Natural Events Policy Documentation of a Natural Event Due to High Winds on 12-Aug-2005 Kennewick, WA

Benton Clean Air Authority

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OVERVIEW

On August 12, 2005, the Hi-Volume PM_{10} FRM (Federal Reference Method) and the PM_{10} Tapered Element Oscillating Microbalance (TEOM) FRM in Kennewick, Washington measured concentrations of particulate matter 10 microns and smaller in size (PM_{10}) of 590 and 153 $\mu g/m^3$, respectively. These concentrations exceeded the primary 24-hour PM_{10} National Ambient Air Quality Standard (NAAQS) of 150 $\mu g/m^3$. A particulate-laden air mass associated with an outflow boundary moved south across the Columbia Plateau in the late afternoon hours of 12-Aug-2005. Reports of wind speeds and gusts throughout the area to the north of the Tri-Cities provide adequate evidence that conditions were sufficient to produce the 590 ug/cm3 PM_{10} concentration measured in Kennewick, Washington, given a vulnerable landscape susceptible to soil erosion.

High wind speeds from the north, into the Tri-Cities, from 1800 to 2400 were sufficient to raise and transport significant dust. PM_{10} from beyond the immediate area was transported into Kennewick and caused the PM_{10} exceedance on 12-Aug-2005. Available forecasts coupled with surface observations and ambient concentrations support this hypothesis. An exact quantification of the source contributions is not available. The Benton Clean Air Authority (BCAA) believes that the 12-Aug-2005 event is a "natural event" in accordance with the EPA Natural Events Policy.

Natural Events Policy

The Natural Events Policy (NEP) was issued in May 1996 to provide an avenue of response to PM_{10} air quality data that are due to uncontrollable natural events. Under NEP provisions PM_{10} attributable to a natural event can be excluded from an attainment or non-attainment decision. The NEP is applicable when PM_{10} data is due to uncontrollable natural events and the dust originates from non-anthropogenic sources or from contributing anthropogenic sources controlled with best available control measures (BACM)

The two basic requirements of the NEP are:

1) The states must develop a Natural Events Action Plan (NEAP) to deal with future PM_{10} NAAQS exceedances.

2) The states must also establish a clear and casual relationship between the observed natural event and the observed exceedance and document the event.

Natural Events Action Plan

Washington State's NEAP to address PM_{10} from natural events occurring in the Columbia Plateau region of eastern Washington was a result of a larger number of PM_{10} NAAQS exceedances in this region in the period from the late 1980's and early 1990's. Agricultural fields upwind of PM_{10} monitoring sites were identified as the principal

sources of windblown dust. The Washington State Department of Ecology's Air Program developed the initial NEAP in 1998.

Definition of High Wind Event

The 2003 NEAP refined the definition of a high wind event for Washington State in accordance with the provisions of the NEP allowing the states to determine this definition. This provision recognizes the multiple variables that affect the wind erosion processes that result in windblown dust and the generation and transport of PM_{10}, which geographically differs. Following is the definition of a "high wind event" from pages A1-A4 of the Washington State Columbia Plateau Windblown Dust Natural Events Action Plan (Ref 5):

"A high wind event occurs when the wind entrains and suspends dust to the extent that concentrations of PM_{10} are elevated. This occurs when the average hourly wind speed at 10m is 18 miles per hour or greater for two or more hours; or in excess of 13 miles per hour for two or more hours when conditions of higher susceptibility to wind erosion exist (see attachment A1). A high wind event that exceeds PM_{10} standard is a natural event."

This definition recognizes the concept that the wind speed threshold for wind erosive processes on soil to cause elevated PM_{10} concentrations in the air is variable. This variability depends on multiple variables related to soil characteristics, wind gustiness, soil surface residue cover, moisture content, and others. The high wind event definition also necessarily includes the concept that the intensity of the wind event is a combination of wind speed and significant duration (sustained wind).

Accordingly, the amount of detail in the event documentation required by the NEAP varies with the category (18 mph for ≥ 2 hr; or 13 mph for ≥ 2 hr under higher wind erosion susceptibility) of high wind event definition. For the "18 + 2" category the documentation burden is less because of the more clear cut association of the observed PM_{10} data and the wind speed profile. The wind speed profile contains wind speed, wind direction, and duration and essentially is a data plot of wind speed and direction against a period of time. Antecedent precipitation preceding the day of the event completes the "18 + 2" data set. The higher wind speed event more easily meets the "clear and casual" criteria of the Natural Events Policy.

The NEAP has several purposes:

- Development of procedures for taking appropriate, reasonable measures to safeguard public health when natural events occur.
- Responsibility to assure that emission controls are applied to sources that contribute to exceedances of the PM_{10} NAAQS, when those controls will result in fewer violations of the standards.
- Authorization for documentation to be submitted to request designation of an exceedance of the NAAQS for PM_{10} as being the result of a natural event.

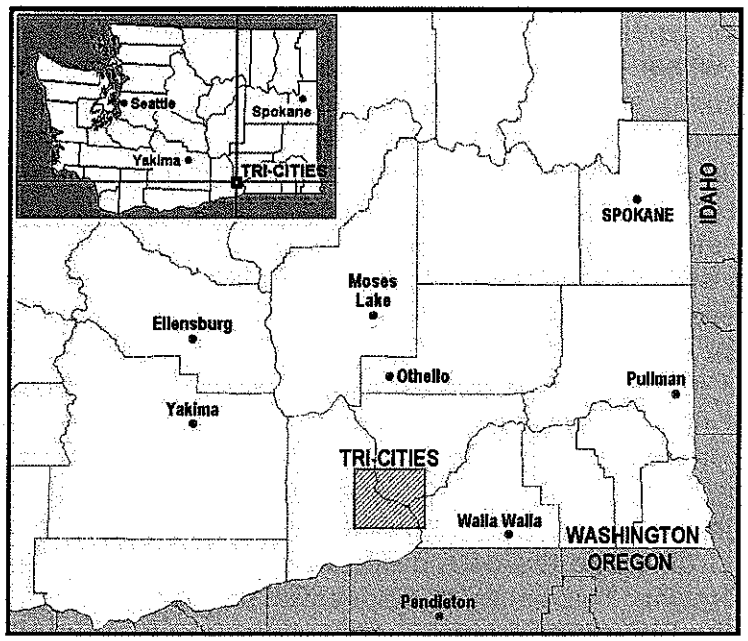
Emission controls include BACM development and implementation. The development or implementation of BACM for anthropogenic sources of fugitive dust within three years of the violation is an important goal of the NEAP.

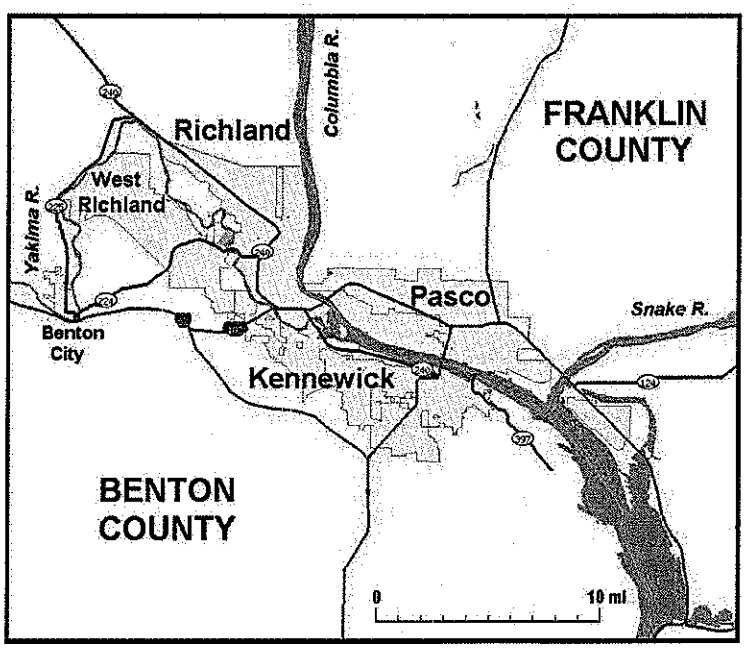
For agricultural sources, BACM is more commonly referred to as Best Management Practices (BMPs). A variety of management practices to control wind erosion and associated PM_{10} emissions were one of the expected outcomes of the Columbia Plateau PM_{10} Project. To qualify as a BMP, the practice must be proven to reduce wind erosion significantly below that which would occur with bare and tilled soil under similar weather conditions. Meteorological and climatological conditions strongly affect effective wind erosion or dust control on agricultural lands. Maintaining soil stability on agricultural fields is a problem in the Tri-Cities region only during the most vulnerable times, such as crop planting and harvesting, or for other tillage operations that leave the soil vulnerable to wind erosion.

