Constellation

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April 28, 2023

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

Limerick Generating Station, Units 1 and 2
Renewed Facility Operating License Nos. NPF-39 and NPF-85
NRC Docket Nos. 50-352 and 50-353

Subject: 2022 Annual Radiological Environmental Operating Report

In accordance with the requirements of Section 6.9.1.7 of Limerick Generating Station (LGS) Units 1 and 2 Technical Specifications (TS), and Section 6.1 of the LGS Units 1 and 2 Offsite Dose Calculation Manual (ODCM), this letter submits the 2022 Annual Radiological Environmental Operating Report. This report provides the 2022 results for the Radiological Environmental Monitoring Program (REMP), as called for in the ODCM.

In assessing the data collected for the REMP, it has been concluded that the operation of LGS, Units 1 and 2 had no adverse impact on the environment. No plant-produced fission or activation products were found in any pathway modeled by the REMP. The results of the groundwater protection program are also included in this report.

There are no commitments contained in this letter.

If you have any questions or require additional information, please contact Amanda Sborz at 610-718-2700.

Respectfully,

Michael F. Gillin

Michael F. Gillin
Site Vice President – Limerick Generating Station
Constellation Energy Generation, LLC

Attachment: 2022 Annual Radiological Environmental Operating Report

cc:	Administrator, Region I, USNRC	(w/attachment)
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ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT FOR THE LIMERICK GENERATING STATION

UNITS 1 AND 2

January 1 - December 31, 2022

Prepared by
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CONSTELLATION GENERATION
CONSTELLATION NUCLEAR GENERATION

APRIL 2023

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I. SUMMARY

The following sections of the summary are meant to help define key concepts, provide clarity, and give context of the monitoring program and results to the readers of this report.

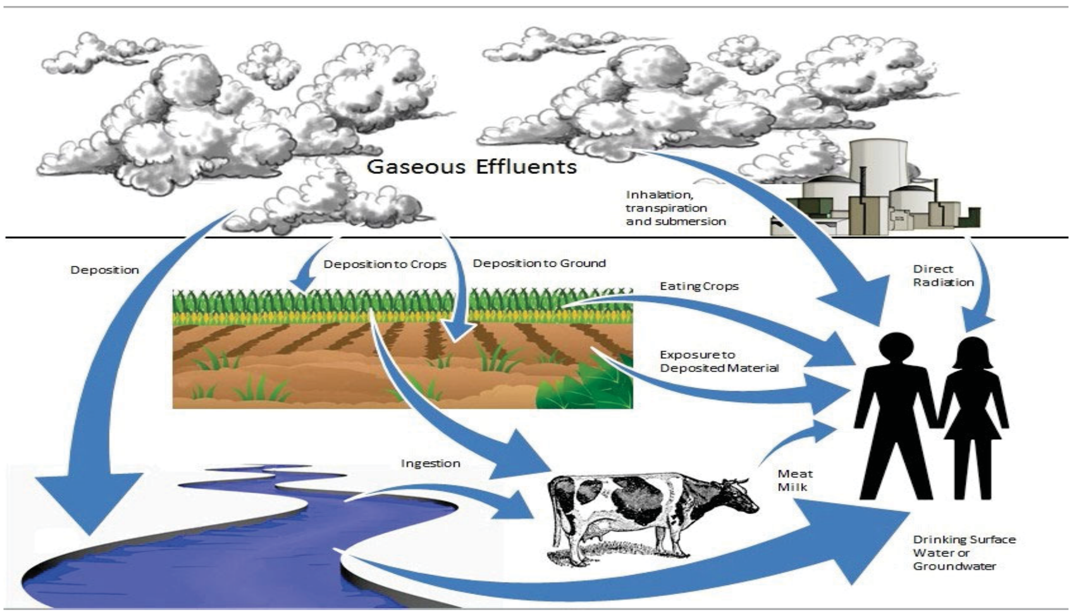
Annual Reports

The Nuclear Regulatory Commission (NRC) is the federal agency who has the role to protect public health and safety related to nuclear energy. Nuclear Power Plants have made many commitments to the NRC to ensure the safety of the public. As part of these commitments, they provide two reports annually to specifically address how the station's operation impacts the environment of the local communities. The NRC then reviews these reports and makes them available to the public. The names of the reports are the Annual Radioactive Effluent Release Report (ARERR) and the Annual Radiological Environmental Operating Report (AREOR).

The ARERR reports the results of the analyses of samples taken from the effluent release paths at the station. An effluent is a liquid or gaseous waste, containing plant-related radioactive material emitted at the boundary of the facility.

The AREOR reports the results of the analyses of samples obtained in the environment surrounding the station. Environmental samples include air, water, vegetation, and other sample types that are identified as potential pathways radioactivity can reach humans.

Graphic 1. Examples of Gaseous and Liquid Effluent Pathways

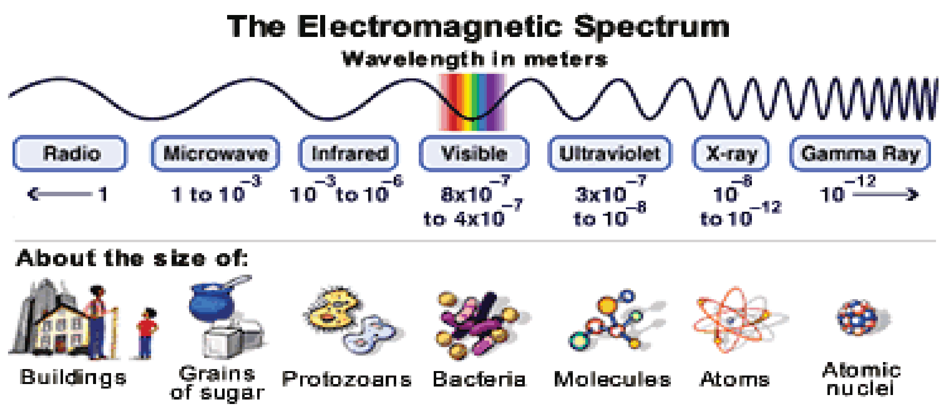


Graphic 1 demonstrates some potential exposure pathways from Limerick Generating Station. The ARERR and AREOR together ensure Nuclear Power Plants are operating in a manner that is within established regulatory commitments meant to adequately protect the public.

Understanding Radiation

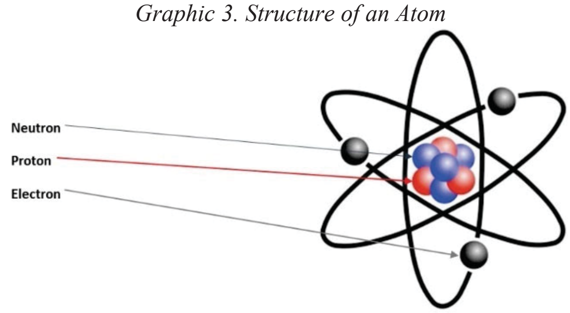
Generally radiation is defined as emitted energy in the form of waves or particles. Radiation has enough energy to displace electrons from an atom it is termed "ionizing", otherwise it is "non-ionizing." Non-Ionizing radiation includes light, heat given off from a stove, radiowaves and microwaves. Ionizing radiation occurs in atoms, particles too small for the eye to see. So, what are atoms and how does radiation come from them?

Graphic 2. Types of Radiation, from NASA Hubblesite



An atom is the smallest part of an element that maintains the characteristics of that element. Atoms are made up of three parts: protons, neutrons, and electrons.

Graphic 3. Structure of an Atom



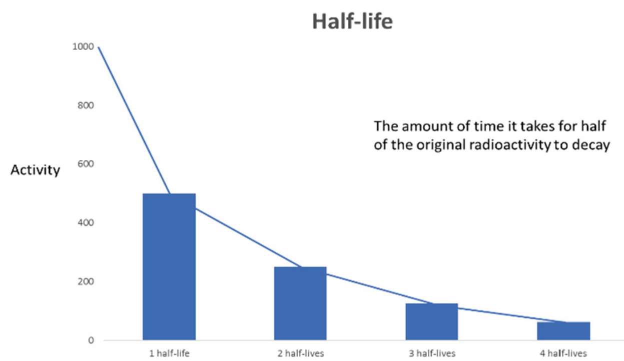
The number of protons in an atom determines the element. For example, a hydrogen atom will always have one proton while an oxygen atom will always have eight protons. The protons are clustered with the neutrons forming the nucleus at the center of the atom. Orbiting around the nucleus are the relatively small electrons. Isotopes are atoms that have the same number of protons but different numbers of neutrons. Different isotopes of an element will all have the same chemical properties and many isotopes are radioactive while other isotopes are not radioactive. A radioactive isotope can emit radiation because it contains excess energy in its nucleus. Radioactive atoms and isotopes are also referred to as radionuclides and radioisotopes.

There are two basic ways that radionuclides are produced at a nuclear power plant. The first is fission, which creates radionuclides that are called *fission products*. Fission occurs when a very large atom, such as uranium-235 (U-235) or plutonium- 239 (Pu-239), absorbs a neutron into its nucleus making the atom unstable. The unstable atom can then split into smaller atoms. When fission occurs, there is a large amount of energy released in the form of heat. A nuclear power plant uses the heat generated to boil water that spins turbines to produce electricity.

The second way a radionuclide is produced at a nuclear power plant is through a process called activation and the radionuclides produced in this method are termed *activation products*. Pure water that passes over the fissioning atoms is used to cool the reactor and also produce steam to turn the turbines. Although this water is considered to be very pure, there are always some contaminants within the water from material used in the plant's construction and operation. These contaminants are exposed to the fission process and may become activation products. The atoms in the water itself can also become activated and create radionuclides.

Over time, radioactive atoms will reach a stable state and no longer be radioactive. To do this they must release their excess energy. This release of excess energy is called radioactive decay. The time it takes for a radionuclide to become stable is measured in units called half-lives. A half-life is the amount of time it takes for half of the original radioactivity to decay. Each radionuclide has a specific half-life. Some half-lives can be very long and measured in years while others may be very short and measured in seconds.

Graphic 4. Radioactive Decay Half-Life



In the annual reports you will see both man made and naturally occurring radionuclides listed, for example potassium-40 (K-40, natural) and cobalt-60 (Co-60, man-made). We are mostly concerned about man-made radionuclides because they can be produced as by-products when generating electricity at a nuclear power plant. It is important to note that there are also other ways man-made radionuclides are produced, such as detonating nuclear weapons. Weapons testing has deposited some of the same man-made radionuclides into the environment as those generated by nuclear power, and some are still present today because of long half-lives.

Measuring Radiation

There are four different but interrelated units for measuring radioactivity, exposure, absorbed dose, and dose equivalent. Together, they are used to scientifically report the amount of radiation and its effects on humans.

- Radioactivity refers to the amount of ionizing radiation released by a material. The units of measure for radioactivity used within the AREOR and ARERR are the Curie (Ci). Small fractions of the Ci often have a prefix, such as the microCurie (μCi), which means 1/1,000,000 of a Curie.

- Exposure describes the amount of radiation traveling through the air. The units of measure for exposure used within the AREOR and ARERR are the Roentgen (R). Traditionally direct radiation monitors placed around the site are measured in milliRoentgen (mR), 1/1,000 of one R.

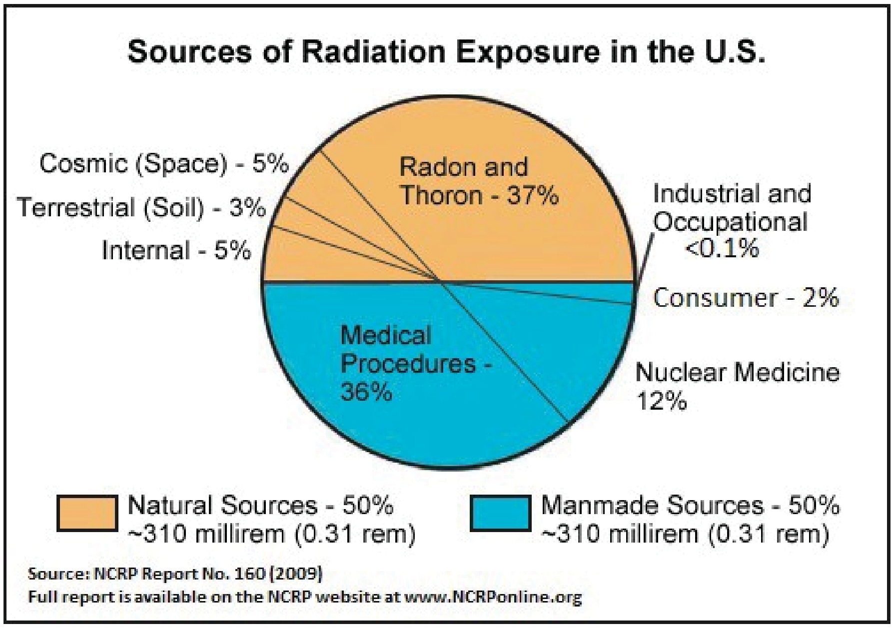
- Absorbed dose describes the amount of radiation absorbed by an object or person. The units of measure for absorbed dose used within the AREOR and ARERR are the rad. Noble gas air doses are reported by the site are measured in millirad (mrad), 1/1,000 of one rad.

- Dose equivalent (or effective dose) combines the amount of radiation absorbed and the health effects of that type of radiation. The units used within the AREOR and ARERR are the Roentgen equivalent man (rem). Regulations require doses to the whole body, specific organ, and direct radiation to be reported in millirem (mrem), 1/1,000 of one rem.

Sources of Radiation

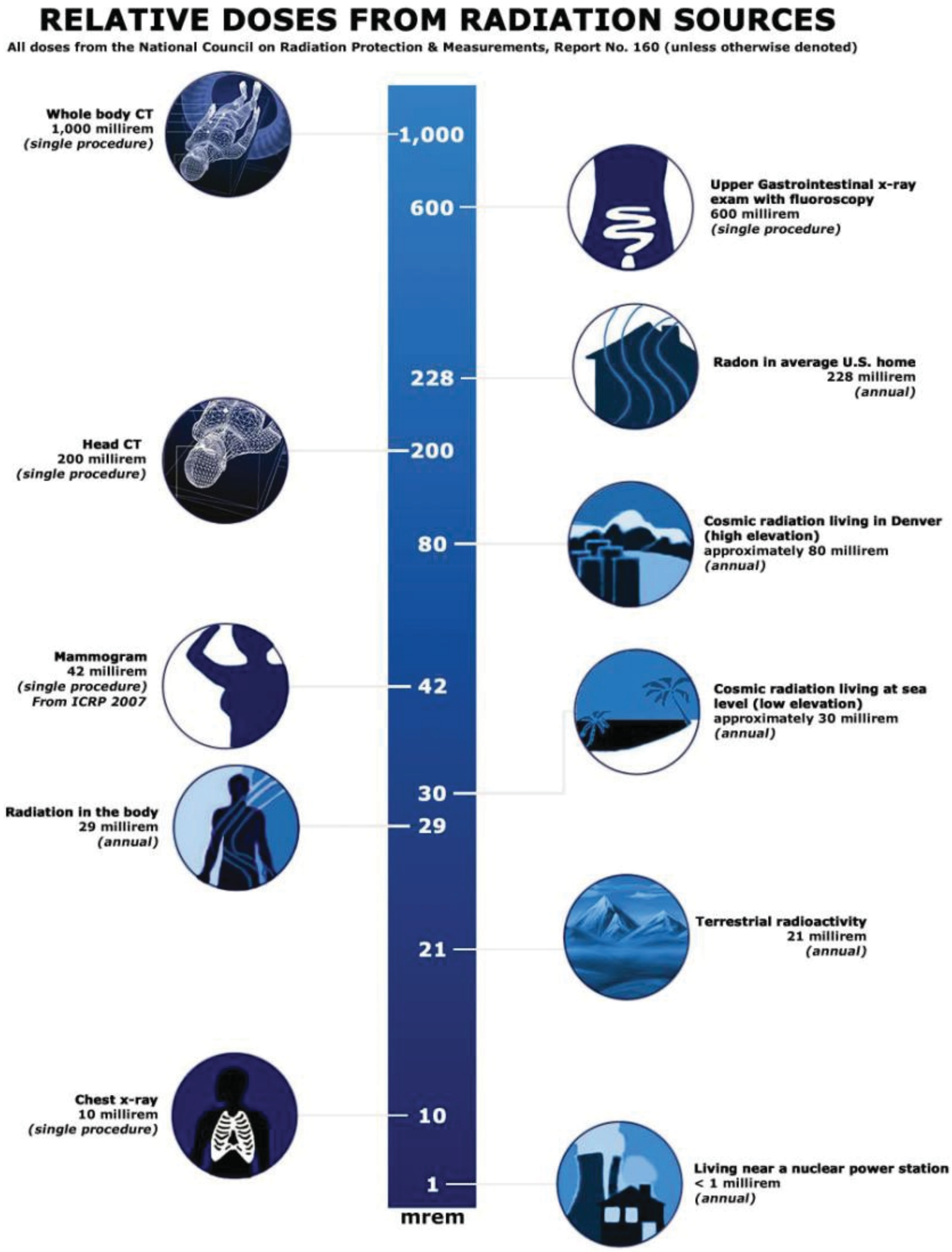
People are exposed to radiation every day of their lives and have been since the dawn of mankind. Some of this radiation is naturally occurring while some is man- made. There are many factors that will determine the amount of radiation individuals will be exposed to such as where they live, medical treatments, etc. The average person in the United States is exposed to approximately 620 mrem each year. 310 mrem comes from natural sources and 310 from man-made sources. The Graphic 5 shows what the typical sources of radiation are for an individual over a calendar year:

Graphic 5. Sources of Radiation Exposure in the U.S., from NCRP Report No. 160



The radiation from a nuclear power plant is included in the chart as part of the "Industrial and Occupational" fraction, <0.1%. The largest natural source of radiation is from radon, because radon gas travels in the air we breathe. Perhaps you know someone who had a CT scan at a hospital to check his or her bones, brain, or heart. CT scans are included in the chart as "Medical Procedures," which make up the next largest fraction. Graphic 6 on the following page shows some of the common doses humans receive from radiation every year.

Graphic 6 .Relative Doses from Radiation Sources, from EPA Radiation Doses and Sources

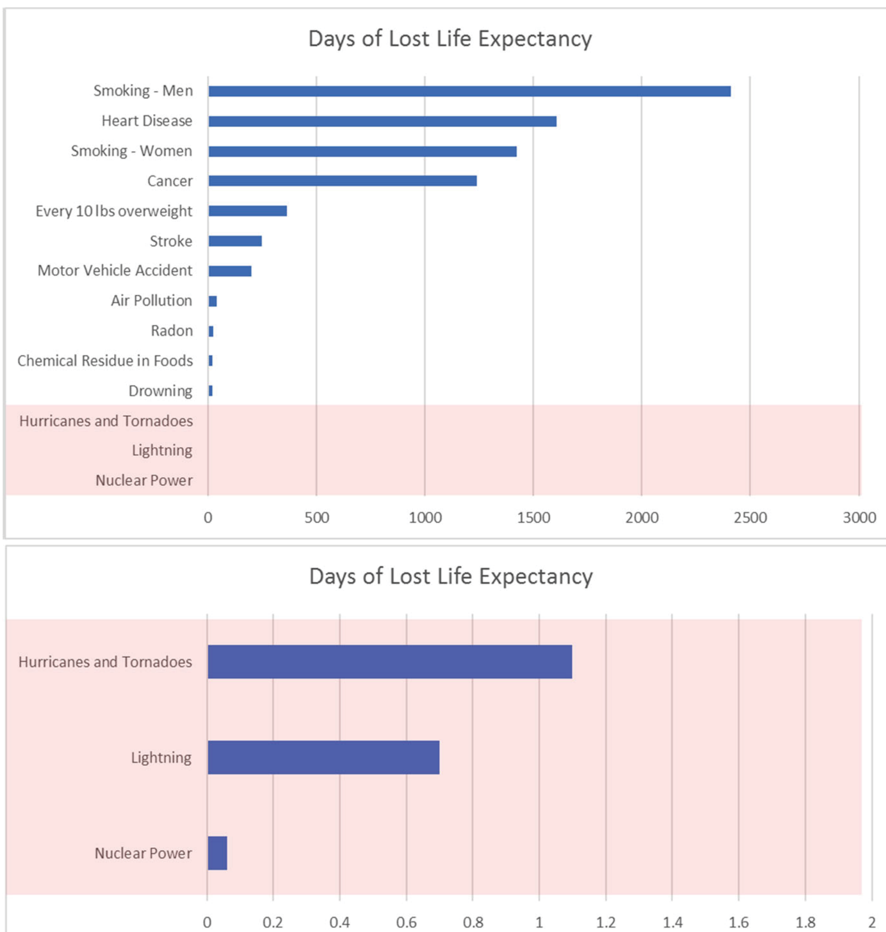


Radiation Risk

Current science suggests there is some risk from any exposure to radiation. However, it is very hard to tell whether cancers or deaths can be attributed to very low doses of radiation or by something else. U.S. radiation protection standards are based on the premise that any radiation exposure carries some risk.

The following graph is an example of one study that tries to relate risk from many different factors. This graph represents risk as “Days of Lost Life Expectancy.” All the categories are averaged over the entire population except Male Smokers, Female Smokers, and individuals that are overweight. Those risks are only for people that fall into those categories. The category for Nuclear Power is a government estimate based on all radioactivity releases from nuclear power, including accidents and wastes.

Graphic 7. Days of Lost Life Expectancy, Adapted from the Journal of American Physicians and Surgeons Volume 8 Number 2 Summer 2003



In 2022, the Limerick Generating Station released to the environment through the radioactive effluent liquid and gaseous pathways approximately 87 curies of noble gas, fission and activation products and approximately 17 curies of tritium. The dose from both liquid and gaseous effluents was conservatively calculated for the Maximum Exposed Member of the Public. The results of those calculations and their comparison to the allowable limits were as follows:

Summary of Gaseous and Liquid Effluent Doses to Members of the Public at the Highest Dose Receptors						
Maximum Individual Noble Gas	**Applicable Dose**	**Estimated Dose**	**Age Group**	**% of Applicable Limit**	**Limit**	**Unit**
RR Tracks W	Gamma Air Dose	8.008E-03	All	4.00E-02	20	mRad
RR Tracks W	Beta Air Dose	4.710E-03	All	1.18E-02	40	mRad
RR Tracks W	Total Body	7.642E-03	All	7.64E-02	10	mrem
RR Tracks W	Skin	1.273E-02	All	4.24E-02	30	mrem
Iodine, Particulate, C-14 & Tritium						
Vegetation Pathway	Bone	4.946E-01	Child	1.65E+00	30	mrem
Liquid						
LGS OUTFALL	Total Body	5.327E-03	Adult	8.88E-02	6	mrem
LGS OUTFALL	Liver	7.065E-03	Teen	3.53E-02	20	mrem

The calculated doses, from the radiological effluents released from Limerick, were a very small percentage of the allowable limits.

This report on the Radiological Environmental Monitoring Program conducted for the Limerick Generating Station (LGS) by Constellation covers the period of January 1, 2022 through December 31, 2022. During that time period, 1,483 analyses were performed on 1,352 samples.

Surface and drinking water samples were analyzed for concentrations of tritium (H-3), low level iodine-131 (I-131) and gamma-emitting nuclides. Drinking water samples were also analyzed for concentrations of total gross beta. Total gross beta activities detected were consistent with those detected in previous years. No other fission or activation products were detected.

Fish (predator and bottom feeder) samples were analyzed for concentrations of gamma-emitting nuclides. Concentrations of naturally occurring potassium-40 (K-40) were consistent with those detected in previous years. No fission or activation products were detected in fish.

Sediment samples were analyzed for concentrations of gamma-emitting nuclides. No station-produced fission or activation products were found in sediment. For results, discussion, and dose to member of the public calculation see Section II.B.6.

Air particulate samples were analyzed for concentrations of gross beta and gamma- emitting nuclides**.** Gross beta and cosmogenic, naturally occurring beryllium-7 (Be-7) were detected at levels consistent with those detected in previous years. No fission or activation products were detected. High-sensitivity I-131 analyses were performed on weekly air samples. All results were less than the minimum detectable concentration.

The air monitoring systems employed in the nuclear industry have proven to be capable of detecting very low levels of activity in the atmosphere, as activity from both the Chernobyl and Fukushima events was detected at many of the world's nuclear power plants, including Limerick Generating Station.

Cow milk samples were analyzed for concentrations of I-131 and gamma-emitting nuclides. Concentrations of naturally occurring K-40 were consistent with those detected in previous years. No fission or activation products were found.

Broadleaf vegetation samples were analyzed for gamma-emitting nuclides. Only naturally occurring activity was detected. K-40 was detected in all samples. Be-7 was found in 25 of 36 samples. Radium-226 (Ra-226) was found in 6 of 36 samples. Thorium-232 (Th-232) was found in 15 of 36 samples. No activity due to plant operations were detected.

Review of the gamma spectroscopy results from the surface water samples located at the Limerick intake (24S1) and downstream of the 10 CFR 20.2002 permitted storage area showed no evidence of offsite radionuclide transport from the 2002 permitted storage area.

Environmental ambient gamma radiation measurements were performed quarterly using Dosimeters of Legal Record (DLR). Levels detected were consistent with those observed in previous years and no facility-related dose was detected. A review of the dosimetry data for the nearest residence to the Independent Spent Fuel Storage Installation (ISFSI) indicates no direct dose was received.

A Radiological Groundwater Protection Program (RGPP) was established in 2006 as part of an Exelon Nuclear fleetwide assessment of potential groundwater intrusion from the operation of the Station. Results and Discussion of groundwater samples are covered in Appendix E.

In assessing the data gathered for this report and comparing these results with preoperational data, it was concluded that the operation of LGS had no adverse radiological impact on the environment.

II. LIMERICK GENERATING STATION RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

II.A. INTRODUCTION

The Limerick Generating Station (LGS), consisting of two 3,515 MW boiling water reactors owned and operated by Constellation Corporation, is located adjacent to the Schuylkill River in Montgomery County, Pennsylvania. Unit No. 1 went critical on December 22, 1984. Unit No. 2 went critical on August 11, 1989. The site is located in Piedmont countryside, transversed by numerous valleys containing small tributaries that feed into the Schuylkill River. On the eastern riverbank, elevation rises from approximately 110 to 300 feet mean sea level (MSL). On the western riverbank elevation rises to approximately 50 feet MSL to the western site boundary.

A Radiological Environmental Monitoring Program (REMP) for LGS was initiated in 1971. Review of the 1971 through 1977 REMP data resulted in the modification of the program to comply with changes in the Environmental Report Operating License Stage (EROL) and the Branch Technical Position Paper (Rev. 1, 1979). The preoperational period for most media covers the periods January 1, 1982 through December 21, 1984 and was summarized in a separate report. This report covers those analyses performed by Constellation Generation Solutions (CGS), Mirion Technologies, and Teledyne Brown Engineering (TBE)/GEL Laboratories (GEL) on samples collected during the period January 1, 2022 through December 31, 2022.

On July 6, 1996, a 10 CFR 20.2002 permit was issued to Limerick for storage of slightly contaminated soils, sediments and sludges obtained from the holding pond, cooling tower and spray pond systems. These materials will decay to background while in storage. Final disposition will be determined at Station decommissioning.

On July 21, 2008, an ISFSI pad was put into service. The ISFSI is dry cask storage, where spent nuclear fuel is stored.

II.B. PROGRAM

II.B.1 Objectives

A. Objective of the REMP

The objectives of the REMP are to:

1. Provide data on measurable levels of radiation and radioactive materials in the site environs;
2. Validate the radioactive effluent control program by evaluating the relationship between quantities of radioactive material released from the plant and resultant radiation doses to individuals from principal pathways of exposure.

