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April 16, 2001

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Document Control Desk

Subject: Grand Gulf Nuclear Station
Docket No. 50-416
License No. NPF-29
2000 Grand Gulf Nuclear Station (GGNS) Annual Radiological
Environmental Operating Report (AREOR)

GNRO-2001/00032

Gentlemen:

In accordance with the Grand Gulf Nuclear Station Unit 1 Technical Specification 5.6.2, attached is the Annual Radiological Environmental Operating Report for the period January 1, 2000 through December 31, 2000.

If you have questions or require additional information concerning these reports, please contact Ms. L. A. Patterson at (601) 437-6252, or this office at (601) 437-6685.

Yours truly,

A handwritten signature in black ink, appearing to be "C. Bottemiller", written over a horizontal line.

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cc: (See Next Page)

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GRAND GULF NUCLEAR STATION

**ANNUAL RADIOLOGICAL ENVIRONMENTAL
OPERATING REPORT FOR 2000**

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Summary

The Annual Radiological Environmental Operating Report presents data obtained through analyses of environmental samples collected for Grand Gulf Nuclear Station's (GGNS) Radiological Environmental Monitoring Program (REMP) for the period January 1, 2000 through December 31, 2000. This report fulfills the requirements of GGNS Technical Specification 5.6.2.

During 2000, Manganese-54, Cobalt-60 and Cesium-137 was detected in the special sediment sample collected from the barge slip. GGNS' review of results from this area indicates the following:

- Presence of radioactivity at this area is attributed to previous years of buildup of very small amounts of particulate materials present in the liquid discharges.
- Cesium-137 is attributed to past atmospheric weapons testing.
- Levels of radioactivity are not demonstrating any increase in comparison to previous years.

Tritium was detected in an annual downstream surface water sample collected during a liquid radwaste discharge at a concentration of 50,475 pCi/liter. Confirmatory analysis of the original sample and analysis of a backup sample confirmed the results. Weather conditions at the time of sampling resulted in sample collection from the shoreline where minimal dilution was present. When the release conditions are considered, the tritium concentration in the surface water was consistent with what would be anticipated. Although liquid effluent limitations imposed by 10CFR20 were met for the discharge, the tritium results were evaluated against REMP reporting criteria for non-drinking water pathway. Because this sample is collected annually and the reporting criteria of 30,000 pCi/liter applies when averaged over a calendar quarter, the results were determined not reportable. This sample meets the definition of a non-routine result and is noted as such in Table 3.1. This data confirms the effectiveness of the GGNS Radioactive Effluent Controls Program.

To supplement the REMP, GGNS personnel collected venison, hay and fish samples during 2000 for gamma isotopic analysis. GGNS did not detect any gamma radionuclides in the samples.

Radiological Environmental Monitoring Program

GGNS established the REMP in 1978 prior to the station becoming operational (1985) to provide data on background radiation and radioactivity normally present in the area. GGNS has continued to monitor the environment by sampling air, water, sediment, fish and food products, as well as measuring radiation directly. GGNS also samples milk if milk-producing animals are present within five miles of the plant.

The REMP includes sampling indicator and control locations within an 18-mile radius of the plant. The REMP utilizes indicator locations near the site to show any increases or buildup of radioactivity that might occur due to station operation, and control locations farther away from the site to indicate the presence of only naturally occurring radioactivity. GGNS personnel compare indicator results with control and preoperational results to assess any impact GGNS operation might have had on the surrounding environment.

In 2000, GGNS personnel collected environmental samples for radiological analysis. They compared results of indicator locations with control locations and previous studies, and concluded that overall no significant relationship exists between GGNS operation and effect on the plant environs. Their review of 2000 data, in many cases, showed undetectable radiation levels in the environment and near background level in significant pathways associated with GGNS.

Harmful Effects or Irreversible Damage

The REMP monitoring did not detect any harmful effects or evidence of irreversible damage in 2000. Therefore, no analysis or planned course of action to alleviate problems was necessary.

Reporting Levels

GGNS' review indicates that no samples equaled or exceeded reporting levels for radioactivity concentration in environmental samples, as outlined in ODCM Specifications Table 6.12.1-2 when averaged over any calendar quarter, due to GGNS effluents. Therefore, 2000 results did not trigger any Radiological Monitoring Program Special Reports.

Radioactivity Not Attributable to GGNS

The GGNS REMP detected radioactivity attributable to other sources twice. These include the 25th Chinese nuclear test explosion in 1980, and the radioactivity plume release due to reactor core degradation at the Chernobyl Nuclear Power Plant in 1986.

Comparison to Federal and State Programs

GGNS personnel compared REMP data to federal and state monitoring programs as results became available. Historically, the programs used for comparison have included the U.S. Nuclear Regulatory Commission (NRC) TLD Direct Radiation Monitoring Network and the Mississippi State Department of Health (MSDH), Division of Radiological Health.

The NRC TLD Network Program was discontinued in 1998. Historically these results have compared to those from the GGNS REMP. GGNS TLD results continue to remain similar to the historical average and continue to verify that plant operation is not affecting the ambient radiation levels in the environment.

The MSDH and the GGNS REMP entail similar radiological environmental monitoring program requirements. These programs include concurrent air sampling and splitting or sharing sample media such as water, sediment, fish and food products. Both programs have obtained similar results over previous years.

Sample Deviations

◆ Milk

The REMP did not include milk sampling within five miles (8 km) of GGNS in 2000 due to unavailability. ODCM Specifications require collection of milk samples if available commercially within 8 km (5 miles) of the plant. GGNS personnel collected vegetation samples to monitor the ingestion pathway, as specified in ODCM Specifications Table 6.12.1-1, because of milk unavailability.

◆ Required Lower Limit of Detection (LLD) Values

All LLDs during this reporting period were within the acceptable limits required by the technical specifications.

◆ Air Samples

The following air sample locations had reduced run times due to weather-related outages or mechanical problems. However, required LLDs were achieved in all cases. As described in footnote (a) to ODCM Specification Table 6.12.1-1, deviations are permitted from the required sampling schedule due to malfunction of sampling equipment and other legitimate reasons.

Location	Sample period	Run Time (hr:min)	Problem Description	Comment
AS1-PG	07/18/2000 - 07/25/2000	166:12	Weather Outage	Sample period shortened by 02:00.
AS3-61VA	04/04/2000 - 04/11/2000	167:40	Weather Outage	Sample period shortened by 00:14.
	11/07/2000 - 11/14/2000	164:11	Sampler Failure	Sample volume reduced due to mechanical failure, Iodine-131 LLD was met.

◆ **Air Samples (cont'd)**

Location	Sample period	Run Time (hr:min)	Problem Description	Comment
AS7-UH	01/18/2000 - 01/25/2000	166:33	Weather Outage	Sample period shortened by 01:22.
	05/02/2000 - 05/09/2000	163:36	Weather Outage	Sample period shortened by 04:27.
	05/16/2000 - 05/23/2000	164:30	Sampler Failure	Sample period shortened by 03:28.
	06/20/2000 - 06/27/2000	165:52	Weather Outage	Sample period shortened by 01:47.
	07/25/2000 - 08/01/2000	167:44	Weather Outage	Sample period shortened by 00:16.
	10/03/2000 - 10/10/2000	166:56	Weather Outage	Sample period shortened by 01:07.
	10/31/2000 - 11/07/2000	169:08	Weather Outage	Sample period shortened by 01:04.

Based on the total sample collection period being reduced by 15.75 hours as a result of these deviations, air samples were collected 99.9 % of the available time.

◆ **TLDs**

TLD station M-09 (Warner Tully YMCA Camp) was displaced by campers from its' designated location for a brief period of time during the third quarter of 2000. Upon notification from the YMCA Camp Director that the TLD had been found, GGNS returned the TLD to its' designated location. GGNS' review of third quarter results for this TLD indicate no impact from the displacement.

◆ **Missed Samples**

Air Samples: An air sample was not obtained at AS-7 UH during the sampling period of November 7 – November 14, 2000 due to sampler failure that resulted in an inadequate sample volume. As a result of the failure, the sampling period was shortened by 165 hours and 33 minutes. GGNS personnel replaced the sampler upon discovery.

TLDs: One third quarter TLD station M-48 (Mont Gomer Road) was missing during 2000 due to vandalism. This loss was an isolated instance that did not recur during the year and was replaced with a new TLD by GGNS personnel once discovered. The recovery rate for TLDs during 2000 was 99.2% (119 of 120).

◆ **Unavailable Results**

GGNS received analytical results in adequate time for inclusion in this report. In addition, GGNS' review identified no missing results.

Program Modifications

GGNS made no modifications to the REMP during 2000.

Attachments

Attachment 1 contains results of air, TLD, water, sediment, fish, food products and special samples collected in 2000. TLDs were analyzed by Waterford-3 Dosimetry. All remaining samples were analyzed by River Bend Station's (RBS) Environmental Laboratory. Attachment 1 also contains RBS' participation in the interlaboratory comparison program during 2000.

1.0 Introduction

1.1 Radiological Environmental Monitoring Program

GGNS established the REMP to ensure that plant operating controls properly function to minimize any associated radiation endangerment to human health or the environment. The REMP is designed for:

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

1.2 Pathways Monitored

The airborne, direct radiation, waterborne and ingestion pathways, as seen in Figure 1-1, are monitored as required by GGNS ODCM Table 6.12.1-1. A description of the GGNS REMP utilized to monitor the exposure pathways is described in Table 1.1 and shown in Figures 1-2 and 1-3. GGNS may supplement this program with additional sampling in order to provide a comprehensive and well-balanced program. Only sample locations required by the ODCM are shown in Figures 1-2 and 1-3.

Section 2.0 of this report provides a discussion of 2000 sampling results with Section 3.0 providing a summary of results for the monitored exposure pathways.

1.3 Land Use Census

GGNS personnel conduct a land use census biannually, as required by ODCM Specification 6.12.2. The purpose of this census is to identify changes in uses of land within five miles of GGNS that would require modifications to the REMP or the ODCM. The most important criteria during this census is to determine location in each sector of the nearest:

- 1) Residence
- 2) Animal milked for human consumption
- 3) Garden of greater than 50 m² (500 ft²) producing broadleaf vegetation.

GGNS personnel conduct the land use census by:

- Field surveys in each meteorological sector out to five miles in order to confirm:
 - Nearest permanent residence
 - Nearest unoccupied residence
 - Nearest garden and approximate size
 - Nearest milking animal.
- Identifying locations on map, measuring distances to GGNS and recording results on surveillance data sheets.
- Comparing current census results to previous results.
- Contacting the Claiborne County Agent for verification of nearest dairy animals.

