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50-353

LIMERICK GENERATING STATION
UNITS 1 AND 2

Annual Radiological Environmental Operating Report

1 January through 31 December 2020

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Limerick Power Station
Pottstown, PA 19464

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Appendices

I. Preface

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

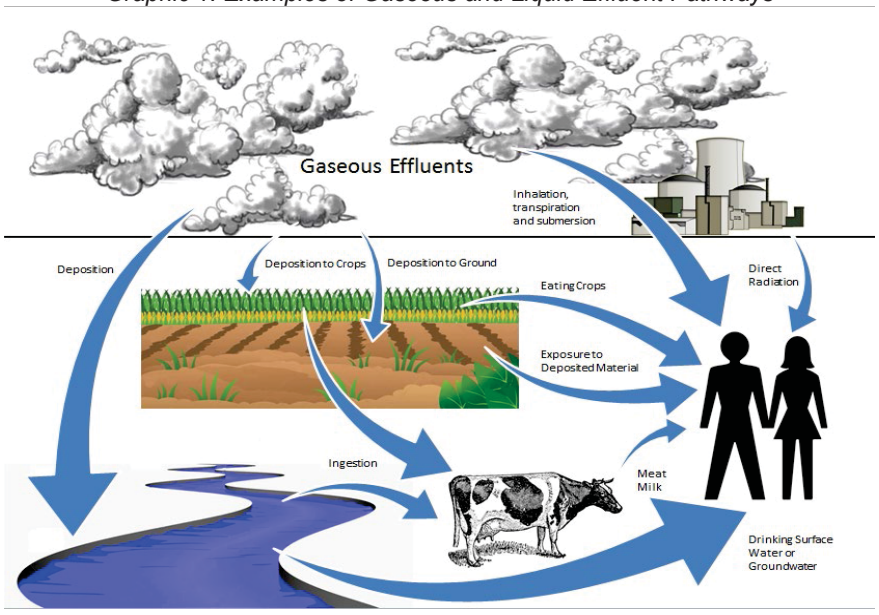
Annual Reports

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

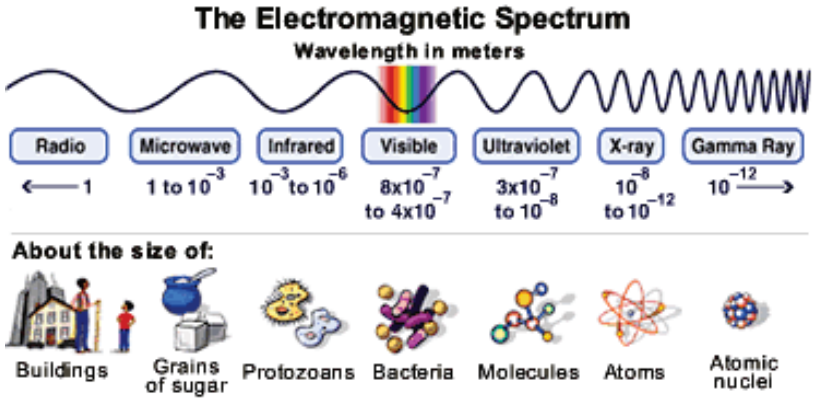


Graphic 1 demonstrates some potential exposure pathways from Limerick Generating Station. The ARERR and AREOR together ensure Nuclear Power Plants are operating in a manner that is within established regulatory commitments meant to adequately protect the public.

Understanding Radiation

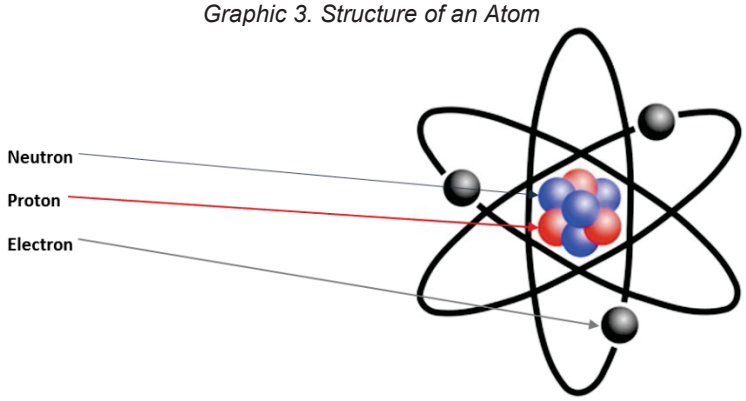
Generally radiation is defined as emitted energy in the form of waves or particles. If radiation has enough energy to displace electrons from an atom it is termed "ionizing", otherwise it is "non-ionizing". Non-Ionizing radiation includes light, heat given off from a stove, radiowaves and microwaves. 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

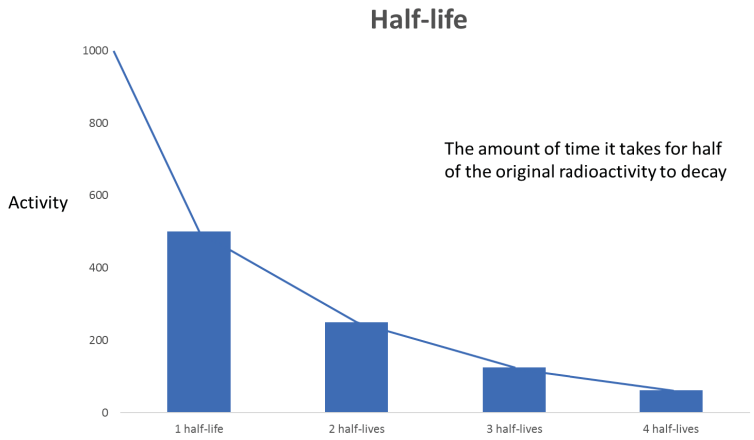
radionuclides and radioisotopes.

There are two basic ways that radionuclides are produced at a nuclear power plant. The first is fission, which creates radionucides 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 ocurring 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 milliRoentgen (mR), 1/1,000 of one R.

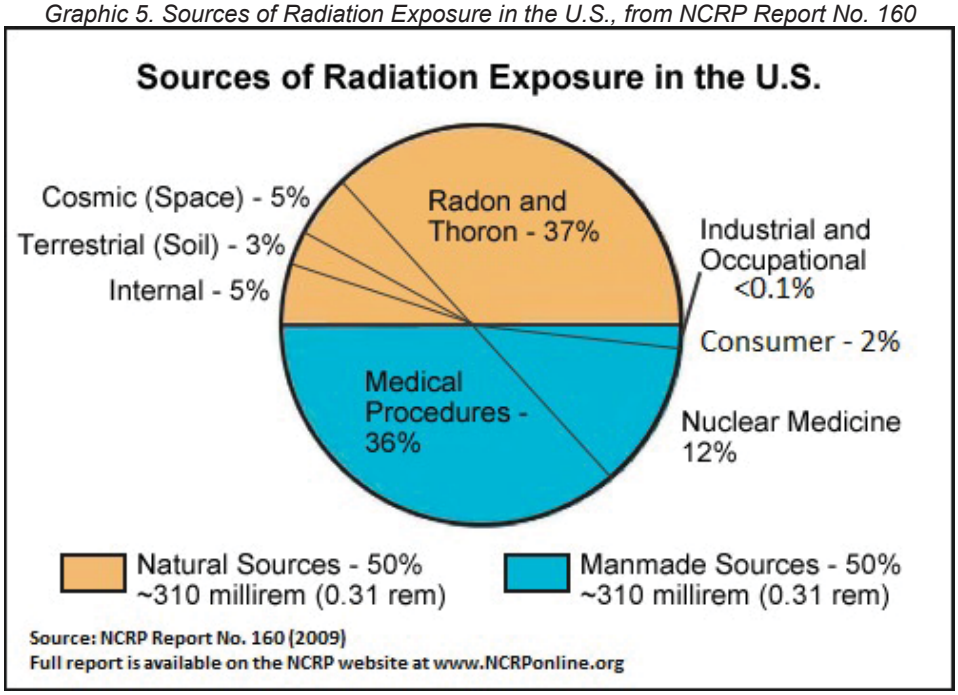
- Absorbed dose describes the amount of radiation absorbed by an object or person. The units of measure for absorbed dose used within the AREOR and ARERR are the rad. Noble gas air doses are reported by the site are measured in millirad (mrad), 1/1,000 of one rad.

- 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

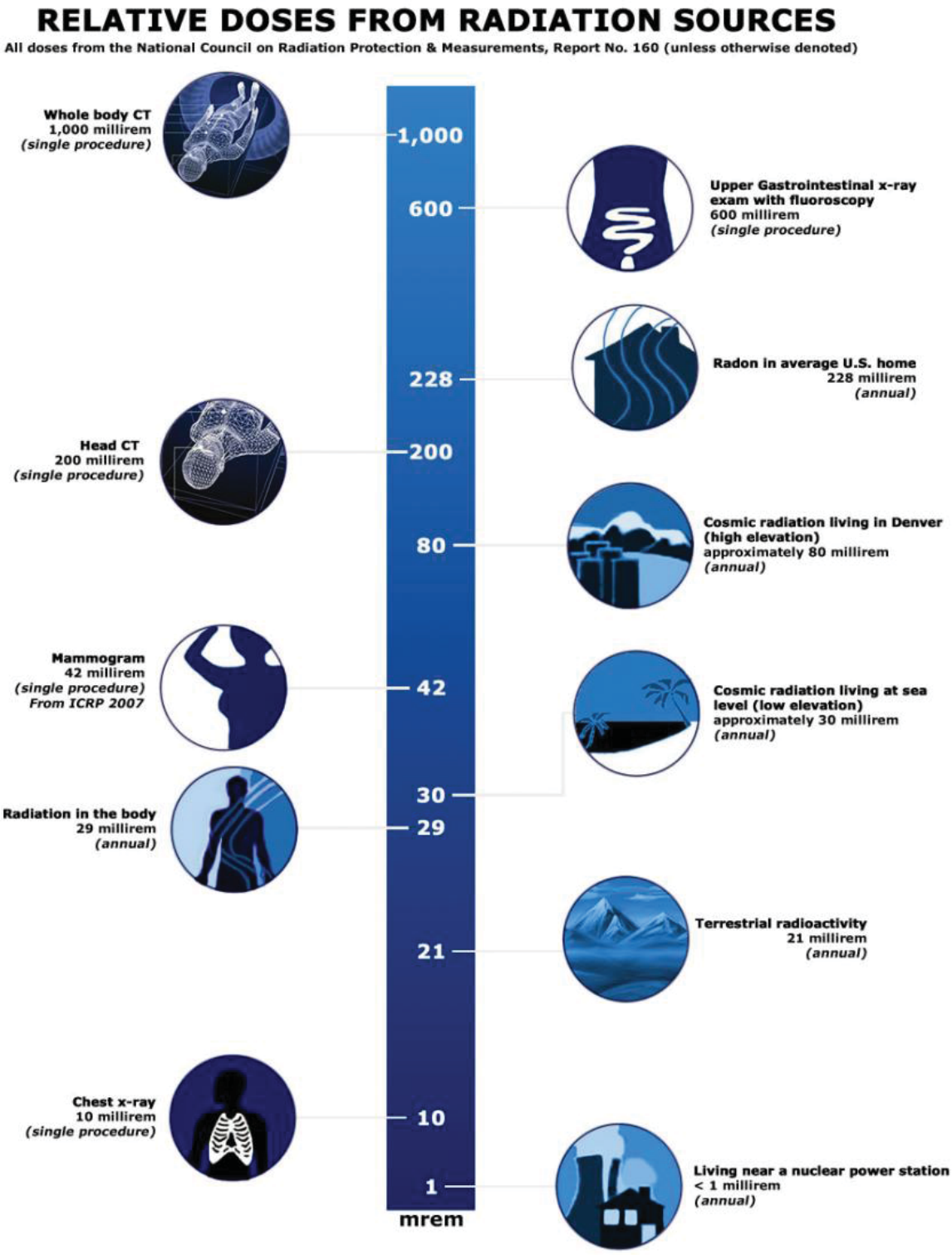
People are exposed to radiation every day of their lives and have been since the dawn of mankind. Some of this radiation is naturally occurring while some is man-made. There are many factors that will determine the amount of radiation individuals will be exposed to such as where they live, medical treatments, 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

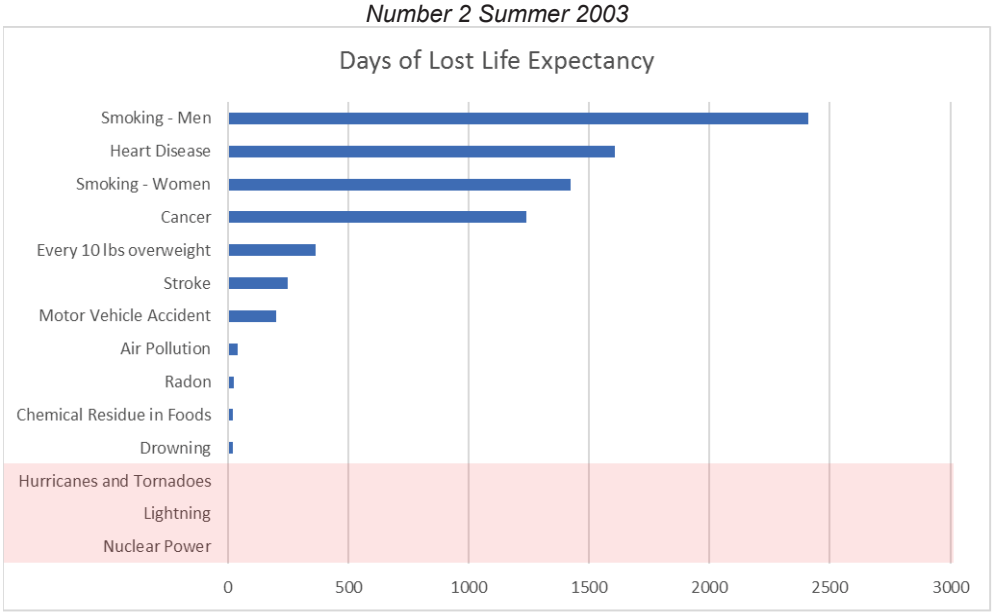


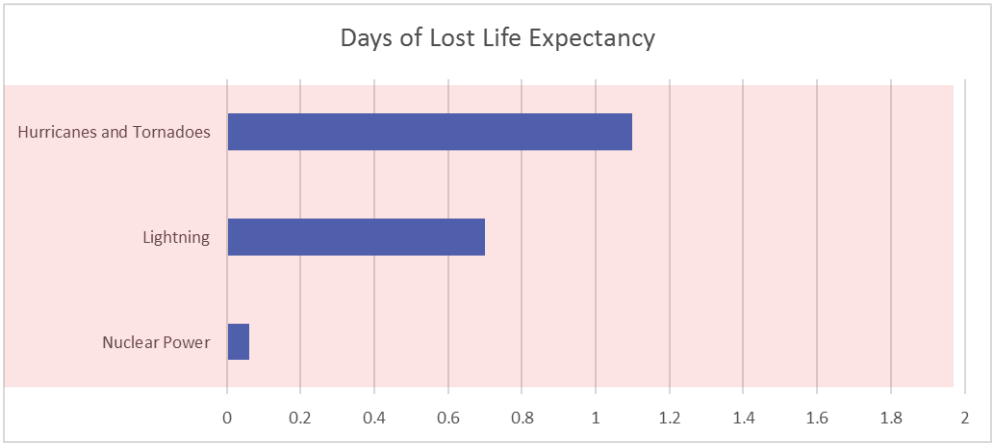
Radiation Risk

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





II. Summary and Conclusions

In 2020, the Limerick Generating Station released to the environment through the radioactive effluent liquid and gaseous pathways approximately 96 curies of noble gas, fission and activation products and approximately 36 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:

Gaseous and Liquid Radiation Doses to Members of the Public at the Highest Dose Receptor						
Maximum Individual Noble Gas	**Applicable Dose**	**Estimated Dose**	**Age Group**	**% of Applicable Limit**	**Limit**	**Unit**
Nearest Residence	Gamma Air Dose	2.66E-03	All	1.33E-02	20	mRad
Nearest Residence	Beta Air Dose	2.13E-03	All	5.33E-03	40	mRad
Nearest Residence	Total Body	2.52E-03	All	2.52E-02	10	mrem
Nearest Residence	Skin	4.39E-03	All	1.46E-02	30	mrem
Iodine, Particulate, C-14 & Tritium						
Vegetation Pathway	Bone	1.33E+00	Child	4.42E+00	30	mrem
Liquid						
LGS Outfall	Total Body	2.83E-04	Adult	4.71E-03	6	mrem
LGS Outfall	Liver	2.34E-03	Teen	1.17E-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 Exelon covers the period 1 January 2020 through 31 December 2020. During that time period, 1,488 analyses were performed on 1,244 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 IV.F.1.

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 16 of 32 samples. Radium-226 (Ra-226) was found in 2 of 32 samples. Thorium-228 (Th-228) was found in 18 of 32 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 G.

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.

III. Introduction

The Limerick Generating Station (LGS), consisting of two 3,515 MW boiling water reactors owned and operated by Exelon Corporation, is located adjacent to the Schuylkill River in Montgomery County, Pennsylvania. Unit No. 1 went critical on 22 December 1984. Unit No. 2 went critical on 11 August 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 1 January 1982 through 21 December 1984 and was summarized in a separate report. This report covers those analyses performed by Teledyne Brown Engineering (TBE), Mirion Technologies, and Exelon Industrial Services (EIS)/GEL Laboratories (GEL) on samples collected during the period 1 January 2020 through 31 December 2020.

On 6 July 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 21 July 2008, an ISFSI pad was put into service. The ISFSI is dry cask storage, where spent nuclear fuel is stored.

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

IV. Program Description

A. Sample Collection

Samples for the LGS REMP were collected for Exelon Nuclear by Exelon Industrial Services (EIS) and Normandeau Associates, Inc. (NAI). This section describes the general collection methods used to obtain environmental samples for the LGS REMP in 2020. Sample locations and descriptions can be found in Tables B–1 and B–2, and Figures B–1 through B–3, Appendix B. The collection procedures used by EIS are listed in Table B-3. 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.

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).

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.

Terrestrial Environment

Milk samples were collected biweekly at four locations (18E1, 19B1, 23F1, and 25C1) from April through November, and monthly from December through March. 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. Twelve different kinds of vegetation samples were collected and placed in new unused plastic bags and sent to the laboratory for analysis.

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.

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. In 2020, 0 cubic feet of cooling water sludge was placed on the permitted storage area.

Independent Spent Fuel Storage Installation (ISFSI)

The results from the dosimeter locations 36S2 and 3S1 were used to determine the direct radiation exposure to the nearest residence from the ISFSI pad.

B. Sample Analysis

This section lists the analyses performed by the primary laboratory, Teledyne Brown Engineering (TBE), the secondary laboratories, Exelon Industrial Services, LLC (EIS) and GEL Laboratories, LLC (GEL) and also Mirion Technologies on environmental samples for the LGS REMP in 2020. The analytical procedures used by the laboratories are listed in Appendix B Table B-3. Analysis results from TBE are provided in Appendix C. Analysis results from EIS and GEL Laboratories are provided in Appendix D of this report.

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

1. Concentrations of beta emitters in drinking water and air particulates
2. Concentrations of gamma emitters in surface and drinking water, air particulates, milk, fish, broad leaf vegetation, and sediment
3. Concentrations of tritium in surface and drinking water
4. Concentrations of I-131 in air, milk, and drinking water
5. Ambient gamma radiation levels at various site environs

C. 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.

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

2. Net Activity Calculation and Reporting of Results

Net activity for a sample was calculated by subtracting background activity from the sample activity. Since the REMP measures extremely small changes in radioactivity in the environment, background variations may result in sample activity being lower than the background activity affecting a negative number. An MDC was reported in all cases where positive activity was not detected.

Gamma spectroscopy analyzes samples for the full range of nuclides. All nuclides that identified positive results are reported. Each type of sample also looks for specific nuclides and the results for each type of sample were reported as follows:

For surface and drinking water, twelve nuclides, 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 were reported

For broadleaf vegetation, eleven nuclides, Be-7, K-40, Mn-54, Co-58, Co-60, I-131, Cs-134, Cs-137, Ra-226, Th-228, and Th-232 were reported

For fish, nine nuclides, K-40, Mn-54, Co-58, Fe-59, Co-60, Zn-65, I-131, Cs-134, and Cs-137 were reported

For sediment, eight nuclides, Be-7, K-40, Mn-54, Co-58, Co-60, I-131, Cs-134, and Cs-137 were reported

For air particulates, six nuclides, Be-7, Mn-54, Co-58, Co-60, Cs-134, and Cs-137 were reported

For milk, five nuclides, K-40, Cs-134, Cs-137, Ba-140, and La-140 were reported

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.

D. Program Exceptions

For 2020 the LGS REMP had a sample recovery rate of greater than 99%. Exceptions are listed below:

1. Air sample from location 13S4 for the weeks of 8/01/2020 – 8/08/2020 and 8/08/2020 – 8/15/2020 was not available due to no power supplied to the sample station. It was determined that the breaker on the pole supplying power to the sample station had tripped during a severe storm. (IR 4360178)

2. Air samples from locations 11S1/11S2 for the week of 12/14/2020 – 12/21/2020 were not available due to work being performed by PECO. Once it was discovered that PECO was performing work that removed the power from the station location, PECO was contacted, and power was restored. (IR 4386138)

3. When the air particulate sample from location 11S1 was pulled on 8/24/2020, it was noticed by the Exelon Industrial Services (EIS) technician that the filter loading appeared to be light in comparison to previous samples and in comparison with the particulate sample from 11S2 which is co-located with 11S1. The EIS technician verified the flow roto-meter was reading within the expected range. When the particulate filter for 11S1 was pulled the following week, it again appeared to have light loading. The EIS technician examined the sample pump and determined the muffler was loose on the sample pump. The following week, the loading appeared to return to normal. Though the sample pump vendor states that a loose muffler will not impact filter loading, a corrective action to inspect all sample pump mufflers weekly was implemented. (IR 4370772)

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.

E. Program Changes

There were no program changes to the ODCM in 2020.

F. Compliance to 40 CFR 190 Limits

1. 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 0.27 mRem (total body), 1.33 mRem (organ), or 0.28 mRem (thyroid).

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

Table 1: 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	2.52E-03	2.66E-01	2.83E-04	0.00E+00	2.69E-01	1.08E+00	25	mRem
Organ Dose	4.39E-03	1.33E+00	2.34E-03	0.00E+00	1.33E+00	5.33E+00	25	mRem
Thyroid Dose	2.13E-03	2.76E-01	2.28E-04	0.00E+00	2.78E-01	3.71E-01	75	mRem

V. Results and Discussion

A. Aquatic Environment

1. Surface Water

Samples were taken from a continuous sampler at two locations (13B1 and 24S1) on a monthly schedule. Of these locations only 13B1 located downstream, could be affected by Limerick's effluent releases. The following analyses were performed:

Tritium

Monthly samples from all locations were composited quarterly and analyzed for tritium activity (Appendix C, Table C–I.1). All results were below the required LLD.

Iodine-131

Monthly samples were taken from location 24S1 and analyzed for low-level I-131 activity (Appendix C, Table C–I.2). All results were below the required LLD.

Gamma Spectrometry

Samples from all locations were analyzed for gamma-emitting nuclides (Appendix C, Table C–I.3). All nuclides were below the required LLDs.

2. Drinking Water

Monthly samples were collected from continuous water samplers at four locations (15F4, 15F7, 16C2, and 28F3). Three locations (15F4, 15F7, and 16C2) could be affected by Limerick's effluent releases. The following analyses were performed:

Gross Beta

Samples from all locations were analyzed for concentrations of total gross beta (Appendix C, Tables C–II.1). The values ranged from 2.2 to 7.2 pCi/L and total gross beta was detected at all sample locations. Concentrations detected were consistent with those detected in previous years (Appendix C, Figure C–1).

Tritium

Monthly samples from all locations were composited quarterly and analyzed for tritium activity. All results were below required LLD (Appendix C, Table C–II.2).

Iodine-131

Monthly samples were taken from all locations and analyzed for I-131 activity (Appendix C, Table C–II.3). All results were below the required LLD.

Gamma Spectrometry

Samples from all locations were analyzed for gamma-emitting nuclides (Appendix C, Table C–II.4). All results were below the required LLDs.

3. Fish

Fish samples comprised of 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 at two locations (16C5 and 29C1) in the spring and fall season. Location 16C5 could be affected by Limerick's effluent releases. The following analysis was performed:

Gamma Spectrometry

The edible portion of fish samples from both locations was analyzed for gamma-emitting nuclides (Appendix C, Table C–III.1). Naturally-occurring K-40 was found at all stations and ranged from 1,938 to 3,979 pCi/kg wet and was consistent with levels detected in previous years. No other activity was detected and the required LLD was met.

4. Sediment

Aquatic sediment samples were collected at three locations (16B2, 16C4 and 33A2) semiannually. Two of these locations (16B2 and 16C4) could be affected by Limerick's effluent releases. The following analysis was performed:

Gamma Spectrometry

Sediment samples from all three locations were analyzed for gamma-emitting nuclides (Appendix C, Table C–IV.1). Nuclides detected were naturally-occurring Be-7 and K-40.

