

**Guidance on the Preparation of
Demonstrations in Support of Requests to
Exclude Ambient Air Quality Data Affected
by High Winds under the Exceptional Events
Rule**

United States Environmental Protection Agency

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Acronyms

AAQ	Affects Air Quality
ADEQ	Arizona Department of Environmental Quality
AQS	Air Quality System
BACM	Best Available Control Measures
CAA	Clean Air Act
CCR	Clear Causal Relationship
CFR	Code of Federal Regulation
CLASS	Clean Air Support System
DAQEM	Department of Air Quality and Environmental Management (Clark County, NV)
DRI	Desert Research Institute
EER	Exceptional Events Rule
EPA	Environmental Protection Agency
FEM	Federal Equivalent Method
FRM	Federal Reference Method
GIS	Geographic Information System
HAURL	Human Activity Unlikely to Recur at a particular Location
HF	Historical Fluctuations
MAG	Maricopa Association of Governments (Arizona)
MODIS	Moderate Resolution Imaging Spectroradiometer
nRCP	not Reasonably Controllable or Preventable
NAAQS	National Ambient Air Quality Standards
NEBF	No Exceedance But For the event
NSR	New Source Review
NWS	National Weather Service
RACM	Reasonably Available Control Measures
PM	Particulate Matter
SCAQMD	South Coast Air Quality Management District (California)
SIL	Significant Impact Level
SJV	San Joaquin Valley
SIP	State Implementation Plan
TOEM	Tapered Element Oscillating Microbalance
UNLV	University of Nevada, Las Vegas
WEG	Wind Erodibility Group
WGA	Western Governors' Association
WRAP	Western Regional Air Partnership

1. Highlights

This document clarifies the Exceptional Events Rule¹ (EER) for high wind dust (i.e., particulate matter) events² and provides recommendations for exceptional event demonstrations. High winds can entrain and transport particulate matter (PM) to a monitoring site. These particles can consist of both “inhalable coarse particles” (i.e., larger than 2.5 micrometers (μm) and smaller than 10 μm in diameter, termed PM_{10}) and “fine particles” (i.e., 2.5 μm in diameter and smaller, termed $\text{PM}_{2.5}$). This document applies to both PM_{10} and $\text{PM}_{2.5}$ high wind dust events.

Purpose of this Document

The purpose of this document is to provide assistance and clarification to agencies implementing the EER for high wind dust events.

To Whom does this Document Apply?

The EER refers to the “State” as the entity that may request EPA to exclude data due to exceptional events (e.g., 40 CFR 50.14(a)). However, the preamble to the EER makes it clear that the EER “applies to all States; to local air quality agencies to whom a State has delegated relevant responsibilities for air quality management, including air quality monitoring and data analysis; and ... to Tribal air quality agencies where appropriate.” This document uses the term “State” to be consistent with the EER, but the document similarly applies to all state, local, and Tribal agencies that are responsible for preparation and submission of EER demonstration packages under the EER.

High wind dust events are typically a phenomenon experienced in the western United States where rainfall is seasonal, creating dry and dusty landscapes. Therefore, this document may be of most use to the states from the Great Plains (North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas) and west: generally this will include the states that comprise the Western Regional Air Partnership, which is most of EPA Regions 6, 7, 8, 9, and 10. While the EER requirements referenced in this document apply similarly to eastern states, an alternative wind threshold (see Section 3.1.3) appropriate to the eastern landscape and non-arid regions in the west would need to be developed (see Appendix A for a summary of how this type of threshold can be developed).

Guiding Principles for the Development of this Document

1. States should not be held accountable for exceedances due to events that were beyond their control at the time of the event;
2. It is desirable to implement reasonable controls to protect public health,³ and

¹ “Treatment of Data Influenced by Exceptional Events; Final Rule”, 72 FR 13560, March 22, 2007.

² The term “high wind dust event” is used in this document to refer to the same type of event that was discussed as a “high wind event” in the EER. EPA believes the term “high wind dust event” more clearly describes the referred-to event.

³ With respect to exceptional events, Section 319 of the Clean Air Act states the following guiding principles (among others);

(i) the principle that protection of public health is the highest priority

(iv) the principle that each State must take necessary measures to safeguard public health regardless of the source of the air pollution

3. Clear expectations will enable EPA and other air agencies to better manage resources related to the exceptional events process.

For recurring high wind dust events, EPA believes these principles can be achieved using a progressive approach in which states are expected to consider and implement further controls as events continue to recur.

Definition of a High Wind Dust Event

EPA considers that a high wind dust event includes both the high wind and the dust that the wind entrains and transports to a monitoring site; the event is not merely the occurrence of the high wind.

Critical Elements for the Technical Demonstration of High Wind Dust Events

- There are six technical elements that must be met under the EER for EPA to concur on a high wind dust event demonstration. These are:
 1. whether the event was not reasonably controllable or preventable (nRCP),
 2. whether there was a clear causal relationship (CCR),
 3. whether there would have been no exceedance or violation but for the event (NEBF),
 4. whether the event affects air quality (AAQ),
 5. whether the event was caused by human activity unlikely to occur or was a natural event (HAURL / Natural Event), and
 6. whether the event was in excess of normal historical fluctuations (HF).Failure to sufficiently address any one will prevent EPA's concurrence under the EER of the request to exclude data.
- In reviewing several high wind dust events flagged by states as exceptional events, EPA has found that the following EER elements have played a significant role in our review of the states' supporting documentation: nRCP, CCR, and NEBF. These three elements, along with HF, may be considered independent elements.
- In reviewing several high wind dust events flagged by states as exceptional events, EPA has found that two elements identified by statute, AAQ and HAURL / Natural Event, are necessarily also satisfied for a high wind event if the other elements are satisfied; therefore, they are not treated as independent and there is generally no separate demonstration that needs to be included to show these elements were satisfied.
- EPA has not set pass/fail statistical criteria for the HF element, but will use a weight of evidence approach to assess each demonstration on a case-by-case basis. The state's role in satisfying this element is to provide analyses and statistics as prescribed by EPA in this document. EPA will use the information provided by the state to determine whether the event was in excess of normal historical fluctuations.⁴ Events do not necessarily have to be rare to satisfy this element. EPA expects that failure on this element indicates likely failure for CCR and/or NEBF as well and thus does not expect that non-concurrence will result from failure of this element alone.
- While not listed as a stand-alone element, wind data (e.g., wind speed, direction, and recurrence) will generally play a vital role in informing EPA's decision on elements such

⁴ "Normal historical fluctuations" will generally be defined by those days without any exceptional events (e.g. high wind dust events or other types of exceptional events) for the previous years.

as whether the event was not reasonably controllable or preventable and establishing a clear causal relationship.

Not Reasonably Controllable or Preventable

- Exceedances caused in whole or in part by anthropogenic dust sources within the state's control are unlikely to be eligible for treatment as exceptional events under the EER, even under conditions of elevated winds, unless the state shows that the event, including the emissions from the anthropogenic dust sources, was not reasonably controllable or preventable. EPA intends to evaluate whether an event was not reasonably controllable or preventable at the time of the event by taking into account factors including controls in place, wind speed, an area's attainment status, the frequency and severity of exceedances, and the benefits of the controls.
- In addition to considering the factors above, EPA judges the reasonableness of controls based on the technical information that was available to the state at the time the event occurred. In the case of nonattainment areas EPA would generally expect states to already have the technical information needed to reasonably control sources within nonattainment areas. Also, the U.S. Department of Agriculture's Natural Resources Conservation Service develops best management practices (under various program titles), some of which are aimed at preventing loss of soil during high winds, which may also be informative in particular situations.
- The degree of event-specific information and data necessary for demonstrating "not reasonably controllable or preventable" will generally be less for wind speeds above 25 miles per hour (mph), and greater for speeds below that, at least for western states. Empirical evidence shows that a sustained wind speed of 25 mph is typically the minimum wind speed needed to entrain particles from many stable surfaces (i.e., undisturbed/natural surfaces with a crust or disturbed surfaces that have been re-stabilized) in the western U.S. where rainfall is seasonal (see Appendix A), and thus is a useful threshold for setting differential expectations for the detail to be included in a demonstration that dust from a wind event was not reasonably controllable or preventable. With EPA approval, states may establish a different threshold based on local studies.
- The degree of event-specific information and data necessary for demonstrating "not reasonably controllable or preventable" is likely to be lower for non-recurring events.
- EPA and the submitting state can consider the development of a voluntary High Wind Action Plan that would identify mutually agreed upon reasonable controls that a state could implement for subsequent high wind events. Preparation of such a plan and its approval by EPA could promote a common understanding between the state and EPA about whether subsequent high wind events are not reasonably controllable or preventable.

Clear Causal Relationship

Numerous types of analyses may be useful to establish a clear causal relationship, such as wind and concentration patterns or comparisons to concentrations at other monitoring sites and on other days. Examples of the types of analyses that could be used as part of the CCR are provided in Section 3.3.

No Exceedance But For the Event

For areas where the typical concentrations on non-event days are well below the applicable National Ambient Air Quality Standards (NAAQS), the NEBF demonstration may be relatively straightforward. However, demonstrating NEBF becomes increasingly difficult if concentrations on non-event days during the same season exceed the standard and/or if the contribution of non-event pollution sources produce concentrations near the applicable NAAQS.

Disclaimer

The Exceptional Events Rule is the source of the regulatory requirements for exceptional events and exceptional event demonstrations. This document provides guidance and interpretation of the Exceptional Events Rule rather than imposing any new requirements.

2. Overview of Exceptional Events Rule

The EER and preamble outline specific criteria listed below for an event to be considered an “exceptional event” for purposes of exclusion of air quality data from regulatory decisions. These criteria are more nuanced than the dictionary definition of “exceptional” might suggest. In particular, there is no requirement for an “exceptional event” to be exceptional *per se* in the dictionary sense of the word (i.e., forming an exception or rare instance; unusual; infrequent; extraordinary).

2.1 Definition of the “Event” for High Wind Dust Events

In high wind dust events the meteorological phenomenon (i.e., wind) is purely natural but the pollution from the event can arise from a mixture of natural sources (e.g., undisturbed soil) and anthropogenic sources (e.g., soil disturbed by human activity, dust from sand and gravel facilities). EPA classifies high wind dust events as “natural events” in cases where windblown dust is entirely from natural sources or where all significant anthropogenic sources of windblown dust have been reasonably controlled such that anthropogenic sources can be considered to have little impact as required under the EER.

EPA considers that a high wind dust event includes both the high wind and the dust that the wind entrains and transports to a monitoring site; the event is not merely the occurrence of the high wind. The “not reasonably controllable or preventable” clause in the statutory definition of an exceptional event applies to all types of events. In the case of a high wind event this clause applies to the high wind event as a whole, and encompasses the reasonable controllability of the emissions entrained by the high wind. The fact that the high wind itself was not preventable does not by itself make the high wind event “not reasonably controllable or preventable.”

2.2 Evidence Necessary to Support Exceptional Events Requests

The Exceptional Events Rule was promulgated by EPA in 2007, pursuant to the 2005 amendment⁵ of Clean Air Act (CAA) Section 319. The rule added 40 CFR §50.1(j), (k) and (l), §50.14, and §51.930 to the Code of Federal Regulations. These sections contain definitions, criteria for EPA approval, procedural requirements, and requirements for state demonstrations, all of which must be met for EPA to concur under the EER on the exclusion of air quality data from regulatory decisions.

The definition of an exceptional event given in 40 CFR §50.1(j) parallels the statutory definition of Section 319 of the CAA and itself contains certain criteria for approval by EPA:

- The event “affects air quality.”
- The event “is not reasonably controllable or preventable.”
- The event is “caused by human activity that is unlikely to recur at a particular location or [is] a natural event.”⁶

⁵ Safe, Accountable, Flexible, Efficient Transportation Equity Act: a Legacy for Users (SAFETEA-LU), section 6013 amending CAA §319, became law August 10, 2005; available at <http://thomas.loc.gov/cgi-bin/query/z?c109:H.R.3>:

⁶ A natural event is further described in 40 CFR 50.1(k) as “an event in which human activity plays little or no direct causal role.”

Additional criteria for EPA approval to exclude data affected by a high wind dust event are given (with some repetition of key phrases) in 40 CFR §50.14(a) and (b)(1).⁷ Under these provisions the state must:

- “demonstrat[e] to EPA’s satisfaction that such event caused a specific air pollution concentration at a particular air quality monitoring location.”
- “demonstrate a clear causal relationship between the measured exceedance or violation of such standard and the event ...”
- “demonstrat[e] to EPA’s satisfaction that an exceptional event caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section [regarding schedules, procedures and submission of demonstrations].”

Under 40 CFR §50.14(c)(3)(iv),⁸ the state demonstration to justify exclusion of data must provide evidence that:

- A. “The event satisfies the criteria set forth in 40 CFR §50.1(j)” for the definition of an exceptional event (see above);
- B. “There is a clear causal relationship between the measurement under consideration and the event that is claimed to have affected the air quality in the area”;
- C. “The event is associated with a measured concentration in excess of normal historical fluctuations, including background”;
- D. “There would have been no exceedance or violation but for the event”.

The definition of an exceptional event provided in 40 CFR § 50.1(j) explicitly excludes “stagnation of air masses or meteorological inversions, a meteorological event involving high temperatures or lack of precipitation, or pollution relating to source noncompliance.”⁹ Exceedances due to these events would not be eligible for exclusion under the EER. If there were a significant contribution from sources out of compliance with fugitive dust or other rules, then the PM exceedance would not be excluded as due to an exceptional event.

2.3 Mitigation Requirement

40 CFR §51 Subpart Y includes mitigation requirements at 51.930. While the EER does not require a mitigation plan to be submitted to EPA as part of the demonstration package, it is nonetheless a requirement of this section that “[a] State requesting to exclude air quality data due to exceptional events must take appropriate and reasonable actions to protect public health from exceedances or violations of the national ambient air quality standards.” The mitigation requirement is addressed in Section 4 of this document.

⁷ §50.14 (b)(2) and (b)(3) contain criteria relevant only to firework events and prescribed fire events.

⁸ Prior to the publishing of the 2010 CFR the citation was §50.14(c)(3)(iii)

⁹ For further explanation see “Treatment of Data Influenced by Exceptional Events; Final Rule”, 72 FR at 13577 n.15 (March 22, 2007).

2.4 Process Requirements per EER

In addition to technical demonstration requirements, the EER contains requirements related to the process for a state to request data exclusion under the EER:

- “A State shall notify EPA of its intent to exclude one or more measured exceedances of an applicable ambient air quality standard as being due to an exceptional event by placing a flag in the appropriate field for the data record of concern.” 40 CFR § 50.14(c)(2)(i). The placement of the flags and the submittal of an initial event description should be done concurrently with the submission of data to the AQS database (i.e., within 90 days of the end of the quarterly reporting period), 40 CFR § 50.14(c)(2)(i), but must be done “not later than July 1st of the calendar year following the year in which the flagged measurement occurred” 40 CFR § 50.14(c)(2)(iii).
- “A State that has flagged data as being due to an exceptional event and is requesting exclusion of the affected measurement data shall, after notice and opportunity for public comment, submit a demonstration to justify data exclusion to EPA not later than the lesser of, 3 years following the end of the calendar quarter in which the flagged concentration was recorded or, 12 months prior to the date that a regulatory decision must be made by EPA. A State must submit the public comments it received along with its demonstration to EPA.” 40 CFR § (50.14(c)(3)(i)).
- With the submission of the demonstration, the State “must document that the public comment process was followed.” 40 CFR § (50.14(c)(3)(iv)).

3. Evidence to be Included in a High Wind Dust Event Demonstration Package

As discussed in Section 2.2, the EER identifies technical elements (i.e., criteria or evidence) that need to be addressed for EPA to concur that an exceedance is due to an exceptional event. Table 1 shows the complete list of technical elements to be submitted as part of a demonstration for high wind dust events. All six technical elements need to be met; failure to meet any one will prevent EPA’s concurrence under the EER of the request to exclude data.

Table 1. EER Technical Demonstration Elements for High Wind Dust Events

Element	Abbreviation	Section of this Document Containing Additional Explanation
affects air quality	AAQ	3.4
not reasonably controllable or preventable*	nRCP	3.1
caused by human activity unlikely to recur at a particular location OR a natural event	HAURL / Natural Event	3.5
clear causal relationship between the measurement and the event*	CCR	3.3
no exceedance or violation but for the event*	NEBF	3.6
the event is associated with a measured concentration in excess of normal historical fluctuations, including background*	HF	3.2

*Independent Elements

EPA uses a “weight of evidence” approach in reviewing state requests for data exclusion under the EER, but each and every element should still be met. While evidence and narrative that constitutes a strong demonstration for one element can also be part of the demonstration for another element, meeting one element even beyond any room for doubt should not make up for the absence or failure to satisfy another element. In practice there are linkages among the elements. A given element may be impossible to satisfy unless another one is satisfied, or one element’s analysis may qualitatively affect the evaluation of another element. Although a strong demonstration on one element should not compensate for a failure of another, the strength of the demonstration for one requirement could influence the persuasiveness of evidence used for another.

In reviewing several high wind dust exceptional event demonstrations, EPA has found that the following EER elements have played a significant role in our review of the states’ supporting documentation: nRCP, CCR, and NEBF. EPA’s technical review of a high wind dust exceptional event package will therefore focus on these elements. The criterion that the event be in excess of normal historical fluctuations (HF) is an independent element that should be satisfied based on a weight of evidence. While the HF element is considered an independent element, it plays an important role in its contribution to the CCR and NEBF demonstrations.

EPA has generally found that two elements identified by statute, AAQ¹⁰ and HAURL / Natural Event, are necessarily also satisfied for a high wind event if the other elements are satisfied; therefore, they are not treated as independent and there is generally no separate demonstration that needs to be included to show these elements were satisfied. While not listed as a stand-alone element, wind data (e.g., wind speed, direction, and recurrence) will play a vital role in informing EPA's decision on elements such as whether the event was not reasonably controllable or preventable and establishing a clear causal relationship.

Finally, a demonstration package for a high wind dust event should include a conceptual model of how the event occurred. In its simplest form, this could be a narrative description of how the event unfolded and resulted in the exceedance(s). The conceptual model should help tie the various rule criteria together into a cohesive explanation of the event.

Sections 3.1-3.6 of this document describe and clarify each element identified in Table 1. Section 6 provides recommendations on the preparation of demonstration packages for high wind dust events, including examples of analyses and a recommended structure of the document.

In summary, the technical demonstration for a high wind dust exceptional events package should include:

Elements Required by the Exceptional Events Rule

- Not Reasonably Controllable or Preventable (*Independent Element*) - Analyses and descriptions should show that the event was not reasonably controllable or preventable.
- Clear Causal Relationship (*Independent Element*) - Analyses and descriptions should show that there was a clear causal relationship between the ambient concentration measurement under consideration and the event that is claimed to have affected the air quality in the area.
- No Exceedance But For the Event (*Independent Element*) - Analyses and descriptions should show that there would have been no exceedance or violation but for the event.
- Affects Air Quality (*Technical Element*) - statutory technical element that is generally automatically satisfied with no additional analyses once submitter provides historical fluctuations analyses, establishes a clear causal relationship, and provides explicit statement indicating satisfaction of requirement through clear causal and historical fluctuations showings.
- Human Activity Unlikely to Recur at a Particular Location / Natural Event (*Technical Element*) - statutory technical element that is generally automatically satisfied with no

¹⁰ The preamble to the EER clarifies the AAQ criteria in section V.B. (p. 13569) by stating that the following criteria establish that the event affected air quality: "there is a clear causal relationship between the measurement under consideration and the event that is claimed to have affected the air quality in the area" and "the event is associated with an unusual measured concentration beyond typical fluctuations including background." On this basis AAQ is satisfied once CCR has been demonstrated and evidence for HF has been provided.

additional analyses once submitter shows the event to be not reasonably controllable or preventable (nRCP), establishes a clear causal relationship, and provides explicit statement indicating satisfaction of requirement through clear causal and not reasonable controllable or preventable showings.

