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April 16, 1991

U.S. Nuclear Regulatory Commission  
Mail Station P1-137  
Washington, D.C. 20555

Attention: Document Control Desk

Subject: Grand Gulf Nuclear Station  
Unit 1  
Docket No. 50-416  
License No. NPF-29  
Annual Radiological Environmental Operating Report for 1990

GNRO-91/00068

Gentlemen:

In accordance with the Grand Gulf Nuclear Station Unit 1 Technical Specifications 6.9.1.6 and 6.9.1.7, attached is the Annual Radiological Environmental Operating Report for the period January 1, 1990 through December 31, 1990.

Yours truly,

*W. Y. Cottle*

WTC/WBB/mtc

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# **GRAND GULF NUCLEAR STATION**

**1990 ANNUAL RADIOLOGICAL ENVIRONMENTAL**

**OPERATING REPORT**



### SUMMARY

The Annual Radiological Environmental Operating Report (AREOR) presents data obtained through analyses of environmental samples collected for the Grand Gulf Nuclear Station (GGNS) Environmental Surveillance Program (ESP) for the period January 1, 1990 through December 31, 1990.

An assessment of plant operation by ESP personnel using AREOR data concluded that no significant relationship exists between GGNS operation and effect on the environs surrounding the Plant. As in previous years, radiation levels in the environment were undetectable in many cases and at or near background levels in significant pathways associated with GGNS. Therefore, ESP personnel concluded that GGNS operation has had no harmful effects nor resulted in any irreversible damage to the environment.

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II	1990 Thermoluminescent Dosimetry Report .....	II-i

SECTION 1.0  
INTRODUCTION

## INTRODUCTION

### 1.1 SCOPE

The Annual Radiological Environmental Operating Report (AREOR) presents data obtained through analyses of environmental samples collected for the Grand Gulf Nuclear Station (GGNS) Environmental Surveillance Program (ESP) for the period January 1, 1990 through December 31, 1990. The AREOR fulfills the requirements of GGNS Technical Specifications 6.9.1.6 and 6.9.1.7.

### 1.2 PURPOSE AND DESIGN CRITERIA OF THE ENVIRONMENTAL SURVEILLANCE PROGRAM (ESP)

The purpose of the ESP is:

- o To measure radiation levels and their variations in environmental media in the area surrounding the plant
- o To determine average levels of radiation and radioactive material in various environmental media
- o To evaluate environmental sampling procedures, equipment and techniques
- o To detect effects, if any, of GGNS operation on the environmental radiation levels and concentrations.

The design criteria for the ESP are:

- o To analyze important pathways for anticipated types and quantities of radionuclides released into the environment
- o To consider the possibility of a buildup of long-lived radionuclides in the environment and identify physical and biological accumulations that may contribute to human exposures
- o To consider the potential radiation exposure to plant and animal life in the environment surrounding GGNS
- o To correlate levels of radiation and radioactivity in the environment with radioactive releases from station operation.

### 1.3 DOSE PATHWAYS ASSOCIATED WITH GGNS

The most significant environmental dose pathways from a nuclear power station are direct dose from gaseous effluent and thyroid dose due to the ingestion of milk. GGNS operations are expected to have little, if any, impact by these pathways due to the very low levels of radiation released, the remote location of the station and the absence of milking animals within five miles of GGNS. Also, since the first use of Mississippi River water as drinking water is more than 200 miles downstream of GGNS, the dose from the drinking water pathway is expected to be minimal.

### 1.4 PREVIOUS DATA COMPARISON

A comparison by ESP personnel of 1990 ESP results to preoperational studies, operational controls and previous AREORs shows no significant changes. As in previous years, ESP results remained at or near background levels. Such results confirm that GGNS effluent controls and equipment are performing satisfactorily.

## SECTION 2.0

### ENVIRONMENTAL SURVEILLANCE PROGRAM

- INTERPRETATIONS AND TRENDS  
OF RESULTS
- DEVIATIONS FROM THE ESP
- PROGRAM DESCRIPTION



## 2.1 AIR PARTICULATES AND RADIOIODINES

NOTE: Analytical results are presented in Tables 1.1 through 1.12c of Attachment I and summarized in Section 4.0.

#### 2.1.1 INTERPRETATIONS AND TRENDS OF RESULTS

Air particulate and Iodine-131 results for 1990 were similar to those obtained in previous years of the operational and preoperational ESP. Results from 1990 indicate the airborne exposure pathway has not been affected by the operation of GGNS and that airborne concentrations continue to be at or near background levels.

During 1990, a small concentration of Iodine-131 was detected in an air sample that was collected from Newellton, Louisiana as shown in Table 4-2. Although the source was never determined, an investigation by ESP and plant personnel showed no relationship to plant activity and the incident did not recur.

Air particulate indicator and control locations produced similar values in 1990. This emphasizes the fact that air particulate levels remained at or near background and have been uninfluenced by the operation of GGNS. This point is illustrated in Figures 2-1 and 2-2. These figures show that the control location and indicator locations had similar average values during 1990 (Figure 2-1) and for the past four years (Figure 2-2).

Yearly average gross beta-emitting radionuclide activity from 1979 through 1990 in Figure 2-3 further emphasizes that GGNS has had no influence on ambient radiation levels. This figure shows a twelve year trend for each indicator location compared to the control location. Control and indicator values were equivalent over the twelve-year period which includes operational and preoperational data.

Environmental Surveillance Program personnel made an independent verification of the accuracy of GGNS results through the use of Mississippi State Department of Health and GGNS collocated air sampling stations. Figure 2-4 indicates that consistent, valid data is being collected based on the similarity of results.

#### 2.1.2 DEVIATIONS FROM THE ESP

Seven air samples required by GGNS Technical Specifications were either missed or deviated from the continuous sampler operation in 1990. Listed below are those deviations that occurred:

- 71.9 hours run time for AS-07 ending on January 2, 1990 due to blown fuse
- 78.6 hours run time for AS-07 ending on January 30, 1990 due to vacuum failure
- 42.4 hours run time for AS-03 ending on February 13, 1990 due to blown fuse
- missed sample for AS-06 ending on May 1, 1990 due to mechanical failure
- 135.1 hours run time for AS-07 ending on August 28, 1990 due to blown fuse
- 53.1 hours run time for AS-07 ending on September 11, 1990 due to blown fuse
- missed sample for AS-03 ending on October 16, 1990 due to mechanical failure.

Footnote (a) to GGNS Technical Specifications Table 3.12.1-1 permits deviations from the required sampling schedule if specimens are unobtainable due to malfunction of automatic sampling equipment. No other deviations occurred.

#### 2.1.3 PROGRAM DESCRIPTION

The GGNS Environmental Surveillance Program used eleven continuous air samplers to provide gross beta-emitting radionuclides, gamma-emitting radionuclides and radioiodine activity measurements by the airborne exposure pathway. These

air samplers were placed at distances from 0 to 18 miles, as shown in Figures 2-5 through 2-7 and Table 2-1. Five of the air samplers were used to meet the requirements of GGNS Technical Specification 4.12.1. Placement of the five required air samplers is as follows:

- o Three near the SITE BOUNDARY in areas of the highest calculated annual average groundlevel D/Q values
- o One in a community that has the highest calculated annual average groundlevel D/Q value (Port Gibson)
- o One in a control location (Vicksburg, MS).

The remaining six air samplers were located in areas which provide additional data for the ESP.

The air samplers were placed one meter above the ground in weatherproof houses. A 2-inch glass fiber filter was installed in the intake line of the vacuum pump with a 2 x 1-inch charcoal cartridge located directly downstream. Flows were adjusted to 1.25 cubic feet per minute. Filters and cartridges were changed weekly and analyzed for gross beta-emitting radionuclides and radioiodine activity, respectively. In addition, the filters were composited quarterly and analyzed for gamma-emitting radionuclides.

TABLE 2-1

AIR SAMPLE COLLECTION SITES

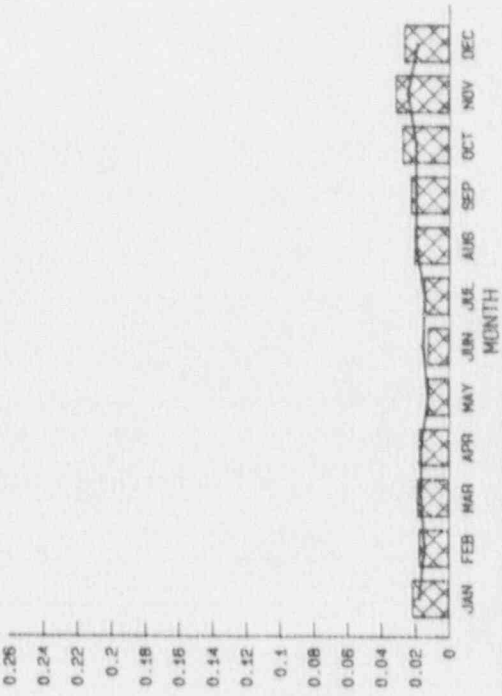
<u>AIR SAMPLE NUMBER</u>	<u>LOCATION</u>
*AS-1 PG	Southeast of GGNS at the Port Gibson City Barn (Sector G, Radius 5.5 miles)
AS-2 61N	North-northeast of GGNS on Hwy. 61, across from the Yokena Church (Sector B, Radius 13 miles)
*AS-3 61VA	North-northeast of GGNS on Hwy. 61, north of the Vicksburg Airport (Sector B, Radius 18 miles)
AS-4 GJCE	Southwest of GGNS, Glodjo property on Bald Hill Road (Sector L, Radius 0.9 miles)
AS-5 TC	South of GGNS behind the Support Services Center (Sector J, Radius 0.4 miles)
*AS-6 RS	Northeast of GGNS, south side of Grand Gulf Road (Sector C, Radius 0.5 miles)
*AS-7 MT	North of GGNS, located next to the Meteorological Tower (Sector A, Radius 0.8 miles)
*AS-8 WR	East of GGNS, located at former site of Maggie Jackson's trailer on Bald Hill Road near the eastern SITE BOUNDARY. (Sector E, Radius 0.6 miles)
AS-9 GGMP	North of GGNS, located in Grand Gulf Military Park (Sector A, Radius 1.5 miles)
AS-10 NLT	West-northwest of GGNS, located at Newellton, Louisiana (Sector P, Radius 12.5 miles)
AS-11 STJ	West-southwest of GGNS, located at St. Joseph, Louisiana (Sector M, Radius 13.0 miles)

\* Technical Specification requirements



FIGURE 2-1  
 Page 1 of 3  
 AIR SAMPLES, MONTHLY AVERAGE  
 GROSS BETA-EMITTING RADIONUCLIDE  
 CONCENTRATIONS, 1990

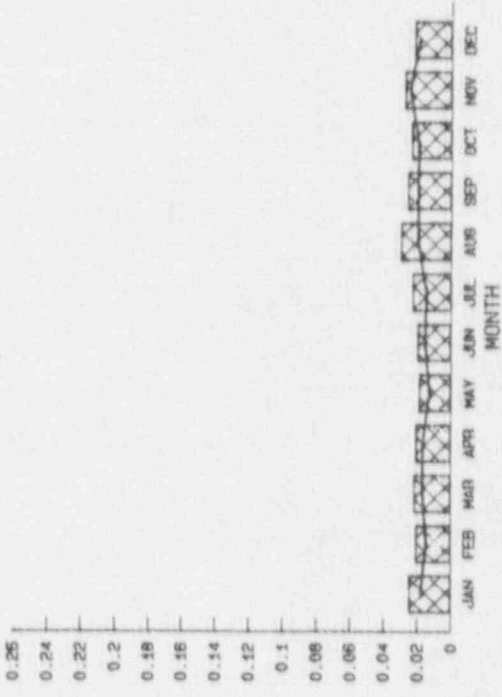
AIR SAMPLER STATION AS-1  
 PORT GIBSON  
 SECTOR 6, RADIUS 5.5 MILES  
 1990 GROSS BETA ACTIVITY pCi/m<sup>3</sup>



NOTE: TECHNICAL SPECIFICATIONS REQUIREMENT (CONTROL)

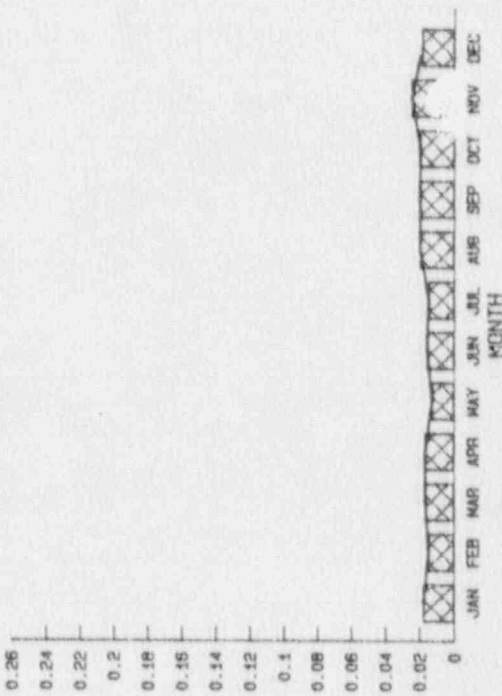
AS-3 VIKERS AIRPORT  
 CONTROL LOCATION

AIR SAMPLER STATION AS-2  
 HWY. 61 YOKENA CHURCH  
 SECTOR 8, RADIUS 13 MILES  
 1990 GROSS BETA ACTIVITY pCi/m<sup>3</sup>



AS-3 VIKERS AIRPORT  
 CONTROL LOCATION

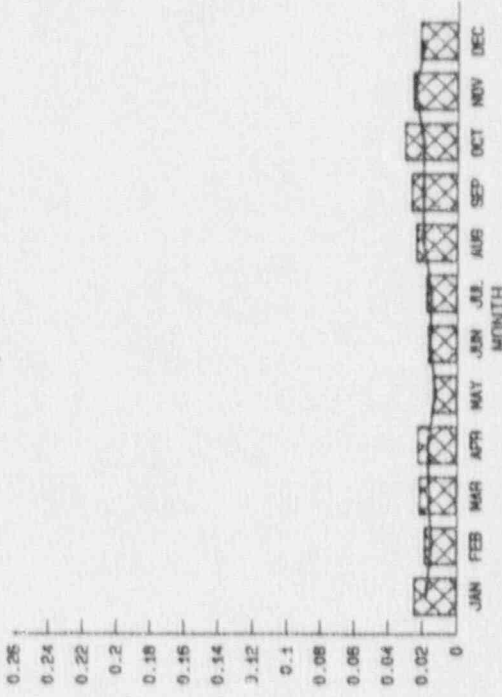
AIR SAMPLER STATION AS-3  
 HWY. 61 VICKSBURG AIRPORT  
 SECTOR 8, RADIUS 18 MILES  
 1990 GROSS BETA ACTIVITY pCi/m<sup>3</sup>



NOTE: TECHNICAL SPECIFICATIONS REQUIREMENT (CONTROL)

AS-3 VIKERS AIRPORT  
 CONTROL LOCATION

AIR SAMPLER STATION AS-4  
 GLODJO PROPERTY  
 SECTOR 1, RADIUS 0.9 MILES  
 1990 GROSS BETA ACTIVITY pCi/m<sup>3</sup>



AS-3 VIKERS AIRPORT  
 CONTROL LOCATION

FIGURE 2-1 (cont'd)

Page 2 of 3

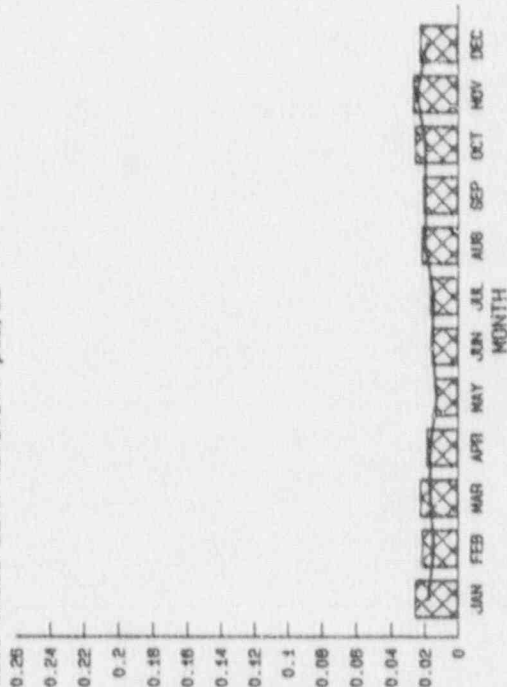
AIR SAMPLES, MONTHLY AVERAGE  
GROSS BETA-EMITTING RADIONUCLIDE  
CONCENTRATIONS, 1990

### AIR SAMPLER STATION AS-5

SUPPORT SERVICES CENTER

SECTOR J, RADIUS 0.4 MILES

1990 GROSS BETA ACTIVITY pCi/m<sup>3</sup>



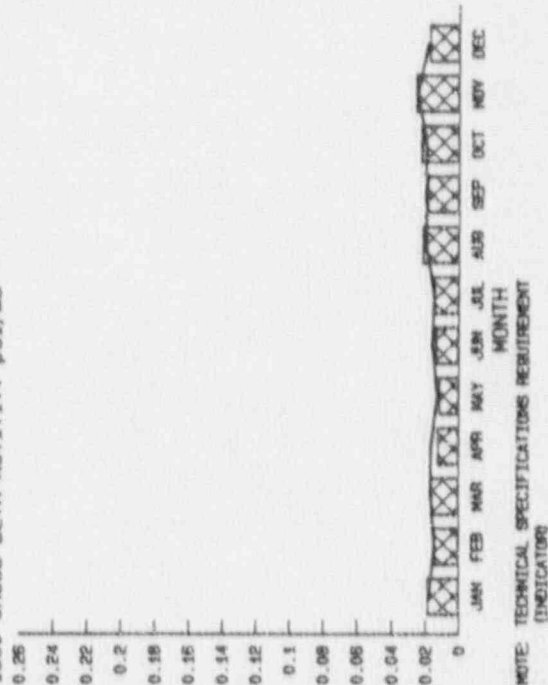
AS-3 VULBRO AIRPORT  
CONTROL LOCATION

### AIR SAMPLER STATION AS-6

ROADSIDE

SECTOR C, RADIUS 0.5 MILES

1990 GROSS BETA ACTIVITY pCi/m<sup>3</sup>



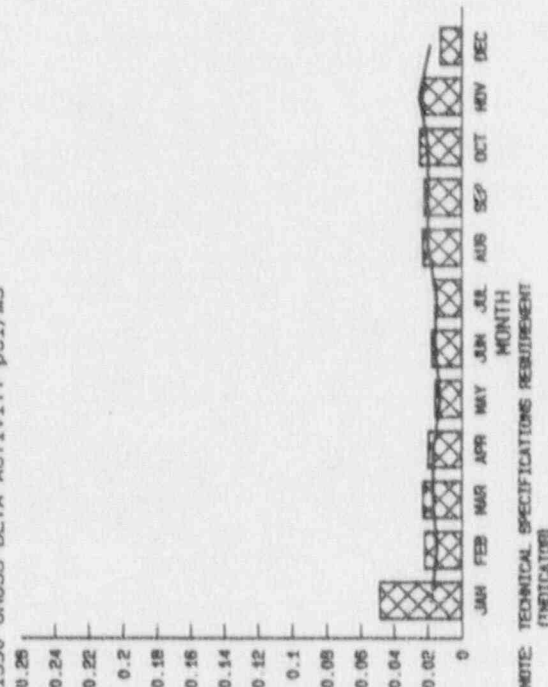
AS-3 VULBRO AIRPORT  
CONTROL LOCATION

### AIR SAMPLER STATION AS-7

METEOROLOGICAL TOWER

SECTOR A, RADIUS 0.8 MILES

1990 GROSS BETA ACTIVITY pCi/m<sup>3</sup>



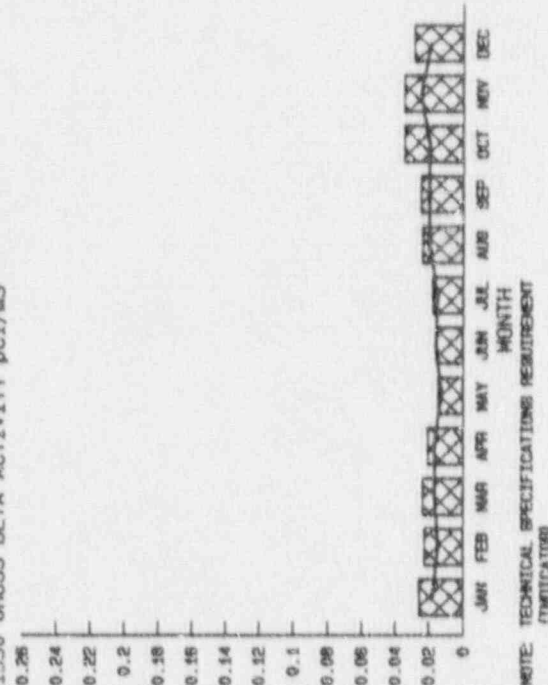
AS-3 VULBRO AIRPORT  
CONTROL LOCATION

### AIR SAMPLER STATION AS-8

FORMER SITE OF MAGGIE JACKSON'S TRAILER

SECTOR E, RADIUS 0.6 MILES

1990 GROSS BETA ACTIVITY pCi/m<sup>3</sup>

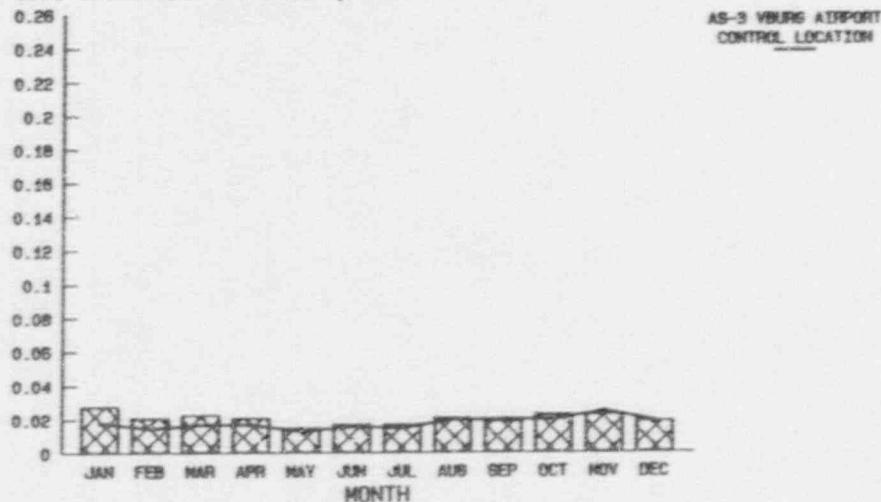


AS-3 VULBRO AIRPORT  
CONTROL LOCATION

FIGURE 2-1 (cont'd)  
 Page 3 of 3  
 AIR SAMPLES, MONTHLY AVERAGE  
 GROSS BETA-EMITTING RADIONUCLIDE  
 CONCENTRATIONS, 1990

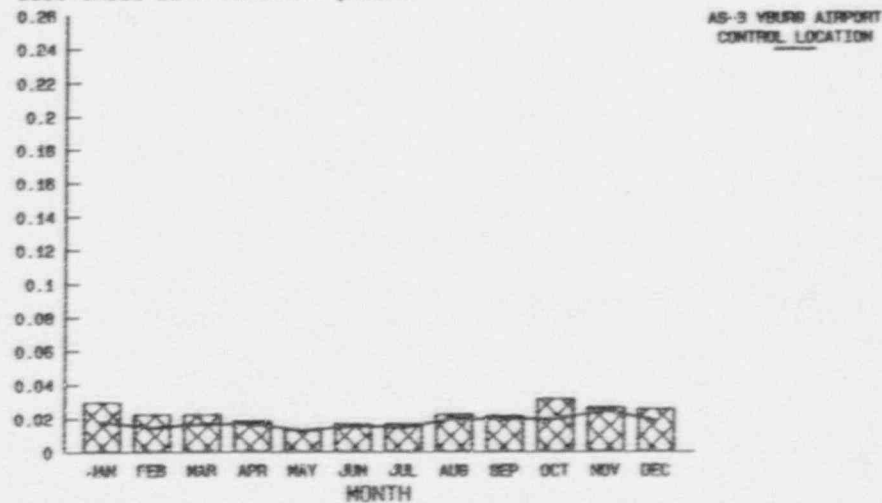
**AIR SAMPLER STATION AS-9**  
 GRAND GULF MILITARY PARK  
 SECTOR A, RADIUS 1.5 MILES

1990 GROSS BETA ACTIVITY pCi/m<sup>3</sup>



**AIR SAMPLER STATION AS-10**  
 NEWELLTON, LOUISIANA  
 SECTOR P, RADIUS 12.5 MILES

1990 GROSS BETA ACTIVITY pCi/m<sup>3</sup>



**AIR SAMPLER STATION AS-11**  
 ST. JOSEPH, LOUISIANA  
 SECTOR M, RADIUS 13.0 MILES

1990 GROSS BETA ACTIVITY pCi/m<sup>3</sup>

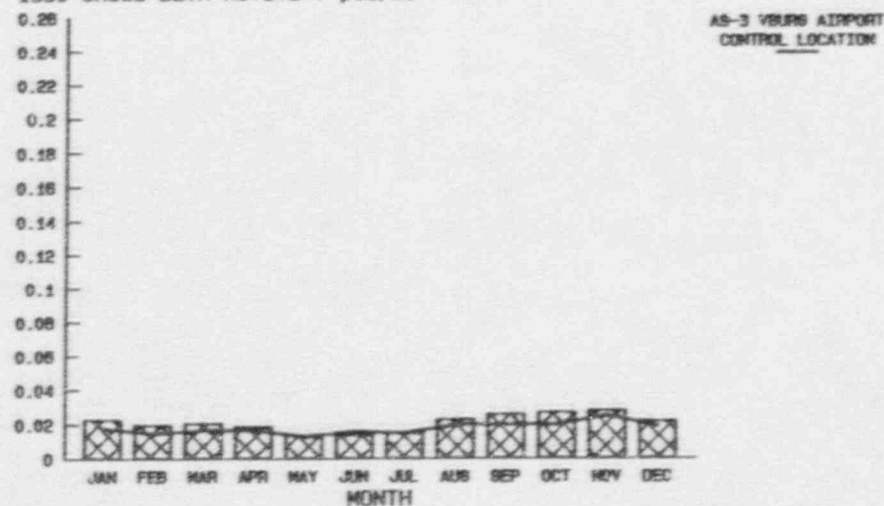
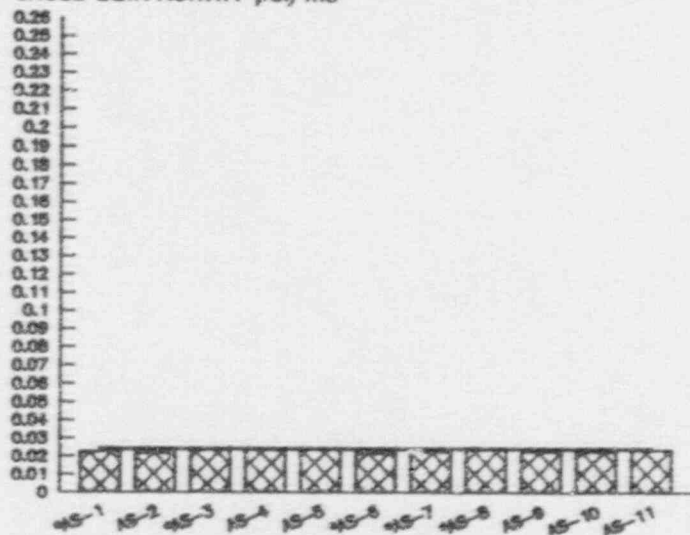


FIGURE 2-2  
AIR SAMPLES, YEARLY AVERAGE  
GROSS BETA-EMITTING RADIONUCLIDE  
CONCENTRATIONS, 1987-1998

1987 AVERAGE GROSS BETA ACTIVITY

AIR SAMPLER STATIONS AS-1 THROUGH AS-11

GROSS BETA ACTIVITY pCi/m<sup>3</sup>



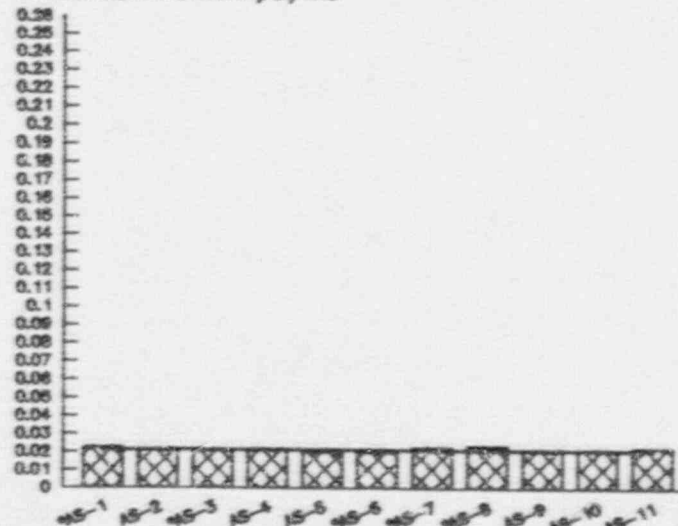
NOTE: \* TECHNICAL SPECIFICATIONS REQUIREMENT

AS-3 VEBURG AIRPORT  
CONTROL LOCATION

1988 AVERAGE GROSS BETA ACTIVITY

AIR SAMPLER STATIONS AS-1 THROUGH AS-11

GROSS BETA ACTIVITY pCi/m<sup>3</sup>



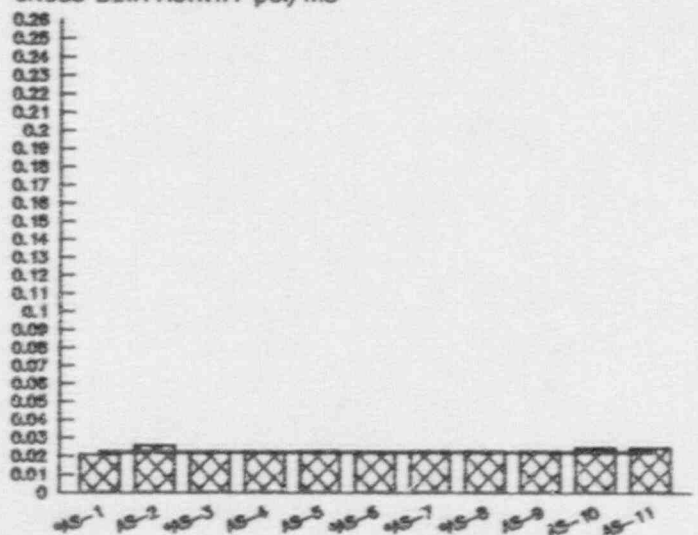
NOTE: \* TECHNICAL SPECIFICATIONS REQUIREMENT

AS-3 VEBURG AIRPORT  
CONTROL LOCATION

1989 AVERAGE GROSS BETA ACTIVITY

AIR SAMPLER STATIONS AS-1 THROUGH AS-11

GROSS BETA ACTIVITY pCi/m<sup>3</sup>



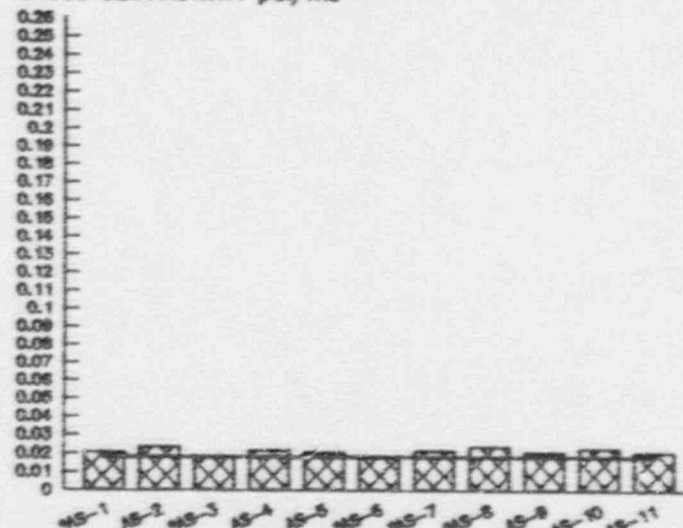
NOTE: \* TECHNICAL SPECIFICATIONS REQUIREMENT

AS-3 VEBURG AIRPORT  
CONTROL LOCATION

1990 AVERAGE GROSS BETA ACTIVITY

AIR SAMPLER STATIONS AS-1 THROUGH AS-11

GROSS BETA ACTIVITY pCi/m<sup>3</sup>



NOTE: \* TECHNICAL SPECIFICATIONS REQUIREMENT

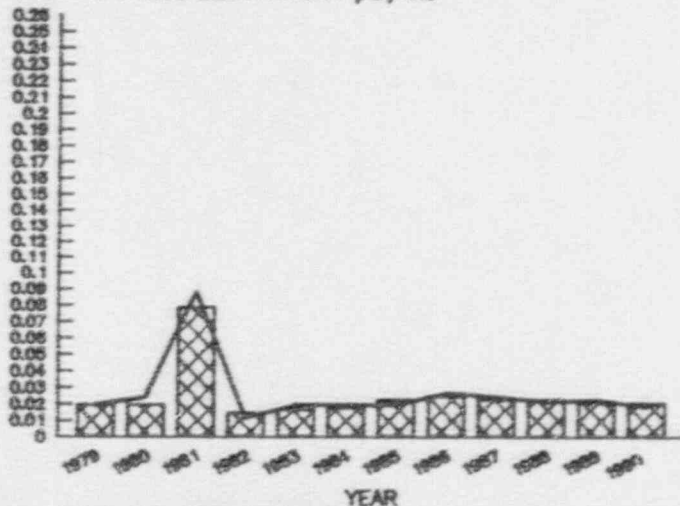
AS-3 VEBURG AIRPORT  
CONTROL LOCATION

FIGURE 2-3  
Page 1 of 3  
AIR SAMPLES, YEARLY AVERAGE COMPARISON  
GROSS BETA-EMITTING RADIONUCLIDE  
CONCENTRATIONS, 1979-1990 \*

AIR SAMPLER STATION AS-1

PORT GIBSON  
SECTOR G, RADIUS 5.5 MILES

AVERAGE GROSS BETA ACTIVITY pCi/m<sup>3</sup>



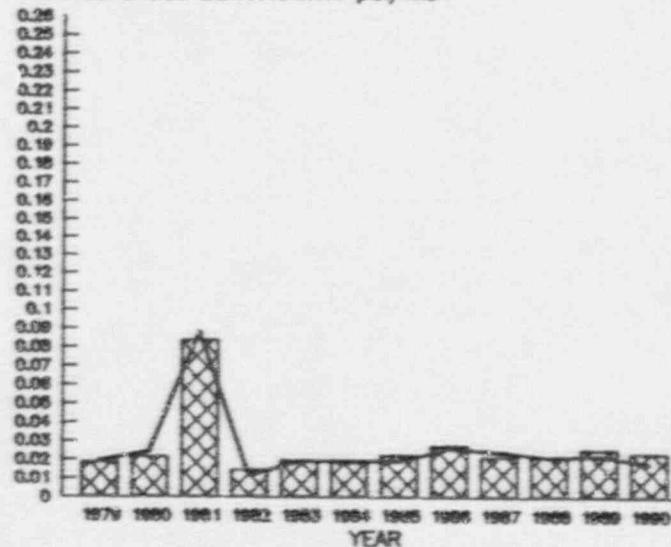
NOTE: TECHNICAL SPECIFICATIONS REQUIREMENT  
(CONTROL)

AS-3 VIBURG AIRPORT  
CONTROL LOCATION

AIR SAMPLER STATION AS-2

HWY. 61 YOKENA CHURCH  
SECTOR B, RADIUS 13 MILES

AVERAGE GROSS BETA ACTIVITY pCi/m<sup>3</sup>

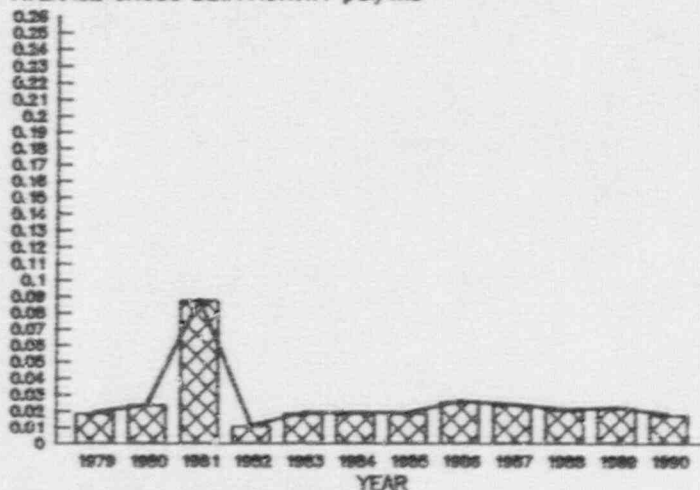


AS-3 VIBURG AIRPORT  
CONTROL LOCATION

AIR SAMPLER STATION AS-3

HWY. 61 VICKSBURG AIRPORT  
SECTOR B, RADIUS 18 MILES

AVERAGE GROSS BETA ACTIVITY pCi/m<sup>3</sup>



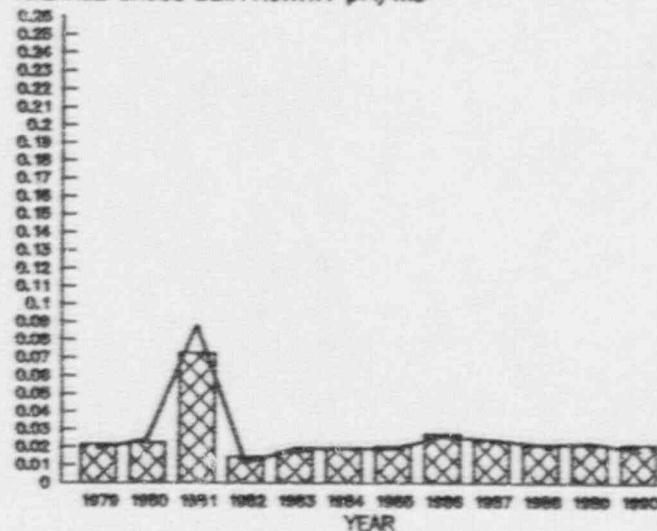
NOTE: TECHNICAL SPECIFICATIONS REQUIREMENT  
(CONTROL)

AS-3 VIBURG AIRPORT  
CONTROL LOCATION

AIR SAMPLER STATION AS-4

GLODJO PROPERTY  
SECTOR L, RADIUS 0.9 MILES

AVERAGE GROSS BETA ACTIVITY pCi/m<sup>3</sup>



AS-3 VIBURG AIRPORT  
CONTROL LOCATION

\* 1981 elevated levels due to Chinese nuclear test explosion.

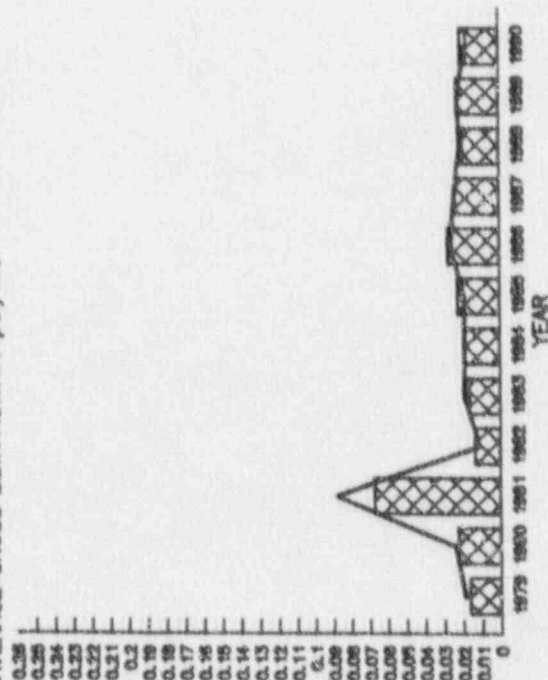


FIGURE 2-3 (cont'd)

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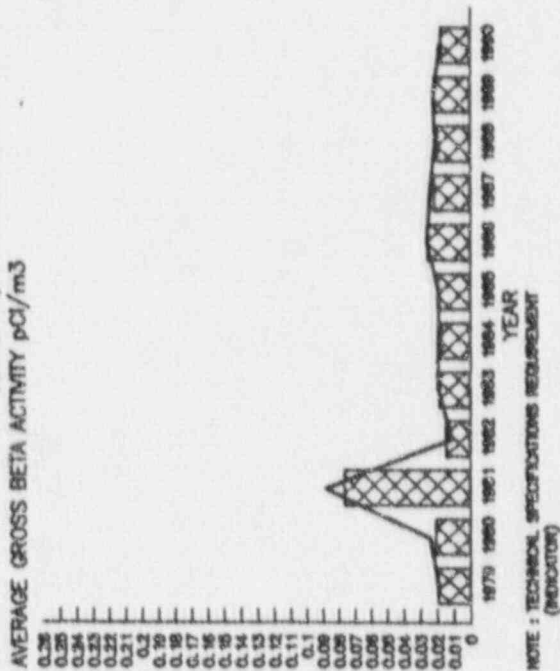
AIR SAMPLES, YEARLY AVERAGE COMPARISON  
GROSS BETA-EMITTING RADIONUCLIDE  
CONCENTRATIONS, 1979-1990 \*

AIR SAMPLER STATION AS-5  
SUPPORT SERVICES CENTER  
SECTOR J, RADIUS 0.4 MILES  
AVERAGE GROSS BETA ACTIVITY pCi/m<sup>3</sup>



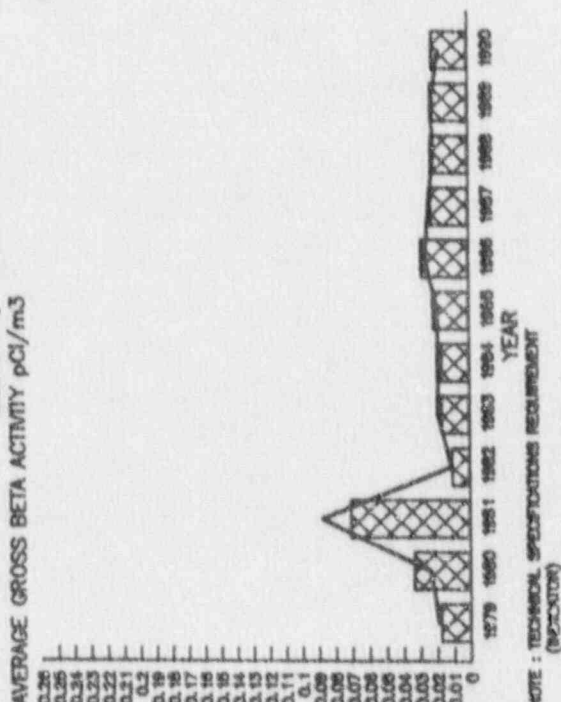
AS-3 VULBERG AIRPORT  
CONTROL LOCATION

AIR SAMPLER STATION AS-6  
ROADSIDE  
SECTOR C, RADIUS 0.5 MILES  
AVERAGE GROSS BETA ACTIVITY pCi/m<sup>3</sup>



AS-3 VULBERG AIRPORT  
CONTROL LOCATION

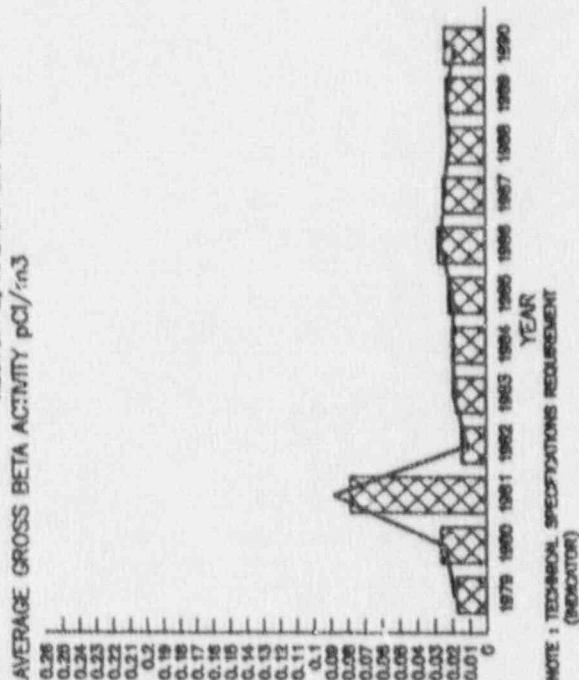
AIR SAMPLER STATION AS-7  
METEOROLOGICAL TOWER  
SECTOR A, RADIUS 0.8 MILES  
AVERAGE GROSS BETA ACTIVITY pCi/m<sup>3</sup>



NOTE: TECHNICAL SPECIFICATIONS REQUIREMENT  
(INDICATOR)

AS-3 VULBERG AIRPORT  
CONTROL LOCATION

AIR SAMPLER STATION AS-8  
FORMER SITE OF MAGGIE JACKSON'S TRAILER  
SECTOR E, RADIUS 0.6 MILES  
AVERAGE GROSS BETA ACTIVITY pCi/m<sup>3</sup>



NOTE: TECHNICAL SPECIFICATIONS REQUIREMENT  
(INDICATOR)

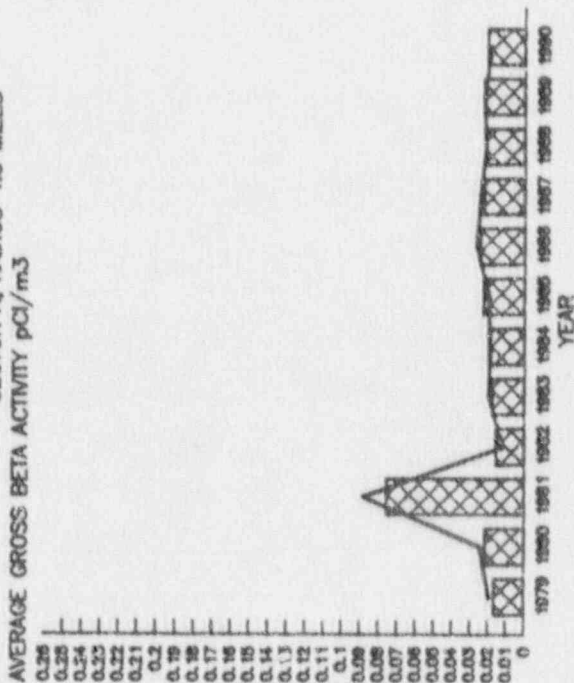
AS-3 VULBERG AIRPORT  
CONTROL LOCATION

\* 1981 elevated levels due to Chinese nuclear test explosion.

