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**VIRGIL C. SUMMER NUCLEAR STATION UNIT 1**  
**DOCKET NO. 50-395**  
**OPERATING LICENSE NO. NPF-12**  
**ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**

Enclosed is the South Carolina Electric & Gas Company Annual Radioactive Effluent Release Report as required by 10CFR50.36a, Section 6.9.1.8 of the Virgil C. Summer Nuclear Station Technical Specifications and Section 1.6.2 of the Offsite Dose Calculation Manual. This submittal covers the period of January 1 through December 31, 2018.

If there are any questions, please call Ms. Susan B. Reese at (803) 345-4591.

Sincerely,

Robert L. Justice  
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File: 818.02-1  
PRSF: SN-19-196 (w/enclosure)

**Concurrences:**

See Correspondence Routing and Approval CHOP Sheet

**Action Plan:** None

**Changes to the UFSAR, USAR, QA Topical Report, or ISFSI FSAR:** None



# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT VIRGIL C. SUMMER NUCLEAR STATION UNIT 1

FOR THE OPERATING PERIOD  
JANUARY 1, 2018 - DECEMBER 31, 2018



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# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

JANUARY - DECEMBER 2018

## VIRGIL C. SUMMER NUCLEAR STATION

### Introduction

This report is being submitted as a summary of quantities of radioactive liquid and gaseous effluents and solid waste released from the Virgil C. Summer Nuclear Station. This report is submitted in fulfillment of the requirements in the V. C. Summer Nuclear Station Operating License Technical Specifications Section 6.9.1.8, Offsite Dose Calculation Manual (ODCM) Section 1.6.2 and 10CFR50.36(a) and follows the reporting details specified in USNRC Regulatory Guide 1.21<sup>(1)</sup>.

Summary information of radioactive gaseous and liquid effluents is presented along with a summary of radioactive waste disposal as well as an evaluation of the radiological impact on man due to operation of the Virgil C. Summer Nuclear Station. Supplemental information including release limits also required by USNRC Regulatory Guide 1.21 is provided as Appendix A.

### A. Supplemental Information

Regulatory limits for doses, dose rate and effluent concentration limits presented in Supplemental Information are from the Virgil C. Summer Nuclear Station ODCM and 40 CFR 190. Average energy ( $\bar{E}$ ) is not applicable to the method for determining release rate limits for fission and activation gaseous effluents, therefore, it has been omitted. A compilation of required supplemental information is provided in Appendix A.

### B. Gaseous Effluents

Gaseous effluents released from ground level are summarized in Tables 1 and 2. An elevated release pathway does not exist at Virgil C. Summer Nuclear Station. Cumulative doses are discussed in Section E.

The total error for all liquid and gaseous pathways except gaseous particulate and iodine is estimated as twenty percent. Total error for gaseous particulate and iodine is estimated as twenty five percent. Error was derived using root sum of squares methodology considering known sources of error including calibration of detectors and flow measurement equipment, sample preparation, and analysis counting error.

### C. Liquid Effluents

Liquid effluents are summarized in Tables 3 and 4. Estimated total errors are expressed as in Section B above.

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### D. Solid Waste Shipments

Solid waste shipments are summarized in Table 5. Curie content of radioactive waste packages is determined by dose rates and/or gamma spectroscopy analysis of samples. The total error for each type of curie content determination is conservatively estimated to be the sum of a 15% systematic error and a 20% photon response error for the detector used.

### E. Radiological Impact on Man

Dose to the maximum exposed individual in the unrestricted area was calculated using measured plant gaseous effluents and meteorological data in accordance with the Offsite Dose Calculation Manual. The source term involved 1 Waste Gas Decay Tank (WGDT) release, 13.23 days of 6-inch Reactor Building purge releases, 18.57 days of 36-inch Reactor Building purge releases and a continuous 12-month Main Plant vent release. Doses are summarized in Table 6. The total gaseous activities released are presented in Tables 1 and 2. The highest quarterly air doses at the station boundary resulting from the release of noble gases were  $2.80\text{E-}04$  mrad for gamma during the fourth quarter and  $2.16\text{E-}04$  mrad for beta during the fourth quarter. The maximum quarterly organ dose attributed to the releases, excluding Carbon-14, was  $3.18\text{E-}03$  mrem. Cumulative annual dose was  $4.50\text{E-}04$  mrad,  $2.76\text{E-}04$  mrad and  $3.39\text{E-}03$  mrem for gamma, beta, and organ dose, respectively. Discussion of the impact of Carbon-14 is included in Section K.

Measured plant liquid effluent data was used to calculate estimates of doses to individuals in accordance with the Offsite Dose Calculation Manual. The source term consisted of the isotopic contents of 241 Waste Monitor Tank batch releases, 14 Condensate Backwash Receiver Tank batch releases, 1 NaOH Sump batch release, 2.17 days of Steam Generator Blowdown release and a continuous Turbine Building Sump release.

Doses are summarized in Table 6 and total liquid radioactivity released is described in Tables 3 and 4. The highest quarterly total body dose to the maximum exposed individual resulting from the release of radioactive liquid was  $2.39\text{E-}03$  mrem during the third quarter. The highest organ dose was  $2.40\text{E-}03$  mrem to the GI-LLI for the third quarter. Cumulative annual doses for the hypothetical maximum exposed individual were  $7.55\text{E-}03$  mrem for the total body and  $7.73\text{E-}3$  mrem for the GI-LLI, the maximum annual organ. The Liver was the maximum exposed organ for the first quarter and the GI-LLI was maximum exposed organ for the last three quarters.

Dose rates and concentrations were below station limits as specified in Supplemental Information, Section II A, B, and C during all the effluent releases.

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Radiation exposure to members of the public within the site boundary was assessed through calculation of gamma and beta air dose at 0.25 miles of the gaseous effluent release point and direct measurement of exposure using thermoluminescent dosimeters. Onsite air dose for this reporting period was  $1.47\text{E-}03$  mrad gamma and  $8.99\text{E-}05$  mrad beta, well below levels that can be distinguished above background. Quarterly thermoluminescent dosimetry (TLD) data from four onsite monitoring locations within 0.2 miles of the Reactor Building and eight locations at the site boundary were analyzed and compared with respective pre-operational background and previous year history. Results showed that the 2018 quarterly dose rates did not differ significantly from the pre-operational or 2017 dose rates.

The impact of Independent Spent Fuel Storage Installation (ISFSI) operation which began cask storage on March 26, 2016 was assessed using six TLD locations monitoring the perimeter of the ISFSI site. The TLD locations were monitored for three quarters prior to fuel storage and continued to be monitored through 2018 during which fuel storage casks were stored. Analysis of monitoring results showed no statistically significant increase in perimeter dose as a result of ISFSI operation.

Based on review of gaseous effluent dose calculations and analysis of onsite TLD monitoring it was concluded that doses to members of the public inside the site boundary were indistinguishable from normal background dose.

Radiation doses from radioactive effluents to workers at the Fairfield Hydro Station for this reporting period were calculated to be  $2.13\text{E-}05$  and  $1.31\text{E-}05$  mrad for gamma and beta, respectively.

Radiation doses from radioactive effluents to workers at the New Nuclear Site for this reporting period were calculated to be  $1.83\text{E-}04$  and  $1.21\text{E-}04$  mrad for gamma and beta, respectively.

Radiation doses from nearby uranium fuel cycle sources were not assessed. The ODCM, Sections 1.3.1 and B/1.3 establish a five (5) mile limit beyond which doses from nearby plants are insignificant. There are no uranium fuel cycle plants within a five (5) mile radius of Virgil C. Summer Nuclear Station.

### F. Abnormal Releases

None

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### G. Meteorology

The meteorological data for 2018 was collected and analyzed. A summary report of joint frequency distributions of wind direction and speed by atmospheric stability class for each quarter is included as Enclosure A along with an annual summary and summary of conditions during a gaseous batch release.

The wind direction and wind speed data used were acquired from the 10-meter level of the primary monitoring tower. Stability was determined by the primary differential temperature (61 to 10 meter).

The combined annual data recovery for wind direction, wind speed and stability was 97.47%. Primary variable recovery rates were as follows: wind direction (10 m) – 97.45%, wind speed (10 m) – 97.45%, and differential temperature (61 - 10 m) – 97.45%.

### H. Offsite Dose Calculation Manual

The Virgil C. Summer Nuclear Station ODCM was not revised in 2018.

### I. Offsite Dose Calculation Manual Reportable Incidents

There were no ODCM reportable incidents in 2018.

### J. Major Changes to Radioactive Waste Treatment Systems

During 2018, there were no major changes to the Radioactive Waste Treatment System.

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### K. Carbon-14 Gaseous Effluents

Carbon-14 production and release estimates were calculated using EPRI Report 1021106<sup>(2)</sup>, "Estimation of Carbon-14 in Nuclear Plant Gaseous Effluents". This calculation uses active core coolant mass, average neutron flux by energy and reactor coolant nitrogen concentrations to determine Carbon-14 generation based upon an effective full power year. The estimated generation for VC Summer Nuclear station for 2018 was 8.68 curies.

Public dose estimates were performed using Regulatory Guide 1.109<sup>(3)</sup> methodology. Carbon dioxide is assumed to make up 20% of the Carbon-14 gaseous emissions from the station based upon available references and on-site testing. Carbon-14 is the highest dose contributor of all radionuclides released in gaseous effluents. Annual dose resulting from Carbon-14 releases in gaseous effluents is estimated to be 1.54E-01 mrem total body and 7.72E-01 mrem to the maximum organ (bone).

### References

1. Regulatory Guide 1.21, *"Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents From Light Water Cooled Nuclear Power Plants"*, Revision 1, US Nuclear Regulatory Commission, Washington D.C., 1974.
2. EPRI Report 1021106, *"Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents"*, Electric Power Research Institute, Palo Alto, CA, 2010.
3. Regulatory Guide 1.109, *"Calculation of Annual Doses to Man from Routine Releases of Reactor effluents for the Purpose of Demonstrating compliance with 10 CFR50, Appendix I"*, US Nuclear Regulatory Commission, Washington D.C., 1976.



