WCS-CISF-16-001

Enclosure 5

Changed WCS CISF Application and SAR Pages, Interim Revision 1

LICENSE FOR INDEPENDENT STORAGE OF SPENT NUCLEAR FUEL AND HIGH-LEVEL RADIOACTIVE WASTE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter 1, Part 72, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, and possess the power reactor spent fuel and other radioactive materials associated with spent fuel storage designated below; to use such material for the purpose(s) and at the place(s) designated below; and to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified herein.

Licensee

1. Waste Control Specialists LLC

2. Waste Control Specialists
Consolidated Interim Storage Facility
9998 Highway 176 West
Andrews, Texas, 79714

3. License No. SNM-1050
Amendment No. 0

4. Expiration Date December XX, 20XX

5. Docket or Reference No. 72-1050

6. Byproduct, Source, and/or Special Nuclear Material	7. Chemical and/or Physical Form	8. Maximum Amount That Licensee May Possess at Any One Time Under This License
A. Spent nuclear fuel elements from commercial nuclear utilities licensed pursuant to 10 CFR Part 50 and associated fuel assembly control components and associated radioactive materials related to the receipt, transfer, and storage of that spent nuclear fuel.	A. Intact fuel assemblies, damaged fuel assemblies, failed fuel and fuel debris, as allowed by Materials License SNM-2510, *Amendment 4*; Table 1-1c or Table 1-1j *of Certificate of Compliance No. 1004, Amendments 3 through 13;* Table 1-1t of Certificate of Compliance No. 1004, *Amendments 10 through 13*; Section 2.1 of Certificate of Compliance No. 1029, *Amendments 0, 1, and 3*; Section B 2.1 of Certificate of Compliance No. 1025, *Amendments 0 through 6*; Section B 2.1.2 of Certificate of Compliance No. 1015, *Amendments 0 through 5; Table B 2-1 of* Certificate of Compliance No. 1031, *Amendments 0 through 3 Revision 1, and 4 through 5*, modified as described in *Condition* 9 below.	A. 5,000 MT of Uranium or Mixed-Oxide (MOX) in the form of intact spent fuel assemblies, damaged fuel assemblies, failed fuel assemblies, and fuel debris. In addition, the cumulative amount of material received and accepted during the licensed term of the facility may not exceed 5,000 Metric Tons of Uranium plus MOX.
B. Greater than Class C Waste, *reactor* related material generated as a result of plant operations and decommissioning where radionuclide concentration limits of Class C waste in 10 CFR 61.55 are exceeded.	B. Greater than Class C Waste, as activated *and potentially surface contaminated* metals comprised of miscellaneous solid waste resulting from segmentation and decommissioning processes.	B. *231.3 MT (510,000 pounds)* of Greater than Class C Waste.

All Indicated Changes are in response to RSI NP-4.2

CHAPTER 2

DECOMMISSIONING OBJECTIVE, ACTIVITIES, AND TASKS

2.1 Decommissioning Objective

The objective of decommissioning activities at the WCS CISF is to verify that any potential radioactive contamination is below established release limits, and in the unlikely event of contamination, to identify and remove radioactive contamination having activities above the NRC release limits, so that the site may be released for unrestricted use and the NRC license terminated.

2.2 Decommissioning Activities

A final Decommissioning Plan detailing activities and procedures for decommissioning will be provided after the spent nuclear fuel is removed from the facility. The facility is configured and will be operated as a "clean" facility. All components of the facility including the transport casks and storage canisters are designed to minimize the potential for any contamination. Continual radiological survey throughout the life of the facility will be performed to identify any possible contamination and to verify that the facility remains clean. The actual decommissioning activities presented in the Final Decommissioning Plan will depend on the operating history of the facility and the results of the initial characterization survey performed at the beginning of the decommissioning period. This preliminary plan will outline the planned approach to decommissioning.

As indicated previously, the facility will be operated as a "clean" facility. Residual radioactive contamination is not anticipated at the WCS facility for several reasons:

- Canisters are surveyed and decontaminated at the generator facility to ensure the outer surfaces are clean before shipment to WCS.
- Canisters are welded shut and sealed to prevent leaks.
- Canisters will not be opened during transport to WCS or during storage at the WCS facility at any time.
- Radiological activation of storage modules and pad materials is expected to be insignificant with radiation levels below the applicable NRC criteria for unrestricted release.

The final decommissioning plan will address final status survey of the site and termination of the license. The final decommissioning plan will include detailed information on the following:

1. *A current description of the existing conditions of the site including all facilities sufficient to evaluate the acceptability of the plan;*
2. *The choice of the alternative for decommissioning and a description of the activities involved including:*

All Indicated Changes are in response to OBS NP-14.1

- Organization and staffing
- Site Preparation
- Procedures for removal of systems and components
- Design activities
- Procurement
- Outside contractors
- Procedures for decontamination
- Procedures for radiological survey
- Schedule

3. *A description of controls and limits on procedures and equipment to protect occupational and public health and safety;*
4. *A description of the planned final radiation survey;*
5. *An updated detailed cost estimate for the chosen alternative for decommissioning, a comparison of that estimate with present funds set aside for decommissioning, and a plan for assuring the availability of adequate funds for completion of the decommissioning including means for adjusting cost estimates and associated funding levels over any storage or surveillance period;*
6. *A description of technical specifications and quality assurance provisions in place during decommissioning;*

The final plan will evaluate NRC criteria for decommissioning to ensure all requirements are satisfied. Decommissioning activities will be planned using ALARA principles and in a manner that protects the public and environment during the process.

2.3 Decontamination Tasks

Once all of the spent nuclear fuel canisters stored at WCS have been shipped off-site and the decommissioning period begins, characterization surveys will be performed to verify that the storage modules and the storage pads are free of contamination. It is anticipated that the storage modules and pads will not be contaminated and will be left in place or removed as determined by WCS. In the unlikely event the characterization surveys identify contamination levels above the NRC limits for unrestricted release, conventional decontamination techniques will be used which minimize the volume of waste. Any waste generated will be sent to a licensed facility for disposal. For conservatism in Financial Assurance, WCS assumes some contamination will be present.

2.4 Decommissioning Organization

Successful planning and execution of the decommissioning plan will include utilizing individuals within the WCS organization. In addition to WCS staff, many of the decommissioning activities will be performed by contractors. The Final Decommissioning Plan will provide information on WCS

All Indicated Changes are in response to OBS NP-14.1

- *Canisterized GTCC waste that consists of only reactor related low-level radioactive waste generated as a result of plant operation and decommissioning where the radionuclide concentration limits of 10 CFR 61.55 are exceeded. This waste may include such components as incore components, core support structures, and small reactor related miscellaneous parts resulting from the reactor vessel internals segmentation/decommissioning processes.*
- *All waste stored within the various GTCC canisters will be in the physical form of activated metals that may have surface contamination. The GTCC canisters will not contain process wastes containing paper, plastics or ion exchange resins that could result in the generation of combustible gases or chemical or galvanic corrosion reactions with the canister.*

Aging Management considerations for the canisters and storage overpacks are discussed in Section 11.5.

1.2.5 Waste Products Generated During Operations

As described in Chapter 6, there are minimal radioactive wastes generated at the WCS CISF. Gaseous and liquid wastes are not generated at the WCS CISF. Small volumes of solid radioactive waste may be produced from routine operations involving contamination surveys and decontamination activities involving incoming and outgoing transportation casks and equipment. Potential solid waste streams are collected and temporarily stored on site *until authorization under WCS Low Level Radioactive Waste (LLRW) License RML R04100 allows* for processing and disposal.

All Indicated Changes are in response to RSI NP-4.2

Table 1-1
Storage Systems at the WCS CISF

Cask System	NRC Docket No.	Canister	Overpack
NUHOMS® MP187 Cask System	71-9255 72-11 (SNM-2510)	FO-DSC	HSM (Model 80)
		FC-DSC	
		FF-DSC	
		GTCC Canister	
Advanced Standardized NUHOMS® System	71-9255 72-1029	NUHOMS® 24PT1	AHSM
Standardized NUHOMS® System	71-9302 72-1004	NUHOMS® 61BT	HSM Model 102
		NUHOMS® 61BTH Type 1	
NAC-MPC	71-9235 72-1025	Yankee Class	VCC
		Connecticut Yankee	
		LACBWR	
		GTCC-Canister-CY	
		GTCC-Canister-YR	
NAC-UMS	71-9270 72-1015	Classes 1 through 5	VCC
		GTCC-Canister-MY	
MAGNASTOR	71-9356 72-1031	TSC1 through TSC4	CC1 through CC4
		GTCC-Canister-ZN	

All Indicated Changes are in response to RSI NP-4.2

All Indicated Changes are in response to OBS NP-2.1

2.3 Meteorology

The proposed WCS CISF has been examined with respect to site, local and regional climatological and meteorological conditions and history that demonstrate that the safe operation of the facility would not be affected.

2.3.1 Regional Climatology

The Weather Forecast Office at Midland, Texas covers the High Plains where the proposed WCS CISF is located. The climate of the WCS CISF in Andrews County, TX can best be described as "semi-arid continental" marked with four seasons. Summers are typically hot, dry weather with the relative humidity being generally low. July is the hottest month with high temperatures occasionally reaching above 100 degrees Fahrenheit. January is the coldest month, although the winters are not generally severe. Temperatures occasionally dip below 32 degrees Fahrenheit.

Precipitation levels are generally very low in this arid climate. The precipitation tends to be heavier in the summer and fall.

During the winter, the regional weather is often dominated by a high-pressure system in the central part of the western United States and a low-pressure system in north-central Mexico. The region is affected by a low-pressure system located over Arizona in the summer.

2.3.2 Local Meteorology

The Weather Forecast Office at Midland-Odessa, Texas covers the High Plains where the proposed WCS CISF is located. In addition to the weather forecast office in Midland, climatological data for atmospheric variables such as temperature, pressure, winds, and precipitation are also collected at stations in Jal, New Mexico; Hobbs, New Mexico; and Andrews, Texas. Table 2-1 indicates the distances and directions of these stations from the WCS CISF and the length of record for the reported data *in the application*. *Additionally, WCS compiled meteorological and climatology data from on-site and off-site stations for the WCS Low Level License R04100 (TCEQ 2015) and this data, which includes the period 1914 to 2006, is included in Attachment H. Attachment H includes compiled meteorological and climatology data from four (4) stations within 65 miles of WCS.*

The WCS site and surrounding meteorological stations listed above are all located in a climatic region classified within the Köppen Classification System as BSk or Arid semi-cold. The CISF elevation is approximately 1,044 meters msl and the surrounding meteorological stations range from 947 meters msl to 1,118 meters msl and are listed in Table 3.6-1 in the CISF Environmental Report, Section 3.6.2.

Using a series of tables and wind-rose diagrams from on and off-site stations, Attachment H demonstrates that data collected from within 65 miles of the site can be considered representative of the general climate of the site.

All Indicated Changes are in response to OBS NP-2.1

Attachment H

Compiled Meteorological and Climatology Data

(80 pages)

Please Note: The attachment is Section 2.3.1, Meteorological and Climatology Data, Revision 12a, dated March 16, 2007, from the APPLICATION FOR LICENSE TO AUTHORIZE NEAR-SURFACE LAND DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE

Added in response to OBS NP-2.1

APPENDIX 2.3.1
METEOROLOGICAL AND CLIMATOLOGY DATA

Added in response to OBS NP-2.1

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Added in response to OBS NP-2.1

1.0 COLLECTION OF METEOROLOGICAL DATA

Meteorological data have been collected on the WCS property to meet two primary criteria. First, precipitation and evaporation data have been collected as required for determining a water balance for the proposed Site. Second, air quality data have been collected for analyzing potential releases of airborne radioactivity.

Data were collected from the on-site meteorological station operated by WCS as well as four additional stations in the area for use as a comparative analysis. The data collected by the on-site meteorological station operated by WCS (WCS station) is summarized in conjunction with data collected by the four regional weather stations listed below:

- WCS Station, located on the WCS property approximately ½ mile southwest of the proposed Site. The WCS station data was collected during the period from January 2000 through December 2005. The WCS Station data is tabulated in Tables 25 through 40 and Figures 8 through 17. WCS station has sensors at both the 2-meter (lower) and 10-meter (upper) height intervals.
- Andrews, Texas station located 50 km (31 miles) southeast of the proposed Site. Data averages, unless otherwise noted, are based on available historic records from 1914–2006, using climate summaries updated on November 2, 2006 (WRCC, 2006). Data for this station are included in Tables 1 through 5 and Figure 1.
- Midland-Odessa Regional Airport, Texas station located 103 km (64 miles) southeast of the proposed Site. Data averages, unless otherwise noted, are based on available historic records from 1948–2006, using climate summaries updated on November 2, 2006 (WRCC, 2006). Data for this station are provided in Tables 13 through 24 and Figures 2 through 7.
- Hobbs, New Mexico station located 32 km (20 miles) northwest of the proposed Site. Data averages, unless otherwise noted, are based on available historic records from 1914–2006, using climate summaries updated on July 28, 2006 (WRCC, 2006). Data for this station are provided in Tables 6 through 9. While there are two weather stations for Hobbs, NM, the airport station has only limited data for a drier ten-year period. So the other weather station in Hobbs, NM (ID 29-4026), which has a much longer historical record (at least 70 years of recorded data), was included in the climate summaries.
- Jal, New Mexico station located 39 km (24 miles) southwest of the proposed Site. Data averages, unless otherwise noted, are based on available historic records from 1919–2006, using climate summaries updated on July 28, 2006 (WRCC, 2006). Data for station are provided in Tables 10 through 12.

The Andrews, Midland, Hobbs, and Jal stations provide a long-term data set to compare against the 6-year data set collected at the WCS station. The Midland-Odessa station is the closest "First-Order" station to the proposed Site and is operated by the National Weather Service.

Added in response to OBS NP-2.1

2.0 TEMPERATURE AND HUMIDITY

On-site measured air temperatures at 2 meters were consistent with an annual pattern of high summer temperatures and low fall (and winter) temperatures as indicated in Table 25 in this appendix. The highest and lowest temperatures recorded on-site between January of 2000 and December of 2005 was 107.9 degrees F and 3.7 degrees F, respectively. The mean monthly average temperatures on-site ranged from 82.0 degrees F in July to 42.2 degrees F in December. The lowest and highest relative humidity values recorded are from 30% in April (lower station) to 84% in October (lower station). The average monthly relative humidity ranged from 50% in April (upper station) to 70% in October (lower station). On-site humidity data for the upper and lower stations are summarized in Tables 27 and 28 respectively in this appendix.

Summaries of the historic record of temperature data, including minimums, maximums, and means, for the Andrews, Hobbs, Jal, and Midland meteorological stations are included in Tables 1, 6, 10, and 13 in this appendix.

3.0 PRECIPITATION

Precipitation data for the WCS station are presented in Table 26 and Table 26A in this appendix. The average annual rainfall at the proposed Site from January 2000 through December 2005 is 15.8 inches. The maximum on-site rainfall amount recorded for a 24-hour period is 4.45 inches. Minimum and maximum monthly rainfall totals recorded for this period were 0.1 and 8.8 inches, respectively. Snow and freezing rain data were not collected at the WCS station.

Summaries of the historic record of rainfall data are presented in Tables 2, 7, 11, and 14 of this appendix for the Andrews, Hobbs, Jal, and Midland meteorological stations. Average annual totals for the respective periods of record were 15.3 inches for Andrews, 16.0 inches for Hobbs, 12.5 inches for Jal, and 14.0 inches for Midland. These tables also present the minimum and maximum monthly totals. The data for all stations clearly demonstrated an annual rainfall in the region of less than 20 inches. The maximum 24-hour maximum rainfall amounts recorded at the four stations were 7.6, 7.5, 5.6, and 4.8 inches for Andrews, Hobbs, Jal, and Midland, respectively. By comparison, the 24-hour, 100-year storm event for the region, as calculated by NOAA, is 6.1 inches (Miller et al., 1973).

Annual snowfall averages were recorded at 3.4, 5.1, 3.5, and 4.1 inches for Andrews, Hobbs, Jal, and Midland, respectively. Summaries of the historic record of snow data, including averages, maximums, and minimums, for the Andrews, Hobbs, Jal, and Midland meteorological stations are included in Tables 3, 8, 12, and 15 in this appendix.

Added in response to OBS NP-2.1

4.0 WIND AND ATMOSPHERIC STABILITY

Wind speed and direction data measured at the WCS station at the 2- (lower) and 10-meter height (upper) are presented in Figures 8 through 12 and 13 through 17 in this appendix, respectively. These data were used to develop joint frequency distributions of wind speed and direction. The data are summarized in Tables 29 through 33 and 35 through 39 in this appendix. Wind direction measured on-site is primarily from the south, south-southeast, and south-southwest, with the greatest percentage from the south. These sectors together account for 28.5 percent of hourly average wind data for the period. The next most frequent wind direction is east-northeast, northeast and east sectors accounting for 17.2%. Average wind speeds varied very little from month to month. The strongest average winds during the monitoring period were from the southerly directions with average wind speeds of 8 to 11.5 mph. The highest one-hour wind speeds occurred during September, blowing from the south-southeast direction. The highest recorded one-hour wind speeds were 32.8 and 43.6 miles per hour at the 2-meter and 10-meter height, respectively.

The Pasquill-Gifford method was used to estimate atmospheric stability at the site using the 2- and 10-meter wind data collected from the WCS station. The joint frequency distributions of wind speed and direction as a function of Pasquill stability class (A-F) are presented in Tables 34 and 40 for the 2-meter and 10-meter stations. Midland-Odessa Station using National Weather Service meteorological data for same joint frequency distributions is presented for the 10-meter height in Table 24. Five years of data (1999 through 2003) from the Midland-Odessa Station were used in comparison to the WCS station data collected between 2000 and 2005.

The most important and potentially adverse condition for atmospheric dispersion, stable (Class F) and low wind speeds 0.4 to 1.3 m/s (1.0 to 3.0 mi/hr) occur 2.2% of the time. The highest occurrences of Pasquill Class F and low wind speeds with respect to wind direction are toward the south. Mixing height limits recorded for Midland reported by Draxler and Heffter, (1981) ranged from 1592 feet in the winter to 2381 feet in the summer, with an annual average of 2014 feet.

5.0 NATURAL HAZARDS AND STORM ACTIVITY

Sand or dust storms typically occur in the winter or early spring when rotors (horizontal vortices) generated by strong westerly winds blowing across the region touch the ground. Most episodes of dust prevail for only six hours or less, when visibility is restricted to less than 0.5 mile. Statistical information is lacking on seasonal distribution intensity and duration of dust storms for the region. Recent data recorded in Lubbock, Texas (110 miles northeast of the site) indicates blowing dust an average of 12 times in the spring and 9 times during the remainder of the year (Bomar, 1995).

Two F2 Class (wind speed from 113 to 157 mph) tornadoes have been recorded in Andrews County, TX from 1880 through 1989 (Grazulis, 1993). According to data reported by NOAA, there has been two F2 Class and eight F1 Class (wind speed from 73 to 112 mph) tornadoes recorded in Andrews County since 1950. The NOAA web search for tornadoes is included as Attachment 5 in this appendix.

The mean number of annual thunderstorm days for Hobbs, NM and Midland, TX is 25.5 and 36.4 days, respectively (Weather Disk Association, Inc., 1990; NOAA, 2004). No records are

Added in response to OBS NP-2.1

maintained for the frequency of thunderstorms at the proposed Site. However, the actual number of events can be expected to be similar to these regional data.

Information regarding extreme natural events, such as flooding, thunderstorms, high winds, hail, and lightning, are presented in Tables 41 - 43 and Attachments 1 – 4. As previously mentioned, the NOAA web search for tornadoes is included as Attachment 5 in this appendix.

Table 1. Andrews, TX Period of Record Temperature Data (1914–2006)

Month	Mean Monthly Temperature		Mean Daily Max. Temperature		Mean Daily Min. Temperature		Highest Daily Max. Temperature		Lowest Daily Min. Temperature	
	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)
January	6.8	(44.2)	14.5	(58.1)	-1.0	(30.2)	29.4	(85.0)	-17.8	(0.0)
February	9.2	(48.6)	17.3	(63.2)	1.1	(33.9)	31.7	(89.0)	-18.3	(-1.0)
March	13.2	(55.8)	21.7	(71.1)	4.7	(40.4)	36.1	(97.0)	-13.3	(8.0)
April	18.2	(64.8)	26.9	(80.4)	9.5	(49.1)	37.2	(99.0)	-5.0	(23.0)
May	22.7	(72.9)	30.9	(87.7)	14.5	(58.1)	41.7	(107.0)	0.6	(33.0)
June	26.4	(79.6)	34.2	(93.6)	18.6	(65.5)	45.0	(113.0)	5.0	(41.0)
July	27.5	(81.5)	34.8	(94.6)	20.2	(68.3)	43.9	(111.0)	13.9	(57.0)
August	26.7	(80.1)	33.9	(93.0)	19.6	(67.2)	41.1	(106.0)	12.2	(54.0)
September	23.3	(74.0)	30.4	(86.8)	16.2	(61.1)	40.0	(104.0)	3.3	(38.0)
October	18.3	(64.9)	26.0	(78.8)	10.5	(50.9)	38.3	(101.0)	-5.6	(22.0)
November	11.7	(53.0)	19.2	(66.6)	4.1	(39.4)	33.9	(93.0)	-11.7	(11.0)
December	7.5	(45.5)	15.1	(59.1)	-0.1	(31.9)	27.2	(81.0)	-17.2	(1.0)
Annual	**17.6**	**(63.7)**	**25.4**	**(77.8)**	**9.8**	**(49.7)**	**45.0**	**(113.0)**	**-18.3**	**(-1.0)**

Source: (WRCC, 2006)

Added in response to OBS NP-2.1

Table 2. Andrews, TX Period of Record Precipitation Data (1914–2006)

Precipitation cm (inches)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Average	1.24 (0.49)	1.50 (0.59)	1.70 (0.67)	2.41 (0.95)	4.19 (1.65)	4.88 (1.92)	5.74 (2.26)	4.78 (1.88)	5.72 (2.25)	3.78 (1.49)	1.58 (0.62)	1.35 (0.53)	**38.86 (15.30)**
Maximum	11.40 (4.49)	6.40 (2.52)	8.46 (3.33)	13.67 (5.38)	14.91 (5.87)	18.06 (7.11)	30.23 (11.90)	14.00 (5.51)	20.17 (7.94)	16.16 (6.36)	8.00 (3.15)	7.80 (3.07)	**78.66 (30.97)**
Minimum	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.36 (0.14)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	**19.30 (7.60)**
Max 24 Hr	5.61 (2.21)	2.54 (1.00)	4.70 (1.85)	6.30 (2.48)	7.62 (3.00)	9.40 (3.70)	19.30 (7.60)	6.10 (2.40)	8.90 (3.50)	5.21 (2.05)	5.33 (2.10)	3.94 (1.55)	**19.30 (7.60)**

Source: (WRCC, 2006)

Table 3. Andrews, TX Period of Record Snow Data (1914–2006)

Snow cm (inches)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Average	3.33 (1.31)	1.52 (0.60)	0.08 (0.03)	0.15 (0.06)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.08 (0.03)	1.45 (0.57)	1.98 (0.78)	**8.59 (3.38)**
Maximum	25.40 (10.00)	17.78 (7.00)	2.54 (1.00)	6.35 (2.50)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	2.54 (1.00)	35.56 (14.00)	13.97 (5.50)	**52.07 (20.50)**
Minimum	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	**0.00 (0.00)**
Max 24 Hr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Source: (WRCC, 2006)

Added in response to OBS NP-2.1

Table 4. Andrews, TX Wind Data (1985–1989)

Wind Direction and Wind Speed Distribution*							
Wind Direction**	1 - 3 mph***	4 - 7 mph	8 - 12 mph	13 - 18 mph	19 - 24 mph	> 24 mph	Total
N	0.46	1.69	1.72	1.39	0.50	0.11	5.87
NNE	0.24	0.76	1.29	1.21	0.43	0.12	4.05
NE	0.24	0.72	1.57	1.60	0.55	0.17	4.86
ENE	0.20	0.87	1.71	1.79	0.33	0.06	4.96
E	0.30	1.45	2.79	1.72	0.19	0.03	6.48
ESE	0.30	1.43	2.57	1.15	0.10	0.02	5.56
SE	0.45	2.23	2.88	1.68	0.18	0.02	7.45
SSE	0.63	2.82	3.75	3.19	0.63	0.08	11.10
S	0.91	4.00	6.43	7.29	1.45	0.11	20.19
SSW	0.40	1.77	2.96	1.92	0.21	0.01	7.26
SW	0.26	0.98	2.16	1.50	0.22	0.04	5.17
WSW	0.23	0.83	1.53	1.44	0.42	0.15	4.59
W	0.32	0.77	1.42	1.21	0.42	0.22	4.35
WNW	0.29	0.62	0.65	0.53	0.14	0.07	2.30
NW	0.34	0.88	0.85	0.47	0.12	0.07	2.72
NNW	0.33	1.17	0.84	0.56	0.17	0.04	3.11
SubTotal	**5.88**	**22.98**	**35.12**	**28.64**	**6.05**	**1.34**	**100**

* average of 5 years of data (1985–1989) available from TNRCC (TCEQ)
** wind is from the indicated direction
*** calms are included in this data range (winds are calm a total of 2.46 percent of the time)
Source: Environmental Analysis for Class C Radioactive Waste Processing and Storage Facility, Table 2.1-3

Table 5. Andrews, TX Stability Table (1985–1989)

Stability Class	Frequency (% of total occurrence)
A	0.50
B	4.12
C	12.38
D	49.36
E	17.89
F	15.74

Note: Average of 5 years of data (1985–1989) available from TNRCC (TCEQ)
Source: Environmental Analysis for Class C Radioactive Waste Processing and Storage Facility, Table 2.1-4

Added in response to OBS NP-2.1

Table 6. Hobbs, NM Period of Record Temperature Data (1914–2006)

Month	Mean Monthly Temperature		Mean Daily Max. Temperature		Mean Daily Min. Temperature		Highest Daily Max. Temperature		Lowest Daily Min. Temperature	
	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)
January	5.7	(42.2)	13.6	(56.5)	-2.3	(27.9)	28.3	(83.0)	-21.7	(-7.0)
February	8.3	(47.0)	16.7	(62.0)	0.0	(32.0)	30.6	(87.0)	-18.9	(-2.0)
March	11.8	(53.2)	20.5	(68.9)	3.0	(37.4)	35.0	(95.0)	-17.2	(1.0)
April	16.7	(62.0)	25.4	(77.8)	7.9	(46.2)	36.7	(98.0)	-7.8	(18.0)
May	21.3	(70.4)	29.7	(85.5)	12.9	(55.3)	41.7	(107.0)	1.1	(34.0)
June	25.6	(78.1)	33.8	(92.9)	17.4	(63.4)	45.6	(114.0)	4.4	(40.0)
July	26.8	(80.2)	34.3	(93.8)	19.2	(66.6)	43.3	(110.0)	10.0	(50.0)
August	26.0	(78.8)	33.4	(92.1)	18.7	(65.6)	41.7	(107.0)	8.3	(47.0)
September	22.6	(72.7)	29.9	(85.9)	15.2	(59.4)	40.6	(105.0)	1.1	(34.0)
October	17.1	(62.8)	25.1	(77.1)	9.2	(48.5)	36.7	(98.0)	-11.1	(12.0)
November	10.6	(51.0)	18.4	(65.2)	2.7	(36.8)	31.1	(88.0)	-15.6	(4.0)
December	6.6	(43.9)	14.4	(58.0)	-1.4	(29.5)	28.9	(84.0)	-18.3	(-1.0)
Annual	**16.6**	**(61.9)**	**24.6**	**(76.3)**	**8.6**	**(47.4)**	**45.6**	**(114.0)**	**-21.7**	**(-7.0)**

Source: (WRCC, 2006)

Added in response to OBS NP-2.1

Table 7. Hobbs, NM Period of Record Precipitation Data (1914–2006)

PRECIPITATION CM (INCHES)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average	1.14 (0.45)	1.14 (0.45)	1.40 (0.55)	2.03 (0.80)	5.21 (2.05)	4.78 (1.88)	5.36 (2.11)	6.02 (2.37)	6.60 (2.60)	4.04 (1.59)	1.47 (0.58)	1.42 (0.56)	**40.59 (15.98)**
Maximum	7.52 (2.96)	6.20 (2.44)	7.57 (2.98)	13.13 (5.17)	35.13 (13.83)	23.62 (9.30)	23.90 (9.41)	23.29 (9.17)	32.99 (12.99)	20.70 (8.15)	11.00 (4.33)	12.90 (5.08)	**81.76 (32.19)**
Minimum	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.10 (0.04)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	**13.41 (5.28)**
Max 24 Hr	3.07 (1.21)	3.53 (1.39)	5.08 (2.00)	4.75 (1.87)	13.21 (5.20)	11.23 (4.42)	11.35 (4.47)	11.30 (4.45)	19.05 (7.50)	14.22 (5.60)	9.65 (3.80)	4.72 (1.86)	**19.05 (7.50)**

Source: (WRCC, 2006)

Table 8. Hobbs, NM Period of Record Snow Data (1914–2006)

SNOW CM (INCHES)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average	3.53 (1.39)	2.95 (1.16)	1.47 (0.58)	0.56 (0.22)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.28 (0.11)	1.63 (0.64)	2.49 (0.98)	**12.90 (5.08)**
Maximum	31.75 (12.50)	36.32 (14.30)	25.40 (10.00)	22.86 (9.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	11.43 (4.50)	41.91 (16.50)	24.13 (9.50)	**68.83 (27.10)**
Minimum	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	**0.00 (0.00)**
Max 24 Hr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Source: (WRCC, 2006)

Added in response to OBS NP-2.1

Table 9. Hobbs, NM Particulate Matter Monitor Summary (2002–2003)

98% PM2.5 µg/m3	Annual Mean PM2.5 µg/m3	99% PM10 µg/m3	Annual Mean PM 10 µg/m3	Year	County
18	6.6	57	17	2002	Lea
13	5.5	61	23	2003	Lea

Source: (EPA, 2003b)

Table 10. Jal, NM Period of Record Temperature Data (1919–2006)

Month	Mean Monthly Temperature		Mean Daily Max. Temperature		Mean Daily Min. Temperature		Highest Daily Max. Temperature		Lowest Daily Min. Temperature	
	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)
January	6.7	(44.0)	15.5	(59.9)	-2.2	(28.1)	29.4	(85.0)	-23.9	(-11.0)
February	9.4	(49.0)	18.6	(65.4)	0.4	(32.7)	31.7	(89.0)	-22.2	(-8.0)
March	13.2	(55.8)	22.7	(72.8)	3.8	(38.8)	36.7	(98.0)	-17.8	(0.0)
April	18.1	(64.6)	27.5	(81.5)	8.7	(47.7)	38.9	(102.0)	-5.6	(22.0)
May	22.8	(73.0)	31.7	(89.0)	13.8	(56.8)	41.7	(107.0)	-2.2	(28.0)
June	26.8	(80.3)	35.2	(95.4)	18.4	(65.2)	44.4	(112.0)	4.4	(40.0)
July	27.9	(82.2)	35.8	(96.5)	20.0	(68.0)	44.4	(112.0)	10.0	(50.0)
August	27.1	(80.8)	34.9	(94.8)	19.3	(66.7)	43.3	(110.0)	10.0	(50.0)
September	23.6	(74.5)	31.5	(88.7)	15.7	(60.3)	42.2	(108.0)	2.8	(37.0)
October	18.1	(64.6)	26.8	(80.3)	9.4	(49.0)	37.8	(100.0)	-6.7	(20.0)
November	11.5	(52.7)	20.2	(68.4)	2.7	(36.8)	31.7	(89.0)	-13.3	(8.0)
December	7.3	(45.2)	16.2	(61.1)	-1.5	(29.3)	28.9	(84.0)	-19.4	(-3.0)
Annual	**17.7**	**(63.9)**	**26.4**	**(79.5)**	**9.1**	**(48.3)**	**44.4**	**(112.0)**	**-23.9**	**(-11.0)**

Source: (WRCC, 2006)

Added in response to OBS NP-2.1

Table 11. Jal, NM Period of Record Precipitation Data (1919–2006)

PRECIPITATION CM (INCHES)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average	1.04 (0.41)	1.27 (0.50)	1.02 (0.40)	1.45 (0.57)	3.61 (1.42)	3.48 (1.37)	4.34 (1.71)	4.70 (1.85)	4.88 (1.92)	3.48 (1.37)	1.24 (0.49)	1.22 (0.48)	**31.72 (12.49)**
Maximum	8.38 (3.30)	6.91 (2.72)	4.47 (1.76)	8.00 (3.15)	20.35 (8.01)	14.88 (5.86)	17.35 (6.83)	21.16 (8.33)	19.41 (7.64)	17.53 (6.90)	10.36 (4.08)	11.05 (4.35)	**63.55 (25.02)**
Minimum	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	**6.22 (2.45)**
Max 24 Hr	2.41 (0.95)	4.45 (1.75)	3.05 (1.20)	5.59 (2.20)	8.81 (3.47)	5.97 (2.35)	7.09 (2.79)	10.13 (3.99)	10.16 (4.00)	14.33 (5.64)	5.99 (2.36)	5.74 (2.26)	**14.33 (5.64)**

Source: (WRCC, 2006)

Table 12. Jal, NM Period of Record Snow Data (1919–2006)

