



Constellation Energy Generation, LLC (CEG)  
Byron Station  
4450 N. German Church Road  
Byron, IL 61010-9794

www.constellationenergy.com

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Byron Station, Units 1 and 2  
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NRC Docket Nos. STN 50-454 and STN 50-455

Subject: 2021 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, Units 1 and 2. This report is required to be submitted to the NRC by May 15<sup>th</sup> 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 Constellation'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 Ms. Zoe Cox, Regulatory Assurance Manager, at (815) 406-2800.

Respectfully,

A handwritten signature in black ink, appearing to read "JJK", written over a white background.

John J. Kowalski  
Site Vice President  
Byron Generating Station

JJK/AH/ZC/sg

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 2021

**Prepared By**

Teledyne Brown Engineering  
Environmental Services



Byron Nuclear Generating Station  
Byron, IL 61010

**April 2022**

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## 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 2021 through 31 December 2021. During that time period, 1,434 analyses were performed on 1,272 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 (H-3), 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).



## 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 online February 2, 1985. Unit Two went online 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 2021 through 31 December 2021.

### 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 2021. 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, golden redhorse, river carpsucker, silver redhorse and freshwater drum 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 and September 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 2021, 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 2021. 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
3. Concentrations of tritium in ground and surface water
4. Concentrations of iodine-131 in air and milk
5. Concentrations of nickel-63 in surface water, fish and sediment
6. 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 2021, 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	02/02/21	Pump stopped working after 104.3 hrs due to tripped breaker; breaker was reset and pump restarted
AP/AI	BY-24	02/16/21	Sample not collected as scheduled due to road closure caused by heavy snow fall; station was informed and sample was taken on 02/17 after snow cleared
AP/AI	BY-21	04/06/21	Timer shows erratic value of 2222.2 due to malfunction; timer was exchanged and times were estimated by start and finish times
AP/AI	BY-24	04/07/21	Time indicates lower reading of 139.8 hrs on 7-day collection period due to recent power restoration
AP/AI	BY-06	05/11/21	Timer indicates 7 hrs less than expected due to power outage
AP/AI	BY-08	06/15/21	Timer indicates a low timer reading of 147.9 hrs due to power outage - next week indicated correct hours
AP/AI	BY-06	06/29/21	Timer indicates 6 hrs less than expected due to power outage
AP/AI	BY-04	07/13/21	Pump showed low Vmax; pump replaced on 07/20/21 due to consistent low Vmax
AP/AI	BY-23	07/13/21	Pump showed 53 cfh flow rate; regulator adjusted and corrected
AP/AI	BY-24	08/31/21	Timer indicates lower reading of 149.6 hrs due to power outage
OSLD	BY-112-4	10/01/21	Dosimeter missing during quarterly exchange

TABLE D-2 LISTING OF MISSED SAMPLES

Sample Type	Location Code	Collection Date	Reason
SW	BY-29	01/05/21 01/26/21	Could not collect sample due to frozen river
SW	BY-29	02/02/21 - 02/23/21	Could not collect sample due to frozen river
SW	BY-29	03/02/21	Could not collect sample due to frozen river
AP/AI	BY-24	04/20/21	No power at air sampler from 04/13 23:30 to 04/27 15:00
OSLD	BY-202-1	10/12/21	Dosimeter missing during quarterly exchange

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 2021.

## 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-1.1, Appendix C). The values ranged from 3.0 to 7.0 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-1.2, Appendix C). Tritium was detected in four samples. (Figure C-2, Appendix C). The concentrations ranged from 473 to 6,590 pCi/L. 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-1.3, 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-1.4, 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, golden redhorse, river carpsucker, silver redhorse and freshwater drum 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 5 to  $37E-3$  pCi/m<sup>3</sup> with a mean of  $19E-3$  pCi/m<sup>3</sup>. The results from the Far Field locations (Group II) ranged from 6 to  $36E-3$  pCi/m<sup>3</sup> with a mean of  $19E-3$  pCi/m<sup>3</sup>. The results from the Control location (Group III) ranged from 7 to  $33E-3$  pCi/m<sup>3</sup> with a mean of  $19E-3$  pCi/m<sup>3</sup>. Comparison of the 2021 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 2021 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 15 to 28 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 2021 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 as follows:

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	1.5	-
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 <sup>(a)</sup>	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	-

<sup>(a)</sup> Denotes the nearest industrial facility located at 1.5 miles

E. Errata Data

There was no errata data for 2021.

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  $\pm 20\%$  of the reference value
- Acceptable with Warning (flag = "W") - result falls in the  $\pm 20\%$  to  $\pm 30\%$  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, 146 out of 154 analyses performed met the specified acceptance criteria. Seven analyses did not meet the specified acceptance criteria and were addressed through the TBE Corrective Action Program. *NOTE: One analysis (soil for Tc-99) that did not meet acceptance criteria was performed for TBE information and is not on the list of required ICP analyses. A summary is found below:*

1. The ERA MRAD March 2021 Water Fe-55 result was evaluated as *Not Acceptable*. The reported value for Fe-55 was 579 pCi/L and the known result was 275 pCi/L (acceptance range 162 - 400). When reviewing the original sample data, it was found that the carrier yield was 52.6% (lower than typical water samples). Looking at the etched plate that was counted, it appeared that some loss of sample could have occurred. The sample was logged for reanalysis and used as the workgroup duplicate. The results were acceptable at 197 and 221 respectively. Yields were 97.4% and 105.7% and the plated samples were centered with no apparent loss of sample. The loss of sample during plating resulted in a low yield which produced an artificially high sample result. (NCR 21-01)
2. The MAPEP February 2021 AP Gross Alpha result was evaluated as *Not Acceptable*. The reported value was 0.371 Bq/sample and the known result was 1.77 Bq/sample (acceptance range 0.53 - 3.01). A similar failure had occurred several years prior due to the filter being placed with the wrong side up on the detector. At that time, a small dot was placed on the top of the filter prior to removal from the package to indicate the correct side for counting. The current sample was still in the detector when the result was received (dot

side facing the detector). The sample was recounted with a similar result and was flipped and recounted. The flipped result was 0.661 Bq/sample, within the acceptable range. Because TBE cannot rely on receiving correct packaging from the provider, MAPEP AP cross-checks will be counted on both sides going forward. *NOTE: The August sample had the same packaging issue (upside down).* (NCR 21-02)

3. The MAPEP February 2021 soil Ni-63 was evaluated as *Not Acceptable*. The reported value was 310 Bq/kg and the known result was 689 (acceptance range 482 - 896). All workgroup QC was reviewed with no anomalies. The analytical procedure had been revised prior to this analysis to eliminate added interferences. The sample yield was >100%, indicative of incomplete separation from interferences, leading to a lower result. The procedure was again revised after acceptable results were obtained. (NCR 21-03)
4. The ERA October 2021 water Gross Beta result was evaluated as *Not Acceptable*. The reported value was 63.0 pCi/L and the known was 55.7 (acceptance range 38.1 - 62.6) or 113% of the known. The 2-sigma error was 6.8, placing the reported result well within the acceptable range. All QA was reviewed with no anomalies. A follow-up Quick Response cross-check was analyzed with a 120% ratio (see item 7). (NCR 21-10)
5. The ERA October 2021 water Tritium result was evaluated as *Not Acceptable*. The reported value was 13,800 pCi/L and the known was 17,200 (acceptance range 15,000 - 18,900). The 2-sigma error was 1,430, placing the result within the acceptable range. TBE's internal QC acceptance is 70% - 130%, while ERA's for this sample was 87% - 110%. All QA was reviewed with no anomalies. A Quick Response follow-up cross-check was analyzed with a result of 17,500 pCi/L (known 17,800 pCi/L). (NCR 21-11)
6. The MAPEP August 2021 soil Ni-63 result was evaluated as *Not Acceptable*. The reported value was 546 Bq/kg and the known result was 1,280 Bq/kg (acceptance range 896 - 1,664). All QC was reviewed and no anomalies found. The procedure revision to remove added MAPAP interferences was ineffective for this sample. No client soil matrix samples were analyzed for Ni-63 in 2020 or 2021. The root cause investigation is still ongoing at this time. (NCR 21-13)
7. The ERA December 2021 Quick Response water Gross Beta result was evaluated as *Not Acceptable*. The reported value was 47.6 pCi/L and the known was 39.8 pCi/L or 120% of the known (acceptance range of 26.4 - 47.3). The 2-sigma error was 6.1, placing the reported result well within the acceptable range. All QA was reviewed with no anomalies. The original sample was recounted on a different detector with a result of  $40.3 \pm 6.27$  pCi/L. The "failure" of this sample and the RAD-127 was due to the narrow upper acceptance ranges assigned (119% and 112%) (NCR 21-14)

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

## **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, 2021**

NAME OF FACILITY:		BYRON NUCLEAR GENERATING STATION			DOCKET NUMBER:		50-454 & 50-455	
LOCATION OF FACILITY:		BYRON, IL			REPORTING PERIOD:		2021	
MEDIUM OR PATHWAY SAMPLED <i>(Unit of Measurement)</i>	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSES 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) (F) RANGE	STATION # NAME DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
SURFACE WATER <i>(PCI/LITER)</i>	GR-B	23	4	4.7 (7/12) 3.0 - 6.6	4.7 (7/11) 3.1 - 7.0	4.7 (7/12) 3.0 - 6.6	BY-12 INDICATOR OREGON POOL OF ROCK RIVER - DOWNSTREAM 4.5 MILES SSW OF SITE	0
	H-3	8	200	2111 (4/4) 473 - 6590	<LLD	2111 (4/4) 473 - 6590	BY-12 INDICATOR OREGON POOL OF ROCK RIVER - DOWNSTREAM 4.5 MILES SSW OF SITE	0
	NI-63	23	30	<LLD	<LLD	-		0
	GAMMA	23						
		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 <i>(PCI/LITER)</i>	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

(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, 2021**

NAME OF FACILITY:		BYRON NUCLEAR GENERATING STATION			DOCKET NUMBER:		50-454 & 50-455	
LOCATION OF FACILITY:		BYRON, IL			REPORTING PERIOD:		2021	
MEDIUM OR PATHWAY SAMPLED (Unit of Measurement)	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSES PERFORMED	REQUIRED LOWER LIMIT OF DETECTION (LLD)	INDICATOR LOCATIONS MEAN (M) (F) RANGE	CONTROL LOCATION MEAN (M) (F) RANGE	LOCATION WITH HIGHEST ANNUAL MEAN (M) MEAN (M) (F) RANGE	STATION # NAME DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
FISH (PCI/LITER)	NI-63	8	260	<LLD	<LLD	-		0
	GAMMA	8						
		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 (PCI/KG DRY)	NI-63	4	260	<LLD	<LLD	-		0
	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 (E-3 PCI/CU.METER)	GR-B	415	10	19 (363/363)	19 (51/52)	20 (52/52)	BY-23 INDICATOR BYRON NEARSITE SOUTH 0.6 MILES S OF SITE	0
	GAMMA	32		5 - 37	7 - 33	6 - 37		
		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, 2021**

NAME OF FACILITY:		BYRON NUCLEAR GENERATING STATION			DOCKET NUMBER:		50-454 & 50-455	
LOCATION OF FACILITY:		BYRON, IL			REPORTING PERIOD:		2021	
MEDIUM OR PATHWAY SAMPLED (Unit of Measurement)	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSES 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) STATION # NAME DISTANCE AND DIRECTION		NUMBER OF NONROUTINE REPORTED MEASUREMENTS
AIR IODINE (E-3 PCI/CU.METER)	GAMMA I-131 (GELI)	415	70	<LLD	<LLD	-		0
MILK (PCI/LITER)	I-131 (LOW LVL) GAMMA	38	1	<LLD	<LLD	-		0
	MN-54	38	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 (PCI/KG WET)	GAMMA	11						
	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	-		0
DIRECT RADIATION (MILLIREM/QTR.)	OSLD-QUARTERLY	331	NA	21.2 (327/327) 15 - 28	17.5 (4/4) 17 - 19	25.1 (4/4) 21 - 28	BY-107-2 INDICATOR  1.4 MILES SE	0

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

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## **APPENDIX B**

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

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TABLE B-1: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction, Byron Nuclear Generating Station, 2021

Location	Location Description	Distance & Direction From Site
<b>A. <u>Surface Water</u></b>		
BY-12	Oregon Pool of Rock River, Downstream	4.5 miles SSW
BY-29	Byron, Upstream (control)	3.0 miles N
<b>B. <u>Ground/Well Water</u></b>		
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
<b>C. <u>Milk</u></b>		
BY-20-1	Ron Snodgrass Farm	4.8 miles WSW
BY-26-2	Joseph Akins Farm (control)	12.2 miles WNW
<b>D. <u>Air Particulates / Air Iodine</u></b>		
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
<b>E. <u>Fish</u></b>		
BY-29	Byron, Upstream (control)	3.0 miles N
BY-31	Byron, Discharge	2.6 miles WNW
<b>F. <u>Sediment</u></b>		
BY-12	Oregon Pool of Rock River, Downstream	4.6 miles SSW
BY-34	Rock River, Upstream of Discharge (control)	2.6 miles WNW
<b>G. <u>Vegetation</u></b>		
Quadrant 1	5186 Cox Road, Stillman Valley	4.6 miles E
Quadrant 2	6970 Linden Wood Road, Stillman Valley	4.9 miles SE
Quadrant 3	555 Park Rd, Oregon	3.7 miles SW
Quadrant 4	4615 N Razorville Road., Byron	2.7 miles SW
Control	2327 Route 251, Rochelle	20.7 miles SE

TABLE B-1: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction, Byron Nuclear Generating Station, 2021

Location	Location Description	Distance & Direction From Site
<u>H. Environmental Dosimetry - OSLD</u>		
<u>Inner Ring</u>		
BY-101-1 and -2		0.3 miles N
BY-102-1		1.0 miles NNE
BY-102-2		1.0 miles NNE
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
<u>Outer Ring</u>		
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, 2021

Location	Location Description	Distance & Direction From Site
<u>Special Interest</u>		
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
<u>Other</u>		
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
<u>Control</u>		
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, 2021

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, 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 sampling 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 <sub>2</sub> O <sub>3</sub> :C Landauer Incorporated elements.	Landauer Incorporated

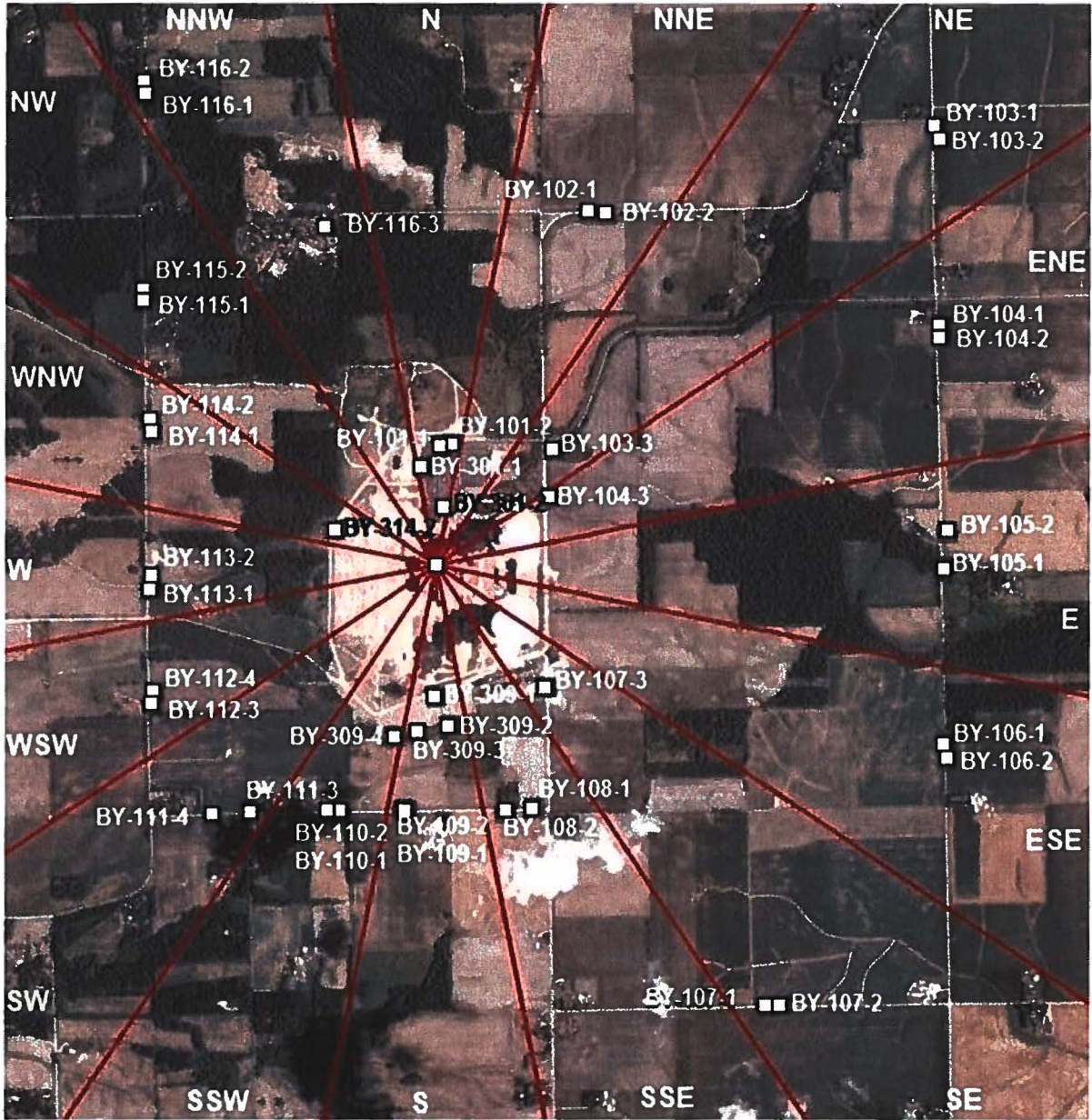


Figure B-1  
 Inner Ring and Special Interest OSRD Locations of the  
 Byron Nuclear Generating Station, 2021

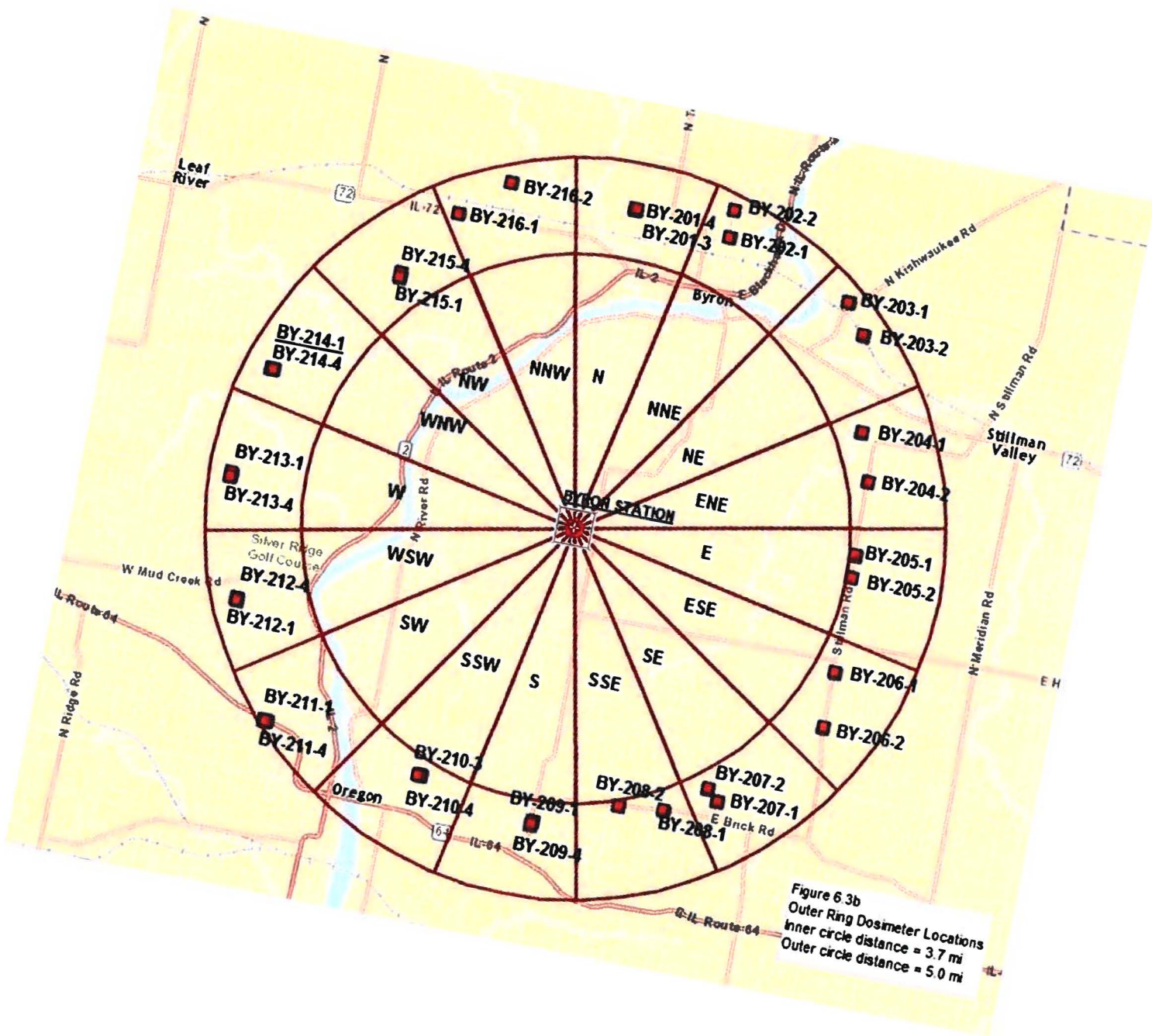


Figure 6.3b  
 Outer Ring Dosimeter Locations  
 Inner circle distance = 3.7 mi  
 Outer circle distance = 5.0 mi

Figure B-2  
 Outer Ring OSLD Locations of the  
 Byron Nuclear Generating Station, 2021

