

February 15 & 16, 2011 PM₁₀
Exceptional Events Package,
for Boise-Nampa, Idaho

Idaho DEQ

Rick Hardy, Yayi Dong, Sara Strachan, Jake Wolf

Unique Case

- A “milky white haze” settled over the Boise-Nampa Idaho area reaching over $500\mu\text{g}/\text{m}^3$, and exceeding the PM_{10} NAAQS on two days.
- 1-hour Boise wind speeds: Calm to 18 mph.
- A unique regional dust source:
 - Dust generation associated with wet conditions not dry.
 - Potential source area $\sim 4,000 \text{ km}^2$

EER Technical Demonstration for High Wind Dust Events

- States can “flag” exceptional data, submit demonstration:
- Conceptual Model
- Affects Air Quality (AAQ)
- Concentration in excess of Historical Fluctuations (HF)
- Not Reasonably Controllable or preventable (nRCP)
- Caused by human Activity Unlikely to Recur or a Natural Event (HAUR/NE)
- Clear Causal Relationship (CCR)
- No Exceedance “But For” (NEBF)

DEQ Closely Followed EPA Guidance and R10 suggestions



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

United States Environmental Protection Agency

May 2013

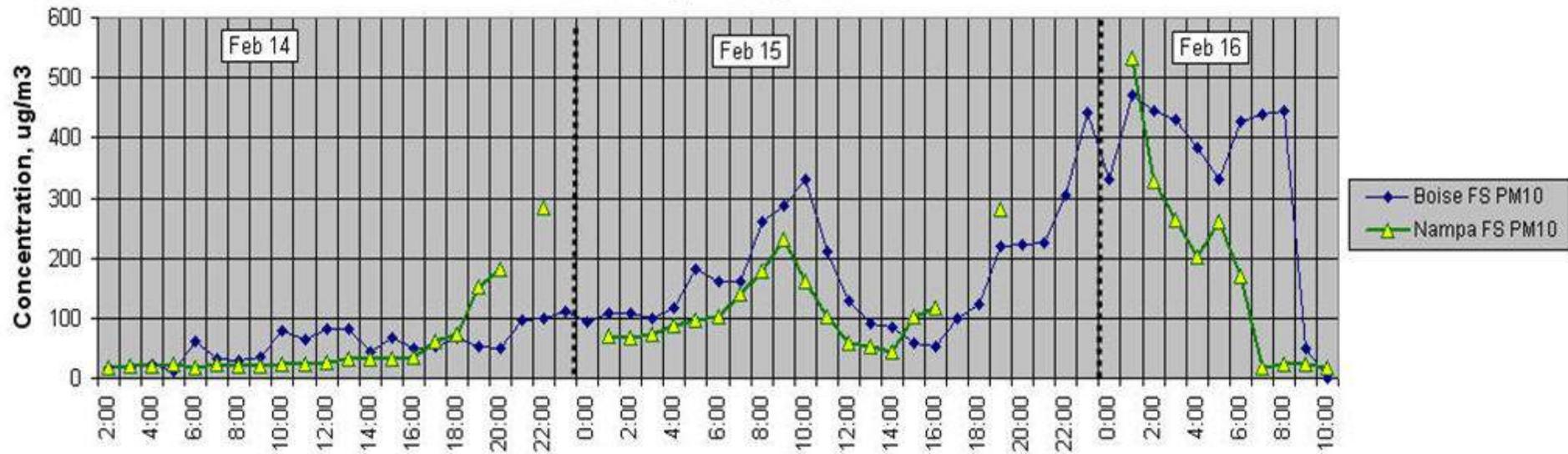
Abstract

Specific Samples for which we are seeking EPA Concurrence

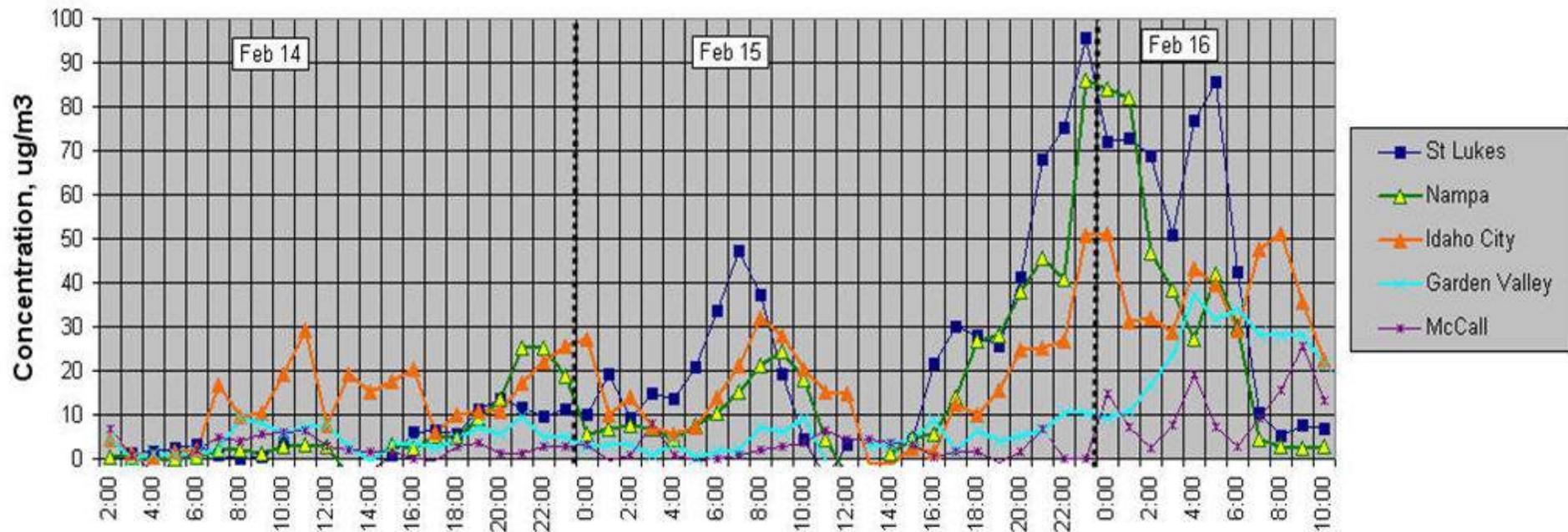
Monitor Site:	Boise Fire Station No. 5, Ada County, Idaho	Nampa Fire Station, Canyon County Idaho
Monitor ID (AQS#/POC):	16-001-0009 (POC 3)	16-027-0002 (POC 2)
Date	PM₁₀ Concentration Recorded, $\mu\text{g}/\text{m}^3$	
2/15/2011	183	174
2/16/2011	156	*

EER Element	Sect.	Summary
Conceptual Model (EPA guidance)	1	The conceptual model describes the source, natural dry lake beds in NW Nevada, high wind conditions and emissions mechanisms leading to the event along with transport conditions and concentration patterns. Impact area wind conditions contributing to high PM ₁₀ levels remaining in place over portions of two days are also presented.
Not Reasonably Controllable or Preventable (nRCP)	2	Pleistocene era dry lake bed playa surfaces, including Black Rock Playa (BRP) and Carson Sink Playa (CSP) are identified as the source areas. These are natural areas in another state that are not reasonably controllable or preventable.
Exceeds Historical Fluctuations (HF)	3	The PM ₁₀ concentrations on Feb 15 and 16, 2011 are the highest 24-hour concentrations observed in over ten years at Boise FS, and the Feb 15 concentration is the second highest observed at Nampa in the previous ten years. A comparison to annual and seasonal data sets for the last ten years is provided showing that normal historical fluctuations are well below these levels.
Clear Causal Relationship (CCR)	4	Evidence is provided to show that the dry lake bed playas of northwest Nevada, notably BRP and CSP, are the source of dust impacting Boise-Nampa area on Feb 15 and 16, 2011. Evidence includes wind data at the source area and at monitors, satellite images of dust blowing toward Boise-Nampa, Hysplit back trajectories linking BRP and CSP with the monitors in question, and chemical composition fingerprinting of the BRP soils that matches NCORE air filters collected on Feb 14, 2011 the first day of the event. Finally, alternative source hypotheses are discussed and determined to be incapable of creating levels this high.
Affects Air Quality (AAQ)	5	The AAQ element is met by demonstrating PM ₁₀ in excess of historical fluctuations (HF) and a Clear Causal Relationship (CCR).
Natural Event or Human Activity Unlikely to Recur (NE/HAUR)	6	The NE/HAURL criterion is met by demonstrating that the event is a natural event that is not reasonably controllable or preventable (nRCP) and that there is a Clear Causal Relationship with the identified natural source area (CCR).
No Exceedance “But For” Event (NEBF)	7	Non-event PM ₁₀ levels are typically well below the NAAQS. A quantitative NEBF analysis for the last ten years shows that PM ₁₀ levels are typically not more than 23 to 66 µg/m ³ for Boise and 24 to 78 µg/m ³ for Nampa (annual average to 99 th tile) and the 3 PM ₁₀ values under consideration are all more than 90 µg/m ³ over the 99 th percentile background level. Clearly, there would be no exceedance “but for” the high wind event involving the BRP and CSP source areas.
Mitigation	8	DEQ provided prompt public advisory of the elevated levels and advice to reduce public health exposure on both Feb 15 and 16, 2011.
EER Procedures	9	DEQ met EER procedural requirements for flagging, demonstration and public comment as summarized in this section.

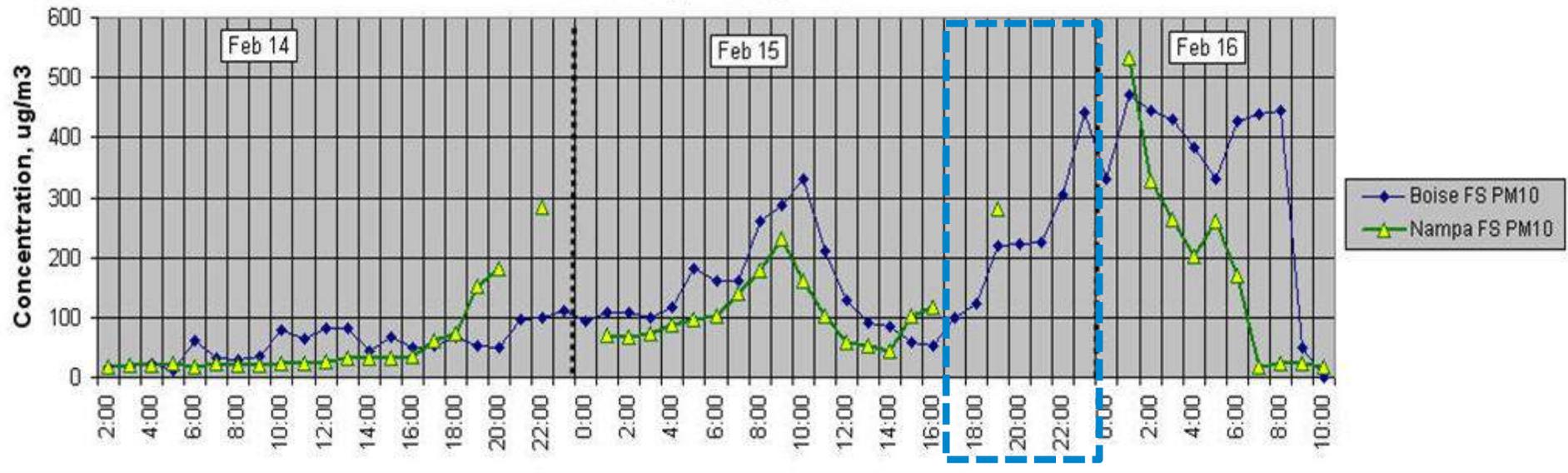
Boise and Nampa Hourly PM10



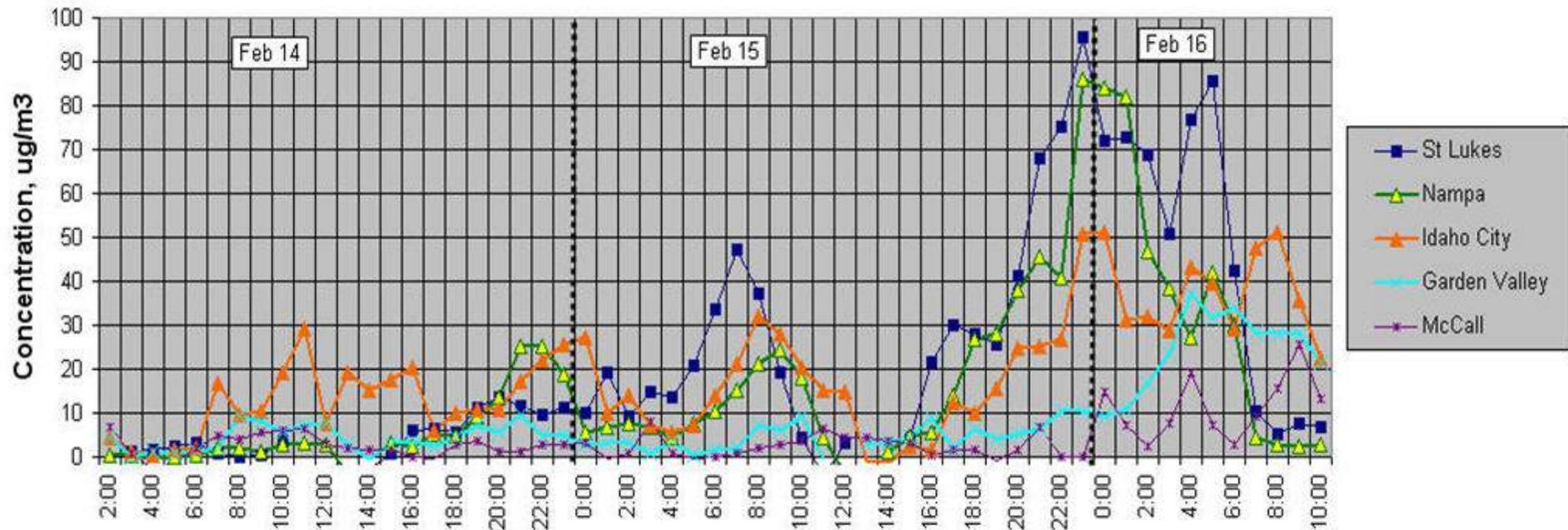
Southwest Idaho Hourly PM2.5 Concentrations



Boise and Nampa Hourly PM10

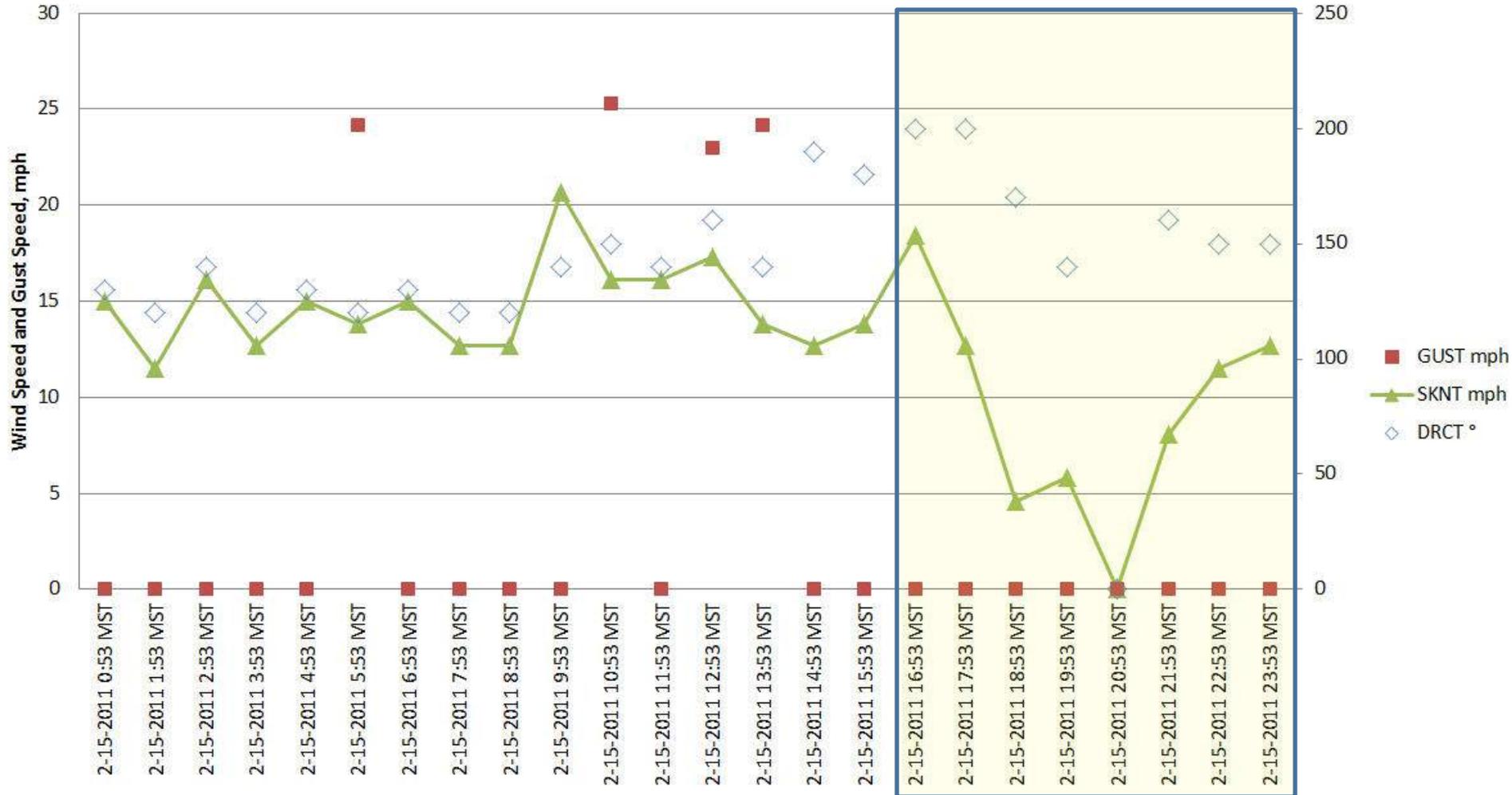


Southwest Idaho Hourly PM2.5 Concentrations



During Event, Winds were Calm to 18mph

Boise Airport Winds, Feb 15, 2011



“Milky white haze”

