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Byron Station, Units 1 and 2
Renewed Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. STN 50-454 and STN 50-455

Subject: 2018 Annual Radiological Environmental Operating Report (AREOR)

In accordance with Technical Specification 5.6.2, "Annual Radiological Environmental Operating Report," we are submitting the Annual Radiological Environmental Operating Report (AREOR) for Byron Station. This report is required to be submitted to the NRC by May 15th of each year and contains the results of the radiological environmental and meteorological monitoring programs. The Radioactive Effluent Release Report was submitted under separate cover. Also included are the results of groundwater monitoring conducted in accordance with Exelon's Radiological Groundwater Protection Program (RGPP), which is a voluntary program implemented in 2006. This information is being reported in accordance with a nuclear industry initiative.

If you have any questions regarding this information, please contact Mr. Jon Cunzeman, Regulatory Assurance Manager, at (815) 406-2800.

Respectfully,

Mark E. Kanavos
Site Vice President
Byron Generating Station

MEK/JG/ZC/rm

Attachment: AREOR Report

cc: Regional Administrator – NRC Region III

NRC.Docket No: 50-454
50-455

BYRON NUCLEAR GENERATING STATION
UNITS 1 and 2

Annual Radiological
Environmental Operating Report

1 January Through 31 December 2018

Prepared By

Teledyne Brown Engineering
Environmental Services

Byron Nuclear Generating Station
Byron, IL 61010

April 2019

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Appendices

I. Summary and Conclusions

This report on the Radiological Environmental Monitoring Program conducted for the Byron Nuclear Generating Station by Exelon covers the period 1 January 2018 through 31 December 2018. During that time period, 1,439 analyses were performed on 1,275 samples. In assessing all the data gathered for this report and comparing these results with preoperational data, it was concluded that the operation of BNGS had no adverse radiological impact on the environment.

Surface water samples were analyzed for concentrations of gross beta, tritium, Nickel-63 (Ni-63), and gamma-emitting nuclides. Ground water samples were analyzed for concentrations of tritium and gamma-emitting nuclides. Gross beta activities detected were consistent with those detected in previous years. All surface water samples analyzed for Ni-63 were less than the minimum detectable concentration. Tritium detected in downstream surface water was well below reportable limits and consistent with expected levels as a result of permitted liquid discharges.

Fish (commercially and/or recreationally important species) and sediment samples were analyzed for concentrations of Ni-63 and gamma-emitting nuclides. No fission or activation products were detected.

Air particulate samples were analyzed for concentrations of gross beta and gamma-emitting nuclides. No fission or activation products were detected.

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

Cow milk samples were analyzed for concentrations of I-131 and gamma-emitting nuclides. All I-131 results were below the minimum detectable activity. No fission or activation products were found.

Food Product samples were analyzed for concentrations of gamma-emitting nuclides. No fission or activation products were detected.

Environmental gamma radiation measurements were performed quarterly using Optically Stimulated Luminescence Dosimeters (OSLD). Beginning in 2012, Exelon changed the type of dosimetry used for the Radiological Environmental Monitoring Program (REMP). Optically Stimulated Luminescent Dosimetry were deployed and Thermoluminescent Dosimetry (TLD) were discontinued. This change may have resulted in a step change in readings, up or down, depending on site characteristics. The relative comparison to control locations remains valid. OSLD technology is different than that used in a TLD but has the same purpose (to measure direct radiation).

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II. Introduction

Byron Station, a two-unit PWR station, is located about two miles east of the Rock River and approximately three miles southwest of Byron in Ogle County, Illinois. The reactors are designed to have capacities of 1,268 and 1,241 MW gross, respectively. Unit One loaded fuel in November 1984 and went on line February 2, 1985. Unit Two went on line January 9, 1987. The station has been designed to keep releases to the environment at levels below those specified in the codes of federal regulations.

This report covers those analyses performed by Teledyne Brown Engineering (TBE) and Landauer on samples collected during the period 1 January 2018 through 31 December 2018.

A. Objectives of the REMP

The objectives of the REMP are to:

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

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

B. Implementation of the Objectives

The implementation of the objectives is accomplished by:

1. Identifying significant exposure pathways

2. Establishing baseline radiological data of media within those pathways

3. Continuously monitoring those media before and during Station operation to assess Station radiological effects (if any) on man and the environment

III. Program Description

A. Sample Collection

Samples for the BNGS REMP were collected for Exelon Nuclear by Environmental Inc. (Midwest Labs). This section describes the general collection methods used by Environmental Inc. to obtain environmental samples for the BNGS REMP in 2018. Sample locations and descriptions can be found in Table B–1 and Figures B–1 through B–5, Appendix B.

Aquatic Environment

The aquatic environment was evaluated by performing radiological analyses on samples of surface water, ground water, fish and sediment. Two gallon water samples were collected weekly from two surface water locations (BY-12 and BY-29 [Control location]) and quarterly from six ground water locations (BY-14-1, BY-18-1, BY-32, BY-35, BY-37 and BY-38). All samples were collected in new unused plastic bottles, which were rinsed with source water prior to collection. Fish samples comprising the flesh of quillback, silver redhorse, golden redhorse, shorthead redhorse, river carpsucker and common carp were collected semiannually at two locations, BY-29 (control) and BY-31. Sediment samples composed of recently deposited substrate were collected at two locations semiannually, BY-12 and BY-34 (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 (BY-01, BY-04, BY-06, BY-08, BY-21, BY-22, BY-23 and BY-24). The control location was BY-08. Airborne iodine and air particulate samples were obtained at each location, using a vacuum pump with charcoal and glass fiber filters attached. The pumps ran continuously and sampled air at the rate of approximately one cubic foot per minute. The air filters and air iodine samples were replaced weekly and sent to the laboratory for analysis.

Terrestrial Environment

The terrestrial environment was evaluated by performing radiological analyses on samples of milk and food products. Milk samples were collected monthly from January through April and November through December, and biweekly May through October. The control location was BY-26-2 and the indicator location was BY-20-1. All samples were collected in new unused two gallon plastic bottles from the bulk tank at each

location, preserved with sodium bisulfite and shipped promptly to the laboratory.

Food products were collected annually in August at five locations (BY-Control, BY-Quad 1, BY-Quad 2, BY-Quad 3 and BY-Quad 4). Various types of samples were collected and placed in new unused plastic bags, and sent to the laboratory for analysis.

Ambient Gamma Radiation

Beginning in 2012, Exelon changed the type of dosimetry used for the Radiological Environmental Monitoring Program (REMP). Optically Stimulated Luminescent Dosimetry (OSLD) were deployed and Thermoluminescent Dosimetry (TLD) were discontinued. This change may result in a step change in readings, up or down, depending on site characteristics. The relative comparison to control locations remains valid. OSLD technology is different than that used in a TLD but has the same purpose (to measure direct radiation).

In recent years, the industry recognized the need for a standard method of reporting environmental dosimetry results. In 2018, Exelon began assessing facility-related dose in accordance with ANSI N13.37-2014, Environmental Dosimetry – Criteria for System Design and Implementation. This standard is applicable to passive environmental dosimetry systems used to monitor areas surrounding radiological facilities to assess potential facility-related radiation doses and to verify compliance with public dose limits. Such environmental dosimetry systems include dosimeters which accumulate radiation dose and any readout device required to process the dosimeters. Passive dosimeters include optically stimulated luminescence (OSL) dosimeters which are deployed at field locations around a facility and exchanged periodically (e.g., quarterly). Facility-related dose is calculated using a statistical model that uses baseline historical data and accounts for transit and deploy dose. In 2018, none of the Byron Station field locations listed in this report exhibited facility-related dose as calculated in accordance with this standard.

Each location consisted of 2 OSLD sets. The OSLDs were exchanged quarterly and sent to Landauer for analysis. The OSLDs were placed at locations on and around the BNGS Station site as follows:

An inner ring consisting of 16 locations (BY-101, BY-102, BY-103, BY-104, BY-105, BY-106, BY-107, BY-108, BY-109, BY-110, BY-111, BY-112, BY-113, BY-114, BY-115 and BY-116) near and within the site perimeter representing fence post doses (i.e., at locations where the doses will be potentially greater than maximum annual off–site doses) from BNGS releases.

An outer ring consisting of 16 locations (BY-201, BY-202, BY-203, BY-204, BY-205, BY-206, BY-207, BY-208, BY-209, BY-210, BY-211, BY-212, BY-213, BY-214, BY-215 and BY-216) extending to approximately 5 miles from the site designed to measure possible exposures to close-in population.

A special interest set consisting of seven locations (BY-301-1, BY-301-2, BY-309-1, BY-309-2, BY-309-3, BY-309-4, and BY-314-2) to measure possible exposures from on-site storage facilities.

An other set consisting of seven locations (BY-01, BY-04, BY-06, BY-21, BY-22, BY-23 and BY-24) at locations where air samplers are present.

The balance of one location (BY-08) representing the control area.

The specific OSLD locations were determined by the following criteria:

1. The presence of relatively dense population;

2. Site meteorological data taking into account distance and elevation for each of the sixteen–22 1/2 degree sectors around the site, where estimated annual dose from BNGS, if any, would be most significant;

3. On hills free from local obstructions and within sight of the vents (where practical);

4. And near the closest dwelling to the vents in the prevailing downwind direction if applicable.

Two OSLDs were placed at each location 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 to analyze the environmental samples for radioactivity for the BNGS REMP in 2018. The analytical procedures used by the laboratory are listed in Table B-2.

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

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

2. Concentrations of gamma emitters in ground and surface water, air particulates, milk, fish, sediment and vegetation

Concentrations of tritium in ground and surface water

3. Concentrations of Iodine-131 in air and milk

4. Concentrations of Nickel-63 in surface water, fish and sediment

5. Ambient gamma radiation levels at various site environs

C. Data Interpretation

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

1. Lower Limit of Detection and Minimum Detectable Concentration

The lower limit of detection (LLD) was 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 was intended as a before-the- fact estimate of a system (including instrumentation, procedure and sample type) and not as an after-the-fact criteria for the presence of activity. All analyses were designed to achieve the required BNGS 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, effecting a negative number. An 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 water, ground water, milk and vegetation, twelve nuclides, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Nb-95, Zr-95, I-131, Cs-134, Cs-137, Ba-140 and La-140 were reported. For fish, sediment, and air particulates, eleven nuclides,

Mn-54, Co-58, Fe-59, Co-60, Zn-65, Nb-95, Zr-95, 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 2018, the BNGS REMP had a sample recovery rate in excess of 99%. Sample anomalies and missed samples are listed in the tables below:

TABLE D-1 LISTING OF SAMPLE ANOMALIES

Sample Type	Location Code	Collection Date	Reason
AP/AI	BY-08	05/01/18	Replaced broken vacuum gauge
AP/AI	BY-08	06/12/18	Replaced run time meter – time estimated
AP/AI	ALL	09/25/18	Pump field checks delayed until 10/2 – sample collector ill
AP/AI	BY-24	10/02/18	Replaced hard to reset run time meter
SED	BY-12 BY-34	10/31/18	Unable to obtain sample in October due to high river levels; Sample obtained on 11/20/18

TABLE D-2 LISTING OF MISSED SAMPLES

Sample Type	Location Code	Collection Date	Reason
SW	BY-12 BY-29	01/02/18	Sample unobtainable due to ice on river
SW	BY-12 BY-29	01/09/18	Sample unobtainable due to ice on river
SW	BY-12 BY-12	01/16/18	Sample unobtainable due to ice on river
SW	BY-12 BY-29	02/06/18	Sample unobtainable due to ice on river
SW	BY-12 BY-29	02/13/18	Sample unobtainable due to ice on river
SW	BY-12 BY-29	02/20/18	Sample unobtainable due to ice on river
OSLD	BY-109-2	03/28/18	Dosimeter received damaged – readings not obtained
OSLD	BY-04	07/02/18	Dosimeter missing during quarterly exchange
SW	BY-29	11/27/18	Sample unobtainable due to icy conditions

Each program exception was reviewed to understand the causes of the program exception. Sampling and maintenance errors were reviewed with the personnel involved to prevent recurrence. Occasional equipment breakdowns and power outages were unavoidable.

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

E. Program Changes

There were no program changes in 2018.

IV. Results and Discussion

A. Aquatic Environment

1. Surface Water

Samples were taken weekly and composited monthly at two locations (BY-12 and BY-29). Of these locations only BY-12 located downstream, could be affected by Byron Nuclear Generating Station's effluent releases. The following analyses were performed:

Gross Beta

Samples from both locations were analyzed for concentrations of gross beta (Table C–I.1, Appendix C). The values ranged from 3.2 to 11.4 pCi/l. Concentrations detected were consistent with those detected in previous years (Figure C–1, Appendix C).

Tritium

Quarterly composites of weekly collections were analyzed for tritium activity (Table C–I.2, Appendix C). Tritium was detected in two samples. The concentrations ranged from 258 - 799 pCi/L (Figure C–2, Appendix C). Tritium detected in downstream surface water was well below reportable limits and consistent with expected levels as a result of permitted liquid discharges.

Nickel

Samples from both locations were analyzed for concentration of Ni-63 (Table C–I.3, Appendix C). All results were less than the minimum detectable concentration.

Gamma Spectrometry

Samples from both locations were analyzed for gamma-emitting nuclides (Table C–I.4, Appendix C). No nuclides were detected, and all required LLDs were met.

2. Ground Water

Quarterly grab samples were collected at six locations (BY-14-1, BY-18-1, BY-32, BY-35, BY-37 and BY-38). These locations could be affected by Byron Nuclear Generating Station's effluent releases. The following analyses were performed:

Tritium

Quarterly grab samples from the locations were analyzed for tritium activity (Table C–II.1, Appendix C). No tritium was detected, and the required LLD was met (Figures C–3 through C–7, Appendix C).

Gamma Spectrometry

Samples from all locations were analyzed for gamma-emitting nuclides (Table C–II.2 Appendix C). No nuclides were detected, and all required LLDs were met.

3. Fish

Fish samples comprised of quillback, silver redhorse, golden redhorse, shorthead redhorse, river carpsucker and common carp were collected at two locations (BY-29 and BY-31) semiannually. Location BY-31 could be affected by Byron Nuclear Generating Station's effluent releases. The following analyses were performed:

Nickel

The edible portion of fish samples from both locations was analyzed for Ni-63 (Table C–III.1, Appendix C). Nickel-63 was not detected and the required LLD was met.

Gamma Spectrometry

The edible portion of fish samples from both locations was analyzed for gamma-emitting nuclides (Table C–III.1, Appendix C). No nuclides were detected, and all required LLDs were met.

4. Sediment

Aquatic sediment samples were collected at two locations (BY-12 and BY-34) semiannually. BY-12, located downstream, could be affected by Byron Nuclear Generating Station's effluent releases. The following analyses were performed:

Nickel

Sediment samples from both locations were analyzed for Ni-63 (Table C–IV.1, Appendix C). Ni-63 was not detected and the required LLD was met.

Gamma Spectrometry

Sediment samples from both locations were analyzed for gamma-emitting nuclides (Table C–IV.1, Appendix C). No nuclides were detected, and all required LLDs were met.

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: Nearsite samplers within 4 km of the site (BY-21, BY-22, BY-23 and BY-24), Far Field samplers between 4 and 10 km of the site (BY-01, BY-04 and BY-06) and the Control sampler between 10 and 30 km from the site (BY-08). The following analyses were performed:

Gross Beta

Weekly samples were analyzed for concentrations of beta emitters (Table C–V.1 and C–V.2, Appendix C).
Detectable gross beta activity was observed at all locations. Comparison of results among the three groups aid in determining the effects, if any, resulting from the operation of BNGS.

The results from the Nearsite locations (Group I) ranged from 7 to 42E–3 pCi/m^3 with a mean of 17E–3 pCi/m^3.
The results from the Far Field locations (Group II) ranged from 6 to 37E–3 pCi/m^3 with a mean of 17E–3 pCi/m^3.
The results from the Control location (Group III) ranged from 7 to 42E–3 pCi/m^3 with a mean of 17E–3 pCi/m^3. Comparison of the 2018 air particulate data with previous year's data indicate no effects from the operation of BNGS. In addition, a comparison of the weekly mean values for 2018 indicate no notable differences among the three groups (Figures C–8 through C-12, Appendix C).

Gamma Spectrometry

Weekly samples were composited quarterly and analyzed for gamma-emitting nuclides (Table C–V.3, Appendix C). No nuclides were detected, and all required LLDs were met.

b. Airborne Iodine

Continuous air samples were collected from eight locations (BY-01, BY-04, BY-06, BY-08, BY-21, BY-22, BY-23 and BY-24) and analyzed weekly for I-131 (Table C–VI.1, Appendix C). All results were less than the minimum detectable concentration for I-131.

2. Terrestrial

a. Milk

Samples were collected from two locations (BY-20-1 and BY-26-2) monthly from January to April and November through December, and biweekly May through October.
The following analyses were performed:

Iodine-131

Milk samples from all locations were analyzed for concentrations of I-131 (Table C–VII.1, Appendix C). No nuclides were detected, and all required LLDs were met.

Gamma Spectrometry

Each milk sample was analyzed for concentrations of gamma-emitting nuclides (Table C–VII.2, Appendix C). No nuclides were detected, and all required LLDs were met.

b. Vegetation

Vegetation samples were collected at five locations (BY-Control, BY-Quad 1, BY-Quad 2, BY-Quad 3 and BY-Quad 4). Four locations (BY-Quad 1, BY-Quad 2, BY-Quad 3 and BY-Quad 4) could be affected by Byron Nuclear Generating Station's effluent releases. The following analysis was performed:

Gamma Spectrometry

Samples from all locations were analyzed for gamma- emitting nuclides (Table C–VIII.1, Appendix C). No nuclides were detected, and all required LLDs were met.

C. Ambient Gamma Radiation

Ambient gamma radiation levels were measured utilizing OSLDs.

Ninety-one OSLD locations were established around the site. Results of OSLD measurements are listed in Tables C–IX.1 to C–IX.3, Appendix C.

All OSLD measurements were below 28 mR/standard quarter, with a range of 14 to 27 mR/standard quarter. A comparison of the Inner Ring, Outer Ring, Special Interest, Other and Control Location data indicate that the ambient gamma radiation levels were comparable among the groups.

D. Land Use Survey

A Land Use Survey conducted during August, 2018 around the Byron Nuclear Generating Station (BNGS) was performed by Environmental Inc. (Midwest Labs) for Exelon Nuclear to comply with the Byron Nuclear Generating Station's Offsite Dose Calculation Manual. The purpose of the survey was to document the nearest resident, livestock, and milk producing animals in each of the sixteen 22 ½ degree sectors. The results of this survey are summarized below:

Distance in Miles from the BNGS Vent Stacks				
Sector		Residence Miles	Livestock Miles	Milk Farm Miles
A	N	1.2	5.9	-
B	NNE	1.6	6.2	-
C	NE	1.1	2.0	-
D	ENE	1.4	3.7	-
E	E	1.0	4.2	-
F	ESE	1.5	3.0	-
G	SE	1.7	3.5	-
H	SSE	0.7	3.3	-
J	S	0.6	0.7	-
K	SSW	0.7	0.7	-
L	SW	0.8	2.0	-
M	WSW[(a)]	1.6	0.8	4.5
N	W	1.8	3.2	-
P	WNW	1.6	1.6	11.5
Q	NW	0.8	1.5	-
R	NNW	0.9	1.4	-

(a) *Denotes the nearest industrial facility located at 1.5 miles*

E. Errata Data

There was no errata data for 2018.

F. Summary of Results – Inter-Laboratory Comparison Program

The TBE Laboratory analyzed Performance Evaluation (PE) samples of air

particulate, air iodine (charcoal), milk, soil, vegetation and water (including fish) matrices (Appendix D). The PE sample matrices were chosen based on the types of samples submitted to the primary laboratory for analysis. The selected parameters for the PE samples are based on the appropriate matrices, methodologies and geometries, which include geometries that are comparable. The PE samples, supplied by Analytics Inc., Environmental Resource Associates (ERA) and DOE's Mixed Analyte Performance Program (MAPEP) were evaluated against the following pre-set acceptance criteria:

1. Analytics Evaluation Criteria

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

2. 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, NELAC, state specific 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.

3. 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, 166 out of 172 analyses performed met the specified acceptance criteria. Six analyses did not meet the specified

acceptance criteria for the following reasons and were addressed through the TBE Corrective Action Program.

1. TBE was unable to report the February 2018 DOE MAPEP vegetation Sr-90 result due to QC failure and limited sample amount. (NCR 18-09)

2. The Analytics September 2018 milk Fe-59 result was evaluated as *Not Acceptable* (Ratio of TBE to known result at 133%). The reported value was 158 ± 17.6 pCi/L and the known value was 119 ± 19.9 pCi/L. No cause for the failure could be determined. TBE has passed 24 of the previous 27 milk cross-check results since 2012. This sample was run in duplicate on a different detector with comparable results (162 +/- 16 pCi/L). *NOTE: TBE's 4th Qtr result passed at 105%* (NCR 18-20)

3. The Analytics September milk I-131 result was evaluated as *Not Acceptable* (Ratio of TBE to known result at 143%). Due to a personnel change in the gamma prep lab, the sample was not prepped/counted in a timely manner such as to accommodate the I-131 8-day half-life. Analysts have been made aware of the urgency for this analysis and it will be monitored more closely by QA. *NOTE: TBE's 4th Qtr result passed at 101%* (NCR 18-24)

4. The Analytics September soil Cr-51 result was evaluated as *Not Acceptable* (Ratio of TBE to known result at 131%). As with #3 above, the sample was not prepped/counted in a timely manner such as to accommodate the Cr-51 27-day half-life. The same corrective action applies here as in #3. (NCR 18-21)

5. The MAPEP November vegetation Sr-90 result of 0.338 Bq/sample was evaluated as Not Acceptable (Lower acceptable range was 0.554 Bq/sample). It appears that there has been incomplete dissolution of Sr-90 due to the composition of the MAPEP vegetation "matrix". To resolve this issue, the TBE-2018 procedure has been modified to add H_2O_2 to assist in breaking down the organic material that comprises this "matrix". This corrective action will be monitored closely by QA. (NCR 18-25).

6. The ERA November 2018 water Sr-90 sample was evaluated as *Not Acceptable*. TBE's initial reported result of 36.8 pCi/L exceeded the upper acceptance range (22.9 – 36.4 pCi/L). After reviewing the data for this sample, it was discovered that there was a typographical error at the time the results were entered at the ERA website. The correct result in LIMS of 36.2 should have been submitted instead. This result is within ERA's acceptance limits. In addition to the typo

error, ERA's very stringent upper acceptance limit of 116% is not a reflection of TBE's ability to successfully perform this analysis. (NCR 18-23)

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

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APPENDIX A

RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT SUMMARY

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TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR BYRON NUCLEAR GENERATING STATION, 2018

NAME OF FACILITY: BYRON NUCLEAR GENERATING STATION **DOCKET NUMBER:** 50-454 & 50-455
LOCATION OF FACILITY: BYRON, IL **REPORTING PERIOD:** 2018

MEDIUM OR PATHWAY SAMPLED (Uint 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)	**GR-B**	24	**4**	5.4 (10/12) *(3.2/8.7)*	5.8 (10/12) *(4.0/11.4)*	5.8 (10/12) *(4.0/11.4)*	BY-29 CONTROL BYRON - UPSTREAM 3.0 MILES N OF SITE	0
	H-3	8	**200**	529 (2/4) *(258/799)*	<LLD	529 (2/4) *(258/799)*	BY-12 INDICATOR DOWNSTREAM 4.5 MILES SSW OF SITE	0
	NI-63	24	**30**	<LLD	<LLD	-		0
	GAMMA	24						
	MN-54		**15**	<LLD	<LLD	-		0
	CO-58		**15**	<LLD	<LLD	-		0
	FE-59		**30**	<LLD	<LLD	-		0
	CO-60		**15**	<LLD	<LLD	-		0
	ZN-65		**30**	<LLD	<LLD	-		0
	NB-95		**15**	<LLD	<LLD	-		0
	ZR-95		**30**	<LLD	<LLD	-		0
	I-131		**15**	<LLD	<LLD	-		0
	CS-134		**15**	<LLD	<LLD	-		0
	CS-137		**18**	<LLD	<LLD	-		0
	BA-140		**60**	<LLD	<LLD	-		0
	LA-140		**15**	<LLD	<LLD	-		0
GROUND WATER (PCI/LITER)	**H-3**	24	**200**	<LLD	NA	-		0
	GAMMA	24						
	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
FISH (PCI/KG WET)	**NI-63**	8	**260**	<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 BYRON NUCLEAR GENERATING STATION, 2018

NAME OF FACILITY: BYRON NUCLEAR GENERATING STATION | **DOCKET NUMBER:** 50-454 & 50-455

LOCATION OF FACILITY: BYRON, IL | **REPORTING PERIOD:** 2018

MEDIUM OR PATHWAY SAMPLED (Uint 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
FISH	**GAMMA**	8						
(PCI/KG WET)	*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
	NB-95		*NA*	<LLD	<LLD	-		0
	ZR-95		*NA*	<LLD	<LLD	-		0
	CS-134		**130**	<LLD	<LLD	-		0
	CS-137		**150**	<LLD	<LLD	-		0
	BA-140		*NA*	<LLD	<LLD	-		0
	LA-140		*NA*	<LLD	<LLD	-		0
SEDIMENT	**NI-63**	4	**260**	<LLD	<LLD	-		0
(PCI/KG DRY)								
	GAMMA	4				-		
	MN-54		*NA*	<LLD	<LLD			0
	CO-58		*NA*	<LLD	<LLD	-		0
	FE-59		*NA*	<LLD	<LLD	-		0
	CO-60		*NA*	<LLD	<LLD	-		0
	ZN-65		*NA*	<LLD	<LLD	-		0
	NB-95		*NA*	<LLD	<LLD	-		0
	ZR-95		*NA*	<LLD	<LLD	-		0
	CS-134		**150**	<LLD	<LLD	-		0
	CS-137		**180**	<LLD	<LLD	-		0
	BA-140		*NA*	<LLD	<LLD	-		0
	LA-140		*NA*	<LLD	<LLD	-		0
AIR PARTICULATE	**GR-B**	416	**10**	17 (364/364) *(6/42)*	17 (52/52) *(7/42)*	18 (52/52) *(8/42)*	BY-21 INDICATOR BYRON NEARSITE NORTH 0.3 MILES N OF SITE	0
(E-3 PCI/CU.METER)								
	GAMMA	32						
	MN-54		*NA*	<LLD	<LLD	-		0
	CO-58		*NA*	<LLD	<LLD	-		0
	FE-59		*NA*	<LLD	<LLD	-		0
	CO-60		*NA*	<LLD	<LLD	-		0
	ZN-65		*NA*	<LLD	<LLD	-		0
	NB-95		*NA*	<LLD	<LLD	-		0
	ZR-95		*NA*	<LLD	<LLD	-		0
	CS-134		**15**	<LLD	<LLD	-		0
	CS-137		**18**	<LLD	<LLD	-		0
	BA-140		*NA*	<LLD	<LLD	-		0
	LA-140		*NA*	<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 BYRON NUCLEAR GENERATING STATION, 2018

NAME OF FACILITY: BYRON NUCLEAR GENERATING STATION **DOCKET NUMBER:** 50-454 & 50-455
LOCATION OF FACILITY: BYRON, IL **REPORTING PERIOD:** 2018

MEDIUM OR PATHWAY SAMPLED (Uint 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
AIR IODINE	**GAMMA**	416						
(E-3 PCI/CU.METER)	*I-131 (GELI)*		**70**	<LLD	<LLD	-		0
MILK	**I-131 (LOW LVL)**	40	**1**	<LLD	<LLD	-		0
(PCI/LITER)								
	GAMMA							
	MN-54	40	*NA*	<LLD	<LLD	-		0
	CO-58		*NA*	<LLD	<LLD	-		0
	FE-59		*NA*	<LLD	<LLD	-		0
	CO-60		*NA*	<LLD	<LLD	-		0
	ZN-65		*NA*	<LLD	<LLD	-		0
	NB-95		*NA*	<LLD	<LLD	-		0
	ZR-95		*NA*	<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
VEGETATION	**GAMMA**	11						
(PCI/KG WET)	*MN-54*		*NA*	<LLD	<LLD	-		0
	CO-58		*NA*	<LLD	<LLD	-		0
	FE-59		*NA*	<LLD	<LLD	-		0
	CO-60		*NA*	<LLD	<LLD	-		0
	ZN-65		*NA*	<LLD	<LLD	-		0
	NB-95		*NA*	<LLD	<LLD	-		0
	ZR-95		*NA*	<LLD	<LLD	-		0
	I-131		**60**	<LLD	<LLD	-		0
	CS-134		**60**	<LLD	<LLD	-		0
	CS-137		**80**	<LLD	<LLD	-		0
	BA-140		*NA*	<LLD	<LLD	-		0
	LA-140		*NA*	<LLD	<LLD	-		
DIRECT RADIATION	**OSLD-QUARTERLY**	332	*NA*	21.2 (328/328) *(14.3/27.1)*	17.9 (4/4) *(16.1/19.4)*	24.3 (4/4) *(22.1/26.5)*	BY-102-2 INDICATOR 1.0 MILES NNE	0
(MILLIREM/QTR.)								