GENERAL DESCRIPTION OF COLUMBIA PLATEAU

The eastern half of the state lies in the rain shadow of the Cascade Mountains making the region a semi-arid desert. A large basalt plateau in eastern Washington surrounds the confluence of the Snake River with the Columbia River. This plateau is bounded by the Selkirk Mountains and Okanogan Highlands on the north, the Wallowa Mountains on the south, Cascade Mountains on the west, and the west slope of the Bitteroot Range on the east. The Cascade Mountains extract moisture from fronts moving inland from the Pacific Ocean and leaves the Columbia Plateau very dry compared to the western areas in Washington. Precipitation varies from 6 inches per year at the center of the plateau to over 30 inches per year along the perimeter of the plateau. Vegetation types reflect the moisture distribution pattern. The perimeter of the Columbia Plateau is covered with forests which quickly changes to savanna and then steppe as one nears the center of the plateau. Much of the area outside of the forested lands have been tilled and converted to dryland agriculture and range. The central part of the Columbia Plateau is the driest and in that area irrigation is required.

Figure 1: The Eastern Washington Columbia Plateau Area





Dryland and Irrigated Agriculture

There are two major types of wheat planted in the Columbia Plateau area – winter wheat and spring wheat. Winter wheat is planted in September or October and harvested the following summer. Spring wheat is planted in April or May and is harvested in August or September. Both varieties of wheat are grown throughout the Columbia Plateau, often growing very near to the urban areas. The arid conditions of this area often necessitates that a specific method of farming, called fallow farming, be used to maximize water conservation in the soil. After a wheat crop is harvested in late summer, the land is worked and then allowed to lie dormant, or fallow, until the following summer or fall. Weeds are controlled by chemical herbicide, which is called chem-fallow or with an implement called a rod weeder, which is called traditional fallow. This 12-14 month fallow period allows time for precipitation to replace the depleted soil moisture needed to grow the new wheat crop. The new crop is usually planted on the fallowed land in September or October. However, prolonged periods of little or no precipitation can extend the dryland wheat planting into November or December because there simply is not enough moisture in the soil for the next cropping cycle. During the period between the harvest date and the date of the new planting, dryland wheat lands are vulnerable to wind erosion. This period coincides with the higher probability of high wind speeds throughout the Columbia Plateau.

These agricultural soils remain vulnerable until there is sufficient moisture in the soil to promote the growth of the new wheat crop. A similar situation occurs with the spring wheat crop, which is vulnerable in the spring during planting. A lack of moisture in the soil over the winter months can delay the growth of the spring wheat crop and leave these areas vulnerable to wind erosion as well. Fields intended for winter wheat can become spring wheat plantings if precipitation is lacking or inadequate for fall planting of winter wheat. Winter-kill of winter wheat from severe cold weather can also result in fields being planted to spring wheat.

As an alternative to dryland farming, in areas where irrigation is available, irrigated farming is quite common throughout the region. Crops that normally would not grow in this arid climate have become very productive due to the center pivot irrigation system. Annual irrigated crops, including irrigated wheat, are usually planted in the spring, and harvested in the summer or fall, which periodically exposes the soil to wind erosion. Perennial irrigated crops such as alfalfa generally have less wind erosion exposure because the fields have vegetative cover continuously for several years. Because irrigated crops have access to water for the majority of the year, they are generally less vulnerable to wind erosion. However, during and after harvest of these crops, when crop residue in the fields is very low, wind erosion potential can be very high.

Wind Erosion of Agricultural Lands

Agricultural fields are the principal contributors to windblown dust events in the Columbia Plateau area. A windblown dust event occurs because of the interplay of wind, seasonal variations in landscape vulnerability to wind erosion, and other weather

variables. Operational activities, which disturb soil on agricultural fields function principally not as primary dust generators, but primarily increase the susceptibility of the soil to wind action. In most cases, however, there is no one factor that shows a direct causal effect for wind erosion or dust events.

The period of highest potential for higher wind speeds, late summer through early spring, corresponds to the periods of maximum agricultural field susceptibility to wind erosion. This is the case because crop residues are lower overall because of spring planting or fall harvest. Conversely, the late spring to mid-summer period of lower frequency of higher wind speeds corresponds to the period of maximum agricultural field stability against wind erosion because of higher overall crop cover during the peak crop growing season. These two circumstances combine to make the probability of significant windblown dust events, with agricultural origins, greater in the period from September through April. The latter is verified by the pattern of previously observed PM_{10} NAAQS exceedances, which are most frequent from late summer through early spring.

These seasonal effects are manifested in both irrigated lands and dryland wheat. Generally, irrigated fields are vulnerable during the spring when planting begins and during the late summer after harvest. Unless wind erosion control is accomplished via significant plant residue left after harvest, an established cover crop, or some other control mechanism, windblown dust can be significant from irrigated fields. On dryland wheat fields, a series of events such as drought, winterkill from lack of snow cover, or a combination of these will diminish the amount of crop residue available to help hold soil in place. The amount of control of soil erosion on winter wheat lands is almost entirely dependent upon the weather, which affects the amount of crop residue, soil moisture, and snow cover which in turn determines the soil susceptibility to wind. Regardless of the crop type or farming practice, the chief determinant of susceptibility to windblown dust is the amount of vegetative cover on the soil.

DESCRIPTION OF 12-AUG-2005 EVENT

This section describes the major factors that affected the occurrence of the windblown dust event and an exceedance of the PM_{10} NAAQS on 12-Aug-2005 in Kennewick, WA. Analysis of the high wind event summarizes the circumstances and characteristics of the event. Best available control measures (BACM) are reviewed to demonstrate compliance with the BACM requirement of the Natural Events Policy. Landscape stability conditions are described to show what factors on the land and the activities taking place contributed to the observed windblown dust PM_{10} NAAQS exceedance.

PM_{10} Data

The Kennewick PM_{10} High Volume FRM (Federal Reference Method) operates on a 1-in - 1 day schedule. In addition, a continuous PM_{10} Tapered Element Oscillating Microbalance (TEOM) has been operating since 1998 which EPA designated a PM_{10} FRM in July 2005. The average PM_{10} High Volume FRM concentration for 2004 was 24.2 ug/m^3. The other recorded exceedance of the PM_{10} NAAQS in 2005 was 205 ug/m^3 on 16-Mar-2005. Documentation for this natural event was developed and subsequently submitted to EPA in August, 2005. The average PM_{10} High Volume FRM concentration in the months prior to the 12-Aug-2005 exceedance was 21.6 ug/m^3 in June 2005 and 26.9 ug/m^3 in July 2005. The days with 24-Hour PM_{10} concentrations that exceed the NAAQS are relatively rare and are much higher than the majority of daily values and other maximums for the period. The annual average PM_{10} concentration has not exceeded the annual NAAQS standard of 50 ug/m^3 in 18 years of monitoring at the Kennewick site.

Table 1 shows the occurrence of windblown PM_{10} exceedances, which have been documented as natural events since the inception of the NEP in May 1996. The BCAA takes principal responsibility for high wind events and natural events documentation for exceedances that affect primarily Benton County. Documentation of larger regional events that affect a greater area of the Columbia Plateau including Benton County is the principal responsibility of the Washington State Department of Ecology's Air Program.

