



Randy Crawford
Manager
Regulatory Assurance
225-381-4177

RBG-48221

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ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: 2022 Annual Radiological Environmental Operating Report
River Bend Station – Unit 1
Renewed Operating License No. NPF-47
Docket No. 50-458

Enclosed is the River Bend Station (RBS) Annual Radiological Environmental Operating Report for the period of January 1, 2022, through December 31, 2022. This report is submitted in accordance with the RBS Technical Specifications, Section 5.6.2.

Should you have any questions regarding the enclosed, please contact Randy Crawford, at (225) 381-4177.

Sincerely,

A handwritten signature in black ink, appearing to read 'Randy Crawford', written over a horizontal line.

Randy Crawford

RTC/twf

Enclosure: 2022 Annual Radiological Environmental Operating Report

cc: NRC Senior Resident Inspector – River Bend Station, Unit 1

Enclosure
2022 Annual Radiological Environmental Operating Report



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Annual Radiological Environmental Operating Report**1.0 EXECUTIVE SUMMARY****1.1 Radiological Environmental Monitoring Program**

The Annual Radiological Environmental Operating Report presents data obtained through analyses of environmental samples collected for River Bend Station (RBS) Radiological Environmental Monitoring Program (REMP) for the period January 1 through December 31, 2022. This report fulfills the requirements of RBS Technical Specification 5.6.2 of Appendix A to RBS License Number NPF-47.

All required lower limit of detection (LLD) capabilities were achieved in all sample analyses during 2022, as required by the RBS Technical Requirement Manual (TRM). No measurable levels of radiation above baseline levels attributable to River Bend Station operation were detected in the vicinity of RBS. The 2022 Radiological Environmental Monitoring Program thus substantiated the adequacy of source control and effluent monitoring at River Bend Station with no observed impact of plant operations on the environment.

River Bend Station established the REMP prior to the station's becoming operational 1985 to provide data on background radiation and radioactivity normally present in the area. RBS has continued to monitor the environment by sampling air, water, sediment, fish and food products, as well as measuring direct radiation. RBS also samples milk if milk-producing animals used for human consumption are present within five miles (8 km) of the plant.

The REMP includes sampling indicator and control locations within an approximate 20-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. RBS personnel compare indicator results with control and preoperational results to assess any impact RBS operation might have had on the surrounding environment.

In 2022, environmental samples were collected for radiological analysis. The results of indicator locations were compared with control locations and previous studies. It was concluded that no significant relationship exists between RBS operation and effect on the area around the plant. The review of 2022 data showed radioactivity levels in the environment were undetectable in many locations and near background levels in significant pathways.

1.2 Reporting Levels

No samples equaled or exceeded reporting levels.

Annual Radiological Environmental Operating Report**1.3 Comparison to State and Federal Program**

RBS personnel compared REMP data to state monitoring programs as results became available. Historically, the programs used for comparison have included the U.S. Nuclear Regulatory Commission (NRC) Thermoluminescent Dosimeter (TLD) Direct Radiation Monitoring Network and the Louisiana Department of Environmental Quality – Office of Environmental Compliance (LDEQ-OEC).

The NRC TLD Network Program was discontinued in 1998. Historically these results have compared to those from the RBS REMP. RBS 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 LDEQ-OEC and the RBS REMP entail similar radiological environmental monitoring program requirements. These programs include co-located air samples and splitting or sharing sample media such as water, sediment and fish. Both programs have obtained similar results over previous years.

1.4 Sample Deviations

During 2022, environmental sampling was performed for eight media types addressed in the ODCM and for direct radiation. A total of 328 samples of the 328 scheduled were obtained. Of the scheduled samples, 100 percent were collected and analyzed in accordance with the requirements specified in the ODCM. Attachment 1 contains the listing of sample deviations and actions taken.

1.5 Program Modifications

- There were no program modifications during the reporting period.

Annual Radiological Environmental Operating Report**2.0 INTRODUCTION****2.1 Radiological Environmental Monitoring Program**

River Bend Station 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 applicable 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 River Bend Station.
- Correlating levels of radiation and radioactivity in the environment with radioactive releases from station operation.

2.2 Pathways Monitored

The airborne, direct radiation, waterborne and ingestion pathways are monitored as required by RBS TRM 3.12.1. A description of the REMP utilized to monitor the exposure pathways is described in the attached Tables and Figures.

Section 4.0 of this report provides a discussion of 2022 sampling results with Section 5.0 providing a summary of results for the monitored exposure pathways.

2.3 Land Use Census

RBS conducts a land use census biennially, as required by 3.12.2 of the TRM. The purpose of this census is to identify changes in uses of land within five miles of RBS that would require modifications to the REMP and the Offsite Dose Calculation Manual (ODCM/TRM). The next scheduled land use census will be performed in 2024. Section 4.5 on the report contains a narrative on the results of the 2022 land use census.

3.0 RADIOLOGICAL ENVIRONMENTAL SAMPLING PROGRAM REQUIREMENTS

Table 1: Exposure Pathway – Airborne

Requirement	Sample Point Description Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
<p><u>RADIOIODINE AND PARTICULATES</u> 2 samples from close to the 2 SITE BOUNDARY locations, in different sectors, of the highest calculated annual average ground level D/Q.</p>	<ul style="list-style-type: none"> • AN1 (0.9 km W) - RBS site Hwy 965; 0.4 km south of Activity Center. • AP1 (0.9 km WNW) – Behind River Bend Station Activity Center. 	Continuous sampler operation with sample collection every two weeks, or more frequently if required by dust loading.	<ul style="list-style-type: none"> • Radioiodine Canisters – I-131 analysis every two weeks. • Air Particulate – Gross beta radioactivity analysis following filter change.
<p><u>RADIOIODINE AND PARTICULATES</u> 1 sample from the vicinity of a community having the highest calculated annual average ground level D/Q.</p>	<ul style="list-style-type: none"> • AQS2 (5.8 km NW) - St. Francis Substation on US Hwy. (Bus.) 61 in St. Francisville. 	Continuous sampler operation with sample collection every two weeks, or more frequently if required by dust loading.	<ul style="list-style-type: none"> • Radioiodine Canisters – I-131 analysis every two weeks. • Air Particulate – Gross beta radioactivity analysis following filter change.
<p><u>RADIOIODINE AND PARTICULATES</u> 1 sample from a control location, as for example 15 - 30 km distance and in the least prevalent wind direction.</p>	<ul style="list-style-type: none"> • AGC (17.0 km SE) – Entergy Service Center compound in Zachary. (Control) 	Continuous sampler operation with sample collection every two weeks, or more frequently if required by dust loading.	<ul style="list-style-type: none"> • Radioiodine Canisters – I-131 analysis every two weeks. • Air Particulate – Gross beta radioactivity analysis following filter change.

Table 2: Exposure Pathway – Direct Radiation

Requirement	Sample Point Description Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
<p><u>TLDS</u> One ring of stations, one in each meteorological sector in the general area of the SITE BOUNDARY.</p>	<ul style="list-style-type: none"> • TA1 (1.7 km N) - River Bend Training Center. • TB1 (0.5 km NNE) - Utility pole near River Bend Station cooling tower yard area. • TC1 (1.7 km NE) - Telephone pole at Jct. US Hwy. 61 and Old Highway 61. • TD1 (1.6 km ENE) – Stub pole along WF7, 150m S of Jct. WF7 and US Hwy. 61. • TE1 (1.3 km E) – Stub pole along WF7, 1 km S of Jct. WF7 and US Hwy. 61. • TF1 (1.3 km ESE) – Stub pole along WF7, 1.6 km S of Jct. WF7 and US Hwy. 61. • TG1 (1.6 km SE) – Stub pole along WF7, 2 km S of Jct. WF7 and US Hwy. 61. • TH1 (1.7 km SSE) – Stub pole at power line crossing of WF7 (near Grants Bayou). • TJ1 (1.5 km S) – Stub pole near River Bend Station Gate #23 on Powell Station Road (LA Hwy. 965). 	<p>Quarterly</p>	<ul style="list-style-type: none"> • mR exposure quarterly.

Table 2: Exposure Pathway – Direct Radiation

Requirement	Sample Point Description Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
<p><u>TLDS</u> One ring of stations, one in each meteorological sector in the general area of the SITE BOUNDARY.</p>	<ul style="list-style-type: none"> • TK1 (0.9 km SSW) – Utility pole on Powell Station Road (LA Hwy. 965), 20 m S of River Bend Station River Access Road. • TL1 (1.0 km SW) – First utility pole on Powell Station Road (LA Hwy. 965) S of former Illinois Central Gulf RR crossing. • TM1 (0.9 km WSW) - Third utility pole on Powell Station Road (LA Hwy. 965) N of former Illinois Central Gulf RR crossing. • TN1 (0.9 km W) – Utility pole along Powell Station Road (LA Hwy. 965), near garden and AN1 air sampler location. • TP1 (0.9 km WNW) - Behind River Bend Station Activity Center at AP1 air sampler location. • TQ1 (0.6 km NW) – Across from MA-1 on RBS North Access Road. • TR1 (0.8 km NNW) – River Bend Station North Access Road across from Main Plant entrance. 	<p>Quarterly</p>	<ul style="list-style-type: none"> • mR exposure quarterly.

