

Appendix A

Annual Report on the Meteorological Monitoring Program At the Ginna Nuclear Power Plant

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On the
Meteorological Monitoring Program
At the
Ginna Nuclear Power Plant

2017

prepared for

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Reviewed By: 

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1. Introduction

The purpose of the meteorological program being conducted at the Ginna Plant site is to provide information sufficient to assess the local weather conditions and to determine the degree of atmospheric dispersion of airborne radioactive effluent from the station.

The meteorological tower is 300 ft. high and is instrumented at three levels. Wind speed and direction, and ambient temperature are measured at 33 ft., 150 ft., and 250 ft. Differential temperatures, referenced to 33 ft., are measured at 150 ft. and 250 ft. Precipitation is measured at ground level.

Joint frequency stability wind rose tables of wind direction, wind speed, and stability are routinely tabulated from hourly measurements. The annual tables are included in this report.

Descriptions of the instruments and data computers are given in Section 3 (Data Acquisition) of this report. Data reduction and processing are described in Section 4 (Data Analysis). The results given in Section 5 of this report include X/Q and D/Q data results and site meteorology.

2. Summary

The Ginna Plant meteorological monitoring program produced 96,171 hours of valid data out of a possible 96,360 priority parameter hours during 2016, which represents an overall data recovery rate of 99.8%. Priority parameters are all parameters except precipitation.

The stability wind rose tables included in this report have been generated using the 33 ft. wind data with the 150-33 ft. differential temperature data, the 150 ft. wind data with the 150-33 ft differential temperature data and the 250 ft. wind data with the 250-33 ft. differential temperature data.

3. Data Acquisition

Wind speed and direction are measured with Climatronics F460 wind sensors. The wind speed sensors have a starting speed of 0.5 mph (0.22 mps), a range of 0 to 100 mph (0 to 44.7 mps), and a system accuracy of ± 1.0 mph at 100 mph (± 0.45 mps at 44.7 mps). The wind direction sensors have a threshold speed of 0.5 mph (0.22 mps), a range of 0 to 540°, and a system accuracy of $\pm 5^\circ$.

Ambient and differential temperature are measured with the Climatronics 100093 system. Ambient temperature is measured within the range of -20 to 120°F (-28.9 to 48.9°C) with an accuracy of $\pm 0.5^\circ\text{F}$ ($\pm 0.3^\circ\text{C}$). Differential temperature is measured within the range of -10 to 20°F (-5.6 to 11.1°C) with an accuracy of $\pm 0.18^\circ\text{F}$ ($\pm 0.10^\circ\text{C}$). Precipitation is measured with a Climatronics tipping bucket rain gauge and is measured in increments of one one-hundredth of an inch with a system accuracy of $\pm 0.01''$ ($\pm 0.25\text{mm}$).

The meteorological data are collected and stored by Campbell Scientific CR3000 and CR850 data loggers. The data loggers measure the analog voltages of the instruments and record the digital equivalent within the range of 0 to +5 volts. Data are obtained from the Campbell Scientific CR850 by a direct dial telephone hookup to an in-house computer system.

Table 1

Instrument Locations

<u>Measurement</u>	<u>Sensor Type</u>	<u>Location</u>	<u>Elevation</u>
Wind Speed	Climatronics 100075 F460	Tower	250 ft.
Wind Direction	Climatronics 100076 F460	Tower	250 ft.
Differential Temperature	Climatronics 100093	Tower	250 ft.
Wind Speed	Climatronics 100075 F460	Tower	150 ft.
Wind Direction	Climatronics 100076 F460	Tower	150 ft.
Differential Temperature	Climatronics 100093	Tower	150 ft.
Wind Speed	Climatronics 100075 F460	Tower	33 ft.
Wind Direction	Climatronics 100076 F460	Tower	33 ft.
Ambient Temperature	Climatronics 100093	Tower	33 ft.
Precipitation	Climatronics 100097-1 Tipping Bucket Rain Gage	Meteorological shelter roof	Ground

Table 2

Data Loggers

<u>Measurement</u>	<u>Logger Type</u>	<u>Sampling Frequency</u>
Winds, Temperatures, and Precipitation	Campbell Scientific CR3000 (A & B) and CR850	1 sec.
Winds, Temperatures, and Precipitation	Johnson Yokogawa Corp. Digital Recorder	10 sec.

4. Data Analysis

The meteorological data are collected via modem connection to a Campbell Scientific CR850 data logger. Data are sampled once per second. The data are then stored in the meteorological data base and hourly listings of the data are generated. The data listings are examined by qualified personnel and any apparent problems are brought to the attention of the Project Manager or Environmental Meteorologist and the Instrument Maintenance staff.

Hourly values of wind speed, wind direction, ambient temperature, differential temperature, and precipitation are obtained through measurements taken at the site. The standard deviation of wind direction (sigma) is derived. The wind direction variation is described in terms of the standard deviation of the direction about the mean direction. The MIDAS computer derives an hourly value of wind sigma.

The data base files are edited approximately once a week. Missing values are replaced with back up data values, when available. Invalid data are deleted from the data base.

When an hourly value is missing or invalid, the numeral 999 is entered into the computer data file in the appropriate location.

A professional meteorologist reviews the data, calibration findings, equipment maintenance reports, and other information and determines which data are valid. Only the valid data are retained in the data base.

Joint frequency stability wind rose tables of hourly data measured at the site are generated. These tables indicate the prevailing wind direction, wind speed, and stability classes measured during the period of observation as well as the joint frequencies of occurrence of the wind direction, wind speed, and stability classes. The values are also used as input to the atmospheric transport and diffusion models. Wind direction, wind speed, and stability classes are given in Tables 3, 4, and 5.

Table 3Wind Direction Classes

IF	348.75°	<	WD	<	11.25°	THEN	Class is	N
IF	11.25°	<	WD	<	33.75°	THEN	Class is	NNE
IF	33.75°	<	WD	<	56.25°	THEN	Class is	NE
IF	56.25°	<	WD	<	78.75°	THEN	Class is	ENE
IF	78.75°	<	WD	<	101.25°	THEN	Class is	E
IF	101.25°	<	WD	<	123.75°	THEN	Class is	ESE
IF	123.75°	<	WD	<	146.25°	THEN	Class is	SE
IF	146.25°	<	WD	<	168.75°	THEN	Class is	SSE
IF	168.75°	<	WD	<	191.25°	THEN	Class is	S
IF	191.25°	<	WD	<	213.75°	THEN	Class is	SSW
IF	213.75°	<	WD	<	236.25°	THEN	Class is	SW
IF	236.25°	<	WD	<	258.75°	THEN	Class is	WSW
IF	258.75°	<	WD	<	281.25°	THEN	Class is	W
IF	281.25°	<	WD	<	303.75°	THEN	Class is	WNW
IF	303.75°	<	WD	<	326.25°	THEN	Class is	NW
IF	326.25°	<	WD	<	348.75°	THEN	Class is	NNW

Table 4Wind Speed Classes

IF		<	WS	<	0.50 m/s	THEN	Class is	1
IF	0.50 m/s	<	WS	<	1.0 m/s	THEN	Class is	2
IF	1.1 m/s	<	WS	<	1.5 m/s	THEN	Class is	3
IF	1.6 m/s	<	WS	<	2.0 m/s	THEN	Class is	4
IF	2.1 m/s	<	WS	<	3.0 m/s	THEN	Class is	5
IF	3.1 m/s	<	WS	<	4.0 m/s	THEN	Class is	6
IF	4.1 m/s	<	WS	<	5.0 m/s	THEN	Class is	7
IF	5.1 m/s	<	WS	<	6.0 m/s	THEN	Class is	8
IF	6.1 m/s	<	WS	<	8.0 m/s	THEN	Class is	9
IF	8.1 m/s	<	WS	<	10.0 m/s	THEN	Class is	10
IF	10.0 m/s	<	WS			THEN	Class is	11