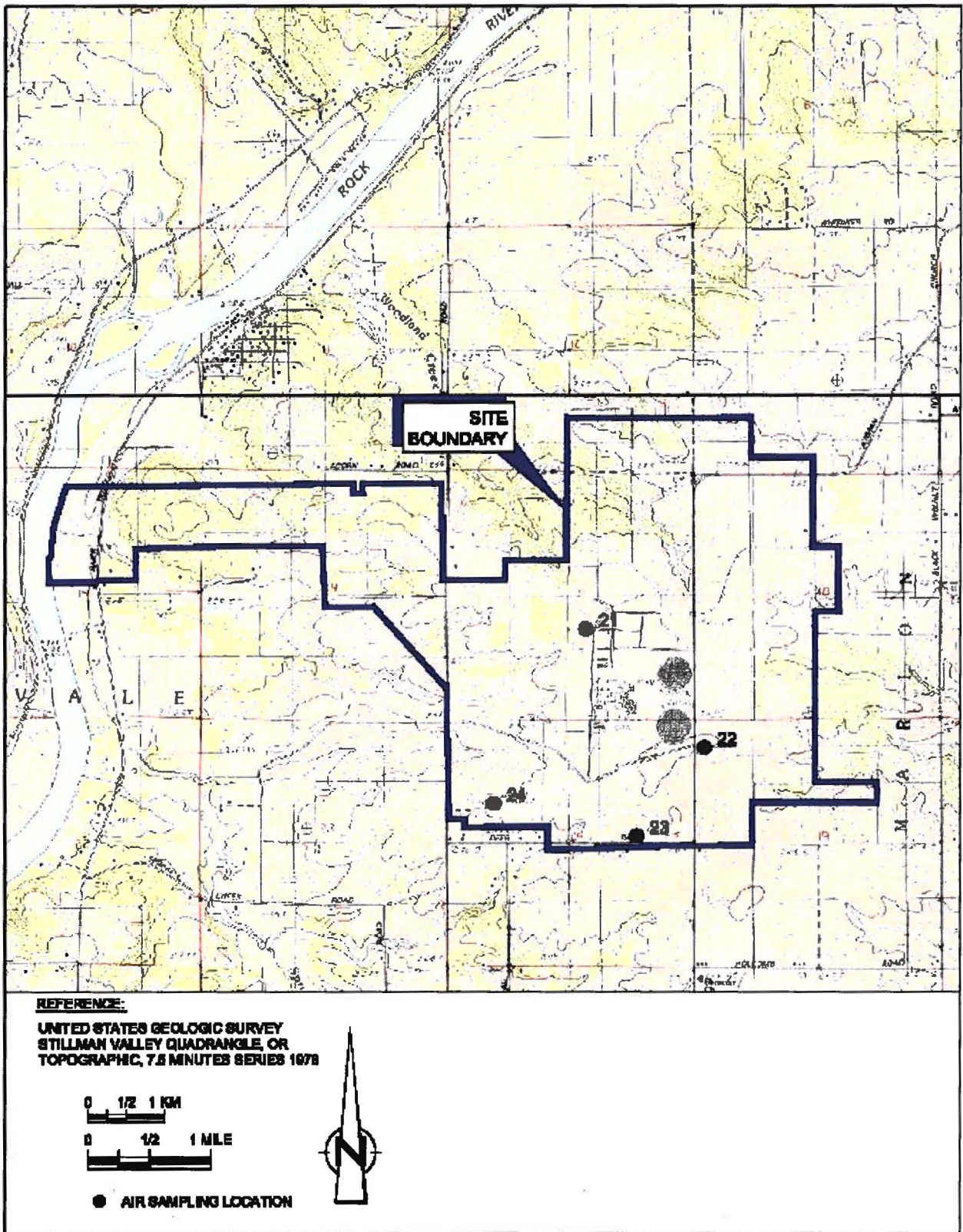
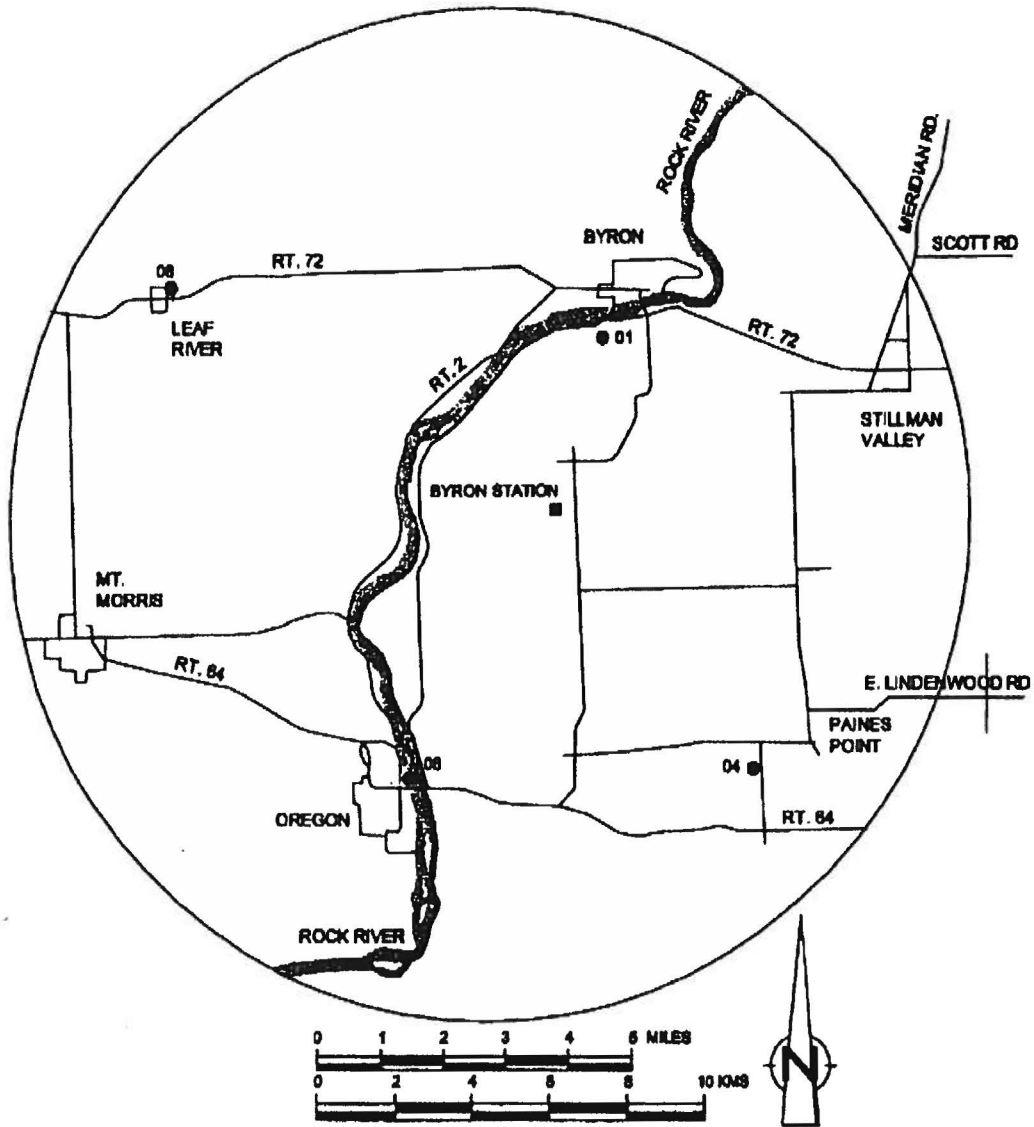


Figure B-3  
 Onsite Air Sampling Locations of the  
 Byron Nuclear Generating Station, 2021



- AIR SAMPLING LOCATION
- BYRON STATION

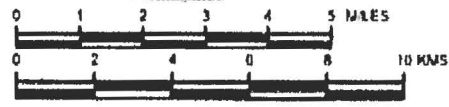
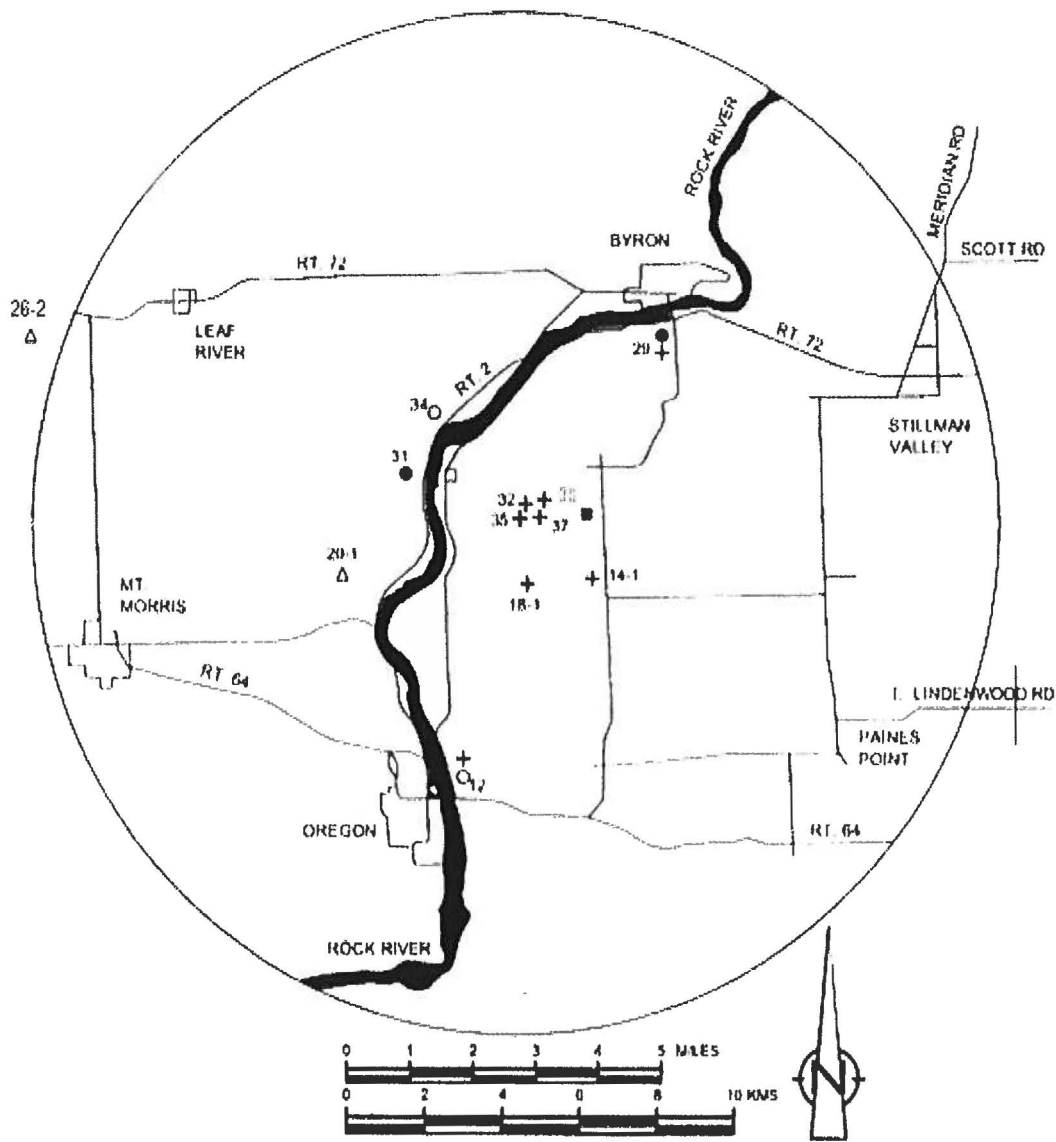
**OFFSITE DOSE CALCULATION MANUAL  
BYRON STATION**

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**FIGURE 6-2**

**OFFSITE AIR SAMPLING LOCATIONS**

Figure B-4  
Offsite Air Sampling Locations of the  
Byron Nuclear Generating Station, 2021



- FISH
- Δ MILK
- SEDIMENT
- + WATER
- BYRON STATION
- PLANT LIQUID DISCHARGE

OFFSITE DOSE CALCULATION MANUAL  
BYRON STATION

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FIGURE 6-4

INGESTION AND WATERBORNE EXPOSURE  
PATHWAY SAMPLE LOCATIONS

Figure B-5  
Ingestion and Waterborne Exposure Pathway Sampling Locations  
of the Byron Nuclear Generating Station, 2021  
B-9

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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, 2021  
RESULTS IN UNITS OF PCI/LITER  $\pm$  2 SIGMA**

COLLECTION PERIOD	BY-12	BY-29
01/12/21 - 01/19/21	< 2.9	< 2.9
02/02/21 - 02/23/21	< 3.5	(1)
03/09/21 - 03/30/21	3.7 $\pm$ 1.9	4.0 $\pm$ 1.9
04/06/21 - 04/27/21	5.3 $\pm$ 1.9	3.1 $\pm$ 1.8
05/04/21 - 05/25/21	< 3.2	< 3.2
06/01/21 - 06/29/21	< 2.7	< 2.6
07/07/21 - 07/27/21	< 3.7	< 3.7
08/03/21 - 08/31/21	5.2 $\pm$ 2.3	5.7 $\pm$ 2.0
09/07/21 - 09/28/21	4.1 $\pm$ 2.7	7.0 $\pm$ 2.9
10/05/21 - 10/26/21	6.6 $\pm$ 2.2	5.0 $\pm$ 2.1
11/02/21 - 11/30/21	5.2 $\pm$ 2.1	4.4 $\pm$ 2.1
12/07/21 - 12/28/21	3.0 $\pm$ 2.0	3.7 $\pm$ 2.0
<i>MEAN <math>\pm</math> 2 STD DEV</i>	4.7 $\pm$ 2.4	4.7 $\pm$ 2.7

Table C-I.2

**CONCENTRATIONS OF TRITIUM IN SURFACE WATER SAMPLES  
COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2021  
RESULTS IN UNITS OF PCI/LITER  $\pm$  2 SIGMA**

COLLECTION PERIOD	BY-12	BY-29
01/12/21 - 03/30/21	693 $\pm$ 154	< 199
04/06/21 - 06/29/21	473 $\pm$ 131	< 181
07/06/21 - 09/28/21	6590 $\pm$ 727	< 197
10/05/21 - 12/28/21	688 $\pm$ 138	< 196
<i>MEAN <math>\pm</math> 2 STD DEV</i>	2111 $\pm$ 5976	-

Table C-I.3

**CONCENTRATIONS OF NI-63 IN SURFACE WATER SAMPLES  
COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2021  
RESULTS IN UNITS OF PCI/LITER  $\pm$  2 SIGMA**

COLLECTION PERIOD	BY-12	BY-29
01/12/21 - 01/19/21	< 19	< 17
02/02/21 - 02/23/21	< 23	(1)
03/09/21 - 03/30/21	< 24	< 22
04/06/21 - 04/27/21	< 18	< 20
05/04/21 - 05/25/21	< 22	< 20
06/01/21 - 06/29/21	< 19	< 19
07/07/21 - 07/27/21	< 21	< 20
08/03/21 - 08/31/21	< 22	< 17
09/07/21 - 09/28/21	< 23	< 20
10/05/21 - 10/26/21	< 13	< 14
11/02/21 - 11/30/21	< 21	< 29
12/07/21 - 12/28/21	< 22	< 21
<i>MEAN</i>	-	-

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

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

Table C-I.4

**CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES  
COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2021  
RESULTS IN UNITS OF PCI/LITER  $\pm$  2 SIGMA**

SITE	COLLECTION		Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	I-131	Cs-134	Cs-137	Ba-140	La-140
	PERIOD													
BY-12	01/05/21 - 01/26/21		< 3	< 3	< 6	< 3	< 6	< 3	< 5	< 8	< 3	< 3	< 19	< 6
	02/02/21 - 02/23/21		< 4	< 4	< 12	< 5	< 13	< 4	< 10	< 13	< 5	< 4	< 26	< 11
	03/02/21 - 03/30/21		< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 11	< 2	< 2	< 20	< 6
	04/06/21 - 04/27/21		< 3	< 3	< 7	< 3	< 5	< 3	< 6	< 8	< 3	< 3	< 20	< 7
	05/04/21 - 05/25/21		< 2	< 2	< 5	< 2	< 4	< 3	< 5	< 7	< 3	< 2	< 16	< 5
	06/01/21 - 06/29/21		< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 7	< 2	< 2	< 14	< 5
	07/07/21 - 07/27/21		< 5	< 5	< 9	< 6	< 11	< 4	< 9	< 13	< 6	< 5	< 27	< 9
	08/03/21 - 08/31/21		< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 7	< 2	< 2	< 16	< 5
	09/07/21 - 09/28/21		< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 8	< 2	< 2	< 17	< 6
	10/05/21 - 10/26/21		< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 9	< 2	< 2	< 17	< 5
	11/02/21 - 11/30/21		< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 9	< 2	< 2	< 17	< 6
	12/07/21 - 12/28/21		< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 8	< 2	< 2	< 17	< 5
	<i>MEAN</i>			-	-	-	-	-	-	-	-	-	-	-
BY-29	01/12/21 - 01/19/21		< 3	< 3	< 7	< 3	< 5	< 3	< 5	< 9	< 3	< 3	< 21	< 6
	02/02/21 - 02/23/21		(1)											
	03/09/21 - 03/30/21		< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 9	< 2	< 2	< 16	< 5
	04/06/21 - 04/27/21		< 3	< 3	< 7	< 3	< 6	< 3	< 5	< 9	< 3	< 3	< 21	< 7
	05/04/21 - 05/25/21		< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 7	< 2	< 2	< 15	< 5
	06/01/21 - 06/29/21		< 1	< 2	< 3	< 1	< 3	< 2	< 3	< 5	< 1	< 1	< 10	< 3
	07/07/21 - 07/27/21		< 5	< 4	< 13	< 6	< 12	< 5	< 10	< 13	< 5	< 5	< 33	< 13
	08/03/21 - 08/31/21		< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 7	< 2	< 2	< 15	< 5
	09/07/21 - 09/28/21		< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 8	< 2	< 2	< 17	< 6
	10/05/21 - 10/26/21		< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 6	< 2	< 2	< 13	< 5
	11/02/21 - 11/30/21		< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 9	< 2	< 1	< 15	< 5
	12/07/21 - 12/28/21		< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 8	< 2	< 2	< 17	< 5
	<i>MEAN</i>			-	-	-	-	-	-	-	-	-	-	-

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

**Table C-II.1**                      **CONCENTRATIONS OF TRITIUM IN GROUND WATER SAMPLES**  
**COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2021**  
RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	BY-14-1	BY-18-1	BY-32	BY-35	BY-37	BY-38
01/12/21 - 01/12/21	< 186	< 194	< 194	< 185	< 189	< 187
04/13/21 - 04/13/21	< 187	< 187	< 185	< 186	< 191	< 185
07/13/21 - 07/13/21	< 175	< 174	< 179	< 188	< 190	< 183
10/12/21 - 10/12/21	< 141	< 192	< 183	< 182	< 200	< 184
<i>MEAN</i>	-	-	-	-	-	-

Table C-II.2

**CONCENTRATIONS OF GAMMA EMITTERS IN GROUND WATER SAMPLES  
COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2021  
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	01/12/21 - 01/12/21	< 3	< 4	< 7	< 3	< 8	< 4	< 5	< 4	< 4	< 3	< 13	< 5
	04/13/21 - 04/13/21	< 7	< 7	< 17	< 9	< 15	< 8	< 11	< 10	< 10	< 8	< 27	< 9
	07/13/21 - 07/13/21	< 7	< 5	< 16	< 7	< 17	< 8	< 13	< 8	< 9	< 8	< 24	< 6
	10/12/21 - 10/12/21	< 6	< 8	< 13	< 6	< 12	< 7	< 11	< 10	< 8	< 6	< 25	< 10
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
BY-18-1	01/12/21 - 01/12/21	< 4	< 4	< 7	< 4	< 9	< 5	< 7	< 5	< 5	< 4	< 17	< 5
	04/13/21 - 04/13/21	< 8	< 8	< 17	< 7	< 10	< 9	< 13	< 11	< 7	< 8	< 32	< 9
	07/13/21 - 07/13/21	< 8	< 8	< 12	< 6	< 18	< 9	< 13	< 8	< 8	< 8	< 30	< 7
	10/12/21 - 10/12/21	< 7	< 8	< 14	< 7	< 13	< 8	< 11	< 8	< 9	< 6	< 26	< 12
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
BY-32	01/12/21 - 01/12/21	< 4	< 4	< 8	< 3	< 8	< 4	< 6	< 5	< 4	< 3	< 14	< 5
	04/13/21 - 04/13/21	< 9	< 7	< 16	< 7	< 14	< 7	< 15	< 8	< 10	< 8	< 25	< 10
	07/13/21 - 07/13/21	< 5	< 8	< 15	< 7	< 18	< 8	< 13	< 9	< 8	< 8	< 24	< 7
	10/12/21 - 10/12/21	< 5	< 6	< 11	< 6	< 13	< 5	< 10	< 6	< 8	< 7	< 23	< 9
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
BY-35	01/12/21 - 01/12/21	< 4	< 4	< 7	< 5	< 8	< 4	< 7	< 5	< 5	< 4	< 15	< 5
	04/13/21 - 04/13/21	< 7	< 7	< 14	< 7	< 13	< 6	< 13	< 8	< 8	< 7	< 21	< 8
	07/13/21 - 07/13/21	< 6	< 6	< 11	< 7	< 15	< 8	< 10	< 8	< 7	< 8	< 26	< 8
	10/12/21 - 10/12/21	< 5	< 6	< 9	< 4	< 9	< 5	< 8	< 5	< 5	< 6	< 19	< 7
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
BY-37	01/12/21 - 01/12/21	< 4	< 3	< 8	< 4	< 9	< 4	< 6	< 5	< 4	< 4	< 15	< 5
	04/13/21 - 04/13/21	< 5	< 6	< 14	< 6	< 13	< 8	< 12	< 9	< 8	< 7	< 29	< 9
	07/13/21 - 07/13/21	< 7	< 6	< 11	< 6	< 13	< 7	< 11	< 9	< 8	< 6	< 25	< 8
	10/12/21 - 10/12/21	< 7	< 7	< 11	< 6	< 15	< 6	< 12	< 8	< 6	< 7	< 25	< 7
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-
BY-38	01/12/21 - 01/12/21	< 2	< 2	< 5	< 3	< 5	< 2	< 4	< 3	< 3	< 2	< 10	< 4
	04/13/21 - 04/13/21	< 8	< 7	< 16	< 11	< 15	< 11	< 14	< 11	< 7	< 8	< 30	< 11
	07/13/21 - 07/13/21	< 6	< 6	< 13	< 7	< 14	< 6	< 10	< 6	< 7	< 7	< 21	< 6
	10/12/21 - 10/12/21	< 6	< 6	< 15	< 7	< 14	< 6	< 13	< 9	< 6	< 8	< 29	< 9
	MEAN	-	-	-	-	-	-	-	-	-	-	-	-

C-4

Table C-III.1

**CONCENTRATIONS OF NICKEL-63 AND GAMMA EMITTERS IN FISH SAMPLES  
COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2021  
RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA**

SITE	COLLECTION	Ni-63	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
	PERIOD												
<b>BY-29</b>													
<i>Quillback</i>	05/13/21 - 05/13/21	< 214	< 52	< 51	< 85	< 39	< 96	< 53	< 90	< 64	< 44	< 214	< 68
<i>Golden Redhorse</i>	05/13/21 - 05/13/21	< 85	< 52	< 52	< 112	< 70	< 150	< 57	< 91	< 61	< 39	< 239	< 90
<i>River Carpsucker</i>	10/19/21 - 10/19/21	< 131	< 57	< 71	< 120	< 51	< 113	< 53	< 123	< 51	< 43	< 307	< 107
<i>Golden Redhorse</i>	10/19/21 - 10/19/21	< 179	< 53	< 49	< 152	< 66	< 133	< 83	< 120	< 75	< 66	< 370	< 61
	<i>MEAN</i>	-	-	-	-	-	-	-	-	-	-	-	-
<b>BY-31</b>													
<i>Quillback</i>	05/13/21 - 05/13/21	< 172	< 86	< 74	< 192	< 80	< 164	< 91	< 157	< 94	< 82	< 388	< 100
<i>Silver Redhorse</i>	05/13/21 - 05/13/21	< 182	< 48	< 50	< 96	< 75	< 153	< 63	< 100	< 56	< 55	< 258	< 110
<i>Freshwater Drum</i>	10/19/21 - 10/19/21	< 136	< 45	< 58	< 105	< 46	< 75	< 51	< 98	< 64	< 53	< 327	< 119
<i>River Carpsucker</i>	10/19/21 - 10/19/21	< 134	< 70	< 62	< 146	< 64	< 135	< 68	< 117	< 67	< 68	< 393	< 164
	<i>MEAN</i>	-	-	-	-	-	-	-	-	-	-	-	-

Table C-IV.1

**CONCENTRATIONS OF NICKEL-63 AND GAMMA EMITTERS IN SEDIMENT SAMPLES  
COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2021  
RESULTS IN UNITS OF PCI/KG DRY ± 2 SIGMA**

SITE	COLLECTION	Ni-63	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
	PERIOD												
BY-12	05/11/21 - 05/11/21	< 208	< 107	< 100	< 181	< 69	< 207	< 107	< 161	< 127	< 129	< 507	< 149
	10/05/21 - 10/05/21	< 244	< 103	< 90	< 193	< 106	< 160	< 91	< 139	< 100	< 115	< 365	< 114
	<i>MEAN</i>	-	-	-	-	-	-	-	-	-	-	-	-
BY-34	05/11/21 - 05/11/21	< 236	< 70	< 61	< 140	< 50	< 144	< 88	< 117	< 78	< 75	< 365	< 70
	10/05/21 - 10/05/21	< 247	< 53	< 59	< 94	< 66	< 108	< 62	< 116	< 64	< 72	< 300	< 100
	<i>MEAN</i>	-	-	-	-	-	-	-	-	-	-	-	-

Table C-V.1

**CONCENTRATIONS OF GROSS BETA IN AIR PARTICULATE SAMPLES  
COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2021  
RESULTS IN UNITS OF E-3 PCI/CU METER  $\pm$  2 SIGMA**