Table 1.1

Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Airborne	Radioiodine and Particulates 1 sample close to the SITE BOUNDARY having the highest calculated annual average groundlevel D/Q.	AS-7 UH (Sector H, Radius 0.5 Miles) – South-southeast of GGNS at the IBEW Union Hall.	Continuous sampler operation with sample collection per 7 days or as required by dust loading, whichever is more frequent	Radioiodine Cannister – I-131; 7 days Particulate Sampler – Gross beta radioactivity following filter change, composite (by location) for gamma isotopic; 92 days
	Radioiodine and Particulates 1 sample from the vicinity of a community having the highest calculated annual average groundlevel D/Q.	AS-1 PG (Sector G, Radius 5.5 Miles) – Southeast of GGNS at the Port Gibson City Barn.		
	Radioiodine and Particulates 1 sample from a control location 15 - 30 km (10 - 20 miles) distance.	AS-3 61VA (Sector B, Radius 18 Miles) – North-northeast of GGNS on Hwy 61, North of the Vicksburg Airport.		
Direct Radiation	TLDs An inner ring of stations in the general areas of the SITE BOUNDARY.	M-16 (Sector A, Radius 0.9 Miles) – Meteorological Tower. M-17 (Sector C, Radius 0.5 Miles) – South Side, Grand Gulf Road. M-19 (Sector E, Radius 0.5 Miles) – Eastern SITE BOUNDARY Property line, North-northeast of HWSA.	92 days	Gamma dose; 92 days

Table 1.1

Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	<u>TLDs</u> An inner ring of stations in the general areas of the SITE BOUNDARY.	M-21 (Sector J, Radius 0.4 Miles) – Near Former Training Center Building on Bald Hill Road. M-22 (Sector G, Radius 0.5 Miles) – Former RR Entrance Crossing On Bald Hill Road. M-23 (Sector Q, Radius 0.5 Miles) – Gin Lake Road 50 Yards North of Heavy Haul Road on Power Pole. M-25 (Sector N, Radius 1.6 Miles) – Radial Well Number 1. M-28 (Sector L, Radius 0.9 Miles) – Former Glodjo Residence. M-94 (Sector R, Radius 0.8 Miles) – Sector R Near Meteorological Tower.	92 days	Gamma dose; 92 days
	<u>TLDs</u> An outer ring approximately 3 to 5 miles from the site.	M-36 (Sector P, Radius 5.0 Miles) – Curve on HW 608, Point Nearest GGNS at Power Pole. M-40 (Sector M, Radius 2.3 Miles) – Headly Drive, Near River Port Entrance.		

Table 1.1

Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	<u>TLDs</u> An outer ring approximately 3 to 5 miles from the site.	M-48 (Sector K, Radius 4.8 Miles) – 0.4 Miles South on Mont Gomer Road on West Side. M-49 (Sector H, Radius 4.5 Miles) – Fork in Bessie Weathers Road/Shafter Road. M-50 (Sector B, Radius 5.3 Miles) – Panola Hunting Club Entrance. M-55 (Sector D, Radius 5.0 Miles) – Near Ingelside Karnac Ferry Road/Ashland Road Intersection. M-57 (Sector F, Radius 4.5 Miles) – Hwy 61, Behind the Welcome to Port Gibson Sign at Glensdale Subdivision.	92 days	Gamma dose; 92 days
	<u>TLDs</u> 8 stations in special interest areas such as population centers, nearby residences, schools, and in 1 or 2 areas to serve as control stations.	M-01 (Sector E, Radius 3.5 Miles) – Across the road from Lake Claiborne Entry Gate. (Special Interest) M-07 (Sector G, Radius 5.5 Miles) – AS-1 PG, Port Gibson City Barn. (Special Interest) M-09 (Sector D, Radius 3.5 Miles) – Warner Tully Y-Camp. (Special Interest) M-10 (Sector A, Radius 1.5 Miles) – Grand Gulf Military Park. (Special Interest)		

Table 1.1

Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	TLDs 8 stations in special interest areas such as population centers, nearby residences, schools, and in 1 or 2 areas to serve as control stations	M-14 (Sector B, Radius 18.0 Miles) – AS-3-61VA, Hwy 61, North of Vicksburg Airport. (Control) M-33 (Sector P, Radius 12.5 Miles) – Newellton, Louisiana Water Tower. (Special Interest) M-38 (Sector M, Radius 9.5 Miles) – Lake Bruin State Park, Entrance Road. (Special Interest) M-39 (Sector M, Radius 13.0 Miles) – St. Joseph, Louisiana, Auxiliary Water Tank. (Special Interest)	92 days	Gamma dose; 92 days
	TLDs Sixteen permanent TLD stations at the protected area boundary (these are in addition to ODCM requirements).	M-61 (Sector D, Onsite) – Protected Area Fence. M-62 (Sector E, Onsite) – Protected Area Fence. M-63 (Sector N, Onsite) – Protected Area Fence. M-64 (Sector M, Onsite) – Protected Area Fence.		

Table 1.1

Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	<u>TLDs</u> Sixteen permanent TLD stations at the protected area boundary.	<p>M-65 (Sector L, Onsite) – Protected Area Fence.</p> <p>M-66 (Sector K, Onsite) – Protected Area Fence.</p> <p>M-67 (Sector J, Onsite) – Protected Area Fence.</p> <p>M-68 (Sector H, Onsite) – Protected Area Fence.</p> <p>M-69 (Sector G, Onsite) – Protected Area Fence.</p> <p>M-70 (Sector F, Onsite) – Protected Area Fence.</p> <p>M-71 (Sector C, Onsite) – Protected Area Fence.</p> <p>M-72 (Sector B, Onsite) – Protected Area Fence.</p> <p>M-74 (Sector Q, Onsite) – Protected Area Fence.</p> <p>M-76 (Sector A, Onsite) – Protected Area Fence.</p>	92 days	Gamma dose; 92 days

Table 1.1

Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	TLDs Sixteen permanent TLD stations at the protected area boundary.	M-77 (Sector R, Onsite) – Protected Area Fence. M-81 (Sector P, Onsite) – Protected Area Fence.	92 days	Gamma dose; 92 days
	TLDs Three TLDs utilized as duplicates at varying locations (these are in addition to ODCM requirements).	M-31 (Sector Varies, Radius Varies) – Duplicate TLD Installed Quarterly At Varying Locations. M-32 (Sector Varies, Radius Varies) – Duplicate TLD Installed Quarterly At Varying Locations. M-60 (Sector Varies, Radius Varies) – Duplicate TLD Installed Quarterly At Varying Locations.		
Waterborne	Surface Water 1 sample upstream.	MRUP (Sector Q - R, Radius 1.8 Miles) - At least 4500 ft upstream of the GGNS discharge point into the Mississippi River to allow adequate mixing of the Mississippi and Big Black Rivers.	92 days	Gamma isotopic and tritium analyses; 92 days
	1 sample downstream.	MRDOWN (Sector N, Radius 1.6 Miles) - At least 5000 ft downstream of the GGNS discharge point into the Mississippi River near Radial Well No. 1.		
	1 sample downstream during a Liquid Radwaste Discharge.	MRDOWN (Sector Q – P, Radius 1.3 Miles) – Downstream of the GGNS discharge point into the Mississippi River near Radial Well No. 5.	366 days	Gamma isotopic and tritium analyses; 366 days

Table 1.1

Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Waterborne	Groundwater Samples from 2 sources.	PGWELL (Sector G, Radius 5.0 Miles) - Port Gibson Wells – Take from distribution system or one of the five wells. CONSTWELL (Sector P, Radius 0.4 Miles) – GGNS Construction Water Well – Taken from distribution system or the well.	366 days	Gamma isotopic and tritium analyses; 366 days
	Sediment From Shoreline 1 sample from downstream area. 1 sample from upstream area.	SEDHAM (Sector N, Radius 1.6 Miles) – Downstream of the GGNS discharge point in the Mississippi River near Hamilton Lake outlet. SEDCONT (Minimum of 100 yds) – Upstream of the GGNS discharge point in the Mississippi River.	366 days	Gamma isotopic; 366 days
Ingestion	Milk 1 sample from milking animals within 8 km if milk is available commercially. 1 control sample (only if indicator exists) >8 km if milk is available.	Currently, no available milking animals within 8 km of GGNS. ALCONT (Sector K, Radius 10.5 Miles) - Located South-southwest of GGNS at Alcorn State University.	92 days when required	Gamma isotopic and I-131; 92 days

Table 1.1

Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Ingestion	<p>Fish 1 sample in vicinity of GGNS discharge point.</p> <p>1 sample uninfluenced by GGNS discharge.</p>	<p>FISHDOWN – Downstream of the GGNS discharge point into the Mississippi River</p> <p>FISHUP – Upstream of the GGNS discharge point in the Mississippi River uninfluenced by plant operations.</p>	366 days	Gamma isotopic on edible portion; 366 days
	<p>Food Products 1 sample of broadleaf vegetation grown in one of two different offsite locations with highest anticipated annual average ground level D/Q if milk sampling is not performed.</p> <p>1 sample of similar vegetation grown 15 – 30 km distant if milk sampling is not performed.</p>	<p>VEG-J (Sector J, Radius 0.4 Miles) – South of GGNS near former Training Center on Bald Hill Road.</p> <p>VEG-H (Sector H, Radius 0.4 Miles) - South-southeast of GGNS between the former Training Center and the IBEW Union Hall on Bald Hill Road.</p> <p>VEG-CONT (Sector K, Radius 10.5 Miles) – Alcorn State University south-southwest of GGNS when available, otherwise a location 15-30 km distant.</p>	92 days when available	Gamma isotopic and I-131; 92 days