B. Implementation of the Objectives

The implementation of the objectives is accomplished by:

1. Identifying significant exposure pathways
2. Establishing baseline radiological data of media within those pathways
3. Continuously monitoring those media before and during station operation to assess station radiological effects (if any) on man and the environment

II.B.2 Sample Collection and Analysis

Samples for the LGS REMP were collected for Constellation Nuclear by contractors to, or personnel of, CGS according to applicable procedures (Ref. 6,12,13). Control locations are sample locations that are not expected to be impacted by plant operations and are used to determine a baseline in the environment for each type of sample. This section describes the general collection methods used to obtain environmental samples for the LGS REMP in 2022.

The locations of the individual sampling stations are listed in Table A-1 and A-2 and shown in Figures A-1, A-2, and A-3.

Analyses are performed in accordance with applicable procedures (Ref. 7,10,11,13) and results are provided in Appendix B for primary REMP Analysis. Analysis results for quality assurance are provided in Appendix C. Analysis results for LGS RGPP are provided in Appendix E.

All Samples were collected and analyzed as required except as noted in section II.B.4 Program exceptions.

II.B.2.a Aquatic Environment

The aquatic environment was evaluated by performing radiological analyses on samples of surface water, drinking water, fish, and sediment. Two-gallon water samples were collected monthly from composite samplers located at two surface water locations (13B1 and 24S1) and four drinking water locations (15F4, 15F7, 16C2, and 28F3). Control locations were 24S1, and 28F3. All samples were collected in new unused plastic bottles, which were rinsed at least twice with source water prior to collection. Fish samples comprising of the flesh of two groups, bottom feeder (Carp / Northern Hogsucker / Norther Sucker / White Sucker) and predator (American Eel / Black Crappie / Bluegill / Brown Trout / Channel Catfish / Flathead Catfish / Green Sunfish / Smallmouth Bass / Yellow Perch), were collected semiannually at two locations, 16C5 and 29C1 (control). Sediment samples composed of recently deposited substrate were collected at three locations semiannually, 16B2, 16C4, and 33A2 (control).

II.B.2.b Atmospheric Environment

The atmospheric environment was evaluated by performing radiological analyses on samples of air particulate, airborne iodine, and milk. Airborne iodine and particulate samples were collected and analyzed weekly at seven locations (6C1, 10S3, 11S1, 13S4, 14S1, 15D1, and 22G1). The control location was 22G1. Airborne iodine and particulate samples were obtained at each location, using a vacuum pump with charcoal and glass fiber filters attached. The pumps were run continuously and sampled air at the rate of approximately one cubic foot per minute. The filters were replaced weekly and sent to the laboratory for analysis.

II.B.2.c Terrestrial Environment

Milk samples were collected biweekly at three locations (18E1, 19B1, 23F1, and 25C1) from April through November due to a farmer injury at 25C1 that made collection from that site impossible since his cows were given to another farm while he recovered, and monthly from all locations December through March since the farmer injury did not occur until late April. Location 23F1 was the control. All samples were collected in new unused two gallon plastic bottles from the bulk tank at each location, preserved with sodium bisulfite, and shipped promptly to the laboratory.

Broadleaf vegetation was collected monthly, during the growing season, at three locations (11S3, 13S3, and 31G1). The control location was 31G1. Eight different kinds of vegetation samples were collected and placed in new unused plastic bags and sent to the laboratory for analysis.

II.B.2.d Ambient Gamma Radiation

Direct Radiation measurements were made using thermoluminescent dosimeters. The DLR locations were placed on and around the LGS site as follows:

A site boundary ring consisting of 16 locations (36S2, 3S1, 5S1, 7S1, 10S3, 11S1, 13S2, 14S1, 18S2, 21S2, 23S2, 25S2, 26S3, 29S1, 31S1, and 34S2) near and within the site perimeter representing fence post doses (i.e., at locations where the doses will be potentially greater than maximum annual off–site doses) from LGS releases.

An intermediate distance ring consisting of 16 locations (36D1, 2E1, 4E1, 7E1, 10E1, 10F3, 13E1, 16F1, 19D1, 20F1, 24D1, 25D1, 28D2, 29E1, 31D2, and 34E1) extending to approximately 5 miles from the site designed to measure possible exposures to close-in population.

The balance of eight locations (5H1, 6C1, 9C1, 13C1, 15D1, 17B1, 20D1, and 31D1) representing control and special interest areas such as population centers, schools, etc.

The specific dosimetry locations were determined by the following criteria:

1. The presence of relatively dense population,
2. Site meteorological data taking into account distance and elevation for each of the sixteen–22 1/2-degree sectors around the site, where estimated annual dose from LGS, if any, would be most significant,
3. On hills free from local obstructions and within sight of the vents (where practical);
4. And near the closest dwelling to the vents in the prevailing downwind direction.

Two dosimeters were placed at each location in a mesh basket tube located approximately three feet above ground level. The dosimeters were exchanged quarterly and sent to Mirion Technologies for analysis.

II.B.2.e 10 CFR 20.2002 Permit Storage Area

In 1996, the Limerick Generating Station received NRC approval to store slightly contaminated soils, sludges, and sediments on site per the requirements of 10 CFR 20.2002. These materials will be stored until end of the site's renewed operating license. At that time the material will be evaluated along with the site for decommissioning. The area is approximately 1.5 acres in size and was evaluated to hold a maximum of 1.12E+06 cubic feet with no more than 7E+04 cubic feet added to the area in any single year. After each material placement on the storage area, the area is graded and seeded to prevent erosion. Since all groundwater movement is to the river, the use of the REMP surface water sampling program is used as a check on potential groundwater movement from the pad.

II.B.2.f Independent Spent Fuel Storage Installation (ISFSI)

The results from the dosimeter location 36S2 was used to determine the direct radiation exposure to the nearest residence from the ISFSI pad.

II.B.3 Data Interpretation

The radiological and direct radiation data collected prior to LGS becoming operational was used as a baseline with which these operational data were compared. For the purpose of this report, LGS was considered operational at initial criticality. In addition, data were compared to previous years' operational data for consistency and trending. Several factors were important in the interpretation of the data:

1. Lower Limit of Detection and Minimum Detectable Concentration

   The lower limit of detection (LLD) is defined as the smallest concentration of radioactive material in a sample that would yield a net count (above background) that would be detected with only a 5% probability of falsely concluding that a blank observation represents a "real" signal. The LLD is intended as a before the fact estimate of a system (including instrumentation, procedure, and sample type) and not as an after the fact criteria for the presence of activity. All analyses are designed to achieve the required LGS detection limits for environmental sample analysis.

2. Reporting of Results

   Gamma spectroscopy analyzes samples for the full range of nuclides. All nuclides that identified positive results for non-natural gamma emitters are reported. Each type of sample also looks for specific nuclides which must meet LLD requirements as described above. The required nuclides and their LLDs for each type of sample are provided in Table C-3.

   Means and standard deviations of positive results were calculated. The standard deviations represent the variability of measured results for different samples rather than single analysis uncertainty.

3. Minimum Detectable Activity

   Many results in environmental monitoring occur at or below the minimum detectable activity (MDA). In this report, all results at or below the relevant MDA are reported as being "<MDA" indicating less than the MDA value of all non-natural gamma emitters.

II.B.4 Program Exceptions

For 2022, the LGS REMP had a sample recovery rate of greater than 99%. Program exceptions are listed below:

1. On 4/25/22, biweekly milk samples were unavailable at the 25C1 Kolb Farm location due to a serious farmer injury. The cows from that farm were given to another farm while the farmer recovered. A new milk location was found and beginning in 2023, a new location will replace 25C1. ODCM revision 35 is in progress and will include this location change (IR 04495527).

2. An NRC enhancement to the REMP program was recommended during the 2022 NRC REMP inspection. The inspector recommended that the program should try to comply with a recognized standard such as ASTM D5111.12. The main part of the standard to try and meet would be, "No object or structure will project onto the sampling device with an angle greater than 30 degrees from the horizontal plane measured from the sample intake. The standard states that this can also be accomplished by ensuring that the distance of any object higher than sample intake be twice the height of the object." Effort will be made to determine who owns the land around each affected air sampler to determine if tree trimming is possible. (IR 04537826).

3. Tritium was detected in the MW-LR-9 groundwater sample collected on 10/25/22. Vendor analysis detected 5710 pCi/L. The tritium alert level is 2000 pCi/L. As this is part of on-going monitoring and is not indicative of a new release, no executive notification was required. The sample was reanalyzed and the result was confirmed. More frequent samples continue for this groundwater sample location. (IR 04540232).

Each program exception was reviewed to understand the causes of the program exception. Occasional equipment breakdowns were unavoidable. The overall sample recovery rate indicates that the appropriate procedures and equipment are in place to assure reliable program implementation.

II.B.5 Program Changes

Revision 34 of the ODCM was approved and implemented on 4/1/22. The major change was to revise LGS Technical Specifications definitions for CHANNEL CAILBRATION, CHANNEL FUNCTIONAL TEST, AND LOGIC SYSTEM FUNCTIONAL TEST.

Dose to Members of the Public at or Beyond Site Boundary:

Per the ODCM Control 6.2, the Annual Radioactive Effluent Release Report shall include an assessment of the radiation doses to the hypothetically highest exposed MEMBER OF THE PUBLIC from reactor releases and other nearby uranium fuel cycle sources. The ODCM does not require population doses to be calculated. For purposes of this calculation the following assumptions were made:

- Long term annual average meteorology X/Q and D/Q and
- Actual gaseous effluent releases were used.
- Gamma air dose, Beta air dose, Total Body and Skin doses were attributed to noble gas releases.
- Critical organ and age group dose attributed to iodine, particulate, Carbon-14 and tritium releases.
- 100 percent occupancy factor was assumed.
- Dosimetry measurements obtained from the REMP for the nearest residence to the Independent Spent Fuel Storage Installation (ISFSI) was used to determine direct radiation exposure.
- The highest doses from the critical organ and critical age group for each release pathway was summed and added to the net dosimetry measurement from nearest residence to the ISFSI for 40 CFR 190 compliance.

40 CFR 190 Compliance:
The maximum calculated dose to a real individual would not exceed 0.12 mRem (total body), 0.52 mRem (organ), or 0.10 mRem (thyroid).

All doses calculated were below all ODCM and 40 CFR Part 190 limits to a real individual.

40 CFR 190 Compliance								
	Gaseous Effluents		Liquid Effluents	Net Direct Radiation	Total	% of Applicable Limit	Limit	Unit
	Noble Gas	Particulate, Iodine, C-14 & Tritium						
Total Body Dose	1.15E-02	9.91E-02	5.33E-03	0.00E+00	1.16E-01	4.64E-01	25	mrem
Organ Dose	1.91E-02	4.95E-01	7.06E-03	0.00E+00	5.21E-01	2.08E+00	25	mrem
Thyroid Dose	NA	1.00E-01	2.66E-03	0.00E+00	1.03E-01	1.37E-01	75	mrem

II.C. RESULTS AND DISCUSSIONS

All the environmental samples collected during the year were analyzed using Constellation Generation Services laboratory procedures CY-ES-205 and CY-ES-206, except Tritium which was analyzed by GEL Laboratories (GL-RAD-A-002 REV# 24), in accordance with analytical method EPA 906.0 Modified, and Dosimetry analysis by Mirion Technologies. The analytical results for this reporting period are presented in Appendix B and are also summarized in Table 2. For discussion, the analytical results are divided into four categories. The categories are Aquatic Environment, Atmospheric Environment, Terrestrial Environment, and Direct Radiation. These categories are further divided into subcategories according to sample type (e.g. Surface Water/Drinking Water and Aquatic Organisms for Aquatic Environment).

II.C.1 Aquatic Environment

The aquatic environment was evaluated by performing radiological analyses on samples of surface water, drinking water, fish, and sediment. Two-gallon water samples were collected monthly from composite samplers located at two surface water locations (13B1 and 24S1) and four drinking water locations (15F4, 15F7, 16C2, and 28F3). Control locations were 24S1 and 28F3. All samples were collected in new unused plastic bottles, which were rinsed at least twice with source water prior to collection. Fish samples comprising of the flesh of two groups, bottom feeder (Northern Hogsucker / Quillback / White Sucker) and predator (Channel Catfish / Red-Breast Sunfish / Smallmouth Bass), were collected semiannually at two locations, 16C5 and 29C1 (control). Sediment samples composed of recently deposited substrate were collected at three locations semiannually, 16B2, 16C4, and 33A2 (control).

II.C.1.a Surface and Drinking Water

Surface and drinking water samples were analyzed for concentrations of tritium (H-3), low level iodine-131 (I-131) and gamma-emitting nuclides. Drinking water samples were also analyzed for concentrations of total gross beta. Total gross beta activities detected were consistent with those detected in previous years. No other fission or activation products were detected.

Gamma and gross beta analysis were performed on all water samples on a monthly basis Composites are made from the weekly samples. Results for all water Gamma and gross beta analyses are listed in Table B-1.

Tritium analysis was performed on all water samples on a quarterly basis. Composites are made from the weekly samples. Tritium data is given in Table B-1.

Review of the gamma spectroscopy results from the surface water samples located at the Limerick intake (24S1) and downstream of the 10 CFR 20.2002 permitted storage area showed no evidence of offsite radionuclide transport from the 2002 permitted storage area.

A Radiological Groundwater Protection Program (RGPP) was established in 2006 as part of an Exelon Nuclear fleetwide assessment of potential groundwater intrusion from the operation of the Station. Results and Discussion of groundwater samples are covered in Appendix E.

II.C.1.b Aquatic Organisms

Fish (predator and bottom feeder) samples were analyzed for concentrations of gamma-emitting nuclides. Concentrations of naturally occurring potassium-40 (K-40) were consistent with those detected in previous years. No fission or activation products were detected in fish.

II.C.1.c Shoreline Sediment

Sediment samples were analyzed for concentrations of gamma-emitting nuclides. No station-produced fission or activation products were found in sediment. For results, discussion, and dose to member of the public calculation see Section II.B.6.

II.C.2 Atmospheric Environment

The atmospheric environment was evaluated by performing radiological analyses on samples of air particulate, airborne iodine, and milk. Airborne iodine and particulate samples were collected and analyzed weekly at seven locations (6C1, 10S3, 11S1, 13S4, 14S1, 15D1, and 22G1). The control location was 22G1. Airborne iodine and particulate samples were obtained at each location, using a vacuum pump with charcoal and glass fiber filters attached. The pumps were run continuously and sampled air at the rate of approximately one cubic foot per minute. The filters were replaced weekly and sent to the laboratory for analysis.

II.C.2.a Air Particulate Filters

Air particulate samples were analyzed for concentrations of gross beta and gamma- emitting nuclides**.** Gross beta and cosmogenic, naturally occurring beryllium-7(Be-7) were detected at levels consistent with those detected in previous years. No fission or activation products were detected.

Based on weekly comparisons, there was no statistical difference between the Control and Indicator radioactive particulate concentrations. The averages for the control samples were 0.023 pCi/m^3, and the averages for the indicators were 0.022 pCi/m^3 for the period of January to December, 2022. Maximum weekly concentrations for each station were less than 0.045 pCi/m^3.

The particulate filters from each sampling location were saved and a 13 week composite was made. A gamma isotopic analysis was performed for each sampling location and corrected for decay. The results of these analyses are listed in Tables B-6.

II.C.2.b Air Iodine

High-sensitivity I-131 analyses were performed on weekly air samples. All results were less than the minimum detectable concentration.

The air monitoring systems employed in the nuclear industry have proven to be capable of detecting very low levels of activity in the atmosphere, as activity from both the Chernobyl and Fukushima events was detected at many of the world's nuclear power plants, including Limerick Generating Station.

Radioiodine cartridges are placed at seven locations. These cartridges are changed and analyzed each week. No positive analytical results were found on any sample. A list of values for these cartridges is given in Table B-4.

II.C.3 Terrestrial Environment

II.C.3.a Vegetation

Broadleaf vegetation was collected monthly, during the growing season, at three locations (11S3, 13S3, and 31G1). The control location was 31G1. Ten different kinds of vegetation samples were collected and placed in new unused plastic bags and sent to the laboratory for analysis.

Broadleaf vegetation samples were analyzed for gamma-emitting nuclides. Only naturally occurring activity was detected. K-40 was detected in all samples. Be-7 was found in 25 of 36 samples. Radium-226 (Ra-226) was found in 6 of 36 samples. Thorium-232 (Th-232) was found in 15 of 36 samples. No activity due to plant operations were detected.

Data for Non Natural Gamma Emitters is given in Table B-7.

II.C.3.b Milk

Milk samples were collected biweekly at three locations (18E1, 19B1, 23F1, and 25C1) from April through November due to a farmer injury at 25C1 that made collection from that site impossible since his cows were given to another farm while he recovered, and monthly from all locations December through March since the farmer injury did not occur until late April. All samples were collected in new unused two gallon plastic bottles from the bulk tank at each location, preserved with sodium bisulfite, and shipped promptly to the laboratory.

In ODCM revision 35, location 25C1 will be removed as a sample location and replaced with location 22B1. The associated map will also be updated to include this new location. The map shown in Figure A-3 is the old map featuring the old locations. After the ODCM revision is approved, a new map will be generated and included in next year's AREOR.

Cow milk samples were analyzed for concentrations of I-131 and gamma-emitting nuclides. Concentrations of naturally-occurring K-40 were consistent with those detected in previous years. No fission or activation products were found.

Gamma isotopic data is given in Table B-8.

II.C.4 Direct Radiation

Environmental ambient gamma radiation measurements were performed quarterly using Dosimeters of Legal Record (DLR). Levels detected were consistent with those observed in previous years and no facility-related dose was detected. A review of the dosimetry data for the nearest residence to the Independent Spent Fuel Storage Installation (ISFSI) indicates no direct dose was received.

Ambient Gamma Radiation

Direct Radiation measurements were made using thermoluminescent dosimeters. The DLR locations were placed on and around the LGS site as follows:

A site boundary ring consisting of 16 locations (36S2, 3S1, 5S1, 7S1, 10S3, 11S1, 13S2, 14S1, 18S2, 21S2, 23S2, 25S2, 26S3, 29S1, 31S1, and 34S2) near and within the site perimeter representing fence post doses (i.e., at locations where the doses will be potentially greater than maximum annual off–site doses) from LGS releases.

An intermediate distance ring consisting of 16 locations (36D1, 2E1, 4E1, 7E1, 10E1, 10F3, 13E1, 16F1, 19D1, 20F1, 24D1, 25D1, 28D2, 29E1, 31D2, and 34E1) extending to approximately 5 miles from the site designed to measure possible exposures to close-in population.

The balance of eight locations (5H1, 6C1, 9C1, 13C1, 15D1, 17B1, 20D1, and 31D1) representing control and special interest areas such as population centers, schools, etc.

The specific dosimetry locations were determined by the following criteria:

1. The presence of relatively dense population,
2. Site meteorological data taking into account distance and elevation for each of the sixteen–22 ½-degree sectors around the site, where estimated annual dose from LGS, if any, would be most significant.
3. On hills free from local obstructions and within sight of the vents (where practical),
4. And near the closest dwelling to the vents in the prevailing downwind direction.

Two dosimeters were placed at each location in a mesh basket tube located approximately three feet above ground level. The dosimeters were exchanged quarterly and sent to Mirion Technologies for analysis.

10 CFR 20.2002 Permit Storage Area

In 1996, the Limerick Generating Station received NRC approval to store slightly contaminated soils, sludges, and sediments on site per the requirements of 10 CFR 20.2002. These materials will be stored until end of the site's renewed operating license. At that time the material will be evaluated along with the site for decommissioning. The area is approximately 1.5 acres in size and was evaluated to hold a maximum of 1.12E+06 cubic feet with no more than 7E+04 cubic feet added to the area in any single year. After each material placement on the storage area, the area is graded and seeded to prevent erosion. Since all groundwater movement is to the river, the use of the REMP surface water sampling program is used as a check on potential groundwater movement from the pad.

Independent Spent Fuel Storage Installation (ISFSI)
The results from the dosimeter location 36S2 was used to determine the direct radiation exposure to the nearest residence from the ISFSI pad.

II.D. CONCLUSION

In assessing the data gathered for this report and comparing these results with preoperational data, it was concluded that the operation of LGS had no adverse radiological impact on the environment.

In 2022, the Limerick Generating Station released to the environment through the radioactive effluent liquid and gaseous pathways approximately 87 curies of noble gas, fission and activation products and approximately 17 curies of tritium. The dose from both liquid and gaseous effluents was conservatively calculated for the Maximum Exposed Member of the Public. The results of those calculations and their comparison to LLD's in Table C-3 were as follows:

Table 1

Synopsis of 2022 Limerick Generating Station Radiological Environmental Monitoring Program

Sample Type	Sampling Frequency[1]	Number of Locations	Number Collected	Analysis	Analysis Frequency[1]	Number Analyzed
Aquatic Environment						
Surface Water, Drinking Water	MC	6	72	Gamma	MC	72
				Gross Beta	MC	48
				Tritium	QC	24
Fish[2]	SA	2	8	Gamma	SA	8
Shoreline Sediment	SA	3	3	Gamma	SA	3
Atmospheric Environment						
Air Iodine[3]	W	7	364	I-131	W	364
Air Particulates[4]	W	7	364	Gross Beta	W	364
				Gamma	QC	28

Table 1

Synopsis of 2022 Limerick Generating Station Radiological Environmental Monitoring Program

Sample Type	Sampling Frequency[1]	Number of Locations	Number Collected	Analysis	Analysis Frequency[1]	Number Analyzed
Terrestrial Environment						
Milk[5]	M/BW	4	69	Gamma	W	69
Vegetation[6]	M	3	36	Gamma	M	36
Dosimetry	Q	40	320	Direct Radiation	Q	320

[1] W=Weekly, BW=BiWeekly (15 days), M=Monthly (31 days), Q=Quarterly (92 days), SA=Semiannual, A=Annual, C=Composite
[2] Twice during fishing season including at least four species
[3] The collection device contains activated charcoal
[4] Beta counting is performed >= 24 hours following filter change. Gamma spectroscopy performed on quarterly composite of weekly samples
[5] Bi-Weekly during growing season.
[6] Monthly during growing season. Samples include broad leaf vegetation

Table 2

Annual Summary of Radioactivity in the Environs of the Limerick Generating Station

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	Indicator Locations Mean (F)/Range[1]	Location with Highest Annual Mean Name/Distance & Direction[2]	Highest Annual Mean (F) / Range[1]	Control Locations Mean (F)/Range
Aquatic Environment						
Surface Water, Drinking Water (pCi/L)	Gross Beta (48)	4	2.9 (36/36) (1.6 - 5.1)	AQUA Water 15F4 13.9 km	3.4 (12/12) (1.6 - 5.0)	2.9 (12/12) (1.7 - 5.3)
Atmospheric Environment						
Air Particulates (10^{-2} pCi/m^3)	Gross Beta (364)	1.0	2.2 (312/312) (0.7-4.4)	Limerick Airport 6C1 3.4 km NE	2.6 (52/52) (1.3 – 4.4)	2.3 (52/52) (1.0-3.8)
Dosimetry (mrem/Qtr)	Thermoluminescent Dosimetry (320)	NA	13.8(256/256) ((0.8 - 28.2))	500KV Substation 13S2 0.04 km SE	21.7 (8/8) (16 - 28.2)	14.2 (64/64) (1.4-25.5)

[1] Mean and range based upon detectable measurements only. Fraction (F) of detectable measurements at specified location is indicated in parentheses
[2] From the centerpoint of the containment building

V. REFERENCES

(1) Environmental Report Operating License Stage, Limerick Generating Station, Units 1 and 2, Volumes 1–5 Philadelphia Electric Company

(2) NUREG-1302 Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling Water Reactors

(3) Branch Technical Position Paper, Regulatory Guide 4.8, Revision 1, November 1979

(4) Pre-operational Radiological Environmental Monitoring Program Report, Limerick Generating Station Units 1 and 2, 1 January 1982 through 21 December 1984, Teledyne Isotopes and Radiation Management Corporation

(5) CY-LG-170-301 Current Revision, Limerick Generating Station Units 1 and 2 Offsite Dose Calculation Manual

(6) Constellation Generation Solutions Analytical Sampling Procedures

a. CY-ES-214, Collection of RGPP Water Samples for Radiological Analysis
b. CY-ES-237, Air Iodine and Air Particulate Sample Collection for Radiological
c. CY-ES-239, CGS Collection Exchange of Field Dosimeters for Radiological Analysis
d. CY-ES-241, Vegetation Sample Collection for Radiological Analysis
e. CY-ES-242, Soil and Sediment Sample Collection for Radiological Analysis
f. CY-ES-247, Precipitation Sampling and Collection for Radiological Analysis

(7) Constellation Generation Solutions Analytical Procedures
a. CY-ES-204, Sample Preparation for Gamma Analysis
b. CY-ES-205, Operation of HPGE Detectors with the Genie PC Counting System
c. CY-ES-206, Operation of the Tennelec S5E Proportional Counter
d. CY-ES-246, Sample Preparation for Gross Beta Analysis

(8) Limerick Generating Station 2022 Land use Survey

(9) CY-AA-170-1000, Radiological Environmental Monitoring Program (REMP) and Meteorological Program Implementation.

(10) Teledyne Browne Engineering, (TBE) 2018 Analysis Procedures Current Revisions
a. TBE-2001 Alpha Isotopic and Pu-241
b. TBE-2006 Iron-55 Activity in Various Matrices if needed
c. TBE-2007 Gamma Emitting Radioisotope Analysis
d. TBE-2008 Gross Alpha and/or Gross Beta Activity in Various Matrices
d. TBE-2011 Tritium Analysis in Drinking Water by Liquid Scintillation
e. TBE-2012 Radioiodine in Various Matrices
f. TBE-2013 Radionickel Activity in Various Matrices

g.TBE-2018 Radiostrontium Analysis by Chemical Separation

(11) GEL Laboratory Procedures
a. GL-RAD-A-002 Tritium
b. GL-RAD-A-022 Ni-63
c. GL-RAD-A-004 Sr89/90, Liquid
d. GL-RAD-A-040 Fe-55

(12) Normandeau Associates, Inc. (NAI) Sampling Procedures Current Revisions for Collection of Fish and Bottom Sediment for Radiological Analysis
a. ER6 COLLECTION OF FISH SAMPLES FOR RADIOLOGICAL ANALYSIS
b. ER7 COLLECTION OF SEDIMENT SAMPLES FOR RADIOLOGICAL ANALYSIS

(13) Mirion Technologies, Proprietary procedures

(14) Teledyne Browne Engineering Environmental Services, 4th Quarter 2022 Quality Assurance Report, January – December 2022

(15) GEL 2022 Annual Environmental Quality Assurance Report for the Radiological Environmental Monitoring Program (REMP)

APPENDIX A

Sample Locations for the REMP

Appendix A contains information concerning the environmental samples which were collected during this operating period.

Sample locations and specific information about individual locations for the Limerick Generating Station are given in Table A-1 and A-2. Figure A-1 shows the Environmental Sampling Locations within 1 mile of the Limerick Generating Station. Figures A-2 shows the "Environmental Sampling Locations between 1 and 5 miles" and A-3 shows the "Locations greater than 5 miles from Limerick Generating Station."