Table 2: Exposure Pathway – Direct Radiation

Requirement	Sample Point Description Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
<p><u>TLDS</u> The balance of the stations (8) to be placed in special interest areas such as population centers, nearby residences, schools, and in 1 or 2 areas to serve as control locations.</p>	<ul style="list-style-type: none"> • TAC (15.8 km N) – Utility pole at Jct. of US Hwy. 61 and LA Hwy. 421, 7.9 km north of Bains. (Control) • TCS (12.3 km NE) – Utility pole at gate to East Louisiana State Hospital in Jackson. (Special) • TEC (16.0 km E) – Stub pole at jct. of Hwy. 955 and Greenbrier Road, 4.8 km North of Jct. of Hwys 955 and 964. (Control) • TGS (17.0 km SE) – Entergy Service Center compound in Zachary. (Special) • TNS (6.0 km W) – Utility pole with electrical meter at west bank ferry landing (LA Hwy. 10). (Special) • TQS1 (4.0 km NW) – Utility pole front of Pentecostal church (opposite West Feliciana Parish Hospital) near Jct. US Hwy. 61 and Commerce Street. (Special) • TQS2 (5.8 km NW) – St. Francis Substation on business US Hwy. 61 in St. Francisville. (Special) • TRS (9.2 km NNW) - Stub pole at Jct. of US Hwy. 61 and WF2 near Bains (West Feliciana High School). (Special) 	<p>Quarterly</p>	<ul style="list-style-type: none"> • mR exposure quarterly.

Table 3: Exposure Pathway – Waterborne

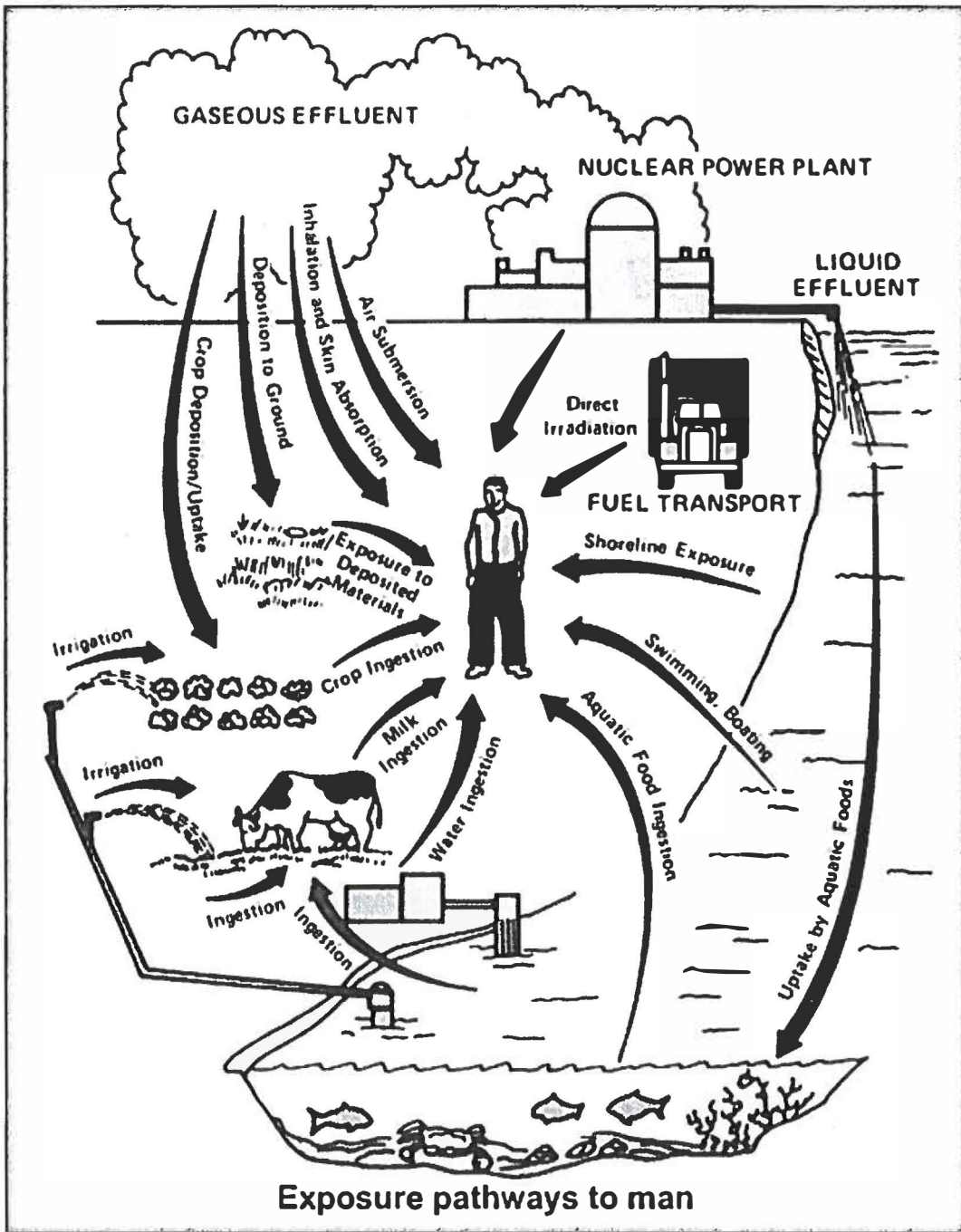
Requirement	Sample Point Description Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
<p><u>SURFACE WATER</u> 1 sample upstream and 1 sample downstream.</p>	<ul style="list-style-type: none"> • SWU (5.0 km W) - Mississippi River about 4 km upstream from the plant liquid discharge outfall, near LA Hwy. 10 ferry crossing. • SWD (7.75 km S) - Mississippi River about 4 km downstream from plant liquid discharge outfall, near paper mill. 	Grab samples quarterly	<ul style="list-style-type: none"> • Gamma isotopic analysis and tritium analysis quarterly.
<p><u>GROUNDWATER</u> Samples from 1 or 2 sources only if likely to be affected.</p>	<ul style="list-style-type: none"> • WU (~470 m NNE) - Upland Terrace Aquifer well upgradient from plant. • WD (~470 m SW) – Upland Terrace Aquifer well downgradient from plant. 	Semiannually	<ul style="list-style-type: none"> • Gamma isotopic and tritium analysis semiannually.
<p><u>SEDIMENT FROM SHORELINE</u> 1 sample from downstream area with existing or potential recreational value.</p>	<ul style="list-style-type: none"> • SEDD (7.75 km S) – Mississippi River about 4 km downstream from plant liquid discharge outfall, near paper mill. 	Annually	<ul style="list-style-type: none"> • Gamma isotopic analysis annually.

Table 4: Exposure Pathway – Ingestion

Requirement	Sample Point Description Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
<p><u>MILK</u></p> <ul style="list-style-type: none"> If commercially available, 1 sample from milking animals within 8 km distant where doses are calculated to be greater than 1 mrem per year. 1 sample from milking animals at a control location 15 – 30 km distant when an indicator location exists. 	<ul style="list-style-type: none"> Currently, no available milking animals within 8 km of RBS. 	<p>Quarterly when animals are on pasture.</p>	<p>Gamma isotopic and I-131 analysis quarterly when animals are on pasture.</p>
<p><u>FISH AND INVERTEBRATES</u></p> <ul style="list-style-type: none"> 1 sample of a commercially and/or recreationally important species in vicinity of plant discharge area. 1 sample of similar species in area not influenced by plant discharge. 	<ul style="list-style-type: none"> FD (7.75 km S) - One sample of a commercially and/or recreationally important species from downstream area influenced by plant discharge. FU (4.0 km WSW) - One sample of a commercially and/or recreationally important species from upstream area not influenced by plant discharge. 	<p>Annually</p>	<p>Gamma isotopic analysis on edible portions annually</p>
<p><u>FOOD PRODUCTS</u></p> <ul style="list-style-type: none"> 1 sample of one type of broadleaf vegetation grown near the SITE BOUNDARY location of highest predicted annual average ground level D/Q if milk sampling is not performed. 1 sample of similar broadleaf vegetation grown 15 – 30 km distant, if milk sampling is not performed. 	<ul style="list-style-type: none"> GN1 (0.9 km W) – Sampling will be performed in accordance with Table 3.12.1-1 Section 4.a of the Technical Requirements Manual. GQC (32.0 km NW) - One sample of similar vegetables from LA State Penitentiary at Angola. (Control) 	<p>Quarterly during the growing season.</p>	<p>Gamma isotopic and I-131 analysis quarterly.</p>

