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A unit of American Electric Power

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Cook Nuclear Plant  
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April 29, 2022

AEP-NRC-2022-28  
10 CFR 50.36a

Docket Nos.: 50-315  
50-316

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

Donald C. Cook Nuclear Plant Units 1 and 2  
2021 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

In accordance with Technical Specification 5.6.3, Indiana Michigan Power Company, the licensee for Donald C. Cook Nuclear Plant Units 1 and 2, is providing as the enclosure to this letter, the Annual Radioactive Effluent Release Report. This report covers the period January 1, 2021, through December 31, 2021.

This letter contains no new or modified regulatory commitments. Should you have any questions, please contact me at (269) 466-2649.

Sincerely

Michael K. Scarpello  
Regulatory Affairs Director

DLW/kmh

Enclosure: Donald C. Cook Nuclear Plant Units 1 and 2 - 2021 Annual Radioactive Effluent Release Report

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**ENCLOSURE to AEP-NRC-2022-28**

**DONALD C. COOK NUCLEAR PLANT UNITS 1 AND 2  
2021 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**

## SOURCE DOCUMENT LIST

**ACTION ITEM NO.**  
**DESCRIPTION**

2021 Annual Radioactive Effluent Release Report

THE FOLLOWING DOCUMENTS HAVE BEEN USED AS SOURCES OF INFORMATION FOR PREPARATION OF THE ATTACHED. COPIES OF THESE DOCUMENTS ARE AVAILABLE FOR REVIEW AT THE LOCATION SPECIFIED.

NO	PAGE PARA.	SOURCE DOCUMENT DESCRIPTION TITLE, NUMBER, REVISION, ETC.	CURRENT SOURCE DOC. LOCATION (FILE NO., ETC.)
A	1	Control Room logs	PowerView and INPO web page
B	2	12-OHP-4021-006-004, Data Sheet 1 L-21-01 → L-21-67 1 -OHP-4021-028-005, Data Sheet 1; 2 -OHP-4021-028-005, Data Sheet 1; 1-OHP-4021-028-004, Data Sheet 1; 2-OHP-4021-028-004, Data Sheet 1; and 12-OHP-4021-023-002, Data Sheet 1 G-21-01 → G-21-12; 1-CPR-21-01 → 1-CPR-21-120; and 2-CPR-21-01 → 2-CPR-21-134 Radioactive waste shipments and Processor data	NDM
C	3	Quarterly Dose Calculations with MIDAS and Site Specific Data and vendor Analysis of REMP TLDs	Source Docs in NDM, Vendor files, and REMP results
D	4	Control Room logs	PowerView
E	A1.1-1	PMP-6010-OSD-001 <u>OFF-SITE DOSE CALCULATION MANUAL</u>	Documentum
E	A1.1-2	PMP-6010-OSD-001 <u>OFF-SITE DOSE CALCULATION MANUAL</u>	Documentum
E	A1.1-3	PMP-6010-OSD-001 <u>OFF-SITE DOSE CALCULATION MANUAL</u>	Documentum
F	A1.1-4	12-OHP-4021-006-004, Data Sheet 1 L-21-01 → L-21-67	NDM
G	A1.1-5	1 -OHP-4021-028-005, Data Sheet 1; 2 -OHP-4021-028-005, Data Sheet 1; 1-OHP-4021-028-004, Data Sheet 1; 2-OHP-4021-028-004, Data Sheet 1; and 12-OHP-4021-023-002, Data Sheet 1 G-21-01 → G-21-12; 1-CPR-21-01 → 1-CPR-21-120; and 2-CPR-21-01 → 2-CPR-21-134	NDM
H	A1.1-6	None	
I	A1.1-7	12-THP-6020-ADM-010 Data Sheet 1	NDM
J	A1.1-8	1 -OHP-4021-028-005, Data Sheet 1; 2 -OHP-4021-028-005, Data Sheet 1; 1-OHP-4021-028-004, Data Sheet 1; 2-OHP-4021-028-004, Data Sheet 1; and 12-OHP-4021-023-002, Data Sheet 1 G-21-01 → G-21-12; 1-CPR-21-01 → 1-CPR-21-120; and 2-CPR-21-01 → 2-CPR-21-134	NDM
K	A1.1-9	Totals from pages A1.1-7 & 8. PMP-6010-OSD-001 <u>OFF-SITE DOSE CALCULATION MANUAL</u> (for % of quarterly limit)	Documentum
L	A1.1-10	12-OHP-4021-006-004, Data Sheet 1 L-21-01 → L-21-67 12 THP 6020 ADM 010 Data Sheet 1 Vendor Analysis of Quarterly Composites	NDM

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NO	PAGE PARA.	SOURCE DOCUMENT DESCRIPTION TITLE, NUMBER, REVISION, ETC.	CURRENT SOURCE DOC. LOCATION (FILE NO.,ETC.)
M	A1.1-11&12	Totals from page A1.1-10. Limits from 10 CFR Part 20, Appendix B and PMP-6010-OSD-001 <u>OFF-SITE DOSE CALCULATION MANUAL</u>	Documentum
N	A1.1-13	Radioactive Waste shipments	NDM
O	A1.1-14	Yearly totals and % of PMP-6010-OSD-001, <u>OFF-SITE DOSE CALCULATION MANUAL</u>	Documentum
P	A1.1-15	Site Specific Data for Site Boundary Distances	NDM
Q	A1.2-1 → 4	Quarterly Dose Calculations with MIDAS and Site Specific Data PMP-6010-OSD-001, <u>OFF-SITE DOSE CALCULATION MANUAL</u>	Source Docs in NDM
R	A1.3-1 → 6	GPI Sample Data	NDM
S	A2.1-1 → 8 A2.2-1 → 8 A2.3-1 → 8 A2.4-1 → 8	MIDAS System with Site Specific Data, Meteorological Joint Frequency Tables	IT Network drive
T	A3.0-1	Off-Site Dose Calculation Manual Revision	Documentum

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## I. INTRODUCTION

This report discusses the radioactive discharges from Unit 1 and Unit 2 of the Donald C. Cook Nuclear Plant (CNP) during 2021. This is in accordance with the requirements of CNP Technical Specification (TS) 5.6.3.

The table below summarizes the pertinent statistics concerning the Plant's operation during the period from January 1, 2021, to December 31, 2021. The data in this table and the descriptive information on plant operation are based upon the respective unit's Monthly Operating Reports, Performance Indicators, and Control Room Logs for 2021.

Parameter	Unit 1	Unit 2
Gross Electrical Energy Generation (Megawatt Hour (MWH))	9,414,062	9,107,344
Unit Service Factor (Percent (%))	98.7	86.5
Unit Capacity Factor (Maximum Dependable Capacity (MDC)) Net (%)	100.6	86.1

Unit 1 entered the reporting period in Mode 1 at Nominal Full Power (NFP). Small power adjustments were made to facilitate main turbine valve testing throughout the year. The unit performed a normal downpower and was manually tripped on July 28, 2021, to perform repairs on 1-WMO-13 Discharge Valve. The unit attained criticality on July 31, 2021, and returned to NFP on August 2, 2021. The unit exited the reporting period at NFP.

Unit 2 entered the reporting period in Mode 1 at NFP. Small power adjustments were made to facilitate main turbine valve testing throughout the year. The unit performed a normal downpower and was manually tripped on April 17, 2021, entering refueling outage U2C26. The unit attained criticality on May 19, 2021, and attained NFP on May 24, 2021. The unit performed a manual trip from 100% power on June 22, 2021, to isolate and repair a steam leak on a Moisture Separator Reheater. The unit attained criticality on July 7, 2021, and attained NFP on July 10, 2021. The unit exited the reporting period at NFP.

## II. RADIOACTIVE RELEASES AND RADIOLOGICAL IMPACT ON MAN

Since a number of release points are common to both units, the release data from both units are combined to form this two-unit, Annual Radioactive Effluent Release Report (ARERR). Appendix A1.1 through A2.4 of this report present the information in accordance with Section 5.6.3 of Appendix A to the Facility Operating Licenses, as specified in the Technical Specifications, Regulatory Guide 1.21, and 10 CFR Part 50, Appendix I.

The "MIDAS System" is a computer code that calculates doses due to radionuclides that were released from the CNP.

All liquid and gaseous releases were well within Offsite Dose Calculation Manual (ODCM) limits and federal limits.

There were no abnormal liquid or gaseous releases in 2021. There were no spills or leaks of radioactive liquids requiring voluntary notifications per the Industry Groundwater Protection Initiative or site procedures.

The Independent Spent Fuel Storage Installation (ISFSI) impacts are included with Unit 1 and Unit 2 statistics. The ISFSI cask system does not create any radioactive materials or have any radioactive waste treatment systems. Therefore, specific operating procedures for the control of radioactive effluents are not required. Technical Specifications for the HI-Storm 100 Cask System, Specification 3.1.1, Multi-Purpose Canister (MPC), provides assurance that there are not radioactive effluents from the ISFSI.

### **Liquid Releases**

During 2021 there were 65 liquid batch releases performed. The number of liquid batch releases for the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> quarters in 2021 were 18, 25, 13, and 9, respectively.

Estimated doses (in mrem) to maximally exposed individuals via the liquid release pathways are given in Appendix A1.2 of this report.

### **Gaseous Releases**

During the first quarter of 2021 there were three batch release from Gas Decay Tanks (GDT) and 65 Containment Pressure Reliefs (CPR). During the second quarter there was one batch release from GDTs, one containment purge, one system tank vent, and 59 CPR. During the third quarter there were three batch releases from GDTs and 68 CPR. During the fourth quarter there were four batch releases from GDTs and 62 CPR. The CPR continue to be listed as batch releases as described in Nuclear Regulatory Commission Inspections 50-315/89016 (DRSS); 50-316/89017 (DRSS) for CNP, dated June 13, 1989. Doses continue to be calculated utilizing continuous criteria as allowed by NUREG-0133. There were a total of eleven GDT releases, one containment purge, one system tank vent, and 254 CPR gaseous batch releases made during 2021.

In calculating the dose consequences for continuous and batch gaseous releases during 2021, the meteorological data measured at the time of the release were used.

The estimated doses (in mrem) to maximally exposed individuals via the gaseous release pathways are given in Appendix A1.2 of this report. For individuals that are within the site boundary, the occupancy time is sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the site boundary.

### **Solid Waste Disposition**

There were 16 shipments of radioactive waste made during 2021. These included shipments made from the site to various radioactive waste processors for ultimate disposal.

### III. METEOROLOGICAL

Appendices A2.1, A2.2, A2.3, and A2.4 of this report contain the cumulative joint frequency distribution tables of wind speed and wind direction, corresponding to the various atmospheric stability classes for the first, second, third, and fourth quarters of 2021. Hourly meteorological data is available for review and/or inspection upon request.