Be-7 was found at one location at a concentration of 1,082 pCi/kg dry. K-40 was found at all locations and ranged from 10,650 to 14,520 pCi/kg dry. No other activity was detected and the require LLD was met.

B. Atmospheric Environment

1. Airborne

a. Air Particulates

Continuous air particulate samples were collected from seven

locations on a weekly basis. The seven locations were separated into three groups: Group I represents locations within the LGS site boundary (10S3, 11S1, 13S4, and 14S1), Group II represents the locations at an intermediate distance from the LGS site (6C1 and 15D1), and Group III represents the control location at a remote distance from LGS (22G1). The following analyses were performed:

Gross Beta

Weekly samples were analyzed for concentrations of beta emitters (Appendix C, Table C–V.1 and C–V.2). Detectable gross beta activity was observed at all locations as expected. The results from the on-site locations (Group I) ranged from 4E-03 to 29E-03 pCi/m^3 with a mean of 13E-03 pCi/m^3. The results from the intermediate distance location (Group II) ranged from 5E-03 to 30E-03 pCi/m^3 with a mean of 13E-03 pCi/m^3. The results from the remote distance locations (Group III) ranged from 6E-03 to 29E-03 pCi/m^3 with a mean of 13E-03 pCi/m^3. Comparison of the 2020 air particulate data with previous year's data indicates no effects from the operation of LGS (Appendix C, Figure C–2). In addition, a comparison of the weekly mean values for 2020 indicates no notable differences among the three groups. (Appendix C, Figure C–3).

Gamma Spectrometry

Weekly samples were composited quarterly and analyzed for gamma-emitting nuclides. Naturally-occurring Be-7 was detected in all 28 samples and is attributed to cosmic ray activity (cosmogenic). These values ranged from 48E-03 to 93E-03 pCi/m^3. All other nuclides were below the required LLDs. (Appendix C, Table C–V.3)

b. Airborne Iodine

Continuous air samples were collected from seven locations (6C1, 10S3, 11S1, 13S4, 14S1, 15D1, and 22G1) and analyzed weekly for I-131. All results were below the required LLD.
(Appendix C, Table C–VI.1)

2. Terrestrial

a. Milk

Samples were collected from four locations (18E1, 19B1, 23F1, and 25C1) biweekly April through November and monthly December through March. The following analyses were performed:

Iodine-131

Milk samples from all locations were analyzed for concentrations of I-131. All results were below the required LLD.
(Appendix C, Table C–VII.1)

Gamma Spectrometry

Each milk sample was analyzed for concentrations of gamma-emitting nuclides (Appendix C, Table C–VII.2).

Naturally-occurring K-40 activity was found in all samples and ranged from 890 to 1,664 pCi/L. All other nuclides were below the required LLDs.

b. Broadleaf Vegetation

Eleven types of broadleaf vegetation samples were collected from three locations (11S3, 13S3, and 31G1) monthly from June through September. The following analysis was performed:

Gamma Spectrometry

Each broadleaf vegetation sample was analyzed for concentrations of gamma-emitting nuclides (Appendix C, Table C-VIII.1). Cosmogenic, naturally-occurring Be-7 was found in 16 of 32 samples and ranged from 339 to 2,570 pCi/kg wet. Naturally-occurring K-40 was found in all samples and ranged from 2,681 to 8,133 pCi/kg wet. Naturally-occurring Ra-226 was found in 2 of 32 samples and ranged from 1,084 to 1,273 pCi/kg wet. Naturally-occurring Th-228 was found in 18 of 32 samples and ranged from 37 to 626 pCi/kg wet. All other nuclides were below the required LLDs.

C. Ambient Gamma Radiation

Ambient gamma radiation levels were measured utilizing Panasonic 814 ($CaSO_4$) thermoluminescent dosimeters. Forty dosimeter locations were established around the site. Results of dosimeter measurements are listed in Appendix C, Table C–IX.1. Dosimeter measurements were reported in mR/standard month. All dosimeter measurements were below 28 mR/standard month, with a range of 12.5 to 27.4 mR/standard month. A comparison of the Site Boundary and Intermediate Distance data to the Control Location (5H1) data indicate that the ambient gamma radiation levels from the Control Location were consistently higher than all other locations, except 13S2. Location 13S2 historically shows higher ambient gamma radiation, which is due to the rock substrate. The area that this dosimeter is located in has been determined to emanate radon prodigy. *NRC Regulatory Guide 4.13, Revision 2* was released in 2019 and provided a new methodology for determining facility-related dose. Exelon procedures were revised to adopt the new methodology and results will be reported per this

revision.

D. 10 CFR 20.2002 Permit Storage Area

The results of the surface water aquatic monitoring program from Location 24S1 were used to determine if radioactivity from the permit storage area had made it to the Schuylkill River. The data obtained from the gamma analysis program did not detect any migration of radioactivity from the permit storage area.

E. Independent Spent Fuel Storage Installation

The results of the ambient gamma radiation level at dosimeter locations 36S2 and 3S1 were used to determine the direct radiation exposure to the nearest residence from the ISFSI pad. The data did not identify any facility-related dose as a result of operation of the ISFSI pad.

F. Land Use Survey

A Land Use Survey conducted in the fall of 2020 around Limerick Generating Station (LGS) was performed by Exelon Industrial Services to comply with Bases 3.3.2 of the Limerick's 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 2020 Land Use Survey identified differences in locations for gardens and meat animals between 2019 and 2020. Sixteen (16) new gardens were located this year in sectors NE, E, ESE, SE, S, SSW, SW, WSW, W, and NNW meteorological sectors. 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. There were eight (8) new meat sites identified this year in N, NNW, ESE, SSW, WSW and W sectors. All other locations were the same as in the 2019 report. 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 below:

Distance in feet from the LGS Reactor Buildings (Out to 26,400 feet)

Sector		Residence Feet	Garden Feet	Milk Farm Feet	Meat Animal Feet
1	N	3,109	3,333	24,775	10,077
2	NNE	2,706	12,399	-	13,418
3	NE	3,469	13,452	-	16,044
4	ENE	3,231	8,241	-	7,451
5	E	2,864	4,117	-	-
6	ESE	3,434	3,434	-	12,264
7	SE	3,928	6,376	-	10,903
8	SSE	5,403	6,912	-	8,177
9	S	4,347	6,103	22,114	12,210
10	SSW	5,063	5,732	10,390	10,390
11	SW	3,251	6,319	-	23,145
12	WSW	3,799	4,507	14,177	4,084
13	W	3,627	8,886	-	14,123
14	WNW	3,685	12.022	-	-
15	NW	3,619	8,200	-	-
16	NNW	5,050	6,473	-	12,065

G. Summary of Results – Inter-laboratory Comparison Program

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

- Analytics Evaluation Criteria

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

- ERA Evaluation Criteria

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

❖ DOE Evaluation Criteria

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

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

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

1. TBE Laboratory Results

For the TBE laboratory, 126 out of 133 analyses performed met the specified acceptance criteria. Seven analyses did not meet the specified acceptance criteria for the following reasons and were addressed through the TBE Corrective Action Program. A summary is found below:

a) The MAPEP February 2020 AP U-233/234 and U-238 results were evaluated as *Not Acceptable*. The reported value for U-233/234 was 0.0416 ± 0.0102 Bq/sample and the known result was 0.075 Bq/sample (acceptance range 0.053 - 0.098). The reported value for U-238 was 0.0388 ± 0.00991 Bq/sample and the known result was 0.078 Bq/sample (acceptance range 0.055 - 0.101). This sample was run as the workgroup duplicate and had RPD's of 10.4% (U-234) and 11.7% (U-238). After the known results were obtained, the sample was relogged. The filter was completely digested with tracer added originally; the R1 results were almost identical. It was concluded that the recorded tracer amount was actually double, causing the results to be skewed. Lab worksheets have been modified to verify actual tracer amount vs. LIMS data. TBE changed vendors for this cross-check to ERA MRAD during the 2nd half of 2020. Results were acceptable at 97.8% for U-234 and 106% for U-238. (NCR 20-13)

b) The ERA Analytics September 2020 milk Sr-89 result was evaluated as *Not Acceptable*. The reported value was 62.8 pCi/L and the known result was 95.4 (66%). All QC data was reviewed and there were no anomalies. This was the first failure for milk Sr-89 since 2013 and there have only been 3 upper/lower boundary warnings since that time. It is believed that there may have been some Sr-89 loss during sample prep. The December 2020 result was at 92% of

the known. (NCR 20-19)

c) The ERA October 2020 water I-131 result was evaluated as *Not Acceptable*. The reported value was 22.9 pCi/L and the known result was 28.2 (acceptance range 23.5 - 33.1). The reported result was 81% of the known, which passes TBE QC criteria. This was the first failure for water I-131. (NCR 20-17)

d) The ERA October 2020 water Gross Alpha and Gross Beta results were evaluated as *Not Acceptable*. The reported/acceptable values and ranges are as follows:

	Reported	Known	Range
Gross Alpha	40.0	26.2	13.3 - 34.7
Gross Beta	47.5	69.1	48.0 - 76.0

All QC data was reviewed with no anomalies and a cause for failure could not be determined. This was the first failure for water Gross Beta. A Quick Response follow-up cross-check was analyzed as soon as possible with acceptable results at 96.8% for Gross Alpha and 102% for Gross Beta. (NCR 20-1-13)

e) The MAPEP August 2020 soil Ni-63 result was evaluated as *Not Acceptable*. The reported value was 438 ± 21.1 Bq/kg and the known result was 980 Bq/kg (acceptance range 686 - 1274). It is believed that some Ni-63 loss occurred during the sample prep step. (NCR 20-20)

2. EIS Laboratory Results

For secondary QC samples, EIS laboratory analyzed gross beta, gamma and low-level I-131. For the EIS Laboratory, 158 out of 162 analyses performed met the specified NRC Resolution Test Criteria (NRC Inspection Manual, Inspection Procedure 84750, March 15, 1994). The EIS Laboratory's results are reported with 2-sigma uncertainty. When evaluating with the NRC Resolution Test, a 1-sigma uncertainty is used to determine Pass or Fail. Failures have been entered into the Corrective Action Program for tracking and to prevent future occurrence. Failures are summarized below:

a. The ERA April 2020 reported Gross Beta result was 43.3 pCi/L and the known was 60.5 pCi/L (acceptance range was 41.7 - 67.2 pCi/L). Although the reported result passed the low end of the vendor acceptance criteria, but failed NRC Resolution Test Criteria. It was determined that glassware used in preparation is cleaned with nitric acid except for the volumetric pipets, which are rinsed with DI water only. The glass is potentially not as clean and could retain microdroplets of activity on the glass. Going forward, volumetric pipets are rinsed with nitric acid to remove mineral deposit and activity that might be retained on the glass during use and preventing a clean

delivery of the sample.

b. The Analytics (EZA) December 2020 result for AP filter and milk Zn-65 were evaluated as failing. The reported result and known are :

	Reported	Known
AP (Detector 2)	105 pCi	149 pCi
AP (Detector 5)	111 pCi	149 pCi
Milk	135 pCi/L	190 pCi/L

The failure was due to an error in mapping the raw data cell to the calculated data cell in the evaluation spreadsheet. The spreadsheet was peer-reviewed and verified. The cell was mapped to the Co-60 raw data instead of the Zn-65 raw data. Had the cell been mapped correctly, the result and uncertainty would have passed NRC acceptance criteria with less than 10% difference from the True value.

3. GEL Laboratory Results

For the secondary QC samples, GEL laboratory analyzed only H-3 (water) for LGS REMP and for the RGPP, gamma, gross alpha/beta, H-3, and Sr-89/90 (water for each). For these analyses, 94 of 101 cross-check samples met the specified acceptance criteria. Failures were addressed through GEL's Corrective Action Program and the pertinent failures are described below:

a) CARR 190225-1192 - ERA 1st quarter 2020 (RAD-120) water:

i. The H-3 reported value of 15,200 pCi/L were evaluated as *Not Acceptable*. The known result was 17,800 pCi/L with an acceptance range of 15,600 - 19,600 pCi/L. All data and lab processes were evaluated and no errors were found. It was concluded that the low bias was an isolated occurrence and that the overall process is within control.

ii. Two Sr-89 results were evaluated as *Not Acceptable*. The reported values were 73.3 pCi/L and 70.8 pCi/L. The known result was 59.3 pCi/L, with an acceptance range of 47.6 - 67.1 pCi/L. A review of the data as well as of the preparation processes did not reveal any errors or possible contributors to the high bias. In addition, the reported values are 117% and 114% of the reference value, which is within the lab's standard acceptance criteria of +/- 25% for Laboratory Control Samples.

iii. The I-131 reported value of 23.7 pCi/L was evaluated as *Not Acceptable*. The known result was 29.9 pCi/L with an acceptance range of 24.9 - 34.9 pCi/L. The laboratory reviewed the data and found no errors. All batch QA samples including a duplicate, met acceptability criteria. The lab will continue to investigate all steps of the analytical process.

No permanent corrective actions/preventative actions or improvements were needed at this time. The lab must assume unidentified random errors caused the biases because all quality control criteria were met in the batch. Subsequent analyses of these isotopes for drinking water were acceptable in other PT samples during the year.

b) Two ERA 2nd quarter 2020 water Sr-89 results were evaluated as *Not Acceptable*. The reported values were 68.8 and 71.6 pCi/L and the known result was 60.1 pCi/L (acceptance range of 48.3 - 67.9 pCi/L). No Corrective Action information was included in the 2020 QA Report.

c) CARR 200902-1287 - The ERA 3rd quarter 2020 water Co-60 result was evaluated as *Not Acceptable*. The reported value was 97.9 pCi/L and the known result was 86.1 pCi/L (acceptance range of 77.5 - 97.0 pCi/L). The data was reviewed and no anomalies were noted. The batch duplicate result from the original analysis met the acceptance criteria of the study and replication criteria of the lab with RPDs of <10%. Laboratory processes were evaluated and no gross errors were found. The other reported analytes for this method were within the limits of the study (except for Ba-133). A definitive contributor to the slightly high bias could not be identified, concluding that this was an isolated occurrence.

No permanent corrective actions/preventative actions or improvements were needed at this time. The lab will continue to monitor the recoveries to ensure that there are no continued process issues.

The Inter-Laboratory Comparison Program provides evidence of “in control” counting systems and methods, and that the laboratories are producing accurate and reliable data. Interlaboratory Comparison results may be found in Appendix E.

VI. References

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

B. NUREG-1302 Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling Water Reactors

C. Branch Technical Position Paper, Regulatory Guide 4.8, Revision 1, November 1979

D. 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

APPENDIX A

RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT SUMMARY

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TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE LIMERICK GENERATING STATION, 2020

NAME OF FACILITY: LIMERICK GENERATING STATION | **DOCKET NUMBER:** 50-352 & 50-353

LOCATION OF FACILITY: MONTGOMERY, PA | **REPORTING PERIOD:** 2020

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSIS PERFORMED	REQUIRED LOWER LIMIT OF DETECTION (LLD)	INDICATOR LOCATIONS MEAN (M) (F) *RANGE*	CONTROL LOCATION MEAN (M) (F) *RANGE*	LOCATION WITH HIGHEST ANNUAL MEAN (M) MEAN (M) (F) *RANGE*	STATION # NAME DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
SURFACE WATER *(PCI/LITER)*	**H-3**	8	**200**	<LLD	<LLD	-		0
	GAMMA	24						
	MN-54		**15**	<LLD	<LLD	-		0
	CO-58		**15**	<LLD	<LLD	-		0
	FE-59		**30**	<LLD	<LLD	-		0
	CO-60		**15**	<LLD	<LLD	-		0
	ZN-65		**30**	<LLD	<LLD	-		0
	NB-95		**15**	<LLD	<LLD	-		0
	ZR-95		**30**	<LLD	<LLD	-		0
	I-131		**15**	<LLD	<LLD	-		0
	CS-134		**15**	<LLD	<LLD	-		0
	CS-137		**18**	<LLD	<LLD	-		0
	BA-140		**60**	<LLD	<LLD	-		0
	LA-140		**15**	<LLD	<LLD	-		0
	I-131 (LOW LVL)	12	**1**	<LLD	<LLD			0
DRINKING WATER *(PCI/LITER)*	**GR-B**	48	**4**	3.6 (27/36) *2.3 - 5.3*	3.9 (11/12) *2.2 - 7.2*	3.9 (9/12) *2.3 - 5.3*	15F4 INDICATOR AQUA AMERICA	0
	H-3	16	**200**	<LLD	<LLD	-		0
	I-131 (LOW LVL)	48	**1**	<LLD	<LLD	-		0

(M) The Mean Values are calculated using the positive values. **(F)** Fraction of dectectable measurements at specified locations are indicated in parentheses.

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE LIMERICK GENERATING STATION, 2020

NAME OF FACILITY:	LIMERICK GENERATING STATION			DOCKET NUMBER:		50-352 & 50-353		
LOCATION OF FACILITY:	MONTGOMERY, PA			REPORTING PERIOD:		2020		
				INDICATOR LOCATIONS	CONTROL LOCATION	LOCATION WITH HIGHEST ANNUAL MEAN (M)		
MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSIS PERFORMED	REQUIRED LOWER LIMIT OF DETECTION (LLD)	MEAN (M) (F) *RANGE*	MEAN (M) (F) *RANGE*	MEAN (M) (F) *RANGE*	STATION # NAME DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
DRINKING WATER	**GAMMA**	48						
(PCI/LITER)	*MN-54*		**15**	<LLD	<LLD	-		0
	CO-58		**15**	<LLD	<LLD	-		0
	FE-59		**30**	<LLD	<LLD	-		0
	CO-60		**15**	<LLD	<LLD	-		0
	ZN-65		**30**	<LLD	<LLD	-		0
	NB-95		**15**	<LLD	<LLD	-		0
	ZR-95		**30**	<LLD	<LLD	-		0
	CS-134		**15**	<LLD	<LLD	-		0
	CS-137		**18**	<LLD	<LLD	-		0
	BA-140		**60**	<LLD	<LLD	-		0
	LA-140		**15**	<LLD	<LLD	-		0
FISH - BOTTOM FEEDER	**GAMMA**	4						
(PCI/KG WET)	*K-40*		*NA*	3438 (2/2) *3389 - 3487*	3362.5 (2/2) *2746 - 3979*	3438 (2/2) *3389 - 3487*	16C5 INDICATOR VINCENT POOL DOWNSTREAM OF DISCHARGE	0
	MN-54		**130**	<LLD	<LLD	-		0
	CO-58		**130**	<LLD	<LLD	-		0
	FE-59		**260**	<LLD	<LLD	-		0
	CO-60		**130**	<LLD	<LLD	-		0
	ZN-65		**260**	<LLD	<LLD	-		0
	I-131		*NA*	<LLD	<LLD	-		0
	CS-134		**130**	<LLD	<LLD	-		0
	CS-137		**150**	<LLD	<LLD	-		0

(M) The Mean Values are calculated using the positive values. **(F)** Fraction of dectectable measurements at specified locations are indicated in parentheses.

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE LIMERICK GENERATING STATION, 2020

NAME OF FACILITY:	LIMERICK GENERATING STATION			DOCKET NUMBER:		50-352 & 50-353		
LOCATION OF FACILITY:	MONTGOMERY, PA			REPORTING PERIOD:		2020		
				INDICATOR LOCATIONS	CONTROL LOCATION	LOCATION WITH HIGHEST ANNUAL MEAN (M)		
MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSIS PERFORMED	REQUIRED LOWER LIMIT OF DETECTION (LLD)	MEAN (M) (F) *RANGE*	MEAN (M) (F) *RANGE*	MEAN (M) (F) *RANGE*	STATION # NAME DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
FISH - PREDATOR	**GAMMA**	4						
(PCI/KG WET)	*K-40*		*NA*	2160	2550	2550	29C1 CONTROL	0
				(2/2)	(2/2)	(2/2)	POTTSTOWN VICINITY	
				1938 - 2382	*2235 - 2865*	*2235 - 2865*	UPSTREAM OF INTAKE	
	MN-54		**130**	<LLD	<LLD	-		0
	CO-58		**130**	<LLD	<LLD	-		0
	FE-59		**260**	<LLD	<LLD	-		0
	CO-60		**130**	<LLD	<LLD	-		0
	ZN-65		**260**	<LLD	<LLD	-		0
	I-131		*NA*	<LLD	<LLD	-		0
	CS-134		**130**	<LLD	<LLD	-		0
	CS-137		**150**	<LLD	<LLD	-		0
SEDIMENT	**GAMMA**	6						
(PCI/KG DRY)	*BE-7*		*NA*	1082	<LLD	1082	16B2 INDICATOR	0
				(1/4)		(1/4)	LINFIELD BRIDGE	
							1.35 MILES SSE OF SITE	
	K-40		*NA*	12188	13140	13140	33A2 CONTROL	0
				(4/4)	*(2/2)*	*(2/2)*	UPSTREAM OF INTAKE	
				10650 - 12920	*11760 - 14520*	*11760 - 14520*	2.18 MILES SSE OF SITE	
	MN-54		*NA*	<LLD	<LLD	-		0
	CO-58		*NA*	<LLD	<LLD	-		0
	CO-60		*NA*	<LLD	<LLD	-		0
	I-131		*NA*	<LLD	<LLD	-		0
	CS-134		**150**	<LLD	<LLD	-		0
	CS-137		**180**	<LLD	<LLD	-		0

(M) The Mean Values are calculated using the positive values. **(F)** Fraction of dectectable measurements at specified locations are indicated in parentheses.

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE LIMERICK GENERATING STATION, 2020

NAME OF FACILITY:	LIMERICK GENERATING STATION			DOCKET NUMBER:		50-352 & 50-353		
LOCATION OF FACILITY:	MONTGOMERY, PA			REPORTING PERIOD:		2020		
				INDICATOR LOCATIONS	CONTROL LOCATION	LOCATION WITH HIGHEST ANNUAL MEAN (M)		
MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSIS PERFORMED	REQUIRED LOWER LIMIT OF DETECTION (LLD)	MEAN (M) (F) *RANGE*	MEAN (M) (F) *RANGE*	MEAN (M) (F) *RANGE*	STATION # NAME DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
AIR PARTICULATE	**GR-B**	361	**10**	13	13	14	13S4 INDICATOR	0
(E-03 PCI/CU.METER)				(305/309)	(51/52)	(49/50)	LONGVIEW ROAD	
				4 - 30	*6 - 29*	*5 - 29*	1186 FEET SE OF SITE	
	GAMMA	28						
	BE-7		*NA*	68.1	64.3	74.5	13S4 INDICATOR	0
				(24/24)	(4/4)	(4/4)	LONGVIEW ROAD	
				48 - 93	*58 - 70*	*53 - 92*	1186 FEET SE OF SITE	
	MN-54		*NA*	<LLD	<LLD	-		0
	CO-58		*NA*	<LLD	<LLD	-		0
	CO-60		*NA*	<LLD	<LLD	-		0
	CS-134		**50**	<LLD	<LLD	-		0
	CS-137		**60**	<LLD	<LLD	-		0
AIR IODINE	**GAMMA**	361						
(E-03 PCI/CU.METER)	*I-131 (GELI)*		**70**	<LLD	<LLD	-		0
MILK	**I-131 (LOW LVL)**	84	**1**	<LLD	<LLD	-		0
(PCI/LITER)								
	GAMMA	84						
	K-40		*NA*	1223	1261	1275	25C1 INDICATOR	0
				(63/63)	(21/21)	(21/21)		
				890 - 1664	*919 - 1463*	*890 - 1664*	2.69 MILES WSW OF SITE	
	CS-134		**15**	<LLD	<LLD	-		0
	CS-137		**18**	<LLD	<LLD	-		0
	BA-140		**60**	<LLD	<LLD	-		0
	LA-140		**15**	<LLD	<LLD	-		0

(M) The Mean Values are calculated using the positive values. **(F)** Fraction of dectectable measurements at specified locations are indicated in parentheses.

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE LIMERICK GENERATING STATION, 2020

NAME OF FACILITY:	LIMERICK GENERATING STATION			DOCKET NUMBER:		50-352 & 50-353		
LOCATION OF FACILITY:	MONTGOMERY, PA			REPORTING PERIOD:		2020		
				INDICATOR LOCATIONS	CONTROL LOCATION	LOCATION WITH HIGHEST ANNUAL MEAN (M)		
MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSIS PERFORMED	REQUIRED LOWER LIMIT OF DETECTION (LLD)	MEAN (M) (F) *RANGE*	MEAN (M) (F) *RANGE*	MEAN (M) (F) *RANGE*	STATION # NAME DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
VEGETATION	**GAMMA**	32						
(PCI/KG WET)	*BE-7*		*NA*	626.8 (9/21) *339 - 908*	1416.2 (7/11) *614 - 2570*	1416.2 (7/11) *614 - 2570*	31G1 CONTROL PROUTS'S JOLLYVIEW FARM (CONTROL) 71,808 FEET NW	0
	K-40		*NA*	4938 (21/21) *2722 - 8133*	4444.7 (11/11) *2681 - 6358*	5089.5 (11/11) *3197 - 8133*	11S3 INDICATOR LGS INFORMATION CENTER 0.35 MILES ESE OF SITE	0
	MN-54		*NA*	<LLD	<LLD	-		0
	CO-58		*NA*	<LLD	<LLD	-		0
	CO-60		*NA*	<LLD	<LLD	-		0
	I-131		**60**	<LLD	<LLD	-		0
	CS-134		**60**	<LLD	<LLD	-		0
	CS-137		**80**	<LLD	<LLD	-		0
	RA-226		*NA*	1178.5 (2/21) *1084 - 1273*	<LLD	1178.5 (2/10) *1084 - 1273*	13S3 INDICATOR VINCENT DAM 0.24 MILES SE OF SITE	0
	TH-228		*NA*	82.3 (11/21) *37 - 122*	290.8 (7/11) 103 - 626	290.8 (7/11) 103 - 626	31G1 CONTROL PROUTS'S JOLLYVIEW FARM (CONTROL) 71,808 FEET NW	0
	TH-232		*NA*	<LLD	<LLD	-		0
								0
DIRECT RADIATION	**OSLD-QUARTERLY**	320	*NA*	17.7	22.2	24.6	13S2 INDICATOR	0
(MILLI-ROENTGEN/STD.MO.)				(312/312)	(8/8)	(8/8)	500 KV SUBSTATION	
				12.5 - 27.4	*21.5 - 23.3*	*23.4 - 25.4*	0.41 MILES SE	

(M) The Mean Values are calculated using the positive values. **(F)** Fraction of dectectable measurements at specified locations are indicated in parentheses.

