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GGNS TS 5.6.2

GNRO2023-00008

April 20, 2023

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

SUBJECT: Grand Gulf Nuclear Station Annual Radiological Environmental Operating Report (AREOR)

Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416
License No. NPF-29

In accordance with Grand Gulf Nuclear Station Unit 1 Technical Specification 5.6.2, attached is the Annual Radiological Environmental Operating Report (AREOR) for the time-period of January 1, 2022 through December 31, 2022.

There are no commitments contained in this submittal. If you have any questions or need additional information, please contact me at 802-380-5124.

Sincerely,

JH/ram

Attachment: 1, Annual Radiological Environmental Operating Report

cc: NRC Senior Resident Inspector
Grand Gulf Nuclear Station
Port Gibson, MS 39150

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

Attachment 1

GNRO2023-00008
Annual Radiological Environmental Operating Report

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Annual Radiological Environmental Operating Report	

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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 Grand Gulf Nuclear Station (GGNS) Radiological Environmental Monitoring Program (REMP) for the period January 1 through December 31, 2022. This report fulfills the requirements of Grand Gulf Nuclear Station Technical Specification 5.6.2.

All required lower limit of detection (LLD) capabilities were achieved in all sample analyses during 2022, as required by the GGNS Offsite Dose Calculation Manual (ODCM) Specifications Table 6.12.1-3. No measurable levels of radiation above reporting levels for radioactivity as outlined in ODCM Specifications Table 6.12.1-2 were detected in the vicinity of GGNS. The 2022 Radiological Environmental Monitoring Program thus substantiated the adequacy of source control and effluent monitoring at GGNS, with impacts of plant operations to the environment within regulatory limits.

GGNS established the REMP in 1978 prior to the station's 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 direct radiation. GGNS 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. GGNS personnel compare indicator results with control and preoperational results to assess any impact GGNS 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 GGNS 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

When averaged over any calendar quarter, no environmental samples equaled or exceeded reporting levels for radioactivity as outlined in ODCM Specifications Table 6.12.1-2; the analytical results did not trigger any Radiological Monitoring Program Special Reports.

1.3 Comparison to State and/or Federal Program

GGNS 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 Mississippi State Department of Health (MSDH), Division of Radiological Health monitoring program.

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 collecting 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 5 media types addressed in the ODCM and for direct radiation. A total of 358 samples of the 359 scheduled were obtained. Of the scheduled samples, 99 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.

2.0 INTRODUCTION

2.1 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 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 GGNS.
- 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 GGNS ODCM Table 6.12.1-1. 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

GGNS conducts a land use census biennially, as required by Section 6.12.2 of the ODCM. 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 and the ODCM. The most important criteria during this census are to determine the location in each sector of the nearest occupied residence, unoccupied residence, garden, and milking animal.

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
RADIOIODINE AND PARTICULATES 1 sample close to the SITE BOUNDARY having the highest calculated annual average ground level D/Q.	AS-7 (Sector H, 0.5 miles) – South-southeast of GGNS at the IBEW Union Hall	7 days, or more frequently if required by dust loading.	• Radioiodine Canisters – I-131 analysis every 7 days • Air Particulate – Gross beta radioactivity analysis following filter change • Air Particulate – Gamma Isotopic composite (by location) every 92 days
RADIOIODINE AND PARTICULATES 1 sample from the vicinity of a community having the highest calculated annual average ground level D/Q.	AS-1 (Sector G, 5.5 miles) – Southeast of GGNS at the Port Gibson City Barn		
RADIOIODINE AND PARTICULATES 1 sample from the vicinity of a community having the highest calculated annual average ground level D/Q.	AS-20 (Sector L, 0.9 miles) – South-southeast of GGNS at the former Glodjo residence		
RADIOIODINE AND PARTICULATES 1 sample from a control location 15 - 30 km distance.	AS-3 (Sector B, 18 miles) – North of the Vicksburg Airport		

Table 2, Exposure Pathway – Direct Radiation

Requirement	Sample Point Description Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
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-19 (Sector E, Radius 0.5 Miles)** – Eastern SITE BOUNDARY Property line, North-northeast of HWSA. • **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)** – Bald Hill Road. • **M-94 (Sector R, Radius 0.8 Miles)** – Sector R Near Meteorological Tower. • **M-95 (Sector F, Radius 0.5 mi)** – Spoils Area, fence of old storage area, near entrance gate	92 days	Gamma dose; 92 days

Table 2, Exposure Pathway – Direct Radiation

Requirement	Sample Point Description Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
TLDS An inner ring of stations in the general areas of the SITE BOUNDARY.	• **M-96 (Sector B, Radius 0.7 mi.)** – North Gate Fence • **M-97 (Sector D, Radius 0.8 mi.)** – Grand Gulf Road entrance gate to spoils area • **M-98 (Sector H, Radius 0.5 mi.)** – Bald Hill Road, across from Union Hall, in curve • **M-99 (Sector K, Radius 0.4 mi.)** – North Fence of old Ball Field near utility pole • **M-100 (Sector C, Radius 0.6 mi.)** – Grand Gulf Road	92 days	Gamma dose; 92 days

Table 2, Exposure Pathway – Direct Radiation

Requirement	Sample Point Description Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
TLDS An outer ring of stations 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. • **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/Shaifer 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

Table 2, Exposure Pathway – Direct Radiation

Requirement	Sample Point Description Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
TLDS Additional stations in special interest areas such as population centers, nearby residences, schools, and in 1 or 2 areas to serve as control locations.	• **M-01 (Sector E, Radius 3.5 Miles)** – Across the road from Lake Claiborne Entry Gate. (Special) • **M-07 (Sector G, Radius 5.5 Miles)** – AS-1 PG, Port Gibson City Barn. (Special) • **M-09 (Sector D, Radius 3.5 Miles)** – Warner Tully Y-Camp. (Special) • **M-10 (Sector A, Radius 1.5 Miles)** – Grand Gulf Military Park. (Special) • **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. (Control) • **M-38 (Sector M, Radius 9.5 Miles)** – Lake Bruin State Park, Entrance Road. (Special) • **M-39 (Sector M, Radius 13.0 Miles)** – St. Joseph, Louisiana, Auxiliary Water Tank. (Special)	92 days	Gamma dose; 92 days

Table 3, Exposure Pathway – Waterborne

Requirement	Sample Point Description Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
SURFACE WATER 1 sample upstream and 1 sample downstream.	• **MRUP (Sector 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. • **MRDOWN (Sector N, Radius 1.6 Miles)** - At least 5000 ft downstream of the GGNS discharge point in the Mississippi River near Radial Well No. 1.	92 days	Gamma isotopic and tritium analysis; 92 days
1 sample downstream during a Liquid Radwaste Discharge.	• **MRDOWN (Sector P, Radius 1.3 Miles)** – Downstream of the GGNS discharge point in the Mississippi River near Radial Well No. 5.	366 days	Gamma isotopic and tritium analysis; 366 days
1 sample from Outfall 007	• **OUTFALL 007 (Sector N, Radius 0.2 Miles)** – Storm Drain System	31 days	Tritium; 31 days
GROUNDWATER Samples from 2 sources	• **PGWELL (Sector G, Radius 5.0 Miles)** - Port Gibson Wells – Taken from distribution system or one of the five wells. • **CONSTWELL (Sector Q, Radius 0.4 Miles)** – GGNS Construction Water Well – Taken from distribution system or the well.	366 days	Gamma isotopic and tritium analysis; 366 days

Table 3, Exposure Pathway – Waterborne

Requirement	Sample Point Description Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
SEDIMENT FROM SHORELINE 1 sample from downstream area and 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

Table 4, Exposure Pathway – Ingestion

Requirement	Sample Point Description Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
MILK • If commercially available, 1 sample from milking animals within 8 km distant • 1 sample from milking animals at a control location >8 km distant when an indicator location exists.	• 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. (Control)	92 days when required	Gamma isotopic and I-131; 92 days
FISH AND INVERTEBRATES • 1 sample in vicinity of GGNS discharge point. • 1 sample uninfluenced by GGNS discharge.	• **FISHDOWN** – Downstream of the GGNS discharge point into the Mississippi River • **FISHUP** – Upstream of the GGNS discharge point into the Mississippi River uninfluenced by plant operations.	366 days	Gamma isotopic on edible portions; 366 days
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. • 1 sample of similar vegetation grown 15 – 30 km distant if milk sampling is not performed.	• **VEG-J (Sector J, Radius 0.4 Miles)** – South of GGNS near former Training Center on Bald Hill Road. • **VEG-CONT (Sector K, Radius 10.5 Miles)** – Alcorn State University south-southwest of GGNS when available, otherwise a location 15-30 km distant. (Control)	92 days when available	Gamma isotopic and I-131; 92 days