### IV. OFFSITE DOSE CALCULATION MANUAL (ODCM) CHANGES

The ODCM, PMP-6010-OSD-001, was not revised during the report period.

### V. TOTAL DOSE

Section 3.2.5 of the ODCM requires that the dose or dose commitment to a real individual from all uranium fuel cycle sources in Berrien County be limited to no more than 25 mrem to the total body or any organ (except the thyroid, which is limited to no more than 75 mrem) over a period of 12 consecutive months to show conformance with the requirements of 40 CFR Part 190. The maximum cumulative dose to an individual from liquid and gaseous effluents during 2021 was well within the ODCM limits. Measurements using thermoluminescent dosimeters (TLD) at 12 onsite stations indicate that the dose due to direct radiation is consistent with preoperational and current control (background) levels. This is fully evaluated in CNP's 2021 Annual Radiological Environmental Operating Report. Additional TLD dosimetry installed by Radiation Protection department programs monitor dose received by individuals on site as visitors.

The annual dose to the maximum individual will be estimated by first, summing the quarterly total body air dose, the quarterly skin air dose, the quarterly critical organ dose from iodines and particulates (I&P), the quarterly total body dose from liquid effluents, the quarterly critical organ dose from liquid effluents, and the Radiological Environmental Monitoring Program onsite direct radiation TLD data. These quarterly values are summed with the annual Carbon-14 dose and compared to the annual total body limit for conservative reasons. The table that follows here represents the above written description:



Dose (mrem)	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
I & P	1.27E-02	3.17E-02	4.03E-02	3.28E-02
Total Body Air	2.00E-04	8.40E-04	1.00E-03	1.20E-03
Skin	3.20E-04	1.30E-03	1.60E-03	2.00E-03
Liquid TB	1.71E-02	1.55E-02	1.45E-02	3.02E-03
Liquid Organ	1.71E-02	1.55E-02	1.45E-02	3.02E-03
Direct Radiation	0	0	0	0
Quarterly Dose Total	4.74E-02	6.48E-02	7.19E-02	4.20E-02
Sum of Quarter Doses				2.26E-01
C14 (Annual) Curies				19.87
C14 (Annual) Dose				2.30E+00
Grand Total Dose (Total Body or any other Organ) mrem				2.53E+00
Annual Dose Limit (mrem)				25
Percent of limit				1.01E+01

The following data reflects a comparison with 2009 annual dose data (the last year without calculating C-14 dose), 2021 annual dose data, and 2021 annual dose data with C-14 added. This indicates that 2021 annual dose was 'typical' for a year in regards to radioactive effluents. The table is presented as follows:

	Annual Dose (mrem)	% of limit
2009	2.60E-01	1.04
2021	2.26E-01	0.905
2021 with C-14	2.53E+00	10.1

## VI. RADIATION MONITORS INOPERABLE GREATER THAN 30 DAYS

The Radiation Monitor System has undergone an extensive replacement project to upgrade and modernize the equipment to support the expected operational lives of the two CNP units. This work completed in April of 2020. One effluent monitor pathway continues to have issues with the background radiation levels due to the detector sensitivities. 12-RRS-1001/1021 channels of the Waste Disposal liquid effluent monitors were declared inoperable on July 24, 2020, and required software changes in order to address the higher background detected due to the increased sensitivity. The actual room area radiation levels are relatively unchanged, but the new detectors are far more sensitive and capable of detecting much lower radiation levels. The software was redeveloped and delivered to CNP in December, 2021 with software testing and validation in progress up to the end of the year. The new software changes appear successful at addressing the issue. All releases on this pathway have been and remain in compliance with ODCM and any required compensatory actions. Additional actions to reduce the background radiation are also being scheduled in order to further alleviate the conditions. These detectors remained inoperable to the end of the year. There were no other release pathways with inoperable monitors for greater than 30 days.

## VII. NOTEWORTHY CONDITIONS IDENTIFIED IN 2021

The Carbon-14 Supplemental Information section has been returned to this report following stakeholder feedback. The clarity on the Carbon-14 dose determinations was appreciated and ensured all stakeholders could properly evaluate where the majority of CNP public dose originates from.

### **Carbon-14 Supplemental Information for the 2021 Annual Radioactive Effluent Release Report.**

C-14 has a 5730 year half-life and is a naturally occurring radionuclide produced by cosmic ray interactions in the atmosphere. C-14 is a relatively low energy beta emitter. Nuclear weapons testing in the 1950s and 1960s significantly increased the amount of C-14 in the atmosphere. C-14 is also produced in commercial nuclear reactors, but the amounts produced are much less than those produced naturally, from weapons testing, or coal burning power plants. The inventory of C-14 in Earth's biosphere is about 300 million Curies, of which most is in the oceans.

Since the U.S. Nuclear Regulatory Commission published Regulatory Guide (RG) 1.21, Revision 1, in 1974, the analytical methods for determining C-14 have improved. Coincidentally, the radioactive effluents from commercial nuclear power plants over the same period have decreased to the point that C-14 is likely to be a principal radionuclide in gaseous effluents. Based on these reasons and a desire to adjust policy to align with international standards, the nuclear industry was required to report, starting in 2010, the quantity and dose impact of C-14 here in the United States. The dose will be reported both with and without C-14 so a comparison to 2009 can be made, keeping in mind the differing standards.

The quantity of C-14 released to the environment can be estimated by use of a C-14 source term scaling factor based on power generation (Ref. RG 1.21, Revision 2). A recent study recommends a source term scaling factor of approximately 9.0 to 9.8 Curies/GWe-yr for a Westinghouse Pressurized Water Reactor (Ref. EPRI 1021106, "Estimation of Carbon-14 in Nuclear Plant Gaseous Effluents", dated December 23, 2010). A scaling factor of 9.4 Curies/GWe-yr was assumed for this report. Using this source term scaling factor and actual electrical generation (in MWH) produced during 2021 results in a site total of 19.87 Curies produced.

C-14 releases from Pressurized Water Reactors (PWR) occur primarily as a mix of organic carbon (methane) and inorganic carbon (carbon dioxide). As a general rule, C-14 in the primary coolant is essentially all organic with a large fraction as gas. Any time the primary coolant is exposed to an oxidizing environment (during shutdown or refueling), a slow transformation from an organic to an inorganic species occurs. Various studies documenting measured C-14 releases from PWRs suggest an average 80% organic fraction with the remainder being carbon dioxide, of which 70% is assumed to be released from

gaseous batch releases. This equates to 2.78 Curies released as carbon dioxide which is available for the food pathway through photosynthesis to vegetation.

Dose is calculated utilizing the methodology prescribed in RG 1.109, Appendix C, with the vegetation dose being the predominant pathway. A 'p' factor of 0.33 is determined utilizing the time of batch gaseous releases performed during 2021 and the time available for photosynthesis in plants. A further reduction to the vegetation and leafy vegetable dose is warranted due to the limited growing season in Michigan, which was conservatively limited to nine months.

The final results indicated a calculated organ dose from C-14 to a child at the site boundary of 1.92 mrem to the bone and a whole body dose of 0.381 mrem, for a combined total C-14 dose of 2.30 mrem. This is less than the dose limit of 15 mrem/unit to any organ prescribed in 10 CFR 50, Appendix I, and the 40 CFR Part 190 limit of 25 mrem for total body and for any organ ( $\leq 75$  mrem for thyroid).

The C-14 dose is now the major contributor, and will consistently be about 8-10 times higher than the pre-2010 calculations. This dose will only change with online power generation, so it will not alter significantly unless the plant is shutdown for an extended period.

## VIII. CONCLUSION

Based on the information presented in this report, it is concluded that CNP Units 1 and 2 performed their intended design function with no demonstrable adverse effect on the health and safety of the general public.

## IX. ERRATA

There are no errata documents attached for 2021.

2021 Effluent and Waste Disposal Annual Report

SUPPLEMENTAL INFORMATION

Facility: Donald C. Cook Nuclear Plant  
Licensee: Indiana Michigan Power Company

**1 REGULATORY LIMITS**

1.1 Noble Gases

The air dose in unrestricted areas due to noble gases released in gaseous effluents shall be limited to the following:

1.1.1 During any calendar quarter, to  $\leq 5$  mrad/unit for gamma radiation and  $\leq 10$  mrad/unit for beta radiation.

1.1.2 During any calendar year, to  $\leq 10$  mrad/unit for gamma radiation and  $\leq 20$  mrad/unit for beta radiation.

1.2 Iodines - Particulates

The dose to a member of the public from radioiodines, radioactive materials in particulate form, and radionuclides other than noble gases with half-lives greater than eight days in gaseous effluents released to unrestricted areas shall be limited to the following:

1.2.1 During any calendar quarter to  $\leq 7.5$  mrem/unit to any organ.

1.2.2 During any calendar year to  $\leq 15$  mrem/unit to any organ.

1.3 Liquid Effluents

The dose or dose commitment to an individual from radioactive material in liquid effluents released to unrestricted areas shall be limited:

1.3.1 During any calendar quarter to  $\leq 1.5$  mrem/unit to the total body and to  $\leq 5$  mrem/unit to any organ.

1.3.2 During any calendar year to  $\leq 3$  mrem/unit to the total body and to  $\leq 10$  mrem/unit to any organ.

## 2021 Effluent and Waste Disposal Annual Report

### 1.4 Total Dose

The dose or dose commitment to a real individual from all uranium fuel cycle sources is limited to  $\leq 25$  mrem to the total body or any organ (except the thyroid, which is limited to  $\leq 75$  mrem) over a period of 12 consecutive months.

## 2 MAXIMUM PERMISSIBLE CONCENTRATIONS

### 2.1 Gaseous Effluents

The dose rate due to radioactive materials released in gaseous effluents from the site shall be limited to the following:

2.1.1 For noble gases:  $\leq 500$  mrem/yr to the total body and  $\leq 3000$  mrem/yr to the skin.

2.1.2 For all radioiodines and for all radioactive materials in particulate form and radionuclides (other than noble gases) with half-lives greater than eight days:  $\leq 1500$  mrem/yr to any organ.

The above limits are provided to ensure that radioactive material discharged in gaseous effluents will not result in the exposure of an individual in an unrestricted area to annual average concentrations exceeding the limits in 10 CFR Part 20, Appendix B, Table 2, Column 1.

### 2.2 Liquid Effluents

The concentration of radioactive material released at any time from the site to unrestricted areas shall be limited to the concentrations specified in 10 CFR Part 20, Appendix B, Table 2, Column 2, for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to  $2 \times 10^{-4}$   $\mu\text{Ci/ml}$  total activity.

## 2021 Effluent and Waste Disposal Annual Report

### 3 AVERAGE ENERGY

The average energy ( $\bar{E}$ ) of the radionuclide mixture in releases of fission and activation gases as defined in Regulatory Guide 1.21, Appendix B, Section A.3 is not applicable because the limits used for gaseous releases are based on calculated dose to members of the public. Release rates are calculated using an isotopic mix from actual samples rather than average energy.

