



DEPARTMENT OF
ECOLOGY
State of Washington

Exceptional Event Demonstration for the August 14, 2015 PM₁₀ Exceedance due to High Winds

at Kennewick, Washington

Washington Department of Ecology

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For more information contact:

Air Quality Program
P.O. Box 47600
Olympia, WA 98504-7600
Phone: (360) 407-7528

Washington State Department of Ecology – www.ecy.wa.gov

- Headquarters, Olympia 360-407-6000
- Northwest Regional Office, Bellevue 425-649-7000
- Southwest Regional Office, Olympia 360-407-6300
- Central Regional Office, Yakima 509-575-2490
- Eastern Regional Office, Spokane 509-329-3400

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**Exceptional Event Demonstration
for the August 14, 2015 PM₁₀
Exceedance due to High Winds
at Kennewick, Washington**

by
Caroline (Ying) Sun

Air Quality Program
Washington State Department of Ecology
Lacey, Washington

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Acronyms and Abbreviations

AQS.....	Air Quality System
ARS.....	Agricultural Research Service
BACM.....	Best Available Control Measures
BCAA	Benton Clean Air Authority
BCD	Benton Conservation District
BLM.....	Bureau of Land Management
BMP	Best Management Practices
BPKEN	Bonneville Power's Kennewick monitor
BPHOR	Bonneville Power's Horse Heaven Hills monitor
CAA	Clean Air Act
CCR	Clear Causal Relationship
CFR	Code of Federal Regulation
CP3	Columbia Plateau PM10 Project
CRO	Ecology Central Regional Office
CRP.....	Conservation Reserve Program
CSP	Conservation Security/Stewardship Program
CTIC	Conservation Technology Information Center
EER	Exceptional Events Rule
EPA.....	U.S. Environmental Protection Agency
ERO.....	Ecology Eastern Regional Office
EQIP.....	Environmental Quality Incentives Program
FEM	Federal Equivalent Method
FRM	Federal Reference Method
FSA	Farm Service Agency
GIS	Geographic Information System
GMT.....	Greenwich Mean Time
HAURL.....	Human Activity Unlikely to Recur at a Particular Location
HEL.....	Highly Erodible Land
HELC	Highly Erodible Land Conservation
HHH	Horse Heaven Hills
KENMETA	Monitoring Station at Kennewick, Metaline Avenue
MODIS	Moderate Resolution Imaging Spectroradiometer
MPH	Miles Per Hour
nRCP	Not Reasonably Controllable or Preventable
NAAQS	National Ambient Air Quality Standards
NAMS	North American Mesoscale (forecast system model)
NASS	National Agricultural Statistics Service
NCDC	National Climatic Data Center

NEAP	Natural Events Action Plan
NEP	Natural Events Policy
NSR	New Source Review
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
OWSC	Office of Washington State Climatologist
PDSI	Palmer Drought Severity Index
PDT	Pacific Daylight (Savings) Time
PM	Particulate Matter
PM ₁₀	Particulate matter with an aerodynamic diameter of less than 10 micrometers
PM _{2.5}	Particulate matter with an aerodynamic diameter of less than 2.5 micrometers
PST	Pacific Standard Time
RACM	Reasonably Available Control Measures
RAWS	Remote Automated Weather System
SLAMS	State and Local Air Monitoring Station
TEOM	Tapered Element Oscillating Microbalance
USDA	United States Department of Agriculture
UTC	Coordinated Universal Time
WAC	Washington Administrative Code
WEPS	Wind Erosion Prediction System
WRAP	Western Regional Air Partnership
WSU	Washington State University

Executive Summary

A high wind dust event caused particulate pollution levels to exceed national ambient air quality standard (NAAQS) for PM₁₀ at the Kennewick Metaline Road monitoring station (KENMETA) on August 14, 2015. Washington State Department of Ecology (Ecology) documented this event and provided sufficient evidence based on the requirements of 2016 Exceptional Event Rule (EER) in this demonstration (EPA, 2016). Ecology requests EPA to exclude this PM₁₀ exceedance from NAAQS compliance determinations.

This dust storm impacted the Columbia Plateau in Eastern Washington, including Kennewick. The National Weather Service issued a wind advisory, blowing dust advisory, and dust storm warning throughout the region. The high wind overwhelmed the existing erosion control measures on the agricultural lands and caused the 24-hour PM₁₀ reading of 589 µg/m³ at Kennewick, which exceeded the PM₁₀ NAAQS.

Ecology identified farmlands southwest of Kennewick in the Horse Heaven Hills area as the likely main source of dust for this event. These farmlands are part of the Columbia Plateau, which is highly susceptible to windblown dust because of its semi-arid nature and very fine soil.

The incentive-based conservation programs overseen by the United States Department of Agriculture-Natural Resources Conservation Service are the best available control measures to control and prevent soil erosion and wind-blown dust from agricultural activities. Producers take precautions, when appropriate and feasible, and engage in conservation practices year round. However, there are key stages in crop cycles when lands are vulnerable to soil erosion by high winds. In addition, drought, high temperatures and soil conditions in the months and years leading up to the event also contributed to the vulnerability of the soil and led to wind erosion.

The EER allows exclusion of qualifying NAAQS exceedances from compliance determinations, upon EPA approval. Without exclusion of this exceedance, Kennewick would violate the PM₁₀ NAAQS.

Therefore, Ecology developed this demonstration as required by the EER. Ecology determined that the high wind on August 14, 2015 overwhelmed adequate controls and caused the PM₁₀ exceedance.

Ecology requests EPA to evaluate Ecology's assessment and agree to exclude the 24-hour PM₁₀ value for August 14, 2015, when making compliance determinations using the KENMETA data.

1 Introduction

Ecology submits this exceptional event demonstration for the exceedance of PM₁₀ national ambient air quality standard (NAAQS) that occurred on August 14, 2015 in Kennewick, Washington. This document presents evidence and requests EPA's concurrence with this demonstration to exclude this value from regulatory compliance determination for this area.

Kennewick, together with Pasco and Richland, comprises the Tri-Cities and is located on the Columbia Plateau. The dominant land use and source of PM₁₀ in the area is agriculture activities. Producers use the best available control measures, incentive-based United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) practices, to control and prevent soil erosion (USDA, 2016). However, high temperatures and a multi-year drought left the soil vulnerable in the Horse Heaven Hills (HHH) source area and contributed to the enhanced wind erosion in 2015.

On August 14, 2015, a strong cold front brought southwest high winds at 25 to 35 miles per hour (mph) with gusts of more than 50 mph. The high wind dust event overwhelmed controls on agricultural lands and caused the elevated 24-hour PM₁₀ level of 589 µg/m³. This value exceeded the 24-hour PM₁₀ NAAQS of 150 µg/m³ at the Kennewick Metaline Road monitoring station (KENMETA, Air Quality System site number 53-005-0002, POC 3) on August 14, 2015.

EPA adopted the Exceptional Event Rule (EER) on March 22, 2007 (EPA, 2007) and revised the rule on October 3, 2016. EPA developed this rule to not penalize adequately controlled areas for events beyond their control. The EER provides criteria and process for states to demonstrate and EPA to approve/disapprove under these circumstances. Ecology developed this demonstration to meet the following requirements of the 2016 EER to exclude the PM₁₀ exceedance on August 14, 2015 from compliance determination of PM₁₀ NAAQS (See Section 3 for details) (EPA, 2016):

- A demonstration that this event met the high wind threshold of a sustained wind speed of 25 mph or alternative area-specific high wind threshold.
- A narrative conceptual model to describe the event and discuss how the emissions from the events led to the exceedance/violation;
- A demonstration that there exists a clear causal relationship between the measurement and the event;
- Analyses comparing the event-influenced concentration to concentrations at the same monitoring site at other times to support item C above;
- Evidence that the event was not reasonably controllable or preventable; and

- Evidence that the event was a human activity that is unlikely to recur at a particular location, or was a natural event.

Ecology also fulfilled the following procedural requirements:

- Provide prompt public notification whenever air quality concentrations exceed or Ecology expects them to exceed an applicable NAAQS;
- Create initial event description and flagging the associated data in EPA's Air Quality System (AQS);
- Engage in the Initial Notification of Potential Exceptional Event process unless waived by EPA; and
- Provide opportunity for public comment for a minimum of 30 days;

Ecology requests EPA to concur with our determination that the high wind dust event occurring on August 14, 2015 qualifies as an exceptional event under the EER and EPA should exclude this exceedance from compliance determination for the PM₁₀ NAAQS in Kennewick, Washington.

2 PM₁₀ Emission Sources

This section identifies and describes particulate matter sources contributing to the August 14, 2015 PM₁₀ exceedance and the source area.

Ecology reviewed the 2014 emission inventory information and concluded that emissions from agricultural activities (tilling and harvest) remain the largest source of PM₁₀ in Benton and Klickitat Counties. We considered whether wildfires and agricultural burning contributed to the air pollution exceedances and determined that contribution from fires was minimal. We also checked with the Benton Clean Air Agency (BCAA) and Ecology Central Regional Office (CRO) and there were no identified upsets from industrial sources or other unusual activities.

Washington State University (WSU) and its partners has studied Washington Columbia Plateau for more than 30 years. Based on our knowledge of the land use and the soil condition, review of the monitoring data and other available evidence, Ecology concluded the main source of the dust for this event was the agricultural lands in the HHH area.

2.1 Horse Heaven Hills Sources

The local source of the dust for this event from the southwest was the agriculture activities in the HHH area with dryland farming operation in Klickitat and Benton County. Although the wind also traveled over irrigated farmlands, natural steppes and rangelands, these areas are generally stable due to irrigation or established vegetation anchoring the soils and were not likely the major contributors of dust for this event.

Land Use in the Area: Figure 1 below shows that agriculture is the dominant activity southwest of Kennewick in both Washington and Oregon. The green dots are irrigated agriculture and the beige squares are dryland farming. As shown in Figure 2 below, the land use on the wind path of this event are mostly agriculture (in pink) and steppes (in yellow) (NHI and NWPCC, 2000).

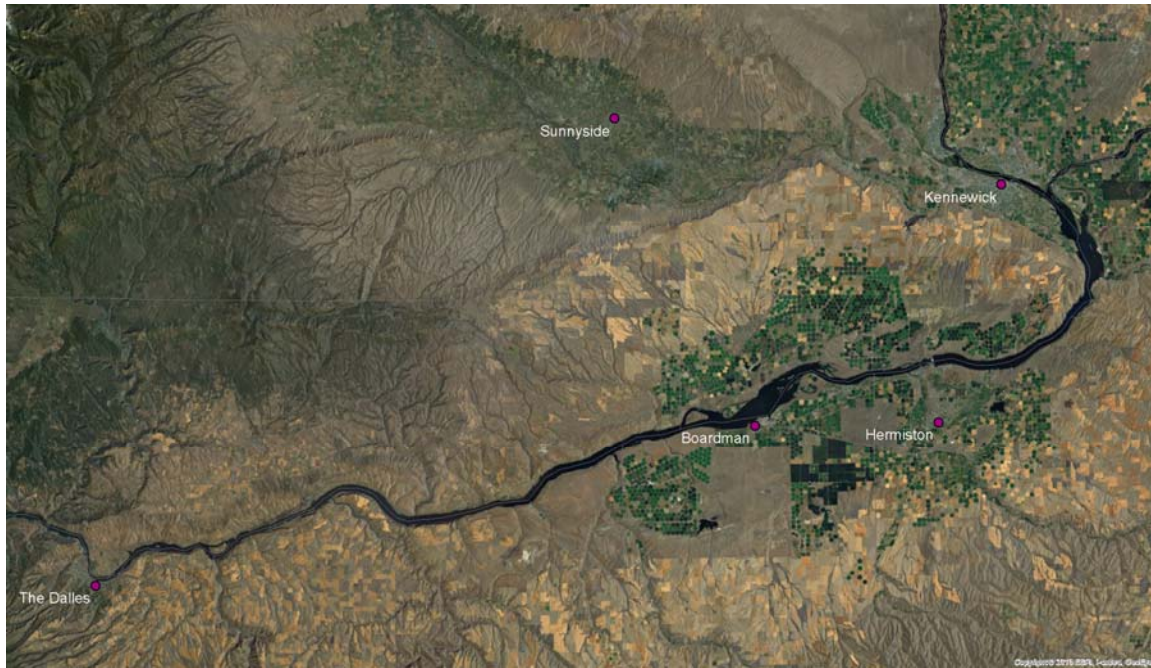


Figure 1. Satellite Image for Land Use in the Area West Southwest of Kennewick as of May 3, 2015

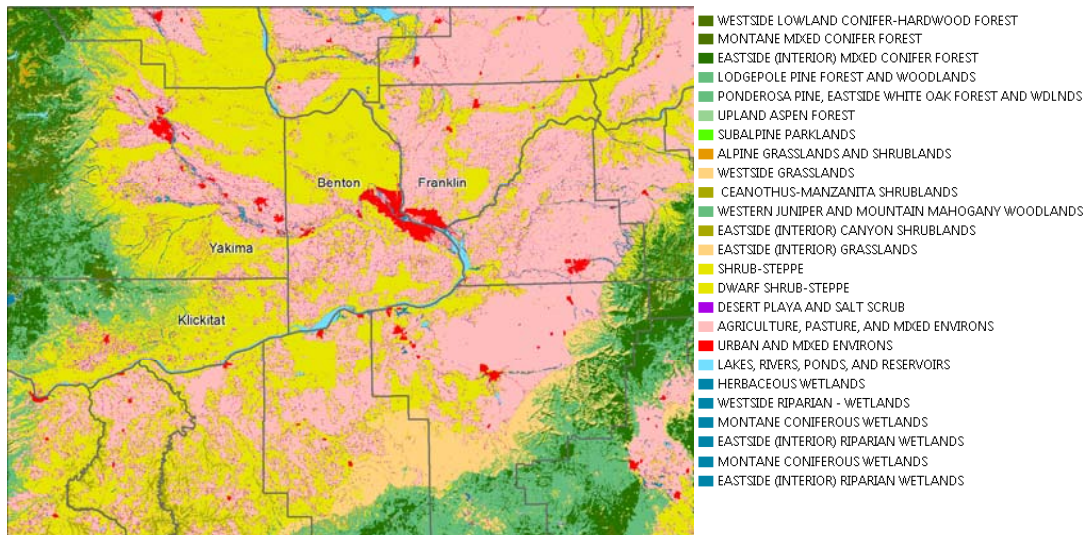


Figure 2. Land Use and Land Cover in Kennewick and Source Area

The HHH area includes both the southwest portion of Benton County and the southeast portion of Klickitat County.

According to the 2012 Census of Agriculture conducted by the USDA-National Agricultural Statistics Service (NASS), Benton County has 519,123 acres or 50 percent of its land classified

as total cropland (USDA- NASS, 2014)¹. To further demonstrate the dominance of agricultural activity in Benton County, Figure 3 below shows that a majority of the land in the county is zoned for agriculture, denoted by the green shading covering more than half of the county (Benton County, 2012).

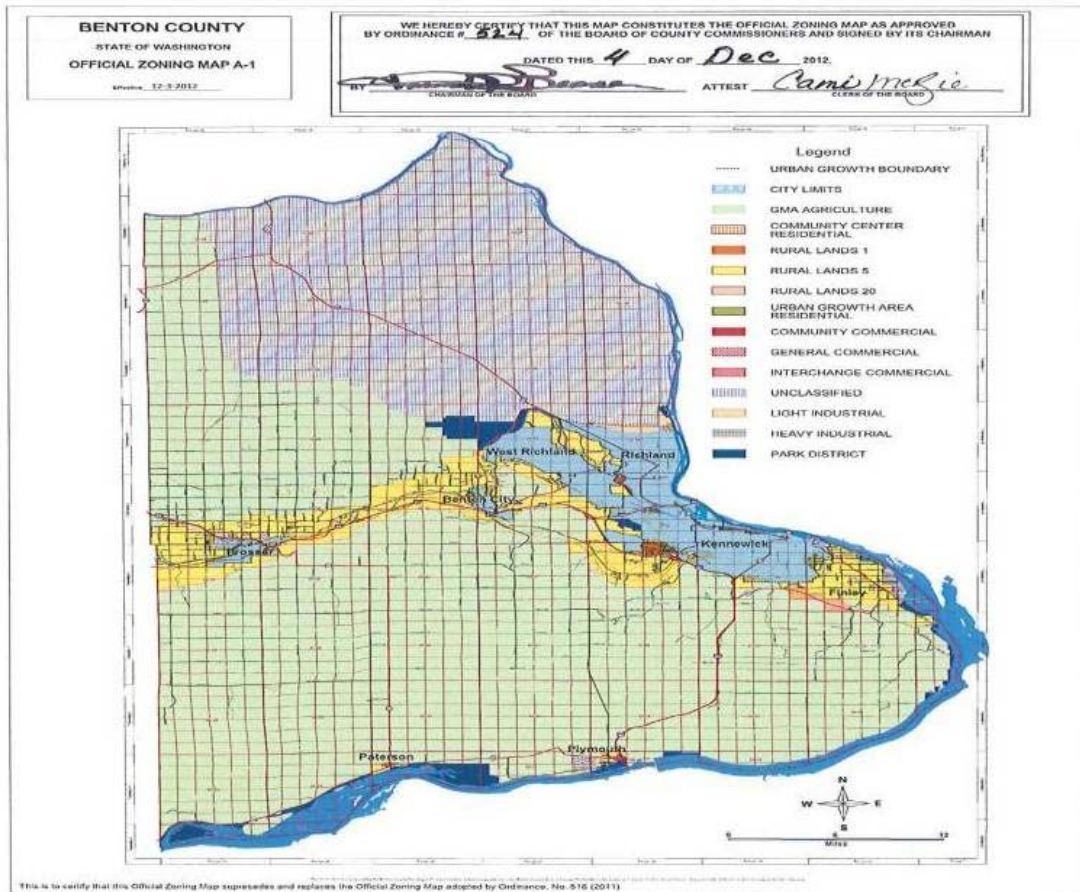


Figure 3. Benton County Zoning map

According to the 2012 Census of Agriculture conducted by the USDA-NASS, Klickitat County has 192,258 acres or 16 percent of its land classified as Total Cropland¹ (USDA- NASS, 2014). Figure 4 below shows that the HHH area in eastern Klickitat County is zoned as extensive agriculture, which is denoted by the yellow-brown shading (Klickitat County, 2017). The Klickitat county portion of the HHH is only about one fifth of the total HHH area.

¹ 519, 123 (total cropland from 2012 Ag Census) /1,036,975 (acres in Benton county) = 50%. 192,258 (Total Cropland)/1,219,840 (acres in Klickitat County) = 16%. The USDA definition is that total cropland includes areas used for the production of adapted crops for harvest.

Klickitat Maps

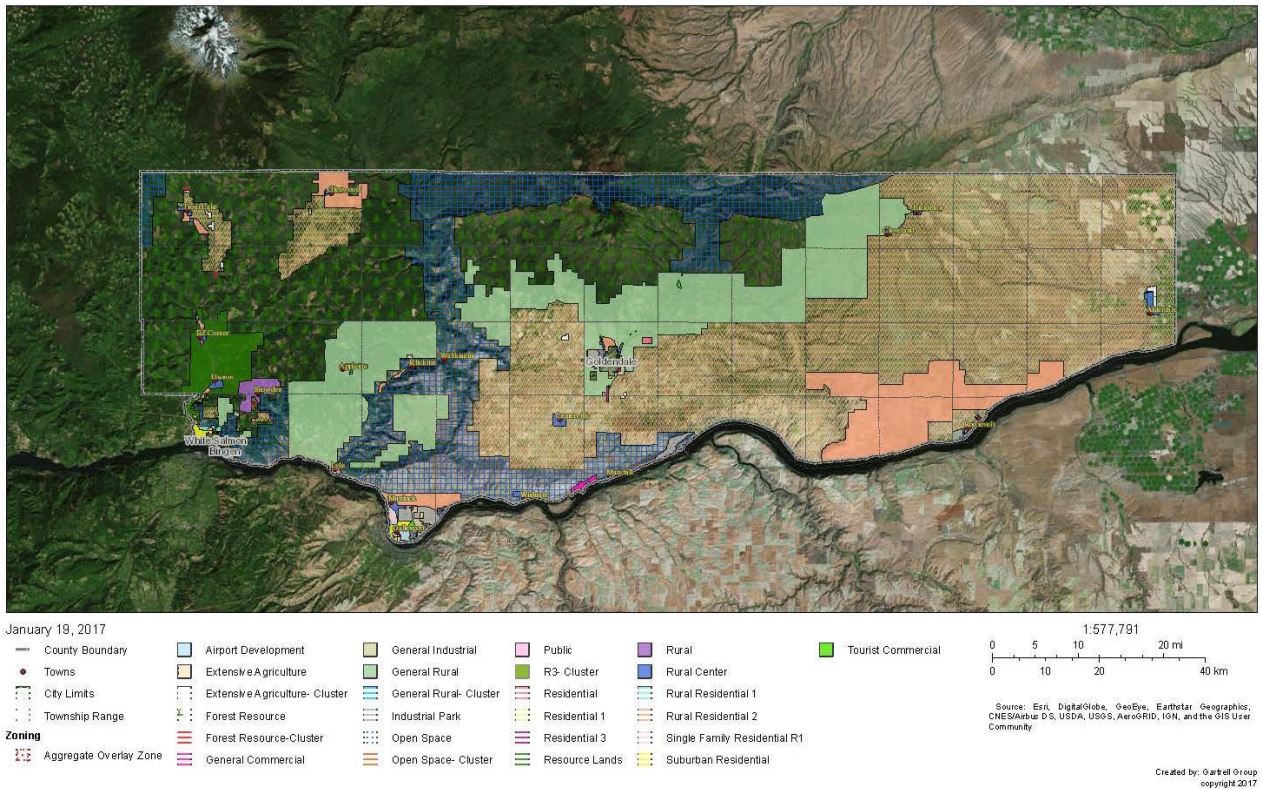


Figure 4. Klickitat County Zoning

Dust Shown on Satellite Imagery: The largest dust plume (circled) shown in Figure 5 originated from a field in Klickitat county, south of Peterson Ranch Road and east of Alderdale Road in the HHH area (NASA, 2015). Figure 6 shows the location of the non-irrigated wheat field that initiated the dust plume (Google Map, 2015). More dust was picked up by high wind from the farm lands between there and the Kennewick monitor (shown as dust streaks over the HHH).



Figure 5. MODIS Satellite Images Showing the Dust Plume on 8/14/2015. Terra/MODIS visible imagery at ~11 am (top) and Aqua/MODIS visible imagery at ~2 pm (bottom).



Figure 6. Largest Dust Plume Origin

Triennial Emission Inventory: Table 1 below shows data from Ecology’s 2014 statewide triennial emission inventory supporting the conclusion that emissions from agricultural activities (tillage and harvest) are the largest contributors of PM₁₀ in Benton and Klickitat Counties (Ecology, 2016). Tillage and harvesting contributed 54 percent and seven percent, respectively, for the annual total PM₁₀ emissions in Benton County and 68 percent and three percent, respectively, in Klickitat County.

Table 1. 2014 PM₁₀ Emissions Percentage by Categories for Benton and Klickitat County

Source Types	Benton	Klickitat
Agricultural Burning	1%	0%
Agricultural Harvesting	7%	3%
Agricultural Tilling	54%	68%
Construction Dust	10%	0%
On-Road Mobile	3%	0%
Open Burning: Yard Waste, Land clearing, Household Waste	3%	1%
Paved Road Dust	9%	5%
Point Sources	1%	2%
Residential Wood Combustion	3%	1%
Silvicultural Burning	0%	3%
Unpaved Road Dust	6%	14%
Other	4%	2%

Source Types	Benton	Klickitat
Total	100%	100%

Section 3.2, Narrative Conceptual Model provides more details about the HHH PM₁₀ source area.

2.2 Oregon Sources

Oregon sources did not likely contribute to this event. The nearest upwind PM monitor in Oregon is the PM_{2.5} monitor at The Dalles, roughly 107 miles WSW of Kennewick. Figure 7 below shows there was no significant increase of PM_{2.5} at The Dalles on August 14, 2015 and the wind direction was between west and northwest following the Columbia River Gorge (EPA, 2015). Satellite imagery supports that wildfires did not impact The Dalles on that day either. Therefore, the data shows that the source region for this exceptional event was not more than 107 miles upwind of the Kennewick monitor.

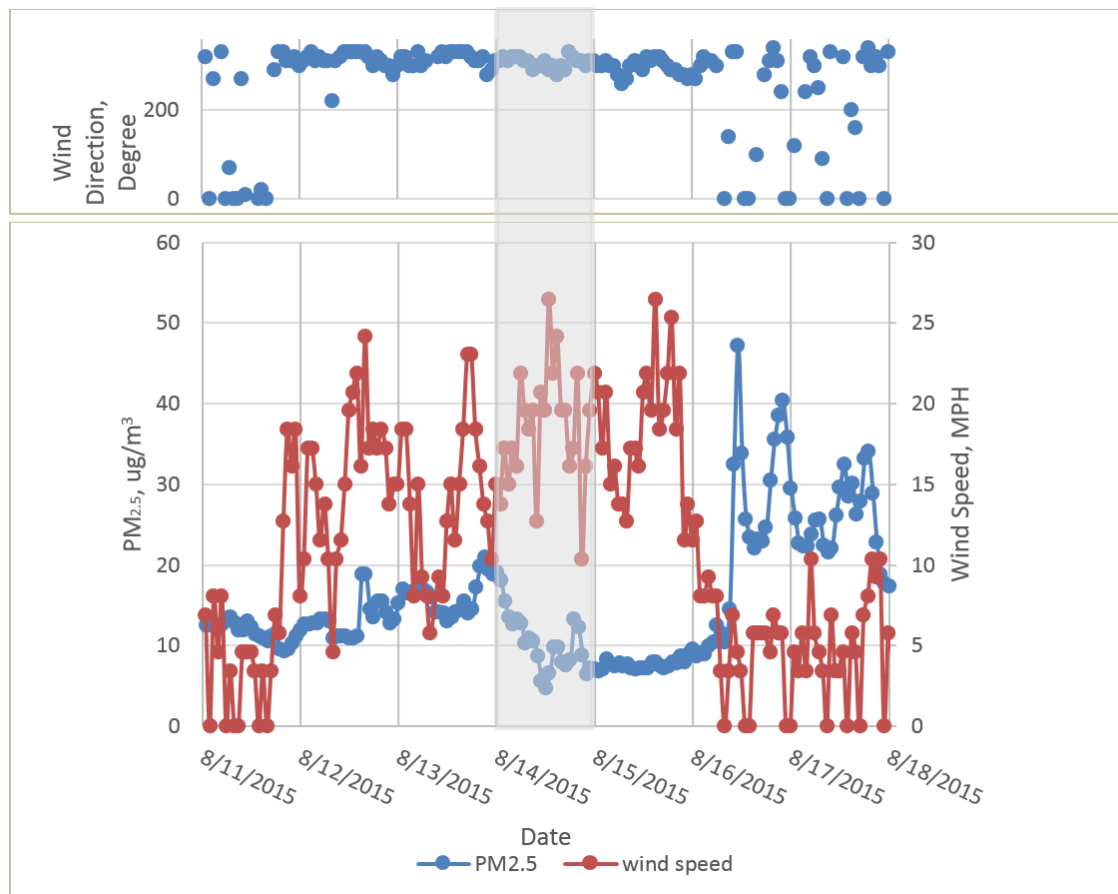


Figure 7. The Dalles Hourly Average PM_{2.5} Concentration, Wind Speed and Wind Direction Data²

² Pacific Standard Time (PST) without day light saving is used throughout this document unless noted otherwise.

In addition, as shown by the satellite imagery in Figure 5, there were no noticeable dust streaks or plumes coming from Oregon to Kennewick.

Therefore, particulate matter was not likely transported from Oregon for this exceptional event.

2.3 Wildfires and Agricultural Burning

We also considered whether wildfires and agricultural burning were potential sources of particulate matter for this event. We determined that fires were not likely a major contributor to this exceedance. We based this conclusion on the PM_{2.5} to PM₁₀ ratio, satellite imagery, and agriculture burn call authorizations on the event day.

Smoke Contribution and Particle Size: Generally, 85 percent of particulate matter in smoke from fires is fine particulate matter (PM_{2.5}) (Battye & Battye, 2002).³ As shown in Figure 8 below, on August 14, 2015, the maximum percentage of PM_{2.5} in PM₁₀ at KENMETA monitor was 52 percent (EPA, 2015). However, this was when PM₁₀ level was low. From 5 am to 5 pm, when PM₁₀ was elevated over the NAAQS (150 µg/m³), PM_{2.5} was only 0.2 percent to seven percent of PM₁₀. Therefore, any potential smoke contribution on that day was insignificant to the total PM₁₀.

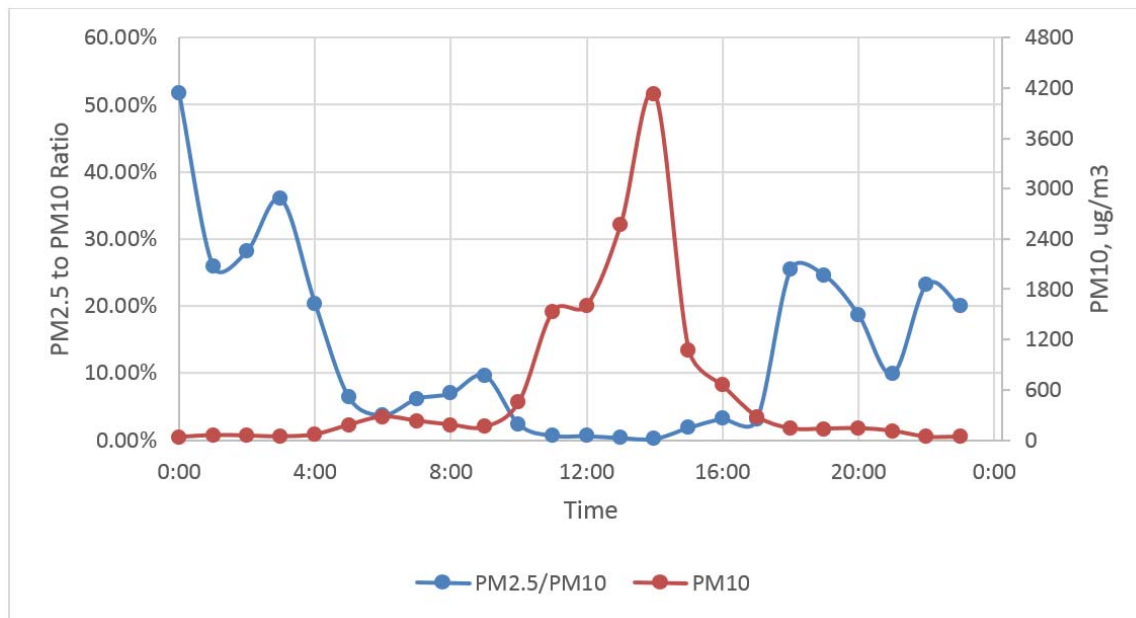


Figure 8. Hourly PM_{2.5} to PM₁₀ Ratio and PM₁₀ on August 14, 2015

³ Equation 10 in EPA, AP-42, Volume I, Fifth Edition, Chapter 13 Miscellaneous Sources, [Development of Emissions Inventory Methods for Wildland Fire](#): ($PM_{10} = 1.18 \times PM_{2.5}$), which means that 85 percent of PM₁₀ from fires is PM_{2.5}.

Wildfire Satellite Imagery: The Cougar Creek wildfire on Mt. Adams (Incident Information System , 2015) and the County Line 2 wildfire (Incident Information System, 2015) on the Warm Springs Reservation carried some light smoke to the area on August 14, 2015 (See Appendix C.5 for details).

There was some smoke over the Kennewick area in the Terra/MODIS satellite imagery retrieved at ~11:00 am, as shown in Figure 9 below. However, the $PM_{2.5}$ to PM_{10} ratio was less than one percent at that time.

When the Aqua/MODIS satellite passed overhead at ~2 pm (Figure 9), no smoke was visible in the Kennewick area (NASA, 2015).

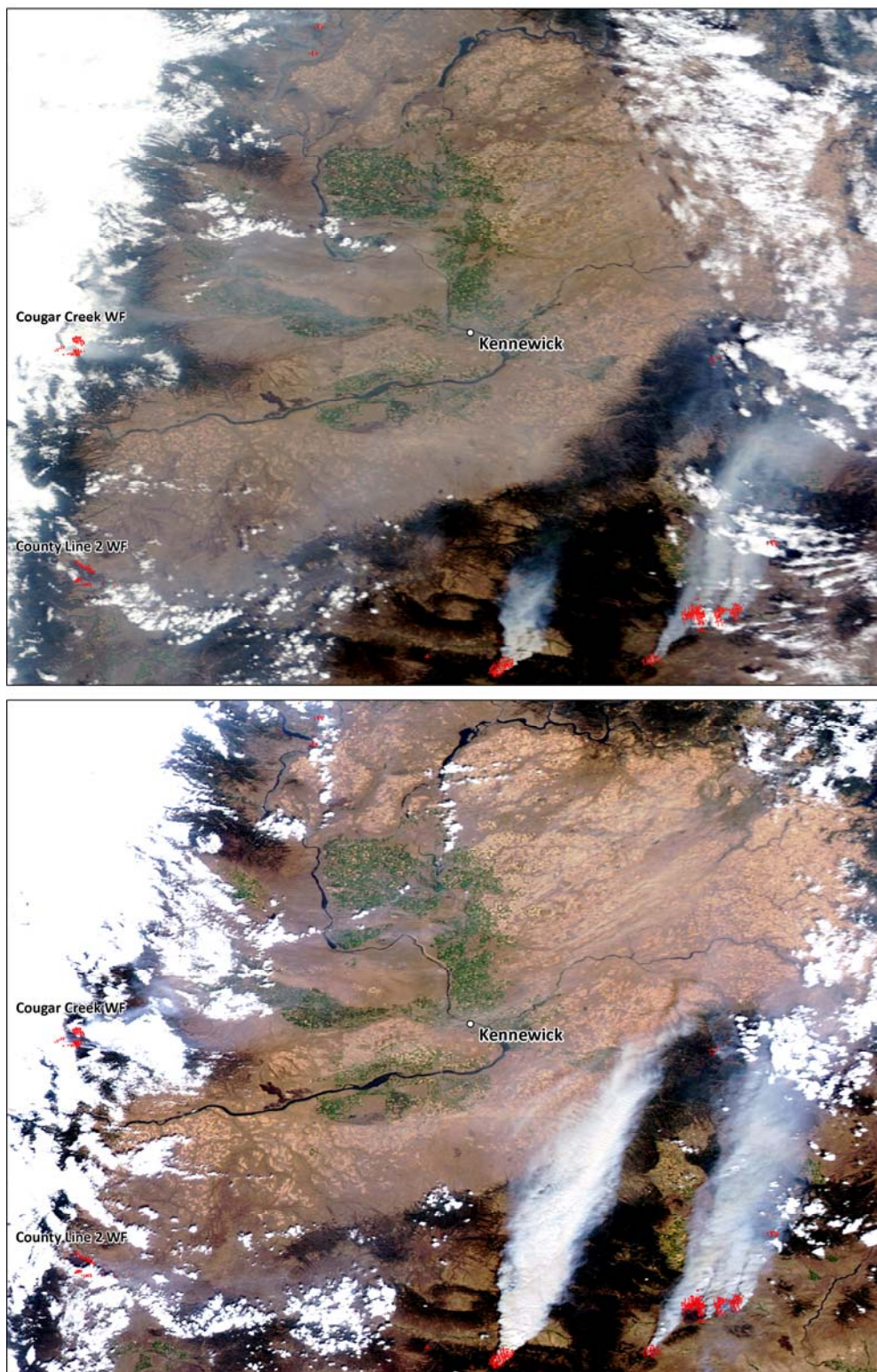


Figure 9. Terra and Aqua Satellite Images Showing the Wildfire Plumes. Terra/MODIS satellite imagery at ~11 am (top) and Aqua/MODIS imagery at ~2 pm (bottom).

