Documentation of a Natural Event Due to High Winds

June 21, 2005
Spokane, Washington

SPOKANE COUNTY AIR POLLUTION CONTROL AUTHORITY

December 2005

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1. RATIONALE

On June 21, 2005, the Federal Reference Method (FRM) sampler used for measuring the concentration of particulate matter with an aerodynamic diameter of 10 or less micrometers in ambient air (PM_{10}) at the Crown Z National Air Monitoring Station (NAMS) in Spokane, Washington measured a 24 hour average PM_{10} mass concentration of 159 $\mu g\ m^{-3}$. This exceeded the primary 24 hour National Ambient Air Quality Standard (NAAQS) for PM_{10} of 150 $\mu g\ m^{-3}$. The Spokane County Air Pollution Control Authority (SCAPCA) has determined that this exceedance of the NAAQS would not have occurred in the absence of an uncontrollable "natural event" caused by high winds.

The Washington Department of Ecology (Ecology) flagged the Crown Z PM_{10} data for June 21, 2005 in the Aerometric Information Retrieval System (AIRS) database maintained by the United States Environmental Protection Agency (EPA) to indicate a natural event was involved. This report is submitted to EPA in support of the data flag for EPA's acknowledgement and flagging of the data. The flagged data would be excluded from any assessment of the Spokane area's NAAQS attainment status, as provided for under EPA's Natural Events Policy (NEP). Section 2 will explain how the NEP applies to high wind events in eastern Washington State.

2. NATURAL EVENTS POLICY

2.1 EPA Requirements

In May 1996, the EPA issued a policy memorandum regarding "Areas Affected by PM-10 Natural Events," commonly referred to as the Natural Events Policy, to provide a means to exclude PM_{10} data attributable to uncontrollable natural events from the determination of an area's NAAQS attainment status. Under the NEP, PM_{10} data collected on days when natural events cause exceedances of the NAAQS can be excluded, provided certain conditions are met. The NEP recognizes three types of natural events: volcanic and seismic activities, wildland fires, and high winds and is applicable only if the pollution originates from non-anthropogenic sources or anthropogenic sources controlled with best available control measures (BACM).

States fulfill the NEP requirements by submitting to EPA a Natural Events Action Plan (NEAP), which specifies the process required to qualify a natural event under the policy. When a state has reason to believe a natural event caused a monitored exceedance of the PM_{10} standard, the state is responsible for establishing a clear causal relationship between the natural event and the exceedance based on the criteria defined in its EPA-approved NEAP. Documentation of the natural event should be sufficient to demonstrate that the natural event occurred and provide evidence that concentrations at the monitoring site where the exceedance was recorded would not have exceeded the PM_{10} standard in the absence of a natural event.

During the late 1980's and early 1990's, a large number of exceedances of the 24 hour standard for PM_{10} were recorded in the Columbia Plateau region of eastern Washington. Some of these exceedances occurred in the Spokane area. Analysis of the exceedances showed a close correlation to high wind events. Agricultural fields were identified as a contributing source of the windblown

dust. Accordingly, the Washington Department of Ecology developed the *Natural Events Action Plan for High Wind Events in the Columbia Plateau* in March 1998 in response to certain criteria and requirements set forth in EPA's NEP. The document was re-evaluated and revised in June 2003 under the title *Columbia Plateau Windblown Dust Natural Events Action Plan.*

2.2 Washington State's Columbia Plateau Windblown Dust Natural Events Action Plan

The NEP identifies various criteria states are expected to address in a NEAP, including a commitment to re-evaluate the NEAP every five years. As stated previously, Ecology completed a re-evaluation and submitted a revised NEAP to EPA in June 2003. The Columbia Plateau Windblown Dust NEAP continues to address the NEP by providing for:

- Notification of citizens when air quality is likely to be impaired due to high wind events.
- Advice to citizens on steps to minimize exposure.
- Development of a program to identify and implement controls for anthropogenic sources of windblown dust in the Columbia Plateau.

Based on the evaluation, several changes were also incorporated into the 2003 NEAP. Significant changes include a finding that BACM is in place throughout the Columbia Plateau and a more refined definition for a high wind event.

The 2003 NEAP identified BACM for agricultural fields as conservation programs and practices that reduce or minimize wind erosion. Specifically, this means USDA Conservation Title Programs supplemented by incentive based implementation of wind erosion conservation practices of best management practices (BMPs).

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}. A high wind event is defined by the NEAP as follows:

> "*A high wind event occurs when the wind entrains and suspends dust to the extent that concentrations of PM_{10} are elevated. This typically occurs when the average hourly wind speed at 33 ft 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. A high wind event that exceeds the PM_{10} standard is a natural event.*"

The Columbia Plateau Windblown Dust NEAP documents the research and explains the logic behind this "high wind event" definition. The high wind event definition necessarily includes the concept that the intensity of the wind event is a combination of wind speed and significant duration.

The State of Washington finds that windblown dust from agricultural fields is still a significant contributing source of PM_{10} exceedances throughout that Columbia Plateau. The soil is very fine

with low organic content. This, coupled with low precipitation, results in very dry soil that is highly susceptible to wind erosion. Section 3 describes the climate and other characteristics of the Spokane area further.

3. DESCRIPTION OF THE SPOKANE, WASHINGTON AREA

3.1 Location

The Spokane metropolitan area has a population of about 430,000 and is located near the eastern border of Washington State. It lies at the northeastern edge of the Columbia Plateau, a semi-arid region of grasslands and agricultural use, primarily dryland (non-irrigated) wheat farming, covering an area of approximately 18,000 square miles.

3.2 Climate

The climate of Spokane and the Columbia Plateau is characterized by cool, moist winters and dry summers with occasional drought cycles and high intensity winds associated with Pacific frontal systems. These high wind events can cause elevated PM_{10} concentrations in the spring, summer, and fall seasons. During the winter wet season, soil moisture is normally adequate to prevent suspension of dust from agricultural or undeveloped land.

The average annual precipitation is 16.67 inches at Spokane International Airport. Of this, about 4.98 inches, or 30 percent, usually falls during the months of May through September. The average annual precipitation across the western portion of Spokane County is between 15 and 18 inches. It increases eastward to approximately 20 to 22 inches along the Idaho border. Thunderstorms occur on about 10 days each year, and most occur between May and August. The prevailing wind is from the south, except from November to January when it is from the northeast. Average wind speed is highest, around 10 miles per hour, in March and April (USDA/Natural Resources Conservation Service, retrieved on 12 Dec 2005).

3.3 Air Quality

The average annual PM_{10} concentration at the Crown Z monitoring station has decreased gradually over the last ten years, from 32 $\mu g\ m^{-3}$ in 1995 to 27 $\mu g\ m^{-3}$ in 2004. The average PM_{10} concentration for the period January through October 2005 was 29 $\mu g\ m^{-3}$. There were three PM_{10} exceedances recorded in the ten years preceding the June 21, 2005 event, all of which are attributable to windblown dust natural events. More detailed information about past exceedances is available in Appendix 1. Section 4 examines the windblown dust event that caused the exceedance of the PM_{10} NAAQS on June 21, 2005.

4. EVALUATION OF THE JUNE 21, 2005 WINDBLOWN DUST EVENT

This section provides evidence that the PM_{10} NAAQS exceedance recorded on June 21, 2005 at the Crown Z NAMS station (AIRS No. 530630016) in Spokane qualifies as a natural event under the 13 mph wind speed criterion defined by the Columbia Plateau Windblown Dust NEAP. For the definition of a high wind event in eastern Washington, please refer to the excerpt from the NEAP on page 4 of this report. The 13 mph criterion carries a higher burden of proof than the 18 mph criterion to qualify an exceedance as a natural event. Record wind gusts (up to 77 mph) and low precipitation prior to the June 21 high winds established conditions under which soils were highly susceptible to wind erosion. No rainfall was measured at local meteorological stations in the 72 hours prior to the event. The south-southwesterly 13+ mph sustained winds subsequently transported the dust entrained by the severe gusts from rural source areas into the Spokane urban area.

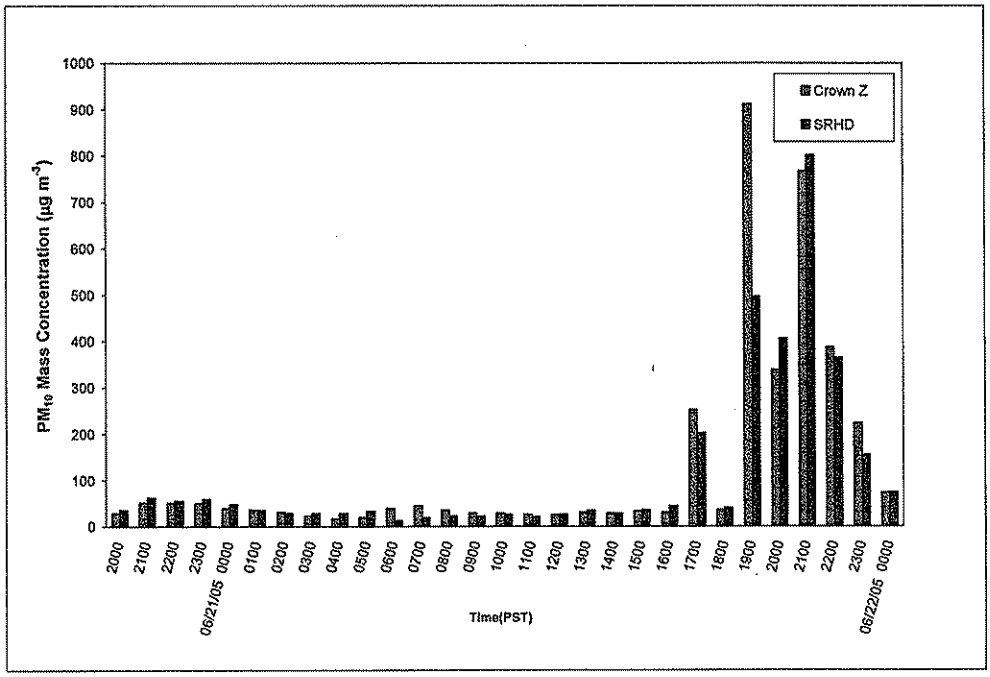
At 1640 PST (540 PM PDT) on June 21 the National Weather Service (NWS) reported that thunderstorms were moving north across the Palouse and Columbia Basin, areas of predominantly agricultural land use south and west of Spokane, causing blowing dust (Appendix 2). A cold front and thunderstorms with extreme gusts were forecast for the Spokane area on the evening of June 21.

4.1 PM_{10} Data

On June, 21 2005, the Federal Reference Method (FRM) high volume PM_{10} sampler (Graseby-Andersen Model 1200) at the Crown Z monitoring station in Spokane, Washington measured a 24 hour average PM_{10} mass concentration of 159 $\mu g\ m^{-3}$. Crown Z, also referred to as SPOFER, Freya & Ferry, or Ferry Street in official records, is located in a light industrial area in east Spokane, near the center of the Spokane urban area. The PM_{10} sampler at Crown Z operates every three days, following the EPA monitoring schedule.

SCAPCA monitors PM_{10} on a continuous basis at Crown Z using a Tapered Element Oscillating Microbalance (TEOM) Model 1400AT manufactured by Rupprecht & Patashnick Co. Hourly average PM_{10} data collected using the TEOM show that concentrations on June 21 remained in the 16-45 $\mu g\ m^{-3}$ range until 1700 Pacific Standard Time (PST; Figure 1). At 1700 PST, the hourly average concentration increased suddenly to 252 $\mu g\ m^{-3}$ with the onset of high wind speeds. The concentration peaked in the 1900 PST hour at 912 $\mu g\ m^{-3}$, decreased briefly with a lull in the wind speeds and then reached a second peak of 768 $\mu g\ m^{-3}$ for the 2100 PST hour. Hourly PM_{10} data from an air monitoring station at the Spokane Regional Health District office, about three miles west of Crown Z, show a similar pattern. Hourly average PM_{10} data from both monitoring stations for June 20-22 are provided in Appendix 3.

Figure 1: Hourly average PM_{10} mass concentration monitored at the Crown Z and Spokane Regional Health District (SRHD) monitoring stations in Spokane, Washington. Period: 2000 (PST) June 20, 2005 - 0000 (PST) June 22, 2005.



