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W3F1-2023-0033

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

Subject: Annual Radiological Environmental Operating Report – 2022

Waterford Steam Electric Station, Unit 3
Docket No. 50-382
Renewed Facility Operating License No. NPF-38

Attached is the Annual Radiological Environmental Operating Report for the period of January 1 through December 31, 2022. This report is submitted pursuant to the requirements of Waterford 3 Technical Specification Section 6.9.1.7.

There are no commitments contained in this submittal.

If you have any questions, please contact Leia Milster, Regulatory Assurance Manager, at 504-739-6250.

Respectfully,

Leia Milster

LM/llb

Enclosure: Annual Radiological Environmental Operating Report – 2022

cc: NRC Region IV Regional Administrator
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Enclosure to

W3F1-2023-0033

Annual Radiological Environmental Operating Report – 2022

(53 pages follow)

2022 Annual Radiological Environmental Operating Report
Waterford 3
Document Number: 50-382

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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 Waterford 3 Radiological Environmental Monitoring Program (REMP) for the period January 1 through December 31, 2022. This report fulfills the requirements of Waterford 3 Technical Specification 6.9.1.7.

All required lower limit of detection (LLD) capabilities were achieved in all sample analyses during 2022, as required by Waterford 3's Technical Requirements Manual (TRM) Table 4.12-1. No measurable levels of radiation above baseline levels attributable to Waterford 3's operation were detected in the vicinity of Waterford 3. The 2022 Radiological Environmental Monitoring Program thus substantiated the adequacy of source control and effluent monitoring at Waterford 3 with no observed impact of plant operations on the environment.

Waterford 3 established the REMP prior to the station becoming operational in 1985 to provide data on background radiation and radioactivity normally present in the area. Waterford 3 has continued to monitor the environment by sampling air, water, sediment, fish and broad leaf, as well as measuring direct radiation. Waterford 3 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 31-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. Waterford 3 personnel compare indicator results with control and preoperational results to assess any impact Waterford 3 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 Waterford 3 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

Waterford 3's review indicates that no samples equaled or exceeded reporting levels for radioactivity concentration in environmental samples, as outlined in Technical Requirements Manual (TRM) Table 3.12-2 when averaged over any calendar quarter, due to Waterford 3 effluents. Therefore, 2022 results did not trigger any radiological monitoring program special reports.

1.3 Comparison to State Program

Waterford 3 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 Environmental Radiological Laboratory – Department of Environmental Quality Laboratory Services Division (ERL-DEQLSD).

The NRC TLD Network Program was discontinued in 1998. Historically these results have compared to those from the Waterford 3 REMP. Waterford 3's 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 ERL-DEQLSD and the Waterford 3 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 seven media types addressed in the ODCM and for direct radiation. A total of 467 samples of the 472 scheduled were obtained. Of the scheduled samples, 98.9% 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

Milk collection was removed from the 2022 sampling program due to the lack of indicator and control sampling locations. There were no other program modifications during the reporting period.

2.0 INTRODUCTION

2.1 Radiological Environmental Monitoring Program

Waterford 3 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 Waterford 3.
- 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 Waterford 3 TRM Table 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

Waterford 3 conducts a land use census biennially, as required by Section 3.12.2 of the TRM. The purpose of this census is to identify changes in uses of land within five miles of Waterford 3 that would require modifications to the REMP and the Offsite Dose Calculation Manual (ODCM/TRM). The most important criteria during this census are to determine the location in each sector of the nearest:

1) Residence
2) Animal milked for human consumption
3) Garden of greater than 50 m^2 (500 ft^2) producing broad leaf vegetation.

Waterford 3 conducts the land use census by:

- Field surveys in each meteorological sector out to five miles in order to confirm:
  - Nearest permanent residence
  - Nearest garden > 50 square meters
  - Nearest beef cow
  - Nearest milking animal
- Identifying locations on maps, measuring distances to Waterford 3 and recording results on data sheets.
- Comparing current census results to previous results.

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 Three samples from close to the three SITE BOUNDARY locations, in different sectors, in or near sectors having the highest calculated annual average ground-level D/Q.	• **APQ-1 (NW, 0.81 Miles)** – (West bank) Located in soybean/sugarcane field off LA 18 east of LA 18/3141 intersection. • **APF-1 (ESE, 0.35 Miles) –** (West bank) Located on north side of Secondary Meteorological Tower. • **APC-1 (NE, 0.67 Miles)** – (East bank) Located inside Little Gypsy Cooling Water Intake Structure fence.	Continuous sampler operation with sample collection biweekly, or more frequently if required by dust loading.	• Radioiodine Canisters – I-131 analysis biweekly. • Air Particulate – Gross beta radioactivity analysis following filter change. Gamma isotopic analysis of composite (by location) quarterly.
RADIOIODINE AND PARTICULATES One sample from the vicinity of a community having the highest calculated annual average ground level D/Q.	• **APP-1 (WNW, 0.84 Miles)** – (West bank) Located in soybean/sugarcane field on Short St. in Killona.	Continuous sampler operation with sample collection biweekly, or more frequently if required by dust loading.	• Radioiodine Canisters – I-131 analysis biweekly. • Air Particulate – Gross beta radioactivity analysis following filter change. Gamma isotopic analysis of composite quarterly.
RADIOIODINE AND PARTICULATES One sample from a control location, as for example 15 - 30 km distance and in the least prevalent wind direction.	• **APE-26 (E, 25.8 Miles)** – (West bank) Located at Entergy office on Virgil Street in Gretna. (Control)	Continuous sampler operation with sample collection biweekly, or more frequently if required by dust loading.	• Radioiodine Canisters – I-131 analysis biweekly. • Air Particulate – Gross beta radioactivity analysis following filter change. Gamma isotopic analysis of composite quarterly.

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, one in each meteorological sector in the general area of the SITE BOUNDARY.	• **A-2 (N, 1.27 Miles)** – (East bank) Located on pole on LA 628 at Zephrin L. Perriloux Fire House. • **B-1 (NNE, 0.75 Miles)** – (East bank) Located on fence west of Little Gypsy. • **C-1 (NE, 0.67 Miles)** – (East bank) Located on fence at Little Gypsy Cooling Water Intake structure. • **D-2 (ENE, 1.24 Miles)** – (East bank) Located on pole on levee at west entrance to Bonnet Carre Spillway • **E-1 (E, 0.41 Miles)** – (West bank) Located on pole on LA 18 east of Waterford 3 plant entrance. • **F-2 (ESE, 1.15 Miles)** – (West bank) Located on fence on LA 3142 south of LA 18. • **G-2 (SE, 1.26 Miles)** – (West bank) Located on fence on LA 3142 north of railroad overpass. • **H-2 (SSE, 1.54 Miles)** – (West bank) Located on fence on LA 3142 north of LA 3127/3142 intersection.	Quarterly	• Gamma dose quarterly.

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, one in each meteorological sector in the general area of the SITE BOUNDARY.	• **J-2 (S, 1.38 Miles)** – (West bank) Located on fence south of LA 3127 west of LA 3127/3142 intersection. • **K-1 (SSW, 1.06 Miles)** – (West bank) Located on stop sign at entrance to Entergy Education Center on LA 3127. • **L-1 (SW, 1.06 Miles)** – (West bank) Located on gate on LA 3127 west of LA 3127/3142 intersection. • **M-1 (WSW, 0.76 Miles)** – (West bank) Located on south gate of Waterford 1 and 2. • **N-1 (W, 0.98 Miles)** – (West bank) Located on pole at corner of Railroad Avenue and School House Road. • **P-1 (WNW, 0.84 Miles)** – (West bank) Located on fence enclosing air sample station APP-1. • **Q-1 (NW, 0.81 Miles)** – (West bank) Located on fence enclosing air sample station APQ-1. • **R-1 (NNW, 0.51 Miles)** – (West bank) Located at Waterford 1 and 2 Cooling Water Intake Structure.	Quarterly	• Gamma dose quarterly.

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, one in ten of the meteorological sectors in the 6 to 8 km ranges from the site.	• **A-5 (N, 4.59 Miles)** – (East bank) Located on pole at intersection of Oswald Avenue and US 61. • **B-4 (NNE, 3.75 Miles)** – (East bank) Located on pole near weigh station on US 61. • **D-5 (ENE, 4.09 Miles)** – (East bank) Located on gate on shell road north of US 61/LA 48 intersection. • **E-5 (E, 3.90 Miles)** – (East bank) Located on fence on Wesco Street off LA 48. • **F-4 (ESE, 3.53 Miles)** – (West bank) Located on pole behind house at 646 Aquarius St. in Hahnville. • **G-4 (SE, 3.30 Miles)** – (West bank) Located on pole on LA 3160 north of railroad track. • **H-8 (SSE, 8.13 Miles)** – (West bank) Located on pole in front of Hahnville High School. • **P-6 (WNW, 5.58 Miles)** – (West bank) Located on fence at LA 640/railroad track intersection. • **Q-5 (NW, 5.01 Miles)** – (West bank) Located on pole on LA 18 across from Mississippi River marker 137. • **R-6 (NNW, 5.52 Miles)** – (East bank) Located on fence on LA 3223 near railroad crossing.	Quarterly	• Gamma dose quarterly.

Table 2: Exposure Pathway – Direct Radiation

Requirement	Sample Point Description Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
TLDS The balance of the stations (five) to be placed in special interest areas such as population centers, nearby residences, schools, and in one or two areas to serve as control locations.	• **E-15 (E, 11.7 Miles)** – (East bank) Located on fence on Alliance Avenue. • **F-9 (ESE, 8.18 Miles)** – (East bank) Located on fence north of railroad tracks on Jonathan Street. • **G-8 (SE, 7.74 Miles)** – (West bank) Located on back fence of Luling Entergy Office. • **J-15 (S, 11.7 Miles)** - (West bank) Located on pole near LA 631/Hwy 90 intersection in Des Allemands. • **E-26 (E, 25.8 Miles)** - (West bank) Located at Entergy office on Virgil Street in Gretna. (Control)	Quarterly	• Gamma dose quarterly.