Therefore, the satellite imagery supports the conclusion that wildfire smoke was not likely a significant contributor to the PM₁₀ exceedance on that day.

Burn Scar from Highway 8 Fire: The Highway 8 (Incident Information System , 2015) fire started on August 4 and mainly contained by August 8, 2015 (See Appendix C.5 for details). The fire left a scar southwest of Kennewick as shown in the left bottom corner of Figure 5. The fire scar was vulnerable to soil erosion since the wildfire burned the cover plants. Based on the satellite imagery, no noticeable dust came off the burn scar on the event day. However, we could not rule out the possibility that wind might have transported some dust from the dust scar to the Kennewick monitor.

Ecology Agricultural Daily Burn Decisions: Ecology Eastern Regional Office (ERO) and Central Regional Office (CRO)⁴ make daily burn decisions restricting burning to specific time periods or areas. ERO and CRO base these decisions on meteorology, air quality and permitted acreage. Klickitat County is under CRO's jurisdiction. Each Ecology burn permits contains a "When to Burn" provision, "Burn with daily burn decision approval and when the wind takes the smoke away from roads, homes, highly populated areas, or other public areas. Do not burn during poor weather conditions such as inversions or strong winds" (Ecology, 2016). A review of the burn decisions shows Ecology did not allow agriculture burning on August 14, 2015 (Ecology, 2015). See Appendix C for the Ecology burn decision text.

Benton Clean Air Agency Daily Burn Decisions: BCAA checked records from August 14, 2015 and confirmed that they prohibited agricultural burning that day due to extreme fire danger (Priddy, 2017).

Therefore, we ruled out wildfires and agricultural burning as significant contributing sources of particulate matter for this event.

2.4 Industrial Sources

There were no known unusual emissions from local industries . BCAA and Ecology CRO reviewed their files and confirmed there was no record of upsets or complaints on August 14, 2015. Also, neither BCAA nor Ecology CRO received phone calls from sources, the public, emergency response organizations or facility contacts. (Priddy, 2017; Carmony, 2017).

In conclusion, Ecology determined the main source of the PM₁₀ for this event was the agricultural lands in HHH Area.

⁴ Click [here](#) to access Map of Washington Ecology Regional Offices and Clean Air Agencies.

3 Exceptional Event Rule Criteria

The EER criteria for the high wind events include (EPA, 2016):

- Under 40 CFR 50.14(b)(5)(iii), high wind threshold of a sustained wind of 25 mph or alternative area-specific high wind threshold.
- Under 40 C.F.R. 50.14(c)(3)(iv), the demonstration to justify data exclusion must include:
 - A narrative conceptual model.
 - A demonstration that there exists a clear causal relationship between the specific event and the monitored exceedance.
 - A comparison of event-related concentration to historical concentrations.
 - A demonstration that the event was not reasonably controllable or preventable (nRCP).
 - A demonstration that the event was a human activity that is unlikely to recur at a particular location or was a natural event.
- Under 40 CFR 50.14(c)(1) Public notification
- Under 40 CFR 50.14(c)(2) Initial notification of potential exceptional event and flagging
- Under 40 CFR 50.14(c)(3)(v) Public comment

The information provided below satisfies these requirements.

3.1 High Wind Threshold

Under 40 C.F.R. 50.14 (b)(5)(iii) in the 2016 EER, EPA generally accepts a high wind threshold of a sustained wind (1-hour average wind speed) of 25 mph for certain named states. However, the state of Washington is not one of the named states. States can also identify and use an EPA-approved alternate area-specific high wind threshold.

Reason for Using the 25 mph High Wind Threshold for this Event: EPA approved the 2003 Columbia Plateau Windblown Dust Natural Events Action Plan (2003 NEAP) into the SIP in 2005⁵. In the 2003 NEAP, the defined high wind event on Columbia Plateau in the state of Washington is as follows (Ecology, 2003; Ecology, 2005):

“A high wind event occurs when the wind entrains and suspends dust to the extent that concentrations of PM₁₀ are elevated. This occurs when the average hourly wind speed at 10 m is 18 miles per hour or greater for two or more hours; or in excess of 13 miles per

⁵ The 2003 NEAP was submitted as part of the [2005 Wallula PM₁₀ Maintenance Plan](#).

hour for two or more hours when conditions of higher susceptibility to wind erosion exist. A high wind event that exceeds the PM₁₀ standard is a natural event.”

Ecology determined the area-specific high wind threshold in the above definition based on extensive agriculture windblown dust research by USDA-NRCS and the Columbia Plateau PM₁₀ Project (CP3). The Attachment A1 of the 2003 NEAP provided the scientific basis and evidence for the area-specific high wind threshold (Ecology, 2003).

The 1-hour average wind speed at KENMETA monitor on August 14, 2015 was over 18 mph for 11 hours and over 13 mph for 16 hours. However, EPA had not yet approved the high wind thresholds in this definition as alternate area-specific high wind thresholds under the EER.

The scientific evidence in the 2003 NEAP showed that a lower high wind threshold of 18 mph and even 13 mph under certain circumstances is capable of causing excess PM emissions from reasonably controlled agriculture lands. Therefore, the general high wind threshold of 25 mph is sufficient to disturb the land and cause PM₁₀ exceedances. Also, the 2013 exceptional event demonstration, concurred upon by EPA, showed that wind speed over 25 mph can lead to excessive PM₁₀ emissions (Ecology, 2016).

In addition, the soil, plant coverage and land usage conditions in Kennewick are similar to the arid, semi-arid or seasonally dry regions of the named western states in the 40 C.F.R. §50.14 (b)(5)(iii) in the 2016 EER.

Therefore, the 25 mph high wind threshold is appropriate for this exceptional event demonstration.

This Event Met the 25 mph High Wind Threshold: The high wind event on August 14, 2015 had a sustained 3-hour period with 1-hour average wind speed over 25 mph at Kennewick Monitor. The 1-hour average wind speed was over 40 mph at BPKEN, the upwind source area station. Therefore, this event met the high wind threshold criteria.

This section discusses the data from the following monitors (See Appendix B for detailed monitor information):

- KENMETA: The monitor that recorded the PM₁₀ exceedance on August 14, 2015.
- BPKEN: Operated by the Bonneville Power Administration (BPA) on the ridgeline of the HHH about 10 miles south southeast of KENMETA.
- BPHOR: Operated by BPA about 30 miles southwest of KENMETA within one mile of the north shore of the Columbia River.

Table 2 shows the summary wind data at KENMETA and its upwind monitors, BPKEN and BPHOR for the August 14, 2015 event (EPA, 2015; BPA, 2015). KENMETA reports 1-minute wind data while BPKEN and BPHOR only report 5-minute wind data.

Table 2. Wind data summary for KENMETA, BPKEN and BHOR monitors.

Monitor	Max sustained wind (1-hour average)	Max gust (1-minute average)	Max gust (5-minute average)
KENMETA	28.6	38.2	
BPKEN	54.0		58.9
BPHOR	35.6		38.0

As shown in Figure 10 below, sustained wind speed was above the 25 mph threshold for over three hours from 1:00 PM to 4:00 PM PST at KENMETA monitor (EPA, 2015). Figure 11 shows that the wind direction was mostly southwest on the event day at KENMETA monitor (EPA, 2015; Carslaw & Ropkins, 2012). The pollution rose in Figure 12 shows that when the PM₁₀ concentrations were over 150 µg/m³, the wind direction was from the west and southwest, consistent with the identified trajectories of the storm in Figure 20 to Figure 23 (EPA, 2015; Carslaw & Ropkins, 2012).

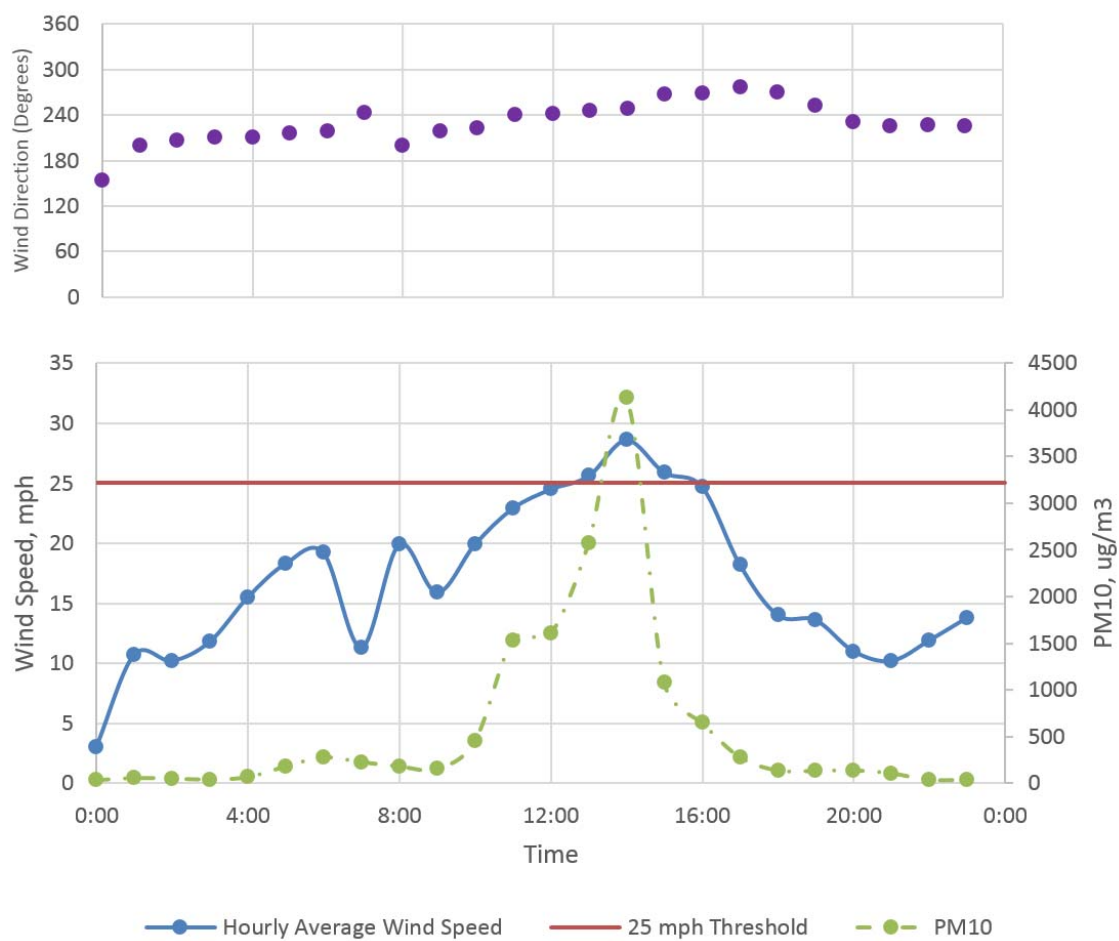


Figure 10. Hourly Average Wind Speed, PM₁₀ and Wind Direction at KENMETA on August 14, 2015

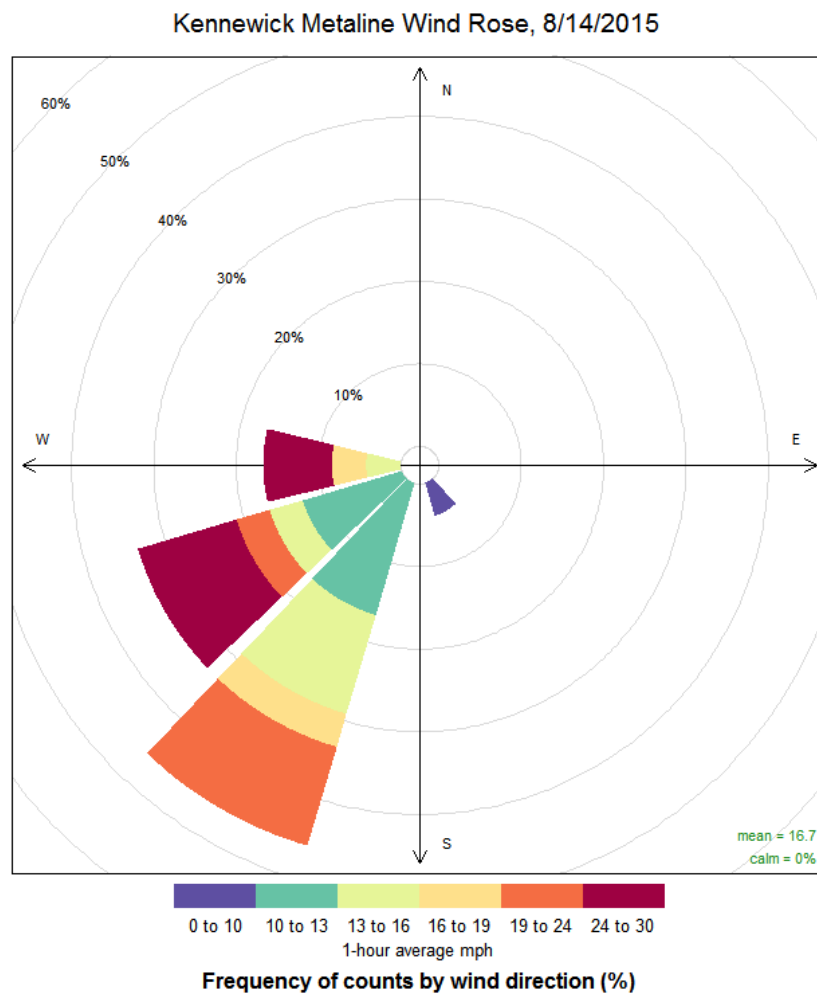


Figure 11. KENMETA Wind Rose for August 14, 2015

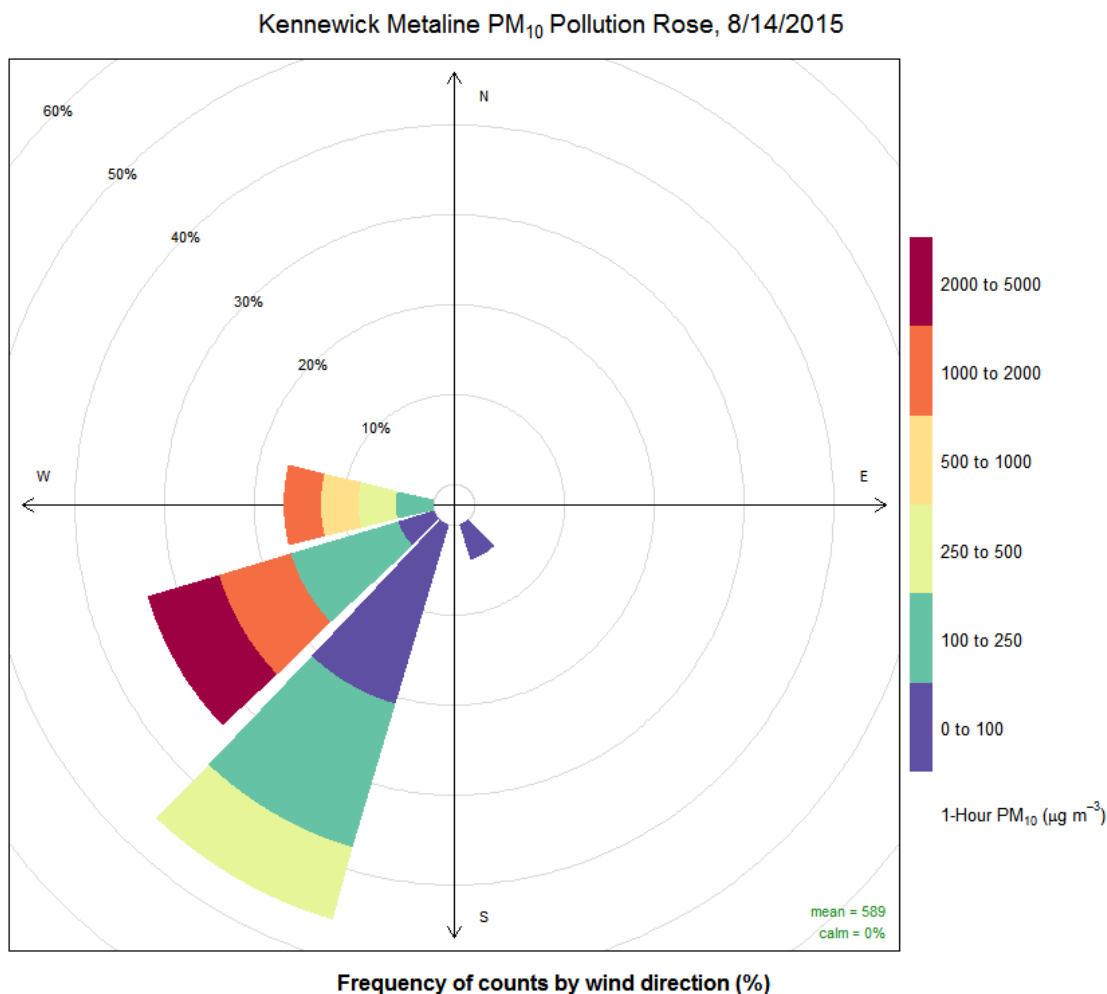


Figure 12. KENMETA Pollution Rose for August 14, 2015.

BPKEN is a meteorological monitor located on the HHH and within the dry wheat farming area where soil was disturbed and entrained (See map in Appendix B for monitor locations). Therefore, wind data at BPKEN represents the HHH emissions source area. As shown in Figure 13, sustained wind speed was above the 25 mph threshold for over 19 hours from 3:00 am to 23:00 pm PST at the BPKEN monitor (BPA, 2015). The sustained wind speed was over 40 mph for over 11 hours from 5:00 am to 16:00 pm. The wind direction was mostly from the southwest as shown in the wind rose in Figure 14 (BPA, 2015; Carslaw & Ropkins, 2012). In the HHH emissions source region, the extreme high wind overwhelmed reasonable controls on agricultural lands, transported the excessive particulate matter to the KENMETA monitor and caused the exceedance.

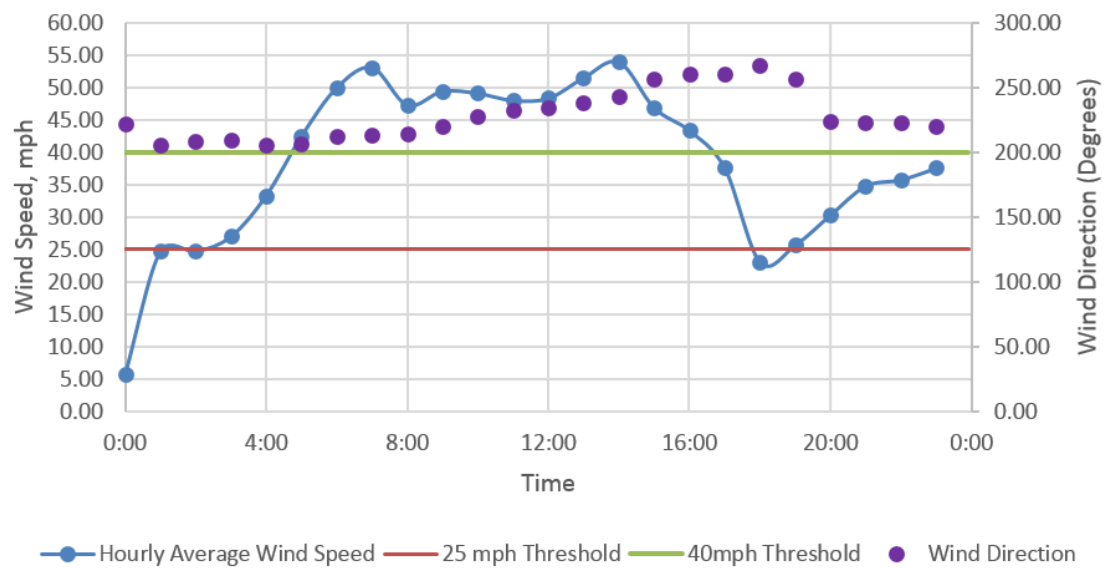


Figure 13. Wind Direction and Hourly Average Wind Speed at BPKEN on August 14, 2015

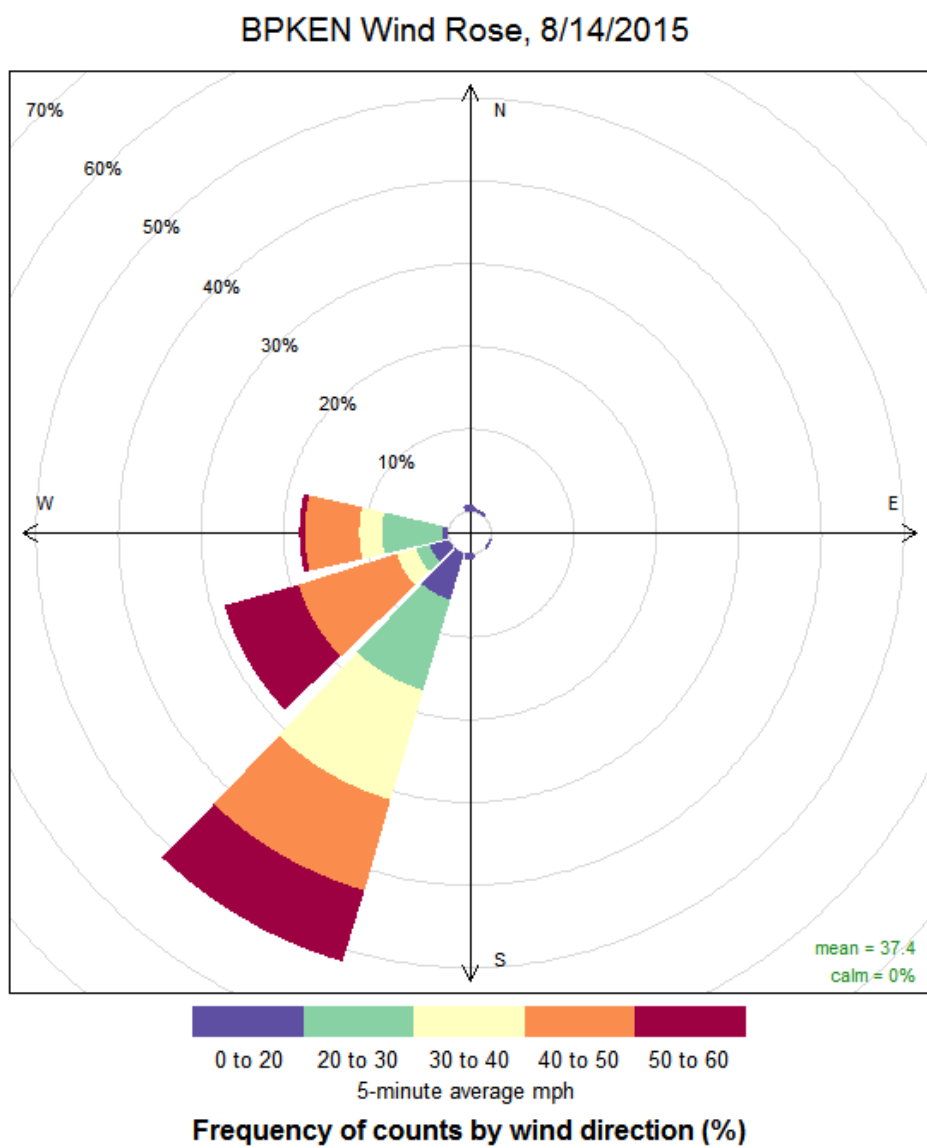


Figure 14. BPKEN Wind Rose for August 14, 2015.

BPHOR is a meteorological monitor located by the Columbia River, south of the HHH emissions source area (See map in Appendix B for monitor locations). As shown in Figure 15 below, the wind speed at BPHOR was consistently above 25 mph for over 8 hours from 7:00 am to 15:00 pm PST (BPA, 2015).

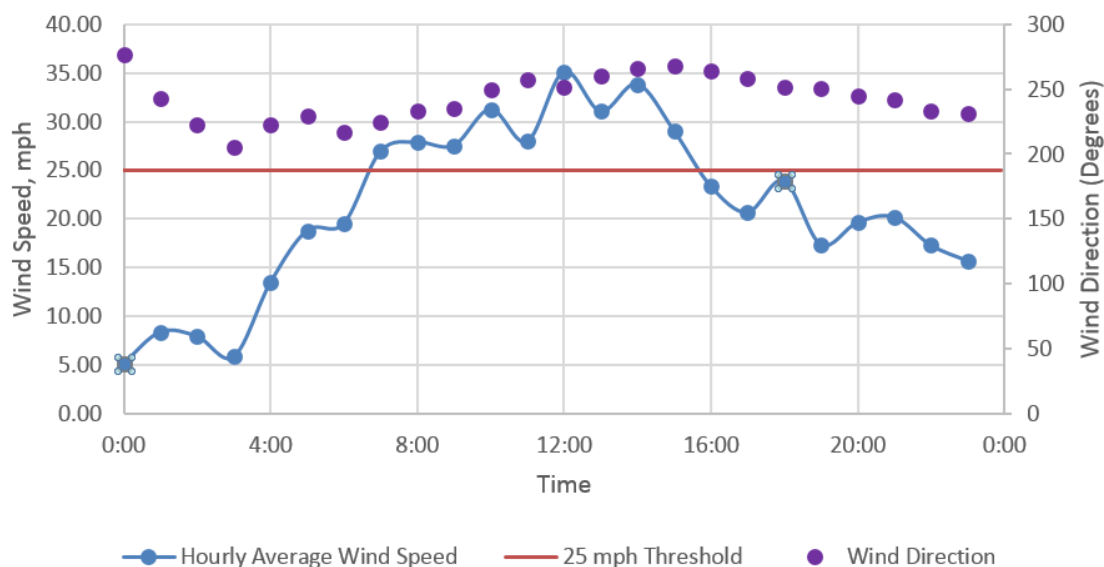


Figure 15. Wind Direction and Hourly Average Wind Speed at BPHOR on August 14, 2015

This event had sustained wind speed that exceeded the 25 mph threshold met the exceptional event criteria.

3.2 Narrative Conceptual Model

The 2016 EER requires a narrative conceptual model that describes the event causing the exceedance and a discussion of how emissions from the event led to the exceedance at the affected monitor (EPA, 2016). This section addresses this criteria required by the EER.

The circumstances leading up to this exceptional event, especially multiyear low precipitation and high temperatures, contributed to the soil vulnerability and erosion in the region. Appendix A includes the general information concerning the geological setting, climate and soil of the HHH area and Columbia Plateau. The mechanism that created this event was a low pressure system and strong cold front that generated high wind (NWS Pendleton, 2015). The KENMETA monitor in Kennewick, Benton County recorded the exceedance.

3.2.1 Conditions Before the Event

The lack of precipitation in combination with three consecutive years of high temperature (2013-2015) contributed to low soil moisture in the area. The multiyear drought had a cumulative negative effect on wheat yield. This led to low plant coverage on the lands in production and low stubble/residue on the fallow fields. These factors greatly increased the wind erosion potential of the soil.

Climate conditions in 2013: The USDA Drought Monitor rated Kennewick and nearby areas “abnormally dry” from May through September in 2013 (U.S. Drought Monitor , 2013-2015). From the Office of Washington State Climatologist (OWSC) monthly summaries, this area had significantly lower than normal precipitation throughout most of the year. There was no rainfall in July and only 0.04” (six percent of normal) in October. High temperature records were set in September (OWSC, 2013-2015). Section 5.1.2 in the “2013 Exceptional Event Demonstration: PM₁₀ Exceedances due to High Winds at Kennewick” (Ecology, 2016) contains details of 2013 climate and soil conditions for this area.

Climate conditions in 2014: The Drought Monitor rated Kennewick and nearby areas “abnormally dry” in January, 2014 and “moderate drought” for the rest of 2014 (U.S. Drought Monitor , 2013-2015). The OWSC monthly summaries reported that this area had significantly lower than normal precipitation throughout most of the year as well. In particular, there was extremely low rainfall in June (0.18”), July (0.03”) and September (0.03”), 2014. The temperature was warmer than normal three months in a row from August to October (OWSC, 2013-2015).

Climate conditions in 2015 before the event: The Drought Monitor rated Kennewick and nearby areas in “moderate drought” from January to April 2015 and elevated to “severe drought” from May 2015 until the event day. Figure 16 below (U.S. Drought Monitor , 2013-2015) shows the U.S Drought Monitor for Washington on August 11, 2015.

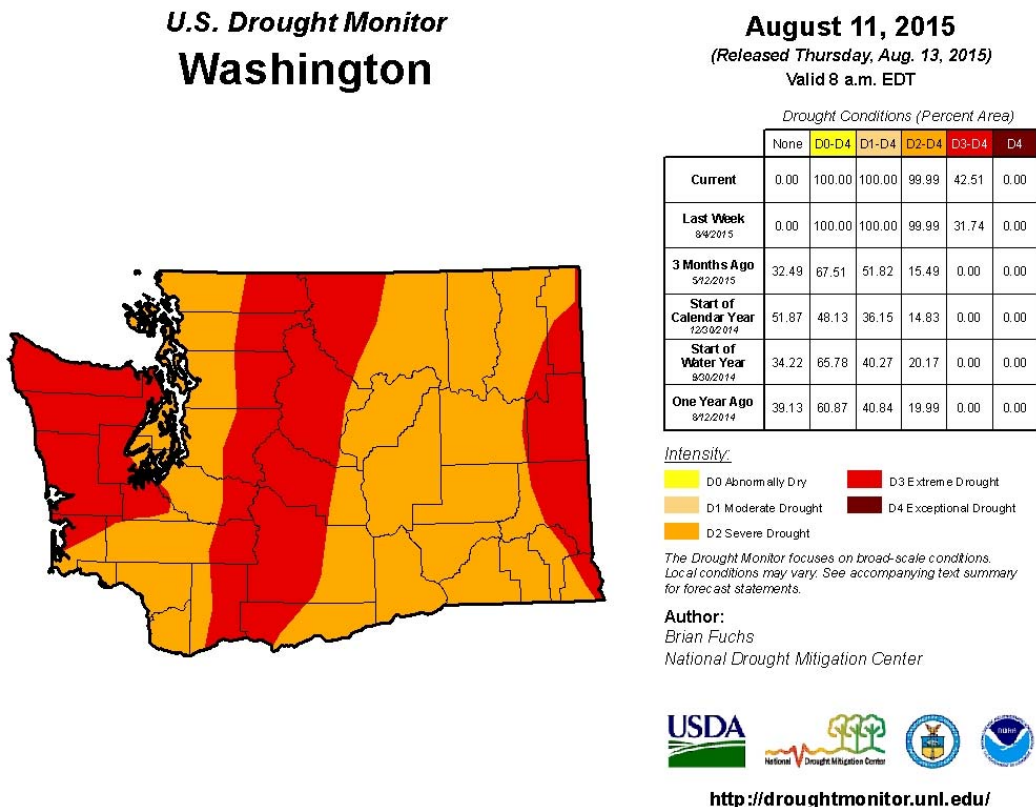


Figure 16. U.S Drought Monitor report for August 11, 2015

The NWS Climate Prediction Center issues drought outlooks for seasonal or monthly drought forecast. The drought monitors report the actual drought condition of the week. Figure 17 below is the U.S. Seasonal Drought Outlook for May 21 to August 31, 2015. Kennewick and HHH area were in the drought persists/intensifies zone (shown in brown) (NWS-Climate Prediction Center, 2015).

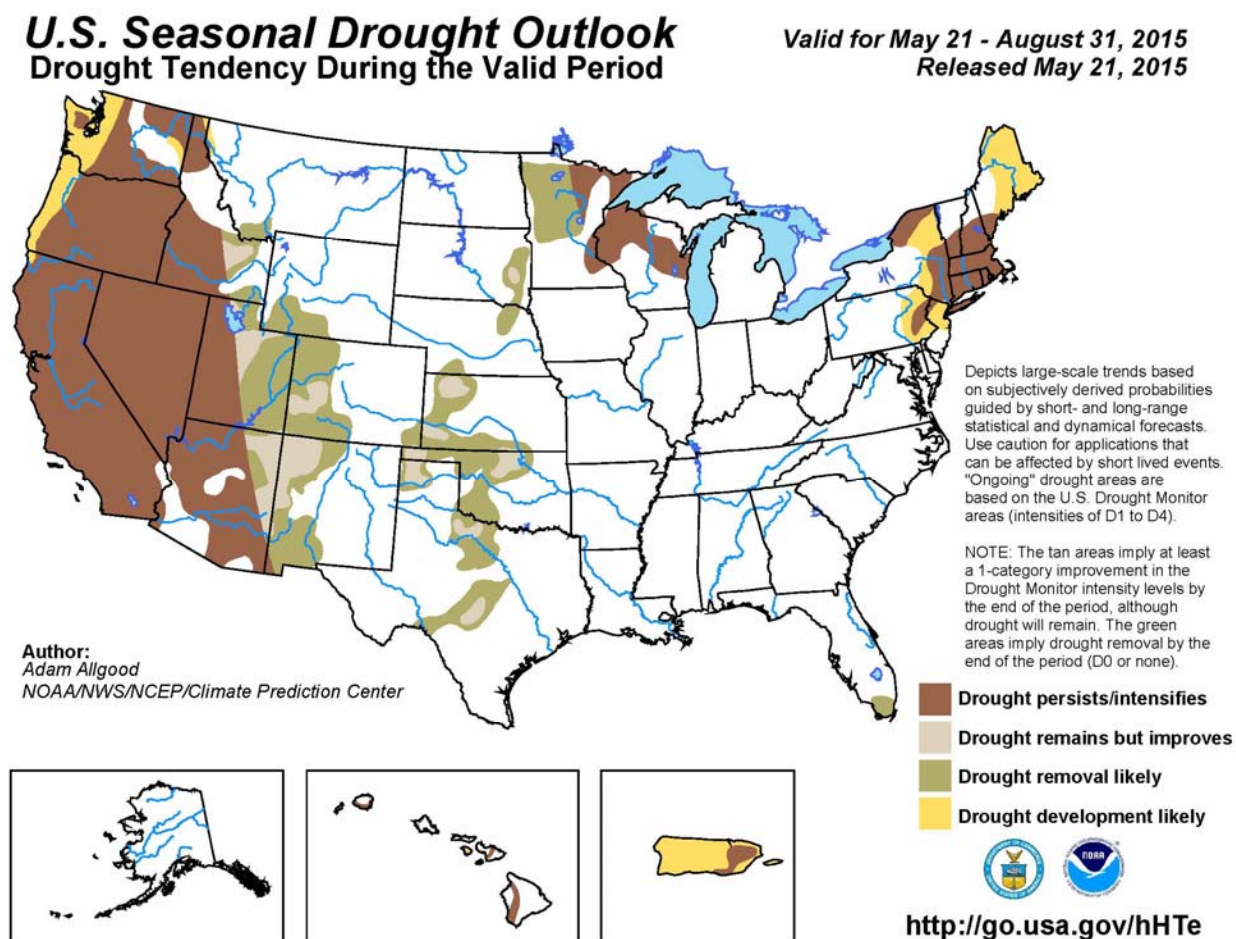


Figure 17. U.S. Seasonal Drought Outlook for May 21 – August 31, 2015.

