UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

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OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: Guidance on the Preparation of Demonstrations in Support of Requests to Exclude Ambient Air Quality Data Influenced by High Wind Dust Events Under the 2016 Exceptional Events Rule

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TO: Regional Air Division Directors, Regions 1 – 10

The purpose of this memorandum is to distribute a non-binding guidance document titled: "Guidance on the Preparation of Demonstrations in Support of Requests to Exclude Ambient Air Quality Data Influenced by High Wind Dust Events Under the 2016 Exceptional Events Rule" (High Wind Dust Event Guidance).

The EPA Headquarters and EPA Regional offices collaborated in the development of the High Wind Dust Event Guidance to assist air agencies with preparing exceptional events demonstrations for high wind dust events that meet the requirements of Clean Air Act section 319(b) and the Exceptional Events Rule signed on September 16, 2016.

This document is posted on EPA's website at: *https://www.epa.gov/air-quality-analysis/final-2016-exceptional-events-rule-supporting-guidance-documents-updated-tags-guidance*.

Please share this memorandum with appropriate contacts at state, local and tribal air agencies. If you have questions concerning this document, please contact Ben Gibson at (919) 541-3277 or *gibson.benjamin@epa.gov* for further information.

Attachment

Guidance on the Preparation of Demonstrations in Support of Requests to Exclude Ambient Air Quality Data Influenced by High Wind Dust Events Under the 2016 Exceptional Events Rule

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Guidance on the Preparation of Demonstrations in Support of Requests to Exclude Ambient Air Quality Data Influenced by High Wind Dust Events Under the 2016 Exceptional Events Rule

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Air Quality Policy Division
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Research Triangle Park, NC

Disclaimer

The Exceptional Events Rule is the source of the regulatory requirements for exceptional events and exceptional events demonstrations. This document provides guidance and interpretation of the Exceptional Events Rule rather than imposing any new requirements and shall not be considered binding on any party. Any determination that an event is exceptional made on the basis of this guidance will need documentation to support the decision. If and when the Environmental Protection Agency (EPA) takes a regulatory action that relies on a decision to exclude data under the Exceptional Events Rule, EPA intends to publish notice of its proposed action in the *Federal Register*. EPA's concurrence letter and accompanying technical support document will be included in the record as part of the technical basis for that proposal. When EPA issues that regulatory action, it will be a final agency action subject to judicial review.

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Acronyms

AQS	Air Quality System
BACM	Best Available Control Measures
CAA	Clean Air Act
CCR	Clear Causal Relationship
CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
FIP	Federal Implementation Plan
HYSPLIT	Hybrid Single-Particle Lagrangian Integrated Trajectory
km	kilometer
LS/HE/HWD	Large-Scale/High-Energy/High Wind Dust
µg/m3	Micrograms Per Cubic Meter
MODIS	Moderate Resolution Imaging Spectroradiometer
MPH	Miles Per Hour
NAAQS	National Ambient Air Quality Standards
NCDC	National Climatic Data Center
nRC	not Reasonably Controllable
nRCP	not Reasonably Controllable or Preventable
NWS	National Weather Service
PM	Particulate Matter
PM_{10}	Inhalable particles with aerodynamic diameter ≤ 10 micrometers (µm)
$PM_{2.5}$	Fine inhalable particles with aerodynamic diameter ≤ 2.5 µm
RACM	Reasonably Available Control Measures
SIP	State Implementation Plan
TIP	Tribal Implementation Plan

1. Introduction

1.1 Purpose of This Document

The Environmental Protection Agency (EPA) developed this document to assist air agencies[1] in meeting the requirements of the Exceptional Events Rule for high wind dust (*i.e.*, PM_{10} and $PM_{2.5}$) events and to provide example elements for exceptional events demonstrations.

EPA recognizes the limited resources of air agencies that prepare and submit exceptional events demonstrations and of EPA Regional offices that review these demonstrations. One of EPA's goals in developing this document is to establish clear expectations to enable air agencies to better manage resources as they prepare the documentation required under the Exceptional Events Rule and to avoid the preparation and submission of extraneous information. EPA will work with air agencies to help right-size the level of supporting documentation, which will vary on a case-by-case basis depending on the nature and severity of the event, as appropriate under a weight-of-evidence approach.

One purpose of this document is to help air agencies determine the appropriate kinds of information and analyses to include in a demonstration. With the goal of right-sizing demonstrations, this guidance identifies three tiers of analyses for developing evidence for exceptional events demonstrations for high wind dust events. A similar tiering process is recommended in EPA's *Guidance on the Preparation of Exceptional Events Demonstrations for Wildfire Events that May Influence Ozone Concentrations* (EPA, 2016)[2]. In developing this guidance, EPA's goal, in collaboration with air agencies, is to ensure that exceptional events demonstrations satisfy the Exceptional Events Rule criteria and support the regulatory determination(s) for which they are significant.

This guidance identifies important analyses and language to include within an exceptional events demonstration and promotes a common understanding of these elements between the interested air agency and the reviewing EPA Regional office. As a result, this document should help improve efficiency of air agency development and EPA review of high wind dust event demonstrations. While this guidance contains example analyses and language that air agencies may use in their demonstrations, air agencies may also consider additional analyses or information not included in this document if useful to satisfy the Exceptional Events Rule criteria. Additionally, EPA recognizes that new types of analyses, tools, and other types of evidence may become available for demonstrations in the future with continuing advancements in technology.

The Exceptional Events Rule details the regulatory requirements for exceptional events and exceptional events demonstrations. This document provides guidance on applying the rule criteria to the development of demonstrations for high wind dust events that cause monitored PM

[1] References to "air agencies" in this guidance document are meant to include state, local, and tribal air agencies.

[2] "Guidance on the Preparation of Exceptional Events Demonstrations for Wildfire Events that May Influence Ozone Concentrations" is available at https://www.epa.gov/sites/production/files/2016-09/documents/exceptional_events_guidance_9-16-16_final.pdf.

exceedances or violations. The guidance provides examples and recommendations, but does not impose any new requirements. The Exceptional Events Rule its preamble contain additional details beyond the scope of the scope of this document regarding the following: entities authorized to submit demonstrations; the timing associated with demonstration preparation, submittal, and review; the communication and coordination process between air agencies and their EPA Regional office; regional consistency; and other concepts or rule provisions that apply generally to demonstrations for all event types and pollutants.

EPA acknowledges the complexity and diversity of regional conditions across the country. In addition to the rule and this guidance, EPA is further committed to continuing to provide case-specific clarification and assistance to state, local, and tribal air agencies as the Exceptional Events Rule is implemented through communication between EPA Regional offices and the air agencies. Similarly, we intend to post new information and resources as they become available on EPA's exceptional events website at https://www.epa.gov/air-quality-analysis/treatment-air-quality-data-influenced-exceptional-events-homepage-exceptional.

1.2 Statutory and Regulatory Requirements

EPA revised the Exceptional Events Rule in 2016, consistent with Clean Air Act (CAA) section 319(b), which allows for the exclusion of air quality monitoring data influenced by exceptional events from use in determinations related to exceedances or violations of the National Ambient Air Quality Standards (NAAQS). This document provides example language and analyses that may be helpful to address the regulatory requirements for exceptional events demonstrations for high wind dust events that cause monitored particulate matter (PM) exceedances or violations. The revised Exceptional Events Rule at 40 Code of Federal Regulations (CFR) 50.14(c)(3)(iv) clarifies that an exceptional events demonstration must include the following six elements:

1) A narrative conceptual model that describes the event(s) causing the exceedance or violation and a discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s);
2) A demonstration that the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation;
3) Analyses comparing the claimed event-influenced concentration(s) to concentrations at the same monitoring site at other times. The Administrator shall not require a state to prove a specific percentile point in the distribution of data;
4) A demonstration that the event was both not reasonably controllable and not reasonably preventable;
5) A demonstration that the event was caused by human activity that is unlikely to recur at a particular location or was a natural event[3]; and
6) Documentation that the submitting air agency followed the public comment process.

Demonstrations prepared by air agencies and submitted to EPA must address each of the above elements. As part of the initial notification process introduced in the 2016 Exceptional Events Rule, air agencies are required to contact their EPA Regional office and engage in

[3] High wind dust events are considered to be natural events in cases where windblown dust is entirely from natural undisturbed lands in the area or where all anthropogenic sources are reasonably controlled (40 CFR 50.14(b)(5)(ii)).

communications after the air agency identifies potentially event-influenced data to determine whether the identified data may affect a regulatory determination, and to discuss whether the air agency would like to develop and submit a demonstration[4].

EPA encourages air agencies to visit EPA's Exceptional Events website, which contains the final rule, supporting guidance documents, links to external resources, and previously concurred demonstrations, which may provide helpful examples of the kinds of analyses discussed in this guidance. New example demonstrations informed by this guidance will be added to the website as submission and review processes are completed.[5] See https://www.epa.gov/air-quality-analysis/example-demonstrations-and-epa-responses-prepared-under-2016-exceptional-events#PM.

1.3 Scope of This Guidance Document

Event types: This document focuses on the preparation of exceptional events demonstrations for high wind dust events that caused monitored PM exceedances or violations.

Regulatory determinations: The Exceptional Events Rule clarifies that it applies to the treatment of data showing exceedances or violations for the following types of regulatory actions[6]:

- An action to designate or redesignate an area as attainment, unclassifiable/attainment, nonattainment or unclassifiable for a particular NAAQS. Such designations rely on the existence or lack of a violation at a monitoring site in or near the area being designated;
- The assignment or re-assignment of a classification category (marginal, moderate, serious, *etc.*) to a nonattainment area to the extent this is based on a comparison of its "design value" to the established framework for such classifications;
- A determination regarding whether a nonattainment area has attained a NAAQS by its CAA deadline. This type of determination includes "clean data determinations";
- A determination that an area has data for the specific NAAQS, which qualify the area for an attainment date extension under the CAA provisions for the applicable pollutant;
- A finding of State Implementation Plan (SIP) inadequacy leading to a SIP call to the extent the finding hinges on a determination that the area is violating a NAAQS; and
- Other actions on a case-by-case basis if determined by EPA to have regulatory significance based on discussions between the air agency and its EPA Regional office during the Initial Notification of Potential Exceptional Event process.

1.4 Intended Audience for This Document

This document is intended for the national audience of Exceptional Events Rule stakeholders. However, high wind dust events are a phenomenon most commonly experienced in certain areas of the western United States. Consequently, this document may be of most relevance to Exceptional Events Rule stakeholders in the states of Alaska, Arizona, California, Colorado,

[4] 40 CFR 50.14(c)(2)(i)(A).
[5] Example demonstrations available at the time of the completion of this guidance did not reflect the analytical tiering structure introduced in Section 4 of this document for high wind dust event demonstrations.
[6] 40 CFR 50.14(a)(1)(i).

Idaho, Kansas, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington and Wyoming.

1.5 **Definition of a High Wind Dust Event and Related Terminology**

The Exceptional Events Rule at 40 CFR 50.1(p) defines a high wind dust event as an event that includes the high-speed 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.

This guidance uses the following terminology:

- *Evidence* includes, but is not limited to, measurements and analyses based on measurements, as well as qualitative information, such as media reports, time-lapse videos, and National Weather Service forecasts (warnings/advisories).

- *Exceptional event* means an event(s) and its resulting emissions that affect air quality in such a way that there exists a clear causal relationship between the specific event(s) and the monitored exceedance(s) or violation(s); is not reasonably controllable or preventable; is an event(s) caused by human activity that is unlikely to recur at a particular location or a natural event(s); and is determined by the Administrator in accordance with 40 CFR 50.14 to be an exceptional event. It does not include air pollution relating to source noncompliance. Stagnation of air masses and meteorological inversions do not directly cause pollutant emissions and are not exceptional events. Meteorological events involving high temperatures or lack of precipitation (*i.e.*, severe, extreme, or exceptional drought) also do not directly cause pollutant emissions and are not considered exceptional events. However, conditions involving high temperatures or lack of precipitation may promote occurrences of particular types of exceptional events, such as wildfires or high wind dust events, which do directly cause emissions.[7]

- *High wind threshold* is the minimum wind speed capable of causing particulate matter emissions from natural undisturbed lands in the area affected by a high wind dust event.[8] As specified in the Exceptional Events Rule, EPA will accept a threshold of a sustained wind of 25 miles per hour (mph) for certain areas in the western U.S. (Arizona, California, Colorado, Kansas, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah, and Wyoming), provided this value is not contradicted by evidence in the record during the review of a demonstration. In lieu of this threshold, air agencies can establish and use an Administrator-approved alternate area-specific high wind threshold that is more representative of local or regional conditions, if appropriate.[9]

[7] 40 CFR 50.1(j).

[8] 40 CFR 50.1(q).

[9] 40 CFR 50.14(b)(5)(iii). Additional supporting information on high wind thresholds can also be found in Appendices A1, A2, and A3.

- *Large-scale and high-energy high wind dust event* will generally be considered those high wind dust events that are the focus of a Dust Storm Warning,[10] have sustained winds that are greater than or equal to 40 mph;[11] and have reduced visibility equal to or less than 0.5 miles.[12]

- *Natural event* includes a high wind dust event where windblown dust is entirely from natural undisturbed lands in the area or where all anthropogenic sources are reasonably controlled.[13] The Exceptional Events Rule defines "natural event" as an event and its resulting emissions, which may recur at the same location, in which human activity plays little or no direct causal role. For purposes of the definition of a natural event, anthropogenic sources that are reasonably controlled shall be considered to not play a direct role in causing emissions.[14]

1.6 Weight-of-Evidence Approach

Each exceptional events demonstration submitted by an air agency under the Exceptional Events Rule must meet the specific criteria defined in the CAA and the implementing regulations (see section 1.2). EPA understands that the documentation and analyses that air agencies include in demonstrations will vary based on event characteristics, the relationship between the event and the monitor where the exceedance or violation occurred, the complexity of the airshed, and other unique conditions. EPA reviews exceptional events demonstrations on a case-by-case basis using a weight-of-evidence approach. This means EPA will consider all relevant evidence submitted in a demonstration, or otherwise known to EPA, and qualitatively "weigh" this evidence based on its relevance to the Exceptional Events Rule criteria, the degree of certainty, the persuasiveness, and other considerations appropriate to the individual pollutant, as well as the nature and type of event, before concurring or nonconcurring with an air agency's request to exclude data.