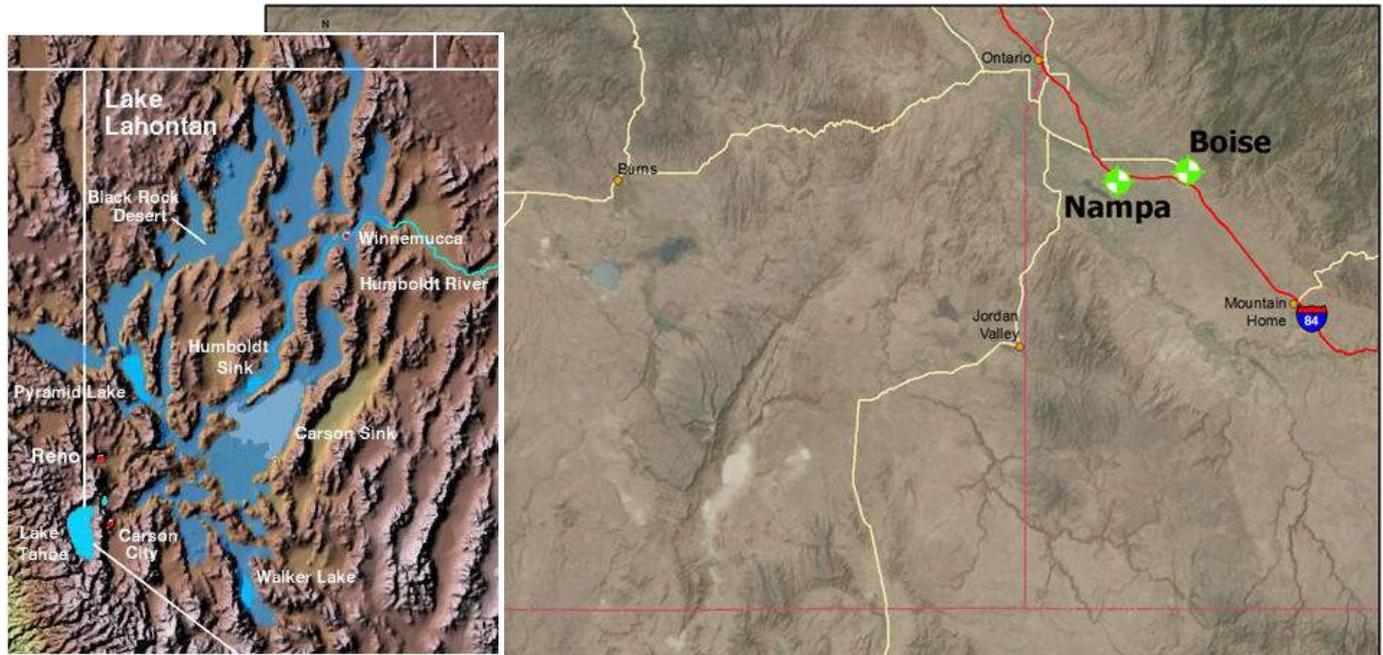
March 28, 2012 photo from I-80 near Lovelock, NV



March 28, 2012 photo from I-80 near Lovelock, NV

Windspeeds ≤ 22 mph





Black Rock Playa,
 Carson Sink Playa
 and other smaller
 playa are remnants
 of Pleistocene
 Lake Lahontan
 (~4,000 km²)



Conceptual Model

- Evaporite playa minerals, were loosened by antecedant precipitation, ~ 2 weeks earlier.
- Crystal growth of e.g. Calcite (Ca), Halite (Na) evaporites disrupts hard, smooth clay surface.
- Winds 3x threshold velocity (>45mph) erodes playa surface, blowing toward Boise-Nampa.
- Dust reaches Boise as evening winds drop and dust is trapped in valley by overnight inversion.

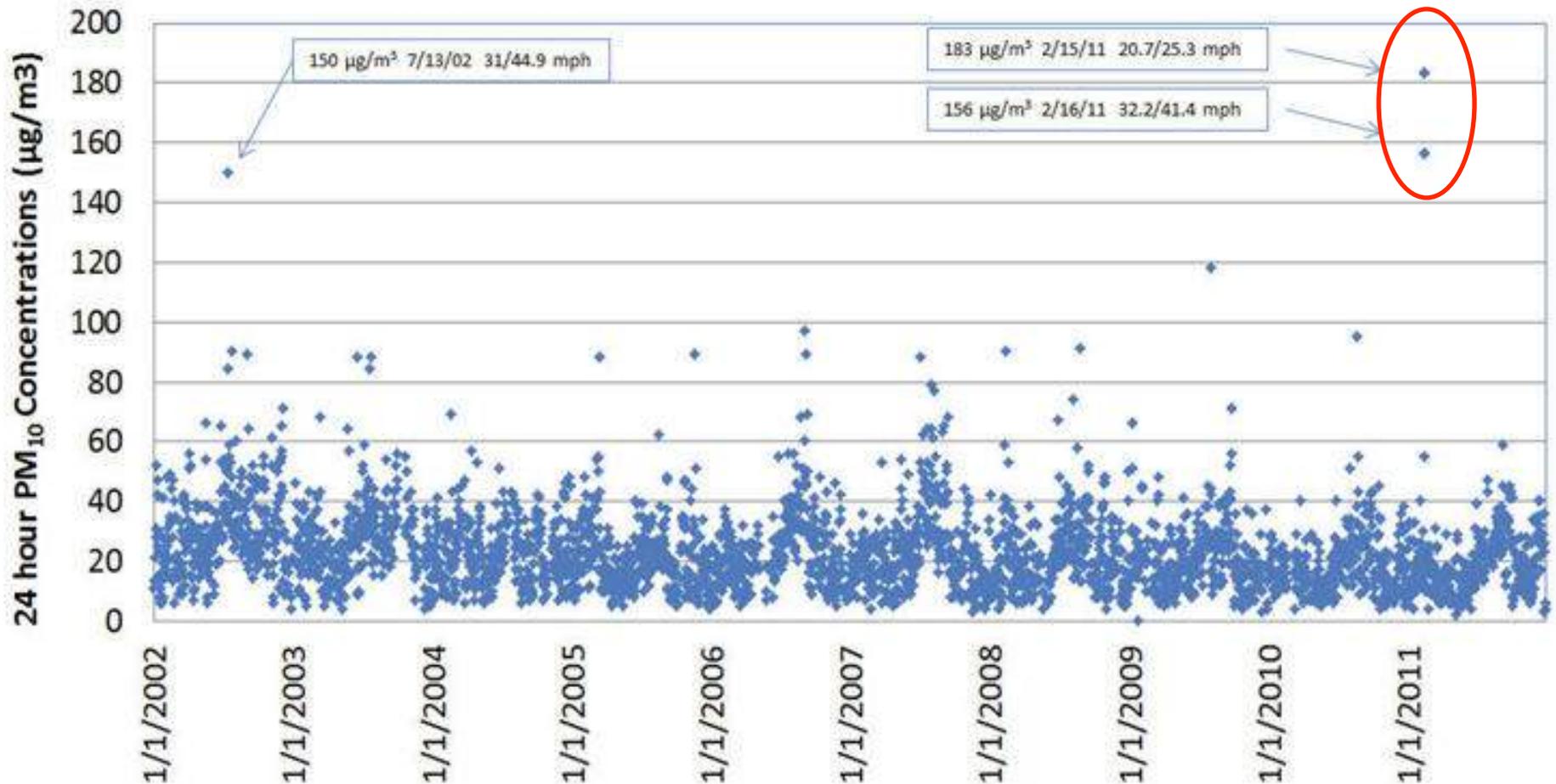
Not Reasonably Controllable or Preventable

Human activities on Black Rock Playa disturb up to 7% of the 2,600km² playa surface, however fall/winter weather largely return it to natural conditions. BLM manages.



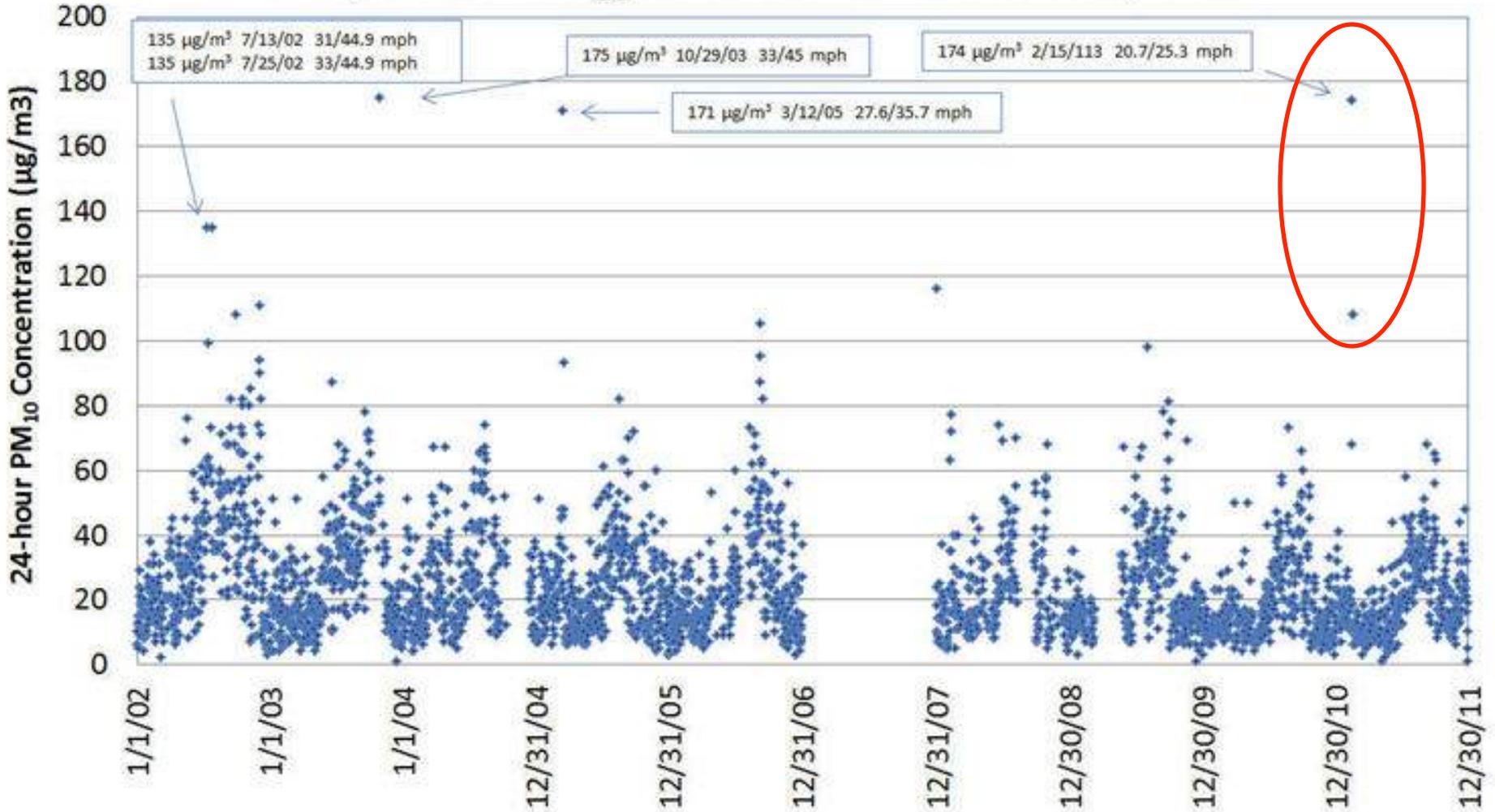
Exceeds Historical Fluctuations

Daily Mean PM₁₀ Concentrations at Boise FS No. 5



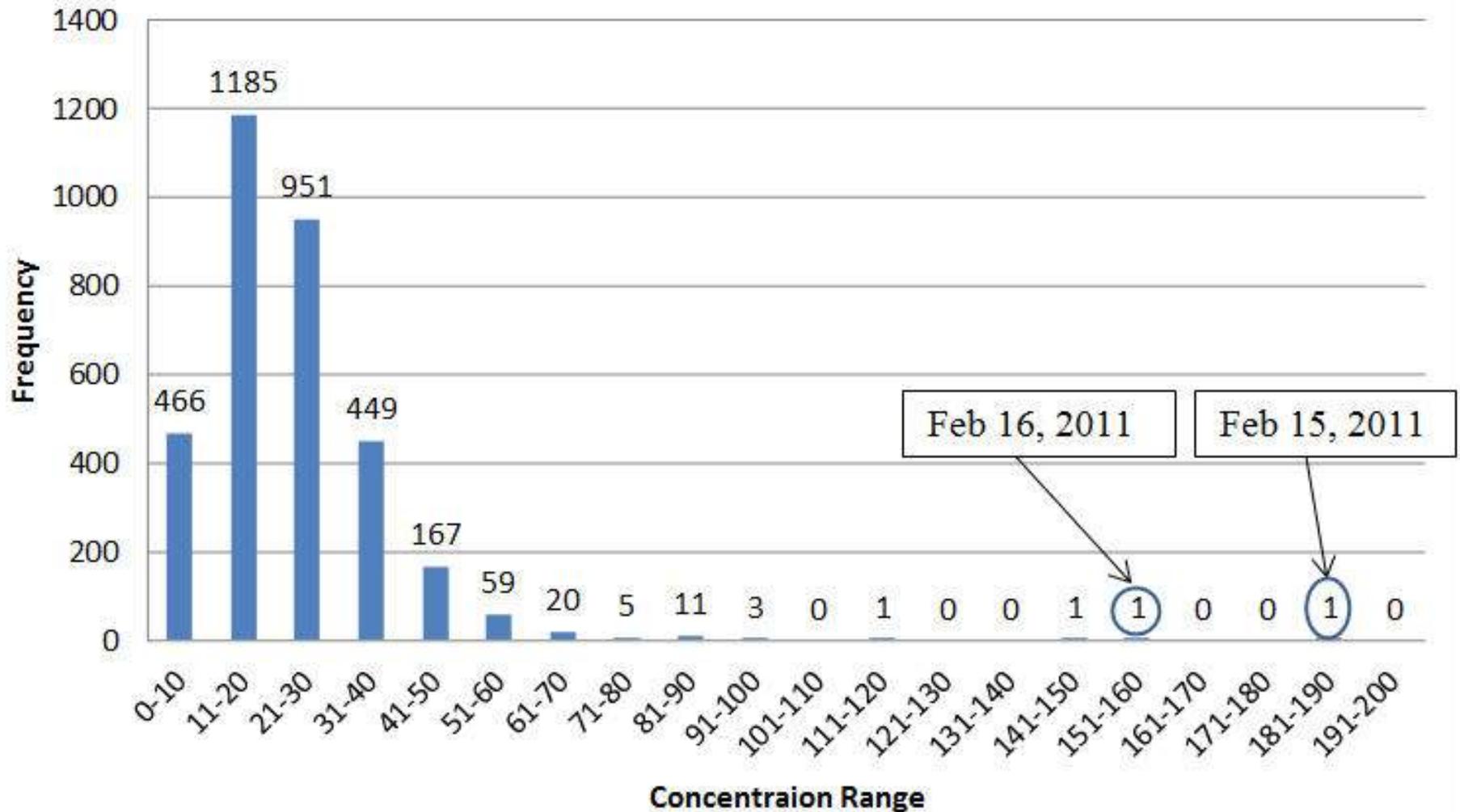
Exceeds Historical Fluctuations

Daily Mean PM₁₀ Concentration at Nampa FS



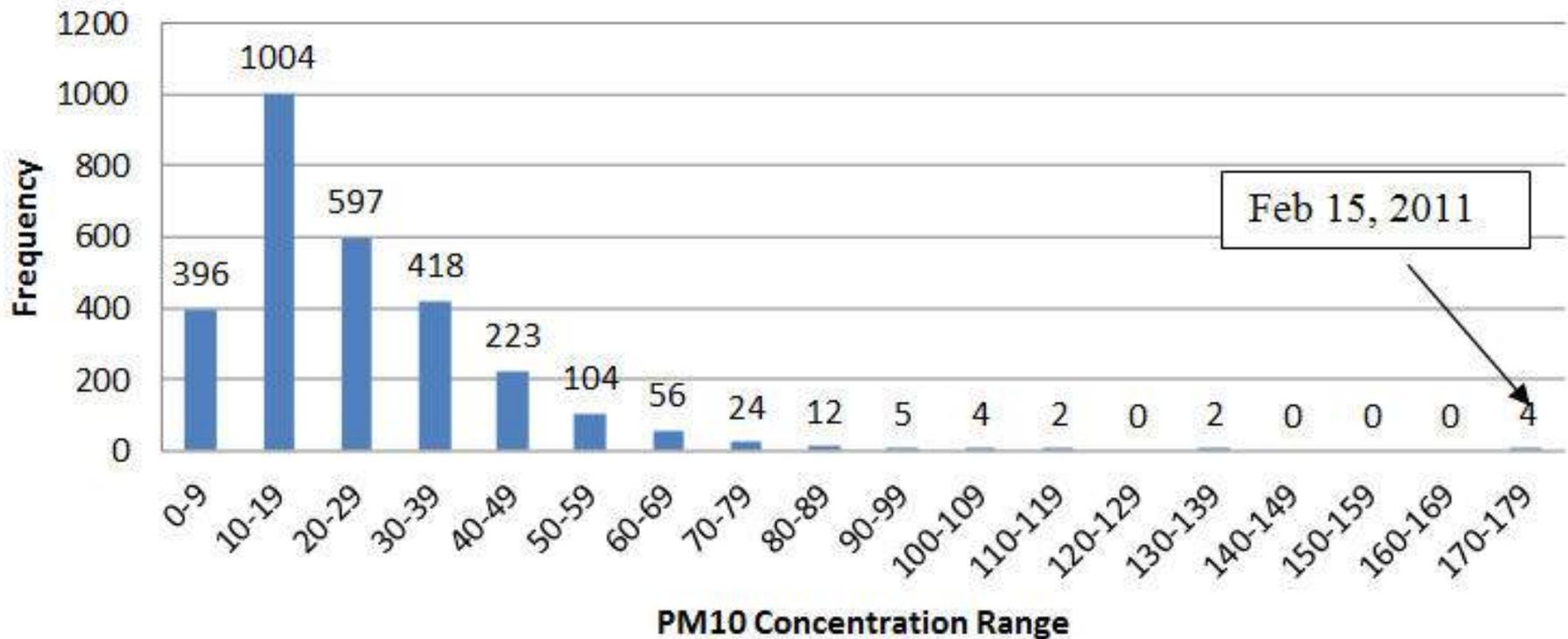
Exceeds Historical Fluctuations

PM10 Concentration Distribution
Boise Fire Station PM10, 2002-2011



Exceeds Historical Fluctuations

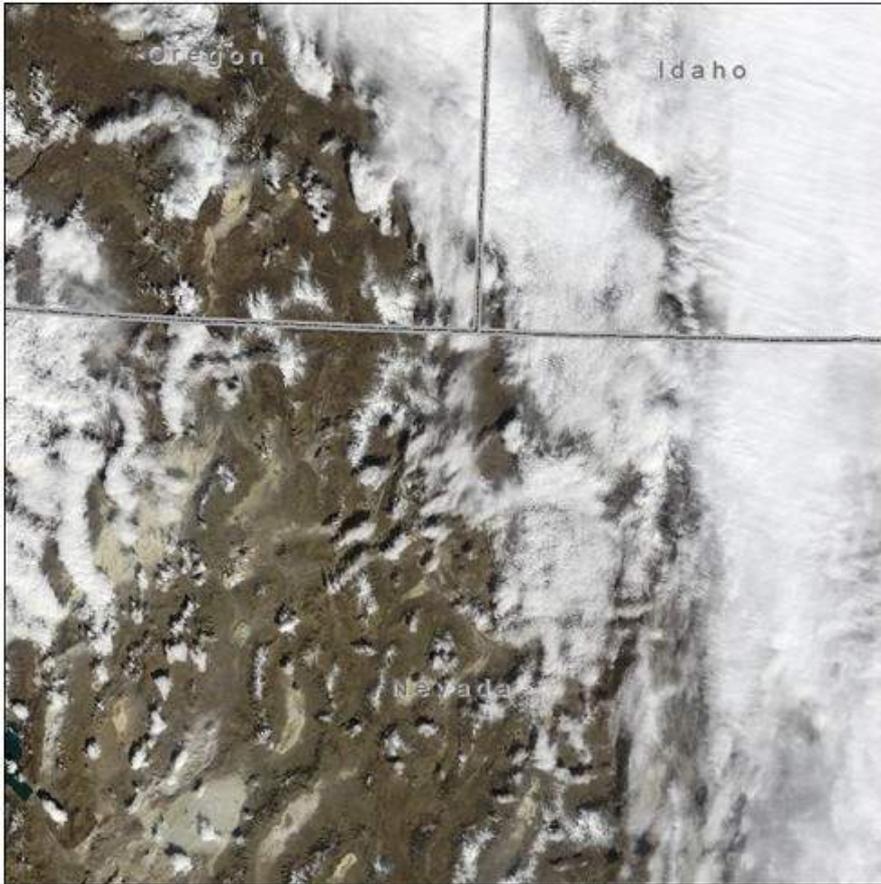
**PM10 Concentration Distribution
(Nampa Fire Station, 2002-2011)**