From the OWSC monthly summaries, winter 2014-2015 had a historically low snowpack due to warmer-than-normal temperatures and below average precipitation all winter (OWSC, 2013-2015). Governor Inslee declared a statewide drought emergency on May 15, 2015 due to the historically low snowpack, dwindling rivers, and irrigation districts cutting off farming water (Inslee, 2015). Appendix C.6 includes the statewide drought emergency declaration.

The Tri-City Herald reported on May 6, 2017 that 2015 was one of the driest years on record and the growers across the state lost \$700 million due to the 2015 drought (Bain, 2017). When

considering the complete economic impact of the drought, the total losses could be as high as \$1.2 billion. Appendix C.7 includes this news report.

The year to date precipitation from January 1 to August 14, 2015 was only 3.74 inches as shown in Figure 18 below (WeatherDB, 2015). Only 0.03 inch of rain fell from May 23 to August 14, 2015 as shown in Figure 19 below.

In 2015, Kennewick received some form of precipitation on 80 days, for an approximate total of 7 in.

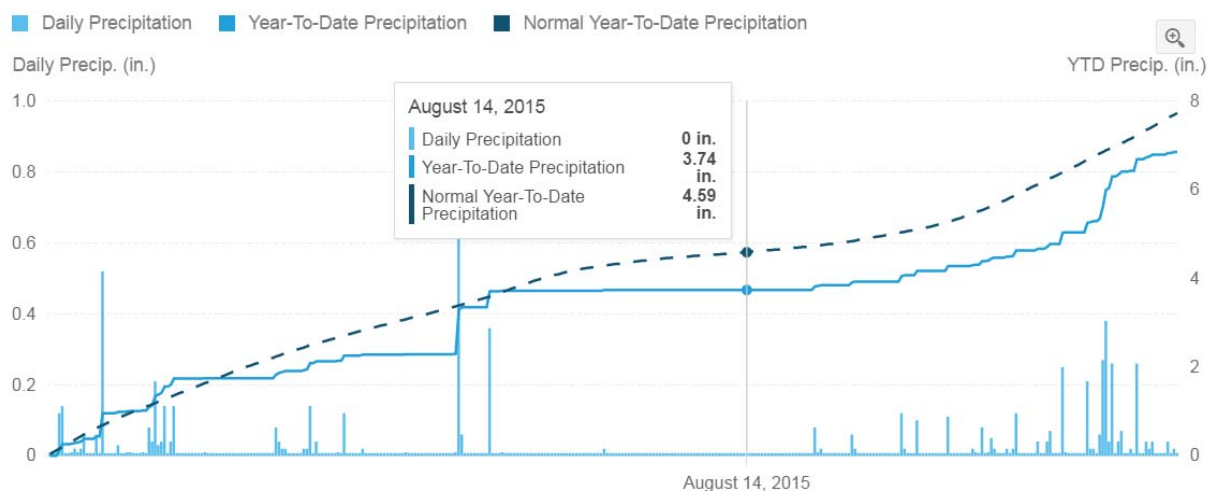


Figure 18. Year to Date Precipitation for August 14, 2015.

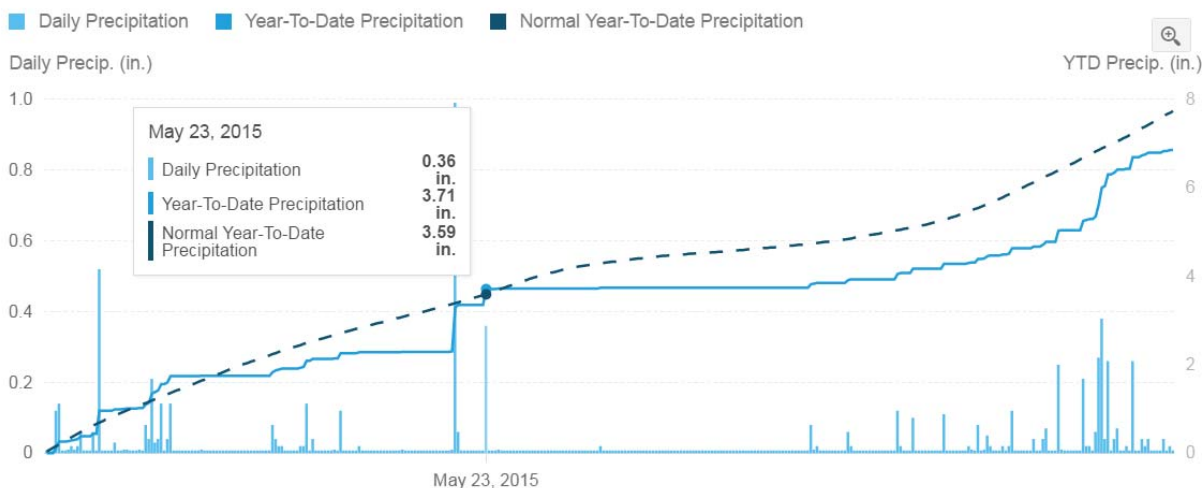


Figure 19. Year to Date Precipitation for May 23, 2015 showing there was only 0.3 inch of rain between May 23 and August 14, 2015.

Table 3 and Table 4 below summarizes temperatures and precipitation at the Pasco Airport (five miles northeast of KENMETA) from June to August 2015 (OWSC, 2013-2015). Temperatures were consistently higher than normal and precipitation was minimal and far below normal.

Table 3. Temperature at Pasco Airport, June to August, 2015.

Month	Average (°F)	Normal (°F)	Departure from Normal (°F)
June	75.3	67.5	7.8
July	77.5	73.5	4.0
August	73.8	72.8	1.0

Table 4. Precipitation at Pasco Airport, June to August, 2015.

Month	Total (inches)	Normal (inches)	Percent of Normal (%)
June	0	0.68	0
July	0	0.28	0
August	0.03	0.27	11

Palmer Index Drought Index: Ecology evaluated potential drought conditions using the Palmer Drought Severity Index (PDSI). The PDSI uses available temperature and precipitation data to estimate relative soil moisture and effectively determine long-term drought (Dai, Aiguo & National Center for Atmospheric Research Staff (Eds), 2017). Long-term drought is the cumulative intensity of the drought during the current month and depends on current weather plus the cumulative patterns of previous months. Based on the [PDSI value](#), the month of July 2015 was in severe drought and August 2015 was in extreme drought (NWS-Climate Prediction Center, 2015).

Therefore, the low snowpack level, low precipitation and high temperatures during the years and months leading up to the event made the soil exceptionally dry and vulnerable to erosion.

Agriculture activities: Section 5.1.2 in the [2013 exceptional event demonstration](#) describes agriculture activities and soil conditions in 2013 in detail (Ecology, 2016). This section focuses on agriculture activities during 2014 and the period of 2015 leading up to this exceptional event.

Agriculture lands in production at the time of the event (Wendt, 2017): In the fall of 2014, there was no moisture due to drought conditions throughout 2014 (See Section 3.2.1). Wheat producers anticipated late fall rains and planted their seeds shallow so that the seeds would germinate⁶. However, the rains never came in time. Some wheat germinated, some did not. Wheat producers did not complete seeding until November 2014 and then the weather turned cold quickly. The first frost killed some of the wheat that germinated because the wheat germinated too late and the plants were not mature enough to survive the frost.

⁶ Fall rains provide moisture that allows the wheat seed to germinate and the plants must grow large enough so that they can survive the first frost.

In February 2015, some producers over-seeded, which means that they re-planted over the spots where the winter wheat did not grow (they did not take out the wheat that survived). Other producers re-seeded, which means they sprayed out (i.e., killed) their winter wheat and planted spring wheat. Passing over the loose soil to plant the spring wheat disturbed the soil again. Over-seeding and re-seeding provided additional plant coverage and residue for soil erosion control purposes, but, the continued drought in 2015 did not provide adequate moisture to grow these crops. During a typical year with average moisture, the agriculture lands generally yield around 40 bushels of wheat per acre (See 2013 and 2016 yield in Table 5). There was insignificant yield from WSU Wheat and Small Grains Variety Testing Program in 2015, which shows that the drought condition was serious and the plant coverage on the agriculture lands was extremely poor prior to this event. Even though the lands were in crop, the soil was still vulnerable to wind erosion due to low plant density and loose soil.

Agriculture lands fallow at the time of the event: The residue/stubble on the fallow lands left from the fall 2014 harvest was low due to low yield that year. Land owners harvested 24-25 bushels per acre in fall 2014, compared with a typical yield of around 40 bushels per acre. In addition, there was no moisture due to drought conditions in 2014 and 2015. The soil on the fallow farm lands did not have enough moisture or stubble to form or maintain clods, therefore, the soil on the fallow lands in August 2015 was loose and vulnerable to soil erosion.

Table 5 below shows winter wheat yield data from WSU Wheat and Small Grains Variety Testing Program in HHH area over the last several years (WSU Extension, 2015).

Table 5. Dry wheat yield information from 2013 to 2016.

Time of Harvest	Time of Crop Planted	Soft White Winter Wheat Average Yield (Bushel per Acre)	Hard Winter Wheat Average Yield (Bushel per Acre)
July and August, 2013	Fall, 2012	40	43
July and August, 2014	Fall, 2013	25	24
July and August, 2015	Fall, 2014	NY ¹	NY ¹
July and August, 2016	Fall, 2015	37	37

¹ No yield data due to variability and insignificant results.

Therefore, conditions in the years and months leading up to this event contributed to soil vulnerability to wind erosion on August 14, 2015.

3.2.2 Conditions During the Event

As determined in Section 2 of this demonstration, the main source of dust for this event was the agricultural lands in HHH Area. The strong sustained wind from the southwest of Kennewick

overwhelmed the controls on agricultural lands and carried particulate matter to the KENMETA, which caused this exceedance.

As discussed in Section 3.1, at KENMETA monitor, hourly average wind speed stayed elevated over 25 mph for over three hours and peaked at 28.6 mph at 2:00 PM. At the HHH source area monitor, BPKEN, the hourly average wind speed stayed elevated over 25 mph for over 19 hours, over 40 mph for over 11 hours and peaked at 54.0 mph at 2:00 PM.

As a result, hourly average PM₁₀ exceeded 150 µg/m³ for 12 hours and peaked at 4,126 µg/m³ at 2:00 pm (See Figure 10). The 24-hour PM₁₀ reading of 589 µg/m³ exceeded the PM₁₀ NAAQS at Kennewick.

The NWS issued a wind advisory, a blowing dust advisory and a dust storm warning throughout the region prior to and during this event (See Appendix C.1) (NWS Pendleton, 2015). There were also multiple media reports on this high wind event and collisions caused by this event (See Appendix C.4).

The dust plume as shown in Figure 5 originated in a field in eastern Klickitat County, south of Peterson Ranch Road and east of Alderdale Road, in the HHH area. Figure 6 shows the location of the non-irrigated wheat field where the dust plume initiated. High wind picked up more dust from other farmlands on the way from this area to the Kennewick monitor.

The back trajectories below at 50, 100 and 500 meters and the close up back trajectories support that the wind came from the southwest of Kennewick and passed over the HHH area (Draxler & Rolph, 2013).

NOAA HYSPLIT MODEL
Backward trajectories ending at 18:00 PST 14 Aug 15
HRRR Meteorological Data

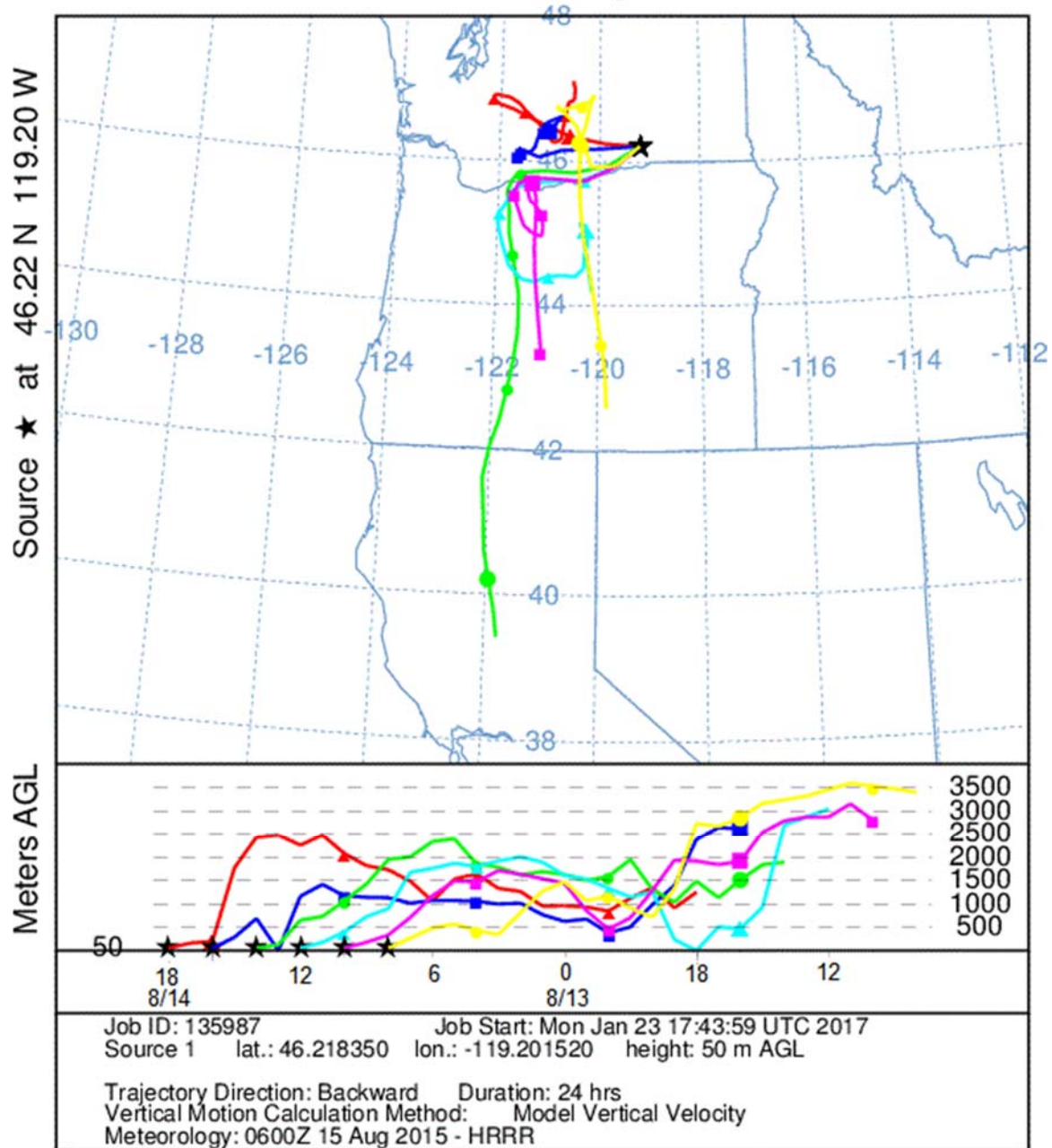


Figure 20. Back Trajectories on August 14, 2015 at 50 m.

NOAA HYSPLIT MODEL
 Backward trajectories ending at 18:00 PST 14 Aug 15
 HRRR Meteorological Data

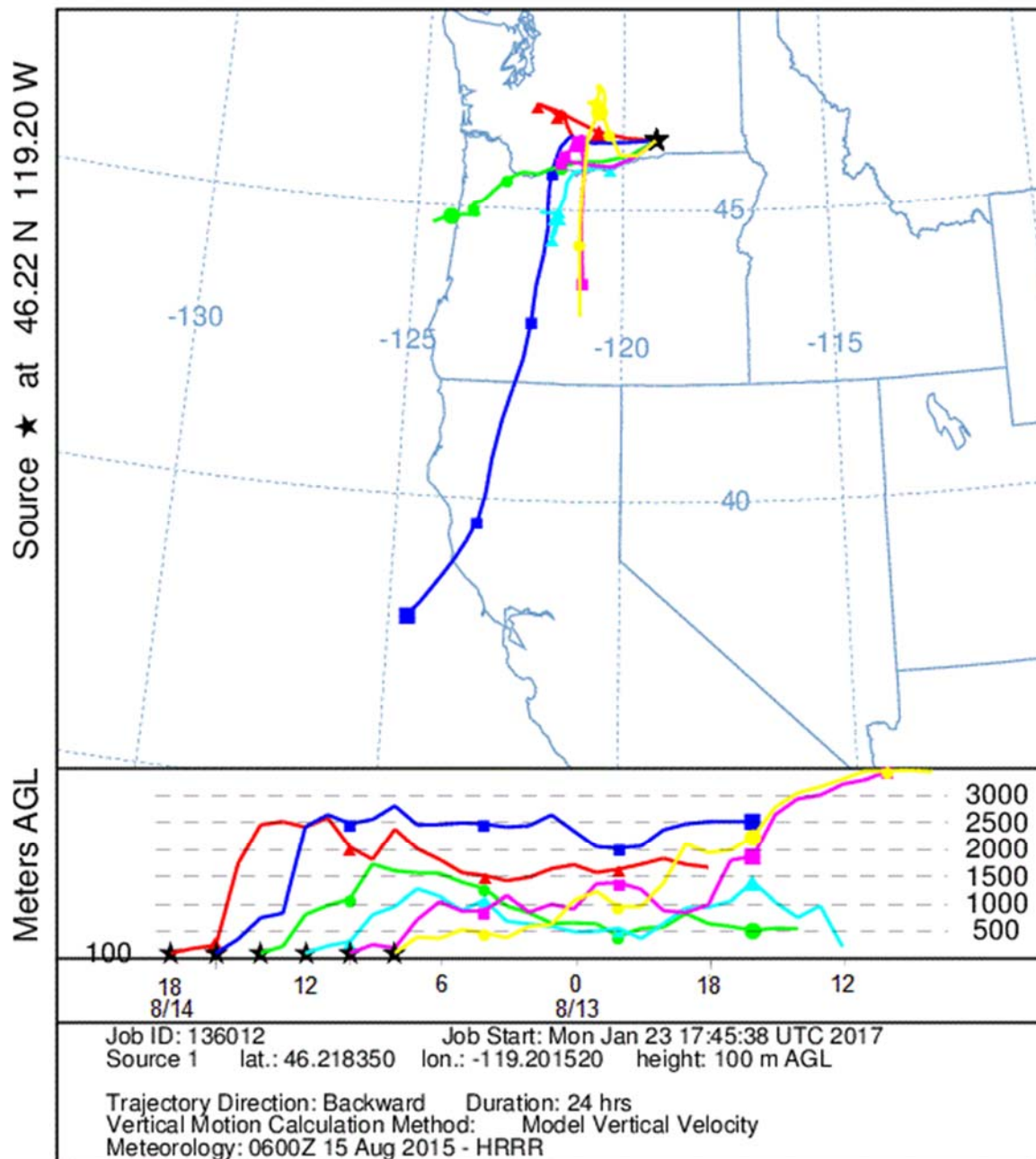


Figure 21. Back Trajectories on August 14, 2015 at 100 m

NOAA HYSPLIT MODEL
Backward trajectories ending at 18:00 PST 14 Aug 15
HRRR Meteorological Data

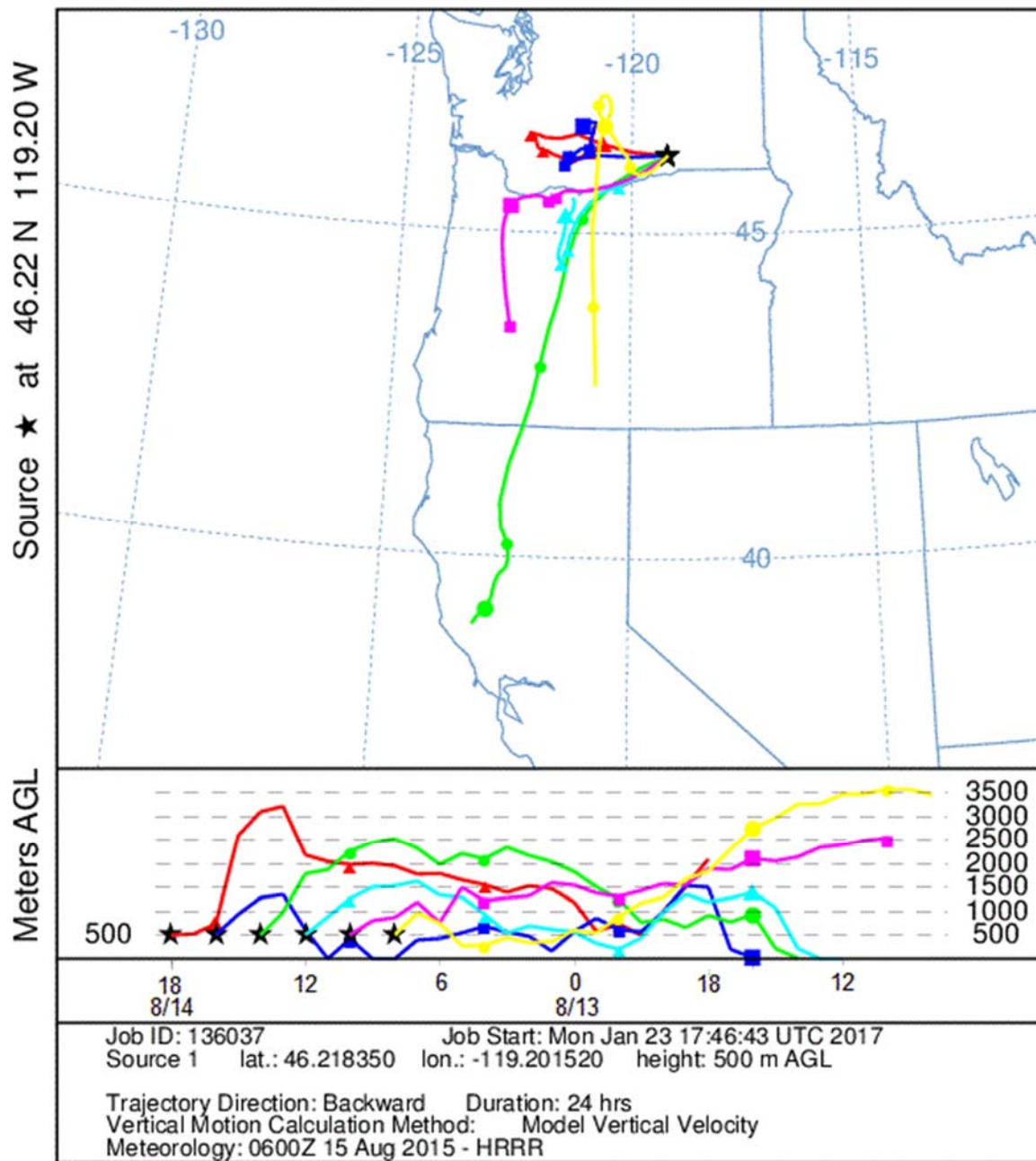


Figure 22. Back Trajectories on August 14, 2015 at 500 m

Kennewick Back Trajectory Close-Up **8/14/2015 2:00-18:00**

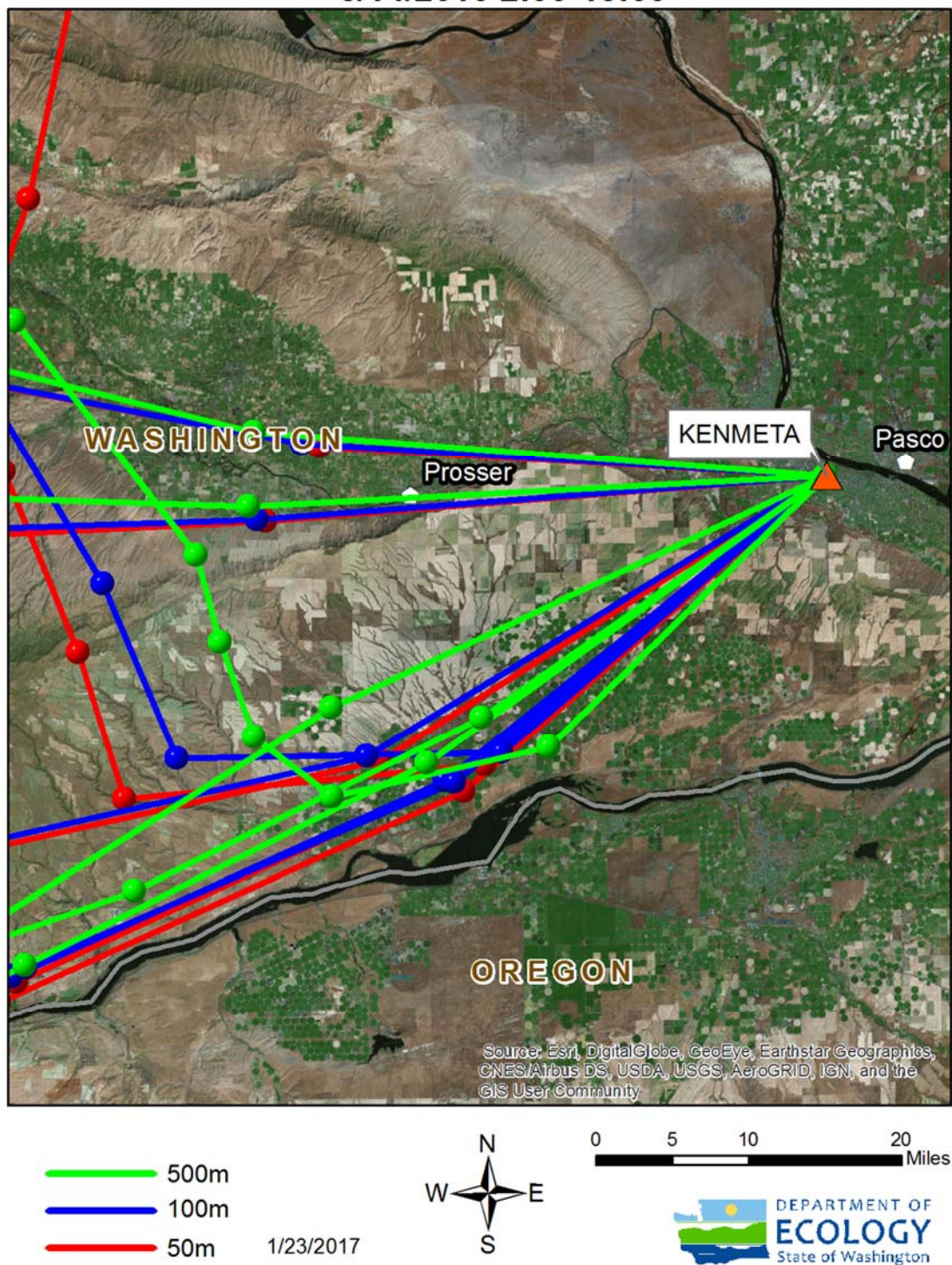


Figure 23. Close up Back Trajectories on August 14, 2015

3.3 Clear Causal Relationship

The 2016 EER requires that states demonstrate that a clear causal relationship exists between the event that affected air quality and the monitored exceedance. We prepared this section according to the guidance provided in Table 1 “Example Clear Causal Relationship Evidence and Analyses” on 81 F.R. 68241 (October 3, 2016). The following facts demonstrate a clear causal relationship for this event for this exceedance:

- The comparison of event-related concentration to historical concentrations discussed in Section 3.4 supports the direct causal relationship between high wind and the PM₁₀ exceedance.
- The NWS issued a wind advisory, blowing dust advisory, and dust storm warning throughout the region prior to and during this event (See Appendix C.1). These NWS advisories and warnings indicated the low pressure system and strong cold front caused the high winds which led to this exceptional event.
- News reports described strong winds and blowing dust in the Columbia Plateau (See Appendix C.4).
- Back trajectories (See Figure 20, Figure 21, Figure 22, and Figure 23) support that the winds came from the southwest of Kennewick and passed over the HHH area.
- The high wind picked up particulate matter from the dry wheat farmlands in the HHH area as shown in satellite imageries in Figure 5 and analyzed in Section 2.1.
- Pollution roses show that when the PM₁₀ concentrations were over 150 µg/m³, the wind direction was from the identified direction of the storm (See Figure 11 and Figure 12).
- PM₁₀ concentration patterns corresponded directly to the winds entraining the dust. As wind speeds increased, PM₁₀ monitored values increased, then declined after the storm passed the area, showing a direct causal relationship (See Figure 10).
- Comparison of PM₁₀ concentration and meteorology conditions to days preceding and following the event in Section 3.4.2 of this demonstration showed that the PM₁₀ level at KENMETA only exceeded the 150 µg/m³ NAAQS when the wind speed was over the 25 mph high wind threshold on August 14, 2015.
- There were no high PM₁₀ days without high wind events in the last five years since 2012 (See section 3.4.1).

Therefore, the current weight of evidence supports that high wind overwhelmed reasonable controls, entrained dust and caused the PM₁₀ exceedance in Kennewick on August 14, 2015.

3.4 Comparison of Event-Related Concentration to Historical Concentrations

The 2016 EER requires states to compare the event-related concentration to the historical concentrations. We prepared this section according to the guidance provided in Table 2 “Evidence and Analyses for the Comparison to Historical Concentrations” from 81 F.R. 68242 (October 3, 2016). The information also serves as an important basis for the clear causal relationship criteria.

3.4.1 Comparison with Historical Data and Identified “High” Values

Analysis and observations showed that high wind can cause significantly elevated PM₁₀ concentrations in the Kennewick area. In the most recent five years, records show 24-hour PM₁₀ concentrations at Kennewick were only over the federal PM₁₀ standard of 150 µg/m³ during high wind events. Figure 24 below shows most recent five year 24-hour PM₁₀ data from 2012 to 2016 and all exceedances are labeled with dates. There were seven 24-hour PM₁₀ exceedances during the most recent five year period (EPA, 2015).

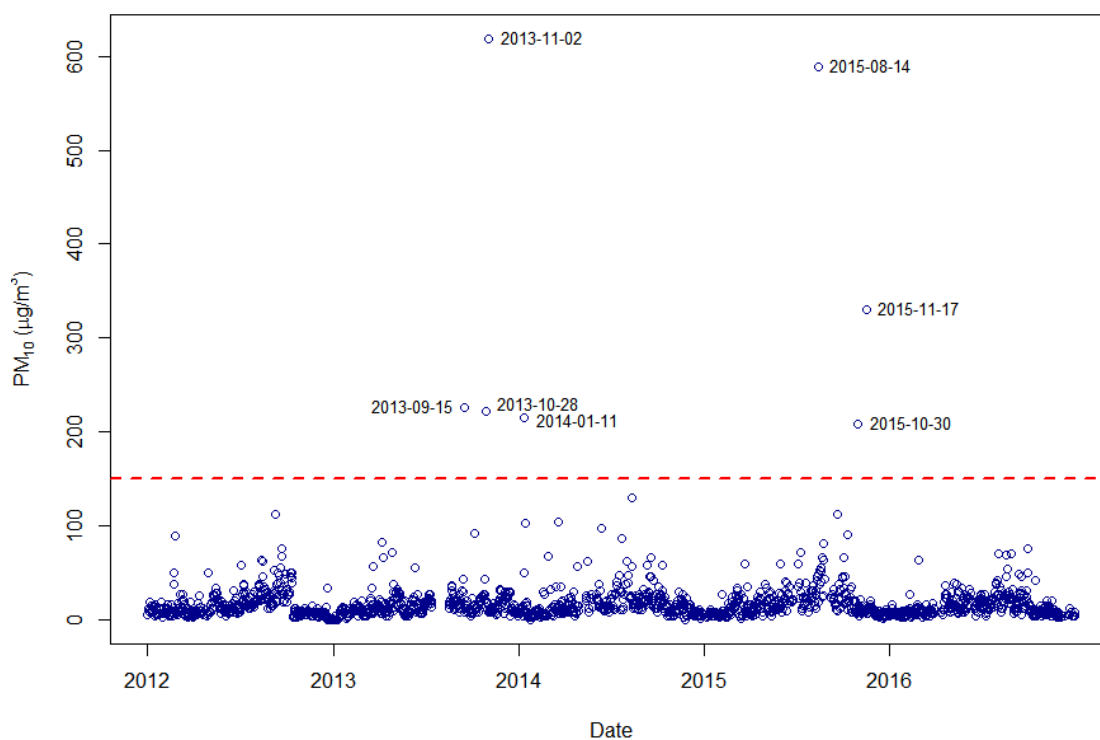


Figure 24. Kennewick 24-hour PM₁₀ concentrations by date, 2012-2016.

Figure 25 shows the correlation between 24-hour PM_{10} and daily 1-hour maximum wind speed. Ecology flagged all the exceedances in AQS, EPA's official database, as caused by high wind dust events. EPA concurred upon three exceedances in 2013 for exclusion from compliance determination through an exceptional event demonstration. The four exceedances in 2014 and 2015 had sustained wind speeds over the 25 mph high wind threshold in the EER and therefore, Ecology suspected exceptional events to have caused those exceedances.

Figure 25 does not show the September 15, 2013 data point because Ecology's Quality Assurance Unit invalidated the wind speed data from KENMETA on that day and these data were not available in AQS (EPA, 2015). The BPKEN monitor at the source area (See Appendix B for monitor location) of this event had maximum 1-hour wind speed of 55.7 mph and qualified as an exceptional event. The October 28, 2013 event had sustained wind speed below 25 mph at KENMETA. Wind data at the JUFW1 monitor in its source area reached 32 mph and these data were used to qualify this event as an exceptional event. "2013 Exceptional Event Demonstration: PM10 Exceedances due to High Winds at Kennewick" contains details concerning these two exceptional events.