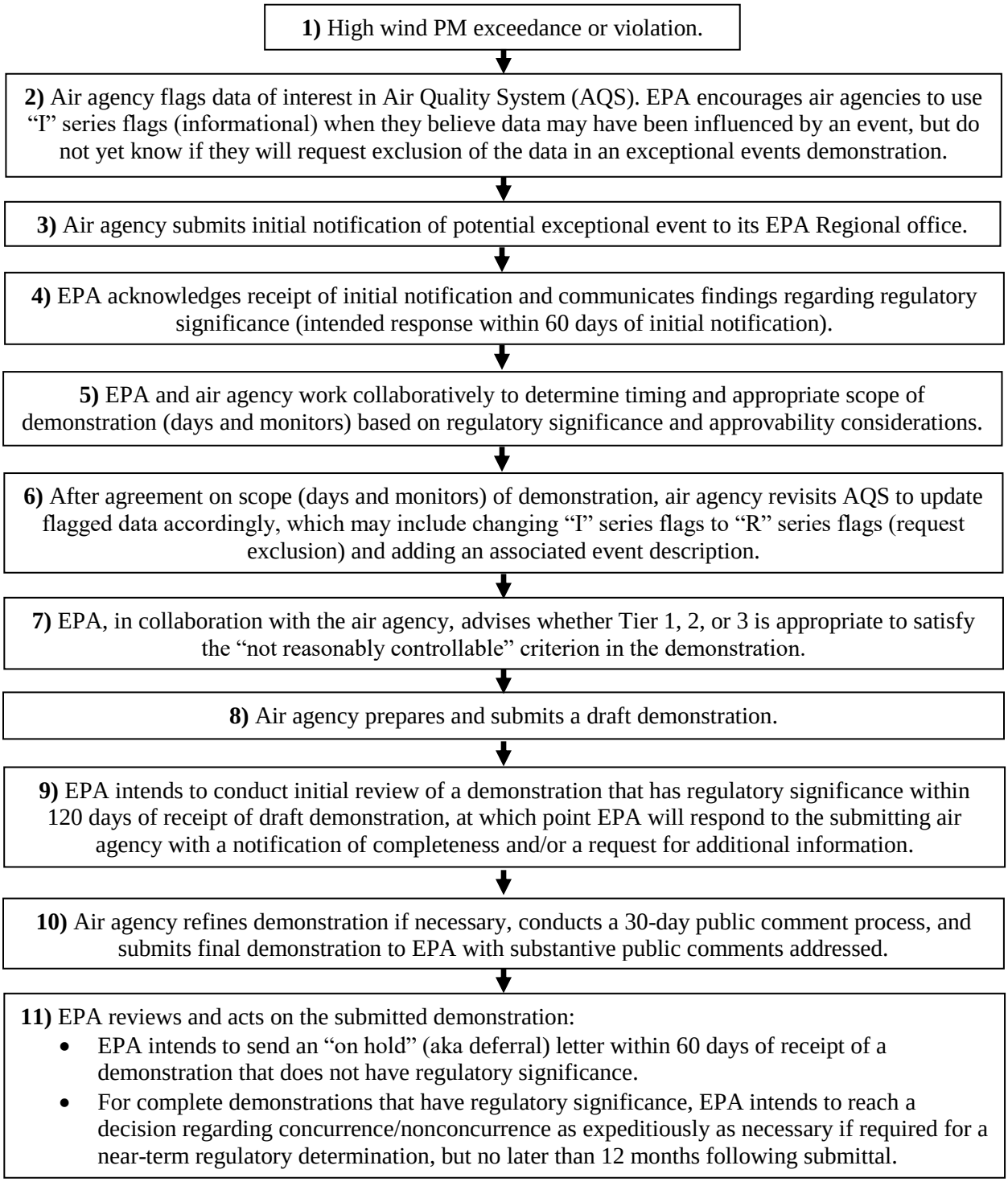
1.7 Recommended Process for Developing, Submitting, and Reviewing an Exceptional Events Demonstration for High Wind Dust Events

Figure 1 summarizes the process for preparing, submitting, and reviewing a high wind dust event demonstration including the intended review timelines. The Exceptional Events Rule requires an air agency to provide an "Initial Notification of Potential Exceptional Event" to its EPA Regional office after the air agency identifies a potential exceptional event.[15] During the initial notification process, EPA and the interested air agency will typically discuss potential event-influenced monitored concentrations, the potential regulatory significance of event-influenced data, and process timing with an affected air agency prior to the air agency preparing and submitting a demonstration.

[10] 40 CFR 50.14(b)(5)(vi)(A).
[11] 40 CFR 50.14(b)(5)(vi)(B).
[12] 40 CFR 50.14(b)(5)(vi)(C).
[13] 40 CFR 50.14(b)(8).
[14] 40 CFR 50.1(k).
[15] 40 CFR 50.14(c)(2).

For high wind dust events, this "initial notification" is expected to include basic information on observed PM concentrations and sustained wind speeds, as well as other case-specific information based on air agency discussions with their EPA Regional office. As part of the initial notification process, EPA and the air agency will also begin discussions regarding the appropriate tier (Tier 1, 2, or 3) for a demonstration. EPA encourages air agencies regularly communicate with their Regional office during the initial notification process and during the development of demonstrations. EPA also encourages air agencies to submit draft demonstrations as part of an iterative and collaborative process.

Figure 1: Flowchart of EPA's recommended process for preparing, submitting, and reviewing exceptional events demonstrations for high wind dust events*



*** Note:** This flowchart is illustrative of a typical exceptional events demonstration process, but the order and nature of some steps may vary based on case-specific circumstances. Please consult with your EPA Regional office at the beginning of the process to establish expectations. 40 CFR 50.14 identifies the required components for the exceptional events demonstration process.

2. Initial Notification Process

2.1 Overview and Exceptional Events Rule Provisions

According to 40 CFR 50.14(c)(2) of the Exceptional Events Rule, "A State shall notify the Administrator of its intent to request exclusion of one or more measured exceedances of an applicable NAAQS as being due to an exceptional event by creating an initial event description and flagging the associated data that have been submitted to the AQS database and by engaging in the Initial Notification of Potential Exceptional Event process. The initial notification requirement is intended to begin a process of regular communication and consultation between air agencies and EPA Regional offices to determine the regulatory implications of a potential demonstration for a specific event."

The Exceptional Events Rule does not require demonstrations to be submitted or data to be flagged in AQS within a certain amount of time following a suspected exceptional event. The only Exceptional Events Rule deadline for demonstration submission is for data that will or may influence the initial designation of an area for any new or revised NAAQS, as detailed in Table 2 to 40 CFR 50.14 of the Exceptional Events Rule. Additionally, air agencies can enter informational "I" (informational) flags at any time and subsequently change "I" flags to "R" (request exclusion) flags at a later date, but air agencies should enter the "R" flags for data requested for exclusion before a demonstration is submitted to EPA. EPA will not be able to act on exceptional events demonstrations for event-related data that has not been assigned an "R" flag in AQS.

The 2016 Exceptional Events Rule and preamble contain extensive information about the initial notification process. Stakeholders are encouraged to review the rule and preamble information and may also contact their EPA Regional office with questions.

2.2 Examples of Supporting Information

Each EPA Regional office can develop its own suggested procedures for the initial notification process, and air agencies are encouraged to contact their EPA Regional office to discuss options. The initial notification may include basic information such as the location of the event, the event type, the pollutant affected, including the impact on the design value, type and timing of regulatory determination anticipated, and other factors of importance to the air agency.

2.3 Example Summary Statement

We recommend air agencies include a summary statement in the demonstration similar to the language below to document that it followed the initial notification process.

"The [air agency] submitted an initial notification to EPA Region [#] and engaged in discussions with its EPA Regional office regarding the demonstration prior to formal submittal. A summary of those discussions and their impact on the final demonstration submittal follows: *(Add summary.)*

3. Narrative Conceptual Model of Event

3.1 Overview and Exceptional Events Rule Provisions

The Exceptional Events Rule requires that demonstrations include a narrative conceptual model describing how the event-related emissions caused the monitored exceedance(s) or violation(s).[16] The narrative conceptual model, included at or near the beginning of a demonstration, is designed to help the EPA Regional office understand the context of the event and its influence on monitored pollutant concentrations. The conceptual model can include summaries of technical information and evidence that provides helpful context for the more detailed Clear Causal Relationship (CCR) analyses. EPA expects that much of the information the air agency discussed with or submitted to EPA during the initial notification process would also be useful in developing the narrative conceptual model.

Subsequent sections of this guidance describe the possible types of evidence and technical analyses that air agencies can include in a demonstration. To be meaningful and clearly interpreted, air agencies should tie these analyses to a simple narrative conceptual model that describes how emissions from a specific high wind dust event caused PM exceedances or violations at a particular location (monitor), and how the event-related emissions and resulting exceedances or violations differ from typical high PM episodes in the area.

3.2 Examples of Supporting Information for the Conceptual Model

The conceptual model should help tie the rule criteria together into a cohesive explanation of the event and how this information is useful in the more detailed clear causal analyses. The narrative conceptual model should describe the principal features of the event and event-related emissions, transport and meteorology (*e.g.*, wind patterns such as strength, convergence, subsidence, recirculation), and how emissions from the event(s) caused the exceedance or violation at the affected monitor(s).

A conceptual model that describes non-event related PM exceedances and illustrates differences between conditions during event day(s) and non-event day(s) can provide helpful context for the CCR analyses. For example, if the directional pattern and speed of winds on the event days differed from most non-event PM exceedance days, the difference can inform a theme in the overall demonstration if it is described in the conceptual model discussion. Section 6 discusses this type of evidence in the context of the CCR.

EPA generally recommends that air agencies include the following kinds of information, where applicable and reasonably available, in the narrative conceptual model:

- Maps and tables of the high wind dust event information including location, temporal path, and spatial extent. The maps should also include the location of the monitor(s) where data exclusion is requested.

[16] 40 CFR 50.14(c)(3)(iv)(A).

- A brief explanation of the cause and point of origin of the event (to the extent known) including a description of the route of the event's windblown dust emissions to the influenced monitor.
- Examples of media coverage of the event, including special weather statements, advisories, and news reports to inform the CCR.
- A description of meteorological forecasts, data, and conditions (*e.g.*, event-specific wind patterns, rainfall, drought conditions) from or near the affected monitor and how this relates to the transport of the high wind dust emissions to inform the CCR.
- A summary of spatial and temporal PM and meteorological patterns on the day of interest, and days before and after the event, relative to other, non-event days (either high PM days, or days with meteorology similar to the event day).
- NAAQS designation and classification information, including the status of the development, submission, and EPA review of any required SIP revision if in a nonattainment area.
- A description of air quality data, including a table of the monitor data requested for exclusion (*e.g.*, date, hours, monitor values, and design value calculations with and without the PM measurements claimed to be due to an exceptional event).
- Expected influence of event-related contributing sources.

Sections 4 through 6 of this document provide additional examples of the types of analyses and evidence that may also help support a conceptual model. Some information provided in a narrative conceptual model can often be directly applicable to CCR analyses, in which case such information may be referenced rather than reproduced in the CCR section of the demonstration.

4. Not Reasonably Controllable or Preventable Criterion

4.1 General Considerations

The Exceptional Events Rule clarifies that a successful demonstration must show that the event was both not reasonably controllable and not reasonably preventable.[17] The not reasonably controllable or preventable (nRCP) criterion plays a significant role in the supporting documentation in high wind dust event demonstrations. EPA does not expect that exceedances caused in whole or in part by anthropogenic dust sources that are not reasonably controlled would qualify as exceptional events under the Exceptional Events Rule.

Not Reasonably Controllable

An event is not reasonably controllable if reasonable measures to control the influence of event-related emissions on air quality were implemented at the time of the event. The reasonableness of measures is case-specific and is evaluated based on information available at the time of the event. To satisfy the not reasonably controllable criterion, the air agency must include the following components in the demonstration:

> 1) Identification of the natural and anthropogenic sources of emissions causing and contributing to the monitored exceedance or violation, including the contribution from local sources;[18]
>
> 2) Identification of the relevant SIP, Tribal Implementation Plan (TIP), or Federal Implementation Plan (FIP) or other enforceable control measures in place for the sources identified as natural and anthropogenic sources of emissions causing and contributing to the monitored exceedance or violation, including the contribution from local sources and the implementation status of these controls;[19] and
>
> 3) Evidence of effective implementation and enforcement of the identified enforceable control measures.[20]

EPA intends to use a three-tiered approach for evaluating whether an exceptional events demonstration shows that a high wind dust event (and its resulting emissions) was not reasonably controllable. Tier 1 demonstrations apply to large-scale and high-energy high wind dust events (Section 4.2). Tier 2 demonstrations apply to events with sustained wind speeds at or above an area-specific high wind threshold (Section 4.4). Tier 3 demonstrations apply to all other high wind dust events (Section 4.5). To determine whether to develop a Tier 2 or Tier 3 demonstration, the air agency should consult with its EPA Regional office and consider the following information:

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[17] 40 CFR 50.14(c)(3)(iv)(D).
[18] 40 CFR 50.14(b)(8)(viii)(A).
[19] 40 CFR 50.14(b)(8)(viii)(B).
[20] 40 CFR 50.14(b)(8)(viii)(C).

1. Sustained wind speed
2. Contributing sources of windblown dust
3. Reasonable controls that address the event-related pollutant and all relevant sources, which may include:
    a. Whether or not EPA has acted within the last 5 years to approve a SIP, TIP, or FIP with respect to the adequacy of measures intended to protect the $PM_{2.5}$ and PM_{10} NAAQS.
    b. Other documented controls as outlined in Section 4.4.2.
4. Implementation and enforcement of reasonable controls
    a. Controls in place at time of event
    b. Effectiveness/enforcement
5. Other relevant factors

As part of the assessment of contributing sources and reasonable controls, if an air agency has identified agricultural activities as contributing to event-related windblown dust emissions, the air agency may also identify applied U.S. Department of Agriculture / Natural Resources Conservation Service-approved conservation management practices designed to effectively reduce fugitive dust air emissions and prevent loss of soil during high winds, if such practices were implemented at the time of the event.