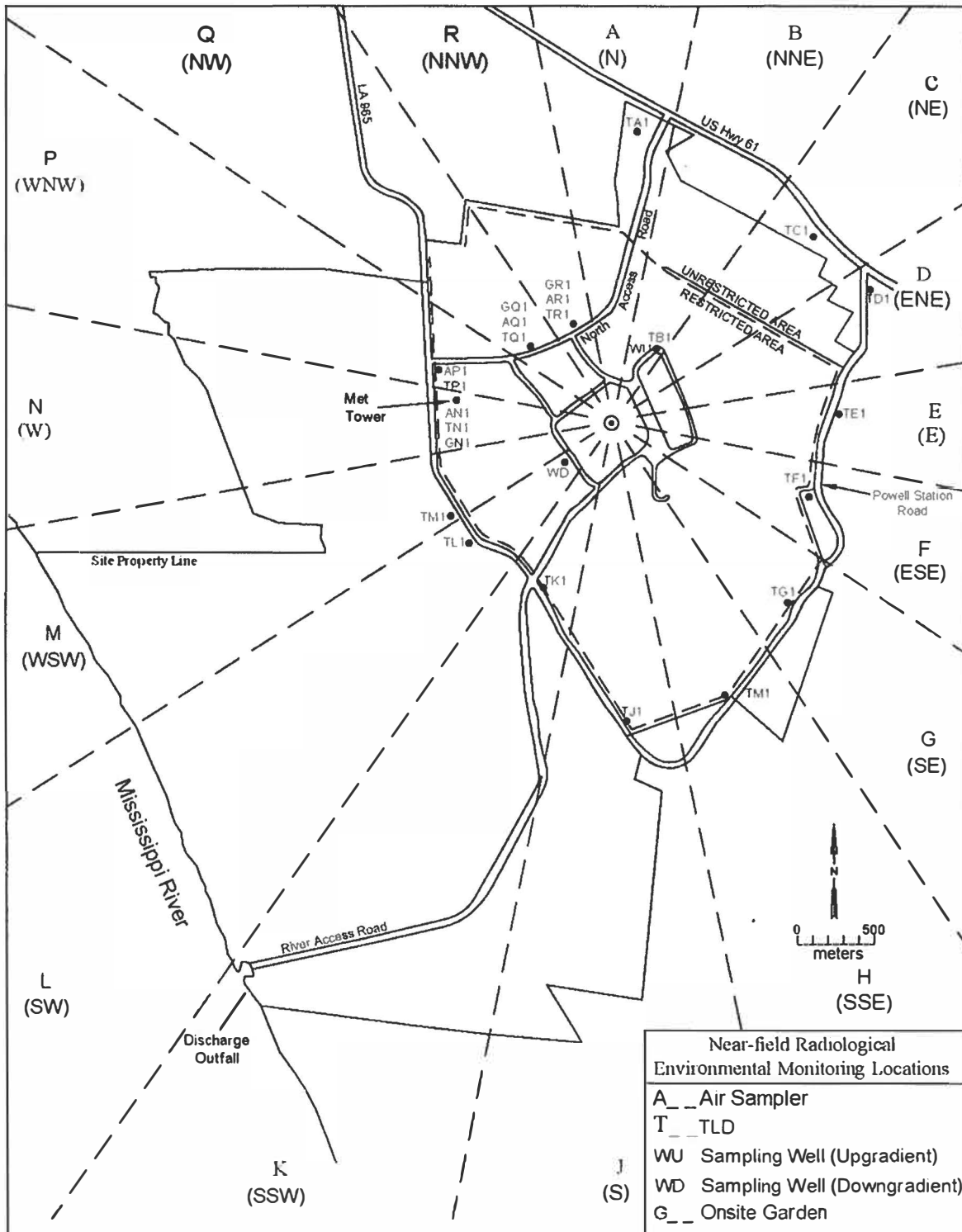
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Figure 1: Exposure Pathway



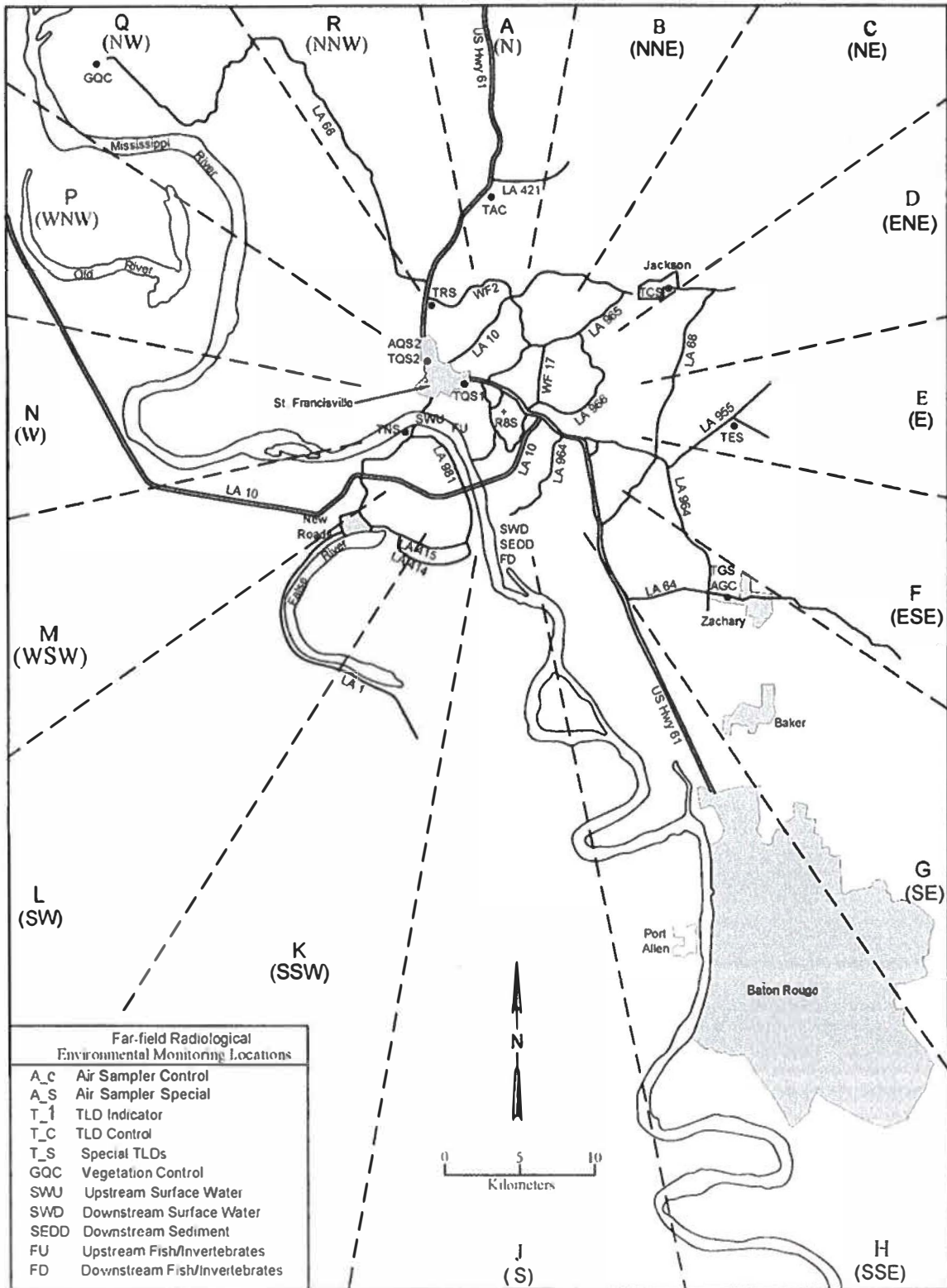
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Figure 2: Sample Collection Sites – Near Field



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Figure 3: Sample Collection Sites - Far Field



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4.0 INTERPRETATION AND TRENDS OF RESULTS

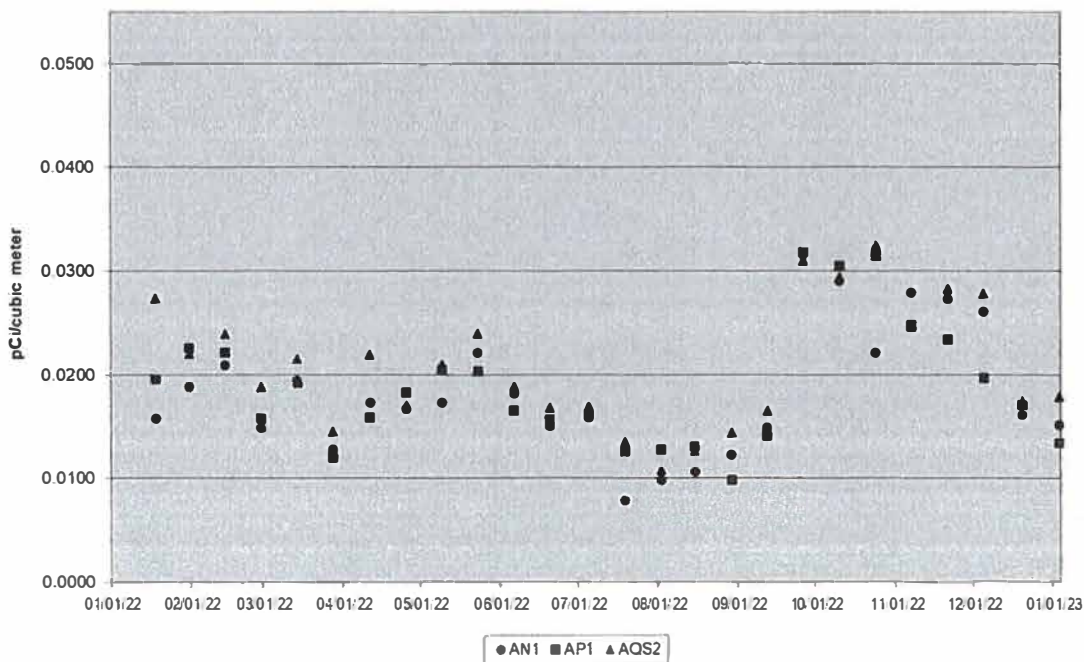
4.1 Air Particulate and Radioiodine Sample Results

In 2022 there were no samples above the LLD for I-131. Indicator gross beta air particulate results for 2022 were comparable to results obtained from 2012-2021 of the operational REMP. Also, the 2022 gross beta annual average was less than the average for preoperational levels. Results are reported as annual average picocuries per cubic meter (pCi/m³).

<u>Monitoring Period</u>	<u>Result</u>
2012 – 2021 (Minimum Value)	0.016
2022 Average Value	0.020
2012 – 2021 (Maximum Value)	0.024
Preoperational	0.030

Gross beta activity is attributed to naturally occurring radionuclides. Table 6, which include gross beta concentrations and provide a comparison of the indicator and control means and ranges emphasizes the consistent trends seen in this pathway to support the presence of naturally occurring activity. Therefore, it can be concluded that the airborne pathway continues to be unaffected by River Bend Station operations.