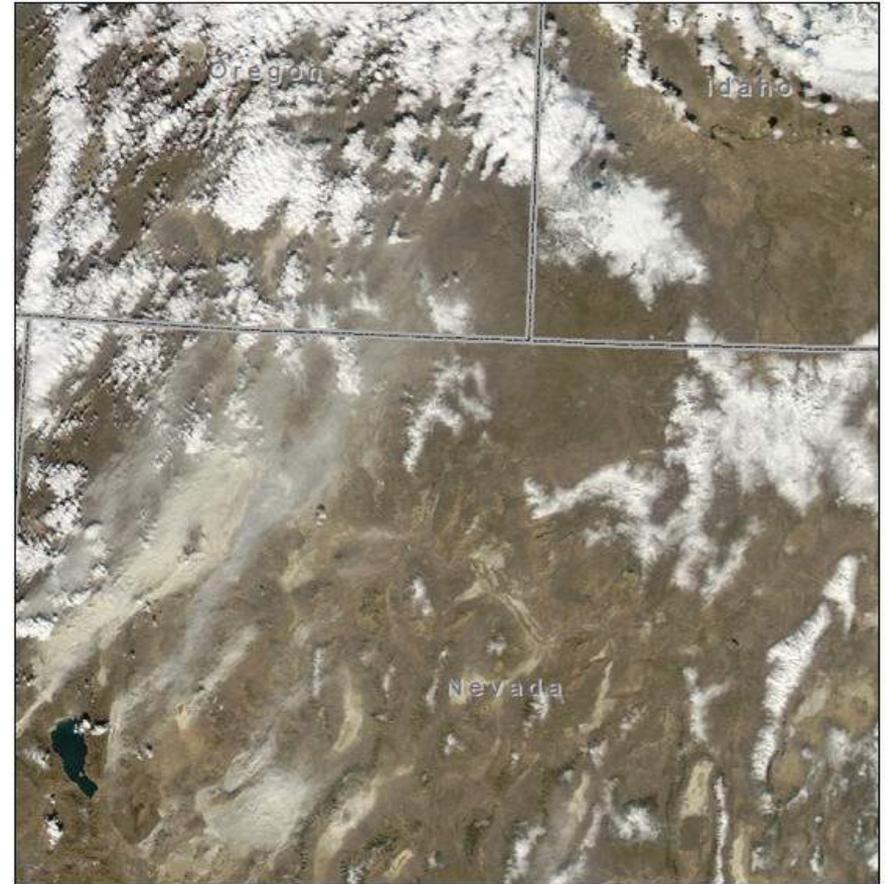
Exceeds Historical Fluctuations

Site	AQS	Date	PM ₁₀ μg/m ³	Percentile Relative to				
				Annual Data ^a	Annual data without High Wind Days (>25mph) ^b	Winter Season Data ^c	Winter data without High Wind Days (>25mph) ^d	High Wind Days with Max 1-hr Wind Speed > 25mph ^e
Boise Fire Station Observations:				3322	3112	809	769	208
Boise Fire Station	16-001-0009	2/15/11	183	99.970%	99.968%	99.88%	99.87%	99.52% ^g
Boise Fire Station	16-001-0009	2/16/11	156	99.940%	99.936% ^f	99.75%	99.74% ^f	99.52%
Nampa Fire Station Observations:				2820	2647	757	724	173
Nampa Fire Station	16-027-0002	2/15/11	174	99.18%	99.96%	99.87%	99.86%	98.84% ^g

Clear Causal Relationship

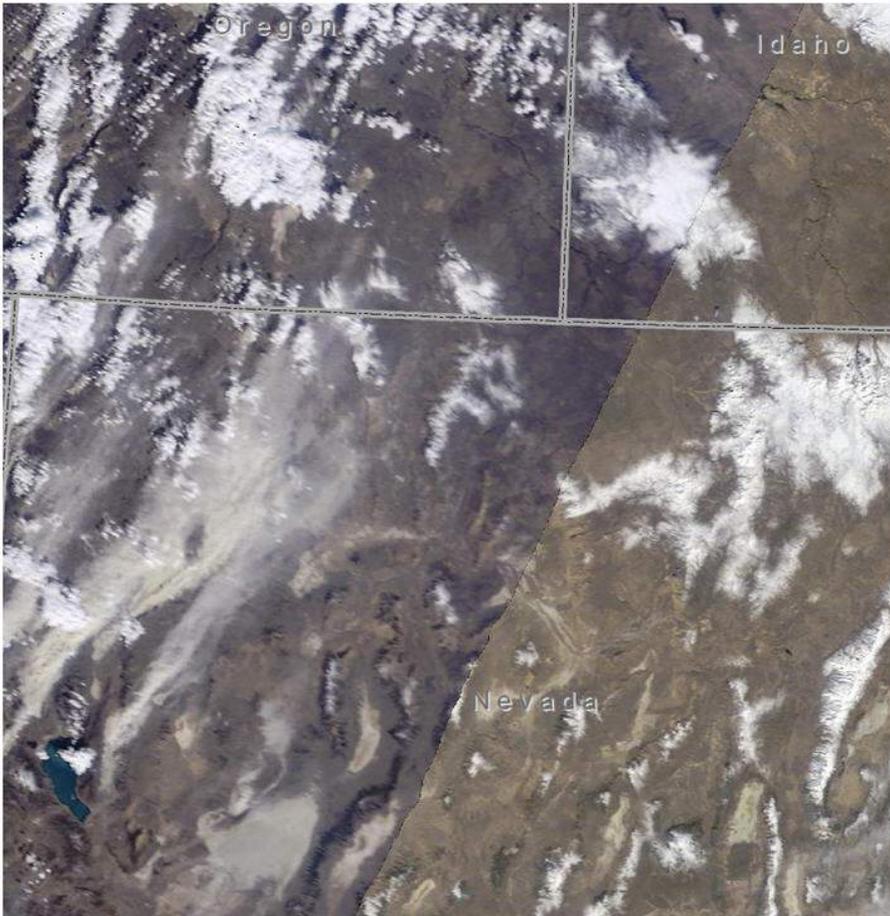


Feb 14, 2011 ~ 10:30 LST

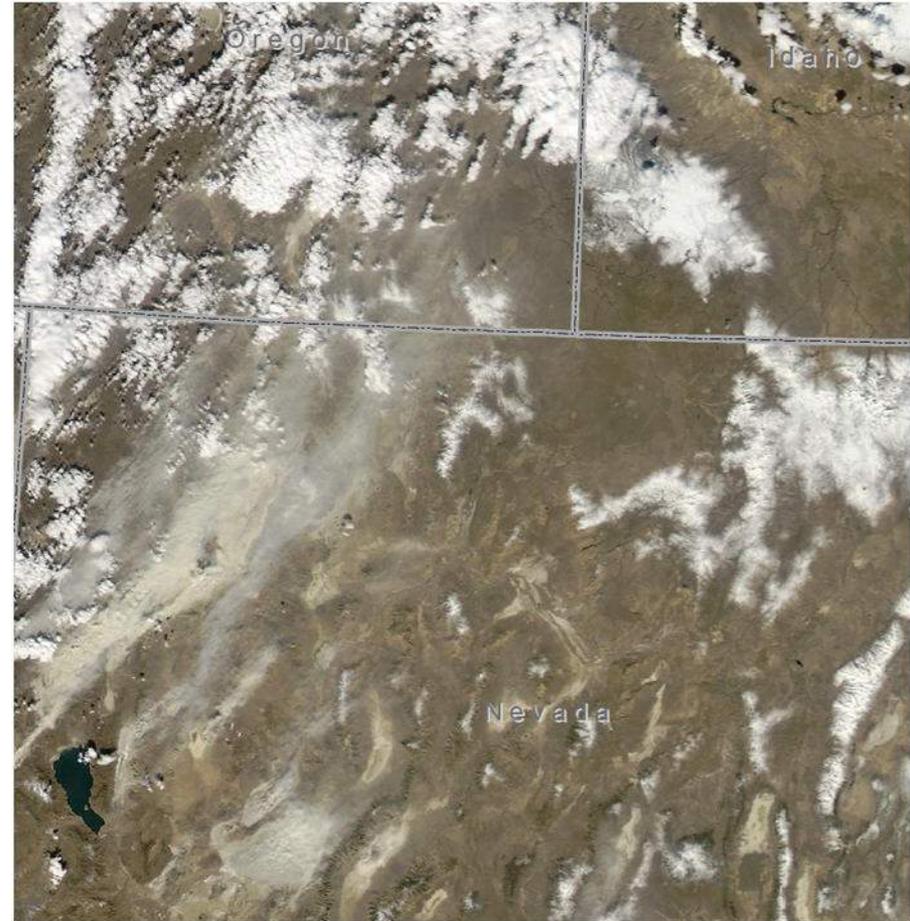


Feb 14, 2011 ~ 13:30 LST

Clear Causal Relationship

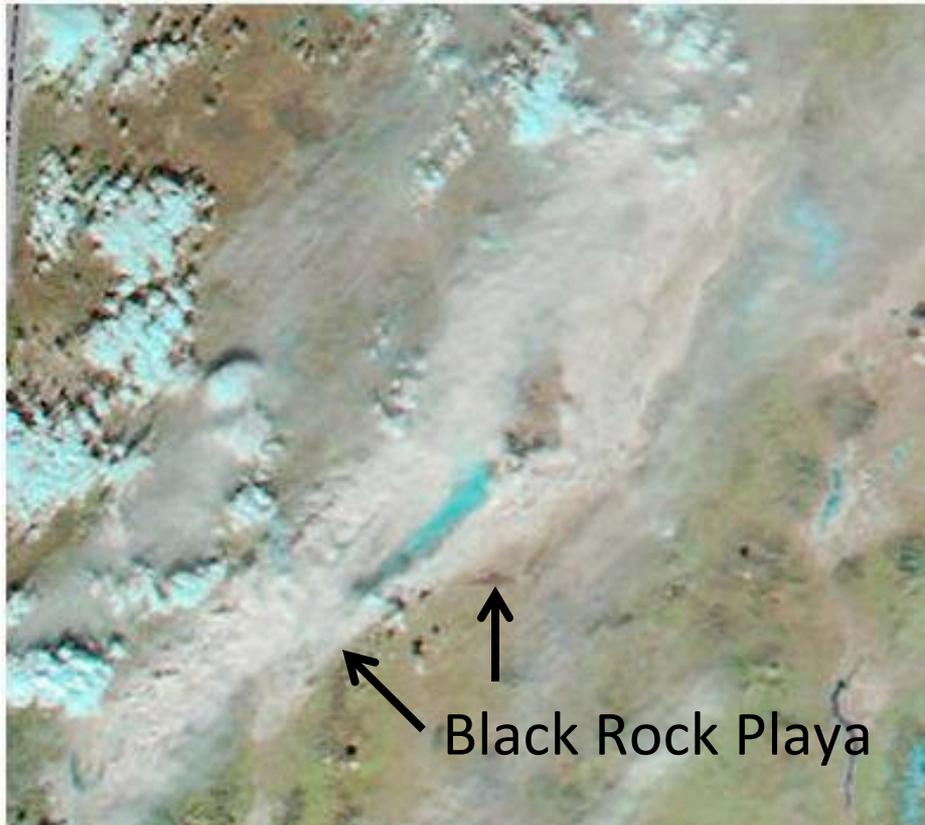


Feb 15, 2011 ~ 10:30 LST



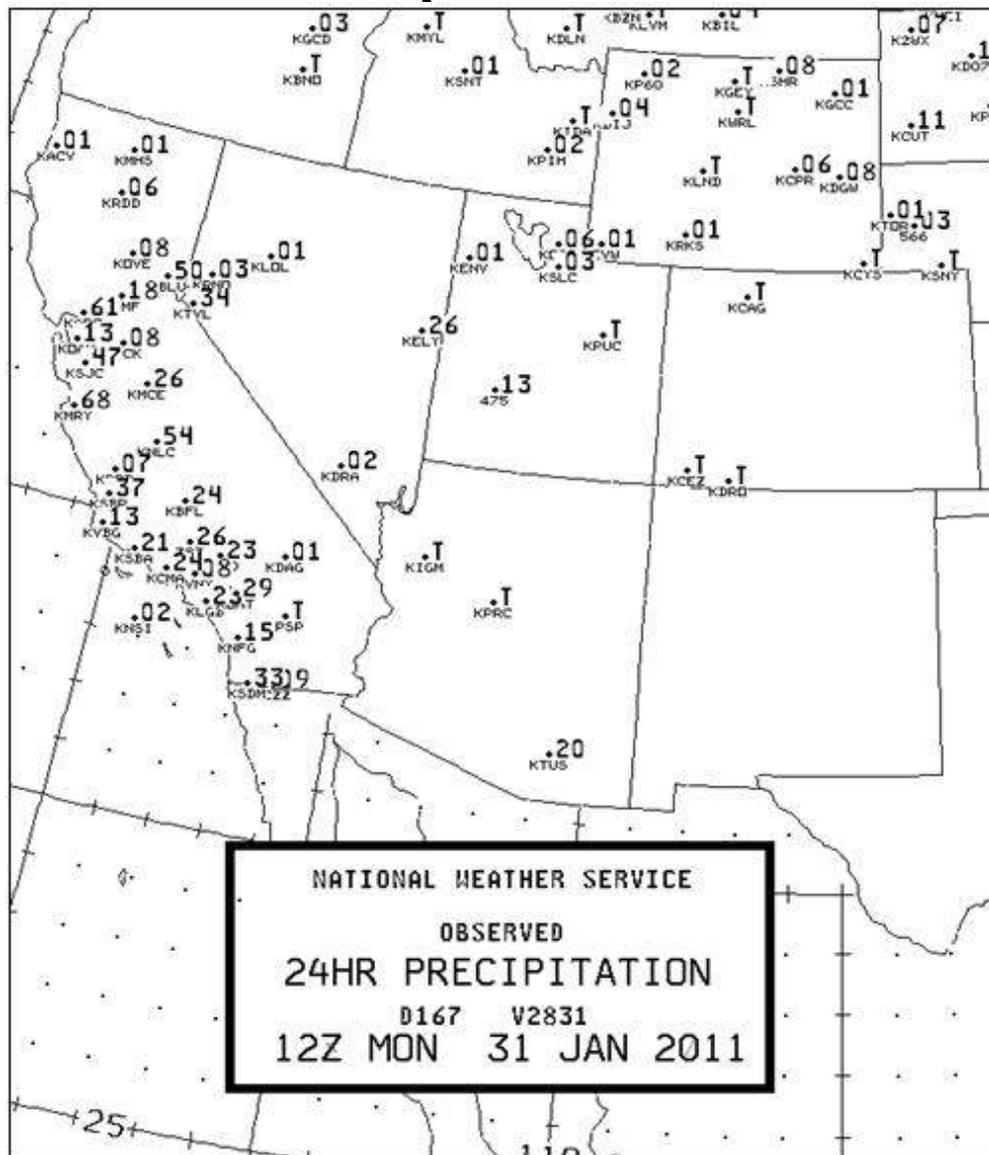
Feb 15, 2011 ~ 13:30 LST

Clear Causal Relationship

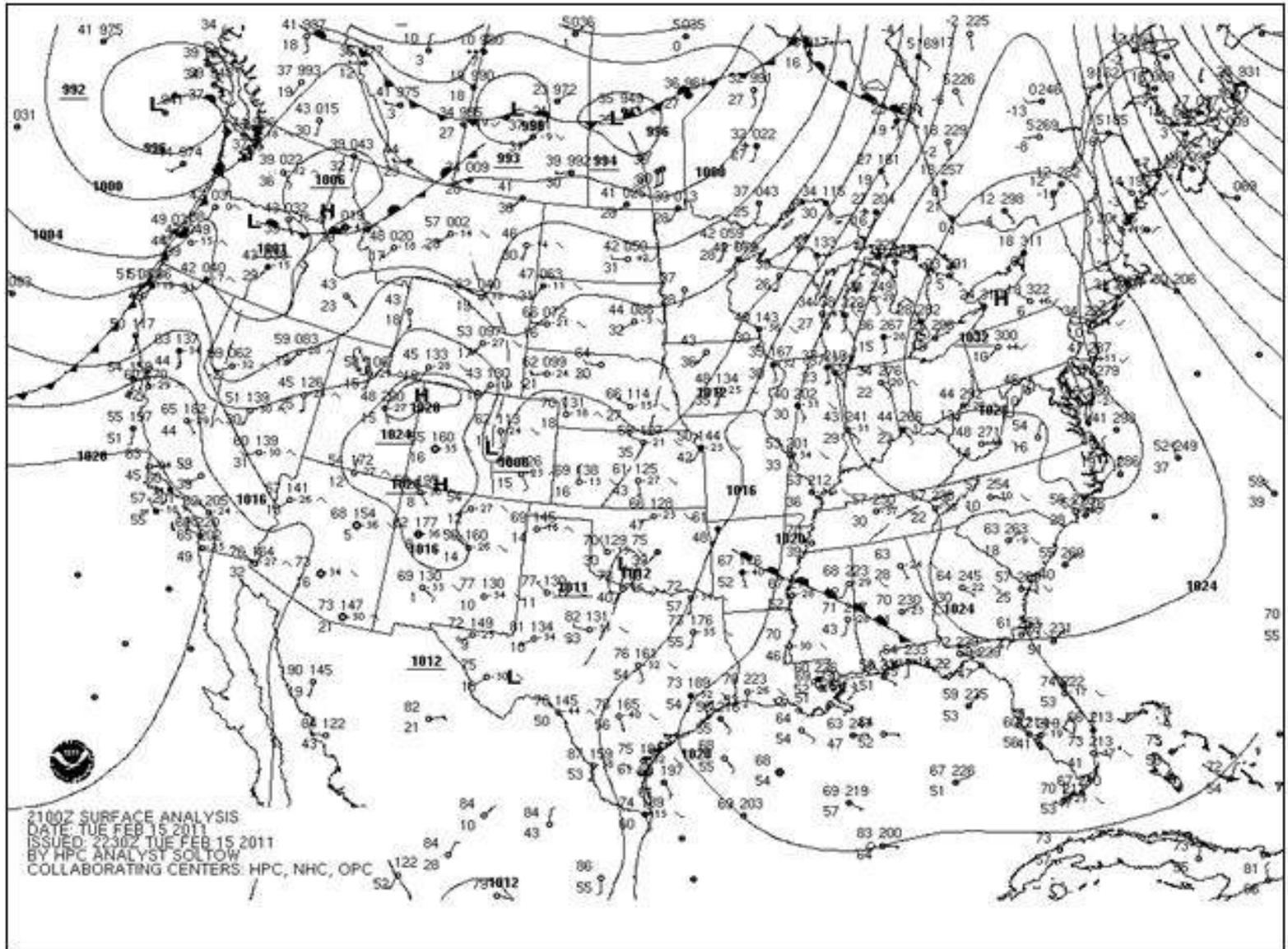


Feb 15, 2011 ~ 13:30 LST False Color Images distinguish between dust and clouds/snow