Figure 1, Exposure Pathway

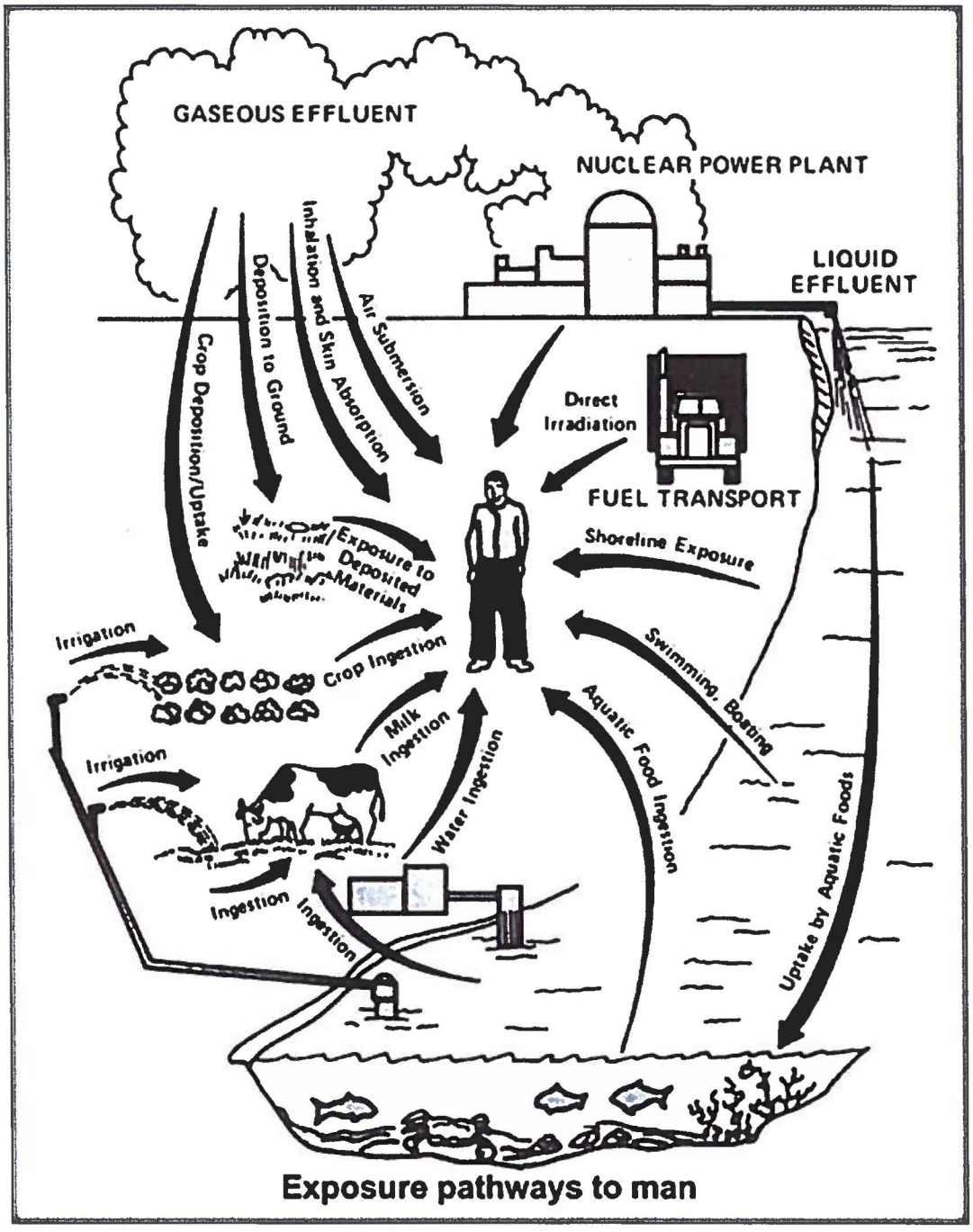


Figure 2, Sample Collection Sites –Near Field

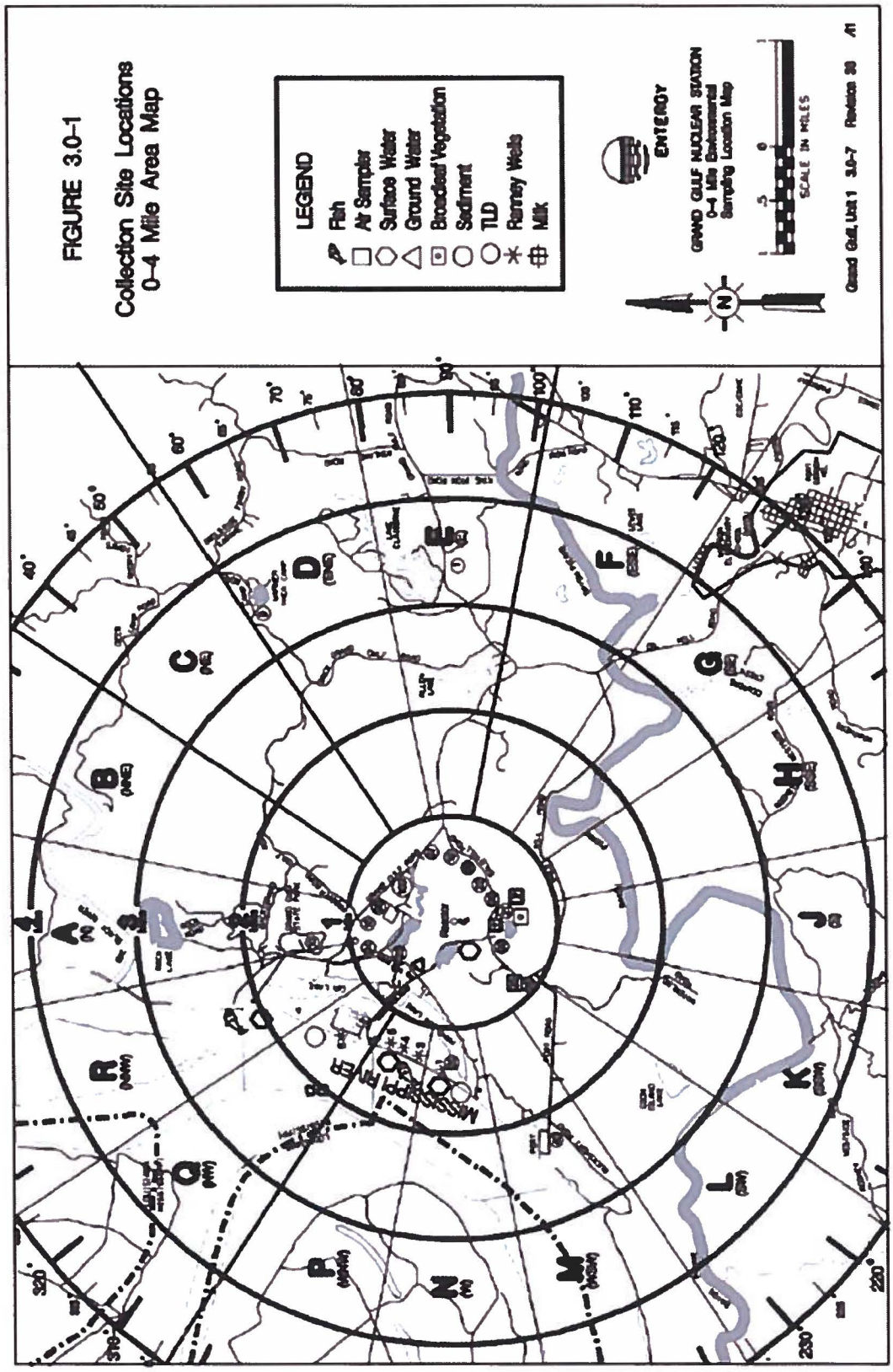
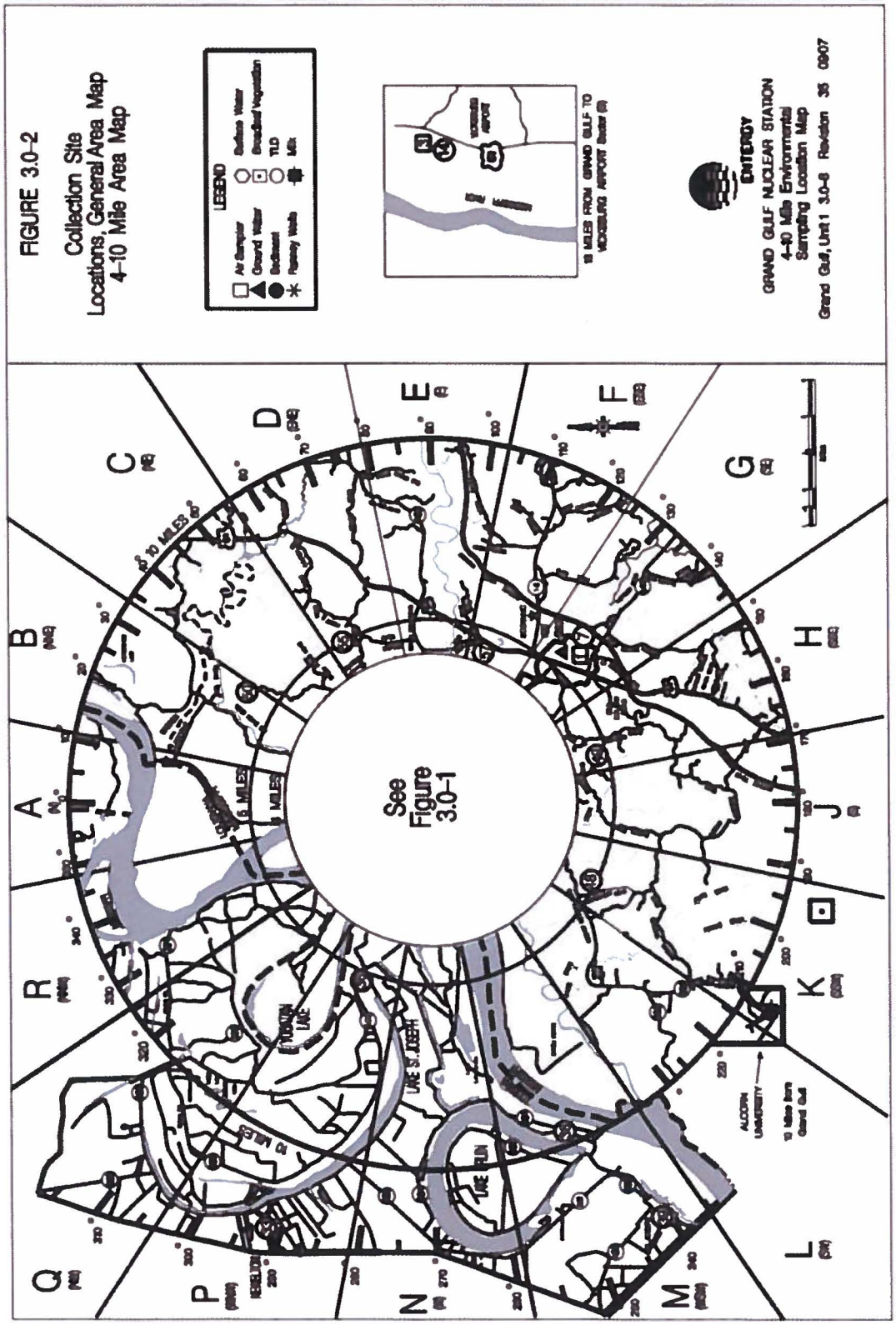


Figure 3, Sample Collection Sites - Far Field



4.0 INTERPRETATION AND TRENDS OF RESULTS

4.1 Air Particulate and Radioiodine Sample Results

GGNS did not detect any plant related gamma emitting radionuclides in the quarterly air particulate composites. The REMP had previously detected airborne radioactivity attributable to other sources in this pathway. These sources include the Chinese nuclear test in 1980 and the accident at the Chernobyl Nuclear Power Plant in 1986. The GGNS REMP detected radioactivity released from the Fukushima Dai-ichi Nuclear Power Plant following the March 11, 2011, Tohoku earthquake.

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/m^3).

Monitoring Period	Result
2012 – 2021 (Minimum Value)	0.008
2022 Average Value	0.022
2012 – 2021 (Maximum Value)	0.041
Preoperational	0.032

In the absence of plant-related gamma radionuclides, gross beta activity is attributed to naturally occurring radionuclides. Table 3.1, 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 Grand Gulf Nuclear Station operations.

