Docket No: 50-219

OYSTER CREEK GENERATING STATION
UNIT 1

Annual Radiological
Environmental Operating Report

1 January through 31 December 2019

Prepared By

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Environmental Services

HOLTEC DECOMMISSIONING INTERNATIONAL

Oyster Creek Generating Station

Forked River, NJ 08731

April 2020

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Preface

The nuclear power industry uses terms and concepts that may be unfamiliar to all readers of this report. This section of the report is intended to help the reader better understand some of these terms and concepts. In this section, we will discuss radiation and exposure pathways. This section is intended only to give a basic understanding of these subjects to hopefully allow the reader to better understand the data provided within the report.

Every nuclear power station is required to submit two reports annually, the Annual Radioactive Effluents Release Report (ARERR) and the Annual Radiological Environmental Operating Report (AREOR). The following information is provided in both reports for Oyster Creek Generating Station.

Understanding Radiation

Radiation is simply defined as the process of emitting radiant energy in the form of waves or particles. Radiation can be categorized as ionizing or non-ionizing radiation. If the radiation has enough energy to displace electrons from an atom it is termed ionizing radiation. Typically you will see a warning sign where there is a potential to be exposed to man-made ionizing radiation. These signs normally have the trefoil symbol on a yellow background.

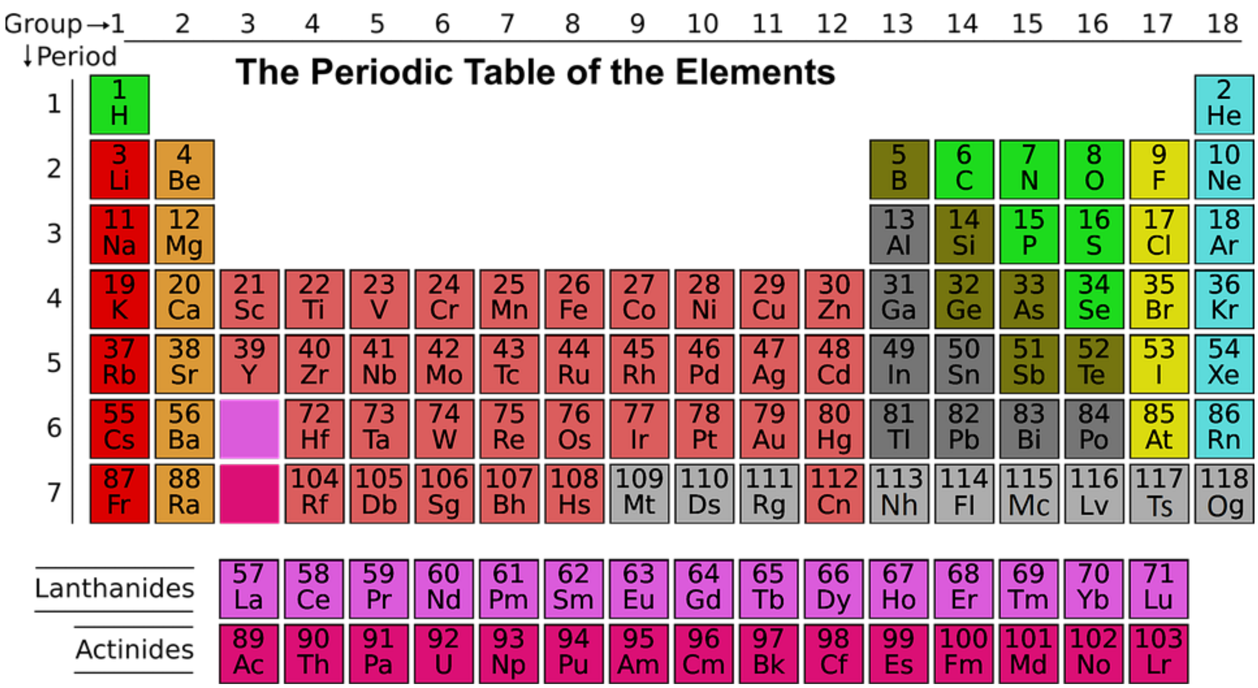
Example Radiological warning signs

People do not always recognize non-ionizing radiation as a form of radiation, such as light, heat given off from a stove, radiowaves and microwaves. In our report we focus on the ionizing radiation that is produced at a nuclear power plant though it is important to note that ionizing radiation comes from many sources. In fact, the amount of ionizing radiation an average person is exposed to due to operation of a nuclear power plant is a very small fraction of the total ionizing radiation they will be exposed to in their lifetime and will be discussed later.

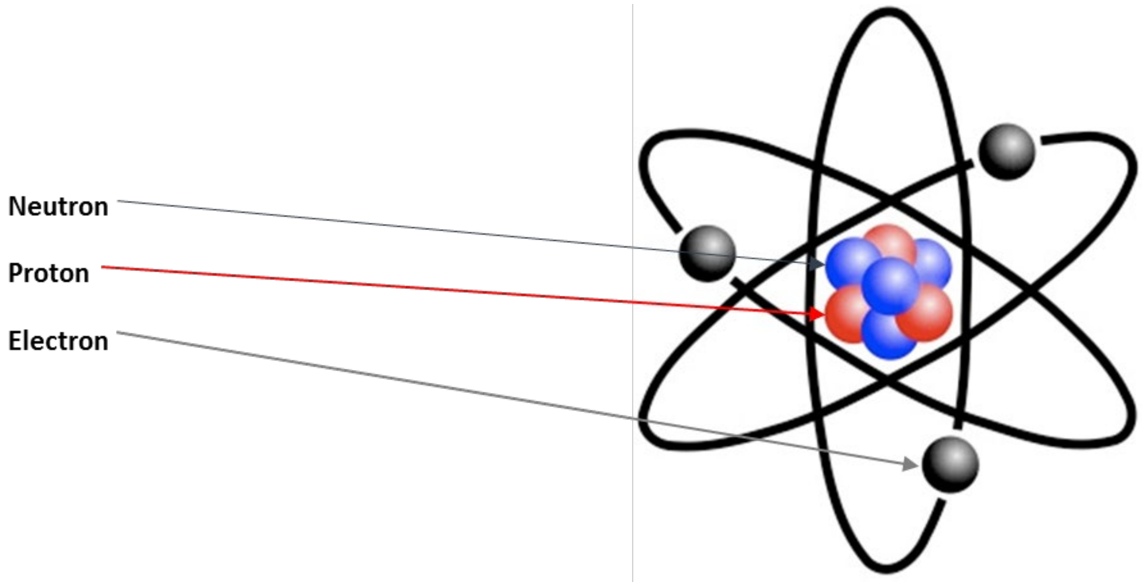
From this point forward we will only be discussing ionizing radiation but we will just use the term radiation.

Since this report discusses radiation in different forms and different pathways we first need to understand where the radiation comes from that we report. Radiation comes from atoms. So, what are atoms and how does radiation come from atoms?

You may have seen a Periodic Table of the Elements



This table lists all the elements found on earth. An atom is the smallest part of an element that maintains the characteristics of that element. An atom is made up of three parts, protons, neutrons and electrons.



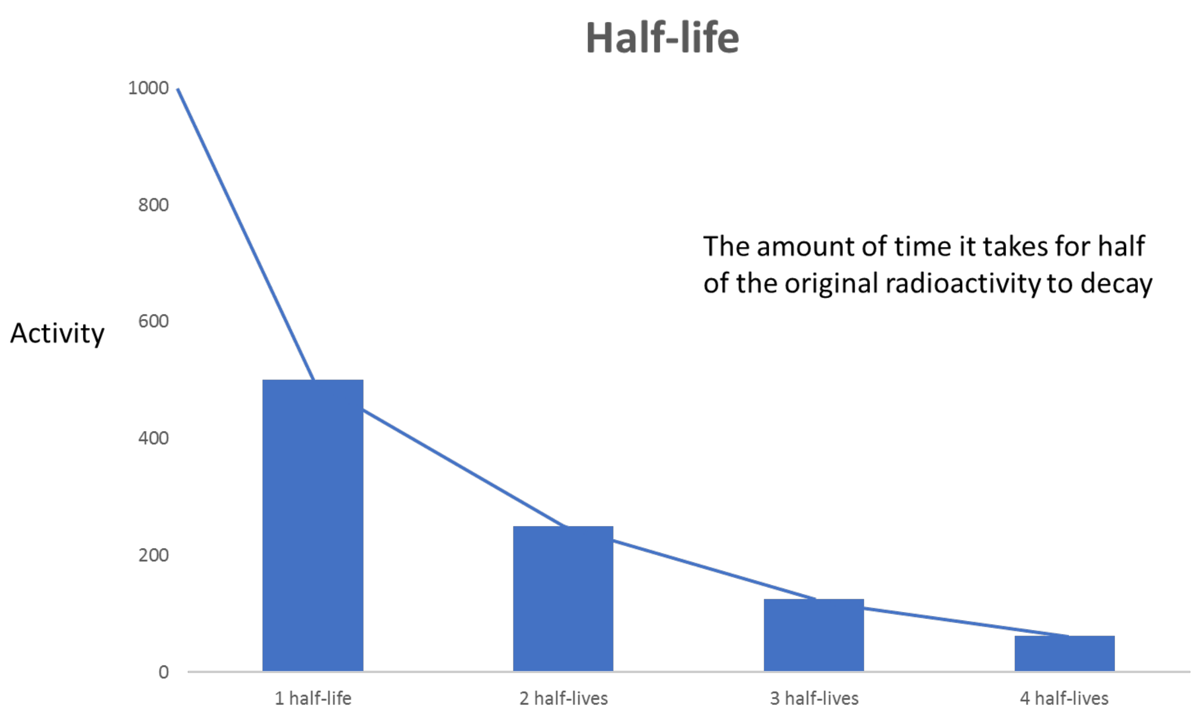
The number of protons in an atom determines the element. A hydrogen atom will always have one proton while an oxygen atom will always have eight protons. The protons are clustered with the neutrons at the center of the atom and this is called the nucleus. Orbiting around the nucleus are the relatively small electrons. Neutrons do not have an electrical charge, protons have a positive charge while electrons have a negative charge. In an electrically neutral atom, the negative and positive charges are balanced. Atoms of the same element that have a different number of neutrons in their nucleus are called isotopes.

Isotopes are atoms that have the same number of protons but different number of neutrons. They all have the same chemical properties and many isotopes are nonradioactive or stable while other isotopes may be unstable and are radioactive. Radioactive isotopes can be called a radionuclide, a radioisotope or simply called a radioactive atom. A radionuclide usually contains an excess amount of energy in the nucleus usually due to a deficit or excess of neutrons in the nucleus.

There are two basic ways radionuclides are produced at a nuclear power plant. The first way is a direct result of the fission process and the radionuclides created through this process are termed fission products. Fission occurs when a very large atom, such as U-235 (Uranium-235) and Pu-239 (Plutonium-239), absorbs a neutron into its nucleus making the atom unstable. In this instance the atom can actually split into smaller atoms, this splitting of the atom is called fission. When fission occurs there is also a large amount of energy released from the atom in the form of heat which is what is used to produce the steam that will spin the turbines to produce electricity at a nuclear power plant.

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. Water passes through the core where the fission process is occurring. This water is used to both produce the steam to turn the turbines and to cool the reactor. Though the water passing through the core is considered to be very pure water, there is always some other material within the water. This material typically comes from the material used in the plant's construction. As the water passes through the core, the material is exposed to the fission process and the radiation within the core can react with the material causing it to become unstable, creating a radionuclide. The atoms in the water itself can become activated and create radionuclides.

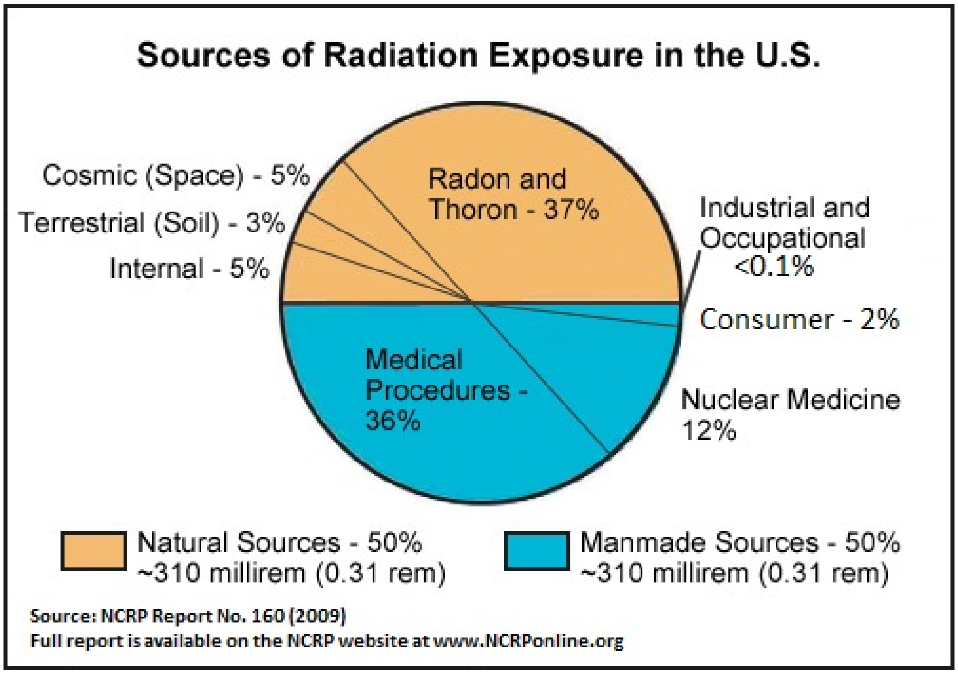
Over time, radioactive atoms will reach a stable state and no longer be radioactive. To do this they must release the excess energy. The release of excess energy can be in different forms and is called radioactive decay and the energy released is called radiation. The time it takes for a radionuclide 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 are measured in years while others may be very short and are measured in seconds.



In this report, you will see radionuclides listed such as K-40 (potassium-40) and Co-60 (cobalt-60). The letter(s) represents the element and the number represents the specific isotope of that element and is the number of nuetrons in the nucleus of that radionuclide. You may hear the term naturally occurring radionuclide which refers to radionuclides that naturally occur in nature such as K-40. There are man-made radionuclides such as Co-60 that we are concerned with since these man-made radionuclides result as a by-product when generating electricity at a nuclear power plant. There are other ways man-made radionuclides are produced, such as detonating nuclear weapons, and this is important to note since nuclear weapons testing deposited these man-made radionuclides into the environment and some are still present today. There is a discussion in the AREOR for the radionculides Cs-137, Sr-89 and Sr-90. The reason we only see some of the radionuclides today is due to the fact that some of the radionuclides released into the environment had relatively short half-lives and all the atoms have decayed to a stable state while other radionuclides have relatively long half-lives and will be measurable in the environment for years to come.

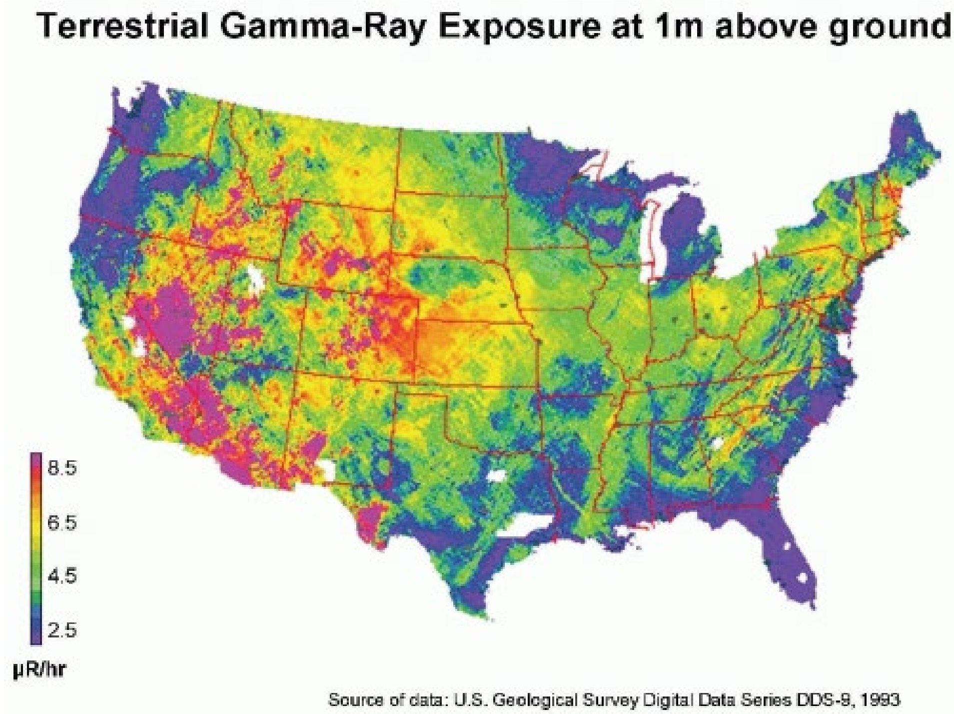
Sources of Radiation

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 an individual will be exposed to such as where you live, medical treatments, etc. Below are examples of some of the typical sources of radiation an individual is exposed to in a year.



Adapted with permission of the National Council on Radiation Protection and Measurements, http://NCRPonline.org

As you can see from the graph, the largest natural source of radiation is due to Radon. That is because essentially all air contains Radon. Cosmic and Internal make up the next largest natural sources of radiation. Cosmic radiation comes from the sun and stars and there are multiple factors which can impact the amount of cosmic radiation you are exposed to such as the elevation at which you live and the amount of air travel you take a year. The internal natural source of radiation mainly comes from two sources. Technically, all organic material is slightly radioactive due to C-14 (Carbon-14), including humans and the food we eat. C-14 makes up a percentage of the carbon in all organic material. Another contributor to the internal natural source is K-40 (Potassium-40). Potassium is present in many of the foods we eat, such as brazil nuts, bananas, carrots and red meat. The smallest natural source listed is terrestrial. Soil and rocks contain radioactive materials such as Radium and Uranium. The amount of terrestrial radiation you are exposed to depends on where you live. The map below shows terrestrial exposure levels across the United States. The radiation released from nuclear power plants is included in the Industrial and Occupational slice and is listed as <0.1%.



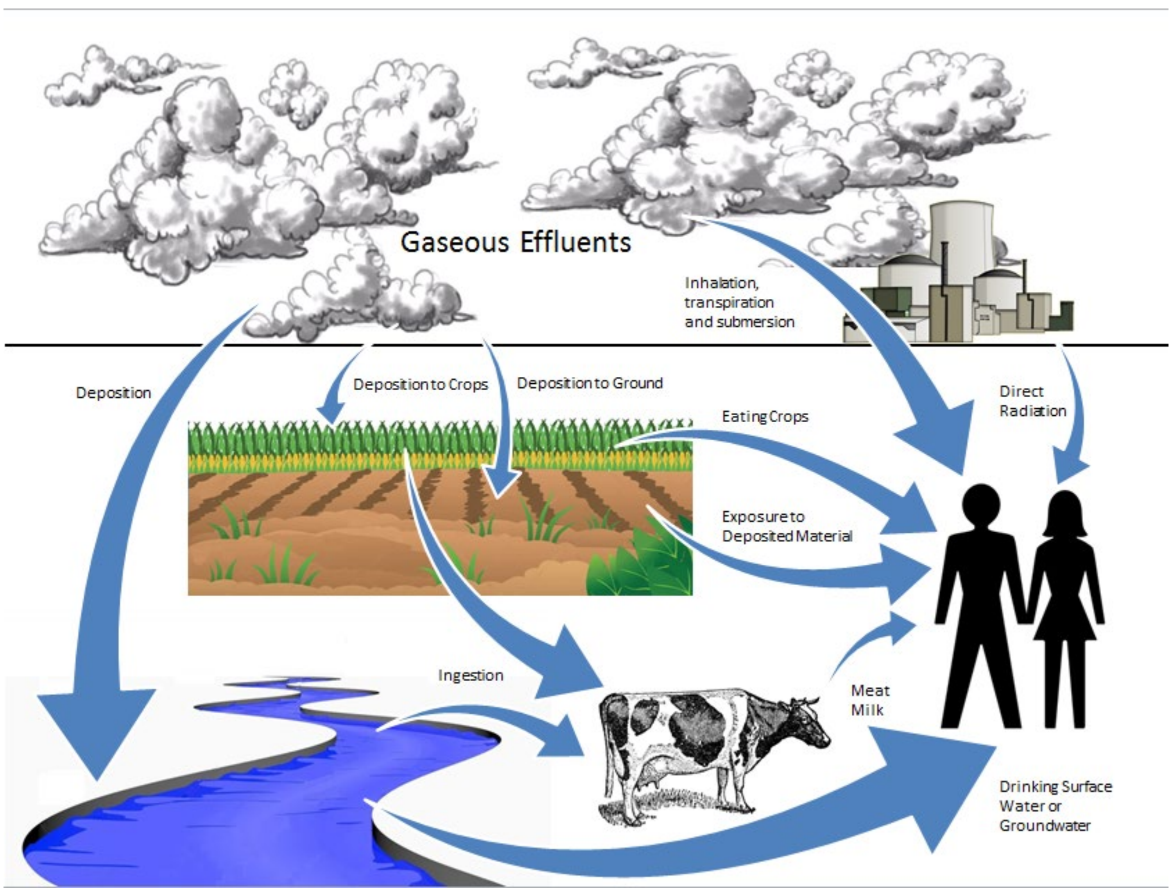
Exposure Pathways

Radiological exposure pathways define the methods by which people may become exposed to radioactive material. The major pathways of concern are those which could cause the highest calculated radiation dose. These projected pathways are determined from the type and amount of radioactive material released into the environment and how the environment is used. The way radioactive material is transported in the environment includes consideration of physical factors, such as the hydrological (water) and meteorological (weather) characteristics of the area. An annual average of the water flow, wind speed, and wind direction are used to evaluate how the radionuclides will be distributed in an area for gaseous or liquid releases. An important factor in evaluating the exposure pathways is the use of the environment. Many factors are considered such as dietary intake of residents, recreational use of the area, and the locations of homes and farms in the area.

The external and internal exposure pathways considered are shown in Figure 2.1. The release of radioactive gaseous effluents involves pathways such as external whole-body exposure, deposition of radioactive material on plants, deposition on soil, inhalation by animals destined for human consumption, and inhalation by humans. The release of radioactive material in liquid effluents involves pathways such as drinking water, fish, and direct exposure from the water at the shoreline while swimming.

Although radionuclides can reach humans by many different pathways, some result in more dose than others. The critical pathway is the exposure route that will provide, for a specific radionuclide, the greatest dose to a population, or to a specific group of the population called the critical group. The critical group may vary depending on the radionuclides involved, the age and diet of the group, or other cultural factors. The dose may be delivered to the whole body or to a specific organ. The organ receiving the greatest fraction of the dose is called the critical organ.

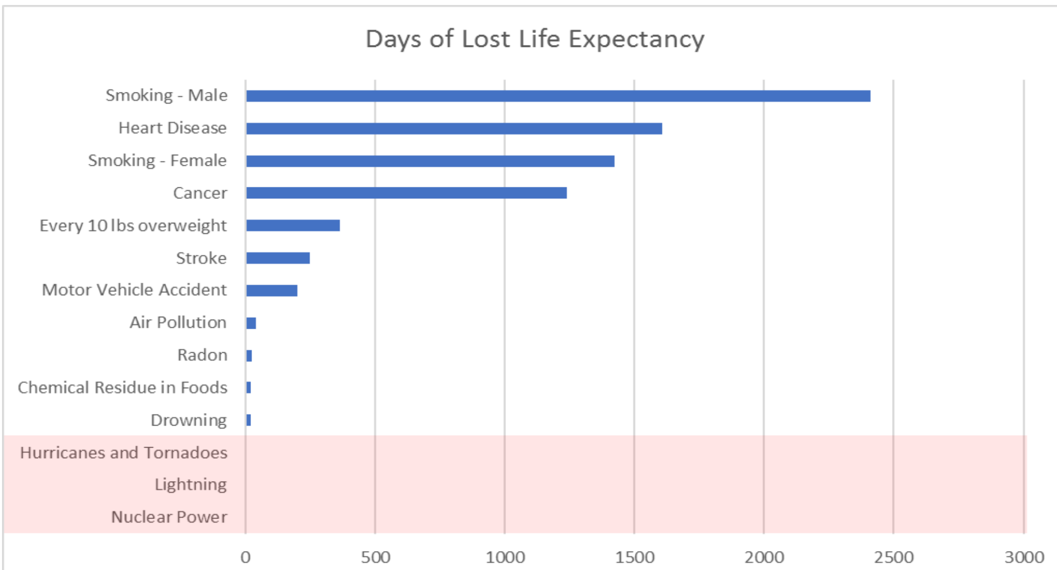
Figure 2.1 External and Internal Exposure Pathways

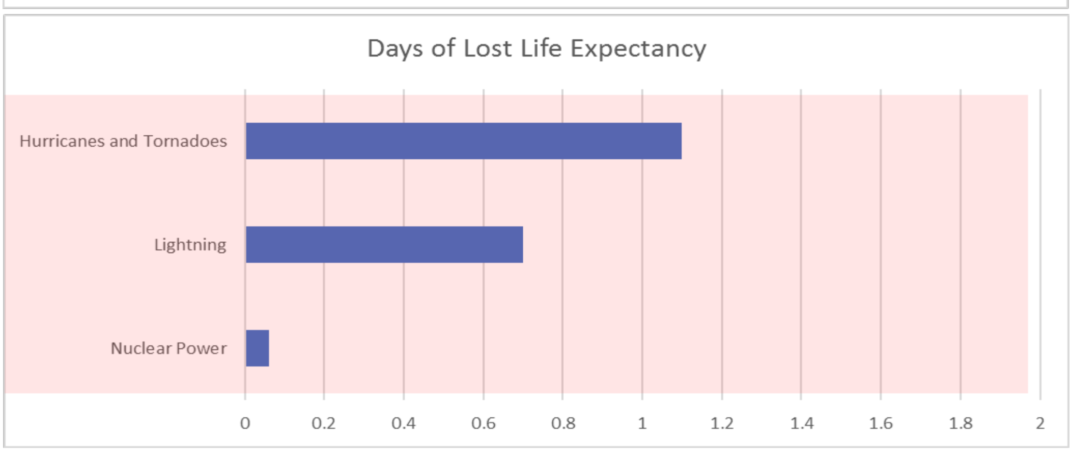


This simple diagram demonstrates some potential exposure pathways from Oyster Creek Generating Station.

Radiation Risk

U.S. radiation protection standards are based on the premise that any radiation exposure carries some risk. There is a risk whether the radiation exposure is due to man-made sources or natural sources. There have been many studies performed trying to determine the level of 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.





Adapted from the article by Bernard L. Cohen, Ph.D. in the Journal of American Physicians and Surgeons Volume 8 Number 2 Summer 2003.

The full article can be found at http://www.jpands.org/vol8no2/cohen.pdf

Annual Reports

All nuclear power plants are required to perform sampling of both the potential release paths from the plant and the potential exposure pathways in the environment. The results of this sampling are required to be reported annually to the Nuclear Regulatory Commission (NRC) and made available to the public. There are two reports generated annually, the Annual Radioactive Effluents Release Report (ARERR) and the Annual Radiological Environmental Operating Report (AREOR). The ARERR summarizes all of the effluents released from the plant and quantifies the doses to the public from these effluents. The AREOR summarizes the results of the samples obtained in the environment looking at all the potential exposure pathways by sampling different media such as air, vegetation, direct radiation, etc. These two reports are related in that the results should be aligned. The AREOR should validate that the effluent program is accurate. The ARERR and AREOR together ensure Nuclear Power Plants are operating in a manner that adequately protects the public.

In the reports, there are four different but interrelated units for measuring radioactivity, exposure, absorbed dose, and dose equivalent. Together, they are used to properly capture both 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 µCi that means 1/1,000,000. That means there are 1,000,000 µCi in one Ci.

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

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

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

Typically releases from nuclear power plants are so low that the samples taken in the environment are below the detection levels required to be met by all nuclear power plants. There are some radionuclides identified in the environment during the routine sampling but this is typically background radiation from nuclear weapons testing and events such as Chernobyl and these radionuclides are discussed in the AREOR.

Each report lists the types of samples that are collected and the analyses performed. Different types of media may be used at one sample location looking for specific radionuclides. For example, at our gaseous effluent release points we use different media to collect samples for particulates, iodines, noble gases and tritium. There are also examples where a sample collected on one media is analyzed differently depending on the radionuclide for which the sample is being analyzed.

These annual reports, and much more information related to nuclear power, are available on the NRC website at www.nrc.gov.

I. Summary and Conclusions

On July 1st 2019, ownership of the Oyster Creek Nuclear Power Station and transfer of the station and decommissioning license from Exelon Generation Company, LLC to Oyster Creek Environmental Protection, LLC (OCEP) as the licensed owner and Holtec Decommissioning International, LLC (HDI) as the licensed operator, was completed. Exelon had determined that transitioning operational nuclear plants to decommissioning nuclear plants targeted for permanent shutdown was not aligned with its core objectives and actively sought buyers who would assume ownership and complete decommissioning and license termination.

This report on the Radiological Environmental Monitoring Program (REMP) conducted for the Oyster Creek Generating Station (OCGS) by Holtec Decommissioning International, LLC (HDI) covers the period 01 January 2019 through 31 December 2019. During that time period, a total of 1,778 analyses were performed on 1,460 samples. In assessing all the data gathered for this report and comparing these results with historical data, it was concluded that the operation of OCGS had no adverse radiological impact on the environment.

REMP-designated surface water samples were analyzed for concentrations of tritium and gamma-emitting nuclides. No tritium, fission or activation products were detected in any of the surface water samples collected as part of the Radiological Environmental Monitoring Program during 2019.

REMP-designated drinking water samples were analyzed for concentrations of gross beta, tritium, Iodine-131 (I-131), and gamma-emitting nuclides. The preoperational environmental monitoring program did not include analysis of drinking water for gross beta. No tritium, I-131, or fission or activation products were detected in any of the drinking water samples collected.

REMP-designated groundwater samples were analyzed for concentrations of tritium and gamma-emitting nuclides. No tritium and no fission or activation products were detected in REMP groundwater samples.

Fish (predator and bottom feeder), clams, crabs, and sediment samples were analyzed for concentrations of gamma-emitting nuclides. No OCGS-produced fission or activation products were detected in fish, clams, or crabs. Cesium-137 (Cs-137) was not detected in any sediment samples.

Air particulate samples were analyzed for concentrations of gross beta, gamma-emitting nuclides, Strontium-89 (Sr-89), and Strontium-90 (Sr-90). Gross beta and cosmogenic Beryllium-7 (Be-7) were detected at levels consistent with those detected in previous years. No fission or activation products were detected. Sr-89 and Sr-90 analyses were performed on quarterly composites of air particulate samples. All Sr-89 and Sr-90 results were below the minimum detectable activity.

Iodine-131 (I-131) analyses were performed on weekly air samples. All results were less than the minimum detectable concentration.

Vegetation samples were analyzed for gamma-emitting nuclides, Sr-89, and Sr-90. Concentrations of naturally occurring Potassium-40 (K-40) were consistent with those detected in previous years. No fission or activation products were detected. All Sr-89 results were below the minimum detectable activity. Sr-90 activity was at levels consistent with those detected in previous years at both control and indicator stations, and can be attributed to historical nuclear weapons testing and the Chernobyl accident.

Environmental gamma radiation measurements were performed quarterly using Optically Stimulated Luminescence Dosimeters (OSLD). Beginning in calendar year 2012, Exelon (the previous plant owner) began using OSLDs and discontinued the use of Thermoluminescent Dosimetry (TLD). There were two main reasons for this change. First, OSLDs have minimal “fade” over a quarterly time period. Fade is where the dose on the dosimeter drifts lower over time. Second, OSLDs may be re-read if necessary. TLDs are reset to zero after they are read. Levels detected were consistent with those observed in previous years. The maximum dose to any member of the public attributable to radioactive effluents and direct radiation from the OCGS was less than the 25 mRem/year limit established by the United States Environmental Protection Agency (EPA).

II. Introduction

The Oyster Creek Generating Station (OCGS) is a non-operational single unit nuclear power plant owned and operated by HDI. OCGS is located on the Atlantic Coastal Plain Physiographic Province in Ocean County, New Jersey, about 60 miles south of Newark, 9 miles south of Toms River, and 35 miles north of Atlantic City. It lies approximately 2 miles inland from the Barnegat Bay. The property, covering approximately 781 acres, is situated partly in Lacey Township and, to a lesser extent, in Ocean Township. Access is provided by U.S. Route 9, passing through the ~150-acre site and separating a 637-acre eastern portion from the balance of the property west of the highway. The station is about ¼ mile west of the highway and 1¼ miles east of the Garden State Parkway. The site property extends about 2½ miles inland from the bay; the maximum width in the north-south direction is almost 1 mile. The site location is part of the New Jersey shore area with its relatively flat topography and extensive freshwater and saltwater marshlands. The South Branch of Forked River runs across the northern side of the site and Oyster Creek partly borders the southern side.

A preoperational Radiological Environmental Monitoring Program (REMP) for OCGS was established in 1966, and continued prior to the plant becoming operational in 1969. This report covers those analyses performed by Teledyne Brown Engineering (TBE), Landauer and Environmental Inc. (Midwest Labs) on samples collected during the period 01 January 2019 through 31 December 2019.

A. Objectives of the REMP

The objectives of the REMP are to:

1. Provide data on measurable levels of radiation and radioactive materials in and beyond the site environs

2. Evaluate the relationship between quantities of radioactive material released from the plant and resultant radiation doses to individuals from principal pathways of exposure

3. Validate the effluent computer model that predicts radioactive material concentrations at populated off-site locations

4. Fulfill the obligations of the radiological surveillance sections of Oyster Creek's Offsite Dose Calculation Manual (ODCM)

B. Implementation of the Objectives

The implementation of the objectives is accomplished by:

1. Identifying significant exposure pathways

2. Establishing baseline radiological data for media within those pathways

3. Continuously monitoring those media before, during and after terminating Station operation to assess Station radiological effects (if any) on the public, plant workers and the environment

C. Discussion

1. General Program

The Radiological Environmental Monitoring Program (REMP) was established in 1966, before the plant became operational. This preoperational surveillance program was established to describe and quantify the radioactivity, and its variability, in the area prior to the operation of OCGS. After OCGS became operational in 1969, the operational surveillance program continued to measure radiation and radioactivity in the surrounding areas.