Antecedent Precipitation 2 weeks prior



Weather Conditions Contributing



700mb Winds

NCEP North American Regional Reanalysis
700mb Vector Wind (m/s) Composite Mean

NOAA/ESRL Physical Sciences Division

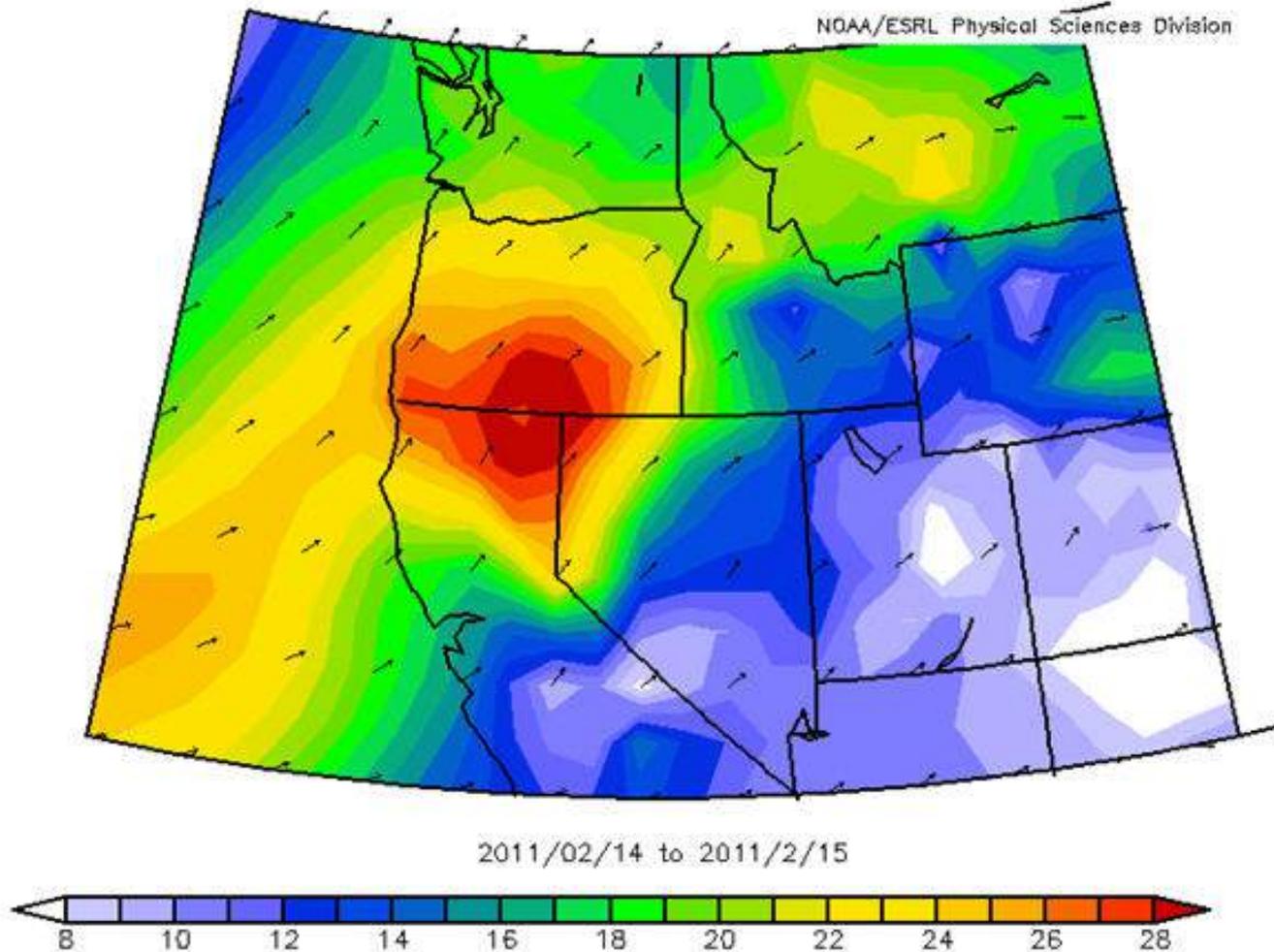
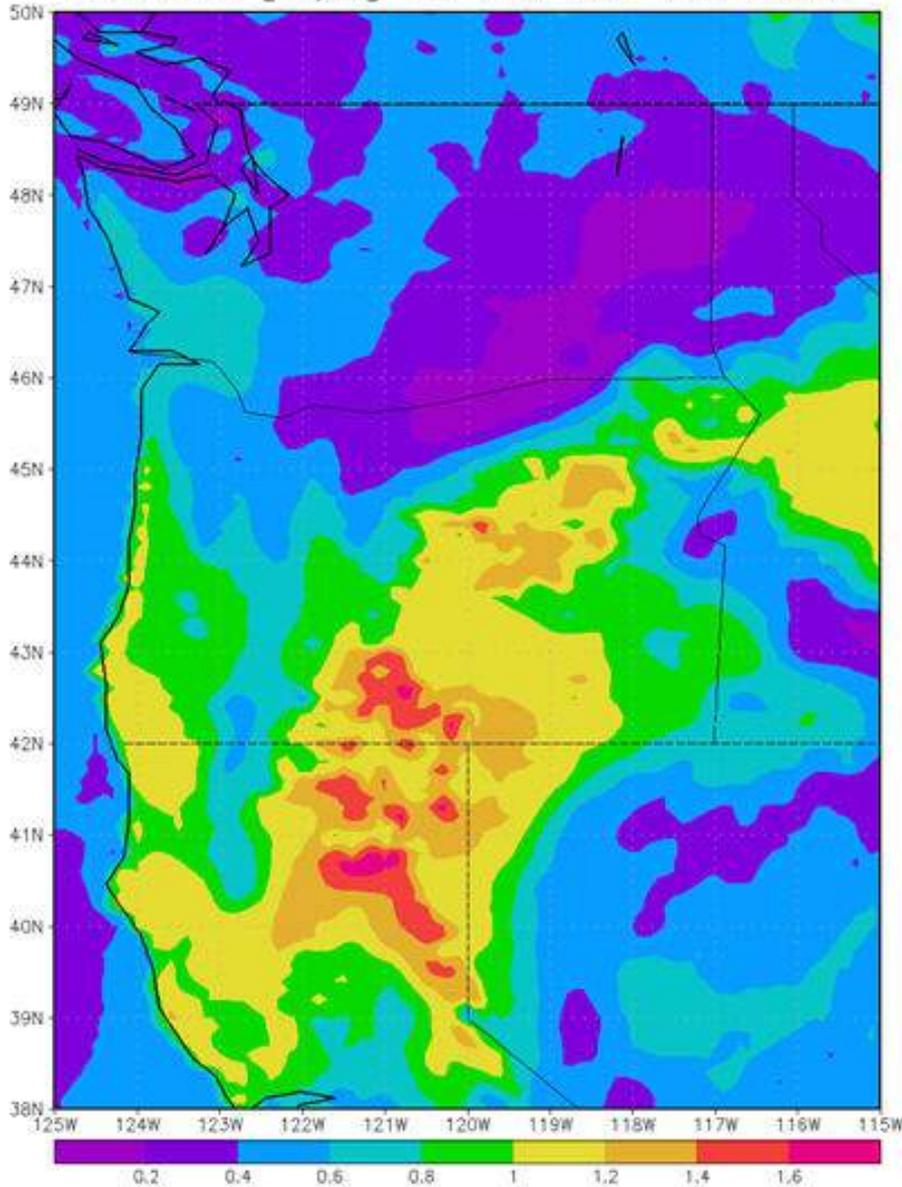


Figure 20 NCEP/NARR reanalysis of mid-level winds 02/14/11-02/15/11.

FRICVsfc [m/s] at 18Z Tue 15feb2011

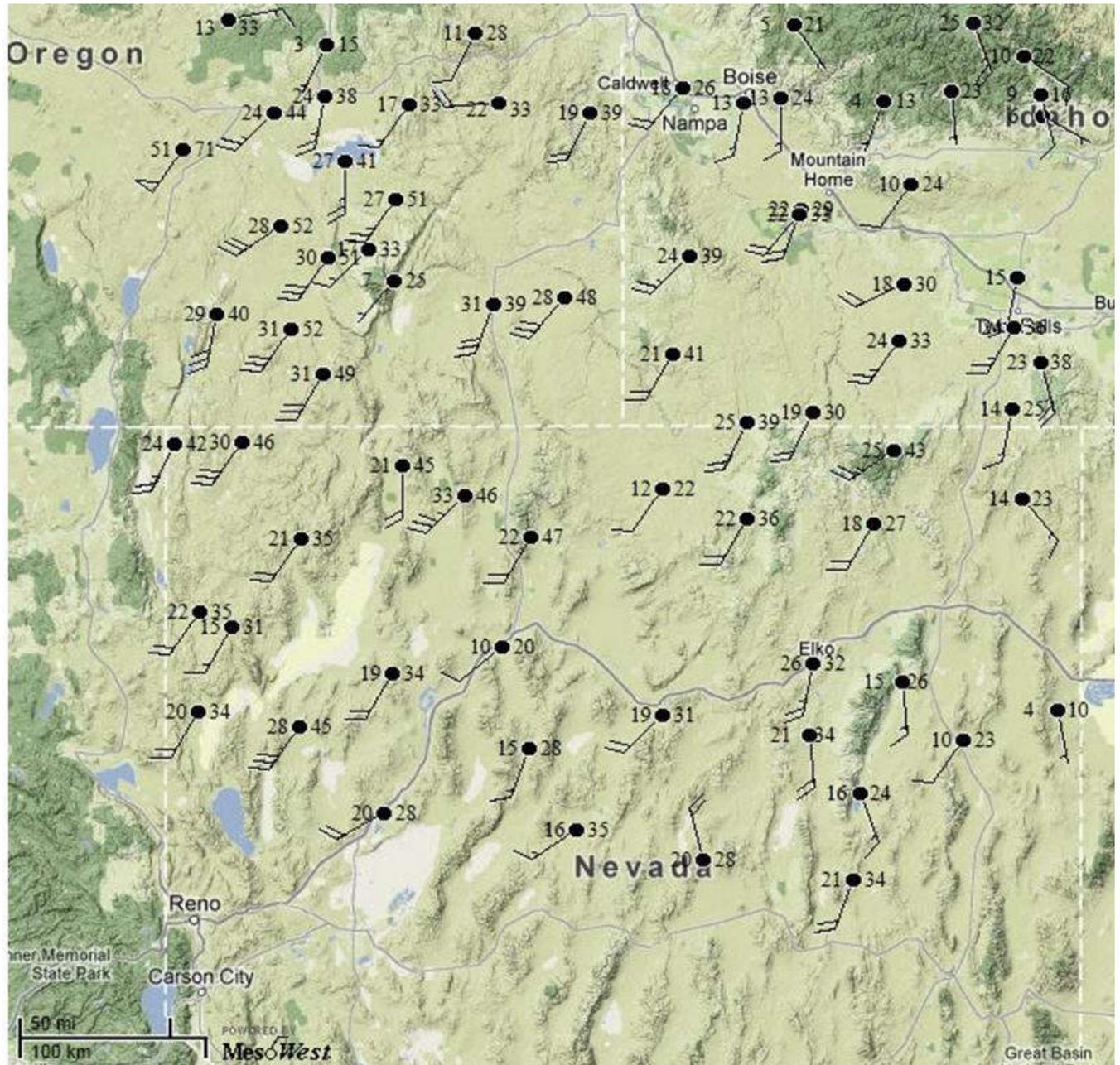


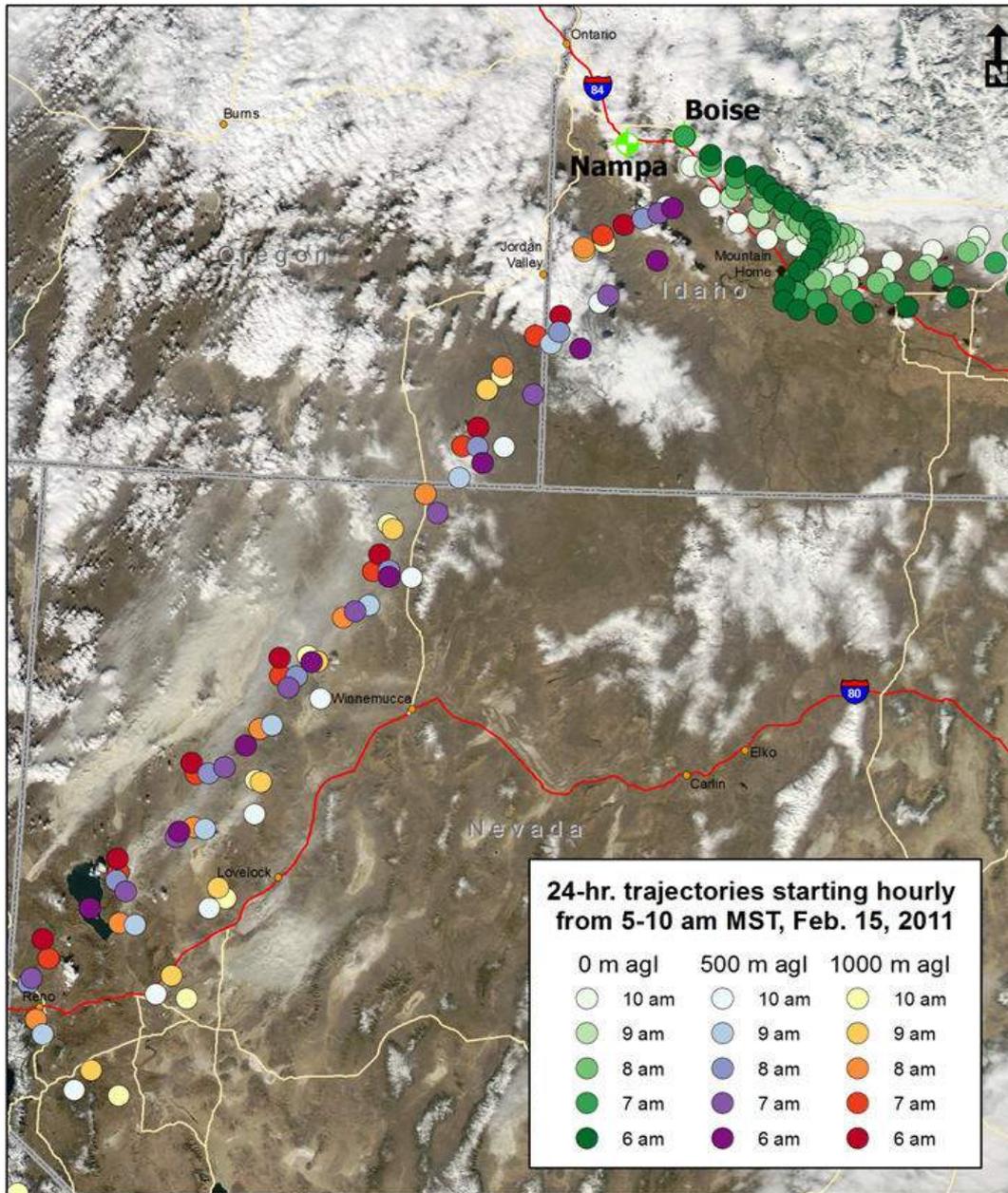
Clear Causal
Relationship

Friction Velocities
>1m/s

Figure 22 Friction velocity for 18Z 02/15/12 (12pm MST 02/15/12).