4.2 Thermoluminescent Dosimetry (TLD) Sample Results

Grand Gulf Nuclear Station reports measured dose as net exposure (field reading less transit reading) normalized to 92 days and relies on comparison of the indicator locations to the control as a measure of plant impact. Grand Gulf Nuclear Station's comparison of the inner ring and special interest area TLD results to the control, as seen in Table 7, identified no noticeable trend that would indicate that the ambient radiation levels are being affected by plant operations. In addition, the inner ring value of 9.6 millirem/quarter (mR/Qtr) shown in Table 7 for 2022 is within the historical bounds of 2012 – 2021 annual average results, which have ranged from 9.3 to 10.0 mrem. Overall, Grand Gulf Nuclear Station concluded that the ambient radiation levels are not being affected by plant operations.

Table 5, Direct Radiation Annual Summary

Year	Inner Ring (mR/Qtr)	Outer Ring (mR/Qtr)	Control Location (mR/Qtr)
2012	9.5	9.7	11.0
2013	9.8	9.7	10.8
2014	10.0	9.9	11.0
2015	9.6	9.5	10.8
2016	9.3	9.3	10.7
2017	9.9	9.9	11.3
2018	9.7	9.8	10.6
2019	10.0	9.7	10.7
2020	9.6	9.4	10.7
2021	9.9	10.2	11.7
2022	9.6	9.7	10.8

4.3 Waterborne Sample Results

Analytical results for 2022 surface water and drinking water samples were similar to those reported in previous years. Gamma radionuclides analytical results for 2022 surface water samples were similar to those reported in previous years. Tritium in Grand Gulf Nuclear Station surface water indicator samples continues to be detected, but is attributed to washout and entrainment of normal, previously monitored gaseous effluents. These results are further explained below.

4.3.1 Surface Water

Samples were collected from two indicator locations (Outfall 007, MRDOWN) and one control location (MRUP) and analyzed for gamma emitting radionuclides and tritium. Plant related gamma emitting radionuclides and tritium remained undetectable in the upstream and downstream Mississippi River locations, which is consistent with previous operational years. Storm waters contribute to Outfall 007 and can include tritium as a result of washout and

entrainment of normal, previously monitored gaseous effluents. Results are reported as annual average pCi/l.

Monitoring Period	Result
2012 – 2021 (Minimum Value)	449
2022 Average Value	5087
2012 – 2021 (Maximum Value)	6530
Preoperational	2739

In addition to the tritium samples required by the REMP, 50 special surface water samples for tritium and nine special surface water samples for gamma emitting radionuclides were collected at the Outfall 007 location. During the first quarter of 2022, the stormwater system was impacted when condensation from a steam leak migrated out of the Turbine Building to a storm drain. Elevated tritium concentrations were observed in Outfall 007 samples during the first quarter of 2022. The average tritium concentration in Outfall 007 for all samples collected during the first quarter of 2022 was 29,796 pCi/l, which is less than the reportable level specified in the GGNS ODCM Table 6.12.1-2. The steam leak was repaired in February 2022, and tritium concentrations have remained near baseline levels since March 2022. Plant related gamma emitting radionuclides remained undetectable in surface water samples during 2022. Special sample results are summarized in Table 23 and Table 24.

Grand Gulf Nuclear Station personnel have noted no definable increasing trends associated with the tritium levels at the discharge location (Outfall 007). Levels detected during 2022 and previous operational years have remained below regulatory limits. Therefore, the operation of Grand Gulf Nuclear Station had no definable impact on this waterborne pathway during 2022 and levels of radionuclides remain similar to those obtained in previous operational years.

4.3.2 Drinking Water

Drinking water samples were collected from two locations, CONSTWELL (indicator) and PGWELL (control). Drinking water samples were analyzed for I-131, gamma radionuclides and tritium. During 2022, gamma radionuclides, I-131, and tritium concentrations were below the LLD limits at the indicator and control locations, which is consistent with previous operational years. Results are reported as annual average pCi/L.

Radionuclide	2022	2012 – 2021	Preoperational
Gross Beta	< LLD	< LLD	<LLD
Iodine-131	< LLD	< LLD	< LLD
Gamma	< LLD	< LLD	< LLD
Tritium	< LLD	< LLD	<LLD

Grand Gulf Nuclear Station personnel have noted no definable trends associated with drinking water results at the indicator location. Therefore, the operation of Grand Gulf Nuclear Station had no definable impact on this waterborne pathway during 2022 and levels of radionuclides remain similar to those obtained in previous operational years. Results from 2022 are summarized in Table 7.

4.3.3 Groundwater

Groundwater monitoring data collected during administration of the Groundwater Protection Initiative (GPI) site program are included in the Annual Radioactive Effluent Release Report.

4.4 Soil Sample Results

Sediment samples were collected from two locations in 2022 and analyzed for gamma radionuclides. Listed below is a comparison of 2022 indicator results to the 2012 – 2021 operational years. Grand Gulf Nuclear Station operations had no significant impact on the environment or public by this waterborne pathway. Results are reported as pCi/kg.

Monitoring Period	Result
2012 – 2021 (Minimum Value)	<LLD
2022 Value	< LLD
2012 – 2021 (Maximum Value)	40.1
Preoperational	295.0

4.5 Ingestion Sample Results

4.5.1 Milk Sample Results

Milk samples were not collected during 2022 due to the unavailability of indicator locations within five miles of Grand Gulf Nuclear Station.

4.5.2 Fish Sample Results

Fish samples were collected from two locations and analyzed for gamma radionuclides. In 2022, gamma radionuclides were below detectable limits which are consistent with preoperational and operational years. Therefore, based on these measurements, Grand Gulf Nuclear Station operations had no significant radiological impact upon the environment or public by this ingestion pathway.

4.5.3 Food Product 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 product samples were collected from two locations and analyzed for plant related Iodine-131 and gamma radionuclides. The 2022 levels remained undetectable, as has been the case in previous years. Therefore, based on these measurements, Grand Gulf Nuclear Station operations had no significant radiological impact upon the environment or public by this ingestion pathway.

4.6 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.

The land use census identified no milk-producing animals within a five-mile radius of the plant site. In accordance with ODCM Section 6.12.1, Grand Gulf Nuclear Station personnel sampled broadleaf vegetation.

Table 6, Land Use Census – 2022 Nearest Residence Within Five Miles

Sector	Direction	Nearest Residence (miles)	Nearest Garden (miles)
A	N	1.02	none within 5 miles
B	NNE	1.51	1.52
C	NE	0.70	none within 5 miles
D	ENE	2.60	4.50
E	E	0.83	0.91
F	ESE	2.25	none within 5 miles
G	SE	3.72	4.20
H	SSE	1.10	4.31
J	S	3.14	none within 5 miles
K	SSW	2.20	2.18
L	SW	0.89	0.89
M	WSW	none within 5 miles	none within 5 miles
N	W	none within 5 miles	none within 5 miles
P	WNW	none within 5 miles	none within 5 miles
Q	NW	none within 5 miles	none within 5 miles
R	NNW	1.44	none within 5 miles

The next land use census is scheduled to be conducted in 2024.

4.7 Interlaboratory Comparison Results

Teledyne Brown Engineering and Stanford Dosimetry analyzed interlaboratory comparison samples to fulfill the requirements of ODCM Specification 6.12.1. The results are shown in Attachment 3.

5.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

1. Table 7, Radiological Environmental Monitoring Program Summary, summarizes data for the 2022 REMP program.

Table 7, Radiological Environmental Monitoring Program Summary

Sample Type (Units)	Type / Number of Analyses [Note 1]	LLD [Note 2]	Indicator Locations Mean (F)[Note 3] [Range]	Location with the Highest Annual Mean		Control Locations Mean (F)[Note 3] [Range]	Number of Non-Routine Results [Note 5]
				Location [Note 4]	Mean (F)[Note 3] [Range]		
Air Particulates (pCi/m^3)	GB / 208	0.01	0.0218 (156 / 156) [0.0074 – 0.0384]	AS-1 PG (Sector G, 5.5 mi)	0.0220 (52 / 52) [0.0074 - 0.0384]	0.0228 (52 / 52) [0.0075 - 0.0356]	0
	GS / 16						
	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 / 208	0.07	< LLD	N/A	N/A	< LLD	0
Inner Ring TLDs (mR/Qtr)	Gamma / 56	[Note 6]	9.6 (56 / 56) [5.3 – 13.5]	M-99 (Sector J, 0.4 mi.)	12.1 (4 / 4) [11.1 – 13.5]	N/A	0
Outer Ring TLDs (mR/Qtr)	Gamma / 28	[Note 6]	9.7 (28 / 28) [5.0 – 12.4]	M-57 (Sector F, 4.5 mi.)	11.4 (4 / 4) [10.3 – 12.4]	N/A	0
Special Interest TLDs (mR/Qtr)	Gamma / 27	[Note 6]	10.3 (27 / 27) [7.7 – 13.0]	M-01 (Sector E, 3.5 mi.)	12.0 (4 / 4) [11.5 – 13.0]	N/A	0
Control TLD (mR/Qtr)	Gamma / 4	[Note 6]	N/A	N/A	N/A	10.8 (4 / 4) [9.7 – 12.2]	0

Table 7, Radiological Environmental Monitoring Program Summary

Sample Type (Units)	Type / Number of Analyses [Note 1]	LLD [Note 2]	Indicator Locations Mean (F)[Note 3] [Range]	Location with the Highest Annual Mean		Control Locations Mean (F)[Note 3] [Range]	Number of Non-Routine Results [Note 5]
				Location [Note 4]	Mean (F)[Note 3] [Range]		
Surface Water (pCi/l)	H-3 / 35	3000	5087 (7 / 27) [347 – 24600]	Outfall 007 (Sector N, 0.2 mi.)	5087 (7 / 17) [347 – 24600]	< LLD	0
	GS / 18						
	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
	I-131	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 7, Radiological Environmental Monitoring Program Summary

Sample Type (Units)	Type / Number of Analyses [Note 1]	LLD [Note 2]	Indicator Locations Mean (F)[Note 3] [Range]	Location with the Highest Annual Mean		Control Locations Mean (F)[Note 3] [Range]	Number of Non-Routine Results [Note 5]
				Location [Note 4]	Mean (F)[Note 3] [Range]		
Drinking Water (pCi/1)	I-131 / 4	1	< LLD	N/A	N/A	< LLD	0
	H-3 / 4	2000	< LLD	N/A	N/A	< LLD	0
	GS / 4						
	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
Sediment (pCi/kg)	GS / 4						
	Cs-134	150	< LLD	N/A	N/A	N/A	0
	Cs-137	180	< LLD	N/A	N/A	N/A	0