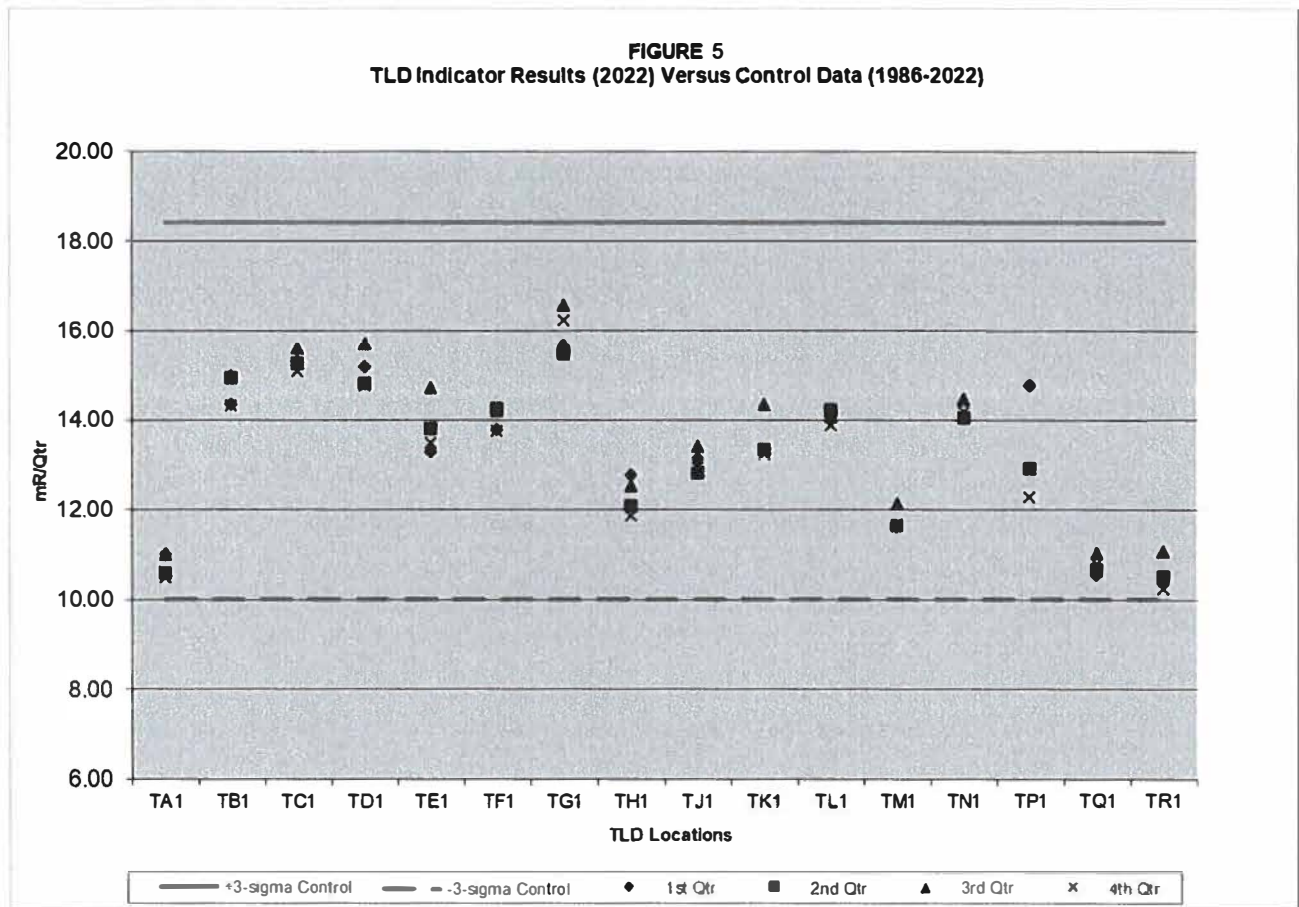
FIGURE 4
Gross Beta Indicator Results (2022)



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4.2 Thermoluminescent Dosimetry (TLD) Sample Results

River Bend Station reports measured dose as net exposure (field reading less transit reading) normalized to 90 days and relies on comparison of the indicator locations to the control as a measure of plant impact. River Bend Station's comparison of the indicator and special interest area TLD results to the control, as seen in Table 6, identified no noticeable trend that would indicate that the ambient radiation levels are being affected by plant operations. In addition, the indicator value of 13.3 millirem (mrem) shown in the TLD radiation dose comparison graph below shows the 2022 concentration is comparable to historic results. Overall, River Bend Station concluded that the ambient radiation levels are not being affected by plant operations.



4.3 Waterborne Sample Results

Analytical results for 2022 surface water and groundwater water samples were similar to those reported in previous years. Gamma radionuclides and tritium analytical results for 2022 waterborne samples were below the ODCM-required LLD similar to those reported in previous years. These results are further explained below.

Annual Radiological Environmental Operating Report**4.3.1 Surface Water Results**

Samples were collected from one indicator and one control location and analyzed for gamma radionuclides and tritium. Tritium and gamma radionuclides were below detectable limits which is consistent with results seen in previous operational years. Therefore, the operation of River Bend Station had no definable impact on this waterborne pathway during 2022.

4.3.2 Groundwater Results

Samples were collected from one indicator and one control location. Groundwater samples were analyzed for gamma radionuclides and tritium. Gamma radionuclides and tritium concentrations were below the LLD limits at the indicator and control locations. The operation of River Bend Station had no definable impact on this waterborne pathway during 2022.

4.3.3 Sediment Sample Results

Sediment samples were collected from one indicator and one control location in 2022 and analyzed for gamma radionuclides. Gamma radionuclides were below the LLD limits at both indicator and control locations. River Bend Station operations had no significant impact on the environment or public by this waterborne pathway.

4.4 Ingestion Sample Results**4.4.1 Fish Sample Results**

Fish samples were collected from one indicator and one control location and analyzed for gamma radionuclides. In 2022, gamma radionuclides were below detectable limits which are consistent with the preoperational monitoring period and operational results. Therefore, based on these measurements, River Bend Station operations had no significant radiological impact upon the environment or public by this ingestion pathway.

4.4.2 Food Products Sample Results

The REMP has detected radionuclides prior to 1990 that are attributable to other sources. These include the radioactive plume release due to reactor core degradation at Chernobyl Nuclear Power Plant in 1986 and atmospheric weapons testing.

In 2022, food products samples were collected when available from one indicator and one control location and analyzed for gamma radionuclides. The 2022 levels remained undetectable, as has been the case in previous years. Therefore, based on these measurements, River Bend Station operations had no significant radiological impact upon the environment or public by this ingestion pathway.

Annual Radiological Environmental Operating Report**4.4.3 Milk Sample Results**

In 2022 milk samples within five miles (8 km) of River Bend Station were unable to be collected due to the unavailability of milk-producing animals used for human consumption. The River Bend Station Technical Requirements Manual requires collection of milk samples if available commercially within 8 km (5 miles) of the plant. River Bend Station personnel collected food product samples to monitor the ingestion pathway, as specified in River Bend Station Technical Requirements Manual Table 3.12.1-1, because of milk unavailability. Food product sample results are in section 4.4.2.

4.5 Land Use Census Results

The latest land use census (performed in 2022) did not identify any new locations that yielded a calculated dose or dose commitment greater than those currently calculated (see Table 5).

A garden census is not conducted pursuant to the footnote in the TRM (TLCO 3.12.2) that allows the sampling of broad leaf vegetation in the highest calculated average ground-level D/Q sector (Sector N) near site boundary in lieu of the garden census.

The land use census identified no changes in the new resident census.

There were no changes in the milk cows or food products in 2022.

Table 5: Land Use Census –2022 Nearest Residence And Milk Animal Within Five Miles

Sector	Direction	Nearest Residence	Range (Unit)	Nearest Milk Animal	Range (Unit)	Comment
A	N	5637 Hwy 61 St. Francisville, LA 70775	1.7	-	-	2
B	NNE	4549 Old Hwy 61 St. Francisville, LA 70775	1.4	-	-	2
C	NE	4553 Old Hwy 61 St. Francisville, LA 70775	1.5	-	-	2
D	ENE	12657 Powell Station Rd. St. Francisville, LA 70775	1.4	-	-	2
E	E	4635 Hwy 61 St. Francisville, LA 70775	2.4	-	-	2
F	ESE	12019 Fairview Way Jackson, LA 70748	2.6	-	-	2
G	SE	3319 Hwy 964 Jackson, LA 70748	3.7	-	-	2
H	SSE	11813 Powell Station Rd. St. Francisville, LA 70775	1.7	-	-	2
J	S	11649 Powell Station Rd. St. Francisville, LA 70775	1.8	-	-	2
K	SSW	8909 Hwy 981 New Roads, LA 70760	6.6	-	-	2
L	SW	--		-	-	1, 2
M	WSW	8809 Hwy 981 New Roads, LA 70760	5.1	-	-	2
N	W	--		-	-	1, 2
P	WNW	10426 Old Field Rd. St. Francisville, LA 70775	3.7	-	-	2
Q	NW	9537 Hwy 965 St. Francisville, LA 70775	1.3	-	-	2
R	NNW	9794 Hwy 965 St. Francisville, LA 70775	1.6	-	-	2

#	Comment
1	No Residence was located within a five-mile (8 km) radius of River Bend Station 3.
2	No Milk animals were found located within a five-mile (8 km) radius of River Bend Station 3.

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4.6 Interlaboratory Comparison Results

Attachment 3 contains result summary for Interlaboratory Comparison program for Teledyne Brown Engineering to fulfill the requirements of River Bend Station's Technical Requirements Manual 3.12.3.