Table 1: History of Documented Windblown Dust Natural Events in Benton County (BCAA jurisdiction)

YEAR	DATE	CONCENTRATION µg/m3	ACTION TAKEN
1999	September 23	180	Ecology NEP[1]
1999	September 25	305	Ecology NEP[1]
2000	July 31	218	BCAA NEP[2]
2001	March 13	351	BCAA NEP[2]
2001	September 25	284	Ecology NEP[1]
2001	October 23	267	BCAA NEP[2]
2002	August 16	186	BCAA NEP[2]
2003	March 5	186	BCAA NEP[2]
2003	October 28	1438	Ecology NEP[1]
2003	Nov 10	164	BCAA NEP[2]
2004	Mar 18	301	BCAA NEP[2]
2004	April 27	539	Ecology NEP[1]
2005	March 16	205	BCAA NEP[2] (Pending)

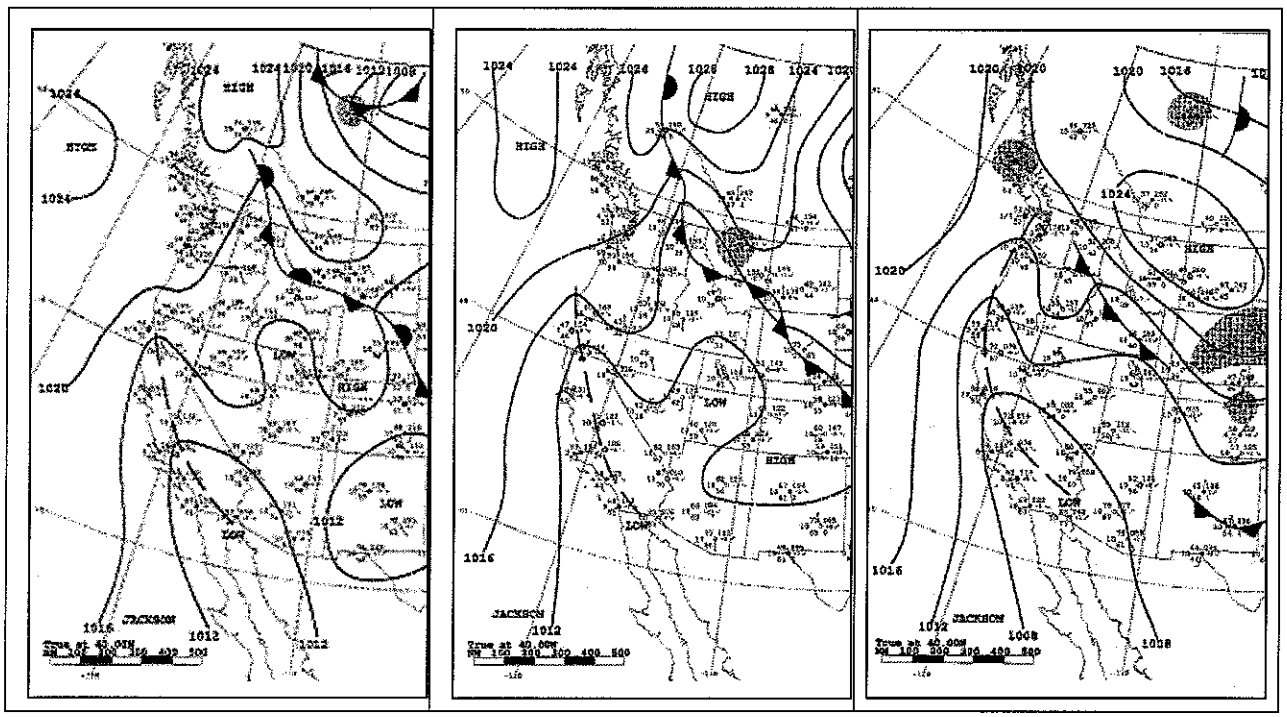
[1] Regional event with generalized dust storm conditions from a high wind event occurring in the intermountain region east of the Cascade Mountain range, which are documented by the Washington State Department of Ecology's Air Program.

[2] Dust storm conditions from a high wind event that affected primarily Benton County documented by the Benton Clean Air Authority

High Wind Event Analysis

A slow moving cold front that had stalled out over Northeastern Washington since 11-Aug-2005 (Figure 2) formed thunderstorms in Northeastern Washington on 12-Aug-2005 which created an outflow boundary with gusty winds that expanded southward across the lower Columbia basin of Washington. This outflow boundary is illustrated in Figure 4 from the National Weather Service (NWS).

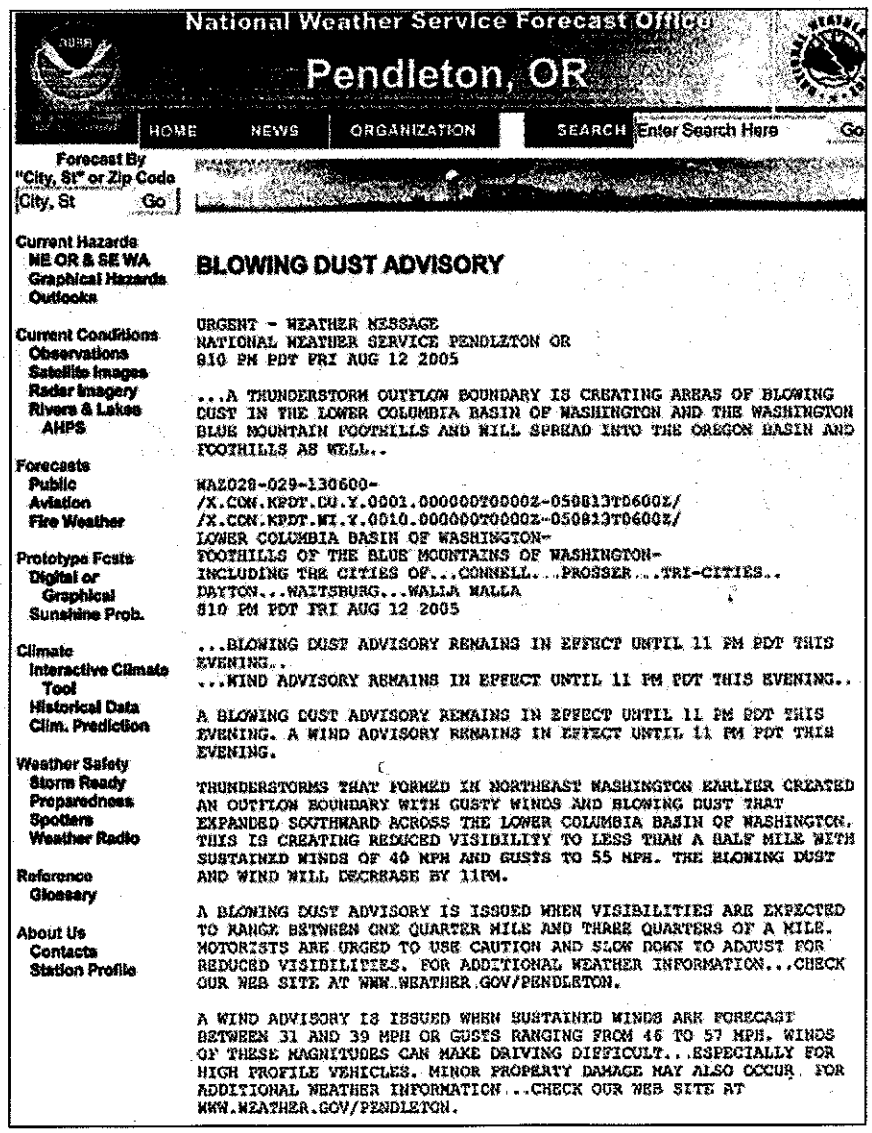
Figure 2: Synoptic Maps 11-Aug-2005 through 13-Aug-2005



Forecast Discussion

The 2010 PST, 12-Aug-2005 Blowing Dust Advisory (Figure 3) from the National Weather Service (NWS), Pendleton, Oregon show that high winds were anticipated across Central Washington. The discussion describes an outflow boundary moving across the area 12-Aug-2005. This outflow boundary is shown in the radar images in Figure 4. The radar images show the outflow boundary approaching the Tri-Cities area and shows the front as it crosses over the Kennewick area. It is easy to see the dust in the radar. A blowing dust and wind advisory was issued until 2200 PST. A blowing dust advisory is issued when visibilities are expected to range between one quarter mile and three quarters of a mile. A wind advisory is issued when sustained winds are forecast between 31 and 39 MPH and gusts to 55 MPH.

Figure 3: NWS Advisory



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Forecast By "City, St" or Zip Code
City, St Go

Current Hazards
NE OR & SE WA
Graphical Hazards
Outlooks

Current Conditions
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Forecasts
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Preparedness
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BLOWING DUST ADVISORY

URGENT - WEATHER MESSAGE
NATIONAL WEATHER SERVICE PENDLETON OR
810 PM PDT FRI AUG 12 2005

...A THUNDERSTORM OUTFLOW BOUNDARY IS CREATING AREAS OF BLOWING DUST IN THE LOWER COLUMBIA BASIN OF WASHINGTON AND THE WASHINGTON BLUE MOUNTAIN FOOTHILLS AND WILL SPREAD INTO THE OREGON BASIN AND FOOTHILLS AS WELL..