FIGURE 1-1
EXPOSURE PATHWAYS

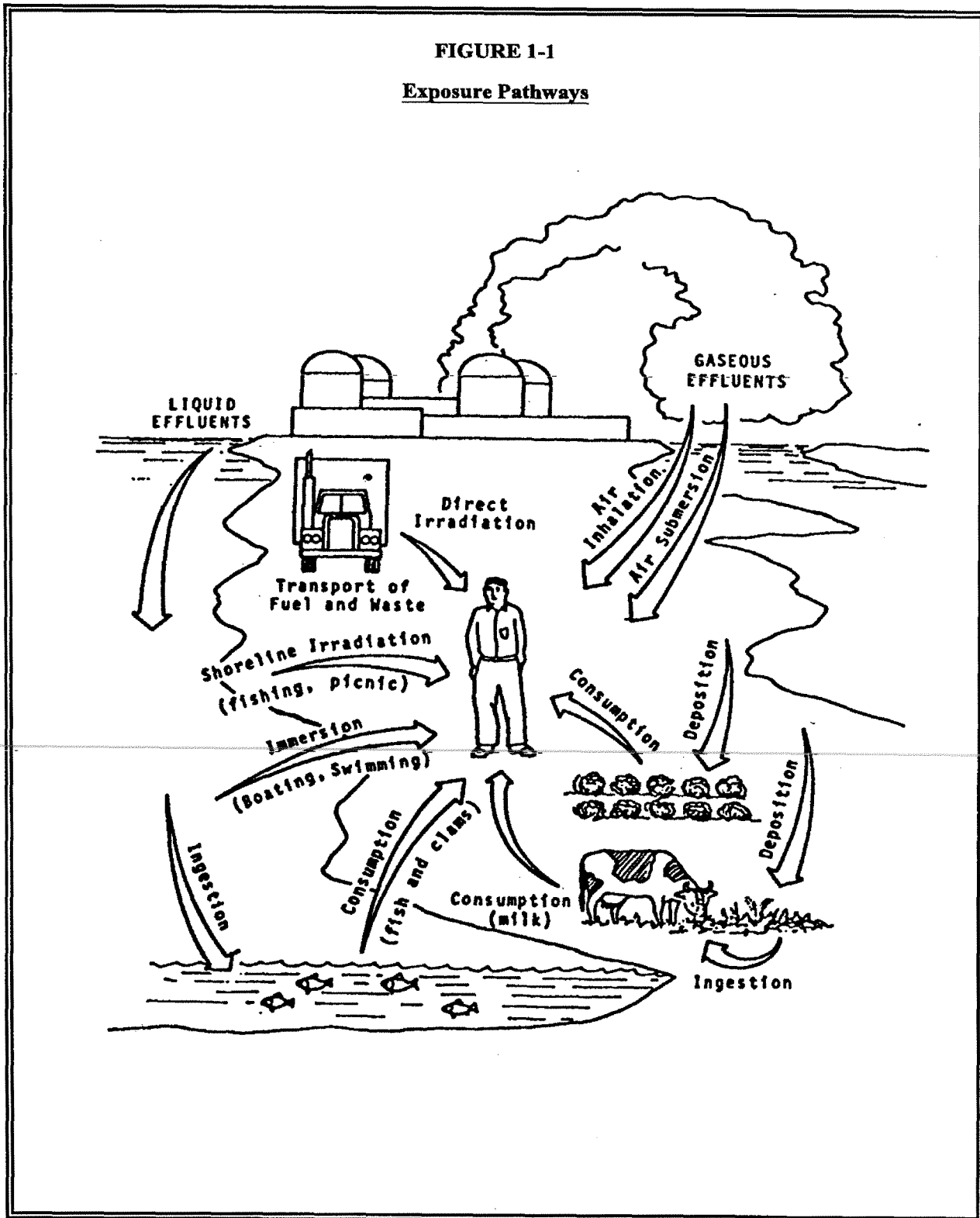


FIGURE 1-2

SAMPLE COLLECTION SITES – NEAR FIELD

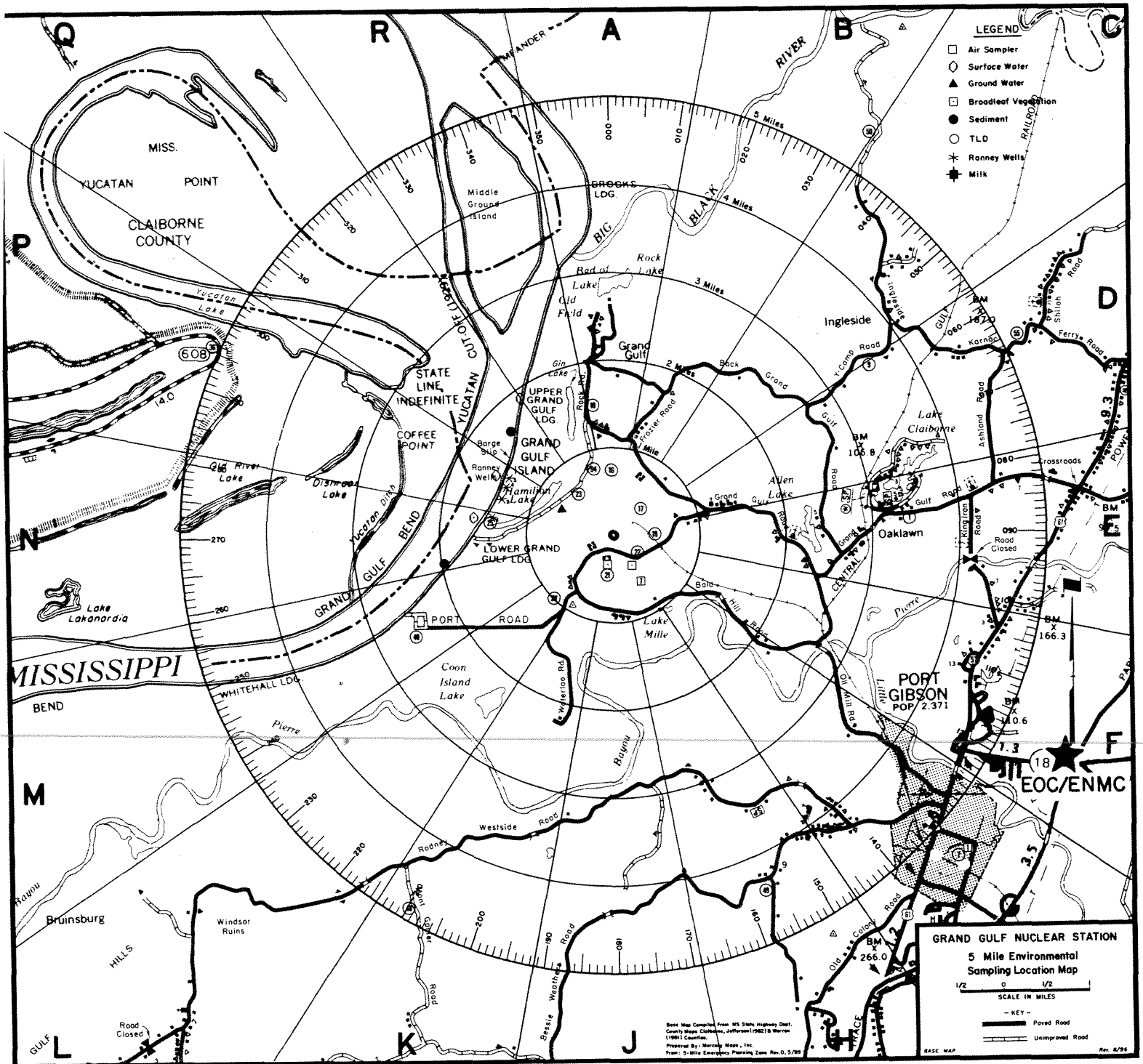
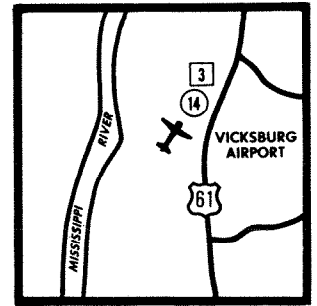
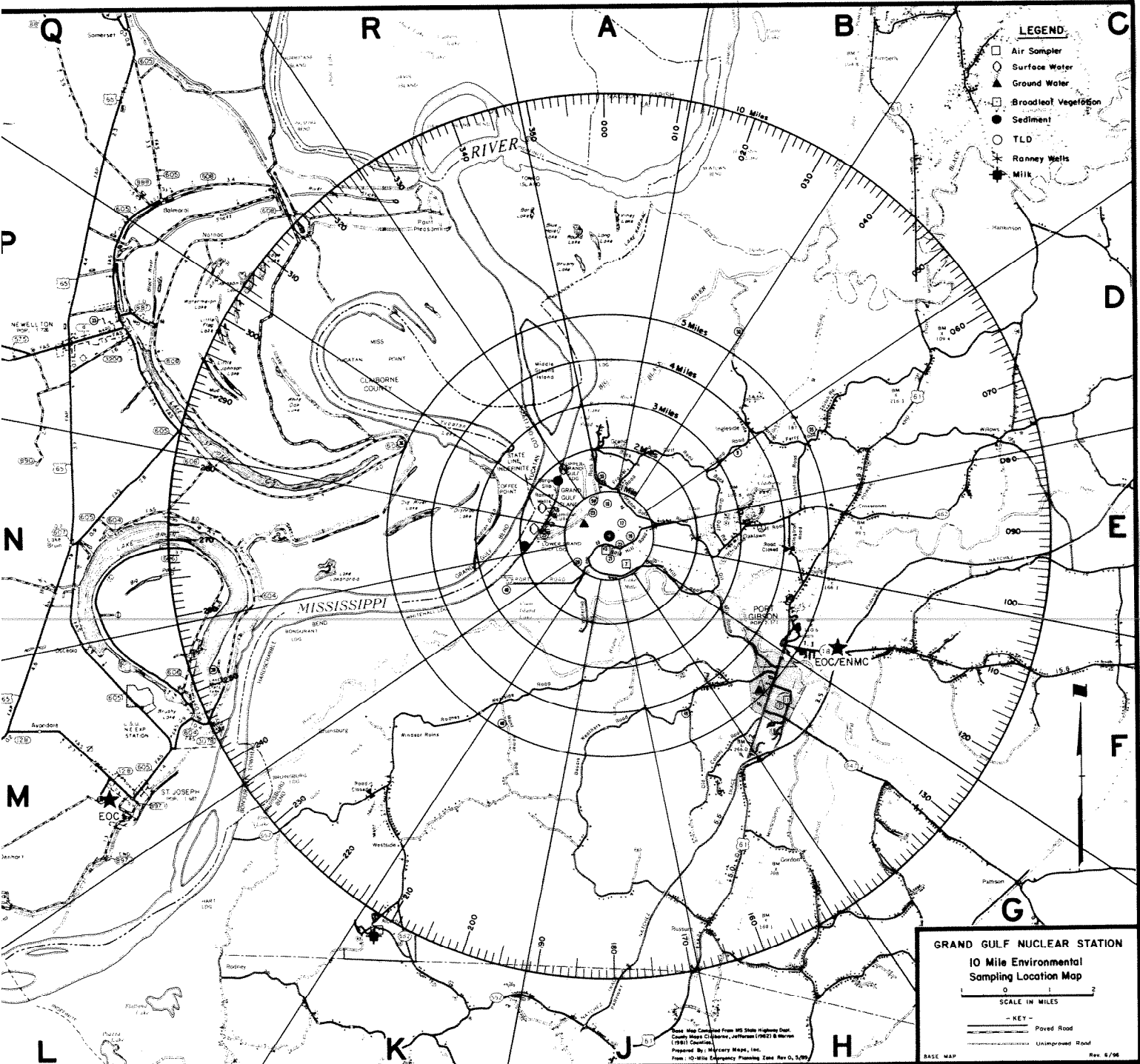


FIGURE 1-3

SAMPLE COLLECTION SITES – FAR FIELD



18 MILES FROM GRAND GULF
TO VICKSBURG AIRPORT



2.0 Interpretation and Trends of Results

2.1 Air Particulate and Radioiodine Sample Results

GGNS did not detect any gamma radionuclides in the quarterly air particulate composites or Iodine-131 in the radioiodine cartridges during the reporting period, as has been the case in previous years. The REMP detected radioactivity in this pathway attributable to other sources twice. These include the 25th Chinese nuclear test explosion in 1980, and the radioactive plume release due to reactor core degradation at Chernobyl Nuclear Power Plant in 1986. Therefore, the airborne exposure pathway has been unaffected by the operation of GGNS and airborne concentrations continue to be at background levels.