APPENDIX A  
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**SUPPLEMENTAL INFORMATION**

I. Regulatory Dose Limits:

A. Fission and Activation Gases:

The air dose to an individual due to noble gases released in gaseous effluents shall be limited to less than or equal to 5 mrad for gamma radiation and 10 mrad for beta radiation during any calendar quarter and 10 mrad for gamma radiation and 20 mrad for beta radiation during any calendar year (ODCM, Section 1.2.3.1).

B. Iodines, Particulates (half-lives > 8 days) and Tritium:

The dose to an individual from radioiodine's, tritium and radioactive materials in particulate form with half-lives greater than 8 days in gaseous effluents shall be limited to less than or equal to 7.5 mrem to any organ during any calendar quarter and 15 mrem to any organ during any calendar year (ODCM, Section 1.2.4.1).

C. Liquid Effluents:

The dose or dose commitment to an individual from radioactive materials in liquid effluents released shall be limited to less than or equal to 1.5 mrem to the total body and 5 mrem to any organ during any calendar quarter and 3 mrem to the total body and 10 mrem to any organ during any calendar year (ODCM, Section 1.1.3.1).

D. All Sources:

The annual dose equivalent shall not exceed 25 mrem to the whole body, 75 mrem to the thyroid and 25 mrem to any other organ (40 CFR 190).

II. Dose Rate and Effluent Concentration Limits:

A. Fission and Activation Gases

The dose rate in unrestricted areas due to radioactive materials released in gaseous effluents shall be limited to less than or equal to 500 mrem/year to the total body and less than or equal to 3000 mrem/year to the skin (ODCM, Section 1.2.2.1).

## APPENDIX A

### ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

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B. Iodines, Particulates (half-lives > 8 days) and Tritium:

The dose rate in unrestricted areas due to radioactive materials in effluents shall be limited to less than or equal to 1500 mrem/year to any organ (ODCM, Section 1.2.2.1).

C. Liquid Effluents:

The concentration of radioactive materials released from the site shall be limited to 10 times the concentrations specified in 10 CFR 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 2E-04  $\mu\text{Ci/ml}$  total activity (ODCM, Section 1.1.2.1).

III. Average Energy:

Not Applicable

IV. Measurements and Approximations of Total Radioactivity:

- A. Fission and activation gases: Gamma spectrometry (HPGe)
- B. Iodines: Gamma spectrometry (HPGe)
- C. Particulates: Gamma spectrometry (HPGe), beta proportional counting, alpha proportional counting
- D. Tritium: Liquid scintillation
- E. Liquid effluents: Gamma spectrometry (HPGe), liquid scintillation (H-3), beta proportional counting, alpha proportional counting.

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V. Batch Releases:

A. Gaseous:

1. Number of batch releases: 1
2. Total time period for batch releases: 362 min
3. Maximum time period for a batch release: 362 min
4. Average time period for a batch release: 362 min
5. Minimum time period for a batch release: 362 min

B. Liquid:

1. Number of batch releases:

37	For first quarter, 2018
41	For second quarter, 2018
66	For third quarter, 2018
126	For fourth quarter, 2018

2. Total time period for batch releases:

2.70E+03	min. for first quarter, 2018
3.02E+03	min. for second quarter, 2018
4.77E+03	min. for third quarter, 2018
7.78E+03	min. for fourth quarter 2018

3. Maximum time period for a batch release:

1.01E+02	min. for second quarter, 2018
1.39E+02	min. for second quarter, 2018
9.20E+01	min. for third quarter, 2018
9.70E+01	min. for fourth quarter, 2018

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4. Average time period for batch releases:  
  
7.30E+01 min. for first quarter, 2018  
7.37E+01 min. for second quarter, 2018  
7.23E+01 min. for third quarter, 2018  
6.17E+01 min. for fourth quarter, 2018
5. Minimum time period for a batch release:  
  
4.00E+01 min. for first quarter, 2018  
1.00E+01 min. for second quarter, 2018  
6.40E+01 min. for third quarter, 2018  
1.00E+00 min. for fourth quarter, 2018\*  
\* NaOH sump release
6. Average stream flow during periods of release of effluent into a flowing stream:  
  
2.98E+06 gpm for first quarter, 2018  
5.11E+06 gpm for second quarter, 2018  
7.95E+06 gpm for third quarter, 2018  
3.88E+06 gpm for fourth quarter, 2018

VI. Abnormal Releases:

A. Gaseous:

1. Number of releases: 0
2. Total activity released: 0

B. Liquid:

1. Number of releases: 0
2. Total activity released: 0

**ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**  
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**Virgil C. Summer Nuclear Station, Unit 1**

**TABLE 1**

**Gaseous Effluents-Summation of All Releases**

Type of Effluent	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Error, %
<b>A. Fission &amp; Activation Gases</b>						
1. Total Release	Curies	0.00E+00	0.00E+00	9.15E-02	4.20E-01	2.00E+01
2. Average Release Rate for Period	µCi/sec	0.00E+00	0.00E+00	1.15E-02	5.28E-02	
3. Percent of Applicable Limit	%	0.00E+00	0.00E+00	3.40E-03	5.60E-03	
<b>B. Iodines</b>						
1. Total Iodine-131	Curies	0.00E+00	0.00E+00	0.00E+00	2.37E-06	2.50E+01
2. Average Release Rate for Period	µCi/sec	0.00E+00	0.00E+00	0.00E+00	2.98E-07	
3. Percent of Applicable Limit	%	0.00E+00	0.00E+00	0.00E+00	2.37E-04	
<b>C. Particulates</b>						
1. Total Particulates (Half-lives > 8 days)	Curies	0.00E+00	0.00E+00	1.25E-06	6.06E-06	2.50E+01
2. Average Release Rate for Period	µCi/sec	0.00E+00	0.00E+00	1.57E-07	7.62E-07	
3. Percent of Applicable Limit	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
4. Gross Alpha Activity	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<b>D. Tritium</b>						
1. Total Release	Curies	0.00E+00	0.00E+00	3.78E-01	5.50E+00	2.00E+01
2. Average Release Rate for Period	µCi/sec	0.00E+00	0.00E+00	4.75E-02	6.92E-01	
3. Percent of Applicable Limit	%	0.00E+00	0.00E+00	2.87E-03	4.18E-02	
<b>E. Carbon-14</b>						
1. Total Release	Curies	2.14E+00	2.16E+00	2.19E+00	2.19E+00	N/A
2. Average Release Rate for Period	µCi/sec	2.75E-01	2.75E-01	2.75E-01	2.75E-01	

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**TABLE 2**

**Gaseous Effluents-Ground Level Releases**

Nuclides Released	Units	Continuous Mode				Batch Mode			
		Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4
1. Fission and Activation Gases									
Ar-41	Curies	0.00E+00	0.00E+00	9.15E-02	8.37E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-133	Curies	0.00E+00	0.00E+00	0.00E+00	1.36E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-135	Curies	0.00E+00	0.00E+00	0.00E+00	3.22E-01	0.00E+00	0.00E+00	6.01E-07	0.00E+00
Total for Period	Curies	0.00E+00	0.00E+00	9.15E-02	4.20E-01	0.00E+00	0.00E+00	6.01E-07	0.00E+00
2. Iodines									
I-131	Curies	0.00E+00	0.00E+00	0.00E+00	2.37E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	Curies	0.00E+00	0.00E+00	0.00E+00	2.37E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Particulates									
Be-7	Curies	0.00E+00	0.00E+00	1.25E-06	6.06E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-82	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	Curies	0.00E+00	0.00E+00	1.25E-06	6.06E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Tritium									
H-3	Curies	0.00E+00	0.00E+00	3.78E-01	5.50E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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**TABLE 3**

**Liquid Effluents-Summation of All Releases**

Type of Effluent	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Error, %
<b><u>A. Fission &amp; Activation Products</u></b>						
1. Total Release (not including Tritium, Gases, and Alpha)	Curies	1.80E-03	1.49E-03	4.04E-03	7.39E-03	2.00E+01
2. Average Diluted Concentration During Period	µCi/ml	3.40E-11	2.42E-11	2.41E-11	6.69E-11	
3. Percent of Applicable Limit	%	3.60E-02	2.97E-02	8.09E-02	1.48E-01	
<b><u>B. Tritium</u></b>						
1. Total Release	Curies	7.61E+01	2.28E+02	4.15E+02	9.72E+01	2.00E+01
2. Average Diluted Concentration During Period	µCi/ml	1.43E-06	3.72E-06	2.48E-06	8.81E-07	
3. Percent of Applicable Limit	%	1.43E-01	3.72E-01	2.48E-01	8.81E-02	
<b><u>C. Dissolved and Entrained Gases</u></b>						
1. Total Release	Curies	0.00E+00	1.33E-05	2.07E-04	1.92E-03	2.00E+01
2. Average Diluted Concentration During Period	µCi/ses	0.00E+00	2.16E-13	1.24E-12	1.74E-11	
3. Percent of Applicable Limit	%	0.00E+00	1.08E-07	6.19E-07	8.71E-06	
<b><u>D. Gross Alpha Radioactivity</u></b>						
1. Total Release	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<b><u>E. Waste Volume Released (Pre-Dilution)</u></b>						
	Liters	1.09E+08	1.30E+07	1.10E+08	5.50E+07	3.00E+00
<b><u>F. Volume of Dilution Water Used</u></b>						
	Liters	5.30E+10	6.14E+10	1.67E+11	1.10E+11	4.30E+00