5.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

1. Table 6, Radiological Environmental Monitoring Program Summary, summarizes data for the 2022 REMP program.

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Table 6: Radiological Environmental Monitoring Program Summary

Sample Type (Units)	Type / Number of Analyses ⁽¹⁾	LLD ⁽²⁾	Indicator Locations Mean (F) ⁽³⁾ [Range]	Location ⁽⁴⁾ [Highest Annual Mean]	Mean (F) ⁽³⁾ [Range]	Control Locations Mean (F) ⁽³⁾ [Range]	Number of Non Routine Results ⁽⁵⁾
Air Particulates (pCi/m ³)	GB / 104	0.01	0.019 (78/78) [0.008 - 0.033]	AQS2 (5.8 km NW)	0.020 (26/26) [0.012 - 0.033]	0.020 (26/26) [0.012 - 0.030]	0
Airborne Iodine (pCi/m ³)	I-131 / 104	0.07	< LLD	N/A	N/A	< LLD	0
Indicator TLDs (mR/Qtr)	Gamma / 64	⁽⁶⁾	13.3 (64/64) [10.2 - 16.6]	TG1 (1.6 km SE)	16.0 (4/4) [15.5 - 16.6]	N/A	0
Special Interest TLDs (mR/Qtr)	Gamma / 24	⁽⁶⁾	13.8 (24/24) [12.1 - 16.1]	TGS (17.0 km SE)	15.5 (4/4) [15.1 - 16.1]	N/A	0
Control TLDs (mR/Qtr)	Gamma / 8	⁽⁶⁾	N/A	TAC (15.8 km N)	15.0 (4/4) [14.2 - 15.4]	14.3 (8/8) [13.1 - 15.4]	0
Surface Water (pCi/L)	H-3 / 8	700	< LLD	N/A	N/A	< LLD	0
	GS / 8						
	Mn-54	15	< LLD	N/A	N/A	< LLD	0
	Co-58	15	< LLD	N/A	N/A	< LLD	0
	Fe-59	30	< 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
	Nb-95	15	< LLD	N/A	N/A	< LLD	0
	I-131	15	< LLD	N/A	N/A	< LLD	0
	Zr-95	30	< 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	

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Table 6: Radiological Environmental Monitoring Program Summary

Sample Type (Units)	Type / Number of Analyses ⁽¹⁾	LLD ⁽²⁾	Indicator Locations Mean (F) ⁽³⁾ [Range]	Location ⁽⁴⁾ [Highest Annual Mean]	Mean (F) ⁽³⁾ [Range]	Control Locations Mean (F) ⁽³⁾ [Range]	Number of Non Routine Results ⁽⁵⁾
Groundwater (pCi/L)	H-3 / 4	2000	< LLD	N/A	N/A	< LLD	0
	GS / 4						
	Mn-54	15	< LLD	N/A	N/A	< LLD	0
	Co-58	15	< LLD	N/A	N/A	< LLD	0
	Fe-59	30	< 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
	Nb-95	15	< LLD	N/A	N/A	< LLD	0
	I-131	15	< LLD	N/A	N/A	< LLD	0
	Zr-95	30	< 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	

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Table 6: Radiological Environmental Monitoring Program Summary

Sample Type (Units)	Type / Number of Analyses ⁽¹⁾	LLD ⁽²⁾	Indicator Locations Mean (F) ⁽³⁾ [Range]	Location ⁽⁴⁾ [Highest Annual Mean]	Mean (F) ⁽³⁾ [Range]	Control Locations Mean (F) ⁽³⁾ [Range]	Number of Non Routine Results ⁽⁵⁾
Sediment (pCi/kg dry)	GS / 2						
	Cs-134	150	< LLD	N/A	N/A	< LLD	0
	Cs-137	180	< LLD	N/A	N/A	< LLD	0
Fish (pCi/kg wet)	GS / 2						
	Mn-54	130	< LLD	N/A	N/A	< LLD	0
	Co-58	130	< LLD	N/A	N/A	< LLD	0
	Fe-59	260	< 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 wet)	GS / 8						
	I-131	60	< LLD	N/A	N/A	< LLD	0
	Cs-134	60	< LLD	N/A	N/A	< LLD	0
	Cs-137	80	< LLD	N/A	N/A	< LLD	0

LEGEND:

⁽¹⁾ - GB = Gross beta; I-131 = Iodine-131; H-3 = Tritium; GS = Gamma scan.

⁽²⁾ - LLD = Required lower limit of detection based on River Bend Station TRM.

⁽³⁾ - Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parenthesis (F).

⁽⁴⁾ - Locations are specified (1) by name and (2) direction relative to reactor site.

⁽⁵⁾ - 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.

⁽⁶⁾ - LLD is not defined in River Bend Station TRM.

Interlaboratory Comparison Program Results

Table 7: Sample Deviations Table

Comment No.	Sample Media Affected	Sample Location	Date	Problem	Evaluation / Actions
1	Air Sample	AR1 AQ1 AP1 AN1	07/19/2022	Power Outage	During the performance of REMP-3, it was noted that air samplers at locations AR1, AQ1, AP1, and AN1 lost power for three hours and thirty-three minutes. This was caused by a loss of Grant Substation during a severe thunderstorm event. AR1, AQ1, and AP1 resumed normal operation after power restoration, and it was verified that sufficient sample volume was obtained for the period. Due to an unknown error, AN1 did not resume normal operation and an insufficient sample volume was collected for the period. The digital unit on the sampler was reset and it returned to normal operation with no further issues. These events will be documented in the 2022 AREOR as sample deviations. No further actions are needed at this time. (CR-RBS-2022-04115)
2	Air Sample	AGC AR1 AQ1 AP1 AN1	08/04/2022	Power Outage	During the performance of REMP-3, several air samplers logged power outages during the sample period. The sampler at location AGC logged a 0-minute power outage on 7/22/22 06:09. The samplers at locations AR1, AQ1, AP1, and AN1 logged power outages on 7/24/22 17:16 for a duration of 4 hours and 20 minutes. These temporary outages were caused by severe weather events. All samples obtained had sufficient sample volume to meet the required LLD for the period. These events will be reported in the 2022 AREOR as sample deviations. No further actions are needed at this time. (CR-RBS-2022-04467)
3	Air Sample	AR1 AQ1 AP1 AN1	09/13/2022	Power Outage	During the performance of REMP-3 on 09/12/22, it was noted that REMP air samplers at locations AR1, AQ1, AP1, and AN1 experienced a loss of power on 09/01/22 2308. The duration of the power outage was approximately two hours and thirty-five minutes. This outage was caused by a loss of Grant Substation power documented previously in CR-RBS-2022-5082. It was verified that sufficient sample volumes were obtained to meet the required LLD. This event will be reported in the 2022 AREOR as a sample deviation. No further actions are needed at this time. (CR-RBS-2022-05300)

Interlaboratory Comparison Program Results

Table 7: Sample Deviations Table

Comment No.	Sample Media Affected	Sample Location	Date	Problem	Evaluation / Actions
4	Air Sample	AGC	10/11/2022	Power Outage	<p>During the performance of REMP-3, it was discovered that the REMP air sampler at location AGC logged a power outage on 09/26/22 1157 for a duration of three hours and fifty-five minutes. The air sampler was operating normally on discovery of the outage event, and it was verified that a sufficient sample volume was obtained to meet the required LLD. This condition will be reported in the 2022 AREOR as a sample deviation. No further actions are needed at this time. (CR-RBS-2022-05853)</p>
5	TLD	TAC	02/23/2023	TLD not processed in timely manner	<p>During the performance of the REMP-2 surveillance, it was identified that the result for one control TLD, #3740 for location TAC, was missing from the vendor processing report. The vendor noted that TLD#3276 was received instead. Further investigation revealed that the vendor performing the TLD collection/deployment for REMP-1 accidentally confused the 4th Qtr. 2022 TAC TLD with the 1st Qtr. 2023 TLD. This resulted in the 4th Qtr. TLD being redeployed at location TAC and the unexposed TLD was returned to the vendor for processing in its place. Results for this TLD will not be available during the performance of REMP-2, WO-53021025.</p> <p>No other actions are required except documentation by this condition report as an Environmental Deviation to be included in the Annual Radiological Environmental Operating Report for year 2022. Such deviations are permitted in accordance with RBS TRM, Table 3.12.1-1, note (a). (CR-RBS-2023-01696)</p> <p>NOTE: TLD #3740 was retrieved and processed the following quarter and the reported result is the 90-day normalized dose for the period.</p>

Monitoring Results Tables

Table 8: Air Particulate Data Table

Analysis: Gross Beta		Units: pCi/m ³			
Start Date	End Date	AN1 (Indicator)	AP1 (Indicator)	AQS2 ⁽¹⁾ (Indicator)	AGC (Control)
REQUIRED LLD →		0.01	0.01	0.01	0.01
01/04/2022	01/18/2022	0.016	0.020	0.024	0.023
01/18/2022	01/31/2022	0.019	0.023	0.016	0.023
01/31/2022	02/14/2022	0.021	0.022	0.021	0.019
02/14/2022	02/28/2022	0.015	0.016	0.017	0.017
02/28/2022	03/14/2022	0.019	0.019	0.022	0.022
03/14/2022	03/28/2022	0.013	0.012	0.014	0.013
03/28/2022	04/11/2022	0.017	0.016	0.020	0.021
04/11/2022	04/25/2022	0.017	0.018	0.019	0.019
04/25/2022	05/09/2022	0.017	0.021	0.018	0.015
05/09/2022	05/23/2022	0.022	0.020	0.019	0.021
05/23/2022	06/06/2022	0.018	0.017	0.018	0.020
06/06/2022	06/20/2022	0.015	0.016	0.013	0.014
06/20/2022	07/05/2022	0.016	0.016	0.017	0.016
07/05/2022	07/19/2022	0.008 ⁽²⁾	0.013 ⁽²⁾	0.014	0.014
07/19/2022	08/02/2022	0.010	0.013	0.014	0.012
08/02/2022	08/15/2022	0.011 ⁽³⁾	0.013 ⁽³⁾	0.012	0.013 ⁽³⁾
08/15/2022	08/29/2022	0.012	0.010	0.012	0.013
08/29/2022	09/12/2022	0.015	0.014	0.014	0.018
09/12/2022	09/26/2022	0.032 ⁽⁴⁾	0.032 ⁽⁴⁾	0.033	0.030
09/26/2022	10/10/2022	0.029	0.031	0.028	0.029
10/10/2022	10/24/2022	0.022	0.032	0.031	0.027 ⁽⁵⁾
10/24/2022	11/07/2022	0.028	0.025	0.026	0.028
11/07/2022	11/21/2022	0.027	0.023	0.028	0.025
11/21/2022	12/05/2022	0.026	0.020	0.029	0.025
12/05/2022	12/20/2022	0.016	0.017	0.016	0.013
12/20/2022	01/03/2023	0.015	0.013	0.016	0.017

⁽¹⁾ Station with highest annual mean.