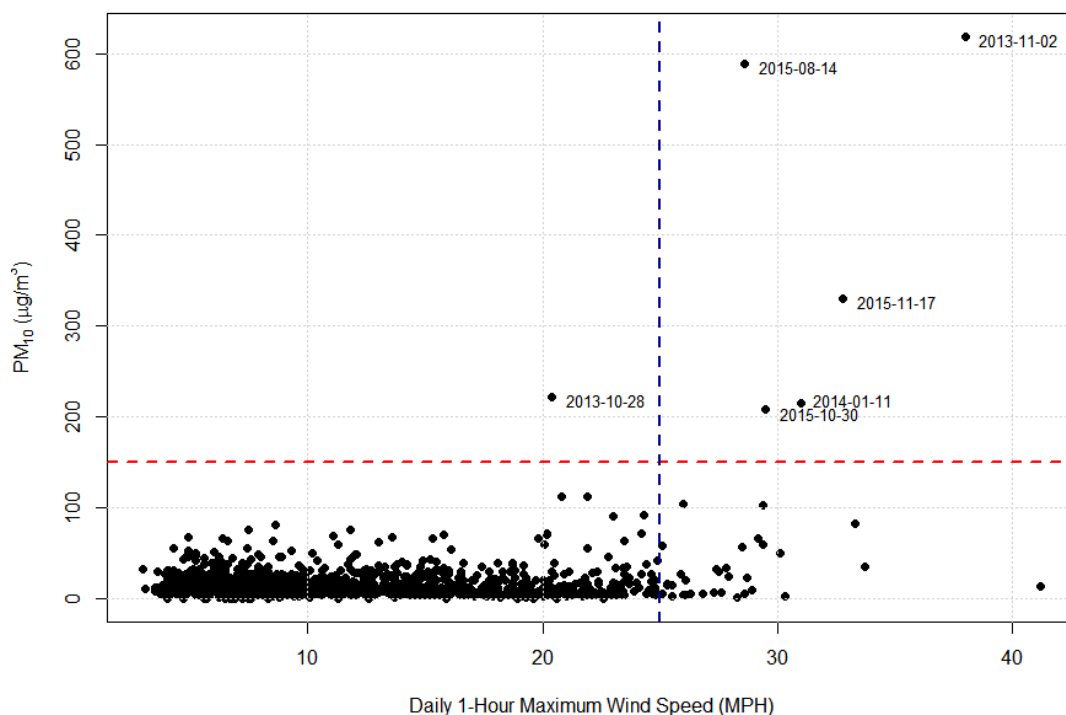


Figure 25. Kennewick 24-hour PM_{10} concentrations with daily 1-hour maximum wind speed, 2012-2016. The 25 mph wind speed threshold is shown in blue and the 24-hour PM_{10} standard of 150 $\mu g/m^3$ is shown in red.

The “high” values are identified and labeled in Table 6 below (EPA, 2015; Ecology, 2016).

Table 6. Dates and values of exceedances and wind speeds from area monitors, 2010 through 2016

Exceedance Date	24-hr PM₁₀ (µg/m³)	KENMETA Max 1-hr Average Wind Speed (mpg)	BPKE Max 1-hr Average Wind Speed (mpg)	JUFW1 Max 1-hr Average Wind Speed (mpg)	High Value Status
September 15, 2013	227	Invalidated	55.7		Exceptional Event
October 28, 2013	224	20.5		32	Exceptional Event
November 2, 2013	620	38.0			Exceptional Event
January 11, 2014	216	31.0			Suspected Exceptional Event
August 14, 2015	589	28.6	54.0		Suspected Exceptional Event
October 30, 2015	208	29.6			Suspected Exceptional Event
November 17, 2015	331	32.0			Suspected Exceptional Event

3.4.2 Demonstrate Spatial and Temporal Variability of PM₁₀ in the Area

No Nearby PM₁₀ Compliance Monitors: KENMETA was the affected monitor that recorded the exceedance on August 14, 2015 and it was the only PM₁₀ monitor in the area. The nearest compliance-grade PM₁₀ monitors are Yakima-4th Ave S monitor ~80 miles to the northwest (53-077-0009) and Spokane-Augusta monitor ~140 miles to the northeast (53-063-0021), neither of which were in the area affected by this high wind dust event. Since there were no nearby official compliance PM₁₀ monitors, the requirement to prepare one or more time series plots showing PM₁₀ concentrations at the affected monitor and nearby monitors in Table 2 on 81 FR 68242 (October 3, 2016) does not apply to this exceptional event demonstration.

Comparison of Concentration on the Event Day with Neighboring Days: Figure 26 below shows the hourly average wind speed, PM₁₀ and wind direction at KENMETA on August 14, 2015, along with the same data from the surrounding two weeks. The PM₁₀ level at KENMETA corresponded well with the wind speed in this figure (EPA, 2015). It only exceeded the 150 µg/m³ NAAQS when the wind speed was significantly elevated on August 14, 2015 (shaded in grey in the figure).

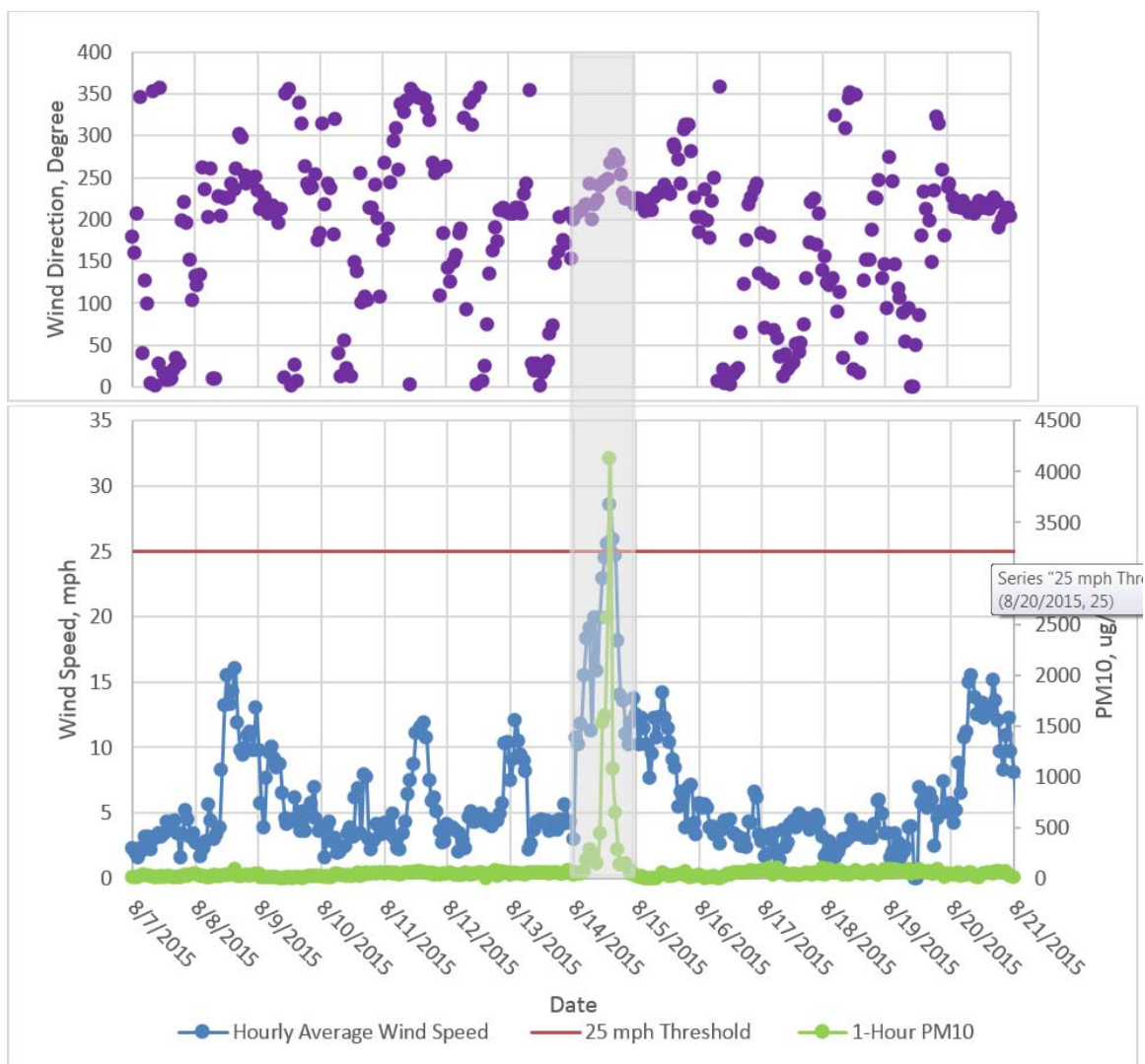


Figure 26. Hourly average wind speed, PM₁₀ and wind direction at KENMETA with the surrounding two weeks of the event day on August 14, 2015

Similarities of This Event with Historical Events: Ecology had three PM₁₀ exceedances at KENMETA in 2013 that EPA concurred upon the exceedances as caused by exceptional events. Exceptional events on September 15, 2013 and November 2, 2013 had wind direction from southwest, which were similar to this event. The exceptional event on October 28, 2013 had wind direction from northeast and therefore, had a different source area than this event. Ecology determined that the exceptional events on September 15, 2013 and November 2, 2013 are appropriate to compare with this event.

You can find the meteorological reports for all three events in:

- Appendix C of 2013 demonstration for September 15, 2013

- Appendix E of 2013 demonstration for November 2, 2013
- Appendix C.1 of this demonstration for August 14, 2015

Comparison with September 15, 2013 EE (Ecology, 2016): At Kennewick, there was a severe thunderstorm with 0.27” of rainfall on September 15, 2013. There was a strong cold front without any precipitation on August 14, 2015. Both the thunderstorm and the strong cold front led to sustained high winds from southwest of Kennewick. The high wind overwhelmed the controls on the agriculture lands in the HHH area and created abnormally high dust (PM₁₀) levels.

Figure 27 below shows the hourly average PM₁₀ at KENMETA, and hourly average wind speed and direction at BPKEN (source area monitor for this event) on September 15, 2013, along with the same data for the surrounding two weeks (EPA, 2015; BPA, 2015). Comparing with Figure 26, the PM₁₀ level at KENMETA only exceeded the 150 µg/m³ NAAQS when the wind speed was significantly elevated on September 15, 2013 (shaded in grey in the figure). The difference is that the PM₁₀ level was only elevated for a short period of time on September 15, 2013. Although there were some high winds following the event day, they did not cause elevated PM₁₀ levels because the rainfall during the thunderstorm added moisture to the soil suppressing the dust in the air.

Comparison with November 2, 2013 EE (Ecology, 2016): At Kennewick, there were strong cold fronts on both November 2, 2013 and August 14, 2015. The strong cold fronts led to sustained high wind from southwest of Kennewick. There was 0.14” of light rain on November 2, 2013 before the wind speed picked up, while there was no rain fall at all on August 14, 2015. During both events, the high wind overwhelmed the controls on the agriculture lands in the HHH area and created abnormally high dust (PM₁₀) levels.

Figure 28 below shows the hourly average PM₁₀, wind speed and direction at KENMETA on November 2, 2013, along with the same data for the surrounding two weeks (EPA, 2015). Compared with Figure 26, the PM₁₀ level at KENMETA only exceeded the 150 µg/m³ NAAQS when the wind speed was significantly elevated on November 2, 2013 (shaded in grey in the figure). The light rainfall on November 2, 2013 did not help to suppress the dust due to the long lasting drought conditions in the months leading up to the event.

At Kennewick, PM₁₀ exceedances are likely associated with high wind events. There were apparent similarities between the previously approved exceptional events in 2013 and the event on August 14, 2015.

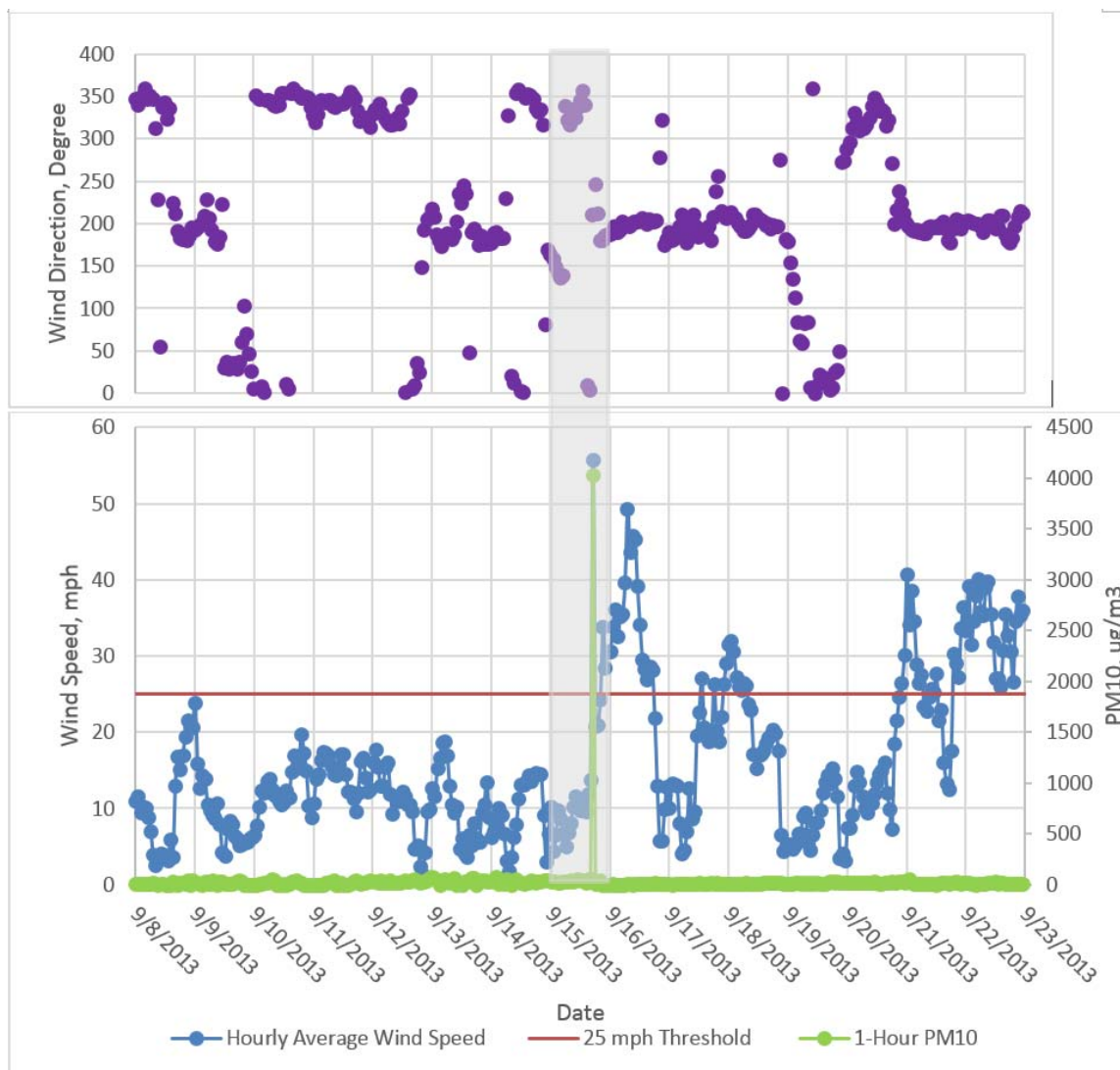


Figure 27. Hourly average PM10 at KENMETA and hourly average wind direction and wind speed at BPKEN with the surrounding two weeks of the event day on September 15, 2013⁷

⁷ Wind speed and direction data from KENMETA on September 15, 2013 was invalidated and not available in AQS. Therefore, the wind speed and direction data from the source area monitor, BPKEN, are shown in this figure.

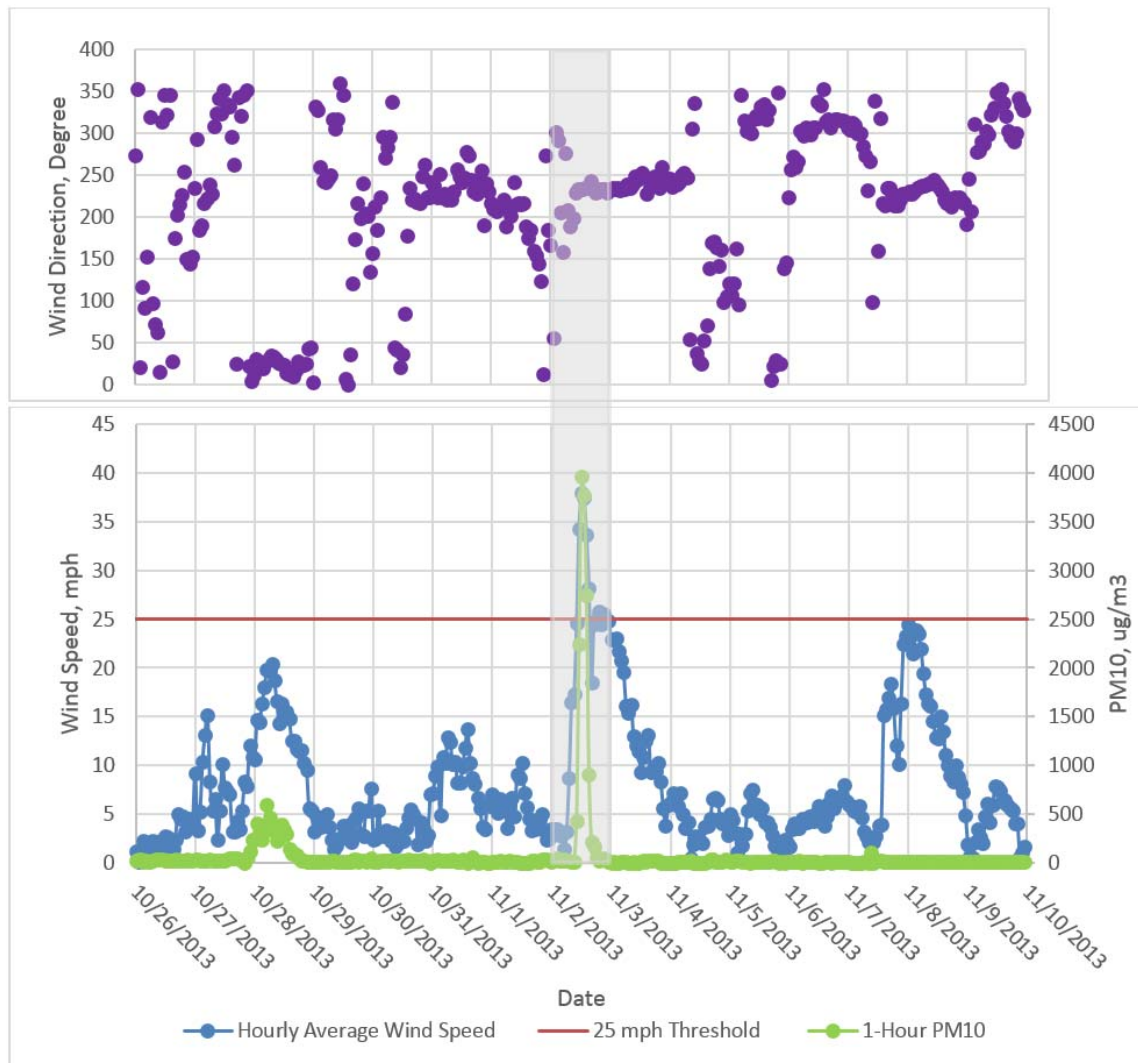


Figure 28. Hourly average wind speed, PM₁₀ and wind direction at KENMETA with the surrounding two weeks of the event day on November 2, 2013.

3.4.3 Determine Percentile Ranking

Figure 29 shows a frequency distribution for the 24-hour PM₁₀ levels for the most recent five years, 2012-2016, at Kennewick (EPA, 2015). This illustrates that exceedances of the PM₁₀ standard at this monitor are rare and values are normally well below the standard. The PM₁₀ exceedance that occurred on August 14, 2015 was the second highest in the most recent five years.

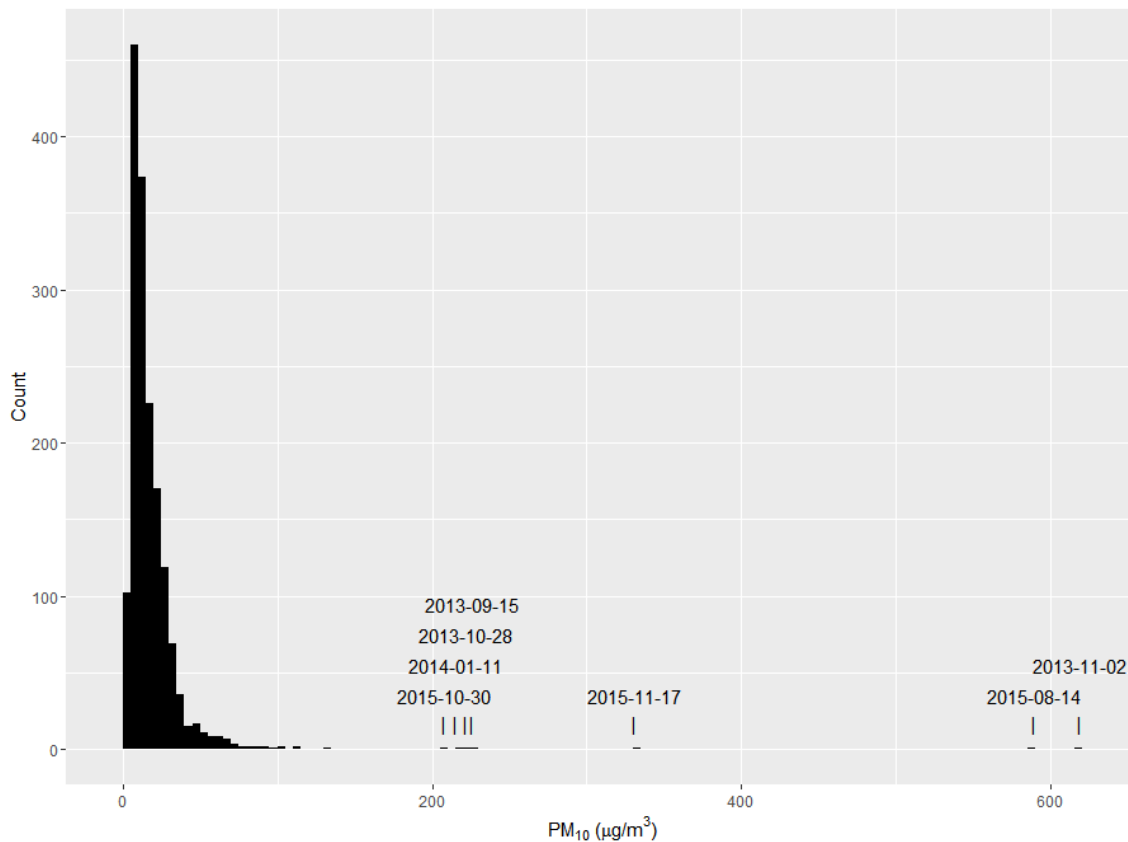


Figure 29. Kennewick frequency distribution of 24-hour PM₁₀ concentrations, 2010-2016.

Table 7 below shows that the PM₁₀ exceedance on August 14, 2015 was higher than 99.9 percent of values during most recent five years and was the highest in CY2015 at KENMETA monitor (EPA, 2015).

Table 7. August 14, 2015 Kennewick 24-hour PM₁₀ value and its percentile ranking.

24-hour PM ₁₀ (µg/m ³)	589
5-year Percentile Ranking	99.9%
Annual Percentile Ranking (CY2015)	>99.99%

This evidence shows that PM₁₀ exceedances occur infrequently and the August 14, 2015 exceedance was outside the range of normal PM₁₀ values at Kennewick.

3.4.4 Plot Annual Time Series

Table 2 from 81 F.R. 68242 (October 3, 2016) also suggested an annual time series plot to show the range of “normal” values. Figure 30 overlays five years of 24-hour PM₁₀ data and marks data points with EE and suspected EE (EPA, 2015). The PM₁₀ exceedances typically occurred in late summer to fall of the year (August to November). One exceedance occurred on January 11,

2014. All exceedances were associated with sustained high wind. During non-event days, the PM₁₀ levels were typically well below the NAAQS.

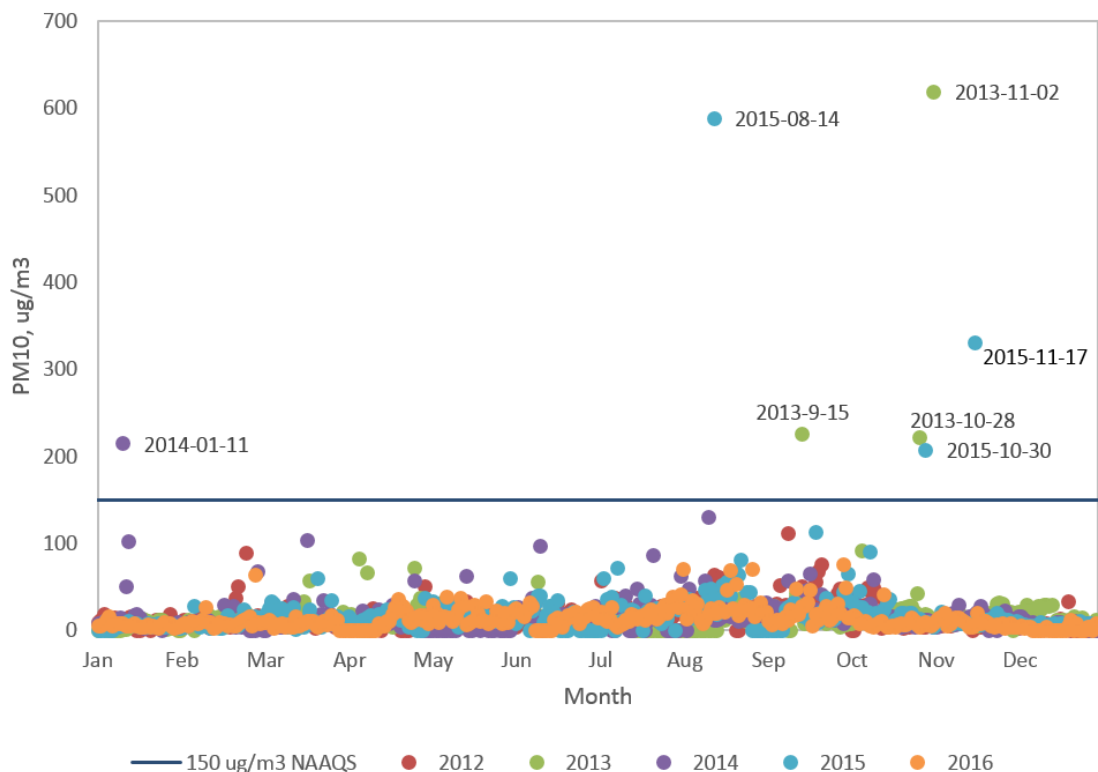


Figure 30. Overlay Five Years of 24-hour PM₁₀ data from KENMETA Monitor.

3.4.1 Identify Diurnal or Seasonal Patterns

The high wind dust events do not have diurnal patterns since the meteorological conditions that generate high wind can hit Kennewick anytime during the day. The high wind dust events typically happen late summer to fall of the year (August to November). This event follows the seasonal patterns of high wind dust events in the area.

With all the evidence and analysis provided in this section, the PM₁₀ exceedances at KENMETA monitor were not likely to occur without the sustained high wind. The high wind event on August 14, 2015 was consistent with previous approved exceptional events in 2013. Therefore, the comparison of event-related concentrations to historical concentrations discussed in this section supports the direct causal relationship between high wind and PM₁₀ exceedances.

3.5 Not Reasonably Controllable or Preventable

Per 40 C.F.R. 50.14(c)(3)(iv), 2016 EER requires states to demonstrate that the event was both not reasonably controllable and not reasonably preventable. Per 40 C.F.R. 50.14(b)(5)(iv), states

are not required to provide a case-specific justification for a high wind dust event to address the not reasonably preventable criterion. Therefore, Ecology only provides demonstration to meet the not reasonably controllable criterion in this section for this high wind dust event.

Ecology prepared this section according to the guidance provided on 81 F.R. 68235 (October 3, 2016). Ecology determined that the level of control in place before and during the event was sufficient to meet the not reasonably controllable criterion in the EER.

3.5.1 Identify Natural and Anthropogenic Sources

Section 2 and Section 3.2 of this demonstration identifies and describes particulate matter sources that contributed to the August 14, 2015 exceedance. The sources include:

- Natural sources in HHH source area
 - Wildfires: there was minimal contribution for this event.
- Anthropogenic sources in HHH source area
 - Agriculture activities (dry wheat farming): they were the main contributing emission sources for this event.
 - Industrial sources: there were no known identified upsets or complaints on that day and therefore they were not contributing sources for this event.

Therefore, this section focuses on demonstrating that the event was not reasonably controllable, and providing information of control measures for agriculture activities in the source area.

3.5.2 Control Measures in Place

As identified in Section 2 of this demonstration, the main source of PM₁₀ for the exceedance on August 14, 2015 was the dust from agriculture lands in HHH area. This section provides information on control measures in place for the agriculture activities in this area prior to and during the event on August 14, 2015.

As we will demonstrate in this section, reasonable controls were in place to minimize wind erosion and fugitive dust from agriculture activities.

3.5.2.1 USDA-NRCS Conservation Measures for Agriculture

USDA-NRCS, previously known as the Soil Conservation Service, has an over 80-year history and is the recognized expert in managing soil erosion from agriculture lands. Since the agency was formed, conservation research has shown that keeping crop residues on the soil surface and reducing or eliminating tillage are effective for reducing soil erosion. NRCS emphasizes these conservation measures for both post-harvest and during fallow for

reducing agricultural soil erosion and windblown dust in the Pacific Northwest (Papendick & Moldenhauer, 1995).

According to USDA's National Agronomy Manual, the NRCS bases conservation practices to reduce wind erosion on the following principles (USDA-NRCS, 2011):

- Establish and maintain adequate vegetation or other land cover, including crop residue
- Reduce unsheltered distance along the wind erosion direction
- Produce and maintain stable clods or aggregates on the land surface
- Roughen the land with ridge and/or random roughness

Conservation Title Programs: NRCS offers the following three major Conservation Title Programs, which are financial assistance programs designed to treat natural resources concerns, such as soil erosion:

- Farm Service Agency (FSA) Conservation Reserve Program (CRP)
- NRCS Environmental Quality Incentives Program (EQIP)
- NRCS Conservation Security/Stewardship Program (CSP)

These programs help agriculture producers adopt conservation practices to reduce soil erosion, improve soil health and reduce air quality concerns. Conservation practices included in these programs are recognized as Best Management Practices (BMPs) for controlling agriculture soil erosion and windblown dust. Federal Farm Bills have funded these Conservation Title Programs since 1985 and their participation fluctuates depending on funding levels and crop prices.

While participation in NRCS Conservation Title Programs is voluntary, hundreds of agricultural producers implement conservation practices that keep the soil protected and dust out of the air. NRCS and FSA programs have audit provisions that check whether land owners have implemented or maintained the conservation practices properly. A violation of these provisions can put producer's eligibility at risk for most NRCS and FSA programs.

Each producer works with their county conservation district and chooses measures appropriate for their particular land characteristics. While some producers implement conservation practices without receiving financial assistance, most producers use USDA Programs' financial assistance to implement no-till or mulch/reduced tillage conservation practices.

Ecology identified these Conservation Measures as Best Available Control Measures (BACM) in the 2003 NEAP and BMP by NRCS for agricultural dust sources. More details on these three NRCS Title programs are as follows.

Conservation Reserve Program: Historically, CRP has been the most used conservation program on the Columbia Plateau. FSA administers CRP with technical support from the NRCS and

other partners. Producers enrolled in CRP remove environmentally sensitive agricultural land from production and plant with cover vegetation to control soil erosion, improve the water quality, and enhance wildlife habitat.

FSA designated parts of Benton, Franklin, Adams, Grant, Douglas, Lincoln, Walla Walla, Yakima and Klickitat counties as Air Quality Zone (See Figure 31 below), which is a type of Conservation Priority Areas. Lands in the Conservation Priority Areas automatically qualify to apply for general CRP and get maximum of extra five points toward national general CRP ranking (Gertsch, 2017).

Under Food Security Act of 1985, highly erodible land (HEL) contains soils that have an erodibility index of eight or more and qualifies to apply for the general CRP (USDA-FSA, 2013). The HEL with erodibility index of 20 or more qualified to apply for the CRP - Highly Erodible Land Initiative (USDA-FSA, 2012).

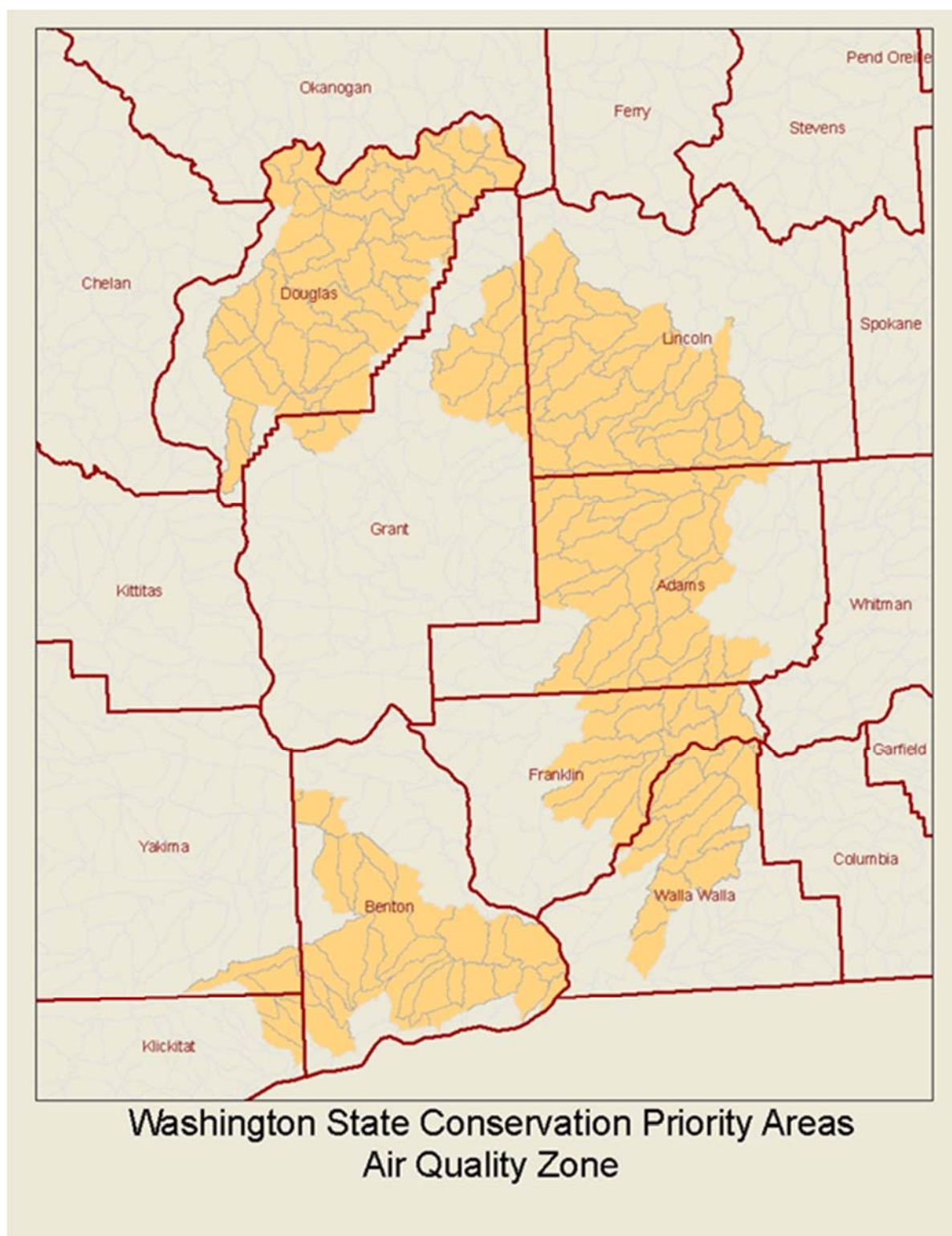


Figure 31. Washington State Conservation Priority Area - Air Quality Zone (in yellow)

The NRCS encourages producers to enter lands in the Air Quality Zone into CRP contracts with FSA. Producers who qualify to remove land from crop production establish a cover on the land

to control wind and/or water erosion and are compensated for the length of the contract. Contracts are generally 10 to 15 years.