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**TABLE 4**

**Liquid Effluents**

Nuclides Released	Units	Continuous Mode				Batch Mode			
		Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4
Ag-110m	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.56E-06	0.00E+00	0.00E+00
As-76	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.70E-06
Co-58	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.76E-05	6.34E-06	2.49E-05	5.90E-04
Co-60	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.06E-04	3.44E-04	1.56E-03	6.19E-04
Cr-51	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.31E-05
Cs-137	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.67E-05	3.80E-06	3.66E-05	2.74E-06
Fe-55	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.14E-04	5.28E-04	6.58E-04	4.92E-04
H-3	Curies	0.00E+00	3.52E-03	5.04E-02	4.78E-02	7.61E+01	2.28E+02	4.15E+02	9.72E+01
Mn-54	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.55E-05	1.32E-05	1.11E-04	4.94E-05
Na-24	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-04	0.00E+00	8.50E-07	0.00E+00
Nb-95	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.74E-06	2.51E-06	2.10E-05	3.61E-05
Ni-63	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.99E-04	5.19E-04	1.48E-03	1.91E-03
Sb-124	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.42E-06
Sb-125	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.64E-05	6.75E-05	1.34E-04	1.67E-05
Te-123M	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.49E-04
Te-125m	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.46E-03
Xe-133	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.33E-05	2.02E-04	1.91E-03
Xe-133m	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E-05
Xe-135	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.65E-06	1.23E-06
Zn-65	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.68E-05	0.00E+00
Zr-95	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.01E-05
<hr/>									
Total for Period	Curies	0.00E+00	3.52E-03	5.04E-02	4.78E-02	7.61E+01	2.28E+02	4.15E+02	9.72E+01



**ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**  
**JANUARY - DECEMBER 2018**  
**Virgil C. Summer Nuclear Station, Unit 1**

**TABLE 5**  
**Solid Waste Shipments**

1. Solid Waste Shipped Offsite for Burial or Disposal (Not irradiated fuel)

Type of Waste	Unit	2018 Total	Est. Total Error, %
a. Spent resins, filters, sludge, evaporator bottoms, etc.	m <sup>3</sup> Ci	2.34E+01 1.24E+02	2.5E+01
b. Dry compressible waste, metals, contaminated equipment, etc.	m <sup>3</sup> Ci	4.33E+02 1.10E-01	2.5E+01
c. Irradiated components, control rods, etc.	m <sup>3</sup> Ci	0.00E+00 0.00E+00	N/A
d. Other waste, oil, etc.	m <sup>3</sup> Ci	2.70E-01 3.00E-01	2.5E+01

2. Estimate of major nuclide composition for the year (by type of waste) for concentrations above 1.0%

a.

Ni-63	75.37 %	9.34E+01 Ci
Co-60	9.39 %	1.16E+01 Ci
Co-58	5.35 %	6.63E+00 Ci
Mn-54	3.13 %	3.87E+00 Ci
Fe-55	2.59 %	3.21E+00 Ci
H-3	2.19 %	2.71E+00 Ci

b.

Co-60	33.41 %	3.77E-02 Ci
Nb-95	16.37 %	1.85E-02 Ci
Fe-55	14.19 %	1.60E-02 Ci
Zr-95	10.07 %	1.14E-02 Ci
Co-58	7.30 %	8.25E-03 Ci
Ni-63	6.40 %	7.23E-03 Ci
Cr-51	5.80 %	6.55E-03 Ci
Mn-54	2.60 %	2.94E-03 Ci
Sb-125	1.95 %	2.21E-03 Ci

c.

None	N/A	N/A
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d.

H-3	100.00 %	3.00E-01 Ci
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**ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**  
**JANUARY - DECEMBER 2018**  
**Virgil C. Summer Nuclear Station, Unit 1**

**TABLE 5**  
**Solid Waste Shipments**

**3. Solid Waste Disposition**

Number of Shipments	Mode of Transportation	Destination
2	Cast Transportation	UniTech Services Group, Inc. Oakridge, TN
1	Federal Express	Nuclear Containment Systems Columbus, OH
3	Hittman	Energy Solutions, LLC Barnwell Processing Facility Barnwell, SC
3	Landstar	Aaron - Wampum, PA
4	PGT Trucking	Aaron - Wampum, PA

**Notes:**

- Two** shipments by Cast Transportation containing (3) 20-foot Sealands of Green is Clean Waste were shipped to Oakridge, TN for processing.
- One** shipment by Federal Express containing (1) Halocarbon Analyzer was shipped to Aaron in Wampum, PA for processing and disposal.
- Three** shipments by Hittman containing (1) 8-120 High Integrity Container of Dewatered Charcoal/Anion/Cation Resin; (1) 8-120 High Integrity Container of Dewatered Primary Resin; and (1) 14-195 High Integrity Container of Dewatered Nuclear Blowdown/Component Cooling Water Resin were shipped to the Barnwell Processing Facility for processing and burial.
- Three** shipments by Landstar containing (1) 40-foot Sealand holding one deconstructed Auxiliary 'B' Crane; (1) 20-foot Sealand of Dry Active Waste; (3) B-25 Boxes of Gross Dewatered Nuclear Blowdown Resin; (1) B-25 Box of Gross Dewatered Nuclear Blowdown Polisher/Charcoal; (1) B-25 Box of Mopheads/Rags; (2) B-25 Boxes of Plenum Charcoal; (1) B-12 Box of E-Waste; (1) B-25 Box of Metal; (1) B-25 Box of Insulation/Metal; (1) B-25 Box of Scaffold Waste; and (1) B-12 Box of Metal were shipped to Aaron in Wampum, PA for processing.
- Four** shipments by PGT Trucking containing (1) 20-foot Sealand of Dry Active Waste; (2) 20-foot Sealands of OREX Waste; (4) 20-foot Sealands of Dry Active Waste/OREX Waste; (2) B-25 Boxes of Mopheads/Rags; and (4) B-25 Boxes of Metal were shipped to Aaron in Wampum, PA for processing.

**ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**  
**JANUARY – DECEMBER 2018**  
**Virgil C. Summer Nuclear Station, Unit 1**

**TABLE 6**

**Gaseous Effluents**

	Parameter	Location	Dose	Dose Limit	% of Limit
<u>Qtr 1</u>	Gamma Air Dose (mrad)	1.61 km ENE	0.00E+00	5.00E+00	0.00
	Beta Air Dose (mrad)	1.61 km ENE	0.00E+00	1.00E+01	0.00
	Total Body Dose (mrem)	1.61 km ENE	0.00E+00	5.00E+00	0.00
	Skin Dose (mrem)	1.61 km ENE	0.00E+00	7.50E+00	0.00
	Max Organ Dose (mrem)*	1.77 km E	0.00E+00	7.50E+00	0.00
	None - None				
<u>Qtr 2</u>	Gamma Air Dose (mrad)	1.61 km ENE	0.00E+00	5.00E+00	0.00
	Beta Air Dose (mrad)	1.61 km ENE	0.00E+00	1.00E+01	0.00
	Total Body Dose (mrem)	1.61 km ENE	0.00E+00	5.00E+00	0.00
	Skin Dose (mrem)	1.61 km ENE	0.00E+00	7.50E+00	0.00
	Max Organ Dose (mrem)*	1.77 km E	0.00E+00	7.50E+00	0.00
	None - None				
<u>Qtr 3</u>	Gamma Air Dose (mrad)	1.61 km ENE	1.70E-04	5.00E+00	0.00
	Beta Air Dose (mrad)	1.61 km ENE	5.99E-05	1.00E+01	0.00
	Total Body Dose (mrem)	1.61 km ENE	1.62E-04	5.00E+00	0.00
	Skin Dose (mrem)	1.61 km ENE	2.36E-04	7.50E+00	0.00
	Max Organ Dose (mrem)*	1.77 km E	2.15E-04	7.50E+00	0.00
	Child - Liver				
<u>Qtr 4</u>	Gamma Air Dose (mrad)	1.61 km ENE	2.80E-04	5.00E+00	0.01
	Beta Air Dose (mrad)	1.61 km ENE	2.16E-04	1.00E+01	0.00
	Total Body Dose (mrem)	1.61 km ENE	2.65E-04	5.00E+00	0.01
	Skin Dose (mrem)	1.61 km ENE	4.74E-04	7.50E+00	0.01
	Max Organ Dose (mrem)*	1.77 km E	3.18E-03	7.50E+00	0.04
	Child - Thyroid				
<u>Year</u>	Gamma Air Dose (mrad)	1.61 km ENE	4.50E-04	1.00E+01	0.00
	Beta Air Dose (mrad)	1.61 km ENE	2.76E-04	2.00E+01	0.00
	Total Body Dose (mrem)	1.61 km ENE	4.27E-04	1.00E+01	0.00
	Skin Dose (mrem)	1.61 km ENE	7.10E-04	1.50E+01	0.00
	Max Organ Dose (mrem)*	1.77 km E	3.39E-03	1.50E+01	0.02
	Child – Thyroid				

( \* Includes dose from all nuclides excluding Carbon-14. See Section K for C-14. )

**Liquid Effluents**

	Parameter	Max Receptor	Dose	Dose Limit	% of Limit
<u>Qtr 1</u>	Max Organ Dose (mrem)	Adult - Liver	1.14E-03	5.00E+00	0.02
	Total Body Dose (mrem)	Adult - Total Body	1.13E-03	1.50E+00	0.08
<u>Qtr 2</u>	Max Organ Dose (mrem)	Adult - Gi-LLi	2.21E-03	5.00E+00	0.04
	Total Body Dose (mrem)	Adult - Total Body	2.20E-03	1.50E+00	0.15
<u>Qtr 3</u>	Max Organ Dose (mrem)	Adult - Gi-LLi	2.40E-03	5.00E+00	0.05
	Total Body Dose (mrem)	Adult - Total Body	2.39E-03	1.50E+00	0.16
<u>Qtr 4</u>	Max Organ Dose (mrem)	Adult - Gi-LLi	1.99E-03	5.00E+00	0.04
	Total Body Dose (mrem)	Adult - Total Body	1.83E-03	1.50E+00	0.12
<u>Year</u>	Max Organ Dose (mrem)	Adult - Gi-LLi	7.73E-03	1.00E+01	0.08
	Total Body Dose (mrem)	Adult - Total Body	7.55E-03	3.00E+00	0.25

NOTE: See Section E for max organ for each quarter

**ENCLOSURE A**  
**ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**  
**JANUARY - DECEMBER 2018**  
**VIRGIL C. SUMMER NUCLEAR STATION**