AIR SAMPLES, YEARLY AVERAGE COMPARISON  
GROSS BETA-EMITTING RADIONUCLIDE  
CONCENTRATIONS, 1979-1990 \*

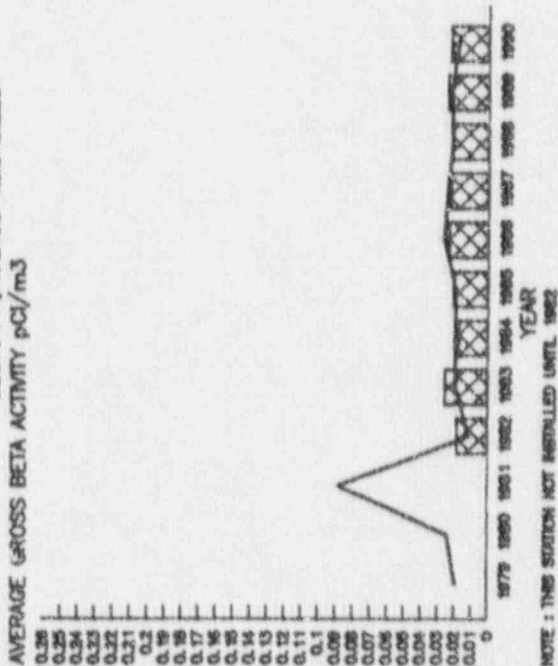
AIR SAMPLER STATION AS-9

GRAND GULF MILITARY PARK  
SECTOR A, RADIUS 1.5 MILES



AIR SAMPLER STATION AS-10

NEWELLTON, LOUISIANA  
SECTOR P, RADIUS 12.5 MILES



AIR SAMPLER STATION AS-11

ST. JOSEPH, LOUISIANA  
SECTOR M, RADIUS 13.0 MILES

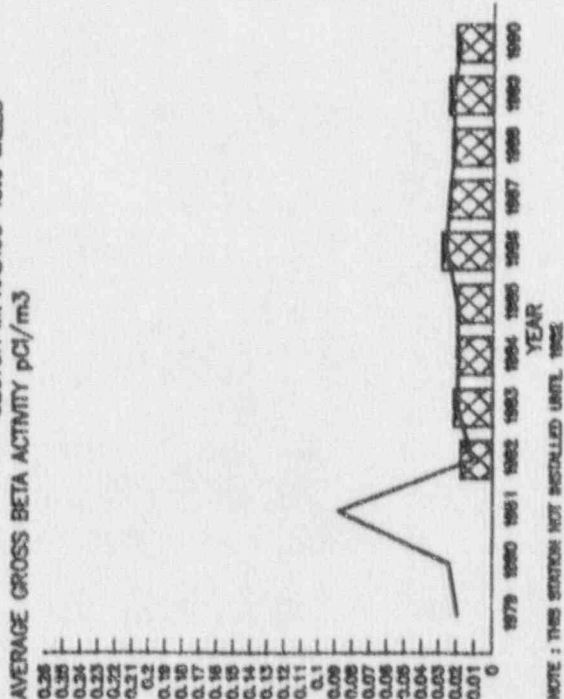


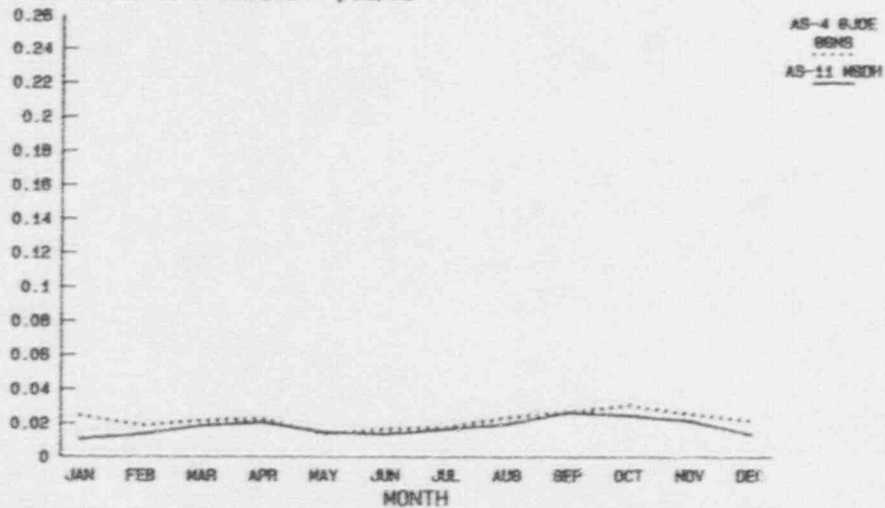
FIGURE 2-4

AIR SAMPLES COLLOCATED

GGNS/MSDH COLLOCATED AIR SAMPLER STATIONS

1990

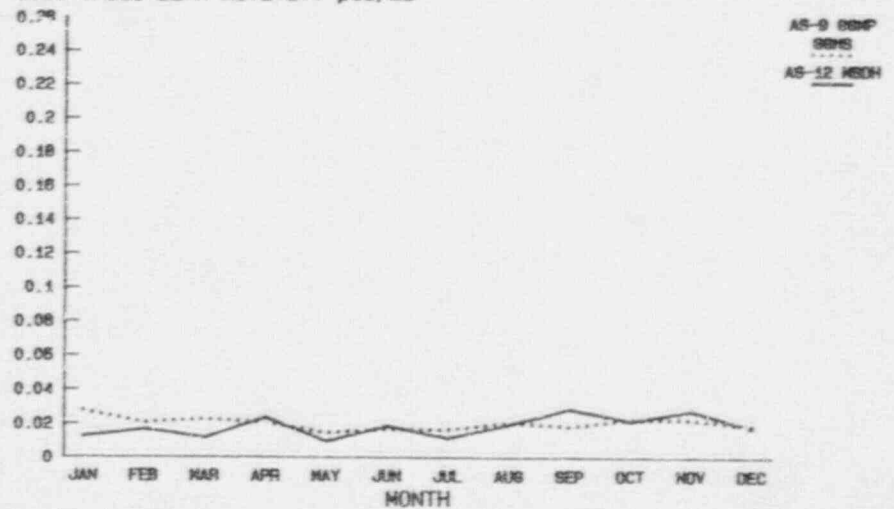
1990 GROSS BETA ACTIVITY pCi/m3



GGNS/MSDH COLLOCATED AIR SAMPLER STATIONS

1990

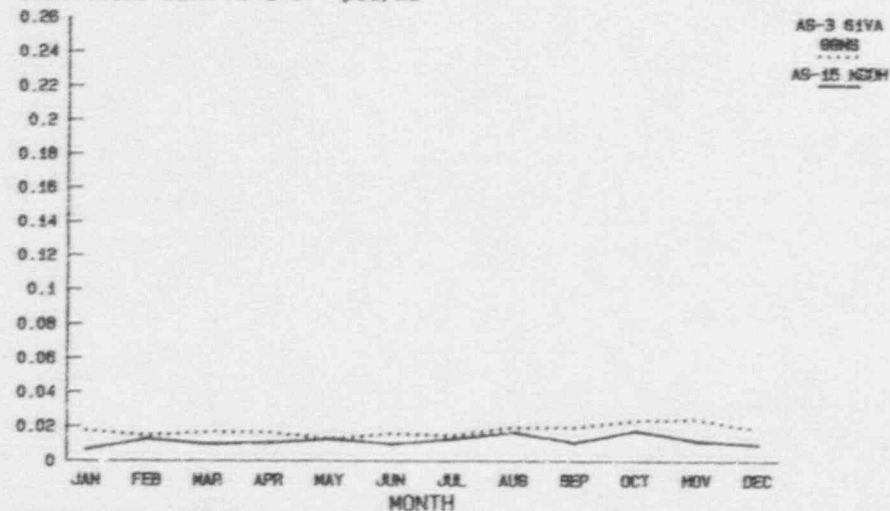
1990 GROSS BETA ACTIVITY pCi/m3



GGNS/MSDH CONTROL AIR SAMPLER LOCATIONS

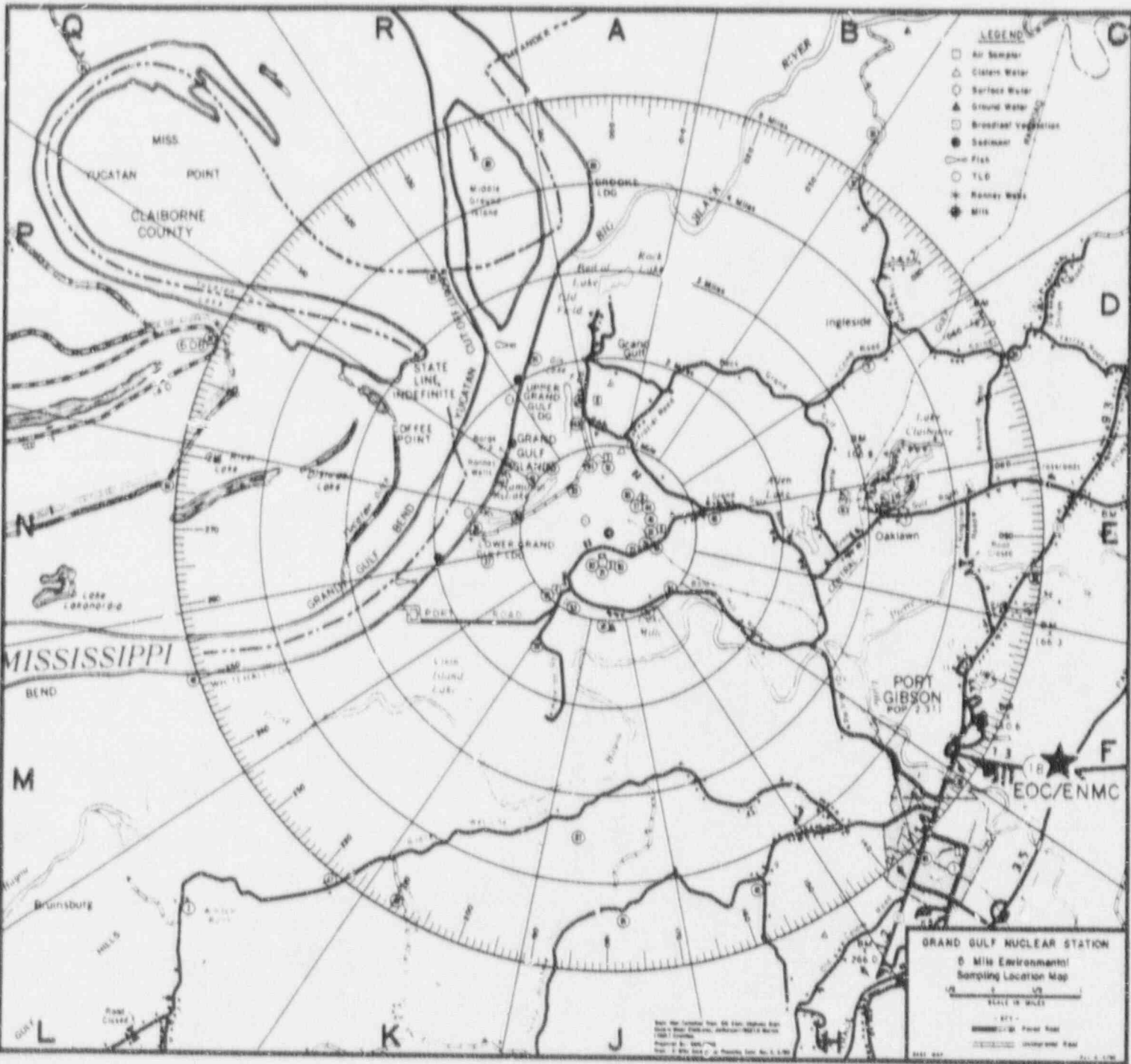
1990

1990 GROSS BETA ACTIVITY pCi/m3



NOTE: THESE STATIONS ARE NOT COLLOCATED.

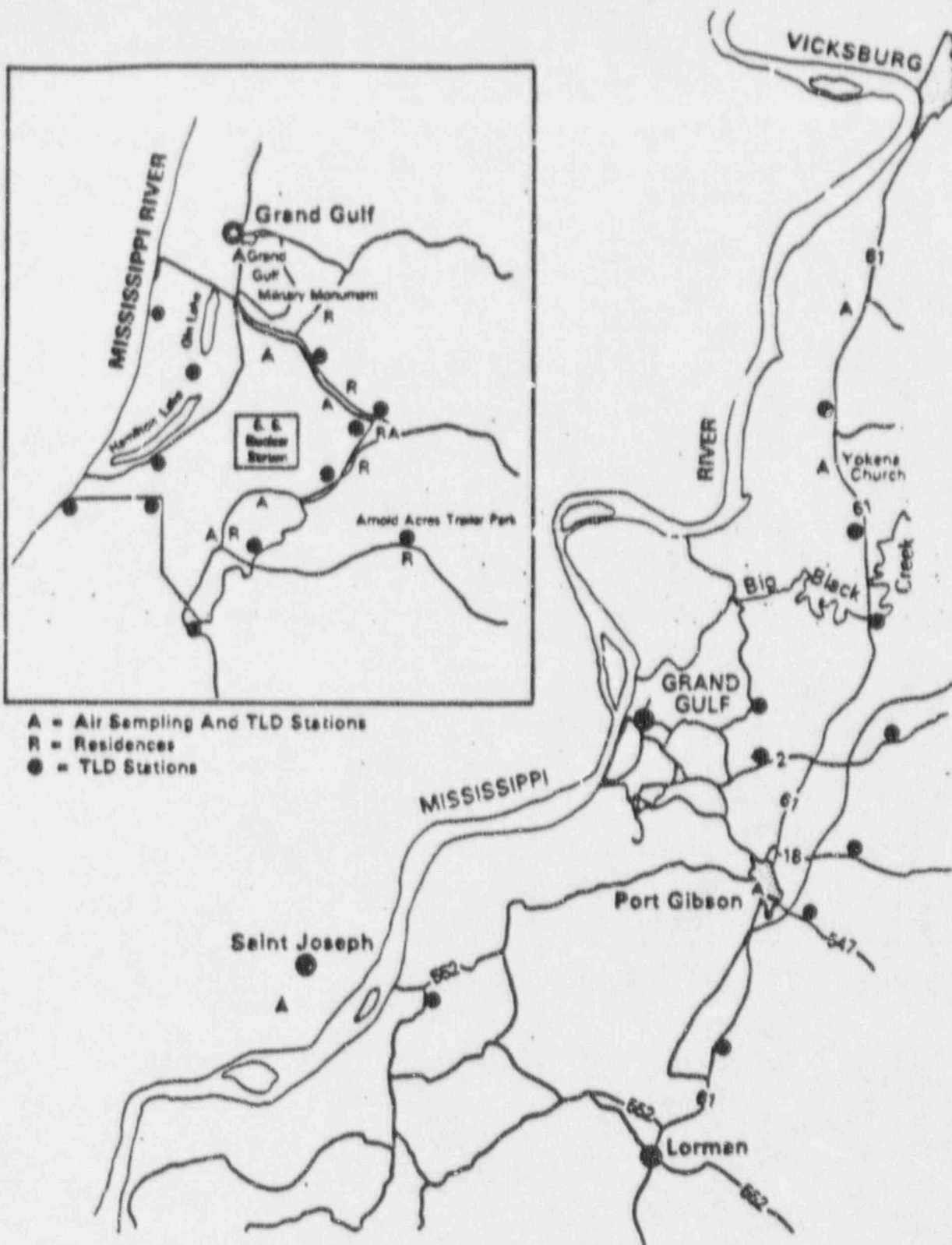
(5-MILE MAP)





(20-MILE MAP)





GRAND GULF NUCLEAR STATION

ENVIRONMENTAL  
MONITORING LOCATIONS  
FIGURE 2-7



## 2.2 THERMOLUMINESCENT DOSIMETRY (TLD)

NOTE #1: Analytical results are presented in Attachment II and summarized in Section 4.0.

NOTE #2: TLD Locations are shown in Figures 2-5 through 2-7 of Section 2.1.

#### 2.2.1 INTERPRETATIONS AND TRENDS OF RESULTS

Gamma radiation dose in 1990 was measured with thermoluminescent dosimeters (TLDs) on a quarterly schedule. There was no significant difference in 1985 through 1990 average dose rates as illustrated in Table 2-2.

Direct radiation dose to the public from 1983 through 1990 is presented in Table 2-3. As indicated in Table 2-3, the overall operation of GGNS has had minimal impact on direct radiation dose to the public.

Indicator and control locations for 1990 produced similar values. This indicates that the ambient radiation levels remained at or near background and have been uninfluenced by the operation of GGNS. This conclusion is represented in Figures 2-8 and 2-9 showing 1979 through 1990 annual average of quarterly average TLD results and 1989 through 1990 quarterly average TLD results, respectively. These figures also indicate that ambient radiation levels have remained at or near background levels.

Environmental Surveillance Program personnel performed an independent verification of the accuracy of GGNS TLD results through the use of NRC and GGNS collocated TLDs. Figure 2-10 presents NRC and GGNS collocated TLD results for the eleven most recent quarters available. This figure indicates that consistent, valid data is being collected based on the similarity of TLD results.

### 2.2.2 DEVIATIONS FROM THE ESP

Six TLDs required by GGNS Technical Specifications were lost in the field during 1990. Vandalism and flooding of the Mississippi River caused these losses. TLD losses of this type are characteristic of other TLD programs. The 1990 recovery rate for TLDs required by GGNS Technical Specifications was 96% (154 of 160) and is comparable with other TLD programs.

### 2.2.3 PROGRAM DESCRIPTION

Environmental Surveillance Program personnel measured ambient radiation in the environment surrounding GGNS with 94 TLD cards (calcium sulfate:dysprosium phosphor dosimeters) to provide a quantitative measurement of the area radiation levels.

Environmental Surveillance Program personnel placed these environmental TLDs at distances from 0 to 18 miles, as shown in Table 2-4.

Each dosimeter was sealed in a plastic protective holder and normally suspended one meter above the ground. The dosimeters were collected quarterly.

The criteria used in establishing TLD locations are:

- o GGNS Technical Specification 4.12.1 requires 40 TLDs to be positioned as outlined below:
  - An inner ring of 16 stations in the general area of the site boundary with one TLD in each meteorological sector
  - An outer ring of 16 stations approximately in the 3 to 5-mile range with one TLD in each meteorological sector
  - Eight TLDs located in special interest areas such as population centers and residences or utilized as controls.

- o Twenty-four permanent TLD stations at the protected area boundary.
- o The remaining 30 TLDs in areas away from the GGNS site. These TLDs gather supplemental and supporting data for determining direct radiation dose.

In summary, the TLD locations are as follows:

	<u>No. of Locations</u>
o Technical Specifications requirement	
- Inner Ring	16
- Outer Ring	16
- Population Centers & Controls	8
o Protected Area Boundary	24
o Supplemental Data	<u>30</u>
Total	94

TABLE 2-2

1985-1990 AVERAGE TLD DOSE RATES

Location	1985 Avg. Dose Rates (mR/Qtr)	1986 Avg. Dose Rates (mR/Qtr)	1987 Avg. Dose Rates (mR/Qtr)	1988 Avg. Dose Rates (mR/Qtr)	1989 Avg. Dose Rates (mR/Qtr)	1990 Avg. Dose Rates (mR/Qtr)
Inner Ring, Within Two-Mile Radius	16.1	18.6	18.3	17.8	18.0	17.2
Outer Ring, Within Six-Mile Radius	16.6	18.3	17.7	16.7	17.6	17.0
Special Interest Areas	17.0	18.4	17.9	17.3	18.5	17.6
Control (M-14)	20.1	19.8	18.8	17.5	18.2	17.5
On-Site (Protected Area Boundary)	20.0	21.3	21.8	22.8	20.9	20.7
Supplemental Locations	18.2	19.6	18.7	17.8	18.6	17.9

TABLE 2-3

DIRECT RADIATION DOSE  
TO THE PUBLIC

Year	mrem 1st Qtr	mrem 2nd Qtr	mrem 3rd Qtr	mrem 4th Qtr	mrem <sup>1</sup> Annual Total	mrem <sup>2</sup> Annual Total
1983	<1	<1	<1	<1	<1	<1
1984	<1	<1	<1	<1	<1	<1
1985	<1	<1	<1	<1	<1	0 <sup>3</sup>
1986	<1	<1	<1	<1	<1	0 <sup>3</sup>
1987	0.1	0 <sup>3</sup>	0.2	0.5	0.8	0 <sup>3</sup>
1988	0.9	0 <sup>3</sup>	0.2	0 <sup>3</sup>	1.1	0.2
1989	0 <sup>3</sup>	0 <sup>3</sup>	1.9	0 <sup>3</sup>	1.9	0 <sup>4</sup>
1990	0.4	0 <sup>3</sup>	0.7	0.5	1.6	0.2

<sup>1</sup> Calculated quarterly as described in the GGNS ODCM and reported in the Semiannual Radioactive Effluent Release Reports.

<sup>2</sup> Values in this column obtained by subtracting the yearly average control values from the yearly average indicator values, however the GGNS ODCM requires only averaged quarterly calculations.

<sup>3</sup> Control average values were greater than the indicators, therefore a value of zero was used to show no dose received even though negative values were obtained.

<sup>4</sup> Control and indicator average values were the same, therefore no dose received.



TABLE 2-4

Page 1 of 6

TLD LOCATIONS

<u>TLD NO.</u>	<u>LOCATION</u>	<u>SECTOR</u>	<u>MILE</u>
M-00	Maintained in lead shield during the exposure period	--	--
*M-01 (SI)	Across the road from the Lake Claiborne entry gate	E	3.5
M-02 (S)	Windsor Ruins entry gate	L	7.0
M-03 (S)	Hwy. 61 across from P.G. Country Club entrance	H	7.0
M-04 (S)	Hwy. 547 between twin power poles	G	6.5
M-05 (S)	Hwy. 18, 5 miles east of Hwy. 61	F	9.0
M-06 (S)	REA pole east of Willows beyond Campbell Church, Miss. Hwy. 462	D	10.0
*M-07 (SI)	Port Gibson City Barn, AS-1	G	5.5
M-08 (S)	West side Big Black River, south entrance	C	8.5
*M-09 (SI)	Tree adjacent to Warner Tully Camp entrance	D	3.5
*M-10 (SI)	Grand Gulf Military Park entrance gate	R	1.5
M-11 (S)	Hwy. 61, 3 miles north of Big Black River at twin tower	C	10.5
M-12 (S)	Hwy. 61 at AS-2-61 across from Yokena Church	B	13.0
M-13 (S)	West side of Hwy. 61, Letourneau Hill	B	15.0
*M-14 (SI) (CONTROL)	Hwy. 61, AS-3-61VA, north of Vicksburg Airport	B	18.0

- \* Technical Specification requirements  
 (SI) Special Interest Area  
 (S) Supplemental Location

TABLE 2-4 (cont'd)

Page 2 of 6

TLD LOCATIONS

<u>LOC ID</u>	<u>LOCATION</u>	<u>SECTOR</u>	<u>MILE</u>
M-15 (I)	Barge slip (south edge)	P	1.5
*M-16 (I)	AS-7-MT, Meteorological Tower	A	0.8
M-17 (S)	AS-6-RS, Grand Gulf Road	C	0.5
*M-18 (I)	Former railroad crossing eastern SITE BOUNDARY	F	0.5
M-19 (S)	Behind burn pit on fence at eastern SITE BOUNDARY	E	0.5
M-20 (S)	Eastern SITE BOUNDARY behind hazardous waste storage area	F	0.5
M-21 (S)	AS-5-TC, Support Services Center	J	0.4
M-22 (S)	100 yards south of former RR entrance crossing on west side	G	0.5
M-23 (S)	County Road/Heavy Haul Road 50 yards north on power pole	Q	0.5
M-24 (S)	Upper Grand Gulf Landing	R	2.2
*M-25 (I)	Hamilton Lake boat launch	N	1.0
M-26 (S)	Hamilton Lake outfall	N	1.5
*M-27 (I)	South point SITE BOUNDARY 200 yards along property line	M	1.5
*M-28 (I)	AS-4-GJOE, Glodjo residence	L	0.9
M-29 (S)	In sharp curve of Waterloo Road to Waterloo Plantation	K	1.5
*M-30 (I)	Arnold Acres Trailer Park (inactive) entrance	J	1.1
M-31	Duplicate TLD installed quarterly at varying locations	--	--
M-32	Duplicate TLD installed quarterly at varying locations	--	--

\* Technical Specification requirements  
 (S) Supplemental Location  
 (I) Inner Ring

TABLE 2-4 (cont'd)

Page 3 of 6

TLD LOCATIONS

<u>TLD NO.</u>	<u>LOCATION</u>	<u>SECTOR</u>	<u>MILE</u>
*M-33 (SI)	Newellton, Louisiana, Water Tower	P	12.5
M-34 (S)	Levee at end of County Road at Point Pleasant, Louisiana	R	8.0
M-35 (S)	Amacker Landing - Lake Yucatan	Q	8.0
*M-36 (O)	Curve on 608, point nearest GGNS at power pole	P	5.0
M-37 (S)	Winter Quarters Home	N	8.0
*M-38 (SI)	Lake Bruin State Park, second pole	M	9.5
*M-39 (SI)	St. Joseph, Louisiana, Aux. Water Tank	M	13.0
*M-40 (O)	International Paper Road, 5 miles from site	M	5.0
*M-41 (I)	Heavy Haul Road-J pipe on concrete block	P	1.0
*M-42 (I)	Heavy Haul Road north iron gate	Q	1.0
*M-43 (I)	Gin Lake entrance	R	1.2
*M-44 (I)	Truck bypass on Grand Gulf Road	C	0.5
*M-45 (I)	Old Visitor Center gate	D	0.5
*M-46 (I)	Church yard across from Grand Gulf/Bald Hill Roads intersection	E	1.0
*M-47 (O)	Bridge 0.6 miles west of Rodney Westside Road/ Mont Gomer Road intersection, north side	L	5.2
*M-48 (O)	Property line fence 0.4 miles on Mont Gomer Road on west side	K	4.8

\* Technical Specification requirements  
 (SI) Special Interest Area  
 (S) Supplemental Location  
 (O) Outer Ring  
 (I) Inner Ring

TABLE 2-4 (cont'd)

Page 4 of 6

TLD LOCATIONS

<u>TLD NO.</u>	<u>LOCATION</u>	<u>SECTOR</u>	<u>MILE</u>
*M-49 (O)	Fork in Weathers Road	H	4.5
*M-50 (O)	Panola Hunting Club entrance	B	5.5
*M-51 (O)	Power pole, 0.5 miles on gravel road to Big Black on west side	C	4.8
*M-52 (I)	Power pole, Bald Hill Road	K	1.0
*M-53 (I)	Arnold Acres property fence past inactive trailer park	H	1.1
*M-54 (I)	Bottom of curve past Arnold's house	G	1.0
*M-55 (O)	Behind Bonner's Beauty Shop at MSDH air sampler	D	5.0
*M-56 (O)	Hwy. 61 at "All Creatures Veterinary Hospital"	G	5.0
*M-57 (O)	Hwy. 61, behind the Welcome to Port Gibson sign at Glensdale Subdivision	F	4.5
*M-58 (O)	Hwy. 61, Big Bayou Pierre bridge, southeast end	E	5.0
*M-59 (O)	Off levee at Winter Quarters Hunting Camp	N	5.1
M-60	Duplicate TLD installed quarterly at varying locations	--	--
M-61 (P)	Protected area fence by vehicle entrance gate	P	Onsite
M-62 (P)	Protected area fence northeast corner parking lot	N	Onsite
M-63 (P)	Protected area fence middle parking lot	N	Onsite

- \* Technical Specification requirements  
(O) Outer Ring  
(I) Inner Ring  
(P) Protected Area Boundary

TABLE 2-4 (cont'd)

Page 5 of 6

TLD LOCATIONS

<u>TLD NO.</u>	<u>LOCATION</u>	<u>SECTOR</u>	<u>MILE</u>
M-64 (P)	Protected area fence southeast corner parking lot	M	Onsite
M-65 (P)	South protected area fence behind warehouse	L	Onsite
M-66 (P)	South protected area fence across from cooling tower	K	Onsite
M-67 (P)	South protected area fence east end	J	Onsite
M-68 (P)	East protected area fence across from chlorination tank	H	Onsite
M-69 (P)	East protected area fence near electric bus	G	Onsite
M-70 (P)	North fence behind Turbine Building	F	Onsite
M-71 (P)	133' elevation railway bay	C	Onsite
M-72 (P)	133' elevation railway bay	B	Onsite
M-73 (P)	Corner of fence outside Control Building	P	Onsite
M-74 (P)	Midway of north fence	P	Onsite
M-75 (P)	Corner in fence in front of Maintenance Shop	A	Onsite
M-76 (P)	Southeast corner SSW Basins	A	Onsite
M-77 (P)	Protected area fence beside Maintenance Shop	R	Onsite
M-78 (P)	Outside vault in Admin. Bldg.	Q	Onsite
M-79 (P)	Wall in Central Records (middle)	Q	Onsite

(P) Protected Area Boundary

TABLE 2-4 (cont'd)

Page 6 of 6

TLD LOCATIONS

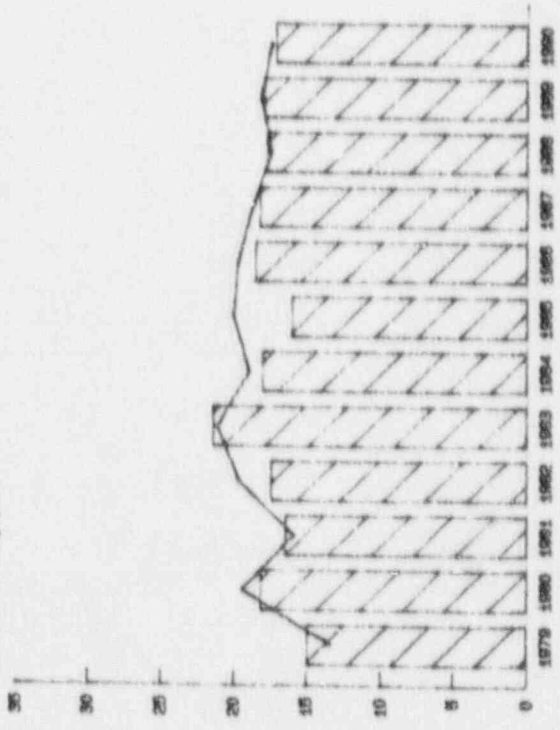
<u>TLD NO.</u>	<u>LOCATION</u>	<u>SECTOR</u>	<u>MILE</u>
M-80 (P)	Wall in Central Records, old library location	Q	Onsite
M-81 (P)	Inside Admin. Bldg., 2nd floor, northeast wall	Q	Onsite
M-82 (P)	Tech Support area	Q	Onsite
M-83 (P)	Tech Support secretary's office	Q	Onsite
M-84 (P)	Security Island	P	Onsite
M-85 (S)	Lee Electric Building across from Port Gibson High School	G	5.2
*M-86 (I)	Bechtel gate north SITE BOUNDARY	B	0.5
M-87 (S)	Intersection of Rodney Westside Road & transmission line	J	3.5
*M-88 (O)	River mile marker 409.5	A	4.2
*M-89 (O)	Middle Ground Island	R	4.4
*M-90 (O)	Across from Middle Ground Island	Q	3.5
*M-91 (O)	Transmission line by pond	J	4.5
M-92 (S)	Fence behind orchard	K	0.4
M-93 (S)	Underground cable sign	H	0.4
M-94 (S)	Sector R garden	R	0.8

- \* Technical Specification requirements
- (P) Protected Area Boundary
- (S) Supplemental Location
- (I) Inner Ring
- (O) Outer Ring

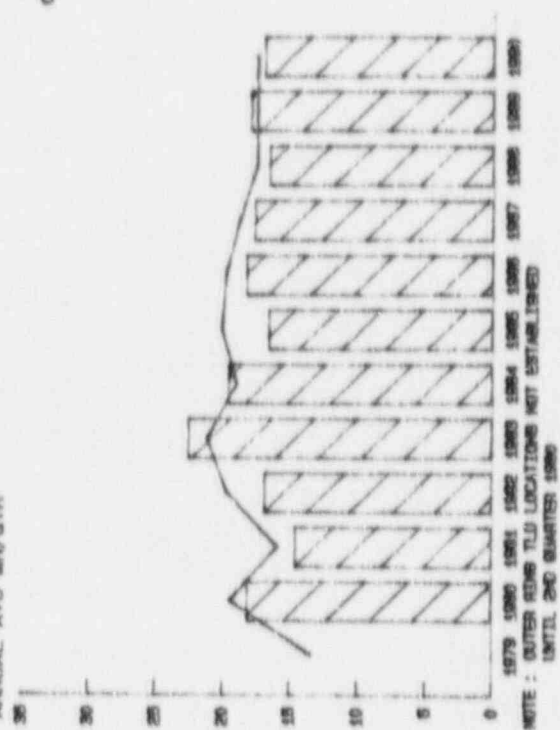


TLDs, Annual Average mR/Quarter  
1979-1990

**INNER RING TLDs**  
WITHIN TWO (2) MILE RADIUS  
REQUIRED BY TECHNICAL SPECIFICATIONS  
ANNUAL AVG mR/QTR

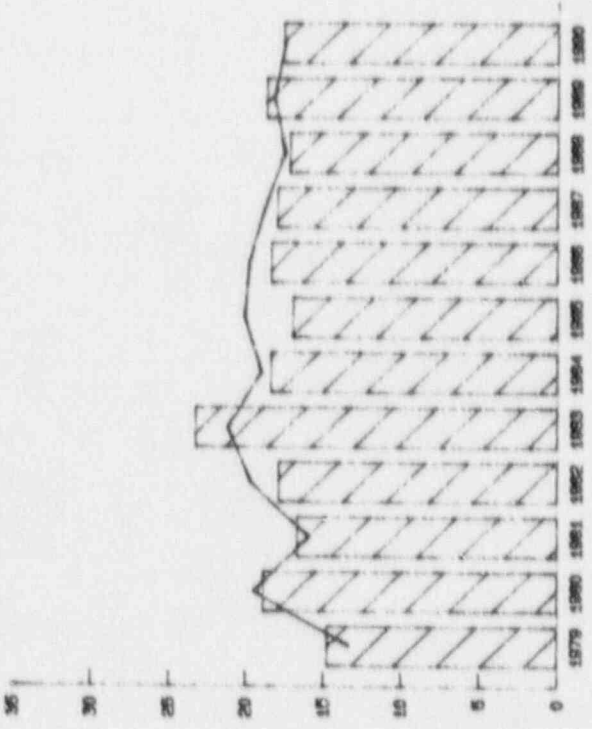


**OUTER RING TLDs**  
WITHIN SIX (6) MILE RADIUS  
REQUIRED BY TECHNICAL SPECIFICATIONS  
ANNUAL AVG mR/QTR



NOTE: OUTER RING TLD LOCATIONS NOT ESTABLISHED  
UNTIL 2ND QUARTER 1986

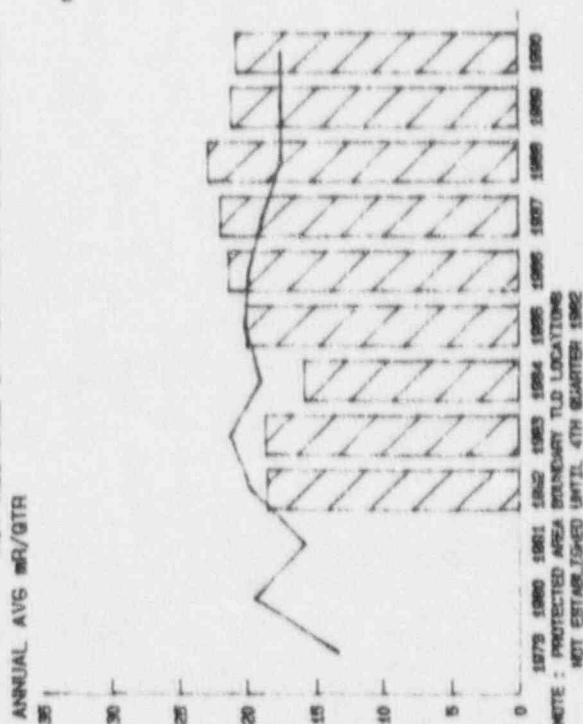
**SPECIAL INTEREST AREA TLDs**  
REQUIRED BY TECHNICAL SPECIFICATIONS  
ANNUAL AVG mR/QTR