⁽²⁾ See Attachment 1, Table 7, Sample Deviations Table, Comment #1

⁽³⁾ See Attachment 1, Table 7, Sample Deviations Table, Comment #2

⁽⁴⁾ See Attachment 1, Table 7, Sample Deviations Table, Comment #3

⁽⁵⁾ See Attachment 1, Table 7, Sample Deviations Table, Comment #4

Monitoring Results Tables

Table 9: Radioiodine Cartridge Data Table

Analysis: I-131		Units: pCi/m ³			
Start Date	End Date	AN1 (Indicator)	AP1 (Indicator)	AQS2 (Indicator)	AGC (Control)
REQUIRED LLD →		0.07	0.07	0.07	0.07
01/04/2022	01/18/2022	< 0.008	< 0.020	< 0.019	< 0.008
01/18/2022	01/31/2022	< 0.013	< 0.023	< 0.010	< 0.024
01/31/2022	02/14/2022	< 0.010	< 0.017	< 0.017	< 0.007
02/14/2022	02/28/2022	< 0.012	< 0.023	< 0.023	< 0.010
02/28/2022	03/14/2022	< 0.010	< 0.023	< 0.024	< 0.010
03/14/2022	03/28/2022	< 0.013	< 0.015	< 0.015	< 0.007
03/28/2022	04/11/2022	< 0.013	< 0.018	< 0.019	< 0.008
04/11/2022	04/25/2022	< 0.008	< 0.018	< 0.019	< 0.012
04/25/2022	05/09/2022	< 0.006	< 0.012	< 0.012	< 0.006
05/09/2022	05/23/2022	< 0.011	< 0.017	< 0.017	< 0.007
05/23/2022	06/06/2022	< 0.008	< 0.019	< 0.019	< 0.015
06/06/2022	06/20/2022	< 0.023	< 0.023	< 0.010	< 0.023
06/20/2022	07/05/2022	< 0.006	< 0.014	< 0.006	< 0.014
07/05/2022	07/19/2022	< 0.035 ⁽¹⁾	< 0.015 ⁽¹⁾	< 0.015	< 0.022
07/19/2022	08/02/2022	< 0.011	< 0.017	< 0.017	< 0.007
08/02/2022	08/15/2022	< 0.010 ⁽²⁾	< 0.022 ⁽²⁾	< 0.022	< 0.012 ⁽²⁾
08/15/2022	08/29/2022	< 0.015	< 0.015	< 0.006	< 0.010
08/29/2022	09/12/2022	< 0.009	< 0.020	< 0.020	< 0.009
09/12/2022	09/26/2022	< 0.014 ⁽³⁾	< 0.018 ⁽³⁾	< 0.018	< 0.008
09/26/2022	10/10/2022	< 0.020	< 0.020	< 0.009	< 0.011
10/10/2022	10/24/2022	< 0.016	< 0.018	< 0.018	< 0.008 ⁽⁴⁾
10/24/2022	11/07/2022	< 0.014	< 0.019	< 0.019	< 0.008
11/07/2022	11/21/2022	< 0.010	< 0.023	< 0.023	< 0.007
11/21/2022	12/05/2022	< 0.024	< 0.024	< 0.011	< 0.010
12/05/2022	12/20/2022	< 0.016	< 0.009	< 0.020	< 0.021
12/20/2022	01/03/2023	< 0.007	< 0.016	< 0.017	< 0.007

⁽¹⁾ See Attachment 1, Table 7, Sample Deviations Table, Comment #1

⁽²⁾ See Attachment 1, Table 7, Sample Deviations Table, Comment #2

⁽³⁾ See Attachment 1, Table 7, Sample Deviations Table, Comment #3

⁽⁴⁾ See Attachment 1, Table 7, Sample Deviations Table, Comment #4

Monitoring Results Tables

Table 10: Thermoluminescent Dosimeters – Indicators

Analysis: Gamma Dose			Units: mrem/Std. Qtr.		
Station	1st Qtr 2022	2nd Qtr 2022	3rd Qtr 2022	4th Qtr 2022	Annual Mean 2022
TA1	11.0	10.6	11.0	10.5	10.8
TB1	14.3	15.0	15.0	14.3	14.7
TC1	15.3	15.3	15.6	15.1	15.3
TD1	15.2	14.8	15.7	14.7	15.1
TE1	13.3	13.8	14.7	13.4	13.8
TF1	13.8	14.3	14.2	13.7	14.0
TG1⁽¹⁾	15.7	15.5	16.6	16.1	16.0
TH1	12.8	12.1	12.5	11.8	12.3
TJ1	13.2	12.8	13.4	12.9	13.1
TK1	13.3	13.3	14.4	13.2	13.6
TL1	14.1	14.2	14.1	13.8	14.1
TM1	11.6	11.7	12.1	11.5	11.7
TN1	14.0	14.1	14.5	14.1	14.2
TP1	14.8	12.9	12.9	12.2	13.2
TQ1	10.5	10.7	11.1	10.7	10.7
TR1	10.4	10.5	11.1	10.2	10.5

⁽¹⁾ Indicator station with highest annual mean.

Monitoring Results Tables

Table 11: Thermoluminescent Dosimeters – Special Interest Areas

Analysis: Gamma Dose			Units: mrem/Std. Qtr.		
Station	1st Qtr 2022	2nd Qtr 2022	3rd Qtr 2022	4th Qtr 2022	Annual Mean 2022
TCS	12.4	12.1	12.9	12.6	12.5
TGS⁽¹⁾	15.4	15.1	16.1	15.3	15.5
TNS	13.3	12.6	13.9	13.0	13.2
TRS	14.2	14.0	14.3	13.8	14.1
TQS1	14.9	14.8	15.5	14.3	14.9
TQS2	12.6	12.2	13.1	12.3	12.5

⁽¹⁾ Special interest station with highest annual mean.

Table 12: Thermoluminescent Dosimeters – Control

Analysis: Gamma Dose			Units: mrem/Std. Qtr.		
Station	1st Qtr 2022	2nd Qtr 2022	3rd Qtr 2022	4th Qtr 2022	Annual Mean 2022
TAC⁽¹⁾	15.4	15.0	15.4	14.2	15.0
TEC	13.2	13.1	14.2	13.6	13.5

⁽¹⁾ Control station with highest annual mean.

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Monitoring Results Tables

Table 13: Surface Water – Gamma

		Analysis: Gamma Isotopic						Units: pCi/L						
Location	Start Date	End Date	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	I-131	Zr-95	Cs-134	Cs-137	Ba-140	La-140
REQUIRED LLD →			15	15	30	15	30	15	15	30	15	18	60	15
SWD (Indicator)	02/09/2022	02/09/2022	< 7.20	< 7.93	< 15.1	< 8.82	< 12.6	< 6.75	< 11.6	< 12.5	< 7.81	< 9.71	< 37.1	< 9.80
SWU (Control)	02/09/2022	02/09/2022	< 7.96	< 7.98	< 15.3	< 5.52	< 14.5	< 7.19	< 13.7	< 13.5	< 6.39	< 6.07	< 29.2	< 12.1
SWD (Indicator)	06/03/2022	06/03/2022	< 5.21	< 7.21	< 13.2	< 6.03	< 8.40	< 7.31	< 8.84	< 11.9	< 6.77	< 5.73	< 28.1	< 11.1
SWU (Control)	06/03/2022	06/03/2022	< 6.29	< 6.11	< 14.9	< 5.55	< 13.5	< 7.30	< 8.18	< 11.7	< 6.36	< 7.17	< 26.9	< 11.1
SWD (Indicator)	08/15/2022	08/15/2022	< 1.38	< 1.66	< 3.42	< 1.48	< 2.87	< 1.76	< 14.8	< 2.96	< 1.59	< 1.37	< 20.9	< 7.20
SWU (Control)	08/15/2022	08/15/2022	< 1.51	< 1.51	< 4.07	< 1.48	< 3.02	< 1.73	< 14.3	< 3.09	< 1.49	< 1.40	< 20.9	< 7.77
SWD (Indicator)	11/02/2022	11/02/2022	< 2.62	< 2.58	< 5.68	< 2.74	< 5.26	< 2.91	< 8.47	< 4.86	< 3.15	< 2.55	< 18.9	< 7.18
SWU (Control)	11/02/2022	11/02/2022	< 2.82	< 2.56	< 6.11	< 3.39	< 6.05	< 2.74	< 8.10	< 5.08	< 2.83	< 2.76	< 19.1	< 6.77

Monitoring Results Tables

Table 14: Surface Water – Tritium

Analysis: H-3		Units: pCi/L	
Location	Start Date	End Date	H-3
REQUIRED LLD →			2000
SWD (Indicator)	02/09/2022	02/09/2022	< 525
SWU (Control)	02/09/2022	02/09/2022	< 536
SWD (Indicator)	06/03/2022	06/03/2022	< 534
SWU (Control)	06/03/2022	06/03/2022	< 534
SWD (Indicator)	08/15/2022	08/15/2022	< 568
SWU (Control)	08/15/2022	08/15/2022	< 588
SWD (Indicator)	11/02/2022	11/02/2022	< 583
SWU (Control)	11/02/2022	11/02/2022	< 582