4.2 Wind Data

The hourly average wind speed at Crown Z was 16.2 mph for the hour beginning at 1700 PST on June 21, 15.7 mph at 1900 PST, 13.8 mph at 2200 PST, and 17.3 mph at 2300 PST (Figure 2). No wind gust data are available for Crown Z. While the hourly average wind speeds recorded at Crown Z might not be sufficient cause for the windblown dust event that occurred on June 21, SCAPCA believes that extreme wind gusts observed at Spokane International Airport, about eight miles southwest of Crown Z, provide an explanation.

The Spokane International Airport meteorological data show extreme winds lasted for about three hours between 1555 PST and 1920 PST and, except for a brief lull, continued to be strong through the evening. Significant developments in the storm are indicated in Figure 3 with posted times. The data are also provided in Table A4.1. At about 1355 PST, wind direction shifted south and strong gusts began as a low pressure system passed through the area. The 1600 PST (0000z) surface weather map shows this system centered over eastern Washington (Figure 4). At 1719 PST (619 PM PDT) the NWS issued a severe thunderstorm warning for central Spokane County, including the city of Spokane. Doppler radar had indicated that a severe thunderstorm capable of producing winds in excess of 60 mph was near Cheney, about 17 miles southwest of Spokane, and moving northeast toward Spokane. The NWS stated that wind damage would occur well ahead of any rain (Appendix 2). By 1720 PST, sustained wind speeds reached 62 mph with record gusts of 77 mph. Wind speed decreased to 3 mph at 1940 PST, but a 31 mph gust was observed. At 2130 PST, wind speed increased again to 16 mph and remained in the 14 to 16 mph range into the early hours of June 22. The NWS observed blowing dust and low visibility at Spokane International Airport during the hours when the high wind speeds occurred (Table A4.1).

A National Climatic Data Center (NCDC) Event Record (Appendix 5) and local news media (Appendix 6) provided information about the June 21 thunderstorms and consequent wind damage that caused widespread power outages. These accounts of the event reported that two "gust fronts" moving through the Spokane area caused the severe wind gusts. A gust front is the leading edge of the downdraft outflow from a thunderstorm. The outflow can produce intense gusts at the surface as the downdraft air descends, strikes the surface and spreads out (Figure 5). The strong surface winds can pick up large quantities of dust in regions of dry, exposed soil, which is distributed throughout the layer of cold outflow air, making the gust front clearly visible (Wallace and Hobbs, 1977). Figure 6 shows a dust cloud lifted by a gust front near Spokane on June 21.

4.3 Precipitation Data

There was no measurable precipitation at Spokane International Airport, Fairchild Air Force Base, or Cheney for 72 hours preceding the dust storm, which began at about 1700 PST. A trace was observed at Fairchild Air Force Base during a three hour period ending 72 hours prior to the start of the event (Table 1). Hourly precipitation and other meteorological observations from these stations for June 17-21 are provided Tables A4.1, A4.2, and A 4.3. Precipitation totals measured at Spokane International Airport and Fairchild Air Force Base for the 30 day period prior to the event were 0.63 and 0.81 inches, respectively. The 1971-2000 June precipitation normal for Spokane International Airport is 1.18 inches. Precipitation measured at Spokane International Airport for the period October through May was 11.13 inches, 84% of normal (NOAA/National Weather Service, 2005).

Table 1: Precipitation totals for Spokane area meteorological stations prior to the start of the dust storm at 1700 PST on June 21, 2005.

Station	Precipitation (inches)				
	24 HR	72 HR	7 days	10 days	30 days
Spokane International Airport, WA (KGEG)	0	0	0.05	0.16	0.63
Fairchild Air Force Base, WA (KSKA)	0	T*	T	0.08	0.81
Cheney, WA (TWRW1)	0	0	0.12	0.26	NA

*A trace of precipitation (T) is defined as less than 0.01 inch.

Although the meteorological data provide evidence that the PM_{10} exceedance on June 21 was caused by windblown dust, the NEP requires that BACM must be implemented on the agricultural source area before the exceedance can be classified as a natural event. Section 5 assesses BACM implementation on the Columbia Plateau.

Figure 2: Hourly average wind speed and wind direction at the Crown Z monitoring station in Spokane, Washington. Period: 2000 (PST) June 20, 2005 - 0000 (PST) June 22, 2005.

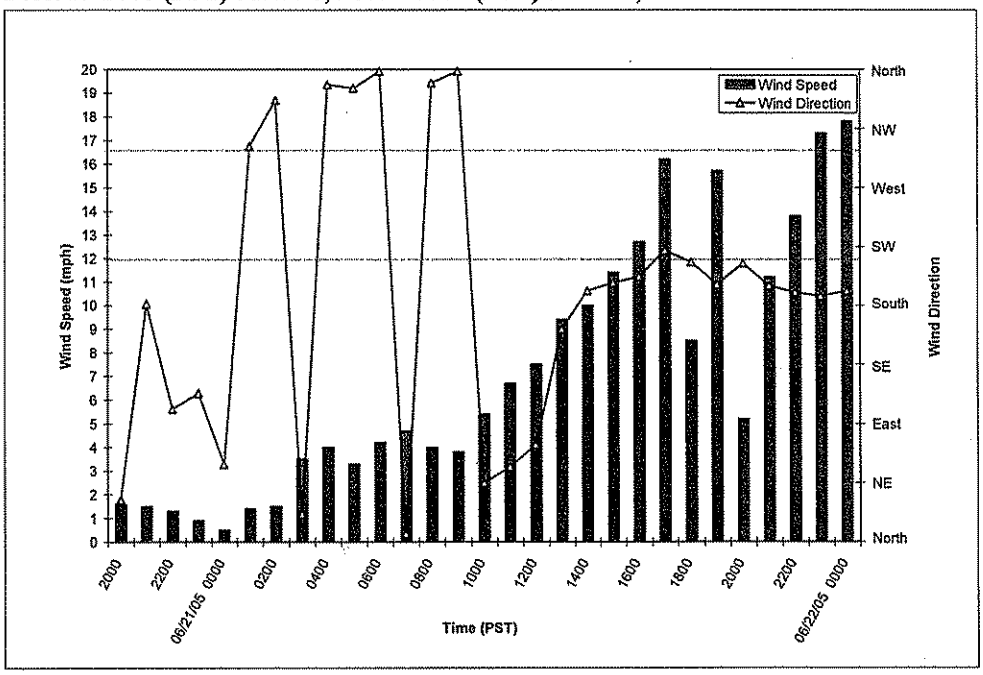


Figure 3: Hourly wind speeds, gusts, and wind direction at Spokane International Airport. Period: 2000 (PST) June 20, 2005 - 0000 (PST) June 22, 2005.

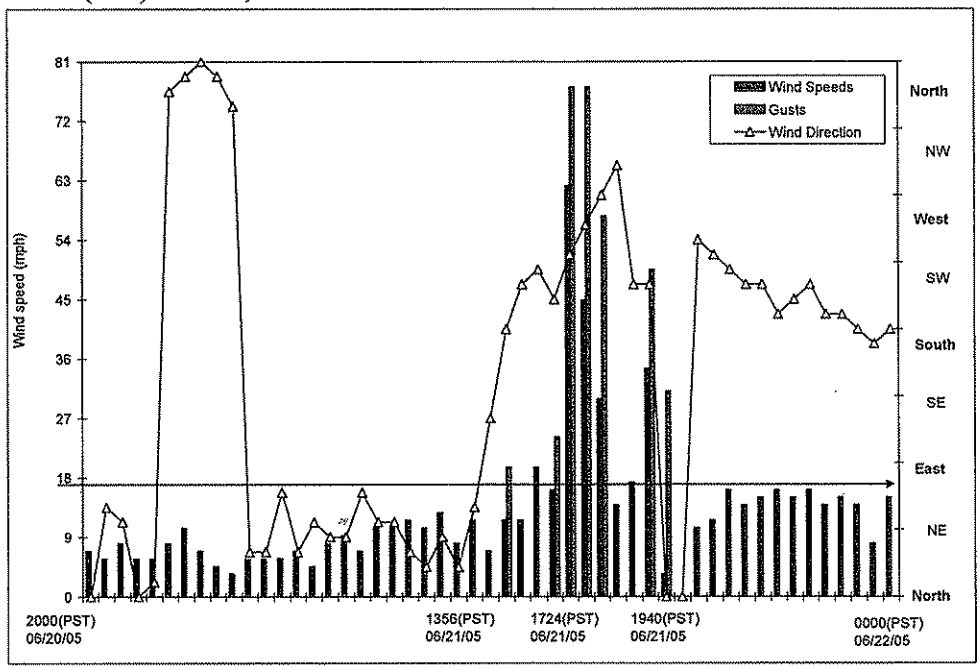


Figure 4: Surface weather map of the contiguous United States at 1600 PST on June 21, 2005 (0000Z June 22). Note the low pressure system centered over eastern Washington State (NOAA weather map retrieved from Crisp, 2005).

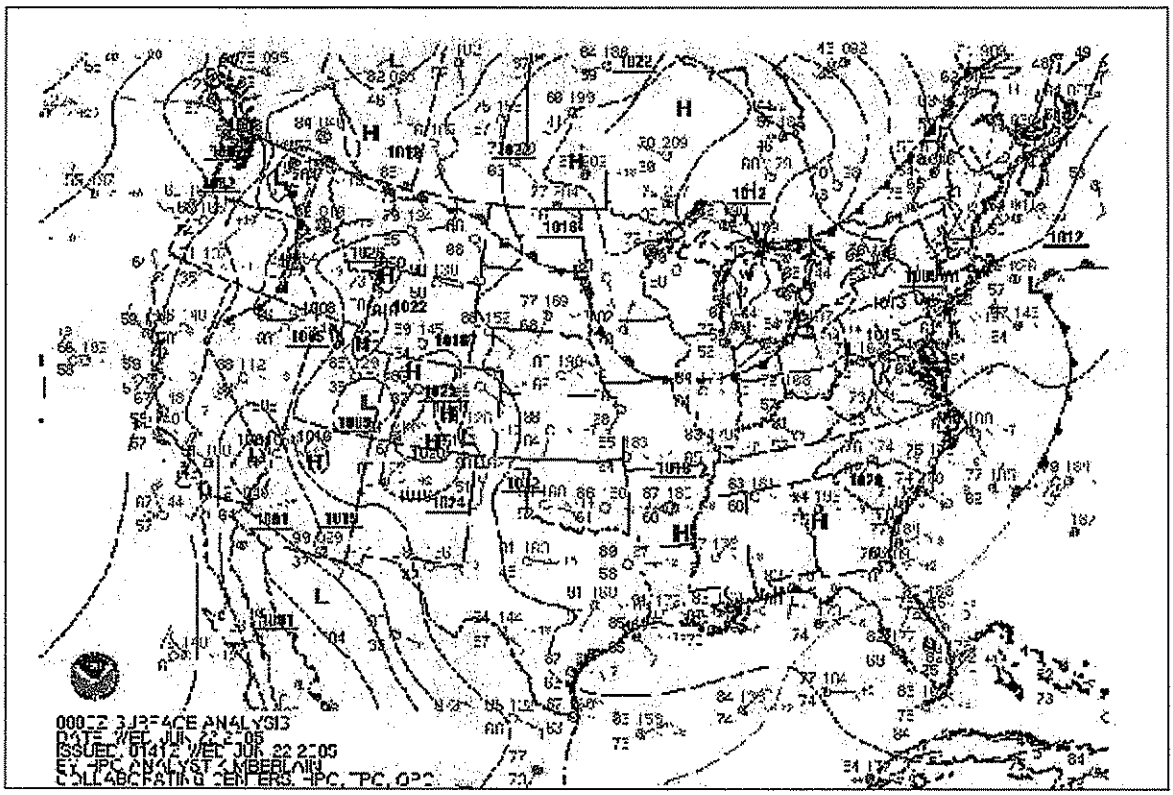


Figure 5: Illustration of a thunderstorm downdraft. Intense gust front (outflow front) outflows can cause dust storms like the one that occurred in the Spokane, Washington area on June 21, 2005 (from Fisher, retrieved 12 Dec 2005).