### 4 MEASUREMENTS and APPROXIMATIONS of TOTAL RADIOACTIVITY

#### 4.1 Fission and Activation Gases

Sampled and analyzed on an 8192 channel analyzer and HpGe detector. Tritium analysis is performed using liquid scintillation counters.

#### 4.2 Iodines

Sampled on iodine adsorbing media, and analyzed on an 8192 channel analyzer and HpGe detector.

#### 4.3 Particulates

Sampled on a glass filter and analyzed on an 8192 channel analyzer and HpGe detector. Sr-89 and Sr-90 analyses are performed by offsite vendor.

#### 4.4 Liquid Effluents

Sampled and analyzed on an 8192 channel analyzer and HpGe detector. Tritium analysis is performed using liquid scintillation counters. Fe-55, Sr-89 and Sr-90 analyses are performed by an offsite vendor. Ni-63 is also currently being analyzed by the offsite vendor in response to evaluation of the 10 CFR 61 sample results.

2021 Effluent and Waste Disposal Annual Report

**5 BATCH RELEASES**

5.1 Liquid

5.1.1 Number of batch releases:

18 releases in the 1<sup>st</sup> quarter, 2021

25 releases in the 2<sup>nd</sup> quarter, 2021

13 releases in the 3<sup>rd</sup> quarter, 2021

9 releases in the 4<sup>th</sup> quarter, 2021

5.1.2 Total time period for batch releases:

20,997 minutes

5.1.3 Maximum time for a batch release:

804 minutes

5.1.4 Average time period for batch release:

323 minutes

5.1.5 Minimum time period for a batch release:

127 minutes

5.1.6 Average stream flow during periods of release of effluent into a flowing stream:

6.11E+5 gpm circulating water

2021 Effluent and Waste Disposal Annual Report

5.2 Gaseous

5.2.1 Number of batch releases:

127 releases in the 1<sup>st</sup> quarter, 2021  
83 releases in the 2<sup>nd</sup> quarter, 2021  
69 releases in the 3<sup>rd</sup> quarter, 2021  
72 releases in the 4<sup>th</sup> quarter, 2021

5.2.2 Total time period for batch releases:

22,560 minutes

5.2.3 Maximum time for a batch release:

354 minutes

5.2.4 Average time period for batch release:

64.3 minutes

5.2.5 Minimum time period for a batch release:

5 minutes



2021 Effluent and Waste Disposal Annual Report

6 ABNORMAL RELEASES

6.1 Liquid

6.1.1 Number of Releases:

<u>1<sup>st</sup> Quarter</u>	<u>2<sup>nd</sup> Quarter</u>	<u>3<sup>rd</sup> Quarter</u>	<u>4<sup>th</sup> Quarter</u>
0	0	0	0

6.1.2 Total activity released (Ci):

<u>1<sup>st</sup> Quarter</u>	<u>2<sup>nd</sup> Quarter</u>	<u>3<sup>rd</sup> Quarter</u>	<u>4<sup>th</sup> Quarter</u>
0	0	0	0

6.2 Gaseous

6.2.1 Number of Releases:

<u>1<sup>st</sup> Quarter</u>	<u>2<sup>nd</sup> Quarter</u>	<u>3<sup>rd</sup> Quarter</u>	<u>4<sup>th</sup> Quarter</u>
0	0	0	0

6.2.2 Total activity released (Ci):

<u>1<sup>st</sup> Quarter</u>	<u>2<sup>nd</sup> Quarter</u>	<u>3<sup>rd</sup> Quarter</u>	<u>4<sup>th</sup> Quarter</u>
0	0	0	0

2021 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT  
GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

CONTINUOUS MODE

Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1. FISSION GASES					
H3	Ci	1.64E+01	2.18E+01	1.85E+01	1.61E+01
AR41	Ci	-----	-----	-----	-----
KR85	Ci	-----	-----	-----	-----
XE133	Ci	-----	-----	-----	-----
XE135	Ci	-----	-----	-----	-----
XE131m	Ci	-----	-----	-----	-----
XE133m	Ci	-----	-----	-----	-----
XE135m	Ci	-----	-----	-----	-----
Total for Period	Ci	1.64E+01	2.18E+01	1.85E+01	1.61E+01

2. IODINES					
I131	Ci	-----	1.72E-06	4.81E-06	-----
I132	Ci	-----	-----	-----	-----
I133	Ci	-----	-----	-----	-----
Total for Period	Ci	-----	1.72E-06	4.81E-06	-----

3. PARTICULATES					
MN54	Ci	-----	-----	-----	-----
CO60	Ci	-----	-----	-----	-----
CS137	Ci	-----	-----	-----	-----
Total for Period	Ci	-----	-----	-----	-----

\* DENOTES SUPPLEMENTAL ISOTOPES

2021 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT  
GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

BATCH MODE

Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1. FISSION GASES					
H3	Ci	1.11E-01	2.57E-01	1.72E-01	1.89E-01
AR41	Ci	2.00E-01	2.09E-01	2.27E-01	2.85E-01
KR85	Ci	5.71E-03	2.95E-03	4.71E-03	3.18E-03
KR85m	Ci	-----	1.96E-05	-----	-----
KR87	Ci	-----	-----	-----	-----
KR88	Ci	-----	-----	-----	-----
XE133	Ci	1.80E-03	1.05E-02	5.01E-03	9.20E-03
XE135m	Ci	-----	2.02E-04	-----	-----
XE135	Ci	-----	1.37E-03	4.14E-04	5.31E-04
Total for Period	Ci	3.19E-01	4.81E-01	4.09E-01	4.87E-01
2. IODINES					
I131	Ci	-----	-----	-----	-----
I132	Ci	-----	-----	-----	-----
I133	Ci	-----	-----	-----	-----
I134	Ci	-----	-----	-----	-----
I135	Ci	-----	-----	-----	-----
Total for Period	Ci	-----	-----	-----	-----

\* DENOTES SUPPLEMENTAL ISOTOPES

2021 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT  
GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

BATCH MODE

Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
3. PARTICULATES					
CR51	Ci	-----	-----	-----	-----
CO58	Ci	-----	-----	-----	-----
CO60	Ci	-----	-----	-----	-----
NB95	Ci	-----	-----	-----	-----
Total for Period	Ci	-----	-----	-----	-----

\* DENOTES SUPPLEMENTAL ISOTOPES

2021 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT  
GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

		Units	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Est. Total Error, %
-----							
A.	FISSION AND ACTIVATION GASES						
-----							
1.	Total Release	Ci	2.07E-01	2.24E-01	2.38E-01	2.98E-01	16.0
-----							
2.	Average release rate for period	uCi/sec	2.66E-02	2.85E-02	2.99E-02	3.75E-02	
-----							
3.	Percent of applicable limit*	% Gamma Beta	3.45E-03 6.10E-04	1.51E-02 2.73E-03	1.85E-02 3.27E-03	2.32E-03 4.18E-03	
-----							
B. IODINES							
-----							
1.	Total I-131	Ci	0.00E+00	1.72E-06	4.81E-06	0.00E+00	22.6
-----							
2.	Average release rate for period	uCi/sec	0.00E+00	2.19E-07	6.05E-07	0.00E+00	
-----							
3.	Percent of applicable limit*	%	0.00E+00	6.23E-07	1.72E-06	0.00E+00	
-----							
C. PARTICULATES							
-----							
1.	Particulates with half lives>8 days	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A
-----							
2.	Average release rate for period	uCi/sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
-----							
3.	Percent of applicable limit*	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
-----							
4.	Gross alpha radioactivity	Ci	<8.97E-07	<8.08E-07	<1.25E-06	<9.26E-07	
-----							
D. TRITIUM							
-----							
1.	Total Release	Ci	1.64E+01	2.19E+01	1.85E+01	1.61E+01	21.3
-----							
2.	Average release rate for period	uCi/sec	2.11E+00	2.79E+00	2.32E+00	2.03E+00	
-----							
3.	Percent of applicable limit*	%	1.20E-02	1.59E-02	1.32E-02	1.15E-02	
-----							

\* Applicable limits are expressed in terms of dose. See Appendices A1.2-1 through A1.2-4

2021 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT  
LIQUID EFFLUENTS  
CONTINUOUS MODE

Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
H3	Ci	8.61E-03	8.62E-03	-----	-----

BATCH MODE

Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
H3	Ci	4.97E+02	4.56E+02	4.58E+02	1.16E+02
CR51	Ci	-----	-----	-----	-----
MN54	Ci	8.32E-06	7.56E-06	6.65E-06	-----
CO57	Ci	-----	-----	-----	-----
CO58	Ci	5.97E-05	1.05E-04	4.87E-06	2.44E-06
CO60	Ci	2.18E-04	3.34E-04	1.76E-04	3.83E-05
NI63	Ci	7.21E-04	-----	-----	-----
ZN65	Ci	-----	-----	-----	-----
ZR95	Ci	-----	-----	-----	-----
NB95	Ci	3.97E-06	-----	-----	-----
MO99	Ci	-----	-----	-----	-----
TC99m	Ci	-----	1.25E-06	-----	-----
AG110m	Ci	8.21E-06	1.74E-05	3.02E-06	2.24E-06
SB124	Ci	-----	7.05E-06	-----	-----
SB125	Ci	1.02E-05	4.30E-05	-----	5.78E-06
CS134	Ci	-----	-----	-----	-----
CS137	Ci	-----	5.56E-06	-----	-----
I131	Ci	-----	-----	-----	-----
I133	Ci	-----	-----	-----	-----
*SN113	Ci	-----	-----	-----	-----
*XE133	Ci	1.83E-04	4.95E-04	5.19E-05	2.62E-06
*XE135	Ci	7.72E-06	3.77E-05	7.92E-06	-----
*XE135m	Ci	4.34E-06	6.87E-06	-----	-----