A variety of environmental samples are collected as part of the REMP at OCGS. The selection of sample types is based on the established pathways for the transfer of radionuclides through the environment to humans. The selection of sampling locations is based on sample availability, local meteorological and hydrological characteristics, local population characteristics, and land usage in the area of interest. The selection of sampling frequencies for the various environmental media is based on the radionuclides of interest, their respective half-lives, and their behavior in both the biological and physical environment.

2. Preoperational Surveillance Program

The federal government requires nuclear facilities to conduct radiological environmental monitoring prior to constructing the facility. This preoperational surveillance program is aimed at collecting the data needed to identify pathways, including selection of the radioisotope and sample media combinations to be included in the environmental surveillance program conducted after facility operation begins. Radiochemical analyses performed on the environmental samples should include not only those nuclides expected to be released during facility operation, but should also include typical radionuclides from nuclear weapons testing and natural background radioactivity. All environmental media with a potential to be affected by facility operation as well as those media directly in the major pathways, should be sampled on at least an annual basis during the preoperational phase of the environmental surveillance program.

The preoperational surveillance design, including nuclide/media combinations, sampling frequencies and locations, collection techniques, and radioanalyses performed, should be carefully considered and incorporated in the design of the operational surveillance program. In this manner, data can be compared in a variety of ways (for example, from year to year, location to location, etc.) in order to detect any radiological impact the facility has on the surrounding environment. Data collection during the preoperational phase should be planned to provide a comprehensive database for evaluating any future changes in the environment surrounding the nuclear facility.

OCGS began its preoperational environmental surveillance program three years before the plant began operating in 1969. Data accumulated during those early years provide an extensive database from which environmental monitoring personnel are able to identify trends in the radiological characteristics of the local environment. The environmental surveillance program at OCGS will continue after the plant has reached the end of its economically useful life and decommissioning has begun.

3. Consideration of Plant Effluents

Effluents are strictly monitored to ensure that radioactivity released to the environment is as low as reasonably achievable and does not exceed regulatory limits. Effluent control includes the operation of monitoring systems, in-plant and environmental sampling and analyses programs, quality assurance programs for effluent and environmental programs, and procedures covering all aspects of effluent and environmental monitoring.

Both radiological environmental and effluent monitoring indicate that the operation of OCGS does not result in significant radiation exposure of the people or the environment surrounding OCGS and is well below the applicable levels set by the Nuclear Regulatory Commission (NRC) and the EPA.

Environmental sampling of airborne iodine and particulates showed no radioactivity attributable to the operation of OCGS.

III. Program Description

A. Sample Collection

Samples for the OCGS REMP were collected for HDI by on-site personnel and Normandeau Associates, Incorporated. This section describes the general collection methods used to obtain environmental samples for the OCGS REMP in 2019. Sample locations and descriptions can be found in Tables B-1 and B-2, and Figures B-1, B-2, and B-3, Appendix B. The collection procedures are listed in Table B-3.

Aquatic Environment

The aquatic environment was evaluated by performing radiological analyses on samples of surface water, drinking water, groundwater, fish, clams, crabs, and sediment. One gallon water samples were collected monthly from two surface locations (33 and 94), semiannually at two surface water locations (23 and 24), monthly from five drinking water wells (1N, 1S, 37, 38, and 114) and quarterly from 2 groundwater stations (MW-24-3A and W-3C). Control locations were 94 and 37. All samples were collected in plastic bottles, which were rinsed at least twice with source water prior to collection. Fish samples comprising the flesh of two groups, bottom feeder and predator, were collected semiannually at three locations (33, 93 and 94 [control]). Clams were collected semiannually from three locations (23, 24, and 94 [control]). Two annual crab samples were collected from two locations (33 and 93). Sediment samples were collected at four locations semiannually (23, 24, 33, and 94 [control]).

Atmospheric Environment

The atmospheric environment was evaluated by performing radiological analyses on samples of air particulate and airborne iodine. Airborne iodine and particulate samples were collected and analyzed weekly at eight locations (C, 3, 20, 66, 71, 72, 73, and 111). The control location was C. 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

The terrestrial environment was evaluated by performing radiological analyses on samples of garden vegetation. No commercial dairy operations and no dairy animals producing milk for human consumption are located within a 5-mile radius of the plant. Therefore, vegetation samples were collected in lieu of milk. Vegetation samples were collected, when available, at four locations

(35, 36, 66 and 115). Station 36 is the control location as it is 24 miles northwest of the plant in the lowest X/Q sector, beyond any influence of the plant when the plant was operating, and while it is permanently shut down for decommissioning. All samples were collected in 18” x 24” new unused plastic bags and shipped promptly to the laboratory.

Ambient Gamma Radiation

Direct radiation measurements were made using Al_2O_3:C Optically Stimulated Luminescence Dosimetry (OSLD). Exelon Nuclear (the previous plant owner) changed the dosimetry used for environmental monitoring. Beginning in calendar year 2012, Exelon began using OSLDs and discontinued the use of Thermoluminescent Dosimetry (TLD). There were two main reasons for this change. First, OSLDs are subject to minimal fade. Fade is where the dose on the dosimeter drifts lower over time. Second, OSLDs may be re-read if necessary. TLDs are reset to zero after they are read. The OSLDs were placed on and around the OCGS site and were categorized as follows:

An inner ring consisting of 19 locations (1, T1, 51, 52, 53, 54, 55, 56, 57, 58, 59, 61, 62, 63, 64, 65, 66, 112, and 113) near the site boundary.

An outer ring consisting of 31 locations (4, 5, 6, 8, 9, 22, 46, 47, 48, 68, 73, 74, 75, 78, 79, 82, 84, 85, 86, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 109, and 110) extending to approximately 5 miles from the site designed to measure possible exposures to close-in population.

Special interest stations consisting of 9 locations (3, 11, 71, 72, 81, 88, 89, 90, and 92) representing special interest areas such as population centers, state parks, etc.

Background (Control) stations consisting of two locations (C and 14) greater than 20 miles distant from the site.

Indicator OSLDs were placed systematically, with at least one station in each of 16 meteorological compass sectors in the general area of the site boundary. OSLDs were also placed in each meteorological sector in the 1 to 5 mile range, where reasonable highway access would permit, in areas of public interest and population centers. Background locations were located greater than twenty miles distant from the OCGS and generally in an upwind direction from the OCGS.

Two OSLDs were placed at each location approximately three to eight feet above ground level. The OSLDs were exchanged quarterly and sent to Landauer for analysis.

B. Sample Analysis

This section describes the general analytical methodologies used by TBE and Environmental Inc. (Midwest Labs) to analyze the environmental samples for radioactivity for the OCGS REMP in 2019. The analytical procedures used by the laboratories are listed in Table B–3.

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

1. Concentrations of beta emitters in air particulates and drinking water

2. Concentrations of gamma emitters in surface, drinking water, groundwater, fish, clams, crabs, sediment, air particulates and vegetation

3. Concentrations of tritium in REMP-designated surface, drinking water and groundwater

4. Concentrations of I-131 in air iodine cartridges and drinking water

5. Concentrations of strontium in air particulates and vegetation

6. Ambient gamma radiation levels at various locations around the OCGS

C. Data Interpretation

For trending purposes, the radiological and direct radiation data collected during 2019 were compared with data from past years. The results of environmental sampling show that radioactivity levels have not increased from the background radioactivity detected prior to the operation of OCGS. The operation of OCGS continues to have no measurable radiological impact upon the environment.

Several factors were important in the interpretation of the data:

1. <u>Lower Limit of Detection and Minimum Detectable Concentration</u>

   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 OCGS 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. 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, which results in a negative number. A less than MDC was reported in all cases where positive activity was not detected.

Gamma spectroscopy results for each type of sample were grouped as follows:

For surface, drinking water, and groundwater - 12 nuclides: Mn-54, Co-58, Fe-59, Co-60, Zn-65, Zr-95, Nb-95, I-131, Cs-134, Cs-137, Ba-140, and La-140 were reported

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

For clams - eight nuclides: K-40, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Cs-134, and Cs-137 were reported

For crabs - eight nuclides: K-40, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Cs-134, and Cs-137 were reported

For sediment - nine nuclides: Be-7, K-40, Mn-54, Co-58, Co-60, Cs-134, Cs-137, Ra-226, and Th-228 were reported

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

For air iodine cartridges - one nuclide: I-131 was reported

For vegetation – seven nuclides: Be-7, K-40, I-131, Cs-134, Cs-137, Ba-140, and La-140 were reported

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

D. Program Exceptions

For 2019, the OCGS REMP had a sample recovery rate in excess of 97%. Exceptions are listed below:

Environmental Dosimetry

1. July, 2019: Station 6 (Lane Place, Lacey) - No 2nd quarter results due to both dosimeters missing - reason unknown. 3rd quarter Station 6 dosimeters placed in holder.

2. October, 2019: Station 5 (GSP Rest Area) - No 3rd quarter results due to dosimeters and holder being removed (construction at the rest area). Dosimeters could not be located. New dosimeter holder & dosimeters were installed on 10/29/19 at the rest area.

Air

1. 01/09/19 & 01/16/19: Station 20 - No valid samples for Weeks 1 & 2 due to no power to station. Sampler restarted on 1/14, but not enough run time to constitute a valid sample. Connector fitting on pump and timer replaced on 01/14/19. (AR 04209785)

2. 02/14/19: Station 73 - No valid sample for Week 6 due to pump not running at time of collection (timer running normally). Pump replaced 02/15/19.

3. 04/24/19: Station C - No valid sample for Week 16 due to pump not running (but timer was) at time of collection. As per procedure, sample not valid and not sent to lab; replaced pump the same day.

4. 05/29/19: Station 71 - Main power breaker switch had been turned off. Pump ran long enough to constitute a valid sample; reset breaker switch.

5. 06/12/19: Station 72 - Shorter run time than expected - samples are valid; will monitor timer.

6. 06/19/19: Station C - No valid sample for Week 24 due to pump not running (but timer was) at time of collection. As per procedure, sample not valid and not sent to lab; pump replaced 06/21/19.

7. 09/18/19: Station 20 - No valid sample for Week 37 due to a tripped breaker. Pump did not run long enough to constitute a valid sample; reset breaker and replaced timer on 10/1719.

8. 01/20/20: All Stations - No iodine results for Week 52 of 2019 due to lack of replacement cartridges. Normandeau had been told that the number of air stations would be reduced in 2020 and did not resupply cartridges. CDI Task Manager was informed and Normandeau was

instructed to keep AI cartridges in place for a 2-week run. Additional iodine cartridges ordered until air station changes take effect. No iodine was detected in effluents released from the plant or in the field in 2019.

Drinking Water

Note: Stations 1S and 1N are on-site drinking water wells. Typically, only one well is in service at a time. They are only listed as deviations when there is not a sample for every week of the composite period.

1. 2019: Station 1S was not operational for the entire year.

2. March, 2019: Station 38 composite 3 of 4 weeks. 3rd week of the month treatment plant offline for maintenance.

3. April, 2019: Station 114 was operational 3 of 5 weeks. Pump out of service during this period.

4. May, 2019: Station 114 taken out of service permanently.

Fish

1. Spring & Fall, 2019: Control Station 94 - no fish for spring & fall sampling. Local fisherman that had supplied sample fish for many years had passed away. Normandeau fishing efforts unsuccessful. Hired a charter boat in June to fish, but still no success. Asked other local fishermen - no fish. (Fall note - Likely to use different methods going forward)

2. Spring, 2019: Stations 93 & 33 collected only 2 species, each likely due to lack of warm water in canal from the plant not producing.

3. Fall, 2019: Station 93 - no fish for fall sampling likely due to the lack of warm water in discharge canal. Fished discharge area with rod and reel for approximately 20 man-hours but no fish.

Vegetation

1. June - October, 2019: Station 66 - No crops produced for entire growing season. Fertilizer & top soil added but still no production. Garden sits in low spot and is often too wet for plants. Garden is no longer a tech spec location.

2. September - October, 2019: Station 15 - Only 2 of 3 species of

vegetation were collected due to lateness of growing season.

Program exceptions are tracked by Oyster Creek staff and Normandeau and investigated to understand the causes of the program exception. Sampling and maintenance errors are reviewed with the personnel involved to prevent recurrence.

The overall sample recovery rate indicates that the appropriate procedures and equipment are in place to assure reliable program implementation.

E. Program Changes

To address the accumulated water inventory at Oyster Creek following permanent plant shutdown (with the transition to decommissioning), permitted batch processing and discharge of treated water was re-introduced with revision 9 to the ODCM. This over boarding of treated water using a permitted process implements controls specified in NUREG 1302. Aquatic sampling was evaluated and increased where warranted to assure pathways to man are monitored.

IV. Results and Discussion

A. Aquatic Environment

1. Surface Water

Samples were taken via grab sample methodology at two locations (33 and 94) on a monthly schedule. In addition, grab samples were collected semi-annually at two locations (23 and 24). Of these locations 23, 24, and 33, located downstream, could be affected by Oyster Creek's effluent releases. The following analyses were performed:

<u>Tritium</u>

Surface water sampling began in 1966, and the samples were analyzed for tritium as well as other radioactivity. During this preoperational program, tritium was detected at an average concentration of 1,050 pCi/L. At that time, counting instrumentation was not as sensitive as it now, and the minimum detectable concentration was 1,000 pCi/L versus 200 pCi/L used today. By comparing the 2019 sampling results to the decay-corrected average preoperational concentration reported in the 2007 Annual Radiological Environmental Operating Report (111 pCi/L), it can be seen that the inventory of tritium in the environment is due to fallout from past atmospheric nuclear weapons testing, and is decreasing with time.

Samples from all locations were analyzed for tritium activity. No tritium activity was detected. (Table C–I.1, Appendix C)

<u>Gamma Spectrometry</u>

Samples from all locations were analyzed for gamma-emitting nuclides. All nuclides were less than the MDC. (Table C–I.2, Appendix C)

2. Drinking water

Monthly samples were composited from monthly grab samples from six drinking water wells (1N, 1S, 37, 38, and 114). Station 1, because it is located on the OCGS site, could potentially be affected by radioactive releases from the plant. Station 1 was split into two separate locations, 1N and 1S. Station 38, the Ocean Township Municipal Utility Authority Well, could potentially be affected by effluent releases from the OCGS. Given its distance from the facility (1.6 miles) and depth (approximately 360 feet), however, the probability of any OCGS-related impacts is very small. Stations 37 and 39, Lacey Township Municipal Utility Authority wells, are not likely to be impacted by effluents from the OCGS. These wells are located generally up-gradient of the regional groundwater flow direction (southeast). In addition, because of their depth (> 200 feet) and distance from the site (2.2 and 3.5 miles respectively), they are unlikely to be affected by OCGS operations. The following analyses were performed:

Tritium

Monthly samples from all locations were analyzed for tritium activity. No tritium activity was detected. Drinking water was sampled during the preoperational program and throughout the almost 50 years of the plant's operational program. Tritium sampling results during the preoperational years, yielded results all less than the minimum detectable concentration of 1000 pCi/L. The 2019 results are all less than the current MDC of 200 pCi/L. (Table C–II.1, Appendix C)

Gross Beta

Monthly samples from all locations were analyzed for concentrations of total gross beta activity. Gross beta was detected in 27 of 40 samples and is attributed to natural sources and fallout residual from previous bomb testing residual fallout. The values ranged from 1.6 to 11.8 pCi/L. (Table C-II.2, Appendix C)

The investigation level for gross beta in water is 15 pCi/L. Drinking water sample 1N result for gross beta exceeded the investigation level beginning in January 2012.

The initial result for gross beta was 15.1 pCi/L in 2012. This issue was entered into the Corrective Action Program (CAP) and an investigation initiated. The 1N water sample was analyzed for known beta-emitters Sr-89, Sr-90, Iron-55 (Fe-55) and Nickel-63 (Ni-63). These analyses results were all <MDC. It was also identified that the 1N well treatment system was upgraded the previous month and a potassium chloride softener system was added as part of the upgrade. Samples were obtained pre- and post-treatment. The pre-treatment result for gross beta was 3.6 pCi/L, which is a value that has been seen previously in drinking water samples. The post-treatment sample result for gross beta was 22.2 pCi/L.

Based on the fact that there were no typical plant-produced beta-emitters detected and that natural potassium is a known beta- emitter, along with the results of the pre- and post-sampling, the gross beta values obtained for 1N can be attributed to the addition of the water softener system installed during the system upgrade in December of 2011.

Iodine

Monthly samples from all locations were analyzed for I-131 by the low level method to detect down to 1.0 pCi/L. All results were less than the

MDC. (Table C-II.3, Appendix C)

Gamma Spectrometry

Samples from all locations were analyzed for gamma-emitting nuclides. All nuclides were less than the MDC. (Table C–II.4, Appendix C)

3. Groundwater

The following analyses were performed:

Tritium

Samples from all locations were analyzed for tritium activity. No tritium activity was detected. (Table C–III.1, Appendix C)

Gamma Spectrometry

Samples from all locations were analyzed for gamma-emitting nuclides (Table C–III.2, Appendix C). All nuclides were less than the MDC.

4. Fish

Fish samples comprised of bottom feeder (American eel, winter flounder, tautaug, summer flounder) and predator (bluefish, striped bass, white perch) were collected at three locations (33, 93, and 94) semiannually. Locations 93 and 33 could be affected by Oyster Creek's effluent releases. The following analysis was performed:

Gamma Spectrometry

The edible portions of fish samples from three locations were analyzed for gamma-emitting nuclides. Naturally occurring K-40 was found at all stations and ranged from 2,467 to 5,932 pCi/kg wet and was consistent with levels detected in previous years. No fission or activation products were found. (Table C–IV.1, Appendix C)

No fish were sampled during the preoperational sampling program for OCGS.

5. Clams and Crabs

Clams were collected at three locations (23, 24, and 94) semiannually. Crabs were collected at two locations (33 and 93) annually. Locations 23, 24, 33, and 93 could be affected by Oyster Creek's effluent releases. The following analysis was performed:

Gamma Spectrometry

The edible portions of clam samples from all three locations were analyzed for gamma-emitting nuclides. Naturally occurring K-40 was found at all stations and ranged from 1,041 to 1,704 pCi/kg wet and was consistent with levels detected in previous years. No fission or activation products were found. (Table C–IV.2, Appendix C) Historical levels of Co-60 in clams are shown in Figure C–1, Appendix C. After 1986, all results were less than the Lower Limit of Detection (LLD).

Preoperational clam sample results for naturally occurring K-40 ranged from 600 to 9,800 pCi/kg wet, which are consistent with current sample results.

The edible portions of crab samples from 2 locations were analyzed for gamma-emitting nuclides. Naturally occurring K-40 was found at both stations and ranged from 2,587 to 2,731 pCi/kg wet, consistent with levels detected in previous years. No fission or activation products were found. (Table C–IV.2, Appendix C)

Crabs were not sampled during the preoperational years of the OCGS environmental monitoring program.

6. Sediment

Aquatic sediment samples were collected at four locations (23, 24, 33, and 94) semiannually. Of these locations, stations 23, 24, and 33 located downstream, could be affected by Oyster Creek's effluent releases. The following analysis was performed:

Gamma Spectrometry

Sediment samples from all four locations were analyzed for gamma-emitting nuclides. Naturally occurring K-40 was found at all stations and ranged from 1,010 to 18,160 pCi/kg dry. Naturally occurring Ra-226 was found at one location at a concentration of 866 pCi/kg dry. Naturally occurring Th-228 was found at 7 of 8 stations and ranged from 110 to 8,666 pCi/kg wet. Cs-137 was not detected in any of the samples. No fission or activation products were found. (Table C–V.1, Appendix C)

The Figure C-3, Appendix C graph shows Cs-137 concentrations in sediment from 1984 through 2019 and Figure C–2, Appendix C graph shows Co-60 concentrations in sediment from 1984 through 2019.

The requirement for sampling sediment is a requirement of ODCM 3.12.1, Table 3.12.1-1.d. ODCM Table 3.12.1-2, "Reporting Levels for Radioactive Concentrations in Environmental Samples Reporting Levels" does not include requirements for sediment. CY-AA-170-1000, Radiological Environmental Monitoring Program and Meteorological Program Implementation, Attachment 1, Analytical Results Investigation Levels, includes sediment investigation level for Cs-137 of 1000E+00 pCi/kg dry.

While aquatic sediment sampling was part of the preoperational program, samples were not analyzed for gamma-emitting nuclides until 1981.

In conclusion, the 2019 aquatic monitoring results for surface water, drinking water, groundwater, fish, clams, crabs, and sediment showed only naturally occurring radioactivity and were consistent with levels measured prior to the operation of OCGS, and with levels measured in past years. No radioactivity attributable to activities at OCGS was detected in any aquatic samples during 2019 and no adverse long-term trends are shown in the aquatic monitoring data.

B. Atmospheric Environment

1. Airborne

a. Air Particulates

Continuous air particulate samples were collected from eight locations on a weekly basis. The eight locations were separated into three groups: Group I represents locations near the OCGS site boundary (20, 66 and 111), Group II represents the locations at an intermediate distance from the OCGS site (71, 72, and 73), and Group III represents the control and locations at a remote distance from OCGS (C and 3). The following analyses were performed:

Gross Beta

Weekly samples were analyzed for concentrations of beta emitters. Detectable gross beta activity was observed at all locations. Comparison of results among the three groups aids in determining the effects, if any, resulting from the operation of OCGS. The results from the Site Boundary locations (Group I) ranged from 6.00E-03 to 50.00E–03 pCi/m^3 with a mean of 13.00E–03 pCi/m^3. The results from the Intermediate Distance locations (Group II) ranged from 5.00E-03 to 27.00E–03 pCi/m^3 with a mean of 1200E–03 pCi/m^3. The results from the Distant locations (Group III) ranged from 6.00E-03 to 25.00E–03 pCi/m^3 with a mean of 12.00E–03 pCi/m^3. (Table C–VI.1 and C–VI.2, Appendix C)

The similarity of the results from the three groups indicates that there is no relationship between gross beta activity and distance from OCGS. These results are consistent with data from previous years and indicate no effects from the operation of OCGS (Figures C-4 and C–5, Appendix C).

Air sample filters have been analyzed for gross beta activity since the inception of the preoperational environmental monitoring program in 1966. The preoperational data values ranged from 1.90E-02 to 2.77E-01 pCi/m3. The 2019 gross beta activity values ranged from <5.00E-03 to 28.00E-03 pCi/m3. The 2019 results are consistent with historical operational data (Figure C-5, Appendix C) and fall within the range of results observed during the preoperational period.

Strontium-89 and Strontium-90

Weekly samples were composited quarterly and analyzed for Sr-89 and Sr-90. No strontium was detected in any of the samples. (Table C–VI.3, Appendix C) These results are consistent with historical operational data. The preoperational environmental monitoring program did not include analysis of air samples for Sr-89 and Sr-90.

Gamma Spectrometry

Weekly samples were composited quarterly and analyzed for gamma-emitting nuclides. Naturally occurring Be-7 due to cosmic ray activity was detected in 32 of 32 samples. The values ranged from 27.00E-03 to 113E–03 pCi/m^3. All other nuclides were less than the MDC. (Table C–VI.4, Appendix C) These results are consistent with historical operational data. The preoperational environmental monitoring program did not include analysis of air samples for gamma-emitting nuclides.

b. Airborne Iodine

Continuous air samples were collected from eight (C, 3, 20, 66, 71, 72, 73, 111) locations and analyzed weekly for I-131. Consistent with historical operational data, all results were less than the MDC for I-131. (Table C–VII.1, Appendix C) The preoperational environmental monitoring program for OCGS did not include analysis of air media for I-131.

In conclusion, the atmospheric monitoring data are consistent with preoperational and prior operational data and show no long-term trends in the environment attributable to the operation of OCGS.

2. Terrestrial

a. Vegetation

Samples were collected from four locations (35, 36, 66 and 115) when available. The following analyses were performed:

Strontium-89 and Strontium-90

Vegetation samples from all locations were analyzed for concentrations of Sr-89 and Sr-90. All Sr-89 results were less than the MDC. Sr-90 was detected in 16 of 33 samples. The values ranged from 2.7 to 13.8 pCi/kg wet, which is consistent with historical data. (Table C–VIII.1, Appendix C)

The following information on Sr-90 is available on the NRC web page under “Backgrounder Radiation Protection and the “Tooth Fairy” Issue” published in December of 2004:

The largest source of Sr-90 in the environment (~99%) is from weapons testing fallout. Approximately 16.8 million curies of Sr-90 were produced and globally dispersed in atmospheric nuclear weapons testing until 1980. As a result of the Chernobyl accident, approximately 216,000 curies of Sr-90 were released into the atmosphere. With a 28-year half-life, Sr-90 still remains in the environment at nominal levels.

The total annual release of Sr-90 into the atmosphere from all 103 commercial nuclear power plants operating in the United States is typically 1/1000th of a curie. (NUREG/CR-2907 Vol.12). At an individual nuclear power plant, the amount of Sr-90 is so low that it is usually at or below the minimum detectable activity of sensitive detection equipment.

Oyster Creek did not report any Sr-90 released in the Annual Radioactive Effluent Release Report as all analyses for Sr-90 performed were less than the minimum detectable activity.

Gamma Spectrometry

Vegetation samples from locations 35, 36, and 115 were analyzed for concentrations of gamma-emitting nuclides. Naturally occurring K-40 activity was found in all samples and ranged from 743 to 5,420 pCi/kg wet. Naturally occurring Be-7 was detected in 6 of 33 samples and ranged from 195 to 859 pCi/kg wet. All other nuclides were less than the MDC. (Table C–VIII.1, Appendix C)

Preoperational vegetation sample analyses did not include strontium analyses or gamma spectroscopy.

Oyster Creek conducted a Cs-137 study in 2006/2007. A report was generated titled "Evaluation of Cesium-137 in Environmental Samples from the Amergen Property East of the Oyster Creek Generating Station". Below is an excerpt from that report:

“The levels of Cs-137 observed in the soil and vegetation samples are consistent with environmental concentrations known to be attributable to fallout from historic nuclear weapons testing and the Chernobyl accident. In addition, the variability of Cs-137 concentrations in soil and vegetation on the farm property appears to be driven by a number of environmental factors. Cs-137 concentrations in soil were non-detectable. Vegetation samples exhibited Cs-137 concentrations from non-detectable to 0.130 pCi/g, with a mean concentration of 0.078 pCi/g. For comparison, in the year 2000, as part of the confirmatory release survey for the adjacent Forked River site to the west of OCGS, the NRC reported that the maximum observed soil concentration of 0.53 pCi/g was not distinguishable from the variation in Cs-137 in the environment due to these fallout sources. The NRC also reported background Cs-137 concentrations in New Jersey coastal plain soils as high as 1.5 and 2.8 pCi/g. In addition, decay-corrected historic REMP data from a predominantly upwind location, nearly four miles from the OCGS, yields present-day Cs-137 concentrations ranging from 0.862 to 1.68 pCi/g.”

In 2019, there was no Cs-137 identified in REMP soil samples, but it was detected in 3 vegetation samples. The concentrations ranged from 29 to 68 pCi/kg wet. It is not unusual for Cs-137 to be identified given the known environmental levels of this radionuclide attributable to atmospheric nuclear weapons testing and the Chernobyl accident.

In conclusion, terrestrial monitoring results for vegetation samples during 2019 showed only naturally-occurring radioactivity and radioactivity associated with fallout from past atmospheric nuclear weapons testing and Chernobyl. The radioactivity levels detected were consistent with levels measured in past years, and no radioactivity attributable to activities at OCGS was detected in any terrestrial samples. The terrestrial monitoring data show no adverse long-term trends in the terrestrial environment.

C. Ambient Gamma Radiation

Ambient gamma radiation levels were measured using Optically Stimulated Luminenscence Dosimeters (OSLD). Sixty-one OSLD locations were monitored around the site with all measurements below 25 mRem/yr. Results of background corrected OSLD measurements are summarized in Tables C-IX.1 to C-IX.3 and Figure C-6.

The non-background corrected OSLD measurements ranged from 17.0 to 42.7 mR/standard quarter. In order to correct these results for background radiation, the mean of the dose rates measured at the background OSLD station (C) was subtracted from the dose measured at each indicator station.

The preoperational environmental monitoring program utilized film badges, the results of which are not comparable with the doses measured using thermoluminescent dosimeters or optically stimulated dosimeters during the operational REMP. In conclusion, the 2019 OSLD results are consistent with past operational measurements of direct radiation, and demonstrate that the OCGS continues to be in compliance with the 40 CFR 190 limit on maximum dose to the public.

D. Land Use Survey

A Land Use Survey, conducted in August 2019 around the Oyster Creek Generating Station (OCGS), was performed by Normandeau Associates, Inc. for HDI. The survey is conducted annually to identify any changes from the previous year. The purpose of the survey is to identify all milk animals and their locations, within each meteorological sector, at a distance of 5 miles from the plant. Additionally, the survey also identifies the location in each of the 16 meteorological sectors of the nearest milk animal, residence and garden greater than 500 $feet^2$ in size producing broadleaf vegetation within 5 miles. The census shall also identify within a distance of 3 miles the location in each of the 16 meteorological sectors all milk animals and gardens greater than 500 $feet^2$ producing broadleaf vegetation. For animals producing milk for human consumption in each of the 16 meteorological sectors out to a distance of 5 miles from the OCGS, none were observed. The distance and direction of all locations from the OCGS Reactor Building were determined using Global Positioning System (GPS) technology. A new garden was found at the same distance from the site as the current garden sampled in the ENE sector; no action was necessary. The results of this survey are summarized below:

Distance in Feet from the OCGS Reactor Building			
Sector		Residence (ft.)	Garden* (ft.)
1	N	5,655	6,434
2	NNE	3,240	4,557
3	NE	3,245	3,932
4	ENE	5,704	6,386
5	E	6,549	1,758
6	ESE	3,189	2,081
7	SE	3,073	2,321
8	SSE	4,666	5,248
9	S	7,971	8,303
10	SSW	8,344	9,618
11	SW	9,285	9,776
12	WSW	10,713	12,354
13	W	22,191	None
14	WNW	None	None
15	NW	27,985	None
16	NNW	7,506	12,159

**Greater than 500 ft^2 in size producing broad leaf vegetation*

E. Summary of Results – Inter-laboratory Comparison Program

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

A. Analytics Evaluation Criteria

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

B. ERA Evaluation Criteria

ERA's evaluation report provides an acceptance range for control and warning limits with associated flag values. ERA's acceptance limits are established per the 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.

C. DOE Evaluation Criteria

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

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

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

For the TBE laboratory, 119 out of 129 analyses performed met the specified acceptance criteria. Ten 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:

1. The ERA April 2019 water Cs-134 result was evaluated as *Not Acceptable*. The reported value was 15.2 pCi/L (error 2.82 pCi/L) and the known result was 12.1 pCi/L (acceptance range of 8.39 - 14.4 pCi/L). With the error, the reported result overlaps the acceptable range. This sample was run as the workgroup duplicate on a different detector with a result of 10.7 pCi/L (within acceptable range). (NCR 19-10)

2. The ERA April 2019 water Sr-89 result was evaluated as *Not Acceptable*. The reported value was 44.9 pCi/L and the known result was 33.3 pCi/L (acceptance range of 24.5 - 40.1 pCi/L). The sample was only counted for 15 minutes instead of 200 minutes. The sample was re-prepped in duplicate and counted for 200 minutes with results of 30.7 ± 5.37 pCi/L and 33.0 ± 8.71 pCi/L. This was the 1st "high" failure for Sr-89 in 5 years. (NCR 19-11)

3. The MAPEP February 2019 soil Sr-90 result was not submitted and therefore evaluated as *Not Acceptable*. The sample was run in duplicate, with results of -1.32 ± 4.09 Bq/kg (<6.87) and -1.030 ± 3.55

Bq/kg (<5.97). The known result was a false positive test (no significant activity). TBE did not submit a result because it appeared that the results may not be accurate. TBE analyzed a substitute soil Sr-90 sample from another vendor, with a result within the acceptable range. (NCR 19-12)

4. The MAPEP February 2019 water Am-241 result was evaluated as *Not Acceptable*. The reported value was 0.764 ± 0.00725 Bq/L with a known result of 0.582 Bq/L (acceptable range 0.407 - 0.757 Bq/L). TBE's result falls within the upper acceptable range with the error. It appeared that a non-radiological interference was added and lead to an increased mass and higher result. (NCR 19-13)

5. The MAPEP February 2019 vegetation Sr-90 result was evaluated as *Not Acceptable*. The reported result was -0.1060 ± 0.0328 Bq/kg and the known result was a false positive test (no significant activity). TBE's result was correct in that there was no activity. MAPEP's evaluation was a "statistical failure" at 3 standard deviations. (NCR 19-14)

6. The ERA October 2019 water Gross Alpha result was evaluated as *Not Acceptable*. TBE's reported result was 40.5 ± 10.3 pCi/L and the known result was 27.6 pCi/L (ratio of TBE to known result at 135%). With the associated error, the result falls within the acceptable range (14.0 - 36.3 pCi/L). The sample was run as the workgroup duplicate on a different detector with a result of 30.8 ± 9.17 pCi/L (within the acceptable range). This was the first failure for drinking water Gr-A since 2012. (NCR 19-23)

7. The ERA October 2019 water Sr-90 result was evaluated as *Not Acceptable*. TBE's reported result was 32.5 ± 2.12 pCi/L and the known result was 26.5 pCi/L (ratio of TBE to known result at 123%). With the associated error, the result falls within the acceptable range (19.2 - 30.9 pCi/L). The sample was run as the workgroup duplicate on a different detector with a result of 20.0 ± 1.91 pCi/L (within the acceptable range). Both TBE results are within internal QC limits. A substitute "quick response" sample was analyzed with an acceptable result of 18.6 pCi/L (known range of 13.2 - 22.1 pCi/L). (NCR 19-24)

8. The MAPEP August 2019 soil Ni-63 result of 436 ± 22.8 Bq/kg was evaluated as Not Acceptable. The known result was 629 Bq/kg (acceptable range 440 - 818 Bq/sample). With the associated error, the TBE result falls within the lower acceptance range. All associated QC was acceptable. No reason for failure could be found. This is the first failure for soil Ni-63 since 2012. (NCR 19-25)

9. The MAPEP August 2019 water Am-241 result was not reported and therefore evaluated as *Not Acceptable*. Initial review of the results showed a large peak where Am-241 should be (same as the February, 2019 sample results). It is believed that Th-228 was intentionally added as an interference. The sample was re-prepped and analyzed using a smaller sample aliquot. The unusual large peak (Th-228) was seen again and also this time a smaller peak (Am-241). The result was 436 ± 22.8 Bq/L (acceptable range 0.365 ± 0.679 Bq/L). Th-228 is not a typical nuclide requested by clients, so there is no analytical purpose to take samples through an additional separation step. TBE will pursue using another vendor for Am-241 water cross-checks that more closely reflects actual customer samples. (NCR 19-26)

10. The Analytics September 2019 soil Cr-51 sample was evaluated as *Not Acceptable*. TBE's reported result of 0.765 ± 0.135 pCi/g exceeded the upper acceptance range (140% of the known result of 0.547 pCi/g). The TBE result was within the acceptable range (0.63 - 0.90 pCi/g) with the associated error. The Cr-51 result is very close to TBE's normal detection limit. In order to get a reportable result, the sample must be counted for 15 hours (10x longer than client samples). There is no client or regulatory requirement for this nuclide and TBE will remove Cr-51 from the reported gamma nuclides going forward. (NCR 19-27)

For the secondary QC samples, Environmental Inc., Midwest Laboratories (EIML) analyzed samples for H-3, Sr-89/90 and gamma nuclides. For these analyses, 43 of 44 analyses met the specified acceptance criteria. One analysis did not meet the specified acceptance criteria for the following reason:

1. The July 2019 ERA water H-3 sample result was evaluated as Not Acceptable. The reported result was 8,630 ± 0.135 pCi/L and the known result was 16,700 (range of 14,600 - 18,400). EIML's routine analysis does include a blank sample. The ERA-provided blank was paired with a H-3 standard vial and EIML's blank was also paired with a standard vial. Inadvertently, the efficiency was overestimated by a factor of 2, which caused the calculated result to be half of the actual value. The result of reanalysis (17,400 pCi/L) is within the control limits for the study.