If an area has a SIP/TIP/FIP that was approved 5 years or less prior to the event and that addresses the event-related pollutant and all relevant sources, there is a presumption that controls identified in the applicable plan are reasonable. If an area has an approved SIP/TIP/FIP and the wind speed is above the area's high wind threshold, then it is presumed that emissions are reasonably controlled. If, however, an agency does not have a SIP/TIP/FIP that was approved 5 years or less prior to the event and that does not address the event-related pollutant and all sources, but the event exceeds the high wind threshold, some level of documentation is necessary to satisfy the not reasonably controllable criterion. Additional documentation is necessary when the high wind speed threshold is not met, regardless of whether the area has an approved SIP/TIP/FIP within 5 years.

To facilitate clearer expectations regarding the level of evidence needed to satisfy the not reasonably controllable criterion, the Exceptional Events Rule defined the high wind threshold as the minimum wind speed capable of overwhelming reasonable controls on anthropogenic sources (*i.e.*, significant emissions from controlled sources) or causing emissions from natural undisturbed lands. Typically, undisturbed desert landscapes in the west have a natural crust that protects the surface and tends to prevent windblown dust emissions. Similarly, many anthropogenic sources (*e.g.*, disturbed surfaces) can be reasonably controlled by employing techniques that stabilize surfaces since disturbed surfaces are a primary source of anthropogenic dust. Numerous studies have been conducted to determine the minimum wind speed capable of causing emissions from natural undisturbed areas or overwhelming reasonable controls on anthropogenic sources. The speed at which this occurs varies by location, depending on characteristics of the local landscape (*e.g.*, soil type and characteristics, vegetation) and type and level of control.

As stated in the Exceptional Events Rule, EPA will generally accept a high wind threshold of a sustained wind of 25 mph for areas in the States of Arizona, California, Colorado, Kansas, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah and Wyoming as long as the value is not contradicted by evidence in the record at the time the demonstration is submitted. The default 25 mph high wind threshold is based on extensive windblown dust emissions research performed by the University of Nevada, Las Vegas (UNLV). 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, and unstabilized, disturbed surfaces.[21] Additional information on these studies is provided in Appendix A1.

In lieu of a high wind threshold of sustained wind of 25 mph, states can identify and use an Administrator-approved alternate area-specific high wind threshold that is more representative of local or regional conditions, if appropriate. A summary of literature related to establishing area-specific high wind thresholds is provided in Appendix A2, and guidance on methods for establishing area-specific high wind thresholds is provided in Appendix A3. Air agencies should also consult with their EPA Regional office if interested in developing an alternative high wind threshold for an area.

If sustained wind speeds were below the high wind threshold, it is more likely that human activity had a direct role in causing emissions. Significant emissions under low wind conditions typically occur only if the area has been disturbed by human activity and those sources have not been reasonably controlled. At sustained wind speeds below the high wind threshold it is more likely that local sources contributed or caused the exceedance rather than the entrainment of dust. In such a scenario, more evidence may be needed to satisfy the not reasonably controllable criterion.

When evaluating measured sustained wind speeds, EPA will generally accept that the sustained wind was at or above the area-specific high wind threshold in cases where there was at least one full hour in which the hourly average wind speed was at or above the area specific high wind threshold. EPA will consider a sustained wind speed based on shorter averaging times (*e.g.*, 1 to 5 minutes) on a case-by-case basis. EPA may also consider multiple occurrences of high wind measured at shorter averaging times as part of the weight-of-evidence demonstration, even if the hourly average was not above the threshold. At a minimum, demonstrations should include the maximum sustained wind speed for each hour of the event and the number of periods above the high wind threshold.

Not Reasonably Preventable

The Exceptional Events Rule, at 40 CFR 50.14(b)(5)(iv) states: "In addressing the requirements set forth in paragraph (c)(3)(iv)(D) of this section regarding the not reasonably preventable

[21] Refined PM_{10} Aeolian Emission Factors for Native Desert and Disturbed Vacant Land Areas for Year 2004 - Final Report, June 30, 2006, http://www.clarkcountynv.gov/airquality/planning/Documents/Studies/WindTunnelStudy/CCWindTunnelStudySect4.pdf.

criterion, the State shall not be required to provide a case-specific justification for a high wind dust event." Air agencies may simply include in their demonstration a statement that cites this provision of the Exceptional Events Rule as satisfying the not reasonably preventable criterion for high wind dust events.

4.2 Tier 1: Large-Scale, High-Energy High Wind Dust Events

In the 2016 Exceptional Events Rule, EPA streamlined demonstration requirements for the nRCP criterion for LS/HE/HWD events relative to the demonstration required for other high wind dust events. EPA set criteria to qualify as an LS/HE/HWD based on a review of prior concurred high wind dust events with the aim of characterizing relatively extreme and widespread conditions associated with an event that could be presumed to overwhelm all reasonable controls in its path. Air agencies do not need to include case-specific justification to support the "not reasonably controllable" criterion for LS/HE/HWD events, provided the demonstration shows that a LS/HE/HWD event occurred in the area of the affected monitor(s).

To satisfy the not reasonably controllable criterion for LS/HE/HWD events, a demonstration must document that the event qualifies as an LS/HE/HWD event based on the following criteria in the rule:[22]

1) The event is associated with a dust storm and is the focus of a Dust Storm Warning;
2) The event has sustained winds that are greater than or equal to 40 mph; and
3) The event has reduced visibility equal to or less than 0.5 miles.

In addition, as stated in the Exceptional Events Rule preamble, an LS/HE/HWD event would be associated with measured exceedances occurring at multiple monitoring sites over a *large geographic area* unless the area has only a single PM monitor or if the area has monitors operating on a sampling frequency that does not coincide with the timing of the event.[23]

The National Weather Service (NWS) definition of a dust storm referenced in the preamble and found at http://w1.weather.gov/glossary/index.php?word=dust+storm[24]is: "a severe weather condition characterized by strong winds and dust-filled air over an *extensive area*."[25] The "extensive area" portion of the dust storm definition is consistent with the notion of a "large-scale" event and the "large geographic area" description cited in the preceding paragraph. This concept of scale is a key reason why the Exceptional Events Rule reserves the streamlined LS/HE/HWD controls presumption for Dust Storm Warnings, and not other types of blowing dust advisories, which can be more localized in nature.

Documentation of a Dust Storm Warning issued from either the NWS or a similar scientifically based government entity may be used to satisfy the Dust Storm Warning criterion above. EPA recognizes the wind speed and visibility criteria that constitute a "Dust Storm Warning" may vary by region or issuing agency. The Exceptional Events Rule therefore references the static NWS definition of a dust storm above and sets fixed wind speed (40 mph) and visibility (0.5

[22] 40 CFR 50.14(b)(5)(vi).
[23] 81 FR 68216, 68259 (October 3, 2016).
[24] (last visited April 4, 2019).
[25] 81 FR at 68259 (October 3, 2016).

miles) criteria to qualify for the LS/HE/HWD streamlined controls presumption. Events that do not satisfy any of the specific criteria for the streamlined LS/HE/HWD controls presumption can still qualify as exceptional events if a corresponding demonstration with Tier 2 or Tier 3 analyses satisfies the Exceptional Events Rule requirements.

While visibility must be 0.5 miles or less to qualify as an LS/HE/HWD, the preamble provides some flexibility on the source of this information, recognizing that NWS estimates of visibility may not be readily available: "Many NWS-distributed alerts and advisories include visibility estimates. In addition, many airports provide estimates of surface visibility.[26] Air agencies may also be able to use visibility values determined by nephelometers. To satisfy the visibility criterion, a demonstration for a LS/HE/HWD event should endeavor to include the best evidence available, including specific visibility data. Less precise evidence such as photographic or video documentation of visibility reduction may be considered on a case-by-case basis for this criterion in circumstances where more precise visibility data is not available.

LS/HE/HWD events, by their very nature, have the potential to transport dust over significant distances. In some cases, an LS/HE/HWD may occur at a point of origin outside an affected area, then transport dust to the area and cause elevated PM concentrations even as conditions no longer resemble those of an LS/HE/HWD. In cases where conditions in the area affected by elevated PM concentrations do not satisfy the LS/HE/HWD criteria, even if the criteria were satisfied at a point of origin outside the area's jurisdiction, the affected area would still need to conduct Tier 2 or 3 controls analysis for sources inside its jurisdiction. This is because the streamlined LS/HE/HWD controls analysis presumption is based on a presumption that control measures for sources *in the affected area* were overwhelmed due to the strength and scale of the event. If conditions in the area affected by elevated PM concentrations do not satisfy the LS/HE/HWD criteria, then such a presumption is no longer appropriate. However, as noted in factor 4 of Table 2, air agencies are not required to develop a case-specific justification to satisfy the 'not reasonably controllable or preventable' criterion for sources located outside the air agency's jurisdictional boundaries.

Storm data, including date, estimated damage, as well as meteorological descriptions may be found via National Climatic Data Center (NCDC) Storm data at the following link: https://www.ncdc.noaa.gov/IPS/sd/sd.html. Meteorological data, including hourly visibility measurements, wind speed and wind gust data may be found at https://mesowest.utah.edu/%20 or https://www.ncdc.noaa.gov/cdo-web/datatools/lcd.

4.3 **Reasonable Controls Analysis (Summary Comparison of Tier 2 and Tier 3 Events)**

Air agency demonstrations should include a controls analysis for each specific high wind dust event, with the exception of LS/HE/HWD events. The air agency should identify sources, document whether or not a SIP/TIP/FIP addresses the event-related pollutant and all sources, and confirm the effective implementation and enforcement of controls.[27] The extent of the controls analysis should primarily depend on the level of the wind speed relative to that of the high wind

[26] 81 FR 68259 (October 3, 2016).
[27] 40 CFR 50.14(b)(8)(viii)(A)-(C).

threshold for the area. A basic controls analysis may be sufficient for cases when the sustained wind speed at the source area[28] is greater than or equal to the high wind threshold (Tier 2 – Sections 4.4 and 4.6), while a more comprehensive controls analysis (Tier 3 – Sections 4.5 and 4.6) may be necessary when sustained wind speeds are below the high wind threshold. An event involving windblown dust solely from natural undisturbed landscapes is considered a natural event and therefore not reasonably controllable. Evidence of effective implementation and enforcement of control measures would not be necessary in such a situation.

Table 1 summarizes example controls analysis elements that would be helpful to demonstrate that the event was not reasonably controllable. Not all of the additional controls analysis elements for Tier 3 (incremental to Tier 2) listed in **Table 1** are required for every situation. For example, some types of modeling may only be reliable and appropriate for certain situations, as influenced by local conditions, the type of monitoring technology used, and the nature of the event. EPA encourages air agencies to discuss the merits of specific analyses with their EPA Regional office before developing them for a Tier 3 comprehensive controls analysis.

Table 1 : Summary of example controls analysis elements for not reasonably controllable demonstration

Control Analysis Elements	Basic Controls Analysis (Tier 2)	Comprehensive Controls Analysis (Tier 3)
Description and contribution of anthropogenic sources within the area and existing controls	X	X
Description and contribution of natural sources within the area and existing controls if any	X	X
Identification and implementation status of controls previously recommended by EPA as reasonable, if applicable	X	X
Statement regarding reasonableness of controls	X	X
Explanation that emissions occurred despite controls	X	X
Evidence of effective implementation and enforcement of reasonable controls	X	X
Trajectories of source area		X
Source-specific emissions inventories		X
Meteorological and chemical transport modeling		X

[28] Cases where dust was entrained by sustained winds at or above the high wind threshold upwind of the monitor and subsequently transported at lower wind speeds to the monitor could still qualify for the basic controls analysis category, but in such cases, the state should show that sustained winds were at or above the high wind threshold in the expected source area. Cases of long-range transport (*e.g.*, >50 miles) could still qualify for a basic controls analysis but air agencies may need to include supplementary analyses such as a trajectory analysis (and/or satellite plume imagery) as part of the nRCP or CCR demonstration.

PM filter chemical speciation analysis where filter-based monitors are used		X

4.4 Tier 2: High Wind Dust Events with Sustained Winds at or above the High Wind Threshold

4.4.1 Area has a SIP/TIP/FIP that was approved 5 years or less prior to the event

The Exceptional Events Rule includes a provision whereby nonattainment areas and maintenance areas with approved maintenance plans may qualify for more streamlined documentation to satisfy the not reasonably controllable criterion. Specifically, for areas that experience events with sustained wind speeds above the high wind threshold and that have a SIP/TIP/FIP approved 5 years or less prior to the event that addresses the event-related pollutant and sources, the air agency may rely on only documentation of the implementation and enforcement of the control measures in the SIP/TIP/FIP to satisfy the not reasonably controllable criterion.

EPA selected 5 years as the SIP/TIP/FIP approval window for this presumption because this period represents a reasonable timeframe during which (1) the control measures in a current SIP/TIP/FIP address all event-relevant sources of current importance; (2) the control measures that were considered by the air agency and EPA at the time EPA last approved the SIP/TIP/FIP are the same measures that are known and available at the time of a more recent event; and (3) the conditions in the area have likely not changed in a way that would affect the approvability of the same SIP/TIP/FIP if it newly needed EPA's renewed approval.

The following evidence could be used to satisfy the not reasonably controllable criterion under scenarios where the high wind threshold has been met or exceeded and have an approved SIP/TIP/FIP within 5 years: 1) Evidence comparing the sustained wind speed during an event to the high wind threshold; 2) Evidence that the sustained wind speed above the high wind threshold occurred simultaneously with the high monitored PM concentrations; 3) EPA approved the SIP/TIP/FIP 5 years or less prior to the date of the event; and 4) the SIP/TIP/FIP addresses the event-related pollutant and all sources necessary to fulfill the requirements of the CAA; and 5) Documentation of implementation and enforcement of SIP/TIP/FIP controls that address the event-related pollutant and sources.

Air agencies should work with their EPA Regional office to ensure that their supporting documentation for the not reasonably controllable criterion is sufficient.

4.4.2 Area does not have a SIP/TIP/FIP that was approved 5 years or less prior to the event

This section describes an approach for demonstrating the reasonableness of the controls in place when the sustained wind speed is greater than the high wind threshold, but there is not a relevant SIP/TIP/FIP approved within 5 years of the event. In such scenarios, the air agency should complete a basic controls analysis (outlined in sections 4.4.2.1, 4.4.2.2, and 4.6), and submit documentation that event-related emissions generated by sources in the area meet the not reasonably controllable criterion.