**METEOROLOGICAL DATA**  
**JOINT FREQUENCY DISTRIBUTION**  
**TABLES**

**Quarterly Summaries**

**Annual Summary**

**WGDT Batch Release Period**  
**(9/26/18 1200-1800)**

## **Quarterly Summaries**

**Joint Frequency Distribution**

## Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record =

01/01/2018 01:00 - 04/01/2018 00:00

Elevation:

Speed:

SP10T1

Direction:

DR10T1

Lapse:

DT61T1

Stability Class:

A

Delta Temperature

Extremely Unstable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	1	4	2	4	0	0	11
NNE	0	5	1	3	0	0	9
NE	2	1	0	3	0	0	6
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	1	0	0	0	1
SE	0	0	0	0	0	0	0
SSE	0	1	0	0	0	0	1
S	0	0	1	0	0	0	1
SSW	0	0	2	1	0	0	3
SW	0	5	8	0	0	0	13
WSW	3	8	11	0	0	0	22
W	0	10	5	0	0	0	15
WNW	0	13	5	0	0	0	18
NW	3	6	16	4	0	0	29
NNW	1	2	4	11	0	0	18
<b>Total</b>	<b>10</b>	<b>55</b>	<b>56</b>	<b>26</b>	<b>0</b>	<b>0</b>	<b>147</b>

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	147
Total Hours for the Period:			2160

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Period of Record =** **Total Period** **All Hours**  
 01/01/2018 01:00 - 04/01/2018 00:00

**Elevation:** **Speed:** SP10T1 **Direction:** DR10T1 **Lapse:** DT61T1

**Stability Class:** B **Delta Temperature** Moderately Unstable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	2	4	3	8	5	0	22
NNE	1	4	8	9	0	0	22
NE	2	2	9	13	0	0	26
ENE	0	3	3	3	0	0	9
E	0	3	2	0	0	0	5
ESE	0	1	1	0	0	0	2
SE	0	1	0	0	0	0	1
SSE	0	2	1	0	0	0	3
S	1	1	0	1	0	0	3
SSW	1	4	9	0	0	0	14
SW	2	7	6	0	0	0	15
WSW	1	3	3	0	0	0	7
W	3	5	1	0	0	0	9
WNW	1	6	4	0	0	0	11
NW	0	4	10	2	0	0	16
NNW	0	3	2	4	1	0	10
<b>Total</b>	<b>14</b>	<b>53</b>	<b>62</b>	<b>40</b>	<b>6</b>	<b>0</b>	<b>175</b>

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	175
Total Hours for the Period:			2160

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record =

01/01/2018 01:00 - 04/01/2018 00:00

Elevation:

Speed:

SP10T1

Direction:

DR10T1

Lapse:

DT61T1

Stability Class:

C

Delta Temperature

Slightly Unstable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	2	4	5	10	0	0	21
NNE	5	8	10	11	0	0	34
NE	3	6	23	15	0	0	47
ENE	0	5	7	4	0	0	16
E	2	6	3	0	0	0	11
ESE	1	1	1	0	0	0	3
SE	0	3	3	0	0	0	6
SSE	2	2	1	0	0	0	5
S	0	8	3	0	0	0	11
SSW	1	7	8	0	0	0	16
SW	3	12	5	0	0	0	20
WSW	2	8	4	0	0	0	14
W	4	5	2	0	0	0	11
WNW	2	6	1	0	0	0	9
NW	1	2	9	0	0	0	12
NNW	0	1	4	3	0	0	8
<b>Total</b>	<b>28</b>	<b>84</b>	<b>89</b>	<b>43</b>	<b>0</b>	<b>0</b>	<b>244</b>

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	244
Total Hours for the Period:			2160



**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record =

01/01/2018 01:00 - 04/01/2018 00:00

Elevation:

Speed:

SP10T1

Direction:

DR10T1

Lapse:

DT61T1

Stability Class:

D

Delta Temperature

Neutral

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	3	14	16	11	0	0	44
NNE	5	17	27	12	0	0	61
NE	2	20	35	7	1	0	65
ENE	8	28	36	5	0	0	77
E	8	40	28	0	0	0	76
ESE	4	19	8	0	0	0	31
SE	11	32	3	0	0	0	46
SSE	14	25	10	0	0	0	49
S	5	49	36	3	0	0	93
SSW	3	26	19	2	0	0	50
SW	13	39	13	0	0	0	65
WSW	8	32	9	0	0	0	49
W	20	23	13	0	0	0	56
WNW	13	16	4	0	0	0	33
NW	9	29	9	0	0	0	47
NNW	1	11	15	12	0	0	39
<b>Total</b>	<b>127</b>	<b>420</b>	<b>281</b>	<b>52</b>	<b>1</b>	<b>0</b>	<b>881</b>

Calm Hours not Included above for:

Total Period

All Hours

0

Variable Direction Hours for:

Total Period

All Hours

0

Invalid Hours for:

Total Period

All Hours

0

Number of Valid Hours for this Table:

Total Period

All Hours

881

Total Hours for the Period:

2160

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record =

01/01/2018 01:00 - 04/01/2018 00:00

Elevation:

Speed:

SP10T1

Direction:

DR10T1

Lapse:

DT61T1

Stability Class:

E

Delta Temperature

Slightly Stable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	6	8	5	0	0	0	19
NNE	2	9	0	0	0	0	11
NE	3	7	0	1	0	0	11
ENE	5	4	0	0	0	0	9
E	3	5	0	0	0	0	8
ESE	2	16	0	0	0	0	18
SE	7	23	1	0	0	0	31
SSE	13	25	2	0	0	0	40
S	13	29	1	1	0	0	44
SSW	13	24	7	0	0	0	44
SW	26	25	2	0	0	0	53
WSW	24	26	2	0	0	0	52
W	20	28	0	0	0	0	48
WNW	9	16	0	0	0	0	25
NW	6	14	2	0	0	0	22
NNW	2	6	4	2	0	0	14
<b>Total</b>	<b>154</b>	<b>265</b>	<b>26</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>449</b>

Calm Hours not Included above for:

Total Period

All Hours

0

Variable Direction Hours for:

Total Period

All Hours

0

Invalid Hours for:

Total Period

All Hours

0

Number of Valid Hours for this Table:

Total Period

All Hours

449

Total Hours for the Period:

2160

**Joint Frequency Distribution**

## Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record =

01/01/2018 01:00 - 04/01/2018 00:00

Elevation:      Speed:      SP10T1      Direction:      DR10T1      Lapse:      DT61T1

Stability Class:      F      Delta Temperature      Moderately Stable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	1	0	0	0	0	0	1
NNE	1	1	0	0	0	0	2
NE	2	1	0	0	0	0	3
ENE	4	2	0	0	0	0	6
E	0	0	0	0	0	0	0
ESE	2	2	0	0	0	0	4
SE	2	14	0	0	0	0	16
SSE	9	23	0	0	0	0	32
S	8	5	0	0	0	0	13
SSW	9	3	0	0	0	0	12
SW	9	3	0	0	0	0	12
WSW	9	5	0	0	0	0	14
W	12	3	0	0	0	0	15
WNW	9	5	0	0	0	0	14
NW	3	4	0	0	0	0	7
NNW	1	0	0	0	0	0	1
<b>Total</b>	<b>81</b>	<b>71</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>152</b>

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	152
Total Hours for the Period:			2160

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Period of Record =** **Total Period** **All Hours**  
 01/01/2018 01:00 - 04/01/2018 00:00

**Elevation:** **Speed:** SP10T1 **Direction:** DR10T1 **Lapse:** DT61T1

**Stability Class:** G **Delta Temperature** **Extremely Stable**

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	1	0	0	0	0	0	1
NNE	3	1	0	0	0	0	4
NE	1	0	0	0	0	0	1
ENE	0	1	0	0	0	0	1
E	0	0	0	0	0	0	0
ESE	3	0	0	0	0	0	3
SE	4	2	0	0	0	0	6
SSE	9	7	0	0	0	0	16
S	8	1	0	0	0	0	9
SSW	7	4	0	0	0	0	11
SW	13	5	0	0	0	0	18
WSW	15	5	0	0	0	0	20
W	2	4	0	0	0	0	6
WNW	10	2	0	0	0	0	12
NW	1	0	1	0	0	0	2
NNW	2	0	0	0	0	0	2
<b>Total</b>	<b>79</b>	<b>32</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>112</b>

<b>Calm Hours not Included above for:</b>	<b>Total Period</b>	<b>All Hours</b>	<b>0</b>
<b>Variable Direction Hours for:</b>	<b>Total Period</b>	<b>All Hours</b>	<b>0</b>
<b>Invalid Hours for:</b>	<b>Total Period</b>	<b>All Hours</b>	<b>0</b>
<b>Number of Valid Hours for this Table:</b>	<b>Total Period</b>	<b>All Hours</b>	<b>112</b>
<b>Total Hours for the Period:</b>			<b>2160</b>

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

Period of Record = **Total Period** **All Hours**  
 01/01/2018 01:00 - 04/01/2018 00:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: ALL Delta Temperature

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	16	34	31	33	5	0	119
NNE	17	45	46	35	0	0	143
NE	15	37	67	39	1	0	159
ENE	17	43	46	12	0	0	118
E	13	54	33	0	0	0	100
ESE	12	39	11	0	0	0	62
SE	24	75	7	0	0	0	106
SSE	47	85	14	0	0	0	146
S	35	93	41	5	0	0	174
SSW	34	68	45	3	0	0	150
SW	66	96	34	0	0	0	196
WSW	62	87	29	0	0	0	178
W	61	78	21	0	0	0	160
WNW	44	64	14	0	0	0	122
NW	23	59	47	6	0	0	135
NNW	7	23	29	32	1	0	92
<b>Total</b>	<b>493</b>	<b>980</b>	<b>515</b>	<b>165</b>	<b>7</b>	<b>0</b>	<b>2160</b>

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	2160
Total Hours for the Period:			2160