COLLECTION PERIOD	GROUP I				GROUP II			GROUP III
	BY-21	BY-22	BY-23	BY-24	BY-01	BY-04	BY-06	BY-08
12/29/20 - 01/05/21	10 $\pm$ 4	26 $\pm$ 5	21 $\pm$ 4	24 $\pm$ 5	24 $\pm$ 5	20 $\pm$ 4	21 $\pm$ 4	21 $\pm$ 4
01/05/21 - 01/12/21	16 $\pm$ 4	19 $\pm$ 4	18 $\pm$ 4	19 $\pm$ 4	16 $\pm$ 4	17 $\pm$ 4	22 $\pm$ 4	8 $\pm$ 3
01/12/21 - 01/19/21	25 $\pm$ 5	24 $\pm$ 5	23 $\pm$ 5	22 $\pm$ 5	24 $\pm$ 5	21 $\pm$ 5	24 $\pm$ 5	7 $\pm$ 4
01/19/21 - 01/26/21	16 $\pm$ 4	12 $\pm$ 4	13 $\pm$ 4	13 $\pm$ 4	14 $\pm$ 4	13 $\pm$ 4	14 $\pm$ 4	< 5
01/26/21 - 02/02/21	20 $\pm$ 4	19 $\pm$ 4	19 $\pm$ 4	18 $\pm$ 4	16 $\pm$ 4	12 $\pm$ 4	14 $\pm$ 4	22 $\pm$ 6
02/02/21 - 02/09/21	27 $\pm$ 5	29 $\pm$ 5	30 $\pm$ 5	35 $\pm$ 5	27 $\pm$ 5	28 $\pm$ 5	31 $\pm$ 5	32 $\pm$ 5
02/09/21 - 02/16/21	19 $\pm$ 4	18 $\pm$ 4	22 $\pm$ 4	21 $\pm$ 4	23 $\pm$ 4	21 $\pm$ 4	21 $\pm$ 4	21 $\pm$ 4
02/16/21 - 02/23/21	22 $\pm$ 4	36 $\pm$ 5	26 $\pm$ 5	32 $\pm$ 6	27 $\pm$ 5	32 $\pm$ 5	32 $\pm$ 5	29 $\pm$ 5
02/23/21 - 03/02/21	16 $\pm$ 4	17 $\pm$ 4	12 $\pm$ 4	18 $\pm$ 4	17 $\pm$ 4	16 $\pm$ 4	14 $\pm$ 4	13 $\pm$ 4
03/02/21 - 03/09/21	13 $\pm$ 4	15 $\pm$ 4	10 $\pm$ 3	15 $\pm$ 4	12 $\pm$ 4	11 $\pm$ 4	15 $\pm$ 4	15 $\pm$ 4
03/09/21 - 03/16/21	16 $\pm$ 4	16 $\pm$ 4	21 $\pm$ 4	16 $\pm$ 4	21 $\pm$ 4	15 $\pm$ 4	17 $\pm$ 4	14 $\pm$ 4
03/16/21 - 03/23/21	16 $\pm$ 5	16 $\pm$ 5	16 $\pm$ 4	19 $\pm$ 5	15 $\pm$ 4	7 $\pm$ 4	16 $\pm$ 5	17 $\pm$ 5
03/23/21 - 03/30/21	11 $\pm$ 4	12 $\pm$ 4	10 $\pm$ 4	11 $\pm$ 4	11 $\pm$ 4	14 $\pm$ 4	10 $\pm$ 4	9 $\pm$ 4
03/30/21 - 04/06/21	23 $\pm$ 5	18 $\pm$ 5	24 $\pm$ 5	23 $\pm$ 5	23 $\pm$ 5	19 $\pm$ 5	25 $\pm$ 5	22 $\pm$ 5
04/06/21 - 04/13/21	7 $\pm$ 4	8 $\pm$ 4	6 $\pm$ 4	6 $\pm$ 4	8 $\pm$ 4	9 $\pm$ 4	6 $\pm$ 4	11 $\pm$ 4
04/13/21 - 04/20/21	9 $\pm$ 3	9 $\pm$ 3	20 $\pm$ 4	(1)	6 $\pm$ 3	10 $\pm$ 4	11 $\pm$ 4	10 $\pm$ 4
04/20/21 - 04/27/21	19 $\pm$ 4	20 $\pm$ 5	19 $\pm$ 4	17 $\pm$ 5	16 $\pm$ 4	18 $\pm$ 4	22 $\pm$ 5	17 $\pm$ 4
04/27/21 - 05/04/21	16 $\pm$ 4	18 $\pm$ 4	18 $\pm$ 4	17 $\pm$ 4	14 $\pm$ 4	16 $\pm$ 4	15 $\pm$ 4	16 $\pm$ 4
05/04/21 - 05/11/21	7 $\pm$ 3	9 $\pm$ 4	9 $\pm$ 4	14 $\pm$ 4	9 $\pm$ 4	11 $\pm$ 4	12 $\pm$ 4	10 $\pm$ 4
05/11/21 - 05/18/21	13 $\pm$ 4	12 $\pm$ 4	13 $\pm$ 4	16 $\pm$ 4	10 $\pm$ 4	12 $\pm$ 4	10 $\pm$ 4	13 $\pm$ 4
05/18/21 - 05/25/21	15 $\pm$ 4	14 $\pm$ 4	15 $\pm$ 4	17 $\pm$ 4	13 $\pm$ 4	20 $\pm$ 5	19 $\pm$ 5	16 $\pm$ 4
05/25/21 - 06/01/21	13 $\pm$ 4	5 $\pm$ 3	11 $\pm$ 4	13 $\pm$ 4	10 $\pm$ 4	12 $\pm$ 4	15 $\pm$ 4	10 $\pm$ 4
06/01/21 - 06/08/21	23 $\pm$ 5	23 $\pm$ 5	22 $\pm$ 5	24 $\pm$ 5	17 $\pm$ 4	21 $\pm$ 4	21 $\pm$ 4	20 $\pm$ 4
06/08/21 - 06/15/21	15 $\pm$ 4	18 $\pm$ 4	15 $\pm$ 4	19 $\pm$ 4	15 $\pm$ 4	18 $\pm$ 4	18 $\pm$ 4	20 $\pm$ 4
06/15/21 - 06/22/21	16 $\pm$ 4	12 $\pm$ 4	17 $\pm$ 4	18 $\pm$ 4	17 $\pm$ 4	20 $\pm$ 4	15 $\pm$ 4	11 $\pm$ 4
06/22/21 - 06/29/21	11 $\pm$ 4	8 $\pm$ 4	12 $\pm$ 4	12 $\pm$ 4	11 $\pm$ 4	15 $\pm$ 4	9 $\pm$ 4	15 $\pm$ 4
06/29/21 - 07/06/21	12 $\pm$ 4	16 $\pm$ 4	15 $\pm$ 4	14 $\pm$ 4	15 $\pm$ 4	11 $\pm$ 4	13 $\pm$ 4	17 $\pm$ 4
07/06/21 - 07/13/21	18 $\pm$ 4	18 $\pm$ 4	15 $\pm$ 4	16 $\pm$ 4	18 $\pm$ 4	15 $\pm$ 4	25 $\pm$ 5	18 $\pm$ 4
07/13/21 - 07/20/21	16 $\pm$ 4	13 $\pm$ 4	17 $\pm$ 4	13 $\pm$ 4	12 $\pm$ 4	17 $\pm$ 4	14 $\pm$ 4	19 $\pm$ 4
07/20/21 - 07/27/21	26 $\pm$ 5	24 $\pm$ 5	25 $\pm$ 5	23 $\pm$ 5	7 $\pm$ 3	24 $\pm$ 5	26 $\pm$ 5	25 $\pm$ 5
07/27/21 - 08/03/21	23 $\pm$ 5	21 $\pm$ 4	23 $\pm$ 5	21 $\pm$ 4	20 $\pm$ 4	21 $\pm$ 4	20 $\pm$ 4	22 $\pm$ 5
08/03/21 - 08/10/21	25 $\pm$ 5	23 $\pm$ 5	25 $\pm$ 5	25 $\pm$ 5	20 $\pm$ 5	23 $\pm$ 5	28 $\pm$ 5	26 $\pm$ 5
08/10/21 - 08/17/21	17 $\pm$ 4	16 $\pm$ 4	22 $\pm$ 5	22 $\pm$ 5	16 $\pm$ 4	15 $\pm$ 4	17 $\pm$ 4	21 $\pm$ 4
08/17/21 - 08/24/21	25 $\pm$ 5	27 $\pm$ 5	28 $\pm$ 5	33 $\pm$ 5	28 $\pm$ 5	23 $\pm$ 5	28 $\pm$ 5	33 $\pm$ 5
08/24/21 - 08/31/21	21 $\pm$ 5	24 $\pm$ 5	23 $\pm$ 5	23 $\pm$ 5	23 $\pm$ 5	24 $\pm$ 5	22 $\pm$ 5	26 $\pm$ 5
08/31/21 - 09/07/21	23 $\pm$ 5	22 $\pm$ 5	27 $\pm$ 5	28 $\pm$ 5	20 $\pm$ 5	25 $\pm$ 5	19 $\pm$ 4	25 $\pm$ 5
09/07/21 - 09/14/21	21 $\pm$ 5	19 $\pm$ 4	23 $\pm$ 5	23 $\pm$ 5	22 $\pm$ 5	15 $\pm$ 4	20 $\pm$ 5	22 $\pm$ 5
09/14/21 - 09/21/21	18 $\pm$ 4	21 $\pm$ 5	23 $\pm$ 5	15 $\pm$ 4	17 $\pm$ 4	19 $\pm$ 4	22 $\pm$ 5	20 $\pm$ 5
09/21/21 - 09/28/21	20 $\pm$ 5	20 $\pm$ 5	20 $\pm$ 5	17 $\pm$ 4	24 $\pm$ 5	17 $\pm$ 4	19 $\pm$ 5	21 $\pm$ 5
09/28/21 - 10/05/21	25 $\pm$ 5	27 $\pm$ 5	27 $\pm$ 5	28 $\pm$ 5	27 $\pm$ 5	28 $\pm$ 5	26 $\pm$ 5	29 $\pm$ 5
10/05/21 - 10/12/21	15 $\pm$ 4	24 $\pm$ 5	26 $\pm$ 5	21 $\pm$ 5	20 $\pm$ 5	21 $\pm$ 5	23 $\pm$ 5	22 $\pm$ 5
10/12/21 - 10/19/21	22 $\pm$ 4	20 $\pm$ 4	23 $\pm$ 4	21 $\pm$ 4	22 $\pm$ 4	21 $\pm$ 4	23 $\pm$ 4	24 $\pm$ 5
10/19/21 - 10/26/21	17 $\pm$ 4	16 $\pm$ 4	15 $\pm$ 4	16 $\pm$ 4	15 $\pm$ 4	14 $\pm$ 4	14 $\pm$ 4	16 $\pm$ 4
10/26/21 - 11/02/21	12 $\pm$ 4	16 $\pm$ 4	15 $\pm$ 4	15 $\pm$ 4	12 $\pm$ 4	14 $\pm$ 4	14 $\pm$ 4	13 $\pm$ 4
11/02/21 - 11/09/21	23 $\pm$ 5	26 $\pm$ 5	28 $\pm$ 5	25 $\pm$ 5	24 $\pm$ 5	32 $\pm$ 5	26 $\pm$ 5	23 $\pm$ 5
11/09/21 - 11/16/21	13 $\pm$ 4	13 $\pm$ 4	18 $\pm$ 5	12 $\pm$ 4	16 $\pm$ 4	12 $\pm$ 4	15 $\pm$ 4	10 $\pm$ 4
11/16/21 - 11/23/21	20 $\pm$ 4	20 $\pm$ 4	23 $\pm$ 5	22 $\pm$ 5	17 $\pm$ 4	23 $\pm$ 5	19 $\pm$ 4	22 $\pm$ 5
11/23/21 - 11/30/21	17 $\pm$ 4	22 $\pm$ 5	24 $\pm$ 5	19 $\pm$ 5	23 $\pm$ 5	20 $\pm$ 5	25 $\pm$ 5	23 $\pm$ 5
11/30/21 - 12/07/21	16 $\pm$ 4	19 $\pm$ 4	22 $\pm$ 4	17 $\pm$ 4	20 $\pm$ 4	15 $\pm$ 4	18 $\pm$ 4	22 $\pm$ 4
12/07/21 - 12/14/21	22 $\pm$ 5	26 $\pm$ 5	28 $\pm$ 5	22 $\pm$ 5	25 $\pm$ 5	20 $\pm$ 4	21 $\pm$ 4	25 $\pm$ 5
12/14/21 - 12/21/21	26 $\pm$ 5	26 $\pm$ 5	32 $\pm$ 5	27 $\pm$ 5	26 $\pm$ 5	28 $\pm$ 5	29 $\pm$ 5	19 $\pm$ 4
12/21/21 - 12/28/21	35 $\pm$ 6	35 $\pm$ 6	37 $\pm$ 6	35 $\pm$ 6	36 $\pm$ 6	30 $\pm$ 5	36 $\pm$ 6	31 $\pm$ 5
MEAN $\pm$ 2 STD DEV	18 $\pm$ 11	19 $\pm$ 13	20 $\pm$ 13	20 $\pm$ 12	18 $\pm$ 12	18 $\pm$ 12	19 $\pm$ 13	19 $\pm$ 13

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



**Table C-V.2 MONTHLY AND YEARLY MEAN VALUES OF GROSS BETA CONCENTRATIONS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2021**  
RESULTS IN UNITS OF E-3 PCI/CU METER  $\pm$  2 SIGMA

GROUP I - NEARSITE LOCATIONS				GROUP II - FAR FIELD LOCATIONS				GROUP III - CONTROL LOCATIONS			
COLLECTION PERIOD	MIN	MAX	MEAN $\pm$ 2SD	COLLECTION PERIOD	MIN	MAX	MEAN $\pm$ 2SD	COLLECTION PERIOD	MIN	MAX	MEAN $\pm$ 2SD
12/29/20 - 02/02/21	10	26	19 $\pm$ 9	12/29/20 - 02/02/21	12	24	18 $\pm$ 8	12/29/20 - 02/02/21	7	22	14 $\pm$ 16
02/02/21 - 03/02/21	12	36	24 $\pm$ 14	02/02/21 - 03/02/21	14	32	24 $\pm$ 13	02/02/21 - 03/02/21	13	32	24 $\pm$ 17
03/02/21 - 03/30/21	10	21	15 $\pm$ 6	03/02/21 - 03/30/21	7	21	14 $\pm$ 7	03/02/21 - 03/30/21	9	17	14 $\pm$ 6
03/30/21 - 05/04/21	6	24	16 $\pm$ 12	03/30/21 - 05/04/21	6	25	14 $\pm$ 12	03/30/21 - 05/04/21	10	22	15 $\pm$ 10
05/04/21 - 06/01/21	5	17	12 $\pm$ 7	05/04/21 - 06/01/21	9	20	13 $\pm$ 7	05/04/21 - 06/01/21	10	16	12 $\pm$ 6
06/01/21 - 06/29/21	8	24	16 $\pm$ 10	06/01/21 - 06/29/21	9	21	16 $\pm$ 7	06/01/21 - 06/29/21	11	20	17 $\pm$ 9
06/29/21 - 08/03/21	12	26	18 $\pm$ 9	06/29/21 - 08/03/21	7	26	17 $\pm$ 11	06/29/21 - 08/03/21	17	25	20 $\pm$ 7
08/03/21 - 08/31/21	16	33	24 $\pm$ 8	08/03/21 - 08/31/21	15	28	22 $\pm$ 9	08/03/21 - 08/31/21	21	33	26 $\pm$ 10
08/31/21 - 09/28/21	15	28	21 $\pm$ 7	08/31/21 - 09/28/21	15	25	20 $\pm$ 6	08/31/21 - 09/28/21	20	25	22 $\pm$ 5
09/28/21 - 11/02/21	12	28	20 $\pm$ 10	09/28/21 - 11/02/21	12	28	20 $\pm$ 11	09/28/21 - 11/02/21	13	29	21 $\pm$ 13
11/02/21 - 11/30/21	12	28	20 $\pm$ 9	11/02/21 - 11/30/21	12	32	21 $\pm$ 11	11/02/21 - 11/30/21	10	23	19 $\pm$ 12
11/30/21 - 12/28/21	16	37	27 $\pm$ 13	11/30/21 - 12/28/21	15	36	25 $\pm$ 14	11/30/21 - 12/28/21	19	31	24 $\pm$ 10
12/29/20 - 12/28/21	5	37	19 $\pm$ 12	12/29/20 - 12/28/21	6	36	19 $\pm$ 12	12/29/20 - 12/28/21	7	33	19 $\pm$ 13

Table C-V.3

**CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES  
COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2021  
RESULTS IN UNITS OF E-3 PCI/CU METER  $\pm$  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	12/29/20 - 03/30/21	< 3	< 4	< 12	< 3	< 6	< 4	< 8	< 3	< 3	< 139	< 48
	03/30/21 - 06/29/21	< 3	< 3	< 14	< 3	< 6	< 4	< 6	< 3	< 3	< 153	< 71
	06/29/21 - 09/28/21	< 3	< 5	< 10	< 3	< 9	< 4	< 9	< 3	< 2	< 188	< 41
	09/28/21 - 12/28/21	< 2	< 3	< 11	< 3	< 8	< 3	< 7	< 3	< 2	< 150	< 65
	<i>MEAN</i>	-	-	-	-	-	-	-	-	-	-	-
BY-04	12/29/20 - 03/30/21	< 3	< 3	< 11	< 3	< 7	< 4	< 7	< 2	< 3	< 131	< 44
	03/30/21 - 06/29/21	< 2	< 2	< 8	< 1	< 6	< 3	< 6	< 2	< 2	< 117	< 51
	06/29/21 - 09/28/21	< 2	< 3	< 10	< 1	< 6	< 3	< 4	< 2	< 2	< 93	< 47
	09/28/21 - 12/28/21	< 3	< 4	< 10	< 3	< 7	< 4	< 7	< 2	< 2	< 152	< 58
	<i>MEAN</i>	-	-	-	-	-	-	-	-	-	-	-
BY-06	12/29/20 - 03/30/21	< 3	< 3	< 8	< 1	< 5	< 3	< 5	< 2	< 2	< 112	< 46
	03/30/21 - 06/29/21	< 2	< 3	< 10	< 3	< 5	< 3	< 6	< 2	< 2	< 135	< 69
	06/29/21 - 09/28/21	< 2	< 3	< 8	< 2	< 6	< 3	< 7	< 2	< 2	< 141	< 40
	09/28/21 - 12/28/21	< 1	< 3	< 7	< 2	< 6	< 3	< 5	< 2	< 2	< 97	< 58
	<i>MEAN</i>	-	-	-	-	-	-	-	-	-	-	-
BY-08	12/29/20 - 03/30/21	< 3	< 4	< 9	< 2	< 5	< 3	< 5	< 2	< 2	< 88	< 55
	03/30/21 - 06/29/21	< 3	< 3	< 11	< 2	< 8	< 4	< 7	< 3	< 3	< 178	< 59
	06/29/21 - 09/28/21	< 4	< 4	< 11	< 3	< 9	< 5	< 8	< 3	< 3	< 207	< 79
	09/28/21 - 12/28/21	< 2	< 3	< 8	< 2	< 3	< 2	< 5	< 2	< 2	< 119	< 47
	<i>MEAN</i>	-	-	-	-	-	-	-	-	-	-	-

Table C-V.3

**CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES  
COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2021  
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	12/29/20 - 03/30/21	< 3	< 3	< 13	< 3	< 9	< 4	< 9	< 3	< 3	< 132	< 64
	03/30/21 - 06/29/21	< 3	< 4	< 14	< 3	< 8	< 5	< 9	< 3	< 3	< 217	< 50
	06/29/21 - 09/28/21	< 2	< 3	< 9	< 2	< 5	< 3	< 6	< 3	< 2	< 164	< 41
	09/28/21 - 12/28/21	< 2	< 3	< 11	< 2	< 7	< 4	< 6	< 2	< 2	< 144	< 70
	<i>MEAN</i>	-	-	-	-	-	-	-	-	-	-	-
BY-22	12/29/20 - 03/30/21	< 2	< 2	< 8	< 3	< 3	< 4	< 6	< 2	< 2	< 89	< 53
	03/30/21 - 06/29/21	< 3	< 5	< 16	< 4	< 7	< 6	< 8	< 4	< 3	< 248	< 74
	06/29/21 - 09/28/21	< 3	< 4	< 10	< 3	< 7	< 4	< 8	< 3	< 3	< 173	< 83
	09/28/21 - 12/28/21	< 3	< 5	< 13	< 3	< 10	< 5	< 8	< 3	< 3	< 195	< 75
	<i>MEAN</i>	-	-	-	-	-	-	-	-	-	-	-
BY-23	12/29/20 - 03/30/21	< 4	< 5	< 11	< 4	< 9	< 5	< 11	< 3	< 3	< 187	< 93
	03/30/21 - 06/29/21	< 2	< 4	< 10	< 1	< 5	< 4	< 7	< 2	< 2	< 126	< 51
	06/29/21 - 09/28/21	< 2	< 3	< 10	< 2	< 7	< 4	< 7	< 2	< 2	< 128	< 66
	09/28/21 - 12/28/21	< 2	< 3	< 7	< 2	< 3	< 3	< 6	< 2	< 2	< 129	< 33
	<i>MEAN</i>	-	-	-	-	-	-	-	-	-	-	-
BY-24	12/29/20 - 03/30/21	< 2	< 4	< 10	< 2	< 4	< 4	< 8	< 2	< 2	< 105	< 76
	03/30/21 - 06/29/21	< 2	< 3	< 7	< 3	< 8	< 3	< 6	< 3	< 2	< 152	< 62
	06/29/21 - 09/28/21	< 4	< 5	< 15	< 4	< 11	< 5	< 11	< 4	< 3	< 235	< 95
	09/28/21 - 12/28/21	< 2	< 3	< 8	< 2	< 6	< 3	< 5	< 3	< 2	< 103	< 41
	<i>MEAN</i>	-	-	-	-	-	-	-	-	-	-	-

Table C-VI.1

**CONCENTRATIONS OF I-131 IN AIR IODINE SAMPLES COLLECTED  
IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2020  
RESULTS IN UNITS OF E-3 PCI/CU METER ± 2 SIGMA**

COLLECTION PERIOD	GROUP I				GROUP II			GROUP III
	BY-21	BY-22	BY-23	BY-24	BY-01	BY-04	BY-06	BY-08
12/29/20 - 01/05/21	< 28	< 13	< 28	< 28	< 35	< 35	< 35	< 35
01/05/21 - 01/12/21	< 35	< 35	< 35	< 35	< 34	< 34	< 34	< 34
01/12/21 - 01/19/21	< 28	< 28	< 28	< 28	< 36	< 24	< 37	< 37
01/19/21 - 01/26/21	< 18	< 36	< 36	< 36	< 36	< 36	< 36	< 36
01/26/21 - 02/02/21	< 33	< 33	< 33	< 33	< 65	< 65	< 65	< 44
02/02/21 - 02/09/21	< 40	< 40	< 40	< 40	< 57	< 57	< 57	< 57
02/09/21 - 02/16/21	< 37	< 39	< 39	< 18	< 37	< 18	< 37	< 37
02/16/21 - 02/23/21	< 38	< 38	< 39	< 43	< 34	< 34	< 34	< 34
02/23/21 - 03/02/21	< 44	< 44	< 44	< 44	< 49	< 49	< 49	< 50
03/02/21 - 03/09/21	< 51	< 51	< 51	< 51	< 54	< 54	< 54	< 54
03/09/21 - 03/16/21	< 49	< 49	< 49	< 49	< 29	< 29	< 29	< 29
03/16/21 - 03/23/21	< 57	< 57	< 24	< 57	< 58	< 58	< 58	< 58
03/23/21 - 03/30/21	< 55	< 55	< 55	< 55	< 52	< 52	< 52	< 52
03/30/21 - 04/06/21	< 64	< 64	< 64	< 64	< 61	< 61	< 61	< 61
04/06/21 - 04/13/21	< 31	< 31	< 31	< 31	< 43	< 44	< 44	< 22
04/13/21 - 04/20/21	< 35	< 21	< 18	(1)	< 35	< 35	< 35	< 18
04/20/21 - 04/27/21	< 22	< 22	< 22	< 21	< 38	< 38	< 38	< 38
04/27/21 - 05/04/21	< 50	< 50	< 51	< 51	< 47	< 47	< 48	< 48
05/04/21 - 05/11/21	< 43	< 43	< 43	< 43	< 47	< 47	< 49	< 20
05/11/21 - 05/18/21	< 34	< 34	< 34	< 34	< 57	< 57	< 57	< 57
05/18/21 - 05/25/21	< 49	< 49	< 49	< 49	< 34	< 34	< 34	< 14
05/25/21 - 06/01/21	< 43	< 43	< 43	< 43	< 30	< 25	< 31	< 31
06/01/21 - 06/08/21	< 42	< 37	< 37	< 37	< 41	< 17	< 42	< 42
06/08/21 - 06/15/21	< 55	< 55	< 55	< 55	< 59	< 59	< 25	< 68
06/15/21 - 06/22/21	< 52	< 52	< 52	< 22	< 49	< 50	< 50	< 50
06/22/21 - 06/29/21	< 48	< 20	< 48	< 48	< 36	< 36	< 37	< 36
06/29/21 - 07/06/21	< 30	< 30	< 30	< 30	< 28	< 28	< 28	< 28
07/06/21 - 07/13/21	< 37	< 37	< 39	< 35	< 39	< 32	< 39	< 38
07/13/21 - 07/20/21	< 35	< 35	< 35	< 35	< 31	< 31	< 31	< 31
07/20/21 - 07/27/21	< 39	< 39	< 39	< 39	< 48	< 49	< 49	< 49
07/27/21 - 08/03/21	< 43	< 43	< 43	< 43	< 33	< 40	< 40	< 40
08/03/21 - 08/10/21	< 61	< 61	< 61	< 61	< 36	< 36	< 36	< 36
08/10/21 - 08/17/21	< 52	< 52	< 52	< 52	< 51	< 51	< 52	< 51
08/17/21 - 08/24/21	< 65	< 65	< 65	< 65	< 57	< 57	< 57	< 58
08/24/21 - 08/31/21	< 30	< 31	< 30	< 34	< 31	< 31	< 31	< 16
08/31/21 - 09/07/21	< 28	< 28	< 28	< 28	< 46	< 46	< 46	< 46
09/07/21 - 09/14/21	< 40	< 40	< 40	< 21	< 33	< 33	< 33	< 33
09/14/21 - 09/21/21	< 52	< 52	< 52	< 52	< 68	< 68	< 68	< 68
09/21/21 - 09/28/21	< 58	< 58	< 58	< 28	< 59	< 59	< 59	< 59
09/28/21 - 10/05/21	< 49	< 49	< 49	< 49	< 49	< 49	< 49	< 49
10/05/21 - 10/12/21	< 41	< 60	< 60	< 60	< 41	< 41	< 41	< 34
10/12/21 - 10/19/21	< 63	< 63	< 63	< 26	< 59	< 25	< 60	< 60
10/19/21 - 10/26/21	< 60	< 60	< 60	< 60	< 49	< 49	< 49	< 21
10/26/21 - 11/02/21	< 39	< 39	< 39	< 39	< 44	< 44	< 44	< 45
11/02/21 - 11/09/21	< 55	< 55	< 55	< 55	< 51	< 51	< 51	< 51
11/09/21 - 11/16/21	< 64	< 64	< 64	< 64	< 56	< 56	< 56	< 57
11/16/21 - 11/23/21	< 65	< 65	< 65	< 65	< 65	< 65	< 31	< 65
11/23/21 - 11/30/21	< 57	< 57	< 57	< 57	< 59	< 59	< 59	< 59
11/30/21 - 12/07/21	< 39	< 39	< 39	< 39	< 47	< 47	< 47	< 48
12/07/21 - 12/14/21	< 58	< 58	< 58	< 58	< 41	< 41	< 41	< 34
12/14/21 - 12/21/21	< 20	< 20	< 20	< 20	< 58	< 58	< 58	< 58
12/21/21 - 12/28/21	< 42	< 42	< 42	< 42	< 24	< 29	< 29	< 29
MEAN	-	-	-	-	-	-	-	-