Table 3.1, which includes gross beta concentrations, provides a comparison of the indicator and control means, further emphasizes that the airborne pathway continues to remain at background levels.

2.2 Thermoluminescent Dosimetry Sample Results

Gamma radiation dose in the reporting period compares to previous years as shown in Figure 2-1. This figure, which indicates that ambient radiation levels have remained at or near background levels, shows 1996 - 2000 annual average results for indicator locations compared to the Vicksburg control.

GGNS reports measured dose as net exposure (field reading less [transit + shield reading]) normalized to 92 days and relies on comparison of the indicator locations to the control as a measure of plant impact. GGNS' comparison of the inner ring, outer ring, and special interest area TLD results to the control, as seen in Table 3.1, indicates that the ambient radiation levels are unaffected by plant operations. Therefore, levels continue to remain at or near background.

2.3 Water Sample Results

Analytical results for 2000 surface water and groundwater samples were similar to those reported in previous years.

Surface water samples were collected from two indicator and one control location and analyzed for gamma radionuclides and tritium. Gamma radionuclides remained undetectable in the upstream and downstream Mississippi River locations, which is consistent with preoperational and previous operational years. In addition, gamma radionuclides were undetectable in an annual downstream sample collected during a liquid radwaste discharge.

In addition, tritium was undetectable in the upstream and downstream Mississippi River locations. However, tritium was detected in an annual downstream surface water sample collected during a liquid radwaste discharge at a concentration of 50,475 pCi/liter. Confirmatory analysis of the original sample and analysis of a backup sample confirmed the results. Weather conditions at the time of sampling resulted in sample collection from the shoreline where minimal dilution was present. When the release conditions are considered, the tritium concentration in the surface water was consistent with what would be anticipated. Although liquid effluent limitations imposed by 10CFR20 were met for the discharge, the tritium results were evaluated against REMP reporting criteria for non-drinking water pathway. Because this sample is collected annually and the reporting criteria of 30,000 pCi/liter applies when averaged over a calendar quarter, the results were determined not reportable. This sample meets the definition of a non-routine result and is noted as such in Table 3.1. This data confirms the effectiveness of the GGNS Radioactive Effluent Controls Program. Listed below is an estimate of the observed concentration at the sample point versus the predicted concentration in the release:

- ◆ Concentration in tank: 1.53E7 pCi/liter
- ◆ Dilution prior to release: 0.011 [91.2 gpm tank flow / 8233 gpm dilution flow]
- ◆ Minimum credit for Dilution in Ms River: 0.5
- ◆ Maximum expected concentration at sample point: $1.53E7 \times 0.011 \times 0.5$
= 8.4E4 pCi/liter
- ◆ Observed concentration at sample point: 5.0E4 pCi/liter

Groundwater samples were collected from two locations (indicator and control) and analyzed for gamma radionuclides and tritium. GGNS did not detect any gamma radionuclides or tritium in groundwater samples during the reporting period. These results are comparable with previous years and indicate that this pathway has not been affected by plant operations.

Based on review of results and previous historical data, GGNS concluded that plant operations had no significant impact on this pathway during 2000.

2.4 Sediment Sample Results

Sediment samples were collected from two ODCM Specification locations (indicator and control) and analyzed for gamma radionuclides. In 2000, gamma radionuclides were below detectable limits in the upstream and downstream locations, which is consistent with the preoperational and operational monitoring periods.

Manganese-54, Cobalt-60 and Cesium-137 was detected at the barge slip location (SEDBAR) during this reporting period. This sample location supplements the REMP and is collected as a special sample. GGNS personnel attribute the presence

of radioactivity at this location over previous years to buildup of very small amounts of particulate materials present in liquid discharges. Figure 2-2 shows that radionuclide concentrations in the barge slip sediment are not increasing. Therefore, GGNS concluded that plant operations had no significant impact on this pathway during 2000.

2.5 Milk Sample Results

GGNS personnel did not collect milk samples within five miles of the site in the reporting period due to the absence of milking animals. Since there are no dairies within five miles of the GGNS, it is concluded GGNS' operation had no impact on this pathway in 2000.

2.6 Fish Sample Results

Fish samples were collected from two locations (indicator and control) and analyzed for gamma radionuclides. GGNS did not detect any gamma radionuclides in fish samples during the reporting period, as has been the case in preoperational and previous operational years. These results indicate that this pathway has not been affected by plant operations.

Two special samples were collected from an upstream (control) and downstream (indicator) location during 2000 to supplement the REMP. GGNS did not detect any gamma radionuclides in these samples.

2.7 Food Product Sample Results

Food product samples were collected when available from control and indicator locations in 2000 and analyzed for Iodine-131 and gamma radionuclides. GGNS did not detect any gamma radionuclides in vegetation samples during the reporting period. Nuclides detected previously at the control and indicator locations are attributed to the Chernobyl accident and weapons testing. These results indicate that this pathway has not been affected by plant operations.

Two special samples of hay were collected on the GGNS property during 2000 to supplement the REMP. GGNS did not detect any gamma radionuclides in these samples.

2.8 Land Use Census Results

GGNS personnel conduct a land use census biannually. The most recent land use census was reported in the 1999 AREOR. The next land use census data will be reported in the 2001 AREOR.

2.9 Interlaboratory Comparison Results

River Bend Station (RBS) Environmental Laboratory analyzed interlaboratory comparison samples for GGNS to fulfill the requirements of the ODCM Specifications 6.12.1. Attachment 1, 2000 Radiological Environmental Monitoring Report, contains these results. GGNS' review of RBS' interlaboratory comparison indicated that 96% of the sample results for accuracy and precision were within the acceptable control limits of the three normalized deviations. For those sample results outside the acceptable control limits, GGNS' and RBS's review indicated no impact on previously reported data. Attachment 1 also provides additional discussion regarding sample results outside the acceptable control limits.

Figure 2-1

TLD Radiation Dose

1996 - 2000 TLD Results
Indicators Versus Control

Annual Average mR/Qtr

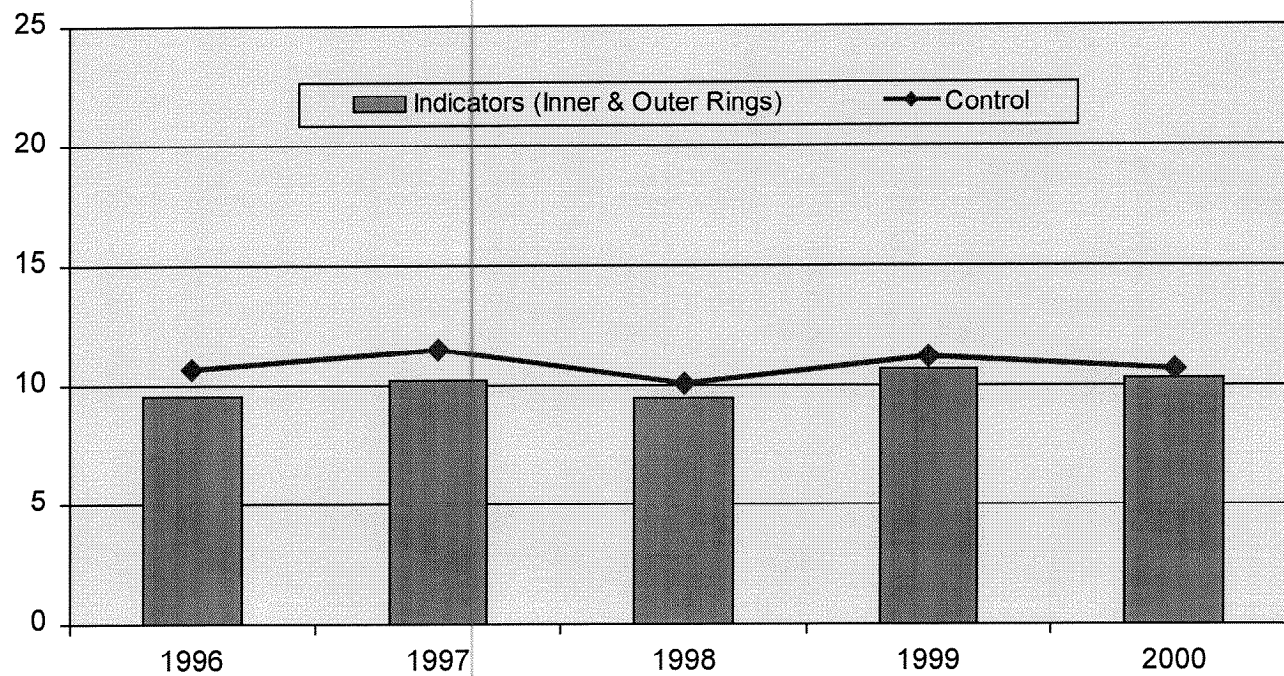
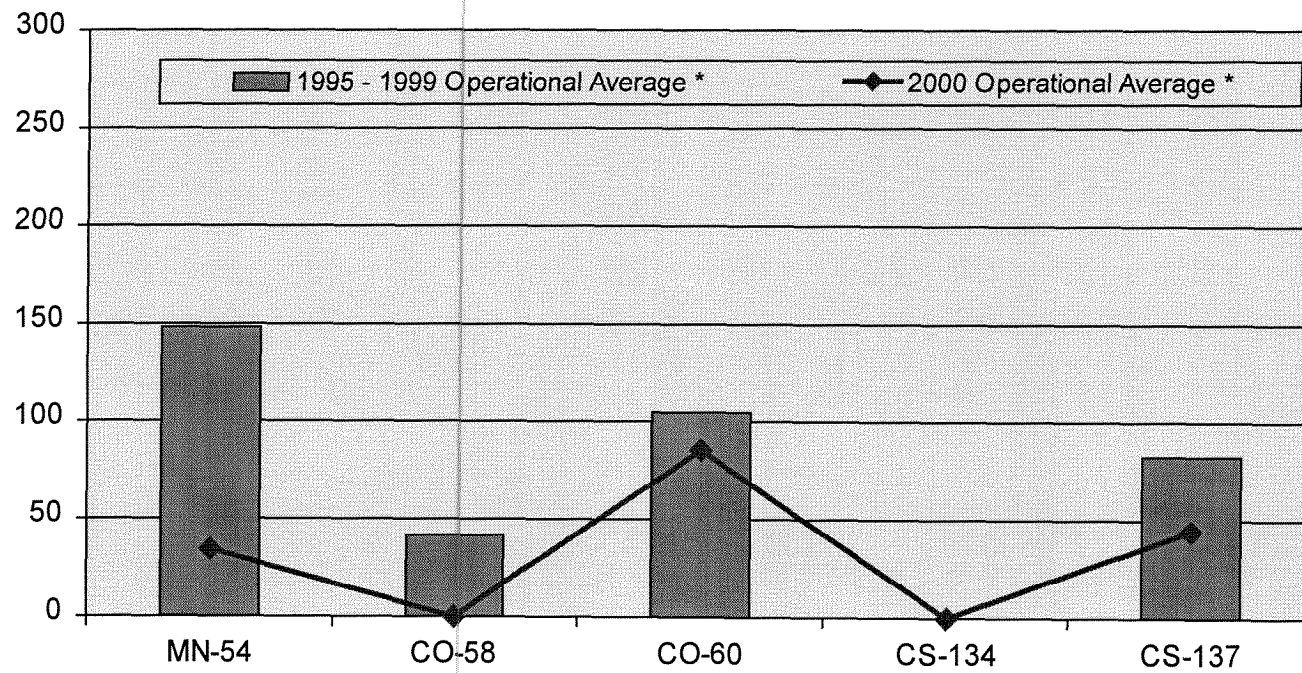