- Historical Fluctuations (*Independent Element*) - Analyses and descriptions should be provided in the format suggested in this document. EPA will use this information in a weight of evidence determination for this criterion.

EPA-Recommended Elements for Demonstration Package

- Wind Data - Data on wind speed, direction, and frequency of recurrence is needed to support all four independent critical elements.
- Conceptual model - Narrative summary at the beginning of a demonstration package describing how the event unfolded to produce elevated PM at the monitor(s) that recorded the exceedance(s) and providing context for the supporting elements.

3.1 Not Reasonably Controllable or Preventable (nRCP)

Exceedances caused by dust sources are not eligible for treatment as exceptional events under the EER, even under conditions of elevated winds, unless the state shows that the event (i.e., emissions of dust due to wind) was not reasonably controllable or preventable. EPA evaluates whether an event was not reasonably controllable or preventable at the time of the event by taking into account controls in place and wind speed, along with other factors.¹¹ The factors and approach identified in this section are intended to clarify EPA's expectations for high wind dust exceptional event packages and promote consistency in their review. Nonetheless, each package will be considered on a case-by-case basis per the EER. Note that for anthropogenic sources, EPA considers a source that is "reasonably controlled" to be one whose emissions were "not reasonably controllable or preventable"; therefore, these terms are used interchangeably throughout this document for anthropogenic controls.

3.1.1 Reasonable Controls

To meet the definition of an exceptional event, the event must be "not reasonably controllable or preventable" (40 CFR § 50.1(j)). Since EPA considers the event to include both the high winds and the dust entrained by those winds, it is necessary to identify the sources of windblown dust – both natural and anthropogenic – and determine whether their wind-driven emissions were reasonably controllable or preventable. For purposes of evaluating high wind dust exceptional events in the West, EPA will generally use the definitions of natural and anthropogenic windblown dust emissions that have been developed in the *Western Regional Air Partnership (WRAP) Fugitive Dust Handbook*.¹² According to the *WRAP Fugitive Dust Handbook*, all mechanically suspended dust from human activities should be considered anthropogenic

¹¹See SJV Attainment Affirmation, 73 FR73 14691, for a prior high wind dust event in which EPA considered controls and wind speed, along with other factors.

¹²*WRAP Fugitive Dust Handbook*, Prepared for Western Governors' Association, Countess Environmental (WGA Contract No. 30204-111), September 7, 2006. Available at <http://www.wrapair.org/forums/dejf/fdh/index.html>

emissions, while windblown dust from lands not disturbed or altered by human activity should be considered natural emissions. Furthermore, windblown dust from surfaces that have been significantly disturbed or altered by humans should be categorized as anthropogenic emissions. Such surfaces may include: undeveloped lands,¹³ construction and mining sites, material storage piles, landfills, vacant lots, agricultural lands, roadways, parking lots, artificially exposed beds of natural lakes and rivers, exposed beds of artificial water bodies, areas subject to off-road vehicle activity, and areas burned by anthropogenic fires. Natural sources may include: naturally-dry river and lake beds; barren lands; sand dunes; exposed rock; sea spray from natural water bodies; non-agricultural grass, range, and forest lands; areas burned by naturally-ignited fires; and glacial silt.

EPA generally considers dust entrained by high wind from undisturbed land (e.g., undisturbed desert) to be not reasonably controllable or preventable, due to the cost of treating large land areas and the likely disturbance to natural ecosystems. EPA also generally considers that wind-generated dust from previously disturbed land that is being allowed to fully return to natural conditions by effective prevention of any new disturbance is also not reasonably controllable or preventable, provided that there are no reasonable active measures that could be taken to control dust during the transition back to natural conditions.¹⁴ While emissions from most other natural sources of wind-blown dust could be similarly not reasonably controllable, EPA will consider those on a case-by-case basis. In areas where events recur, EPA may require increased characterization of the natural sources (e.g., historical surface disturbance, water diversions, vegetation changes, etc.).

While EPA generally does not expect natural sources of dust, e.g., from undisturbed land, to be reasonably controllable or preventable in most cases, EPA does expect reasonable controls on the wind-driven anthropogenic contribution to the concentration measured during the event. Experience in several areas in the western United States has shown that it is practical and reasonable to apply dust-suppression controls to disturbed lands and other anthropogenic dust sources, and that these controls help limit ambient concentrations of PM during high wind events, up to certain wind speeds. For example, many areas in the west have successfully controlled dust with measures such as water or chemical stabilization of disturbed areas such as construction zones, or limiting disturbance activities on windy days. If reasonable controls on wind-driven anthropogenic sources were not in place, then the event would not be considered “not reasonably controllable or preventable” and would not satisfy the nRCP element of the definition of an exceptional event. That is, to meet the EER the state should identify wind-driven contributing anthropogenic sources and show that reasonable controls were in place. For events with wind-driven anthropogenic contributions, it will be important for the state to address how the exceedance occurred despite the implementation of those reasonable controls (e.g., wind speeds high enough to entrain dust from stable surfaces). EPA will evaluate the reasonableness of controls based on the controls that should have been in place given the information the state had when the event occurred.

Typically, measured ambient air concentrations during an event will include some contribution from natural or anthropogenic sources whose emissions are not affected by high wind, for

¹³ Undeveloped lands refer to those that are disturbed for purposes of development but not yet developed.

¹⁴ An example of such a measure might be the restoration of all or part of natural surface water flows.

example transportation and industrial point sources: these are considered non-event sources. Non-event sources are not subject to the nRCP requirement of the EER, but a state may apply full-time or event-dependent controls on such sources as part of its attainment/maintenance SIP or as part of meeting the mitigation requirement under 40 CFR §51.930.

3.1.2 Reasonableness of Controls in Place

Under the EER the event must be “not reasonably controllable *or* preventable” [emphasis added]; therefore, controls need not prevent the exceedance altogether to be reasonable. The fact that high winds are not preventable does not automatically mean that a high wind dust event is “not reasonably controllable or preventable.” If a set of control measures *could reasonably have been in place* for contributing sources at the time of the event, then they *must* have been in place for the event to qualify as an exceptional event under the EER. Among other factors to consider, reasonableness needs to be judged in light of the technical information available to the state at the time the event occurred. In the case of nonattainment areas EPA would generally expect states to already have the technical information needed to reasonably control sources in nonattainment areas, although there could be attainment areas that also have advanced implementation of controls. If EPA has given notice to the state that EPA considers controls on particular uncontrolled sources to be reasonable (e.g., as part of a previous exceptional event review) then EPA will consider the state to have been informed of the need for reasonable controls on those sources for future events. Also, the U.S. Department of Agriculture’s Natural Resources Conservation Service develops best management practices (under various program titles), some of which are aimed at preventing loss of soil during high winds, which may also be informative in particular situations. In evaluating reasonableness, EPA will generally consider first and foremost whether the wind speeds were above the minimum threshold to entrain dust from stable surfaces. As described in Section 3.1.3, stable surfaces typically resist dust entrainment from wind speeds below this minimum threshold and above this threshold some reasonable controls could be ineffective. In addition to wind speed, EPA may also consider factors such as those listed in Table 2.

Table 2. Example Factors Considered In Determining the Reasonableness of Controls.

“Reasonableness” Factor	Description of “Reasonableness” Factor
1. Control requirements based on area attainment status	Generally, areas classified as attainment, unclassifiable, or maintenance for a NAAQS would not be expected to have the same level of controls as areas that are non-attainment for the same NAAQS. The reasonableness of the controls depends upon historical concentrations and designation status.
2. Frequency and severity of past exceedances	More stringent controls are reasonable if an area experiences frequent and/or severe exceptional event exceedances due to high winds than if the area has experienced only rare and/or mild isolated exceedances.
3. Controls on primary sources expected to have contributed to the event	Were significant sources of anthropogenic windblown dust controlled during the event?
4. Ease and effectiveness of control	Cost-effective and readily deployable controls may be

Table 2. Example Factors Considered In Determining the Reasonableness of Controls.

“Reasonableness” Factor	Description of “Reasonableness” Factor
implementation	considered more reasonable.
5. Use of specific, reasonably available control measures	Were measures considered “standard practices” and/or those in widespread use for dust control in other areas employed during the event?
6. Jurisdiction	Only sources within the state (or tribal) land need to be considered or demonstrated to have had reasonable controls in place at the time of the event. (However, it may be necessary to include sources outside the local jurisdiction in the conceptual model of the event, and to assess their contribution to the measured concentration, to fully understand the contribution of in-state sources.)
7. Overall benefit of controls to remedy the exceedance	There may be benefits to controlling even small anthropogenic sources. Reducing ambient concentrations may have a public health benefit, or even remove an exceedance.
8. Significant contribution of sources to the exceedance	There is no defined <i>de minimis</i> emission rate or ambient contribution that limits which sources should be considered for control, and EPA will review this on a case by case basis. However, as a starting point, we believe it is generally reasonable to consider source categories that may contribute 5 µg/m ³ or more to an exceedance of the 150 µg 24-hour PM ₁₀ standard. ¹⁵ In some cases (i.e., wind speeds above the threshold to entrain stable surfaces) it may not be necessary to consider sources down to 5 µg, while in other situations it may be appropriate to consider sources below 5 µg. This starting point may be revisited should the PM ₁₀ NAAQS be revised. <i>De minimis</i> levels for PM _{2.5} have not been clearly established.

Although Reasonably Available Control Measures (RACM) and Best Available Control Measures (BACM) are not necessarily required to have been in place at the time of the event, they are measures that have been identified as being or possibly being reasonable.¹⁶ A state needs to demonstrate that the controls that were in place were “reasonable” at the time. The CAA requires BACM for serious PM₁₀ non-attainment areas and RACM in moderate PM₁₀ non-attainment areas; therefore, EPA may use the local list of BACM or RACM measures (as applicable) as a reference point to review the reasonableness of in-place controls. Having BACM/RACM in place during the time of the event is an important consideration, but does not

¹⁵ 5µg is the “significant impact level” (SIL) used in NSR permitting to decide whether an individual source has a significant contribution to a 24-hr PM₁₀ NAAQS violation, based on 40 CFR 51.165(b)(2).

¹⁶ Legally, EPA believes the event-relevant measures that have already been included in the approved SIP as RACM or BACM to be an essential part of the set of controls that need to be in place for an event to be considered “not reasonably controllable or preventable,” but they may not be sufficient by themselves particularly if the SIP has not been recently reviewed or revised.

automatically qualify the controls as reasonable. In some cases, a lower level of control could be reasonable, while in other cases it could be reasonable to require controls more stringent than BACM or RACM, particularly in areas with recurring exceedances. Other areas (i.e., attainment, maintenance, or unclassified areas) are not required to have put BACM in place and also may not have implemented RACM. In these cases, EPA may use local RACM measures, where available, along with other RACM measures that may be appropriate for the location and source categories, as the reference point. In areas where events continue to recur, EPA may consider BACM, or greater levels of control, as the appropriate starting point, regardless of attainment status. RACM/BACM lists may be **a reference point, but not the sole means**, by which EPA assesses the reasonableness of controls. If an agency believes that RACM/BACM should not be used by EPA as the starting point to judge the reasonableness of controls, the state should include this justification in the demonstration package. EPA will also generally consider implementation and enforcement of control measures in its determination of whether the event meets the nRCP criterion. Cases where relevant control measures were not being fully implemented or properly enforced, but reasonably could and should have been, will not generally be eligible for data exclusion under the Exceptional Events Rule.

3.1.3 Consideration of Wind Speed

Wind speed is an important consideration when EPA judges whether the requirement for nRCP is met. Typically, undisturbed desert landscapes in the West have a natural crust that protects the surface and tends to prevent wind entrainment of soil. Similarly, many reasonably-controlled anthropogenic sources (e.g., disturbed surfaces) employ techniques that stabilize surfaces to reduce entrainment since disturbed surfaces are a primary source of anthropogenic dust. Numerous studies have been conducted to determine the minimum wind speed that can entrain dust from stable surfaces (i.e., undisturbed/natural surfaces with a crust or disturbed surfaces that have been re-stabilized). The speed varies by location, depending on characteristics of the local landscape (e.g., soil type) and controls (See Appendix A). In the absence of local studies, EPA intends to use 25 mph as the minimum sustained wind speed¹⁷ sufficient to entrain particles from stable surfaces for western states.¹⁸

Throughout this document 25 mph will be used as the minimum threshold wind speed necessary to entrain particles from stable surfaces, but generally a state can use an alternative wind speed based on local studies subsequent to EPA approval. It is important to note that if a state would like to implement a different threshold, it should be representative of conditions (sustained wind speeds) that are capable of overwhelming the naturally developed stabilization of undisturbed natural sources or anthropogenic sources that are subject to reasonable control for the area in question. If EPA has specific information based on relevant studies to choose an alternative wind speed threshold, EPA will notify the state once a package has been submitted.

If a demonstration can show that the sustained wind speed was 25 mph or higher at or proximately upwind of the location of the exceedance, then a lesser amount of information and data (i.e., a basic controls analysis) could show that the event was not reasonably controllable or

¹⁷ See Section 6.2.2.2 for details on the calculation of sustained wind speed.

¹⁸ The 25 mph threshold is based on studies conducted on natural surfaces.

preventable (nRCP). See Section 3.1.5 for more specific information on the controls analysis for cases at or above 25 mph (3.1.5.1) and below 25 mph (3.1.5.2).

The rationale for allowing states to submit a basic controls analysis when wind speeds are at or above 25 mph is that it is expected that in many cases controls to prevent wind-blown dust become overwhelmed at or above 25 mph, and thus wind-driven emissions could include significant contributions from natural and reasonably-controlled sources under those conditions. If most controls to prevent wind-blown dust become overwhelmed at 25 mph, it could be difficult to identify additional reasonable controls that could be put into place to reduce wind-blown dust. In contrast, if the wind speeds associated with the event are below the threshold levels required to initiate dust emissions from natural or stable (i.e., reasonably-controlled) sources, more detailed information and more extensive data (i.e., a comprehensive controls analysis) are likely to be necessary to satisfy the nRCP requirement. The rationale for requiring a comprehensive controls analysis when wind speeds are below the entrainment threshold is that events with wind speeds below this threshold should entrain very little dust from natural and reasonably-controlled disturbed surfaces and therefore it is expected that wind-driven emissions would include significant contributions from sources that are neither natural nor reasonably-controlled. In these cases it is important to identify the various land areas contributing to the event, evaluate the controls in place on those land areas, and determine whether those controls were reasonable based on those factors identified in Section 3.1.2 (e.g., cost of controls vs. benefit).

3.1.4 Consideration of Recurrence

High wind dust events can recur in the western United States, particularly in the arid regions. Typically, stable surfaces resist entrainment, even under conditions of elevated winds. EPA will generally consider recurrence for high wind dust events¹⁹ as more than one high wind dust event per year, averaged over three years. High wind dust events can recur if: (1) wind speeds that exceed the threshold to entrain dust from stable surfaces (i.e., 25 mph) are common, or (2) surfaces are not stable (i.e., not reasonably controlled). Since recurrence can indicate that surfaces are not reasonably controlled, the controls analysis should be more extensive if events recur, particularly at wind speeds below 25 mph.²⁰ There are some especially windy areas in the West where sustained wind speeds above 25 mph are not uncommon. In these areas, the protection of public health may be compelling enough to seek more controls that are effective beyond the 25 mph threshold. For this reason, a detailed controls analysis should be conducted when events recur, even if the wind speeds are above 25 mph, although it would not be expected to be as comprehensive as that for recurring events with wind speeds below 25 mph (see Section 3.1.5.2).

3.1.5 Controls Analysis

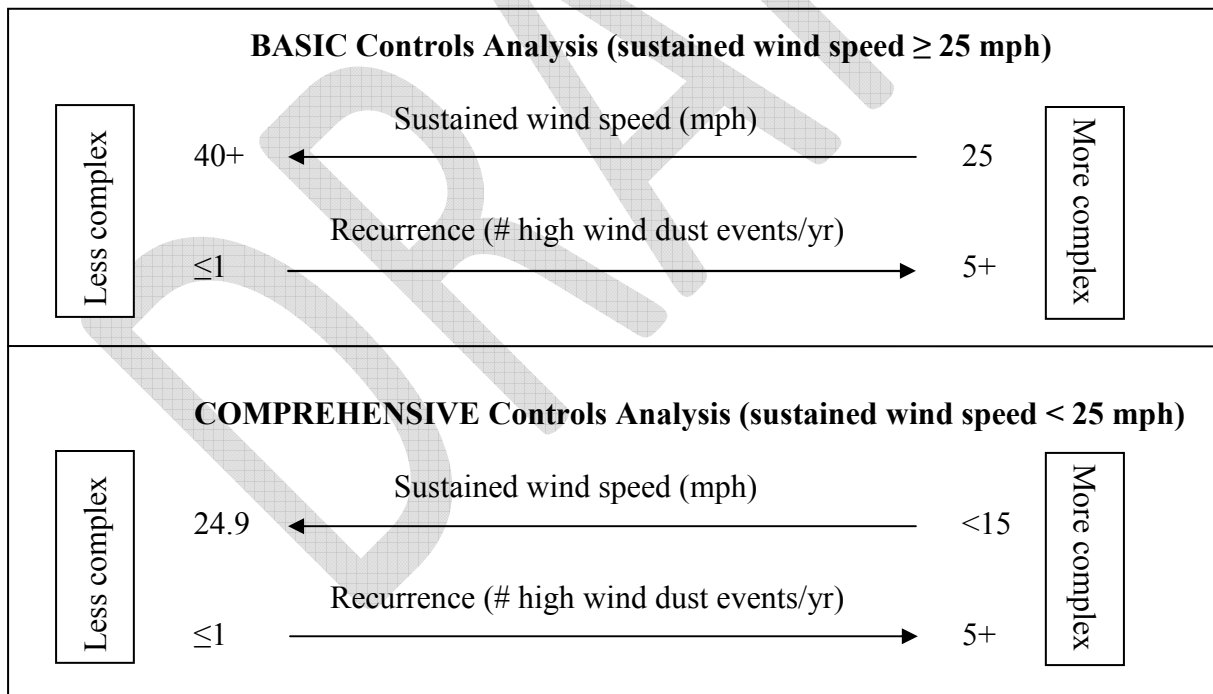
EPA expects exceptional event demonstration packages for high wind dust events to include an analysis of controls because the reasonableness of the controls that were in place affects whether

¹⁹ This approach to recurrence is specific to high wind dust events and does not define how recurrence is treated for other types of events such as those caused by human activity unlikely to recur at a particular location.

²⁰ Recurrence is not discussed here as a criterion to meet the EER but rather as an indicator for the level of analysis needed to meet nRCP.

the event was “not reasonably controllable or preventable” and whether the event can be considered a natural event. The extent of the controls analysis should primarily depend upon the level of the wind speed: a basic controls analysis may be sufficient for cases when sustained wind speed at the source area²¹ is greater than or equal to 25 mph, and a comprehensive controls analysis may be necessary when sustained wind speeds are below 25 mph. Generally, a basic controls analysis will identify likely sources in the expected source contribution area, describe the controls in place for anthropogenic sources, and indicate whether the natural sources were reasonably controllable. The comprehensive controls analysis is expected to have back-trajectories indicating specific sources in the upwind area, an inventory of the contribution for the significant sources, and detailed descriptions of controls and their effective implementation and enforcement.²² This two-pronged approach is intended to streamline preparation and review of high wind dust packages for the more straightforward events and focus additional EPA and state resources on more complex cases. Within each category of basic versus comprehensive controls analysis, the level of complexity should be further informed by the recurrence frequency and how high (more basic) or low (more comprehensive) the wind speed is (Figure 1). On this basis, the nRCP demonstration should start with an analysis of sustained wind speed during the event and an analysis of the recurrence frequency, since this may indicate that only the lower-effort basic controls analysis is needed. See Section 6.2.2.2 for details on how to calculate the sustained wind speed and Section 6.2.2.3 to determine the recurrence frequency.