Table 7, Radiological Environmental Monitoring Program Summary

Sample Type (Units)	Type / Number of Analyses [Note 1]	LLD [Note 2]	Indicator Locations Mean (F)[Note 3] [Range]	Location with the Highest Annual Mean		Control Locations Mean (F)[Note 3] [Range]	Number of Non-Routine Results [Note 5]
				Location [Note 4]	Mean (F)[Note 3] [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 / 10	60	< LLD	N/A	N/A	N/A	0
	GS / 10						
	Cs-134	60	< LLD	N/A	N/A	N/A	0
	Cs-137	80	< LLD	N/A	N/A	N/A	0

Table 7, Radiological Environmental Monitoring Program Summary

Sample Type (Units)	Type / Number of Analyses [Note 1]	LLD [Note 2]	Indicator Locations Mean (F)[Note 3] [Range]	Location with the Highest Annual Mean		Control Locations Mean (F)[Note 3] [Range]	Number of Non-Routine Results [Note 5]
				Location [Note 4]	Mean (F)[Note 3] [Range]		
Surface Water (Special) (pCi/l)	H-3 / 50	3000	44,498 (19 / 50) [1230 – 261000]	Outfall 007 (Sector N, 0.2 mi.)	44498 (19 / 50) [1230 – 261000]	< LLD	5
	GS / 9						
	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
	I-131	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

LEGEND:

[Note 1] - GB = Gross beta; I-131 = Iodine-131; H-3 = Tritium; GS = Gamma scan.
[Note 2] - LLD = Required lower limit of detection based on ODCM Table 6.12.1-3.
[Note 3] - Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parenthesis (F).
[Note 4] – Where applicable, locations are specified (1) by name, (2) distance from reactor site, and (3) meteorological sector.
[Note 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.
[Note 6] - LLD is not defined in ODCM Table 6.12.1-3.

Attachment 1

Sample Deviations

Table 8, Sample Deviations Table

Comment No.	Sample Media Affected	Sample Location	Date	Problem	Evaluation / Actions
1	TLD	M-39	03/29/22	TLD Lost	During collection of 1st quarter 2022 TLDs, monitoring location M-39 was could not be located. Field observation indicated the TLD was may have been inadvertently removed during landscaping activities. CR-GGN-2022-03623 documents the condition.

Monitoring Results Tables

Table 9, Air Particulate Data Summary Table

Analysis: Gross Beta			Units: pCi/m^3		
Start Date	End Date	Station AS-1 (Indicator)	Station AS-7 (Indicator)	Station AS-20 (Indicator)	Station AS-3 [Note 1] (Control)
REQUIRED LLD →		0.01	0.01	0.01	0.01
12/28/21	01/04/22	0.01780	0.0206	0.01940	0.0242
01/04/22	01/11/22	0.03090	0.0239	0.02580	0.0287
01/11/22	01/18/22	0.02570	0.0257	0.02430	0.0231
01/18/22	01/25/22	0.02280	0.0240	0.02600	0.0290
01/25/22	02/01/22	0.02340	0.0244	0.02250	0.0260
02/01/22	02/08/22	0.01700	0.0188	0.01870	0.0191
02/08/22	02/15/22	0.02890	0.0317	0.02580	0.0288
02/15/22	02/22/22	0.02190	0.0275	0.01730	0.0211
02/22/22	03/01/22	0.01800	0.0187	0.01800	0.0178
03/01/22	03/08/22	0.02600	0.0249	0.02410	0.0261
03/08/22	03/15/22	0.01520	0.0160	0.01800	0.0196
03/15/22	03/22/22	0.01330	0.0146	0.01520	0.0197
03/22/22	03/29/22	0.01690	0.0181	0.01680	0.0192
03/29/22	04/05/22	0.02430	0.0204	0.02010	0.0217
04/05/22	04/12/22	0.01780	0.0162	0.01760	0.0223
04/12/22	04/19/22	0.01700	0.0145	0.01460	0.0161
04/19/22	04/26/22	0.02080	0.0237	0.02340	0.0268
04/26/22	05/03/22	0.02520	0.0193	0.02290	0.0297
05/03/22	05/10/22	0.01870	0.0179	0.02290	0.0205
05/10/22	05/17/22	0.02140	0.0255	0.02640	0.0202
05/17/22	05/24/22	0.02490	0.0220	0.02340	0.0247
05/24/22	05/31/22	0.02200	0.0197	0.01850	0.0244
05/31/22	06/07/22	0.01420	0.0163	0.01830	0.0199
06/07/22	06/14/22	0.02040	0.0194	0.01740	0.0188
06/14/22	06/21/22	0.02360	0.0197	0.01940	0.0245
06/21/22	06/28/22	0.03840	0.0329	0.03310	0.0303
06/28/22	07/05/22	0.0157	0.0156	0.0130	0.0163

Monitoring Results Tables

Table 9, Air Particulate Data Summary Table

Analysis: Gross Beta				Units: pCi/m^3	
Start Date	End Date	Station AS-1 (Indicator)	Station AS-7 (Indicator)	Station AS-20 (Indicator)	Station AS-3 [Note 1] (Control)
REQUIRED LLD →		0.01	0.01	0.01	0.01
07/05/22	07/12/22	0.0121	0.0090	0.0075	0.0129
07/12/22	07/19/22	0.0162	0.0163	0.0189	0.0213
07/19/22	07/26/22	0.0176	0.0155	0.0160	0.0194
07/26/22	08/02/22	0.0113	0.0136	0.0141	0.0135
08/02/22	08/09/22	0.0074	0.0090	0.0081	0.0094
08/09/22	08/16/22	0.0111	0.0202	0.0123	0.0125
08/16/22	08/23/22	0.0144	0.0128	0.0132	0.0155
08/23/22	08/30/22	0.0076	0.0085	0.0076	0.0075
08/30/22	09/06/22	0.0207	0.0196	0.0169	0.0237
09/06/22	09/13/22	0.0197	0.0199	0.0191	0.0245
09/13/22	09/20/22	0.0348	0.0337	0.0298	0.0317
09/20/22	09/27/22	0.0355	0.0361	0.0346	0.0343
09/27/22	10/04/22	0.0247	0.0250	0.0244	0.0231
10/04/22	10/11/22	0.0383	0.0380	0.0377	0.0356
10/11/22	10/18/22	0.0327	0.0323	0.0380	0.0340
10/18/22	10/25/22	0.0269	0.0310	0.0254	0.0300
10/25/22	11/01/22	0.0273	0.0290	0.0261	0.0226
11/01/22	11/08/22	0.0323	0.0264	0.0288	0.0289
11/08/22	11/15/22	0.0235	0.0257	0.0231	0.0229
11/15/22	11/22/22	0.0348	0.0317	0.0337	0.0307
11/22/22	11/29/22	0.0254	0.0300	0.0348	0.0250
11/29/22	12/06/22	0.0312	0.0285	0.0338	0.0299
12/06/22	12/13/22	0.0160	0.0132	0.0140	0.0161
12/13/22	12/20/22	0.0185	0.0222	0.0216	0.0204
12/20/22	12/27/22	0.0206	0.0189	0.0198	0.0192

[Note 1] – Station with highest annual mean.

Monitoring Results Tables

Table 10, Radioiodine Cartridge Data Table Summary

Analysis: I-131				Units: pCi/m^3	
Start Date	End Date	AS-1 (Indicator)	AS-7 (Indicator)	AS-20 (Indicator)	AS-3 (Control)
REQUIRED LLD →		0.07	0.07	0.07	0.07
12/28/21	01/04/22	<0.03591	<0.03624	<0.03733	<0.0369
01/04/22	01/11/22	<0.05535	<0.05558	<0.05798	<0.05714
01/11/22	01/18/22	<0.01733	<0.01768	<0.01816	<0.01815
01/18/22	01/25/22	<0.04629	<0.04588	<0.04612	<0.0463
01/25/22	02/01/22	<0.02798	<0.02771	<0.02802	<0.02841
02/01/22	02/08/22	<0.02668	<0.02646	<0.02686	<0.02663
02/08/22	02/15/22	<0.02614	<0.02576	<0.02621	<0.02622
02/15/22	02/22/22	<0.02721	<0.02676	<0.02746	<0.02737
02/22/22	03/01/22	<0.02767	<0.0123	<0.02776	<0.02762
03/01/22	03/08/22	<0.02413	<0.02349	<0.02421	<0.02438
03/08/22	03/15/22	<0.04405	<0.04433	<0.04481	<0.04562
03/15/22	03/22/22	<0.03072	<0.03143	<0.03172	<0.03097
03/22/22	03/29/22	<0.02765	<0.0284	<0.02866	<0.0284
03/29/22	04/05/22	<0.0264	<0.02656	<0.02692	<0.02688
04/05/22	04/12/22	<0.04303	<0.04365	<0.04506	<0.04475
04/12/22	04/19/22	<0.03226	<0.03764	<0.03861	<0.03344
04/19/22	04/26/22	<0.02818	<0.02936	<0.02955	<0.02927
04/26/22	05/03/22	<0.04161	<0.0429	<0.0432	<0.04297
05/03/22	05/10/22	<0.04167	<0.04296	<0.04417	<0.04314
05/10/22	05/17/22	<0.02511	<0.02906	<0.02893	<0.026
05/17/22	05/24/22	<0.02878	<0.0302	<0.0296	<0.0295
05/24/22	05/31/22	<0.01828	<0.01898	<0.01576	<0.01903
05/31/22	06/07/22	<0.03293	<0.03413	<0.03388	<0.03402
06/07/22	06/14/22	<0.04944	<0.05139	<0.05105	<0.05221
06/14/22	06/21/22	<0.02763	<0.02815	<0.02819	<0.0281
06/21/22	06/28/22	<0.05033	<0.05671	<0.05675	<0.05057
06/28/22	07/05/22	<0.02863	<0.03054	<0.03028	<0.02857