WAZ028-029-130600-
/X.CON.KPDT.DU.Y.0001.000000T0000Z-050813T0600Z/
/X.CON.KPDT.WI.Y.0010.000000T0000Z-050813T0600Z/
LOWER COLUMBIA BASIN OF WASHINGTON-
FOOTHILLS OF THE BLUE MOUNTAINS OF WASHINGTON-
INCLUDING THE CITIES OF...CONNELL...PROSSER...TRI-CITIES..
DAYTON...WAITSBURG...WALLA WALLA
810 PM PDT FRI AUG 12 2005

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

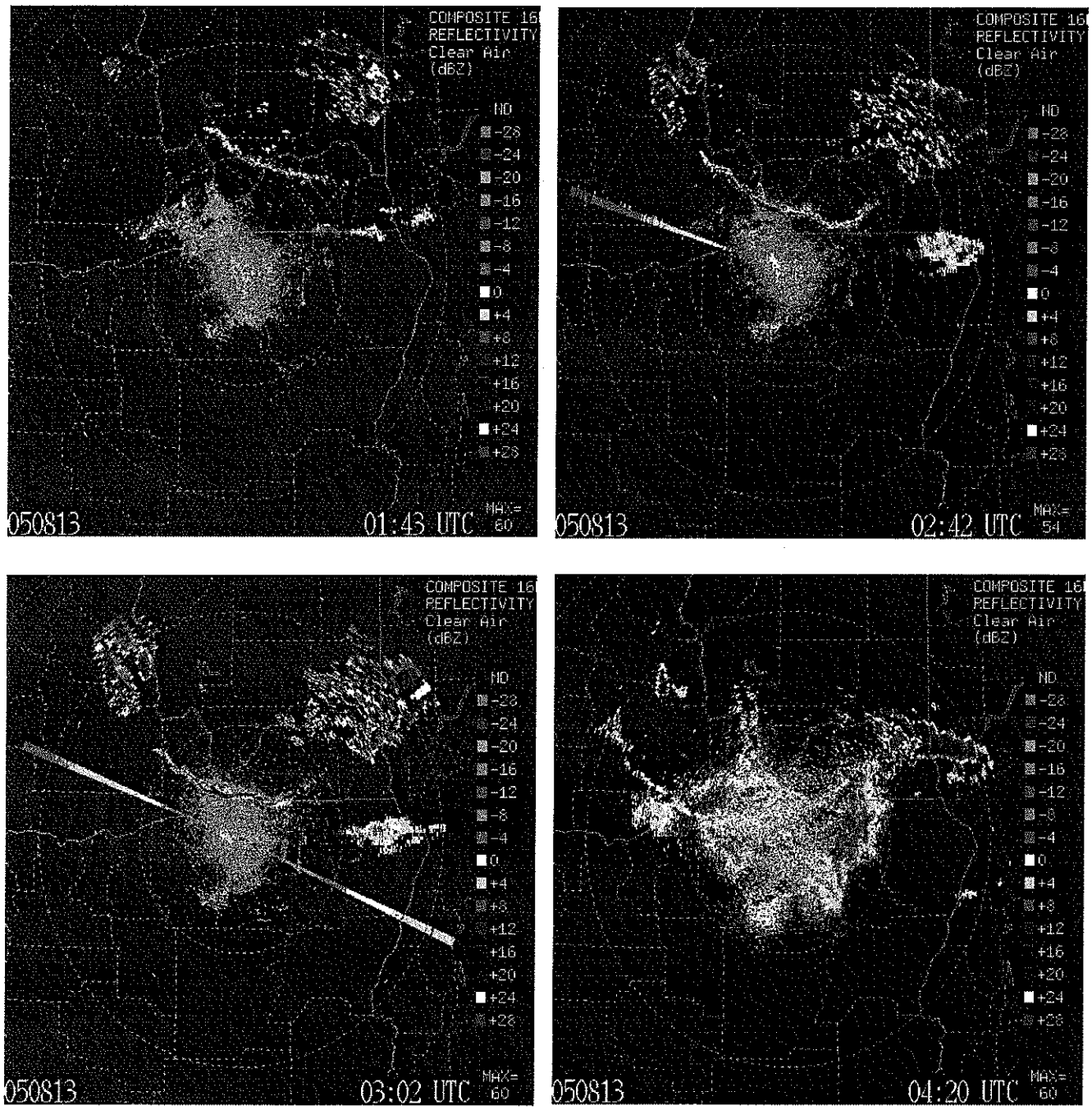
A BLOWING DUST ADVISORY REMAINS IN EFFECT UNTIL 11 PM PDT THIS EVENING. A WIND ADVISORY REMAINS IN EFFECT UNTIL 11 PM PDT THIS EVENING.

THUNDERSTORMS THAT FORMED IN NORTHEAST WASHINGTON EARLIER CREATED AN OUTFLOW BOUNDARY WITH GUSTY WINDS AND BLOWING DUST THAT EXPANDED SOUTHWARD ACROSS THE LOWER COLUMBIA BASIN OF WASHINGTON. THIS IS CREATING REDUCED VISIBILITY TO LESS THAN A HALF MILE WITH SUSTAINED WINDS OF 40 MPH AND GUSTS TO 55 MPH. THE BLOWING DUST AND WIND WILL DECREASE BY 11PM.

A BLOWING DUST ADVISORY IS ISSUED WHEN VISIBILITIES ARE EXPECTED TO RANGE BETWEEN ONE QUARTER MILE AND THREE QUARTERS OF A MILE. MOTORISTS ARE URGED TO USE CAUTION AND SLOW DOWN TO ADJUST FOR REDUCED VISIBILITIES. FOR ADDITIONAL WEATHER INFORMATION...CHECK OUR WEB SITE AT WWW.WEATHER.GOV/PENDLETON.

A WIND ADVISORY IS ISSUED WHEN SUSTAINED WINDS ARE FORECAST BETWEEN 31 AND 39 MPH OR GUSTS RANGING FROM 46 TO 57 MPH. WINDS OF THESE MAGNITUDES CAN MAKE DRIVING DIFFICULT...ESPECIALLY FOR HIGH PROFILE VEHICLES. MINOR PROPERTY DAMAGE MAY ALSO OCCUR. FOR ADDITIONAL WEATHER INFORMATION...CHECK OUR WEB SITE AT WWW.WEATHER.GOV/PENDLETON.

Figure 4: NWS Radar Images (12-Aug-2005)



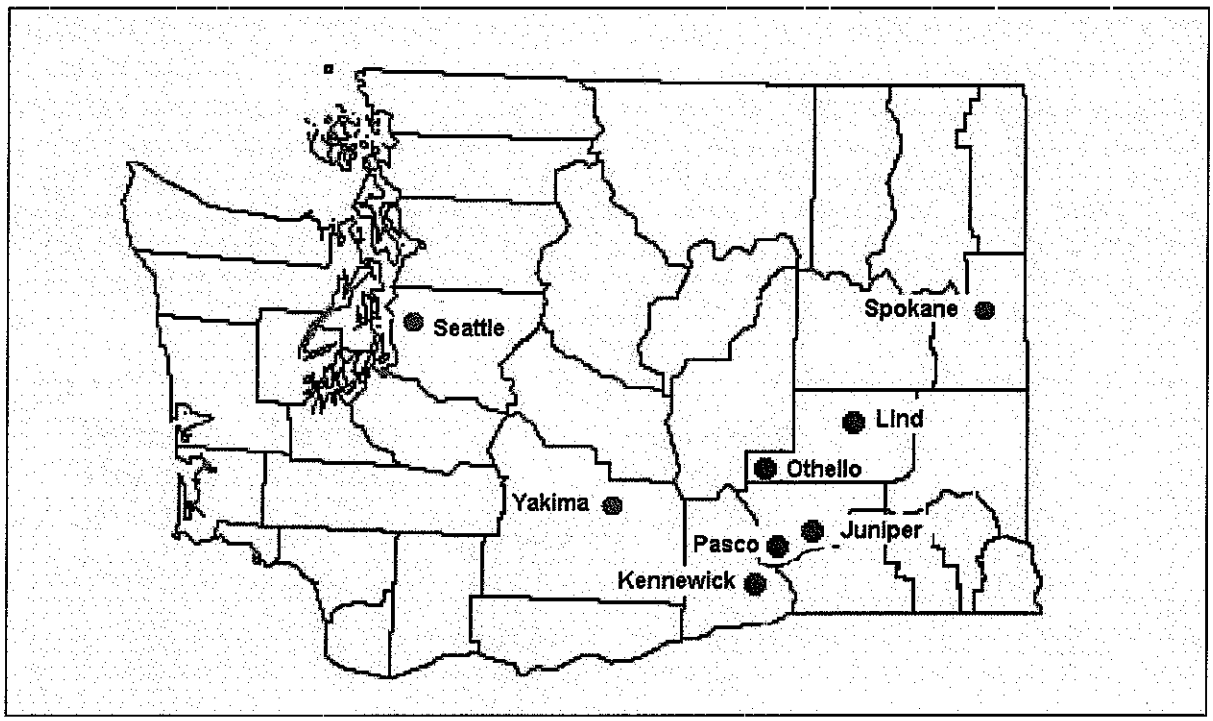
Wind Profiles in the PM_{10} Source Area and the Urban Receptor Area