Table 3: Exposure Pathway – Waterborne

Requirement	Sample Point Description Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
SURFACE WATER One sample upstream and one sample downstream.	• **SWP-7 (WNW, 7.37 Miles)** - (West bank) Located at St. John Parish Waterworks in Edgard. (Control) • **SWF-2 (ESE, 1.51 Miles)** - (West bank) Located at Dow Chemical Plant drinking water canal. • **SWE-5 (E, 4.59 Miles)** - (East bank) Located at St. Charles Parish Waterworks in New Sarpy. • **SWK-1 (SSW, 0.49 Miles)** - (West bank) Located at 40 Arpent Canal south of the plant.	Composite sample over one quarter period.	• Gamma isotopic analysis and tritium analysis quarterly.
DRINKING WATER One sample upstream and one sample downstream.	• **DWP-7 (WNW, 7.37 Miles)** - (West bank) Located at St. John Parish Waterworks in Edgard. (Control) • **DWF-2 (ESE, 1.51 Miles)** - (West bank) Located at Dow Chemical Plant drinking water canal. • **DWE-5 (E, 4.59 Miles)** - (East bank) Located at St. Charles Parish Waterworks in New Sarpy.	Composite sample over one month period when I-131 analysis is performed, quarterly composite otherwise.	• I-131 analysis on each composite when the dose calculated for the consumption of the water is greater than one mrem per year. Composite for gross beta and gamma isotopic analyses quarterly. Composite for tritium analysis quarterly.
SEDIMENT FROM SHORELINE One sample upstream and one sample downstream.	• **SHWQ-6 (NW, 5.99 Miles)** – (East bank) Located on LA 628 east of Reserve ferry landing. (Control) • **SHWE-3 (E, 2.99 Miles)** – (West bank) Located at Foot Ferry landing on LA 18. • **SHWK-1 (SSW, 0.49 Miles)** – (West bank) Located at 40 Arpent Canal south of plant.	Annually	• 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
MILK • Samples from milking animals in the three locations within 5 km distance having the highest dose potential. If there are none, then, one sample from milking animals in each of the three areas between 5 to 8 km distant where doses are calculated to be greater than 1 mrem per year. • One sample from milking animals at a control location 15 – 30 km distant and in the least prevalent wind direction.	• **MKE-3 (E, 2.35 Miles)** - (West bank) Located at the Zeringue's house on LA 18 in Taft. • **MKA-31 (N, 31.2 Miles)** – (East bank) Located at 18736 Sisters Road, Ponchatoula, LA. (Control)	Quarterly (When Available)	• Gamma isotopic and I-131 analysis quarterly.
FISH AND INVERTEBRATES • One sample of each commercially and/or recreationally important species in vicinity of plant discharge area. • One sample of same species in area not influenced by plant discharge.	• **FH-2 (Distance/Direction Not Applicable)** – Downstream of the plant discharge structure. • **FH-3 (Distance/Direction Not Applicable)** - (Westbank) Waterways downstream of plant discharge directed to 40 Arpent Canal. • **FH-1 (Distance/Direction Not Applicable)** – Upstream of the plant intake structure. (Control)	Sample in season, or annually if they are not seasonal.	• Gamma isotopic analysis on edible portions annually.
BROAD LEAF VEGATATION • Samples of one to three different types of broadleaf vegetation grown nearest each of the two different off-site locations of highest predicted annual average ground level D/Q if milk sampling is not performed. • One sample of each of the similar broadleaf vegetation grown 15 – 30 km distant in the least prevalent wind direction if milk sampling is not performed.	• **BLQ-1 (NW, 0.83 Miles)** – (West bank) Located near air sample station APQ-1. • **BLB-1 (NNE, 0.81 Miles)** – (East bank) Located west of Little Gypsy on LA 628 • **BLE-20 (E, 19.7 Miles)** – (West bank) Located on property of Nine Mile Point in Westwego. (Control)	Quarterly during the growing season.	• Gamma isotopic and I-131 analysis quarterly.