NRCS Environmental Quality Incentive Program (EQIP): [EQIP](#) is a voluntary program that provides financial and technical assistance to eligible agricultural producers to address soil, water, air and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner (USDA-NRCS, 2017). Producers receive assistance after practices and activities identified in EQIP plan are implemented and certified to meet NRCS practice standards. EQIP contracts are typically three years.

EQIP programs incentivize residue and tillage conservation practices because they are consistent with soil erosion prevention principles by increasing crop residue and/or surface roughness.

The following is a comparison of different types of tillage:

- Conventional tillage: producers leave less than 15% soil surface covered by previous year's crop residue following harvesting.
- Reduced tillage: Producers leave between 15 and 30% residue cover on the soil. This may involve the use of a chisel plow, field cultivators, or other implements. Many practices can leave much more cover, 50% or higher. Reduced-till limits tillage and the soil-disturbing activities before planting, and manages plant residue year-round.
- Conservation tillage: To qualify as full conservation tillage, producers must leave at least 30% residue and they often leave more.
- No-till: Producers plant crops directly through vegetative cover or crop residue of the previous year's crop and aim for 100% soil cover year round. Using any form of tillage disqualifies the land for true no-till.

Producers in the eastern HHH in Klickitat County use another EQIP conservation measure, Forage and biomass, to convert crop land to permanent cover that can be grazed, hayed or used for other biomass production. The permanent plant cover will anchor the soil and prevent wind erosion.

The EQIP [Air Quality Initiative](#) (AQI) is a National Initiative funded under the EQIP program and rolled out in Washington in 2014 (USDA-NRCS, 2014). This program provides technical and financial assistance to qualified operations in select counties to implement reduced till (mulch till), no till, direct seeding practices, etc. This Initiative made additional funding available, beyond the normal EQIP funding, to counties having historical nonattainment designations for PM₁₀.

Washington received \$1.6 million of AQI funding in 2014. Benton County received almost all of that allotment for conservation measures to improve air quality by implementing soil erosion practices. Land owners signed seven contracts committing 9,605 acres to high residue tillage

practices for approximately three years (Gekosky, 2014). Washington received \$2.3 million of AQI funding in 2015 and land owners signed 3-year contracts for 10,367 acres for residue management practices in Benton County.

Klickitat County became eligible to apply for AQI funding in April 2017.

NRCS Conservation Stewardship Program (CSP): The [CSP](#) provides financial assistance to participants according to their conservation performance — the better the performance, the higher the payment. In CSP, producers apply conservation enhancements to make positive changes in soil, water and air quality, water quantity, plant and animal resources, and energy conservation (USDA-NRCS, 2017).

Besides USDA, other organizations that promote conservation practices that prevent soil erosion are:

- [Pacific Northwest Direct Seed Association](#)
- [WA Conservation Partners to Soil Health Committee](#)
- [Washington Tilth Association](#)

3.5.2.2 Federal Legislation

The following federal laws include requirements that apply to producers.

Food Security Act: Title XII of the Food Security Act enacted on December 23, 1985 introduced a number of conservation provisions to address environmental concerns associated with soil erosion and water resources. Highly Erodible Land Conservation (HELC), or the “Sodbuster” provision, in Food Security Act requires all producers of agriculture commodities to protect all croplands classified as highly erodible lands (erodibility index of eight or more) from excessive erosion.

To comply with this provision, producers must certify that they will not plant or produce an agricultural commodity on HEL without following an NRCS approved conservation plan (USDA-NRCS, 2017). Producers with HEL must follow a conservation plan or system approved by NRCS that substantially reduces soil loss. Producers that are not in compliance with HELC provision are not eligible to receive benefits for most FSA and NRCS funds.

FSA administers this program while NRCS and the Risk Management Agency (RMA) complies with these provisions of Food Security Act.

Farm Bills: The Agricultural Act passed in 2014 (2014 Farm Bill) maintained many of the same programs. CRP, EQIP and CSP Programs were well funded even though CRP has an enrollment reduction from previous level.

The 2014 Farm Bill recoupled conservation compliance with eligibility for most USDA conservation programs. Since the 1985 Farm Bill, HEL producers were required to certify that they followed an NRCS approved conservation plan or program and any HEL producers in violation would jeopardize their eligibility for most USDA programs and federal crop insurance premium subsidies. After the 2014 Farm Bill was announced, these requirements extended to all producers wanting federal crop insurance premium subsidies and this requires producers to certify that they are following an NRCS approved conservation plan that details minimum levels of surface residue during the critical erosion period.

A new farm bill is in development and adoption is expected to be in 2018 or later.

3.5.2.3 Washington's NEAP

EPA accepts USDA/NRCS-approved BMP as reasonable controls in cases where these measures have been incorporated into an EPA-approved SIP, according to the EER preamble on 81 F.R. 68260 (October 3, 2016). The NEAP and its updates contains USDS/NRCS-approved BMPs for agriculture activities on the Columbia Plateau which includes the HHH source area. EPA approved the NEAP into the SIP as part of the Wallula Maintenance Plan in 2005.

Washington's original NEAP was completed in 1998, updated in 2003, reported in 2007 for CY 2006 and remains in effect. You can access the 2003 NEAP through Ecology's Publications Webpage, [Publication 03-02-014](#), which includes the original 1998 plan in its Appendix C. The 2006 Status Report (March, 2007) was included in [the 2013 Exceptional Event Demonstration as Appendix H](#).

The NEAP and its updates:

- Highlighted the extensive research done on the soil and conservation methods and documented the conditions when controls could be overwhelmed.
- Defined agricultural BACM as USDA Conservation Title Programs supplemented by implementation of incentive-based wind erosion conservation practices.
- Determined that Columbia Plateau counties were using BACM.

When developing the NEAP, Ecology relied on the NRCS Field Office Technical Guide for adoption of conservation practices and the CP3 for conservation practice research. These resources provided a fundamental basis for well proven conservation practices and region-specific BMPs for reducing wind soil erosion.

The 2006 Status Report summarized data from 2004, the last year for which Core 4 compiled data was available⁸. The Core 4 evaluation included data for CRP, minimum tillage, and residue remaining on fields. The 2004 data showed almost 80 percent of Columbia Plateau counties' total farmable lands were in USDA conservation programs and used one of the conservation tillage practices which contained at least 15-30 percent residue.

3.5.2.4 Washington State Laws and Rules

Washington Clean Air Act and Right to Farm Act both apply to agricultural operations statewide (Klickitat County is under Ecology's Jurisdiction).

Clean Air Act: RCW (Revised Code of Washington) 70.94.640 exempts agricultural operations from fugitive dust requirement under Clean Air Act with good agricultural practices unless they have a substantial, adverse effect on public health (RCW 70.94.640, 2005). The RCW defines Good agricultural as "economically feasible practices which are customary among or appropriate to farms and ranches of a similar nature in the local area."

Right to Farm Act: Per RCW 7.48.305, the Right to Farm Act provides exemption from enforcement of fugitive dust rules if the agricultural activities (RCW 7.48.305, 2009):

1. Are consistent with good agricultural practices;
2. Pre-date the surrounding nonagricultural activities; and
3. Do not have a substantial adverse effect on the public's health and safety.

Washington State Fugitive Dust and Fugitive Emissions rules (Chapter 173-400 WAC, 2016): are codified in Chapter 173-400 WAC (Washington Administrative Code).

WAC 173-400-030 and 173-400-040 define fugitive emissions and fugitive dust and require sources to take reasonable precautions to prevent fugitive dust/emissions.

These state fugitive dust and fugitive emissions rules were effective on September 20, 1993 and approved into [Washington's State Implementation Plan](#) (SIP) by EPA on June 2, 1995 before this exceedance.

3.5.2.5 BCAA Fugitive Dust Policies and Rules

In Benton County, BCAA has their own fugitive dust and emissions rules, Urban Fugitive Dust Policy and dust provisions in their Compliance Manual.

⁸ Core 4 was an information sharing and management system sponsored by private and public sector organizations. This project provided the most comprehensive information on minimum tillage practices available and included residue-on-the-field estimations that represent a collection of conservation practices. This program was not funded after 2004.

Benton Clean Air Agency Fugitive Dust and Emissions rules: BCAA Regulation 1 Article 4 contains BCAA fugitive dust rules. EPA adopted these rules into the SIP on 11/17/2015 ([80 FR 71695](#)). BCAA amended these rules on April 28, 2017 and added:

1. Definition for agricultural activities, agricultural land and good agricultural practices.
2. Project notification requirements to promote quick response primarily for construction sites dust issues.
3. Agricultural particulate matter emissions provision to establish and enforce good agricultural practices.

These amendments of the BCAA fugitive dust rules strengthened enforceability towards agricultural fugitive dust.

Urban Fugitive Dust Policy (BCAA, 2017): BCAA has an active dust enforcement program in their [Urban Fugitive Dust Policy](#). The agency has one full-time person dedicated to dust control. BCAA provides dust control enforcement for Benton County and the cities in Benton County (Kennewick, Richland, Prosser, Benton City and West Richland). Local planning departments refer construction applicants to BCAA for guidance on dust control and, depending on the scale of the project, BCAA may require the contractor to submit a dust control plan. That plan may become part of an enforceable Compliance Order. BCAA responds to complaints about dust moving off property and works with the property owner or contractor to mitigate the dust. Generally, BCAA promptly remediates sites with dust control issues. BCAA expects property owners or contractors to implement practices in the Urban Fugitive Dust Policy. If responsible parties do not follow these practices and someone observes dust leaving the property, BCAA begins warning and other enforcement actions. BCAA may issue penalties under certain circumstances.

Benton County Clean Air Agency Compliance Manual (BCAA, 2017): This manual includes policies and procedures for dust sources inspections and enforcement in Benton County. The BCAA Board of Directors adopted a new compliance manual in April 2017 and added “Appropriate Compliance Response for Dust from Agricultural Operations” section. This new section provided additional guidance on how to evaluate whether agriculture operations are following good agricultural practices prior to issuing any notices of violation.

As indicated by BCAA, the agriculture related amendments in both BCAA rules and Compliance Manual primarily focus on addressing fugitive dust issues from agriculture tillage and vineyard conversion. NRCS documents good agricultural practices for tillage. However, BCAA has not found any third party expert with good agriculture practices for vineyard establishment. The dust typically only occurs when soil is disturbed and exposed during conversion to vineyard,

which is short term. Land owners generally irrigate the new vineyards by drip systems and cover the soil with plants, reducing the chance of fugitive dust after conversion.

The new BCAA rules and policies allow the agency to request the agriculture operation to provide information of their good agriculture practices and timeline. This information will assist with informing the complainant and enforcing the fugitive dust rule.

3.5.3 Effectiveness and Implementation Status of Reasonable Controls

This section presents information on the effectiveness and implementation status of conservation practices Benton and Klickitat Counties had in place to minimize soil erosion and control dust before and during the exceptional event on August 14, 2015.

3.5.3.1 Conservation Measures Effectiveness

WEPS Model: Wind Erosion Prediction System (WEPS) is a tool for predicting the effects of management practices and crop rotations on wind erosion for an individual field. In order to illustrate the benefits of implementing reduced tillage residue management system, NRCS estimated PM₁₀ emissions from a field in Douglas County using the WEPS model. The HHH area has similar soil type as the field in Douglas County, which is further north on the Columbia Plateau and uses the same conservation measures as Douglas County. Therefore, the results of implementing conservation measures in both areas are likely similar.

Below are the results from both low residue crop and a high residue crop (USDA-NRCS, 2017). After the first year of reduced tillage practice implementation, the estimated reductions of PM₁₀ emissions per acre are shown in Table 8 below.

Table 8. Douglas County field estimate of PM₁₀ loss before and after implementation of reduced tillage practices, tons/acre

Crop Type	Before (ton/acre)	After (ton/acre)
Low residue crop	1.89-2.24	0.58
High residue crop	1.51-2.11	0.01-0.9

With reduced tillage practices, PM₁₀ emissions from the agriculture lands were largely reduced for both high residue crop and low residue crop operation.

The producers typically implement the reduced tillage practices on a large scale (200 acres or even more) under NRCS conservation programs and the amount of PM₁₀ emissions reduction are significant. Therefore, based on the WEPS model results, these conservation measures are effective in reducing fugitive dust from agriculture operations.

WSU Research: WSU and its partners have studied Washington’s Columbia Plateau for more than 30 years. Their extensive research shows that conservation measures, such as no-till and under cutter conservation tillage, are the best management practice for producers and the environment and can effectively reduce wind soil erosion in the HHH area.⁹

USDA Conservation Effects Assessment Project (CEAP) Studies (NRCS-CEAP, 2014): The CEAP conducted studies to quantify the effects of conservation practices on cultivated cropland in the Pacific Northwest Basin. The basin includes all of Washington, most of Oregon and Idaho, part of western Montana, and small parts of California, Nevada, Utah, and Wyoming. This study established a baseline using data from 2003 through 2006 and estimated wind erosion in APEX using the Wind Erosion Continuous Simulation (WECS) model. The model simulations indicated that conservation practices, such as residue and tillage management and reduced tillage, have reduced the average wind erosion rate by 25 percent in the region (See Table 9 below). Also, the results showed that wind erosion on land in long-term conservation cover, such as land in CRP and land using forage and biomass, is negligible when responsible parties establish grass or other cover on land.

Table 9. Average annual wind erosion for cultivated cropland in the Pacific Northwest Basin

Land Type	Baseline conservation condition (ton/acre)	No-practice scenario (ton/acre)	Reduction due to practices (ton/acre)	Percent reduction (%)
Cropped acres	1.90	2.53	0.62	25
Land in long-term conserving cover	<0.01	0.02	0.02	100

3.5.3.2 USDA-NRCS Conservation Measures Implementation Status

Growers in Benton and Klickitat Counties participate in USDA agricultural conservation programs as appropriate and NRCS South Central Local Work Group represents them. NRCS Local Work Groups set priorities and provide funding allocation recommendations to the state NRCS office.

Ecology maintains a good working relationship with the NRCS South Central Washington workgroup and generally attends their annual local workgroup meetings. During the meetings, Ecology encourages this local work group to improve air quality by applying soil erosion prevention practices for agriculture activities. The NRCS South Central Washington workgroup

⁹ The WSU publications can be found [here](#).

consistently recommends that soil erosion stays a priority resource concern in their jurisdiction. Local work group recommendations influence NRCS funding prioritization.

While information on CRP participation is still available, the county-by-county reporting through Core 4¹⁰ on conservation tillage practices was discontinued after 2004. There is no such information available elsewhere. Instead, the FSA, Washington NRCS and Benton and Eastern Klickitat County Conservation Districts provided the following information for Conservation Title Programs participation:

- CRP implemented acres, 1986-2015, FSA
- EQIP implemented acres for Benton county on no-till and reduced-till, 2009-2015
- CSP implemented acres by county
- Benton County Conservation District funded programs
- Eastern Klickitat County Conservation District funded programs

CRP Implementation Status: The CRP is a highly successful program for removing certain agricultural land from production and planting with soil cover vegetation. Figure 32 shows the acres in CRP for both Benton and Klickitat Counties since 1986. From 1998 to 2008, land in CRP in Benton County grew from ~40,000 to 120,000 acres, while land in CRP in Klickitat County grew from ~35,000 to 65,000 acres. However, CRP participation in Benton and Klickitat Counties has leveled out and dropped slightly after 2008 due to the following reasons:

1. The 2014 Farm Bill reduced CRP enrollment from 32 million acres to 26 million in FY2015, 25 million acres in FY2016, and 24 million acres in FY2017 and FY2018 nationwide (Stubbs, 2014), which contributed to the drop after 2014 as shown in Figure 32.
2. Several years of high commodity prices after 2007 convinced some producers to return land into production. However, the commodity prices have dropped across the board in the last 2-3 years. Therefore, producers are not likely to return CRP land into production. The high commodity prices contributed to the drop between 2008 and 2014 as shown in Figure 32 (Hamilton, 2017).

CRP enrollment in State of Washington dropped approximately 20 percent from 1.5 to 1.2 million acres from 2008 to 2016. For the land out of CRP contract, producers had to decide whether to return the land to production or leave it as it was. Even though the producers might put the land back to production, they could choose to apply for different conservation measures

¹⁰ Core 4 was an information sharing and management system sponsored by private and public sector organizations. This project provided the most comprehensive information on minimum tillage practices available and included residue-on-the-field estimations that represent a collection of conservation practices.

incentives provided by EQIP, CSP or local conservation districts to prevent wind erosion for these lands.

The Food Security Act HELC provisions require producers to certify that they will not plant or produce an agricultural commodity on HEL without following an NRCS approved conservation plan or system (USDA-NRCS, 2017). Non-compliance with this requirement may affect the following types of USDA program benefits:

- FSA loans and disaster assistance payments
- Protection of the nation's long-term capability to produce food and fiber
- NRCS and FSA conservation program benefits
- Federal crop insurance premium subsidies

Therefore, HEL out of CRP is likely to follow an NRCS conservation plan to continue to prevent soil erosion.

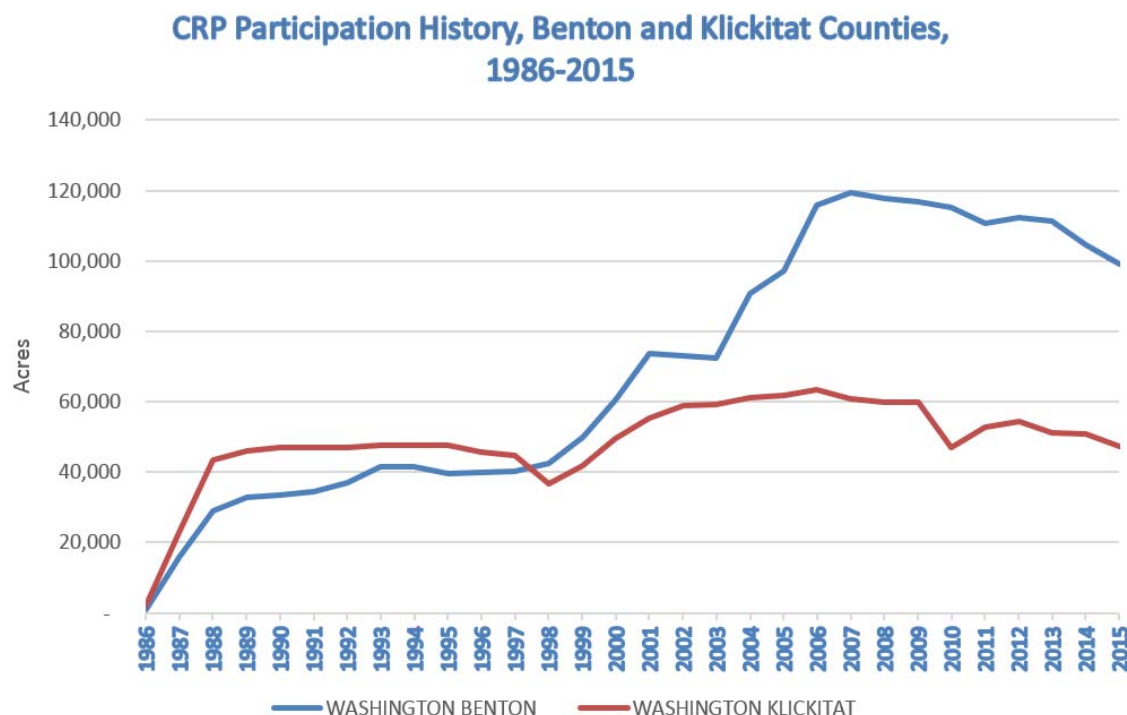


Figure 32. Conservation Reserve Program participation in Benton and Klickitat counties, Fiscal 1986-2015, acres.

EQIP Implementation Status: This section summarizes the NRCS EQIP program implementation in Benton and Klickitat counties. These programs are implemented statewide (USDA-NRCS, 2009-2015). We provide the following information concerning conservation measures funded by EQIP for these two counties.

The EQIP contracts in this section only capture a portion of the no-till and reduced-till conservation practices for these two counties. Many producers plant cover crops and install wind breaks or other conservation measures without any cost sharing or technical assistance from EQIP.

Benton County EQIP conservation measures: Washington NRCS provided financial assistance for producers in Benton County on ~30,000 acres for no-till residue tillage and management and ~65,000 acres of mulch/reduced-till residue and tillage conservation practices from 2009 to 2015.

EQIP Future Work for Benton County: The AQI provided additional funding that contributed to the total acres that implement EQIP for Benton County for fiscal year 2015. The AQI provided funding for 2,481 acres of land to use reduced-till conservation measures land for three consecutive years: 2017, 2018, and 2019.

Recent Benton-Franklin Conservation District funded trial: Benton Conservation District (CD) contracted with local producers in 2016 to test the stripper header conservation measure. Harvesting with a stripper header strips the grains from the wheat heads and leaves tall (up to 10”) stubble on the ground. This reduces wind soil erosion and increase moisture retention. Benton CD will document its impact on yield for the 2016/2017 crop (Benton CD, 2016). The potential economic benefits may attract other producers to consider using the stripper header.

As shown in the following picture taken by Benton CD, comparing with the field with no stubble, the taller stubble left by the stripper header reduced wind velocities in the field and kept the snow from blowing onto the road (Wendt, 2017). It demonstrates that the tall stubble left by the stripper header can effectively reduce wind blowing dust from agricultural land.



Figure 33. Effectiveness of stripper header to reduce wind erosion

Franklin CD partnered WSU to test a prototype deep furrow conservation drill (Benton-Franklin CD, 2016). The deep furrow conservation drill was designed for direct seeding and mulch-till conservation methods all with one drill. This prototype drill was successful in seeding through large amounts of residue from previous crop. The demonstrated economic benefits attract the producers in cost sharing for this new equipment. This drill also provides up to a 40 percent reduction in wind erosion. They are currently working on the next step to scale up the prototype to the manufacturing level. Benton and Franklin CDs are working together on this and have similar agricultural operations. Once manufactured, producers across eastern Washington will be able to take advantage of this new drill.



Figure 34. Deep furrow conservation drill prototype (photo credit – Samantha Crow, WSU Lind Research Station)

Klickitat County NRCS and Conservation District efforts: In eastern Klickitat County, NRCS provides funding for producers to implement “Forage and Biomass Planting” (Practice 512), which is planting permanent grass cover for grazing purposes. This practice can prevent wind erosion with permanent cover (for the life of the contract). Klickitat County did not receive any EQIP contracts for no till and reduced till practices before 2015. Beginning in 2015, the local work group gave equal consideration to producers who convert from conventional tillage to permanent grass cover as those who convert from conventional tillage to direct seeding. This made it possible for Klickitat County to receive EQIP contracts for no till/reduced till. Even though Klickitat county producers did not contract for the no till or reduced till practices at the time of this exceptional event, Practice 512 was in place to address the same air quality concern of soil erosion from wind.

Klickitat county producers purchased or rented GPS guidance systems through cost share from NRCS or the local CD to accurately and precisely cover large areas with fertilizer or pesticides (Meagher, 2017). This technology significantly improved efficiency and reduced the fuel consumption and fertilizer overlapping. The GPS guidance systems makes conservation tillage practices economically viable through gained efficiencies so that it increases the incentive to change from conventional tillage to reduced or no-till operation. This system also reduces the number of passes over the fields, which also reduces soil erosion. There were 66,000 total acres treated using the GPS guidance systems from 2009 to 2011. Eleven new users signed up for this technology since 2011.

Some Klickitat county producers were able to participate in the low income loan program offered by Spokane County Conservation District and convert from conventional to direct seeding operations. This program converted a total of 6,650 acres in Klickitat County to direct seeding since 2000 (Meagher, 2017).

EQIP Future Work for Klickitat County: In 2016, Klickitat Conservation District had eight applications for addressing wind soil erosion for 3,694 acres. They funded four of them to treat 1,847 acres. Two contracts were for mulch till and scheduled for implementation from 2017-2019. The other two contracts were for forage and biomass planting, one of which has been completed and certified. The CD received more applications for 2017.

AQI Future Work for Klickitat County: FSA added Klickitat County to the AQI list in April 2017. Klickitat may receive funding for reduced tillage and no till practices under [AQI](#). Klickitat County Conservation District plans to reach out to the producers and notify them of their eligibility for this program before the next signup in 2018.

CSP Implementation Status: Based on information provided by USDA-NRCS, there were total of 37,661 acres in Benton and 15,136 acres in Klickitat County contracted with CSP program in 2015 (Benson, 2017). However, the USDA-NRCS database doesn't show the specific enhancements for each CSP contract, therefore, it is difficult to identify the specific contracted acres with soil erosion enhancements.

Compliance Audits for NRCS and FSA Conservation Programs: NRCS and FSA programs have audit provisions that check whether land owners have properly implemented and maintained the conservation practices. A violation of these provisions can put a producer's eligibility at risk for most NRCS and FSA programs.

A conservation compliance plan or program specifies the minimum residue cover required to protect the soil. USDA Risk Management Agency (RMA), FSA and NRCS require producers with HEL have a conservation plan or program.

NRCS conducts random compliance reviews annually to verify whether the producer has the specified amount of surface residue necessary to protect the field from wind erosion. Producers with HEL must agree to plant or produce an agricultural commodity with an NRCS approved conservation plan or system to keep substantial reduction of soil loss. Non-compliance may affect eligibility for USDA program benefits (Vilsack, 2014).

EQIP and CSP Spot Checks: Annually, NRCS spot checks five percent of EQIP or CSP Program participants in Washington on their conservation measures implementation. Therefore, NRCS randomly selects 150 to 175 farms in Washington to check against minimum crop residue required for soil erosion protection. The violation rate in Washington is typically one percent per year (Habets, 2015).

NRCS planners need to have the appropriate authorization (i.e., Job Approval Authority) to issue conservation practice design to producers. If producers are found in violation, they have to refund benefits with interest.

CRP Spot Checks: “Nationally selected” spot checks by FSA include a certain percentage of CRP contracts. Producers chosen in the national selection process are subject to review for all FSA program participation, including CRP. The state also has its own formula for the number of on-the-ground spot checks that each local FSA must complete every year. The number of CRP contracts determines the number of checks. FSA randomly chooses particular operations to check based on the CRP spot check policy (Hamilton, 2014).

Typically, FSA spot checks about 4.5 percent of CRP contracts in Washington under the combined national and state selections (Hamilton, 2014). FSA contracts with NRCS to make sure the residue on the ground meet standards (i.e., have the minimum plant growth and number of plant species as directed by the practice standards) before paying on the contract.

The local FSA uses the Washington CRP Spot Check Worksheet to review grower operations with contracts for compliance with the Washington State FSA Committee (STC) policy. FSA documents spot checks conducted based on the national spot check selection process in the National Compliance Review Database.

Questions in the Spot Check Worksheet include:

- Was an unauthorized crop planted on CRP land?
- Has there been activity, such as mowing, spraying or burning during primary nesting and brood rearing season, if applicable?
- Has CRP land been used for haystacks, parking or converted to non-ag use?
- Has there been any unauthorized harvesting of CRP cover, including haying or grazing?
- Has there been any unauthorized treating of weeds, plants, insects, or other pests?
- A failure to maintain an acceptable stand of approved cover?

County FSA offices must spot check and review those producers identified on the national producer selection list. However, they may spot check any producer not on the list if they identify a reason to question the producer’s compliance with any program provisions (USDA-FSA, 2015). Noncompliance can affect the producer’s FSA program benefits for the current year.

HELC Spot Checks: NRCS offices spot check a nationally selected group of producers each year for compliance with HELC requirements. Growers who plant crops on HEL or other environmentally sensitive land in violation of these requirements may have to refund benefits and/or pay a penalty. In these cases, growers may lose all benefits or receive reduced benefits

for the year(s) when the violation(s) occurred. FSA and NRCS each determine grower compliance for their own programs.

If FSA or NRCS finds a violation without a ‘good faith effort’ determination, the grower will also lose the crop insurance subsidy for the year.

3.5.3.3 Benton Clean Air Agency Rules and Policies for Enforcement

BCAA enforces fugitive rules and policies in Benton County. The agency has one full-time employee dedicated for dust control. Local planning departments refer construction applicants to BCAA for guidance on dust control. BCAA responds to dust complaints and works with the property owner or contractor to mitigate the dust. BCAA may require a dust control plan under certain circumstances and the plan may become part of an enforceable compliance order. BCAA may issue penalties per BCAA rules and policies. Generally, BCAA promptly resolves dust control issues. BCAA expects contractors to implement practices in the Urban Fugitive Dust Policy. If someone observes dust leaving the property due to a violation, BCAA begins enforcement actions. BCAA issued over three hundred dust control warnings and 13 violations in 2015; over 250 warnings and 19 violations in 2016 (Priddy, 2017). BCAA resolved all of the warnings and violations in a timely manner.

3.5.3.4 Washington State Fugitive Dust rules

Unpaved roads, construction sites, and tilled land are examples of areas that originate fugitive dust. Fugitive dust is a type of fugitive emission. Washington’s air quality rules in Washington Administrative Code (WAC) 173-400-030 and 173-400-040, define fugitive emissions and fugitive dust and require that sources take reasonable precautions to prevent dust. EPA approved WAC 173-400-030 and 173-400-040 in Washington’s State Implementation Plan (SIP) prior to this exceedance.

Future work:

Mitigation Plan for Wallula Maintenance Area: The 2016 EER requires Ecology to develop a Mitigation Plan. This is because the Kennewick monitor had recurring exceedances caused by high wind events and is the compliance monitor for the Wallula maintenance area.

Ecology will develop the mitigation plan to:

1. Provide public notification and education
2. Identify, study and implement mitigation measures
3. Periodically review and evaluate the mitigation plan

Ecology will submit the mitigation plan by September 30, 2018 as required by the EER (EPA, 2016).

Ecology finds that prior to and during August 2015 event at Kennewick, there were reasonable controls on the anthropogenic sources (agriculture lands in HHH area) that contributed to the PM₁₀ exceedance. Therefore, this high wind dust event met the not reasonably controllable or preventable criterion.

3.6 Human Activity Unlikely to Recur or Natural Event

Based on the 2016 EER, EPA considers high wind dust events natural events in cases where windblown dust is entirely from natural undisturbed lands or where all anthropogenic sources are reasonably controlled.

A high wind dust event caused this exceedance was a natural event and the anthropogenic sources, agriculture lands, were reasonably controlled as demonstrated in Section 3.4.1 of this document.

Therefore, this high wind dust event met this criterion.

3.7 Public Notification

The Exceptional Event Rule requires all States to notify the public promptly whenever an event occurs or is reasonably anticipated to occur which may result in the exceedance of an applicable air quality standard. The following subsections discuss the early notification of wind events in detail.

3.7.1 Northwest Weather Service Warnings and Advisories

NWS warnings and advisories provide prediction of high wind dust events and are likely to be the first report to reach media for these types of events. Often radio stations will feature these reports as part of the news, particularly when wind speed elevates quickly. Public Health Departments, Local Clean Air Agencies, the Hanford site (for its workers and contractors), and Ecology may also issue warnings based on these alerts.

The NWS Pendleton and Spokane offices issued advisories and warnings before this event. Excerpts below (See Appendix C.1 for full advisories and warning):

Wind Advisory (August 13 2015 11:50 am) (NWS Pendleton, 2015): “The National Weather Service in Pendleton has issued a wind advisory...Which is in effect from 11 am to 10 pm PDT Friday. Winds...west 20 to 30 mph with gusts to 40 mph...main

concern with the gusty winds will be blowing dust in the Columbia Basin. Visibility may be reduced in areas.”

Blowing Dust Advisory (August 14, 2015 5:01 am) (NWS Pendleton, 2015): “The National Weather Service in Pendleton has issued a blowing dust advisory...which is in effect from 11 am this morning to 10 pm PDT this evening. The wind advisory has been cancelled. Winds...west 25 to 35 mph with gusts up to 50 mph...main concern with the gusty winds will be blowing dust in the Columbia Basin and adjacent valleys and Blue Mountain Foothills. The visibility may be reduced in areas to as low as a quarter of a mile at times.”

Dust Storm Warning (August 14, 2015 2:54 pm) (NWS Spokane, 2015): “The National Weather Service in Spokane has issued a Dust Storm Warning...Which is in effect until 11 pm PDT this evening. This Blowing Dust Advisory is no longer in effect. Winds...southwest 20 to 30 mph with gusts up to 45 mph. Impacts...blowing dust with visibility below one mile will be possible across the Moses Lake area and the upper Columbia Basin.”

3.7.2 Ecology Air Quality Notifications

Ecology Air Quality Program developed the following methods to provide notification of these events to the public (Klickitat County is under Ecology CRO’s jurisdiction):

Monitoring Website: The [Washington State monitoring network system webpage](#) (Ecology, 2015) contains current air quality conditions. The public can access this webpage and it features monitors with near "real -time" air quality data for a number of monitoring sites throughout the state. Each color-coded monitor shows the current local air quality conditions.

EPA’s [Air Data website](#) (EPA, 2015) has air quality results for filter-based official data, air quality statistics, and specific monitor information.

Ecology Dust Warning Procedure: Ecology developed a Dust Warning Procedure to use social media to notify the public of impending events expected to affect air quality and public health. Ecology relies on National Weather Service high wind and hazardous weather outlook warning systems to alert the public. If time allows, Ecology considers issuing warnings to amplify the message.

Ecology updates the Dust Warning Procedure every year and the following summarizes the procedure:

- Ecology forecasters monitor weather conditions and other organizations' warnings and other staff notifies forecasters.
- Ecology forecasters evaluate risk of air quality impacts and work with Communications Managers at Headquarters.
- Ecology Headquarters Communication Managers consider issuing news releases or public information statements using social media to alert the public, if time allows before an event occurs.

Ecology CRO sent out a blowing dust tweet for the lower Yakima Valley and Columbia Basin on August 14, 2015 (See Figure 35 below).