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APPENDIX B

LOCATION DESIGNATION, DISTANCE & DIRECTION, AND SAMPLE COLLECTION & ANALYTICAL METHODS

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TABLE B-1: Location Designation and Identification System for the Limerick Generating Station

XXYZ - General code for identification of locations, where:

XX - Angular Sector of Sampling Location. The compass is divided into 36 sectors of 10 degrees each with center at Limerick's Units 1 and 2 off-gas vents. Sector 36 is centered due North, and others are numbered in a clockwise direction.

Y - Radial Zone of Sampling Location (in this report, the radial distance from the Limerick vent for all regional stations).

S : on-site location
A : 0-5,280 feet off-site
B : 5,280-10,560 feet off-site
C : 10,560-15,840 feet off-site
D : 15,840-21,120 feet off-site
E : 21,120-26,400 feet off-site
F : 26,400-52,800 feet off-site
G : 52,800-105,600 feet off-site
H : 105,600-528,000 feet off-site

Z - Station's Numerical Designation within sector and zone, using 1, 2, 3... in each sector and zone.

TABLE B-2: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction
Limerick Generating Station, 2020

Location	Location Description	Distance & Direction From Site
A.	Surface Water	
13B1	Vincent Dam	9,225 feet SE
24S1	Limerick Intake (control)	1,058 feet SW
B.	Drinking (Potable) Water	
15F4	AQUA Water Company	45,514 feet SE
15F7	Phoenixville Water Works	33,400 feet SSE
16C2	PA American	14,034 feet SSE
28F3	Pottstown Borough Authority, Water Distribution Division (control)	30,811 feet WNW
C.	Milk - bi-weekly / monthly	
18E1		22,229 feet S
19B1		10,317 feet SSW
23F1	Control	26,505 feet SW
25C1		14,224 feet WSW
D.	Air Particulates / Air Iodine	
10S3	Keen Road	2,648 feet E
11S1	LGS Information Center	2,017 feet ESE
11S2	LGS Information Center (quality control)	2,017 feet ESE
13S4	Longview Road, near 500 KV Yard	1,186 feet SE
14S1	Longview Road	3,319 feet SSE
15D1	Spring City Substation	16,877 feet SE
22G1	Manor Substation (control)	93,619 feet SW
6C1	Limerick Airport	11,305 feet NE
E .	Fish	
16C5	Vincent Pool	Downstream of Discharge
29C1	Pottstown Vicinity (control)	Upstream of Intake
F .	Sediment	
16B2	Linfield Bridge	7,128 feet SSE
16C4	Vincent Dam	11,510 feet SSE
33A2	Upstream of Intake (control)	4,435 feet NNW
G.	Broad Leaf Vegetation	
11S3	LGS Information Center	1,848 feet ESE
13S3	LGS 500 KV Yard	1,267 feet SE
31G1	Prout's Jollyview Farm (control)	71,808 feet NW

TABLE B-2: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction
Limerick Generating Station, 2020

Location	Location Description	Distance & Direction From Site
I.	Environmental Dosimetry - DLR	
	Site Boundary	
36S2	Evergreen & Sanatoga Road	183 feet N
3S1	Sanatoga Road	301 feet NNE
5S1	Possum Hollow Road	350 feet NE
7S1	LGS Training Center	099 feet ENE
10S3	Keen Road	348 feet E
11S1	LGS Information Center	017 feet ESE
13S2	500 KV Substation	149 feet SE
14S1	Longview Road	319 feet SSE
18S2	Rail Line along Longview Road	390 feet S
21S2	Near Intake Building	7 feet SSW
23S2	Transmission Tower	793 feet SW
25S2	Sector Site Boundary	145 feet WSW
26S3	Met. Tower #2	088 feet W
29S1	Sector Site Boundary	386 feet WNW
31S1	Sector Site Boundary	395 feet NW
34S2	Met. Tower #1	071 feet NNW
	Intermediate Distance	
36D1	Siren Tower No. 147	18,527 feet N
2E1	Laughing Waters GSC	25,112 feet NNE
4E1	Neiffer Road	25,221 feet NE
7E1	Pheasant Road	22,489 feet ENE
10E1	Royersford Road	20,826 feet E
10F3	Trappe Substation	29,442 feet ESE
13E1	Vaughn Substation	22,772 feet SE
16F1	Pikeland Substation	26,608 feet SSE
19D1	Snowden Substation	18,439 feet S
20F1	Sheeder Substation	27,648 feet SSW
24D1	Porters Mill Substation	20,972 feet SW
25D1	Hoffecker & Keim Streets	21,044 feet WSW
28D2	W. Cedarville Road	20,231 feet W
29E1	Prince Street	26,110 feet WNW
31D2	Poplar Substation	20,446 feet NW
34E1	Varnell Road	24,243 feet NNW
	Control and Special Interest	
5H1	Birch Substation (control)	130,742 feet NE
6C1	Limerick Airport	11,305 feet NE
9C1	Reed Road	11,377 feet E
13C1	King Road	14,980 feet SE
15D1	Spring City Substation	16,877 feet SE
17B1	Linfield Substation	8,462 feet S
20D1	Ellis Woods Road	16,157 feet SSW
31D1	Lincoln Substation	15,853 feet WNW

TABLE B-3: Radiological Environmental Monitoring Program – Summary of Sample Collection and Analytical Methods, Limerick Generating Station, 2020

Sample Medium	Analysis	Sampling Method	Collection Procedure Number	Sample Size	Analytical Procedure Number
Drinking Water	Gross Beta	Monthly composite from a continuous water compositor	CY-ES-240 EIS Collection of water samples for Radiological Analysis (Limerick Generating Station)	2 gallon	TBE, TBE-2008 Gross Alpha and/or Gross Beta Activity in Various Matrices EIS, CY-ES-206, Operation of the Tennelec S5E Proportional Counter
Drinking Water	I-131	Monthly composite from a continuous water compositor	CY-ES-240 EIS Collection of water samples for Radiological Analysis (Limerick Generating Station)	2 gallon	TBE, TBE-2012 Radioiodine in Various Matrices EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Drinking Water	Gamma Spectroscopy	Monthly composite from a continuous water compositor	CY-ES-240 EIS Collection of water samples for Radiological Analysis (Limerick Generating Station)	2 gallon	TBE, TBE-2007 Gamma-Emitting Radioisotope Analysis EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Drinking Water	Tritium	Quarterly composite from a continuous water compositor	CY-ES-240 EIS Collection of water samples for Radiological Analysis (Limerick Generating Station)	500 ml	TBE, TBE-2011 Tritium Analysis in Drinking Water by Liquid Scintillation GEL, EPA906.0 Mod for Tritium analysis by Liquid Scintillation
Fish	Gamma Spectroscopy	Semi-annual samples collected via electroshocking or other techniques	RMC-ER6 Collection of fish samples for radiological analysis (Limerick Generating Station)	1000 grams (wet)	TBE-2007 Gamma-Emitting Radioisotope Analysis
Sediment	Gamma Spectroscopy	Semi-annual grab samples	RMC-ER7 Collection of sediment samples for radiological analysis (Limerick Generating Station)	500 grams (dry)	TBE, TBE-2007 Gamma-Emitting Radioisotope Analysis
Air Particulates	Gross Beta	One-week composite of continuous air sampling through glass fiber filter paper	CY-ES-237 Sample Collection of Air Iodine and Air Particulate for Radiological Analysis (Limerick Generating Station)	1 filter (approximately 280 cubic meters weekly)	TBE, TBE-2008 Gross Alpha and/or Gross Beta Activity in Various Matrices EIS, CY-ES-206 Operation of the Tennelec S5E Proportional Counter
Air Particulates	Gamma Spectroscopy	Quarterly composite of each station	TBE, TBE-2023 Compositing of Samples CY-ES-204 Sample Preparation for Gamma and Beta Counting	13 filters (approximately 3600 cubic meters)	TBE, TBE-2007 Gamma-Emitting Radioisotope Analysis EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Air Iodine	Gamma Spectroscopy	One-week composite of continuous air sampling through charcoal filter	CY-ES-237 Sample Collection of Air Iodine and Air Particulate for Radiological Analysis (Limerick Generating Station)	1 filter (approximately 280 cubic meters weekly)	TBE, TBE-2007 Gamma-Emitting Radioisotope Analysis EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Milk	I-131	Bi-weekly grab sample when cows are on pasture; Monthly all other times	CY-ES-238 EIS Sample Collection for Gamma Counting - Milk (Limerick Generating Station)	2 gallon	TBE, TBE-2012 Radioiodine in Various Matrices EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
Milk	Gamma Spectroscopy	Bi-weekly grab sample when cows are on pasture; Monthly all other times	CY-ES-238 EIS Sample Collection for Gamma Counting - Milk (Limerick Generating Station)	2 gallon	TBE, TBE-2007 Gamma-Emitting Radioisotope Analysis EIS, CY-ES-205 Gamma Counting Using the HPGe Detector with the Genie PC Counting System
DLR	Thermoluminescent Dosimetry	Quarterly DLRs comprised of two dosimeter elements	CY-ES-239 EIS Sample Collection for OSLD for Radiological Analysis (Limerick Generating Station)	2 dosimeters	Mirion Technologies

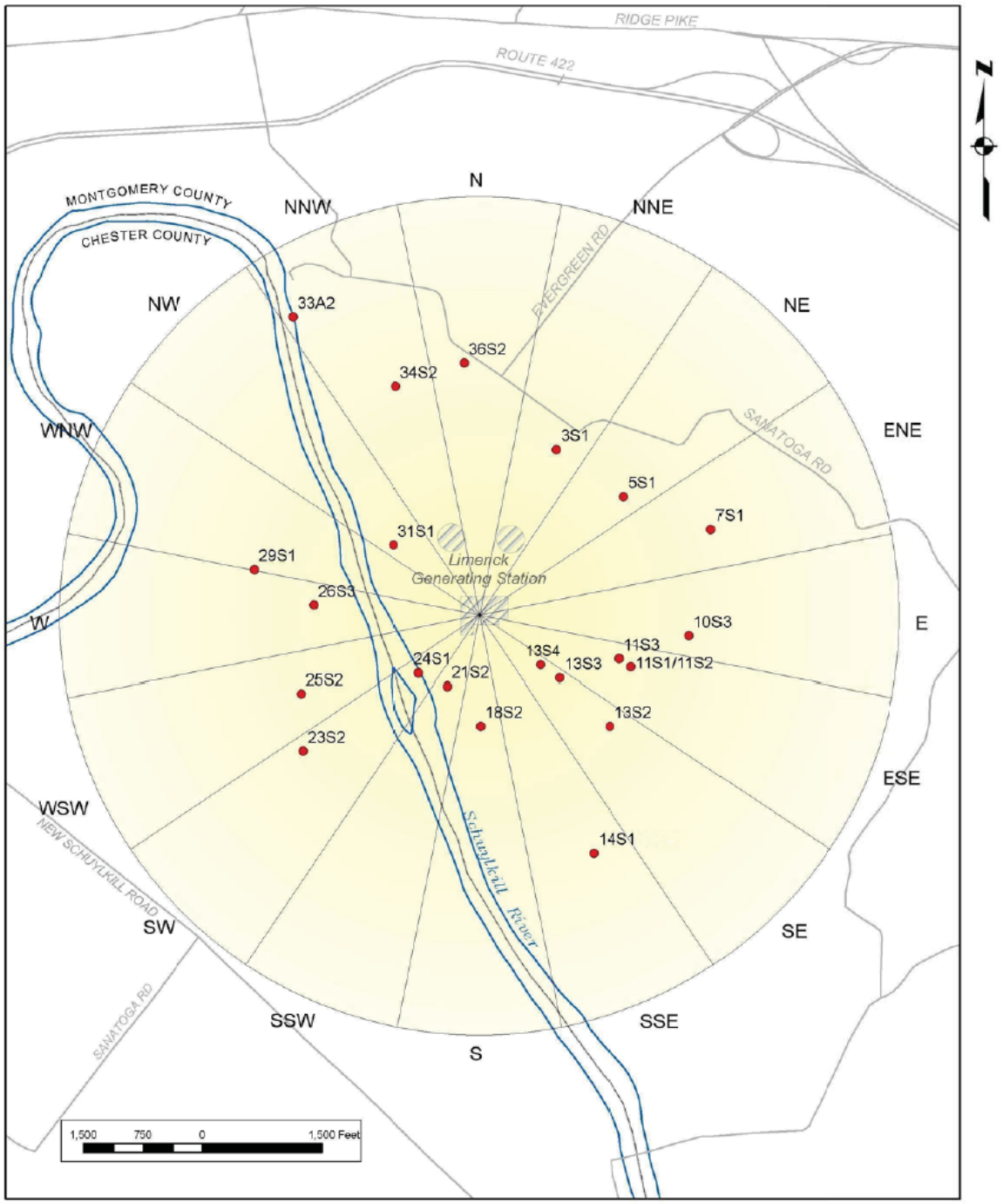

Figure B-1
Environmental Sampling Locations Within 5,280 Feet
of the Limerick Generating Station, 2020

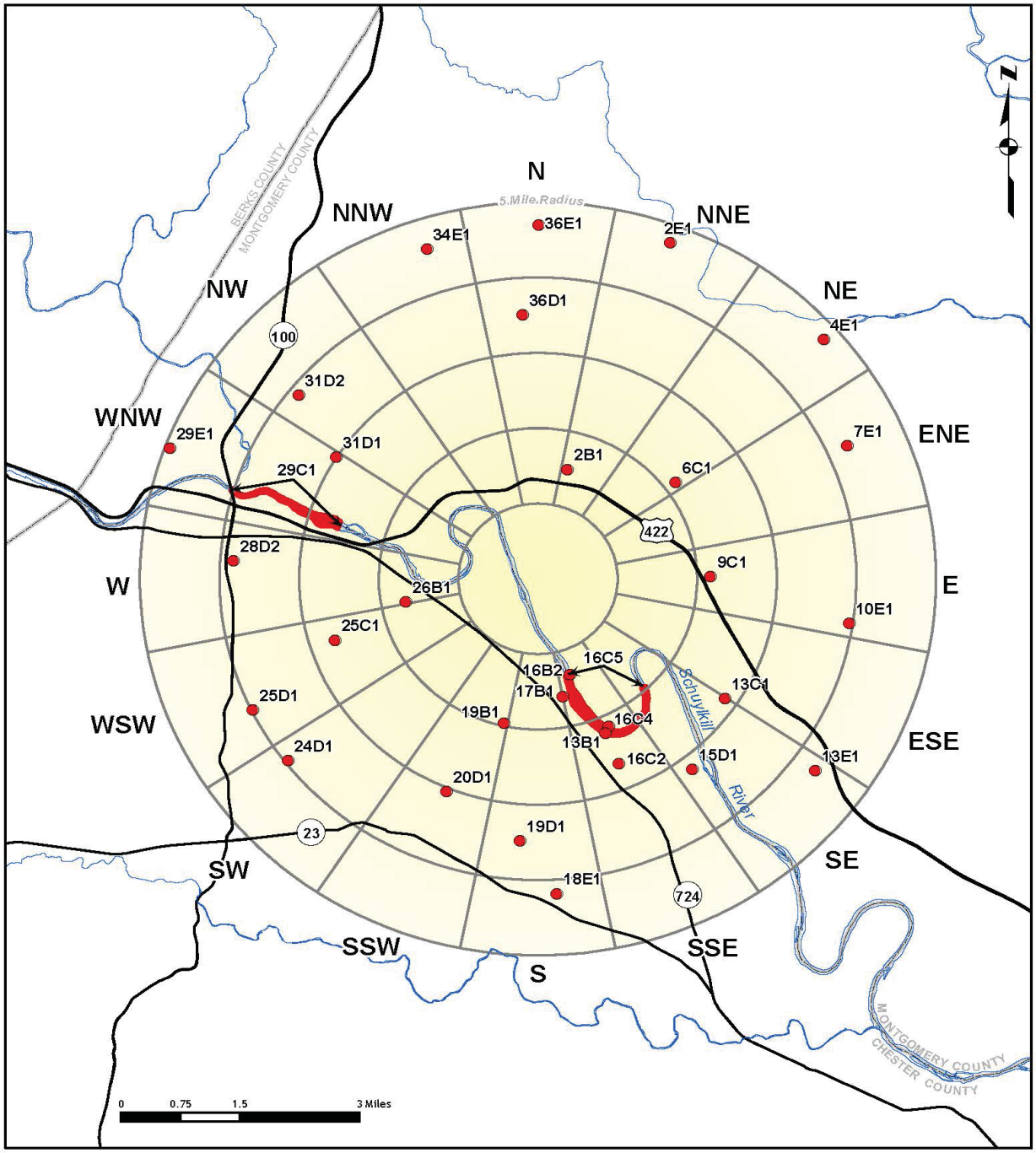

Figure B-2
Environmental Sampling Locations Between 5,280 and 26,400 Feet
from the Limerick Generating Station, 2020

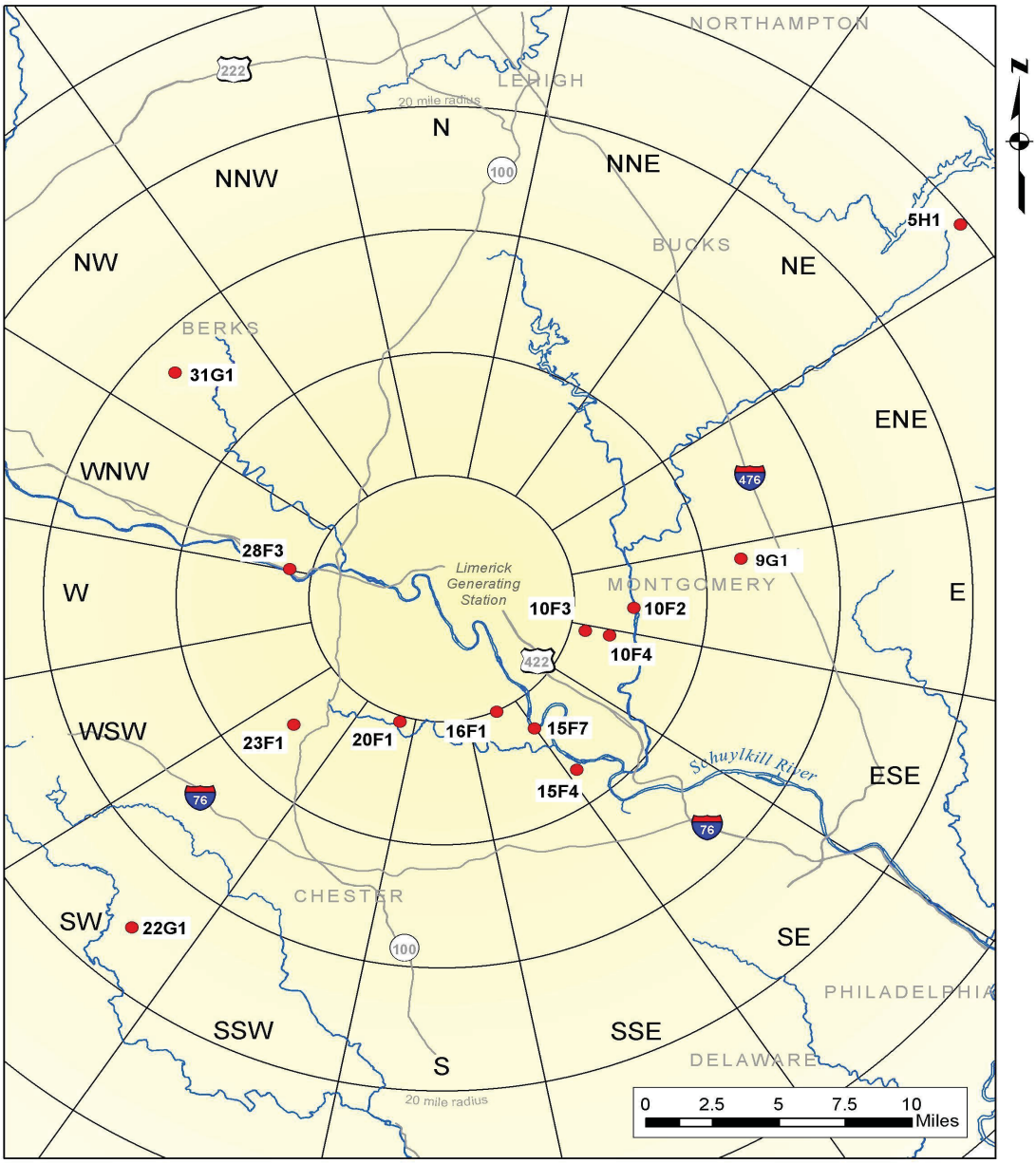

Figure B-3
Environmental Sampling Locations Greater than 26,400 Feet
from the Limerick Generating Station, 2020

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APPENDIX C

DATA TABLES AND FIGURES

PRIMARY LABORATORY

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Table C-I.1 **CONCENTRATIONS OF TRITIUM IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	13B1	24S1
12/30/19 - 03/30/20	< 193	< 195
03/30/20 - 06/29/20	< 184	< 184
06/29/20 - 09/29/20	< 172	< 165
09/29/20 - 12/28/20	< 179	< 184
MEAN	-	-

Table C-I.2 **CONCENTRATIONS OF I-131 IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	24S1
12/30/19 - 02/03/20	< 0.7
02/03/20 - 03/02/20	< 0.5
03/02/20 - 03/30/20	< 0.7
03/30/20 - 04/27/20	< 0.7
04/27/20 - 06/02/20	< 0.8
06/02/20 - 06/29/20	< 0.8
06/29/20 - 07/28/20	< 0.8
07/28/20 - 08/31/20	< 0.8
08/31/20 - 09/29/20	< 0.8
09/29/20 - 11/03/20	< 0.9
11/03/20 - 12/01/20	< 0.7
12/01/20 - 12/28/20	< 0.9
MEAN	-