Figure 1: Exposure Pathway

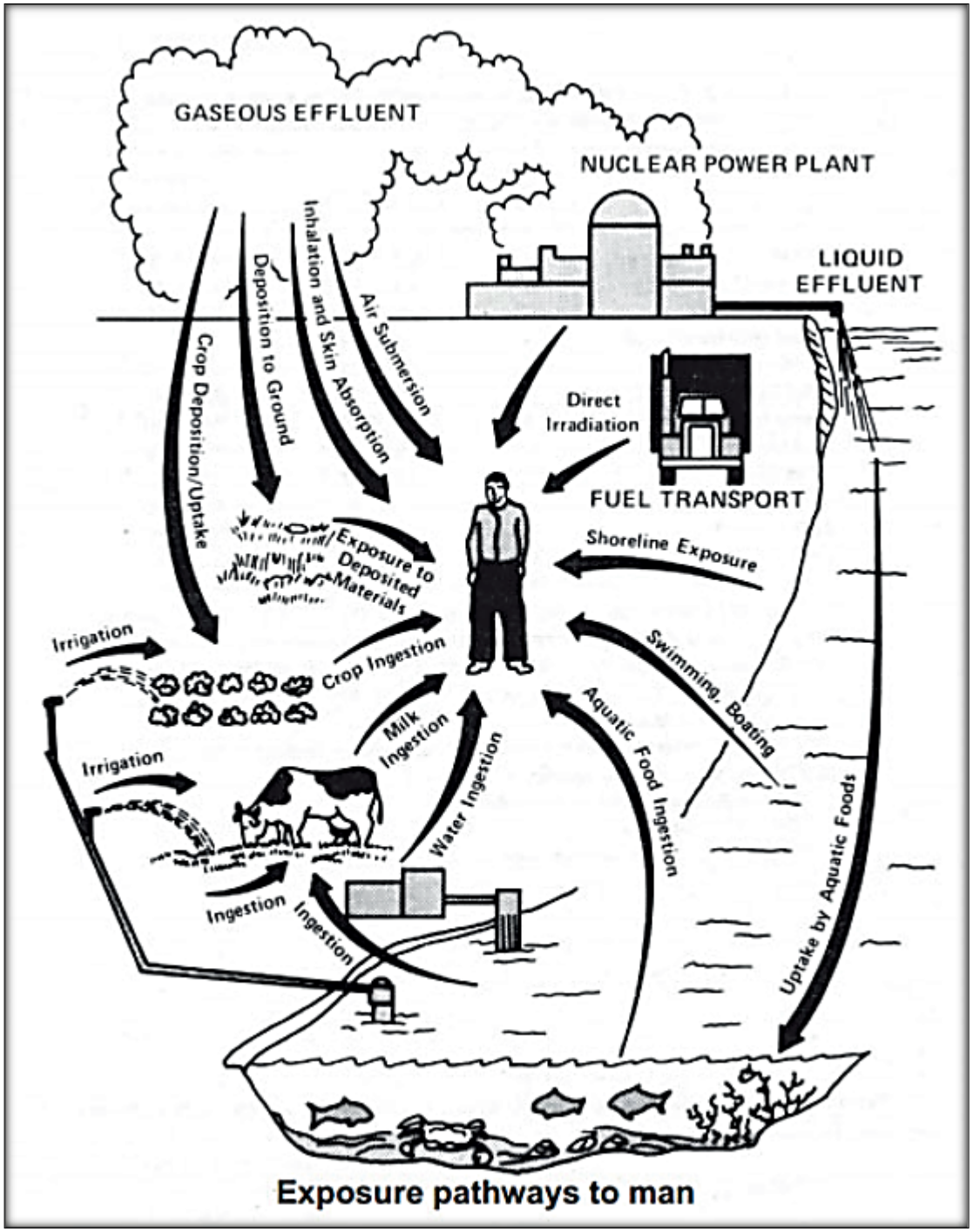


Figure 2: REMP Samples Within 2 Miles of Waterford 3

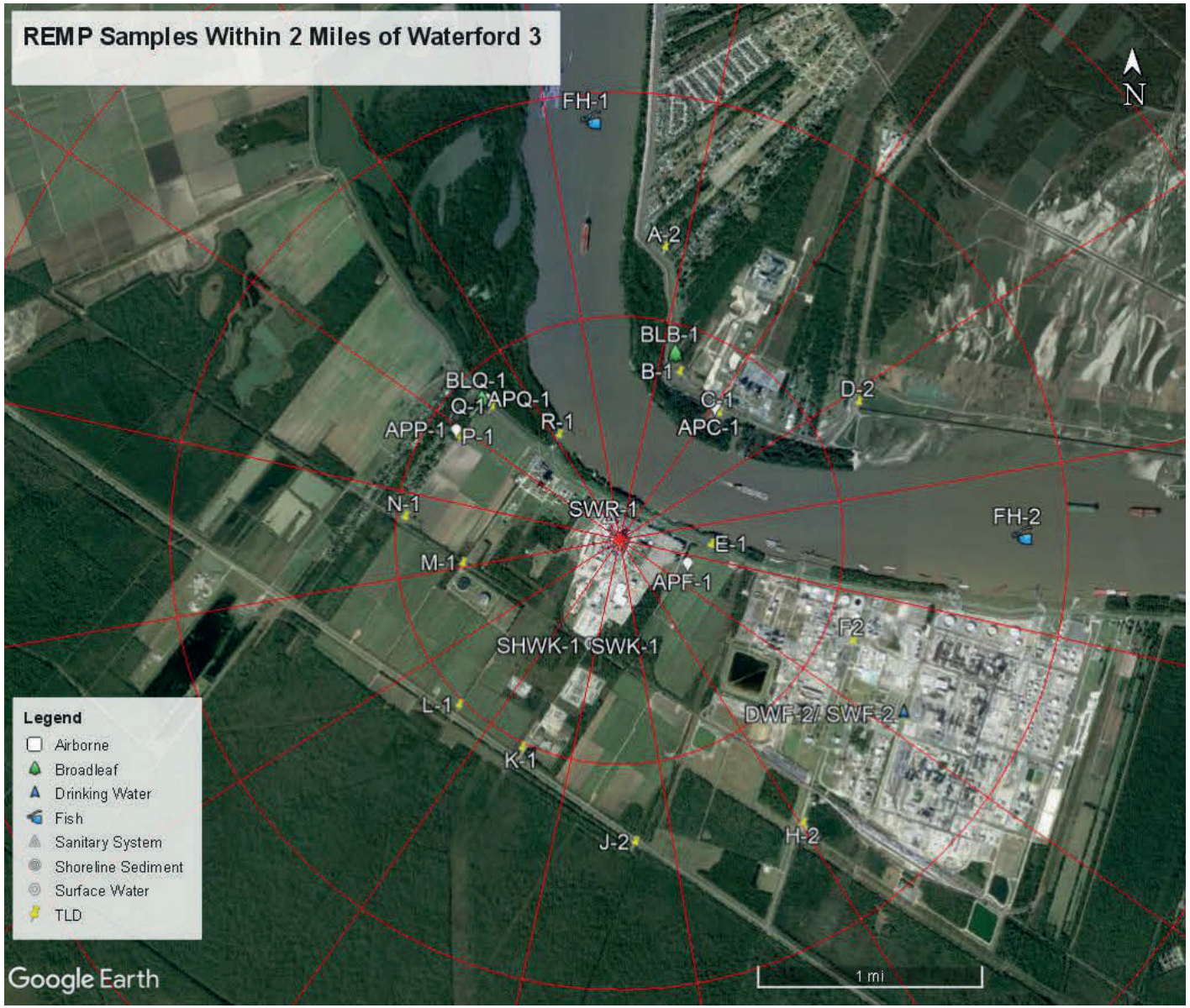


Figure 3: REMP Samples within 2 to 10 Miles of Waterford 3

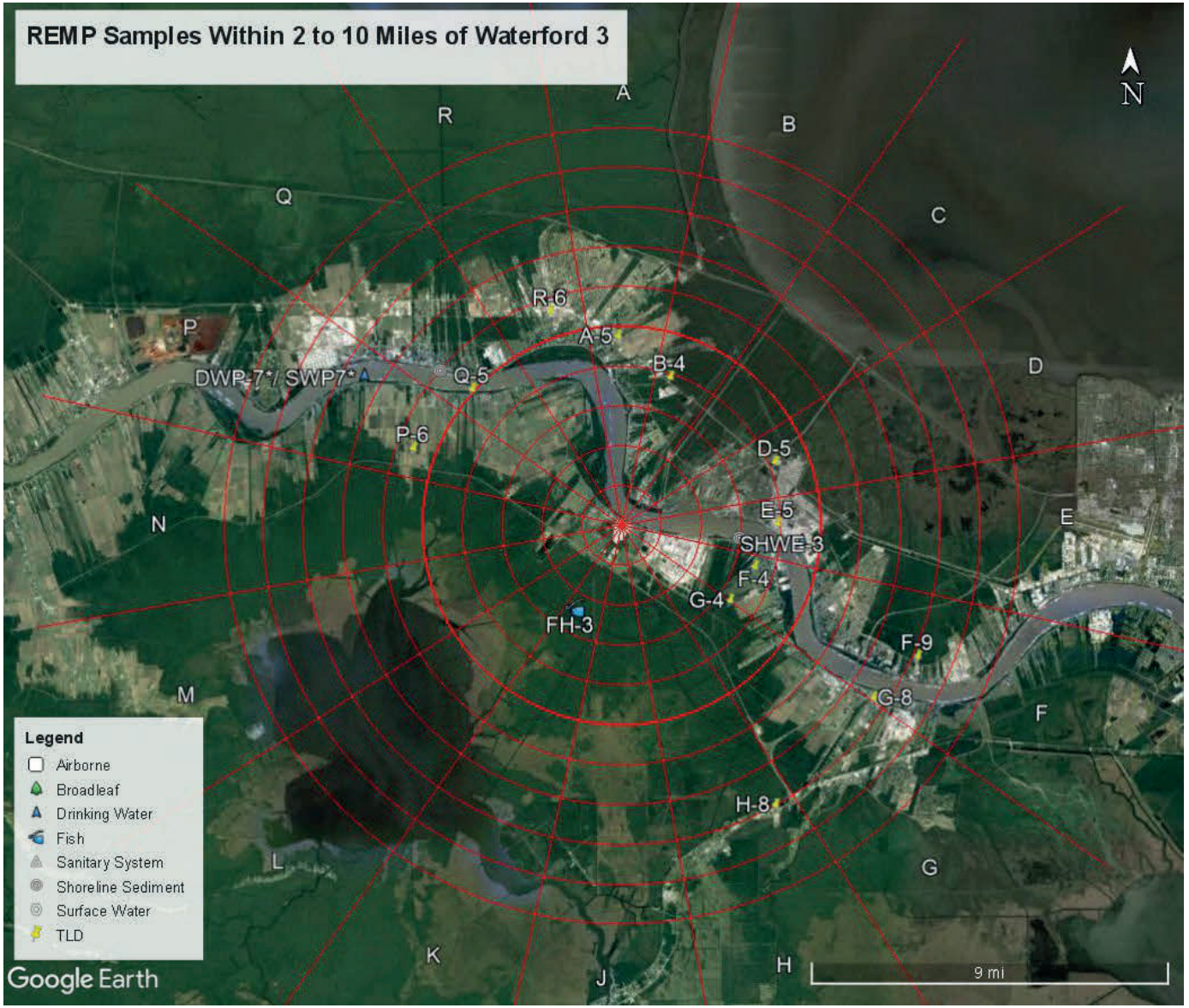
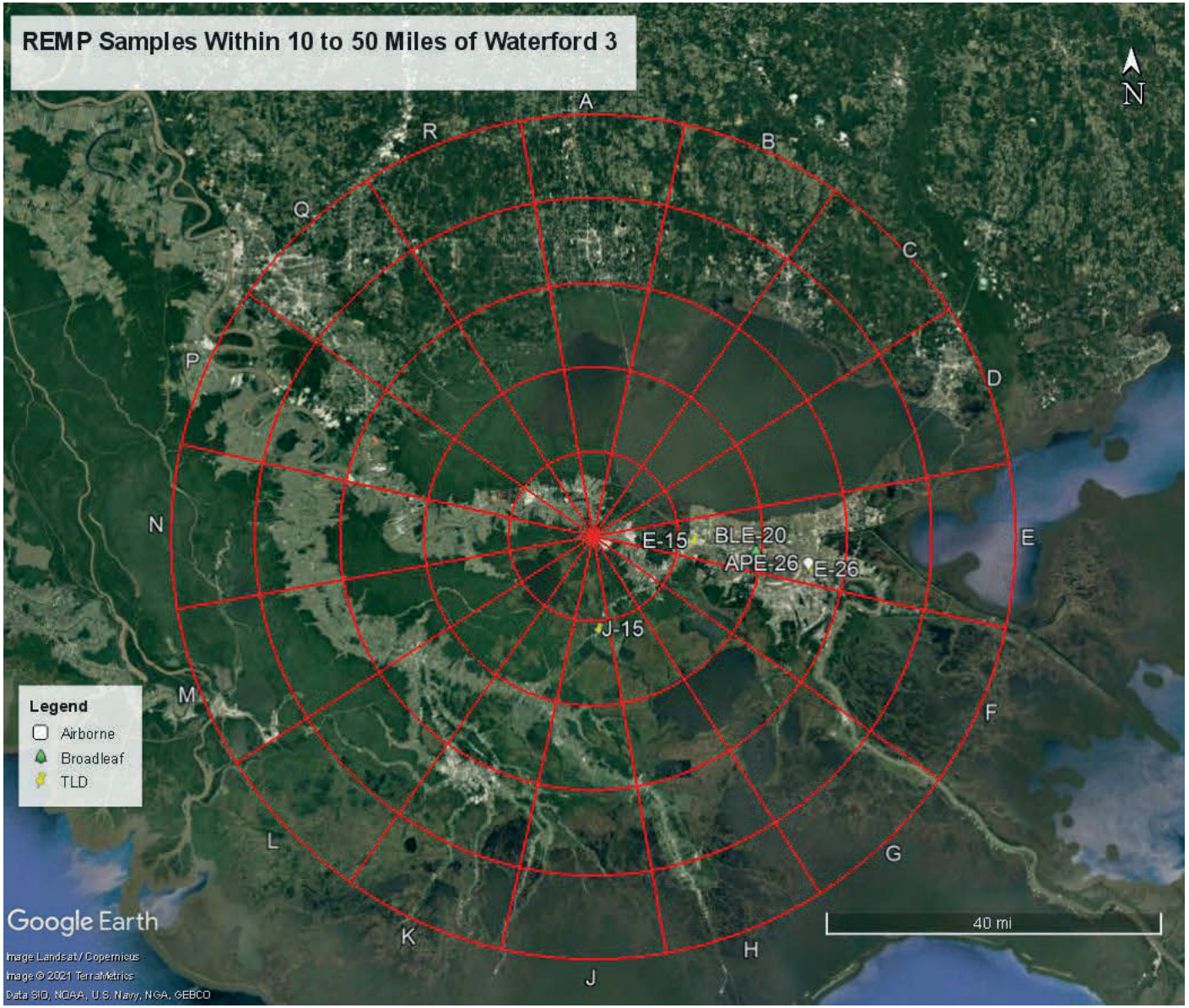


Figure 4: REMP Samples within 10 to 50 Miles of Waterford 3



4.0 INTERPRETATION AND TRENDS OF RESULTS

4.1 Air Particulate and Radioiodine Sample Results

Samples of airborne particulate and radioiodine were collected at four indicator locations and one control location and analyzed for gross beta radionuclides, Iodine-131 and gamma radionuclides (quarterly air particulate filter composites only). Waterford 3 did not detect any gamma radionuclides in the quarterly air particulate composites or Iodine-131 in the radioiodine cartridges during the reporting period as has been the case in previous years. Indicator gross beta air particulate results for 2022 were similar to background levels obtained during previous years of the operational REMP and well below preoperational levels as seen below. Results are reported as annual average pCi/m3.