SNOW CM (INCHES)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average	3.10 (1.22)	1.80 (0.71)	0.74 (0.29)	0.03 (0.01)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.08 (0.03)	1.37 (0.54)	1.85 (0.73)	**8.97 (3.53)**
Maximum	21.84 (8.60)	17.53 (6.90)	13.97 (5.50)	1.27 (0.50)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	2.54 (1.00)	40.64 (16.00)	20.32 (8.00)	**41.91 (16.50)**
Minimum	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	**0.00 (0.00)**
Max 24 Hr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Source: (WRCC, 2006)

Added in response to OBS NP-2.1

Table 13. Midland, TX Period of Record Temperature Data (1948–2006)

Month	Mean Monthly Temperature		Mean Daily Max. Temperature		Mean Daily Min. Temperature		Highest Daily Max. Temperature		Lowest Daily Min. Temperature	
	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)
January	6.5	(43.7)	14.1	(57.3)	-1.1	(30.1)	28.9	(84.0)	-22.2	(-8.0)
February	8.9	(48.1)	16.7	(62.0)	1.2	(34.1)	32.2	(90.0)	-23.9	(-11.0)
March	12.9	(55.2)	21.0	(69.8)	4.8	(40.6)	35.0	(95.0)	-12.8	(9.0)
April	17.9	(64.2)	26.0	(78.8)	9.7	(49.5)	38.3	(101.0)	-6.7	(20.0)
May	22.7	(72.9)	30.4	(86.7)	15.1	(59.1)	42.2	(108.0)	1.1	(34.0)
June	26.7	(80.0)	33.9	(93.0)	19.4	(66.9)	46.7	(116.0)	8.3	(47.0)
July	27.7	(81.9)	34.7	(94.5)	20.8	(69.4)	44.4	(112.0)	11.7	(53.0)
August	27.2	(80.9)	34.1	(93.3)	20.3	(68.5)	41.7	(107.0)	12.2	(54.0)
September	23.6	(74.4)	30.3	(86.6)	16.7	(62.1)	41.7	(107.0)	2.2	(36.0)
October	18.2	(64.7)	25.3	(77.6)	10.9	(51.7)	37.8	(100.0)	-4.4	(24.0)
November	11.4	(52.5)	18.8	(65.9)	3.9	(39.1)	32.2	(90.0)	-10.6	(13.0)
December	7.3	(45.2)	14.9	(58.8)	-0.2	(31.7)	29.4	(85.0)	-18.3	(-1.0)
Annual	**17.6**	**(63.6)**	**25.0**	**(77.0)**	**10.1**	**(50.2)**	**46.7**	**(116.0)**	**-23.9**	**(-11.0)**

Source: (WRCC, 2006)

Added in response to OBS NP-2.1

Table 14. Midland, TX Period of Record Precipitation Data (1948–2006)

Precipitation cm (inches)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Average	1.35 (0.53)	1.63 (0.64)	1.32 (0.52)	1.83 (0.72)	4.85 (1.91)	3.96 (1.56)	4.45 (1.75)	4.14 (1.63)	4.95 (1.95)	4.11 (1.62)	1.68 (0.66)	1.27 (0.50)	**35.56 (14.00)**
Maximum	9.30 (3.66)	6.48 (2.55)	7.26 (2.86)	6.20 (2.44)	19.38 (7.63)	10.06 (3.96)	21.59 (8.50)	11.25 (4.43)	24.64 (9.70)	18.92 (7.45)	13.77 (5.42)	8.38 (3.30)	**81.61 (32.13)**
Minimum	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.05 (0.02)	0.03 (0.01)	0.00 (0.00)	0.13 (0.05)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	**11.68 (4.60)**
Max 24 Hr	2.84 (1.12)	3.10 (1.22)	5.49 (2.16)	4.11 (1.62)	12.07 (4.75)	7.80 (3.07)	10.41 (4.10)	6.12 (2.41)	8.36 (3.29)	9.12 (3.59)	4.50 (1.77)	3.15 (1.24)	**12.07 (4.75)**

Source: (WRCC, 2006)

Table 15. Midland, TX Period of Record Snow Data (1948–2006)

Snow cm (inches)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Average	4.04 (1.59)	1.93 (0.76)	0.84 (0.33)	0.13 (0.05)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.03 (0.01)	0.94 (0.37)	2.44 (0.96)	**10.34 (4.07)**
Maximum	22.86 (9.00)	9.91 (3.90)	14.99 (5.90)	5.08 (2.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	1.52 (0.60)	18.29 (7.20)	24.89 (9.80)	**30.73 (12.10)**
Max 24 Hr	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	**0.00 (0.00)**

Source: (WRCC, 2006)

Added in response to OBS NP-2.1

Table 16. Midland, TX Six-Year Temperature Data (2000–2005)

MONTH	MEAN MONTHLY TEMPERATURE		MEAN DAILY MAX. TEMPERATURE		MEAN DAILY MIN. TEMPERATURE		HIGHEST DAILY MAX. TEMPERATURE		LOWEST DAILY MIN. TEMPERATURE	
	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)
January	7.6	(45.7)	14.5	(58.1)	0.6	(33.1)	28.3	(83.0)	-17.8	(0.0)
February	8.9	(48.0)	15.8	(60.4)	1.9	(35.5)	28.9	(84.0)	-18.3	(-1.0)
March	13.0	(55.4)	20.4	(68.7)	5.6	(42.0)	31.1	(88.0)	-13.3	(8.0)
April	18.6	(65.5)	26.6	(79.8)	10.6	(51.1)	35.6	(96.0)	-5.0	(23.0)
May	24.0	(75.2)	31.7	(89.0)	16.3	(61.4)	42.2	(108.0)	0.6	(33.0)
June	27.2	(81.0)	33.9	(93.1)	20.4	(68.7)	40.6	(105.0)	5.0	(41.0)
July	28.5	(83.3)	35.2	(95.3)	21.8	(71.3)	41.1	(106.0)	13.9	(57.0)
August	27.8	(82.0)	34.3	(93.8)	21.2	(70.1)	41.1	(106.0)	12.2	(54.0)
September	24.3	(75.8)	31.1	(88.0)	17.5	(63.5)	40.0	(104.0)	3.3	(38.0)
October	18.2	(64.8)	24.3	(75.7)	12.1	(53.8)	38.3	(101.0)	-5.6	(22.0)
November	11.1	(51.9)	17.5	(63.5)	4.6	(40.3)	30.6	(87.0)	-11.7	(11.0)
December	6.7	(44.1)	13.9	(57.1)	-0.5	(31.1)	28.3	(83.0)	-17.2	(1.0)
Annual	**18.0**	**(64.4)**	**24.9**	**(76.9)**	**11.0**	**(51.8)**	**42.2**	**(108.0)**	**-18.3**	**(-1.0)**

Source: (NOAA, 2006)

Added in response to OBS NP-2.1

Table 17. Midland, TX Six-Year Precipitation Data (2000–2005)

PRECIPITATION CM (INCHES)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average	1.14 (0.45)	2.26 (0.89)	1.85 (0.73)	1.04 (0.41)	3.07 (1.21)	3.48 (1.37)	2.79 (1.10)	3.78 (1.49)	3.15 (1.24)	5.54 (2.18)	3.56 (1.40)	0.71 (0.28)	**32.36 (12.74)**
Maximum	1.75 (0.69)	3.84 (1.51)	3.38 (1.33)	4.78 (1.88)	7.98 (3.14)	7.98 (3.14)	6.40 (2.52)	8.74 (3.44)	13.49 (5.31)	9.50 (3.74)	13.77 (5.42)	2.67 (1.05)	**57.02 (22.45)**
Minimum	0.20 (0.08)	0.00 (0.00)	0.43 (0.17)	0.00 (0.00)	0.25 (0.10)	0.03 (0.01)	0.00 (0.00)	0.15 (0.06)	0.00 (0.00)	0.08 (0.03)	0.03 (0.01)	0.00 (0.00)	**23.75 (9.35)**
Max 24 Hr	0.89 (0.35)	1.57 (0.62)	1.80 (0.71)	3.38 (1.33)	4.72 (1.86)	2.67 (1.05)	4.04 (1.59)	5.74 (2.26)	3.15 (1.24)	2.95 (1.16)	3.94 (1.55)	2.13 (0.84)	**5.74 (2.26)**

Source: (NOAA, 2006)

Added in response to OBS NP-2.1

Table 18. Midland, TX Wind Data (1999)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.002352	0.011441	0.012083	0.010372	0.003529	0.001390	0.041168
NNE	0.002352	0.008234	0.010158	0.013045	0.004812	0.000962	0.039564
NE	0.001604	0.005881	0.013794	0.017216	0.006737	0.001390	0.046621
ENE	0.001711	0.008982	0.015719	0.018392	0.005346	0.000535	0.050684
E	0.001604	0.010051	0.018071	0.012725	0.002459	0.000214	0.045124
ESE	0.002139	0.011976	0.017964	0.012725	0.002673	0.000428	0.047904
SE	0.004812	0.018499	0.025663	0.020958	0.004812	0.001925	0.076668
SSE	0.003101	0.028336	0.040740	0.039991	0.012404	0.003956	0.128529
S	0.002887	0.022883	0.053144	0.063195	0.013901	0.001604	0.157613
SSW	0.001818	0.015932	0.037639	0.028122	0.003315	0.000214	0.087040
SW	0.002139	0.014542	0.028978	0.013259	0.001925	0.000535	0.061377
WSW	0.001925	0.008661	0.013580	0.013473	0.004919	0.002139	0.044696
W	0.001604	0.006630	0.008768	0.009196	0.005133	0.003529	0.034859
WNW	0.002139	0.007699	0.007592	0.007378	0.001497	0.001283	0.027588
NW	0.001497	0.007378	0.011441	0.005453	0.001176	0.001069	0.028015
NNW	0.002566	0.009089	0.009303	0.008340	0.004384	0.002780	0.036463
Total	**0.036249**	**0.196215**	**0.324636**	**0.293841**	**0.079021**	**0.023952**	

Frequency of Calm Winds: 4.61%
Average Wind Speed: 10.15 Knots
Source: (NOAA, 2004)

Table 19. Midland, TX Wind Data (2000)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.002100	0.009494	0.013968	0.008855	0.002739	0.001461	0.038616
NNE	0.001552	0.009951	0.012781	0.016250	0.005112	0.002282	0.047928
NE	0.001278	0.007029	0.013968	0.019810	0.007029	0.002921	0.052036
ENE	0.001278	0.006208	0.023827	0.020267	0.005204	0.000639	0.057422
E	0.001369	0.011137	0.024192	0.012598	0.001643	0.000822	0.051762
ESE	0.001187	0.013968	0.017710	0.009220	0.001187	0.000548	0.043820
SE	0.002556	0.021727	0.029487	0.024283	0.003834	0.000822	0.082710
SSE	0.002465	0.024557	0.047563	0.056053	0.014241	0.002100	0.146978
S	0.001917	0.016067	0.049023	0.071207	0.015246	0.003834	0.157294
SSW	0.001917	0.016706	0.034873	0.031313	0.003469	0.000365	0.088643
SW	0.002282	0.014241	0.020449	0.011959	0.001004	0.000183	0.050119
WSW	0.001735	0.009312	0.012142	0.010316	0.002647	0.001826	0.037977
W	0.001461	0.007395	0.010590	0.012142	0.005934	0.005386	0.042907
WNW	0.001095	0.005204	0.006025	0.005204	0.002556	0.001735	0.021819
NW	0.001187	0.005934	0.006664	0.004382	0.001187	0.000274	0.019628
NNW	0.000913	0.005843	0.007395	0.004656	0.001278	0.000091	0.020175
Total	**0.026292**	**0.184773**	**0.330655**	**0.318514**	**0.074311**	**0.025288**	

Frequency of Calm Winds: 4.02%
Average Wind Speed: 10.36 Knots
Source: (NOAA, 2004)

Added in response to OBS NP-2.1

Table 20. Midland, TX Wind Data (2001)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.002898	0.011311	0.009067	0.005141	0.001309	0.000841	0.030566
NNE	0.002056	0.009534	0.011124	0.009628	0.004206	0.001776	0.038325
NE	0.002150	0.007665	0.010376	0.018415	0.005982	0.002150	0.046738
ENE	0.001122	0.008506	0.014395	0.015050	0.003178	0.000561	0.042812
E	0.002243	0.014115	0.023930	0.015984	0.002337	0.000280	0.058890
ESE	0.003459	0.018321	0.025425	0.016826	0.001215	0.000654	0.065900
SE	0.003178	0.023930	0.039914	0.031221	0.005422	0.000280	0.103945
SSE	0.003646	0.030566	0.053842	0.057581	0.011404	0.003178	0.160217
S	0.002617	0.019069	0.050757	0.067396	0.013460	0.001963	0.155263
SSW	0.001870	0.016732	0.032156	0.022715	0.001963	0.000280	0.075715
SW	0.003178	0.012245	0.019630	0.013274	0.000748	0.000093	0.049168
WSW	0.001402	0.009815	0.012245	0.012713	0.004206	0.001028	0.041410
W	0.001402	0.007945	0.009254	0.009908	0.005609	0.003646	0.037764
WNW	0.001402	0.007198	0.006824	0.003739	0.001402	0.000467	0.021032
NW	0.003365	0.008132	0.006169	0.003646	0.001215	0.000000	0.022528
NNW	0.001496	0.008974	0.007758	0.003926	0.001122	0.000467	0.023743
Total	**0.037484**	**0.214059**	**0.332866**	**0.307160**	**0.064778**	**0.017667**	

Frequency of Calm Winds: 2.60%
Average Wind Speed: 9.86 Knots
Source: (NOAA, 2004)

Table 21. Midland, TX Wind Data (2002)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.002551	0.008534	0.014911	0.008927	0.002452	0.000883	0.038258
NNE	0.002158	0.006867	0.011674	0.014518	0.004414	0.003630	0.043261
NE	0.001864	0.009123	0.015990	0.018737	0.007259	0.002747	0.055719
ENE	0.001570	0.007063	0.021581	0.015597	0.003531	0.000589	0.049931
E	0.002354	0.011379	0.027663	0.013341	0.001079	0.000294	0.056111
ESE	0.001471	0.014224	0.028840	0.018344	0.000785	0.000000	0.063665
SE	0.002158	0.017265	0.033843	0.026879	0.004316	0.000490	0.084952
SSE	0.003041	0.021679	0.038748	0.049147	0.012556	0.002943	0.128115
S	0.003041	0.017756	0.050226	0.067098	0.012851	0.000785	0.151756
SSW	0.001668	0.015107	0.034040	0.031685	0.002943	0.000098	0.085541
SW	0.003041	0.016676	0.023641	0.014420	0.002158	0.000000	0.059937
WSW	0.003139	0.012655	0.013047	0.010202	0.003531	0.001766	0.044340
W	0.003041	0.011477	0.007455	0.006867	0.003728	0.002452	0.035021
WNW	0.002649	0.004512	0.005690	0.004709	0.001373	0.000196	0.019129
NW	0.002060	0.008240	0.007750	0.005297	0.001275	0.000196	0.024819
NNW	0.001471	0.007357	0.008142	0.007259	0.002158	0.000785	0.027173
Total	**0.037277**	**0.189916**	**0.343241**	**0.313027**	**0.066412**	**0.017854**	

Frequency of Calm Winds: 3.23%
Average Wind Speed:10.00 Knots
Source: (NOAA, 2004)

Added in response to OBS NP-2.1

Table 22. Midland, TX Wind Data (2003)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.001680	0.009985	0.010825	0.009052	0.001960	0.000933	0.034434
NNE	0.001306	0.008212	0.014838	0.010452	0.004479	0.001680	0.040967
NE	0.001773	0.009052	0.018384	0.017077	0.008492	0.001027	0.055804
ENE	0.001027	0.012598	0.026876	0.016424	0.003546	0.000653	0.061124
E	0.001773	0.017077	0.024449	0.010918	0.001680	0.000560	0.056458
ESE	0.002053	0.015398	0.022116	0.012598	0.001960	0.000840	0.054965
SE	0.002053	0.018570	0.030702	0.021183	0.004199	0.000467	0.077174
SSE	0.002986	0.022583	0.042087	0.047032	0.008492	0.000840	0.124020
S	0.001680	0.019130	0.051232	0.055898	0.007186	0.001866	0.136991
SSW	0.001866	0.019970	0.041900	0.025196	0.002240	0.000373	0.091545
SW	0.002800	0.012785	0.027996	0.014838	0.001866	0.000280	0.060564
WSW	0.002800	0.012505	0.013811	0.011758	0.005412	0.001493	0.047779
W	0.001773	0.010825	0.011665	0.014091	0.006906	0.005039	0.050299
WNW	0.001400	0.007559	0.006906	0.004853	0.002146	0.002240	0.025103
NW	0.002240	0.006626	0.005692	0.004479	0.001960	0.001120	0.022116
NNW	0.001213	0.006066	0.005226	0.004386	0.001493	0.001213	0.019597
Total	**0.030422**	**0.208940**	**0.354703**	**0.280235**	**0.064016**	**0.020623**	

Frequency of Calm Winds: 4.11%
Average Wind Speed:9.86 Knots
Source: (NOAA, 2004)

Table 23. Midland, TX Wind Data (1999–2003)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.002312	0.010132	0.012155	0.008418	0.002369	0.001098	0.036483
NNE	0.001868	0.008591	0.012174	0.012771	0.004604	0.002080	0.042089
NE	0.001734	0.007782	0.014505	0.018280	0.007108	0.002061	0.051470
ENE	0.001329	0.008668	0.020611	0.017144	0.004141	0.000597	0.052491
E	0.001868	0.012829	0.023770	0.013118	0.001830	0.000443	0.053858
ESE	0.002061	0.014851	0.022441	0.013908	0.001541	0.000501	0.055303
SE	0.002909	0.020072	0.032053	0.024984	0.004507	0.000771	0.085295
SSE	0.003043	0.025504	0.044766	0.050256	0.011808	0.002562	0.137940
S	0.002408	0.018877	0.050815	0.065011	0.012501	0.002042	0.151655
SSW	0.001830	0.016932	0.036098	0.027777	0.002774	0.000270	0.085680
SW	0.002697	0.014062	0.024001	0.013542	0.001522	0.000212	0.056035
WSW	0.002196	0.010614	0.012944	0.011654	0.004122	0.001637	0.043168
W	0.001849	0.008880	0.009593	0.010517	0.005490	0.004045	0.040374
WNW	0.001714	0.006414	0.006588	0.005124	0.001811	0.001194	0.022845
NW	0.002080	0.007243	0.007435	0.004623	0.001368	0.000520	0.023269
NNW	0.001502	0.007416	0.007512	0.005625	0.002023	0.001021	0.025099
Total	**0.033401**	**0.198867**	**0.337462**	**0.302751**	**0.069519**	**0.021054**	

Frequency of Calm Winds: 3.69%
Average Wind Speed:10.04 Knots
Source: (NOAA, 2004)

Added in response to OBS NP-2.1

Table 24. Midland, TX Stability Table (1999–2003)

STABILITY	1999	2000	2001	2002	2003	1999–2003
A	0.2%	0.6%	0.9%	0.4%	0.3%	0.48%
B	13.7%	12.2%	12.1%	12.3%	12.5%	12.53%
C	19.9%	19.4%	19.2%	19.0%	18.7%	19.24%
D	46.1%	42.4%	42.1%	43.2%	41.7%	43.02%
E	12.9%	15.4%	16.0%	16.3%	16.6%	15.51%
F	7.1%	10.1%	9.7%	8.8%	10.1%	9.22%

Source: (NOAA, 2004)

Table 25. WCS Lower Six-Year Temperature Data (2000–2005)

MONTH	MEAN MONTHLY TEMPERATURE		MEAN DAILY MAXIMUM TEMPERATURE		MEAN DAILY MINIMUM TEMPERATURE		HIGHEST DAILY MAXIMUM TEMPERATURE		LOWEST DAILY MINIMUM TEMPERATURE	
	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)	°C	(°F)
January	6.4	(43.5)	22.3	(72.1)	-5.7	(21.7)	27.6	(81.6)	-11.3	(11.7)
February	8.0	(46.4)	24.0	(75.2)	-4.7	(23.5)	28.8	(83.8)	-11.4	(11.4)
March	12.1	(53.8)	26.9	(80.4)	-1.7	(28.9)	32.0	(89.6)	-11.3	(11.6)
April	17.8	(64.1)	31.9	(89.4)	4.7	(40.5)	36.3	(97.4)	-0.6	(30.9)
May	22.7	(72.8)	36.7	(98.0)	9.9	(49.9)	40.8	(105.4)	3.8	(38.9)
June	25.3	(77.6)	38.7	(101.6)	10.2	(50.4)	41.9	(107.4)	-2.7	(27.1)
July	27.8	(82.0)	39.1	(102.3)	18.1	(64.6)	42.1	(107.7)	15.4	(59.7)
August	26.8	(80.2)	38.5	(101.4)	17.4	(63.2)	42.2	(107.9)	14.8	(58.7)
September	23.6	(74.4)	36.5	(97.8)	13.0	(55.5)	40.9	(105.6)	2.6	(36.6)
October	17.3	(63.1)	30.5	(86.9)	6.0	(42.7)	38.6	(101.5)	-0.7	(30.7)
November	9.8	(49.7)	24.5	(76.2)	-2.4	(27.6)	29.8	(85.7)	-10.3	(13.5)
December	5.7	(42.2)	21.2	(70.1)	-7.2	(19.0)	26.4	(79.6)	-15.7	(3.7)
Annual	**16.8**	**(62.2)**	**30.9**	**(87.6)**	**4.8**	**(40.6)**	**42.2**	**(107.9)**	**-15.7**	**(3.7)**

Source: (WCS, 2005)

Added in response to OBS NP-2.1

Table 26. WCS Lower Six-Year Precipitation Data (2000–2005)

PRECIPITATION CM (INCHES)	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	ANNUAL
Average	1.28	2.62	3.53	2.46	1.63	3.96	3.66	4.29	6.31	6.21	3.38	0.75	40.08
	(0.51)	(1.03)	(1.39)	(0.97)	(0.64)	(1.56)	(1.44)	(1.69)	(2.48)	(2.45)	(1.33)	(0.29)	(15.78)
Maximum	2.13	7.21	7.75	10.39	5.79	10.13	3.96	7.70	22.38	12.27	11.35	1.93	76.28
	(0.84)	(2.84)	(3.05)	(4.09)	(2.28)	(3.99)	(1.56)	(3.03)	(8.81)	(4.83)	(4.47)	(0.76)	(30.03)
Minimum	0.76	0.18	0.61	0.30	0.25	0.33	3.15	0.53	1.73	0.23	0.25	0.15	12.83
	(0.30)	(0.07)	(0.24)	(0.12)	(0.10)	(0.13)	(1.24)	(0.21)	(0.68)	(0.09)	(0.10)	(0.06)	(5.05)
Max 24 Hr	1.55	3.78	4.45	5.31	3.18	4.95	3.30	7.11	11.30	4.80	3.78	1.32	11.30
	(0.61)	(1.49)	(1.75)	(2.09)	(1.25)	(1.95)	(1.30)	(2.80)	(4.45)	(1.89)	(1.49)	(0.52)	(4.45)

Source: (WCS, 2005)

Table 26A. WCS Six-Year Precipitation Duration (2000–2005)

DURATION MINUTES	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	ANNUAL
Average	21	36	33	31	43	50	41	41	55	46	36	22	36
Maximum	135	525	210	300	240	240	210	240	315	345	180	255	525
Minimum	15	15	15	15	15	15	15	15	15	15	15	15	15
EVENT INTENSITY CM/EVENT (INCHES/EVENT)													
Average	0.06	0.12	0.18	0.23	0.21	0.50	0.66	0.41	0.61	0.36	0.15	0.07	0.19
	(0.02)	(0.05)	(0.07)	(0.09)	(0.08)	(0.20)	(0.26)	(0.16)	(0.24)	(0.14)	(0.06)	(0.03)	(0.07)
Maximum	0.94	3.20	3.96	3.99	1.45	4.78	3.15	7.09	4.67	4.80	2.36	0.84	7.09
	(0.37)	(1.26)	(1.56)	(1.57)	(0.57)	(1.88)	(1.24)	(2.79)	(1.84)	(1.89)	(0.93)	(0.33)	(2.79)
Minium	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
OCCURRENCES # OF EVENTS													
Average	26	22	20	11	8	8	10	11	13	17	22	16	163
Maximum	67	38	44	27	17	22	26	22	27	25	63	25	342
Minimum	5	2	9	2	3	2	3	2	7	4	1	4	80

Source: (WCS, 2005)

Added in response to OBS NP-2.1

Table 27. WCS Lower Six-Year Humidity Data (2000–2005)

Relative Humidity (%)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Average	62.81	59.49	56.67	49.81	51.44	56.20	56.03	59.52	61.13	70.28	68.73	59.92	59.10
00 LST	74.83	70.68	70.59	67.32	70.28	75.68	72.64	75.06	76.71	84.46	82.19	72.30	74.14
06 LST	71.42	69.41	67.22	58.84	61.66	64.13	65.91	67.64	70.30	77.78	74.66	66.87	67.78
12 LST	44.82	42.61	38.07	29.59	30.59	36.00	36.96	39.86	41.05	49.43	48.72	40.50	39.66
18 LST	60.04	55.27	50.82	43.49	43.15	49.00	48.59	55.29	56.46	69.44	69.33	60.00	54.79

Source: (WCS, 2005)

Table 28. WCS Upper Six-Year Humidity Data (2000–2005)

Relative Humidity (%)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Average	59.96	55.79	54.51	47.93	50.28	55.73	54.61	57.82	55.97	64.83	62.23	53.74	55.98
00 LST	70.00	66.44	66.32	62.88	66.44	72.25	68.35	70.77	68.39	76.82	73.61	63.29	68.63
06 LST	68.69	61.92	65.45	57.67	61.38	65.74	65.19	66.89	65.50	72.83	69.01	60.87	64.99
12 LST	45.34	42.98	38.64	30.29	32.00	37.67	38.38	40.91	39.57	47.38	45.64	38.44	39.66
18 LST	55.72	51.82	47.64	40.90	41.24	47.27	56.52	52.51	50.43	62.28	60.62	52.36	50.58

Source: (WCS, 2005)

Added in response to OBS NP-2.1

Table 29. WCS Lower Wind Data (2000)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.006450	0.011439	0.009002	0.002695	0.000430	0.000000	0.030015
NNE	0.004587	0.014449	0.016627	0.009346	0.000430	0.000000	0.045439
NE	0.009546	0.024683	0.018061	0.004673	0.000029	0.000000	0.056992
ENE	0.018806	0.024769	0.020555	0.006794	0.000057	0.000000	0.070982
E	0.021157	0.024913	0.018892	0.002379	0.000000	0.000000	0.067341
ESE	0.021415	0.026862	0.011324	0.000631	0.000000	0.000000	0.060232
SE	0.024282	0.037641	0.021816	0.001319	0.000000	0.000000	0.085058
SSE	0.015710	0.046127	0.053925	0.005103	0.000000	0.000000	0.120865
S	0.012872	0.040766	0.047388	0.002551	0.000029	0.000000	0.103606
SSW	0.010407	0.028209	0.030015	0.002064	0.000029	0.000000	0.070724
SW	0.010607	0.021530	0.017946	0.004358	0.000057	0.000000	0.054498
WSW	0.009116	0.010349	0.010378	0.008285	0.001233	0.000201	0.039562
W	0.009116	0.006938	0.009747	0.008228	0.002379	0.000229	0.036638
WNW	0.009632	0.007998	0.007798	0.003526	0.000946	0.000029	0.029929
NW	0.013503	0.011381	0.008400	0.003612	0.000258	0.000000	0.037154
NNW	0.010235	0.009116	0.005705	0.002064	0.000143	0.000000	0.027263
Total	**0.207442**	**0.347170**	**0.307580**	**0.067628**	**0.006020**	**0.000459**	**1**

Frequency of Calm Winds: 6.60%
Average Wind Speed: 6.06 Knots
Source: (WCS, 2004)

Table 30. WCS Lower Wind Data (2001)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.007078	0.011615	0.008134	0.002026	0.000086	0.000000	0.028938
NNE	0.006707	0.016267	0.015468	0.005451	0.000228	0.000029	0.044150
NE	0.012557	0.024743	0.013841	0.003539	0.000057	0.000000	0.054737
ENE	0.019892	0.026398	0.015953	0.003881	0.000542	0.000000	0.066667
E	0.019549	0.025999	0.021318	0.003710	0.000000	0.000000	0.070576
ESE	0.018037	0.031992	0.014412	0.002369	0.000057	0.000000	0.066866
SE	0.021062	0.042666	0.025171	0.001484	0.000000	0.000000	0.090382
SSE	0.018807	0.048716	0.038242	0.004880	0.000029	0.000000	0.110674
S	0.015439	0.042951	0.040953	0.004309	0.000228	0.000000	0.103881
SSW	0.013128	0.027711	0.021946	0.001998	0.000029	0.000086	0.064897
SW	0.009389	0.019635	0.015811	0.003796	0.000029	0.000000	0.048659
WSW	0.007677	0.011558	0.011358	0.006621	0.000171	0.000029	0.037414
W	0.008333	0.006992	0.012015	0.008248	0.002055	0.000599	0.038242
WNW	0.009618	0.007677	0.007734	0.003082	0.000371	0.000086	0.028567
NW	0.012300	0.011929	0.005993	0.001769	0.000114	0.000000	0.032106
NNW	0.010360	0.009989	0.003567	0.001855	0.000200	0.000000	0.025970
Total	**0.209932**	**0.366838**	**0.271918**	**0.059018**	**0.004195**	**0.000828**	**1**

Frequency of Calm Winds: 8.90%
Average Wind Speed: 5.83 Knots
Source: (WCS, 2004)

Added in response to OBS NP-2.1

Table 31. WCS Lower Wind Data (2002)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.006507	0.007714	0.010170	0.006766	0.000431	0.000000	0.031588
NNE	0.005042	0.014393	0.020728	0.009696	0.001207	0.000000	0.051067
NE	0.008877	0.018660	0.013402	0.006723	0.000172	0.000000	0.047835
ENE	0.016677	0.023917	0.014911	0.006162	0.000129	0.000000	0.061797
E	0.015342	0.024305	0.014221	0.001077	0.000215	0.000000	0.055161
ESE	0.013833	0.039173	0.014135	0.000905	0.000000	0.000000	0.068046
SE	0.017410	0.039560	0.021030	0.001939	0.000086	0.000000	0.080026
SSE	0.018229	0.055333	0.051928	0.004913	0.000000	0.000000	0.130403
S	0.019651	0.054945	0.058393	0.000991	0.000000	0.000000	0.133980
SSW	0.015729	0.034303	0.032622	0.003103	0.000000	0.000000	0.085757
SW	0.013144	0.016591	0.019608	0.009007	0.000043	0.000000	0.058393
WSW	0.009308	0.007455	0.010558	0.008317	0.000690	0.000000	0.036328
W	0.008016	0.007800	0.010774	0.005818	0.000215	0.000000	0.032622
WNW	0.008920	0.005430	0.004180	0.001767	0.000474	0.000043	0.020814
NW	0.013402	0.006206	0.004999	0.000991	0.000431	0.000086	0.026115
NNW	0.011592	0.005732	0.003534	0.004008	0.000646	0.000000	0.025512
Total	**0.201681**	**0.361517**	**0.305193**	**0.072183**	**0.004740**	**0.000129**	**1**

Frequency of Calm Winds: 5.50%
Average Wind Speed: 6.04 Knots
Source: (WCS, 2004)

Table 32. WCS Lower Wind Data (2003)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.005508	0.007363	0.006421	0.004595	0.000428	0.000143	0.024458
NNE	0.003168	0.013984	0.015953	0.008105	0.000542	0.000000	0.041752
NE	0.008076	0.019463	0.017123	0.006621	0.000143	0.000000	0.051427
ENE	0.016124	0.026370	0.030565	0.006450	0.000057	0.000000	0.079566
E	0.027797	0.050970	0.023830	0.001684	0.000000	0.000000	0.104281
ESE	0.015268	0.031678	0.018522	0.001199	0.000029	0.000000	0.066695
SE	0.014098	0.024486	0.017323	0.002768	0.000000	0.000000	0.058676
SSE	0.015097	0.032021	0.028881	0.004595	0.000029	0.000000	0.080622
S	0.015240	0.038984	0.035131	0.002997	0.000342	0.000000	0.092694
SSW	0.014583	0.029680	0.027854	0.002540	0.000029	0.000000	0.074686
SW	0.012500	0.023687	0.025143	0.008619	0.000257	0.000029	0.070234
WSW	0.009361	0.011387	0.014384	0.011558	0.002397	0.000171	0.049258
W	0.007934	0.006621	0.010103	0.013042	0.003881	0.000428	0.042009
WNW	0.007135	0.006564	0.006792	0.003539	0.000485	0.000114	0.024629
NW	0.010217	0.010873	0.005993	0.003196	0.001370	0.000000	0.031650
NNW	0.009332	0.006279	0.004167	0.003253	0.000656	0.000057	0.023744
Total	**0.191438**	**0.340411**	**0.288185**	**0.084760**	**0.010645**	**0.000942**	**1**

Frequency of Calm Winds: 8.40%
Average Wind Speed: 6.29 Knots
Source: (WCS, 2004)

