	C04 41(1/ 1)	SEE COLUMN 4	
	-137	4	128(6/ 7) (26- 325)	C04 325(1/ 1)	SEE COLUMN 4	
	ZR-95	6	4(1/ 7)	C26 4(1/ 1)	SEE COLUMN 4	
	MN-54	3	2(1/ 7)	C04 2(1/ 1)	SEE COLUMN 4	
	ZN-65	7	ND			
	K -40	34	154(4/ 7) (71- 261)	C46 261(1/ 1)	SEE COLUMN 4	

Table III-43

FOOD CHAIN (SOIL) PATHWAY

ANNUAL GAMMA ANALYSIS (pCi/kg)

Nuclide	Preoperational Values		Operational Values		
	Median	95 Percentile	Median	Mean	95 Percentile
Ra-226	--	2200	131.0	371.6	1012.3
Th-232	--	300	49.0	102.3	338.7
I-131	<10	<10	<2.0	<2.1	<3.5
Ba-140	<10	<10	<5.5	<6.8	<11.8
Ru-106	0	330	<29.0	<27.3	<47.9
Cs-137	270	1100	64.0	110.1	343.9
Zr-95	40	150	<3.5	<3.1	<5.5
Mn-54	<10	<10	<2.0	<1.6	<2.9
Zn-65	--	--	<2.5	<3.5	<6.3
K-40	713	1482	<71.0	<96.2	<286.9

FOOD CHAIN (MEAT) PATHWAY

The State has the responsibility to collect and analyze meat samples. There are no additional stations in this pathway.

Semiannual Gamma Analysis

The summary for the gamma analysis of the semiannual samples is in Table III-44. All samples were collected and analyzed and all nuclides had LLDs equal to or less than those required. There is no critical sample station in this pathway. A statistical evaluation of the operational data is presented in Table III-44a. There was no preoperational data for this pathway and all 1978 operational analyses resulted in nondetectable activity as did the 1977 operational analyses.

Table III-44

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
MEAT (PCI/KG) FOOD CHAIN	GAMMA ANALYSIS 2					0
	I- 131	38	ND			
	BA-140	39	ND			
	CO- 58	60	ND			
	CS-137	37	ND			
	CS-134	60	ND			
	MN- 54	32	ND			
	ZN- 65	66	ND			
	CO- 60	60	ND			

Table III-44a

FOOD CHAIN (MEAT) PATHWAY

SEMIANNUAL GAMMA ANALYSIS (pCi/kg)

Nuclide	Operational Values	
	Mean	95 Percentile
I-131	<19.0	<19.0
Ba-140	<19.5	<19.5
Co-58	<30.0	<30.0
Cs-137	<16.5	<16.5
Cs-134	<30.0	<30.0
Mn-54	<16.0	<16.0
Zn-65	<33.0	<33.0
Co-60	<30.0	<30.0

FOOD CHAIN (POULTRY) PATHWAY

The State has the responsibility to collect and analyze poultry samples. There are no additional stations in this pathway.

Semiannual Gamma Analysis

The summary for the gamma analysis of the semiannual samples is in Table III-45. All samples were collected and analyzed and all had LLDs equal to or less than those required. There is no critical sample station in this pathway. A statistical evaluation of the operational data is in Table III-45a. There is no preoperational data for this pathway.

The 1978 operational concentrations were non detectable as were the 1977 operational and the preoperational concentrations except for Cs-137 in the second half of 1978. This is considered spurious as Cs-137 has never been found in poultry before and there were no other detectable nuclides in the same sample.

