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Appendix 5.1G
Class II Visibility Assessment

AES Alamitos Energy Center Class II Visibility Assessment

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AES Alamitos, LLC (AES) owns and operates the Alamitos Generating Station located in Long Beach, California and is proposing to replace the existing power boilers with more efficient natural-gas-fired combustion turbines in a combined-cycle configuration. The proposed Alamitos Energy Center (AEC) would be one of the 28 major source categories defined in Title 40 of the Code of Federal Regulations (CFR), Section 51.166, and the modification would trigger Prevention of Significant Deterioration (PSD) permitting requirements.

The South Coast Air Quality Management District (SCAQMD) is a responsible agency with regards to the permitting of AEC. In addition to the information needed to satisfy the requirements for a complete PSD permit application, the SCAQMD has requested an analysis of the project's impacts on visibility for nearby Class II areas. This memorandum outlines the AEC visibility analysis approach and results at the Class II areas of concern identified through consultation with SCAQMD.

Class II Areas of Concern

A survey of California State Parks and Wilderness areas designated as Class II areas was conducted within 50 kilometers (km) of AEC. The results of this survey were summarized and presented to the SCAQMD staff for review and approval. The Class II areas identified and approved by the SCAQMD for inclusion in the Class II visibility analysis are presented in Table 1 below and shown on Figure 1.

TABLE 1
Class II Areas within 50 km of AEC

Class II Area	Nearest Distance	Furthest Distance
Water Canyon National Park [a]	29.6 km	42.2 km
Chino Hills State Park [a]	29.6 km	42.2 km
Crystal Cove State Park	30.3 km	35.5 km
Kenneth Hahn State Park	34.6 km	37.3 km

[a] Assumed Water Canyon National Park and Chino Hills State Park cover the same area since they are directly adjacent to one another.