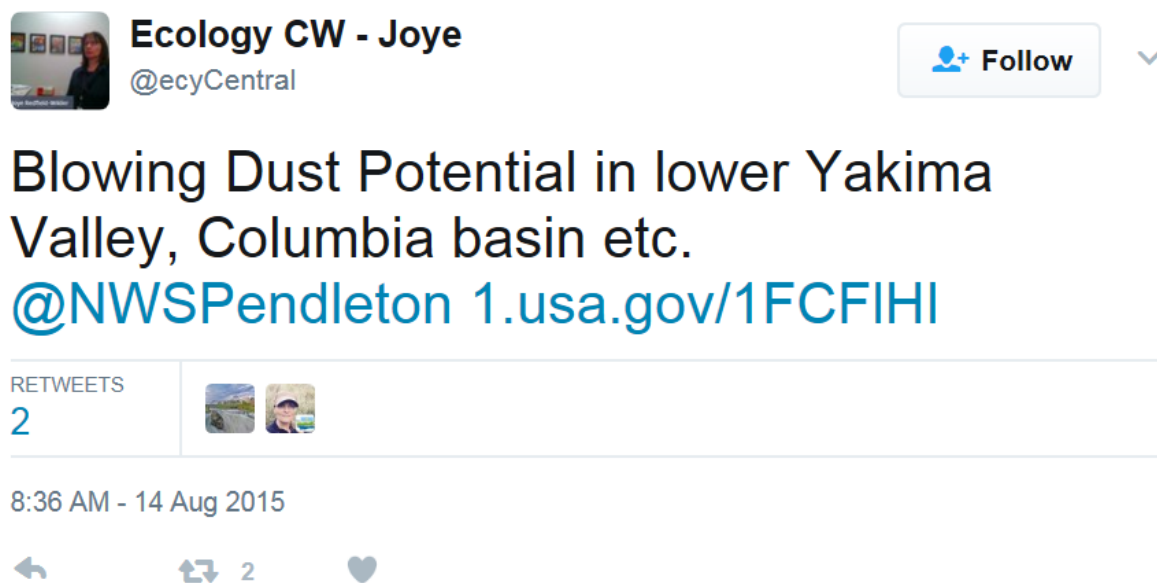


Figure 35. Tweet sent by Ecology CRO on August 14, 2015

Annual News Release and Informational Webpage: In the 2003 NEAP update, Ecology agreed to prepare an annual news release that combines wind erosion and a health message, develop a windblown dust page for the website, and continue to post air quality data (Ecology, 2003). Ecology also committed to post the NEAP and Natural Event documentation. These documents are available through Ecology's publication site.

- The spring 2015 News Releases (See Appendix D.1 for details):
 - "Forecast: Dust storms and wildfires ahead for Central and Eastern Washington" issued on March 18, 2015.
- The informational webpage on outdoor dust is at [Ecology's website](#) (See Appendix D.2.1 for details).

This webpage outlines precautions residents may take to protect themselves during times of elevated particulate matter levels and provides a link to the NWS website as well as other publications.

In 2012, Ecology updated the Windblown Dust brochure (See Appendix D.2.2 for details) (Ecology, 2012). This describes wind events on the Columbia Plateau and suggests actions to minimize exposure if possible, and precautions if you cannot avoid exposure.

3.7.3 Benton County Notifications

BCAA staff also monitors meteorological conditions and work closely with local media to ensure public notification of potential and actual blowing dust. Benton County can be subject to sudden strong winds, and at times the wind picks up particulate matter and causes a dust storm. On a daily or hourly basis as conditions warrant, BCAA keeps alert for the potential for blowing dust using weather forecasts and other tools provided by the National Weather Service and Washington State University. Agency staff scans the media releases for their notifications when conditions warrant. If BCAA determines media are not alerting the public, BCAA issues a press release making the public aware of the potential for blowing dust. As these events can be severe and sudden when they do occur, BCAA works with the local media to assure quick and effective notification of potential, as well as actual, windblown dust events. BCAA shares information from their daily analysis with Ecology when conditions impact air quality.

3.8 Flagging and Initial Notification

Exceedance: Ecology properly documented the exceedance of the 24-hour PM₁₀ NAAQS at KENMETA monitor on August 14, 2015.

Flagging: Ecology flagged the data in EPA's AQS in June, 2016 to notify EPA that Ecology suspected a high wind dust event caused this exceedance.

Regular Communications: Ecology discussed flagging of this PM₁₀ exceedance in AQS during the EPA Region 10 Exceptional Event 4th Annual Meeting on March 10, 2016. Since then, Ecology and EPA Region 10 staff engaged in regular communications and determined that this exceedance had regulatory significance and Ecology should submit this exceptional event demonstration.

Initial Notification: Ecology notified EPA of its intent to submit this demonstration during the EPA Region 10 Exceptional Event 4th Annual Meeting on March 10, 2016 and in periodic meetings with EPA thereafter. Therefore, Ecology met the initial notification requirement.

3.9 Public Involvement and Public Comments

This section will be filled in before final submittal.

4 Conclusion

Ecology asserts that the PM₁₀ exceedance recorded by the KENMETA monitor on August 14, 2015 qualifies for exclusion under the 2016 Exceptional Event Rule because:

- This event had sustained high wind speed over the threshold of 25 mph.
- This demonstration included a narrative conceptual model to describe the event and discussed how the emissions from the event led to the exceedance.
- It was demonstrated that there was a clear causal relationship between the PM₁₀ exceedance measured in Kennewick on August 14, 2015 and the high wind event.
- This demonstration conducted analyses comparing the event-influenced concentration to historical concentrations at KENMETA, which supported clear causal relationship between the PM₁₀ exceedance and the high wind event.
- The event was not reasonably controllable or preventable due to the fact that the high winds overwhelmed reasonably controlled agricultural sources.
- This high wind event was a natural event because the anthropogenic sources, agriculture lands, were reasonably controlled.
- Ecology fulfilled all the procedural requirements in the EER.

Based on the evidence provided in this document, Ecology requests EPA support the exclusion of the PM₁₀ exceedances at Kennewick, Metaline monitoring station for August 14, 2015, when determining compliance with the PM₁₀ 24-hour NAAQS or other regulatory compliance purposes by placing a concurrence flag on the data in the Air Quality System.

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6 Appendixes

Appendices

- Appendix A Regional Information – Geological Setting, Climate and Soil
- Appendix B Monitors Information
- Appendix C August 14, 2015 Supporting Information
- Appendix D Public Notification
- Appendix E Public Involvement and Public Comments

Appendix A Regional Information – Geological Setting, Climate and Soil

A.1 Geographic Setting

Kennewick is located in the Columbia Basin of Washington State and, together with Pasco and Richland, comprises the metropolitan area known as the Tri-Cities.

Figure 36 shows the Washington's portion of the Columbia Plateau, a 50,000 square mile region covering eastern Washington, northeastern Oregon, and the Idaho panhandle.

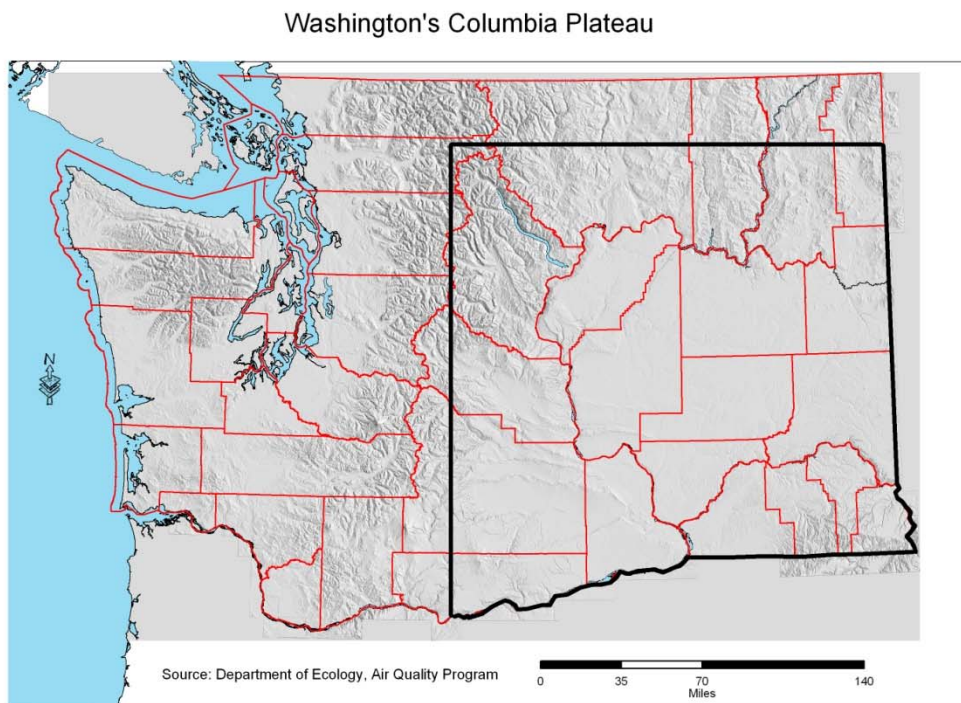


Figure 36. Eastern Washington's Columbia Plateau

The Columbia Plateau contains one of the driest as well as the most productive rain fed wheat regions in the world. The Columbia Plateau, and its irrigated counterpart, the Columbia Basin are defined by the U.S. Department of Agriculture as Major Land Resource Areas (Saxton, Chandler, & Schilinger, 1999).

The Washington portion of the Columbia Plateau includes most of the eastern Washington counties. The Washington's 1998 Natural Event Action Plan (NEAP) identified the priority counties (most susceptible to wind erosion) were Adams, Douglas, Franklin, Grant, and Lincoln counties (Ecology, 1998). Benton and Walla Walla counties were added during 2003 NEAP update, bringing the total of priority counties to seven (Ecology, 2003).

Klickitat County is also susceptible to wind erosion. Ecology requested USDA-NRCS add Klickitat County to the list of counties that are eligible to apply for AQI funding provided by USDA-NRCS in the first quarter of 2017.

Historically, some of the high wind events that caused exceedances came from central and northeastern Oregon which are southwest of Kennewick. This area of Oregon is dominated by agricultural activities. Since Washington does not have authority over Oregon sources, the exceptional event demonstrations focused on emission sources in Washington.

Geographic Area: The Columbia Plateau includes nearly 500 miles of the Columbia River, as well as the lower reaches of major tributaries, which include the Snake and Yakima rivers and their associated drainage basins. The arid sagebrush steppe and grasslands of the region are flanked by moister, predominantly forested, mountainous ecoregions on all sides.

The Columbia Plateau occupies about 500 square miles in Benton County. Eastern Klickitat County is mostly rolling prairies and high plateau where farming and ranching predominate. Upper parts of the Plateau are generally planted in dryland wheat and use a summer fallow system; lower parts of the plateau include more irrigated farmland (Kocher, 1916).

South and west of Kennewick lay by the HHH, a dominant feature of the area. The HHH rise abruptly from the Yakima Valley and then slowly drop to the southeast and gradually slope to the Columbia River on the south and the Cascades on the west. To the west, lay the Rattlesnake Hills.

Figure 37 shows Eastern Washington, including the Tri-Cities, topographical elements and the Kennewick monitoring site.

Eastern Washington Overview Map

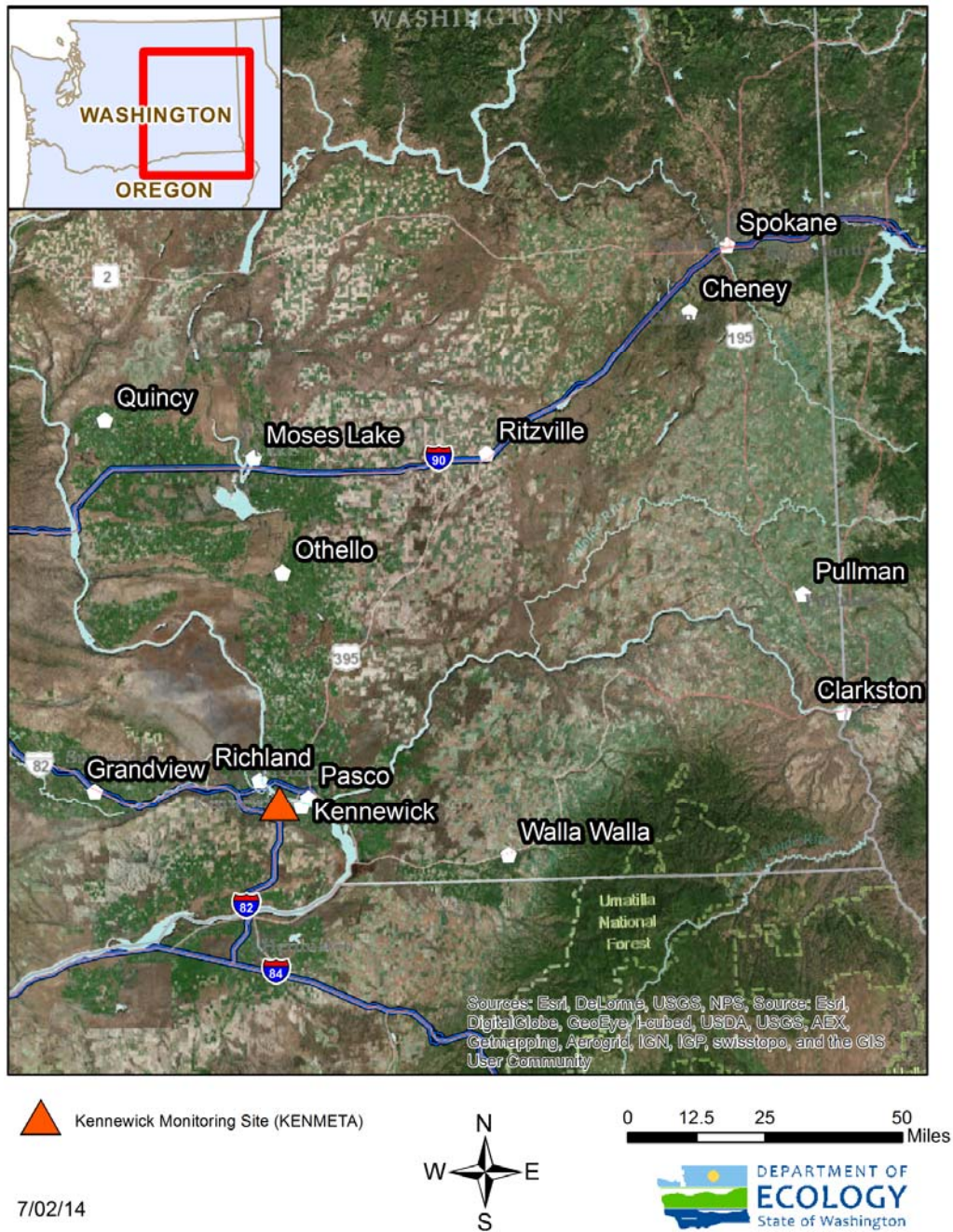


Figure 37. Eastern Washington Overview Map

A.2 Climate

The eastern Washington region is semi-arid desert because it lies in the rain shadow of the Cascade Mountains.

Average annual precipitation in this region ranges from 10 to 12 inches to below 8 inches. About 60% to 70% of annual precipitation occurs between November and April. During the summer, high pressure systems dominate, which create warm, dry conditions and low relative humidity. The mean annual temperature is approximately 48° F, and the frost-free season is about 140 days (USDA-NRCS, 1961-1990).

The terrain coupled with prevailing south and west winds limit local stagnant air pollution by ventilating the area. However, this coupling can also produce some extraordinary wind speeds and patterns. These winds can produce significant wind erosion events that can impact the Tri-Cities area with dust from vulnerable agricultural fields and natural areas.

Figure 38 shows the irrigated and dryland cropping areas and denotes the three average annual precipitation zones on the Columbia Plateau (Schillinger, Papendick, & McCool, 2010). The three zones are:

- Low precipitation –less than 12 inches;
- Intermediate precipitation –12 to 18 inches; and
- High precipitation –18 to 24 inches.

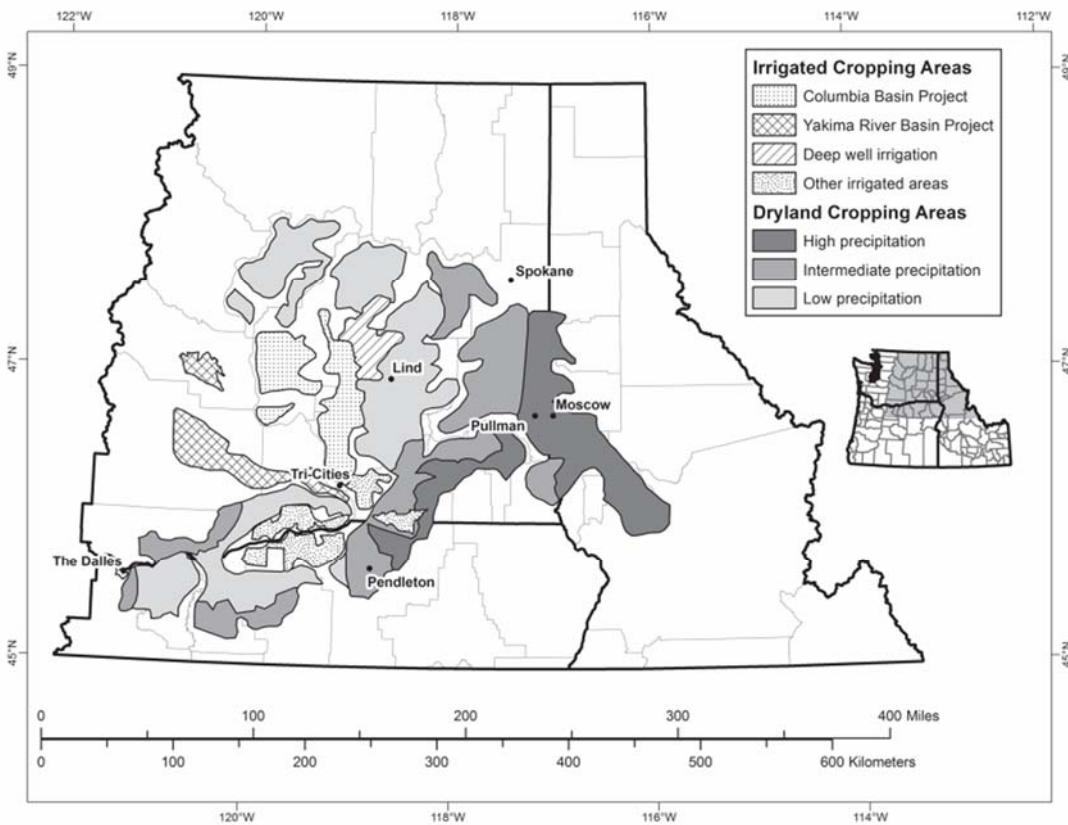


Figure 38. Columbia Basin Precipitation Zones

The areas noted to the southwest of the Tri-Cities, the emission sources of the high wind event, fall in the low precipitation zone (Schillinger, Papendick, & McCool, 2010).

Eastern Klickitat County and Benton County where HHH is located is the driest of the Columbia Plateau counties and receives approximately 6 inches of precipitation at a 500-foot elevation and about 15 inches at 3,500 feet. Precipitation is generally gentle showers, but can also be light snow during the dormant season.

Benton County and Eastern Klickitat County have both marine and continental characteristics. It is influenced by moist air moving in from the Pacific Ocean and by cold air moving southward from Canada. The weather systems are modified by the Rocky Mountains to the east and north and by the Cascade Mountains to the west. The summers are hot, and the winters are clear, dry and cold. Occasional cold snaps late in spring or early in fall can cause extensive damage to crops. In summer, the afternoon temperature can reach the nineties, and the nighttime temperature falls to about 60° F. In an average summer, the temperature exceeds 90° on 50 to 60 days and 100° on 8 to 12 days. The relative humidity ranges from approximately 50 percent at sunrise to about 25 percent in the afternoon.

Drought and lack of precipitation are typically key factors leading into the large dust storms in this area.

A.3 Soils

The Columbia Plateau soils erode and break up easily since the soil crusting forces are weak. The soil type in this region is silty to fine sandy textured, which is reference to dominant particle size, and low clay and organic matter content. These soil characteristics create very weak soil structure. The lack of the ability to form clods results in breakdown of the soil into individual particles when mechanically disturbed from tillage, planting operations, or traffic. Soils are the most susceptible when soil surface:

- Is dry,
- Has no surface vegetative cover and
- Has been mechanically disturbed.

These soil characteristics coupled with low precipitation and high temperatures result in very dry soils that are highly susceptible to wind erosion.

A.3.1 Soil Classification and Characteristics

A survey done by the NRCS in 1971 classified the soils in the Columbia Plateau and the HHH as part of the Ritzville-Willis association. These fine-grained soils are excellent for farming; soils that are shallow, stony or steep are used for grazing. The underlying basalt on the Plateau is up to 2 miles (3 km) thick and partially covered by thick loess. Loess soils are fine -grained, windblown deposits, composed mainly of silt-sized particles and can be up to 40 inches deep (Rasmussen, 1971).

Figure 39 below shows that the Ritzville Soil Series (USDA-NRCS, 2014) covers not only Benton County but also the areas to the northeast and to the southwest of Kennewick, in northeastern Oregon. The darker color denotes a greater density of this soil type. Benton, Walla Walla, Franklin and Adams counties have the greatest density of these soils.

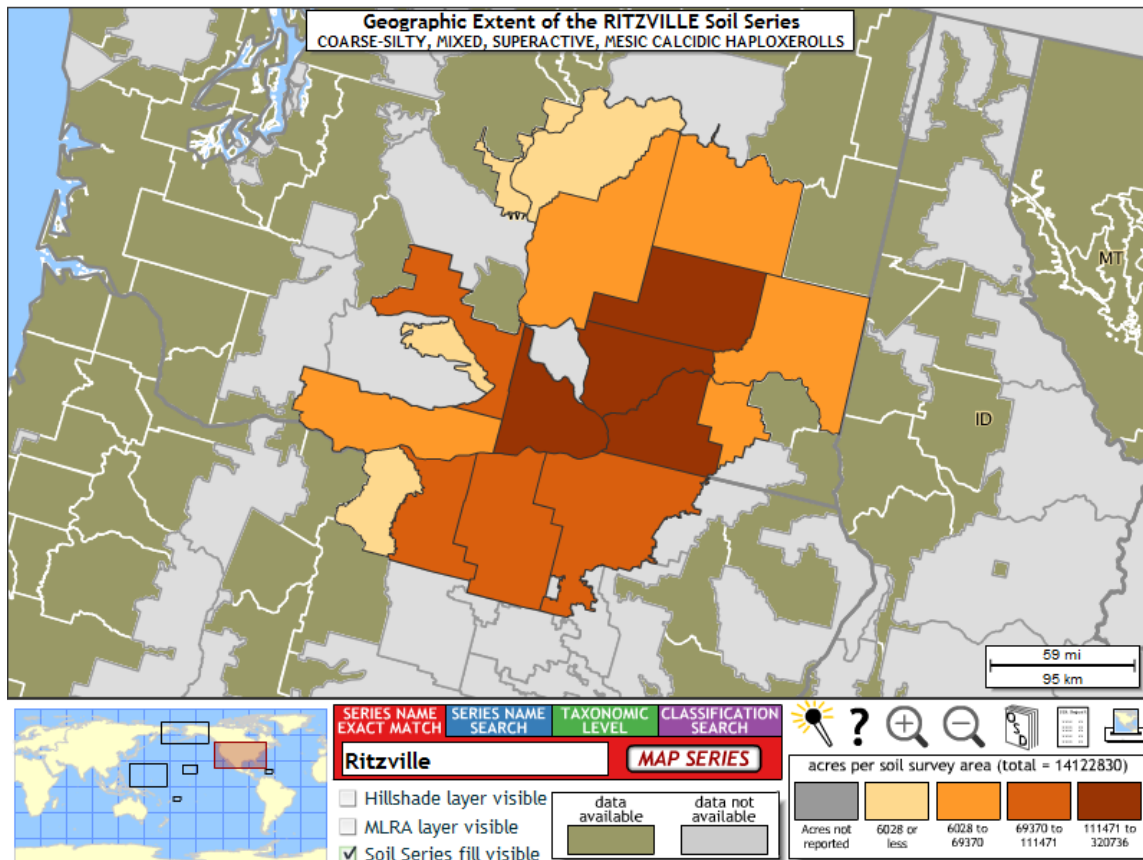


Figure 39. Geographic Extent of Ritzville Soils, USDA-NRCS Official Soil Series Descriptions

The light precipitation in Benton County rarely saturates the soils. Consequently, the amount of clay and other particles that moves downward in the soil is insufficient to form a strong lower horizon in the soil profile and therefore, unable to contribute to the stabilization of the soil column (Rasmussen, 1971).

It is well established that the soils on the Columbia Plateau are extremely vulnerable to erosion (i.e., highly erodible land or HEL), making it a focus area of the NRCS. These areas are given more weight in ranking systems for grower eligibility for NRCS funding sources to apply soil erosion preventative measures.

A.3.2 Soil Entrainment Mechanisms

Wind erosion is a dynamic and highly complex process. In 2003, Ecology evaluated the scientific literature in order to refine a workable high wind event definition for an update to the Columbia Plateau Natural Event Action Plan (NEAP). Threshold velocity, gusts, previous moisture levels, soil types, crusts, and transport of previously lofted material are all important

factors to consider when developing a high wind definition. Ecology was particularly interested to find what wind speeds are sufficient to loft dust into the air (threshold velocity) in the Plateau.

Ecology's high wind definition was documented in the NEAP. Essentially, a high wind event can occur when wind entrains and suspends dust and PM₁₀ levels are elevated. Generally, this occurs when the hourly wind speed at 10 meters is 18 mph or greater for two or more hours; or more than 13 mph for two or more hours when conditions of higher susceptibility to wind erosion exists (Ecology, 2003).

Gusts: Short-term fluctuations contain significant amounts of wind energy not seen when using longer-term (hourly) averages (Ecology, 2003). The long-term mean wind speeds are generally much lower than the intermittent short-period gusts which actually produce the dust. This is particularly evident when considering wind speeds associated with meteorological events such as thunderstorms, microbursts and fast moving fronts. Wind speeds measured in five-minute increments may show 30-40+ mph gusts. However, the corresponding hourly average wind speed may be as low as 10 mph due to winds calming after the storm passes.

Precipitation and Soil Surface Stability: Precipitation prior to high wind events also affects soil vulnerability and wind erosion. Soil moisture is directly related to formation of surface crusts and surface crust strengths are related to wind erosion vulnerability.

If high winds overcome surface crust formation, they generate dust. The phenomenon of surface crust formation is directly related to variations in soil composition and moisture. The texture of a particular soil is determined by the relative amounts of sand, silt or clay in the soil. Generally, soils with high clay content tend to develop a stronger surface crust than soils with low clay content. Sandy textured soils such as loamy sands and sandy loam can produce dust virtually regardless of moisture content because they do not form strong surface crusts (Ecology, 2003). Columbia Plateau soils are very fine and so have a weak surface crust.

Appendix B Monitors Information

The monitoring site that exceeded the standard was Kennewick Metaline Avenue site. Ecology also used the following sites' meteorological and particulate measurements to evaluate the storm path and provide supporting information for exceptional event demonstrations:

- Bureau of Land Management (BLM) sites
- Bonneville Power Administration (BPA) sites
- Hanford Meteorological [Station sites](#), 25 miles NW of Richland, Washington
- Airports Pasco (KPSC) sites
- Hermiston (KHRI) sites
- Spokane (KGEG) sites
- Oregon Department of Environmental Quality (DEQ) sites

Data from Washington State monitors can be accessed from [Ecology air monitoring sites website](#). All other meteorological data other than that from Ecology's network can be accessed on [Utah Meso West site](#). Oregon DEQ data for the named sites is available through EPA's [Air Data](#) interface or registered users can query EPA's [AQS website](#).

Kennewick Monitor: The Kennewick, Metaline monitoring site is located in Benton County at the Kennewick Skills Center, 5929 W Metaline, Kennewick, WA, (Lat 46.21835, Long - 119.20152). This monitor is a Federal Equivalent Method (FEM) continuous ambient particulate Tapered Element Oscillating Microbalance monitor (TEOM) TM, AQS site number 53-005-0002, POC 3, and measures midnight-to-midnight 1-hour average PM₁₀ concentrations. Since 2004, the site also has meteorological equipment. This monitor is the official compliance monitor for the PM₁₀ Wallula maintenance area.

BPA and BLM monitors: Four regional meteorological monitoring sites are operated by the BP) and the Bureau of Land Management (BLM). These sites are located in areas of agricultural land and open space between 10 and 50 miles from Kennewick. All sites are shown in the map in Figure 40 and listed in Table 10 below.

Kennewick Area Meteorological Monitoring Sites

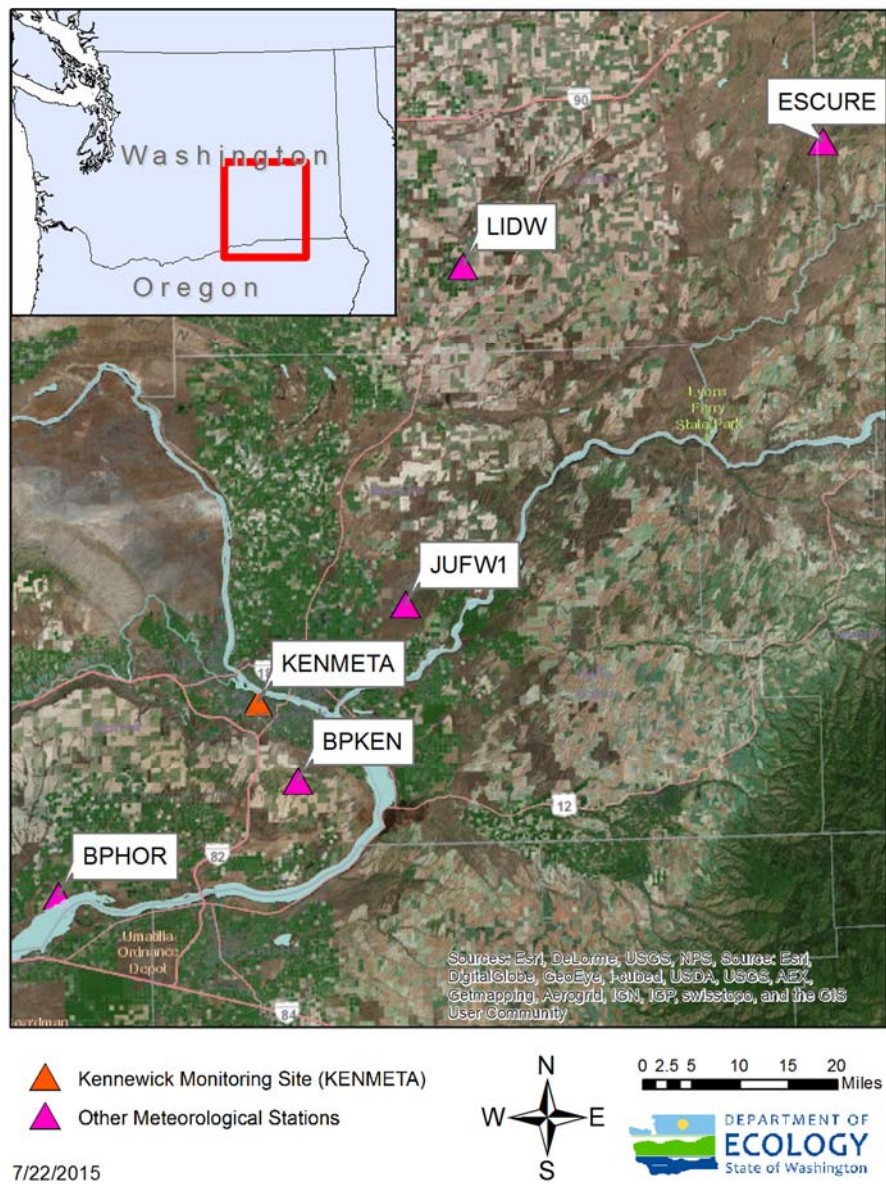


Figure 40. Kennewick area meteorological monitoring stations

Table 10. Kennewick and surrounding area meteorological stations

Station Abbreviation	Station Name	Location
KENMETA	Kennewick - Metaline	Kennewick Technical Skills Center, 5929 W. Metaline Avenue

Station Abbreviation	Station Name	Location
BPKEN	BPA, Kennewick	On the ridgeline approximately 10 miles SSE of KENMETA
BPHOR	BPA, Horse Heaven Hills	Approximately 30 miles SW of KENMETA, within one mile of the north shore of the Columbia River
JUFW1	Juniper Dunes Wilderness	20 miles NE of KENMETA
LIDW	Lind	Near the town of Lind, WA along U.S. Highway 395 between Connell and Ritzville, approximately 50 miles NNE of KENMETA
ESCW1	Escure	Located approximately 50 miles SW of Spokane and 80 miles NE of Kennewick

The BPA's Kennewick monitor (BPKEN) is located atop a ridgeline approximately 10 miles SSE of KENMETA in an area of agricultural land and open space. At an elevation of 1990 feet, it is near the highest point in the segment of Horse Heaven Hills nearest Kennewick, which reach approximately 2000 feet at their peak. This site reports wind speed, wind direction and peak wind gust every 5 minutes. BPKEN is the nearest monitor to the suspected dust entrainment area, source area, when high wind comes from southwest direction.

The BPA's Horse Heaven Hills Monitor (BPHOR) is located approximately 30 miles southwest of KENMETA, within one mile of the north shore of the Columbia River. Its elevation is approximately 500 feet, relative to the elevation of 265 feet at the nearest point on the Columbia River. Due to its lower elevation and proximity to the river, this site represents the wind patterns through the Columbia River Gorge.

The [Remote Automated Weather Station](#) (RAWS) located within the Juniper Dunes Wilderness (JUFW1) preserve is managed by the BLM approximately 20 miles NE of KENMETA at an elevation of 1000 feet. The Juniper Dunes Wilderness is an undeveloped open space preserve. This site reports instantaneous wind speed and wind direction once per hour as well as the hourly maximum wind gust.

The Lind, WA site (LIDW) is located near the town of Lind, WA along U.S. Highway 395 between Connell and Ritzville. It is approximately 50 miles NNE of KENMETA at an elevation of 1475 feet in an area of predominantly agricultural land. The site is operated by the Bureau of Reclamation (BLM) and reports maximum wind gust, mean wind speed and mean wind direction at 15-minute intervals. The RAWS site in Escure, Washington is approximately 50 miles SW of Spokane and 80 miles NW of Kennewick in a largely agricultural areas. This site reports 10-

minute average wind speed, once an hour. This site represents the area between Spokane and Kennewick.

The Lind (LIDW, Juniper Dunes (JUFW1) and Escure (ESCW1) sites are the best available meteorological monitoring stations to represent a suspected dust entrainment area along the path of the storm for the 10/28/2013 event.

Airport Monitors: Supporting meteorological information was obtained from the Pasco, Spokane and Hermiston airports. National Weather Service stations at airports typically report two-minute average wind speed observations near the end of each hour. Occasionally, multiple two-minute averages are available within a single hour. However, true one hour averages are not available from these sites.

Appendix C August 14, 2015 Supporting Information

C.1 Weather Forecasts and Warnings

C.1.1 NWS Pendleton, Wind Advisory, 11:50 am, Aug 13, 2015

11:50 AM PDT AUG 13, 2015 – NWS, Pendleton

Your Severe Weather Watches and Warnings

KENNEWICK, WA

[Your Radar](#) | [Current Conditions](#) | [15-Day Forecast](#)

URGENT - WEATHER MESSAGE

NATIONAL WEATHER SERVICE PENDLETON OR

1150 AM PDT THU AUG 13 2015

...WINDY FRIDAY AFTERNOON AND EVENING WITH AREAS OF BLOWING DUST...

.A LOW PRESSURE SYSTEM AND COLD FRONT WILL MOVE ACROSS THE REGION FRIDAY. THIS WILL RESULT IN GUSTY WINDS OVER THE COLUMBIA BASIN. AREAS OF BLOWING DUST AND REDUCED VISIBILITY ARE LIKELY. ...WIND ADVISORY IN EFFECT FROM 11 AM TO 10 PM PDT FRIDAY...