(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: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction, Byron Nuclear Generating Station, 2018

Location	Location Description	Distance & Direction From Site
A. Surface Water		
BY-12	Oregon Pool of Rock River, Downstream	4.5 miles SSW
BY-29	Byron, Upstream (control)	3.0 miles N
B. Ground/Well Water		
BY-14-1	3200 North German Church Road	1.0 miles SSE
BY-18-1	Calhoun	0.7 miles SSW
BY-32	Krueger Well	1.9 miles W
BY-35	Vancko Well	1.9 miles WNW
BY-37	Cavage Well	2.0 miles WNW
BY-38	Steve Storz Well	2.0 miles WNW
C. Milk		
BY-20-1	Ron Snodgrass Farm	4.8 miles WSW
BY-26-2	Joseph Akins Farm (control)	12.2 miles WNW
D. Air Particulates / Air Iodine		
BY-01	Byron	3.0 miles N
BY-04	Paynes Point	5.0 miles SE
BY-06	Oregon	4.7 miles SSW
BY-08	Leaf River (control)	7.0 miles WNW
BY-21	Byron Nearsite North	0.3 miles N
BY-22	Byron Nearsite Southeast	0.4 miles SE
BY-23	Byron Nearsite South	0.6 miles S
BY-24	Byron Nearsite Southwest	0.7 miles SW
E. Fish		
BY-29	Byron, Upstream (control)	3.0 miles N
BY-31	Byron, Discharge	2.6 miles WNW
F. Sediment		
BY-12	Oregon Pool of Rock River, Downstream	4.6 miles SSW
BY-34	Rock River, Upstream of Discharge (control)	2.6 miles WNW
G. Vegetation		
Quadrant 1	3989 Cox Road, Stillman Valley	4.8 miles E
Quadrant 2	6402 Brick Road, Oregon	4.8 miles SE
Quadrant 3	2002 Deer Path Road, Byron	1.0 miles SW
Quadrant 4	6315 River Rd., Byron	2.3 miles SW
Control	1725 Michigan Ave., Rockford	14.7 miles NNE
H. Environmental Dosimetry - OSLD		
Inner Ring		
BY-101-1 and -2		0.3 miles N
BY-102-1		1.0 miles NNE
BY-102-2		1.0 miles NNE

TABLE B-1: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction, Byron Nuclear Generating Station, 2018

Location	Location Description	Distance & Direction From Site
H. Environmental Dosimetry – OSLD (continued)		
Inner Ring		
BY-103-1 and -2		1.7 miles NE
BY-103-3		0.4 miles NE
BY-104-1 and -2		1.4 miles ENE
BY-104-3		0.3 miles ENE
BY-105-1 and -2		1.3 miles E
BY-106-1 and -2		1.4 miles ESE
BY-107-1 and -2		1.4 miles SE
BY-107-3		0.4 miles SE
BY-108-1		0.7 miles SSE
BY-108-2		0.6 miles SSE
BY-109-1 and -2		0.6 miles S
BY-110-1 and -2		0.7 miles SSW
BY-111-3		0.8 miles SW
BY-111-4		0.9 miles SW
BY-112-3 and -4		0.8 miles WSW
BY-113-1 and -2		0.7 miles W
BY-114-1 and -2		0.8 miles WNW
BY-115-1 and -2		1.0 miles NW
BY-116-1 and -2		1.4 miles NNW
BY-116-3		0.9 miles NNW
Outer Ring		
BY-201-3		4.4 miles N
BY-201-4		4.4 miles N
BY-202-1		4.4 miles NNE
BY-202-2		4.8 miles NNE
BY-203-1		4.8 miles NE
BY-203-2		4.7 miles NE
BY-204-1		4.1 miles ENE
BY-204-2		4.0 miles ENE
BY-205-1 and -2		3.8 miles E
BY-206-1		4.0 miles ESE
BY-206-2		4.3 miles ESE
BY-207-1		4.2 miles SE
BY-207-2		3.9 miles SE
BY-208-1		4.0 miles SSE
BY-208-2		3.8 miles SSE
BY-209-1 and -4		4.0 miles S
BY-210-3 and -4		3.9 miles SSW
BY-211-1 and -4		4.9 miles SW
BY-212-1 and -4		4.7 miles WSW
BY-213-1		4.7 miles W
BY-213-4		4.7 miles W
BY-214-1		4.7 miles WNW
BY-214-4		4.6 miles WNW
BY-215-1		4.2 miles NW
BY-215-4		4.2 miles NW
BY-216-1		4.5 miles NNW
BY-216-2		4.7 miles NNW

TABLE B-1: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction, Byron Nuclear Generating Station, 2018

Location	Location Description	Distance & Direction From Site
Special Interest		
BY-301-1		0.3 miles N
BY-301-2		0.2 miles N
BY-309-1		0.3 miles S
BY-309-2		0.4 miles S
BY-309-3		0.4 miles S
BY-309-4		0.4 miles SSW
BY-314-2		0.3 miles WNW
Other		
BY-01-1 and -2		3.0 miles N
BY-04-1 and -2		5.0 miles SE
BY-06-1 and -2		4.7 miles SSW
BY-21-1 and -2		0.3 miles N
BY-22-1 and -2		0.4 miles SE
BY-23-1 and -2		0.6 miles S
BY-24-1 and -2		0.7 miles SW
Control		
BY-08-1 and -2		7.0 miles WNW

TABLE B-2: Radiological Environmental Monitoring Program – Summary of Sample Collection and Analytical Methods, Byron Nuclear Generating Station, 2018

Sample Medium	Analysis	Sampling Method	Analytical Procedure Number
Surface Water	Gamma Spectroscopy	Monthly composite from weekly grab samples.	TBE, TBE-2007 Gamma emitting radioisotope analysis
Surface Water	Gross Beta	Monthly composite from weekly grab samples.	TBE, TBE-2008 Gross Alpha and/or gross beta activity in various matrices
Surface Water	Nickel-63	Monthly composite from weekly grab samples.	TBE, TBE-2013 Radionickel activity in various matrices
Surface Water	Tritium	Quarterly composite from weekly grab samples.	TBE, TBE-2011 Tritium analysis in drinking water by liquid scintillation
Ground Water	Gamma Spectroscopy	Quarterly grab samples.	TBE, TBE-2007 Gamma emitting radioisotope analysis
Ground Water	Tritium	Quarterly grab samples.	TBE, TBE-2011 Tritium analysis in drinking water by liquid scintillation
Fish	Gamma Spectroscopy	Semi-annual samples collected via electroshocking or other techniques	TBE-2007 Gamma emitting radioisotope analysis
Fish	Nickel-63	Semi-annual samples collected via electroshocking or other techniques	TBE, TBE-2013 Radionickel activity in various matrices
Sediment	Gamma Spectroscopy	Semi-annual grab samples	TBE, TBE-2007 Gamma emitting radioisotope analysis
Sediment	Nickel-63	Semi-annual grab samples	TBE, TBE-2013 Radionickel activity in various matrices
Air Particulates	Gross Beta	One-week composite of continuous air sampling through glass fiber filter paper	TBE, TBE-2008 Gross Alpha and/or gross beta activity in various matrices
Air Particulates	Gamma Spectroscopy	Quarterly composite of continuous air sapling through glass fiber filter paper	TBE, TBE-2007 Gamma emitting radioisotope analysis
Air Iodine	Gamma Spectroscopy	One-week composite of continuous air sampling through charcoal filter	TBE, TBE-2007 Gamma emitting radioisotope analysis
Milk	I-131	Bi-weekly grab sample when cows are on pasture. Monthly all other times	TBE, TBE-2012 Radioiodine in various matrices
Milk	Gamma Spectroscopy	Bi-weekly grab sample when cows are on pasture. Monthly all other times	TBE, TBE-2007 Gamma emitting radioisotope analysis
Vegetation	Gamma Spectroscopy	Annual grab samples.	TBE, TBE-2007 Gamma emitting radioisotope analysis
OSLD	Optically Stimulated Luminescence Dosimetry	Quarterly OSLDs comprised of two Al_2O_3:C Landauer Incorporated elements.	Landauer Incorporated

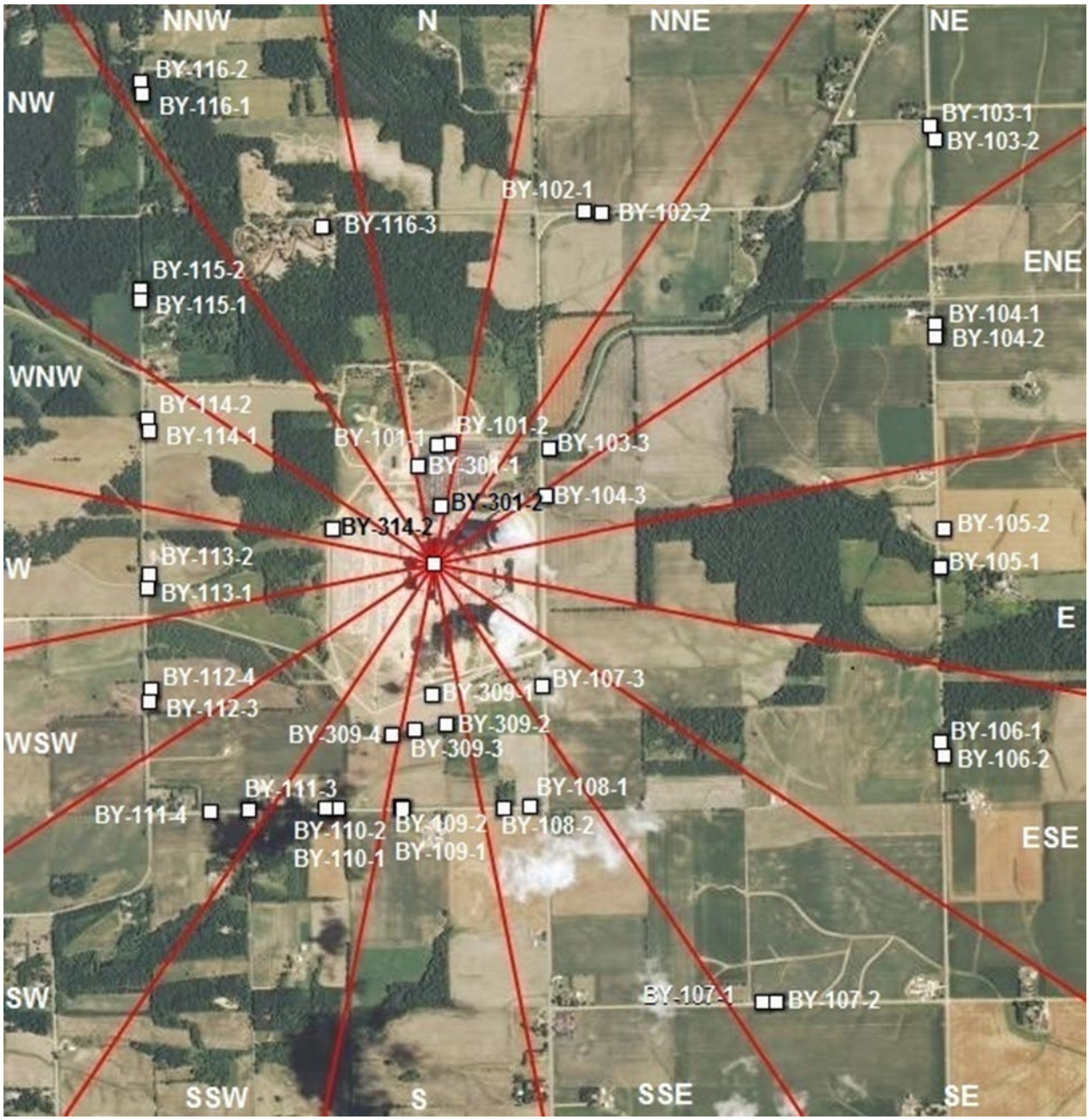


Figure B-1
Inner Ring and Special Interest OSLD Locations of the
Byron Nuclear Generating Station, 2018

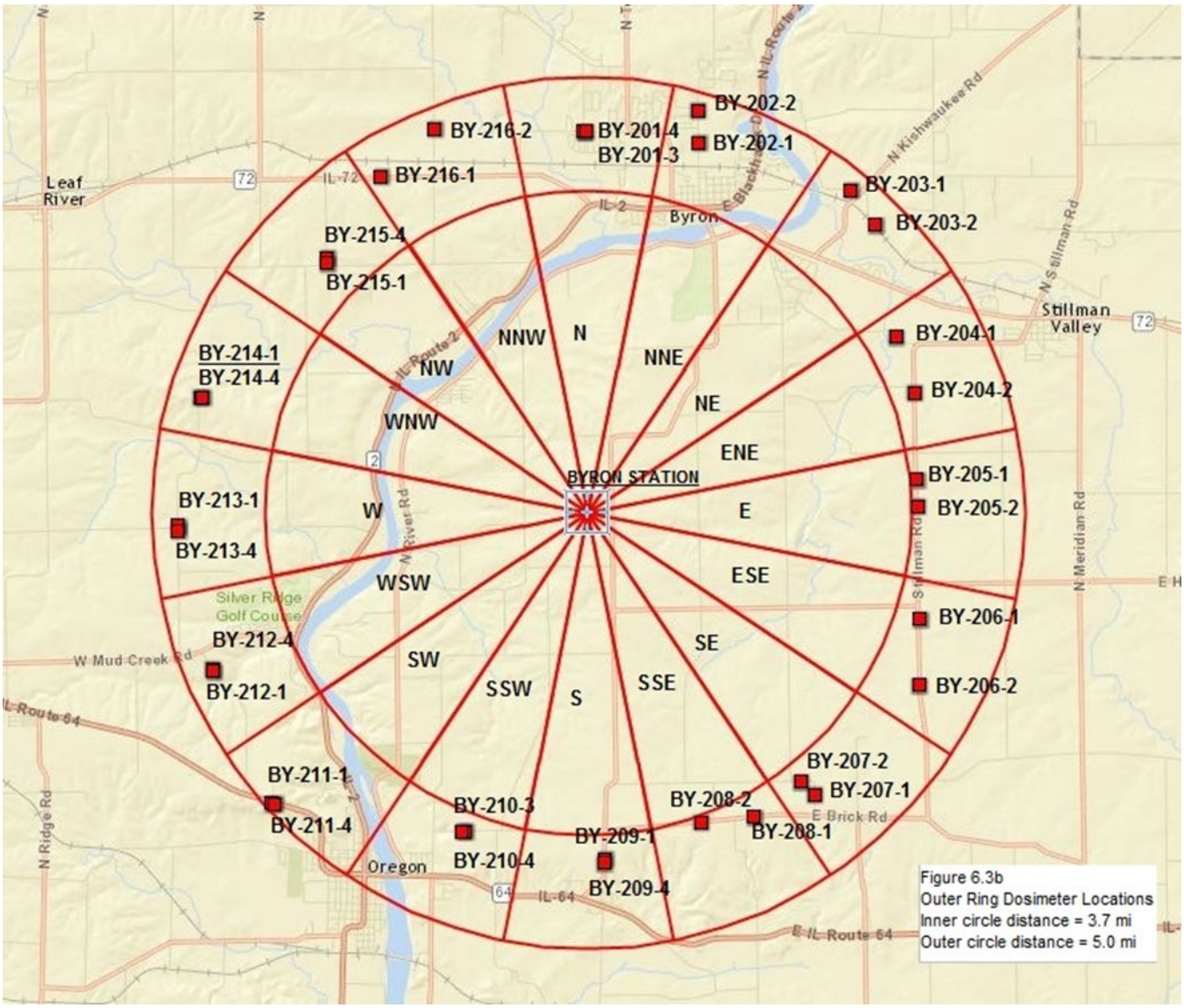


Figure B-2
Outer Ring OSLD Locations of the
Byron Nuclear Generating Station, 2018

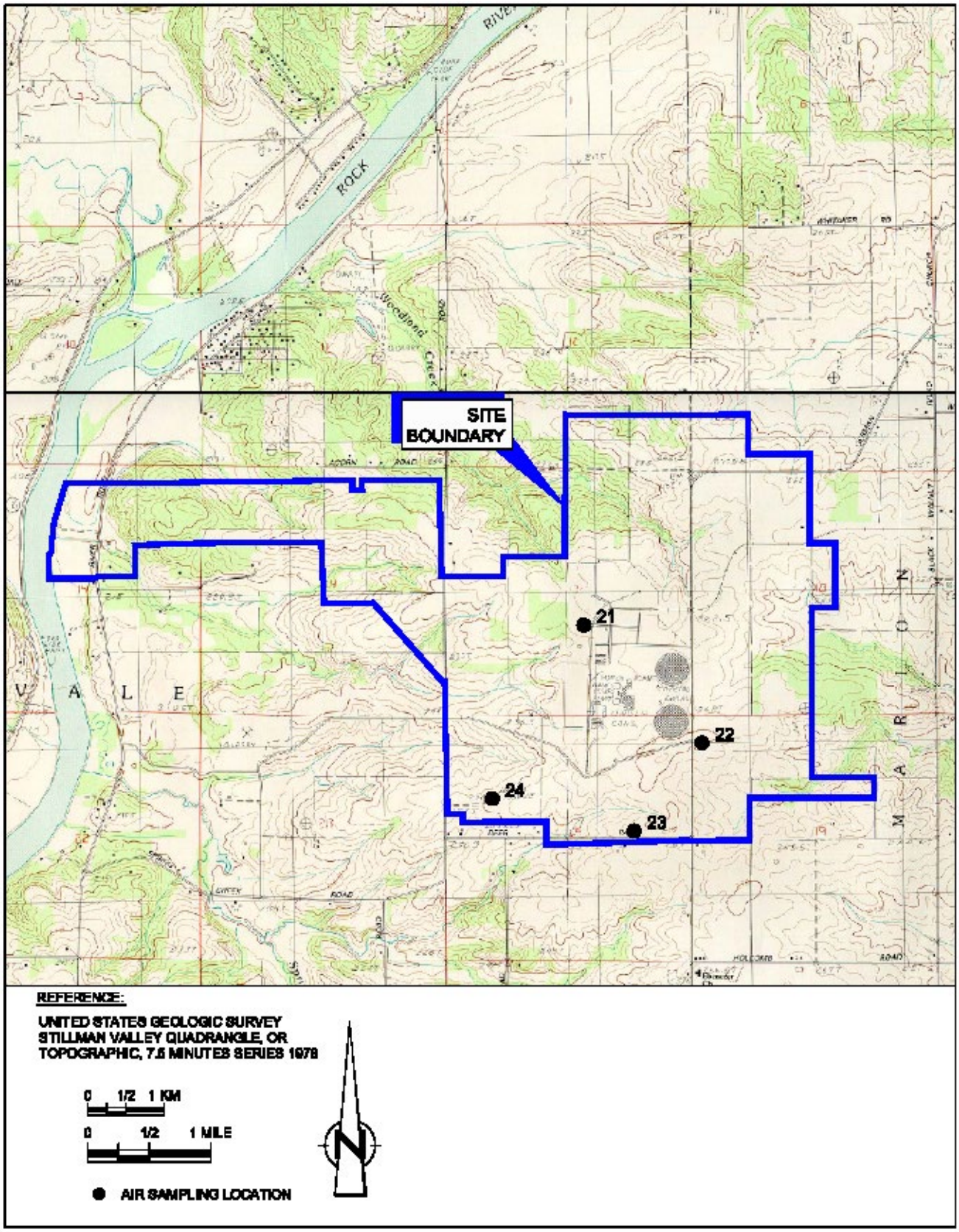
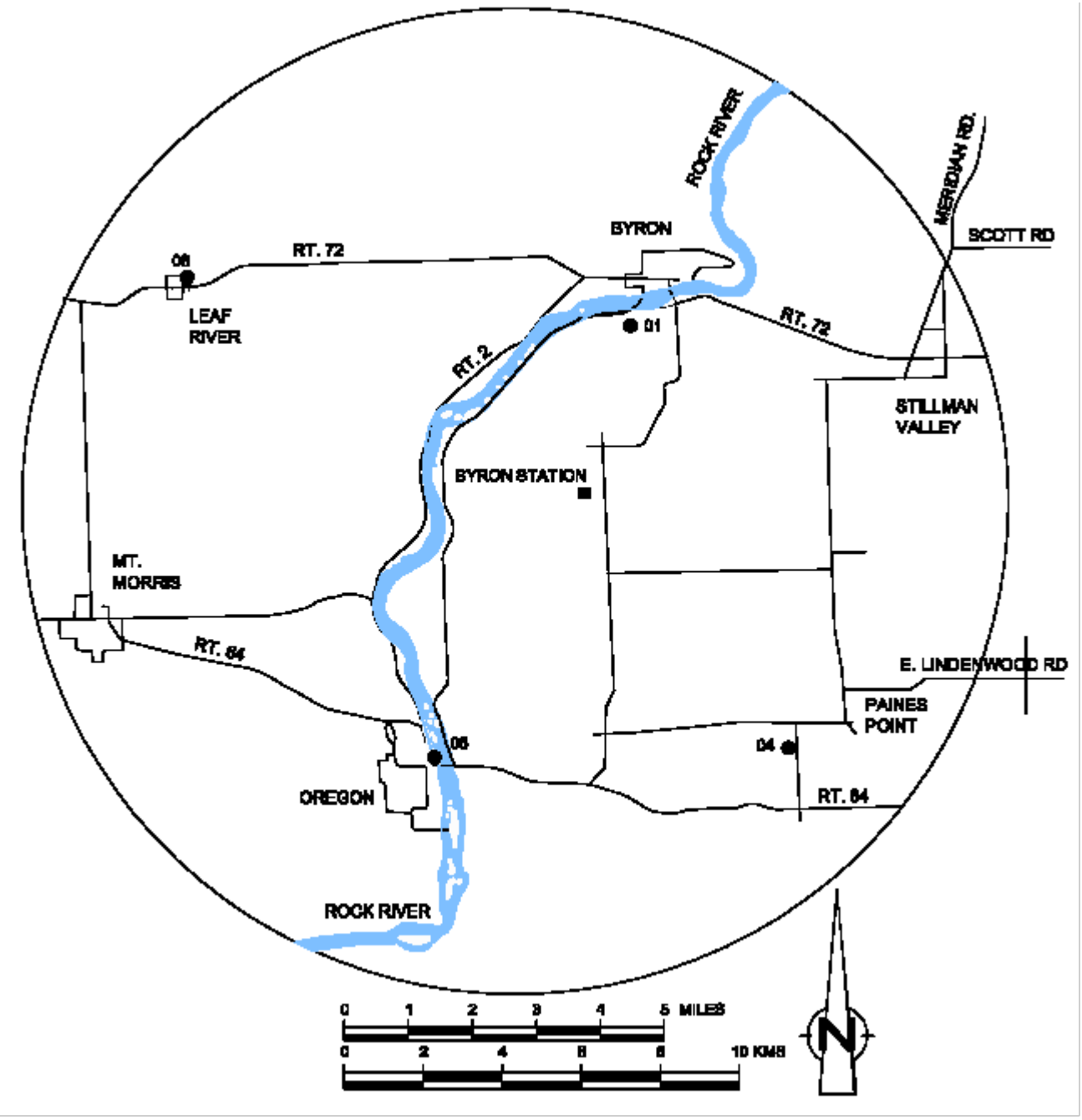


Figure B-3
Onsite Air Sampling Locations of the
Byron Nuclear Generating Station, 2018



- Air Sampling Location

■ Byron Station

Figure B-4
Offsite Air Sampling Locations of the
Byron Nuclear Generating Station, 2018

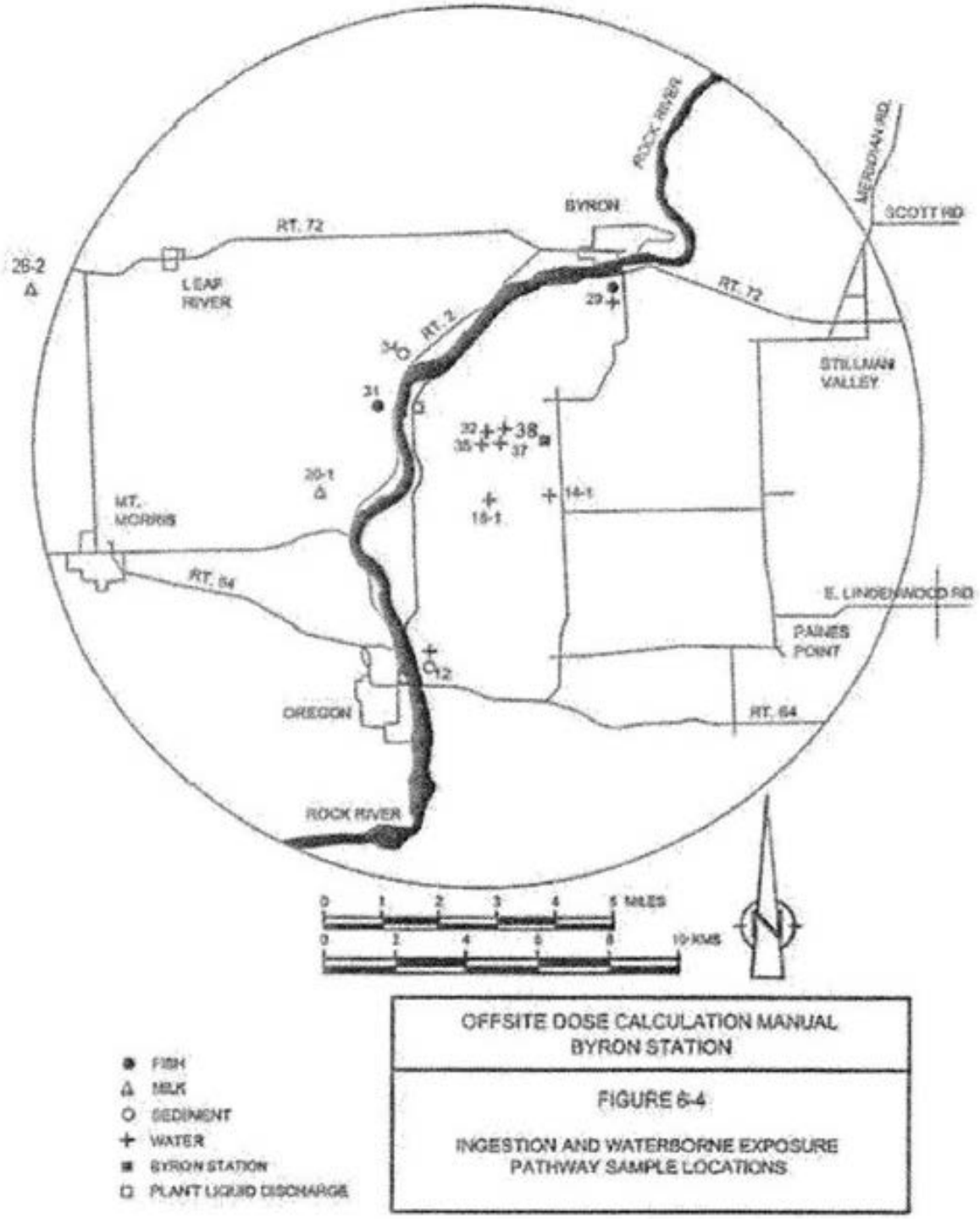


Figure B-5
Ingestion and Waterborne Exposure Pathway Sampling Locations
of the Byron Nuclear Generating Station, 2018

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APPENDIX C

DATA TABLES AND FIGURES

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Table C-I.1 **CONCENTRATIONS OF GROSS BETA IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2018**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	BY-12	BY-29
01/23/18 - 01/30/18	7.3 ± 2.3	11.4 ± 2.4
02/27/18 - 02/27/18	8.7 ± 2.0	7.5 ± 2.0
03/06/18 - 03/27/18	7.6 ± 2.4	5.6 ± 2.3
04/03/18 - 04/24/18	< 3.2	4.3 ± 2.3
05/01/18 - 05/29/18	4.9 ± 2.1	4.0 ± 2.0
06/05/18 - 06/26/18	< 2.8	4.6 ± 2.0
07/03/18 - 07/31/18	3.3 ± 1.8	< 1.4
08/07/18 - 08/28/18	3.2 ± 2.0	4.2 ± 2.1
09/04/18 - 09/25/18	4.9 ± 1.7	5.1 ± 1.7
10/02/18 - 10/30/18	6.8 ± 2.2	6.5 ± 2.1
11/06/18 - 11/27/18	4.0 ± 2.0	< 2.7
12/04/18 - 12/26/18	3.3 ± 1.7	4.4 ± 1.9
MEAN ± 2 STD DEV	5.4 ± 4.1	5.8 ± 4.5

Table C-I.2 **CONCENTRATIONS OF TRITIUM IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2018**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	BY-12	BY-29
01/23/18 - 03/27/18	< 186	< 186
04/03/18 - 06/26/18	258 ± 131	< 195
07/03/18 - 09/25/18	799 ± 155	< 193
10/02/18 - 12/26/18	< 194	< 196
MEAN ± 2 STD DEV	529 ± 765	-

Table C-I.3 **CONCENTRATIONS OF NI-63 IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2018**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	BY-12	BY-29
01/23/18 - 01/30/18	< 17	< 18
02/27/18 - 02/27/18	< 19	< 25
03/06/18 - 03/27/18	< 19	< 18
04/03/18 - 04/24/18	< 17	< 17
05/01/18 - 05/29/18	< 18	< 20
06/05/18 - 06/26/18	< 20	< 19
07/03/18 - 07/31/18	< 20	< 16
08/07/18 - 08/28/18	< 18	< 13
09/04/18 - 09/25/18	< 17	< 13
10/02/18 - 10/30/18	< 19	< 20
11/06/18 - 11/27/18	< 22	< 20
12/04/18 - 12/26/18	< 19	< 20
MEAN	-	-

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

Table C-I.4

CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2018

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
BY-12	01/23/18 - 01/30/18	< 8	< 6	< 16	< 8	< 13	< 8	< 13	< 12	< 7	< 7	< 28	< 8
	02/27/18 - 02/27/18	< 5	< 5	< 13	< 6	< 12	< 6	< 11	< 10	< 6	< 6	< 24	< 10
	03/06/18 - 03/27/18	< 3	< 4	< 7	< 4	< 7	< 4	< 6	< 12	< 4	< 4	< 24	< 8
	04/03/18 - 04/24/18	< 2	< 2	< 5	< 2	< 5	< 2	< 4	< 10	< 2	< 2	< 20	< 7
	05/01/18 - 05/29/18	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 9	< 2	< 1	< 16	< 7
	06/05/18 - 06/26/18	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 6	< 2	< 2	< 14	< 5
	07/03/18 - 07/31/18	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 10	< 2	< 1	< 16	< 6
	08/07/18 - 08/28/18	< 2	< 2	< 4	< 1	< 3	< 2	< 3	< 9	< 2	< 2	< 15	< 5
	09/04/18 - 09/25/18	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 10	< 2	< 2	< 18	< 6
	10/02/18 - 10/30/18	< 1	< 2	< 4	< 2	< 3	< 2	< 3	< 11	< 2	< 2	< 19	< 6
	11/06/18 - 11/27/18	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 7	< 2	< 2	< 14	< 4
	12/04/18 - 12/26/18	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 10	< 2	< 2	< 19	< 7
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
BY-29	01/23/18 - 01/30/18	< 9	< 8	< 14	< 7	< 16	< 7	< 13	< 12	< 8	< 8	< 37	< 13
	02/27/18 - 02/27/18	< 9	< 7	< 18	< 8	< 15	< 7	< 14	< 10	< 8	< 6	< 32	< 13
	03/06/18 - 03/27/18	< 4	< 4	< 11	< 5	< 8	< 5	< 8	< 13	< 5	< 5	< 28	< 8
	04/03/18 - 04/24/18	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 9	< 2	< 2	< 18	< 5
	05/01/18 - 05/29/18	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 10	< 2	< 1	< 16	< 5
	06/05/18 - 06/26/18	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 7	< 2	< 2	< 14	< 5
	07/03/18 - 07/31/18	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 12	< 2	< 2	< 21	< 7
	08/07/18 - 08/28/18	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 10	< 2	< 2	< 16	< 5
	09/04/18 - 09/25/18	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 12	< 2	< 2	< 22	< 7
	10/02/18 - 10/30/18	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 13	< 2	< 2	< 22	< 7
	11/06/18 - 11/20/18	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 11	< 2	< 2	< 19	< 6
	12/04/18 - 12/26/18	< 2	< 3	< 8	< 4	< 6	< 3	< 6	< 14	< 3	< 3	< 27	< 11
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-II.1 **CONCENTRATIONS OF TRITIUM IN GROUND WATER SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2018**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	BY-14-1	BY-18-1	BY-32	BY-35	BY-37	BY-38
01/09/18 - 01/23/18	< 183	< 197	< 179	< 186	< 180	< 197
04/10/18 - 04/10/18	< 170	< 180	< 178	< 183	< 182	< 181
07/09/18 - 07/09/18	< 186	< 181	< 179	< 176	< 183	< 173
10/09/18 - 10/09/18	< 194	< 193	< 193	< 182	< 181	< 182
MEAN	-	-	-	-	-	-