Monitoring Period	Result
2012 – 2021 (Minimum Value)	0.017
2022 Average Value	0.021
2012 – 2021 (Maximum Value)	0.024
Preoperational	0.080

In the absence of plant-related gamma radionuclides, gross beta activity is attributed to naturally occurring radionuclides. Table 6, which includes gross beta concentrations and provides 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 Waterford 3 operations.

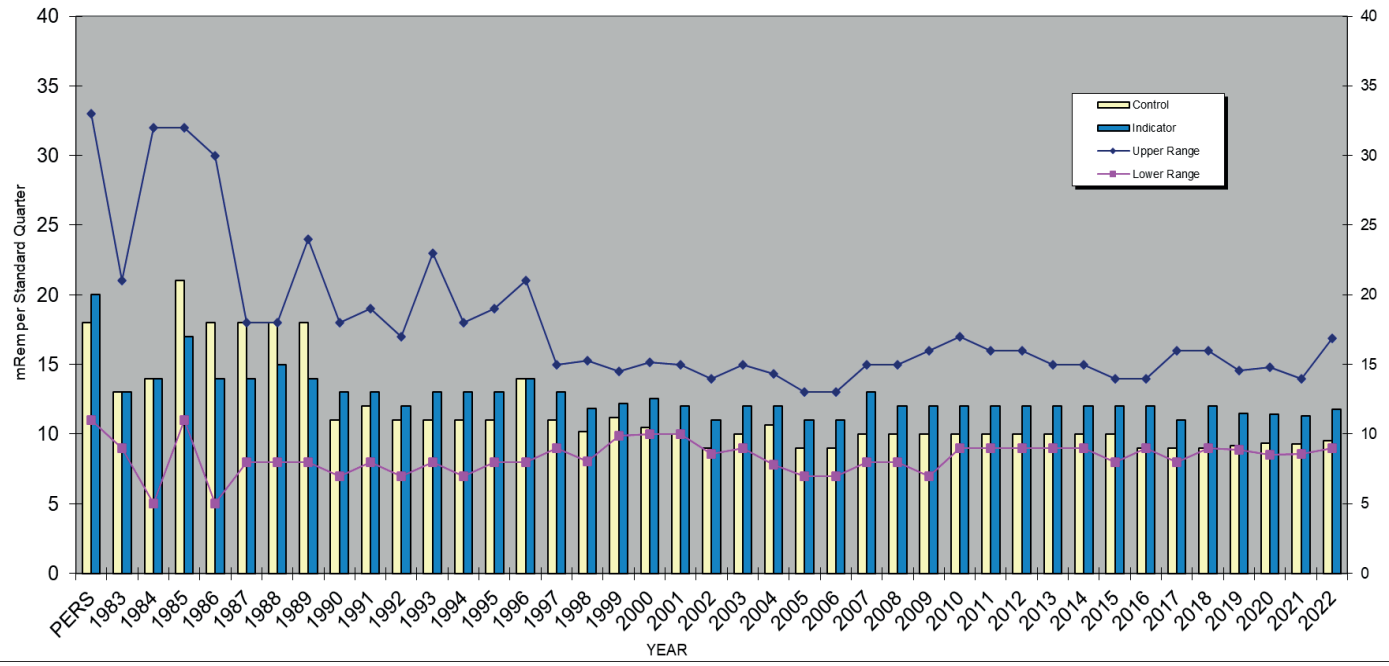
4.2 Thermoluminescent Dosimetry (TLD) Sample Results

Waterford 3 reports measured dose as net exposure (field reading less transit reading) normalized to 92 days and relies on comparison of the thirty indicator locations to the one control as a measure of plant impact. Waterford 3's comparison of the inner ring, outer ring, 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 average indicator value of 11.8 millirem (mrem) shown in the TLD radiation dose comparison graph below shows the 2022 concentration is comparable to historic results. Overall, Waterford 3 concluded that the ambient radiation levels are not being affected by plant operations.

The average exposure rates during 2022 are consistent with those from the preoperational program and the previous five years of operation. In particular, the preoperational survey indicates that exposure rates ranged between 11 and 33 mrem/standard quarter with an average of 20 mrem/standard quarter. The range during the previous five years of operation was 9 to 15 mrem/standard quarter with an average exposure rate of 11.4 mrem/standard quarter.

A comparison of the indicator results to the control results, as seen in Table 6, shows that the average indicator locations are slightly higher than that of the control. As shown in Attachment 2, Tables 11-14, several indicator locations are higher than the control by a few mrem with a maximum difference of 7.8 mrem/std. qtr. The differences between indicator locations and the control, and TLD stations grouped by distance from the plant are expected due to a variety of factors not related to Waterford 3 plant operations that can affect background radiation in the vicinity of each TLD station.

Figure 5
TLD Radiation Dose Comparison By Year



4.3 Waterborne Sample Results

Analytical results for 2022 drinking water/surface water samples were similar to those reported in previous years. Gamma radionuclides, iodine-131 and tritium analytical results for 2022 waterborne samples were below the ODCM-required LLD similar to those reported in previous years. Gross Beta continues to be detected in Waterford 3 drinking water samples consistent with historical results. These results are further explained below.

4.3.1 Surface Water Results

Samples were collected from one indicator location and analyzed for gamma radionuclides and tritium. Gamma radionuclides were below detectable limits which is consistent with results seen in previous operational years. Tritium was not detected in any of the quarterly samples. Therefore, the operation of Waterford 3 had no definable impact on this waterborne pathway in 2022.

4.3.2 Drinking/Surface Water Results

Drinking water samples also serve as surface water samples for Waterford 3. Therefore, monthly and quarterly gamma spectroscopy and tritium analyses of drinking water also satisfy the surface water sampling requirement.

Samples were collected from two indicators and one control location. Drinking/Surface water samples were analyzed for, gamma radionuclides, gross beta, iodine-131, and tritium. Gamma radionuclides, iodine-131, and tritium concentrations were below the LLD limits at the indicator and control locations. Gross beta was detected in both indicator and control locations. The average concentration of the indicator locations is comparable to the 2012 – 2021 operational years and below background preoperational data as shown below. Gross beta results from 2022 are summarized in Table 6. Results are reported as annual average pCi/L.

Monitoring Period	Result
2012 – 2021 (Minimum Value)	3.8
2022 Average Value	4.2
2012 – 2021 (Maximum Value)	6.6
Preoperational	7.0

Table 17, which includes gross beta concentrations for 2022, provides a comparison of the indicator and control means. It shows that the waterborne pathway continues to remain at background levels. Waterford 3 personnel have noted no definable trends associated with drinking water results at the indicator location. Therefore, the operation of Waterford 3 had no definable impact on this waterborne pathway in 2022 and levels of radionuclides remain similar to those obtained in previous operational years.

4.3.3 Sediment Sample Results

Sediment samples were collected from two indicators and one control location in 2022 and analyzed for gamma radionuclides. Gamma radionuclides were below the LLD limits at both indicator and control locations. Listed below is a comparison of 2022 Cs-137 indicator results to the 2012-2021 operational years. Waterford 3 operations had no significant impact on the environment or public by this waterborne pathway.

Monitoring Period	Result
2012-2021 (Minimum Value)	<LLD
2022 Value	<LLD
2012-2021 (Maximum Value)	<LLD

4.4 Ingestion Sample Results

4.4.1 Fish Sample Results

Fish samples were collected from two 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, Waterford 3 operations had no significant radiological impact upon the environment or public by this ingestion pathway.

4.4.2 Broad Leaf Vegetation 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, broad leaf vegetation samples were collected from two indicator and one control location and analyzed for iodine-131 and gamma radionuclides. The 2022 levels remained undetectable, as has been the case in recent years. Therefore, based on these measurements, Waterford 3 operations had no significant radiological impact upon the environment or public by this ingestion pathway.

4.4.3 Milk Sample Results

Milk samples from the indicator and control location were unavailable for collection during 2022; therefore, broad leaf vegetation sampling was performed as required by TRM 3.12-1. Results are shown in section 4.4.2.

4.5 Land Use Census Results

The latest land use census was conducted October 4 – October 5, 2022. The nearest residence, garden, beef cow, food product and milk animal in each sector within a five mile radius of the plant was located by visual inspection and verbal inquiry.

The land use census identified several changes in 2022. These changes include one nearest residence change, and 6 nearest garden changes.

The nearest residence change identified was in sector A. The nearest residence in sector A has changed to 109 Evangeline Road at a distance of 1.26 miles from the plant.

The six nearest garden changes identified were in sectors B, C, N, P, Q, and R. The nearest garden in sector B has changed to 148 Evangeline Street at a distance of 1.30 miles from the plant. The nearest garden in sector C has changed to 254 Union Street at a distance of 1.12 miles from the plant. The nearest garden in sector N has changed to 390 Post Street at a distance of 1.04 miles from the plant. The nearest garden in sector P has changed to 313 Post Street at a distance of 0.96 miles from the plant. The nearest garden in sector Q has changed to 174 Post Street at a distance of 0.94 miles from the plant. The nearest garden in sector R has changed to 171 Glendale Plantation Road at a distance of 3.05 miles from the plant.

Based upon the locations identified in this survey, the locations identified in previous surveys and the locations currently being used to calculate dose commitments from liquid and gaseous effluents released from Waterford 3, no REMP sampling location changes are necessary. Results of the 2022 biennial census are shown in Table 5.