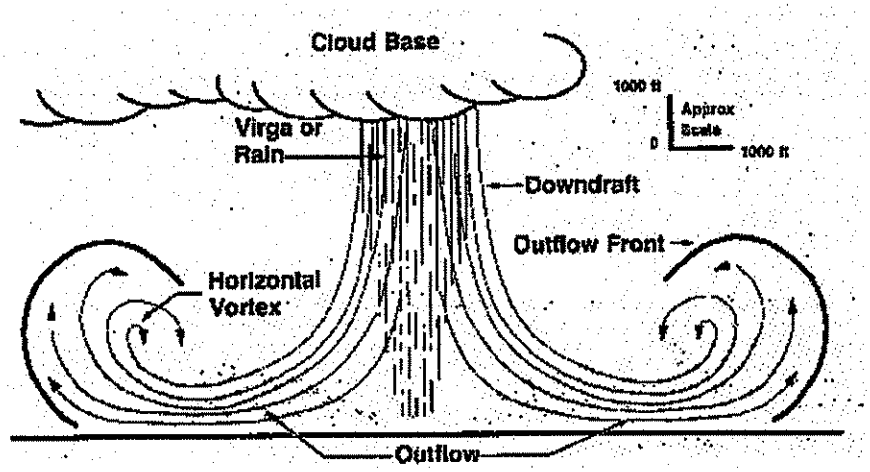


Figure 6: Dust cloud generated by thunderstorm outflow winds on June 21, 2005. Note the edge of the dust cloud distinctly marks the gust front. The photo was taken from approximately 9 miles west of Spokane; the view is toward the northeast looking across Spokane (National Weather Service photograph).

5. AGRICULTURAL BACM ASSESSMENT

5.1 Columbia Plateau

The 2003 NEAP determined BACM is implemented in the Columbia Plateau based on 68 percent use of conservation practices. BACM for agricultural fields is defined 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 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 Conservation Reserve Program (CRP) and the wind erosion BMPs encouraged by 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 percent and 15-30 percent residue) practices and CRP enrollment on a county by county basis.

A 2004 Annual Status Report regarding BACM implementation (Appendix 7) shows the levels of CRP and BMP use have increased to 79 percent in Columbia Plateau counties. Seventy-nine percent of the total farmable acres in these counties are now part of a USDA conservation program, use one of the minimum till practices, or contain 15-30 percent residue.

5.2 Spokane County

Saxton et al. (2000) developed a regional windblown dust modeling system for the Columbia Plateau in order to simulate a dust storm that occurred during September 23-25, 1999. This work shows that during high wind speeds accompanying a storm, emissions affecting urban receptors are within approximately 25 miles of the receptor.

High winds and gusts were predominantly out of the southwest on June 21, 2005. The National Climatic Data Center reports the beginning of thunderstorm associated winds beginning about six miles southwest of Spokane. In light of this and results from Saxton's source–receptor modeling, Ecology finds agricultural fields lying to the southwest and within about six miles of Spokane, Washington are candidates for contributing to the measured emissions. Accordingly, Ecology reviewed the 2004 Annual Status Report regarding BACM implementation for Spokane County. The data shows that 83 percent of the total farmable acres in Spokane County are either in a USDA conservation program, use one of the minimum till practices, or contain 15-30 percent residue.

Washington State determines that BACM for agricultural fields was implemented in Spokane County on June 21, 2005. A full discussion on Ecology's BACM definition and tracking mechanism may be found in the revised NEAP.

5. CONCLUSIONS

From the evidence presented, the following conclusions can be drawn:

a) Spokane and outlying agricultural areas were subjected to high wind speeds on June 21, 2005.

b) Wind speeds recorded in the urban and rural PM_{10} source areas met the wind speed criterion of 13 miles per hour for two or more consecutive hours *when conditions of higher susceptibility to wind erosion exist*, as required under Washington State's Columbia Plateau Windblown Dust Natural Events Action Plan.

c) Wind speeds from about 1700 to 2300 PST were sufficient to transport the windblown dust generated by severe gust fronts into the Spokane area.

d) Low precipitation totals prior to the windblown dust event and severe wind gusts were extenuating factors which led to the event.

e) BACM was implemented on agricultural fields.

f) The previous statements 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}.

Based upon these conclusions, SCAPCA considers the PM_{10} mass concentration recorded at the Crown Z monitoring station on June 21, 2005 to have been caused by a high wind event and requests that the data for this date be flagged as such in the AIRS database.

ABBREVIATIONS AND ACRONYMS

AIRS	Aerometric Information Retrieval System
ARS	Agricultural Research Service
BACM	Best Available Control Measures
BCAA	Benton Clean Air Authority
BCD	Benton Conservation District
BMP	Best Management Practice
CP3	Columbia Plateau PM_{10} Project
Crown Z	Crown Z air monitoring station
CRP	Conservation Reserve Program
CSP	Conservation Security Program
CTIC	Conservation Technology Information Center
Ecology	Washington Department of Ecology
EPA	U.S. Environmental Protection Agency
FRM	Federal Reference Method
FSA	Farm Service Agency
HHH	Horse Heaven Hills
J/KG	Joules per kilogram
mph	miles per hour
NAAQS	National Ambient Air Quality Standard
NAMS	National Air Monitoring Station
NCDC	National Climatic Data Center
NEAP	Natural Events Action Plan
NEP	Natural Events Policy
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
PDT	Pacific Daylight (Savings) Time
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometers, mass concentration in ambient air
PST	Pacific Standard Time
RAWS	Remote Automated Weather System
SCAPCA	Spokane County Air Pollution Control Authority
SLAMS	State and Local Air Monitoring Station
SRHD	Spokane Regional Health District air monitoring station
TEOM	Tapered Element Oscillating Microbalance
USDA	United States Department of Agriculture
Z	"Zulu Time," same as Coordinated Universal Time (UTC)
$\mu g\ m^{-3}$	micrograms per cubic meter, measure of particulate matter mass concentration in the air

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APPENDIX 1

Spokane PM_{10} Long-Term Trends and Past NAAQS Exceedances

The average annual PM_{10} concentration at the Crown Z monitoring station has decreased gradually over the last ten years, from 32 $\mu g\ m^{-3}$ in 1995 to 27 $\mu g\ m^{-3}$ in 2004 (Figure A1.1). The average PM_{10} concentration for the period January through October 2005 was 29 $\mu g\ m^{-3}$. The PM_{10} FRM samplers at Crown Z operated on a daily basis until January 2005, when sampling frequency was reduced to once every three days, following the EPA monitoring schedule.

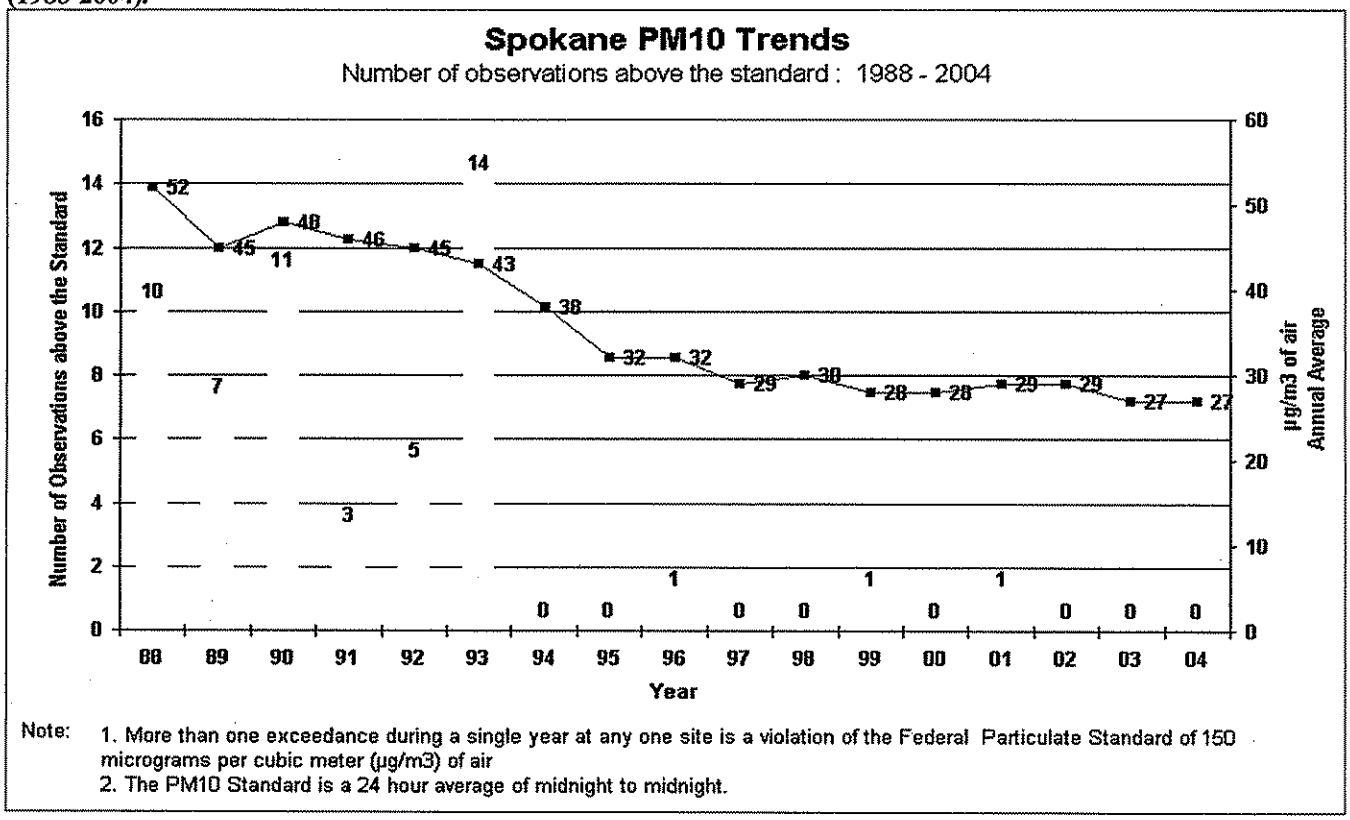
There were several exceedances of the PM_{10} NAAQS observed in Spokane during the late 1980's and early 1990's, a period when areas across eastern Washington State were experiencing an unusually high number of exceedances caused by windblown dust. In the ten years preceding the June 21, 2005 event, Spokane had only three PM10 exceedances, all of which are attributable to windblown dust natural events. Some details about each of the three events follow:

a) On August 30, 1996, a PM_{10} mass concentration of 186 $\mu g\ m^{-3}$ was recorded at Crown Z. Wind speed averaged greater than 13 mph for 8 consecutive hours at Crown Z.

b) On September 25, 1999, a PM_{10} mass concentration of 343 $\mu g\ m^{-3}$ was recorded at Crown Z. Wind speed averaged greater than 18 mph for five consecutive hours at Crown Z. The NWS reported that September was warm and dry. The Spokane International Airport climatological station received only a trace of precipitation, i.e., less than 0.01 inches, during the month (Miller, 2001).

c) On September 25, 2001, a PM_{10} mass concentration of 260 $\mu g\ m^{-3}$ was recorded at Crown Z. Wind speed was relatively low at Crown Z. It was greater than 13 mph for 3 consecutive hours, but not until the blowing dust had subsided, based on the PM_{10} TEOM hourly averages. Hourly average wind speeds recorded at Crown Z were in the 8-13 mph range during most of the episode but were less than 1 mph when the event began. Data from Spokane International Airport, however, show wind speeds averaged in the 25-29 mph range for six consecutive hours with gusts as high as 36 mph. The strong southerly winds were caused by the passage of a surface low pressure system and associated cold front (Fox, 2001). The NWS observed widespread blowing dust from agricultural fields and reported the area was experiencing drought conditions. Spokane had the second driest "water year" for the period October 2000 through September 2001 ever, with records going back to 1881. Total precipitation for the period was 9.67 inches recorded at Spokane International Airport. All local weather stations recorded below normal precipitation for the month with temperatures well above average (Miller, 2001).

Figure A1.1: Spokane long-term PM_{10} trends and annual number of observations above the NAAQS standard (1988-2004).



Note: 1. More than one exceedance during a single year at any one site is a violation of the Federal Particulate Standard of 150 micrograms per cubic meter (µg/m3) of air
2. The PM10 Standard is a 24 hour average of midnight to midnight.