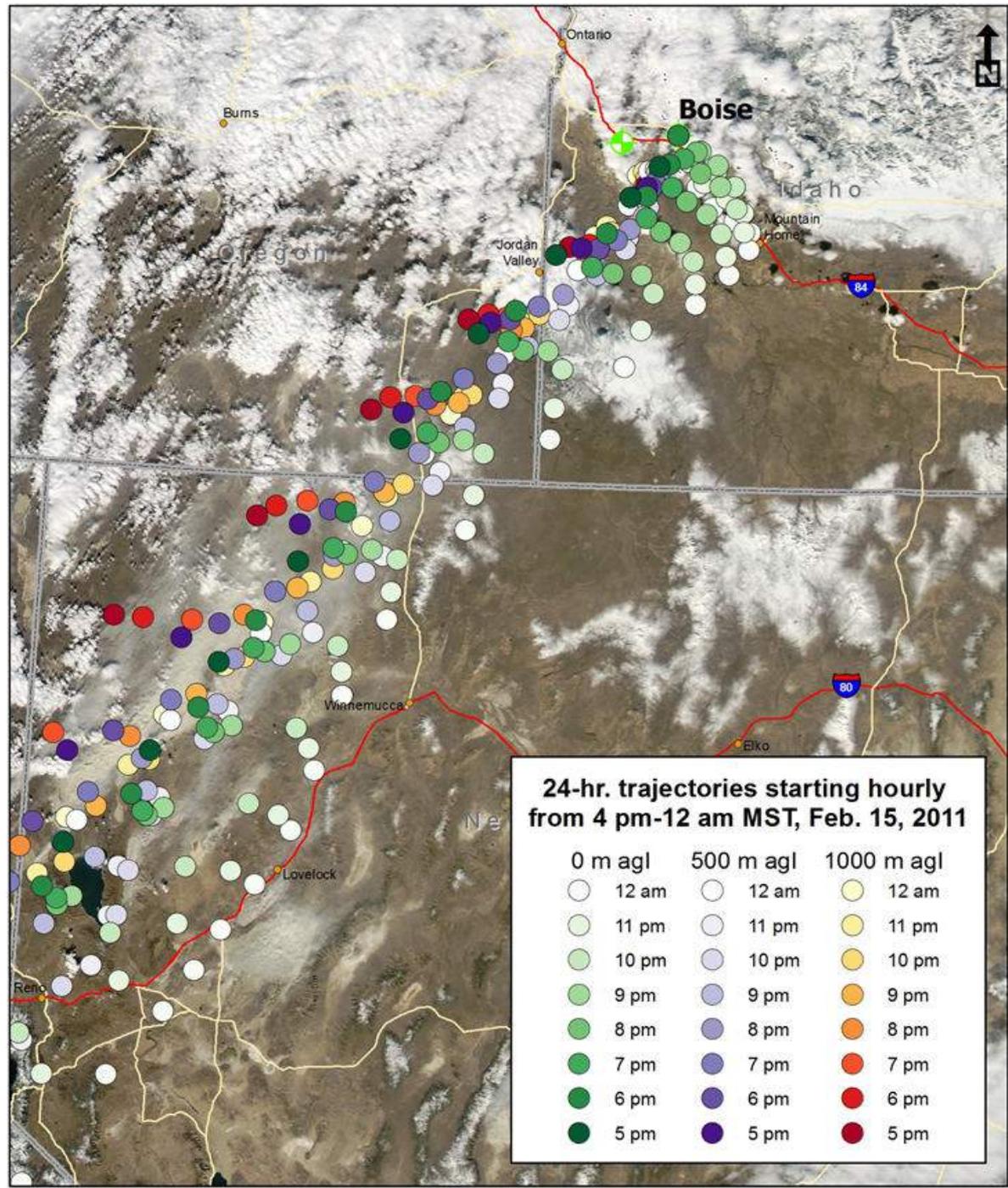
Feb 15 afternoon surface winds

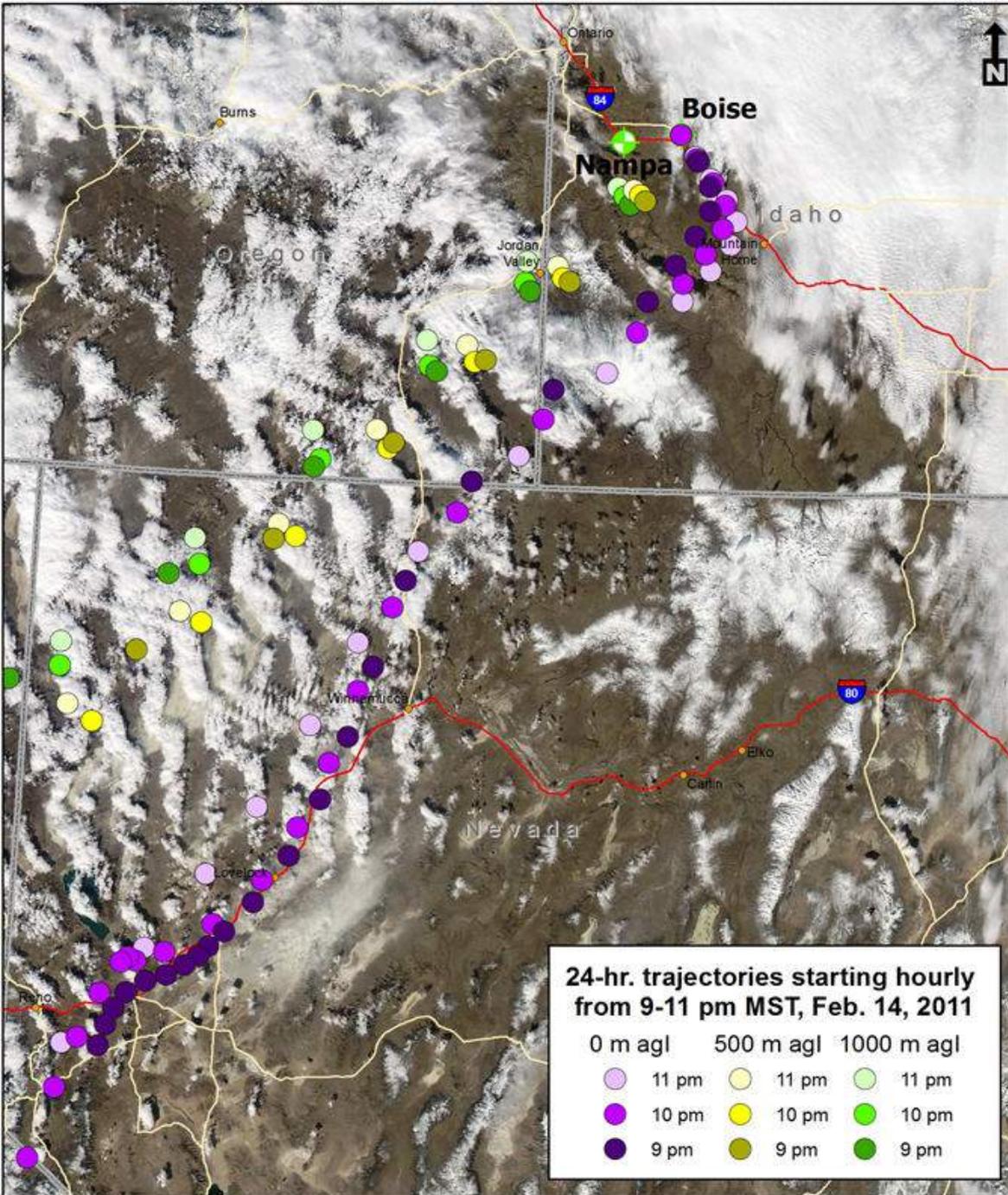




Hysplit Back-Trajectories from Feb 15 5am – 10am PM₁₀ “impact period”

Feb 15 back-trajectories ending at Boise 1600 – 2400 during greatest impact

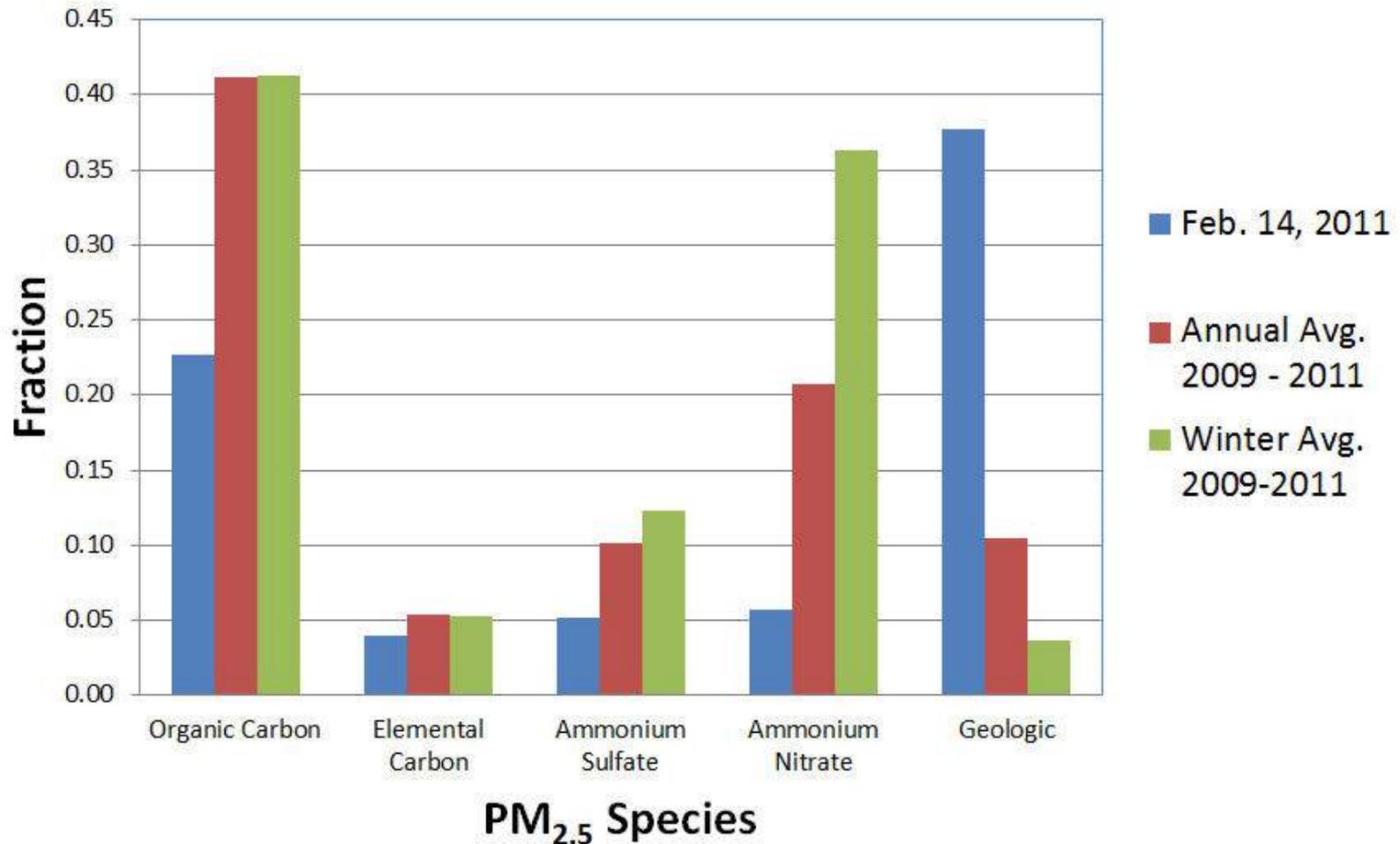




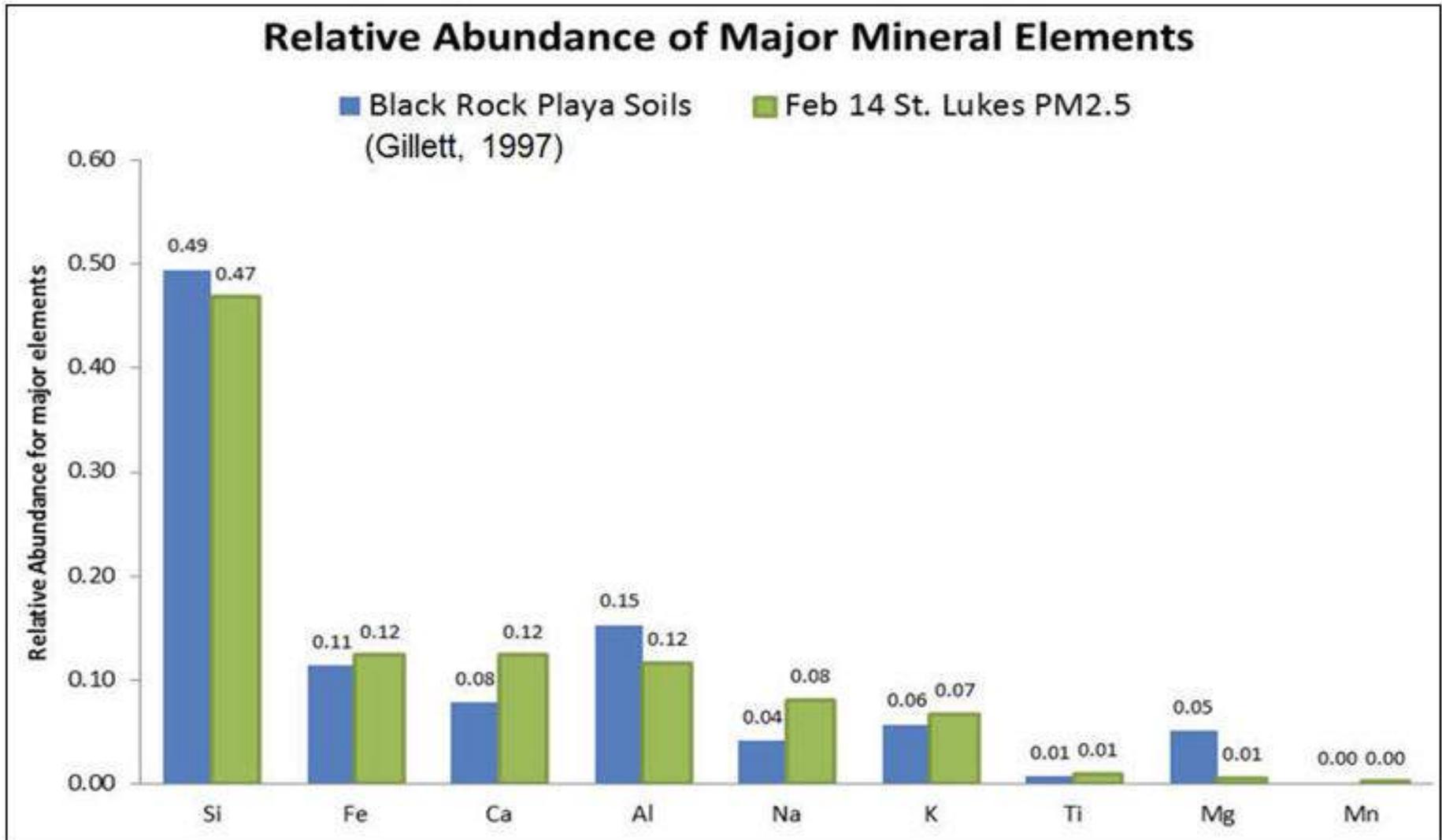
Feb 14 Back-trajectories show NCORE speciation sample also affected by playa dust

Feb 14 Comparison to Average Speciation

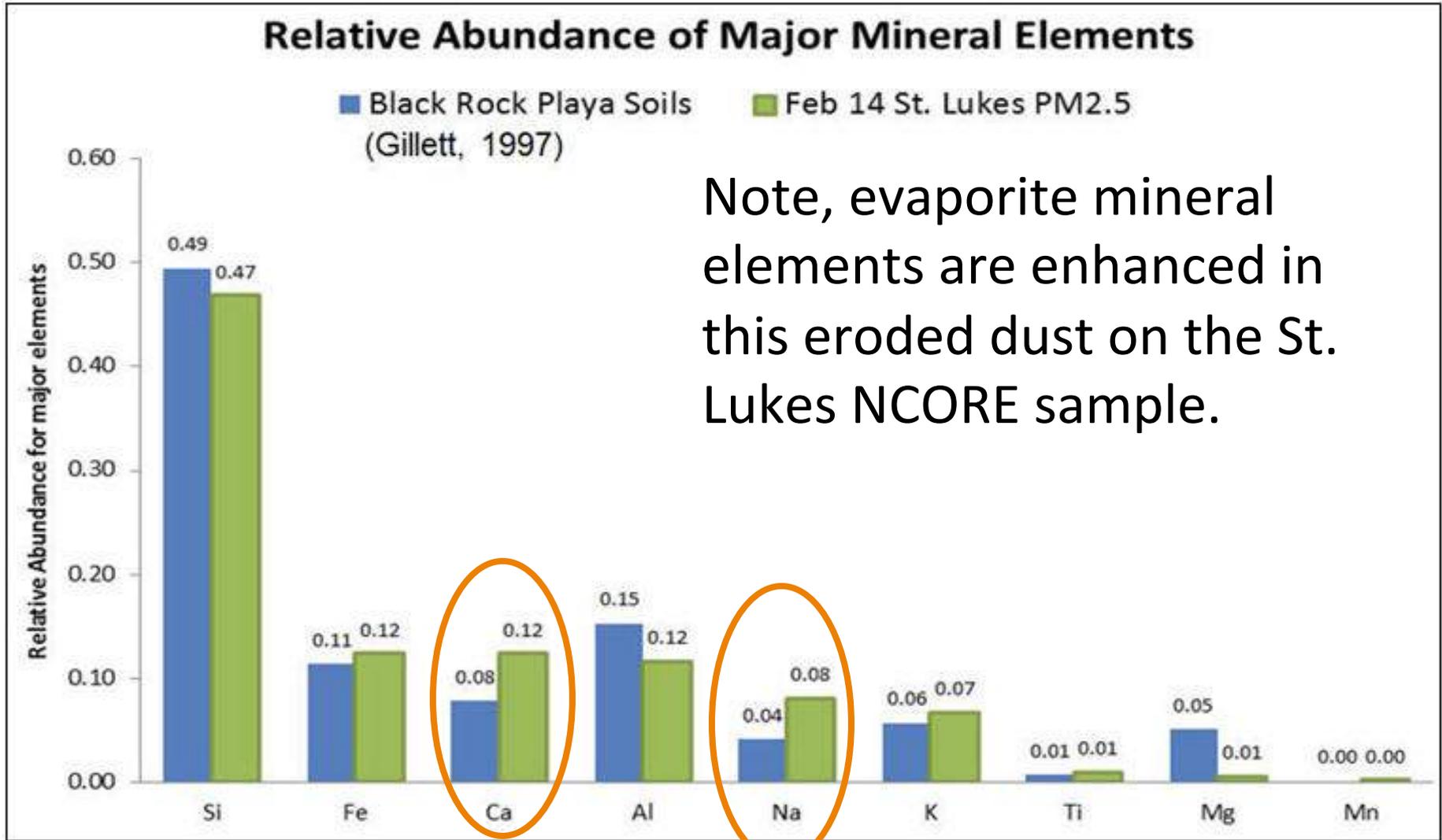
Feb. 14, 2011 Speciation vs Annual and Winter Average
St. Lukes Meridian, NCORE Site (2009 - 2011)



Feb 14 Speciation matches BRP Soils



Feb 14 Speciation matches BRP Soils

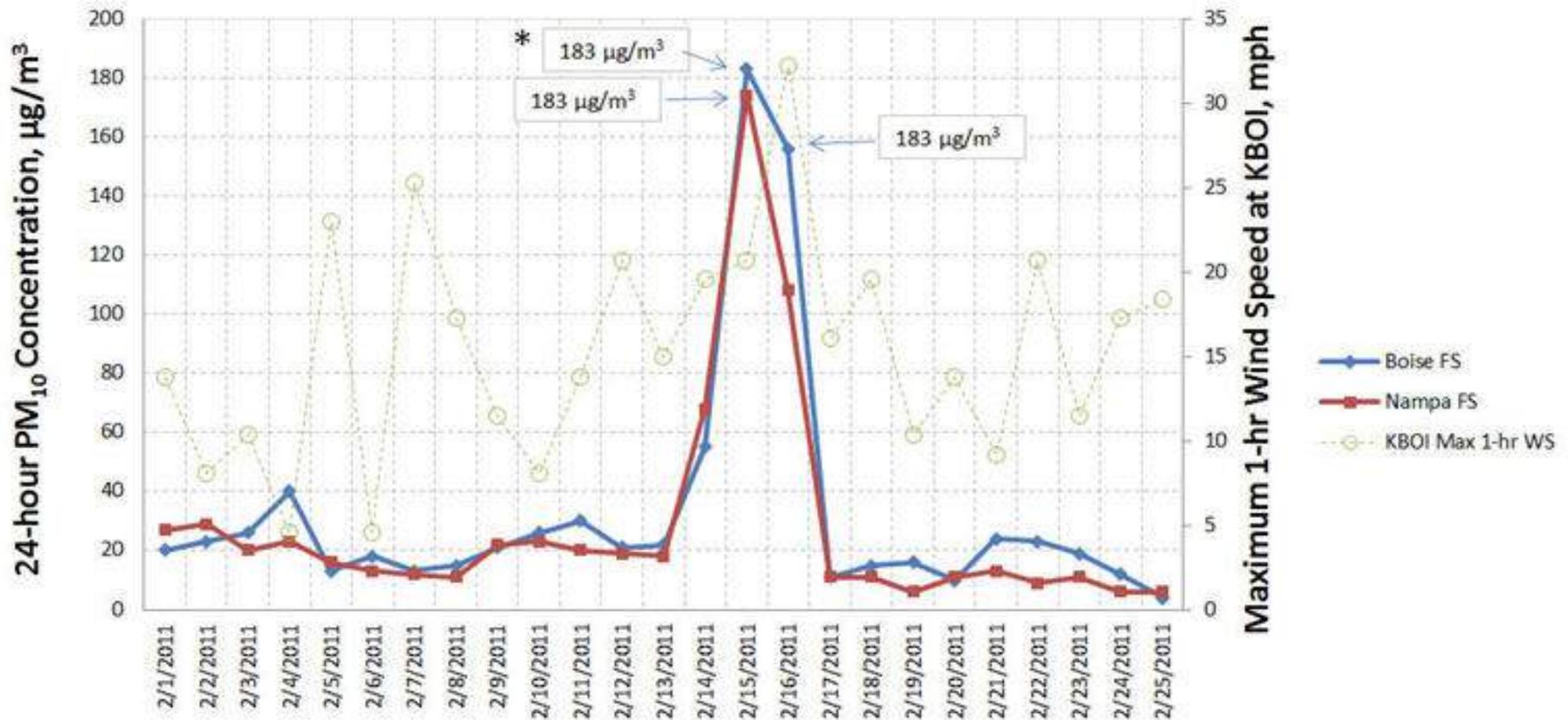


Water-mediated erodable surface

- *. . . small increases in water-table depth cause large, nonlinear increases in windblown-dust emissions. Pelletier, 2005.*
- *Dust emission may respond rapidly to heavy precipitation. . . newly formed crusts that are vulnerable to wind erosion and (or) the production of loose aggregates of evaporite minerals that are quickly removed by even moderate winds. Reynolds, 2009*
- Evaporite minerals include calcite, halite, gypsum

Clear Causal Relationship: Compare non-event days before and after.