Table C-I.3 **CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140
13B1	12/30/19 - 02/03/20	< 5	< 6	< 10	< 6	< 12	< 7	< 11	< 11	< 6	< 5	< 27	< 9
	02/03/20 - 03/02/20	< 5	< 5	< 13	< 5	< 12	< 6	< 11	< 9	< 7	< 6	< 21	< 5
	03/02/20 - 03/30/20	< 7	< 5	< 12	< 6	< 11	< 8	< 13	< 11	< 7	< 7	< 35	< 11
	03/30/20 - 04/27/20	< 6	< 7	< 10	< 8	< 13	< 6	< 11	< 11	< 9	< 7	< 31	< 12
	04/27/20 - 06/02/20	< 7	< 6	< 11	< 10	< 11	< 6	< 10	< 9	< 7	< 7	< 32	< 6
	06/02/20 - 06/29/20	< 5	< 5	< 10	< 6	< 9	< 5	< 7	< 10	< 6	< 5	< 29	< 10
	06/29/20 - 07/28/20	< 7	< 6	< 12	< 8	< 12	< 5	< 11	< 12	< 9	< 7	< 29	< 8
	07/28/20 - 08/31/20	< 7	< 7	< 15	< 7	< 14	< 7	< 12	< 11	< 8	< 6	< 31	< 8
	08/31/20 - 09/29/20	< 6	< 5	< 12	< 7	< 12	< 5	< 12	< 11	< 4	< 6	< 24	< 9
	09/29/20 - 11/03/20	< 8	< 7	< 15	< 8	< 11	< 6	< 14	< 14	< 8	< 8	< 36	< 11
	11/03/20 - 12/01/20	< 9	< 7	< 18	< 9	< 19	< 7	< 14	< 13	< 8	< 10	< 38	< 8
	12/01/20 - 12/28/20	< 5	< 5	< 14	< 7	< 14	< 8	< 10	< 11	< 7	< 7	< 30	< 7
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
24S1	12/30/19 - 02/03/20	< 7	< 8	< 9	< 7	< 15	< 7	< 14	< 10	< 8	< 6	< 35	< 10
	02/03/20 - 03/02/20	< 5	< 6	< 9	< 7	< 12	< 8	< 11	< 9	< 6	< 6	< 25	< 12
	03/02/20 - 03/30/20	< 7	< 7	< 13	< 8	< 13	< 7	< 12	< 13	< 7	< 6	< 36	< 10
	03/30/20 - 04/27/20	< 6	< 6	< 12	< 7	< 13	< 5	< 11	< 11	< 8	< 5	< 25	< 10
	04/27/20 - 06/02/20	< 6	< 6	< 12	< 9	< 15	< 8	< 8	< 11	< 7	< 8	< 29	< 13
	06/02/20 - 06/29/20	< 5	< 6	< 10	< 7	< 10	< 5	< 9	< 10	< 5	< 6	< 30	< 10
	06/29/20 - 07/28/20	< 6	< 7	< 12	< 7	< 13	< 7	< 12	< 9	< 7	< 6	< 32	< 9
	07/28/20 - 08/31/20	< 4	< 5	< 10	< 5	< 12	< 6	< 9	< 10	< 6	< 6	< 30	< 8
	08/31/20 - 09/29/20	< 5	< 7	< 11	< 7	< 13	< 6	< 12	< 12	< 6	< 5	< 31	< 10
	09/29/20 - 11/03/20	< 5	< 7	< 14	< 5	< 15	< 5	< 18	< 12	< 8	< 8	< 30	< 9
	11/03/20 - 12/01/20	< 6	< 6	< 13	< 9	< 16	< 4	< 11	< 10	< 7	< 6	< 23	< 9
	12/01/20 - 12/28/20	< 6	< 7	< 16	< 8	< 16	< 8	< 12	< 11	< 7	< 7	< 30	< 9
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-II.1 CONCENTRATIONS OF GROSS BETA IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	15F4	15F7	16C2	28F3
12/30/19 - 02/03/20	2.3 ± 1.4	4.2 ± 1.5	4.3 ± 1.5	3.3 ± 1.4
02/03/20 - 03/02/20	2.8 ± 1.2	2.8 ± 1.5	2.9 ± 1.6	3.4 ± 1.6
03/02/20 - 03/30/20	< 2.0	2.7 ± 1.5	< 2.1	2.2 ± 1.5
03/30/20 - 04/27/20	< 2.1	< 2.1	< 2.3	2.6 ± 1.5
04/27/20 - 06/02/20	3.6 ± 1.5	3.5 ± 1.5	2.3 ± 1.5	2.9 ± 1.5
06/02/20 - 06/29/20	4.6 ± 1.8	< 2.3	< 2.5	< 2.4
06/29/20 - 07/28/20	4.6 ± 1.6	4.7 ± 1.6	2.8 ± 1.5	4.4 ± 1.5
07/28/20 - 08/31/20	< 2.1	2.5 ± 1.5	< 2.3	2.7 ± 1.6
08/31/20 - 09/29/20	3.4 ± 1.6	3.9 ± 1.6	3.7 ± 1.7	5.3 ± 1.8
09/29/20 - 11/03/20	5.3 ± 1.9	3.9 ± 1.8	4.8 ± 2.0	4.4 ± 1.9
11/03/20 - 12/01/20	3.5 ± 1.5	2.9 ± 1.5	2.4 ± 1.5	7.2 ± 1.8
12/01/20 - 12/28/20	5.3 ± 1.5	4.2 ± 1.5	3.7 ± 1.5	4.8 ± 1.5
MEAN ± 2 STD DEV	3.9 ± 2.1	3.5 ± 1.5	3.3 ± 1.8	3.9 ± 2.9

Table C-II.2 CONCENTRATIONS OF TRITIUM IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	15F4	15F7	16C2	28F3
12/30/19 - 03/30/20	< 191	< 189	< 191	< 190
03/30/20 - 06/29/20	< 186	< 181	< 185	< 183
06/29/20 - 09/29/20	< 172	< 174	< 173	< 176
09/29/20 - 12/28/20	< 189	< 183	< 184	< 180
MEAN	-	-	-	-

Table C-II.3 CONCENTRATIONS OF I-131 IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	15F4	15F7	16C2	28F3
12/30/19 - 02/03/20	< 0.9	< 0.9	< 0.9	< 0.9
02/03/20 - 03/02/20	< 0.5	< 0.6	< 0.7	< 0.6
03/02/20 - 03/30/20	< 0.7	< 0.8	< 0.6	< 0.6
03/30/20 - 04/27/20	< 0.6	< 0.6	< 0.6	< 0.9
04/27/20 - 06/02/20	< 0.8	< 0.7	< 0.8	< 0.8
06/02/20 - 06/29/20	< 0.8	< 0.9	< 0.7	< 0.8
06/29/20 - 07/28/20	< 1.0	< 0.8	< 0.9	< 0.9
07/28/20 - 08/31/20	< 1.0	< 0.9	< 0.7	< 0.8
08/31/20 - 09/29/20	< 0.9	< 0.8	< 0.9	< 0.8
09/29/20 - 11/03/20	< 0.9	< 0.9	< 0.9	< 0.8
11/03/20 - 12/01/20	< 0.6	< 0.8	< 0.8	< 0.8
12/01/20 - 12/28/20	< 0.8	< 0.9	< 0.8	< 0.8
MEAN	-	-	-	-

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

Table C-II.4 CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
15F4	12/30/19 - 02/03/20	< 7	< 8	< 13	< 6	< 16	< 6	< 13	< 7	< 8	< 32	< 12
	02/03/20 - 03/02/20	< 7	< 5	< 15	< 7	< 13	< 7	< 10	< 7	< 6	< 26	< 10
	03/02/20 - 03/30/20	< 6	< 7	< 13	< 6	< 11	< 6	< 11	< 6	< 6	< 40	< 12
	03/30/20 - 04/27/20	< 6	< 7	< 13	< 8	< 14	< 7	< 12	< 8	< 6	< 38	< 5
	04/27/20 - 06/02/20	< 6	< 6	< 11	< 5	< 13	< 6	< 12	< 8	< 7	< 31	< 12
	06/02/20 - 06/29/20	< 5	< 6	< 13	< 5	< 13	< 5	< 12	< 5	< 6	< 30	< 9
	06/29/20 - 07/28/20	< 7	< 7	< 15	< 9	< 14	< 7	< 9	< 8	< 7	< 36	< 10
	07/28/20 - 08/31/20	< 7	< 7	< 15	< 9	< 16	< 6	< 11	< 9	< 6	< 32	< 10
	08/31/20 - 09/29/20	< 9	< 8	< 17	< 9	< 16	< 7	< 8	< 5	< 8	< 36	< 12
	09/29/20 - 11/03/20	< 7	< 7	< 13	< 6	< 14	< 6	< 12	< 8	< 6	< 36	< 13
	11/03/20 - 12/01/20	< 7	< 6	< 14	< 7	< 14	< 7	< 11	< 7	< 7	< 35	< 15
	12/01/20 - 12/28/20	< 7	< 7	< 15	< 8	< 14	< 8	< 12	< 10	< 8	< 33	< 8
	MEAN	-	-	-	-	-	-	-	-	-	-	-
15F7	12/30/19 - 02/03/20	< 6	< 8	< 13	< 6	< 14	< 9	< 12	< 8	< 7	< 34	< 8
	02/03/20 - 03/02/20	< 7	< 6	< 15	< 6	< 13	< 9	< 13	< 7	< 6	< 34	< 11
	03/02/20 - 03/30/20	< 6	< 7	< 15	< 8	< 14	< 7	< 11	< 7	< 6	< 30	< 12
	03/30/20 - 04/27/20	< 6	< 9	< 18	< 7	< 15	< 7	< 12	< 7	< 10	< 36	< 14
	04/27/20 - 06/02/20	< 6	< 5	< 13	< 7	< 12	< 7	< 12	< 6	< 7	< 25	< 10
	06/02/20 - 06/29/20	< 5	< 4	< 10	< 4	< 9	< 4	< 9	< 4	< 4	< 25	< 7
	06/29/20 - 07/28/20	< 6	< 6	< 14	< 10	< 11	< 7	< 13	< 8	< 8	< 33	< 9
	07/28/20 - 08/31/20	< 5	< 6	< 12	< 5	< 12	< 5	< 11	< 6	< 5	< 30	< 12
	08/31/20 - 09/29/20	< 5	< 6	< 9	< 6	< 14	< 5	< 10	< 7	< 6	< 26	< 7
	09/29/20 - 11/03/20	< 6	< 6	< 13	< 8	< 14	< 7	< 10	< 6	< 8	< 39	< 12
	11/03/20 - 12/01/20	< 6	< 7	< 13	< 7	< 14	< 6	< 15	< 7	< 7	< 29	< 13
	12/01/20 - 12/28/20	< 4	< 7	< 17	< 8	< 16	< 8	< 16	< 8	< 8	< 32	< 13
	MEAN	-	-	-	-	-	-	-	-	-	-	-

Table C-II.4 CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
16C2	12/30/19 - 02/03/20	< 5	< 6	< 11	< 6	< 9	< 8	< 14	< 7	< 5	< 30	< 11
	02/03/20 - 03/02/20	< 8	< 7	< 12	< 8	< 13	< 9	< 14	< 10	< 7	< 40	< 9
	03/02/20 - 03/30/20	< 6	< 6	< 11	< 6	< 10	< 6	< 11	< 5	< 6	< 30	< 12
	03/30/20 - 04/27/20	< 8	< 5	< 13	< 8	< 13	< 5	< 10	< 7	< 7	< 26	< 11
	04/27/20 - 06/02/20	< 6	< 7	< 14	< 8	< 14	< 8	< 12	< 8	< 7	< 26	< 8
	06/02/20 - 06/29/20	< 5	< 5	< 10	< 5	< 11	< 5	< 10	< 5	< 5	< 24	< 8
	06/29/20 - 07/28/20	< 7	< 5	< 13	< 7	< 12	< 6	< 10	< 8	< 7	< 31	< 8
	07/28/20 - 08/31/20	< 7	< 8	< 11	< 4	< 19	< 6	< 14	< 7	< 8	< 37	< 11
	08/31/20 - 09/29/20	< 6	< 6	< 14	< 6	< 15	< 7	< 13	< 8	< 6	< 32	< 8
	09/29/20 - 11/03/20	< 7	< 7	< 15	< 7	< 16	< 7	< 10	< 6	< 7	< 37	< 13
	11/03/20 - 12/01/20	< 7	< 7	< 15	< 7	< 17	< 8	< 13	< 7	< 6	< 40	< 11
	12/01/20 - 12/28/20	< 5	< 5	< 18	< 8	< 13	< 7	< 12	< 8	< 7	< 36	< 10
	MEAN	-	-	-	-	-	-	-	-	-	-	-
28F3	12/30/19 - 02/03/20	< 6	< 5	< 13	< 5	< 12	< 7	< 13	< 7	< 5	< 29	< 8
	02/03/20 - 03/02/20	< 8	< 7	< 14	< 8	< 14	< 7	< 13	< 9	< 7	< 28	< 12
	03/02/20 - 03/30/20	< 5	< 5	< 12	< 5	< 12	< 7	< 9	< 6	< 6	< 27	< 9
	03/30/20 - 04/27/20	< 7	< 7	< 12	< 6	< 13	< 7	< 11	< 7	< 7	< 30	< 10
	04/27/20 - 06/02/20	< 6	< 5	< 13	< 8	< 14	< 7	< 13	< 7	< 6	< 30	< 11
	06/02/20 - 06/29/20	< 4	< 4	< 12	< 5	< 10	< 6	< 9	< 5	< 5	< 26	< 7
	06/29/20 - 07/28/20	< 5	< 8	< 18	< 6	< 13	< 7	< 12	< 6	< 8	< 18	< 14
	07/28/20 - 08/31/20	< 7	< 6	< 16	< 8	< 12	< 8	< 8	< 10	< 7	< 34	< 10
	08/31/20 - 09/29/20	< 7	< 8	< 14	< 7	< 13	< 8	< 12	< 7	< 7	< 31	< 10
	09/29/20 - 11/03/20	< 8	< 7	< 15	< 8	< 15	< 8	< 13	< 7	< 7	< 39	< 13
	11/03/20 - 12/01/20	< 8	< 9	< 15	< 9	< 15	< 6	< 12	< 9	< 8	< 37	< 7
	12/01/20 - 12/28/20	< 6	< 7	< 13	< 5	< 15	< 6	< 10	< 8	< 6	< 28	< 8
	MEAN	-	-	-	-	-	-	-	-	-	-	-

Table C-III.1 **CONCENTRATIONS OF GAMMA EMITTERS IN PREDATOR AND BOTTOM FEEDER (FISH) SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020**

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE	COLLECTION PERIOD	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	I-131	Cs-134	Cs-137
16C5	PREDATOR									
	05/27/20	1938 ± 963	< 60	< 45	< 92	< 59	< 124	< 75	< 46	< 65
	11/19/20	2382 ± 877	< 73	< 39	< 76	< 37	< 118	< 69	< 56	< 60
	MEAN ± 2 STD DEV	2160 ± 628	-	-	-	-	-	-	-	-
16C5	BOTTOM FEEDER									
	05/27/20	3487 ± 939	< 75	< 62	< 132	< 49	< 161	< 104	< 86	< 67
	11/19/20	3389 ± 682	< 33	< 37	< 77	< 37	< 79	< 46	< 37	< 36
	MEAN ± 2 STD DEV	3438 ± 139	-	-	-	-	-	-	-	-
29C1	PREDATOR									
	05/28/20	2865 ± 828	< 47	< 39	< 90	< 55	< 89	< 63	< 56	< 53
	11/18/20	2235 ± 721	< 40	< 38	< 51	< 29	< 92	< 51	< 44	< 43
	MEAN ± 2 STD DEV	2550 ± 891	-	-	-	-	-	-	-	-
29C1	BOTTOM FEEDER									
	05/28/20	3979 ± 1287	< 87	< 98	< 196	< 112	< 149	< 118	< 85	< 92
	10/23/20	2746 ± 898	< 55	< 41	< 100	< 46	< 102	< 67	< 56	< 49
	MEAN ± 2 STD DEV	3363 ± 1744	-	-	-	-	-	-	-	-

THE MEAN AND 2-STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

Table C-IV.1 **CONCENTRATIONS OF GAMMA EMITTERS IN SEDIMENT SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020**

RESULTS IN UNITS OF PCI/KG DRY ± 2 SIGMA

SITE	COLLECTION PERIOD	Be-7	K-40	Mn-54	Co-58	Co-60	I-131	Cs-134	Cs-137
16B2	06/10/20	1082 ± 679	12920 ± 1878	< 105	< 71	< 78	< 168	< 104	< 112
	11/20/20	< 1047	12650 ± 1919	< 95	< 107	< 98	< 203	< 130	< 115
	MEAN ± 2 STD DEV	1082 ± 0	12785 ± 382	-	-	-	-	-	-
16C4	06/10/20	< 1127	10650 ± 1592	< 103	< 99	< 100	< 184	< 138	< 118
	11/20/20	< 902	12530 ± 1849	< 92	< 89	< 87	< 193	< 112	< 89
	MEAN ± 2 STD DEV	-	11590 ± 2659	-	-	-	-	-	-
33A2	06/10/20	< 848	11760 ± 1885	< 71	< 79	< 100	< 134	< 128	< 96
	11/20/20	< 972	14520 ± 2004	< 82	< 88	< 103	< 190	< 116	< 114
	MEAN ± 2 STD DEV	-	13140 ± 3903	-	-	-	-	-	-

THE MEAN AND 2-STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

Table C-V.1 **CONCENTRATIONS OF GROSS BETA IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020**

RESULTS IN UNITS OF E-03 PCI/CU METER ± 2 SIGMA

COLLECTION	GROUP I				GROUP II		GROUP III
PERIOD	10S3	11S1	13S4	14S1	6C1	15D1	22G1
12/30/19 - 01/06/20	9 ± 3	11 ± 4	6 ± 3	10 ± 4	11 ± 4	10 ± 4	10 ± 4
01/06/20 - 01/13/20	12 ± 3	14 ± 3	11 ± 3	11 ± 3	10 ± 3	13 ± 3	14 ± 3
01/13/20 - 01/21/20	13 ± 3	16 ± 4	13 ± 3	16 ± 3	15 ± 3	14 ± 3	18 ± 4
01/21/20 - 01/27/20	< 6	6 ± 4	< 6	11 ± 4	8 ± 4	9 ± 4	8 ± 4
01/27/20 - 02/03/20	8 ± 3	9 ± 3	8 ± 3	6 ± 3	11 ± 3	9 ± 3	6 ± 3
02/03/20 - 02/10/20	7 ± 3	9 ± 3	8 ± 3	9 ± 3	11 ± 3	7 ± 3	10 ± 3
02/10/20 - 02/17/20	9 ± 4	8 ± 3	9 ± 4	8 ± 3	13 ± 4	8 ± 3	10 ± 4
02/17/20 - 02/24/20	21 ± 4	18 ± 4	20 ± 4	19 ± 4	20 ± 4	15 ± 4	17 ± 4
02/24/20 - 03/02/20	11 ± 4	12 ± 4	10 ± 4	11 ± 4	12 ± 4	13 ± 4	10 ± 4
03/02/20 - 03/09/20	12 ± 4	9 ± 3	10 ± 4	12 ± 4	9 ± 3	13 ± 4	11 ± 3
03/09/20 - 03/16/20	12 ± 4	12 ± 4	13 ± 4	14 ± 4	11 ± 4	14 ± 4	13 ± 4
03/16/20 - 03/23/20	16 ± 4	10 ± 4	15 ± 4	13 ± 4	17 ± 4	15 ± 4	9 ± 4
03/23/20 - 03/30/20	6 ± 3	4 ± 3	5 ± 3	6 ± 3	6 ± 3	7 ± 3	< 4
03/30/20 - 04/06/20	9 ± 3	8 ± 3	9 ± 3	9 ± 3	5 ± 3	9 ± 3	8 ± 3
04/06/20 - 04/13/20	13 ± 4	14 ± 4	18 ± 4	14 ± 4	12 ± 4	14 ± 4	15 ± 4
04/13/20 - 04/20/20	15 ± 4	10 ± 4	12 ± 4	14 ± 4	11 ± 4	12 ± 4	11 ± 4
04/20/20 - 04/27/20	11 ± 4	7 ± 3	8 ± 3	8 ± 4	11 ± 4	14 ± 4	10 ± 4
04/27/20 - 05/04/20	13 ± 4	11 ± 3	12 ± 4	11 ± 4	12 ± 4	13 ± 4	12 ± 4
05/04/20 - 05/11/20	7 ± 3	7 ± 3	9 ± 4	12 ± 4	11 ± 4	5 ± 3	10 ± 3
05/11/20 - 05/18/20	14 ± 4	13 ± 4	15 ± 4	17 ± 4	15 ± 4	16 ± 4	16 ± 4
05/18/20 - 05/26/20	10 ± 3	7 ± 3	10 ± 3	8 ± 3	12 ± 3	8 ± 3	8 ± 3
05/26/20 - 06/02/20	10 ± 3	7 ± 3	12 ± 4	8 ± 3	10 ± 4	8 ± 3	8 ± 3
06/02/20 - 06/08/20	13 ± 4	11 ± 4	17 ± 5	17 ± 5	14 ± 5	16 ± 8	14 ± 4
06/08/20 - 06/15/20	10 ± 4	7 ± 3	12 ± 4	12 ± 4	11 ± 4	13 ± 4	11 ± 4
06/15/20 - 06/22/20	9 ± 3	7 ± 3	9 ± 4	7 ± 3	5 ± 3	9 ± 4	7 ± 3
06/22/20 - 06/29/20	13 ± 4	12 ± 4	16 ± 4	15 ± 4	15 ± 4	15 ± 4	13 ± 4
06/29/20 - 07/06/20	16 ± 4	15 ± 4	19 ± 4	17 ± 4	16 ± 4	18 ± 4	16 ± 4
07/06/20 - 07/13/20	9 ± 4	8 ± 4	12 ± 4	11 ± 4	11 ± 4	10 ± 4	10 ± 3
07/13/20 - 07/20/20	14 ± 4	12 ± 3	15 ± 4	14 ± 4	14 ± 4	14 ± 4	13 ± 3
07/20/20 - 07/28/20	13 ± 3	15 ± 4	19 ± 10	23 ± 4	13 ± 4	14 ± 4	16 ± 4
07/28/20 - 08/04/20	15 ± 4	13 ± 4	*(1)*	17 ± 4	16 ± 4	15 ± 4	14 ± 4
08/04/20 - 08/10/20	15 ± 4	14 ± 4	*(1)*	14 ± 4	17 ± 4	14 ± 4	18 ± 5
08/10/20 - 08/17/20	21 ± 4	5 ± 3	18 ± 5	27 ± 5	19 ± 4	17 ± 4	23 ± 5
08/17/20 - 08/24/20	13 ± 4	< 4	13 ± 4	12 ± 4	14 ± 4	13 ± 4	13 ± 4
08/24/20 - 08/31/20	13 ± 4	< 5	18 ± 4	18 ± 4	17 ± 4	14 ± 4	12 ± 4
08/31/20 - 09/08/20	13 ± 3	14 ± 3	15 ± 3	14 ± 3	20 ± 4	12 ± 3	11 ± 3
09/08/20 - 09/14/20	11 ± 4	12 ± 4	10 ± 4	13 ± 4	15 ± 4	12 ± 4	12 ± 4
09/14/20 - 09/21/20	15 ± 4	11 ± 4	18 ± 4	16 ± 4	13 ± 4	13 ± 4	10 ± 4
09/21/20 - 09/29/20	22 ± 4	18 ± 4	29 ± 4	23 ± 4	25 ± 4	24 ± 4	21 ± 4
09/29/20 - 10/05/20	10 ± 4	12 ± 4	14 ± 4	11 ± 4	10 ± 4	10 ± 4	8 ± 4
10/05/20 - 10/12/20	23 ± 4	16 ± 4	25 ± 4	18 ± 4	21 ± 4	21 ± 4	14 ± 4
10/12/20 - 10/19/20	10 ± 3	8 ± 3	15 ± 4	10 ± 3	10 ± 3	9 ± 3	10 ± 3
10/19/20 - 10/26/20	10 ± 4	8 ± 3	11 ± 4	12 ± 4	12 ± 4	10 ± 4	7 ± 3
10/26/20 - 11/03/20	9 ± 3	9 ± 3	10 ± 3	8 ± 3	10 ± 3	10 ± 3	9 ± 3
11/03/20 - 11/10/20	22 ± 4	23 ± 4	27 ± 5	29 ± 5	23 ± 4	30 ± 5	29 ± 5
11/10/20 - 11/16/20	12 ± 4	11 ± 4	18 ± 5	15 ± 4	16 ± 5	16 ± 5	15 ± 4
11/16/20 - 11/23/20	10 ± 3	10 ± 4	13 ± 4	11 ± 4	15 ± 4	13 ± 4	12 ± 4
11/23/20 - 12/01/20	17 ± 4	16 ± 4	14 ± 4	15 ± 4	16 ± 4	15 ± 4	17 ± 4
12/01/20 - 12/07/20	11 ± 4	7 ± 4	10 ± 4	10 ± 4	10 ± 4	11 ± 4	10 ± 4
12/07/20 - 12/14/20	27 ± 5	11 ± 4	23 ± 4	25 ± 4	22 ± 4	23 ± 4	24 ± 4
12/14/20 - 12/21/20	15 ± 3	*(1)*	14 ± 3	12 ± 3	15 ± 3	13 ± 3	9 ± 3
12/21/20 - 12/28/20	14 ± 4	13 ± 4	11 ± 4	13 ± 4	14 ± 4	15 ± 4	12 ± 4
MEAN ± 2 STD DEV	13 ± 9	11 ± 7	14 ± 10	14 ± 10	13 ± 8	13 ± 9	13 ± 9

THE MEAN AND 2-STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-V.2

MONTHLY AND YEARLY MEAN VALUES OF GROSS BETA CONCENTRATIONS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020

RESULTS IN UNITS OF E-03 PCI/CU METER ± 2 SIGMA

GROUP I - ON-SITE LOCATIONS				GROUP II - INTERMEDIATE DISTANCE LOCATIONS				GROUP III - CONTROL LOCATIONS			
COLLECTION PERIOD	MIN	MAX	MEAN ± 2SD	COLLECTION PERIOD	MIN	MAX	MEAN ± 2SD	COLLECTION PERIOD	MIN	MAX	MEAN ± 2SD
12/30/19 - 02/03/20	6	16	11 ± 6	12/30/19 - 02/03/20	8	15	11 ± 5	12/30/19 - 02/03/20	6	18	11 ± 9
02/03/20 - 03/02/20	7	21	12 ± 9	02/03/20 - 03/02/20	7	20	12 ± 8	02/03/20 - 03/02/20	10	17	12 ± 7
03/02/20 - 03/30/20	4	16	11 ± 7	03/02/20 - 03/30/20	6	17	12 ± 8	03/02/20 - 03/23/20	9	13	11 ± 4
03/30/20 - 05/04/20	7	18	11 ± 6	03/30/20 - 05/04/20	5	14	11 ± 5	03/30/20 - 05/04/20	8	15	11 ± 5
05/04/20 - 06/02/20	7	17	10 ± 6	05/04/20 - 06/02/20	5	16	11 ± 7	05/04/20 - 06/02/20	8	16	10 ± 8
06/02/20 - 06/29/20	7	17	12 ± 7	06/02/20 - 06/29/20	5	16	12 ± 8	06/02/20 - 06/29/20	7	14	11 ± 7
06/29/20 - 08/04/20	8	23	15 ± 7	06/29/20 - 08/04/20	10	18	14 ± 5	06/29/20 - 08/04/20	10	16	14 ± 5
08/04/20 - 08/31/20	5	27	15 ± 11	08/04/20 - 08/31/20	13	19	16 ± 5	08/04/20 - 08/31/20	12	23	17 ± 10
08/31/20 - 09/29/20	10	29	16 ± 10	08/31/20 - 09/29/20	12	25	17 ± 11	08/31/20 - 09/29/20	10	21	13 ± 10
09/29/20 - 11/03/20	8	25	12 ± 10	09/29/20 - 11/03/20	9	21	12 ± 9	09/29/20 - 11/03/20	7	14	10 ± 6
11/03/20 - 12/01/20	10	29	16 ± 12	11/03/20 - 12/01/20	13	30	18 ± 11	11/03/20 - 12/01/20	12	29	18 ± 14
12/01/20 - 12/28/20	7	27	14 ± 12	12/01/20 - 12/28/20	10	23	15 ± 10	12/01/20 - 12/28/20	9	24	14 ± 14
12/30/19 - 12/28/20	4	29	13 ± 9	12/30/19 - 12/28/20	5	30	13 ± 9	12/30/19 - 12/28/20	6	29	13 ± 9