Table 5

Atmospheric Stability Classes

Class	Differential Temperature Interval (in °C/100m) ⁽¹⁾	Differential Temperature Interval (in °F over the 150-33ft. range) ⁽²⁾	Differential Temperature Interval (in °F over the 250-33ft. range) ⁽²⁾
Extremely Unstable	$\Delta T \leq -1.9$	$\Delta T \leq -1.2$	$\Delta T \leq -2.3$
Moderately Unstable	$-1.9 < \Delta T \leq -1.7$	$-1.2 < \Delta T \leq -1.1$	$-2.3 < \Delta T \leq -2.1$
Slightly Unstable	$-1.7 < \Delta T \leq -1.5$	$-1.1 < \Delta T \leq -1.0$	$-2.1 < \Delta T \leq -1.8$
Neutral	$-1.5 < \Delta T \leq -0.5$	$-1.0 < \Delta T \leq -0.3$	$-1.8 < \Delta T \leq -0.6$
Slightly Stable	$-0.5 < \Delta T \leq 1.5$	$-0.3 < \Delta T \leq 1.0$	$-0.6 < \Delta T \leq 1.8$
Moderately Stable	$1.5 < \Delta T \leq 4.0$	$1.0 < \Delta T \leq 2.6$	$1.8 < \Delta T \leq 4.8$
Extremely Stable	$4.0 < \Delta T$	$2.6 < \Delta T$	$4.8 < \Delta T$

⁽¹⁾ from ANSI/ANS 2.5

⁽²⁾ ANSI/ANS 2.5 intervals scaled for instrument heights on the Ginna meteorological tower

5. Results

5.1 X/Q and D/Q

The ground and mixed mode values for X/Q and D/Q can be found in tables 4-9.

The following program was used to calculate X/Q and D/Q values:

1. XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations (NUREG/CR-2919).

The program is based on the theory that material released to the atmosphere will be normally distributed (Gaussian) about the plume centerline. A straight-line trajectory is assumed between the point of release and all receptors.

The program implements the assumptions outlined in Section C of NRC Regulatory Guide 1.111. In evaluating routine releases from nuclear power plants, it primarily is designed to calculate annual relative effluent concentrations, X/Q values and annual average relative deposition, D/Q values.

Table 6

D/Q PLANT VENT 2017

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DIRECTION	804m	1609m	2416m	3218m	4022m	4827m	5632m	6436m	7240m	8045m
D/Q										
N	2.71E-09	1.26E-09	7.30E-10	4.73E-10	3.32E-10	2.48E-10	1.92E-10	1.54E-10	1.27E-10	1.06E-10
NNE	2.19E-09	9.65E-10	5.50E-10	3.56E-10	2.50E-10	1.87E-10	1.46E-10	1.17E-10	9.60E-11	8.04E-11
NE	4.26E-09	1.88E-09	1.07E-09	6.94E-10	4.88E-10	3.65E-10	2.84E-10	2.28E-10	1.87E-10	1.57E-10
ENE	5.06E-09	2.39E-09	1.39E-09	9.02E-10	6.33E-10	4.72E-10	3.67E-10	2.94E-10	2.41E-10	2.02E-10
E	4.82E-09	2.33E-09	1.37E-09	8.88E-10	6.24E-10	4.66E-10	3.69E-10	2.94E-10	2.41E-10	2.01E-10
ESE	8.61E-09	3.79E-09	1.81E-09	1.15E-09	8.10E-10	5.99E-10	4.59E-10	3.78E-10	3.17E-10	2.74E-10
SE	9.92E-09	3.28E-09	1.67E-09	1.03E-09	7.07E-10	5.20E-10	4.56E-10	3.65E-10	3.33E-10	2.92E-10
SSE	4.76E-09	1.52E-09	8.21E-10	5.20E-10	3.74E-10	2.74E-10	2.35E-10	2.28E-10	1.75E-10	1.49E-10
S	2.44E-09	9.05E-10	4.62E-10	2.90E-10	2.02E-10	1.67E-10	1.40E-10	1.21E-10	1.06E-10	8.78E-11
SSW	1.97E-09	7.43E-10	4.07E-10	2.54E-10	1.81E-10	1.34E-10	1.11E-10	1.09E-10	9.56E-11	8.29E-11
SW	2.73E-09	1.09E-09	5.70E-10	3.74E-10	2.58E-10	1.98E-10	1.60E-10	1.30E-10	1.15E-10	1.09E-10
WSW	3.95E-09	1.47E-09	7.80E-10	5.06E-10	3.48E-10	2.61E-10	2.03E-10	1.64E-10	1.41E-10	1.21E-10
W	2.83E-09	1.30E-09	7.18E-10	4.74E-10	3.38E-10	2.55E-10	2.00E-10	1.61E-10	1.33E-10	1.11E-10
WNW	5.13E-10	3.50E-10	2.27E-10	1.55E-10	1.13E-10	8.64E-11	6.82E-11	5.52E-11	4.55E-11	3.81E-11
NW	1.11E-09	6.63E-10	4.20E-10	2.85E-10	2.06E-10	1.57E-10	1.24E-10	9.98E-11	8.22E-11	6.89E-11
NNW	3.27E-09	1.57E-09	9.18E-10	5.96E-10	4.20E-10	3.14E-10	2.44E-10	1.96E-10	1.61E-10	1.35E-10

Table 7

X/Q PLANT VENT 2017

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DIRECTION	804m	1609m	2416m	3218m	4022m	4827m	5632m	6436m	7240m	8045m
X/Q										
N	1.16E-07	1.04E-07	8.86E-08	7.29E-08	6.07E-08	5.15E-08	4.44E-08	3.88E-08	3.44E-08	3.08E-08
NNE	9.73E-08	8.60E-08	7.53E-08	6.32E-08	5.32E-08	4.55E-08	3.95E-08	3.47E-08	3.09E-08	2.78E-08
NE	1.54E-07	1.37E-07	1.17E-07	9.73E-08	8.13E-08	6.91E-08	5.96E-08	5.22E-08	4.62E-08	4.14E-08
ENE	1.62E-07	1.38E-07	1.13E-07	9.20E-08	7.62E-08	6.43E-08	5.53E-08	4.83E-08	4.27E-08	3.82E-08
E	1.62E-07	1.28E-07	9.87E-08	7.74E-08	6.25E-08	5.19E-08	4.61E-08	3.98E-08	3.65E-08	3.10E-08
ESE	1.65E-07	1.52E-07	8.03E-08	6.55E-08	6.41E-08	5.63E-08	4.22E-08	4.22E-08	3.84E-08	3.47E-08
SE	1.70E-07	9.44E-08	7.55E-08	5.91E-08	4.83E-08	4.37E-08	3.75E-08	3.27E-08	2.97E-08	2.64E-08
SSE	1.38E-07	7.48E-08	5.86E-08	5.19E-08	4.28E-08	3.53E-08	3.06E-08	2.93E-08	2.35E-08	2.06E-08
S	6.82E-08	5.25E-08	3.28E-08	2.87E-08	2.40E-08	2.33E-08	2.07E-08	1.86E-08	1.62E-08	2.19E-08
SSW	4.08E-08	2.88E-08	2.98E-08	2.59E-08	2.05E-08	1.71E-08	1.49E-08	1.36E-08	1.21E-08	2.19E-08
SW	6.66E-08	4.71E-08	3.88E-08	3.72E-08	2.94E-08	2.76E-08	2.54E-08	2.17E-08	1.91E-08	3.14E-08
WSW	8.24E-08	5.75E-08	4.27E-08	4.34E-08	3.32E-08	3.00E-08	2.52E-08	2.25E-08	2.11E-08	2.33E-08
W	9.23E-08	9.73E-08	7.20E-08	6.03E-08	5.07E-08	4.31E-08	3.73E-08	3.26E-08	2.89E-08	2.51E-08
WNW	1.73E-08	3.63E-08	3.68E-08	3.24E-08	2.79E-08	2.41E-08	2.10E-08	1.85E-08	1.65E-08	1.37E-08
NW	3.63E-08	5.37E-08	4.92E-08	4.12E-08	3.43E-08	2.90E-08	2.49E-08	2.17E-08	1.92E-08	1.46E-08
NNW	1.11E-07	9.31E-08	7.39E-08	5.84E-08	4.73E-08	3.94E-08	3.34E-08	2.89E-08	2.54E-08	2.42E-08