APPENDIX 2

National Weather Service Forecast Discussion and Public Information Statement

The following weather forecast discussions issued by the Spokane National Weather Service Office show that thunderstorms producing gusty winds and blowing dust were moving through the Spokane area on June 21, 2005. The Palouse and Basin zones mentioned in the 540 PM Pacific Daylight Time (PDT) forecast discussion are predominantly agricultural areas that were directly upwind of Spokane. Some passages relating to the high wind natural event are underlined. A Public Information Statement showing record wind gusts for the Spokane area is included.

FXUS66 KOTX 220040
AFDOTX

AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE SPOKANE WA
540 PM PDT TUE JUN 21 2005

.SYNOPSIS...THE LOW OFF THE NORTHERN CALIFORNIA COAST WILL CONTINUE TO MOVE NORTHEAST THIS EVENING AND EXIT THE REGION BY WEDNESDAY EVENING. THERE WILL BE THUNDERSTORMS WITH THE COLD FRONT THIS AFTERNOON AND EVENING WITH THE POSSIBILITY OF SMALL HAIL AND GUSTY WINDS. COOLER AND UNSETTLED WEATHER CAN BE EXPECTED FOR THE REMAINDER OF THIS WEEK.

&&

.DISCUSSION...
UPDATE...MADE A QUICK UPDATE TO ADD BLOWING DUST TO THE PALOUSE AND BASIN ZONES. HIGH BASED THUNDERSTORMS ARE DRIFTING NORTH AND PRODUCING GUSTY WINDS WITH LITTLE RAIN.

TONIGHT THROUGH FRIDAY...UPPER LEVEL LOW JUST OFF THE NORTHERN CALIFORNIA COAST IS FINALLY SHOWING SIGNS OF MOVING NORTHEAST TOWARD OUR REGION THIS AFTERNOON IN RESPONSE OF A STRONG NEGATIVELY TILTED WAVE ROTATING AROUND THE LOW. WAVE HAS AN ASSOCIATED JET STREAK MOVING INTO OREGON CURRENTLY. THIS JET IS EVIDENT IN THE LATEST WATER VAPOR IMAGERY WITH ALSO SOME EXCELLENT DIFLUENCE ALOFT. CURRENT MODEL SOUNDING FOR OUR AREA HAVE US CAPPED WITH ABOUT 60 TO 100 J/KG PREVENTING ANY PREMATURE CONVECTION BEFORE THE WAVE LIFTS THIS LID AND FIRES OFF CONVECTION ACROSS THE SOUTHERN AND WESTERN PORTIONS. MODEL SOUNDINGS ALSO HAVE AROUND 1500 J/KG WITH THE TEMPERATURES IN THE LOW 90S AND DEWPOINTS IN THE LOWER 50S. ALL OF THESE INGREDIENTS POINT TO SOME STORMS HAVING HAIL AND GUSTY STRONG WINDS WITH THE OUTFLOW. CONVECTION WILL MOVE NORTH AND EAST WITH THE WAVE LATER ON BEFORE DISSIPATING AFTER 06Z TONIGHT. SURFACE COLD FRONT WILL MARCH ACROSS THE DISTRICT BETWEEN 00Z AND 04Z BRINGING LOW LEVEL COLD ADVECTION AND BREEZY CONDITIONS. WE WILL REMAIN IN THE TROF AFTER THE WAVE MOVES INTO MONTANA BY WEDNESDAY EVENING...KEEPING US SHOWERY AND COOL INTO FRIDAY. FRIDAY NIGHT THROUGH TUESDAY...LONGWAVE PATTERN EVOLUTION SHOWS A GRADUAL TRANSITION TO MORE OF A RESOLVED LONGWAVE TROF OVER THIS PERIOD WITH AN AXIS CENTERED OVER THE WASHINGTON COAST EXTENDING UPWARD THRU BRITISH COLUMBIA. THIS MAKES SENSE GIVEN HOW THE SOUTHERN BRANCH OF FLOW OFF THE PACIFIC OPENS UP WHAT IS LEFT OF A STALLED OFFSHORE CLOSED LOW/TROF AND PUTS IT IN PHASE WITH THE NORTHERN BRANCH OVER THE WEEKEND. ONE WOULD EXPECT SHORTWAVES TO BE BETTER RESOLVED AND MORE

ENHANCED TRAVELING THROUGH A LONGWAVE TROF OUR OUR REGION FOR THIS TIME PERIOD. THEREFORE WILL CONTINUE THE PREVIOUS FORECAST CALLING FOR UNSETTLED CONDITIONS THRU THIS PERIOD AND FORECAST HIGH TEMPERATURES ON THE COOL SIDE OF NORMAL FOR THIS TIME OF YEAR.

&&

.AVIATION...A COLD FRONT WILL PUSHING ACROSS ERN WA AND N IDAHO THIS EVENING WITH A CHANCE OF HIGH BASED CONVECTION WITH POSSIBLE GUSTS 40-45 MPH WITH THE THUNDERSTORMS. BEHIND THE FRONT THE WINDS WILL SHIFT TO WESTERLY WITH STRONG GUSTS AT TIMES TO 35 MPH. CONDITIONS ARE EXPECTED TO REMAIN VFR THROUGH THE PERIOD. RFOX

&&

.PRELIMINARY POINT TEMPS/POPS...

SPOKANE	58	77	49	78	48	81 /	30	20	20	10	10	10
COEUR D`ALENE	57	77	48	78	47	81 /	30	20	20	20	10	20
PULLMAN	54	76	45	74	44	78 /	30	20	20	10	10	10
LEWISTON	61	83	53	83	52	87 /	30	20	20	20	10	10
COLVILLE	53	78	45	79	45	84 /	30	20	20	30	10	20
SANDPOINT	55	77	47	78	46	81 /	30	20	20	30	10	20
KELLOGG	56	77	48	79	46	84 /	30	20	20	30	10	20
MOSES LAKE	62	82	51	82	50	86 /	30	20	10	10	0	10
WENATCHEE	64	79	54	82	54	84 /	30	20	20	10	0	10
OMAK	61	79	48	83	49	87 /	30	20	20	10	10	10

&&

.OTX WATCHES/WARNINGS/ADVISORIES...
ID...NONE.
WA...NONE.

BULLETIN - IMMEDIATE BROADCAST REQUESTED
SEVERE THUNDERSTORM WARNING
NATIONAL WEATHER SERVICE SPOKANE WA
619 PM PDT TUE JUN 21 2005

THE NATIONAL WEATHER SERVICE IN SPOKANE HAS ISSUED A SEVERE THUNDERSTORM WARNING FOR... CENTRAL SPOKANE COUNTY IN EASTERN WASHINGTON
THIS INCLUDES THE CITY OF SPOKANE

* UNTIL 645 PM PDT

* AT 607 PM PDT...NATIONAL WEATHER SERVICE DOPPLER RADAR INDICATED A SEVERE THUNDERSTORM CAPABLE OF PRODUCING DAMAGING WINDS IN EXCESS OF 60 MPH. THIS STORM WAS LOCATED 17 MILES SOUTHWEST OF SPOKANE... OR ABOUT NEAR CHENEY...AND MOVING NORTHEAST AT 35 MPH.

* THE SEVERE THUNDERSTORM WILL BE NEAR... SPOKANE BY 635 PM PDT
WIND DAMAGE WITH THIS STORM WILL OCCUR WELL AHEAD OF ANY RAIN OR LIGHTNING. DO NOT WAIT FOR THE SOUND OF THUNDER BEFORE TAKING COVER. SEEK SHELTER IMMEDIATELY INSIDE A STURDY STRUCTURE AND STAY AWAY FROM WINDOWS.

LAT...LON 4753 11778 4746 11754 4771 11722 4778 11763

APPENDIX 3

PM_{10} Hourly Data
Crown Z and Spokane Regional Health District Monitoring Stations
Spokane, Washington
(June 20–22, 2005)

Table A3.1: Hourly average PM_{10} and meteorology data for June 20, 2005. Crown Z and Spokane Regional Health District monitoring stations.

	PM_{10} ($\mu g\ m^{-3}$)		Crown Z Meteorology		
Hour	Crown Z	SRHD	Wind Dir DEG	Wind Spd MPH	Temp DEG_F
0	31	31	6	1.5	58.5
1	25	37	24	1	56.3
2	30	21	28	1.5	55.3
3	25	21	346	2.2	55.8
4	24	28	351	5.1	55.4
5	14	27	357	4.3	57.4
6	23	9	340	5.1	58.7
7	31	15	336	3.5	62.3
8	28	16	6	3.1	66.6
9	25	14	353	4.5	70.3
10	21	15	32	4.3	74.4
11	17	13	81	4.8	78
12	15	13	44	4.8	81
13	16	14	323	4.8	83.2
14	9	12	350	5.4	84.2
15	15	9	28	5.4	85.2
16	16	11	355	6.2	85.7
17	12	14	0	6.9	85.9
18	21	13	356	7.3	84.7
19	17	13	2	2.4	82.6
20	29	35	32	1.6	79.6
21	52	62	181	1.5	74.4
22	51	55	101	1.3	69.8
23	50	59	113	0.9	67.4
Max	52	62	357	7.3	85.9
Min	9	9	0	0.9	55.3
Mean	25	23	12	3.7	71.3
Hours	24	24	24	24	24

Table A3.2: Hourly average PM_{10} and meteorology data for June 21, 2005. Crown Z and Spokane Regional Health District monitoring stations.

	PM_{10} ($\mu g\ m^{-3}$)		Crown Z Meteorology		
Hour	Crown Z	SRHD	Wind Dir (DEG)	Wind Spd (MPH)	Temp (DEG_F)
0	40	48	59	0.5	65.3
1	36	35	301	1.4	64
2	31	29	336	1.5	63.5
3	23	28	21	3.5	64.7
4	16	28	348	4	63.8
5	20	33	345	3.3	64.1
6	39	13	358	4.2	66.3
7	45	19	6	4.7	69.9
8	35	23	349	4	73.1
9	29	22	358	3.8	77.7
10	29	26	45	5.4	82.7
11	26	21	57	6.7	86.3
12	25	26	74	7.5	90.4
13	30	34	162	9.4	92.3
14	29	28	191	10	92.9
15	33	36	197	11.4	92.9
16	30	44	202	12.7	90.6
17	252	202	222	16.2	87.9
18	36	40	213	8.5	86.1
19	912	496	196	15.7	79.6
20	338	406	212	5.2	77.4
21	768	802	195	11.2	75.7
22	387	364	190	13.8	72.1
23	223	155	187	17.3	68.4
Max	912	802	358	17.3	92.9
Min	16	13	6	0.5	63.5
Mean	143	123	277	7.5	76.9
Hours	24	24	24	24	24

Table A3.3: Hourly average PM_{10} and meteorology data for June 22, 2005. Crown Z and Spokane Regional Health District monitoring stations.

	PM_{10} ($\mu g\ m^{-3}$)		Crown Z Meteorology		
Hour	Crown Z	SRHD	Wind Dir (DEG)	Wind Spd (MPH)	Temp (DEG_F)
0	73	74	191	17.8	66.1
1	56	56	182	12.1	63.5
2	42	42	165	4	60.9
3	28	33	143	3.3	59.4
4	21	24	169	7.3	58.6
5	21	24	176	10.3	58.9
6	24	25	178	10.4	60.1
7	20	27	180	9.4	62.2
8	20	30	189	9.5	65.3
9	20	25	207	9.8	67.9
10	23	29	216	8.4	70.3
11	24	27	220	9.1	72.2
12	32	28	234	10.5	74.7
13	30	30	220	10.9	76.1
14	35	34	213	11.7	76.8
15	37	40	222	12	77.3
16	38	32	228	12.7	77.4
17	50	32	240	12.4	76.8
18	67	43	252	15.5	74.9
19	116	49	244	17.5	70.9
20	22	28	227	11.6	67.7
21	63	70	205	8.9	63.7
22	105	112	202	7.3	61.1
23	79	69	191	9.8	58.1
Max	116	112	252	17.8	77.4
Min	20	24	143	3.3	58.1
Mean	44	41	204	10.5	67.5
Hours	24	24	24	24	24

APPENDIX 4

National Weather Service and Remote Automated Weather System Meteorological Data
Spokane International Airport, Fairchild Air Force Base, and Cheney, Washington
(June 17-21, 2005)

Table A4.1: National Weather Service meteorological data observed at Spokane International Airport: June 17-21, 2005.