Table III-45

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
POULTRY (PCI/KG) FOOD CHAIN	GAMMA ANALYSIS 2					0
	I- 131	38	ND			
	BA-140	39	ND			
	CO- 58	60	ND			
	CS-137	37	170(1/ 2)	C49 170(1/ 2)	SEE COLUMN 4	
	CS-134	60	ND			
	MN- 54	32	ND			
	ZN- 65	66	ND			
	CO- 60	60	ND			

Table III-45a

FOOD CHAIN (POULTRY) PATHWAY

SEMIANNUAL GAMMA ANALYSIS (pCi/kg)

Nuclide	Operational Values	
	Mean	95 Percentile
I-131	<19.0	<19.0
Ba-140	<19.5	<19.5
Co-58	<30.0	<30.0
Cs-137	<94.3	<304.2
Cs-134	<30.0	<30.0
Mn-54	<16.0	<16.0
Zn-65	<33.0	<33.0
Co-60	<30.0	<30.0

FOOD CHAIN (EGGS) PATHWAY

The State has the responsibility to collect and analyze egg samples. There are no additional stations in this pathway.

Semiannual Gamma Analysis

The summary for the gamma analysis of the semiannual samples is in Table III-46. All samples were collected and analyzed and all had LLDs equal to or less than those required. There is no critical sample station in this pathway. A statistical evaluation of the operational data is presented in Table III-46a. There was no preoperational data for this pathway and all 1978 operational analyses resulted in nondetectable activity as did all 1977 operational analyses.

Table III-46

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
EGGS (PCI/KG) FOOD CHAIN	GAMMA ANALYSIS 2					0
	I- 131	38	ND			
	BA-140	39	ND			
	CO- 58	60	ND			
	CS-137	37	ND			
	CS-134	60	ND			
	MN- 54	32	ND			
	ZN- 65	66	ND			
	CO- 60	60	ND			

Table III-46a

FOOD CHAIN (EGGS) PATHWAY

SEMIANNUAL GAMMA ANALYSIS (pCi/kg)

Nuclide	Operational Values	
	Mean	95 Percentile
I-131	<19.0	<19.0
Ba-140	<19.5	<19.5
Co-58	<30.0	<30.0
Cs-137	<18.5	<18.5
Cs-134	<30.0	<30.0
Mn-54	<16.0	<16.0
Zn-65	<33.0	<33.0
Co-60	<30.0	<30.0

FOOD CHAIN (GREEN LEAFY VEGETABLES) PATHWAY

The University has the responsibility to collect and analyze green leafy vegetable samples. There are no additional stations in this pathway. Five additional samples were collected at each station as part of the Enhanced Sampling Program for the gamma analysis.

Semiannual Gamma Analysis

The summary for the gamma analysis of the semiannual samples is in Table III-47. All samples were collected and analyzed and all nuclides had LLDs that were equal to or less than those required. The critical station for this type of analysis (Sample Station C48) is in the east sector at 4.5 miles from the plant. A statistical evaluation of the operational data is presented in Table III-48. There is no preoperational data for this pathway.

The 1978 operational concentrations are similar to the 1977 operational concentrations.

Semiannual Sr-90 Analysis

The summary for the gamma analysis of the semiannual samples is in Table III-49. All samples were collected and analyzed and all nuclides had LLDs that were equal to or less than those required. There is no critical station for this type of analysis. A statistical evaluation of the operational data is presented in Table III-48. There is no preoperational data for this pathway and the 1977 operational data showed no detectable activity. The 1978 samples showed no detectable activity but the first half samples collected subsequent to the fallout from a Chinese weapons test. This is probably the cause for the higher than normal activity.

Table III-47

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
GREEN LEAF VE (PCI/L)	GAMMA ANALYSIS 24					0
	RA-226	17	52(13/ 13)*C48 (34- 148)	61(7/ 7)* (34- 148)	43(6/ 6)* (34- 62)	
	TH-232	15	62(12/ 13)*C47 (20- 166)	95(6/ 6)* (20- 166)	95(6/ 6)* (20- 166)	
	I-131	20	6(1/ 13)*C47	6(1/ 6)*	6(1/ 6)*	
	BA-140	40	21(2/ 13)*C48 (20- 21)	21(1/ 7)*	20(1/ 6)*	
	RU-106	59	62(1/ 13)*C47	62(1/ 6)*	62(1/ 6)*	
	CS-137	9	360(13/ 13)*C48 (6- 2070)	656(7/ 7)* (77- 2070)	16(6/ 6)* (6- 41)	
	ZR-95	12	8(1/ 13)*C48	8(1/ 7)*	0(0/ 6)*	
	MN-54	7	ND			
	ZN-65	17	ND			
	K-40	142	2438(13/ 13)*C47 (1503- 4230)	2598(6/ 6)* (1780- 3780)	2598(6/ 6)* (1780- 3780)	