Table C-II.2

CONCENTRATIONS OF GAMMA EMITTERS IN GROUND WATER SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2018

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
BY-14-1	01/09/18 - 01/09/18	< 9	< 7	< 18	< 10	< 17	< 9	< 12	< 13	< 10	< 8	< 43	< 12
	04/10/18 - 04/10/18	< 9	< 9	< 17	< 9	< 20	< 9	< 16	< 11	< 10	< 8	< 37	< 14
	07/09/18 - 07/09/18	< 7	< 7	< 14	< 9	< 14	< 8	< 13	< 12	< 8	< 7	< 38	< 9
	10/09/18 - 10/09/18	< 5	< 5	< 17	< 8	< 14	< 6	< 12	< 14	< 11	< 9	< 34	< 11
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
BY-18-1	01/23/18 - 01/23/18	< 9	< 10	< 19	< 7	< 13	< 8	< 14	< 9	< 11	< 8	< 31	< 12
	04/10/18 - 04/10/18	< 9	< 8	< 12	< 6	< 17	< 9	< 10	< 10	< 7	< 8	< 38	< 11
	07/09/18 - 07/09/18	< 7	< 6	< 9	< 6	< 15	< 6	< 13	< 12	< 7	< 7	< 30	< 12
	10/09/18 - 10/09/18	< 7	< 8	< 18	< 8	< 12	< 8	< 16	< 14	< 9	< 7	< 43	< 9
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
BY-32	01/09/18 - 01/09/18	< 7	< 7	< 13	< 6	< 14	< 7	< 11	< 11	< 6	< 7	< 27	< 9
	04/10/18 - 04/10/18	< 8	< 8	< 15	< 7	< 18	< 10	< 14	< 9	< 8	< 8	< 31	< 11
	07/09/18 - 07/09/18	< 7	< 5	< 14	< 7	< 14	< 8	< 13	< 13	< 9	< 7	< 30	< 10
	10/09/18 - 10/09/18	< 7	< 6	< 14	< 7	< 12	< 9	< 14	< 14	< 8	< 8	< 38	< 11
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
BY-35	01/09/18 - 01/09/18	< 6	< 6	< 13	< 8	< 13	< 7	< 10	< 11	< 7	< 7	< 26	< 6
	04/10/18 - 04/10/18	< 8	< 7	< 14	< 10	< 20	< 7	< 12	< 11	< 10	< 9	< 32	< 8
	07/09/18 - 07/09/18	< 6	< 7	< 14	< 8	< 16	< 6	< 14	< 11	< 5	< 5	< 37	< 14
	10/09/18 - 10/09/18	< 6	< 6	< 19	< 7	< 13	< 6	< 14	< 12	< 9	< 7	< 37	< 14
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
BY-37	01/09/18 - 01/09/18	< 5	< 6	< 12	< 6	< 12	< 7	< 8	< 10	< 7	< 5	< 28	< 9
	04/10/18 - 04/10/18	< 6	< 6	< 12	< 8	< 14	< 7	< 13	< 10	< 7	< 7	< 33	< 11
	07/09/18 - 07/09/18	< 6	< 5	< 14	< 9	< 12	< 7	< 16	< 14	< 7	< 8	< 29	< 11
	10/09/18 - 10/09/18	< 6	< 6	< 20	< 8	< 14	< 8	< 14	< 12	< 9	< 8	< 33	< 12
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
BY-38	01/23/18 - 01/23/18	< 7	< 6	< 13	< 6	< 13	< 7	< 11	< 9	< 8	< 7	< 23	< 5
	04/10/18 - 04/10/18	< 7	< 7	< 14	< 8	< 14	< 8	< 12	< 9	< 6	< 8	< 29	< 10
	07/09/18 - 07/09/18	< 7	< 7	< 17	< 7	< 14	< 8	< 13	< 15	< 10	< 8	< 40	< 12
	10/09/18 - 10/09/18	< 6	< 7	< 13	< 7	< 17	< 7	< 15	< 11	< 9	< 7	< 35	< 13
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-III.1

CONCENTRATIONS OF NICKEL-63 AND GAMMA EMITTERS IN FISH SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2018

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

SITE	COLLECTION PERIOD	Ni-63	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
BY-29													
Quillback	05/23/18 - 05/23/18	< 51	< 78	< 93	< 166	< 83	< 101	< 71	< 204	< 79	< 95	< 644	< 142
Silver Redhorse	05/23/18 - 05/23/18	< 41	< 59	< 70	< 176	< 90	< 145	< 70	< 124	< 78	< 62	< 481	< 192
Golden Redhorse	10/25/18 - 10/25/18	< 59	< 67	< 60	< 147	< 51	< 138	< 58	< 97	< 68	< 67	< 432	< 111
Shorthead Redhorse	10/25/18 - 10/25/18	< 95	< 86	< 90	< 175	< 109	< 228	< 92	< 156	< 69	< 90	< 662	< 115
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
BY-31													
River Carpsucker	05/23/18 - 05/23/18	< 38	< 86	< 98	< 201	< 96	< 223	< 91	< 132	< 83	< 93	< 536	< 187
Silver Redhorse	05/23/18 - 05/23/18	< 39	< 83	< 84	< 151	< 72	< 154	< 87	< 141	< 87	< 79	< 512	< 142
Silver Redhorse	10/25/18 - 10/25/18	< 122	< 75	< 74	< 166	< 67	< 132	< 76	< 136	< 74	< 82	< 479	< 114
Common Carp	10/25/18 - 10/25/18	< 80	< 85	< 73	< 138	< 118	< 169	< 91	< 87	< 95	< 78	< 504	< 171
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-IV.1

CONCENTRATIONS OF NICKEL-63 AND GAMMA EMITTERS IN SEDIMENT SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2018

RESULTS IN UNITS OF PCI/KG DRY ± 2 SIGMA

SITE	COLLECTION PERIOD	Ni-63	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
BY-12	05/08/18 - 05/08/18	< 234	< 55	< 60	< 143	< 59	< 127	< 70	< 120	< 91	< 75	< 425	< 156
	11/20/18 - 11/20/18	< 219	< 96	< 95	< 250	< 86	< 278	< 109	< 161	< 108	< 122	< 472	< 136
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
BY-34	05/08/18 - 05/08/18	< 247	< 79	< 72	< 172	< 68	< 179	< 88	< 150	< 102	< 97	< 497	< 128
	11/20/18 - 11/20/18	< 221	< 96	< 97	< 255	< 105	< 233	< 107	< 194	< 124	< 137	< 377	< 139
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

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

Table C-V.1 **CONCENTRATIONS OF GROSS BETA IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2018**

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

COLLECTION	GROUP I				GROUP II			GROUP III
PERIOD	BY-21	BY-22	BY-23	BY-24	BY-01	BY-04	BY-06	BY-08
01/02/18 - 01/09/18	30 ± 5	27 ± 5	24 ± 5	28 ± 5	31 ± 5	27 ± 5	30 ± 5	31 ± 5
01/09/18 - 01/16/18	17 ± 4	17 ± 4	16 ± 4	17 ± 4	17 ± 4	12 ± 4	19 ± 4	23 ± 4
01/16/18 - 01/23/18	21 ± 5	26 ± 5	23 ± 5	20 ± 5	23 ± 5	21 ± 5	18 ± 4	24 ± 5
01/23/18 - 01/30/18	20 ± 4	18 ± 4	16 ± 4	18 ± 4	17 ± 4	18 ± 4	18 ± 4	17 ± 4
01/30/18 - 02/06/18	14 ± 4	15 ± 4	15 ± 4	14 ± 4	19 ± 4	17 ± 4	14 ± 4	13 ± 4
02/06/18 - 02/13/18	25 ± 5	22 ± 4	25 ± 5	23 ± 4	23 ± 4	25 ± 5	27 ± 5	23 ± 4
02/13/18 - 02/20/18	21 ± 5	25 ± 5	23 ± 5	22 ± 5	22 ± 5	22 ± 5	23 ± 5	22 ± 5
02/20/18 - 02/27/18	15 ± 4	13 ± 4	16 ± 4	13 ± 4	17 ± 4	17 ± 4	14 ± 4	17 ± 4
02/27/18 - 03/06/18	19 ± 4	19 ± 4	20 ± 4	17 ± 4	18 ± 4	20 ± 4	16 ± 4	18 ± 4
03/06/18 - 03/13/18	15 ± 4	17 ± 4	15 ± 4	16 ± 4	16 ± 4	12 ± 4	12 ± 4	12 ± 4
03/13/18 - 03/20/18	21 ± 4	15 ± 4	18 ± 4	18 ± 4	17 ± 4	19 ± 4	22 ± 5	17 ± 4
03/20/18 - 03/27/18	12 ± 4	12 ± 4	12 ± 4	12 ± 4	13 ± 4	14 ± 4	13 ± 4	16 ± 4
03/27/18 - 04/03/18	14 ± 4	14 ± 4	15 ± 4	13 ± 4	13 ± 4	16 ± 4	11 ± 4	14 ± 4
04/03/18 - 04/10/18	18 ± 4	16 ± 4	18 ± 4	20 ± 5	20 ± 5	20 ± 4	22 ± 5	20 ± 4
04/10/18 - 04/17/18	12 ± 4	10 ± 3	13 ± 4	14 ± 4	11 ± 4	10 ± 4	10 ± 3	11 ± 4
04/17/18 - 04/24/18	17 ± 4	10 ± 4	12 ± 4	13 ± 4	14 ± 4	11 ± 4	12 ± 4	12 ± 4
04/24/18 - 05/01/18	14 ± 4	18 ± 4	18 ± 4	15 ± 4	14 ± 4	14 ± 4	14 ± 4	15 ± 4
05/01/18 - 05/08/18	17 ± 5	13 ± 4	14 ± 4	15 ± 4	16 ± 4	14 ± 4	20 ± 5	15 ± 4
05/08/18 - 05/15/18	12 ± 4	10 ± 4	13 ± 4	13 ± 4	13 ± 4	10 ± 4	13 ± 4	13 ± 4
05/15/18 - 05/22/18	11 ± 4	11 ± 4	10 ± 4	11 ± 4	10 ± 4	10 ± 4	11 ± 4	10 ± 4
05/22/18 - 05/29/18	22 ± 4	23 ± 4	26 ± 5	22 ± 4	24 ± 4	22 ± 4	23 ± 4	27 ± 5
05/29/18 - 06/05/18	9 ± 4	14 ± 4	13 ± 4	13 ± 4	13 ± 4	12 ± 4	11 ± 4	14 ± 4
06/05/18 - 06/12/18	16 ± 4	14 ± 4	13 ± 4	15 ± 4	14 ± 4	14 ± 4	15 ± 4	11 ± 4
06/12/18 - 06/19/18	17 ± 4	16 ± 4	17 ± 4	18 ± 4	15 ± 4	15 ± 4	15 ± 4	17 ± 4
06/19/18 - 06/26/18	10 ± 4	12 ± 4	9 ± 4	7 ± 4	8 ± 4	8 ± 4	11 ± 4	9 ± 4
06/26/18 - 07/03/18	15 ± 4	14 ± 4	18 ± 4	15 ± 4	14 ± 4	15 ± 4	16 ± 4	11 ± 4
07/03/18 - 07/09/18	17 ± 5	16 ± 5	15 ± 5	21 ± 5	15 ± 5	16 ± 5	13 ± 5	18 ± 5
07/09/18 - 07/17/18	18 ± 4	16 ± 4	17 ± 4	16 ± 4	14 ± 4	15 ± 4	15 ± 4	16 ± 4
07/17/18 - 07/24/18	18 ± 4	19 ± 4	18 ± 4	19 ± 4	17 ± 4	13 ± 4	20 ± 4	17 ± 4
07/24/18 - 07/31/18	19 ± 4	17 ± 4	17 ± 4	14 ± 4	16 ± 4	13 ± 4	18 ± 4	19 ± 4
07/31/18 - 08/07/18	25 ± 5	18 ± 4	23 ± 5	18 ± 4	21 ± 5	21 ± 5	17 ± 4	18 ± 5
08/07/18 - 08/14/18	21 ± 4	16 ± 4	20 ± 4	20 ± 4	18 ± 4	17 ± 4	20 ± 4	15 ± 4
08/14/18 - 08/21/18	23 ± 5	20 ± 4	24 ± 5	21 ± 4	18 ± 4	22 ± 4	20 ± 4	23 ± 5
08/21/18 - 08/28/18	26 ± 5	28 ± 5	29 ± 5	27 ± 5	26 ± 5	29 ± 5	29 ± 5	24 ± 5
08/28/18 - 09/04/18	8 ± 3	10 ± 4	9 ± 4	9 ± 4	6 ± 3	8 ± 4	12 ± 4	7 ± 3
09/04/18 - 09/11/18	14 ± 4	14 ± 4	13 ± 4	13 ± 4	15 ± 4	12 ± 4	14 ± 4	13 ± 4
09/11/18 - 09/18/18	19 ± 4	16 ± 4	19 ± 4	21 ± 4	16 ± 4	17 ± 4	17 ± 4	17 ± 4
09/18/18 - 09/25/18	13 ± 4	15 ± 4	14 ± 4	12 ± 4	10 ± 4	13 ± 4	12 ± 4	12 ± 4
09/25/18 - 10/02/18	14 ± 4	11 ± 4	11 ± 4	11 ± 4	13 ± 4	12 ± 4	12 ± 4	13 ± 4
10/02/18 - 10/09/18	14 ± 4	13 ± 4	14 ± 4	13 ± 4	11 ± 3	11 ± 3	9 ± 3	9 ± 3
10/09/18 - 10/16/18	12 ± 4	14 ± 4	13 ± 4	11 ± 3	15 ± 4	15 ± 4	11 ± 4	13 ± 4
10/16/18 - 10/22/18	13 ± 4	15 ± 4	12 ± 4	15 ± 4	15 ± 4	14 ± 4	16 ± 4	11 ± 4
10/22/18 - 10/30/18	18 ± 4	14 ± 3	14 ± 3	16 ± 4	14 ± 3	14 ± 3	15 ± 3	19 ± 4
10/30/18 - 11/06/18	11 ± 4	15 ± 4	11 ± 4	14 ± 4	13 ± 4	13 ± 4	11 ± 4	14 ± 4
11/06/18 - 11/13/18	13 ± 4	13 ± 4	17 ± 4	13 ± 4	16 ± 4	13 ± 4	12 ± 4	15 ± 4
11/13/18 - 11/20/18	21 ± 4	20 ± 4	22 ± 4	22 ± 4	19 ± 4	17 ± 4	22 ± 4	18 ± 4
11/20/18 - 11/27/18	30 ± 5	23 ± 4	27 ± 5	24 ± 4	31 ± 5	27 ± 5	25 ± 5	38 ± 5
11/27/18 - 12/04/18	12 ± 4	12 ± 4	17 ± 4	15 ± 4	13 ± 4	13 ± 4	14 ± 4	17 ± 4
12/04/18 - 12/11/18	29 ± 5	32 ± 5	32 ± 5	34 ± 5	32 ± 5	32 ± 5	32 ± 5	28 ± 5
12/11/18 - 12/18/18	42 ± 6	32 ± 5	41 ± 6	33 ± 5	36 ± 6	37 ± 6	34 ± 5	42 ± 6
12/18/18 - 12/26/18	20 ± 4	19 ± 4	19 ± 4	21 ± 4	20 ± 4	17 ± 4	20 ± 4	16 ± 4
12/26/18 - 01/02/19	14 ± 4	13 ± 4	13 ± 4	15 ± 4	14 ± 4	12 ± 4	11 ± 4	14 ± 4
MEAN	18 ± 13	17 ± 11	17 ± 12	17 ± 11	17 ± 12	16 ± 12	17 ± 12	17 ± 13

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

Table C-V.2 **MONTHLY AND YEARLY MEAN VALUES OF GROSS BETA CONCENTRATIONS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2018**

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

GROUP I - NEARSITE LOCATIONS				GROUP II - FAR FIELD LOCATIONS				GROUP III - CONTROL LOCATIONS			
COLLECTION PERIOD	MIN	MAX	MEAN ± 2SD	COLLECTION PERIOD	MIN	MAX	MEAN ± 2SD	COLLECTION PERIOD	MIN	MAX	MEAN ± 2SD
01/02/18 - 01/30/18	16	30	21 ± 9	01/02/18 - 01/30/18	12	31	21 ± 12	01/02/18 - 01/30/18	17	31	24 ± 11
01/30/18 - 02/27/18	13	25	19 ± 10	01/30/18 - 02/27/18	14	27	20 ± 8	01/30/18 - 02/27/18	13	23	19 ± 9
02/27/18 - 04/03/18	12	21	16 ± 6	02/27/18 - 04/03/18	11	22	15 ± 7	02/27/18 - 04/03/18	12	18	15 ± 5
04/03/18 - 05/01/18	10	20	15 ± 6	04/03/18 - 05/01/18	10	22	14 ± 8	04/03/18 - 05/01/18	11	20	15 ± 8
05/01/18 - 05/29/18	10	26	15 ± 10	05/01/18 - 05/29/18	10	24	15 ± 11	05/01/18 - 05/29/18	10	27	16 ± 15
05/29/18 - 07/03/18	7	18	14 ± 6	05/29/18 - 07/03/18	8	16	13 ± 5	05/29/18 - 07/03/18	9	17	12 ± 6
07/03/18 - 07/31/18	14	21	17 ± 3	07/03/18 - 07/31/18	13	20	15 ± 4	07/03/18 - 07/31/18	16	19	18 ± 3
07/31/18 - 09/04/18	8	29	20 ± 13	07/31/18 - 09/04/18	6	29	19 ± 13	07/31/18 - 09/04/18	7	24	17 ± 13
09/04/18 - 10/02/18	11	21	14 ± 6	09/04/18 - 10/02/18	10	17	14 ± 5	09/04/18 - 10/02/18	12	17	14 ± 4
10/02/18 - 10/30/18	11	18	14 ± 3	10/02/18 - 10/30/18	9	16	13 ± 4	10/02/18 - 10/30/18	9	19	13 ± 8
10/30/18 - 12/04/18	11	30	18 ± 11	10/30/18 - 12/04/18	11	31	17 ± 12	10/30/18 - 12/04/18	14	38	20 ± 20
12/04/18 - 01/02/19	13	42	26 ± 20	12/04/18 - 01/02/19	11	37	25 ± 20	12/04/18 - 01/02/19	14	42	25 ± 26
01/02/18 - 01/02/19	7	42	17 ± 12	01/02/18 - 01/02/19	6	37	17 ± 12	01/02/18 - 01/02/19	7	42	17 ± 13

Table C-V.3 **CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2018**

RESULTS IN UNITS OF E-3 PCI/CU METER ± 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
BY-01	01/02/18 - 04/03/18	< 3	< 3	< 12	< 2	< 4	< 5	< 6	< 2	< 2	< 217	< 116
	04/03/18 - 07/03/18	< 2	< 3	< 12	< 3	< 6	< 4	< 7	< 3	< 2	< 167	< 31
	07/03/18 - 10/02/18	< 2	< 4	< 13	< 3	< 6	< 5	< 9	< 3	< 2	< 353	< 169
	10/02/18 - 01/02/19	< 2	< 4	< 13	< 3	< 5	< 4	< 6	< 3	< 2	< 160	< 59
	MEAN	-	-	-	-	-	-	-	-	-	-	-
BY-04	01/02/18 - 04/03/18	< 2	< 3	< 14	< 3	< 7	< 4	< 8	< 3	< 2	< 226	< 85
	04/03/18 - 07/03/18	< 2	< 3	< 10	< 2	< 5	< 3	< 5	< 2	< 2	< 144	< 67
	07/03/18 - 10/02/18	< 3	< 4	< 15	< 3	< 7	< 4	< 8	< 2	< 3	< 403	< 110
	10/02/18 - 01/02/19	< 2	< 4	< 9	< 3	< 7	< 5	< 8	< 2	< 2	< 179	< 50
	MEAN	-	-	-	-	-	-	-	-	-	-	-
BY-06	01/02/18 - 04/03/18	< 4	< 7	< 20	< 6	< 11	< 6	< 11	< 5	< 3	< 361	< 157
	04/03/18 - 07/03/18	< 2	< 5	< 12	< 2	< 6	< 4	< 7	< 3	< 2	< 178	< 94
	07/03/18 - 10/02/18	< 3	< 3	< 14	< 3	< 5	< 3	< 6	< 2	< 2	< 326	< 71
	10/02/18 - 01/02/19	< 3	< 4	< 8	< 3	< 7	< 3	< 7	< 2	< 2	< 192	< 68
	MEAN	-	-	-	-	-	-	-	-	-	-	-
BY-08	01/02/18 - 04/03/18	< 3	< 4	< 9	< 3	< 6	< 4	< 8	< 2	< 3	< 235	< 87
	04/03/18 - 07/03/18	< 2	< 4	< 12	< 2	< 5	< 5	< 7	< 2	< 3	< 200	< 84
	07/03/18 - 10/02/18	< 4	< 7	< 20	< 4	< 9	< 6	< 11	< 4	< 3	< 637	< 257
	10/02/18 - 01/02/19	< 2	< 4	< 15	< 3	< 6	< 5	< 7	< 3	< 2	< 251	< 79
	MEAN	-	-	-	-	-	-	-	-	-	-	-

Table C-V.3 **CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2018**

RESULTS IN UNITS OF E-3 PCI/CU METER ± 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
BY-21	01/02/18 - 04/03/18	< 3	< 4	< 17	< 2	< 5	< 6	< 10	< 2	< 2	< 284	< 83
	04/03/18 - 07/03/18	< 3	< 4	< 13	< 3	< 5	< 5	< 8	< 3	< 2	< 223	< 66
	07/03/18 - 10/02/18	< 3	< 4	< 13	< 3	< 6	< 4	< 8	< 3	< 2	< 415	< 138
	10/02/18 - 01/02/19	< 2	< 4	< 11	< 3	< 8	< 3	< 7	< 3	< 2	< 145	< 77
	MEAN	-	-	-	-	-	-	-	-	-	-	-
BY-22	01/02/18 - 04/03/18	< 2	< 4	< 12	< 2	< 7	< 4	< 7	< 2	< 3	< 198	< 97
	04/03/18 - 07/03/18	< 3	< 3	< 9	< 3	< 4	< 3	< 5	< 2	< 2	< 163	< 70
	07/03/18 - 10/02/18	< 3	< 5	< 9	< 3	< 6	< 5	< 7	< 2	< 2	< 317	< 174
	10/02/18 - 01/02/19	< 3	< 5	< 11	< 3	< 7	< 5	< 8	< 3	< 3	< 211	< 72
	MEAN	-	-	-	-	-	-	-	-	-	-	-
BY-23	01/02/18 - 04/03/18	< 4	< 6	< 18	< 4	< 9	< 7	< 13	< 4	< 4	< 412	< 170
	04/03/18 - 07/03/18	< 3	< 5	< 19	< 4	< 7	< 8	< 12	< 4	< 3	< 279	< 68
	07/03/18 - 10/02/18	< 2	< 4	< 12	< 3	< 5	< 5	< 7	< 3	< 3	< 233	< 201
	10/02/18 - 01/02/19	< 2	< 4	< 10	< 3	< 5	< 5	< 7	< 3	< 3	< 181	< 64
	MEAN	-	-	-	-	-	-	-	-	-	-	-
BY-24	01/02/18 - 04/03/18	< 2	< 5	< 12	< 4	< 6	< 4	< 5	< 2	< 2	< 186	< 126
	04/03/18 - 07/03/18	< 3	< 4	< 14	< 3	< 6	< 5	< 7	< 2	< 2	< 185	< 50
	07/03/18 - 10/02/18	< 5	< 6	< 23	< 3	< 10	< 8	< 16	< 4	< 3	< 562	< 229
	10/02/18 - 01/02/19	< 3	< 4	< 13	< 2	< 7	< 4	< 6	< 3	< 2	< 140	< 66
	MEAN	-	-	-	-	-	-	-	-	-	-	-

Table C-VI.1

CONCENTRATIONS OF I-131 IN AIR IODINE SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2018

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

COLLECTION	GROUP I				GROUP II			GROUP III
PERIOD	BY-21	BY-22	BY-23	BY-24	BY-01	BY-04	BY-06	BY-08
01/02/18 - 01/09/18	< 39	< 39	< 40	< 40	< 57	< 58	< 57	< 57
01/09/18 - 01/16/18	< 63	< 63	< 62	< 62	< 69	< 67	< 68	< 69
01/16/18 - 01/23/18	< 39	< 39	< 39	< 39	< 38	< 38	< 38	< 37
01/23/18 - 01/30/18	< 31	< 31	< 31	< 26	< 45	< 45	< 45	< 46
01/30/18 - 02/06/18	< 32	< 38	< 38	< 38	< 48	< 49	< 49	< 49
02/06/18 - 02/13/18	< 54	< 54	< 54	< 54	< 36	< 35	< 35	< 35
02/13/18 - 02/20/18	< 31	< 31	< 31	< 31	< 49	< 49	< 49	< 49
02/20/18 - 02/27/18	< 32	< 32	< 32	< 32	< 63	< 63	< 63	< 63
02/27/18 - 03/06/18	< 50	< 49	< 49	< 49	< 38	< 39	< 39	< 39
03/06/18 - 03/13/18	< 32	< 32	< 32	< 32	< 51	< 50	< 50	< 50
03/13/18 - 03/20/18	< 38	< 38	< 38	< 38	< 64	< 65	< 64	< 64
03/20/18 - 03/27/18	< 31	< 31	< 31	< 31	< 46	< 45	< 46	< 46
03/27/18 - 04/03/18	< 37	< 37	< 37	< 37	< 44	< 45	< 46	< 46
04/03/18 - 04/10/18	< 29	< 25	< 29	< 29	< 51	< 50	< 50	< 50
04/10/18 - 04/17/18	< 35	< 35	< 35	< 35	< 60	< 59	< 59	< 59
04/17/18 - 04/24/18	< 60	< 60	< 60	< 25	< 34	< 40	< 40	< 41
04/24/18 - 05/01/18	< 46	< 46	< 19	< 46	< 39	< 47	< 47	< 48
05/01/18 - 05/08/18	< 26	< 63	< 63	< 63	< 46	< 44	< 44	< 36
05/08/18 - 05/15/18	< 38	< 38	< 38	< 16	< 22	< 22	< 22	< 23
05/15/18 - 05/22/18	< 61	< 61	< 60	< 60	< 44	< 43	< 43	< 43
05/22/18 - 05/29/18	< 60	< 59	< 59	< 59	< 63	< 65	< 65	< 66
05/29/18 - 06/05/18	< 56	< 55	< 56	< 56	< 64	< 62	< 62	< 63
06/05/18 - 06/12/18	< 64	< 64	< 63	< 63	< 41	< 42	< 43	< 43
06/12/18 - 06/19/18	< 69	< 69	< 67	< 67	< 69	< 70	< 69	< 69
06/19/18 - 06/26/18	< 32	< 32	< 33	< 33	< 22	< 21	< 22	< 22
06/26/18 - 07/03/18	< 61	< 60	< 60	< 60	< 64	< 67	< 67	< 67
07/03/18 - 07/09/18	< 67	< 67	< 67	< 66	< 56	< 53	< 45	< 53
07/09/18 - 07/17/18	< 31	< 31	< 31	< 14	< 41	< 42	< 42	< 42
07/17/18 - 07/24/18	< 48	< 48	< 48	< 48	< 43	< 18	< 44	< 44
07/24/18 - 07/31/18	< 40	< 40	< 40	< 40	< 46	< 47	< 46	< 45
07/31/18 - 08/07/18	< 17	< 17	< 17	< 17	< 57	< 57	< 59	< 60
08/07/18 - 08/14/18	< 64	< 64	< 65	< 65	< 51	< 51	< 51	< 50
08/14/18 - 08/21/18	< 67	< 67	< 67	< 67	< 60	< 59	< 60	< 60
08/21/18 - 08/28/18	< 50	< 50	< 50	< 50	< 61	< 60	< 60	< 58
08/28/18 - 09/04/18	< 47	< 46	< 46	< 46	< 58	< 59	< 59	< 60
09/04/18 - 09/11/18	< 61	< 61	< 61	< 61	< 53	< 51	< 52	< 52
09/11/18 - 09/18/18	< 49	< 49	< 50	< 50	< 42	< 42	< 42	< 43
09/18/18 - 09/25/18	< 50	< 50	< 27	< 49	< 59	< 60	< 58	< 58
09/25/18 - 10/02/18	< 28	< 28	< 29	< 28	< 16	< 16	< 16	< 16
10/02/18 - 10/09/18	< 39	< 39	< 40	< 40	< 59	< 57	< 57	< 31
10/09/18 - 10/16/18	< 59	< 59	< 59	< 59	< 43	< 44	< 44	< 44
10/16/18 - 10/22/18	< 59	< 59	< 60	< 60	< 39	< 39	< 39	< 39
10/22/18 - 10/30/18	< 52	< 52	< 52	< 52	< 51	< 52	< 52	< 52
10/30/18 - 11/06/18	< 55	< 55	< 55	< 56	< 48	< 49	< 48	< 48
11/06/18 - 11/13/18	< 34	< 34	< 34	< 33	< 24	< 24	< 24	< 24
11/13/18 - 11/20/18	< 57	< 57	< 57	< 58	< 64	< 62	< 62	< 33
11/20/18 - 11/27/18	< 64	< 61	< 64	< 61	< 42	< 43	< 43	< 43
11/27/18 - 12/04/18	< 47	< 48	< 46	< 47	< 67	< 67	< 68	< 68
12/04/18 - 12/11/18	< 54	< 54	< 54	< 54	< 57	< 55	< 55	< 55
12/11/18 - 12/18/18	< 20	< 20	< 20	< 20	< 12	< 12	< 12	< 12
12/18/18 - 12/26/18	< 30	< 12	< 30	< 30	< 16	< 19	< 19	< 19
12/26/18 - 01/02/19	< 45	< 45	< 44	< 44	< 31	< 31	< 31	< 32
MEAN	-	-	-	-	-	-	-	-