TLDs, Annual Average mR/Quarter  
1979-1990

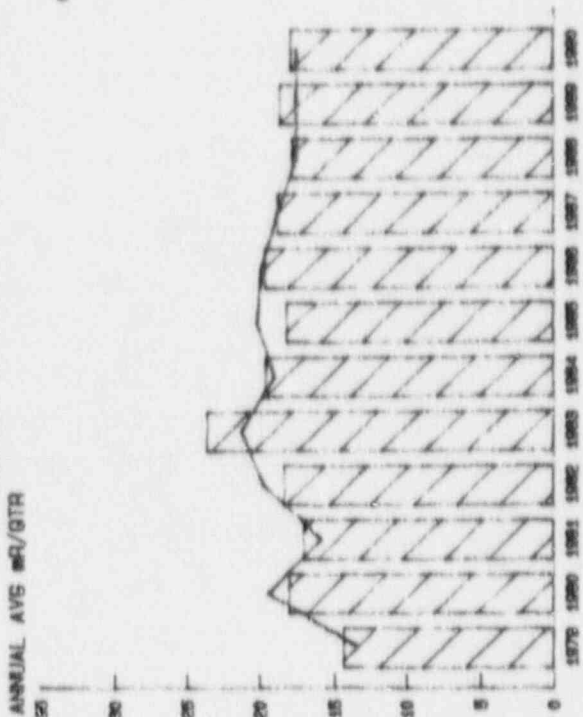
ONSITE TLDs

PROTECTED AREA BOUNDARY  
NOT REQUIRED BY TECHNICAL SPECIFICATIONS



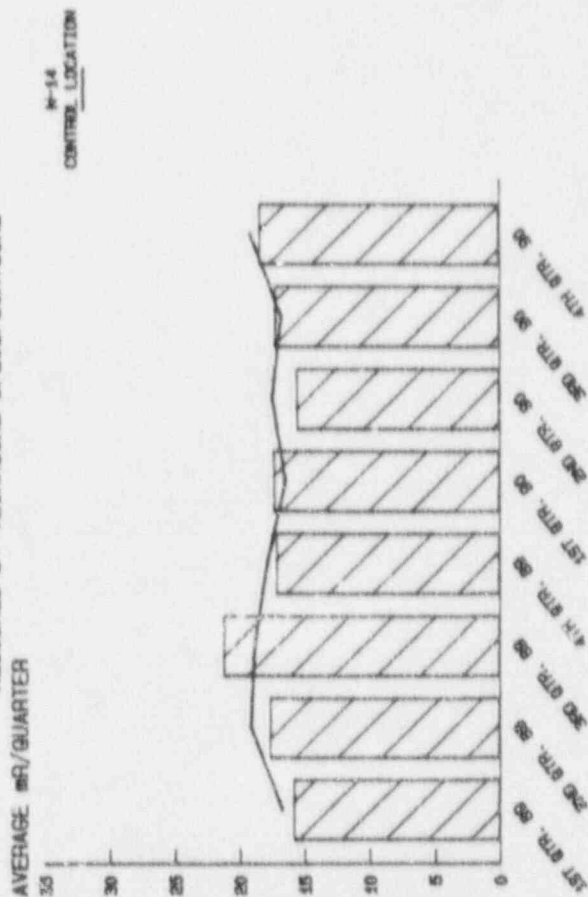
W-14  
CONTROL LOCATION

SUPPLEMENTAL TLDs  
WITHIN FIFTEEN (15) MILE RADIUS  
NOT REQUIRED BY TECHNICAL SPECIFICATIONS



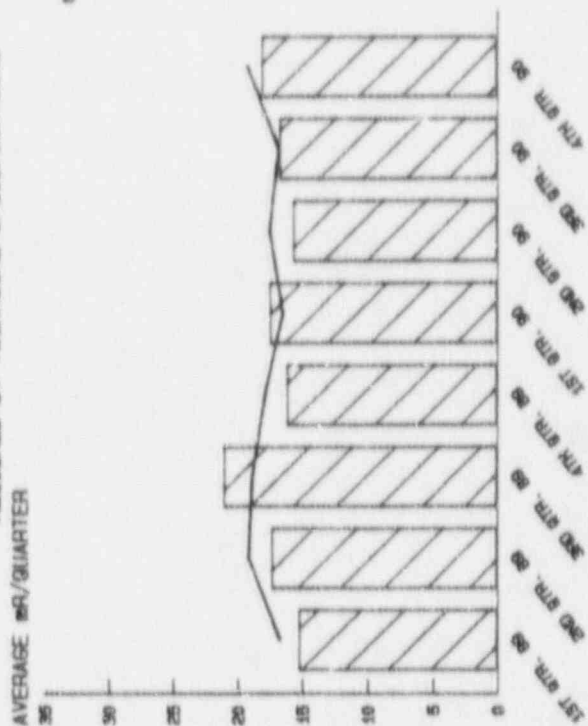
W-14  
CONTROL LOCATION

# INNER RING TLDs WITHIN TWO (2) MILE RADIUS REQUIRED BY TECHNICAL SPECIFICATIONS



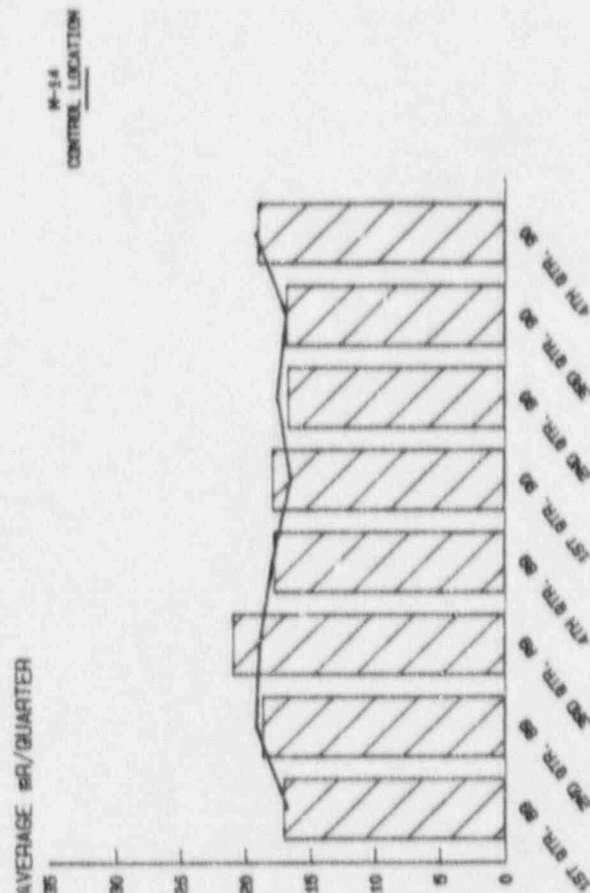
M-14  
 CONTROL LOCATION

# OUTER RING TLDs WITHIN SIX (6) MILE RADIUS REQUIRED BY TECHNICAL SPECIFICATIONS



M-14  
 CONTROL LOCATION

# SPECIAL INTEREST AREA TLDs REQUIRED BY TECHNICAL SPECIFICATIONS

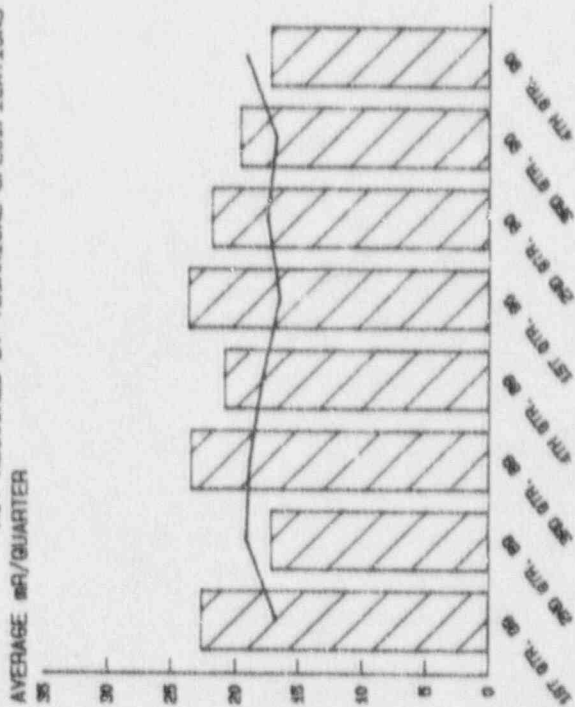


M-14  
 CONTROL LOCATION

TLDs. AVERAGE  $\mu R$ /QUARTER.  
1989-1990

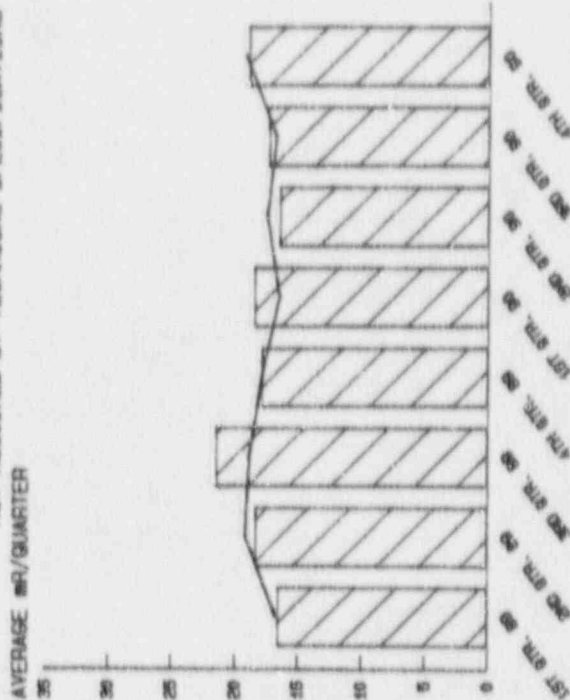
ONSITE TLDs

PROTECTED AREA BOUNDARY  
NOT REQUIRED BY TECHNICAL SPECIFICATIONS



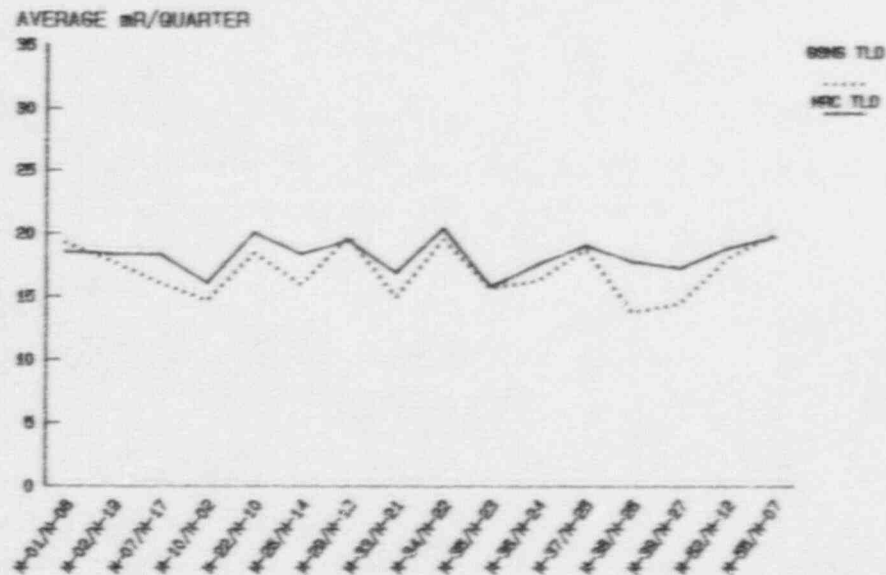
M-14  
CONTROL LOCATION

SUPPLEMENTAL TLDs  
WITHIN FIFTEEN (15) MILE RADIUS  
NOT REQUIRED BY TECHNICAL SPECIFICATIONS

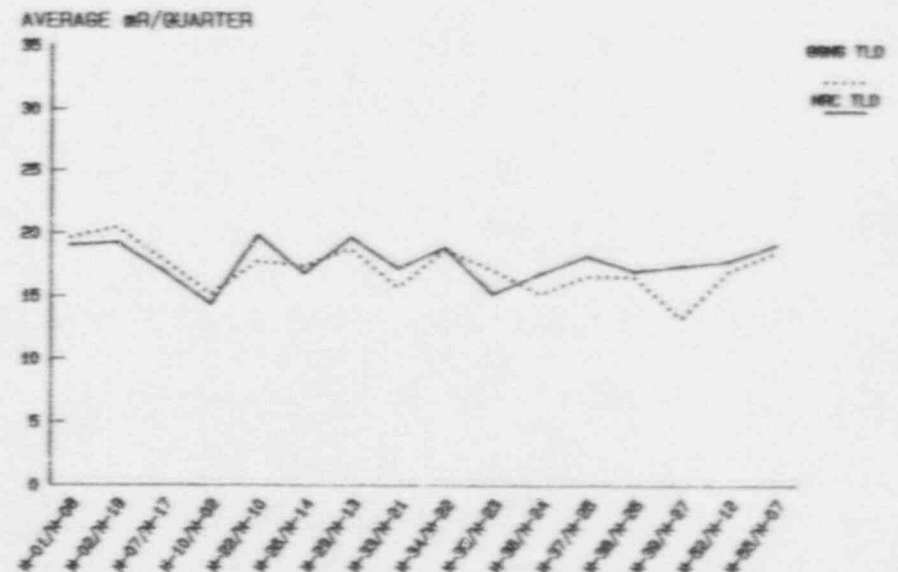


M-14  
CONTROL LOCATION

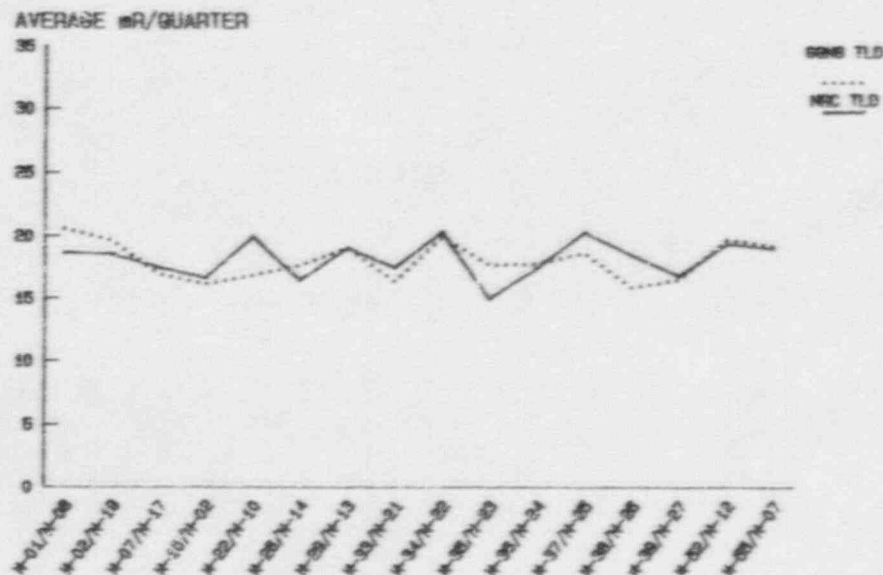
GGNS/NRC COLLOCATED TLDs  
1ST QUARTER 1988



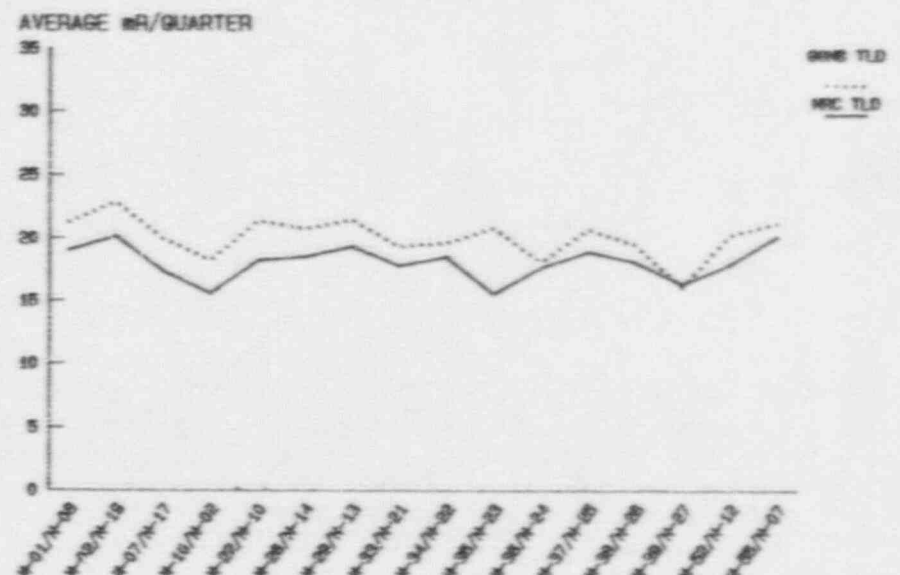
GGNS/NRC COLLOCATED TLDs  
2ND QUARTER 1988



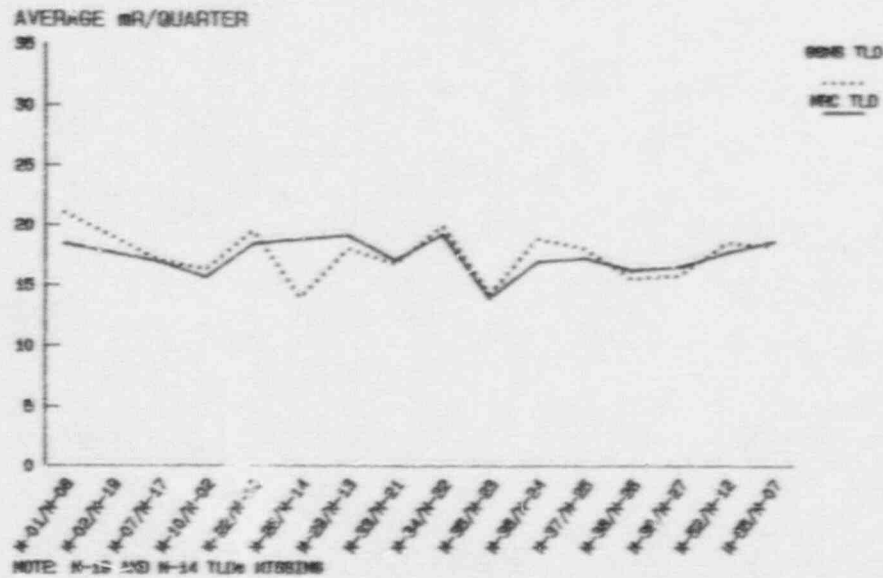
GGNS/NRC COLLOCATED TLDs  
3RD QUARTER 1988



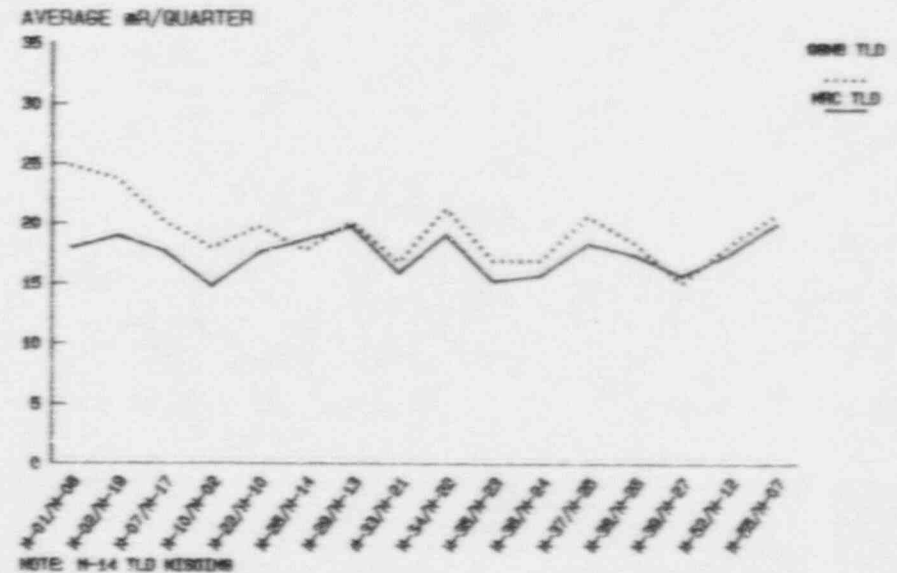
GGNS/NRC COLLOCATED TLDs  
4TH QUARTER 1988



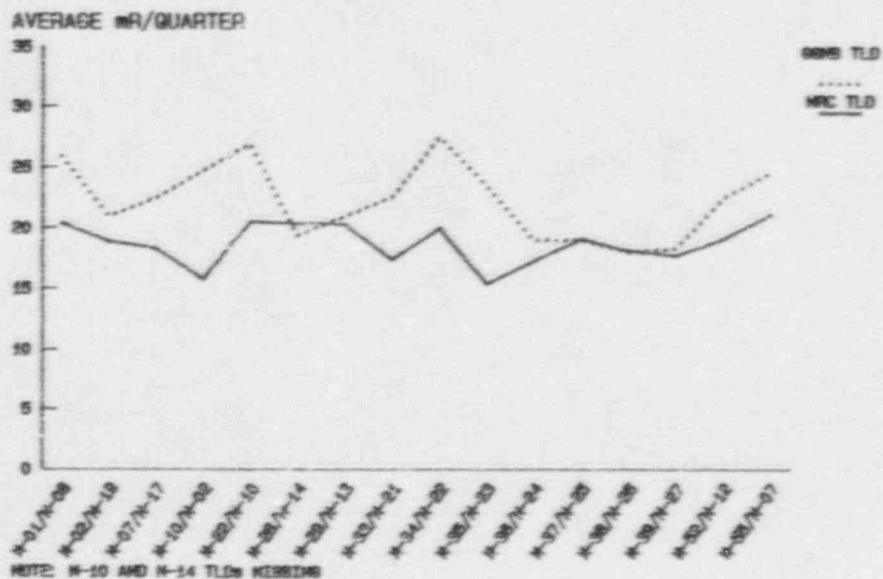
GGNS/NRC COLLOCATED TLDs  
1ST QUARTER 1989



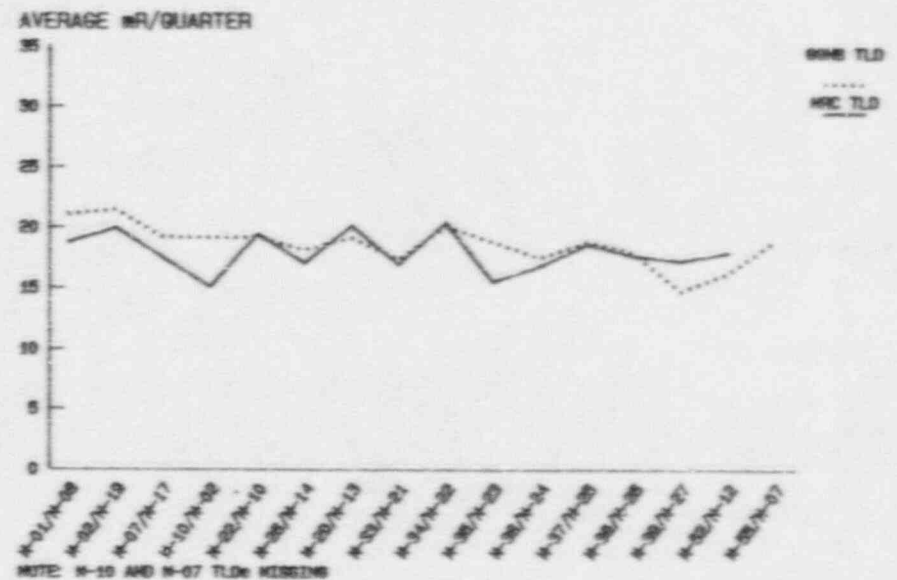
GGNS/NRC COLLOCATED TLDs  
2ND QUARTER 1989



GGNS/NRC COLLOCATED TLDs  
3RD QUARTER 1989



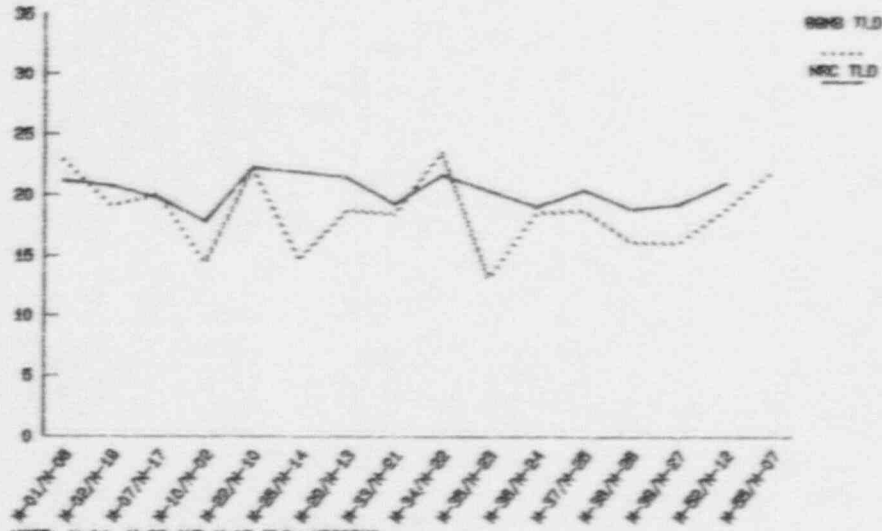
GGNS/NRC COLLOCATED TLDs  
4TH QUARTER 1989



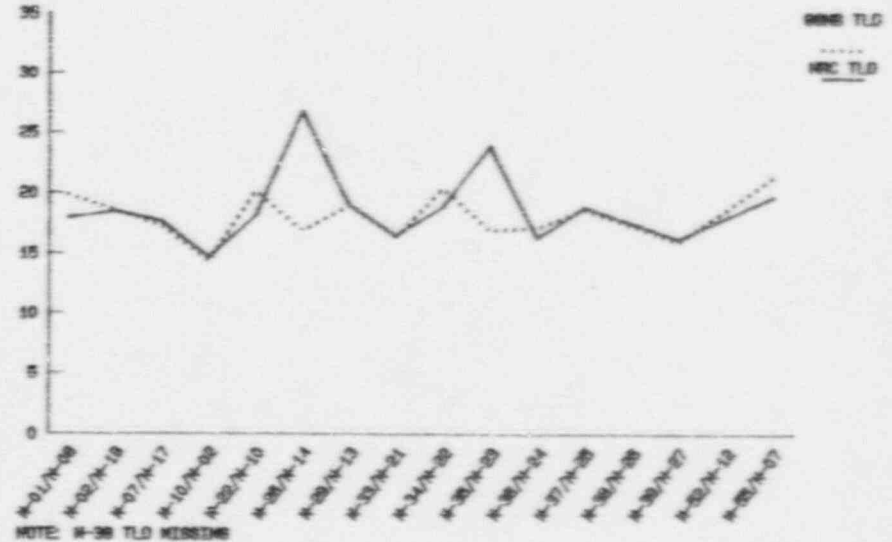


TLDs, COLLOCATEDGGNS/NRC COLLOCATED TLDs  
1ST QUARTER 1990

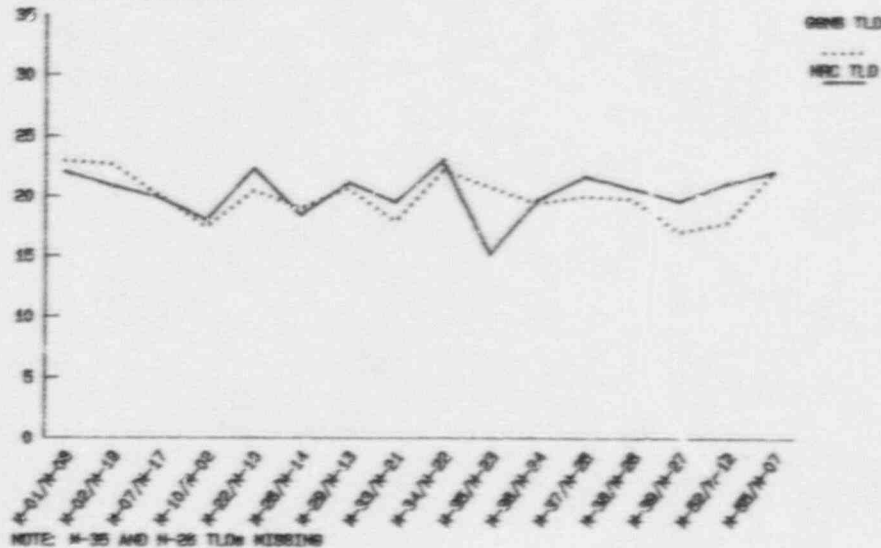
AVERAGE mR/QUARTER

GGNS/NRC COLLOCATED TLDs  
2ND QUARTER 1990

AVERAGE mR/QUARTER

GGNS/NRC COLLOCATED TLDs  
3RD QUARTER 1990

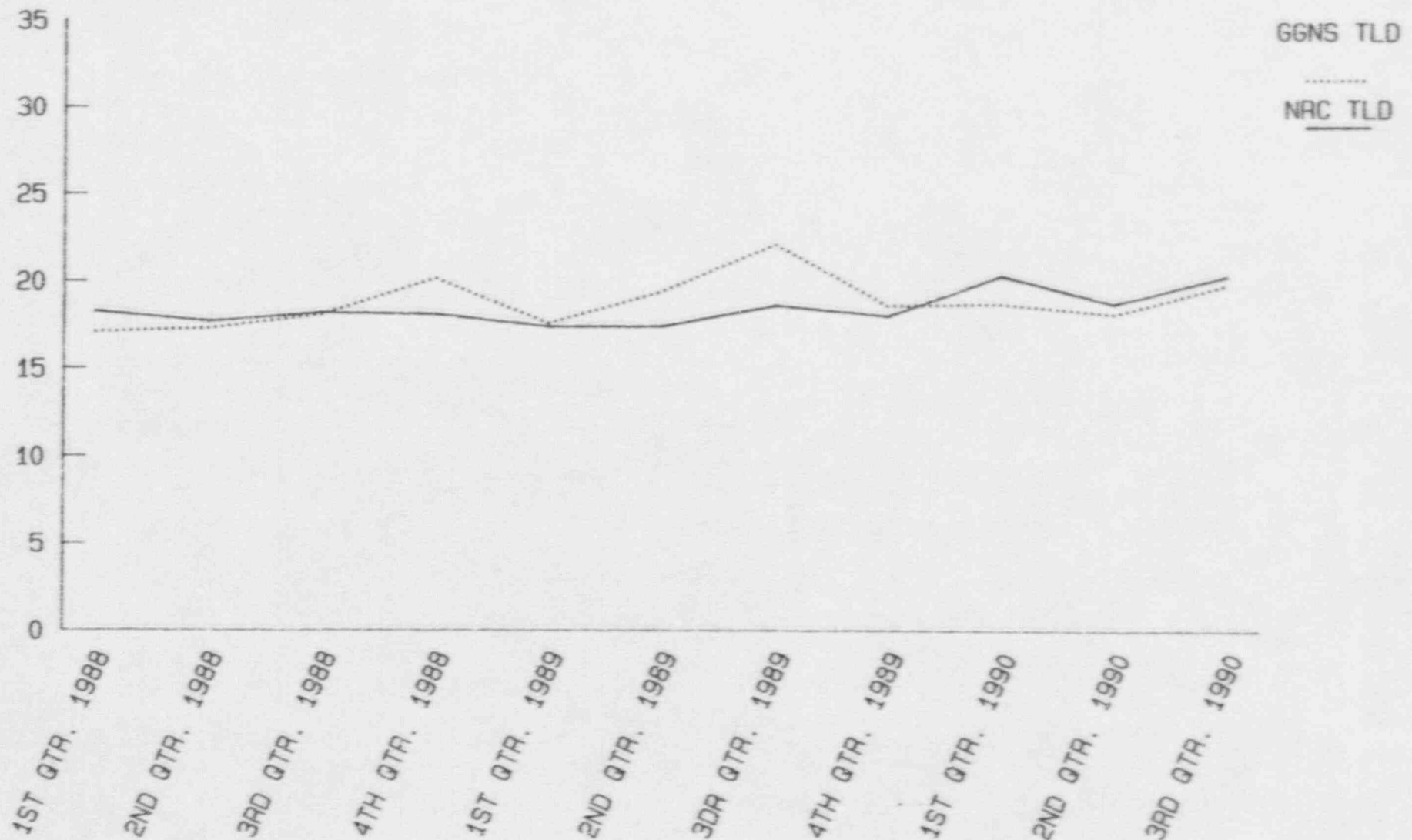
AVERAGE mR/QUARTER



## GGNS/NRC COLLOCATED TLDs

1988-1990 QUARTERS

AVERAGE mR/QUARTER



### 2.3 MILK

NOTE #1: Analytical results are presented in Table 5.1 of Attachment 1 and summarized in Section 4.0.

NOTE #2: Milk sampling locations are shown in Figure 2-6 of Section 2.1.

### 2.3.1 INTERPRETATIONS AND TRENDS OF RESULTS

Milk samples within five miles of the GGNS site were unavailable in 1990 due to the absence of milking animals. Milk samples from the Alcorn State University control location were collected semiannually and analyzed for Iodine-131 and gamma-emitting radionuclides. As in previous years, no radioactivity attributable to GGNS was detected in milk samples.

The ingestion pathway shown in Technical Specification Table 3.12.1-1 specifies the frequency and location for obtaining milk samples. If milk sampling is not performed, the ingestion section provides for the use of a food product pathway as an alternative. This alternative was utilized in 1990 and is described in Section 2.5 of this report.

### 2.3.2 DEVIATIONS FROM THE ESP

As noted above, milk samples were unavailable within five miles (8 km) of GGNS in 1990. Therefore, ESP personnel reduced sampling frequency at the Alcorn State University control location to semiannually until such time that milk samples become available within five miles (8 km) of GGNS.

Because of milk unavailability, ESP personnel collected vegetation samples to monitor the ingestion pathway, as specified in Technical Specification 3.12.1-1.

### 2.3.3 PROGRAM DESCRIPTION

GGNS Technical Specifications required sample collection from milking animals in three locations within a five km distance having the highest dose potential. If there were none, then one

2.3.3 PROGRAM DESCRIPTION (Cont'd)

sample was required from milking animals in each of three areas, between five to eight km, where doses were calculated to be greater than one mrem per year. Also required was one control sample at a distance of 15-30 km.

A control milk sample was collected semiannually from the Alcorn State University Dairy (Table 2-5) to establish background data. But, milk animals were unavailable in 1990 within eight km (five miles) of GGNS. Section 2.5, Vegetation, addresses the unavailability of milk samples within the vicinity of GGNS.

TABLE 2-5

MILK SAMPLING LOCATIONS

Alcorn State University\*

Located south-southwest of GGNS (Sector K,  
Radius 10.5 miles)

\* Technical Specification requirements

NOTE

Collected semiannually when milk samples are not available within 5 miles (8 km) of GGNS; required serimonthly when animals are on pasture, monthly at other times, if milk samples become available within 5 miles (8 km) of GGNS.



## 2.4 WATER

NOTE #1: Analytical results are presented in Tables 2.1 through 4.6 of Attachment I and summarized in Section 4.0.

NOTE #2: Water sampling locations are shown in Figures 2-5 and 2-6 of Section 2.1.

#### 2.4.1 INTERPRETATIONS AND TRENDS OF RESULTS

Environmental Surveillance Program personnel sampled cistern water, surface water and groundwater as required during 1990. Analytical results were similar to those reported in previous years.

##### Cistern Water

Cistern water samples were collected from two locations and analyzed for gross beta-emitting radionuclides, Iodine-131, tritium and gamma-emitting radionuclides. As in previous years, gamma-emitting radionuclides, Iodine-131, tritium and gross beta-emitting radionuclides continue to be at or near background levels.

##### Surface Water

Surface water samples included the upstream and downstream Mississippi River and the Discharge Basin. These samples were collected monthly and analyzed for gamma-emitting radionuclides. Gamma-emitting radionuclide concentrations continued to be at or near background levels in upstream, downstream and Discharge Basin samples.

In addition, composites from each location were analyzed quarterly for tritium. Tritium levels for Discharge Basin surface water ranged from 531-1930 pCi/l with a mean of 1021 pCi/l. This activity is attributed to plant operating levels and radwaste discharges in 1990. Tritium continues to be at or near background levels at the upstream and downstream Mississippi River locations. Tritium results from 1985 through 1990 for the Discharge Basin are provided in Figure 2-11.

From September 1989 through March 1990, a study was conducted to determine if upstream and downstream samples collected at the shoreline would differ in radioactivity when compared to the midstream samples. Table 2-6 shows there was no difference in radioactivity. This finding indicates that shoreline sampling would be representative for radioactivity measurement in surface water.

#### Groundwater

Groundwater samples were collected quarterly and analyzed for gamma-emitting radionuclides and tritium. As in previous years, gamma-emitting radionuclides were not detected in 1990. Tritium continues to be at or near background levels.

#### 2.4.2 DEVIATIONS FROM THE ESP

Water samples required by GGNS Technical Specifications were collected and analyzed during 1990 without exception.

#### 2.4.3 PROGRAM DESCRIPTION

Water samples were collected in the vicinity of GGNS for the measurement of radioactivity by the waterborne exposure pathway. Samples were collected in clean, labelled containers which were rinsed with the sample media prior to collection.

Cistern water was sampled monthly at two locations, an indicator location near the site (McGee Cistern) and a control location (Willis Cistern) (Table 2-7). Cistern water was analyzed monthly for gross beta-emitting radionuclides, Iodine-131 and gamma-emitting radionuclides. In addition, a composite was analyzed quarterly for tritium.

Groundwater was sampled quarterly from three sources (Table 2-7). The two sources fulfilling the Technical Specifications requirement were the Arnold Acres Well (indicator location) and the Port Gibson City Well (control location). The other source was a well serving Lake Bruin State Park in Louisiana. Groundwater was analyzed quarterly for gamma-emitting radionuclides and tritium.

Surface water samples from the Mississippi River were collected monthly at points upstream (control location) and downstream (indicator location) of the plant discharge (Table 2-7). Surface water was analyzed monthly for gamma-emitting radionuclides and a composite was analyzed quarterly for tritium.

An additional surface water sample was taken from the GGNS Discharge Basin. A sample was composited monthly with an automatic sampler that collected a preset volume at hourly intervals. This sample was analyzed monthly for gamma-emitting radionuclides and a composite was analyzed quarterly for tritium.

TABLE 2-6

SHORELINE AND MIDSTREAM SAMPLING

## UPSTREAM MISSISSIPPI RIVER

Location	Sample Date	Gamma-Emitting Radionuclides (pCi/l)	Tritium (pCi/l)*
Midstream	09/05/89	None Detected	
Shoreline	09/05/89	None Detected	
Midstream	10/02/89	None Detected	
Shoreline	10/02/89	None Detected	
Midstream	11/01/89	None Detected	
Shoreline	11/01/89	None Detected	
Midstream	12/05/89	None Detected	<367
Shoreline	12/05/89	None Detected	<367
Midstream	01/02/90	None Detected	
Shoreline	01/02/90	None Detected	
Midstream	02/06/90	None Detected	
Shoreline	02/06/90	None Detected	
Midstream	03/06/90	None Detected	310 ± 219
Midstream	03/06/90**	None Detected	<360
Shoreline	03/06/90	None Detected	<360
Shoreline	03/06/90**	None Detected	

## DOWNSTREAM MISSISSIPPI RIVER

Location	Sample Date	Gamma-Emitting Radionuclides (pCi/l)	Tritium (pCi/l)*
Midstream	09/05/89	None Detected	
Shoreline	09/05/89	None Detected	
Midstream	10/02/89	None Detected	
Shoreline	10/02/89	None Detected	
Midstream	11/01/89	None Detected	
Shoreline	11/01/89	None Detected	
Midstream	12/05/89	None Detected	<367
Shoreline	12/05/89	None Detected	<367
Midstream	01/02/90	None Detected	
Shoreline	01/02/90	None Detected	
Midstream	02/06/90	None Detected	
Shoreline	02/06/90	None Detected	
Midstream	03/06/90	None Detected	252 ± 218
Midstream**	03/06/90	None Detected	<360
Shoreline	03/06/90	None Detected	<360
Shoreline**	03/06/90	None Detected	

\* Quarterly tritium composite

\*\* Duplicate sample



TABLE 2-7

WATER SAMPLING LOCATIONS

CISTERN WATER

McGee Cistern*	Located north of GGNS at the McGee house (Sector A, Radius 0.9 miles)
Willis Cistern*	Located at the C. E. Willis house east-northeast of GGNS across from the Shiloh Baptist Church (Sector D, Radius 6 miles)

GROUNDWATER

PGWELL*	Port Gibson Wells - Taken from distribution system or one of the five wells (Sector G, Radius 5.0 miles)
AAWELL*	Arnold Acres Trailer Park, inactive (Sector J, Radius 1.1 miles)
LAKE BRUIN	Taken from faucet at the bath house in Lake Bruin State Park, Louisiana (Sector M, Radius 9.5 miles)

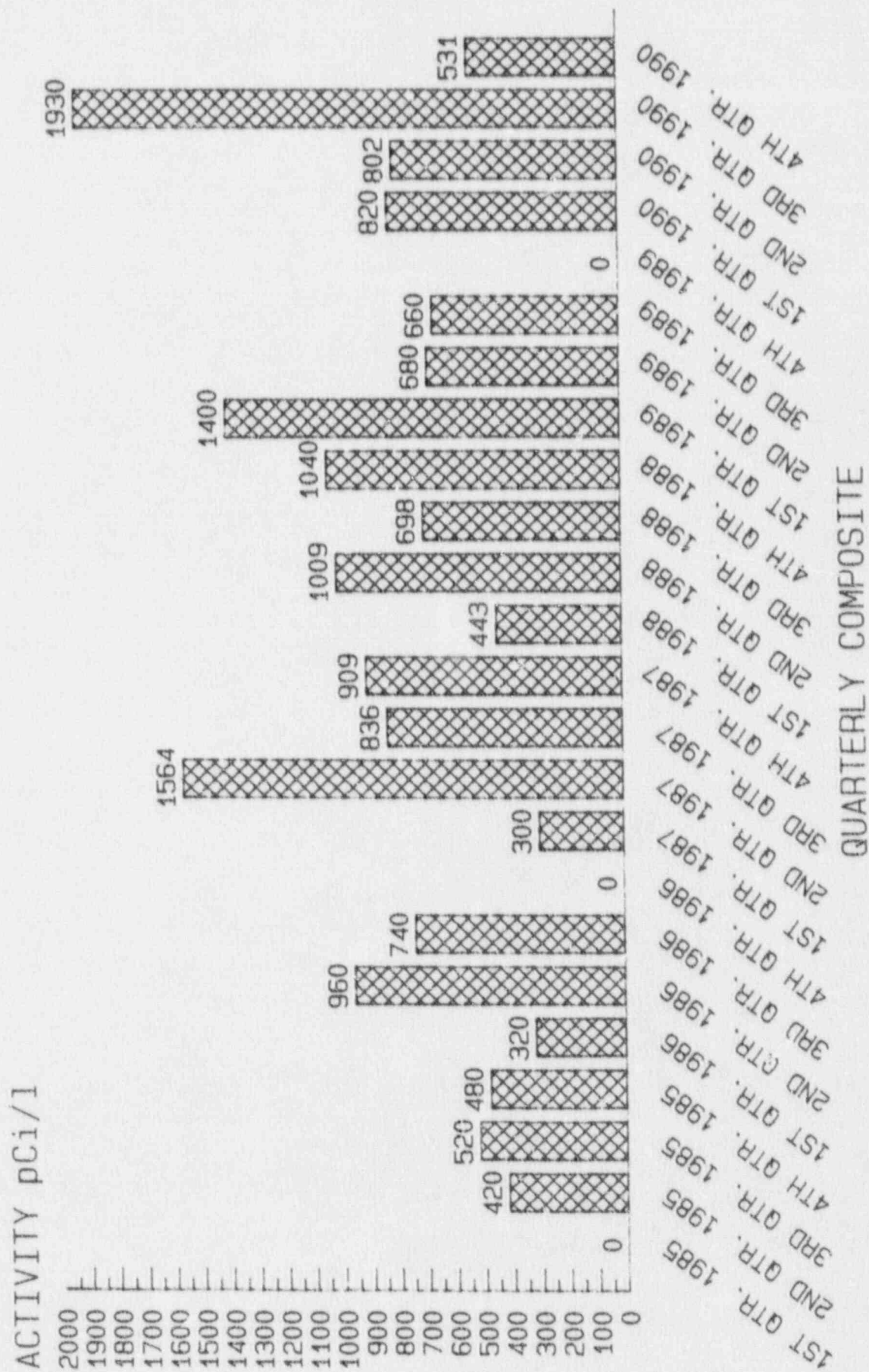
SURFACE WATER

Upstream*	4500 ft upstream of the GGNS discharge point into the Mississippi River to allow adequate mixing of the Mississippi and Big Black Rivers (Sector Q)
Downstream*	5000 ft downstream of the GGNS discharge point into the Mississippi River near Radial Well No. 1 (Sector N)
Discharge Basin*	West-northwest of GGNS in parking lot (Sector P, Radius 0.3 miles)

\*Technical Specification requirements



FIGURE 2-11  
DISCHARGE BASIN, TRITIUM



NOTE : TECHNICAL SPECIFICATIONS REQUIREMENT

NOTE : 0 REPRESENTS < LLD

## 2.5 VEGETATION

' #1: Analytical results are presented in Tables 6.1 through 6.3a of Attachment I and summarized in Section 4.0.

NOTE #2: Vegetation sampling locations are shown in Figures 2-5 and 2-6 of Section 2.1.

#### 2.5.1 INTERPRETATIONS AND TRENDS OF RESULTS

Analytical results for vegetation in 1990 and previous years have shown no data which was attributable to the operation of GGNS. Radionuclide levels for vegetation continue to remain at background levels.

#### 2.5.2 DEVIATIONS FROM THE ESP

Vegetation samples required by GGNS Technical Specifications were collected and analyzed during 1990 without exception.

#### 2.5.3 PROGRAM DESCRIPTION

Since milk samples were unavailable within five miles of GGNS, broadleaf vegetation samples were collected for the measurement of radioactivity by the ingestion exposure pathway. Samples of three different kinds of broadleaf vegetation grown nearest each of two different offsite locations with the highest anticipated annual average groundlevel D/Q were required.

Environmental Surveillance Program personnel met vegetation sampling requirements by maintaining two gardens inside the SITE BOUNDARY, Sectors J and R. These sampling locations (Table 2-8) provided a more conservative assessment of doses due to the higher deposition rates (D/Qs) than would be measured at offsite sampling locations.

The GGNS Technical Specifications also required control samples of each of the similar types of onsite vegetation 15-30 km from the site. To fulfill this requirement, a control vegetation sample location has been established in Sector K at Alcorn State University (Table 2-8).

The preferred source of broadleaf vegetation was green-leafy vegetables suitable for human consumption. If such vegetables were not available, samples of any vegetation with relatively broad leaves on which airborne radioactive particulate material might be deposited were sampled. The raw samples were then analyzed for gamma-emitting radionuclides and Iodine-131.

TABLE 2-8

VEGETATION SAMPLING LOCATIONS

Broadleaf Vegetation\*

South of GGNS near the Support Services  
Center (Sector J, 0.4 miles)

North-northwest of GGNS near the  
Meteorological Tower (Sector R, 0.8 miles)

Alcorn State University south-southwest of  
GGNS (Sector K, 10.5 miles) when available,  
otherwise a location 15-30 km distant

\*Technical Specification requirements



## 2.6 SEDIMENT

NOTE #1: Analytical results are presented in Tables 8.1 and 10.1 of Attachment I and summarized in Section 4.0.

NOTE #2: Sediment sampling locations are shown in Figure 2-5 of Section 2.1.



#### 2.6.1 INTERPRETATIONS AND TRENDS OF RESULTS

Sediment samples were collected semiannually in 1990 and analyzed for gamma-emitting radionuclides as required by the GGNS Technical Specifications.

An analytical results summary for 1985 through 1990 barge slip sediment samples, which includes semiannual and special samples, is provided in Table 2-9. A comparison of 1985 through 1989 average concentrations is provided in Figure 2-12. These radionuclides were not detected prior to 1985. Their presence since 1985 may be attributed to build up of very small amounts of particulates.

As shown in Table 2-9, radionuclide concentrations in barge slip sediment appear to be stabilizing. However, previous sampling of the barge slip sediment revealed a wide range of concentrations. No definite correlation between radionuclide concentrations and plant operating levels, effluent releases or river elevation has been found by ESP personnel.

#### 2.6.2 DEVIATIONS FROM THE ESP

Sediment samples required by GGNS Technical Specifications were collected and analyzed during 1990 without exception.

#### 2.6.3 PROGRAM DESCRIPTION

Sediment samples were collected semiannually at the following locations (Table 2-10):

- o River shoreline where the plant effluent is discharged (Barge Slip)

- o Downstream of the barge slip in the vicinity of the Hamilton Lake outfall (indicator location)
- o Upstream from the influence of GGNS discharges (Upper Grand Gulf Landing)

The only sediment sample required by GGNS Technical Specifications is the downstream location (indicator). The upstream location would be classified as a control and the barge slip as an indicator.

Sediment samples were collected near the shoreline from the top one-inch layer of sediment. After foreign objects were discarded, the samples were transferred to clean, labelled containers. The samples were then analyzed for gamma-emitting radionuclides.

TABLE 2-9

1985-1990 BARGE SLIP SEDIMENT ANALYTICAL SUMMARY

Range (pCi/kg)

Radionuclide	1985	1986	1987	1988	1989	1990
Cesium-134	N/A*	N/A*	N/A**	72-131	N/A**	N/A**
Cesium-137	N/A**	34-140	110-414	60-189	135-191	34-209
Cobalt-58	170-1050	26-280	44-191	30-148	13-200	N/A**
Cobalt-60	230-690	74-1100	205-2878	149-1149	281-1970	99-797
Manganese-54	310-2620	36-4400	36-11240	10-1310	222-2130	52-619
Chromium-51	N/A*	N/A*	N/A**	303-1503	168-230	325-1994

Mean (pCi/kg)

Radionuclide	1985	1986	1987	1988	1989	1990
Cesium-134	N/A*	N/A*	87	109	104	N/A*
Cesium-137	240	99	189	142	159	124
Cobalt-58	493	98	103	82	56	39
Cobalt-60	487	263	799	628	736	424
Manganese-54	1293	837	2205	480	734	258
Chromium-51	N/A*	N/A*	1454	777	199	853

\* Analytical results were below lower limit of detection.