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

**Table C-VII.1 CONCENTRATIONS OF I-131 IN MILK SAMPLES COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2021**  
RESULTS IN UNITS OF PCI/LITER  $\pm$  2 SIGMA

COLLECTION PERIOD	CONTROL FARM BY-26-2	INDICATOR FARM BY-20-1
01/05/21	< 0.9	< 0.9
02/02/21	< 0.8	< 0.8
03/02/21	< 0.8	< 1.0
04/06/21	< 0.7	< 0.9
05/04/21	< 0.8	< 0.9
05/18/21	< 0.7	< 0.5
06/01/21	< 0.9	< 0.8
06/15/21	< 0.6	< 0.7
06/29/21	< 0.8	< 0.6
07/13/21	< 0.9	< 0.7
07/27/21	< 0.9	< 0.7
08/10/21	< 0.8	< 0.9
08/24/21	< 0.8	< 0.9
09/07/21	< 0.9	< 0.8
09/21/21	< 0.9	< 0.9
10/05/21	< 0.8	< 0.8
10/19/21	< 0.9	< 0.9
11/02/21	< 0.8	< 0.7
12/07/21	< 0.8	< 0.9
<i>MEAN</i>	-	-

Table C-VII.2

**CONCENTRATIONS OF GAMMA EMMITTERS IN MILK SAMPLES  
COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2021**

RESULTS IN UNITS OF PCI/LITER  $\pm$  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	01/05/21	< 7	< 6	< 17	< 8	< 17	< 7	< 12	< 7	< 7	< 24	< 10
	02/02/21	< 8	< 9	< 15	< 7	< 23	< 10	< 12	< 9	< 9	< 26	< 13
	03/02/21	< 7	< 7	< 16	< 9	< 17	< 9	< 12	< 8	< 8	< 37	< 10
	04/06/21	< 6	< 7	< 15	< 8	< 14	< 6	< 12	< 7	< 8	< 31	< 7
	05/04/21	< 8	< 7	< 20	< 9	< 17	< 9	< 16	< 10	< 9	< 42	< 10
	05/18/21	< 9	< 8	< 16	< 9	< 15	< 6	< 10	< 8	< 9	< 24	< 8
	06/01/21	< 9	< 6	< 16	< 8	< 17	< 9	< 15	< 9	< 9	< 32	< 9
	06/15/21	< 8	< 8	< 15	< 13	< 19	< 9	< 16	< 11	< 9	< 35	< 8
	06/29/21	< 7	< 10	< 18	< 11	< 17	< 8	< 15	< 9	< 9	< 30	< 11
	07/13/21	< 6	< 5	< 16	< 10	< 15	< 6	< 13	< 9	< 8	< 26	< 11
	07/27/21	< 7	< 7	< 16	< 8	< 16	< 7	< 15	< 8	< 8	< 30	< 10
	08/10/21	< 7	< 7	< 19	< 4	< 14	< 6	< 14	< 8	< 8	< 24	< 6
	08/24/21	< 9	< 10	< 20	< 11	< 23	< 9	< 18	< 10	< 11	< 49	< 9
	09/07/21	< 8	< 8	< 19	< 8	< 16	< 10	< 15	< 10	< 9	< 41	< 9
	09/21/21	< 7	< 8	< 22	< 9	< 15	< 8	< 12	< 9	< 8	< 40	< 14
	10/05/21	< 8	< 6	< 15	< 6	< 19	< 9	< 12	< 9	< 8	< 29	< 8
	10/19/21	< 5	< 6	< 13	< 7	< 16	< 7	< 8	< 7	< 7	< 21	< 8
11/02/21	< 5	< 5	< 12	< 6	< 13	< 5	< 9	< 6	< 5	< 25	< 7	
12/07/21	< 9	< 9	< 16	< 9	< 23	< 7	< 14	< 11	< 7	< 34	< 13	
	MEAN	-	-	-	-	-	-	-	-	-	-	-
BY-26-2	01/05/21	< 8	< 7	< 19	< 8	< 19	< 9	< 15	< 9	< 8	< 26	< 10
	02/02/21	< 4	< 4	< 11	< 5	< 13	< 5	< 8	< 6	< 4	< 17	< 8
	03/02/21	< 7	< 7	< 15	< 7	< 17	< 7	< 12	< 7	< 7	< 34	< 11
	04/06/21	< 8	< 10	< 19	< 8	< 21	< 10	< 17	< 12	< 11	< 52	< 11
	05/04/21	< 10	< 10	< 24	< 8	< 25	< 11	< 15	< 11	< 9	< 44	< 9
	05/18/21	< 7	< 9	< 20	< 7	< 19	< 8	< 12	< 9	< 8	< 28	< 7
	06/01/21	< 8	< 7	< 18	< 10	< 18	< 8	< 13	< 9	< 8	< 29	< 11
	06/15/21	< 9	< 8	< 19	< 11	< 24	< 9	< 14	< 11	< 8	< 36	< 10
	06/29/21	< 8	< 8	< 16	< 9	< 15	< 8	< 15	< 9	< 8	< 31	< 6
	07/13/21	< 7	< 8	< 15	< 9	< 17	< 7	< 15	< 8	< 8	< 30	< 5
	07/27/21	< 7	< 9	< 17	< 9	< 19	< 10	< 15	< 10	< 9	< 31	< 8
	08/10/21	< 9	< 9	< 16	< 9	< 19	< 10	< 16	< 10	< 10	< 37	< 12
	08/24/21	< 10	< 9	< 23	< 9	< 20	< 11	< 20	< 11	< 11	< 44	< 13
	09/07/21	< 7	< 8	< 17	< 7	< 17	< 8	< 13	< 8	< 8	< 32	< 10
	09/21/21	< 7	< 6	< 18	< 7	< 20	< 7	< 13	< 8	< 9	< 33	< 12
	10/05/21	< 7	< 9	< 20	< 9	< 17	< 8	< 15	< 11	< 9	< 27	< 10
	10/19/21	< 8	< 7	< 14	< 9	< 16	< 9	< 12	< 10	< 8	< 31	< 8
11/02/21	< 7	< 8	< 15	< 8	< 17	< 8	< 13	< 5	< 8	< 36	< 8	
12/07/21	< 7	< 7	< 13	< 8	< 16	< 7	< 13	< 7	< 7	< 24	< 8	
	MEAN	-	-	-	-	-	-	-	-	-	-	-

Table C-VIII.1

**CONCENTRATIONS OF GAMMA EMITTERS IN VEGETATION SAMPLES  
COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2021  
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														
	<i>Cabbage</i>	08/31/21	< 25	< 21	< 46	< 26	< 41	< 20	< 33	< 26	< 19	< 20	< 85	< 16
	<i>Potatoes</i>	09/01/21	< 32	< 30	< 65	< 34	< 83	< 36	< 57	< 52	< 35	< 34	< 151	< 33
	<i>MEAN</i>		-	-	-	-	-	-	-	-	-	-	-	-
BY-QUAD 1														
	<i>Onion/String Beans</i>	08/31/21	< 31	< 31	< 77	< 58	< 72	< 39	< 56	< 42	< 41	< 39	< 113	< 49
	<i>Romaine Lettuce</i>	09/27/21	< 34	< 36	< 74	< 34	< 82	< 36	< 66	< 58	< 39	< 36	< 150	< 48
	<i>Potatoes</i>	09/27/21	< 49	< 40	< 105	< 51	< 96	< 44	< 73	< 55	< 39	< 48	< 153	< 49
	<i>MEAN</i>		-	-	-	-	-	-	-	-	-	-	-	-
BY-QUAD 2														
	<i>Zucchini/Peppers</i>	08/31/21	< 23	< 13	< 44	< 23	< 34	< 17	< 42	< 25	< 16	< 26	< 73	< 21
	<i>Potatoes/Beets</i>	09/04/21	< 25	< 31	< 60	< 23	< 71	< 30	< 55	< 42	< 37	< 31	< 142	< 29
	<i>MEAN</i>		-	-	-	-	-	-	-	-	-	-	-	-
BY-QUAD 3														
	<i>Potatoes/Onion/Beet</i>	09/01/21	< 24	< 22	< 46	< 25	< 53	< 18	< 44	< 40	< 24	< 22	< 107	< 29
	<i>Radish Leaves</i>	09/04/21	< 33	< 26	< 62	< 31	< 59	< 30	< 46	< 50	< 27	< 32	< 130	< 41
	<i>MEAN</i>		-	-	-	-	-	-	-	-	-	-	-	-
BY-QUAD 4														
	<i>Potatoes/Onion</i>	09/01/21	< 35	< 37	< 95	< 41	< 79	< 39	< 69	< 52	< 43	< 37	< 157	< 51
	<i>Onion Leaves</i>	09/01/21	< 19	< 18	< 34	< 20	< 43	< 20	< 33	< 34	< 21	< 21	< 88	< 27
	<i>MEAN</i>		-	-	-	-	-	-	-	-	-	-	-	-

**Table C-IX.1 QUARTERLY OSLD RESULTS FOR BYRON NUCLEAR GENERATING STATION, 2021**  
**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 ± 1	18	19	18	19
BY-04-1	22 ± 4	20	22	22	24
BY-06-1	19 ± 1	18	19	19	19
BY-08-1 (Ctrl)	18 ± 1	17	18	18	17
BY-21-1	16 ± 1	16	15	17	16
BY-22-1	22 ± 1	22	22	23	22
BY-23-1	21 ± 2	20	23	22	20
BY-24-2	21 ± 2	19	22	21	20
BY-101-1	16 ± 1	16	16	17	16
BY-101-2	16 ± 1	15	16	17	17
BY-102-1	23 ± 4	20	24	25	23
BY-102-2	23 ± 4	21	25	24	24
BY-103-1	22 ± 3	21	20	22	24
BY-103-2	22 ± 2	20	22	22	22
BY-103-3	20 ± 3	20	20	22	19
BY-104-1	22 ± 3	21	23	24	21
BY-104-2	23 ± 4	21	22	25	24
BY-104-3	20 ± 3	19	20	21	21
BY-105-1	23 ± 2	21	24	22	23
BY-105-2	23 ± 4	21	25	24	20
BY-106-1	22 ± 4	19	23	24	22
BY-106-2	22 ± 2	21	23	23	22
BY-107-1	24 ± 4	21	23	24	26
BY-107-2	25 ± 6	21	24	26	28
BY-107-3	20 ± 3	19	21	19	21
BY-108-1	22 ± 3	21	22	24	23
BY-108-2	22 ± 2	21	21	23	23
BY-109-1	22 ± 2	20	22	23	23
BY-109-2	21 ± 3	19	22	22	21
BY-110-1	20 ± 2	18	20	21	20
BY-110-2	21 ± 3	19	21	22	22
BY-111-3	23 ± 3	21	23	24	24
BY-111-4	22 ± 5	19	23	23	24
BY-112-3	21 ± 4	19	21	25	21
BY-112-4	21 ± 4	19	23	23	21
BY-113-1	22 ± 2	21	22	23	24
BY-113-2	19 ± 3	18	18	20	21
BY-114-1	18 ± 3	17	17	20	17
BY-114-2	21 ± 2	20	20	21	23
BY-115-1	21 ± 4	20	21	24	20
BY-115-2	21 ± 1	20	21	22	22
BY-116-1	19 ± 2	18	20	20	21
BY-116-2	20 ± 2	19	19	20	20
BY-116-3	19 ± 2	19	20	18	19
BY-201-3	20 ± 1	20	20	21	21
BY-201-4	23 ± 3	22	24	25	22
BY-202-1	21 ± 3	19	21	(1)	22
BY-202-2	23 ± 1	23	23	24	24

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION



**Table C-IX.1 QUARTERLY OSLD RESULTS FOR BYRON NUCLEAR GENERATING STATION, 2021**  
**RESULTS IN UNITS OF MREM/QUARTER ± 2 STANDARD DEVIATIONS**

STATION CODE	MEAN ± 2 S.D.	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC
BY-203-1	18 ± 2	17	18	19	19
BY-203-2	21 ± 2	20	22	22	21
BY-204-1	19 ± 2	17	19	20	19
BY-204-2	23 ± 3	21	23	23	24
BY-205-1	24 ± 4	21	24	26	25
BY-205-2	20 ± 2	19	20	20	22
BY-206-1	23 ± 4	20	24	24	23
BY-206-2	24 ± 5	20	25	25	24
BY-207-1	23 ± 5	21	25	26	22
BY-207-2	22 ± 5	19	23	24	23
BY-208-1	23 ± 5	20	23	25	24
BY-208-2	22 ± 4	19	24	23	23
BY-209-1	22 ± 7	18	26	24	21
BY-209-4	24 ± 5	21	24	25	27
BY-210-3	22 ± 4	20	23	23	24
BY-210-4	22 ± 4	19	22	23	24
BY-211-1	23 ± 3	21	23	24	24
BY-211-4	22 ± 2	21	22	23	23
BY-212-1	23 ± 5	22	25	26	20
BY-212-4	23 ± 4	22	24	24	20
BY-213-1	23 ± 3	20	23	24	23
BY-213-4	23 ± 5	20	22	25	23
BY-214-1	22 ± 5	20	21	24	25
BY-214-4	22 ± 5	19	21	23	24
BY-215-1	20 ± 4	19	22	23	19
BY-215-4	22 ± 3	20	22	22	23
BY-216-1	23 ± 4	20	24	25	24
BY-216-2	22 ± 4	21	22	25	20
BY-301-1	16 ± 1	16	17	16	16
BY-301-2	18 ± 2	18	17	18	19
BY-309-1	20 ± 2	19	21	20	22
BY-309-2	21 ± 2	19	22	22	22
BY-309-3	21 ± 1	21	21	21	20
BY-309-4	19 ± 2	17	19	20	19
BY-314-2	16 ± 1	16	17	17	16

**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, 2021**  
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	20 ± 3	20 ± 3	18 ± 3	19 ± 4	17 ± 0
APR-JUN	21 ± 5	22 ± 4	19 ± 5	20 ± 6	18 ± 0
JUL-SEP	22 ± 4	23 ± 4	19 ± 4	20 ± 5	18 ± 0
OCT-DEC	22 ± 5	23 ± 4	19 ± 5	20 ± 5	17 ± 0

**TABLE C-IX.3 SUMMARY OF THE AMBIENT DOSIMETRY PROGRAM FOR BYRON NUCLEAR GENERATING STATION, 2021**  
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	28	21 ± 5
OUTER RING	127	17	27	22 ± 5
SPECIAL INTEREST	28	16	22	19 ± 4
OTHER	28	15	24	20 ± 5
CONTROL	4	17	19	18 ± 1

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

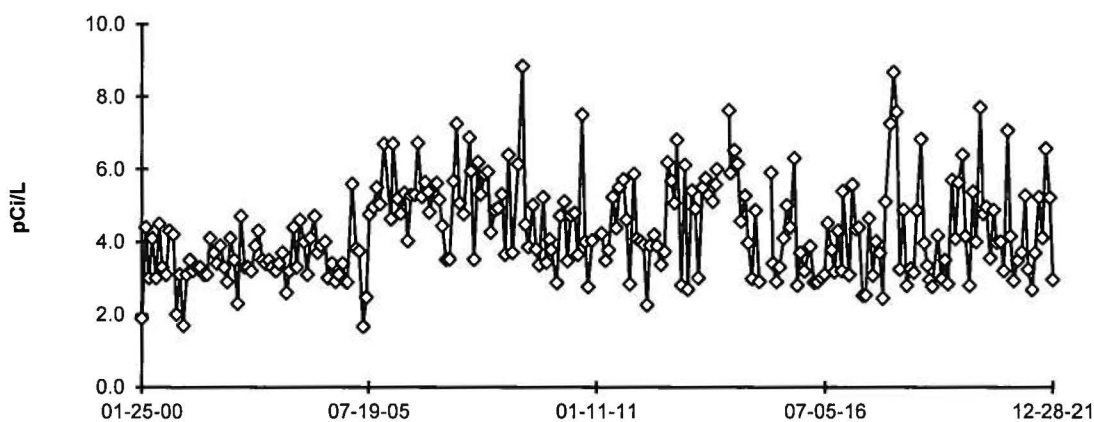
OTHER STATIONS - BY-01-1, BY-04-1, BY-06-1, BY-21-1, BY-22-1, BY-23-1, BY-24

CONTROL STATION - BY-08-1

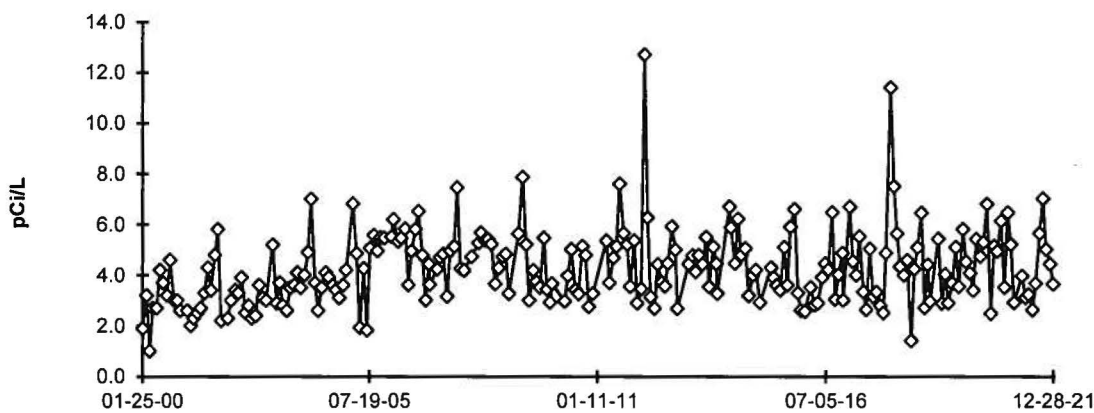
*\*For ISFSI Monitoring*

**FIGURE C-1**  
**Surface Water - Gross Beta - Stations BY-12 and BY-29 (C)**  
**Collected in the Vicinity of BNGS, 2000 - 2021**

**BY-12 Oregon Pool of Rock River, Downstream**

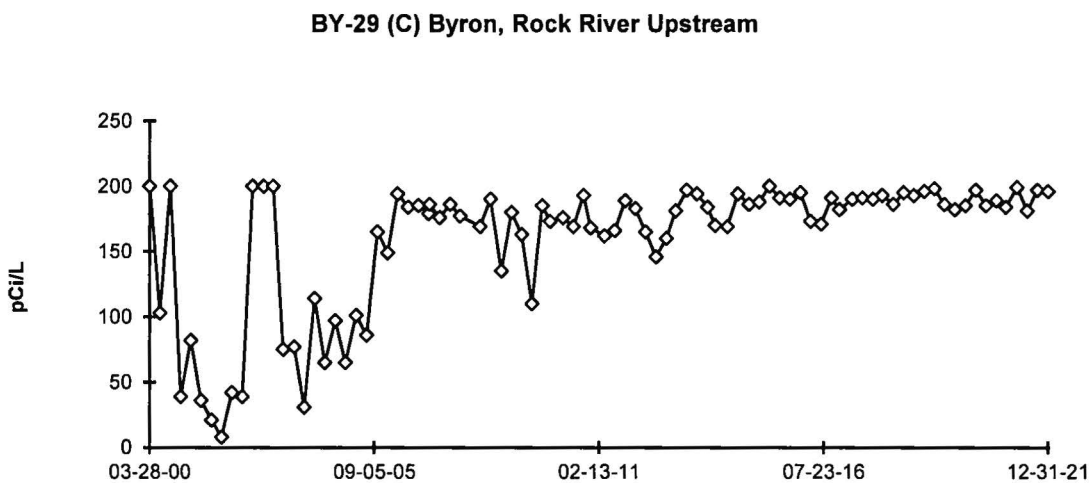
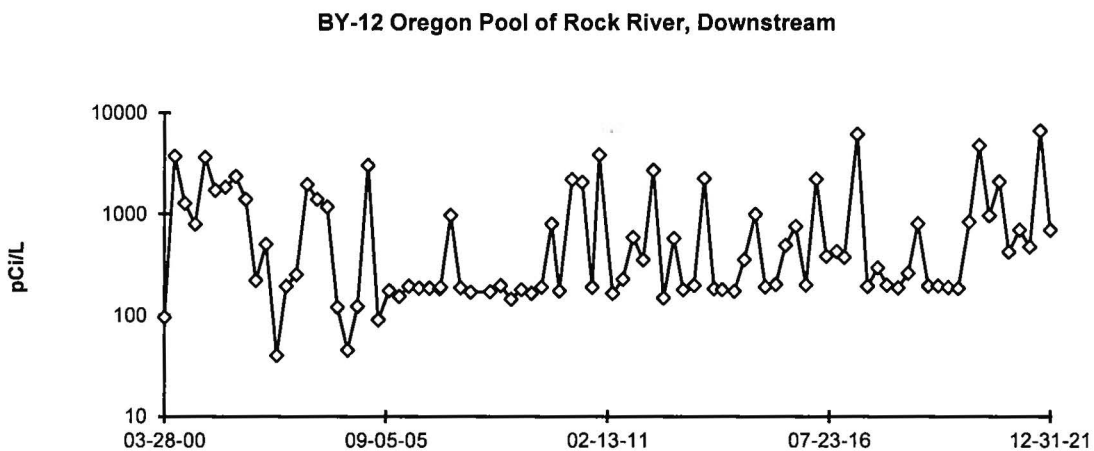


**BY-29 (C) Byron, Rock River Upstream**



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

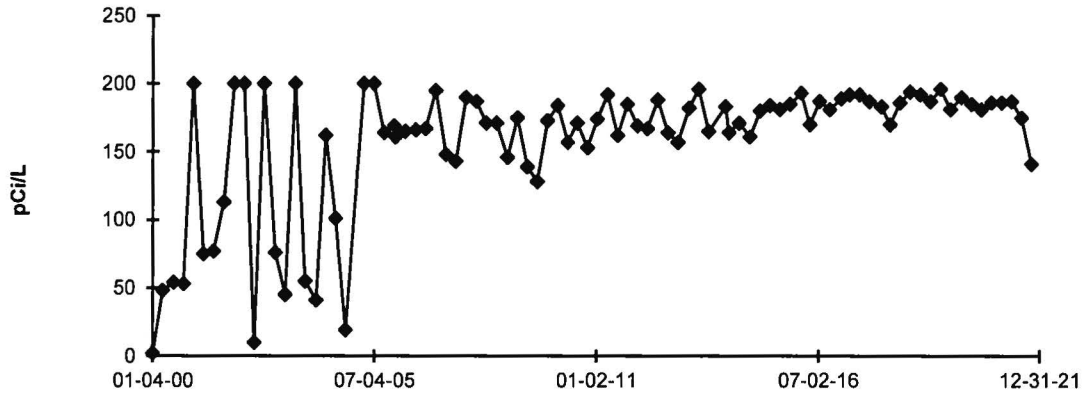
**FIGURE C-2**  
**Surface Water - Tritium - Stations BY-12 and BY-29 (C)**  
**Collected in the Vicinity of BNGS, 2000 - 2021**



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

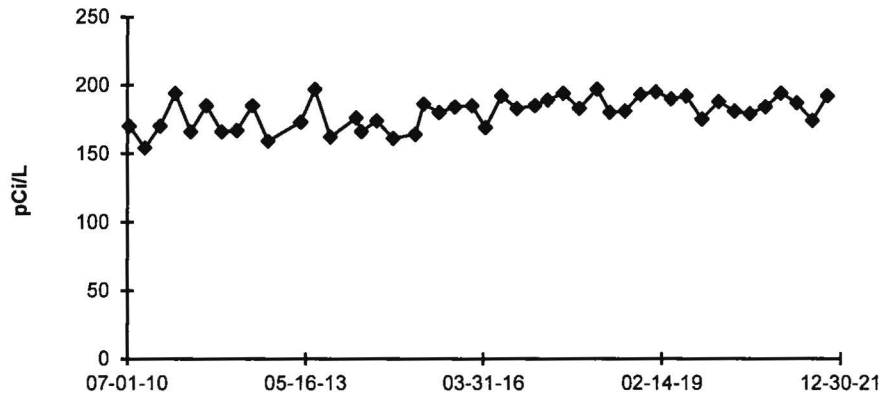
**FIGURE C-3**  
**Ground Water - Tritium - Station BY-14-1**  
**Collected in the Vicinity of BNGS, 2000 - 2021**