Added in response to OBS NP-2.1

Table 32A. WCS Lower Wind Data (2004)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.009045	0.012132	0.011067	0.003831	0.000532	0	0.036607
NNE	0.009684	0.016388	0.014898	0.007024	0.000319	0	0.048313
NE	0.017878	0.024795	0.015537	0.002448	0	0	0.060658
ENE	0.026391	0.025114	0.019581	0.005534	0.000106	0	0.076727
E	0.02139	0.021709	0.011599	0.002341	0	0	0.057039
ESE	0.01724	0.017346	0.005427	0.000851	0.000106	0	0.040971
SE	0.022135	0.019794	0.009578	0.001383	0	0	0.052889
SSE	0.022986	0.044163	0.029371	0.001596	0	0	0.098116
S	0.021709	0.055975	0.032031	0.001277	0	0	0.110993
SSW	0.020645	0.032564	0.023731	0.000851	0	0	0.077791
SW	0.019261	0.026391	0.015005	0.003086	0.000106	0	0.06385
WSW	0.013089	0.011493	0.013196	0.00564	0.001064	0.000319	0.044802
W	0.007981	0.007981	0.009045	0.006917	0.002022	0.000213	0.03416
WNW	0.008194	0.007343	0.004895	0.000851	0	0	0.021283
NW	0.012983	0.009578	0.004257	0.003193	0.000426	0.000213	0.030648
NNW	0.011387	0.009471	0.005427	0.004682	0	0	0.030967
Total	**0.261999**	**0.342237**	**0.224646**	**0.051506**	**0.004682**	**0.000745**	**1**

Frequency of Calm Winds: 11.42%
Average Wind Speed: 5.31 Knots
Source: (WCS, 2005)

Table 32B. WCS Lower Wind Data (2005)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.008789	0.009930	0.005022	0.001598	0.000342	0.000000	0.025682
NNE	0.011072	0.014154	0.008218	0.003310	0.000000	0.000000	0.036754
NE	0.015295	0.018605	0.011072	0.001826	0.000000	0.000000	0.046798
ENE	0.024198	0.025568	0.012556	0.001141	0.000000	0.000000	0.063463
E	0.024312	0.024769	0.008903	0.000342	0.000000	0.000000	0.058327
ESE	0.030362	0.020089	0.006392	0.000114	0.000000	0.000000	0.056957
SE	0.027851	0.028878	0.008789	0.000571	0.000000	0.000000	0.066088
SSE	0.024769	0.035384	0.017464	0.000571	0.000000	0.000000	0.078187
S	0.019176	0.039493	0.016551	0.000799	0.000000	0.000000	0.076019
SSW	0.015181	0.026367	0.010958	0.000913	0.000000	0.000000	0.053419
SW	0.011300	0.017920	0.010501	0.001141	0.000000	0.000000	0.040863
WSW	0.007762	0.008903	0.009816	0.003995	0.000114	0.000000	0.030590
W	0.010729	0.007990	0.009702	0.007077	0.001826	0.000114	0.037439
WNW	0.008447	0.006620	0.007876	0.004223	0.001027	0.000342	0.028536
NW	0.010045	0.007990	0.005022	0.002968	0.000342	0.000000	0.026367
NNW	0.010501	0.009930	0.003995	0.002169	0.000342	0.000000	0.026938
Total	**0.259788**	**0.302591**	**0.152836**	**0.032759**	**0.003995**	**0.000457**	**1**

Frequency of Calm Winds: 24.76%
Average Wind Speed: 4.21 Knots
Source: (WCS, 2006)

Added in response to OBS NP-2.1

Table 33. WCS Lower Wind Data (2000–2005)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.008920	0.011068	0.008149	0.002753	0.000441	0.000000	0.031331
NNE	0.010352	0.015308	0.011673	0.005231	0.000165	0.000000	0.042729
NE	0.016629	0.021805	0.013380	0.002147	0.000000	0.000000	0.053962
ENE	0.025329	0.025384	0.016189	0.003414	0.000055	0.000000	0.070371
E	0.022796	0.023182	0.010297	0.001377	0.000000	0.000000	0.057651
ESE	0.023567	0.018666	0.005892	0.000496	0.000055	0.000000	0.048676
SE	0.024888	0.024173	0.009196	0.000991	0.000000	0.000000	0.059248
SSE	0.023842	0.039921	0.023622	0.001101	0.000000	0.000000	0.088486
S	0.020483	0.048015	0.024558	0.001046	0.000000	0.000000	0.094103
SSW	0.018006	0.029569	0.017565	0.000881	0.000000	0.000000	0.066021
SW	0.015418	0.022301	0.012830	0.002147	0.000055	0.000000	0.052750
WSW	0.010517	0.010242	0.011563	0.004846	0.000606	0.000165	0.037938
W	0.009306	0.007984	0.009361	0.006993	0.001927	0.000165	0.035736
WNW	0.008315	0.006993	0.006332	0.002478	0.000496	0.000165	0.024778
NW	0.011563	0.008810	0.004625	0.003084	0.000385	0.000110	0.028578
NNW	0.010958	0.009691	0.004735	0.003469	0.000165	0.000000	0.029018
Total	**0.260889**	**0.323110**	**0.189968**	**0.042454**	**0.004350**	**0.000606**	**1**

Frequency of Calm Winds: 17.86%
Average Wind Speed: 4.78 Knots
Source: (WCS, 2006)

Table 34. WCS Lower Stability Table (2000–2005)

Lower Stability	2000	2001	2002	2003	2004	2005	2000–2005
A	6%	7%	8%	7%	7%	7%	7%
B	5%	5%	5%	5%	5%	5%	5%
C	13%	13%	14%	12%	13%	13%	13%
D	70%	70%	66%	71%	70%	69%	69%
E	2%	3%	4%	3%	3%	3%	3%
F	2%	2%	2%	2%	2%	2%	2%

Source: (WCS, 2004)

Added in response to OBS NP-2.1

Table 35. WCS Upper Wind Data (2000)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 - 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.002343	0.006671	0.012018	0.009041	0.001433	0.000827	0.032334
NNE	0.002343	0.005954	0.013782	0.016291	0.006257	0.001323	0.045951
NE	0.003060	0.011384	0.021308	0.016456	0.005734	0.000965	0.058906
ENE	0.003060	0.012652	0.024808	0.016815	0.003473	0.000358	0.061167
E	0.003170	0.019957	0.026352	0.010723	0.000662	0.000028	0.060891
ESE	0.003473	0.018358	0.027262	0.004934	0.000055	0.000000	0.054082
SE	0.004355	0.030294	0.048569	0.018468	0.001020	0.000055	0.102762
SSE	0.005182	0.026738	0.054606	0.043497	0.003583	0.000551	0.134158
S	0.007691	0.023044	0.046695	0.033298	0.001020	0.000331	0.112079
SSW	0.008876	0.020784	0.029798	0.016677	0.000441	0.000055	0.076630
SW	0.009372	0.020894	0.017890	0.011991	0.001709	0.000276	0.062131
WSW	0.007277	0.014637	0.010723	0.008545	0.004107	0.001792	0.047081
W	0.005541	0.011136	0.007112	0.008683	0.004052	0.002646	0.039170
WNW	0.004052	0.012239	0.009179	0.006450	0.001599	0.000965	0.034484
NW	0.004052	0.012322	0.014113	0.006175	0.001351	0.000358	0.038370
NNW	0.003335	0.007139	0.008628	0.005072	0.000827	0.000276	0.025277
Total	**0.077182**	**0.254204**	**0.372843**	**0.233116**	**0.037323**	**0.010805**	**1**

Frequency of Calm Winds: 1.50%
Average Wind Speed: 8.63 Knots
Source: (WCS, 2004)

Table 36. WCS Upper Wind Data (2001)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 – 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.003533	0.007066	0.012877	0.007014	0.000811	0.000157	0.031459
NNE	0.003507	0.008139	0.014473	0.015049	0.003769	0.001492	0.046429
NE	0.003795	0.015311	0.019917	0.011908	0.002931	0.000419	0.054280
ENE	0.003324	0.018791	0.022822	0.011961	0.001596	0.000680	0.059175
E	0.003664	0.020754	0.028946	0.011568	0.000995	0.000288	0.066215
ESE	0.003507	0.020152	0.033421	0.007642	0.001282	0.000052	0.066058
SE	0.004868	0.029600	0.049753	0.016907	0.000602	0.000026	0.101756
SSE	0.006595	0.028501	0.051035	0.031197	0.004083	0.000445	0.121856
S	0.008558	0.028109	0.047371	0.027847	0.001701	0.000419	0.114005
SSW	0.010312	0.024628	0.029312	0.010783	0.000497	0.000183	0.075715
SW	0.008768	0.017221	0.017090	0.009396	0.001413	0.000079	0.053966
WSW	0.007537	0.012484	0.011149	0.010312	0.003376	0.000497	0.045356
W	0.006962	0.012248	0.009239	0.012458	0.003900	0.002722	0.047528
WNW	0.007014	0.013400	0.010024	0.005915	0.001675	0.000393	0.038420
NW	0.005104	0.015965	0.013819	0.003900	0.001309	0.000157	0.040252
NNW	0.003769	0.007930	0.008872	0.003167	0.000995	0.000262	0.024994
Total	**0.090816**	**0.280300**	**0.380120**	**0.197022**	**0.030935**	**0.008270**	**1**

Frequency of Calm Winds: 1.30%
Average Wind Speed: 8.19 Knots
Source: (WCS, 2004)

Added in response to OBS NP-2.1

Table 37. WCS Upper Wind Data (2002)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 – 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.002084	0.004806	0.009017	0.013101	0.003063	0.001191	0.033262
NNE	0.001361	0.007741	0.013994	0.019056	0.006508	0.003998	0.052658
NE	0.002254	0.013952	0.016206	0.010634	0.005615	0.000510	0.049171
ENE	0.002807	0.017780	0.019736	0.011357	0.003275	0.000425	0.055381
E	0.003488	0.018248	0.028158	0.007061	0.000468	0.000298	0.057720
ESE	0.003148	0.016929	0.039983	0.008337	0.000510	0.000085	0.068992
SE	0.004211	0.023267	0.041131	0.023054	0.002722	0.000383	0.094768
SSE	0.005189	0.028073	0.057975	0.048065	0.004679	0.000043	0.144024
S	0.007784	0.032454	0.056231	0.038069	0.000468	0.000000	0.135006
SSW	0.007784	0.029264	0.034964	0.017482	0.000468	0.000043	0.090004
SW	0.007826	0.018843	0.013952	0.015483	0.003701	0.000170	0.059974
WSW	0.006848	0.010846	0.007826	0.011740	0.003445	0.000978	0.041684
W	0.006210	0.010506	0.007146	0.009911	0.001999	0.000255	0.036027
WNW	0.005530	0.011144	0.004849	0.003105	0.001106	0.000595	0.026329
NW	0.004594	0.011527	0.006635	0.003530	0.001021	0.000468	0.027775
NNW	0.003871	0.006380	0.004977	0.004424	0.001659	0.000723	0.022033
Total	**0.074989**	**0.261761**	**0.362782**	**0.244407**	**0.040706**	**0.010166**	**1**

Frequency of Calm Winds: 0.52%
Average Wind Speed: 8.72 Knots
Source: (WCS, 2004)

Table 38. WCS Upper Wind Data (2003)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 – 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.001910	0.004903	0.007012	0.007439	0.001625	0.000855	0.023743
NNE	0.002280	0.004789	0.007439	0.011487	0.001853	0.000114	0.027961
NE	0.001311	0.006185	0.010945	0.010290	0.003107	0.000228	0.032066
ENE	0.001511	0.008950	0.011629	0.008209	0.002138	0.000428	0.032864
E	0.001739	0.011145	0.010261	0.005701	0.002195	0.001340	0.032379
ESE	0.001739	0.006271	0.008209	0.006328	0.002480	0.000656	0.025681
SE	0.002166	0.008579	0.007867	0.011316	0.000941	0.000057	0.030926
SSE	0.002822	0.009549	0.018327	0.010518	0.000770	0.000029	0.042013
S	0.008294	0.027648	0.034688	0.010347	0.000684	0.000114	0.081775
SSW	0.024256	0.070773	0.059144	0.017928	0.002394	0.000798	0.175294
SW	0.015734	0.071030	0.105176	0.029102	0.004446	0.001368	0.226856
WSW	0.005444	0.014423	0.046545	0.033691	0.003221	0.000599	0.103922
W	0.005102	0.008494	0.008893	0.035714	0.004789	0.001026	0.064018
WNW	0.003705	0.008066	0.006955	0.012342	0.003819	0.000599	0.035486
NW	0.003762	0.009292	0.009377	0.005986	0.003819	0.001425	0.033662
NNW	0.002765	0.005359	0.005815	0.003905	0.002508	0.000741	0.021092
Total	**0.084540**	**0.275453**	**0.358283**	**0.220300**	**0.040788**	**0.010375**	**1**

Frequency of Calm Winds: 1.00%
Average Wind Speed: 8.51 Knots
Source: (WCS, 2004)

Added in response to OBS NP-2.1

Table 38A. WCS Upper Wind Data (2004)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 – 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.005534	0.008407	0.01128	0.008301	0.002022	0.000639	0.036182
NNE	0.003512	0.012025	0.014898	0.012132	0.003831	0.001596	0.047994
NE	0.003831	0.015218	0.021177	0.013834	0.001383	0.000426	0.055869
ENE	0.005853	0.020006	0.023199	0.01543	0.003831	0.000319	0.068639
E	0.007556	0.023731	0.023518	0.010748	0.000851	0.000213	0.066617
ESE	0.006811	0.016388	0.017665	0.002767	0.000319	0.000532	0.044482
SE	0.007875	0.025753	0.019261	0.009045	0.000532	0.000106	0.062573
SSE	0.009258	0.026923	0.043737	0.028626	0.000958	0	0.109503
S	0.012983	0.030861	0.058636	0.029158	0.000745	0	0.132383
SSW	0.014686	0.032457	0.036075	0.009578	0.000319	0	0.093115
SW	0.013941	0.025008	0.020645	0.01011	0.000851	0	0.070554
WSW	0.012451	0.017346	0.013515	0.00979	0.001596	0.001277	0.055975
W	0.010961	0.008194	0.008088	0.009684	0.003512	0.002554	0.042992
WNW	0.007024	0.011599	0.006704	0.003937	0	0	0.029265
NW	0.007556	0.014579	0.00713	0.002767	0.000532	0.000851	0.033415
NNW	0.00564	0.011493	0.008088	0.005321	0.000639	0	0.03118
Total	**0.135469**	**0.299989**	**0.333617**	**0.181228**	**0.021922**	**0.008513**	**1**

Frequency of Calm Winds: 193%
Average Wind Speed: 8.08 Knots
Source: (WCS, 2005)

Table 38B. WCS Upper Wind Data (2005)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 – 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.004680	0.007191	0.009131	0.003310	0.001256	0.000571	0.026139
NNE	0.003310	0.008789	0.014268	0.006849	0.002625	0.000571	0.036411
NE	0.004680	0.014039	0.020774	0.013811	0.003310	0.000913	0.057528
ENE	0.005935	0.019062	0.025796	0.012670	0.001141	0.000000	0.064604
E	0.007305	0.026823	0.026024	0.007876	0.000228	0.000000	0.068257
ESE	0.008104	0.030248	0.025340	0.005593	0.000114	0.000000	0.069398
SE	0.007990	0.041776	0.040178	0.011414	0.000342	0.000000	0.101701
SSE	0.012442	0.036069	0.048054	0.021573	0.000571	0.000000	0.118708
S	0.014382	0.031389	0.042803	0.016208	0.000457	0.000228	0.105467
SSW	0.016665	0.028650	0.026709	0.007762	0.000571	0.000114	0.080470
SW	0.014953	0.022600	0.018149	0.007876	0.000913	0.000114	0.064604
WSW	0.013012	0.013925	0.009588	0.008561	0.002739	0.000114	0.047940
W	0.009246	0.011757	0.009017	0.010387	0.002283	0.002625	0.045314
WNW	0.008218	0.009588	0.008218	0.005593	0.002739	0.001484	0.035841
NW	0.007191	0.012556	0.010844	0.003310	0.001598	0.000114	0.035612
NNW	0.005365	0.009474	0.009930	0.002968	0.000457	0.000342	0.028536
Total	**0.143477**	**0.323936**	**0.344824**	**0.145760**	**0.021345**	**0.007191**	**1**

Frequency of Calm Winds: 1.35%
Average Wind Speed: 7.79 Knots
Source: (WCS, 2006)

Added in response to OBS NP-2.1

Table 39. WCS Upper Wind Data (2000–2005)

Frequency Distribution (Normalized)							
Wind Direction (Blowing From)	Wind Speed (Knots)						Total
	1 – 3	4 – 6	7 - 10	11 - 16	17 - 21	> 21	
N	0.004180	0.006493	0.010207	0.007310	0.001361	0.000564	0.030115
NNE	0.003519	0.008263	0.013998	0.012151	0.003519	0.001303	0.042751
NE	0.003791	0.013609	0.018411	0.012442	0.002800	0.000661	0.051714
ENE	0.005191	0.017167	0.020802	0.011898	0.002119	0.000544	0.057721
E	0.005696	0.021755	0.022319	0.007738	0.000739	0.000311	0.058557
ESE	0.005716	0.020647	0.022688	0.004724	0.000758	0.000233	0.054766
SE	0.006552	0.029959	0.032117	0.012404	0.000778	0.000097	0.081906
SSE	0.009273	0.027879	0.044715	0.026421	0.001614	0.000214	0.110115
S	0.012520	0.029609	0.046426	0.022221	0.000680	0.000175	0.111632
SSW	0.019072	0.034839	0.033789	0.010751	0.000661	0.000214	0.099325
SW	0.015592	0.029881	0.031242	0.011626	0.001808	0.000350	0.090499
WSW	0.010712	0.012481	0.017925	0.011917	0.002566	0.000894	0.056496
W	0.009312	0.009332	0.008593	0.014095	0.003266	0.002002	0.046601
WNW	0.007252	0.010518	0.007213	0.006105	0.001614	0.000583	0.033283
NW	0.006377	0.012753	0.009818	0.003752	0.001380	0.000525	0.034605
NNW	0.005113	0.008671	0.007077	0.004063	0.000972	0.000467	0.026362
Total	**0.129868**	**0.293855**	**0.347338**	**0.179618**	**0.026635**	**0.009137**	**1**

Frequency of Calm Winds: 1.36%
Average Wind Speed: 8.23 Knots
Source: (WCS, 2006)

Table 40. WCS Upper Stability Table (2000–2005)

Upper Stability	2000	2001	2002	2003	2004	2005	2000–2005
A	0%	0%	1%	0%	0%	0%	0%
B	8%	8%	8%	9%	8%	8%	8%
C	14%	15%	16%	15%	15%	15%	15%
D	65%	62%	63%	61%	63%	63%	63%
E	5%	6%	6%	6%	6%	6%	6%
F	8%	8%	6%	9%	8%	8%	8%

Source: (WCS, 2004)

Added in response to OBS NP-2.1

Table 41. Flood Occurrences for Andrews County (1993–2004)

FLOOD OF 12 OCCURRENCES			
YEARLY OCCURRENCES		FREQUENCY BY MONTH	
1993	0	Jan	0%
1994	0	Feb	0%
1995	0	Mar	8%
1996	2	Apr	8%
1997	1	May	25%
1998	1	Jun	17%
1999	0	Jul	17%
2000	4	Aug	17%
2001	0	Sep	0%
2002	1	Oct	8%
2003	2	Nov	0%
2004	1	Dec	0%
Yearly Average	**1.0**		

Table 42. Thunderstorm and High Wind Occurrences for Andrews County (1993–2004)

THUNDERSTORM & HIGH WIND OF 38 OCCURRENCES			
YEARLY OCCURRENCES		FREQUENCY BY MONTH	
1993	6	Jan	3%
1994	2	Feb	3%
1995	5	Mar	5%
1996	3	Apr	16%
1997	2	May	21%
1998	3	Jun	16%
1999	3	Jul	5%
2000	2	Aug	11%
2001	0	Sep	16%
2002	6	Oct	3%
2003	5	Nov	0%
2004	1	Dec	3%
Yearly Average	**3.2**		

Added in response to OBS NP-2.1

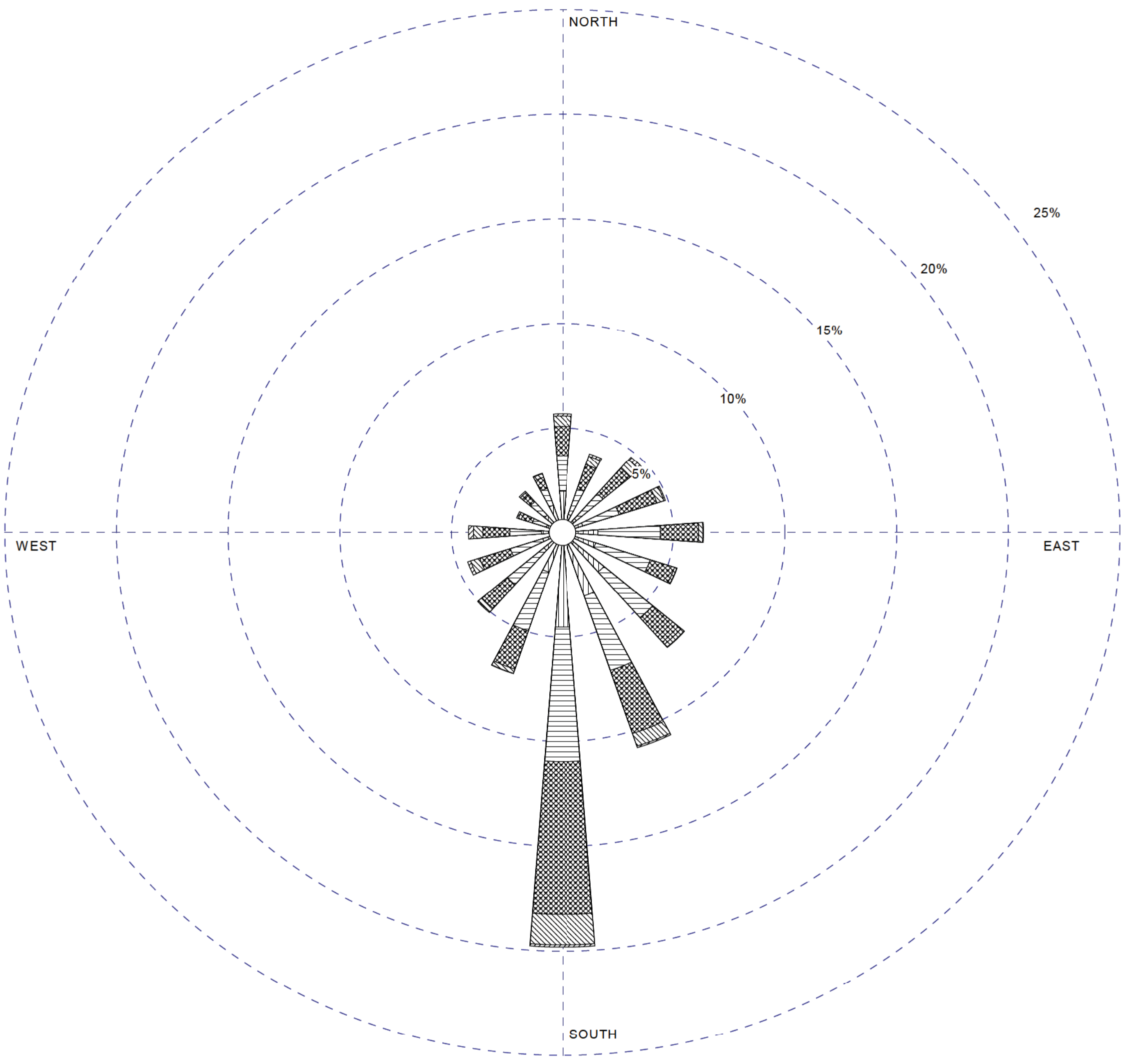
Table 43. Hail Occurrences for Andrews County (1993–2004)

HAIL OF 74 OCCURRENCES				AVERAGE INCHES BY MONTH
YEARLY OCCURRENCES		FREQUENCY BY MONTH		
1993	2	Jan	0%	0.00
1994	2	Feb	0%	0.00
1995	22	Mar	5%	0.91
1996	1	Apr	12%	1.17
1997	10	May	26%	1.48
1998	9	Jun	39%	1.69
1999	9	Jul	1%	0.75
2000	2	Aug	1%	0.75
2001	3	Sep	8%	1.38
2002	6	Oct	7%	1.03
2003	6	Nov	0%	0.00
2004	2	Dec	0%	0.00
Yearly Average	**6.2**			

Added in response to OBS NP-2.1

Figure 1. Andrews, TX Windrose Data (1985–1989)

Andrews County, Texas (1985–1989)



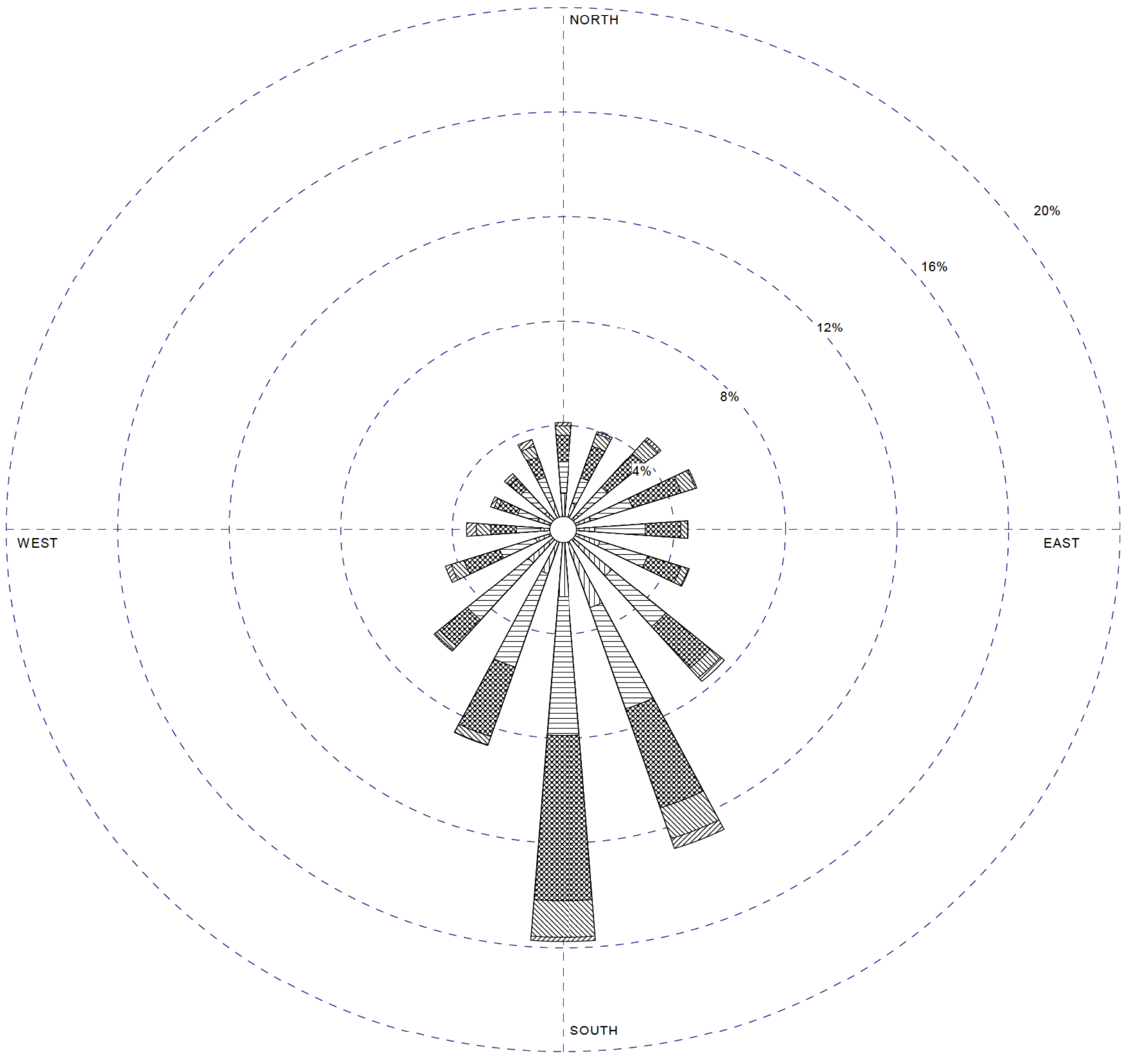
Wind Speed (Knots)			
> 21 17 - 21 11 - 16 7 - 10 4 - 6 1 - 3	DISPLAY Wind Speed	UNIT Knots	
	AVG WIND SPEED 9.75 Knots	CALM WINDS 2.46%	**FIGURE 1** **ANDREWS COUNTY, TX 1985–1989** **WINDROSE** **ENVIRONMENTAL REPORT** **REVISION DATE: APRIL 2004**
	ORIENTATION Direction **(blowing from)**	PLOT YEAR-DATE-TIME 1985–1989 Jan 1 - Dec 31 Midnight - 11 PM	

Source: (NOAA, 2004)

Added in response to OBS NP-2.1

Figure 2. Midland, TX Windrose Data (1999)

Midland, TX 1999



Wind Speed (Knots)
- > 21
- 17 - 21
- 11 - 16
- 7 - 10
- 4 - 6
- 1 - 3

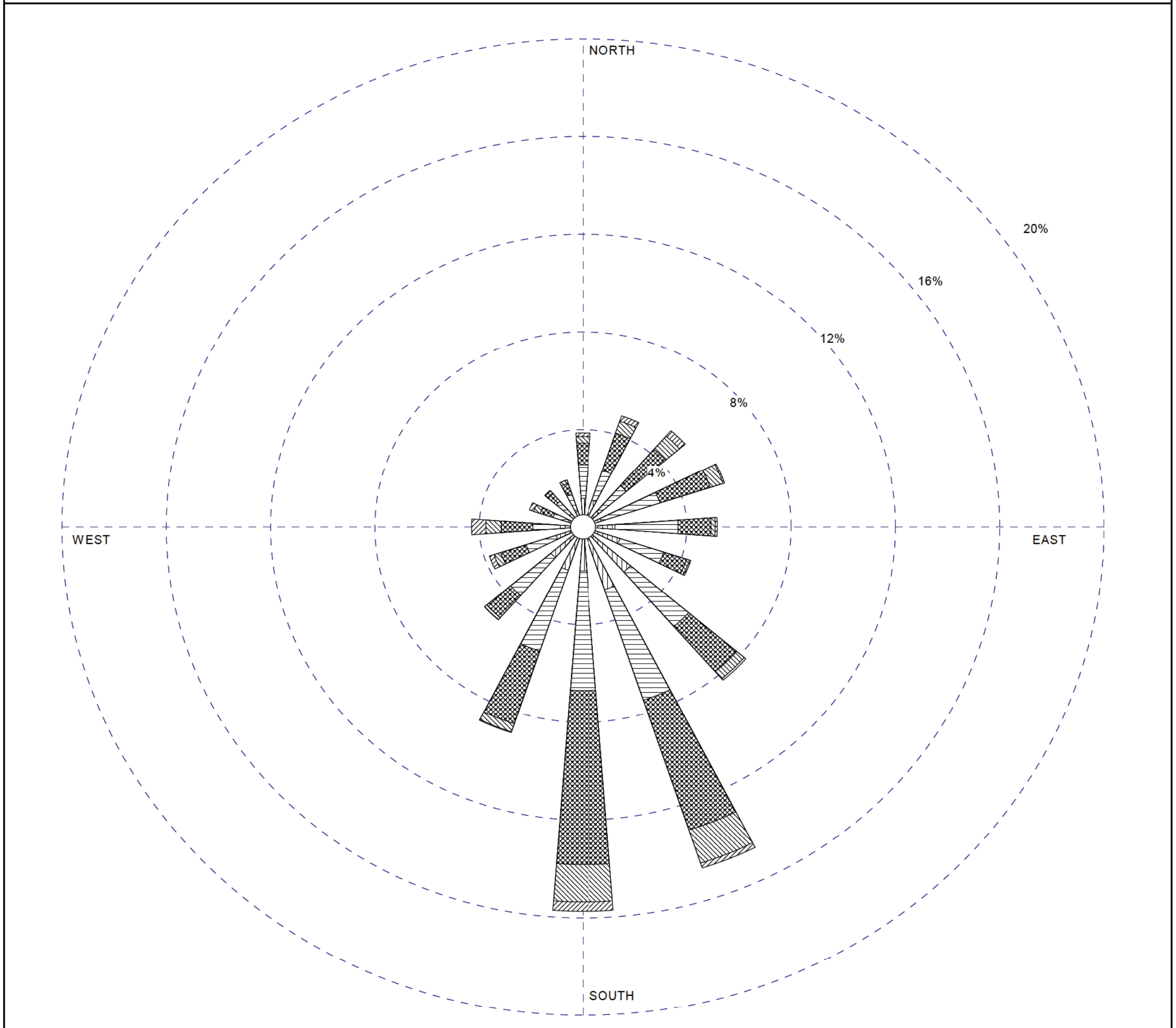
DISPLAY Wind Speed	UNIT Knots	
AVG WIND SPEED 10.15 Knots	CALM WINDS 4.61%	**FIGURE 2** **MIDLAND, TX 1999** **WINDROSE** **ENVIRONMENTAL REPORT** **REVISION DATE: MARCH 2004**
ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 1999 Jan 1 - Dec 31 Midnight - 11 PM	

Source: (NOAA, 2004)

Added in response to OBS NP-2.1

Figure 3. Midland, TX Windrose Data (2000)

Midland, TX 2000



Wind Speed (Knots)