Boise & Nampa 24-hour PM₁₀ Concentrations and Winds before and after the Feb 15/16, 2011 Exceptional Events



* Note, all samples on 2/14, 2/15 and 2/16 were affected by the Nevada dust storm, however only 3 samples labelled are proposed for concurrence.

Clear Causal Relationship: Alternative Hypotheses

- Industrial Emissions – Normal. Reduced by permits in 2004 SIP.
- Road Dust – Preceding 45 days had 2nd lowest snowfall in 10 years so road sand/silt should be lower than normal. Elevated Ca, Na indicates Playa origin.
- Construction Dust – February is outside season. Both sites at urban centers with no significant new construction.
- Agricultural areas – For area crops, earliest planting March 21, latest harvest November 10, so fields not freshly disturbed.
- Non-agricultural lands – Boise winds < 20mph. Winds less than 30 - 40mph rarely increase PM₁₀.

No Exceedence “But For”

Site	Annual Average	Annual 95 th Percentile	Annual 99 th Percentile
Boise	23	45	66
Nampa	24	56	78
Site	Seasonal Average	Seasonal 95 th Percentile	Seasonal 99 th Percentile
Boise	20	41	65
Nampa	19	40	80

No Exceedence “But For”

Site	Annual Average	Annual 95 th Percentile	Annual 99 th Percentile
Boise	23	45	66
Nampa	24	56	78
Site	Seasonal Average	Seasonal 95 th Percentile	Seasonal 99 th Percentile
Boise	20	41	65
Nampa	19	40	80

Concentrations at Boise FS and Nampa FS would not have been over about 45 to 56 $\mu\text{g}/\text{m}^3$ “but for” the exceptional event under consideration.

Therefore the Nevada playas contributed at least 138 $\mu\text{g}/\text{m}^3$ at Boise (=183-45 $\mu\text{g}/\text{m}^3$) and at least 118 $\mu\text{g}/\text{m}^3$ at Nampa (=174-56 $\mu\text{g}/\text{m}^3$).

The NAAQS would not have been exceeded “but for” the playa dust event.

Mitigation – Feb 15, morning alert

David Luft

From: David Luft
Sent: Tuesday, February 15, 2011 10:23 AM
To: David Luft
Subject: UPDATED AQI - Yellow Air Quality Alert for the Treasure Valley for Today - Tuesday, February 15, 2010 - AQI = 80
Attachments: Yellow Alert-Winter.pdf; Ordinance & Contact Info.pdf

UPDATED AQI Forecast: Due to the deterioration of air quality from high levels of windblown dust in the Treasure Valley, the Idaho Department of Environmental Quality has issued a **YELLOW/MODERATE** air quality alert for **TODAY, Tuesday, February 15, 2011** for Ada and Canyon Counties.

The forecast **Air Quality Index (AQI)** is **80**.

- **ALL OPEN OUTDOOR BURNING IS PROHIBITED IN ADA COUNTY AND THE CITIES WITHIN WHEN THE AQI IS 60 OR GREATER.**
- **ALL OPEN OUTDOOR BURNING IS PROHIBITED IN THE INCORPORATED CITIES WITHIN CANYON COUNTY WHEN THE AQI IS 60 OR GREATER.**
- **ALL OPEN BURNING IS PROHIBITED IN UNINCORPORATED CANYON COUNTY WHEN THE AQI IS 75 OR GREATER.**
- **INDOOR/WOOD BURNING IS RESTRICTED IN THE CITIES WITHIN ADA COUNTY WHEN THE AQI IS 74 OR GREATER. WITHIN UNINCORPORATED ADA AND CANYON COUNTIES ONLY EPA-CERTIFIED WOODSTOVES ARE ALLOWED WHEN THE AQI IS 74 OR GREATER.**

Today's air quality index and burning ordinance information can be viewed on the Department of Environmental Quality's website at <http://www.deq.idaho.gov/air/aqindex.cfm>

- All individuals may want to consider postponing strenuous activities until air quality improves.
- Please consider taking some of the following actions to reduce air pollution during this period:

- Limit driving
- Combine trips & errands
- Avoid woodstove and fireplace use if possible
- Don't burn outdoors

All open outdoor burning is prohibited in Ada County and the cities within by municipal and county ordinance and in the incorporated cities within Canyon County by municipal ordinance when the AQI reaches **60 or above**. All open outdoor burning is prohibited in unincorporated portions of Canyon County when the AQI reaches **75 or above**. Indoor/wood burning is restricted in the City of Boise and Ada County when the AQI reaches **74 or above**.

Air Quality Alert Condition for today



→ The current air quality alert condition is **YELLOW**. The air quality is deteriorating and the increasing pollution levels may impact sensitive populations like children, the elderly, and people with breathing or heart conditions.

→ Open Burning is strictly prohibited by local ordinances in many cities around the Valley and DEQ requests that residents in all areas of the Valley do not burn during this air quality alert period. Find out where to call in your city on the DEQ website listed below.

→ Limit driving, use public transportation, and consider carpooling today. Pollution emitted from vehicles is one of the main sources of air pollution in the Valley.

→ Air quality alerts are issued daily at 3 p.m. For updated alerts and air quality information call 373-0313 or log on at <http://www.deq.idaho.gov/air/aqindex.cfm>



Department of Environmental Quality

David Luft

From: David Luft
Sent: Wednesday, February 16, 2011 9:09 AM
To: David Luft
Subject: UPDATED AQI - Orange Air Quality Alert for the Treasure Valley for Today - Wednesday, February 16, 2010 - AQI = 110
Attachments: Orange Alert Winter.pdf; Ordinance & Contact Info.pdf

UPDATED AQI Forecast: Due to the continued deterioration of air quality from high levels of windblown dust in the Treasure Valley, the Idaho Department of Environmental Quality has issued an **ORANGE/UNHEALTHY FOR SENSITIVE GROUPS** air quality alert for **TODAY, Wednesday, February 16, 2011** for Ada and Canyon Counties.

The forecast Air Quality Index (AQI) is **110**.

- **BURNING IS PROHIBITED IN THE TREASURE VALLEY (ADA AND CANYON COUNTIES AND THE CITIES WITHIN) DURING THIS AIR QUALITY ALERT.**
- **INDOOR/WOOD BURNING IS RESTRICTED IN THE CITIES WITHIN ADA COUNTY WHEN THE AQI IS 74 OR GREATER. WITHIN UNINCORPORATED ADA AND CANYON COUNTIES ONLY EPA-CERTIFIED WOODSTOVES ARE ALLOWED WHEN THE AQI IS 74 OR GREATER.**

Today's air quality index and burning ordinance information can be viewed on the Department of Environmental Quality's website at <http://www.deq.idaho.gov/air/aqindex.cf>

- All individuals may want to consider postponing strenuous activities until air quality improves.
- Please consider taking some of the following actions to reduce air pollution during this period:

- Limit driving
- Combine trips & errands
- Avoid woodstove and fireplace use if possible
- Don't burn outdoors

All open outdoor burning is prohibited in Ada County and the cities within by municipal and county ordinance and in the incorporated cities within Canyon County by municipal ordinance when the AQI reaches **60 or above**. All open outdoor burning is prohibited in unincorporated portions of Canyon County when the AQI reaches **75 or above**. Indoor/wood burning is restricted in the City of Boise and Ada County when the AQI reaches **74 or above**.

Orange

**Air Quality Index (AQI)
101-150**

Air quality alert notifications are issued daily when warranted. For air quality information call 373-0113 or check DEQ's website at <http://www.deq.idaho.gov/air/aqindex.cfm>

Air Quality is in the Unhealthy for Sensitive Groups Category Today

The current air quality alert is **Orange**. Members of sensitive groups may experience health effects. Everyone should limit exertion outdoors.

Burning is prohibited in the Treasure Valley (Ada and Canyon Counties and Cities within) during this air quality alert period.

Indoor/wood burning is restricted in the City of Boise and Ada County by municipal and county ordinance.

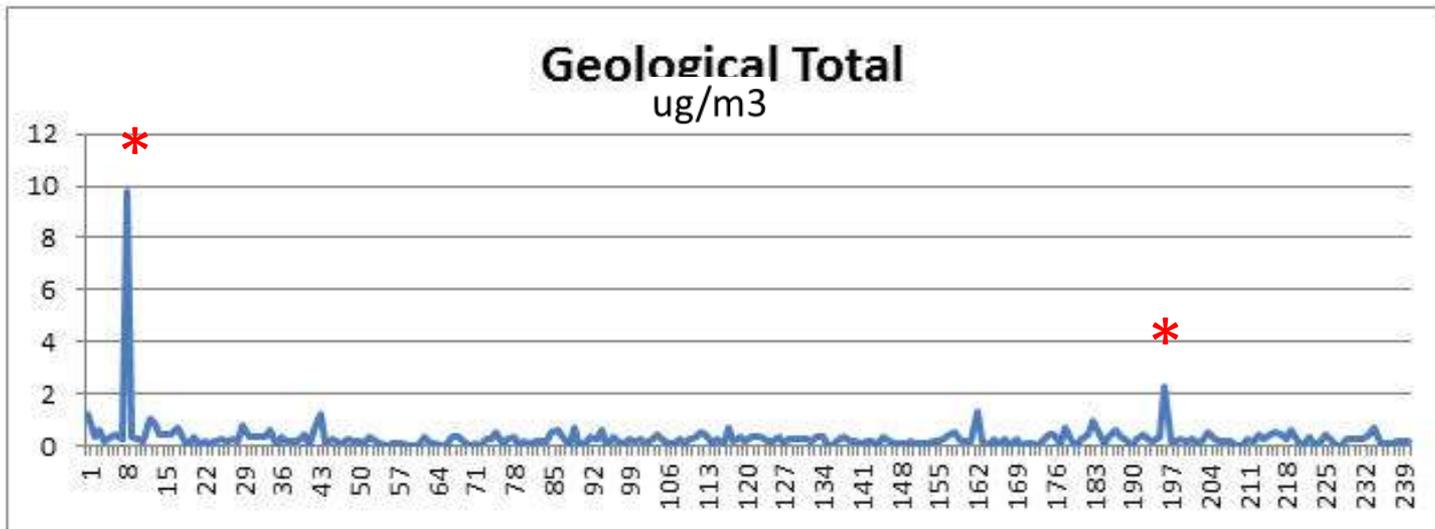
Don't idle your vehicle. Consider walking inside of banks and restaurants instead of using the drive-up window.

Limit driving and making unnecessary trips.

Idaho Department of Environmental Quality - Boise Regional Office (208) 373-0550
<http://www.deq.idaho.gov/air/aqindex.cfm>

Additional Weight of Evidence: Boise-Nampa Winter Geologic Component, 2006 - 2012

Normally averages 0.34 ug/m³. Highest 5 Geologic components are shown below.



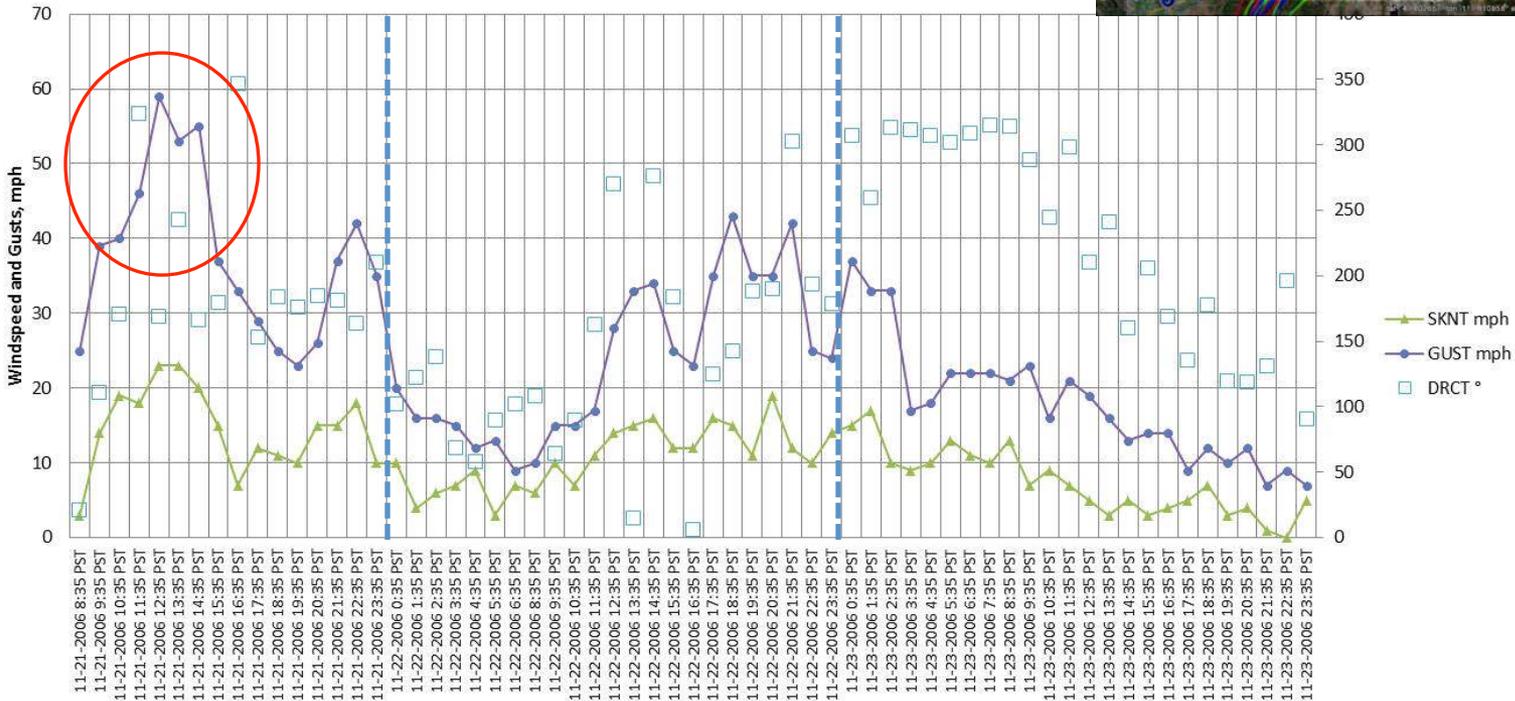
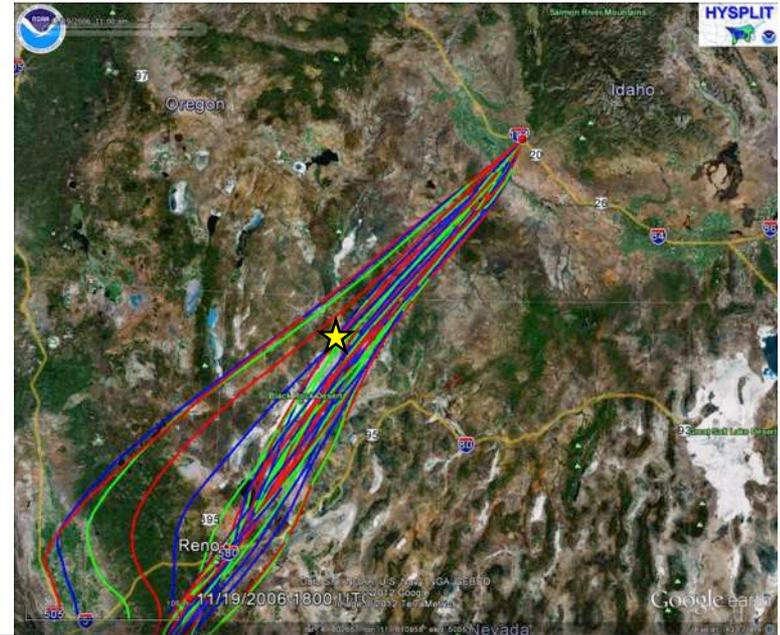
Top 5 samples with highest geological material

Date	Al	Si	Ca	Fe	Ti	Total Geological ug/m ³
11/1/2006	8.65%	16.15%	7.51%	11.78%	0.00%	1.21
* 11/22/2006	7.65%	24.02%	6.00%	5.37%	0.31%	9.78
* 2/14/2011	6.00%	24.08%	6.39%	6.39%	0.49%	2.30
11/4/2010	3.89%	16.65%	4.50%	17.56%	0.07%	1.31
11/8/2007	4.77%	18.32%	11.97%	9.88%	0.23%	1.24

* Associated with back trajectories over Black Rock Desert and high winds in NV

24-hr HYSPLIT Back- Trajectories Ending in Boise from 1600PST Nov 21 to 2300PST Nov 22, 2006

★TEXN2 Mesowest Site, NV Nov 21 - 23, 2006



Questions? Suggestions?