THE NATIONAL WEATHER SERVICE IN PENDLETON HAS ISSUED A WIND ADVISORY...WHICH IS IN EFFECT FROM 11 AM TO 10 PM PDT FRIDAY.

* WINDS...WEST 20 TO 35 MPH WITH GUSTS TO 40 MPH.

* TIMING...WINDS WILL INCREASE IN THE MORNING BECOMING STRONG IN THE AFTERNOON AND EVENING.

* IMPACTS...MAIN CONCERN WITH THE GUSTY WINDS WILL BE BLOWING DUST IN THE COLUMBIA BASIN. VISIBILITY MAY BE REDUCED IN AREAS.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A WIND ADVISORY MEANS THAT WINDS OF 35 MPH ARE EXPECTED. WINDS THIS STRONG CAN MAKE DRIVING DIFFICULT...ESPECIALLY FOR HIGH PROFILE VEHICLES. USE EXTRA CAUTION.

C.1.2 NWS Pendleton, Blowing Dust Advisory, 5:01 AM, Aug 14, 2015

5:01 AM PDT FRI AUG 14 2015, NWS Pendleton

Your Severe Weather Watches and Warnings

KENNEWICK, WA

URGENT - WEATHER MESSAGE

NATIONAL WEATHER SERVICE PENDLETON OR
501 AM PDT FRI AUG 14 2015

...BLOWING DUST ADVISORY THIS AFTERNOON AND EVENING...

.A LOW PRESSURE SYSTEM AND COLD FRONT WILL MOVE ACROSS THE REGION TODAY. THIS WILL RESULT IN GUSTY WINDS OVER THE COLUMBIA BASIN WITH AREAS OF BLOWING DUST THAT WILL REDUCE THE VISIBILITY TO BETWEEN A QUARTER OF A MILE TO THREE QUARTERS OF A MILE AT TIMES.

...BLOWING DUST ADVISORY IN EFFECT FROM 11 AM THIS MORNING TO 10 PM PDT THIS EVENING...

...WIND ADVISORY IS CANCELLED...)

THE NATIONAL WEATHER SERVICE IN PENDLETON HAS ISSUED A BLOWING DUST ADVISORY...WHICH IS IN EFFECT FROM 11 AM THIS MORNING TO 10 PM PDT THIS EVENING. THE WIND ADVISORY HAS BEEN CANCELLED.

* WINDS...WEST 25 TO 35 MPH WITH GUSTS UP TO 50 MPH.

* TIMING...WINDS WILL INCREASE IN THE MORNING BECOMING STRONG IN THE AFTERNOON AND EVENING CAUSING AREAS OF BLOWING DUST WITH REDUCED VISIBILITY...ESPECIALLY NEAR FRESH PLOWED FIELDS.

* IMPACTS...MAIN CONCERN WITH THE GUSTY WINDS WILL BE BLOWING DUST IN THE COLUMBIA BASIN AND ADJACENT VALLEYS AND BLUE MOUNTAIN FOOTHILLS. THE VISIBILITY MAY BE REDUCED IN AREAS TO AS LOW AS A QUARTER OF A MILE AT TIMES.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A BLOWING DUST ADVISORY MEANS THAT BLOWING DUST WILL RESTRICT VISIBILITIES. TRAVELERS ARE URGED TO SLOW DOWN AND USE CAUTION.

&&

RSC

C.1.3 NWS Spokane, Dust Storm Warning, 2:54 PM, Aug 14, 2015

[2:54 PM AUG 14, 2015, NWS Spokane](#)

000

WWUS76 KOTX 142154

NPWOTX

URGENT - WEATHER MESSAGE

NATIONAL WEATHER SERVICE SPOKANE WA

254 PM PDT FRI AUG 14 2015

...STRONG COLD FRONT BRINGS WIND AND AREAS OF BLOWING DUST...

.SOUTHWEST WINDS OF 20 TO 30 MPH WITH GUSTS TO 45 MPH HAVE DEVELOPED ACROSS MUCH OF EASTERN WASHINGTON AND ARE EXPECTED TO CONTINUE THROUGH THE EVENING. AREAS OF BLOWING DUST WAS REPORTED NEAR RITZVILLE. THERE IS A HIGH PROBABILITY THAT BLOWING DUST WILL DECREASE VISIBILITIES ACROSS THE UPPER COLUMBIA BASIN...THE WATERVILLE PLATEAU...THE WEST PLAINS...AND THE WASHINGTON PALOUSE.

WAZ034-035-150600-
/O.UPG.KOTX.DU.Y.0001.000000T0000Z-150815T0600Z/
/O.NEW.KOTX.DS.W.0001.150814T2154Z-150815T0600Z/
MOSES LAKE AREA-UPPER COLUMBIA BASIN-
254 PM PDT FRI AUG 14 2015

...DUST STORM WARNING IN EFFECT UNTIL 11 PM PDT THIS EVENING...

THE NATIONAL WEATHER SERVICE IN SPOKANE HAS ISSUED A DUST STORM WARNING...WHICH IS IN EFFECT UNTIL 11 PM PDT THIS EVENING. THE BLOWING DUST ADVISORY IS NO LONGER IN EFFECT.¹¹

* WINDS...SOUTHWEST 20 TO 30 MPH WITH GUSTS UP TO 45 MPH.

* TIMING...THIS AFTERNOON AND EVENING.

* LOCATIONS...MOSES LAKE...WARDED...LIND...EPHRATA...RITZVILLE...
COULEE CITY...WILBUR...ODESSA

. * IMPACTS...BLOWING DUST WITH VISIBILITY BELOW ONE MILE WILL BE POSSIBLE ACROSS THE MOSES LAKE AREA AND THE UPPER COLUMBIA BASIN. THIS WILL CREATE HAZARDOUS TRAVEL CONDITIONS...WHICH WILL INCLUDE INTERSTATE 90 BETWEEN SPRAGUE AND GEORGE AND ALONG HIGHWAY 2 BETWEEN COULEE CITY AND DAVENPORT. POOR VISIBILITY HAS ALREADY BEEN REPORTED ALONG 395 NEAR RITZVILLE AND SOUTH TOWARD THE TRI-CITIES. MULTIPLE ACCIDENTS HAVE BEEN REPORTED ALONG THIS STRETCH DUE TO THE BLOWING DUST.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A DUST STORM WARNING MEANS SEVERELY LIMITED VISIBILITIES ARE EXPECTED WITH BLOWING DUST. TRAVEL COULD BECOME EXTREMELY DANGEROUS. PERSONS WITH RESPIRATORY PROBLEMS SHOULD MAKE PREPARATIONS TO STAY INDOORS UNTIL THE STORM PASSES.

WAZ032-033-036-044-150600-
/O.CON.KOTX.DU.Y.0001.000000T0000Z-150815T0600Z/
LOWER GARFIELD AND ASOTIN COUNTIES-WASHINGTON PALOUSE-
SPOKANE AREA-WATERVILLE PLATEAU-
254 PM PDT FRI AUG 14 2015

¹¹ the advisory was elevated to a warning

...BLOWING DUST ADVISORY REMAINS IN EFFECT UNTIL 11 PM PDT THIS EVENING...

* WINDS...SOUTHWEST 20 TO 30 MPH WITH GUSTS UP TO 45 MPH.

* TIMING...THIS AFTERNOON AND EVENING.

* LOCATIONS...WATERVILLE...DAVENPORT...CHENEY...SPOKANE...
PULLMAN...LACROSSE

* IMPACTS...VISIBILITIES MAY BE REDUCED TO A MILE OR LESS THIS
AFTERNOON AND EVENING. MOTORISTS ON INTERSTATE 90...HIGHWAY 2...AND HIGHWAY
195 SHOULD BE PREPARED FOR AREAS OF POOR VISIBILITY AND GUSTY CROSS WINDS.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A BLOWING DUST ADVISORY MEANS THAT BLOWING DUST WILL RESTRICT
VISIBILITIES. TRAVELERS ARE URGED TO USE CAUTION.

C.1.4 NOAA Storm Events Database Event Details, August 14

[National Climatic Data Center Storm Events Database](#)

[National Centers for Environmental Information](#)

Storm Events Database

Event Details:

Event	Dust Storm
State	WASHINGTON
County/Area	Upper Columbia Basin
WFO	OTX
Report Source	Broadcast Media
NCEI Data Source	CSV
Begin Date	2015-08-14 13:50:00.0 PST-8
End Date	2015-08-14 14:10:00.0 PST-8
Deaths Direcd/Indirect	0/0 (fatality details below, when available...)
Injuries Direcd/Indirect	0/0
Property Damage	0.00K
Crop Damage	0.00K
Episode Narrative	A strong cold front passage on Friday August 14th brought windy conditions and resulted in substantial blowing dust. Additionally the very hot and dry conditions and wildfire ignitions (both human caused and from lightning) over the two to three days preceding it resulted in explosive fire growth for numerous fires in Eastern Washington.
Event Narrative	Broadcast media reported that multiple wrecks occurred on highway 395 south of Ritzville, WA associated with poor visibility due to blowing dusts. Highway 395 had to be closed between highway 26 and Ritzville, WA. At least one vehicle caught on fire and the fire spread into the brush along the highway.

All events for this episode:

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
Totals:								0	0	0.00K	0.00K
UPPER COLUMBIA BASIN (ZONE)	UPPER COLUMBIA BASIN (ZONE)	WA	08/14/2015	13:50	PST-8	Dust Storm		0	0	0.00K	0.00K
CARLTON	OKANOGAN CO.	WA	08/15/2015	17:10	PST-8	Debris Flow		0	0	0.00K	0.00K
Totals:								0	0	0.00K	0.00K

<https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=592579>

9/19/2017

C.2 Climatologist Report



Office of the Washington State Climatologist

September 4, 2015

August Event Summary

Average August temperatures were warmer than normal across the entire state for the 4th consecutive month. Precipitation, on the other hand, was vastly different for the two sides of the state: western WA received well above normal for the month while eastern WA was drier than usual. Despite SeaTac Airport's high ranking compared to precipitation during historical Augusts (4th wettest), the rankings for the rest of western WA do not end up being too impressive (Table 1). The temperature rankings for average August temperature are actually higher, as all listed in Table 1 were among the top 8 warmest Augusts for the selected western WA locations. Stations in eastern WA were also ranked among the top ten warmest Augusts (e.g., Pullman - 4th, Omak - 8th, Wenatchee - 6th).

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1902 Yacolt Burn.....	3
Climate Summary.....	5
Climate Outlook.....	7

The month started out warm, with daily record high temperatures in the upper 80s, 90s and 100s around the state on August 1. It wasn't long before temperatures cooled statewide, however, and cloudier mornings were the rule for western WA. Thunderstorms were common from the 8th through the 14th, and ignited several fires throughout the state. Daily high tem-

Station	August Precipitation (inches)	Rank	August Temp (°F)	Rank	Records Began
SeaTac	3.28	4	68.7	4	1946
Olympia	2.84	6	66.2	7	1948
Quillayute	4.06	10	62.8	2	1966
Everett	2.11	16	67.3	8	1894
Arlington	2.23	20	64.0	6	1923
Hoquiam	1.77	21	63.3	4	1963
Bellingham	1.63	22	66.8	4	1949

Table 1: August total precipitation and ranking (ascending) and August average temperature and ranking (descending), along with the period of record for selected western WA stations.

perature records were set in eastern WA on the 12th (e.g., Wenatchee - 103°F and Omak - 104°F), and then again on the 13th (e.g., Spokane Airport - 100°F). A lightning-caused fire near Chelan started overnight on the 13th/14th, forcing evacuations of hundreds of homes in the area; 21 residences were destroyed and the fire is 70% contained at the time of this writing. The Okanogan Complex fire -

now the largest fire in state history and only 60% contained - was also started on the same day and 123 residences and 72 other structures have been destroyed. On the west side of the Cascades, the thunderstorms on the 14th were associated with a cold frontal passage, and brought some heavy rain, especially in the central Puget Sound region. Daily maximum rainfall records were set at Olympia (0.93") and the Seattle Weather Forecast Office (0.90"), but there were localized totals well over an inch. Strong winds on that day also caused widespread dust storms east of the Cascades. Even stronger winds occurred in eastern WA on the 21st, resulting in extreme fire behavior.

The large, active fires in eastern WA produced a great amount of smoke, and an air quality alert was issued for all of eastern WA during the latter part of the month. For the most part, the weather for the remaining two weeks of the month was typical of summer with warm temperatures and little precipitation, until a series of frontal systems impacted the state beginning on the 27th, bringing rain and strong winds. The storm on the 29th caused widespread power outages in western WA from broken limbs and downed trees. Wind gusts were between 40 and 65 mph in western WA, and mostly in the 30s and 40s in eastern WA. It was a very strong system for the time of year, and there were even two deaths due to falling trees. Both the recent drought conditions and the summer foliage on trees likely exasperated the damage (see [article](#)). Daily rainfall records were set at SeaTac Airport (1.28") and the Seattle Weather Forecast Office (1.28") on the 29th, and then again at SeaTac on the 30th (0.40"). Rain even fell in eastern WA on the 30th, with as much as 0.30" in Spokane county, though totals elsewhere were much less.

Drought Update

Though the recent precipitation has certainly helped the drought situation, especially in western WA, we are by no means in the clear. Despite the wet August, summer precipitation deficits still reach up to 6" in some parts of western WA and the increased streamflows are expected to be temporary. The Seattle, Everett, and Tacoma utility districts are still urging voluntary water conservation efforts, for example. Still, the recent precipitation in western WA has prompted some improvement on the US Drought Monitor for the drought designation on the Olympic Peninsula; the Peninsula is now in "severe drought" as opposed to "extreme drought". Since the last edition of the OWSC newsletter, however, the area of "extreme drought" has been expanded to include all of eastern WA due to continued low streamflows, little precipitation, and warm summer temperatures. OWSC produces a weekly drought monitoring [report](#) on statewide weather and hydrological conditions as well as drought impacts, which can be referenced for more details.



Figure 1: The 1 September 2015 edition of the US Drought Monitor (<http://droughtmonitor.unl.edu/>).

The Yacolt Burn of 1902

A message from the State Climatologist

This summer has included the largest fire (the Okanogan Complex) in WA state history and the most acres burned since at least 2002. The vast majority of wildfires in WA occur east of the Cascade Range crest but that is not the only part of state that can face a serious threat. In particular, prior to 2014, the largest fire in state history burned on the west flank of Cascades, the so-called Yacolt Burn of September 1902, which burned over 238,000 acres. There was little capability to fight large wildfires at that time, and the property damages and loss of life were exacerbated by the lack of reliable communication. On the other hand, the weather generally plays a critical role in severe fires in the Pacific Northwest (Gedalof et al. 2005) and it appears the Yacolt Burn was no exception. Our objective here is to briefly summarize conditions during the Yacolt Burn and determine how often similar conditions have arisen in recent decades.

The history of the Yacolt Burn is not fully known. It appears that the first fires may have begun in Oregon on 8 September, with embers crossing the Columbia into Washington state. Another fire started a day or two later near Stevenson, WA in the Columbia River gorge. It definitely seems that there were multiple points of ignition with separate fires merging into the conflagration. More detail on the Yacolt Burn is available at the following websites, among others: [Clark County Government](#) and [History Link](#).

The temperatures in the region of interest were abnormally warm but not extremely hot before and during the fire. The maximum temperatures from three nearby stations, Centralia and Vancouver, WA and Hood River, OR during the first 12 days of month were typically in the 80s or 6 to 8°F above normal, and no daily records were set. The historical accounts of this event generally include mention of strong east winds, and one description used the term “devil wind from eastern Washington”. Because of the probable importance of the east winds to the severity of the Yacolt Burn, here we will focus on that aspect of the regional weather conditions.

The NCEP 20th Century Reanalysis is used to document the regional flow at 850 hPa for the Yacolt Burn, and to identify other strong easterly events in the recent record (back to late 1940s). This product has a coarse spatial resolution and cannot be used to specify details in the specific location of the fire. Presumably it is suitable for comparing regional aspects of the circulation during the Yacolt Burn with similar events in the historical record. The distribution of mean 850 hPa geopotential height (Z) for the 3 days of 9-11 Sept 1902 is shown in Figure 2. This pattern was associated with a mean easterly wind of ~5 m/s in the general region of the fire. There was also a thermally-induced trough of low sea level pressure (SLP) at the coast (not shown); a hint of this feature is in the 850 hPa Z map included here.

As indicated above, the zonal winds at 850 hPa are used to ascertain when conditions comparable to those of the Yacolt Burn have occurred in recent decades. Specifically, 3-day average values of the zonal winds (U) at 850 hPa in SW WA were computed during the period of 15 August through 15 September for the years 1948 through 2014 in the region of the Yacolt fire.

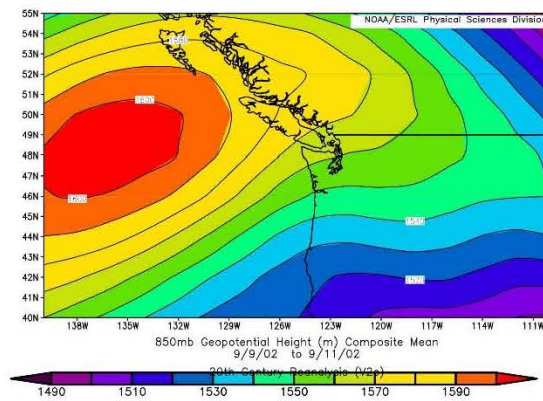


Figure 2: The 850 hPa geopotential heights (Z) for 9-11 September 1902 from the NCEP 20th Century Reanalysis.

Date	850 hPa U (m/s)	500 hPa Z (m)	1000 hPa Temperature (°C)
10 Sept 1902	-5	5910	27
8 Sept 1948	-4	5870	23
5 Sept 1949	-4	5860	27
14 Sept 1951	-4	5870	26
8 Sept 1960	-4.5	5880	21
12 Sept 1961	-4.5	5780	24
24 Aug 1966	-4	5850	26
14 Sept 1967	-6	5860	22
12 Sept 1988	-5	5890	22
8 Sept 1989	-4	5880	23
12 Sept 2014	-5	5840	20

Table 2: The historical cases of strong 850 hPa zonal winds during August 15 to September 15. Note: The 850 hPa U and 1000 hPa T refer to the region of southwest WA in the vicinity of the Yacolt Burn; the 500 hPa Z refers to the maximum Z at the axis of the ridge (typically west of the coastline).

The 3-day periods with the 10 strongest mean easterly flow were examined individually. Table 2 itemizes the dates of these events, and approximate values for the 3-day means of the easterly flow (U) at 850 hPa, peak magnitude of 500 hPa ridge (Z), and 1000 hPa air temperature.

The cases identified on the basis of 850 hPa zonal winds can give insight into the conditions present during the Yacolt Burn. The atmospheric conditions during Yacolt Burn were more extreme than might be supposed based on surface air temperatures alone. There was one event found since the late 1940s with stronger east winds at the 850 hPa level (14 Sept 1967), but this case also included more moderate air temperatures. Our selection process revealed that strong easterlies are much more likely in early September than in late August. While temperatures are cooling off this time of year on average, the increased likelihood of winds promoting the growth of fires, and in many cases the continued drying of the landscape, may make early September the period of greatest fire threat west of the Cascade crest. Perhaps the rain we are receiving from the end of August into September 2015 is especially timely.

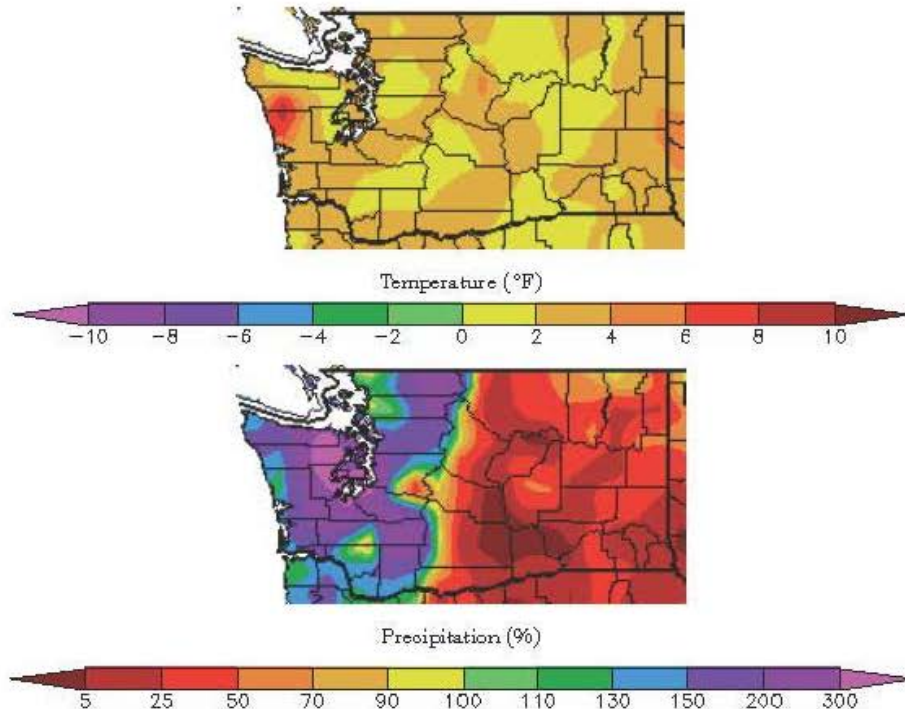
Reference:

Gedalof, Z., D.L. Peterson and N.J. Mantua (2005): Atmospheric, climatic and ecological controls on extreme wildfire years in the northwestern United States. *Ecological Applications*, 15: 154-174.

Climate Summary

Mean monthly August temperatures were warmer than normal throughout the entire state, but the anomalies are not as large in magnitude as previous months this summer. According to the map from the High Plains Regional Climate Center, average August temperatures were between 2 and 4°F above normal for most of the state. A few of the locations in listed in Table 3 were closer to normal, with Omak and Pasco only 1.2 and 1.0°F above normal, respectively. The smoke in the former location may have been dense enough to limit solar heating.

Total August precipitation was drastically different for the two halves of WA State: western WA received well above normal precipitation, with values exceeding 300% of normal, while eastern WA remained much drier than normal, receiving less than half of typical August precipitation. Hanford was a dry spot, and didn't receive any precipitation during the month. Wenatchee and Pasco only received 10 and 11% of normal precipitation, respectively. Meanwhile, two periods of heavy rain in western WA during the month brought totals to over 300% of normal at Olympia, Seattle, and the eastern Olympic Peninsula. The rest of western WA received between 130 and 300% of normal August precipitation.



*August temperature (°F) departure from normal (top) and precipitation % of normal (bottom).
(High Plains Regional Climate Center; relative to the 1981-2010 normal).*

	Mean Temperature (°F)			Precipitation (inches)		
	Average	Normal	Departure from Normal	Total	Normal	Percent of Normal
Western Washington						
Olympia	66.2	64.1	2.1	2.84	0.94	302
Seattle WFO	68.4	66.5	1.9	2.70	0.97	278
Sea Tac AP	68.7	66.1	2.6	3.28	0.88	372
Quillayute	62.8	59.6	3.2	4.05	2.49	163
Hoquiam	63.3	60.6	2.7	1.77	1.31	135
Bellingham AP	64.5	65.8	3.3	1.53	1.23	124
Vancouver AP	71.2	69.2	2.0	0.55	0.77	71
Eastern Washington						
Spokane AP	72.5	69.3	3.2	0.18	0.59	31
Wenatchee	76.9	73.5	3.4	0.02	0.20	10
Omak	73.6	72.4	1.2	0.17	0.49	35
Pullman AP	67.8	65.7	2.1	0.15	0.63	24
Ephrata	75.2	72.9	2.3	0.09	0.19	47
Pasco AP	73.8	72.8	1.0	0.03	0.27	11
Hanford	77.9	75.8	2.1	0	0.18	0

Table 3: August 2015 climate summaries for locations around Washington with a climate normal baseline of 1981-2010. Note that the Vancouver Pearson Airport and Seattle WFO 1981-2010 normals involved using surrounding stations in NCDC's new normal release, as records for these station began in 1998 and 1986, respectively. M denotes missing data.

Climate Outlook

El Niño is alive and well in the tropical Pacific, and sea surface temperature (SST) anomalies in each of the Niño monitoring regions are above normal, according to the Climate Prediction Center (CPC). The weekly SST anomalies exceed 2°C in the central and eastern equatorial Pacific and these anomalies have persisted over the last 4 weeks as well. The "El Niño Advisory" released on 6 March is still in effect. There is about a 90% chance that El Niño conditions will continue through next winter (2015-16), and most ENSO models have the Niño3.4 anomaly staying above 1°C.

The CPC seasonal outlook for September is calling for increased chances of above normal temperatures statewide. September precipitation is more uncertain: there are equal chances that there will be below, equal to, or above normal precipitation for most of the state. In other words, each outcome is assigned a 33% chance of occurring. The odds of below normal precipitation are slightly elevated for the southern portion of the state.

The September-October-November (SON) CPC outlook is calling for higher than normal temperatures statewide, with the odds of warmer temperatures exceeding 60% for the western two-thirds of the state. For precipitation, there are higher chances of below normal precipitation for the entire state.



September outlook for temperature (left) and precipitation (right) from the CPC.



September-October-November outlook for temperature (left) and precipitation (right) from the CPC.

C.3 Ecology Burn Decision

Click [here](#) to access Burn Zone maps.

C.3.1 Ecology Eastern Regional Office

Decision For: Friday, August 14, 2015

Daily Notes: Red Flag Warnings and elevated monitor readings continue. NO BURN All Counties.
If a recording is listed as CALL IN, growers need to contact Ecology in Spokane at 509-329-3400 Mon-Fri from 8-5 to get scheduled for a burn decision (NOTE: calling 329-3400 outside of M-F 8-5 will reach WA DEM who cannot help with burn call issues). Calling in the afternoon is preferred. It is very unlikely a grower will get permission the same day they first call Ecology. - plan ahead.

Please Note: The daily burn decision for Ecology regulated Eastern Washington counties is determined by the regional office responsible for the county in question. If you have questions about the daily burn decision please call the correct office. If you wish to subscribe or unsubscribe from the listserv used to distribute the daily burn decisions see the links under "ERO listserv" and "CRO listserv" below.
The Eastern Regional Office (ERO) in Spokane is responsible for the following counties: Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Stevens, Walla Walla and Whitman. Call (509) 329-3400 for questions concerning these counties.
[ERO listserv](#)

The Central Regional Office (CRO) in Yakima is responsible for the following counties: Chelan, Douglas, Kittitas, Klickitat and Okanogan. Call (509) 575-2490 for questions concerning these counties.
[CRO listserv](#)

The three remaining counties (Benton, Spokane and Yakima) have local air authorities. See the listings below for phone numbers.

Winds are indicated by direction the wind is coming from (i.e.: if you face in the direction listed, the wind would be blowing in your face)

Air authorities: [Air authorities](#)

Zone map: [Zone map](#)

Ag & outdoor burning questions in:

Spokane (509) 477-4727, Benton (509) 783-1304 or Yakima (509) 834-2050 (all local air authorities)

Okanogan, Chelan, Douglas, Kittitas, or Klickitat: (509) 575-2490 (Ecology, Yakima office)

Eastern Washington counties not listed: (509) 329-3400 (Ecology, Spokane office)

FORECAST: Forecasted winds should lighten up a bit but elevated monitor readings will most likely limit burning. Expect very limited to no burning on Saturday.

Adams	NO BURN
notes:	Red Flag Warning
Asotin	NO BURN
notes:	- County Fire Safety Burn Ban
Columbia	NO BURN
notes:	- County Fire Safety Burn Ban
Zone 11:	
notes:	
Zone 12:	
notes:	
Zone 13:	
notes:	
Franklin	NO BURN
notes:	Red Flag Warning
Zone 51:	
notes:	
Zone 52:	
notes:	
Zone 53:	
notes:	
Garfield	NO BURN
notes:	- County Fire Safety Burn Ban
Grant	NO BURN
notes:	Red Flag Warning
Zone 41:	
notes:	
Zone 42:	
notes:	
Zone 43:	
notes:	
Lincoln	NO BURN
notes:	Red Flag Warning
Stevens	NO BURN
notes:	- County Fire Safety Burn Ban
& P. Oreille	NO BURN
notes:	- County Fire Safety Burn Ban
Walla Walla	NO BURN

notes: Red Flag Warning
 Zone 01:
 notes:
 Zone02:
 notes:
 Zone 03:
 notes:
 Zone 04:
 notes:
 Zone 05:
 notes:
 Zone 06:
 notes:
 Zone 07:
 notes:
 Zone 08:
 notes:
 Whitman NO BURN
 notes: Red Flag Warning
 Zone 1:
 notes:
 Zone 2:
 notes:
 Zone 3:
 notes:
 Zone 4:
 notes:
 Zone 5:
 notes:
 Zone 7:
 notes:
 Zone 8:
 notes:
 Not routinely called (does not have mailbox, ag burning in this area is almost exclusively on Indian lands)
 Ferry NO BURN
 notes: - County Fire Safety Burn Ban

C.3.2 Ecology Central Regional Office

There was a burn call “No Burn until Further Notice” issued on June 24, 2015. No burn call was issued until October 1, 2015.

Decision For: Wednesday, June 24, 2015

Daily Notes: NO BURN, until further notice

<https://fortress.wa.gov/ecy/enviwa/Default.htm> for ambient air quality monitoring information in your area and Follow burn bans @ <http://waburnbans.net>

Standard Notes: Customers can also get the Daily Burn Decision information by calling 1-800-406-5322. If a recording is listed as CALL IN, permit holders need to contact Ecology in Yakima at 509-575-2490, Mon-Fri from 8-5 to get scheduled for a burn decision. (NOTE: calling 575-2490 outside of M-F 8-5 will reach Wash Dept. of Emergency Mngt. who cannot help with burn call issues).

Please plan ahead, Daily Burn Decisions are based on local weather conditions and local pollution levels.

Winds are indicated by direction the wind is coming from (i.e.: if you face in the direction listed, the wind would be blowing in your face)

Air authorities: <http://www.ecy.wa.gov/programs/air/local.html>

Subscription: For subscription services to Central Regions Daily Burn Decision you must go to:

<http://listserv.wa.gov/cgi-bin/wa?SUBED1=BURN-DECISION-CRO&A=1>

For subscription services to Eastern Regions Daily Burn Decision you must go to:

<http://listserv.wa.gov/cgi-bin/wa?SUBED1=AG-BURN-DECISION-ERO&A=1>

Questions about the daily burn decision? Call (509) 575-2490 and ask for the smoke manager on duty.

For Agricultural & Outdoor Burning Questions In:

Spokane (509) 477-4727, Benton (509) 943-3396 or Yakima (509) 834-2050 (all local air authorities)

Okanogan, Chelan, Douglas, Kittitas, or Klickitat: (509) 575-2490 (Ecology, Yakima office) CRO

Eastern Washington counties not listed: (509) 329-3400 (Ecology, Spokane office) ERO

Tomorrows Forecast: Burn bans in place Region wide. In addition, Dept. of Natural Resources and other land management agencies have burn bans within their jurisdiction.

Okanogan No Burn, See Notes

notes: Fire Safety Burn Ban: Permit holders in burn ban counties need permission from the fire district to burn under pest infestation circumstances. In these cases, call Ecology before 10:30 am for permission to burn. If you have any questions please contact Ecology at (509) 575-2490.

Chelan No Burn, See Notes

notes: Fire Safety Burn Ban: Permit holders in burn ban counties need permission from the fire district to burn under pest infestation circumstances. In these cases, call Ecology before 10:30 am for permission to burn. If you have any questions please contact Ecology at (509) 575-2490.

Douglas No Burn, See Notes

notes: Fire Safety Burn Ban: Permit holders in burn ban counties need permission from the fire district to burn under pest infestation circumstances. In these cases, call Ecology before 10:30 am for permission to burn. If you have any questions please contact Ecology at (509) 575-2490.

Kittitas No Burn, See Notes

notes: Fire Safety Burn Ban: Permit holders in burn ban counties need permission from the fire district to burn under pest infestation circumstances. In these cases, call Ecology before 10:30 am for permission to burn. If you have any questions please contact Ecology at (509) 575-2490.

Klickitat No Burn, See Notes

notes: Fire Safety Burn Ban: Permit holders in burn ban counties need permission from the fire district to burn under pest infestation circumstances. In these cases, call Ecology before 10:30 am for permission to burn. If you have any questions please contact Ecology at (509) 575-2490.

C.4 Media Reports

C.4.1 KHQ Web Story, August 14, 2015, 2:30 PM

Dust Storm Causes Multiple Collisions on Highway 395 South of Ritzville

A dust storm moving across eastern Washington dropped visibility down to almost nil, leading to multiple car crashes, a brush fire and the shutdown of Highway 395 south of Ritzville Friday. A car on fire pulled off the road started the brush fire.

Dust storm causes multiple collisions on Highway 395 south of Ritzville

Posted: Aug 14, 2015 2:12 PM PDT <em class="wnDate">Friday, August 14, 2015 5:12 PM EDT *Updated: Aug 15, 2015 3:36 PM PDT* <em class="wnDate">Saturday, August 15, 2015 6:36 PM EDT
by Cory Howard, Executive Producer Interactive, KHQ.com

MULTIPLE COLLISIONS ON HIGHWAY 395 IN ADAMS COUNTY

Aug 14, 2015 02:30 PM

Multiple collisions on Highway 395 in Adams County



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<script type='text/javascript' src='http://api.worldnow.com/feed/v3.0/widgets/167275?alt=js&contextaffiliate=438'></script> X



ADAMS COUNTY, Wash.
PHOTO: Peter Schmidt
Photo from the scene on Highway 395 just south of Ritzville

Slideshow: Multiple collisions on Highway 395 in Adams County

Update: 3:30 p.m.: Washington State Patrol reports both lanes of Highway 395 are open as of Saturday afternoon. The highway was closed for several hours Friday because a duststorm in the area was causing low visibility and multiple collisions.

Update: As of Saturday morning Washington State Patrol reports all units are clear of the scene of a duststorm on Highway 395. Northbound 395 from State Route 26 to I-90 will remain closed until further notice. Southbound Highway 395 is open to all traffic. The Department of Transportation is on scene providing traffic control. Detours are in place.

The Washington State Patrol is responding to multiple collisions on Highway 395 due to a duststorm causing low visibility about 11 miles south of Ritzville.

Trooper Jeff Sevigney says there haven't been any major injuries reported, however there is a brush fire burning near milepost 71 and they are working to evacuate motorists.

Highway 395 from I-90 to State Route 26 is closed.

If you are in the area and can safely take a photo, please post it to our [Facebook page](#).

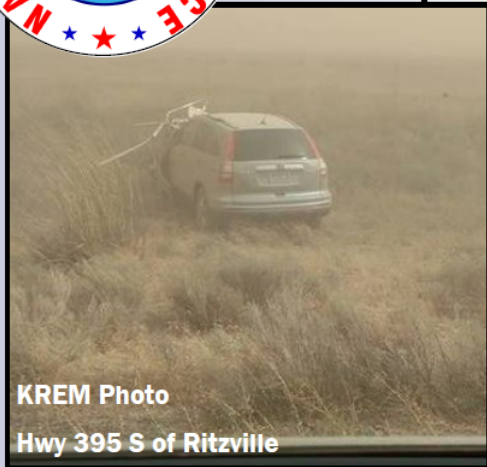
This is a developing story and we will update you as soon as we confirm any additional details.