EPA will evaluate reasonableness based on the technical information available to the air agency and any relevant area-specific control requirements in place at the time the event occurred. EPA would generally consider sources under the following conditions as needing high wind dust controls: 1) Formal communication from EPA indicated the need for high wind dust controls on specific sources or source categories; and 2) Promulgation of federal rules required high wind dust controls on specific sources or source categories.

For the applicable anthropogenic sources to be considered reasonably controlled, EPA anticipates that it is reasonable for an air agency to have the controls required based on an area's attainment status. EPA does not expect areas classified as attainment, unclassifiable, or maintenance to have the same level of controls as areas that are nonattainment for the same NAAQS. Also, if an area has recently been designated as nonattainment but has not yet been required to implement controls, the level of controls that is appropriate for the planning stage will generally be expected. In cases where EPA does not require high wind dust controls, air agencies may note where state or local fugitive dust controls that may apply to high wind dust events are implemented and enforced.

Table 2 provides example factors that the air agency and EPA may consider when assessing the reasonableness of controls as part of the nRCP criterion. **Table 2** is not intended to be all-inclusive. Example analyses can be found in exceptional events demonstrations posted on EPA's exceptional events website at https://www.epa.gov/air-quality-analysis/example-demonstrations-and-epa-responses-prepared-under-2016-exceptional-events.

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	The reasonableness of the controls depends on historical concentrations and designation status.
2. Frequency and severity of past exceedances	More stringent controls may be reasonable if an area experiences frequent exceedances due to high winds, but perhaps less so if the area has experienced only infrequent and/or isolated low intensity high wind dust event exceedances.
3. Use of measures that are in widespread use	Controls that are considered "standard practices" and/or measures in widespread use for dust control in other areas could serve as a benchmark for what may be considered "reasonable."

4. Jurisdiction	Consistent with the Exceptional Events Rule preamble, air agencies are not expected to develop a case-specific justification of the not reasonably controllable or preventable requirements for emissions-generating activities originating on lands outside the air agency's jurisdictional lines. However, it may be helpful to identify key event-related contributing sources (without analyzing controls) outside the air agency's jurisdiction for demonstrating a clear causal relationship.

In areas of PM attainment, absent other requirements, controls are not expected for the first high wind dust exceptional event in a PM attainment area because it is generally not reasonable to expect air agencies to undertake control efforts that have not been required to meet a NAAQS (although control of nuisance dust sources or precautionary NAAQS protection often have resulted in fugitive dust control requirements in attainment areas even if high wind dust events have not been previously observed). However, as explained in the Exceptional Events Rule, areas with historically documented or known seasonal events are required to develop exceptional events mitigation plans.[29] Historically documented or known seasonal events generally include events or event seasons of the same type and pollutant that recur in a 3-year period.[30] As part of a mitigation plan, an air agency should identify measures to abate or minimize contributing controllable sources of identified pollutants.[31] The presence of a mitigation plan does not necessarily ensure that nRCP will be satisfied through implementation of the plan's controls alone.

A PM nonattainment area is expected to have reasonable controls in place, although Reasonably Available Control Measures (RACM) and Best Available Control Measures (BACM) for windblown dust are not necessarily required to have been in place at the time of the event for all areas, they are measures that EPA and affected agencies have identified as being reasonable in PM nonattainment areas. For areas with moderate and serious PM_{10} nonattainment areas, the CAA requires RACM and BACM, respectively. EPA will use the local list of RACM or BACM measures (as applicable) as a reference point to review the reasonableness of controls. The control measures evaluated should be related to windblown dust. 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. RACM/BACM lists may be a reference point, but not the sole means, by which EPA assesses the reasonableness of controls. If an air agency believes that EPA should not use RACM/BACM as the reference point for reasonable controls, the air agency should provide supporting rationale and an alternative reference point in the demonstration package.

[29] 40 CFR 51.930.

[30] 40 CFR 51.930(b)(1).

[31] 40 CFR 51.930(b)(2)(ii)(A).

Controls either not in an approved SIP/TIP/FIP, or controls approved by EPA more than 5 years prior to the date of the event, may be considered in the evaluation of reasonable controls. We encourage air agencies to document and account for these types of controls, if relevant. However, it is important to note that such controls will not be given the deference afforded to controls in a SIP/TIP/FIP that EPA has approved within the 5-year period.

4.4.2.1 *Identification of natural and anthropogenic sources*

A basic controls analysis should include a list or table describing the upwind natural and anthropogenic sources of emissions within the air agency's jurisdiction that caused or contributed to the monitored exceedance or violation. The analysis should also provide the location of such sources and, if applicable, should reference the relevant sections of the Conceptual Model or CCR with respect to wind direction and location of upwind sources. One example of how to convey this information would be to overlay source locations and wind direction onto satellite images or GIS maps of the relevant area(s).

4.4.2.2 *Identify SIP, TIP, FIP, or other enforceable control measures*

Documentation should include a list or a table describing the relevant control measures that correspond to the list of contributing sources identified in Step 1 of **Table 2**, including the implementation status of the identified controls. Implementation status should include adoption date, SIP/FIP/TIP approval date, and dates of any subsequent revisions made to applicable control measures.

4.5 Tier 3: High Wind Dust Events with Sustained Winds less than the High Wind Threshold

Unique scenarios may exist where sustained wind speeds of an event are less than the high wind threshold and, in these cases, more in-depth analyses may be required to support the nRCP criterion. Air agencies are strongly encouraged to discuss with their Regional office the appropriateness of analyses before developing the demonstration. In situations where wind speeds are below the high wind threshold, an area must submit documentation that winds were high enough to overwhelm controls that address the event-related pollutant, where applicable as identified in a SIP/TIP/FIP or other documented controls as outlined in Section 4.4.2. If the wind speeds associated with the event are below the threshold required to initiate dust emissions from natural undisturbed lands or stable (*i.e.*, anthropogenically altered but reasonably-controlled) sources, air agencies should submit more detailed information to satisfy the nRCP requirement.

EPA recommends that air agencies complete additional controls analysis (comprehensive controls analysis) when wind speeds are below the high wind threshold. This recommendation is based on the understanding that events with wind speeds below this threshold are not likely to entrain significant dust from natural undisturbed lands and reasonably-controlled sources. Further, EPA anticipates that in scenarios where sustained winds are less than the high wind threshold, windblown emissions in the area are more likely to result from sources that are neither natural nor reasonably-controlled. Thus, the event is less likely to be nRCP. In these cases, air agencies should identify the various land areas and anthropogenic sources contributing to the

event, discuss the controls in place on those land areas and sources, and determine whether those controls were reasonable. Controls either not in an approved SIP/TIP/FIP, or controls approved by EPA more than five years prior to the date of the event may be considered in the evaluation of reasonable controls of disturbed surfaces. We encourage air agencies to document and account for these types of controls, if relevant. However, it is important to note that such controls will not be given the deference afforded to controls in a SIP/TIP/FIP approved by EPA within the 5-year period.

Unique scenarios may exist where the presumed high wind threshold may not be appropriate for some natural areas. In such cases, air agencies may consider discussing with their Regional office whether the not reasonably controllable criterion could be satisfied with wind speeds below the area's high wind threshold. If so, it may be appropriate for the air agency to explore the development of an alternative area-specific high wind threshold.

When high wind dust events are associated with measured sustained wind speeds below the high wind threshold, the documentation should include a comprehensive controls analysis, which involves additional controls analysis elements beyond those in a basic control analysis (see **Table 1**). Comprehensive controls analysis is outlined in **Sections 4.5.1, 4.5.2, and 4.6**.

4.5.1 Identification of natural and anthropogenic sources

Documentation should include, relative to a Tier 2 demonstration, a more detailed review of upwind natural and anthropogenic sources within the air agency's jurisdiction. Examples of more detailed analyses include: air parcel trajectories of source area, day-specific emissions inventories, and analysis of upwind land use information. If wind speeds are low, the probability of uncontrolled anthropogenic sources causing exceedances is greater, and more rigorous analyses may be necessary. More in-depth analysis involving the use of three-dimensional meteorological and chemical transport modeling that adequately replicates the meteorological conditions[32] and associated dust emissions or filter speciation are additional examples to consider. However, consultation with the EPA Regional office should be undertaken before these analyses are conducted.

4.5.2 Identify SIP, TIP, FIP, or other enforceable control measures

Similar to the basic controls analysis, documentation should include a list or a table describing the relevant control measures that correspond to the contributing sources identified in Step 1 of **Table 1**, including the implementation status of the identified controls.

4.6 **Implementation and Enforcement of High Wind Dust Control Measures**

[32] Accurate representation of meteorological conditions is paramount to being able to adequately simulate transport and formation of chemical species in photochemical models. Information on setup and evaluation of meteorological models can be found in Section 2.6 of the Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze (https://www3.epa.gov/ttn/scram/guidance/guide/Draft_O3-PM-RH_Modeling_Guidance-2014.pdf).

In addition to assessing the reasonableness of control measures, to determine whether an event meets the nRCP criterion, the demonstration should provide evidence that the relevant controls identified were effectively implemented and enforced. In their demonstration, air agencies may submit available inspection reports and/or notices of violations in upwind areas to show that all reasonable controls were implemented and functioning properly at the time of the event, or state that no notices of violations exist. EPA recognizes that records may not be available for all events and that agencies have varying methods of permitting and enforcement. EPA therefore does not expect agencies to have the same level of documentation for all events and for all control measures. However, the documentation should make a general showing that the agency has a program in place to ensure control measures are being appropriately implemented and enforced (not necessarily documented on the specific day of the event).

If an air agency identifies several categories of anthropogenic sources as significant or probable contributors to an event, the air agency should also describe in the demonstration the means used to determine compliance with reasonable control requirements for each category. EPA will also consider adoption and implementations dates of specific control measures, and the overall compliance rates or rule effectiveness for specific source categories in determining whether reasonable controls were in place at the time of the event.

In instances where sustained wind speeds are below the high wind threshold, exceedances may occur when reasonable controls are in place but not properly enforced. In these cases, the evidence of effective implementation and enforcement generally should be more detailed and compelling. EPA expects that cases where relevant control measures were not being fully implemented or properly enforced, but reasonably could and should have been, will not be eligible for data exclusion under the Exceptional Events Rule.

An event involving windblown dust solely from natural undisturbed landscapes is considered a natural event and therefore not reasonably controllable. Evidence of effective implementation and enforcement of control measures is not necessary in such a situation.

4.7 Consideration of Controls on Tribal Lands

This section pertains to demonstrations prepared by tribal air agencies. A case-specific justification of the nRCP requirements for emissions-generating activities occurring on lands outside the tribe's jurisdictional lines is not required. However, if sources of emissions causing or contributing to an exceedance or violation are located within the tribe's jurisdiction, a demonstration of reasonable controls is required.

When reviewing the "reasonableness of controls" element within tribal exceptional event demonstration submittals, EPA may consider both controls on tribal sources and cultural factors for tribal lands. For example, EPA could consider tribal cultural factors and subsequently identify "reasonable" controls. It might have been reasonable for the tribal government to encourage the use of certain practices, but not to have required them as a matter of tribal law.

4.8 Example Conclusion Statement

In addition to the supporting information previously suggested, the air agency should include a conclusion statement similar to the language below to demonstrate why the high wind dust event was nRCP:

"The documentation and analysis presented in [section x] demonstrates that all identified sources that caused or contributed to the exceedance [or violation] were reasonably controlled, effectively implemented, and enforced at the time of the event, therefore emissions associated with the high wind dust event were not reasonably controllable or preventable."

5. Human Activity Unlikely to Recur at a Particular Location or a Natural Event

5.1 Overview and Exceptional Events Rule Provisions

According to the CAA and the Exceptional Events Rule, an exceptional event must be "an event caused by human activity that is unlikely to recur at a particular location *or* a natural event" (emphasis added).[33] EPA will consider high wind dust events to be natural events in cases where windblown dust is entirely from natural undisturbed lands in the area or where generation of windblown dust from anthropogenic sources is reasonably controlled.[34]

An event involving windblown dust solely from natural undisturbed landscapes is considered a natural event. However, many high wind dust events affecting the ambient monitoring network include event-related emissions from anthropogenic sources of dust, and their treatment under the Exceptional Events Rule is more complicated. EPA presumes that dust controls on anthropogenic sources shall be considered reasonable in any case in which the controls render the anthropogenic sources as resistant to high winds as natural undisturbed lands in the area. Since anthropogenic sources of windblown dust must be reasonably controlled for the event to be considered a natural event under the Exceptional Events Rule, the air agency must first demonstrate that the nRCP criterion (Section 4) is met. In summary, EPA will generally consider a high wind dust event to be a natural event if the air agency successfully satisfies the nRCP criterion, or if the windblown dust is entirely from natural undisturbed lands.[35]

5.2 Examples of Supporting Documentation

To support this rule element, the air agency should clearly identify the geographic area and conditions of the high wind dust event and describe how windblown dust was entirely from natural undisturbed lands in the area or where all anthropogenic sources were reasonably controlled according to the Exceptional Events Rule definition. Much of this supporting information is likely to already be included in the demonstration's narrative conceptual model and/or the clear causal relationship analyses, in which case this section may summarize and reference it.

5.3 Example Conclusion Statement

In addition to the supporting information suggested in Section 5.2, the air agency should include a conclusion statement similar to the language below to demonstrate that the high wind dust event was a natural event.

"Based on the documentation provided in [Section X] of this submittal, the event qualifies as a natural event. The [exceedance/violation] associated with the event meets the regulatory

[33] 42 U.S.C. § 7619(b)(1)(A)(ii) and 40 CFR 50.1(j).
[34] 40 CFR 50.14(b)(8).
[35] 40 CFR 50.14(b)(5)(ii).

definition of a natural event at 40 CFR 50.14(b)(8). This event transported windblown dust from [natural undisturbed lands/anthropogenic sources that were reasonably controlled at the time of the event] [as documented in X, or because…] and accordingly, [Air Agency Name] has demonstrated that the event is a natural event and may be considered for treatment as an exceptional event."

6. Clear Causal Relationship between the Event/Monitored Concentration

6.1 Overview and Exceptional Events Rule Provisions

The Exceptional Events Rule requires that demonstrations address the technical element that "the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation," in part, with a comparison of event-related concentrations and historical concentrations.[36] Air agencies should support the CCR with a comparison of the PM data requested for exclusion with historical concentrations at the air quality monitor. **Section 6.3** provides guidance on analyses that may be used for this comparison.