Source: Friends of the Black Rock/High Rock

<http://blackrockdesert.org/friends/black-rock-desert-landscape>



*The Leave No Trace Spirit: "A Healthy Playa is a Happy Playa."
Mike Bilbo photo 9/21/98*

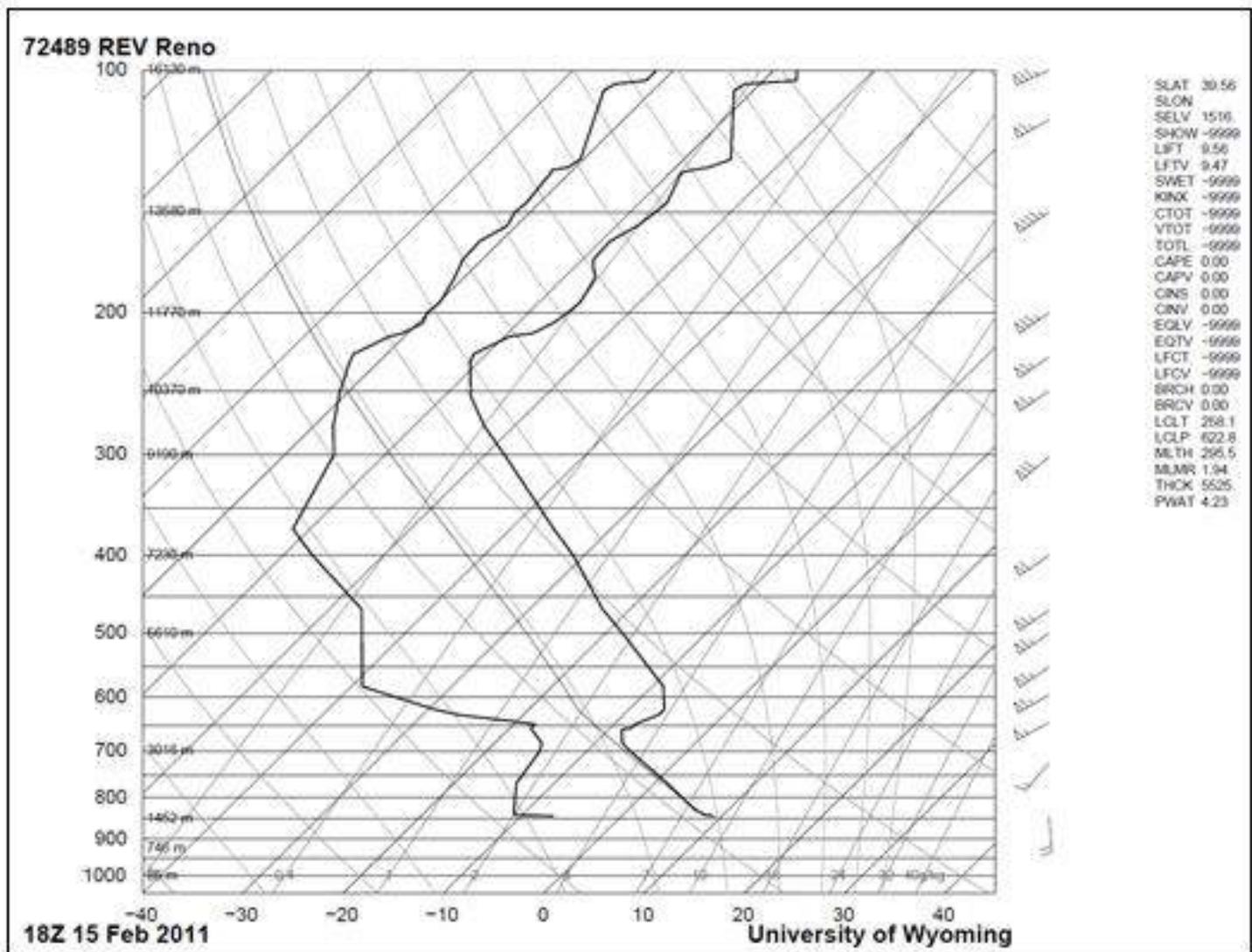
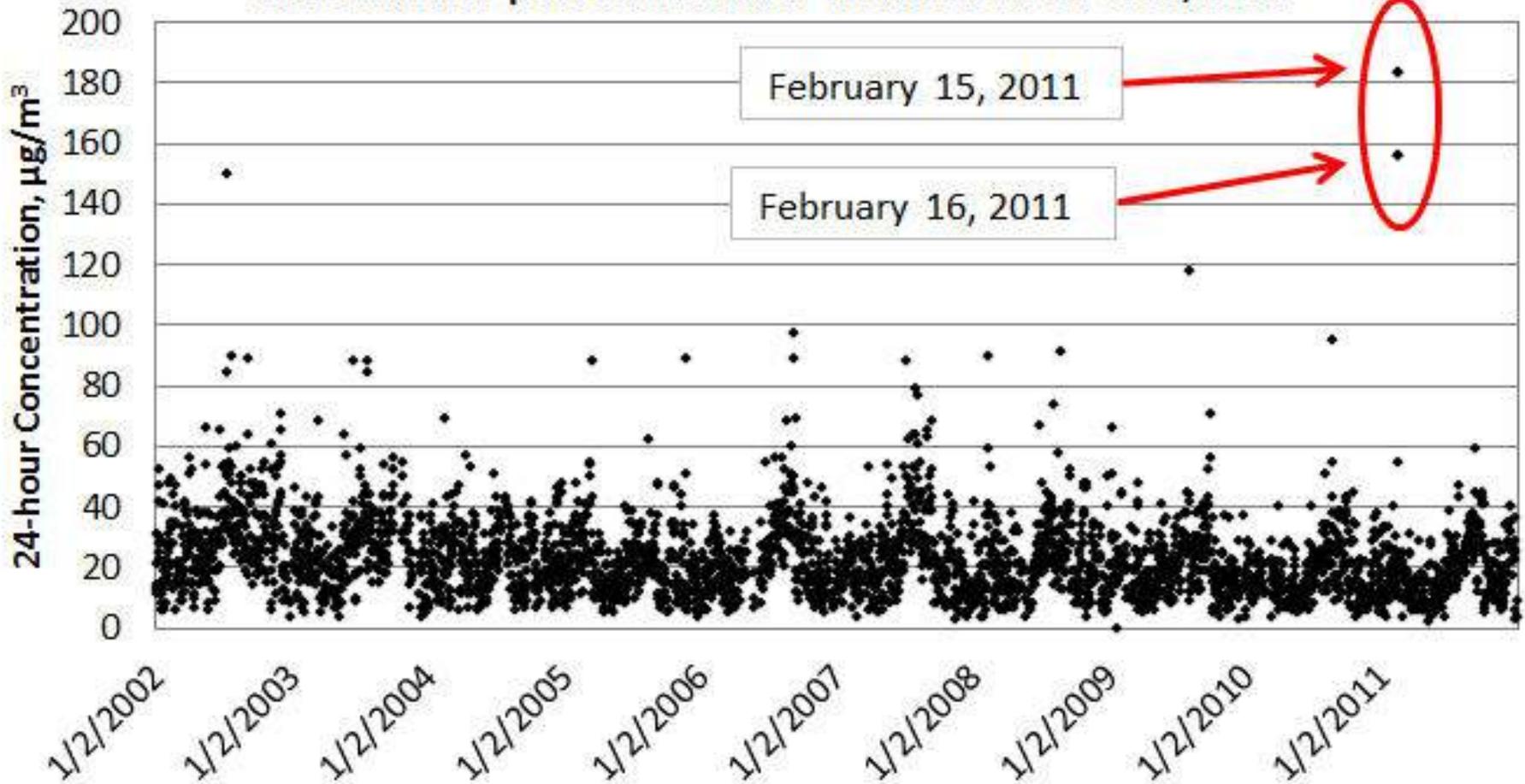


Figure 21 Sounding information for Reno, NV at 18Z (11am) 02/15/11.

Historical Fluctuations

Boise Fire Station PM₁₀ Concentrations 2002-2011

0.03 and 0.05 percentile values occurred Feb 15 & 16, 2011



Dust storm over the Black Rock Desert: Larger-scale dynamic signatures

Key Points

- A dust storm that originated over the Black Rock Desert of northwestern Nevada

John M. Lewis

National Severe Storms Laboratory, NOAA, Norman, Oklahoma, USA

Division of Atmospheric Sciences, Desert Research Institute, Reno, Nevada, USA

Michael L. Kaplan

Division of Atmospheric Sciences, Desert Research Institute, Reno, Nevada, USA

Ramesh Vellore

Division of Atmospheric Sciences, Desert Research Institute, Reno, Nevada, USA

Robert M. Rabin

National Severe Storms Laboratory, NOAA, Norman, Oklahoma, USA

Space Science and Engineering Center, Madison, Wisconsin, USA

John Hallett

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Stephen A. Cohn

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A dust storm that originated over the Black Rock Desert (BRD) of northwestern Nevada is investigated. Our primary goal is to more clearly understand the sequence of dynamical processes that generate surface winds responsible for entraining dust from this desert. In addition to reliance on conventional surface and upper-air observations, we make use of reanalysis data sets (NCAR/NCEP and NARR)—blends of primitive equation model forecasts and observations. From these data sets, we obtain the evolution of vertical motion patterns and ageostrophic motions associated with the event. In contrast to earlier studies that have emphasized the importance of indirect transverse circulations about an upper-level jet streak, our results indicate that in this case the transition from an indirect to a direct circulation pattern across the exit region of upper-level jet streak is central to creation of low-level winds that ablate dust from the desert. It is further argued that the transition of vertical circulation patterns is in response to adjustments to geostrophic imbalance—an adjustment time scale of 6–9 h. Although unproven, we suggest that antecedent rainfall over the alkali desert 2 weeks prior to the event was instrumental in lowering the bulk density of sediments and thereby improved the chances for dust ablation by the atmospheric disturbance. We comprehensively compare/contrast our results with those of earlier investigators, and we present an alternative view of key dynamical signatures in atmospheric flow that portend the likelihood of dust storms over the western United States.

Conceptual
Model

and

Clear Causal
Relationship
CCR

Steenburgh, W. James, Jeffrey D. Massey, Thomas H. Painter, 2012: Episodic Dust Events of Utah's Wasatch Front and Adjoining Region. *J. Appl. Meteor. Climatol.*, **51**, 1654–1669.
doi: <http://dx.doi.org/10.1175/JAMC-D-12-07.1>

Episodic Dust Events of Utah's Wasatch Front and Adjoining Region

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Conceptual Model:

Salt Lake City Dust Events
also traced back to western
Nevada Playa areas

Abstract

Episodic dust events cause hazardous air quality along Utah's Wasatch Front and dust loading of the snowpack in the adjacent Wasatch Mountains. This paper presents a climatology of episodic dust events of the Wasatch Front and adjoining region that is based on surface weather observations from the Salt Lake City International Airport (KSLC), Geostationary Operational Environmental Satellite (GOES) imagery, and additional meteorological datasets. Dust events at KSLC—defined as any day [mountain standard time (MST)] with at least one report of a dust storm, blowing dust, and/or dust in suspension with a visibility of 10 km or less—average 4.3 per water year (WY: October–September), with considerable interannual variability and a general decline in frequency during the 1930–2010 observational record. The distributions of monthly dust-event frequency and total dust flux are bimodal, with primary and secondary maxima in April and September, respectively. Dust reports are most common in the late afternoon and evening. An analysis of the 33 most recent (2001–10 WY) events at KSLC indicates that 11 were associated with airmass convection, 16 were associated with a cold front or baroclinic trough entering Utah from the west or northwest, 4 were associated with a stationary or slowly moving front or baroclinic trough west of Utah, and 2 were associated with other synoptic patterns. GOES imagery from these 33 events, as well as 61 additional events from the surrounding region, illustrates that emission sources are located primarily in low-elevation Late Pleistocene–Holocene alluvial environments in southern and western Utah and southern and western Nevada.