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record =

04/01/2018 01:00 - 07/01/2018 00:00

Elevation:

Speed:

SP10T1

Direction:

DR10T1

Lapse:

DT61T1

Stability Class:

A

Delta Temperature

Extremely Unstable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	10	12	0	0	0	0	22
NNE	1	5	1	0	0	0	7
NE	0	10	0	0	0	0	10
ENE	0	3	0	0	0	0	3
E	0	1	2	0	0	0	3
ESE	0	0	1	0	0	0	1
SE	0	0	0	0	0	0	0
SSE	0	1	0	0	0	0	1
S	0	0	3	0	0	0	3
SSW	0	0	7	0	0	0	7
SW	0	24	10	0	0	0	34
WSW	3	33	18	0	0	0	54
W	5	14	7	0	0	0	26
WNW	4	4	3	0	0	0	11
NW	3	7	0	0	0	0	10
NNW	5	6	1	0	0	0	12
<b>Total</b>	<b>31</b>	<b>120</b>	<b>53</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>204</b>

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	204
Total Hours for the Period:			2184

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

Period of Record = **Total Period** **All Hours**  
 04/01/2018 01:00 - 07/01/2018 00:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: B Delta Temperature Moderately Unstable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	1	8	1	0	0	0	10
NNE	2	7	1	2	0	0	12
NE	4	5	6	2	0	0	17
ENE	1	5	2	0	0	0	8
E	0	6	2	0	0	0	8
ESE	0	1	3	0	0	0	4
SE	0	0	3	0	0	0	3
SSE	0	0	1	0	0	0	1
S	0	1	6	0	0	0	7
SSW	0	4	22	0	0	0	26
SW	3	29	4	0	0	0	36
WSW	7	22	2	0	0	0	31
W	6	11	3	0	0	0	20
WNW	5	5	1	0	0	0	11
NW	3	8	1	0	0	0	12
NNW	2	1	0	0	1	0	4
<b>Total</b>	<b>34</b>	<b>113</b>	<b>58</b>	<b>4</b>	<b>1</b>	<b>0</b>	<b>210</b>

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	210
Total Hours for the Period:			2184

**Joint Frequency Distribution****Hours at Each Wind Speed and Direction**

**Period of Record =** **Total Period** **All Hours**  
 04/01/2018 01:00 - 07/01/2018 00:00

**Elevation:** **Speed:** SP10T1 **Direction:** DR10T1 **Lapse:** DT61T1

**Stability Class:** C **Delta Temperature** Slightly Unstable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	3	6	8	3	1	0	21
NNE	3	6	9	0	1	0	19
NE	2	5	9	7	0	0	23
ENE	0	6	3	0	0	0	9
E	1	4	1	2	0	0	8
ESE	1	5	3	0	0	0	9
SE	0	2	10	0	0	0	12
SSE	1	4	6	2	0	0	13
S	0	19	8	2	0	0	29
SSW	0	26	9	0	0	0	35
SW	4	32	1	0	0	0	37
WSW	8	16	4	0	0	0	28
W	8	8	0	0	0	0	16
WNW	3	4	0	0	0	0	7
NW	1	4	2	0	0	0	7
NNW	3	3	1	0	0	0	7
<b>Total</b>	<b>38</b>	<b>150</b>	<b>74</b>	<b>16</b>	<b>2</b>	<b>0</b>	<b>280</b>

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	280
Total Hours for the Period:			2184



**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record =

04/01/2018 01:00 - 07/01/2018 00:00

Elevation:

Speed:

SP10T1

Direction:

DR10T1

Lapse:

DT61T1

Stability Class:

D

Delta Temperature

Neutral

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	5	11	6	5	2	0	29
NNE	7	7	15	12	3	0	44
NE	3	9	15	8	2	0	37
ENE	2	10	13	3	0	0	28
E	1	14	22	8	0	0	45
ESE	2	33	12	2	0	0	49
SE	3	49	10	0	0	0	62
SSE	6	55	13	2	0	0	76
S	7	60	23	4	0	0	94
SSW	10	82	21	2	0	0	115
SW	26	40	6	0	0	0	72
WSW	12	20	10	0	0	0	42
W	12	8	2	0	0	0	22
WNW	11	8	4	0	0	0	23
NW	10	7	1	0	0	0	18
NNW	7	2	8	3	0	0	20
<b>Total</b>	<b>124</b>	<b>415</b>	<b>181</b>	<b>49</b>	<b>7</b>	<b>0</b>	<b>776</b>

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	776
Total Hours for the Period:			2184

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record =

04/01/2018 01:00 - 07/01/2018 00:00

Elevation:

Speed:

SP10T1

Direction:

DR10T1

Lapse:

DT61T1

Stability Class:

E

Delta Temperature

Slightly Stable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	1	2	2	0	0	0	5
NNE	2	5	0	0	0	0	7
NE	3	3	1	0	0	0	7
ENE	0	1	0	0	0	0	1
E	2	8	3	0	0	0	13
ESE	5	5	1	0	0	0	11
SE	2	33	1	0	0	0	36
SSE	13	35	2	0	0	0	50
S	16	45	6	0	0	0	67
SSW	30	74	0	0	0	0	104
SW	62	26	3	0	0	0	91
WSW	28	20	0	0	0	0	48
W	25	13	1	0	0	0	39
WNW	10	1	0	0	0	0	11
NW	17	4	1	0	0	0	22
NNW	4	4	4	0	0	0	12
<b>Total</b>	<b>220</b>	<b>279</b>	<b>25</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>524</b>

Calm Hours not Included above for:

Total Period

All Hours

0

Variable Direction Hours for:

Total Period

All Hours

0

Invalid Hours for:

Total Period

All Hours

0

Number of Valid Hours for this Table:

Total Period

All Hours

524

Total Hours for the Period:

2184

**Joint Frequency Distribution**

## Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record =

04/01/2018 01:00 - 07/01/2018 00:00

Elevation:

Speed:

SP10T1

Direction:

DR10T1

Lapse:

DT61T1

Stability Class:

F

Delta Temperature

Moderately Stable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	1	0	0	0	0	0	1
NNE	0	2	0	0	0	0	2
NE	1	0	0	0	0	0	1
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	1	0	0	0	0	1
SSE	4	14	0	0	0	0	18
S	10	15	0	0	0	0	25
SSW	7	10	0	0	0	0	17
SW	20	3	0	0	0	0	23
WSW	17	2	1	0	0	0	20
W	8	3	0	0	0	0	11
WNW	8	2	0	0	0	0	10
NW	6	0	0	0	0	0	6
NNW	0	1	0	0	0	0	1
<b>Total</b>	<b>83</b>	<b>53</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>137</b>

Calm Hours not Included above for:

Total Period

All Hours

0

Variable Direction Hours for:

Total Period

All Hours

0

Invalid Hours for:

Total Period

All Hours

0

Number of Valid Hours for this Table:

Total Period

All Hours

137

Total Hours for the Period:

2184

**Joint Frequency Distribution**

## Hours at Each Wind Speed and Direction

Period of Record = **Total Period** **All Hours**  
 04/01/2018 01:00 - 07/01/2018 00:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: G Delta Temperature Extremely Stable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	3	0	0	0	0	3
S	2	0	0	0	0	0	2
SSW	5	2	0	0	0	0	7
SW	8	3	0	0	0	0	11
WSW	11	1	0	0	0	0	12
W	13	0	0	0	0	0	13
WNW	5	0	0	0	0	0	5
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
<b>Total</b>	<b>44</b>	<b>9</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>53</b>

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	53
Total Hours for the Period:			2184

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

Period of Record = **Total Period** **All Hours**  
 04/01/2018 01:00 - 07/01/2018 00:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: ALL Delta Temperature

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	21	39	17	8	3	0	88
NNE	15	32	26	14	4	0	91
NE	13	32	31	17	2	0	95
ENE	3	25	18	3	0	0	49
E	5	33	30	10	0	0	78
ESE	8	44	20	2	0	0	74
SE	5	85	24	0	0	0	114
SSE	24	112	22	4	0	0	162
S	35	140	46	6	0	0	227
SSW	52	198	59	2	0	0	311
SW	123	157	24	0	0	0	304
WSW	86	114	35	0	0	0	235
W	77	57	13	0	0	0	147
WNW	46	24	8	0	0	0	78
NW	40	30	5	0	0	0	75
NNW	21	17	14	3	1	0	56
<b>Total</b>	<b>574</b>	<b>1139</b>	<b>392</b>	<b>69</b>	<b>10</b>	<b>0</b>	<b>2184</b>

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	2184
Total Hours for the Period:			2184

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record =

07/01/2018 01:00 - 10/01/2018 00:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: A Delta Temperature Extremely Unstable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	6	8	0	0	0	0	14
NNE	2	8	0	0	0	0	10
NE	0	11	0	0	0	0	11
ENE	0	10	3	0	0	0	13
E	0	5	5	0	0	0	10
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	1	0	0	0	1
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	10	4	0	0	0	14
WSW	1	16	0	0	0	0	17
W	7	9	0	0	0	0	16
WNW	3	2	0	0	0	0	5
NW	1	3	0	0	0	0	4
NNW	3	5	0	0	0	0	8
<b>Total</b>	<b>23</b>	<b>87</b>	<b>13</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>123</b>

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	138
Number of Valid Hours for this Table:	Total Period	All Hours	123
Total Hours for the Period:			2208

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

Period of Record = **Total Period** **All Hours**  
 07/01/2018 01:00 - 10/01/2018 00:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: B Delta Temperature Moderately Unstable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	8	20	1	0	0	1	30
NNE	7	22	2	5	0	0	36
NE	5	9	5	3	0	0	22
ENE	0	7	7	0	0	0	14
E	1	4	6	0	0	0	11
ESE	0	1	4	0	0	0	5
SE	0	1	0	0	0	0	1
SSE	0	0	7	0	0	0	7
S	0	1	6	0	0	0	7
SSW	2	7	3	0	0	0	12
SW	3	26	1	0	0	0	30
WSW	10	15	0	0	0	0	25
W	5	3	0	0	0	0	8
WNW	6	5	0	0	0	0	11
NW	3	0	0	0	0	0	3
NNW	6	5	1	0	1	0	13
<b>Total</b>	<b>56</b>	<b>126</b>	<b>43</b>	<b>8</b>	<b>1</b>	<b>1</b>	<b>235</b>