Figure 1. Complexity of Controls Analysis Based on Wind Speed and Concurrence



²¹ Cases where dust was entrained by sustained winds above 25 mph upwind of the monitor and subsequently transported at lower wind speeds to the monitor could still qualify for the basic controls analysis category as long as the State shows that sustained winds were above 25 mph in the expected source area. Cases of long-range transport (e.g., >50 miles) could still qualify for a basic controls analysis but a robust trajectory analysis (and/or satellite plume imagery) would need to be included as part of the nRCP or CCR demonstration.

²² While the basic and comprehensive categories are intended to generally outline the information that EPA expects to be included in a demonstration, EPA may request case-specific information to inform the nRCP determination, regardless of the category.

The most basic controls analysis will be for those events that have wind speeds well above 25 mph and are non-recurring while the most comprehensive controls analysis will be for events that have wind speeds well below 25 mph and recur (note: these may represent concurrable cases less often). Events with wind speeds at or above 25 mph that recur will need to have a basic controls analysis that includes identification of specific sources in the upwind area, but does not necessarily require trajectories or specific inventories. The purpose of identifying specific sources in the upwind area for recurring cases with wind speeds above 25 mph is to inform both the state and EPA about whether there are sources that might be reasonably controlled to wind speeds above 25 mph. For example, if there were a large construction area in the upwind source area that used gravel to control construction roadways, consideration could be given to whether chemical dust suppressants that stabilize the surface to wind speeds up to 40 mph could be reasonably implemented. In the interest of public health, it is important to consider what additional controls might be reasonable if events recur. Events with wind speeds below 25 mph that are non-recurring will need to have a comprehensive controls analysis because dust from stable surfaces is usually not entrained below wind speeds of 25 mph. Although EPA expects a comprehensive controls analysis for these cases, it will not be expected to be as complex as for the case when wind speeds are below 25 mph *and* recurring. Table 3 summarizes the elements that should be included for both basic and comprehensive controls analyses while Section 6.2.2 provides example analyses that have been included in demonstration submittals.

Table 3. Summary of Recommended Controls Analysis Elements for not Reasonably Controllable or Preventable Demonstration

Control Analysis Elements	Basic Controls Analysis (wind speed \geq 25 mph)		Comprehensive Controls Analysis (wind speed < 25 mph)	
	Non-recurring	Recurring	Non-recurring	Recurring
Identification of local/upwind contributing sources	X	X*	X	X*
Anthropogenic sources – description of controls	X	X*	X	X*
Natural sources – statement regarding reasonableness of controls	X	X*	X	X*
Explanation of how entrainment occurred despite controls	X	X	X	X
Identification and implementation status of controls previously recommended by EPA, if applicable	X	X	X	X
Evidence of effective implementation and enforcement of controls			X	X
Back trajectories of source area			X	X
Source apportionment				X
Source-specific emissions inventories			X	X
Meteorological data associated with measured concentration			X	X

*Indicates that additional detail should be included beyond that for non-recurring cases

3.1.5.1 Basic controls analysis

If the wind speed for the event in question was at or above the 25 mph threshold then a simplified (i.e., basic) controls analysis may be sufficient to show that the event was not reasonably controllable or preventable. Within this category, the complexity of the controls analysis may be informed by the recurrence frequency and wind speed (Figure 1). The most basic controls analysis would include a brief description of local/upwind sources that were suspected to significantly contribute to the event and a description of the controls on the anthropogenic sources in place at the time of the event (e.g., local BACM measures). For the sources identified, the submitter would explain how dust entrainment occurred despite having reasonable controls in place (e.g., controls were overwhelmed by high wind). A basic controls analysis with more complexity (e.g., for recurring events) would specifically identify likely sources in the upwind source area and discuss specific controls. The basic controls analysis, regardless of complexity, would not need to include back-trajectories, specific emissions inventories or detailed reports of controls implementation and enforcement. Finally, if EPA recommended controls improvements as part of a previous high wind dust exceptional event

review then the controls analysis should address the impact of these control improvements. See Section 6.2.2.4 for examples of a basic control analysis.

3.1.5.2 Comprehensive controls analysis

When events occur under conditions with sustained wind speeds below 25 mph, EPA and the state must consider the appropriateness, implementation, and enforcement of in-place controls. For example, exceedances can occur when appropriate measures are in place but not properly enforced. Or, new sources not addressed under the current set of control measures may be contributing to the exceedance. In these cases more comprehensive information on sources and controls will be expected, including: back-trajectories of source area, source apportionment, emissions inventories of specific sources in source area, and evidence of effective implementation and enforcement of controls. As wind speeds decrease from 25 mph and/or recurrence increases, the demonstration would need to be more complex and compelling for EPA to be able to concur. As with the basic controls analysis, if EPA recommended controls improvements as part of a previous high wind dust exceptional event review, then the controls analysis should address how these controls improvements have been addressed. See Section 6.2.2.5 for an example of a comprehensive controls analysis.

3.1.6 Controls for Recurring Events (High Wind Action Plan)

As mentioned above, EPA will judge the reasonableness of controls based on information that was available to the state at the time of the event. For example, if a state were in attainment at the time of the event, it may be reasonable that certain controls on certain sources may not have been in place. Alternatively, in the course of a high wind dust exceptional event demonstration preparation and/or review, the state or EPA may identify previously unknown sources that should be subject to reasonable controls. EPA or the state may determine that additional controls could minimize the likelihood or the health impact of future events. While this would not itself affect the review of the current event, the additional controls could be considered reasonable for future events. EPA and the submitting state can consider the development of a High Wind Action Plan that would identify mutually agreed upon reasonable controls that a state could implement for subsequent high wind events. Preparation of such a plan and its approval by EPA may promote a common understanding between the state and EPA about whether subsequent high wind events are not reasonably controllable or preventable. A High Wind Action Plan could be submitted with the exceptional events demonstration package or as a separate submittal.²³ Establishing a High Wind Action Plan consists of the following steps:

- (1) State development and submittal of the High Wind Action Plan after an opportunity for public comment
- (2) EPA approval of the High Wind Action Plan
- (3) State implementation of the identified and approved control measures
- (4) Formal recognition by EPA that the High Wind Action Plan is being implemented

Once the state has begun implementation of the measures approved by EPA and EPA has formally recognized implementation of the High Wind Action Plan, EPA would consider the

²³ If the High Wind Action Plan is submitted separately from the exceptional event demonstration package, an opportunity for public comment should be provided by the State, as the High Wind Action Plan would be part of the basis for EPA's decision on subsequent events.

controls to be reasonable as long as events do not recur. EPA suggests that states use the Annual Monitoring Network Plan process to indicate that high wind dust events have not recurred and that the current High Wind Action Plan remains in effect. It is the state's obligation to notify EPA if events recur so that EPA and the state can discuss possible revisions to the High Wind Action Plan. If events recur, EPA will need to re-approve the High Wind Action Plan regardless of whether it is revised or remains as-is. If EPA indicates that the High Wind Action Plan needs to be revised and the state chooses not to do so, this will be considered in EPA's determination of whether the controls in place were reasonable for subsequent events.

Note that having an approved High Wind Action Plan does not automatically mean that in every case EPA will find all subsequent events to have been not reasonably controllable or preventable. For example, EPA may not be able to make such a finding if it is determined that the controls in place were not effectively implemented or enforced. The benefits of the High Wind Action Plan are that it establishes clear mutual expectations regarding what constitutes reasonable controls for high wind dust events and strengthens protection of human health.²⁴

3.2 Historical Fluctuations (HF)

Information on the historical fluctuations of concentration in the area is required to be submitted as part of an exceptional event package and serves as an important basis for the CCR, NEBF, and AAQ criteria (see Table 2). The more that a concentration that is temporally associated with an event stands out from historical concentrations, the more plausible it is that the event was the cause of a substantial portion of the concentration. The objective of this analysis is to give a full and accurate portrayal of the historical context for the claimed event day. EPA expects, at a minimum:

- a time series for concentration and wind data for the event area for the previous 3-5 years, or longer if available, with high wind dust events identified;
- percentile of concentration relative to annual data with and without high wind dust events; and
- percentile of concentration relative to seasonal data with and without high wind dust events.

Because the methods of analyses influence the sensitivity of the historical fluctuation statistics (e.g., percentile calculations are dependent on the number of data points included), EPA provides specific statistics calculation recommendations in Section 6.2.3.

EPA has not set pass/fail statistical criteria for this element but will use a weight of evidence approach to assess each demonstration on a case-by-case basis. The state's role in satisfying this element is to provide analyses and statistics as prescribed by EPA in this document. EPA will use the information provided by the state to determine whether the event was in excess of normal historical fluctuations. "Normal historical fluctuations" will generally be defined by those days without high wind dust events for the previous years. It is not the state's role to show that the

²⁴ Note that if and when EPA takes a regulatory action that hinges on a decision to exclude data under the Exceptional Events Rule, EPA may be required to consider and appropriately respond to public comments on whether the event was "not reasonably controllable or preventable."

event was above a particular threshold since EPA is not establishing a threshold. EPA acknowledges that natural events, such as high wind dust events, can recur and still be eligible for exclusion under the EER; therefore, events do not necessarily have to be rare to satisfy this element. EPA expects that failure on this element indicates likely failure for CCR and/or NEBF as well and thus does not expect that non-concurrence will result from failure of this element alone.

3.3 Clear Causal Relationship (CCR)

40 CFR §50.14(c)(3)(iv) requires demonstration of a clear causal relationship between the ambient concentration measurement under consideration and the event that is claimed to have affected the air quality in the area. The CCR demonstration must show that elevated concentrations were caused by dust entrained by high wind. The sources of dust implicated by the CCR demonstration should be shown to be not reasonably controllable or preventable as part of the nRCP demonstration. If the CCR implicates new or not reasonably controlled sources, nRCP should be re-evaluated. The CCR demonstration is expected to establish causality between the event and a portion of the ambient concentration, which cannot be demonstrated by simply showing that high wind was coincident with high concentrations. A correlation between high wind and high concentrations is important but does not independently demonstrate that the high concentrations were caused by wind-entrained dust from the sources that were addressed as part of the nRCP demonstration. This section explains in qualitative terms the types of analyses that would support a CCR demonstration. Examples of the quantitative analyses that could be performed are included in Section 6.2.4. Demonstrations for CCR should ultimately support the conceptual model. Table 4 provides examples of the information/analyses that support the CCR demonstration. Demonstrations that support their conceptual model by using the analyses listed below and possibly others are likely to be more convincing than those that employ fewer analyses.

Table 4. Evidence and Analyses Recommended for CCR Demonstration

CCR Evidence	Types of Analyses/Information to Support Evidence
1. Occurrence and geographic extent of the event	Special weather statements, advisories, news reports, nearby visibility readings, measurements from monitoring stations, satellite imagery
2. Transport of emissions related to the event in the direction of the monitor(s) where measurements were recorded	Wind direction data showing that emissions from sources identified as part of the nRCP demonstration were upwind of the monitor(s) in question, satellite imagery
3. Spatial relationship between the event, sources, transport of emissions, and recorded concentrations	Map showing likely source area, wind speeds, wind direction, and PM concentrations for affected area during the time of the event
4. Temporal relationship between the high wind and elevated PM concentrations at the monitor in question	24-hour time series showing PM concentrations at the monitor in question in combination with sustained and maximum wind speed data at area where dust was entrained

CCR Evidence	Types of Analyses/Information to Support Evidence
5. Chemical composition and/or size distribution of measured pollution that links the pollution at the monitor(s) with particular sources or phenomenon	Chemical speciation data from the monitored exceedance(s) and sources; size distribution data
6. Comparison of event-affected day(s) to specific non-event days	Comparison of concentration and wind speed to days preceding and following the event; comparison of concentration data to specific days that are similar to the event day with respect to emissions and meteorology except for the high wind; comparison to high concentration days in the same season (if any) without high wind; comparison to other high wind days without elevated concentrations (if any); comparison of chemical speciation data
7. Comparison of concentration and wind speed during the period of the event to historical (e.g., 3-5 years) data (i.e., analyses from historical fluctuations section)	Time series over entire length of time with potential identification of other claimed events; percentile relative to annual data; percentile relative to seasonal data

A demonstration will be less compelling if there is evidence that is not consistent with the conceptual model of how the event caused the exceedance. For example, a hypothesis that an exceedance was caused by a large-scale wind event is inconsistent with a situation where an isolated monitor exceeds while nearby monitors do not. Comparison of concentrations and conditions at other monitors could thus be very important for the demonstration of a clear causal relationship. Alternatively, eliminating plausible non-event causes supports the claimed causal relationship to the high wind event. Conclusively proving the absence of all possible or plausible other causes is not required or expected. (See Section 6.2.4.8 for an example of eliminating alternative hypotheses.)

3.4 Affects Air Quality (AAQ)

The AAQ element is generally supported by historical fluctuations in concentration data (HF) and demonstrated as part of the clear causal relationship (CCR). Submitting agencies that provide HF analyses that EPA then finds show the HF element is met and that demonstrate the CCR element will generally, by default, have also satisfied the “affects air quality” (AAQ) part of the definition of an exceptional event. To avoid any misperception that a rule requirement has been overlooked, the demonstration should nevertheless explicitly recognize this element, and state that it has been met by having addressed both the HF and the CCR criteria.

3.5 Caused by Human Activity Unlikely to Recur at a Particular Location or a Natural Event (HAURL/Natural Event)

3.5.1 Consideration of High Wind Dust Events as Natural Events

According to both the regulatory and statutory definition, an exceptional event must be “an event caused by human activity that is unlikely to recur at a particular location or a natural event.” The distinction between an event caused by human activity versus a natural event is critical for high wind dust events because only natural events can be likely to recur and still be eligible for data exclusion. Events caused by human activity that are likely to recur do not qualify as exceptional events. A natural event is defined as “an event in which human activity plays little or no direct causal role” (40 CFR §50.1(k)).²⁵

An event involving wind-entrained dust solely from undisturbed natural sources is clearly a natural event. However, many high wind dust events affecting the ambient monitoring network include significant contributions from anthropogenic sources of dust, and their treatment under the EER is more complicated. In these cases, a high wind dust event can be considered a natural event, even when a portion of the wind-driven emissions are anthropogenic, as long as those emissions were determined to be not reasonably controllable or preventable. Exceedances that include a significant contribution by anthropogenic sources of windblown dust that were not reasonably controlled will not be considered as due to a natural high wind dust event. In addition, high dust concentrations outside the period of high wind (e.g., dust from rock-crushing or tilling that precedes the period of high wind) cannot be considered as due to a natural event and therefore could not be considered as a high wind dust event. In both of the above cases, it would be assumed that human activity played a large and direct causal role and therefore these exceptional events claims could only be considered under the criterion of “human activity unlikely to recur.”²⁶

3.5.2 Natural Event Demonstration

Since windblown anthropogenic dust must be reasonably controlled for the event to be considered a natural event under the EER, the state would need to show that the criterion for nRCP is met (see Section 3.1). Further, to satisfy the EER it must also be demonstrated that the windblown dust generated by high wind has a clear causal relationship (CCR) to the event. In

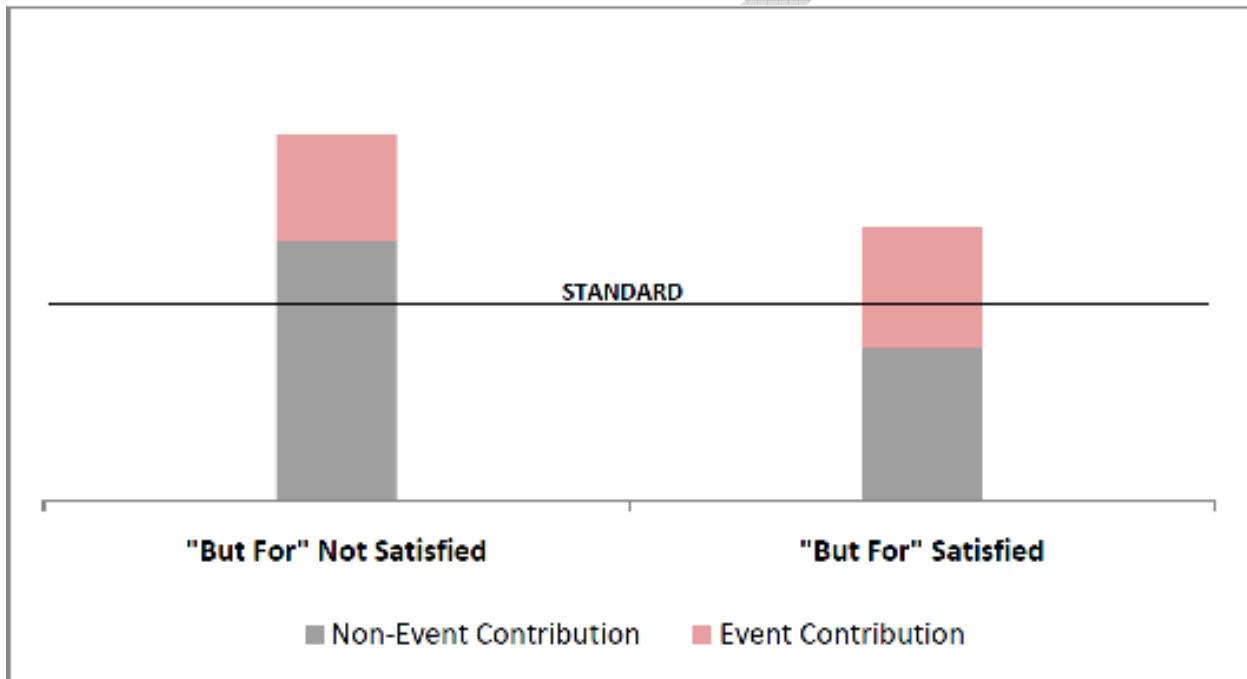
²⁵ Human activity would be considered to have played little or no *direct* causal role in causing the entrainment of the dust by high wind if contributing anthropogenic sources of the entrained dust are reasonably controlled, regardless of the amount of dust coming from these reasonably controlled anthropogenic sources and thus the event would be considered a natural event. If anthropogenic sources of windblown dust that are reasonably controllable but that did not have those reasonable controls applied at the time of the high wind event have contributed significantly to a measured concentration, the event would not be considered a natural event.

²⁶ In theory, a high wind dust event for which anthropogenic sources were not reasonably controlled could be considered an anthropogenic event if the event satisfies certain criteria. However, if the event (which includes the dust from both natural and anthropogenic sources) was not “not reasonably controllable or preventable” then the event does not meet the definition of an exceptional event. For this reason, EPA does not believe it is useful to pursue a line of reasoning that would consider a high wind dust event to be an anthropogenic event. If the very unlikelihood of recurrence of similarly high winds means that controls in addition to those that were in place would not have been reasonable, the event can be treated as a natural event and must then meet the criteria laid forth in the EER and explained in this document.

summary, a high wind dust event will generally be considered a natural event if both the nRCP and CCR elements are demonstrated to EPA's satisfaction.