TABLE OF CONTENTS - SAMPLING LOCATIONS

TABLE A-1

Locations of Environmental Sampling Stations for the Limerick Generating Station

Station	Description	Distance and Direction from Site (KM)	(Miles)	(Sector)
10S3	10S3	0.8	0.5	E
11S1	11S1	0.6	0.4	ESE
11S3	Training Center	0.6	0.3	ESE
13B1	PA American	2.8	1.7	SE
13S3	500 Kv Sub	0.4	0.2	SE
13S4	13S4	0.4	0.2	SE
14S1	14S1	1.0	0.6	SSE
15D1	15D1	5.1	3.2	SE
15F4	15F4	13.9	8.6	SE
15F7	15F7	10.2	6.3	SSE
16B2	16B2	2.2	1.3	SSE
16C2	16C2	4.3	2.7	SSE
16C4	16C4	3.5	2.2	SSE
16C5	16C5	--	--	Downstream of Discharge
18E1	18E1	6.8	4.2	S
19B1	19B1	3.1	2.0	SSW
22B1	22B1	6.1	3.8	SW
22G1	22G1 (Control)	28.5	17.7	SW
23F1	23F1 (Control)	8.1	5.0	SW
24S1	24S1 (Control)	0.3	0.2	SW
25C1 [1]	25C1	4.3	2.7	WSW
28F3	28F3 (Control)	9.4	5.8	WNW
29C1	29C1 (Control)	--	--	Upstream of Intake
31G1	31G1 (Control)	21.9	13.6	NW
33A2	33A2 (Control)	1.4	0.8	NNW
6C1	6C1	3.4	2.1	Ne
11S2	11S2 (QC collocated with 11S1)	0.6	0.4	ESE

[1] 25C1 Discontinued during 2022 and replaced by 22B1

TABLE A-2

Descriptions of Environmental Sampling Stations for the Limerick Generating Station

Location	Location Description	Distance and Direction from Site (KM)	(Miles)	(Sector)
Inner Ring				
	36S2 Evergreen & Sanatoga Road	1.0	0.6	N
	3S1 Sanatoga Road	0.7	0.4	NNE
	5S1 Possum Hollow Road	0.7	0.4	NE
	7S1 LGS Training Center	0.9	0.6	ENE
	10S3 Keen Road	0.8	0.5	E
	11S1 LGS Information Center	0.6	0.4	ESE
	13S2 500 KV Substation	0.7	0.4	SE
	14S1 Longview Road	1.0	0.6	SSE
	18S2 Rail Line along Longview Road	0.4	0.3	S
	21S2 Near Intake Building	0.3	0.2	SSW
	23S2 Transmission Tower	0.9	0.5	SW
	25S2 Sector Site Boundary	0.7	0.5	WSW
	26S3 Met. Tower #2	0.6	0.4	W
	29S1 Sector Site Boundary	0.9	0.5	WNW
	31S1 Sector Site Boundary	0.4	0.3	NW
	34S2 Met. Tower #1	0.9	0.6	NNW
Outer Ring	36D1 Siren Tower No. 147	5.6	3.5	N
	2E1 Laughing Waters GSC	7.7	4.8	NNE
	4E1 Neiffer Road	7.7	4.8	NE
	7E1 Pheasant Road	6.9	4.3	ENE
	10E1 Royersford Road	6.3	4.0	E
	10F3 Trappe Substation	9.0	5.6	ESE
	13E1 Vaughn Substation	6.9	4.3	SE
	16F1 Pikeland Substation	8.1	5.0	SSE
	19D1 Snowden Substation	5.6	3.5	S
	20F1 Sheeder Substation	8.4	5.2	SSW
	24D1 Porters Mill Substation	6.4	4.0	SW
	25D1 Hoffecker & Keim Streets	6.4	4.0	WSW
	28D2 W. Cedarville Road	6.2	4.0	W
	29E1 Prince Street	8.0	5.0	WNW
	31D2 Popular Substation	6.2	4.0	NW
	34E1 Varnell Road	7.4	4.6	NNW
Control & Special Interest	5H1 C Birch Substation (control)	40.0	24.8	NE
	6C1 Limerick Airport	3.4	2.1	NE
	9C1 Reed Road	3.5	2.2	E
	13C1 King Road	4.6	2.8	SE
	15D1 Spring City Substation	5.1	3.2	SE
	17B1 Linfield Substation	2.6	1.6	S
	20D1 Ellis Woods Road	5.0	3.0	SSW
	31D1 Lincoln Substation	4.8	3.0	WNW

Figure A-1

Limerick Generating Station Sample Locations
Environmental Sampling Locations Within 1 mile of the
Limerick Generating Station, 2022

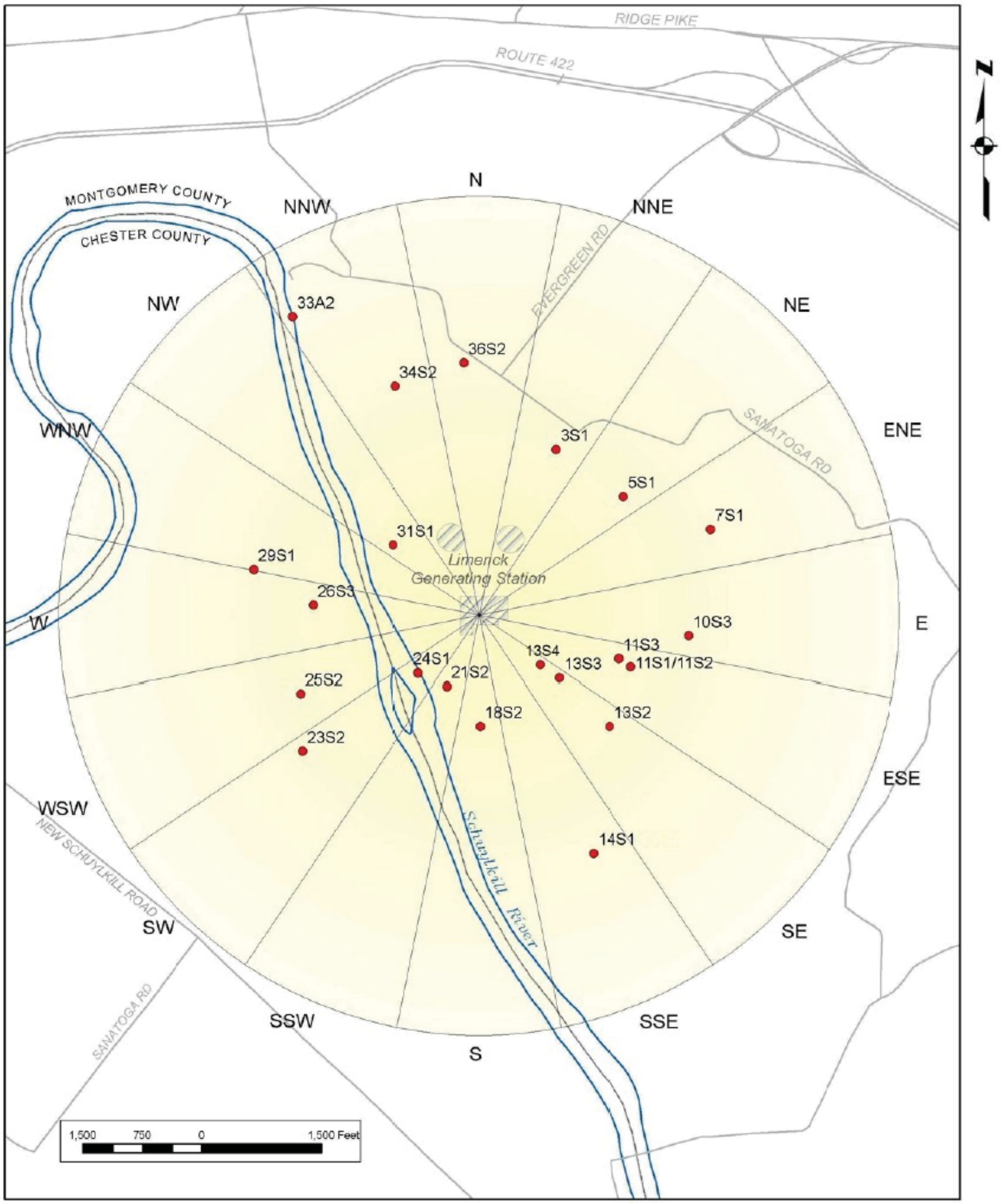
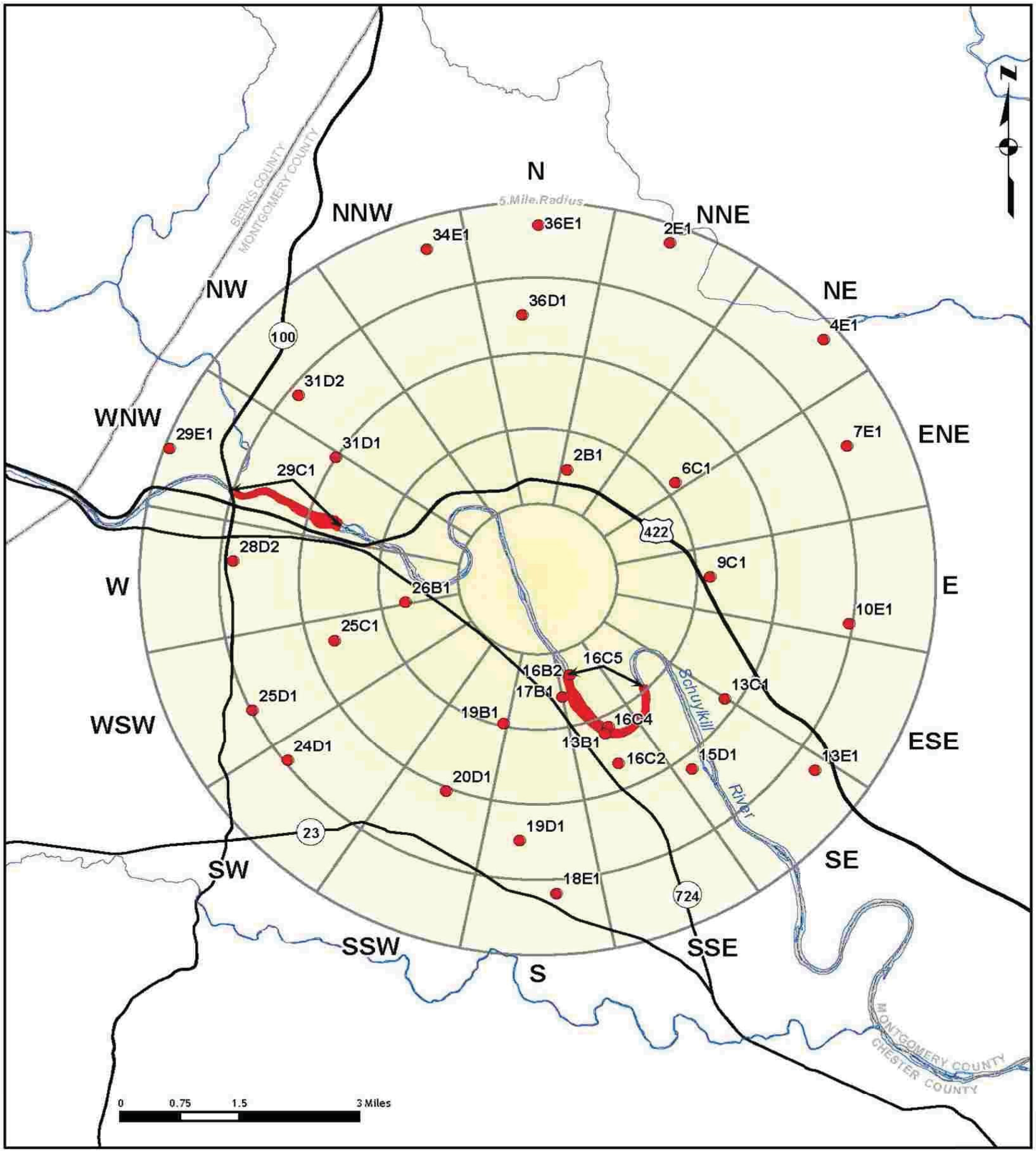


Figure A-2

Limerick Generating Station Sample Locations
Environmental Sampling Locations Between 1 and 5 miles from the Limerick Generating Station, 2022



Location 25C1 was removed at the end of 2022 and in 2023 was replaced by location 22B1. Map will be updated when ODCM revision 35 is approved with location changes

Figure A-3

Limerick Generating Station Sample Locations
Environmental Sampling Locations Greater than 5 miles from the Limerick Generating Station, 2022

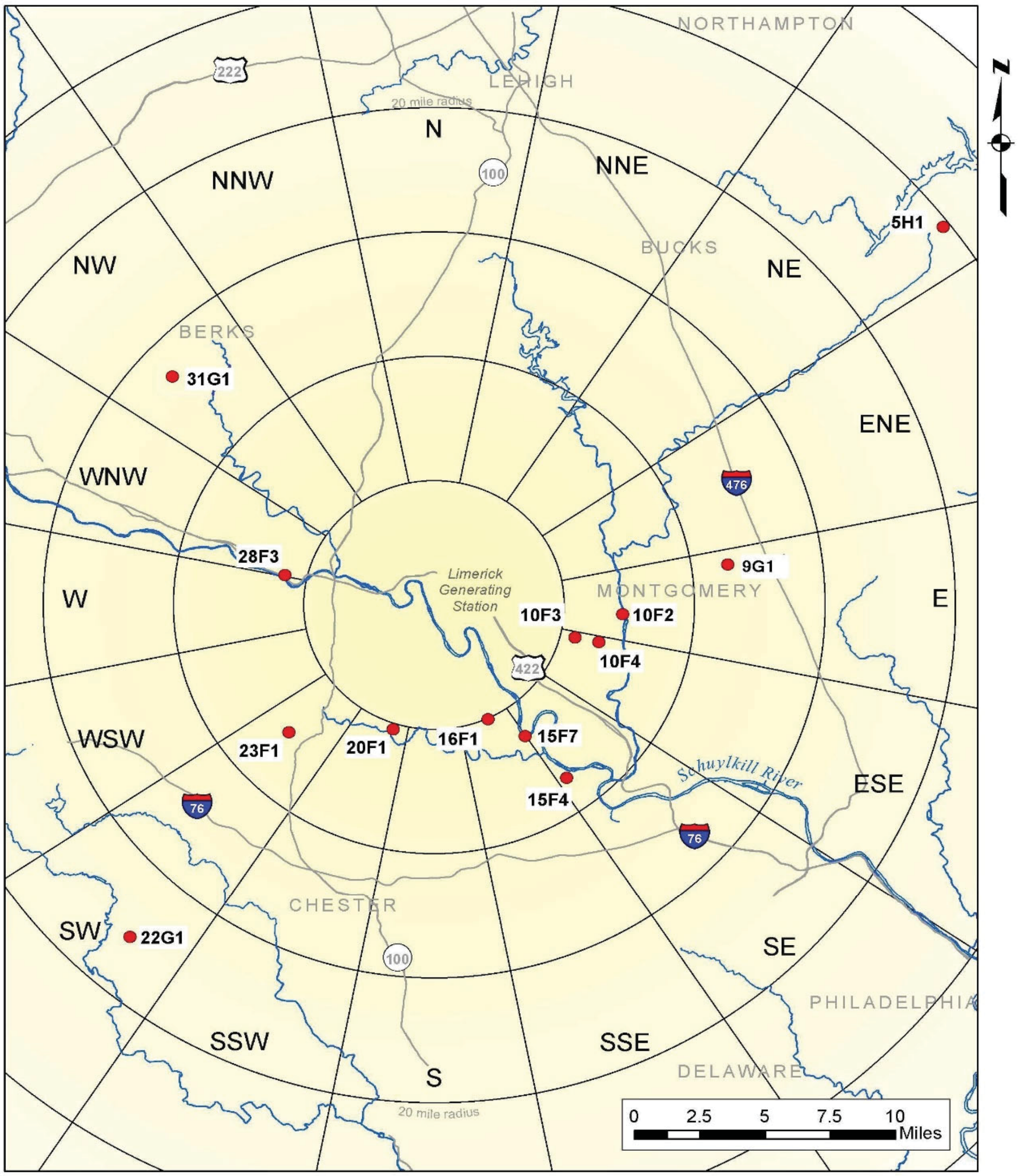


Figure A-4

Gross Beta in Public Water for the Last Ten Years

2013-2022

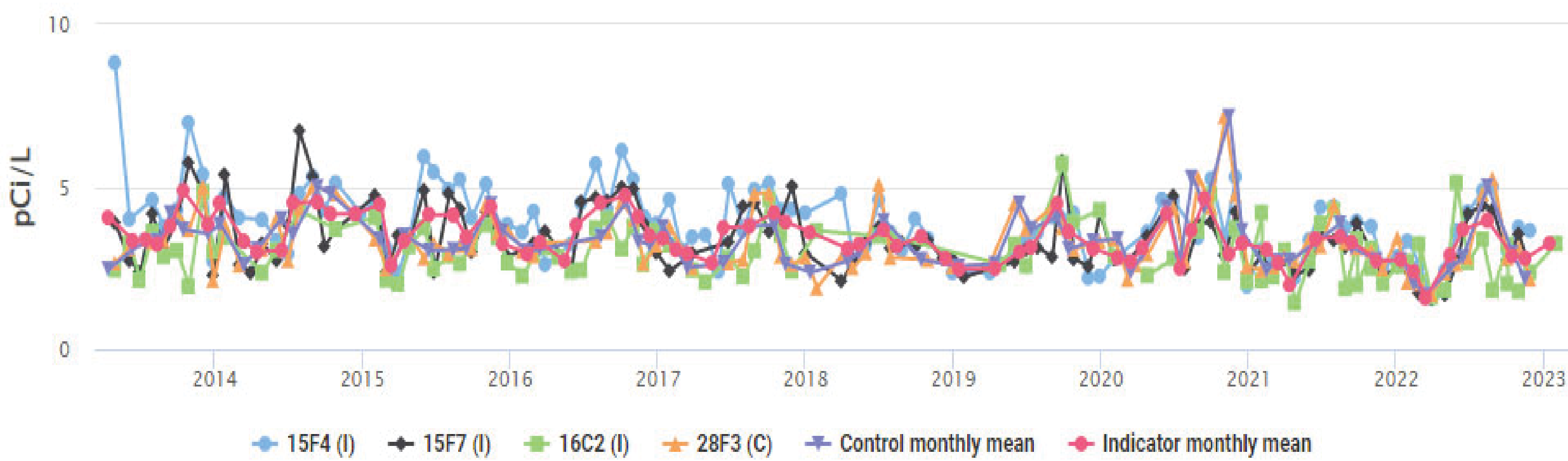


Figure A-5

Gross Beta in Air for the Last Ten Years

2013-2022

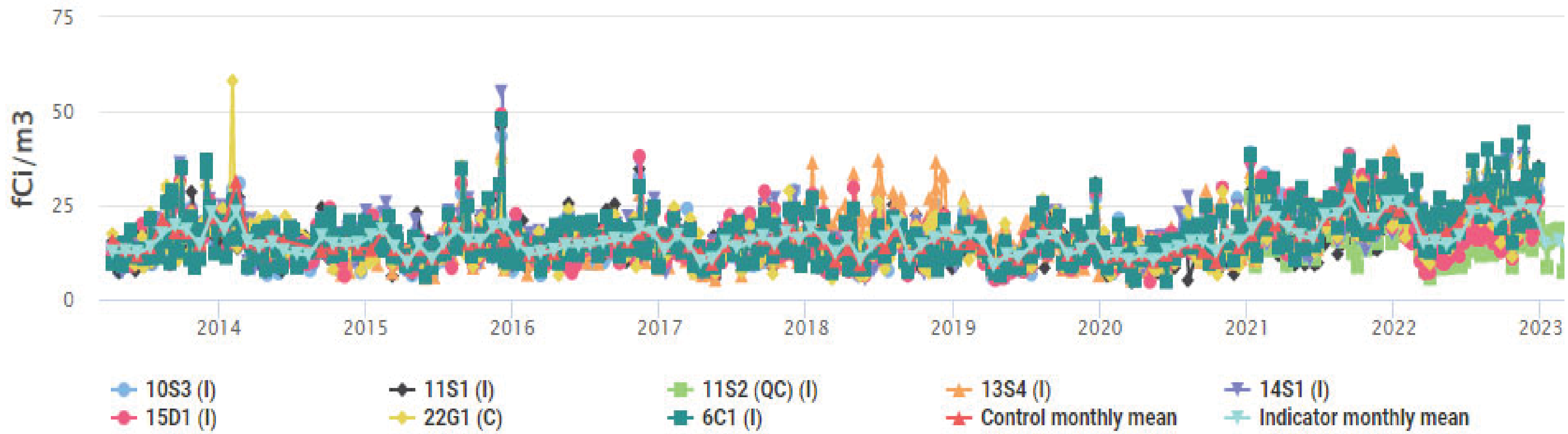


Figure A-6
Annual Trending of Air Activity (Gross Beta)

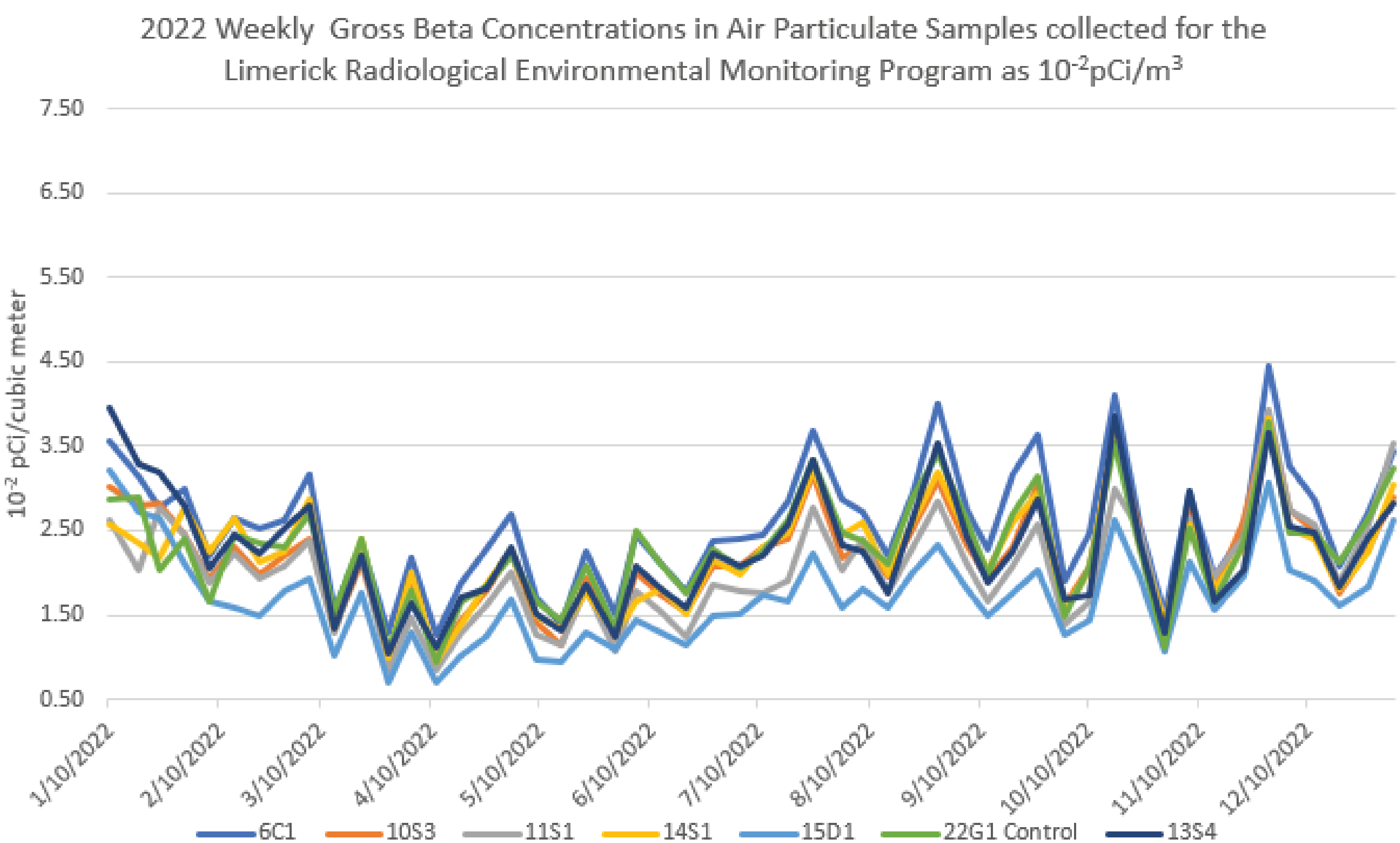


Figure A-7
2022 Monthly Gross Beta Concentrations in Drinking Water, (16C2)
Split between CGS and TBE