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Monitoring Results Tables

Table 15: Groundwater – Gamma

Analysis: Gamma Isotopic							Units: pCi/L						
Location	Collection Date	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	I-131	Zr-95	Cs-134	Cs-137	Ba-140	La-140
REQUIRED LLD →		15	15	30	15	30	15	15	30	15	18	60	15
WD (Indicator)	05/26/2022	< 5.31	< 4.84	< 11.5	< 5.85	< 9.95	< 5.68	< 13.8	< 7.79	< 5.52	< 5.85	< 32.6	< 9.99
WU (Control)	05/26/2022	< 5.71	< 6.88	< 17.6	< 6.63	< 10.8	< 7.16	< 14.2	< 11.9	< 6.56	< 6.54	< 39.8	< 14.4
WD (Indicator)	10/10/2022	< 8.18	< 8.69	< 15.8	< 9.86	< 21.5	< 9.93	< 10.9	< 14.9	< 8.95	< 9.71	< 37.4	< 9.71
WU (Control)	10/10/2022	< 7.49	< 5.47	< 15.2	< 8.41	< 14.0	< 9.59	< 10.3	< 12.5	< 8.55	< 8.06	< 28.3	< 8.64

Monitoring Results Tables

Table 16: Groundwater – Tritium

Analysis: H-3		Units: pCi/L	
Location	Start Date	End Date	H-3
REQUIRED LLD →			2000
WD (Indicator)	05/26/2022	05/26/2022	< 540
WU (Control)	05/26/2022	05/26/2022	< 522
WD (Indicator)	10/10/2022	10/10/2022	< 463
WU (Control)	10/10/2022	10/10/2022	< 470

Monitoring Results Tables

Table 17: Sediment - Gamma

Analysis: Gamma Isotopic		Units: pCi/kg (dry)	
Location	Collection Date	Cs-134	Cs-137
REQUIRED LLD →		150	180
SEDD (Indicator)	11/02/2022	< 78.93	< 53.07
SEDU (Control)	11/02/2022	< 62.43	< 58.16

Monitoring Results Tables

Table 18: Fish - Gamma

Analysis: Gamma Isotopic				Units: pCi/kg (wet)				
Location	Collection Date	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137
REQUIRED LLD →		<u>130</u>	<u>130</u>	<u>260</u>	<u>130</u>	<u>260</u>	<u>130</u>	<u>150</u>
FD (Indicator)	09/20/2022	< 58.81	< 43.19	< 119.9	< 68.35	< 99.44	< 48.95	< 55.29
FU (Control)	09/20/2022	< 58.04	< 64.93	< 134.3	< 76.24	< 159.9	< 74.16	< 68.56

Monitoring Results Tables

Table 19: Food Products - Gamma

Analysis: Gamma Isotopic		Units: pCi/kg (wet)		
Location	Collection Date	I-131	Cs-134	Cs-137
REQUIRED LLD →		60	60	80
GN1 (Indicator)	02/10/2022	< 28.16	< 31.43	< 30.90
GQC (Control)	02/09/2022	< 30.32	< 32.86	< 28.70
GN1 (Indicator)	04/26/2022	< 35.63	< 34.32	< 24.69
GQC (Control)	04/26/2022	< 25.98	< 22.01	< 19.41
GN1 (Indicator)	08/03/2022	< 28.75	< 26.53	< 26.79
GQC (Control)	08/03/2022	< 21.65	< 16.06	< 21.17
GN1 (Indicator)	11/02/2022	< 29.80	< 12.85	< 11.60
GQC (Control)	11/02/2022	< 35.49	< 12.59	< 12.13

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Interlaboratory Comparison Program Results

1.0 Summary

For the Teledyne Brown Engineering (TBE) laboratory, 142 out of 150 analyses performed met the specified acceptance criteria. Eight analyses did not meet the specified acceptance criteria for the following reasons and were addressed through the TBE Corrective Action Program. *NOTE: Two analyses (soil for Tc-99 and U-238) that did not meet acceptance criteria was performed for TBE information and is not on the list of required ICP analyses.*

Note: The Department of Energy (DOE) Mixed Analyte Performance Evaluation Program (MAPEP) samples are created to mimic conditions found at DOE sites which do not resemble typical environmental samples obtained at commercial nuclear power facilities.

1. The Analytics March 2022 AP Ce-141 result was evaluated as Not Acceptable. The reported value for Ce-141 was 60.9 pCi and the known result was 42.0 pCi/L (1.45 ratio of reported result vs. known; TBE's internal acceptance range is 0.70 - 1.30). This sample was used as the workgroup duplicate with a result of 45.7 (109% of known) and was also counted on a different detector with a result of 50.9 (121% of known). This was TBE's first failure for AP Ce-141. (NCR 22-04)
2. The MAPEP February 2022 Urine U-234 & U-238 results were evaluated as Not Acceptable. TBE's reported values of 0.142 and 0.0254 were above the known upper ranges of 0.0096 and 0.0134 respectively for U-234 and U-238. These spiked values were below TBE's typical MDC for urine client samples. The samples were re-prepped using a larger sample aliquot and counted for 60 hours as opposed to 48 hours. The recount results were 0.00732 for U-234 and 0.0119 for U-238 (both within acceptable range). MAPEP urine samples will be flagged to use a larger sample aliquot and counting time than typical client samples. MAPEP did not include any urine cross-check samples in August. (NCR 22-05)
3. The ERA MRAD September 2022 AP Pu-238 was evaluated as Not Acceptable. The reported value was 38.8 pCi and the known result was 29.9 (acceptance range 22.6 – 36.7). The AP filter was cut in half prior to digestion (shared with Fe-55) but should have been completely digested together and aliquoted afterwards like typical client samples. This is the first failure for AP Pu-238. (NCR 22-19)
4. The ERA October 2022 water Uranium result was evaluated as Not Acceptable. The reported value was 10.54 pCi/L and the known was 8.53 (acceptance range 6.60 – 9.88) or 124% of the known (acceptable for TBE QC). The 2-sigma error was 3.2, placing the reported result well within the acceptable range. This sample was used as the workgroup duplicate with a result of 8.2 +/- 2.9 pCi/L (also within the acceptable range). All other QA was reviewed with no anomalies. (NCR 22-20)

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Interlaboratory Comparison Program Results

5. The Analytics AP Co-60 result was evaluated as Not Acceptable. The reported value was 207 pCi and the known was 147 (141% of the known). TBE's internal QC acceptance is 70 - 130%. All QA was reviewed with no anomalies. This sample was used as the workgroup duplicate and counted on a different detector with a result of 167 pCi (114% of the known). This is the first failure for AP Co-60 – average result ratio compared to the known is 109%. (NCR 22-21)
6. The MAPEP August 2022 water Tc-99 result was evaluated as Not Acceptable. The reported value was 1.86 +/- 0.414 Bq/L for this "false positive" test. The evaluation of the submitted result to the 3 times the uncertainty indicated a slight positive. This sample was used as the workgroup duplicate with a result of 0.88 +/- 0.374 Bq/L. All QC was reviewed, and no anomalies found. This is the first unacceptable since the resumption of reporting water Tc-99 for the 3rd quarter of 2020. TBE to known ratios have ranged from 94-109% during this time. (NCR 22-22) The Inter-Laboratory Comparison Program provides evidence of "in control" counting systems and methods, and that the laboratories are producing accurate and reliable data.

The Inter-Laboratory Comparison Program provides evidence of "in control" counting systems and methods, and that the laboratories are producing accurate and reliable data.

**Table 20: Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services**

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value ^(a)	Ratio of TBE to Analytics Result	Evaluation ^(b)		
March 2022	E13706	Milk	Sr-89	pCi/L	80.3	96.8	0.83	A		
			Sr-90	pCi/L	12.7	12.6	1.01	A		
	E13707	Milk	Ce-141	pCi/L	62.3	65	0.96	A		
			Co-58	pCi/L	158	164	0.96	A		
			Co-60	pCi/L	286	302	0.95	A		
			Cr-51	pCi/L	314	339	0.93	A		
			Cs-134	pCi/L	155	182	0.85	A		
			Cs-137	pCi/L	210	223	0.94	A		
			Fe-59	pCi/L	211	185	1.14	A		
			I-131	pCi/L	88.0	96.7	0.91	A		
			Mn-54	pCi/L	169	164	1.03	A		
			Zn-65	pCi/L	238	246	0.97	A		
			E13708	Charcoal	I-131	pCi	79.9	87.1	0.92	A
			E13709	AP	Ce-141	pCi	60.9	42.0	1.45	N ⁽¹⁾
					Co-58	pCi	118	107	1.11	A
Co-60	pCi	218			196	1.11	A			
Cr-51	pCi	251			221	1.14	A			
Cs-134	pCi	129			118	1.09	A			
Cs-137	pCi	156			145.0	1.07	A			
Fe-59	pCi	124			120.0	1.03	A			
Mn-54	pCi	120			107	1.12	A			
Zn-65	pCi	162	160	1.01	A					
E13710	Soil	Ce-141	pCi/g	0.123	0.103	1.19	A			
		Co-58	pCi/g	0.254	0.263	0.97	A			
		Co-60	pCi/g	0.493	0.483	1.02	A			
		Cr-51	pCi/g	0.603	0.543	1.11	A			
		Cs-134	pCi/g	0.268	0.292	0.92	A			
		Cs-137	pCi/g	0.399	0.431	0.93	A			
		Fe-59	pCi/g	0.320	0.296	1.08	A			
		Mn-54	pCi/g	0.263	0.263	1.00	A			
Zn-65	pCi/g	0.407	0.395	1.03	A					
E13711	AP	Sr-89	pCi	83.2	97.4	0.85	A			
		Sr-90	pCi	12.7	12.7	1.00	A			

(a) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) Analytics evaluation based on TBE internal QC limits:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