Table 5: 2022 Land Use Census Results

Sector	Direction	Nearest Residence (miles)	Nearest Garden (miles)	Nearest Milk Cow (miles)	Nearest Beef Cow (miles)	Nearest Goat (miles)
A	N	1.3	1.3	^	3.6	*3.8
B	NNE	1.0	1.3	^	1.9	^
C	NE	0.9	1.1	^	^	^
D	ENE	0.9	0.9	^	^	^
E	E	2.3	2.3	^	2.3	^
F	ESE	3.2	2.3	^	2.3	^
G	SE	4.0	4.0	^	2.5	^
H	SSE	^	^	^	^	^
J	S	^	^	^	^	^
K	SSW	^	^	^	^	^
L	SW	^	^	^	^	^
M	WSW	^	^	^	^	^
N	W	0.9	1.0	^	^	^
P	WNW	0.9	1.0	^	^	^
Q	NW	0.9	0.9	^	^	^
R	NNW	3.1	3.1	^	5.0	^

Symbol	Comment
^	Nothing was located within a five-mile radius of Waterford 3.
*	Animals were located at this distance from Waterford 3, but the milk is not used for human consumption.

4.6 Interlaboratory Comparison Results

Attachment 3 contains result summary for Interlaboratory Comparison program for Teledyne Brown Engineering and Environmental Dosimetry services to fulfill the requirements of section 5.7.2 of the ODCM.

5.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

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

Table 6: Radiological Environmental Monitoring Program Summary

Sample Type (Units)	Type / Number of Analyses[1]	LLD [2]	Indicator Locations Mean (F)[3] [Range]	Indicator[4] Location [Highest Annual Mean]	Mean (F)[3] [Range]	Control Locations Mean (F)[3] [Range]	Number of Non Routine Results[5]
Air Particulate (pCi/m^3)	GB / 130	0.01	0.0212 (104 / 104) [0.0098 - 0.034]	APF-1 (299°- 0.35 mi)	0.0222 (26 / 26) [0.0125 - 0.0316]	0.0211 (26 / 26) [0.0100 - 0.0302]	0
	GS / 20						
	Cs-134	0.05	< LLD	N/A	N/A	< LLD	0
	Cs-137	0.06	< LLD	N/A	N/A	< LLD	0
Airborne Iodine (pCi/m^3)	I-131 / 130	0.07	< LLD	N/A	N/A	< LLD	0
Inner Ring TLD (mR/Qtr)	Gamma / 64	[6]	11.4 (64 / 64) [9.0 - 15.2]	B-1 (200°- 0.75 mi)	13.4 (4 / 4) [12.5 - 15.2]	N/A	0
Outer Ring TLD (mR/Qtr)	Gamma / 39	[6]	12.8 (39 / 39) [9.2 - 16.9]	P-6 (107°- 5.58 mi)	14.5 (4 / 4) [13.4 - 16.9]	N/A	0
Special Interest TLD (mR/Qtr)	Gamma / 16	[6]	10.9 (16 / 16) [9.7 - 12.9]	G-8 (305°- 7.74 mi)	11.6 (4 / 4) [11.0 - 12.9]	N/A	0
Control TLD (mR/Qtr)	Gamma / 4	[6]	N/A	N/A	N/A	9.5 (4 / 4) [9.1 - 10.7]	0

Table 6: Radiological Environmental Monitoring Program Summary

Sample Type (Units)	Type / Number of Analyses[1]	LLD [2]	Indicator Locations Mean (F)[3] [Range]	Indicator[4] Location [Highest Annual Mean]	Mean (F)[3] [Range]	Control Locations Mean (F)[3] [Range]	Number of Non Routine Results[5]
Surface Water (pCi/L)	H-3 / 5	2000	< LLD	N/A	N/A	N/A	0
	GS / 14						
	Mn-54	15	< LLD	N/A	N/A	N/A	0
	Co-58	15	< LLD	N/A	N/A	N/A	0
	Fe-59	30	< LLD	N/A	N/A	N/A	0
	Co-60	15	< LLD	N/A	N/A	N/A	0
	Zn-65	30	< LLD	N/A	N/A	N/A	0
	Nb-95	15	< LLD	N/A	N/A	N/A	0
	I-131	15	< LLD	N/A	N/A	N/A	0
	Zr-95	15	< LLD	N/A	N/A	N/A	0
	Cs-134	15	< LLD	N/A	N/A	N/A	0
	Cs-137	18	< LLD	N/A	N/A	N/A	0
	Ba-140	15	< LLD	N/A	N/A	N/A	0
	La-140	15	< LLD	N/A	N/A	N/A	0

Table 6: Radiological Environmental Monitoring Program Summary

Sample Type (Units)	Type / Number of Analyses[1]	LLD [2]	Indicator Locations Mean (F)[3] [Range]	Indicator[4] Location [Highest Annual Mean]	Mean (F)[3] [Range]	Control Locations Mean (F)[3] [Range]	Number of Non Routine Results[5]
Drinking/Surface Water (pCi/L)	GB / 15	4	4.2 (10 / 10) [3.1 - 6.2]	DW/SWF-2 (302°- 1.51 mi)	4.5 (5 / 5) [3.1 - 6.2]	4.3 (5 / 5) [3.2 - 5.8]	0
	I-131 / 43	1	< LLD	N/A	N/A	< LLD	0
	H-3 / 15	2000	< LLD	N/A	N/A	< LLD	0
	GS / 15						
	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
	Zr-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	15	< LLD	N/A	N/A	< LLD	0
	La-140	15	< LLD	N/A	N/A	< LLD	0
Sediment (pCi/kg dry)	GS / 3						
	Cs-134	150	< LLD	N/A	N/A	< LLD	0
	Cs-137	180	< LLD	N/A	N/A	< LLD	0

Table 6: Radiological Environmental Monitoring Program Summary

Sample Type (Units)	Type / Number of Analyses[1]	LLD [2]	Indicator Locations Mean (F)[3] [Range]	Indicator[4] Location [Highest Annual Mean]	Mean (F)[3] [Range]	Control Locations Mean (F)[3] [Range]	Number of Non Routine Results[5]
Fish (pCi/kg wet)	GS / 12						
	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
Broad Leaf (pCi/kg wet)	GS / 12						
	I-131	60	< LLD	N/A	N/A	N/A	0
	Cs-134	60	< LLD	N/A	N/A	N/A	0
	Cs-137	80	< LLD	N/A	N/A	N/A	0
Milk (pCi/L) ***Milk samples were unavailable in 2022.**	I-131 / 0	1	N/A	N/A	N/A	N/A	0
	GS / 0						
	Cs-134	15	N/A	N/A	N/A	N/A	0
	Cs-137	18	N/A	N/A	N/A	N/A	0
	Ba-140	15	N/A	N/A	N/A	N/A	0
	La-140	15	N/A	N/A	N/A	N/A	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 Waterford 3 TRM Table 4.12-1.

[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) degrees 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 Waterford 3 TRM.

Attachment 1

Sample Deviations

Table 7: Sample Deviations Table

Comment No.	Sample Media Affected	Sample Location	Date	Problem	Evaluation / Actions
1	Milk	MKE-3	2022	Sample Unavailable	Milk samples from indicator station MKE-3 were unavailable for all four quarters of 2022 due to there being no indicator milk animals within 8 km of the plant. Broad Leaf vegetation sampling was performed in place of the milk indicator sampling.
2	Milk	MKA-31	2022	Sample Unavailable	Milk samples from control station MKA-31 were not collected in 2022 due to there being no indicator milk animals within 8 km of the plant. Broad Leaf vegetation sampling was performed in place of the milk indicator sampling.
3	AP/C	APP-1	05/16/22-05/30/22	Low Volume	The air particulate and charcoal sample collected from 05/16/22-05/30/22 had low volumes due to a loss of power to the sample pump. Electricians restored power to the pump.
4	TLD	H-8	3rd Quarter	Sample Missing	TLD from station H-8 was unable to be analyzed due to sample being missing at time of collection. A new TLD was put in place.
5	AP/C	APP-1	12/12/22-12/26/22	Low Volume	The air particulate and charcoal sample collected from 12/12/22-12/26/22 had low volumes due a power outage associated with severe weather in the area. The sample pump operated as expected once power was restored to the area.

Monitoring Results Tables

Table 8: Air Particulate Data Table

Analysis: Gross Beta					Units: pCi/m^3	
Start Date	End Date	APF-1[1] (Indicator)	APQ-1 (Indicator)	APP-1 (Indicator)	APC-1 (Indicator)	APE-26 (Control)
REQUIRED LLD ➔		0.01	0.01	0.01	0.01	0.01
12/27/2021	01/10/2022	0.018	0.013	0.016	0.015	0.013
01/10/2022	01/24/2022	0.025	0.025	0.026	0.024	0.023
01/24/2022	02/07/2022	0.018	0.016	0.015	0.016	0.020
02/07/2022	02/21/2022	0.024	0.025	0.024	0.025	0.028
02/21/2022	03/07/2022	0.022	0.021	0.021	0.024	0.021
03/07/2022	03/21/2022	0.022	0.017	0.017	0.018	0.018
03/21/2022	04/04/2022	0.021	0.021	0.022	0.022	0.023
04/04/2022	04/18/2022	0.019	0.020	0.016	0.015	0.016
04/18/2022	05/02/2022	0.024	0.023	0.022	0.021	0.021
05/02/2022	05/16/2022	0.022	0.022	0.021	0.021	0.020
05/16/2022	05/30/2022	0.022	0.021	0.023[2]	0.023	0.024
05/30/2022	06/13/2022	0.014	0.014	0.015	0.014	0.016
06/13/2022	06/27/2022	0.028	0.027	0.028	0.029	0.029
06/27/2022	07/11/2022	0.017	0.013	0.015	0.015	0.015
07/11/2022	07/25/2022	0.019	0.016	0.015	0.013	0.016
07/25/2022	08/08/2022	0.013	0.012	0.010	0.011	0.010
08/08/2022	08/22/2022	0.028	0.017	0.023	0.016	0.017
08/22/2022	09/05/2022	0.013	0.011	0.011	0.012	0.012
09/05/2022	09/19/2022	0.031	0.023	0.023	0.025	0.024
09/19/2022	10/03/2022	0.029	0.031	0.029	0.030	0.030
10/03/2022	10/17/2022	0.032	0.030	0.031	0.029	0.030
10/17/2022	10/31/2022	0.025	0.028	0.027	0.027	0.028
10/31/2022	11/14/2022	0.025	0.026	0.022	0.025	0.027
11/14/2022	11/28/2022	0.027	0.029	0.029	0.025	0.030
11/28/2022	12/12/2022	0.020	0.022	0.018	0.019	0.018
12/12/2022	12/26/2022	0.021	0.021	0.034[3]	0.019	0.024