- > 21
- 17 - 21
- 11 - 16
- 7 - 10
- 4 - 6
- 1 - 3

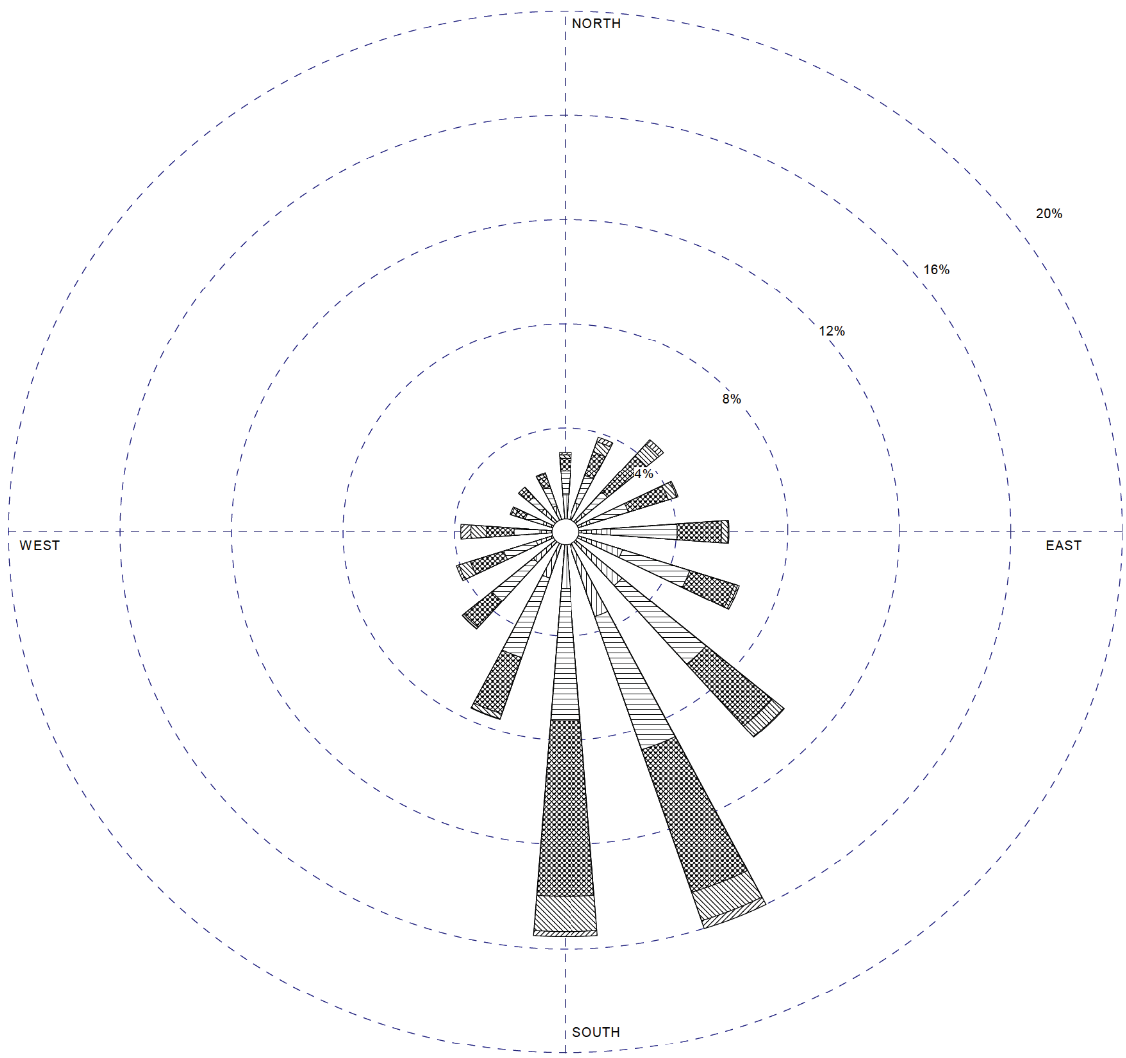
DISPLAY Wind Speed	UNIT Knots	
AVG WIND SPEED 10.36 Knots	CALM WINDS 4.02%	**FIGURE 3** **MIDLAND, TX 2000** **WINDROSE** **ENVIRONMENTAL REPORT** **REVISION DATE: MARCH 2004**
ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 2000 Jan 1 - Dec 31 Midnight - 11 PM	

Source: (NOAA, 2004)

Added in response to OBS NP-2.1

Figure 4. Midland, TX Windrose Data (2001)

Midland, TX 2001



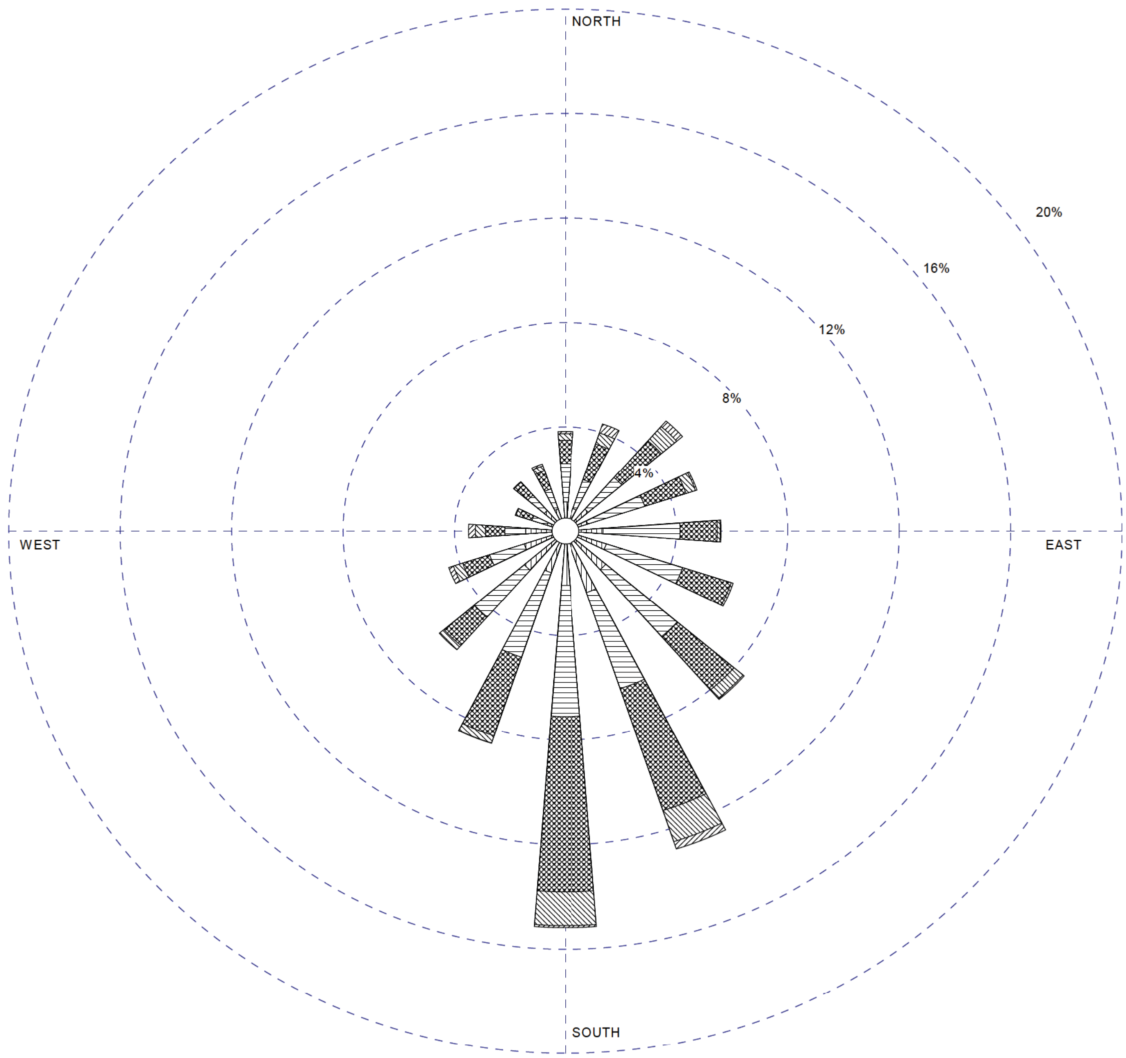
Wind Speed (Knots)			
> 21 17 - 21 11 - 16 7 - 10 4 - 6 1 - 3	DISPLAY Wind Speed	UNIT Knots	
	AVG WIND SPEED 9.86 Knots	CALM WINDS 2.60%	**FIGURE 4** **MIDLAND, TX 2001** **WINDROSE** **ENVIRONMENTAL REPORT** **REVISION DATE: MARCH 2004**
	ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 2001 Jan 1 - Dec 31 Midnight - 11 PM	

Source: (NOAA, 2004)

Added in response to OBS NP-2.1

Figure 5. Midland, TX Windrose Data (2002)

Midland, TX 2002



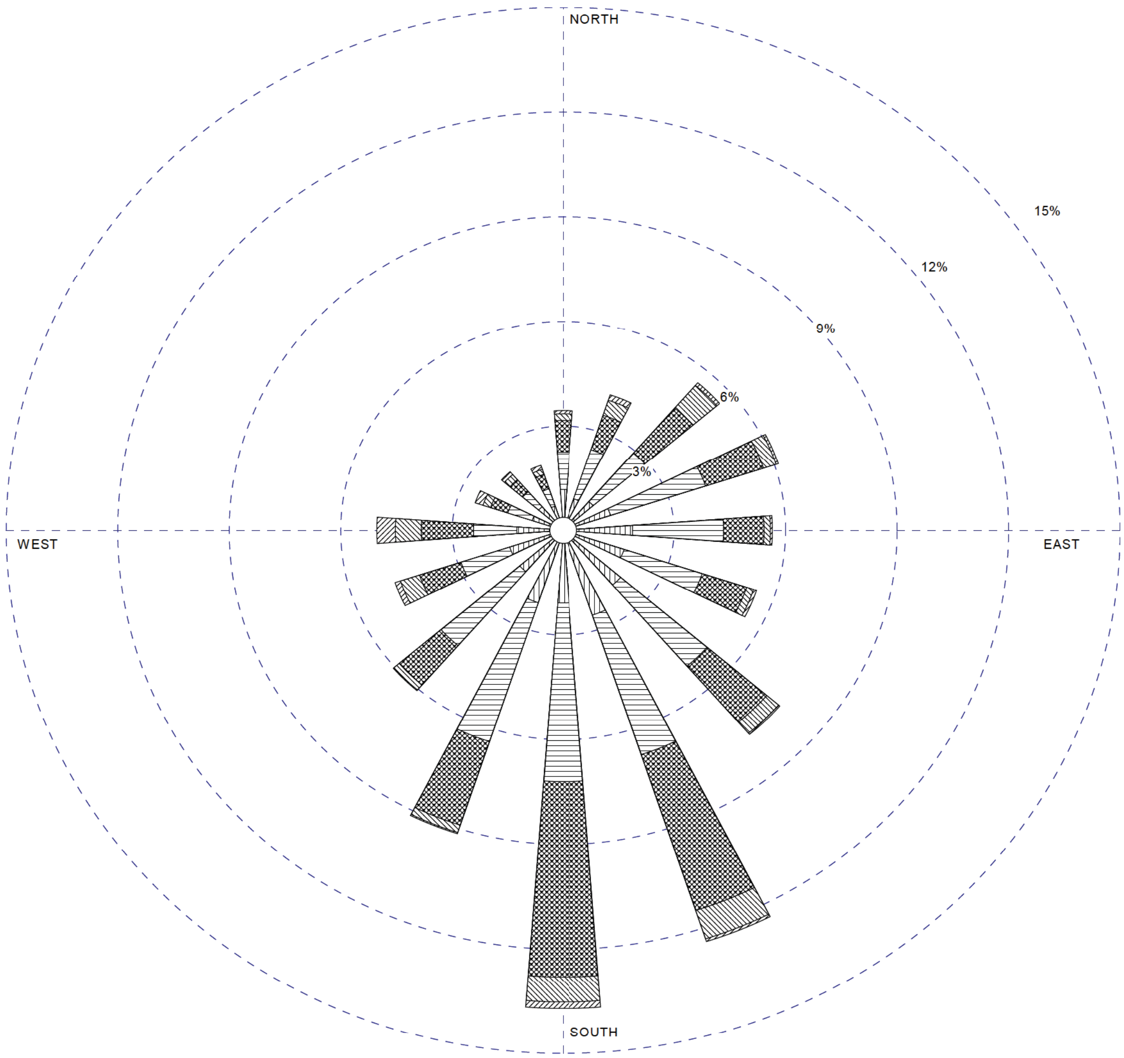
Wind Speed (Knots)			
> 21	DISPLAY Wind Speed	UNIT Knots	
17 - 21	AVG WIND SPEED 10.00 Knots	CALM WINDS 3.23%	**FIGURE 5** **MIDLAND, TX 2002** **WINDROSE** **ENVIRONMENTAL REPORT** **REVISION DATE: MARCH 2004**
11 - 16 7 - 10 4 - 6 1 - 3	ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 2002 Jan 1 - Dec 31 Midnight - 11 PM	

Source: (NOAA, 2004)

Added in response to OBS NP-2.1

Figure 6. Midland, TX Windrose Data (2003)

Midland, TX 2003



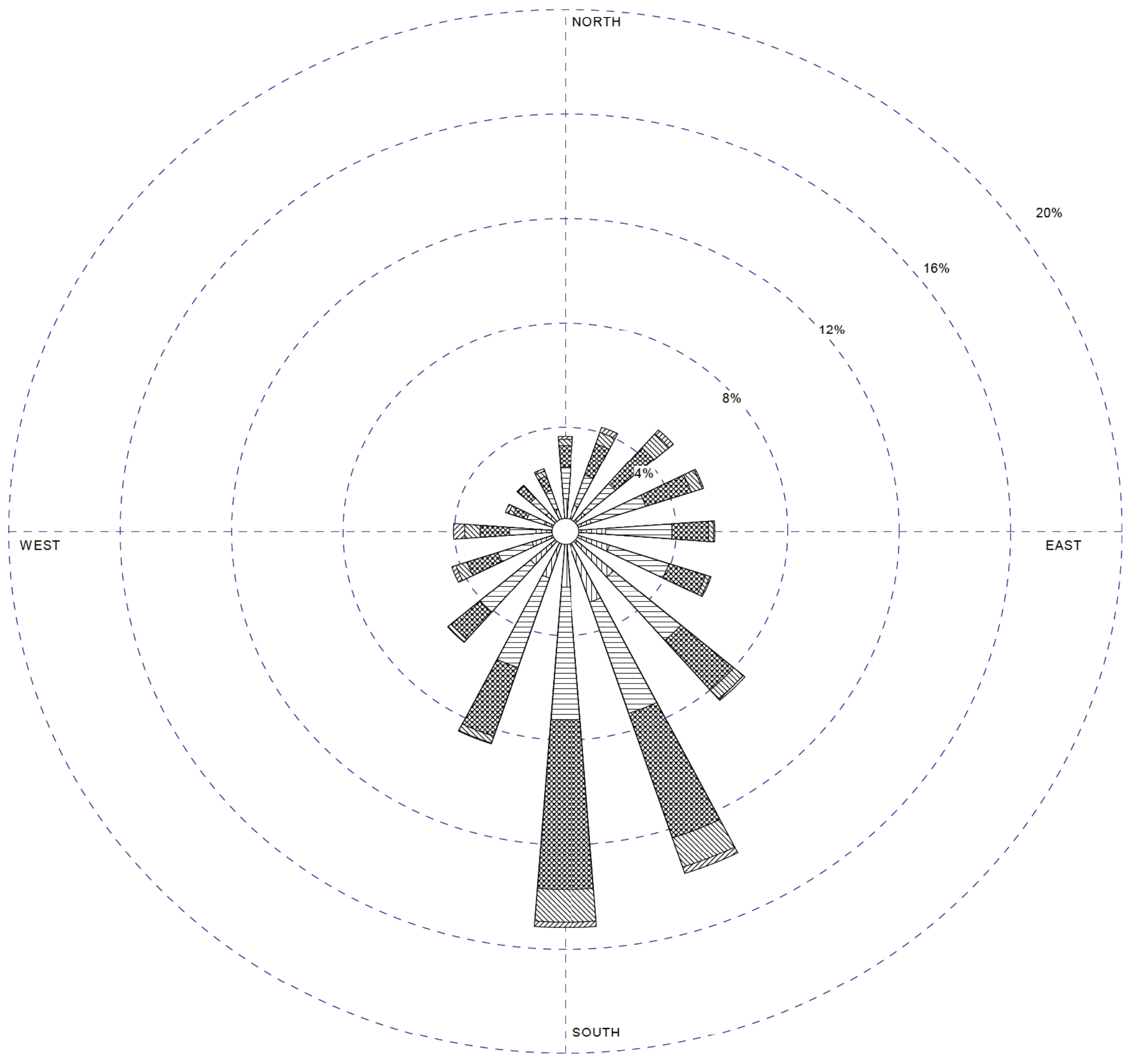
Wind Speed (Knots)			
> 21 17 - 21 11 - 16 7 - 10 4 - 6 1 - 3	DISPLAY Wind Speed	UNIT Knots	
	AVG WIND SPEED 9.86 Knots	CALM WINDS 4.11%	**FIGURE 6** **MIDLAND, TX 2003** **WINDROSE** **ENVIRONMENTAL REPORT** **REVISION DATE: MARCH 2004**
	ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 2003 Jan 1 - Dec 31 Midnight - 11 PM	

Source: (NOAA, 2004)

Added in response to OBS NP-2.1

Figure 7. Midland, TX Windrose Data (1999–2003)

Midland, TX 1999–2003



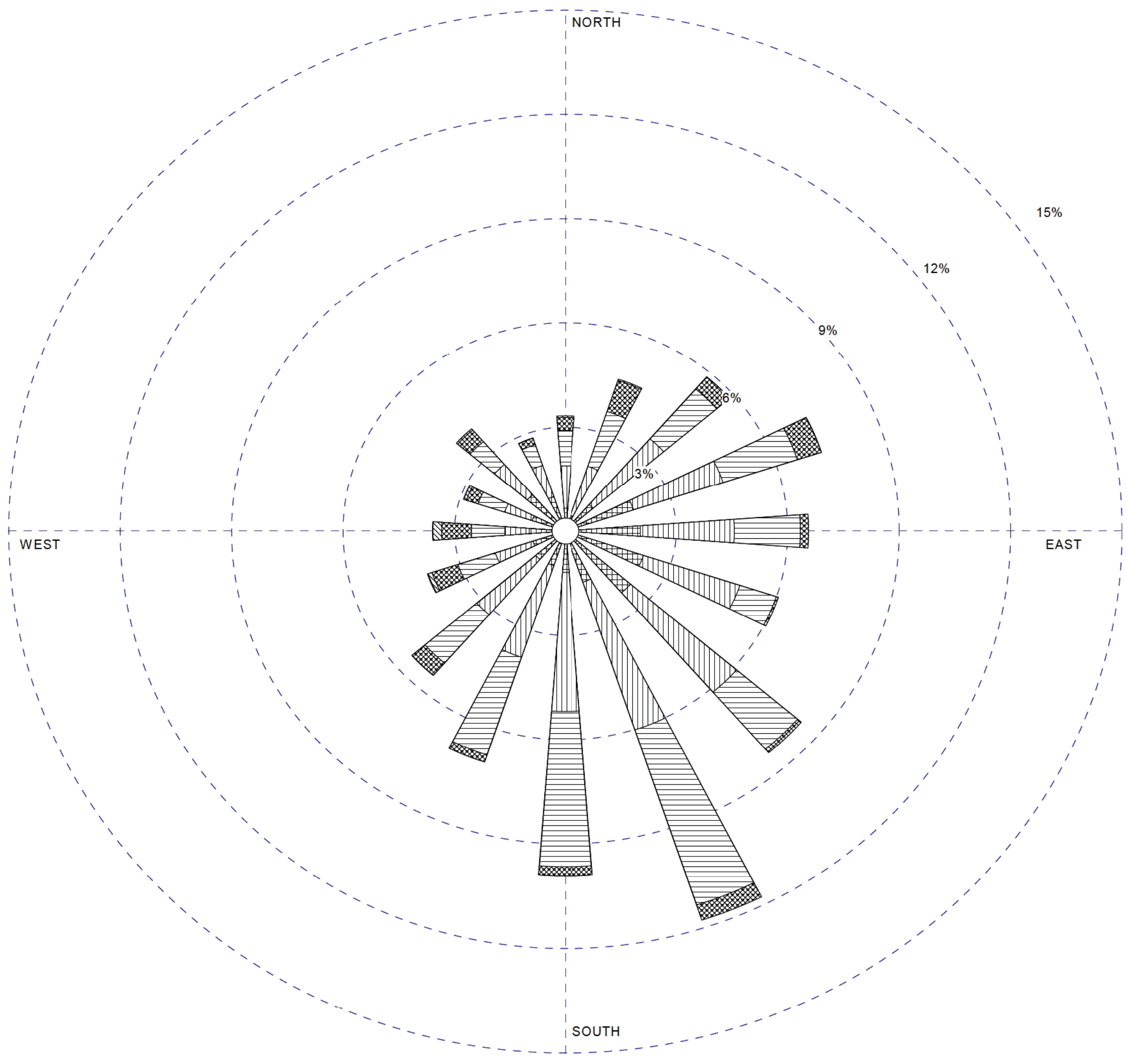
Wind Speed (Knots)			
> 21	DISPLAY Wind Speed	UNIT Knots	
17 - 21	AVG WIND SPEED 10.04 Knots	CALM WINDS 3.69%	
11 - 16 7 - 10 4 - 6 1 - 3	ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 1999 2000 2001 2002 2003 Jan 1 - Dec 31 Midnight - 11 PM	**FIGURE 7** **MIDLAND, TX 1999 2000 2001 2002 2003** **WINDROSE** **ENVIRONMENTAL REPORT** **REVISION DATE: MARCH 2004**

Source: (NOAA, 2004)

Added in response to OBS NP-2.1

Figure 8. WCS Lower Windrose Data (2000)

WCS Lower Onsite, TX 2000

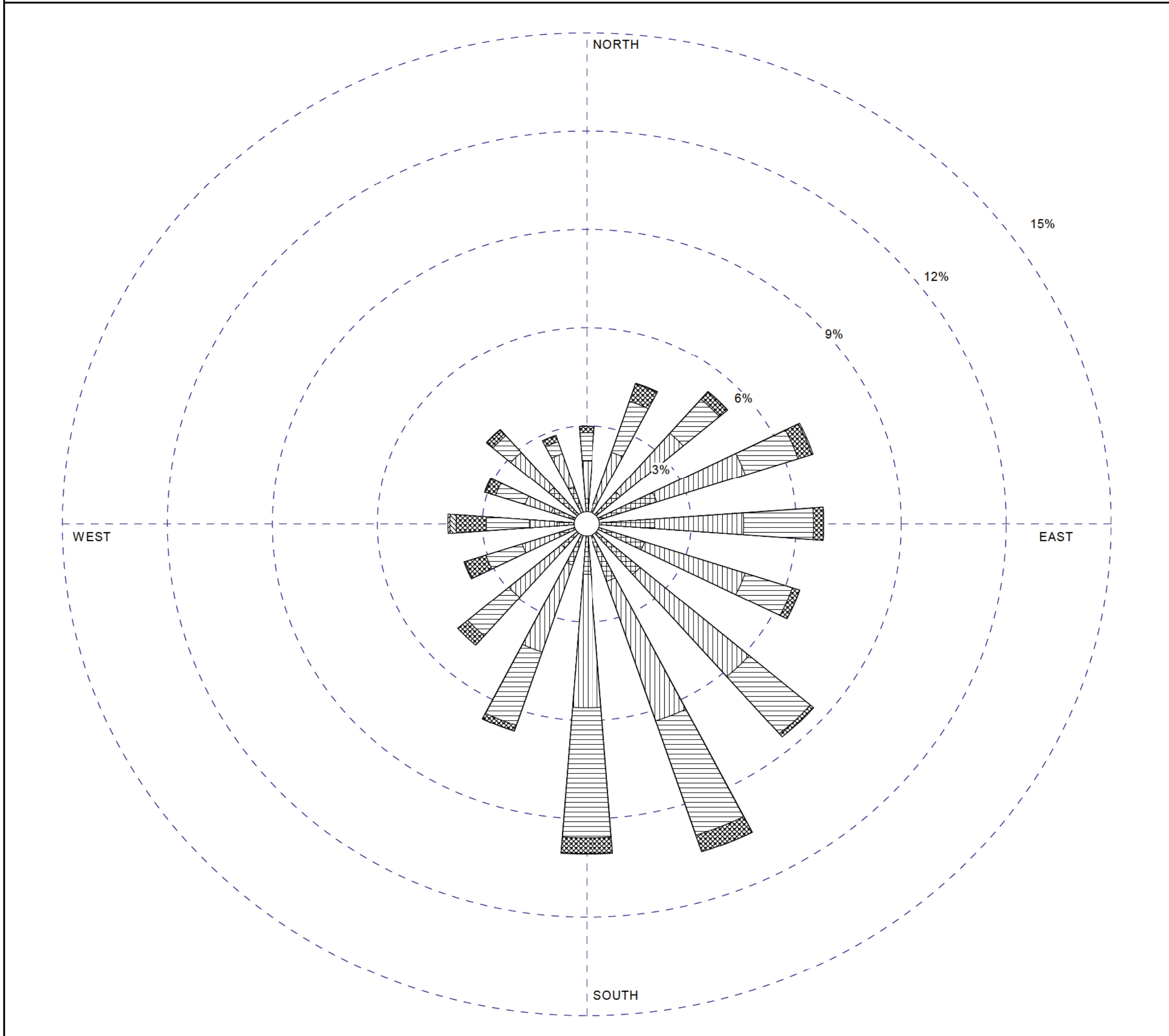


Wind Speed (Knots)			
> 21 17 - 21 11 - 16 7 - 10 4 - 6 1 - 3	DISPLAY Wind Speed	UNIT Knots	
	AVG WIND SPEED 6.06 Knots	CALM WINDS 6.60%	**FIGURE 8** **WCS LOWER ONSITE, TX 2000** **WINDROSE** **ENVIRONMENTAL REPORT** **REVISION DATE: MARCH 2004**
	ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 2000 Jan 1 - Dec 31 Midnight - 11 PM	

Added in response to OBS NP-2.1

Figure 9. WCS Lower Windrose Data (2001)

WCS Lower Onsite, TX 2001

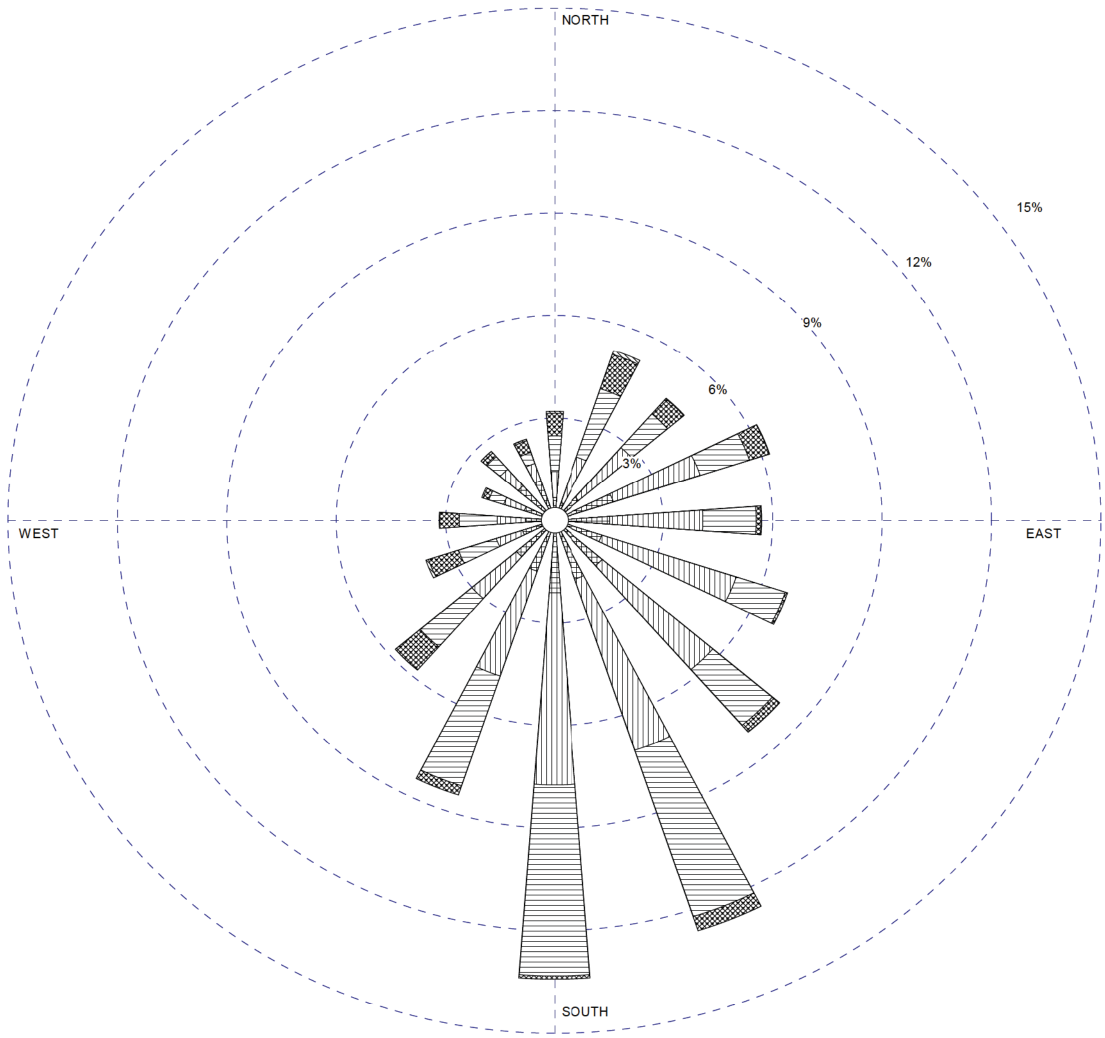


Wind Speed (Knots)			
> 21 17 - 21 11 - 16 7 - 10 4 - 6 1 - 3	DISPLAY Wind Speed	UNIT Knots	
	AVG WIND SPEED 5.83 Knots	CALM WINDS 8.89%	**FIGURE 9** **WCS LOWER ONSITE, TX 2001** **WINDROSE** **ENVIRONMENTAL REPORT** **REVISION DATE: MARCH 2004**
	ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 2001 Jan 1 - Dec 31 Midnight - 11 PM	

Added in response to OBS NP-2.1

Figure 10. WCS Lower Windrose Data (2002)

WCS Lower Onsite, TX 2002

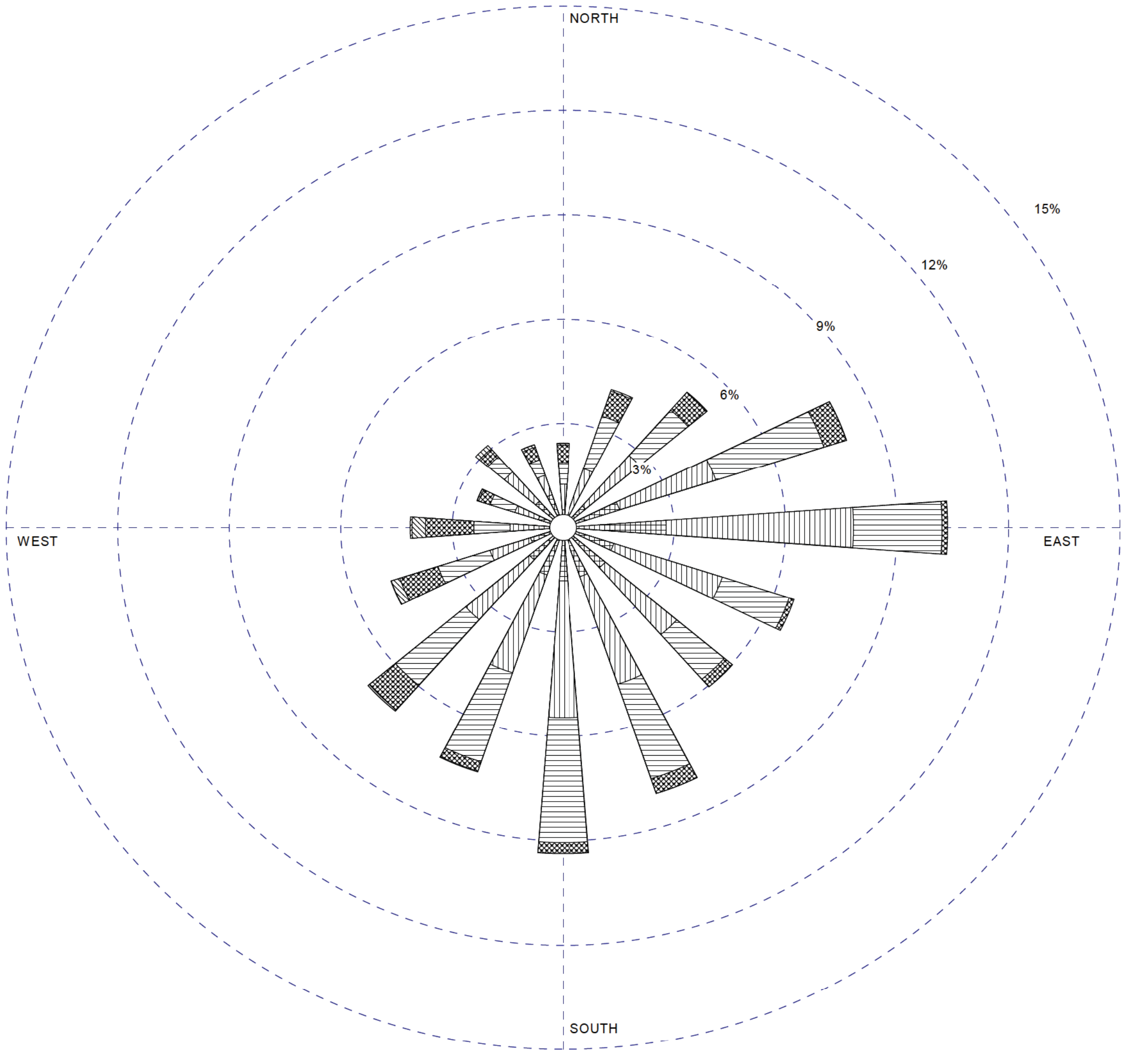


Wind Speed (Knots)			
> 21 17 - 21 11 - 16 7 - 10 4 - 6 1 - 3	DISPLAY Wind Speed	UNIT Knots	
	AVG WIND SPEED 6.04 Knots	CALM WINDS 5.50%	**FIGURE 10** **WCS LOWER ONSITE, TX 2002** **WINDROSE** **ENVIRONMENTAL REPORT** **REVISION DATE: MARCH 2004**
	ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 2002 Jan 1 - Dec 31 Midnight - 11 PM	