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

V. References

1. HDI Offsite Dose Calculation Manual for Oyster Creek Generating Station, Procedure CY-OC-170-301.

2. United States Nuclear Regulatory Commission Branch Technical Position, An Acceptable Radiological Environmental Monitoring Program, Revision 1, November 1979.

3 Pre-Operational Environmental Radiation Survey, Oyster Creek Nuclear Electric Generating Station, Jersey Central Power and Light Company, March 1968.

VI. Errata

There was no errata data for 2019.

APPENDIX A

RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT SUMMARY

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TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE OYSTER CREEK GENERATING STATION, 2019

NAME OF FACILITY: OYSTER CREEK GENERATING STATION — **DOCKET NUMBER: 50-219**

LOCATION OF FACILITY: OCEAN COUNTY, NJ — **REPORTING PERIOD: 2019**

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*	**LOCATION WITH HIGHEST ANNUAL MEAN (M)** STATION # NAME DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
SURFACE WATER *(PCI/LITER)*	**H-3**		30	**200**	<LLD	<LLD	-		0
	GAMMA		30						
		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
DRINKING WATER *(PCI/LITER)*	**H-3**		40	*NA*	<LLD	<LLD	-		0
	GR-B		40	**4**	3.7 (19/28) *1.8 - 11.8*	2.5 (8/12) *1.6 - 5.3*	7.7 (3/12) *2.9 - 11.8*	1N INDICATOR ON-SITE DOMESTIC WELL AT OCGS 0.2 MILES N OF SITE	0
	I-131 (LOW LVL)		40	**1**	<LLD	<LLD	-		0
	GAMMA		40						
		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

(M) *The Mean Values are calculated using the positive values.* ***(F)*** *Fraction of detectable measurement are indicated in parentheses.*

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE OYSTER CREEK GENERATING STATION, 2019

NAME OF FACILITY: OYSTER CREEK GENERATING STATION — **DOCKET NUMBER: 50-219**
LOCATION OF FACILITY: OCEAN COUNTY, NJ — **REPORTING PERIOD: 2019**

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
GROUNDWATER *(PCI/LITER)*	**H-3**	8	**200**	<LLD	*NA*	-		0
	GAMMA	8						
	MN-54		**15**	<LLD	*NA*	-		0
	CO-58		**15**	<LLD	*NA*	-		0
	FE-59		**30**	<LLD	*NA*	-		0
	CO-60		**15**	<LLD	*NA*	-		0
	ZN-65		**30**	<LLD	*NA*	-		0
	NB-95		**15**	<LLD	*NA*	-		0
	ZR-95		**30**	<LLD	*NA*	-		0
	I-131		**15**	<LLD	*NA*	-		0
	CS-134		**15**	<LLD	*NA*	-		0
	CS-137		**18**	<LLD	*NA*	-		0
	BA-140		**60**	<LLD	*NA*	-		0
	LA-140		**15**	<LLD	*NA*	-		0
BOTTOM FEEDER *(PCI/KG WET)*	**GAMMA**	4						
	K-40		*NA*	3290 (4/4) *2467 - 4717*	*NA*	3290 (4/4) *2467 - 4717*	33 INDICATOR EAST OF RT 9 BRIDGE IN OCGS DISCHARGE 0.4 MILES ESE OF SITE	0
	MN-54		**130**	<LLD	*NA*	-		0
	CO-58		**130**	<LLD	*NA*	-		0
	FE-59		**260**	<LLD	*NA*	-		0
	CO-60		**130**	<LLD	*NA*	-		0
	ZN-65		**260**	<LLD	*NA*	-		0
	CS-134		**130**	<LLD	*NA*	-		0
	CS-137		**150**	<LLD	*NA*	-		0

(M) *The Mean Values are calculated using the positive values.* ***(F)*** *Fraction of detectable measurement are indicated in parentheses.*

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE OYSTER CREEK GENERATING STATION, 2019

NAME OF FACILITY: OYSTER CREEK GENERATING STATION | **DOCKET NUMBER: 50-219**
LOCATION OF FACILITY: OCEAN COUNTY, NJ | **REPORTING PERIOD: 2019**

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
PREDATOR	**GAMMA**	3						
(PCI/KG WET)	*K-40*		*NA*	4748 (3/3) *4070 - 5932*	*NA*	5087 (2/2) *4241 - 5932*	93 INDICATOR OCGS DISCHARGE CANAL 0.1 MILES WSW OF SITE	0
	MN-54		**130**	<LLD	*NA*	-		0
	CO-58		**130**	<LLD	*NA*	-		0
	FE-59		**260**	<LLD	*NA*	-		0
	CO-60		**130**	<LLD	*NA*	-		0
	ZN-65		**260**	<LLD	*NA*	-		0
	CS-134		**130**	<LLD	*NA*	-		0
	CS-137		**150**	<LLD	*NA*	-		0
CLAMS	**GAMMA**	6						
(PCI/KG WET)	*K-40*		*NA*	1192 (4/4) *1041 - 1475*	1496 (2/2) *1288 - 1704*	1496 (2/2) *1288 - 1704*	94 CONTROL GREAT BAY/LITTLE EGG HARBOR 20.0 MILES SSW OF SITE	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
	CS-134		**130**	<LLD	<LLD	-		0
	CS-137		**150**	<LLD	<LLD	-		0
CRABS	**GAMMA**	2						
(PCI/KG WET)	*K-40*		*NA*	2659 (2/2) *2587 - 2731*	*NA*	2731 (1/1)	33 INDICATOR EAST OF RT 9 BRIDGE IN OCGS DISCHARGE 0.4 MILES ESE OF SITE	0
	MN-54		**130**	<LLD	*NA*	-		0
	CO-58		**130**	<LLD	*NA*	-		0
	FE-59		**260**	<LLD	*NA*	-		0
	CO-60		**130**	<LLD	*NA*	-		0
	ZN-65		**260**	<LLD	*NA*	-		0
	CS-134		**130**	<LLD	*NA*	-		0
	CS-137		**150**	<LLD	*NA*	-		0

(M) *The Mean Values are calculated using the positive values.* ***(F)*** *Fraction of detectable measurement are indicated in parentheses.*

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE OYSTER CREEK GENERATING STATION, 2019

NAME OF FACILITY: OYSTER CREEK GENERATING STATION **DOCKET NUMBER: 50-219**
LOCATION OF FACILITY: OCEAN COUNTY, NJ **REPORTING PERIOD: 2019**

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*	**LOCATION WITH HIGHEST ANNUAL MEAN (M)** STATION # NAME DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
SEDIMENT	**GAMMA**	8						
(PCI/KG DRY)	*BE-7*		*NA*	<LLD	<LLD	-		0
	K-40		*NA*	8340 (6/6) *1010 - 18160*	16150 (2/2) *15000 - 17300*	17160 (2/2) *16160 - 18160*	24 INDICATOR BARNEGAT BAY 2.1 MILES E OF SITE	0
	MN-54		*NA*	<LLD	<LLD	-		0
	CO-58		*NA*	<LLD	<LLD	-		0
	CO-60		*NA*	<LLD	<LLD	-		0
	CS-134		**150**	<LLD	<LLD	-		0
	CS-137		**180**	<LLD	<LLD	-		0
	Ra-226		*NA*	866 (1/6)	*NA*	866 (1/2)	33 INDICATOR EAST OF RT 9 BRIDGE IN OCGS DISCHARGE 0.4 MILES ESE OF SITE	0
	Th-226		*NA*	478 *(6/6)* *110 - 866*	642 *(1/2)*	806 *(2/2)* *745 - 866*	24 INDICATOR BARNEGAT BAY 2.1 MILES E OF SITE	0
AIR PARTICULATE *(E-3 PCI/CU.METER)*	**GR-B**	410	**10**	12 (282/308) *6 - 50*	12 (92/102) *6 - 25*	14 (48/50) *7 - 25*	C CONTROL JCP&L OFFICE - COOKSTOWN NJ 24.7 MILES NW OF SITE	0
	SR-89	32	**10**	<LLD	<LLD	-		0
	SR-90	32	**10**	<LLD	<LLD	-		0
	GAMMA	32						
	BE-7		*NA*	60 (24/24) *27 - 113*	68 (8/8) *41 - 90*	78 (4/4) *47 - 113*	66 INDICATOR EAST OF RT 9 AND SOUTH OF OCGS DISCHG 0.4 MILES SE OF SITE	0
	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

(M) *The Mean Values are calculated using the positive values.* ***(F)*** *Fraction of detectable measurement are indicated in parentheses.*

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE OYSTER CREEK GENERATING STATION, 2019

NAME OF FACILITY: OYSTER CREEK GENERATING STATION **DOCKET NUMBER: 50-219**
LOCATION OF FACILITY: OCEAN COUNTY, NJ **REPORTING PERIOD: 2019**

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
AIR IODINE	**GAMMA**	402						
(E-3 PCI/CU.METER)	*I-131*		**70**	<LLD	<LLD	-		0
VEGETATION *(PCI/KGWET)*	**SR-89**	33	**25**	<LLD	<LLD	-		0
	SR-90	33	**5**	6.4 (8/21) *2.7 - 13.8*	9.2 (8/12) *3.1 - 13.7*	9.2 (8/12) *3.1 - 13.7*	36 CONTROL U-PICK FARM - NEW EGYPT NJ 23.1 MILES NW OF SITE	0
	GAMMA	33						
	BE-7		*NA*	420 (6/21) *195 - 859*	<LLD	447 (3/10) *210 - 859*	115 INDICATOR EAST OF SITE 0.4 MILES SE OF SITE	0
	K-40		*NA*	2202 (21/21) *743 - 4926*	3651 (12/12) *1425 - 5240*	3651 (12/12) *1425 - 5240*	36 CONTROL U-PICK FARM - NEW EGYPT NJ 23.1 MILES NW OF SITE	0
	I-131		**60**	<LLD	<LLD	-		0
	CS-134		**60**	<LLD	<LLD	-		0
	CS-137		**80**	48 (3/21) 29 - 68	<LLD	48 (3/10) 29 - 63	115 INDICATOR EAST OF SITE 0.3 MILES E OF SITE	0
	BA-140		*NA*	<LLD	<LLD	-		0
	LA-140		*NA*	<LLD	<LLD	-		0
DIRECT RADIATION *(MILLIREM/STD.MO.)*	**OSLD-QUARTERLY**	516	*NA*	24.6 (492/492) *17.0 - 42.7*	22.6 (24/24) *19.4 - 25.9*	32.8 (16/16) *26.3 - 42.7*	55 INDICATOR SOUTHERN AREA STORES SECURITY FENCE 0.3 MILES W	0

(M) *The Mean Values are calculated using the positive values.* ***(F)*** *Fraction of detectable measurement 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 Oyster Creek Generating Station

Sample Medium	-	APT = Air Particulate AIO = Air Iodine DW = Drinking Water VEG = Vegetation SWA = Surface Water AQS = Aquatic Sediment	Clam = Clam OSLD = Optically Stimulated Dosimetry Fish = Fish Crab = Crab GW = Ground Water
Station Code	-	Station's Designation	
Distance	-	Distance from the OCGS in miles	
Azimuth	-	Azimuth with respect to the OCGS in degrees	
Description	-	Meteorological sector in which the station is located and a narrative description	

TABLE B-2: Radiological Environmental Monitoring Program – Sampling Locations, Distance and Direction, Oyster Creek Generating Station, 2019

Sample Medium	Station Code	Distance (miles)	Azimuth (degrees)	Description
OSLD	1	0.4	219	SW of site at OCGS Fire Pond, Forked River, NJ
DW	1S	0.1	209	On-site southern domestic well at OCGS, Forked River, NJ
DW	1N	0.2	349	On-site northern domestic well at OCGS, Forked River, NJ
APT, AIO, OSLD	3	6.0	97	East of site, near old Coast Guard Station, Island Beach State Park
OSLD	4	4.6	213	SSW of site, Route 554 and Garden State Parkway, Barnegat, NJ
OSLD	5	4.2	353	North of site, at Garden State Parkway Rest Area, Forked River, NJ
OSLD	6	2.1	13	NNE of site, Lane Place, behind St. Pius Church, Forked River, NJ
OSLD	8	2.3	177	South of site, Route 9 at the Waretown Substation, Waretown, NJ
OSLD	9	2.0	230	WSW of site, west of where Route 532 and the Garden State Parkway meet, Waretown, NJ
APT, AIO, OSLD	C	24.7	313	NW of site, JCP&L office in rear parking lot, Cookstown, NJ
OSLD	11	8.2	152	SSE of site, 80th and Anchor Streets, Harvey Cedars, NJ
OSLD	14	20.8	2	North of site, Larrabee Substation on Randolph Road, Lakewood, NJ
APT, AIO	20	0.7	95	East of site, on Finninger Farm on south side of access road, Forked River, NJ
OSLD	22	1.6	145	SE of site, on Long John Silver Way, Skippers Cove, Waretown, NJ
SWA, CLAM, AQS	23	3.6	64	ENE of site, Barnegat Bay off Stouts Creek, approximately 400 yards SE of "Flashing Light 1"
SWA, CLAM, AQS	24	2.1	101	East of site, Barnegat Bay, approximately 250 yards SE of "Flashing Light 3"
SWA, AQS, FISH, CRAB	33	0.4	123	ESE of site, east of Route 9 Bridge in OCGS Discharge Canal
VEG	35	0.4	111	ESE of site, east of Route 9 and north of the OCGS Discharge Canal, Forked River, NJ
VEG	36	23.1	319	NW of site, at "U-Pick" Farm, New Egypt, NJ

TABLE B-2: Radiological Environmental Monitoring Program – Sampling Locations, Distance and Direction, Oyster Creek Generating Station, 2019

Sample Medium	Station Code	Distance (miles)	Azimuth (degrees)	Description
DW	37	2.2	18	NNE of Site, off Boox Road at Lacey MUA Pumping Station, Forked River, NJ
DW	38	1.6	197	SSW of Site, on Route 532, at Ocean Township MUA Pumping Station, Waretown, NJ
OSLD	46	5.6	323	NW of site, on Lacey Road, adjacent to utility pole BT 259 65, Forked River, NJ
OSLD	47	4.6	26	NNE of site, Route 9 and Harbor Inn Road, Bayville, NJ
OSLD	48	4.5	189	South of site, at intersection of Brook and School Streets, Barnegat, NJ
OSLD	51	0.4	358	North of site, on the access road to Forked River site, Forked River, NJ
OSLD	52	0.3	333	NNW of site, on the access road to Forked River site, Forked River, NJ
OSLD	53	0.3	309	NW of site, at sewage lift station on the access road to the Forked River site, Forked River, NJ
OSLD	54	0.3	288	WNW of site, on the access road to Forked River site, Forked River, NJ
OSLD	55	0.3	263	West of site, on Southern Area Stores security fence, west of OCGS Switchyard, Forked River, NJ
OSLD	56	0.3	249	WSW of site, on utility pole east of Southern Area Stores, west of the OCGS Switchyard, Forked River, NJ
OSLD	57	0.2	206	SSW of site, on Southern Area Stores access road, Forked River, NJ
OSLD	58	0.2	188	South of site, on Southern Area Stores access road, Forked River, NJ
OSLD	59	0.3	166	SSE of site, on Southern Area Stores access road, Waretown, NJ
OSLD	61	0.3	104	ESE of site, on Route 9 south of OCGS Main Entrance, Forked River, NJ

TABLE B-2: Radiological Environmental Monitoring Program – Sampling Locations, Distance and Direction, Oyster Creek Generating Station, 2019

Sample Medium	Station Code	Distance (miles)	Azimuth (degrees)	Description
OSLD	62	0.2	83	East of site, on Route 9 at access road to OCGS Main Gate, Forked River, NJ
OSLD	63	0.2	70	ENE of site, on Route 9, between main gate and OCGS North Gate access road, Forked River, NJ
OSLD	64	0.3	42	NE of site, on Route 9 North at entrance to Finninger Farm, Forked River, NJ
OSLD	65	0.4	19	NNE of site, on Route 9 at Intake Canal Bridge, Forked River, NJ
APT, AIO, OSLD, VEG	66	0.4	133	SE of site, east of Route 9 and south of the OCGS Discharge Canal, inside fence, Waretown, NJ
OSLD	68	1.3	266	West of site, on Garden State Parkway North at mile marker 71.7, Lacey Township, NJ
APT, AIO, OSLD	71	1.6	164	SSE of site, on Route 532 at the Waretown Municipal Building, Waretown, NJ
APT, AIO, OSLD	72	1.9	25	NNE of site, on Lacey Road at Knights of Columbus Hall, Forked River, NJ
APT, AIO, OSLD	73	1.8	108	ESE of site, on Bay Parkway, Sands Point Harbor, Waretown, NJ
OSLD	74	1.8	88	East of site, Orlando Drive and Penguin Court, Forked River, NJ
OSLD	75	2.0	71	ENE of site, Beach Blvd. and Maui Drive, Forked River, NJ
OSLD	78	1.8	2	North of site, 1514 Arient Road, Forked River, NJ
OSLD	79	2.9	160	SSE of site, Hightide Drive and Bonita Drive, Waretown, NJ
OSLD	81	3.5	201	SSW of site, on Rose Hill Road at intersection with Barnegat Boulevard, Barnegat, NJ
OSLD	82	4.4	36	NE of site, Bay Way and Clairmore Avenue, Lanoka Harbor, NJ
OSLD	84	4.4	332	NNW of site, on Lacey Road, 1.3 miles west of the Garden State Parkway on siren pole, Lacey Township, NJ
OSLD	85	3.9	250	WSW of site, on Route 532, just east of Wells Mills Park, Waretown, NJ
OSLD	86	5.0	224	SW of site, on Route 554, 1 mile west of the Garden State Parkway, Barnegat, NJ

TABLE B-2: Radiological Environmental Monitoring Program – Sampling Locations, Distance and Direction, Oyster Creek Generating Station, 2019

Sample Medium	Station Code	Distance (miles)	Azimuth (degrees)	Description
OSLD	88	6.6	125	SE of site, eastern end of 3rd Street, Barnegat Light, NJ
OSLD	89	6.1	108	ESE of site, Job Francis residence, Island Beach State Park
OSLD	90	6.3	75	ENE of site, parking lot A-5, Island Beach State Park
OSLD	92	9.0	108	NE of site, at Guard Shack/Toll Booth, Island Beach State Park
FISH, CRAB	93	0.1	242	WSE of site, OCGS Discharge Canal between Pump Discharges and Route 9, Forked River, NJ
SWA, AQS, CLAM, FISH	94	20.0	198	SSW of site, in Great Bay/Little Egg Harbor
OSLD	98	1.6	318	NW of site, on Garden State Parkway North at mile marker 73, Lacey Township, NJ
OSLD	99	1.5	310	NW of site, on Garden State Parkway at mile marker 72.8, Lacey Township, NJ
OSLD	100	1.4	43	NE of site, Yacht Basin Plaza South off Lakeside Dr., Lacey Township, NJ
OSLD	101	1.7	49	NE of site, end of Lacey Rd. East, Lacey Township, NJ
OSLD	102	1.6	344	NNW of site, end of Sheffield Dr., Barnegat Pines, Lacey Township, NJ
OSLD	103	2.4	337	NNW of site, Llewellyn Pkwy., Barnegat Pines, Lacey Township, NJ
OSLD	104	1.8	221	SW of site, Rt. 532 West, before Garden State Parkway, Ocean Township, NJ
OSLD	105	2.8	222	SW of site, Garden State Parkway North beside mile marker 69.6, Ocean Township, NJ
OSLD	106	1.2	288	WNW of site, Garden State Parkway North beside mile marker 72.2, Lacey Township, NJ
OSLD	107	1.3	301	WNW of site, Garden State Parkway North beside mile marker 72.5, Lacey Township, NJ
OSLD	109	1.2	141	SE of site, Lighthouse Dr., Waretown, Ocean Township, NJ

TABLE B-2: Radiological Environmental Monitoring Program – Sampling Locations, Distance and Direction, Oyster Creek Generating Station, 2019

Sample Medium	Station Code	Distance (miles)	Azimuth (degrees)	Description
OSLD	110	1.5	127	SE of site, Tiller Dr. and Admiral Way, Waretown, Ocean Township, NJ
APT, AIO	111	0.3	64	ENE of site, Finninger Farm property along access road, Lacey Township, NJ
OLSD	112	0.2	176	S of site, along southern access road
OLSD	113	0.3	90	E of site, along Rt.9, North
DW	114	0.8	267	Well at Bldg 25 on Forked River site
VEG	115	0.3	96	E of Site, on Finninger Farm
OSLD	T1	0.4	219	SW of site, at OCGS Fire Pond, Forked River, NJ
GW	MW-24-3A	0.8	97	ESE of site, Finninger Farm on South side of access road, Lacey Township, NJ
GW	W-3C	0.4	112	ESE of site, Finninger Farm adjacent to Station 35, Lacey Township, NJ

TABLE B-3: Radiological Environmental Monitoring Program – Summary of Sample Collection and Analytical Methods, Oyster Creek Generating Station, 2019

Sample Medium	Analysis	Sampling Method	Collection Procedure Number	Sample Size	Analytical Procedure Number
Drinking Water	Gamma Spectroscopy	Monthly samples	ER-OCGS-06, Collection of water samples for radiological analysis CY-OC-120-1200, REMP sample collection procedure – well water	1 gallon	TBE, TBE-2007 Gamma-Emitting Radioisotopes Analysis Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy
Drinking Water	Tritium	Monthly samples	ER-OCGS-06, Collection of water samples for radiological analysis CY-OC-120-1200, REMP sample collection procedure – well water	1 gallon	TBE, TBE-2011 Tritium in Drinking Water by Liquid Scintillation Env. Inc., T-02 Determination of tritium in water (direct method)
Drinking water	Iodine	Monthly Samples	ER-OCGS-06, Collection of water samples for radiological analysis CY-OC-120-1200, REMP sample collection procedure – well water	1 gallon	TBE, TBE-2012 Radioiodine in Various Matrices Env. Inc., I-131-01 Determination of I-131 in water by anion exchange
Drinking Water	Gross Beta	Monthly Samples	ER-OCGS-06, Collection of water samples for radiological analysis CY-OC-120-1200, REMP sample collection procedure – well water	1 gallon	TBE, TBE-2008 Gross Alpha and/or Gross Beta Activity in Various Matrices
Surface Water	Gamma Spectroscopy	Grab Sample	ER-OCGS-06, Collection of water samples for radiological analysis	1 gallon	TBE, TBE-2007 Gamma-Emitting Radioisotopes Analysis Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy
Surface Water	Tritium	Grab Sample	ER-OCGS-06, Collection of water samples for radiological analysis	1 gallon	TBE, TBE-2011 Tritium in Drinking Water by Liquid Scintillation Env. Inc., T-02 Determination of tritium in water (direct method)
Groundwater	Tritium	Grab Sample	ER-OCGS-06, Collection of water samples for radiological analysis	1 gallon	TBE, TBE-2011 Tritium in Drinking Water by Liquid Scintillation
Groundwater	Gamma	Grab Sample	ER-OCGS-06, Collection of water samples for radiological analysis	1 gallon	TBE, TBE-2007 Gamma-Emitting Radioisotopes Analysis Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy
Fish	Gamma Spectroscopy	Semi-annual samples collected via hook and line technique and traps	ER-OCGS-14, Collection of fish samples for radiological analysis	250 grams (wet)	TBE, TBE-2007 Gamma-Emitting Radioisotopes Analysis

TABLE B-3: Radiological Environmental Monitoring Program – Summary of Sample Collection and Analytical Methods, Oyster Creek Generating Station, 2019

Sample Medium	Analysis	Sampling Method	Collection Procedure Number	Sample Size	Analytical Procedure Number
Clams and Crabs	Gamma Spectroscopy	Semi-annual and annual samples collected using clam tongs and traps.	ER-OCGS-16, Collection of clam and crab samples for radiological analysis	300 grams (wet)	TBE, TBE-2007 Gamma-Emitting Radioisotopes Analysis
Sediment	Gamma Spectroscopy	Semi-annual grab samples	ER-OCGS-03, Collection of aquatic sediment samples for radiological analysis	1000 grams (dry)	TBE, TBE-2007 Gamma-Emitting Radioisotopes Analysis Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy
Air Particulates	Gross Beta	One-week composite of continuous air sampling through glass fiber filter paper	ER-OCGS-05, Collection of air iodine and air particulate samples for radiological analysis	1 filter (approximately 300 cubic meters weekly)	TBE, TBE-2008 Gross alpha and/or beta activity in various matrices
Air Particulates	Gamma Spectroscopy	Quarterly composite of each station	TBE, TBE-2023 Compositing of samples Env. Inc., AP-03 Procedure for compositing air particulate filters for gamma spectroscopic analysis	13 filters (approximately 4000 cubic meters)	TBE, TBE-2007 Gamma-Emitting Radioisotopes Analysis
Air Particulates	Strontium-89/90	Quarterly composite of each station	ER-OCGS-05, Collection of air iodine and air particulate samples for radiological analysis	13 filters (approximately 4000 cubic meters)	TBE, TBE-2018 Radiostrontium Analysis by Chemical Separation
Air Iodine	Gamma Spectroscopy	One-week composite of continuous air sampling through charcoal filter	ER-OCGS-05, Collection of air iodine and air particulate samples for radiological analysis	1 filter (approximately 300 cubic meters weekly)	TBE, TBE-2007 Gamma-Emitting Radioisotopes Analysis
Vegetation	Gamma Spectroscopy	Grab sample during growing season	ER-OCGS-04, Collection of food products and broadleaf vegetation samples for radiological analysis	1000 grams	TBE, TBE-2007 Gamma-Emitting Radioisotopes Analysis Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy
Vegetation	Strontium-89/90	Grab sample during growing season	ER-OCGS-04, Collection of food products and broadleaf vegetation samples for radiological analysis	1000 grams	TBE, TBE-2018 Radiostrontium Analysis by Chemical Separation Env. Inc., SR-05 Determination of Sr-89 and Sr-90 in Ashed Samples
OSLD	Optically Stimulated Luminescence Dosimetry	Quarterly OSLDs comprised of two Al_2O_3:C Landauer Incorporated elements.	ER OCGS-02, Collection/Exchange of Field Dosimeters for Radiological Analysis	2 dosimeters	Landauer Incorporated

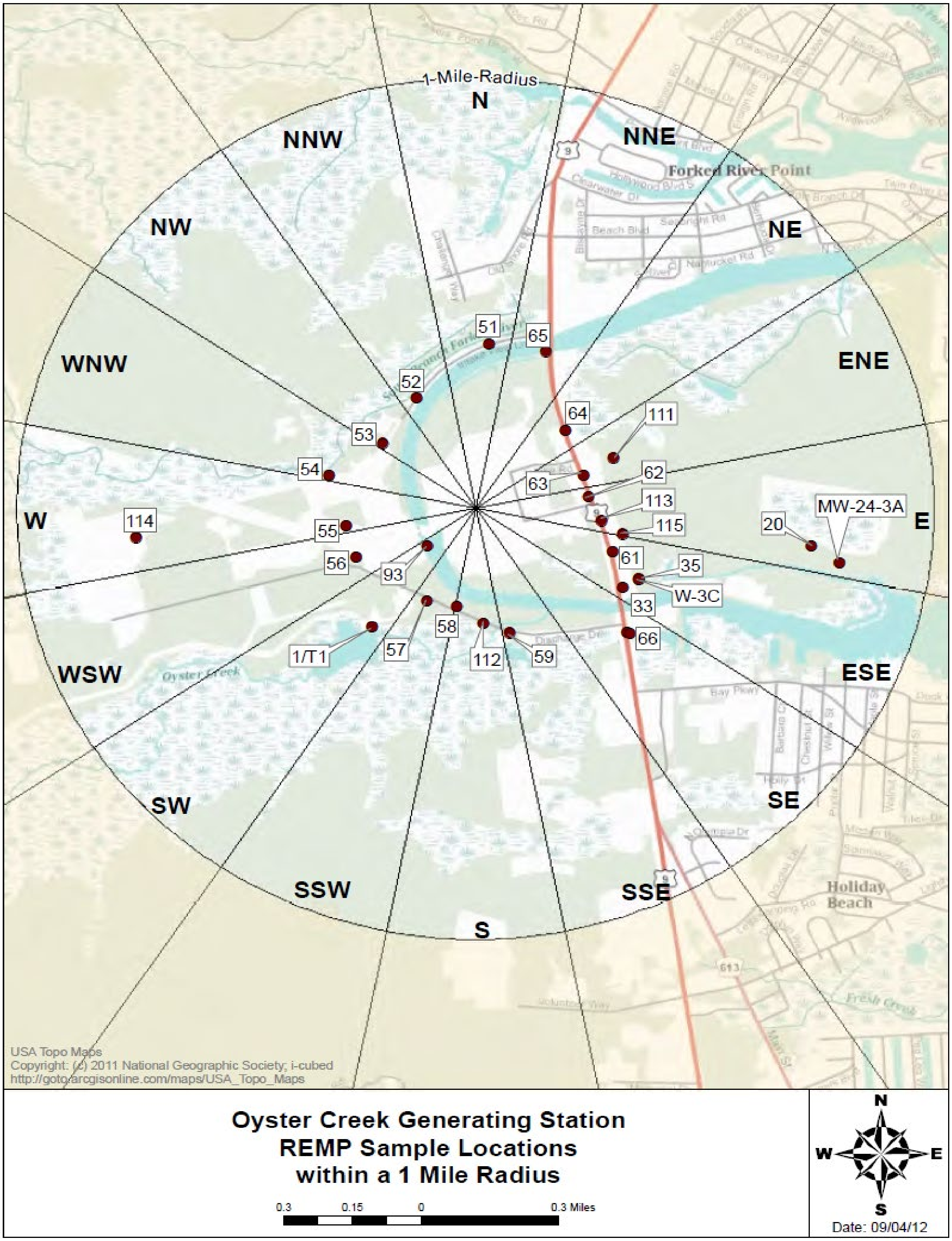

Figure B-1
Locations of REMP Stations within a 1-mile radius
of the Oyster Creek Generating Station

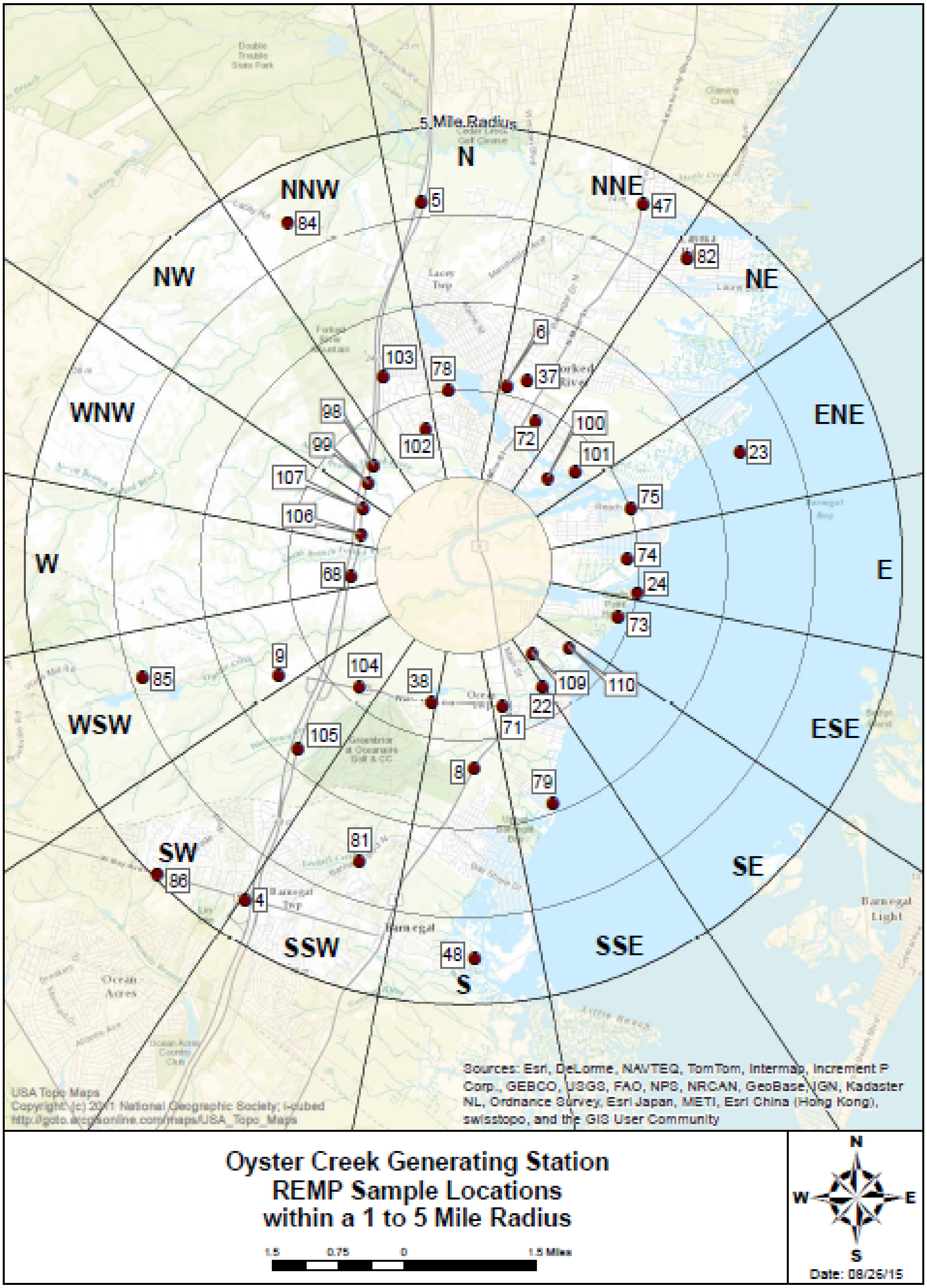

Figure B-2
Locations of REMP Stations within a 1 to 5-mile radius
of the Oyster Creek Generating Station