Table 8

D/Q CONTAINMENT VENT 2017

DIRECTION	804m	1609m	2416m	3218m	4022m	4827m	5632m	6436m	7240m	8045m
D/Q										
N	1.50E-08	4.75E-09	2.38E-09	1.44E-09	9.76E-10	7.08E-10	5.39E-10	4.26E-10	3.45E-10	2.86E-10
NNE	1.27E-08	4.03E-09	2.01E-09	1.22E-09	8.29E-10	6.02E-10	4.58E-10	3.62E-10	2.94E-10	2.44E-10
NE	2.02E-08	6.41E-09	3.21E-09	1.95E-09	1.32E-09	9.58E-10	7.30E-10	5.77E-10	4.69E-10	3.89E-10
ENE	1.98E-08	6.25E-09	3.12E-09	1.90E-09	1.28E-09	9.31E-10	7.09E-10	5.60E-10	4.54E-10	3.77E-10
E	1.67E-08	5.29E-09	2.64E-09	1.61E-09	1.09E-09	7.89E-10	6.04E-10	4.78E-10	3.91E-10	3.25E-10
ESE	1.76E-08	5.64E-09	2.81E-09	1.71E-09	1.16E-09	8.39E-10	6.40E-10	5.07E-10	4.19E-10	3.65E-10
SE	1.45E-08	4.53E-09	2.26E-09	1.37E-09	9.28E-10	7.14E-10	5.61E-10	4.45E-10	3.60E-10	2.98E-10
SSE	6.89E-09	2.15E-09	1.07E-09	6.54E-10	5.14E-10	3.75E-10	2.85E-10	2.25E-10	1.82E-10	1.50E-10
S	3.83E-09	1.20E-09	5.97E-10	3.69E-10	2.88E-10	2.12E-10	1.61E-10	1.27E-10	1.03E-10	8.52E-11
SSW	3.39E-09	1.16E-09	5.75E-10	3.76E-10	2.72E-10	1.97E-10	1.50E-10	1.18E-10	9.57E-11	7.91E-11
SW	4.80E-09	1.66E-09	8.28E-10	5.03E-10	3.40E-10	2.92E-10	2.24E-10	1.77E-10	1.43E-10	1.18E-10
WSW	7.34E-09	2.39E-09	1.19E-09	7.25E-10	4.91E-10	3.57E-10	2.73E-10	2.17E-10	1.77E-10	1.49E-10
W	9.70E-09	3.13E-09	1.54E-09	9.38E-10	6.37E-10	4.64E-10	3.54E-10	2.80E-10	2.28E-10	1.90E-10
WNW	3.53E-09	1.18E-09	6.01E-10	3.69E-10	2.51E-10	1.83E-10	1.40E-10	1.11E-10	9.07E-11	7.57E-11
NW	5.33E-09	1.77E-09	9.07E-10	5.56E-10	3.78E-10	2.76E-10	2.10E-10	1.67E-10	1.36E-10	1.13E-10
NNW	1.20E-08	3.80E-09	1.90E-09	1.15E-09	7.81E-10	5.67E-10	4.32E-10	3.41E-10	2.77E-10	2.29E-10

Table 9

X/Q CONTAINMENT VENT 2017

DIRECTION	804m	1609m	2416m	3218m	4022m	4827m	5632m	6436m	7240m	8045m
X/Q										
N	1.35E-06	4.93E-07	2.82E-07	1.90E-07	1.41E-07	1.10E-07	8.97E-08	7.51E-08	6.43E-08	5.60E-08
NNE	1.29E-06	4.69E-07	2.70E-07	1.83E-07	1.36E-07	1.06E-07	8.67E-08	7.27E-08	6.23E-08	5.43E-08
NE	1.86E-06	6.75E-07	3.83E-07	2.57E-07	1.89E-07	1.47E-07	1.19E-07	9.96E-08	8.50E-08	7.38E-08
ENE	1.63E-06	5.93E-07	3.40E-07	2.30E-07	1.70E-07	1.33E-07	1.08E-07	9.03E-08	7.72E-08	6.71E-08
E	1.20E-06	4.33E-07	2.46E-07	1.66E-07	1.22E-07	9.55E-08	7.91E-08	6.62E-08	5.78E-08	4.92E-08
ESE	7.73E-07	3.26E-07	1.69E-07	1.19E-07	9.91E-08	8.08E-08	6.19E-08	5.61E-08	4.88E-08	4.28E-08
SE	5.32E-07	2.13E-07	1.34E-07	9.34E-08	7.04E-08	5.77E-08	4.70E-08	3.93E-08	3.36E-08	2.90E-08
SSE	4.33E-07	1.65E-07	1.03E-07	7.77E-08	5.84E-08	4.54E-08	3.67E-08	3.03E-08	2.55E-08	2.19E-08
S	2.28E-07	1.10E-07	6.03E-08	4.83E-08	3.73E-08	3.10E-08	2.49E-08	2.05E-08	1.73E-08	1.49E-08
SSW	1.80E-07	7.85E-08	5.34E-08	3.82E-08	2.79E-08	2.17E-08	1.76E-08	1.46E-08	1.23E-08	1.05E-08
SW	2.71E-07	1.31E-07	8.19E-08	6.31E-08	4.61E-08	3.80E-08	3.15E-08	2.61E-08	2.21E-08	1.91E-08
WSW	4.05E-07	1.89E-07	1.13E-07	9.08E-08	6.52E-08	5.38E-08	4.34E-08	3.70E-08	3.28E-08	2.85E-08
W	9.47E-07	3.82E-07	2.16E-07	1.48E-07	1.10E-07	8.62E-08	7.02E-08	5.88E-08	5.03E-08	4.37E-08
WNW	4.67E-07	1.93E-07	1.16E-07	8.06E-08	6.06E-08	4.79E-08	3.93E-08	3.31E-08	2.84E-08	2.48E-08
NW	6.00E-07	2.37E-07	1.40E-07	9.64E-08	7.21E-08	5.69E-08	4.66E-08	3.92E-08	3.37E-08	2.94E-08
NNW	9.83E-07	3.51E-07	1.99E-07	1.34E-07	9.83E-08	7.66E-08	6.22E-08	5.19E-08	4.43E-08	3.85E-08

DIRECTION	804m	1609m	2416m	3218m	4022m	4827m	5632m	6436m	7240m	8045m
D/Q										
N	1.64E-08	5.18E-09	2.59E-09	1.57E-09	1.06E-09	7.68E-10	5.84E-10	4.60E-10	3.73E-10	3.08E-10
NNE	1.42E-08	4.46E-09	2.23E-09	1.35E-09	9.13E-10	6.61E-10	5.03E-10	3.96E-10	3.21E-10	2.65E-10
NE	2.20E-08	6.95E-09	3.47E-09	2.10E-09	1.42E-09	1.03E-09	7.83E-10	6.17E-10	4.99E-10	4.13E-10
ENE	2.17E-08	6.85E-09	3.42E-09	2.07E-09	1.40E-09	1.02E-09	7.72E-10	6.08E-10	4.92E-10	4.07E-10
E	1.84E-08	5.79E-09	2.89E-09	1.75E-09	1.18E-09	8.58E-10	6.52E-10	5.14E-10	4.16E-10	3.44E-10
ESE	1.93E-08	6.10E-09	3.04E-09	1.84E-09	1.25E-09	9.03E-10	6.87E-10	5.41E-10	4.38E-10	3.62E-10
SE	1.56E-08	4.91E-09	2.45E-09	1.48E-09	1.00E-09	7.27E-10	5.53E-10	4.36E-10	3.53E-10	2.92E-10
SSE	7.77E-09	2.45E-09	1.22E-09	7.41E-10	5.01E-10	3.63E-10	2.76E-10	2.18E-10	1.76E-10	1.46E-10
S	4.39E-09	1.39E-09	6.90E-10	4.19E-10	2.83E-10	2.05E-10	1.56E-10	1.23E-10	9.95E-11	8.23E-11
SSW	4.08E-09	1.29E-09	6.41E-10	3.89E-10	2.63E-10	1.90E-10	1.45E-10	1.14E-10	9.23E-11	7.64E-11
SW	6.03E-09	1.90E-09	9.47E-10	5.74E-10	3.88E-10	2.81E-10	2.14E-10	1.69E-10	1.37E-10	1.13E-10
WSW	8.70E-09	2.74E-09	1.37E-09	8.29E-10	5.60E-10	4.06E-10	3.09E-10	2.43E-10	1.97E-10	1.63E-10
W	1.17E-08	3.70E-09	1.84E-09	1.12E-09	7.55E-10	5.47E-10	4.16E-10	3.28E-10	2.66E-10	2.20E-10
WNW	5.13E-09	1.62E-09	8.06E-10	4.89E-10	3.31E-10	2.40E-10	1.82E-10	1.44E-10	1.16E-10	9.61E-11
NW	7.12E-09	2.25E-09	1.12E-09	6.79E-10	4.59E-10	3.33E-10	2.53E-10	1.99E-10	1.61E-10	1.34E-10
NNW	1.32E-08	4.17E-09	2.08E-09	1.26E-09	8.52E-10	6.17E-10	4.69E-10	3.70E-10	2.99E-10	2.48E-10