[1] Station with highest annual mean.
[2] See Attachment 1, Table 7, Samples Deviations Table, Comment 3
[3] See Attachment 1, Table 7, Samples Deviations Table, Comment 5

Monitoring Results Tables

Table 9: Radioiodine Cartridge Data Table

Analysis: I-131					Units: pCi/m^3	
Start Date	**End Date**	**APF-1 (Indicator)**	**APQ-1 (Indicator)**	**APP-1 (Indicator)**	**APC-1 (Indicator)**	**APE-26 (Control)**
REQUIRED LLD ➔		**0.07**	**0.07**	**0.07**	**0.07**	**0.07**
12/27/2021	01/10/2022	< 0.007	< 0.015	< 0.014	< 0.014	< 0.014
01/10/2022	01/24/2022	< 0.015	< 0.013	< 0.015	< 0.014	< 0.015
01/24/2022	02/07/2022	< 0.019	< 0.009	< 0.019	< 0.018	< 0.019
02/07/2022	02/21/2022	< 0.014	< 0.012	< 0.014	< 0.013	< 0.014
02/21/2022	03/07/2022	< 0.024	< 0.011	< 0.024	< 0.023	< 0.024
03/07/2022	03/21/2022	< 0.022	< 0.010	< 0.022	< 0.021	< 0.022
03/21/2022	04/04/2022	< 0.013	< 0.009	< 0.013	< 0.013	< 0.013
04/04/2022	04/18/2022	< 0.019	< 0.008	< 0.018	< 0.018	< 0.018
04/18/2022	05/02/2022	< 0.012	< 0.011	< 0.012	< 0.012	< 0.012
05/02/2022	05/16/2022	< 0.016	< 0.018	< 0.017	< 0.007	< 0.017
05/16/2022	05/30/2022	< 0.020	< 0.021	< 0.015[(1)]	< 0.019	< 0.020
05/30/2022	06/13/2022	< 0.016	< 0.017	< 0.008	< 0.016	< 0.016
06/13/2022	06/27/2022	< 0.011	< 0.010	< 0.011	< 0.011	< 0.011
06/27/2022	07/11/2022	< 0.016	< 0.007	< 0.016	< 0.015	< 0.016
07/11/2022	07/25/2022	< 0.016	< 0.008	< 0.016	< 0.015	< 0.016
07/25/2022	08/08/2022	< 0.014	< 0.006	< 0.014	< 0.013	< 0.014
08/08/2022	08/22/2022	< 0.019	< 0.009	< 0.019	< 0.018	< 0.019
08/22/2022	09/05/2022	< 0.015	< 0.016	< 0.015	< 0.006	< 0.015
09/05/2022	09/19/2022	< 0.017	< 0.008	< 0.017	< 0.016	< 0.017
09/19/2022	10/03/2022	< 0.019	< 0.008	< 0.019	< 0.018	< 0.019
10/03/2022	10/17/2022	< 0.016	< 0.007	< 0.017	< 0.015	< 0.017
10/17/2022	10/31/2022	< 0.024	< 0.011	< 0.024	< 0.022	< 0.024
10/31/2022	11/14/2022	< 0.017	< 0.008	< 0.018	< 0.016	< 0.018
11/14/2022	11/28/2022	< 0.021	< 0.009	< 0.021	< 0.019	< 0.021
11/28/2022	12/12/2022	< 0.019	< 0.010	< 0.019	< 0.018	< 0.019
12/12/2022	12/26/2022	< 0.017	< 0.018	< 0.049[(2)]	< 0.016	< 0.017

[(1)] See Attachment 1, Table 7, Samples Deviations Table, Comment 3
[(2)] See Attachment 1, Table 7, Samples Deviations Table, Comment 5

Monitoring Results Tables

Table 10: Air Particulate Composite Data Table

Analysis: Gamma Isotopic		Units: pCi/m^3	
Location	**Collection Date**	**Cs-134**	**Cs-137**
	REQUIRED LLD ➔	**0.05**	**0.06**
APF-1 (Indicator)	03/21/2022	< 0.003	< 0.003
APQ-1 (Indicator)	03/21/2022	< 0.003	< 0.003
APP-1 (Indicator)	03/21/2022	< 0.002	< 0.002
APC-1 (Indicator)	03/21/2022	< 0.004	< 0.003
APE-26 (Control)	03/21/2022	< 0.003	< 0.003
APF-1 (Indicator)	06/13/2022	< 0.002	< 0.002
APQ-1 (Indicator)	06/13/2022	< 0.004	< 0.002
APP-1 (Indicator)	06/13/2022	< 0.004	< 0.003
APC-1 (Indicator)	06/13/2022	< 0.002	< 0.002
APE-26 (Control)	06/13/2022	< 0.004	< 0.004
APF-1 (Indicator)	09/05/2022	< 0.002	< 0.002
APQ-1 (Indicator)	09/05/2022	< 0.003	< 0.003
APP-1 (Indicator)	09/05/2022	< 0.002	< 0.002
APC-1 (Indicator)	09/05/2022	< 0.004	< 0.003
APE-26 (Control)	09/05/2022	< 0.004	< 0.003
APF-1 (Indicator)	11/28/2022	< 0.002	< 0.002
APQ-1 (Indicator)	11/28/2022	< 0.001	< 0.002
APP-1 (Indicator)	11/28/2022	< 0.002	< 0.002
APC-1 (Indicator)	11/28/2022	< 0.002	< 0.001
APE-26 (Control)	11/28/2022	< 0.003	< 0.002

Monitoring Results Tables

Table 11: Thermoluminescent Dosimeters – Inner Ring

Analysis: Gamma Dose			Units: mrem/Std. Qtr.		
Station	1st Qtr 2022	2nd Qtr 2022	3rd Qtr 2022	4th Qtr 2022	Annual Mean 2022
A-2	11.7	11.7	11.1	13.9	**12.1**
B-1(1)	**13.1**	**12.6**	**12.5**	**15.2**	**13.4**
C-1	9.1	9.0	9.0	11.0	**9.5**
D-2	12.4	11.6	12.3	13.7	**12.5**
E-1	11.2	11.1	11.2	13.3	**11.7**
F-2	11.0	10.4	11.7	12.9	**11.5**
G-2	10.9	10.4	10.9	12.2	**11.1**
H-2	10.3	10.4	11.1	12.4	**11.1**
J-2	10.0	9.5	10.6	12.0	**10.5**
K-1	10.9	10.9	11.7	12.9	**11.6**
L-1	12.1	12.4	12.6	14.9	**13.0**
M-1	9.9	9.3	10.3	11.6	**10.3**
N-1	10.1	9.7	10.3	11.6	**10.4**
P-1	11.1	9.9	10.9	12.1	**11.0**
Q-1	12.2	11.8	12.3	14.1	**12.6**
R-1	9.3	9.3	9.3	10.4	**9.6**

(1) Inner ring station with highest annual mean.

Table 12: Thermoluminescent Dosimeters – Outer Ring

Analysis: Gamma Dose			Units: mrem/Std. Qtr.		
Station	1st Qtr 2022	2nd Qtr 2022	3rd Qtr 2022	4th Qtr 2022	Annual Mean 2022
A-5	12.2	12.0	11.8	14.7	**12.7**
B-4	13.2	13.0	12.4	15.7	**13.6**
D-5	12.6	12.3	12.2	13.4	**12.6**
E-5	12.6	12.0	13.0	15.4	**13.3**
F-4	13.0	12.9	13.5	15.7	**13.8**
G-4	10.7	10.4	10.7	12.8	**11.2**
H-8	13.2	12.9	(2)	15.9	**14.0**
P-6(1)	**13.6**	**13.4**	**13.9**	**16.9**	**14.5**
Q-5	12.0	11.5	12.5	14.1	**12.5**
R-6	9.8	9.2	10.0	10.8	**10.0**

(1) Outer ring station with highest annual mean.

(2) See Attachment 1, Table 7, Samples Deviations Table, Comment 4

Monitoring Results Tables

Table 13: 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
E-15	9.9	9.7	10.0	12.2	**10.5**
F-9	10.8	10.3	10.9	12.4	**11.1**
G-8(1)	**11.1**	**11.0**	**11.2**	**12.9**	**11.6**
J-15	10.2	9.7	10.2	11.7	**10.5**

(1) Special interest station with highest annual mean.