\* DENOTES SUPPLEMENTAL ISOTOPES

2021 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT  
LIQUID EFFLUENTS-SUMMATION OF ALL RELEASES  
BATCH MODE

		Units	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Est. Total Error, %
-----							
A.	FISSION AND ACTIVATION PRODUCTS						
-----							
1.	Total Release	Ci	1.03E-03	5.21E-04	1.91E-04	4.88E-05	12.7
-----							
2.	Average diluted concentration during period	uCi/ml	7.56E-11	2.83E-11	1.59E-11	9.87E-12	
-----							
3.	Percent of applicable limit	%	6.24E-04	6.95E-04	4.99E-04	2.72E-04	
-----							
-----							
B.	TRITIUM						
-----							
1.	Total Release	Ci	4.97E+02	4.56E+02	4.58E+02	1.16E+02	10.1
-----							
2.	Average diluted concentration during period	uCi/ml	3.65E-05	2.48E-05	3.83E-05	2.35E-05	
-----							
3.	Percent of applicable limit	%	3.65E+00	2.48E+00	3.83E+00	2.35E+00	
-----							
-----							
C.	DISSOLVED AND ENTRAINED GASES						
-----							
1.	Total Release	Ci	1.91E-04	5.32E-04	5.98E-05	2.62E-06	12.0
-----							
2.	Average diluted concentration during period	uCi/ml	1.40E-11	2.90E-11	5.00E-12	5.30E-13	
-----							
3.	Percent of applicable limit	%	7.01E-06	1.45E-05	2.50E-06	2.65E-07	
-----							
-----							
D.	GROSS ALPHA RADIOACTIVITY TOTAL RELEASE	Ci	<5.40E-04	<6.94E-04	<8.28E-05	<3.77E-05	N/A
-----							
E.	VOLUME OF WASTE RELEASED	Liters	5.82E+06	7.48E+06	8.92E+05	4.06E+05	2.00
-----							
F.	VOLUME OF DILUTION WATER USED DURING PERIOD	Liters	2.64E+11	2.18E+11	1.20E+10	4.95E+09	3.48
-----							

2021 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT  
LIQUID EFFLUENTS-SUMMATION OF ALL RELEASES  
CONTINUOUS MODE

		Units	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Est. Total Error, %
-----							
A.	FISSION AND ACTIVATION PRODUCTS						
1.	Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A
2.	Average diluted concentration during period	uCi/ml	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
3.	Percent of applicable limit	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
-----							
B.	TRITIUM						
1.	Total Release	Ci	8.61E-03	8.62E-03	0.00E+00	0.00E+00	53.8
2.	Average diluted concentration during period	uCi/ml	1.27E-11	1.30E-11	0.00E+00	0.00E+00	
3.	Percent of applicable limit	%	1.27E-06	1.30E-06	0.00E+00	0.00E+00	
-----							
C.	DISSOLVED AND ENTRAINED GASES						
1.	Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A
2.	Average diluted concentration during period	uCi/ml	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
3.	Percent of applicable limit	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
-----							
D.	GROSS ALPHA RADIOACTIVITY TOTAL RELEASE	Ci	<1.16E-04	<1.47E-04	0.00E+00	0.00E+00	N/A
-----							
E.	VOLUME OF WASTE RELEASED	Liters	1.25E+06	1.58E+06	0.00E+00	0.00E+00	2.00
-----							
F.	VOLUME OF DILUTION WATER USED DURING PERIOD	Liters	6.77E+11	6.85E+11	0.00E+00	0.00E+00	3.48
-----							



## 2021 Effluent and Waste Disposal Annual Report Solid Waste and Irradiated Fuel Shipments

### Solid Waste Shipped Offsite for Burial or Disposal

1) Type of Waste	Unit	Estimated amount	Estimated Total Error, %
a) Spent resins, filters, sludge, evaporator bottoms, etc.	m <sup>3</sup> Curies	1.82E+01 1.19E+02	1.00E+00 3.75E+00
b) Dry compressible waste, contaminated equipment, etc.	m <sup>3</sup> Curies	3.31E+02 2.32E-01	1.00E+00 6.48E+00
c) Irradiated components, control rods, etc.	m <sup>3</sup> Curies		
d) Other (oil, soil, etc)	m <sup>3</sup> Curies	1.18E+00 9.92E-04	1.00E+00 3.75E+00

### 2) Estimate of Principle Radionuclide Composition

a)	H-3	10 %	Co-58	1 %	Sb-125	1 %	Cs-137	1 %
	Mn-54	1 %	Co-60	10%	Cs-134	1 %		
	Fe-55	33%	Ni-63	40%	C-14	2 %		
b)	H-3	2 %	Co-58	2 %	Sb-125	1 %		
	Mn-54	2 %	Co-60	31%	Zr/Nb-95	2 %		
	Fe-55	40%	Ni-63	13%	Cs-137	6 %	C-14	1 %
d)	H-3	2 %	Co-60	40%	Zr/Nb-95	6 %	Sb-125	2 %
	Fe-55	34%	Ni-63	13%	Mn-54	2 %	Cs-137	1 %

### 3) Solid Waste Disposition

No. of Shipments	Mode of Transportation	Destination
9	Truck	Oak Ridge, TN
7	Truck	Andrews, TX

4) Type of Containers used for Shipment: Containers used are excepted packages, Type A, Sea Land, metal boxes, drums, tankers, and high integrity containers (HICs).

5) Solidification Agent: There were no solidifications performed during this report period.

**2021 Effluent and Waste Disposal Annual Report Yearly Release Rates**

<b>GASES</b>		
Fission and Activation Gases	Total Release	9.67E-01 Curies
	Average Release Rate	3.07E-02 $\mu$ Ci/sec
	% of Applicable Limits*	$\gamma$ 3.00E-02 % $\beta$ 5.39E-03 %
Iodines	Total I-131 Release	6.53E-06 Curies
	Average Release Rate	2.07E-07 $\mu$ Ci/sec
	% of Applicable Limit*	3.92E-01 %
Particulates	Total Release	0.00E+00 Curies
	Average Release Rate	0.00E+00 $\mu$ Ci/sec
	% of Applicable Limit*	0.00E+00 %
<b>LIQUIDS</b>		
Fission and Activation Products	Total Release	1.79E-03 Curies
	Average Diluted Concentration	3.69E-11 $\mu$ Ci/ml
	% of Applicable Limits*	Total Body 8.35E-01 % Organ 2.51E-01 %

\* Applicable limits are expressed in terms of the annual 10 CFR 50, Appendix I, dose limits.

## 2021 Effluent and Waste Disposal Annual Report

### Site Boundary and Nearest Residence Listing

The following distances were used in the calculation of the maximum individual doses:

<u>Sector</u>	<u>Direction</u>	<u>Boundary (Meters)</u>	<u>Nearest Residence (Meters)</u>
A	N	651	659
B	NNE	617	660
C	NE	789	943
D	ENE	1497	1577
E	E	1274	1716
F	ESE	972	1643
G	SE	629	1640
H	SSE	594	964
J	S	594	997
K	SSW	629	942

## Summary of Maximum Individual Doses

First Quarter 2021

EFFLUENT	APPLICABLE ORGAN	ESTIMATED DOSE (mrem)	AGE GROUP	LOCATION DIST DIR (M) (Toward)	% OF APPLICABLE LIMIT	LIMIT (mrem) QTR
Liquid	Total Body	1.71E-02	Child	Receptor 1	5.70E-01	1.5E+0
Liquid	Liver	1.71E-02	Child	Receptor 1	1.71E-01	5.0E+0
Noble Gas	Air Dose (Gamma-mrad)	3.45E-04	Any Age	594 (S)	3.45E-03	5.0E+0
Noble Gas	Air dose (Beta-mrad)	1.22E-04	Any Age	594 (S)	6.10E-04	1.0E+1
Iodines and Particulates	Total Body	1.27E-02	Child	659 (N)	8.47E-02	7.5E+0

## Summary of Maximum Individual Doses

Second Quarter 2021

EFFLUENT	APPLICABLE ORGAN	ESTIMATED DOSE (mrem)	AGE GROUP	LOCATION DIST DIR (M) (Toward)	% OF APPLICABLE LIMIT	LIMIT (mrem) QTR
Liquid	Total Body	1.55E-02	Child	Receptor 1	5.17E-01	1.5E+0
Liquid	Liver	1.55E-02	Child	Receptor 1	1.55E-01	5.0E+0
Noble Gas	Air Dose (Gamma-mrad)	1.50E-03	Any Age	651 (N)	1.50E-02	5.0E+0
Noble Gas	Air dose (Beta-mrad)	5.46E-04	Any Age	651 (N)	2.73E-03	1.0E+1
Iodines and Particulates	Total Body	3.17E-02	Child	659 (N)	2.11E-01	7.5E+0

## Summary of Maximum Individual Doses

Third Quarter 2021

EFFLUENT	APPLICABLE ORGAN	ESTIMATED DOSE (mrem)	AGE GROUP	LOCATION DIST DIR (M) (Toward)	% OF APPLICABLE LIMIT	LIMIT (mrem) QTR
Liquid	Total Body	1.45E-02	Child	Receptor 1	4.83E-01	1.5E+0
Liquid	GI-LLI	1.45E-02	Child	Receptor 1	1.45E-01	5.0E+0
Noble Gas	Air Dose (Gamma-mrad)	1.84E-03	Any Age	651 (N)	1.84E-02	5.0E+0
Noble Gas	Air dose (Beta-mrad)	6.54E-04	Any Age	651 (N)	3.27E-03	1.0E+1
Iodines and Particulates	Total Body	4.03E-02	Child	660 (NNE)	2.69E-01	7.5E+0

## Summary of Maximum Individual Doses

Fourth Quarter 2021

<b>EFFLUENT</b>	<b>APPLICABLE ORGAN</b>	<b>ESTIMATED DOSE (mrem)</b>	<b>AGE GROUP</b>	<b>LOCATION DIST DIR (M) (Toward)</b>	<b>% OF APPLICABLE LIMIT</b>	<b>LIMIT (mrem) QTR</b>
Liquid	Total Body	3.02E-03	Child	Receptor 1	1.01E-01	1.5E+0
Liquid	GI_LLI	3.02E-03	Child	Receptor 1	3.02E-02	5.0E+0
Noble Gas	Air Dose (Gamma-mrad)	2.32E-03	Any Age	651 (N)	2.32E-02	5.0E+0
Noble Gas	Air dose (Beta-mrad)	8.35E-04	Any Age	651 (N)	4.18E-03	1.0E+1
Iodines and Particulates	Total Body	3.28E-02	Child	659 (N)	2.19E-01	7.5E+0

**2021 NEI GROUNDWATER PROTECTION INITIATIVE SAMPLE DATA**



### Analysis of the Sample Data

The Groundwater Protection Initiative (GPI) Sample Data for 2021 indicates no groundwater contamination in excess of the reporting threshold of  $2.00\text{E-}5$  uCi/mL for tritium. Gamma spectroscopy was performed on all Radiological Environmental Monitoring Program (REMP) wells quarterly. Those results are not actual GPI results so are not included in the ARERR, but are part of CNP's 2021 Annual Radiological Environmental Operating Report. There were no positively identified gamma radionuclides from plant effluents detected in any of the GPI well samples, and no wells with levels of tritium above detection limits.

The Lower Limit of Detection (LLD) value used for tritium counting of the samples was  $9.45\text{E-}7$  or  $9.83\text{E-}7$ , depending on lab equipment used. This is well below the required maximum LLD value of  $2.00\text{E-}6$  uCi/mL per the ODCM.

No tritium values were found above LLD for 2021, though values found above the LLD are not abnormal, unexpected, or inconsistent with past sampling history. The samples observed above LLD historically were expected results from the release of tritiated water into the Absorption Pond, a licensed pathway and part of plant design, or the result of recapture deposition of tritium from licensed radioactive gaseous release points. The 2021 results were within expected parameters considering the reduction in tritium released to the Absorption Pond and typical rainfall recapture of tritium experienced.