BY-14-1 3200 N. German Church Road Well



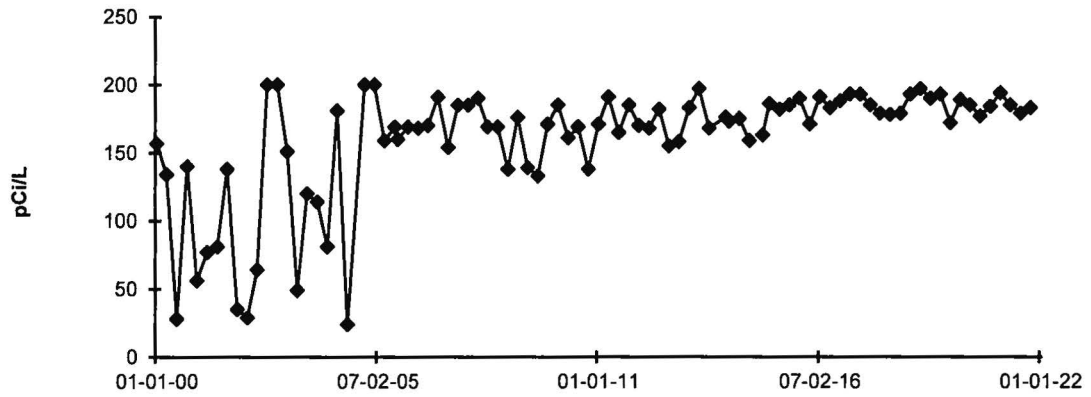
**FIGURE C-4**  
**Ground Water - Tritium - Station BY-18-1**  
**Collected in the Vicinity of BNGS, 2010 - 2021**

BY-18-1 Calhoun Well



**FIGURE C-5**  
**Ground Water - Tritium - Station BY-32**  
**Collected in the Vicinity of BNGS, 2000 - 2021**

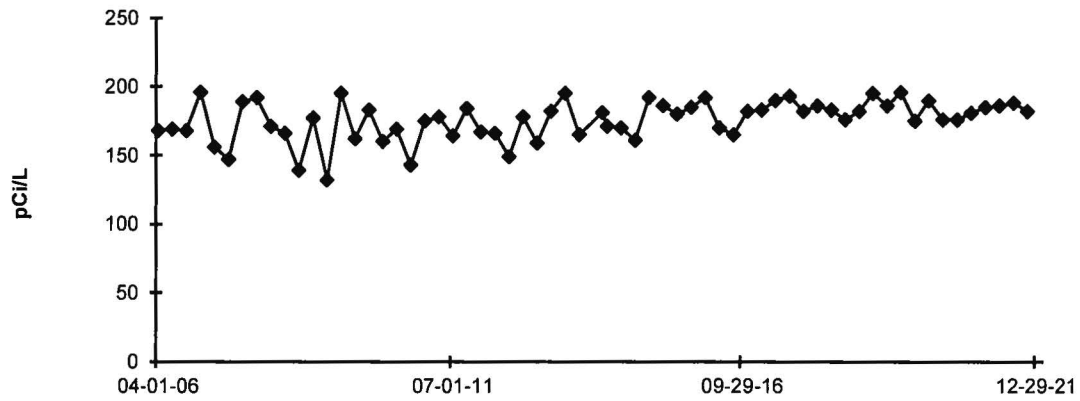
BY-32 Krueger Well



*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 - 2021**

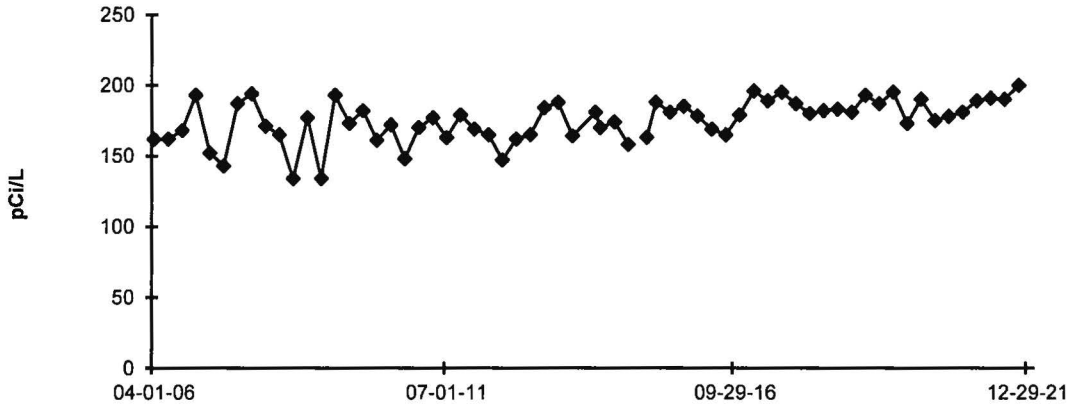
BY-35 Vancko Well





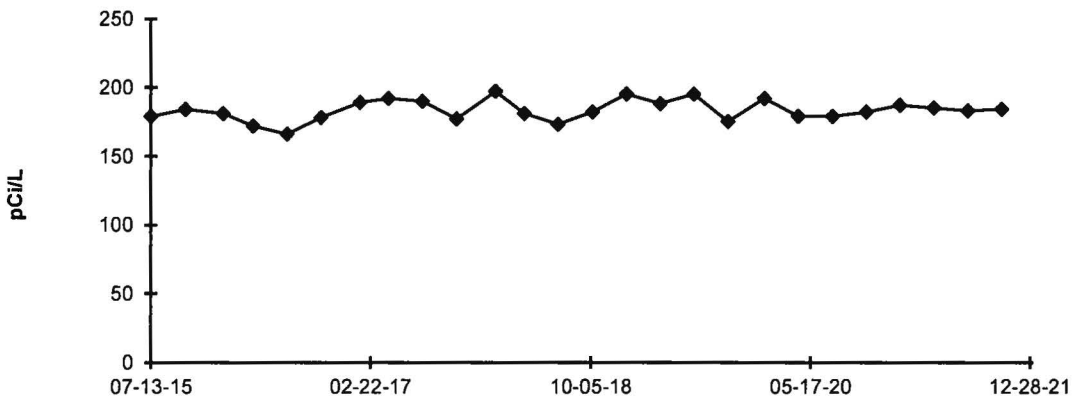
**FIGURE C-7**  
**Ground Water - Tritium - Station BY-37**  
**Collected in the Vicinity of BNGS, 2006 - 2021**

**BY-37 Cavage Well**



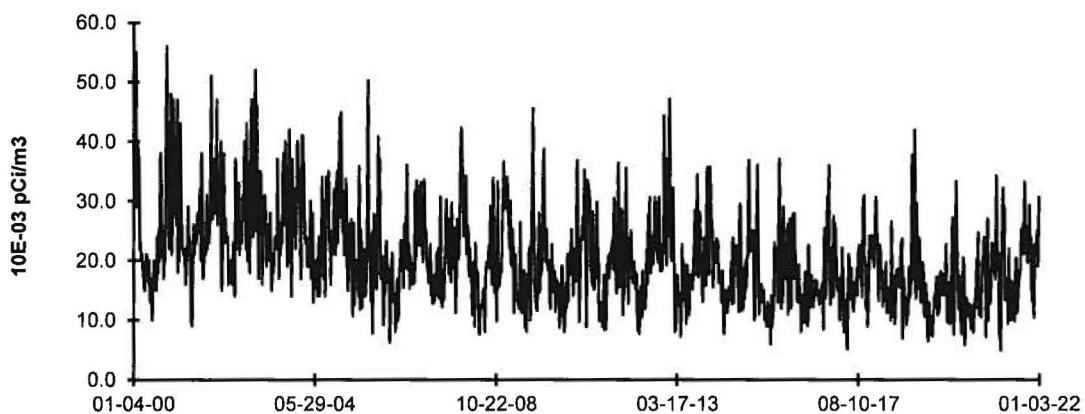
**Ground Water - Tritium - Station BY-38**  
**Collected in the Vicinity of BNGS, 2006 - 2021**

**BY-38 Steve Storz Well**

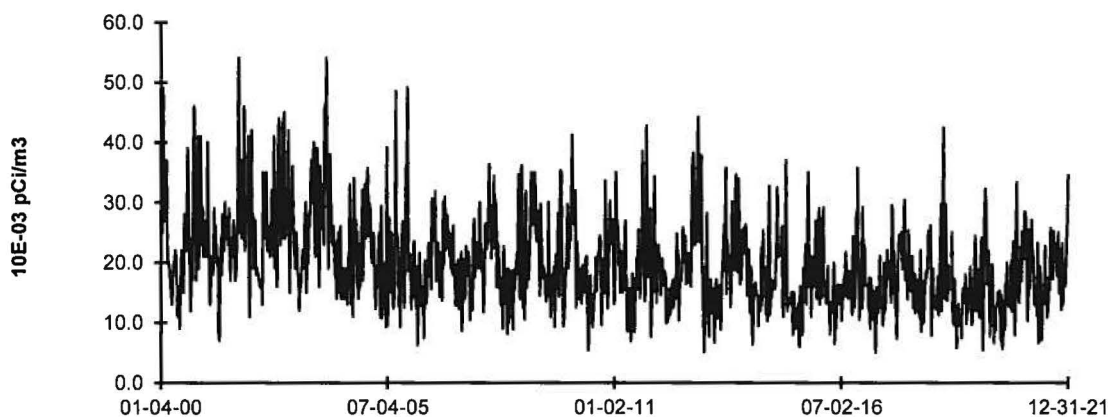


**FIGURE C-8**  
**Air Particulate - Gross Beta - Stations BY-08 (C) and BY-21**  
**Collected in the Vicinity of BNGS, 2000 - 2021**

**BY-08 (C) Leaf River WNW**

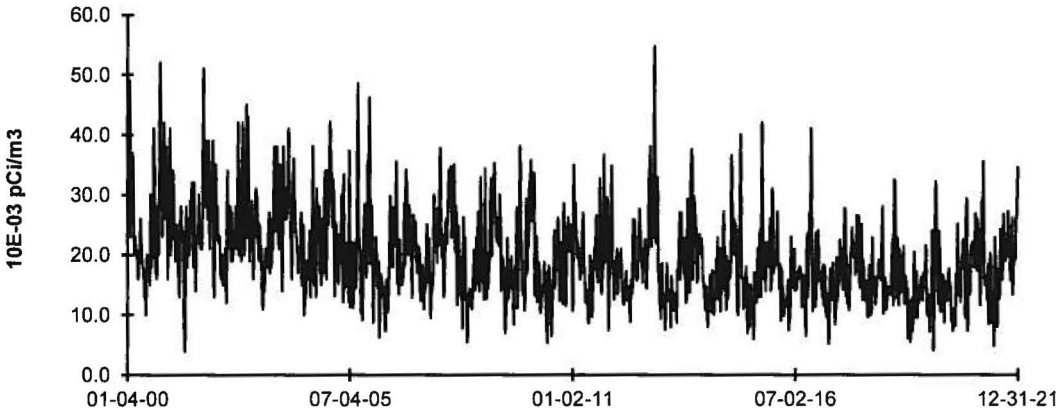


**BY-21 Byron Nearsite N**

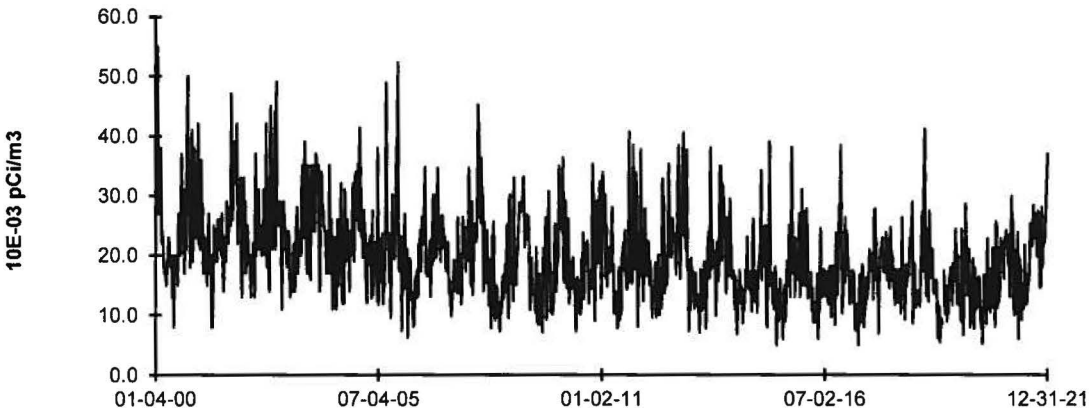


**FIGURE C-9**  
**Air Particulate - Gross Beta - Stations BY-22 and BY-23**  
**Collected in the Vicinity of BNGS, 2000 - 2021**

**BY-22 Byron Nearsite SE**

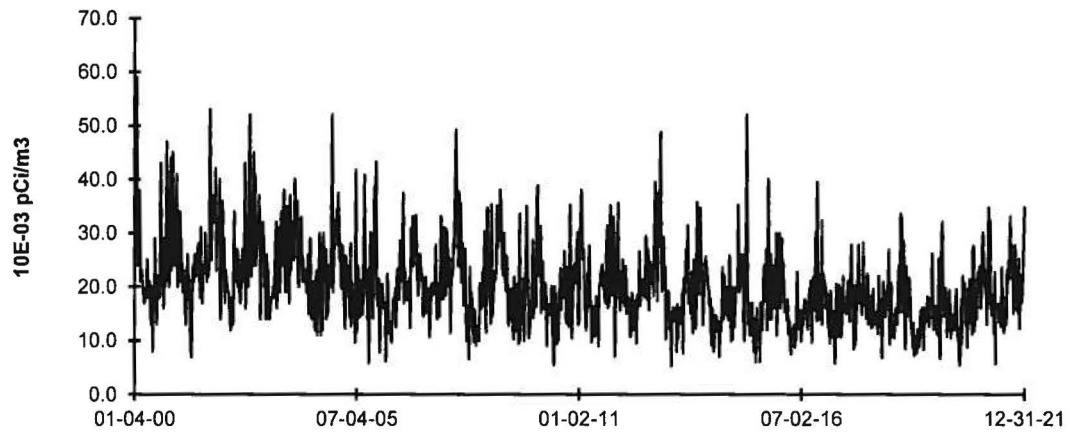


**BY-23 Byron Nearsite S**



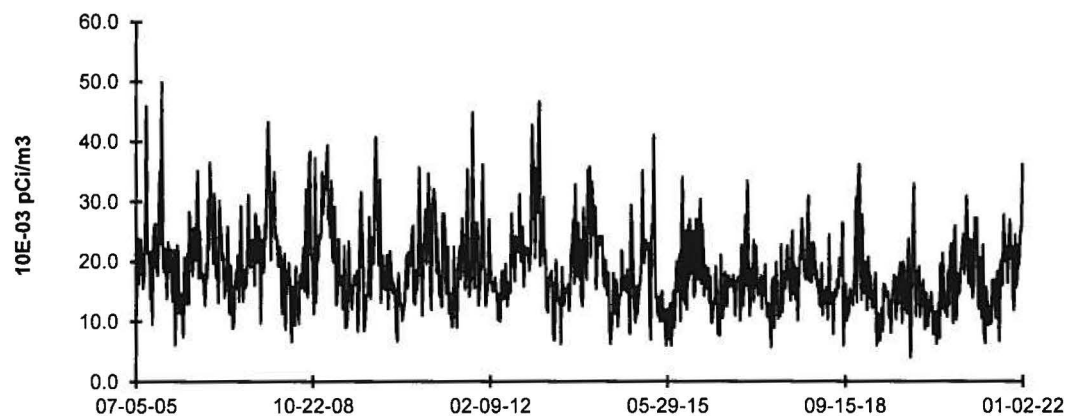
**FIGURE C-10**  
**Air Particulate - Gross Beta - Station BY-24**  
**Collected in the Vicinity of BNGS, 2000 - 2021**

**BY-24 Byron Nearsite SW**

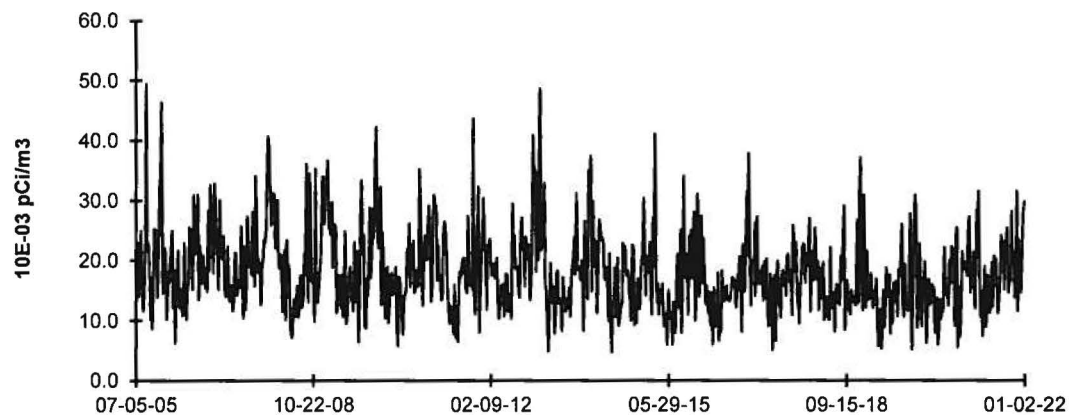


**FIGURE C-11**  
**Air Particulate - Gross Beta - Stations BY-01 and BY-04**  
**Collected in the Vicinity of BNGS, 2005 - 2021**

**BY-01 Byron N**



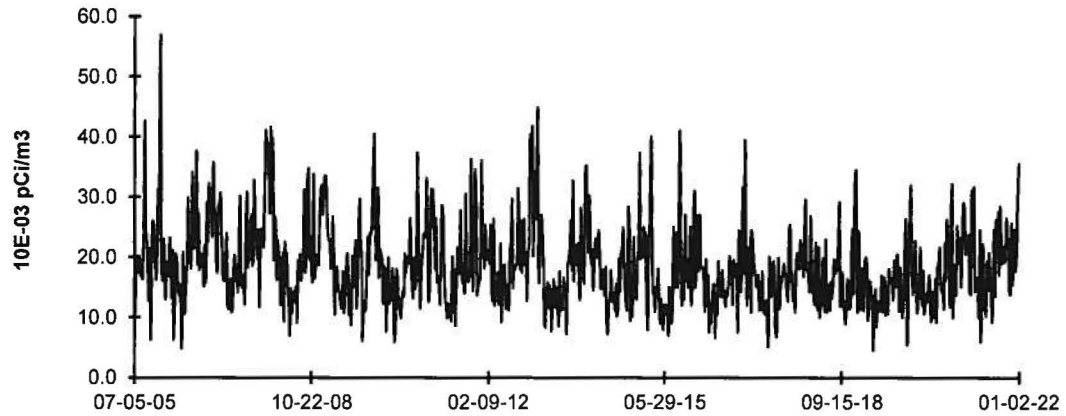
**BY-04 Paynes Point SE**



*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 - 2021**

BY-06 Oregon SSW



*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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**Analytics Environmental Radioactivity Cross Check Program  
Teledyne Brown Engineering Environmental Services**

**Table D.1**

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value <sup>(a)</sup>	Ratio of TBE to Analytics Result	Evaluation <sup>(b)</sup>			
March 2021	E13466	Milk	Sr-89	pCi/L	84.6	87.1	0.97	A			
			Sr-90	pCi/L	11.5	12.6	0.91	A			
March 2021	E13467	Milk	Ce-141	pCi/L	111	125	0.89	A			
			Co-58	pCi/L	123	128	0.96	A			
			Co-60	pCi/L	140	154	0.91	A			
			Cr-51	pCi/L	252	242	1.04	A			
			Cs-134	pCi/L	130	151	0.86	A			
			Cs-137	pCi/L	110	110	1.00	A			
			Fe-59	pCi/L	105	109	0.96	A			
			I-131	pCi/L	77.6	86.9	0.89	A			
			Mn-54	pCi/L	111	112	0.99	A			
			Zn-65	pCi/L	200	211	0.95	A			
			E13468	Charcoal	I-131	pCi	83.5	88.5	0.94	A	
			March 2021	E13469	AP	Ce-141	pCi	103.0	103	1.00	A
						Co-58	pCi	93.3	105	0.89	A
Co-60	pCi	136				126	1.08	A			
Cr-51	pCi	213				198	1.07	A			
Cs-134	pCi	123.0				124	0.99	A			
Cs-137	pCi	86.3				90.1	0.96	A			
Fe-59	pCi	81.3				89.6	0.91	A			
Mn-54	pCi	93.5				92.0	1.02	A			
Zn-65	pCi	166	173	0.96	A						
March 2021	E13470	Soil	Ce-141	pCi/g	0.232	0.262	0.89	A			
			Co-58	pCi/g	0.251	0.268	0.94	A			
			Co-60	pCi/g	0.306	0.322	0.95	A			
			Cr-51	pCi/g	0.517	0.506	1.02	A			
			Cs-134	pCi/g	0.263	0.317	0.83	A			
			Cs-137	pCi/g	0.278	0.301	0.92	A			
			Fe-59	pCi/g	0.228	0.229	1.00	A			
			Mn-54	pCi/g	0.221	0.235	0.94	A			
			Zn-65	pCi/g	0.448	0.441	1.02	A			
March 2021	E13471	AP	Sr-89	pCi	92.2	95.5	0.97	A			
			Sr-90	pCi	11.7	13.9	0.84	A			

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

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

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

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

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

**Analytics Environmental Radioactivity Cross Check Program  
Teledyne Brown Engineering Environmental Services**

**Table D.1**

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value <sup>(a)</sup>	Ratio of TBE to Analytics Result	Evaluation <sup>(b)</sup>			
September 2021	E13472	Milk	Sr-89	pCi/L	66.4	85.4	0.78	W			
			Sr-90	pCi/L	11.9	14.0	0.85	A			
September 2021	E13473	Milk	Ce-141	pCi/L	118	114	1.03	A			
			Co-58	pCi/L	116	118	0.98	A			
			Co-60	pCi/L	142	145	0.98	A			
			Cr-51	pCi/L	244	236	1.03	A			
			Cs-134	pCi/L	81	93.1	0.87	A			
			Cs-137	pCi/L	105	112	0.94	A			
			Fe-59	pCi/L	105	102	1.03	A			
			I-131	pCi/L	65.1	85.6	0.76	W			
			Mn-54	pCi/L	128	128	1.00	A			
			Zn-65	pCi/L	158	153	1.03	A			
			E13474	Charcoal	I-131	pCi	85.2	90.9	0.94	A	
			September 2021	E13475	AP	Ce-141	pCi	126	135	0.94	A
						Co-58	pCi	148	139	1.07	A
Co-60	pCi	183				171	1.07	A			
Cr-51	pCi	322				278	1.16	A			
Cs-134	pCi	118				110	1.08	A			
Cs-137	pCi	147				132	1.12	A			
Fe-59	pCi	131				120	1.09	A			
Mn-54	pCi	161				151	1.06	A			
Zn-65	pCi	202	180	1.12	A						
September 2021	E13476	Soil	Ce-141	pCi/g	0.215	0.219	0.98	A			
			Co-58	pCi/g	0.208	0.226	0.92	A			
			Co-60	pCi/g	0.277	0.277	1.00	A			
			Cr-51	pCi/g	0.388	0.452	0.86	A			
			Cs-134	pCi/g	0.157	0.178	0.88	A			
			Cs-137	pCi/g	0.270	0.284	0.95	A			
			Fe-59	pCi/g	0.218	0.195	1.12	A			
			Mn-54	pCi/g	0.239	0.246	0.97	A			
			Zn-65	pCi/g	0.312	0.293	1.06	A			
September 2021	E13477	AP	Sr-89	pCi	85.6	68.3	1.25	W			
			Sr-90	pCi	12.6	11.2	1.13	A			