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	138
Number of Valid Hours for this Table:	Total Period	All Hours	235
Total Hours for the Period:			2208

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record =

07/01/2018 01:00 - 10/01/2018 00:00

Elevation:

Speed:

SP10T1

Direction:

DR10T1

Lapse:

DT61T1

Stability Class:

C

Delta Temperature

Slightly Unstable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	5	16	9	1	0	9	40
NNE	12	11	5	10	0	7	45
NE	5	7	13	12	1	0	38
ENE	2	6	17	1	0	0	26
E	0	8	4	0	0	0	12
ESE	1	4	3	0	0	0	8
SE	1	5	3	0	0	0	9
SSE	0	5	3	0	0	0	8
S	1	12	1	0	0	0	14
SSW	1	22	1	0	0	0	24
SW	10	19	3	0	0	0	32
WSW	11	5	0	0	0	0	16
W	5	1	0	0	0	0	6
WNW	4	4	0	0	0	0	8
NW	5	0	0	0	0	0	5
NNW	4	3	3	2	3	2	17
<b>Total</b>	<b>67</b>	<b>128</b>	<b>65</b>	<b>26</b>	<b>4</b>	<b>18</b>	<b>308</b>

Calm Hours not Included above for:

Total Period

All Hours

0

Variable Direction Hours for:

Total Period

All Hours

0

Invalid Hours for:

Total Period

All Hours

138

Number of Valid Hours for this Table:

Total Period

All Hours

308

Total Hours for the Period:

2208



**Joint Frequency Distribution**

## Hours at Each Wind Speed and Direction

Period of Record =		Total Period			All Hours		
		07/01/2018 01:00 - 10/01/2018 00:00					
Elevation:	Speed:	SP10T1	Direction:	DR10T1	Lapse:	DT61T1	
Stability Class:	D	Delta Temperature	Neutral				
Wind Speed (mph)							
Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	7	17	17	3	0	13	57
NNE	4	15	17	5	0	2	43
NE	5	30	28	5	1	0	69
ENE	7	31	27	3	0	0	68
E	5	40	13	0	0	0	58
ESE	1	20	4	0	0	0	25
SE	5	33	8	0	0	0	46
SSE	7	49	10	0	0	0	66
S	12	52	10	0	0	0	74
SSW	10	78	3	0	0	0	91
SW	29	38	2	0	0	0	69
WSW	25	14	0	0	0	0	39
W	11	4	0	0	0	0	15
WNW	11	4	0	0	0	0	15
NW	5	1	0	0	0	0	6
NNW	9	6	7	4	1	4	31
Total	153	432	146	20	2	19	772
<hr/>							
Calm Hours not Included above for:	Total Period		All Hours		0		
Variable Direction Hours for:	Total Period		All Hours		0		
Invalid Hours for:	Total Period		All Hours		138		
Number of Valid Hours for this Table:	Total Period		All Hours		772		
Total Hours for the Period:					2208		

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record =

07/01/2018 01:00 - 10/01/2018 00:00

Elevation:      Speed:      SP10T1      Direction:      DR10T1      Lapse:      DT61T1

Stability Class:      E      Delta Temperature      Slightly Stable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	5	3	1	0	0	0	9
NNE	2	1	0	0	0	0	3
NE	5	0	0	0	0	0	5
ENE	5	1	0	0	0	0	6
E	10	9	2	0	0	0	21
ESE	3	6	1	0	0	0	10
SE	19	35	1	0	0	0	55
SSE	33	38	0	0	0	0	71
S	36	25	0	0	0	0	61
SSW	44	34	0	0	0	0	78
SW	34	18	0	0	0	0	52
WSW	36	1	0	0	0	0	37
W	23	1	0	0	0	0	24
WNW	23	1	0	0	0	0	24
NW	12	2	0	0	0	0	14
NNW	4	4	0	0	0	0	8
<b>Total</b>	<b>294</b>	<b>179</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>478</b>

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	138
Number of Valid Hours for this Table:	Total Period	All Hours	478
Total Hours for the Period:			2208

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record =

07/01/2018 01:00 - 10/01/2018 00:00

Elevation:

Speed:

SP10T1

Direction:

DR10T1

Lapse:

DT61T1

Stability Class:

F

Delta Temperature

Moderately Stable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	0	1	0	0	0	0	1
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	3	3	0	0	0	0	6
SSE	5	8	0	0	0	0	13
S	7	3	0	0	0	0	10
SSW	12	2	0	0	0	0	14
SW	18	1	0	0	0	0	19
WSW	16	2	0	0	0	0	18
W	10	2	0	0	0	0	12
WNW	9	0	1	0	0	0	10
NW	6	0	0	0	0	0	6
NNW	0	0	0	0	0	0	0
<b>Total</b>	<b>86</b>	<b>22</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>109</b>

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	138
Number of Valid Hours for this Table:	Total Period	All Hours	109
Total Hours for the Period:			2208

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record =

07/01/2018 01:00 - 10/01/2018 00:00

Elevation:      Speed:      SP10T1      Direction:      DR10T1      Lapse:      DT61T1

Stability Class:      G      Delta Temperature      Extremely Stable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	3	0	0	0	0	0	3
S	1	0	0	0	0	0	1
SSW	1	0	0	0	0	0	1
SW	11	1	0	0	0	0	12
WSW	13	0	0	0	0	0	13
W	11	0	0	0	0	0	11
WNW	4	0	0	0	0	0	4
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
<b>Total</b>	<b>44</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>45</b>

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	138
Number of Valid Hours for this Table:	Total Period	All Hours	45
Total Hours for the Period:			2208

**Joint Frequency Distribution**

## Hours at Each Wind Speed and Direction

Period of Record = **Total Period** **All Hours**  
 07/01/2018 01:00 - 10/01/2018 00:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: ALL Delta Temperature

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	31	65	28	4	0	23	151
NNE	27	57	24	20	0	9	137
NE	20	57	46	20	2	0	145
ENE	14	55	54	4	0	0	127
E	16	66	30	0	0	0	112
ESE	5	31	12	0	0	0	48
SE	28	77	12	0	0	0	117
SSE	48	100	21	0	0	0	169
S	57	93	17	0	0	0	167
SSW	70	143	7	0	0	0	220
SW	105	113	10	0	0	0	228
WSW	112	53	0	0	0	0	165
W	72	20	0	0	0	0	92
WNW	60	16	1	0	0	0	77
NW	32	6	0	0	0	0	38
NNW	26	23	11	6	5	6	77
<b>Total</b>	<b>723</b>	<b>975</b>	<b>273</b>	<b>54</b>	<b>7</b>	<b>38</b>	<b>2070</b>

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	138
Number of Valid Hours for this Table:	Total Period	All Hours	2070
Total Hours for the Period:			2208

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Total Period** **All Hours**  
**Period of Record =** 10/01/2018 01:00 - 01/01/2019 00:00

**Elevation:**      **Speed:**      SP10T1      **Direction:**      DR10T1      **Lapse:**      DT61T1

**Stability Class:**      A      **Delta Temperature**      Extremely Unstable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	1	4	6	3	2	0	16
NNE	0	0	0	1	4	1	6
NE	0	1	3	5	0	0	9
ENE	0	1	2	0	0	0	3
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	0	0	1
SSW	0	1	0	0	0	0	1
SW	1	5	0	0	0	0	6
WSW	1	19	3	0	0	0	23
W	3	8	1	0	0	0	12
WNW	1	14	0	0	0	0	15
NW	3	5	0	0	0	0	8
NNW	1	4	4	0	0	0	9
<b>Total</b>	11	62	20	9	6	1	109

<b>Calm Hours not Included above for:</b>	<b>Total Period</b>	<b>All Hours</b>	1
<b>Variable Direction Hours for:</b>	<b>Total Period</b>	<b>All Hours</b>	0
<b>Invalid Hours for:</b>	<b>Total Period</b>	<b>All Hours</b>	84
<b>Number of Valid Hours for this Table:</b>	<b>Total Period</b>	<b>All Hours</b>	109
<b>Total Hours for the Period:</b>			2208

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

Period of Record = **Total Period** **All Hours**  
 10/01/2018 01:00 - 01/01/2019 00:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: B Delta Temperature Moderately Unstable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	3	10	8	5	2	0	28
NNE	1	2	4	9	3	0	19
NE	0	13	9	15	2	0	39
ENE	1	5	11	8	1	0	26
E	2	3	6	0	0	0	11
ESE	0	0	2	0	0	0	2
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	2	0	0	0	2
SSW	0	2	2	0	0	0	4
SW	1	5	0	0	0	0	6
WSW	4	4	0	0	0	0	8
W	4	9	1	0	0	0	14
WNW	4	7	0	0	0	0	11
NW	1	8	3	0	0	0	12
NNW	0	4	1	1	0	0	6
<b>Total</b>	<b>21</b>	<b>72</b>	<b>49</b>	<b>38</b>	<b>8</b>	<b>0</b>	<b>188</b>

Calm Hours not Included above for:	Total Period	All Hours	1
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	84
Number of Valid Hours for this Table:	Total Period	All Hours	188
Total Hours for the Period:			2208

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Period of Record =** **Total Period** **All Hours**  
 10/01/2018 01:00 - 01/01/2019 00:00