Figure 2-2

Barge Slip Sediment

1995 - 2000 Gamma Radionuclide Results
Barge Slip Sediment

Annual Average pCi/kg



* Average based on positive results only.

3.0 Radiological Environmental Monitoring Program Summary

3.1 2000 Program Results Summary

Table 3.1 summarizes the 2000 REMP results. GGNS personnel did not use values reported as less than the lower limit of detection (<LLD) when determining ranges and means for indicator and control locations.

TABLE 3.1

Radiological Environmental Monitoring Program SummaryName of Facility: Grand Gulf Nuclear Station Docket No: 50-416Location of Facility: Claiborne County, MississippiReporting Period: January - December 2000

Sample Type (Units)	Type & Number of Analyses ^a	LLD ^b	Indicator Locations Mean (F) ^c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) ^c [Range]	Number of Nonroutine Results ^e
				Location ^d	Mean (F) ^c [Range]		
Air Particulates (pCi/m ³)	GB 155	0.01	0.03 (51 / 51) [0.01 - 0.05]	AS-7 UH (Sector H, 0.5 mi.)	0.03 (51 / 51) [0.01 - 0.05]	0.03 (104 / 104) [0.01 - 0.05]	0
	GS 12						
	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 ³)	I-131 155	0.07	<LLD	N/A	N/A	<LLD	0
Inner Ring TLDs (mR/Qtr)	Gamma 36	(f)	9.8 (36 / 36) [6.2 – 14.3]	M-21 (Sector J, 0.4 mi.)	12.1 (4 / 4) [10.3 – 14.3]	N/A	0
Outer Ring TLDs (mR/Qtr)	Gamma 27	(f)	10.8 (27 / 27) [8.0 – 13.7]	M-49 (Sector H, 4.5 mi.)	12.2 (4 / 4) [10.3 – 13.6]	N/A	0
Special Interest TLDs (mR/Qtr)	Gamma 28	(f)	9.2 (28 / 28) [6.1 – 12.7]	M-01 (Sector E, 3.5 mi.)	11.0 (4 / 4) [10.0 – 12.7]	N/A	0
Control TLDs (mR/Qtr)	Gamma 4	(f)	N/A	N/A	N/A	10.7 (4 / 4) [9.4 – 12.5]	0
Protected Area TLDs (mR/Qtr)	Gamma 64	(f)	43.2 (64 / 64) [8.2 – 140.2]	M-69 (Sector G, Onsite)	123.7 (4 / 4) [105.1 – 140.2]	N/A	0

TABLE 3.1

Radiological Environmental Monitoring Program SummaryName of Facility: Grand Gulf Nuclear Station Docket No: 50-416Location of Facility: Claiborne County, Mississippi Reporting Period: January - December 2000

Sample Type (Units)	Type & Number of Analyses ^a	LLD ^b	Indicator Location Mean (F) ^c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) ^c [Range]	Number of Nonroutine Results ^e
				Location ^d	Mean (F) ^c [Range]		
Surface Water (pCi/l)	H-3 10	3000	50,344 (2 / 6) [50,213 – 50,475]	Downstream Ms. River (Sector Q-P, 1.3 mi.)	50,344 (2 / 2) [50,213 – 50,475]	<LLD	2
	GS 9						
	I-131	15	<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

TABLE 3.1

Radiological Environmental Monitoring Program SummaryName of Facility: Grand Gulf Nuclear Station Docket No: 50-416Location of Facility: Claiborne County, Mississippi Reporting Period: January - December 2000

Sample Type (Units)	Type & Number of Analyses ^a	LLD ^b	Indicator Locations Mean (F) ^c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) ^c [Range]	Number of Nonroutine Results ^e
				Location ^d	Mean (F) ^c [Range]		
Groundwater (pCi/l)	H-3 3	2000	<LLD	N/A	N/A	<LLD	0
	I-131 2	1	<LLD	N/A	N/A	<LLD	0
	GS 3						
	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
Bottom Sediment (pCi/kg)	GS 4						
	Cs-134 150		<LLD	N/A	N/A	<LLD	0
	Cs-137 180		<LLD	N/A	N/A	<LLD	0

TABLE 3.1

Radiological Environmental Monitoring Program SummaryName of Facility: Grand Gulf Nuclear Station Docket No: 50-416Location of Facility: Claiborne County, MississippiReporting Period: January - December 2000

Sample Type (Units)	Type & Number of Analyses ^a	LLD ^b	Indicator Location Mean (F) ^c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) ^c [Range]	Number of Nonroutine Results ^e
				Location ^d	Mean (F) ^c [Range]		
Fish (pCi/kg)	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
Food Products (pCi/kg)	I-131 ⁹	60	<LLD	N/A	N/A	<LLD	0
	GS ⁹						
	Cs-134	60	<LLD	N/A	N/A	<LLD	0
	Cs-137	80	<LLD	N/A	N/A	<LLD	0
Sediment (Special) (pCi/kg)	GS ²						
	Mn-54	(f)	34.3 (1 / 2) [N/A]	SEDBAR (Sector Q, 1.5 mi.)	34.3 (1 / 2) [N/A]	N/A	0
	Co-60	(f)	85.3 (2 / 2) [35.6 – 135.0]	SEDBAR (Sector Q, 1 1.5 mi.)]	85.3 (2 / 2) [35.6 – 135.0]	N/A	0
	Cs-134	150	<LLD	N/A	N/A	N/A	0
	Cs-137	180	44.0 (2 / 2) [22.7 – 65.3]	N/A	44.0 (2 / 2) [22.7 – 65.3]	N/A	0
				SEDBAR (Sector Q, 1.5 mi.)			

TABLE 3.1

Radiological Environmental Monitoring Program SummaryName of Facility: Grand Gulf Nuclear Station Docket No: 50-416Location of Facility: Claiborne County, Mississippi Reporting Period: January - December 2000

Sample Type (Units)	Type & Number of Analyses ^a	LLD ^b	Indicator Location Mean (F) ^c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) ^c [Range]	Number of Nonroutine Results ^e
				Location ^d	Mean (F) ^c [Range]		
Fish (Special) (pCi/kg)	GS 2						
	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
Venison (Special) (pCi/kg)	GS 2						
	Mn-54	130	<LLD	N/A	N/A	N/A	0
	Fe-59	260	<LLD	N/A	N/A	N/A	0
	Co-58	130	<LLD	N/A	N/A	N/A	0
	Co-60	130	<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
Food Products (Special) (pCi/kg)	I-131 2	60	<LLD	N/A	N/A	N/A	0
	GS 2						
	Cs-134	60	<LLD	N/A	N/A	N/A	0
	Cs-137	80	<LLD	N/A	N/A	N/A	0

^a GB = Gross beta; I-131 = Iodine-131; H-3 = Tritium; GS = Gamma scan.^b LLD = Required lower limit of detection based on GGNS ODCM Table 6.12.1-3.^c Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parenthesis (F).^d Locations are specified (1) by name and (2) degrees relative to reactor site.^e 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.^f LLD is not defined in GGNS ODCM Table 6.12.1-3.