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

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

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

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

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

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

**Table D.2**

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value <sup>(a)</sup>	Acceptance Range	Evaluation <sup>(b)</sup>
February 2021	21-GrF44	AP	Gross Alpha	Bq/sample	0.371	1.77	0.53 - 3.01	N <sup>(3)</sup>
			Gross Beta	Bq/sample	0.731	0.65	0.325 - 0.974	A
	21-MaS44	Soil	Ni-63	Bq/kg	310	689.0	482 - 896	N <sup>(4)</sup>
			Tc-99	Bq/kg	457	638	447 - 829	W
	21-MaSU44	Urine	Cs-134	Bq/L	2.34	2.73	1.91 - 3.55	A
			Cs-137	Bq/L	2.54	2.71	1.90 - 3.52	A
			Co-57	Bq/L	0.4100		(1)	A
			Co-60	Bq/L	2.24	2.44	1.71 - 3.17	A
			Mn-54	Bq/L	2.03	2.03	1.42 - 2.64	A
			K-40	Bq/L	52.8	54.0	38 - 70	A
			U-234	Bq/L	0.108	0.0877	0.0614 - 0.114	W
			U-238	Bq/L	0.101	0.091	0.064 - 0.118	A
			Zn-65	Bq/L	1.06	1.34	(2)	A
			21-MaW44	Water	Ni-63	Bq/L	6.7	8.2
	Tc-99	Bq/L			3.850	4.01	2.81 - 5.21	A
	21-RdV44	Vegetation	Cs-134	Bq/sample	3.13	3.60	2.5 - 4.7	A
			Cs-137	Bq/sample	4.64	4.69	3.28 - 6.10	A
			Co-57	Bq/sample	5.25	5.05	3.54 - 6.57	A
			Co-60	Bq/sample	2.86	2.99	2.09 - 3.89	A
			Mn-54	Bq/sample	5.02	5.25	3.68 - 6.83	A
			Sr-90	Bq/sample	0.631	0.673	0.471 - 0.875	A
			Zn-65	Bq/sample	-0.233		(1)	A
	August 2021	21-GrF45	AP	Gross Alpha	Bq/sample	0.368	0.960	0.288 - 1.632
Gross Beta				Bq/sample	0.595	0.553	0.277 - 0.830	A
21-MaS45		Soil	Ni-63	Bq/kg	546	1280	896 - 1664	N <sup>(5)</sup>
			Tc-99	Bq/kg	453	777	544 - 1010	N <sup>(6)</sup>
21-MaSU45		Urine	Cs-134	Bq/L	3.10	3.62	2.53 - 4.71	A
			Cs-137	Bq/L	0.083		(1)	A
			Co-57	Bq/L	0.844	0.87	0.606 - 1.125	A
			Co-60	Bq/L	0.0535		(1)	A
			Mn-54	Bq/L	0.459	0.417	(2)	A
			K-40	Bq/L	48.8	54.0	38 - 70	A
			U-234	Bq/L	0.133	0.116	0.081 - 0.151	A
			U-238	Bq/L	0.137	0.121	0.085 - 0.157	A
Zn-65		Bq/L	0.339	0.420	(2)	A		
21-MaW45		Water	Ni-63	Bq/L	33.5	39.5	27.7 - 51.4	A
			Tc-99	Bq/L	3.5	3.7	2.60 - 4.82	A
21-RdV45		Vegetation	Cs-134	Bq/sample	3.42	4.34	3.04 - 5.64	W
			Cs-137	Bq/sample	2.14	2.21	1.55 - 2.87	A
			Co-57	Bq/sample	4.08	4.66	3.26 - 6.06	A
			Co-60	Bq/sample	2.81	3.51	2.46 - 4.56	A
			Mn-54	Bq/sample	0.035		(1)	A
			Sr-90	Bq/sample	1.15	1.320	0.92 - 1.72	A
			Zn-65	Bq/sample	2.05	2.43	1.70 - 3.16	A

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

(b) DOE/MAPEP evaluation:

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

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

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

(1) False positive test

(2) Sensitivity evaluation

(3) See NCR 21-02

(4) See NCR 21-03

(5) See NCR 21-13

(6) Tc-99 cross-checks done for TBE information only - not required

**ERA Environmental Radioactivity Cross Check Program  
Teledyne Brown Engineering Environmental Services**

**Table D.3**

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value <sup>(a)</sup>	Acceptance Limits	Evaluation <sup>(b)</sup>
March 2021	MRAD-34	Water	Am-241	pCi/L	175	157	108 - 201	A
			Fe-55	pCi/L	579	275	162 - 400	N <sup>(1)</sup>
			Pu-238	pCi/L	181	171	103 - 222	A
			Pu-239	pCi/L	153	142	87.9 - 175	A
		Soil	Sr-90	pCi/kg	6570	9190	2860 - 14,300	A
		AP	Fe-55	pCi/filter	107	121	44.2 - 193	A
			U-234	pCi/filter	25.99	25.5	18.9 - 29.9	A
U-238	pCi/filter		24.7	25.3	19.1 - 30.2	A		
April 2021	RAD-125	Water	Ba-133	pCi/L	92.3	90.5	76.2 - 99.6	A
			Cs-134	pCi/L	62.9	70.5	57.5 - 77.6	A
			Cs-137	pCi/L	161	168	151 - 187	A
			Co-60	pCi/L	22.5	20.9	17.7 - 25.8	A
			Zn-65	pCi/L	183	177.0	159 - 208	A
			GR-A	pCi/L	30.8	30.2	15.4 - 39.4	A
			GR-B	pCi/L	60.1	67.5	46.8 - 74.2	A
			U-Nat	pCi/L	36.45	36.9	30.0 - 40.8	A
			H-3	pCi/L	13,400	14,600	12,800 - 16,100	A
			Sr-89	pCi/L	64.5	63.5	51.4 - 71.5	A
			Sr-90	pCi/L	22.8	23.0	16.5 - 27.0	A
			I-131	pCi/L	28.2	26.7	22.2 - 31.4	A
			September 2021	MRAD-35	Water	Am-241	pCi/L	68
Fe-55	pCi/L	179				246	145 - 358	A
Pu-238	pCi/L	102				114	68.5 - 148	A
Pu-239	pCi/L	32				34.3	21.2 - 42.3	A
Soil	Sr-90	pCi/kg			6160	6090	1,900 - 9,490	A
AP	Fe-55	pCi/filter			493	548	200 - 874	A
	Pu-238	pCi/filter			28	28.5	21.5 - 35.0	A
	Pu-239	pCi/filter			21	21.6	16.1 - 26.1	A
	U-234	pCi/filter			7.95	7.76	5.75 - 9.09	A
	U-238	pCi/filter			8.0	7.69	5.81 - 9.17	A
October 2021	RAD-127	Water	Ba-133	pCi/L	82.8	87.5	73.6 - 96.2	A
			Cs-134	pCi/L	64.0	70.1	57.1 - 77.1	A
			Cs-137	pCi/L	145	156	140 - 174	A
			Co-60	pCi/L	83.2	85.9	77.3 - 96.8	A
			Zn-65	pCi/L	133	145	130 - 171	A
			GR-A	pCi/L	76.0	66.7	35.0 - 82.5	A
			GR-B	pCi/L	63.0	55.7	38.1 - 62.6	N <sup>(2)</sup>
			U-Nat	pCi/L	52.88	55.5	45.3 - 61.1	A
			H-3	pCi/L	13,800	17,200	15,000 - 18,900	N <sup>(3)</sup>
			Sr-89	pCi/L	54.9	61.0	49.1 - 68.9	A
			Sr-90	pCi/L	24.8	29.3	21.3 - 34.0	A
			I-131	pCi/L	27.4	26.4	21.9 - 31.1	A
December 2021	QR 120121Y	Water	GR-B	pCi/L	47.6	39.8	26.4 - 47.3	N <sup>(4)</sup>
			H-3	pCi/L	17,500	17,800	15,600 - 19,600	A

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

(b) ERA evaluation:

A = Acceptable - Reported value falls within the Acceptance Limits

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

(1) See **NCR 21-01**

(2) See **NCR 21-10**

(3) See **NCR 21-11**

(4) See **NCR 21-14**

## **APPENDIX E**

### **EFFLUENT REPORT**

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## 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 5.02E-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 2021.

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 2021 gaseous dose was vegetation. The critical pathway for 2021 liquid dose was freshwater fish.

## 1.0 Releases

### 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. The average quarterly release rate for all gaseous effluents were below detectable limits.

A total of 1.41E+00 curies of fission and activation gases were released.

A total of 8.79E+00 curies of other (C-14) radioisotopes were released.

A total of 9.65E+01 curies of tritium were released.

Iodine-131 and gross alpha-emitting radionuclides were below detectable limits.

### 1.2 Liquids Released to Rock River

Quarterly release totals of principal radionuclides in liquid effluents are given in Table 2.

A total of 3.12E+10 liters of radioactive liquid wastes containing 4.08E-02 curies of fission and activation products were discharged with a maximum quarterly average concentration of 3.74E-09  $\mu\text{Ci/ml}$ .

A total of 3.52E+03 curies of tritium were discharged with a maximum quarterly average concentration of 2.89E-04  $\mu\text{Ci/ml}$ .

A total of 1.13E-03 curies of dissolved and entrained gases were discharged with a maximum quarterly average concentration of 2.62E-10  $\mu\text{Ci/ml}$ .

A total of 1.13E-03 of gross alpha-emitting radionuclides were discharged.

## 2.0 Solid Radioactive Waste

Solid radioactive wastes were shipped by truck. For detail, refer to Byron Station 2021 Annual Radiological Effluent Release Report.

### 3.0 Dose to Man

#### 3.1 Gaseous Effluent Pathways

Offsite Gamma air and whole body dose rates are shown in Table 3 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 4.

##### 3.1.1 Noble Gas

###### 3.1.1.1 Gamma Dose Rates

Based on measured effluents and average meteorological data, the maximum gamma air dose was  $2.27\text{E-}04$  mrad based on measured effluents and average meteorological data, and  $4.00\text{E-}05$  mrad based on measured effluents and concurrent meteorological data.

###### 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  $7.0\text{ mg/cm}^2$  and an occupancy factor of 1.0 is used.

The maximum offsite beta air dose for the year based on measured effluents and average meteorological data was  $1.08\text{E-}04$  mrad. The beta air dose based on measured effluents and concurrent meteorological data was  $9.93\text{E-}05$  mrad.

The skin dose based on measured effluents and average meteorological data was  $3.15\text{E-}04$  mrem, and  $4.53\text{E-}05$  mrem based on measured effluents and concurrent meteorological data.

##### 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 requirement to begin reporting C-14 dose in 2011 and 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 an individual was  $2.29\text{E}+00$  mrem (child/bone) based on measured effluents and average meteorological data.

### 3.1.3 Gaseous Total Dose

The maximum total dose from gaseous releases to the whole body was  $4.77\text{E}-01$  mrem based on measured effluents and average meteorological data, and  $1.40\text{E}-01$  mrem (child-bone) based on measured effluents and concurrent meteorological data.

The maximum total dose from gaseous releases to any organ was  $2.30\text{E}+00$  mrem based on measured effluents and average meteorological data, and  $6.76\text{E}-01$  mrem (child/bone) 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 the whole body was  $2.52\text{E}-02$

mrem (child). The maximum dose from liquid releases to any organ was  $3.00\text{E}-02$  mrem (child/bone).

### 3.3 Gaseous + Liquid Total Dose

The maximum dose to the whole body via both gaseous and liquid effluents is  $5.02\text{E}-01$  mrem. The maximum total dose to any organ via both gaseous and liquid effluents to any organ is  $2.33\text{E}+00$  mrem.

### 3.4 Dose Limits to Members of the Public

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

- The 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 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 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 annual 10CFR20 limit on Total Effective Dose Equivalent to individual members of the public is 100 mrem.
- 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 Metrology

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 99.6% during 2021.

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**APPENDIX E-1**

**EFFLUENT AND WASTE DISPOSAL REPORT  
DATA TABLES**



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**Table 1  
GASEOUS EFFLUENTS  
SUMMATION OF ALL RELEASES  
UNIT 1**

REPORT FOR 2021	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
<b>Fission &amp; Activation Gases</b>						
1. Total Release	Ci	9.31E-02	1.28E-01	2.37E-01	3.98E-01	8.56E-01
2. Avg. Release Rate	μCi/sec	1.20E-02	1.63E-02	2.98E-02	5.00E-02	
<b>Iodine-131</b>						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	μCi/sec	(1)	(1)	(1)	(1)	
<b>Particulates Half Life &gt;= 8 days</b>						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	μCi/sec	(1)	(1)	(1)	(1)	
<b>Carbon-14</b>						
1. Total Release	Ci	1.10E+00	1.11E+00	8.75E-01	1.10E+00	4.18E+00
2. Avg. Release Rate	μCi/sec	1.41E-01	1.41E-01	1.10E-01	1.38E-01	
<b>Tritium</b>						
1. Total Release	Ci	6.34E+00	2.65E+00	2.51E+00	5.31E+00	1.68E+01
2. Avg. Release Rate	μCi/sec	8.16E-01	3.37E-01	3.16E-01	6.68E-01	
<b>Gross Alpha Radioactivity</b>						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	μCi/sec	(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 (cont.)  
GASEOUS EFFLUENTS  
SUMMATION OF ALL RELEASES  
UNIT 2**

REPORT FOR 2021	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
<b>Fission &amp; Activation Gases</b>						
1. Total Release	Ci	3.22E-02	6.10E-02	9.44E-02	3.68E-01	5.56E-01
2. Avg. Release Rate	μCi/sec	4.14E-03	7.76E-03	1.19E-02	4.63E-02	
<b>Iodine-131</b>						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	μCi/sec	(1)	(1)	(1)	(1)	
<b>Particulates Half Life &gt;= 8 days</b>						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	μCi/sec	(1)	(1)	(1)	(1)	
<b>Carbon-14</b>						
1. Total Release	Ci	1.16E+00	1.12E+00	1.16E+00	1.17E+00	4.61E+00
2. Avg. Release Rate	μCi/sec	1.49E-01	1.43E-01	1.46E-01	1.47E-01	
<b>Tritium</b>						
1. Total Release	Ci	1.02E+01	1.81E+01	2.60E+01	2.61E+01	8.04E+01
2. Avg. Release Rate	μCi/sec	1.31E+00	2.30E+00	3.27E+00	3.29E+00	
<b>Gross Alpha Radioactivity</b>						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	μCi/sec	(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 2**  
**LIQUID EFFLUENTS**  
**SUMMATION OF ALL RELEASES**  
**UNIT 1**

REPORT FOR 2021	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
<b>Fission and Activation Products</b>						
1. Total Release	Ci	4.36E-03	4.39E-03	7.36E-03	4.25E-03	2.04E-02
2. Avg. Diluted Conc.	μCi/ml	1.11E-09	1.15E-09	1.87E-09	1.08E-09	1.31E-09
<b>Tritium</b>						
1. Total Release	Ci	7.11E+01	3.51E+02	5.87E+02	2.56E+02	1.26E+03
2. Avg. Diluted Conc.	μCi/ml	1.82E-05	9.17E-05	1.49E-04	6.53E-05	8.11E-05
<b>Dissolved &amp; Entrained Gases</b>						
1. Total Release	Ci	(1)	(1)	5.14E-04	4.89E-05	5.63E-04
2. Avg. Diluted Conc.	μCi/ml	N/A	N/A	1.31E-10	1.25E-11	3.61E-11
<b>Gross Alpha Radioactivity</b>						
1. Total Release	Ci	(1)	(1)	5.14E-04	4.89E-05	5.63E-04
Volume of liquid waste	Liters	3.92E+09	3.83E+09	3.93E+09	3.91E+09	1.56E+10
Volume of dil. water	Liters	7.83E+09	7.65E+09	7.86E+09	7.83E+09	3.12E+10

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

**Table 2 (cont.)  
LIQUID EFFLUENTS  
SUMMATION OF ALL RELEASES  
Unit 2**

REPORT FOR 2021	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
<b>Fission and Activation Products</b>						
1. Total Release	Ci	4.36E-03	4.39E-03	7.36E-03	4.25E-03	2.04E-02
2. Avg. Diluted Conc.	μCi/ml	6.97E-06	4.29E-06	5.80E-06	5.56E-06	5.53E-06
<b>Tritium</b>						
1. Total Release	Ci	5.29E+01	3.39E+02	4.96E+02	2.24E+02	1.11E+03
2. Avg. Diluted Conc.	μCi/ml	8.44E-02	3.31E-01	3.91E-01	2.94E-01	3.02E-01
<b>Dissolved &amp; Entrained Gases</b>						
1. Total Release	Ci	(1)	(1)	5.14E-04	4.89E-05	5.63E-04
2. Avg. Diluted Conc.	μCi/ml	N/A	N/A	4.06E-07	6.40E-08	1.53E-07
<b>Gross Alpha Radioactivity</b>						
1. Total Release	Ci	(1)	(1)	5.14E-04	4.89E-05	5.63E-04
Volume of liquid waste	Liters	6.26E+05	1.02E+06	1.27E+06	7.64E+05	3.68E+06
Volume of dil. water	Liters	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.12E+10

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

**Table 3**  
**Summary of Gaseous and Liquid Effluents Doses to Members of the Public**  
**at the Highest Dose Receptors vs 10CFR50 Design Objectives**

**Unit 1**

Noble Gas	Applicable Dose	Estimated Dose	Age Group	% of Applicable Limit	Design Objective Limit (per year, combined)	Unit
Maximum Location	Gamma Air	1.68E-04	All	1.68E-03	10	mrad
Maximum Location	Beta Air Dose	7.12E-05	All	3.56E-04	20	mrad
Maximum Location	Total Body	1.59E-04	All	3.17E-03	5	mrem
Maximum Location	Skin	2.31E-04	All	1.54E-03	15	mrem
<b>Non-Noble Gas</b>						
Maximum	Bone	1.09E+00	Child	7.28E+00	15	mrem
<b>Liquid</b>						
Maximum	Total Body	1.26E-02	Child	4.19E-01	3	mrem
Maximum	GI-Lli	1.50E-02	Child	1.50E-01	10	mrem

**Unit 2**

Noble Gas	Applicable Dose	Estimated Dose	Age Group	% of Applicable Limit	Design Objective Limit (per year, combined)	Unit
Maximum Location	Gamma Air	5.91E-05	All	5.91E-04	10	mrad
Maximum Location	Beta Air Dose	3.65E-05	All	1.83E-04	20	mrad
Maximum Location	Total Body	5.51E-05	All	1.10E-03	5	mrem
Maximum Location	Skin	8.40E-05	All	5.60E-04	15	mrem
<b>Non-Noble Gas</b>						
Maximum	Bone	1.20E+00	Child	8.03E+00	15	mrem
<b>Liquid</b>						
Maximum	Total Body	1.26E-02	Child	4.19E-01	3	mrem
Maximum	GI-Lli	1.50E-02	Child	1.50E-01	10	mrem

**Table 4**  
**Summary of Doses to Members of the Public at the**  
**Highest Dose Receptors for 40CFR190 and 10CFR72.104 Compliance**

Highest Dose Receptors	Noble Gas	Non-Noble Gas	Liquid	On-Site Storage Facilities	Total	% of Applicable Limit	Limit	Unit
Total Body	2.14E-04	4.77E-01	2.52E-02	0.00E+00	5.02E-01	2.01E+00	25	mrem
Organ Dose	N/A	2.30E+00	3.00E-02	0.00E+00	2.33E+00	9.30E+00	25	mrem
Thyroid Dose	N/A	4.77E-01	2.50E-02	0.00E+00	5.02E-01	6.69E-01	75	mrem

**Table 5**  
**MAXIMUM ANNUAL CALCULATED CUMULATIVE OFFSITE DOSES**  
**Resulting from Airborne Releases**  
**Based on Concurrent Meteorological Data 2021**

**Unit 1:**

<u>Dose</u>	<u>Maximum Value</u>	<u>Sector Affected</u>
gamma air <sup>(1)</sup>	2.96 x10 <sup>-5</sup> mrad	North-Northwest
beta air <sup>(2)</sup>	1.61 x10 <sup>-5</sup> mrad	North-Northwest
whole body <sup>(3)</sup>	6.53 x10 <sup>-2</sup> mrem	North-Northwest
skin <sup>(4)</sup>	3.30 x10 <sup>-5</sup> mrem	North-Northwest
organ <sup>(5)</sup> (child-bone)	3.21 x10 <sup>-1</sup> mrem	North-Northwest

**Unit 1 Compliance Status**

<b>10 CFR 50 Appendix I</b>	<b>Yearly Objective</b>	<b>% of Appendix I</b>
gamma air	10.0 mrad	0.00
beta air	20.0 mrad	0.00
whole body	5.0 mrem	1.31
skin	15.0 mrem	0.00
organ	15.0 mrem	2.14

**Unit 2:**

<u>Dose</u>	<u>Maximum Value</u>	<u>Sector Affected</u>
gamma air <sup>(1)</sup>	1.04 x10 <sup>-5</sup> mrad	North-Northwest
beta air <sup>(2)</sup>	8.32 x10 <sup>-5</sup> mrad	North-Northwest
whole body <sup>(3)</sup>	7.57 x10 <sup>-2</sup> mrem	North-Northwest
skin <sup>(4)</sup>	1.23 x10 <sup>-5</sup> mrem	North-Northwest
organ <sup>(5)</sup> (child-bone)	3.55 x10 <sup>-1</sup> mrem	North-Northwest

**Unit 2 Compliance Status**

<b>10 CFR 50 Appendix I</b>	<b>Yearly Objective</b>	<b>% of Appendix I</b>
gamma air	10.0 mrad	0.00
beta air	20.0 mrad	0.00
whole body	5.0 mrem	1.51
skin	15.0 mrem	0.00
organ	15.0 mrem	2.37

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(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

## **APPENDIX F**

### **METEOROLOGICAL DATA**



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Byron Generating Station

Period of Record: January - March 2021  
 Stability Class - Extremely Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	3	0	0	0	3
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	0	0	0	0	0
NNW	0	0	6	0	0	0	6
Variable	0	0	0	0	0	0	0
Total	0	0	9	0	0	0	9

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: 3

Byron Generating Station

Period of Record: January - March 2021  
 Stability Class - Moderately Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	1	1	0	0	0	2
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	1	0	0	1
W	0	0	0	0	0	0	0
WNW	0	0	0	1	0	0	1
NW	0	0	0	0	0	0	0
NNW	0	0	1	0	0	0	1
Variable	0	0	0	0	0	0	0
Total	0	1	2	2	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: 3

Byron Generating Station

Period of Record: January - March 2021  
 Stability Class - Slightly Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	1	5	0	0	0	6
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	2	1	0	3
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	1	0	0	1
W	0	0	0	1	0	0	1
WNW	0	0	0	0	1	0	1
NW	0	0	0	0	0	0	0
NNW	0	0	2	0	0	0	2
Variable	0	0	0	0	0	0	0
Total	0	1	7	4	2	0	14

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: 3

Byron Generating Station

Period of Record: January - March 2021  
 Stability Class - Neutral - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	4	13	42	27	0	0	86
NNE	5	11	15	13	3	0	47
NE	2	8	14	12	9	4	49
ENE	3	11	8	12	0	0	34
E	6	19	19	10	0	0	54
ESE	0	9	11	3	0	0	23
SE	1	9	28	7	1	0	46
SSE	3	10	17	23	0	0	53
S	3	3	24	14	6	2	52
SSW	1	15	18	9	0	0	43
SW	2	20	14	7	0	0	43
WSW	3	21	14	15	10	0	63
W	5	47	37	34	6	0	129
WNW	9	24	27	24	7	0	91
NW	5	35	44	22	9	0	115
NNW	5	38	84	18	0	0	145
Variable	0	0	0	0	0	0	0
Total	57	293	416	250	51	6	1073

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: 3

Byron Generating Station

Period of Record: January - March 2021  
 Stability Class - Slightly Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	4	16	12	0	0	0	32
NNE	4	13	15	2	1	0	35
NE	1	6	6	0	0	0	13
ENE	1	12	3	4	0	0	20
E	7	8	6	1	0	0	22
ESE	2	16	25	18	8	0	69
SE	1	13	28	10	0	0	52
SSE	2	8	23	22	0	0	55
S	0	11	15	20	5	1	52
SSW	0	9	11	10	2	0	32
SW	1	26	8	8	0	0	43
WSW	3	13	4	14	0	0	34
W	15	49	42	10	0	0	116
WNW	3	30	23	9	1	0	66
NW	9	24	16	4	0	0	53
NNW	4	24	12	0	0	0	40
Variable	0	0	0	0	0	0	0
Total	57	278	249	132	17	1	734

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: 3

Byron Generating Station

Period of Record: January - March 2021  
 Stability Class - Moderately Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	1	2	0	0	0	0	3
NNE	1	1	0	0	0	0	2
NE	0	1	0	0	0	0	1
ENE	1	0	1	0	0	0	2
E	1	2	0	0	0	0	3
ESE	0	9	18	0	0	0	27
SE	3	13	18	1	0	0	35
SSE	0	6	14	2	0	0	22
S	3	6	4	5	0	0	18
SSW	3	0	0	0	0	0	3
SW	5	1	0	0	0	0	6
WSW	4	0	0	0	0	0	4
W	10	11	0	0	0	0	21
WNW	14	4	0	0	0	0	18
NW	11	12	0	0	0	0	23
NNW	3	16	0	0	0	0	19
Variable	0	0	0	0	0	0	0
Total	60	84	55	8	0	0	207

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: 3

Byron Generating Station

Period of Record: January - March 2021  
 Stability Class - Extremely Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	3	0	0	0	0	0	3
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	1	0	0	0	0	0	1
E	2	1	1	0	0	0	4
ESE	2	3	7	0	0	0	12
SE	4	10	2	0	0	0	16
SSE	0	13	6	0	0	0	19
S	4	3	1	0	0	0	8
SSW	3	0	0	0	0	0	3
SW	1	0	0	0	0	0	1
WSW	7	0	0	0	0	0	7
W	8	0	0	0	0	0	8
WNW	13	0	0	0	0	0	13
NW	13	4	0	0	0	0	17
NNW	2	0	0	0	0	0	2
Variable	0	0	0	0	0	0	0
Total	63	34	17	0	0	0	114