Table C-VII.1 CONCENTRATIONS OF I-131 IN MILK SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2018

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	CONTROL FARM BY-26-2	INDICATOR FARM BY-20-1
01/02/18	< 0.5	< 0.6
02/06/18	< 0.4	< 0.4
03/06/18	< 0.6	< 0.8
04/03/18	< 0.8	< 0.5
05/01/18	< 0.7	< 0.8
05/15/18	< 0.6	< 0.6
05/29/18	< 0.9	< 0.6
06/12/18	< 1.0	< 0.7
06/26/18	< 0.6	< 0.9
07/09/18	< 0.4	< 0.5
07/24/18	< 0.6	< 0.7
08/07/18	< 0.8	< 0.7
08/21/18	< 0.8	< 0.7
09/04/18	< 0.7	< 0.7
09/18/18	< 0.6	< 0.8
10/02/18	< 0.5	< 0.5
10/16/18	< 0.6	< 0.6
10/30/18	< 0.7	< 0.8
11/13/18	< 0.6	< 0.9
12/04/18	< 0.6	< 0.8
MEAN	-	-

Table C-VII.2 **CONCENTRATIONS OF GAMMA EMMITTERS IN MILK SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2018**

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
BY-20-1	01/02/18	< 6	< 6	< 14	< 8	< 14	< 6	< 12	< 7	< 6	< 27	< 9
	02/06/18	< 5	< 6	< 14	< 6	< 14	< 7	< 11	< 7	< 6	< 24	< 6
	03/06/18	< 7	< 8	< 19	< 9	< 19	< 9	< 13	< 8	< 9	< 31	< 9
	04/03/18	< 6	< 4	< 12	< 4	< 11	< 5	< 9	< 6	< 6	< 22	< 7
	05/01/18	< 5	< 5	< 12	< 6	< 10	< 5	< 9	< 6	< 5	< 28	< 9
	05/15/18	< 6	< 5	< 12	< 5	< 10	< 6	< 8	< 6	< 5	< 24	< 8
	05/29/18	< 7	< 6	< 15	< 7	< 16	< 7	< 11	< 8	< 7	< 29	< 9
	06/12/18	< 8	< 8	< 22	< 8	< 20	< 8	< 17	< 8	< 8	< 36	< 12
	06/26/18	< 6	< 7	< 15	< 7	< 16	< 8	< 11	< 7	< 8	< 28	< 6
	07/09/18	< 9	< 9	< 19	< 6	< 19	< 11	< 15	< 8	< 9	< 35	< 7
	07/24/18	< 8	< 7	< 18	< 5	< 17	< 7	< 9	< 7	< 7	< 22	< 9
	08/07/18	< 8	< 8	< 18	< 7	< 16	< 10	< 15	< 9	< 9	< 32	< 12
	08/21/18	< 8	< 7	< 15	< 8	< 21	< 9	< 14	< 9	< 7	< 30	< 10
	09/04/18	< 6	< 8	< 17	< 8	< 15	< 6	< 12	< 8	< 7	< 38	< 11
	09/18/18	< 10	< 9	< 20	< 9	< 20	< 9	< 12	< 10	< 9	< 33	< 8
	10/02/18	< 8	< 9	< 21	< 11	< 20	< 9	< 13	< 9	< 9	< 42	< 9
	10/16/18	< 7	< 9	< 19	< 8	< 21	< 9	< 15	< 10	< 8	< 44	< 12
	10/30/18	< 10	< 10	< 21	< 9	< 20	< 10	< 16	< 11	< 11	< 40	< 14
	11/13/18	< 8	< 8	< 18	< 10	< 17	< 7	< 13	< 8	< 7	< 34	< 8
	12/04/18	< 6	< 7	< 17	< 7	< 19	< 9	< 13	< 9	< 8	< 33	< 11
	MEAN	-	-	-	-	-	-	-	-	-	-	-
BY-26-2	01/02/18	< 9	< 8	< 20	< 7	< 18	< 8	< 16	< 9	< 8	< 41	< 11
	02/06/18	< 9	< 9	< 20	< 10	< 20	< 9	< 13	< 9	< 10	< 27	< 12
	03/06/18	< 8	< 7	< 20	< 10	< 22	< 9	< 15	< 11	< 10	< 32	< 7
	04/03/18	< 9	< 7	< 17	< 10	< 19	< 9	< 14	< 9	< 7	< 30	< 9
	05/01/18	< 6	< 6	< 12	< 5	< 13	< 6	< 9	< 6	< 6	< 26	< 5
	05/15/18	< 5	< 5	< 11	< 5	< 12	< 5	< 10	< 5	< 6	< 25	< 8
	05/29/18	< 6	< 7	< 18	< 9	< 17	< 8	< 14	< 10	< 8	< 34	< 8
	06/12/18	< 8	< 8	< 17	< 8	< 17	< 8	< 12	< 8	< 7	< 33	< 5
	06/26/18	< 5	< 6	< 15	< 7	< 15	< 6	< 11	< 7	< 6	< 25	< 7
	07/09/18	< 7	< 9	< 19	< 9	< 19	< 8	< 15	< 9	< 9	< 36	< 13
	07/24/18	< 5	< 6	< 14	< 6	< 12	< 6	< 11	< 6	< 6	< 26	< 7
	08/07/18	< 8	< 6	< 18	< 9	< 19	< 8	< 14	< 9	< 7	< 33	< 10
	08/21/18	< 7	< 7	< 14	< 6	< 19	< 6	< 12	< 9	< 8	< 25	< 7
	09/04/18	< 6	< 7	< 18	< 7	< 14	< 7	< 11	< 8	< 8	< 34	< 9
	09/18/18	< 7	< 9	< 19	< 10	< 20	< 9	< 15	< 9	< 8	< 26	< 7
	10/02/18	< 7	< 9	< 19	< 7	< 19	< 8	< 16	< 9	< 8	< 34	< 11
	10/16/18	< 7	< 7	< 24	< 11	< 16	< 8	< 13	< 10	< 6	< 30	< 12
	10/30/18	< 8	< 7	< 15	< 9	< 20	< 7	< 15	< 8	< 9	< 40	< 7
	11/13/18	< 6	< 7	< 18	< 8	< 17	< 7	< 15	< 8	< 7	< 28	< 10
	12/04/18	< 5	< 7	< 17	< 8	< 18	< 6	< 11	< 7	< 7	< 42	< 13
	MEAN	-	-	-	-	-	-	-	-	-	-	-

Table C-VIII.1 **CONCENTRATIONS OF GAMMA EMITTERS IN VEGETATION SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2018**

RESULTS IN UNITS OF PCI/KG WET ± 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
BY-CONTROL													
Cabbage	07/30/18	< 16	< 16	< 40	< 16	< 36	< 16	< 35	< 36	< 18	< 20	< 75	< 23
Kohlrabi	07/30/18	< 13	< 14	< 35	< 18	< 31	< 16	< 30	< 31	< 14	< 16	< 85	< 21
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
BY-QUAD 1													
Carrots	08/06/18	< 26	< 25	< 54	< 26	< 54	< 25	< 44	< 44	< 28	< 28	< 127	< 31
Lettuce	08/06/18	< 38	< 39	< 88	< 34	< 71	< 40	< 65	< 58	< 41	< 38	< 166	< 47
Onions	08/06/18	< 29	< 30	< 65	< 29	< 62	< 35	< 55	< 57	< 34	< 30	< 158	< 42
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
BY-QUAD 2													
Onions	07/30/18	< 22	< 21	< 39	< 26	< 45	< 27	< 39	< 41	< 23	< 22	< 114	< 42
Lettuce	07/30/18	< 29	< 28	< 56	< 26	< 61	< 26	< 47	< 54	< 27	< 31	< 130	< 48
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
BY-QUAD 3													
Potatoes	08/07/18	< 31	< 27	< 71	< 23	< 72	< 33	< 46	< 47	< 33	< 24	< 132	< 40
Cabbage	08/07/18	< 31	< 25	< 64	< 25	< 61	< 26	< 39	< 43	< 30	< 27	< 135	< 48
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
BY-QUAD 4													
Cabbage	07/30/18	< 17	< 14	< 33	< 23	< 35	< 15	< 29	< 31	< 15	< 13	< 87	< 27
Beets/Carrots	07/30/18	< 20	< 21	< 46	< 25	< 45	< 21	< 38	< 38	< 27	< 23	< 99	< 31
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

Table C-IX.1 QUARTERLY OSLD RESULTS FOR BYRON NUCLEAR GENERATING STATION, 2018

RESULTS IN UNITS OF MREM/QUARTER ± 2 STANDARD DEVIATIONS

STATION CODE	MEAN ± 2 S.D.	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC
BY-01-1	18 ± 2	19	19	17	17
BY-04-1	21 ± 1	22	21	22	21
BY-06-1	18 ± 2	19	19	18	17
BY-08-1 (Ctrl)	18 ± 3	19	18	16	18
BY-21-1	17 ± 2	17	16	15	18
BY-22-1	21 ± 2	23	20	21	21
BY-23-1	21 ± 2	20	22	21	21
BY-24-2	19 ± 3	21	18	19	18
BY-101-1	16 ± 5	20	15	15	16
BY-101-2	16 ± 4	19	15	16	15
BY-102-1	23 ± 5	26	21	23	20
BY-102-2	24 ± 4	27	23	25	22
BY-103-1	21 ± 2	22	20	21	21
BY-103-2	22 ± 6	27	21	22	20
BY-103-3	22 ± 4	24	20	22	20
BY-104-1	23 ± 5	26	20	23	22
BY-104-2	23 ± 6	27	22	24	20
BY-104-3	20 ± 5	24	19	19	18
BY-105-1	23 ± 3	24	21	24	22
BY-105-2	23 ± 4	26	22	23	22
BY-106-1	22 ± 4	25	20	23	21
BY-106-2	22 ± 4	25	21	22	20
BY-107-1	24 ± 5	27	21	24	22
BY-107-2	24 ± 5	27	23	24	21
BY-107-3	21 ± 6	25	18	20	19
BY-108-1	22 ± 7	26	20	24	19
BY-108-2	21 ± 7	26	19	21	19
BY-109-1	21 ± 5	25	19	22	19
BY-109-2	21 ± 5	25	19	21	19
BY-110-1	20 ± 6	24	17	20	18
BY-110-2	22 ± 3	23	20	22	22
BY-111-3	22 ± 4	25	21	23	21
BY-111-4	21 ± 5	25	19	22	20
BY-112-3	22 ± 4	24	21	23	19
BY-112-4	22 ± 4	25	21	22	20
BY-113-1	22 ± 6	25	21	23	18
BY-113-2	19 ± 6	23	18	18	17
BY-114-1	18 ± 5	22	16	18	17
BY-114-2	21 ± 5	24	19	21	19
BY-115-1	21 ± 5	24	20	23	19
BY-115-2	20 ± 6	25	19	21	18
BY-116-1	19 ± 4	21	17	20	18
BY-116-2	20 ± 4	22	18	20	18
BY-116-3	20 ± 6	24	19	21	17
BY-201-3	21 ± 3	23	20	22	19
BY-201-4	23 ± 3	25	22	24	21
BY-202-1	22 ± 4	24	20	22	20
BY-202-2	23 ± 5	26	23	24	21
BY-203-1	18 ± 2	19	18	18	16

Table C-IX.1 QUARTERLY OSLD RESULTS FOR BYRON NUCLEAR GENERATING STATION, 2018

RESULTS IN UNITS OF MREM/QUARTER ± 2 STANDARD DEVIATIONS

STATION CODE	MEAN ± 2 S.D.	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC
BY-203-2	20 ± 4	23	19	20	18
BY-204-1	19 ± 3	21	18	20	17
BY-204-2	22 ± 3	24	22	23	20
BY-205-1	22 ± 4	25	22	23	20
BY-205-2	21 ± 3	22	20	21	19
BY-206-1	22 ± 4	24	21	24	20
BY-206-2	23 ± 5	26	23	24	20
BY-207-1	23 ± 3	25	23	24	22
BY-207-2	22 ± 3	23	21	23	20
BY-208-1	23 ± 4	26	22	24	21
BY-208-2	22 ± 4	25	22	22	20
BY-209-1	23 ± 3	24	21	23	23
BY-209-4	23 ± 4	26	23	24	21
BY-210-3	22 ± 4	25	21	22	20
BY-210-4	21 ± 3	23	21	22	20
BY-211-1	22 ± 5	25	21	24	20
BY-211-4	23 ± 4	25	22	24	20
BY-212-1	23 ± 5	26	22	23	21
BY-212-4	24 ± 4	26	23	25	22
BY-213-1	23 ± 2	24	22	22	22
BY-213-4	23 ± 4	26	22	24	20
BY-214-1	22 ± 5	25	21	23	19
BY-214-4	22 ± 4	25	22	22	20
BY-215-1	22 ± 2	23	21	22	21
BY-215-4	23 ± 3	25	22	24	21
BY-216-1	24 ± 4	26	23	23	22
BY-216-2	22 ± 4	25	21	24	21
BY-301-1	16 ± 5	20	14	16	15
BY-301-2	19 ± 4	21	17	18	18
BY-309-1	21 ± 4	24	19	21	19
BY-309-2	22 ± 4	25	20	22	20
BY-309-3	20 ± 5	23	19	19	18
BY-309-4	19 ± 4	22	17	19	18
BY-314-1	18 ± 4	20	17	17	17

TABLE C-IX.2 MEAN QUARTERLY OSLD RESULTS FOR THE INNER RING, OUTER RING, SPECIAL INTEREST, OTHER, AND CONTROL LOCATIONS FOR BYRON NUCLEAR GENERATING STATION, 2018

RESULTS IN UNITS OF MILLIREM/STD. QUARTER ± 2 STANDARD DEVIATION

COLLECTION PERIOD	INNER RING ± 2 S.D.	OUTER RING ± 2 S.D.	SPECIAL INTEREST ± 2 S.D.	OTHER ± 2 S.D.	CONTROL ± 2 S.D.
JAN-MAR	24 + 4	24 + 3	22 + 4	20 + 4	19 + 0
APR-JUN	20 + 4	21 + 3	18 + 4	19 + 4	18 + 0
JUL-SEP	22 + 4	23 + 3	19 + 4	19 + 5	16 + 0
OCT-DEC	19 + 4	20 + 3	18 + 3	19 + 4	18 + 0

TABLE C-IX.3 SUMMARY OF THE AMBIENT DOSIMETRY PROGRAM FOR BYRON NUCLEAR GENERATING STATION, 2018

RESULTS IN UNITS OF MILLIREM/STD. QUARTER ± 2 STANDARD DEVIATION

LOCATION	SAMPLES ANALYZED	PERIOD MINIMUM	PERIOD MAXIMUM	PERIOD MEAN ± 2 S.D.
INNER RING	144	15	27	21 + 6
OUTER RING	128	16	26	22 + 4
SPECIAL INTEREST	28	14	25	19 + 5
OTHER	28	15	23	19 + 4
CONTROL	4	16	19	18 + 2

INNER RING STATIONS - BY-101-1, BY-101-2, BY-102-1, BY-102-2, BY-103-1, BY-103-2, BY-103-3, BY-104-1, BY-104-2, BY-104-3, BY-105-1, BY-105-2, BY-106-1, BY-106-2, BY-107-1, BY-107-2, BY-107-3, BY-108-1, BY-108-2, BY-109-1, BY-109-2, BY-110-1, BY-110-2, BY-111-3, BY-111-4, BY-112-3, BY-112-4, BY-113-1, BY-113-2, BY-114-1, BY-114-2, BY-115-1, BY-115-2, BY-116-1, BY-116-2, BY-116-3

OUTER RING STATIONS - BY-201-3, BY-201-4, BY-202-1, BY-202-2, BY-203-1, BY-203-2, BY-204-1, BY-204-2, BY-205-1, BY-205-2, BY-206-1, BY-206-2, BY-207-1, BY-207-2, BY-208-1, BY-208-2, BY-209-1, BY-209-4, BY-210-3, BY-210-4, BY-211-1, BY-211-4, BY-212-1, BY-212-4, BY-213-1, BY-213-4, BY-214-1, BY-214-4, BY-215-1, BY-215-4, BY-216-1, BY-216-2

SPECIAL INTEREST STATIONS - BY-301-1, BY-301-2, BY-309-1*, BY-309-2*, BY-309-3*, BY-309-4*, BY-314-2

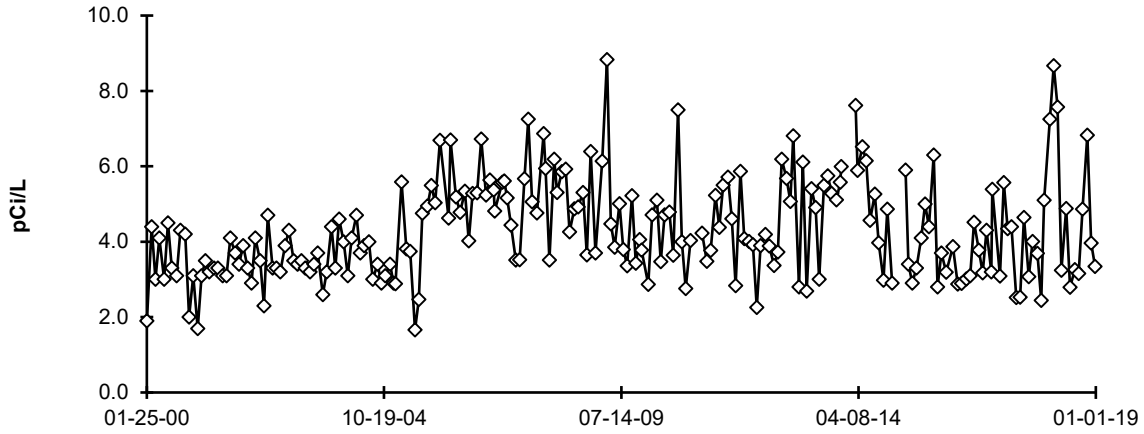
OTHER STATIONS - BY-01-1, BY-04-1, BY-06-1, BY-21-1, BY-22-1,BY-23-1, BY-24

CONTROL STATION - BY-08-1

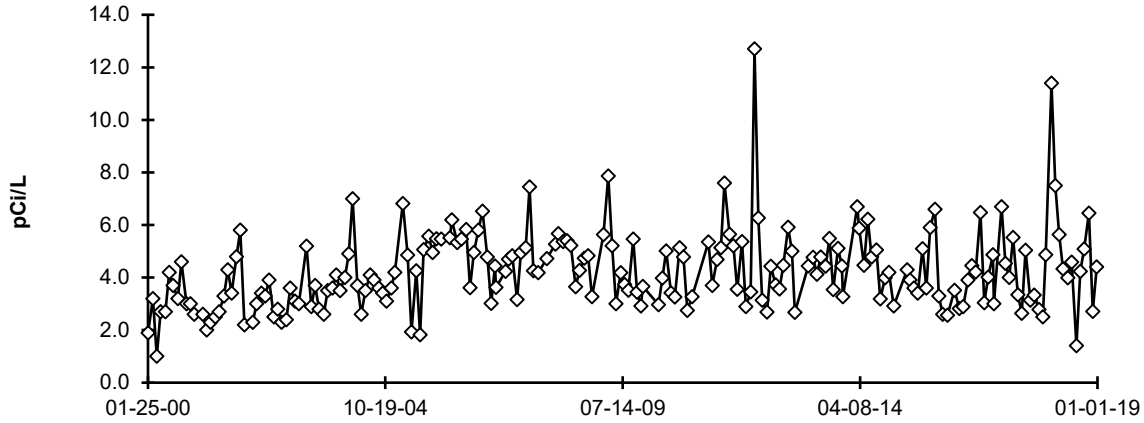
**For ISFSI Monitoring*

FIGURE C-1
Surface Water - Gross Beta - Stations BY-12 and BY-29 (C) Collected in the Vicinity of BNGS, 2000 - 2018

BY-12 Oregon Pool of Rock River, Downstream

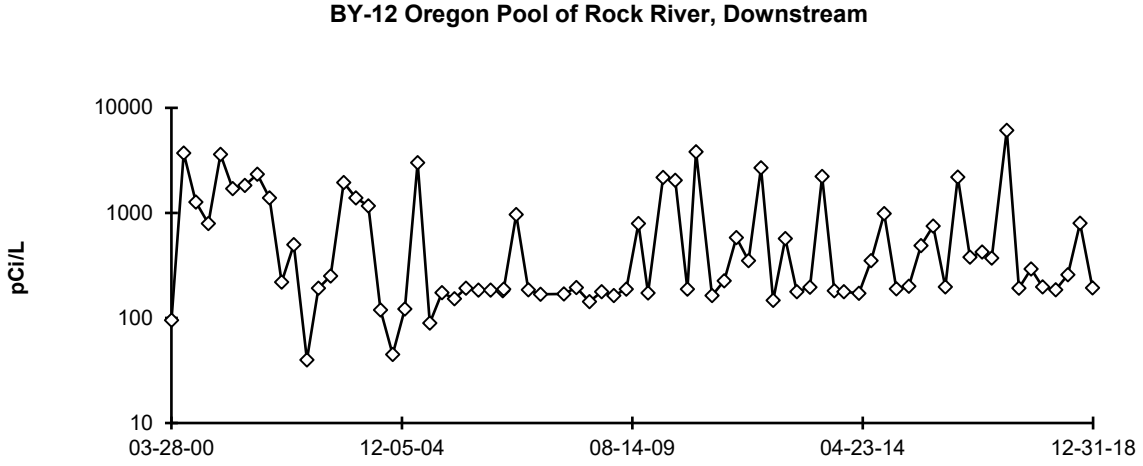


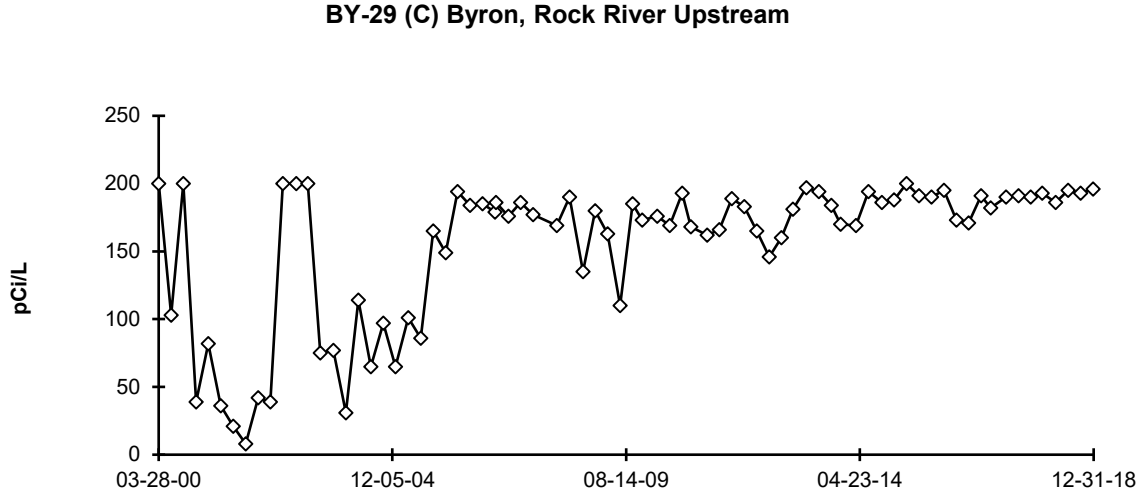
BY-29 (C) Byron, Rock River Upstream



DUE TO VENDOR CHANGE IN 2005, < VALUES ARE LLD VALUES JANUARY THROUGH JUNE 2005 AND MDC VALUES AFTER JUNE 2005

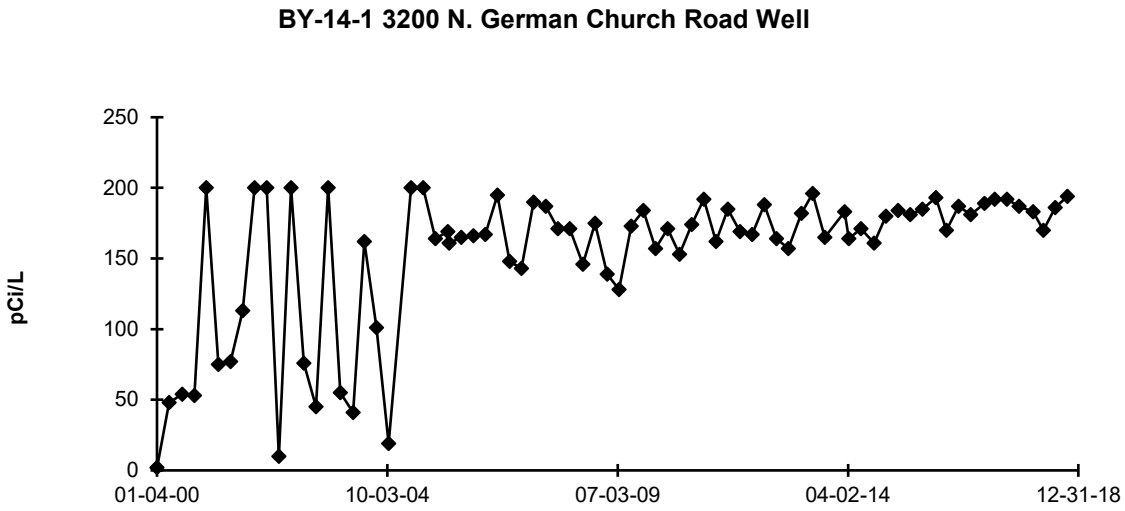
FIGURE C-2
Surface Water - Tritium - Stations BY-12 and BY-29 (C) Collected in the Vicinity of BNGS, 2000 - 2018





DUE TO VENDOR CHANGE IN 2005, < VALUES ARE LLD VALUES JANUARY THROUGH JUNE 2005 AND MDC VALUES AFTER JUNE 2005

FIGURE C-3
Ground Water - Tritium - Station BY-14-1
Collected in the Vicinity of BNGS, 2000 - 2018



DUE TO VENDOR CHANGE IN 2005, < VALUES ARE LLD VALUES JANUARY THROUGH JUNE 2005 AND MDC VALUES AFTER JUNE 2005

FIGURE C-4
Ground Water - Tritium - Stations BY-18-1
Collected in the Vicinity of BNGS, 2010 - 2018

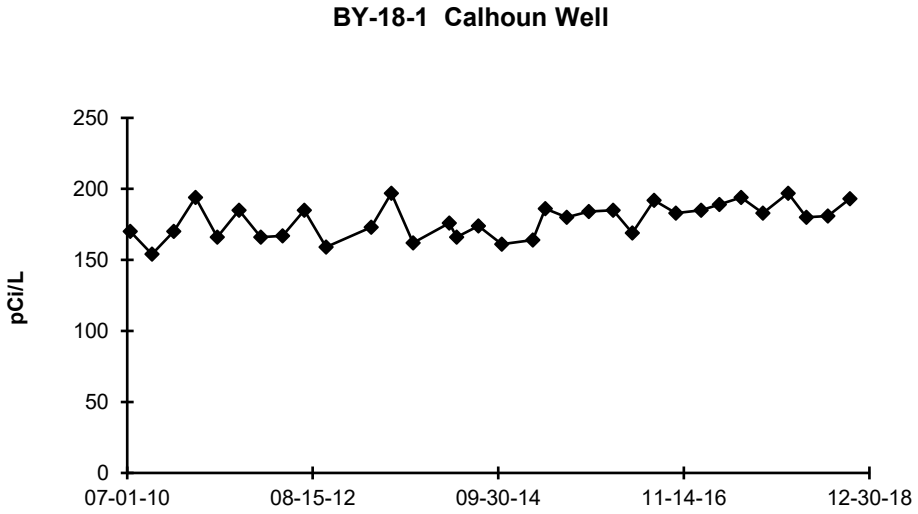
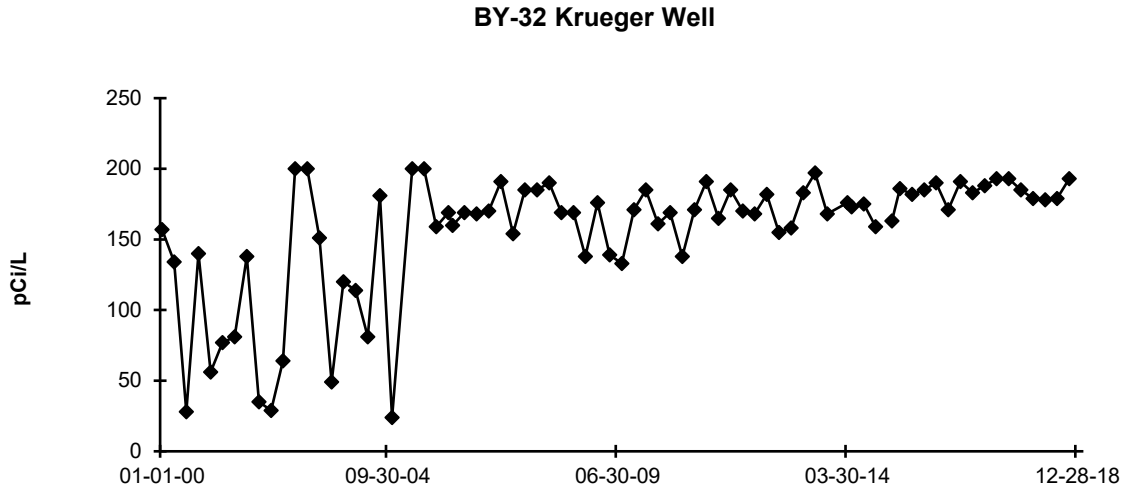


FIGURE C-5
Ground Water - Tritium - Station BY-32
Collected in the Vicinity of BNGS, 2000 - 2018



DUE TO VENDOR CHANGE IN 2005, < VALUES ARE LLD VALUES JANUARY THROUGH JUNE 2005 AND MDC VALUES AFTER JUNE 2005

FIGURE C-6
Ground Water - Tritium - Station BY-35
Collected in the Vicinity of BNGS, 2006 - 2018