DIRECTION	804m	1609m	2416m	3218m	4022m	4827m	5632m	6436m	7240m	8045m
X/Q										
N	1.96E-06	6.79E-07	3.75E-07	2.48E-07	1.80E-07	1.40E-07	1.12E-07	9.33E-08	7.92E-08	6.85E-08
NNE	1.85E-06	6.40E-07	3.55E-07	2.35E-07	1.71E-07	1.33E-07	1.07E-07	8.89E-08	7.56E-08	6.54E-08
NE	2.50E-06	8.65E-07	4.75E-07	3.12E-07	2.27E-07	1.75E-07	1.41E-07	1.16E-07	9.87E-08	8.53E-08
ENE	2.33E-06	8.03E-07	4.41E-07	2.90E-07	2.10E-07	1.62E-07	1.30E-07	1.08E-07	9.14E-08	7.90E-08
E	1.87E-06	6.38E-07	3.49E-07	2.29E-07	1.66E-07	1.28E-07	1.03E-07	8.48E-08	7.18E-08	6.20E-08
ESE	1.34E-06	4.47E-07	2.45E-07	1.61E-07	1.16E-07	8.97E-08	7.21E-08	5.97E-08	5.06E-08	4.37E-08
SE	9.50E-07	3.10E-07	1.67E-07	1.08E-07	7.77E-08	5.95E-08	4.75E-08	3.92E-08	3.31E-08	2.85E-08
SSE	7.42E-07	2.41E-07	1.29E-07	8.28E-08	5.91E-08	4.50E-08	3.58E-08	2.94E-08	2.48E-08	2.13E-08
S	4.72E-07	1.53E-07	8.24E-08	5.36E-08	3.85E-08	2.95E-08	2.36E-08	1.95E-08	1.65E-08	1.42E-08
SSW	3.58E-07	1.15E-07	6.14E-08	3.97E-08	2.84E-08	2.17E-08	1.73E-08	1.43E-08	1.20E-08	1.03E-08
SW	6.10E-07	2.00E-07	1.08E-07	7.01E-08	5.04E-08	3.86E-08	3.09E-08	2.55E-08	2.15E-08	1.86E-08
WSW	1.00E-06	3.35E-07	1.83E-07	1.20E-07	8.68E-08	6.68E-08	5.36E-08	4.44E-08	3.76E-08	3.25E-08
W	1.70E-06	5.76E-07	3.13E-07	2.05E-07	1.48E-07	1.13E-07	9.07E-08	7.49E-08	6.34E-08	5.46E-08
WNW	9.61E-07	3.32E-07	1.82E-07	1.20E-07	8.68E-08	6.69E-08	5.37E-08	4.45E-08	3.77E-08	3.25E-08
NW	1.22E-06	4.15E-07	2.29E-07	1.50E-07	1.09E-07	8.41E-08	6.76E-08	5.60E-08	4.75E-08	4.10E-08
NNW	1.41E-06	4.81E-07	2.64E-07	1.73E-07	1.25E-07	9.65E-08	7.75E-08	6.42E-08	5.44E-08	4.70E-08

Direction	Distance to Nearset Residence (m)	Air Ejector		Containment Vent		Plant Vent	
		X/Q (sec/m ³)	D/Q (m ⁻²)	X/Q (sec/m ³)	D/Q (m ⁻²)	X/Q (sec/m ³)	D/Q (m ⁻²)
E	1170	1.03E-06	9.94E-09	6.86E-07	9.06E-09	1.44E-07	3.33E-09
ESE	1660	4.27E-07	5.78E-09	3.10E-07	5.35E-09	1.44E-07	3.60E-09
SE	840	8.84E-07	1.45E-08	4.99E-07	1.35E-08	1.56E-07	9.30E-09
SSE	610	1.17E-06	1.21E-08	5.77E-07	1.07E-08	1.44E-07	6.55E-09
S	1500	1.71E-07	1.56E-09	1.16E-07	1.35E-09	5.35E-08	1.02E-09
SSW	620	5.56E-07	6.18E-09	2.60E-07	5.06E-09	5.07E-08	2.67E-09
SW	740	7.02E-07	6.90E-09	3.04E-07	5.46E-09	7.03E-08	3.03E-09
WSW	1470	3.84E-07	3.20E-09	2.05E-07	2.79E-09	5.71E-08	1.70E-09
W	2420	3.12E-07	1.83E-09	2.16E-07	1.53E-09	7.18E-08	7.16E-10

Direction	Distance to Nearest Milk Producing Animal (m)	Air Ejector		Containment Vent		Plant Vent	
		X/Q (sec/m ³)	D/Q (m ⁻²)	X/Q (sec/m ³)	D/Q (m ⁻²)	X/Q (sec/m ³)	D/Q (m ⁻²)
SE	8270	2.74E-08	2.78E-10	2.79E-08	2.84E-10	2.55E-08	2.79E-10

5.2 Instrument Maintenance

In March, A calibration of the Primary Tower was performed. At the Backup Tower, the logger is reading an incorrect time and date. No data has been collected because of this issue. Site IT is aware of the issue and has yet to fix it. This issue continued through the entire year of 2017.

In April-May, the Backup Towers logger issued continued until May 12 once it was fixed.

In August, a calibration of the Primary Tower and Backup Tower was performed.

In November, a calibration of the Primary Tower and Backup Tower was performed.

No other problems were encountered with the equipment, and at the end of the year, other than the Backup Tower issues, no other problems were evident at the site.

5.3 Data Recovery

The record of data recovery for the year is summarized in Table 12.

Table 12

Ginna Site
Data Recovery Summary
2017

<u>Measurement</u>	<u>Elevation</u>	<u>Recovered Hours</u>	<u>Recovered Percent</u>	<u>Lost Hours</u>	<u>Percent Changed</u>
Wind Speed	33 ft.	8744	99.8	16	0.2
Wind Speed	150 ft.	8741	99.8	19	0.5
Wind Speed	250 ft.	8734	99.7	26	0.3
Wind Direction	33 ft.	8744	99.8	16	0.2
Wind Direction	150 ft.	8744	99.8	16	0.2
Wind Direction	250 ft.	8744	99.8	16	0.3
Ambient Temperature	33 ft.	8744	99.8	16	0.2
Ambient Temperature	150 ft.	8744	99.8	16	0.2
Ambient Temperature	250 ft.	8744	99.8	16	0.2
Differential Temperature	150-33 ft.	8744	99.8	16	0.2
Differential Temperature	250-33 ft.	8744	99.8	16	0.6
Precipitation	10 ft.	8703	99.3	57	0.7
AVERAGE*			99.8		

* average of priority parameters (all except precipitation)

	<u>Valid Hours</u>	<u>Recovered Percent</u>	<u>Lost Hours</u>
Lower Level Joint Frequency %	8744	99.8	16
Middle Level Joint Frequency %	8741	99.8	19
Upper Level Joint Frequency %	8734	99.7	26

5.4 Stability Wind Rose Data

The annual stability wind roses are given at the end of this report. Wind speed classes have been altered to reflect the sensor threshold.

For the year, winds measured at 33 ft. most frequently came from the southwest (13.59%) and most frequently fell into the 2.1-3.0 m/s wind speed class (23.76%). Calms (wind speeds at or below the sensor threshold) were measured 0.00% of the time and speeds greater than 10.0 m/s were measured (2.04%) of the time. Winds measured at 150 ft. most frequently came from the southwest (11.26%) and most frequently fell into the 6.1-8.0 m/s wind speed class (19.36%). Calms were measured 0.00% of the time and speeds greater than 10.0 m/s were measured (10.24%) of the time. Winds measured at 250 ft. most frequently came from the west-southwest (11.69%) and most frequently fell into the 6.1-8.1 m/s wind speed class (23.18%). Calms were measured 0.00% of the time and speeds greater than 10.0 m/s were measured (15.98%) of the time.