Table C-V.3 **CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020**

RESULTS IN UNITS OF E-03 PCI/CU METER ± 2 SIGMA

SITE	COLLECTION PERIOD	Be-7	Mn-54	Co-58	Co-60	Cs-134	Cs-137
10S3	12/30/19 - 03/30/20	63 ± 17	< 2	< 2	< 1	< 2	< 2
	03/30/20 - 06/29/20	93 ± 22	< 3	< 2	< 2	< 3	< 2
	06/29/20 - 09/29/20	71 ± 17	< 1	< 2	< 2	< 2	< 2
	09/29/20 - 12/28/20	49 ± 18	< 1	< 2	< 2	< 2	< 2
	MEAN ± 2 STD DEV	69 ± 37	-	-	-	-	-
11S1	12/30/19 - 03/30/20	48 ± 21	< 3	< 3	< 2	< 2	< 2
	03/30/20 - 06/29/20	62 ± 21	< 2	< 2	< 2	< 2	< 2
	06/29/20 - 09/29/20	59 ± 20	< 2	< 2	< 2	< 3	< 2
	09/29/20 - 12/28/20	59 ± 19	< 2	< 2	< 3	< 2	< 2
	MEAN ± 2 STD DEV	57 ± 12	-	-	-	-	-
13S4	12/30/19 - 03/30/20	67 ± 18	< 2	< 2	< 3	< 2	< 2
	03/30/20 - 06/29/20	86 ± 21	< 2	< 2	< 3	< 2	< 2
	06/29/20 - 09/29/20	92 ± 23	< 3	< 3	< 2	< 3	< 3
	09/29/20 - 12/28/20	53 ± 18	< 2	< 2	< 2	< 2	< 2
	MEAN ± 2 STD DEV	74 ± 35	-	-	-	-	-
14S1	12/30/19 - 03/30/20	59 ± 21	< 4	< 3	< 3	< 4	< 3
	03/30/20 - 06/29/20	73 ± 28	< 3	< 3	< 4	< 4	< 3
	06/29/20 - 09/29/20	83 ± 19	< 2	< 2	< 1	< 2	< 2
	09/29/20 - 12/28/20	49 ± 17	< 1	< 2	< 2	< 2	< 2
	MEAN ± 2 STD DEV	66 ± 30	-	-	-	-	-
15D1	12/30/19 - 03/30/20	64 ± 17	< 2	< 2	< 2	< 2	< 2
	03/30/20 - 06/29/20	83 ± 28	< 3	< 4	< 4	< 4	< 3
	06/29/20 - 09/29/20	75 ± 15	< 3	< 2	< 1	< 2	< 2
	09/29/20 - 12/28/20	67 ± 19	< 3	< 3	< 3	< 2	< 2
	MEAN ± 2 STD DEV	72 ± 17	-	-	-	-	-
22G1	12/30/19 - 03/30/20	59 ± 15	< 1	< 2	< 2	< 2	< 2
	03/30/20 - 06/29/20	70 ± 18	< 1	< 2	< 1	< 2	< 1
	06/29/20 - 09/29/20	70 ± 21	< 3	< 4	< 4	< 4	< 3
	09/29/20 - 12/28/20	57 ± 15	< 2	< 2	< 2	< 2	< 2
	MEAN ± 2 STD DEV	64 ± 14	-	-	-	-	-
6C1	12/30/19 - 03/30/20	73 ± 18	< 1	< 1	< 2	< 1	< 2
	03/30/20 - 06/29/20	67 ± 18	< 2	< 2	< 2	< 1	< 1
	06/29/20 - 09/29/20	83 ± 22	< 1	< 2	< 3	< 2	< 2
	09/29/20 - 12/28/20	54 ± 18	< 3	< 2	< 3	< 3	< 2
	MEAN ± 2 STD DEV	70 ± 24	-	-	-	-	-

THE MEAN AND 2-STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

Table C-VI.1

CONCENTRATIONS OF I-131 IN AIR IODINE SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020

RESULTS IN UNITS OF E-03 PCI/CU METER + 2 SIGMA

COLLECTION	GROUP I				GROUP II		GROUP III
PERIOD	10S3	11S1	13S4	14S1	6C1	15D1	22G1
12/30/19 - 01/06/20	< 19	< 19	< 35	< 19	< 19	< 16	< 34
01/06/20 - 01/13/20	< 35	< 29	< 28	< 29	< 33	< 29	< 12
01/13/20 - 01/21/20	< 18	< 21	< 25	< 20	< 21	< 21	< 24
01/21/20 - 01/27/20	< 42	< 20	< 24	< 22	< 39	< 22	< 22
01/27/20 - 02/03/20	< 12	< 28	< 17	< 28	< 27	< 28	< 17
02/03/20 - 02/10/20	< 28	< 14	< 28	< 27	< 27	< 27	< 28
02/10/20 - 02/17/20	< 35	< 15	< 21	< 35	< 35	< 35	< 28
02/17/20 - 02/24/20	< 25	< 25	< 29	< 25	< 13	< 25	< 28
02/24/20 - 03/02/20	< 28	< 27	< 14	< 18	< 27	< 27	< 29
03/02/20 - 03/09/20	< 16	< 22	< 19	< 22	< 17	< 22	< 21
03/09/20 - 03/16/20	< 22	< 21	< 38	< 21	< 21	< 18	< 36
03/16/20 - 03/23/20	< 25	< 11	< 20	< 22	< 25	< 22	< 22
03/23/20 - 03/30/20	< 16	< 15	< 28	< 28	< 16	< 28	< 28
03/30/20 - 04/06/20	< 24	< 24	< 10	< 24	< 25	< 24	< 25
04/06/20 - 04/13/20	< 22	< 38	< 38	< 16	< 23	< 39	< 36
04/13/20 - 04/20/20	< 27	< 27	< 22	< 26	< 14	< 27	< 16
04/20/20 - 04/27/20	< 19	< 20	< 23	< 16	< 20	< 19	< 23
04/27/20 - 05/04/20	< 24	< 24	< 25	< 25	< 24	< 21	< 25
05/04/20 - 05/11/20	< 35	< 23	< 24	< 24	< 35	< 23	< 13
05/11/20 - 05/18/20	< 30	< 42	< 18	< 42	< 30	< 42	< 42
05/18/20 - 05/26/20	< 19	< 19	< 14	< 19	< 11	< 19	< 36
05/26/20 - 06/02/20	< 17	< 32	*< 31*	< 14	< 17	< 31	< 32
06/02/20 - 06/08/20	< 28	< 29	< 44	< 35	< 29	< 32	< 39
06/08/20 - 06/15/20	< 30	< 13	< 23	< 30	< 30	< 30	< 23
06/15/20 - 06/22/20	< 25	< 12	< 21	< 22	< 25	< 21	< 20
06/22/20 - 06/29/20	< 28	< 28	< 12	< 30	< 29	< 28	< 27
06/29/20 - 07/06/20	< 17	< 17	< 9	< 10	< 17	< 17	< 13
07/06/20 - 07/13/20	< 17	< 40	< 26	< 37	< 38	< 38	< 24
07/13/20 - 07/20/20	< 18	< 11	< 30	< 18	< 18	< 18	< 30
07/20/20 - 07/28/20	< 28	< 27	< 17	< 12	< 28	< 28	< 13
07/28/20 - 08/04/20	< 32	< 32	*(1)*	< 26	< 14	< 32	< 32
08/04/20 - 08/10/20	< 33	< 13	*(1)*	< 31	< 33	< 32	< 18
08/10/20 - 08/17/20	< 20	< 40	< 24	< 40	< 13	< 40	< 41
08/17/20 - 08/24/20	< 44	< 22	< 23	< 11	< 44	< 22	< 22
08/24/20 - 08/31/20	< 35	< 37	< 27	< 35	< 15	< 36	< 27
08/31/20 - 09/08/20	< 18	< 51	< 51	< 51	< 17	< 51	< 21
09/08/20 - 09/14/20	< 28	< 32	< 14	< 32	< 12	< 32	< 31
09/14/20 - 09/21/20	< 18	< 39	< 17	< 39	< 17	< 39	< 38
09/21/20 - 09/29/20	< 24	< 11	< 10	< 24	< 24	< 24	< 13
09/29/20 - 10/05/20	< 21	< 48	< 22	< 48	< 21	< 50	< 50
10/05/20 - 10/12/20	< 19	< 19	< 18	< 19	< 16	< 19	< 18
10/12/20 - 10/19/20	< 23	< 23	< 26	< 23	< 15	< 24	< 13
10/19/20 - 10/26/20	< 33	< 33	< 12	< 18	< 33	< 33	< 19
10/26/20 - 11/03/20	< 40	< 40	< 26	< 40	< 17	< 40	< 25
11/03/20 - 11/10/20	< 32	< 27	< 27	< 27	< 32	< 23	< 28
11/10/20 - 11/16/20	< 14	< 26	< 26	< 26	< 27	< 27	< 27
11/16/20 - 11/23/20	< 52	*< 66*	< 50	< 54	< 23	< 53	< 48
11/23/20 - 12/01/20	< 14	< 25	< 24	< 24	< 26	< 24	< 24
12/01/20 - 12/07/20	< 46	< 47	< 20	< 20	< 45	< 45	< 32
12/07/20 - 12/14/20	< 26	< 35	< 17	< 25	< 11	< 26	< 13
12/14/20 - 12/21/20	< 45	*(1)*	< 39	< 45	< 45	< 47	< 25
12/21/20 - 12/28/20	< 23	< 24	< 23	< 23	< 23	< 23	< 11
MEAN	-	-	-	-	-	-	-

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-VII.1 CONCENTRATIONS OF I-131 IN MILK SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION	CONTROL FARM	INDICATOR FARMS		
PERIOD	23F1	18E1	19B1	25C1
01/14/20	< 0.9	< 0.8	< 0.9	< 0.9
02/10/20	< 0.8	< 0.8	< 0.7	< 0.8
03/10/20	< 0.6	< 0.7	< 0.7	< 0.8
04/06/20	< 0.6	< 0.8	< 0.8	< 0.7
04/21/20	< 0.6	< 0.7	< 0.7	< 0.6
05/05/20	< 0.6	< 0.8	< 0.7	< 0.7
05/19/20	< 0.7	< 0.8	< 0.8	< 0.7
06/01/20	< 0.7	< 0.7	< 0.7	< 0.7
06/16/20	< 0.6	< 0.7	< 0.9	< 0.6
06/29/20	< 0.7	< 0.8	< 0.7	< 0.8
07/14/20	< 0.8	< 0.7	< 0.9	< 0.6
07/27/20	< 0.7	< 0.8	< 0.8	< 0.8
08/10/20	< 0.8	< 0.8	< 0.8	< 0.9
08/24/20	< 0.8	< 0.8	< 0.8	< 0.7
09/08/20	< 0.8	< 0.8	< 0.8	< 0.7
09/21/20	< 0.8	< 0.8	< 0.8	< 0.8
10/06/20	< 0.9	< 0.8	< 0.9	< 0.8
10/19/20	< 0.7	< 0.9	< 0.9	< 0.8
11/03/20	< 0.9	< 0.9	< 0.9	< 0.9
11/17/20	< 0.8	< 0.9	< 0.8	< 0.7
12/07/20				< 0.9
12/11/20	< 0.8	< 0.8	< 0.8	
MEAN	-	-	-	-

Table C-VII.2 **CONCENTRATIONS OF GAMMA EMITTERS IN MILK SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	K-40	Cs-134	Cs-137	Ba-140	La-140
18E1	01/14/20	1241 ± 107	< 4	< 4	< 16	< 4
	02/10/20	1228 ± 180	< 9	< 8	< 32	< 9
	03/10/20	1297 ± 167	< 7	< 7	< 29	< 8
	04/06/20	1243 ± 199	< 7	< 8	< 31	< 9
	04/21/20	1252 ± 183	< 8	< 9	< 25	< 6
	05/05/20	1155 ± 166	< 8	< 10	< 34	< 11
	05/19/20	1069 ± 197	< 7	< 8	< 20	< 7
	06/01/20	1153 ± 147	< 7	< 7	< 22	< 8
	06/16/20	1137 ± 162	< 8	< 7	< 27	< 9
	06/29/20	1134 ± 180	< 8	< 8	< 27	< 8
	07/14/20	1047 ± 171	< 11	< 7	< 28	< 9
	07/27/20	1028 ± 179	< 7	< 8	< 29	< 10
	08/10/20	1239 ± 178	< 10	< 8	< 32	< 5
	08/24/20	1218 ± 167	< 7	< 7	< 22	< 7
	09/08/20	1249 ± 176	< 9	< 7	< 24	< 10
	09/21/20	1122 ± 186	< 7	< 8	< 30	< 13
	10/06/20	992 ± 163	< 10	< 9	< 35	< 10
	10/19/20	1216 ± 187	< 8	< 9	< 31	< 8
	11/03/20	1224 ± 165	< 9	< 7	< 22	< 8
	11/17/20	1026 ± 169	< 9	< 8	< 28	< 6
	12/11/20	1203 ± 181	< 11	< 8	< 34	< 9
	MEAN ± 2 STD DEV	1165 ± 178	-	-	-	-
19B1	01/14/20	1314 ± 179	< 8	< 6	< 24	< 7
	02/10/20	1141 ± 152	< 7	< 6	< 22	< 5
	03/10/20	1103 ± 153	< 8	< 7	< 23	< 9
	04/06/20	1220 ± 111	< 6	< 5	< 18	< 6
	04/21/20	1179 ± 160	< 7	< 7	< 23	< 8
	05/05/20	1144 ± 160	< 8	< 8	< 29	< 10
	05/19/20	1149 ± 150	< 8	< 7	< 25	< 9
	06/01/20	1203 ± 161	< 10	< 8	< 39	< 10
	06/16/20	1056 ± 166	< 8	< 9	< 29	< 9
	06/29/20	1426 ± 163	< 10	< 7	< 23	< 10
	07/14/20	1412 ± 186	< 9	< 8	< 27	< 6
	07/27/20	1254 ± 175	< 10	< 8	< 24	< 8
	08/10/20	1265 ± 193	< 9	< 10	< 31	< 7
	08/24/20	1109 ± 198	< 10	< 9	< 21	< 12
	09/08/20	1337 ± 155	< 8	< 7	< 31	< 8
	09/21/20	1268 ± 200	< 8	< 6	< 32	< 8
	10/06/20	1181 ± 188	< 8	< 8	< 25	< 10
	10/19/20	1378 ± 216	< 9	< 7	< 28	< 10
	11/03/20	1167 ± 187	< 8	< 7	< 29	< 9
	11/17/20	1343 ± 197	< 9	< 7	< 30	< 10
	12/11/20	1176 ± 167	< 8	< 8	< 38	< 10
	MEAN ± 2 STD DEV	1230 ± 211	-	-	-	-

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

Table C-VII.2 **CONCENTRATIONS OF GAMMA EMITTERS IN MILK SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	K-40	Cs-134	Cs-137	Ba-140	La-140
23F1	01/14/20	1402 ± 158	< 7	< 7	< 22	< 9
	02/10/20	1463 ± 163	< 6	< 7	< 26	< 9
	03/10/20	919 ± 136	< 7	< 6	< 23	< 7
	04/06/20	1318 ± 132	< 6	< 6	< 20	< 6
	04/21/20	1361 ± 171	< 7	< 7	< 22	< 7
	05/05/20	1083 ± 188	< 8	< 7	< 29	< 9
	05/19/20	1242 ± 166	< 7	< 7	< 27	< 7
	06/01/20	1273 ± 158	< 9	< 9	< 32	< 10
	06/16/20	1166 ± 181	< 7	< 6	< 26	< 9
	06/29/20	1321 ± 157	< 7	< 7	< 27	< 7
	07/14/20	1268 ± 199	< 9	< 9	< 26	< 5
	07/27/20	1170 ± 207	< 8	< 7	< 27	< 9
	08/10/20	1244 ± 192	< 10	< 9	< 29	< 9
	08/24/20	1302 ± 157	< 8	< 8	< 29	< 10
	09/08/20	1376 ± 185	< 10	< 9	< 33	< 3
	09/21/20	1030 ± 188	< 11	< 9	< 36	< 7
	10/06/20	1293 ± 151	< 9	< 8	< 29	< 9
	10/19/20	1199 ± 185	< 8	< 8	< 28	< 11
	11/03/20	1344 ± 174	< 8	< 9	< 29	< 9
	11/17/20	1306 ± 175	< 8	< 7	< 30	< 6
	12/11/20	1406 ± 211	< 7	< 9	< 40	< 8
	MEAN ± 2 STD DEV	1261 ± 264	-	-	-	-
25C1	01/14/20	1146 ± 150	< 9	< 6	< 30	< 8
	02/10/20	1145 ± 155	< 8	< 7	< 26	< 8
	03/10/20	1325 ± 146	< 6	< 7	< 22	< 5
	04/06/20	1225 ± 204	< 8	< 8	< 31	< 8
	04/21/20	983 ± 152	< 7	< 7	< 27	< 10
	05/05/20	1433 ± 202	< 10	< 10	< 35	< 11
	05/19/20	890 ± 129	< 6	< 5	< 20	< 6
	06/02/20	1330 ± 195	< 10	< 8	< 29	< 10
	06/16/20	1664 ± 224	< 9	< 8	< 40	< 9
	06/29/20	1441 ± 179	< 7	< 7	< 29	< 7
	07/14/20	1223 ± 169	< 8	< 8	< 26	< 6
	07/27/20	1389 ± 189	< 9	< 8	< 32	< 14
	08/10/20	1154 ± 164	< 9	< 8	< 27	< 10
	08/24/20	1183 ± 181	< 9	< 9	< 28	< 7
	09/08/20	1466 ± 164	< 6	< 7	< 25	< 7
	09/21/20	1480 ± 176	< 10	< 8	< 36	< 8
	10/06/20	1310 ± 178	< 11	< 7	< 29	< 9
	10/19/20	1198 ± 182	< 8	< 8	< 27	< 10
	11/03/20	1312 ± 186	< 10	< 7	< 29	< 12
	11/17/20	1188 ± 206	< 10	< 10	< 37	< 9
	12/07/20	1283 ± 158	< 9	< 9	< 32	< 10
	MEAN ± 2 STD DEV	1275 ± 350	-	-	-	-

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

TABLE C-VIII.1

CONCENTRATIONS OF GAMMA EMITTERS IN BROAD LEAFY VEGETATION SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE	COLLECTION PERIOD		Be-7	K-40	Mn-54	Co-58	Co-60	I-131	Cs-134	Cs-137	Ra-226	Th-228	Th-232
11S3	06/16/20	*Kale Leaves*	< 235	5037 ± 640	< 28	< 29	< 24	< 28	< 33	< 19	< 603	101 ± 47	< 115
	06/16/20	*Cabbage Leaves*	< 240	4477 ± 668	< 27	< 31	< 31	< 29	< 23	< 26	< 551	87 ± 37	< 98
	06/16/20	*Swiss Chard Leaves*	< 238	6858 ± 648	< 28	< 25	< 33	< 27	< 30	< 27	< 511	97 ± 40	< 120
	07/09/20	*Kale Leaves*	< 339	4234 ± 648	< 33	< 29	< 44	< 38	< 34	< 41	< 689	< 56	< 132
	07/09/20	*Swiss Chard Leaves*	342 ± 305	8133 ± 899	< 24	< 27	< 38	< 34	< 26	< 27	< 696	< 52	< 126
	07/09/20	*Brussels Sprouts Leaves*	< 307	3682 ± 641	< 29	< 33	< 38	< 36	< 25	< 22	< 579	< 47	< 109
	08/11/20	*Cabbage Leaves*	531 ± 233	3197 ± 553	< 26	< 21	< 21	< 26	< 31	< 30	< 629	< 50	< 117
	08/11/20	*Collard Leaves*	908 ± 317	3929 ± 608	< 36	< 26	< 33	< 29	< 29	< 27	< 618	48 ± 42	< 114
	08/11/20	*Swiss Chard Leaves*	872 ± 329	7718 ± 792	< 29	< 35	< 46	< 34	< 31	< 26	< 653	< 46	< 119
	09/14/20	*Swiss Chard Leaves*	< 206	4476 ± 581	< 24	< 27	< 30	< 30	< 34	< 26	< 653	< 52	< 105
	09/14/20	*Cucumber Leaves*	< 346	4243 ± 682	< 31	< 30	< 37	< 35	< 26	< 36	< 691	< 66	< 119
		MEAN ± 2 STD DEV	663 ± 546	5089 ± 3371	-	-	-	-	-	-	-	83 ± 49	-
13S3	06/16/20	*Kale Leaves*	< 329	4199 ± 799	< 29	< 36	< 28	< 32	< 37	< 45	< 951	111 ± 53	< 150
	06/16/20	*Swiss Chard Leaves*	< 376	7174 ± 971	< 37	< 41	< 51	< 35	< 48	< 44	< 814	117 ± 56	< 173
	06/16/20	*Brussels Sprouts Leaves*	< 357	3190 ± 730	< 46	< 42	< 50	< 50	< 55	< 52	< 1286	122 ± 89	< 216
	07/09/20	*Kale Leaves*	339 ± 190	3786 ± 518	< 24	< 22	< 27	< 31	< 27	< 23	1084 ± 540	< 42	< 90
	07/09/20	*Swiss Chard Leaves*	714 ± 177	6688 ± 569	< 19	< 20	< 24	< 18	< 20	< 24	< 433	37 ± 27	< 90
	07/09/20	*Brussels Sprouts Leaves*	< 216	4112 ± 425	< 22	< 22	< 24	< 23	< 27	< 23	1273 ± 562	50 ± 34	< 95
	08/11/20	*Kale Leaves*	742 ± 229	2722 ± 496	< 23	< 22	< 24	< 25	< 25	< 30	< 719	79 ± 40	< 105
	08/11/20	*Cabbage Leaves*	703 ± 313	3432 ± 560	< 32	< 24	< 31	< 32	< 38	< 36	< 846	< 73	< 133
	08/11/20	*Swiss Chard Leaves*	492 ± 334	6347 ± 739	< 29	< 29	< 39	< 27	< 30	< 29	< 636	56 ± 56	< 133
	09/14/20	*Swiss Chard Leaves*	< 272	6064 ± 727	< 30	< 24	< 26	< 33	< 31	< 24	< 699	< 52	< 121
		MEAN ± 2 STD DEV	598 ± 351	4771 ± 3254	-	-	-	-	-	-	1179 ± 267	82 ± 70	-
31G1	06/16/20	*Cabbage Leaves*	< 321	5446 ± 806	< 37	< 39	< 33	< 37	< 41	< 40	< 984	363 ± 79	< 143
	06/16/20	*Pepper Leaves*	< 446	5567 ± 812	< 33	< 41	< 46	< 39	< 43	< 36	< 981	580 ± 100	< 160
	06/16/20	*Corn Leaves*	< 452	5882 ± 850	< 44	< 36	< 46	< 41	< 43	< 42	< 908	626 ± 88	< 138
	07/09/20	*Zucchini Leaves*	904 ± 170	2817 ± 477	< 18	< 18	< 19	< 21	< 21	< 21	< 439	123 ± 27	< 88
	07/09/20	*Yellow Squash Leaves*	1989 ± 343	6358 ± 712	< 27	< 21	< 39	< 36	< 35	< 32	< 730	< 62	< 121
	07/09/20	*Corn Leaves*	2570 ± 401	5062 ± 704	< 32	< 27	< 29	< 45	< 42	< 29	< 801	< 65.5	< 118
	08/11/20	*Yellow Squash Leaves*	1583 ± 278	4219 ± 561	< 26	< 21	< 22	< 26	< 27	< 22	< 661	105 ± 44	< 125
	08/11/20	*Cucumber Leaves*	947 ± 237	3530 ± 612	< 26	< 30	< 36	< 23	< 29	< 26	< 568	136 ± 56	< 153
	08/11/20	*Watermelon Leaves*	1307 ± 261	2681 ± 457	< 25	< 29	< 33	< 24	< 34	< 30	< 615	103 ± 50	< 103
	09/14/20	*Yellow Squash Leaves*	< 330	3715 ± 580	< 29	< 28	< 23	< 30	< 33	< 31	< 625	< 62	< 128
	09/14/20	*Cucumber Leaves*	614 ± 209	3615 ± 546	< 22	< 24	< 32	< 25	< 18	< 29	< 420	< 41	< 99
		MEAN ± 2 STD DEV	1416 ± 1373	4445 ± 2549	-	-	-	-	-	-	-	291 ± 464	-