\*\* Range not applicable due to only one number averaged.

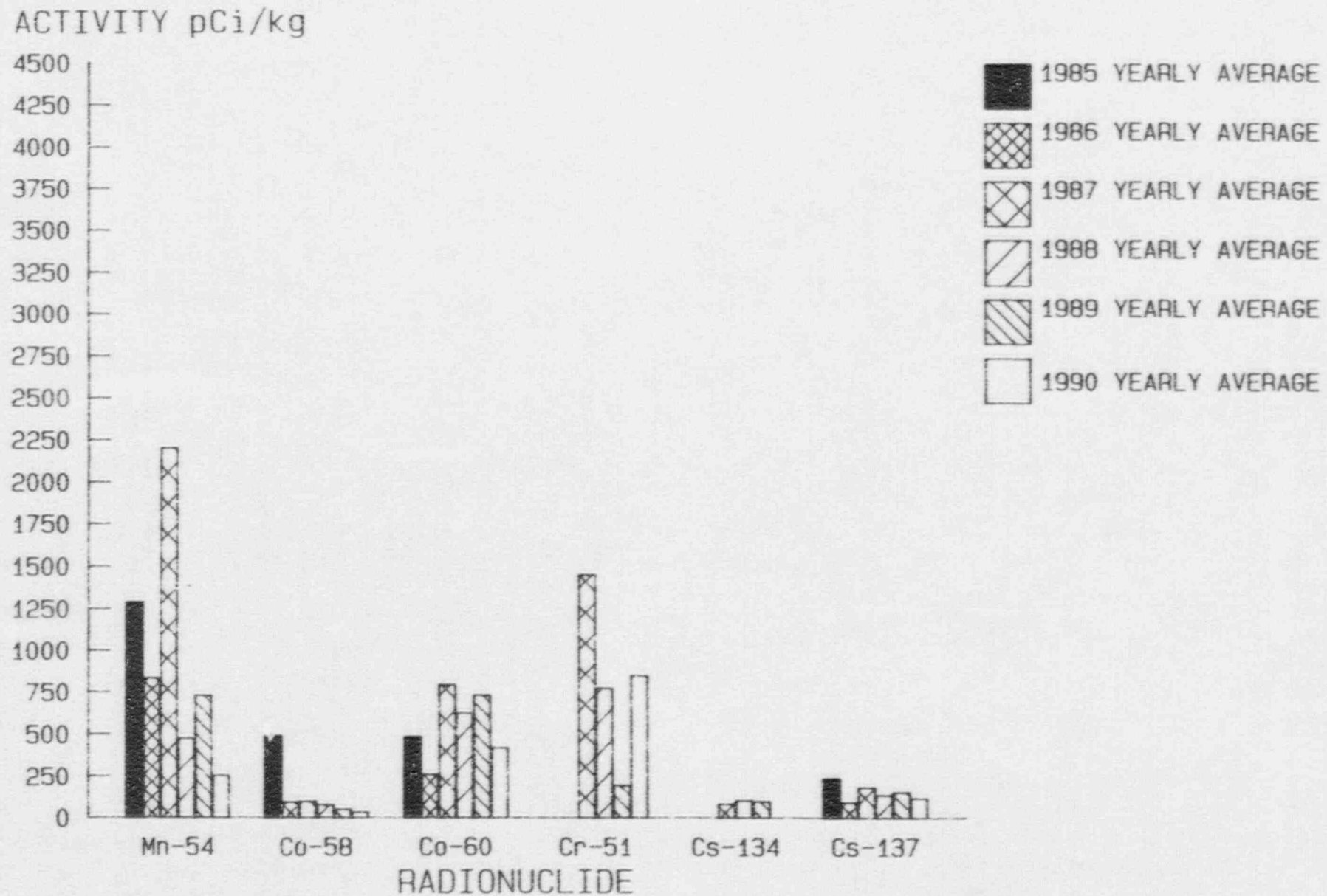
TABLE 2-10

SEDIMENT SAMPLING LOCATIONS

SEDHAM*	Downstream of the GGNS discharge point into the Mississippi River in the vicinity of the boat landing near Hamilton Lake outlet (Sector N, 2 miles)
SEDBAR	Barge slip (Sector Q, 1.5 miles)
SEDCONT	Upstream from the GGNS discharge point into the Mississippi River in the vicinity of Upper Grand Gulf Landing (Sector R, 2 miles)

\* Technical Specification requirements

FIGURE 2-12  
BARGE SLIP SEDIMENT



## 2.7 FISH

NOTE #1: Analytical results are presented in Tables 7.1 and 7.2 of Attachment I and summarized in Section 4.0.

NOTE #2: Fish sampling locations are shown in Figure 2-5 of Section 2.1.



#### 2.7.1 INTERPRETATIONS AND TRENDS OF RESULTS

Fish samples were collected semiannually and analyzed for gamma-emitting radionuclides. Analytical results for fish in 1990 and previous years have shown no data which was attributable to the operation of GGNS.

#### 2.7.2 DEVIATIONS FROM THE ESP

Fish samples required by GGNS Technical Specifications were collected and analyzed during 1990 without exception.

#### 2.7.3 PROGRAM DESCRIPTION

Fish were collected semiannually in the Mississippi River at the following locations (Table 2-11):

- o Minimum of 1000 yards upstream from the GGNS barge slip (control location)
- o Minimum of 2000 but less than 6000 yards downstream from the GGNS barge slip (indicator location)

Fish can be collected by net, trotline, electroshock or purchase from commercial fishermen. If samples were purchased from a commercial fisherman, ESP personnel accompanied the fisherman to ensure samples were collected from the required locations.

A sufficient amount was collected from each location to provide a minimum of 1000 grams (wet weight) of eviscerated fish sample. The samples were analyzed for gamma-emitting radionuclides.

TABLE 2-11

FISH SAMPLING LOCATIONS

Commercially or  
Recreationally  
Important Species\*

Downstream of the GGNS discharge point into  
the Mississippi River

Upstream of the GGNS discharge point into  
the Mississippi River uninfluenced by plant  
operations

\* Technical Specification requirements

## 2.8 SPECIAL SAMPLES

NOTE: Analytical results are presented in Tables 9.1 through 12.1 of Attachment I and summarized in Section 4.0.

### 2.8.1 INTERPRETATIONS AND TRENDS OF RESULTS

Forty-nine special samples were collected during the year and analyzed for gamma-emitting radionuclides. Descriptions of the special samples collected and a discussion of the results are provided below.

- o Surface Water - Twenty-five samples were collected from ten locations in 1990 to provide supplemental information about GGNS effluent and site background radioactive concentrations. A discussion of the results for each location is listed below.
  - Four samples were collected from Outfall 007. Plant-related radionuclides were not detected.
  - Three samples were collected from Outfall 015. Plant-related radionuclides were not detected.
  - Two samples were collected from Manhole #54. Plant-related radionuclides were not detected.
  - One sample was collected from Outfall 010. Plant-related radionuclides were not detected.
  - One sample was collected at the effluent end of Sediment Basin A. Plant-related radionuclides were not detected.
  - One sample was collected from the GGNS Resin Pond. Plant-related radionuclides were not detected.
  - One sample was collected at the effluent end of Sediment Basin B. Plant-related radionuclides were not detected.
  - Four samples were collected from the Barge Slip. Small concentrations of Manganese-54 and Cobalt-60 were detected. Results are summarized in Section 4.0.
  - Four upstream shoreline Mississippi River samples were collected. Plant-related radionuclides and tritium were not detected.
  - Four downstream shoreline Mississippi River samples were collected. Plant-related radionuclides and tritium were not detected.

- o Sediment - Seventeen sediment samples were collected from four locations to provide supplemental information about GGNS effluents and site background radiation levels. A discussion of the results for each location is provided below.
  - Eleven samples were collected from the GGNS barge slip. A discussion of these results is presented in Section 2.6.
  - Four samples were collected at the influent end of Sediment Basin B. Plant-related radionuclides were not detected.
  - One sample was collected at the effluent end of Sediment Basin A. Plant-related radionuclides were not detected.
  - One sample was collected from the GGNS Resin Pond. Plant-related radionuclides were not detected.
- o Raw Sewage - Six samples were collected from two locations to provide supplemental information about GGNS sewage sludge radionuclide concentrations. A discussion of the results for each location is listed below.
  - Four samples were collected from the Unit 1 Sewage Plant (Outfall 015). Small concentrations of Manganese-54 and Cobalt-60 were detected. Results are summarized in Sections 4.0 and 5.0.
  - Two samples were collected from the Unit 2 Sewage Plant (Outfall 010). Plant-related radionuclides were not detected.
- o Meat - one sample was collected from one location to provide supplemental information and background radionuclide concentrations. A discussion of the results is listed below.
  - One sample of venison was collected at the Bucksport Hunting Camp. Plant-related radionuclides were not detected.

#### 2.8.2 DEVIATIONS FROM THE ESP

Special samples are not a part of the GGNS Technical Specifications requirement. Therefore, deviations from the ESP do not apply.

### 2.8.3 PROGRAM DESCRIPTION

Special samples were occasionally taken from locations which were not part of the routine ESP to provide supplementary data and to address areas of special interests. Sample media may include sediment, water, milk, fish, meat and vegetation and may be analyzed for gamma-emitting radionuclides, Iodine-131 or gross beta-emitting radionuclides depending upon current interest.



## 2.9 ANNUAL LAND USE CENSUS

#### 2.9.1 INTERPRETATIONS AND TRENDS OF RESULTS

Although some minor changes occurred from 1989 to 1990, as shown in Table 2-12, there was no need to modify the ESP. Also, there was no location identified which yielded a calculated dose or dose commitment greater than those currently being calculated.

The results of the 1990 Land Use Census indicated the land uses in the zero to 5-mile area surrounding GGNS have remained basically the same as those reported in the 1988 and 1989 Annual Land Use Census. The 1990 Land Use Census data sheets are presented in Table 2-13.

#### 2.9.2 DEVIATIONS FROM THE ESP

The Annual Land Use Census required by GGNS Technical Specifications was conducted during 1990 without exception.

#### 2.9.3 PROGRAM DESCRIPTION

As required by GGNS Technical Specification 3.12.2, ESP personnel conducted an Annual Land Use Census. The purpose of the census was to identify changes in the uses of land in the unrestricted areas surrounding GGNS which would require modifications to the ESP or the Offsite Dose Calculation Manual (ODCM). The most important criteria during the census were to determine the location, in each of the 16 meteorological sectors, of the nearest:

- o Residence
- o Animal milked for human consumption
- o Garden of greater than 50 m<sup>2</sup> (500 ft<sup>2</sup>) producing broadleaf vegetation.

The method used for conducting the 1990 Land Use Census was as follows:

- o Environmental Surveillance Program (ESP) personnel conducted field surveys in each meteorological sector out to five miles in order to locate the nearest resident, milk animal and garden.
- o Telephone confirmation was used in several instances when personal contact could not be made.
- o As a result of these surveys, the following information was obtained/confirmed in each meteorological sector:
  - Nearest permanent residence
  - Nearer unoccupied residence
  - Nearest garden and approximate size
  - Nearest milking animal.
- o ESP personnel identified the locations on the map, measured the distances to GGNS and recorded results on data sheets.
- o ESP personnel compared the 1990 Census results to 1989 Census results.

TABLE 2-12

1989-1990 LAND USE CENSUS CHANGES

SECTOR	PARAMETER	1989 DATA*	1990 DATA*	REASON FOR CHANGE
A	Nearest Broadleaf Garden	J.E. Marsalis 2.6	M. Presson 2.6	J. E. Marsalis property sold to M. Presson.
G	Nearest Broadleaf Garden	C.B. Buckner 3.4	S. Lowe 3.4	C. B. Buckner property sold to S. Lowe.
J	Nearest Broadleaf Garden	SERI (ENV) 0.6	CGNS (ENV) 0.6	Due to frequent Company name changes, garden location will now be referred to as GGNS.
R	Nearest Broadleaf Garden	SERI (ENV) 1.7	GGNS (ENV) 1.7	Due to frequent Company name changes, garden location will now be referred to as GGNS.

\* Distances in kilometers

TABLE 2-13  
Page 1 of 5  
1990 LAND USE CENSUS

PARAMETER		SECTOR A	SECTOR B	SECTOR C	SECTOR D
I. Nearest Occupied Residence	a. Distance (km)	1.5	1.2	1.1	4.3
	b. Name	Elizabeth McGee	Prince Dotson	Lanell Frazier	Ethel May Ryals
	c. Address	Rt. 2, Box 391 Port Gibson, MS	Rt. 2, Box 392 Port Gibson, MS	P. O. Box 33 Port Gibson, MS	Rt. 2, Box 372B Port Gibson, MS
	d. Number of Occupants	1	7	3	6
II. Nearer Unoccupied Residence	a. Distance (km)	None	None	None	None
II. Nearest Milk Animal	a. Distance (km)				
	b. Owner's Name	None	None	None	None
	c. Address				
IV. Nearest Broadleaf Garden	a. Distance (km)	2.6		1.1	4.5
	b. Owner's Name	Michael Presson *		Lanell Frazier	John H. Jackson
	c. Address	Rt. 2, Box 377 Port Gibson, MS	None	P. O. Box 33 Port Gibson, MS	Rt. 2, Box 171A Port Gibson, MS
	d. Garden Size (m <sup>2</sup> )	50		50	250
V. Census Comparison:					
a. Is the nearest occupied residence in the same location as last census?		YES	YES	YES	YES
b. Is the nearest milk animal in the same location as last census?		N/A	N/A	N/A	N/A
c. Is the nearest broadleaf garden in the same location as last census?		YES	N/A	YES	YES

Changed since 1989 census



TABLE 2-13 (cont'd)  
Page 2 of 5  
1990 LAND USE CENSUS

PARAMETER		SECTOR E	SECTOR F	SECTOR G	SECTOR H
I. Nearest Occupied Residence	a. Distance (km)	1.0	7.0	3.1	1.8
	b. Name	Roy Rogers	Pykes Cupstid	David McGee	John Nichols**
	c. Address	P. O. Box 783 Port Gibson, MS	Rt. 2, Box 156 Port Gibson, MS	Rt. 2, Box 415 Port Gibson, MS	P. O. Box 437 Port Gibson, MS
	d. Number of Occupants	2	4	2	2
II. Nearer Unoccupied Residence	a. Distance (km)	None	None	None	None
III. Nearest Milk Animal	a. Distance (km)				
	b. Owner's Name	None	None	None	None
	c. Address				
IV. Nearest Broadleaf Garden	a. Distance (km)	1.3	7.8	3.4	5.2
	b. Owner's Name	Hiram Wells	Gerald Baker	Stephanie Lowe*	Nathan Noble
	c. Address	Rt. 2, Box 399A Port Gibson, MS	Rt. 2, Box 172 Port Gibson, MS	Rt. 2, Box 416A Port Gibson, MS	P. O. Box 811 Port Gibson, MS
	d. Garden Size (m <sup>2</sup> )	106	50	1000 (Grapes)	70
V. Census Comparison:					
a. Is the nearest occupied residence in the same location as last census?		YES	YES	YES	YES
b. Is the nearest milk animal in the same location as last census?		N/A	N/A	N/A	N/A
c. Is the nearest broadleaf garden in the same location as last census?		YES	YES	YES	YES

\* Changed since 1989 census

\*\* Maintains a small garden, but < 50 m<sup>2</sup>



TABLE 2-13 (cont'd)  
Page 3 of 5  
1990 LAND USE CENSUS

PARAMETER		SECTOR J	SECTOR K	SECTOR L	SECTOR M
I. Nearest Occupied Residence	a. Distance (km)	5.0	3.5	1.4	
	b. Name	Steve Price	Jim Cassell, Jr	Glodjo (Buddy Roddey)***	
	c. Address	Rt. 1, Box 412D Port Gibson, MS	Rt. 2, Box 404 Port Gibson, MS	Rt. 2, Box 401 Port Gibson, MS	None
	d. Number of Occupants	2	4	4	
I. Nearer Unoccupied Residence	a. Distance (km)	3.8 (B. Cassell House)	None	None	None
I. Nearest Milk Animal	a. Distance (km)				
	b. Owner's Name	None	None	None	None
	c. Address				
V. Nearest Broadleaf Garden	a. Distance (km)	0.6	3.5	1.4	
	b. Owner's Name	GGNS (Env)*	Jim Cassell, Jr	Papa Johns-GG Bait Shop****	
	c. Address	P. O. Box 756 Port Gibson, MS	Rt. 2, Box 404 Port Gibson, MS	Rt. 2, Box 400J Port Gibson, MS	None
	d. Garden Size (m <sup>2</sup> )	2500	50	150	
V. Census Comparison:					
a. Is the nearest occupied residence in the same location as last census?		YES	YES	YES	N/A
b. Is the nearest milk animal in the same location as last census?		N/A	N/A	N/A	N/A
c. Is the nearest broadleaf garden in the same location as last census?		YES	YES	YES	N/A

\* Changed since 1989 census

\*\*\* Now owned and occupied by Buddy Roddey.

\*\*\* Not a residence. Store is owned and operated by B. Roddey.

TABLE 2-13 (cont'd)  
Page 4 of 5  
1990 LAND USE CENSUS

PARAMETER		SECTOR N	SECTOR P	SECTOR Q	SECTOR R
I. Nearest Occupied Residence	a. Distance (km) b. Name c. Address d. Number of Occupants	None	None	None	1.7 Christine Roddey Rt. 2, Box 390 Port Gibson, MS 2
II. Nearer Unoccupied Residence	a. Distance (km)	2.6 (Bucksnort Camp)	6.9 (Dr. Cobb Hunting Camp)	None	None
I. Nearest Milk Animal	a. Distance (km) b. Owner's Name c. Address	None	None	None	None
V. Nearest Broadleaf Garden	a. Distance (km) b. Owner's Name c. Address d. Garden Size (m <sup>2</sup> )	None	None	None	1.2 GGNS (Env)* P. O. Box 756 Port Gibson, MS 2500
V. Census Comparison:					
a. Is the nearest occupied residence in the same location as last census?		N/A	N/A	N/A	YES
b. Is the nearest milk animal in the same location as last census?		N/A	N/A	N/A	N/A
c. Is the nearest broadleaf garden in the same location as last census?		N/A	N/A	N/A	YES

\* Changed since 1989 census

VI. Remarks: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Census conducted by: Warren Hinder 10/26/90  
Signature Date

II. Review:

a. Comparison of previous and present locations:

- ☐ No differences  
☒ Differences  
☐ Significant  
☒ Insignificant

b. Calculations:

- ☒ Not required  
☐ Required

Completed: Warren Hinder 10/26/90  
Signature Date

III. Reviewed/Approved: [Signature] 12/11/90  
Supervisor, Environmental Services Date

SECTION 3.0

ANALYTICAL PROGRAM TECHNICAL DESCRIPTION

### 3.1 SAMPLE HANDLING AND TREATMENT

Once a representative sample is received by the analytical laboratory, the laboratory staff is responsible for properly treating and storing the sample. Environmental samples frequently require treatment prior to analysis. Treatment of the sample after it is received depends on the sample and the analyses to be performed on it.

#### 3.1.1 Water Samples

Generally, one-gallon water samples were acidified with five ml of concentrated HCl acid when collected. Samples for tritium analyses should not be stored in polyethylene bottles for more than 3 or 4 months because water can evaporate through the polyethylene.

#### 3.1.2 Air Filters

Air filters were handled with care when heavy dust loadings were observed because particulate matter is easily removed from the filter. Air filters were normally received by the laboratory in plastic containers; some extremely low-level analyses required analysis of the container as well as the sample.

#### 3.1.3 Milk

Milk samples were usually refrigerated until analyses could be performed. If analyses were delayed for more than a few days, a preservative (formaldehyde) was added to inhibit bacterial growth and retard spoilage. Milk samples analyzed for Iodine-131 had 100 ml formaldehyde added to avoid binding of the iodine that may occur with smaller levels of formaldehyde.

#### 3.1.4 Soil and Bottom Sediment

Soil and sediment samples were dried, pulverized and sieved before analysis. To ensure a homogeneous sample, thorough mixing was required.

#### 3.1.5 Other Samples

Perishable samples were preserved by refrigeration or freezing. Vegetation and other samples may need to be dried, pulverized or ashed before or after analysis for long-term storage.

### 3.2 GROSS ALPHA/BETA-EMITTING RADIONUCLIDE ANALYSIS OF AIR PARTICULATE SAMPLES

Air filters were counted in a low-background alpha-beta counter at least 24 hours after collection in order to allow for decay of short-lived materials such as radon and thoron.

Calculations of the results, the two sigma error and the lower limit of detection (LLD) were performed as indicated in the following:

$$\begin{array}{ll} \text{ALPHA RESULT} & = [(N/T)-(B/t)]/(2.22 \cdot V \cdot E) \\ (\text{pCi/m}^3) & \end{array}$$

$$\begin{array}{ll} \text{BETA RESULT} & = [(N/T)-(B/t)-(r)(N/T)]/(2.22 \cdot V \cdot E) \\ (\text{pCi/m}^3) & \end{array}$$

$$\begin{array}{ll} \text{TWO SIGMA ERROR} & = 1.96 \sqrt{(N/T^2)+(B/t^2)}/(2.22 \cdot V \cdot E) \\ (\text{pCi/m}^3) & \end{array}$$

$$\begin{array}{ll} \text{LLD (pCi/m}^3) & = 4.66 \sqrt{B}/(2.22 \cdot V \cdot E \cdot t) \end{array}$$

where: N = Gross counts of sample  
T = Number of minutes sample was counted  
B = Counts of blank  
t = Number of minutes blank was counted  
2.22 = dpm/pCi  
V = Sample aliquot size (cubic meters)  
E = Counting efficiency  
r = Ratio of alpha counts in beta counting (cross-talk)



### 3.3 DETERMINATION OF GROSS ALPHA-EMITTING RADIONUCLIDE AND/OR GROSS BETA-EMITTING RADIONUCLIDE ACTIVITY IN WATER SAMPLES

Section 3.3 describes the process used to measure the overall alpha-emitting radionuclides and beta-emitting radionuclides of water samples without identifying the specific radioactive isotope present. No chemical separation techniques were involved. Two hundred ml of the sample was evaporated in a beaker at approximately 100°C. The residue was transferred and dried in a 2-inch stainless steel planchet.

The planchets were counted for 100 minutes in a low-background alpha-beta counting system. Calculation of activity includes a self-absorption correction factor for counter efficiency based on the weight of residue on each planchet.

Calculations of the results, the two sigma error and the lower limit of detection (LLD) were performed as indicated in the following:

$$\begin{array}{l} \text{ALPHA RESULT} \\ (\text{pCi/l}) \end{array} = [(N/T)-(B/t)]/(2.22 \cdot V \cdot E)$$

$$\begin{array}{l} \text{BETA RESULT} \\ (\text{pCi/l}) \end{array} = [(N/T)-(B/t)-(r)(N/T)]/(2.22 \cdot V \cdot E)$$

$$\begin{array}{l} \text{TWO SIGMA ERROR} \\ (\text{pCi/l}) \end{array} = 1.96 \sqrt{(N/T^2)+(B/t^2)}/(2.22 \cdot V \cdot E)$$

$$\text{LLD (pCi/l)} = 4.66 \sqrt{(B)/(2.22 \cdot V \cdot E \cdot t)}$$

where: N = Gross counts of sample  
T = Number of minutes sample was counted  
B = Counts of blank  
t = Number of minutes blank was counted  
2.22 = dpm/pCi  
V = Sample aliquot size (liters)  
E = Counting efficiency  
r = Ratio of alpha counts in beta counting (cross-talk)

If the net activity  $(N/T-B/t)$  was equal to or less than the counting error, the activity on the collection date was below the limits of detection and was designated less than the lower limit of detection (LLD).

### 3.4 ANALYSIS OF WATER SAMPLES FOR TRITIUM

Five milliliters of water was added to .5 ml of liquid scintillation solution in a 25 ml vial. The sample was inserted into a liquid scintillation spectrometer and counted for 300-500 minutes.

Calculations of the results, the two sigma error and the lower limit of detection (LLD) were performed as indicated in the following:

$$\begin{array}{l} \text{RESULT} \\ (\text{pCi/l}) \end{array} = [(N/T)-(B/t)]/[(2.22 \cdot V \cdot E) \exp(-\lambda \Delta t_2)]$$

$$\begin{array}{l} \text{TWO SIGMA ERROR} \\ (\text{pCi/l}) \end{array} = 1.96 \sqrt{(N/T^2)+(B/t^2)+[(2.22 \cdot V \cdot E) \exp(-\lambda \Delta t_2)]}$$

$$\begin{array}{l} \text{LLD (pCi/l)} \end{array} = \frac{4.66 \sqrt{B}}{2.22 \cdot E \cdot V \cdot t \cdot \exp(-\lambda \Delta t_2)}$$

where: N = Gross counts of sample  
T = Number of minutes sample was counted  
B = Counts of blank  
t = Number of minutes blank was counted  
2.22 = dpm/pCi  
V = Sample aliquot size (l)  
E = Counting efficiency  
 $\exp(-\lambda \Delta t_2)$  = Decay correction where  $\Delta t_2$  is time elapsed between collection of sample and date of counting.

### 3.5 ANALYSIS OF SAMPLES FOR IODINE-131

Up to four liters of sample was thoroughly mixed with a stable iodine carrier solution. The sample was then passed through an anion exchange resin column to remove iodine from the sample. The iodine was then stripped from the resin with a sodium hypochlorite solution, reduced with hydroxylamine hydrochloride and extracted into carbon tetrachloride

as free iodine. It was then back-extracted into sodium bisulfite solution and was precipitated as silver iodide. The precipitate was weighed to determine chemical yield and mounted on a stainless steel planchet for low-level beta counting. The chemical yield was corrected by measuring the stable iodide content of the milk or the water with a specific ion electrode.

Calculations of the results, two sigma error and the lower limit of detection (LLD) in pCi/l were performed as indicated in the following:

$$\text{RESULT (pCi/l)} = (N/t - B/t) / [(2.22 \cdot E \cdot V \cdot Y) \exp(-\lambda \Delta t_2)]$$

$$\text{TWO SIGMA ERROR (pCi/l)} = (1.96 \sqrt{(N/t^2) + (B/t^2)}) + [(2.22 \cdot E \cdot V \cdot Y) \exp(-\lambda \Delta t_2)]$$

$$\text{LLD (pCi/l)} = (4.66 \sqrt{(B/t^2)}) + [(2.22 \cdot E \cdot V \cdot Y) \exp(-\lambda \Delta t_2)]$$

where: N = Total counts from sample (counts)  
 t = Counting time for sample (min)  
 B = Total counts of blank (counts)  
 2.22 = dpm/pCi  
 E = Efficiency of the counter for Iodine I-131 corrected for self absorption effects  
 V = Volume of sample analyzed  
 Y = Chemical yield of the amount of sample counted  
 $\exp(-\lambda \Delta t_2)$  = Decay factor from the time of collection to the counting date

### 3.6 GAMMA SPECTROMETRY OF SAMPLES

#### 3.6.1 Milk and Water

A 3.5-liter Marinelli beaker was filled with a representative aliquot of the sample. The sample was then counted for a minimum of 240 minutes, or until the required LLDs were achieved, in a shielded Germanium-Lithium (GeLi) detector coupled to a computer-based data acquisition system which performed a pulse height analysis.

A computer software program defined peaks by certain changes in the slope of the spectrum. The program also compared the energy of each peak with a library of peaks for radionuclide identification and then performed the radioactivity calculation using the appropriate fractional gamma ray abundance, half life, detector efficiency and net counts in the peak region.

#### 3.6.2 Vegetation, Food and Garden Crops, and Fish

A maximum quantity of undried vegetation, food or garden crop sample was loaded into a tared 3.5-liter Marinelli beaker and weighed. The sample was then counted for a minimum of 200 minutes, or until the required LLDs were achieved, in a shielded GeLi detector as described in Section 3.6.1.

As much as possible (up to the total sample) of the edible portion of a fish was loaded into a tared Marinelli beaker and weighed. The sample was then diluted with deionized water to weigh 3.5 kg and counted for a minimum of 240 minutes in a shielded GeLi detector as described in Section 3.6.1.

#### 3.6.3 Soils and Sediments

Soils and sediments were dried at a low temperature (less than 100°C), loaded into a tared 1.0-liter Marinelli beaker and weighed. The sample was then counted for 240 minutes, or until the required LLDs were achieved, in a shielded GeLi detector as described in Section 3.6.1.

#### 3.6.4 Charcoal Cartridges

Charcoal cartridges were counted in a Marinelli beaker, with one to four cartridges positioned on the face of a GeLi detector and up to seven cartridges on its side. Each detector was

calibrated for both top and side positions and a counting efficiency determined. The Iodine-131 detection limit was determined for each charcoal cartridge, assuming no positive results for Iodine-131, by utilizing the smallest volume of air recorded for a cartridge within the Marinelli beaker. If Iodine-131 was observed in the screening count of a set of cartridges, each charcoal cartridge was positioned on the face of the detector and then counted separately.

### 3.6.5 Air Particulate

The 12 to 14 (depending on the calendar quarter) air particulate filters for a quarterly composite for each field station were stacked one on top of another and counted for at least four hours, or until the required LLDs were achieved, in a shielded GeLi detector as described in Section 3.6.1.

The calculations of results, two sigma error and the lower limit of detection (LLD) in pCi/volume or pCi/mass were performed as indicated in the following:

$$\text{RESULT} = (S-B)/[(2.22 \cdot T \cdot E \cdot V \cdot F) \exp(-\lambda \Delta t_2)]$$

$$\begin{array}{l} \text{TWO SIGMA} \\ \text{ERROR} \end{array} = (1.96 \sqrt{S+B})/[(2.22 \cdot T \cdot E \cdot V \cdot F) \exp(-\lambda \Delta t_2)]$$

$$\text{LLD} = (4.66 \sqrt{B})/[(2.22 \cdot T \cdot E \cdot V \cdot F) \exp(-\lambda \Delta t_2)]$$

where: S = Area, in counts, of sample peak and background (region of spectrum of interest)  
 B = Background area, in counts, under sample peak, determined by a linear interpolation of the representative backgrounds on either side of the peak  
 2.22 = dpm/pCi  
 T = Length of time in minutes the sample was counted  
 E = Detector efficiency for energy of interest and geometry of sample

$V$  = Sample aliquot size (liters, cubic meters, kilograms, or grams)  
 $F$  = Fractional gamma abundance (specific for each emitted gamma)  
 $\exp(-\lambda\Delta t_2)$  = Decay factor from the time of collection to the counting date

### 3.7 THERMOLUMINESCENT DOSIMETERS (TLDs)

Environmental radiation doses were measured using TLD cards impregnated with calcium sulfate:dysprosium phosphor sealed in plastic protective holders. These TLD cards had four main readout areas utilized in calculating dose rates and four reserve areas as a backup dosimeter.

Prior to installation the cards were spread out in a single layer on a perforated metal tray and annealed for two hours at 250-260°C. After cooling, the cards were mounted in a card holder, sealed in a plastic protective holder and shipped for placement in the field.

Upon return from the field, the TLD cards were read in a Teledyne Isotopes Model 8300 TLD Reader. After readout, the cards were annealed again and irradiated with a known dose using a Radium-226 source encapsulated in an iridium needle and then read again to determine the card efficiency. The net exposure was calculated by the computer after in-transit exposure was subtracted. The LLD for environmental TLDs is 1 mrem/quarter.

### 3.8 DATA REPORTING CONVENTIONS

The mean of analytical results is as follows:

$$\bar{X} = \sum X_i / n$$

Where

$\bar{X}$  = Mean  
 $X_i$  = Individual sample results  
 $n$  = Number of sample results



Rounding of calculated values is accomplished by inspection of the digits to the right of the last reported digit with values less than 5 rounded down and values greater than 5 rounded up. When the value equals 5, the reported value is rounded to an even number.

Analytical results which are less than the 2 sigma counting error are reported as less than the LLD calculated for that sample. Analytical results greater than the 2 sigma counting error are reported along with the associated 2 sigma counting error as a plus or minus ( $\pm$ ) term.

Calendar quarters are considered to be the following time periods:

1ST QUARTER = JAN - MAR  
2ND QUARTER = APR - JUN  
3RD QUARTER = JUL - SEP  
4TH QUARTER = OCT - DEC

SECTION 4.0

ENVIRONMENTAL SURVEILLANCE PROGRAM SUMMARY

#### 4.1 1990 PROGRAM RESULTS SUMMARY\*

Results of the ESP for 1990 are summarized in Tables 4-1 and 4-2. Results from sampling locations required by GGNS Technical Specifications, which are identified in Sections 2.1 through 2.7, were used to develop Table 4-1. Table 4-2 includes results from all sampling locations, not just those required by Technical Specifications.

Indicator and control locations for Table 4-1 are as designated by the GGNS Technical Specifications and summarized in Table 4-3. Indicator and control locations for Table 4-2 are listed in Table 4-4. For determining ranges and means for indicator and control locations, values reported as less than (<) were not used.

\* Analytical results were provided by Arkansas Power & Light Company's Technical Analysis Section, with the exception of thermoluminescent dosimeter analysis provided by Teledyne Isotopes Midwest Laboratory.

Table 4-1

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ENVIRONMENTAL MONITORING PROGRAM SUMMARY  
(GGNS Technical Specification Samples)

Name of Facility Grand Gulf Nuclear Station  
 Location of Facility Claiborne, Mississippi  
 (County, State)

Docket No. 58-416  
 Reporting Period January - December 1998

Sample Type (Units)	Type and Number a of Analyses	b LLD	Indicator Locations Mean (F) c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) [Range]	Number c of Non-Routine Results e
				d Location	Mean (F) [Range]		
Air Particulates (pCi/m <sup>3</sup> )	GB 258	0.01	.021 (154/155) [.005 - .069]	AS-8 WR (Sector E, 0.6 mi)	.024 (52/52) [.009 - .047]	.020 (103/103) [.005 - .037]	0
	GS 20 Cs-134	0.05	<LLD	N/A	N/A	<LLD	0
	Cs-137	0.06	<LLD	N/A	N/A	<LLD	0
Airborne Iodine (pCi/m <sup>3</sup> )	I-131 258	0.07	<LLD	N/A	N/A	<LLD	0
TLD (Inner Ring) (mR/Qtr.)	Gamma 60	1.0	17.2 (60/60) [10.0 - 25.8]	M-18 (Sector F, 0.5 mi)	22.2 (4/4) [20.1 - 25.8]	N/A	0
TLD (Outer Ring) (mR/Qtr.)	Gamma 64	1.0	17.0 (64/64) [10.0 - 22.1]	M-55 (Sector D, 5.0 mi)	21.4 (4/4) [20.1 - 22.1]	N/A	0
TLD (Special Interest Areas) (mR/Qtr.)	Gamma 26	1.0	17.6 (26/26) [14.4 - 23.0]	M-01 (Sector E, 3.5 mi)	21.4 (4/4) [19.6 - 23.0]	N/A	0
TLD (Control) (mR/Qtr.)	Gamma 4	1.0	N/A	N/A	N/A	17.5 (4/4) [16.5 - 19.2]	0

Table 4-1 (cont'd)

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ENVIRONMENTAL MONITORING PROGRAM SUMMARY  
(GGNS Technical Specification Samples)

Name of Facility Grand Gulf Nuclear Station      Docket No. 58-416  
 Location of Facility Claiborne, Mississippi      Reporting Period January - December 1990  
 (County, State)

Sample Type (Units)	Type and Number a of Analyses		b LLD	Indicator Locations Mean (F) c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) [Range]	Number of Non-Routine Results e
					d Location	Mean (F) [Range]		
Cistern Water (pCi/l)	GB	24	4	3.4 (3/12) [2.5 - 3.9]	McGee Cistern (Sector A, 0.9 mi.)	3.4 (3/12) [2.5 - 3.9]	4.4 (2/12) [3.7 - 5.0]	0
	I-131	24	1.0	<LLD	N/A	N/A	0.5 (1/12) [N/A]	0
	H-3	8	2000	424 (1/4) [N/A]	McGee Cistern (Sector A, 0.9 mi.)	424 (1/4) [N/A]	272 (1/4) [N/A]	0
	GS	24						
	Mn-54		15	<LLD	N/A	N/A	<LLD	0
	Fe-59		30	<LLD	N/A	N/A	<LLD	0
	Co-58		15	<LLD	N/A	N/A	<LLD	0
	Co-60		15	<LLD	N/A	N/A	<LLD	0
	Zn-65		30	<LLD	N/A	N/A	<LLD	0
	Zr-95		30	<LLD	N/A	N/A	<LLD	0
	Nb-95		15	<LLD	N/A	N/A	<LLD	0
	Cs-134		15	<LLD	N/A	N/A	<LLD	0
	Cs-137		18	<LLD	N/A	N/A	<LLD	0
	Ba-140		60	<LLD	N/A	N/A	<LLD	0
	La-140		15	<LLD	N/A	N/A	<LLD	0
Surface Water (pCi/l)	H-3	12	2000	803 (6/8) [252-1930]	Discharge Basin (Sector P, 0.3 mi)	1021 (4/4) [531-1930]	310 (1/4) [N/A]	0
	GS	36						
	Mn-54		15	<LLD	N/A	N/A	<LLD	0
	Fe-59		30	<LLD	N/A	N/A	<LLD	0
	Co-58		15	<LLD	N/A	N/A	<LLD	0
	Co-60		15	4 (1/24) [N/A]	Discharge Basin (Sector P, 0.3 mi)	4 (1/12) [N/A]	<LLD	0
	Zn-65		30	<LLD	N/A	N/A	<LLD	0
	Zr-95		30	<LLD	N/A	N/A	<LLD	0
	Nb-95		15	<LLD	N/A	N/A	<LLD	0
	Cs-134		15	<LLD	N/A	N/A	<LLD	0
	Cs-137		18	<LLD	N/A	N/A	<LLD	0
	Ba-140		60	<LLD	N/A	N/A	<LLD	0
	La-140		15	<LLD	N/A	N/A	<LLD	0

Table 4-1 (cont'd)

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**ENVIRONMENTAL MONITORING PROGRAM SUMMARY**  
**(GNS Technical Specification Samples)**

Name of Facility Grand Gulf Nuclear Station      Docket No. 50-416  
 Location of Facility Claiborne, Mississippi      Reporting Period January - December 1998  
 (County, State)

Sample Type (Units)	Type and Number of Analyses	b LLD	Indicator Locations Mean (F) c [Range]	Location with Highest Annual Mean d		Control Locations Mean (F) [Range]	Number of Non-Routine Results e
				Location	Mean (F) [Range]		
Well Water (pCi/l)	H-3	8	<LLD	N/A	N/A	N/A	0
	GS	2000	<LLD	N/A	N/A	<LLD	0
	Mn-54	15	<LLD	N/A	N/A	<LLD	0
	Fe-59	30	<LLD	N/A	N/A	<LLD	0
	Co-58	15	<LLD	N/A	N/A	<LLD	0
	Co-60	15	<LLD	N/A	N/A	<LLD	0
	Zn-65	30	<LLD	N/A	N/A	<LLD	0
	Zr-95	30	<LLD	N/A	N/A	<LLD	0
	Nb-95	15	<LLD	N/A	N/A	<LLD	0
	Cs-134	15	<LLD	N/A	N/A	<LLD	0
	Cs-137	18	<LLD	N/A	N/A	<LLD	0
	Ba-140	60	<LLD	N/A	N/A	<LLD	0
	La-140	15	<LLD	N/A	N/A	<LLD	0
Milk (pCi/l)	I-131	3	N/A	N/A	N/A	<LLD	0
	GS	2	N/A	N/A	N/A	<LLD	0
	Cs-134	15	N/A	N/A	N/A	<LLD	0
	Cs-137	18	N/A	N/A	N/A	<LLD	0
	Ba-140	60	N/A	N/A	N/A	<LLD	0
Vegetation (pCi/kg wet)	I-131	108	<LLD	N/A	N/A	<LLD	0
	GS	108	<LLD	N/A	N/A	<LLD	0
	Cs-134	60	13 (2/72)	Sector J, 0.4 mi	13 (2/36) [7-18]	<LLD	0



Table 4-1 (cont'd)

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ENVIRONMENTAL MONITORING PROGRAM SUMMARY  
(GGNS Technical Specification Samples)

Name of Facility Grand Gulf Nuclear Station      Docket No. 50-416  
 Location of Facility Claiborne, Mississippi      Reporting Period January - December 1990  
 (County, State)

Sample Type (Units)	Type and Number of Analyses <sup>a</sup>	b LLD	Indicator Locations Mean (F) <sup>c</sup> [Range]	Location with Highest Annual Mean		Control Locations Mean (F) [Range]	Number of Non-Routine Results <sup>e</sup>
				d Location	Mean (F) [Range]		
Fish (pCi/kg wet)	GS      4						
	Mn-54	130	<LLD	N/A	N/A	<LLD	0
	Fe-59	260	<LLD	N/A	N/A	<LLD	0
	Co-58	130	<LLD	N/A	N/A	<LLD	0
	Co-60	130	<LLD	N/A	N/A	<LLD	0
	Zn-65	260	<LLD	N/A	N/A	<LLD	0
	Cs-134	130	<LLD	N/A	N/A	<LLD	0
	Cs-137	150	<LLD	N/A	N/A	<LLD	0
Bottom Sediments (pCi/kg dry)	GS      2						
	Cs-134	150	<LLD	N/A	N/A	N/A	0
	Cs-137	180	36 (2/2) [16-55]	Hamilton Lake (Sector N, 2 mi.)	36 (2/2) [16-55]	N/A	0

<sup>a</sup> GB = Gross beta; GS = Gamma scan.

<sup>b</sup> LLD = Required lower limit of detection based on Grand Gulf Nuclear Station Technical Specification Table 4.12.1-1.

<sup>c</sup> Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (F).

<sup>d</sup> Locations are specified (1) by name and (2) sector relative to reactor site.

<sup>e</sup> Non-routine results are those which exceed ten times the control station value. If no control station value is available, the result is considered non-routine if it exceeds ten times the preoperational value for the location.