Added in response to OBS NP-2.1

Figure 11. WCS Lower Windrose Data (2003)

WCS Lower Onsite, TX 2003

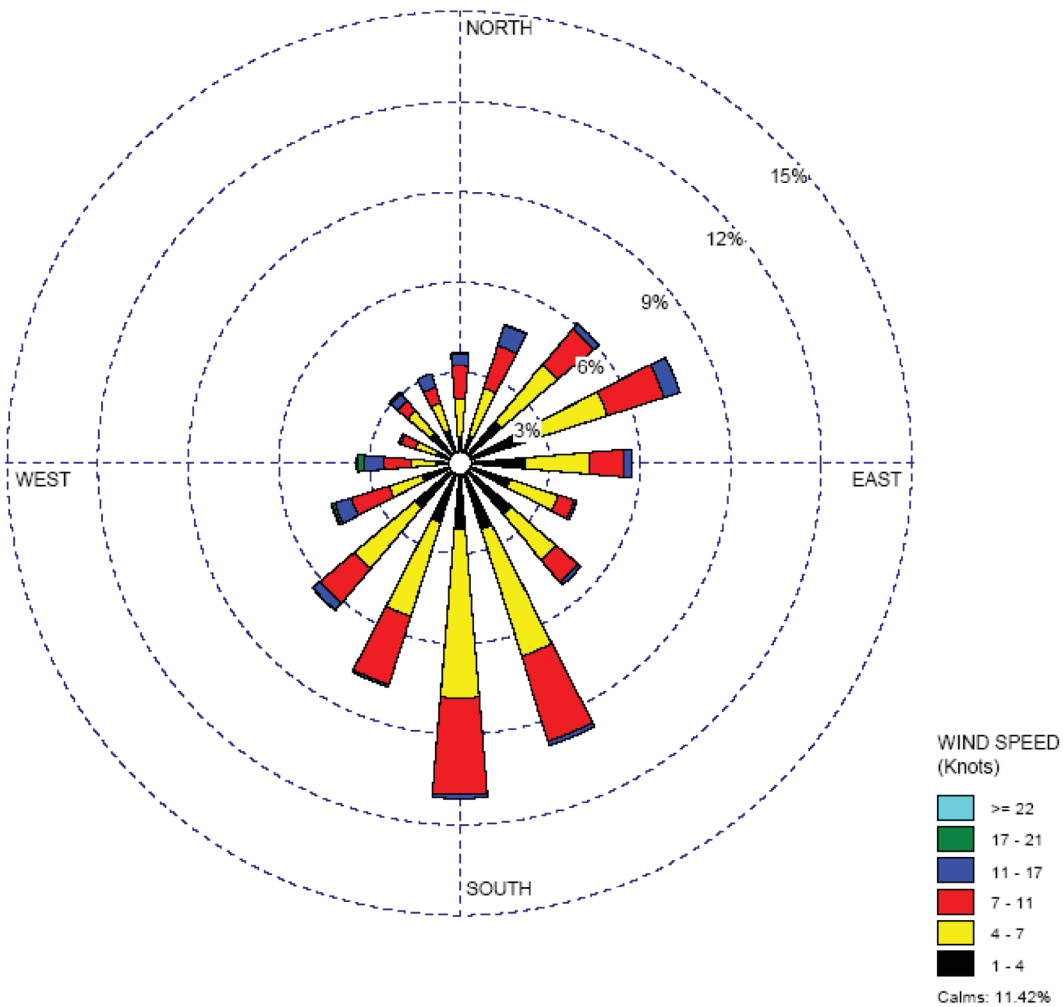


Wind Speed (Knots)			
> 21 17 - 21 11 - 16 7 - 10 4 - 6 1 - 3	DISPLAY Wind Speed	UNIT Knots	
	AVG WIND SPEED 6.29 Knots	CALM WINDS 8.35%	**FIGURE 11** **WCS LOWER ONSITE, TX 2003** **WINDROSE** **ENVIRONMENTAL REPORT** **REVISION DATE: MARCH 2004**
	ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 2003 Jan 1 - Dec 31 Midnight - 11 PM	

Added in response to OBS NP-2.1

Figure 11A. WCS Lower Windrose Data (2004)

WCS Lower Onsite, TX 2004

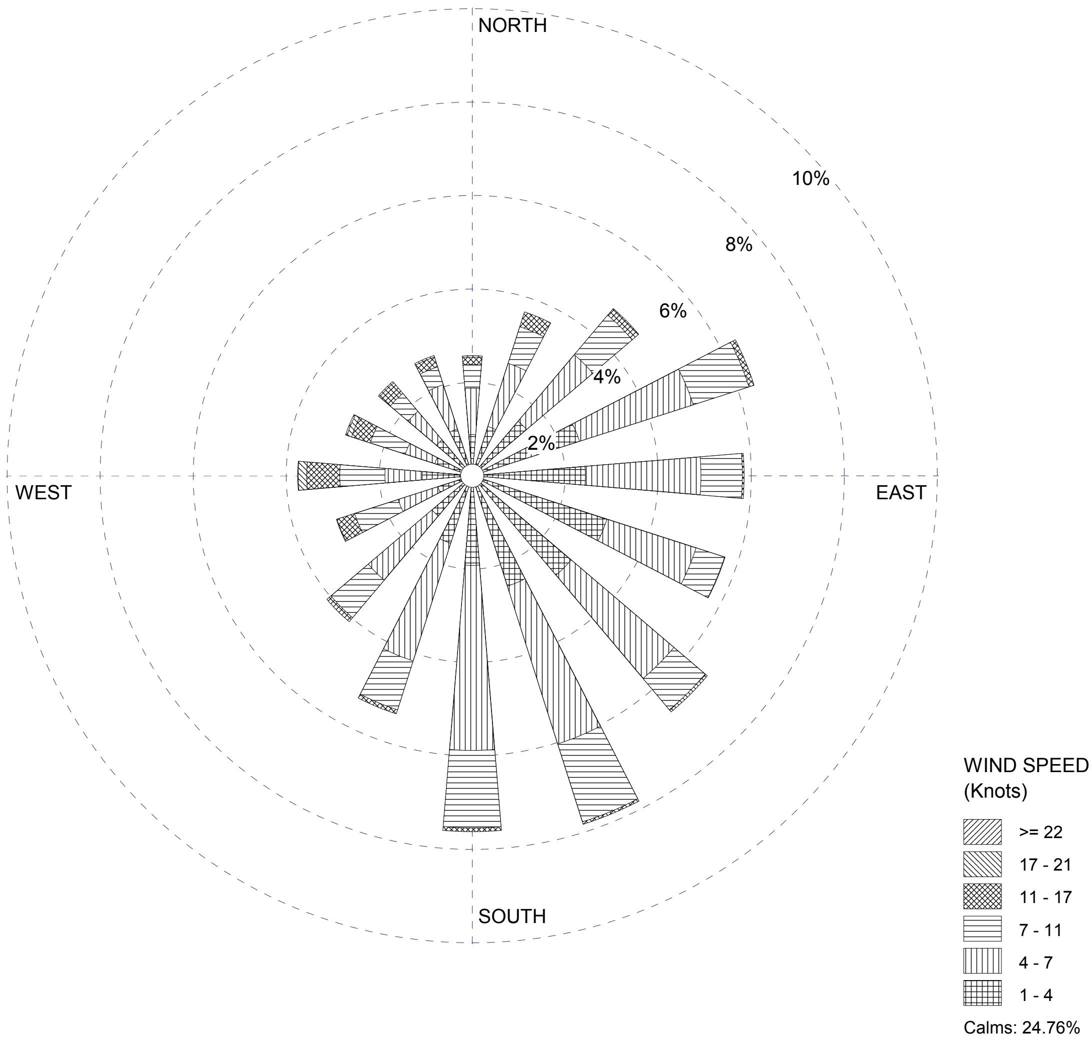


DISPLAY Wind Speed	UNIT Knots	
AVG WIND SPEED 5.31 Knots	CALM WINDS 11.42%	**FIGURE 11A** **WCS LOWER ONSITE, TX 2004** **WINDROSE**
ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 2004 Jan 1 - Dec 31 Midnight - 11 PM	

Added in response to OBS NP-2.1

Figure 11B. WCS Lower Windrose Data (2005)

WCS Lower Onsite, TX 2005

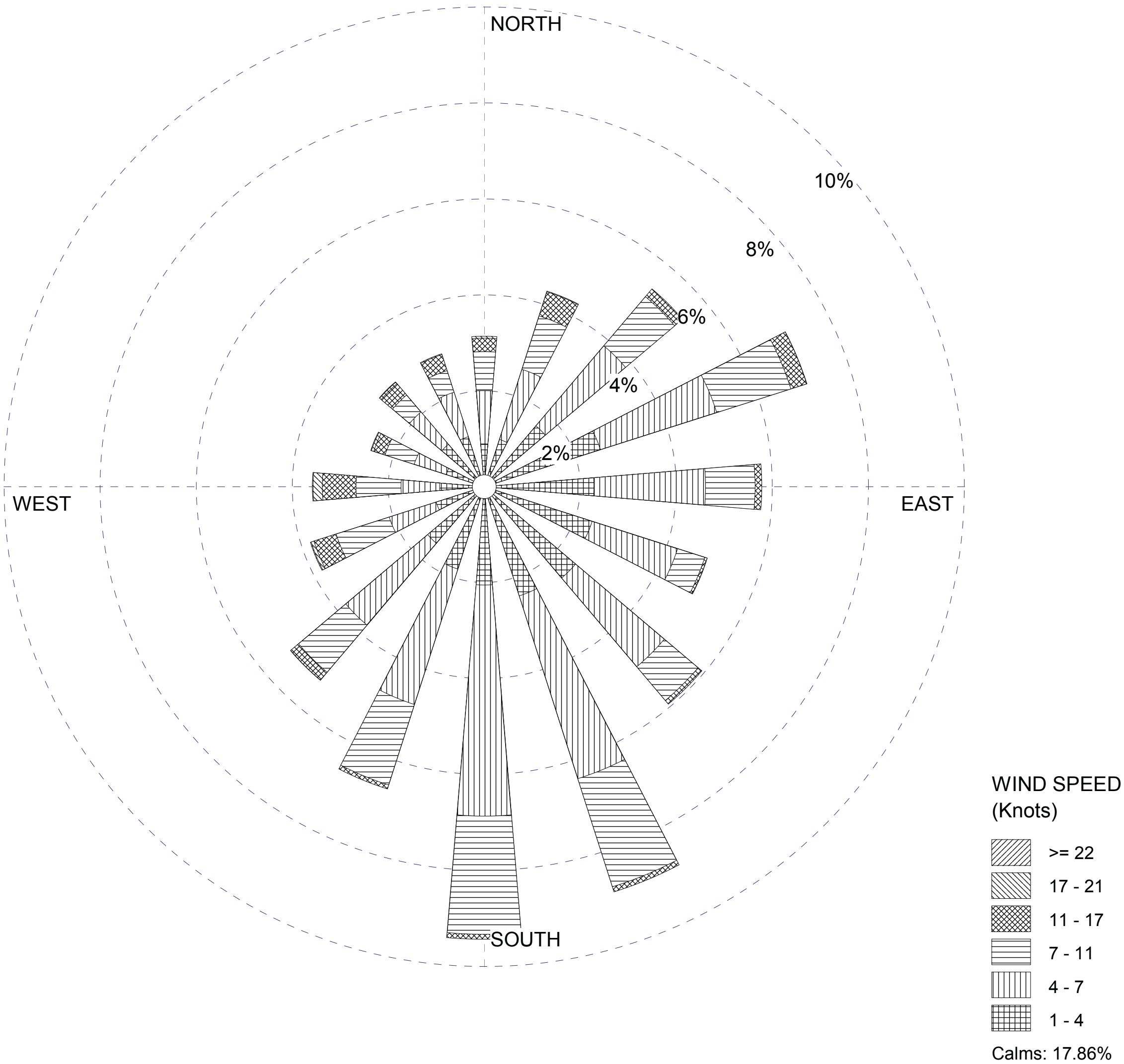


	DISPLAY Wind Speed	UNIT Knots	
	AVG WIND SPEED 4.21 Knots	CALM WINDS 24.76%	**FIGURE 11B** **WCS LOWER ONSITE, TX 2005** **WINDROSE**
	ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 2005 Jan 1 - Dec 31 Midnight - 11 PM	

Added in response to OBS NP-2.1

Figure 12. WCS Lower Windrose Data (2000–2005)

WCS Lower Onsite, TX 2000–2005

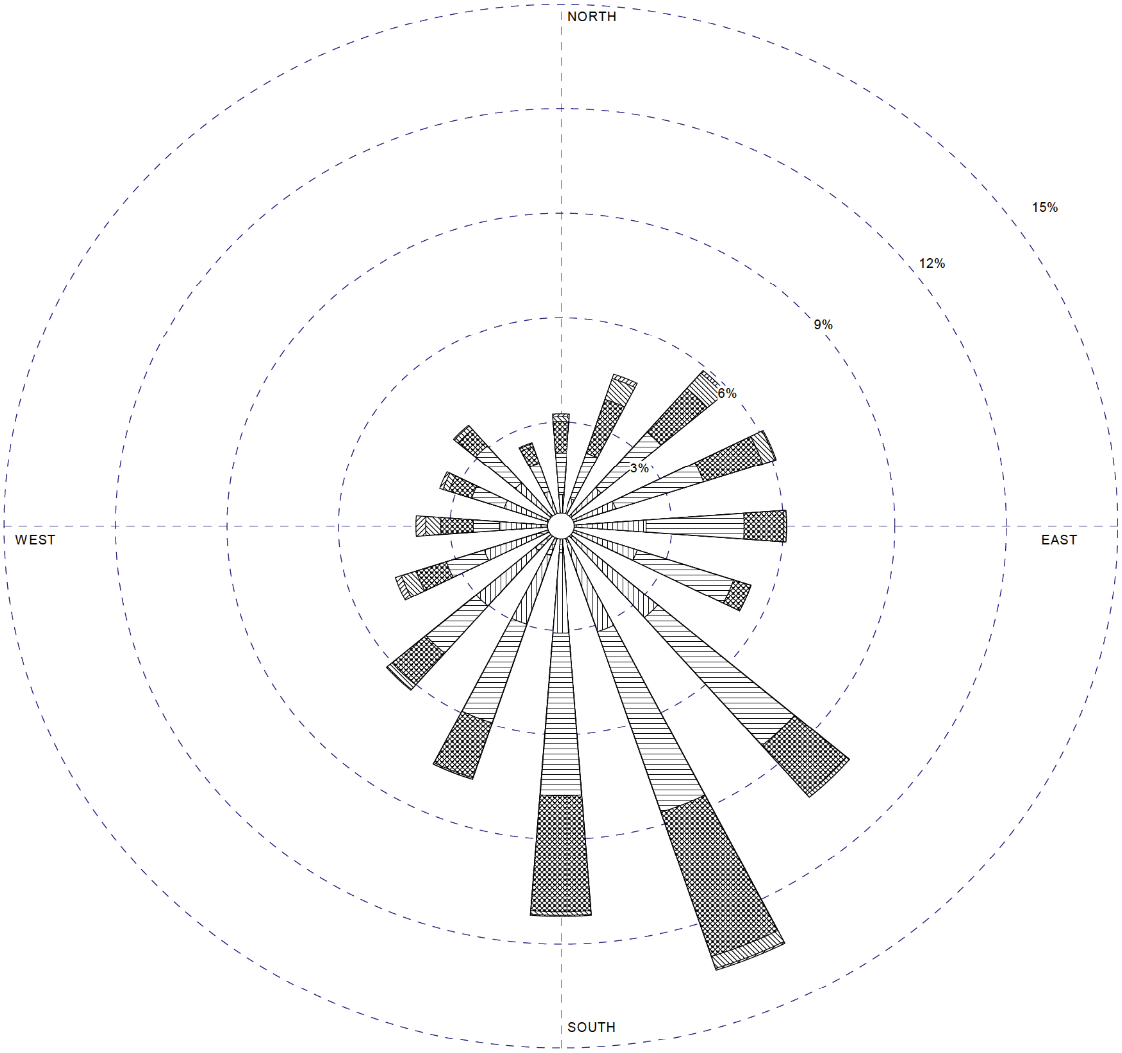


DISPLAY Wind Speed	UNIT Knots	
AVG WIND SPEED 4.78 Knots	CALM WINDS 17.86%	**FIGURE 12** **WCS LOWER ONSITE, TX 2000–2005 WINDROSE**
ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 2000 2001 2002 2003 2004 2005 Jan 1 - Dec 31 Midnight - 11 PM	

Added in response to OBS NP-2.1

Figure 13. WCS Upper Windrose Data (2000)

WCS Upper Onsite, TX 2000

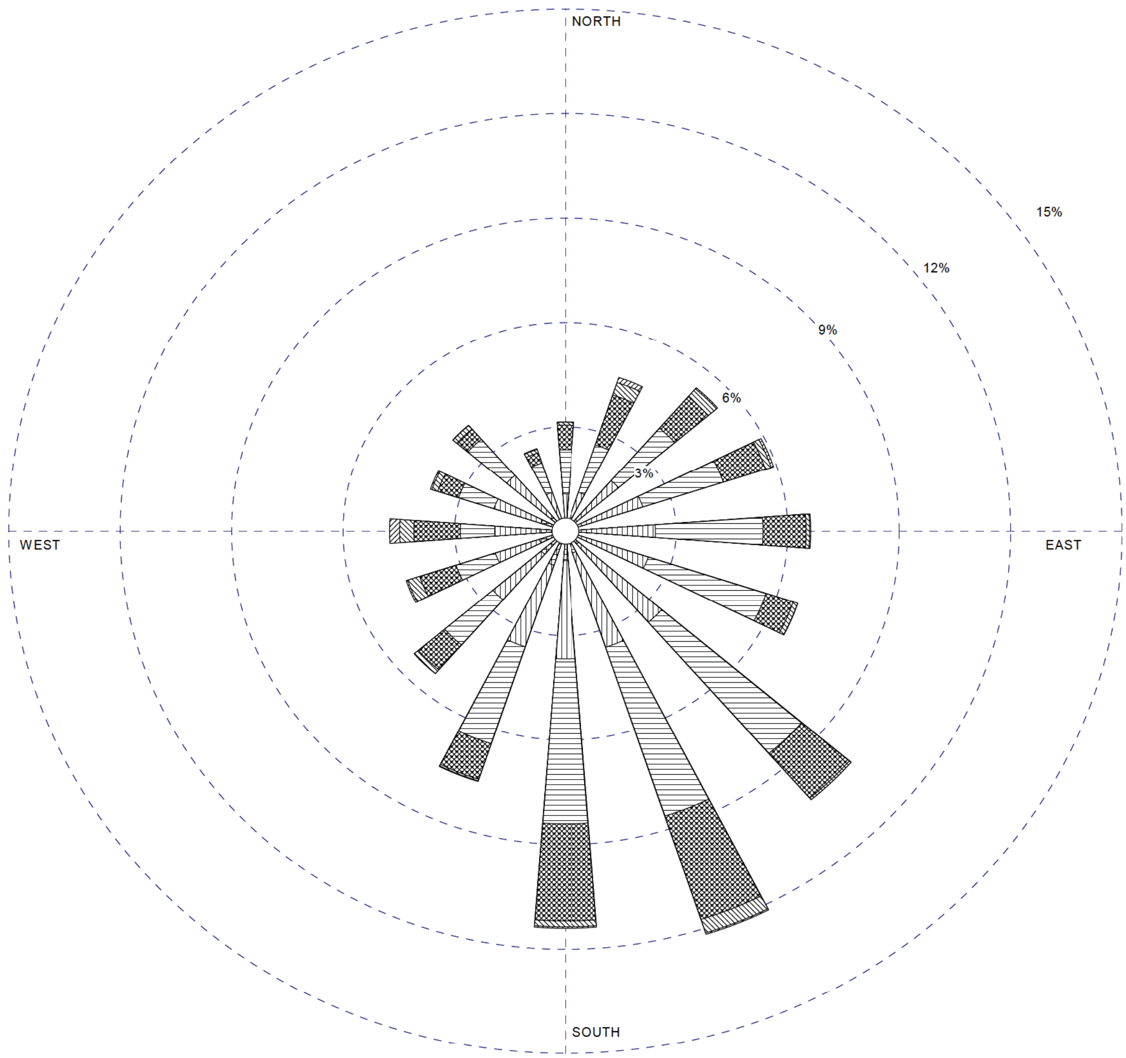


Wind Speed (Knots)			
> 21 17 - 21 11 - 16 7 - 10 4 - 6 1 - 3	DISPLAY Wind Speed	UNIT Knots	
	AVG WIND SPEED 8.63 Knots	CALM WINDS 1.45%	**FIGURE 13** **WCS UPPER ONSITE, TX 2000** **WINDROSE** **ENVIRONMENTAL REPORT** **REVISION DATE: MARCH 2004**
	ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 2000 Jan 1 - Dec 31 Midnight - 11 PM	

Added in response to OBS NP-2.1

Figure 14. WCS Upper Windrose Data (2001)

WCS Upper Onsite, TX 2001

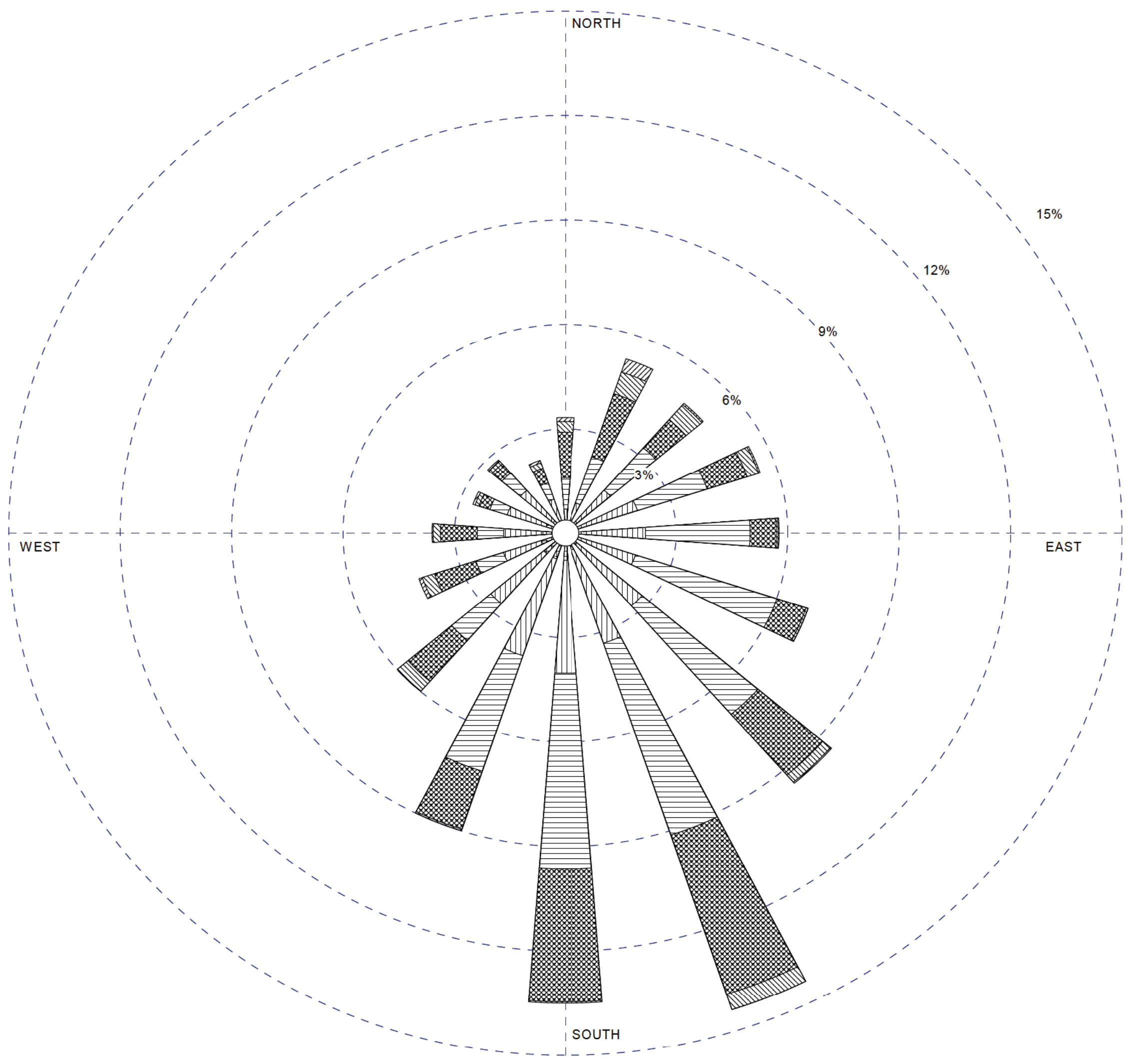


Wind Speed (Knots)			
> 21 17 - 21 11 - 16 7 - 10 4 - 6 1 - 3	DISPLAY Wind Speed	UNIT Knots	
	AVG WIND SPEED 8.19 Knots	CALM WINDS 1.25%	**FIGURE 14** **WCS UPPER ONSITE, TX 2001** **WINDROSE** **ENVIRONMENTAL REPORT** **REVISION DATE: MARCH 2004**
	ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 2001 Jan 1 - Dec 31 Midnight - 11 PM	

Added in response to OBS NP-2.1

Figure 15. WCS Upper Windrose Data (2002)

WCS Upper Onsite, TX 2002

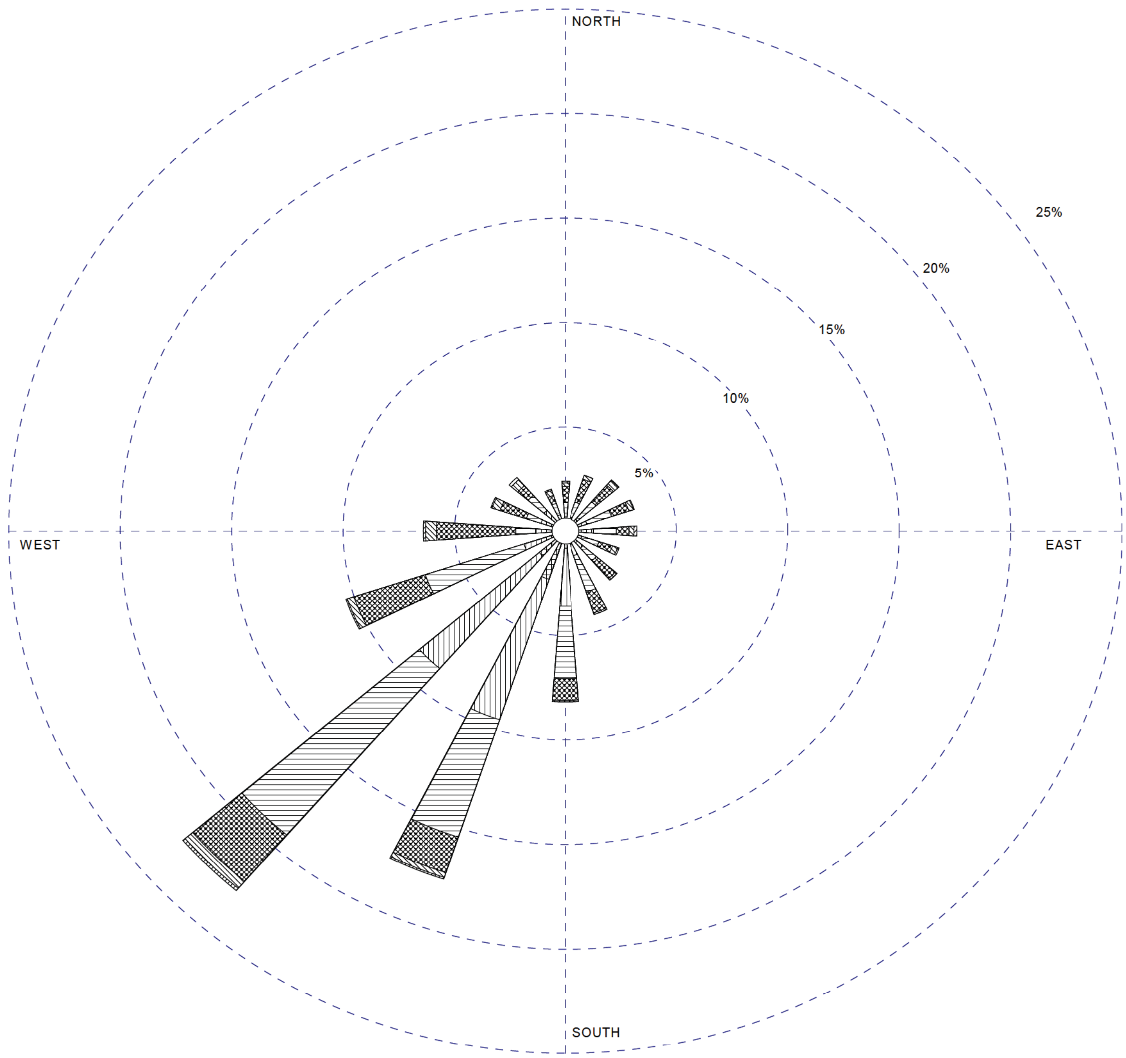


Wind Speed (Knots)			
> 21	DISPLAY Wind Speed	UNIT Knots	
17 - 21 11 - 16	AVG WIND SPEED 8.72 Knots	CALM WINDS 0.52%	**FIGURE 15** **WCS UPPER ONSITE, TX 2002** **WINDROSE** **ENVIRONMENTAL REPORT** **REVISION DATE: MARCH 2004**
7 - 10 4 - 6 1 - 3	ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 2002 Jan 1 - Dec 31 Midnight - 11 PM	

Added in response to OBS NP-2.1

Figure 16. WCS Upper Windrose Data (2003)

WCS Upper Onsite, TX 2003

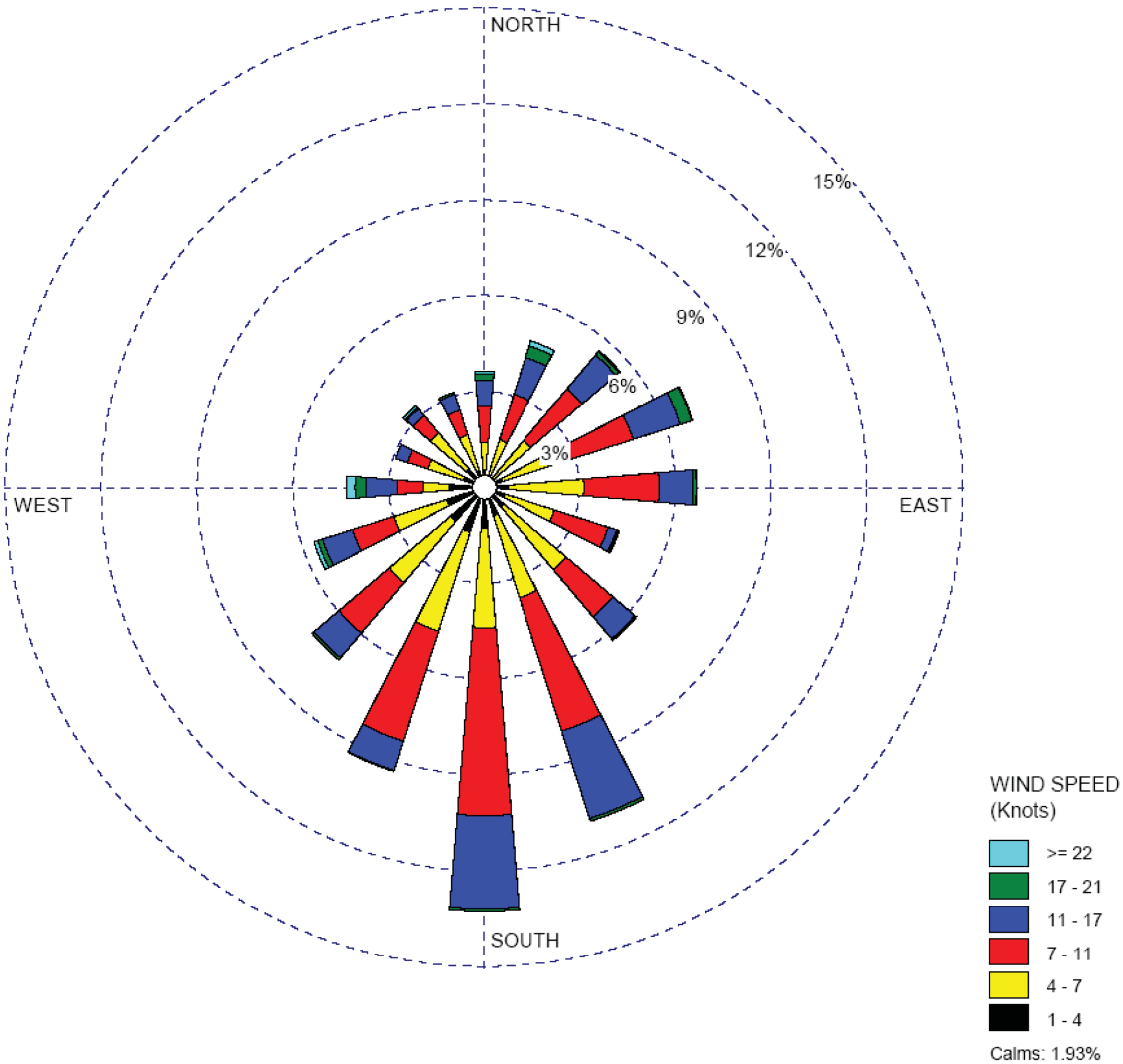


Wind Speed (Knots)			
> 21	DISPLAY Wind Speed	UNIT Knots	
17 - 21	AVG WIND SPEED 8.51 Knots	CALM WINDS 1.03%	
11 - 16 7 - 10 4 - 6 1 - 3	ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 2003 Jan 1 - Dec 31 Midnight - 11 PM	**FIGURE 16** **WCS UPPER ONSITE, TX 2003** **WINDROSE** **ENVIRONMENTAL REPORT** **REVISION DATE: MARCH 2004**