Stability based on the 150-33 ft. differential temperature most frequently fell into the neutral classification (33.28%) and stability based on the 250-33 ft. differential temperature most frequently fell into the neutral classification (46.03%).

5.5 Precipitation

Table 13
Precipitation Totals (Inches) - 2017
Ginna Site

<u>Month</u>	<u>Total</u>
January	2.73
February	1.80
March	3.72
April	5.21
May	5.68
June	5.18
July	3.37
August	2.77
September	1.20
October	8.43
November	4.34
December	1.90
 TOTAL:	 46.33*

*Indicates some precipitation missing.

2017

Joint Frequency Tables

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

All Stabilities

Elevations:: Winds 33ft Stability 150ft

Wind Direction Sector	Wind Speed Range (m/s)											Total
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	
N	0	6	18	34	59	42	17	4	2	6	0	188
NNE	0	9	20	45	112	65	50	23	20	4	7	355
NE	0	6	17	34	44	41	20	24	28	13	17	244
ENE	0	8	24	53	72	45	48	43	83	29	19	424
E	1	5	34	65	145	142	89	43	51	5	0	580
ESE	0	5	10	40	96	43	6	0	0	0	0	200
SE	0	11	13	24	82	42	23	7	1	0	0	203
SSE	0	10	21	26	100	89	77	41	36	7	1	408
S	0	16	41	51	154	159	99	94	122	32	4	772
SSW	0	14	53	132	303	226	129	62	36	4	0	959
SW	1	16	58	197	411	208	164	92	40	1	0	1188
WSW	0	12	42	45	164	166	118	122	189	57	34	949
W	0	8	30	29	100	134	164	92	167	40	12	776
WNW	1	7	23	43	102	144	124	104	138	84	67	837
NW	0	9	26	51	103	71	70	62	77	39	18	526
NNW	0	9	19	37	31	38	1	0	0	0	0	135
Tot	3	151	449	906	2078	1655	1199	813	990	321	179	8744

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 8744
 Hours of Missing Data 16
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class A Extremely Unstable based on Lapse Rate

Elevations:: Winds 33ft Stability 150ft

Wind Direction Sector	Wind Speed Range (m/s)										Total	
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0		>10.00
N	0	0	2	8	11	14	8	3	1	4	0	51
NNE	0	0	0	1	27	24	29	16	19	4	7	127
NE	0	0	0	4	8	10	4	13	13	12	15	79
ENE	0	0	0	0	18	12	25	27	49	13	19	163
E	0	0	0	0	4	8	5	5	6	1	0	29
ESE	0	0	0	0	3	2	0	0	0	0	0	5
SE	0	0	0	0	1	3	0	0	0	0	0	4
SSE	0	0	0	0	7	17	9	3	7	0	0	43
S	0	0	0	1	5	6	5	3	1	0	0	21
SSW	0	0	1	2	8	9	7	3	1	0	0	31
SW	0	0	0	5	10	18	10	17	10	0	0	70
WSW	0	0	0	1	9	9	10	6	14	3	0	52
W	0	0	0	3	6	9	11	5	4	3	0	41
WNW	0	0	1	8	46	82	56	42	45	20	26	326
NW	0	0	2	21	56	20	28	21	26	18	12	204
NNW	0	0	5	21	7	14	1	0	0	0	0	48
Tot	0	0	11	75	226	257	208	164	196	78	79	1294

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 1294
 Hours of Missing Data 16
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class B Moderately Unstable based on Lapse Rate

Elevations:: Winds 33ft Stability 150ft

Wind Direction Sector	Wind Speed Range (m/s)											Total
	<0.50	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	>10.00	
N	0	0	4	9	7	16	9	0	1	2	0	48
NNE	0	0	1	9	24	17	11	1	0	0	0	63
NE	0	1	1	5	10	15	7	4	7	1	2	53
ENE	0	0	0	3	6	8	11	11	15	9	0	63
E	0	0	0	2	6	7	12	16	21	1	0	65
ESE	0	0	0	1	0	3	1	0	0	0	0	5
SE	0	0	0	0	3	1	0	1	0	0	0	5
SSE	0	0	1	2	5	8	9	6	6	1	0	38
S	0	0	0	0	6	8	3	4	3	0	0	24
SSW	0	0	0	4	7	7	5	5	3	0	0	31
SW	0	0	1	6	14	8	9	13	4	1	0	56
WSW	0	0	0	3	4	6	4	11	18	2	2	50
W	0	0	0	4	8	9	8	7	8	1	0	45
WNW	0	0	2	6	14	17	6	4	13	15	10	87
NW	0	0	2	7	0	5	12	14	18	9	3	70
NNW	0	0	4	6	2	14	0	0	0	0	0	26
Tot	0	1	16	67	116	149	107	97	117	42	17	729

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 729
 Hours of Missing Data 16
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class C Slightly Unstable based on Lapse Rate

Elevations:: Winds 33ft Stability 150ft

Wind Direction Sector	Wind Speed Range (m/s)										Total	
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0		>10.00
N	0	0	0	3	10	5	0	0	0	0	0	18
NNE	0	1	3	8	8	9	3	1	1	0	0	34
NE	0	0	0	1	7	4	4	0	4	0	0	20
ENE	0	1	0	2	6	6	1	0	7	1	0	24
E	0	0	2	1	3	7	10	4	9	2	0	38
ESE	0	0	0	3	0	3	0	0	0	0	0	6
SE	0	0	0	0	1	5	0	0	0	0	0	6
SSE	0	0	0	0	4	4	4	3	2	0	0	17
S	0	0	1	0	3	5	7	3	4	0	0	23
SSW	0	0	0	1	4	8	8	1	0	0	0	22
SW	0	0	1	1	10	9	6	1	0	0	0	28
WSW	0	0	0	0	3	5	1	6	11	3	1	30
W	0	0	0	1	3	13	6	4	7	1	0	35
WNW	0	0	0	2	5	5	1	9	13	9	5	49
NW	0	0	4	3	1	7	5	7	12	2	1	42
NNW	0	1	3	1	3	6	0	0	0	0	0	14
Tot	0	3	14	27	71	101	56	39	70	18	7	406

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 406
 Hours of Missing Data 16
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class D Neutral based on Lapse Rate

Elevations:: Winds 33ft Stability 150ft

Wind Direction Sector	Wind Speed Range (m/s)											Total
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	
N	0	3	3	11	31	7	0	1	0	0	0	56
NNE	0	4	12	18	44	12	6	4	0	0	0	100
NE	0	1	8	14	12	7	3	5	4	0	0	54
ENE	0	3	12	16	16	14	5	5	12	6	0	89
E	1	3	14	22	63	64	38	15	10	1	0	231
ESE	0	0	1	12	50	26	4	0	0	0	0	93
SE	0	0	2	9	56	24	19	6	1	0	0	117
SSE	0	1	3	9	38	40	46	26	19	6	1	189
S	0	0	7	3	33	41	43	43	64	24	4	262
SSW	0	3	6	8	31	39	44	24	17	1	0	173
SW	0	3	5	22	45	74	52	41	19	0	0	261
WSW	0	1	7	4	38	62	59	73	123	45	28	440
W	0	3	5	5	45	47	90	53	133	33	12	426
WNW	0	3	9	10	24	22	30	31	55	31	22	237
NW	0	4	9	10	24	33	23	15	19	10	2	149
NNW	0	3	6	6	15	3	0	0	0	0	0	33
Tot	1	35	109	179	565	515	462	342	476	157	69	2910

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 2910
 Hours of Missing Data 16
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class E Slightly Stable based on Lapse Rate

Elevations:: Winds 33ft Stability 150ft

Wind Direction Sector	Wind Speed Range (m/s)											Total
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	
N	0	2	6	3	0	0	0	0	0	0	0	11
NNE	0	1	3	7	6	3	1	1	0	0	0	22
NE	0	2	5	5	7	3	2	2	0	0	0	26
ENE	0	0	4	7	10	5	5	0	0	0	0	31
E	0	1	5	20	36	32	9	0	3	0	0	106
ESE	0	3	4	17	39	7	1	0	0	0	0	71
SE	0	4	4	9	16	8	3	0	0	0	0	44
SSE	0	1	7	9	30	14	9	3	2	0	0	75
S	0	5	8	17	50	87	41	41	50	8	0	307
SSW	0	3	8	22	72	112	53	29	15	3	0	317
SW	1	6	18	44	159	89	86	20	7	0	0	430
WSW	0	5	15	17	68	75	42	26	23	4	3	278
W	0	2	11	12	32	49	49	21	15	2	0	193
WNW	0	4	9	12	12	16	25	18	11	9	4	120
NW	0	5	6	10	16	5	2	5	2	0	0	51
NNW	0	5	0	2	3	1	0	0	0	0	0	11
Tot	1	49	113	213	556	506	328	166	128	26	7	2093