Table 14: 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
E-26	9.1	9.1	9.1	10.7	**9.5**

Monitoring Results Tables

Table 15: 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**	**15**	**15**	**18**	**15**	**15**
SWK-1 (Indicator)	12/21/2021	01/18/2022	< 2.06	< 1.95	< 3.93	< 2.02	< 3.93	< 2.06	< 2.13	< 3.02	< 2.13	< 2.07	< 6.85	< 2.43
SWK-1 (Indicator)	01/18/2022	02/15/2022	< 4.46	< 4.38	< 6.61	< 2.85	< 8.00	< 3.34	< 4.78	< 7.02	< 4.78	< 4.34	< 12.9	< 4.82
SWK-1 (Indicator)	02/15/2022	03/15/2022	< 1.61	< 1.72	< 3.55	< 1.73	< 3.24	< 1.61	< 2.46	< 2.87	< 1.83	< 1.58	< 7.40	< 2.69
SWK-1 (Indicator)	03/15/2022	04/12/2022	< 2.90	< 3.94	< 7.13	< 3.66	< 5.58	< 4.01	< 4.65	< 6.15	< 4.17	< 4.11	< 14.5	< 5.77
SWK-1 (Indicator)	04/12/2022	05/10/2022	< 4.40	< 3.55	< 7.76	< 3.89	< 6.96	< 3.56	< 4.45	< 6.69	< 4.01	< 3.00	< 13.6	< 4.10
SWK-1 (Indicator)	05/10/2022	06/07/2022	< 1.50	< 1.64	< 3.31	< 1.44	< 3.04	< 1.52	< 2.45	< 2.69	< 1.61	< 1.54	< 7.07	< 2.52
SWK-1 (Indicator)	06/07/2022	07/05/2022	< 1.95	< 1.99	< 4.19	< 2.07	< 4.49	< 2.05	< 2.52	< 3.42	< 2.24	< 2.09	< 8.06	< 2.98
SWK-1 (Indicator)	07/05/2022	08/02/2022	< 1.90	< 1.82	< 3.83	< 2.23	< 3.54	< 1.83	< 2.53	< 3.38	< 2.23	< 2.16	< 7.64	< 2.40
SWK-1 (Indicator)	08/02/2022	08/30/2022	< 2.40	< 2.48	< 4.77	< 3.02	< 4.72	< 2.27	< 2.86	< 3.79	< 2.89	< 2.38	< 10.2	< 2.98
SWK-1 (Indicator)	08/30/2022	09/27/2022	< 2.45	< 2.15	< 4.57	< 2.47	< 4.78	< 2.03	< 2.60	< 4.04	< 2.42	< 2.57	< 8.11	< 2.92
SWK-1 (Indicator)	09/27/2022	10/24/2022	< 1.65	< 1.58	< 2.79	< 1.73	< 2.99	< 1.49	< 1.94	< 2.62	< 1.76	< 1.65	< 5.86	< 2.09
SWK-1 (Indicator)	10/24/2022	11/22/2022	< 1.65	< 1.58	< 3.18	< 1.96	< 3.31	< 1.62	< 1.67	< 2.73	< 1.83	< 1.68	< 5.47	< 2.16
SWK-1 (Indicator)	11/22/2022	12/19/2022	< 2.16	< 1.99	< 3.97	< 2.18	< 4.31	< 2.08	< 2.55	< 3.56	< 2.20	< 2.17	< 7.96	< 2.53

Monitoring Results Tables

Table 16: Surface Water – Tritium

Analysis: H-3		Units: pCi/L	
Location	**Start Date**	**End Date**	**H-3**
		REQUIRED LLD ➔	**3000**
SWK-1 (Indicator)	11/23/2021	02/15/2022	< 563
SWK-1 (Indicator)	02/15/2022	05/10/2022	< 535
SWK-1 (Indicator)	05/10/2022	08/02/2022	< 473
SWK-1 (Indicator)	08/02/2022	10/24/2022	< 498
SWK-1 (Indicator)	10/24/2022	01/17/2023	< 568

Monitoring Results Tables

Table 17: Drinking/Surface Water – Gamma and Gross Beta

Analysis: Gamma Isotopic, Gross Beta													Units: pCi/L
Location	Collection Date	Gross Beta	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
REQUIRED LLD ➔		4	15	15	30	15	30	15	15	15	18	15	15
DWF/SWF-2[(1)] (Indicator)	02/15/2022	4.32	< 2.76	< 2.69	< 5.42	< 3.55	< 6.17	< 3.31	< 5.14	< 3.50	< 3.26	< 12.97	< 4.28
DWE/SWE-5 (Indicator)	02/15/2022	3.50	< 2.87	< 2.91	< 5.58	< 2.88	< 5.77	< 2.49	< 4.04	< 2.84	< 2.76	< 13.77	< 4.39
DWP/SWP-7 (Control)	02/15/2022	4.03	< 2.14	< 2.20	< 4.36	< 2.28	< 4.02	< 2.28	< 3.72	< 2.50	< 2.13	< 10.32	< 3.44
DWF/SWF-2[(1)] (Indicator)	05/10/2022	6.22	< 2.03	< 2.12	< 4.38	< 2.24	< 4.00	< 2.19	< 3.70	< 2.43	< 2.01	< 9.75	< 3.33
DWE/SWE-5 (Indicator)	05/10/2022	5.28	< 1.78	< 1.72	< 3.87	< 1.81	< 3.57	< 1.79	< 3.26	< 1.95	< 1.91	< 8.24	< 2.70
DWP/SWP-7 (Control)	05/10/2022	5.79	< 1.95	< 2.01	< 3.73	< 1.98	< 4.01	< 2.07	< 3.40	< 1.98	< 2.00	< 9.66	< 3.34
DWF/SWF-2[(1)] (Indicator)	08/02/2022	3.10	< 1.79	< 1.77	< 4.02	< 2.07	< 3.66	< 1.83	< 3.24	< 2.07	< 1.82	< 8.93	< 3.05
DWE/SWE-5 (Indicator)	08/02/2022	3.22	< 1.77	< 1.95	< 3.91	< 1.84	< 3.49	< 1.72	< 3.12	< 1.99	< 1.91	< 8.31	< 3.16
DWP/SWP-7 (Control)	08/02/2022	4.08	< 1.79	< 2.04	< 4.44	< 1.93	< 3.69	< 1.81	< 3.37	< 2.15	< 1.75	< 8.69	< 3.24
DWF/SWF-2[(1)] (Indicator)	10/24/2022	4.96	< 1.71	< 1.59	< 3.29	< 1.84	< 3.46	< 1.83	< 2.66	< 1.79	< 1.67	< 6.98	< 2.25
DWE/SWE-5 (Indicator)	10/24/2022	4.18	< 1.53	< 1.65	< 3.23	< 2.11	< 3.43	< 1.64	< 2.77	< 1.85	< 1.62	< 7.20	< 2.17
DWP/SWP-7 (Control)	10/24/2022	3.19	< 1.66	< 1.74	< 3.56	< 1.86	< 3.64	< 1.87	< 2.94	< 1.85	< 1.93	< 7.16	< 2.49
DWF/SWF-2[(1)] (Indicator)	01/17/2023	3.75	< 1.75	< 1.83	< 4.02	< 2.16	< 3.90	< 1.86	< 3.42	< 2.07	< 1.90	< 8.56	< 2.55
DWE/SWE-5 (Indicator)	01/17/2023	3.30	< 1.65	< 1.62	< 3.33	< 1.98	< 3.30	< 1.73	< 2.94	< 1.87	< 1.77	< 8.09	< 2.75
DWP/SWP-7 (Control)	01/17/2023	4.26	< 1.92	< 1.74	< 3.91	< 1.97	< 3.54	< 1.98	< 3.55	< 1.82	< 1.92	< 8.97	< 3.11

[(1)] Station with highest annual Gr-B mean.

Monitoring Results Tables

Table 18: Drinking/Surface Water- Iodine-131

Analysis: Iodine-131		Units: pCi/L	
Location	**Start Date**	**End Date**	**I-131**
		REQUIRED LLD ➔	**1.0**
DWF/SWF-2 (Indicator)	12/21/2021	01/18/2022	< 0.873
DWE/SWE-5 (Indicator)	12/21/2021	01/18/2022	< 0.801
DWP/SWP-7 (Control)	12/21/2021	01/18/2022	< 0.750
DWF/SWF-2 (Indicator)	01/18/2022	02/15/2022	< 0.853
DWE/SWE-5 (Indicator)	01/18/2022	02/15/2022	< 0.867
DWP/SWP-7 (Control)	01/18/2022	02/15/2022	< 0.862
DWF/SWF-2 (Indicator)	02/15/2022	03/15/2022	< 0.451
DWE/SWE-5 (Indicator)	02/15/2022	03/15/2022	< 0.478
DWP/SWP-7 (Control)	02/15/2022	03/15/2022	< 0.801
DWF/SWF-2 (Indicator)	03/15/2022	04/12/2022	< 0.870
DWE/SWE-5 (Indicator)	03/15/2022	04/12/2022	< 0.764
DWP/SWP-7 (Control)	03/15/2022	04/12/2022	< 0.863
DWF/SWF-2 (Indicator)	04/12/2022	05/10/2022	< 0.545
DWE/SWE-5 (Indicator)	04/12/2022	05/10/2022	< 0.532
DWP/SWP-7 (Control)	04/12/2022	05/10/2022	< 0.568
DWF/SWF-2 (Indicator)	05/10/2022	06/07/2022	< 0.697
DWE/SWE-5 (Indicator)	05/10/2022	06/07/2022	< 0.866
DWP/SWP-7 (Control)	05/10/2022	06/07/2022	< 0.685
DWF/SWF-2 (Indicator)	06/07/2022	07/05/2022	< 0.698
DWE/SWE-5 (Indicator)	06/07/2022	07/05/2022	< 0.676
DWP/SWP-7 (Control)	06/07/2022	07/05/2022	< 0.749
DWF/SWF-2 (Indicator)	07/05/2022	08/02/2022	< 0.798
DWE/SWE-5 (Indicator)	07/05/2022	08/02/2022	< 0.693
DWP/SWP-7 (Control)	07/05/2022	08/02/2022	< 0.825
DWF/SWF-2 (Indicator)	08/02/2022	08/30/2022	< 0.540
DWE/SWE-5 (Indicator)	08/02/2022	08/30/2022	< 0.877
DWP/SWP-7 (Control)	08/02/2022	08/30/2022	< 0.674
DWF/SWF-2 (Indicator)	08/30/2022	09/27/2022	< 0.839
DWE/SWE-5 (Indicator)	08/30/2022	09/27/2022	< 0.832
DWP/SWP-7 (Control)	08/30/2022	09/27/2022	< 0.784
DWF/SWF-2 (Indicator)	09/27/2022	10/24/2022	< 0.951
DWE/SWE-5 (Indicator)	09/27/2022	10/24/2022	< 0.886
DWP/SWP-7 (Control)	09/27/2022	10/24/2022	< 0.906
DWF/SWF-2 (Indicator)	10/24/2022	11/22/2022	< 0.891
DWE/SWE-5 (Indicator)	10/24/2022	11/22/2022	< 0.834
DWP/SWP-7 (Control)	10/24/2022	11/22/2022	< 0.848
DWF/SWF-2 (Indicator)	11/22/2022	12/19/2022	< 0.814
DWE/SWE-5 (Indicator)	11/22/2022	12/19/2022	< 0.889
DWP/SWP-7 (Control)	11/22/2022	12/19/2022	< 0.890
DWF/SWF-2 (Indicator)	12/19/2022	01/17/2023	< 0.761
DWE/SWE-5 (Indicator)	12/19/2022	01/17/2023	< 0.867
DWP/SWP-7 (Control)	12/19/2022	01/17/2023	< 0.802
DWP/SWP-7 DUP (Control)	12/19/2022	01/17/2023	< 0.870