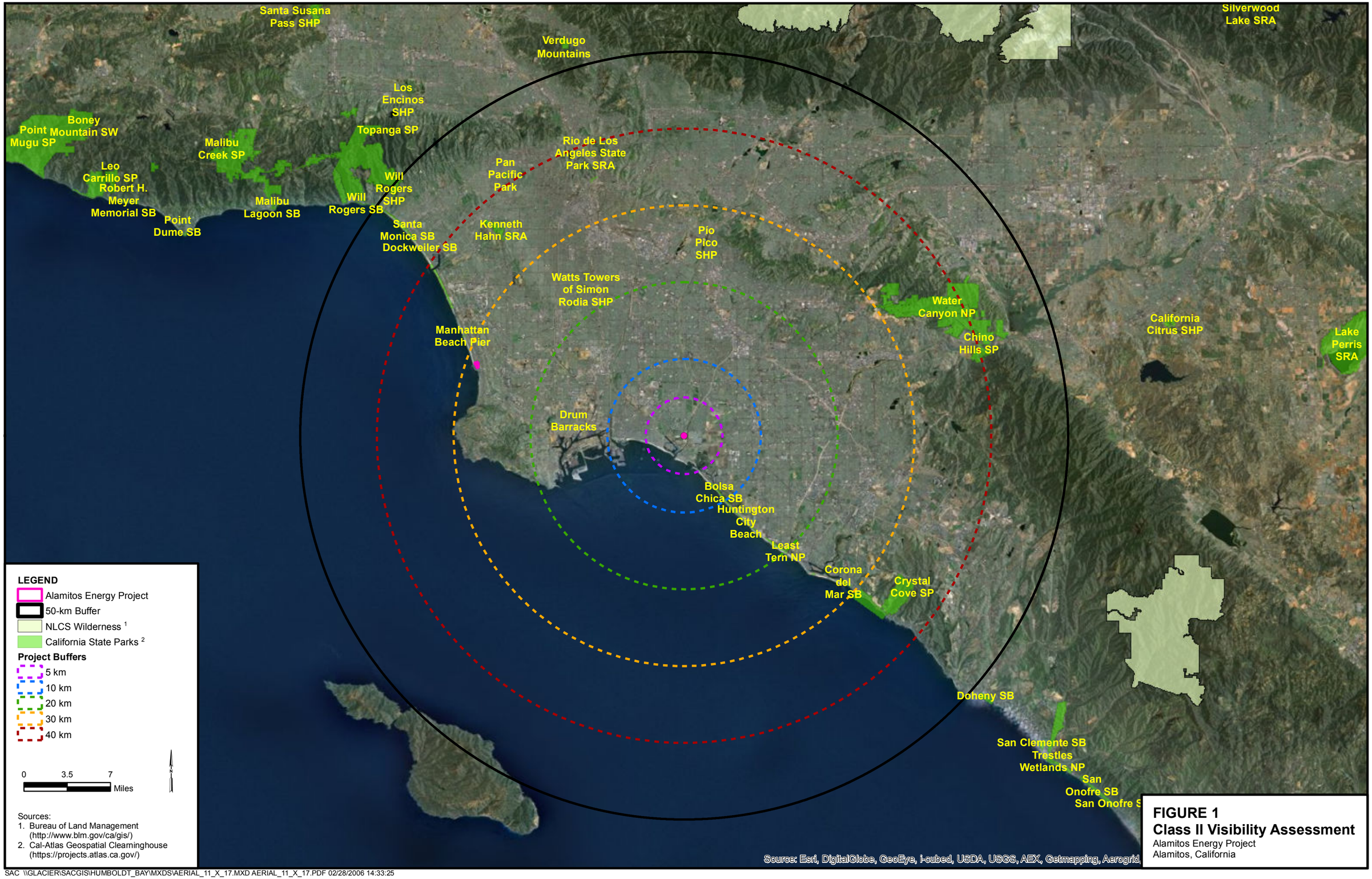

FIGURE 1
Class II Visibility Assessment
Alamitos Energy Project
Alamitos, California

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Visibility Assessment Approach

No specific requirements or criteria exist in the PSD regulations for assessing Class II visibility impacts. Therefore, the general approach used to assess visibility impacts of Class I areas within 50 km of a PSD project site were used.

The *Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report – Revised (2010)* (Federal Land Managers [FLM], 2010) guidance document for addressing Class I areas initially recommends the use of the U.S. Environmental Protection Agency's (EPA) VISCREEN screening model to assess the change in color difference (ΔE) and contrast between the facility's plume and the viewing background. The VISCREEN screening model can use a tiered approach to determine if the facility's emissions would impact visibility at a nearby Class I area. If the VISCREEN Tier I and Tier II screening assessment demonstrate that visibility could be impacted at the Class I area, then the PLUVUE II model is recommended for a Tier III assessment. The PLUVUE II model differs from the VISCREEN screening model as VISCREEN uses a single representative worst-case meteorological condition to determine the facility's potential impacts on visibility while PLUVUE II considers a realistic array of all conditions that would be expected to occur in a typical year in the region. Procedures outlined in the *Workbook for Plume Visual Impact Screening and Analysis* (EPA, 1992) were followed to conduct a visibility assessment with VISCREEN at the nearby Class II areas.

The VISCREEN screening model was developed to present a visual effect evaluation of emissions from a source as observed from a given vantage point on either a sky or terrain background. Emissions input into the model are assumed to travel along an infinitely long, straight line toward the specified area of concern. As mentioned above, the VISCREEN screening model allows for the use of a tiered approach to assess a proposed source's impacts on visibility. A Tier I assessment utilizes conservative assumptions for both plume characteristics and dispersion conditions to determine if the plume would have an impact on visibility. If a Tier I assessment exceeds the FLAG guidance for Class I areas of 2.0 for ΔE and 0.05 for contrast, then a Tier II assessment would be conducted. A Tier II assessment provides a more realistic representation of the possible worst-case meteorology and plume transport for a specific area to be analyzed.

Background visual ranges for the Class II areas presented in Table 1 were selected from the Interagency Monitoring of Protected Visual Environments (IMPROVE) annual average background visual range map. These data are provided on the IMPROVE Web site (IMPROVE, 2013). The average of the annual upper and lower bounds of the background visual range for the identified Class II areas was used for the analysis.

For AEC, if a VISCREEN Tier I assessment exceeded the conservative criteria for Class I areas for either ΔE or contrast, a Tier II assessment utilized the meteorological dataset for the Long Beach monitoring station, which was provided by SCAQMD staff for the PSD modeling analysis for years 2006 through 2009 and 2011, to determine representative worst-case single combinations of wind speed, wind direction, and atmospheric stability for each Class II area above the screening criteria. The 5-years of Long Beach meteorological data were pre-processed with the EPA Meteorological Processor for Regulatory Modeling Applications (MPRM, Version 99349) for the Industrial Source Complex (ISC) modeling system. These data, pre-processed with MPRM, contain the required parameters of wind speed, wind direction, and stability class to create the joint frequency distributions.[1] These meteorological data would be considered representative for creating the joint frequency tables for determining the conservative representative worst-case single wind speed and stability class required for a Class I area VISCREEN assessment.