Spokane International Airport, WA (KGEG)

MNET: NWS/FAA; Elevation: 2372 ft; Latitude: 47.62139; Longitude: -117.52778

Date	Time(PST)	Temp	Dew Point	Relative Humidity	Wind Speed	Wind Gust	Wind Dir	Weather conditions	Visibility	Precipitation 1hr
		° F	° F	%	mph	mph			miles	in
06/22/05	0:55	62.1	51.1	67	15		SSW	clear	10	
06/21/05	23:55	64	50	60	16		S	clear	10	
06/21/05	22:55	66.9	46.9	49	15		SSW	clear	10	
06/21/05	21:55	70	44.1	39	14		SSW	mostly clear	7	
06/21/05	21:30	71.6	42.8	35	16		SW	haze	5	
06/21/05	20:55	73	42.1	33	12		SW	haze	2	
06/21/05	20:20	73.4	46.4	38	10		WSW	haze	2	
06/21/05	19:55	73	52	48	0			blowing dust	3	0
06/21/05	19:40	75.2	48.2	39	3	31		lt rain	1	0
06/21/05	19:20	75.2	50	41	35	49	SSW	lt rain	0.75	0
06/21/05	18:55	82	43	25	17		SSW	overcast	10	
06/21/05	17:55	82	37.9	21	14		WNW	blowing dust	10	
06/21/05	17:35	82.4	37.4	20	30	58	W	blowing dust	6	
06/21/05	17:30	84.2	37.4	19	45	77	WSW	blowing dust	1	
06/21/05	17:20	86	37.4	18	62	77	SW	haze	1	
06/21/05	16:55	84.9	48	28	16	24	SSW	mostly cloudy	10	
06/21/05	15:55	90	45	21	20		SW	mostly cloudy	10	
06/21/05	14:55	91.9	48.9	23	12		SSW	partly cloudy	10	
06/21/05	13:55	91.9	54	28	12	20	S	mostly cloudy	10	
06/21/05	12:55	91	51.1	26	7		ESE	mostly cloudy	10	
06/21/05	11:55	89.1	51.1	27	12		ENE	partly cloudy	10	
06/21/05	10:55	84.9	51.1	31	8		NNE	partly cloudy	10	
06/21/05	10:50	86	50	29				partly cloudy		
06/21/05	10:45	84.2	50	31				partly cloudy		
06/21/05	9:55	82	50	33	13		NE	mostly clear	10	
06/21/05	8:55	77	51.8	41	10		NNE	mostly clear	10	
06/21/05	7:55	72	48.9	44	12		NNE	partly cloudy	10	
06/21/05	6:55	66.9	46.9	49	10		NE	mostly clear	10	
06/21/05	5:55	64	46.9	54	10		NE	mostly clear	10	
06/21/05	4:55	62.1	46.9	58	7		ENE	mostly clear	10	
06/21/05	3:55	63	46	54	9		NE	mostly clear	10	
06/21/05	2:55	62.1	46.9	58	8		NE	mostly clear	10	
06/21/05	1:55	64	46.9	54	5		NE	mostly clear	10	
06/21/05	0:55	63	46.9	56	7		NNE	mostly clear	10	
06/20/05	23:55	68	44.6	43	6		ENE	clear	10	
06/20/05	22:55	69.1	43	39	6		NNE	mostly clear	10	
06/20/05	21:55	70	44.1	39	0			mostly clear	10	
06/20/05	20:55	73	43	34	3		NNW	mostly clear	10	
06/20/05	19:55	75.9	44.1	32	5		N	partly cloudy	10	
06/20/05	18:55	79	46	31	7		N	partly cloudy	10	
06/20/05	17:55	82.9	45	26	10		N	partly cloudy	10	
06/20/05	16:55	84.9	43	23	8		NNW	partly cloudy	10	

(KGEG continued)

Date	Time(PST)	Temp	Dew Point	Relative Humidity	Wind Speed	Wind Gust	Wind Dir	Weather conditions	Visibility	Precipitation 1hr
		° F	° F	%	mph	mph			miles	in
06/20/05	15:55	86	42.8	22	6		N	partly cloudy	10	
06/20/05	14:55	84.9	41	21	6			partly cloudy	10	
06/20/05	13:55	82.9	43	25	8		NE	partly cloudy	10	
06/20/05	12:55	82	43	25	6		ENE	partly cloudy	10	
06/20/05	11:55	80.1	42.1	26	7			mostly clear	10	
06/20/05	10:55	75.9	46	35	10		ENE	mostly clear	10	
06/20/05	9:55	73.9	48	40	14	17	NE	mostly clear	10	
06/20/05	8:55	69.1	48	47	10		ENE	mostly clear	10	
06/20/05	7:55	64	48	56	9		ENE	mostly clear	10	
06/20/05	6:55	61	46.9	60	8		NE	mostly clear	10	
06/20/05	5:55	59	46.4	63	8		NNE	mostly clear	10	
06/20/05	4:55	55.9	46	69	7		NE	mostly clear	10	
06/20/05	3:55	53.1	45	74	9		NNE	mostly clear	10	
06/20/05	2:55	53.1	46	77	7		NNE	clear	10	
06/20/05	1:55	55.9	46	69	8		ENE	clear	10	
06/20/05	0:55	55	45	69	3		N	clear	10	
06/19/05	23:55	57	43	59	0			mostly clear	10	
06/19/05	22:55	57.9	43	57	3		N	mostly clear	10	
06/19/05	21:55	61	43	52	0			mostly clear	10	
06/19/05	20:55	68	42.8	40	5		ENE	mostly clear	10	
06/19/05	19:55	68	41	37	5		NNE	mostly clear	10	
06/19/05	18:55	73	41	31	7		NNE	partly cloudy	10	
06/19/05	17:55	73.9	39	28	3			partly cloudy	10	
06/19/05	16:55	73.9	39.9	29	5		WNW	mostly clear	10	
06/19/05	15:55	75	39.9	28	6		E	partly cloudy	10	
06/19/05	14:55	73	39	29	3			partly cloudy	10	
06/19/05	13:55	72	41	33	3			partly cloudy	10	
06/19/05	12:55	73	43	34	6		ESE	partly cloudy	10	
06/19/05	11:55	70	42.1	36	3			partly cloudy	10	
06/19/05	10:55	69.1	44.1	40	3			partly cloudy	10	
06/19/05	9:55	68	44.6	43	8		SSW	mostly clear	10	
06/19/05	8:55	64	46	52	6			mostly clear	10	
06/19/05	7:55	61	45	56	7		SSE	clear	10	
06/19/05	6:55	57.9	46	65	9		ESE	mostly clear	10	
06/19/05	5:55	54	46	74	5		E	mostly clear	10	
06/19/05	4:55	52	45	77	3		SE	mostly clear	10	
06/19/05	3:55	50	44.6	82	3		SE	partly cloudy	10	
06/19/05	2:55	51.1	45	79	6		SSE	partly cloudy	10	
06/19/05	1:55	52	45	77	0			partly cloudy	10	
06/19/05	0:55	52	46	80	7		SE	mostly cloudy	10	
06/18/05	23:55	52	46	80	12		SSE	mostly cloudy	10	
06/18/05	22:55	53.1	46	77	10		SSE	mostly cloudy	10	
06/18/05	21:55	55	46	72	13		S	partly cloudy	10	
06/18/05	20:55	57	46	67	10		S	partly cloudy	10	
06/18/05	19:55	60.1	45	57	13		S	partly cloudy	10	
06/18/05	18:55	63	43	48	15		S	partly cloudy	10	

(KGEG continued)

Date	Time(PST)	Temp	Dew Point	Relative Humidity	Wind Speed	Wind Gust	Wind Dir	Weather conditions	Visibility	Precipitation 1hr
		° F	° F	%	mph	mph			miles	in
06/18/05	17:55	64.9	43	45	18		SSW	partly cloudy	10	
06/18/05	16:55	66.9	43	42	21	29	S	mostly cloudy	10	
06/18/05	15:55	70	39	32	9		WSW	mostly cloudy	10	0
06/18/05	14:55	68	42.8	40	9		SW	mostly cloudy	10	
06/18/05	14:15	66.9	41	39	6		SW	partly cloudy	10	0
06/18/05	13:55	68	42.8	40	8		W	mostly cloudy	10	0
06/18/05	12:55	64.9	43	45	21		SW	mostly cloudy	10	
06/18/05	11:55	68	44.6	43	13		WSW	mostly cloudy	10	
06/18/05	10:55	64.9	43	45	9		SW	mostly cloudy	10	
06/18/05	9:55	62.1	44.1	52	10		SSW	mostly cloudy	10	
06/18/05	8:55	61	45	56	14	20	SW	mostly cloudy	10	
06/18/05	7:55	57	45	64	12		SW	mostly cloudy	10	
06/18/05	6:55	53.1	45	74	8		SSW	mostly cloudy	10	
06/18/05	5:55	50	44.6	82	14		S	mostly cloudy	10	
06/18/05	4:55	50	44.6	82	8		SSE	mostly cloudy	10	
06/18/05	3:55	48.9	45	86	8		SSE	mostly cloudy	10	
06/18/05	2:55	48.9	45	86	9		SSE	mostly cloudy	10	
06/18/05	1:55	46.9	44.1	90	9		SSE	partly cloudy	10	
06/18/05	0:55	48	45	89	10		SSE	partly cloudy	10	
06/17/05	23:55	48	45	89	6		SE	partly cloudy	10	
06/17/05	22:55	50	46.4	87	8		SE	partly cloudy	10	
06/17/05	21:55	50	46.4	87	8		SE	partly cloudy	10	
06/17/05	20:55	52	46	80	12		SSE	partly cloudy	10	
06/17/05	19:55	53.1	46.9	80	10		SE	partly cloudy	10	
06/17/05	18:55	57	46.9	69	10		SE	mostly cloudy	10	
06/17/05	17:55	57	46	67	9		SSE	mostly cloudy	10	
06/17/05	16:55	57.9	46.9	67	13		SSE	mostly cloudy	10	
06/17/05	15:55	61	48	62	14		SE	overcast	10	
06/17/05	14:55	60.1	46	60	5		S	mostly cloudy	10	
06/17/05	13:55	57.9	48.9	72	8		SSE	mostly cloudy	10	0
06/17/05	12:55	55	48.9	80	7		SSW	lt rain	10	0
06/17/05	11:55	55.9	50	80	12		SW	lt rain	10	0
06/17/05	10:55	55.9	48	75	8		SW	overcast	10	0
06/17/05	9:55	55.9	51.1	84	7		S	overcast	10	
06/17/05	8:55	54	50	86	8		SSW	overcast	10	0.01
06/17/05	7:55	54	51.1	90	8		SSW	overcast	10	0.01
06/17/05	6:55	53.1	50	89	7		WSW	lt rain	10	0.01
06/17/05	5:55	55	48.9	80	13		SSW	lt rain	10	0
06/17/05	4:55	55.9	46	69	7		S	overcast	10	
06/17/05	3:55	57	46.9	69	8		SE	overcast	10	0
06/17/05	2:55	57	48	72	5		WSW	overcast	10	
06/17/05	1:55	57.9	46.9	67	6		SSW	overcast	10	
06/17/05	0:55	60.1	45	57	3		E	OK	10	

Retrieved from http://www.met.utah.edu/cgibin/droman/meso_base_past.cgi?stn=KGEG&unit=0 &hours=24&year1=2005&month1=6&day1=22&hour1=0 &time=GMT (12 Dec 2005).

Table A4.2: National Weather Service meteorological data observed at Fairchild Air Force Base: June 17-21, 2005.