THE MEAN AND 2-STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

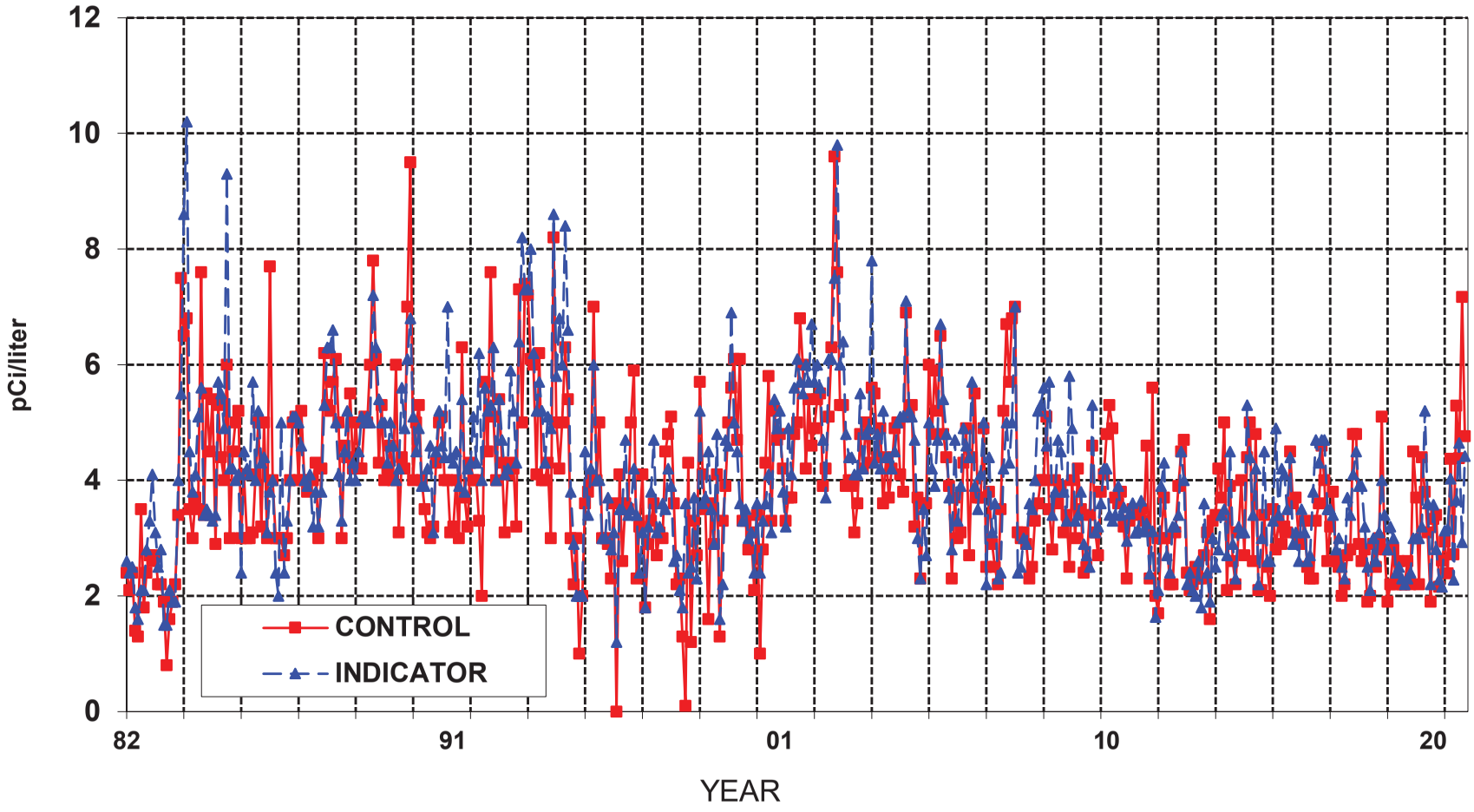
Table C-IX.1 QUARTERLY DLR RESULTS FOR LIMERICK GENERATING STATION, 2020

Location	Qtr 1 (mrem)	Qtr 2 (mrem)	Qtr 3 (mrem)	Qtr 4 (mrem)	Normalized Annual Dose, M_A (mrem/yr)	B_A[(1)]	B_A + MDD_A[(2)]	Annual Facility Dose, F_A (mrem)	Annual Facility Dose, F_A >10 mrem
10E1	17.7	18.7	19.0	18.4	73.8	71.0	82.7	ND	No
10F3	18.6	18.7	17.9	19.0	74.1	69.7	81.4	ND	No
10S3	18.3	19.2	18.8	19.3	75.5	70.9	82.6	ND	No
11S1	20.6	22.5	21.5	20.9	85.4	83.1	94.8	ND	No
13C1	13.1	13.3	13.2	12.5	52.1	49.8	61.5	ND	No
130	18.4	18.0	18.7	19.6	74.7	70.1	81.8	ND	No
13S2	26.2	25.4	27.4	26.1	105.2	112.1	123.8	ND	No
14S1	16.0	17.6	15.9	16.7	66.2	63.2	74.9	ND	No
15D1	18.3	20.0	19.1	19.2	76.6	72.5	84.2	ND	No
16F1	17.5	17.6	18.7	18.8	72.6	73.4	85.1	ND	No
17B1	17.1	17.2	17.2	17.6	69.1	66.8	78.5	ND	No
18S2	19.0	19.8	18.9	19.5	77.2	78.4	90.1	ND	No
19D1	16.4	17.0	17.0	16.6	67.1	66.3	78.0	ND	No
20D1	14.8	15.7	15.5	16.0	62.0	63.0	74.7	ND	No
20F1	17.6	17.9	17.5	16.5	69.5	67.5	79.2	ND	No
21S2	16.3	16.6	16.6	17.1	66.6	64.1	75.8	ND	No
23S2	16.3	16.6	16.8	16.0	65.7	63.9	75.6	ND	No
24D1	14.6	15.2	15.1	15.4	60.2	59.7	71.4	ND	No
25D1	14.0	15.9	14.4	15.0	59.3	56.5	68.2	ND	No
25S2	15.0	15.6	15.9	15.8	62.3	58.1	69.8	ND	No
26S3	14.1	16.4	15.7	16.7	62.9	60.4	72.1	ND	No
28D2	15.6	16.0	17.0	17.1	65.7	63.5	75.2	ND	No
29E1	17.0	16.8	16.5	16.7	67.0	62.3	74.0	ND	No
29S1	15.9	15.5	15.5	16.3	63.3	61.4	73.1	ND	No
2E1	17.9	19.0	20.2	19.4	76.4	71.9	83.6	ND	No
31D1	20.8	21.3	20.5	21.8	84.5	83.0	94.7	ND	No
31D2	19.6	19.6	19.1	19.4	77.6	71.2	82.9	ND	No
31S1	19.3	18.3	18.8	19.9	76.3	71.6	83.3	ND	No
34E1	17.4	17.7	18.0	17.6	70.7	67.0	78.7	ND	No
34S2	14.3	15.8	17.4	18.2	65.7	71.6	83.3	ND	No
36D1	15.0	14.5	15.7	15.7	60.9	62.1	73.8	ND	No
36S2	17.6	18.1	19.4	18.4	73.5	73.4	85.1	ND	No
3S1	16.4	18.7	17.9	18.7	71.6	70.1	81.8	ND	No
4E1	13.3	14.0	13.5	13.3	54.1	51.4	63.1	ND	No
5H1	21.5	22.5	23.3	21.5	88.8	86.3	98.0	ND	No
5S1	17.8	20.5	19.8	20.0	78.1	80.0	91.7	ND	No
6C1	17.3	17.3	18.7	18.3	71.6	69.5	81.2	ND	No
7E1	18.5	20.1	19.5	19.5	77.5	74.6	86.3	ND	No
7S1	18.0	17.6	18.7	18.4	72.7	73.1	84.8	ND	No
9C1	17.6	19.1	17.3	17.6	71.6	68.1	79.8	ND	No

[(1)] **Baseline background dose (BB_A):** The estimated mean background radiation dose at each field monitoring location annually based on historical measurements, excluding any dose contribution from the monitored facility

[(2)] **Minimum differential dose (MDD_A)**: The smallest amount of facility related dose at each monitored location annually above the baseline background dose that can be reliably detected by an environmental dosimetry system

FIGURE C-1
MEAN MONTHLY TOTAL GROSS BETA CONCENTRATIONS IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF LGS, 1982 - 2020



Note: 2005 analysis changed from Insoluble & Soluble to Total Gross Beta

LGS CRITICALITY
UNIT NO. 1: 12/22/84
UNIT NO. 2: 08/11/89

LGS CHANGED TO TOTAL GROSS BETA AT THE BEGINNING OF 2005.
PREVIOUS DATA INCLUDED SUMMATION OF LESS THAN VALUES.

FIGURE C-2
MEAN MONTHLY GROSS BETA CONCENTRATIONS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF LGS, 1982 – 2020

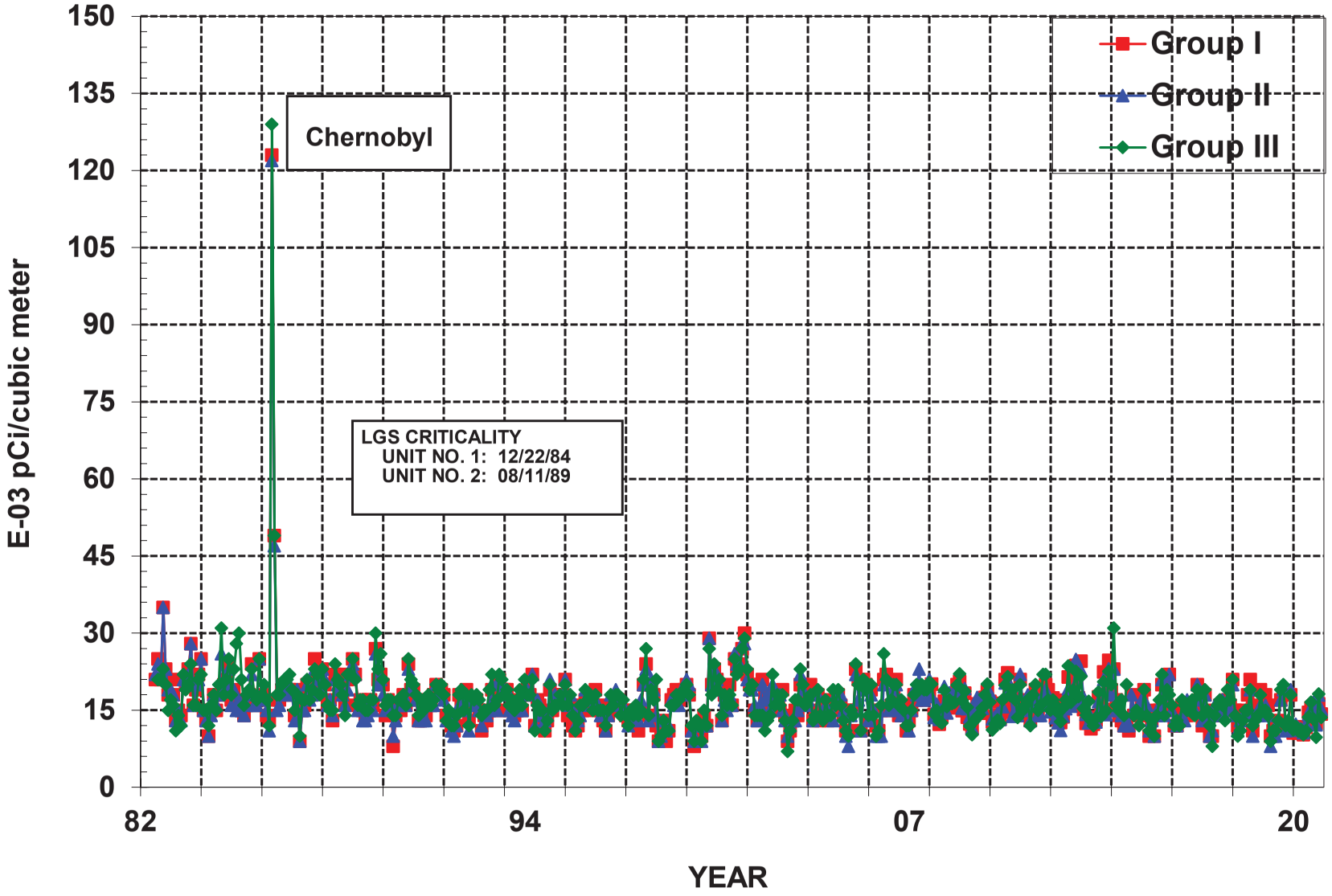
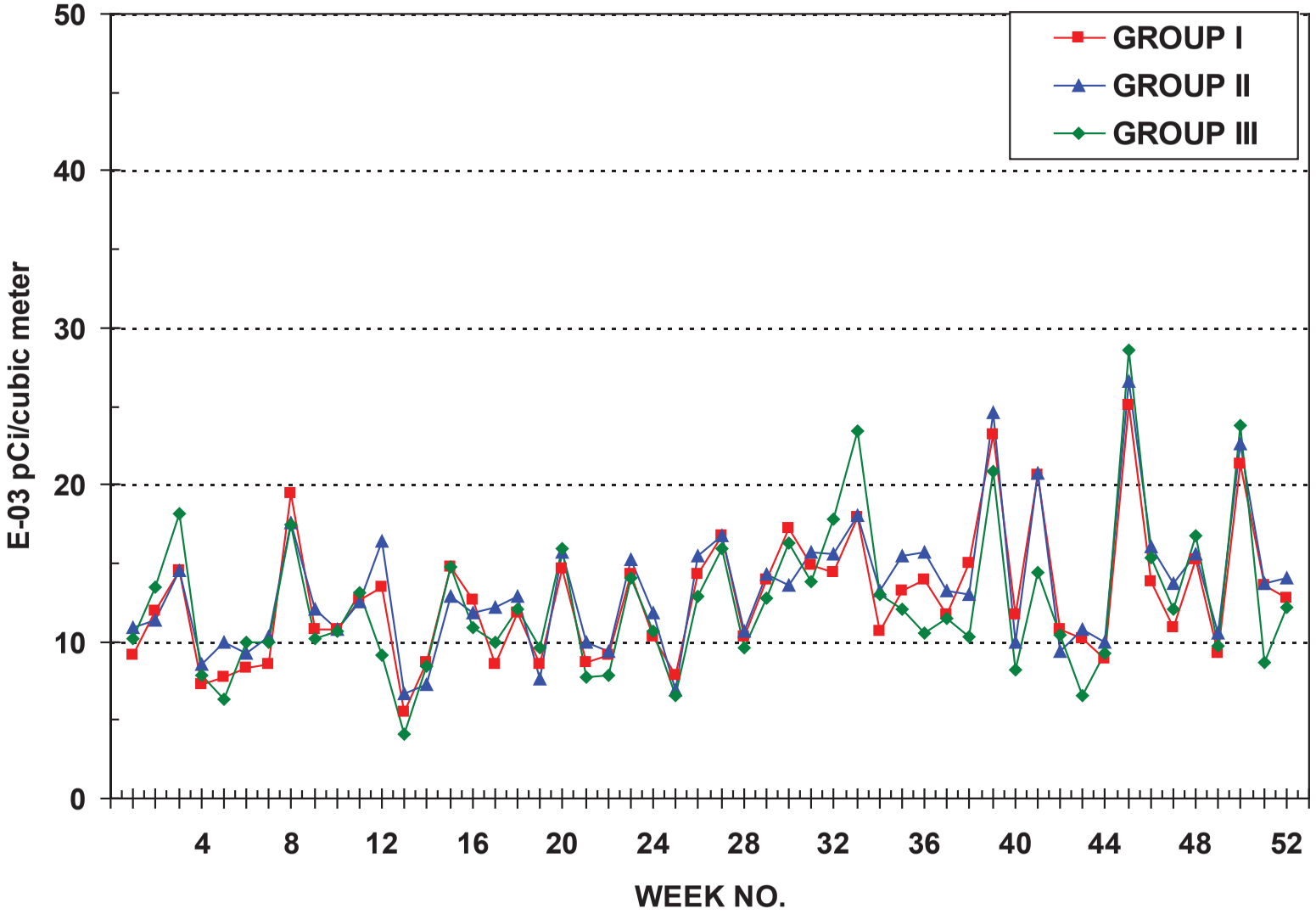


FIGURE C-3
MEAN WEEKLY GROSS BETA CONCENTRATIONS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF LGS, 2020



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APPENDIX D

DATA TABLES AND FIGURES
COMPARISON LABORATORY

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TABLE D-I.1 CONCENTRATIONS OF TOTAL GROSS BETA IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	16C2
12/30/19 - 02/03/20	2.0 ± 0.7
02/03/20 - 03/02/20	1.9 ± 0.7
03/02/20 - 03/30/20	1.4 ± 0.6
03/30/20 - 04/27/20	2.3 ± 0.7
04/27/20 - 06/02/20	2.2 ± 0.7
06/02/20 - 06/29/20	1.7 ± 0.7
06/29/20 - 07/28/20	4.5 ± 0.8
07/28/20 - 08/31/20	1.9 ± 0.6
08/31/20 - 09/29/20	3.8 ± 0.8
09/29/20 - 11/03/20	2.1 ± 0.7
11/03/20 - 12/01/20	2.0 ± 0.7
12/01/20 - 12/28/20	2.6 ± 0.8
MEAN ± 2 STD DEV	2.4 ± 1.8

TABLE D-I.2 CONCENTRATIONS OF I-131 IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	16C2
12/30/19 - 02/03/20	< 1.0
02/03/20 - 03/02/20	< 0.7
03/02/20 - 03/30/20	< 0.6
03/30/20 - 04/27/20	< 0.8
04/27/20 - 06/02/20	< 0.4
06/02/20 - 06/29/20	< 0.8
06/29/20 - 07/28/20	< 0.6
07/28/20 - 08/31/20	< 0.6
08/31/20 - 09/29/20	< 0.6
09/29/20 - 11/03/20	< 1.0
11/03/20 - 12/01/20	< 0.7
12/01/20 - 12/28/20	< 0.8
MEAN	-

TABLE D-I.3 CONCENTRATIONS OF TRITIUM IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	16C2
12/30/19 - 03/30/20	< 146
03/30/20 - 06/29/20	< 139
06/29/20 - 09/29/20	< 172
09/29/20 - 12/28/20	< 121
MEAN	-

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

TABLE D-I.4 **CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140
16C2	12/30/19 - 02/03/20	< 4	< 4	< 8	< 4	< 9	< 5	< 7	< 9	< 4	< 4	< 22	< 7
	02/03/20 - 03/02/20	< 3	< 3	< 7	< 3	< 6	< 4	< 6	< 6	< 3	< 3	< 17	< 6
	03/02/20 - 03/30/20	< 7	< 5	< 12	< 6	< 10	< 6	< 10	< 7	< 6	< 6	< 25	< 9
	03/30/20 - 04/27/20	< 4	< 4	< 9	< 4	< 7	< 4	< 7	< 8	< 4	< 4	< 19	< 8
	04/27/20 - 06/02/20	< 7	< 6	< 11	< 6	< 10	< 6	< 10	< 7	< 5	< 6	< 24	< 13
	06/02/20 - 06/29/20	< 3	< 3	< 7	< 3	< 6	< 4	< 6	< 8	< 3	< 4	< 19	< 6
	06/29/20 - 07/28/20	< 4	< 4	< 8	< 4	< 8	< 5	< 7	< 6	< 4	< 4	< 18	< 7
	07/28/20 - 08/31/20	< 5	< 4	< 9	< 5	< 12	< 5	< 8	< 6	< 5	< 5	< 19	< 7
	08/31/20 - 09/29/20	< 4	< 4	< 8	< 4	< 9	< 5	< 7	< 4	< 4	< 4	< 16	< 7
	09/29/20 - 11/03/20	< 5	< 5	< 10	< 5	< 11	< 6	< 9	< 10	< 5	< 6	< 34	< 9
	11/03/20 - 12/01/20	< 4	< 3	< 7	< 5	< 9	< 5	< 7	< 8	< 4	< 4	< 17	< 6
	12/01/20 - 12/28/20	< 4	< 4	< 8	< 4	< 9	< 4	< 7	8 7	< 4	< 5	< 19	< 7
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

TABLE D-II.1 CONCENTRATIONS OF GROSS BETA IN AIR PARTICULATE AND I-131 IN AIR IODINE SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020

RESULTS IN UNITS OF E-03 PCI/CU METER ± 2 SIGMA

COLLECTION PERIOD	11S2 GROSS BETA	11S2 I-131
12/30/19 - 01/06/20	16 ± 2	< 9
01/06/20 - 01/13/20	10 ± 2	< 11
01/13/20 - 01/21/20	23 ± 2	< 11
01/21/20 - 01/27/20	16 ± 2	< 23
01/27/20 - 02/03/20	12 ± 2	< 11
02/03/20 - 02/10/20	14 ± 2	< 13
02/10/20 - 02/17/20	19 ± 2	< 13
02/17/20 - 02/24/20	30 ± 2	< 12
02/24/20 - 03/02/20	21 ± 2	< 16
03/02/20 - 03/09/20	17 ± 2	< 10
03/09/20 - 03/16/20	19 ± 2	< 11
03/16/20 - 03/23/20	23 ± 2	< 19
03/23/20 - 03/30/20	11 ± 2	< 17
03/30/20 - 04/06/20	12 ± 1	< 20
04/06/20 - 04/13/20	19 ± 1	< 20
04/13/20 - 04/20/20	24 ± 1	< 27
04/20/20 - 04/27/20	18 ± 1	< 14
04/27/20 - 05/04/20	16 ± 2	< 17
05/04/20 - 05/11/20	15 ± 2	< 25
05/11/20 - 05/18/20	21 ± 2	< 19
05/18/20 - 05/26/20	14 ± 2	< 13
05/26/20 - 06/02/20	15 ± 2	< 17
06/02/20 - 06/08/20	20 ± 2	< 30
06/08/20 - 06/15/20	13 ± 2	< 12
06/15/20 - 06/22/20	12 ± 2	< 21
06/22/20 - 06/29/20	22 ± 2	< 17
06/29/20 - 07/06/20	18 ± 2	< 23
07/06/20 - 07/13/20	19 ± 2	< 18
07/13/20 - 07/20/20	21 ± 2	< 11
07/20/20 - 07/28/20	25 ± 2	< 14
07/28/20 - 08/04/20	28 ± 2	< 18
08/04/20 - 08/10/20	24 ± 2	< 23
08/10/20 - 08/17/20	32 ± 2	< 23
08/17/20 - 08/24/20	25 ± 2	< 18
08/24/20 - 08/31/20	23 ± 2	< 22
08/31/20 - 09/08/20	23 ± 2	< 13
09/08/20 - 09/14/20	17 ± 2	< 23
09/14/20 - 09/21/20	20 ± 2	< 16
09/21/20 - 09/29/20	38 ± 2	< 15
09/29/20 - 10/05/20	18 ± 2	< 27
10/05/20 - 10/12/20	29 ± 2	< 23
10/12/20 - 10/19/20	16 ± 2	< 15
10/19/20 - 10/26/20	14 ± 2	< 19
10/26/20 - 11/03/20	18 ± 2	< 15
11/03/20 - 11/10/20	44 ± 3	< 43
11/10/20 - 11/16/20	21 ± 2	< 17
11/16/20 - 11/23/20	22 ± 2	< 24
11/23/20 - 12/01/20	28 ± 3	< 23
12/01/20 - 12/07/20	18 ± 2	< 17
12/07/20 - 12/14/20	22 ± 3	< 49
12/14/20 - 12/21/20	*(1)*	*(1)*
12/21/20 - 12/28/20	27 ± 2	< 15
MEAN ± 2 STD DEV	20 ± 13	-

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUE

TABLE D-II.2 CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020

RESULTS IN UNITS OF E-03 PCI/CU METER ± 2 SIGMA

SITE	COLLECTION PERIOD	Be-7	Mn-54	Co-58	Co-60	Cs-134	Cs-137
11S2	12/30/19 - 03/30/20	70 ± 16	< 1.9	< 1.8	< 1.0	< 1.5	< 1.4
	03/30/20 - 06/29/20	82 ± 16	< 1.6	< 1.9	< 1.6	< 1.2	< 1.5
	06/29/20 - 09/29/20	76 ± 16	< 1.8	< 1.6	< 1.5	< 1.2	< 1.4
	09/29/20 - 12/28/20	50 ± 11	< 1.2	< 1.3	< 1.2	< 1.3	< 1.2
	MEAN ± 2 STD DEV	69 ± 28	-	-	-	-	-

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

TABLE D-III.1 CONCENTRATIONS OF I-131 BY CHEMICAL SEPARATION AND GAMMA EMITTERS IN MILK SAMPLES COLLECTED IN THE VICINITY OF LIMERICK GENERATING STATION, 2020