The meteorological data processing utilized the SCAQMD-provided AERMET data for wind speed, wind direction, temperature, and cloud cover. The ceiling height data were from the raw integrated surface hourly (ISH) format from the Long Beach Airport National Weather Service (NWS) station. The meteorological data processed with MPRM would be representative of the Class II area VISCREEN assessment. These parameters are required to create the corresponding hourly Pasquill-Gifford stability classes (EPA, 1996). The meteorological data joint frequency distribution of these parameters for each Class II area requiring a Tier II assessment is provided in

[1] Meteorological data processed for ISC is preferred to create the joint frequency distribution tables for a Tier II VISCREEN assessment since the data contain Pasquill-Gifford Stability Classes. Meteorological data pre-processed for AERMOD do not contain the Pasquill-Gifford stability parameters.

Attachment A. These joint frequency distribution tables conservatively assessed all hours of the meteorological data.

Since the annual average background visual ranges for each Class II area were used, the annual average AEC emissions in ton(s) per year (tpy) were used for oxides of nitrogen (NO_x) and total particulate matter (PM). The assessment conservatively assumes only the project increases in emissions from AEC would be modeled and would not consider any contemporaneous decreases of these pollutants from removal of the existing Alamitos Generating Station Units 1–6 boilers. The AEC potential to emit are 271.8 tpy of NO_x and 99.5 tpy of PM.

Visibility Assessment Results

Following the approach above, Table 2 summarizes the VISCREEN Tier I modeled results for each Class II area shown in Table 1. The maximum modeled values for ΔE and contrast are presented for inside the area analyzed, regardless of the VISCREEN modeled lines of sight for the observer.

TABLE 2

Tier I VISCREEN Results

Class II Area	Minimum Distance	Maximum Distance	Variable	Sky	Terrain	Criteria
Crystal Cove State Park	30.3 km	35.5 km	ΔE	1.732	**2.656**	2.0
			Contrast	-0.017	0.023	|0.05|
Water Canyon National Park/ Chino Hills State Park	29.6 km	42.2 km	ΔE	**2.293**	**2.736**	2.0
			Contrast	-0.023	0.023	|0.05|
Kenneth Hahn State Park	34.6 km	37.3 km	ΔE	1.409	**2.237**	2.0
			Contrast	-0.014	0.02	|0.05|

Bold Values exceed the Class I criteria.

As shown in Table 2, the Tier I assessment exceeded the criteria for ΔE at each Class II area analyzed. As a result, a Tier II assessment was performed for each Class II area shown in Table 1. The Tier II VISCREEN results are summarized in Table 3.

TABLE 3

Tier II VISCREEN Results

Class II Area	Minimum Distance	Maximum Distance	Wind Speed [a]	Stability [a]	Variable	Sky	Terrain	Criteria
Crystal Cove State Park	30.3 km	35.5 km	4	D	ΔE	0.118	0.193	2.0
					Contrast	0.001	0.002	|0.05|
Water Canyon National Park/ Chino Hills State Park	29.6 km	42.2 km	2	D	ΔE	0.304	0.398	2.0
					Contrast	0.003	0.003	|0.05|
Kenneth Hahn State Park	34.6 km	37.3 km	4	D	ΔE	0.095	0.157	2.0
					Contrast	0.001	0.001	|0.05|

[a] The Joint Frequency Distribution table used to calculate the wind speed and stability for the Tier II assessment is presented in Attachment A.

The VISCREEN Tier II assessment for each Class II area analyzed did not exceed the criteria for ΔE or contrast. As the modeled results are below the conservative Class I area criteria for both ΔE and contrast, AEC would not adversely affect visibility at nearby Class II areas.

References

U.S. Environmental Protection Agency (EPA). 1992. *Workbook for Plume Visual Impact Screening and Analysis* (EPA-454/R-92-023). October.

U.S. Environmental Protection Agency (EPA). 1996. Meteorological Processor for Regulatory Models (MPRM) User's Guide. Office of Air Quality Planning and Standards. Research Triangle Park. EPA-454/B-96-002. August.

Federal Land Managers (FLM). 2010. *Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I Report – Revised (2010), Natural Resource Report NPS/NRPC/NRR-2010/232*. October.

Interagency Monitoring of Protected Visual Environments (IMPROVE). 2013. *Visibility Monitoring Data, Results*. http://www2.nature.nps.gov/air/monitoring/vismonresults.cfm. Accessed August 27, 2013.