Fairchild Air Force Base, WA (KSKA)

Elev: 2461 ft; Latitude: 47.62; Longitude: -117.65

Date	Time(PST)	Temp	Dew Point	Relative Humidity	Wind Speed	Wind Gust	Wind Direction	Weather conditions	Visibility	Precipitation 3hr
		° F	° F	%	mph	mph			miles	in
06/22/05	0:55	60.8	48.2	63	14		E	clear	7	
06/21/05	23:55	62.6	46.4	55	9		S	clear	7	
06/21/05	22:55	64.4	44.6	49	8		SSW	clear	7	
06/21/05	21:55	68	41	37	8		S	partly cloudy	7	
06/21/05	20:55	71.6	41	33	9		SSW	haze	1	
06/21/05	19:55	77	42.8	30	12		SW	blowing dust	0.5	
06/21/05	19:40	77	41	28	12	29	W	blowing dust	0.25	
06/21/05	19:20	78.8	41	26	35	41	SSW	blowing dust	0.5	
06/21/05	18:55	80.6	46.4	30	18	33	S	lt rain thunder shwr	3	0
06/21/05	17:55	82.4	39.2	22	7		S	lt rain shwr	7	
06/21/05	17:25	82.4	37.4	20	8	56	N	lt rain shwr	7	
06/21/05	16:55	82.4	46.4	28	10		S	mostly cloudy	7	
06/21/05	15:55	86	46.4	25	15	23	S	mostly cloudy	7	
06/21/05	14:55	91.4	50	24	10		SSE	mostly clear	7	
06/21/05	13:55	91.4	53.6	28	9		SE	mostly cloudy	7	
06/21/05	12:55	91.4	51.8	26	9		NE	partly cloudy	7	
06/21/05	11:55	87.8	51.8	29	12		NNE	partly cloudy	7	
06/21/05	10:55	84.2	50	31	12		N	mostly clear	7	
06/21/05	9:55	80.6	50	34	14		N	mostly clear	7	
06/21/05	8:55	73.4	46.4	38	15		NNE	mostly clear	7	
06/21/05	7:55	71.6	46.4	41	13		NNE	mostly clear	7	
06/21/05	6:55	68	46.4	46	17		NE	mostly clear	7	
06/21/05	5:55	64.4	44.6	49	10		NE	clear	7	
06/21/05	4:55	60.8	42.8	51	7		NNE	mostly clear	7	
06/21/05	3:55	62.6	42.8	48	7		NE	mostly clear	7	
06/21/05	2:55	64.4	42.8	45	6		NNE	mostly clear	7	
06/21/05	1:55	64.4	41	42	5		ENE	clear	7	
06/21/05	0:55	66.2	41	40	2		NNE	clear	7	
06/20/05	23:55	68	39.2	35	7		NNE	clear	7	
06/20/05	22:55	71.6	39.2	31	6		NNE	mostly clear	7	
06/20/05	21:55	73.4	37.4	27	0			mostly clear	7	
06/20/05	20:55	73.4	39.2	29	6		NW	mostly clear	7	
06/20/05	19:55	77	41	28	6		N	mostly clear	7	
06/20/05	18:55	78.8	41	26	7		N	partly cloudy	7	
06/20/05	17:55	82.4	41	23	7		N	partly cloudy	7	
06/20/05	16:55	82.4	41	23	8		NNW	partly cloudy	7	
06/20/05	15:55	84.2	37.4	19	0			partly cloudy	7	
06/20/05	14:55	82.4	39.2	22	3		ESE	mostly clear	7	
06/20/05	13:55	82.4	41	23	9		ENE	mostly clear	7	
06/20/05	12:55	80.6	42.8	26	2			mostly clear	7	

(KSKA continued)

Date	Time(PST)	Temp	Dew Point	Relative Humidity	Wind Speed	Wind Gust	Wind Direction	Weather conditions	Visibility	Precipitation 3hr
		° F	° F	%	mph	mph			miles	in
06/20/05	11:55	78.8	42.8	28	12		ENE	mostly clear	7	
06/20/05	10:55	77	44.6	32	6		NE	mostly clear	7	
06/20/05	9:55	73.4	46.4	38	14		NNE	mostly clear	7	
06/20/05	8:55	69.8	44.6	40	13		NE	mostly clear	7	
06/20/05	7:55	64.4	44.6	49	14		NE	mostly clear	7	
06/20/05	6:55	60.8	41	48	8		NE	mostly clear	7	
06/20/05	5:55	57.2	44.6	63	8		NE	mostly clear	7	
06/20/05	4:55	55.4	44.6	67	7		N	mostly clear	7	
06/20/05	3:55	53.6	42.8	67	5		NNE	mostly clear	7	
06/20/05	2:55	55.4	42.8	62	5		NNE	clear	7	
06/20/05	1:55	55.4	39.2	54	2		NE	clear	7	
06/20/05	0:55	59	39.2	48	5		NNE	clear	7	
06/19/05	23:55	59	41	51	1		NNE	mostly clear	7	
06/19/05	22:55	59	39.2	48	1		S	mostly clear	7	
06/19/05	21:55	66.2	39.2	37	5		N	mostly clear	7	
06/19/05	20:55	68	39.2	35	3		N	mostly clear	7	
06/19/05	19:55	68	39.2	35	5		N	mostly clear	7	
06/19/05	18:55	71.6	37.4	29	5		N	mostly clear	7	
06/19/05	17:55	73.4	39.2	29	1			mostly clear	7	
06/19/05	16:55	75.2	41	29	2			partly cloudy	7	
06/19/05	15:55	73.4	37.4	27	0			partly cloudy	7	
06/19/05	14:55	73.4	41	31	3		NNW	partly cloudy	7	
06/19/05	13:55	73.4	41	31	2			partly cloudy	7	
06/19/05	12:55	71.6	39.2	31	5			partly cloudy	7	
06/19/05	11:55	73.4	42.8	33	3			partly cloudy	7	
06/19/05	10:55	69.8	44.6	40	7			partly cloudy	7	
06/19/05	9:55	68	42.8	40	2			mostly clear	7	
06/19/05	8:55	64.4	44.6	49	6		SE	mostly clear	7	
06/19/05	7:55	62.6	44.6	52	8		SSE	clear	7	
06/19/05	6:55	57.2	42.8	59	7		E	clear	7	
06/19/05	5:55	53.6	44.6	71	3			clear	7	
06/19/05	4:55	48.2	42.8	81	3			clear	7	
06/19/05	3:55	48.2	42.8	81	1			mostly clear	7	
06/19/05	2:55	48.2	42.8	81	0			mostly clear	7	
06/19/05	1:55	48.2	41	76	0			mostly clear	7	
06/19/05	0:55	50	42.8	76	3		E	partly cloudy	7	
06/18/05	23:55	50	44.6	82	3			partly cloudy	7	
06/18/05	22:55	51.8	44.6	76	7		SSE	partly cloudy	7	
06/18/05	21:55	53.6	42.8	67	6		SSE	mostly clear	7	
06/18/05	20:55	55.4	42.8	62	6		SSE	mostly clear	7	
06/18/05	19:55	57.2	42.8	59	7		SSE	mostly clear	7	
06/18/05	18:55	60.8	41	48	10		SSE	mostly clear	7	0
06/18/05	17:55	64.4	41	42	10		S	mostly cloudy	7	
06/18/05	16:55	68	41	37	16	23	S	partly cloudy	7	
06/18/05	15:55	68	39.2	35	13		WSW	partly cloudy	7	
06/18/05	15:25	69.8	41	35	7		W	mostly cloudy	7	

(KSKA continued)

Date	Time(PST)	Temp	Dew Point	Relative Humidity	Wind Speed	Wind Gust	Wind Direction	Weather conditions	Visibility	Precipitation 3hr
		° F	° F	%	mph	mph			miles	in
06/18/05	14:55	68	42.8	40	3			lt rain shwr	7	
06/18/05	13:55	68	42.8	40	5			lt rain shwr	7	
06/18/05	13:10	62.6	42.8	48	9		WSW	lt rain shwr	7	
06/18/05	12:55	62.6	42.8	48	8		SSW	mostly cloudy	7	0
06/18/05	12:40	64.4	42.8	45	7		WSW	lt rain shwr	7	
06/18/05	11:55	62.6	42.8	48	7			mostly cloudy	7	
06/18/05	11:05	64.4	44.6	49	9		SSW	mostly cloudy	7	
06/18/05	10:55	62.6	42.8	48	9		SSW	lt rain shwr	7	
06/18/05	9:55	62.6	42.8	48	10		SSW	mostly cloudy	7	
06/18/05	8:55	60.8	42.8	51	8		S	partly cloudy	7	
06/18/05	7:55	59	44.6	59	7		S	partly cloudy	7	
06/18/05	6:55	51.8	44.6	76	8		S	mostly cloudy	7	
06/18/05	5:55	50	44.6	82	9		S	mostly cloudy	7	
06/18/05	4:55	50	42.8	76	5		SE	mostly cloudy	7	
06/18/05	3:55	48.2	42.8	81	5		SSE	mostly cloudy	7	
06/18/05	2:55	50	42.8	76	3		SE	mostly cloudy	7	
06/18/05	1:55	48.2	44.6	87	3		SSE	mostly cloudy	7	
06/18/05	0:55	48.2	44.6	87	5		SSE	partly cloudy	7	
06/17/05	23:55	46.4	42.8	87	2			mostly cloudy	7	
06/17/05	22:55	48.2	42.8	81	0			mostly clear	7	
06/17/05	21:55	48.2	44.6	87	3		SE	mostly clear	7	
06/17/05	20:55	48.2	44.6	87	5		SE	partly cloudy	7	
06/17/05	19:55	53.6	42.8	67	5		SSE	mostly cloudy	7	
06/17/05	18:55	59	42.8	55	8		SE	mostly cloudy	7	
06/17/05	17:55	59	41	51	6		SE	mostly cloudy	7	
06/17/05	16:55	59	44.6	59	9		SE	mostly cloudy	7	
06/17/05	15:55	62.6	42.8	48	9		S	mostly cloudy	7	
06/17/05	14:55	62.6	42.8	48	1			overcast	7	
06/17/05	13:55	60.8	41	48	6		S	overcast	7	
06/17/05	12:55	57.2	50	77	8		S	lt rain shwr	7	0
06/17/05	12:25	57.2	48.2	72	8		S	lt rain shwr	7	
06/17/05	11:55	55.4	46.4	72	6			lt rain shwr	7	
06/17/05	10:55	55.4	48.2	77	3			overcast	7	
06/17/05	9:55	55.4	50	82	7		SSW	mostly cloudy	7	
06/17/05	9:20	55.4	50	82	7		S	overcast	7	
06/17/05	8:55	53.6	48.2	82	3			lt rain shwr	7	
06/17/05	7:55	53.6	50	88	5		SSW	lt rain shwr	7	
06/17/05	6:55	51.8	50	94	3		S	lt rain shwr	7	0
06/17/05	5:55	53.6	48.2	82	8		SSW	lt rain shwr	7	
06/17/05	4:55	55.4	44.6	67	3		SSE	overcast	7	
06/17/05	3:55	55.4	44.6	67	3			overcast	7	
06/17/05	2:55	55.4	44.6	67	2		W	overcast	7	
06/17/05	1:55	59	42.8	55	0			overcast	7	
06/17/05	0:55	57.2	42.8	59	3	ENE	OK	7		

Retrieved from http://www.met.utah.edu/cgibin/droman/meso_base_past.cgi?stn=KSKA&unit=0 &hours=24&year1=2005&month1=6&day1=22&hour1=0 &time=GMT (12 Dec 2005).

Table A4.3: RAWS meteorological data observed at Cheney, Washington: June 17-21, 2005.