In addition to providing information on the historical context of the event-influenced data, air agencies should further support the CCR criterion by demonstrating that the emissions generated by the high wind dust event were transported to the monitor and that the emissions associated with the event influenced the monitored concentrations, causing the monitored PM exceedance or violation. This guidance provides examples of analyses that may be used to support the CCR in a demonstration for a high wind dust event. The analyses that are necessary in a demonstration will vary on a case-by-case basis and air agencies are encouraged to consult with their EPA Regional office to determine the most appropriate analyses.

6.2 General Clear Causal Relationship Considerations and Analyses

In addition to comparing event-related PM concentrations to historical PM concentrations, to satisfy the CCR criterion, a demonstration must show the high wind dust event caused a monitored exceedance or violation of the NAAQS. The CCR demonstration establishes causality between the event and the ambient concentration at the monitor. Simply establishing that high sustained wind speeds coincided with high PM concentrations may not, by itself, demonstrate causality. A correlation between high wind and high concentrations is important, but such a correlation does not independently demonstrate that windblown dust from the natural undisturbed landscape and/or reasonably controlled anthropogenic sources caused the monitored high concentrations. The CCR portion of a demonstration should also include analyses showing that the event-related emissions were transported to the monitor(s) and caused elevated PM concentrations at the monitor. For each relevant high wind dust event, CCR analyses and evidence should be consistent with information presented in the conceptual model.

[36] 40 CFR 50.14(c)(3)(iv)(B)-(C).

Table 3 lists examples of analyses and evidence that, in addition to comparisons of event-related and historical data, may be used to demonstrate a CCR and are detailed in **Sections 6.2.1** through **6.2.7**. The types of analyses necessary in a demonstration will vary on a case-by-case basis, depending on the nature of the event.

Table 3: Example analyses and information to demonstrate a CCR

Key Elements	Examples of Analyses/Information
1. Occurrence and geographic extent of the event.	Special weather statements, advisories, news reports, nearby visibility readings, measurements from monitoring stations, satellite imagery, photographs, video, etc.
2. Transport of event emissions in the direction of and down to the monitor(s) where measurements were recorded.	Wind direction data showing that emissions from the high wind dust event sources identified as part of the nRCP demonstration were upwind of the monitor(s) in question.
3. Spatial relationship between the event, sources, transport of emissions, and recorded concentrations.	Map showing source area(s), wind speed, wind direction, and PM concentrations for the affected area during the time of the event, including trajectory analyses.
4. Temporal relationship between the high wind and elevated PM concentrations at the monitor in question.	Time series showing PM concentrations at the monitor(s) in question in combination with sustained and maximum wind speed data for each affected monitor or source area.
5. Chemical composition and/or size distribution (for $PM_{2.5}$ to PM_{10}) of measured pollution that links the pollution at the monitor(s) with relevant 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 meteorology to days preceding and following the event, comparison to high concentration days in the same season (if any) without events, comparison to other event days without elevated concentrations (if any), comparison of chemical speciation data.
7. Assessment of possible alternative causes for the relevant PM exceedances or violations.	The listing and rationale for excluding other possible anthropogenic causes for the relevant PM exceedances or violations at each monitor.

6.2.1 Occurrence and Geographic Extent of the Event

Air agencies can provide the following information to help establish the occurrence and geographic extent of the event: a description of weather conditions, such as wind speed measurements in the area, nearby visibility measurements, and special weather statements/advisories/watches/warnings; media coverage of the event, photographic images of the area, and time lapse video; a map of PM concentrations; and Moderate Resolution Imaging Spectroradiometer (MODIS) and other satellite maps.

Relevant wind data (*e.g.*, wind speed and direction), including wind speed analyses and statistics, compared to the established high wind threshold is related to demonstrating a CCR between the sustained wind speeds and PM data requested for exclusion at each relevant monitor(s). It is critical that wind direction data indicate that the high wind dust event was upwind of the monitor(s) with PM data requested for exclusion. Since EPA is making monitor-specific exceptional event decisions, on-site and upwind wind speed data in the source area is preferable. If the monitor in question does not collect on-site wind data, the air agency should discuss the possibility of an appropriate surrogate for wind data with its EPA Regional office. The illustrate relevant conditions, EPA recommends the inclusion of a map indicating the identified source area, wind speeds, wind direction, monitor locations, and PM concentrations for the affected area during the time of the event.

6.2.2 Transport of Event Emissions to the Relevant PM Monitor(s)

The air agency should provide evidence to demonstrate that the high wind dust event transported PM to the monitoring location. Critical to this analysis are wind speed and direction data and the location of the PM source area identified as part of the nRCP demonstration.

Examples to support transport of event-related emissions to the monitor(s) include:

- Analysis of Hourly PM and Meteorological Data: If available, one method of establishing transport from the expected event source area to the monitoring location is to plot hourly PM concentrations and associated meteorological data measured in the upwind source area and the affected downwind locations.

- Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT).

- Satellite Imagery: Because plume elevation is not directly available from simple satellite imagery, plume imagery alone does not conclusively show that PM transported aloft by a high wind dust event reached the monitor(s). If plume arrival at a given location coincides with elevated PM concentrations at the monitor, the two pieces of evidence combined can show that dust was transported from the event location to the monitor with the elevated PM concentration.

- Spatial and Temporal GIS Analysis: Detailed hour-by-hour maps of PM concentrations, wind speed, wind direction, and other layers (*i.e.*, land use, source area identification, radar, *etc.*) can show more detailed PM transport throughout an area.

6.2.3 Spatial Relationship Between the Event, PM Sources, Transport of Emissions, and Recorded Concentrations

Air agencies can provide information to help establish the relevant spatial relationships during the event, including area maps of the origin of the high wind dust event, wind direction, anthropogenic/natural PM source locations; monitor locations, and measured PM concentrations.

Maps showing local sources and wind direction should identify probable significant PM sources such as agricultural fields, desert areas, and anthropogenic sources upwind of PM monitors. Trajectory analysis can be used to establish that emissions from sources identified as part of the nRCP analysis were upwind of the monitors in question and are explained in more detail below.

- Air Parcel Trajectories:

  Atmospheric trajectory models use meteorological data and mathematical equations to simulate three-dimensional transport in the atmosphere. Generally, these models calculate the position of particles or parcels of air with time based on meteorological data such as wind speed and direction, temperature, humidity, and pressure. Model results depend on the spatial and temporal resolution of the atmospheric data used and on the attributes of the model itself.

  The HYSPLIT model is frequently used to produce trajectories for assessments associated with air quality programs. HYSPLIT contains models for trajectory, dispersion, and deposition. However, analyses applicable to exceptional events demonstrations typically use the trajectory component. The trajectory model, which uses existing meteorological forecast fields from regional or global models to compute advection (*i.e.*, the rate of change of an atmospheric property caused by the horizontal movement of air) and stability, is designed to support a wide range of simulations related to the atmospheric transport of pollutants. Note that HYSPLIT trajectories that cover hundreds of miles are of limited use if the sources of dust are local.[37]

  Air agencies can produce HYSPLIT trajectories for various combinations of time, location, and plume rise. HYSPLIT back-trajectories generated for specific monitor locations for days of high PM concentrations illustrate the *potential* source region for the air parcel that affected the monitor on the day of the high concentration and provide a useful tool for identifying meteorological patterns associated with monitored exceedances. Forward-trajectories from specific high wind dust events to specific monitors can also be used to indicate *potential* receptors. HYSPLIT trajectories alone cannot definitively prove that a specific region contributed to high pollutant concentrations, but a set of HYSPLIT trajectories that show no wind flow from a particular region on days with high concentrations might support discounting the possibility that sources in the area contributed to the exceedance or violation.

  Air agencies could use other trajectory models to demonstrate expected transport, in which case EPA may request background information and detail supporting the model application to allow reviewers to thoroughly understand the model and, if necessary, to reproduce the results.

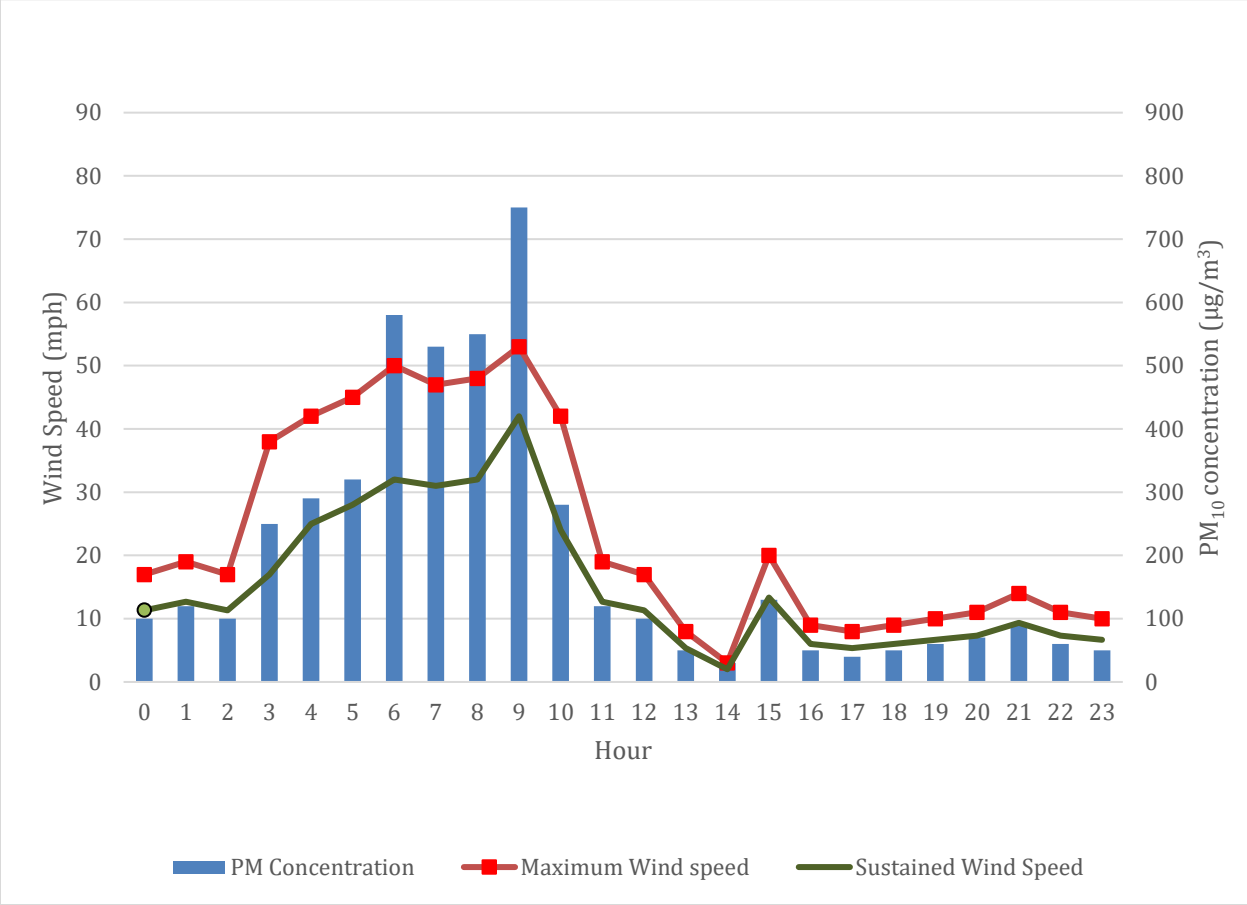
6.2.4 Temporal Relationship Between the High Wind and Elevated PM Concentrations at the Monitor in Question

[37] HYSPLIT runs on a 12-kilometer (km) model grids (for North American Mesoscale Model). Trajectories that cover hundreds of miles may be of limited use for hyperlocal sources within 500 m to 1 km from a monitor and may need further refined analysis. For larger events, 12 km away from a monitor can be considered fairly close.

Where available based on area monitoring methods, the analyses and evidence in the demonstration should include a 24-hour time series plot showing PM concentrations at the monitor(s) in question in combination with sustained and maximum wind speed data for each affected monitor. EPA recognizes that there are times where there is a lag time between entrainment of dust and deposition at a monitor. To support a demonstration that a high wind dust event clearly caused the relevant PM concentrations, the wind speeds should be compared to the relevant high wind threshold, and elevated PM concentrations should have occurred at the same time as, or within a reasonable time after, the high wind speeds. EPA acknowledges that hourly PM data is not always available. As local monitoring methods allow, similar graphs of PM concentrations and maximum wind speeds during the days and/or hours before and after the high wind dust event (e.g., over the course of a week) may also help establish a CCR.

Figure 2 provides an example of when elevated wind speeds and elevated PM concentrations directly coincide (occur in the same timeframe). Maximum wind speed data, where available, can also support a demonstration that an event caused a monitored exceedance. The combination of high sustained wind speed data with maximum wind speed can provide further evidence of the strength of the wind. For example, during particularly strong events the gusts are much greater than the sustained wind. In **Figure 2**, both sustained and maximum wind speeds coincide with elevated PM_{10} concentrations (greater than 150 micrograms per cubic meter ($\mu g/m^3$)) from hour 3 to hour 10.

Figure 2: Temporal relationship between the high wind and elevated PM concentrations at the monitor in question



While wind speed is an important factor for demonstrating the CCR, an event can occur below the defined high wind threshold as long as nRCP is met. If, however, the timing of high wind speeds and elevated PM measurements do not directly coincide, the exceedance is close to the NAAQS, or if there are only isolated PM concentration increases in a network, then the CCR analysis is likely to be more complicated and supplemental information may be needed or is advisable to satisfy the CCR criterion.

EPA recognizes that the timing of high wind speeds may not always directly coincide with monitored elevated PM measurements if the nature of the event or the type of PM result in delayed deposition at the monitor from the time of the occurrence of high wind speeds. In this scenario, additional information may be needed to confirm that the event was clearly the cause of the elevated PM and to rule out other potential causes of the elevated PM measurements. The key conditions to illustrate are the wind speed and that the contributing sources are upwind from the monitor(s) in question. A situation that would need even more analysis and evidence, or result in nonconcurrence, would be when high wind speeds occur *after* the observed high PM concentrations.

6.2.5 Speciation Data: Chemical Composition and/or Size Distribution

On a case-by-case basis, if monitored speciation data exists, it may be helpful for the air agency to include the area's normal speciated data profile (or normal speciated data profile on a high concentration non-event day) as supporting evidence in its demonstration. If an air agency can show with speciation data that the event-day compositions were different than "normal" compositions and/or compositions from specific anthropogenic sources upwind of the affected monitor(s), it can strengthen the case for a clear causal demonstration. Specifically, the agency should examine whether a significant portion of the PM on the event day was comprised of crustal material or contained elemental components consistent with natural soils.