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: 3



Byron Generating Station

Period of Record: January - March 2021  
 Stability Class - Extremely Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	1	5	0	0	6
NNE	0	0	1	0	0	0	1
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	0	0	0	0	0
NNW	0	0	0	2	0	0	2
Variable	0	0	0	0	0	0	0
Total	0	0	2	7	0	0	9

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: 3

Byron Generating Station

Period of Record: January - March 2021  
 Stability Class - Moderately Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	0	2	0	0	2
NNE	0	0	1	0	0	0	1
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	1	0	0	1
W	0	0	0	0	0	0	0
WNW	0	0	0	0	1	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	1	3	1	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: 3

Byron Generating Station

Period of Record: January - March 2021  
 Stability Class - Slightly Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	4	3	0	0	7
NNE	0	0	1	0	0	0	1
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	2	1	3
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	1	0	0	1
W	0	0	0	0	1	0	1
WNW	0	0	0	0	1	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	5	4	4	1	14

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: 3

Byron Generating Station

Period of Record: January - March 2021  
 Stability Class - Neutral - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	1	14	40	57	18	0	130
NNE	1	8	12	11	13	5	50
NE	2	4	12	7	13	15	53
ENE	2	9	4	9	10	1	35
E	1	10	22	10	4	6	53
ESE	0	1	5	5	2	2	15
SE	2	0	6	15	2	2	27
SSE	0	5	10	25	9	3	52
S	0	2	9	13	19	10	53
SSW	1	4	4	19	4	0	32
SW	0	6	13	12	6	1	38
WSW	0	6	8	12	14	9	49
W	2	28	39	27	25	7	128
WNW	3	16	22	9	26	6	82
NW	3	18	19	30	12	6	88
NNW	0	16	41	53	1	0	111
Variable	0	0	0	0	0	0	0
Total	18	147	266	314	178	73	996

Hours of calm in this stability class: 0  
 Hours of missing wind measurements in this stability class: 77  
 Hours of missing stability measurements in all stability classes: 3

Byron Generating Station

Period of Record: January - March 2021  
 Stability Class - Slightly Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	2	3	11	11	1	0	28
NNE	0	5	7	13	8	1	34
NE	0	2	9	7	3	1	22
ENE	2	3	7	2	2	2	18
E	0	2	9	1	2	0	14
ESE	0	2	3	12	11	13	41
SE	2	2	7	16	15	6	48
SSE	1	4	11	15	22	7	60
S	0	1	2	10	20	21	54
SSW	1	0	8	10	16	7	42
SW	0	1	7	23	13	3	47
WSW	1	1	6	15	13	0	36
W	1	2	20	43	13	0	79
WNW	0	7	20	30	8	1	66
NW	0	9	13	24	3	0	49
NNW	1	2	6	21	0	0	30
Variable	0	0	0	0	0	0	0
Total	11	46	146	253	150	62	668

Hours of calm in this stability class: 0  
 Hours of missing wind measurements in this stability class: 66  
 Hours of missing stability measurements in all stability classes: 3

Byron Generating Station

Period of Record: January - March 2021  
 Stability Class - Moderately Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	1	8	7	0	0	16
NNE	0	1	2	6	0	0	9
NE	1	0	0	0	0	0	1
ENE	1	0	1	0	0	0	2
E	0	1	4	1	0	0	6
ESE	0	0	1	2	0	0	3
SE	2	0	3	6	13	2	26
SSE	0	0	6	10	12	5	33
S	0	1	2	9	9	7	28
SSW	0	1	1	3	1	3	9
SW	0	1	0	0	0	0	1
WSW	2	2	1	0	0	0	5
W	1	0	4	4	0	0	9
WNW	0	1	10	7	0	0	18
NW	0	2	12	8	0	0	22
NNW	0	1	6	12	0	0	19
Variable	0	0	0	0	0	0	0
Total	7	12	61	75	35	17	207

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: 3

Byron Generating Station

Period of Record: January - March 2021  
 Stability Class - Extremely Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	2	4	5	0	0	11
NNE	0	0	0	0	0	0	0
NE	1	4	0	0	0	0	5
ENE	2	5	0	0	0	0	7
E	0	2	0	0	0	0	2
ESE	0	1	3	0	0	0	4
SE	0	1	2	3	7	0	13
SSE	0	2	5	5	3	2	17
S	0	0	1	8	4	0	13
SSW	0	0	1	7	1	0	9
SW	1	0	0	0	0	0	1
WSW	0	0	1	0	0	0	1
W	0	1	3	1	0	0	5
WNW	0	4	2	2	0	0	8
NW	1	2	4	4	0	0	11
NNW	1	2	4	1	0	0	8
Variable	0	0	0	0	0	0	0
Total	6	26	30	36	15	2	115

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: 3

Byron Generating Station

Period of Record: April - June 2021  
 Stability Class - Extremely Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
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	1	0	0	0	0	0	1
SSE	1	2	1	0	0	0	4
S	0	0	1	0	0	0	1
SSW	0	0	0	0	0	0	0
SW	0	0	0	1	0	0	1
WSW	0	0	0	3	0	0	3
W	0	1	0	0	0	0	1
WNW	1	2	0	0	0	0	3
NW	0	0	0	0	0	0	0
NNW	0	0	1	0	0	0	1
Variable	0	0	0	0	0	0	0
Total	3	6	3	4	0	0	16

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: 3



Byron Generating Station

Period of Record: April - June 2021

Stability Class - Moderately Unstable - 250Ft-30Ft Delta-T (F)

Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	1	0	0	0	1
NNE	0	0	0	0	0	0	0
NE	0	1	0	0	0	0	1
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	1	0	0	0	1
SSE	0	0	0	0	0	0	0
S	0	0	3	4	0	0	7
SSW	0	0	3	1	1	0	5
SW	0	0	7	3	0	0	10
WSW	0	0	4	2	0	0	6
W	0	0	6	1	0	0	7
WNW	0	0	1	0	0	0	1
NW	0	1	1	0	0	0	2
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	2	27	11	1	0	41

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: 3

Byron Generating Station

Period of Record: April - June 2021  
 Stability Class - Slightly Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	1	1	3	0	0	5
NNE	0	0	2	0	0	0	2
NE	0	0	2	0	0	0	2
ENE	0	3	1	0	0	0	4
E	0	1	0	0	0	0	1
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	2	3	1	6
S	0	2	1	6	0	0	9
SSW	0	2	6	1	0	0	9
SW	0	0	6	4	1	0	11
WSW	0	1	3	3	0	0	7
W	0	1	4	5	0	0	10
WNW	0	0	2	1	0	0	3
NW	1	0	2	1	0	0	4
NNW	0	2	6	0	0	0	8
Variable	0	0	0	0	0	0	0
Total	1	13	36	26	4	1	81

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: 3

Byron Generating Station

Period of Record: April - June 2021  
 Stability Class - Neutral - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	2	14	34	13	0	0	63
NNE	3	23	29	14	0	0	69
NE	2	7	5	18	0	0	32
ENE	0	20	10	7	0	0	37
E	3	14	12	2	0	0	31
ESE	5	15	8	7	1	0	36
SE	0	12	15	14	0	0	41
SSE	1	11	30	7	0	0	49
S	6	30	42	38	2	0	118
SSW	1	38	67	23	1	0	130
SW	4	25	43	13	2	0	87
WSW	2	14	31	6	1	1	55
W	4	20	22	20	3	0	69
WNW	1	20	19	26	0	0	66
NW	5	26	45	33	0	0	109
NNW	3	24	43	7	0	0	77
Variable	0	0	0	0	0	0	0
Total	42	313	455	248	10	1	1069

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: 3

Byron Generating Station

Period of Record: April - June 2021  
 Stability Class - Slightly Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	4	11	4	0	0	0	19
NNE	3	10	3	0	0	0	16
NE	1	6	1	0	0	0	8
ENE	4	6	8	2	0	0	20
E	6	26	4	0	0	0	36
ESE	7	17	16	5	0	0	45
SE	9	13	14	2	0	0	38
SSE	8	17	59	3	0	0	87
S	4	42	29	11	0	0	86
SSW	5	30	27	9	0	0	71
SW	5	21	20	8	0	0	54
WSW	4	13	16	0	1	0	34
W	15	15	11	1	0	0	42
WNW	6	15	7	0	0	0	28
NW	0	20	6	4	0	0	30
NNW	1	16	11	0	0	0	28
Variable	0	0	0	0	0	0	0
Total	82	278	236	45	1	0	642

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: 3

Byron Generating Station

Period of Record: April - June 2021  
 Stability Class - Moderately Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	4	1	0	0	0	0	5
NNE	1	0	0	0	0	0	1
NE	2	1	0	0	0	0	3
ENE	3	4	0	0	0	0	7
E	6	14	3	0	0	0	23
ESE	6	22	2	0	0	0	30
SE	1	17	3	0	0	0	21
SSE	7	28	16	0	0	0	51
S	5	10	12	0	0	0	27
SSW	9	6	1	0	0	0	16
SW	14	3	0	0	0	0	17
WSW	9	1	0	0	0	0	10
W	13	3	0	0	0	0	16
WNW	9	2	0	0	0	0	11
NW	5	4	0	0	0	0	9
NNW	3	9	0	0	0	0	12
Variable	0	0	0	0	0	0	0
Total	97	125	37	0	0	0	259

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: 3

Byron Generating Station

Period of Record: April - June 2021  
 Stability Class - Extremely Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
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	2	0	0	0	0	0	2
E	0	1	0	0	0	0	1
ESE	4	2	0	0	0	0	6
SE	3	6	0	0	0	0	9
SSE	1	2	0	0	0	0	3
S	6	3	0	0	0	0	9
SSW	4	1	0	0	0	0	5
SW	8	0	0	0	0	0	8
WSW	5	0	0	0	0	0	5
W	6	0	0	0	0	0	6
WNW	6	1	0	0	0	0	7
NW	7	2	0	0	0	0	9
NNW	1	2	0	0	0	0	3
Variable	0	0	0	0	0	0	0
Total	53	20	0	0	0	0	73

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: 3

Byron Generating Station

Period of Record: April - June 2021  
 Stability Class - Extremely Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	0	1	0	0	1
NNE	0	0	1	0	0	0	1
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	1	0	0	0	0	0	1
SSE	0	1	2	1	0	0	4
S	0	0	0	0	0	0	0
SSW	0	0	0	1	0	0	1
SW	0	0	0	0	1	0	1
WSW	0	0	0	2	1	0	3
W	0	1	0	0	0	0	1
WNW	1	2	0	0	0	0	3
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	2	4	3	5	2	0	16

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: 3

Byron Generating Station

Period of Record: April - June 2021

Stability Class - Moderately Unstable - 250Ft-30Ft Delta-T (F)

Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	0	1	0	0	1
NNE	0	0	0	0	0	0	0
NE	0	0	1	0	0	0	1
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	1	0	1
SSE	0	0	0	0	0	0	0
S	0	0	0	3	2	0	5
SSW	0	0	1	4	0	1	6
SW	0	0	2	5	3	1	11
WSW	0	0	1	3	2	0	6
W	0	0	3	4	0	0	7
WNW	0	0	0	1	0	0	1
NW	0	1	1	0	0	0	2
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	1	9	21	8	2	41

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: 3



Byron Generating Station

Period of Record: April - June 2021

Stability Class - Slightly Unstable - 250Ft-30Ft Delta-T (F)

Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	1	1	6	0	0	8
NNE	0	0	0	1	0	0	1
NE	0	0	3	2	0	0	5
ENE	0	1	1	0	0	0	2
E	0	2	0	0	0	0	2
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	1	1	4	6
S	0	0	2	4	2	0	8
SSW	0	1	4	2	1	0	8
SW	0	0	3	5	4	1	13
WSW	0	0	3	1	3	0	7
W	0	0	2	5	3	0	10
WNW	0	0	2	2	0	0	4
NW	1	0	1	1	0	0	3
NNW	0	1	0	3	0	0	4
Variable	0	0	0	0	0	0	0
Total	1	6	22	33	14	5	81

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: 3

Byron Generating Station

Period of Record: April - June 2021  
 Stability Class - Neutral - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	4	12	28	25	3	0	72
NNE	1	9	25	9	5	0	49
NE	2	10	9	9	17	9	56
ENE	0	8	8	6	5	2	29
E	2	12	5	12	3	1	35
ESE	3	12	3	9	6	1	34
SE	1	8	7	9	15	0	40
SSE	2	10	8	27	4	1	52
S	0	12	22	49	20	7	110
SSW	1	24	47	40	23	3	138
SW	1	8	26	33	13	4	85
WSW	2	4	22	21	4	2	55
W	3	17	18	20	17	1	76
WNW	2	14	15	27	7	0	65
NW	1	13	25	38	17	0	94
NNW	1	15	27	34	2	0	79
Variable	0	0	0	0	0	0	0
Total	26	188	295	368	161	31	1069

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: 3

Byron Generating Station

Period of Record: April - June 2021  
 Stability Class - Slightly Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	1	2	10	7	0	0	20
NNE	1	1	8	14	0	0	24
NE	2	2	1	2	0	0	7
ENE	3	3	3	4	7	0	20
E	0	4	10	6	1	0	21
ESE	2	5	14	19	8	0	48
SE	0	4	5	12	6	1	28
SSE	0	5	7	26	12	1	51
S	1	5	15	44	27	3	95
SSW	0	13	24	50	17	2	106
SW	1	2	6	24	18	6	57
WSW	2	6	9	18	3	1	39
W	0	6	10	19	2	0	37
WNW	1	4	14	4	0	0	23
NW	0	2	25	8	4	0	39
NNW	0	3	7	15	1	0	26
Variable	0	0	0	0	0	0	0
Total	14	67	168	272	106	14	641

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: 3

Byron Generating Station

Period of Record: April - June 2021  
 Stability Class - Moderately Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	2	2	4	0	0	8
NNE	0	1	3	0	0	0	4
NE	0	0	3	0	0	0	3
ENE	0	5	0	1	0	0	6
E	0	3	5	4	0	0	12
ESE	1	3	9	10	2	0	25
SE	0	3	7	9	1	0	20
SSE	0	3	13	10	8	0	34
S	1	4	11	16	19	1	52
SSW	1	0	6	9	5	0	21
SW	0	2	6	5	1	0	14
WSW	0	1	7	6	0	0	14
W	0	3	8	6	0	0	17
WNW	0	2	7	0	0	0	9
NW	0	2	7	2	0	0	11
NNW	1	2	5	1	0	0	9
Variable	0	0	0	0	0	0	0
Total	4	36	99	83	36	1	259

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: 3

Byron Generating Station

Period of Record: April - June 2021  
 Stability Class - Extremely Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	0	3	0	0	3
NNE	0	0	1	0	0	0	1
NE	0	0	0	0	0	0	0
ENE	1	0	0	0	0	0	1
E	0	3	0	0	0	0	3
ESE	0	2	0	0	0	0	2
SE	0	1	1	0	0	0	2
SSE	0	6	1	0	3	0	10
S	0	2	1	1	1	0	5
SSW	0	5	0	0	0	0	5
SW	0	3	7	0	1	0	11
WSW	0	2	6	5	0	0	13
W	1	3	3	1	0	0	8
WNW	1	1	3	0	0	0	5
NW	0	0	2	0	0	0	2
NNW	0	0	0	2	0	0	2
Variable	0	0	0	0	0	0	0
Total	3	28	25	12	5	0	73

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: 3

Byron Generating Station

Period of Record: July - September 2021  
 Stability Class - Extremely Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	1	0	4	0	0	0	5
NNE	0	1	0	0	0	0	1
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	0	0	0	2
S	0	0	0	0	0	0	0
SSW	0	1	0	0	0	0	1
SW	0	0	1	0	0	0	1
WSW	0	0	2	0	0	0	2
W	0	0	0	2	0	0	2
WNW	0	0	1	1	0	0	2
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	2	10	3	0	0	16

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: 8

Byron Generating Station

Period of Record: July - September 2021  
 Stability Class - Moderately Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	1	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	4	0	0	0	4
SSW	0	0	3	0	0	0	3
SW	0	0	3	0	0	0	3
WSW	0	0	3	6	0	0	9
W	0	3	4	1	0	0	8
WNW	0	1	0	2	0	0	3
NW	0	1	0	2	0	0	3
NNW	1	0	0	0	0	0	1
Variable	0	0	0	0	0	0	0
Total	1	5	18	11	0	0	35

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: 8

Byron Generating Station

Period of Record: July - September 2021  
 Stability Class - Slightly Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	1	2	1	1	0	0	5
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	0	1	0	0	0	0	1
ESE	0	1	3	0	0	0	4
SE	0	0	2	0	0	0	2
SSE	0	0	3	0	0	0	3
S	0	1	2	3	0	0	6
SSW	0	3	4	3	0	0	10
SW	0	0	7	2	0	0	9
WSW	0	0	8	1	0	0	9
W	0	2	3	1	0	0	6
WNW	0	1	3	3	0	0	7
NW	0	2	2	1	0	0	5
NNW	0	3	0	1	0	0	4
Variable	0	0	0	0	0	0	0
Total	1	19	39	16	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: 8



Byron Generating Station

Period of Record: July - September 2021  
 Stability Class - Neutral - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	3	22	22	8	0	0	55
NNE	1	12	20	0	0	0	33
NE	2	13	28	3	0	0	46
ENE	5	43	6	0	0	0	54
E	1	35	2	0	0	0	38
ESE	3	23	9	0	0	0	35
SE	3	33	7	0	0	0	43
SSE	2	21	26	1	0	0	50
S	1	18	35	7	0	0	61
SSW	2	22	52	12	1	0	89
SW	1	24	42	6	0	0	73
WSW	4	18	19	5	0	0	46
W	9	30	32	8	0	0	79
WNW	6	26	26	1	0	0	59
NW	3	20	22	8	0	0	53
NNW	4	25	20	2	0	0	51
Variable	0	0	0	0	0	0	0
Total	50	385	368	61	1	0	865

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: 8

Byron Generating Station

Period of Record: July - September 2021  
 Stability Class - Slightly Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	8	21	7	0	0	0	36
NNE	8	18	0	0	0	0	26
NE	3	18	19	0	0	0	40
ENE	8	19	8	0	0	0	35
E	9	38	0	0	0	0	47
ESE	2	17	2	0	1	0	22
SE	4	18	4	0	0	0	26
SSE	3	42	26	1	0	0	72
S	6	50	24	3	0	0	83
SSW	6	34	28	3	0	0	71
SW	9	34	15	3	0	0	61
WSW	6	14	2	0	0	0	22
W	5	16	4	0	0	0	25
WNW	10	16	3	1	0	0	30
NW	10	30	6	0	1	0	47
NNW	6	28	6	0	0	0	40
Variable	0	0	0	0	0	0	0
Total	103	413	154	11	2	0	683

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: 8

Byron Generating Station

Period of Record: July - September 2021  
 Stability Class - Moderately Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	2	4	0	0	0	0	6
NNE	4	3	0	0	0	0	7
NE	0	0	0	0	0	0	0
ENE	4	5	0	0	0	0	9
E	8	31	0	0	0	0	39
ESE	5	29	4	0	0	0	38
SE	6	26	2	0	0	0	34
SSE	8	31	6	0	0	0	45
S	6	23	4	0	0	0	33
SSW	7	6	0	0	0	0	13
SW	4	1	0	0	0	0	5
WSW	10	6	0	0	0	0	16
W	19	11	0	0	0	0	30
WNW	17	4	0	0	0	0	21
NW	18	11	0	0	0	0	29
NNW	4	10	0	0	0	0	14
Variable	0	0	0	0	0	0	0
Total	122	201	16	0	0	0	339

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: 8

Byron Generating Station

Period of Record: July - September 2021  
 Stability Class - Extremely Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	2	0	0	0	0	0	2
NNE	0	0	0	0	0	0	0
NE	3	0	0	0	0	0	3
ENE	2	0	0	0	0	0	2
E	11	13	0	0	0	0	24
ESE	2	6	3	0	0	0	11
SE	4	11	0	0	0	0	15
SSE	4	8	3	0	0	0	15
S	11	7	1	0	0	0	19
SSW	9	4	0	0	0	0	13
SW	7	0	0	0	0	0	7
WSW	10	0	0	0	0	0	10
W	14	0	0	0	0	0	14
WNW	21	0	0	0	0	0	21
NW	18	0	0	0	0	0	18
NNW	4	2	0	0	0	0	6
Variable	0	0	0	0	0	0	0
Total	122	51	7	0	0	0	180

Hours of calm in this stability class: 7  
 Hours of missing wind measurements in this stability class: 0  
 Hours of missing stability measurements in all stability classes: 8

Byron Generating Station

Period of Record: July - September 2021  
 Stability Class - Extremely Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	2	0	2	0	0	4
NNE	0	0	0	2	0	0	2
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	1	0	0	1
S	0	0	0	1	0	0	1
SSW	0	1	0	0	0	0	1
SW	0	0	0	1	0	0	1
WSW	0	0	0	2	0	0	2
W	0	2	0	0	0	0	2
WNW	0	1	0	1	0	0	2
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	0	10	0	0	16

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: 8

Byron Generating Station

Period of Record: July - September 2021  
 Stability Class - Moderately Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	1	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	3	0	0	3
SSW	0	0	3	0	0	0	3
SW	0	0	1	3	0	0	4
WSW	0	0	1	5	3	0	9
W	2	1	4	1	0	0	8
WNW	0	0	0	1	1	0	2
NW	0	1	0	1	1	0	3
NNW	0	2	0	0	0	0	2
Variable	0	0	0	0	0	0	0
Total	2	4	10	14	5	0	35

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: 8

Byron Generating Station

Period of Record: July - September 2021  
 Stability Class - Slightly Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	1	0	1	1	0	3
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	2	1	0	0	0	3
E	0	1	1	0	0	0	2
ESE	0	0	3	1	0	0	4
SE	0	0	2	0	0	0	2
SSE	0	0	0	2	0	0	2
S	0	0	3	1	3	0	7
SSW	0	0	4	2	2	0	8
SW	0	0	3	5	3	0	11
WSW	0	0	4	5	1	0	10
W	0	2	2	2	0	0	6
WNW	1	0	2	2	2	0	7
NW	0	0	3	1	1	0	5
NNW	0	2	3	0	0	0	5
Variable	0	0	0	0	0	0	0
Total	1	8	31	22	13	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: 8

Byron Generating Station

Period of Record: July - September 2021  
 Stability Class - Neutral - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	2	8	19	16	3	0	48
NNE	1	9	20	8	0	0	38
NE	1	6	13	21	2	0	43
ENE	2	12	27	8	2	0	51
E	1	18	23	2	0	0	44
ESE	1	16	16	0	0	0	33
SE	0	19	24	1	0	0	44
SSE	3	9	15	15	0	0	42
S	2	8	21	26	6	0	63
SSW	2	7	22	42	14	1	88
SW	3	11	22	38	8	2	84
WSW	4	13	11	15	3	0	46
W	5	15	37	13	5	0	75
WNW	8	10	27	7	1	0	53
NW	5	21	11	10	6	0	53
NNW	1	18	18	9	0	0	46
Variable	0	0	0	0	0	0	0
Total	41	200	326	231	50	3	851

Hours of calm in this stability class: 14  
 Hours of missing wind measurements in this stability class: 0  
 Hours of missing stability measurements in all stability classes: 8



Byron Generating Station

Period of Record: July - September 2021  
 Stability Class - Slightly Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	1	8	17	18	0	0	44
NNE	2	4	11	10	0	0	27
NE	4	7	13	14	0	0	38
ENE	0	7	20	24	1	0	52
E	0	10	17	11	1	0	39
ESE	0	3	7	9	1	0	20
SE	5	4	7	2	1	0	19
SSE	7	10	8	14	4	0	43
S	0	4	15	53	12	0	84
SSW	1	1	17	48	14	0	81
SW	2	5	9	52	7	3	78
WSW	2	4	12	4	0	0	22
W	0	5	14	6	1	0	26
WNW	3	4	12	1	1	0	21
NW	0	11	16	12	0	1	40
NNW	2	11	15	12	0	0	40
Variable	0	0	0	0	0	0	0
Total	29	98	210	290	43	4	674

Hours of calm in this stability class: 9  
 Hours of missing wind measurements in this stability class: 0  
 Hours of missing stability measurements in all stability classes: 8

Byron Generating Station

Period of Record: July - September 2021  
 Stability Class - Moderately Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	2	1	4	5	0	0	12
NNE	0	0	6	5	0	0	11
NE	0	3	4	1	0	0	8
ENE	0	0	2	2	0	0	4
E	0	6	6	7	3	0	22
ESE	0	1	11	15	9	0	36
SE	1	3	7	15	7	0	33
SSE	2	2	5	18	7	0	34
S	1	0	4	13	11	0	29
SSW	1	0	9	18	0	0	28
SW	1	2	7	8	0	0	18
WSW	1	1	4	2	0	0	8
W	1	2	1	4	0	0	8
WNW	8	2	7	10	0	0	27
NW	1	8	14	6	0	0	29
NNW	2	6	10	6	0	0	24
Variable	0	0	0	0	0	0	0
Total	21	37	101	135	37	0	331