Table 4-2

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ENVIRONMENTAL MONITORING PROGRAM SUMMARY  
(All Samples)

Name of Facility Grand Gulf Nuclear Station      Docket No. 50-416  
 Location of Facility Claiborne, Mississippi      Reporting Period January - December 1990  
 (County, State)

Sample Type (Units)	Type and Number of Analyses	b LLD	Indicator Locations Mean (F) c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) [Range]	Number of Non-Routine Results
				Location	Mean (F) [Range]		
Air Particulates (pCi/m <sup>3</sup> )	GB 570	0.01	.021 (309/311) [.005 - .069]	A5-6 WR (Sector E, 0.6 mi.)	.024 (52/52) [.009 - .047]	.021 (259/259) [.005 - .055]	0
	GS 44						
	Cs-134	0.05	<LLD	N/A	N/A	<LLD	0
	Cs-137	0.06	<LLD	N/A	N/A	<LLD	0
Airborne Iodine (pCi/m <sup>3</sup> )	I-131 570	0.07	<LLD	N/A	N/A	.026 (1/259) [N/A]	0
TLD (0-2 Miles) (mR/qtr.)	Gamma 201	1.0	18.8 (201/201) [10.0 - 75.8]	M-69 (Sector G, Protected Area Boundary)	57.8 (4/4) [33.0 - 75.8]	N/A	0
TLD (2-6 Miles) (mR/qtr.)	Gamma 85	1.0	17.2 (85/85) [10.8 - 23.0]	M-01 (Sector E, 3.5 mi.) M-55 (Sector D, 5.0 mi.)	21.4 (4/4) [19.6 - 23.0] 21.4 (4/4) [20.1 - 22.1]	N/A	0
TLD (> 6 Miles) (mR/qtr.)	Gamma 61	1.0	N/A	N/A	N/A	18.1 (61/61) [13.2 - 23.6]	0

Table 4-2 (cont'd)

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**ENVIRONMENTAL MONITORING PROGRAM SUMMARY**  
(All Samples)

Name of Facility Grand Gulf Nuclear Station Docket No. 50-416  
 Location of Facility Claiborne, Mississippi Reporting Period January - December 1990  
 (County, State)

Sample Type (Units)	Type and Number a of Analyses		b LLD	Indicator Locations Mean (F) c [Range]	Location with Highest Annual Mean:		Control Locations Mean (F) [Range]	Number of Non-Routine Results e
					d Location	Mean (F) [Range]		
Cistern Water (pCi/l)	GB	24	4	3.4 (3/12) [2.5 - 3.9]	McGee Cistern (Sector A, 0.9 mi.)	3.4 (3/12) [2.5 - 3.9]	4.4 (2/12) [3.7 - 5.0]	0
	I-131	24	1.0	<LLD	N/A	N/A	0.5 (1/12) [N/A]	0
	H-3	8	2000	424 (1/4) [N/A]	McGee Cistern (Sector A, 0.9 mi.)	424 (1/4) [N/A]	272 (1/4) [N/A]	0
	GS	24						
	Mn-54		15	<LLD	N/A	N/A	<LLD	0
	Fe-59		30	<LLD	N/A	N/A	<LLD	0
	Co-58		15	<LLD	N/A	N/A	<LLD	0
	Co-60		15	<LLD	N/A	N/A	<LLD	0
	Zn-65		30	<LLD	N/A	N/A	<LLD	0
	Zr-95		30	<LLD	N/A	N/A	<LLD	0
	Nb-95		15	<LLD	N/A	N/A	<LLD	0
	Cs-134		15	<LLD	N/A	N/A	<LLD	0
	Cs-137		18	<LLD	N/A	N/A	<LLD	0
	Ba-140		60	<LLD	N/A	N/A	<LLD	0
	La-140		15	<LLD	N/A	N/A	<LLD	0
Surface Water (pCi/l)	H-3	14	2000	803 (6/9) [252-1930]	Discharge Basin (Sector P, 0.3 mi)	1021 (4/4) [531-1930]	310 (1/5) [N/A]	0
	GS	59						
	Mn-54		15	6 (1/45) [N/A]	Barge Slip (Sector Q, 1.5 mi)	6 (1/4) [N/A]	<LLD	0
	Fe-59		30	<LLD	N/A	N/A	<LLD	0
	Co-58		15	<LLD	N/A	N/A	<LLD	0
	Co-60		15	15 (2/45) [4-26]	Barge Slip (Sector Q, 1.5 mi)	26 (1/4) [N/A]	<LLD	0
	Zn-65		30	<LLD	N/A	N/A	<LLD	0
	Zr-95		30	<LLD	N/A	N/A	<LLD	0
	Nb-95		15	<LLD	N/A	N/A	<LLD	0
	Cs-134		15	<LLD	N/A	N/A	<LLD	0
	Cs-137		18	<LLD	N/A	N/A	<LLD	0
	Ba-140		60	<LLD	N/A	N/A	<LLD	0
	La-140		15	<LLD	N/A	N/A	<LLD	0

Table 4-2 (cont'd)

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ENVIRONMENTAL MONITORING PROGRAM SUMMARY  
(All Samples)

Name of Facility Grand Gulf Nuclear Station  
 Location of Facility Claiborne, Mississippi  
 (County, State)

Docket No. 50-416  
 Reporting Period January - December 1990

Sample Type (Units)	Type and Number a of Analyses	b LLD	Indicator Locations Mean (F) c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) [Range]	Number of Non-Routine Results e
				d Location	Mean (F) [Range]		
Well Water (pCi/l)	H-3 12	2000	<LLD	N/A	N/A	N/A	0
	GS 12						
	Mn-54 15		<LLD	N/A	N/A	<LLD	0
	Fe-59 30		<LLD	N/A	N/A	<LLD	0
	Co-58 15		<LLD	N/A	N/A	<LLD	0
	Co-60 15		<LLD	N/A	N/A	<LLD	0
	Zn-65 30		<LLD	N/A	N/A	<LLD	0
	Zr-95 30		<LLD	N/A	N/A	<LLD	0
	Nb-95 15		<LLD	N/A	N/A	<LLD	0
	Cs-134 15		<LLD	N/A	N/A	<LLD	0
	Cs-137 18		<LLD	N/A	N/A	<LLD	0
	Ba-140 60		<LLD	N/A	N/A	<LLD	0
	La-140 15		<LLD	N/A	N/A	<LLD	0
Milk (pCi/l)	I-131 3	1.0	N/A	N/A	N/A	<LLD	0
	GS 2						
	Cs-134 15		N/A	N/A	N/A	<LLD	0
	Cs-137 18		N/A	N/A	N/A	<LLD	0
	Ba-140 60		N/A	N/A	N/A	<LLD	0
	La-140 15		N/A	N/A	N/A	<LLD	0
Vegetation (pCi/kg wet)	I-131 100	60	<LLD	N/A	N/A	<LLD	0
	GS 100						
	Cs-134 60		<LLD	N/A	N/A	<LLD	0
	Cs-137 80		13 (2/72) [7-18]	Sector J, 0.4 mi	13 (2/36) [7-18]	<LLD	0

Table 4-2 (cont'd)

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ENVIRONMENTAL MONITORING PROGRAM SUMMARY  
(All Samples)

Name of Facility Grand Gulf Nuclear Station      Docket No. 58-416  
 Location of Facility Claiborne, Mississippi      Reporting Period January - December 1990  
 (County, State)

Sample Type (Units)	Type and Number a of Analyses	b LLD	Indicator Locations Mean (F) c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) [Range]	Number of Non-Routine Results e
				d Location	Mean (F) [Range]		
Fish (pCi/kg wet)	GS      4						
	Mn-54	130	<LLD	N/A	N/A	<LLD	0
	Fe-59	260	<LLD	N/A	N/A	<LLD	0
	Co-58	130	<LLD	N/A	N/A	<LLD	0
	Co-60	130	<LLD	N/A	N/A	<LLD	0
	Zn-65	260	<LLD	N/A	N/A	<LLD	0
	Cs-134	130	<LLD	N/A	N/A	<LLD	0
	Cs-137	150	<LLD	N/A	N/A	<LLD	0
Bottom Sediments (pCi/kg dry)	GS      23						
	Mn-54	130	258 (12/21) [52-619]	Barge Slip (Sector Q)	258 (12/13) [52-619]	<LLD	10*
	Co-58	130	39 (1/21) [N/A]	Barge Slip (Sector Q)	39 (1/13) [N/A]	<LLD	0
	Co-60	130	424 (12/21) [99-797]	Barge Slip (Sector Q)	424 (12/13) [99-797]	<LLD	12*
	Cr-51	130	853 (4/21) [325-1994]	Barge Slip (Sector Q)	853 (4/13) [325-1994]	<LLD	4*
	Cs-134	150	<LLD	N/A	N/A	<LLD	0
	Cs-137	180	112 (15/21) [16-209]	Barge Slip (Sector Q)	124 (13/13) [34-209]	<LLD	10*

\* Concentrations exceeded ten times the control station value (LLD). Regulatory reporting requirements for nonroutine results have not been established.



Table 4-2 (cont'd)

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**ENVIRONMENTAL MONITORING PROGRAM SUMMARY**  
(All Samples)

Name of Facility Grand Gulf Nuclear Station      Docket No. 50-416  
 Location of Facility Claiborne, Mississippi      Reporting Period January - December 1990  
 (County, State)

Sample Type (Units)	Type and Number <sup>a</sup> of Analyses	b LLD	Indicator Locations Mean (F) <sup>c</sup> [Range]	Location with Highest Annual Mean		Control Locations Mean (F) [Range]	Number of Non-Routine Results <sup>e</sup>
				d Location	Mean (F) [Range]		
Meat (pCi/kg wet)	GS      1						
	Fe-59	260	<LLD	N/A	N/A	N/A	0
	Zn-65	260	<LLD	N/A	N/A	N/A	0
	Cs-134	130	<LLD	N/A	N/A	N/A	0
	Cs-137	150	<LLD	N/A	N/A	N/A	0
Raw Sewage (pCi/l)	GS      4						
	Mn-54	15	42 (3/4) [18-67]	Unit 1 Sewage Plant (Sector A, 0.3 mi.)	42 (3/3) [18-67]	N/A	0
	Fe-59	30	<LLD	N/A	N/A	N/A	0
	Co-58	15	<LLD	N/A	N/A	N/A	0
	Co-60	15	88 (3/4) [57-146]	Unit 1 Sewage Plant (Sector A, 0.3 mi.)	88 (3/3) [57-146]	N/A	0
	Zn-65	30	<LLD	N/A	N/A	N/A	0
	Zr-95	30	<LLD	N/A	N/A	N/A	0
	Nb-95	15	<LLD	N/A	N/A	N/A	0
	Cs-134	15	<LLD	N/A	N/A	N/A	0
	Cs-137	18	<LLD	N/A	N/A	N/A	0
	Ba-140	60	<LLD	N/A	N/A	N/A	0
	La-140	15	<LLD	N/A	N/A	N/A	0

<sup>a</sup> GB = Gross beta; GS = Gamma scan.

<sup>b</sup> LLD = Required lower limit of detection based on Grand Gulf Nuclear Station Technical Specification Table 4.12.1-1.

<sup>c</sup> Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (F).

<sup>d</sup> Locations are specified (1) by name and (2) sector relative to reactor site.

<sup>e</sup> Non-routine results are those which exceed ten times the control station value. If no control station value is available, the result is considered non-routine if it exceeds ten times the preoperational value for the location.



TABLE 4-3

Page 1 of 3

INDICATOR & CONTROL LOCATIONS  
(GGNS Technical Specification Samples)

Sample Type	Locations	Total No. of Samples	Total No. & Type of Analyses
<u>AIR</u>	o Indicators - AS-6 RS	51	51 ea. - Gross Beta, I-131; 4-Gamma
	AS-7 MT	52	52 ea. - Gross Beta, I-131; 4-Gamma
	AS-8 WR	52	52 ea. - Gross Beta, I-131; 4-Gamma
	o Control - AS-1 PG	52	52 ea. - Gross Beta, I-131; 4-Gamma
	AS-3 61VA	51	51 ea. - Gross Beta, I-131; 4-Gamma
<u>TLDs</u>	o Indicators		
	- Inner Ring M-16, 18, 25, 27, 28, 30, 41, 42, 43, 44, 45, 46, 52, 53, 54, 86	60	60-Gamma
	- Outer Ring M-36, 40, 47, 48, 49, 50, 51, 55, 56, 57, 58, 59, 88, 89, 90, 91	64	64-Gamma
	- Special Interest Areas M-01, 07, 09, 10, 33, 38, 39	26	26-Gamma
	o Control - M-14	4	4-Gamma
<u>WATER</u>	<u>Cistern</u>		
	o Indicator - McGee	12	12 ea. - Gross Beta, I-131, Gamma; 4-Tritium (H-3)
	o Control - Willis	12	12 ea. - Gross Beta, I-131, Gamma; 4-Tritium (H-3)

TABLE 4-3 (cont'd)

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INDICATOR & CONTROL LOCATIONS  
(GGNS Technical Specification Samples)

<u>Sample Type</u>	<u>Locations</u>	<u>Total No. of Samples</u>	<u>Total No. &amp; Type of Analyses</u>
<u>WATER</u> (cont'd)	<u>Surface</u>		
	o Indicators -		
	Downstream Mississippi River	12	4-Tritium (H-3); 12-Gamma
	Discharge Basin	12	4-Tritium (H-3); 12-Gamma
	o Control - Upstream Mississippi River	12	4-Tritium (H-3); 12-Gamma
	<u>Groundwater</u>		
	o Indicator - Arnold Acres	4	4 ea. - Tritium (H-3), Gamma
	o Control - Port Gibson City	4	4 ea. - Tritium (H-3), Gamma
<u>MILK</u>	o Indicator - None	N/A	N/A
	o Control - Alcorn State University	3	3 - I-131; 2-Gamma
<u>VEGETATION</u>	o Indicators -		
	Sector J Garden	36	36 ea. - I-131, Gamma
	Sector R Garden	36	36 ea. - I-131, Gamma
	o Control - Sector K (Alcorn State University)	36	36 ea. - I-131, Gamma

TABLE 4-3 (cont'd)

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INDICATOR & CONTROL LOCATIONS  
(GGNS Technical Specification Samples)

Sample Type	Locations	Total No. of Samples	Total No. & Type of Analyses
<u>FISH</u>	o Indicator - Downstream Mississippi River	2	2-Gamma
	o Control - Upstream Mississippi River	2	2-Gamma
<u>SEDIMENT</u>	o Indicator - Hamilton Lake (SEDHAM)	2	2-Gamma
	o Control (1) - None	N/A	N/A

(1) A control location was not required by GGNS Technical Specifications, but one was collected upstream of the GGNS discharge into the Mississippi River.

TABLE 4-4

Page 1 of 4

INDICATOR & CONTROL LOCATIONS  
(All Samples)

Sample Type	Locations		Total No. of Samples	Total No. & Type of Analyses
<u>AIR</u>	o Indicators	AS-4 GJOE	52	52 ea. - Gross Beta, I-131; 4-Gamma
		AS-5 TC	52	52 ea. - Gross Beta, I-131; 4-Gamma
		AS-6 RS	51	51 ea. - Gross Beta, I-131; 4-Gamma
		AS-7 MT	52	52 ea. - Gross Beta, I-131; 4-Gamma
		AS-8 WR	52	52 ea. - Gross Beta, I-131; 4-Gamma
		AS-9 GGMP	52	52 ea. - Gross Beta, I-131; 4-Gamma
	o Controls	AS-1 PG	52	52 ea. - Gross Beta, I-131; 4-Gamma
		AS-2 61N	52	52 ea. - Gross Beta, I-131; 4-Gamma
		AS-3 61VA	51	51 ea. - Gross Beta, I-131; 4-Gamma
		AS-10 NLT	52	52 ea. - Gross Beta, I-131; 4-Gamma
		AS-11 STJ	52	52 ea. - Gross Beta, I-131; 4-Gamma
<u>TLDs</u>	o Indicators	- 0-2 Miles		
		M-10, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 29, 30, 41, 42, 43, 44, 45, 46, 52, 53, 54, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 86, 92, 93, 94	201	201-Gamma
		- 2-6 Miles		
		M-01, 07, 09, 24, 36, 40, 47, 48, 49, 50, 51, 55, 56, 57, 58, 59, 85, 87, 88, 89, 90, 91	8	85-Gamma

TABLE 4-4 (cont'd)

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INDICATOR & CONTROL LOCATIONS  
(All Samples)

Sample Type	Locations	Total No. of Samples	Total No. & Type of Analyses
<u>TLDs</u> (cont'd)	o Controls		
	- >6 Miles		
	M-02, 03, 04, 05, 06, 08, 11, 12, 13, 14, 33, 34, 35, 37, 38, 39	61	61-Gamma
<u>WATER</u>	<u>Cistern</u>		
	o Indicator - McGee	12	12 ea. - Gross Beta, I-131, Gamma; 4-Tritium (H-3)
	o Control - Willis	12	12 ea. - Gross Beta, I-131, Gamma; 4-Tritium (H-3)
	<u>Surface</u>		
	o Indicators -		
	Downstream Ms. River	12	12-Gamma; 4-Tritium (H-3)
	Downstream Ms. River Shoreline (1)	3	3-Gamma; 1-Tritium (H-3)
	Discharge Basin	12	12-Gamma; 4-Tritium (H-3)
	Outfall 007 (1)	4	4-Gamma
	Outfall 010 (1)	1	1-Gamma
	Outfall 015 (1)	3	3-Gamma
	Manhole #54 (1)	2	2-Gamma
	Resin Pond (1)	1	1-Gamma
	Basin A (1)	1	1-Gamma
	Basin B (1)	1	1-Gamma
	Barge Slip (1)	4	4-Gamma
	o Controls -		
	Upstream Mississippi River	12	12-Gamma; 4-Tritium (H-3)
	Upstream Mississippi River Shoreline (1)	3	3-Gamma; 1-Tritium (H-3)

TABLE 4-4 (cont'd)

Page 3 of 4

INDICATOR & CONTROL LOCATIONS  
(All Samples)

<u>Sample Type</u>	<u>Locations</u>	<u>Total No. of Samples</u>	<u>Total No. &amp; Type of Analyses</u>
<u>WATER</u> <u>(cont'd)</u>	<u>Groundwater</u>		
	o Indicator -		
	Arnold Acres	4	4-Gamma; 4-Tritium (H-3)
	o Controls -		
	Port Gibson City	4	4 ea. - Tritium (H-3), Gamma
	Lake Bruin State Park	4	4 ea. - Tritium (H-3), Gamma
<u>MILK</u>	o Indicator - None	N/A	N/A
	o Control - Alcorn State University	3	3 - I-131; 2-Gamma
<u>VEGETATION</u>	o Indicators -		
	Sector J Garden	36	36 ea. - I-131, Gamma
	Sector R Garden	36	36 ea. - I-131, Gamma
	o Control - Sector K (Alcorn State University)	36	36 ea. - I-131, Gamma
<u>FISH</u>	o Indicator - Downstream Mississippi River	2	2-Gamma
	o Control - Upstream Mississippi River	2	2-Gamma



TABLE 4-4 (cont'd)

Page 4 of 4

INDICATOR & CONTROL LOCATIONS  
(All Samples)

Sample Type	Locations	Total No. of Samples	Total No. & Type of Analyses
<u>SEDIMENT</u>	o Indicators -		
	Hamilton Lake (SEDHAM)	2	2-Gamma
	Barge Slip (SEDBAR)	2	2-Gamma
	Barge Slip (1)	11	11-Gamma
	Basin B (1)	4	4-Gamma
	Resin Pond (1)	1	1-Gamma
	Basin A (1)	1	1-Gamma
	o Control - Upstream Mississippi River (SEDCONT)	2	2-Gamma
<u>MEAT</u>	o Indicator - Sector N (Bucksport Hunting Camp) (1)	1	1-Gamma
	o Control - None	N/A	N/A
<u>SEWAGE</u>	o Indicators -		
	Unit 1 Sewage Plant (Outfall 015) (1)	3	3-Gamma
	Unit 2 Sewage Plant (Outfall 010) (1)	1	1-Gamma
	o Control - None	N/A	N/A

(1) Special samples

SECTION 5.0

QUALITY CONTROL DATA

### 5.1 CROSSCHECK PROGRAM RESULTS

Arkansas Power & Light's (AP&L) Technical Analysis Section analyzed the crosscheck samples for GGNS. The results of GGNS' Crosscheck Program are provided in Attachment I, 1990 Environmental Sampling and Analytical Report. Graphs of AP&L's intercomparison results are provided in Figure 5-1. This figure indicates that AP&L reports consistent, valid data based on the similarity of EPA and AP&L results.

Teledyne Isotopes Midwest Laboratory provided thermoluminescent dosimeter (TLD) analytical capabilities. Attachment II contains the most recent results obtained through Teledyne's participation in the International Intercomparison of Environmental Dosimeters. Results were within the acceptable range of deviation.

### 5.2 DUPLICATE SAMPLES

Results for duplicate samples of water, milk, fish, sediment, sewage and vegetation media submitted by GGNS to AP&L are included in Attachment I. These results are in the appropriate tables and identified by the suffix (GG) accompanying the laboratory number. Table 5-1 summarizes the results of the ESP duplicate sampling for 1990.

A graph presents results for duplicate TLDs from 1987 through 1990 in Figure 5-2. This figure, which is based on averaging the three duplicate and permanent TLD location results, shows that consistent, valid data is being reported based on the similarity of results.

Table 5-1

Page 1 of 3

## DUPLICATE SAMPLING PROGRAM SUMMARY

Sample Type (Units)	Type and Number a of Analyses		b LLD	Indicator Locations Mean (F) c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) [Range]
					d Location	Mean (F) [Range]	
TLD (0-2 Miles) (mR/Qtr)	Gamma	6	1.0	17.5 (6/6) [15.2 - 19.7]	M-31 at M-18 (Sector F, 0.5 mi)	19.7 (1/1) [N/A]	N/A
TLD (2-6 Miles) (mR/Qtr)	Gamma	3	1.0	18.5 (3/3) [16.7 - 20.3]	M-32 at M-55 (Sector D, 5.0 mi)	20.3 (1/1) [N/A]	N/A
TLD (>6 Miles) (mR/Qtr)	Gamma	3	1.0	N/A	N/A	N/A	17.7 (3/3) [15.6 - 19.7]
Cistern Water (pCi/l)	GB	4	4	4.5 (2/2) [3.0 - 5.9]	McGee Cistern (Sector A, 0.9 mi)	4.5 (2/2) [3.0 - 5.9]	4.1 (2/2) [3.6 - 4.6]
	I-131	4	1.0	<LLD	N/A	N/A	<LLD
	H-3	4	2000	400 (1/2)	McGee Cistern	400 (1/2)	317 (1/2)
	GS	4		[N/A]	(Sector A, 0.9 mi)	[N/A]	[N/A]
	Mn-54		15	<LLD	N/A	N/A	<LLD
	Fe-59		30	<LLD	N/A	N/A	<LLD
	Co-58		15	<LLD	N/A	N/A	<LLD
	Co-60		15	<LLD	N/A	N/A	<LLD
	Zn-65		30	<LLD	N/A	N/A	<LLD
	Zr-95		30	<LLD	N/A	N/A	<LLD
	Nb-95		15	<LLD	N/A	N/A	<LLD
	Cs-134		15	<LLD	N/A	N/A	<LLD
	Cs-137		18	<LLD	N/A	N/A	<LLD
	Ba-140		60	<LLD	N/A	N/A	<LLD
	La-140		15	<LLD	N/A	N/A	<LLD

Table 5-1 (cont'd)

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## DUPLICATE SAMPLING PROGRAM SUMMARY

Sample Type (Units)	Type and Number of Analyses	b LLD	Indicator Locations Mean (F) c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) [Range]
				d Location	Mean (F) [Range]	
Surface Water (pCi/l)	H-3 7	2000	1059 (4/5) [405-2026]	Discharge Basin (Sector P, 0.3 mi)	1276 (3/3) [900-2026]	<LLD
	GS 9					
	Mn-54	15	<LLD	N/A	N/A	<LLD
	Fe-59	30	<LLD	N/A	N/A	<LLD
	Co-58	15	<LLD	N/A	N/A	<LLD
	Co-60	15	<LLD	N/A	N/A	<LLD
	Zn-65	30	<LLD	N/A	N/A	<LLD
	Zr-95	30	<LLD	N/A	N/A	<LLD
	Nb-95	15	<LLD	N/A	N/A	<LLD
	Cs-134	15	<LLD	N/A	N/A	<LLD
	Cs-137	18	<LLD	N/A	N/A	<LLD
	Ba-140	60	<LLD	N/A	N/A	<LLD
	La-140	15	<LLD	N/A	N/A	<LLD
Well Water (pCi/l)	H-3 3	2000	<LLD	N/A	N/A	<LLD
	GS 3					
	Mn-54	15	<LLD	N/A	N/A	<LLD
	Fe-59	30	<LLD	N/A	N/A	<LLD
	Co-58	15	<LLD	N/A	N/A	<LLD
	Co-60	15	<LLD	N/A	N/A	<LLD
	Zn-65	30	<LLD	N/A	N/A	<LLD
	Zr-95	30	<LLD	N/A	N/A	<LLD
	Nb-95	15	<LLD	N/A	N/A	<LLD
	Cs-134	15	<LLD	N/A	N/A	<LLD
	Cs-137	18	<LLD	N/A	N/A	<LLD
	Ba-140	60	<LLD	N/A	N/A	<LLD
	La-140	15	<LLD	N/A	N/A	<LLD
Milk (pCi/l)	I-131 1	1.0	N/A	N/A	N/A	<LLD
	GS 1					
	Cs-134	15	N/A	N/A	N/A	<LLD
	Cs-137	18	N/A	N/A	N/A	<LLD
	Ba-140	60	N/A	N/A	N/A	<LLD
	La-140	15	N/A	N/A	N/A	<LLD



Table 5-1 (cont'd)

Page 3 of 3

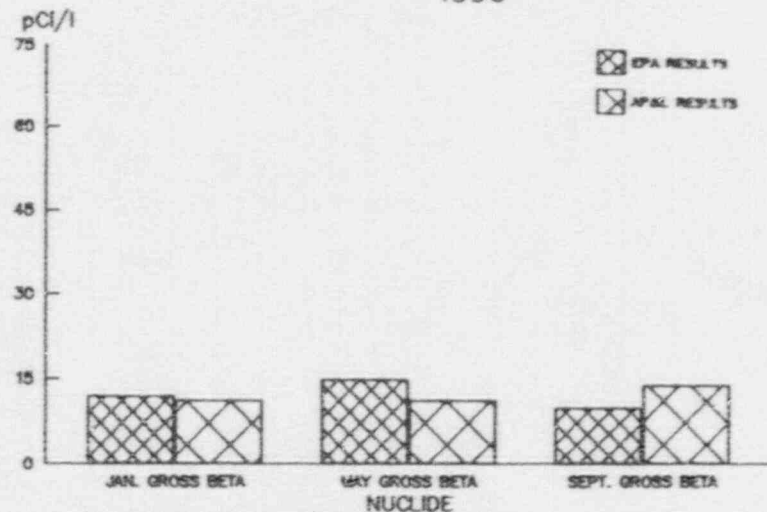
## DUPLICATE SAMPLING PROGRAM SUMMARY

Sample Type (Units)	Type and Number of Analyses <sup>a</sup>	b LLD	Indicator Locations Mean (F) <sup>c</sup> [Range]	Location with Highest Annual Mean		Control Locations Mean (F) [Range]
				d Location	Mean (F) [Range]	
Vegetation (pCi/kg wet)	I-131 18	60	<LLD	N/A	N/A	<LLD
	GS 18					
	Cs-134 60		<LLD	N/A	N/A	<LLD
	Cs-137 80		<LLD	N/A	N/A	<LLD
Fish (pCi/kg wet)	GS 2					
	Mn-54 130		<LLD	N/A	N/A	<LLD
	Fe-59 260		<LLD	N/A	N/A	<LLD
	Co-58 130		<LLD	N/A	N/A	<LLD
	Co-60 130		<LLD	N/A	N/A	<LLD
	Zn-65 260		<LLD	N/A	N/A	<LLD
	Cs-134 130		<LLD	N/A	N/A	<LLD
	Cs-137 150		<LLD	N/A	N/A	<LLD
Bottom Sediments (pCi/kg dry)	GS 3					
	Mn-54 130		122 (1/2) [N/A]	Barge Slip (Sector Q)	122 (1/1) [N/A]	<LLD
	Co-58 130		14 (1/2) [N/A]	Barge Slip (Sector Q)	14 (1/1) [N/A]	<LLD
	Co-60 130		427 (1/2) [N/A]	Barge Slip (Sector Q)	427 (1/1) [N/A]	<LLD
	Cs-134 150		<LLD	N/A	N/A	<LLD
	Cs-137 180		63 (2/2) [53-72]	Hamilton Lake (Sector N)	72 (1/1) [N/A]	<LLD
Raw Sewage (pCi/l)	GS 2					
	Mn-54 15		58 (1/2) [N/A]	Unit 1 Sewage Plant (Sector A, 0.3 mi.)	58 (1/1) [N/A]	N/A
	Fe-59 30		<LLD	N/A	N/A	N/A
	Co-58 15		<LLD	N/A	N/A	N/A
	Co-60 15		135 (1/2) [N/A]	Unit 1 Sewage Plant (Sector A, 0.3 mi.)	135 (1/1) [N/A]	N/A
	Zn-65 30		<LLD	N/A	N/A	N/A
	Zr-95 30		<LLD	N/A	N/A	N/A
	Nb-95 15		<LLD	N/A	N/A	N/A
	Cs-134 15		<LLD	N/A	N/A	N/A
	Cs-137 18		<LLD	N/A	N/A	N/A
	Ba-140 60		<LLD	N/A	N/A	N/A
	La-140 15		<LLD	N/A	N/A	N/A

<sup>a</sup> GB = Gross beta; GS = Gamma scan.<sup>b</sup> LLD = Required lower limit of detection based on Grand Gulf Nuclear Station Technical Specification Table 4.12.1-1.<sup>c</sup> Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (F).<sup>d</sup> Locations are specified (1) by name and (2) sector relative to reactor site.

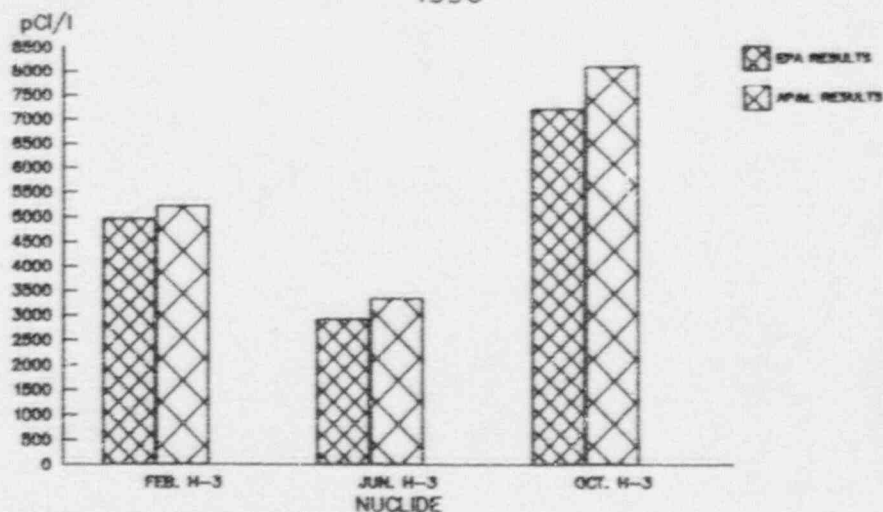


INTERLABORATORY COMPARISON  
GROSS BETA IN WATER  
1990



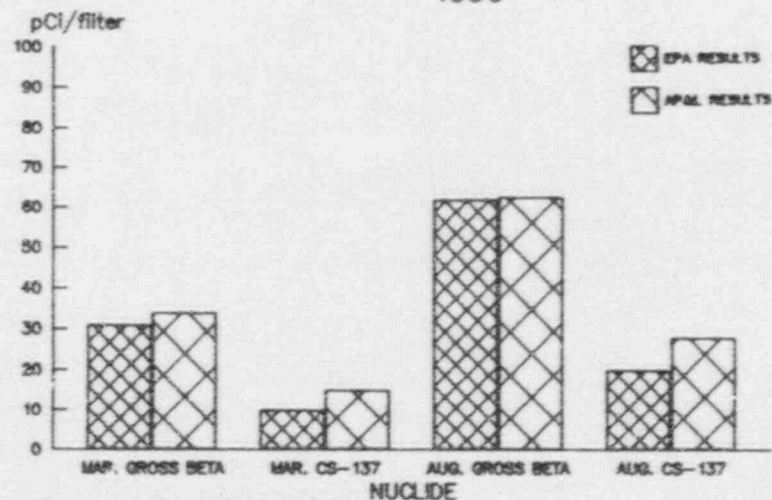
NOTE : AP&L RESULTS WERE WITHIN THE ACCEPTABLE THREE STANDARD DEVIATION RANGE.

INTERLABORATORY COMPARISON  
TRITIUM IN WATER  
1990



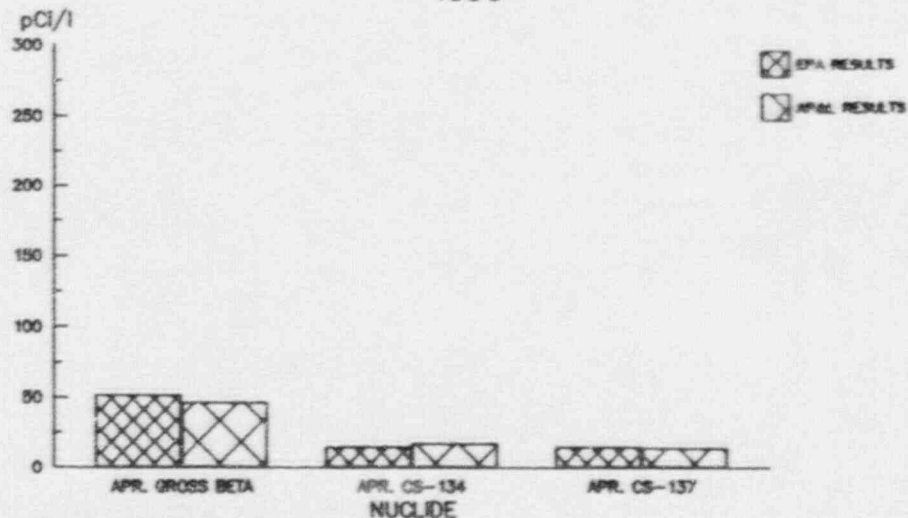
NOTE : AP&L RESULTS WERE WITHIN THE ACCEPTABLE THREE STANDARD DEVIATION RANGE.

INTERLABORATORY COMPARISON  
AIR FILTER  
1990



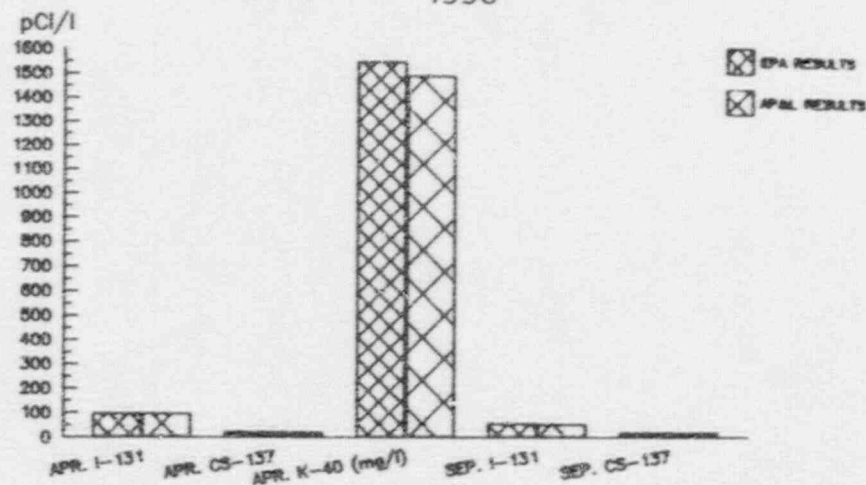
NOTE : AP&L RESULTS WERE WITHIN THE ACCEPTABLE THREE STANDARD DEVIATION RANGE.

INTERLABORATORY COMPARISON  
BLIND RADIONUCLIDES IN WATER  
1990



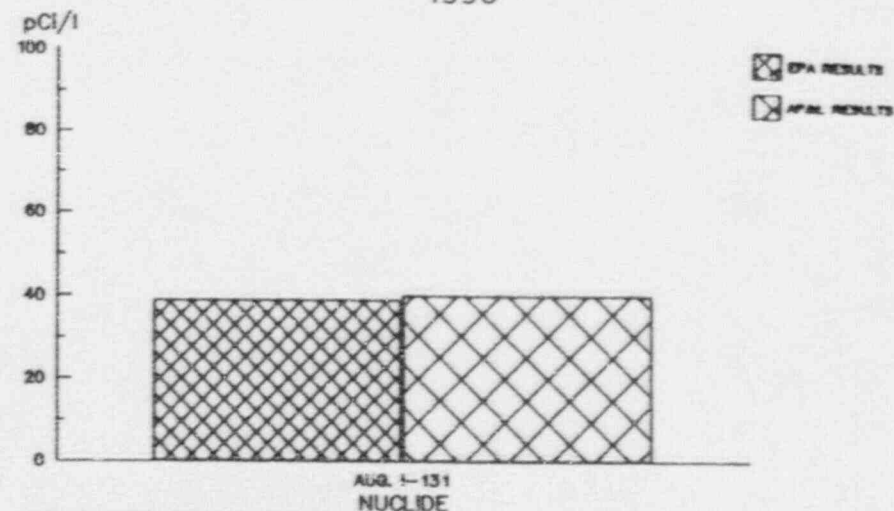
NOTE : AP&L RESULTS WERE WITHIN THE ACCEPTABLE THREE STANDARD DEVIATION RANGE.

### INTERLABORATORY COMPARISON RADIONUCLIDES IN MILK 1990



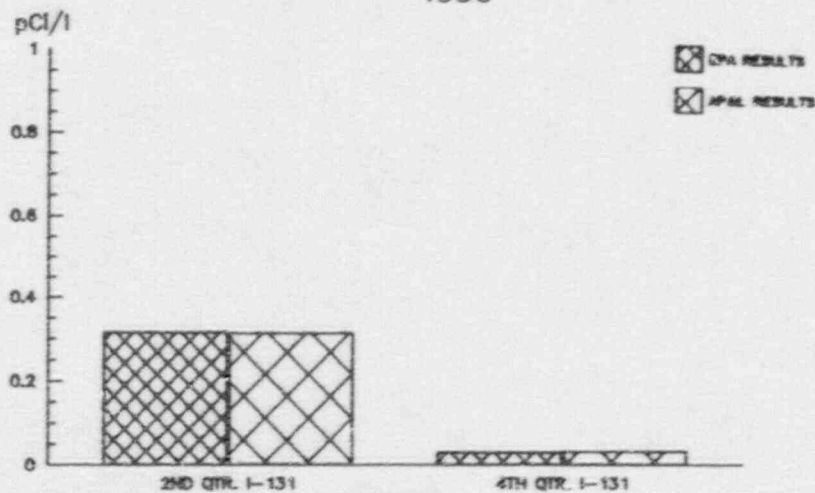
NOTE: AP&L RESULTS WERE WITHIN THE ACCEPTABLE THREE STANDARD DEVIATION RANGE.

### INTERLABORATORY COMPARISON IODINE-131 IN WATER 1990



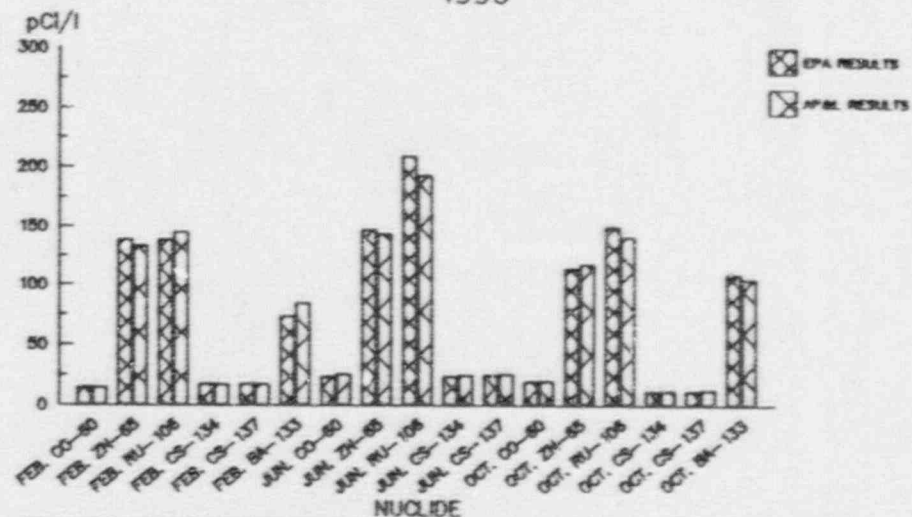
NOTE: AP&L RESULTS WERE WITHIN THE ACCEPTABLE THREE STANDARD DEVIATION RANGE.

### INTERLABORATORY COMPARISON IODINE-131 IN CARTRIDGE 1990



NOTE: AP&L RESULTS WERE WITHIN THE ACCEPTABLE THREE STANDARD DEVIATION RANGE.

### INTERLABORATORY COMPARISON GAMMA IN WATER 1990

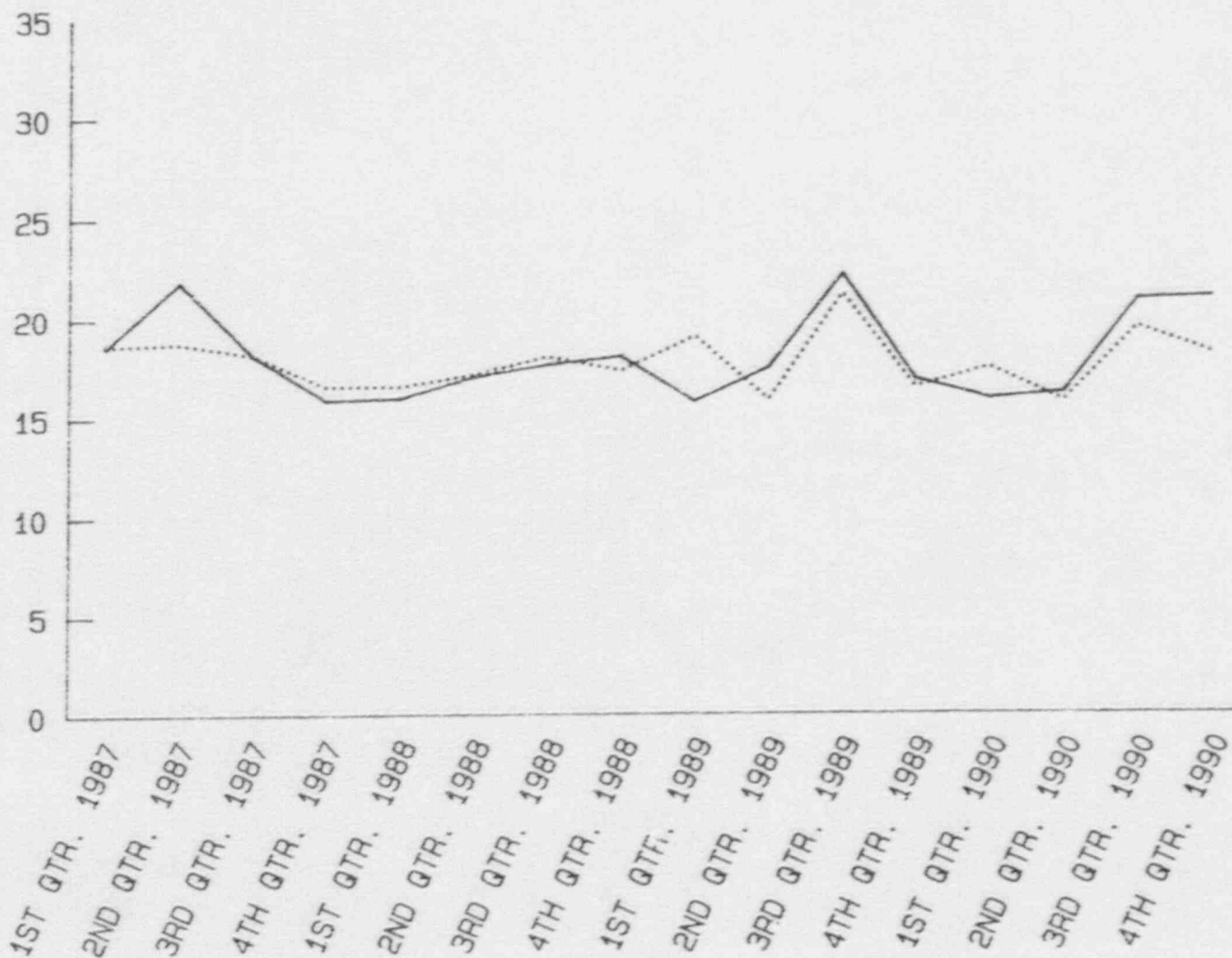


NOTE: AP&L RESULTS WERE WITHIN THE ACCEPTABLE THREE STANDARD DEVIATION RANGE.

FIGURE 5-2

DUPLICATE TLDs  
1987 - 1990

AVERAGE mR/QUARTER



DUPLICATE TLDs AVG.  
(M-31, M-32, M-60)  
.....  
PERMANENT TLDs AVG.

SECTION 6.0

1990 SAMPLING AND ANALYTICAL RESULTS

### 6.1 1990 DATA

Attachments I and II presents data obtained by Arkansas Power and Light's (AP&L) Technical Analysis Section and Teledyne Isotopes Midwest Laboratory on samples collected from January through December 1990. With the exception of thermoluminescent dosimeters (TLDs), data was provided by AP&L in monthly progress reports. Teledyne Isotopes provided TLD data in quarterly reports.

Data presented in Attachments I and II is comparable to that encountered in previous years.

### 6.2 LOWER LIMIT OF DETECTION (LLD)

In many analyses, the LLD achieved by the AP&L Technical Analysis Laboratory was lower than the maximum LLD permitted by GGNS Technical Specification Table 4.12.1-1. Factors such as unavoidable small sample size, background fluctuations, the presence of interfering radionuclides or other uncontrollable circumstances may cause the Technical Specifications' LLD to be unachievable. However, in 1990 all Technical Specification LLDs were achieved.

### 6.3 REPORTING LEVELS

Radioactivity attributable to GGNS was found in the discharge basin water, sewage sludge and barge slip sediment. However, no reporting levels for radioactivity concentration in environmental samples, as outlined in Technical Specifications Table 3.12.1-2 when averaged over any calendar quarter, were equaled or exceeded due to GGNS effluents. One radionuclide (Chromium-51), which is not listed in the GGNS Technical Specifications Table 3.12.1-2, was detected during 1990 in the barge slip sediment. However, the quantity detected was not capable of causing a



dose to a member of the public exceeding the calendar year limits of Technical Specifications 3.11.1.2, 3.11.2.2 and 3.11.2.3. Therefore, no Radiological Monitoring Program Special Reports were required.