Table 19: Drinking/Surface Water – Tritium

Analysis: H-3		Units: pCi/L	
Location	**Start Date**	**End Date**	**H-3**
		REQUIRED LLD ➔	**2000**
DWF/SWF-2 (Indicator)	11/23/2021	02/15/2022	< 592
DWE/SWE-5 (Indicator)	11/23/2021	02/15/2022	< 589
DWP/SWP-7 (Control)	11/23/2021	02/15/2022	< 552
DWF/SWF-2 (Indicator)	02/15/2022	05/10/2022	< 595
DWE/SWE-5 (Indicator)	02/15/2022	05/10/2022	< 544
DWP/SWP-7 (Control)	02/15/2022	05/10/2022	< 494
DWF/SWF-2 (Indicator)	05/10/2022	08/02/2022	< 523
DWE/SWE-5 (Indicator)	05/10/2022	08/02/2022	< 514
DWP/SWP-7 (Control)	05/10/2022	08/02/2022	< 471
DWF/SWF-2 (Indicator)	08/02/2022	10/24/2022	< 483
DWE/SWE-5 (Indicator)	08/02/2022	10/24/2022	< 473
DWP/SWP-7 (Control)	08/02/2022	10/24/2022	< 490
DWF/SWF-2 (Indicator)	10/24/2022	01/17/2023	< 564
DWE/SWE-5 (Indicator)	10/24/2022	01/17/2023	< 576
DWP/SWP-7 (Control)	10/24/2022	01/17/2023	< 589

Monitoring Results Tables

Table 20: Sediment - Gamma

Analysis: Gamma Isotopic		Units: pCi/kg (dry)	
Location	Collection Date	Cs-134	Cs-137
	REQUIRED LLD ➔	150	180
SHWK-1 (Indicator)	09/07/2022	< 106.4	< 106.9
SHWE-3 (Indicator)	09/07/2022	< 103.9	< 82.82
SHWQ-6 (Control)	09/07/2022	< 73.11	< 53.68

Monitoring Results Tables

Table 21: Fish - Gamma

Analysis: Gamma Isotopic								Units: pCi/kg (wet)	
Location	**Collection Date**	**Species**	**Mn-54**	**Co-58**	**Fe-59**	**Co-60**	**Zn-65**	**Cs-134**	**Cs-137**
REQUIRED LLD ➔			**130**	**130**	**260**	**130**	**260**	**130**	**150**
FH-1 (Control)	12/16/2022	CATFISH	< 42.38	< 32.61	< 70.3	< 36.31	< 68.0	< 37.85	< 33.53
FH-2 (Indicator)	12/12/2022	CATFISH	< 66.84	< 59.62	< 119.3	< 38.73	< 90.4	< 36.61	< 50.49
FH-3 (Indicator)	11/08/2022	MULLET	< 54.15	< 77.80	< 161.0	< 56.28	< 133.5	< 46.78	< 44.34
FH-1 (Control)	12/16/2022	BUFFALO	< 42.56	< 38.45	< 92.8	< 53.77	< 106.6	< 51.12	< 57.54
FH-2 (Indicator)	12/12/2022	BUFFALO	< 57.09	< 54.19	< 100.3	< 68.57	< 110.4	< 51.66	< 58.50
FH-3 (Indicator)	12/09/2022	BUFFALO	< 69.67	< 65.76	< 140.0	< 48.93	< 71.8	< 74.61	< 63.53
FH-1 (Control)	12/16/2022	MULLET	< 41.50	< 34.20	< 62.01	< 32.63	< 89.6	< 44.00	< 34.04
FH-2 (Indicator)	12/12/2022	MULLET	< 53.52	< 61.78	< 119.9	< 29.88	< 128.1	< 59.93	< 46.46
FH-3 (Indicator)	11/08/2022	CARP	< 60.85	< 70.85	< 189.9	< 54.28	< 145.0	< 55.88	< 49.90
FH-1 (Control)	12/16/2022	CARP	< 39.01	< 32.52	< 70.0	< 41.88	< 82.1	< 41.66	< 29.36
FH-2 (Indicator)	12/12/2022	CARP	< 66.97	< 70.49	< 178.4	< 72.01	< 124.7	< 79.78	< 68.74
FH-3 (Indicator)	12/09/2022	CATFISH	< 70.80	< 66.49	< 137.6	< 69.73	< 162.5	< 79.14	< 75.17

Monitoring Results Tables

Table 22: Broad Leaf Vegatation - Gamma

Analysis: Gamma Isotopic		Units: pCi/kg (wet)		
Location	**Collection Date**	**I-131**	**Cs-134**	**Cs-137**
	REQUIRED LLD →	**60**	**60**	**80**
BLQ-1 (Indicator)	03/08/2022	< 19.58	< 19.18	< 15.22
BLB-1 (Indicator)	03/08/2022	< 17.09	< 18.31	< 20.88
BLE-20 (Control)	03/08/2022	< 12.41	< 15.57	< 15.99
BLQ-1 (Indicator)	06/08/2022	< 43.13	< 30.28	< 35.38
BLB-1 (Indicator)	06/08/2022	< 36.66	< 25.29	< 25.12
BLE-20 (Control)	06/08/2022	< 43.65	< 37.75	< 36.76
BLQ-1 (Indicator)	09/07/2022	< 57.42	< 34.33	< 37.26
BLB-1 (Indicator)	09/07/2022	< 33.60	< 22.92	< 26.70
BLE-20 (Control)	09/07/2022	< 57.06	< 36.06	< 41.08
BLQ-1 (Indicator)	12/05/2022	< 48.75	< 43.17	< 48.10
BLB-1 (Indicator)	12/05/2022	< 40.79	< 37.93	< 36.31
BLE-20 (Control)	12/05/2022	< 38.70	< 30.02	< 31.30

Monitoring Results Tables

Table 23: Milk - Gamma and Iodine-131

Analysis: Gamma Isotopic, Iodine-131				Units: pCi/L		
Location	**Collection Date**	**I-131**	**Cs-134**	**Cs-137**	**Ba-140**	**La-140**
REQUIRED LLD ➔		**1**	**15**	**18**	**15**	**15**
MKE-3 (Indicator)	03/01/2022	(1)	(1)	(1)	(1)	(1)
MKA-31 (Control)	03/01/2022	(2)	(2)	(2)	(2)	(2)
MKE-3 (Indicator)	06/01/2022	(1)	(1)	(1)	(1)	(1)
MKA-31 (Control)	06/01/2022	(2)	(2)	(2)	(2)	(2)
MKE-3 (Indicator)	09/01/2022	(1)	(1)	(1)	(1)	(1)
MKA-31 (Control)	09/01/2022	(2)	(2)	(2)	(2)	(2)
MKE-3 (Indicator)	12/01/2022	(1)	(1)	(1)	(1)	(1)
MKA-31 (Control)	12/01/2022	(2)	(2)	(2)	(2)	(2)

(1) See Attachment 1, Table 7, Samples Deviations Table, Comment 1

(2) See Attachment 1, Table 7, Samples Deviations Table, Comment 2

Attachment 3

Interlaboratory Comparison Program Results

1.0 Summary of Teledyne Brown Engineering Quality Assurance

For the Teledyne Brown Engineering (TBE) laboratory, 146 out of 154 analyses performed met the specified acceptance criteria. Seven analyses did not meet the specified acceptance criteria for the following reasons and were addressed through the TBE Corrective Action Program. *NOTE: One analysis (soil for Tc-99) 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:

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 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)

Interlaboratory Comparison Program Results

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.

Table 24: 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

Table 24: 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
	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
	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
			Zn-65	pCi	240	211	1.14	A
	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
			Zn-65	pCi/g	0.666	0.660	1.01	A
	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

*(1) See **NCR 22-04***

*(2) See **NCR 22-21***

Attachment 3

Table 25: 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***

Table 26: 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	A
			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***

2.0 Environmental TLD Quality Assurance

Environmental dosimetry services for the reporting period of January – December, 2022 were provided by the Environmental Dosimetry Company (EDC), Sterling, Massachusetts. 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.

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. Dosimetry quality control tests are performed on EDC Panasonic 814 Environmental dosimeters. These tests include: (1) the in house testing program conducted by the EDC QA Officer and (2) independent test perform by EDC clients.

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.

Table 27 provides a summary of individual dosimeter results evaluated against the EDC internal acceptance criteria for high-energy photons (Cs-137) only. The internal acceptance (tolerance) criteria for the Panasonic Environmental dosimeters are: ± 15% for bias and ± 12.8% for precision. During this period, 100% (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.

Table 28 provides the Bias + 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.

Table 29 presents the independent blind spike results for irradiated dosimeters provided by client utilities during this annual period. All results passed the performance acceptance criterion.

Table 27
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.

Interlaboratory Comparison Program Results

Table 28
MEAN DOSIMETER ANALYSES (N=6)
JANUARY – DECEMBER 2022 [1], [2]

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

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

Table 29
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 +/- 30%.
[2]Blind spike irradiations using Cs-137