Data from various meteorological stations throughout the area are consistent with the above forecasts and observations. Table 2 reflects select data from meteorological stations, their geographic proximity to the Tri-Cities, the highest 15 min average wind speeds as well as the time associated with the peak average wind speeds. Appendix A shows the complete data set from these locations. It is in these areas, or areas similar in location and landscape stability conditions which contributed to the high concentrations of PM_{10} measured in Kennewick on 12-Aug-2005 and the wind in these areas met the "18 + 2" category (See Figure 5 for locations). The highest average wind speed in Kennewick was 9 mph at 19:00 PDT.

Table 2:

Location	Relative to Kennewick (miles)	Time (PDT) 1-Hr Ave	Avg Wind Speed (MPH)	Avg Wind Direction (Degrees)
Lind	68	18:30	21	68
	68	19:30	19	62
	68	20:30	18	67.5
	68	21:30	19	61.5
Othello	54	19:25	21	73
Pasco	5	19:53	22	40
	5	20:53	20	50
	5	21:53	22	60
	5	22:53	23	60
	5	23:53	19	70
Juniper	18	19:40	30	60
	18	21:40	18	64
	18	22:40	19	40
	18	23:40	21	37

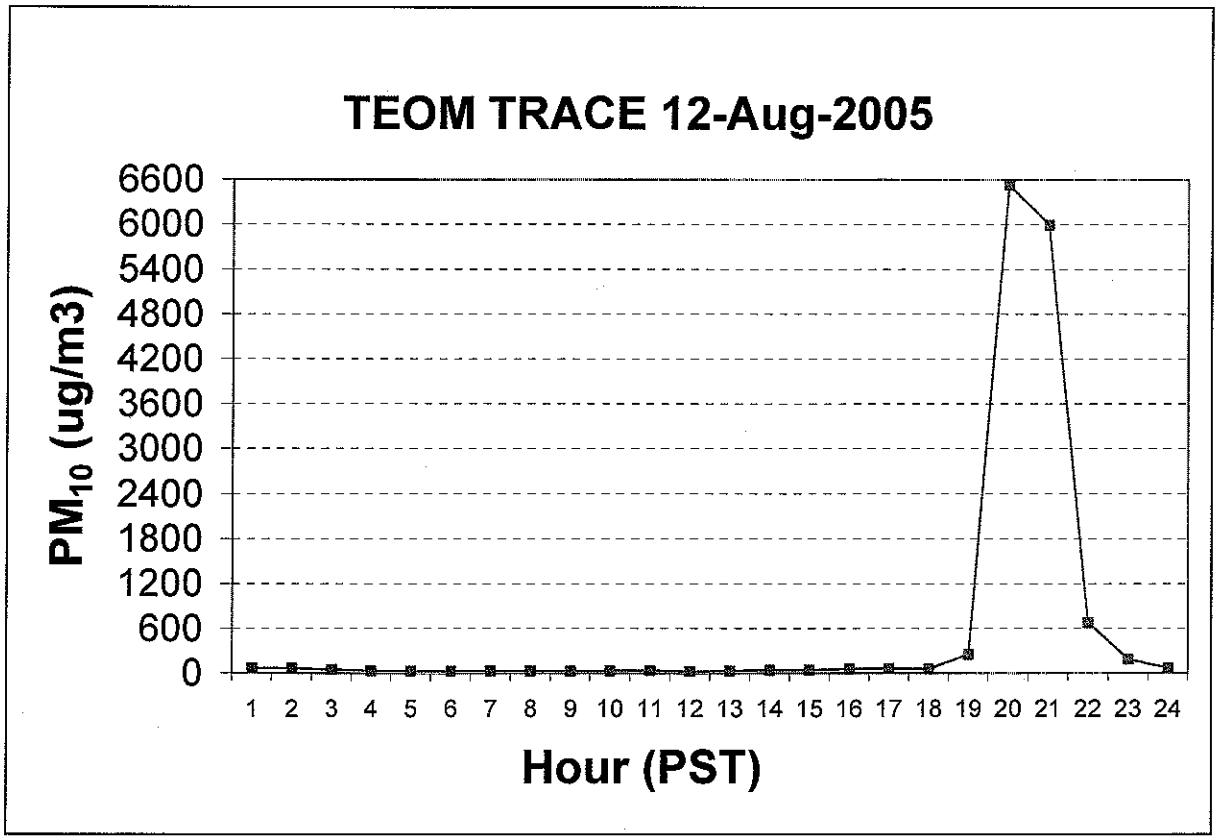
Figure 5:


Seattle
Spokane
Lind
Othello
Yakima
Pasco
Juniper
Kennewick

PM_{10} Levels in Kennewick

PM10 concentrations rose sharply on 12-Aug-2005 between 1900 through 2000 PST. By 2000 PST concentrations over 6000 (ug/cm^3) had impacted Kennewick FRM's. By 0000 PST 13-Aug-2005, the PM_{10} levels had returned to near normal levels (Figure 6). The Kennewick SLAMS (State and Local Air Monitoring Station), had the only PM_{10} FRM's (Federal Reference Monitor) that was operating in the impacted areas of Eastern Washington, thus, Kennewick recorded the only exceedance of the PM_{10} NAAQS (National Ambient Air Quality Standard).

Figure 6: TEOM Trace



LANDSCAPE STABILITY CONDITIONS IN THE COLUMBIA PLATEAU

Antecedent Precipitation

The Columbia Plateau received no measurable precipitation amounts in the 72 hours preceding the 12-Aug-2005 exceedance (Table 3). The dry landscape conditions in the Columbia Plateau, combined with other factors, such as agricultural field operations, set up a vulnerable landscape situation primed for wind erosion when a wind event occurs in the Columbia Basin area.

Table 3: Antecedent Precipitation (In.)

	Kennewick	Pasco	Lind	Juniper	Othello
9-Aug-2005	0	0	0	0	0
10-Aug-2005	0	0	0	0	0
11-Aug-2005	0	0	0	0	0
12-Aug-2005	0	0	0	0	0

Most Probable Agricultural Activities Affecting Landscape Stability

Several agricultural operations in the area that could contribute to lower landscape stability in the period near 12-Aug-2005 would include operations in dryland wheat areas and activity in irrigated areas.

One such soil disturbing activity in wheat producing areas is fallow field spraying that can leave these areas with a loosened soil surface. Also, early harvested potato fields are tilled in preparation for planting of a second crop for the growing season. If not recently irrigated these fields could have a dry, bare surface vulnerable to wind erosion. There is no practical way to determine the effect of these activities, but if occurring, they can contribute to windblown dust.

The arid climate in the wheat producing land in the areas of eastern Washington, make fallow farming a necessary water harvesting method. The exposed soils in fallowed areas were potentially susceptible to wind erosion on 12-Aug-2005. The previous year's dryland wheat yield also determines the amount of straw residue available for holding the soil against the wind in the subsequent fallow period. Some early preparation or late summer weed control could disturb summer fallow fields and increase their vulnerability to wind erosion. The most probable sources of windblown dust and most vulnerable fields are, as previously mentioned, summer fallow fields with marginally adequate or inadequate surface crop residue.

Summary of Landscape Stability

Overall, the landscape stability of the eastern Columbia Plateau agricultural PM_{10} source area on 12-Aug-2005 was sufficiently low to allow wind erosion. Surface soils were subject to wind erosion and PM_{10} emissions. Sustained winds blowing across these unprotected and unstabilized soil surfaces cause soil particles to become airborne and transported into the Tri-Cities urban area even when BACM and BMP are being used. Fallow fields with in-sufficient residue from previous wheat harvest were also subject to high wind speeds.