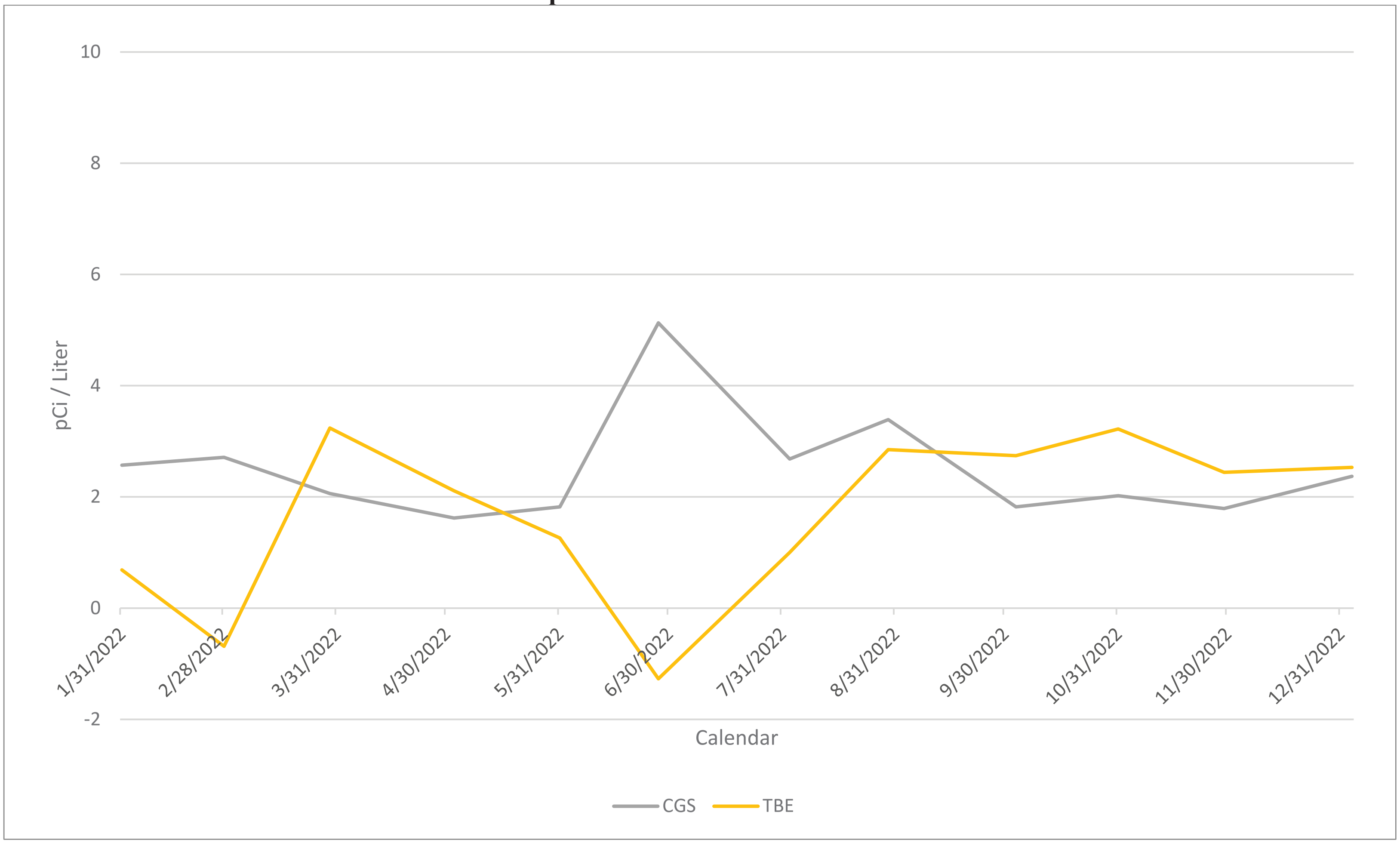
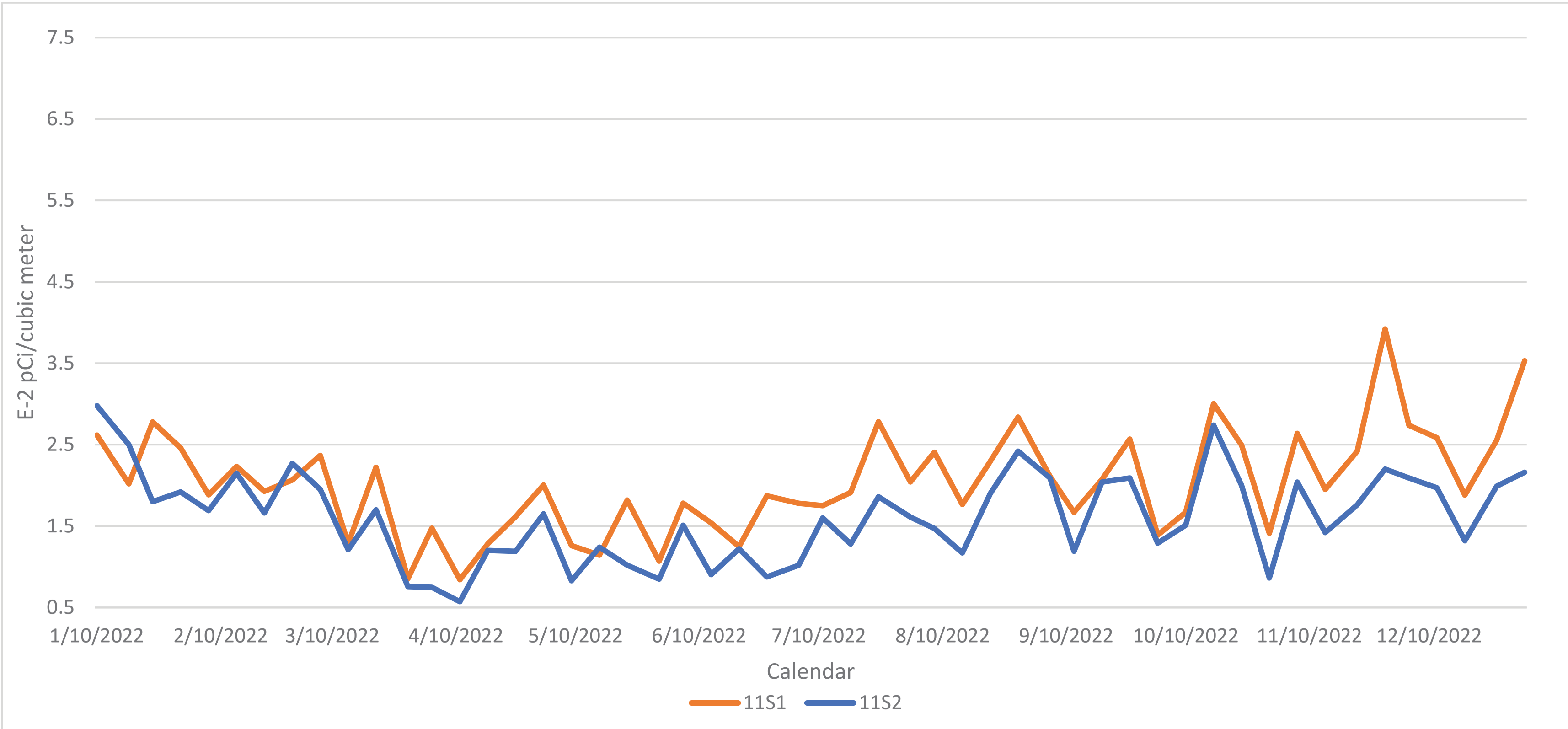


Figure A-8
2022 Weekly Gross Beta Concentrations in Air Particulate Samples from Co-Located Air samplers 11S1 and 11S2 analyzed by CGS and TBE as 10^{-2}pCi/m^3



APPENDIX B

Analysis Results for the REMP

Appendix B is a presentation of the analytical results for the Limerick Generating Station radiological environmental monitoring programs.

TABLE OF CONTENTS - ANALYTICAL RESULTS

Table B-1

Concentration of Gamma Emitters, Tritium, and Gross Beta in Surface and Drinking Water

(Results in units of pCi/L +/- 2σ)

Sample Code	Sample Date	Gamma Emitters	Tritium[2]	Gross Beta[3]
13B1				
Vincent Dam	1/31/2022	*		ND
	2/28/2022	*		ND
	3/29/2022	*	<117	ND
	5/2/2022	*		ND
	5/31/2022	*		ND
	6/27/2022	*	<170	ND
	8/2/2022	*		ND
	8/29/2022	*		ND
	10/3/2022	*	<158	ND
	10/31/2022	*		ND
	11/29/2022	*		ND
	1/3/2023	*	<154	ND
15F4				
AQUA Water	1/31/2022	*		2.85 ± 0.85
	2/28/2022	*		3.33 ± 0.90
	3/29/2022	*	<115	2.56 ± 0.85
	5/2/2022	*		1.57 ± 0.81
	5/31/2022	*		2.42 ± 0.80
	6/27/2022	*	<167	3.66 ± 0.94
	8/2/2022	*		4.23 ± 0.80
	8/29/2022	*		4.88 ± 0.82
	10/3/2022	*	<163	5.00 ± 0.98
	10/31/2022	*		3.06 ± 0.86
	11/29/2022	*		3.76 ± 0.88
	1/3/2023	*	<156	3.66 ± 0.86
15F7				
Phoenixville	1/31/2022	*		2.57 ± 0.83
	2/28/2022	*		2.46 ± 0.84
	3/29/2022	*	<118	1.72 ± 0.79
	5/2/2022	*		1.56 ± 0.81
	5/31/2022	*		1.68 ± 0.74
	6/27/2022	*	<173	2.71 ± 0.88
	8/2/2022	*		4.16 ± 0.60
	8/29/2022	*		4.44 ± 0.86
	10/3/2022	*	<160	4.29 ± 0.94
	10/31/2022	*		2.75 ± 0.85
	11/29/2022	*		3.55 ± 0.86
	1/3/2023	*	<156	2.36 ± 0.77

Table B-1

Concentration of Gamma Emitters, Tritium, and Gross Beta in Surface and Drinking Water

(Results in units of pCi/L +/- 2σ)

Sample Code	Sample Date	Gamma Emitters	Tritium[2]	Gross Beta[3]
16C2				
PA American	1/31/2022	*		2.57 ± 0.84
	2/28/2022	*		2.71 ± 0.87
	3/29/2022	*	<123	2.06 ± 0.82
	5/2/2022	*		1.62 ± 0.82
	5/31/2022	*		1.82 ± 0.77
	6/27/2022	*	<164	5.13 ± 1.03
	8/2/2022	*		2.68 ± 1.59
	8/29/2022	*		3.39 ± 0.68
	10/3/2022	*	<163	1.82 ± 0.78
	10/31/2022	*		2.02 ± 0.80
	11/29/2022	*		1.79 ± 0.75
	1/3/2023	*	<156	2.37 ± 0.78
24S1[1]				
LGS Intake	1/31/2022	*		ND
	2/28/2022	*		ND
	3/29/2022	*	<120	ND
	5/2/2022	*		ND
	5/31/2022	*		ND
	6/27/2022	*	<172	ND
	8/2/2022	*		ND
	8/29/2022	*		ND
	10/3/2022	*	<161	ND
	10/31/2022	*		ND
	11/29/2022	*		ND
	1/3/2023	*	<153	ND
28F3[1]				
Pottstown	1/31/2022	*		3.43 ± 0.89
	2/28/2022	*		2.06 ± 0.81
	3/29/2022	*	<121	2.03 ± 0.81
	5/2/2022	*		1.68 ± 0.81
	5/31/2022	*		2.36 ± 0.79
	6/27/2022	*	<164	2.63 ± 0.88
	8/2/2022	*		2.83 ± 0.78
	8/29/2022	*		4.79 ± 0.56
	10/3/2022	*	<160	5.26 ± 0.99
	10/31/2022	*		2.81 ± 0.85
	11/29/2022	*		3.13 ± 0.84
	1/3/2023	*	<154	2.17 ± 0.75

[1] Control Location
[2] Tritium result for the quarterly composite
[3] ND, No Data, analysis not required
* All Non-Natural Gamma Emitters <MDA

Table B-2

Concentration of Gamma Emitters in the Flesh of Edible Fish

(Results in units of pCi/kg (wet) +/- 2σ)

Sample Code	Sample Date	Sample Type	Gamma Emitters
16C5			
SE Sector	5/19/2022	Bottom Feeder Fish	*
	5/19/2022	Predator Fish	*
	11/01/2022	Bottom Feeder Fish	*
	11/01/2022	Predator Fish	*
29C1[1]			
WNW Sector	5/18/2022	Bottom Feeder Fish	*
	5/18/2022	Predator Fish	*
	10/19/2022	Bottom Feeder Fish	*
	10/19/2022	Predator Fish	*

[1] Control Location
* All Non-Natural Gamma Emitters <MDA

Table B-3

Concentration of Gamma Emitters in Sediment

(Results in units of pCi/kg (wet) +/- 2σ)

Sample Code	Sample Date	Gamma Emitters
16B2 SSE Sector	11/14/2022	*
16C4 SSE Sector	11/14/2022	*
33A2[1] NNW Sector	11/14/2022	*

[1] Control Location
* All Non-Natural Gamma Emitters <MDA

Table B-4
Concentration of Iodine-131 in Filtered Air
(Results in units of 10^{-3} pCi/m^3 +/- 2σ)

Start Coll date	End Coll date	6C1	10S3	11S1	14S1	15D1	22G1[1]	13S4
1/3/2022	1/10/2022	*	*	*	*	*	*	*
1/10/2022	1/18/2022	*	*	*	*	*	*	*
1/18/2022	1/24/2022	*	*	*	*	*	*	*
1/24/2022	1/31/2022	*	*	*	*	*	*	*
1/31/2022	2/7/2022	*	*	*	*	*	*	*
2/7/2022	2/14/2022	*	*	*	*	*	*	*
2/14/2022	2/21/2022	*	*	*	*	*	*	*
2/21/2022	2/28/2022	*	*	*	*	*	*	*
2/28/2022	3/7/2022	*	*	*	*	*	*	*
3/7/2022	3/14/2022	*	*	*	*	*	*	*
3/14/2022	3/21/2022	*	*	*	*	*	*	*
3/21/2022	3/29/2022	*	*	*	*	*	*	*
3/29/2022	4/4/2022	*	*	*	*	*	*	*
4/4/2022	4/11/2022	*	*	*	*	*	*	*
4/11/2022	4/18/2022	*	*	*	*	*	*	*
4/18/2022	4/25/2022	*	*	*	*	*	*	*
4/25/2022	5/2/2022	*	*	*	*	*	*	*
5/2/2022	5/9/2022	*	*	*	*	*	*	*
5/9/2022	5/16/2022	*	*	*	*	*	*	*
5/16/2022	5/23/2022	*	*	*	*	*	*	*
5/23/2022	5/31/2022	*	*	*	*	*	*	*
5/31/2022	6/6/2022	*	*	*	*	*	*	[2]
6/6/2022	6/13/2022	*	*	*	*	*	*	*
6/13/2022	6/20/2022	*	*	*	*	*	*	*
6/20/2022	6/27/2022	*	*	*	*	*	*	*
6/27/2022	7/5/2022	*	*	*	*	*	*	*

Table B-4 Continued
Concentration of Iodine-131 in Filtered Air
(Results in units of 10^{-3} pCi/m^3 +/- 2σ)

Start Coll date	End Coll date	6C1	10S3	11S1	14S1	15D1	22G1[1]	13S4
7/5/2022	7/11/2022	*	*	*	*	*	*	*
7/11/2022	7/18/2022	*	*	*	*	*	*	*
7/18/2022	7/25/2022	*	*	*	*	*	*	*
7/25/2022	8/2/2022	*	*	*	*	*	*	*
8/2/2022	8/8/2022	*	*	*	*	*	*	*
8/8/2022	8/15/2022	*	*	*	*	*	*	*
8/15/2022	8/22/2022	*	*	*	*	*	*	*
8/22/2022	8/29/2022	*	*	*	*	*	*	*
8/29/2022	9/6/2022	*	*	*	*	*	*	*
9/6/2022	9/12/2022	*	*	*	*	*	*	*
9/12/2022	9/19/2022	*	*	*	*	*	*	*
9/19/2022	9/26/2022	*	*	*	*	*	*	*
9/26/2022	10/3/2022	*	*	*	*	*	*	*
10/3/2022	10/10/2022	*	*	*	*	*	*	*
10/10/2022	10/17/2022	*	*	*	*	*	*	*
10/17/2022	10/24/2022	*	*	*	*	*	*	*
10/24/2022	10/31/2022	*	*	*	*	*	*	*
10/31/2022	11/7/2022	*	*	*	*	*	*	*
11/7/2022	11/14/2022	*	*	*	*	*	*	*
11/14/2022	11/22/2022	*	*	*	*	*	*	*
11/22/2022	11/29/2022	*	*	*	*	*	*	*
11/29/2022	12/5/2022	*	*	*	*	*	*	*
12/5/2022	12/12/2022	*	*	*	*	*	*	*
12/12/2022	12/19/2022	*	*	*	*	*	*	*
12/19/2022	12/27/2022	*	*	*	*	*	*	*
12/27/2022	1/3/2023	*	*	*	*	*	*	*

[1] Control Location
* <MDA (I-131)

Table B-5
Concentration of Beta Emitters in Air Particulates
(Results in units of 10^{-2} pCi/m^3 +/- 2σ)

Start Date	End Date	6C1	10S3	11S1	14S1	15D1	22G1[1]	13S4
1/3/2022	1/10/2022	3.56 ± 0.26	3.01 ± 0.24	2.62 ± 0.22	2.56 ± 0.22	3.21 ± 0.24	2.87 ± 0.23	3.95 ± 0.26
1/10/2022	1/18/2022	3.13 ± 0.22	2.79 ± 0.22	2.02 ± 0.19	2.35 ± 0.21	2.71 ± 0.21	2.89 ± 0.23	3.28 ± 0.23
1/18/2022	1/24/2022	2.77 ± 0.26	2.82 ± 0.26	2.78 ± 0.26	2.17 ± 0.25	2.65 ± 0.26	2.05 ± 0.22	3.19 ± 0.27
1/24/2022	1/31/2022	3.00 ± 0.24	2.46 ± 0.22	2.46 ± 0.22	2.78 ± 0.23	2.11 ± 0.21	2.41 ± 0.23	2.79 ± 0.23
1/31/2022	2/7/2022	2.20 ± 0.21	1.93 ± 0.20	1.88 ± 0.20	2.24 ± 0.21	1.66 ± 0.19	1.65 ± 0.21	2.06 ± 0.21
2/7/2022	2/14/2022	2.64 ± 0.22	2.31 ± 0.21	2.23 ± 0.21	2.64 ± 0.22	1.58 ± 0.19	2.44 ± 0.22	2.44 ± 0.22
2/14/2022	2/21/2022	2.53 ± 0.23	1.98 ± 0.21	1.93 ± 0.21	2.12 ± 0.21	1.49 ± 0.19	2.34 ± 0.22	2.23 ± 0.22
2/21/2022	2/28/2022	2.63 ± 0.23	2.20 ± 0.22	2.07 ± 0.21	2.25 ± 0.22	1.79 ± 0.20	2.30 ± 0.22	2.52 ± 0.23
2/28/2022	3/7/2022	3.17 ± 0.25	2.39 ± 0.23	2.37 ± 0.23	2.86 ± 0.24	1.94 ± 0.21	2.70 ± 0.24	2.79 ± 0.24
3/7/2022	3/14/2022	1.55 ± 0.19	1.35 ± 0.18	1.29 ± 0.18	1.35 ± 0.18	1.01 ± 0.17	1.54 ± 0.19	1.35 ± 0.18
3/14/2022	3/21/2022	2.35 ± 0.22	2.14 ± 0.21	2.22 ± 0.21	2.41 ± 0.22	1.75 ± 0.20	2.39 ± 0.22	2.20 ± 0.21
3/21/2022	3/29/2022	1.30 ± 0.17	1.00 ± 0.16	0.85 ± 0.15	1.00 ± 0.16	0.70 ± 0.15	1.10 ± 0.16	1.05 ± 0.16
3/29/2022	4/4/2022	2.17 ± 0.23	1.84 ± 0.22	1.47 ± 0.21	2.01 ± 0.23	1.30 ± 0.20	1.79 ± 0.22	1.64 ± 0.21
4/4/2022	4/11/2022	1.26 ± 0.18	1.00 ± 0.17	0.84 ± 0.16	0.94 ± 0.17	0.71 ± 0.16	0.95 ± 0.17	1.11 ± 0.17
4/11/2022	4/18/2022	1.89 ± 0.21	1.43 ± 0.20	1.28 ± 0.19	1.39 ± 0.19	1.03 ± 0.18	1.67 ± 0.20	1.70 ± 0.20
4/18/2022	4/25/2022	2.28 ± 0.22	1.79 ± 0.20	1.62 ± 0.19	1.85 ± 0.20	1.23 ± 0.18	1.83 ± 0.20	1.81 ± 0.20
4/25/2022	5/2/2022	2.69 ± 0.23	2.24 ± 0.21	2.00 ± 0.20	2.27 ± 0.21	1.69 ± 0.19	2.21 ± 0.21	2.30 ± 0.21
5/2/2022	5/9/2022	1.70 ± 0.20	1.42 ± 0.19	1.26 ± 0.18	1.48 ± 0.19	0.96 ± 0.17	1.65 ± 0.20	1.52 ± 0.19
5/9/2022	5/16/2022	1.40 ± 0.18	1.14 ± 0.17	1.14 ± 0.17	1.34 ± 0.18	0.94 ± 0.16	1.44 ± 0.18	1.31 ± 0.18
5/16/2022	5/23/2022	2.24 ± 0.21	1.94 ± 0.20	1.82 ± 0.19	1.77 ± 0.19	1.28 ± 0.17	2.08 ± 0.20	1.87 ± 0.19
5/23/2022	5/31/2022	1.52 ± 0.17	1.21 ± 0.16	1.07 ± 0.16	1.28 ± 0.16	1.09 ± 0.16	1.34 ± 0.16	1.24 ± 0.16

Table B-5 -Continued

Concentration of Beta Emitters in Air Particulates
(Results in units of 10^{-2} pCi/m^3 +/- 2σ)

Start Date	Stop Date	6C1	10S3	11S1	14S1	15D1	22G1[1]	13S4
5/31/2022	6/6/2022	2.44 ± 0.25	2.01 ± 0.23	1.78 ± 0.23	1.67 ± 0.18	1.43 ± 0.16	2.51 ± 0.18	2.07 ± 0.24
6/6/2022	6/13/2022	2.11 ± 0.23	1.74 ± 0.22	1.54 ± 0.21	1.81 ± 0.18	1.29 ± 0.20	2.10 ± 0.23	1.80 ± 0.22
6/13/2022	6/20/2022	1.78 ± 0.24	1.53 ± 0.22	1.25 ± 0.23	1.51 ± 0.23	1.14 ± 0.20	1.75 ± 0.24	1.58 ± 0.22
6/20/2022	6/27/2022	2.37 ± 0.16	2.09 ± 0.15	1.87 ± 0.13	2.15 ± 0.15	1.48 ± 0.14	2.28 ± 0.17	2.22 ± 0.15
6/27/2022	7/5/2022	2.41 ± 0.20	2.08 ± 0.19	1.78 ± 0.19	1.99 ± 0.20	1.51 ± 0.17	2.06 ± 0.21	2.08 ± 0.20
7/5/2022	7/11/2022	2.46 ± 0.23	2.30 ± 0.21	1.75 ± 0.21	2.31 ± 0.20	1.73 ± 0.18	2.25 ± 0.21	2.21 ± 0.21
7/11/2022	7/18/2022	2.84 ± 0.20	2.41 ± 0.20	1.91 ± 0.18	2.48 ± 0.20	1.65 ± 0.20	2.61 ± 0.19	2.57 ± 0.19
7/18/2022	7/25/2022	3.69 ± 0.20	3.17 ± 0.18	2.78 ± 0.16	3.21 ± 0.19	2.22 ± 0.16	3.33 ± 0.19	3.33 ± 0.19
7/25/2022	8/2/2022	2.88 ± 0.28	2.18 ± 0.29	2.04 ± 0.28	2.44 ± 0.27	1.59 ± 0.25	2.48 ± 0.28	2.33 ± 0.29
8/2/2022	8/8/2022	2.72 ± 0.26	2.33 ± 0.22	2.41 ± 0.20	2.60 ± 0.23	1.81 ± 0.19	2.38 ± 0.24	2.25 ± 0.24
8/8/2022	8/15/2022	2.20 ± 0.26	1.95 ± 0.24	1.77 ± 0.27	1.97 ± 0.27	1.59 ± 0.21	2.11 ± 0.23	1.77 ± 0.25
8/15/2022	8/22/2022	2.94 ± 0.17	2.52 ± 0.17	2.30 ± 0.16	2.59 ± 0.17	2.00 ± 0.16	2.89 ± 0.17	2.64 ± 0.15
8/22/2022	8/29/2022	3.99 ± 0.20	3.08 ± 0.21	2.84 ± 0.20	3.19 ± 0.21	2.33 ± 0.19	3.40 ± 0.21	3.54 ± 0.20
8/29/2022	9/6/2022	2.75 ± 0.30	2.32 ± 0.26	2.11 ± 0.25	2.45 ± 0.26	1.81 ± 0.23	2.62 ± 0.27	2.43 ± 0.29
9/6/2022	9/12/2022	2.27 ± 0.29	1.93 ± 0.27	1.67 ± 0.27	2.03 ± 0.27	1.50 ± 0.25	1.99 ± 0.30	1.88 ± 0.29
9/12/2022	9/19/2022	3.16 ± 0.25	2.30 ± 0.22	2.07 ± 0.22	2.60 ± 0.23	1.75 ± 0.20	2.69 ± 0.23	2.24 ± 0.22
9/19/2022	9/26/2022	3.63 ± 0.26	3.05 ± 0.24	2.57 ± 0.22	2.95 ± 0.24	2.02 ± 0.20	3.13 ± 0.24	2.86 ± 0.23
9/26/2022	10/3/2022	1.90 ± 0.20	1.61 ± 0.19	1.39 ± 0.18	1.55 ± 0.19	1.27 ± 0.18	1.50 ± 0.19	1.69 ± 0.19
10/3/2022	10/10/2022	2.48 ± 0.23	2.08 ± 0.21	1.67 ± 0.20	2.02 ± 0.21	1.43 ± 0.19	2.07 ± 0.21	1.74 ± 0.20
10/10/2022	10/17/2022	4.09 ± 0.28	3.64 ± 0.26	3.00 ± 0.25	3.69 ± 0.26	2.62 ± 0.24	3.54 ± 0.26	3.85 ± 0.27
10/17/2022	10/24/2022	2.56 ± 0.23	2.49 ± 0.23	2.49 ± 0.23	2.30 ± 0.22	1.96 ± 0.21	2.31 ± 0.22	2.38 ± 0.22
10/24/2022	10/31/2022	1.51 ± 0.19	1.30 ± 0.18	1.41 ± 0.18	1.42 ± 0.18	1.08 ± 0.17	1.13 ± 0.17	1.29 ± 0.18

Table B-5 -Continued

Concentration of Beta Emitters in Air Particulates)
(Results in units of 10^{-2} pCi/m^3 +/- 2σ)

Start Date	Stop Date	6C1	10S3	11S1	14S1	15D1	22G1[1]	13S4
10/31/2022	11/7/2022	2.95 ± 0.24	2.75 ± 0.23	2.64 ± 0.23	2.56 ± 0.22	2.14 ± 0.21	2.52 ± 0.23	2.96 ± 0.25
11/7/2022	11/14/2022	1.96 ± 0.21	1.78 ± 0.20	1.95 ± 0.21	1.82 ± 0.20	1.57 ± 0.19	1.67 ± 0.19	1.65 ± 0.20
11/14/2022	11/22/2022	2.48 ± 0.20	2.62 ± 0.20	2.42 ± 0.20	2.30 ± 0.20	1.96 ± 0.18	2.35 ± 0.19	2.04 ± 0.18
11/22/2022	11/29/2022	4.44 ± 0.27	3.85 ± 0.26	3.92 ± 0.26	3.84 ± 0.26	3.07 ± 0.23	3.77 ± 0.26	3.66 ± 0.25
11/29/2022	12/5/2022	3.26 ± 0.27	2.74 ± 0.25	2.74 ± 0.25	2.53 ± 0.25	2.03 ± 0.23	2.48 ± 0.25	2.55 ± 0.25
12/5/2022	12/12/2022	2.88 ± 0.23	2.51 ± 0.22	2.58 ± 0.22	2.41 ± 0.21	1.90 ± 0.19	2.47 ± 0.22	2.48 ± 0.22
12/12/2022	12/19/2022	2.07 ± 0.20	1.75 ± 0.19	1.88 ± 0.19	1.81 ± 0.19	1.60 ± 0.19	2.13 ± 0.21	1.83 ± 0.20
12/19/2022	12/27/2022	2.71 ± 0.21	2.31 ± 0.19	2.56 ± 0.20	2.24 ± 0.19	1.84 ± 0.18	2.64 ± 0.20	2.42 ± 0.21
12/27/2022	1/3/2023	3.44 ± 0.24	2.90 ± 0.23	3.53 ± 0.25	3.05 ± 0.23	2.62 ± 0.22	3.23 ± 0.24	2.82 ± 0.23

[1] Control Location

Table B-6

Concentration of Gamma Emitters in Air Particulates

(Results in units of 10^{-3} pCi/m^3 +/- 2σ)

Start Date	Stop Date	6C1	10S3	11S1	14S1	15D1	22G1[1]	13S4
1/3/2022	3/29/2022	*	*	*	*	*	*	*
3/29/2022	6/27/2022	*	*	*	*	*	*	*
6/27/2022	10/3/2022	*	*	*	*	*	*	*
10/3/2022	1/3/2023	*	*	*	*	*	*	*

[1] Control Location
* All Non-Natural Gamma Emitters <MDA

Table B-7

Concentration of Gamma Emitters in Vegetation Samples

(Results in units of pCi/kg (wet) +/- 2σ)

Sample Code	Sample Date	Sample Type	Gamma Emitters
11S3			
LGS	6/21/2022	Broccoli	*
Information Ctr	6/21/2022	Cauliflower	*
	6/21/2022	Cabbage	*
	7/14/2022	Cauliflower	*
	7/14/2022	Swiss Chard	*
	7/14/2022	Broccoli	*
	8/16/2022	Swiss Chard	*
	8/16/2022	Cauliflower	*
	8/16/2022	Kale	*
	9/19/2022	Swiss Chard	*
	9/19/2022	Yellow Squash Leaves	*
	9/19/2022	Cucumber	*
13S3			
LGS	6/21/2022	Broccoli	*
500 KV Yard	6/21/2022	Cauliflower	*
	6/21/2022	Cabbage	*
	7/14/2022	Cauliflower	*
	7/14/2022	Cabbage	*
	7/14/2022	Swiss Chard	*
	8/16/2022	Kale	*
	8/16/2022	Cauliflower	*
	8/16/2022	Swiss Chard	*
	9/19/2022	Swiss Chard	*
	9/19/2022	Kale	*
	9/19/2022	Collards	*
31G1[1]			
Jollyview Farm	6/21/2022	Yellow Squash Leaves	*
	6/21/2022	Cabbage	*
	6/21/2022	Broccoli	*
	7/14/2022	Yellow Squash Leaves	*
	7/14/2022	Zucchini	*
	7/14/2022	Broccoli	*
	8/16/2022	Zucchini	*
	8/16/2022	Yellow Squash Leaves	*
	8/16/2022	Melon Leaves	*
	9/19/2022	Yellow Squash Leaves	*
	9/19/2022	Cucumber	*
	9/19/2022	Pumpkin	*