Monitoring Results Tables

Table 10, Radioiodine Cartridge Data Table Summary

Analysis: I-131				Units: pCi/m^3	
Start Date	End Date	AS-1 (Indicator)	AS-7 (Indicator)	AS-20 (Indicator)	AS-3 (Control)
REQUIRED LLD →		0.07	0.07	0.07	0.07
07/05/22	07/12/22	<0.03869	<0.04414	<0.04414	<0.03922
07/12/22	07/19/22	<0.05641	<0.05985	<0.05947	<0.05933
07/19/22	07/26/22	<0.02416	<0.02447	<0.02488	<0.02424
07/26/22	08/02/22	<0.02023	<0.02029	<0.02043	<0.02022
08/02/22	08/09/22	<0.04947	<0.04986	<0.04957	<0.04929
08/09/22	08/16/22	<0.03983	<0.0429	<0.04262	<0.03939
08/16/22	08/23/22	<0.04175	<0.04212	<0.04197	<0.04211
08/23/22	08/30/22	<0.03602	<0.0358	<0.03577	<0.03565
08/30/22	09/06/22	<0.03585	<0.03674	<0.03644	<0.037
09/06/22	09/13/22	<0.03609	<0.03762	<0.03735	<0.03691
09/13/22	09/20/22	<0.03666	<0.03636	<0.03643	<0.03774
09/20/22	09/27/22	<0.03166	<0.03111	<0.03107	<0.03075
09/27/22	10/04/22	<0.05452	<0.05467	<0.05388	<0.02219
10/04/22	10/11/22	<0.03767	<0.03722	<0.03739	<0.03675
10/11/22	10/18/22	<0.01537	<0.02974	<0.02978	<0.02961
10/18/22	10/25/22	<0.0311	<0.03069	<0.03093	<0.03055
10/25/22	11/01/22	<0.04005	<0.0397	<0.03988	<0.03936
11/01/22	11/08/22	<0.06095	<0.05771	<0.05835	<0.05744
11/08/22	11/15/22	<0.04347	<0.04302	<0.04329	<0.01805
11/15/22	11/22/22	<0.03142	<0.03067	<0.03175	<0.03142
11/22/22	11/29/22	<0.0338	<0.03308	<0.03369	<0.03305
11/29/22	12/06/22	<0.01672	<0.01644	<0.01677	<0.01646
12/06/22	12/13/22	<0.04078	<0.01702	<0.04147	<0.04092
12/13/22	12/20/22	<0.02758	<0.01488	<0.03033	<0.02719
12/20/22	12/27/22	<0.0406	<0.04002	<0.04088	<0.04096

Monitoring Results Tables

Table 11, Air Gamma Quarterly Composite

Analysis: Gamma Isotopic		Units: pCi/cu.m	
Location	Date	CS-134	CS-137
REQUIRED LLD →		0.05	0.06
AS-1	02/11/22	<0.002752	<0.00279
AS-3		<0.002212	<0.002072
AS-7		<0.002178	<0.001906
AS-20		<0.002401	<0.002448
AS-1	05/13/22	<0.001759	<0.001954
AS-3		<0.001943	<0.001571
AS-7		<0.002711	<0.001868
AS-20		<0.002039	<0.001773
AS-1	08/12/22	<0.001812	<0.001646
AS-3		<0.002504	<0.002322
AS-7		<0.002485	<0.00212
AS-20		<0.001761	<0.003233
AS-1	11/11/22	<0.002674	<0.002242
AS-3		<0.001478	<0.00157
AS-7		<0.001673	<0.001348
AS-20		<0.001916	<0.001768

Monitoring Results Tables

Table 12, Thermoluminescent Dosimeters – Inner Ring

Analysis: Gamma Dose			Units: mrem		
Station	1st Qtr 2022	2nd Qtr 2022	3rd Qtr 2022	4th Qtr 2022	Annual Mean 2022
M-16	10.1	10.4	10.8	12.0	10.8
M-19	8.8	9.2	8.9	10.4	9.3
M-21	11.1	11.9	11.8	12.8	11.9
M-22	8.2	8.4	7.6	9.1	8.3
M-23	8.2	8.1	9.2	10.1	8.9
M-25	6.1	5.3	8.6	9.9	7.5
M-28	10.3	10.2	10.4	12.0	10.7
M-94	10.1	9.5	10.5	11.2	10.3
M-95	6.7	10.3	6.6	8.3	8.0
M-96	7.8	6.6	7.9	9.3	7.9
M-97	6.8	8.0	7.3	9.6	7.9
M-98	10.5	7.3	11.2	12.5	10.4
M-99[Note 1]	11.1	11.7	12.3	13.5	12.1
M-100	8.6	11.8	9.1	10.6	10.0

[Note 1] – Station with highest annual mean.

Monitoring Results Tables

Table 13, Thermoluminescent Dosimeters – Outer Ring

Analysis: Gamma Dose			Units: mrem		
Station	1st Qtr 2022	2nd Qtr 2022	3rd Qtr 2022	4th Qtr 2022	Annual Mean 2022
M-36	8.0	12.3	8.8	9.5	9.7
M-40	5.2	8.8	5.7	6.6	6.6
M-48	9.5	5.0	9.5	10.1	8.5
M-49	10.0	9.5	9.9	11.6	10.3
M-50	9.3	10.7	10.1	10.7	10.2
M-55	10.4	10.6	10.9	12.2	11.0
M-57[Note 1]	10.9	10.3	11.8	12.4	11.4

[Note 1] – Station with highest annual mean.

Table 14, Thermoluminescent Dosimeters – Special Interest Areas

Analysis: Gamma Dose			Units: mrem		
Station	1st Qtr 2022	2nd Qtr 2022	3rd Qtr 2022	4th Qtr 2022	Annual Mean 2022
M-01[Note 1]	11.5	11.7	11.6	13.0	12.0
M-07	10.1	10.1	10.0	11.5	10.4
M-09	9.5	9.4	9.3	10.3	9.6
M-10	8.6	8.3	8.5	9.9	8.8
M-33	10.9	12.3	11.4	12.6	11.8
M-38	9.4	7.7	9.6	10.4	9.3
M-39	Lost[Note 2]	9.0	9.4	11.3	9.9

[Note 1] – Station with highest annual mean.
[Note 2] - Reference Attachment 1, Sample Deviations, Table 8, Sample Deviations Table, Comment 1

Table 15, Thermoluminescent Dosimeters – Control

Analysis: Gamma Dose			Units: mrem		
Station	1st Qtr 2022	2nd Qtr 2022	3rd Qtr 2022	4th Qtr 2022	Annual Mean 2022
M-14	9.7	10.8	10.5	12.2	10.8

Monitoring Results Tables

Table 16, Surface Water – Gamma

Analysis: Gamma Isotopic			Units: pCi/L										
Location	Date	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140
REQUIRED LLD →		15	15	30	15	30	15	30	15	15	18	60	15
MRDOWN	02/01/22	<5.234	<5.393	<11.04	<6.052	<9.451	<7.526	<9.599	<9.13	<6.47	<6.558	<24.13	<8.869
MRUP	02/01/22	<5.347	<5.953	<13.17	<7.846	<12.45	<7.198	<12.34	<10.88	<6.129	<6.176	<29.49	<8.495
MRDOWN GG	02/01/22	<7.221	<5.526	<10.15	<5.731	<12.3	<5.987	<10.59	<9.306	<6.959	<5.808	<28.53	<8.475
MRUP GG	02/01/22	<6.404	<5.449	<12.19	<4.664	<7.033	<8.262	<12.34	<8.128	<4.374	<6.366	<31.32	<11.6
MRDOWN	05/04/22	<6.419	<5.795	<14.51	<7.294	<12.33	<7.171	<10.68	<9.161	<6.702	<6.363	<28.08	<8.269
MRUP	05/04/22	<4.748	<6.355	<11.03	<5.315	<10.79	<6.133	<8.762	<9.756	<6.042	<4.68	<29.12	<7.096
MRDOWN GG	05/04/22	<5.285	<7.139	<13.81	<7.307	<11.89	<6.413	<10.63	<10.54	<6.059	<5.891	<29.36	<11.31
MRUP GG	05/04/22	<4.752	<4.538	<11.84	<5.856	<12.86	<5.687	<9.369	<8.838	<6.022	<4.932	<28.03	<7.225
MRDOWN	08/03/22	<6.638	<4.422	<14.89	<6.23	<15.12	<6.288	<11.42	<10.83	<6.452	<8.024	<27.58	<10.54
MRUP	08/03/22	<6.204	<7.292	<13.83	<6.148	<10.92	<6.973	<11.06	<10.65	<6.759	<6.68	<23.03	<10.4

Monitoring Results Tables

Table 16, Surface Water – Gamma

Analysis: Gamma Isotopic			Units: pCi/L										
Location	Date	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140
REQUIRED LLD →		15	15	30	15	30	15	30	15	15	18	60	15
MRDOWN GG	08/03/22	<4.858	<6.006	<11.9	<5.483	<13.75	<5.878	<9.26	<10.49	<6.678	<5.115	<24.37	<8.85
MRUP GG	08/03/22	<6.12	<5.06	<10.14	<6.841	<11.7	<6.37	<10.15	<11.55	<5.879	<6.718	<27.91	<5.081
MRDOWN	11/02/22	<7.033	<5.3	<17.76	<6.674	<11.91	<6.1	<13.19	<11.29	<6.964	<5.202	<29.6	<6.743
MRUP	11/02/22	<5.398	<6.805	<12.47	<6.449	<10.31	<6.638	<11.24	<11.7	<7.171	<6.057	<29.77	<9.026
MRDOWN GG	11/02/22	<5.927	<5.305	<15.18	<5.741	<11.31	<6.175	<9.763	<12.57	<7.498	<5.77	<27.46	<10.68
MRUP GG	11/02/22	<4.635	<5.468	<12.51	<4.915	<14.89	<6.716	<10.76	<9.9	<4.79	<4.478	<24.71	<11.12
MRDOWN*	11/14/22	<7.101	<4.784	<12.87	<5.13	<11.66	<8.049	<9.602	<10.96	<7.288	<5.847	<29.11	<13.8
MRDOWN GG*	11/14/22	<6.787	<6.761	<12.72	<5.337	<12.16	<7.022	<8.678	<10.64	<7.727	<6.275	<26.63	<11.16

GG - indicates duplicate sample
* - indicates annual sample collected during liquid effluent discharge

Monitoring Results Tables

Table 17, Surface Water – Tritium

Analysis: H-3		Units: pCi/L
Location	Date	H-3
REQUIRED LLD →		3000
OUTFALL 007	01/18/22	24600
MRDOWN	02/01/22	<563
MRUP	02/01/22	<554
MRDOWN GG	02/01/22	<557
MRUP GG	02/01/22	<596
OUTFALL 007	02/14/22	1140
OUTFALL 007	03/16/22	6500
OUTFALL 007	04/20/22	<477
OUTFALL 007 GG	04/20/22	<480
MRDOWN	05/04/22	<546
MRUP	05/04/22	<533
MRDOWN GG	05/04/22	<522
MRUP GG	05/04/22	<522
OUTFALL 007	06/15/22	<437
OUTFALL 007 GG	06/15/22	<573
OUTFALL 007	07/20/22	<555
MRDOWN	08/03/22	<587
MRUP	08/03/22	<590
MRDOWN GG	08/03/22	<583
MRUP GG	08/03/22	<567
OUTFALL 007	08/16/22	<510
OUTFALL 007 GG	08/16/22	<525
OUTFALL 007	09/12/22	<616
OUTFALL 007	10/18/22	<595
OUTFALL 007 GG	10/18/22	<606