C.4.2 NWS Slide for Top Ten Weather Events, #5 Dust Storm: August 14

wrh.noaa.gov/otx/



#5. Dust Storm: Aug 14



Dust Storm—August 14: The first of several late summer dust storms. Temperatures around 100 degrees on the 13th were followed by wind gusts of 30 to 35 mph on the 14th creating blowing dust and extreme wildfire behavior. Portions of Hwy 395 and I-90 were closed due to multi-car pile ups.



C.5 Wildfire Information

The wildfire information is obtained from [Incident Information System](#).

C.5.1 Cougar Creek Wildfire

InciWeb the Incident Information System: Cougar Creek

Page 1 of 2

InciWeb - Incident Information System

Cougar Creek

This incident is no longer being updated.

INCIDENT UPDATED 9/15/2015

Approximate Location

46.134 latitude, -121.374 longitude zoom to incident



Incident Overview

GLENWOOD, WA –

Firefighters continue to focus on mop-up and suppression repair on all divisions of the fire today. The warmer weather is aiding firefighters in locating and extinguishing hot spots within the containment lines, reducing any threat to the line.

A warming and drying trend continues today as a ridge builds over the region. Temperatures will get warmer, winds will increase, and humidity levels will decrease. Weather for Wednesday will feature breezy, dry and unstable conditions. As the weekend approaches a trough is expected to bring cooler and more humid conditions.

Many post fire surveys will be generated by a team of scientists. The BAER assessment team generates a "Soil Burn Severity" map by using satellite imagery which is then validated and adjusted by BAER team field surveys to assess watershed conditions and watershed response to the wildfire. The map identifies areas of soil burn severity by categories of low/unburned, moderate, and high which corresponds to a projected increase in watershed response.

The BAER team presents these findings and treatment recommendations to Agency Supervisors in an assessment report that identifies immediate and emergency stabilization actions needed to address potential post-fire risks to human life and safety, property, cultural-heritage and critical natural resources. In most cases, only a portion of the burned area is actually treated. Severely burned areas, steep slopes, places where water run-off will be excessive, fragile slopes above homes, businesses, municipal water supplies, and other valuable facilities are focus areas and described in the BAER assessment report as values-at-risk.

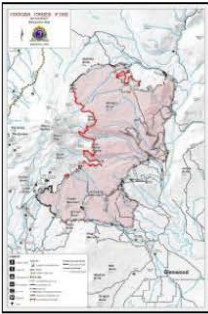


Image options: [Enlarge] [Full Size]

Type III Management team Joe Wyatt will work with the outgoing team to exchange crucial information, strategize and transfer key logistical needs today. Official transition to the new team will occur Wednesday morning at 6:00 AM.

Closures in effect to minimize risks to public safety: **DNR** - All DNR State Trust lands and recreation sites within the Glenwood Block are closed.

Yakama Nation – Nation lands are closed to the public, except enrolled members. Burned areas remain closed until further notice. **USFS** – The Mount Adams Wilderness closure has been rescinded. Please click on the Closure tab to review reduced closure on the Gifford Pinchot National Forest.

Basic Information

Current as of	9/14/2015 5:00:32 PM
Incident Type	Wildfire
Cause	Lightning/natural
Date of Origin	Monday August 10th, 2015 approx. 06:00 PM
Location	6 miles NW of Glenwood, WA
Incident Commander	Mike Wakoski
Incident Description	Wildfire

Current Situation

<https://inciweb.nwcg.gov/incident/4484/>

4/19/2017

Total Personnel	440
Size	53,523 Acres
Percent of Perimeter Contained	97%
Estimated Containment Date	Tuesday September 15th, 2015 approx. 12:00 AM
Fuels Involved	Timber (litter and understory), light logging slash, tall grass. Extensive bug killed timber in portions of fire.
Significant Events	Minimal, Smoldering, Creeping. Minimal surface spread due to high relative humidity and cloud cover.

Outlook

Planned Actions	Today firefighters will continue mopping up and improving the strength of existing containment lines. Crews are also focused on completing a small portion of containment line on the north end of the fire in an area of heavy fuels and large timber.
Projected Incident Activity	No forward fire spread is expected. Fire is expected to burn in the pockets of the interior islands.
Remarks	Type III Management team Joe Wyatt will work with the outgoing team to exchange crucial information, strategize and transfer key logistical needs today. Official transition to the new team will occur Wednesday morning at 6:00 AM.

Current Weather

Weather Concerns	Firefighters continue to focus on mop-up and suppression repair on all divisions of the fire today. The warmer weather is aiding firefighters in locating and extinguishing hot spots within the containment lines, reducing any threat to the line.
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C.5.2 County Line 2 Wildfire

InciWeb the Incident Information System: County Line 2 Fire

Page 1 of 2

InciWeb - Incident Information System

County Line 2 Fire

This incident is no longer being updated.

INCIDENT UPDATED 9/3/2015

Approximate Location

44.83 latitude, -121.377 longitude zoom to incident



Incident Overview

The County line 2 fire, started on Wednesday the 12th, in the afternoon. It started along Hwy 26, with multiple starts, on both sides of the Highway. With the weather conditions at the time, these fires quickly exceeded the capabilities of the local resources, and their mutual aid. The State Fire Marshals office, sent their Blue Management Team, along with 8 task force contingents, to help with structure protection. Oregon Interagency Incident Management Team#1, was also ordered, for the wild land component. It is a Unified Command between the two teams. This fire has gone through changing levels of evacuations, and numerous challenges.

Wednesday August 19, 2015 at 0600, the Oregon State Fire Marshal's Blue Team, and all remaining task forces assigned to them were released from this fire. Oregon Interagency Incident Management Team #1, with Incident Commander Shawn Sheldon, will be remaining to be in command of the fire.

Thursday September 3, 2015, at 0600, Incident Command was transferred to a Type 3 team, with Dorian Soliz, as Incident Commander.



Image options: [Enlarge] [Full Size]

Basic Information

Current as of	9/3/2015 6:50:32 AM
Incident Type	Wildfire
Cause	Under Investigation
Date of Origin	Wednesday August 12th, 2015 approx. 01:30 PM
Location	Warm Springs Reservation, North of Warm Springs Oregon
Incident Commander	Dorian Soliz, Warm Springs Type 3 Management Team
Incident Description	Wildfire

Current Situation

Total Personnel	429
Size	67,207 Acres
Percent of Perimeter Contained	97%
Estimated Containment Date	Thursday September 03rd, 2015 approx. 12:00 AM
Fuels Involved	Brush (2 feet), Timber (Grass and Understory)
Significant Events	Minimal, Creeping, Smoldering.

Outlook

Planned Actions	9/3/2015 the fire will be taken by a Warm Springs Type 3 team at 0600hrs, continue with structure protection, use hose lays, crews and dozers to reinforce line, contain spots/slop over, continue going direct and reinforcing hand line.
-----------------	--

Projected Incident Activity	12hours: No growth expected on the north edge, lack of IR makes it difficult to know amount of heat left on that side - Patrol status. As the fire activity continues to be minimal, the fire-line will be greatly reinforced contained at the west end of Shitake Canyon, Minimal fire behavior today with creeping and smoldering behavior. 24hours: Backing and creeping fire is expected to continue in the Shitake Canyon, crews will continue to use roads to check the fire and build direct line. With slightly cooler weather and decreased fire activity the potential for spotting should remain low. 48hours: same as 24 hours, 72hours: same as 48 hours Anticipated after 72 hours: same until containment.
Remarks	5 x Type 2 crews are an essential need for the Type 3 organization to replace crews that are timing out.

Current Weather	
Weather Concerns	Temperatures were in the upper 50 degree range across the fire area today with relative humidity in the upper 50's. Westerly winds 3-8 mph with light rain. Thursday, temperatures in the 60's, with relative humidity between 30-40 percent. West winds 4-7 mph gusting to 15 mph. Extended forecast calls for a chance of showers and thunderstorm activity, slightly cooler.



Content posted to this website is for information purposes only.

C.5.3 Highway 8 Wildfire

InciWeb the Incident Information System: Highway 8 Fire

Page 1 of 2

InciWeb - Incident Information System

Highway 8 Fire

This incident is no longer being updated.

INCIDENT UPDATED 8/10/2015

Approximate Location

45.717 latitude, -120.315 longitude zoom to incident



Incident Overview

Highway 8 Fire

The Highway 8 fire is burning in grassland and in various canyons approximately three miles north/northwest of Roosevelt, WA in Klickitat County. The fire was reported on August 4, 2015 at approximately 1:00pm (pacific time). Local firefighters, and landowners initially provided suppression efforts but the fire quickly grew due to the fuel type, dry conditions, hot temperatures, and strong wind. Southeast Washington Incident Management Team (Type III Team), took command and a state mobilization was put into place for additional resources. Due to the complexity of the incident, Washington Incident Team Three (Type II Team) is currently managing the fire. The team is still working closely with Klickitat Fire District 9, Klickitat Fire District 10, Klickitat Fire District 2 and other local agencies.

Klickitat County Sheriff's Office has evacuations in place as of August 8, 2015 and Klickitat County Office of Emergency Management has notified affected residents.

Basic Information

Current as of	10/5/2015 8:51:31 AM
Incident Type	Wildfire
Cause	Unknown
Date of Origin	Tuesday August 04th, 2015 approx. 03:00 PM
Location	Klickitat County, SR 14 in Roosevelt
Incident Commander	Bob Albee

Current Situation

Size	33,100 Acres
Percent of Perimeter Contained	95%
Fuels Involved	Tall Grass (2.5 feet)
Significant Events	Minimal Creeping and smoldering

Outlook

Planned Actions	1. Direct & Indirect 2. Mop-up 3. Patrol Status in DIV-Y & DIV-Z
Projected Incident Activity	Fire growth was zero as crews continue to mop-up and patrol.
Remarks	Massive demob will occur on 8/10. The incident will be a Type 4 starting at the end of shift on 8/10.

Current Weather

Weather Concerns	Temp 87, RH-23%, and winds 1-2 mph,
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<https://inciweb.nwcg.gov/incident/4464/>

4/19/2017

C.6 Governor Declaration of Statewide Drought Emergency

Governor declares statewide drought emergency | Governor Jay Inslee

Page 1 of 2

Washington Governor - Jay Inslee

Governor declares statewide drought emergency

May 15, 2015

Summary

Gov. Jay Inslee today declared a statewide drought for Washington. Snowpack is at historic lows, rivers are dwindling and irrigation districts are cutting off water to farmers. State agencies are already ramping up work to relieve hardships from water shortages and the Department of Natural Resources expects more early-season and higher-elevation wildfires.

Quotes

"We're really starting to feel the pain from this snowpack drought. Impacts are already severe in several areas of the state. Difficult decisions are being made about what crops get priority water and how best to save fish."
Governor Inslee

"This drought is unlike any we've ever experienced. Rain amounts have been normal but snow has been scarce. And we're watching what little snow we have quickly disappear."
Washington Department of Ecology Director Maia Bellon

"We have some tough, challenging months ahead of us. We're ready to bring support and relief to the hardest hit areas of the state. We're going to do everything we can to get through this."
Governor Inslee

"We've been busy the past few months working with sister agencies, tribes and communities to prepare and respond to this. We're working hard to help farmers, communities and fish survive this drought."
Washington Department of Ecology Director Maia Bellon

Story

State ramps up work to relieve hardships from water shortages

OLYMPIA — With snowpack at historic lows, rivers dwindling and irrigation districts cutting off water to farmers, Gov. Jay Inslee today declared a statewide drought for Washington.

"We're really starting to feel the pain from this snowpack drought," Inslee said. "Impacts are already severe in several areas of the state. Difficult decisions are being made about what crops get priority water and how best to save fish."

The Washington Department of Agriculture is projecting a \$1.2 billion crop loss this year as a result of the drought.

To protect crops in the state's most productive agricultural region — the Yakima Basin — irrigation districts are turning off water for weeks at a time to try to extend water supplies longer into the summer.

In the Walla Walla region, water is being shifted from creek to creek to keep water flowing for steelhead, Chinook and bull trout. Fish are even being hauled farther upstream to cooler water.

On the Olympic Peninsula, where there would normally be 80 inches of snow now, flowers such as glacier lilies are blooming.

As things continue to dry out, the Department of Natural Resources expects more early-season and higher-elevation wildfires.

In the Puget Sound region, the large municipal water suppliers such as Seattle, Tacoma and Everett have adequate reservoir storage to meet their customers' needs and do not anticipate water shortages. Homeowners and businesses with questions about water use should contact their local utility district.

"This drought is unlike any we've ever experienced," said Washington Department of Ecology Director Maia Bellon. "Rain amounts have been normal but snow has been scarce. And we're watching what little snow we have quickly disappear."

Snowpack in the mountains has dropped to just 16 percent of normal levels statewide. Snowmelt through the spring and summer is what usually keeps rivers flowing, crops watered and fish alive. However, the snow has already melted in the central Puget Sound basin and upper Yakima basin, and on the Olympic Peninsula.

<http://www.governor.wa.gov/news-media/governor-declares-statewide-drought-emergency> 4/19/2017

On May 1, the Natural Resources Conservation Service found 11 snow sites in Washington that are snow free for the first time ever. Of the 98 snow sites the Conservation Service measured in Washington, 86 of them are currently snow free.

The U.S. Geological Survey reported in April that 78 percent of streams statewide were running below or much below normal. Some were already at historic lows.

The Bureau of Reclamation, which manages water for the Yakima Basin, has tapped into reservoir storage two months earlier than normal.

"We have some tough, challenging months ahead of us. We're ready to bring support and relief to the hardest hit areas of the state. We're going to do everything we can to get through this," Inslee said.

Farmers and communities facing hardships may qualify for drought relief funds. Money can be used to drill water wells, lease water rights and acquire pumps and pipes to move water from one location to another.

The Department of Ecology has been leasing water rights to boost stream flows, partnering with other agencies to evaluate fish passage problems and monitoring well water supplies.

A request for \$9.5 million in drought relief funds has been submitted to the Legislature. Until funding is approved, Ecology is using existing funds for drought relief work.

"We've been busy the past few months working with sister agencies, tribes and communities to prepare and respond to this," Bellon said. "We're working hard to help farmers, communities and fish survive this drought."

Relevant Links

Washington Drought - Dept. of Ecology (<http://www.ecy.wa.gov/drought/index.html>)

Prior drought declaration from April 2015 (<http://www.governor.wa.gov/news-media/governor-inslee-expands-drought-emergency-include-more-washington>)

Original drought declaration from March 2015 (<http://www.governor.wa.gov/news-media/governor-inslee-declares-drought-three-washington-regions>)

Media Contact

Dan Partridge

Department of Ecology's Communications Office
360-407-7139

C.7 Tri-City Herald News Report – 2015 Drought

2015 drought damage much worse than expected | Tri-City Herald

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LOCAL

MAY 06, 2017 4:22PM

2015 drought damage much worse than expected

BY KAITLIN BAIN

Yakima Herald-Republic

Growers across the state lost \$700 million as a result of Washington's 2015 drought — far more than an early \$85 million estimate, a state report estimates.

But officials also say the revised valuation may be too low when it comes to the complete economic impact of the drought — total losses could be as high as \$1.2 billion.



<http://www.tri-cityherald.com/news/local/article149092044.html>

5/8/2017

“There are all these ripple effects from the drought that our analysis can’t catch, like dollars spent in stores or land not purchased, trucks not bought or equipment not maintained,” said Kelly McLain, lead author of the report and a state Department of Agriculture scientist. “In a state that produces 300 commodities, it’s hard to determine all the drought effects.”

ADVERTISING



McLain and others in agriculture are worried that a recent winter season with adequate, if not above average, snowpack levels could erase the memory of those millions of dollars lost. And, that would be a mistake, they say.

Rapid snowmelt, high temperatures and one of the driest years on record hit growers, especially those with junior water rights, especially hard in 2015 as they scrambled to recover profits from lower yields and lower-quality fruit. Growers, water management officials and legislators need to keep the tough lessons of drought years front of mind even when water is more bountiful, experts say.

The planning that happens in years with healthy water levels helps to prevent losses similar to those growers experienced in 2015, said Washington Tree Fruit Association president Jon DeVaney.

“Water management infrastructure is one of those issues that when (a drought) is happening you realize it’s hugely important, but then it’s easy to forget about it and move on to other problems,” DeVaney said.

The analysis, released in February — more than a year after the drought — comes at a perfect time to serve as motivation for increased investment in irrigation, such as through the Yakima River Basin Water Enhancement Project, which aims to improve river flows, habitat and fish passages in addition to increasing water storage.

“This shows that drought has a significant cost to the local, regional and national economies and is exactly why we need to make some investment in the water management infrastructure to ensure we can provide a reliable supply for all uses so that our economy will do well,” DeVaney said.

Efforts to ensure a reliable water supply during drought conditions are already underway. For example, the Department of Agriculture has already started planning its future drought response based on findings from the study, McLain said. That plan includes mobilizing emergency drought permitting, which allows irrigators who get surface water to have access to groundwater, and also includes declaring the drought earlier.

But new plans can only be made as long as the department continues to track crop and related losses each year there is a drought.

“It gives us some perspective about how bad the droughts are and enables us to form contingency plans because we’re able to determine what resources we need,” McLain said. “It’s only as relevant as the last data point collected.”

The 2015 study allows the agency to devise drought plans, but continued study in successive drought years is needed to determine effectiveness.

In the future, McLain wants to spend more time verifying crop prices with growers, such as the Washington Tree Fruit Association and the Washington Wine Growers, to ensure loss estimates are as accurate as possible.

“It’s hard with 300 commodity groups in the state, but I think some of that verification work could be done and be valuable to the process,” she said.

No matter the changes made, it’s impossible to fully quantify the impact droughts have on communities.



For instance, because of the 2015 drought, some trees still aren’t producing the same amount of fruit they were in previous years — the study simply can’t measure those and other long-term effects.

“It will always be hard to track what the actual losses are from something like a drought because you try to take into account choices people make in response to it,” DeVaney said. “In the end, getting the exact number is less important than just showing there is a large cost in drought, no matter what that cost is.”



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Life of a Kumari Goddess: The Young Girls Whose Feet
Never Touch Ground

BY BROADLY

Broadly.

Appendix D Public Notification

D.1 The spring 2015 News Releases

Forecast: Dust storms and wildfires ahead for Central and Eastern Washington

Forecast: Dust storms and wildfires ahead for Central and Eastern Washington | March 2015 News | Washington State Department of Ecology



Search

[Ecology home](#) > [News](#) > News Release

FEEDBACK

Department of Ecology News Release - March 18, 2015

Forecast: Dust storms and wildfires ahead for Central and Eastern Washington

OLYMPIA – On the heels of Gov. Jay Inslee's March 13 declaration of drought for three Washington regions comes a forecast predicting dust storms and wildfires in the months ahead.

The same conditions that set the stage for the drought — above-average temperatures and low snowpack—are also expected to create dry fields and forest beds in Central and Eastern Washington.

"Drought-like conditions increase the potential not only for dust storms, but for wildfires" said Clint Bowman, an atmospheric scientist with the Washington Department of Ecology. "Spring and summer thunderstorms will bring the threat of dust storms to the Columbia Basin and lightning-caused wildfires throughout the region."

Strong winds blowing over loose soil on fields can cause extremely intense desert-style storms known as haboobs.

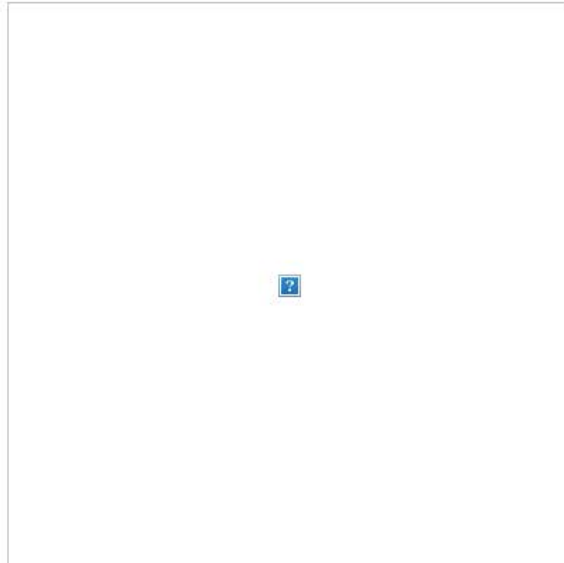
Haboobs carry a wall of dust and dirt that has the potential to make driving hazardous, knock out power, close schools and cause severe breathing issues for people. Infants, small children and asthmatics are particularly vulnerable.

Among air pollutants that Ecology monitors is pollution from dust storms and wildfires, which can cause respiratory issues for people and lead to a number of other health risks.

"Wildfires also pose health problems," said Gary Palcisko, a toxicologist with Ecology's Air Quality program.

While wildfires may be viewed as short-term incidents, often times communities are exposed to high levels of particulate pollution from wood, vegetation and anything else burned in the fire.

"Sensitive individuals can experience serious respiratory and cardiovascular effects which



[Click to enlarge current map.](#)

<http://www.ecy.wa.gov/news/2015/034.html> [3/7/2017 2:48:05 PM]

Photo of a haboob dust storm approaching a highway



could require a visit to hospital emergency rooms," said Plalcisko. "Air pollution can reach such high levels that even healthy people could experience difficulty breathing and burning eyes."

April 2014 haboob, Moab, Wash.

If you live in Central or Eastern Washington and are caught in a dust storm, Ecology recommends:

- Cover your nose and mouth with a wet handkerchief
- Cover your nose and mouth with a dust mask
- Stay indoors
- Keep your windows closed
- Pull over if driving

If you plan to travel to these areas this summer, visit the National Weather Service online [dust-storm forecast](#) page.

For more information about how to protect yourself in dust storms, visit the [outdoor dust page](#) on Ecology's website or consult your physician.

To see photos and videos of recent dust storms and wildfires in Washington, visit Ecology's Flickr account: [Dust storms](#) and [Wildfires](#).

###

Contact: Camille St. Onge, communications manager, 360-584-6501, camille.st.onge@ecy.wa.gov, 360-584-6501, [@ecologyWA](#)




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D.1.1 Dust storm advisory for Tri Cities

Dust storm advisory for Tri Cities | March 2015 News | Washington State Department of Ecology



DEPARTMENT OF
ECOLOGY
State of Washington

Search

[Ecology home](#) > [News](#) > News Release**Department of Ecology News Release - March 27, 2015****Dust storm advisory for Tri Cities**

OLYMPIA – Strong winds that may carry a large amount of dust are forecast for Kennewick from 10 p.m. Friday, March 27, to 12 p.m. Saturday, March 28.

Blowing dust is likely with sustained southwest winds around 20 mph and gusts up to 35 mph.

If you are in an area with dust:

- Stay indoors, close your windows and set your air system to recirculate.
- If driving, pull over.
- If working outside, use a dust mask, N95 or N100
- Cover your nose and mouth with a damp handkerchief.

For more information about how to protect yourself in dust storms, visit Ecology's [outdoor dust page](#) and [seasonal dust storm forecast](#). People with respiratory problems may want to consult their physician for recommendations.

###

Contacts:[Camille St. Onge](#), communication manager, 360-584-6501, [@ecologyWA](#) SHARE Copyright © Washington State Department of Ecology
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<http://www.ecy.wa.gov/news/2015/037.html>[3/7/2017 2:55:05 PM]

D.2 Ecology Outdoor Dust Website and Brochure

D.2.1 Ecology Outdoor Dust Website

Windblown & Construction Dust Information

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[Air Quality](#)

[Air Quality > Other Air Quality Page Links > Windblown & Construction Dust Information](#)

Outdoor Dust

[HEALTH & DUST](#) [DUST MANAGEMENT](#) [EXCEPTIONAL EVENTS](#) [OTHER INFORMATION](#)

Outdoor dust occurs throughout Washington, but in dry areas like Eastern Washington, dust is a significant air pollution problem. If you live in Eastern Washington, you have probably experienced dust storms. From spring through fall, high winds in the Columbia Plateau region can combine with dry weather conditions to disturb farm fields and other areas with disturbed soils resulting in dust storms. These dust storms can lead to extremely high levels of particle air pollution.



Current News and Information

Managing dust near Kennewick and Wallula

We're focusing efforts to reduce dust in areas near Kennewick and Wallula because recent hot, dry summers have made soils vulnerable and extreme windstorms caused air quality values to go above federal air quality standards. The area is also called out in a federal rule and we're required to update a plan for managing dust.

In the months ahead, we will update Wallula's dust maintenance plan, produce a report that demonstrates the high values recorded at our Kennewick air monitoring station were naturally caused and develop a new plan that outlines strategies for reducing sources of dust that affect people near Kennewick and Wallula. We will also continue our work with the agriculture community to encourage farming practices that prevent erosion and windblown dust.

Exceptional Event Reports

An exceptional event is an unusual or naturally-occurring event that can affect air quality. Air pollution laws allow us to demonstrate that these events can't be reasonably controlled can be omitted when determining that an area is meeting federal air quality standards.

We're currently preparing a report to demonstrate that high winds on Aug. 14, 2015 overwhelmed agriculture erosion controls contributing to elevated levels of particle pollution being recorded in Kennewick.

The report will be available for public review and comment before submitting it to the Environmental Protection Agency for approval. We expect the report will be ready for review in the fall of 2017.

We received approval from EPA on our 2013 Exceptional Event Report for Kennewick. Three unusual thunderstorms created strong winds that carried dust and air pollution through Eastern Washington.

Information on the 2013 Exceptional Event Report

- [2013 Exceptional Event Demonstration: PM10 Exceedances due to High Winds at Kennewick, Publication 15-02-18](#)
- Watch the [Webinar](#) held August 13, 2015

Updating the Wallula Dust Management Plan

A 144-square-mile area that includes Wallula is designated as an air quality maintenance area under federal rules because, historically, it didn't meet standards for particle pollution. We developed a plan to manage the pollution in 2005 to cover the first ten years. Federal rules require an updated plan to cover another 10 years.

We're developing an updated dust management maintenance plan that will be available for public review and comment sometime next year that will provide protection through 2025. The 2015 exceptional event report must be approved by EPA before we can finalize the updated plan.

Sign-up for more information

If you would like to be added to the email list to get updates on this project or if you have questions, contact [Laurie Hulse-Moyer@ecy.wa.gov](mailto:Laurie.Hulse-Moyer@ecy.wa.gov).

Sign up for the [Air Program's Rules and SIP updates list serv](#) to get notice on all Ecology rule and SIP projects.

Visit the Ecology [State Implementation Plan](#) page for more information.

Your Health and Dust

Dust is made up of tiny particles (particulate matter). The smallest particles, known as PM₁₀ and PM_{2.5}, are too small to be filtered out by your nose and your body's other natural defense systems. Dust with these fine particles is inhaled deep into your lungs where they cause increased problems with:

- Lung irritation.
- Emphysema.
- Asthma.

http://www.ecy.wa.gov/programs/air/other/Windblown_dust_information.htm

4/28/2017

- Bronchitis.
- Cancer.
- Heart disease.
- Allergic reactions.
- Other serious conditions that can lead to death.

What you can do

Breathing too much dust can potentially harm anyone. However, the following groups are at the highest risk:

- Infants, children, teens, the elderly, and pregnant women.
- People with asthma, bronchitis, emphysema, or other respiratory conditions.
- People with heart disease.
- Healthy adults working or exercising outdoors (for example, agricultural workers, construction workers, and runners).

How to protect yourself and others

Since small dust particles are the most harmful, the best precaution is simply to avoid going outside when there is a lot of dust in the air.

If you must go out:

- Spend as little time outside as possible.
- Avoid hard exercise.
- Wear some type of covering over your nose and mouth.
- Staying out of areas of dust.
- When driving, be alert for sudden changes in visibility and pull over if you have trouble seeing.

Dust storm warnings and notices

Sometimes it's possible to know that a dust storm may occur. Most dust storms happen in the spring or fall, because of a combination of high winds, dry weather conditions, and uncovered fields. The National Weather Service announces high wind warnings, so your local news may be able to warn you in advance when conditions are ripe for a dust storm. You can sign up to receive Wireless Emergency Alerts about high wind warnings from the National Weather Service (visit <http://www.weather.gov/subscribe> for more information). The best thing to do is always be prepared.

How to Prepare for Dust Storms

Windblown dust can't be completely controlled or avoided, but there are some things you can do to protect yourself during a dust storm. Be ready to stay inside and close your windows, vents, and doors, and plug drafts. If you have allergies or breathing problems, ask your health care provider or local health department what they recommend. If they suggest wearing a mask during a dust storm, buy some and keep them on hand. If dust is a serious health problem for you, your health care provider may advise you to be ready to leave the area during a dust storm.

Reduce Your Risk from Dust Storms

There are some things we can do to prevent windblown dust; but even our best efforts can be overwhelmed by drought and high winds. Farmers prevent and reduce dust by using less intensive tilling methods and planting cover crops that hold the soil in place. Dust controls at construction sites include working in phases to minimize the amount of exposed land area, and using dust suppressants or gravel on bare ground. Contact your local clean air agency or city or county planning department if there is a dust problem in your area. Big dust storms can't be prevented, but throughout Washington, Ecology and our partners monitor air quality to measure amounts of pollution in the air. This helps pinpoint areas with levels of pollution that could cause health problems so we can work toward reducing and controlling pollution.

Dust Management

Ecology monitors the air for dust in many areas of Washington. Monitors track air quality to find out if areas meet national ambient air quality standards (NAAQS).

When an exceptional event, like a thunderstorm, causes fine particle pollution to exceed the federal air pollution standards Ecology reports this to the Environmental Protection Agency.

Others Who Help Manage Dust

Local governments, the Environmental Protection Agency and others are also part of managing outdoor dust:

- Local air agencies and city planning departments enforce rules that require dust control.
- The federal Clean Air Act requires EPA to review NAAQS (standards) every 5 years to make sure the standards protect human health and the environment. The standards must protect groups of people who are most at risk from air pollution.
- Farmers help by using voluntary practices that stabilize their fields to preserve soil and keep dirt from leaving their farms. See [Natural Resource Conservation Service](#)

Outdoor Dust Categories

Dust is categorized three ways:

1. Windblown dust
 - Tilled, harvested, and fallow farm fields
 - Natural areas during highest winds
2. Construction dust
 - While work is underway
 - Cleared and vacant land
3. Fugitive dust
 - Paved and unpaved roads
 - Activities on vacant land or disturbed areas
 - Unpaved parking lots and equipment yards
 - Military training exercises

Exceptional Events

An exceptional event is an unusual or naturally-occurring event that can affect air quality, but cannot be reasonably controlled. Under air pollution laws, exceptional events are regulated differently than other sources of air pollution. For example, if a storm causes

monitor readings to go over the federal limit and EPA agrees the reading was beyond our control, the high reading may be considered an exceptional event. The high reading then would not count when determining if an area meets the NAAQS standard.

Other Information:

- [Windblown Dust](#)
- [Dust Control Measures](#)

For more information about dust control, contact your [local air agency](#).

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D.2.2 Ecology Windblown Dust brochure

Dust may seem like a fairly mild problem compared to other air pollutants. But if you live in certain areas of eastern Washington, you probably know how serious the problem of windblown dust in the air can be. From spring through fall, high winds in the Columbia Plateau region can combine with dry weather conditions and unprotected fields to result in dust storms. These dust storms can lead to extremely high levels of particulate matter air pollution.

Dust storms have occurred in eastern Washington for many years. Lewis and Clark experienced them during their expedition in the early 1800s. Windblown dust storms can be either local events or large, regional events that affect the entire Columbia River Plateau. Of course, larger numbers of people are exposed in higher population areas such as Spokane and the TriCities.

Windblown dust can be neither completely controlled nor avoided. The purpose of this brochure is to help you understand the problem of windblown dust and minimize your exposure to the small particulate matter it contains.

For more information

For more information about windblown dust, contact your local air quality agency:

- **Benton Clean Air Agency**
(509) 783-1304
Email: email@bcaa.net
- **Yakima Regional Clean Air Agency**
(509) 834-2050 or 1-800-540-6950
Email: info@yrcaa.org
- **Spokane Regional Clean Air Agency**
509-477-4727
Email: publicinfo@spokanecleanair.org
- **Department of Ecology**
Eastern Regional Office
(509) 329-3400
(Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Stevens, Walla Walla, and Whitman counties)

If you need this document in a format for the visually impaired, call the Air Quality Program at 360-407-6800. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.

Windblown Dust



Publication # 04-02-009
(rev. 4/2012)

Why is windblown dust a concern?

During the 1990s, numerous, intense dust storms occurred, caused by several years of drought conditions. These storms led to increased concern over windblown dust on the Columbia River Plateau. Also during this time, health studies more firmly established the health effects from small particulate matter. In response, state and local agencies, along with the agricultural community, have been working cooperatively to minimize dust from agricultural activity.

How can breathing dust hurt me?

The smallest dust particles are too small to be filtered out by your nose and your body's other natural defense systems. They can be breathed deep into your lungs, where they lodge and cause structural and chemical changes. These particles can also act as carriers for other toxic and cancer-causing materials. Exposure to particulate matter has been associated with emphysema, asthma, chronic bronchitis, cancer, heart disease, and even death.



Some farming practices help protect soil from eroding and becoming windblown dust. Examples are planting cover crops, leaving some plant residue in the field, and planting strips of alternating crops.

How concerned about my health should I be?

Anyone exposed to particulate matter can suffer health effects. However, the people most likely to experience health problems are young children, the elderly, and people with pre-existing respiratory diseases (for example, asthma or bronchitis).

High levels of particulate matter can be most dangerous to health when people are exposed for long periods of time. Since many population centers in eastern Washington (for example, Spokane, Pullman, and Colfax) are located in natural valleys or "bowls," air pollution can become trapped there for extended periods. So when a storm blows dust into these areas, the particles can remain in the air for quite a while, depending on weather conditions. This makes health effects an even greater concern. Studies on the health effects of particulate matter continue to be a high priority in eastern Washington. A recent study done in Spokane found that particulate matter composed mostly of dust could not be associated with excess deaths. However, this study addressed only deaths, and not the health effects from dust.

What should I do if there is a dust storm?

- ⊙ Stay indoors as much as you can. This will not completely eliminate your exposure to particulate matter, but it will lessen it.
- ⊙ If dust bothers you and you must go outside, it may help to wear a mask specially designed for small particulate matter. Check with your doctor about whether you should wear one of these masks, and where to get them.
- ⊙ If you are driving during a dust storm, be alert for sudden changes in visibility along your route. If possible, avoid driving during windy conditions that generally create windblown dust on roadways.
- ⊙ You may be able to avoid exposure to dust, or lessen it, by temporarily detouring to a nearby area where the dust is less intense.
- ⊙ When possible, try to anticipate upcoming windblown dust conditions and take actions appropriate to your situation and area. If windblown dust affects your health, seek medical advice in advance when a dust storm is expected.

Appendix E Public Involvement and Public Comments

This section will be filled in before final submittal.