BACM IN THE COLUMBIA PLATEAU

Agricultural BACM Assessment

For agricultural sources, BACM is more commonly referred to as Best Management Practices (BMPs). A variety of management practices to control wind erosion and associated PM_{10} emissions were one of the expected outcomes of the Columbia Plateau PM_{10} Project. To qualify as a BMP, the practice must be proven to reduce wind erosion significantly below that which would occur with bare and tilled soil under similar weather conditions. Meteorological and climatological conditions strongly affect effective wind erosion or dust control on agricultural lands. Maintaining soil stability on agricultural fields is a problem in the Tri-Cities region principally during the most vulnerable times, such as crop planting and harvesting, or for other tillage operations that leave the soil vulnerable to wind erosion.

In the 2004 Annual Status Report regarding Best Available Control Measures (BACM) implementation shows the level of Conservation Reserve Program (CRP) and Best Management Practice use has increased from 70 to 78 percent in the priority counties of the Columbia Plateau. Seventy nine percent of the total farmable acres in all counties of the Columbia Plateau NEAP are now part of a United States Department of Agriculture (USDA) conservation program, use on of the minimum till practices, or contain 15-30% residue. Washington State found that BACM is implemented throughout the Columbia Plateau, which includes Benton County. Based on this evaluation, Washington State views these levels of wind erosion control as sufficient to fulfill BACM criterion of the Natural Events Policy. A more detailed discussion can be found in Appendix A.

CONCLUSIONS

From the evidence presented, the following conclusions are drawn:

1. Agricultural areas in the Columbia Plateau were subjected to high wind speeds on 12-Aug-2005. A combination of standard meteorological observation analysis, and TEOM trace analysis in a geographic area widely separated across the Columbia Plateau presents a picture of a regional windblown dust event and dust transport which resulted in the observed PM_{10} NAAQS exceedance at Kennewick WA.
2. Agricultural fields, which were highly susceptible to wind erosion during the 12-Aug-2005 wind events, included dryland wheat fields, irrigated areas disrupted by harvest and some fallowed fields with insufficient crop residue were blowing most severely.
3. The combination of the wind event, which had the necessary wind speed, duration, and direction to generate and transport PM_{10}, and the vulnerable landscape, caused the 12-Aug-2005 exceedance. Although the lowered landscape stability was principally due to agricultural operations, any unprotected area of soil surface elsewhere in the landscape would have potential to contribute to the exceedance.
4. The lack of direct observational evidence of other significant emission sources (other than windblown fugitive dust from agricultural fields) and the acknowledgment that the Columbia Plateau is, in general, highly susceptible to high wind events, show that windblown dust is the most probable source of the PM_{10} NAAQS.
5. Based upon these conclusions, the BCAA considers the PM_{10} concentration recorded on 12-Aug-2005 to have been caused by a high wind natural event, with winds that met the Washington State's definition of a high wind event, and requests that the data for this date be flagged as such in the AIRS database.

ABBREVIATIONS AND ACRONYMS

BACM ..... Best Available Control Measures

BMP ..... Best Management Practices

SLAMS ..... State and Local Air Monitoring Station

EPA ..... U.S. Environmental Protection Agency

BCAA ..... Benton Clean Air Authority

MET ..... Meteorological

NAAQS ..... National Ambient Air Quality Standard

NOAA ..... National Oceanic and Atmospheric Administration

PM_{10} ..... Particulate Matter, 10 microns in diameter

Ecology ..... Washington State Department of Ecology

PST ..... Pacific Standard Time

NEP ..... Natural Events Policy

NEAP ..... Natural Event Action Plan

MOA ..... Memorandum of Agreement

RACM ..... Reasonably Available Control Measures

HMN ..... Hanford Meteorological Network

PAWS ..... Public Agricultural Weather System operated by Washington State University

REFERENCES

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APPENDICIES

Appendix A

2004 Best Available Control Measures for Columbia Plateau Agriculture

Summary

This report fulfills Ecology's commitment to review and report annually on the use of Best Available Control Measures (BACM) in the Columbia Plateau. Ecology committed to provide such a report to the Environmental Protection Agency (EPA) in the revised Natural Events Action Plan (NEAP).

The level of Conservation Reserve Program (CRP) and Best Management Practice (BMP) use have increased from 70 to 78 percent in the priority counties of the Columbia Plateau. Seventy eight percent of the total farmable acres in these counties are now part of a United States Department of Agriculture (USDA) conservation program, use one of the minimum till practices, or contain 15-30% residue. Washington State finds this level of CRP and BMP implementation easily fulfills BACM criteria.

Background

EPA issued the policy on "Areas Affected by PM-10 Natural Events", or the Natural Events Policy (NEP), on May 30, 1996. Under the NEP, ambient PM_{10} concentrations raised by unusually high winds may be treated as uncontrollable natural events when the dust originates from nonanthropogenic sources, or when the dust originates from contributing anthropogenic sources controlled with BACM. After natural events cause the PM_{10} concentration to violate the PM_{10} National Ambient Air Quality Standard, the NEP allows a state to develop a natural events action plan (NEAP) to deal with future exceedances.

A number of exceedances of the 24-hour standard for PM_{10} were recorded in eastern Washington in the late 1980*s* and early 1990*s*. Examination of the exceedances showed a close correlation to high wind events and upwind agricultural fields were identified as the chief source of the wind-blown dust. The Washington State Department of Ecology (Ecology) developed the *Natural Events Action Plan for High Wind Events in the Columbia Plateau* in March 1998, and submitted it to Region 10 EPA, in accordance with the NEP.

The 1998 NEAP included Ecology's commitment to re-evaluate the NEAP at the end of 2001. The 2001 evaluation is embodied in the revised NEAP submitted to EPA in July, 2003. Several changes were incorporated into the revised NEAP including Ecology's commitment to review and report to EPA annual BACM implementation.

BACM Definition and Tracking Mechanism

The revised NEAP defines BACM for agricultural fields as USDA Conservation Title Programs supplemented by incentive based implementation of wind erosion conservation practices or BMPs. In short, the BACM definition recognizes the critical role of agricultural agencies in defining and instituting BACM on the Columbia Plateau. The primary agencies include those directly reporting to the USDA such as the Natural Resources Conservation Service (NRCS), the Farm Service Agency (FSA), and the Agricultural Research Service (ARS). Additional agricultural agencies include the Washington State Conservation Commission, local Conservation Districts and various agriculture related departments of the Washington State University. The NEAP acknowledges the combined expertise of these agencies and relies on the various programs of these agencies in implementing the conservation practices that constitute BACM.

For defining BACM, the NEAP uses the USDA's CRP program and the wind erosion BMPs encouraged by the NRCS and/or the Columbia Plateau Wind Erosion /Air Quality Project (referred to as the CP3). Use of these practices is tracked by the Conservation Technology Information Center's (CTIC), Core 4 program. The CTIC's Core 4 program tracks conservation tillage (No-Till, Ridge-Till, Mulch-Till) and conventional tillage (0-15% and 15-30% residue) practices and CRP enrollment on a county by county basis.

A full discussion on Ecology's BACM definition and tracking mechanism is found in the revised NEAP.

STATUS REPORT: 2004 BACM

The 2003 NEAP determined BACM is implemented in the Columbia Plateau based on 68 percent use of conservation practices. Attachment 1 shows the implementation of conservation practices for the seven priority counties, as defined in the NEAP. These counties have the lowest rainfall and thus are the most susceptible to windblown dust.

Data evaluated is for the year 2004. The evaluation includes data on CRP, minimum tillage, and residue remaining on the field for the lowest rainfall counties of the Columbia Plateau - counties Ecology finds to be high priority in terms of addressing wind blown dust. Ecology identified Adams, Douglas, Franklin, Grant and Lincoln as priority counties in the 1998 NEAP. Benton and Walla Walla counties were added to the list more recently. The Core 4 data shows 78 percent of the priority counties' total farmable acres are in a USDA conservation program, use one of the minimum till practices, or contain 15-30% residue.

Similarly, attachment 2 shows the implementation of conservation practices for all counties of the Columbia Plateau NEAP. The data shows 79 percent use of conservation practices throughout the Columbia Plateau.

The results are consistent with the 2003 NEAP determination and show that we continue to meet BACM requirements.