Monitoring Results Tables

Table 17, Surface Water – Tritium

Analysis: H-3		Units: pCi/L
Location	Date	H-3
MRDOWN	11/02/22	<530
MRUP	11/02/22	<566
MRDOWN GG	11/02/22	<533
MRUP GG	11/02/22	<587
MRDOWN*	11/14/22	<587
MRDOWN GG*	11/14/22	<570
OUTFALL 007	11/15/22	1370
OUTFALL 007 GG	11/15/22	1270
OUTFALL 007	12/12/22	347
OUTFALL 007 GG	12/12/22	382

GG - indicates duplicate sample
* - indicates Annual Sample collected during liquid discharge

Monitoring Results Tables

Table 18, Drinking Water - Gamma, I-131

Analysis: Gamma Isotopic, I-131						Units: pCi/L							
Location	Date	I-131	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
REQUIRED LLD →		1	15	15	30	15	30	15	30	15	18	60	15
CONSTWELL 3	11/08/22	<0.65	<5.574	<5.797	<11.43	<6.485	<14.03	<7.632	<10.04	<6.275	<6.349	<25.94	<8.62
CONSTWELL 3 GG	11/08/22	<0.844	<4.539	<6.138	<13.04	<6.913	<11.49	<5.479	<10.76	<5.852	<5.5	<23.1	<9.971
PGWELL	11/08/22	<0.571	<7.388	<7.581	<13.49	<7.492	<17.24	<9.179	<10.99	<8.575	<8.488	<23.16	<8.519
PGWELL GG	11/08/22	<0.62	<7.872	<6.292	<8.48	<6.543	<19.8	<7.429	<10.45	<6.514	<8.044	<25.31	<6.392

GG - indicates duplicate sample

Monitoring Results Tables

Table 19, Drinking Water – Tritium

Analysis: H-3		Units: pCi/L
Location	Date	H-3
REQUIRED LLD →		2000
CONSTWELL 3	11/08/22	<575
CONSTWELL 3 GG	11/08/22	<560
PGWELL	11/08/22	<589
PGWELL GG	11/08/22	<564

GG - indicates duplicate sample

Table 20, Sediment

Analysis: Gamma Isotopic		Units: pCi/kg	
Location	Date	Cs-134	Cs-137
REQUIRED LLD →		150	180
SEDHAM	09/08/22	<97.68	<81.36
SEDHAM GG	09/08/22	<53.55	<51.94
SEDCONT	09/08/22	<73.9	<61.6
SEDCONT GG	09/08/22	<59.78	<52.04

GG - indicates duplicate sample

Monitoring Results Tables

Table 21, Fish

Analysis: Gamma Isotopic				Units: pCi/kg				
Location	Collection Date	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137
REQUIRED LLD →		130	130	260	130	260	130	150
FISHDOWN	08/31/22	<43.71	<36.58	<96.53	<55.01	<106.6	<47.48	<47.95
FISHDOWN GG	08/31/22	<55.76	<61.6	<146.5	<59.52	<136.1	<53.41	<49.66
FISHUP	08/31/22	<59.34	<63.87	<145.3	<73.23	<123.3	<66.11	<49.63
FISHUP GG	08/31/22	<44.04	<46.68	<90.07	<50.18	<79.22	<43.97	<36.47

GG - indicates duplicate sample

Table 22, Food Products

Analysis: Gamma Isotopic, I-131		Units: pCi/kg		
Location	Collection Date	I-131	Cs-134	Cs-137
REQUIRED LLD →		60	60	80
VEG-CONT	02/14/22	<22.06	<27.17	<22.47
VEG-J	02/14/22	<25.18	<23.98	<18.49
VEG-CONT	05/19/22	<42.13	<27.22	<22.39
VEG-J	05/19/22	<26.82	<27.59	<24.19
VEG-CONT GG	05/19/22	<29.79	<24.54	<23.38

Monitoring Results Tables

Table 22, Food Products

Analysis: Gamma Isotopic, I-131		Units: pCi/kg		
Location	Collection Date	I-131	Cs-134	Cs-137
VEG-J GG	05/19/22	<35.42	<23.26	<26.23
VEG-CONT	08/22/22	<47.52	<22.34	<23.57
VEG-J	08/24/22	<45.19	<24.7	<34.99
VEG-CONT	11/14/22	<31.28	<29.57	<28.48
VEG-J	11/14/22	<31.85	<34.84	<22.02

GG - indicates duplicate sample

Monitoring Results Tables

Table 23, Special Samples, Surface Water - Tritium

Analysis: H-3		Units: pCi/L
Location	Date	H-3
REQUIRED LLD →		3000
OUTFALL 007	01/06/22	9320
OUTFALL 007 GG	01/06/22	10100
OUTFALL 007	01/17/22	137000
OUTFALL 007	01/19/22	73800
OUTFALL 007	01/24/22	14120
OUTFALL 007	01/27/22	193000
OUTFALL 007	01/31/22	52100
OUTFALL 007	02/04/22	261000
OUTFALL 007	02/08/22	1836
OUTFALL 007	02/11/22	26600
OUTFALL 007	02/17/22	1480
OUTFALL 007	02/21/22	18800
OUTFALL 007	02/22/22	7550
OUTFALL 007	02/24/22	7800
OUTFALL 007	02/28/22	<424
OUTFALL 007	03/03/22	<550
OUTFALL 007	03/04/22	<535
OUTFALL 007	03/07/22	<531
OUTFALL 007	03/09/22	<562
OUTFALL 007	03/10/22	5240
OUTFALL 007	03/14/22	<613
OUTFALL 007	03/17/22	8290
OUTFALL 007 GG	03/17/22	10500
OUTFALL 007	03/21/22	<593
OUTFALL 007 GG	03/21/22	<614

Monitoring Results Tables

Table 23, Special Samples, Surface Water - Tritium

Analysis: H-3		Units: pCi/L
Location	Date	H-3
OUTFALL 007	03/23/22	5700
OUTFALL 007	03/24/22	<459
OUTFALL 007	03/28/22	<477
OUTFALL 007	03/31/22	<449
OUTFALL 007	04/05/22	<522
OUTFALL 007	04/08/22	<513
OUTFALL 007	04/14/22	<570
OUTFALL 007	04/11/22	857
OUTFALL 007	04/12/22	<558
OUTFALL 007	04/18/22	<515
OUTFALL 007	04/21/22	<518
OUTFALL 007	04/25/22	1230
OUTFALL 007	04/29/22	<543
OUTFALL 007	05/02/22	<544
OUTFALL 007	05/05/22	<556
OUTFALL 007	05/09/22	<509
OUTFALL 007	05/12/22	<558
OUTFALL 007	05/16/22	<528
OUTFALL 007	05/17/22	<521
OUTFALL 007 GG	05/17/22	<541
OUTFALL 007	05/19/22	<492
OUTFALL 007	05/23/22	<507
OUTFALL 007	05/26/22	<503
OUTFALL 007	05/30/22	<518
OUTFALL 007	06/02/22	<518

GG - indicates duplicate sample

Monitoring Results Tables

Table 24, Special Samples, Surface Water – Gamma Isotopic

Analysis: Gamma Isotopic			Units: pCi/L										
Location	Date	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140
REQUIRED LLD →		15	15	30	15	30	15	30	15	15	18	60	15
OSN 007	02/11/22	<4.552	<6.263	<10.11	<5.986	<10.99	<4.633	<8.475	<13.99	<5.848	<4.113	<25.61	<10.13
OSN 007	03/17/22	<5.844	<6.213	<11.59	<5.918	<6.439	<5.645	<11	<8.234	<7.645	<6.172	<24.69	<10.61
OSN 007 GG	03/17/22	<6.229	<7.172	<16.88	<6.8	<15.97	<7.18	<12.68	<12.05	<7.703	<8.072	<32.96	<10.01
OSN 007	06/20/22	<5.383	<5.138	<9.173	<3.855	<11.6	<4.793	<9.427	<7.5	<5.696	<5.539	<25.59	<6.168
OSN 007 GG	06/20/22	<6.119	<5.939	<14.05	<6.86	<11.55	<6.149	<12.22	<9.716	<7.496	<5.952	<33.25	<7.034
OSN 007	09/19/22	<6.309	<6.27	<11.79	<5.725	<12.07	<6.854	<11.86	<8.78	<8.678	<5.505	<29.14	<9.649
OSN 007 GG	09/19/22	<5.311	<6.513	<16.47	<7.565	<9.234	<4.209	<9.79	<9.306	<7.151	<6.418	<28.21	<8.582
OSN 007	12/05/22	<7.285	<7.672	<16.07	<7.978	<18.85	<6.705	<14.95	<9.038	<9.676	<5.483	<33.81	<8.889
OSN 007 GG	12/05/22	<6.002	<6.496	<12	<4.803	<10.98	<6.206	<11.56	<9.693	<7.715	<6.826	<25.79	<10.33

GG - indicates duplicate sample

ATTACHMENT 3

INTERLABORATORY COMPARISON RESULTS

Quality control data from the following offsite environmental laboratories are summarized in the following pages.

Teledyne Brown Engineering

Environmental Dosimetry Company / Stanford Dosimetry.

TELEDYNE BROWN ENGINEERING

The TBE Laboratory analyzed Performance Evaluation (PE) samples of air particulate (AP), air iodine, milk, soil, vegetation, and water matrices for various analytes. The PE samples supplied by Analytics Inc., Environmental Resource Associates (ERA) and Department of Energy (DOE) Mixed Analyte Performance Evaluation Program (MAPEP), were evaluated against the following pre-set acceptance criteria:

A. Analytics Evaluation Criteria

Analytics' evaluation report provides a ratio of TBE's result and Analytics' known value. Since flag values are not assigned by Analytics, TBE evaluates the reported ratios based on internal QC requirements based on the DOE MAPEP criteria.

B. ERA Evaluation Criteria

ERA's evaluation report provides an acceptance range for control and warning limits with associated flag values. ERA's acceptance limits are established per the US EPA, National Environmental Laboratory Accreditation Conference (NELAC), state-specific Performance Testing (PT) program requirements or ERA's SOP for the Generation of Performance Acceptance Limits, as applicable. The acceptance limits are either determined by a regression equation specific to each analyte or a fixed percentage limit promulgated under the appropriate regulatory document.

C. DOE Evaluation Criteria

MAPEP's evaluation report provides an acceptance range with associated flag values. MAPEP defines three levels of performance:

- Acceptable (flag = "A") - result within ± 20% of the reference value
- Acceptable with Warning (flag = "W") - result falls in the ± 20% to ± 30% of the reference value
- Not Acceptable (flag = "N") - bias is greater than 30% of the reference value

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.

For the TBE laboratory, 142 out of 150 analyses performed met the specified acceptance criteria. Eight analyses did not meet the specified acceptance criteria 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.* A summary is found below:

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 complete 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)
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.