Added in response to OBS NP-2.1

Figure 16A. WCS Upper Windrose Data (2004)

WCS Upper Onsite, TX 2004

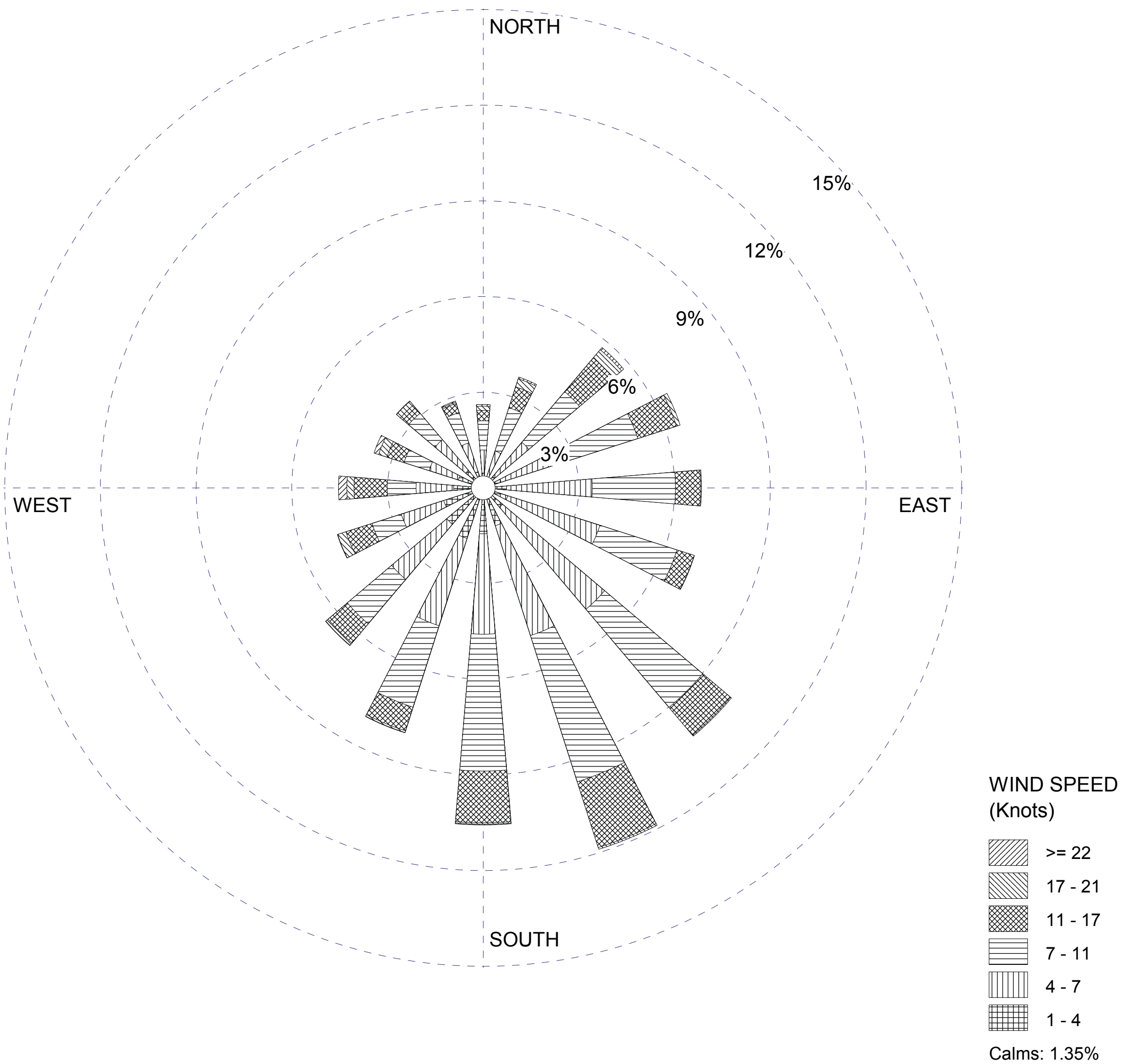


DISPLAY Wind Speed	UNIT Knots	
AVG WIND SPEED 8.08 Knots	CALM WINDS 1.93%	**FIGURE 16A** **WCS UPPER ONSITE, TX 2004** **WINDROSE**
ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 2004 Jan 1 - Dec 31 Midnight - 11 PM	

Added in response to OBS NP-2.1

Figure 16B. WCS Upper Windrose Data (2005)

WCS Upper Onsite, TX 2005

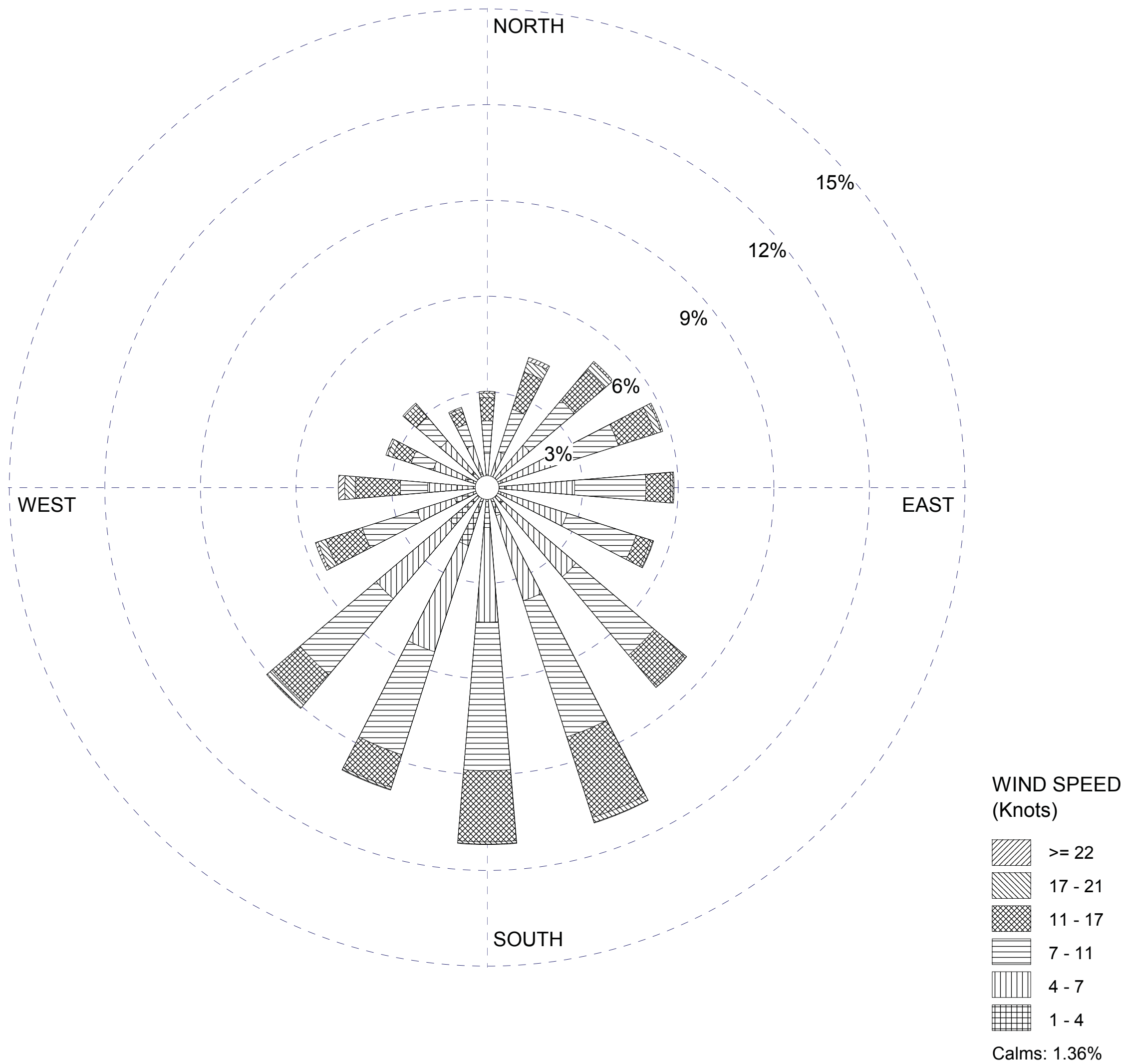


DISPLAY Wind Speed	UNIT Knots	
AVG WIND SPEED 7.79 Knots	CALM WINDS 1.35%	**FIGURE 16B** **WCS UPPER ONSITE, TX 2005** **WINDROSE**
ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 2005 Jan 1 - Dec 31 Midnight - 11 PM	

Added in response to OBS NP-2.1

Figure 17. WCS Upper Windrose Data (2000–2005)

WCS Upper Onsite, TX 2000–2005



	DISPLAY Wind Speed	UNIT Knots	
	AVG WIND SPEED 8.23 Knots	CALM WINDS 1. 36%	**FIGURE 17** **WCS UPPER ONSITE, TX** **2000 2001 2002 2003 2004 2005** **WINDROSE**
	ORIENTATION Direction (blowing from)	PLOT YEAR-DATE-TIME 2000 2001 2002 2003 2004 2005 Jan 1 - Dec 31 Midnight - 11 PM	

Added in response to OBS NP-2.1

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Added in response to OBS NP-2.1

ATTACHMENT 1: FLOOD EVENTS REPORTED IN ANDREWS COUNTY

Added in response to OBS NP-2.1

Query Results

12 FLOOD event(s) were reported in **Andrews County, Texas** between **01/01/1993** and **05/31/2004**.

*Click on **Location or County** to display Details.*

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Texas

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 Andrews	06/25/1996	08:07 PM	Flash Flood	N/A	0	0	0	0
2 Andrews	08/28/1996	03:10 PM	Flash Flood	N/A	0	0	0	0
3 Andrews	07/08/1997	06:15 PM	Flash Flood	N/A	0	0	0	0
4 West Portion	05/26/1998	04:30 PM	Flash Flood	N/A	0	0	0	0
5 Andrews	03/22/2000	02:00 AM	Flash Flood	N/A	0	0	0	0
6 Andrews	06/28/2000	11:45 PM	Flood	N/A	0	0	0	0
7 Andrews	07/01/2000	08:10 AM	Flash Flood	N/A	0	0	0	0
8 Andrews	10/24/2000	03:40 PM	Flash Flood	N/A	0	0	0	0
9 Andrews	08/01/2002	10:55 PM	Flash Flood	N/A	0	0	0	0
10 Andrews	05/24/2003	07:20 PM	Flash Flood	N/A	0	0	0	0
11 Andrews	05/24/2003	09:00 PM	Flash Flood	N/A	0	0	0	0
12 Frankel City	04/04/2004	12:45 PM	Flash Flood	N/A	0	0	0	0
				TOTALS:	0	0	0	0

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ATTACHMENT 2: THUNDERSTORM AND HIGH WIND EVENTS REPORTED IN ANDREWS COUNTY

Query Results

38 THUNDERSTORM & HIGH WIND event(s) were reported in **Andrews County, Texas** between **01/01/1993** and **05/31/2004**.

*Click on **Location or County** to display Details.*

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Added in response to OBS NP-2.1

Texas

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 Andrews	04/27/1993	1855	Thunderstorm Winds	N/A	0	0	5K	0
2 Andrews	04/27/1993	1920	Thunderstorm Winds	N/A	0	0	50K	0
3 Andrews	05/01/1993	1620	Thunderstorm Winds	N/A	0	0	5K	5K
4 Andrews	08/24/1993	2300	Thunderstorm Winds	N/A	0	0	1K	0
5 Andrews	08/24/1993	2346	Thunderstorm Winds	N/A	0	0	0	0
6 Andrews	12/12/1993	1530	Thunderstorm Winds	N/A	0	0	0	0
7 Andrews	05/26/1994	2057	Thunderstorm Winds	N/A	0	0	0	0
8 Andrews	07/13/1994	1830	Thunderstorm Winds	N/A	0	0	50K	1K
9 Permian Basin	04/17/1995	1300	High Winds	0 kts.	0	0	0	0
10 TXZ045>047 - 050>052 - 058>063 - 067>069	04/19/1995	1300	High Winds	0 kts.	0	0	0	0
11 Loop	06/04/1995	1548	Thunderstorm Winds	N/A	0	0	0	0
12 Frankel City	09/24/1995	2140	Thunderstorm Wind	N/A	0	0	0	0
13 Andrews	09/24/1995	2210	Thunderstorm Winds	N/A	0	0	5K	0
14 TXZ050	01/17/1996	12:20 PM	High Wind	79 kts.	0	0	0	0
15 Andrews	06/02/1996	10:34 PM	Tstm Wind	61 kts.	0	0	0	0
16 Andrews	09/02/1996	04:30 PM	Tstm Wind	52 kts.	0	0	0	0
17 Andrews	05/28/1997	04:17 PM	Tstm Wind	52 kts.	0	0	0	0
18 Andrews	06/11/1997	05:40 PM	Tstm Wind	52 kts.	0	0	10K	0

Added in response to OBS NP-2.1

19 Andrews	05/26/1998	05:00 PM	Tstm Wind	0 kts.	0	0	10K	0
20 Andrews	06/22/1998	06:15 PM	Tstm Wind	0 kts.	0	0	2K	0
21 Andrews	07/16/1998	03:30 PM	Tstm Wind	0 kts.	0	0	1K	0
22 Andrews	04/30/1999	02:33 PM	Tstm Wind	59 kts.	0	0	0	0
23 Andrews	05/29/1999	12:05 AM	Tstm Wind	52 kts.	0	0	0	0
24 Florey	05/29/1999	12:12 AM	Tstm Wind	0 kts.	0	0	3K	0
25 Andrews	03/07/2000	12:30 PM	Tstm Wind	0 kts.	0	0	10K	0
26 Frankel City	03/22/2000	12:25 AM	Tstm Wind	60 kts.	0	0	0	0
27 Andrews	05/10/2002	07:50 PM	Tstm Wind	52 kts.	0	0	0	0
28 Andrews	05/29/2002	06:00 PM	Tstm Wind	57 kts.	0	0	0	0
29 Andrews	08/01/2002	08:25 PM	Tstm Wind	61 kts.	0	0	50K	0
30 Florey	08/21/2002	06:30 PM	Tstm Wind	52 kts.	0	0	0	0
31 Andrews	09/13/2002	05:52 PM	Tstm Wind	52 kts.	0	0	0	0
32 Frankel City	10/01/2002	06:05 PM	Tstm Wind	52 kts.	0	0	0	0
33 TXZ050 - 074 - 258	04/15/2003	11:00 AM	High Wind	86 kts.	0	0	35K	0
34 Andrews	06/13/2003	09:46 PM	Tstm Wind	52 kts.	0	0	0	0
35 Andrews	06/22/2003	06:55 PM	Tstm Wind	61 kts.	0	0	30K	0
36 Andrews	09/07/2003	04:10 PM	Tstm Wind	65 kts.	0	0	20K	0
37 Andrews	09/08/2003	12:20 AM	Tstm Wind	70 kts.	0	0	75K	0
38 TXZ045 - 050 - 074 - 258	02/19/2004	03:00 AM	High Wind	82 kts.	0	0	35K	0
				TOTALS:	0	0	396K	6K

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ATTACHMENT 3: HAIL EVENTS REPORTED IN ANDREWS COUNTY

Added in response to OBS NP-2.1

Query Results

74 HAIL event(s) were reported in **Andrews County, Texas** between **01/01/1993** and **05/31/2004**.

*Click on **Location or County** to display Details.*

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Added in response to OBS NP-2.1

Texas

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 Andrews	04/28/1993	2050	Hail	1.50 in.	0	0	0	1K
2 Andrews	08/24/1993	2300	Hail	0.75 in.	0	0	0	0
3 Andrews	05/10/1994	2147	Hail	1.75 in.	0	0	0	0
4 Andrews	05/10/1994	2235	Hail	1.75 in.	0	0	0	0
5 Andrews	06/04/1995	0730	Hail	1.75 in.	0	0	0	0
6 Gaines	06/04/1995	1342	Hail	0.75 in.	0	0	0	0
7 Seagraves	06/04/1995	1425	Hail	0.75 in.	0	0	0	0
8 Loop	06/04/1995	1455	Hail	0.75 in.	0	0	0	0
9 Loop	06/04/1995	1506	Hail	1.75 in.	0	0	0	0
10 Loop	06/04/1995	1524	Hail	2.75 in.	0	0	0	0
11 Loop	06/04/1995	1545	Hail	4.50 in.	0	0	0	0
12 Loop	06/04/1995	1616	Hail	1.75 in.	0	0	0	0
13 Loop	06/04/1995	1700	Hail	4.50 in.	0	0	0	0
14 Andrews	06/04/1995	2010	Hail	0.75 in.	0	0	0	0
15 Andrews	06/04/1995	2114	Hail	1.75 in.	0	0	0	0
16 Andrews	06/04/1995	2133	Hail	2.50 in.	0	0	0	0
17 Andrews	06/04/1995	2134	Hail	3.50 in.	0	0	6.0M	0
18 Andrews	06/04/1995	2137	Hail	2.75 in.	0	0	0	0
19 Andrews	06/04/1995	2153	Hail	0.75 in.	0	0	0	0
20 Andrews	06/04/1995	2200	Hail	0.75 in.	0	0	0	0
21 Andrews	06/10/1995	1708	Hail	1.75 in.	0	0	500K	0
22 Andrews	06/27/1995	0015	Hail	0.75 in.	0	0	0	0
23 Frankel City	09/24/1995	2140	Hail	1.75 in.	0	0	0	0
24 Andrews	09/24/1995	2200	Hail	0.75 in.	0	0	0	0
25 Andrews	09/24/1995	2210	Hail	1.75 in.	0	0	0	0
26 Andrews	10/02/1995	1318	Hail	0.75 in.	0	0	0	0
27 Frankel City	09/17/1996	07:50 PM	Hail	2.25 in.	0	0	0	0
28 Florey	04/09/1997	09:20 PM	Hail	1.00 in.	0	0	0	0
29 Andrews	04/24/1997	11:18 PM	Hail	1.00 in.	0	0	0	0
30 Andrews	05/14/1997	07:23 PM	Hail	1.50 in.	0	0	0	0

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31 Andrews	05/28/1997	04:17 PM	Hail	0.75 in.	0	0	0	0
32 Andrews	05/28/1997	04:20 PM	Hail	0.88 in.	0	0	0	0
33 Andrews	05/28/1997	06:10 PM	Hail	1.75 in.	0	0	0	0
34 Frankel City	05/29/1997	07:33 PM	Hail	0.75 in.	0	0	0	0
35 Andrews	05/29/1997	07:47 PM	Hail	1.00 in.	0	0	0	0
36 Andrews	06/11/1997	05:06 PM	Hail	1.75 in.	0	0	0	0
37 Andrews	06/11/1997	05:30 PM	Hail	1.00 in.	0	0	0	0
38 Andrews	05/14/1998	10:35 PM	Hail	1.75 in.	0	0	0	0
39 Andrews	05/26/1998	03:00 PM	Hail	1.75 in.	0	0	0	0
40 Andrews	05/26/1998	03:28 PM	Hail	2.75 in.	0	0	0	0
41 Andrews	05/26/1998	04:30 PM	Hail	1.75 in.	0	0	0	0
42 Andrews	06/22/1998	06:15 PM	Hail	1.75 in.	0	0	0	0
43 Andrews	06/22/1998	06:57 PM	Hail	1.25 in.	0	0	0	0
44 Andrews	07/16/1998	03:30 PM	Hail	0.75 in.	0	0	0	0
45 Andrews	10/27/1998	05:45 PM	Hail	0.75 in.	0	0	0	0
46 Andrews	10/30/1998	10:02 PM	Hail	0.88 in.	0	0	0	0
47 Andrews	04/28/1999	06:53 PM	Hail	0.75 in.	0	0	0	0
48 Andrews	04/28/1999	08:43 PM	Hail	1.75 in.	0	0	5.0M	0
49 Frankel City	05/01/1999	08:30 PM	Hail	1.00 in.	0	0	0	0
50 Andrews	05/26/1999	07:10 PM	Hail	1.75 in.	0	0	0	0
51 Andrews	06/06/1999	06:10 PM	Hail	0.75 in.	0	0	0	0
52 Andrews	06/09/1999	07:50 PM	Hail	1.00 in.	0	0	0	0
53 Andrews	06/09/1999	07:58 PM	Hail	1.00 in.	0	0	0	0
54 Andrews Co Arpt	06/09/1999	08:12 PM	Hail	1.00 in.	0	0	0	0
55 Frankel City	06/11/1999	05:25 PM	Hail	2.25 in.	0	0	0	0
56 Frankel City	03/22/2000	12:25 AM	Hail	1.00 in.	0	0	0	0
57 Frankel City	03/22/2000	12:55 AM	Hail	1.00 in.	0	0	0	0
58 Andrews	05/10/2001	08:18 AM	Hail	1.00 in.	0	0	0	0
59 Florey	05/11/2001	02:52 PM	Hail	1.00 in.	0	0	0	0
60 Andrews	05/11/2001	03:10 PM	Hail	1.75 in.	0	0	0	0
61 Andrews	04/19/2002	04:57 PM	Hail	1.75 in.	0	0	0	0

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62 Andrews	04/19/2002	05:05 PM	Hail	1.00 in.	0	0	0	0
63 Andrews	04/19/2002	06:40 PM	Hail	0.75 in.	0	0	0	0
64 Andrews	05/27/2002	02:45 PM	Hail	1.75 in.	0	0	0	0
65 Andrews	05/27/2002	09:00 AM	Hail	1.75 in.	0	0	0	0
66 Frankel City	10/01/2002	06:05 PM	Hail	1.00 in.	0	0	0	0
67 Andrews	04/28/2003	05:10 PM	Hail	1.00 in.	0	0	0	0
68 Andrews	06/07/2003	06:22 PM	Hail	0.88 in.	0	0	0	0
69 Andrews	06/22/2003	06:45 PM	Hail	1.75 in.	0	0	0	0
70 Andrews	09/07/2003	04:10 PM	Hail	0.75 in.	0	0	0	0
71 Andrews	09/08/2003	12:25 AM	Hail	1.00 in.	0	0	0	0
72 Andrews	10/05/2003	06:40 PM	Hail	1.75 in.	0	0	0	0
73 Frankel City	03/03/2004	09:55 PM	Hail	0.88 in.	0	0	0	0
74 Andrews	03/20/2004	05:15 PM	Hail	0.75 in.	0	0	0	0
				TOTALS:	0	0	11.500M	500

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Added in response to OBS NP-2.1

ATTACHMENT 4: LIGHTNING EVENTS REPORTED IN ANDREWS COUNTY

Added in response to OBS NP-2.1

Query Results

0 LIGHTNING event(s) were reported in **Andrews County, Texas** between **01/01/1993** and **05/31/2004**.

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ATTACHMENT 5: TORNADO EVENTS REPORTED IN ANDREWS COUNTY

Added in response to OBS NP-2.1

Query Results

2 TORNADO(s) were reported in **Andrews County, Texas** between **01/01/1993** and **05/31/2004**.

*Click on **Location or County** to display Details.*

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Texas

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 Andrews	05/26/1994	2046	Tornado	F0	0	0	0	0
2 Andrews	05/08/1997	07:26 PM	Tornado	F1	0	0	0	0
				TOTALS:	0	0	0	0

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Added in response to OBS NP-2.1

Query Results

22 TORNADO(s) were reported in **Andrews County, Texas** between **01/01/1950** and **12/31/2003**.

*Click on **Location or County** to display Details.*

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Texas

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 ANDREWS	05/29/1954	1722	Tornado	F1	0	9	0K	0
2 ANDREWS	05/07/1956	1835	Tornado	F1	0	1	25K	0
3 ANDREWS	05/15/1959	0115	Tornado	F0	0	0	0K	0
4 ANDREWS	05/31/1960	1900	Tornado	F0	0	0	0K	0
5 ANDREWS	06/16/1962	1915	Tornado	F2	0	0	0K	0
6 ANDREWS	05/13/1965	1445	Tornado	F1	0	0	3K	0
7 ANDREWS	04/10/1969	2300	Tornado	F0	0	0	0K	0
8 ANDREWS	05/05/1969	1457	Tornado	F0	0	0	0K	0
9 ANDREWS	05/05/1969	1500	Tornado	F0	0	0	0K	0
10 ANDREWS	05/05/1969	1500	Tornado	F0	0	0	0K	0
11 ANDREWS	06/13/1969	1955	Tornado	F0	0	0	0K	0
12 ANDREWS	06/07/1980	2130	Tornado	F1	0	0	25K	0
13 ANDREWS	05/12/1982	0235	Tornado	F2	0	0	0K	0
14 ANDREWS	10/02/1986	1553	Tornado	F1	0	0	250K	0
15 ANDREWS	05/30/1987	1915	Tornado	F1	0	0	0K	0
16 ANDREWS	04/16/1988	1548	Tornado	F1	0	0	0K	0
17 ANDREWS	04/16/1988	1617	Tornado	F0	0	0	0K	0
18 ANDREWS	04/16/1988	1620	Tornado	F0	0	0	0K	0
19 ANDREWS	05/19/1988	1705	Tornado	F0	0	0	0K	0
20 ANDREWS	06/06/1992	1558	Tornado	F0	0	0	0K	0
21 Andrews	05/26/1994	2046	Tornado	F0	0	0	0	0

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22 Andrews	05/08/1997	07:26 PM	Tornado	F1	0	0	0	0
				TOTALS:	0	10	303K	0

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Event Record Details

Event: **Tornado**
Begin Date: **12 May 1982, 0235 CST**
Begin Location: **Not Known**
Begin LAT/LON: **32°25'N / 102°45'W**
End Location: **Not Known**
End LAT/LON: **32°32'N / 102°43'W**
Length: **6 Miles**
Width: **100 Yards**
Magnitude: **F2**
Fatalities: **0**
Injuries: **0**
Property Damage: **$ 0.3K**
Crop Damage: **$ 0.0**

State: **Texas**
Map of Counties
County: **Andrews**

Description:
None Reported

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Event Record Details

Event: **Tornado**
Begin Date: **16 Jun 1962, 1915 CST**
Begin Location: **Not Known**
Begin LAT/LON: **32°28'N / 102°14'W**
End Location: **Not Known**
Length: **1 Mile**
Width: **20 Yards**
Magnitude: **F2**
Fatalities: **0**
Injuries: **0**
Property Damage: **$ 0.0K**
Crop Damage: **$ 0.0**

State: **Texas**
Map of Counties
County: **Andrews**

Description:
None Reported

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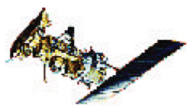

The Fujita Tornado Scale

Wind speeds in tornadoes range from values below that of hurricane speeds to more than 300 miles per hour! Unlike hurricanes, which produce wind speeds of similar values over relatively widespread areas (when compared to tornadoes), the maximum winds in tornadoes are often confined to extremely small areas, and vary tremendously over very short distances, even within the funnel itself. The tales of complete destruction of one house next to one that is totally undamaged are true and well documented.

In 1971, Dr. T. Theodore Fujita of the University of Chicago devised a six-category scale to classify U.S. tornadoes into six intensity categories, named F0-F5. These categories are based upon the estimated maximum winds occurring within the funnel. The Fujita Tornado Scale (or the "F Scale") has subsequently become the definitive scale for estimating wind speeds within tornadoes based upon the damage done to buildings and structures. It is used extensively by the National Weather Service in investigating tornadoes (all tornadoes are now assigned an F scale), and by engineers in correlating damage to building structures and techniques with different wind speeds caused by tornadoes.

The Fujita scale bridges the gap between the Beaufort Wind Speed Scale and Mach numbers (ratio of the speed of an object to the speed of sound) by connecting Beaufort Force 12 with Mach 1 in twelve steps. The equation relating the wind velocities (V in mph) with the F scale (F) is V = 14.1 * ((F+2) to the 1.5 power).

F1 on the Fujita scale is equal to B12 (73 mph) on the Beaufort scale, which is the minimum windspeed required to upgrade a tropical storm to a hurricane. F12 on the Fujita scale is equal to M1 (738 mph) on the Mach numbers. Though the Fujita scale itself ranges up to F12, the strongest tornadoes max out in the F5 range (261 to 318 mph).

The Fujita Tornado Scale

Maximum Wind Speeds	Equivalent Saffir-Simpson Scale*	Typical Effects
F0 Category Tornado		
40-72 mph (35-62 kt)	NA	Gale Tornado. Light Damage: Some damage to chimneys; breaks twigs and branches off tress; pushes over shallow-rooted trees; damages signboards; some windows broken; hurricane wind speed

Added in response to OBS NP-2.1

		begins at 73 mph.
F1 Category Tornado		
73-112 mph (63-97 kt)	Cat 1/2/3	Moderate Tornado. Moderate damage: Peels surfaces off roofs; mobile homes pushed off foundations or overturned; outbuildings demolished; moving autos pushed off the roads; trees snapped or broken.
F2 Category Tornado		
113-157 mph (98-136 kt)	Cat 3/4/5	Significant Tornado. Considerable damage: Roofs torn off frame houses; mobile homes demolished; frame houses with weak foundations lifted and moved; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
F3 Category Tornado		
158-206 mph (137-179 kt)	Cat 5	Severe Tornado. Severe damage: Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forests uprooted; heavy cars lifted off the ground and thrown; weak pavement blown off roads.
F4 Category Tornado		
207-260 mph (180-226 kt)	Cat 5?	Devastating Tornado. Devastating damage: Well constructed homes leveled; structures with weak foundations blown off some distance; cars thrown and disintegrated; large missiles generated; trees in forest uprooted and carried some distance away.
F5 Category Tornado		
261-318 mph (227-276 kt)	NA	Incredible Tornado. Incredible damage: Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 300 ft (100 m); trees debarked; incredible phenomena will occur.
F6-F12 Category Tornadoes		
Gtr than 319 mph (277 kt)	NA	The maximum wind speeds of tornadoes are not expected to reach the F6 wind speeds.

* The Saffir-Simpson Scale is a five-category wind speed / storm surge classification scale used to classify Atlantic hurricane intensities. The Saffir-Simpson values range from Category 1 to Category 5. The strongest SUSTAINED hurricane wind speeds correspond to a strong F3 (Severe Tornado) or possibly a weak F4 (Devastating Tornado) value. Whereas the highest wind gusts in Category 5 hurricanes correspond to moderate F4 tornado values, F5 tornado wind speeds are not reached in hurricanes.

Added in response to OBS NP-2.1

Reference:

1987: Fujita, T. Theodore, "U.S. Tornadoes Part 1 70-Year Statistics," Satellite and Mesometeorology Research Project (SMRP) Research Paper Number 218, University of Chicago, 122 pp.

Added in response to OBS NP-2.1

ATTACHMENT 6: SOURCE PRECIPITATION DATA CD

Added in response to OBS NP-2.1

3.1 Stored Materials

The WCS CISF provides interim storage for SNF and GTCC waste loaded in canisterized systems until retrieval of the canisters for transport to a repository or other site. The SNF and GTCC waste is stored in sealed, metallic canisters inside storage overpacks. The canisters contain multiple SNF assemblies and associated hardware or GTCC waste in a dry, inert environment. The WCS Phase 1 CISF is designed to store approximately 470 casks with a canisters containing SNF or GTCC waste. The total storage capacity for the WCS CISF is 5,000 metric tons of heavy metal (MTHM) and *231.3 MT (510,000 pounds)* of GTCC waste.

Physical, thermal and radiological characteristics of stored SNF are described in the safety documentation for each cask system listed in Table 1-1. The physical, thermal and radiological characteristics of GTCC canisters are described in the *Rancho Seco FSAR, Appendix C [3-18], for the GTCC waste proposed for storage at the WCS CISF for storage in a NUHOMS® System. The GTCC waste stored in NAC systems is described in the storage systems associated transportation cask SAR and Certificate of Compliance (CoC). GTCC waste for NAC systems will be received from Maine Yankee (GTCC-Canister-MY), Connecticut Yankee (GTCC-Canister-CY), Yankee Rowe (GTCC-Canister-YR), and Zion (GTCC-Canister-ZN). For GTCC-Canister-MY, the GTCC waste is described in the NAC-UMS transportation cask SAR, Section 1.3.1.1.2 [3-20]. For GTCC-Canister-CY and GTCC-Canister-YR, the GTCC waste is described in the NAC-STC transportation cask SAR, Section 1.2.3.2 [3-19]. For GTCC-Canister-ZN, the GTCC waste is described in the NAC-MAGNATRAN SAR, Section 1.3.2 [3-21].*

All Indicated Changes are in response to RSI NP-4.2

3.6 Performance Requirements

The function of the WCS CISF is to store canisterized SNF and GTCC waste resulting from commercial nuclear activities in an NRC-approved storage facility, until removal from the WCS CISF for disposal in a repository or other site as directed by the DOE. This section provides principal performance requirements imposed upon the design to ensure the facility can function as required.