[1] Control Location
* All Non-Natural Gamma Emitters <MDA

Table B-8
Concentration of Gamma Emitters (including I-131) in Milk
(Results in units of pCi/Liter +/- 2σ

Sample Code	Sample Date	Gamma Emitters
18E1 Miller Farm		
	1/18/2022	*
	2/15/2022	*
	3/1/2022	*
	4/11/2022	*
	4/25/2022	*
	5/10/2022	*
	5/23/2022	*
	6/7/2022	*
	6/21/2022	*
	7/5/2022	*
	7/18/2022	*
	8/2/2022	*
	8/16/2022	*
	8/30/2022	*
	9/12/2022	*
	9/27/2022	*
	10/11/2022	*
	10/24/2022	*
	11/8/2022	*
	11/22/2022	*
	12/6/2022	*
19B1 Kolb Farm		
	1/18/2022	*
	2/15/2022	*
	3/1/2022	*
	4/11/2022	*
	4/25/2022	*
	5/10/2022	*
	5/23/2022	*
	6/7/2022	*
	6/21/2022	*
	7/5/2022	*
	7/18/2022	*
	8/2/2022	*
	8/16/2022	*
	8/30/2022	*
	9/12/2022	*
	9/27/2022	*
	10/11/2022	*
	10/24/2022	*
	11/8/2022	*
	11/22/2022	*
	12/6/2022	*

Table B-8
Concentration of Gamma Emitters (including I-131) in Milk
(Results in units of pCi/Liter +/- 2σ

Sample Code	Sample Date	Gamma Emitters
23F1[1] Guest Farm	1/18/2022	*
	2/15/2022	*
	3/1/2022	*
	4/11/2022	*
	4/25/2022	*
	5/10/2022	*
	5/24/2022	*
	6/7/2022	*
	6/21/2022	*
	7/5/2022	*
	7/18/2022	*
	8/2/2022	*
	8/16/2022	*
	8/30/2022	*
	9/12/2022	*
	9/27/2022	*
	10/11/2022	*
	10/24/2022	*
	11/8/2022	*
	11/22/2022	*
	12/6/2022	*
25C1 Kulp Farm	1/18/2022	*
	2/15/2022	*
	3/1/2022	*
	4/11/2022	*
	4/25/2022	[2]
22B1 Pigeon Creek Farm Replaces 25C1	12/6/2022	*

[1] Control Locations
[2] Samples No Longer Available
* All Non-Natural Gamma Emitters <MDA

Table B-9

Typical MDA Ranges for Gamma Spectrometry

Selected Nuclides	Air Particulates (10^{-3} pCi/m^3)	Surface Water, Drinking Water (pCi/L)	Fish (pCi/kg) Wet	Ground water (pCi/L)	Milk (pCi/L)	Oysters (pCi/kg)	Shoreline Sediment (pCi/kg)Dry	Soil (pCi/kg) Dry	Vegetation (pCi/kg) Wet
K-40	5.65 - 24.6	16 - 182	2,747 - 4,505	21.5 -66.4	1,286 - 1,529	1,269 - 2,069	781 - 13,761	789 - 10,713	671 - 11,829
Mn-54	0.32 - 1.16	2.7 - 5.6	9.8 - 19.6	2.86 - 5.14	3.6 - 6.6	10.8 - 16.4	41.4 - 67.1	37.4 - 91.9	10.3 - 53.0
Fe-59	1.01 - 8.52	5.6 - 13.2	31.6 - 93.2	6.04 - 11.7	9.2 - 15.9	29.3 - 56.7	142 - 251	96.4 – 389	22.0 - 151
Co-58	0.38 - 2.07	2.7 - 5.6	10.9 - 28.3	2.86 - 5.27	3.7 - 6.3	10.5 - 19.3	53.7 - 82.9	44.6 – 133	10.9 - 59.8
Co-60	0.28 - 1.09	2.8 - 5.5	10.9 - 24.3	3.01 - 5.38	4.1 - 7.2	11.7 - 17.0	38.6 - 57.9	32.8 - 85.8	12.9 - 55.0
Zn-65	0.81 - 3.10	5.5 - 11.4	23.3 - 57.2	6.41 - 14.4	9.4 - 16.1	22.0 - 43.3	112 - 198	96.4 – 275	24.7 - 116
Ag-110m	0.33 – 1.06	2.42 - 4.96	8.2 – 18.1	2.79 - 5.06	3.26- 5.64	8.7 - 16.0	36.6 - 175	40.7 – 99.4	10.1 - 61.4
Zr-95	0.72 - 3.88	4.7 - 10.2	20.0 - 47.1	5.62 - 8.75	5.8 - 11.5	19.0 - 34.0	93.5 - 151	84.6 – 261	19.3 - 116
Nb-95	0.56 - 4.91	2.9 - 6.0	13.7 - 42.7	3.3 - 5.88	3.9 - 6.5	13.9 - 24.3	82.1 - 157	61.5 – 227	10.9 - 90.5
Ru-106	3.00 - 12.1	23.8 - 48.1	77.1 - 197	25.6 - 45.3	29.3 - 51.8	88.0 - 141	327.0 – 570	314.0 – 840	92.9 - 541
I-131[1]	2.73 - 914	0.52 - 11.7	21.4 - 2,340	4.87 - 9.04	0.5 - 7.03	22.4 - 107	470 - 2,040	139 - 8,060	13.4 - 854
Cs-134	0.47 - 0.88	3.2 - 5.7	7.8 - 16.0	2.92 - 5.48	4.09 - 4.82	9.7 - 16.5	43.3 - 82.4	33.4 - 109	11.1 - 58.1
Cs-137	0.46 - 0.88	3.7 - 5.9	3.8 - 17.5	2.97 - 5.43	4.08 - 5.29	10.0 - 16.7	38.4 - 65.4	39.1 - 135	11.1 - 62.3
La-140	2.01 – 116	5.05 - 11.5	15.9 - 444	4.87 - 10.3	4.89 - 6.28	24.1 - 80.4	368 - 773	136 - 1,820	9.1 - 388
Ba-140	2.01 - 116	5.05 - 11.5	15.9 - 444	5.86 - 26.0	4.89 - 6.28	24.1 - 80.4	368 – 773	136 - 1,820	9.1 - 388
Ce-144	1.12 - 3.27	16.8 - 36.7	38.1 - 70.9	17.8 - 32.0	20.5 - 31.0	42.6 - 72.6	208 - 279	191 - 414	46.6 - 289
Cr-51	4.90 - 45.0	23.2 - 50.6	93.0 - 395	26.7 - 42.1	30.4 - 46.8	97.0 - 199	711 - 1,110	489 - 1,810	93.9 - 850
Na-22	0.34 - 1.33	2.7 - 6.0	12.1 - 28.0	2.78 - 5.94	4.9 - 8.5	13.4 - 19.5	46.4 - 77.4	36.4 - 92.4	8.9 - 54.1

[1] This MDA range for I-131 on a charcoal cartridge is typically 5.22×10^{-3} to 1.37×10^{-2} pCi/m^3

Table B-10

Typical LLDs for Gamma Spectrometry

Selected Nuclides	Air Particulates 10-3 pCi/m3	Surface Water, Drinking Water pCi/L	Fish pCi/kg (wet)	Ground water pCi/L	Oysters pCi/kg (wet)	Milk pCi/L	Soil pCi/kg (dry)	Vegetation pCi/kg (wet)
Na-22	5	5.3	12	5.3	12	9.1	78	27
Cr-51	74	37	76	37	76	62	452	174
Mn-54	4.6	4.7	13	4.7	13	7.4	63	19
Co-58	6.7	4.3	12	4.3	12	8.2	78	23
Fe-59	20	11	27	11	27	18	123	57
Co-60	3.5	4.8	12	4.8	12	7.5	59	24
Zn-65	8.9	11	27	11	27	17	162	55
Nb-95	9.8	4.5	13	4.5	13	9.5	73	25
Zr-95	11	7.9	18	7.9	18	14	117	34
Ru-106	43	38	111	38	111	62	624	174
Ag-110m	4.2	4.3	11	4.3	11	6	65	20
Te-129m	101	56	118	56	118	90	833	263
I-131*	90	0.8	11	6.4	11	0.8	58	42
Cs-134	4.7	4.7	11	4.7	11	6.7	66	18
Cs-137	4.2	5.1	11	5.1	11	6.9	78	21
Ba-140	47	23	39	23	39	46	103	111
La-140	47	9.2	15	9.2	15	13	103	30
Ce-144	15	23	45	23	45	37	288	70

* The LLD for I-131 measured on a Charcoal cartridge is 3.7 $x10^{-2}$ pCi/m^3

Table B-11

Quarterly DLR Results for Limerick Generating Station

(Results in Units of mR/91 days ± 2σ)

Location	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Normalized Annual Dose, MA (mrem/yr)	BA	BA + MDDA	Annual Facility Dose, FA (mrem)	Annual Facility Dose, FA >10 mrem
10E1	19.1	7.4	8.4	20.7	55.6	71.0	82.7	ND	No
10F3	18.3	8.1	7.3	21.6	55.3	69.7	81.4	ND	No
10S3	18.8	8.7	7.3	22.2	57.1	70.9	82.6	ND	No
11S1	21.9	12.0	14.4	24.4	72.6	83.1	94.8	ND	No
13C1[1]	13.7	3.5	1.4	15.6	34.1	49.8	61.5	ND	No
13E1	19.0	12.0	8.4	21.4	60.8	70.1	81.8	ND	No
13S2	26.1	16.5	16.0	28.2	86.9	112.1	123.8	ND	No
14S1	16.7	8.7	6.2	19.1	50.7	63.2	74.9	ND	No
15D1[1]	19.1	12.6	8.9	21.3	61.9	72.5	84.2	ND	No
16F1[1]	19.0	10.0	7.3	21.3	57.6	73.4	85.1	ND	No
17B1	18.2	10.0	6.2	19.1	53.5	66.8	78.5	ND	No
18S2	20.6	11.3	9.5	22.7	64.1	78.4	90.1	ND	No
19D1	19.1	8.7	6.2	19.9	53.9	66.3	78.0	ND	No
20D1[1]	17.7	7.4	5.7	19.3	50.1	63.0	74.7	ND	No

Table B-11

Direct Radiation

(Results in Units of mR/91 days ± 2σ)

Location	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Normalized Annual Dose, MA (mrem/yr)	BA	BA + MDDA	Annual Facility Dose, FA (mrem)	Annual Facility Dose, FA >10 mrem
20F1	18.7	8.7	6.2	20.7	54.3	67.5	79.2	ND	No
21S2	18.8	9.4	6.2	20.0	54.5	64.1	75.8	ND	No
23S2	16.7	8.1	5.1	18.3	48.2	63.9	75.6	ND	No
24D1	16.0	8.1	4.6	17.9	46.5	59.7	71.4	ND	No
25D1	14.9	8.1	3.5	17.1	43.6	56.5	68.2	ND	No
25S2	16.4	7.4	8.4	17.7	49.9	58.1	69.8	ND	No
26S3	16.0	8.7	4.6	18.3	47.6	60.4	72.1	ND	No
28D2	17.5	8.7	8.9	19.0	54.1	63.5	75.2	ND	No
29E1	17.1	6.8	7.9	19.4	51.1	62.3	74.0	ND	No
29S1	16.5	6.8	5.1	17.9	46.3	61.4	73.1	ND	No
2E1	18.2	10.7	7.3	21.3	57.4	71.9	83.6	ND	No
31D1[1]	21.8	12.6	13.3	23.1	70.8	83.0	94.7	ND	No
31D2	19.1	15.9	8.9	20.2	64.1	71.2	82.9	ND	No
31S1	19.8	12.6	7.3	21.7	61.4	71.6	83.3	ND	No
34E1	17.6	12.0	5.7	19.7	55.0	67.0	78.7	ND	No

Table B-11

Direct Radiation

(Results in Units of mR/91 days ± 2σ)

Location	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Normalized Annual Dose, MA (mrem/yr)	BA	BA + MDDA	Annual Facility Dose, FA (mrem)	Annual Facility Dose, FA >10 mrem
34S2	18.7	16.5	5.1	20.5	60.9	71.6	83.3	ND	No
36D1	14.9	8.1	4.1	17.6	44.6	62.1	73.8	ND	No
36S2	19.0	9.4	6.8	20.7	55.8	73.4	85.1	ND	No
3S1	18.6	8.1	7.3	20.5	54.4	70.1	81.8	ND	No
4E1	14.4	2.2	0.8	15.6	32.9	51.4	63.1	ND	No
5H1[1]	22.9	15.2	10.6	25.5	74.1	86.3	98.0	ND	No
5S1	20.5	9.4	10.6	23.6	64.0	80.0	91.7	ND	No
6C1[1]	18.7	6.1	13.8	20.0	58.7	69.5	81.2	ND	No
7E1	19.9	8.1	7.3	21.7	57.0	74.6	86.3	ND	No
7S1	19.9	9.4	5.7	21.0	55.9	73.1	84.8	ND	No
9C1[1]	18.2	3.5	6.8	19.7	48.2	68.1	79.8	ND	No

[1] Control & Special Interest Locations

APPENDIX C

Quality Assurance Program

Appendix C is a summary of Constellation Generation Solutions (CGS) laboratory's quality assurance program. It consists of Table C-1 which is a compilation of the results of the CGS Laboratory's participation in an interlaboratory comparison program with Environmental Resource Associates (ERA) located in Arvada, Colorado and Eckert and Ziegler Analytics, Inc. (EZA) located in Atlanta, Georgia.

It also includes Table C-2, which is a compilation of the results of the Constellation Generation Solutions (CGS) Laboratory's participation in a split sample program with Teledyne Brown Engineering (TBE) located in Knoxville, Tennessee and Table C-3, which is a list of the Site Specific LLDs required by the ODCM.

The CGS Laboratory's results contained in Table C-1, intercomparison results, are in full agreement when they were evaluated using the NRC Resolution Test Criteria [1] except as noted in the Pass/Fail column and described below. The CGS Laboratory's results are provided with their analytical uncertainties of 2 sigma. When evaluating with the NRC Resolution Test a one sigma uncertainty is used to determine Pass or Fail and noted accordingly.

All results reported passed their respective vendor acceptance ranges and NRC Resolution Test Criteria [1] with one exception for the Gross Beta Study ERA RAD 129, reference date 4/4/2022. The CGS result passed the low end of vendor acceptance criteria but failed NRC Resolution Test Criteria. Low recovery of activity was likely due to an ineffective residue correction factor that undercompensates for the significant residue weight present in the study accounting for the low result reported. This low value and a low uncertainty in turn resulted in an NRC Resolution Test Criteria Failure. A set of 3rd party, NIST traceable standards has been procured to build a residue correction curve for more accurate results going forward. This event has been entered into the Corrective Action Program for tracking and to prevent future occurrence (IR 04559044).

All results reported passed their respective vendor acceptance ranges and NRC Resolution Test Criteria [1].

The vendor laboratories used by CGS for subcontracting and interlaboratory comparison samples, GEL Laboratories and TBE, also participate in the ERA and EZA interlaboratory comparison program. A presentation of their full data report is provided in their Annual Environmental Quality Assurance Program Reports, (Ref 14,15). In summary, GEL and TBE reported results met vendor and laboratory acceptance ranges with the following exceptions discussed here:

1. TBE result for Air particulate Ce-144 submitted for a study in March 2022 failed the upper acceptance limit. The laboratory investigated and the study results were outside the acceptable range specified in TBE's QA plan, 70-130% of True Value, but would have been acceptable when taking the uncertainty into account. A duplicate study was analyzed on two other detectors and passed the upper acceptance limit. In both cases, TBE's published QA requirements of acceptable range being 70-130% of True value were met. The lab's performance is within the acceptable range specified in their QA plan. This same range is considered acceptable by Constellation Nuclear Quality Assurance Requirements as well. TBE states in their investigation that there was no impact to sample data and no further action is warranted.

2. TBE result for Air particulate Co-60 study in September 2022 failed the upper acceptance limit. The laboratory investigated and the study results were outside the acceptable range specified in TBE's QA plan, 70-130% of True Value. The study was analyzed as a duplicate on another detector and passed within 114% of True Value. Historical results for Air particulate Co-60 have ranged from 91% - 141% with a mean of 91%. The lab determined no correction action needed at this time as it is the first failure for this nuclide for Air particulate.

3. GEL results for MRAD-37 Sr-90 failed vendor acceptance criteria, exceeding the maximum range for both vegetation and water. The laboratory review did not reveal any gross errors or possible contributors to the high bias. During this same analysis time period, the laboratory successfully analyzed these same matrices in PT for MAPEP-47 which required the same preparation and analysis processes and procedures. The lab will continue to monitor the recoveries of these parameters to ensure there are no continued issues.

The Inter and Intra laboratory results contained in Table C-2 are intercomparison results for routine samples analyzed for replicate and split analyses and evaluated for beta and non-natural gamma emitters. The CGS Laboratory's results are provided with their analytical uncertainties of 2 sigma. When evaluating with the NRC Resolution Test a one sigma uncertainty is used to determine Pass or Fail and noted accordingly. In the event there are no non-natural isotopes detected, the samples are reported <MDA and designated as Pass.

All the results contained in Table C-2 agree with their respective CGS laboratory original, replicate and/or TBE's split laboratory sample according to NRC Resolution Test Criteria[1]. The results for separate air samplers collocated at 11S1 and 11S2 analyzed by CGS and TBE respectively are provided in Table C-2a for Air Iodine and C-2b for the Beta particulate. The results are generally in trend and a plot of the data between the two locations is found in the main body of the report, Figure A-8.

There were three of the 4 quarterly samples for soil at SFS3 that indicated low level, Non-Plant related Cs-137 just above the analyses Minimum Detectable Activity. This activity has been investigated previously and levels are in trend with historical data at this location.

1. The original analysis of soil collected on February 21, 2022, at SFS3 indicated low level, Non-Plant related Cs-137 just above the analyses Minimum Detectable Activity at 146 ± 61.9 pCi/kg. The replicate and split samples also indicated Cs-137 above the Minimum Detectable Activity, MDA, at 212 ±37.5 pCi/kg and 141±83.0 pCi/kg, respectively.

2. The original analysis of soil collected on June 6, 2022, at SFS3 indicated low level, Non-Plant related Cs-137 just above the analyses Minimum Detectable Activity at 140 ± 56.2 pCi/kg. The replicate analysis confirmed Cs-137 above the Minimum Detectable Activity, MDA, at 98.9 ±52.3 pCi/kg and results are in agreement when evaluated using the NRC Resolution Test Criteria[1].

3. The original analysis of soil collected on November 15, 2022, at SFS3 indicated low level, Non Plant related Cs-137 just above the analyses Minimum Detectable Activity at 133 ± 55.3 pCi/kg. The replicate analysis confirmed Cs-137 above the Minimum Detectable Activity, MDA, at 169 ±61.3 pCi/kg and these results are in agreement when evaluated using the NRC Resolution Test Criteria[1].

The original, replicate and split results pass the NRC Resolution Test Criteria[1], as specified in the rule. The low-level Cs-137 observed in these soil analyses is consistent with weapons related fallout previously identified in the environs around Limerick Generating Station.

All air particulate samples contain Beta emitters and are reported with a 2 sigma uncertainty. The original and replicate analyses are evaluated for agreement using the NRC Resolution Test Criteria[1]. These samples must be composited for further analysis and this precludes them from being split for analysis of beta emitters. These filters and other samples whose nature generally preclude sample splitting are marked "**" in the Split Analysis column.

TABLE OF CONTENTS -Appendix C ANALYTICAL RESULTS

Table C-1
Results of Participation in Cross Check Programs

Sample Date	Vendor	Study ID	Sample Type		Units	Equip ID	Isotope Observed	Reported Laboratory's Results			Cross Check Lab Results	NRC Resolution Test Pass / Fail [1]
3/10/2022	ANA	E13643	Milk	Gamma	pCi/L	D4	Ce-141	58.6	±	11.5	64.6	Pass
							Co-58	160	±	15.6	164	Pass
							Co-60	313	±	15.8	302	Pass
							Cr-51	390	±	95.0	339	Pass
							Cs-134	168	±	8.98	182	Pass
							Cs-137	222	±	17.4	223	Pass
							Fe-59	185	±	20.8	185	Pass
							I-131	98.9	±	21.6	96.7	Pass
							Mn-54	157	±	14.8	164	Pass
							Zn-65	231	±	31.7	246	Pass
3/10/2022	ANA	E13643	Milk	Gamma	pCi/L	D5	Ce-141	71.6	±	16.3	64.6	Pass
							Co-58	164	±	15.1	164	Pass
							Co-60	302	±	14.8	302	Pass
							Cr-51	398	±	107	339	Pass
							Cs-134	168	±	9.67	182	Pass
							Cs-137	212	±	16.0	223	Pass
							Fe-59	207	±	21.3	185	Pass
							I-131	96.2	±	26.7	96.7	Pass
							Mn-54	166	±	15.0	164	Pass
							Zn-65	230	±	31.0	246	Pass

3/10/2022	ANA	E13644	Water	Beta	pCi/L	S5E	Cs-137	224	±	4.43	222	Pass
3/10/2022	ANA	E13645	Cartridge	Gamma	pCi	D2	I-131	81.9	±	8.35	88.2	Pass
						D3	I-131	84.7	±	7.96	88.2	Pass
						D4	I-131	82.0	±	7.39	88.2	Pass
4/4/2022	ERA	RAD129	Water	Gamma	pCi/L	D4	Ba-133	56.6	±	4.24	62.9	Pass
							Cs-134	81.0	±	3.61	81.6	Pass
							Cs-137	37.8	±	4.54	36.6	Pass
							Co-60	97.6	±	5.11	97.4	Pass
							Zn-65	293	±	17.9	302	Pass
4/4/2022	ERA	RAD129	Water	Beta	pCi/L	S5E	Cs-137	35.8	±	1.88	51.0	Fail[1]
4/4/2022	ERA	RAD129	Water	Gamma	pCi/L	D4	I-131	27.1	±	4.39	26.2	Pass
6/16/2022	ANA	E13646	Water	Beta	pCi/L	S5E	Cs-137	250	±	4.66	260	Pass
6/16/2022	ANA	E13647	Water	Gamma	pCi/L	D3	Ce-141	141	±	15.5	139	Pass
							Co-58	126	±	14.9	128	Pass
							Co-60	244	±	12.6	242	Pass
							Cr-51	314	±	84.7	344	Pass
							Cs-134	163	±	9.09	172	Pass
							Cs-137	213	±	15.4	204	Pass
							Fe-59	170	±	19.0	157	Pass
							I-131	112	±	22.6	91.2	Pass
							Mn-54	243	±	16.9	229	Pass
							Zn-65	302	±	30.5	296	Pass

6/16/2022	ANA	E13647	Water	Gamma	pCi/L	D4	Ce-141	126	±	14.6	139	Pass
							Co-58	124	±	13.8	128	Pass
							Co-60	248	±	13.1	242	Pass
							Cr-51	358	±	92.9	344	Pass
							Cs-134	163	±	9.11	172	Pass
							Cs-137	217	±	15.8	204	Pass
							Fe-59	180	±	19.0	157	Pass
							I-131	86.2	±	24.2	91.2	Pass
							Mn-54	253	±	17.0	229	Pass
							Zn-65	253	±	30.2	296	Pass
6/16/2022	ANA	E13648	Filter	Gamma	pCi	D5	Ce-141	101	±	5.17	96.6	Pass
							Co-58	89.3	±	4.93	89.3	Pass
							Co-60	169	±	4.85	168	Pass
							Cr-51	252	±	34.6	239	Pass
							Cs-134	100	±	2.67	119	Pass
							Cs-137	142	±	5.25	142	Pass
							Fe-59	129	±	8.07	109	Pass
							Mn-54	168	±	5.97	159	Pass
							Zn-65	211	±	11.7	206	Pass
6/16/2022	ANA	E13648	Filter	Gamma	pCi	D4	Ce-141	96.7	±	7.64	97.0	Pass
							Co-58	89.2	±	7.09	89.0	Pass
							Co-60	171	±	7.27	168	Pass
							Cr-51	265	±	35.4	239	Pass
							Cs-134	104	±	4.09	119	Pass
							Cs-137	147	±	7.98	142	Pass
							Fe-59	136	±	10.6	109	Pass

							Mn-54	170	±	9.08	159	Pass
							Zn-65	198	±	16.4	206	Pass
6/16/2022	ANA	E13649	Filter	Beta	pCi	S5E	Cs-137	276	±	3.47	242	Pass
						S5E	Cs-137	276	±	3.47	242	Pass
						S5E	Cs-137	275	±	3.47	242	Pass
9/15/2022	ANA	E13650A	Filter	Beta	pCi	S5E	Cs-137	242	±	3.25	224	Pass
9/19/2022	ERA	MRAD037	Filter	Gamma	pCi	D4	Cs-134	270	±	6.71	325	Pass
							Cs-137	706	±	19.3	795	Pass
							Co-60	198	±	8.36	191	Pass
							Zn-65	125	±	16.5	120	Pass
10/7/2022	ERA	RAD131	Water	Gamma	pCi/L	D4	Ba-133	75.0	±	3.79	79.4	Pass
							Cs-134	29.0	±	2.09	30.5	Pass
							Cs-137	212	±	7.45	212	Pass
							Co-60	50.4	±	3.06	51.4	Pass
							Zn-65	212	±	12.8	216	Pass
							I-131	25.4	±	6.03	24.4	Pass
12/1/2022	ANA	E13651	Filter	Gamma	pCi	D4	Ce-141	144	±	9.4	140	Pass
							Co-58	143	±	12.0	144	Pass
							Co-60	174	±	10.0	181	Pass
							Cr-51	287	±	54.4	290	Pass
							Cs-134	93.0	±	5.59	120	Pass
							Cs-137	134	±	10.7	137	Pass
							Fe-59	142	±	15.9	124	Pass
							Mn-54	162	±	12.1	158	Pass

							Zn-65	192	±	23.5	191	Pass
12/1/2022	ANA	E13651	Filter	Gamma	pCi	D5	Ce-141	146	±	8.6	140	Pass
							Co-58	140	±	10.1	144	Pass
							Co-60	180	±	8.97	181	Pass
							Cr-51	286	±	46.1	290	Pass
							Cs-134	94.5	±	48.6	120	Pass
							Cs-137	125	±	91.6	137	Pass
							Fe-59	148	±	12.8	124	Pass
							Mn-54	172	±	10.4	158	Pass
							Zn-65	199	±	20.3	191	Pass
12/1/2022	ANA	E13652	Water	Beta	pCi/L	S5E	Cs-137	308	±	5.11	283	Pass
12/1/2022	ANA	E13653	Cartridge	Gamma	pCi	D2	I-131	88.7	±	9.50	91.6	Pass
						D3	I-131	88.5	±	9.40	91.6	Pass
						D4	I-131	93.5	±	8.60	91.6	Pass
						D5	I-131	89.8	±	9.10	91.6	Pass
12/1/2022	ANA	E13654	Milk	Gamma	pCi/L	D4	Ce-141	223	±	19.5	225	Pass
							Co-58	222	±	19.7	230	Pass
							Co-60	281	±	16.3	290	Pass
							Cr-51	433	±	111	464	Pass
							Cs-134	182	±	114	191	Pass
							Cs-137	214	±	18.6	219	Pass
							Fe-59	220	±	23.3	198	Pass
							I-131	104	±	22.1	95.1	Pass
							Mn-54	252	±	19.7	252	Pass
							Zn-65	274	±	38.0	305	Pass