ENVIRONMENTAL DOSIMETRY COMPANY

ANNUAL QUALITY ASSURANCE STATUS REPORT

January - December 2022

Prepared By: _____ Date: 3/24/23

Approved By: _____ Date: 3/24/23

Environmental Dosimetry Company
10 Ashton Lane
Sterling, MA 01564

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EXECUTIVE SUMMARY

Routine quality control (QC) testing was performed for dosimeters issued by the Environmental Dosimetry Company (EDC) .

During this annual period100% (72/72) of the individual dosimeters, evaluated against the EDC internal performance acceptance criteria (high-energy photons only), met the criterion for accuracy and 100% (72/72) met the criterion for precision (Table 1). In addition, 100% (12/12) of the dosimeter sets evaluated against the internal tolerance limits met EDC acceptance criteria (Table 2) and 100% (6/6) of independent testing passed the performance criteria (Table 3). Trending graphs, which evaluate performance statistic for high-energy photon irradiations and co-located stations are given in Appendix A.

One internal assessment was performed in 2022.There were no findings.

I. INTRODUCTION

The TLD systems at the Environmental Dosimetry Company (EDC) are calibrated and operated to ensure consistent and accurate evaluation of TLDs. The quality of the dosimetric results reported to EDC clients is ensured by in-house performance testing and independent performance testing by EDC clients, and both internal and client directed program assessments.

The purpose of the dosimetry quality assurance program is to provide performance documentation of the routine processing of EDC dosimeters. Performance testing provides a statistical measure of the bias and precision of dosimetry processing against a reliable standard, which in turn points out any trends or performance changes. Two programs are used:

A. QC Program

Dosimetry quality control tests are performed on EDC Panasonic 814 Environmental dosimeters. These tests include: (1) the in-house testing program coordinated by the EDC QA Officer and (2) independent test perform by EDC clients. In-house test are performed using six pairs of 814 dosimeters, a pair is reported as an individual result and six pairs are reported as the mean result. Results of these tests are described in this report.

Excluded from this report are instrumentation checks. Although instrumentation checks represent an important aspect of the quality assurance program, they are not included as process checks in this report. Instrumentation checks represent between 5-10% of the TLDs processed.

B. QA Program

An internal assessment of dosimetry activities is conducted annually by the Quality Assurance Officer (Reference 1). The purpose of the assessment is to review procedures, results, materials or components to identify opportunities to improve or enhance processes and/or services.

II. PERFORMANCE EVALUATION CRITERIA

A. Acceptance Criteria for Internal Evaluations

1. Bias

For each dosimeter tested, the measure of bias is the percent deviation of the reported result relative to the delivered exposure. The percent deviation relative to the delivered exposure is calculated as follows:

$$\frac{(H_i' - H_i)}{H_i} 100$$

where:

H_i' = the corresponding reported exposure for the i^{th} dosimeter (i.e., the reported exposure)

H_i = the exposure delivered to the i^{th} irradiated dosimeter (i.e., the delivered exposure)

2. Mean Bias

For each group of test dosimeters, the mean bias is the average percent deviation of the reported result relative to the delivered exposure. The mean percent deviation relative to the delivered exposure is calculated as follows:

$$\sum\left(\frac{(H_i' - H_i)}{H_i}\right)100\left(\frac{1}{n}\right)$$

where:

H_i' = the corresponding reported exposure for the i^{th} dosimeter (i.e., the reported exposure)

H_i = the exposure delivered to the i^{th} irradiated test dosimeter (i.e., the delivered exposure)

n = the number of dosimeters in the test group

Precision

For a group of test dosimeters irradiated to a given exposure, the measure of precision is the percent deviation of individual results relative to the mean reported exposure. At least two values are required for the determination of precision. The measure of precision for the i^{th} dosimeter is:

$$\left(\frac{(H_i' - \bar{H})}{\bar{H}}\right)100$$

where:

H_i' = the reported exposure for the i^{th} dosimeter (i.e., the reported exposure)

$\bar{H}$ = the mean reported exposure; i.e., $\bar{H} = \sum H_i'\left(\frac{1}{n}\right)$

n = the number of dosimeters in the test group

3. EDC Internal Tolerance Limits

All evaluation criteria are taken from the "EDC Quality System Manual," (Reference 2). These criteria are only applied to individual test dosimeters irradiated with high-energy photons (Cs-137) and are as follows for Panasonic Environmental dosimeters: ± 15% for bias and ± 12.8% for precision.

B. QC Investigation Criteria and Result Reporting

EDC Quality System Manual (Reference 2) specifies when an investigation is required due to a QC analysis that has failed the EDC bias criteria. The criteria are as follows:

1. No investigation is necessary when an individual QC result falls outside the QC performance criteria for accuracy.

2. Investigations are initiated when the mean of a QC processing batch is outside the performance criterion for bias.

C. Reporting of Environmental Dosimetry Results to EDC Customers

1. All results are to be reported in a timely fashion.

4. If the QA Officer determines that an investigation is required for a process, the results shall be issued as normal. If the QC results prompting the investigation have a mean bias from the known of greater than ±20%, the results shall be issued with a note indicating that they may be updated in the future, pending resolution of a QA issue.

5. Environmental dosimetry results do not require updating if the investigation has shown that the mean bias between the original results and the corrected results, based on applicable correction factors from the investigation, does not exceed ±20%.

III. DATA SUMMARY FOR ISSUANCE PERIOD JANUARY-DECEMBER 2022

A. General Discussion

Results of performance tests conducted are summarized and discussed in the following sections. Summaries of the performance tests for the reporting period are given in Tables 1 through 3 and Figures 1 through 4.

Table 1 provides a summary of individual dosimeter results evaluated against the EDC internal acceptance criteria for high-energy photons only. During this period100% (72/72) of the individual dosimeters, evaluated against these criteria, met the tolerance limits for accuracy and 100% (72/72) met the criterion for precision. A graphical interpretation is provided in Figures 1 and 2.

Table 2 provides the bias and standard deviation results for each group (N=6) of dosimeters evaluated against the internal tolerance criteria. Overall,100% (12/12) of the dosimeter sets, evaluated against the internal tolerance performance criteria, met these criteria. A graphical interpretation is provided in Figure 3.

Table 3 presents the independent blind spike results for dosimeters processed during this annual period. All results passed the performance acceptance criterion. Figure 4 is a graphical interpretation of Seabrook Station blind co-located station results.

B. Result Trending

One of the main benefits of performing quality control tests on a routine basis is to identify trends or performance changes. The results of the Panasonic environmental dosimeter performance tests are presented in Appendix A. The results are evaluated against each of the performance criteria listed in Section II, namely: individual dosimeter accuracy, individual dosimeter precision, and mean bias.

All of the results presented in Appendix A are plotted sequentially by processing date.

IV. STATUS OF EDC CONDITION REPORTS (CR)

No condition reports were issued during this annual period.

V. STATUS OF AUDITS/ASSESSMENTS

1. Internal

   EDC Internal Quality Assurance Assessment was conducted during the fourth quarter 2022. There were no findings identified.

2. External

   None.

VI. PROCEDURES AND MANUALS REVISED DURING JANUARY - DECEMBER 2022

Two procedures were reissued with no changes as part of the 5 year review cycle.

VII. CONCLUSION AND RECOMMENDATIONS

The quality control evaluations continue to indicate the dosimetry processing programs at the EDC satisfy the criteria specified in the Quality System Manual. The EDC demonstrated the ability to meet all applicable acceptance criteria.

VIII. REFERENCES

1. EDC Quality Control and Audit Assessment Schedule, 2022.
2. EDC Manual 1, Quality System Manual, Rev. 4, September 28, 2020.

TABLE 1

PERCENTAGE OF INDIVIDUAL DOSIMETERS THAT PASSED EDC INTERNAL CRITERIA JANUARY – DECEMBER 2022[1], [2]

Dosimeter Type	Number Tested	% Passed Bias Criteria	% Passed Precision Criteria
Panasonic Environmental	72	100	100

[1]This table summarizes results of tests conducted by EDC.
[2]Environmental dosimeter results are free in air.

TABLE 2

MEAN DOSIMETER ANALYSES (N=6) JANUARY – DECEMBER 2022[1], [2]

Process Date	Exposure Level	Mean Bias %	Standard Deviation %	Tolerance Limit +/-15%
4/25/2022	43	1.2	1.8	Pass
4/27/2022	62	6.2	1.0	Pass
5/05/2022	99	2.3	0.7	Pass
7/26/2022	34	-2.6	1.2	Pass
7/27/2022	81	0.6	1.7	Pass
8/07/2022	107	-3.5	0.7	Pass
10/27/2022	52	1.8	0.9	Pass
11/02/2022	76	2.0	0.9	Pass
11/07/2022	27	7.0	0.7	Pass
01/24/2023	38	1.5	1.7	Pass
01/26/2023	115	-0.3	2.0	Pass
02/14/2023	49	2.3	4.0	Pass

[1]This table summarizes results of tests conducted by EDC for TLDs issued in 2022.
[2]Environmental dosimeter results are free in air.