6.2.6 Comparison of Event-Affected Day(s) to Other High Wind Days without Elevated Concentrations

The comparison of event-influenced day(s) to specific non-event high wind days without elevated PM concentrations can be used to help support a CCR. This analysis could include a comparison of meteorological data, including wind speed and visibility, on elevated PM high wind days and non-elevated PM high wind days.

6.2.7 Assessment of Possible Alternative Causes for the Relevant PM Exceedances or Violations

While much of the focus of this section thus far has been on documenting a CCR between the event and the relevant PM concentrations, it may also be useful to rule out or demonstrate the unlikelihood of potential anthropogenic causes of the relevant PM exceedances or violation at each monitor.

Evaluating whether the exceedance had alternative causes, other than the high wind dust event, can be approached in a variety of ways, such as:

- Documenting that the significant non-event PM sources were not upwind of the affected monitors;
- Documenting implementation and enforcement of high wind dust control measures;
- Comparing non-event concentrations of ground-level PM when significant non-event PM sources are upwind of a monitor to those during the high wind dust event;
- Confirming that source non-compliance of significant non-event PM sources upwind of the relevant monitor(s) did not occur at or near the time of the event.

6.3 **Comparing Event-Related Concentration(s) to Historical Concentrations**

As noted above, part of demonstrating a CCR between the event and the monitored PM exceedance involves comparing the exceedance with historical concentrations measured at the affected monitor or at other monitors in the area during the same season. Air agencies should compare the data requested for exclusion with the historical concentrations at the monitor, including all other "high" values in the relevant historical record. If other values in the historical record are believed to have been affected by exceptional events, EPA recommends identifying

those values and including basic information to support that an event caused these high PM values, such as a list of previous high wind dust event dates and locations.

In addition to showing how the level of the event-related PM exceedance compares with historical data, air agencies can also show how the diurnal or seasonal pattern differed, if such a deviation occurred, due to the event. Statistical summaries that characterize non-event, high-concentration day historical data and the differences between event and non-event days would carry more weight than anecdotal or general assertions of when non-event behavior occurs, without evidence or quantification.

The data used in the comparison of historical concentrations should focus on PM concentrations at each monitor claimed to be impacted by the event as well as nearby monitors, when applicable. There is not a pass or fail threshold that exists for the comparison of event-related concentration(s) with historical concentrations.

Table 4 provides examples of types of statistics, graphics, and explanatory text regarding comparisons to historical concentrations. The analyses described in **Table 4** are sufficient to satisfy the rule's requirement regarding the comparison to historical concentration data and the relative concentrations do not need to surpass any specific threshold. The analyses described in **Table 4** are described in more detail in sub-sections of Section 6.3.

Table 4: Example analyses and information for the comparison of historical concentrations

Historical Concentration Evidence	**Examples of analyses/information**
1. Compare the concentrations on the claimed event day with past historical data.	• Provide the data in the form relevant to the form of the standard being considered for data exclusion. • Monthly maximums of the NAAQS-relevant metric (*e.g.*, 24-hour average $PM_{2.5}$) are preferred to monthly or other averaged daily data as the latter can mask high values for the most recent 5-year period that includes the event(s). • Alternatively, if informative, include separate plots for each year (or corresponding season).[38]

[38] "Season" can be pollutant- and area-specific. The general concept behind "seasonal" analyses is to compare the season of anthropogenic pollutant generation to the season in which the event occurred.

2. Demonstrate spatial and/or temporal variability of the pollutant of interest in the area.	• Prepare one or more time-series plots showing the concentrations of the pollutant of interest at the affected monitor and nearby monitors. • Compare concentrations on the event day with neighboring days at the same location (*e.g.,* a time series of two to three weeks) and/or other days with similar meteorological conditions (possibly from other years) at the same or nearby locations with similar historical air quality along with a discussion of the meteorological conditions during the same timeframe.[39]
3. Determine percentile ranking.	• Determine the 5-year percentile of the data requested for exclusion on a per-monitor basis. • Determine the annual ranking of the data requested for exclusion. This assessment may be helpful to show when the non-event concentrations during the year with the exclusion request were lower than surrounding years.
4. Plot annual time series to show the range of "normal" values (*i.e.,* Display Interannual Variability).	• Prepare a time-series plot covering 12 months (or all months in which the data were collected), overlaying at least 5 years of monitoring data from the event-influenced monitor to show how monitored concentrations compare at a given time of year and/or coincide with the subject event. This plot will display the non-event variability over the appropriate seasons or number of years. • For annual comparisons, use the daily statistic (*e.g.,* 24-hour average PM) appropriate for the form of the NAAQS being considered for data exclusion.

[39] If an air agency compares the concentration on the claimed event day with days with similar meteorological conditions, the agency should provide information regarding changes in wind patterns or sources of emissions of the pollutant(s) of concern in the area, including increases or reductions in the emissions inventory, or other emissions information that could have affected relevant concentrations.

5. Identify all "high" values in all plots.	• If applicable, label historically "high" data points as being associated with concurred exceptional events, suspected exceptional events, other unusual occurrences, or high pollution days due to local emissions (provide evidence to support the identification when possible). • Include comparisons omitting known or suspected exceptional events points, if applicable.
6. Identify historical trends (optional if this trends analysis provides no additional "weight").	• Describe how pollutant concentrations have decreased over the 5-year or greater window, if applicable. • Identify and discuss trends due to emission reductions from planning efforts and/or implementing emission control strategies. • Identify and discuss trends or other variability due to meteorology or economics of an area. • If appropriate, create a plot to show how a downward trend in pollutant concentrations over the 5-year or greater historical data record obscures the uniqueness of the event-related concentration.
7. Identify diurnal or seasonal patterns.	• Show how the diurnal or seasonal pattern differs due to the event, if the event causes a change from typical diurnal/seasonal patterns.

6.3.1 Example Comparisons of Concentrations on the Claimed Event Day with Past Historical Data.

A graph exhibiting historical PM concentrations over a 5-year period is one method to compare the claimed event-influenced PM concentration(s) to historical PM concentrations at the same monitoring site. **Figure 3** exhibits historical fluctuations in 24-hour average PM_{10} concentrations, which is the form relevant to the PM_{10} standard, for the 5-year period. Two examples are provided, comparing the claimed event-influenced PM_{10} concentrations (circled or triangulated) to the historical PM_{10} concentrations for the 5-year period: 1) Triangulated data points, with PM_{10} concentrations far above historical concentrations and the PM_{10} standard; and 2) Circled data points, which have concentrations closer to the PM_{10} standard and closer to historical concentrations.

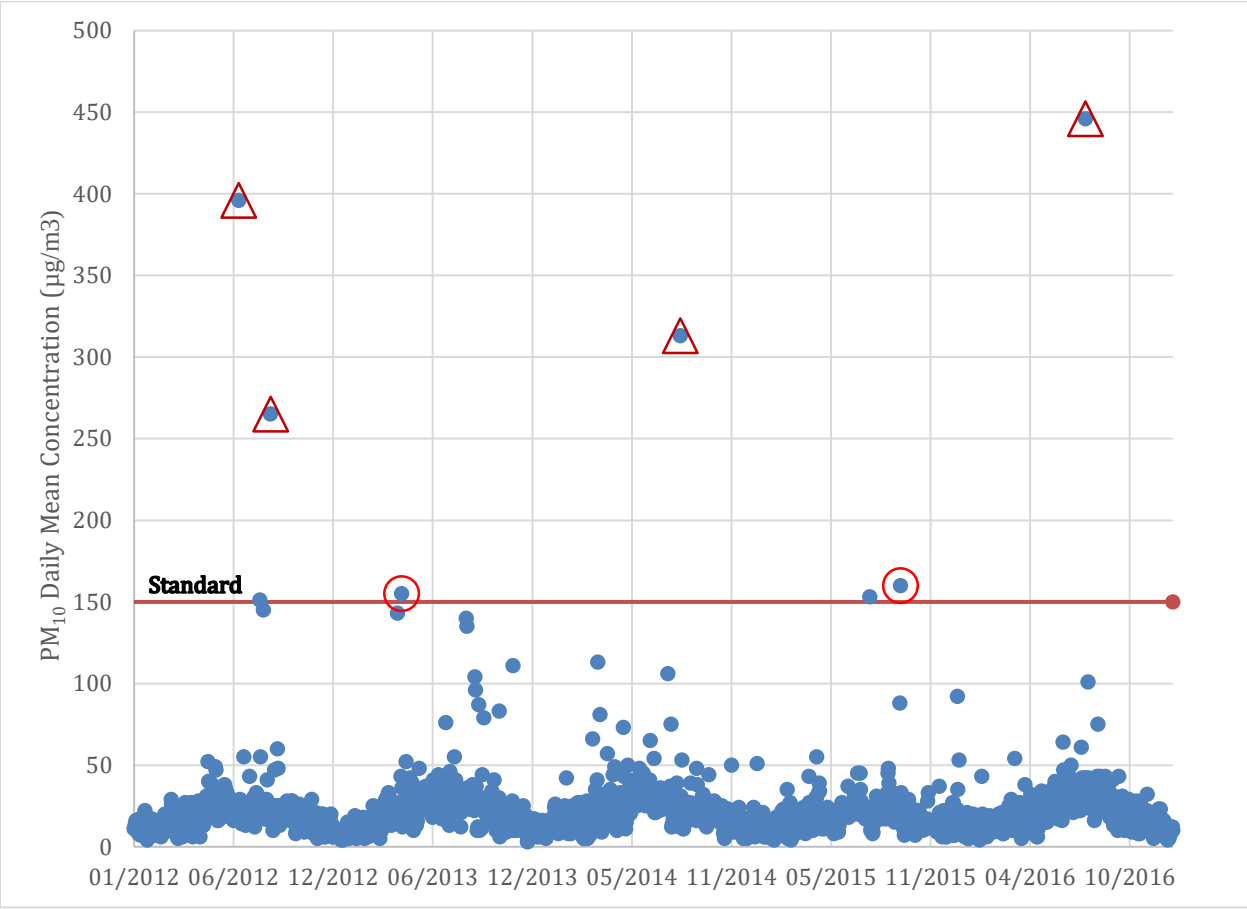
In example 1 (triangulated data points), the greater magnitude of event-influenced concentrations compared to historical concentrations provides context that on event days, concentrations were more likely to be caused by an exceptional event.

In example 2 (circled data points), while the event-related monitored concentrations (circled in red) exceed the 150 $\mu g/m^3$ daily PM_{10} standard, the concentrations are also more similar to historical non-event related concentrations. The circled, claimed event-influenced concentrations are in the upper range of the historical concentrations at the site, but more non-event concentrations historically have occurred in those ranges before. In general, the more the claimed event-influenced concentrations are in the range of non-event historical concentrations at the same site, the more challenging it is to demonstrate a CCR. Such circumstances require additional event-specific evidence to demonstrate there was a clear causal relationship between a natural or reasonably controlled anthropogenic emissions sources and the measured exceedance or violation, as alternate causes (*i.e.*, non-event related emissions) become more plausible.

While the above discussion mentions obtaining and analyzing 5 years of historical PM data, EPA recognizes that 5 years of data may not be available from each relevant monitoring site or that a different historical time period may be appropriate due to area/monitor-specific circumstances.

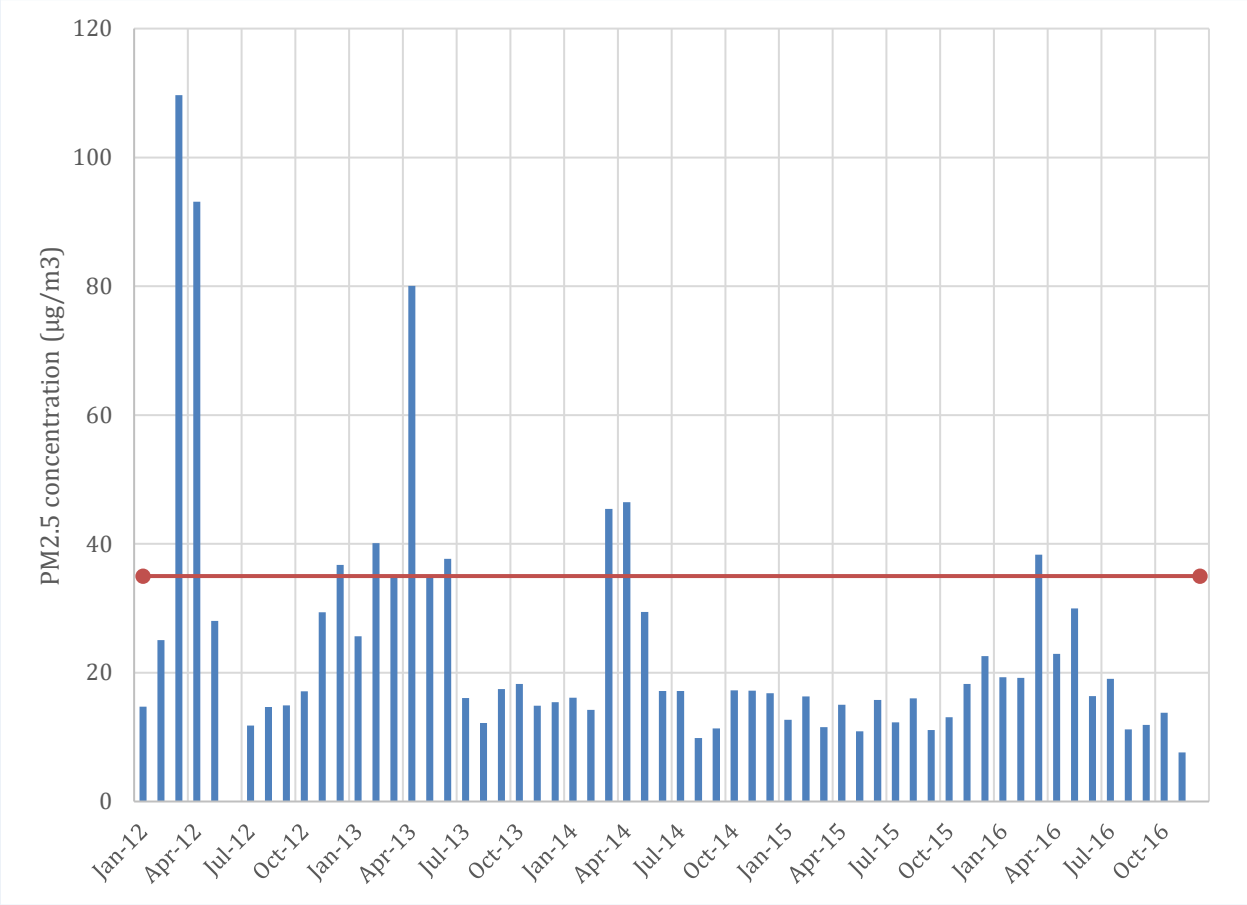
Figure 3: Example plots of historic $PM_{2.5}$ concentrations compared to data requested for exclusion

Under hypothetical example 1, event-influenced concentrations requested for data exclusion are *triangulated* in red. Under hypothetical example 2, event-influenced concentrations are requested for data exclusions are *circled* in red.