Wells located inside the Protected Area of the plant are subject to recapture deposition of tritium and may show occasional sample results above LLD values following rainfalls and snow melt. The results observed in 2021 continue to reflect normal expectations and behaviors as they relate to recaptured tritium for the weather conditions observed. It was a drier year resulting in less recaptured tritium, as shown by the lack of positive tritium sample results.

There were impacts from the COVID-19 pandemic on sampling resulting in slightly lower numbers of samples performed than historically. Sampling in support of the NEI 07-07 Groundwater Protection Initiative (GPI) was performed per our plant processes and procedures, though the efforts to prevent exposure of essential plant personnel to potential COVID-19 virus exposure led to reducing some sampling activities during periods of increasing trends in virus hospitalizations and positive test information provided by the State of Michigan. Our focus is always on the safety of our workers and the members of the public, and the CNP management made every effort to keep non-essential personnel offsite if possible and away from essential workers required for safe operation of the plant. The GPI is a voluntary industry initiative, so focus was again made on assuring essential regulatory required activities received priority. ODCM required sampling activities as part of the REMP Program are very similar to the GPI utilizing many of the same wells. This redundancy allowed for the scaling back of the non-essential GPI sampling to help reduce worker risk to virus exposure in 2021.

The sample data indicates that no radioactive spills or unidentified leaks have occurred in 2021 impacting groundwater. The sample results indicate proper well placement to ensure the protection of the groundwater and early identification of any abnormal conditions involving groundwater. This is validated by the demonstrated ability to monitor percolation from the Absorption Pond and recaptured tritium in precipitation, with flow direction and behavior acting as described in the plant licensing documents

## 2021 GPI Sample Data

Samples analyzed for tritium. Values noted are in microcuries per milliliter (uCi/mL). Lower Limit of Detection = LLD

Sample Date	W-1	W-2	W-3	W-4	W-5	W-6	W-7	W-8	W-9	W-10
1/21/2021				<LLD	<LLD	<LLD				
1/22/2021	<LLD	<LLD	<LLD				<LLD		<LLD	<LLD
1/26/2021								<LLD		
3/2/2021										
4/5/2021										
4/16/2021	<LLD	<LLD	<LLD					<LLD	<LLD	<LLD
4/20/2021							<LLD			
4/23/2021				<LLD	<LLD	<LLD				
5/14/2021										
7/6/2021										
7/16/2021		<LLD					<LLD		<LLD	<LLD
7/19/2021			<LLD					<LLD		
7/22/2021	<LLD			<LLD	<LLD	<LLD				
10/4/2021										
10/18/2021										
10/22/2021	<LLD	<LLD	<LLD				<LLD		<LLD	<LLD
11/1/2021				<LLD	<LLD	<LLD				
11/9/2021										

2021 GPI Sample Data

Sample Date	W-11	W-12	W-13	W-14	W-15	W-20	W-21	EW-19	MW-28	MW-29
1/21/2021										
1/22/2021	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD			
1/26/2021										
3/2/2021									<LLD	<LLD
4/5/2021								<LLD		
4/16/2021	<LLD	<LLD								
4/20/2021			<LLD	<LLD	<LLD	<LLD	<LLD			
4/23/2021										
5/14/2021										
7/6/2021								<LLD		
7/16/2021	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD			
7/19/2021									<LLD	<LLD
7/22/2021										
10/4/2021								<LLD		
10/18/2021									<LLD	<LLD
10/22/2021	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD			
11/1/2021										
11/9/2021									<LLD	<LLD

## 2021 GPI Sample Data

Sample Date	MW-22S	MW-22M	MW-22D	MW-24S	MW-24M	MW-24D	MW-25S	MW-25M	MW-25D
1/21/2021									
1/22/2021									
1/26/2021									
3/2/2021	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD			
4/5/2021									
4/16/2021									
4/20/2021									
4/23/2021									
5/14/2021	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
7/6/2021									
7/16/2021									
7/19/2021									
7/22/2021									
10/4/2021									
10/18/2021	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
10/22/2021									
11/1/2021									
11/9/2021									

(Note: Wells MW-22 through MW- 27 are multi-port wells installed in the Fall of 2009, with three sample points placed at different depths. S= Shallow M= Middle D= Deep).

(Note: A "\*" symbol following a sample result denotes a gamma count was performed. Any gamma results above LLD will be additionally flagged and documented in the analysis section).

## 2021 GPI Sample Data

Sample Date	MW-26S	MW-26M	MW-26D	MW-27S	MW-27-M	MW-27D	SG-1	SG-2	SG-4	SG-5
1/21/2021										
1/22/2021							<LLD	<LLD	<LLD	<LLD
1/26/2021										
3/2/2021										
4/5/2021										
4/16/2021										
4/20/2021							<LLD	<LLD	<LLD	<LLD
4/23/2021										
5/14/2021	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD				
7/6/2021										
7/16/2021							<LLD	<LLD	<LLD	<LLD
7/19/2021										
7/22/2021										
10/4/2021										
10/18/2021	<LLD	<LLD	<LLD*	<LLD	<LLD	<LLD				
10/22/2021										
11/1/2021										
11/9/2021										

(Note: Wells MW-22 through MW- 27 are multi-port wells installed in the Fall of 2009, with three sample points placed at different depths. S= Shallow M= Middle D= Deep).

### Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Total Period**

1/1/2021 - 3/31/2021

Period of Record =

Elevation: Speed: SP10M

Direction: DIR10M

Lapse: DT60M

Stability Class A

Delta Temperature Extremely Unstable

**Wind Speed (mph)**

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	0	13	5	0	0	0	18
NNE	0	3	0	0	0	0	3
NE	0	6	0	0	0	0	6
ENE	0	3	0	0	0	0	3
E	0	1	0	0	0	0	1
ESE	0	0	0	0	0	0	0
SE	0	4	3	0	0	0	7
SSE	0	1	13	1	0	0	15
S	0	1	4	0	0	0	5
SSW	0	0	4	2	0	0	6
SW	0	1	6	0	0	0	7
WSW	0	5	2	0	0	0	7
W	0	5	1	0	0	0	6
WNW	0	9	0	0	0	0	9
NW	1	16	0	0	0	0	17
NNW	1	22	3	0	0	0	26
<b>Total</b>	<b>2</b>	<b>90</b>	<b>41</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>136</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period 3</b>
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period 136</b>
<b>Total Hours for Period</b>							<b>2160</b>

### Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Total Period**

Period of Record =

1/1/2021 - 3/31/2021

Elevation: Speed: SP10M

Direction: DIR10M

Lapse: DT60M

Stability Class B

Delta Temperature Moderately Unstable

**Wind Speed (mph)**

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	1	11	1	0	0	0	13
NNE	1	1	1	0	0	0	3
NE	1	5	0	0	0	0	6
ENE	0	2	0	0	0	0	2
E	0	0	0	0	0	0	0
ESE	0	1	0	0	0	0	1
SE	0	3	4	0	0	0	7
SSE	0	5	2	0	0	0	7
S	0	2	2	1	0	0	5
SSW	0	0	4	0	0	0	4
SW	0	7	1	0	0	0	8
WSW	0	2	0	0	0	0	2
W	0	5	0	0	0	0	5
WNW	0	1	0	0	0	0	1
NW	1	4	0	0	0	0	5
NNW	2	7	0	0	0	0	9
<b>Total</b>	<b>6</b>	<b>56</b>	<b>15</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>78</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period</b>
							<b>3</b>
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period</b>
							<b>78</b>
<b>Total Hours for Period</b>							<b>2160</b>

## Joint Frequency Distribution

Hours at Each Wind Speed and Direction

### Total Period

**Period of Record =** 1/1/2021 - 3/31/2021  
**Elevation: Speed:** SP10M      **Direction:** DIR10M      **Lapse:** DT60M  
**Stability Class** C      **Delta Temperature**      **Slightly Unstable**

### Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>	
N	2	9	0	0	0	0	11	
NNE	0	3	0	0	0	0	3	
NE	1	4	1	0	0	0	6	
ENE	0	2	1	0	0	0	3	
E	0	1	0	0	0	0	1	
ESE	0	2	1	0	0	0	3	
SE	0	4	3	0	0	0	7	
SSE	0	10	1	0	0	0	11	
S	0	0	7	3	0	0	10	
SSW	0	3	3	2	0	0	8	
SW	0	12	5	0	0	0	17	
WSW	1	7	3	0	0	0	11	
W	1	0	0	0	0	0	1	
WNW	1	2	0	0	0	0	3	
NW	0	7	0	0	0	0	7	
NNW	4	10	1	0	0	0	15	
<b>Total</b>	<b>10</b>	<b>76</b>	<b>26</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>117</b>	
<b>Calm Hours not Included above for :</b>							<b>Total Period</b>	<b>3</b>
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period</b>	<b>117</b>
<b>Total Hours for Period</b>								<b>2160</b>



### Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Total Period**

Period of Record =

1/1/2021 - 3/31/2021

Elevation: Speed: SP10M

Direction: DIR10M

Lapse: DT60M

Stability Class D

Delta Temperature Neutral

**Wind Speed (mph)**

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	20	64	6	0	0	0	90
NNE	19	46	1	0	0	0	66
NE	38	35	7	0	0	0	80
ENE	40	25	9	0	0	0	74
E	24	15	14	1	0	0	54
ESE	16	23	5	0	0	0	44
SE	23	51	15	0	0	0	89
SSE	16	28	8	0	0	0	52
S	10	54	22	8	0	0	94
SSW	10	57	24	3	0	0	94
SW	8	61	25	0	0	0	94
WSW	9	30	23	3	0	0	65
W	7	44	13	0	0	0	64
WNW	6	21	3	0	0	0	30
NW	7	41	6	0	0	0	54
NNW	16	70	9	0	0	0	95
<b>Total</b>	<b>269</b>	<b>665</b>	<b>190</b>	<b>15</b>	<b>0</b>	<b>0</b>	<b>1139</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period 3</b>
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period 1139</b>
<b>Total Hours for Period</b>							<b>2160</b>

## Joint Frequency Distribution

Hours at Each Wind Speed and Direction

### Total Period

**Period of Record =** 1/1/2021 - 3/31/2021  
**Elevation: Speed:** SP10M      **Direction:** DIR10M      **Lapse:** DT60M  
**Stability Class** E      **Delta Temperature**      **Slightly Stable**

### Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	19	14	0	0	0	0	33
NNE	31	8	0	0	0	0	39
NE	23	13	1	0	0	0	37
ENE	15	4	0	0	0	0	19
E	15	3	0	0	0	0	18
ESE	12	9	0	0	0	0	21
SE	15	23	0	0	0	0	38
SSE	25	40	5	0	0	0	70
S	13	21	19	1	0	0	54
SSW	7	14	10	0	0	0	31
SW	0	24	7	0	0	0	31
WSW	3	3	4	0	0	0	10
W	4	2	0	0	0	0	6
WNW	7	6	0	0	0	0	13
NW	10	10	0	0	0	0	20
NNW	8	5	0	0	0	0	13
<b>Total</b>	<b>207</b>	<b>199</b>	<b>46</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>453</b>
<b>Calm Hours not Included above for :</b>							<b>3</b>
<b>Valid Hours for this Stability Class for:</b>							<b>453</b>
<b>Total Hours for Period</b>							<b>2160</b>

### Joint Frequency Distribution

Hours at Each Wind Speed and Direction

#### Total Period

Period of Record =

1/1/2021 - 3/31/2021

Elevation: Speed: SP10M

Direction: DIR10M Lapse: DT60M

Stability Class F

Delta Temperature Moderately Stable

#### Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	4	0	0	0	0	0	4
NNE	3	0	0	0	0	0	3
NE	9	0	0	0	0	0	9
ENE	4	1	0	0	0	0	5
E	16	0	0	0	0	0	16
ESE	8	0	0	0	0	0	8
SE	15	4	0	0	0	0	19
SSE	21	8	0	0	0	0	29
S	9	0	0	0	0	0	9
SSW	1	0	0	0	0	0	1
SW	1	0	0	0	0	0	1
WSW	1	1	0	0	0	0	2
W	4	0	0	0	0	0	4
WNW	4	0	0	0	0	0	4
NW	5	0	0	0	0	0	5
NNW	2	0	0	0	0	0	2
<b>Total</b>	<b>107</b>	<b>14</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>121</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period</b>
							<b>3</b>
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period</b>
							<b>121</b>
<b>Total Hours for Period</b>							<b>2160</b>

## Joint Frequency Distribution

Hours at Each Wind Speed and Direction

### Total Period

Period of Record = 1/1/2021 - 3/31/2021  
 Elevation: Speed: SP10M      Direction: DIR10M      Lapse: DT60M  
 Stability Class G      Delta Temperature      Extremely Stable

### Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	1	0	0	0	0	0	1
NNE	2	0	0	0	0	0	2
NE	2	0	0	0	0	0	2
ENE	11	0	0	0	0	0	11
E	14	0	0	0	0	0	14
ESE	23	0	0	0	0	0	23
SE	25	1	0	0	0	0	26
SSE	13	0	0	0	0	0	13
S	10	0	0	0	0	0	10
SSW	5	0	0	0	0	0	5
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	2	0	0	0	0	0	2
WNW	0	0	0	0	0	0	0
NW	2	0	0	0	0	0	2
NNW	2	0	0	0	0	0	2
<b>Total</b>	<b>112</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>113</b>
<b>Calm Hours not Included above for :</b>							<b>3</b>
<b>Valid Hours for this Stability Class for:</b>							<b>113</b>
<b>Total Hours for Period</b>							<b>2160</b>

## Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Summary of All Stability Classes**

**Total Period**

Period of Record =

1/1/2021 - 3/31/2021

Elevation:   Speed: SP10M

Direction: DIR10M

Lapse: DT60M

Delta Temperature

**Wind Speed (mph)**

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	47	111	12	0	0	0	170
NNE	56	61	2	0	0	0	119
NE	74	63	9	0	0	0	146
ENE	70	37	10	0	0	0	117
E	69	20	14	1	0	0	104
ESE	59	35	6	0	0	0	100
SE	78	90	25	0	0	0	193
SSE	75	92	29	1	0	0	197
S	42	78	54	13	0	0	187
SSW	23	74	45	7	0	0	149
SW	9	105	44	0	0	0	158
WSW	14	48	32	3	0	0	97
W	18	56	14	0	0	0	88
WNW	18	39	3	0	0	0	60
NW	26	78	6	0	0	0	110
NNW	35	114	13	0	0	0	162
<b>Total</b>	<b>713</b>	<b>1101</b>	<b>318</b>	<b>25</b>	<b>0</b>	<b>0</b>	<b>2157</b>

Calm Hours not Included above for :

Total Period

3

Variable Direction Hours for:

Total Period

0

Invalid Hours for:

Total Period

0

Valid Hours for this Stability Class for:

Total Period

2157

**Total Hours for Period**

**2160**

## Joint Frequency Distribution

Hours at Each Wind Speed and Direction

### Total Period

**Period of Record =** 4/1/2021 - 6/30/2021  
**Elevation: Speed:** SP10M      **Direction:** DIR10M      **Lapse:** DT60M  
**Stability Class** A      **Delta Temperature**      **Extremely Unstable**

### Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	5	82	18	0	0	0	105
NNE	1	7	0	0	0	0	8
NE	2	0	0	0	0	0	2
ENE	0	4	0	0	0	0	4
E	0	0	0	0	0	0	0
ESE	1	1	0	0	0	0	2
SE	0	4	2	0	0	0	6
SSE	0	8	9	0	0	0	17
S	2	7	2	1	0	0	12
SSW	0	12	5	0	0	0	17
SW	2	36	6	0	0	0	44
WSW	2	26	2	0	0	0	30
W	4	24	1	0	0	0	29
WNW	7	13	0	0	0	0	20
NW	5	21	0	0	0	0	26
NNW	11	73	4	0	0	0	88
<b>Total</b>	<b>42</b>	<b>318</b>	<b>49</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>410</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period</b> 12
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period</b> 410
<b>Total Hours for Period</b>							<b>2184</b>

## Joint Frequency Distribution

Hours at Each Wind Speed and Direction

### Total Period

**Period of Record =** 4/1/2021 - 6/30/2021  
**Elevation: Speed:** SP10M      **Direction:** DIR10M      **Lapse:** DT60M  
**Stability Class** B      **Delta Temperature**      **Moderately Unstable**

### Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>	
N	2	20	2	0	0	0	24	
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	4	2	0	0	0	0	6	
SE	1	1	2	0	0	0	4	
SSE	1	7	2	0	0	0	10	
S	0	9	5	0	0	0	14	
SSW	2	10	3	0	0	0	15	
SW	4	17	0	0	0	0	21	
WSW	1	7	1	0	0	0	9	
W	2	1	0	0	0	0	3	
WNW	2	3	0	0	0	0	5	
NW	1	1	0	0	0	0	2	
NNW	3	9	1	0	0	0	13	
<b>Total</b>	<b>23</b>	<b>87</b>	<b>16</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>126</b>	
<b>Calm Hours not Included above for :</b>							<b>Total Period</b>	<b>12</b>
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period</b>	<b>126</b>
<b>Total Hours for Period</b>								<b>2184</b>

### Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Total Period**

Period of Record =

4/1/2021 - 6/30/2021

Elevation: Speed: SP10M

Direction: DIR10M Lapse: DT60M

Stability Class C

Delta Temperature Slightly Unstable

**Wind Speed (mph)**

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	5	5	1	0	0	0	11
NNE	1	2	0	0	0	0	3
NE	1	2	0	0	0	0	3
ENE	3	1	0	0	0	0	4
E	1	1	0	0	0	0	2
ESE	0	0	0	0	0	0	0
SE	2	4	1	0	0	0	7
SSE	2	5	1	0	0	0	8
S	2	6	5	0	0	0	13
SSW	1	5	6	1	0	0	13
SW	0	14	2	0	0	0	16
WSW	2	1	0	0	0	0	3
W	4	2	0	0	0	0	6
WNW	3	2	0	0	0	0	5
NW	4	0	0	0	0	0	4
NNW	7	5	2	0	0	0	14
<b>Total</b>	<b>38</b>	<b>55</b>	<b>18</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>112</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period</b> 12
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period</b> 112
<b>Total Hours for Period</b>							<b>2184</b>



### Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Total Period**

Period of Record =

4/1/2021 - 6/30/2021

Elevation: Speed: SP10M

Direction: DIR10M

Lapse: DT60M

Stability Class D

Delta Temperature Neutral

**Wind Speed (mph)**

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	27	54	3	0	0	0	84
NNE	12	6	0	0	0	0	18
NE	6	16	0	0	0	0	22
ENE	7	8	0	0	0	0	15
E	6	4	0	0	0	0	10
ESE	8	6	0	0	0	0	14
SE	12	8	0	0	0	0	20
SSE	11	20	6	0	0	0	37
S	9	42	21	2	0	0	74
SSW	15	31	23	1	0	0	70
SW	14	29	2	0	0	0	45
WSW	16	9	0	0	0	0	25
W	10	5	0	0	0	0	15
WNW	7	5	0	0	0	0	12
NW	10	5	0	0	0	0	15
NNW	36	23	3	0	0	0	62
<b>Total</b>	<b>206</b>	<b>271</b>	<b>58</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>538</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period</b> 12
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period</b> 538
<b>Total Hours for Period</b>							<b>2184</b>

### Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Total Period**

Period of Record =

4/1/2021 - 6/30/2021

Elevation: Speed: SP10M

Direction: DIR10M

Lapse: DT60M

Stability Class E

Delta Temperature Slightly Stable

**Wind Speed (mph)**

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	45	14	0	0	0	0	59
NNE	19	1	0	0	0	0	20
NE	13	0	0	0	0	0	13
ENE	8	0	0	0	0	0	8
E	14	2	0	0	0	0	16
ESE	14	4	0	0	0	0	18
SE	24	13	0	0	0	0	37
SSE	30	33	0	0	0	0	63
S	23	73	9	0	0	0	105
SSW	14	38	12	0	0	0	64
SW	12	23	1	0	0	0	36
WSW	12	6	0	0	0	0	18
W	6	1	0	0	0	0	7
WNW	9	1	0	0	0	0	10
NW	15	1	0	0	0	0	16
NNW	23	1	0	0	0	0	24
<b>Total</b>	<b>281</b>	<b>211</b>	<b>22</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>514</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period</b>
							12
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period</b>
							514
<b>Total Hours for Period</b>							<b>2184</b>

### Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Total Period**

Period of Record =

4/1/2021 - 6/30/2021

Elevation: Speed: SP10M

Direction: DIR10M Lapse: DT60M

Stability Class F

Delta Temperature Moderately Stable

**Wind Speed (mph)**

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	6	0	0	0	0	0	6
NNE	11	0	0	0	0	0	11
NE	12	0	0	0	0	0	12
ENE	12	0	0	0	0	0	12
E	25	0	0	0	0	0	25
ESE	21	0	0	0	0	0	21
SE	18	5	0	0	0	0	23
SSE	34	8	0	0	0	0	42
S	18	13	0	0	0	0	31
SSW	13	0	0	0	0	0	13
SW	5	1	0	0	0	0	6
WSW	4	0	0	0	0	0	4
W	2	0	0	0	0	0	2
WNW	3	0	0	0	0	0	3
NW	6	0	0	0	0	0	6
NNW	11	0	0	0	0	0	11
<b>Total</b>	<b>201</b>	<b>27</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>228</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period</b> 12
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period</b> 228
<b>Total Hours for Period</b>							<b>2184</b>

### Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Total Period**

Period of Record = 4/1/2021 - 6/30/2021  
 Elevation: Speed: SP10M Direction: DIR10M Lapse: DT60M  
 Stability Class G Delta Temperature Extremely Stable

**Wind Speed (mph)**

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	2	0	0	0	0	0	2
NNE	4	0	0	0	0	0	4
NE	14	0	0	0	0	0	14
ENE	20	0	0	0	0	0	20
E	33	0	0	0	0	0	33
ESE	25	0	0	0	0	0	25
SE	38	0	0	0	0	0	38
SSE	40	0	0	0	0	0	40
S	33	0	0	0	0	0	33
SSW	16	0	0	0	0	0	16
SW	3	0	0	0	0	0	3
WSW	4	0	0	0	0	0	4
W	2	0	0	0	0	0	2
WNW	2	0	0	0	0	0	2
NW	4	0	0	0	0	0	4
NNW	4	0	0	0	0	0	4
<b>Total</b>	<b>244</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>244</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period</b> 12
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period</b> 244
<b>Total Hours for Period</b>							<b>2184</b>

## Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Summary of All Stability Classes**

**Total Period**

Period of Record =

4/1/2021 - 6/30/2021

Elevation: Speed: SP10M

Direction: DIR10M

Lapse: DT60M

Delta Temperature

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	92	175	24	0	0	0	291
NNE	48	16	0	0	0	0	64
NE	48	18	0	0	0	0	66
ENE	50	13	0	0	0	0	63
E	79	7	0	0	0	0	86
ESE	73	13	0	0	0	0	86
SE	95	35	5	0	0	0	135
SSE	118	81	18	0	0	0	217
S	87	150	42	3	0	0	282
SSW	61	96	49	2	0	0	208
SW	40	120	11	0	0	0	171
WSW	41	49	3	0	0	0	93
W	30	33	1	0	0	0	64
WNW	33	24	0	0	0	0	57
NW	45	28	0	0	0	0	73
NNW	95	111	10	0	0	0	216
<b>Total</b>	<b>1035</b>	<b>969</b>	<b>163</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>2172</b>

<b>Calm Hours not Included above for :</b>	<b>Total Period</b>	<b>12</b>
<b>Variable Direction Hours for:</b>	<b>Total Period</b>	<b>0</b>
<b>Invalid Hours for:</b>	<b>Total Period</b>	<b>0</b>
<b>Valid Hours for this Stability Class for:</b>	<b>Total Period</b>	<b>2172</b>
<b>Total Hours for Period</b>		<b>2184</b>

### Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Total Period**

7/1/2021 - 9/30/2021

Period of Record =

Elevation: Speed: SP10M

Direction: DIR10M

Lapse: DT60M

Stability Class A

Delta Temperature Extremely Unstable

**Wind Speed (mph)**

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	16	41	0	0	0	0	57
NNE	4	2	0	0	0	0	6
NE	2	4	0	0	0	0	6
ENE	3	2	0	0	0	0	5
E	3	2	0	0	0	0	5
ESE	5	0	0	0	0	0	5
SE	3	3	0	0	0	0	6
SSE	0	1	0	0	0	0	1
S	0	10	4	0	0	0	14
SSW	2	11	1	0	0	0	14
SW	1	14	0	0	0	0	15
WSW	6	11	0	0	0	0	17
W	4	11	0	0	0	0	15
WNW	5	2	0	0	0	0	7
NW	13	7	0	0	0	0	20
NNW	19	31	0	0	0	0	50
<b>Total</b>	<b>86</b>	<b>152</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>243</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period 301</b>
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period 243</b>
<b>Total Hours for Period</b>							<b>2208</b>

## Joint Frequency Distribution

Hours at Each Wind Speed and Direction

### Total Period

Period of Record =

7/1/2021 - 9/30/2021

Elevation: Speed: SP10M

Direction: DIR10M Lapse: DT60M

Stability Class B

Delta Temperature Moderately Unstable

### Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	4	5	0	0	0	0	9
NNE	1	0	0	0	0	0	1
NE	1	1	0	0	0	0	2
ENE	0	0	0	0	0	0	0
E	2	2	0	0	0	0	4
ESE	3	0	0	0	0	0	3
SE	4	1	0	0	0	0	5
SSE	1	2	0	0	0	0	3
S	1	11	1	0	0	0	13
SSW	1	17	1	0	0	0	19
SW	1	14	0	0	0	0	15
WSW	2	3	0	0	0	0	5
W	2	2	0	0	0	0	4
WNW	2	1	0	0	0	0	3
NW	5	2	0	0	0	0	7
NNW	6	1	0	0	0	0	7
<b>Total</b>	<b>36</b>	<b>62</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>100</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period</b>
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period</b>
<b>Total Hours for Period</b>							<b>2208</b>

### Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Total Period**

Period of Record =

7/1/2021 - 9/30/2021

Elevation: Speed: SP10M

Direction: DIR10M Lapse: DT60M

Stability Class C

Delta Temperature Slightly Unstable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	7	2	0	0	0	0	9
NNE	2	0	0	0	0	0	2
NE	2	0	0	0	0	0	2
ENE	3	1	0	0	0	0	4
E	0	0	0	0	0	0	0
ESE	3	1	0	0	0	0	4
SE	8	2	0	0	0	0	10
SSE	4	1	0	0	0	0	5
S	2	15	3	1	0	0	21
SSW	4	26	3	0	0	0	33
SW	3	10	1	0	0	0	14
WSW	0	4	0	0	0	0	4
W	3	2	0	0	0	0	5
WNW	2	3	0	0	0	0	5
NW	5	1	0	0	0	0	6
NNW	5	2	0	0	0	0	7
<b>Total</b>	<b>53</b>	<b>70</b>	<b>7</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>131</b>

Calm Hours not Included above for :

Total Period

301

Valid Hours for this Stability Class for:

Total Period

131

Total Hours for Period

2208



### Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Total Period**

Period of Record =

7/1/2021 - 9/30/2021

Elevation: Speed: SP10M

Direction: DIR10M

Lapse: DT60M

Stability Class D

Delta Temperature Neutral

**Wind Speed (mph)**

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	47	16	0	0	0	0	63
NNE	21	1	0	0	0	0	22
NE	14	3	0	0	0	0	17
ENE	6	0	0	0	0	0	6
E	11	0	0	0	0	0	11
ESE	11	4	0	0	0	0	15
SE	12	0	0	0	0	0	12
SSE	10	4	0	0	0	0	14
S	15	47	8	0	0	0	70
SSW	15	61	19	0	0	0	95
SW	10	22	1	0	0	0	33
WSW	9	0	0	0	0	0	9
W	11	1	1	0	0	0	13
WNW	8	2	0	0	0	0	10
NW	8	0	0	0	0	0	8
NNW	35	8	0	0	0	0	43
<b>Total</b>	<b>243</b>	<b>169</b>	<b>29</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>441</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period 301</b>
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period 441</b>
<b>Total Hours for Period</b>							<b>2208</b>

## Joint Frequency Distribution

Hours at Each Wind Speed and Direction

### Total Period

Period of Record =

7/1/2021 - 9/30/2021

Elevation: Speed: SP10M

Direction: DIR10M Lapse: DT60M

Stability Class E

Delta Temperature Slightly Stable

### Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	63	11	0	0	0	0	74
NNE	42	1	0	0	0	0	43
NE	33	1	0	0	0	0	34
ENE	16	0	0	0	0	0	16
E	11	0	0	0	0	0	11
ESE	29	0	0	0	0	0	29
SE	34	0	0	0	0	0	34
SSE	34	3	0	0	0	0	37
S	48	49	7	0	0	0	104
SSW	31	44	5	0	0	0	80
SW	23	9	0	0	0	0	32
WSW	5	2	0	0	0	0	7
W	6	6	0	0	0	0	12
WNW	5	3	0	0	0	0	8
NW	8	0	0	0	0	0	8
NNW	23	2	0	0	0	0	25
<b>Total</b>	<b>411</b>	<b>131</b>	<b>12</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>554</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period</b>
<b>Valid Hours for this Stability Class for:</b>							<b>301</b>
<b>Total Hours for Period</b>							<b>Total Period</b>
							<b>554</b>
							<b>2208</b>

## Joint Frequency Distribution

Hours at Each Wind Speed and Direction

### Total Period

**Period of Record =** 7/1/2021 - 9/30/2021  
**Elevation: Speed:** SP10M      **Direction:** DIR10M      **Lapse:** DT60M  
**Stability Class** F      **Delta Temperature** Moderately Stable

### Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	6	0	0	0	0	0	6
NNE	6	0	0	0	0	0	6
NE	13	0	0	0	0	0	13
ENE	15	0	0	0	0	0	15
E	15	0	0	0	0	0	15
ESE	24	0	0	0	0	0	24
SE	13	0	0	0	0	0	13
SSE	32	0	0	0	0	0	32
S	22	1	0	0	0	0	23
SSW	13	0	0	0	0	0	13
SW	5	0	0	0	0	0	5
WSW	1	0	0	0	0	0	1
W	3	0	0	0	0	0	3
WNW	2	0	0	0	0	0	2
NW	5	0	0	0	0	0	5
NNW	1	1	0	0	0	0	2
<b>Total</b>	<b>176</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>178</b>
<b>Calm Hours not Included above for :</b>				<b>Total Period</b>		<b>301</b>	
<b>Valid Hours for this Stability Class for:</b>				<b>Total Period</b>		<b>178</b>	
<b>Total Hours for Period</b>						<b>2208</b>	

### Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Total Period**

7/1/2021 - 9/30/2021

Period of Record =

Elevation: Speed: SP10M

Direction: DIR10M

Lapse: DT60M

Stability Class G

Delta Temperature Extremely Stable

**Wind Speed (mph)**

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	0	0	0	0	0	0	0
NNE	3	1	0	0	0	0	4
NE	11	0	0	0	0	0	11
ENE	35	0	0	0	0	0	35
E	53	0	0	0	0	0	53
ESE	39	0	0	0	0	0	39
SE	32	0	0	0	0	0	32
SSE	35	0	0	0	0	0	35
S	28	0	0	0	0	0	28
SSW	15	0	0	0	0	0	15
SW	3	0	0	0	0	0	3
WSW	2	0	0	0	0	0	2
W	1	0	0	0	0	0	1
WNW	1	0	0	0	0	0	1
NW	0	0	0	0	0	0	0
NNW	1	0	0	0	0	0	1
<b>Total</b>	<b>259</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>260</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period 301</b>
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period 260</b>
<b>Total Hours for Period</b>							<b>2208</b>

## Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Summary of All Stability Classes**