#### 6.4 SAMPLING DEVIATIONS

Samples required by GGNS Technical Specification 3.12.1 were collected within the scheduled period unless noted otherwise in Attachments I and II.

Sample deviations at locations required by GGNS Technical Specifications are discussed in Sections 2.1 through 2.7. These sections provide more explanation concerning reasons why samples were missed and describes corrective action where appropriate.

#### 6.5 RADIOACTIVITY NOT ATTRIBUTABLE TO GGNS

Radioactivity attributable to other sources has been detected twice by the GGNS ESP. In early 1980, the 25th Chinese nuclear test explosion was detected. In 1986, the radioactive plume release due to reactor core degradation at the Chernobyl Nuclear Power Plant was detected.

#### 6.6 SAMPLING RELOCATION

Sampling locations did not change in 1990. Therefore, there was no need to identify new locations and report the circumstances of unavailability in the Semiannual Radioactive Effluent Release Report.

#### 6.7 COMPARISON TO FEDERAL AND STATE PROGRAMS

Data from the GGNS ESP was compared to federal and state monitoring programs as the results became available. The federal monitoring program used for comparison was the U.S. Nuclear Regulatory Commission (NRC) TLD Direct Radiation Monitoring Network. The state programs are conducted by the Mississippi State Department of Health, Division of Radiological Health, and the Louisiana Department of Natural Resources, Nuclear Energy Division.



The latest available results from the NRC TLD Network have been comparable to those from the GGNS ESP through September 1990. These results cover 33 TLD locations, 16 of which are collocated. On the average, collocated TLDs have produced similar results. Prior to September 1990, no change in collocated TLD results has been attributed to GGNS operation.

Radiological monitoring by Mississippi and Louisiana agencies entails similar sampling requirements as the GGNS ESP. In many cases air samples and TLDs are collocated, while sample media such as vegetation, water, sediment, fish and milk are shared or split. Through 1990, all three programs have obtained results that are within similar ranges. The only common location where radioactivity attributable to GGNS has been detected is the GGNS barge slip. Barge slip sediment results were above background due to GGNS effluents.

#### 6.8 UNAVAILABLE RESULTS

Analytical contractor results were received in adequate time for inclusion. No missing results were identified during ESP personnel's review of these results.

#### 6.9 HARMFUL EFFECTS OR IRREVERSIBLE DAMAGE

No harmful effects or evidence of irreversible damage were detected by ESP monitoring. Therefore, no analysis or planned course of action to alleviate problems was necessary.

ATTACHMENT I  
1990 ENVIRONMENTAL SAMPLING AND  
ANALYTICAL REPORT



Arkansas Power & Light Company  
900 Center Street  
P. O. Box 551  
Little Rock, AR 72203  
Tel 501 370 8815

EC-91-11

January 25, 1991

Ms. Rita R. Jackson  
System Energy Resources, Inc.  
Radiological and Environmental Services  
1340 Echelon Parkway  
Jackson, Mississippi 39213

Dear Rita:

Enclosed is the December, 1990 Grand Gulf Radiological Environmental Monitoring Program Report. Also, enclosed are any radiological analysis report sheets which have not been previously transmitted to you. Call me at 501-370-8875 or Gary Rowlett at 501-370-8887 if you need additional information.

Sincerely,

A handwritten signature in cursive script that reads "Paul Whitfield".

Paul D. Whitfield  
Senior Chemist

PDW:GWR:hbm

Enclosures

cc: Mr. Chris Longinotti  
Ms. Rosemarie W. Feckham  
Mr. Gary Rowlett

GRAND GULF  
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM  
December, 1990

PREPARED BY:

ENVIRONMENTAL SERVICES  
ARKANSAS POWER & LIGHT COMPANY

GRAND GULF  
ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

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SUMMARY OF MONITORING RESULTS

As in previous samples, plant-related isotopes were detected in the Barge Slip sediment.

The term "GG" ending of a lab number denotes a duplicate sample.



## Environmental Radiological Monitoring Report

Table No.: 1.1

Sample: Air Samples, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/M<sup>3</sup>

Location: AS-1, PG

Lab No.	Begin Date	End Date	Gross-Beta	I-131
900010	12/27/89	01/02/90	0.026 +/-0.003	< 0.040
900054	01/02/90	01/09/90	0.028 +/-0.003	< 0.023
900094	01/09/90	01/16/90	0.022 +/-0.003	< 0.050
900120	01/16/90	01/23/90	0.020 +/-0.003	< 0.043
900159	01/23/90	01/30/90	0.015 +/-0.002	< 0.018
900218	01/30/90	02/06/90	0.019 +/-0.003	< 0.033
900261	02/06/90	02/13/90	0.019 +/-0.003	< 0.024
900299	02/13/90	02/20/90	0.021 +/-0.003	< 0.025
900328	02/20/90	02/27/90	0.012 +/-0.003	< 0.010
900372	02/27/90	03/06/90	0.026 +/-0.003	< 0.014
900430	03/06/90	03/13/90	0.013 +/-0.003	< 0.021
900462	03/13/90	03/20/90	0.013 +/-0.003	< 0.014
900500	03/20/90	03/27/90	0.024 +/-0.003	< 0.018
900562	03/27/90	04/03/90	0.015 +/-0.003	< 0.021
900611	04/03/90	04/10/90	0.021 +/-0.003	< 0.020
900649	04/10/90	04/17/90	0.020 +/-0.003	< 0.015
900679	04/17/90	04/24/90	0.014 +/-0.003	< 0.010
900718	04/24/90	05/01/90	0.015 +/-0.003	< 0.011
900782	05/01/90	05/08/90	0.016 +/-0.003	< 0.019
900813	05/08/90	05/15/90	0.008 +/-0.003	< 0.013
900851	05/15/90	05/22/90	0.010 +/-0.003	< 0.011
900881	05/22/90	05/29/90	0.015 +/-0.003	< 0.016
900924	05/29/90	06/05/90	0.016 +/-0.003	< 0.013
901006	06/05/90	06/12/90	0.011 +/-0.003	< 0.024
901032	06/12/90	06/19/90	0.010 +/-0.002	< 0.013
901056	06/19/90	06/26/90	0.016 +/-0.003	< 0.015

## Environmental Radiological Monitoring Report

Table No.: 1.1a  
 Sample: Air Samples, (Beta, I-131)  
 Collection: Continuous with Weekly Exchange  
 Units: pCi/M<sup>3</sup>

Location: AS-1, PG

Lab No.	Begin Date	End Date	Gross-Beta	I-131
901126	06/26/90	07/03/90	0.019 +/-0.002	< 0.020
901166	07/03/90	07/10/90	0.013 +/-0.002	< 0.014
901210	07/10/90	07/17/90	0.011 +/-0.002	< 0.013
901276	07/17/90	07/24/90	0.013 +/-0.002	< 0.011
901313	07/24/90	07/31/90	0.021 +/-0.002	< 0.011
901353	07/31/90	08/07/90	0.016 +/-0.002	< 0.013
901383	08/07/90	08/14/90	0.025 +/-0.002	< 0.013
901410	08/14/90	08/21/90	0.021 +/-0.002	< 0.013
901461	08/21/90	08/28/90	0.021 +/-0.002	< 0.015
901485	08/28/90	09/04/90	0.022 +/-0.002	< 0.013
901549	09/04/90	09/11/90	0.025 +/-0.002	< 0.015
901571	09/11/90	09/18/90	0.018 +/-0.002	< 0.015
901613	09/18/90	09/25/90	0.027 +/-0.002	< 0.014
901659	09/25/90	10/02/90	0.035 +/-0.003	< 0.022
901733	10/02/90	10/09/90	0.024 +/-0.003	< 0.023
901766	10/09/90	10/16/90	0.017 +/-0.002	< 0.016
901817	10/16/90	10/23/90	0.032 +/-0.003	< 0.019
901874	10/23/90	10/30/90	0.034 +/-0.003	< 0.012
901919	10/30/90	11/06/90	0.034 +/-0.003	< 0.018
901973	11/06/90	11/13/90	0.030 +/-0.003	< 0.018
902008	11/13/90	11/20/90	0.037 +/-0.003	< 0.020
902045	11/20/90	11/27/90	0.027 +/-0.002	< 0.017

Date: 01/24/91

Environmental Radiological Monitoring Report

Table No.: 1.1b  
Sample: Air Samples, (Beta, I-131)  
Collection: Continuous with Weekly Exchange  
Units: pCi/M<sup>3</sup>

Location: AS-1, PG

Lab No.	Begin Date	End Date	Gross-Beta	I-131
902100	11/27/90	12/04/90	0.028 +/-0.002	< 0.012
902150	12/04/90	12/11/90	0.025 +/-0.002	< 0.022
902181	12/11/90	12/18/90	0.029 +/-0.002	< 0.016
902202	12/18/90	12/25/90	0.027 +/-0.002	< 0.018

# - Control Location \* - Low Level Analysis

## Environmental Radiological Monitoring Report

Table No.: 1.2

Sample: Air Samples, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/m<sup>3</sup>

Location: AS-2, 61N

Lab No.	Begin Date	End Date	Gross-Beta	I-131
900011	12/27/89	01/02/90	0.026 +/-0.003	< 0.040
900055	01/02/90	01/09/90	0.035 +/-0.003	< 0.023
900095	01/09/90	01/16/90	0.023 +/-0.003	< 0.050
900121	01/16/90	01/23/90	0.021 +/-0.003	< 0.043
900160	01/23/90	01/30/90	0.018 +/-0.003	< 0.018
900219	01/30/90	02/06/90	0.022 +/-0.003	< 0.033
900262	02/06/90	02/13/90	0.023 +/-0.003	< 0.024
900300	02/13/90	02/20/90	0.021 +/-0.003	< 0.025
900329	02/20/90	02/27/90	0.019 +/-0.003	< 0.010
900373	02/27/90	03/06/90	0.031 +/-0.003	< 0.014
900431	03/06/90	03/13/90	0.016 +/-0.003	< 0.021
900463	03/13/90	03/20/90	0.016 +/-0.003	< 0.014
900501	03/20/90	03/27/90	0.024 +/-0.003	< 0.018
900563	03/27/90	04/03/90	0.013 +/-0.003	< 0.021
900612	04/03/90	04/10/90	0.023 +/-0.003	< 0.020
900650	04/10/90	04/17/90	0.025 +/-0.003	< 0.015
900690	04/17/90	04/24/90	0.021 +/-0.003	< 0.010
900719	04/24/90	05/01/90	0.023 +/-0.003	< 0.011
900783	05/01/90	05/08/90	0.023 +/-0.003	< 0.019
900814	05/08/90	05/15/90	0.012 +/-0.003	< 0.013
900852	05/15/90	05/22/90	0.017 +/-0.003	< 0.011
900892	05/22/90	05/29/90	0.022 +/-0.003	< 0.016
900925	05/29/90	06/05/90	0.022 +/-0.003	< 0.013
901007	06/05/90	06/12/90	0.018 +/-0.003	< 0.024
901033	06/12/90	06/19/90	0.012 +/-0.003	< 0.013
901069	06/19/90	06/26/90	0.026 +/-0.003	< 0.015

# = Control Location \* = Low Level Analysis

## Environmental Radiological Monitoring Report

Table No.: 1.2a  
 Sample: Air Samples, (Beta, I-131)  
 Collection: Continuous with Weekly Exchange  
 Units: pCi/Hr\*3

Location: AS-2, 6IN

Lab No.	Begin Date	End Date	Gross Beta	I-131
901127	06/26/90	07/03/90	0.024 +/-0.002	< 0.020
901167	07/03/90	07/10/90	0.022 +/-0.002	< 0.014
901219	07/10/90	07/17/90	0.018 +/-0.002	< 0.013
901277	07/17/90	07/24/90	0.019 +/-0.002	< 0.011
901314	07/24/90	07/31/90	0.034 +/-0.003	< 0.011
901354	07/31/90	08/07/90	0.023 +/-0.002	< 0.013
901384	08/07/90	08/14/90	0.035 +/-0.003	< 0.013
901419	08/14/90	08/21/90	0.031 +/-0.003	< 0.013
901462	08/21/90	08/28/90	0.030 +/-0.002	< 0.015
901486	08/28/90	09/04/90	0.031 +/-0.003	< 0.013
901550	09/04/90	09/11/90	0.036 +/-0.003	< 0.015
901572	09/11/90	09/18/90	0.019 +/-0.002	< 0.015
901614	09/18/90	09/25/90	0.017 +/-0.002	< 0.014
901660	09/25/90	10/02/90	0.030 +/-0.003	< 0.022
901734	10/02/90	10/09/90	0.019 +/-0.002	< 0.023
901767	10/09/90	10/16/90	0.017 +/-0.002	< 0.016
901816	10/16/90	10/23/90	0.027 +/-0.003	< 0.019
901875	10/23/90	10/30/90	0.026 +/-0.003	< 0.012
901920	10/30/90	11/06/90	0.030 +/-0.002	< 0.018
901979	11/06/90	11/13/90	0.027 +/-0.002	< 0.016
902009	11/13/90	11/20/90	0.032 +/-0.003	< 0.020
902050	11/20/90	11/27/90	0.021 +/-0.002	< 0.017



Table No.: 1.2b

Sample: Air Samples, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/M<sup>3</sup>

Location: AS-2, 61W

Environmental Radiological Monitoring Report

Date: 01/24/91

Lab No.	Begin Date	End Date	Gross-Beta	I-131
902101	11/27/90	12/04/90	0.022 +/-0.002	< 0.012
902153	12/04/90	12/11/90	0.022 +/-0.002	< 0.022
902182	12/11/90	12/18/90	0.026 +/-0.002	< 0.016
902203	12/18/90	12/25/90	0.019 +/-0.002	< 0.018



## Environmental Radiological Monitoring Report

Table No.: 1.3

Sample: Air Samples, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/m<sup>3</sup>

Location: AS-3, 61VA

Lab No.	Begin Date	End Date	Gross-Beta	I-131
900012	12/27/89	01/02/90	0.015 +/-0.003	< 0.040
900056	01/02/90	01/09/90	0.019 +/-0.003	< 0.023
900096	01/09/90	01/16/90	0.012 +/-0.003	< 0.050
900122	01/16/90	01/23/90	0.028 +/-0.007	< 0.043
900161	01/23/90	01/30/90	0.013 +/-0.002	< 0.018
900220	01/30/90	02/06/90	0.015 +/-0.003	< 0.033
900263	02/06/90	02/13/90	0.016 +/-0.009	< 0.024
900301	02/13/90	02/20/90	0.016 +/-0.003	< 0.025
900330	02/20/90	02/27/90	0.014 +/-0.003	< 0.010
900374	02/27/90	03/06/90	0.022 +/-0.003	< 0.014
900432	03/06/90	03/13/90	0.012 +/-0.003	< 0.021
900464	03/13/90	03/20/90	0.013 +/-0.003	< 0.014
900502	03/20/90	03/27/90	0.021 +/-0.003	< 0.018
900564	03/27/90	04/03/90	0.017 +/-0.003	< 0.021
900613	04/03/90	04/10/90	0.018 +/-0.003	< 0.020
900651	04/10/90	04/17/90	0.019 +/-0.003	< 0.015
900681	04/17/90	04/24/90	0.013 +/-0.003	< 0.010
900720	04/24/90	05/01/90	0.014 +/-0.003	< 0.011
900784	05/01/90	05/08/90	0.016 +/-0.003	< 0.019
900815	05/08/90	05/15/90	0.007 +/-0.003	< 0.013
900853	05/15/90	05/22/90	0.011 +/-0.003	< 0.011
900883	05/22/90	05/29/90	0.015 +/-0.003	< 0.016
900926	05/29/90	06/05/90	0.014 +/-0.003	< 0.013
901008	06/05/90	06/12/90	0.010 +/-0.003	< 0.024
901034	06/12/90	06/19/90	0.019 +/-0.003	< 0.013
901070	06/19/90	06/26/90	0.020 +/-0.003	< 0.015

# = Control Location \* = Low Level Analysis

## Environmental Radiological Monitoring Report

Table No.: 1.3a

Sample: Air Samples, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/M<sup>3</sup>

Location: AS-3, 6IVA

Lab No.	Begin Date	End Date	Gross-Beta	I-131
901124	06/26/90	07/03/90	0.019 +/-0.002	< 0.020
901168	07/03/90	07/10/90	0.013 +/-0.002	< 0.014
901220	07/10/90	07/17/90	0.011 +/-0.002	< 0.013
901278	07/17/90	07/24/90	0.011 +/-0.002	< 0.011
901315	07/24/90	07/31/90	0.020 +/-0.002	< 0.011
901355	07/31/90	08/07/90	0.014 +/-0.002	< 0.013
901385	08/07/90	08/14/90	0.011 +/-0.002	< 0.013
901420	08/14/90	08/21/90	0.022 +/-0.002	< 0.013
901463	08/21/90	08/28/90	0.023 +/-0.002	< 0.015
901487	08/28/90	09/04/90	0.022 +/-0.002	< 0.013
901551	09/04/90	09/11/90	0.024 +/-0.002	< 0.015
901573	09/11/90	09/18/90	0.013 +/-0.002	< 0.015
901615	09/18/90	09/25/90	0.020 +/-0.002	< 0.014
901661	09/25/90	10/02/90	0.025 +/-0.003	< 0.022
901735	10/02/90	10/09/90	0.016 +/-0.002	< 0.023
901768	10/09/90	10/16/90	FOUR FAIL	
901819	10/16/90	10/23/90	0.015 +/-0.002	< 0.019
901876	10/23/90	10/30/90	0.022 +/-0.002	< 0.012
901921	10/30/90	11/06/90	0.026 +/-0.002	< 0.018
901980	11/06/90	11/13/90	0.024 +/-0.002	< 0.018
902010	11/13/90	11/20/90	0.029 +/-0.002	< 0.020
902051	11/20/90	11/27/90	0.022 +/-0.002	< 0.017

Environmental Radiological Monitoring Report

Table No.: 1.3b  
 Sampler: Air Samples, (Beta, I-131)  
 Collection: Continuous with Weekly Exchange  
 Units: pCi/m<sup>3</sup>

Location: AS-3, 61VA

Lab No.	Begin Date	End Date	Gross-Beta	I-131
902102	11/27/90	12/04/90	0.022 +/- 0.002	< 0.012
902154	12/04/90	12/11/90	0.022 +/- 0.002	< 0.022
902183	12/11/90	12/18/90	0.028 +/- 0.002	< 0.015
902204	12/18/90	12/26/90	0.005 +/- 0.002	< 0.018

Table No.: 1.4

Sample: Air Samples, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/M<sup>3</sup>

Location: AS-4, GJOE

## Environmental Radiological Monitoring Report

Date: 04/23/90

Lab No.	Begin Date	End Date	Gross Beta	I-131
900013	12/27/89	01/02/90	0.027 +/-0.003	< 0.040
900057	01/02/90	01/09/90	0.030 +/-0.003	< 0.023
900097	01/09/90	01/16/90	0.025 +/-0.003	< 0.050
90012	01/16/90	01/23/90	0.024 +/-0.003	< 0.043
900162	01/23/90	01/30/90	0.017 +/-0.003	< 0.018
900221	01/30/90	02/06/90	0.016 +/-0.003	< 0.033
900264	02/06/90	02/13/90	0.017 +/-0.003	< 0.024
900302	02/13/90	02/20/90	0.024 +/-0.003	< 0.025
900331	02/20/90	02/27/90	0.018 +/-0.003	< 0.010
900375	02/27/90	03/06/90	0.020 +/-0.003	< 0.014
900433	03/06/90	03/13/90	0.015 +/-0.003	< 0.021
900465	03/13/90	03/20/90	0.019 +/-0.003	< 0.014
900503	03/20/90	03/27/90	0.024 +/-0.003	< 0.018
900565	03/27/90	04/03/90	0.021 +/-0.003	< 0.021
900614	04/03/90	04/10/90	0.024 +/-0.003	< 0.020
900652	04/10/90	04/17/90	0.024 +/-0.003	< 0.015
900682	04/17/90	04/24/90	0.021 +/-0.003	< 0.010
900721	04/24/90	05/01/90	0.014 +/-0.003	< 0.011
900765	05/01/90	05/08/90	0.018 +/-0.003	< 0.019
900816	05/08/90	05/15/90	0.009 +/-0.003	< 0.013
900854	05/15/90	05/22/90	0.012 +/-0.003	< 0.011
900884	05/22/90	05/29/90	0.016 +/-0.003	< 0.016
900927	05/29/90	06/05/90	0.016 +/-0.003	< 0.013
901009	06/05/90	06/12/90	0.013 +/-0.003	< 0.024
901035	06/12/90	06/19/90	0.016 +/-0.003	< 0.013
901071	06/19/90	06/26/90	0.022 +/-0.003	< 0.015

# = Control Location \* = Low Level Analysis

## Environmental Radiological Monitoring Report

Table No.: 1.4a

Sample: Air Samples, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/M<sup>3</sup>

Location: AS-4, GJOE

Lab No.	Begin Date	End Date	Gross-Beta	I-131
901129	06/26/90	07/03/90	0.020 +/-0.002	< 0.020
901169	07/03/90	07/10/90	0.018 +/-0.002	< 0.014
901221	07/10/90	07/17/90	0.013 +/-0.002	< 0.013
901279	07/17/90	07/24/90	0.014 +/-0.002	< 0.011
901316	07/24/90	07/31/90	0.029 +/-0.003	< 0.011
901356	07/31/90	08/07/90	0.018 +/-0.002	< 0.013
901386	08/07/90	08/14/90	0.027 +/-0.003	< 0.013
901421	08/14/90	08/21/90	0.024 +/-0.002	< 0.013
901464	08/21/90	08/28/90	0.028 +/-0.002	< 0.015
901488	08/28/90	09/04/90	0.036 +/-0.003	< 0.013
901552	09/04/90	09/11/90	0.034 +/-0.003	< 0.015
901574	09/11/90	09/18/90	0.018 +/-0.002	< 0.015
901616	09/18/90	09/25/90	0.020 +/-0.002	< 0.014
901662	09/25/90	10/02/90	0.031 +/-0.003	< 0.022
901736	10/02/90	10/09/90	0.020 +/-0.002	< 0.023
901769	10/09/90	10/16/90	< 0.003	< 0.016
901820	10/16/90	10/23/90	0.047 +/-0.003	< 0.019
901877	10/23/90	10/30/90	0.025 +/-0.003	< 0.012
901922	10/30/90	11/06/90	0.026 +/-0.002	< 0.018
901981	11/06/90	11/13/90	0.025 +/-0.002	< 0.018
902011	11/13/90	11/20/90	0.029 +/-0.002	< 0.020
902052	11/20/90	11/27/90	0.023 +/-0.002	< 0.017

Environmental Radiological Monitoring Report

Table No.: 1.4b  
 Sample: Air Samples, (Beta, I-131)  
 Collection: Continuous with Weekly Exchange  
 Units: pCi/m<sup>3</sup>

Location: AS-4, GYR

Lab No.	Begin Date	End Date	Gross Beta	I-131
902103	11/27/90	12/04/90	0.022 +/-0.002	< 0.012
902155	12/04/90	12/11/90	0.020 +/-0.002	< 0.022
902184	12/11/90	12/18/90	0.028 +/-0.002	< 0.016
902205	12/18/90	12/26/90	0.018 +/-0.002	< 0.018



## Environmental Radiological Monitoring Report

Table No.: 1.5

Sample: Air Samples, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/M<sup>3</sup>

Location: AS-5, TC

Lab No.	Begin Date	End Date	Gross Beta	I-131
900014	12/27/89	01/02/90	0.029 +/-0.003	< 0.040
900058	01/02/90	01/09/90	0.031 +/-0.003	< 0.023
900098	01/09/90	01/16/90	0.026 +/-0.003	< 0.050
900124	01/16/90	01/23/90	0.021 +/-0.003	< 0.043
900163	01/23/90	01/30/90	0.020 +/-0.003	< 0.018
900222	01/30/90	02/06/90	0.021 +/-0.003	< 0.033
900265	02/06/90	02/13/90	0.025 +/-0.003	< 0.024
900303	02/13/90	02/20/90	0.023 +/-0.003	< 0.025
900332	02/20/90	02/27/90	0.019 +/-0.003	< 0.010
900375	02/27/90	03/06/90	0.030 +/-0.003	< 0.014
900434	03/06/90	03/13/90	0.014 +/-0.003	< 0.021
900466	03/13/90	03/20/90	0.019 +/-0.002	< 0.014
900504	03/20/90	03/27/90	0.027 +/-0.003	< 0.018
900566	03/27/90	04/03/90	0.017 +/-0.003	< 0.021
900615	04/03/90	04/10/90	0.021 +/-0.003	< 0.020
900653	04/10/90	04/17/90	0.022 +/-0.003	< 0.015
900683	04/17/90	04/24/90	0.017 +/-0.003	< 0.010
900722	04/24/90	05/01/90	0.014 +/-0.003	< 0.011
900786	05/01/90	05/08/90	0.017 +/-0.003	< 0.019
900817	05/08/90	05/15/90	0.009 +/-0.003	< 0.013
900855	05/15/90	05/22/90	0.015 +/-0.003	< 0.011
900885	05/22/90	05/29/90	0.017 +/-0.003	< 0.016
900928	05/29/90	06/05/90	0.018 +/-0.003	< 0.013
901010	06/05/90	06/12/90	0.013 +/-0.003	< 0.024
901036	06/12/90	06/19/90	0.015 +/-0.003	< 0.013
901072	06/19/90	06/26/90	0.018 +/-0.003	< 0.015

## Environmental Radiological Monitoring Report

Table No.: 1.5a

Sample: Air Samples, (Beta I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/m<sup>3</sup>

Location: AS-3, TC

Lab No.	Begin Date	End Date	Gross Data	I-131
901130	06/26/90	07/03/90	0.021 +/-0.002	< 0.020
901170	07/03/90	07/10/90	0.016 +/-0.002	< 0.014
901222	07/10/90	07/17/90	0.013 +/-0.002	< 0.013
901280	07/17/90	07/24/90	0.012 +/-0.002	< 0.011
901317	07/24/90	07/31/90	0.024 +/-0.002	< 0.011
901357	07/31/90	08/07/90	0.017 +/-0.002	< 0.013
901387	08/07/90	08/14/90	0.024 +/-0.002	< 0.013
901422	08/14/90	08/21/90	0.023 +/-0.002	< 0.013
901465	08/21/90	08/28/90	0.023 +/-0.002	< 0.015
901489	08/28/90	09/04/90	0.025 +/-0.002	< 0.013
901553	09/04/90	09/11/90	0.024 +/-0.002	< 0.015
901575	09/11/90	09/18/90	0.015 +/-0.002	< 0.015
901617	09/18/90	09/25/90	0.019 +/-0.002	< 0.014
901663	09/25/90	10/02/90	0.035 +/-0.003	< 0.022
901737	10/02/90	10/09/90	0.020 +/-0.002	< 0.023
901770	10/09/90	10/16/90	0.020 +/-0.002	< 0.015
901821	10/16/90	10/23/90	0.028 +/-0.003	< 0.019
901878	10/23/90	10/30/90	0.029 +/-0.003	< 0.012
901923	10/30/90	11/06/90	0.030 +/-0.002	< 0.018
901982	11/06/90	11/13/90	0.025 +/-0.002	< 0.018
902012	11/13/90	11/20/90	0.029 +/-0.002	< 0.020
902053	11/20/90	11/27/90	0.023 +/-0.002	< 0.017

Date: 01/24/91

Environmental Radiological Monitoring Report

Table No.: 1.5b  
Sample: Air Samples, (Beta, I-131)  
Collection: Continuous with Weekly Exchange  
Units: pCi/M<sup>3</sup>  
Location: NS-5, TC

Lab No.	Begin Date	End Date	Gross Beta	I-131
902104	11/27/90	12/04/90	0.022 +/-0.002	< 0.012
902156	12/04/90	12/11/90	0.023 +/-0.002	< 0.022
902185	12/11/90	12/18/90	0.025 +/-0.002	< 0.016
902206	12/18/90	12/26/90	0.020 +/-0.002	< 0.016

## Environmental Radiological Monitoring Report

Table No.: 1.6

Sample: Air Samples, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/M<sup>3</sup>

Location: AS-6, RS

Lab No.	Begin Date	End Date	Gross-Beta	I-131
900015	12/27/89	01/02/90	0.024 +/-0.003	< 0.040
900059	01/02/90	01/09/90	0.020 +/-0.003	< 0.023
900099	01/09/90	01/16/90	0.020 +/-0.003	< 0.050
900125	01/16/90	01/23/90	0.017 +/-0.003	< 0.043
900164	01/23/90	01/30/90	0.015 +/-0.003	< 0.018
900223	01/30/90	02/06/90	0.013 +/-0.003	< 0.033
900266	02/06/90	02/13/90	0.015 +/-0.003	< 0.024
900304	02/13/90	02/20/90	0.019 +/-0.003	< 0.025
900333	02/20/90	02/27/90	0.013 +/-0.003	< 0.010
900377	02/27/90	03/06/90	0.023 +/-0.003	< 0.014
900435	03/06/90	03/13/90	0.012 +/-0.003	< 0.021
900467	03/13/90	03/20/90	0.012 +/-0.003	< 0.014
900505	03/20/90	03/27/90	0.021 +/-0.003	< 0.018
900567	03/27/90	04/03/90	0.012 +/-0.002	< 0.021
900616	04/03/90	04/10/90	0.014 +/-0.003	< 0.020
900654	04/10/90	04/17/90	0.014 +/-0.003	< 0.015
900684	04/17/90	04/24/90	0.012 +/-0.003	< 0.010
900723	04/24/90	05/01/90	PUMP FAIL.	
900767	05/01/90	05/08/90	0.016 +/-0.003	< 0.019
900818	05/08/90	05/15/90	0.005 +/-0.003	< 0.013
900856	05/15/90	05/22/90	0.013 +/-0.003	< 0.011
900886	05/22/90	05/29/90	0.013 +/-0.003	< 0.016
900929	05/29/90	06/05/90	0.012 +/-0.002	< 0.013
901011	06/05/90	06/12/90	0.010 +/-0.003	< 0.024
901037	06/12/90	06/19/90	0.013 +/-0.003	< 0.013
901073	06/19/90	06/26/90	0.009 +/-0.003	< 0.015

# = Control Location \* = Low Level Analysis

## Environmental Radiological Monitoring Report

Table No.: 1.6a

Sample: Air Samples, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/M<sup>3</sup>

Location: AS-6, RS

Lab No.	Begin Date	End Date	Gross-Beta	I-131
901131	06/26/90	07/03/90	0.016 +/-0.002	< 0.020
901171	07/03/90	07/10/90	0.016 +/-0.002	< 0.014
901223	07/10/90	07/17/90	0.011 +/-0.002	< 0.013
901281	07/17/90	07/24/90	0.011 +/-0.002	< 0.011
901318	07/24/90	07/31/90	0.023 +/-0.002	< 0.011
901358	07/31/90	08/07/90	0.013 +/-0.002	< 0.013
901388	08/07/90	08/14/90	0.025 +/-0.002	< 0.013
901423	08/14/90	08/21/90	0.026 +/-0.002	< 0.013
901466	08/21/90	08/28/90	0.022 +/-0.002	< 0.015
901490	08/28/90	09/04/90	0.025 +/-0.002	< 0.013
901554	09/04/90	09/11/90	0.021 +/-0.002	< 0.015
901576	09/11/90	09/18/90	0.015 +/-0.002	< 0.015
901618	09/18/90	09/25/90	0.015 +/-0.002	< 0.014
901664	09/25/90	10/02/90	0.027 +/-0.003	< 0.003
901738	10/02/90	10/09/90	0.018 +/-0.002	< 0.023
901771	10/09/90	10/16/90	0.017 +/-0.002	< 0.016
901822	10/16/90	10/23/90	0.025 +/-0.003	< 0.019
901875	10/23/90	10/30/90	0.027 +/-0.003	< 0.012
901924	10/30/90	11/06/90	0.028 +/-0.002	< 0.018
901983	11/06/90	11/13/90	0.025 +/-0.002	< 0.018
902013	11/13/90	11/20/90	0.028 +/-0.002	< 0.020
902054	11/20/90	11/27/90	0.022 +/-0.002	< 0.017

## Environmental Radiological Monitoring Report

Table No.: 1.6b

Sample: Air Samples, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/m<sup>3</sup>

Location: AS-6, RS

Lab No.	Begin Date	End Date	Gross-Beta	I-131
902105	11/27/90	12/04/90	0.018 +/-0.002	< 0.012
902157	12/04/90	12/11/90	0.019 +/-0.002	< 0.022
902106	12/11/90	12/18/90	0.020 +/-0.002	< 0.016
902207	12/18/90	12/26/90	0.015 +/-0.002	< 0.018



## Environmental Radiological Monitoring Report

Table No.: 1.7

Sample: Air Samples, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/M<sup>3</sup>

Location: AS-7, MT

Lab No.	Begin Date	End Date	Gross-Seta	I-131
900016	12/27/89	01/02/90	0.057 +/-0.007	< 0.040
900060	01/02/90	01/09/90	0.032 +/-0.003	< 0.023
900150	01/09/90	01/16/90	0.026 +/-0.003	< 0.050
900126	01/16/90	01/23/90	0.069 +/-0.009	< 0.043
900165	01/23/90	01/30/90	0.061 +/-0.011	< 0.018
900224	01/30/90	02/06/90	0.019 +/-0.003	< 0.033
900267	02/06/90	02/13/90	0.024 +/-0.003	< 0.024
900305	02/13/90	02/20/90	0.026 +/-0.003	< 0.025
900334	02/20/90	02/27/90	0.017 +/-0.003	< 0.010
900378	02/27/90	03/06/90	0.029 +/-0.003	< 0.014
900436	03/06/90	03/13/90	0.017 +/-0.003	< 0.021
900468	03/13/90	03/20/90	0.020 +/-0.003	< 0.014
900506	03/20/90	03/27/90	0.025 +/-0.003	< 0.018
900568	03/27/90	04/03/90	0.017 +/-0.003	< 0.021
900617	04/03/90	04/10/90	0.021 +/-0.003	< 0.020
900655	04/10/90	04/17/90	0.024 +/-0.003	< 0.015
900685	04/17/90	04/24/90	0.019 +/-0.003	< 0.010
900724	04/24/90	05/01/90	0.018 +/-0.003	< 0.011
900786	05/01/90	05/08/90	0.018 +/-0.003	< 0.015
900819	05/08/90	05/15/90	0.010 +/-0.003	< 0.013
900857	05/15/90	05/22/90	0.018 +/-0.003	< 0.011
900887	05/22/90	05/29/90	0.016 +/-0.003	< 0.016
900930	05/29/90	06/05/90	0.019 +/-0.003	< 0.013
901012	06/05/90	06/12/90	0.013 +/-0.003	< 0.024
901038	06/12/90	06/19/90	0.016 +/-0.003	< 0.013
901074	06/19/90	06/26/90	0.022 +/-0.003	< 0.015

## Environmental Radiological Monitoring Report

Table No.: 1.7a  
 Sample: Air Samples, (Beta, I-131)  
 Collection: Continuous with Weekly Exchange  
 Units: pCi/M<sup>3</sup>

Location: AS-7, MT

Lab No.	Begin Date	End Date	Gross-Beta	I-131
901132	06/26/90	07/03/90	0.019 +/-0.002	< 0.020
901172	07/03/90	07/10/90	0.016 +/-0.002	< 0.014
901224	07/10/90	07/17/90	0.014 +/-0.002	< 0.013
901282	07/17/90	07/24/90	0.014 +/-0.002	< 0.011
901319	07/24/90	07/31/90	< 0.003	< 0.011
901359	07/31/90	08/07/90	0.017 +/-0.002	< 0.013
901389	08/07/90	08/14/90	0.021 +/-0.003	< 0.013
901424	08/14/90	08/21/90	0.025 +/-0.002	< 0.013
901467	08/21/90	08/28/90	0.024 +/-0.003	< 0.015
901491	08/28/90	09/04/90	0.024 +/-0.002	< 0.013
901555	09/04/90	09/11/90	0.033 +/-0.006	< 0.015
901577	09/11/90	09/18/90	0.014 +/-0.002	< 0.015
901619	09/18/90	09/25/90	0.017 +/-0.002	< 0.014
901665	09/25/90	10/02/90	0.030 +/-0.003	< 0.022
901739	10/02/90	10/09/90	0.021 +/-0.002	< 0.023
901772	10/09/90	10/16/90	0.020 +/-0.002	< 0.016
901823	10/16/90	10/23/90	0.028 +/-0.003	< 0.019
901880	10/23/90	10/30/90	0.027 +/-0.003	< 0.012
901925	10/30/90	11/06/90	0.028 +/-0.002	< 0.018
901984	11/06/90	11/13/90	0.025 +/-0.002	< 0.018
902014	11/13/90	11/20/90	0.027 +/-0.002	< 0.020
902055	11/20/90	11/27/90	0.012 +/-0.002	< 0.017

## Environmental Radiological Monitoring Report

Table No.: 1.7b  
 Sample: Air Samples, (Beta, I-131)  
 Collection: Continuous with Weekly Exchange  
 Units: pCi/M<sup>3</sup>  
 Location: AS-7, MT

Lab No.	Begin Date	End Date	Gross-Beta	I-131
902106	11/27/90	12/04/90	0.014 +/-0.002	< 0.012
902156	12/04/90	12/11/90	0.012 +/-0.002	< 0.022
902187	12/11/90	12/18/90	0.015 +/-0.002	< 0.016
902206	12/18/90	12/26/90	0.010 +/-0.002	< 0.018

## Environmental Radiological Monitoring Report

Table No.: 1.8

Sample: Air Samples, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/M<sup>3</sup>

Location: AS-8, WR

Lab No.	Begin Date	End Date	Gross-Data	I-131
900017	12/27/89	01/02/90	0.030 +/-0.003	< 0.040
900061	01/02/90	01/09/90	0.035 +/-0.003	< 0.023
900101	01/09/90	01/16/90	0.024 +/-0.003	< 0.050
900127	01/16/90	01/23/90	0.022 +/-0.003	< 0.043
900166	01/23/90	01/30/90	0.019 +/-0.003	< 0.018
900225	01/30/90	02/06/90	0.023 +/-0.003	< 0.033
900268	02/06/90	02/13/90	0.023 +/-0.003	< 0.028
900306	02/13/90	02/20/90	0.026 +/-0.003	< 0.025
900335	02/20/90	02/27/90	0.018 +/-0.003	< 0.010
900379	02/27/90	03/06/90	0.029 +/-0.003	< 0.014
900437	03/06/90	03/13/90	0.019 +/-0.003	< 0.021
900469	03/13/90	03/20/90	0.018 +/-0.003	< 0.014
900507	03/20/90	03/27/90	0.029 +/-0.003	< 0.018
900569	03/27/90	04/03/90	0.016 +/-0.003	< 0.021
900618	04/03/90	04/10/90	0.023 +/-0.003	< 0.020
900656	04/10/90	04/17/90	0.025 +/-0.003	< 0.015
900686	04/17/90	04/24/90	0.019 +/-0.003	< 0.010
900725	04/24/90	05/01/90	0.016 +/-0.003	< 0.011
900789	05/01/90	05/08/90	0.018 +/-0.003	< 0.019
900820	05/08/90	05/15/90	0.009 +/-0.003	< 0.013
900858	05/15/90	05/22/90	0.014 +/-0.003	< 0.011
900888	05/22/90	05/29/90	0.017 +/-0.003	< 0.016
900931	05/29/90	06/05/90	0.016 +/-0.003	< 0.013
901013	06/05/90	06/12/90	0.015 +/-0.003	< 0.024
901039	06/12/90	06/19/90	0.014 +/-0.003	< 0.013
901075	06/19/90	06/26/90	0.022 +/-0.003	< 0.015

## Environmental Radiological Monitoring Report

Table No.: 1.8a

Sample: Air Samples, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/M<sup>3</sup>

Location: AS-8, WR

Lab No.	Begin Date	End Date	Gross-Beta	I-131
901133	06/26/90	07/03/90	0.020 +/-0.002	< 0.020
901173	07/03/90	07/10/90	0.016 +/-0.002	< 0.014
901225	07/10/90	07/17/90	0.016 +/-0.002	< 0.013
901283	07/17/90	07/24/90	0.012 +/-0.002	< 0.011
901320	07/24/90	07/31/90	0.026 +/-0.003	< 0.011
901360	07/31/90	08/07/90	0.017 +/-0.002	< 0.013
901390	08/07/90	08/14/90	0.027 +/-0.003	< 0.013
901425	08/14/90	08/21/90	0.027 +/-0.003	< 0.013
901468	08/21/90	08/28/90	0.025 +/-0.002	< 0.015
901492	08/28/90	09/04/90	0.024 +/-0.002	< 0.013
901556	09/04/90	09/11/90	0.026 +/-0.002	< 0.013
901578	09/11/90	09/18/90	0.022 +/-0.002	< 0.015
901620	09/18/90	09/25/90	0.026 +/-0.002	< 0.014
901666	09/25/90	10/02/90	0.047 +/-0.003	< 0.022
901740	10/02/90	10/09/90	0.027 +/-0.003	< 0.023
901773	10/09/90	10/16/90	0.027 +/-0.003	< 0.016
901824	10/16/90	10/23/90	0.038 +/-0.003	< 0.019
901881	10/23/90	10/30/90	0.038 +/-0.003	< 0.012
901926	10/30/90	11/06/90	0.040 +/-0.003	< 0.018
901985	11/06/90	11/13/90	0.032 +/-0.003	< 0.018
902015	11/13/90	11/20/90	0.039 +/-0.003	< 0.020
902056	11/20/90	11/27/90	0.029 +/-0.003	< 0.017

# = Control Location \* = Low Level Analysis

Table No.: 1.8b

Sample: Air Sample, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/M<sup>3</sup>

Location: AS-8, WR

Environmental Radiological Monitoring Report

Date: 01/26/91

Lab No.	Begin Date	End Date	Gross-Beta	I-131
902107	11/27/90	12/04/90	0.028 +/-0.002	< 0.012
902159	12/04/90	12/11/90	0.030 +/-0.002	< 0.022
902188	12/11/90	12/18/90	0.034 +/-0.003	< 0.016
902209	12/18/90	12/26/90	0.023 +/-0.002	< 0.018



## Environmental Radiological Monitoring Report

Table No.: I-9  
 Sample: Air Samples, (Beta, I-131)  
 Collection: Continuous with Weekly Exchange  
 Units: pCi/M<sup>3</sup>

Location: AS-9, COMP

Lab No.	Begin Date	End Date	Gross-Beta	I-131
900018	12/27/89	01/02/90	0.024 +/-0.003	< 0.040
900062	01/02/90	01/09/90	0.036 +/-0.003	< 0.023
900102	01/09/90	01/16/90	0.050 +/-0.009	< 0.050
900128	01/16/90	01/23/90	0.011 +/-0.005	< 0.043
900167	01/23/90	01/30/90	0.019 +/-0.003	< 0.018
900226	01/30/90	02/06/90	0.018 +/-0.003	< 0.033
900269	02/06/90	02/13/90	0.019 +/-0.004	< 0.024
900307	02/13/90	02/20/90	0.027 +/-0.003	< 0.025
900336	02/20/90	02/27/90	0.018 +/-0.003	< 0.010
900380	02/27/90	03/06/90	0.027 +/-0.003	< 0.014
900438	03/06/90	03/13/90	0.018 +/-0.003	< 0.021
900470	03/13/90	03/20/90	0.019 +/-0.003	< 0.014
900508	03/20/90	03/27/90	0.027 +/-0.003	< 0.018
900570	03/27/90	04/03/90	0.019 +/-0.003	< 0.021
900519	04/03/90	04/10/90	0.022 +/-0.003	< 0.020
900657	04/10/90	04/17/90	0.020 +/-0.003	< 0.015
900687	04/17/90	04/24/90	0.021 +/-0.003	< 0.010
900726	04/24/90	05/01/90	0.017 +/-0.003	< 0.011
900790	05/01/90	05/08/90	0.019 +/-0.003	< 0.019
900821	05/08/90	05/15/90	0.010 +/-0.003	< 0.013
900859	05/15/90	05/22/90	0.016 +/-0.003	< 0.011
900899	05/22/90	05/29/90	0.015 +/-0.003	< 0.016
900932	05/29/90	06/05/90	0.018 +/-0.003	< 0.013
901014	06/05/90	06/12/90	0.012 +/-0.003	< 0.024
901040	06/12/90	06/19/90	0.016 +/-0.003	< 0.013
901076	06/19/90	06/26/90	0.022 +/-0.003	< 0.015