(1) See NCR 22-04

**Table 20: Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services**

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value ^(a)	Ratio of TBE to Analytics Result	Evaluation ^(b)			
September 2022	E13712	Milk	Sr-89	pCi/L	71.1	89.1	0.80	A			
			Sr-90	pCi/L	12.0	13.6	0.88	A			
September 2022	E13713	Milk	Ce-141	pCi/L	148	161	0.92	A			
			Co-58	pCi/L	178	189	0.94	A			
			Co-60	pCi/L	229	260	0.88	A			
			Cr-51	pCi/L	486	456	1.07	A			
			Cs-134	pCi/L	220	252	0.87	A			
			Cs-137	pCi/L	203	222	0.92	A			
			Fe-59	pCi/L	174	173	1.01	A			
			I-131	pCi/L	75.9	94.2	0.81	A			
			Mn-54	pCi/L	269	282	0.95	A			
			Zn-65	pCi/L	364	373	0.97	A			
			E13714	Charcoal	I-131	pCi	81.4	83.6	0.97	A	
			September 2022	E13715	AP	Ce-141	pCi	102	91	1.12	A
						Co-58	pCi	118	107	1.11	A
Co-60	pCi	207				147	1.41	N ⁽²⁾			
Cr-51	pCi	310				257	1.21	W			
Cs-134	pCi	148				142	1.04	A			
Cs-137	pCi	137				125	1.10	A			
Fe-59	pCi	115				98	1.18	A			
Mn-54	pCi	168				159	1.05	A			
September 2022	E13716	Soil	Ce-141	pCi/g	0.288	0.284	1.01	A			
			Co-58	pCi/g	0.320	0.334	0.96	A			
			Co-60	pCi/g	0.445	0.459	0.97	A			
			Cr-51	pCi/g	0.883	0.805	1.10	A			
			Cs-134	pCi/g	0.410	0.446	0.92	A			
			Cs-137	pCi/g	0.447	0.465	0.96	A			
			Fe-59	pCi/g	0.314	0.305	1.03	A			
			Mn-54	pCi/g	0.489	0.499	0.98	A			
September 2022	E13717	AP	Sr-89	pCi	87.5	98.3	0.89	A			
			Sr-90	pCi	12.6	15.0	0.84	A			

(a) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) Analytics evaluation based on TBE internal QC limits:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

(2) See NCR 22-21

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**Table 21: DOE's Mixed Analyte Performance Evaluation Program (MAPEP)
Teledyne Brown Engineering Environmental Services**

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value ^(a)	Acceptance Range	Evaluation ^(b)		
February 2022	22-GrF46	AP	Gross Alpha	Bq/sample	0.402	1.20	0.36 - 2.04	A		
			Gross Beta	Bq/sample	0.669	0.68	0.341 - 1.022	A		
	22-MaS46	Soil	Ni-63	Bq/kg	645	780	546 - 1014	A		
			Tc-99	Bq/kg	526	778	545 - 1011	N ⁽³⁾		
	22-MaSU46	Urine	Cs-134	Bq/L	1.67	1.77	1.24 - 2.30	A		
			Cs-137	Bq/L	1.50	1.56	1.09 - 2.03	A		
			Co-57	Bq/L	4.93	5.39	3.77 - 7.01	A		
			Co-60	Bq/L	2.13	2.06	1.44 - 2.68	A		
			Mn-54	Bq/L	4.83	5.08	3.56 - 6.60	A		
			U-234	Bq/L	0.142	0.0074	0.0052 - 0.0096	N ⁽⁴⁾		
			U-238	Bq/L	0.0254	0.0103	0.0072 - 0.0134	N ⁽⁴⁾		
			Zn-65	Bq/L	4.71	4.48	3.14 - 5.82	A		
			22-MaW46	Water	Ni-63	Bq/L	28.6	34.0	23.8 - 44.2	A
					Tc-99	Bq/L	8.59	7.90	5.5 - 10.3	A
22-RdV46	Vegetation	Cs-134	Bq/sample	6.61	7.61	5.33 - 9.89	A			
		Cs-137	Bq/sample	1.50	1.52	1.06 - 1.98	A			
		Co-57	Bq/sample	5.11	5.09	3.56 - 6.62	A			
		Co-60	Bq/sample	0.0162		(1)	A			
		Mn-54	Bq/sample	2.42	2.59	1.81 - 3.37	A			
		Sr-90	Bq/sample	0.684	0.789	0.552 - 1.026	A			
		Zn-65	Bq/sample	1.44	1.47	1.03 - 1.91	A			
August 2022	22-MaS47	Soil	Ni-63	Bq/kg	14.6		(1)	A		
			Tc-99	Bq/kg	994	1000	700 - 1300	A		
	22-MaW47	Water	Ni-63	Bq/L	24.4	32.9	23.0 - 42.8	A		
			Tc-99	Bq/L	1.9		(1)	N ⁽⁵⁾		
25-RdV47	Vegetation	Cs-134	Bq/sample	0.032		(1)	A			
		Cs-137	Bq/sample	0.891	1.08	0.758 - 1.408	A			
		Co-57	Bq/sample	0.006		(1)	A			
		Co-60	Bq/sample	4.04	4.62	3.23 - 6.01	A			
		Mn-54	Bq/sample	2.01	2.43	1.70 - 3.16	A			
		Sr-90	Bq/sample	1.25	1.60	1.12 - 2.08	W			
		Zn-65	Bq/sample	6.16	7.49	5.24 - 9.74	A			

(a) The MAPEP known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) DOE/MAPEP evaluation:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

(1) False positive test

(2) Sensitivity evaluation

(3) Tc-99 soil cross-checks done for TBE information only - not required

(4) See NCR 22-05

(5) See NCR 22-22

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ERA Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value ^(a)	Acceptance Limits	Evaluation ^(b)		
March 2022	MRAD-36	Water	Am-241	pCi/L	68.3	74.6	51.2 - 95.4	A		
			Fe-55	pCi/L	797	1140	670 - 1660	A		
			Pu-238	pCi/L	146	147	88.4 - 190	A		
			Pu-239	pCi/L	69.9	71.9	44.5 - 88.6	A		
		Soil	Sr-90	pCi/kg	8050	6720	2090 - 10500	A		
			AP	Fe-55	pCi/filter	148	127	46.4 - 203	A	
		Pu-238		pCi/filter	29.9	29.6	22.3 - 36.4	A		
		Pu-239		pCi/filter	51.6	49.7	37.2 - 60.0	A		
		U-234		pCi/filter	59.9	67.3	49.9 - 78.9	A		
		U-238		pCi/filter	59.0	66.7	50.4 - 79.6	A		
		GR-A		pCi/filter	95.6	94.2	49.2 - 155	A		
		GR-B	pCi/filter	71.2	66.8	40.5 - 101	A			
		April 2022	RAD-129	Water	Ba-133	pCi/L	61.7	62.9	52.3 - 69.2	A
					Cs-134	pCi/L	80.9	81.6	68.8 - 89.8	A
Cs-137	pCi/L				37.4	36.6	32.1 - 43.3	A		
Co-60	pCi/L				103	97.4	87.7 - 109	A		
Zn-65	pCi/L				318	302	272 - 353	A		
GR-A	pCi/L				26.9	20.8	10.4 - 28.3	A		
GR-B	pCi/L				49.7	51.0	34.7 - 58.1	A		
U-Nat	pCi/L				56.3	68.9	56.3 - 75.8	A		
H-3	pCi/L				17,000	18,100	15,800 - 19,000	A		
Sr-89	pCi/L				65.3	67.9	55.3 - 76.1	A		
Sr-90	pCi/L				42.1	42.7	31.5 - 49.0	A		
I-131	pCi/L				25.7	26.2	21.8 - 30.9	A		
September 2022	MRAD-37				Water	Am-241	pCi/L	111	96.2	66.0 - 123
		Fe-55	pCi/L	850		926	544 - 1350	A		
		Pu-238	pCi/L	62.1		52.6	31.6 - 68.2	A		
		Pu-239	pCi/L	139.5		117	72.5 - 144	A		
		Soil	Sr-90	pCi/kg	3350	6270	1950 - 9770	A		
			U-234	pCi/kg	1684	3350	1570 - 4390	A		
			U-238	pCi/kg	1658	3320	1820 - 4460	N ⁽²⁾		
		AP	Fe-55	pCi/filter	71.9	122	44.5 - 195	A		
			Pu-238	pCi/filter	38.8	29.9	22.6 - 36.7	N ⁽¹⁾		
			Pu-239	pCi/filter	14.5	13.0	9.73 - 15.7	A		
			U-234	pCi/filter	78.0	71.5	53.0 - 83.8	A		
			U-238	pCi/filter	79.7	70.9	53.5 - 84.6	A		
			GR-A	pCi/filter	62.8	55.5	29.0 - 91.4	A		
			GR-B	pCi/filter	70.9	64.8	39.3 - 97.9	A		
October 2022	RAD-131	Water	Ba-133	pCi/L	76.2	79.4	66.6 - 87.3	A		
			Cs-134	pCi/L	28.0	30.5	23.9 - 33.6	A		
			Cs-137	pCi/L	202	212	191 - 235	A		
			Co-60	pCi/L	52.4	51.4	46.3 - 59.1	A		
			Zn-65	pCi/L	216	216	194 - 253	A		
			GR-A	pCi/L	19.7	16.9	8.28 - 23.7	A		
			GR-B	pCi/L	49.8	53.0	36.1 - 60.0	A		
			U-Nat	pCi/L	10.54	8.53	6.60 - 9.88	N ⁽³⁾		
			H-3	pCi/L	13,900	15,100	13,200 - 16,600	A		
			Sr-89	pCi/L	59.7	64.5	52.3 - 72.5	A		
			Sr-90	pCi/L	32.9	37.3	27.4 - 43.0	A		
			I-131	pCi/L	26.9	24.4	20.2 - 28.9	A		

(a) The ERA known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation.

(b) ERA evaluation:

A = Acceptable - Reported value falls within the Acceptance Limits

N = Not Acceptable - Reported value falls outside of the Acceptance Limits

(1) See NCR 22-19

(2) U soil cross-checks done for TBE information only - not required

(3) See NCR 22-20