3.6 No Exceedance or Violation But For the Event (NEBF)

40 CFR 50.14(b)(1) directs EPA to exclude data only where a state demonstrates that an event caused a concentration in excess of a NAAQS. This means that there was a concentration in excess of the NAAQS when the event occurred that would have been below the NAAQS if the event had not occurred. §50.14(c)(3)(iv)(D) requires the state to submit evidence that "[t]here would have been no exceedance or violation but for the event." These two statements express the same criterion for EPA approval. The following figure depicts the NEBF concept:



This analysis generally does not need a single or precise approximation of the estimated air quality impact from the event. It would generally be sufficient to develop a reasonably likely range of concentrations contributed by the event itself, and then assert that NEBF is satisfied for all concentrations in that range. EPA is not prescribing the type of analysis that needs to be done to satisfy this regulatory requirement, but the analysis should show that the measured concentration would have been below the applicable NAAQS without the impact of the high wind dust event. For most cases, EPA expects a **quantitative** NEBF analysis. For events where the typical concentrations on non-event days are well below the applicable NAAQS, the NEBF demonstration may be relatively straightforward and a qualitative NEBF demonstration may be acceptable. However, demonstrating NEBF becomes increasingly difficult if concentrations on non-event days during the same season exceed the standard and/or if the contribution of non-event pollution sources produce concentrations near the applicable NAAQS. For example, if days without high winds that neighbor the claimed event day were near the standard (e.g., $150 \mu\text{g}/\text{m}^3$), the NEBF analysis would need to be very rigorous to show that the exceedance would

not have happened regardless of the high wind dust event. Examples of how to conduct the NEBF analysis are provided in Section 6.2.7.

The NEBF demonstration builds upon analyses presented as part of the nRCP and CCR elements, although it should be treated as an independent element and will likely include additional analyses. The rigor of the NEBF will be informed by the nRCP and CCR analyses. NEBF also depends upon the CCR demonstration: if there is no CCR then NEBF becomes moot since there is no portion of the exceedance that can clearly be attributed to the event. For these reasons, EPA recommends conducting the NEBF analyses after all other analyses have been completed.

DRAFT

4. Mitigation

Clean Air Act Section 319(b)(3)(A) contains five principles, including the principle that each state “must take necessary measures to safeguard public health.” On this basis, Subpart Y of 40 CFR §51 was developed to address mitigation requirements for exceptional events and states (40 CFR §51.930):

“(a) A State requesting to exclude air quality data due to exceptional events must take appropriate and reasonable actions to protect public health from exceedances or violations of the national ambient air quality standards. At a minimum, the State must:

- (1) Provide for prompt public notification whenever air quality concentrations exceed or are expected to exceed an applicable ambient air quality standard;
- (2) Provide for public education concerning actions that individuals may take to reduce exposures to unhealthy levels of air quality during and following an exceptional event; and
- (3) Provide for the implementation of appropriate measures to protect public health from exceedances or violations of ambient air quality standards caused by exceptional events.”

The mitigation requirement does not require the state to prepare and submit a mitigation plan, per se, but the state is required to put in place programs that address the three actions listed above. It should be noted that the regulatory mitigation requirement is separate from the nRCP demonstration criterion. The nRCP criterion states that the demonstration package must include documentation showing that emissions due to high wind from sources were not reasonably controllable or preventable. The mitigation criterion focuses on specific measures and actions to protect public health, rather than on measures that control or prevent emissions. In addition, any controls related to nRCP apply to high wind-generated dust emissions, whereas mitigation control measures can apply to any source of particulate matter. A mitigation plan may also include procedures and responsibilities for public alerts and sheltering advisories. Implementation of effective mitigation measures that reduce dust emissions from wind may become part of the nRCP documentation for future event submittal packages, especially when high wind dust events recur, but this is not necessarily the case.

5. Process Issues for Exceptional Events Including High Wind Dust Events

5.1 Demonstrations Package Submittal and Review

EPA encourages states to engage in regular communication with EPA to prepare complete demonstration packages that meet the requirements stated in this document. EPA will make its decision based on information presented by the state. Discussions and/or cooperation between EPA and the state during the preparation of a state's package do not imply or guarantee EPA approval of that package. EPA cannot concur when information is lacking. It is the responsibility of the state to demonstrate to EPA's satisfaction that the requirements have been met, and EPA reiterates that discussions of potentially sufficient showings in this document are guidance only and may vary for specific cases. Upon initial review of a package, EPA will alert the state if additional information is required and provide a deadline by which the supplemental information should be submitted for EPA's consideration. It will be necessary that the state provide **all** supplemental information requested by EPA prior to EPA's final decision. Determinations on Exceptional Event demonstrations do not constitute final agency action until they are relied upon in a regulatory decision such as a finding of attainment or nonattainment which will be conducted through notice-and-comment rulemaking procedures. EPA does not generally intend to consider additional information after the concurrence decision has been made, except in the context of such a rulemaking procedure.

5.2 Timeframes

EPA recommends the following timeframes for exceptional events processes:

Exceptional Event Demonstration Action	Timing	Timing Specified by EER?
1. State places flags in AQS	Flags and an initial event description should be placed in AQS in accordance with the schedules for submission of data to the AQS database (i.e., within 90 days of the end of the previous quarter) but not later than July 1 st of the calendar year following the event in which the flagged measurement occurred. Note that for data certification purposes, it is recommended to flag data prior to submittal of data certification (May 1 st).	Yes
2. State submits letter of intent to submit a package (<i>optional</i>)	Recommended within 12 months of event. This is an optional step that would alert EPA of a state's intention to submit a package for a flag and prompt EPA to notify the state whether and when EPA plans to act on the claimed exceptional event (EPA may choose not act on exceedance flags which have no bearing on design values, or which are not likely to impact any future regulatory decision). This saves	No

Exceptional Event Demonstration Action	Timing	Timing Specified by EER?
	wasted resources from a state preparing a package that EPA does not intend to review.	
3. EPA responds to notice of intent to inform the state whether EPA will review package or defer. EPA provides timeframe for review if needed for regulatory action.	Anticipated to be within 60 days of receipt of letter of intent to submit a package from state. EPA will generally give priority to exceptional event decisions that affect near-term regulatory decisions and may need to defer review of exceptional event packages that are not associated with near-term or anticipated regulatory decisions.	No
4. State submits exceptional event package to EPA	The EER allows states to submit packages up to 3 years following the end of the calendar quarter in which the event occurred, or 12 months prior to the date that a regulatory decision must be made by EPA.	Yes
5. State submits High Wind Action Plan (optional)	Submit with EE package or recommended within 12 months of EPA concurrence. As discussed in Section 3.1.6 controls will be considered reasonable for events only after control measures identified in the High Wind Action Plan have been implemented and EPA has issued formal recognition of implementation.	No
6. EPA completes initial review of exceptional event package & sends letter to state outlining (1) timing of final review, and (2) preliminary assessment of completeness of package/need for additional information ²⁷	Anticipated within 120 days of receipt by EPA. Note: If state did not send a notice of intent (step 2), EPA's initial review letter will address whether EPA intends to review the package or will defer (see step 3). EPA will address completeness and timing only for those packages that will be reviewed by EPA in the near term.	No
7. State provides supplemental information requested by EPA, if needed	Requested within timeframe identified by EPA in the initial review letter (step 4). This will typically be 60 days from receipt of the letter from EPA. (Letters will be e-mailed with a hard copy to follow. The date of the e-mail will be considered the date of receipt.)	No
8. EPA final review of EE package	The timing of EPA's final decision will depend on the regulatory impact of the data and will be	No

²⁷ EPA may request additional information as part of the final review (step 8).

Exceptional Event Demonstration Action	Timing	Timing Specified by EER?
	described in the initial review letter. For EE packages that impact a regulatory decision EPA intends to make a decision regarding concurrence within 18 months of submittal of the complete package, or sooner if required by a regulatory action.	

5.3 Public Comment

If supplemental information submitted to EPA after the state's initial opportunity for public comment is substantial, the state may need to provide an additional opportunity for public comment. EPA will inform the state if public comment is needed for supplemental information; states wishing to submit unsolicited additional information should consult with EPA to determine if public comment is needed. If an additional opportunity for public comment is needed, the state should submit the additional information to EPA within the timeframe outlined in step 7 above and then post the information for public comment. Once the opportunity for public comment has closed, the state should submit the public comments along with the state's responses, if any, to EPA within 10 days of the close of the public comment period. If not submitted as part of the exceptional event demonstration package, the High Wind Action Plan should also have an opportunity for public comment provided.

6. Recommendations for the Preparation of High Wind Dust Exceptional Event Demonstrations

Section 6 provides practical information on the preparation and evaluation of exceptional events demonstrations for high wind dust events. This information is based on the guidance laid out in this document and EPA's experience from demonstrations that EPA has reviewed since the promulgation of the EER. Section 6.1 provides the general framework suggested to prepare a high wind dust event package and Section 6.2 provides details and examples for the technical elements. EPA encourages the submittal of a mitigation plan with the demonstration package although submission of this plan is not a regulatory requirement.

6.1 Framework for Preparing Evidence in Support of a High Wind Dust Exceptional Event

While the technical elements outlined in the EER suggest that each element can be demonstrated independently, many of the elements are linked. EPA suggests the following approach to a demonstration, as depicted in Figure 2.

Step 1. Develop a conceptual model of how the event unfolded and resulted in the exceedance(s).

Step 2. Address not Reasonably Controllable or Preventable (nRCP).

- Calculate sustained wind speed
 - Wind speed will inform whether a basic or comprehensive controls analysis is needed.
- Determine recurrence frequency
 - Recurrence will further inform how complex the controls analysis will need to be.
- Develop controls analysis

Step 3. Present Historical Fluctuations analyses for EPA's assessment of whether the event was in excess of normal historical fluctuations (HF).

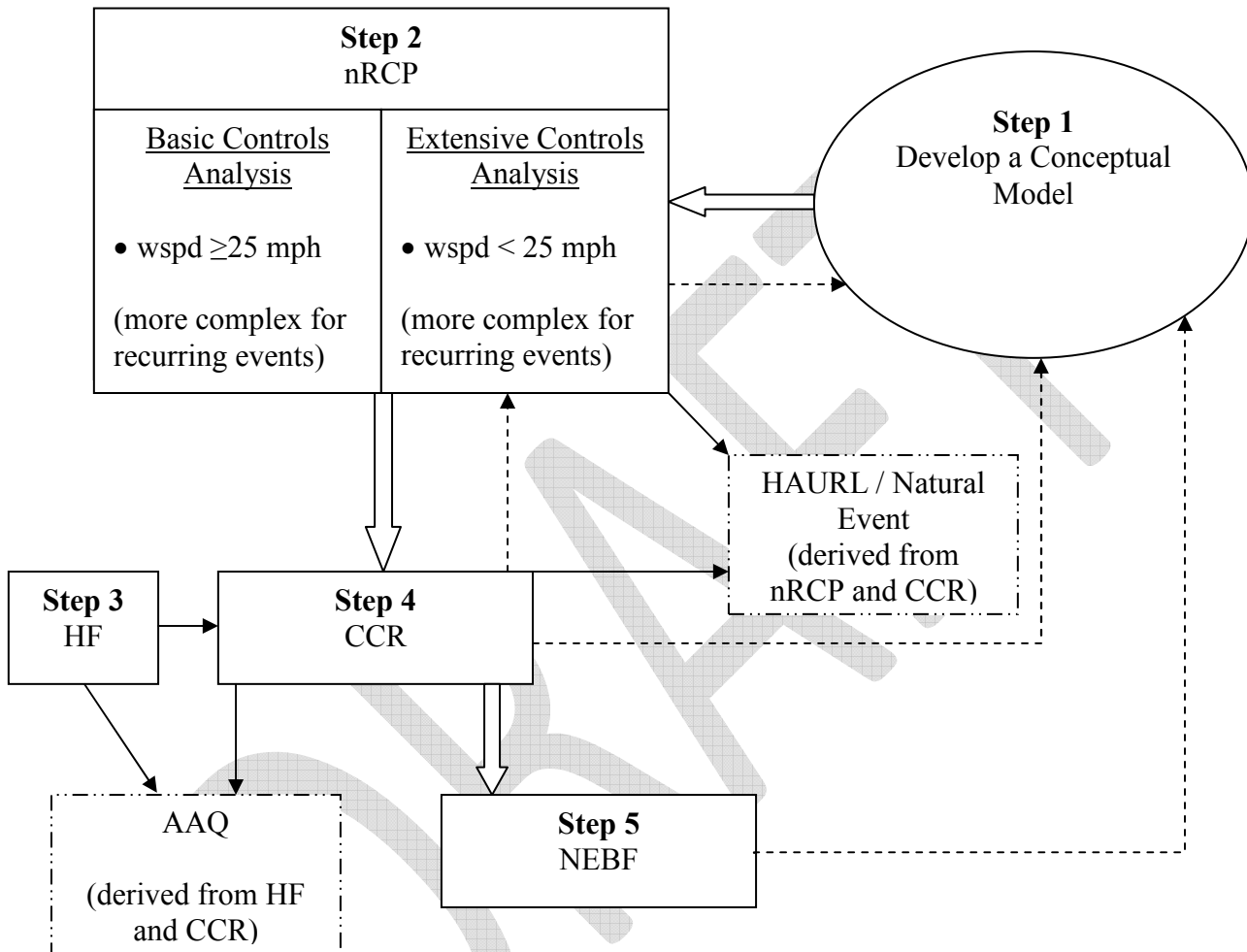
Step 4. Address Clear Causal Relationship (CCR).

- Conduct CCR analyses
 - Consider whether CCR identified sources not addressed in nRCP.
- Once sufficient HF analyses have been completed and CCR has been demonstrated, then Affects Air Quality (AAQ) will generally have also been satisfied. Prepare statement that AAQ has been met by providing HF analyses and demonstrating CCR.
- Once nRCP and CCR have been satisfied, then the element for Human Activity Unlikely to Recur at a particular Location / Natural Event (HAURL / Natural Event) will generally have also been satisfied. Prepare statement that HAURL / Natural Event has been satisfied by demonstrating nRCP and CCR.

Step 5. Address No Exceedance But For the event (NEBF) only after all previous criteria have been satisfied.

After each step it is recommended that the conceptual model be reviewed and revised as needed.

Figure 2. Suggested order for preparing technical elements for demonstration packages for high wind dust events.



6.2 Recommended Methods for the Technical Elements of a High Wind Dust Exceptional Events Package

This section contains recommendations for preparing and demonstrating the technical elements for high wind dust events. These recommendations and examples do not represent the full suite of analyses that could be conducted as part of a high wind dust exceptional events package, but are intended to show the kinds of analyses and descriptions that EPA expects. The examples were taken from EPA Region IX analyses and the following high wind dust exceptional event demonstration packages that were submitted to EPA Region IX.²⁸

- Anaheim: South Coast Air Quality Management District (SCAQMD)
- Las Vegas: Clark County Department of Air Quality and Environmental Management (Clark County DAQEM)
- Phoenix: Arizona Department of Environmental Quality (ADEQ)

6.2.1 Step 1: Develop a Conceptual Model

A demonstration package for a high wind dust event should include a conceptual model of how the event occurred. In its simplest form this could be a narrative description of how the event unfolded to result in the exceedance(s). The conceptual model should help tie the various rule criteria together into a cohesive explanation of the event. The following information is suggested to be included in the conceptual model:

- Description of weather phenomena that resulted in high wind
- Description of sources (land areas, industrial sources, other anthropogenic sources, natural sources, types of PM/dust) likely entrained by the high wind
- Explanation of the path by which the dust reached the monitor(s)
- Description of and map showing relevant monitors, topography, and other relevant geographic features that assist in understanding how the event developed and resulted in the exceedance.
- Description of how the event day differs from non-event days
- Description of concentration and wind patterns for the exceeding monitor(s) and for surrounding area

The following is an example of the type of narrative EPA suggests for the conceptual model.²⁹

²⁸ Full exceptional event demonstration packages are available as follows:

- Anaheim (SCAQMD, event date: October 13, 2008) at http://www.aqmd.gov/pub_edu/notice_exceptional_events_2009.html
- Las Vegas (Clark County DAQEM, event date: February 13, 2008) at <http://www.clarkcountynv.gov/Depts/daqem/Pages/ExceptionalEvents.aspx>
- Phoenix (ADEQ, event date: April 30, 2008) at http://www.azdeq.gov/environ/air/plan/reear_2008.html

²⁹ Letter dated November 22, 2010 to Matthew Lakin, Manager Air Quality Analysis Office USEPA Region 9, from Karen Magliano, Chief Air Quality Data Branch California Air Resources Board, transmitting final report dated August 5, 2010 entitled, "Analysis of Exceptional Events Contributing to High PM10 Concentrations in the South Coast Air Basin on October 13, 2008."

Southern California's South Coast Air Basin (Basin) consists of 10,743 square miles and consists of Orange County and the non-desert portions of Los Angeles, Riverside and San Bernardino Counties. The population of the Basin is approximately 16 million people, with approximately 11 million gasoline powered vehicles and 300,000 diesel vehicles. The coastal plain contains most of the population of the Basin, which is surrounded by tall mountains, including the San Gabriel Mountains to the north, the San Bernardino Mountains to the northeast, and the San Jacinto Mountains to the east. The coastal range of the Santa Ana Mountains separates the inland part of Orange County from Riverside County. The proximity of the Pacific Ocean to the west has a strong influence on the climate, weather patterns and air quality of the Basin. The mountains also have a significant impact on the wind patterns of the Basin. Offshore winds flow down slope and are warmed and dried by compressional heating, gaining momentum through the passes and canyons. Northeasterly winds, known as Santa Ana winds, typically account for the highest wind events in the Basin, occurring several times each year. Onshore high-wind events also occur with the strongest winds typically occurring in the mountains and deserts.

Violations of the PM₁₀ NAAQS were recorded at the South Coast Air Basin Anaheim monitoring station on October 13, 2008, due to high winds. The 24-hour mass concentration at Anaheim was measured with a federal equivalent method (FEM) Tapered Element Oscillating Microbalance (TEOM) continuous monitor, with a midnight-to-midnight 24-hour average concentration of 199 µg/m³. This was not a sampling day for the Federal Reference Method (FRM) filter measurements in the Basin. While no other PM₁₀ measurements exceeded the federal standard level (150 µg/m³), other stations in the Basin had elevated concentrations during the same period.

A strong Santa Ana wind event developed on October 13th, causing very high northerly through easterly winds in the mountains and deserts, especially through and below the wind-favored passes and canyons in the Basin. National Weather Service (NWS) weather stations measured extremely high peak wind gusts throughout the day in areas upwind of the high SCAQMD PM₁₀ stations, including: 87 mph by in [*sic*] the Santa Ana Mountains of Orange County (Freemont Canyon RAWS); 87 mph in the San Gabriel Mountains of Los Angeles County (Chilao RAWS); 79 mph in the Malibu Hills of Los Angeles County; 61 mph at Ontario International Airport in San Bernardino County; 55 mph at Corona Airport in Riverside County; 51 mph at Chino Airport in San Bernardino County and 41 mph at the Santa Ana – John Wayne Airport in Orange County. Due to the widespread winds, sources of the windblown dust were both natural areas, particularly from the mountains and deserts, and BACM-controlled anthropogenic sources. The timing of this event is verified with the high wind observations and reports of reduced visibility and blowing sand and dust, in conjunction with the hourly TEOM and BAM PM₁₀ measurement data from nearby monitors in the Basin, when available.

The following maps support the conceptual model:

- Map of the South Coast Air Basin Showing Air Monitoring Stations and Forecast Areas
- Map of South Coast Air Basin with Selected Cities and Topography
- Map of South Coast Air Basin PM₁₀ Monitors

6.2.2 Step 2: Address not Reasonably Controllable or Preventable (nRCP).

The nRCP demonstration should identify the sources that were expected to have contributed to the event, both natural and anthropogenic, and indicate how they were not reasonably controllable or preventable. Generally, the nRCP will include identification of natural sources and whether they are reasonably controllable, and identification of anthropogenic sources and their associated controls.