# - Control Location \* - Low Level Analysis

## Environmental Radiological Monitoring Report

Table No.: 1.9a  
 Sample: Air Samples, (Beta, I-131)  
 Collection: Continuous with Weekly Exchange  
 Units: pCi/W<sup>h</sup>

Location: AS-9, COMP

Lab No.	Begin Date	End Date	Gross Beta	I-131
901134	06/26/90	07/03/90	0.018 +/-0.002	< 0.020
901174	07/03/90	07/10/90	0.018 +/-0.002	< 0.014
901226	07/10/90	07/17/90	0.015 +/-0.004	< 0.013
901284	07/17/90	07/24/90	0.012 +/-0.002	< 0.011
901321	07/24/90	07/31/90	0.024 +/-0.002	< 0.011
901361	07/31/90	08/07/90	0.016 +/-0.002	< 0.013
901391	08/07/90	08/14/90	0.023 +/-0.002	< 0.013
901426	08/14/90	08/21/90	0.022 +/-0.002	< 0.013
901469	08/21/90	08/28/90	0.022 +/-0.002	< 0.015
901493	08/28/90	09/04/90	0.019 +/-0.002	< 0.013
901537	09/04/90	09/11/90	0.024 +/-0.002	< 0.015
901579	09/11/90	09/18/90	0.015 +/-0.002	< 0.015
901621	09/18/90	09/25/90	0.016 +/-0.002	< 0.014
901667	09/25/90	10/02/90	0.030 +/-0.003	< 0.022
901741	10/02/90	10/09/90	0.019 +/-0.002	< 0.023
901774	10/09/90	10/16/90	0.016 +/-0.002	< 0.016
901825	10/16/90	10/23/90	0.024 +/-0.003	< 0.019
901882	10/23/90	10/30/90	0.027 +/-0.003	< 0.012
901927	10/30/90	11/06/90	0.024 +/-0.002	< 0.018
901986	11/06/90	11/13/90	0.021 +/-0.002	< 0.018
902016	11/13/90	11/20/90	0.026 +/-0.002	< 0.020
902057	11/20/90	11/27/90	0.019 +/-0.002	< 0.017

Table No.: 1.9b

Sample: Air Samples, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/M<sup>3</sup>

Location: AS-9, COMP

Environmental Radiological Monitoring Report

Date: 01/24/91

Lab No.	Begin Date	End Date	Gross Beta	I-131
902108	11/27/90	12/04/90	0.020 +/-0.002	< 0.012
902160	12/04/90	12/11/90	0.018 +/-0.002	+ 0.022
902189	12/11/90	12/18/90	0.017 +/-0.002	< 0.016
902210	12/18/90	12/26/90	0.020 +/-0.002	< 0.017

Table No.: 1.10

Sample: Air Samples, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/M<sup>3</sup>

Location: AS-10, WLT

Environmental Radiological Monitoring Report

Date: 08/23/90

Lab No.	Begin Date	End Date	Gross Beta	I-131
900042	12/25/89	01/01/90	0.032 +/-0.003	< 0.046
900077	01/01/90	01/09/90	0.043 +/-0.003	< 0.029
900111	01/09/90	01/15/90	0.028 +/-0.003	< 0.027
900136	01/15/90	01/22/90	0.022 +/-0.003	< 0.020
900216	01/22/90	01/29/90	0.023 +/-0.003	< 0.059
900243	01/29/90	02/06/90	0.024 +/-0.003	< 0.034
900281	02/06/90	02/13/90	0.024 +/-0.003	< 0.030
900318	02/13/90	02/19/90	0.024 +/-0.003	< 0.022
900348	02/19/90	02/26/90	0.019 +/-0.003	< 0.007
900413	02/26/90	03/05/90	0.026 +/-0.003	< 0.026
900448	03/05/90	03/13/90	0.018 +/-0.003	< 0.015
900496	03/13/90	03/20/90	0.019 +/-0.003	< 0.024
900522	03/20/90	03/27/90	0.028 +/-0.003	< 0.018
900586	03/27/90	04/02/90	0.021 +/-0.003	< 0.023
900638	04/02/90	04/10/90	0.020 +/-0.002	< 0.019
900677	04/10/90	04/17/90	0.022 +/-0.003	< 0.021
900702	04/17/90	04/23/90	0.018 +/-0.003	0.026 +/-0.007
900730	04/23/90	04/30/90	0.016 +/-0.003	< 0.009
900807	04/30/90	05/07/90	0.016 +/-0.003	< 0.017
900849	05/07/90	05/14/90	0.010 +/-0.003	< 0.023
900861	05/14/90	05/22/90	0.012 +/-0.002	< 0.010
900888	05/22/90	05/28/90	0.015 +/-0.003	< 0.024
901000	05/28/90	06/04/90	0.018 +/-0.003	< 0.020
901028	06/04/90	06/11/90	0.012 +/-0.001	< 0.016
901066	06/11/90	06/18/90	0.015 +/-0.003	< 0.024
901096	06/18/90	06/25/90	0.021 +/-0.003	< 0.013

# = Control Location \* = Low Level Analysis

## Environmental Radiological Monitoring Report

Table No.: 1.10a

Sample: Air Samples, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/M<sup>3</sup>

Location: AS-10, NLI

Lab No.	Begin Date	End Date	Gross-Beta	I-131
901151	06/25/90	07/03/90	0.019 +/-0.002	< 0.021
901188	07/03/90	07/09/90	0.017 +/-0.002	< 0.022
901265	07/09/90	07/16/90	0.013 +/-0.002	< 0.014
901286	07/16/90	07/24/90	0.011 +/-0.002	< 0.020
901334	07/24/90	07/31/90	0.023 +/-0.002	< 0.015
901363	07/31/90	08/06/90	0.016 +/-0.002	< 0.013
901402	08/06/90	08/14/90	0.025 +/-0.002	< 0.014
901446	08/14/90	08/22/90	0.024 +/-0.002	< 0.014
901478	08/22/90	08/28/90	0.025 +/-0.003	< 0.027
901532	08/28/90	09/03/90	0.024 +/-0.003	< 0.022
901562	09/03/90	09/11/90	0.025 +/-0.002	< 0.019
901588	09/11/90	09/17/90	0.014 +/-0.003	< 0.026
901634	09/17/90	09/24/90	0.023 +/-0.002	< 0.024
901731	09/24/90	10/02/90	PUMP FAIL.	
901748	10/02/90	10/09/90	0.020 +/-0.002	< 0.020
901811	10/09/90	10/15/90	0.020 +/-0.003	< 0.015
901826	10/15/90	10/23/90	0.031 +/-0.003	< 0.019
901884	10/23/90	10/30/90	0.055 +/-0.005	< 0.018
901946	10/30/90	11/05/90	0.031 +/-0.003	< 0.023
901990	11/05/90	11/13/90	0.027 +/-0.002	< 0.018
902018	11/13/90	11/19/90	0.027 +/-0.003	< 0.025
902088	11/19/90	11/27/90	0.024 +/-0.002	< 0.018

# = Control Location \* = Low Level Analysis

## Environmental Radiological Monitoring Report

Table No.: 1.10b

Sample: Air Samples, (Beta, I-131)

Collection: Continuous with Weekly Exchange

Units: pCi/M<sup>3</sup>

Locations: AS-10, WLT

Lab No.	Begin Date	End Date	Gross-Rate	I-131
902110	11/27/90	12/03/90	0.029 +/-0.003	< 0.012
902169	12/03/90	12/11/90	0.023 +/-0.002	< 0.020
902195	12/11/90	12/18/90	0.028 +/-0.002	< 0.021
902216	12/18/90	12/24/90	0.019 +/-0.003	< 0.020
910056	12/24/90	12/31/90	0.029 +/-0.003	< 0.026



Environmental Radiological Monitoring Report

Table No.: 1.11  
 Sample: Air Samples, (Beta, I-131)  
 Collection: Continuous with Weekly Exchange  
 Units: pCi/M<sup>3</sup>

Location: AS-11, STJ

Lab No.	Begin Date	End Date	Gross-Beta	I-131
900043	12/26/89	01/02/90	0.024 +/-0.003	< 0.045
900078	01/02/90	01/05/90	0.033 +/-0.003	< 0.029
900112	01/09/90	01/16/90	0.023 +/-0.003	< 0.027
900137	01/16/90	01/23/90	0.019 +/-0.003	< 0.020
900217	01/23/90	01/30/90	0.018 +/-0.003	< 0.059
900244	01/30/90	02/06/90	0.019 +/-0.003	< 0.034
900282	02/06/90	02/13/90	0.019 +/-0.003	< 0.030
900319	02/13/90	02/20/90	0.027 +/-0.003	< 0.022
900349	02/20/90	02/27/90	0.015 +/-0.003	< 0.007
900414	02/27/90	03/06/90	0.025 +/-0.003	< 0.026
900449	03/06/90	03/13/90	0.017 +/-0.003	< 0.015
900499	03/13/90	03/20/90	0.016 +/-0.003	< 0.024
900523	03/20/90	03/27/90	0.025 +/-0.003	< 0.018
900587	03/27/90	04/03/90	0.020 +/-0.003	< 0.023
900639	04/03/90	04/10/90	0.016 +/-0.003	< 0.019
900678	04/10/90	04/17/90	0.021 +/-0.003	< 0.021
900703	04/17/90	04/24/90	0.017 +/-0.003	< 0.007
900731	04/24/90	05/01/90	0.015 +/-0.003	< 0.010
900808	05/01/90	05/08/90	0.019 +/-0.003	< 0.017
900850	05/08/90	05/15/90	0.010 +/-0.003	< 0.023
900862	05/15/90	05/22/90	0.012 +/-0.003	< 0.010
900899	05/22/90	05/29/90	0.014 +/-0.003	< 0.024
901001	05/29/90	06/05/90	0.014 +/-0.002	< 0.020
901029	06/05/90	06/12/90	0.009 +/-0.002	< 0.015
901067	06/12/90	06/19/90	0.012 +/-0.003	< 0.024
901097	06/19/90	06/26/90	0.019 +/-0.003	< 0.013

## Environmental Radiological Monitoring Report

Table No.: 1.11a  
 Sample: Air Samples, (Beta, I-131)  
 Collection: Continuous with Weekly Exchange  
 Units: pCi/M<sup>3</sup>

Location: AS-11, STJ

Lab No.	Begin Date	End Date	Gross-Rate	I-131
901152	06/26/90	07/03/90	0.017 +/-0.002	< 0.021
901189	07/03/90	07/10/90	0.014 +/-0.002	< 0.022
901266	07/10/90	07/17/90	0.012 +/-0.002	< 0.014
901287	07/17/90	07/24/90	0.011 +/-0.002	< 0.020
901335	07/24/90	07/31/90	0.022 +/-0.002	< 0.015
901364	07/31/90	08/07/90	0.016 +/-0.002	< 0.013
901403	08/07/90	08/14/90	0.025 +/-0.002	< 0.014
901447	08/14/90	08/21/90	0.024 +/-0.002	< 0.014
901479	08/21/90	08/28/90	0.025 +/-0.002	< 0.027
901533	08/28/90	09/04/90	0.022 +/-0.002	< 0.022
901563	09/04/90	09/11/90	0.041 +/-0.003	< 0.019
901589	09/11/90	09/18/90	0.015 +/-0.002	< 0.026
901635	09/18/90	09/25/90	0.024 +/-0.002	< 0.024
901732	09/25/90	10/02/90	0.036 +/-0.003	< 0.031
901750	10/02/90	10/09/90	0.018 +/-0.002	< 0.020
901812	10/09/90	10/16/90	0.023 +/-0.002	< 0.015
901827	10/16/90	10/23/90	0.028 +/-0.003	< 0.019
901885	10/23/90	10/30/90	0.032 +/-0.003	< 0.018
901947	10/30/90	11/06/90	0.029 +/-0.002	< 0.023
901991	11/06/90	11/13/90	0.028 +/-0.003	< 0.018
902019	11/13/90	11/20/90	0.032 +/-0.002	< 0.025
902099	11/20/90	11/27/90	0.024 +/-0.002	< 0.018

## Environmental Radiological Monitoring Report

Table No.: 1.11b  
Sample: Air Samples, (Beta, I-131)  
Collection: Continuous with Weekly Exchange  
Units: pCi/M<sup>3</sup>±3

Location: AS-11, STJ

Lab No.	Begin Date	End Date	Gross-Beta	I-131
902111	11/27/90	12/04/90	5.024 +/-0.002	< 0.012
902170	12/04/90	12/11/90	0.022 +/-0.002	< 0.022
902196	12/11/90	12/18/90	0.022 +/-0.002	< 0.021
902217	12/18/90	12/26/90	0.019 +/-0.002	< 0.020

## Environmental Radiological Monitoring Report

Table No.: 1.12

Sample: Air Samples, (Gamma)

Collection: Quarterly Composite of Weekly Samples

Units: pCi/M<sup>3</sup>

Location	Lab No.	Begin Date	End Date	Cs-134	Cs-137
AS-1, PG	900626	12/27/89	03/27/90	< 0.0012	< 0.0010
AS-2, 61K	900627	12/27/89	03/27/90	< 0.0009	< 0.0008
AS-3, 61VA	900628	12/27/89	03/27/90	< 0.0010	< 0.0008
AS-4, GJOK	900629	12/27/89	03/27/90	< 0.0007	< 0.0005
AS-5, TC	900630	12/27/89	03/27/90	< 0.0008	< 0.0006
AS-6, RS	900631	12/27/89	03/27/90	< 0.0005	< 0.0004
AS-7, MT	900632	12/27/89	03/27/90	< 0.0007	< 0.0005
AS-8, WR	900633	12/27/89	03/27/90	< 0.0009	< 0.0007
AS-9, GCMF	900634	12/27/89	03/27/90	< 0.0007	< 0.0007
AS-10, NLT	900635	12/25/89	03/27/90	< 0.0007	< 0.0006
AS-11, STJ	900636	12/26/89	03/27/90	< 0.0010	< 0.0008

## Environmental Radiological Monitoring Report

Table No.: 1-12a

Sample: Air Samples, (Gamma)

Collection: Quarterly Composite of Weekly Sample

Units: pCi/m<sup>3</sup>

Location	Lab No.	Begin Date	End Date	Ce-134	Ce-137
AS-1, PG	901176	03/27/90	06/26/90	< 0.0009	< 0.0008
AS-2, 61K	901177	03/27/90	06/26/90	< 0.0018	< 0.0014
AS-3, 61VA	901178	03/27/90	06/26/90	< 0.0016	< 0.0013
AS-4, CJOE	901179	03/27/90	06/26/90	< 0.0011	< 0.0010
AS-5, TC	901180	03/27/90	06/26/90	< 0.0006	< 0.0005
AS-6, RS	901181	03/27/90	06/26/90	< 0.0016	< 0.0013
AS-7, MT	901182	03/27/90	06/26/90	< 0.0012	< 0.0010
AS-8, WR	901183	03/27/90	06/26/90	< 0.0011	< 0.0011
AS-9, COMP	901184	03/27/90	06/26/90	< 0.0014	< 0.0011
AS-10, NLT	901185	03/27/90	06/25/90	< 0.0008	< 0.0008
AS-11, STJ	901186	03/27/90	06/26/90	< 0.0010	< 0.0011

Table No.: 1.12b

Sample: Air Samples, (Gamma)

Collection: Quarterly Composite of Weekly Samples

Units: pCi/m<sup>3</sup>

Environmental Radiological Monitoring Report

Date: 10/25/90

Location	Lab No.	Begin Date	End Date	Cs-134	Cs-137
AS-1, PG	901782	06/26/90	09/25/90	< 0.0011	< 0.0008
AS-2, 61K	901783	06/26/90	09/25/90	< 0.0010	< 0.0009
AS-3, 61VA	901784	06/26/90	09/25/90	< 0.0012	< 0.0012
AS-4, 61OE	901785	06/26/90	09/25/90	< 0.0006	< 0.0006
AS-5, TC	901786	06/26/90	09/25/90	< 0.0015	< 0.0012
AS-6, BS	901787	06/26/90	09/25/90	< 0.0009	< 0.0009
AS-7, MT	901788	06/26/90	09/25/90	< 0.0013	< 0.0010
AS-8, WR	901789	06/26/90	09/25/90	< 0.0014	< 0.0012
AS-9, COMP	901790	06/26/90	09/25/90	< 0.0009	< 0.0007
AS-10, NLT	901791	06/25/90	09/24/90	< 0.0010	< 0.0010
AS-11, STJ	901792	06/26/90	09/25/90	< 0.0009	< 0.0009

# = Control Location \* = Low Level Analysis



Table No.: 1.12c

Sample: Air Samples.(Gamma)

Collection: Quarterly Composite of Weekly Samples

Units: pCi/M<sup>3</sup>

Environmental Radiological Monitoring Report

Date: 02/08/91

Location	Lab No.	Begin Date	End Date	Cs-134	Cs-137
AS-1, PG	910111	09/25/90	01/02/91	< 0.0010	< 0.0009
AS-2, 61N	910112	09/25/90	01/02/91	< 0.0015	< 0.0012
AS-3, 61VA	910113	09/25/90	01/02/91	< 0.0007	< 0.0006
AS-4, GJOE	910114	09/25/90	01/02/91	< 0.0010	< 0.0008
AS-5, TC	910115	09/25/90	01/02/91	< 0.0004	< 0.0002
AS-6, RS	910116	09/25/90	01/02/91	< 0.0010	< 0.0010
AS-7, MT	910117	09/25/90	01/02/91	< 0.0002	< 0.0003
AS-8, WR	910118	09/25/90	01/02/91	< 0.0008	< 0.0006
AS-9, COMP	910119	09/25/90	01/02/91	< 0.0007	< 0.0006
AS-10, NLT	910120	09/24/90	12/31/90	< 0.0014	< 0.0011
AS-11, STJ	910121	09/25/90	01/02/91	< 0.0002	< 0.0002

# = Control Location \* = Low Level Analysis

Table No.: 2.1

## Environmental Radiological Monitoring Report

Date: 02/04/91

Sample: Cistern Water, (Beta, I-131, Gamma)

Collection: Monthly

Units: pCi/L

Location: WILLIS CISTERN

Lab. No.	Collection		Beta	I-131*	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
	Date														
900040	01/03/90		< 4	< 0.6	< 2	< 2	< 3	< 2	< 4	< 2	< 5	< 2	< 2	< 9	< 3
900228	02/05/90		< 4	< 0.3	< 4	< 4	< 6	< 4	< 9	< 5	< 10	< 4	< 3	< 22	< 5
900364	03/05/90		5.0+/-2.9	< 0.5	< 4	< 4	< 5	< 4	< 9	< 4	< 9	< 4	< 4	< 18	< 5
900365 GG	03/05/90		4.6+/-3.1	< 0.4	< 2	< 2	< 2	< 5	< 4	< 2	< 4	< 2	< 2	< 8	< 2
900555	04/02/90		< 4.0	< 0.4	< 3	< 3	< 4	< 3	< 6	< 2	< 6	< 3	< 3	< 10	< 3
900728	05/01/90		< 4.0	< 0.5	< 4	< 4	< 6	< 4	< 9	< 4	< 9	< 5	< 4	< 16	< 5
900922	06/04/90		< 3.9	< 0.3	< 3	< 3	< 3	< 3	< 6	< 3	< 5	< 3	< 3	< 11	< 4
901104	07/02/90		< 3.7	< 0.4	< 2	< 3	< 4	< 3	< 6	< 3	< 6	< 3	< 3	< 12	< 4
901351	08/05/90		< 4.0	< 0.4	< 3	< 3	< 5	< 3	< 7	< 3	< 7	< 4	< 3	< 14	< 5
901498	09/04/90		3.7+/-3.0	0.5+/-0.4	< 4	< 4	< 6	< 4	< 10	< 4	< 9	< 5	< 4	< 2	< 4
901500 GG	09/04/90		3.6+/-2.7	< 0.3	< 4	< 4	< 6	< 4	< 9	< 4	< 9	< 5	< 4	< 2	< 7
901687	10/02/90		< 3.3	< 0.3	< 3	< 3	< 4	< 3	< 5	< 3	< 6	< 3	< 3	< 15	< 5
901932	11/05/90		< 3.8	< 0.3	< 2	< 2	< 2	< 4	< 4	< 2	< 4	< 2	< 2	< 7	< 3
902133	12/10/90		< 2.2	< 0.3	< 2	< 2	< 2	< 2	< 4	< 2	< 4	< 2	< 2	< 7	< 2

Table No.: 2.2

Sample: Cistern Water, (H-3)

Collection: Quarterly composite.

Units: pCi/L

Location: WILLIS CISTERN

Environmental Radiological Monitoring Report

Date: 02/04/91

Lab. No.	Begin Date	End Date	H-3
900366	01/03/90	03/05/90	< 360
900367	03/03/90	03/05/90	< 360
900934	04/02/90	06/04/90	< 370
901511	07/02/90	09/04/90	7 +/- 240
901512	09/02/90	09/04/90	317 +/- 240
902134	10/02/90	12/10/90	< 350

Table No.: 2.3

## Environmental Radiological Monitoring Report

Date: 02/04/91

Sample: Cistern Water, (Beta, I-131, Gamma)

Collection: Monthly

Units: pCi/L

Location: MCGEE CISTERN

Lab. No.	Collection		Beta	I-131*	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
	Date														
900041	01/03/90		< 4	< 0.5	< 2	< 3	< 5	< 3	< 5	< 3	< 6	< 3	< 3	< 12	< 4
900229	02/05/90		< 4	< 0.4	< 4	< 4	< 5	< 4	< 8	< 4	< 8	< 4	< 4	< 16	< 5
900370	03/05/90		3.9+/-3.1	< 0.3	< 2	< 2	< 3	< 3	< 5	< 2	< 5	< 3	< 2	< 11	< 4
900371	GC 03/05/90		5.9+/-3.1	< 0.3	< 2	< 2	< 3	< 2	< 5	< 2	< 5	< 3	< 2	< 11	< 3
900556	04/02/90		< 3.9	< 0.3	< 2	< 2	< 5	< 2	< 6	< 2	< 4	< 2	< 2	< 7	< 2
900729	05/01/90		< 3.9	< 0.5	< 4	< 4	< 6	< 4	< 10	< 4	< 9	< 5	< 4	< 20	< 5
900923	06/04/90		< 4.0	< 0.3	< 4	< 4	< 6	< 4	< 8	< 4	< 8	< 4	< 4	< 15	< 5
901105	07/02/90		< 4.0	< 0.3	< 2	< 2	< 3	< 3	< 4	< 2	< 4	< 2	< 2	< 9	< 3
901352	08/06/90		< 4.0	< 0.4	< 5	< 5	< 7	< 5	< 11	< 5	< 11	< 6	< 5	< 22	< 6
901499	09/04/90		3.8+/- 2.6	< 0.4	< 2	< 2	< 3	< 3	< 5	< 2	< 4	< 2	< 2	< 7	< 3
901501	GC 09/04/90		3.0+/- 2.6	< 0.3	< 3	< 3	< 4	< 3	< 6	< 3	< 6	< 3	< 2	< 13	< 6
901688	10/02/90		< 3.2	< 0.3	< 2	< 2	< 2	< 2	< 3	< 2	< 4	< 2	< 2	< 9	< 3
901933	11/05/90		2.5+/- 2.4	< 0.4	< 2	< 2	< 3	< 2	< 5	< 2	< 5	< 3	< 2	< 8	< 3
902155	12/10/90		< 2.4	< 0.3	< 3	< 3	< 4	< 3	< 6	< 3	< 6	< 3	< 2	< 8	< 3

## Environmental Radiological Monitoring Report

Table No.: 2.4

Sample: Cistern Water, (H-3)

Collection: Quarterly composite.

Units: pCi/L

Location: MCCES CISTERN

Lab. No.	Begin Date	End Date	H-3
900368	01/03/90	03/05/90	< 360
900369	03 01/03/90	03/05/90	< 360
900935	04/02/90	06/04/90	< 370
901513	07/02/90	03/04/90	424 +/- 240
901514	03 07/02/90	09/04/90	400 +/- 240
902136	10/02/90	12/10/90	< 350

# = Control Location \* = Low Level Analysis

Table No.: 3.1

Environmental Radiological Monitoring Report

Date: 11/29/90

Sample: Ground Water, (H-3, Gamma)

Collection: Quarterly

Units: pCi/L

Location: PGWELL P. Gibson

Lab. No.	Collection		H-3	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Zr-95	Nb-95	I-131	Cs-134	Cs-137	Ba-140	La-140
	Date														
900032	01/02/90		< 370	< 2	< 2	< 5	< 3	< 5	< 6	< 2	< 4	< 3	< 2	< 12	< 3
900547	04/02/90			< 5	< 4	< 6	< 5	< 11	< 9	< 4	< 8	< 5	< 5	< 24	< 8
900548	GG 04/02/90			< 2	< 2	< 6	< 2	< 5	< 4	< 2	< 4	< 2	< 2	< 9	< 3
900551	04/02/90		< 360												
900552	GG 04/02/90		< 360												
901108	07/02/90		< 360	< 3	< 4	< 5	< 4	< 9	< 9	< 4	< 7	< 4	< 4	< 17	< 7
901699	10/01/90		< 360	< 2	< 2	< 3	< 2	< 4	< 4	< 2	< 5	< 2	< 2	< 11	< 4



Table No.: 3.2

Environmental Radiological Monitoring Report

Date: 11/29/90

Sample: Ground Water, (H-3, Gamma)

Collection: Quarterly

Units: pCi/L

Location: AAWELL, Arnold Acr

Lab. No.	Collection		H-3	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Er-95	Nb-95	I-131	Cs-134	Cs-137	Ba-140	La-140
	Date														
900033	01/02/90	< 370		< 3	< 3	< 3	< 2	< 3	< 5	< 2	< 4	< 3	< 2	< 10	< 3
900549	04/02/90			< 4	< 4	< 5	< 4	< 9	< 9	< 4	< 6	< 5	< 4	< 18	< 5
900550	GG 04/02/90			< 3	< 3	< 8	< 3	< 12	< 7	< 3	< 6	< 3	< 3	< 13	< 5
900553	04/02/90	< 360													
900554	GG 04/02/90	< 360													
901109	07/02/90	< 360		< 3	< 3	< 4	< 6	< 6	< 6	< 3	< 5	< 3	< 3	< 12	< 5
901700	10/01/90	< 360		< 3	< 3	< 5	< 7	< 8	< 6	< 3	< 5	< 3	< 3	< 13	< 5

Table No.: 3.3

Environmental Radiological Monitoring Report

Date: 11/29/90

Sample: Ground Water, (H-3, Gamma)

Collection: Quarterly

Units: pCi/L

Location: Lake Bruin Well

Lab. No.	Collection		H-3	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Zr-95	Nb-95	I-131	Cs-134	Cs-137	Ba-140	La-140
	Date														
900034	01/02/90		< 370	< 2	< 3	< 5	< 2	< 5	< 9	< 5	< 6	< 4	< 3	< 14	< 4
900557	04/02/90			< 3	< 3	< 7	< 4	< 8	< 8	< 4	< 6	< 4	< 3	< 17	< 6
900558	GG 04/02/90			< 3	< 3	< 4	< 3	< 6	< 6	< 3	< 5	< 3	< 3	< 14	< 4
900559	04/02/90		< 360												
900560	GG 04/02/90		< 360												
901110	07/02/90		< 360	< 4	< 4	< 5	< 4	< 8	< 8	< 4	< 6	< 4	< 4	< 17	< 5
901701	10/01/90		< 360	< 2	< 2	< 3	< 2	< 4	< 4	< 2	< 4	< 2	< 2	< 10	< 4

Table No.: 4.1

Environmental Radiological Monitoring Report

Date: 01/24/91

Sample: Surface water, Grab (Gamma)

Collection: Monthly.

Units: pCi/L

Location: MISS. RIVER UP

Lab. No.	Date	Collection											
		Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-95	Nb-95	I-131	Cs-134	Cs-137	Ba-140	La-140
900037	01/02/90	< 4	< 7	< 4	< 4	< 8	< 9	< 4	< 8	< 4	< 4	< 12	< 5
900246	02/06/90	< 3	< 5	< 2	< 2	< 5	< 4	< 3	< 7	< 3	< 2	< 15	< 4
900399	03/06/90	< 3	< 4	< 3	< 3	< 6	< 6	< 3	< 5	< 3	< 3	< 14	< 5
900400 GG	03/06/90	< 3	< 4	< 3	< 3	< 6	< 6	< 3	< 6	< 3	< 3	< 15	< 5
900575	04/03/90	< 2	< 2	< 2	< 2	< 3	< 4	< 2	< 4	< 2	< 2	< 9	< 3
900751	05/01/90	< 3	< 4	< 3	< 3	< 6	< 6	< 3	< 6	< 3	< 3	< 15	< 5
901002	06/07/90	< 3	< 4	< 3	< 3	< 6	< 7	< 3	< 8	< 3	< 3	< 18	< 6
901137	07/03/90	< 6	< 8	< 6	< 6	< 13	< 13	< 6	< 11	< 7	< 6	< 27	< 9
901330	08/01/90	< 2	< 4	< 3	< 3	< 5	< 6	< 3	< 7	< 3	< 2	< 16	< 6
901522	09/04/90	< 6	< 9	< 6	< 6	< 13	< 14	< 6	< 10	< 7	< 6	< 29	< 8
901523 GG	09/04/90	< 2	< 4	< 3	< 3	< 6	< 6	< 4	< 4	< 3	< 2	< 11	< 4
901702	10/02/90	< 6	< 9	< 7	< 7	< 14	< 14	< 6	< 11	< 8	< 7	< 31	< 9
901937	11/06/90	< 3	< 4	< 3	< 3	< 7	< 8	< 3	< 5	< 4	< 3	< 14	< 4
902116	12/04/90	< 3	< 4	< 3	< 3	< 5	< 5	< 3	< 4	< 3	< 2	< 12	< 4

Environmental Radiological Monitoring Report

Table No.: 4.2  
 Sample: Surface Water, (H-3)  
 Collection: Quarterly Composite  
 Units: pCi/L

Location: MISS. RIVER UP

Lab. No.	Beg'n Date	End Date	H-3
900401	01/02/90	03/06/90	310+/-219
900402	03/01/90	03/06/90	< 360
901003	04/03/90	06/07/90	< 368
901524	07/03/90	09/04/90	< 362
901525	08/03/90	09/04/90	< 362
902117	10/02/90	12/04/90	< 350

Table No.: 4.3

## Environmental Radiological Monitoring Report

Date: 01/24/91

Sample: Surface water, Grab (Gamma)

Collection: Monthly.

Units: pCi/L

Location: MISS. RIVER DOWN

Lab. No.	Collection		Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-95	Nb-95	I-131	Cs-134	Cs-137	Ba-140	La-140
	Date													
900038	01/02/90		< 3	< 5	< 3	< 2	< 5	< 6	< 3	< 6	< 3	< 2	< 16	< 4
900247	02/06/90		< 2	< 5	< 3	< 3	< 5	< 6	< 3	< 5	< 3	< 3	< 13	< 3
900403	03/06/90		< 3	< 5	< 3	< 3	< 6	< 6	< 3	< 5	< 3	< 3	< 15	< 5
900404 OG	03/06/90		< 2	< 3	< 2	< 3	< 4	< 4	< 2	< 4	< 2	< 2	< 10	< 4
900576	04/03/90		< 4	< 6	< 4	< 4	< 9	< 9	< 5	< 10	< 5	< 4	< 24	< 7
900752	05/01/90		< 2	< 3	< 2	< 2	< 4	< 4	< 2	< 4	< 2	< 2	< 10	< 4
901004	06/07/90		< 2	< 4	< 3	< 2	< 6	< 6	< 3	< 4	< 3	< 2	< 13	< 4
901138	07/03/90		< 2	< 3	< 2	< 2	< 4	< 4	< 2	< 3	< 2	< 2	< 9	< 3
901331	08/01/90		< 2	< 4	< 2	< 2	< 7	< 5	< 2	< 3	< 2	< 2	< 10	< 3
901526	09/04/90		< 3	< 3	< 3	< 3	< 6	< 5	< 3	< 5	< 3	< 3	< 12	< 4
901527 OG	09/04/90		< 3	< 4	< 3	< 3	< 6	< 6	< 3	< 4	< 3	< 3	< 13	< 5
901703	10/02/90		< 6	< 8	< 6	< 6	< 13	< 13	< 6	< 10	< 7	< 6	< 30	< 8
901938	11/06/90		< 3	< 4	< 3	< 4	< 6	< 5	< 3	< 4	< 3	< 3	< 12	< 5
902118	12/04/90		< 4	< 5	< 4	< 4	< 8	< 8	< 4	< 6	< 4	< 4	< 14	< 5

## Environmental Radiological Monitoring Report

Table No.: 4.4  
Sample: Surface Water, (H-3)  
Collection: Quarterly Composite  
Units: pCi/L

Location: MISS. RIVER DOWN

Lab. No.	Begin Date	End Date	H-3
900405	01/02/90	03/06/90	252 +/- 218
900406	03/02/90	03/06/90	< 360
901005	04/03/90	06/07/90	< 370
901528	07/03/90	09/04/90	483 +/- 220
901529	07/03/90	09/04/90	405 +/- 219
902119	10/02/90	12/04/90	< 350



Table No.: 4.5

## Environmental Radiological Monitoring Report

Date: 01/24/91

Sample: Surface Water, (Gamma)

Collection: Monthly Composite

Units: pCi/L

Location: DISCHARGE BASIN

Lab. No.	Begin Date	End Date	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140
900204	01/02/90	02/01/90	< 2	< 3	< 5	< 3	< 5	< 2	< 6	< 4	< 3	< 2	< 12	< 3
900386	02/01/90	03/02/90	< 5	< 3	< 5	< 3	< 7	< 3	< 6	< 4	< 4	< 3	< 14	< 4
900532	03/02/90	03/30/90	< 3	< 3	< 4	< 3	< 6	< 3	< 6	< 7	< 3	< 3	< 17	< 5
900533 GG	03/02/90	03/30/90	< 4	< 4	< 6	< 4	< 10	< 4	< 9	< 7	< 5	< 4	< 19	< 5
900753	03/30/90	04/30/90	< 3	< 3	< 4	< 3	< 6	< 3	< 6	< 6	< 3	< 3	< 15	< 5
900754 GG	03/30/90	04/30/90	< 4	< 4	< 6	< 4	< 9	< 4	< 10	< 8	< 5	< 4	< 23	< 6
900949	04/30/90	06/01/90	< 4	< 4	< 6	< 4	< 9	< 4	< 9	< 10	< 4	< 4	< 22	< 7
901111	06/01/90	06/29/90	< 3	< 3	< 4	< 5	< 6	< 3	< 6	< 6	< 3	< 3	< 15	< 6
901333	06/29/90	08/01/90	< 3	< 3	< 4	< 3	< 6	< 3	< 7	< 5	< 3	< 3	< 15	< 5
901497	08/01/90	08/31/90	< 2	< 2	< 3	< 2	< 4	< 2	< 4	< 5	< 2	< 2	< 12	< 4
901695	08/31/90	09/28/90	< 2	< 2	< 3	< 5	< 5	< 2	< 4	< 5	< 2	< 2	< 11	< 4
901696 GG	08/31/90	09/28/90	< 3	< 4	< 5	< 4	< 8	< 4	< 8	< 12	< 4	< 3	< 26	< 7
901900	09/28/90	11/01/90	< 3	< 3	< 4	< 3	< 6	< 3	< 6	< 4	< 3	< 3	< 10	< 4
902115	11/01/90	11/30/90	< 3	< 3	< 4	< 3	< 6	< 3	< 6	< 6	< 3	< 2	< 14	< 5
910056	11/30/90	12/31/90	< 2	< 3	< 4	4 +/- 2	< 5	< 3	< 5	< 6	< 3	< 2	< 12	< 5

# = Control Location \* = Low Level Analysis

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Environmental Radiological Monitoring Report

Table No.: 4.6  
 Sample: Surface Water, (H-3)  
 Collection: Quarterly Composite  
 Units: pCi/L

Location: DISCHARGE BASIN

Lab. No.	Begin Date	End Date	H-3
900534	01/02/90	03/30/90	820+/-220
900535	01/02/90	03/30/90	900+/-220
901112	03/30/90	06/29/90	802+/-226
901113	03/30/90	06/29/90	903+/-226
901597	06/29/90	09/28/90	1930+/- 250
901598	06/29/90	09/28/90	2026+/- 250
910055	09/28/90	12/31/90	531 +/-214

## Environmental Radiological Monitoring Report

Table No.: 5.1

Sample: Milk, (I-131\*, Gamma)

Collection: Semiannual

Units: pCi/L

Location: ALCON STATE

Lab No.	Collection Date	I-131*	Cs-134	Cs-137	Ba-140	La-140
900755	05/02/90	< 0.4	< 3	< 2	< 10	< 3
90075600	05/02/90	< 0.8	< 3	< 3	< 14	< 4
901901	11/05/90	< 0.7	< 2	< 2	< 8	< 3
901987	11/13/90	< 0.3				

Table No.: 6.1

Environmental Radiological Monitoring Report

Date: 10/23/90

Sample: Vegetation: Broadleaf, (Gamma)

Collection: Monthly when available.

Units: pCi/Kg

Location: SECTOR K, 17 KM

Lab No.	Collection Date	Sample type	I-131	Cs-134	Cs-137
900029	01/03/90	RAPE	< 25	< 16	< 12
900030	01/03/90	MUSTARD GREENS	< 33	< 28	< 24
900031	01/03/90	COLLARDS	< 29	< 19	< 16
900207	02/05/90	COLLARDS	< 32	< 26	< 22
900208	02/05/90	RAPE	< 14	< 9	< 7
900209	02/05/90	VETCH	< 20	< 15	< 13
900355	03/05/90	SPINACH	< 28	< 33	< 24
900356	03/05/90	RAPE	< 31	< 30	< 22
900357	03/05/90	VETCH	< 14	< 15	< 13
900538	04/03/90	FLA. BL MUSTARD	< 27	< 28	< 24
900539	04/03/90	SPINACH	< 28	< 30	< 20
900540	04/03/90	COLLARDS	< 28	< 27	< 25
900732	05/02/90	CHINESE CABBAGE	< 22	< 20	< 17
900733	05/02/90	FLA. MUSTARD	< 20	< 22	< 17
900734	05/02/90	COLLARDS	< 16	< 17	< 15
900950	06/06/90	COLLARDS	< 13	< 12	< 10
900951	06/06/90	ASPARAGUS	< 14	< 14	< 12
900952	06/06/90	CABBAGE	< 32	< 36	< 30
900959 GG	06/06/90	COLLARDS	< 24	< 22	< 19
900960 GG	06/06/90	CABBAGE	< 11	< 11	< 9
900961 GG	06/06/90	ASPARAGUS	< 25	< 27	< 23



Table No.: 6.1a

Environmental Radiological Monitoring Report

Date: 01/24/91

Sample: Vegetation: Broadleaf, (Gamma)

Collection: Monthly when available.

Units: pCi/Kg

Location: SECTOR K, 17 KM

Lab No.	Collection Date	Sample type	I-131	Cs-134	Cs-137
901153	07/09/90	SWISS CHARD	< 26	< 21	< 18
901154	07/09/90	FLA BL MUSTARDS	< 41	< 33	< 29
901155	07/09/90	COLLARDS	< 18	< 17	< 14
901341	08/06/90	SWISS CHARD	< 19	< 19	< 16
901343	08/06/90	COLLARDS	< 13	< 14	< 12
901342	08/07/90	MUSTARD GREENS	< 16	< 18	< 15
901502	09/04/90	TURNIP GREENS	< 25	< 29	< 23
901503	09/04/90	COLLARDS	< 29	< 26	< 21
901504	09/04/90	SWISS CHARD	< 51	< 47	< 38
901676	10/01/90	SWISS CHARD	< 25	< 23	< 19
901677	10/01/90	COLLARDS	< 17	< 17	< 16
901678	10/01/90	SW. POTATO LEAFS	< 15	< 14	< 12
901902	11/05/90	COLLARDS	< 7	< 7	< 6
901903	11/05/90	CABBAGE	< 18	< 17	< 14
901904	11/05/90	BROCCOLI	< 20	< 21	< 18
902069	12/03/90	COLLARDS	< 22	< 21	< 20
902070	12/03/90	CABBAGE	< 6	< 6	< 5
902071	12/03/90	KALE	< 26	< 28	< 22
902072 GG	12/03/90	COLLARDS	< 28	< 29	< 26
902073 GG	12/03/90	CABBAGE	< 22	< 21	< 18
902074 GG	12/03/90	KALE	< 19	< 19	< 15

Table No.: 6.2

Environmental Radiological Monitoring Report

Date: 02/04/91

Sample: Vegetation: Broadleaf, (Gamma)

Collection: Monthly when available.

Units: pCi/Kg

Location: SECTOR J, 0.6 KM

Lab No.	Collection Date	Sample type	I-131	Cs-134	Cs-137
900026	01/03/90	COLLARDS	< 27	< 19	< 17
900027	01/03/90	BRUSSEL SPROUTS	< 26	< 22	< 19
900028	01/03/90	PHOTINIA LEAVES	< 26	< 18	< 16
900210	02/05/90	HENBIT	< 43	< 29	< 26
900211	02/05/90	BRUSSEL SPROUTS	< 23	< 20	< 17
900212	02/05/90	PHOTINIA LVS	< 25	< 20	< 17
900358	03/05/90	PHOTINIA LEAVES	< 17	< 17	< 14
900359	03/05/90	VETCH	< 28	< 30	< 28
900360	03/05/90	DOCK	< 28	< 28	< 24
900541	04/03/90	COLLARDS	< 23	< 23	< 20
900542	04/03/90	SUNFLR LEAVES	< 30	< 37	< 31
900543	04/03/90	BRUSSEL SPROUTS	< 41	< 42	< 35
900735	05/02/90	COLLARDS	< 22	< 22	< 23
900736	05/02/90	CABBAGE	< 17	< 15	< 12
900737	05/02/90	LETTUCE	< 16	< 14	< 12
900953	06/06/90	BRUSSELS SPROUT	< 24	< 27	< 23
900954	06/06/90	COLLARDS	< 12	< 12	< 10
900955	06/06/90	SUNFLOWER LVS	< 29	< 26	< 21
900962 GG	06/06/90	BRUSSELS SPROUT	< 18	< 17	< 15
900963 GG	06/06/90	COLLARDS	< 30	< 24	< 20
900964 GG	06/06/90	SUNFLOWER LVS	< 23	< 26	< 22



## Environmental Radiological Monitoring Report

Table No.: 6.2a  
 Sample: Vegetation: Broadleaf, (Gamma)  
 Collection: Monthly when available.  
 Units: pCi/kg

Location: SECTOR J, 0.6 KM

Lab No.	Collection Date	Sample type	I-131	Cs-134	Cs-137
901156	07/09/90	SUNFLOWER LVS	< 23	< 20	< 21
901157	07/09/90	COLLARDS	< 24	< 20	< 21
901158	07/09/90	SWISS CHARD	< 14	< 17	< 15
901344	08/06/90	MUSTARD GREENS	< 18	< 16	< 15
901345	08/06/90	COLLARDS	< 25	< 22	< 19
901346	08/06/90	SQUASH LEAVES	< 17	< 17	< 14
901505	09/05/90	SWISS CHARD	< 15	< 15	< 15
901506	09/05/90	BRUSSELS SPROUT	< 27	< 32	< 31
901507	09/05/90	MUSTARDS	< 14	< 12	18+/- 10
901679	10/01/90	SWISS CHARD	< 10	< 10	< 9
901680	10/01/90	TURNIP GREENS	< 39	< 38	< 30
901681	10/01/90	COLLARDS	< 32	< 31	< 26
901905	11/03/90	SUNFLOWER LVS	< 17	< 16	< 15
901906	11/03/90	BL MUSTARD	< 6	< 6	7 +/- 5
901907	11/03/90	SWISS CHARD	< 13	< 17	< 15
902075	12/03/90	MUSTARD GREENS	< 11	< 12	< 10
902076	12/03/90	SWISS CHARD	< 28	< 27	< 25
902077	12/03/90	SUNFLOWER LVS	< 13	< 9	< 7
902078	02 12/03/90	MUSTARD GREENS	< 25	< 24	< 25
902079	02 12/03/90	SWISS CHARD	< 32	< 29	< 23
902080	02 12/03/90	SUNFLOWER LVS	< 29	< 28	< 25

# = Control Location \* = Low Level Analysis

## Environmental Radiological Monitoring Report

Table No.: 6.3

Sample: Vegetation: Broadleaf (Gamas)

Collection: Monthly when available.