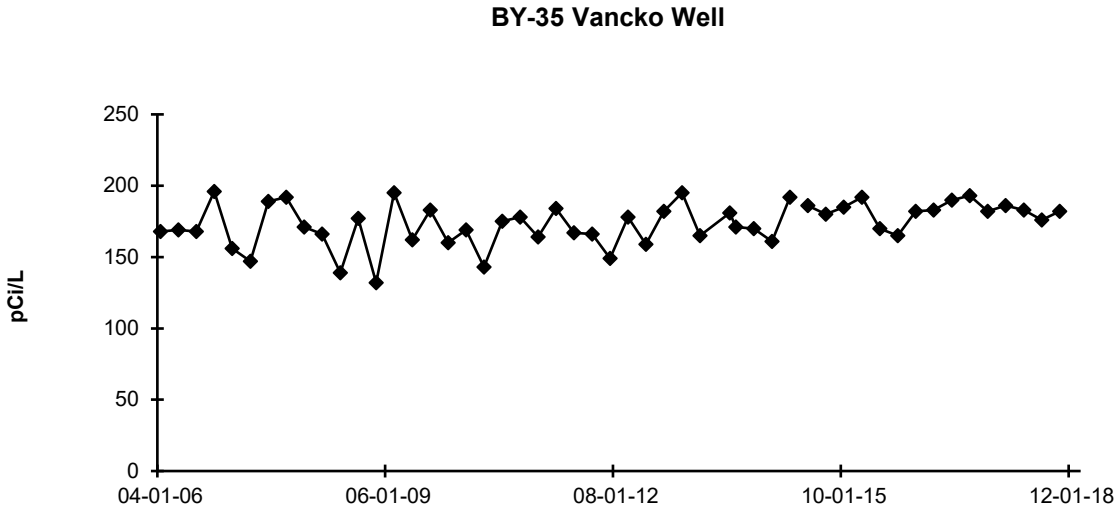
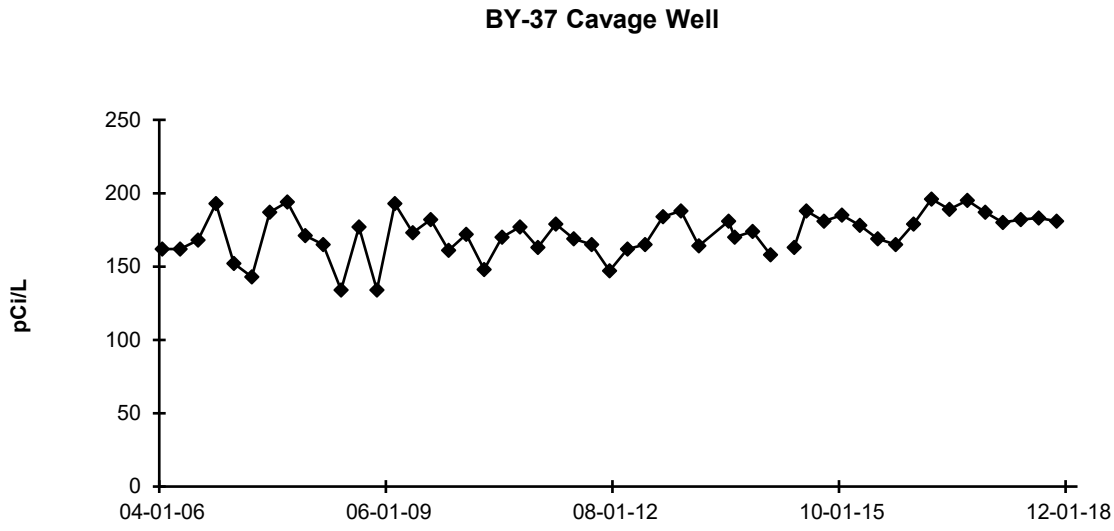


FIGURE C-7
Ground Water - Tritium - Station BY-37
Collected in the Vicinity of BNGS, 2006 - 2018



Ground Water - Tritium - Station BY-38
Collected in the Vicinity of BNGS, 2006 - 2018

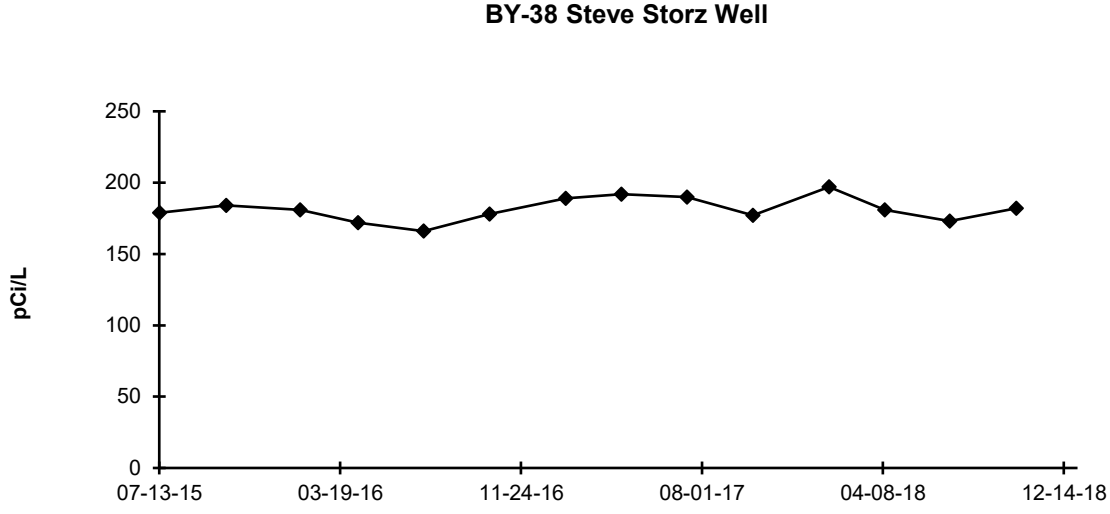
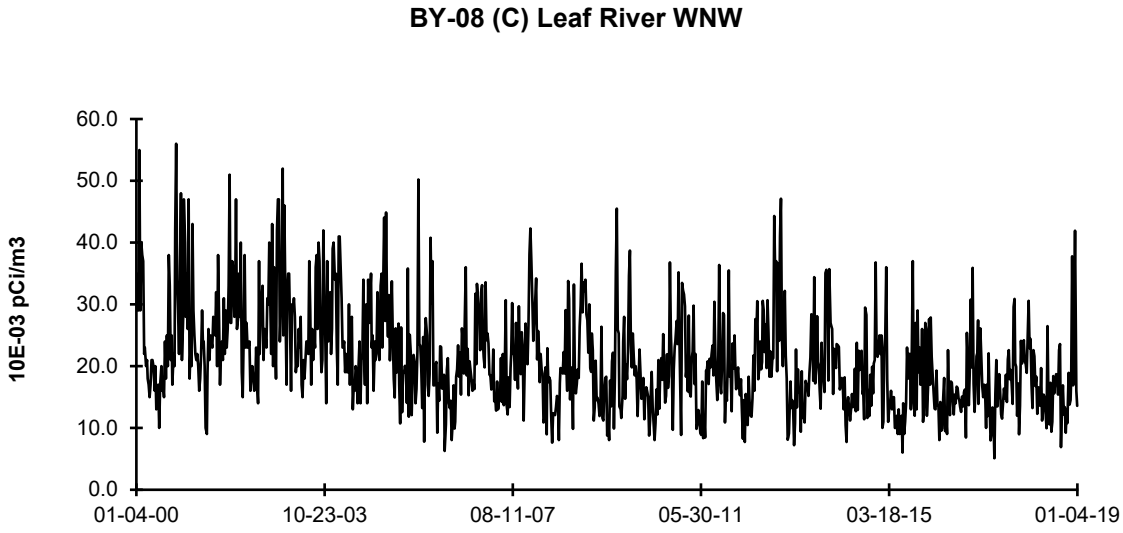


FIGURE C-8
Air Particulate - Gross Beta - Stations BY-08 (C) and BY-21 Collected in the Vicinity of BNGS, 2000 - 2018



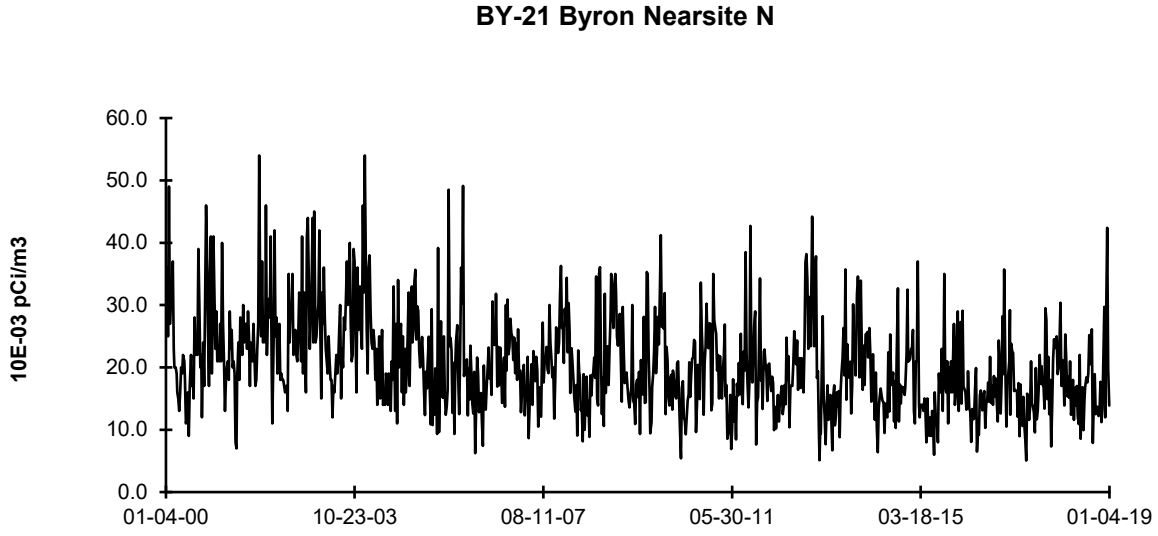
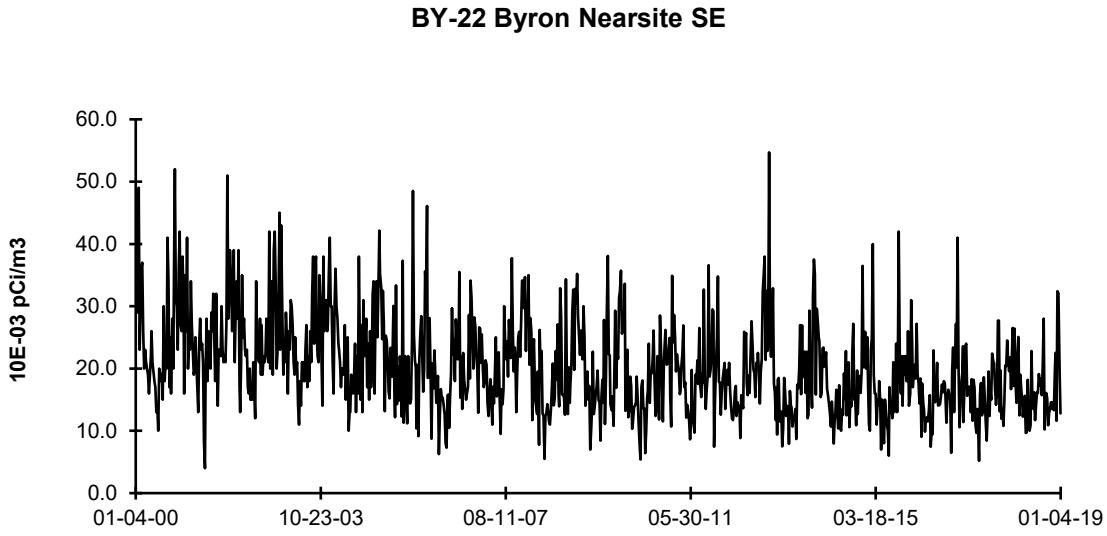


FIGURE C-9
Air Particulate - Gross Beta - Stations BY-22 and BY-23 Collected in the Vicinity of BNGS, 2000 - 2018



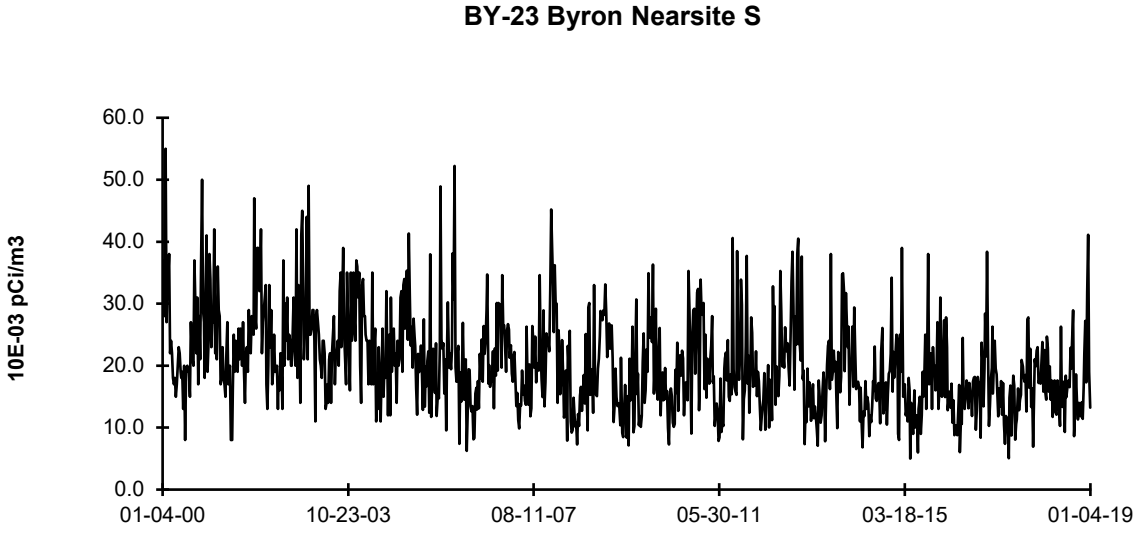


FIGURE C-10
Air Particulate - Gross Beta - Stations BY-24
Collected in the Vicinity of BNGS, 2000 - 2018

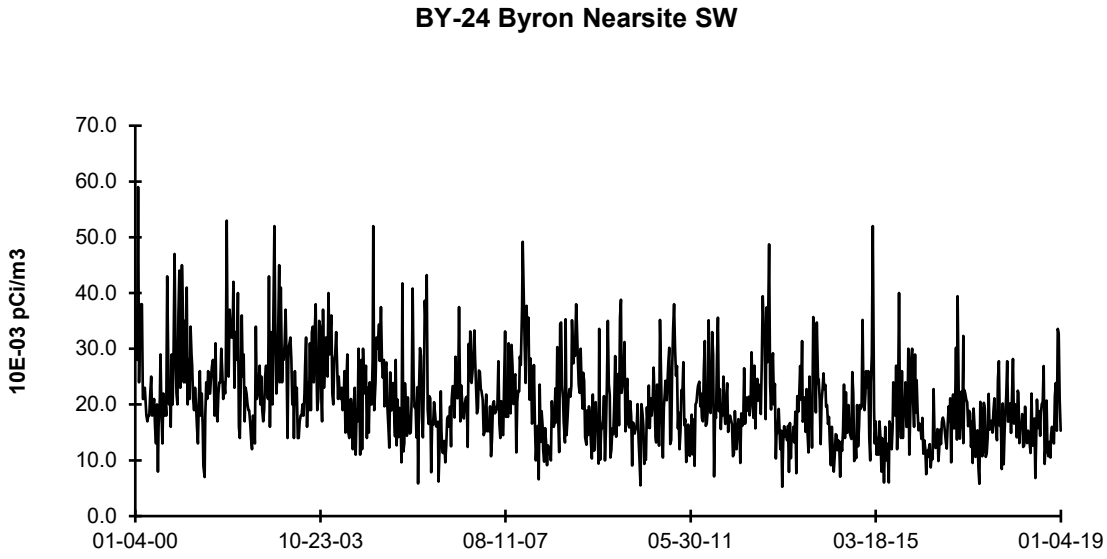
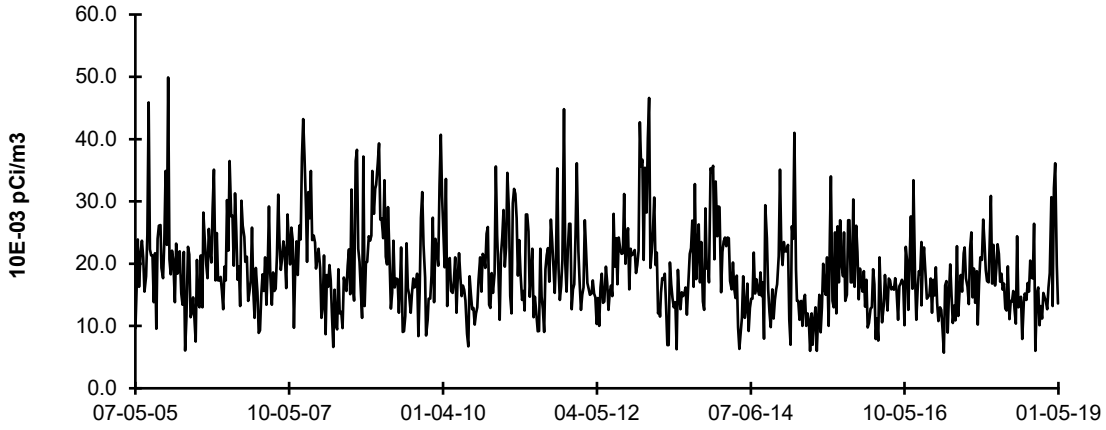
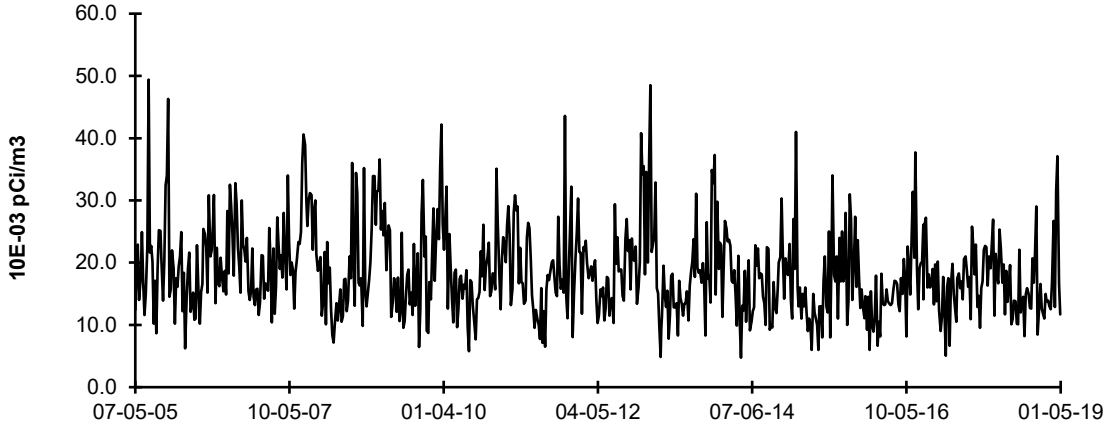


FIGURE C-11
Air Particulate - Gross Beta - Stations BY-01 and BY-04 Collected in the Vicinity of BNGS, 2005 - 2018

BY-01 Byron N

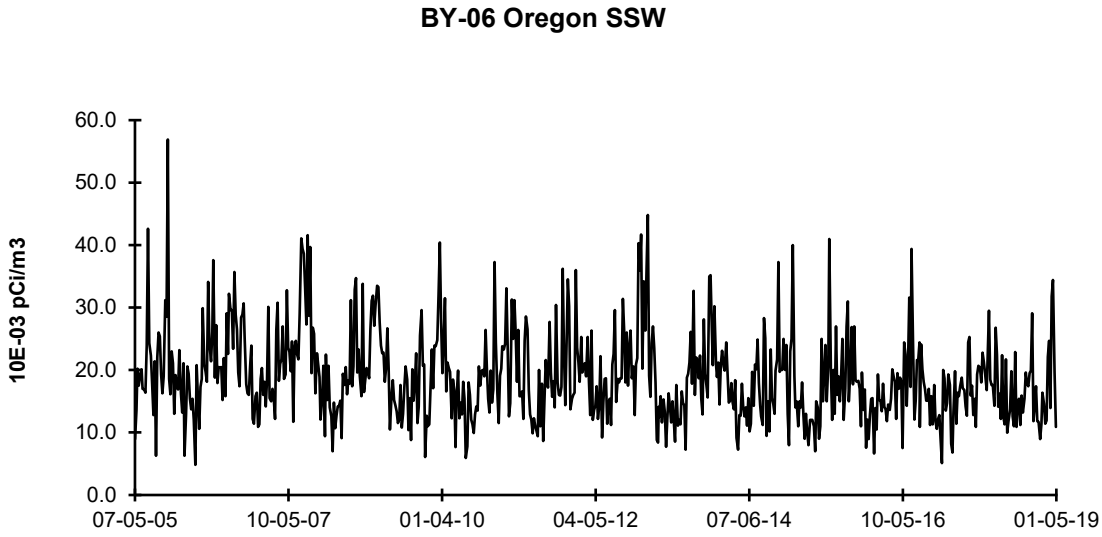


BY-04 Paynes Point SE



Regular analysis of far field air particulate & gross beta did not take place prior to 2005

FIGURE C-12
Air Particulate - Gross Beta - Station BY-06
Collected in the Vicinity of BNGS, 2005 - 2018



Regular analysis of far field air particulate & gross beta did not take place prior to 2005

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APPENDIX D

INTER-LABORATORY COMPARISON PROGRAM

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TABLE D-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 2018	E12133	Milk	Sr-89	pCi/L	76.1	90.1	0.84	A
			Sr-90	pCi/L	12.2	12.5	0.98	A
	E12134	Milk	Ce-141	pCi/L	77.8	77.0	1.01	A
			Co-58	pCi/L	105	114	0.92	A
			Co-60	pCi/L	181	187	0.97	A
			Cr-51	pCi/L	298	326	0.92	A
			Cs-134	pCi/L	150	180	0.84	A
			Cs-137	pCi/L	164	172	0.95	A
			Fe-59	pCi/L	140	139	1.01	A
			I-131	pCi/L	105	108.0	0.97	A
			Mn-54	pCi/L	133	131	1.01	A
			Zn-65	pCi/L	242	244	0.99	A
	E12135	Charcoal	I-131	pCi	93.7	95.4	0.98	A
	E12136	AP	Ce-141	pCi	92.6	85.3	1.09	A
			Co-58	pCi	130	126	1.03	A
			Co-60	pCi	237	207	1.14	A
			Cr-51	pCi	411	361	1.14	A
			Cs-134	pCi	194	199	0.98	A
			Cs-137	pCi	200	191	1.05	A
			Fe-59	pCi	160	154	1.04	A
			Mn-54	pCi	152	145	1.05	A
			Zn-65	pCi	267	271	0.99	A
	E12137	Water	Fe-55	pCi/L	1990	1700	1.17	A
	E12138	Soil	Ce-141	pCi/g	0.148	0.118	1.26	W
			Co-58	pCi/g	0.171	0.174	0.98	A
			Co-60	pCi/g	0.297	0.286	1.04	A
			Cr-51	pCi/g	0.537	0.498	1.08	A
			Cs-134	pCi/g	0.274	0.275	1.00	A
			Cs-137	pCi/g	0.355	0.337	1.05	A
			Fe-59	pCi/g	0.243	0.212	1.15	A
			Mn-54	pCi/g	0.228	0.201	1.14	A
			Zn-65	pCi/g	0.395	0.374	1.06	A

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

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

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

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

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

TABLE D-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)]
June 2018	E12205	Milk	Sr-89	pCi/L	74.9	84.6	0.89	A
			Sr-90	pCi/L	10.5	11.4	0.92	A
	E12206	Milk	Ce-141	pCi/L	89.2	82.2	1.08	A
			Co-58	pCi/L	94.8	89	1.07	A
			Co-60	pCi/L	125	113	1.10	A
			Cr-51	pCi/L	256	239	1.07	A
			Cs-134	pCi/L	112	114	0.99	A
			Cs-137	pCi/L	107	98.8	1.08	A
			Fe-59	pCi/L	95.9	86.0	1.12	A
			I-131	pCi/L	69.8	71.9	0.97	A
			Mn-54	pCi/L	138	130	1.06	A
			Zn-65	pCi/L	186	157	1.18	A
	E12207	Charcoal	I-131	pCi	69.6	72.2	0.96	A
	E12208	AP	Ce-141	pCi	151	165	0.92	A
			Co-58	pCi	174	178	0.98	A
			Co-60	pCi	290	227	1.28	W
			Cr-51	pCi	452	478	0.95	A
			Cs-134	pCi	215	227	0.95	A
			Cs-137	pCi	206	198	1.04	A
			Fe-59	pCi	180	172	1.05	A
			Mn-54	pCi	265	260	1.02	A
			Zn-65	pCi	280	315	0.89	A
	E12209	Water	Fe-55	pCi/L	1790	1740	1.03	A
	E12210	AP	Sr-89	pCi	77.8	90.3	0.86	A
			Sr-90	pCi	9.54	12.2	0.78	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 D-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 2018	E12271	Milk	Sr-89	pCi/L	79.4	81.7	0.97	A
			Sr-90	pCi/L	12.2	14.8	0.82	A
	E12272	Milk	Ce-141	pCi/L	152	128	1.19	A
			Co-58	pCi/L	161	144	1.12	A
			Co-60	pCi/L	208	190	1.10	A
			Cr-51	pCi/L	244	265	0.92	A
			Cs-134	pCi/L	124	123	1.01	A
			Cs-137	pCi/L	166	147	1.13	A
			Fe-59	pCi/L	158	119	1.32	N(1)
			I-131	pCi/L	83.1	58.2	1.43	N(2)
			Mn-54	pCi/L	191	167	1.14	A
			Zn-65	pCi/L	229	201	1.14	A
	E12273	Charcoal	I-131	pCi	83.0	80.7	1.03	A
	E12274	AP	Ce-141	pCi	101	85.6	1.18	A
			Co-58	pCi	92.7	96.0	0.97	A
			Co-60	pCi	142	127	1.12	A
			Cr-51	pCi	218	177	1.23	W
			Cs-134	pCi	81.2	81.9	0.99	A
			Cs-137	pCi	99.0	98.5	1.01	A
			Fe-59	pCi	93.7	79.7	1.18	A
			Mn-54	pCi	116	112	1.04	A
			Zn-65	pCi	139	134	1.04	A
	E12302	Water	Fe-55	pCi/L	2120	1820	1.17	A
	E12276	Soil	Ce-141	pCi/g	0.259	0.221	1.17	A
			Co-58	pCi/g	0.279	0.248	1.12	A
			Co-60	pCi/g	0.367	0.328	1.12	A
			Cr-51	pCi/g	0.597	0.457	1.31	N [3]
			Cs-134	pCi/g	0.261	0.212	1.23	W
			Cs-137	pCi/g	0.376	0.330	1.14	A
			Fe-59	pCi/g	0.248	0.206	1.20	A
			Mn-54	pCi/g	0.317	0.289	1.10	A
			Zn-65	pCi/g	0.407	0.347	1.17	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 18-20***
*(2) See **NCR 18-24***
*(3) See **NCR 18-21***

TABLE D-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)]
December 2018	E12313	Milk	Sr-89	pCi/L	71.9	91.9	0.78	W
			Sr-90	pCi/L	12.1	13.3	0.91	A
	E12314	Milk	Ce-141	pCi/L	124	133	0.93	A
			Co-58	pCi/L	110	119	0.93	A
			Co-60	pCi/L	202	212	0.95	A
			Cr-51	pCi/L	292	298	0.98	A
			Cs-134	pCi/L	146	171	0.85	A
			Cs-137	pCi/L	118	121	0.98	A
			Fe-59	pCi/L	120	114	1.05	A
			I-131	pCi/L	94.2	93.3	1.01	A
			Mn-54	pCi/L	151	154	0.98	A
			Zn-65	pCi/L	266	264	1.01	A
	E12315	Charcoal	I-131	pCi	94.8	89.9	1.05	A
	E12316A	AP	Ce-141	pCi	92.3	94.0	0.98	A
			Co-58	pCi	73.4	83.8	0.88	A
			Co-60	pCi	137	150	0.91	A
			Cr-51	pCi	202	210	0.96	A
			Cs-134	pCi	115	121	0.95	A
			Cs-137	pCi	85.0	85.4	1.00	A
			Fe-59	pCi	83.1	80.8	1.03	A
			Mn-54	pCi	104	109	0.96	A
			Zn-65	pCi	168	187	0.90	A
	E12317	Water	Fe-55	pCi/L	2110	1840	1.15	A
	E12318	AP	Sr-89	pCi	81.1	83.0	0.98	A
			Sr-90	pCi	11.4	12.0	0.95	A

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

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

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

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

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

TABLE D-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 2018	18-MaS38	Soil	Ni-63	Bq/kg	9.94		*(1)*	A
			Sr-90	Bq/kg	0.846		*(1)*	A
	18-MaW38	Water	Am-241	Bq/L	0.785	0.709	0.496 - 0.922	A
			Ni-63	Bq/L	12.6	14.0	9.8 - 18.2	A
			Pu-238	Bq/L	0.0214	0.023	*(2)*	A
			Pu-239/240	Bq/L	0.544	0.600	0.420 - 0.780	A
	18-RdF38	AP	U-234/233	Bq/sample	0.111	0.124	0.087 - 0.161	A
			U-238	Bq/sample	0.123	0.128	0.090 - 0.166	A
	18-RdV38	Vegetation	Cs-134	Bq/sample	2.46	3.23	2.26 - 4.20	W
			Cs-137	Bq/sample	3.14	3.67	2.57 - 4.77	A
			Co-57	Bq/sample	4.12	4.42	3.09 - 5.75	A
			Co-60	Bq/sample	1.86	2.29	1.60 - 2.98	A
			Mn-54	Bq/sample	2.21	2.66	1.86 - 3.46	A
			Sr-90	Bq/sample				NR[3]
			Zn-65	Bq/sample	-0.201		*(1)*	A
November 2018	18-MaS39	Soil	Ni-63	Bq/kg	703	765	536 - 995	A
			Sr-90	Bq/kg	137	193	*135 - 251*	W
	18-MaW39	Water	Am-241	Bq/L	0.0363		*(1)*	A
			Ni-63	Bq/L	6.18	7.0	4.9 - 9.1	A
			Pu-238	Bq/L	0.73	0.674	0.472 - 0.876	A
			Pu-239/240	Bq/L	0.89	0.928	0.650 - 1.206	A
	18-RdF39	AP	U-234/233	Bq/sample	0.159	0.152	0.106 - 0.198	A
			U-238	Bq/sample	0.162	0.158	0.111 - 0.205	A
	18-RdV39	Vegetation	Cs-134	Bq/sample	1.85	1.94	1.36 - 2.52	A
			Cs-137	Bq/sample	2.5	2.36	1.65 - 3.07	A
			Co-57	Bq/sample	3.53	3.31	2.32 - 4.30	A
			Co-60	Bq/sample	1.6	1.68	1.18 - 2.18	A
			Mn-54	Bq/sample	2.61	2.53	1.77 - 3.29	A
			Sr-90	Bq/sample	0.338	0.791	0.554 - 1.028	N[4]
			Zn-65	Bq/sample	1.32	1.37	*0.96 - 1.78*	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) NR = Not Reported - See **NCR 18-09***

*(4) See **NCR 18-25***

TABLE D-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]
March 2018	MRAD-28	AP	GR-A	pCi/sample	65.7	43.4	22.7 - 71.5	A
			GR-B	pCi/sample	57.2	52	31.5 - 78.6	A
April 2018	RAD-113	Water	Ba-133	pCi/L	91.2	91.5	77.1 - 101	A
			Cs-134	pCi/L	70.4	75.9	62.0 - 83.5	A
			Cs-137	pCi/L	122	123	111 - 138	A
			Co-60	pCi/L	64.8	64.3	57.9 - 73.2	A
			Zn-65	pCi/L	98.6	86.7	78.0 - 104	A
			GR-A	pCi/L	32.8	28.6	14.6 - 37.5	A
			GR-B	pCi/L	62.9	73.7	51.4 - 81.1	A
			U-Nat	pCi/L	6.7	6.93	5.28 - 8.13	A
			H-3	pCi/L	17100	17200	15000 - 18900	A
			Sr-89	pCi/L	38.6	48.8	38.3 - 56.2	A
			Sr-90	pCi/L	27.1	26.5	19.2 - 30.9	A
			I-131	pCi/L	26.7	24.6	20.4 - 29.1	A
September 2018	MRAD-29	AP	GR-A	pCi/sample	49.7	55.3	28.9 - 91.1	A
		AP	GR-B	pCi/sample	75.3	86.5	52.4 - 131	A
October 2018	RAD-115	Water	Ba-133	pCi/L	15.2	16.3	11.9 - 19.4	A
			Cs-134	pCi/L	85.9	93.0	76.4 - 102	A
			Cs-137	pCi/L	229	235	212 - 260	A
			Co-60	pCi/L	81.9	80.7	72.6 - 91.1	A
			Zn-65	pCi/L	348	336	302 - 392	A
			GR-A	pCi/L	38.9	60.7	31.8 - 75.4	A
			GR-B	pCi/L	36.5	41.8	27.9 - 49.2	A
			U-Nat	pCi/L	17.48	20.9	16.8 - 23.4	A
			H-3	pCi/L	2790	2870	2410 - 3170	A
			I-131	pCi/L	26.9	27.2	22.6 - 32.0	A
			Sr-89	pCi/L	57.2	56.9	45.5 - 64.6	A
			Sr-90	pCi/L	36.8	31.4	22.9- 36.4	N[1]

(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 18-23***

APPENDIX E

EFFLUENT REPORT

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Table of Contents (cont.)