Attachment 1

2000 Radiological Monitoring Report

Summary of Monitoring Results

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Table 1.1
Sample Type: Air Particulate Filter
Analysis: Gross Beta
Units: pCi/m³

Start Date	End Date	AS-1 PG (Indicator)	Start Date	End Date	AS-3 61VA (Control)	AS-7 UH (Indicator)
<u>Required LLD</u> →		<u>0.01</u>	<u>Required LLD</u> →		<u>0.01</u>	<u>0.01</u>
12/28/1999	01/04/2000	0.03	12/28/1999	01/04/2000	0.03	0.03
01/04/2000	01/11/2000	0.03	01/04/2000	01/11/2000	0.03	0.03
01/11/2000	01/18/2000	0.02	01/11/2000	01/18/2000	0.02	0.02
01/18/2000	01/25/2000	0.03	01/18/2000	01/25/2000	0.03	0.03
01/25/2000	02/01/2000	0.03	01/25/2000	02/01/2000	0.03	0.03
02/01/2000	02/08/2000	0.04	02/01/2000	02/08/2000	0.05	0.04
02/08/2000	02/15/2000	0.04	02/08/2000	02/15/2000	0.05	0.05
02/15/2000	02/22/2000	0.02	02/15/2000	02/22/2000	0.03	0.03
02/22/2000	02/29/2000	0.02	02/22/2000	02/29/2000	0.02	0.02
02/29/2000	03/07/2000	0.02	02/29/2000	03/07/2000	0.02	0.02
03/07/2000	03/14/2000	0.02	03/07/2000	03/14/2000	0.02	0.02
03/14/2000	03/21/2000	0.01	03/14/2000	03/21/2000	0.02	0.02
03/21/2000	03/28/2000	0.02	03/21/2000	03/28/2000	0.02	0.02
03/28/2000	04/04/2000	0.02	03/28/2000	04/04/2000	0.02	0.02
04/04/2000	04/11/2000	0.02	04/04/2000	04/11/2000	0.02	0.02
04/11/2000	04/18/2000	0.02	04/11/2000	04/18/2000	0.02	0.02
04/18/2000	04/25/2000	0.02	04/18/2000	04/25/2000	0.02	0.02
04/25/2000	05/02/2000	0.03	04/25/2000	05/02/2000	0.03	0.02
05/02/2000	05/09/2000	0.02	05/02/2000	05/09/2000	0.02	0.02
05/09/2000	05/16/2000	0.02	05/09/2000	05/16/2000	0.02	0.02
05/16/2000	05/23/2000	0.02	05/16/2000	05/23/2000	0.03	0.02
05/23/2000	05/30/2000	0.02	05/23/2000	05/30/2000	0.02	0.01
05/30/2000	06/06/2000	0.02	05/30/2000	06/06/2000	0.02	0.02
06/06/2000	06/13/2000	0.02	06/06/2000	06/13/2000	0.02	0.02
06/13/2000	06/20/2000	0.01	06/13/2000	06/20/2000	0.02	0.01
06/20/2000	06/27/2000	0.02	06/20/2000	06/27/2000	0.02	0.02

Table 1.1
Sample Type: **Air Particulate Filter**
Analysis: Gross Beta
Units: pCi/m³

Start Date	End Date	AS-1 PG (Indicator)	Start Date	End Date	AS-3 61VA (Control)	AS-7 UH (Indicator)
<u>Required LLD</u> →		<u>0.01</u>	<u>Required LLD</u> →		<u>0.01</u>	<u>0.01</u>
06/27/2000	07/05/2000	0.02	06/27/2000	07/04/2000	0.02	0.02
07/05/2000	07/11/2000	0.03	07/04/2000	07/11/2000	0.03	0.03
07/11/2000	07/18/2000	0.04	07/11/2000	07/18/2000	0.04	0.03
07/18/2000	07/25/2000	0.03	07/18/2000	07/25/2000	0.03	0.02
07/25/2000	08/01/2000	0.03	07/25/2000	08/01/2000	0.03	0.03
08/01/2000	08/08/2000	0.02	08/01/2000	08/08/2000	0.02	0.02
08/08/2000	08/15/2000	0.02	08/08/2000	08/15/2000	0.02	0.02
08/15/2000	08/21/2000	0.04	08/15/2000	08/22/2000	0.04	0.04
08/22/2000	08/29/2000	0.03	08/22/2000	08/29/2000	0.03	0.03
08/29/2000	09/05/2000	0.03	08/29/2000	09/05/2000	0.04	0.03
09/05/2000	09/12/2000	0.01	09/05/2000	09/12/2000	0.01	0.01
09/12/2000	09/19/2000	0.03	09/12/2000	09/19/2000	0.03	0.02
09/19/2000	09/26/2000	0.01	09/19/2000	09/26/2000	0.01	0.01
09/26/2000	10/03/2000	0.02	09/26/2000	10/03/2000	0.03	0.02
10/03/2000	10/10/2000	0.02	10/03/2000	10/10/2000	0.02	0.02
10/10/2000	10/17/2000	0.04	10/10/2000	10/17/2000	0.03	0.04
10/17/2000	10/24/2000	0.05	10/17/2000	10/24/2000	0.04	0.04
10/24/2000	10/31/2000	0.05	10/24/2000	10/31/2000	0.05	0.05
10/31/2000	11/07/2000	0.04	10/31/2000	11/07/2000	0.04	0.04
11/07/2000	11/14/2000	0.02	11/07/2000	11/14/2000	0.03	*
11/14/2000	11/21/2000	0.03	11/14/2000	11/21/2000	0.03	0.03
11/21/2000	11/28/2000	0.03	11/21/2000	11/28/2000	0.03	0.03
11/28/2000	12/05/2000	0.03	11/28/2000	12/05/2000	0.03	0.03
12/05/2000	12/12/2000	0.04	12/05/2000	12/12/2000	0.04	0.04
12/12/2000	12/19/2000	0.03	12/12/2000	12/19/2000	0.03	0.03
12/19/2000	12/27/2000	0.04	12/19/2000	12/27/2000	0.04	0.03

* Sample missed due to sampler failure.

Table 1.2
Sample Type: **Radioiodine Cartridge**
Analysis: Iodine-131
Units: pCi/m³

Start Date	End Date	AS-1 PG (Indicator)	Start Date	End Date	AS-3 61VA (Control)	AS-7 UH (Indicator)
<u>Required LLD</u> →		<u>0.07</u>	<u>Required LLD</u> →		<u>0.07</u>	<u>0.07</u>
12/28/1999	01/04/2000	<0.02	12/28/1999	01/04/2000	<0.02	<0.02
01/04/2000	01/11/2000	<0.02	01/04/2000	01/11/2000	<0.02	<0.02
01/11/2000	01/18/2000	<0.02	01/11/2000	01/18/2000	<0.02	<0.02
01/18/2000	01/25/2000	<0.01	01/18/2000	01/25/2000	<0.02	<0.01
01/25/2000	02/01/2000	<0.01	01/25/2000	02/01/2000	<0.02	<0.02
02/01/2000	02/08/2000	<0.02	02/01/2000	02/08/2000	<0.02	<0.01
02/08/2000	02/15/2000	<0.02	02/08/2000	02/15/2000	<0.02	<0.02
02/15/2000	02/22/2000	<0.02	02/15/2000	02/22/2000	<0.02	<0.02
02/22/2000	02/29/2000	<0.01	02/22/2000	02/29/2000	<0.02	<0.02
02/29/2000	03/07/2000	<0.01	02/29/2000	03/07/2000	<0.02	<0.02
03/07/2000	03/14/2000	<0.02	03/07/2000	03/14/2000	<0.02	<0.02
03/14/2000	03/21/2000	<0.02	03/14/2000	03/21/2000	<0.02	<0.01
03/21/2000	03/28/2000	<0.02	03/21/2000	03/28/2000	<0.02	<0.01
03/28/2000	04/04/2000	<0.01	03/28/2000	04/04/2000	<0.02	<0.01
04/04/2000	04/11/2000	<0.01	04/04/2000	04/11/2000	<0.02	<0.02
04/11/2000	04/18/2000	<0.02	04/11/2000	04/18/2000	<0.02	<0.01
04/18/2000	04/25/2000	<0.01	04/18/2000	04/25/2000	<0.01	<0.01
04/25/2000	05/02/2000	<0.02	04/25/2000	05/02/2000	<0.02	<0.02
05/02/2000	05/09/2000	<0.02	05/02/2000	05/09/2000	<0.02	<0.02
05/09/2000	05/16/2000	<0.02	05/09/2000	05/16/2000	<0.01	<0.02
05/16/2000	05/23/2000	<0.02	05/16/2000	05/23/2000	<0.01	<0.02
05/23/2000	05/30/2000	<0.01	05/23/2000	05/30/2000	<0.01	<0.02
05/30/2000	06/06/2000	<0.02	05/30/2000	06/06/2000	<0.03	<0.02
06/06/2000	06/13/2000	<0.02	06/06/2000	06/13/2000	<0.02	<0.02
06/13/2000	06/20/2000	<0.01	06/13/2000	06/20/2000	<0.01	<0.01
06/20/2000	06/27/2000	<0.01	06/20/2000	06/27/2000	<0.02	<0.02

Table 1.2
Sample Type: Radioiodine Cartridge
Analysis: Iodine-131
Units: pCi/m³

Start Date	End Date	AS-1 PG (Indicator)	Start Date	End Date	AS-3 61VA (Control)	AS-7 UH (Indicator)
<u>Required LLD</u> →		<u>0.01</u>	<u>Required LLD</u> →		<u>0.01</u>	<u>0.01</u>
06/27/2000	07/05/2000	<0.01	06/27/2000	07/04/2000	<0.02	<0.02
07/05/2000	07/11/2000	<0.02	07/04/2000	07/11/2000	<0.02	<0.02
07/11/2000	07/18/2000	<0.01	07/11/2000	07/18/2000	<0.02	<0.02
07/18/2000	07/25/2000	<0.02	07/18/2000	07/25/2000	<0.02	<0.01
07/25/2000	08/01/2000	<0.02	07/25/2000	08/01/2000	<0.01	<0.01
08/01/2000	08/08/2000	<0.01	08/01/2000	08/08/2000	<0.01	<0.02
08/08/2000	08/15/2000	<0.02	08/08/2000	08/15/2000	<0.02	<0.01
08/15/2000	08/21/2000	<0.02	08/15/2000	08/22/2000	<0.02	<0.01
08/22/2000	08/29/2000	<0.02	08/22/2000	08/29/2000	<0.02	<0.03
08/29/2000	09/05/2000	<0.01	08/29/2000	09/05/2000	<0.02	<0.01
09/05/2000	09/12/2000	<0.02	09/05/2000	09/12/2000	<0.01	<0.02
09/12/2000	09/19/2000	<0.02	09/12/2000	09/19/2000	<0.02	<0.01
09/19/2000	09/26/2000	<0.01	09/19/2000	09/26/2000	<0.02	<0.02
09/26/2000	10/03/2000	<0.02	09/26/2000	10/03/2000	<0.02	<0.01
10/03/2000	10/10/2000	<0.02	10/03/2000	10/10/2000	<0.01	<0.01
10/10/2000	10/17/2000	<0.02	10/10/2000	10/17/2000	<0.02	<0.02
10/17/2000	10/24/2000	<0.02	10/17/2000	10/24/2000	<0.02	<0.02
10/24/2000	10/31/2000	<0.02	10/24/2000	10/31/2000	<0.02	<0.01
10/31/2000	11/07/2000	<0.02	10/31/2000	11/07/2000	<0.02	<0.01
11/07/2000	11/14/2000	<0.02	11/07/2000	11/14/2000	<0.03	*
11/14/2000	11/21/2000	<0.03	11/14/2000	11/21/2000	<0.02	<0.02
11/21/2000	11/28/2000	<0.02	11/21/2000	11/28/2000	<0.02	<0.01
11/28/2000	12/05/2000	<0.01	11/28/2000	12/05/2000	<0.02	<0.02
12/05/2000	12/12/2000	<0.02	12/05/2000	12/12/2000	<0.01	<0.02
12/12/2000	12/19/2000	<0.02	12/12/2000	12/19/2000	<0.01	<0.01
12/19/2000	12/27/2000	<0.02	12/19/2000	12/27/2000	<0.01	<0.02

* Sample missed due to sampler failure.