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	I-131	K-40	Cs-134	Cs-137	Ba-140	La-140
19B1	01/14/20	< 0.5	1330 ± 84	< 3	< 4	< 12	< 4
	04/06/20	< 0.8	1110 ± 95	< 4	< 5	< 21	< 7
	07/14/20	< 0.6	1300 ± 102	< 4	< 5	< 20	< 6
	10/06/20	< 0.8	1280 ± 100	< 4	< 4	< 21	< 6
MEAN ± 2 STD DEV		-	1255 ± 198	-	-	-	-
25C1	01/14/20	< 0.4	1160 ± 85	< 4	< 5	< 15	< 5
	04/06/20	< 0.6	1270 ± 101	< 5	< 5	< 21	< 7
	07/14/20	< 0.8	1410 ± 108	< 5	< 6	< 21	< 8
	10/06/20	< 0.7	1370 ± 105	< 4	< 5	< 24	< 7
MEAN ± 2 STD DEV		-	1303 ± 224	-	-	-	-

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES

FIGURE D-1
COMPARISON OF MONTHLY TOTAL GROSS BETA CONCENTRATIONS IN DRINKING WATER SAMPLES SPLIT BETWEEN EIS AND TBE, 2020

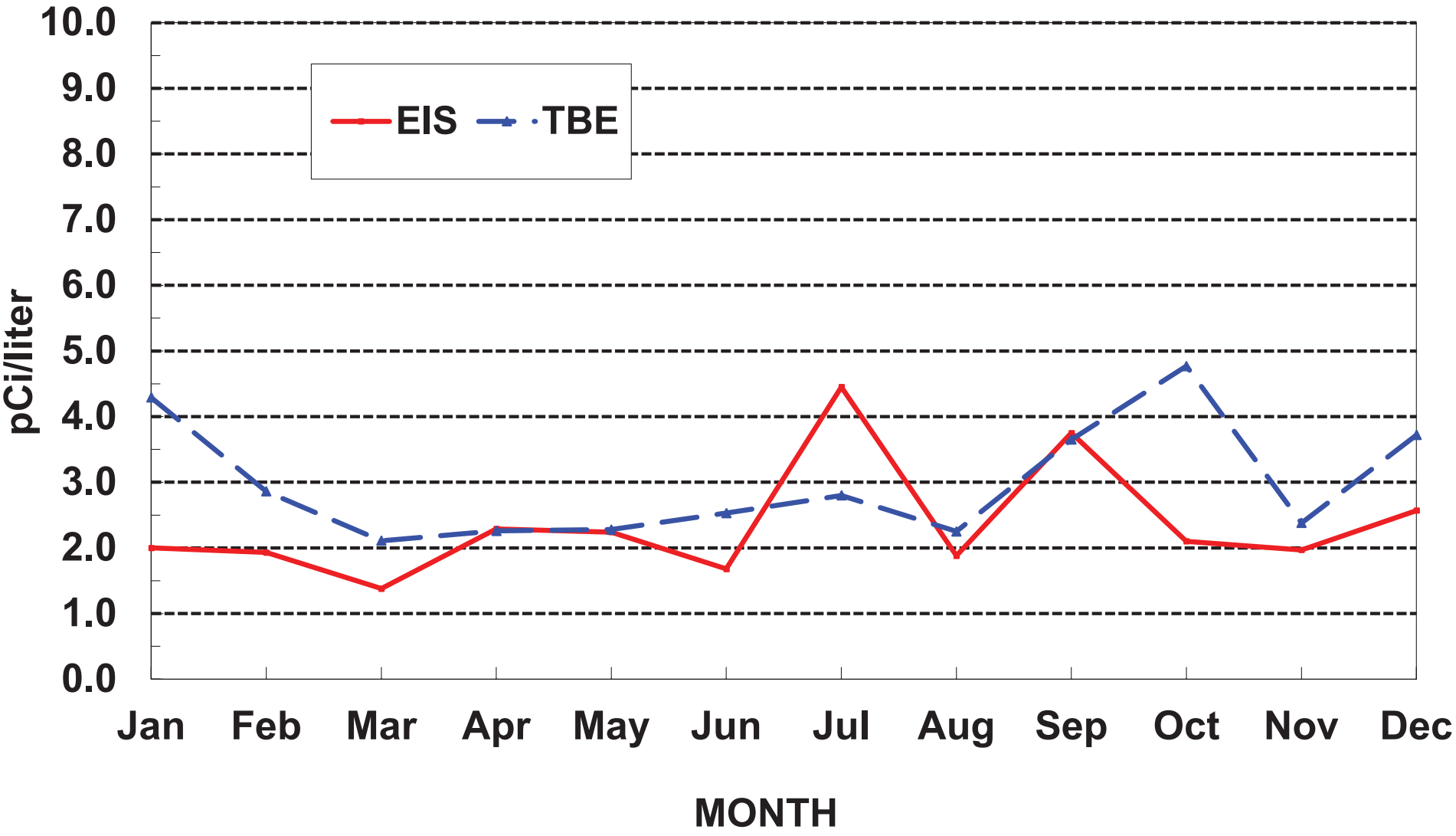
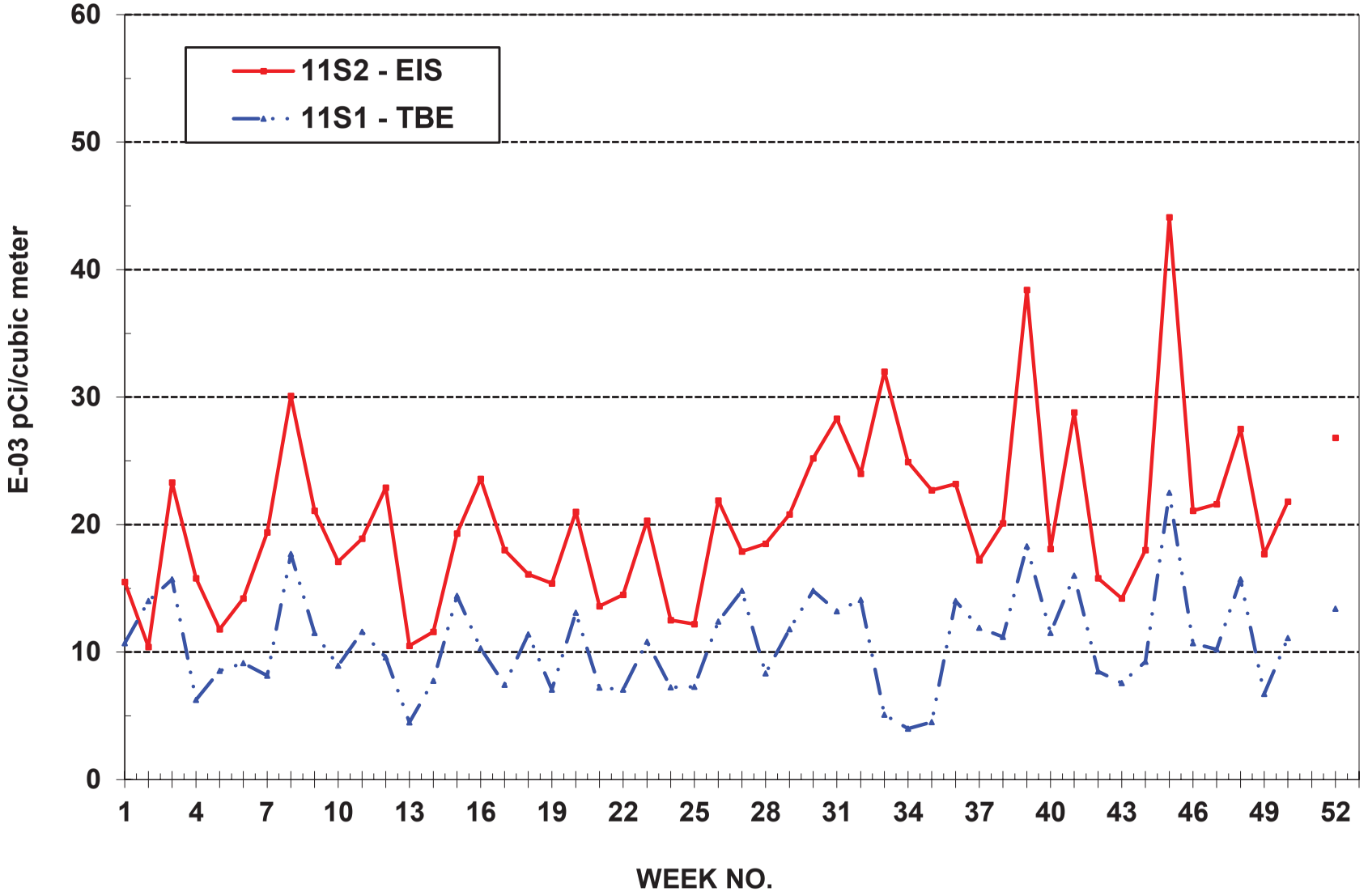


FIGURE D-2
COMPARISON OF WEEKLY GROSS BETA CONCENTRATIONS IN AIR PARTICULATE SAMPLES COLLECTED FROM LGS COLLOCATED LOCATIONS 11S1 AND 11S2, 2020



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APPENDIX E

INTER-LABORATORY COMPARISON PROGRAM

Table E.1 **Analytics Environmental Radioactivity Cross Check Program**
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Value	Known Value [(a)]	Ratio of TBE to Known Result	Evaluation [(b)]
September 2020	E13247	Milk	Sr-89	pCi/L	62.8	95.4	0.66	N[(1)]
			Sr-90	pCi/L	12.0	12.8	0.94	A
	E13248	Milk	Ce-141	pCi/L	156	150	1.04	A
			Co-58	pCi/L	172	180	0.96	A
			Co-60	pCi/L	369	379	0.97	A
			Cr-51	pCi/L	372	372	1.00	A
			Cs-134	pCi/L	171	200	0.85	A
			Cs-137	pCi/L	241	250	0.96	A
			Fe-59	pCi/L	217	200	1.08	A
			I-131	pCi/L	84.6	95.0	0.89	A
			Mn-54	pCi/L	175	180	0.97	A
			Zn-65	pCi/L	252	270	0.93	A
	E13249	Charcoal	I-131	pCi	70.2	75.8	0.93	A
	E13250	AP	Ce-141	pCi	101	101	1.00	A
			Co-58	pCi	111	120	0.92	A
			Co-60	pCi	249	254	0.98	A
			Cr-51	pCi	287	249	1.15	A
			Cs-134	pCi	114	134	0.85	A
			Cs-137	pCi	159	168	0.95	A
			Fe-59	pCi	127	134	0.95	A
			Mn-54	pCi	114	121	0.94	A
			Zn-65	pCi	168	181	0.93	A
	E13251	Soil	Ce-141	pCi/g	0.241	0.191	1.26	W
			Co-58	pCi/g	0.211	0.228	0.93	A
			Co-60	pCi/g	0.466	0.481	0.97	A
			Cr-51	pCi/g	0.450	0.472	0.95	A
			Cs-134	pCi/g	0.273	0.254	1.07	A
			Cs-137	pCi/g	0.370	0.390	0.95	A
			Fe-59	pCi/g	0.233	0.254	0.92	A
			Mn-54	pCi/g	0.217	0.229	0.95	A
			Zn-65	pCi/g	0.368	0.343	1.07	A
	E13252	AP	Sr-89	pCi	79.9	100.0	0.80	A
			Sr-90	pCi	12.1	13.4	0.90	A

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

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

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

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

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

*(1) See **NCR 20-19***

Table E.1 **Analytics Environmental Radioactivity Cross Check Program**
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Value	Known Value [(a)]	Ratio of TBE to Known Result	Evaluation [(b)]
December 2020	E13254	Milk	Sr-89	pCi/L	82.2	89.7	0.92	A
			Sr-90	pCi/L	12.4	13.0	0.96	A
	E13255	Milk	Ce-141	pCi/L	91.1	100	0.91	A
			Co-58	pCi/L	77.5	84.3	0.92	A
			Co-60	pCi/L	147	152	0.97	A
			Cr-51	pCi/L	259	253	1.02	A
			Cs-134	pCi/L	97.1	108	0.90	A
			Cs-137	pCi/L	117	127	0.92	A
			Fe-59	pCi/L	114	112	1.02	A
			I-131	pCi/L	84.3	91.9	0.92	A
			Mn-54	pCi/L	137	143	0.96	A
			Zn-65	pCi/L	175	190	0.92	A
	E13256	Charcoal	I-131	pCi	70.2	78.2	0.90	A
	E13257A	AP	Ce-141	pCi	67.4	74.6	0.90	A
			Co-58	pCi	57.9	62.9	0.92	A
			Co-60	pCi	108	113	0.95	A
			Cr-51	pCi	162	189	0.86	A
			Cs-134	pCi	68.1	80.4	0.85	A
			Cs-137	pCi	82.4	95.0	0.87	A
			Fe-59	pCi	80.5	83.7	0.96	A
			Mn-54	pCi	102	107	0.95	A
			Zn-65	pCi	115	142	0.81	A
	E13258	Soil	Ce-141	pCi/g	0.167	0.170	0.98	A
			Co-58	pCi/g	0.125	0.143	0.87	A
			Co-60	pCi/g	0.245	0.257	0.95	A
			Cr-51	pCi/g	0.393	0.429	0.92	A
			Cs-134	pCi/g	0.147	0.183	0.80	A
			Cs-137	pCi/g	0.260	0.288	0.90	A
			Fe-59	pCi/g	0.199	0.190	1.05	A
			Mn-54	pCi/g	0.229	0.243	0.94	A
			Zn-65	pCi/g	0.320	0.322	0.99	A
	E13259	AP	Sr-89	pCi	85.0	78.6	1.08	A
			Sr-90	pCi	13.1	11.4	1.15	A

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

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

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

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

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

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

Table E.2

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Value	Known Value [a]	Acceptance Range	Evaluation [b]
February 2020	20-GrF42	AP	Gross Alpha	Bq/sample	0.676	1.24	0.37 - 2.11	A
			Gross Beta	Bq/sample	2.03	2.00	1.00 - 3.00	A
	20-MaS42	Soil	Ni-63	Bq/kg	0.01		*(1)*	A
			Sr-90	Bq/kg	348	340	238 - 442	A
	20-MaW42	Water	Ni-63	Bq/L	11.6	11.1	7.8 - 14.4	A
			Pu-238	Bq/L	0.926	0.94	0.66 - 1.22	A
			Pu-239/240	Bq/L	0.712	0.737	0.516 - 0.958	A
	20-RdF42	AP	U-234/233	Bq/sample	0.0416	0.075	0.053 - 0.098	N[3]
			U-238	Bq/sample	0.0388	0.078	0.055 - 0.101	N[3]
	20-RdV42	Vegetation	Cs-134	Bq/sample	3.23	3.82	2.67 - 4.97	A
			Cs-137	Bq/sample	2.64	2.77	1.94 - 3.60	A
			Co-57	Bq/sample	0.0281		*(1)*	A
			Co-60	Bq/sample	2.62	2.79	1.95 - 3.63	A
			Mn-54	Bq/sample	4.3	4.58	3.21 - 5.95	A
			Sr-90	Bq/sample	0.396	0.492	0.344 - 0.640	A
			Zn-65	Bq/sample	3.93	3.79	2.65 - 4.93	A
August 2020	20-GrF43	AP	Gross Alpha	Bq/sample	0.267	0.528	0.158 - 0.989	A
			Gross Beta	Bq/sample	0.939	0.915	0.458 - 1.373	A
	20-MaS43	Soil	Ni-63	Bq/kg	438	980	686 - 1274	N[4]
			Tc-99	Bq/kg	1.11		*(1)*	A
	20-MaW43	Water	Ni-63	Bq/L	0.175		*(1)*	A
			Tc-99	Bq/L	8.8	9.4	6.6 - 12.2	A
	20-RdV43	Vegetation	Cs-134	Bq/sample	3.635	4.94	3.46 - 6.42	W
			Cs-137	Bq/sample	0.0341		*(1)*	A
			Co-57	Bq/sample	5.855	6.67	4.67 - 8.67	W
			Co-60	Bq/sample	3.122	4.13	2.89 - 5.37	W
			Mn-54	Bq/sample	4.524	5.84	4.09 - 7.59	A
			Sr-90	Bq/sample	1.01	1.39	0.97 - 1.81	W
			Zn-65	Bq/sample	4.706	6.38	4.47 - 8.29	W

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

(b) DOE/MAPEP evaluation:

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

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

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

(1) False positive test

(2) Sensitivity evaluation

*(3) See **NCR 20-13***

*(4) See **NCR 20-20***

Table E.3

ERA Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Value	Known Value [(a)]	Acceptance Limits	Evaluation [(b)]
March 2020	MRAD-32	Water	Am-241	pCi/L	52.5	45.3	31.1 - 57.9	A
			Fe-55	pCi/L	155	152	89.3 - 221	A
			Pu-238	pCi/L	34.0	36.4	21.9 - 47.2	A
			Pu-239	pCi/L	30.9	33.6	20.8 - 41.4	A
April 2020	RAD-121	Water	Ba-133	pCi/L	41.8	41.8	34.0- 46.7	A
			Cs-134	pCi/L	42.9	46.3	37.1 - 50.9	A
			Cs-137	pCi/L	226	234	211 - 259	A
			Co-60	pCi/L	52.4	50.3	45.3 - 57.9	A
			Zn-65	pCi/L	83.3	86.8	78.1 - 104	A
			GR-A	pCi/L	20.1	23.6	11.9 - 31.6	A
			GR-B	pCi/L	45.6	60.5	41.7 - 67.2	A
			U-Nat	pCi/L	18.45	18.6	14.9 - 20.9	A
			H-3	pCi/L	14200	14100	12300 - 15500	A
			Sr-89	pCi/L	58.0	60.1	48.3 - 67.9	A
			Sr-90	pCi/L	34.1	44.7	33.0 - 51.2	A
			I-131	pCi/L	27.4	28.9	24.1 - 33.8	A
September 2020	MRAD-33	Soil	Sr-90	pCi/Kg	4360	4980	1550 - 7760	A
		AP	Fe-55	pCi/Filter	189	407	149 - 649	A
			U-234	pCi/Filter	17.9	18.3	13.6 - 21.4	A
			U-238	pCi/Filter	19.1	18.1	13.7 - 21.6	A
		Water	Am-241	pCi/L	160	176	121 - 225	A
			Fe-55	pCi/L	299	298	175 - 433	A
			Pu-238	pCi/L	200	191	115 - 247	A
			Pu-239	pCi/L	105	100	61.9 - 123	A
October 2020	RAD-123	Water	Ba-133	pCi/L	37.1	37.0	29.8 - 41.6	A
			Cs-134	pCi/L	50.6	52.7	42.5 - 58.0	A
			Cs-137	pCi/L	131	131	118 - 146	A
			Co-60	pCi/L	62.9	60.5	54.4 - 69.1	A
			Zn-65	pCi/L	167	162	146 - 191	A
			GR-A	pCi/L	40.0	26.2	13.3 - 34.7	N[(1)]
			GR-B	pCi/L	47.5	69.1	48.0 - 76.0	N[(1)]
			U-Nat	pCi/L	17.2	20.3	16.3 - 22.7	A
			H-3	pCi/L	23800	23200	20,300 - 25,500	A
			Sr-89	pCi/L	41.1	43.3	33.4 - 50.5	A
			Sr-90	pCi/L	28.5	30.2	22.0 - 35.0	A
			I-131	pCi/L	22.9	28.2	23.5 - 33.1	N[(2)]
November 2020	QR111920K	Water	GR-A	pCi/L	50.7	52.4	27.3 - 65.6	A
			GR-B	pCi/L	24.9	24.3	15.0 - 32.3	A

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

(b) ERA evaluation:

A = Acceptable - Reported value falls within the Acceptance Limits

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

*(1) See **NCR 20-18***

*(2) See **NCR 20-17***

TABLE E.4 **Analytics Environmental Radioactivity Cross Check Program**
Exelon Industrial Services (2020)

Month/Year	Identification Number	Matrix	Nuclide	Units	EIS Reported Value	Known Value [(a)]	Ratio of Analytics to EIS Result	Evaluation [(b)]
June 2020	E13065 Detector 2	AP	Ce-141	pCi/Filter	71.5	75.5	95	Pass
			Co-58	pCi/Filter	60.7	65.4	93	Pass
			Co-60	pCi/Filter	125	127	98	Pass
			Cr-51	pCi/Filter	115	167	69	Pass
			Cs-134	pCi/Filter	82.9	95.2	87	Pass
			Cs-137	pCi/Filter	64.0	67.5	95	Pass
			Fe-59	pCi/Filter	65.8	65.7	100	Pass
			Mn-54	pCi/Filter	87.3	87.0	100	Pass
			Zn-65	pCi/Filter	136	146	93	Pass
	E13065 Detector 3	AP	Ce-141	pCi/Filter	68.0	75.5	90	Pass
			Co-58	pCi/Filter	67.3	65.4	103	Pass
			Co-60	pCi/Filter	125	127	99	Pass
			Cr-51	pCi/Filter	135	167	81	Pass
			Cs-134	pCi/Filter	83.9	95.2	88	Pass
			Cs-137	pCi/Filter	70.9	67.5	105	Pass
			Fe-59	pCi/Filter	72.4	65.7	110	Pass
			Mn-54	pCi/Filter	91.8	87.0	106	Pass
			Zn-65	pCi/Filter	154	146	106	Pass
	E13065 Detector 4	AP	Ce-141	pCi/Filter	82.8	75.5	110	Pass
			Co-58	pCi/Filter	55.0	65.4	84	Pass
			Co-60	pCi/Filter	124	127	98	Pass
			Cr-51	pCi/Filter	159	167	95	Pass
			Cs-134	pCi/Filter	75.8	95.2	80	Pass
			Cs-137	pCi/Filter	64.2	67.5	95	Pass
			Fe-59	pCi/Filter	82.9	65.7	126	Pass
			Mn-54	pCi/Filter	88.3	87.0	102	Pass
			Zn-65	pCi/Filter	153	146	105	Pass
	E13065 Detector 5	AP	Ce-141	pCi/Filter	79.4	75.5	105	Pass
			Co-58	pCi/Filter	62.1	65.4	95	Pass
			Co-60	pCi/Filter	136	127	107	Pass
			Cr-51	pCi/Filter	179	167	107	Pass
			Cs-134	pCi/Filter	81.4	95.2	86	Pass
			Cs-137	pCi/Filter	71.8	67.5	106	Pass
			Fe-59	pCi/Filter	71.7	65.7	109	Pass
			Mn-54	pCi/Filter	94.1	87.0	108	Pass
			Zn-65	pCi/Filter	152	146	104	Pass
June 2020	E13062 Detectors 2,3,4,5	AP	I-131	pCi/Filter	82.5	91.7	90	Pass
			I-131	pCi/Filter	87.6	91.7	96	Pass
			I-131	pCi/Filter	88.1	91.7	96	Pass
			I-131	pCi/Filter	86.2	91.7	94	Pass
	E13063	Water	Gr-B	pCi/L	273	272	100	Pass
	E13060 Detector 2	Milk	I-131	pCi/L	80.8	81.5	99	Pass
			Ce-141	pCi/L	107	116	92	Pass
			Co-58	pCi/L	107	100	107	Pass
			Co-60	pCi/L	200	195	103	Pass
			Cr-51	pCi/L	223	256	87	Pass
			Cs-134	pCi/L	142	146	97	Pass
			Cs-137	pCi/L	97.9	104	94	Pass
			Fe-59	pCi/L	96.0	101	95	Pass
			Mn-54	pCi/L	154	134	115	Pass
			Zn-65	pCi/L	225	225	100	Pass

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

(b) Analytics evaluation based on EIS internal QC limits in accordance with the NRC Resolution Test criteria

TABLE E.4 **Analytics Environmental Radioactivity Cross Check Program**
Exelon Industrial Services (2020)

Month/Year	Identification Number	Matrix	Nuclide	Units	EIS Reported Value	Known Value [(a)]	Ratio of Analytics to EIS Result	Evaluation [(b)]
	E13060 Detector 3	Milk	I-131	pCi/L	81.2	81.5	100	Pass
			Ce-141	pCi/L	106	116	91	Pass
			Co-58	pCi/L	101	100	101	Pass
			Co-60	pCi/L	195	195	100	Pass
			Cr-51	pCi/L	250	256	98	Pass
			Cs-134	pCi/L	131	146	90	Pass
			Cs-137	pCi/L	102	104	98	Pass
			Fe-59	pCi/L	99.1	101	98	Pass
			Mn-54	pCi/L	133	134	99	Pass
			Zn-65	pCi/L	189	225	84	Pass
	E13060 Detector 4	Milk	I-131	pCi/L	71.4	81.5	88	Pass
			Ce-141	pCi/L	114	116	98	Pass
			Co-58	pCi/L	99.2	100	99	Pass
			Co-60	pCi/L	199	195	102	Pass
			Cr-51	pCi/L	251	256	98	Pass
			Cs-134	pCi/L	125	146	86	Pass
			Cs-137	pCi/L	98.9	104	95	Pass
			Fe-59	pCi/L	104	101	103	Pass
			Mn-54	pCi/L	124	134	92	Pass
			Zn-65	pCi/L	211	225	94	Pass
	E13060 Detector 5	Milk	I-131	pCi/L	87.3	81.5	107	Pass
			Ce-141	pCi/L	118	116	102	Pass
			Co-58	pCi/L	94.9	100	95	Pass
			Co-60	pCi/L	181	195	93	Pass
			Cr-51	pCi/L	231	256	90	Pass
			Cs-134	pCi/L	128	146	88	Pass
			Cs-137	pCi/L	101	104	97	Pass
			Fe-59	pCi/L	106	101	105	Pass
			Mn-54	pCi/L	130	134	97	Pass
			Zn-65	pCi/L	200	225	89	Pass
	E13064 Detector 2	Water	I-131	pCi/L	63.9	80.5	79	Pass
			Ce-141	pCi/L	116	117	99	Pass
			Co-58	pCi/L	91.4	102	90	Pass
			Co-60	pCi/L	201	198	101	Pass
			Cr-51	pCi/L	208	259	80	Pass
			Cs-134	pCi/L	150	148	101	Pass
			Cs-137	pCi/L	109	105	104	Pass
			Fe-59	pCi/L	116	102	114	Pass
			Mn-54	pCi/L	129	135	95	Pass
			Zn-65	pCi/L	218	227	96	Pass
	E13064 Detector 4	Water	I-131	pCi/L	67.4	80.5	84	Pass
			Ce-141	pCi/L	126	117	107	Pass
			Co-58	pCi/L	100	102	98	Pass
			Co-60	pCi/L	204	198	103	Pass
			Cr-51	pCi/L	216	259	83	Pass
			Cs-134	pCi/L	150	148	102	Pass
			Cs-137	pCi/L	106	105	101	Pass
			Fe-59	pCi/L	119	102	116	Pass
			Mn-54	pCi/L	159	135	117	Pass
			Zn-65	pCi/L	211	227	93	Pass