SUMMARY

Calculations based on gaseous and liquid effluents and meteorological data indicate that public dose due to radioactive material attributable to Byron Station during the period does not exceed regulatory or Offsite Dose Calculation Manual (ODCM) limits.

The Total Effective Dose Equivalent (TEDE) due to licensed activities at Byron Station calculated for the maximum exposed individual for the period is 2.65E-01 mrem. The annual limit on TEDE is 100 mrem.

The assessment of radiation doses to the public is performed in accordance with the ODCM. The results of these analyses confirm that the station is operating in compliance with 10CFR50 Appendix I, 10CFR20 and 40CFR190.

There were no additional operational controls implemented which affected the areas of radiological effluents in 2018.

There were no measurements which exceeded the reporting levels, including any which would not have been attributable to station effluents.

The results of the current radiological environmental monitoring program are approximately the same as those found during the pre-operational studies conducted at Byron Station.

INTRODUCTION

Liquid effluents from Byron Station are released to the Rock River in controlled batches after radioassay of each batch. Gaseous effluents are released to the atmosphere and are calculated on the basis of analyses of weekly grab samples and grab samples of batch releases prior to the release of noble gases as well as continuously collected composite samples of iodine and particulate radioactivity sampled during the course of the year. The results of effluent analyses are summarized on a monthly basis. Airborne concentrations of noble gases, I-131, and particulate radioactivity in offsite areas are calculated using isotopic composition of effluents and meteorological data. C-14 concentration in offsite areas is calculated based on industry-approved methodology for estimation of the amount released and meteorological data.

Environmental monitoring is conducted by sampling at indicator and control (background) locations in the vicinity of Byron Station to measure changes in radiation or radioactivity levels that may be attributable to station operation. If significant changes attributable to Byron Station are measured, these changes are correlated with effluent releases. An environmental monitoring program is conducted which also includes all potential pathways at the site. Gaseous pathways include ground plane (direct), inhalation, vegetation, meat, and milk. Liquid pathways include potable water and freshwater fish. The critical pathway for 2018 gaseous dose was vegetation. The critical pathway for 2018 liquid dose was freshwater fish.

1.0 EFFLUENTS

1.1 Gaseous Effluents to the Atmosphere

Measured concentrations and isotopic composition of noble gases, radioiodine, tritium and particulate radioactivity released to the atmosphere during the year are listed in Table 1.1-1.

A total of 1.41E+00 curies of fission and activation gases were released with a maximum average quarterly release rate of 1.10E-01 µCi/sec.

A total of 6.32E-07 curies of 1-131 were released during the year with a maximum average quarterly release rate of 6.92E-08 µCi/sec.

A total of 0.00E+00 curies were released as airborne particulate matter with a maximum average quarterly release rate of 0.00E+00 µCi/sec.

A total of 9.01E+00 curies of other (C-14) radioisotopes were released with a maximum average quarterly release rate of 3.09E-01 µCi/sec.

A total of 5.87E+01 curies of tritium were released with a maximum average quarterly release rate of 2.80E+00 µCi/sec.

Gross alpha-emitting radionuclides were below detectable limits.

1.2 Liquids Released to Rock River

A total of 3.00E+10 liters of radioactive liquid wastes containing 2.04E-02 curies of fission and activation products were discharged with a maximum quarterly average concentration of 9.51E-10 µCi/ml.

A total of 2.82E+03 curies of tritium were discharged with a maximum quarterly average concentration of 1.75E-04 uCi/ml.

A total of 7.32E-04 curies of dissolved and entrained gases were discharged with a maximum quarterly average concentration of 9.14E-11 uCi/ml.

Gross alpha-emitting radionuclides were below detectable limits.

Quarterly release totals of principal radionuclides in liquid effluents are given in Table 1.2-1.

2.0 SOLID RADIOACTIVE WASTE

Solid radioactive wastes were shipped by truck. For detail, refer to Byron Station 2018 Annual Radiological Effluent Release Report.

3.0 DOSE TO MAN

3.1 Gaseous Effluent Pathways

Table 3.2-1 summarizes the doses resulting from releases of airborne radioactivity via the different exposure pathways.

3.1.1 Noble Gases

3.1.1.1 Gamma Dose Rates

Offsite Gamma air and whole body dose rates are shown in Table 3.2-1 and were calculated based on measured release rates, isotopic composition of the noble gases, and average meteorological data for the period. Dose rates based on concurrent meteorological data are shown in Table 3.4-1. Based on measured effluents and average meteorological data, the maximum gamma air dose was 5.81E-05 mrad based on measured effluents and average meteorological data, and 9.70E-06 mrad based on measured effluents and concurrent meteorological data. (Table 3.4-1).

3.1.1.2 Beta Air and Skin Dose Rates

The range of beta particles in air is relatively small (on the order of a few meters or less); consequently, plumes of gaseous effluents may be considered "semi-infinite" for purpose of calculating the dose from beta radiation incident on the skin. However, the actual dose to sensitive skin tissues is difficult to calculate due to the effect of the beta particle energies, thickness of inert skin and clothing covering sensitive tissues. For purposes of this report the skin is taken to have a thickness of 7.0 mg/cm^2 and an occupancy factor of 1.0 is used. The skin dose based on measured effluents and average meteorological data was 2.70E-05 mrem, and 1.31E-05 mrem based on measured effluents and concurrent meteorological data.

The maximum offsite beta air dose for the year based on measured effluents and average meteorological data was 2.29E-05 mrad. The beta air dose based on measured effluents and concurrent meteorological data was 1.57E-05 mrad.

3.1.2 Radioactive Iodine & Particulate

The human thyroid exhibits a significant capacity to concentrate ingested or inhaled iodine. I-131 released during routine operation of the station may be made available to man resulting in a dose to the thyroid. C-14 is also included in this category. C-14 exhibits a capacity to concentrate in bone. C-14 is released in gaseous form and is absorbed into vegetation through photosynthesis. The principal pathways of interest for C-14 are the consumption of vegetation by humans and milk from which animals have ingested C-14 through the consumption of vegetation. With the addition of C-14 to plant effluents, human dose in this category is primarily driven by the release of C-14 from the plant.

The hypothetical dose to the maximum exposed individual living near the station via ingestion of milk and vegetation was calculated. The source of milk and vegetation was assumed to be at the nearest site boundary with the cows pastured and vegetation grown from May through October. The maximum dose from radioactive iodine and particulate (including C-14) to any organ was 7.33E-01 mrem (child/bone) based on measured effluents and average meteorological data and 6.45E-01 mrem based on measured effluents and concurrent meteorological data. The maximum dose from radioactive iodine and particulate (including C-14) to the whole body was 1.50E-01 mrem (child) based on measured effluents and average meteorological data and 1.32E-01 mrem based on measured effluents and concurrent meteorological data.

3.1.3 Gaseous Total Dose

The maximum total dose from gaseous releases to any organ was 7.33E-01 mrem (child/bone) based on measured effluents and average meteorological data, and 6.45E-01 mrem (child/bone) based on measured effluents and concurrent meteorological data. The maximum total dose from gaseous releases to the whole body was 1.50E-01 mrem (child) based on measured effluents and average meteorological data, and 1.32E-01 mrem (child) based on measured effluents and concurrent meteorological data.

3.2 Liquid Effluent Pathways

The principal pathways through the aquatic environment for potential doses to man from liquid waste are ingestion of potable water and eating aquatic foods. Liquid dose was calculated based on the ingestion of potable water and sport fish. It should be noted, however, there were no communities within 10 km downstream of the plant using the Rock River for drinking water. NRC-developed equations were used to calculate the doses to the whole body, bone, liver, thyroid, kidney, lung, lower GI tract, and skin. Specific parameters for use in the equations are given in the Exelon Offsite Dose Calculation Manual (ODCM). The maximum dose from liquid releases to any organ was 1.92E-01 mrem (adult/gilli). The maximum dose from liquid releases to the whole body was 1.38E-01 mrem (adult).

3.3 Total Dose

The maximum total dose to any organ via both gaseous and liquid effluents to any organ is 8.19E-01 mrem (child/bone). The maximum dose to the whole body via both gaseous and liquid effluents is 2.67E-01 mrem (child).

3.4 Assessment of Dose to Member of Public

Byron Station did not exceed any of the dose limits as shown below based on concurrent or historical meteorological data.

- The RETS limits on dose or dose commitment to a member of the public due to radioactive materials in liquid effluents from each reactor is 1.5 mrem to the whole body or 5 mrem to any organ during any calendar quarter and 3 mrem to the whole body or 10 mrem to any organ during a calendar year.

- The RETS limits on air dose in noble gases released in gaseous effluents to a member of the public from each reactor is 5 mrad for gamma radiation or 10 mrad for beta radiation during any calendar quarter and 10 mrad for gamma radiation or 20 mrad for beta radiation during a calendar year.

- The RETS limits on dose to a member of the public due to radioactive iodine & particulate with half-lives greater than eight days in gaseous effluents released from each reactor is 7.5 mrem to any organ during any calendar quarter and 15 mrem during a calendar year.

- The 10CFR20 limit on Total Effective Dose Equivalent to individual members of the public is 100 mrem during a calendar year.

- The 40CFR190 limits on individual members of the public is 25 mrem to the whole body, 25 mrem to any organ (except thyroid), and 75 mrem to the thyroid.

4.0 SITE METEOROLOGY

Detailed records of the site meteorological measurements taken during each calendar quarter of the year are maintained by the meteorological vendor, retained on site, and are available upon request. The data are presented as cumulative joint frequency distributions of the wind direction for the 250' level and wind speed class by atmospheric stability class determined from the temperature difference between the 250' and 30' levels. Data recovery for all measurements on the meteorological tower was 99.8% during 2018.

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APPENDIX E-1

DATA TABLES AND FIGURES

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Table 1.1-1

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES
Unit 1

REPORT FOR 2018	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
Fission and Activation Gases						
1. Total Release	Ci	8.04E-02	1.23E-01	4.30E-01	3.04E-02	6.64E-01
2. Avg. Release Rate	uCi/sec	1.03E-02	1.56E-02	5.41E-02	3.82E-03	2.11E-02
Iodine-131						
1. Total Release	Ci	5.38E-07	9.42E-08	(1)	(1)	6.32E-07
2. Avg. Release Rate	uCi/sec	6.92E-08	1.20E-08	(1)	(1)	2.00E-08
Particulates Half Life >= 8 days						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	uCi/sec	(1)	(1)	(1)	(1)	(1)
Others						
1. Total Release	Ci	1.18E+00	1.10E+00	9.62E-01	1.12E+00	4.37E+00
2. Avg. Release Rate	uCi/sec	1.52E-01	1.40E-01	1.21E-01	1.41E-01	1.38E-01
Tritium						
1. Total Release	Ci	3.51E+00	5.22E+00	3.21E+00	1.22E+00	1.32E+01
2. Avg. Release Rate	uCi/sec	4.51E-01	6.64E-01	4.04E-01	1.54E-01	4.17E-01
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	uCi/sec	(1)	(1)	(1)	(1)	(1)

(1)Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

Table 1.1-1 (cont.)

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES
Unit 2

REPORT FOR 2018	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
Fission and Activation Gases						
1. Total Release	Ci	8.04E-02	1.26E-01	4.41E-01	9.33E-02	7.41E-01
2. Avg. Release Rate	uCi/sec	1.03E-02	1.60E-02	5.55E-02	1.17E-02	2.35E-02
Iodine-131						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	uCi/sec	(1)	(1)	(1)	(1)	(1)
Particulates Half Life >= 8 days						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	uCi/sec	(1)	(1)	(1)	(1)	(1)
Others						
1. Total Release	Ci	1.22E+00	1.12E+00	1.17E+00	1.12E+00	4.64E+00
2. Avg. Release Rate	uCi/sec	1.57E-01	1.43E-01	1.47E-01	1.41E-01	1.47E-01
Tritium						
1. Total Release	Ci	8.60E+00	1.68E+01	1.28E+01	7.37E+00	4.55E+01
2. Avg. Release Rate	uCi/sec	1.11E+00	2.14E+00	1.61E+00	9.27E-01	1.44E+00
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	uCi/sec	(1)	(1)	(1)	(1)	(1)

(1)Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

Table 1.2-1

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES
Unit 1

REPORT FOR 2018	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
Fission and Activation Products						
1. Total Release	Ci	1.85E-03	2.33E-03	2.43E-03	3.60E-03	1.02E-02
2. Avg. Diluted Conc.	uCi/ml	5.05E-10	6.09E-10	6.61E-10	9.51E-10	6.82E-10
Tritium						
1. Total Release	Ci	7.89E+01	6.73E+02	5.65E+02	9.67E+01	1.41E+03
2. Avg. Diluted Conc.	uCi/ml	2.15E-05	1.75E-04	1.54E-04	2.56E-05	9.44E-05
Dissolved and Entrained Gases						
1. Total Release	Ci	(1)	2.97E-05	3.36E-04	(1)	3.66E-04
2. Avg. Diluted Conc.	uCi/ml	(1)	7.74E-12	9.14E-11	(1)	2.44E-11
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
Volume of liquid waste	liters	3.67E+09	3.83E+09	3.67E+09	3.78E+09	1.50E+10

(1)Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

Table 1.2-1 (cont.)

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES
Unit 2

REPORT FOR 2018	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
Fission and Activation Products						
1. Total Release	Ci	1.85E-03	2.33E-03	2.43E-03	3.60E-03	1.02E-02
2. Avg. Diluted Conc.	uCi/ml	5.05E-10	6.09E-10	6.61E-10	9.51E-10	6.82E-10
Tritium						
1. Total Release	Ci	7.89E+01	6.73E+02	5.65E+02	9.67E+01	1.41E+03
2. Avg. Diluted Conc.	uCi/ml	2.15E-05	1.75E-04	1.54E-04	2.56E-05	9.44E-05
Dissolved and Entrained Gases						
1. Total Release	Ci	(1)	2.97E-05	3.36E-04	(1)	3.66E-04
2. Avg. Diluted Conc.	uCi/ml	(1)	7.74E-12	9.14E-11	(1)	2.44E-11
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
Volume of liquid waste	liters	3.67E+09	3.83E+09	3.67E+09	3.78E+09	1.50E+10

(1)Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

Table 3.1-1

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

LIQUID DOSE SUMMARY

Units 1 & 2

Report for: 2018
Unit Range - From: 1 To: 2
Liquid Receptor

=== PERIOD DOSE BY ORGAN AND AGE GROUP (mrem) ========== ANNUAL 2018 =========

Agegrp	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	Skin	TB
ADULT	6.23E-02	1.40E-01	1.35E-01	1.35E-01	1.35E-01	1.92E-01	0.00E+00	1.38E-01
TEEN	6.46E-02	1.06E-01	1.01E-01	1.01E-01	1.01E-01	1.41E-01	0.00E+00	1.05E-01
CHILD	8.51E-02	1.18E-01	1.13E-01	1.13E-01	1.13E-01	1.27E-01	0.00E+00	1.17E-01
INFANT	4.76E-04	5.00E-02	5.00E-02	5.00E-02	5.00E-02	5.00E-02	0.00E+00	5.00E-02

=== SITE DOSE LIMIT ANALYSIS ============================== ANNUAL 2018 =========

Annual - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
2018 - Admin. Any Organ	ADULT	GILLI	1.92E-01	7.50E+00	2.55E+00
2018 - Admin. Total Body	ADULT	TBODY	1.38E-01	2.25E+00	6.14E+00
2018 - T.Spc. Any Organ	ADULT	GILLI	1.92E-01	1.00E+01	1.92E+00

Critical Pathway: Fresh Water Fish - Sport (FFSP)
Major Contributors (0% or greater to total)

Nuclide	Percentage
H-3	7.03E+01
CR-51	7.26E-02
MN-54	1.33E-01
FE-59	5.56E-02
CO-58	2.16E+00
CO-60	3.40E+00
NI-63	4.70E-01
ZR-95	1.39E-03
NB-95	2.34E+01
AG-110M	5.47E-04
SB-124	6.93E-05
SB-125	2.10E-03
CS-136	9.21E-03

2018 - T.Spc. Total Body	ADULT	TBODY	1.38E-01	3.00E+00	4.60E+00

Critical Pathway: Fresh Water Fish - Sport (FFSP)
Major Contributors (0% or greater to total)

Nuclide	Percentage
H-3	9.75E+01
CR-51	4.00E-04
MN-54	1.15E-02
FE-59	8.86E-03
CO-58	3.31E-01

Table 3.1-1 (cont.)

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

LIQUID DOSE SUMMARY

Units 1 & 2

Nuclide	Percentage
CO-60	5.53E-01
NI-63	1.51E+00
ZR-95	4.13E-07
NB-95	2.87E-03
AG-110M	1.10E-06
SB-124	1.34E-06
SB-125	6.29E-05
CS-136	8.09E-02

Table 3.2-1

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2018
Unit Range - From: 1 To: 2

=== I&P DOSE LIMIT ANALYSIS ========== ANNUAL 2018 =========

Annual - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
2018 - Admin. Any Organ	CHILD	BONE	7.33E-01	1.13E+01	6.52E+00
2018 - Admin. Total Body	CHILD	TBODY	1.50E-01	1.05E+01	1.43E+00
2018 - T.Spc. Any Organ	CHILD	BONE	7.33E-01	1.50E+01	4.89E+00

Receptor: 5 Composite Crit. Receptor - IP
Distance: 800 (meters) Compass Point: SSE
Critical Pathway: Vegetation
Major Contributors (0% or greater to total)

Nuclide	Percentage
H-3	0.00E+00
C-14	1.00E+02
I-131	1.53E-05

2018 - T.Spc. Total Body	CHILD	TBODY	1.50E-01	1.50E+01	1.00E+00

Receptor: 5 Composite Crit. Receptor - IP
Distance: 800 (meters) Compass Point: SSE
Critical Pathway: Vegetation
Major Contributors (0% or greater to total)

Nuclide	Percentage
H-3	2.21E+00
C-14	9.78E+01
I-131	4.30E-05

Table 3.2-1 (cont.)

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2018
Unit Range - From: 1 To: 2

=== NG DOSE LIMIT ANALYSIS ========== ANNUAL 2018 =========

Annual - Limit	Dose (mrad)	Limit (mrad)	Max % of Limit
2018 - Admin. Gamma	5.81E-05	7.50E+00	7.75E-04
2018 - Admin. Beta	2.29E-05	1.50E+01	1.53E-04
2018 - T.Spc. Gamma	5.81E-05	1.00E+01	5.81E-04

Receptor: 4 Composite Crit. Receptor - NG
Distance: 800 (meters) Compass Point: SSE

Nuclide	Percentage
AR-41	5.13E+01
KR-85M	8.36E-03
XE-135	1.46E+00
XE-133M	2.64E-02
KR-88	3.08E-02
XE-131M	1.96E-03
XE-133	4.72E+01

2018 - T.Spc. Beta	2.29E-05	2.00E+01	1.15E-04

Receptor: 4 Composite Crit. Receptor - NG
Distance: 800 (meters) Compass Point: SSE

Nuclide	Percentage
AR-41	1.13E+01
KR-85M	8.34E-03
XE-135	1.16E+00
XE-133M	7.45E-02
KR-88	3.70E-03
XE-131M	8.68E-03
XE-133	8.75E+01

Table 3.3-1

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Units 1 & 2

Report for: 2018
Unit Range - From: 1 To: 2

=== MAXIMUM DOSE ANALYSIS ================================ ANNUAL 2018 =========

Dose Type	Age Group	Organ	Dose (mrem)
Any Organ	CHILD	BONE	8.19E-01

Liquid Receptor: 0 Liquid Receptor
Gaseous Receptor: 5 Composite Crit. Receptor - IP
Distance: 800 (meters) Compass Point: SSE

Liquid Dose: 8.51E-02 % of Total: 1.04E+01
Critical Pathway: Fresh Water Fish - Sport (FFSP)
Major Contributors (0% or greater to total)

Nuclide	Percentage
H-3	0.00E+00
CR-51	0.00E+00
MN-54	0.00E+00
FE-59	2.00E-02
CO-58	0.00E+00
CO-60	0.00E+00
NI-63	9.99E+01
ZR-95	4.28E-06
NB-95	1.85E-02
AG-110M	4.15E-06
SB-124	9.22E-06
SB-125	7.29E-04
CS-136	5.48E-02

Gaseous Dose: 7.33E-01 % of Total: 8.95E+01
Critical Pathway: Vegetation (VEG)
Major Contributors (0% or greater to total)

Nuclide	Percentage
H-3	0.00E+00
C-14	1.00E+02
I-131	1.53E-05

Table 3.3-1 (cont.)

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Units 1 & 2

```
=== MAXIMUM DOSE ANALYSIS ================================ ANNUAL 2018 =========
                                Age                Dose
Dose Type                       Group    Organ     (mrem)
------------------------------  -------  --------  --------
Total Body                      CHILD    TBODY     2.67E-01
Liquid Receptor:  0   Liquid Receptor
Gaseous Receptor: 5   Composite Crit. Receptor - IP
Distance: 800 (meters)          Compass Point: SSE

Liquid Dose:       1.17E-01    % of Total: 4.38E+01
Critical Pathway:  Fresh Water Fish - Sport (FFSP)
Major Contributors (0% or greater to total)
Nuclide             Percentage
-------             ----------
H-3                 9.63E+01
CR-51               5.20E-04
MN-54               1.46E-02
FE-59               1.17E-02
CO-58               4.27E-01
CO-60               7.15E-01
NI-63               2.47E+00
ZR-95               6.10E-07
NB-95               3.75E-03
AG-110M             1.63E-06
SB-124              2.35E-06
SB-125              1.11E-04
CS-136              7.10E-02

Gaseous Dose:      1.50E-01    % of Total: 5.62E+01
Critical Pathway:  Vegetation (VEG)
Major Contributors (0% or greater to total)
Nuclide             Percentage
-------             ----------
H-3                 2.21E+00
C-14                9.78E+01
I-131               4.30E-05
```

Table 3.4-1

The following are the maximum annual calculated cumulative offsite doses resulting from Byron airborne releases in 2018 based on concurrent meteorological data:

Unit 1:

Dose	*Maximum Value*		*Sector Affected*
gamma air [(1)]	2.59×10^{-6}	mrad	South-Southeast
beta air [(2)]	6.95×10^{-6}	mrad	South-Southeast
whole body [(3)]	6.33×10^{-2}	mrem	South-Southeast
skin [(4)]	4.12×10^{-6}	mrem	South-Southeast
organ [(5)] (child-bone)	3.13×10^{-1}	mrem	South-Southeast

Unit 1 Compliance Status

10 CFR 50 Appendix I	**Yearly Objective**		**% of Appendix I**
gamma air	10.0	mrad	0.00
beta air	20.0	mrad	0.00
whole body	5.0	mrem	1.27
skin	15.0	mrem	0.00
organ	15.0	mrem	2.09

Unit 2:

Dose	*Maximum Value*		*Sector Affected*
gamma air [(1)]	7.11×10^{-6}	mrad	South-Southeast
beta air [(2)]	8.78×10^{-6}	mrad	South-Southeast
whole body [(3)]	6.90×10^{-2}	mrem	South-Southeast
skin [(4)]	9.00×10^{-6}	mrem	South-Southeast
organ [(5)] (child-bone)	3.32×10^{-1}	mrem	South-Southeast

Unit 2 Compliance Status

10 CFR 50 Appendix I	**Yearly Objective**		**% of Appendix I**
gamma air	10.0	mrad	0.00
beta air	20.0	mrad	0.00
whole body	5.0	mrem	1.38
skin	15.0	mrem	0.00
organ	15.0	mrem	2.21

---

(1) Gamma Air Dose - GASPAR II, NUREG-0597
(2) Beta Air Dose - GASPAR II, NUREG-0597
(3) Whole Body Dose - GASPAR II, NUREG-0597
(4) Skin Dose - GASPAR II, NUREG-0597
(5) Inhalation and Food Pathways Dose - GASPAR II, NUREG-0597

Data recovery: 99.8%

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APPENDIX F

METEOROLOGICAL DATA

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Byron Generating Station

Period of Record: January – March 2018
Stability Class - Extremely Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	2	0	0	0	2
SSE	0	0	3	0	0	0	3
S	0	3	9	5	0	0	17
SSW	0	2	5	1	0	0	8
SW	0	1	3	0	0	0	4
WSW	0	0	1	1	1	0	3
W	0	0	1	2	0	0	3
WNW	0	0	4	0	0	0	4
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	6	28	9	1	0	44

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Byron Generating Station

Period of Record: January – March 2018
Stability Class - Moderately Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	2	2	0	0	4
S	0	0	0	0	0	0	0
SSW	0	1	1	0	0	0	2
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	1	0	0	0	1
WNW	0	0	1	0	0	0	1
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	1	5	2	0	0	8

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Byron Generating Station

Period of Record: January - March 2018
Stability Class - Slightly Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	1	0	0	1
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	2	0	0	0	2
ESE	0	0	0	0	0	0	0
SE	0	0	1	0	0	0	1
SSE	0	0	1	0	0	0	1
S	0	0	0	0	0	0	0
SSW	0	0	1	0	0	0	1
SW	0	0	1	1	0	0	2
WSW	0	0	0	2	0	0	2
W	0	0	2	1	0	0	3
WNW	0	0	2	1	0	0	3
NW	0	0	2	2	0	0	4
NNW	0	1	0	0	0	0	1
Variable	0	0	0	0	0	0	0
Total	0	1	12	8	0	0	21

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Byron Generating Station

Period of Record: January - March 2018
Stability Class – Neutral - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	5	14	66	35	0	0	120
NNE	4	14	17	7	0	0	42
NE	3	3	17	8	1	0	32
ENE	0	9	33	17	0	0	59
E	4	15	46	5	0	0	70
ESE	2	9	14	19	1	0	45
SE	0	10	14	6	0	0	30
SSE	0	14	25	27	1	0	67
S	3	9	30	35	0	0	77
SSW	1	10	25	16	1	0	53
SW	1	24	32	12	0	0	69
WSW	1	17	26	10	4	0	58
W	3	12	45	15	8	0	83
WNW	0	21	61	18	3	0	103
NW	3	16	62	54	7	0	142
NNW	2	17	69	23	0	0	111
Variable	0	0	0	0	0	0	0
Total	32	214	582	307	26	0	1161

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 30
Hours of missing stability measurements in all stability classes: 4

Byron Generating Station

Period of Record: January - March 2018
Stability Class - Slightly Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	3	11	9	0	0	0	23
NNE	4	9	7	1	0	0	21
NE	2	5	2	5	0	0	14
ENE	7	11	11	7	0	0	36
E	3	43	10	4	2	0	62
ESE	2	16	17	10	3	1	49
SE	2	10	9	3	0	0	24
SSE	1	11	15	7	4	0	38
S	4	9	16	14	3	0	46
SSW	6	13	12	14	2	0	47
SW	11	18	20	5	0	0	54
WSW	4	25	18	5	0	0	52
W	10	41	23	0	1	2	77
WNW	8	28	6	0	0	0	42
NW	8	42	21	0	0	0	71
NNW	3	15	8	1	0	0	27
Variable	0	0	0	0	0	0	0
Total	78	307	204	76	15	3	683

Hours of calm in this stability class: 1
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Byron Generating Station

Period of Record: January - March 2018
Stability Class - Moderately Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	1	0	0	0	0	1
ENE	0	2	1	0	0	0	3
E	3	8	0	0	0	0	11
ESE	2	16	3	0	0	0	21
SE	0	5	1	0	0	0	6
SSE	0	9	13	0	0	0	22
S	4	11	7	0	0	0	22
SSW	1	5	5	0	0	0	11
SW	2	4	0	0	0	0	6
WSW	4	1	0	0	0	0	5
W	10	2	0	0	0	0	12
WNW	8	6	0	0	0	0	14
NW	3	14	0	0	0	0	17
NNW	0	4	0	0	0	0	4
Variable	0	0	0	0	0	0	0
Total	37	88	30	0	0	0	155

Hours of calm in this stability class: 4
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Byron Generating Station