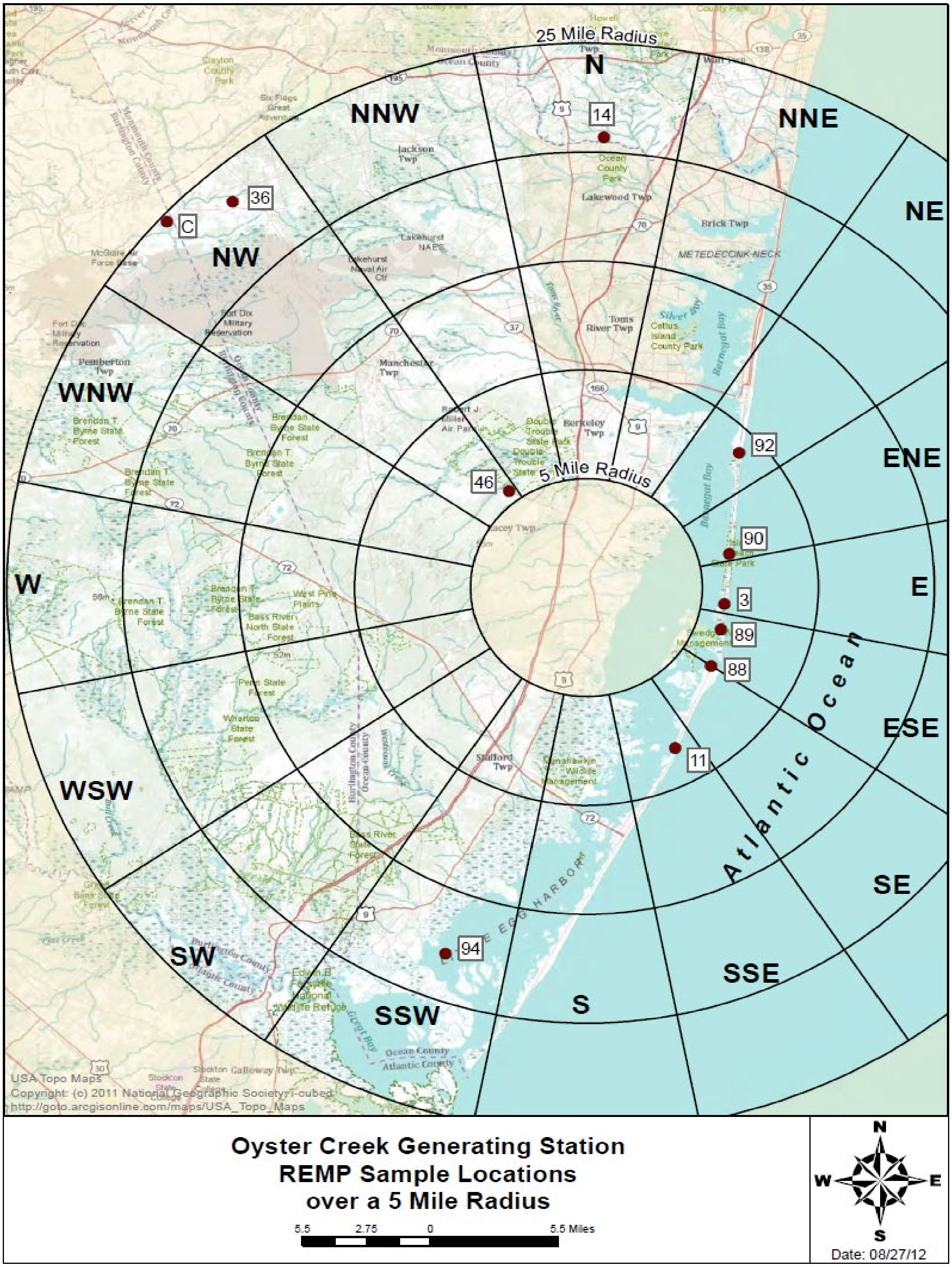

Figure B-3
Locations of REMP Stations greater than 5 miles from the Oyster Creek Generating Station

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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 OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	23	24	33	94
01/07/19 - 01/31/19			< 197	< 191
02/05/19 - 02/28/19			< 188	< 188
03/06/19 - 03/26/19			< 196	< 194
04/01/19 - 05/01/19			< 188	< 186
05/09/19 - 05/31/19			< 182	< 184
06/03/19 - 06/26/19	< 193	< 191	< 194	< 184
07/01/19 - 07/31/19			< 192	< 198
08/06/19 - 08/28/19			< 197	< 199
09/05/19 - 09/30/19		< 180	< 188	< 191
10/01/19 - 10/29/19	< 180		< 184	< 184
11/05/19 - 11/25/19			< 190	< 190
12/06/19 - 01/02/20			< 185	< 188
MEAN	-	-	-	-

Table C-I.2

CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

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
23	06/03/19 - 06/03/19	< 7	< 7	< 16	< 6	< 14	< 10	< 11	< 13	< 8	< 5	< 30	< 11
	10/01/19 - 10/01/19	< 7	< 6	< 14	< 6	< 12	< 5	< 9	< 8	< 6	< 7	< 27	< 7
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
24	06/03/19 - 06/03/19	< 6	< 7	< 11	< 5	< 19	< 7	< 12	< 11	< 8	< 8	< 35	< 10
	09/30/19 - 09/30/19	< 6	< 6	< 14	< 7	< 10	< 5	< 7	< 8	< 5	< 4	< 24	< 8
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
33	01/09/19 - 01/31/19	< 7	< 5	< 11	< 6	< 11	< 6	< 11	< 9	< 6	< 7	< 22	< 7
	02/06/19 - 02/27/19	< 6	< 6	< 12	< 6	< 13	< 7	< 12	< 13	< 7	< 6	< 33	< 10
	03/06/19 - 03/26/19	< 6	< 5	< 15	< 6	< 10	< 7	< 9	< 12	< 6	< 7	< 31	< 6
	04/03/19 - 05/01/19	< 6	< 7	< 13	< 8	< 11	< 7	< 11	< 11	< 7	< 6	< 28	< 9
	05/09/19 - 05/31/19	< 5	< 5	< 13	< 5	< 14	< 6	< 10	< 10	< 5	< 6	< 25	< 8
	06/04/19 - 06/26/19	< 7	< 6	< 17	< 6	< 13	< 8	< 11	< 12	< 8	< 7	< 33	< 11
	07/01/19 - 07/31/19	< 7	< 7	< 17	< 9	< 16	< 8	< 13	< 15	< 8	< 8	< 39	< 11
	08/06/19 - 08/28/19	< 7	< 6	< 16	< 6	< 16	< 6	< 10	< 12	< 7	< 7	< 32	< 14
	09/05/19 - 09/25/19	< 5	< 6	< 12	< 6	< 10	< 5	< 8	< 8	< 5	< 5	< 23	< 10
	10/01/19 - 10/29/19	< 3	< 3	< 7	< 4	< 8	< 4	< 6	< 6	< 4	< 3	< 18	< 5
	11/05/19 - 11/25/19	< 6	< 8	< 13	< 7	< 13	< 8	< 12	< 13	< 8	< 8	< 35	< 12
	12/06/19 - 01/02/20	< 7	< 6	< 11	< 5	< 11	< 7	< 11	< 10	< 7	< 8	< 33	< 14
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
94	01/07/19 - 01/28/19	< 6	< 6	< 14	< 7	< 17	< 8	< 11	< 13	< 6	< 7	< 40	< 14
	02/05/19 - 02/28/19	< 6	< 7	< 18	< 10	< 17	< 8	< 14	< 15	< 10	< 9	< 38	< 11
	03/07/19 - 03/26/19	< 5	< 5	< 11	< 5	< 10	< 4	< 9	< 8	< 6	< 5	< 27	< 10
	04/01/19 - 05/01/19	< 5	< 5	< 10	< 5	< 12	< 5	< 8	< 8	< 6	< 6	< 23	< 7
	05/09/19 - 05/31/19	< 6	< 6	< 13	< 8	< 11	< 8	< 11	< 9	< 7	< 6	< 28	< 10
	06/04/19 - 06/25/19	< 5	< 6	< 11	< 6	< 13	< 6	< 10	< 10	< 7	< 6	< 23	< 6
	07/01/19 - 07/30/19	< 6	< 7	< 14	< 7	< 14	< 5	< 13	< 13	< 7	< 6	< 28	< 13
	08/06/19 - 08/27/19	< 7	< 7	< 16	< 7	< 11	< 8	< 11	< 11	< 7	< 7	< 39	< 12
	09/05/19 - 09/24/19	< 6	< 5	< 11	< 6	< 12	< 7	< 11	< 11	< 6	< 6	< 30	< 9
	10/01/19 - 10/28/19	< 3	< 4	< 7	< 4	< 9	< 4	< 7	< 6	< 4	< 4	< 14	< 6
	11/05/19 - 11/25/19	< 6	< 6	< 17	< 5	< 15	< 9	< 12	< 12	< 8	< 7	< 30	< 13
	12/06/19 - 01/02/20	< 6	< 5	< 11	< 6	< 11	< 5	< 12	< 9	< 6	< 6	< 25	< 8
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-II.1 CONCENTRATIONS OF TRITIUM IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	114	1N	1S	37	38
01/07/19 - 01/31/19	< 190	< 186	*(1)*	< 185	< 189
02/04/19 - 03/06/19	< 190	< 190	*(1)*	< 191	< 188
03/06/19 - 03/27/19	< 195	< 193	*(1)*	< 196	< 198
04/01/19 - 05/01/19	< 190	< 189	*(1)*	< 189	< 186
05/06/19 - 05/31/19	*(1)*	< 185	*(1)*	< 185	< 185
06/04/19 - 06/26/19	*(1)*	< 197	*(1)*	< 196	< 191
07/01/19 - 07/31/19	*(1)*	< 191	*(1)*	< 197	< 192
08/06/19 - 08/28/19	*(1)*	< 198	*(1)*	< 198	< 196
09/04/19 - 09/26/19	*(1)*	< 195	*(1)*	< 190	< 188
10/02/19 - 10/30/19	*(1)*	< 191	*(1)*	< 186	< 186
11/05/19 - 11/29/19	*(1)*	< 188	*(1)*	< 189	< 182
12/04/19 - 01/02/20	*(1)*	< 191	*(1)*	< 188	< 185
MEAN	-	-	-	-	-

Table C-II.2 CONCENTRATIONS OF GROSS BETA IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	114	1N	1S	37	38
01/07/19 - 01/31/19	3.3 ± 1.4	11.8 ± 1.9	*(1)*	< 1.7	2.3 ± 1.2
02/04/19 - 03/06/19	3.5 ± 1.2	8.5 ± 1.7	*(1)*	< 1.6	2.3 ± 1.1
03/06/19 - 03/27/19	4.1 ± 1.3	< 1.8	*(1)*	1.8 ± 1.0	1.8 ± 1.0
04/01/19 - 05/01/19	4.2 ± 1.4	< 1.7	*(1)*	3.0 ± 1.2	2.2 ± 1.2
05/06/19 - 05/31/19	*(1)*	< 1.7	*(1)*	< 1.6	2.9 ± 1.2
06/04/19 - 06/26/19	*(1)*	< 1.6	*(1)*	< 1.6	1.8 ± 1.1
07/01/19 - 07/31/19	*(1)*	< 1.8	*(1)*	2.5 ± 1.3	2.9 ± 1.3
08/06/19 - 08/28/19	*(1)*	< 1.9	*(1)*	1.6 ± 1.1	2.9 ± 1.2
09/04/19 - 09/26/19	*(1)*	< 1.8	*(1)*	2.3 ± 1.2	3.1 ± 1.2
10/02/19 - 10/30/19	*(1)*	2.9 ± 1.4	*(1)*	1.8 ± 1.2	2.7 ± 1.3
11/05/19 - 11/29/19	*(1)*	< 1.7	*(1)*	5.3 ± 1.4	4.3 ± 1.4
12/04/19 - 01/02/20	*(1)*	< 1.6	*(1)*	1.7 ± 1.1	2.1 ± 1.1
MEAN ± 2 STD DEV	3.8 ± 0.9	7.7 ± 9.0	-	2.5 ± 2.5	2.6 ± 1.4

Table C-II.3 CONCENTRATIONS OF I-131 IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	114	1N	1S	37	38
01/07/19 - 01/31/19	< 0.6	< 0.6	*(1)*	< 0.7	< 0.4
02/04/19 - 03/06/19	< 0.7	< 0.4	*(1)*	< 0.7	< 0.7
03/06/19 - 03/27/19	< 0.5	< 0.6	*(1)*	< 0.5	< 0.8
04/01/19 - 05/01/19	< 0.9	< 0.5	*(1)*	< 0.5	< 0.5
05/06/19 - 05/31/19	*(1)*	< 0.7	*(1)*	< 0.6	< 0.8
06/04/19 - 06/26/19	*(1)*	< 0.9	*(1)*	< 0.8	< 0.7
07/01/19 - 07/31/19	*(1)*	< 0.9	*(1)*	< 0.7	< 0.7
08/06/19 - 08/28/19	*(1)*	< 0.8	*(1)*	< 0.8	< 0.8
09/04/19 - 09/26/19	*(1)*	< 1.0	*(1)*	< 0.9	< 0.8
10/02/19 - 10/30/19	*(1)*	< 0.9	*(1)*	< 0.7	< 0.8
11/05/19 - 11/29/19	*(1)*	< 0.9	*(1)*	< 0.9	< 0.7
12/04/19 - 01/02/20	*(1)*	< 0.5	*(1)*	< 0.5	< 0.8
MEAN	-	-	-	-	-

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES
(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-II.4

CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

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
114	01/07/19 - 01/28/19		< 4	< 5	< 11	< 5	< 9	< 6	< 11	< 6	< 5	< 29	< 8
	02/05/19 - 02/27/19		< 7	< 7	< 13	< 7	< 15	< 7	< 13	< 7	< 8	< 37	< 10
	03/07/19 - 03/26/19		< 5	< 5	< 10	< 4	< 11	< 5	< 10	< 7	< 6	< 24	< 8
	04/01/19 - 04/17/19		< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 19	< 5
	05/06/19 - 05/31/19	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	06/04/19 - 06/26/19	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	07/01/19 - 07/31/19	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	08/06/19 - 08/28/19	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	09/04/19 - 09/26/19	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	10/02/19 - 10/30/19	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	11/05/19 - 11/29/19	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	12/04/19 - 01/02/20	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	MEAN		-	-	-	-	-	-	-	-	-	-	-
1N	01/07/19 - 01/28/19		< 4	< 6	< 11	< 4	< 11	< 4	< 10	< 5	< 5	< 29	< 8
	02/04/19 - 03/06/19		< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 7	< 3
	03/06/19 - 03/27/19		< 7	< 8	< 12	< 8	< 16	< 7	< 14	< 8	< 7	< 28	< 14
	04/01/19 - 05/01/19		< 4	< 3	< 8	< 3	< 8	< 3	< 6	< 4	< 4	< 21	< 6
	05/06/19 - 05/29/19		< 4	< 5	< 11	< 6	< 12	< 6	< 11	< 7	< 7	< 28	< 6
	06/05/19 - 06/26/19		< 5	< 5	< 9	< 6	< 11	< 6	< 9	< 6	< 5	< 28	< 10
	07/03/19 - 07/29/19		< 4	< 6	< 11	< 8	< 11	< 7	< 7	< 5	< 6	< 29	< 10
	08/07/19 - 08/28/19		< 4	< 5	< 10	< 4	< 8	< 5	< 9	< 5	< 4	< 30	< 9
	09/04/19 - 09/26/19		< 5	< 4	< 13	< 5	< 11	< 5	< 10	< 5	< 6	< 27	< 10
	10/03/19 - 10/30/19		< 3	< 4	< 9	< 4	< 7	< 4	< 6	< 4	< 4	< 27	< 10
	11/06/19 - 11/27/19		< 6	< 6	< 11	< 6	< 13	< 6	< 9	< 7	< 5	< 34	< 9
	12/04/19 - 01/02/20		< 7	< 5	< 9	< 6	< 9	< 6	< 11	< 7	< 6	< 25	< 6
	MEAN		-	-	-	-	-	-	-	-	-	-	-
1S	01/07/19 - 01/31/19	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	02/04/19 - 02/28/19	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	03/06/19 - 03/27/19	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	04/01/19 - 05/01/19	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	05/06/19 - 05/31/19	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	06/04/19 - 06/26/19	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	07/01/19 - 07/31/19	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	08/06/19 - 08/28/19	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	09/04/19 - 09/26/19	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	10/02/19 - 10/30/19	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	11/05/19 - 11/29/19	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	12/04/19 - 01/02/20	*(1)*	-	-	-	-	-	-	-	-	-	-	-
	MEAN		-	-	-	-	-	-	-	-	-	-	-

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-II.4

CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

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
37	01/07/19 - 01/28/19	< 6	< 7	< 12	< 5	< 12	< 6	< 9	< 6	< 6	< 31	< 10
	02/06/19 - 02/27/19	< 7	< 7	< 15	< 7	< 16	< 8	< 13	< 7	< 7	< 35	< 12
	03/06/19 - 03/26/19	< 7	< 7	< 16	< 8	< 11	< 9	< 12	< 10	< 7	< 42	< 14
	04/01/19 - 05/01/19	< 5	< 4	< 6	< 5	< 10	< 5	< 8	< 5	< 5	< 19	< 6
	05/07/19 - 05/31/19	< 4	< 5	< 12	< 6	< 11	< 5	< 11	< 5	< 5	< 36	< 11
	06/04/19 - 06/26/19	< 5	< 5	< 10	< 7	< 11	< 5	< 12	< 4	< 7	< 29	< 6
	07/01/19 - 07/31/19	< 7	< 4	< 17	< 7	< 13	< 9	< 13	< 7	< 9	< 29	< 13
	08/06/19 - 08/27/19	< 7	< 7	< 14	< 8	< 13	< 4	< 10	< 7	< 6	< 29	< 9
	09/05/19 - 09/24/19	< 4	< 4	< 9	< 4	< 10	< 4	< 7	< 5	< 4	< 21	< 7
	10/04/19 - 10/28/19	< 3	< 3	< 8	< 4	< 7	< 4	< 6	< 4	< 3	< 16	< 6
	11/05/19 - 11/25/19	< 5	< 6	< 12	< 8	< 13	< 6	< 11	< 7	< 6	< 30	< 10
	12/06/19 - 01/02/20	< 7	< 7	< 11	< 8	< 14	< 7	< 10	< 8	< 7	< 26	< 9
	MEAN	-	-	-	-	-	-	-	-	-	-	-
38	01/09/19 - 01/31/19	< 6	< 6	< 13	< 7	< 16	< 8	< 10	< 7	< 7	< 29	< 14
	02/06/19 - 02/28/19	< 9	< 7	< 15	< 8	< 18	< 8	< 14	< 8	< 9	< 38	< 11
	03/06/19 - 03/20/19	< 5	< 5	< 12	< 7	< 12	< 5	< 9	< 5	< 5	< 35	< 9
	04/03/19 - 05/01/19	< 5	< 6	< 12	< 6	< 11	< 7	< 9	< 7	< 7	< 28	< 8
	05/09/19 - 05/31/19	< 8	< 8	< 16	< 7	< 17	< 8	< 12	< 8	< 8	< 36	< 8
	06/05/19 - 06/26/19	< 5	< 4	< 14	< 7	< 10	< 7	< 12	< 7	< 6	< 27	< 8
	07/02/19 - 07/31/19	< 7	< 6	< 13	< 9	< 9	< 7	< 12	< 7	< 7	< 29	< 14
	08/07/19 - 08/28/19	< 8	< 8	< 14	< 9	< 18	< 8	< 13	< 9	< 7	< 41	< 13
	09/11/19 - 09/24/19	< 4	< 4	< 11	< 5	< 7	< 4	< 8	< 5	< 5	< 21	< 9
	10/02/19 - 10/29/19	< 4	< 5	< 10	< 4	< 11	< 5	< 8	< 5	< 5	< 23	< 7
	11/06/19 - 11/29/19	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 15	< 4
	12/06/19 - 01/02/20	< 6	< 6	< 14	< 6	< 12	< 6	< 9	< 7	< 6	< 28	< 8
	MEAN	-	-	-	-	-	-	-	-	-	-	-

Table C-III.1 CONCENTRATIONS OF TRITIUM IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	MW-24-3A	W-3C
01/16/19 - 01/16/19	< 191	< 193
04/17/19 - 04/17/19	< 189	< 186
07/23/19 - 07/23/19	< 183	< 184
10/09/19 - 10/09/19	< 178	< 182
MEAN	-	-

Table C-III.2

CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

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
MW-24-3A	01/16/19 - 01/16/19	< 6	< 6	< 11	< 4	< 10	< 6	< 10	< 8	< 6	< 6	< 25	< 9
	04/17/19 - 04/17/19	< 6	< 7	< 12	< 6	< 14	< 6	< 10	< 12	< 6	< 6	< 29	< 8
	07/23/19 - 07/23/19	< 8	< 7	< 15	< 10	< 14	< 7	< 12	< 15	< 9	< 7	< 39	< 10
	10/09/19 - 10/09/19	< 9	< 9	< 15	< 8	< 25	< 9	< 14	< 12	< 10	< 8	< 40	< 11
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
W-3C	01/16/19 - 01/16/19	< 5	< 4	< 11	< 6	< 13	< 5	< 11	< 7	< 6	< 7	< 26	< 6
	04/17/19 - 04/17/19	< 7	< 6	< 15	< 8	< 10	< 5	< 11	< 12	< 9	< 7	< 32	< 11
	07/23/19 - 07/23/19	< 6	< 6	< 14	< 8	< 14	< 7	< 15	< 13	< 8	< 7	< 30	< 15
	10/09/19 - 10/09/19	< 5	< 8	< 9	< 4	< 17	< 8	< 15	< 11	< 9	< 6	< 29	< 14
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-IV.1 CONCENTRATIONS OF GAMMA EMITTERS IN PREDATOR AND BOTTOM FEEDER (FISH) SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE	COLLECTION PERIOD		K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137
33 *PREDATOR*	09/27/19		4070 ± 1285	< 82	< 89	< 187	< 100	< 209	< 96	< 81
	MEAN ± 2 STD DEV		4070 ± 0	-	-	-	-	-	-	-
33 *BOTTOM FEEDER*	06/04/19		3482 ± 1226	< 70	< 93	< 162	< 83	< 151	< 87	< 76
	06/04/19		2495 ± 760	< 43	< 48	< 100	< 43	< 78	< 45	< 50
	09/27/19		4717 ± 1215	< 66	< 72	< 119	< 84	< 137	< 66	< 83
	09/27/19		2467 ± 726	< 43	< 50	< 119	< 57	< 89	< 50	< 37
	MEAN ± 2 STD DEV		3290 ± 2124	-	-	-	-	-	-	-
93 *PREDATOR*	06/05/19		5932 ± 1522	< 90	< 80	< 196	< 76	< 201	< 88	< 90
	06/05/19		4241 ± 1036	< 36	< 45	< 70	< 25	< 92	< 50	< 51
	09/27/19	*(1)*								
	MEAN ± 2 STD DEV		5087 ± 2391	-	-	-	-	-	-	-
93 *BOTTONFEEDER*	06/05/19	*(1)*								
	09/27/19	*(1)*								
94 *PREDATOR*	06/05/19	*(1)*								
	09/27/19	*(1)*								
94 *BOTTONFEEDER*	06/05/19	*(1)*								
	09/27/19	*(1)*								

THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES
(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-IV.2 CONCENTRATIONS OF GAMMA EMITTERS IN CLAM AND CRAB SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE	COLLECTION PERIOD	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137
23									
Clams	06/03/19	1155 ± 716	< 37	< 42	< 86	< 65	< 82	< 54	< 39
	10/01/19	1041 ± 641	< 45	< 41	< 95	< 47	< 93	< 51	< 44
	MEAN ± 2 STD DEV	1098 ± 161	-	-	-	-	-	-	-
24									
Clams	06/03/19	1475 ± 929	< 62	< 51	< 110	< 70	< 87	< 31	< 57
	09/30/19	1097 ± 546	< 41	< 40	< 69	< 38	< 73	< 41	< 42
	MEAN ± 2 STD DEV	1286 ± 535	-	-	-	-	-	-	-
33									
Crabs	09/27/19	2731 ± 907	< 69	< 57	< 92	< 53	< 132	< 72	< 61
	MEAN ± 2 STD DEV	2731 ± 0	-	-	-	-	-	-	-
93									
Crabs	09/27/19	2587 ± 1246	< 67	< 63	< 147	< 83	< 156	< 86	< 84
	MEAN ± 2 STD DEV	2587 ± 0	-	-	-	-	-	-	-
94									
Clams	06/05/19	1704 ± 831	< 47	< 47	< 89	< 42	< 125	< 47	< 42
	10/02/19	1288 ± 804	< 56	< 45	< 88	< 60	< 114	< 62	< 50
	MEAN ± 2 STD DEV	1496 ± 588	-	-	-	-	-	-	-

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

Table C-V.1 **CONCENTRATIONS OF GAMMA EMITTERS IN SEDIMENT SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019**

RESULTS IN UNITS OF PCI/KG DRY ± 2 SIGMA

SITE	COLLECTION PERIOD	Be-7	K-40	Mn-54	Co-58	Co-60	Cs-134	Cs-137	Ra-226	Th-228
23	06/03/19	< 339	1571 ± 566	< 35	< 40	< 40	< 43	< 39	< 728	249 ± 61
	10/01/19	< 926	10500 ± 1813	< 110	< 95	< 99	< 98	< 108	< 1811	570 ± 170
MEAN ± 2 STD DEV		-	6036 ± 12628	-	-	-	-	-	-	409 ± 454
24	06/03/19	< 695	18160 ± 1586	< 83	< 64	< 83	< 88	< 79	< 1931	866 ± 144
	09/30/19	< 677	16160 ± 2025	< 96	< 69	< 92	< 103	< 74	< 1455	745 ± 179
MEAN ± 2 STD DEV		-	17160 ± 2828	-	-	-	-	-	-	806 ± 171
33	06/04/19	< 252	2636 ± 583	< 38	< 34	< 30	< 49	< 43	866 ± 702	331 ± 59
	09/30/19	< 446	1010 ± 546	< 56	< 51	< 53	< 56	< 55	< 1112	110 ± 91
MEAN ± 2 STD DEV		-	1823 ± 2300	-	-	-	-	-	866 ± 0	220 ± 313
94	06/05/19	< 538	17300 ± 1633	< 60	< 62	< 63	< 85	< 57	< 1463	642 ± 122
	10/01/19	< 731	15000 ± 1775	< 94	< 104	< 91	< 110	< 106	< 1987	< 231
MEAN ± 2 STD DEV		-	16150 ± 3253	-	-	-	-	-	-	642 ± 0

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

Table C-VI.1 **CONCENTRATIONS OF GROSS BETA IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019**

RESULTS IN UNITS OF E-3 PCI/CU METER ± 2 SIGMA

COLLECTION	GROUP I			GROUP II			GROUP III	
PERIOD	20	66	111	71	72	73	3	C
01/02/19 - 01/09/19	*(1)*	12 ± 5	16 ± 5	15 ± 5	19 ± 5	11 ± 5	13 ± 5	17 ± 5
01/09/19 - 01/16/19	*(1)*	9 ± 4	7 ± 4	6 ± 4	10 ± 4	7 ± 4	8 ± 4	9 ± 5
01/16/19 - 01/23/19	50 ± 16	15 ± 4	12 ± 4	14 ± 4	15 ± 4	15 ± 5	14 ± 4	11 ± 4
01/23/19 - 01/31/19	15 ± 4	15 ± 4	17 ± 4	16 ± 4	16 ± 4	17 ± 4	14 ± 4	15 ± 4
01/31/19 - 02/06/19	18 ± 5	17 ± 5	15 ± 5	17 ± 5	15 ± 5	22 ± 5	21 ± 5	22 ± 5
02/06/19 - 02/14/19	8 ± 4	9 ± 4	10 ± 4	6 ± 3	9 ± 3	*(1)*	6 ± 3	12 ± 4
02/14/19 - 02/21/19	13 ± 4	15 ± 4	12 ± 4	14 ± 4	14 ± 4	13 ± 5	17 ± 5	14 ± 5
02/21/19 - 02/27/19	20 ± 6	15 ± 5	16 ± 5	15 ± 5	20 ± 6	13 ± 5	14 ± 5	19 ± 6
02/27/19 - 03/06/19	15 ± 4	13 ± 4	11 ± 4	17 ± 5	13 ± 5	12 ± 4	16 ± 5	15 ± 5
03/06/19 - 03/13/19	12 ± 4	8 ± 4	9 ± 4	< 6	7 ± 4	7 ± 4	11 ± 4	7 ± 4
03/13/19 - 03/20/19	21 ± 5	18 ± 4	21 ± 4	23 ± 5	21 ± 5	27 ± 5	8 ± 4	25 ± 5
03/20/19 - 03/27/19	9 ± 4	11 ± 4	6 ± 4	11 ± 4	9 ± 4	6 ± 4	8 ± 4	14 ± 5
03/27/19 - 04/03/19	11 ± 5	10 ± 4	9 ± 4	10 ± 5	8 ± 5	7 ± 4	8 ± 4	9 ± 5
04/03/19 - 04/09/19	9 ± 5	7 ± 5	11 ± 5	7 ± 5	10 ± 5	8 ± 5	< 7	11 ± 6
04/09/19 - 04/17/19	8 ± 4	6 ± 3	8 ± 3	13 ± 4	7 ± 4	7 ± 4	< 5	11 ± 4
04/17/19 - 04/24/19	11 ± 5	9 ± 4	6 ± 4	8 ± 4	9 ± 5	7 ± 4	7 ± 4	*(1)*
04/24/19 - 05/01/19	6 ± 4	7 ± 4	11 ± 4	11 ± 4	12 ± 4	9 ± 4	8 ± 4	8 ± 4
05/01/19 - 05/09/19	6 ± 4	6 ± 4	8 ± 4	8 ± 4	< 6	< 5	< 5	7 ± 4
05/09/19 - 05/15/19	< 7	< 7	7 ± 4	< 7	< 7	< 7	8 ± 5	< 8
05/15/19 - 05/21/19	22 ± 6	19 ± 6	21 ± 5	25 ± 6	22 ± 6	16 ± 5	18 ± 5	20 ± 6
05/21/19 - 05/29/19	9 ± 4	10 ± 4	8 ± 4	11 ± 6	9 ± 4	9 ± 4	8 ± 4	8 ± 4
05/29/19 - 06/05/19	12 ± 4	9 ± 4	9 ± 4	9 ± 4	12 ± 4	6 ± 4	< 6	11 ± 4
06/05/19 - 06/12/19	11 ± 5	8 ± 5	10 ± 4	10 ± 5	9 ± 5	10 ± 5	7 ± 4	11 ± 5
06/12/19 - 06/19/19	8 ± 4	8 ± 4	7 ± 4	7 ± 4	9 ± 4	8 ± 4	7 ± 4	*(1)*
06/19/19 - 06/25/19	< 7	7 ± 5	9 ± 5	10 ± 5	< 7	< 7	8 ± 5	15 ± 8
06/25/19 - 07/02/19	19 ± 4	19 ± 5	15 ± 4	12 ± 4	15 ± 4	8 ± 4	14 ± 4	16 ± 4
07/02/19 - 07/10/19	11 ± 4	7 ± 3	11 ± 3	14 ± 4	9 ± 4	9 ± 3	10 ± 3	13 ± 4
07/10/19 - 07/16/19	10 ± 5	8 ± 5	9 ± 5	< 7	< 8	10 ± 5	< 8	< 8
07/16/19 - 07/24/19	12 ± 4	12 ± 5	10 ± 4	12 ± 4	11 ± 4	12 ± 4	13 ± 4	14 ± 5
07/24/19 - 07/30/19	15 ± 5	14 ± 4	14 ± 4	10 ± 4	12 ± 4	15 ± 5	12 ± 4	14 ± 5
07/30/19 - 08/07/19	15 ± 5	13 ± 5	15 ± 5	14 ± 5	10 ± 5	13 ± 5	7 ± 4	17 ± 5
08/07/19 - 08/15/19	18 ± 4	18 ± 4	13 ± 4	13 ± 4	18 ± 4	11 ± 4	8 ± 4	17 ± 4
08/15/19 - 08/21/19	12 ± 6	15 ± 6	11 ± 5	< 8	9 ± 6	< 8	11 ± 5	14 ± 6
08/21/19 - 08/27/19	11 ± 5	9 ± 5	9 ± 5	< 7	9 ± 5	12 ± 5	< 8	16 ± 6
08/27/19 - 09/04/19	11 ± 4	9 ± 4	9 ± 4	7 ± 4	13 ± 4	12 ± 4	9 ± 4	15 ± 4
09/04/19 - 09/11/19	20 ± 5	15 ± 5	15 ± 4	11 ± 4	17 ± 5	8 ± 4	11 ± 4	17 ± 5
09/11/19 - 09/18/19	*(1)*	13 ± 5	10 ± 4	12 ± 5	14 ± 5	11 ± 5	10 ± 4	20 ± 5
09/18/19 - 09/24/19	17 ± 5	15 ± 5	12 ± 5	12 ± 5	14 ± 5	10 ± 5	7 ± 4	20 ± 5
09/24/19 - 10/02/19	11 ± 4	16 ± 4	17 ± 4	13 ± 4	15 ± 5	14 ± 4	8 ± 4	19 ± 5
10/02/19 - 10/09/19	7 ± 4	6 ± 4	7 ± 4	8 ± 4	< 7	< 6	< 6	9 ± 5
10/09/19 - 10/17/19	13 ± 4	13 ± 4	11 ± 4	13 ± 4	11 ± 4	14 ± 4	11 ± 4	13 ± 4
10/17/19 - 10/23/19	14 ± 5	12 ± 4	9 ± 4	10 ± 4	11 ± 5	7 ± 4	7 ± 4	14 ± 5
10/23/19 - 10/29/19	13 ± 5	12 ± 5	10 ± 5	12 ± 5	< 7	9 ± 5	9 ± 5	11 ± 5
10/29/19 - 11/05/19	< 5	7 ± 4	< 5	< 5	7 ± 4	6 ± 4	< 5	11 ± 4
11/05/19 - 11/13/19	19 ± 4	16 ± 4	16 ± 4	20 ± 4	10 ± 4	16 ± 4	16 ± 4	14 ± 4
11/13/19 - 11/20/19	10 ± 4	15 ± 5	11 ± 4	10 ± 4	10 ± 5	10 ± 4	12 ± 5	14 ± 5
11/20/19 - 11/26/19	15 ± 5	12 ± 5	15 ± 5	12 ± 5	10 ± 5	19 ± 6	15 ± 5	11 ± 5
11/26/19 - 12/04/19	9 ± 4	7 ± 4	7 ± 3	< 5	8 ± 4	< 5	8 ± 4	13 ± 4
12/04/19 - 12/11/19	13 ± 5	9 ± 5	11 ± 5	11 ± 5	14 ± 5	9 ± 5	11 ± 5	13 ± 5
12/11/19 - 12/18/19	12 ± 5	8 ± 4	11 ± 4	< 6	11 ± 5	< 6	9 ± 4	12 ± 5
12/18/19 - 12/26/19	24 ± 5	21 ± 5	24 ± 5	17 ± 4	17 ± 5	22 ± 5	19 ± 5	21 ± 5
12/26/19 - 01/02/20	13 ± 5	15 ± 5	14 ± 4	14 ± 5	8 ± 4	13 ± 5	7 ± 4	17 ± 5
MEAN ± 2 STD DEV	14 ± 14	12 ± 8	12 ± 8	12 ± 8	12 ± 8	12 ± 9	11 ± 8	14 ± 8