Table 1.3
Sample Type: Air Particulate Filter
Analysis: Gamma Isotopic
Units: pCi/m³

Location	Quarterly Composite	Cs-134	Cs-137
	<u>Required LLD</u> →	<u>0.05</u>	<u>0.06</u>
AS-1 PG (Indicator)	1 ST	<0.002	<0.002
AS-3 61VA (Control)	1 ST	<0.001	<0.001
AS-7 UH (Indicator)	1 ST	<0.002	<0.002
AS-1 PG (Indicator)	2 ND	<0.002	<0.002
AS-3 61VA (Control)	2 ND	<0.002	<0.002
AS-7 UH (Indicator)	2 ND	<0.001	<0.001
AS-1 PG (Indicator)	3 RD	<0.002	<0.002
AS-3 61VA (Control)	3 RD	<0.002	<0.002
AS-7 UH (Indicator)	3 RD	<0.001	<0.001
AS-1 PG (Indicator)	4 TH	<0.002	<0.001
AS-3 61VA (Control)	4 TH	<0.002	<0.001
AS-7 UH (Indicator)	4 TH	<0.001	<0.001

Table 2.1
Sample Type: Thermoluminescent Dosimeters
Analysis: Gamma Dose
Units: mrem/Qtr

Inner Ring - Within General Area of Site Boundary (ODCM Specifications)					
Station	1st Qtr '00	2nd Qtr '00	3rd Qtr '00	4th Qtr '00	Annual Mean '00
M-16	9.6	8.8	10.6	12.2	10.3
M-17	9.0	8.1	9.9	11.1	9.5
M-19	8.9	7.6	9.7	12.4	9.7
M-21 *	11.4	10.3	12.6	14.3	12.1
M-22	7.8	6.2	8.3	10.4	8.2
M-23	7.8	6.3	8.8	10.4	8.3
M-25	8.3	7.0	9.0	11.7	9.0
M-28	10.2	8.7	11.0	12.6	10.6
M-94	9.1	9.5	11.8	13.0	10.7

Outer Ring – Approximately Three (3) to Five (5) Miles from the Site (ODCM Specifications)					
Station	1st Qtr '00	2nd Qtr '00	3rd Qtr '00	4th Qtr '00	Annual Mean '00
M-36	8.2	8.0	9.1	11.2	9.1
M-40	9.4	8.4	10.0	12.3	10.0
M-48	9.4	10.6	Missing	12.5	10.8
M-49 *	12.1	10.3	12.6	13.6	12.2
M-50	9.3	8.9	10.8	12.0	10.2
M-55	10.3	10.0	11.6	13.2	11.3
M-57	10.6	10.8	12.3	13.7	11.8

* Location with highest annual mean.

Table 2.2

Sample Type: Thermoluminescent Dosimeters

Analysis: Gamma Dose

Units: mrem/Qtr

Special Interest Areas – Population Centers & Schools (ODCM Specifications)					
Station	1st Qtr '00	2nd Qtr '00	3rd Qtr '00	4th Qtr '00	Annual Mean '00
M-01 *	10.2	10.0	11.0	12.7	11.0
M-07	10.1	8.3	10.2	11.7	10.1
M-09	8.8	7.5	9.2	11.4	9.2
M-10	6.8	6.1	7.2	10.4	7.6
M-33	8.1	7.1	7.7	10.1	8.3
M-38	8.4	8.3	9.9	11.2	9.4
M-39	8.0	8.0	9.2	11.1	9.1

* Location with highest annual mean.

Special Interest Areas – Control (ODCM Specifications)					
Station	1st Qtr '00	2nd Qtr '00	3rd Qtr '00	4th Qtr '00	Annual Mean '00
M-14	10.1	9.4	10.9	12.5	10.7

Table 2.3
Sample Type: Thermoluminescent Dosimeters
Analysis: Gamma Dose
Units: mrem/Qtr

Protected Area Boundary					
Station	1st Qtr '00	2nd Qtr '00	3rd Qtr '00	4th Qtr '00	Annual Mean '00
M-61	61.1	63.9	64.8	68.5	64.6
M-62	74.6	83.0	92.5	96.7	86.7
M-63	15.1	15.4	18.2	18.3	16.7
M-64	19.8	20.3	23.1	24.2	21.9
M-65	16.9	16.2	18.7	20.7	18.1
M-66	20.0	22.4	25.2	25.2	23.2
M-67	21.8	21.9	23.8	27.9	23.8
M-68	88.7	94.2	98.2	110.3	97.9
M-69 *	105.1	113.6	136.0	140.2	123.7
M-70	100.2	112.4	117.2	120.2	112.5
M-71	29.1	29.6	33.1	34.5	31.6
M-72	20.6	20.5	22.5	25.4	22.3
M-74	10.5	9.6	10.3	13.2	10.9
M-76	14.5	16.1	17.6	19.0	16.8
M-77	8.8	9.3	10.7	12.0	10.2
M-81	9.1	8.2	9.5	12.1	9.7

* Location with highest annual mean.

Duplicates					
Station	1st Qtr '00	2nd Qtr '00	3rd Qtr '00	4th Qtr '00	Annual Mean '00
M-31	9.2	9.6	11.0	12.5	10.6
M-32	8.6	8.4	9.4	10.4	9.2
M-60	10.2	10.6	9.9	12.4	10.7

Table 3.1
Sample Type: Surface Water
Analysis: Gamma Isotopic
Units: pCi/l

Location	Collection 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
	<u>Required LLD</u> →	<u>15</u>	<u>30</u>	<u>15</u>	<u>15</u>	<u>30</u>	<u>30</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>18</u>	<u>60</u>	<u>15</u>
MRDOWN (Indicator)	01/11/2000	<3.46	<7.54	<3.43	<4.32	<8.23	<7.62	<4.00	<10.70	<4.70	<3.60	<23.80	<9.04
MRUP (Control)	01/11/2000	<5.35	<12.70	<3.65	<5.25	<8.99	<8.51	<6.23	<14.80	<5.14	<4.93	<29.80	<9.55
MRDOWN (Indicator)	04/04/2000	<5.10	<7.46	<4.93	<5.45	<9.85	<8.59	<4.64	<11.20	<4.60	<4.84	<23.20	<11.10
MRUP (Control)	04/04/2000	<4.08	<9.47	<3.45	<3.26	<6.89	<6.30	<4.30	<7.69	<3.36	<3.04	<19.60	<6.22
MRDOWN (Indicator)	07/11/2000	<5.90	<7.95	<5.43	<4.77	<9.32	<8.68	<6.07	<8.45	<4.80	<6.37	<32.80	<12.00
MRUP (Control)	07/11/2000	<4.41	<11.20	<4.09	<3.19	<11.30	<8.06	<5.12	<7.07	<5.11	<5.81	<23.00	<6.12
MRDOWN (Indicator)	10/03/2000	<4.10	<7.48	<3.52	<3.90	<10.70	<10.10	<5.13	<7.09	<4.34	<5.32	<16.00	<6.12
MRUP (Control)	10/03/2000	<4.00	<4.36	<3.99	<4.76	<7.33	<4.50	<3.84	<4.65	<4.16	<3.63	<16.00	<5.44
MRDOWN (Indicator)	12/21/2000	<4.97	<8.75	<3.22	<4.49	<8.66	<4.83	<5.31	<14.10	<4.26	<2.89	<29.40	<7.21

Table 3.2
Sample Type: Surface Water
Analysis: Tritium
Units: pCi/l

Location	Collection Date	H-3
	<u>Required LLD</u> →	<u>3000</u>
MRDOWN (Indicator)	01/11/2000	<552.00
MRUP (Control)	01/11/2000	<553.00
MRDOWN (Indicator)	04/04/2000	<551.00
MRUP (Control)	04/04/2000	<548.00
MRDOWN (Indicator)	07/11/2000	<553.00
MRUP (Control)	07/11/2000	<553.00
MRDOWN (Indicator)	10/03/2000	<538.00
MRUP (Control)	10/03/2000	<529.00
MRDOWN (Indicator)	12/21/2000	50,475
MRDOWN "GG" (Indicator)	12/21/2000	50,213

"GG" – indicates duplicate sample.

Table 4.1
Sample Type: **Groundwater**
Analysis: Gamma Isotopic
Units: pCi/l

Location	Collection Date	I-131	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-95	Nb-95	Cs-134	Cs-137	Ba-140	La-140
	<u>Required LLD</u> →	<u>1</u>	<u>15</u>	<u>30</u>	<u>15</u>	<u>15</u>	<u>30</u>	<u>30</u>	<u>15</u>	<u>15</u>	<u>18</u>	<u>60</u>	<u>15</u>
PGWELL (Control)	09/14/2000	<0.90	<6.14	<10.70	<4.16	<4.30	<8.21	<7.46	<4.66	<5.23	<4.15	<24.30	<11.20
CONSTWELL 4 (Indicator)	09/14/2000	<0.82	<5.10	<11.10	<5.21	<4.47	<11.40	<11.10	<5.14	<4.27	<5.35	<26.90	<9.53
CONSTWELL 1 "GG" (Indicator)	09/14/2000	N/A	<5.65	<10.50	<5.30	<4.51	<12.10	<9.27	<5.53	<4.92	<5.85	<23.00	<9.71

"GG" – indicates duplicate sample.

Table 4.2
Sample Type: Groundwater
Analysis: Tritium
Units: pCi/l

Location	Collection Date	H-3
	<u>Required LLD</u> →	<u>2000</u>
PGWELL (Control)	09/14/2000	<552
CONSTWELL 4 (Indicator)	09/14/2000	<553
CONSTWELL 1 “GG” (Indicator)	09/14/2000	<557

“GG” – indicates duplicate sample.