6.2.2.1 Identify source areas and source categories expected to have contributed to the event

EPA recommends that the first step of the nRCP demonstration is to identify the likely source area and source categories expected to have contributed to the event. The source areas and categories can be general, such as, “The area upwind of the monitor includes portions of the Santa Ana Mountains to the NE of the station and extending down into the Basin. Sources of the windblown dust were both natural areas, particularly from the mountains and deserts, and BACM-controlled anthropogenic sources.”³⁰ It is important to identify the geographic references on a map.

6.2.2.2 Calculate sustained wind speed

Sustained wind speed is generally calculated as the wind speed averaged over a period of at least one minute: typical averaging times for a sustained wind speed are one to five minutes.³¹ EPA will not consider any average less than one minute to represent a sustained wind speed. Packages should include the maximum sustained wind speed for each hour of the event and also the number of periods above 25 mph (as part of the clear causal relationship a time series with sustained wind speeds during the event should also be included (see Section 6.2.2.4)). The maximum sustained wind speed does not necessarily have to be at the site of the exceedance, but it should represent the source area. If the sustained wind speed provided is not at the exceeding monitor then the CCR demonstration will generally be expected to support this claim. Sustained wind speed data are typically available from sources such as local air monitoring stations and National Weather Service Stations. The demonstration should indicate what the expected entrainment threshold is for the local area and whether the sustained wind speed exceeded this level. If the default entrainment threshold of 25 mph is used then this guidance document should be cited and a statement should be made indicating that this threshold is appropriate for the local area.

6.2.2.3 Determine recurrence frequency

EPA intends to consider the recurrence frequency for high wind dust exceptional events to be the number of events flagged in AQS as high wind dust exceptional events. An event is generally a continuous period of elevated wind linked to the same weather pattern: it is typically multiple hours, but could span one or more successive days. EPA is defining a recurring event for purpose of high wind dust events as more than one expected high wind dust event per year,

³⁰ Letter dated November 22, 2010 to Matthew Lakin, Manager Air Quality Analysis Office USEPA Region 9, from Karen Magliano, Chief Air Quality Data Branch California Air Resources Board, transmitting final report dated August 5, 2010 entitled, “Analysis of Exceptional Events Contributing to High PM10 Concentrations in the South Coast Air Basin on October 13, 2008.”

³¹ National Weather Service defines a “sustained wind” as the wind speed determined by averaging observed values over a two-minute period.

averaged over three years. The use of “expected” events is necessary to account for variable sampling frequencies. EPA will rely on flagged high wind dust events in AQS to indicate the number of high wind dust events in an area. To calculate the recurrence frequency for every-day sampling (i.e., 1-in-1) the state would count the number of events with data flagged in AQS as a high wind dust event over the relevant three-year time period and divide the number of flagged days by three years. For 1-in-3 day sampling the state would count the number of events with data flagged in AQS as a high wind dust event over the relevant three-year period, multiply by three to get the equivalent of 1-in-1 day sampling, and then divide by three years. For both 1-in-1 and 1-in-3 day sampling schedules, if the three-year average recurrence frequency exceeds one then high wind dust exceptional events within that period will be treated as recurring. In the case of 1-in-6 day sampling a different approach is necessary since even one high wind dust event would result in an expected recurrence frequency greater than one and it is illogical to call one exceedance recurring. In this case, one flagged high wind dust event will be considered non-recurring. If there is more than one flagged high wind dust event in three years then events during that period will be treated as recurring.

6.2.2.4 Prepare basic controls analysis

If the sustained wind speed calculated in Section 6.2.2.2 is at or above 25 mph (or an alternative entrainment threshold approved by EPA) then generally the state can provide a basic controls analysis to show that the event was not reasonably controllable or preventable (see Section 3.1.5.1). The level of detail in the basic controls analysis will be informed by the recurrence frequency and level of wind speed above 25 mph (Figure 1). Generally, a basic controls analysis will identify likely sources in the expected source contribution area, describe the controls in place for anthropogenic sources, and indicate whether the natural sources were reasonably controllable and why. The basic controls analysis, regardless of complexity, generally does not need to include back-trajectories, specific emissions inventories, or detailed reports of controls implementation and enforcement.

Cases where dust was entrained by sustained winds above 25 mph upwind of the monitor and subsequently transported at lower wind speeds to the monitor could still qualify for the basic controls analysis category as long as the state shows that sustained winds were above 25 mph in the expected source area. Cases of long-range transport (e.g., >50 miles) could still qualify for a basic controls analysis, but a robust trajectory analysis and/or satellite imagery should be included as part of the CCR demonstration.

Basic controls analysis for non-recurring cases

The basic controls analysis for non-recurring cases should discuss in general terms the controls on the sources identified in Section 6.2.2.1 and explain why the sources were not reasonably controllable or preventable. As discussed in Section 3.1.5, there is a range of complexity within the basic controls analysis category. As sustained winds (both level and duration) increase, the controls analysis can be more basic. The most basic controls analysis would include a brief description of local/upwind sources that were suspected to significantly contribute to the event and a description of the controls on the anthropogenic sources in place at the time of the event (e.g., local BACM measures) and why they are reasonable. For the sources identified, the submitter should explain how dust entrainment occurred despite having reasonable controls in place (e.g., controls were overwhelmed by high wind).

An example of a basic controls analysis for the anthropogenic sources in a non-attainment area is:³²

This requirement is met by demonstrating that despite reasonable and appropriate measures in place, the October 13, 2008 wind event caused the NAAQS violation. During this event, there were no other unusual PM₁₀-producing activities occurring in the Basin and anthropogenic emissions were approximately constant before, during and after the event. SCAQMD has implemented regulatory measures to control emissions from fugitive dust sources and open burning in the South Coast Air Basin. Implementation of Best Available Control Measures (BACM) in the Basin has been carried out through SCAQMD Rule 403 (Fugitive Dust), as well as source-specific rules. With its approvals of the South Coast PM₁₀ Attainment Plans in the State Implementation Plan (SIP), EPA has concluded that this control strategy represents BACM and Most Stringent Measures (MSM) for each significant source category, and that the implementation schedule was as expeditious as practicable.

- SCAQMD Rule 403 establishes best available fugitive dust control measures to reduce fugitive dust emissions associated with agricultural operations, construction/demolition activities (including grading, excavation, loading, crushing, cutting, planning, shaping or ground breaking), earth-moving activities, track-out of bulk material onto public paved roadways, and open storage piles or disturbed surface areas.
- SCAQMD Rule 1156, Further Reductions of Particulate Emissions from Cement Manufacturing Facilities, is a source-specific rule that applies to all operations, including material handling, storage and transport at cement manufacturing facilities. It restricts visible emissions from facility operations, open piles, roadways and unpaved areas and requires enclosed systems for loading, unloading and transfer of materials. Other operations must employ wind fencing and wet suppression systems or be enclosed with permitted control equipment.
- SCAQMD Rule 1157, PM₁₀ Emissions Reductions from Aggregate and Related Operations, is a source-specific rule applicable to all permanent and temporary aggregate and related operations that produce sand, gravel, crushed stone or quarried rocks. Like Rule 1156, this rule restricts the discharge of fugitive dust emissions into the atmosphere through plume opacity tests and limiting visible plume travel to within 100 feet of the operation. This rule requires: prompt removal of material spillage; stabilization of piles with dust suppressants; the control of loading, unloading, transferring, conveyors, and crushing or screening activities with dust suppressants or other control methods; stabilization of unpaved roads, parking and staging areas; sweeping of paved roads; and the use of track-out control systems.
- SCAQMD Rule 1158, Storage, Handling, and Transport of Coke, Coal and Sulfur, is a source-specific rule that applies to any facility that produces, stores, handles, transports or uses these materials. This rule restricts visible emissions

³² Letter dated November 22, 2010 to Matthew Lakin, Manager Air Quality Analysis Office USEPA Region 9, from Karen Magliano, Chief Air Quality Data Branch California Air Resources Board, transmitting final report dated August 5, 2010 entitled, "Analysis of Exceptional Events Contributing to High PM10 Concentrations in the South Coast Air Basin on October 13, 2008."

and requires that piles be maintained in enclosed storage and that unloading operations be conducted in enclosed structures with water spray systems or venting to permitted air pollution control equipment. It also has specific requirements to control emissions from roadways, other facility areas, and conveyors and the loading of materials.

- SCAQMD Rule 1186, PM₁₀ Emissions from Paved and Unpaved Roads and Livestock Operations, requires rapid removal of paved road dust accumulations and establishes a treatment schedule for unpaved roads, street sweeper procurement standards, and design standards for new road construction. SCAQMD Rule 1186.1, Less-Polluting Sweepers, requires procurement of alternative-fueled equipment when governmental agencies replace street sweepers.
- SCAQMD Rule 444, Open Burning, ensures that open burning is conducted in a manner that minimizes emissions and impacts, and that smoke is managed to protect public health and safety. This rule requires authorization for agricultural and prescribed fire, limited to days that are predicted to be meteorologically conducive to smoke dispersion and that will not contribute to air quality that is unhealthy for sensitive groups or worse. It also restricts residential and waste burning.
- SCAQMD Rule 445, Wood Burning Devices, reduces pollution from wood-burning fireplaces and other devices through requirements for new construction, curtailment of wintertime wood burning in specified areas when poor air quality is forecast and restriction of the sale of unseasoned firewood. The SCAQMD Healthy Hearths program provides public education on how to reduce air pollution from wood burning and encourages the conversion to natural gas burning fireplaces through an incentive program.

October 13, 2008 was designated an agricultural and prescribed wildland “no-burn” day, in accordance with SCAQMD rule 444. The PM_{2.5} 24-hour averages at all stations in the Basin, including Anaheim, were well below the 24-hour PM_{2.5} NAAQS and the PM₁₀ was estimated to be composed of 87% PM-Coarse particles (PM_{10-2.5}) and only 13 percent PM_{2.5}. This shows that mostly crustal material comprised the PM₁₀ mass and not transported or locally generated urban pollution or combustion sources.

A survey of the SCAQMD complaint records and inspection reports for Anaheim and all other areas of the Basin indicated no evidence of unusual particulate emissions on October 13, 2008 other than related to the strong winds. The complaints are summarized in Table 2-7 from the SCAQMD Clean Air Support System (CLASS) database for complaints and compliance actions. Due to the windy conditions, SCAQMD compliance staff responded to 17 complaints related to windblown dust on October 13. Most were in Riverside and San Bernardino County, but two were in Orange County with no further compliance action taken. No Notices of Violation or Notices to Comply were issued in the Basin for fugitive dust on this day. Several complaints were directly related to the strong winds and windblown dust that overwhelmed the strict fugitive dust controls that are enforced in the Basin. The control methods were generally effective throughout the Basin, but were apparently overwhelmed in several instances by the strong, gusty winds, causing windblown dust and sand to be entrained in the atmosphere.

While the above example provided a basic controls analysis for anthropogenic sources in a non-attainment area, an area attaining the NAAQS can similarly present the current rules, if any, and how the identified rules are reasonable given the attainment status.

In addition to identifying controls on anthropogenic sources, it is important that a submitting agency indicate whether the natural sources could have been reasonably controlled. For example, the following statement could fulfill this need: “Wind speeds were high enough to entrain dust from natural areas including undisturbed mountain and desert areas upwind of the monitor. Dust from these sources was not reasonably controllable due to the cost of applying controls over such a large land area and because of the detrimental effect on the natural ecosystem that could result.”

Basic controls analysis for recurring cases

When sustained wind speeds are at or above 25 mph and there is more than one high wind dust event in the year, a controls analysis can be basic but will need more information than the most basic case. This kind of controls analysis will need to include identification of specific sources in the upwind area and a discussion of specific controls on those sources; this does not require trajectories or specific inventories. The purpose of identifying specific sources in the upwind area for recurring cases with wind speeds above 25 mph is to inform both the state and EPA about whether reasonable control of sources includes increasing controls that would be effective above 25 mph.

An example of a basic controls analysis for the anthropogenic sources in a non-attainment area for recurring cases will be incorporated in this document as one becomes available.

Similar to the basic controls analysis for non-recurring cases, it is important that a submitting agency indicate whether the natural sources could have been reasonably controlled. As with the anthropogenic sources for recurring events, it is important to specifically identify natural sources that are expected to be contributing to the event(s) so that the state and EPA can consider whether controls such as wind breaks near the natural sources might be reasonable. For example, the following type of assessment and statement could fulfill this need:

Wind speeds were high enough to entrain dust from natural areas upwind of the monitor, in particular at the Mojave Tortoise Natural Preserve which is five miles upwind of the monitor. Wind breaks and other control measures are prohibited in this area because it interferes with the natural landscape movement required by the endangered Mojave Desert Tortoise. Dust from this source was not reasonably controllable due to the cost of applying controls over such a large land area and because of the detrimental effect on the natural ecosystem and health of the desert tortoise that could result.

Finally, if EPA recommended controls improvements as part of a previous high wind dust exceptional event review then the controls analysis should address how these controls improvements have been addressed.

6.2.2.5 Prepare comprehensive controls analysis

If the sustained wind speed calculated in Section 6.2.2.2 is below 25 mph (or alternative entrainment threshold approved by EPA) then the state will generally be expected to provide comprehensive controls analysis (see Section 3.1.5.2). The comprehensive controls analysis is

expected to have back-trajectories indicating specific sources in the upwind area, an inventory of the contribution for the significant sources, and detailed descriptions of controls and their effective implementation and enforcement. The further below 25 mph the wind speeds are at the source area and/or the higher the recurrence frequency, the more complex and compelling the demonstration will generally need to be for EPA to be able to concur. Note that some of the information generated as part of a comprehensive controls analysis will also contribute to the CCR and should be referred to in that portion of the demonstration package.

All controls analyses when wind speeds are below 25 mph, regardless of complexity, should generally address whether control improvements were recommended by EPA as part of a previous high wind dust exceptional event review. If controls improvement had been previously recommended then the controls analysis should address how these controls improvements have been implemented.

Comprehensive controls analysis for non-recurring cases

States will generally need to prepare a comprehensive controls analysis for non-recurring events with wind speeds below 25 mph. Because dust from stable surfaces is usually not entrained below the 25 mph, this analysis should consider whether all contributing sources are reasonably controlled. The comprehensive controls analysis for non-recurring cases should include: back-trajectories indicating specific sources in the upwind area, an inventory of the contribution for the significant sources, and detailed descriptions of controls and their effective implementation and enforcement. Although EPA expects a comprehensive controls analysis for these cases, EPA does not expect analyses for non-recurring cases to be as complex as analyses for recurring cases with wind speeds are below 25 mph.

An example of a comprehensive controls analysis for non-recurring cases will be incorporated in this document as one becomes available.

Detailed descriptions of enforcement efforts, any notice of violations, and evidence of proper implementation of controls should be included.

Finally, in addition to identifying controls on anthropogenic sources, it is important that a submitting agency indicate whether the natural sources could have been reasonably controlled. For example, the following statement could fulfill this need:

Wind speeds were high enough to entrain dust from natural areas including undisturbed mountain and desert areas upwind of the monitor. Dust from these sources was not reasonably controllable due to the cost of applying controls over such a large land area and because of the detrimental effect on the natural ecosystem that could result.

Comprehensive controls analysis for recurring cases

Recurring cases with wind speeds below 25 mph will require the most comprehensive analyses to show that the wind-entrained emissions were not reasonably controllable or preventable. The demonstration is likely to be increasingly difficult as sustained wind speeds decrease from 25 mph (see Section 3.1.5.2 and Figure 1). Many of these cases may not, in fact, represent concurable cases. Those cases that could be concurable will require considerable analyses to show that specific sources upwind of the exceeding monitor had reasonable controls that were properly implemented and enforced. Specifically, the comprehensive controls analysis for recurring cases should include: back-trajectories indicating specific sources in the upwind area, an inventory of the contribution for the significant sources, and detailed descriptions of controls and their effective implementation and enforcement.

For comprehensive controls analysis for recurring events, EPA will place significantly more weight on the meteorological data associated with the measured high particulate matter concentration. A state may be required to provide a source contribution analysis, similar to the analysis presented below, for multiple hours of the day, as a single back trajectory does not account for wind direction fluctuations during the event and may not accurately capture all the sources that may be contributing to the exceedance. Also, when moderate winds are responsible for high levels of measured particulate matter, considerably more attention should also be placed on the hours of the day preceding the event to adequately assess the sources contributing to the exceedance that may have influenced particulate matter concentrations before the arrival of the claimed event.

Following is an example of a methodology of a back-trajectories and inventory³³ for a comprehensive controls analysis for recurring cases:

Back-trajectories were plotted in 5-minute links based on 5-minute average wind speed and wind direction data recorded at the West 43rd Avenue station. The back-trajectory plot for April 30, 2008 is shown in the following figure. These back-trajectories revealed that winds accompanying peak PM₁₀ concentrations typically blew from the west-southwest to the West 43rd Avenue station, crossing a mosaic of agricultural, residential, industrial, and riverbed lands. GIS files were used to determine the zoned uses of all lands within ½ mile of each back-trajectory track over which wind parcels travelled during the two hours prior to delivering the peak PM₁₀ concentration to the West 43rd Avenue monitor. Lands under active construction on each exceedance day were identified from earthmoving permit records. Parcel areas were aggregated within seven general categories for which limited emission factor data were available: vacant, agriculture, construction, open/restricted access, riverbed, sand and gravel/landfill, and other lands. The uses of these land categories are generally defined as follows:

Vacant – represents undeveloped land to which public access is not restricted;

Agriculture – represents lands under agricultural cultivation;

³³ Assessment of Qualification for Treatment under the Federal Exceptional Events Rule: High Particulate (PM10) Concentration Event in the Phoenix Area on April 30, 2008. Technical report prepared by the Arizona Department of Environmental Quality, Air Quality Division. August 16, 2010.

Construction – represents lands being developed for long term use that will include ground coverage elements such as pavement, structures, or landscaping that will prevent the generation of windblown dust;
Passive/restricted open space – represents undeveloped or partially developed lands to which public vehicular access is restricted (these lands include public parks, national forests, military posts, and Indian reservations);
Riverbed – represents riverbed channels of the Salt and Gila River branches;
Landfill/sand and gravel – represents lands being used for mineral extraction or waste deposit;
Other – represents developed lands that are protected from windblown dust generation by elements such as paving, structures, and landscaping.

April 30, 2008 Back-Trajectory



PM₁₀ emissions were calculated for each back-trajectory hour using emission factors derived from the Nickling and Gillies data, 5-minute wind speed averages recorded at the West 43rd Avenue monitoring station, and the land use acreage along each back-trajectory computed by MAG staff. The emission factor equations were used to compute PM₁₀ emissions for each 5-minute portion of each back-trajectory hour. For each 5-minute period, the measured average wind speed was compared to the threshold friction velocity calculated at a 10-meter height to determine whether the threshold wind speed necessary to the generation of windblown PM₁₀ on each land use, undisturbed and disturbed, had been exceeded. If the threshold velocity was exceeded, the appropriate Nickling and Gillies emission factor equation was used to compute PM₁₀ emissions in units of gm/cm²-

sec. Emissions for each 5-minute period within each hour and within each land use category were converted to units of lb/acre-hr and then summed to produce hourly average PM₁₀ emission rates per land use category. The emission rates for the other land use categories and the 2nd hour were calculated using a similar methodology. The land use category emission rates were then multiplied by the acreages within each appropriate land use category to derive PM₁₀ emissions for each back-trajectory hour by land use category. The PM₁₀ emissions for each of the back-trajectory hours on each exceedance day were summed together to calculate total emissions over each exceedance day back-trajectory by land use category. These land use category emissions were then grouped by anthropogenic and nonanthropogenic categories to assess the relative contribution of nonanthropogenic sources to exceedances recorded at the West 43rd Avenue monitoring station during 2008. A summary of the results of these calculations for the April 30, 2008 exceedance day is presented in the following table.