Cheney, WA (TWRW1)

MNET: RAWS; Elevation: 2230 ft; Latitude: 47.4175; Longitude: -117.5283

Date	Time(PST)	Temp	Dew Point	Relative Humidity	Wind Speed	Wind Gust	Wind Direction	Precipitation 1hr
		° F	° F	%	mph	mph		in
06/22/05	0:25	60	50.6	71	7	17	SSW	
06/21/05	23:25	62	47.5	59	8	15	SSW	
06/21/05	22:25	64	47.5	55	7	13	SW	
06/21/05	21:25	60	57.4	91	5	11	WSW	
06/21/05	20:25	60	54.1	81	2	6	E	
06/21/05	19:25	65	36.7	35	8	56	NNE	0.03
06/21/05	18:25	80	42	26	4	21	S	
06/21/05	17:25	84	42.2	23	18	41	W	
06/21/05	16:25	85	43	23	10	21	SW	
06/21/05	15:25	89	44	21	13	24	SSW	
06/21/05	14:25	92	52.2	26	12	21	SW	
06/21/05	13:25	91	58.7	34	7	15	SSW	
06/21/05	12:25	91	56.1	31	6	15	ESE	
06/21/05	11:25	87	54.4	33	8	15	NNE	
06/21/05	10:25	85	54.2	35	9	15	NE	
06/21/05	9:25	81	53	38	8	14	NNE	
06/21/05	8:25	78	52.4	41	6	14	NNE	
06/21/05	7:25	73	52.7	49	9	13	NE	
06/21/05	6:25	67	50.8	56	7	9	NE	
06/21/05	5:25	62	52.1	70	5	8	NNE	
06/21/05	4:25	52	51.5	98	5	7	NNE	
06/21/05	3:25	46	45.5	98	1	4	NW	
06/21/05	2:25	47	45.6	95	3	6	NE	
06/21/05	1:25	47	46.5	98	3	5	NE	
06/21/05	0:25	48	46.6	95	3	4	ENE	
06/20/05	23:25	50	48.1	93	2	5	E	
06/20/05	22:25	52	48.9	89	2	4	E	
06/20/05	21:25	55	49.9	83	2	4	ESE	
06/20/05	19:25	73	39.7	30	1	7	N	
06/20/05	18:25	83	40.2	22	6	11	NE	
06/20/05	17:25	85	40.7	21	7	11	NNE	
06/20/05	16:25	87	41	20	4	12	NNE	
06/20/05	15:25	87	42.3	21	5	14	NNW	
06/20/05	14:25	85	44.1	24	7	14	NE	
06/20/05	13:25	85	46.2	26	4	12	NNW	
06/20/05	12:25	82	47.5	30	7	12	NE	
06/20/05	11:25	80	50.6	36	5	12	N	
06/20/05	10:25	77	50.8	40	7	14	NE	
06/20/05	9:25	74	50.1	43	7	14	NE	
06/20/05	8:25	71	50.9	49	6	12	NNE	
06/20/05	7:25	67	50.8	56	7	11	NE	

(TWRW1 continued)

Date	Time(PST)	Temp	Dew Point	Relative Humidity	Wind Speed	Wind Gust	Wind Direction	Precipitation 1hr
		° F	° F	%	mph	mph		in
06/20/05	6:25	60	49.4	68	8	11	NE	
06/20/05	5:25	53	53	100	3	7	NE	
06/20/05	4:25	39	39	100	2	5	E	
06/20/05	3:25	37	37	100	2	4	NE	
06/20/05	2:25	38	38	100	1	4	E	
06/20/05	1:25	39	39	100	2	4	NE	
06/20/05	0:25	41	40.7	99	1	4	W	
06/19/05	23:25	42	40.9	96	3	4	ESE	
06/19/05	22:25	44	41.8	92	2	5	SE	
06/19/05	21:25	48	43.4	84	2	3	SE	
06/19/05	19:25	65	35.9	34	2	8	NNE	
06/19/05	18:25	74	38.8	28	4	8	NE	
06/19/05	17:25	74	46.1	37	4	6	NE	
06/19/05	16:25	77	41.4	28	4	13	NE	
06/19/05	15:25	76	44	32	3	8	W	
06/19/05	14:25	75	42.3	31	6	11	ENE	
06/19/05	13:25	76	43.2	31	4	14	W	
06/19/05	12:25	74	45.3	36	5	12	SW	
06/19/05	11:25	73	46.6	39	6	11	E	
06/19/05	10:25	70	46.5	43	6	14	E	
06/19/05	9:25	69	48.5	48	6	12	SE	
06/19/05	8:25	66	49.8	56	5	11	SE	
06/19/05	7:25	62	48.8	62	7	11	SE	
06/19/05	6:25	59	50	72	5	9	ESE	
06/19/05	5:25	51	50.5	98	0	2	E	
06/19/05	4:25	37	37	100	0	4	SSW	
06/19/05	3:25	37	37	100	1	4	ENE	
06/19/05	2:25	40	38.7	95	0	5	N	
06/19/05	1:25	43	40	89	2	5	ESE	
06/19/05	0:25	47	44.5	91	1	6	ESE	
06/18/05	23:25	48	46.6	95	1	6	SSE	
06/18/05	22:25	45	42	89	2	6	ESE	
06/18/05	21:25	49	40.4	72	1	6	ENE	
06/18/05	19:25	59	42.9	55	6	15	S	
06/18/05	18:25	63	41.3	45	10	21	S	
06/18/05	17:25	66	45.7	48	13	21	SSW	
06/18/05	16:25	64	31.9	30	15	27	S	
06/18/05	15:25	71	38.8	31	7	17	SSW	
06/18/05	14:25	69	37.9	32	10	19	SW	
06/18/05	13:25	69	40.9	36	7	15	SW	
06/18/05	12:25	70	42.5	37	10	18	SW	
06/18/05	11:25	66	42.2	42	8	16	SSW	
06/18/05	10:25	67	47.2	49	9	19	WSW	
06/18/05	9:25	63	45.1	52	10	16	SSW	
06/18/05	8:25	61	45.7	57	10	17	SW	
06/18/05	7:25	58	46.7	66	10	15	SSW	

(TWRW1 continued)

Date	Time(PST)	Temp	Dew Point	Relative Humidity	Wind Speed	Wind Gust	Wind Direction	Precipitation 1hr
		° F	° F	%	mph	mph		in
06/18/05	6:25	53	47.7	82	8	12	SSW	
06/18/05	5:25	49	47.6	95	3	5	SSE	
06/18/05	4:25	46	44.9	96	4	6	SE	
06/18/05	3:25	45	44.5	98	3	6	ESE	
06/18/05	2:25	44	43.2	97	2	4	WSW	
06/18/05	1:25	44	44	100	3	7	NE	
06/18/05	0:25	42	42	100	4	7	SE	
06/17/05	23:25	40	39.5	98	1	4	N	
06/17/05	22:25	42	41.2	97	2	4	NNE	
06/17/05	21:25	46	43.2	90	3	8	E	
06/17/05	19:25	53	41.6	65	6	12	E	
06/17/05	18:25	59	43.8	57	9	18	SE	
06/17/05	17:25	58	47.5	68	6	14	ESE	
06/17/05	16:25	57	48.1	72	10	17	ESE	
06/17/05	15:25	60	49.8	69	9	16	SE	
06/17/05	14:25	62	49.3	63	8	13	S	
06/17/05	13:25	58	50.8	77	6	12	S	
06/17/05	12:25	54	47.6	79	5	13	S	0.03
06/17/05	11:25	56	48.5	76	8	11	SSW	
06/17/05	10:25	56	50.9	83	6	11	SW	
06/17/05	9:25	55	51.2	87	6	10	SSW	
06/17/05	8:25	53	49.8	89	4	13	SW	0.01
06/17/05	7:25	53	51.6	95	6	9	SSW	0.01
06/17/05	6:25	53	50.4	91	2	8	ESE	0.03
06/17/05	5:25	53	47.3	81	4	7	WSW	0.01
06/17/05	4:25	54	46.6	76	2	6	SSW	
06/17/05	3:25	52	48.9	89	3	6	SE	
06/17/05	2:25	53	47	80	2	3	SSE	
06/17/05	1:25	54	47.3	78	1	6	SSW	
06/17/05	0:25	54	47	77	2	4	ESE	

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APPENDIX 5

National Climatic Data Center Event Record Details
of the June 21, 2005 Thunderstorms and High Winds

The following National Climatic Data Center (NCDC) report documents property damage and the occurrence of blowing dust caused by severe thunderstorm wind gusts in the Spokane, Washington area on June 21, 2005. See http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~storms.

Event Record Details

Event:Tstm Wind
Begin Date:21 Jun 2005, 07:20:00 PM PST
Begin Location:Spokane
Begin LAT/LON:47°40'N / 117°25'W
End Date:21 Jun 2005, 08:15:00 PM PST
End Location:Elk
End LAT/LON:48°01'N / 117°17'W
Magnitude:65
Fatalities:0
Injuries:12
Property Damage:$ 0.0
Crop Damage:$ 0.0
State:Washington
Map of Counties
County:Spokane

Description:
On the evening of the 21st, two severe thunderstorm gust fronts moved across eastern Washington. The first one hit between the hours of approximately 5pm PST to around 7pm from northern Spokane County to eastern Stevens and western Pend Orielle Counties. Widespread power outages, downed trees and structure damage was caused by the severe thunderstorm wind gusts. In Spokane County, the Spokane International Airport measured sustained winds at 62 mph with a gust to 77 mph. This was the highest wind gust measured on record. There was wind damage to hangers and other structures at the Fairchild Air Force Base. There was widespread structure damage and power outages to the town of Airway Heights. In Pend Orielle County, numerous power outages and downed trees were reported. A barn and a truck were damaged at the Fairgrounds of Newport. The second severe thunderstorm gust front occurred between the hours of 630pm and 815 pm PST. The severe winds first started across Adams and Whitman Counties and moved north to eventually affect southern Pend Orielle and Stevens Counties. In Adams County, the towns of Ritzville and Ralston had downed trees and many power outages with visibilities reduced to a half a mile in blowing dust. In Whitman County, an official weather sensor measured a wind gust to 61 mph. Widespread fallen trees, power outages, fire starts and structure damage were experienced near the towns of Rosalia and St. John. In northeastern Lincoln County, the town of Davenport was especially hard hit. Widespread power outages, fallen trees and some structure damage occurred. In Spokane County, at least 30,000 homes were without power. Many homes and businesses were damaged in the Spokane metro area. There were at least a dozen injuries due to the severe wind. The wind also caused at least a dozen fire starts visibility was reduced to a quarter of a mile at times across Spokane County. Southern Stevens and Pend Orielle Counties were the last to be hit wind gust. Many homes were without power along with some damage to structures. there were a few fire starts as well in both counties.

APPENDIX 6

News Media Account of the June 21, 2005 Thunderstorm

krem•com
2 Coverage You Can Count On

Thunderstorms rip through Inland Northwest

12:18 AM PDT on Wednesday, June 22, 2005

Rob Kauder / KREM.com

SPOKANE - Two huge thunderstorms ripped through Spokane County just hours apart Tuesday night causing widespread damage throughout the region. Thousands throughout the region were without power because of trees knocked down by the high winds onto houses and power lines.

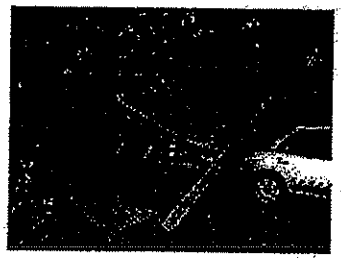
A storm warning, issued by the National Weather Service at 6:19 p.m., predicted a severe thunderstorm 17 miles southwest of Spokane would hit central Spokane County before 7 p.m. with winds gusting in excess of 60 m.p.h.

The storm hit with winds gusting in excess of 77 m.p.h. in Spokane down to 49 m.p.h. in Coeur d'Alene, uprooting trees and downing power lines from Cheney in the west to Post Falls, Idaho in the east. Because of multiple calls of downed power lines, emergency responders were forced to close throughout Spokane County, according to Cpl. Dave Reagan of the Spokane County Sheriff's Office.

As the storm moved from west to east, power lines first dropped in the Four Lakes and Silver Lakes area. Spokane County Sheriff deputies received reports of trees and power lines being knocked down. Sheriff's dispatchers received 16 reports of trees down on roadways or structures, and 34 reports of power lines that were downed or arcing in the first hour-and-a-half of the storm.

The storm took many people in Airway Heights by surprise saying that the storm came and went in a matter of minutes. High winds hit Airway Heights twice, first around 6 p.m. and again around 8 p.m. County crews went from one road to another chopping up downed trees. Residents say the winds took fences, sent patio furniture flying and almost picked one woman off her feet.

Out at the Spokane International Airport strong winds blew the roof off the Dollar Rent-a-Car into the parking lot. No major damage to any of the vehicles in the parking lot was reported.



Courtesy of Brian Swelha

Video Clip

KREM 2 News Team coverage at 11

WB22 News @ 10 coverage of the storm

More ... Custom Video ...
Weather

Storm Tracker 2 Weather

Live Doppler Radar

Weather Pix

Submit your pictures of storm damage
Home Video

If you shot home video of damage from the windstorm and would like to share it, click here to e-mail us

This carport blew down on a pick up and a car at 11302 E Maxwell in the Spokane Valley.

The Sheriff's Special Incident Response Teams were mobilized to assist in blocking off roads where there were downed power lines and felled trees.