TABLE 3
SUMMARY OF INDEPENDENT DOSIMETER TESTING JANUARY – DECEMBER 2022[1], [2]

Issuance Period	Client	Mean Bias %	Standard Deviation %	Pass / Fail
1st Qtr. 2022	Millstone	-0.6	0.6	Pass
2nd Qtr.2022	Millstone	-3.9	1.0	Pass
3rd Qtr. 2022	Millstone	0.1	0.5	Pass
4th Qtr.2022	Millstone	-2.6	1.2	Pass
4th Qtr.2022	PSEG(PNNL) 48mR	1.1	1.5	Pass
4th Qtr.2022	PSEG(PNNL) 95mR	0.7	0.3	Pass
4th Qtr.2022	PSEG(PNNL) 143mR	2.3	0.8	Pass
4th Qtr.2022	PSEG(PNNL) 190mR	1.4	0.8	Pass
4th Qtr.2022	SONGS	-5.6	1.1	Pass

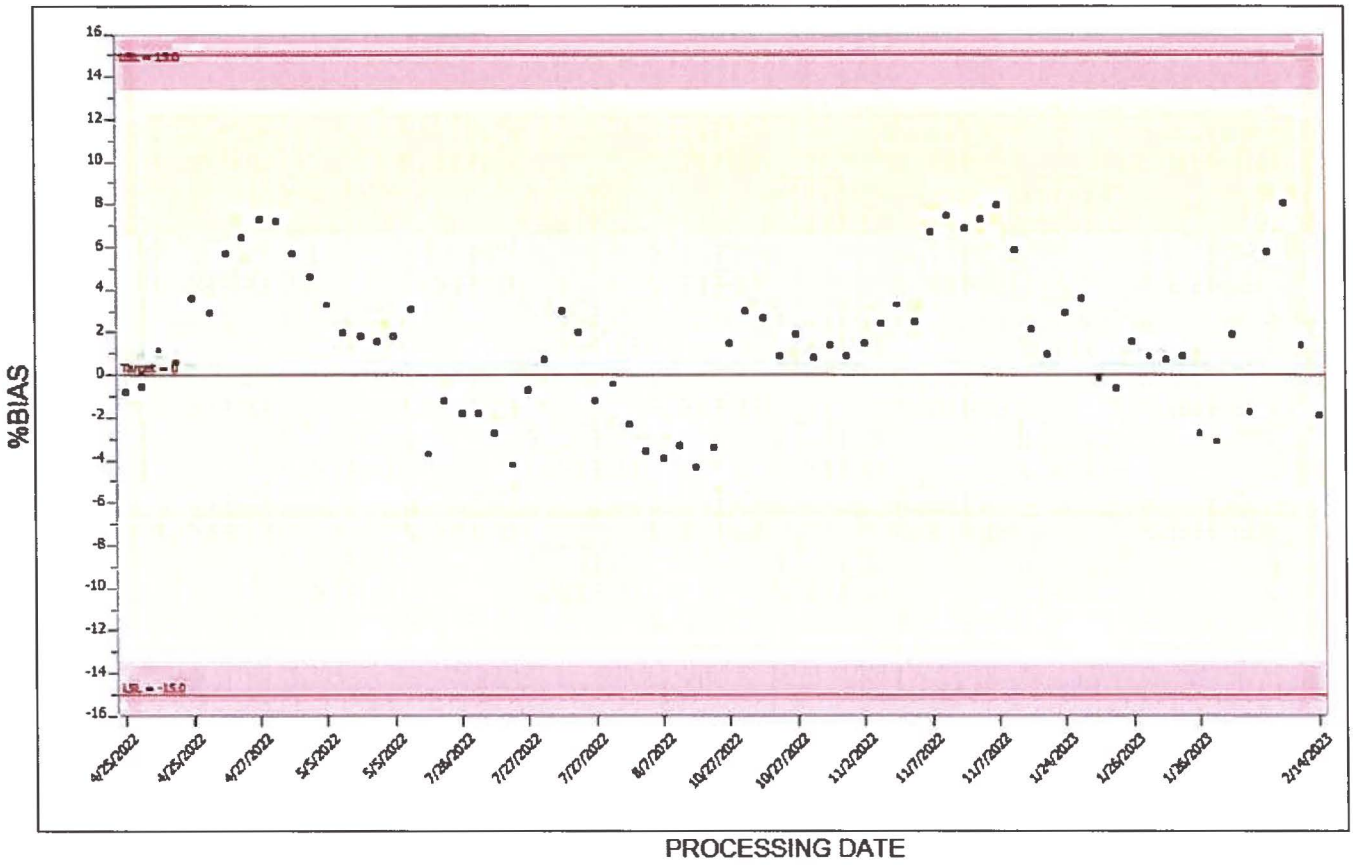
[1]Performance criteria are +/- 15%.
[2]Blind spike irradiations using Cs-137

APPENDIX A

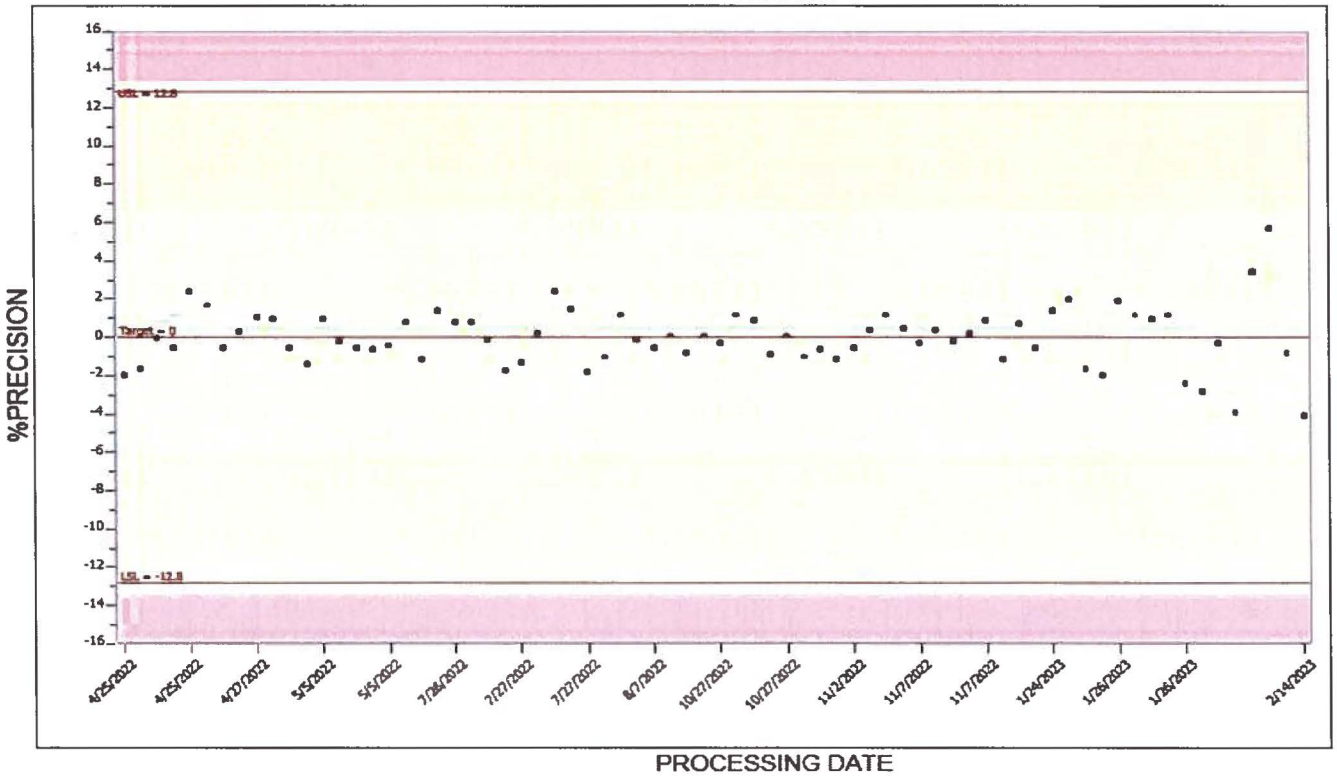
DOSIMETRY QUALITY CONTROL TRENDING GRAPHS

ISSUE PERIOD JANAURY - DECEMBER 2022

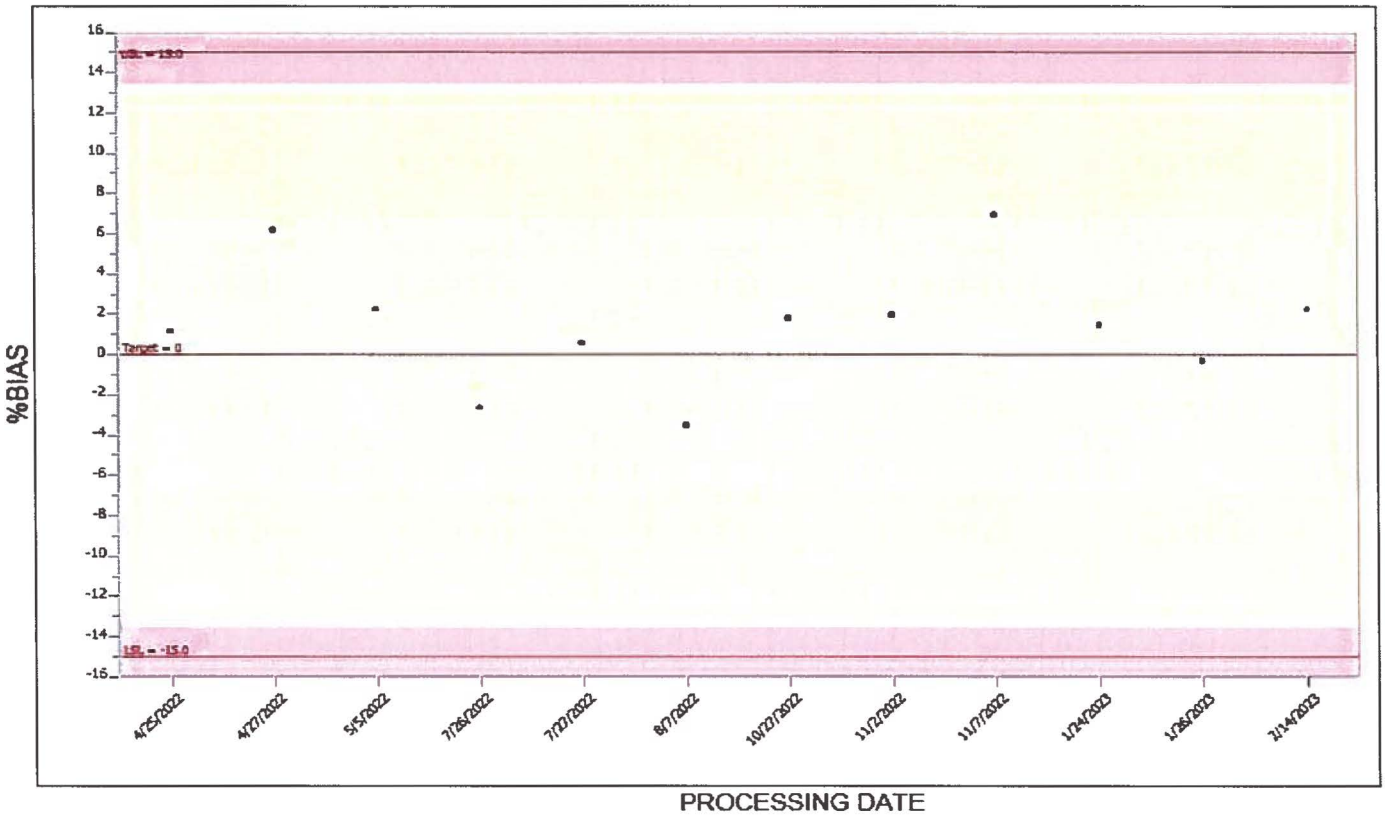
INDIVIDUAL ACCURACY ENVIRONMENTAL
FIGURE 1



INDIVIDUAL PRECISION ENVIRONMENTAL
FIGURE 2



MEAN ACCURACY ENVIRONMENTAL
FIGURE 3



SEABROOK C0-LOCATE ACCURACY
FIGURE 4