Additional Efforts to Enhance Wind Erosion Conservation Measures

Ecology continues to work with the various agricultural agencies to enhance the use of conservation practices in the Columbia Plateau. In doing so, implementation of wind erosion conservation measures is enhanced beyond that tracked and reported by the Core 4.

Enhancing Wind Erosion Conservation Measures in Priority Counties of the Columbia Plateau:

Ecology completed a contract with the Benton Conservation District (BCD) for tasks associated with a special funds grant from the EPA. The project a) provided immediate, temporary treatment to critical areas and, b) promoted conservation buffers as options for longer-term or permanent wind erosion control measures. Results of the grant include the following:

1.) To date, 14 different farm operations used the straw mulcher to apply roughly 771 tons of grass straw to about 520 acres of "hot spots" (highly erodible areas). An additional 300 tons was applied without project-supplied cost-share straw. In total, over 1000 tons of straw were applied to highly erodible areas in an effort to protect against the occurrence of windblown dust. Even though all the cost-share money for this project has been expended, several growers have shown continued interest in using the straw mulcher.

2.) The BCD, USDA-Natural Resources Conservation Service, Ecology, and the Benton Clean Air Authority conducted an education and outreach program that focused on wind erosion conservation buffers as a longer-term solution to wind erosion. Material covered included the Natural Events Policy, Washington's Natural Events Action Plan and the importance of implementing Best Available Control Measures. The meeting was attended by thirty state natural resource agency staff and dryland wheat growers from the Horse Heaven Hills. The effort was an adjunct to a three-day technical workshop (May 17-20, 2004) that focused on implementing wind erosion conservation measures in the Columbia Plateau. The NRCS supplemented funds from this grant to conduct the workshop. The attached news release announcing the spring 2004 workshop was published in the Tri-City Herald and the Spokesman Review.

Numerous growers responded favorably to implementing conservation buffers on a trail basis. Ecology, the BCD and EPA will develop a grant to facilitate such an effort in the spring of 2005.

3.) Dryland growers also encouraged the agencies involved with this grant to consider advocating for increased CRP eligibility in the HHHs. In November, 2002, the BCAA, the BCD and others wrote letters to the Washington State FSA regarding CRP eligibility

in the HHH. The BCAA expressed their view that the HHH dryland wheat region should receive greater consideration as an air quality conservation priority area for the purpose of CRP eligibility. In support of their view, the BCAA points to air quality concerns due to windblown dust impacting the Tri-Cities and the Wallula, Washington areas and the HHH as an identified source area. Ecology's Air Quality Program wrote to the FSA, as well, supporting BCAA's position.

Prior to this grant (06/2002), roughly 74,000 acres were enrolled in the USDA CRP. As of the most recent enrollment (12/2004), over 120,000 acres were enrolled – of which – 108,000 acres are in the HHHs. The most recent signup took Benton County up to the federally mandated county limit that allows no more than 25% of eligible cropland in CRP. As a result, numerous growers wanting to enroll cropland were turned away.

4.) Staff from the BCD, the NRCS, Ecology's AQ Program and several dryland growers from the HHHs participated in NRCS's local work group process regarding criteria and eligibility for EQIP funding. These levels of involvement lead directly to the following changes in criteria and eligibility that will facilitate increased implementation of wind erosion conservation measures in the HHHs.

- Air quality is elevated as a natural resource concern – now second only to water quality.

- Dryland farmers/air quality projects no longer must compete against ALL resources concerns identified in the three-county workgroup. The initial screening/funding phase will only consider dryland farmers/air quality projects competing directly with one another.

- Criteria for air quality projects now includes increased points for projects that include:

    - No-Till (applicant gets more points for this(52) than direct seed (42) and mulch till (32)), and
    - Full season chemical fallow.

- bonus points are awarded for projects that include buffers and/or involve a pool of contiguous/adjacent landowners.

As evidenced above, this grant was tremendously successful. The quantitative outcomes are discussed in large part above. Moreover, this multi-agency effort significantly raised awareness regarding windblown dust and the critical importance of implementing appropriate controls to reduce emissions. To this end, both the growers and the agencies involved with this grant are willing and anxious to continue such efforts. Numerous growers are willing to install long-term (10 years to permanent) wind erosion buffers if funding support is available. The BCD and Ecology look forward to supporting their interest via additional EPA grant funds.

Additional Ecology Grants:

As presented in the 2003 Best Available Control Measures Status Report, Ecology's Water Quality Program is funding two projects that enhance wind erosion control measures on the Columbia Plateau. The objectives of both water and wind erosion control are to prevent or minimize soil particle detachment and entrainment by the medium (air or water.) Consequently, conservation practices to reduce the effects from both types of erosion are substantially similar. For this reason, air quality is improved when conservation measures to reduce water erosion are increased.

Both the Spokane Conservation District *Conservation Tillage Program* and the Franklin Conservation District *Wheat Erosion Buffer Program* continue. Additional details regarding these two programs are found in the 2003 Best Available Control Measures Status Report and at http://www.sccd.org/sccd/productionag/.

The Conservation Security Program and the Moses Coulee Watershed:

The Farm Security and Rural Investment Act of 2002 (2002 Farm Bill) amended the Food Security Act of 1985 to authorize the Conservation Security Program (CSP). The CSP is a voluntary program administered by USDA's Natural Resources Conservation Service (NRCS). It is designed to support on-going stewardship of private agriculture lands by providing payments for maintaining and enhancing natural resources. CSP identifies and rewards growers who are meeting the highest standards of conservation and environmental management on their operation.

Nationally, eighteen watersheds were selected to participate in the CSP in 2004 – one of which is the Moses Coulee Watershed. Located in Central Washington, the Moses Coulee includes portions of both Douglas and Grant counties. Eligible growers that apply and are selected will receive funding support to maintain and enhance conservation management practices on their operations. NRCS reports that air quality management practices are among the most important practices targeted for enhancement in the Moses Coulee through the CSP. Additional information regarding the CSP and the Moses Coulee Watershed are attached.

Conclusion

Ecology and the identified agricultural agencies continue to carry out the Columbia Plateau NEAP. Ecology finds the level of CRP and BMP implementation identified in this report continues to fulfill BACM criteria. Ecology will continue to document natural events and flag exceedances when justified under the terms of the 2003 NEAP.

1) To date, 14 different farm operations used the straw mulcher to apply roughly 771 tons of grass straw to about 520 acres of "hot spots" (highly erodible areas). An additional 300 tons was applied without project-supplied cost-share straw. In total, over 1000 tons of straw were applied to highly erodible areas in an effort to protect against the occurrence of windblown dust. Even though all the cost-share money for this

project has been expended, several growers have shown continued interest in using the straw mulcher.

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Other additional grants include Ecology's Water Quality Program that is funding two projects that enhance wind erosion control measures on the Columbia Plateau. The objectives of both water and wind erosion control are to prevent or minimize soil particle detachment and entrainment by the medium (air or water). Consequently, conservation practices to reduce the effects from both types of erosion are substantially similar. For this reason, air quality is improved when conservation measures to reduce water erosion are increased.

The BCAA continues to carry out the Columbia Plateau NEAP. The BCAA finds the level of CRP and BMP implementation identified in this report continues to fulfill BACM criteria. Ecology will continue to document natural events and flag exceedances when justified under the terms of the 2003 NEAP.