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THE MEAN AND TWO STANDARD DEVIATION ARE CALCULATED USING THE POSITIVE VALUES
(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-VI.2 MONTHLY AND YEARLY MEAN VALUES OF GROSS BETA CONCENTRATIONS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF E-3 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
01/02/19 - 01/31/19	7	50	17 ± 24	01/02/19 - 01/31/19	6	19	13 ± 8	01/02/19 - 01/31/19	8	17	13 ± 6
01/31/19 - 02/27/19	8	20	14 ± 7	01/31/19 - 02/27/19	6	22	14 ± 9	01/31/19 - 02/27/19	6	22	16 ± 10
02/27/19 - 04/03/19	6	21	12 ± 9	02/27/19 - 04/03/19	6	27	13 ± 13	02/27/19 - 04/03/19	7	25	12 ± 11
04/03/19 - 05/01/19	6	11	8 ± 4	04/03/19 - 05/01/19	7	13	9 ± 4	04/03/19 - 05/01/19	7	11	9 ± 4
05/01/19 - 05/29/19	6	22	12 ± 13	05/01/19 - 05/29/19	8	25	14 ± 14	05/01/19 - 05/29/19	7	20	11 ± 12
05/29/19 - 07/02/19	7	19	11 ± 8	05/29/19 - 07/02/19	6	15	10 ± 5	05/29/19 - 07/02/19	7	16	11 ± 7
07/02/19 - 07/30/19	7	15	11 ± 5	07/02/19 - 07/30/19	9	15	11 ± 4	07/02/19 - 07/30/19	10	14	13 ± 3
07/30/19 - 09/04/19	9	18	13 ± 6	07/30/19 - 09/04/19	7	18	12 ± 5	07/30/19 - 09/04/19	7	17	13 ± 8
09/04/19 - 10/02/19	10	20	15 ± 6	09/04/19 - 10/02/19	8	17	13 ± 5	09/04/19 - 10/02/19	7	20	14 ± 11
10/02/19 - 10/29/19	6	14	11 ± 5	10/02/19 - 10/29/19	7	14	11 ± 5	10/02/19 - 10/29/19	7	14	10 ± 5
10/29/19 - 12/04/19	7	19	12 ± 8	10/29/19 - 12/04/19	6	20	11 ± 9	10/29/19 - 12/04/19	8	16	13 ± 5
12/04/19 - 01/02/20	8	24	15 ± 11	12/04/19 - 01/02/20	8	22	13 ± 8	12/04/19 - 01/02/20	7	21	13 ± 10
01/02/19 - 01/02/20	6	50	12 ± 10	01/02/19 - 01/02/20	6	27	12 ± 8	01/02/19 - 01/02/20	6	25	12 ± 9

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

Table C-VI.3 CONCENTRATIONS OF STRONTIUM IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF E-3 PCI/CU METER ± 2 SIGMA

SITE	COLLECTION PERIOD	SR-89	SR-90
3	01/03/18 - 03/28/18	< 6	< 5
	03/28/18 - 07/03/18	< 4	< 4
	07/03/18 - 10/03/18	< 6	< 4
	10/03/18 - 01/02/19	< 5	< 7
	MEAN	-	-
20	01/11/18 - 03/28/18	< 8	< 6
	03/28/18 - 07/03/18	< 5	< 4
	07/03/18 - 10/03/18	< 6	< 3
	10/03/18 - 12/27/18	< 9	< 8
	MEAN	-	-
66	01/03/18 - 03/28/18	< 6	< 4
	03/28/18 - 07/03/18	< 5	< 5
	07/11/18 - 10/03/18	< 7	< 4
	10/03/18 - 01/02/19	< 5	< 5
	MEAN	-	-
71	01/03/18 - 03/28/18	< 6	< 5
	03/28/18 - 07/03/18	< 5	< 4
	07/03/18 - 10/03/18	< 5	< 3
	10/03/18 - 01/02/19	< 7	< 9
	MEAN	-	-
72	01/03/18 - 03/28/18	< 5	< 5
	03/28/18 - 07/03/18	< 6	< 7
	07/03/18 - 10/03/18	< 6	< 4
	10/03/18 - 01/02/19	< 7	< 10
	MEAN	-	-
73	01/11/18 - 03/28/18	< 9	< 7
	03/28/18 - 07/03/18	< 6	< 7
	07/03/18 - 10/03/18	< 6	< 3
	10/03/18 - 01/02/19	< 6	< 6
	MEAN	-	-
111	01/03/18 - 03/28/18	< 6	< 6
	03/28/18 - 07/03/18	< 5	< 5
	07/03/18 - 10/03/18	< 7	< 4
	10/03/18 - 01/02/19	< 6	< 5
	MEAN	-	-
C	01/03/18 - 03/28/18	< 6	< 5
	03/28/18 - 07/03/18	< 6	< 5
	07/03/18 - 10/03/18	< 6	< 3
	10/03/18 - 01/02/19	< 6	< 9
	MEAN	-	-

Table C-VI.4 **CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019**

RESULTS IN UNITS OF E-3 PCI/CU METER ± 2 SIGMA

SITE	COLLECTION PERIOD	Be-7	Mn-54	Co-58	Co-60	Cs-134	Cs-137
3	01/02/19 - 04/03/19	71 ± 12	< 2	< 2	< 2	< 2	< 2
	04/03/19 - 07/02/19	44 ± 14	< 3	< 3	< 3	< 3	< 2
	07/02/19 - 10/02/19	47 ± 13	< 2	< 2	< 2	< 2	< 2
	10/02/19 - 01/02/20	39 ± 13	< 2	< 3	< 2	< 2	< 2
	MEAN ± 2 STD DEV	50 ± 28	-	-	-	-	-
20	01/16/19 - 04/03/19	98 ± 16	< 2	< 2	< 2	< 2	< 2
	04/03/19 - 07/02/19	79 ± 24	< 2	< 2	< 3	< 2	< 2
	07/02/19 - 10/02/19	64 ± 22	< 2	< 2	< 1	< 2	< 2
	10/02/19 - 01/02/20	42 ± 18	< 2	< 2	< 3	< 3	< 3
	MEAN ± 2 STD DEV	71 ± 47	-	-	-	-	-
66	01/02/19 - 04/03/19	87 ± 15	< 2	< 2	< 2	< 2	< 2
	04/03/19 - 07/02/19	113 ± 20	< 2	< 2	< 2	< 2	< 2
	07/02/19 - 10/02/19	65 ± 15	< 2	< 3	< 3	< 2	< 2
	10/02/19 - 01/02/20	47 ± 17	< 2	< 2	< 3	< 2	< 2
		78 ± 57	-	-	-	-	-
71	01/02/19 - 04/03/19	58 ± 10	< 1	< 1	< 2	< 1	< 1
	04/03/19 - 07/02/19	58 ± 24	< 3	< 3	< 3	< 2	< 3
	07/02/19 - 10/02/19	54 ± 16	< 2	< 3	< 2	< 2	< 2
	10/02/19 - 01/02/20	36 ± 13	< 2	< 2	< 2	< 2	< 2
	MEAN ± 2 STD DEV	52 ± 21	-	-	-	-	-
72	01/02/19 - 04/03/19	82 ± 13	< 1	< 1	< 1	< 2	< 1
	04/03/19 - 07/02/19	52 ± 22	< 2	< 3	< 3	< 3	< 2
	07/02/19 - 10/02/19	57 ± 17	< 2	< 3	< 2	< 3	< 3
	10/02/19 - 01/02/20	27 ± 12	< 2	< 2	< 2	< 2	< 2
		50 ± 42	-	-	-	-	-
73	01/02/19 - 04/03/19	62 ± 16	< 2	< 2	< 2	< 2	< 2
	04/03/19 - 07/02/19	52 ± 26	< 2	< 3	< 4	< 2	< 2
	07/02/19 - 10/02/19	56 ± 23	< 3	< 2	< 2	< 3	< 2
	10/02/19 - 01/02/20	44 ± 12	< 2	< 2	< 2	< 2	< 2
	MEAN ± 2 STD DEV	54 ± 15	-	-	-	-	-
111	01/02/19 - 04/03/19	72 ± 15	< 2	< 2	< 2	< 2	< 2
	04/03/19 - 07/02/19	81 ± 23	< 2	< 3	< 4	< 3	< 3
	07/02/19 - 10/02/19	52 ± 16	< 2	< 2	< 2	< 2	< 3
	10/02/19 - 01/02/20	41 ± 14	< 2	< 2	< 2	< 2	< 2
	MEAN ± 2 STD DEV	61 ± 37	-	-	-	-	-
C	01/02/19 - 04/03/19	90 ± 20	< 2	< 3	< 3	< 2	< 2
	04/03/19 - 07/02/19	74 ± 33	< 4	< 4	< 3	< 3	< 4
	07/02/19 - 10/02/19	89 ± 19	< 2	< 2	< 2	< 2	< 2
	10/02/19 - 01/02/20	48 ± 23	< 3	< 4	< 5	< 3	< 4
	MEAN ± 2 STD DEV	75 ± 39	-	-	-	-	-

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

Table C-VII.1 **CONCENTRATIONS OF I-131 IN AIR IODINE SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019**

RESULTS IN UNITS OF E-3 PCI/CU METER ± 2 SIGMA

COLLECTION	GROUP I			GROUP II			GROUP III	
PERIOD	20	66	111	71	72	73	3	C
01/02/19 - 01/09/19	*(1)*	< 46	< 46	< 19	< 44	< 47	< 18	< 23
01/09/19 - 01/16/19	*(1)*	< 30	< 30	< 25	< 28	< 30	< 38	< 41
01/16/19 - 01/23/19	< 46	< 28	< 28	< 27	< 5	< 29	< 12	< 46
01/23/19 - 01/31/19	< 39	< 38	< 38	< 37	< 36	< 39	< 36	< 39
01/31/19 - 02/06/19	< 35	< 33	< 34	< 28	< 56	< 34	< 22	< 56
02/06/19 - 02/14/19	< 23	< 22	< 22	< 18	< 21	*(1)*	< 15	< 38
02/14/19 - 02/21/19	< 50	< 39	< 40	< 39	< 46	< 47	< 48	< 52
02/21/19 - 02/27/19	< 42	< 53	< 51	< 53	< 45	< 54	< 43	< 46
02/27/19 - 03/06/19	< 30	< 32	< 26	< 32	< 32	< 32	< 30	< 30
03/06/19 - 03/13/19	< 40	< 27	< 11	< 27	< 43	< 27	< 41	< 45
03/13/19 - 03/20/19	< 32	< 39	< 37	< 38	< 35	< 39	< 33	< 35
03/20/19 - 03/27/19	< 47	< 41	< 39	< 41	< 51	< 41	< 48	< 51
03/27/19 - 04/03/19	< 28	< 46	< 16	< 46	< 30	< 47	< 28	< 28
04/03/19 - 04/09/19	< 63	< 64	< 61	< 27	< 45	< 64	< 37	< 48
04/09/19 - 04/17/19	< 42	< 35	< 34	< 35	< 44	< 36	< 41	< 42
04/17/19 - 04/24/19	< 59	< 60	< 20	< 59	< 45	< 59	< 42	*(1)*
04/24/19 - 05/01/19	< 47	< 48	< 45	< 20	< 30	< 48	< 35	< 38
05/01/19 - 05/09/19	< 38	< 39	< 16	< 39	< 18	< 39	< 40	< 41
05/09/19 - 05/15/19	< 36	< 37	< 35	< 15	< 25	< 37	< 28	< 31
05/15/19 - 05/21/19	< 54	< 54	< 22	< 54	< 28	< 55	< 32	< 32
05/21/19 - 05/29/19	< 23	< 23	< 19	< 33	< 16	< 24	< 37	< 41
05/29/19 - 06/05/19	< 53	< 54	< 51	< 22	< 27	< 54	< 31	< 33
06/05/19 - 06/12/19	< 49	< 49	< 47	< 20	< 24	< 49	< 52	< 55
06/12/19 - 06/19/19	< 14	< 14	< 6	< 14	< 59	< 14	< 56	*(1)*
06/19/19 - 06/25/19	< 54	< 55	< 22	< 54	< 39	< 54	< 37	< 50
06/25/19 - 07/02/19	< 34	< 34	< 18	< 34	< 37	< 35	< 35	< 38
07/02/19 - 07/10/19	< 40	< 40	< 16	< 40	< 29	< 40	< 26	< 27
07/10/19 - 07/16/19	< 64	< 54	< 62	< 64	< 64	< 23	< 62	< 28
07/16/19 - 07/24/19	< 33	< 16	< 32	< 33	< 29	< 34	< 27	< 18
07/24/19 - 07/30/19	< 49	< 49	< 48	< 27	< 57	< 49	< 55	< 60
07/30/19 - 08/07/19	< 45	< 45	< 43	< 45	< 24	< 19	< 26	< 27
08/07/19 - 08/15/19	< 36	< 15	< 35	< 36	< 23	< 36	< 23	< 19
08/15/19 - 08/21/19	< 44	< 44	< 43	< 44	< 36	< 19	< 32	< 35
08/21/19 - 08/27/19	< 49	< 48	< 47	< 49	< 34	< 21	< 34	< 31
08/27/19 - 09/04/19	< 33	< 18	< 32	< 33	< 26	< 33	< 29	< 31
09/04/19 - 09/11/19	< 36	< 36	< 35	< 36	< 32	< 15	< 36	< 38
09/11/19 - 09/18/19	*(1)*	< 38	< 36	< 37	< 17	< 38	< 35	< 31
09/18/19 - 09/24/19	< 30	< 30	< 29	< 30	< 24	< 13	< 27	< 28
09/24/19 - 10/02/19	< 17	< 40	< 38	< 40	< 27	< 40	< 26	< 27
10/02/19 - 10/09/19	< 44	< 44	< 42	< 43	< 27	< 19	< 25	< 26
10/09/19 - 10/17/19	< 25	< 26	< 25	< 22	< 54	< 26	< 52	< 23
10/17/19 - 10/23/19	< 34	< 34	< 32	< 34	< 23	< 14	< 26	< 28
10/23/19 - 10/29/19	< 46	< 46	< 44	< 45	< 27	< 19	< 29	< 30
10/29/19 - 11/05/19	< 17	< 18	< 17	< 17	< 19	< 7	< 19	< 16
11/05/19 - 11/13/19	< 36	< 37	< 35	< 36	< 16	< 15	< 19	< 19
11/13/19 - 11/20/19	< 32	< 32	< 31	< 32	< 31	< 15	< 30	< 25
11/20/19 - 11/26/19	< 34	< 34	< 28	< 34	< 46	< 35	< 43	< 46
11/26/19 - 12/04/19	< 20	< 25	< 24	< 24	< 23	< 25	< 26	< 27
12/04/19 - 12/11/19	< 37	< 37	< 35	< 37	< 44	< 17	< 41	< 25
12/11/19 - 12/18/19	< 35	< 36	< 34	< 35	< 17	< 30	< 35	< 37
12/18/19 - 12/26/19	< 18	< 18	< 17	< 18	< 14	< 7	< 13	< 13
12/26/19 - 01/02/20	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*
MEAN	-	-	-	-	-	-	-	-

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-VIII.1 CONCENTRATIONS OF STRONTIUM AND GAMMA EMITTERS IN VEGETATION SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE	COLLECTION PERIOD	Sr-89	Sr-90	Be-7	K-40	I-131	Cs-134	Cs-137	Ba-140	La-140
115										
Cabbage	06/26/19	< 17	< 3.3	< 335	1597 ± 534	< 43	< 35	< 45	< 151	< 24
Collards	06/26/19	< 18	< 3.4	< 258	743 ± 336	< 34	< 26	< 34	< 105	< 24
Kale	06/26/19	< 19	4.6 ± 2.3	< 174	1249 ± 274	< 30	< 14	29 ± 13	< 77	< 15
Cabbage	07/31/19	< 24	13.8 ± 3.6	< 278	1193 ± 375	< 34	< 29	< 37	< 99	< 41
Collards	07/31/19	< 14	6.3 ± 2.9	210 ± 115	2304 ± 266	< 25	< 14	48 ± 12	< 69	< 18
Kale	07/31/19	< 21	< 4.2	272 ± 123	3182 ± 316	< 32	< 19	68 ± 17	< 87	< 25
Cabbage	09/25/19	< 21	< 2.5	< 221	1376 ± 333	< 32	< 24	< 31	< 105	< 35
Collards	09/25/19	< 14	< 2.9	< 402	1239 ± 470	< 54	< 41	< 39	< 140	< 42
Cabbage	10/24/19	< 15	< 4.6	< 391	1866 ± 529	< 55	< 39	< 43	< 151	< 47
Collards	10/24/19	< 19	3.5 ± 1.2	859 ± 328	2739 ± 550	< 55	< 34	< 43	< 145	< 40
MEAN ± 2 STD DEV		-	7.1 ± 9.3	447 ± 716	1749 ± 1542	-	-	48 ± 39	-	-
35										
Cabbage	06/26/19	< 20	< 4.2	< 267	2687 ± 558	< 45	< 41	< 30	< 116	< 54
Collards	06/26/19	< 21	< 4.2	< 334	3377 ± 616	< 53	< 40	< 39	< 173	< 44
Kale	06/26/19	< 23	6.2 ± 2.8	< 284	4926 ± 813	< 48	< 22	< 37	< 125	< 42
Cabbage	07/31/19	< 19	9.5 ± 3.1	< 224	1866 ± 462	< 37	< 18	< 31	< 68	< 21
Collards	07/31/19	< 18	< 4.7	195 ± 106	2351 ± 258	< 29	< 15	< 15	< 73	< 19
Kale	07/31/19	< 19	< 4.7	< 119	3146 ± 222	< 23	< 13	< 14	< 61	< 15
Cabbage	09/25/19	< 23	< 3.6	< 211	979 ± 359	< 36	< 28	< 27	< 107	< 36
Collards	09/25/19	< 19	4.5 ± 2.2	594 ± 298	1825 ± 524	< 54	< 32	< 40	< 152	< 47
Kale	09/25/19	< 22	< 4.3	387 ± 129	2627 ± 281	< 22	< 17	< 17	< 68	< 20
Cabbage	10/24/19	< 21	2.7 ± 1.0	< 276	1869 ± 430	< 42	< 35	< 29	< 114	< 30
Kale	10/24/19	< 20	< 1.9	< 196	3102 ± 393	< 26	< 25	< 23	< 86	< 26
MEAN ± 2 STD DEV		-	5.7 ± 5.8	392 ± 399	2614 ± 2091	-	-	-	-	-
36 (Control)										
Cabbage	06/26/19	< 24	3.1 ± 1.8	< 117	1425 ± 293	< 21	< 17	< 15	< 64	< 15
Collards	06/26/19	< 19	6.1 ± 2.5	< 161	3911 ± 436	< 21	< 14	< 15	< 61	< 19
Kale	06/26/19	< 19	< 4.2	< 234	4237 ± 469	< 34	< 21	< 22	< 92	< 30
Cabbage	07/31/19	< 16	9.6 ± 3.1	< 280	2640 ± 546	< 44	< 29	< 26	< 129	< 24
Collards	07/31/19	< 17	< 4.7	< 306	5237 ± 594	< 46	< 37	< 29	< 143	< 30
Kale	07/31/19	< 21	< 4.6	< 283	5240 ± 749	< 45	< 28	< 33	< 147	< 29
Cabbage	09/25/19	< 25	11.9 ± 2.9	< 227	3462 ± 436	< 32	< 19	< 21	< 86	< 31
Collards	09/25/19	< 24	11.1 ± 2.9	< 174	4716 ± 528	< 27	< 16	< 15	< 90	< 23
Kale	09/25/19	< 25	12.8 ± 2.6	< 256	4695 ± 702	< 25	< 32	< 19	< 113	< 40
Cabbage	10/24/19	< 21	5.6 ± 1.9	< 150	2416 ± 436	< 29	< 18	< 22	< 78	< 31
Collards	10/24/19	< 23	< 4.5	< 288	3090 ± 528	< 37	< 27	< 26	< 113	< 40
Kale	10/24/19	< 21	13.7 ± 3.6	< 230	2742 ± 502	< 25	< 20	< 23	< 84	< 25
MEAN ± 2 STD DEV		-	9.2 ± 7.7	-	3651 ± 2439	-	-	-	-	-

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

Table C-IX.1 QUARTERLY OSLD RESULTS FOR OYSTER CREEK GENERATING STATION, 2019[(1)]
RESULTS IN UNITS OF MILLIREM/STD. QUARTER ± 2 STANDARD DEVIATION

STATION CODE	MEAN ± 2 S.D.	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC
1	27.2 ± 12.1	21.9	35.6	27.7	23.7
3	19.8 ± 4.4	17.0	19.0	21.8	21.3
4	26.9 ± 13.7	20.8	36.4	27.2	23.4
5	24.8 ± 4.4	24.4	27.2	*(1)*	22.8
6	21.1 ± 5.4	18.1	*(1)*	23.1	22.3
8	25.5 ± 13.3	19.4	34.9	25.1	22.8
9	26.2 ± 17.7	18.5	38.7	25.6	21.9
C	21.8 ± 3.6	19.4	21.8	23.6	22.6
11	25.9 ± 11.6	19.7	33.7	25.9	24.3
14	23.5 ± 4.8	20.8	22.1 `	25.9	25.1
22	28.4 ± 12.2	22.7	36.2	30.4	24.5
46	24.7 ± 14.7	17.7	34.8	24.9	21.4
47	21.2 ± 4.5	18.5	20.3	23.2	22.9
48	26.3 ± 13.2	19.7	35.3	26.3	23.9
51	27.9 ± 11.0	22.1	34.8	29.5	25.3
52	29.2 ± 10.9	23.2	35.8	31.1	27.0
53	28.6 ± 14.7	21.4	38.6	29.0	25.4
54	26.5 ± 16.6	18.6	38.0	26.0	23.4
55	32.8 ± 15.1	26.3	42.7	34.8	27.6
56	30.7 ± 13.8	24.9	39.8	32.4	25.8
57	25.8 ± 13.8	19.7	35.5	25.9	22.3
58	25.0 ± 14.6	18.0	35.3	24.2	22.8
59	28.6 ± 14.0	20.2	37.2	27.4	29.6
61	20.6 ± 5.0	18.4	18.8	23.7	21.7
62	21.8 ± 6.2	18.1	20.7	25.2	23.4
63	21.3 ± 5.8	17.9	20.2	24.6	22.5
64	20.9 ± 4.3	18.3	20.2	22.4	22.9
65	21.0 ± 5.9	17.5	20.4	24.6	21.5
66	20.6 ± 4.2	19.6	18.3	22.9	21.7
68	24.9 ± 14.0	18.1	34.5	25.3	22.0
71	26.2 ± 13.3	20.3	35.7	25.8	23.2
72	21.0 ± 5.0	18.0	20.0	23.1	23.0
73	25.4 ± 11.2	19.2	32.7	25.9	23.9
74	21.1 ± 5.0	18.5	19.4	23.5	23.0
75	22.1 ± 5.0	19.3	21.3	25.3	22.5
78	21.4 ± 4.6	19.0	20.5	24.5	21.6
79	27.5 ± 13.3	21.6	36.6	28.2	23.8
81	26.8 ± 12.7	20.7	35.4	27.5	23.9
82	21.3 ± 5.2	18.5	19.9	24.1	22.8
84	27.1 ± 13.1	20.1	35.5	28.5	24.4
85	26.0 ± 14.9	19.2	36.6	25.0	23.4
86	26.2 ± 11.1	20.3	32.8	28.6	23.3
88	24.2 ± 11.0	18.4	31.5	24.5	22.5
89	19.3 ± 4.3	17.0	18.2	21.6	20.7
90	19.9 ± 4.6	17.3	18.6	22.0	21.6
92	21.4 ± 4.1	19.3	20.3	23.9	22.3
98	25.7 ± 10.9	19.6	32.6	26.7	23.8
99	24.5 ± 9.9	19.6	31.4	23.9	23.3
T1	27.1 ± 12.5	20.4	35.1	28.4	24.4
100	23.6 ± 0.0	23.6	23.6	23.6	23.6
101	20.9 ± 5.2	18.2	19.2	23.5	22.7
102	21.9 ± 4.4	18.9	21.9	23.9	23.1
103	20.7 ± 4.3	18.1	19.9	22.8	22.2
104	28.1 ± 19.0	19.1	41.5	27.3	24.7
105	24.6 ± 13.6	18.3	34.2	24.1	21.9
106	24.2 ± 0.4	24.1	24.1	24.5	24.1
107	25.2 ± 12.1	19.1	33.5	25.1	23.3
109	26.6 ± 10.7	21.2	33.4	27.9	23.7
110	26.6 ± 13.2	19.9	35.3	27.6	23.8
112	28.3 ± 14.0	21.6	38.1	27.8	25.7
113	20.7 ± 4.5	18.1	19.7	22.7	22.6

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

[(1)] Note: There are two (2) OSLD's posted at each indicator station for redunancy and data revcovery. In reporting results, the average of the gross mean for the two readings is reported. There are four (4) single OSLD's posted at Control Station C and the the average of the gross mean for the four readings is reported.

TABLE C-IX.2 MEAN QUARTERLY OSLD RESULTS FOR THE SITE BOUNDARY, INTERMEDIATE, SPECIAL INTEREST, AND CONTROL LOCATIONS FOR OYSTER CREEK GENERATING STATION, 2019[1]

RESULTS IN UNITS OF MILLIREM PER STANDARD QUARTER ± 2 STANDARD DEVIATION

STANDARD DEVIATIONS OF THE STATION DATA

COLLECTION PERIOD	SITE BOUNDARY ± 2 S.D.	INTERMEDIATE ± 2 S.D.	SPECIAL INTEREST ± 2 S.D.	CONTROL ± 2 S.D.
JAN-MAR	20.3 ± 5.0	19.8 ± 3.6	18.6 ± 2.9	20.1 ± 2.0
APR-JUN	30.8 ± 17.7	30.1 ± 14.1	25.8 ± 15.9	22.0 ± 0.4
JUL-SEP	26.8 ± 6.9	25.5 ± 3.9	24.0 ± 4.2	24.7 ± 3.2
OCT-DEC	24.2 ± 4.5	23.1 ± 1.7	22.5 ± 2.4	23.9 ± 3.5

TABLE C-IX.3 SUMMARY OF THE AMBIENT DOSIMETRY PROGRAM FOR OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF MILLIREM/STD. QUARTER

LOCATION	SAMPLES ANALYZED	PERIOD MINIMUM	PERIOD MAXIMUM	PERIOD MEAN ± 2 S.D.
SITE BOUNDARY	160	17.5	42.7	25.5 ± 12.5
INTERMEDIATE	260	17.7	41.5	24.6 ± 10.6
SPECIAL INTEREST	72	17.0	35.7	22.7 ± 9.7
CONTROL	24	18.8	25.1	22.6 ± 4.3

SITE BOUNDARY STATIONS - 1, 51, 52, 53, 54, 55, 56, 57, 58, 59, 61, 62, 63, 64, 65, 66, 112, 113, T1

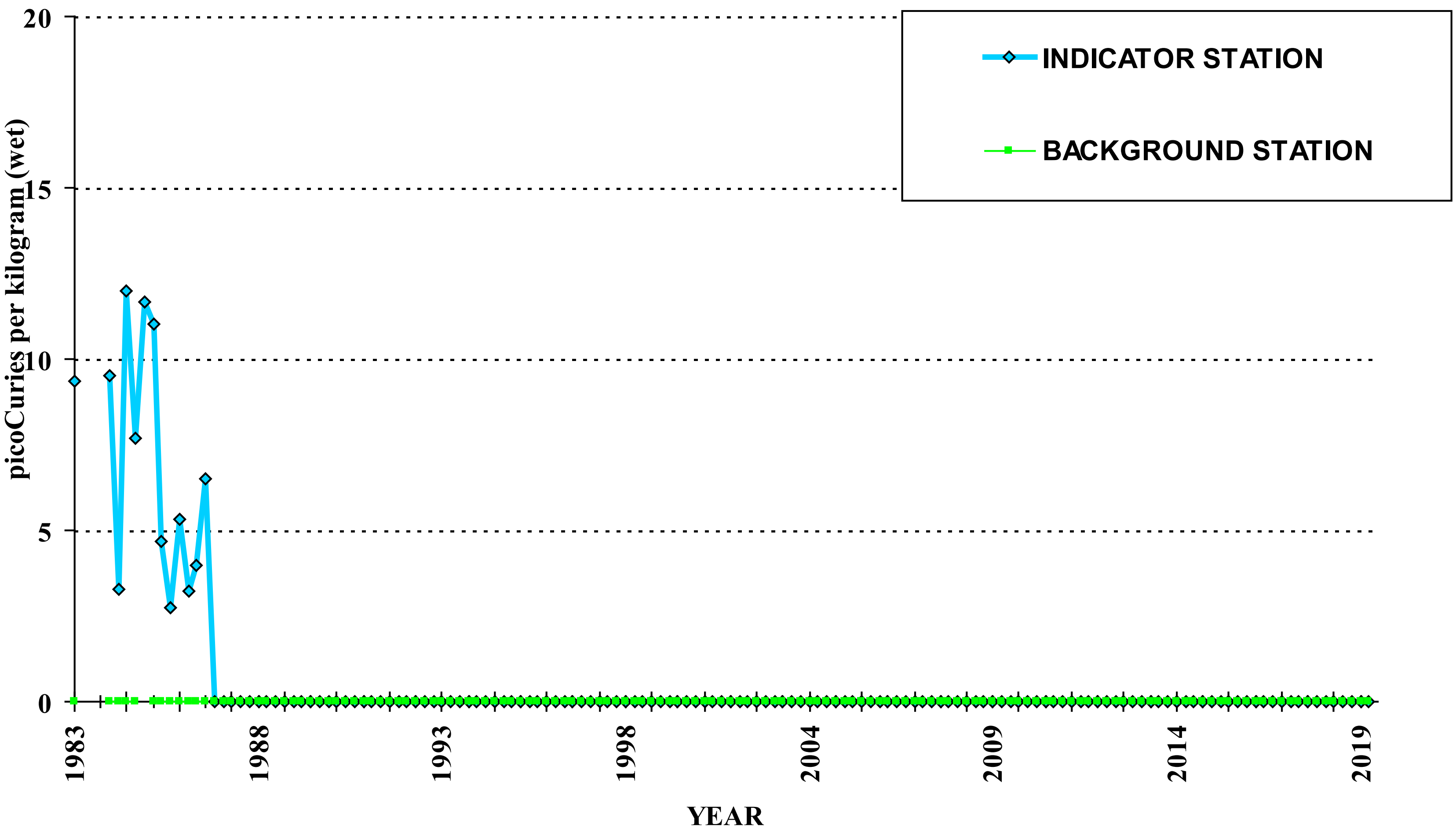
INTERMEDIATE STATIONS - 4, 5, 6, 8, 9, 22, 46, 47, 48, 68, 73, 74, 75, 78, 79, 82, 84, 85, 86, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 109, 110