Hours of calm in this stability class: 8  
 Hours of missing wind measurements in this stability class: 0  
 Hours of missing stability measurements in all stability classes: 8

Byron Generating Station

Period of Record: July - September 2021  
 Stability Class - Extremely Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	1	1	0	0	0	2
NNE	0	2	0	0	0	0	2
NE	0	3	4	0	0	0	7
ENE	3	3	2	0	0	0	8
E	1	2	1	0	0	0	4
ESE	0	0	4	9	2	0	15
SE	1	0	7	20	2	0	30
SSE	1	1	7	3	5	0	17
S	0	4	3	2	3	0	12
SSW	3	1	1	4	0	0	9
SW	0	1	8	5	0	0	14
WSW	0	2	4	4	0	0	10
W	2	4	0	4	0	0	10
WNW	0	2	2	1	0	0	5
NW	0	2	12	1	0	0	15
NNW	1	5	14	3	0	0	23
Variable	0	0	0	0	0	0	0
Total	12	33	70	56	12	0	183

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: 8

Byron Generating Station

Period of Record: October - December 2021  
 Stability Class - Extremely Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
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	5	2	0	0	7
SSW	0	0	0	0	0	0	0
SW	0	1	0	0	0	0	1
WSW	0	0	1	0	0	0	1
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
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	6	2	0	0	9

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 2021  
 Stability Class - Moderately Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	0	1	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	1	0	1	0	0	2
SSW	0	0	0	0	0	0	0
SW	0	1	0	0	0	0	1
WSW	0	0	0	0	0	0	0
W	0	0	1	0	0	0	1
WNW	0	0	2	0	0	0	2
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	2	3	2	0	0	7

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 2021  
 Stability Class - Slightly Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

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

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 2021  
 Stability Class - Neutral - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	2	8	38	23	0	0	71
NNE	1	7	13	6	1	0	28
NE	1	10	12	4	0	0	27
ENE	3	28	28	9	1	0	69
E	0	21	22	6	0	0	49
ESE	1	9	8	11	0	0	29
SE	2	11	24	9	0	0	46
SSE	1	6	38	8	3	0	56
S	1	19	37	24	4	0	85
SSW	2	30	26	7	1	0	66
SW	2	15	18	12	0	0	47
WSW	2	11	17	14	12	3	59
W	1	10	29	19	12	2	73
WNW	4	19	47	44	17	2	133
NW	3	23	25	37	3	1	92
NNW	2	31	31	6	0	0	70
Variable	0	0	0	0	0	0	0
Total	28	258	413	239	54	8	1000

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 2021  
 Stability Class - Slightly Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	3	16	11	5	0	0	35
NNE	1	12	4	0	0	0	17
NE	4	8	4	0	0	0	16
ENE	4	23	12	2	1	0	42
E	3	23	11	3	0	0	40
ESE	1	8	15	9	0	0	33
SE	1	8	20	19	0	0	48
SSE	5	31	31	29	0	0	96
S	5	15	33	9	0	2	64
SSW	5	15	30	16	0	1	67
SW	8	20	20	6	0	2	56
WSW	12	10	19	6	2	3	52
W	3	46	22	12	0	0	83
WNW	8	37	20	8	4	0	77
NW	6	26	21	1	0	0	54
NNW	7	22	10	0	0	0	39
Variable	0	0	0	0	0	0	0
Total	76	320	283	125	7	8	819

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 2021  
 Stability Class - Moderately Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	2	3	0	0	0	0	5
NNE	1	0	0	0	0	0	1
NE	1	1	0	0	0	0	2
ENE	1	4	0	0	0	0	5
E	5	20	3	0	0	0	28
ESE	7	19	8	0	0	0	34
SE	2	14	6	0	0	0	22
SSE	4	24	6	0	0	0	34
S	6	16	1	0	0	0	23
SSW	2	5	0	0	0	0	7
SW	4	2	0	0	0	0	6
WSW	9	3	0	0	0	0	12
W	11	8	0	0	0	0	19
WNW	11	5	0	0	0	0	16
NW	7	7	0	0	0	0	14
NNW	4	4	0	0	0	0	8
Variable	0	0	0	0	0	0	0
Total	77	135	24	0	0	0	236

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 2021

Stability Class - Extremely Stable - 250Ft-30Ft Delta-T (F)

Winds Measured at 30 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
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	1	2	0	0	0	0	3
E	2	19	1	0	0	0	22
ESE	1	13	5	0	0	0	19
SE	2	3	2	0	0	0	7
SSE	0	10	0	0	0	0	10
S	5	8	0	0	0	0	13
SSW	3	1	0	0	0	0	4
SW	4	0	0	0	0	0	4
WSW	4	0	0	0	0	0	4
W	7	0	0	0	0	0	7
WNW	6	0	0	0	0	0	6
NW	12	1	0	0	0	0	13
NNW	4	0	0	0	0	0	4
Variable	0	0	0	0	0	0	0
Total	51	57	8	0	0	0	116

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 2021

Stability Class - Extremely Unstable - 250Ft-30Ft Delta-T (F)

Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
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	2	5	0	7
SSW	0	0	0	0	0	0	0
SW	0	0	1	0	0	0	1
WSW	0	0	0	1	0	0	1
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
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	1	3	5	0	9

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 2021

Stability Class - Moderately Unstable - 250Ft-30Ft Delta-T (F)

Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	0	1	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	1	0	1	0	2
SSW	0	0	0	0	0	0	0
SW	0	1	0	0	0	0	1
WSW	0	0	0	0	0	0	0
W	0	0	0	2	0	0	2
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	1	1	4	1	0	7

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 2021  
 Stability Class - Slightly Unstable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

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

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 2021  
 Stability Class - Neutral - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	9	7	28	14	0	58
NNE	1	4	14	12	8	4	43
NE	0	3	8	14	1	3	29
ENE	1	5	15	14	5	5	45
E	0	12	30	23	12	0	77
ESE	0	4	4	8	9	1	26
SE	1	5	10	17	6	1	40
SSE	1	5	9	26	5	1	47
S	1	7	23	39	15	7	92
SSW	1	9	28	25	7	3	73
SW	2	9	18	13	11	0	53
WSW	0	5	15	13	12	14	59
W	0	5	10	31	17	15	78
WNW	1	12	15	51	32	18	129
NW	3	13	27	21	24	2	90
NNW	2	11	29	15	4	0	61
Variable	0	0	0	0	0	0	0
Total	14	118	262	350	182	74	1000

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 2021  
 Stability Class - Slightly Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	1	5	9	13	4	0	32
NNE	1	3	10	16	1	0	31
NE	0	3	11	5	0	0	19
ENE	1	1	13	13	2	2	32
E	0	2	14	18	7	1	42
ESE	0	1	2	8	15	2	28
SE	2	1	2	11	15	9	40
SSE	1	2	4	19	32	7	65
S	0	1	14	35	17	12	79
SSW	2	8	9	35	41	1	96
SW	0	1	6	17	16	4	44
WSW	1	8	12	20	6	4	51
W	1	4	24	36	12	1	78
WNW	0	6	30	45	5	4	90
NW	0	7	29	23	8	0	67
NNW	0	3	15	6	1	0	25
Variable	0	0	0	0	0	0	0
Total	10	56	204	320	182	47	819

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 2021  
 Stability Class - Moderately Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	1	5	6	0	0	12
NNE	0	1	1	2	0	0	4
NE	1	1	1	0	0	0	3
ENE	1	0	1	0	0	0	2
E	0	1	6	5	0	0	12
ESE	0	5	5	7	10	1	28
SE	1	4	7	6	6	0	24
SSE	2	2	9	5	4	0	22
S	1	2	3	17	4	0	27
SSW	0	0	4	18	3	0	25
SW	1	2	2	4	0	0	9
WSW	1	1	8	3	0	0	13
W	1	4	6	6	0	0	17
WNW	1	2	10	8	0	0	21
NW	0	3	2	6	0	0	11
NNW	0	1	5	1	0	0	7
Variable	0	0	0	0	0	0	0
Total	10	30	75	94	27	1	237

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 2021  
 Stability Class - Extremely Stable - 250Ft-30Ft Delta-T (F)  
 Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	4	0	2	0	0	6
NNE	3	2	2	0	0	0	7
NE	0	1	0	0	0	0	1
ENE	0	1	0	0	0	0	1
E	0	1	4	1	1	0	7
ESE	0	0	0	8	8	2	18
SE	0	0	3	6	4	0	13
SSE	1	1	3	4	1	0	10
S	0	0	1	4	0	0	5
SSW	0	3	3	3	1	0	10
SW	1	0	2	5	0	0	8
WSW	0	1	8	0	0	0	9
W	0	3	2	0	0	0	5
WNW	1	0	2	0	0	0	3
NW	0	3	0	0	0	0	3
NNW	2	4	4	1	0	0	11
Variable	0	0	0	0	0	0	0
Total	8	24	34	34	15	2	117

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 was no errata data for 2021.

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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 2021

**Prepared By**

Teledyne Brown Engineering  
Environmental Services



Byron Nuclear Generating Station  
Byron, IL 61010

**April 2022**



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### Appendix A Location Designation

#### Tables

Table A-1 Radiological Groundwater Protection Program - Sampling Locations, Distance and Direction, Byron Nuclear Generating Station, 2021

#### Figures

Figure A-1 Monitoring Well Locations, Byron Nuclear Generating Station, 2021 (Extra wells noted on map are for reference only.)

### Appendix B Data Tables

#### Tables

Table B-I.1 Concentrations of Tritium, Strontium and Gross Alpha in Groundwater Samples Collected in the Vicinity of Byron Nuclear Generating Station, 2021

Table B-I.2 Concentrations of Gamma Emitters in Groundwater Samples Collected in the Vicinity of Byron Nuclear Generating Station, 2021

Table B-I.3 Concentrations of Hard-To-Detects in Groundwater Samples Collected in the Vicinity of Byron Nuclear Generating Station, 2021

## 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 fifteenth 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 2021. During that time period, 122 analyses were performed on 49 samples from 15 locations.

In 2021, fourteen (14) Radiological Groundwater Protection Program (RGPP) monitoring wells were sampled in total. Groundwater samples were obtained in March, May, September and November and analyzed for tritium.

Three wells contained levels of tritium above the lower limit of detection (LLD) of 200 pCi/L. They were AR-4 (201 pCi/L in March), AR-7 (234 pCi/L in March, 228 pCi/L in June, 230 pCi/L in November) and AR-11 (397 pCi/L in June, 444 pCi/L in November). Well AR-11 is near the Circulating Water Blowdown piping, where historical leakage through vacuum breakers was known to have occurred. Tritium in Well AR-7, located on-site just west of plant structures, has been measured in this well slightly above detection limits on an intermittent basis since the well was first drilled in 2006. The tritium present in this well is likely due to legacy tritium prior to 2006 or precipitation recapture and is not believed to be the result of new leaks. The tritium measured in this well has been at or below tritium levels that have been historically measured in rainwater as a result of precipitation recapture from permitted gaseous releases. In August 2014, a break in the well piping was discovered about six feet below the surface that could have served as the entry point for tritium in the recapture water. Tritium present in well AR-7 has shown a gradual decrease since 2014. 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 tritium standard of 20,000 pCi/L.

In December 2018, two new wells, AR-12 and AR-13, were installed near well AR-7. These wells were added to provide additional monitoring capabilities in the area directly west of plant structures. No tritium was detected in these wells during 2021.

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 in the dissolved and suspended fractions were performed on 10 samples in 2021. Gross Alpha (dissolved or suspended) was not detected at any location above the MDC.

Natural gamma-emitting nuclide potassium-40 (K-40) was detected at two locations with concentrations ranging from 25 to 76 pCi/L. No other gamma-emitting radionuclides were detected at any of other sample locations in 2021.

Hard-To Detect (HTD) analyses for Iron-55 (Fe-55) and Nickel-63 (Ni-63) were performed at 9 groundwater locations in 2021. All analyses results were less than the MDC.

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 online February 2, 1985. Unit Two went online January 9, 1987.

This report covers those analyses performed by Teledyne Brown Engineering (TBE) on samples collected in 2021.

### 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

Sample Collection

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

Groundwater/Surface Water

Samples of water are collected, managed, transported and analyzed in accordance with approved procedures following EPA methods. Groundwater is collected from drilled wells. Surface water is collected from the Construction Runoff Pond (CROP), which collects stormwater runoff from the site protected area prior to discharge offsite. 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 ( $^3\text{He}$ ). 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 2021.

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

1. Concentrations of strontium in groundwater
2. Concentrations of tritium in groundwater/surface water
3. Concentrations of gamma nuclides in groundwater/surface water
4. Concentrations of gross alpha monitoring in groundwater/surface water
5. Concentrations of hard-to-detect nuclides (Fe-55 and Ni-63) 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. Lower Limit of Detection and Minimum Detectable Concentration

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. Laboratory Measurements Uncertainty

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

Statistically, the exact value of a measurement is expressed as a range with a stated level of confidence. The convention is to report results with a 95% level of confidence. The uncertainty comes from calibration standards, sample volume or weight measurements, sampling uncertainty and other factors. Exelon reports the uncertainty of a measurement created by statistical process (counting error) as well as all sources of error (Total Propagated Uncertainty or TPU). Each result has two values calculated. Exelon reports the TPU by following the result with plus or minus  $\pm$  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  $\pm 70$  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  $\pm 70$  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  $140 \pm 100$  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 444 pCi/L. Outside of the station boundary, tritium concentrations were all less than detection limit (<200 pCi/L). 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. (Table B-I.1, Appendix B)

###### Gross Alpha (dissolved and suspended)

Gross Alpha in the dissolved and suspended fractions were not detected above the MDC on any of the 10 sample analyzed in 2021. (Table B-I.1, Appendix B)

###### Gamma Emitters

Naturally-occurring potassium-40 (K-40) was detected at a concentration range of 25 - 76 pCi/L in two samples. No other gamma-emitting nuclides were detected in groundwater or surface water samples in 2021. (Table B-I.2, Appendix B)

###### Hard-To-Detects

Hard-To-Detect (HTD) analyses of iron-55 (Fe-55) and nickel-63 (Ni-63) were performed on nine groundwater samples. All results were less than the MDC. (Table B-I.3, Appendix B)

##### B. Drinking Water Well Survey

No drinking water well surveys were conducted in 2021.

- 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 2021.
- 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 legacy tritium prior to 2006 or precipitation recapture, not the result of a new spill or leak.
- F. Investigations  
There were no investigations that took place in 2021 as a result of groundwater sample results.
- G. Actions Taken
1. Compensatory Actions  
No compensatory actions were initiated in 2021.
  2. Installation of Monitoring Wells  
No new monitoring wells were installed in 2021.
  3. Actions to Recover/Reverse Plumes  
No actions were undertaken to recover/reverse plumes in 2021.

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## **APPENDIX A**

### **LOCATION DESIGNATION**

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TABLE A-1: Radiological Groundwater Protection Program - Sampling Locations  
Distance and Direction, Byron Nuclear Generating Station, 2021

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<u>Site</u>	<u>Site Type</u>	<u>Temporary/Permanent</u>	<u>Distance and Direction</u>
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
AR-12	Monitoring Well	Permanent	366 feet/W
AR-13	Monitoring Well	Permanent	461 feet/WSW
CAR-1	Monitoring Well	Permanent	2.25 miles/WNW
CAR-3	Monitoring Well	Permanent	0.16 miles/SE
TW-13	Monitoring Well	Permanent	2.3 miles/WNW
CROP	Surface Water	Permanent	0.2 miles NE

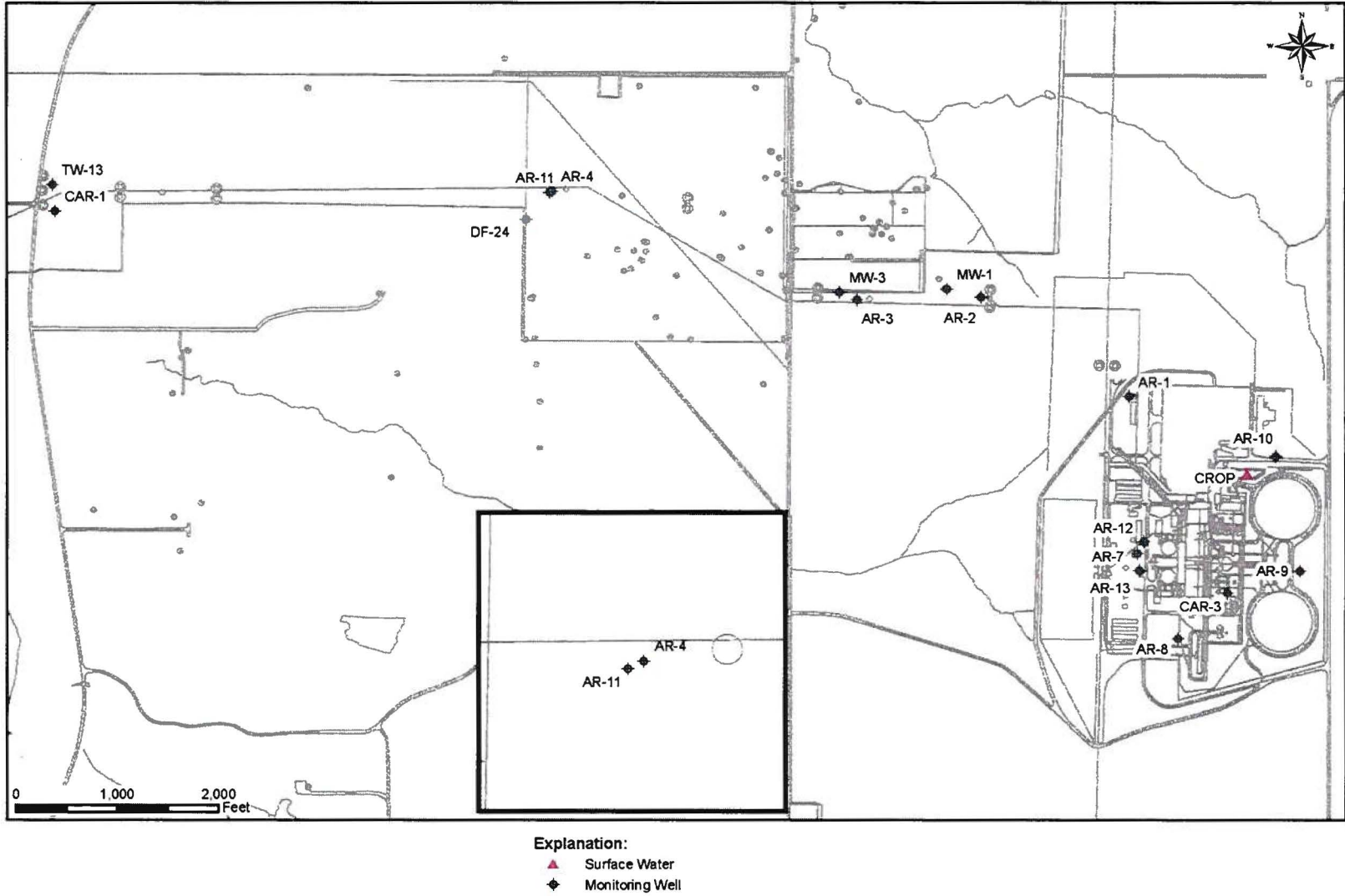


Figure A-1  
Monitoring Well Locations, Byron Nuclear Generating Station, 2021

## **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, 2021**  
RESULTS IN UNITS OF PCI/LITER  $\pm$  2 SIGMA

SITE	COLLECTION		H-3	Sr-89	Sr-90	Gr-A (Dis)	Gr-A (Sus)
	DATE						
AR-1	03/17/21	< 183					
AR-1	06/04/21	< 185		< 9.0	< 0.9	< 0.9	< 0.7
AR-1	09/03/21	< 159					
AR-1	11/03/21	< 177					
AR-2	06/02/21	< 180					
AR-3	03/17/21	< 180					
AR-3	06/02/21	< 186		< 9.0	< 0.9	< 0.9	< 1.1
AR-3	09/01/21	< 169					
AR-3	11/03/21	< 179					
AR-4	03/17/21	201 $\pm$ 118					
AR-4	06/02/21	< 184		< 8.6	< 1.0	< 0.9	< 1.1
AR-4	09/01/21	176 $\pm$ 106					
AR-4	11/03/21	< 179					
AR-7	03/16/21	234 $\pm$ 122					
AR-7	06/02/21	228 $\pm$ 125		< 9.2	< 0.9	< 1.6	< 0.8
AR-7	09/02/21	180 $\pm$ 106					
AR-7	11/03/21	230 $\pm$ 133					
AR-8	03/17/21	< 181					
AR-8	06/02/21	< 189		< 9.2	< 0.8	< 0.7	< 0.7
AR-8	09/02/21	< 164					
AR-8	11/03/21	< 171					
AR-9	03/17/21	< 179					
AR-9	06/04/21	< 189		< 5.9	< 0.9	< 0.8	< 0.7
AR-9	09/02/21	< 161					
AR-9	11/03/21	< 173					
AR-10	03/17/21	< 182					
AR-10	06/04/21	< 189					
AR-10	11/03/21	< 184					
AR-11	06/02/21	397 $\pm$ 128					
AR-11	11/03/21	444 $\pm$ 137					
AR-12	03/16/21	< 185					
AR-12	06/02/21	< 190		< 8.0	< 1.0	< 5.4	< 3.8
AR-12	09/02/21	< 191					
AR-12	11/03/21	< 181					
AR-13	03/17/21	< 183					
AR-13	06/02/21	< 187		< 8.5	< 0.9	< 1.7	< 0.9
AR-13	09/02/21	< 193					
AR-13	11/03/21	< 186					
CAR-1	06/02/21	< 181					
CAR-3	03/17/21	< 187					
CAR-3	06/02/21	< 182		< 8.1	< 0.8	< 0.9	< 1.0
CAR-3	09/02/21	< 184					
CAR-3	11/03/21	< 189					
TW-13	06/02/21	< 179					
*CROP	03/17/21	< 187					
*CROP	06/04/21	281 $\pm$ 125		< 7.9	< 0.8	< 0.7	< 1.1
*CROP	08/03/21	< 181					
*CROP	08/31/21	< 184					
*CROP	11/03/21	< 173					

\*Surface Water Sample

**Bold values indicate LLD was not met due to high solids content**

TABLE B-I.2

**CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SAMPLES  
COLLECTED IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2021  
RESULTS IN UNITS OF PCI/LITER + 2 SIGMA**

SITE	COLLECTION	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
	DATE														
AR-1	06/04/21	< 22	< 39	< 2	< 3	< 6	< 3	< 5	< 2	< 5	< 5	< 3	< 3	< 12	< 5
AR-2	06/02/21	< 14	< 15	< 1	< 2	< 3	< 1	< 3	< 2	< 3	< 5	< 2	< 2	< 11	< 4
AR-3	06/02/21	< 14	< 18	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 4	< 2	< 2	< 11	< 4
AR-4	06/02/21	< 19	< 23	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 5	< 2	< 2	< 13	< 4
AR-7	06/02/21	< 16	< 31	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 5	< 2	< 2	< 12	< 4
AR-8	06/02/21	< 14	< 17	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 5	< 2	< 2	< 11	< 4
AR-9	06/04/21	< 15	< 15	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 4	< 2	< 2	< 10	< 4
AR-10	06/04/21	< 20	< 21	< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 5	< 2	< 2	< 12	< 4
AR-11	06/02/21	< 17	< 36	< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 5	< 2	< 2	< 12	< 4
AR-12	06/02/21	< 13	< 28	< 1	< 1	< 3	< 2	< 3	< 1	< 3	< 4	< 2	< 1	< 9	< 3
AR-13	06/02/21	< 17	< 15	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 5	< 2	< 2	< 12	< 4
CAR-1	06/02/21	< 16	< 30	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 5	< 2	< 2	< 11	< 4
CAR-3	06/02/21	< 11	25 ± 16	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 3	< 1	< 1	< 8	< 3
TW-13	06/02/21	< 13	76 ± 21	< 1	< 1	< 3	< 1	< 3	< 1	< 3	< 4	< 1	< 1	< 9	< 3
*CROP	06/04/21	< 16	< 20	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 5	< 2	< 2	< 12	< 4

\*Surface Water Sample

TABLE B-I.3

**CONCENTRATIONS OF HARD-TO-DETECTS IN GROUNDWATER SAMPLES COLLECTED  
IN THE VICINITY OF BYRON NUCLEAR GENERATING STATION, 2021**

RESULTS IN UNITS OF PCI/LITER  $\pm$  2 SIGMA

SITE	COLLECTION		Am-241	Cm-242	Cm-243/244	Pu-238	Pu-239/240	U-234	U-235	U-238	Fe-55	Ni-63
	DATE											
AR-1	06/04/21										< 104	< 4.7
AR-3	06/02/21										< 95	< 4.3
AR-4	06/02/21										< 182	< 4.5
AR-7	06/02/21										< 31	< 3.9
AR-8	06/02/21										< 146	< 4.2
AR-9	06/04/21										< 119	< 4.6
AR-12	06/02/21										< 57	< 4.4
AR-13	06/02/21										< 91	< 4.3
CAR-3	06/02/21										< 55	< 4.7

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