**Total Period**

Period of Record =

7/1/2021 - 9/30/2021

Elevation: Speed: SP10M

Direction: DIR10M

Lapse: DT60M

Delta Temperature

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	143	75	0	0	0	0	218
NNE	79	5	0	0	0	0	84
NE	76	9	0	0	0	0	85
ENE	78	3	0	0	0	0	81
E	95	4	0	0	0	0	99
ESE	114	5	0	0	0	0	119
SE	106	6	0	0	0	0	112
SSE	116	11	0	0	0	0	127
S	116	133	23	1	0	0	273
SSW	81	159	29	0	0	0	269
SW	46	69	2	0	0	0	117
WSW	25	20	0	0	0	0	45
W	30	22	1	0	0	0	53
WNW	25	11	0	0	0	0	36
NW	44	10	0	0	0	0	54
NNW	90	45	0	0	0	0	135
<b>Total</b>	<b>1264</b>	<b>587</b>	<b>55</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1907</b>

**Calm Hours not Included above for :**

**Total Period**

301

**Variable Direction Hours for:**

**Total Period**

0

**Invalid Hours for:**

**Total Period**

0

**Valid Hours for this Stability Class for:**

**Total Period**

1907

**Total Hours for Period**

2208

## Joint Frequency Distribution

Hours at Each Wind Speed and Direction

### Total Period

Period of Record =

10/1/2021 - 12/31/2021

Elevation: Speed: SP10M

Direction: DIR10M Lapse: DT60M

Stability Class A

Delta Temperature Extremely Unstable

### Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	2	5	0	0	0	0	7
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	1	0	0	0	0	0	1
ESE	0	0	0	0	0	0	0
SE	0	2	0	0	0	0	2
SSE	0	1	0	0	0	0	1
S	0	1	0	0	0	0	1
SSW	0	2	0	0	0	0	2
SW	0	0	1	0	0	0	1
WSW	0	1	1	0	0	0	2
W	0	3	0	0	0	0	3
WNW	0	4	0	0	0	0	4
NW	0	4	0	0	0	0	4
NNW	0	6	0	0	0	0	6
<b>Total</b>	<b>3</b>	<b>29</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>34</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period</b>
							622
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period</b>
							34
<b>Total Hours for Period</b>							<b>2208</b>

### Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Total Period**

Period of Record =

10/1/2021 - 12/31/2021

Elevation: Speed: SP10M

Direction: DIR10M Lapse: DT60M

Stability Class B

Delta Temperature Moderately Unstable

**Wind Speed (mph)**

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	1	0	0	0	0	0	1
NNE	1	0	0	0	0	0	1
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	2	0	0	0	0	2
ESE	0	1	0	0	0	0	1
SE	0	3	1	0	0	0	4
SSE	0	0	0	0	0	0	0
S	0	2	2	0	0	0	4
SSW	0	2	1	0	0	0	3
SW	0	5	3	0	0	0	8
WSW	0	1	1	0	0	0	2
W	0	2	0	0	0	0	2
WNW	0	4	0	0	0	0	4
NW	0	2	0	0	0	0	2
NNW	0	2	0	0	0	0	2
<b>Total</b>	<b>2</b>	<b>26</b>	<b>8</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>36</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period</b>
							622
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period</b>
							36
<b>Total Hours for Period</b>							<b>2208</b>

### Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Total Period**

Period of Record = 10/1/2021 - 12/31/2021  
 Elevation: Speed: SP10M Direction: DIR10M Lapse: DT60M  
 Stability Class C Delta Temperature Slightly Unstable

**Wind Speed (mph)**

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	1	3	0	0	0	0	4
NNE	1	0	0	0	0	0	1
NE	1	1	0	0	0	0	2
ENE	0	0	0	0	0	0	0
E	0	5	0	0	0	0	5
ESE	0	2	0	0	0	0	2
SE	0	3	1	0	0	0	4
SSE	0	2	0	0	0	0	2
S	0	7	0	0	0	0	7
SSW	0	5	5	0	0	0	10
SW	0	0	5	0	0	0	5
WSW	0	1	0	0	0	0	1
W	0	2	0	0	0	0	2
WNW	1	7	0	0	0	0	8
NW	1	1	0	0	0	0	2
NNW	0	6	0	0	0	0	6
<b>Total</b>	<b>5</b>	<b>45</b>	<b>11</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>61</b>
<b>Calm Hours not Included above for :</b>							<b>622</b>
<b>Valid Hours for this Stability Class for:</b>							<b>61</b>
<b>Total Hours for Period</b>							<b>2208</b>



## Joint Frequency Distribution

Hours at Each Wind Speed and Direction

### Total Period

Period of Record =

10/1/2021 - 12/31/2021

Elevation: Speed: SP10M

Direction: DIR10M

Lapse: DT60M

Stability Class D

Delta Temperature Neutral

### Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	12	24	0	0	0	0	36
NNE	16	3	0	0	0	0	19
NE	9	3	0	0	0	0	12
ENE	6	5	0	0	0	0	11
E	16	27	2	0	0	0	45
ESE	13	23	0	0	0	0	36
SE	12	44	7	0	0	0	63
SSE	9	43	8	0	0	0	60
S	4	64	38	15	1	0	122
SSW	6	18	33	5	1	0	63
SW	4	18	20	3	0	0	45
WSW	7	14	19	1	0	0	41
W	9	27	27	0	0	0	63
WNW	2	36	14	1	0	0	53
NW	5	51	7	0	0	0	63
NNW	6	50	7	0	0	0	63
<b>Total</b>	<b>136</b>	<b>450</b>	<b>182</b>	<b>25</b>	<b>2</b>	<b>0</b>	<b>795</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period</b>
							622
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period</b>
							795
<b>Total Hours for Period</b>							<b>2208</b>

### Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Total Period**

Period of Record = 10/1/2021 - 12/31/2021  
 Elevation: Speed: SP10M Direction: DIR10M Lapse: DT60M  
 Stability Class E Delta Temperature Slightly Stable

**Wind Speed (mph)**

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	26	12	0	0	0	0	38
NNE	14	1	0	0	0	0	15
NE	7	0	0	0	0	0	7
ENE	11	0	0	0	0	0	11
E	12	3	0	0	0	0	15
ESE	11	4	0	0	0	0	15
SE	10	28	4	0	0	0	42
SSE	22	30	4	0	0	0	56
S	12	54	19	0	0	0	85
SSW	5	10	16	0	0	0	31
SW	2	10	5	0	0	0	17
WSW	4	10	1	0	0	0	15
W	3	10	2	0	0	0	15
WNW	7	13	3	0	0	0	23
NW	12	22	0	0	0	0	34
NNW	23	25	8	0	0	0	56
<b>Total</b>	<b>181</b>	<b>232</b>	<b>62</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>475</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period</b> 622
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period</b> 475
<b>Total Hours for Period</b>							<b>2208</b>

## Joint Frequency Distribution

Hours at Each Wind Speed and Direction

### Total Period

**Period of Record =** 10/1/2021 - 12/31/2021  
**Elevation: Speed:** SP10M      **Direction:** DIR10M      **Lapse:** DT60M  
**Stability Class** F      **Delta Temperature** Moderately Stable

### Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	4	0	0	0	0	0	4
NNE	3	0	0	0	0	0	3
NE	6	0	0	0	0	0	6
ENE	6	0	0	0	0	0	6
E	3	0	0	0	0	0	3
ESE	2	0	0	0	0	0	2
SE	10	0	0	0	0	0	10
SSE	32	0	0	0	0	0	32
S	10	5	0	0	0	0	15
SSW	2	0	0	0	0	0	2
SW	1	0	0	0	0	0	1
WSW	1	0	0	0	0	0	1
W	0	0	0	0	0	0	0
WNW	1	0	0	0	0	0	1
NW	0	0	0	0	0	0	0
NNW	1	0	0	0	0	0	1
<b>Total</b>	<b>82</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>87</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period</b> 622
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period</b> 87
<b>Total Hours for Period</b>							<b>2208</b>

### Joint Frequency Distribution

Hours at Each Wind Speed and Direction

#### Total Period

Period of Record = 10/1/2021 - 12/31/2021  
 Elevation: Speed: SP10M Direction: DIR10M Lapse: DT60M  
 Stability Class G Delta Temperature Extremely Stable

#### Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	0	0	0	0	0	0	0
NNE	1	0	0	0	0	0	1
NE	6	0	0	0	0	0	6
ENE	11	0	0	0	0	0	11
E	16	0	0	0	0	0	16
ESE	14	0	0	0	0	0	14
SE	13	0	0	0	0	0	13
SSE	25	0	0	0	0	0	25
S	5	0	0	0	0	0	5
SSW	2	0	0	0	0	0	2
SW	1	0	0	0	0	0	1
WSW	2	0	0	0	0	0	2
W	0	0	0	0	0	0	0
WNW	1	0	0	0	0	0	1
NW	1	0	0	0	0	0	1
NNW	0	0	0	0	0	0	0
<b>Total</b>	<b>98</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>98</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period 622</b>
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period 98</b>
<b>Total Hours for Period</b>							<b>2208</b>

### Joint Frequency Distribution

Hours at Each Wind Speed and Direction

**Summary of All Stability Classes**

**Total Period**

Period of Record =

10/1/2021 - 12/31/2021

Elevation: Speed: SP10M

Direction: DIR10M

Lapse: DT60M

Delta Temperature

**Wind Speed (mph)**

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>&gt; 25</u>	<u>Total</u>
N	46	44	0	0	0	0	90
NNE	36	4	0	0	0	0	40
NE	29	4	0	0	0	0	33
ENE	34	5	0	0	0	0	39
E	48	37	2	0	0	0	87
ESE	40	30	0	0	0	0	70
SE	45	80	13	0	0	0	138
SSE	88	76	12	0	0	0	176
S	31	133	59	15	1	0	239
SSW	15	37	55	5	1	0	113
SW	8	33	34	3	0	0	78
WSW	14	27	22	1	0	0	64
W	12	44	29	0	0	0	85
WNW	12	64	17	1	0	0	94
NW	19	80	7	0	0	0	106
NNW	30	89	15	0	0	0	134
<b>Total</b>	<b>507</b>	<b>787</b>	<b>265</b>	<b>25</b>	<b>2</b>	<b>0</b>	<b>1586</b>
<b>Calm Hours not Included above for :</b>							<b>Total Period 622</b>
<b>Variable Direction Hours for:</b>							<b>Total Period 0</b>
<b>Invalid Hours for:</b>							<b>Total Period 0</b>
<b>Valid Hours for this Stability Class for:</b>							<b>Total Period 1586</b>
<b>Total Hours for Period</b>							<b>2208</b>

**OFF-SITE DOSE CALCULATION MANUAL CHANGES**

The Off-Site Dose Calculation Manual, PMP-6010-OSD-001, was not revised during this 2021 reporting period.