SPECIAL INTEREST STATIONS - 3, 11, 71, 72, 81, 88, 89, 90, 92

CONTROL STATIONS - 14, C

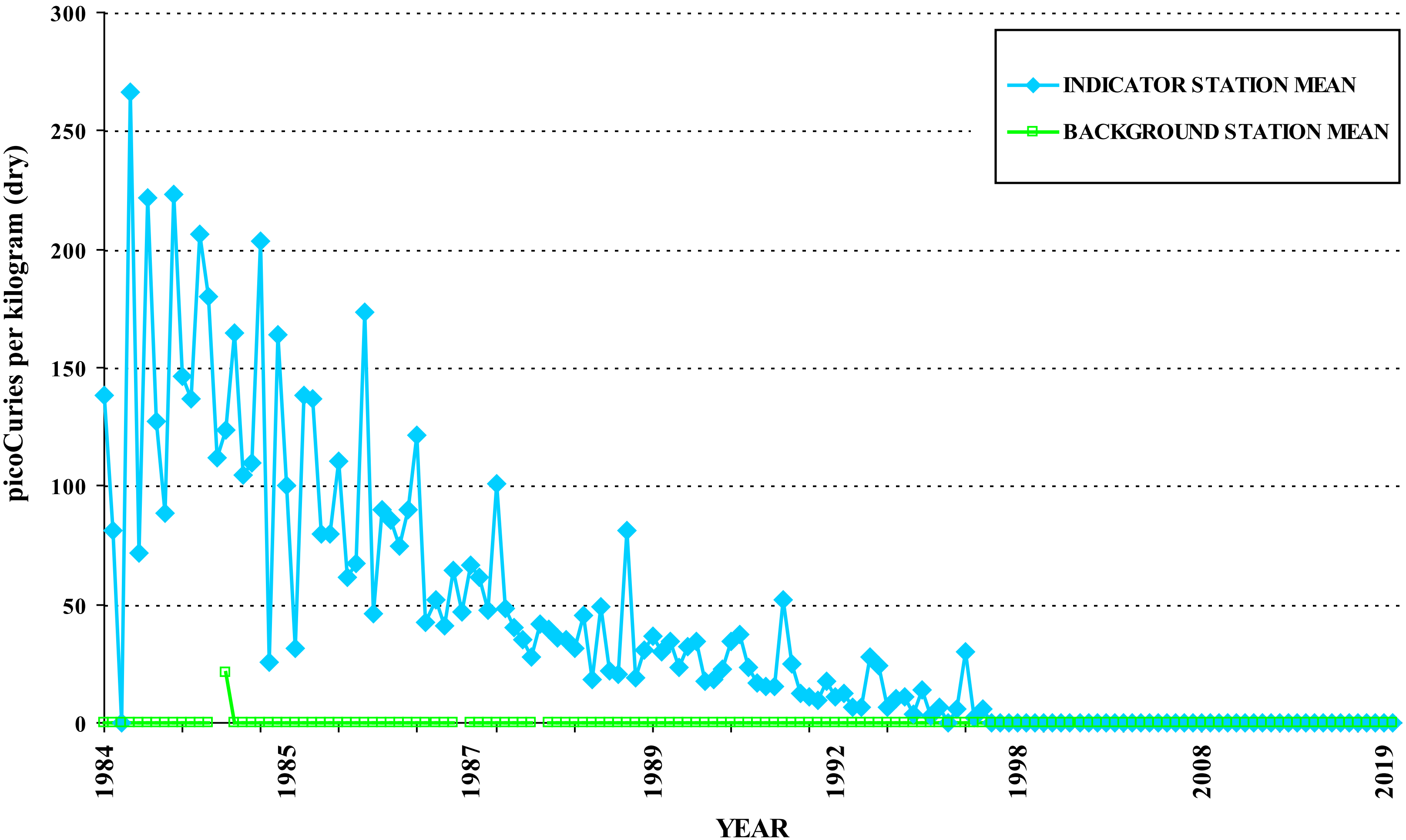
(1) *Note: There are two (2) OSLD's posted at each indicator station for redunancy and data revcovery. In reporting results, the average of the gross mean for the two readings is reported. There are four (4) single OSLD's posted at Control Station C and the average of the gross mean for the four readings is reported.*

FIGURE C-1
MEAN COBALT-60 CONCENTRATION IN CLAMS
OYSTER CREEK GENERATING STATION, 1983 - 2019



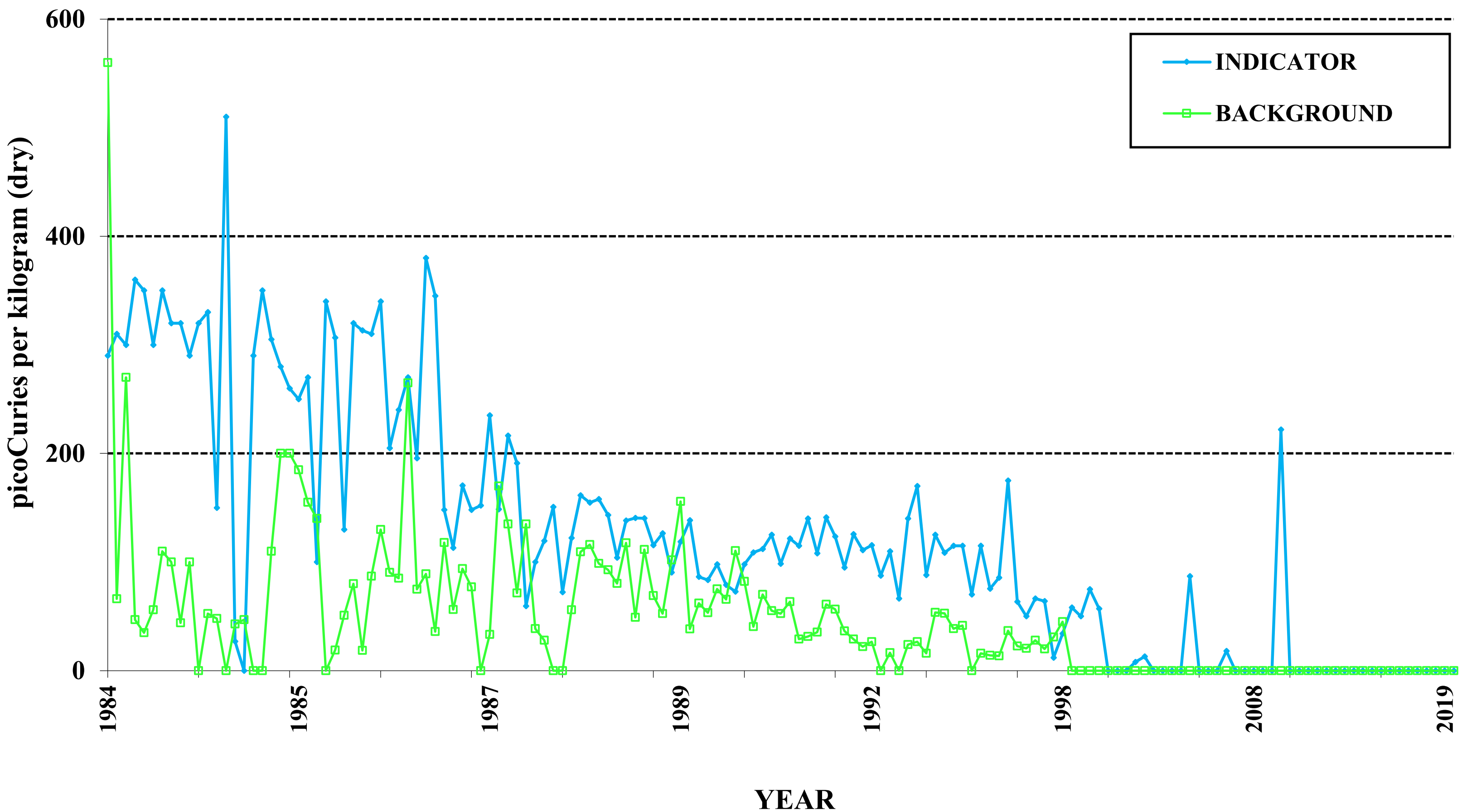
* The year designations on the x-axis reflect multiple sampling periods in a given year, as well as historical changes in the number of sampling periods per year.

FIGURE C-2
MEAN COBALT-60 CONCENTRATION IN AQUATIC SEDIMENT
OYSTER CREEK GENERATING STATION, 1984 - 2019



* The year designations on the x-axis reflect multiple sampling periods in a given year, as well as historical changes in the number of sampling periods per year.

FIGURE C-3
MEAN CESIUM-137 CONCENTRATION IN AQUATIC SEDIMENT
OYSTER CREEK GENERATING STATION, 1984 - 2019



* The year designations on the x-axis reflect multiple sampling periods in a given year, as well as historical changes in the number of sampling periods per year.

FIGURE C-4
MEAN WEEKLY GROSS BETA CONCENTRATIONS
IN AIR PARTICULATES
OYSTER CREEK GENERATING STATION, 2008 - 2019

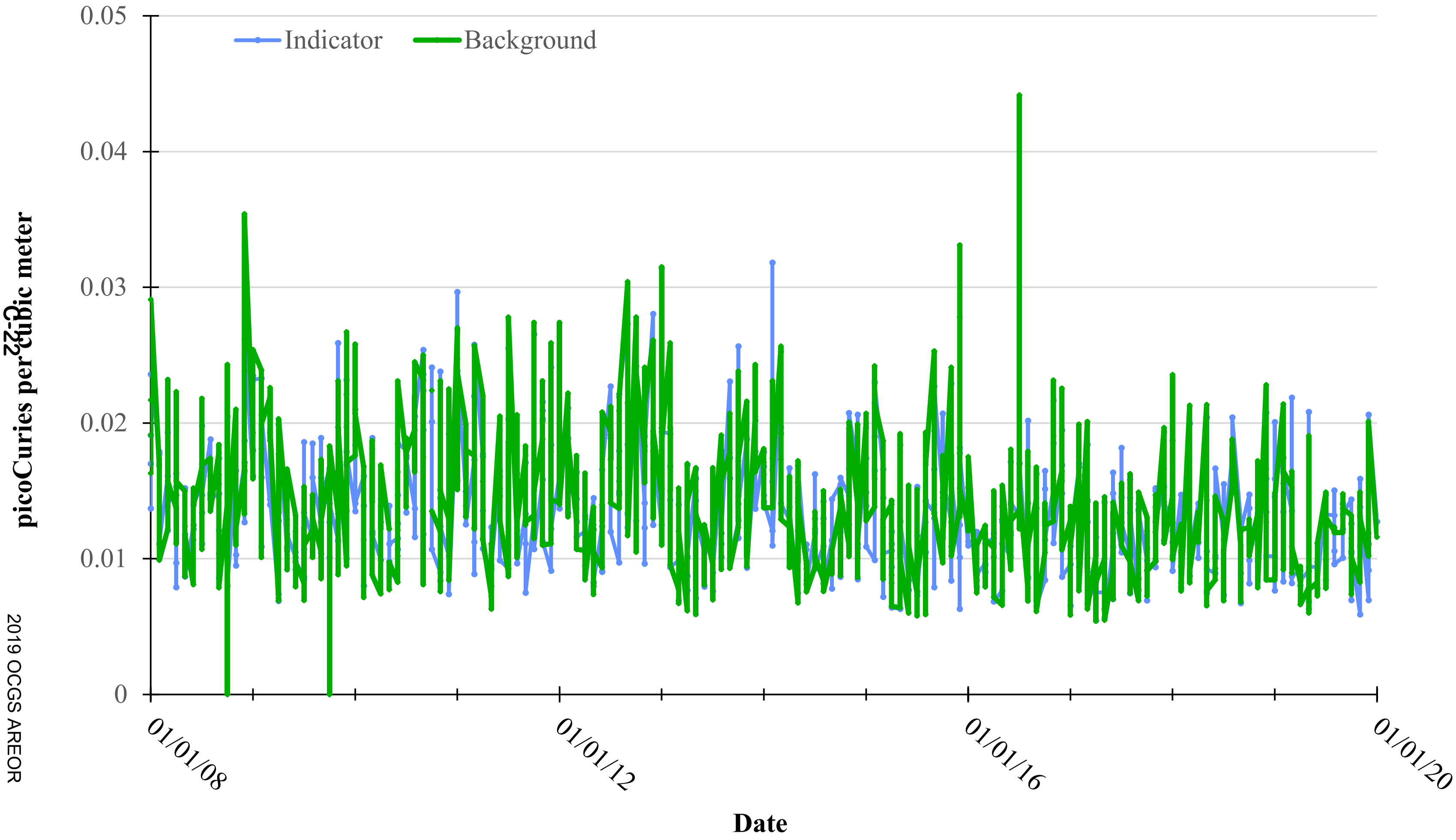
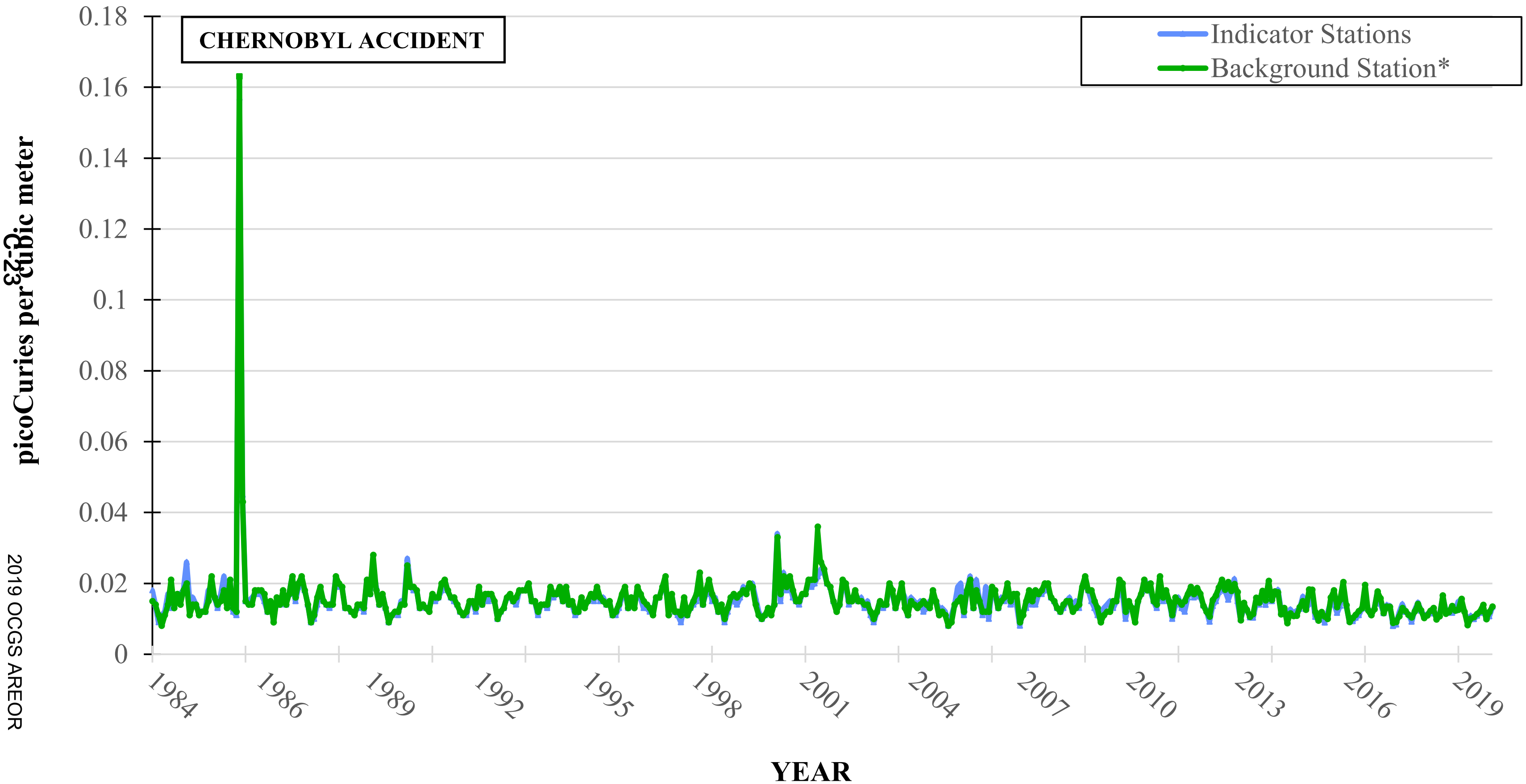
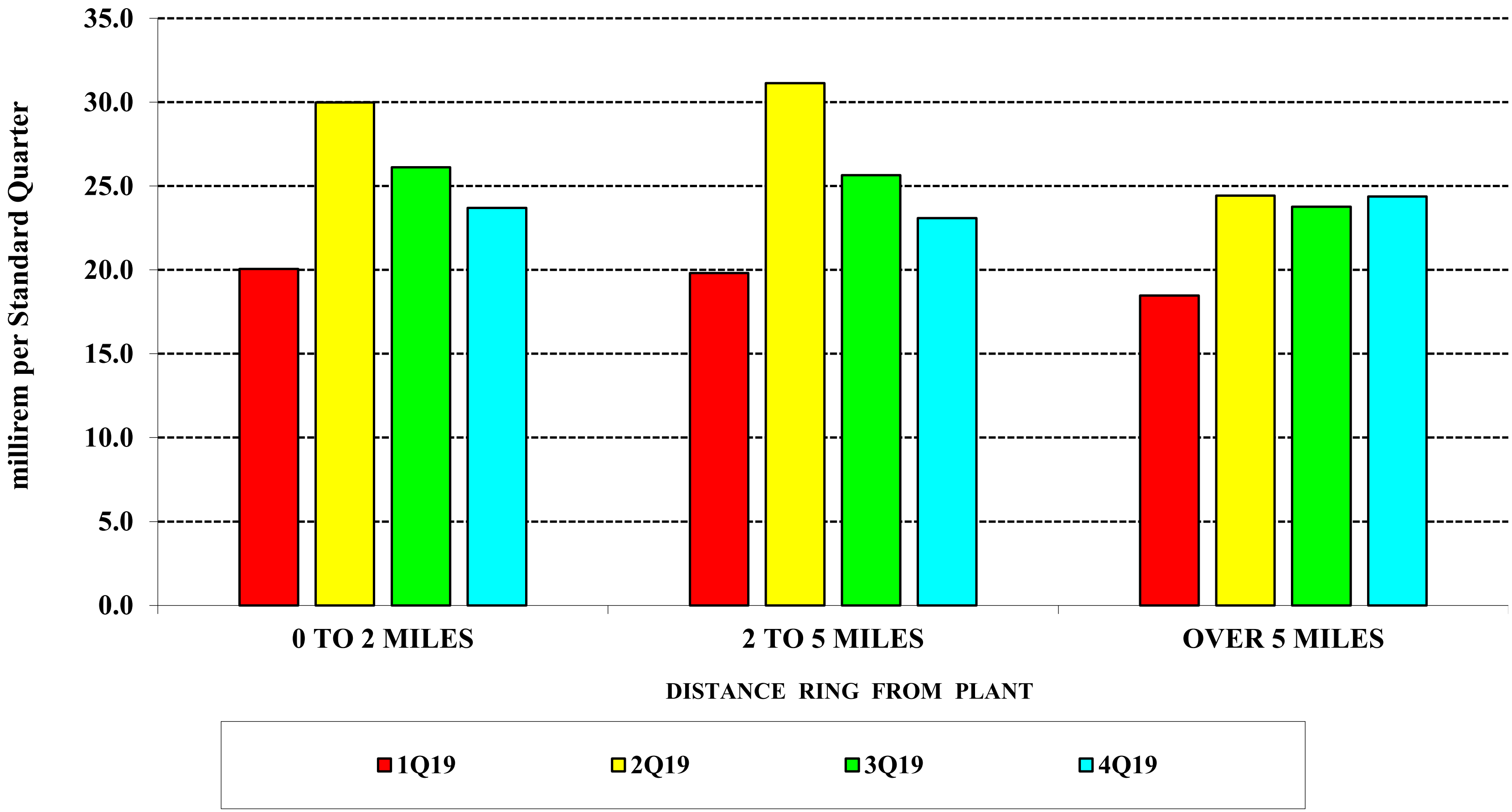


FIGURE C-5
MEAN MONTHLY GROSS BETA CONCENTRATIONS IN AIR PARTICULATES OYSTER CREEK GENERATING STATION, 1984 - 2019



** Data from Cookstown station ONLY after December 1996*

FIGURE C-6
MEAN QUARTERLY OSLD GAMMA DOSE
OYSTER CREEK GENERATING STATION, 2019



Oyster Creek's dosimetry changed from TLD to OSLD in 2012.

APPENDIX D

DATA TABLES
QC COMPARISON SAMPLES

The following section presents the results of data analysis performed by the QC laboratory, Environmental Inc. Duplicate samples were obtained from several locations and media and were split with the primary laboratory, Teledyne Brown Engineering (TBE) and the QC Laboratory. Comparison of the results for all media were within expected ranges.

Table D-I.1 CONCENTRATIONS OF TRITIUM IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	24 (TBE)	QCA (TBE)	QC-24 (EIML)
06/26/19	< 191	< 190	*(1)*
09/30/19	< 180	< 181	< 147

(1) No sample collected or analyzed

Table D-I.2

CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

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
24	06/26/19		< 6	< 7	< 11	< 5	< 19	< 7	< 12	< 8	< 8	< 35	< 10
(TBE)	09/30/19		< 6	< 6	< 14	< 7	< 10	< 5	< 7	< 5	< 4	< 24	< 8
QCA	06/03/19		< 6	< 7	< 10	< 7	< 15	< 5	< 9	< 8	< 6	< 31	< 13
(TBE)	09/30/19		< 5	< 5	< 14	< 7	< 13	< 6	< 8	< 7	< 5	< 27	< 7
QC-24	06/26/19	*(1)*											
(EIML)	09/30/19		< 2	< 2	< 4	< 3	< 7	< 3	< 5	< 3	< 2	< 16	< 3

(1) No sample collected or analyzed

Table D-II.1 CONCENTRATIONS OF TRITIUM IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	1N (TBE)	QC1N (EIML)
09/04/19 - 09/26/19	< 195	< 148
10/02/19 - 10/30/19	< 191	< 154
11/05/19 - 11/29/19	< 188	< 150

TABLE D-II.2 CONCENTRATIONS OF I-131 IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	1N (TBE)	QC1N (EIML)
09/04/19 - 09/26/19	< 1.0	< 0.4
10/02/19 - 10/30/19	< 0.9	< 0.3
11/05/19 - 11/29/19	< 0.9	< 0.4

Table D-II.3

CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

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
1N	09/04/19 - 09/26/19	< 5	< 4	< 13	< 5	< 11	< 5	< 10	< 5	< 6	< 27	< 10
(TBE)	10/03/19 - 10/30/19	< 3	< 4	< 9	< 4	< 7	< 4	< 6	< 4	< 4	< 27	< 10
	11/06/19 - 11/27/19	< 6	< 6	< 11	< 6	< 13	< 6	< 9	< 7	< 5	< 34	< 9
QC1N	09/04/19 - 09/26/19	< 3	< 2	< 7	< 2	< 5	< 3	< 7	< 3	< 4	< 27	< 6
(EIML)	10/03/19 - 10/30/19	< 2	< 2	< 5	< 1	< 4	< 4	< 5	< 2	< 2	< 11	< 4
	11/06/19 - 11/27/19	< 2	< 2	< 4	< 3	< 6	< 4	< 5	< 3	< 3	< 17	< 5

Table D-III.1 CONCENTRATIONS OF TRITIUM IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	W-3C	QC-W-3C (EIML)
10/09/19 - 10/09/19	< 182	< 151

Table D-III.2

CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

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
W-3C (TBE)	10/09/19 - 10/09/19	< 5	< 8	< 9	< 4	< 17	< 8	< 15	< 11	< 9	< 6	< 29	< 14
QC -W-3C (EIML)	10/31/18 - 10/31/18	< 4	< 4	< 6	< 5	< 7	< 3	< 6	< 7	< 3	< 4	< 23	< 3

Table D-IV.1 **CONCENTRATIONS OF GAMMA EMITTERS IN CLAM SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019**

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE		COLLECTION PERIOD	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137
24 (TBE)		06/03/19	1475 ± 929	< 62	< 51	< 110	< 70	< 87	< 31	< 57
QCA (TBE)		06/03/19	1124 ± 597	< 57	< 35	< 61	< 30	< 120	< 52	< 56
QC-24 (EIML)	*(1)*	06/03/19								

(1) No sample collected or analyzed

Table D-V.1

CONCENTRATIONS OF GAMMA EMITTERS IN SEDIMENT SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/KG DRY ± 2 SIGMA

SITE	COLLECTION PERIOD	Be-7	K-40	Mn-54	Co-58	Co-60	Cs-134	Cs-137	Ra-226	Th-228
24	06/03/19	< 695	18160 ± 1586	< 83	< 64	< 83	< 88	< 79	< 1931	866 ± 144
(TBE)	09/30/19	< 677	16160 ± 2025	< 96	< 69	< 92	< 103	< 74	< 1455	745 ± 179
QCA	06/03/19	< 611	11300 ± 1468	< 54	< 62	< 68	< 65	< 62	2767 ± 1548	542 ± 182
(TBE)	09/30/19	< 650	17330 ± 2093	< 104	< 92	< 73	< 113	< 87	< 1880	721 ± 155
QC-24	06/03/19	*(1)*								
(EIML)	09/30/19	< 295	13165 ± 639	< 20	< 25	< 18	< 13	< 18	1523 ± 639	< 1661

(1) No sample collected or analyzed

TABLE D-VI.1 CONCENTRATIONS OF STRONTIUM AND GAMMA EMITTERS IN VEGETATION SAMPLES COLLECTED IN THE VICINITY OF OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE	COLLECTION PERIOD	Sr-89	Sr-90	Be-7	K-40	I-131	Cs-134	Cs-137	Ba-140	La-140
36 (TBE)										
Cabbage	09/25/19	< 25	12 ± 2.9	< 227	3462 ± 436	< 32	< 19	< 21	< 86	< 31
Collard Greens	09/25/19	< 24	11.1 ± 2.9	< 174	4716 ± 528	< 27	< 16	< 15	< 90	< 23
Kale	09/25/19	< 25	13 ± 2.6	< 256	4695 ± 702	< 25	< 32	< 19	< 113	< 40
QC-36 (EIML)										
Cabbage	09/25/19	< 5	< 3	395 ± 204	2822 ± 327	< 29	< 12	< 10	< 54	< 16
Collard Greens	09/25/19	< 5	< 3	41 ± 45	3945 ± 295	< 21	< 10	< 8	< 57	< 14
Rape	09/25/19	< 4	< 2	225 ± 124	4600 ± 386	< 18	< 13	< 13	< 46	< 14

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APPENDIX E

INTER-LABORATORY COMPARISON PROGRAM

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Table E.1

Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [(a)]	Ratio of TBE to Analytics Result	Evaluation [(b)]
March 2019	E12468A	Milk	Sr-89	pCi/L	87.1	96	0.91	A
			Sr-90	pCi/L	12.6	12.6	1.00	A
	E12469A	Milk	Ce-141	pCi/L	113	117	0.97	A
			Co-58	pCi/L	153	143	1.07	A
			Co-60	pCi/L	289	299	0.97	A
			Cr-51	pCi/L	233	293	0.80	A
			Cs-134	pCi/L	147	160	0.92	A
			Cs-137	pCi/L	193	196	0.98	A
			Fe-59	pCi/L	153	159	0.96	A
			I-131	pCi/L	91.5	89.5	1.02	A
			Mn-54	pCi/L	149	143	1.04	A
			Zn-65	pCi/L	209	220	0.95	A
	E12470	Charcoal	I-131	pCi	77.5	75.2	1.03	A
	E12471	AP	Ce-141	pCi	60.7	70.2	0.87	A
			Co-58	pCi	87.9	85.8	1.02	A
			Co-60	pCi	175	179	0.98	A
			Cr-51	pCi	165	176	0.94	A
			Cs-134	pCi	91.2	95.9	0.95	A
			Cs-137	pCi	120	118	1.02	A
			Fe-59	pCi	108	95.3	1.13	A
			Mn-54	pCi	94.2	85.7	1.10	A
			Zn-65	pCi	102	132	0.77	W
	E12472	Water	Fe-55	pCi/L	2230	1920	1.16	A
	E12473	Soil	Ce-141	pCi/g	0.189	0.183	1.03	A
			Co-58	pCi/g	0.209	0.224	0.93	A
			Co-60	pCi/g	0.481	0.466	1.03	A
			Cr-51	pCi/g	0.522	0.457	1.14	A
			Cs-134	pCi/g	0.218	0.250	0.87	A
			Cs-137	pCi/g	0.370	0.381	0.97	A
			Fe-59	pCi/g	0.263	0.248	1.06	A
			Mn-54	pCi/g	0.248	0.223	1.11	A
			Zn-65	pCi/g	0.371	0.344	1.08	A
	E12474	AP	Sr-89	pCi	88.3	95.2	0.93	A
			Sr-90	pCi	11.7	12.5	0.94	A
August 2019	E12562	Soil	Sr-90	pCi/g	4.710	6.710	0.70	W

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

(b) Analytics evaluation based on TBE internal QC limits:
A = Acceptable - reported result falls within ratio limits of 0.80-1.20
W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30
N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

Table E.1

Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Ratio of TBE to Analytics Result	Evaluation [b]
September 2019	E12475	Milk	Sr-89	pCi/L	70.0	93.9	0.75	W
			Sr-90	pCi/L	12.0	12.9	0.93	A
	E12476	Milk	Ce-141	pCi/L	150	167	0.90	A
			Co-58	pCi/L	170	175	0.97	A
			Co-60	pCi/L	211	211	1.00	A
			Cr-51	pCi/L	323	331	0.98	A
			Cs-134	pCi/L	180	207	0.87	A
			Cs-137	pCi/L	147	151	0.97	A
			Fe-59	pCi/L	156	148	1.05	A
			I-131	pCi/L	81.1	92.1	0.88	A
			Mn-54	pCi/L	160	154	1.04	A
			Zn-65	pCi/L	303	293	1.03	A
	E12477	Charcoal	I-131	pCi	95.9	95.1	1.01	A
	E12478	AP	Ce-141	pCi	129	138	0.93	A
			Co-58	pCi	128	145	0.88	A
			Co-60	pCi	181	174	1.04	A
			Cr-51	pCi	292	274	1.07	A
			Cs-134	pCi	166	171	0.97	A
			Cs-137	pCi	115	125	0.92	A
			Fe-59	pCi	119	123	0.97	A
			Mn-54	pCi	129	128	1.01	A
			Zn-65	pCi	230	242	0.95	A
	E12479	Water	Fe-55	pCi/L	1810	1850	0.98	A
	E12480	Soil	Ce-141	pCi/g	0.305	0.276	1.10	A
			Co-58	pCi/g	0.270	0.289	0.93	A
			Co-60	pCi/g	0.358	0.348	1.03	A
			Cr-51	pCi/g	0.765	0.547	1.40	N(1)
			Cs-134	pCi/g	0.327	0.343	0.95	A
			Cs-137	pCi/g	0.308	0.321	0.96	A
			Fe-59	pCi/g	0.257	0.245	1.05	A
			Mn-54	pCi/g	0.274	0.255	1.07	A
			Zn-65	pCi/g	0.536	0.485	1.11	A
	E12481	AP	Sr-89	pCi	95.9	91.9	1.04	A
			Sr-90	pCi	12.3	12.6	0.97	A
	E12563	Soil	Sr-90	pCi/g	0.392	0.360	1.09	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 19-27***

Table E.2

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

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value (a)	Acceptance Range	Evaluation (b)
February 2019	19-GrF40	AP	Gross Alpha	Bq/sample	0.184	0.528	0.158 - 0.898	A
			Gross Beta	Bq/sample	0.785	0.948	0.474 - 1.422	A
	19-MaS40	Soil	Ni-63	Bq/kg	420	519.0	363 - 675	A
			Sr-90	Bq/kg			*(1)*	NR(3)
	19-MaW40	Water	Am-241	Bq/L	0.764	0.582	0.407 - 0.757	N(4)
			Ni-63	Bq/L	4.72	5.8	4.1 - 7.5	A
			Pu-238	Bq/L	0.443	0.451	0.316 - 0.586	A
			Pu-239/240	Bq/L	-0.00161	0.0045	*(2)*	A
	19-RdF40	AP	U-234/233	Bq/sample	0.1138	0.106	0.074 - 0.138	A
			U-238	Bq/sample	0.107	0.110	0.077 - 0.143	A
	19-RdV40	Vegetation	Cs-134	Bq/sample	2.14	2.44	1.71 - 3.17	A
			Cs-137	Bq/sample	2.22	2.30	1.61 - 2.99	A
			Co-57	Bq/sample	2.16	2.07	1.45 - 2.69	A
			Co-60	Bq/sample	0.02382		*(1)*	A
			Mn-54	Bq/sample	-0.03607		*(1)*	A
			Sr-90	Bq/sample	-0.1060		*(1)*	N(5)
			Zn-65	Bq/sample	1.35	1.71	1.20 - 2.22	W
August 2019	19-GrF41	AP	Gross Alpha	Bq/sample	0.192	0.528	0.158 - 0.898	W
			Gross Beta	Bq/sample	0.722	0.937	0.469 - 1.406	A
	19-MaS41	Soil	Ni-63	Bq/kg	436	629	440 - 818	N(6)
			Sr-90	Bq/kg	444	572	400 - 744	W
	19-MaW41	Water	Am-241	Bq/L				NR(7)
			Ni-63	Bq/L	7.28	9.7	6.8 - 12.6	W
			Pu-238	Bq/L	0.0207	0.0063	*(2)*	A
			Pu-239/240	Bq/L	0.741	0.727	0.509 - 0.945	A
	19-RdF41	AP	U-234/233	Bq/sample	0.0966	0.093	0.065 - 0.121	A
			U-238	Bq/sample	0.0852	0.096	0.067-0.125	A
	19-RdV41	Vegetation	Cs-134	Bq/sample	0.0197		*(1)*	A
			Cs-137	Bq/sample	3.21	3.28	2.30 - 4.26	A
			Co-57	Bq/sample	4.62	4.57	3.20 - 5.94	A
			Co-60	Bq/sample	4.88	5.30	3.71 - 6.89	A
			Mn-54	Bq/sample	4.54	4.49	3.14 - 5.84	A
			Sr-90	Bq/sample	0.889	1.00	0.70 - 1.30	A
			Zn-65	Bq/sample	2.78	2.85	2.00 - 3.71	A

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

(b) DOE/MAPEP evaluation:
A = Acceptable - reported result falls within ratio limits of 0.80-1.20
W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30
N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

(1) False positive test
(2) Sensitivity evaluation
(3) See ***NCR 19-12***
(4) See ***NCR 19-13***
(5) See ***NCR 19-14***
(6) See ***NCR 19-25***
(7) See ***NCR 19-26***