Appendix B

Pasco	SKNT mph	GUST mph	DRCT	WNUM	VSBY miles
8-12-2005 0:50 PDT	12	0	220	clear	10
8-12-2005 1:50 PDT	14	0	220	clear	10
8-12-2005 2:50 PDT	10	0	200	clear	10
8-12-2005 3:50 PDT	12	0	210	clear	10
8-12-2005 4:50 PDT	10	0	190	clear	10
8-12-2005 5:50 PDT	10	0	190	clear	10
8-12-2005 6:50 PDT	8	0	200	clear	10
8-12-2005 7:50 PDT	10	0	200	clear	10
8-12-2005 8:50 PDT	12	0	210	clear	10
8-12-2005 9:50 PDT	6	0	180	clear	10
8-12-2005 10:50 PDT	7	0	240	clear	10
8-12-2005 11:50 PDT	6	0	0	clear	10
8-12-2005 12:50 PDT	5	0	0	clear	10
8-12-2005 13:50 PDT	3	0	0	clear	10
8-12-2005 14:50 PDT	6	0	0	clear	10
8-12-2005 15:50 PDT	5	0	350	clear	10
8-12-2005 16:50 PDT	6	0	320	clear	10
8-12-2005 17:50 PDT	6	0	290	clear	10
8-12-2005 18:50 PDT	0	0	0	clear	10
8-12-2005 19:35 PDT	23	33	50	haze	1
8-12-2005 19:45 PDT	25	37	60	haze	0.5
8-12-2005 19:50 PDT	26	37	60	smoke	0.25
8-12-2005 20:50 PDT	22	29	70	blowing dust	1.25
8-12-2005 21:15 PDT	22	28	70	blowing dust	2.5
8-12-2005 21:25 PDT	18	25	60	blowing dust	3
8-12-2005 21:50 PDT	5	0	0	haze	6
8-12-2005 22:35 PDT	16	23	10	clear	7
8-12-2005 22:50 PDT	12	0	320	clear	10
8-12-2005 23:00 PDT	13	0	320	clear	10
8-12-2005 23:50 PDT	14	0	340	clear	10

Lind	SKNT mph	GUST mph	DRCT
8-12-2005 0:15 PDT	5	6	158
8-12-2005 0:30 PDT	5	6	156
8-12-2005 0:45 PDT	5	6	151
8-12-2005 1:00 PDT	5	6	152
8-12-2005 1:15 PDT	5	7	145
8-12-2005 1:30 PDT	5	7	159
8-12-2005 1:45 PDT	5	8	158
8-12-2005 2:00 PDT	4	7	156
8-12-2005 2:15 PDT	4	6	151
8-12-2005 2:30 PDT	3	7	144
8-12-2005 2:45 PDT	4	7	150
8-12-2005 3:00 PDT	5	8	159
8-12-2005 3:15 PDT	3	5	160
8-12-2005 3:30 PDT	4	6	165
8-12-2005 3:45 PDT	6	10	155
8-12-2005 4:00 PDT	5	10	159
8-12-2005 4:15 PDT	5	8	155
8-12-2005 4:30 PDT	2	5	156
8-12-2005 4:45 PDT	4	7	156
8-12-2005 5:00 PDT	3	5	144
8-12-2005 5:15 PDT	3	5	150
8-12-2005 5:30 PDT	4	6	148
8-12-2005 5:45 PDT	5	9	151
8-12-2005 6:00 PDT	5	8	153
8-12-2005 6:15 PDT	5	8	155
8-12-2005 6:30 PDT	3	6	162
8-12-2005 6:45 PDT	3	5	161
8-12-2005 7:00 PDT	5	7	157
8-12-2005 7:15 PDT	4	7	152
8-12-2005 7:30 PDT	4	7	153
8-12-2005 7:45 PDT	4	8	154
8-12-2005 8:00 PDT	5	9	164
8-12-2005 8:15 PDT	6	10	172
8-12-2005 8:30 PDT	6	10	171
8-12-2005 8:45 PDT	6	10	184
8-12-2005 9:00 PDT	4	8	196
8-12-2005 9:15 PDT	4	12	196
8-12-2005 9:30 PDT	4	9	205
8-12-2005 9:45 PDT	4	9	191
8-12-2005 10:00 PDT	4	8	200
8-12-2005 10:15 PDT	4	9	206
8-12-2005 10:30 PDT	5	9	193
8-12-2005 10:45 PDT	5	9	204
8-12-2005 11:00 PDT	5	11	197
8-12-2005 11:15 PDT	4	8	235
8-12-2005 11:30 PDT	4	8	210
8-12-2005 11:45 PDT	3	8	220
8-12-2005 12:00 PDT	3	7	191
8-12-2005 12:15 PDT	3	9	225

8-12-2005 12:30 PDT	2	7	326
8-12-2005 12:45 PDT	2	6	228
8-12-2005 13:00 PDT	3	16	253
8-12-2005 13:15 PDT	3	9	200
8-12-2005 13:30 PDT	3	11	202
8-12-2005 13:45 PDT	3	7	154
8-12-2005 14:00 PDT	2	5	143
8-12-2005 14:15 PDT	3	6	99
8-12-2005 14:30 PDT	4	9	118
8-12-2005 14:45 PDT	3	11	247
8-12-2005 15:00 PDT	4	9	260
8-12-2005 15:15 PDT	4	9	270
8-12-2005 15:30 PDT	4	11	241
8-12-2005 15:45 PDT	3	10	253
8-12-2005 16:00 PDT	4	8	168
8-12-2005 16:15 PDT	2	7	116
8-12-2005 16:30 PDT	3	8	316
8-12-2005 16:45 PDT	4	10	318
8-12-2005 17:00 PDT	6	14	297
8-12-2005 17:15 PDT	6	11	293
8-12-2005 17:30 PDT	4	10	301
8-12-2005 17:45 PDT	5	13	287
8-12-2005 18:00 PDT	5	9	326
8-12-2005 18:15 PDT	17	37	40
8-12-2005 18:30 PDT	23	37	68
8-12-2005 18:45 PDT	24	37	68
8-12-2005 19:00 PDT	21	35	69
8-12-2005 19:15 PDT	22	33	66
8-12-2005 19:30 PDT	20	32	65
8-12-2005 19:45 PDT	19	30	63
8-12-2005 20:00 PDT	18	29	61
8-12-2005 20:15 PDT	18	27	61
8-12-2005 20:30 PDT	17	28	67
8-12-2005 20:45 PDT	18	31	71
8-12-2005 21:00 PDT	18	28	68
8-12-2005 21:15 PDT	18	27	64
8-12-2005 21:30 PDT	17	29	66
8-12-2005 21:45 PDT	19	31	59
8-12-2005 22:00 PDT	21	36	60
8-12-2005 22:15 PDT	19	32	61
8-12-2005 22:30 PDT	19	30	63
8-12-2005 22:45 PDT	18	27	62
8-12-2005 23:00 PDT	17	26	61
8-12-2005 23:15 PDT	17	28	64
8-12-2005 23:30 PDT	17	0	62

Othello	SKNT mph	GUST mph	DRCT
8-12-2005 0:25 PDT	7	9	304
8-12-2005 1:25 PDT	10	12	302
8-12-2005 2:25 PDT	6	12	352
8-12-2005 3:25 PDT	5	8	27
8-12-2005 4:25 PDT	7	7	23
8-12-2005 5:25 PDT	6	7	26
8-12-2005 6:25 PDT	5	7	41
8-12-2005 7:25 PDT	4	6	68
8-12-2005 8:25 PDT	4	7	81
8-12-2005 9:25 PDT	4	6	351
8-12-2005 10:25 PDT	4	7	135
8-12-2005 11:25 PDT	5	8	117
8-12-2005 12:25 PDT	5	9	310
8-12-2005 13:25 PDT	8	11	339
8-12-2005 14:25 PDT	6	13	356
8-12-2005 15:25 PDT	7	12	5
8-12-2005 16:25 PDT	8	11	33
8-12-2005 17:25 PDT	4	10	265
8-12-2005 18:25 PDT	7	11	331
8-12-2005 19:25 PDT	24	36	73
8-12-2005 20:25 PDT	18	30	73
8-12-2005 21:25 PDT	12	26	65
8-12-2005 22:25 PDT	10	16	46
8-12-2005 23:25 PDT	8	14	24

Juniper	SKNT mph	GUST mph	DRCT
8-12-2005 0:40 PDT	7	17	195
8-12-2005 1:40 PDT	9	12	153
8-12-2005 2:40 PDT	10	15	164
8-12-2005 3:40 PDT	6	13	146
8-12-2005 4:40 PDT	8	12	118
8-12-2005 5:40 PDT	11	14	130
8-12-2005 6:40 PDT	9	12	152
8-12-2005 8:40 PDT	8	14	172
8-12-2005 9:40 PDT	9	16	193
8-12-2005 10:40 PDT	8	16	203
8-12-2005 11:40 PDT	5	14	291
8-12-2005 12:40 PDT	6	14	251
8-12-2005 13:40 PDT	5	13	281
8-12-2005 14:40 PDT	5	16	207
8-12-2005 15:40 PDT	8	13	227
8-12-2005 16:40 PDT	8	16	313
8-12-2005 17:40 PDT	11	26	316
8-12-2005 18:40 PDT	8	20	11
8-12-2005 19:40 PDT	30	43	60
8-12-2005 21:40 PDT	18	37	64
8-12-2005 22:40 PDT	19	25	40
8-12-2005 23:40 PDT	21	28	37