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 2093
 Hours of Missing Data 16
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class F Moderately Stable based on Lapse Rate

Elevations:: Winds 33ft Stability 150ft

Wind Direction Sector	Wind Speed Range (m/s)										Total	
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0		>10.00
N	0	1	2	0	0	0	0	0	0	0	0	3
NNE	0	2	0	1	1	0	0	0	0	0	0	4
NE	0	0	0	3	0	2	0	0	0	0	0	5
ENE	0	0	2	7	8	0	1	0	0	0	0	18
E	0	1	6	10	16	13	7	3	2	0	0	58
ESE	0	1	4	4	0	1	0	0	0	0	0	10
SE	0	3	5	5	4	1	1	0	0	0	0	19
SSE	0	6	5	6	14	4	0	0	0	0	0	35
S	0	5	9	10	30	11	0	0	0	0	0	65
SSW	0	3	11	26	64	34	12	0	0	0	0	150
SW	0	6	18	56	96	7	0	0	0	0	0	183
WSW	0	4	13	15	34	8	2	0	0	0	0	76
W	0	1	10	4	5	3	0	2	0	0	0	25
WNW	1	0	2	3	1	0	6	0	1	0	0	14
NW	0	0	3	0	3	0	0	0	0	0	0	6
NNW	0	0	1	1	1	0	0	0	0	0	0	3
Tot	1	33	91	151	277	84	29	5	3	0	0	674

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 674
 Hours of Missing Data 16
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class G Extremely Stable based on Lapse Rate

Elevations:: Winds 33ft Stability 150ft

Wind Direction Sector	Wind Speed Range (m/s)										Total	
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0		>10.00
N	0	0	1	0	0	0	0	0	0	0	0	1
NNE	0	1	1	1	2	0	0	0	0	0	0	5
NE	0	2	3	2	0	0	0	0	0	0	0	7
ENE	0	4	6	18	8	0	0	0	0	0	0	36
E	0	0	7	10	17	11	8	0	0	0	0	53
ESE	0	1	1	3	4	1	0	0	0	0	0	10
SE	0	4	2	1	1	0	0	0	0	0	0	8
SSE	0	2	5	0	2	2	0	0	0	0	0	11
S	0	6	16	20	27	1	0	0	0	0	0	70
SSW	0	5	27	69	117	17	0	0	0	0	0	235
SW	0	1	15	63	77	3	1	0	0	0	0	160
WSW	0	2	7	5	8	1	0	0	0	0	0	23
W	0	2	4	0	1	4	0	0	0	0	0	11
WNW	0	0	0	2	0	2	0	0	0	0	0	4
NW	0	0	0	0	3	1	0	0	0	0	0	4
NNW	0	0	0	0	0	0	0	0	0	0	0	0
Tot	0	30	95	194	267	43	9	0	0	0	0	638

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 638
 Hours of Missing Data 16
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

All Stabilities

Elevations:: Winds 150ft Stability 150ft

Wind Direction Sector	Wind Speed Range (m/s)											Total
	<0.50	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	>10.00	
N	0	4	4	15	38	28	24	15	37	20	11	196
NNE	0	0	6	17	30	22	16	13	37	24	17	182
NE	0	1	10	30	49	37	29	20	43	23	27	269
ENE	0	8	20	20	48	56	57	57	65	36	21	388
E	1	4	15	24	86	107	119	93	71	3	0	523
ESE	0	2	7	11	59	77	49	21	3	0	0	229
SE	0	6	3	10	76	78	71	38	30	6	0	318
SSE	0	0	7	12	47	66	117	108	144	67	22	590
S	0	4	7	11	47	66	110	147	203	101	38	734
SSW	0	3	7	16	47	75	115	171	161	33	4	632
SW	0	2	5	15	66	130	217	213	249	77	10	984
WSW	0	1	8	19	58	127	169	138	195	156	99	970
W	0	2	12	19	51	69	96	132	186	142	111	820
WNW	0	1	9	19	75	77	88	100	145	128	221	863
NW	0	5	19	21	68	58	40	46	65	108	265	695
NNW	0	3	15	37	58	21	29	30	58	47	49	347
Tot	1	46	154	296	903	1094	1346	1342	1692	971	895	8740

Hours of Calm 1
Hours of Variable Direction 0
Hours of Valid Data 8741
Hours of Missing Data 19
Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class A Extremely Unstable based on Lapse Rate

Elevations:: Winds 150ft Stability 150ft

Wind Direction Sector	Wind Speed Range (m/s)											Total
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	
N	0	0	0	0	6	12	3	2	10	9	9	51
NNE	0	0	0	0	3	6	4	6	23	16	16	74
NE	0	0	0	4	12	6	7	8	15	13	24	89
ENE	0	0	0	0	11	13	23	23	38	16	21	145
E	0	0	0	0	2	11	5	9	4	1	0	32
ESE	0	0	0	0	2	1	1	0	0	0	0	4
SE	0	0	0	0	1	2	3	1	2	0	0	9
SSE	0	0	0	0	3	11	12	8	5	6	0	45
S	0	0	0	0	3	5	4	3	4	1	0	20
SSW	0	0	0	2	2	4	11	4	2	1	0	26
SW	0	0	0	4	7	8	10	10	18	12	2	71
WSW	0	0	0	0	6	7	8	8	9	12	4	54
W	0	0	0	0	4	2	6	12	5	2	3	34
WNW	0	0	0	1	10	29	46	47	53	39	63	288
NW	0	0	0	6	33	31	21	22	20	36	90	259
NNW	0	0	0	5	19	7	8	6	6	12	30	93
Tot	0	0	0	22	124	155	172	169	214	176	262	1294

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 1294
 Hours of Missing Data 19
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class B Moderately Unstable based on Lapse Rate

Elevations:: Winds 150ft Stability 150ft

Wind Direction Sector	Wind Speed Range (m/s)										Total	
	<0.50	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0		>10.00
N	0	0	0	2	9	9	3	3	13	4	2	45
NNE	0	0	0	3	7	6	1	1	7	5	0	30
NE	0	0	2	3	7	14	12	4	10	3	2	57
ENE	0	0	0	2	5	7	8	15	10	11	0	58
E	0	0	0	2	6	6	10	16	17	1	0	58
ESE	0	0	0	0	1	1	1	1	0	0	0	4
SE	0	0	0	0	1	2	4	1	2	3	0	13
SSE	0	0	0	1	6	4	7	6	8	1	1	34
S	0	0	0	0	3	4	5	1	7	2	0	22
SSW	0	0	1	1	7	5	5	4	5	3	0	31
SW	0	0	0	3	6	11	4	10	15	6	2	57
WSW	0	0	0	1	7	3	4	4	12	13	8	52
W	0	0	0	0	6	4	4	8	11	8	3	44
WNW	0	0	0	3	3	7	9	10	6	7	25	70
NW	0	0	2	4	7	4	2	0	2	8	61	90
NNW	0	0	2	7	9	3	1	1	16	16	8	63
Tot	0	0	7	32	90	90	80	85	141	91	112	728

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 728
 Hours of Missing Data 19
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class C Slightly Unstable based on Lapse Rate

Elevations:: Winds 150ft Stability 150ft

Wind Direction Sector	Wind Speed Range (m/s)											Total
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	
N	0	1	0	1	5	0	3	1	8	4	0	23
NNE	0	0	0	3	5	2	3	0	2	0	0	15
NE	0	0	0	0	3	5	1	2	4	3	0	18
ENE	0	0	1	1	4	9	3	2	5	2	0	27
E	0	1	1	1	4	0	6	6	10	0	0	29
ESE	0	0	0	1	1	2	1	0	0	0	0	5
SE	0	0	0	0	0	7	1	0	1	0	0	9
SSE	0	0	0	0	3	1	8	4	4	3	0	23
S	0	0	1	0	1	1	1	5	4	3	0	16
SSW	0	0	1	1	1	2	4	7	3	0	0	19
SW	0	0	0	0	3	8	10	6	3	0	1	31
WSW	0	0	0	0	0	4	2	2	9	6	5	28
W	0	0	0	0	0	2	9	6	6	7	2	32
WNW	0	0	0	0	3	3	1	4	4	9	18	42
NW	0	0	1	2	3	1	1	4	3	8	31	54
NNW	0	0	2	4	5	2	1	6	8	5	1	34
Tot	0	2	7	14	41	49	55	55	74	50	58	405