Land Use Category	PM ₁₀ Emissions (lb)		% of Anthropogenic
	Anthropogenic	Nonanthropogenic	
Vacant/Undisturbed	-	0	
Vacant/Disturbed	1,501	-	20.7%
Agriculture/Undisturbed	0	-	0.0%
Agriculture/Disturbed	0	-	0.0%
Construction/Undisturbed	0	-	0.0%
Construction/Disturbed	277	-	3.8%
Passive-Restricted/Undisturbed	-	0	
Passive-Restricted/Disturbed	0	-	0.0%
Riverbed/Undisturbed	-	8,234	
Riverbed/Disturbed	2,408	-	33.3%
Sand & Gravel/Undisturbed	0	-	0.0%
Sand & Gravel/Disturbed	3,053	-	42.2%
Other		-	
Total	7,240	8,234	
% of Grand Total	46.8%	53.2%	

[EPA Addendum: After this detailed source attribution estimate is established for all contributing source areas, the State should then identify all the reasonable control measures associated with each source category. This analysis should include a detailed explanation as to why each of those control measures are reasonable for the area and should also include statements that there were no other control measures that were reasonably available.]

The analysis should include information on whether these required reasonable controls were appropriately implemented and enforced during the time of the event. The state should include all available enforcement, rule effectiveness, and compliance information for the days preceding, during, and following the claimed event day. EPA will consider the number of inspections and notices of violations in upwind areas as evidence that all reasonable controls were, in fact, implemented and functioning appropriately. EPA will also consider the overall compliance rates for specific source categories in determining whether reasonable controls were in place.

Finally, it is important that a submitting agency indicate whether the natural sources could have been reasonably controlled. As with the anthropogenic sources for recurring events, it is important to specifically identify natural sources that are expected to be contributing to the event(s) so that the state and EPA can consider whether controls such as wind breaks near the natural sources might be reasonable. For example, the following type of assessment and statement could fulfill this need:

Wind speeds were high enough to entrain dust from natural areas upwind of the monitor, in particular at the Mojave Tortoise Natural Preserve which is five miles upwind of the monitor. Wind breaks and other control measures are prohibited in this area because it interferes with the natural landscape movement required by the endangered Mojave Desert Tortoise. Dust from this source was not reasonably controllable due to the cost of applying controls over such a large land area and because of the detrimental effect on the natural ecosystem and health of the desert tortoise that could result.

6.2.2.6 Prepare High Wind Action Plan (optional)

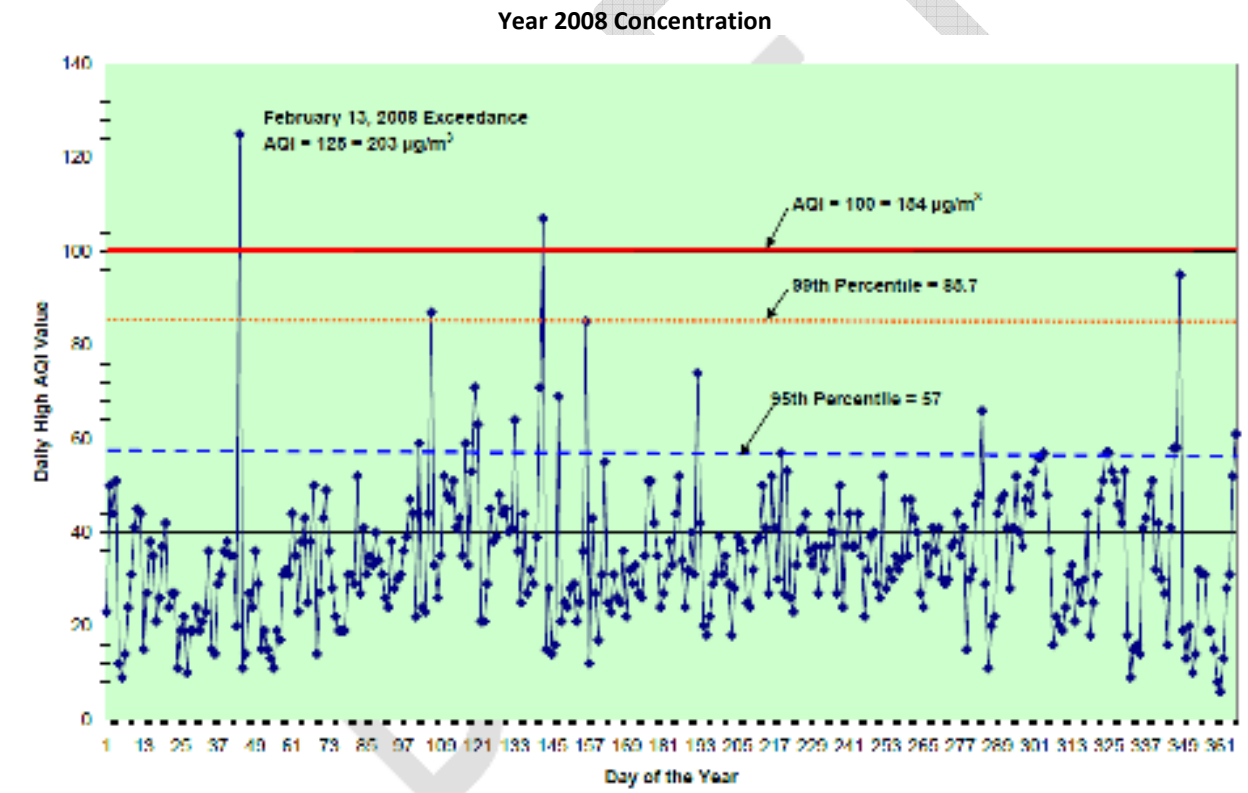
If a state discovers (an) uncontrolled source(s) of dust during the course of the event demonstration, the state may choose to submit a High Wind Action Plan, either separately or along with the demonstration package, so the newly discovered source(s) can be considered reasonably controlled if a subsequent event occurs. Alternatively, EPA may identify a source previously unidentified by the state that EPA considers to be reasonably controllable. In this case, a state could submit a High Wind Action Plan following the submission of the demonstration package. A High Wind Action Plan is developed to address sources that could reasonably be controlled to minimize the occurrence of future events. As such, the following information would be included:

- Source(s) targeted for controls
- Description of controls
- Oversight/enforcement plan for event days
- Implementation timeline
- Documentation of effective implementation and enforcement

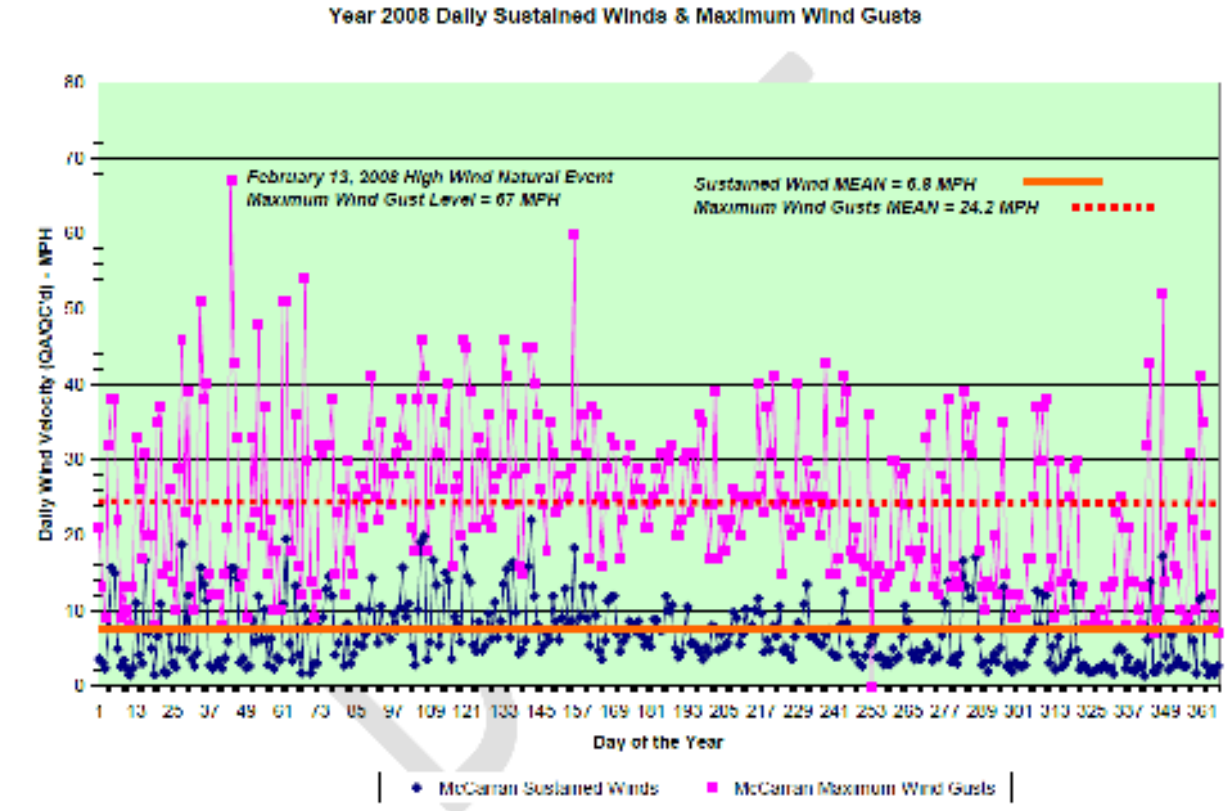
6.2.3 Step 3: Present Historical Fluctuations (HF) Analyses

As described in Section 3.2, historical fluctuations (HF) analyses will inform EPA's determination of whether the event was in excess of normal historical fluctuations and will also inform CCR, NEBF, and AAQ. Specific analyses expected to provide the historical context for the event include:

1. A time series for concentration and wind data for the event area for the previous 3-5 years, or longer if available, with high wind dust events identified: Concentration data should be 24-hour concentrations for each day and wind data should be maximum sustained (1-5 minute average) wind for each day. It would also be appropriate to display wind gusts (1-3 second averages), if available. Depending on the quantity of data, it may be appropriate to present monthly maximums (note that it is not appropriate to present monthly-averaged daily data or any other average of the daily data as this masks other high values). It is appropriate to identify information such as: seasonal or monthly 24-hour means, other event days, and relevant standards. The following figures³⁴ show the type of information EPA is seeking, except that in these cases the time series includes only one year rather than the longer timeframe expected by EPA and other high wind dust events were not specifically identified. Additionally, EPA would prefer concentration statistics rather than AQI statistics. Finally, wind statistics should show a maximum for each day or month rather than averaged data.



³⁴Exceptional Event Documentation for February 13, 2008, PM10 High-Wind Exceedance Event. Technical report prepared by the Clark County (Nevada) Department of Air Quality & Environmental Management. February 8, 2011.



2. Percentile of concentration relative to annual data with and without all high wind dust events: The percentile of the 24-hour average PM concentration should be provided for the event day relative to all measurement days over the previous 3-5 years. EPA expects a minimum of 300 data points to be included in this calculation. If the sampling schedule is 1-in-6 day sampling then this percentile should include five years of data (60 sample days/year for five years provides 300 data points). Higher frequency sampling can utilize fewer years of data but not fewer than three years. If three years is not available, consult with EPA.
3. Percentile of concentration relative to seasonal data with and without all high wind dust events: The percentile of the 24-hour average PM concentration should be provided for the event day relative to all measurement days for the season (or appropriate alternative 3-month period) of the event over the previous 3-5 years. It is appropriate to use the same time horizon as used for the percentile calculated relative to annual data.

6.2.4 Step 4: Address Clear Causal Relationship (CCR)

As described in Section 3.3, the following types of evidence can support the CCR demonstration:

- Occurrence and geographic extent of the event
- Transport of emissions related to the event in the direction of the monitor(s) where measurements were recorded

- Spatial relationship between the event, sources, transport of emissions, and recorded concentrations
- Temporal relationship between the high wind and elevated PM concentrations at the monitor in question
- Chemical composition and/or size distribution of measured pollution that links the pollution at the monitor(s) with particular sources or phenomena
- Comparison of event-affected day(s) to specific non-event days
- Comparison of concentration and wind speed during the period of the event to historical data (i.e., historical fluctuations analyses)

Each of these types of evidence is treated in detail below. Note that information generated in this portion of the demonstration submittal may result in revisions to the conceptual model and controls analysis. As the flow diagram (Figure 2) suggests, preparation of a high wind dust exceptional event package is not necessarily a step-wise process.

6.2.4.1 Occurrence and geographic extent of the event

The following information can be provided to help establish the occurrence and geographic extent of the event: special weather statements, advisories, news reports; nearby visibility readings; measurements from monitoring stations; MODIS and other satellite maps; and description of weather conditions that created the high wind.

- Special weather statements, advisories, news reports:
The following information was provided by SCAQMD for an exceptional event showing for Anaheim (*Note that Appendices from the SCAQMD demonstration submittal are referenced in the excerpt below, but they are not provided as part of this document or the example*).

The National Weather Service had predicted this first strong Santa Ana event of the season well in advance and Governor Schwarzenegger issued a press release on October 10 to prepare the state for Santa Ana winds and the associated wildfire potential (see Appendix A.7).

The Appendix to this document (Sections A.2 through A.6) contains the forecast discussions, short-term forecasts (nowcasts), fire weather forecasts, warnings and significant wind reports, as available from the NWS Los Angeles/Oxnard and San Diego Forecast Offices, whose areas of responsibility cover the Basin and much of southern California. These show that the strong Santa Ana wind event was well predicted in advance, warning the public of potentially damaging winds and windblown dust and sand, along with reduced visibilities.

NWS advisories and warnings for high winds (Appendix, Section A.5) were already in place on October 12, extending through Tuesday, October 14, or longer. A Wind Advisory is issued by NWS when sustained winds of 30 to 39 mph are expected for 1 hour or longer. A High Wind Warning is issued when sustained winds of 40 mph or more are expected for 1 hour or longer, or for wind gusts of 58 mph or more with no time limit. NWS Oxnard issued High Wind Warnings on October 12, extending through the period for the Los Angeles and Ventura County Mountains and Wind Advisories for the Santa Monica Mountains, the Ventura County coastal and interior valleys, the Santa Clarita Valley, the Los Angeles County San Fernando Valley, and the Ventura and Los Angeles County coasts, including

Downtown Los Angeles. NWS San Diego issued High Wind Warnings for the San Bernardino and Riverside County valleys (Inland Empire) and the Santa Ana mountains and foothills and Wind Advisories for the San Bernardino County mountains, Orange County coastal areas, the Riverside County mountains, the San Diego County mountains, and the San Diego County valleys. In short, High Wind Advisories and Warnings were in place for most of the South Coast Air Basin and much of southern California to warn the public of this high wind event. Northeasterly winds with sustained speeds in the 35 to 45 mph range were predicted throughout the region, along with damaging gusts to 70 mph, especially in the mountains and below passes and canyons in the Inland Empire. Hazardous driving conditions were predicted, especially through and below canyons and passes, as well as blowing dust and sand with reduced visibility, broken tree limbs and downed power lines.

The AQMD Meteorology Section predicted high winds for October 13 in the Coachella Valley for AQMD Rule 403.1, which requires specific actions in this area when wind gusts exceed 25 mph. While there are no other AQMD rule requirements to forecast winds in the Basin, the daily forecast discussion by AQMD issued on October 12 for Monday, October 13 predicted the strong winds. A smoke advisory was already in effect in the morning of October 12 and the strong winds were prominent in the forecast discussion, as follows:

- *SMOKE ADVISORY for Sunday: Concentrations of fine particulates may reach Unhealthy for Sensitive Groups or higher in areas of Los Angeles County directly impacted by smoke from a wildfire in the Angeles National Forest north of Pacoima.*
- *Monday will be mostly clear, windy and warmer as the offshore Santa Ana winds strengthen. Gusty winds through and below canyons and passes will cause elevated particulate concentrations due to windblown dust and possibly continued wildfire activity.*

PM10 predictions were increased throughout the Basin for October 13 and agricultural and prescribed burning was prohibited with a No-Burn declaration for the entire Basin. AQMD issued a Smoke and Windblown Dust Advisory in the morning of October 13, reproduced in the Appendix, Section A.10, that warned of the likelihood of strong Santa Ana winds causing high PM10 concentrations in several areas of the Basin, including Central Orange County (Forecast Area 17, including Anaheim), as follows:

In addition, strong Santa Ana winds will likely cause PM10 concentrations to reach Unhealthy for Sensitive Groups concentrations or higher in areas throughout the Basin downwind of the winds areas. This includes any areas where windblown dust is visible, especially through and below passes and canyons, until the winds subside. Wind prone areas are likely to include: the San Bernardino Valley (Areas 32, 33, 34, 35), Riverside County Valleys (Areas 22, 23, 24, 25, 26), Orange County (Areas 16, 17, 18, 19, 20) and the Los Angeles County northern and southern coastal areas (Areas 2 and 4).

- Nearby visibility readings:
Visibility readings were supplied by SCAQMD and visibility pictures were submitted by ADEQ for nearby airports.
- MODIS satellite maps:
SCAQMD provided the following maps showing the spatial distribution of blowing dust.



- Description of weather conditions that created the high wind:
SCAQMD provided the following description of weather conditions around the time of the event

An upper level trough of low pressure moved through California, between October 9 and 11. The low pressure system did not create much rain in California during this period, but temperatures were cool throughout the state. By Sunday, October 12, the backside of the trough was over California, providing upper level support for a developing strong Santa Ana wind event. The strong pressure gradients that developed between the high and low pressure aloft created strong winds. The National Weather Service (NWS) 500 millibar (MB) analyses every 12 hours between 0400 PST on October 12 and 0400 PST on October 14 are shown in the Appendix, Section A.11. The winds over California at

the 500 MB pressure level started out northwesterly in the morning of October 12 with speeds to 81 mph (70 knots), then became more northerly by the morning of Monday, October 13 with speeds to 57 mph (50 knots). The strong northerly flows aloft, coupled with strong northeasterly surface pressure gradients, enhanced the offshore flows at the surface.

The passage of the low pressure trough aloft brought the first strong cold front of the season at the surface. Section A.12 in the Appendix shows the NWS sea-level pressure analyses, every three hours between 1600 PST on October 12 and 0100 PST on October 14. By 1600 PST October 12, the surface low and cold front was over the northeastern border of New Mexico and high pressure was building over northern Nevada, increasing the northerly gradients. By 0100 PST on October 13, the high pressure over Nevada had increased to 1033 MB, strengthening the gradient flows across California. By 0700 PST, the area of high pressure had expanded and peaked at 1037 MB. The strength of the high pressure remained nearly the same through the rest of the day, while the broad area of high pressure slowly moved to the east, causing the winds to shift from northerly to northeasterly, then easterly throughout the day. The strong pressure gradients caused strong winds, especially in southern California as the flow of cold air from the area of high pressure further enhanced the winds as it flowed across the mountains. Some gusty winds had already been observed on October 12, but they increased considerably in the early morning of October 13.

This is the classic Santa Ana wind pattern that brings strong winds to southern California. High pressure builds over the Great Basin desert region of the western United States in the cold air behind the front with lower pressure off the southern California coast. This pressure gradient creates strong north through northeasterly winds, enhanced by thermal gradients due to denser cold air over the Great Basin. The relatively cool air from the Great Basin deserts flows over the southern California mountains, gaining momentum on the lee side. The downslope flow causes compressional warming and drying of the air in the South Coast Air Basin. This combination of strong wind, high temperatures and low relative humidities make these Santa Ana conditions highly conducive to wildfires in southern California.