Table III-48

FOOD CHAIN (GREEN LEAFY VEGETABLES) PATHWAY

STATISTICAL EVALUATION OF ANALYSES (pCi/kg)

Nuclide	Operational Values					
			Control Stations		Critical Stations	
	Mean	95 Percentile	Mean	95 Percentile	Mean	95 Percentile
Gamma Analysis						
Ra-225	52.5	112.5	42.7	63.9	60.9	139.2
Th-232	<63.4	<154.1	94.5	193.5	<36.7	<74.1
I-131*	<10.3	<40.2	<10.0	<42.8	<10.6	<40.3
Ba-140	<22.1	<62.1	<19.0	<58.9	<24.7	<67.3
Ru-106	<32.2	<96.7	<27.0	<61.3	<36.7	<121.1
Cs-137	360.3	1669.9	15.5	41.3	655.9	2262.5
Zr-95	<6.1	<17.6	<4.4	<6.8	<7.6	<23.0
Mn-54	<3.3	<10.5	<2.5	<3.4	<4.0	<14.0
Zn-65	<8.3	<26.2	<6.1	<7.7	<10.3	<34.7
K-40	2438.2	4024.8	2598.3	4012.8	2301.0	4085.4
Strontium Analysis						
Sr-90	16.3	54.6	--	--	--	--

*Critical nuclides for critical station

Table III-49

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
G.L.VEG PCI/KG FOOD CHAIN	SR-90 ANALYSIS 4					0
	SR-90	1	16(4/ 4)(1-42)	C48 22(2/ 2)(1-42)	SEE COLUMN 4	

IV. EXTERNAL RADIATION

The External Radiation portion of the Radiological Environmental Monitoring Program (Specification 3.2.3) is split between the University and the State (See Table I-1). The University also has a TLD at Sample Station C47 and the State has additional TLDs at Sample Stations C04, C40, and C46. The summaries for the University's data is in Table IV-1 and for the State's data in Table IV-2. Because of vandalism, the University's TLDs at Sample Station C04 were lost and because of construction, those at C43 were lost for the third quarter. No other TLDs were lost during the report period. Sample Stations C14H, C14M, and C14G are the critical stations in this pathway.

Table IV-3 presents a statistical summary of all data. The 1978 data from all TLD stations compares very well with the 1977 data and the preoperational data. Additionally, the critical stations and the control stations of the University also compare very well. However, because the University and the State use different types of TLDs, it is necessary to report their results separately.

Table IV-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
AIR SUBMERSION (MREM/YR)						
U OF F	EXTERNAL RADIATION	36	15	47 (36/ 36) C47	59 (4/ 4)	46 (24/ 24)	0
				(22- 70)	(53- 66)	(22- 70)	

Table IV-2

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

CRYSTAL RIVER UNIT 3 DOCKET NO. 50-302

CITRUS COUNTY, FLORIDA REPORTING PERIOD 01/01/78-12/31/78

PATHWAY	TYPE & NO.	LLD	ALL LOCATIONS	HIGHEST MEAN LOCATION	CONTROL LOCATION	NRR
AIR SUBMERSION (MREM/YR)						
STATE	EXTERNAL RADIATION	28	20	38 (28/ 28)	C26	49 (4/ 4)	SEE COLUMN 4	
				(26- 54)		(35- 54)		

Table IV-3

EXTERNAL RADIATION PATHWAY

QUARTERLY TLD ANALYSIS (mrem/yr)

	Median Value	Mean Value	95 Percentile Value
Preoperational	62	--	77
All Stations	44	42.5	65.9
State	35	35.8	59.9
University (All Stations)	48	47.9	65.5
University (Critical Stations)	48	48.0	60.3
University (Control Stations)	48	47.8	47.8