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 405
 Hours of Missing Data 19
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class D Neutral based on Lapse Rate

Elevations:: Winds 150ft Stability 150ft

Wind Direction Sector	Wind Speed Range (m/s)											Total
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	
N	0	1	1	5	10	6	14	8	6	3	0	54
NNE	0	0	2	6	12	3	2	3	3	2	1	34
NE	0	0	5	15	15	3	5	3	10	4	1	61
ENE	0	3	10	8	11	15	9	10	11	7	0	84
E	1	3	4	10	34	39	49	31	23	1	0	195
ESE	0	0	2	2	28	33	20	11	0	0	0	96
SE	0	1	0	5	44	39	36	22	14	3	0	164
SSE	0	0	2	2	10	19	43	46	73	48	18	261
S	0	2	1	1	9	15	28	24	67	30	24	201
SSW	0	1	1	3	9	15	18	37	31	12	1	128
SW	0	1	0	4	20	24	34	57	76	35	4	255
WSW	0	0	0	6	5	35	40	41	102	100	71	400
W	0	1	3	6	5	22	30	49	103	103	97	419
WNW	0	1	3	4	18	16	12	21	42	48	90	255
NW	0	3	4	4	9	7	7	15	29	44	64	186
NNW	0	1	4	10	14	6	15	17	27	13	8	115
Tot	1	18	42	91	253	297	362	395	617	453	379	2908

Hours of Calm 1
 Hours of Variable Direction 0
 Hours of Valid Data 2909
 Hours of Missing Data 19
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class E Slightly Stable based on Lapse Rate

Elevations:: Winds 150ft Stability 150ft

Wind Direction Sector	Wind Speed Range (m/s)											Total
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	
N	0	0	3	5	2	1	1	1	0	0	0	13
NNE	0	0	3	3	3	2	3	3	2	1	0	20
NE	0	0	1	3	6	3	2	2	3	0	0	20
ENE	0	2	4	2	6	4	8	4	1	0	0	31
E	0	0	4	5	19	37	26	14	4	0	0	109
ESE	0	1	1	3	16	25	15	4	0	0	0	65
SE	0	1	2	0	12	18	17	6	8	0	0	64
SSE	0	0	2	5	9	14	24	24	45	9	3	135
S	0	1	0	3	14	19	40	73	88	65	14	317
SSW	0	0	2	4	13	23	42	67	85	17	3	256
SW	0	0	1	0	12	33	85	78	131	24	1	365
WSW	0	1	2	5	19	28	49	57	61	25	11	258
W	0	0	3	5	10	16	28	48	53	22	6	191
WNW	0	0	1	3	16	14	13	13	37	22	23	142
NW	0	2	4	4	10	7	7	4	11	12	17	78
NNW	0	0	3	5	10	3	4	0	1	1	2	29
Tot	0	8	36	55	177	247	364	398	530	198	80	2093

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 2093
 Hours of Missing Data 19
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class F Moderately Stable based on Lapse Rate

Elevations:: Winds 150ft Stability 150ft

Wind Direction Sector	Wind Speed Range (m/s)											Total
	<0.50	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	>10.00	
N	0	0	0	0	2	0	0	0	0	0	0	2
NNE	0	0	0	0	0	1	0	0	0	0	0	1
NE	0	1	1	2	2	2	2	1	1	0	0	12
ENE	0	2	2	4	5	3	3	1	0	0	0	20
E	0	0	3	2	9	9	15	9	7	0	0	54
ESE	0	0	3	2	5	11	5	2	3	0	0	31
SE	0	2	0	0	5	2	2	4	2	0	0	17
SSE	0	0	1	0	4	8	6	12	7	0	0	38
S	0	0	0	1	8	10	15	22	25	0	0	81
SSW	0	0	0	1	8	10	15	30	17	0	0	81
SW	0	0	2	0	11	19	53	40	4	0	0	129
WSW	0	0	4	3	12	26	39	19	2	0	0	105
W	0	1	1	3	9	10	10	4	6	0	0	44
WNW	0	0	2	5	9	3	3	3	1	3	2	31
NW	0	0	4	1	5	6	0	1	0	0	2	19
NNW	0	1	4	3	1	0	0	0	0	0	0	9
Tot	0	7	27	27	95	120	168	148	75	3	4	674

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 674
 Hours of Missing Data 19
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class G Extremely Stable based on Lapse Rate

Elevations:: Winds 150ft Stability 150ft

Wind Direction Sector	Wind Speed Range (m/s)											Total
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	
N	0	2	0	2	4	0	0	0	0	0	0	8
NNE	0	0	1	2	0	2	3	0	0	0	0	8
NE	0	0	1	3	4	4	0	0	0	0	0	12
ENE	0	1	3	3	6	5	3	2	0	0	0	23
E	0	0	3	4	12	5	8	8	6	0	0	46
ESE	0	1	1	3	6	4	6	3	0	0	0	24
SE	0	2	1	5	13	8	8	4	1	0	0	42
SSE	0	0	2	4	12	9	17	8	2	0	0	54
S	0	1	5	6	9	12	17	19	8	0	0	77
SSW	0	2	2	4	7	16	20	22	18	0	0	91
SW	0	1	2	4	7	27	21	12	2	0	0	76
WSW	0	0	2	4	9	24	27	7	0	0	0	73
W	0	0	5	5	17	13	9	5	2	0	0	56
WNW	0	0	3	3	16	5	4	2	2	0	0	35
NW	0	0	4	0	1	2	2	0	0	0	0	9
NNW	0	1	0	3	0	0	0	0	0	0	0	4
Tot	0	11	35	55	123	136	145	92	41	0	0	638

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 638
 Hours of Missing Data 19
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

All Stabilities

Elevations:: Winds 250ft Stability 250ft

Wind Direction Sector	Wind Speed Range (m/s)										Total	
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0		>10.00
N	0	6	7	15	34	28	21	17	31	31	16	206
NNE	0	2	4	16	36	19	15	9	40	15	14	170
NE	0	8	14	27	46	31	24	24	36	21	25	256
ENE	0	4	16	22	56	60	53	70	69	46	27	423
E	0	5	24	19	69	89	100	89	72	4	1	472
ESE	0	2	5	12	28	57	55	47	31	4	0	241
SE	0	3	5	14	37	52	58	76	83	29	2	359
SSE	0	3	1	8	38	32	62	81	150	127	81	583
S	0	3	6	7	17	36	57	67	178	133	125	629
SSW	0	1	4	7	26	49	63	88	172	118	29	557
SW	0	4	2	12	41	57	80	140	312	213	43	904
WSW	0	4	4	10	50	56	98	150	318	178	153	1021
W	0	6	3	17	58	65	87	105	240	144	190	915
WNW	0	3	9	13	58	73	80	84	166	128	340	954
NW	0	6	12	27	67	50	39	52	74	101	293	721
NNW	0	3	5	23	60	23	21	31	53	47	57	323
Tot	0	63	121	249	721	777	913	1130	2025	1339	1396	8734

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 8734
 Hours of Missing Data 26
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class A Extremely Unstable based on Lapse Rate

Elevations:: Winds 250ft Stability 250ft

Wind Direction Sector	Wind Speed Range (m/s)										Total	
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0		>10.00
N	0	0	0	0	0	0	0	1	3	4	5	13
NNE	0	0	0	0	0	0	0	0	3	2	9	14
NE	0	0	0	0	0	0	1	2	1	1	5	10
ENE	0	0	0	0	0	1	4	4	2	2	14	27
E	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0	0	0	0	0	0
W	0	0	0	0	0	1	0	0	0	0	0	1
WNW	0	0	0	0	0	6	12	8	22	10	27	85
NW	0	0	0	0	14	19	9	8	15	11	33	109
NNW	0	0	0	0	5	2	4	4	5	3	10	33
Tot	0	0	0	0	19	29	30	27	51	33	103	292