The AQMD Meteorology Section routinely analyzes sea-level pressure gradients in southern California to assess winds and air pollution potential. The Summation Pressure Gradient (SPG) is a good indicator of the strength of the flow and whether it is onshore (positive) or offshore (negative), where

$$SPG = (SAN-LAS)^{35} + (LGB-DAG)^{36} + (RIV-DAG)^{37}$$

In the morning of October 12, the 0700 PST SPG was -5.5 MB, indicating moderate offshore flow. At the same time in the morning of October 13, the SPG strengthened to

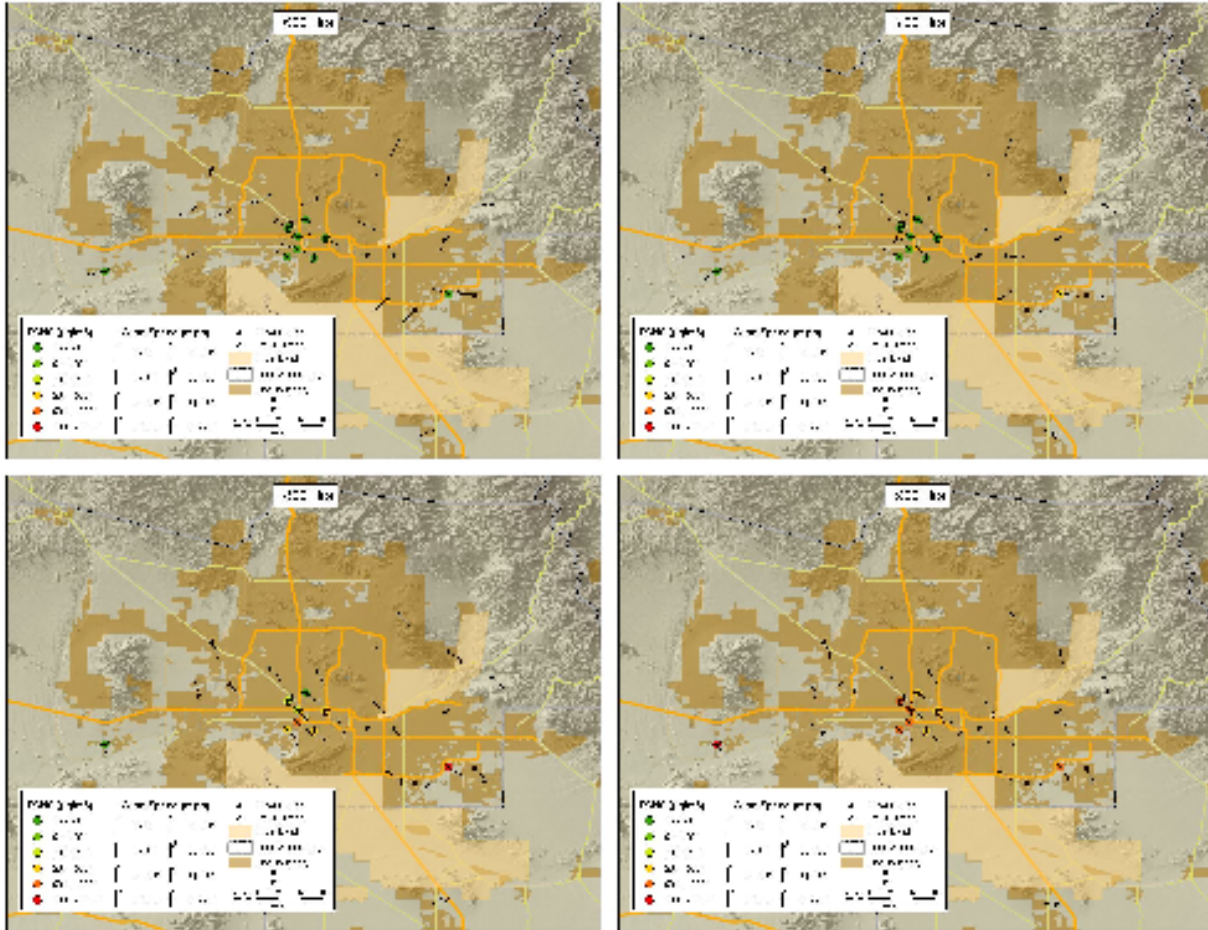
³⁵ Sea Level Pressure difference between San Diego and Las Vegas

³⁶ Sea Level Pressure difference between Long Beach and Daggett

³⁷ Sea Level Pressure difference between Riverside and Daggett

–14.7 MB, indicating a stronger offshore gradient. The gradient was enhanced by the upper level pattern and thermal gradient as described above, to create a strong wind event, especially for several hours through the morning of October 13.

- Measurements from monitoring stations:
The following figures show the kind of analyses based on measurements from air monitoring and meteorological stations that could be used to show the occurrence and geographic extent of the event.³⁸



6.2.4.2 Transport of emissions related to the event in the direction of the monitor(s) where measurements were recorded

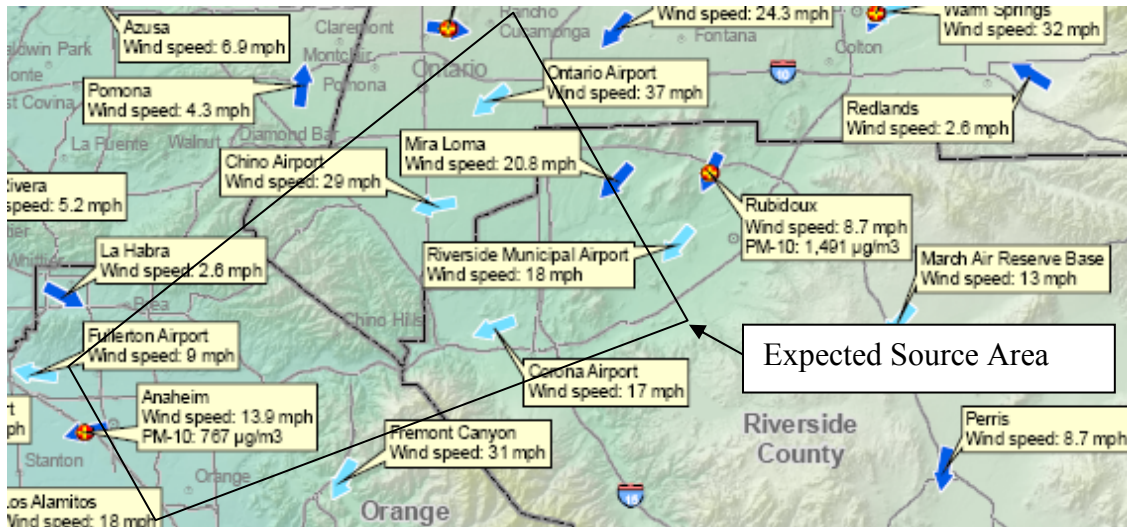
The type of information that would support this kind of evidence is wind direction data showing that emissions from sources identified as part of the nRCP demonstration were upwind of the monitor(s) in question.

- **Example 1:** map showing local sources and wind direction³⁹ – note that the topography gives an indication of sources in this map. Ideally, the likely significant sources such as

³⁸ EPA Region IX

³⁹ EPA Region IX

agriculture fields, desert areas, mountains, and industrial sources would be identified (see next example).

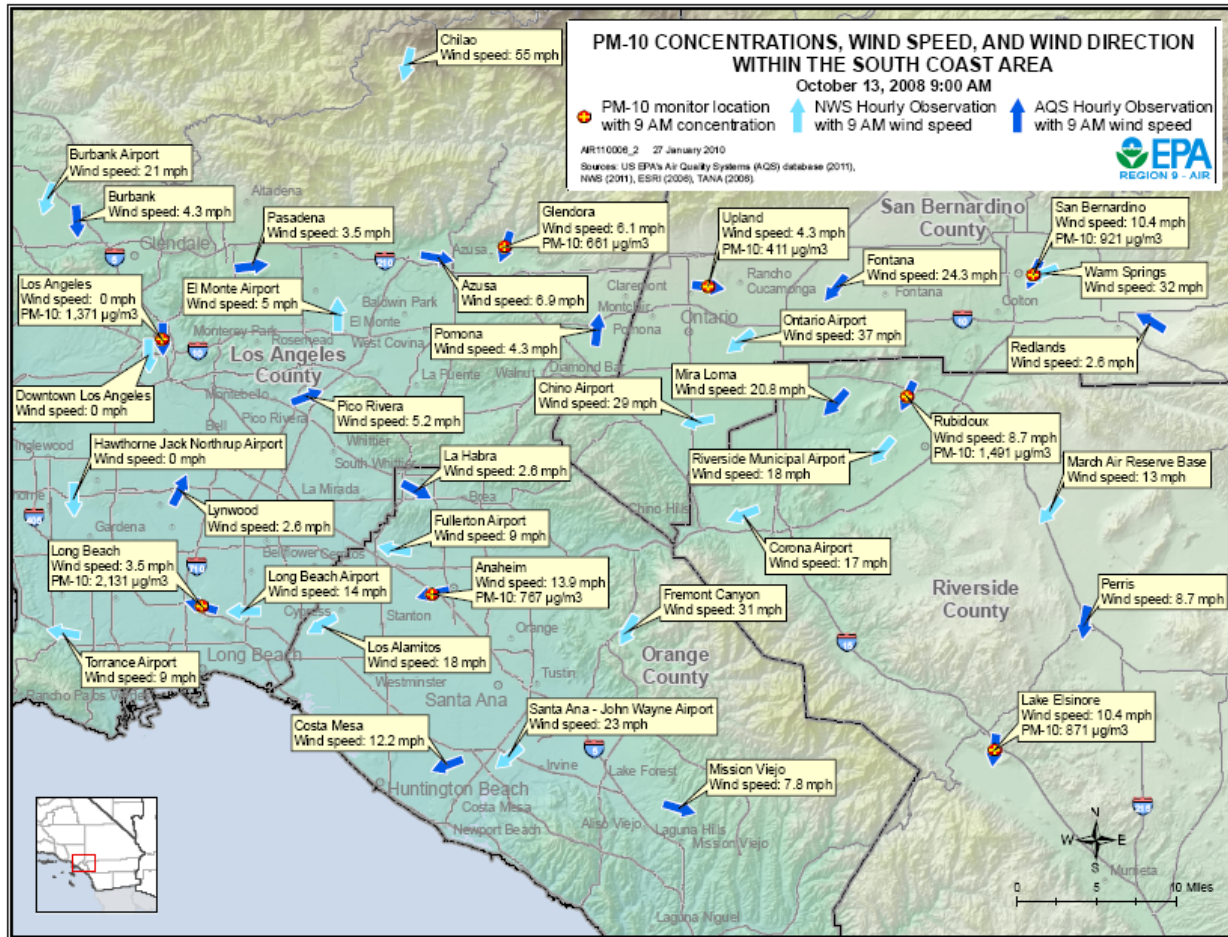


- **Example 2:** trajectories focused on area in question
Even if extensive comprehensive controls analysis is not needed, a back-trajectory analysis as shown in Section 6.2.2.5 would be appropriate as part of the CCR demonstration. Note that HYSPLIT trajectories that cover hundreds of miles are of limited use if the sources of dust are local.
- **Example 3:** wind roses
A wind rose for periods of the event day showing wind speed and direction at or near the concentration monitor, coupled with a description of the area suggested by the wind rose, could provide evidence of where the dust was transported from. This approach may not suffice for situations where the sources of dust are not proximate to the monitor.

6.2.4.3 Spatial relationship between the event, sources, transport of emissions, and recorded concentrations

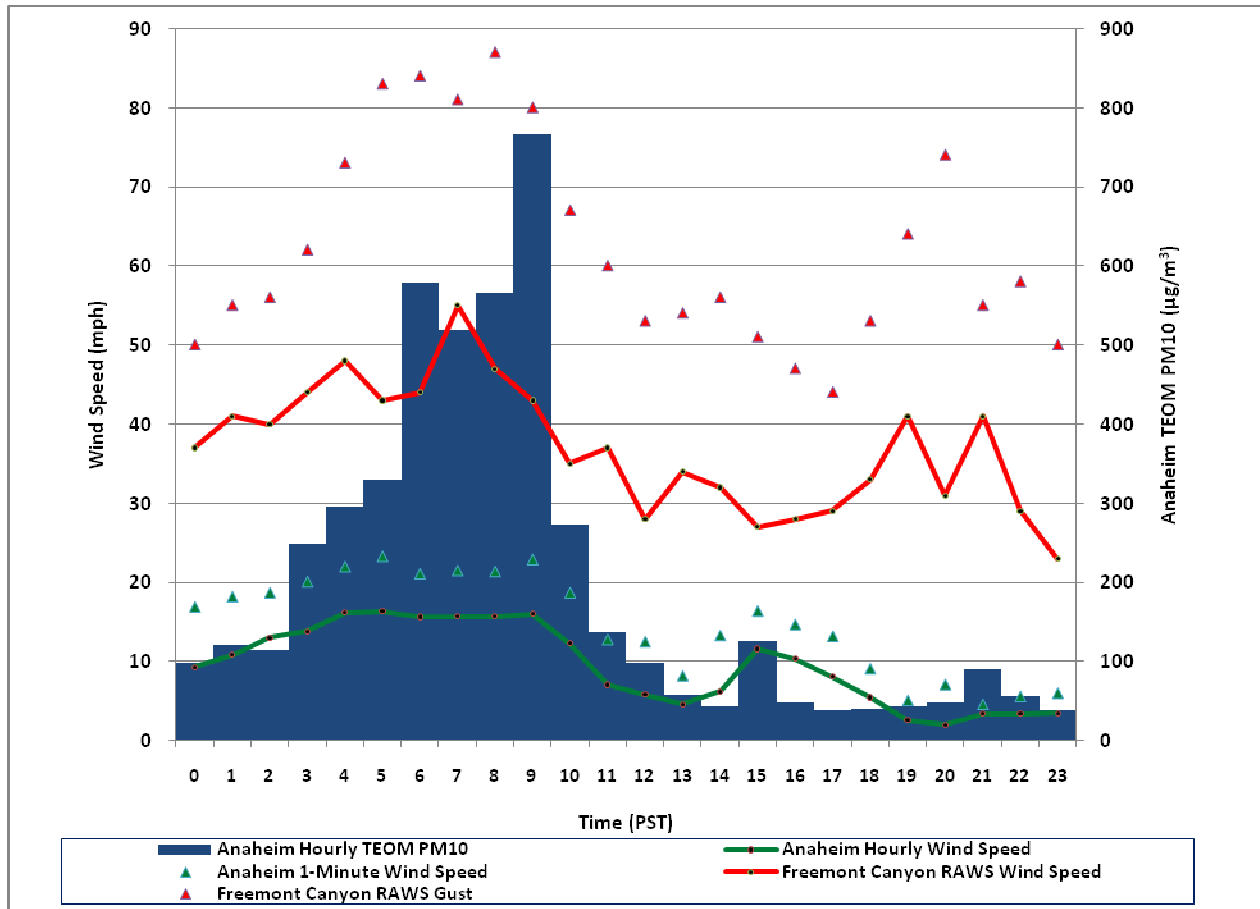
The type of information that would support this evidence could be a map showing likely source area, wind speeds, wind direction, and particulate matter concentrations for the affected area during the time of the event: see the example figure below.⁴⁰

⁴⁰ EPA Region IX



6.2.4.4 Temporal relationship between the high wind and elevated PM concentrations at the monitor in question

Evidence for establishing the temporal relationship can include 24-hour time series showing PM concentrations at the monitor in question in combination with sustained and maximum wind speed data at the area where dust was entrained. As shown below, it is most informative to include the sustained wind speed data for the area of dust entrainment and the concentration data on the same figure.



6.2.4.5 Similarity of chemical composition of measured pollution with that expected from sources identified as upwind

Information such as chemical speciation data from the monitored exceedance(s) and sources, or size distribution data, could be part of this type of evidence. These data are not always available but should be included wherever possible. An example of this type of analysis will be incorporated in this document as one becomes available.

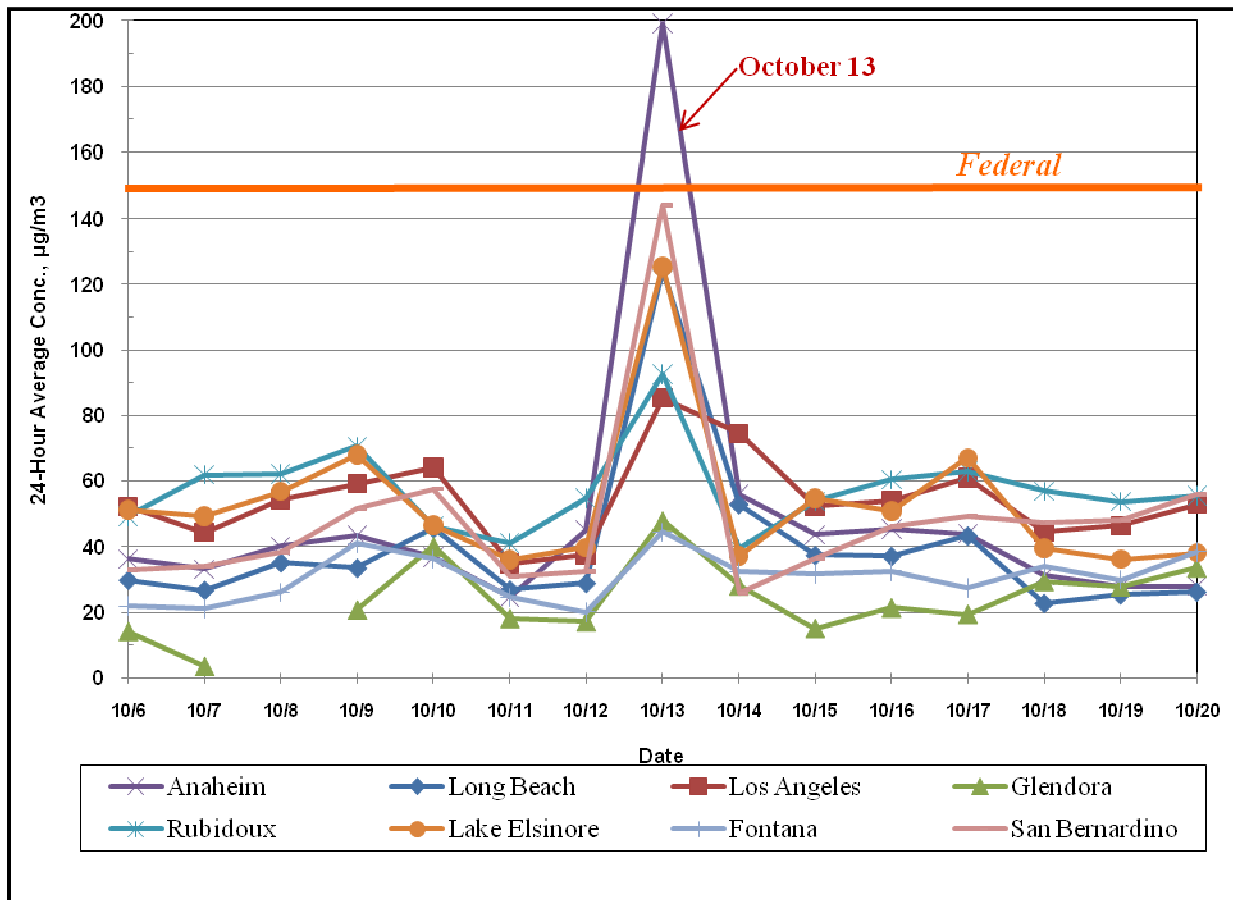
6.2.4.6 Comparison of event-affected day(s) to specific non-event days:

The following types of analyses could be part of this piece of evidence:

- comparison of concentrations and wind speed in the area to days preceding and following the event
- comparison of concentration data to specific days that are similar to the event day with respect to emissions and meteorology except for the high wind
- comparison of chemical composition

The following figure is an example of a comparison of concentrations and wind speed in the area to days preceding and following the event.⁴¹

⁴¹Letter dated November 22, 2010 to Matthew Lakin, Manager Air Quality Analysis Office USEPA Region 9, from Karen Magliano, Chief Air Quality Data Branch California Air Resources Board, transmitting final report dated



6.2.4.7 Comparison of concentration and wind speed during the period of the event to historical (e.g., 3 to 5 years) data: See Section 6.2.3 for discussion and example.