**Elevation:** **Speed:** SP10T1 **Direction:** DR10T1 **Lapse:** DT61T1

**Stability Class:** C **Delta Temperature** Slightly Unstable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	8	4	4	5	0	0	21
NNE	4	15	20	8	1	0	48
NE	6	11	28	14	2	0	61
ENE	2	9	19	9	2	0	41
E	1	9	5	1	0	0	16
ESE	0	7	4	0	0	0	11
SE	0	3	0	0	0	0	3
SSE	1	1	1	0	0	0	3
S	1	3	0	0	0	0	4
SSW	1	5	3	0	0	0	9
SW	3	3	0	0	0	0	6
WSW	3	9	0	0	0	0	12
W	4	6	0	0	0	0	10
WNW	5	2	0	0	0	0	7
NW	4	10	1	0	0	0	15
NNW	6	7	4	1	0	0	18
<b>Total</b>	49	104	89	38	5	0	285

<b>Calm Hours not Included above for:</b>	<b>Total Period</b>	<b>All Hours</b>	1
<b>Variable Direction Hours for:</b>	<b>Total Period</b>	<b>All Hours</b>	0
<b>Invalid Hours for:</b>	<b>Total Period</b>	<b>All Hours</b>	84
<b>Number of Valid Hours for this Table:</b>	<b>Total Period</b>	<b>All Hours</b>	285
<b>Total Hours for the Period:</b>			2208



**Joint Frequency Distribution****Hours at Each Wind Speed and Direction**

**Period of Record =** **Total Period** **All Hours**  
 10/01/2018 01:00 - 01/01/2019 00:00

**Elevation:** **Speed:** SP10T1 **Direction:** DR10T1 **Lapse:** DT61T1

**Stability Class:** D **Delta Temperature** Neutral

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	15	10	10	6	1	0	42
NNE	12	18	10	6	1	0	47
NE	8	35	32	6	0	0	81
ENE	5	42	50	7	0	0	104
E	5	36	40	2	0	0	83
ESE	5	9	9	2	2	0	27
SE	5	13	2	1	0	0	21
SSE	10	22	3	1	0	0	36
S	13	28	5	2	0	0	48
SSW	10	25	24	1	0	0	60
SW	17	16	5	0	0	0	38
WSW	21	41	6	0	0	0	68
W	23	42	9	0	0	0	74
WNW	19	20	0	1	0	0	40
NW	6	20	1	0	0	0	27
NNW	4	14	7	1	0	0	26
<b>Total</b>	<b>178</b>	<b>391</b>	<b>213</b>	<b>36</b>	<b>4</b>	<b>0</b>	<b>822</b>

Calm Hours not Included above for:	Total Period	All Hours	1
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	84
Number of Valid Hours for this Table:	Total Period	All Hours	822
Total Hours for the Period:			2208

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

Period of Record = **Total Period** **All Hours**  
 10/01/2018 01:00 - 01/01/2019 00:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: E Delta Temperature Slightly Stable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	4	2	1	0	0	0	7
NNE	3	1	0	0	0	0	4
NE	5	3	0	1	0	0	9
ENE	2	3	1	0	0	0	6
E	7	14	6	0	0	0	27
ESE	9	9	2	0	0	0	20
SE	5	9	0	0	0	0	14
SSE	12	10	1	0	0	0	23
S	14	10	2	0	0	0	26
SSW	13	17	5	0	0	0	35
SW	34	23	2	0	0	0	59
WSW	23	18	0	0	0	0	41
W	21	39	0	0	0	0	60
WNW	21	9	0	0	0	0	30
NW	10	5	0	0	0	0	15
NNW	6	1	2	0	0	0	9
<b>Total</b>	<b>189</b>	<b>173</b>	<b>22</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>385</b>

Calm Hours not Included above for:	Total Period	All Hours	1
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	84
Number of Valid Hours for this Table:	Total Period	All Hours	385
Total Hours for the Period:			2208

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

Period of Record = **Total Period** **All Hours**  
 10/01/2018 01:00 - 01/01/2019 00:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: F Delta Temperature Moderately Stable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	2	0	0	0	0	0	2
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	1	1	0	0	0	0	2
E	5	0	0	0	0	0	5
ESE	3	0	0	0	0	0	3
SE	2	7	0	0	0	0	9
SSE	9	6	0	0	0	0	15
S	19	3	0	0	0	0	22
SSW	21	7	0	0	0	0	28
SW	24	3	0	0	0	0	27
WSW	17	5	0	0	0	0	22
W	20	1	0	0	0	0	21
WNW	13	1	0	0	0	0	14
NW	1	2	0	0	0	0	3
NNW	1	0	0	0	0	0	1
<b>Total</b>	<b>138</b>	<b>36</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>174</b>

Calm Hours not Included above for:	Total Period	All Hours	1
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	84
Number of Valid Hours for this Table:	Total Period	All Hours	174
Total Hours for the Period:			2208

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Period of Record =** **Total Period** **All Hours**  
 10/01/2018 01:00 - 01/01/2019 00:00

**Elevation:** **Speed:** SP10T1 **Direction:** DR10T1 **Lapse:** DT61T1

**Stability Class:** G **Delta Temperature** Extremely Stable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	0	1	0	0	0	0	1
NNE	0	0	0	0	0	0	0
NE	1	0	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	0	0	0	0	0
SSE	8	0	0	0	0	0	8
S	13	0	0	0	0	0	13
SSW	22	1	0	0	0	0	23
SW	36	4	0	0	0	0	40
WSW	28	1	0	0	0	0	29
W	24	2	0	0	0	0	26
WNW	12	0	0	0	0	0	12
NW	7	0	0	0	0	0	7
NNW	0	0	0	0	0	0	0
<b>Total</b>	<b>151</b>	<b>9</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>160</b>

<b>Calm Hours not Included above for:</b>	<b>Total Period</b>	<b>All Hours</b>	<b>1</b>
<b>Variable Direction Hours for:</b>	<b>Total Period</b>	<b>All Hours</b>	<b>0</b>
<b>Invalid Hours for:</b>	<b>Total Period</b>	<b>All Hours</b>	<b>84</b>
<b>Number of Valid Hours for this Table:</b>	<b>Total Period</b>	<b>All Hours</b>	<b>160</b>
<b>Total Hours for the Period:</b>			<b>2208</b>

**Joint Frequency Distribution**

## Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record =

10/01/2018 01:00 - 01/01/2019 00:00

Elevation:      Speed:      SP10T1      Direction:      DR10T1      Lapse:      DT61T1

Stability Class:      ALL      Delta Temperature

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	33	31	29	19	5	0	117
NNE	20	36	34	24	9	1	124
NE	20	63	72	41	4	0	200
ENE	11	61	83	24	3	0	182
E	20	62	57	3	0	0	142
ESE	17	25	17	2	2	0	63
SE	12	32	2	1	0	0	47
SSE	40	39	5	1	0	0	85
S	60	44	10	2	0	0	116
SSW	67	58	34	1	0	0	160
SW	116	59	7	0	0	0	182
WSW	97	97	9	0	0	0	203
W	99	107	11	0	0	0	217
WNW	75	53	0	1	0	0	129
NW	32	50	5	0	0	0	87
NNW	18	30	18	3	0	0	69
<b>Total</b>	<b>737</b>	<b>847</b>	<b>393</b>	<b>122</b>	<b>23</b>	<b>1</b>	<b>2123</b>

Calm Hours not Included above for:	Total Period	All Hours	1
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	84
Number of Valid Hours for this Table:	Total Period	All Hours	2123
Total Hours for the Period:			2208

# **Annual Summary**

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

Period of Record =		Total Period					All Hours
		01/01/2018 01:00 - 01/01/2019 00:00					
Elevation:	Speed:	SP10T1	Direction:	DR10T1	Lapse:	DT61T1	
Stability Class:	A	Delta Temperature		Extremely Unstable			
Wind Speed (mph)							
Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	18	28	8	7	2	0	63
NNE	3	18	2	4	4	1	32
NE	2	23	3	8	0	0	36
ENE	0	14	5	0	0	0	19
E	0	6	7	0	0	0	13
ESE	0	0	2	0	0	0	2
SE	0	0	0	0	0	0	0
SSE	0	2	1	0	0	0	3
S	0	0	5	0	0	0	5
SSW	0	1	9	1	0	0	11
SW	1	44	22	0	0	0	67
WSW	8	76	32	0	0	0	116
W	15	41	13	0	0	0	69
WNW	8	33	8	0	0	0	49
NW	10	21	16	4	0	0	51
NNW	10	17	9	11	0	0	47
Total	75	324	142	35	6	1	583
Calm Hours not Included above for:			Total Period		All Hours		1
Variable Direction Hours for:			Total Period		All Hours		0
Invalid Hours for:			Total Period		All Hours		222
Number of Valid Hours for this Table:			Total Period		All Hours		583
Total Hours for the Period:							8760

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record = 01/01/2018 01:00 - 01/01/2019 00:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: B Delta Temperature Moderately Unstable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	14	42	13	13	7	1	90
NNE	11	35	15	25	3	0	89
NE	11	29	29	33	2	0	104
ENE	2	20	23	11	1	0	57
E	3	16	16	0	0	0	35
ESE	0	3	10	0	0	0	13
SE	0	2	3	0	0	0	5
SSE	0	2	9	0	0	0	11
S	1	3	14	1	0	0	19
SSW	3	17	36	0	0	0	56
SW	9	67	11	0	0	0	87
WSW	22	44	5	0	0	0	71
W	18	28	5	0	0	0	51
WNW	16	23	5	0	0	0	44
NW	7	20	14	2	0	0	43
NNW	8	13	4	5	3	0	33
<b>Total</b>	<b>125</b>	<b>364</b>	<b>212</b>	<b>90</b>	<b>16</b>	<b>1</b>	<b>808</b>

Calm Hours not Included above for:	Total Period	All Hours	1
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	222
Number of Valid Hours for this Table:	Total Period	All Hours	808
Total Hours for the Period:			8760



**Joint Frequency Distribution**

## Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record =

01/01/2018 01:00 - 01/01/2019 00:00

Elevation:      Speed:      SP10T1      Direction:      DR10T1      Lapse:      DT61T1