As the weather front moved eastward more power lines were knocked down, throwing tens of thousands of homes into the dark across the Inland Northwest.

Avista was reporting that 18,000 customers were without power as of 9:45 p.m. Tuesday with about 1,600 of those in Spokane County. Inland Power and Light reported about 6,000 outages with approximately 2,500 of those homes in South Stevens County. Kootenai Electric reported they had less than 1,000 customers without power.

Power outages were reported from Pullman in the south to Colville in the north and from Davenport in the west to Post Falls.

One power crew operating in the Airway Heights area said they would be working well into the night to get the damage repaired.

Winds in the Seven Mile area knocked down a number of pine trees and a downed power line sparked a brush fire near Seven Mile and Pine Bluff Road. Firefighters say flames rose up to five feet at one point and burned nearly one half of an acre before they were able to contain it.

The storm didn't hit the metropolitan Spokane area until around 8 p.m. The force of the wind kicked up dust for miles making it nearly impossible for drivers to see within two yards of their vehicles. Several thousand power outages in metropolitan Spokane were reported on the South Hill and in Central and North Central Spokane.

In North Idaho, viewers reported that the windstorm tore down canvas boat covers along the Spokane River in Post Falls and tossed debris including tree limbs, boat covers and a trampoline into the river.

Todd Lericos, a meteorologist with the National Weather Service in Spokane, says the winds hit across virtually all of Eastern Washington, as a pair of so-called "gust fronts" moved across the region, generated by a complex of thunderstorms moving north from the Blue Mountains in southeast Washington.

As the fronts moved off the mountains and into the lower elevations of the Palouse country, they produced the strong winds that swept north.

The gust of 77 m.p.h. recorded at Spokane International Airport is the highest recorded since officials began measuring wind speeds back in the 1880s.

The previous record was 67 miles per hour recorded on January 9, 1972.

The Associated Press contributed to this report

Online at: http://www.krem.com/topstories/stories/krem2_062105_thunderstorm.32585aa6.html

APPENDIX 7

STATUS REPORT
2004 Best Available Control Measures for Columbia Plateau Agriculture
January, 2005

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. Table A7.1 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, Table A7.2 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 TriCity 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.

Table A7.1: 2004 BACM status of Columbia Plateau priority counties. The table reflects participation in the Conservation Reserve Program (CRP) and use of conservation tillage practices. Source: Conservation Technology Information Center, Core 4 Program.

County		BACM (component 1)	BACM (component 2) - ADDITIONAL CONSERVATION MEASURES APPLIED				BACM total (components 1 & 2)	
Adams		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	216,362	216,362					216,362	100.00%
Fallow acres	232,154		9,288	0	44,352	155,232	208,872	89.97%
Planted acres	368,264		23,985	0	62,419	197,193	283,597	77.01%
Total farmable acres	816,780	**26%**	33,273	0	106,771	352,425	708,831	**86.78%**
Benton		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	98,885	98,885					98,885	100.00%
Fallow acres	131,488		3,550	0	0	67,979	71,529	54.40%
Total planted acres	232,100		2,488	0	2,212	124,202	128,902	55.54%
Total farmable acres	462,473	**21%**	6,038	0	2,212	192,181	299,316	**64.72%**
Douglas		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	189,094	189,094					189,094	100.00%
Fallow acres	245,000		0	0	15,000	100,000	115,000	46.94%
Total planted acres	183,601		5,200	0	74,700	64,830	144,730	78.83%
Total farmable acres	617,695	**31%**	5,200	0	89,700	164,830	448,824	**72.66%**
Franklin		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	116,048	116,048					116,048	100.00%
Fallow acres	60,000		0	0	0	56,000	56,000	93.33%
Total planted acres	240,330		0	0	8,000	96,300	104,300	43.40%
Total farmable acres	416,378	**28%**	0	0	8,000	152,300	276,348	**66.37%**
Grant		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	62,061	62,061					62,061	100.00%
Fallow acres	102,000		1,020	0	24,480	60,180	85,680	84.00%
Total planted acres	342,700		5,310	0	60,540	101,090	166,940	48.71%
Total farmable acres	506,761	**12%**	6,330	0	85,020	161,270	314,681	**62.10%**
Lincoln		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	112,904	112,904					112,904	100.00%
Fallow acres	273,792		27,379	0	95,827	136,896	260,102	95.00%
Total planted acres	450,061		43,715	0	160,912	213,540	418,167	92.91%
Total farmable acres	836,757	**13%**	71,094	0	256,739	350,436	791,173	**94.55%**
Walla Walla		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	160,263	160,263					160,263	100.00%
Fallow acres	112,624		50,500	0	13,500	18,624	82,624	73.36%
Total planted acres	262,831		43,804	0	86,275	78,981	209,060	79.54%
Total farmable acres	535,718	**30%**	94,304	0	99,775	97,605	451,947	**84.36%**
SUMMARY		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
Total farmable acres	4,192,562	955,617	216,239	0	648,217	1,471,047	3,291,120	
		23%	**5%**	**0%**	**15%**	**35%**		**78%**

Table A7.2: 2004 BACM status of all Columbia Plateau counties. The table reflects participation in the Conservation Reserve Program (CRP) and use of conservation tillage practices. Source: Conservation Technology Information Center, Core 4 Program.

County		BACM (component 1)	BACM (component 2) - ADDITIONAL CONSERVATION MEASURES APPLIED				BACM total (components 1 & 2)	
		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
Adams								
HEL withdrawn from production	216,362	216,362					216,362	100.00 %
Fallow acres	232,154		9,288	0	44,352	155,232	208,872	89.97%
Planted acres	368,264		23,985	0	62,419	197,193	283,597	77.01%
Total farmable acres	816,780	**26%**	33,273	0	106,771	352,425	708,831	**86.78%**
Asotin		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	29,720	29,720					29,720	100.00 %
Fallow acres	18,561		5,000	0	3,000	10,561	18,561	100.00 %
Planted acres	28,763		9,133	0	5,160	14,470	28,763	100.00 %
Total farmable acres	77,044	**39%**	14,133	0	8,160	25,031	77,044	**100.00 %**
Benton		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	98,885	98,885					98,885	100.00 %
Fallow acres	131,488		3,550	0	0	67,979	71,529	54.40%
Total planted acres	232,100		2,488	0	2,212	124,202	128,902	55.54%
Total farmable acres	462,473	**21%**	6,038	0	2,212	192,181	299,316	**64.72%**
Chelan		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	1,373	1,373					1,373	100.00 %
Fallow acres	300		0	0	0	300	300	100.00 %
Total planted acres	390		0	0	0	390	390	100.00 %
Total farmable acres	2,063	**67%**	0	0	0	690	2,063	**100.00 %**
Columbia		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	47,329	47,329					47,329	100.00 %
Fallow acres	24,764		9,906	0	4,952	0	14,858	60.00%
Total planted acres	115,313		77,021	0	0	16,492	93,513	81.09%
Total farmable acres	187,406	**25%**	86,927	0	4,952	16,492	155,700	**83.08%**
Douglas		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	189,094	189,094					189,094	100.00 %
Fallow acres	245,000		0	0	15,000	100,000	115,000	46.94%

Total planted acres	183,601		5,200	0	74,700	64,830	144,730	78.83%
Total farmable acres	617,695	**31%**	5,200	0	89,700	164,830	448,824	**72.66%**

Ferry

		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	1,091	1,091					1,091	100.00 %
Fallow acres	500		0	0	0	200	200	40.00%
Total planted acres	3,800		0	0	0	1,150	1,150	30.26%
Total farmable acres	5,391	**20%**	0	0	0	1,350	2,441	**45.28%**

Table A7.2 continued

County	BACM (component 1)	BACM (component 2) - ADDITIONAL CONSERVATION MEASURES APPLIED				BACM total (components 1 & 2)	

Franklin

		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	116,048	116,048					116,048	100.00 %
Fallow acres	60,000		0	0	0	56,000	56,000	93.33%
Total planted acres	240,330		0	0	8,000	96,300	104,300	43.40%
Total farmable acres	416,378	**28%**	0	0	8,000	152,300	276,348	**66.37%**

Garfield

		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	52,914	52,914					52,914	100.00 %
Fallow acres	48,869		17,871	0	23,668	7,330	48,869	100.00 %
Total planted acres	96,806		30,530	0	37,033	29,243	96,806	100.00 %
Total farmable acres	198,589	**27%**	48,401	0	60,701	36,573	198,589	**100.00 %**

Grant

		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	62,061	62,061					62,061	100.00 %
Fallow acres	102,000		1,020	0	24,480	60,180	85,680	84.00%
Total planted acres	342,700		5,310	0	60,540	101,090	166,940	48.71%
Total farmable acres	506,761	**12%**	6,330	0	85,020	161,270	314,681	**62.10%**

Kittitas

		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	3,270	3,270					3,270	100.00 %
Fallow acres	3,100		0	0	0	2,480	2,480	80.00%
Planted acres	18,300		0	0	0	5,738	5,738	31.36%
Total farmable acres	24,670	**13%**	0	0	0	8,218	11,488	**46.57%**

Klickitat

		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	60,168	60,168					60,168	100.00 %
Fallow acres	22,028		0	0	0	16,080	16,080	73.00%
Planted acres	69,452		16,591	0	0	39,986	56,577	81.46%

Total farmable acres	151,648	**40%**	16,591	0	0	56,066	132,825	**87.59%**

Lincoln		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	112,904	112,904					112,904	100.00 %
Fallow acres	273,792		27,379	0	95,827	136,896	260,102	95.00%
Total planted acres	450,061		43,715	0	160,912	213,540	418,167	92.91%
Total farmable acres	836,757	**13%**	71,094	0	256,739	350,436	791,173	**94.55%**

Okanogan		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	4,108	4,108					4,108	100.00 %
Fallow acres	6,854		0	0	0	4,928	4,928	71.90%
Total planted acres	26,320		0	0	0	19,044	19,044	72.36%
Total farmable acres	37,282	**11%**	0	0	0	23,972	28,080	**75.32%**

Table A7.2 continued

County		BACM (component 1)	BACM (component 2) - ADDITIONAL CONSERVATION MEASURES APPLIED				BACM total (components 1 & 2)	
Pend Oreille		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	0	**0%**					0	NA
Fallow acres	0		0	0	0	0	0	NA
Total planted acres	2,000		0	0	0	1,000	1,000	50.00%
Total farmable acres	2,000	**0%**	0	0	0	1,000	1,000	**50.00%**

Spokane		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	32,096	32,096					32,096	100.00 %
Fallow acres	21,000		5,000	0	10,000	5,000	20,000	95.24%
Total planted acres	251,895		20,500	0	99,189	94,752	214,441	85.13%
Total farmable acres	304,991	**11%**	25,500	0	109,189	99,752	266,537	**87.39%**

Stevens		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	3,138	3,138					3,138	100.00 %
Fallow acres	5,214		0	0	0	4,000	4,000	76.72%
Total planted acres	24,521		1,230	0	1,600	11,007	13,837	56.43%
Total farmable acres	32,873	**10%**	1,230	0	1,600	15,007	20,975	**63.81%**

Walla Walla		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	160,263	160,263					160,263	100.00 %
Fallow acres	112,624		50,500	0	13,500	18,624	82,624	73.36%
Total planted acres	262,831		43,804	0	86,275	78,981	209,060	79.54%
Total farmable acres	535,718	**30%**	94,304	0	99,775	97,605	451,947	**84.36%**

Whitman		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	149,790	149,790					149,790	100.00 %
Fallow acres	170,500		30,000	0	20,000	61,000	111,000	65.10%
Total planted acres	717,202		106,391	0	115,678	306,204	528,273	73.66%
Total farmable acres	1,037,492	14%	136,391	0	135,678	367,204	789,063	**76.05%**

Yakima		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
HEL withdrawn from production	55,455	55,455					53727	96.88%
Fallow acres	8,175		0	0	0	2,853	2,853	34.90%
Total planted acres	66,700		0	0	4,224	16,903	21,127	31.67%
Total farmable acres	130,330	43%	0	0	4,224	19,756	77,707	**59.62%**

SUMMARY		CRP	No-Till	Ridge-Till	Mulch-Till	15-30% Residue.	acres	% acres
Total farmable acres	6,384,341	1,396,069	545,412	0	972,721	2,142,158	5,054,632	
		22%	9%	0%	15%	34%		79%