Period of Record: January - March 2018
Stability Class - Extremely Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	1	1	0	0	0	0	2
ENE	0	1	2	0	0	0	3
E	0	4	0	0	0	0	4
ESE	3	1	4	0	0	0	8
SE	1	0	1	0	0	0	2
SSE	1	0	2	0	0	0	3
S	2	5	1	0	0	0	8
SSW	1	4	0	0	0	0	5
SW	0	0	0	0	0	0	0
WSW	2	0	0	0	0	0	2
W	2	0	0	0	0	0	2
WNW	3	0	0	0	0	0	3
NW	0	5	0	0	0	0	5
NNW	1	0	0	0	0	0	1
Variable	0	0	0	0	0	0	0
Total	17	21	10	0	0	0	48

Hours of calm in this stability class: 1
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Byron Generating Station

Period of Record: January - March 2018
Stability Class - Extremely Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	1	0	0	1
SSE	0	0	0	4	0	0	4
S	0	0	1	10	3	3	17
SSW	0	0	1	2	4	0	7
SW	0	0	1	0	4	0	5
WSW	0	0	1	1	0	1	3
W	0	0	0	1	2	0	3
WNW	0	0	0	4	0	0	4
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	0	4	23	13	4	44

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Byron Generating Station

Period of Record: January - March 2018
Stability Class - Moderately Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	1	0	2	0	3
S	0	0	0	0	1	0	1
SSW	0	0	0	2	0	0	2
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	1	0	0	0	1
WNW	0	0	0	1	0	0	1
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	0	2	3	3	0	8

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Byron Generating Station

Period of Record: January - March 2018
Stability Class - Slightly Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	1	0	0	1
ENE	0	0	0	0	0	0	0
E	0	0	0	2	0	0	2
ESE	0	0	0	0	0	0	0
SE	0	0	0	1	0	0	1
SSE	0	0	0	1	0	0	1
S	0	0	0	0	0	0	0
SSW	0	0	0	1	0	0	1
SW	0	0	0	2	1	0	3
WSW	0	0	0	0	1	0	1
W	0	0	2	0	1	0	3
WNW	0	0	0	2	1	0	3
NW	0	0	2	0	2	0	4
NNW	0	0	1	0	0	0	1
Variable	0	0	0	0	0	0	0
Total	0	0	5	10	6	0	21

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Byron Generating Station

Period of Record: January - March 2018
Stability Class - Neutral - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	15	36	60	30	1	143
NNE	2	10	11	19	8	0	50
NE	0	3	4	19	7	1	34
ENE	0	3	11	19	20	1	54
E	4	6	17	42	9	1	79
ESE	3	6	8	13	10	4	44
SE	1	5	11	8	9	0	34
SSE	0	5	18	21	21	3	68
S	0	2	20	20	19	9	70
SSW	1	8	5	27	16	2	59
SW	0	13	14	29	15	3	74
WSW	0	5	21	23	5	6	60
W	0	2	28	36	5	6	77
WNW	0	7	36	57	9	2	111
NW	1	5	41	68	26	1	142
NNW	0	7	27	48	10	0	92
Variable	0	0	0	0	0	0	0
Total	13	102	308	509	219	40	1191

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Byron Generating Station

Period of Record: January - March 2018
Stability Class - Slightly Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	6	9	8	0	0	23
NNE	0	2	8	8	4	0	22
NE	2	3	4	5	3	0	17
ENE	2	5	8	5	9	2	31
E	1	2	12	30	11	6	62
ESE	1	2	6	11	15	12	47
SE	0	3	10	9	3	0	25
SSE	0	3	5	7	9	5	29
S	1	2	6	11	14	14	48
SSW	1	2	9	6	19	12	49
SW	0	6	5	14	23	4	52
WSW	0	5	17	26	5	1	54
W	1	2	27	40	1	2	73
WNW	0	2	32	12	0	0	46
NW	0	1	31	24	0	0	56
NNW	0	5	21	23	1	0	50
Variable	0	0	0	0	0	0	0
Total	9	51	210	239	117	58	684

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Byron Generating Station

Period of Record: January - March 2018
Stability Class - Moderately Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	1	6	0	0	7
NNE	0	1	0	0	0	0	1
NE	0	2	0	0	0	0	2
ENE	0	0	1	0	1	0	2
E	0	1	2	2	2	0	7
ESE	0	1	2	5	2	0	10
SE	0	2	4	3	0	0	9
SSE	0	2	5	2	2	0	11
S	0	0	10	3	17	0	30
SSW	0	1	2	3	5	1	12
SW	1	0	3	2	5	0	11
WSW	0	2	4	1	0	0	7
W	0	2	8	0	0	0	10
WNW	0	0	5	2	0	0	7
NW	0	2	3	5	0	0	10
NNW	0	2	12	9	0	0	23
Variable	0	0	0	0	0	0	0
Total	1	18	62	43	34	1	159

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Byron Generating Station

Period of Record: January - March 2018
Stability Class - Extremely Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	2	2	0	0	4
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	3	4	0	0	7
ESE	0	0	0	3	2	0	5
SE	0	0	1	2	1	0	4
SSE	0	0	0	0	2	0	2
S	0	2	0	0	0	0	2
SSW	0	1	2	1	2	1	7
SW	0	0	4	2	0	0	6
WSW	0	0	4	0	0	0	4
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	1	0	0	1
NNW	0	0	3	4	0	0	7
Variable	0	0	0	0	0	0	0
Total	0	3	19	19	7	1	49

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Byron Generating Station

Period of Record: April - June 2018
Stability Class - Extremely Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	6	0	0	0	0	6
NNE	4	2	0	0	0	0	6
NE	0	0	1	0	0	0	1
ENE	5	5	1	1	0	0	12
E	2	5	0	0	0	0	7
ESE	1	2	0	0	0	0	3
SE	1	1	1	0	0	0	3
SSE	0	3	1	0	0	0	4
S	0	1	0	0	0	0	1
SSW	1	0	0	0	0	0	1
SW	0	0	0	0	0	0	0
WSW	2	0	0	0	0	0	2
W	0	4	0	0	0	0	4
WNW	0	3	1	0	0	0	4
NW	3	1	1	0	0	0	5
NNW	0	2	0	0	0	0	2
Variable	0	0	0	0	0	0	0
Total	19	35	6	1	0	0	61

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 5

Byron Generating Station

Period of Record: April - June 2018
Stability Class - Moderately Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	1	0	0	0	0	1
ENE	2	4	1	0	0	0	7
E	0	5	0	0	0	0	5
ESE	0	1	1	0	0	0	2
SE	0	2	1	0	0	0	3
SSE	0	0	0	0	0	0	0
S	0	2	0	2	0	0	4
SSW	0	0	0	0	0	0	0
SW	0	1	0	1	0	0	2
WSW	1	0	0	3	0	0	4
W	0	0	0	0	0	0	0
WNW	0	1	0	4	0	0	5
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	3	17	3	10	0	0	33

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 5

Byron Generating Station

Period of Record: April - June 2018
Stability Class - Slightly Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	2	1	0	0	3
ENE	0	2	5	0	0	0	7
E	0	4	3	0	0	0	7
ESE	0	0	1	0	0	0	1
SE	0	0	3	1	0	0	4
SSE	0	0	0	0	0	0	0
S	0	0	2	1	0	0	3
SSW	0	0	2	3	0	0	5
SW	0	1	1	1	0	0	3
WSW	0	2	1	1	0	0	4
W	0	0	3	1	0	0	4
WNW	0	0	1	0	2	0	3
NW	0	1	3	3	0	0	7
NNW	0	0	2	0	0	0	2
Variable	0	0	0	0	0	0	0
Total	0	10	29	12	2	0	53

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 5

Byron Generating Station

Period of Record: April - June 2018
Stability Class - Neutral - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	4	16	40	5	0	0	65
NNE	0	18	29	4	1	0	52
NE	2	23	52	24	11	0	112
ENE	4	34	79	25	10	1	153
E	5	59	57	4	0	0	125
ESE	2	12	12	1	0	0	27
SE	1	25	22	1	0	0	49
SSE	2	17	22	2	0	0	43
S	3	17	47	8	0	0	75
SSW	2	16	20	10	1	0	49
SW	2	18	18	5	0	0	43
WSW	4	10	21	7	2	0	44
W	2	19	25	15	1	0	62
WNW	4	12	30	26	6	0	78
NW	3	18	42	33	5	0	101
NNW	4	19	35	15	0	0	73
Variable	0	0	0	0	0	0	0
Total	44	333	551	185	37	1	1151

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 5

Byron Generating Station

Period of Record: April - June 2018
Stability Class - Slightly Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	5	9	5	0	0	0	19
NNE	4	13	9	1	0	0	27
NE	2	9	14	2	0	0	27
ENE	5	23	32	1	0	0	61
E	9	71	7	0	0	0	87
ESE	0	18	15	0	0	0	33
SE	0	21	8	0	0	0	29
SSE	0	15	9	3	0	0	27
S	7	15	29	11	0	0	62
SSW	6	18	7	11	0	0	42
SW	1	11	9	2	0	0	23
WSW	6	15	5	2	0	1	29
W	7	16	6	0	0	0	29
WNW	6	16	8	3	0	0	33
NW	9	17	5	1	0	0	32
NNW	3	25	7	1	0	0	36
Variable	0	0	0	0	0	0	0
Total	70	312	175	38	0	1	596

Hours of calm in this stability class: 1
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 5

Byron Generating Station

Period of Record: April - June 2018
Stability Class - Moderately Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	2	1	0	0	0	0	3
NNE	2	3	0	0	0	0	5
NE	0	1	2	0	0	0	3
ENE	1	3	0	0	0	0	4
E	2	17	1	0	0	0	20
ESE	6	17	9	0	0	0	32
SE	4	11	2	0	0	0	17
SSE	4	8	7	0	0	0	19
S	7	24	3	1	0	0	35
SSW	7	1	0	0	0	0	8
SW	2	3	0	0	0	0	5
WSW	8	2	0	0	0	0	10
W	12	3	0	0	0	0	15
WNW	12	2	0	0	0	0	14
NW	7	1	0	0	0	0	8
NNW	1	1	0	0	0	0	2
Variable	0	0	0	0	0	0	0
Total	77	98	24	1	0	0	200

Hours of calm in this stability class: 2
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 5

Byron Generating Station

Period of Record: April - June 2018
Stability Class - Extremely Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	0	0	0	0	0	1
NNE	0	0	0	0	0	0	0
NE	2	0	0	0	0	0	2
ENE	1	0	0	0	0	0	1
E	1	0	0	0	0	0	1
ESE	2	5	5	0	0	0	12
SE	0	3	0	0	0	0	3
SSE	2	5	3	0	0	0	10
S	5	7	1	0	0	0	13
SSW	5	1	0	0	0	0	6
SW	4	0	0	0	0	0	4
WSW	6	0	0	0	0	0	6
W	3	0	0	0	0	0	3
WNW	3	1	0	0	0	0	4
NW	6	1	0	0	0	0	7
NNW	4	0	0	0	0	0	4
Variable	0	0	0	0	0	0	0
Total	45	23	9	0	0	0	77

Hours of calm in this stability class: 5
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 5

Byron Generating Station

Period of Record: April - June 2018
Stability Class - Extremely Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	1	1	0	0	0	2
NNE	1	5	1	0	0	0	7
NE	4	0	2	0	0	0	6
ENE	2	2	3	2	0	0	9
E	2	3	3	0	0	0	8
ESE	0	1	2	0	0	0	3
SE	0	1	0	1	0	0	2
SSE	0	1	1	1	0	0	3
S	1	1	1	0	0	0	3
SSW	0	1	0	0	0	0	1
SW	0	1	0	0	0	0	1
WSW	0	0	0	0	0	0	0
W	0	0	3	0	0	0	3
WNW	0	2	3	0	0	0	5
NW	1	0	2	1	0	0	4
NNW	1	3	0	0	0	0	4
Variable	0	0	0	0	0	0	0
Total	12	22	22	5	0	0	61

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 5

Byron Generating Station

Period of Record: April - June 2018
Stability Class - Moderately Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	1	0	0	0	1
ENE	0	2	2	1	0	0	5
E	1	0	4	0	0	0	5
ESE	0	1	1	1	0	0	3
SE	0	1	2	0	0	0	3
SSE	0	0	0	0	0	0	0
S	0	0	2	0	2	0	4
SSW	0	0	0	0	0	0	0
SW	0	1	1	1	0	0	3
WSW	0	1	0	0	3	0	4
W	0	0	0	0	0	0	0
WNW	0	1	0	3	1	0	5
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	1	7	13	6	6	0	33

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 5

Byron Generating Station

Period of Record: April - June 2018
Stability Class - Slightly Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	2	0	1	0	3
ENE	0	1	1	4	0	0	6
E	0	1	3	4	0	0	8
ESE	0	0	0	1	0	0	1
SE	0	0	2	2	0	0	4
SSE	0	0	0	1	0	0	1
S	0	0	2	0	0	0	2
SSW	0	0	1	1	3	0	5
SW	0	0	1	1	1	0	3
WSW	0	0	3	0	1	0	4
W	0	0	2	2	0	0	4
WNW	0	0	0	3	0	2	5
NW	0	0	2	3	0	0	5
NNW	0	0	2	0	0	0	2
Variable	0	0	0	0	0	0	0
Total	0	2	21	22	6	2	53

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 5

Byron Generating Station

Period of Record: April - June 2018
Stability Class - Neutral - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	2	5	30	22	0	0	59
NNE	1	12	20	18	1	1	53
NE	1	20	26	37	15	10	109
ENE	2	15	36	60	28	17	158
E	3	18	66	44	7	0	138
ESE	2	10	8	7	0	1	28
SE	1	14	17	14	1	0	47
SSE	0	16	17	12	3	0	48
S	5	9	38	16	4	0	72
SSW	1	8	19	13	6	3	50
SW	0	14	16	6	6	2	44
WSW	2	7	20	11	7	3	50
W	1	11	18	19	8	1	58
WNW	3	7	17	28	19	5	79
NW	2	11	24	39	16	2	94
NNW	2	11	31	16	4	0	64
Variable	0	0	0	0	0	0	0
Total	28	188	403	362	125	45	1151

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 5

Byron Generating Station

Period of Record: April - June 2018
Stability Class - Slightly Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	4	14	8	1	0	27
NNE	1	2	10	8	2	0	23
NE	1	7	10	10	2	0	30
ENE	1	5	13	31	15	0	65
E	2	10	43	24	1	0	80
ESE	1	3	10	22	7	0	43
SE	0	5	4	9	1	0	19
SSE	2	6	5	7	8	4	32
S	1	1	6	20	13	5	46
SSW	0	5	11	21	17	4	58
SW	1	7	7	12	5	0	32
WSW	0	2	6	9	4	2	23
W	0	4	13	8	0	0	25
WNW	1	2	10	14	5	0	32
NW	1	10	15	9	0	0	35
NNW	1	4	16	6	0	0	27
Variable	0	0	0	0	0	0	0
Total	13	77	193	218	81	15	597

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 5

Byron Generating Station

Period of Record: April - June 2018
Stability Class - Moderately Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	4	1	1	0	0	6
NNE	0	1	0	0	0	0	1
NE	0	2	1	1	0	0	4
ENE	0	4	4	2	0	0	10
E	1	2	9	8	0	0	20
ESE	1	2	4	10	6	0	23
SE	0	0	8	12	2	0	22
SSE	0	0	7	7	3	1	18
S	0	1	5	6	6	1	19
SSW	2	1	1	14	3	0	21
SW	0	2	4	1	0	0	7
WSW	2	1	2	2	0	0	7
W	1	1	3	6	0	0	11
WNW	0	2	4	1	0	0	7
NW	1	3	9	1	0	0	14
NNW	0	4	7	1	0	0	12
Variable	0	0	0	0	0	0	0
Total	8	30	69	73	20	2	202

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 5

Byron Generating Station

Period of Record: April - June 2018
Stability Class - Extremely Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	1	9	0	0	0	11
NNE	0	0	0	0	0	0	0
NE	0	0	1	0	0	0	1
ENE	0	3	0	0	0	0	3
E	1	0	0	0	0	0	1
ESE	0	0	0	2	5	0	7
SE	0	0	1	2	3	0	6
SSE	0	0	1	2	0	0	3
S	1	3	5	3	3	0	15
SSW	1	3	1	4	0	0	9
SW	0	1	4	1	0	0	6
WSW	1	0	4	0	0	0	5
W	0	0	1	0	0	0	1
WNW	2	2	2	0	0	0	6
NW	0	0	3	0	0	0	3
NNW	0	4	1	0	0	0	5
Variable	0	0	0	0	0	0	0
Total	7	17	33	14	11	0	82

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 5

Byron Generating Station

Period of Record: July - September 2018
Stability Class - Extremely Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	1	1	0	0	0	3
NNE	0	7	0	0	0	0	7
NE	1	2	3	0	0	0	6
ENE	1	5	0	0	0	0	6
E	0	2	0	0	0	0	2
ESE	4	2	0	0	0	0	6
SE	3	3	0	0	0	0	6
SSE	0	1	7	0	0	0	8
S	0	5	0	0	0	0	5
SSW	0	4	1	0	0	0	5
SW	0	3	0	0	0	0	3
WSW	0	2	0	0	0	0	2
W	1	0	0	0	0	0	1
WNW	0	0	0	0	0	0	0
NW	0	1	1	0	0	0	2
NNW	2	1	4	0	0	0	7
Variable	0	0	0	0	0	0	0
Total	13	39	17	0	0	0	69

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 7

Byron Generating Station

Period of Record: July - September 2018
Stability Class - Moderately Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	3	0	0	0	0	3
NNE	0	0	2	0	0	0	2
NE	0	3	3	0	0	0	6
ENE	1	0	0	0	0	0	1
E	0	1	0	0	0	0	1
ESE	0	1	0	0	0	0	1
SE	0	1	0	0	0	0	1
SSE	0	1	2	0	0	0	3
S	1	2	1	1	0	0	5
SSW	0	7	2	0	0	0	9
SW	0	2	3	0	0	0	5
WSW	0	2	0	0	0	0	2
W	0	0	0	0	0	0	0
WNW	0	1	1	0	0	0	2
NW	0	0	0	0	0	0	0
NNW	0	3	0	0	0	0	3
Variable	0	0	0	0	0	0	0
Total	2	27	14	1	0	0	44

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 7

Byron Generating Station

Period of Record: July - September 2018
Stability Class - Slightly Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	3	0	0	0	0	3
NNE	0	0	0	0	0	0	0
NE	0	1	0	0	0	0	1
ENE	0	4	3	0	0	0	7
E	0	4	1	0	0	0	5
ESE	1	1	0	0	0	0	2
SE	1	2	0	0	0	0	3
SSE	0	3	1	0	0	0	4
S	0	4	2	2	0	0	8
SSW	0	6	8	0	0	0	14
SW	0	4	2	0	0	0	6
WSW	0	1	1	0	0	0	2
W	1	2	0	0	0	0	3
WNW	0	2	2	0	0	0	4
NW	0	4	4	0	0	0	8
NNW	0	3	2	0	0	0	5
Variable	0	0	0	0	0	0	0
Total	3	44	26	2	0	0	75

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 7

Byron Generating Station

Period of Record: July - September 2018
Stability Class - Neutral - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	8	30	23	2	0	0	63
NNE	3	26	8	0	0	0	37
NE	6	15	30	0	0	0	51
ENE	8	25	9	0	0	0	42
E	4	25	1	0	0	0	30
ESE	8	25	10	0	0	0	43
SE	6	36	8	1	0	0	51
SSE	5	35	20	3	0	0	63
S	3	38	29	3	0	0	73
SSW	7	24	36	6	0	0	73
SW	4	29	15	0	0	0	48
WSW	2	20	12	4	0	0	38
W	3	17	10	1	0	0	31
WNW	6	19	20	6	0	0	51
NW	3	19	33	5	0	0	60
NNW	4	28	50	2	0	0	84
Variable	0	0	0	0	0	0	0
Total	80	411	314	33	0	0	838

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 7

Byron Generating Station

Period of Record: July - September 2018
Stability Class - Slightly Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	7	24	6	1	0	0	38
NNE	4	42	8	0	0	0	54
NE	3	8	15	0	0	0	26
ENE	6	19	3	0	0	0	28
E	16	35	0	0	0	0	51
ESE	4	25	4	0	0	0	33
SE	9	26	9	0	0	0	44
SSE	9	23	12	1	0	0	45
S	8	36	31	5	0	0	80
SSW	7	19	22	9	0	0	57
SW	10	13	4	0	0	0	27
WSW	7	11	1	1	0	0	20
W	13	10	1	0	0	0	24
WNW	10	18	6	1	0	0	35
NW	3	21	5	1	0	0	30
NNW	8	10	10	0	0	0	28
Variable	0	0	0	0	0	0	0
Total	124	340	137	19	0	0	620

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 7

Byron Generating Station

Period of Record: July - September 2018
Stability Class - Moderately Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	7	5	0	0	0	0	12
NNE	1	4	0	0	0	0	5
NE	3	4	0	0	0	0	7
ENE	2	3	0	0	0	0	5
E	13	31	0	0	0	0	44
ESE	8	25	4	0	0	0	37
SE	6	41	0	0	0	0	47
SSE	7	44	1	0	0	0	52
S	6	12	4	0	0	0	22
SSW	11	6	1	0	0	0	18
SW	12	3	0	0	0	0	15
WSW	10	0	0	0	0	0	10
W	15	0	0	0	0	0	15
WNW	16	0	0	0	0	0	16
NW	19	3	0	0	0	0	22
NNW	9	7	0	0	0	0	16
Variable	0	0	0	0	0	0	0
Total	145	188	10	0	0	0	343

Hours of calm in this stability class: 1
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 7

Byron Generating Station

Period of Record: July - September 2018
Stability Class - Extremely Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	1	0	0	0	0	0	1
NE	1	0	0	0	0	0	1
ENE	2	2	0	0	0	0	4
E	7	7	0	0	0	0	14
ESE	4	23	0	0	0	0	27
SE	4	16	0	0	0	0	20
SSE	16	3	0	0	0	0	19
S	24	10	0	0	0	0	34
SSW	15	1	0	0	0	0	16
SW	7	0	0	0	0	0	7
WSW	8	0	0	0	0	0	8
W	9	0	0	0	0	0	9
WNW	17	0	0	0	0	0	17
NW	25	2	0	0	0	0	27
NNW	4	0	0	0	0	0	4
Variable	0	0	0	0	0	0	0
Total	144	64	0	0	0	0	208

Hours of calm in this stability class: 3
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 7

Byron Generating Station

Period of Record: July - September 2018
Stability Class - Extremely Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	3	0	4	0	0	7
NNE	0	2	4	0	0	0	6
NE	0	0	4	3	0	0	7
ENE	0	3	3	0	0	0	6
E	0	1	1	0	0	0	2
ESE	1	4	2	0	0	0	7
SE	0	2	0	0	0	0	2
SSE	0	3	0	6	0	0	9
S	0	0	3	1	0	0	4
SSW	0	1	4	4	0	0	9
SW	0	0	2	0	0	0	2
WSW	0	1	1	0	0	0	2
W	1	0	0	0	0	0	1
WNW	0	0	0	0	0	0	0
NW	0	1	1	0	0	0	2
NNW	0	1	2	0	0	0	3
Variable	0	0	0	0	0	0	0
Total	2	22	27	18	0	0	69

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 7

Byron Generating Station

Period of Record: July - September 2018
Stability Class - Moderately Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	2	1	0	0	0	3
NNE	0	0	0	0	0	0	0
NE	0	0	0	5	0	0	5
ENE	0	2	1	0	0	0	3
E	0	1	1	0	0	0	2
ESE	0	0	2	0	0	0	2
SE	0	0	0	0	0	0	0
SSE	0	2	0	2	0	0	4
S	0	0	2	0	1	0	3
SSW	0	1	6	1	0	0	8
SW	0	2	1	3	0	0	6
WSW	0	2	0	0	0	0	2
W	0	1	0	0	0	0	1
WNW	0	1	0	1	0	0	2
NW	0	2	0	0	0	0	2
NNW	0	1	0	0	0	0	1
Variable	0	0	0	0	0	0	0
Total	0	17	14	12	1	0	44

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 7

Byron Generating Station

Period of Record: July - September 2018
Stability Class - Slightly Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	4	1	0	0	0	5
NNE	0	2	0	0	0	0	2
NE	0	0	0	0	0	0	0
ENE	0	2	3	2	1	0	8
E	0	0	4	0	0	0	4
ESE	0	1	3	0	0	0	4
SE	0	0	1	0	0	0	1
SSE	0	2	2	1	0	0	5
S	0	3	2	1	1	0	7
SSW	0	2	4	6	1	0	13
SW	0	2	4	2	0	0	8
WSW	0	1	0	1	0	0	2
W	0	1	1	0	0	0	2
WNW	0	0	2	2	0	0	4
NW	0	2	4	2	0	0	8
NNW	0	0	2	0	0	0	2
Variable	0	0	0	0	0	0	0
Total	0	22	33	17	3	0	75

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 7

Byron Generating Station

Period of Record: July - September 2018
Stability Class - Neutral - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	10	27	20	3	0	61
NNE	3	15	22	4	1	0	45
NE	1	3	12	23	0	0	39
ENE	4	12	21	13	1	0	51
E	1	20	10	2	0	0	33
ESE	1	25	17	2	4	0	49
SE	3	22	21	6	0	0	52
SSE	2	18	21	13	3	1	58
S	4	16	32	16	7	1	76
SSW	2	18	22	24	12	0	78
SW	2	11	15	13	3	0	44
WSW	0	9	21	8	3	1	42
W	4	8	14	1	2	1	30
WNW	1	7	19	15	7	0	49
NW	1	13	22	19	4	0	59
NNW	3	11	24	33	1	0	72
Variable	0	0	0	0	0	0	0
Total	33	218	320	212	51	4	838

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 7

Byron Generating Station

Period of Record: July - September 2018
Stability Class - Slightly Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	6	8	15	1	0	30
NNE	1	2	18	10	0	0	31
NE	1	7	13	37	0	0	58
ENE	0	5	11	8	0	0	24
E	2	12	15	10	0	0	39
ESE	2	6	16	14	4	0	42
SE	0	9	6	12	5	0	32
SSE	3	8	13	17	5	0	46
S	1	5	10	30	17	1	64
SSW	0	5	19	29	21	7	81
SW	0	5	16	13	0	0	34
WSW	0	3	13	7	2	0	25
W	1	2	11	1	0	0	15
WNW	1	7	16	10	2	0	36
NW	0	5	21	9	1	0	36
NNW	2	2	6	16	1	0	27
Variable	0	0	0	0	0	0	0
Total	14	89	212	238	59	8	620

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 7

Byron Generating Station

Period of Record: July - September 2018
Stability Class - Moderately Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	1	1	2	0	0	4
NNE	0	3	9	0	0	0	12
NE	0	6	7	3	0	0	16
ENE	0	0	5	1	0	0	6
E	1	9	11	13	2	0	36
ESE	1	0	6	16	10	0	33
SE	1	4	9	26	4	0	44
SSE	0	0	8	11	8	0	27
S	0	2	8	27	9	0	46
SSW	0	1	3	14	2	0	20
SW	1	3	2	8	0	0	14
WSW	0	3	4	7	0	0	14
W	0	3	4	2	0	0	9
WNW	0	4	15	2	0	0	21
NW	0	5	10	13	0	0	28
NNW	0	1	8	5	0	0	14
Variable	0	0	0	0	0	0	0
Total	4	45	110	150	35	0	344

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 7

Byron Generating Station

Period of Record: July - September 2018
Stability Class - Extremely Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	1	0	0	0	0	1
NNE	0	1	0	0	0	0	1
NE	2	4	1	0	0	0	7
ENE	2	4	0	0	0	0	6
E	1	2	6	2	2	0	13
ESE	0	2	5	3	4	0	14
SE	1	0	4	16	5	0	26
SSE	1	0	6	14	1	0	22
S	0	0	5	3	0	0	8
SSW	0	2	8	6	0	0	16
SW	0	1	4	10	0	0	15
WSW	0	4	7	4	0	0	15
W	1	3	9	1	0	0	14
WNW	1	8	8	0	0	0	17
NW	2	4	8	3	0	0	17
NNW	2	3	6	8	0	0	19
Variable	0	0	0	0	0	0	0
Total	13	39	77	70	12	0	211

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 7

Byron Generating Station

Period of Record: October – December 2018
Stability Class - Extremely Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	2	0	0	0	0	2
NNW	0	1	0	0	0	0	1
Variable	0	0	0	0	0	0	0
Total	0	3	0	0	0	0	3

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Byron Generating Station

Period of Record: October – December 2018
Stability Class - Moderately Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	0	0	0	0	0	1
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	1	0	0	0	1
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	2	0	0	0	0	2
NNW	0	1	0	0	0	0	1
Variable	0	0	0	0	0	0	0
Total	1	3	1	0	0	0	5

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Byron Generating Station

Period of Record: October – December 2018
Stability Class - Slightly Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	1	0	0	0	1
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	2	0	0	0	2
SSW	0	0	0	0	0	0	0
SW	0	0	2	0	0	0	2
WSW	0	0	1	0	0	0	1
W	0	0	0	0	0	0	0
WNW	0	0	1	4	0	0	5
NW	0	1	0	0	0	0	1
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	1	7	4	0	0	12

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Byron Generating Station

Period of Record: October – December 2018
Stability Class – Neutral - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	8	38	27	7	6	0	86
NNE	2	13	24	7	0	0	46
NE	2	12	6	0	0	0	20
ENE	3	14	18	9	3	0	47
E	4	21	5	0	0	0	30
ESE	3	12	17	4	0	0	36
SE	3	17	12	5	3	0	40
SSE	3	19	19	15	3	0	59
S	3	24	41	6	0	0	74
SSW	3	11	34	13	1	0	62
SW	4	19	35	7	0	0	65
WSW	4	20	37	34	7	0	102
W	4	35	44	39	12	0	134
WNW	7	32	49	33	4	2	127
NW	7	43	58	15	4	1	128
NNW	7	30	89	16	2	0	144
Variable	0	0	0	0	0	0	0
Total	67	360	515	210	45	3	1200

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Byron Generating Station

Period of Record: October – December 2018
Stability Class - Slightly Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	7	20	2	0	0	0	29
NNE	5	17	2	0	0	0	24
NE	5	10	7	1	0	0	23
ENE	6	19	7	3	3	0	38
E	11	41	16	1	0	0	69
ESE	5	12	14	9	8	0	48
SE	1	15	24	10	5	0	55
SSE	4	10	62	7	0	0	83
S	7	15	24	2	0	0	48
SSW	3	24	25	7	0	0	59
SW	7	22	15	0	0	0	44
WSW	10	27	14	2	1	0	54
W	9	26	14	3	0	0	52
WNW	9	25	20	0	0	0	54
NW	3	28	9	3	0	0	43
NNW	7	10	7	3	0	0	27
Variable	0	0	0	0	0	0	0
Total	99	321	262	51	17	0	750