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 292
 Hours of Missing Data 26
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class B Moderately Unstable based on Lapse Rate

Elevations:: Winds 250ft Stability 250ft

Wind Direction Sector	Wind Speed Range (m/s)											Total
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	
N	0	0	0	0	0	0	2	1	2	3	1	9
NNE	0	0	0	0	0	0	1	0	2	2	1	6
NE	0	0	0	0	0	2	1	1	3	1	4	12
ENE	0	0	0	0	2	2	3	5	6	2	3	23
E	0	0	0	0	0	1	0	0	0	0	0	1
ESE	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	1	1	0	2
SSE	0	0	0	0	0	0	1	3	1	0	0	5
S	0	0	0	0	0	0	0	0	1	0	0	1
SSW	0	0	0	0	0	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	1	2	2	1	0	6
WSW	0	0	0	0	1	0	0	0	0	0	0	1
W	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	2	3	5	8	6	10	34
NW	0	0	0	1	5	1	2	4	4	6	20	43
NNW	0	0	0	0	5	1	4	0	0	1	4	15
Tot	0	0	0	1	13	9	18	21	30	23	43	158

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 158
 Hours of Missing Data 26
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class C Slightly Unstable based on Lapse Rate

Elevations:: Winds 250ft Stability 250ft

Wind Direction Sector	Wind Speed Range (m/s)											Total
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	
N	0	0	0	0	6	5	3	0	2	6	6	28
NNE	0	0	0	1	0	3	2	1	16	3	1	27
NE	0	0	0	0	5	4	2	1	5	8	11	36
ENE	0	0	0	0	3	9	6	10	8	5	2	43
E	0	0	0	0	0	4	4	0	1	0	0	9
ESE	0	0	0	0	1	1	0	1	0	0	0	3
SE	0	0	0	0	1	1	2	1	0	0	0	5
SSE	0	0	0	0	1	4	5	4	2	3	3	22
S	0	0	0	0	0	2	2	2	2	0	0	8
SSW	0	0	0	0	0	0	1	3	0	0	0	4
SW	0	0	0	0	0	3	9	7	6	10	2	37
WSW	0	0	0	0	0	2	2	3	5	6	1	19
W	0	0	0	0	0	2	2	4	5	0	0	13
WNW	0	0	0	0	1	5	7	7	10	3	22	55
NW	0	0	0	0	4	4	3	3	3	5	47	69
NNW	0	0	0	3	9	3	2	1	2	3	11	34
Tot	0	0	0	4	31	52	52	48	67	52	106	412

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 412
 Hours of Missing Data 26
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class D Neutral based on Lapse Rate

Elevations:: Winds 250ft Stability 250ft

Wind Direction Sector	Wind Speed Range (m/s)											Total
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	
N	0	3	2	11	18	13	16	15	23	18	4	123
NNE	0	0	2	10	24	11	7	6	16	8	3	87
NE	0	2	9	16	27	15	16	16	22	7	5	135
ENE	0	2	6	11	25	27	16	27	41	34	6	195
E	0	2	6	5	28	34	50	48	48	2	0	223
ESE	0	0	3	3	10	28	26	18	19	1	0	108
SE	0	2	0	2	14	28	35	42	41	13	2	179
SSE	0	0	1	1	14	11	27	42	83	68	52	299
S	0	1	2	0	5	11	18	23	50	28	41	179
SSW	0	1	3	3	14	17	22	30	51	28	7	176
SW	0	0	0	8	19	25	36	45	95	66	24	318
WSW	0	1	1	4	16	19	32	56	125	120	136	510
W	0	0	1	2	22	16	31	37	126	97	168	500
WNW	0	1	3	4	14	27	31	36	59	64	202	441
NW	0	0	3	8	20	13	8	17	39	73	175	356
NNW	0	0	1	8	24	12	6	25	45	38	32	191
Tot	0	15	43	96	294	307	377	483	883	665	857	4020

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 4020
 Hours of Missing Data 26
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class E Slightly Stable based on Lapse Rate

Elevations:: Winds 250ft Stability 250ft

Wind Direction Sector	Wind Speed Range (m/s)										Total	
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0		>10.00
N	0	2	4	3	6	7	0	0	1	0	0	23
NNE	0	1	1	1	7	2	2	2	3	0	0	19
NE	0	1	0	6	8	4	2	4	3	2	0	30
ENE	0	1	3	4	17	15	14	16	8	2	2	82
E	0	1	8	5	26	29	33	20	5	0	0	127
ESE	0	2	2	2	9	17	19	16	3	0	0	70
SE	0	0	2	3	7	14	10	22	23	10	0	91
SSE	0	2	0	1	11	9	13	22	37	39	25	159
S	0	1	1	2	5	9	15	21	81	64	75	274
SSW	0	0	1	1	2	9	16	23	81	50	21	204
SW	0	0	0	2	7	10	19	55	140	111	16	360
WSW	0	1	0	3	10	19	28	56	112	50	16	295
W	0	2	1	8	14	19	23	30	82	43	22	244
WNW	0	0	3	4	20	19	13	17	52	42	66	236
NW	0	2	4	12	14	9	11	13	11	6	14	96
NNW	0	1	2	8	13	5	4	0	1	2	0	36
Tot	0	17	32	65	176	196	222	317	643	421	257	2346

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 2346
 Hours of Missing Data 26
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class F Moderately Stable based on Lapse Rate

Elevations:: Winds 250ft Stability 250ft

Wind Direction Sector	Wind Speed Range (m/s)											Total
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	
N	0	1	0	1	4	3	0	0	0	0	0	9
NNE	0	1	1	0	2	2	1	0	0	0	0	7
NE	0	3	3	4	1	5	0	0	2	2	0	20
ENE	0	1	2	5	6	4	4	3	4	1	0	30
E	0	2	7	4	10	12	8	12	13	1	1	70
ESE	0	0	0	6	2	6	6	6	6	3	0	35
SE	0	1	1	5	6	4	4	3	10	4	0	38
SSE	0	0	0	3	3	2	7	6	14	10	0	45
S	0	1	1	4	4	7	12	10	25	31	6	101
SSW	0	0	0	2	6	8	11	18	26	23	1	95
SW	0	1	0	1	8	9	11	18	49	11	1	109
WSW	0	2	1	2	7	6	24	27	54	1	0	124
W	0	2	1	4	11	15	13	25	16	3	0	90
WNW	0	0	3	4	14	8	8	8	12	3	11	71
NW	0	2	3	4	6	3	6	4	2	0	3	33
NNW	0	1	1	4	3	0	1	0	0	0	0	10
Tot	0	18	24	53	93	94	116	140	233	93	23	887

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 887
 Hours of Missing Data 26
 Hours in Period 8760

Joint Frequency Distribution

Site:: Ginna Primary

Period:: Months Jan - Dec for years 2017 - 2017

Stability Class G Extremely Stable based on Lapse Rate

Elevations:: Winds 250ft Stability 250ft

Wind Direction Sector	Wind Speed Range (m/s)											Total
	<0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	
N	0	0	1	0	0	0	0	0	0	0	0	1
NNE	0	0	0	4	3	1	2	0	0	0	0	10
NE	0	2	2	1	5	1	2	0	0	0	0	13
ENE	0	0	5	2	3	2	6	5	0	0	0	23
E	0	0	3	5	5	9	5	9	5	1	0	42
ESE	0	0	0	1	6	5	4	6	3	0	0	25
SE	0	0	2	4	9	5	7	8	8	1	0	44
SSE	0	1	0	3	9	6	9	4	13	7	1	53
S	0	0	2	1	3	7	10	11	19	10	3	66
SSW	0	0	0	1	4	15	13	14	14	17	0	78
SW	0	3	2	1	7	10	4	13	20	14	0	74
WSW	0	0	2	1	16	10	12	8	22	1	0	72
W	0	2	0	3	11	12	18	9	11	1	0	67
WNW	0	2	0	1	9	6	6	3	3	0	2	32
NW	0	2	2	2	4	1	0	3	0	0	1	15
NNW	0	1	1	0	1	0	0	1	0	0	0	4
Tot	0	13	22	30	95	90	98	94	118	52	7	619

Hours of Calm 0
 Hours of Variable Direction 0
 Hours of Valid Data 619
 Hours of Missing Data 26
 Hours in Period 8760