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

(b) Analytics evaluation based on EIS internal QC limits in accordance with the NRC Resolution Test criteria

TABLE E.4 **Analytics Environmental Radioactivity Cross Check Program**
Exelon Industrial Services (2020)

Month/Year	Identification Number	Matrix	Nuclide	Units	EIS Reported Value	Known Value [a]	Ratio of Analytics to EIS Result	Evaluation [b]
	E13064	Water	I-131	pCi/L	90.2	80.5	112	Pass
			Ce-141	pCi/L	119	117	102	Pass
			Co-58	pCi/L	110	102	108	Pass
			Co-60	pCi/L	188	198	95	Pass
			Cr-51	pCi/L	229	259	89	Pass
			Cs-134	pCi/L	141	148	95	Pass
			Cs-137	pCi/L	105	105	100	Pass
			Fe-59	pCi/L	106	102	104	Pass
			Mn-54	pCi/L	150	135	111	Pass
			Zn-65	pCi/L	221	227	97	Pass
September 2020	E13066	AP	Gr-B	pCi	174	162	107	Pass
			Gr-B	pCi	175	162	108	Pass
December 2020	E13067	AP	Ce-141	pCi/Filter	77.1	78.4	98.3	Pass
	Detector 2		Co-58	pCi/Filter	64.3	66.1	97.2	Pass
			Co-60	pCi/Filter	117	119	98.3	Pass
			Cr-51	pCi/Filter	184	199	92.3	Pass
			Cs-134	pCi/Filter	79.3	84.5	93.8	Pass
			Cs-137	pCi/Filter	92.3	99.9	92.4	Pass
			Fe-59	pCi/Filter	101	87.9	115	Pass
			Mn-54	pCi/Filter	109	112	97.5	Pass
			Zn-65	pCi/Filter	105	149	70.6	Fail(1)
December 2020	E13067	AP	Ce-141	pCi/Filter	83.9	78.4	107	Pass
	Detector 5		Co-58	pCi/Filter	63.0	66.1	95.3	Pass
			Co-60	pCi/Filter	124	119	104	Pass
			Cr-51	pCi/Filter	197	199	98.9	Pass
			Cs-134	pCi/Filter	72.2	85	85.5	Pass
			Cs-137	pCi/Filter	95.0	99.9	95.1	Pass
			Fe-59	pCi/Filter	111	87.9	126	Pass
			Mn-54	pCi/Filter	125	112	112	Pass
			Zn-65	pCi/Filter	111	149	74.7	Fail(1)
December 2020	E13068	Water	Gr-B	pCi/L	300	277	108	Pass
	E13070	Cartridge	I-131	pCi	73.4	78.3	93.7	Pass
	Detector 2, 5			pCi	79.4	78.3	101	Pass
	E13070	Milk	I-131	pCi/L	83.3	91.9	90.6	Pass
			Ce-141	pCi/L	106	100	106	Pass
			Co-58	pCi/L	72.7	84.3	86.3	Pass
			Co-60	pCi/L	150	152	98.8	Pass
			Cr-51	pCi/L	231	253	91.4	Pass
			Cs-134	pCi/L	89.6	108	83.0	Pass
			Cs-137	pCi/L	120	127	94.6	Pass
			Fe-59	pCi/L	116	112	103	Pass
			Mn-54	pCi/L	146	143	102	Pass
			Zn-65	pCi/L	135	190	71.2	Fail(1)

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

(b) Analytics evaluation based on EIS internal QC limits in accordance with the NRC Resolution Test criteria

(1) Failures caused by clerical error in calculation spreadsheet

TABLE E.5 ERA Environmental Radioactivity Cross Check Program
Exelon Industrial Services (2020)

Month/Year	ID Number	Matrix	Nuclide	Units	EIS Reported Value	Known Value [a]	Acceptance Ratio of ERA to EIS Result	Evaluation [b]
April 2020	RAD-121	Water	Ba-133	pCi/L	40.1	41.8	96	Pass
			Cs-134	pCi/L	46.5	46.3	100	Pass
			Cs-137	pCi/L	225	234	96	Pass
			Co-60	pCi/L	50.7	50.3	101	Pass
			Zn-65	pCi/L	87.8	86.8	101	Pass
			I-131	pCi/L	29.7	28.9	103	Pass
			GR-B	pCi/L	43.3	60.5	72	Fail(2)
September 2020	MRAD-33	AP	Am-241	pCi/Filter	26.1	22.2	118	Pass
			Cs-134	pCi/Filter	270	296	91	Pass
			Cs-137	pCi/Filter	439	413	106	Pass
			Co-60	pCi/Filter	528	497	106	Pass
			Zn-65	pCi/Filter	528	500	106	Pass
October 2020	RAD-123	Water	Ba-133	pCi/L	33.3	37.0	90	Pass
	Detector 2		Cs-134	pCi/L	53.7	52.7	102	Pass
			Cs-137	pCi/L	136	131	104	Pass
			Co-60	pCi/L	68.8	60.6	114	Pass
			Zn-65	pCi/L	150	162	93	Pass
			I-131	pCi/L	27.5	28.2	97	Pass

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

(b) ERA evaluation based on EIS internal QC limits in accordance with the NRC Resolution Test criteria

(2) Passed vendor acceptance criteria, but failed NRC Resolution Test criteria

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APPENDIX E

ERRATA DATA

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There was no errata data for 2020.

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APPENDIX G

ANNUAL RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM REPORT (ARGPPR)

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Docket No: 50-352
50-353

LIMERICK GENERATING STATION
UNITS 1 AND 2

Annual Radiological Groundwater Protection Program Report

1 January through 31 December 2020

Prepared By
Teledyne Brown Engineering
Environmental Services

Exelon Generation®

Limerick Power Station
Pottstown, PA 19464

April 2021

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Table of Contents

Appendices

I. Summary and Conclusions

This report on the Radiological Groundwater Protection Program (RGPP) conducted for the Limerick Generating Station (LGS) by Exelon Nuclear covers the period 01 January 2020 through 31 December 2020. During that time period, 117 analyses were performed on 53 samples from 13 groundwater and 12 precipitation water locations collected from the environment, both on and off station property in 2020.

Groundwater samples were analyzed for tritium. Low levels of tritium were detected at 2 of the 13 groundwater monitoring locations. All other results were less than the required Exelon-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.

Groundwater was analyzed for gross alpha in dissolved and suspended fractions. Gross alpha (dissolved) was detected at 3 of the 13 groundwater locations sampled. Gross alpha (suspended) was detected at 2 of the 13 groundwater locations sampled.

Groundwater was analyzed for gamma-emitting radionuclides associated with the renewed licensed plant operation. Naturally-occurring potassium-40 (K-40) was detected in 1 of 13 groundwater locations. All other gamma isotopic 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. No HTD analyses were performed in 2020.

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 MWt boiling water reactors owned and operated by Exelon Corporation, is located adjacent to the Schuylkill River in Montgomery County, Pennsylvania. Unit No. 1 went critical on 22 December 1984. Unit No. 2 went critical on 11 August 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 2020.

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 Exelon Industrial Services (EIS). This section describes the general collection methods used to obtain environmental samples for the LGS RGPP in 2020. Sample locations can be found in Table A–1, Appendix A.

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 (^{3}He). 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 2020. The analytical procedures used by the laboratories are listed in the AREOR Appendix B Table B-3.

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. Exelon 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. Exelon 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 an Exelon 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 Exelon 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 B, Table B–I.1) Tritium values ranged from non-detectable to 743 pCi/L. Although no drinking water pathway is available from groundwater, the theoretical dose via the drinking water pathway was calculated at 0.044 mrem to a child (total body), which represents 0.73% of the 10 CFR 50, Appendix I dose limit of 6 mrem.

Strontium

Samples were analyzed for Sr-89 and Sr-90. All results were below the required LLDs. (Appendix B, Table B–I.1)

Gross Alpha (dissolved and suspended)

All samples were analyzed for gross alpha in the dissolved and suspended fractions once in July 2020. An additional sample was taken in October at one location. Gross alpha (dissolved) was detected in 3 of the 13 groundwater locations. The concentrations ranged from 1.6 to 3.4 pCi/L. Gross alpha (suspended) was detected in 2 of 13 groundwater locations sampled with concentrations ranging from 2.3 to 11.0 pCi/L. (Appendix B, Table B-I.1)

Gamma Emitters

Samples were analyzed for gamma-emitting nuclides. Naturally-occurring potassium-40 (K-40) was detected in 1 of the 13 locations sampled at a concentration of 40 pCi/L, All other gamma results were below the required LLDs. (Appendix B, Table B-I.2)

Hard-To-Detect

No HTD analyses were performed in 2020. (Appendix B, Table B-I.3)

B. Precipitation Sample Results

Tritium

Tritium activity was detected in 6 of 12 precipitation water locations analyzed. The concentrations ranged from 193 to 464 pCi/L. These

concentrations are consistent with historical values observed. (Appendix B, Table B-II.1)

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 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 2019, DW-LR-1 pumped 6,785,500 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 2019, 1,709,275 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.

E. Leaks, Spills, and Releases

There were no spills to ground containing radioactive material in 2020.

F. Trends

Low level tritium detections in monitoring well MW-LR-5 are being trended.

G. Investigations

Intermittent, low-level tritium detections in monitoring well MW-LR-5 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

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APPENDIX A

LOCATION DESIGNATION

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TABLE A-1: Radiological Groundwater Protection Program – Sampling Locations for the Limerick Generating Station, 2020

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

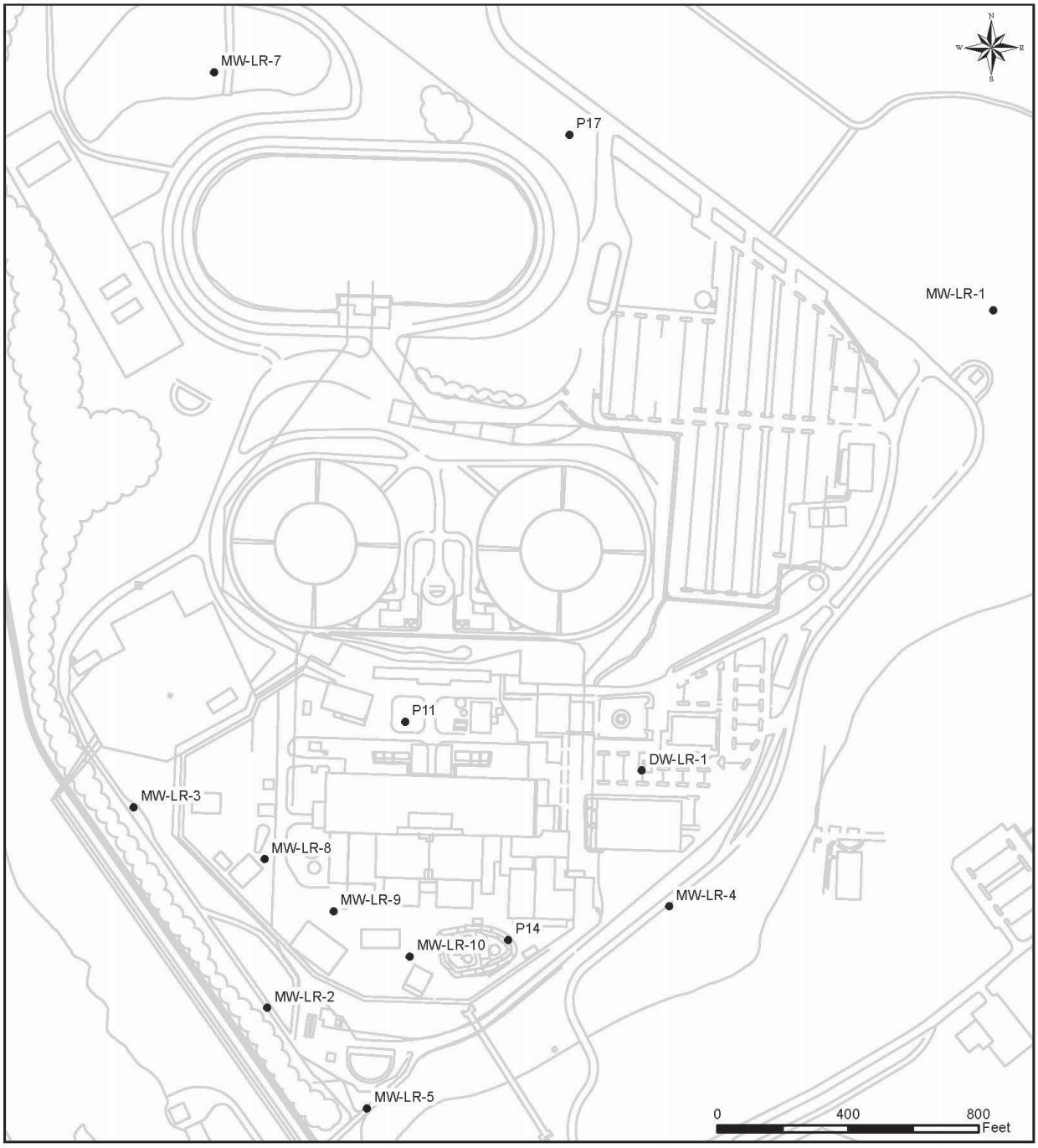

Figure 1 Routine Well Water Sample Locations for the Radiological Groundwater Protection Program, Limerick Generating Station, 2020

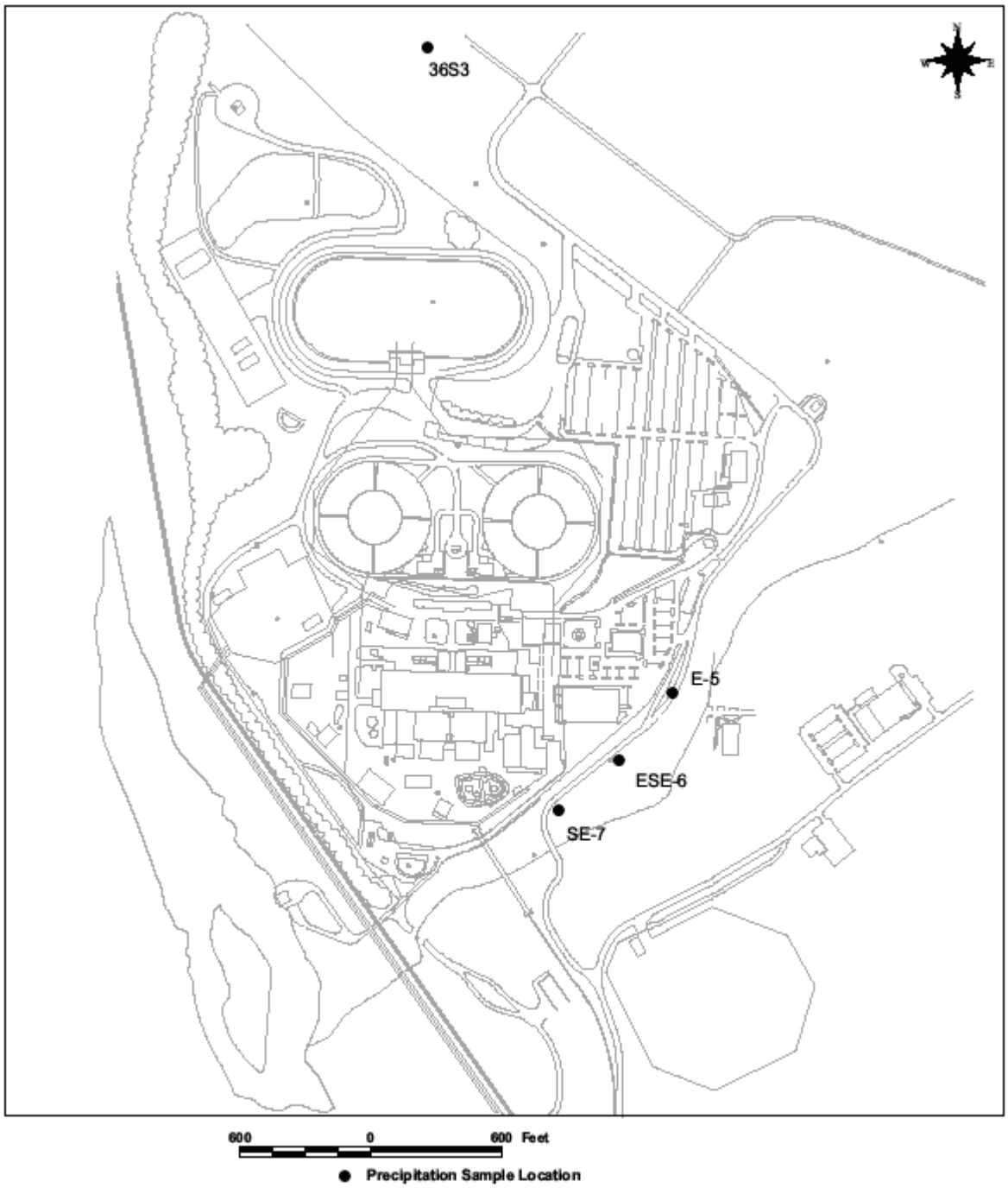

Figure 2 Routine Precipitation Sample Locations for the Radiological Groundwater Protection Program, Limerick Generating Station, 2020

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APPENDIX B

DATA TABLES

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TABLE B-I.1 CONCENTRATIONS OF TRITIUM, STRONTIUM, AND GROSS ALPHA IN WELL WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, LIMERICK GENERATING STATION, 2020

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE		H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)
DW-LR-1	01/28/20		< 186				
DW-LR-1	07/22/20		< 160	< 7.0	< 0.8	1.6 ± 0.7	< 0.6
DW-LR-1	10/28/20		< 183				
MW-LR-1	07/21/20		< 161				
MW-LR-2	07/21/20		< 163				
MW-LR-3	07/21/20		< 165				
MW-LR-4	01/28/20		< 182				
MW-LR-4	07/21/20		< 164	< 8.5	< 0.8	< 1.2	< 0.6
MW-LR-4	10/27/20		< 180				
MW-LR-5	07/21/20		< 163				
MW-LR-7	07/21/20		< 168				
MW-LR-8	01/28/20		519 ± 137				
MW-LR-8	07/22/20		417 ± 118	< 5.8	< 1.0	< 1.1	2.6 ± 1.1
MW-LR-8	07/22/20	*DUP*	536 ± 122	< 7.8	< 0.8	< 1.1	2.3 ± 1.1
MW-LR-8	07/22/20	*GEL*	451 ± 190	< 2.7	< 0.9	*(1)*	9.7 ± 2.3
MW-LR-8	10/28/20		518 ± 135				
MW-LR-8	10/28/20	*DUP*	375 ± 128				
MW-LR-8	10/28/20	*GEL*	456 ± 96				
MW-LR-9	01/28/20		743 ± 153				
MW-LR-9	01/28/20	*DUP*	742 ± 152				
MW-LR-9	01/28/20	*GEL*	835 ± 162				
MW-LR-9	07/22/20		648 ± 133	< 2.6	< 0.9	< 0.8	7.6 ± 2.6
MW-LR-9	07/22/20	*DUP*	672 ± 135	< 3.5	< 0.8	< 1.0	6.3 ± 2.7
MW-LR-9	07/22/20	*GEL*	698 ± 205	< 8.5	< 0.4	*(1)*	5.2 ± 3.3
MW-LR-9	10/28/20		623 ± 143			2.6 ± 1.3	11.0 ± 5.3
MW-LR-9	10/28/20	*DUP*	674 ± 142			< 2.0	9.3 ± 4.4
MW-LR-9	10/28/20	*GEL*	542 ± 102			*(1)*	123 ± 15.9
MW-LR-10	01/28/20		< 186				
MW-LR-10	07/22/20		< 161	< 8.3	< 0.7	3.4 ± 1.0	< 0.6
MW-LR-10	10/28/20		< 185				
P11	01/28/20		< 188				
P11	07/22/20		< 160	< 6.4	< 0.7	< 1.1	< 0.6
P11	10/28/20		< 187				
P14	01/28/20		< 184				
P14	07/22/20		< 162	< 6.3	< 0.9	< 2.3	< 0.9
P14	10/28/20		< 185				
P17	07/21/20		< 166				

(1) Total gross alpha results reported (not dissolved/suspended)

TABLE B-I.2 **CONCENTRATIONS OF GAMMA EMITTERS IN WELL WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, LIMERICK GENERATING STATION, 2020**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE		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	La-140
DW-LR-1	07/22/20		< 19	< 32	< 2	< 2	< 5	< 3	< 5	< 3	< 4	< 4	< 2	< 2	< 11	< 4
MW-LR-1	07/21/20		< 17	< 32	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 4	< 2	< 2	< 10	< 3
MW-LR-2	07/21/20		< 16	< 39	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 3	< 2	< 2	< 9	< 3
MW-LR-3	07/21/20		< 18	< 22	< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 3	< 2	< 2	< 10	< 4
MW-LR-4	07/21/20		< 17	< 20	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 3	< 2	< 2	< 10	< 3
MW-LR-5	07/21/20		*< 19*	*< 30*	< 2	< 2	< 5	< 2	< 5	< 3	< 4	< 4	< 2	< 2	< 11	< 4
MW-LR-7	07/21/20		< 17	< 19	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 4	< 2	< 2	< 10	< 4
MW-LR-8	07/22/20		< 16	< 37	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 3	< 2	< 2	< 10	< 3
MW-LR-8	07/22/20	*DUP*	< 18	< 33	< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 4	< 2	< 2	< 11	< 4
MW-LR-8	07/22/20	*GEL*	*(1)*	*(1)*	< 1	< 2	< 4	< 2	< 3	< 2	< 3	< 5	< 2	< 2	< 12	< 4
MW-LR-9	07/22/20		< 15	< 32	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 4	< 2	< 2	< 9	< 3
MW-LR-9	07/22/20	*DUP*	< 19	< 19	< 2	< 2	< 4	< 2	< 5	< 2	< 4	< 4	< 3	< 2	< 11	< 3
MW-LR-9	07/22/20	*GEL*	*(1)*	*(1)*	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 5	< 2	< 2	< 12	< 4
MW-LR-10	07/22/20		< 21	< 28	< 2	< 2	< 5	< 2	< 5	< 3	< 4	< 5	< 2	< 2	< 13	< 4
P11	07/22/20		< 21	< 21	< 2	< 2	< 5	< 2	< 4	< 3	< 4	< 4	< 3	< 2	< 12	< 4
P14	07/22/20		< 14	< 28	< 1	< 2	< 3	< 2	< 3	< 2	< 3	< 3	< 2	< 2	< 9	< 3
P17	07/21/20		< 15	40 ± 25	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 3	< 2	< 2	< 8	< 3

(1) No result reported

TABLE B-I.3 **CONCENTRATIONS OF HARD TO DETECTS IN GROUNDWATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, LIMERICK GENERATING STATION, 2020**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION PERIOD	AM-241	CM-242	CM-243/244	PU-238	PU-239	U-233/234	U-235	U-238	FE-55	NI-63

There were no HTD's Analyzed in 2020

TABLE B-II.1 CONCENTRATIONS OF TRITIUM IN PRECIPITATION WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, LIMERICK GENERATING STATION, 2020

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	H-3
36S3	05/04/20 - 05/19/20	< 173
36S3	10/28/20 - 11/17/20	< 191
E-5	05/04/20 - 05/19/20	< 176
E-5	10/28/20 - 11/17/20	< 188
ESE-6	05/04/20 - 05/19/20	< 178
ESE-6	10/28/20 - 11/17/20	< 192
RS-1	10/28/20 - 11/17/20	210 ± 127
RS-2	10/28/20 - 11/17/20	< 189
RS-3	10/27/20 - 11/17/20	< 192
RS-4	10/28/20 - 11/17/20	193 ± 126
RS-5	10/28/20 - 11/17/20	204 ± 124
RS-6	10/28/20 - 11/17/20	238 ± 119
RS-7	10/28/20 - 11/17/20	< 187
RS-8	10/28/20 - 11/17/20	464 ± 137
SE-7	05/04/20 - 05/19/20	218 ± 115
SE-7	10/28/20 - 11/17/20	< 190