Hours of calm in this stability class: 1
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Byron Generating Station

Period of Record: October – December 2018
Stability Class - Moderately Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	3	6	0	0	0	0	9
NNE	0	0	0	0	0	0	0
NE	1	0	0	0	0	0	1
ENE	1	1	2	0	0	0	4
E	0	5	2	0	0	0	7
ESE	1	11	6	0	0	0	18
SE	4	21	5	0	0	0	30
SSE	2	5	5	0	0	0	12
S	5	4	0	0	0	0	9
SSW	2	1	0	0	0	0	3
SW	3	1	0	0	0	0	4
WSW	5	1	0	0	0	0	6
W	8	10	1	0	0	0	19
WNW	9	2	0	0	0	0	11
NW	7	1	0	0	0	0	8
NNW	7	1	0	0	0	0	8
Variable	0	0	0	0	0	0	0
Total	58	70	21	0	0	0	149

Hours of calm in this stability class: 5
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Byron Generating Station

Period of Record: October – December 2018
Stability Class - Extremely Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	2	4	0	0	0	0	6
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	2	0	0	0	0	0	2
E	6	0	0	0	0	0	6
ESE	2	5	1	0	0	0	8
SE	3	1	0	0	0	0	4
SSE	4	2	0	0	0	0	6
S	6	1	0	0	0	0	7
SSW	6	1	0	0	0	0	7
SW	5	0	0	0	0	0	5
WSW	0	0	0	0	0	0	0
W	4	0	0	0	0	0	4
WNW	7	0	0	0	0	0	7
NW	8	1	0	0	0	0	9
NNW	6	1	0	0	0	0	7
Variable	0	0	0	0	0	0	0
Total	61	16	1	0	0	0	78

Hours of calm in this stability class: 5
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Byron Generating Station

Period of Record: October – December 2018
Stability Class - Extremely Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	1	0	0	0	1
NNW	0	1	1	0	0	0	2
Variable	0	0	0	0	0	0	0
Total	0	1	2	0	0	0	3

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Byron Generating Station

Period of Record: October – December 2018
Stability Class - Moderately Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	1	0	0	0	0	1
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	1	0	0	1
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	2	0	0	0	2
NNW	0	1	0	0	0	0	1
Variable	0	0	0	0	0	0	0
Total	0	2	2	1	0	0	5

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Byron Generating Station

Period of Record: October – December 2018
Stability Class - Slightly Unstable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	1	0	0	1
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	2	0	0	0	2
SSW	0	0	0	0	0	0	0
SW	0	0	0	2	0	0	2
WSW	0	0	1	0	0	0	1
W	0	0	0	0	0	0	0
WNW	0	0	0	1	3	0	4
NW	0	0	2	0	0	0	2
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	0	5	4	3	0	12

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Byron Generating Station

Period of Record: October – December 2018
Stability Class - Neutral - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	23	35	22	4	7	91
NNE	3	7	29	20	8	3	70
NE	1	5	7	4	0	2	19
ENE	1	13	7	11	2	7	41
E	2	9	15	11	1	3	41
ESE	2	7	8	14	4	0	35
SE	1	11	11	9	5	3	40
SSE	3	11	5	16	6	8	49
S	0	15	17	33	9	1	75
SSW	3	7	19	26	7	4	66
SW	2	10	23	19	11	0	65
WSW	2	6	23	36	26	3	96
W	3	21	41	30	25	18	138
WNW	3	16	37	30	32	7	125
NW	4	22	47	45	3	5	126
NNW	1	12	30	71	6	3	123
Variable	0	0	0	0	0	0	0
Total	31	195	354	397	149	74	1200

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Byron Generating Station

Period of Record: October – December 2018
Stability Class - Slightly Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	6	12	8	1	0	28
NNE	0	4	16	1	0	0	21
NE	0	7	14	6	0	0	27
ENE	2	14	11	6	3	6	42
E	1	3	33	20	3	0	60
ESE	2	4	9	17	8	15	55
SE	2	3	4	12	20	7	48
SSE	1	0	6	14	29	4	54
S	0	3	2	29	37	1	72
SSW	4	2	9	33	11	6	65
SW	0	1	10	26	5	0	42
WSW	0	2	18	24	5	1	50
W	1	3	24	21	6	0	55
WNW	2	2	31	25	1	0	61
NW	1	1	27	16	3	0	48
NNW	1	5	5	10	1	1	23
Variable	0	0	0	0	0	0	0
Total	18	60	231	268	133	41	751

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Byron Generating Station

Period of Record: October – December 2018
Stability Class - Moderately Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	6	6	0	0	0	12
NNE	0	1	2	2	1	0	6
NE	1	0	0	2	0	0	3
ENE	0	6	0	0	0	0	6
E	0	1	2	2	0	0	5
ESE	1	1	3	6	1	0	12
SE	0	1	0	18	8	0	27
SSE	0	0	3	3	4	1	11
S	1	5	5	1	4	0	16
SSW	0	0	1	4	0	0	5
SW	0	1	3	0	0	0	4
WSW	0	3	0	3	0	0	6
W	0	1	0	2	1	0	4
WNW	1	2	6	9	1	0	19
NW	0	0	6	3	0	0	9
NNW	1	1	7	0	0	0	9
Variable	0	0	0	0	0	0	0
Total	5	29	44	55	20	1	154

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Byron Generating Station

Period of Record: October – December 2018
Stability Class - Extremely Stable - 250Ft-30Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	2	2	1	1	0	0	6
NNE	1	0	3	3	0	0	7
NE	0	2	2	6	0	0	10
ENE	0	2	0	0	0	0	2
E	1	4	0	0	0	0	5
ESE	0	0	3	1	0	0	4
SE	2	2	0	2	1	0	7
SSE	0	3	4	0	0	0	7
S	1	3	3	1	0	0	8
SSW	0	3	1	0	0	0	4
SW	1	1	3	0	0	0	5
WSW	0	0	4	1	0	0	5
W	0	0	1	0	0	0	1
WNW	1	1	3	0	0	0	5
NW	0	1	0	1	0	0	2
NNW	2	1	0	2	0	0	5
Variable	0	0	0	0	0	0	0
Total	11	25	28	18	1	0	83

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

APPENDIX G

ERRATA DATA

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There is no errata data for 2018.

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APPENDIX H

ANNUAL RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM REPORT (ARGPPR)

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NRC.Docket No: 50-454
50-455

BYRON NUCLEAR GENERATING STATION
UNITS 1 and 2

Annual Radiological
Groundwater Protection Program Report

1 January Through 31 December 2018

Prepared By

Teledyne Brown Engineering
Environmental Services

Byron Nuclear Generating Station
Byron, IL 61010

April 2019

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Appendices

I. Summary and Conclusions

In 2006, Exelon instituted a comprehensive monitoring program to evaluate the impact of station operations on groundwater in the vicinity of Byron Nuclear Generating Station. The monitoring was conducted in two phases. Phase 1 of the monitoring was part of a comprehensive study initiated by Exelon to determine whether groundwater or surface water at and in the vicinity of Byron Nuclear Generating Station had been adversely impacted by any releases of radionuclides. Phase 1 was conducted by Conestoga Rovers and Associates (CRA) and the conclusions were made available to state and federal regulators as well as the public.

Phase 2 of the RGPP was conducted by Exelon corporate and station personnel to initiate follow up of Phase 1 and begin long-term monitoring at groundwater locations selected during Phase 1. This is the ninth in a series of annual reports on the status of the Radiological Groundwater Protection Program (RGPP) conducted at Byron Nuclear Generating Station. This report covers groundwater and surface water samples collected from the environment both on and off station property in 2018. During that time period, 111 analyses were performed on 54 samples from 16 locations.

Gamma-emitting radionuclides associated with licensed plant operations were not detected at concentrations greater than their respective Lower Limits of Detection (LLDs) as specified in the Offsite Dose Calculation Manual (ODCM) in any of the groundwater samples tested. In the case of tritium, Exelon specified that its laboratories achieve a lower limit of detection 10 times lower than that required by federal regulation.

In 2018, one surface water and fifteen (15) Radiological Groundwater Protection Program (RGPP) monitoring wells were sampled. The samples were obtained throughout the year and analyzed for tritium. In addition, for the samples obtained in June, a study of gamma, beta, and alpha radioisotopes was performed in accordance with Nuclear Energy Institute (NEI) 07-07, Groundwater Protection Initiative. Three wells contained levels of tritium above the lower limit of detection (LLD) of 200 pCi/L. They were: AR-4, with concentrations ranging from 283 - 372 pCi/L; AR-7, with concentrations ranging from 233 - 301 pCi/L; and AR-11, with concentrations ranging from 646 - 685 pCi/L. Wells AR-4 and AR-11 are near the Circulating Water Blowdown piping, where historical leakage through vacuum breakers was known to have occurred. Tritium concentrations in these wells have gradually decreased since being first sampled in 2006. Well AR-7 is located on-site, just west of plant structures. Tritium has been measured in this well just above detectable limits on an intermittent basis since the well was first drilled in 2006. The tritium present in this well is at or below tritium levels that have been measured in rainwater as a result of precipitation recapture from permitted gaseous releases and it is not believed to be the result of new leak(s). In August 2014, a break in the AR-7 well piping was discovered about six feet below the surface that could have served as the entry point for tritium in the

recapture water. Should the water in these aquifers migrate to off-site wells used for drinking, the off-site dose consequence from tritium present in any of these three wells would be negligible. There are no existing or new leaks evident at the site and all groundwater well sample results are well below the drinking water standard of 20,000 pCi/L tritium.

Strontium-89 (Sr-89) and Strontium-90 (Sr-90) were not detected in any samples above their respective LLDs of 10 and 1 pCi/L.

Gross Alpha analyses in the dissolved and suspended fractions were performed on groundwater samples during the second quarter sampling in 2018.

Gross Alpha (dissolved) was not detected in any groundwater locations. Gross Alpha (suspended) was not detected in any groundwater locations.

Concentrations of Gross Alpha which are slightly above detectable levels are considered to be background and are not the result of plant effluents.

In assessing all the data gathered for this report, it was concluded that the operation of Byron Nuclear Generating Station had no adverse radiological impact on the environment, and there are no known active releases into the groundwater at Byron Nuclear Generating Station.

II. Introduction

The Byron Station, a two-unit PWR station, is located about two miles east of the Rock River and approximately three miles southwest of Byron in Ogle County, Illinois. The reactors are designed to have capacities of 1,268 and 1,241 MW gross, respectively. Unit One loaded fuel in November 1984 and went on line February 2, 1985. Unit Two went on line January 9, 1987.

This report covers those analyses performed by Teledyne Brown Engineering (TBE) on samples collected in 2018.

A. Objectives of the RGPP

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

1. Identify suitable locations to monitor and evaluate potential impacts from station operations before significant radiological impact to the environment and potential drinking water sources

2. Understand the local hydrogeologic regime in the vicinity of the station and maintain up-to-date knowledge of flow patterns on the surface and shallow subsurface

3. Perform routine water sampling and radiological analysis of water from selected locations

4. Report new leaks, spills, or other detections with potential radiological significance to stakeholders in a timely manner

5. Regularly assess analytical results to identify adverse trends

6. Take necessary corrective actions to protect groundwater resources

B. Implementation of the Objectives

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

1. Exelon and its consultant identified locations as described in the Phase 1 study. Phase 1 studies were conducted by Conestoga Rovers and Associates (CRA) and the results and conclusions were made available to state and federal regulators as well as the public.

2. The Byron Nuclear Generating Station reports describe the local hydrogeologic regime. Periodically, the flow patterns on the surface and shallow subsurface are updated based on ongoing measurements.

3. Byron Nuclear Generating Station will continue to perform routine sampling and radiological analysis of water from selected locations.

4. Byron Nuclear Generating Station has implemented new procedures to identify and report new leaks, spills, or other detections with potential radiological significance in a timely manner.

5. Byron Nuclear Generating Station staff and consulting hydrogeologist assess analytical results on an ongoing basis to identify adverse trends.

C. Program Description

1. Sample Collection

Sample locations can be found in Table A–1 and Figure A–1, Appendix A.

Groundwater

Samples of water are collected, managed, transported and analyzed in accordance with approved procedures following EPA methods. Only groundwater is 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. Analytical laboratories are subject to internal quality assurance programs, industry cross-check programs, as well as nuclear industry audits. Station personnel review and evaluate all analytical data deliverables as data are received.

Analytical data results are reviewed by both station personnel and an independent 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 skin. Once tritium

enters the body, it disperses quickly and is uniformly distributed throughout the body. Tritium is excreted primarily through urine with a clearance rate characterized by an effective biological half-life of about 14 days. Within one month or so after ingestion, essentially all tritium is cleared. Organically bound tritium (tritium that is incorporated in organic compounds) can remain in the body for a longer period.

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

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

III. Program Description

A. Sample Analysis

This section describes the general analytical methodologies used by TBE to analyze the environmental samples for radioactivity for the Byron Nuclear Generating Station RGPP in 2018.

In order to achieve the stated objectives, the current program includes the following analyses (as required by procedure):

1. Concentrations of gamma emitters in groundwater

2. Concentrations of strontium in groundwater

3. Concentrations of tritium in groundwater

4. Concentrations of gross alpha in groundwater

B. Data Interpretation

The radiological data collected prior to Byron Nuclear Generating Station becoming operational were used as a baseline with which these operational data were compared. For the purpose of this report, Byron Nuclear Generating Station was considered operational at initial criticality. 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 specified by federal regulation as a minimum sensitivity value that must be achieved routinely by the analytical parameter.

2. <u>Laboratory Measurements Uncertainty</u>

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

Statistically, the exact value of a measurement is expressed as a range with a stated level of confidence. The convention is to report results with a 95% level of confidence. The uncertainty comes from calibration standards, sample volume or weight measurements, sampling uncertainty and other factors. Exelon reports the uncertainty of a measurement created by statistical process (counting error) as well as all sources of error (Total

Propagated Uncertainty or TPU). Each result has two values calculated. Exelon reports the TPU by following the result with plus or minus ± the estimated sample standard deviation, as TPU, that is obtained by propagating all sources of analytical uncertainty in measurements.

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

C. Background Analysis

A pre-operational radiological environmental monitoring program (pre-operational REMP) was conducted to establish background radioactivity levels prior to operation of the Station. The environmental media sampled and analyzed during the pre-operational REMP were atmospheric radiation, fall-out, domestic water, surface water, marine life, and foodstuffs. The results of the monitoring were detailed in the report entitled, *Environmental Radiological Monitoring for Byron Nuclear Generating Nuclear Power Station, Commonwealth Edison Company, Annual Report 1984, April, 1985*.

The pre-operational REMP contained analytical results from samples collected from the surface water and groundwater. All groundwater samples listed in the pre-Operational REMP report were <200 pCi/L.

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 (CRA 2006).

a. Tritium Production

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

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

b. Precipitation Data

Precipitation samples are routinely collected at stations around the world for the analysis of tritium and other radionuclides. Two publicly available databases that provide tritium concentrations in precipitation are Global Network of Isotopes in Precipitation (GNIP) and USEPA's RadNet database. GNIP provides tritium precipitation concentration data for samples collected worldwide from 1960 to 2006. RadNet provides tritium precipitation concentration data for samples collected at stations throughout the U.S. from 1960 up to and including 2006. Based on GNIP data for sample stations located in the U.S. Midwest, tritium concentrations peaked around 1963. This peak, which approached 10,000 pCi/L for some stations, coincided with the atmospheric testing of thermonuclear weapons. Tritium concentrations in surface water showed a sharp decline up until 1975 followed by a gradual decline since that time. Tritium concentrations in Midwest precipitation have typically been below 100 pCi/L since around 1980. Tritium concentrations in wells may still be above the 200 pCi/L detection limit from the external causes described above. Water from previous years 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 large surface water bodies, including Lake Michigan and the Mississippi River. Illinois surface water data were typically less than 100 pCi/L.

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

subject to measurement uncertainty of approximately ± 70 to 100 pCi/L.

The radio-analytical laboratory is counting tritium results to an Exelon specified LLD of 200 pCi/L. Typically, the lowest positive measurement will be reported within a range of 40 – 240 pCi/L or 140 ± 100 pCi/L. Clearly, these sample results cannot be distinguished as different from background at this concentration.

IV. Results and Discussion

A. Groundwater Results

Groundwater

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

Tritium

Samples from all locations were analyzed for tritium activity (Table B-I.1, Appendix B). Tritium values ranged from less than the detection limit to 685 pCi/L. Outside of the station boundary, tritium concentrations were all less than detection limit (<200 pCi/L). This is based on evaluation of groundwater sample results obtained as part of the Byron Station REMP. In 2018, fifteen (15) Radiological Groundwater Protection Program (RGPP) monitoring wells were sampled. The samples were obtained throughout the year and analyzed for tritium.

In addition, a study of gamma, beta and alpha radioisotopes was performed in accordance with Nuclear Energy Institute (NEI) 07-07, Groundwater Protection Initiative, for the samples obtained in June. Three wells contained levels of tritium above the lower limit of detection (LLD) of 200 pCi/L. They were: AR-4, with concentrations ranging from 283 - 372 pCi/L; AR-7, with concentrations ranging from 233 - 301 pCi/L; and AR-11, with concentrations ranging from 646 - 685 pCi/L. Wells AR-4 and AR-11 are near the Circulating Water Blowdown piping, where historical leakage through vacuum breakers was known to have occurred. Tritium concentrations in these wells have gradually decreased since being first sampled in 2006. Well AR-7 is located on-site, just west of plant structures. Tritium has been measured in this well just above detectable limits on an intermittent basis since the well was first drilled in 2006. The tritium present in this well is at or below tritium levels that have been measured in rainwater as a result of precipitation recapture from permitted gaseous releases and it is not believed to be the result of new leak(s). In August 2014, a break in the AR-7 well piping was discovered about six feet below the surface that could have served as the entry point for tritium in the recapture water. There are no existing or new leaks evident at the site and all groundwater well sample results are well below the drinking water standard of 20,000 pCi/L tritium. The tritium detected in groundwater samples has been isolated to the Galena- Platteville aquifer, which is isolated from the deeper regional groundwater aquifer by the semi-confining Glenwood Formation. Groundwater quality data from production wells and monitoring wells at the station located below this aquifer do not indicate concentrations of tritium greater than the LLD of 200 pCi/L. As such, the tritium impact is limited to the Galena- Platteville

aquifer.

Strontium

Strontium-89 (Sr-89) and Strontium-90 (Sr-90) were not detected in any samples above their respective LLDs of 10 and 1 pCi/L.

Gross Alpha (dissolved and suspended)

Gross Alpha analyses in the dissolved and suspended fractions were performed on groundwater samples during the second quarter sampling in 2018**.**

Gross Alpha (dissolved) was not detected in any groundwater locations. Gross Alpha (suspended) was not detected in any groundwater locations.

Concentrations of Gross Alpha which are slightly above detectable levels are considered to be background and are not the result of plant effluents.

Gamma Emitters

Gamma-emitting radionuclides associated with licensed plant operations were not detected at concentrations greater than their respective LLDs in any of the samples during 2018.

B. Drinking Water Well Survey

No drinking water well surveys were conducted in 2018.

C. Summary of Results – Inter-Laboratory Comparison Program

Inter-Laboratory Comparison Program results for TBE are presented in the AREOR.

D. Leaks, Spills, and Releases

There are no new previously unidentified leaks or plumes at Byron Station. There were no new leaks, spills or releases at Byron Station in 2018.

E. Trends

Wells AR-4 and AR-11 have shown an overall decrease in tritium concentration since first sampled in 2006. Tritium has been measured in Well AR-7 since 2012, however, tritium has been previously measured in this well and it is believed to be the result of precipitation recapture, not the result of a new spill or leak.

F. Investigations

There were no investigations that took place in 2018 as a result of groundwater sample results.

G. Actions Taken

1. Compensatory Actions

   No compensatory actions were initiated in 2018.

2. Installation of Monitoring Wells

   No new monitoring wells were installed in 2018.

3. Actions to Recover/Reverse Plumes

   No actions were undertaken to recover/reverse plumes in 2018.

APPENDIX A

LOCATION DESIGNATION

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TABLE A-1: Radiological Groundwater Protection Program - Sampling Locations, Distance and Direction, Byron Nuclear Generating Station, 2018

Site	Site Type	Temporary/Permanent	Distance and Direction
AR-1	Monitoring Well	Permanent	0.36 miles/NNW
AR-2	Monitoring Well	Permanent	0.6 miles/NW
AR-3	Monitoring Well	Permanent	0.8 miles/NW
AR-4	Monitoring Well	Permanent	1.36 miles/WNW
AR-5	Monitoring Well	Permanent	1.92 miles/WNW
AR-6	Monitoring Well	Permanent	2.04 miles/WNW
AR-7	Monitoring Well	Permanent	0.04 miles/W
AR-8	Monitoring Well	Permanent	0.12 miles/S
AR-9	Monitoring Well	Permanent	0.24 miles/E
AR-10	Monitoring Well	Permanent	0.28 miles/NE
AR-11	Monitoring Well	Permanent	1.36 miles/WNW
CAR-1	Monitoring Well	Permanent	2.25 miles/WNW
CAR-3	Monitoring Well	Permanent	0.16 miles/SE
DF-24 (EPA well)	Monitoring Well	Permanent	1.36 miles/WNW
GW-9	Monitoring Well	Permanent	0.9 miles/WNW
MW-1 (EPA well)	Monitoring Well	Permanent	0.6 miles/NW
MW-3 (EPA well)	Monitoring Well	Permanent	0.8 miles/NW
TW-13	Monitoring Well	Permanent	2.3 miles/WNW
TW-14	Monitoring Well	Permanent	2.25 miles/WNW
TW-15	Monitoring Well	Permanent	2.2 miles/WNW
Well 7	Monitoring Well	Permanent	0.4 miles/SE
CROP	Surface Water	Permanent	0.2 miles NE

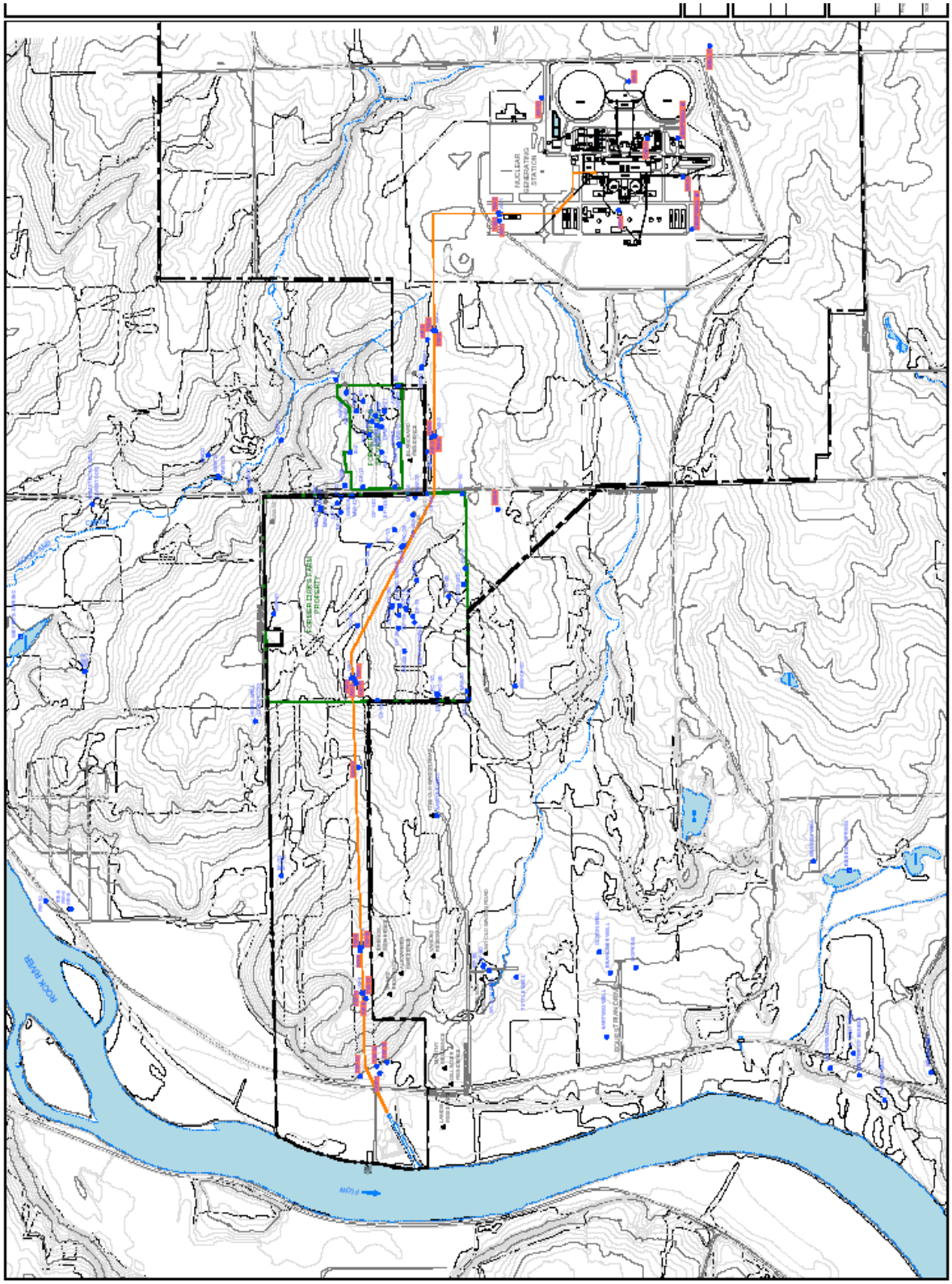

Figure A-1
Monitoring Well Locations, Byron Nuclear Generating Station, 2018

APPENDIX B

DATA TABLES

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TABLE B-I.1 **CONCENTRATIONS OF TRITIUM, STRONTIUM AND GROSS ALPHA IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2018**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)
AR-1	02/28/18	< 176				
AR-1	05/25/18	< 182	< 5.1	< 0.9	< 0.9	< 1.1
AR-1	08/22/18	< 196				
AR-1	10/30/18	< 191				
AR-2	05/23/18	< 181			< 1.0	< 1.1
AR-2	10/29/18	< 196				
AR-3	02/26/18	< 192				
AR-3	05/23/18	< 182	< 4.5	< 0.8	< 1.0	< 1.1
AR-3	08/23/18	< 192				
AR-3	10/29/18	< 200				
AR-4	02/26/18	283 ± 129				
AR-4	05/24/18	372 ± 132	< 3.4	< 0.4	< 1.1	< 1.1
AR-4	08/23/18	336 ± 133				
AR-4	10/29/18	340 ± 136				
AR-7	02/27/18	278 ± 122				
AR-7	05/23/18	301 ± 126	< 6.2	< 0.9	< 2.9	< 1.1
AR-7	08/22/18	237 ± 130				
AR-7	10/30/18	233 ± 126				
AR-8	02/27/18	< 179				
AR-8	05/23/18	< 180	< 3.5	< 0.5	< 0.7	< 1.4
AR-8	08/22/18	< 196				
AR-8	10/30/18	< 187				
AR-9	02/27/18	< 178				
AR-9	05/25/18	< 184	< 6.6	< 0.9	< 0.7	< 1.1
AR-9	08/22/18	< 194				
AR-9	10/30/18	< 185				
AR-10	02/28/18	< 173				
AR-10	05/25/18	< 182	< 5.8	< 0.8	< 1.3	< 1.1
AR-10	08/22/18	< 190				
AR-10	10/30/18	< 188				
AR-11	02/26/18	646 ± 146				
AR-11	05/24/18	675 ± 142	< 4.8	< 0.7	< 1.1	< 1.1
AR-11	08/23/18	653 ± 148				
AR-11	10/29/18	685 ± 150				
CAR-1	05/23/18	< 182			< 0.9	< 1.1
CAR-1	10/29/18	< 195				
CAR-3	02/27/18	< 180				
CAR-3	05/23/18	< 180	< 5.1	< 0.7	< 0.7	< 1.1
CAR-3	08/22/18	< 193				
CAR-3	10/30/18	< 191				
DF-24	02/26/18	< 191				
DF-24	05/23/18	< 177				
DF-24	08/23/18	< 192				
DF-24	10/29/18	< 195				
MW-1	05/23/18	< 184				
MW-1	10/29/18	< 190				
MW-3	05/23/18	< 189				
MW-3	10/29/18	< 194				
TW-13	05/23/18	< 182			< 1.1	< 3.1
TW-13	10/29/18	< 191				
*CROP	02/27/18	< 176				
*CROP	05/23/18	< 185			< 2.2	< 1.1
*CROP	08/22/18	< 189				
*CROP	10/30/18	< 196				

*Surface Water Sample

TABLE B-I.2

CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATION STATION, 2018

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
AR-1	05/25/18	< 31	< 74	< 3	< 3	< 7	< 3	< 6	< 3	< 7	< 13	< 4	< 3	< 25	< 7
AR-2	05/23/18	< 41	< 77	< 5	< 5	< 11	< 5	< 9	< 5	< 9	< 15	< 5	< 4	< 32	< 13
AR-3	05/23/18	< 37	< 83	< 3	< 4	< 7	< 3	< 7	< 4	< 7	< 15	< 4	< 4	< 29	< 10
AR-4	05/24/18	< 18	< 19	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 7	< 2	< 2	< 15	< 5
AR-7	05/23/18	< 26	< 46	< 3	< 3	< 6	< 3	< 5	< 3	< 5	< 11	< 3	< 3	< 24	< 8
AR-8	05/23/18	< 22	< 50	< 2	< 3	< 6	< 3	< 5	< 3	< 5	< 10	< 3	< 2	< 20	< 8
AR-9	05/25/18	< 29	< 35	< 3	< 4	< 8	< 3	< 7	< 4	< 6	< 11	< 3	< 3	< 26	< 8
AR-10	05/25/18	< 30	< 57	< 3	< 3	< 8	< 3	< 7	< 3	< 6	< 11	< 4	< 4	< 23	< 10
AR-11	05/24/18	< 22	< 44	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 9	< 2	< 2	< 17	< 6
CAR-1	05/23/18	< 37	< 83	< 4	< 5	< 8	< 4	< 7	< 4	< 8	< 15	< 5	< 3	< 32	< 11
CAR-3	05/23/18	< 21	< 37	< 2	< 2	< 6	< 2	< 5	< 3	< 4	< 10	< 3	< 2	< 21	< 6
TW-13	05/23/18	< 36	< 32	< 4	< 4	< 9	< 4	< 8	< 4	< 7	< 13	< 4	< 4	< 30	< 10
*CROP	05/23/18	< 28	< 43	< 3	< 3	< 7	< 3	< 5	< 3	< 5	< 12	< 3	< 3	< 23	< 8

*Surface Water Sample