12/1/2022	ANA	E13654	Milk	Gamma	pCi/L	D5	Ce-141	228	±	19.1	225	Pass
							Co-58	226	±	17.7	230	Pass
							Co-60	285	±	14.9	290	Pass
							Cr-51	494	±	110	464	Pass
							Cs-134	179	±	10.1	191	Pass
							Cs-137	231	±	18.0	219	Pass
							Fe-59	214	±	21.6	198	Pass
							I-131	102	±	23.0	95.1	Pass
							Mn-54	252	±	18.6	252	Pass
							Zn-65	282	±	33.4	305	Pass

[1] See discussion at the beginning of the Appendix

Table C-2

Results of Quality Assurance Program

Sample Type and Location	Sample Date	Type of Analysis	Result Units	Original Analysis	Replicate Analysis	Split Analysis	Pass/Fail (Replicate)	Pass/Fail (Split)
Water - Circ in	1/3/2022	Gross Beta	pCi/L	2.03 ± 0.8	2.95 ± 0.8	**	Pass	NA
Water - Circ Out	1/3/2022	Gross Beta	pCi/L	2.53 ± 0.8	2.94 ± 0.8	**	Pass	NA
Water - OWD	1/3/2022	Gross Beta	pCi/L	2.11 ± 0.8	2.86 ± 0.8	**	Pass	NA
Water - MCWA	1/3/2022	Gross Beta	pCi/L	1.64 ± 0.8	2.11 ± 0.8	**	Pass	NA
Water - Webster	1/3/2022	Gross Beta	pCi/L	1.33 ± 0.7	1.75 ± 0.7	**	Pass	NA
Water - DC	1/12/2022	Gross Beta	pCi/L	2.61 ± 1.9	4.48 ± 1.9	**	Pass	NA
Water - ML	1/12/2022	Gross Beta	pCi/L	4.74 ± 4.1	4.96 ± 4.1	**	Pass	NA
Water - Circ in	10/10/2022	Gross Beta	pCi/L	2.64 ± 0.8	3.48 ± 0.8	**	Pass	NA
Water - Circ Out	10/10/2022	Gross Beta	pCi/L	2.07 ± 0.8	2.41 ± 0.8	**	Pass	NA
Water - OWD	10/10/2022	Gross Beta	pCi/L	1.88 ± 0.7	2.61 ± 0.8	**	Pass	NA
Water - MCWA	10/10/2022	Gross Beta	pCi/L	1.82 ± 0.7	1.74 ± 0.7	**	Pass	NA
Water - Webster	10/10/2022	Gross Beta	pCi/L	2.23 ± 0.8	2.36 ± 0.8	**	Pass	NA
Water - DC	10/31/2022	Gross Beta	pCi/L	5.35 ± 2.0	8.89 ± 2.3	**	Pass	NA
Water - ML	10/31/2022	Gross Beta	pCi/L	8.19 ± 2.2	8.58 ± 2.2	**	Pass	NA
Water - 16C2	1/31/2022	Gross Beta	pCi/L	2.6 ± 0.8	NA	<2.5	NA	Pass
Water - 16C2	1/31/2022	LLI	pCi/L	<MDA	NA	<MDA	NA	Pass
Water - 16C2	1/31/2022	Gamma	pCi/L	<MDA	NA	<MDA	NA	Pass
Water - 16C2	2/28/2022	Gross Beta	pCi/L	2.7 ± 0.9	NA	<3.3	NA	Pass
Water - 16C2	2/28/2022	LLI	pCi/L	<MDA	NA	<MDA	NA	Pass
Water - 16C2	2/28/2022	Gamma	pCi/L	<MDA	NA	<MDA	NA	Pass
Water - 16C2	3/29/2022	Gross Beta	pCi/L	2.1 ± 0.8	NA	3.24 ± 1.7	NA	Pass
Water - 16C2	3/29/2022	LLI	pCi/L	<MDA	NA	<MDA	NA	Pass

Water -	16C2	3/29/2022	Gamma	pCi/L		<MDA		NA		<MDA		NA	Pass
Water -	16C2	3/29/2022	Tritium	pCi/L		<123		NA		<194		NA	Pass
Water -	16C2	5/2/2022	Gross Beta	pCi/L	1.6	±	0.8	NA		<2.8		NA	Pass
Water -	16C2	5/2/2022	LLI	pCi/L		<MDA		NA		<MDA		NA	Pass
Water -	16C2	5/2/2022	Gamma	pCi/L		<MDA		NA		<MDA		NA	Pass
Water -	16C2	5/31/2022	Gross Beta	pCi/L	1.8	±	0.8	NA		<3.3		NA	Pass
Water -	16C2	5/31/2022	LLI	pCi/L		<MDA		NA		<MDA		NA	Pass
Water -	16C2	5/31/2022	Gamma	pCi/L		<MDA		NA		<MDA		NA	Pass
Water -	16C2	6/27/2022	Gross Beta	pCi/L	5.1	±	1.0	NA		<3.0		NA	Pass
Water -	16C2	6/27/2022	LLI	pCi/L		<MDA		NA		<MDA		NA	Pass
Water -	16C2	6/27/2022	Gamma	pCi/L		<MDA		NA		<MDA		NA	Pass
Water -	16C2	6/27/2022	Tritium	pCi/L		<164		NA		<182		NA	Pass
Water -	16C2	8/2/2022	Gross Beta	pCi/L	2.7	±	1.6	NA		<1.8		NA	Pass
Water -	16C2	8/2/2022	LLI	pCi/L		<MDA		NA		<MDA		NA	Pass
Water -	16C2	8/2/2022	Gamma	pCi/L		<MDA		NA		<MDA		NA	Pass
Water -	16C2	8/29/2022	Gross Beta	pCi/L	3.4	±	0.7	NA		<3.1		NA	Pass
Water -	16C2	8/29/2022	LLI	pCi/L		<MDA		NA		<MDA		NA	Pass
Water -	16C2	8/29/2022	Gamma	pCi/L		<MDA		NA		<MDA		NA	Pass
Water -	16C2	10/3/2022	Gross Beta	pCi/L	1.8	±	0.8	NA		<3.1		NA	Pass
Water -	16C2	10/3/2022	LLI	pCi/L		<MDA		NA		<MDA		NA	Pass
Water -	16C2	10/3/2022	Gamma	pCi/L		<MDA		NA		<MDA		NA	Pass
Water -	16C2	10/3/2022	Tritium	pCi/L		<163		NA		<188		NA	Pass
Water -	16C2	10/31/2022	Gross Beta	pCi/L	2.0	±	0.8	NA	3.22	±	1.8	NA	Pass
Water -	16C2	10/31/2022	LLI	pCi/L		<MDA		NA		<MDA		NA	Pass

Water -	16C2	10/31/2022	Gamma	pCi/L		<MDA		NA		<MDA	NA	Pass
Water -	16C2	11/29/2022	Gross Beta	pCi/L	1.8	±	0.8	NA		<2.7	NA	Pass
Water -	16C2	11/29/2022	LLI	pCi/L		<MDA		NA		<MDA	NA	Pass
Water -	16C2	11/29/2022	Gamma	pCi/L		<MDA		NA		<MDA	NA	Pass
Water -	16C2	1/3/2023	Gross Beta	pCi/L	2.4	±	0.8	NA		<3.0	NA	Pass
Water -	16C2	1/3/2023	LLI	pCi/L		<MDA		NA		<MDA	NA	Pass
Water -	16C2	1/3/2023	Gamma	pCi/L		<MDA		NA		<MDA	NA	Pass
Water -	16C2	1/3/2023	Tritium	pCi/L		<156		NA		<178	NA	Pass
Milk-	19B1	1/18/2022	LLI	pCi/L		<MDA		NA		<MDA	NA	Pass
Milk-	19B1	1/18/2022	Gamma	pCi/L		<MDA		NA		<MDA	NA	Pass
Milk-	25C1	1/18/2022	LLI	pCi/L		<MDA		NA		<MDA	NA	Pass
Milk-	25C1	1/18/2022	Gamma	pCi/L		<MDA		NA		<MDA	NA	Pass
Milk-	19B1	4/11/2022	LLI	pCi/L		<MDA		NA		<MDA	NA	Pass
Milk-	19B1	4/11/2022	Gamma	pCi/L		<MDA		NA		<MDA	NA	Pass
Milk-	25C1	4/11/2022	LLI	pCi/L		<MDA		NA		<MDA	NA	Pass
Milk-	25C1	4/11/2022	Gamma	pCi/L		<MDA		NA		<MDA	NA	Pass
Milk-	19B1	7/5/2022	LLI	pCi/L		<MDA		NA		<MDA	NA	Pass
Milk-	19B1	7/5/2022	Gamma	pCi/L		<MDA		NA		<MDA	NA	Pass
Milk-	19B1	10/11/2022	LLI	pCi/L		<MDA		NA		<MDA	NA	Pass
Milk-	19B1	10/11/2022	Gamma	pCi/L		<MDA		NA		<MDA	NA	Pass
Milk-	22B1	12/6/2022	LLI	pCi/L		<MDA		NA		<MDA	NA	Pass
Milk-	22B1	12/6/2022	Gamma	pCi/L		<MDA		NA		<MDA	NA	Pass
Composite-	11S1	3/29/2022	Gamma	pCi/m3	11S1	<MDA		NA	11S2	<MDA	NA	Pass
Composite-	11S1	6/27/2022	Gamma	pCi/m3	11S1	<MDA		NA	11S2	<MDA	NA	Pass

Composite-	11S1	10/3/2022	Gamma	pCi/m3	11S1	<MDA			NA			11S2	<MDA	NA	Pass
Composite-	11S1	1/3/2023	Gamma	pCi/m3	11S1	<MDA			NA			11S2	<MDA	NA	Pass
Air Filter -	A1	1/10/2022	Gross Beta	10^{-2} pCi/m^3		2.7	±	0.2	2.8	±	0.2		**	Pass	NA
Air Filter -	A1	4/18/2022	Gross Beta	10^{-2} pCi/m^3		1.6	±	0.1	1.6	±	0.1		**	Pass	NA
Air Filter -	A1	4/25/2022	Gross Beta	10^{-2} pCi/m^3		1.8	±	0.1	1.8	±	0.1		**	Pass	NA
Air Filter -	A1	5/2/2022	Gross Beta	10^{-2} pCi/m^3		2.4	±	0.1	2.3	±	0.1		**	Pass	NA
Air Filter -	A1	6/6/2022	Gross Beta	10^{-2} pCi/m^3		2.3	±	0.1	2.2	±	0.1		**	Pass	NA
Air Filter -	A1	8/29/2022	Gross Beta	10^{-2} pCi/m^3		3.4	±	0.1	3.3	±	0.2		**	Pass	NA
Air Filter -	A1	10/31/2022	Gross Beta	10^{-2} pCi/m^3		1.1	±	0.1	1.3	±	0.1		**	Pass	NA
Air Filter -	A1	11/15/2022	Gross Beta	10^{-2} pCi/m^3		1.5	±	0.1	1.6	±	0.1		**	Pass	NA
Air Filter -	A2	1/10/2022	Gross Beta	10^{-2} pCi/m^3		2.4	±	0.2	2.4	±	0.2		**	Pass	NA
Air Filter -	A2	4/18/2022	Gross Beta	10^{-2} pCi/m^3		1.4	±	0.1	1.3	±	0.1		**	Pass	NA
Air Filter -	A2	4/25/2022	Gross Beta	10^{-2} pCi/m^3		1.6	±	0.1	1.6	±	0.1		**	Pass	NA
Air Filter -	A2	5/2/2022	Gross Beta	10^{-2} pCi/m^3		2.2	±	0.2	2.0	±	0.1		**	Pass	NA
Air Filter -	A2	6/6/2022	Gross Beta	10^{-2} pCi/m^3		1.7	±	0.1	1.7	±	0.1		**	Pass	NA
Air Filter -	A2	8/29/2022	Gross Beta	10^{-2} pCi/m^3		3.0	±	0.1	3.0	±	0.2		**	Pass	NA
Air Filter -	A2	10/31/2022	Gross Beta	10^{-2} pCi/m^3		1.1	±	0.1	1.2	±	0.1		**	Pass	NA
Air Filter -	A2	11/15/2022	Gross Beta	10^{-2} pCi/m^3		1.5	±	0.1	1.6	±	0.1		**	Pass	NA
Air Filter -	A3	1/10/2022	Gross Beta	10^{-2} pCi/m^3		3.1	±	0.2	2.9	±	0.2		**	Pass	NA
Air Filter -	A3	4/18/2022	Gross Beta	10^{-2} pCi/m^3		1.5	±	0.1	1.5	±	0.1		**	Pass	NA
Air Filter -	A3	4/25/2022	Gross Beta	10^{-2} pCi/m^3		1.8	±	0.1	1.8	±	0.1		**	Pass	NA
Air Filter -	A3	5/2/2022	Gross Beta	10^{-2} pCi/m^3		2.6	±	0.1	2.1	±	0.1		**	Pass	NA
Air Filter -	A3	6/6/2022	Gross Beta	10^{-2} pCi/m^3		2.3	±	0.1	2.3	±	0.2		**	Pass	NA
Air Filter -	A3	8/29/2022	Gross Beta	10^{-2} pCi/m^3		3.6	±	0.1	3.5	±	0.2		**	Pass	NA
Air Filter -	A3	10/31/2022	Gross Beta	10^{-2} pCi/m^3		1.0	±	0.1	1.0	±	0.1		**	Pass	NA
Air Filter -	A3	11/15/2022	Gross Beta	10^{-2} pCi/m^3		1.5	±	0.1	1.6	±	0.1		**	Pass	NA

Air Filter -	A4	1/10/2022	Gross Beta	10^{-2} pCi/m^3	2.7	±	0.2	2.9	±	0.2	**	Pass	NA
Air Filter -	A4	4/18/2022	Gross Beta	10^{-2} pCi/m^3	1.5	±	0.1	1.5	±	0.1	**	Pass	NA
Air Filter -	A4	4/25/2022	Gross Beta	10^{-2} pCi/m^3	1.8	±	0.1	1.9	±	0.1	**	Pass	NA
Air Filter -	A4	5/2/2022	Gross Beta	10^{-2} pCi/m^3	2.4	±	0.1	2.2	±	0.1	**	Pass	NA
Air Filter -	A4	6/6/2022	Gross Beta	10^{-2} pCi/m^3	2.3	±	0.1	2.3	±	0.1	**	Pass	NA
Air Filter -	A4	8/29/2022	Gross Beta	10^{-2} pCi/m^3	3.6	±	0.1	3.8	±	0.2	**	Pass	NA
Air Filter -	A4	10/31/2022	Gross Beta	10^{-2} pCi/m^3	1.2	±	0.1	1.3	±	0.1	**	Pass	NA
Air Filter -	A4	11/15/2022	Gross Beta	10^{-2} pCi/m^3	1.6	±	0.1	1.8	±	0.1	**	Pass	NA
Air Filter -	A5	1/10/2022	Gross Beta	10^{-2} pCi/m^3	2.8	±	0.2	2.8	±	0.2	**	Pass	NA
Air Filter -	A5	4/18/2022	Gross Beta	10^{-2} pCi/m^3	1.4	±	0.1	1.4	±	0.1	**	Pass	NA
Air Filter -	A5	4/25/2022	Gross Beta	10^{-2} pCi/m^3	1.7	±	0.1	1.8	±	0.1	**	Pass	NA
Air Filter -	A5	5/2/2022	Gross Beta	10^{-2} pCi/m^3	2.6	±	0.2	2.2	±	0.1	**	Pass	NA
Air Filter -	A5	6/6/2022	Gross Beta	10^{-2} pCi/m^3	2.2	±	0.1	2.3	±	0.2	**	Pass	NA
Air Filter -	A5	8/29/2022	Gross Beta	10^{-2} pCi/m^3	3.9	±	0.1	3.9	±	0.2	**	Pass	NA
Air Filter -	A5	10/31/2022	Gross Beta	10^{-2} pCi/m^3	1.2	±	0.1	1.3	±	0.1	**	Pass	NA
Air Filter -	A5	11/15/2022	Gross Beta	10^{-2} pCi/m^3	1.7	±	0.1	1.8	±	0.1	**	Pass	NA
Air Filter -	SFA1	1/10/2022	Gross Beta	10^{-2} pCi/m^3	3.1	±	0.2	3.0	±	0.2	**	Pass	NA
Air Filter -	SFA1	4/18/2022	Gross Beta	10^{-2} pCi/m^3	1.4	±	0.1	1.5	±	0.1	**	Pass	NA
Air Filter -	SFA1	4/25/2022	Gross Beta	10^{-2} pCi/m^3	1.6	±	0.1	1.7	±	0.1	**	Pass	NA
Air Filter -	SFA1	5/2/2022	Gross Beta	10^{-2} pCi/m^3	2.2	±	0.1	2.2	±	0.1	**	Pass	NA
Air Filter -	SFA1	6/6/2022	Gross Beta	10^{-2} pCi/m^3	2.2	±	0.1	2.0	±	0.2	**	Pass	NA
Air Filter -	SFA1	8/29/2022	Gross Beta	10^{-2} pCi/m^3	3.2	±	0.1	3.2	±	0.2	**	Pass	NA
Air Filter -	SFA1	10/31/2022	Gross Beta	10^{-2} pCi/m^3	1.0	±	0.1	1.1	±	0.1	**	Pass	NA
Air Filter -	SFA1	11/15/2022	Gross Beta	10^{-2} pCi/m^3	1.5	±	0.1	1.6	±	0.1	**	Pass	NA

Air Filter -	SFA2	1/10/2022	Gross Beta	10^{-2} pCi/m^3	2.7	±	0.2	2.8	±	0.2	**	Pass	NA
Air Filter -	SFA2	4/18/2022	Gross Beta	10^{-2} pCi/m^3	1.6	±	0.1	1.6	±	0.1	**	Pass	NA
Air Filter -	SFA2	4/25/2022	Gross Beta	10^{-2} pCi/m^3	1.8	±	0.1	1.8	±	0.1	**	Pass	NA
Air Filter -	SFA2	5/2/2022	Gross Beta	10^{-2} pCi/m^3	2.2	±	0.1	2.4	±	0.1	**	Pass	NA
Air Filter -	SFA2	6/6/2022	Gross Beta	10^{-2} pCi/m^3	2.4	±	0.1	2.4	±	0.1	**	Pass	NA
Air Filter -	SFA2	8/29/2022	Gross Beta	10^{-2} pCi/m^3	3.3	±	0.1	3.4	±	0.2	**	Pass	NA
Air Filter -	SFA2	10/31/2022	Gross Beta	10^{-2} pCi/m^3	1.0	±	0.1	1.0	±	0.1	**	Pass	NA
Air Filter -	SFA2	11/15/2022	Gross Beta	10^{-2} pCi/m^3	1.5	±	0.1	1.6	±	0.1	**	Pass	NA
Air Filter -	SFA3	1/10/2022	Gross Beta	10^{-2} pCi/m^3	2.9	±	0.2	3.0	±	0.2	**	Pass	NA
Air Filter -	SFA3	4/18/2022	Gross Beta	10^{-2} pCi/m^3	1.5	±	0.1	1.4	±	0.1	**	Pass	NA
Air Filter -	SFA3	4/25/2022	Gross Beta	10^{-2} pCi/m^3	1.6	±	0.1	1.7	±	0.1	**	Pass	NA
Air Filter -	SFA3	5/2/2022	Gross Beta	10^{-2} pCi/m^3	2.3	±	0.1	2.1	±	0.1	**	Pass	NA
Air Filter -	SFA3	6/6/2022	Gross Beta	10^{-2} pCi/m^3	2.4	±	0.1	2.2	±	0.2	**	Pass	NA
Air Filter -	SFA3	8/29/2022	Gross Beta	10^{-2} pCi/m^3	3.5	±	0.1	3.3	±	0.2	**	Pass	NA
Air Filter -	SFA3	10/31/2022	Gross Beta	10^{-2} pCi/m^3	0.9	±	0.1	1.1	±	0.1	**	Pass	NA
Air Filter -	SFA3	11/15/2022	Gross Beta	10^{-2} pCi/m^3	1.2	±	0.1	1.5	±	0.1	**	Pass	NA
Air Filter -	SFA4	1/10/2022	Gross Beta	10^{-2} pCi/m^3	2.7	±	0.2	2.8	±	0.2	**	Pass	NA
Air Filter -	SFA4	4/18/2022	Gross Beta	10^{-2} pCi/m^3	1.4	±	0.1	1.4	±	0.1	**	Pass	NA
Air Filter -	SFA4	4/25/2022	Gross Beta	10^{-2} pCi/m^3	1.7	±	0.1	1.7	±	0.1	**	Pass	NA
Air Filter -	SFA4	5/2/2022	Gross Beta	10^{-2} pCi/m^3	2.2	±	0.1	2.0	±	0.1	**	Pass	NA
Air Filter -	SFA4	6/6/2022	Gross Beta	10^{-2} pCi/m^3	2.0	±	0.1	2.1	±	0.1	**	Pass	NA
Air Filter -	SFA4	10/31/2022	Gross Beta	10^{-2} pCi/m^3	0.9	±	0.1	1.1	±	0.1	**	Pass	NA
Air Filter -	SFA4	11/15/2022	Gross Beta	10^{-2} pCi/m^3	1.3	±	0.1	1.5	±	0.1	**	Pass	NA
Air Filter -	STATION-02	4/18/2022	Gross Beta	10^{-2} pCi/m^3	3.0	±	0.1	3.1	±	0.1	**	Pass	NA
Air Filter -	STATION-03	4/18/2022	Gross Beta	10^{-2} pCi/m^3	3.0	±	0.2	3.1	±	0.1	**	Pass	NA
Air Filter -	STATION-04	4/18/2022	Gross Beta	10^{-2} pCi/m^3	3.4	±	0.3	3.2	±	0.3	**	Pass	NA

Air Filter -	STATION-05	4/18/2022	Gross Beta	10^{-2} pCi/m^3	3.4	±	0.2	3.4	±	0.2	**	Pass	NA
Air Filter -	STATION-06	4/18/2022	Gross Beta	10^{-2} pCi/m^3	3.3	±	0.2	3.4	±	0.2	**	Pass	NA
Air Filter -	STATION-07	4/18/2022	Gross Beta	10^{-2} pCi/m^3	3.6	±	0.2	3.6	±	0.2	**	Pass	NA
Air Filter -	STATION-08	4/19/2022	Gross Beta	10^{-2} pCi/m^3	3.0	±	0.2	3.3	±	0.2	**	Pass	NA
Air Filter -	STATION-09	4/19/2022	Gross Beta	10^{-2} pCi/m^3	3.4	±	0.2	3.2	±	0.2	**	Pass	NA
Air Filter -	STATION-10	4/19/2022	Gross Beta	10^{-2} pCi/m^3	3.5	±	0.2	3.5	±	0.2	**	Pass	NA
Air Filter -	STATION-11	4/19/2022	Gross Beta	10^{-2} pCi/m^3	3.4	±	0.2	3.2	±	0.2	**	Pass	NA
Air Filter -	STATION-12	4/19/2022	Gross Beta	10^{-2} pCi/m^3	3.3	±	0.2	3.4	±	0.2	**	Pass	NA
Air Filter -	STATION-13	4/19/2022	Gross Beta	10^{-2} pCi/m^3	3.4	±	0.2	3.4	±	0.2	**	Pass	NA
Air Iodine -	A1	1/18/2022	I-131	pCi/m3	<MDA			<MDA			**	Pass	NA
Air Iodine -	A2	1/18/2022	I-131	pCi/m3	<MDA			<MDA			**	Pass	NA
Air Iodine -	A3	1/18/2022	I-131	pCi/m3	<MDA			<MDA			**	Pass	NA
Air Iodine -	A4	1/18/2022	I-131	pCi/m3	<MDA			<MDA			**	Pass	NA
Air Iodine -	A5	1/18/2022	I-131	pCi/m3	<MDA			<MDA			**	Pass	NA
Air Iodine -	SFA1	1/18/2022	I-131	pCi/m3	<MDA			<MDA			**	Pass	NA
Air Iodine -	SFA2	1/18/2022	I-131	pCi/m3	<MDA			<MDA			**	Pass	NA
Air Iodine -	SFA3	1/18/2022	I-131	pCi/m3	<MDA			<MDA			**	Pass	NA
Air Iodine -	SFA4	1/18/2022	I-131	pCi/m3	<MDA			<MDA			**	Pass	NA
Air Iodine -	A1	2/15/2022	I-131	pCi/m3	<MDA			<MDA			**	Pass	NA
Air Iodine -	A2	2/15/2022	I-131	pCi/m3	<MDA			<MDA			**	Pass	NA
Air Iodine -	A3	2/15/2022	I-131	pCi/m3	<MDA			<MDA			**	Pass	NA
Air Iodine -	A4	2/15/2022	I-131	pCi/m3	<MDA			<MDA			**	Pass	NA
Air Iodine -	A5	2/15/2022	I-131	pCi/m3	<MDA			<MDA			**	Pass	NA
Air Iodine -	SFA1	2/15/2022	I-131	pCi/m3	<MDA			<MDA			**	Pass	NA
Air Iodine -	SFA2	2/15/2022	I-131	pCi/m3	<MDA			<MDA			**	Pass	NA
Air Iodine -	SFA3	2/15/2022	I-131	pCi/m3	<MDA			<MDA			**	Pass	NA
Air Iodine -	SFA4	2/15/2022	I-131	pCi/m3	<MDA			<MDA			**	Pass	NA

Air Iodine -	A1	5/9/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A2	5/9/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A3	5/9/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A4	5/9/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A5	5/9/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA1	5/9/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA2	5/9/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA3	5/9/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA4	5/9/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A1	8/1/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A2	8/1/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A3	8/1/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A4	8/1/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A5	8/1/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA1	8/1/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA2	8/1/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA3	8/1/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA4	8/1/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A1	9/6/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A2	9/6/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A3	9/6/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A4	9/6/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A5	9/6/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA1	9/6/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA2	9/6/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA3	9/6/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA4	9/6/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA

Air Iodine -	STATION-02	10/4/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	STATION-04	10/4/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	STATION-07	10/4/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	STATION-08	10/4/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	STATION-09	10/4/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	STATION-11	10/4/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A1	10/24/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A2	10/24/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A3	10/24/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A4	10/24/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A5	10/24/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA1	10/24/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA2	10/24/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA3	10/24/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA4	10/24/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A1	12/19/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A2	12/19/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A3	12/19/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A4	12/19/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A5	12/19/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA1	12/19/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA2	12/19/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA3	12/19/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA4	12/19/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	STATION-02	12/19/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	STATION-04	12/19/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	STATION-07	12/19/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA

Air Iodine -	STATION-08	12/19/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	STATION-09	12/19/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	STATION-11	12/19/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A1	12/27/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A2	12/27/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A3	12/27/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A4	12/27/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	A5	12/27/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA1	12/27/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA2	12/27/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA3	12/27/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Air Iodine -	SFA4	12/27/2022	I-131	pCi/m3	<MDA	<MDA	**	Pass	NA
Soil-	SFS3[1]	2/21/2022	Gamma	pCi/kg	146 ± 61.9	212 ± 67.5	141 ± 83.0	Pass	Pass
Soil-	SFS3	6/6/2022	Gamma	pCi/kg	<MDA	<MDA	NA	Pass	NA
Soil-	SFS5	6/6/2022	Gamma	pCi/kg	<MDA	<MDA	NA	Pass	NA
Sediment-	WBS2	6/21/2022	Gamma	pCi/kg	<MDA	<MDA	<MDA	Pass	Pass
Air Filter -	A1	6/27/2022	Gamma	pCi/m3	<MDA	<MDA	<MDA	Pass	Pass
Air Filter -	A2	6/27/2022	Gamma	pCi/m3	<MDA	<MDA	<MDA	Pass	Pass
Air Filter -	A3	6/27/2022	Gamma	pCi/m3	<MDA	<MDA	<MDA	Pass	Pass
Air Filter -	A4	6/27/2022	Gamma	pCi/m3	<MDA	<MDA	<MDA	Pass	Pass
Air Filter -	A5	6/27/2022	Gamma	pCi/m3	<MDA	<MDA	<MDA	Pass	Pass
Air Filter -	SFA1	6/27/2022	Gamma	pCi/m3	<MDA	<MDA	<MDA	Pass	Pass
Air Filter -	SFA2	6/27/2022	Gamma	pCi/m3	<MDA	<MDA	<MDA	Pass	Pass
Air Filter -	SFA3	6/27/2022	Gamma	pCi/m3	<MDA	<MDA	<MDA	Pass	Pass
Air Filter -	SFA4	6/27/2022	Gamma	pCi/m3	<MDA	<MDA	<MDA	Pass	Pass
Cabbage-	IB8	6/27/2022	Gamma	pCi/kg	<MDA	<MDA	NA	Pass	NA

Water-	WA1	7/1/2022	Gamma	pCi/L	<MDA	<MDA	NA	Pass	NA
Water-	WA2	7/1/2022	Gamma	pCi/L	<MDA	<MDA	NA	Pass	NA
Cabbage-	IB4	7/25/2022	Gamma	pCi/kg	<MDA	<MDA	<MDA	Pass	Pass
Tomato-	EAST	7/28/2022	Gamma	pCi/kg	<MDA	<MDA	NA	Pass	NA
Zucchini-	SSE	7/28/2022	Gamma	pCi/kg	<MDA	<MDA	NA	Pass	NA
Zucchini-	EAST	7/28/2022	Gamma	pCi/kg	<MDA	<MDA	NA	Pass	NA
Water-	WA1	7/29/2022	Gamma	pCi/L	<MDA	<MDA	<MDA	Pass	Pass
Water-	WA2	7/29/2022	Gamma	pCi/L	<MDA	<MDA	<MDA	Pass	Pass
Fish-	IA1	8/24/2022	Gamma	pCi/kg	<MDA	<MDA	NA	Pass	NA
Oysters-	IA3	8/24/2022	Gamma	pCi/kg	<MDA	<MDA	NA	Pass	NA
Collards-	IB4	9/19/2022	Gamma	pCi/kg	<MDA	<MDA	NA	Pass	NA
Kale-	IB5	9/19/2022	Gamma	pCi/kg	<MDA	<MDA	NA	Pass	NA
Water-	WA1	9/30/2022	Gamma	pCi/L	<MDA	<MDA	NA	Pass	NA
Water-	WA2	9/30/2022	Gamma	pCi/L	<MDA	<MDA	NA	Pass	NA
Sediment-	WB1	10/3/2022	Gamma	pCi/kg	<MDA	<MDA	<MDA	Pass	Pass
Milk-	Farm A	10/5/2022	Gamma	pCi/L	<MDA	<MDA	NA	Pass	NA
Milk-	Farm B	10/3/2022	Gamma	pCi/L	<MDA	<MDA	NA	Pass	NA
Oysters-	IA3	10/11/2022	Gamma	pCi/kg	<MDA	<MDA	<MDA	Pass	Pass
Oysters-	IA6	10/11/2022	Gamma	pCi/kg	<MDA	<MDA	<MDA	Pass	Pass
Vegetation-	SFB1	11/15/2022	Gamma	pCi/kg	<MDA	<MDA	<MDA	Pass	Pass
Vegetation-	SFB5	11/15/2022	Gamma	pCi/kg	<MDA	<MDA	<MDA	Pass	Pass

Fish-	NORTH	11/15/2022	Gamma	pCi/kg	<MDA	<MDA	<MDA	Pass	Pass
Fish-	WEST	11/15/2022	Gamma	pCi/kg	<MDA	<MDA	<MDA	Pass	Pass
Soil-	SFS3[1]	11/15/2022	Gamma	pCi/kg	133 ± 55.3	169 ± 61.3	NA	Pass	NA
Soil-	SFS1	11/15/2022	Gamma	pCi/kg	<MDA	<MDA	NA	Pass	NA
Soil-	SFS2	11/15/2022	Gamma	pCi/kg	<MDA	<MDA	NA	Pass	NA
Milk-	18E1	11/22/2022	Gamma	pCi/L	<MDA	<MDA	NA	Pass	NA
Milk-	19B1	11/22/2022	Gamma	pCi/L	<MDA	<MDA	NA	Pass	NA
Milk-	G2-1Q	11/23/2022	Gamma	pCi/L	<MDA	<MDA	NA	Pass	NA
Milk-	Farm A	11/28/2022	Gamma	pCi/L	<MDA	<MDA	NA	Pass	NA
Milk-	Farm B	11/28/2022	Gamma	pCi/L	<MDA	<MDA	NA	Pass	NA
Water-	WA1	11/29/2022	Gamma	pCi/L	<MDA	<MDA	<MDA	Pass	Pass
Water-	WA2	11/29/2022	Gamma	pCi/L	<MDA	<MDA	<MDA	Pass	Pass
Water-	4L	11/30/2022	Gamma	pCi/L	<MDA	<MDA	<MDA	Pass	Pass
Water-	Q9-1	11/30/2022	Gamma	pCi/L	<MDA	<MDA	NA	Pass	NA
Milk-	Farm J	12/6/2022	Gamma	pCi/L	<MDA	<MDA	NA	Pass	NA
Milk-	Farm S	12/6/2022	Gamma	pCi/L	<MDA	<MDA	NA	Pass	NA
Milk-	Farm V	12/7/2022	Gamma	pCi/L	<MDA	<MDA	NA	Pass	NA
Milk-	G2-1Q	12/7/2022	Gamma	pCi/L	<MDA	<MDA	NA	Pass	NA
Water-	4L	12/29/2022	Gamma	pCi/L	<MDA	<MDA	<MDA	Pass	Pass
Water-	WA1	12/29/2022	Gamma	pCi/L	<MDA	<MDA	NA	Pass	NA
Water-	WA2	12/29/2022	Gamma	pCi/L	<MDA	<MDA	NA	Pass	NA

[1] See discussion at the beginning of the Appendix
** The nature of these samples precluded splitting them with an independent laboratory.

Table C-2a

Results of Quality Assurance Program
Co-Located Air Samplers 11S1 and 11S2

Concentration of Iodine-131 in Filtered Air
(Results in units of 10^{-3} pCi/m^3 ± 2σ)

Start Date	Stop Date	Isotope Observed	11S1 Analysis	11S2 Analysis
1/3/2022	1/10/2022	I-131	<MDA	<MDA
1/10/2022	1/18/2022	I-131	<MDA	<MDA
1/18/2022	1/24/2022	I-131	<MDA	<MDA
1/24/2022	1/31/2022	I-131	<MDA	<MDA
1/31/2022	2/7/2022	I-131	<MDA	<MDA
2/7/2022	2/14/2022	I-131	<MDA	<MDA
2/14/2022	2/21/2022	I-131	<MDA	<MDA
2/21/2022	2/28/2022	I-131	<MDA	<MDA
2/28/2022	3/7/2022	I-131	<MDA	<MDA
3/7/2022	3/14/2022	I-131	<MDA	<MDA
3/14/2022	3/21/2022	I-131	<MDA	<MDA
3/21/2022	3/29/2022	I-131	<MDA	<MDA
3/29/2022	4/4/2022	I-131	<MDA	<MDA
4/4/2022	4/11/2022	I-131	<MDA	<MDA
4/11/2022	4/18/2022	I-131	<MDA	<MDA
4/18/2022	4/25/2022	I-131	<MDA	<MDA
4/25/2022	5/2/2022	I-131	<MDA	<MDA
5/2/2022	5/9/2022	I-131	<MDA	<MDA

Table C-2a

Results of Quality Assurance Program
Co-Located Air Samplers 11S1 and 11S2

Concentration of Iodine-131 in Filtered Air
(Results in units of 10^{-3} pCi/m^3 ± 2σ)

Start Date	Stop Date	Isotope Observed	11S1 Analysis	11S2 Analysis
5/9/2022	5/16/2022	I-131	<MDA	<MDA
5/16/2022	5/23/2022	I-131	<MDA	<MDA
5/23/2022	5/31/2022	I-131	<MDA	<MDA
5/31/2022	6/6/2022	I-131	<MDA	<MDA
6/6/2022	6/13/2022	I-131	<MDA	<MDA
6/13/2022	6/20/2022	I-131	<MDA	<MDA
6/20/2022	6/27/2022	I-131	<MDA	<MDA
6/27/2022	7/5/2022	I-131	<MDA	<MDA
7/5/2022	7/11/2022	I-131	<MDA	<MDA
7/11/2022	7/18/2022	I-131	<MDA	<MDA
7/18/2022	7/25/2022	I-131	<MDA	<MDA
7/25/2022	8/2/2022	I-131	<MDA	<MDA
8/2/2022	8/8/2022	I-131	<MDA	<MDA
8/8/2022	8/15/2022	I-131	<MDA	<MDA
8/15/2022	8/22/2022	I-131	<MDA	<MDA
8/22/2022	8/29/2022	I-131	<MDA	<MDA
8/29/2022	9/6/2022	I-131	<MDA	<MDA
9/6/2022	9/12/2022	I-131	<MDA	<MDA

Table C-2a

Results of Quality Assurance Program
Co-Located Air Samplers 11S1 and 11S2

Concentration of Iodine-131 in Filtered Air
(Results in units of 10^{-3} pCi/m^3 ± 2σ)

Start Date	Stop Date	Isotope Observed	11S1 Analysis	11S2 Analysis
9/12/2022	9/19/2022	I-131	<MDA	<MDA
9/19/2022	9/26/2022	I-131	<MDA	<MDA
9/26/2022	10/3/2022	I-131	<MDA	<MDA
10/3/2022	10/10/2022	I-131	<MDA	<MDA
10/10/2022	10/17/2022	I-131	<MDA	<MDA
10/17/2022	10/24/2022	I-131	<MDA	<MDA
10/24/2022	10/31/2022	I-131	<MDA	<MDA
10/31/2022	11/7/2022	I-131	<MDA	<MDA
11/7/2022	11/14/2022	I-131	<MDA	<MDA
11/14/2022	11/22/2022	I-131	<MDA	<MDA
11/22/2022	11/29/2022	I-131	<MDA	<MDA
11/29/2022	12/5/2022	I-131	<MDA	<MDA
12/5/2022	12/12/2022	I-131	<MDA	<MDA
12/12/2022	12/19/2022	I-131	<MDA	<MDA
12/19/2022	12/27/2022	I-131	<MDA	<MDA
12/27/2022	1/3/2023	I-131	<MDA	<MDA

Table C-2b

Results of Quality Assurance Program

Co-Located Air Samplers 11S1 and 11S2

Concentration of Beta Emitters in Air Particulates

(Results in units of 10^{-2} pCi/m^3 ± 2σ)

Start Date	Stop Date	11S1	11S2
1/3/2022	1/10/2022	2.6 ± 0.2	3.0 ± 0.5
1/10/2022	1/18/2022	2.0 ± 0.2	2.5 ± 0.4
1/18/2022	1/24/2022	2.8 ± 0.3	1.8 ± 0.5
1/24/2022	1/31/2022	2.5 ± 0.2	1.9 ± 0.4
1/31/2022	2/7/2022	1.9 ± 0.2	1.7 ± 0.4
2/7/2022	2/14/2022	2.2 ± 0.2	2.2 ± 0.4
2/14/2022	2/21/2022	1.9 ± 0.2	1.7 ± 0.4
2/21/2022	2/28/2022	2.1 ± 0.2	2.3 ± 0.4
2/28/2022	3/7/2022	2.4 ± 0.2	2.0 ± 0.4
3/7/2022	3/14/2022	1.3 ± 0.2	1.2 ± 0.4
3/14/2022	3/21/2022	2.2 ± 0.2	1.7 ± 0.4
3/21/2022	3/29/2022	0.9 ± 0.2	0.8 ± 0.3
3/29/2022	4/4/2022	1.5 ± 0.2	0.7 ± 0.4
4/4/2022	4/11/2022	0.8 ± 0.2	0.6 ± 0.3
4/11/2022	4/18/2022	1.3 ± 0.2	1.2 ± 0.4
4/18/2022	4/25/2022	1.6 ± 0.2	1.2 ± 0.4
4/25/2022	5/2/2022	2.0 ± 0.2	1.7 ± 0.4
5/2/2022	5/9/2022	1.3 ± 0.2	0.8 ± 0.3
5/9/2022	5/16/2022	1.1 ± 0.2	1.2 ± 0.3
5/16/2022	5/23/2022	1.8 ± 0.2	1.0 ± 0.4
5/23/2022	5/31/2022	1.1 ± 0.2	0.8 ± 0.3
5/31/2022	6/6/2022	1.8 ± 0.2	1.5 ± 0.5
6/6/2022	6/13/2022	1.5 ± 0.2	0.9 ± 0.4
6/13/2022	6/20/2022	1.2 ± 0.2	1.2 ± 0.4
6/20/2022	6/27/2022	1.9 ± 0.1	0.9 ± 0.5

Start Date	Stop Date	11S1			11S2		
6/27/2022	7/5/2022	1.8	±	0.2	1.0	±	0.3
7/5/2022	7/11/2022	1.8	±	0.2	1.6	±	0.4
7/11/2022	7/18/2022	1.9	±	0.2	1.3	±	0.4
7/18/2022	7/25/2022	2.8	±	0.2	1.9	±	0.5
7/25/2022	8/2/2022	2.0	±	0.3	1.6	±	0.4
8/2/2022	8/8/2022	2.4	±	0.2	1.5	±	0.4
8/8/2022	8/15/2022	1.8	±	0.3	1.2	±	0.4
8/15/2022	8/22/2022	2.3	±	0.2	1.9	±	0.4
8/22/2022	8/29/2022	2.8	±	0.2	2.4	±	0.5
8/29/2022	9/6/2022	2.1	±	0.2	2.1	±	0.4
9/6/2022	9/12/2022	1.7	±	0.3	1.2	±	0.4
9/12/2022	9/19/2022	2.1	±	0.2	2.0	±	0.4
9/19/2022	9/26/2022	2.6	±	0.2	2.1	±	0.4
9/26/2022	10/3/2022	1.4	±	0.2	1.3	±	0.4
10/3/2022	10/10/2022	1.7	±	0.2	1.5	±	0.4
10/10/2022	10/17/2022	3.0	±	0.3	2.7	±	0.5
10/17/2022	10/24/2022	2.5	±	0.2	2.0	±	0.4
10/24/2022	10/31/2022	1.4	±	0.2	0.9	±	0.4
10/31/2022	11/7/2022	2.6	±	0.2	2.0	±	0.4
11/7/2022	11/14/2022	2.0	±	0.2	1.4	±	0.4
11/14/2022	11/22/2022	2.4	±	0.2	1.8	±	0.4
11/22/2022	11/29/2022	3.9	±	0.3	2.2	±	0.4
11/29/2022	12/5/2022	2.7	±	0.3	2.1	±	0.4
12/5/2022	12/12/2022	2.6	±	0.2	2.0	±	0.4
12/12/2022	12/19/2022	1.9	±	0.2	1.3	±	0.4
12/19/2022	12/27/2022	2.6	±	0.2	2.0	±	0.4
12/27/2022	1/3/2023	3.5	±	0.2	2.2	±	0.4

[1] See Appendix C Summary

TABLE C-3

Limerick Generating Station ODCM Required LLDs

Selected Nuclides	Water pCi/l	Fish/Shellfish pCi/kg	Milk pCi/L	Sediment pCi/kg	Vegetation pCi/kg	Particulates[1] pCi/m^3
H-3	2000	--	--	--	--	--
Mn-54	15	130	--	--	--	--
Co-58	15	130	--	--	--	--
Fe-59	30	260	--	--	--	--
Co-60	15	130	--	--	--	--
Zn-65	30	260	--	--	--	--
Zr-95/Nb-95	15	--	--	--	--	--
I-131	15	--	1	--	60	0.07[2]
Cs-134	15	130	15	150	60	0.05
Cs-137	18	150	18	180	80	0.06
Ba-140	60	--	60	--	--	--
La-140	15	--	15	--	--	--

[1] Gross Beta activity LLD = 0.01pCi/m^3

[2] Air samples for I-131 are collected separately on a charcoal radioiodine cannister

APPENDIX D

Land Use Survey

Appendix D contains the results of a Land Use Survey conducted in the fall of 2022 around Limerick Generating Station (LGS), performed by Constellation Generation Solutions to comply with Bases 3.3.2 of the Limerick Offsite Dose Calculation Manual. The purpose of the land use survey is to look for all potential pathways of radiation to a person. This is accomplished by documenting the nearest resident, milk- producing animal and garden of greater than 500 ft^2 in each of the sixteen 22 ½ degree sectors out to five miles around the site. The distance and direction of all locations from the LGS reactor buildings were positioned using Global Positioning System (GPS) technology.

The 2022 Land Use Survey identified differences in locations for gardens and meat animals between 2021 and 2022. Twelve (12) new gardens were located this year in meteorological sectors N, NNE, NE, E, ESE, S, SW, and NW. Gardens planted in sectors ESE and SE that are maintained for the REMP program were not included in the survey because of location on LGS property. These REMP program gardens are used as the sample locations for the REMP program. A new garden observed in the NNE sector was identified as the closest in the sector. The nearest gardens in all other sectors reported in the 2022 report are the same as last year's report.

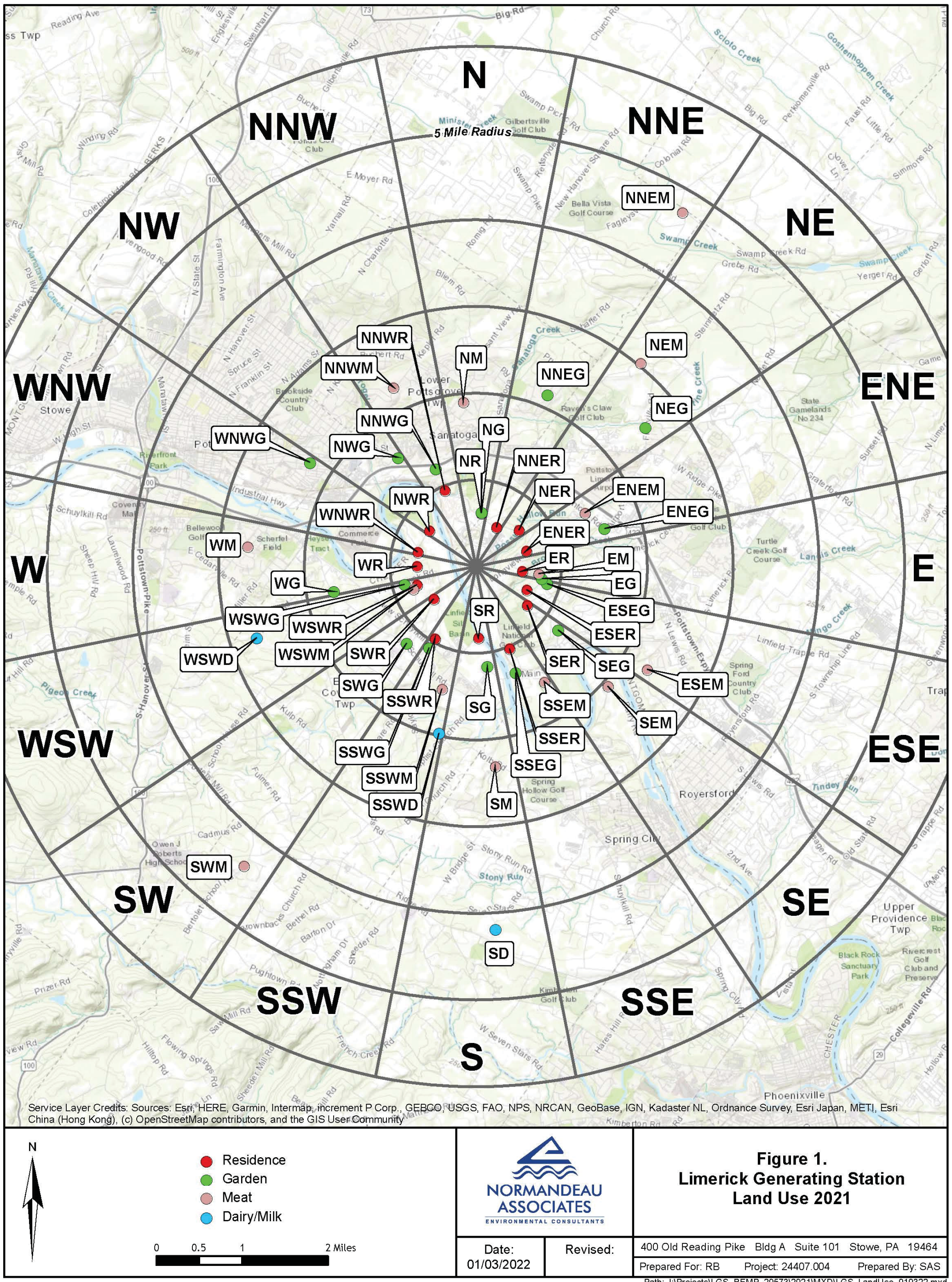
There were ten (10) new meat sites identified this year in N, NNE, NE, ENE, ESE, S, and WSW sectors. All other locations were the same as in the 2021 report. The new locations in the NNE, NE, ENE, and S were identified as the closest meat animals in that sector. There were no changes required to the LGS REMP as a result of this survey. There was no observed water usage for agricultural irrigation of root vegetables drawn directly from the Schuylkill River downriver from Limerick Generation Station. The results of this survey are summarized in Table D-1

Table D-1
Distance of the Nearest Residence, Garden, Dairy,
Meat Animal within a Five Mile Radius of
Limerick Generating Station
(Distance in feet)
2022

Sector	Residence	Garden [(1)]	Dairy Animal	Meat Animal
N	3,109	3,333	24,775*	10,077
NNE	2,706	3,792	-	3,792
NE	3,469	13,917	-	3,469
ENE	3,231	8,241	-	4,070
E	2,864	4,117	-	3,890
ESE	3,434	3,434	-	12,264
SE	3,928	6,376	-	10,903
SSE	5,403	6,912	-	8,177
S	4,347	6,103	22,114*	9,933
SSW	5,063	5,732	10,390*	7,729
SW	3,251	6,319	20,011*	23,145
WSW	3,799	4,507	14,177*	4,084
W	3,627	8,886	-	14,123
WNW	3,685	12,022	-	-
NW	3,619	8,200	-	-
NNW	5,050	6,473	-	12,065

* Denotes current REMP Dairy sample location

Figure D-1
Limerick Generating Station Land Use Census



APPENDIX E

Annual Radiological Groundwater Protection Program Report

For Limerick Generating Station

This report on the Radiological Groundwater Protection Program (RGPP) conducted for the Limerick Generating Station (LGS) by Constellation Nuclear covers the period January 1, 2022 through December 31, 2022. During that time period,85 analyses were performed on 41 samples from 13 groundwater locations and 20 analyses were performed on 12 precipitation water locations collected from the environment, both on and off station property in 2022.

Groundwater samples were analyzed for tritium. Low levels of tritium were detected at 4 of the 13 groundwater monitoring locations. All other results were less than the required Constellation-specified LLD of 200 pCi/L.

Groundwater samples were analyzed for strontium-89 (Sr-89) and strontium-90 (Sr-90). All Sr-89 and Sr-90 results were less than the MDC.

Hard-To-Detect (HTD) analyses are routinely performed on a once per five year frequency for all groundwater monitoring locations. HTD analyses were performed in 2021 for 7 samples. All HTD results were less than the MDC. HTD analyses will be performed again in 2026.

Precipitation water samples were analyzed for tritium. Tritium was detected at 6 of 12 precipitation locations sampled.

In assessing all the data gathered for this report, it was concluded that the operation of Limerick Generating Station had no adverse radiological impact on the environment offsite of LGS. Additionally, there does not appear to be an active source of tritium to groundwater at the Station.

II. Introduction

The Limerick Generating Station (LGS), consisting of two 3515 MW boiling water reactors owned and operated by Constellation Corporation, is located adjacent to the Schuylkill River in Montgomery County, Pennsylvania. Unit No. 1 went critical on December 22, 1984. Unit No. 2 went critical on August 11, 1989.

The site is located in Piedmont countryside, transversed by numerous valleys containing small tributaries that feed into the Schuylkill River. On the eastern riverbank elevation rises from approximately 110 to 300 feet mean sea level (MSL). On the western riverbank elevation rises to approximately 50 feet MSL.

This report covers those analyses performed by Teledyne Brown Engineering (TBE) on samples collected in 2022 and analysis for replicate samples performed by GEL Laboratories.

In 2006, Exelon instituted a comprehensive program to evaluate the impact of station operations on groundwater and surface water in the vicinity of Limerick Generating Station. This evaluation involved numerous station personnel and contractor support personnel.

A. Objective of the RGPP

The long-term objectives of the RGPP are as follows:

1. Identify suitable locations to monitor and evaluate potential impacts from station operations before significant radiological impact to the environment and potential drinking water sources.
2. Understand the local hydrogeologic regime in the vicinity of the station and maintain up-to-date knowledge of flow patterns on the surface and shallow subsurface.
3. Perform routine water sampling and radiological analysis of water from selected locations.
4. Report new leaks, spills, or other detections with potential radiological significance to stakeholders in a timely manner.
5. Regularly assess analytical results to identify adverse trends.
6. Take necessary corrective actions to protect groundwater resources.

B. Implementation of the Objectives

The objectives identified have been implemented at Limerick Generating Station as discussed below:

1. Exelon and its consultant identified locations as described in the 2006 Phase 1 study. The Phase 1 study results and conclusions were made available to state and federal regulators in station specific reports.
2. The Limerick Generating Station reports describe the local hydrogeologic regime. Periodically, the flow patterns on the surface and shallow subsurface are updated based on ongoing measurements.
3. Limerick Generating Station will continue to perform routine sampling and radiological analysis of water from selected locations.
4. Limerick Generating Station has procedures to identify and report new leaks, spills, or other detections with potential radiological significance in a timely manner.
5. Limerick Generating Station staff and consulting hydrogeologist assess analytical results on an ongoing basis to identify adverse trends.

C. Program Description

Samples for the ongoing ground water monitoring program were collected by Constellation Generation Solutions (CGS). This section describes the general collection methods used to obtain environmental samples for the LGS RGPP in 2021. Sample locations can be found in Table E–1, Appendix E.

1. Sample Collection

Groundwater

Samples of groundwater were collected, managed, transported and analyzed in accordance with approved procedures following EPA methods. Sample locations, sample collection frequencies and analytical frequencies were controlled in accordance with approved station procedures. Contractor and/or station personnel were trained in the collection, preservation management, and shipment of samples, as well as in documentation of sampling events. Analytical laboratories were subject to internal quality assurance programs, industry cross- check programs, as well as nuclear industry audits. Station personnel reviewed and evaluated all analytical data deliverables as data were received. Both station personnel and an independent hydrogeologist reviewed analytical data results for adverse trends or changes to hydrogeological conditions.