Table 5.1
Sample Type: Sediment
Analysis: Gamma Isotopic
Units: pCi/kg

Location	Collection Date	Cs-134	Cs-137
	<u>Required LLD</u> →	<u>150</u>	<u>180</u>
SEDHAM (Indicator)	11/09/2000	<26.60	<36.20
SEDCONT (Control)	11/09/2000	<30.30	<33.40
SEDHAM "GG" (Indicator)	11/09/2000	<24.00	<31.80
SEDCONT "GG" (Control)	11/09/2000	<28.90	<30.80

"GG" – indicates duplicate sample.

Table 6.1

Sample Type: **Fish**

Analysis: Gamma Isotopic

Units: pCi/kg

Location	Collection Date	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Cs-134	Cs-137
	<u>Required LLD</u> →	<u>130</u>	<u>260</u>	<u>130</u>	<u>130</u>	<u>260</u>	<u>130</u>	<u>150</u>
FISHDOWN (Indicator)	11/02/2000	<15.80	<49.20	<17.10	<16.00	<48.40	<13.80	<12.20
FISHUP (Control)	11/02/2000	<10.60	<43.50	<18.20	<20.90	<44.70	<15.00	<11.60
FISHDOWN “GG” (Indicator)	11/02/2000	<12.00	<36.00	<12.70	<16.20	<41.10	<10.40	<10.30
FISHUP “GG” (Control)	11/02/2000	<12.80	<37.60	<14.00	<16.10	<36.00	<11.10	<13.60

“GG” – indicates duplicate sample.

Table 7.1

Sample Type: **Food Products**

Analysis: Iodine-131 and Gamma Isotopic

Units: pCi/kg

Location	Collection Date	I-131	Cs-134	Cs-137
	<u>Required LLD</u> →	<u>60</u>	<u>60</u>	<u>80</u>
VEG-J (Indicator)	02/08/2000	<49.40	<36.10	<49.60
VEG-CONT (Control)	02/08/2000	<31.80	<36.50	<43.00
VEG-J (Indicator)	05/12/2000	<58.80	<38.20	<32.30
VEG-CONT (Control)	05/12/2000	<45.80	<32.50	<39.40
VEG-J (Indicator)	05/24/2000	<59.70	<19.70	<20.70
VEG-J (Indicator)	08/24/2000	<57.60	<32.40	<27.90
VEG-CONT (Control)	08/24/2000	<36.10	<36.10	<15.20
VEG-J (Indicator)	12/11/2000	<41.60	<38.60	<27.60
VEG-CONT (Control)	12/11/2000	<44.40	<36.30	<50.00

Table 8.1
Sample Type: Special Samples
Analysis: Gamma Isotopic
Units: pCi/kg

Sediment					
Location	Collection Date	Mn-54	Co-60	Cs-134	Cs-137
	<u>Required LLD</u> →	<u>N/A</u>	<u>N/A</u>	<u>150</u>	<u>180</u>
BARGE SLIP	11/09/2000	34.3	35.6	<36.90	65.30
BARGE SLIP “GG”	11/09/2000	N/A	135.0	<30.30	22.70

“GG” – indicates duplicate sample.

Fish								
Location	Collection Date	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Cs-134	Cs-137
	<u>Required LLD</u> →	<u>130</u>	<u>260</u>	<u>130</u>	<u>130</u>	<u>260</u>	<u>130</u>	<u>150</u>
FISHUP (Control)	10/26/2000	<17.90	<51.70	<21.50	<16.60	<41.10	<15.00	<11.20
FISHDOWN (Indicator)	11/05/2000	<13.80	<38.60	<16.60	<16.10	<30.80	<13.90	<12.20

Table 8.1
Sample Type: **Special Samples**
Analysis: Gamma Isotopic
Units: pCi/kg

Venison								
Location	Collection Date	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Cs-134	Cs-137
	<u>Required LLD</u> →	<u>130</u>	<u>260</u>	<u>130</u>	<u>130</u>	<u>260</u>	<u>130</u>	<u>150</u>
GGNS Property	01/15/2000	<11.90	<146.00	<37.40	<14.50	<39.10	<11.30	<13.80
GGNS Property	12/07/2000	<10.00	<30.60	<11.40	<14.20	<34.40	<10.60	<7.16

Food Products (Hay)				
Location	Collection Date	I-131	Cs-134	Cs-137
	<u>Required LLD</u> →	<u>60</u>	<u>60</u>	<u>80</u>
GGNS Property	08/08/2000	<55.40	<59.80	<46.50
GGNS Property	08/08/2000	<56.40	<46.40	<48.60

Table 9.1

Sample Type: Interlaboratory Comparison

Analysis: Gross Beta, Iodine-131 and Gamma Isotopic

Sample Type (units)	Study	Date	Analysis	Known Value ^a	RBS Value	RBS N-Dev ^b	RBS N-Range ^c
Air Filter (pCi/filter)	E2375-125	09/21/00	BETA	72.0 ± 17.3	78.7	1.15	0.118
Charcoal Cartridge (pCi/cartridge)	E2219-125	06/22/00	I-131	72.0 ± 12.5	75.4	0.82	0.139
	E2483-125	12/07/00	I-131	63.0 ± 10.9	67.6	1.26	0.272
Water (pCi/liter)	E2081-125	03/23/00	BETA	112 ± 29.1	80.2	-3.27 ^d	0.042
	E2079-125	03/10/00	CR-51	238 ± 20.6	246	1.16	1.390
			MN-54	159 ± 13.8	152	-1.45	0.223
			CO-58	44.0 ± 8.66	43.1	-0.31	0.307
			FE-59	92 ± 8.7	91.1	-0.31	0.284
			CO-60	116 ± 10.0	112	-1.29	0.407
			ZN-65	196 ± 33.9	185	-0.97	0.211
			I-131	74.0 ± 12.8	68.0	-1.40	0.231
			CS-134	139 ± 12.0	132	-1.66	0.340
			CS-137	128 ± 11.1	126	-0.45	0.185
			CE-141	427 ± 37.0	425	0.19	0.194
	E2080-125 (Duplicate)	03/10/00	CR-51	238 ± 20.6	250	1.75	2.085
			MN-54	159 ± 13.8	156	-0.58	0.371
			CO-58	44.0 ± 8.66	43.0	-0.36	0.272
			FE-59	92.0 ± 8.66	92.3	0.10	0.815
			CO-60	116 ± 10.0	111	-1.49	0.509
			ZN-65	196 ± 33.9	182	-1.21	0.271
			I-131	74.0 ± 12.8	67.0	-1.63	0.327
			CS-134	139 ± 12.0	134	-1.25	0.680
			CS-137	128 ± 11.1	128	0.09	0.369
			CE-141	427 ± 37.0	423	-0.35	1.079

Table 9.1
Sample Type: Interlaboratory Comparison
Analysis: Tritium and Gamma Isotopic

Sample Type (units)	Study	Date	Analysis	Known Value ^a	RBS Value	RBS N-Dev ^b	RBS N-Range ^c
Water (pCi/liter)	E2220-125	06/22/00	H-3	11400 ± 1975	10683	-1.09	0.070
	E2373-125	09/21/00	CR-51	230 ± 23.9	209	-2.68	0.514
			MN-54	89.0 ± 8.66	90.0	0.23	1.122
			CO-58	60.0 ± 8.66	67.0	2.41	0.378
			FE-59	54.0 ± 8.66	57.0	0.88	1.134
			CO-60	246 ± 21.3	229	-2.35	0.480
			ZN-65	134 ± 23.2	128	-0.82	0.573
			I-131	75 ± 13.0	72	-0.59	0.197
			CS-134	128 ± 22.2	109	-2.57	0.508
			CS-137	218 ± 18.9	219	0.21	0.054
			CE-141	191 ± 16.54	175	-2.96	0.495
	E2374-125 (Duplicate)	9/21/00	CR-51	230 ± 23.9	211	-2.34	1.284
			MN-54	89.0 ± 8.66	94	1.59	1.689
			CO-58	60.0 ± 8.66	62	0.54	1.040
			FE-59	54.0 ± 8.66	63	3.04 ^d	0.484
			CO-60	246 ± 21.3	228	-2.49	0.240
			ZN-65	134 ± 23.2	131	-0.39	0.529
			I-131	75 ± 13.0	74	-0.15	0.480
			CS-134	128 ± 22.2	114	-1.94	0.461
			CS-137	218 ± 18.9	215	-0.53	0.271
			CE-141	191 ± 16.54	179	-2.12	0.557

Table 9.1
Sample Type: Interlaboratory Comparison
Analysis: Gamma Isotopic

Sample Type (units)	Study	Date	Analysis	Known Value ^a	RBS Value	RBS N-Dev ^b	RBS N-Range ^c
Sediment (pCi/gram)	E2484-125	12/07/00	CR-51	0.917 ± 0.079	0.959	1.58	1.278
			MN-54	0.278 ± 0.034	0.307	2.59	0.613
			CO-58	0.139 ± 0.012	0.137	-0.49	1.071
			FE-59	0.149 ± 0.018	0.132	-2.82	1.353
			CO-60	0.336 ± 0.029	0.335	-0.06	0.475
			ZN-65	0.269 ± 0.047	0.293	1.57	0.077
			CS-134	0.155 ± 0.013	0.161	1.29	0.122
			CS-137	0.490 ± 0.042	0.508	1.30	0.338
			CE-141	0.649 ± 0.056	0.670	1.14	0.120

NOTES:

- (a) The "known" values are listed with a range reflecting control (3 sigma) limits.
- (b) The normalized deviation from the "known" value is computed from the deviation and the standard error of the mean; ±2.000 is the warning limit and ±3.000 is the control limit. This is a measure of accuracy of the analytical methods.
- (c) The normalized range is computed from the mean range, the control limit, and the standard error of the range; +2.000 is the warning limit and +3.000 is the control limit. This is a measure of precision of the analytical methods.
- (d) The results reported were out of the control limits.

Interlaboratory Comparison Program Exceptions

There were two results out of control limits (3 sigma) for accuracy in the 2000 cross check program. One result was a gamma analysis in water sample and the other result occurred in a gross beta in water sample. The nuclide, Fe-59, was bias high in a gamma analysis, with a normalized deviation of 3.04, with control limits of ± 3.00 . This result is considered conservative. Other Fe-59 analyses during the year were all within acceptable limits.

The second result, gross beta in water, was biased low with a normalized deviation of -3.27 with control limits of ± 3.00 . Gross beta results have shown a downward trend in past analyses. A system efficiency calibration was performed with the water standard on the alpha-beta counter as corrective action.

There is no impact accessed on previously reported data due to these results. Environmental samples are analyzed and reported with a ninety-five percent confidence level that the analytical result with its associated error encompasses the “true” value. Ninety-six percent of RBS environmental crosscheck results were within control limits for accuracy and precision during 2000.