It may be appropriate in some cases to present monthly maximums of the NAAQS relevant metric to compare the concentrations on the claimed event day with past historical data. Monthly maximums, as opposed to monthly-averaged data or any other average of the daily data, will not mask high values for the most recent 5-year period that includes the event. **Figure 4** indicates monthly maximums of daily $PM_{2.5}$ concentrations for a 5-year period and can be used to compare the event day concentration to historic monthly maximum concentrations.

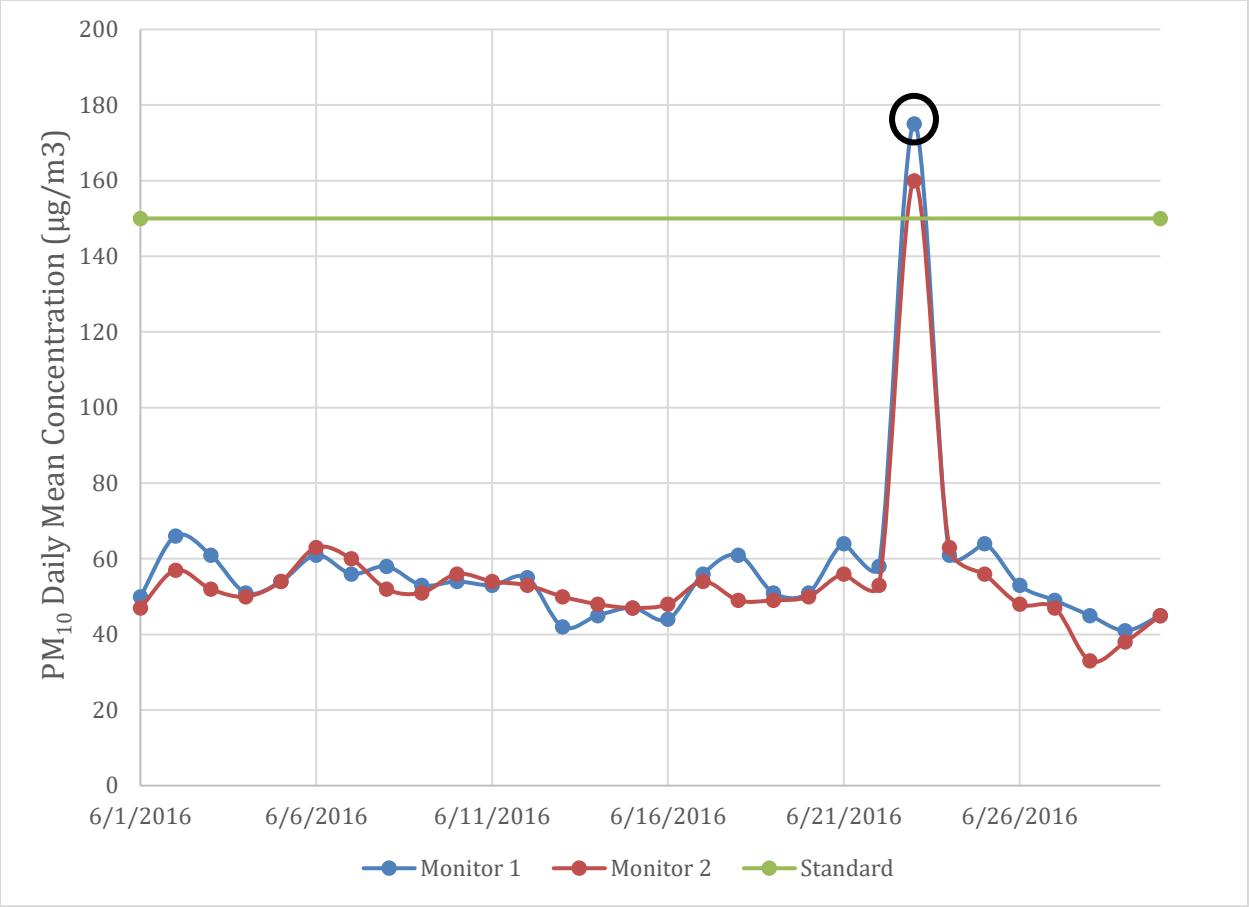
Figure 4: Monthly maximums of daily $PM_{2.5}$ concentrations from 2012-2016



6.3.2 Demonstrate Spatial and/or Temporal Variability of the Pollutant of Interest in the Area

Part of historical concentration evidence could be to compare the concentrations on the claimed event day with a narrower set of similar days by including neighboring days at the same location (two to three-week time series plot) as well as at a nearby location with similar historical air quality. In the hypothetical example in **Figure 5**, the claimed event day is circled, at Monitor 1, with a mean daily PM_{10} concentration on June 23, 2016, of 175 µg/m^3, which is above the daily mean PM_{10} standard of 150 µg/m^3. The plot also illustrates daily mean PM_{10} concentrations at Monitor 2, a nearby monitor with similar historical concentrations in this hypothetical example.

Figure 5: Daily mean PM_{10} concentrations at two monitors. Hypothetical example exhibiting spatial variation between the affected monitor (Monitor 1) and a nearby monitor (Monitor 2)



6.3.3 Determine Percentile Ranking

EPA does not require a specific historical percentile rank point in the seasonal or annual historical data in the analysis or conclusion regarding the clear causal relationship. However, the 5-year percentile of the data requested for exclusion on a per-monitor basis can be useful as a comparison to historical concentrations. In example 2 in **Figure 3** (circled data points), more documentation or evidence may be necessary to demonstrate a CCR between the event and monitored concentration.

6.3.4 Other Evidence and Analyses for the Comparison to Historical Concentrations

Plot annual time series to show the range of historical non-event values. **Figure 3** is an example of a time series plot from the event-influenced monitor, which shows how monitored concentrations at a given time of year compare and/or coincide with the subject event. **Figure 3** uses 5 years of monitoring data, and the time-series plot indicates that annually, in general, mean PM_{10} concentrations tend to be higher in the warmer months and lower during the cooler months. Using the triangulated data points as an example, it is clear that these days are outside the range

of “normal” values. In addition to other analyses for the comparison to historical concentrations, the time-series plot is an appropriate manner to address the range of non-event values, as well as to identify elevated values in plots, such as known or suspected exceptional events, and high pollution days due to local emissions. Time-series plots can also be used to show historical trends, as well as diurnal or seasonal patterns. For example, placing several years of data on the same day-of-year plot can emphasize the seasonal nature of pollution in areas where high seasonal variability occurs, such as in **Figure 3**, which indicates seasonal patterns.

6.4 Example Conclusion Statement

Air agencies should provide supporting evidence and analyses, examples of which are identified in **Sections 6.2-6.3** of this guidance, to document a CCR between the high wind dust event and the monitored PM exceedance or violation. In summarizing the CCR section of a demonstration, the air agency should conclude with this type of statement, which explains how the demonstration meets the relevant statutory and regulatory criteria:

“On [day/time] an [event type] occurred that generated [pollutant X] and resulted in elevated concentrations at [monitoring location(s)]. The monitored [pollutant] concentrations of [ZZ] were [describe the comparison to historical concentrations including the percentile rank over an annual (seasonal) basis]. Meteorological conditions were not consistent with historically high concentrations, etc.” and “The comparisons and analyses, provided in [section X] of this demonstration support [air agency’s] position that the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation on [dates/time of data requested for exclusion, or reference to summary table in demonstration] and thus satisfies the clear causal relationship criterion.”

7. Public Comment Process

7.1 Exceptional Events Rule Provisions

Air agencies must document in their exceptional events demonstration that they followed a public comment process and that the comment period lasted a minimum of 30 days.[40] Where time is limited, and in consultation between EPA and the air agency, the public comment period may take place concurrently with EPA's technical review of an otherwise complete draft demonstration. Air agencies must include as part of its final demonstration package any public comments received, and their submission must address any comments disputing or contradicting the factual evidence in the demonstration.

7.2 Examples of Supporting Documentation

The most appropriate method of making a draft demonstration available for public review and comment shall be determined on a case-by case basis and should be suited to the circumstances and intended audience. In general, it may be sufficient for an air agency to post a draft demonstration on its website, provided the public is provided timely notification of the opportunity to review and comment on the demonstration. The air agency should ensure that relevant stakeholders are aware of the posting. For example, the air agency could submit an email to the air agency listserv announcing the availability of a demonstration for review and comment. The email could include a web link to the draft demonstration document(s) and instructions for submitting comments to the air agency.

Supporting documentation that the air agency followed the public comment process may include the weblink where the public draft demonstration was posted, the opening and closing dates of the public comment period, and a notification letter addressing the opportunity to provide public comment on a draft demonstration (newspaper or webpage notification).

7.3 Example Conclusion Statement

The air agency should include a conclusion statement similar to the language below to demonstrate that it followed the public comment process.

"The [air agency] posted notice of this exceptional events demonstration on [date posted] in the following counties/locations: [list counties affected and locations posted]. [Number] public comments were received and have been included in [Section X] of the demonstration, along with [air agency's] responses to the comments, as appropriate.

[40] 40 CFR 50.14(c)(3)(v).

8. Conclusion

EPA encourages air agencies to contact their EPA Regional office to discuss the applicability of this guidance to a specific event or regulatory scenario. EPA's goal, through communication and collaboration with air agencies, is to help right-size exceptional events demonstrations that can satisfy the Exceptional Events Rule criteria and support the regulatory determination(s) for which they are significant.

Appendix A1. Summary of Studies on Windblown Dust Emissions

Windblown dust is often but not always a controllable and preventable form of PM_{10} pollution. To ensure effective implementation of the Exceptional Events Rule, it is useful to determine the wind speed at which windblown dust no longer becomes reasonably controllable. Agencies may develop a high wind threshold for each area experiencing high wind dust events. Appropriate area-specific thresholds would consider local conditions, sources, and controls and specify a speed above which these controls would be overwhelmed. This approach is consistent with the Natural Events Policy where EPA recommended that the air agencies define the conditions in which BACM level controls were overwhelmed. If an agency is unable to develop an area-specific wind threshold, EPA will generally accept a default threshold of 25 mph for certain areas in the western U.S.[41] provided the agencies support this as the level at which they expect stable surfaces (*i.e.*, controlled anthropogenic and undisturbed natural surfaces) to be overwhelmed. Areas with local data supporting an alternative area-specific high wind threshold should submit this information to EPA for review and approval.

The default 25 mph high wind threshold is mainly based on extensive windblown dust emissions research performed by the University of Nevada, Las Vegas (UNLV). 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 PM_{10} emissions factors for stable natural, and unstabilized, disturbed surfaces.[42] 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] The sites chosen for the wind tunnel tests were determined to be stable "as-is" (*i.e.*, no physical stabilization was performed to alter the site conditions).

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 PM_{10} flux generally begin to occur at sustained 10-meter velocities exceeding 25 mph. Note that the Clark County study found small amounts of entrainment below 25 mph. The small PM_{10} 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

[41] "Areas in the western U.S." for this purpose refers to the states of Arizona, California, Colorado, Kansas, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah and Wyoming.

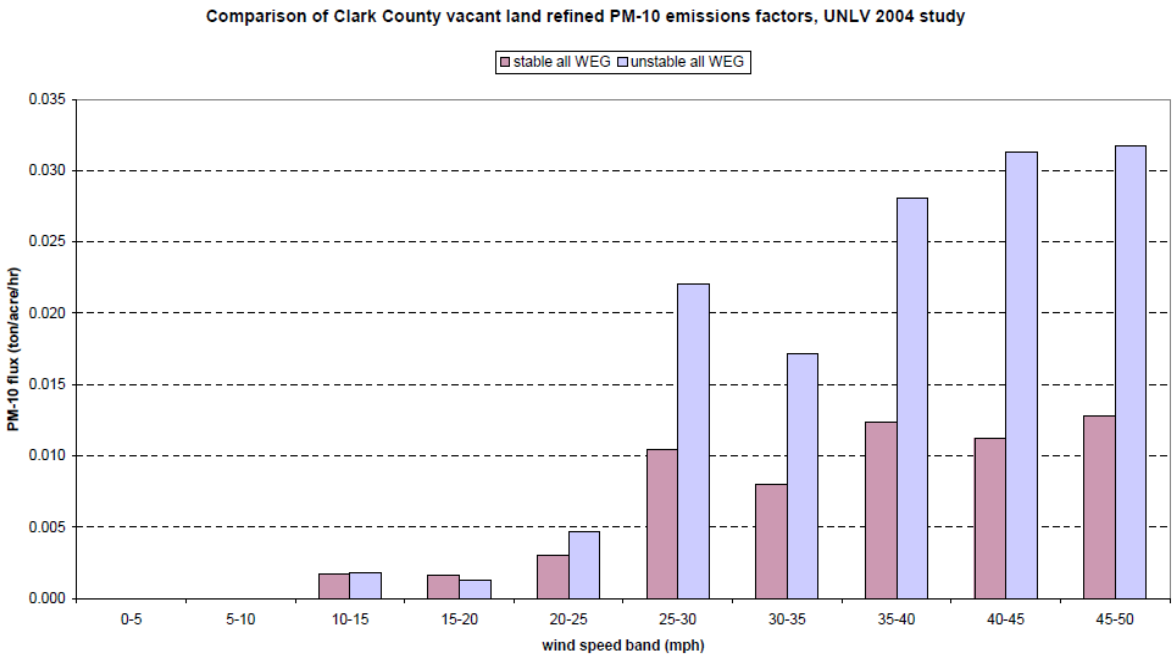
[42] Refined PM_{10} Aeolian Emission Factors for Native Desert and Disturbed Vacant Land Areas. Final Report, June 30, 2006, http://www.clarkcountynv.gov/Depts/daqem/Documents/Planning/SIP/PM10/App_E_-Refined%20Emission%20Factors.pdf.