3.6.1 Receipt Rate Capability

The WCS CISF has the capability to receive SNF at the rates (MTHM/year) listed in Table 3-2.

The WCS CISF has the capability to receive casks and canisters containing commercial SNF at the annual rates (casks/year) specified in Table 3-3.

3.6.2 SNF and GTCC Waste Receiving Mode

The WCS CISF is designed to receive, handle, transfer, store and ship SNF and GTCC waste contained in canisters in Section 2.1 of the Technical Specifications [3-1] via rail in the transportation casks identified in Sections 1.6.1.1 and 1.6.2.1.

3.6.3 Storage Capacity

Phase 1 of the WCS CISF has a SNF storage capacity of 5,000 MTHM with an ultimate capacity of 40,000 MTHM at full build out and *231.3 MT (510,000 pounds)* of GTCC waste.

3.6.4 Facility Service Life

The WCS CISF will be initially licensed for 40 years with the option for renewals for time periods allowable by regulation.

All Indicated Changes are in response to RSI NP-4.2

3.8 References

3-1 Proposed SNM-1050, WCS Interim Storage Facility Technical Specifications, Amendment 0.

3-2 Reg Guide 1.76, "Design-Basis Tornado And Tornado Missiles For Nuclear Power Plants," Revision 1, March 2007.

3-3 NUREG-0800, Standard Review Plan, Section 3.3.1 "Wind Loading", 3.3.2 "Tornado Loads" and Section 3.5.1.4 "Missiles Generated by Tornado and Extreme Winds", Rev 3, March 2007.

3-4 Title 10, Code of Federal Regulations, Part 71, "Packaging and Transportation of Radioactive Material."

3-5 Not Used.

3-6 ACI 318, "Building Code Requirements for Structural Concrete and Commentary," American Concrete Institute, 2011.

3-7 American Institute of Steel Construction, AISC Manual of Steel Construction, 14th Edition.

3-8 NFPA 101 (2015 Edition), National Fire Protection Association.

3-9 ASME/ANSI B31.1, American Society of Mechanical Engineers/American National Standards Institute.

3-10 IBC, 2006, International Building Code.

3-11 NPC, 2006, National Plumbing Code.

3-12 ANSI/NFPA 70e-2012, National Electric Code.

3-13 ANSI C1-212, National Electric Safety Code.

3-14 IEEE 141-1993, Institute for Electrical and Electronic Engineers.

3-15 IEEE 142-1991, Recommended Practice for Grounding of Industrial and Commercial Power System.

3-16 IEEE 80-1991, Guide for Safety in Substation Grounding.

3-17 NFPA 780-2011, Lightning Protection Code.

3-18 "Rancho Seco Independent Spent Fuel Storage Installation, Final Safety Analysis Report, Volume I, ISFSI System," NRC Docket No. 72-11, Revision 4.

3-19 NAC International, "NAC-STC, NAC Storage Transport Cask Safety Analysis Report," Revision 17, CoC 9235 Revision 13, USNRC Docket Number 71-9235.

3-20 NAC International, "Safety Analysis Report for the UMS® Universal Transport Cask," Revision 2, CoC 9270 Revision 4, USNRC Docket Number 71-9270.

3-21 NAC International, "Safety Analysis Report for the MAGNATRAN Transport Cask," Revisions 12A, 14A, 15A, and 16A, USNRC Docket Number 71-9356.

All Indicated Changes are in response to RSI NP-4.2

Table 3-1
Physical Design Characteristics of Storage Systems at the WCS CISF

Cask System	Canister	Overpack	Appendix
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Appendix A.3
	FC-DSC		
	FF-DSC		
	GTCC Canister		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Appendix B.3
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Appendix C.3
	NUHOMS® 61BTH Type 1		Appendix D.3
NAC-MPC	Yankee Class	VCC	Appendix E.3
	Connecticut Yankee		
	LACBWR		
	GTCC-Canister-CY		
	GTCC-Canister-YR		
NAC-UMS	Classes 1 through 5	VCC	Appendix F.3
	GTCC-Canister-MY		
MAGNASTOR	TSC1 through TSC4	CC1 through CC4	Appendix G.3
	GTCC-Canister-ZN		

All Indicated Changes are in response to RSI NP-4.2

4.3.6 Communication and Alarm Systems

The WCS CISF will utilize a variety of communication and alarm systems with redundancy provided for emergency communication situations.

4.3.6.1 Telephone System

A telephone system will be installed at the WCS CISF. This system will have access to the other WCS facilities outside the WCS CISF and outside lines.

4.3.6.2 Public Address System

A Public Address System will be installed at the WCS CISF. This system allows emergency messages and alarms to be broadcast for all personnel in the WCS CISF boundary to hear.

4.3.6.3 Radio System

A wireless radio system will be used at the WCS CISF for standard communication needs.

4.3.7 Fire Protection

Fire protection will be in accordance with requirements of the National Fire Protection Association (NFPA).

4.3.8 Maintenance Systems

No special maintenance techniques are necessary that would require a safety analysis.

There is preventative maintenance performed on a regular basis on the overhead transfer crane, transfer equipment and shipping casks. Maintenance of these SSCs, which are classified as important-to-safety (ITS), ensure that they are safe and reliable throughout the life of the WCS CISF per 10 CFR 72.122(f).

4.3.9 Cold Chemical Systems

There will be no cold chemical systems at the WCS CISF.

4.3.10 Radiation Monitoring Systems

Occupational radiation dose at the WCS CISF is measured by optically stimulated luminescence (OSL) dosimetry devices for beta and photon radiation, along with CR-39 dosimetry devices for fast and thermal neutron monitoring. Monitoring will cover the PA and the OCA to ensure the dose is within 10 CFR 20.1301 and 10 CFR 72.104 limits.

All Indicated Changes are in response to OBS NP-12.1

Table 4-1
Operating Systems Associated with the Storage Systems at the WCS CISF

Cask System	Canister	Overpack	Appendix
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Appendix A.4 *(Drawings are listed in Section A.4.6.)*
	FC-DSC		
	FF-DSC		
	GTCC Canister		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Appendix B.4 *(Drawings are listed in Section B.4.6)*
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Appendix C.4 *(Drawings are listed in Section C.4.6)*
	NUHOMS® 61BTH Type 1		Appendix D.4 *(Drawings are listed in Section D.4.6)*
NAC-MPC	Yankee Class	VCC	Appendix E.4 *(Drawings are listed in Section E.4.4)*
	Connecticut Yankee		
	LACBWR		
	GTCC-Canister-CY		
	GTCC-Canister-YR		
NAC-UMS	Classes 1 through 5	VCC	Appendix F.4 *(Drawings are listed in Section F.4.3)*
	GTCC-Canister-MY		
MAGNASTOR	TSC1 through TSC4	CC1 through CC4	Appendix G.4 *(Drawings are listed in Section G.4.3)*
	GTCC-Canister-ZN		

All Indicated Changes are in response to RSI NP-4.2

Table 5-1
Operating Procedures for the Storage Systems at the WCS CISF

Cask System	Canister	Overpack	Appendix
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Appendix A.5
	FC-DSC		
	FF-DSC		
	GTCC Canister		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Appendix B.5
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Appendix C.5
	NUHOMS® 61BTH Type 1		Appendix D.5
NAC-MPC	Yankee Class	VCC	Appendix E.5
	Connecticut Yankee	VCC	
	LACBWR	VCC	
	GTCC-Canister-CY		
	GTCC-Canister-YR		
NAC-UMS	Classes 1 through 5	VCC	Appendix F.5
	GTCC-Canister-MY		
MAGNASTOR	TSC1 through TSC4	CC1 through CC4	Appendix G.5
	GTCC-Canister-ZN		

All Indicated Changes are in response to RSI NP-4.2

Table 7-2
Structural Evaluations for the Storage Systems at the WCS CISF

Cask System	Canister	Overpack	Appendix
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Appendix A.7
	FC-DSC		
	FF-DSC		
	GTCC Canister		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Appendix B.7
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Appendix C.7
	NUHOMS® 61BTH Type 1		Appendix D.7
NAC-MPC	Yankee Class	VCC	Appendix E.7
	Connecticut Yankee		
	LACBWR		
	GTCC-Canister-CY		
	GTCC-Canister-YR		
NAC-UMS	Classes 1 through 5	VCC	Appendix F.7
	GTCC-Canister-MY		
MAGNASTOR	TSC1 through TSC4	CC1 through CC4	Appendix G.7
	GTCC-Canister-ZN		

All Indicated Changes are in response to RSI NP-4.2

Table 8-1
Thermal Evaluations for the Storage Systems at the WCS CISF

Cask System	Canister	Overpack	Appendix
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Appendix A.8
	FC-DSC		
	FF-DSC		
	GTCC Canister		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Appendix B.8
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Appendix C.8
	NUHOMS® 61BTH Type 1		Appendix D.8
NAC-MPC	Yankee Class	VCC	Appendix E.8
	Connecticut Yankee		
	LACBWR		
	GTCC-Canister-CY		
	GTCC-Canister-YR		
NAC-UMS	Classes 1 through 5	VCC	Appendix F.8
	GTCC-Canister-MY		
MAGNASTOR	TSC1 through TSC4	CC1 through CC4	Appendix G.8
	GTCC-Canister-ZN		

All Indicated Changes are in response to RSI NP-4.2

Cask System	**Canister**	**Overpack**	**Design Considerations**
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Section 7.1.2 of [9-3]
	FC-DSC		
	FF-DSC		
	GTCC Canister		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Section 10.1.2 of [9-5]
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Section 7.1.2 of [9-4]
	NUHOMS® 61BTH Type 1		
NAC-MPC	Yankee Class	VCC	Appendix E.9
	Connecticut Yankee		
	LACBWR		
	GTCC-Canister-CY		
	GTCC-Canister-YR		
NAC-UMS	Classes 1 through 5	VCC	Appendix F.9
	GTCC-Canister-MY		
MAGNASTOR	TSC1 through TSC4	CC1 through CC4	Appendix G.9
	GTCC-Canister-ZN		

All Indicated Changes are in response to RSI NP-4.2

9.1.3 Operational Considerations

Details of the operational considerations for each system are cross-referenced to the applicable FSAR in the table below:

Cask System	Canister	Overpack	Operational Considerations
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Section 7.1.3 of [9-3]
	FC-DSC		
	FF-DSC		
	GTCC Canister		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Section 10.1.3 of [9-5]
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Section 7.1.3 of [9-4]
	NUHOMS® 61BTH Type 1		
NAC-MPC	Yankee Class	VCC	Appendix E.9
	Connecticut Yankee		
	LACBWR		
	GTCC-Canister-CY		
	GTCC-Canister-YR		
NAC-UMS	Classes 1 through 5	VCC	Appendix F.9
	GTCC-Canister-MY		
MAGNASTOR	TSC1 through TSC4	CC1 through CC4	Appendix G.9
	GTCC-Canister-ZN		

All Indicated Changes are in response to RSI NP-4.2

9.2 Radiation Sources

The types and potential magnitudes of radiation sources at the WCS CISF that could contribute to worker or public radiation exposures are described in this section.

9.2.1 Characterization of Sources

The source terms may be classified into three general categories:

- Gamma and neutron source terms from the fuel and GTCC waste
- External radioactive contamination on a canister
- Radioisotopes associated with releases from a canister

The characteristics of each of these radiation sources are discussed in the following sections.

9.2.1.1 Spent Nuclear Fuel and GTCC Waste

Details of the storage source terms for each system are cross-referenced to the applicable FSAR in the table below:

Cask System	Canister	Overpack	Source Terms
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Section 7.2.1 of [9-3] *for fuel and Section 7.2.1 of Appendix C of [9-3] for GTCC waste*
	FC-DSC		
	FF-DSC		
	GTCC Canister		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Section 5.2 of [9-5]
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Section K.5 of [9-4]
	NUHOMS® 61BTH Type 1		Section T.5 of [9-4]
NAC-MPC	Yankee Class	VCC	Appendix E.9 *for fuel and Section 1.2.3.2 of [9-6] for GTCC waste*
	Connecticut Yankee		
	LACBWR		
	GTCC-Canister-CY		
	GTCC-Canister-YR		
NAC-UMS	Classes 1 through 5	VCC	Appendix F.9 *for fuel and Section 1.3.1.1.2 of [9-7] for GTCC waste*
	GTCC-Canister-MY		
MAGNASTOR	TSC1 through TSC4	CC1 through CC4	Appendix G.9 *for fuel and Section 1.3.2 of [9-8] for GTCC waste*
	GTCC-Canister-ZN		

All Indicated Changes are in response to RSI NP-4.2

9.6.2.4 Environmental Monitoring

WCS will establish a Radiological Environmental Monitoring Program (REMP) that will demonstrate compliance with 10 CFR 72.104. Details of this program are described in Chapter 9, section 9.6.2.

In establishing the environmental monitoring program for spent fuel storage, WCS will build upon its current monitoring program for its existing facilities. This program will include the following monitoring parameters: perimeter dosimetry (Landauer Inlight® Environmental X9 (beta/X/gamma) or equivalent), soil, and air locations. This program will be implemented by the radiation safety department in accordance with written procedures.

WCS uses the Luxel+ Ta (beta/photon/neutron) dosimeter for area monitoring under the radiation safety area monitoring program and the Landauer Inlight® Environmental X9 (beta/photon) dosimeter for perimeter environmental monitoring program. Environmental boundary air monitoring (i.e. Low Volume air sampling and High Volume air sampling) will be performed at a minimum of two locations in addition to the locations currently performed under the REMP. Analyses will be for air particulate (gross alpha/beta and gamma spectrometry), H-3, and air cartridges (Kr-85, C-14, and I-129), and performed by a certified offsite laboratory.

9.6.3 Maximum Off-Site Annual Dose

The nearest residence in Lea County, New Mexico is approximately 4 miles from the WCS CISF at SPCS coordinate (541732.42, 6873002.59). At this distance, the computed total dose rate is 4.83E-14 mrem/hr. With continuous occupancy of 8,760 hours per year, the total dose is 4.23E-10 mrem, which is essentially zero and less than the dose from natural background radiation.

9.6.4 Liquid Releases

As described in Section 6.1.2.1, there are no radioactive liquid radioactive wastes to monitor for the WCS CISF.

All Indicated Changes are in response to OBS NP-12.1

Table 9-4
Shielding Evaluations for the Storage Systems at the WCS CISF

Cask System	Canister	Overpack	Appendix
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Appendix A.9
	FC-DSC		
	FF-DSC		
	GTCC Canister		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Appendix B.9
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Appendix C.9
	NUHOMS® 61BTH Type 1		Appendix D.9
NAC-MPC	Yankee Class	VCC	Appendix E.9
	Connecticut Yankee		
	LACBWR		
	GTCC-Canister-CY		
	GTCC-Canister-YR		
NAC-UMS	Classes 1 through 5	VCC	Appendix F.9
	GTCC-Canister-MY		
MAGNASTOR	TSC1 through TSC4	CC1 through CC4	Appendix G.9
	GTCC-Canister-ZN		

All Indicated Changes are in response to RSI NP-4.2

Table 11-1
Confinement Evaluations for Authorized Storage Systems at the WCS CISF

Cask System	Canister	Overpack	Appendix
NUHOMS® MP187-Cask System	FO-DSC	HSM (Model 80)	Appendix A.11
	FC-DSC		
	FF-DSC		
	GTCC Canister		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Appendix B.11
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Appendix C.11
	NUHOMS® 61BTH Type 1		Appendix D.11
NAC-MPC	Yankee Class	VCC	Appendix E.11
	Connecticut Yankee		
	LACBWR		
	GTCC-Canister-CY		
	GTCC-Canister-YR		
NAC-UMS	Classes 1 through 5	VCC	Appendix F.11
	GTCC-Canister-MY		
MAGNASTOR	TSC1 through TSC4	CC1 through CC4	Appendix G.11
	GTCC-Canister-ZN		

All Indicated Changes are in response to RSI NP-4.2

Table 12-1
Off-Normal and Accident Evaluations for the Storage Systems at the WCS CISF

Cask System	Canister	Overpack	Appendix
NUHOMS®-MP187-Cask System	FO-DSC	HSM (Model 80)	Appendix A.12
	FC-DSC		
	FF-DSC		
	GTCC Canister		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Appendix B.12
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Appendix C.12
	NUHOMS® 61BTH Type 1		Appendix D.12
NAC-MPC	Yankee Class	VCC	Appendix E.12
	Connecticut Yankee		
	LACBWR		
	GTCC-Canister-CY		
	GTCC-Canister-YR		
NAC-UMS	Classes 1 through 5	VCC	Appendix F.12
	GTCC-Canister-MY		
MAGNASTOR	TSC1 through TSC4	CC1 through CC4	Appendix G.12
	GTCC-Canister-ZN		

All Indicated Changes are in response to RSI NP-4.2

A.3.1 SSCs Important to Safety

The classifications of the NUHOMS®-MP187 Cask System systems, structures and components are discussed in Section 3.4 of *Volume 1 and Section 3.2 of Appendix C of* the "Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report" [A.3-1]. These classifications are summarized in Table A.3-2 for convenience.

A.3.1.1 FO-, FC-, FF- DSCs *and GTCC Canister*

The FO-, FC- and FF-dry shielded canisters (DSC) provide the fuel assembly (FA) support required to maintain the fuel geometry for criticality control. Accidental criticality inside a DSC could lead to off-site doses exceeding regulatory limits, which must be prevented. The DSCs*, including the GTCC canister,* also provide the confinement boundary for radioactive materials. Therefore, the DSCs*, including the GTCC canister,* are designed to maintain structural integrity under all accident conditions identified in Chapter 12 without losing their function to provide confinement of the spent fuel assemblies. The DSCs*, including the GTCC canister,* important-to-safety (ITS)

A.3.1.2 Horizontal Storage Module

For the NUHOMS®-MP187 Cask System, the horizontal storage modules (HSM) used is the HSM Model 80, herein referred to as HSM. The HSMs are considered ITS since these provide physical protection and shielding for the DSC during storage. The reinforced concrete HSM is designed in accordance with American Concrete Institute (ACI) 349 [A.3-4] and constructed to the requirements of ACI-318 [A.3-5]. The level of testing, inspection, and documentation provided during construction and maintenance is in accordance with the quality assurance requirements defined in 10 CFR Part 72, Subpart G. Thermal instrumentation for monitoring HSM concrete temperatures is considered "not-important-to-safety" (NITS).

A.3.1.3 NUHOMS® Basemat and Approach Slab

The basemat and approach slabs for the HSMs are considered NITS and are designed, constructed, maintained, and tested to ACI-318 [A.3-5] as commercial-grade items.

A.3.1.4 NUHOMS® Transfer Equipment

For the NUHOMS®-MP187 Cask System, the MP187 transportation cask is qualified for transfer operations and herein referred to as a transfer cask. The MP187 transfer cask is ITS since it protects the DSC during handling and is part of the primary load path used while handling the DSCs in the Cask Handling Building. An accidental drop of a loaded transfer cask has the potential for creating conditions adverse to the public health and safety. These possible drop conditions are evaluated with respect to the impact on the DSC in Chapter 12. The MP187 is designed, constructed, and tested in accordance with a QA program incorporating a graded quality approach for ITS requirements as defined by 10 CFR Part 72, Subpart G, paragraph 72.140(b).

All Indicated Changes are in response to RSI NP-4.2

A.8. THERMAL EVALUATION

This Appendix qualifies the NUHOMS®-MP187 Cask System for storage and transfer at the Waste Control Specialists, LLC (WCS) Consolidated Interim Storage Facility (CISF) with the same heat load of 13.5 kW under the WCS CISF environmental conditions. No new thermal analysis is performed in this Appendix. This qualification demonstrates that all the 10 CFR Part 72 thermal requirements for storage and transfer of the FO-, FC-, and FF- Dry Shielded Canisters (DSCs) (hereafter canisters) *and GTCC canister* at the WCS CISF are met.

All Indicated Changes are in response to RSI NP-4.2

A.8.1 Discussion

As discussed in Chapter 1, the canisters from the Rancho Seco Nuclear Generating Station Independent Spent Fuel Storage Installation (ISFSI) will be transported to the WCS CISF in the NUHOMS® MP187 Transportation Cask (MP187 cask) under NRC Certificate of Compliance 9255 [A.8-1]. At the WCS CISF, the canisters, described in Section 4.2.5.2, Volume I of the Rancho Seco SAR [A.8-3], are to be stored inside the HSM Model 80 described in Chapter 4 of the Standardized NUHOMS® UFSAR [A.8-2]. The use of the HSM Model 80 for storing the canisters is justified in Section A.8.4.1.

The canisters at the Rancho Seco site are licensed for storage in the Rancho Seco HSM modules and on-site transfer in the MP187 cask with a design basis heat load of 13.5 kW [A.8-3]. The thermal analysis for storage of the canisters is presented in Sections 8.1.1.2, Volume II of [A.8-3] while the thermal analysis for the transfer of these DSCs is presented in Section 8.1.1.1, Volume III of [A.8-3]. *As documented in Section 3.1.1.2. of Appendix C of [A.8-3] the GTCC canister is bounded by the evaluations for the FO-. FC- and FF-DSCs; therefore, no additional discussion of the GTCC canister is required in this chapter.*

This Appendix qualifies the canisters for storage in HSM Model 80s and transfer operations with the MP187 cask at the WCS CISF with the same heat load of 13.5 kW under the WCS CISF environmental conditions. No new thermal analysis is performed in this Appendix. This demonstrates that all the 10 CFR Part 72 thermal requirements for storage and transfer of the canisters at the WCS CISF are met.

All Indicated Changes are in response to RSI NP-4.2

A.11. CONFINEMENT EVALUATION

The design criteria for the NUHOMS® MP187 Cask System requires that the FO-, FC, FF- Dry Shielded Canisters (DSCs or canisters) *and GTCC Canister* are designed to ensure confinement of stored materials under normal, off-normal, and accident conditions during all operations, transfers, and storage. This chapter summarizes the system design features that ensure radiological releases are within limits and will remain As Low As Reasonably Achievable (ALARA), and that spent nuclear fuel (SNF) cladding and SNF assemblies are protected from degradation during storage. *As documented in Section 8.2.2 of Appendix C of [A.11-1] the confinement evaluation for the FO-, FC- and FF- DSCs bound the GTCC canister; therefore, no additional discussion for the GTCC canister is required in this chapter.*

All Indicated Changes are in response to RSI NP-4.2

A.12. ACCIDENT ANALYSIS

This section describes the postulated off-normal and accident events that could occur during transfer and storage for the NUHOMS® MP187 Cask System. Detailed analysis are provided in the "Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report" [A.12-1] are referenced herein. *As documented in Section 8.2 and associated subsections in Appendix C of [A.12-1] the evaluations for the FO-, FC- and FF-DSCs bound the GTCC Canister, therefore no additional discussion for the GTCC canister is required in this chapter.*

All Indicated Changes are in response to RSI NP-4.2

B.5. OPERATING PROCEDURES

This chapter presents the operating procedures for the Standardized Advanced NUHOMS® System containing the NUHOMS® 24PT1-DSCs originally loaded and stored under Certificate of Compliance (CoC) 1029 with the addition of the NUHOMS®-MP187 transport/transfer cask (TC) qualified for transfer operations with the 24PT1 DSC. The procedures include receipt of the NUHOMS®-MP187 Cask; placing the TC onto the transfer skid on the transfer vehicle, transfer to the Storage Area, DSC transfer into the Standardized Advanced Horizontal Storage Module (AHSM), monitoring operations, and DSC retrieval from the AHSM. The NUHOMS®-MP187 cask transfer equipment, and the Cask Handling Building systems and equipment are used to accomplish these operations. Procedures are delineated here to describe how these operations may be performed and are not intended to be limiting. Temporary shielding may be used throughout as appropriate to maintain doses as low as reasonably achievable (ALARA).

The following sections outline the typical operating procedures for the Standardized Advanced NUHOMS® System. These procedures have been developed to minimize the amount of time required to complete the subject operations, to minimize personnel exposure, and to assure that all operations required for transfer, and storage are performed safely. Operations may be performed in a different order if desired to better utilize personnel and minimize dose as conditions dictate.

Pictograms of the Standardized Advanced NUHOMS® System operations are presented in Figure B.5-1.

The generic terms used throughout this section are as follows.

- TC, or transfer cask is used for the NUHOMS®-MP187 transportation/transfer cask.
- DSC is used for the NUHOMS® 24PT1-DSC.
- AHSM is used for the Standardized Advanced Horizontal Storage Module.

All Indicated Changes are in response to RSI NP-4.2

B.7.1 Discussion

As discussed in Chapter 1, the 24PT1 DSCs, currently stored inside AHSMs at the San Onofre Nuclear Generating Station (SONGS) ISFSI, will be transported to the WCS CISF utilizing the NUHOMS®-MP187 Transportation Cask. The canisters and the AHSM are Standardized Advanced NUHOMS® System components for the storage of SNF under NRC Certificate of Compliance No. 1029 [B.7-6] and are described in Chapter 1 of [B.7-1]. The MP187 transportation cask is licensed under NRC Certificate of Compliance (CoC) No. 9255 [B.7-3].

At the WCS CISF, the canisters will be stored inside newly fabricated AHSMs utilizing the MP187 cask for on-site transfer operations. The MP187 cask is a multi-purpose cask licensed as an on-site transfer cask [B.7-2] under 10 CFR Part 72 as described in [B.7-4].

As described in [B.7-1] the canister and the AHSM utilize the OS197 transfer cask for on-site transfer operations. The OS197 transfer cask is licensed under CoC No. 1004 and is described in the Standardized NUHOMS® UFSAR [B.7-7]. This appendix reconciles the design basis analyses of the 24PT1 DSC in the OS197 transfer cask to justify use of the MP187 cask for transfer of the 24PT1 DSC at the WCS CISF.

The design basis seismic criteria for the canister and AHSM significantly exceed the seismic criteria for the WCS CISF (see Figure B.7-2). Hence, no reconciliation for seismic loads for the canister and AHSM need to be performed in this appendix.

The qualification of the MP187 cask for use as the on-site transfer cask at WCS CISF is based on the design basis analysis as documented in [B.7-4]. The cask stability evaluations in [B.7-4] use the hypothetical case of the cask as a storage component, and hence in the vertical configuration, as bounding the horizontal configuration in the transfer mode.

All Indicated Changes are in response to RSI NP-4.2

B.8. THERMAL EVALUATION

This Appendix qualifies the Standardized Advanced NUHOMS® System for storage and transfer at the Waste Control Specialist, LLC (WCS) Consolidated Interim Storage Facility (CISF) with the same heat load of 14 kW under the WCS CISF environmental conditions. No new thermal analysis is performed in this Appendix. This qualification demonstrates that all the 10 CFR Part 72 thermal requirements for storage and transfer of the 24PT1 Dry Shielded Canisters (DSCs or canisters) at the WCS CISF are met.

As presented in Chapter 1, Table 1-1, the Standardized Advanced NUHOMS® System storage components include the 24PT1 DSC and the AHSM concrete overpack.

The 24PT1 DSC is described in Section 3.1.1.1 of the Standardized Advanced NUHOMS® Updated Final Safety Analysis Report (UFSAR) [B.8-1]. The AHSM is described in Section 3.1.1.2 of the UFSAR [B.8-1].

At the WCS CISF, the NUHOMS®-MP187 cask will be used for on-site transfer operations. The MP187 cask is a multi-purpose cask approved by the NRC as a transportation cask for off-site shipments of the 24PT1 DSC [B.8-2]. This Appendix qualifies the thermal design of the MP187 cask for transfer operations with the 24PT1 DSC.

All Indicated Changes are in response to RSI NP-4.2

B.9.2 Occupational Exposure Evaluation

B.9.2.1 Analysis Methodology

Dose rates are known in the vicinity of the AHSM and MP187 cask based upon the existing FSAR[B.9-1] and SAR[B.9-2]. The operational sequence is determined for each system, as well as the associated number of workers, their location, and duration per operation. The collective dose per step is then computed as:

$$C = D*N*T,$$

where

C is the collective dose (person-mrem),

D is the dose rate for each operation (mrem/hr),

N is the number of workers for that operation, and

T is the duration of the operation (hr)

Once the collective dose is determined for each step, the collective doses are summed to create the total collective dose. The total collective dose is determined for a single receipt/transfer operation.

B.9.2.2 Dose Assessment

A dose assessment is performed for receipt and transfer of an NUHOMS®-24PT1 DSC to AHSM using the MP187 cask.

Seven general locations around the cask are defined, as shown in the top half of Figure B.9-1: top, top edge, top corner, side, bottom corner, bottom edge, and bottom. These seven general locations are reduced to only three locations for which dose rate information is available, as shown in the bottom half of Figure B.9-1: top, side, and bottom.

A loading operation is divided into receipt and transfer operations. Dose rates for receipt operations are obtained from the transportation SAR for the MP187 cask. Dose rates for the transfer operations are obtained from the storage FSAR for the AHSM.

For some configurations, dose rates are not available in the reference transportation SAR or storage FSAR. In these instances, bounding dose rates are obtained for similar systems:

- For transfer of the 24PT1 DSC inside the MP187 cask, bounding dose rates for transfer of the 24PT1 DSC inside the OS197 transfer cask are utilized. This approach is conservative because the OS197 transfer cask contains less shielding than the MP187 cask.

All Indicated Changes are in response to RSI NP-4.2

The configurations used in the dose rate analysis are summarized in Table B.9-1. Results for the various loading scenarios are provided in Table B.9-2 and Table B.9-3. Separate tables are developed for receipt and transfer operations. These tables provide the process steps, number of workers, occupancy time, distance, dose rate, and collective dose for all operations.

The total collective dose for an operation is the sum of the receipt and transfer collective doses. The total collective dose for receipt and transfer of NUHOMS®-24PT1 DSC to an AHSM using the MP187 cask: 1097 person-mrem.

All Indicated Changes are in response to RSI NP-4.2

Table B.9-1
Receipt and Transfer Configurations

Actual Configuration	Receipt Analysis Configuration	Transfer Analysis Configuration
24PT1 DSC transferred from the MP187 cask into an AHSM	24PT1 inside MP187 cask [B.9-2]	24PT1 inside OS197 transfer cask (bounds MP187 cask) [B.9-1]

All Indicated Changes are in response to RSI NP-4.2

C.5. OPERATING PROCEDURES

This chapter presents the operating procedures for the Standardized NUHOMS® System containing the NUHOMS®-61BT DSCs originally loaded and stored under Certificate of Compliance (CoC) 1004 with the addition of the NUHOMS®-MP197HB transport/transfer cask (TC) qualified for transfer operations with the 61BT DSC. The procedures include receipt of the TC; placing the TC onto the transfer skid on the transfer vehicle, transfer to the Storage Area, DSC transfer into the Horizontal Storage Module (HSM), monitoring operations, and DSC retrieval from the HSM. The NUHOMS®-MP197HB transfer equipment, and the Cask Handling Building systems and equipment are used to accomplish these operations. Procedures are delineated here to describe how these operations may be performed and are not intended to be limiting. Temporary shielding may be used throughout as appropriate to maintain doses as low as reasonably achievable (ALARA).

The following sections outline the typical operating procedures for the Standardized NUHOMS®-61BT System. These procedures have been developed to minimize the amount of time required to complete the subject operations, to minimize personnel exposure, and to assure that all operations required for transfer, and storage are performed safely. Operations may be performed in a different order if desired to better utilize personnel and minimize dose as conditions dictate.

Pictograms of the Standardized NUHOMS®-61BT System operations are presented in Figure C.5-1.

The generic terms used throughout this section are as follows.

- TC, or transfer cask is used for the NUHOMS®-MP197HB transport/transfer cask.
- DSC is used for the NUHOMS®-61BT DSC.
- HSM is used for the HSM Model 102.

All Indicated Changes are in response to RSI NP-4.2

C.7. STRUCTURAL EVALUATION

This Appendix describes the structural evaluation of the Standardized NUHOMS®-61BT System components utilized for transfer and storage of canisterized spent nuclear fuel (SNF) at the Waste Control Specialists, LLC (WCS) Consolidated Interim Storage Facility (CISF). As presented in Chapter 1, Table 1-1, the Standardized NUHOMS®-61BT System storage components include the 61BT Dry Shielded Canister (DSC or canister) and the HSM Model 102 concrete overpack. At the WCS CISF, the MP197HB transportation cask is used for on-site transfer activities.

The HSM Model 102 is described in detail in Section 4.2.3.2 of the Standardized NUHOMS® Updated Final Safety Analysis Report (UFSAR) [C.7-13]. The 61BT DSC is described in detail in Section K.1.2 of [C.7-13]. Both of these components are approved by the NRC [C.7-13] for transfer and storage of SNF under the requirements of 10 CFR Part 72.