Precipitation

A five-gallon precipitation collection bucket fitted with a funnel was installed at four locations around the Limerick Generating Station. Three collection buckets were located on site in the highest prevalent wind sectors and one located on site in the least prevalent wind sector.

D. Characteristics of Tritium (H-3)

Tritium (chemical symbol H-3) is a radioactive isotope of hydrogen. The most common form of tritium is tritium oxide, which is also called "tritiated water." The chemical properties of tritium are essentially those of ordinary hydrogen.

Tritiated water behaves the same as ordinary water in both the environment and the body. Tritium can be taken into the body by drinking water, breathing air, eating food, or absorption through skin. Once tritium enters the body, it disperses quickly and is uniformly distributed throughout the body. Tritium is excreted primarily through urine with a clearance rate characterized by an effective biological half-life of about 14 days. Within one month or so after ingestion, essentially all tritium is cleared. Organically bound tritium (tritium that is incorporated in organic compounds) can remain in the body for a longer period.

Tritium is produced naturally in the upper atmosphere when cosmic rays strike air molecules. Tritium is also produced during nuclear weapons explosions, as a by-product in reactors producing electricity, and in special production reactors, where the isotopes lithium-7 and/or boron-10 are activated to produce tritium. Like normal water, tritiated water is colorless and odorless. Tritiated water behaves chemically and physically like non- tritiated water in the subsurface, and therefore tritiated water will travel at the same velocity as the average groundwater velocity.

Tritium has a half-life of approximately 12.3 years. It decays spontaneously to helium-3 (3He). This radioactive decay releases a beta particle (low- energy electron). The radioactive decay of tritium is the source of the health risk from exposure to tritium. Tritium is one of the least dangerous radionuclides because it emits very weak radiation and leaves the body relatively quickly. Since tritium is almost always found as water, it goes directly into soft tissues and organs. The associated dose to these tissues is generally uniform and is dependent on the water content of the specific tissue.

III. Program Description

A. Sample Analysis

This section lists the analyses performed by TBE and GEL Laboratories, LLC (GEL) on environmental samples for the LGS RGPP in 2022. The analytical procedures used by the laboratories are listed in the AREOR References.

In order to achieve the stated objectives, the current program includes the following analyses:

1. Concentrations of tritium in groundwater and precipitation water
2. Concentrations of gross alpha (dissolved and suspended) in groundwater
3. Concentrations of gamma-emitters (Be-7, K-40, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Nb-95, Zr-95, I-131, Cs-134, Cs-137, Ba-140, and La-140) in groundwater
4. Concentrations of strontium (Sr-89 and Sr-90) in groundwater

B. Data Interpretation

The radiological data collected prior to Limerick Generating Station becoming operational were used as a baseline with which these operational data were compared. For the purpose of this report, Limerick Generating Station was considered operational at initial criticality. Several factors were important in the interpretation of the data:

1. Lower Limit of Detection and Minimum Detectable Concentration

The lower limit of detection (LLD) is defined as the smallest concentration of radioactive material in a sample that would yield a net count (above background) that would be detected with only a 5% probability of falsely concluding that a blank observation represents a "real" signal. The LLD is intended as a before the fact estimate of a system (including instrumentation, procedure and sample type) and not as an after the fact criterion for the presence of activity. All analyses were designed to achieve the required LGS detection capabilities for environmental sample analysis.

The minimum detectable concentration (MDC) is defined above with the exception that the measurement is an after the fact estimate of the presence of activity.

2. Laboratory Measurements Uncertainty

The estimated uncertainty in measurement of tritium in environmental samples is frequently on the order of 50% of the measurement value.

Statistically, the exact value of a measurement is expressed as a range with a stated level of confidence. The convention is to report results with a 95% level of confidence. The uncertainty comes from calibration standards, sample volume or weight measurements, sampling uncertainty and other factors. Constellation reports the uncertainty of a measurement created by statistical process (counting error) as well as all sources of error (Total Propagated Uncertainty or TPU). Each result has two values calculated. Constellation reports the TPU by following the result with plus or minus (±) the estimated sample standard deviation, as TPU, that is obtained by propagating all sources of analytical uncertainty in measurements.

Analytical uncertainties are reported at the 95% confidence level in this report for reporting consistency with the AREOR.

C. Background Analysis

A pre-operational radiological environmental monitoring program (pre-operational REMP) was conducted to establish background radioactivity levels prior to operation of the Station. The environmental media sampled and analyzed during the pre-operational REMP were atmospheric radiation, fall-out, domestic water, surface water, aquatic life, and foodstuffs. The results of the monitoring were detailed in the report entitled *Pre-operational Radiological Environmental Monitoring Program Report, Limerick Generating Station Units 1 and 2, 1 January 1982 through 21 December*

1984, Teledyne Isotopes and Radiation Management Corporation.

The pre-operational REMP contained analytical results from samples collected from both surface water and groundwater.

Monthly surface water sampling began in 1982, and the samples were analyzed for tritium as well as other radioactive analytes. During the preoperational program tritium was detected at a maximum concentration of 420 pCi/L, indicating that these preoperational results were from nuclear weapons testing and is radioactively decaying as predicted. Gamma isotopic results from the preoperational program were all less than or at the minimum detectable concentration (MDC) level.

1. Background Concentrations of Tritium

The purpose of the following discussion is to summarize background measurements of tritium in various media performed by others. Additional detail may be found by consulting references.

a. Tritium Production

Tritium is created in the environment from naturally occurring processes both cosmic and subterranean, as well as from anthropogenic (i.e., man-made) sources. In the upper atmosphere, “cosmogenic” tritium is produced from the bombardment of stable nuclides and combines with oxygen to form tritiated water, which will then enter the hydrologic cycle. Below ground, “lithogenic” tritium is produced by the bombardment of natural lithium present in crystalline rocks by neutrons produced by the radioactive decay of naturally abundant uranium and thorium. Lithogenic production of tritium is usually negligible compared to other sources due to the limited abundance of lithium in rock. The lithogenic tritium is introduced directly to groundwater.

A major anthropogenic source of tritium and Sr-90 comes from the former atmospheric testing of thermonuclear weapons. Levels of tritium in precipitation increased significantly during the 1950s and early 1960s, and later with additional testing, resulting in the release of significant amounts of tritium to the atmosphere. The Canadian heavy water nuclear power reactors, other commercial power reactors, nuclear research and weapons production continue to influence tritium concentrations in the environment.

b. Precipitation Data

Precipitation samples are routinely collected at stations around the world for the analysis of tritium and other radionuclides. Two publicly available databases that provide tritium concentrations in precipitation are Global Network of Isotopes in Precipitation (GNIP) and USEPA’s RadNet database. GNIP provides tritium precipitation concentration data for samples collected worldwide since 1960. RadNet provides tritium precipitation concentration data for samples collected at stations throughout the U.S. Based on GNIP data for sample stations located in the U.S. Midwest, tritium concentrations peaked around 1963. This peak, which approached 10,000 pCi/L for some stations, coincided with the atmospheric testing of thermonuclear weapons. Tritium concentrations in surface water showed a sharp decline up until 1975 followed by a gradual decline since that time. Tritium concentrations have typically been below 100 pCi/L since approximately 1980. Tritium concentrations in wells may still be above the 200 pCi/L detection limit from the external causes described above.

Water from previous years was naturally captured in groundwater. As a result, some well water sources today are affected by the surface water from the 1960s that contained elevated tritium activity.

c. Surface Water Data

Tritium concentrations are routinely measured in the Schuylkill and Delaware Rivers. Pennsylvania surface water data are typically less than 100 pCi/L.

The USEPA RadNet surface water data typically has a reported ‘Combined Standard Uncertainty’ of 35 to 50 pCi/L. According to USEPA, this corresponds to a ±70 to 100 pCi/L 95% confidence bound on each given measurement. Therefore, the typical background data provided may be subject to measurement uncertainty of approximately ± 70 to 100 pCi/L.

The radioanalytical laboratory is counting tritium results to a Constellation specified LLD of 200 pCi/L. Typically, the lowest positive measurement will be reported within a range of 40 – 240 pCi/L or 140 ± 100 pCi/L. Clearly, these sample results cannot be distinguished as different from background at this concentration. The surface water data ends in 1999 as the USEPA RadNet surface water program was terminated in March 1999.

The Constellation fleet-wide and Limerick RGPP was modified at the beginning of 2020. Changes to the RGPP included sample locations, frequency and the removal of surface water sampling.

IV. Results and Discussion

A. Groundwater Results

Samples were collected from onsite wells throughout the year in accordance with the station Radiological Groundwater Protection Program. Analytical results and anomalies are discussed below:

Tritium

Samples from 13 locations were analyzed for tritium activity. (Appendix E, Table E–6) Tritium values ranged from non-detectable to 5710 pCi/L. There is no drinking water pathway available from these groundwater sample locations.

Strontium

Samples were analyzed for Sr-89 and Sr-90. All results were below the required LLDs. (Appendix E, Table E–5)

Gross Alpha(dissolved and suspended)

Analyses for gross alpha were performed in 2022. Gross alpha was detected above MDA at 4 locations. (Appendix E, Table E-5b)

Gamma Emitters

Analysis for gamma emitting nuclides were performed in 2022. All results were below the required LLDs. (Appendix E, Table E–4).

Hard-To-Detect

HTD analyses were performed in 2021 on 7 groundwater locations. There were no detects and all results were below the required LLDs. The next sampling event is scheduled to take place in 2026.

B. Precipitation Sample Results

Tritium

Tritium activity was detected in 7 of 12 precipitation water locations analyzed. The concentrations ranged from 203 to 1160 pCi/L. These concentrations are consistent with historical values observed. (Appendix E, Table E-7)

C. Drinking Water Well Survey

In April 2019, GHD (formerly Conestoga Rover Associates) conducted a comprehensive database search (PaGWIS) for private and public wells within one mile of the Station. The detailed results of the 2019 well search are presented in Appendix C of the 2019 Hydrogeologic Investigation Report for Limerick Generating Station. In general, the well depths range from 45 to 585 feet below ground surface (bgs), and yield between 2 and 65 gpm. All wells are completed in the Brunswick Formation. In the GHD report, Figure 2.3 presents the approximate locations of the water wells that surround the Station.

A review of the PaGWIS database table reveals the following type and associated number of off-Station wells within the on-mile radius of the Station:

- Domestic = 41 wells (68%)
- Industrial = 5 wells (8%)
- Observation = 9 wells (15%)
- Abandoned = 5 wells (8%)
- Total = 60 wells

One well was identified at the active quarry, which is approximately 2,000 feet to the northwest of the Station. The PaGWIS database search identifies the quarry well as constructed to a depth of 100 feet bgs, and reportedly yields at least 50,400 gpd (35 gpm). A well inventory included in the Station's USFAR cites the total depth of the quarry supply well as 130 feet bgs, with a yield of 100 gpm, and typical operation of 50 gpm for ten hours a day.

The Station has one potable supply well and one fire water well. The potable supply well is constructed as an open-rock borehole. Groundwater was measured at a depth 102 feet bgs during a well pump replacement in 2014. The pump was placed at a depth of approximately 294 feet bgs. The total well depth and the depth of the steel casing are approximately 310 feet bgs. The well is located approximately 175 feet east of the Reactor Building. The potable supply well is sampled as part of the RGPP and designated as DW-LR-1. In 2022, DW-LR-1 pumped 8,570,500 gallons.

The fire water well is constructed as an open-rock borehole. Groundwater was encountered at 121 feet bgs during a well pump replacement in 2004. The well pump was placed at a depth of approximately 399 feet bgs. The total well depth and the depth of the steel casing are unknown. The well is located approximately 500 feet east of the cooling towers. The well is used in an emergency fire situation and for system testing and flushing. In 2022, 1,257,658 gallons were pumped from the well.

D. Summary of Results – Inter-Laboratory Comparison Program

Inter-Laboratory Comparison Program results for TBE are presented in the Annual Radiological Environmental Operating Report. In addition, the results for interlaboratory comparison RGPP samples are included in the data tables in Appendix E.

E. Leaks, Spills, and Releases

There were no spills to ground containing radioactive material in 2022.

F. Trends

Low level tritium detections in monitoring well MW-LR-9 are being trended.

G. Investigations

Intermittent, low-level tritium detections in monitoring well MW-LR-9 are currently being investigated.

H. Actions Taken

1. Compensatory Actions

   There have been no station events requiring compensatory actions at the Limerick Generating Station.

2. Installation of Monitoring Wells

   No new monitoring wells.

3. Actions to Recover/Reverse Plumes

   No actions were required to recover or reverse groundwater plumes.

V. References

1. GHD, Inc. Hydrogeologic Investigation Report, Limerick Generating Station, 3146 Sanatoga Road, Pottstown, Pennsylvania, Ref. No. 11189800(1), December 2019

2. Pre-operational Radiological Environmental Monitoring Program Report, Limerick Generating Station Units 1 and 2, 1 January 1982 through 21 December 1984, Teledyne Isotopes and Radiation Management Corporation

3. 2022 Annual RGPP Monitoring Report Summary of Results and Conclusions, Limerick Generating Station, AMO Environmental Decisions, Pottstown, Pennsylvania, Feb 8, 2023

TABLE OF CONTENTS - ANALYTICAL RESULTS

TABLE E-1

Locations of Onsite Radiological Groundwater Protection Program

Limerick Generating Station, 2022

RGPP	Description
MW-LR-1	Monitoring Well
MW-LR-2	Monitoring Well
MW-LR-3	Monitoring Well
MW-LR-4	Monitoring Well
MW-LR-5	Monitoring Well
MW-LR-6	Monitoring Well
MW-LR-7	Monitoring Well
MW-LR-8	Monitoring Well
MW-LR-9	Monitoring Well
MW-LR-10	Monitoring Well
P3	Monitoring Well
P11	Monitoring Well
P14	Monitoring Well
P17	Monitoring Well
DW-LR-1	Monitoring Well
36S3	Precipitation Water
E-5	Precipitation Water
ESE-6	Precipitation Water
RS-1	Precipitation Water
RS-2	Precipitation Water
RS-3	Precipitation Water
RS-4	Precipitation Water
RS-5	Precipitation Water
RS-6	Precipitation Water
RS-7	Precipitation Water
RS-8	Precipitation Water
SE-7	Precipitation Water

Figure E-2
Routine Well Water Sample Locations for the Radiological Groundwater Protection Program, Limerick Generating Station, 2022

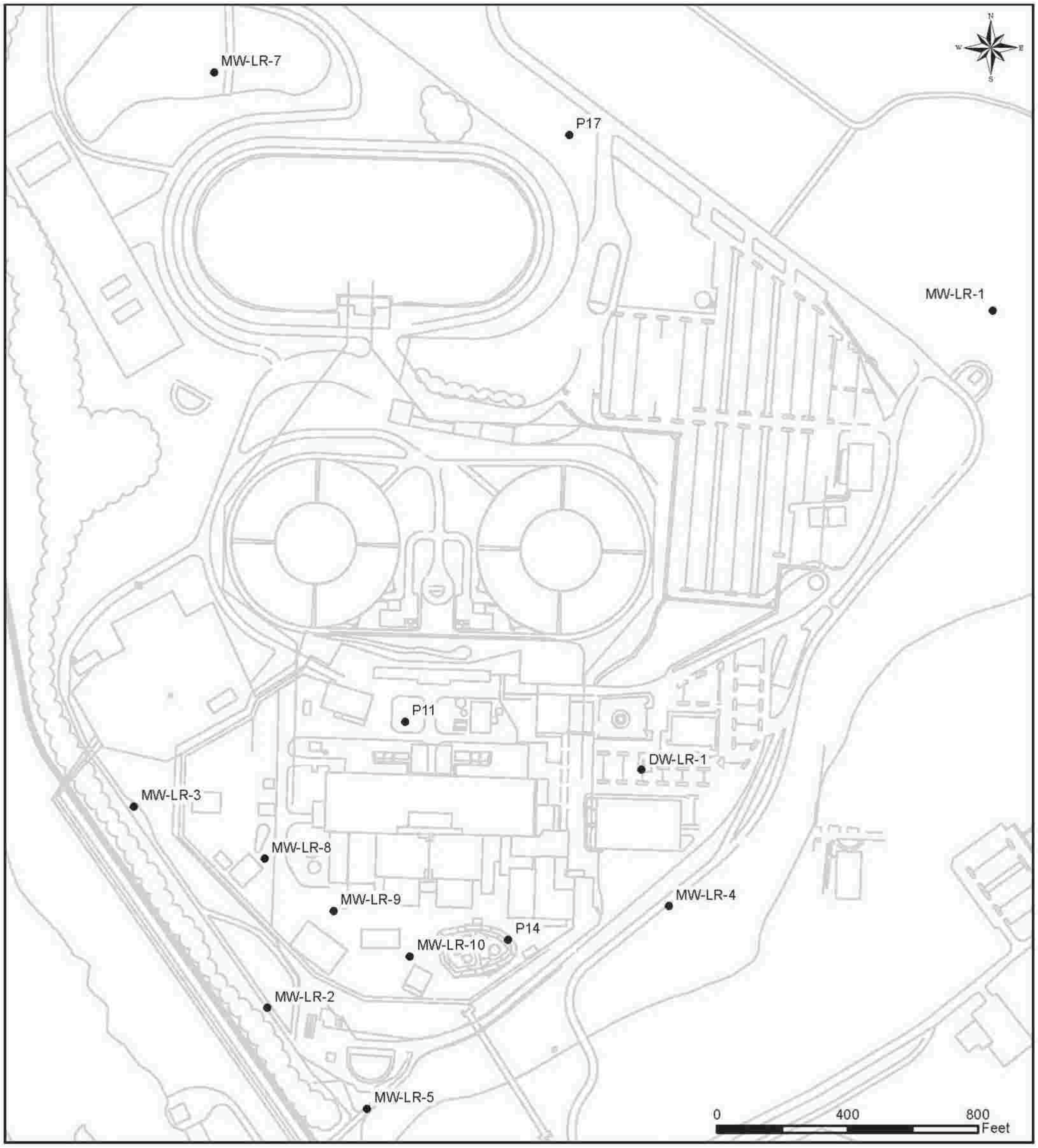


Figure E-3

Routine Precipitation Sample Locations for the Radiological Groundwater Protection Program, Limerick Generating Station, 2022

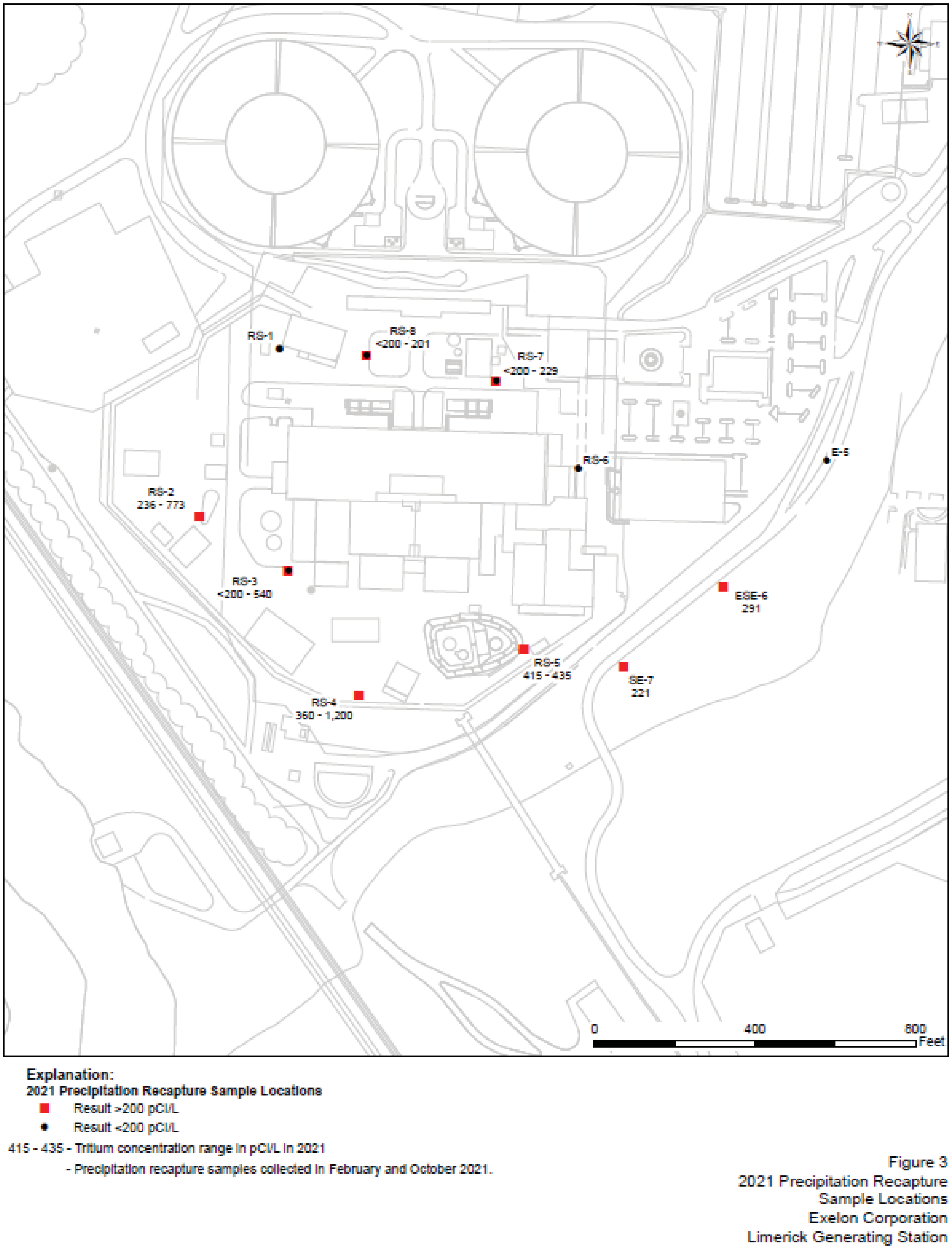


Table E-4

Gamma Emitters in Groundwater
(Results in units of pCi/L ± 2σ)

Station	Sample Date	Non Natural Gamma Emitters
MW-LR-4	06/01/2022	<MDA
DW-LR-1	06/03/2022	<MDA
MW-LR-5	06/01/2022	<MDA
MW-LR-5(Dup)	06/01/2022	<MDA
MW-LR-5(QA)	06/01/2022	<MDA
MW-LR-3	06/01/2022	<MDA
MW-LR-2	06/01/2022	<MDA
MW-LR-7	06/01/2022	<MDA
P17	06/01/2022	<MDA
P14	06/03/2022	<MDA
MW-LR-10	06/03/2022	<MDA
MW-LR-9	06/03/2022	<MDA
MW-LR-9(Dup)	06/03/2022	<MDA
MW-LR-8	06/03/2022	<MDA
P11	06/03/2022	<MDA
MW-LR-1	06/01/2022	<MDA

Table E-5a

Concentration of Radiostrontium in Groundwater
(Results in units of pCi/L ± 2σ)

Station	Sample Date	SR-89 (pCi/L)	SR-90 (pCi/L)
MW-LR-4	06/01/2022	<4.87	<.953
P14	06/03/2022	<9.44	<0.833
MW-LR-10	06/03/2022	<7.93	<.895
MW-LR-9	06/03/2022	<7.98	<.835
MW-LR-9(Dup)	06/03/2022	<7.63	<.903
MW-LR-9(QA)	06/03/2022	<1.54	<.913
MW-LR-8	06/03/2022	<4.27	<0.997
P11	06/03/2022	<6.37	<0.935
MW-LR-1	06/01/2022	<3.77	<0.659

Table E-5b

Concentration of Gross Alpha in Groundwater
(Results in units of pCi/L ± 2σ)

Station	Sample Date	Gross Alpha (pCi/L)	
		Dissolved	Suspended
MW-LR-4	06/01/2022	<1.77	<0.883
MW-LR-10	06/03/2022	2.13	<0.879
P14	06/03/2022	<2.67	<0.903
MW-LR-9	06/03/2022	<2.31	15.0
MW-LR-9(Dup)	06/03/2022	3.58	15.8
MW-LR-9(QA)	06/03/2022	Total Gross Alpha = 64.2±14.2	
MW-LR-8	06/03/2022	4.02	<0.882
P11	06/03/2022	<1.34	<0.879
MW-LR-1	06/01/2022	1.62	<0.881

Table E-6
Concentration of Tritium in Groundwater
(Results in units of pCi/L ± 2σ)

LOCATION	1/26/2022	2/28/2022	3/30/2022	4/22/2022	6/1/2022	6/3/2022	6/29/2022	7/26/2022	8/30/2022	9/27/2022	10/25/2022	11/29/2022	12/19/2022
DW-LR-1	<173	ND	ND	ND	ND	<191	ND	<182	ND	ND	<190	ND	ND
MW-LR-1	ND	ND	ND	ND	<183	ND	ND	ND	ND	ND	ND	ND	ND
MW-LR-2	ND	ND	ND	ND	<189	ND	ND	ND	ND	ND	ND	ND	ND
MW-LR-3	ND	ND	ND	ND	<191	ND	ND	ND	ND	ND	ND	ND	ND
MW-LR-4	<162	ND	ND	ND	<184	ND	ND	<161	ND	ND	226±128	<196	ND
MW-LR-5	ND	ND	ND	ND	<197	ND	ND	ND	ND	ND	ND	ND	ND
MW-LR-5 (Dup)	ND	ND	ND	ND	<184	ND	ND	ND	ND	ND	ND	ND	ND
MW-LR-5 (QA)	ND	ND	ND	ND	<118	ND	ND	ND	ND	ND	ND	ND	ND
MW-LR-7	ND	ND	ND	ND	<180	ND	ND	ND	ND	ND	ND	ND	ND
MW-LR-8	391± 126	ND	ND	ND	ND	464±142	ND	416±123	ND	ND	604±141	ND	ND
MW-LR-8 (Dup)	430±124	ND	ND	ND	ND	ND	ND	441±129	ND	ND	636±149	ND	ND
MW-LR-8 (QA)	332±181	ND	ND	ND	ND	ND	ND	479±130	ND	ND	346 ± 99	ND	ND
MW-LR-9	155 ± 216	1650±230	1980±268	2090±264	ND	2300±303	2170±287	2260±287	1970±258	2170±282	5710±361	2510±318	3250±390
MW-LR-9(Dup)	ND	ND	ND	ND	ND	2590±327	ND	ND	ND	ND	ND	ND	ND
MW-LR-9 (QA)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2100±179	ND	ND
MW-LR-10	<159	ND	ND	ND	ND	<185	ND	<175	ND	ND	222±131	ND	ND
LR-P11	<179	ND	ND	ND	ND	<187	ND	<173	ND	ND	ND	ND	ND
LR-P14	<172	ND	ND	ND	ND	<191	ND	<173	ND	ND	ND	ND	ND
LR-P17	ND	ND	ND	ND	<186	ND	ND	ND	ND	ND	ND	ND	ND

ND – No Data, Sample obtained as required
(Dup) –Sample analyzed in duplicate by TBE
(QA) –Additional sample collected and analyzed for Quality Assurance by GEL Laboratories

Table E-7

Concentration of Tritium in Surface Water, Precipitation, and Subsurface Drainage
(Results in units of pCi/L ± 2σ)

LOCATION	02/02/22	12/19/22
RS-1	211 ±122	<175
RS-2	<187	278 ±120
RS-3	559 ±145	<169
RS-4	703 ±156	<174
RS-5	1160±204	<191
RS-6	<189	<196
RS-7	283 ±128	203 ±132
RS-8	252 ±127	<186
SE-7	ND	<184
ESE-6	ND	<180
E-5	ND	<183
36S3	ND	<188

ND – No Data, Sample obtained as required