Table E.3

ERA Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value (a)	Acceptance Limits	Evaluation (b)
April 2019	Rad-117	Water	Ba-133	pCi/L	26.3	24.1	18.6 - 27.8	A
			Cs-134	pCi/L	15.2	12.1	8.39 - 14.4	N(1)
			Cs-137	pCi/L	33.6	33.1	28.8 - 39.4	A
			Co-60	pCi/L	11.9	11.5	8.67 - 15.5	A
			Zn-65	pCi/L	87.1	89.2	80.3 - 107	A
			GR-A	pCi/L	19	19.3	9.56 - 26.5	A
			GR-B	pCi/L	20.2	29.9	19.1 - 37.7	A
			U-Nat	pCi/L	55.5	55.9	45.6 - 61.5	A
			H-3	pCi/L	21500	21400	18700 - 23500	A
			Sr-89	pCi/L	44.9	33.3	24.5 - 40.1	N(2)
			Sr-90	pCi/L	24.5	26.3	19.0 - 30.7	A
			I-131	pCi/L	28.9	28.4	23.6 - 33.3	A
October 2019	Rad-119	Water	Ba-133	pCi/L	42.7	43.8	35.7 - 48.8	A
			Cs-134	pCi/L	53.5	55.9	45.2 - 61.5	A
			Cs-137	pCi/L	77.7	78.7	70.8 - 89.2	A
			Co-60	pCi/L	51.5	53.4	48.1 - 61.3	A
			Zn-65	pCi/L	36.6	34.0	28.5 - 43.1	A
			GR-A	pCi/L	40.5	27.6	14.0 - 36.3	N(3)
			GR-B	pCi/L	36.3	39.8	26.4 - 47.3	A
			U-Nat	pCi/L	27.66	28.0	22.6 - 31.1	A
			H-3	pCi/L	22800	23400	20500 - 25700	A
			Sr-89	pCi/L	47.1	45.5	35.4 - 52.7	A
			Sr-90	pCi/L	32.5	26.5	19.2 - 30.9	N(4)
			I-131	pCi/L	26.0	23.9	19.8 - 28.4	A
December 2019	QR 120419D	Water	Sr-90	pCi/L	20.1	18.6	13.2 - 22.1	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 19-10***
(2) See ***NCR 19-11***
(3) See ***NCR 19-23***
(4) See ***NCR 19-24***

TABLE E.4

Interlaboratory Comparison Crosscheck Program, New York Department of Health (ELAP)[a]
Environmental, Inc., Midwest Laboratory
(Relevant Nuclides Only)

Lab Code	Date	Analysis	Laboratory Result	Known Activity	Acceptance Limits	Acceptance
NYW-3472	09/17/19	H-3	5,250 ± 229	4,991	4,280 - 5,490	Pass
NYW-3472	09/17/19	I-131	18.7 ± 1.8	15.6	12.8 - 19.3	Pass
NYW-3472	09/17/19	Co-60	63.9 ± 4.0	63.0	56.7 - 71.8	Pass
NYW-3472	09/17/19	Zn-65	108 ± 9.0	113	97.2 - 129	Pass
NYW-3472	09/17/19	Cs-134	47.2 ± 3.4	55.8	45.1 - 61.4	Pass
NYW-3472	09/17/19	Cs-137	52.0 ± 4.6	53.8	48.4 - 62.0	Pass

[a] *Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the crosscheck program for proficiency testing in drinking water conducted by the New York Department of Health Laboratory Approval Program (NY ELAP)*

TABLE E.5

DOE's Mixed Analyte Performance Evaluation Program (MAPEP)
Environmental, Inc., Midwest Laboratory
(Relevant Nuclides Only)

			Concentration [a]			
Lab Code [b]	Reference Date	Analysis	Laboratory Result	Known Activity	Control Limits [c]	Acceptance
MASO-605	02/01/19	Cs-134	0.45 ± 2.52	0	NA [c]	Pass
MASO-605	02/01/19	Cs-137	1273.1 ± 13.0	1,164	815 - 1,513	Pass
MASO-605	02/01/19	Co-60	857.96 ± 8.52	855	599 - 1,112	Pass
MASO-605	02/01/19	Mn-54	1138 ± 13.5	1027	719 - 1,335	Pass
MASO-605	02/01/19	K-40	676 ± 47	585	410 - 761	Pass
MAW-613	02/01/19	Cs-134	5.49 ± 0.18	5.99	4.19 - 7.79	Pass
MAW-613	02/01/19	Cs-137	0.089 ± 0.080	0	NA [c]	Pass
MAW-613	02/01/19	Co-60	6.78 ± 0.19	6.7	4.7 - 8.7	Pass
MAW-613	02/01/19	Mn-54	8.98 ± 0.17	8.4	5.9 - 10.9	Pass
MAW-613	02/01/19	Zn-65	0.096 ± 0.141	0	NA [c]	Pass
MAVE-607	02/01/19	Cs-134	2.33 ± 0.10	2.44	1.71 - 3.17	Pass
MAVE-607	02/01/19	Cs-137	2.62 ± 0.13	2.30	1.61 - 2.99	Pass
MAVE-607	02/01/19	Sr-90	0.013 ± 0.022	0	NA [c]	Pass
MASO-3297	08/01/19	Cs-134	881.98 ± 903	1,020	714 - 1,326	Pass
MASO-3297	08/01/19	Cs-137	871.50 ± 10.83	789	552 - 1,026	Pass
MASO-3297	08/01/19	Co-60	783.69 ± 8.21	760	532 - 988	Pass
MASO-3297	08/01/19	Mn-54	834.48 ± 11.29	745	522 - 969	Pass
MASO-3297	08/01/19	K-40	662.91 ± 42.65	555	389 - 722	Pass
MAW-3240	08/01/19	Cs-134	-0.08 ± 0.06	0	NA [c]	Pass
MAW-3240	08/01/19	Cs-137	18.48 ± 0.90	18.4	12.9 - 23.9	Pass
MAW-3240	08/01/19	Co-60	8.67 ± 0.39	8.8	6.2 - 11.4	Pass
MAW-3240	08/01/19	Mn-54	20.72 ± 0.93	20.6	14.4 - 26.8	Pass
MAW-3240	08/01/19	Zn-65	20.52 ± 1.05	20.3	14.2 - 26.4	Pass
MAW-3240	08/01/19	H-3	179.52 ± 3.32	175	123 - 228	Pass
MAVE-3295	08/01/19	Cs-134	0.02 ± 0.02	0	NA [c]	Pass
MAVE-3295	08/01/19	Cs-137	3.38± 0.32	3.28	2.30 - 4.26	Pass

[a] *Results are reported in units of Bq/kg (soil), Bq/L (water) or Bq/total sample (vegetation)*

[b] *Laboratory codes as follows: MAW (water), MASO (soil), MAVE (vegetation)*

[c] *MAPEP results are presented as the known values and expected laboratory precision (1 sigma, 1 determination) and control limits as defined by the MAPEP. A known value of "zero" indicates an analysis was included in the testing series. as a "false positive". MAPEP does not provide control limits.*

[d] *Provided in the series for "sensitivity evaluation". MAPEP does not provde control limits.*

TABLE E.6

Interlaboratory Comparison Crosscheck Program, Environmental Resource Associates (ERA)[a] RAD Study

Environmental, Inc., Midwest Laboratory

(Relevant Nuclides Only)

Lab Code	Date	Analysis	Laboratory Result	ERA Result	Control Limits	Acceptance
ERW-71	01/07/19	Cs-134	45.4 ± 3.1	49.1	39.5 - 54.0	Pass
ERW-71	01/07/19	Cs-137	129 ± 6.0	125	112 - 140	Pass
ERW-71	01/07/19	Co-60	98.1 ± 4.1	96	86.8 - 108	Pass
ERW-71	01/07/19	Zn-65	80.4 ± 7.8	77.4	69.5 - 93.2	Pass
ERW-71	01/07/19	H-3	2,129 ± 158	2,110	1,740 - 2,340	Pass
ERW-397	02/11/19	I-131	27.2 ± 1.0	25.9	25.1 - 30.6	Pass
ERW-2471	07/08/19	Cs-134	29.6 ± 2.6	32.0	25.1 - 35.2	Pass
ERW-2471	07/08/19	Cs-137	21.3 ± 3.6	21.4	17.6 - 26.7	Pass
ERW-2471	07/08/19	Co-60	99.9 ± 4.4	95.1	85.6 - 107	Pass
ERW-2471	07/08/19	Zn-65	43.7 ± 6.2	41.2	35.3 - 51.4	Pass
ERW-2471	07/08/19	H-3	8,630 ± 200	16,700	14,600 - 18,400	Fail[b]
ERW-2471	07/08/19	I-131	33.6 ± 1.3	29.6	24.6 - 34.6	Pass

[a] *Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the crosscheck program for proficiency testing in drinking water conducted by Environmental Resources Associates (ERA).*

[b] *EIML's routine analysis does include a blank sample. The ERA-provided blank was paired with a H-3 standard vial and EIML's blank was also paired with a standard vial. Inadvertently, the efficiency was overestimated by a factor of 2, which caused the calculated result to be half of the actual value. The result of reanalysis (17,400 pCi/L) is within the control limits for the study.*

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APPENDIX F

ERRATA DATA

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There is no errata data for 2019.

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APPENDIX G

ANNUAL RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM REPORT (ARGPPR)

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Docket No: 50-219

OYSTER CREEK GENERATING STATION
UNIT 1

Annual Radiological
Groundwater Protection Program Report

1 January through 31 December 2019

Prepared By

Teledyne Brown Engineering

Environmental Services

HOLTEC DECOMMISSIONING INTERNATIONAL

Oyster Creek Generating Station
Forked River, NJ 08731

April 26, 2020

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Appendices

Appendix A Location Designation

Security-Related Information: Detailed maps of the Oyster Creek Generating Station have been withheld from public disclosure under 10 CFR 2.390 and N.J.S.A. 47:1A-1.1

Appendix B Data Tables

I. Summary and Conclusions

This report on the Radiological Groundwater Protection Program (RGPP) conducted for the Oyster Creek Generating Station (OCGS) by Holtec Decommissioning International (HDI) covers the period 01 January 2019 through 31 December 2019.

This report covers groundwater and surface water samples collected from the environment, both on and off station property in 2019. In 2019, 393 analyses were performed on 155 samples from 46 locations.

There were three inadvertent releases of contaminated water into the groundwater during 2009 resulting in a plume located west of the turbine building, which is monitored via a series of monitoring wells.

Gamma-emitting radionuclide Potassium-40 (K-40) was detected in 2 of the 55 groundwater well samples. The concentrations ranged from 90 to 100 pCi/L. K-40 was not detected in any surface water sample.

In the case of tritium, HDI specified that its laboratories achieve a lower limit of detection 100 times lower than the drinking water limit specified by the United States Environmental Protection Agency (USEPA) (200 pCi/l versus 20,000 pCi/l). As expected, tritium was detected in groundwater samples, although tritium concentrations have decreased substantially since 2009. The 2019 tritium concentrations varied from <172 to 1,590 pCi/l. The well with the highest concentration was MW-56I.

Surface water samples were collected from onsite and offsite monitoring locations during 2019. Tritium was detected in 1 of 23 samples at a concentration of 211 pCi/L. No detectable tritium (greater than the MDC) was found in precipitation water samples.

Strontium-89 (Sr-89) and Strontium-90 (Sr-90) were not detected in any groundwater samples during 2019.

Gross Alpha and Gross Beta analyses in the dissolved and suspended fractions were performed on groundwater samples during the second and third quarters in 2019. There were 30 samples taken from 20 groundwater well locations. Gross Alpha (dissolved) was detected in 3 samples. The concentrations ranged from 1.2 to 2.2 pCi/L. Gross Alpha (suspended) was detected in 14 samples and ranged from 1.7 to 35.4 pCi/L. Gross Beta (dissolved) was detected in 24 samples and ranged from 1.1 to 22.1 pCi/L. Gross Beta (suspended) was detected in 16 samples and ranged from 2.5 to 52.1 pCi/L.

“Hard-To-Detect” analyses were not performed on any surface or groundwater samples in 2019.

II. Introduction

On July 1st 2019, ownership of the Oyster Creek Nuclear Power Station and transfer of the station and decommissioning license from Exelon Generation Company, LLC to Oyster Creek Environmental Protection, LLC (OCEP) as the licensed owner and Holtec Decommissioning International, LLC (HDI) as the licensed operator, was completed. Exelon had determined that transitioning operational nuclear plants to decommissioning nuclear plants targeted for permanent shutdown was not aligned with its core objectives and actively sought buyers who would assume ownership and complete decommissioning and license termination.

The Oyster Creek Nuclear Generating Station consists of a single boiling water reactor (BWR) and turbine generator was capable of producing 650 megawatts of electricity. The Station operates under Nuclear Regulatory Commission (NRC) renewed facility operating license number DPR-16. Brackish water from Barnegat Bay is supplied to the circulating water system. The circulating water system is designed to supply a continuous flow of water from Barnegat Bay through the plant to remove the waste heat released by the power cycle in the Main Condenser. The circulating water system is comprised of the intake canal from Barnegat Bay to the plant, the Main Condenser Circulating Water System, the dilution plant, and the discharge canal to Barnegat Bay. The dilution plant portion of the system minimizes the adverse effects of hot discharge water on aquatic life in the discharge canal and Barnegat Bay to meet the conditions of the Oyster Creek New Jersey Pollutant Discharge Elimination system (NJPDES) Permit No. NJ0005550. Approximately 125,000 gallons per minute of water were withdrawn, and reduced to 35,000 gallons per minute by the 2nd quarter of 2019, from the intake canal for dilution and station use and returned to the discharge canal.

The Station is located in the Atlantic Coastal Plain physiographic province. Topography in the region of the Station is a slightly undulating coastal plain having low relief. The land surface gradually rises from sea level at Barnegat Bay, which is located east of the Station, to approximately 50 feet above mean sea level (AMSL) 2 miles inland. This region of the coastal plain has numerous tidal marshes and is incised by easterly flowing streams and creeks. Elevations at the Station property west of Route 9 range from approximately 0 to 15 feet AMSL immediately adjacent to the intake and discharge canals to slightly more than 30 feet AMSL in the northwest portion of the Station property. The 150-acre developed portion of the Site located within the "horseshoe" formed by the intake and discharge canals west of Route 9 has an approximate average elevation of 20 feet AMSL. In the immediate vicinity of the intake and discharge canals, the Station property slopes steeply down to the canal. The average elevation of the surface water level in the intake and discharge canals is approximately 1-foot AMSL. The ground surface is relatively level except for the steep slopes at areas adjacent to the intake and discharge canals.

The three shallowest stratigraphic units in the vicinity of the Oyster Creek area in descending order are the Cape May Formation, the Cohansey Formation, and the Kirkwood Formation. Some of the Station structures are constructed to depths of approximately 50 feet below ground surface (bgs). Excavations were completed from grade, through the fill, Cape May Formation, Upper Clay, and into the Cohansey Formation during construction. Consequently, the bottoms of some Station structures are completed within the Cohansey Formation and some structures breach the Upper Clay.

The Cape May Formation regionally has an average thickness of 40 feet and at OCGS, the Cape May is described as a light gray to tan, medium- to fine-grained sand, with trace to some silt and occasional coarse sand. It is generally poorly compacted. The Cape May Formation varies from 0 to 21 feet in thickness based on historical boring logs. The variation principally is due to the varying amount of material excavated and replaced by fill during Station construction. When present, the thickness of the Cape May generally ranges from 15 to 20 feet thick. The base of the Cape May generally is defined by the presence of a dark clay unit referred to as the Upper Clay unit. The Upper Clay is a stiff to hard, gray, plastic organic clay containing inclusions (also described as lenses or partings) of dense fine sand with trace to some organic silt. The deposits of fine sand within the Upper Clay layer have high relative densities and occur as lenses or inclusions.

The Cohansey Formation is primarily composed of a light-colored, fine- to very coarse-grained quartzose sand with lenses of silt and clay. Although most borings at the Station do not penetrate the entire Cohansey Formation, this formation appears to be approximately 60 to 80 feet thick at OCGS. A clay sequence, referred to at the Station as the "Lower Clay", marks the base of the Cohansey, which generally is present to approximately 90 to 100 feet bgs. The lower clay is a dense gray medium- to fine-grained sand containing trace to some organic silt and layers or inclusions of very stiff to hard gray organic clay. The thickness of the lower clay is estimated to be approximately 10 to 20 feet in the vicinity of OCGS.

The Cohansey Formation is underlain by the Kirkwood Formation which consists of several stratigraphic units. The Kirkwood Formation is described as a medium- to fine-grained sand with trace silt. The thickness of this formation beneath the Station is unknown. The south domestic supply well terminates in the Kirkwood at a depth of 310 feet bgs. The Kirkwood thickness in Ocean County ranges from approximately 300 to 400 feet.

This report covers those analyses performed by Teledyne Brown Engineering (TBE) and Environmental Inc. (Midwest Labs) on samples collected in 2019.

A. Objectives of the RGPP

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

- Ensure that the site characterization of geology and hydrology provides an understanding of predominant ground water gradients based upon current site conditions
- Identify site risk based on plant design and work practices
- Evaluate all SSCs that contain or could contain licensed material and for which there is a credible mechanism for the licensed material to reach groundwater
- Evaluate work practices that involve licensed material and for which there is a credible mechanism for the licensed material to reach groundwater
- Perform on-site monitoring to ensure timely detection of inadvertent radiological releases to ground water
- Understand background concentrations of radioactive analytes outside of the REMP, as required
- Evaluate return/re-use of previously discharged radioactive effluents in gaseous or liquid effluents that are returned from the environment to the operating nuclear power facility
- Ensure controls are established for the selection, installation and retirement of monitoring wells
- Perform remediation protocols to prevent migration of licensed material off-site and to minimize decommissioning impacts
- Ensure that records of leaks, spills, remediation efforts are retained and retrievable to meet the requirements of 10 CFR 50.75(g)
- Ensure periodic communications are held on the RGPP with the designated State/Local officials
- Ensure timely verbal and written reporting occurs if there is an inadvertent release of licensed materials to the soil, groundwater or surface water
- Document and report all applicable RGPP data

- Identify and resolve deficiencies via the Corrective Action Process as delineated in PI- DC-125, “Decommissioning Corrective Action Program”

- Perform program oversight to ensure effective implementation of the voluntary RGPP

B. Implementation of the Objectives

The objectives identified have been implemented at the Oyster Creek Generating Station through compliance with approved procedures EN-AA-408-4000, Radiological Groundwater Protection Program Implementation, and site specific procedure EN-OC-408-4160, RGPP Reference Material, for Oyster Creek Generating Station.

C. Program Description

Samples for the OCGS site were collected for HDI by on-site personnel and Normandeau Associates, Inc. This section describes the general collection methods used to obtain environmental samples for the OCGS RGPP in 2019. Sample locations can be found in Table A–1, Appendix A.

1. Sample Collection

Samples of water are collected, managed, transported and analyzed in accordance with approved procedures. Both groundwater and surface water are collected. Sample locations, sample collection frequencies and analytical frequencies are controlled in accordance with approved station procedures. Contractor and/or station personnel are trained in the collection, preservation management, and shipment of samples, as well as in documentation of sampling events.

2. Sample Analysis

Samples are analyzed in accordance with approved procedures that are based on industry standards.

3. Quality Control

Analytical laboratories are subject to internal quality assurance programs, industry cross-check programs, nuclear industry audits, as well as being certified by the State of New Jersey.

4. Data Interpretation

Station personnel review and evaluate all analytical data deliverables as data is received. Analytical data results are reviewed by both station personnel and independent consultants, including a hydrogeologist, for adverse trends or changes to hydrogeologic conditions.

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 the 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 10 days.

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. Also, tritium was released into the atmosphere from Chernobyl in 1986. 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 (He-3). This radioactive decay releases a beta particle (18.6 keV 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 describes the general analytical methodologies used by TBE to analyze the environmental samples for radioactivity for the Oyster Creek Generating Station RGPP in 2019. The sampling frequencies are increased if activity is detected.

In order to achieve the stated objectives, the current program includes the following analyses for groundwater, surface water, and precipitation water:

1. Gamma emitters
2. Strontium-89 and Strontium-90
3. Tritium
4. Gross Alpha (Dissolved and Suspended) and Gross Beta (Dissolved and Suspended)
5. Selected transuranics
6. Fe-55
7. Ni-63

B. Data Interpretation

The radiological data collected prior to Oyster Creek Generating Station becoming operational, as well as background data from publicly available databases, were used as a baseline with which these operational data were compared. For the purpose of this report, Oyster Creek 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 OCGS detection capabilities for environmental sample analysis.

The minimum detectable concentration (MDC) 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 as 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.

C. Background Analysis

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 peaked in 1963 with the signing of the limited test ban treaty. The Canadian heavy water nuclear power reactors, other commercial power reactors, nuclear research and weapons production continue to influence tritium concentrations in the environment. Also, tritium was released into the atmosphere from Chernobyl in 1986.

b. Precipitation Data

Precipitation samples are routinely collected at stations around the world for the analysis of tritium and other radionuclides. One publicly available database that provides tritium concentrations in precipitation is the USEPA's RadNet database. RadNet provides tritium precipitation concentration data for samples collected at stations throughout the U.S. from 1978 up to and including 1996. Tritium concentrations in precipitation in New Jersey from 1978 through 1996 have ranged from 600 pCi/L in 1979 to 0 pCi/L in 1996, with an average of 185 pCi/L. Tritium concentrations in wells may still be above the 200 pCi/l detection limit from the external causes described above. Water from previous years and decades is naturally captured in groundwater, so some well water sources today are affected by the surface water from the 1960s that was elevated in tritium.

c. Surface Water Data

Tritium concentrations are routinely measured in surface water bodies, including Oyster Creek and the Delaware River. New Jersey surface water data between 1978 and 1998 averaged 185 pCi/L.

The USEPA RadNet surface water data typically has a reported 'Combined Standard Uncertainty' of 2 standard deviations. This corresponds to a ± 36 to ±100 pCi/L confidence bound on each given reported measurement so that the typical surface water background data provided by RadNet may be subject to measurement uncertainty of up to 100 pCi/L.

The radio-analytical laboratory counts tritium results to an HDI-specified LLD of 200 pCi/L with a typical uncertainty of ±100 pCi/L. Therefore, sample results reported by TBE near this LLD cannot be distinguished from natural background concentrations in surface water.

IV. Results and Discussion

A. Program Exceptions

There were no program exceptions in 2019.

B. Groundwater Results

Samples were collected from on-site locations in accordance with the station radiological groundwater protection program. As reported in GHD's 2019 Hydrogeologic Investigation Report, groundwater flow in the vicinity of the Torus Water Storage Tank and the Condensate Storage Tank is towards the intake and discharge canals.

Tritium

Samples from 34 locations were analyzed for tritium activity. Tritium was detected in 10 of 108 samples. The values ranged from <172 to 1,590 pCi/L. The well with the highest concentration was MW-56I. (Table B–I.1, Appendix B)

Strontium

Strontium-89 and Strontium-90 were not detected in any location sampled in 2019. (Table B-I.1, Appendix B)

Gross Alpha and Gross Beta (dissolved and suspended)

Gross Alpha and Gross Beta analyses in the dissolved and suspended fractions were performed on groundwater samples during the second and third quarters in 2019. There were 30 samples taken from 20 groundwater well locations. Gross Alpha (dissolved) was detected in 3 samples. The concentrations ranged from 1.2 to 2.2 pCi/L. Gross Alpha (suspended) was detected in 14 samples and ranged from 1.7 to 35.4 pCi/L. Gross Beta (dissolved) was detected in 24 samples and ranged from 1.1 to 22.1 pCi/L. Gross Beta (suspended) was detected in 16 samples and ranged from 2.5 to 52.1 pCi/L. (Table B-I.1, Appendix B)

Gamma Emitters

The naturally occurring gamma-emitting nuclide K-40 was detected in 2 of 55 samples analyzed during 2019. The concentrations ranged from 90 to 100 pCi/L. (Table B–I.2, Appendix B).

"Hard-To-Detect"

"Hard-To-Detect" analyses were not performed on groundwater samples in 2019. (Table B-I.3, Appendix B)

C. Surface Water Results

Samples were collected from on-site locations in accordance with the station radiological groundwater protection program. Analytical results and anomalies are discussed below:

Tritium

Samples from 7 locations were analyzed for tritium activity. Tritium was found in 1 of 23 samples at a concentration of 211 pCi/L. (Table B–II.1, Appendix B)

Gross Alpha and Gross Beta (dissolved and suspended)

Gross Alpha and Gross Beta analyses in the dissolved and suspended fractions are not required on a routine basis and were not analyzed in 2019.

Gamma Emitters

No gamma-emitting nuclides were detected in any surface water sample in 2019. (Table B–II.2, Appendix B)

"Hard-To-Detect"

"Hard-To-Detect" analyses are not required on a routine basis and were not analyzed in 2019.

D. Precipitation Water Results

Precipitation samples were collected from onsite and offsite locations in accordance with the station radiological groundwater protection program. Analytical results and anomalies are discussed below:

Tritium

Samples from five locations were collected from onsite and offsite monitoring locations and analyzed for tritium activity. No detectable tritium (greater than the MDC) was found in any precipitation water sample during 2019. (Table B–III.1, Appendix B)

E. Summary of Results – Inter-Laboratory Comparison Program

Inter-Laboratory Comparison Program results for TBE and Environmental Inc. (Midwest Labs) are presented in the 2019 Oyster Creek AREOR. This report is part of the AREOR.

F. Leaks, Spills, and Releases

There were no abnormal liquid releases during 2019.

G. Trends

Active remediation of tritium in groundwater due to the spills that occurred in 2009 was initiated in October 2010. Trending of the data due to active remediation is on-going. Continuous remediation was terminated in October 2019 with State of New Jersey concurrence. Overall, the station has seen a decreasing trend in tritium values to the point where ground water tritium is below the ODCM LLD.

H. Investigations

GHD Services Inc. performed an independent assessment of the tritium plume. The results of their assessment can be found in References 1, 2 and 3.

I. Actions Taken

1. Compensatory Actions

   Active remediation of tritium in groundwater due to the spills that occurred in 2009 was initiated in October, 2010.

2. Installation of Monitoring Wells

   The following wells were installed in 2010 to better characterize and monitor the tritium plume and site hydrology:

Well Number	Formation	Well Installation Date
W-58 I	Cohansey	July
W-59 I	Cohansey	March
W-60 I	Cohansey	July
W-61 I	Cohansey	July
W-62	Cape May	March
W-63 I	Cohansey	July
W-64	Cape May	March
W-65	Cape May	March
W-66 I	Cohansey	July
W-67	Cape May	March
W-68 I	Cohansey	July
W-69 I	Cohansey	July
W-70 I	Cohansey	July
W-71	Cape May	August
W-72	Cape May	August
W-73 Pumping well	Cohansey	October

3. Actions to Recover/Reverse Plumes

   Oyster Creek Generating Station addressed the tritium in groundwater through continuous pumping of groundwater from of W-73 to the intake structure. Remediation of groundwater progressed to the stage where this program was terminated in the 4th quarter of with State of New Jersey concurrence. Should groundwater tritium levels regress initiating an adverse trend, the ODCM has provisions to restore ground water remediation using well 73 in batch or continuous mode.

V. References

1. Conestoga Rovers and Associates, Hydrogeologic Investigation Report, Fleetwide Assessment, Oyster Creek Generating Station, Forked River, New Jersey, Ref. No. 055875 (6), April 2011
2. Conestoga Rovers and Associates, Site Investigation Report, Oyster Creek Generating Station, Forked River, New Jersey, Ref. No. 055875 (4), August 2009
3. Conestoga Rovers and Associates, Remedial Investigation Workplan, Oyster Creek Generating Station, Forked River, New Jersey, Ref. No. 055875 (5), October 2009

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APPENDIX A

LOCATION DESIGNATION

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Oyster Creek Generating Station RGPP Sample Point List

Sample Identification Number	Location	Well GPS Coordinates (Northing/Easting)	Depth (ft)	RGPP Sample Point Designation	Tritium Alert Value	Aquifer or Water Body Monitored
DWN	North Domestic Well	358373.33 574672.98	300.0	B	2,000 pCi/L	Kirkwood
DWS	South Domestic Well	356955.90 574616.69	145.0	B	2,000 pCi/L	Kirkwood
LW-1	E of ISFSI – (microwave zone)	357632.49 575569.96	21.0	I	2,000 pCi/L	Cape May
LW-2	E of ISFSI – (microwave zone)	357645.30 575581.92	21.0	I	2,000 pCi/L	Cape May
LW-3	E of ISFSI – (microwave zone)	357630.20 575575.52	21.0	D	2,000 pCi/L	Cape May
LW-4	East of ISFSI – (microwave zone)	357652.78 575573.75	49.0	D	2,000 pCi/L	Cohansey
MW-1A-2A	SW of MFOT Moat	357380.76 575043.44	24.0	D	2,000 pCi/L	Cape May
MW-1G-1A	East of fueling station	358551.94 575308.91	20.0	I	2,000 pCi/L	Cape May
MW-1G-1B	East of fueling station	358550.57 575316.19	45.0	I	2,000 pCi/L	Cohansey
MW-1I-1A	Roadway – NW of TWST	357598.17 574412.70	19.0	D	2,000 pCi/L	Cape May
MW-1I-2A	Roadway – SE of TWST	357574.80 574493.50	17.5	D	2,000 pCi/L	Cape May
MW-15K-1A	Roadway - Intake	357297.90 574469.50	19.0	D	2,000 pCi/L	Cape May
MW-16D	Yard – W of MAC Building	357573.30 574746.50	25.0	D	2,000 pCi/L	Cape May

TABLE A-1: Radiological Groundwater Protection Program - Sampling Locations, Oyster Creek Generating Station, 2019

Oyster Creek Generating Station RGPP Sample Point List

Sample Identification Number	Location	Well GPS Coordinates (Northing/Easting)	Depth (ft)	RGPP Sample Point Designation	Tritium Alert Value	Aquifer or Water Body Monitored
MW-24-2A	Finninger Farm – near DSB	356838.52 579470.94	18.0	I	2,000 pCi/L	Cape May
MW-24-3A	Finninger Farm – near DSB	356828.49 578969.05	17.0	I	2,000 pCi/L	Cape May
MCD	Main Condenser Discharge	N/A	N/A	SW	2,000 pCi/L	Surface Water
SW-1	Intake Canal	N/A	N/A	SW	2,000 pCi/L	Surface Water
SW-2	RT 9 South Bridge	N/A	N/A	SW	2,000 pCi/L	Surface Water
SW-3	Fire Pond	N/A	N/A	SW	2,000 pCi/L	Surface Water
W-1	Dilution Pump Area – West Bank	357029.86 574140.61	50.0	I	2,000 pCi/L	Cohansey
W-1A	North Yard Area	358311.70 574679.00	50.0	B	2,000 pCi/L	Cohansey
W-1B	North Yard Area	358312.80 574685.40	20.0	I	2,000 pCi/L	Cape May
W-1C	West end of backsite	357149.22 572741.00	60.0	I	2,000 pCi/L	Cohansey
W-1K	West end of backsite	357151.55 572728.77	150.0	I	2,000 pCi/L	Kirkwood
W-2	S of EDG Bldg	356965.65 574555.73	57.0	I	2,000 pCi/L	Cohansey
W-2A	Field – W of North Yard Bldg	358105.00 574348.60	50.0	I	2,000 pCi/L	Cohansey

TABLE A-1: Radiological Groundwater Protection Program - Sampling Locations, Oyster Creek Generating Station, 2019

Oyster Creek Generating Station RGPP Sample Point List

Sample Identification Number	Location	Well GPS Coordinates (Northing/Easting)	Depth (ft)	RGPP Sample Point Designation	Tritium Alert Value	Aquifer or Water Body Monitored
W-2B	Field – W of North Yard Building	358110.30 574348.50	20.0	B	2,000 pCi/L	Cape May
W-2C	Forked River CT Site	357923.67 573809.92	60.0	I	2,000 pCi/L	Cohansey
W-2K	Forked River CT Site	358030.88 573762.54	150.0	I	2,000 pCi/L	Kirkwood
W-3	Intake – Access Road	357173.00 574499.10	24.0	D	2,000 pCi/L	Cape May
W-3A	Plant Access Road	358067.92 575664.22	50.0	I	2,000 pCi/L	Cohansey
W-3B	Plant Access Road	358070.58 575656.25	20.0	I	2,000 pCi/L	Cape May
W-3C	Finninger Farm – N of Discharge	356595.30 576663.33	60.0	I	2,000 pCi/L	Cohansey
W-3K	Finninger Farm – N of Discharge	356602.17 576675.04	100.0	I	2,000 pCi/L	Kirkwood
W-4	Intake – Access Road	357176.40 574497.70	55.0	D	2,000 pCi/L	Cohansey
W-4A	SE of OCAB Building	356913.30 575387.10	50.0	B	2,000 pCi/L	Cohansey
W-4B	SE of OCAB Building	356916.40 575388.90	20.0	B	2,000 pCi/L	Cape May
W-4C	Finninger Farm – S of Intake	359305.61 575867.58	60.0	I	2,000 pCi/L	Cohansey
W-4K	Finninger Farm – S of Intake	359321.83 575874.07	100.00	I	2,000 pCi/L	Kirkwood

Oyster Creek Generating Station RGPP Sample Point List

Sample Identification Number	Location	Well GPS Coordinates (Northing/Easting)	Depth (ft)	RGPP Sample Point Designation	Tritium Alert Value	Aquifer or Water Body Monitored
W-5	NW Yard area, near Fire Water Tank	357510.95 574374.05	20.5	D	2,000 pCi/L	Cape May
W-5C	Finninger Farm – E of dredge spoils	356758.59 580642.26	60.0	B	2,000 pCi/L	Cohansey
W-5K	Finninger Farm – E of dredge spoils	356743.81 580646.48	150.0	B	2,000 pCi/L	Kirkwood
W-6	NW Yard – near Fire Water Tank	357514.02 574373.77	52.0	D	2,000 pCi/L	Cohansey
W-7	NE – Building 4	357074.46 574713.08	20.0	D	2,000 pCi/L	Cape May
W-9	Roadway – NE of SAS Building	357289.29 574892.74	20.0	D	2,000 pCi/L	Cape May
W-10	NW of SAS Building	357286.29 574890.61	60.0	D	2,000 pCi/L	Cohansey
W-12	Yard – NW of DWPC Building	357669.10 574755.60	20.0	D	2,000 pCi/L	Cape May
W-13	Yard – NW of DWPC Building	357666.00 574755.90	50.0	D	2,000 pCi/L	Cohansey
W-14	Yard – SW of Warehouse	357702.41 575018.75	53.0	D	2,000 pCi/L	Cohansey
W-15	Yard – SW of Warehouse	357705.83 575017.70	20.0	D	2,000 pCi/L	Cape May
W-16	Yard – E of LLRW	357967.26 574933.03	20.0	D	2,000 pCi/L	Cape May
W-17	Road/ Exit Near W-3A	358078.05 575667.14	150.0	I	2,000 pCi/L	Kirkwood

Oyster Creek Generating Station RGPP Sample Point List

Sample Identification Number	Location	Well GPS Coordinates (Northing/Easting)	Depth (ft)	RGPP Sample Point Designation	Tritium Alert Value	Aquifer or Water Body Monitored
W-18	Near EDG Building	357005.78 574621.6	20.0	I	2,000 pCi/L	Cape May
W-19	Near EDG Building	357077.91 574633.23	20.0	I	2,000 pCi/L	Cape May
W-20	SW of EDG Building	356927.46 574542.59	20.0	I	2,000 pCi/L	Cape May
W-21	Near EDG Building	357009.15 574518.22	20.0	I	2,000 pCi/L	Cape May
W-22	Near EDG Building	357024.50 574590.19	39.0	I	2,000 pCi/L	Cape May
W-23	Near EDG Building	357054.89 574564.88	20.0	I	2,000 pCi/L	Cape May
W-24	South of TB W of old Machine Shop	357128.94 574650.77	19.0	D	2,000 pCi/L	Cape May
W-25	Near EDG Building	356962.59 574677.59	20.0	I	2,000 pCi/L	Cape May
W-26	Near EDG Building	357006.60 574644.03	20.0	I	2,000 pCi/L	Cape May
W-27	Near EDG Building	357042.43 574636.35	20.0	I	2,000 pCi/L	Cape May
W-28	Near EDG Building	356991.29 574573.64	19.5	I	2,000 pCi/L	Cape May
W-29	Near EDG Building	357012.62 574568.69	19.5	I	2,000 pCi/L	Cape May
W-30	Near EDG Building	357058.00 574516.71	19.5	I	2,000 pCi/L	Cape May

Oyster Creek Generating Station RGPP Sample Point List

Sample Identification Number	Location	Well GPS Coordinates (Northing/Easting)	Depth (ft)	RGPP Sample Point Designation	Tritium Alert Value	Aquifer or Water Body Monitored
W-31	Near EDG Building	357051.78 574495.62	19.5	I	2,000 pCi/L	Cape May
W-32	Near EDG Building	356978.58 574528.44	19.5	I	2,000 pCi/L	Cape May
W-33	Near EDG Building	357026.93 574499.17	19.5	I	2,000 pCi/L	Cape May
W-34	South of TB W of old Machine Shop	357196.14 574649.43	40.0	D	2,000 pCi/L	Cohansey
MW-50	Between CST and Intake Structure	357368.21 574436.80	20.0	E	2,000 pCi/L	Cape May
MW-51	Near CST	357378.30 574480.80	20.0	E	2,000 pCi/L	Cape May
MW-52	Near Intake Structure	357400.90 574353.00	20.0	D	2,000 pCi/L	Cape May
MW-53	Near end of CW discharge piping	357272.80 574447.60	20.0	D	2,000 pCi/L	Cape May
MW-54	Near Intake Structure	357276.20 574311.70	20.0	E	2,000 pCi/L	Cape May
MW-55	Between CST and Intake Structure	357354.88 574440.07	30.0	E	2,000 pCi/L	Cape May
MW-56I	By NaOCl tanks	357305.30 574465.50	52.0	E	2,000 pCi/L	Cohansey
MW-57I	Near Intake Structure	357343.71 574373.89	50.0	E	2,000 pCi/L	Cohansey
MW-58I	Near Intake Structure	357346.70 574377.28	72.0	D	2,000 pCi/L	Cohansey

Oyster Creek Generating Station RGPP Sample Point List

Sample Identification Number	Location	Well GPS Coordinates (Northing/Easting)	Depth (ft)	RGPP Sample Point Designation	Tritium Alert Value	Aquifer or Water Body Monitored
MW-59I	Intake Roadway – NW of CST	357422.14 574406.38	44.0	D	2,000 pCi/L	Cohansey
MW-60I	Near Intake Structure	357346.55 574373.88	92.0	D	2,000 pCi/L	Cohansey
MW-61I	Between CST and Intake Structure	357328.64 574444.45	72.0	E	2,000 pCi/L	Cohansey
MW-62	NW Corner of Turbine Bldg	357467.93 574524.10	25.0	D	2,000 pCi/L	Cape May
MW-63I	Between CST and Intake Structure	357329.40 574447.67	92.0	D	2,000 pCi/L	Cohansey
MW-64	Near Intake Structure	357343.96 574377.88	25.0	E	2,000 pCi/L	Cape May
MW-65	Intake Roadway – NW of CST	357421.00 574402.55	25.0	D	2,000 pCi/L	Cape May
MW-66I	SE of Reactor Bldg	357320.44 574889.18	80.0	D	2,000 pCi/L	Cohansey
MW-67	West side of Turbine Bldg	357401.99 574540.38	25.0	E	2,000 pCi/L	Cape May
MW-68I	SE of Reactor Bldg	357323.83 574897.64	100.0	D	2,000 pCi/L	Cohansey
MW-69I	Yard – NW of DWPC Building	357664.03 574760.93	78.0	D	2,000 pCi/L	Cohansey
MW-70I	Yard – NW of DWPC Building	357670.57 574759.18	98.0	D	2,000 pCi/L	Cohansey
MW-71	S of Reactor Bldg	357365.52 574841.89	25.0	D	2,000 pCi/L	Cape May

Oyster Creek Generating Station RGPP Sample Point List

Sample Identification Number	Location	Well GPS Coordinates (Northing/Easting)	Depth (ft)	RGPP Sample Point Designation	Tritium Alert Value	Aquifer or Water Body Monitored
MW-72	N of Reactor Bldg	357549.87 574788.52	25.0	D	2,000 pCi/L	Cape May
MW-73	Remediation System	N/A	N/A	N/A	N/A	N/A

*Tritium sampling frequency based upon agreement made with the NJDEP on 04/26/13.