[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.

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.

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.

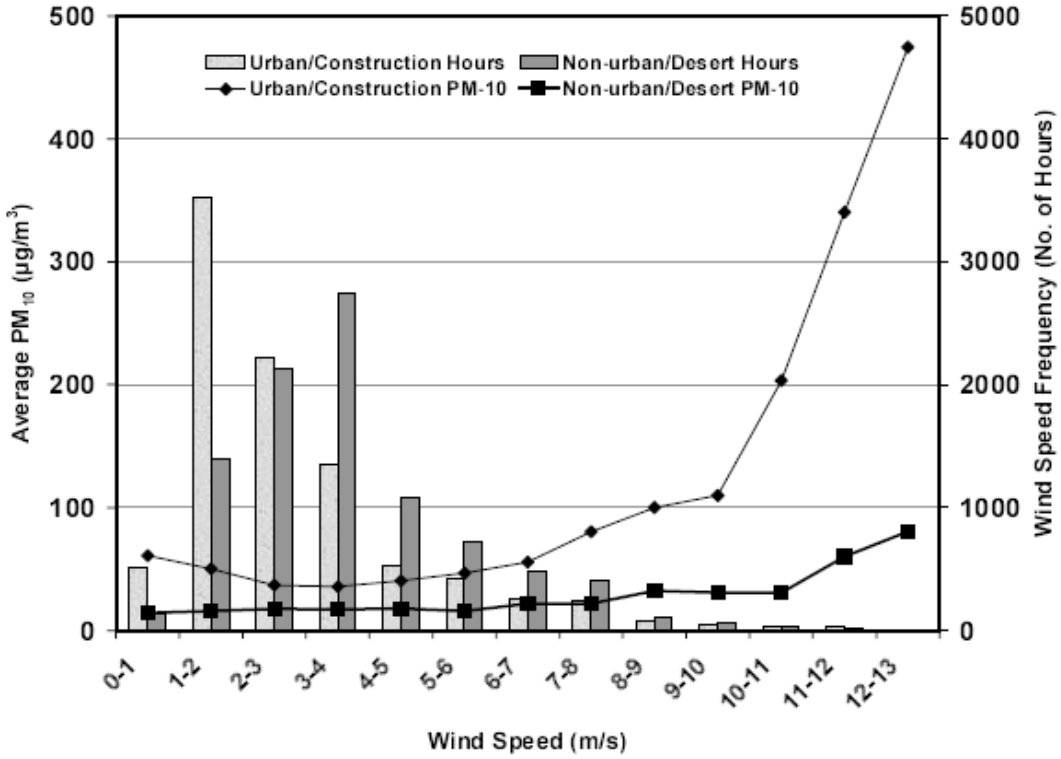


EPA believes that for Clark County and areas similar to it, these results clearly differentiate emissions from stable and disturbed conditions and provide a reasonable baseline for establishing a high wind threshold for exceptional events purposes.

Furthermore, studies conducted by the Desert Research Institute (DRI) in Clark County, NV have concluded that windblown desert dust contributes to approximately 20% of measured PM_{10} in urban areas and that only desert soils that have been disturbed by anthropogenic activities are large emitters under common high wind conditions.[45] These studies also conclude that windblown PM_{10} 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 PM_{10} 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.

[45] 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 PM_{10} classifed 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.[46] 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.[47] The main

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

[47] 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.

conclusion was that disturbance of soils profoundly lowers the threshold friction velocity of desert soils.

In EPA's weight-of-evidence analysis of high wind dust events, EPA will generally assume that sustained wind speeds above the applicable high wind threshold (area specific or 25 mph default) are capable of overwhelming reasonable controls on anthropogenic sources or causing emissions from natural undisturbed areas in arid, semi-arid, or seasonally dry regions, such as in Clark County, NV. Specifically, as stated in the Exceptional Events Rule, EPA will generally accept a high wind threshold of a sustained wind of 25 mph for areas in the States of Arizona, California, Colorado, Kansas, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah and Wyoming as long as the value is not contradicted by evidence in the record at the time the demonstration is submitted. Arid areas in other states may be able to establish a similar area-specific high wind threshold as described in Appendix A3. EPA will generally further assume that wind speeds below this threshold will entrain more dust emissions per acre or square mile from disturbed anthropogenic sources that have not been reasonably-controlled than from natural surfaces and stabilized disturbed surfaces.

Appendix A2. Summary of Literature Related to Establishing Area-Specific High Wind Thresholds

Alfaro, S. 2004. Estimation of PM20 Emissions by Wind Erosion: Main Sources of Uncertainties. Geomorphology, 59: 63-74.

Alfaro, S. 2001 Modeling Mineral Aerosol Production by Wind Erosion: Emission Intensities and Aerosol Size Distributions in Source Areas. Journal of Geophysical Research, 106: NO. D16, 18075-18084.

Benlap, J. and Gillette, D. 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.

Brazel, A.J. and Nickling, W.G. 1986. The Relationship of Weather Types to Dust Storm Generation in Arizona (1965-1980). Journal of Climatology. 6: 255-275.

Brazel, A.J. and Nickling, W.G. 1984. Temporal and Spatial Characteristics of Arizona Dust Storms (1965-1980). Journal of Climatology. 4: 645-660.

Breed, C.S., and Reheis, M.C. (Eds.) 1999. Desert Winds: Monitoring Wind-Related Surface Processes in Arizona, New Mexico, and California. U.S. Geological Survey Professional Paper 1598.

Chow, J.C., Pace, T.G., and Watson, J.G. 2000. Fugitive Dust Emissions. In Air Pollution Engineering Manual, Davis, W.T., (Ed.) Van Nostrand Reinhold, New York, NY.

Countess Environmental. 2006. WRAP Fugitive Dust Handbook. Prepared for Western Governors' Association by Countess Environmental, Westlake Village, California. September 7.

Cowherd, C. 1995. Wind Tunnel Studies of BACM Effectiveness. Final Test Report. Prepared for South Coast Air Quality Management District by Midwest Research Institute (MRI). Contract No. 95017. MRI Project No. 3826.

Cowherd, C. 2000. Wind Erodibility Assessment of the Stabilized Soils in the Antelope Valley. Test Report. Prepared for Southern California Edison and the City of Los Angeles Department of Airports by Midwest Research Institute (MRI). Contract No. U1109008. MRI Project No. 110028.

ENVIRON. 2004. Determining Fugitive Dust Emissions from Wind Erosion. Final Report. Prepared for Western Governors' Association by ENVIRON International Corporation, Novato, California; ERG, Inc., Sacramento, California; Desert Research Institute, Reno, Nevada, MACTEC Engineering & Consulting, Gainsville, Florida and University of California Riverside, Riverside, California. March 12.

ENVIRON. 2006. Fugitive Windblown Dust Emissions and Model Performance Evaluation Phase II Final Report. Prepared for Western Governors' Association by ENVIRON International Corporation, Novato, California and University of California Riverside, Riverside, California. May 5.

Environmental Quality Management and MRI. 2006. An Inventory of Vacant Land Soil Stability and Private Unpaved Roads in the Las Vegas Valley Using Remote Sensing Imagery. Prepared for Clark County Department of Finance Purchasing and Contracts by Environmental Quality Management, Inc. and Midwest Research Institute. PN 70204.001.

Gillette, D.A. 1978. Tests with a Portable Wind Tunnel for Determining Wind Erosion Threshold Velocities. Atmospheric Environment. 12: 2309-2313.

Gillette, D.A., Adams, J., Endo, A., and Smith, D. 1980. Threshold Velocities for Input of Soil Particles into the Air by Desert Soils. Journal of Geophysical Research. 85: 5621-5630.

Gillete, D.A., Adams, J., Muhs, D., and Kihl, R. 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.

Gillette, D.A and Stockton, P.H. 1989. The Effect of Nonerodible Particles On Wind Erosion of Erodible Surfaces. Journal of Geophysical Research. 94: 12855-12893.

Gillette, D.A. 1999. A Qualitative Geophysical Explanation for "Hot Spot' Dust Emitting Source Regions. Contr. Atomos. Phys. 72: 67-77.

Gillies, J.A. and Berkofsky, L. 2004. Eolian Suspension Above the Saltation Layer, the Concentration Profile. Journal of Sedimentary Research. 72: 176-183.

Goudie, A.S. and Middleton, N.J. 1992. The Changing Frequency of Dust Storms Through Time. Climatic Change. 20: 197-225.

Houser, C.A. and Nickling, W.G. 2007. The Emission and Vertical Flux of Particulate Matter <10 μg from a Disturbed Clay Crusted Surface. Sedimentology. 48: 255-267.

Fitz, D.R. 1996. Field Study to Determine Limits of Best Available Control Methods for Fugitive Dust Under High Wind Conditions. Final Report. Prepared for South Coast Air Quality Management District by University of California Riverside, CA. Contract R-C94159.

Kjelgaard, J. 2004. PM10 Emission from Agricultural Soils on the Columbia Plateau: Comparison of Dynamic and Time-Integrated Field-Scale Measurements and Entrainment Mechanisms. Agriculture and Forest Meteorology. 125: 259-277.

Mansell, G.E., Lau, S., Russell, J. and Omary, M. 2006. Fugitive Wind Blown Dust Emissions

and Model Performance Evaluation Phase II. Prepared for Western Governors' Association by ENVIRON International Corporation and the University of California at Riverside College of Engineering.

Macpherson, T., Nickling, W.G., Gillies, J.A., and Etyemezian, V. 2008. Dust Emissions from Undisturbed and Disturbed Supply-Limited Desert Surfaces. Journal of Geophysical Research. doi: 10.1029/2007JF000800.

Neuman, C.M., Boulton, J.W., and Sanderson, S. 2009. Wind Tunnel Simulation of Environmental Controls on Fugitive Dust Emissions from Mine Tailings. Atmospheric Environment. 43: 520-529.

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.

Ono, D. 2006 Application of the Gillette Model for Windblown Dust at Owens Lake, CA. Atmospheric Environment. 40: 3011-3021.

Roney, R.A. and White, B.R. 2004. Definition and Measurement of Dust Aeolian Thresholds. Journal of Geophysical Research. doi: 10.1029/2003JF000061.

Shao, Y., 2000a. Physics and Modelling of Wind Erosion. Kluwer Academic Publishers, Dordrecht, 393 pp.

Sharratt, B., Feng, G, and Wending, L. 2007. Loss of Soil and PM10 From Agricultural Fields Associated with High Winds on the Columbia Plateau. Earth Surface Processes and Landforms. 32: 621-630.

Sierra Research. 2003. Final BACM Technological and Economic Feasibility Analysis. Prepared for San Joaquin Valley Unified Air Pollution Control District by Sierra Research, Inc, Sacramento, California. March 21.

U.S. EPA 1992. Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures. EPA-450/2-92-004.

Wancaser, R., James D., Jeong, H., and Pulurgurtha, S. 2006. Refined PM10 Aeolian Emission Factors for Native Desert and Disturbed Vacant Land Area. Final Report, June 30, 2006.

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.

Appendix A3. Methods for Establishing Area-Specific High Wind Thresholds

As explained in Appendix A1, EPA primarily based the 25-mph threshold on extensive windblown dust emissions research performed by the University of Nevada, Las Vegas (UNLV). During UNLV's studies, researchers used a wind tunnel to quantify emissions from undisturbed areas meeting the definition of "stable" surfaces within Clark County's (Nevada) BACM level fugitive dust regulations and mechanically disturbed open areas. The research performed by UNLV is one of the few field studies that clearly relate BACM level control of windblown dust from open areas and PM_{10} emissions. EPA believes that the study results clearly differentiate emissions from these two types of conditions and provide a reasonable baseline for establishing a high wind threshold that generally can be used for exceptional events purposes for such areas.

While the UNLV study stands out as the most definitive source of information concerning wind speeds capable of overwhelming BACM for open area windblown dust sources and/or causing emissions from natural undisturbed areas, EPA believes that other sources of information can be used to develop an area-specific high wind threshold.

First, EPA encourages state, local, and tribal agencies to evaluate the existing windblown dust literature identified in Appendix A2 when developing an area-specific threshold and determine if any of the preexisting information is applicable to their area. Additionally, in some states for which EPA does not presume the 25-mph high wind threshold, there may be certain arid and dust-prone areas or regions for which the state could establish an area-specific high wind threshold based on a comparison of meteorological, topographical, and other relevant factors with those observed at Clark County in the UNLV studies.

Secondly, while full-scale windblown dust emissions field studies are not always feasible, agencies may deploy temporary monitoring stations or use existing monitoring data to evaluate the effects of wind speed on different source categories. For example, as explained in Appendix A1, DRI used existing monitoring sites in Clark County to evaluate the relationship between urban/construction and non-urban/desert conditions.[48] While this data was independent of the detailed wind tunnel emissions studies performed by UNLV in the same area, the results were similar: nonurban desert show a significant increase in PM_{10} emissions only when wind speeds are greater than 11 m/s (25 mph). EPA believes that this is a valid method for determining an area-specific threshold, but the use of existing monitoring sites (or temporary sites) to establish a wind speed/PM relationship for different source categories should be carefully evaluated for representativeness. For example, sites used to evaluate emissions from natural undisturbed desert areas should not be located downwind of any potential anthropogenic sources, as the influence from such sources would lower the expected high wind threshold. Also, simply correlating PM to wind speed without assessing representativeness of the monitoring site locations does not provide useful information for exceptional events purposes.

[48] 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*.

Finally, area and/or source specific research may be performed, if needed. Specific information on the techniques used to assess windblown dust emissions can be found within the literature listed in Appendix A2.

Regardless of the method used, an area-specific high wind threshold should be consistent with the requirements of the Exceptional Events Rule, specifically nRCP, and representative of wind speeds capable of overwhelming reasonable controls or causing emissions from natural undisturbed areas. EPA generally does not intend to approve the use of an area-specific threshold if these basic principles are not upheld. EPA encourages the state, local, and tribal agencies interested in developing an area-specific threshold to consult with their EPA Regional office regarding the development process and approach.

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