The MP197HB cask is described in detail in Section A.1.2 of the NUHOMS®-MP197 Transportation Package Safety Analysis Report (SAR) [C.7-1]. The MP197HB cask is approved by the NRC for off-site transport of canisters under the requirements of 10 CFR Part 71. This SAR presents the analyses required for approval of the MP197HB cask as the on-site transfer cask at the WCS CISF under the requirements of 10 CFR Part 72. The structural evaluation of the MP197HB cask as the on-site transfer cask is contained in this appendix. The evaluation of the canisters for transfer and storage is contained in Appendix K of [C.7-13] for the Standardized NUHOMS®-61BT System [C.7-13]. The evaluation of the HSM Model 102 is contained in Chapter 8 of [C.7-13].

This appendix is prepared to demonstrate that these licensed Standardized NUHOMS®-61BT System components are also qualified to safely transfer and store SNF at the WCS CISF. In addition to the seismic reconciliation evaluation presented in Section C.7.3, this appendix presents the analyses required to qualify the MP197HB cask for on-site transfer activities per 10 CFR Part 72 for the 61BT and 61BTH Type 1 canisters. These analyses, in combination with existing evaluations in [C.7-13], demonstrate that the MP197HB / Canisters / HSM Model 102 transfer and storage system satisfies all of the 10 CFR Part 72 requirements for storage at the WCS CISF.

MP197HB Cask

The principal design criteria for the MP197HB cask for service at the WCS CISF are described in Table C.7-1 and below in Section C.7.7.1. The design approach, design criteria and loading combinations for the MP197HB cask are also described in Section C.7.7.1.

All Indicated Changes are in response to RSI NP-4.2

C.9.2 Occupational Exposure Evaluation

C.9.2.1 Analysis Methodology

Dose rates are known in the vicinity of the HSM Model 102 and MP197HB casks based upon the existing FSAR [C.9-1] and SAR [C.9-2]. The operational sequence is determined for each system, as well as the associated number of workers, their location, and duration per operation. The collective dose per step is then computed as:

$$C = D*N*T,$$

where

C is the collective dose (person-mrem),

D is the dose rate for each operation (mrem/hr),

N is the number of workers for that operation, and

T is the duration of the operation (hr)

Once the collective dose is determined for each step, the collective doses are summed to create the total collective dose. The total collective dose is determined for a single receipt/transfer operation.

C.9.2.2 Dose Assessment

A dose assessment is performed for receipt and transfer of an 61BT DSC to HSM Model 102 using the MP197HB cask.

Seven general locations around the cask are defined, as shown in the top half of Figure C.9-1: top, top edge, top corner, side, bottom corner, bottom edge, and bottom. These seven general locations are reduced to only three locations for which dose rate information is available, as shown in the bottom half of Figure C.9-1: top, side, and bottom.

A loading operation is divided into receipt and transfer operations. Dose rates for receipt operations are obtained from the transportation SAR for the MP197HB cask. Dose rates for the transfer operations are obtained from the storage FSAR for the HSM Model 102.

For some configurations, dose rates are not available in the reference transportation SAR or storage FSAR. In these instances, bounding dose rates are obtained for similar systems:

- For receipt of the 61BT DSC inside the MP197HB cask, bounding dose rates for receipt of the 69BTH DSC inside the MP197HB cask are utilized. This approach is conservative because the 69BTH DSC contains a larger source than the 61BT DSC.

All Indicated Changes are in response to RSI NP-4.2

- For transfer of the 61BT DSC inside the MP197HB cask, bounding dose rates for transfer of the 69BTH DSC inside the OS200 transfer cask are utilized. This approach is conservative because the OS200 transfer cask contains less shielding than the MP197HB cask, and the 69BTH DSC contains a larger source than the 61BT DSC.

The configurations used in the dose rate analysis are summarized in Table C.9-1. Results for the various loading scenarios are provided in Table C.9-2 and Table C.9-3. Separate tables are developed for receipt and transfer operations. These tables provide the process steps, number of workers, occupancy time, distance, dose rate, and collective dose for all operations.

The total collective dose for an operation is the sum of the receipt and transfer collective doses. The total collective dose for receipt and transfer of NUHOMS®-61BT DSC to an HSM Model 102 using the MP197HB cask: 1016 person-mrem.

The total collective dose for unloading a 61BT DSC from an HSM Model 102 and preparing it for transport off-site is bounded by the loading operations (1016 person-mrem). Operations for removing the 61BT DSC from the HSM Model 102 and off-site shipment are identical to loading operations, except in reverse order. The collective dose for unloading is bounded because during storage at the WCS CISF the source terms will have decayed reducing surface dose rates. The total collective dose is the sum of the receipt, transfer, retrieval, and shipment is 2032 person-mrem.

All Indicated Changes are in response to RSI NP-4.2

D.5. OPERATING PROCEDURES

This chapter presents the operating procedures for the Standardized NUHOMS® System containing the NUHOMS® 61BTH Type 1 DSCs originally loaded and stored under Certificate of Compliance (CoC) 1004 with the addition of the NUHOMS®-MP197HB transport/transfer cask (TC) qualified for transfer operations with the 61BTH Type 1 DSC. The procedures include receipt of the TC; placing the TC onto ~~the transfer skid on the transfer vehicle, transfer to the Storage Area, DSC transfer into~~ the Horizontal Storage Module (HSM), monitoring operations, and DSC retrieval from the HSM. The NUHOMS®-MP197HB transfer equipment, and the Cask Handling Building systems and equipment are used to accomplish these operations. Procedures are delineated here to describe how these operations may be performed and are not intended to be limiting. Temporary shielding may be used throughout as appropriate to maintain doses as low as reasonably achievable (ALARA).

The following sections outline the typical operating procedures for the Standardized NUHOMS®-61BTH Type 1 System. These procedures have been developed to minimize the amount of time required to complete the subject operations, to minimize personnel exposure, and to assure that all operations required for transfer, and storage are performed safely. Operations may be performed in a different order if desired to better utilize personnel and minimize dose as conditions dictate.

Pictograms of the Standardized NUHOMS®-61BTH Type 1 System operations are presented in Figure D.5-1.

The generic terms used throughout this section are as follows.

- TC, or transfer cask is used for the NUHOMS®-MP197HB transport/transfer cask.
- DSC is used for the NUHOMS®-61BTH Type 1 DSC.
- HSM is used for the HSM Model 102.

All Indicated Changes are in response to RSI NP-4.2

E.4 OPERATING SYSTEMS

The principal components of the NAC-MPC system are the canister, the vertical concrete cask and the transfer cask. The loaded canister is moved to and from the concrete cask with the transfer cask. The transfer cask provides radiation shielding while the canister is being transferred. The canister is placed in the concrete cask by positioning the transfer cask with the loaded canister on top of the concrete cask and lowering the canister into the concrete cask. Figure E.4-1 depicts the major components of the NAC-MPC system and shows the transfer cask positioned on the top of the concrete cask.

The NAC-MPC is provided in three configurations. The first is designed to store up to 36 intact Yankee Class spent fuel and reconfigured fuel assemblies and is referred to as the Yankee-MPC. The second is designed to store up to 26 Connecticut Yankee fuel assemblies, reconfigured fuel assemblies and damaged fuel in CY-MPC damaged fuel cans, and is referred to as the CY-MPC. The Yankee-MPC and CY-MPC systems are described in WCS SAR Appendix E, Section E4.1 and are generically referred to as the NAC-MPC. The third configuration, referred to as MPC-LACBWR, is designed to store up to 68 Dairyland Power Cooperative (DPC) La Crosse Boiling Water Reactor (LACBWR) spent fuel assemblies with up to 32 damaged fuel cans. The MPC-LACBWR system is described in WCS SAR Appendix E, Section E4.2.

Section E.4.4 provides reference to all applicable license drawings (i.e., only Yankee-MPC, CY-MPC, and MPC-LACBWR fuel storage systems) from Reference [E.4-1].

In addition to these previously NRC approved license drawings, this WCS SAR appendix includes two site-specific GTCC waste canister storage configuration drawings for previously loaded Yankee Rowe and Connecticut Yankee GTCC waste canisters (GTCC-Canister-YR and GTCC-Canister-CY, respectively).

All Indicated Changes are in response to RSI NP-4.2

E.4.3 References

E.4-1 NAC-MPC Final Safety Analysis Report, Revision 10, January 2014

E.4-2 NAC International, "NAC-STC, NAC Storage Transport Cask Safety Analysis Report," Revision 17, CoC 9235 Revision 13, U.S. NRC Docket Number 71-9235.

All Indicated Changes are in response to RSI NP-4.2

E.4.4 Supplemental Data

The licensing drawings for the NAC-MPC system are listed in Section 1.7, Drawings, and Section 1.A.7, MPC-LACBWR Licensing Drawings, in volume 1 of the NAC-MPC Final Safety Analysis Report, Revision 10 [E.4-1].

Section 1.7.1 lists the Yankee-MPC license drawings; Section 1.7.2 lists the Yankee Class Reconfigured Fuel Assembly License drawings; and Section 1.7.3 lists the CY-MPC license drawings. These drawings appear in the FSAR immediately after the drawing lists in Section 1.7.

Section 1.A.7 lists the MPC-LACBWR licensing drawings. These drawings appear in the FSAR immediately after the drawing list in Section 1.A.7.

The following drawings are located as noted below for the GTCC-Canister-CY and GTCC-Canister-YR GTCC Waste Canisters and Storage configurations:

1. *"Basket Assembly, GTCC, CY-MPC," Sheets 1 thru 4, 414-887, Rev. 4 (See Section 1.3.2 of the "NAC-STC, NAC Storage Transport Cask Safety Analysis Report" [E.4-2])*
2. *"Canister Shell, GTCC, CY-MPC," Sheets 1 thru 2, 414-888, Rev. 4 (See Section 1.3.2 of the "NAC-STC, NAC Storage Transport Cask Safety Analysis Report" [E.4-2])*
3. *"Assembly, Transportable Storage Canister (TSC), GTCC, CY-MPC," Sheets 1 thru 3, 414-889, Rev. 7 (See Section 1.3.2 of the "NAC-STC, NAC Storage Transport Cask Safety Analysis Report" [E.4-2])*
4. *30039-863, "Loaded Vertical Concrete Cask (VCC), CY-MPC, Waste Control Specialists (WCS)," Sheets 1 of 1, Rev. 0 (included at the end of this Section)*
5. *455-887, "Basket Assembly, 24 GTCC Container, MPC-Yankee," Sheets 1 thru 3, Rev. 4 (See Section 1.3.2 of the "NAC-STC, NAC Storage Transport Cask Safety Analysis Report" [E.4-2])*
6. *455-888, "Assembly, Transportable Storage Canister (TSC), 24 GTCC Container, MPC-Yankee," Sheets 1 thru 2, Rev. 8 (See Section 1.3.2 of the "NAC-STC, NAC Storage Transport Cask Safety Analysis Report" [E.4-2])*
7. *30039-862, "Loaded Vertical Concrete Cask (VCC), MPC-YANKEE, Waste Control Specialists (WCS)," Sheets 1 thru 2, Rev. 0 (included at the end of this Section)*

All Indicated Changes are in response to RSI NP-4.2

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LOADED VERTICAL CONCRETE CASK (VCC) MPC-YANKEE, WASTE CONTROL SPECIALISTS (WCS)

PROJECT 30039 DRAWING 862 REV 0

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Security-Related Information Figure Withheld Under 10 CFR 2.390.

NAC INTERNATIONAL

LOADED VERTICAL CONCRETE CASK (VCC) MPC-YANKEE WASTE CONTROL SPECIALISTS (WCS)

PROJECT	DRAWING	REV
30039	862	0
	SHEET 2 of 2	

R-232828

REV	CHANGE
0	INITIAL ISSUE

Security-Related Information Figure Withheld Under 10 CFR 2.390.

NAC INTERNATIONAL

LOADED VERTICAL CONCRETE CASK (VCC) CY-MPC, WASTE CONTROL SPECIALISTS (WCS)

UNLESS OTHERWISE STATED

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PROJECT 30039 DRAWING 863 REV 0

E.8 THERMAL EVALUATION

The NAC-MPC is provided in three configurations. The first is designed to safely store up to 36 intact Yankee Class spent fuel and reconfigured fuel assemblies and is referred to as the Yankee-MPC. The second is the Connecticut-Yankee MPC, referred to as the CY-MPC, is designed to store up to 26 Connecticut Yankee fuel assemblies, CY-MPC reconfigured fuel assemblies and CY-MPC damaged fuel cans. The third is the La Crosse BWR MPC, referred to as the MPC-LACBWR, designed to store up to 68 La Crosse fuel assemblies, including MPC-LACBWR damaged fuel cans.

The Yankee-MPC system is designed to store Yankee class spent fuel with a maximum heat load of 12.5 kW (12.5 kW/36 assemblies = 0.347 kW per fuel assembly) and reconfigured fuel assemblies with a maximum heat load of 0.102 kW per assembly. The temperatures produced by the design basis fuel bound the temperature effects due to the reconfigured fuel assemblies.

The CY-MPC system is designed to store Connecticut Yankee spent fuel with a maximum total heat load of 17.5 kW, or an average heat load of 0.674 kW per assembly. The maximum heat load of a CY-MPC damaged fuel can, as well as CY-MPC reconfigured fuel assembly, is 0.674 kW.

The MPC-LACBWR system is designed to store Dairyland Power Cooperative La Crosse BWR spent fuel with a maximum total heat load of 4.5 kW, or an average heat load of 66.2 W per assembly for all locations with or without damaged fuel can confinement.

The thermal evaluation of the Yankee-MPC configuration is presented in Section 4.4 of Reference E.8-1. The thermal evaluation of the CY-MPC configuration is presented in Section 4.5 of Reference E.8-1. The thermal evaluation for the MPC-LACBWR configuration is presented in Section 4.A.3 of Appendix 4.A to Reference E.8-1.

The results of the aforementioned analyses determined the site-specific environmental thermal parameters, which must be met for the Yankee-MPC, CY-MPC, and MPC-LACBWR systems at the WCS facility. The following sections details those site-specific thermal parameters for each system and demonstrates that they bound the environmental thermal parameters at the WCS facility.

The NAC-MPC storage system may contain GTCC waste from Yankee Rowe and Connecticut Yankee (GTCC-Canister-YR and GTCC-Canister-CY, respectively). The maximum GTCC waste heat generation allowed for transport in the NAC-STC transportation cask for Yankee Rowe and Connecticut Yankee is 2.9 kW and 5.0 kW, respectively. These heat loads are well below the design basis heat loads of 12.5 kW (Yankee Rowe) and 17.5 kW (Connecticut Yankee) for the storage of PWR fuel. Therefore, the thermal analysis results for the storage of Yankee Rowe and Connecticut Yankee PWR fuel is bounding. No further evaluation is required.

All Indicated Changes are in response to RSI NP-4.2

E.11 CONFINEMENT EVALUATION

The NAC-MPC storage system is provided in three configurations. The Yankee-MPC provides storage for up to 36 intact Yankee Class spent fuel assemblies and reconfigured fuel assemblies (RFA). The CY-MPC holds up to 26 Connecticut Yankee spent fuel assemblies, reconfigured fuel assemblies or damaged fuel cans. The MPC-LACBWR provides storage for up to 68 Dairyland Power Cooperative La Crosse Boiling Water Reactor spent fuel assemblies with 32 damaged fuel cans. These three configurations of the NAC-MPC have similar components and operating features, but have different physical dimensions, weights and storage capacities. Confinement features for the Yankee-MPC and CY-MPC systems are addressed in the main body of Chapter 7 of Reference E.11-1. Appendix 7.A of Reference E.11-1 has been added to address the MPC-LACBWR system. *Figures illustrating the confinement boundary for the Yankee-MPC and CY-MPC are found in Figures 7.1-1 and 7.1-2 of Reference E.11-1. The Figure illustrating the confinement boundary for the MPC-LACBWR is found in Figure 7.A.1-1 of Reference E.11.1.*

The codes and standards for the design, fabrication, and inspection of the canister and confinement boundary are detailed in Reference E.11-2. Specifically, Appendix B, Section B.3.3, “Codes and Standards”, which states the ASME Boiler and Pressure Vessel Code (ASME Code), 1995 Edition with Addenda through 1995, is the governing Code for the NAC-MPC System canister except that Addenda through 1997, are applied for critical flaw evaluation of the canister closure weld and Section B.3.3.1, “Alternatives to the ASME Code”, which lists the Code alternatives for the canister in Table B3-1. Included in this table is the leaktight criterion of ANSI N14.5 for the canister.

Appendix A, Section A 3.1, “NAC-MPC System Integrity”, of Reference E.11.2, includes limiting condition for operation (LCO) 3.1.1 for canister maximum vacuum drying time, LCO 3.1.2 for canister vacuum drying pressure, and LCO 3.1.3 for canister helium backfill pressure. These LCOs create a dry, inert, leaktight atmosphere, which contributes to preventing the leakage of radioactive material.

The confinement features of the NAC-MPC system for Yankee Rowe, Connecticut Yankee and La Crosse are such that the potential for canister leakage is not credible. Similarly, the storage of reactor generated GTCC waste from Yankee Rowe and Connecticut Yankee within a welded closed GTCC-Canister-YR and GTCC-Canister-CY does not present the potential for a credible leakage path. In addition, GTCC waste is a non-gas generation media. Thus, there is no means of dispersal from the GTCC-Canister-YR and GTCC-Canister-CY.

All Indicated Changes are in response to RSI NP-4.2

E.12 ACCIDENT ANALYSIS

The analyses of the off-normal and accident design events, including those identified by ANSI/ANS 57.9-1992, are presented in this Chapter 11 of Reference E.12-1. Section 11.1 of Reference E.12-1 describes the off-normal events that could occur during the use of the NAC-MPC storage system, possibly as often as once per calendar year. Section 11.2 of Reference E.12-1 addresses very low probability events that might occur once during the lifetime of the ISFSI or hypothetical events that are postulated because their consequences may result in the maximum potential impact on the surrounding environment. Section 11.3 of Reference E.12-1 describes the design basis load conditions for the Yankee-MPC transportable storage canister. As described in Section 11.3 of Reference E.12-1, the canister is analyzed for loads imposed during transportation. These transport condition loads envelope the loads for the storage condition analyzed herein.

This Chapter 11 of Reference E.12-1 demonstrates that the NAC-MPC satisfies the requirements of 10 CFR 72.24 and 10 CFR 72.122 for off-normal and accident conditions. These analyses are based on conservative assumptions to ensure that the consequences of off-normal conditions and accident events are bounded by the reported results. The actual response of the NAC-MPC system to the postulated events will be much better than that reported, i.e., stresses, temperatures, and radiation doses will be lower than predicted. If required for a site-specific application, a more detailed evaluation could be used to extend the limits defined by the events evaluated in this section.

The NAC-MPC is provided in three configurations. The first is designed to store up to 36 intact Yankee Class spent fuel and reconfigured fuel assemblies and is referred to as the Yankee-MPC. The second is designed to store up to 26 Connecticut Yankee fuel assemblies, reconfigured fuel assemblies or damaged fuel cans and is referred to as the CY-MPC. The third configuration is designed to store up to 68 Dairyland Power Cooperative La Crosse Boiling Water Reactor (LACBWR) spent fuel assemblies, including up to 32 LACBWR damaged fuel cans, and is referred to as MPC-LACBWR.

The off-normal and accident conditions evaluation for each configuration is presented separately when appropriate due to differences in capacity, weight and principal dimensions. The off-normal and accident conditions evaluation for the MPC-LACBWR configuration is presented in Appendix 11.A of Reference E.12-1.

For the storage of reactor generated GTCC waste previously loaded at Yankee Rowe and Connecticut Yankee, the accident analyses for the storage of their fuel bounds the storage of GTCC waste. The GTCC-Canister-YR and GTCC-Canister-CY and concrete overpacks are similar in design to the spent nuclear fuel canisters and overpacks and the storage heat load for GTCC waste is significantly below that of the stored spent nuclear fuel.

All Indicated Changes are in response to RSI NP-4.2

F.4 OPERATING SYSTEMS

The primary components of the NAC-UMS Universal Storage System consist of the transportable storage canister, the vertical concrete cask, and the transfer cask. The NAC-UMS is designed to store up to 24 PWR or up to 56 BWR fuel assemblies. Since the design basis fuel assemblies have different overall lengths, the PWR fuel assemblies are grouped into three classes and the BWR fuel assemblies are grouped into two classes based on overall lengths. To accommodate the different fuel classes the NAC-UMS principal components are provided in an appropriate length for each class of fuel assemblies.

The transportable storage canister is a stainless steel cylindrical shell (with a bottom end plate and closure lids) that confines the fuel basket structure and the contents.

In long-term storage, the transportable storage canister is positioned inside a vertical concrete cask, which provides passive radiation shielding and natural convection cooling. The vertical concrete cask also provides protection during storage for the Transportable Storage Canister under adverse environmental conditions.

The transfer cask is used to lift and place a canister during fuel loading operations and to move a canister to or from the vertical concrete cask. The transfer cask provides radiation shielding while the canister is being transferred.

A loaded canister is placed into a concrete cask by positioning the transfer cask containing the loaded canister on top of the vertical concrete cask and lowering the canister into the concrete cask. The process is reversed for the removal of a canister from a concrete cask. Figure F.4-1 depicts the major components of the NAC-UMS system and shows the transfer cask positioned on the top of the concrete cask.

The Maine Yankee NAC-UMS is described in the following section, Section F.4.1.

Section F.4.3 provides a reference to all applicable license drawings (i.e., NAC-UMS drawings associated with storage PWR fuel and site-specific Maine Yankee fuel drawings) from Reference [F.4.2-1].

In addition to these previously NRC approved license drawings, this WCS SAR appendix includes one site-specific GTCC waste canister storage configuration drawing for previously loaded Maine Yankee GTCC waste canisters (GTCC-Canister-MY).

All Indicated Changes are in response to RSI NP-4.2

F.4.2 References

F.4.2-1 NAC-UMS Universal Storage System Final Safety Analysis Report, Revision 10, October 2012.

F.4.2-2 Amendment No. 5 to Certificate of Compliance No. 1015 for the NAC International, Inc., NAC-UMS Universal Storage System, January 12, 2008.

F.4.2-3 NAC International, "Safety Analysis Report for the UMS® Universal Transport Cask," Revision 2, CoC 9270 Revision 4, USNRC Docket Number 71-9270.

All Indicated Changes are in response to RSI NP-4.2

F.4.3 Supplemental Data

Section F.4.3 provides a listing of all applicable license drawings (i.e., NAC-UMS drawings associated with the storage PWR fuel and site-specific Maine Yankee fuel drawings) from Reference [F.4.2-1].

The following drawings are located as noted below for the GTCC-Canister-MY GTCC Waste Canisters and Storage configuration:

1. *"GTCC Waste Basket, Maine Yankee, NAC-UMS," Sheets 1 thru 2 790-611, Rev. 6 (See Section 1.3.4 of "Safety Analysis Report for the UMS(R) Universal Transport Cask" [F.4-3])*

2. *"GTCC Waste Canister, Maine Yankee, NAC-UMS," Sheets 1 thru 2, 790-612, Rev. 9 (See Section 1.3.4 of "Safety Analysis Report for the UMS(R) Universal Transport Cask" [F.4-3])*

3. *"Loaded Vertical Concrete Cask (VCC), NAC-UMS, Waste Control Specialists (WCS)," Sheets 1 thru 2, 30039-590, Rev. 0 (included at the end of this Section)*

All Indicated Changes are in response to RSI NP-4.2

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Security-Related Information Figure Withheld Under 10 CFR 2.390.

UNLESS OTHERWISE STATED	GROUP	NAME	DATE
DIMENSIONING AND TOLERANCING SHALL BE PER ASME Y14.5M-94		[illegible]	9/2/16
ALL THREAD DEPTH CALLOUTS ARE TO BE CONSIDERED AS A MIN. DEPTH OF PERFECT THREADS		[illegible]	9-2-16
		[illegible]	9-2-16
ALL DIMENSIONS ARE IN INCHES		[illegible]	9-2-16
NEXT ASSEMBLY N/A		[illegible]	9/6/16
DRAWING TYPE LICENSE		B. Barrett	9/7/16

NAC INTERNATIONAL

LOADED VERTICAL CONCRETE CASK (VCC) NAC-UMS®, WASTE CONTROL SPECIALISTS (WCS)

PROJECT 30039 | DRAWING 590 | REV 0

SH 1 OF 2

Security-Related Information Figure Withheld Under 10 CFR 2.390.

NAC INTERNATIONAL

LOADED VERTICAL CONCRETE CASK (VCC)
NAC-UMS®
WASTE CONTROL SPECIALISTS (WCS)

PROJECT	DRAWING	REV
30039	590	0

SH 2 OF 2

F.8 THERMAL EVALUATION

This appendix presents the thermal design and analyses of the NAC-UMS Universal Storage System (NAC-UMS) for normal, off-normal, and accident conditions of storage of spent nuclear fuel. The NAC-UMS is designed to safely store up to 24 PWR spent fuel assemblies. The NAC-UMS is designed to accommodate five different lengths of fuel assemblies - three PWR and two BWR. The NAC-UMS design basis heat load is 23.0 KW.

The thermal evaluation of the NAC-UMS for normal operating (maximum average yearly ambient temperature) conditions is presented in Section 4.4 of Reference F.8.2-1. The thermal evaluation of the NAC-UMS for off-normal operating (maximum average 3-day ambient temperature) conditions is presented in Section 11.1.1 of Reference F.8.2-1. The thermal evaluation of the NAC-UMS for extreme operating (maximum extreme 3-day ambient temperature) conditions is presented in Section 11.2.7 of Reference F.8.2-1.

The results of the above referenced analyses document that the NAC-UMS safely operates within allowable temperature limits for the defined site-specific environmental thermal parameters. These parameters are bounding for the NAC-UMS systems at the WCS facility. The following sections detail those defined site-specific environmental thermal parameters for the NAC-UMS and demonstrate that they bound the site-specific environmental thermal parameters defined for the WCS facility.

The NAC-UMS storage system may contain GTCC waste from Maine Yankee (GTCC-Canister-MY). The maximum GTCC waste heat generation allowed for transport in the NAC-UMS transportation cask for Maine Yankee is 4.5 kW. This heat load is well below the design basis heat load of 23.0 kW for the storage of PWR fuel. Therefore, the thermal analysis results for the storage of Maine Yankee PWR fuel is bounding. No further evaluation is required.

All Indicated Changes are in response to RSI NP-4.2

F.11 CONFINEMENT EVALUATION

The NAC-UMS storage system is provided in two configurations, PWR – 3 different lengths and BWR – 2 different lengths. The NAC-UMS provides storage for up to 24 PWR spent fuel assemblies or up to 56 BWR spent fuel assemblies. These configurations of the NAC-UMS have similar components and operating features, but have different physical dimensions, weights and storage capacities.

Confinement features for the NAC-UMS system are addressed in the main body of Chapter 7 of the NAC-UMS FSAR, Reference F.11.2-1. *Figures illustrating the confinement boundary for the NAC-UMS are found in Figures 7.1-1 and 7.1-2 or Reference F.11-1.*

The codes and standards for the design, fabrication, and inspection of the canister and confinement boundary are detailed in Reference F.11-2. Specifically, Appendix B, Section B 3.3, "Codes and Standards," which states the ASME Code, 1995 Edition with Addenda through 1995, is the governing Code for the NAC-UMS canister and Section B 3.3.1, "Exception to Codes, Standards, and Criteria," which lists the Code exception for the canister in Table B3-1. Included in this table is the leaktight criterion of ANSI N14.5 for the canister.

Appendix A, Section A 3.1, "NAC-UMS System Integrity," of Reference F.11.2, includes limiting condition for operations (LCO) 3.1.1 for canister maximum vacuum drying time, LCO 3.1.2 for canister vacuum drying pressure, and LCO 3.1.3 for canister helium backfill pressure. These LCOs create a dry, inert, leaktight atmosphere, which contributes to preventing the leakage of radioactive material.

The confinement features of the NAC-UMS system for PWR fuel are such that the potential for canister leakage is not credible. Similarly, the storage of reactor generated GTCC waste from Maine Yankee within a welded closed GTCC-Canister-MY does not present the potential for a credible leakage path. In addition, GTCC waste is a non-gas generation media. Thus, there is no means of dispersal from the GTCC-Canister-MY.

All Indicated Changes are in response to RSI NP-4.2

F.12 ACCIDENT ANALYSIS

The analyses of the off-normal and accident design events, including those identified by ANSI/ANS 57.9-1992, are presented in Chapter 11 of the NAC-UMS FSAR, Reference F.12.2-1. Section 11.1 of the FSAR addresses the off-normal events that could occur during the use of the NAC-UMS storage system, possibly as often as once per calendar year. Section 11.2 of the FSAR addresses very low probability events that might occur once during the lifetime of the ISFSI or hypothetical events that are postulated because their consequences may result in the maximum potential effect on the surrounding environment. Section 11.2.14 of the FSAR describes the canister closure weld evaluation for the NAC-UMS transportable storage canister. Section 11.2.15 of the FSAR presents the evaluation of accident and natural phenomena events for site-specific spent fuel, including Maine Yankee site-specific spent fuel. Section 11.2.16 presents the structural evaluation of fuel rods for burnup to 60,000 MWd/MTU.

The analyses presented in Chapter 11 of the NAC-UMS FSAR, Reference F.12.2-1, demonstrates that the NAC-UMS satisfies the requirements of 10 CFR 72.24 and 10 CFR 72.122 for off-normal and accident conditions. These analyses are based on conservative assumptions to ensure that the consequences of off-normal conditions and accident events are bounded by the reported results. The actual response of the NAC-UMS system to the postulated events will be much better than that reported, i.e., stresses, temperatures, and radiation doses will be lower than predicted. If required for a site-specific application, a more detailed evaluation could be used to extend the limits defined by the events evaluated in this section.

The NAC-UMS is provided in two configurations – PWR (3 lengths) and BWR (2 lengths). The PWR configuration is designed to store up to 24 spent fuel assemblies. The BWR configuration is designed to store up to 56 fuel assemblies.

The off-normal and accident conditions evaluation for the PWR and the BWR configurations are presented separately, when appropriate, due to differences in capacity, weight and principal dimensions.

For the storage of reactor generated GTCC waste previously loaded at Maine Yankee (GTCC-Canister-MY), the accident analyses for the storage of NAC-UMS PWR fuel bounds the storage of Maine Yankee GTCC waste. The GTCC-Canister-MY and concrete overpacks are similar in design to the PWR fuel canisters and overpacks and the storage heat load for GTCC waste is significantly below that of the stored spent nuclear fuel.

All Indicated Changes are in response to RSI NP-4.2

G.4 OPERATING SYSTEMS

MAGNASTOR is a spent fuel dry storage system consisting of a concrete cask and a welded stainless steel TSC with a welded closure to safely store spent fuel. The TSC is stored in the central cavity of the concrete cask. The concrete cask provides structural protection, radiation shielding, and internal airflow paths that remove the decay heat from the TSC contents by natural air circulation. MAGNASTOR is designed and analyzed for a 50-year service life.

The loaded TSC is moved to and from the concrete cask using the transfer cask. The transfer cask provides radiation shielding during TSC closure and preparation activities. The TSC is transferred into the concrete cask by positioning the transfer cask with the loaded TSC on top of the concrete cask, opening the shield doors, and lowering the TSC into the concrete cask. Figure G.4-1 depicts the major components of MAGNASTOR in such a configuration.

Section G.4.3 provides a reference to all applicable license drawings (i.e., only undamaged and damaged PWR fuel storage systems) from Reference [G.4-1]. In addition to these previously NRC approved license drawings, this WCS SAR appendix includes one site-specific GTCC waste canister storage configuration drawing for previously loaded Zion GTCC waste canisters (GTCC-Canister-ZN).

All Indicated Changes are in response to RSI NP-4.2

G.4.2 References

G.4-1 MAGNASTOR Final Safety Analysis Report, Revision 7, July 2015.

G.4-2 NAC International, "Safety Analysis Report for the MAGNATRAN Transport Cask," Revisions 12A, 14A, 15A, and 16A U.S. NRC Docket Number 71-9356.

All Indicated Changes are in response to RSI NP-4.2

G.4.3 Supplemental Data

The licensing drawings for the MAGNASTOR® System are listed in Section 1.8, License Drawings of the MAGNASTOR® System Final Safety Analysis Report, Revision 7 [G.4-1]. These drawings appear in the FSAR immediately after the drawing list in Section 1.8.1.

The following drawings are located as noted below for the GTCC-Canister-ZN GTCC Waste Canisters and Storage Configuration:

1. *"GTCC Waste Basket Liner, MAGNASTOR," Sheets 1 thru 2, 71160-711, Rev. 1 (See Section 1.4.3 of the "Safety Analysis Report for the MAGNATRAN Transport Cask" [G.4-2])*

2. *"Shell Weldment, GTCC TSC, MAGNASTOR," Sheets 1 thru 2, 71160-781, Rev. 1 (See Section 1.4.3 of the "Safety Analysis Report for the MAGNATRAN Transport Cask" [G.4-2])*

3. *"GTCC TSC, Assembly, MAGNASTOR," Sheets 1 thru 2, 71160-785, Rev. 3 (See Section 1.4.3 of the "Safety Analysis Report for the MAGNATRAN Transport Cask" [G.4-2])*

4. *"Loaded Vertical Concrete Cask (VCC), MAGNASTOR, Waste Control Specialists (WCS)", Sheets 1 of 1, 30039-591, Rev. 0 (included at the end of this Section)*

All Indicated Changes are in response to RSI NP-4.2

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Security-Related Information Figure Withheld Under 10 CFR 2.390.

NAC INTERNATIONAL

LOADED CONCRETE CASK, MAGNASTOR, WASTE CONTROL SPECIALISTS (WCS)

UNLESS OTHERWISE STATED

NEXT ASSEMBLY N/A

DRAWING TYPE LICENSE

GROUP	NAME	DATE
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		9-1-16
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		9/9/16

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