D = Daily

W = Weekly

M = Monthly

S = Semi-annual

B = Biennial

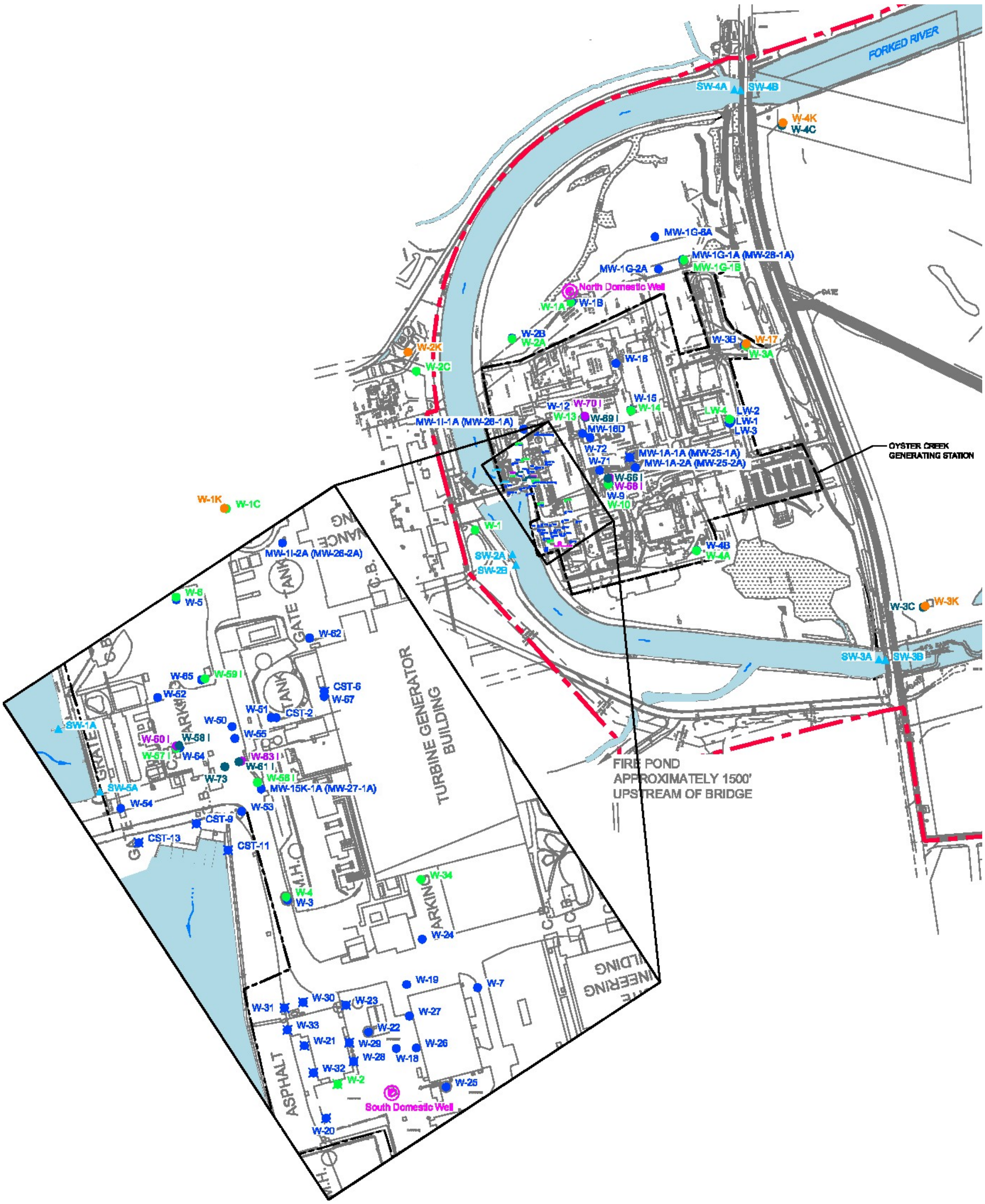

Figure A-1
Sampling Locations – Selected Cohansey
and Cape May Formation Wells,
Oyster Creek Generating Station, 2019

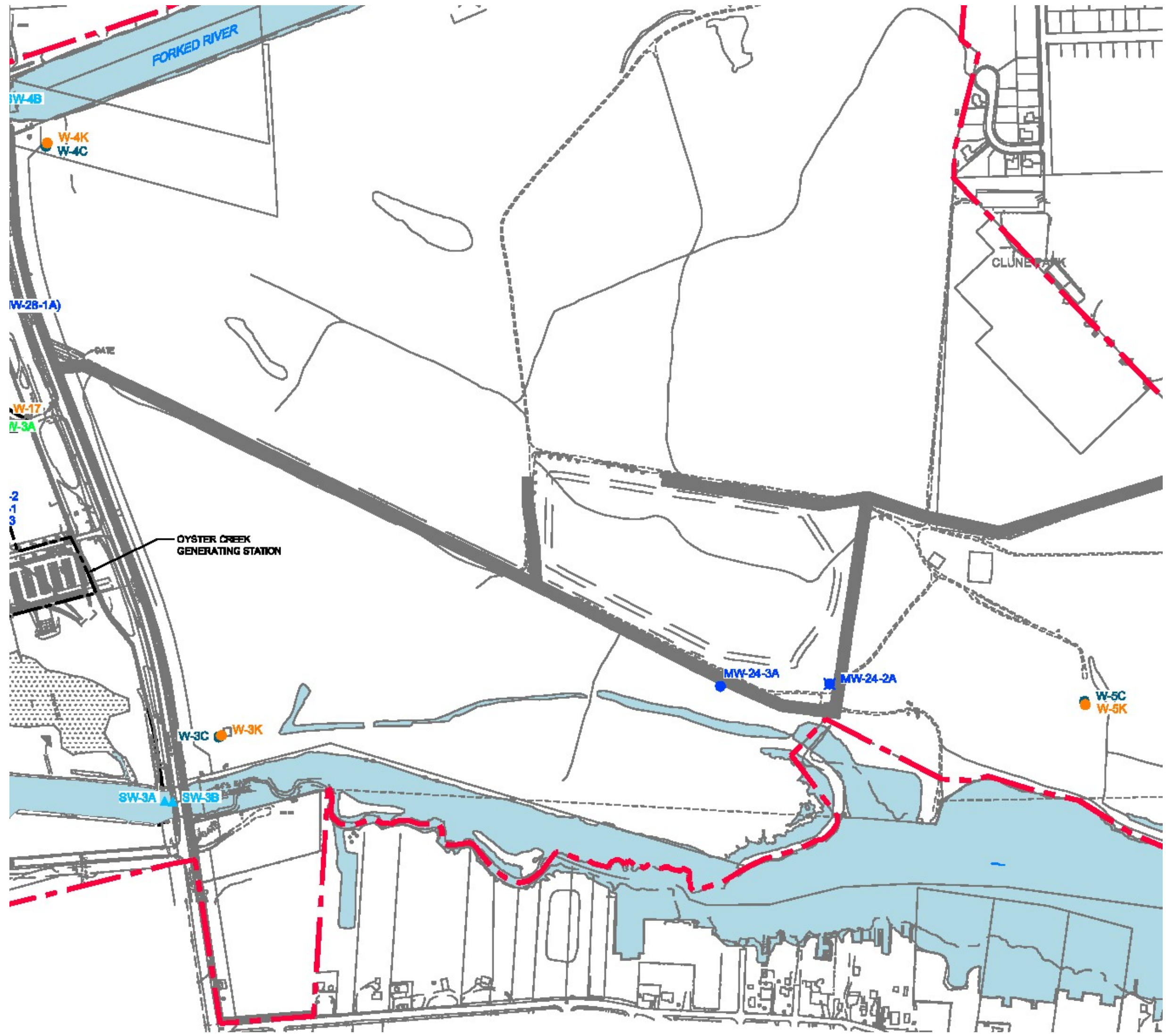

Figure A-1
Sampling Locations – Selected Cohansey
and Cape May Formation Wells,
Oyster Creek Generating Station, 2019

APPENDIX B

DATA TABLES

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TABLE B-I.1 CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA, AND GROSS BETA IN GROUNDWATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE		H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)	Gr-B (Dis)	Gr-B (Sus)
MW-1A-2A	04/18/19		< 173						
MW-1I-1A	01/15/19		< 196						
MW-1I-1A	04/16/19		< 193	< 5.6	< 0.4	< 0.4	< 1.4	1.1 ± 0.6	< 1.5
MW-1I-1A	07/23/19		< 192						
MW-1I-1A	10/08/19		< 192						
MW-1I-2A	01/15/19		< 194						
MW-1I-2A	04/16/19		< 180	< 9.4	< 0.8	< 0.3	< 1.3	< 0.9	< 1.5
MW-1I-2A	07/23/19		< 194						
MW-1I-2A	10/08/19		< 192						
MW-15K-1A	01/15/19		< 199						
MW-15K-1A	04/16/19		< 193	< 7.3	< 0.5	< 0.7	< 3.9	< 2.0	6.4 ± 3.0
MW-15K-1A	04/16/19	*Duplicate*	< 193	< 5.3	< 0.5	< 0.7	7.6 ± 1.5	< 2.1	6.3 ± 1.7
MW-15K-1A	07/23/19		< 191						
MW-15K-1A	10/08/19		< 190	< 4.3	< 0.5	< 0.7	8.0 ± 4.5	4.6 ± 1.3	26.4 ± 5.1
MW-16D	01/16/19		< 197						
MW-16D	04/17/19		< 194	< 7.4	< 0.4	< 0.7	< 1.3	2.2 ± 0.9	< 1.5
MW-16D	07/24/19		< 194						
MW-16D	10/09/19		< 188						
MW-52	04/17/19		< 179						
MW-53	04/18/19		< 178						
MW-54	04/16/19		< 181						
MW-55	01/15/19		< 195						
MW-55	04/16/19		< 178	< 4.7	< 0.6	< 0.5	2.4 ± 1.2	7.4 ± 1.1	3.6 ± 1.3
MW-55	07/23/19		< 189						
MW-55	10/08/19		< 187	< 5.6	< 0.8	< 0.6	2.3 ± 1.1	2.4 ± 0.6	2.5 ± 1.2
MW-56I	01/15/19		793 ± 157						
MW-56I	04/16/19		1140 ± 184	< 6.1	< 0.7	< 0.5	< 0.6	4.8 ± 1.0	< 1.8
MW-56I	07/23/19		1590 ± 230						
MW-56I	10/08/19		815 ± 160	< 5.0	< 0.7	< 0.8	< 1.4	5.4 ± 0.8	< 1.6
MW-57I	01/15/19		704 ± 151						
MW-57I	04/16/19		693 ± 143	< 3.2	< 0.6	< 0.6	3.2 ± 1.2	16.9 ± 1.5	3.0 ± 1.2
MW-57I	07/23/19		676 ± 150						
MW-57I	10/08/19		582 ± 139	< 4.9	< 0.7	< 0.7	1.7 ± 1.0	15.2 ± 1.3	3.4 ± 1.3
MW-59I	01/15/19		< 192						
MW-59I	04/16/19		< 193	< 2.9	< 0.7	< 0.6	< 0.9	3.4 ± 1.0	< 2.4
MW-59I	07/23/19		< 189						
MW-59I	10/08/19		< 187						
MW-61I	01/15/19		< 192						
MW-61I	04/16/19		< 191	< 6.7	< 0.4	< 0.3	< 0.5	1.3 ± 0.5	< 1.4
MW-61I	07/23/19		< 197						
MW-61I	10/08/19		< 187						
MW-61I	10/08/19	*Duplicate*	< 188						
MW-61I	10/08/19	*EIML*	< 151						
MW-62	01/15/19		< 195						
MW-62	04/16/19		< 191	< 4.5	< 0.4	< 0.8	7.0 ± 2.9	2.9 ± 1.4	8.4 ± 3.1
MW-62	07/23/19		< 191						
MW-62	10/08/19		< 188						
MW-64	01/15/19		< 193						
MW-64	01/15/19	*Duplicate*	< 196						
MW-64	04/16/19		< 190	< 3.7	< 0.7	< 2.7	35.4 ± 7.3	**< 7.6**	52.1 ± 8.0
MW-64	04/16/19	*Duplicate*	< 191	< 3.8	< 0.6	1.2 ± 0.7	7.9 ± 1.6	4.8 ± 1.5	8.9 ± 1.7
MW-64	07/23/19		< 196						
MW-64	07/23/19	*Duplicate*	< 179						
MW-64	10/08/19		< 188						
MW-64	10/08/19	*Duplicate*	< 189						
MW-64	10/08/19	*EIML*	< 151						

Bolded values indicate LLD was not met due to high solid content in the sample

TABLE B-I.1 CONCENTRATIONS OF TRITIUM, STRONTIUM, GROSS ALPHA, AND GROSS BETA IN GROUNDWATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE		H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)	Gr-B (Dis)	Gr-B (Sus)
MW-65	01/15/19		< 189						
MW-65	04/16/19		< 191	< 6.2	< 0.6	2.2 ± 1.1	5.3 ± 1.2	4.8 ± 1.9	6.1 ± 1.6
MW-65	07/23/19		< 174						
MW-65	10/08/19		< 192	< 4.5	< 0.6	1.9 ± 0.9	< 6.0	22.1 ± 2.1	18.8 ± 4.4
MW-67	01/15/19		223 ± 130						
MW-67	04/16/19		295 ± 131	< 7.1	< 0.7	< 0.3	2.0 ± 1.3	4.1 ± 0.8	3.4 ± 1.6
MW-67	07/23/19		< 178						
MW-67	10/08/19		< 188	< 5.2	< 0.7	< 0.4	1.7 ± 1.0	2.8 ± 0.6	2.5 ± 1.2
MW-71	01/16/19		< 199						
MW-71	01/16/19	*Duplicate*	< 200						
MW-71	04/18/19		< 189	< 3.5	< 0.6	< 0.4	2.9 ± 1.3	2.2 ± 0.7	2.6 ± 1.3
MW-71	04/18/19	*Duplicate*	< 189	< 6.4	< 0.4	< 0.4	< 0.8	2.5 ± 0.8	< 1.7
MW-71	07/24/19		< 175						
MW-71	07/24/19	*Duplicate*	< 179						
MW-71	10/09/19		< 190						
MW-71	10/09/19	*Duplicate*	< 189						
MW-71	10/09/19	*EIML*	< 151						
MW-72	01/15/19		< 197						
MW-72	04/17/19		< 190	< 6.1	< 0.6	< 0.3	< 0.7	2.2 ± 0.7	< 1.6
MW-72	07/24/19		< 180						
MW-72	10/09/19		< 189						
W-1A	04/18/19		< 187						
W-3	01/15/19		< 198						
W-3	04/16/19		< 192	< 5.2	< 0.7	< 0.9	< 3.2	< 2.3	< 3.6
W-3	07/23/19		< 196						
W-3	10/08/19		< 200						
W-4	04/16/19		< 179						
W-4A	04/18/19		< 189						
W-5	01/15/19		< 191						
W-5	01/15/19	*Duplicate*	< 194						
W-5	04/17/19		< 178	< 6.4	< 0.4	< 2.9	< 0.9	5.0 ± 1.5	< 1.5
W-5	04/17/19	*Duplicate*	< 176	< 8.8	< 0.8	< 0.3	< 0.9	1.7 ± 0.6	< 1.5
W-5	07/23/19		< 192						
W-5	07/23/19	*Duplicate*	< 194						
W-5	10/08/19		< 197						
W-5	10/08/19	*Duplicate*	< 192						
W-5	10/08/19	*EIML*	< 151						
W-6	04/17/19		< 175						
W-9	01/16/19		< 194						
W-9	04/18/19		< 172	< 3.4	< 0.8	< 0.6	< 0.9	10.0 ± 1.3	< 1.5
W-9	07/24/19		< 188						
W-9	10/09/19		< 181						
W-10	04/18/19		< 173						
W-12	01/16/19		< 195						
W-12	04/17/19		< 177	< 4.2	< 0.6	< 0.7	2.2 ± 0.8	< 2.7	4.2 ± 1.7
W-12	07/24/19		< 190						
W-12	10/09/19		< 185						
W-13	04/17/19		< 176						
W-14	04/18/19		< 183						
W-15	04/18/19		< 178						
W-16	04/17/19		< 178						
W-24	04/18/19		< 175						
W-34	01/16/19		< 195						
W-34	04/18/19		< 180	< 5.2	< 0.8	< 0.5	< 0.9	8.0 ± 1.1	< 1.5
W-34	07/23/19		< 197						
W-34	10/08/19		< 184						

TABLE B-I.2

CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, OYSTER CREEK GENERATING STATION, 2019

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
MW-1A-2A	04/18/19		< 73	< 60	< 7	< 8	< 15	< 7	< 17	< 9	< 14	< 13	< 8	< 8	< 36	< 11
MW-1I-1A	04/16/19		< 46	< 104	< 6	< 6	< 15	< 8	< 11	< 6	< 11	< 10	< 6	< 5	< 32	< 10
MW-1I-2A	04/16/19		< 47	< 47	< 6	< 6	< 11	< 6	< 10	< 6	< 9	< 10	< 6	< 7	< 28	< 12
MW-15K-1A	01/15/19		< 61	< 48	< 4	< 7	< 14	< 8	< 17	< 8	< 11	< 11	< 5	< 6	< 33	< 12
MW-15K-1A	04/16/19		< 44	< 55	< 5	< 6	< 9	< 6	< 12	< 5	< 7	< 11	< 5	< 5	< 24	< 8
MW-15K-1A	04/16/19	*Duplicate*	< 40	< 99	< 4	< 4	< 11	< 5	< 10	< 5	< 8	< 10	< 6	< 5	< 25	< 7
MW-15K-1A	07/23/19		< 69	< 134	< 7	< 7	< 15	< 6	< 16	< 8	< 13	< 14	< 7	< 8	< 34	< 9
MW-15K-1A	10/08/19		< 41	< 77	< 4	< 4	< 9	< 4	< 8	< 4	< 7	< 8	< 5	< 3	< 24	< 7
MW-16D	04/17/19		< 50	< 88	< 5	< 5	< 12	< 6	< 10	< 7	< 9	< 9	< 6	< 5	< 23	< 7
MW-52	04/17/19		< 48	< 43	< 5	< 5	< 10	< 5	< 8	< 5	< 8	< 9	< 6	< 5	< 21	< 8
MW-53	04/18/19		< 64	< 139	< 6	< 7	< 11	< 6	< 15	< 8	< 15	< 11	< 7	< 8	< 31	< 10
MW-54	04/16/19		< 47	< 114	< 6	< 7	< 12	< 7	< 14	< 5	< 13	< 12	< 6	< 6	< 27	< 10
MW-55	01/15/19		< 78	< 57	< 8	< 8	< 15	< 7	< 16	< 8	< 14	< 13	< 9	< 8	< 33	< 9
MW-55	04/16/19		< 51	< 153	< 6	< 6	< 13	< 7	< 17	< 7	< 13	< 13	< 8	< 6	< 30	< 10
MW-55	07/23/19		< 47	< 110	< 5	< 8	< 13	< 5	< 17	< 7	< 13	< 12	< 7	< 7	< 32	< 14
MW-55	10/08/19		< 37	< 106	< 5	< 6	< 13	< 7	< 15	< 7	< 11	< 12	< 5	< 5	< 34	< 14
MW-56I	01/15/19		< 46	< 142	< 6	< 4	< 14	< 6	< 15	< 7	< 13	< 11	< 7	< 7	< 26	< 9
MW-56I	04/16/19		< 54	< 114	< 5	< 5	< 17	< 7	< 13	< 6	< 11	< 13	< 7	< 6	< 35	< 11
MW-56I	07/23/19		< 58	< 54	< 7	< 7	< 14	< 7	< 13	< 7	< 11	< 14	< 7	< 8	< 28	< 8
MW-56I	10/08/19		< 40	< 79	< 5	< 5	< 10	< 5	< 8	< 5	< 7	< 8	< 4	< 5	< 21	< 9
MW-57I	01/15/19		< 44	< 134	< 6	< 6	< 16	< 6	< 16	< 6	< 11	< 11	< 8	< 7	< 28	< 11
MW-57I	04/16/19		< 55	< 60	< 6	< 6	< 15	< 7	< 11	< 7	< 10	< 10	< 6	< 7	< 35	< 14
MW-57I	07/23/19		< 59	< 125	< 7	< 8	< 16	< 6	< 22	< 8	< 10	< 14	< 8	< 9	< 38	< 12
MW-57I	10/08/19		< 59	< 132	< 7	< 6	< 15	< 7	< 15	< 8	< 13	< 13	< 8	< 8	< 39	< 15
MW-59I	04/16/19		< 64	< 61	< 7	< 7	< 14	< 7	< 16	< 7	< 10	< 12	< 7	< 7	< 31	< 12
MW-61I	04/16/19		< 68	< 119	< 4	< 6	< 14	< 5	< 17	< 6	< 14	< 12	< 8	< 6	< 27	< 14
MW-62	04/16/19		< 54	< 50	< 7	< 4	< 14	< 7	< 13	< 6	< 9	< 12	< 7	< 7	< 31	< 13
MW-64	04/16/19		< 57	< 143	< 6	< 7	< 14	< 7	< 15	< 7	< 12	< 13	< 7	< 7	< 28	< 14
MW-64	04/16/19	*Reanalysis*	< 32	< 20	< 2	< 3	< 8	< 2	< 5	< 3	< 6	**< 168**	< 2	< 2	**< 106**	**< 37**
MW-64	04/16/19		< 57	< 132	< 6	< 6	< 12	< 7	< 9	< 7	< 10	< 10	< 7	< 6	< 36	< 7
MW-64	04/16/19	*Reanalysis*	< 26	< 15	< 2	< 2	< 7	< 2	< 4	< 3	< 5	**< 129**	< 2	< 2	**< 95**	**< 26**
MW-65	01/15/19		< 53	< 124	< 5	< 6	< 13	< 6	< 11	< 7	< 11	< 9	< 7	< 7	< 23	< 7
MW-65	04/16/19		< 55	< 117	< 7	< 6	< 10	< 7	< 12	< 7	< 9	< 12	< 9	< 6	< 35	< 11
MW-65	07/23/19		< 47	< 100	< 7	< 6	< 12	< 6	< 12	< 7	< 12	< 10	< 6	< 6	< 25	< 11
MW-65	10/08/19		< 54	< 143	< 6	< 7	< 11	< 8	< 16	< 7	< 9	< 13	< 7	< 5	< 29	< 13

Bolded values indicate LLD was not met due to the age of the sample at the time of receipt at the laboratory

TABLE B-I.2 **CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, OYSTER CREEK GENERATING STATION, 2019**

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
MW-67	03/14/19		< 50	< 98	< 6	< 7	< 12	< 5	< 10	< 6	< 12	< 9	< 7	< 8	< 29	< 8
MW-67	04/16/19		< 50	< 69	< 7	< 8	< 14	< 7	< 12	< 7	< 13	< 12	< 7	< 7	< 36	< 9
MW-67	07/23/19		< 70	< 140	< 7	< 8	< 13	< 7	< 15	< 8	< 13	< 15	< 9	< 8	< 38	< 12
MW-67	10/08/19		< 56	< 92	< 6	< 7	< 14	< 8	< 12	< 8	< 13	< 13	< 8	< 8	< 33	< 9
MW-71	04/18/19		< 74	< 95	< 7	< 8	< 17	< 9	< 17	< 7	< 16	< 13	< 8	< 9	< 39	< 10
MW-71	04/18/19	*Duplicate*	< 46	90 ± 51	< 5	< 5	< 12	< 4	< 10	< 6	< 8	< 8	< 6	< 5	< 22	< 6
MW-72	04/17/19		< 49	< 116	< 7	< 7	< 9	< 2	< 10	< 7	< 10	< 10	< 8	< 7	< 36	< 14
W-1A	04/18/19		< 65	< 131	< 7	< 7	< 14	< 8	< 11	< 6	< 13	< 12	< 6	< 7	< 30	< 9
W-3	04/16/19		< 49	< 78	< 6	< 6	< 13	< 7	< 11	< 6	< 7	< 12	< 6	< 5	< 31	< 9
W-4	04/16/19		< 47	< 118	< 5	< 6	< 12	< 6	< 9	< 6	< 9	< 10	< 6	< 6	< 28	< 12
W-4A	04/18/19		< 46	< 106	< 6	< 5	< 10	< 3	< 11	< 5	< 10	< 8	< 6	< 5	< 27	< 9
W-5	04/17/19		< 68	< 107	< 9	< 7	< 17	< 11	< 12	< 7	< 11	< 14	< 8	< 8	< 37	< 14
W-5	04/17/19	*Duplicate*	< 54	< 51	< 5	< 6	< 13	< 7	< 12	< 6	< 11	< 12	< 8	< 6	< 32	< 8
W-6	04/17/19		< 73	100 ± 62	< 9	< 9	< 16	< 7	< 20	< 9	< 15	< 15	< 11	< 9	< 42	< 12
W-9	04/18/19		< 65	< 79	< 8	< 8	< 14	< 9	< 14	< 9	< 13	< 14	< 9	< 8	< 36	< 11
W-10	04/18/19		< 72	< 57	< 9	< 8	< 14	< 9	< 18	< 9	< 16	< 14	< 10	< 9	< 31	< 11
W-12	04/17/19		< 65	< 123	< 6	< 7	< 16	< 8	< 13	< 6	< 10	< 9	< 5	< 8	< 26	< 6
W-13	04/17/19		< 44	< 58	< 4	< 5	< 9	< 5	< 10	< 5	< 9	< 9	< 5	< 5	< 24	< 9
W-14	04/18/19		< 43	< 93	< 5	< 5	< 10	< 6	< 10	< 5	< 7	< 8	< 5	< 6	< 26	< 8
W-15	04/18/19		< 56	< 115	< 7	< 6	< 12	< 8	< 13	< 6	< 13	< 13	< 8	< 6	< 33	< 14
W-16	04/16/19		< 47	< 53	< 5	< 5	< 12	< 5	< 9	< 6	< 9	< 11	< 5	< 6	< 25	< 8
W-24	04/18/19		< 76	< 105	< 6	< 5	< 15	< 9	< 11	< 6	< 10	< 11	< 6	< 8	< 28	< 10
W-34	04/18/19		< 62	< 134	< 8	< 7	< 13	< 7	< 12	< 7	< 10	< 11	< 10	< 6	< 26	< 12

TABLE B-I.3 CONCENTRATIONS OF HARD-TO-DETECTS IN GROUNDWATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	Am-241	Cm-242	Cm-243/244	Pu-238	Pu-239/240	U-234	U-235	U-238	Fe-55	Ni-63

NONE FOR 2019

TABLE B-II.1 CONCENTRATIONS OF TRITIUM IN SURFACE WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/LITER + 2 SIGMA

SITE	COLLECTION DATE	H-3
MCD	01/16/19	< 198
SEWER PIT	01/28/19	< 196
SEWER PIT	04/18/19	< 188
SEWER PIT	07/11/19	< 179
SEWER PIT	10/07/19	< 184
STORM DRAIN EAST	01/28/19	< 195
STORM DRAIN EAST	08/01/19	< 193
STORM DRAIN EAST	10/09/19	< 189
STORM DRAIN OUTFALL #2	01/28/19	< 190
STORM DRAIN OUTFALL #2	08/01/19	< 191
STORM DRAIN OUTFALL #2	11/19/19	< 197
SW-1	01/16/19	< 196
SW-1	04/15/19	< 192
SW-1	08/08/19	< 195
SW-1	10/07/19	< 190
SW-2	01/15/19	< 195
SW-2	04/17/19	211 ± 125
SW-2	07/23/19	< 177
SW-2	10/07/19	< 187
SW-3	01/15/19	< 199
SW-3	04/17/19	< 191
SW-3	07/23/19	< 180
SW-3	10/07/19	< 191

TABLE B-II.2 CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, OYSTER CREEK GENERATING STATION, 2019

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
SW-1	04/15/19	< 38	< 99	< 5	< 5	< 10	< 5	< 13	< 4	< 7	< 10	< 6	< 5	< 24	< 9
SW-2	04/17/19	< 54	< 58	< 5	< 6	< 14	< 7	< 15	< 7	< 8	< 11	< 7	< 7	< 29	< 10
SW-3	04/17/19	< 55	< 62	< 6	< 6	< 13	< 8	< 13	< 7	< 10	< 11	< 8	< 7	< 33	< 9

TABLE B-II.3 CONCENTRATIONS OF HARD TO DETECTS IN SURFACE WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	Am-241	Cm-242	Cm-243/244	Pu-238	Pu-239/240	U-234	U-235	U-238	Fe-55	Ni-63

NONE FOR 2019

TABLE B-III.1 CONCENTRATIONS OF TRITIUM IN PRECIPITATION WATER SAMPLES COLLECTED AS PART OF THE RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM, OYSTER CREEK GENERATING STATION, 2019

RESULTS IN UNITS OF PCI/LITER + 2 SIGMA

SITE	COLLECTION DATE	H-3
2	01/08/19	< 188
2	04/02/19	< 192
2	07/23/19	< 176
2	10/08/19	< 185
3	01/08/19	< 190
3	04/02/19	< 191
3	07/23/19	< 178
3	10/08/19	< 188
4	01/08/19	< 188
4	04/02/19	< 191
4	07/23/19	< 180
4	10/08/19	< 183
5	01/08/19	< 189
5	04/02/19	< 193
5	07/23/19	< 181
5	10/08/19	< 186
6	01/08/19	< 190
6	04/02/19	< 196
6	07/23/19	< 185
6	10/08/19	< 186

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