Attachment A

Joint Frequency Distributions for Tier II VISCREEN Assessment

Table A-1
Crystal Cove State Park Joint Frequency Distribution

Dispersion Condition		σz·σy·u [a]	Transport Time (hours)	Count (hours) [b]	Frequency [c]	Cumulative Frequency
Stability	Wind Speed					
F	1	4.9825E+04	8.4	109	0.002487	0.002487
F	2	9.9651E+04	4.2	40	0.000913	0.0034
E	1	1.3852E+05	8.4	32	0.00073	0.00413
F	3	1.4948E+05	2.8	6	0.000137	0.004267
F	4	1.9930E+05	0.9	1	2.28E-05	0.00429
E	2	2.7703E+05	4.2	22	0.000502	0.004792
D	1	3.6539E+05	8.4	31	0.000707	0.005499
E	3	4.1555E+05	2.8	5	0.000114	0.005613
E	4	5.5407E+05	2.1	0	0	0.005613
E	5	6.9258E+05	1.7	1	2.28E-05	0.005636
D	2	7.3078E+05	4.2	36	0.000821	0.006458
D	3	1.0962E+06	2.8	13	0.000297	0.006754
D	4	1.4616E+06	2.1	2	4.56E-05	0.0068

[a] σz·σy·u is based on a distance of 30.3 km.
[b] Count for hours during which winds blow toward the sector between 119 and 131 degrees from true north.
[C] based on 43,824 total hours

The highlighted row conservatively represents the top 1 percent of the data; the corresponding wind speed and stability were used for the Tier II analysis.

Table A-2
Water Canyon National Park/Chino Hills State Park Joint Frequency Distribution

Dispersion Condition		σz·σy·u [a]	Transport Time	Count	Frequency [c]	Cumulative
Stability	Wind Speed		(hours)	(hours) [b]		Frequency
F	1	4.8470E+04	8.2	95	0.002168	0.002168
F	2	9.6940E+04	4.1	66	0.001506	0.003674
E	1	1.3452E+05	8.2	26	0.000593	0.004267
F	3	1.4541E+05	2.7	17	0.000388	0.004655
F	4	1.9388E+05	0.9	2	4.56E-05	0.004701
E	2	2.6904E+05	4.1	41	0.000936	0.005636
D	1	3.5373E+05	8.2	60	0.001369	0.007005
E	3	4.0356E+05	2.7	36	0.000821	0.007827
E	4	5.3808E+05	2.1	6	0.000137	0.007964
E	5	6.7260E+05	1.6	3	6.85E-05	0.008032
D	2	7.0745E+05	4.1	103	0.00235	0.010382
D	3	1.0612E+06	2.7	67	0.001529	0.011911
D	4	1.4149E+06	2.1	27	0.000616	0.012527

[a] σz·σy·u is based on a distance of 29.6 km.
[b] Count is for hours during which winds blow toward the sector between 51 and 73 degrees from true north.
[C] based on 43,824 total hours

The highlighted row conservatively represents the top 1 percent of the data; the corresponding wind speed and stability were used for the Tier II analysis.

Table A-3
Kenneth Hahn State Park Joint Frequency Distribution

Dispersion Condition		σz·σy·u [a]	Transport Time (hours)	Count (hours) [b]	Frequency [c]	Cumulative Frequency
Stability	Wind Speed					
F	1	5.8038E+04	9.6	70	0.001597	0.001597
F	2	1.1608E+05	4.8	67	0.001529	0.003126
E	1	1.6354E+05	9.6	13	0.000297	0.003423
F	3	1.7411E+05	3.2	24	0.000548	0.00397
F	4	2.3215E+05	0.9	0	0	0.00397
E	2	3.2707E+05	4.8	24	0.000548	0.004518
D	1	4.3920E+05	9.6	18	0.000411	0.004929
E	3	4.9061E+05	3.2	13	0.000297	0.005225
E	4	6.5415E+05	2.4	1	2.28E-05	0.005248
E	5	8.1768E+05	1.9	0	0	0.005248
D	2	8.7840E+05	4.8	42	0.000958	0.006207
D	3	1.3176E+06	3.2	22	0.000502	0.006709
D	4	1.7568E+06	2.4	4	9.13E-05	0.0068

[a] σz·σy·u is based on a distance of 34.6 km.
[b] Count is for hours during which winds blow toward the sector between 319 and 322 degrees from true north.
[C] based on 43,824 total hours

The highlighted row conservatively represents the top 1 percent of the data; the corresponding wind speed and stability were used for the Tier II analysis.