Stability Class:      C      Delta Temperature      Slightly Unstable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	18	30	26	19	1	9	103
NNE	24	40	44	29	2	7	146
NE	16	29	73	48	3	0	169
ENE	4	26	46	14	2	0	92
E	4	27	13	3	0	0	47
ESE	3	17	11	0	0	0	31
SE	1	13	16	0	0	0	30
SSE	4	12	11	2	0	0	29
S	2	42	12	2	0	0	58
SSW	3	60	21	0	0	0	84
SW	20	66	9	0	0	0	95
WSW	24	38	8	0	0	0	70
W	21	20	2	0	0	0	43
WNW	14	16	1	0	0	0	31
NW	11	16	12	0	0	0	39
NNW	13	14	12	6	3	2	50
<b>Total</b>	<b>182</b>	<b>466</b>	<b>317</b>	<b>123</b>	<b>11</b>	<b>18</b>	<b>1117</b>

Calm Hours not Included above for:	Total Period	All Hours	1
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	222
Number of Valid Hours for this Table:	Total Period	All Hours	1117
Total Hours for the Period:			8760

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

Period of Record = **Total Period** **All Hours**  
 01/01/2018 01:00 - 01/01/2019 00:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: D Delta Temperature Neutral

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	30	52	49	25	3	13	172
NNE	28	57	69	35	4	2	195
NE	18	94	110	26	4	0	252
ENE	22	111	126	18	0	0	277
E	19	130	103	10	0	0	262
ESE	12	81	33	4	2	0	132
SE	24	127	23	1	0	0	175
SSE	37	151	36	3	0	0	227
S	37	189	74	9	0	0	309
SSW	33	211	67	5	0	0	316
SW	85	133	26	0	0	0	244
WSW	66	107	25	0	0	0	198
W	66	77	24	0	0	0	167
WNW	54	48	8	1	0	0	111
NW	30	57	11	0	0	0	98
NNW	21	33	37	20	1	4	116
<b>Total</b>	<b>582</b>	<b>1658</b>	<b>821</b>	<b>157</b>	<b>14</b>	<b>19</b>	<b>3251</b>

Calm Hours not Included above for:	Total Period	All Hours	1
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	222
Number of Valid Hours for this Table:	Total Period	All Hours	3251
Total Hours for the Period:			8760

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

Period of Record = **Total Period** 01/01/2018 01:00 - 01/01/2019 00:00 **All Hours**

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: E / Delta Temperature Slightly Stable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	16	15	9	0	0	0	40
NNE	9	16	0	0	0	0	25
NE	16	13	1	2	0	0	32
ENE	12	9	1	0	0	0	22
E	22	36	11	0	0	0	69
ESE	19	36	4	0	0	0	59
SE	33	100	3	0	0	0	136
SSE	71	108	5	0	0	0	184
S	79	109	9	1	0	0	198
SSW	100	149	12	0	0	0	261
SW	156	92	7	0	0	0	255
WSW	111	65	2	0	0	0	178
W	89	81	1	0	0	0	171
WNW	63	27	0	0	0	0	90
NW	45	25	3	0	0	0	73
NNW	16	15	10	2	0	0	43
<b>Total</b>	<b>857</b>	<b>896</b>	<b>78</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>1836</b>

Calm Hours not Included above for:	Total Period	All Hours	1
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	222
Number of Valid Hours for this Table:	Total Period	All Hours	1836
Total Hours for the Period:			8760

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record =

01/01/2018 01:00 - 01/01/2019 00:00

Elevation:      Speed:      SP10T1      Direction:      DR10T1      Lapse:      DT61T1

Stability Class:      F      Delta Temperature      Moderately Stable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	4	1	0	0	0	0	5
NNE	1	3	0	0	0	0	4
NE	3	1	0	0	0	0	4
ENE	5	3	0	0	0	0	8
E	6	0	0	0	0	0	6
ESE	5	2	0	0	0	0	7
SE	7	25	0	0	0	0	32
SSE	27	51	0	0	0	0	78
S	44	26	0	0	0	0	70
SSW	49	22	0	0	0	0	71
SW	71	10	0	0	0	0	81
WSW	59	14	1	0	0	0	74
W	50	9	0	0	0	0	59
WNW	39	8	1	0	0	0	48
NW	16	6	0	0	0	0	22
NNW	2	1	0	0	0	0	3
<b>Total</b>	<b>388</b>	<b>182</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>572</b>

Calm Hours not Included above for:	Total Period	All Hours	1
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	222
Number of Valid Hours for this Table:	Total Period	All Hours	572
Total Hours for the Period:			8760

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record =

01/01/2018 01:00 - 01/01/2019 00:00

Elevation:

Speed:

SP10T1

Direction:

DR10T1

Lapse:

DT61T1

Stability Class:

G

Delta Temperature

Extremely Stable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	1	1	0	0	0	0	2
NNE	3	1	0	0	0	0	4
NE	2	0	0	0	0	0	2
ENE	0	1	0	0	0	0	1
E	0	0	0	0	0	0	0
ESE	3	0	0	0	0	0	3
SE	4	2	0	0	0	0	6
SSE	20	10	0	0	0	0	30
S	24	1	0	0	0	0	25
SSW	35	7	0	0	0	0	42
SW	68	13	0	0	0	0	81
WSW	67	7	0	0	0	0	74
W	50	6	0	0	0	0	56
WNW	31	2	0	0	0	0	33
NW	8	0	1	0	0	0	9
NNW	2	0	0	0	0	0	2
<b>Total</b>	<b>318</b>	<b>51</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>370</b>

Calm Hours not Included above for:

Total Period

All Hours

1

Variable Direction Hours for:

Total Period

All Hours

0

Invalid Hours for:

Total Period

All Hours

222

Number of Valid Hours for this Table:

Total Period

All Hours

370

Total Hours for the Period:

8760

**Joint Frequency Distribution**

## Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record = 01/01/2018 01:00 - 01/01/2019 00:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: ALL Delta Temperature

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	101	169	105	64	13	23	475
NNE	79	170	130	93	13	10	495
NE	68	189	216	117	9	0	599
ENE	45	184	201	43	3	0	476
E	54	215	150	13	0	0	432
ESE	42	139	60	4	2	0	247
SE	69	269	45	1	0	0	384
SSE	159	336	62	5	0	0	562
S	187	370	114	13	0	0	684
SSW	223	467	145	6	0	0	841
SW	410	425	75	0	0	0	910
WSW	357	351	73	0	0	0	781
W	309	262	45	0	0	0	616
WNW	225	157	23	1	0	0	406
NW	127	145	57	6	0	0	335
NNW	72	93	72	44	7	6	294
<b>Total</b>	<b>2527</b>	<b>3941</b>	<b>1573</b>	<b>410</b>	<b>47</b>	<b>39</b>	<b>8537</b>

Calm Hours not Included above for:	Total Period	All Hours	1
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	222
Number of Valid Hours for this Table:	Total Period	All Hours	8537
Total Hours for the Period:			8760

**WGDT Batch Release Period**  
**(9/26/18 1200-1800)**

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

Period of Record = **Total Period** **All Hours**  
 09/26/2018 12:00 - 09/26/2018 18:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: A Delta Temperature Extremely Unstable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	1	0	0	0	0	1
W	0	1	0	0	0	0	1
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Total	0	2	0	0	0	0	2

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	2
Total Hours for the Period:			7



**Joint Frequency Distribution**

## Hours at Each Wind Speed and Direction

**Total Period****All Hours**

Period of Record = 09/26/2018 12:00 - 09/26/2018 18:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: B Delta Temperature Moderately Unstable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	0
Total Hours for the Period:			7

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

Period of Record = **Total Period** **All Hours**  
 09/26/2018 12:00 - 09/26/2018 18:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: C Delta Temperature Slightly Unstable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	1	0	0	0	0	1
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	0	0	0	0
Total	0	1	0	0	0	0	1

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	1
Total Hours for the Period:			7

**Joint Frequency Distribution**

## Hours at Each Wind Speed and Direction

Period of Record = **Total Period** **All Hours**  
 09/26/2018 12:00 - 09/26/2018 18:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: D Delta Temperature Neutral

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	1	0	0	0	0	1
S	0	1	0	0	0	0	1
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	1	0	0	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
Total	1	2	0	0	0	0	3

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	3
Total Hours for the Period:			7

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Total Period**  
**Period of Record =** 09/26/2018 12:00 - 09/26/2018 18:00 **All Hours**

**Elevation:**      **Speed:** SP10T1      **Direction:** DR10T1      **Lapse:** DT61T1

**Stability Class:** E      **Delta Temperature**      Slightly Stable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	1	0	0	0	0	1
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	0	0	0	0
<b>Total</b>	0	1	0	0	0	0	1

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	1
Total Hours for the Period:			7

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

Period of Record = **Total Period** **All Hours**  
 09/26/2018 12:00 - 09/26/2018 18:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: F Delta Temperature Moderately Stable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	0
Total Hours for the Period:			7

**Joint Frequency Distribution****Hours at Each Wind Speed and Direction**

Period of Record = **Total Period** **All Hours**  
 09/26/2018 12:00 - 09/26/2018 18:00

Elevation: Speed: SP10T1 Direction: DR10T1 Lapse: DT61T1

Stability Class: G Delta Temperature Extremely Stable

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	0
Total Hours for the Period:			7

**Joint Frequency Distribution**

Hours at Each Wind Speed and Direction

**Period of Record =** **Total Period** **All Hours**  
 09/26/2018 12:00 - 09/26/2018 18:00

**Elevation:** **Speed:** SP10T1 **Direction:** DR10T1 **Lapse:** DT61T1

**Stability Class:** ALL **Delta Temperature**

**Wind Speed (mph)**

Wind Direction	0.8-3.9	4.0-7.9	8.0-12.9	13.0-18.9	19.0-23.9	> 24.0	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	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	0	0	0	0	0
WSW	1	1	0	0	0	0	2
W	0	1	0	0	0	0	1
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Total	1	6	0	0	0	0	7

Calm Hours not Included above for:	Total Period	All Hours	0
Variable Direction Hours for:	Total Period	All Hours	0
Invalid Hours for:	Total Period	All Hours	0
Number of Valid Hours for this Table:	Total Period	All Hours	7
Total Hours for the Period:			7