Units: pCi/Kg

Location: SECTOR R, 1.2 KM

Lab No.	Collection Date	Sample type	I-131	Cs-134	Cs-137
900023	01/03/90	HEMBIT	< 35	< 34	< 30
900024	01/03/90	MUSTARD GREENS	< 31	< 32	< 28
900025	01/03/90	COLLARDS	< 35	< 32	< 29
900113	02/05/90	HEMBIT	< 34	< 25	< 27
900214	02/05/90	COLLARDS	< 21	< 19	< 17
900215	02/05/90	DOCK	< 30	< 28	< 27
900361	03/05/90	COLLARDS	< 20	< 25	< 17
900362	03/05/90	KALE	< 22	< 20	< 19
900363	03/05/90	MUSTARDS	< 22	< 21	< 18
900544	04/03/90	CAULIFLOWER LVS	< 19	< 18	< 18
900545	04/03/90	CURLY MUSTARDS	< 31	< 28	< 23
900546	04/03/90	COLLARDS	< 20	< 27	< 18
900738	05/02/90	COLLARDS	< 13	< 13	< 11
900739	05/02/90	BROCCOLI	< 17	< 19	< 16
900740	05/02/90	LETTUCE	< 29	< 29	< 24
900956	06/07/90	CABBAGE	< 16	< 20	< 17
900957	06/07/90	COLLARDS	< 23	< 26	< 26
900958	06/07/90	SUNFLOWER LVS	< 26	< 30	< 23
900965	06/07/90	COLLARDS	< 16	< 18	< 15
900966	06/07/90	CABBAGE	< 18	< 19	< 16
900967	06/07/90	SUNFLOWER LVS	< 42	< 39	< 33

# = Control Location \* = Low Level Analysis

## Environmental Radiological Monitoring Report

Table No.: 6.3a

Sample: Vegetation: Broadleaf, (Gamma)

Collection: Monthly when available.

Units: pCi/Kg

Location: SECTOR R, 1.2 KM

Lab No.	Collection Date	Sample type	I-131	Cs-134	Cs-137
901159	07/09/90	SUNFLOWER LVS	< 37	< 30	< 27
901160	07/09/90	COLLARDS	< 22	< 19	< 16
901161	07/09/90	SQUASH LEAVES	< 14	< 15	< 13
901347	08/06/90	SQUASH LEAVES	< 15	< 16	< 12
901348	08/06/90	ZUCCHINI LEAVES	< 13	< 12	< 11
901349	08/06/90	COLLARDS	< 26	< 25	< 22
901508	09/05/90	MARIGOLDS	< 36	< 37	< 30
901509	09/05/90	ZUCCHINI LEAVES	< 33	< 35	< 27
901510	09/05/90	SWISS CHARD	< 34	< 32	< 25
901682	10/01/90	COLLARDS	< 17	< 16	< 14
901683	10/01/90	SQUASH LEAVES	< 24	< 28	< 20
901684	10/01/90	BANANA PEPPERS	< 28	< 34	< 30
901908	11/05/90	SUNFLOWER LVS	< 21	< 21	< 16
901909	11/05/90	BL MUSTARD	< 10	< 10	< 9
901910	11/05/90	COLLARDS	< 30	< 27	< 26
902081	12/03/90	RAPE	< 22	< 18	< 14
902082	12/03/90	COLLARDS	< 17	< 14	< 15
902083	12/03/90	SUNFLOWER LVS	< 27	< 29	< 23
902084 GG	12/03/90	RAPE	< 25	< 23	< 22
902085 GG	12/03/90	COLLARDS	< 21	< 19	< 17
902086 GG	12/03/90	SUNFLOWER LVS	< 24	< 31	< 24

## Environmental: Radiological Monitoring Report

Table No.: 7.1

Sample: Fish Samples (Gamma)

Collection: Semiannually

Units: pCi/Kg

Location: MISS. RIVER UP

Lab No.	Collection Date	Sample type	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137
900809	05/11/90	CATFISH	< 12	< 12	< 17	< 12	< 30	< 14	< 11
902020	11/20/90	CATFISH	< 16	< 16	< 23	< 18	< 40	< 18	< 16
902021	06 11/20/90	CATFISH	< 10	< 11	< 16	< 10	< 25	< 12	< 10

Table No.: 7.2

Environmental Radiological Monitoring Report

Date: 02/04/91

Sample: Fish Samples, (Gamma)

Collection: Semiannually

Units: pCi/Kg

Location: MISS. RIVER DOWN

Lab No.	Collection Date	Sample type	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137
900810	05/11/90	CATFISH	< 8	< 8	< 13	< 8	< 20	< 9	< 8
902022	11/20/90	CATFISH	< 13	< 13	< 20	< 14	< 29	< 13	< 12
902023	GC 11/20/90	CATFISH	< 8	< 8	< 14	< 8	< 20	< 9	< 8

Table No.: 8.1

Sample: Sediment, (Gamma)

Collection: Semiannual

Units: pCi/Kg

## Environmental Radiological Monitoring Report

Date: 02/08/91

Location	Lab No.	Collection Date	Mn-54	Co-58	Co-60	Cs-134	Cs-137
SEDHAR, Barge slip	900797	05/01/90	172+/-13	< 13	464+/-18	< 16	111+/-12
SEDHAR, Barge slip	901939	11/06/90	85+/-20	< 22	213+/-24	< 28	73+/-17
SEDHAR, Barge slip	901940	09 11/06/90	122+/-15	14+/- 7	427+/-20	< 18	53+/-23
SEDCONT, Upstream	900796	05/01/90	< 9	< 9	< 9	< 11	< 8
SEDCONT, Upstream	901941	11/06/90	< 9	< 9	< 9	< 11	< 8
SEDCONT, Upstream	901942	09 11/06/90	< 11	< 10	< 11	< 13	< 9
SEDHAM, Hamilton L	900798	05/01/90	< 9	< 9	< 9	< 11	16+/- 6
SEDHAM, Hamilton L	901943	11/06/90	< 11	< 11	< 11	< 13	55+/-12
SEDHAM, Hamilton L	901944	09 11/06/90	< 10	< 10	< 10	< 12	72+/- 6

# = Control Location \* = Low Level Analysis



Table No.: 9.1

Environmental Radiological Monitoring Report

Date: 10/23/90

Sample: Special surface water, grab. (Gamma)

Collection: As requested.

Units: pCi/L

Location: MRUP, SHORELINE

Lab. No.	Collection		Mn-54	Fe-59	Co-58	Co-60	I-131	In-65	Zr-95	Nb-95	Cs-134	Cs-137	Ba-140	La-140
	Date													
900035	01/02/90		< 4	< 9	< 4	< 4	< 11	< 9	< 10	< 5	< 4	< 4	< 25	< 6
900248	02/06/90		< 2	< 3	< 2	< 2	< 5	< 4	< 4	< 2	< 2	< 2	< 12	< 3
900407	03/06/90		< 3	< 5	< 3	< 4	< 8	< 7	< 8	< 4	< 4	< 3	< 18	< 6
900408	CG 03/06/90		< 4	< 6	< 4	< 4	< 9	< 9	< 10	< 5	< 5	< 4	< 24	< 7

Date: 10/23/90

Environmental Radiological Monitoring Report

Table No.: 9.2  
Sample: Special surface water, (H-3)  
Collection: Quarterly composite  
Units: pCi/L

Location: MRUP, SHORELINE

Lab. No.	Begin Date	End Date	H-3
900409	01/02/90	03/06/90	360

# - Control Location \* - Low Level Analysis

Table No.: 9.3

Environmental Radiological Monitoring Report

Date: 10/23/90

Sample: Special surface water, grab. (Gamma)

Collection: As requested.

Units: pCi/L

Location: MRDOWN SHORELINE

Lab. No.	Collection		Mn-54	Fe-59	Co-58	Co-60	I-131	Zn-65	Zr-95	Nb-95	Cs-134	Cs-137	Ba-140	La-140
	Date													
900036	01/02/90		< 2	< 5	< 3	< 3	< 7	< 5	< 6	< 3	< 3	< 2	< 16	< 4
900249	02/06/90		< 2	< 6	< 3	< 2	< 6	< 5	< 5	< 3	< 3	< 3	< 14	< 3
900410	03/06/90		< 4	< 6	< 4	< 4	< 7	< 9	< 9	< 4	< 4	< 4	< 21	< 7
900411 GG	03/06/90		< 2	< 4	< 2	< 2	< 4	< 4	< 4	< 2	< 2	< 2	< 11	< 4

Date: 10/23/90

Environmental Radiological Monitoring Report

Table No.: 9.4  
Sample: Special surface water, (E-3)  
Collection: Quarterly composite  
Units: pCi/L

Location: MEADOW SHORELINE

Lab. No.	Begin Date	End Date	E-3
905412	01/02/90	03/06/90	< 360

# - Control Location \* - Low Level Analysis

Date: 11/27/90

Environmental Radiological Monitoring Report

Table No.: 9.5  
 Sample: Special surface water, grab. (Gamma)  
 Collection: As requested.  
 Units: pCi/L

Location: Outfall #007

Lab. No.	Date	Collection											
		Mn-54	Fe-59	Co-58	Co-60	I-131	Zn-65	Sr-90	MD-93	Cs-134	Cs-137	Ba-140	La-140
900044	01/03/90	< 5	< 9	< 5	< 6	< 10	< 11	< 12	< 6	< 6	< 5	< 27	< 6
900573	04/03/90	< 4	< 5	< 4	< 4	< 6	< 9	< 9	< 7	< 4	< 4	< 19	< 7
901229	07/09/90	< 2	< 4	< 3	< 3	< 6	< 5	< 6	< 3	< 3	< 3	< 15	< 5
901704	10/02/90	< 4	< 6	< 4	< 4	< 7	< 9	< 9	< 5	< 5	< 4	< 21	< 6

# = Control Location \* = Low Level Analysis

## Environmental Radiological Monitoring Report

Table No.: 9.6

Sample: Special surface water, yreb. (Gamma)

Collection: As requested.

Units:  $\mu\text{Ci/L}$ 

Location: Manhole #54

Lab. No.	Date	Collection											
		Mn-54	Fe-59	Co-58	Co-60	I-131	Er-65	Zr-95	Nb-95	Cs-134	Cs-137	Sr-140	La-140
900045	01/03/90	< 3	< 5	< 3	< 3	< 8	< 6	< 7	< 4	< 3	< 3	< 19	< 5
900561	03/30/90	< 2	< 5	< 2	< 2	< 5	< 6	< 4	< 2	< 2	< 2	< 11	< 4



Table No.: 9.7

Environmental Radiological Monitoring Report

Date: 01/24/91

Sample: Special surface water, grab. (Gamma)

Collection: As requested.

Units: pCi/L

Location: BARGE SLIP

Lab. No.	Collection												
	Date	Mn-54	Fe-59	Co-58	Co-60	I-131	Zn-65	Zr-95	Nb-95	Cs-134	Cs-137	Ba-140	La-140
901530	09/04/90	< 3	< 4	< 3	< 3	< 4	< 5	< 6	< 3	< 3	< 3	< 13	< 4
901694	10/02/90	< 4	< 5	< 4	< 3	< 8	< 6	< 7	< 4	< 4	< 3	< 20	< 7
901936	11/06/90	6 +/- 3	< 4	< 3	26 +/- 3	< 4	< 6	< 5	< 3	< 3	< 3	< 11	< 4
902114	12/04/90	< 3	< 4	< 3	< 3	< 4	< 6	< 6	< 3	< 3	< 3	< 12	< 4

Table No.: 9.8

Environmental Radiological Monitoring Report

Date: 01/24/91

Sample: Special surface water, sewage eff; (Gamma)

Collection: As requested.

Units: pCi/L

Location: Outfall #015

Lab. No.	Collection												
	Date	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140
900093	01/11/90	< 2	< 2	< 4	< 2	< 3	< 2	< 4	< 4	< 2	< 2	< 10	< 3
900645	04/12/90	< 3	< 3	< 4	< 3	< 6	< 3	< 6	< 4	< 3	< 3	< 11	< 4
901228	07/10/90	< 2	< 2	< 3	< 2	< 4	< 2	< 4	< 4	< 2	< 2	< 10	< 4

Table No.: 9.9

Sample: Special surface, water, grab. (Gamma)

Collection: As requested.

Units: pCi/L

Environmental Radiological Monitoring Report

Date: 01/26/91

Location: Basin A

Collection

Lab. No.	Date	Mn-54	Fe-59	Co-58	Co-60	I-131	Zn-65	Zr-95	Rb-95	Cs-134	Cs-137	Ba-140	La-140
902120	12/04/90	< 3	< 4	< 3	< 3	< 5	< 6	< 6	< 3	< 3	< 3	< 13	< 5

## Environmental Radiological Monitoring Report

Table No.: 9.10

Sample: Special surface water, sewage effluent (Cemex)

Collection: As requested.

Units: pCi/L

Location: Outfall #010

## Collection

Lab. No.	Date	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Rb-85	Kr-85	I-131	Ce-134	Cs-137	Ba-140	La-140
510007	12/27/90	< 2	< 2	< 2	< 2	< 2	< 2	< 3	< 3	< 2	< 2	< 7	< 2

Table No.: 9.11

Environmental Radiological Monitoring Report

Date: 02/04/91

Sample: Special surface water, grab. (Gamma)

Collection: As requested.

Units: pCi/L

Location: Resin Pond

		Collection												
Lab. No.	Date	Mn-54	Fe-59	Co-58	Co-60	I-131	Zn-65	Zr-95	Nb-95	Ce-134	Ce-137	Ba-140	La-140	
902123	12/04/90	< 4	< 6	< 4	< 4	< 6	< 8	< 8	< 4	< 4	< 4	< 16	< 6	

## Environmental Radiological Monitoring Report

Table No.: 9.12

Sample: Special surface water, grab. (Gannett)

Collection: As requested.

Unit: pCi/L

Location: Basin 9

Collection													
Lab. No.	Date	Mb-54	Fe-59	Co-58	Co-60	I-131	Zn-65	Zr-95	Nb-95	Ca-134	Ca-137	Ba-140	La-140
202122	12/04/90	< 3	< 4	< 3	< 3	< 4	< 5	< 6	< 3	< 3	< 3	< 6	< 6



Table No.: 10.1

Environmental Radiological Monitoring Report

Date: 01/24/91

Sample: Special sediment, (Gamma)

Collection: As requested.

Units: pCi/Kg

Location: BARGE SLIP

Lab No.	Collection Date	Cr-51	Mn-54	Co-58	Co-60	Cs-134	Cs-137
900039	01/02/90	< 216	619+/-27	< 22	488+/-33	< 25	140+/-18
900245	02/06/90	< 193	580+/-22	< 18	703+/-31	< 22	157+/-16
900398	03/06/90	744+/-150	194+/-18	39+/-19	660+/-28	< 25	148+/-18
900572	04/03/90	349+/-147	324+/- 25	< 25	797+/- 36	< 39	172+/- 20
900999	06/07/90	< 145	91+/-15	< 16	164+/-20	< 18	132+/-20
901136	07/03/90	< 103	< 11	< 11	< 11	< 13	60+/- 12
901332	08/01/90	1994+/-138	189+/- 13	< 15	459+/- 19	< 17	209+/- 12
901531	09/04/90	325+/- 85	176+/- 15	< 13	339+/- 19	< 17	140+/- 11
901693	10/02/90	< 135	175+/- 15	< 16	568+/- 25	< 19	81+/- 12
901945	11/06/90	< 151	443+/-28	< 22	99+/-33	< 27	156+/-20
902125	12/04/90	< 76	52 +/- 11	< 5	134 +/- 17	< 6	34 +/- 9

## Environmental Radiological Monitoring Report

Table No.: 10.2

Sample: Special sediment, (Gamma)

Collection: As requested.

Units: pCi/Kg

Location: Basin B

Lab No.	Collection Date	Cr-51	Mn-54	Co-58	Co-60	Cs-134	Cs-137
900045	01/03/90	< 117	< 11	< 10	< 14	< 14	< 11
900574	04/03/90	< 142	< 16	< 16	< 16	< 19	< 13
901230	07/09/90	< 97	< 10	< 10	< 10	< 12	< 9
901705	10/02/90	< 158	< 16	< 16	< 16	< 20	< 15

Table No.: 10.3

Environmental Radiological Monitoring Report

Date: 01/24/91

Sample: Special sediment, (Gamma)

Collection: As requested.

Units: pCi/Kg

Location: Resin Pond

Lab No.	Collection Date	Cr-51	Mn-54	Co-58	Co-60	Cs-134	Cs-137
902124	12/04/90	< 81	< 4	< 4	< 4	< 6	< 4

## Environmental Radiological Monitoring Report

Table No.: 10.4

Sample: Special sediment, (Gamma)

Collection: As requested.

Units: pCi/Kg

Location: Basin A

Lab No.	Collection Date	Cr-51	Mn-54	Co-58	Co-60	Cs-134	Cs-137
902121	12/04/90	< 86	< 5	< 6	< 4	< 7	< 5

Table No.: 11.1

Environmental Radiological Monitoring Report

Date: 01/24/91

Sample: Special waste water, raw sewage;(Gamma)

Collection: As requested.

Units: pCi/L

Location: UNIT 1

Collection													
Lab. No.	Date	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-95	Nb-95	I-131	Cs-134	Cs-137	Ba-140	La-140
900271	02/14/90	40+/-8	< 14	< 6	62+/-8	< 15	< 12	< 6	< 7	< 7	< 6	< 21	< 6
901395	08/14/90	18+/-8	< 11	< 9	57+/-12	< 19	< 17	< 8	< 9	< 9	< 6	< 30	< 8
902213	12/27/90	67 +/- 16	< 78	< 14	146 +/- 21	< 29	< 35	< 17	< 32	< 19	< 14	< 81	< 20
902215 GG	12/27/90	58 +/- 15	< 23	< 15	135 +/- 17	< 34	< 39	< 19	< 37	< 19	< 14	< 90	< 31

Table No.: 11.2

Environmental Radiological Monitoring Report

Date: 01/24/91

Sample: Special waste water, raw sewage; (Gamma)

Collection: As requested.

Units: pCi/L

Location: Unit 2

Lab. No.	Collection		Mn-54	Fe-59	Co-58	Co-60	Zn-65	Cs-134	Cs-137	I-131	Ce-134	Ce-137	Ba-140	La-140
	Date													
902212	12/27/90		< 6	< 11	< 7	< 6	< 13	< 11	< 5	< 17	< 8	< 6	< 32	< 4
902214	GG 12/27/90		< 10	< 15	< 9	< 9	< 21	< 24	< 12	< 25	< 12	< 9	< 57	< 13



Table No.: 12.1

Environmental Radiological Monitoring Report

Date: 02/04/91

Sample: Special animal meat. (Gamma)

Collection: As requested.

Units: pCi/kg

Location: BUCKSNORT CAMP

Lab No.	Collection Date	Sample type	Mn-54	Co-57	Fe-59	Co-60	Zn-65	Ce-134	Ce-137
902024	11/26/90	VENISON	< 5	< 7	< 10	< 7	< 16	< 8	< 6

## EPA CROSS CHECK RESULTS

EPA PREP DATE	DATE EPA ISSUED RESULTS	MEDIA	NUCLIDE	EPA RESULTS	AP&L RESULTS	NORM DEV KNOWN
10/31/89	1/23/90	Water Sample B (pCi/L)	Gross B Cs-134 Cs-137	32.00 5.00 5.00	30.00 5.67 5.67	-0.69 0.23 0.23
01/26/90	03/30/90	Water (pCi/L)	Gross B	12.00	11.33	-0.23
02/09/90	03/30/90	Water (pCi/L)	Co-60 Zn-65 Ru-106 Cs-134 Cs-137 Ba-133	15.0 139.0 139.0 18.0 18.0 74.0	15.0 133.67 145.33 17.67 17.67 85.00	0 -0.66 0.78 -0.12 -0.12 2.72
02/23/90	03/30/90	Water (pCi/L)	H-3	4976.0	5226.67	0.87
03/30/90	06/29/90	Air Filter (pCi/filter)	Gross B Cs-137	31.0 10.0	34.00 15.00	1.04 1.73
04/17/90	07/08/90	Water Sample B (pCi/L)	Gross B Cs-134 Cs-137	52.0 15.0 15.0	47.0 17.33 14.33	-1.73 0.81 -0.23
05/11/90	07/10/90	Water (pCi/L)	Gross B	15.0	11.33	-1.27
04/27/90	07/27/90	Milk (pCi/L)	I-131 Cs-137 Potassium	99.0 24.0 1550.0	99.33 22.33 1493.33	0.06 -0.58 -1.26
Analytics, #CC35386-74	08/06/90	Analytics, Inc. Iodine Cartridge (uCi/cc)	I-131	3.17E-1	3.15E-1	Ratio: 0.99 Env. Lab: Analytics, Inc.
06/08/90	08/07/90	Water (pCi/L)	Co-60 Zn-65 Ru-106 Cs-134 Cs-137	24.0 148.0 210.0 24.0 25.0	26.0 144.67 194.0 25.0 26.0	0.69 -0.38 -1.132 0.35 0.35
06/22/90	08/07/90	Water (pCi/L)	H-3	2933.0	3350.0	2.02
08/10/90	10/03/90	Water (pCi/L)	I-131	39.0	40.0	0.29
09/21/90	10/10/90	Water (pCi/L)	Gross B	10.0	14.0	1.39

## EPA CROSS CHECK RESULTS

EPA PREP DATE	DATE EPA ISSUED RESULTS	MEDIA	NUCLIDE	EPA RESULTS	AP&L RESULTS	NORM DEV KNOWN
10/19/90	12/05/90	Water (pCi/L)	H-3	7203	8100.	2.16
09/20/90	12/10/90	Milk (pCi/L)	I-131	58.0	56.00	-0.58
			Cs-137	20.0	20.00	0
10/05/90	12/17/90	Water (pCi/L)	Co-60	20.0	20.33	0.12
			Zn-65	115.0	118.67	0.53
			Ru-106	151.0	142.33	-1.00
			Cs-134	12.0	12.33	0.12
			Cs-137	12.0	13.00	0.35
			Ba-133	110.0	106.00	-0.63
08/31/90	12/12/90	Air Filter (pCi/Filter)	Beta	62.0	62.67	0.23
			Cs-137	20.0	28.00	2.77
Fourth Qtr. 1990 CC36036-74	1/11/91	Analytic, Inc. Iodine Cartridge (uCi/cc)	I-131	3.18E-2	3.43E-2	1.08 Ratio

ATTACHMENT II

1990 THERMOLUMINESCENT DOSIMETRY REPORT

# TELEDYNE ISOTOPES

JAN 22 1991

MIDWEST LABORATORY

700 LANDWEHR ROAD • NORTHBROOK, IL 60062-2310  
PHONE (708) 564-0700 • FAX (708) 564-4517

• Mr. Jim Barlow  
System Energy Resources, Inc.  
Radiological Environmental Services  
P.O. Box 31995  
Jackson, MS 39286-1995

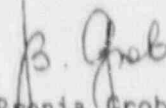
LABORATORY REPORT NO.	8020-2
DATE:	01-17-91
SAMPLES RECEIVED:	-----
SAMPLES ANALYZED:	-----
ANALYTICAL METHOD:	STANDARD
PURCHASE ORDER NO.:	C-2543/02

Dear Mr. Barlow:

Attached are the results of the gamma radiation levels at the Grand Gulf Nuclear Power Plant site as measured by thermoluminescent dosimeters (Teledyne cards CaSO<sub>4</sub>:Dy) for the fourth quarter of 1990.

If you have any questions concerning the results, please do not hesitate to call.

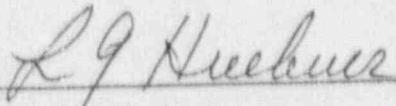
Sincerely,

  
Bronia Grob  
Lab Supervisor

als

Enclosures (6)

APPROVED BY



SAMPLES RETAINED THIRTY DAYS AFTER ANALYSIS

L. G. Huebner  
General Manager

SYSTEM ENERGY RESOURCES, INC.

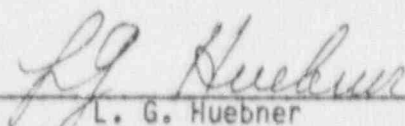
Table 1. Gamma Radiation, as Measured by TLDs, 1990  
(Required by Technical Specification 3.12.1)

Inner Ring, Within Two (2) Mile Radius				
	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
Date Annealed:	12-11-89	03-07-90	06-07-90	09-10-90
Date Read:	04-06-90	07-10-90	10-05-90	01-08-91
Location	Average mR/Quarter			
M-16	16.2±0.7	19.7±0.7	17.6±0.8	19.2±0.6
M-18	25.8±1.0	20.1±0.6	21.5±1.2	21.5±0.4
M-25	14.1±0.5	13.6±0.5	16.4±1.0	19.6±0.9
M-27	16.5±0.7	14.3±0.7	18.7±0.8	ND
M-28	18.3±1.1	18.2±0.4	17.8±0.8	20.4±0.6
M-30	14.4±0.9	12.3±0.5	14.0±0.7	13.9±0.8
M-41	10.0±0.6	10.0±0.8	15.6±0.5	ND
M-42	17.4±0.6	11.2±0.9	17.5±1.0	17.1±0.8
M-43	ND <sup>a</sup>	16.3±0.8	16.6±0.6	18.2±0.4
M-44	13.8±0.5	14.0±0.7	14.0±0.4	15.6±0.8
M-45	17.8±0.8	16.8±0.4	17.4±0.7	18.4±0.3
M-46	17.8±1.0	15.0±0.5	14.7±0.7	18.1±1.0
M-52	18.9±1.2	16.4±1.1	18.6±1.0	17.8±0.4
M-53	19.1±0.6	18.4±0.6	18.7±0.7	20.3±0.8
M-54	22.2±1.1	ND	20.1±1.5	17.3±0.8
M-86	18.5±0.6	18.4±0.9	17.6±0.8	21.8±0.7
Mean ± s.d.	17.4±3.7	15.6±3.1	17.3±2.1	18.5±2.2

<sup>a</sup> ND = No data; TLDs lost in the field.

The error given is the probable counting error at the 95% confidence level (2 sigma).

Approved by

  
L. G. Huebner  
General Manager

Date

1-17-91



SYSTEM ENERGY RESOURCES, INC.

Table 1. Gamma Radiation, as Measured by TLDs, 1990  
(Required by Technical Specification 3.12.1)

Outer Ring, Within six (6) Mile Radius				
	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
Date Annealed:	12-11-89	03-07-90	06-07-90	09-10-90
Date Read:	04-06-90	07-10-90	10-05-90	01-08-91
Location	Average mR/Quarter			
M-36	18.6±0.5	17.2±0.4	17.1±0.8	19.4±0.8
M-40	19.4±0.6	19.0±0.6	18.4±0.9	20.5±0.5
M-47	13.8±0.7	13.0±0.3	13.4±0.8	13.8±0.6
M-48	15.5±1.0	15.8±0.4	15.6±0.8	17.4±0.7
M-49	21.4±0.5	16.3±0.6	18.6±0.4	18.9±0.7
M-50	17.2±0.8	16.6±1.0	17.5±0.6	17.6±1.0
M-51	19.3±1.1	18.4±1.0	18.9±1.0	19.9±0.9
M-55	22.1±1.5	20.1±0.8	21.3±1.0	22.1±0.7
M-56	19.4±0.9	17.1±0.7	18.2±0.4	21.2±0.5
M-57	19.3±0.5	18.4±0.4	18.9±1.3	20.6±0.5
M-58	16.6±0.5	13.2±0.7	14.7±0.4	14.6±0.6
M-59	12.6±0.8	13.1±0.7	15.2±0.9	14.6±1.2
M-88	14.4±0.8	12.3±0.4	13.5±0.4	15.1±0.7
M-89	14.6±0.4	10.8±0.3	13.7±0.6	16.5±0.4
M-90	17.0±0.5	14.6±0.4	15.0±0.4	18.9±1.0
M-91	18.7±0.6	16.0±1.2	16.8±0.7	18.2±1.1
Mean ± s.d.	17.5±2.8	15.7±2.7	16.7±2.3	18.1±2.6

The error given is the probable counting error at the 95% confidence level (2 sigma).

Approved by

*L. G. Huebner*  
L. G. Huebner  
General Manager

Date

1-17-91

SYSTEM ENERGY RESOURCES, INC.

Table 1. Gamma Radiation, as Measured by TLDs, 1990  
(Required by Technical Specification 3.12.1)

Special Interest Areas				
	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
Date Annealed:	12-11-89	03-07-90	06-07-90	09-10-90
Date Read:	04-06-90	07-10-90	10-05-90	01-08-91
Location	Average mR/Quarter			
M-01	22.9±1.4	19.6±0.4	19.9±0.6	23.0±0.6
M-07	20.1±1.0	17.0±0.5	17.3±0.9	20.1±1.1
M-09	17.1±1.0	16.0±0.4	ND <sup>a</sup>	17.6±0.6
M-10	14.5±0.9	16.0±0.6	14.4±0.7	17.4±1.0
M-33	18.5±0.7	16.0±0.3	16.4±0.7	17.9±0.4
M-38	16.2±0.8	17.6±0.4	ND	19.8±0.7
M-39	16.1±0.8	15.0±0.4	16.0±0.6	17.0±0.4
Mean ± s.d.	17.9±2.8	16.7±1.5	16.8±2.0	19.0±2.1
<u>CONTROL</u>				
M-14	16.5±1.3	17.5±1.1	16.8±1.0	19.2±0.9
<u>SHIELD</u>				
M-00	6.9±0.6	6.5±0.4	6.4±0.5	6.0±0.4

<sup>a</sup> ND = No data; TLD's lost in the field.

The error given is the probable counting error at the 95% confidence level (2 sigma).

Approved by

*L. G. Huebner*  
L. G. Huebner  
General Manager

Date

1-17-91

SYSTEM ENERGY RESOURCES, INC.

Table 1. Gamma Radiation, as Measured by TLDs, 1990  
(Not required by Technical Specification 3.12.1)

On-Site				
	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
Date Annealed:	12-11-89	03-07-90	06-07-90	09-10-90
Date Read:	04-06-90	07-10-90	10-05-90	01-08-91
Location	Average mR/Quarter			
M-61	16.8±1.0	14.8±0.8	14.1±0.7	12.4±0.7
M-62	18.5±1.3	16.4±0.7	14.7±0.9	13.0±0.5
M-63	22.2±1.0	20.4±0.7	17.6±0.8	16.7±0.8
M-64	19.8±1.5	18.0±0.6	16.5±0.8	14.4±0.8
M-65	30.8±0.7	25.6±1.3	22.7±0.4	16.5±1.1
M-66	23.2±1.0	20.2±0.8	18.6±0.7	17.0±0.5
M-67	20.8±1.0	20.0±0.5	17.2±0.6	18.2±0.5
M-68	35.5±1.8	33.1±1.4	36.5±1.5	35.4±1.2
M-69	75.8±1.8	67.6±0.8	54.7±2.5	33.0±0.5
M-70	66.7±1.7	62.8±0.5	47.8±3.0	26.8±1.0
M-71	31.8±2.1	26.8±1.0	ND <sup>a</sup>	17.2±0.5
M-72	21.5±1.6	16.8±0.4	ND	15.2±0.8
M-73	18.2±0.6	16.1±0.8	16.7±0.4	14.5±0.6
M-74	17.0±0.8	14.8±0.5	14.3±0.5	15.2±0.5
M-75	15.0±0.9	13.6±0.9	12.6±0.6	14.2±0.8
M-76	14.2±1.1	14.3±0.4	12.5±0.8	15.8±0.8
M-77	17.5±0.3	15.0±0.5	14.4±0.8	15.1±0.5
M-78	12.2±0.8	13.7±0.9	ND	12.5±0.6
M-79	15.1±1.0	15.3±0.8	13.6±0.8	15.9±1.0
M-80	13.0±0.5	ND <sup>a</sup>	15.4±0.5	15.0±0.8
M-81	17.2±0.6	16.4±1.1	15.2±1.0	15.9±0.8
M-82	18.3±0.5	15.1±0.5	14.9±0.5	ND
M-83	14.5±0.9	14.0±1.0	12.6±0.9	13.2±0.8
M-84	12.7±0.4	12.1±0.6	11.7±0.3	15.0±0.4
Mean ± s.d.	23.7±15.9	21.9±14.6	19.7±11.8	17.3±6.0

<sup>a</sup> ND = No data; TLD's lost in the field.

The error given is the probable counting error at the 95% confidence level (2 sigma).

Approved by

*L. G. Huebner*  
L. G. Huebner  
General Manager

Date

1-17-91

SYSTEM ENERGY RESOURCES, INC.

Table 1. Gamma Radiation, as Measured by TLDs, 1990  
(Not required by Technical Specification 3.12.1)

Additional Locations, Within Fifteen (15) Mile Radius				
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Date Annealed:	12-11-89	03-07-90	06-07-90	09-10-90
Date Read:	04-06-90	07-10-90	10-05-90	01-08-91
Location	Average mR/Quarter			
M-02	19.2±0.9	18.9±0.7	18.6±1.0	22.7±0.9
M-03	19.8±1.5	17.8±0.4	18.7±1.0	20.7±0.5
M-04	23.4±1.2	19.2±1.0	20.8±1.0	21.9±0.5
M-05	22.3±0.8	17.4±0.6	18.4±0.8	20.8±0.6
M-06	22.1±1.2	ND <sup>a</sup>	18.8±0.9	19.1±0.8
M-08	14.9±0.7	14.3±0.4	13.7±0.8	16.2±1.1
M-11	16.2±0.7	17.3±0.5	16.6±0.8	18.5±0.4
M-12	16.4±0.7	17.1±0.6	16.3±1.0	18.0±0.5
M-13	15.7±0.3	17.0±0.3	16.6±0.5	18.7±0.4
M-15	16.0±0.7	11.2±0.5	13.6±0.6	15.0±0.4
M-17	19.1±1.1	16.4±1.2	18.0±1.2	18.2±1.1
M-19	23.0±1.2	17.2±0.6	19.4±0.9	19.2±0.4
M-20	20.3±0.7	16.2±0.6	ND	17.3±0.5
M-21	22.5±1.3	19.1±0.8	18.5±0.8	19.8±1.1
M-22	22.3±0.6	17.7±0.4	20.2±1.0	20.5±0.5
M-23	18.5±1.5	16.8±0.4	15.8±0.6	19.9±0.9
M-24	12.2±0.6	ND	15.7±0.6	ND
M-26	14.8±0.5	ND	16.9±0.7	19.0±0.6
M-29	18.8±0.8	18.4±0.6	19.0±1.1	20.7±1.1
M-34	23.6±1.1	19.1±0.4	20.4±0.6	22.2±0.6
M-35	13.2±1.0	14.1±1.2	16.9±1.0	ND
M-37	18.8±0.4	18.6±0.8	18.6±0.8	20.0±0.8
M-85	17.7±0.5	14.4±0.5	15.5±0.7	17.8±0.4
M-87	18.6±1.0	15.3±0.3	18.4±0.8	17.7±0.5
M-92	14.4±1.0	13.6±0.9	14.5±0.9	15.9±0.4
M-93	18.5±1.0	17.8±0.4	18.8±1.3	20.4±0.8
M-94	16.3±0.5	11.6±0.6	14.3±0.4	14.1±0.7
Mean ± s.d.	18.5±3.2	16.5±2.3	17.4±2.0	19.0±2.2
DUPLICATE TLDs				
M-31	17.2±1.0	15.2±0.7	19.7±1.1	18.3±0.6
M-32	19.7±0.8	15.6±0.9	20.3±0.8	18.5±0.3
M-60	15.5±0.8	16.7±0.6	18.5±1.0	17.9±0.7
Mean ± s.d.	17.5±2.1	15.8±0.8	19.5±0.9	18.2±0.3

<sup>a</sup> ND = No data; TLDs lost in the field.

The error given is the probable counting error at the 95% confidence level (2 sigma).

Approved by L. G. Huebner Date 1-21-91  
L. G. Huebner  
General Manager



SYSTEM ENERGY RESOURCES, INC.

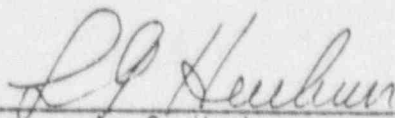
Table 1. Gamma Radiation, as Measured by TLDs, 1990  
(Not required by Technical Specification 3.12.1)

<u>SPECIAL</u>				
	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
Date Annealed:		03-07-90	06-07-90	09-10-90
Date Read:		07-10-90	10-05-90	01-08-91
Location	Average mR/Quarter			
<hr/>				
<u>TLD NUMBER</u>				
S-01	Sector C	15.6±0.7	SK 14.8±0.4	Not Used
S-02	Sector D	25.1±1.4	SJ 19.2±1.2	Not Used
S-03	Sector E	49.5±1.2	SH 19.7±0.9	Not Used
S-04	Sector F	53.8±2.4	SG 17.1±0.6	Not Used
S-05	Sector G	32.8±0.9	SF 20.3±1.0	Not Used
S-06	Sector H	20.7±0.2	SE 19.2±0.9	Not Used
S-07	Sector J	18.4±0.7	SD 22.0±1.0	Not Used
S-08	Sector K	16.2±0.8	SC 20.2±0.9	Not Used
S-09	Sector		SG 16.0±0.8	Not Used
S-10	Sector		SF 16.4±0.8	Not Used
Spare 1	Sector D	20.4±1.1	SE 15.6±0.7	Lost
Spare 2	Sector E	36.4±1.1	SD 20.9±0.8	Not Used
Spare 3	Sector F	34.7±0.3	Note 1	Not Used
Spare 4	Sector G	21.6±0.8	6.1±0.3	Not Used

The error given is the probable counting error at 95% confidence level (2 sigma).

NOTE 1. Used at Location M-23.

Approved by:

  
L. G. Huebner  
General Manager

Date:

1-17-91

APPENDIX A

INTERNATIONAL INTERCOMPARISON

OF

ENVIRONMENTAL DOSIMETERS



Table A-2. Crosscheck program results, thermoluminescent dosimeters (TLDs).

Lab Code	TLD Type	Measurement	mR		
			Teledyne Result ±2 <sup>a</sup>	Known Value <sup>c</sup>	Average ±2 <sup>d</sup> (All Participants)
<u>2nd International Intercomparison<sup>b</sup></u>					
115-2	CaF <sub>2</sub> :Mn Bulb	Field	17.0±1.9	17.1	16.4±7.7
		Lab	20.8±4.1	21.3	18.8±7.6
<u>3rd International Intercomparison<sup>e</sup></u>					
115-3	CaF <sub>2</sub> :Mn Bulb	Field	30.7±3.2	34.9±4.8	31.5±3.0
		Lab	89.6±6.4	91.7±14.6	86.2±24.0
<u>4th International Intercomparison<sup>f</sup></u>					
115-4	CaF <sub>2</sub> :Mn Bulb	Field	14.1±1.1	14.1±1.4	16.0±9.0
		Lab (Low)	9.3±1.3	12.2±2.4	12.0±7.4
		Lab (High)	40.4±1.4	45.8±9.2	43.9±13.2
<u>5th International Intercomparison<sup>g</sup></u>					
115-5A	CaF <sub>2</sub> :Mn Bulb	Field	31.4±1.8	30.0±6.0	30.2±14.6
		Lab at beginning	77.4±5.8	75.2±7.6	75.8±40.4
		Lab at the end	96.6±5.8	88.4±8.8	90.7±31.2
115-5B	LiF-100 Chips	Field	30.3±4.8	30.0±6.0	30.2±14.6
		Lab at beginning	81.1±7.4	75.2±7.6	75.8±40.4
		Lab at the end	85.4±11.7	88.4±8.8	90.7±31.2
<u>7th International Intercomparison<sup>h</sup></u>					
115-7A	LiF-100 Chips	Field	75.4±2.6	75.8±6.0	75.1±29.8
		Lab (Co-60)	80.0±3.5	79.9±4.0	77.9±27.6
		Lab (Cs-137)	66.6±2.5	75.0±3.8	73.0±22.2

Table A-2. (continued)

Lab Code	TLD Type	Measurement	mR		
			Teledyne Result ±2 <sup>a</sup>	Known Value <sup>c</sup>	Average ±2σ <sup>d</sup> (All Participants)
115-7B	CaF <sub>2</sub> :Mn Bulbs	Field	71.5±2.6	75.8±6.0	75.1±29.8
		Lab (Co-60)	84.8±6.4	79.9±4.0	77.9±27.6
		Lab (Cs-137)	78.8±1.6	75.0±3.8	73.0±22.2
115-7C	CaSO <sub>4</sub> :Dy Cards	Field	76.8±2.7	75.8±6.0	75.1±29.8
		Lab (Co-60)	82.5±3.7	79.9±4.0	77.9±27.6
		Lab (Cs-137)	79.0±3.2	75.0±3.8	73.0±22.2
<u>8th International Intercomparison<sup>i</sup></u>					
115-8A	LiF 100 Chips	Field Site 1	29.5±1.4	29.7±1.5	28.9±12.4
		Field Site 2	11.3±0.8	10.4±0.5	10.1±9.06
		Lab (Cs-137)	13.7±0.9	17.2±0.9	16.2±6.8
115-8B	CaF <sub>2</sub> :Mn Bulbs	Field Site 1	32.3±1.2	29.7±1.5	28.9±12.4
		Field Site 2	9.0±1.0	10.4±0.5	10.1±9.0
		Lab (Cs-137)	15.8±0.9	17.2±0.9	16.2±6.8
115-8C	CaSO <sub>4</sub> :Dy Cards	Field Site 1	32.3±0.7	29.7±1.5	28.9±12.4
		Field Site 2	10.6±0.6	10.4±0.5	10.1±9.0
		Lab (Cs-137)	18.1±0.8	17.2±0.9	16.2±6.8
<u>Teledyne Testing<sup>j</sup></u>					
89-1	LiF-100 Chips	Lab	21.0±0.4	22.4	--
89-2	Teledyne CaSO <sub>4</sub> :Dy Cards	Lab	20.9±1.0	20.3	--

Table A-2. (continued)

Lab Code	TLD Type	Measurement	mR		
			Teledyne Result $\pm 2^a$	Known Value <sup>c</sup>	Average $\pm 2\sigma^d$ (All Participants)
<u>Teledyne Testing<sup>j</sup></u>					
90-1 <sup>k</sup>	Teledyne CaSO <sub>4</sub> :Dy Cards	Lab	20.6 $\pm$ 1.4	19.6	--
90-1 <sup>l</sup>	Teledyne CaSO <sub>4</sub> :Dy Cards	Lab	100.8 $\pm$ 4.3	100.0	--

<sup>a</sup> Lab result given is the mean  $\pm 2$  standard deviations of three determinations.

<sup>b</sup> Second International Intercomparison of Environmental Dosimeters conducted in April of 1976 by the Health and Safety Laboratory (GASL), New York, New York, and the School of Public Health of the University of Texas, Houston, Texas.

<sup>c</sup> Value determined by sponsor of the intercomparison using continuously operated pressurized ion chamber.

<sup>d</sup> Mean  $\pm 2$  standard deviations of results obtained by all laboratories participating in the program.

<sup>e</sup> Third International Intercomparison of Environmental Dosimeters conducted in summer of 1977 by Oak Ridge National Laboratory and the School of Public Health of the University of Texas, Houston, Texas.

<sup>f</sup> Fourth International Intercomparison of Environmental Dosimeters conducted in summer of 1979 by the School of Public Health of the University of Texas, Houston, Texas.

<sup>g</sup> Fifth International Intercomparison of Environmental Dosimeter conducted in fall of 1980 at Idaho Falls, Idaho and sponsored by the School of Public Health of the University of Texas, Houston, Texas and Environmental Measurements Laboratory, New York, New York, U.S. Department of Energy.

<sup>h</sup> Seventh International Intercomparison of Environmental Dosimeters conducted in the spring and summer of 1984 at Las Vegas, Nevada, and sponsored by the U.S. Department of Energy, the U.S. Nuclear Regulatory Commission, and the U.S. Environmental Protection Agency.

<sup>i</sup> Eighth International Intercomparison of Environmental Dosimeters conducted in the fall and winter of 1985-1986 at New York, New York, and sponsored by the U.S. Department of Energy.

<sup>j</sup> Chips were submitted in September 1989 and cards were submitted in November 1989 to Teledyne Isotopes, Inc., Westwood, NJ for irradiation.

<sup>k</sup> Cards were irradiated by Teledyne Isotopes, Inc., Westwood, NJ on June 19, 1990.

<sup>l</sup> Cards were irradiated by Dosimetry Associates, Inc., Northville, MI on October 30, 1990.