6.2.4.8 Alternative Hypotheses

Eliminating other possible non-event causes supports the claimed causal relationship to the high wind event, although conclusively proving the absence of all possible or plausible other causes is not required or expected. For example, SCAQMD provided the following:

Three wildfires were reported in southern California on October 13, fanned by the strong, dry Santa Ana winds, two in the San Gabriel Mountains north of the San Fernando Valley and one at Camp Pendleton in the north coastal part of San Diego County. Only one of these, the Marek Fire, was active during the early morning hours when the hourly PM₁₀ concentrations spiked at Anaheim. Also, the northeasterly wind flows throughout the period, make it unlikely the smoke or ash from the fires contributed significantly to the PM₁₀ measured at Anaheim. Crustal material from windblown dust was the primary component of the measured PM₁₀, as confirmed by comparing with the PM_{2.5} measured on this day. Prescribed, agricultural or residential burning did not appear to have added any significant amount of PM₁₀ to the concentrations measured in the Basin; these

August 5, 2010 entitled “Analysis of Exceptional Events Contributing to High PM₁₀ Concentrations in the South Coast Air Basin on October 13, 2008.”

activities were not permitted on this day. The PM_{2.5} portion of PM₁₀, which would indicate combustion sources, was very small throughout the Basin. PM₁₀ was emitted from some BACM-controlled sources (mainly agricultural and construction activities) as BACM controls were locally overwhelmed by the high winds. Natural particulate sources areas also contributed to the measured PM₁₀, particularly the upwind mountain and desert areas.

6.2.5 Address Affects Air Quality (AAQ)

Once sufficient HF analyses have been provided and CCR has been demonstrated the event will generally have been considered to have affected air quality at the exceeding monitor, and thus the AAQ element will have been met. Prepare statement that AAQ has been met by providing HF analyses and demonstrating CCR.

6.2.6 Address Human Activity Unlikely to Recur at a Particular Location / Natural Event (HAURL / Natural Event)

Once both CCR and nRCP have been demonstrated, the event will generally be considered a natural event, thus fulfilling the HAURL / Natural Event element. Prepare statement that HAURL / Natural Event has been met by demonstrating nRCP and CCR.

6.2.7 Step 5: Address No Exceedance But For the Event (NEBF)

The NEBF demonstration generally builds on information gathered to support other elements of an exceptional event demonstration. Further, if the exceptional events demonstration fails on a different element then the NEBF analysis becomes moot since there is no portion of the concentration than can be attributed to an exceptional event. For these reasons, EPA suggests that states complete the NEBF demonstration last after addressing all other EER elements.

6.2.7.1 Qualitative NEBF

If non-event pollution levels are typically significantly below the NAAQS during the season of the event then a qualitative NEBF may be adequate. The following is provided as an example⁴²:

Activities that generate anthropogenic PM₁₀ were approximately constant in the Basin immediately preceding, during and after the event. Activity levels in the Basin were typical for the time of year and PM₁₀ emissions control programs were being implemented, not only for fugitive dust-generating activities, but also for agricultural burning in the Basin. Furthermore, due to the forecasts for high winds on October 13, the SCAQMD compliance teams were ready to act quickly to fugitive dust complaints to minimize emissions and to enforce mitigation methods like watering and soil stabilization.

⁴²Letter dated November 22, 2010 to Matthew Lakin, Manager Air Quality Analysis Office USEPA Region 9, from Karen Magliano, Chief Air Quality Data Branch California Air Resources Board, transmitting final report dated August 5, 2010 entitled "Analysis of Exceptional Events Contributing to High PM10 Concentrations in the South Coast Air Basin on October 13, 2008."

Vehicular traffic, cooking and residential fires do not directly cause PM₁₀ 24-hour NAAQS violations in the Basin. Activity levels in the Basin were typical for the time of year and PM₁₀ emissions control programs were being implemented, for fugitive dust-generating activities, as well as open burning. With the unsettled conditions on October 13, such emissions would not contribute significantly to the PM₁₀ measured. There were reasonable and appropriate measures in place to control PM₁₀ in the Basin on October 13, 2008, including SCAQMD Rules 403, 444, 445, 1156, 1157, 1158 and 1186.

Examining the make-up of the PM₁₀ in the Basin on this day using PM_{2.5} data, the coarse particles (PM_{10-2.5}), which are associated with windblown dust, represent well over 75% of the total PM₁₀ mass collected in the Basin. The three wildfires that were burning in the Basin, one of which started on October 12 and two other after the high hourly PM₁₀ concentrations started, were not the primary cause of the high PM₁₀. PM_{2.5} remained relatively low throughout the Basin on this day with no exceedance of the 24-hour NAAQS. While there were no PM₁₀ filters collected on this day for laboratory analyses for soluble potassium, an indicator of wood smoke, the predominance of coarse particles, the timing of the fires and the lack of supporting wind directions to bring smoke to Anaheim provide support the conclusion that while there could have been a minor contribution from the wildfires, it was relatively small portion of the PM₁₀ measured.

Based on the data provided in this report, SCAQMD concludes that there would not have been exceedances of the PM₁₀ NAAQS in the Basin on October 13, 2008 if high winds were not present. Even if the extreme 99.5 percentile concentration for the Basin, 139.5 µg/m³, were used as the background concentration to compare to the measured PM₁₀ concentrations, the particulate contribution from the high wind event clearly caused these exceedances. The causal connection of the measured PM₁₀ and the strong winds in the Basin, and throughout southern California, along with the high contribution of fugitive dust to the PM₁₀ mass indicate that but for the high wind event this NAAQS violation would not have occurred.

6.2.7.2 Quantitative NEBF

A quantitative NEBF will generally be expected if concentrations on days without events during the same season exceed the standard or nearly exceed the standard and/or if the contribution of non-event pollution produces concentrations near the applicable NAAQS. An example of a quantitative NEBF analysis will be incorporated in this document as one becomes available.

Appendix A. Summary of Studies on Windblown Dust Emissions

Windblown dust is a controllable and preventable form of PM₁₀ pollution when wind speeds are below the threshold to entrain dust from reasonably controlled sources. To ensure effective implementation of the EER, it is useful to determine the wind speeds at which windblown dust no longer becomes controllable. To clarify the related definitions in the EER and its preamble, EPA generally plans to apply a 25 mph sustained wind speed threshold for arid areas. Areas with local data supporting alternate minimum wind speeds to entrain dust from stable surfaces are encouraged to submit this information to EPA for review and approval. In EPA's weight of evidence analysis of high wind dust events, sustained wind speeds above 25 mph will be assumed to have the potential ability to raise dust emissions from some stable surfaces in arid, semi-arid, or seasonally dry regions. Wind speeds below this threshold will be assumed to entrain dust emissions primarily from disturbed anthropogenic sources that have not been reasonably controlled. The following summary of pertinent information provides technical justification for the proposed threshold wind speed.

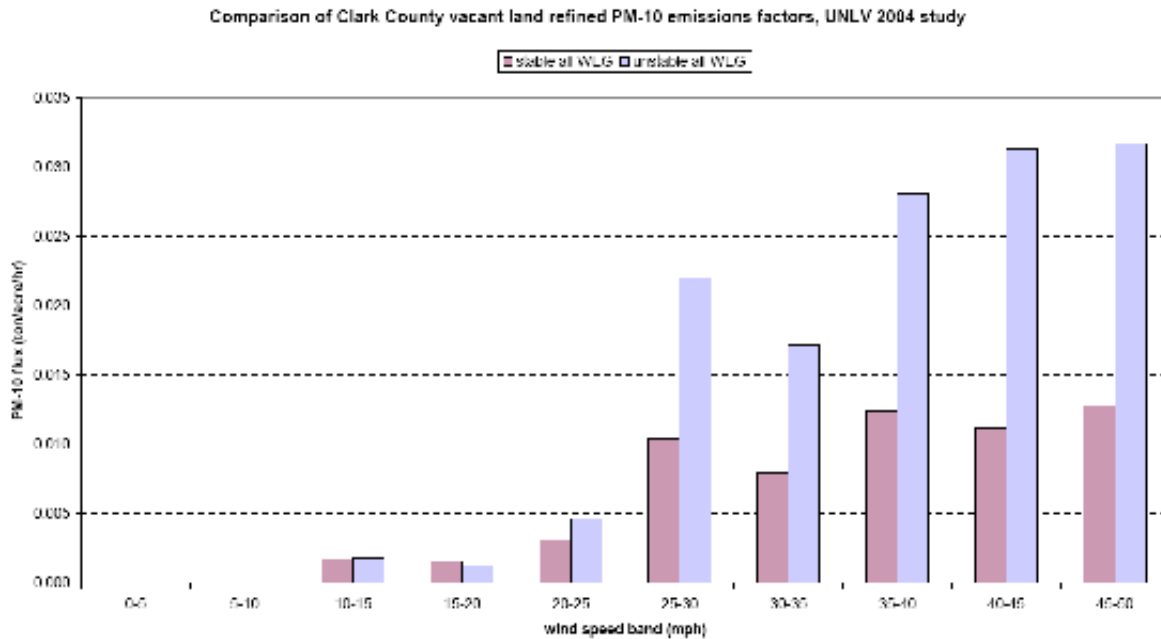
The Clark County Department of Air Quality and Environmental Management (DAQEM) contracted with the Department of Civil and Environmental Engineering, University of Nevada, Las Vegas (UNLV) to conduct field studies to generate refined wind-blown PM₁₀ emissions factors for stable natural, disturbed surfaces that had been re-stabilized, and unstabilized, disturbed surfaces. The latest study was performed in 2004 using a portable wind tunnel at 31 locations in the Las Vegas valley that represented nine different soil groups.⁴³ All of the test sites were determined to be stable through the same methods as outlined in DAQEM's fugitive dust rules for open areas and vacant lots and thus provide a consistent measure of "stable" conditions.⁴⁴ These same test sites were then intentionally destabilized and subsequently retested using the same wind tunnel approach that had been used on the previously stabilized surfaces. A summary of the 2004 field study results can be seen in Figure ES-1. The 2004 data show that non-linear increases in PM₁₀ flux generally begin to occur at sustained 10 meter velocities exceeding 25 mph. These data formed the basis for EPA's selection of a 25 mph threshold for natural events.⁴⁵ Note that the Clark County study found small amounts of entrainment below 25 mph. The small PM₁₀ fluxes observed at lower winds speeds could be attributed to aerodynamic entrainment, which occurs primarily when fine particles are lifted directly off the ground and remain elevated. While it is expected that small amounts of aerodynamic entrainment could occur when wind speeds are below 25 mph, these are not expected to result in exceedances in most western areas, particularly the desert areas such as in Clark County.

⁴³ Sites were characterized in terms of Wind Erodibility Groups (WEGs).

⁴⁴ Clark County Department of Air Quality and Environmental Management Air Quality Regulations, Section 90 – Fugitive Dust from Open Areas and Vacant lots, Subsection 90.4. Test Methods, revised 12/17/2002.

⁴⁵ Refined PM₁₀ Aeolian Emission Factors for Native Desert and Disturbed Vacant Land Areas. Final Report, June 30, 2006.

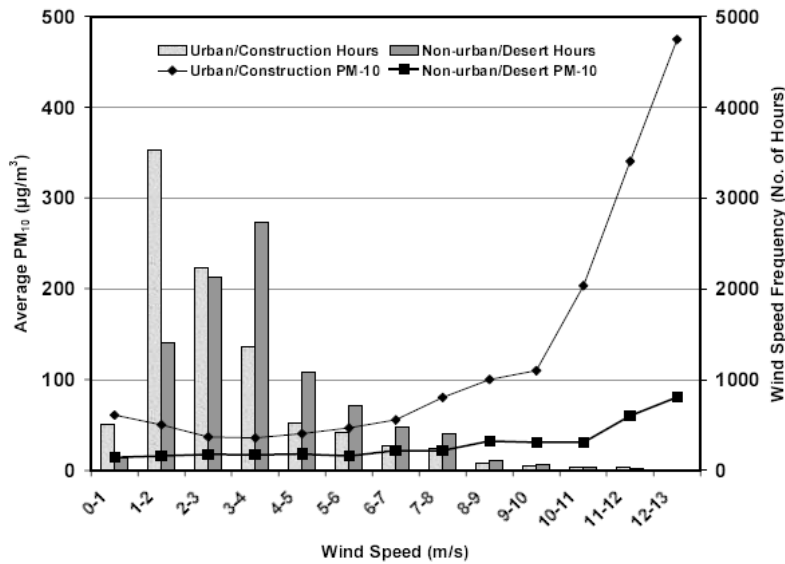
Figure ES 1 Summary of wind blown geometric mean PM 10 Emissions factors, averaged over all wind erodibility groups. UNLV 2004 wind tunnel field study. Error bars omitted to clarify differences between wind speed bands.



Studies conducted by the Desert Research Institute (DRI) in Clark County, NV have concluded that windblown desert dust contributes to approximately 20% of measured PM₁₀ in urban areas and that only desert soils that have been disturbed by anthropogenic activities are large emitters under common high wind conditions.⁴⁶ These studies also conclude that windblown PM₁₀ from urban/disturbed surfaces are not seen until 10 meter hourly average wind speeds are greater than 7 m/s (16 mph), while nonurban desert show a significant increase in PM₁₀ emissions only when hourly average wind speeds are greater than 11 m/s (25 mph). See Figure 3-1 for a graphical representation of these data. The authors note that these results refute the argument that most urban dust derives from natural surfaces.

⁴⁶ Watson, J.G. and Chow, J.C. 2000. Reconciling Urban Fugitive Dust Emissions Inventory and Ambient Source Contribution Estimates: Summary of Current Knowledge and Needed Research. *DRI Document No. 6110.4F*.

Figure 3-1. Average PM₁₀ classified by wind speed from hourly beta attenuation monitor (BAM) measurements at an Urban/Construction site and a Non-Urban/Desert site near Las Vegas, NV during 1995 (Chow and Watson, 1997b; Chow et al., 1999). Wind speeds were measured at 10 m above ground level.



These results are also consistent with results obtained from wind tunnel studies performed throughout the state of Arizona.⁴⁷ These studies suggest that windblown dust emissions from scrub desert and dune flat areas occur when wind speeds are greater than 11.3 m/s (25 mph) and 18.31 (41 mph), respectively. The same study revealed that surfaces that had been disturbed by anthropogenic activities began to produce emissions when wind speeds ranged from 5.11 m/s (11 mph) to 8.11 m/s (18 mph). The effect of surface disturbance on threshold wind speeds was further examined for a number of natural desert soils by a number of researchers.⁴⁸ The main conclusion was that disturbance of soils profoundly lowers the threshold friction velocity of desert soils.

⁴⁷ Nickling, W.G. and Gillies, J.A. 1989. Emission of Fine Grained Particulates From Desert Soils. In *Paleoclimatology and Paleometeorology: Modern and Past Patterns of Global Atmospheric Transport*. Leinen, M. and Sarnthein, M., (Eds.) Kluwer Academic Publishers. 133-165.

⁴⁸ Gillette, D.A. 1980. Threshold Velocities for Input of Soil Particles into the Air by Desert Soils. *Journal of Geophysical Research*. 85: 5621-5630; Gillette, D.A. 1982. Threshold Friction Velocities and Rupture Moduli for Crusted Desert Soils for the Input of Soil Particles into the Air. *Journal of Geophysical Research*. 87: 9003-9015; Belnap, J. 2007. Wind Erodibility of Soils at Fort Irwin, California (Mojave Desert), USA, Before and After Trampling Disturbance: Implications for Land Management. *Earth Surface Processes and Landforms*. 32: 74-84; Belnap, J. 1998. Vulnerability of Desert Biological Soil Crusts to Wind Erosion: The Influences of Crust Development, Soil Texture, and Disturbance. *Journal of Arid Environments*. 39: 133-142.

Appendix B. Checklist for High Wind Exceptional Events Demonstration Submission

Completeness Checklist for High Wind Dust Exceptional Events.

Instructions: This checklist is to be submitted with the exceptional events package for EPA review.

Note that completion of this checklist does not indicate that the event in question is concurable nor does this reflect the entire universe of information that EPA may require to satisfy the demonstration requirements. This checklist represents the minimum information that must be included in a package and serves to identify packages that are incomplete rather than show that a package is complete. In some cases (e.g., very high wind speeds) not all parameters under each criterion will need to be included. EPA will not review incomplete packages; failure to submit a complete package prior to regulatory decision will result in non-concurred events.

Site Name/AQS ID: _____

Pollutant: _____

Date(s): _____

Procedural Criteria		EPA Use
Did an exceedance of the NAAQS occur?	[Y/N]	
Were data flagged by July 1 st of following year?	[Y/N]	
Was there a 30-day public comment period?	[Y/N]	
Is documentation for the comment period included?	[Y/N]	
If public comments were received, are the public comments and responses included?	[Y/N]	
Was the package submitted within 3 years of the end of the quarter in which the event occurred and 12 months prior to the date that any regulatory decision must be made by EPA? [Note: In all cases, EPA encourages submittal within 12 months of when the event occurred.]	[Y/N]	

(over)

Evidence	Information Included	Page(s)	EPA Use
Conceptual Model			
-description of weather phenomena resulting in high wind	[Y/N]	[page #]	
-description of what sources were likely entrained by the high wind	[Y/N]	[page #]	
-explanation of the path by which the dust reached the monitor(s)	[Y/N]	[page #]	
-map showing relevant monitors, topography, other relevant geographic features	[Y/N]	[page #]	
-description of how the event day differs from non-event days	[Y/N]	[page #]	
-description of concentration and wind patterns for the exceeding monitor(s) and surrounding area	[Y/N]	[page #]	
Wind Statistics			
-max sustained wind (5 min avg)	[X mph]	[page #]	
-max gust (1 min avg)	[X mph]	[page #]	
-wind trajectories done?	[Y/N]	[page #]	
-were wind speeds compared to historical data? (i.e., recurrence frequency analysis)	[Y/N]	[page #]	
-other:	[list other wind analyses]	[page #]	
nRCP			
-wind speed at which stabilized surfaces are entrained (default = 25mph)	[25 mph]	[page #]	
-sources contributing to event identified, including anthropogenic vs. natural?	[Y/N]	[page #]	
-controls identified for anthropogenic sources? (note: level of control analysis depends on wind speed)	[Y/N]	[page #]	
-are natural sources not reasonably controllable?	[Y/N]	[page #]	
-was a High Wind Action Plan included?	[Y/N]	[page #]	
HF			
-were time-series analyses for concentration and wind data included?	[Y/N]	[page #]	
-annual comparison to historical data (wind and concentrations)	[%ile]	[page #]	
-seasonal comparison to historical data (wind and concentrations)	[%ile]	[page #]	

CCR (=> AAQ & HAURL / Natural Event)			
-were spatial analyses included, establishing a spatial relationship between the event, sources, transport of emissions, and recorded concentrations?	[Y/N]	[page #]	
-were temporal analyses included, establishing a temporal relationship between the high wind and elevated PM concentrations at the monitor?	[Y/N]	[page #]	
-comparison of event-affected day(s) to specific non-event days?	[Y/N]	[page #]	
-was the dust shown to be from the sources discussed in the nRCP section?	[Y/N]	[page #]	
-were alternative hypotheses discussed?	[Y/N]	[page #]	
-was a causal (not just correlational) relationship established?	[Y/N]	[page #]	
NEBF			
-was a but-for analysis included?	[Y/N]	[page #]	

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