CCR



**Black Rock
Desert**



Lovelock, NV



Reno, NV



© 2012 Google

Image © 2012 TerraMetrics

lat 41.753866° lon -117.544906° elev 5111 ft

Google earth

Eye alt 403.27 mi

CCR

June 2012
Photos
from I-80
near
Lovelock,
NV

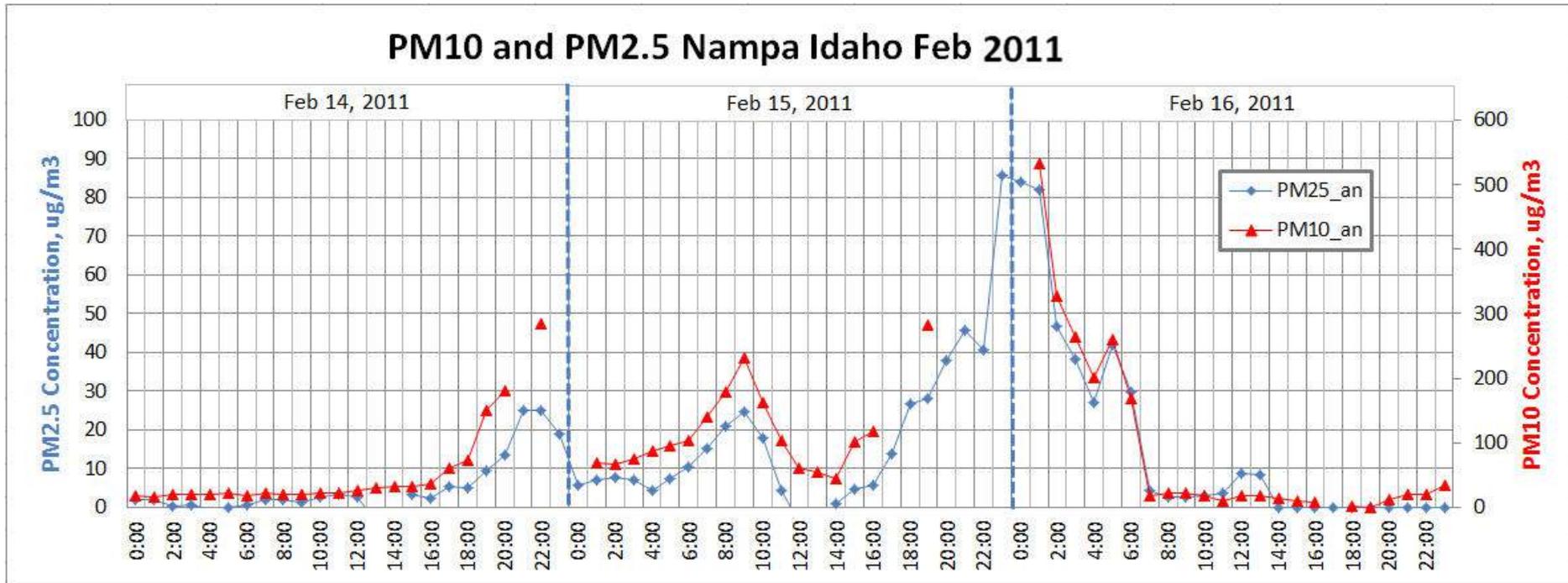


June 2012 Photos from I-80 near Lovelock, NV

CCR

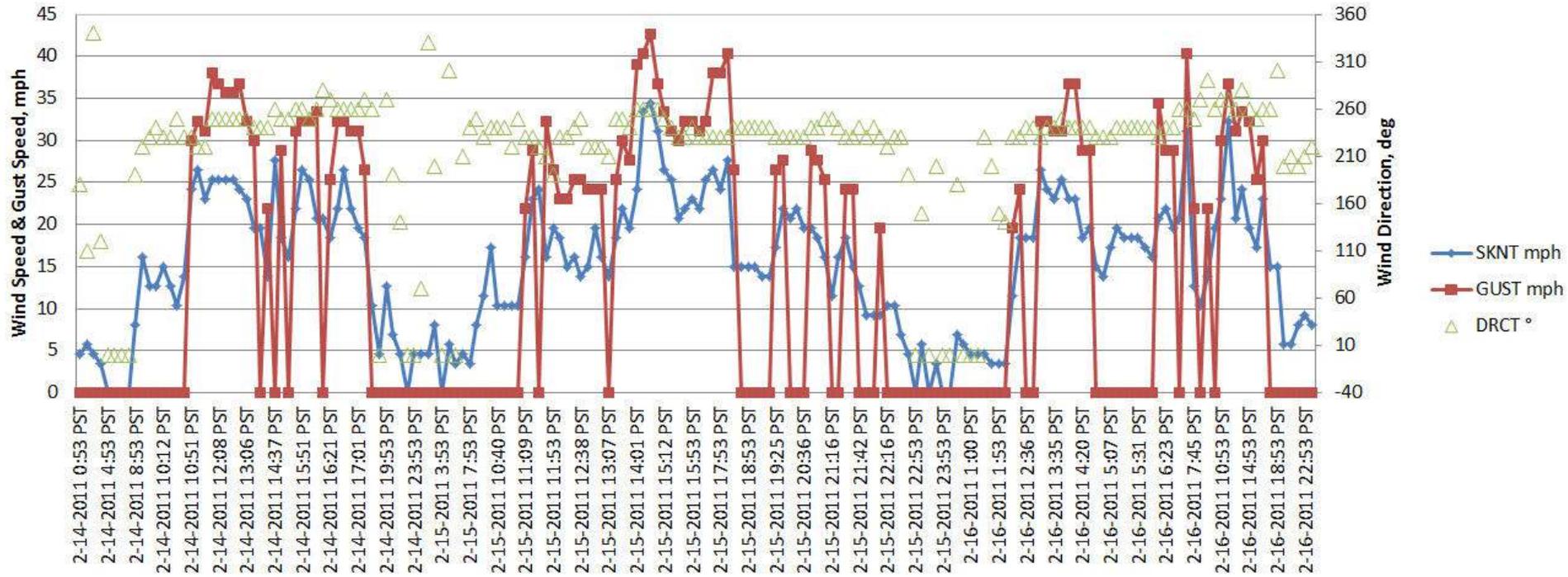


CCR Unusually high PM₁₀ concentrations occurred on all three days, Feb 14 - 16

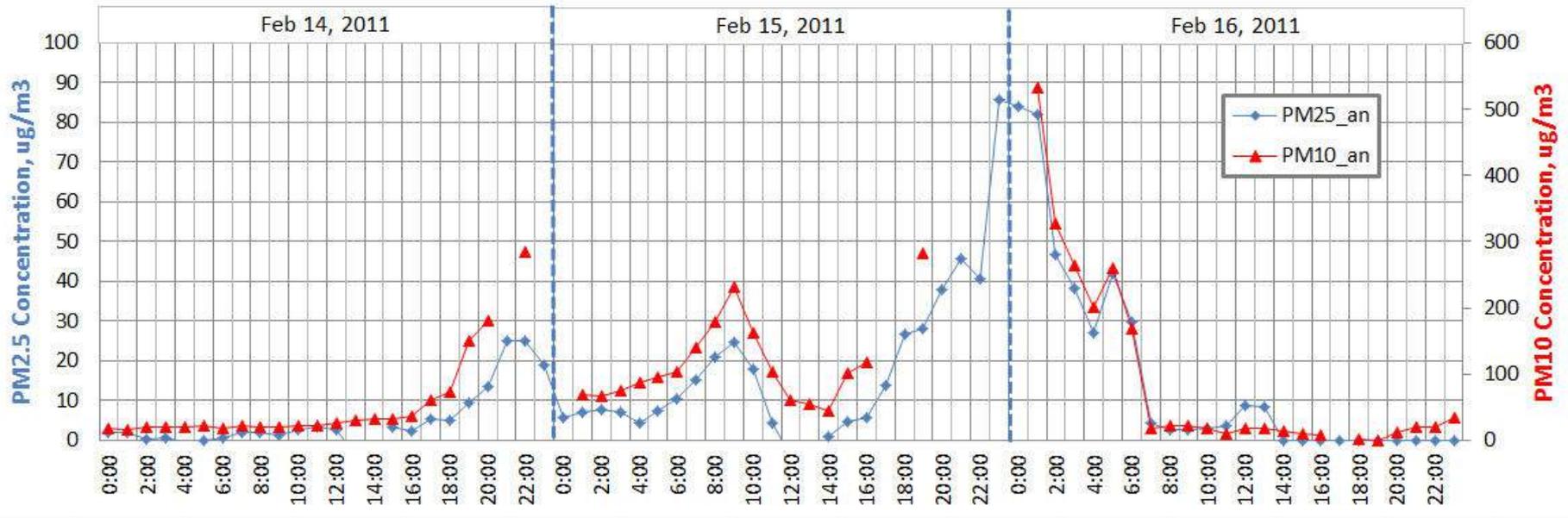


Feb 14 – 16, 2011 Winds at Lovelock, NV

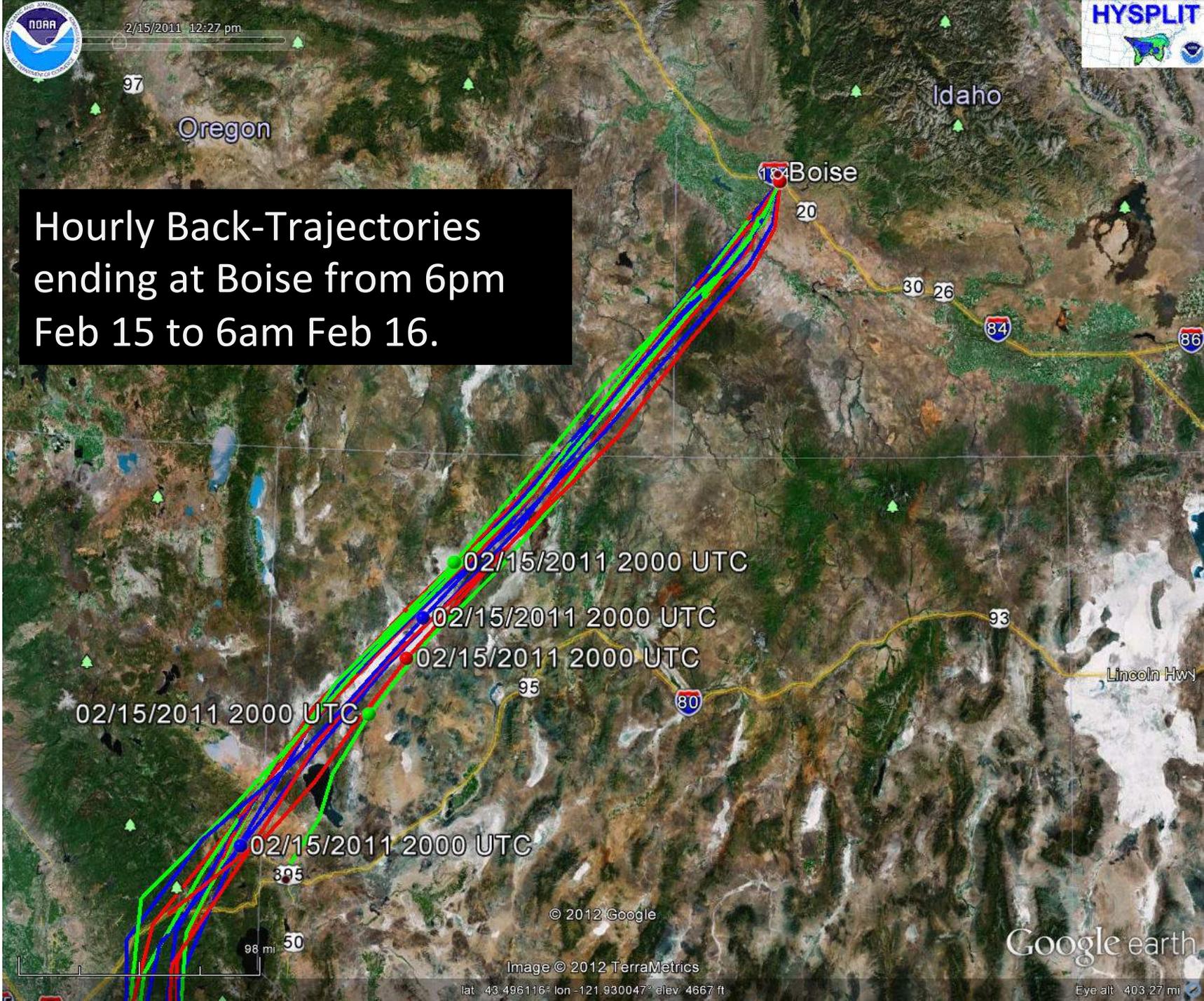
Wind Speed, Gust Speed and Direction, Lovelock NV



PM10 and PM2.5 Nampa Idaho



CCR



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Feb 15, 2011

~ 11:45 PST

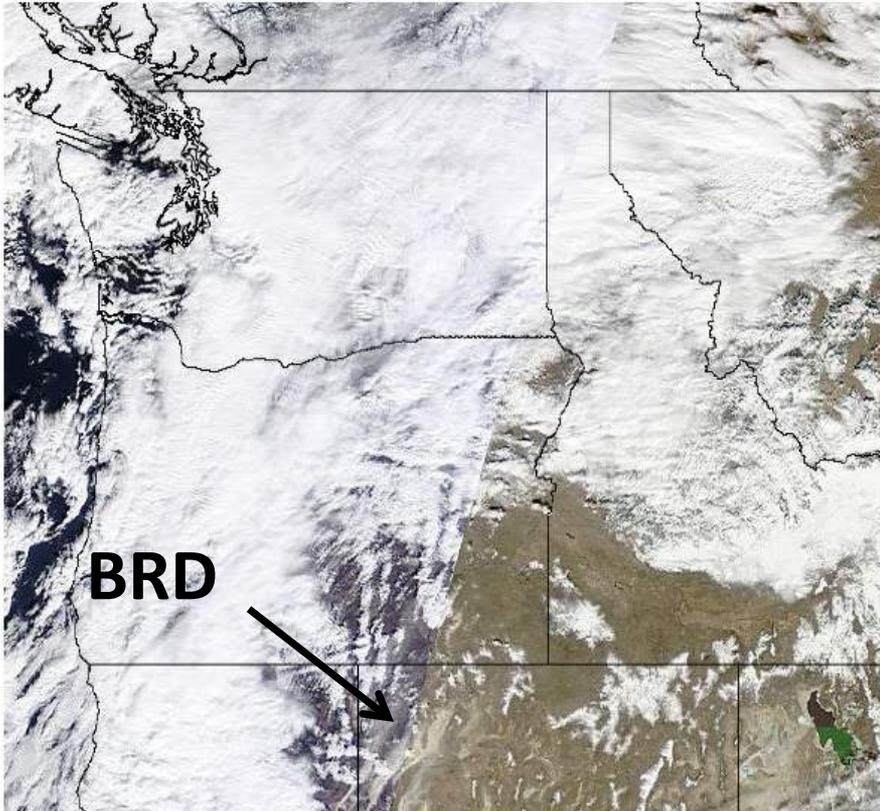
~ 13:45 PST

MODIS imagery

Select MODIS Instrument: terra Select Image Date: February 15 2011

Overpass time: Terra = ~10:45am, Aqua = ~1:45pm. Fires displayed in red.

Composite image provided courtesy of [NASA LANCE-MODIS](#)



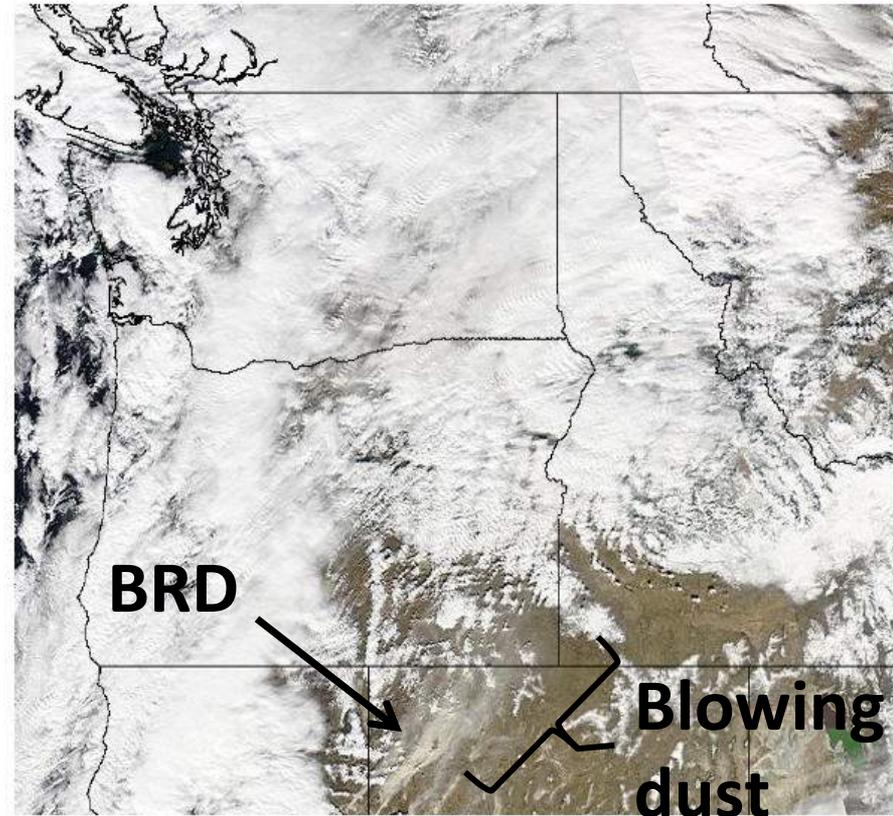
Civil & Environmental Engineering, PO Box 642910, Washington State University, Pullman WA 99164-2910, 509-335-

MODIS imagery

Select MODIS Instrument: aqua Select Image Date: February 15 2011

Overpass time: Terra = ~10:45am, Aqua = ~1:45pm. Fires displayed in red.

Composite image provided courtesy of [NASA LANCE-MODIS](#)

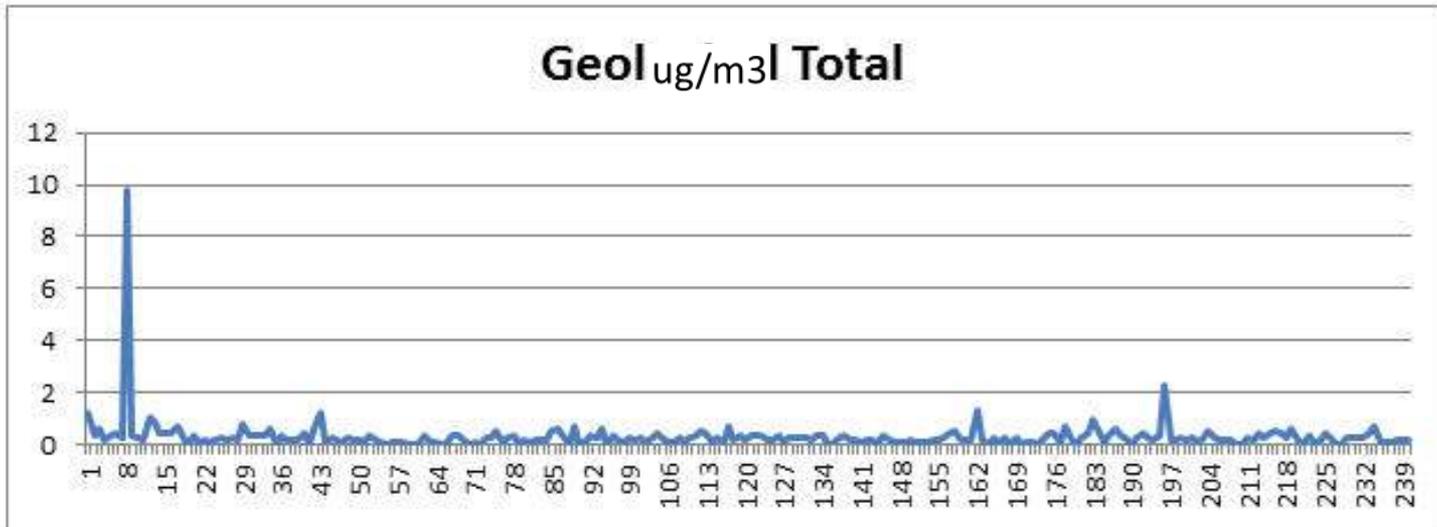


Civil & Environmental Engineering, PO Box 642910, Washington State University, Pullman WA 99164-2910, 509-335-

CCR

Boise-Nampa Winter Geologic Component, 2006 - 2012

Normally averages 0.34 ug/m³. Highest 5 Geologic components are shown below.

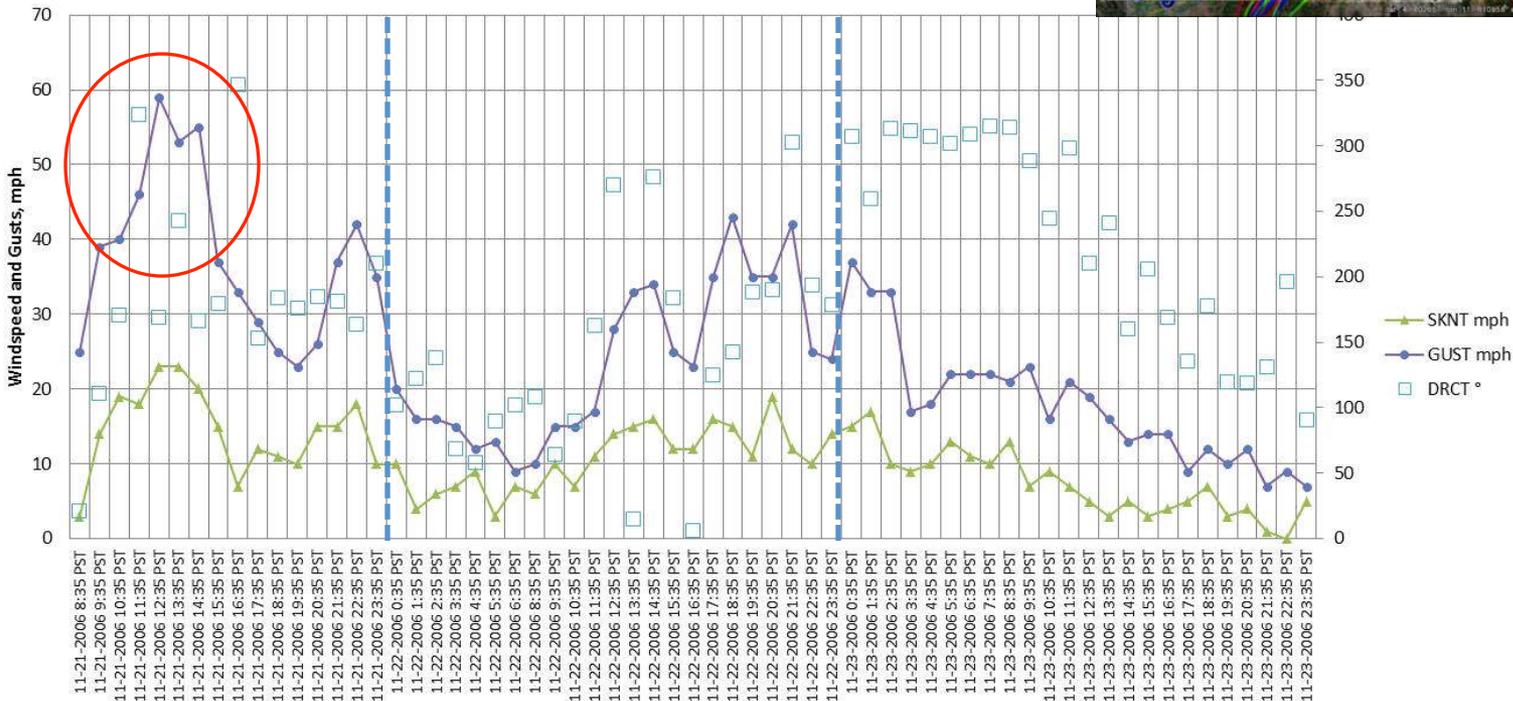
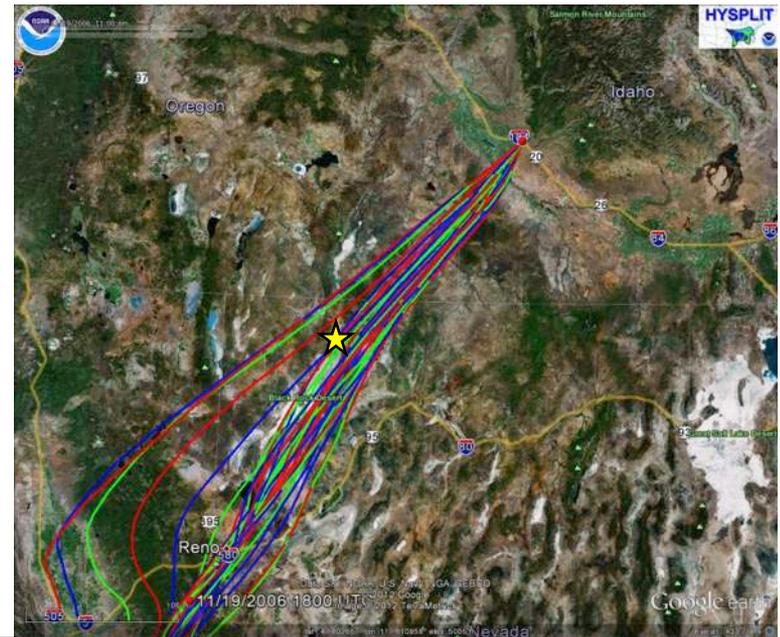


Top 5 samples with highest geological material

Date	Al	Si	Ca	Fe	Ti	Total Geological	Total ug/m ³
11/1/2006	8.65%	16.15%	7.51%	11.78%	0.00%	1.21	
11/22/2006	7.65%	24.02%	6.00%	5.37%	0.31%	9.78	
2/14/2011	6.00%	24.08%	6.39%	6.39%	0.49%	2.30	
11/4/2010	3.89%	16.65%	4.50%	17.56%	0.07%	1.31	
11/8/2007	4.77%	18.32%	11.97%	9.88%	0.23%	1.24	

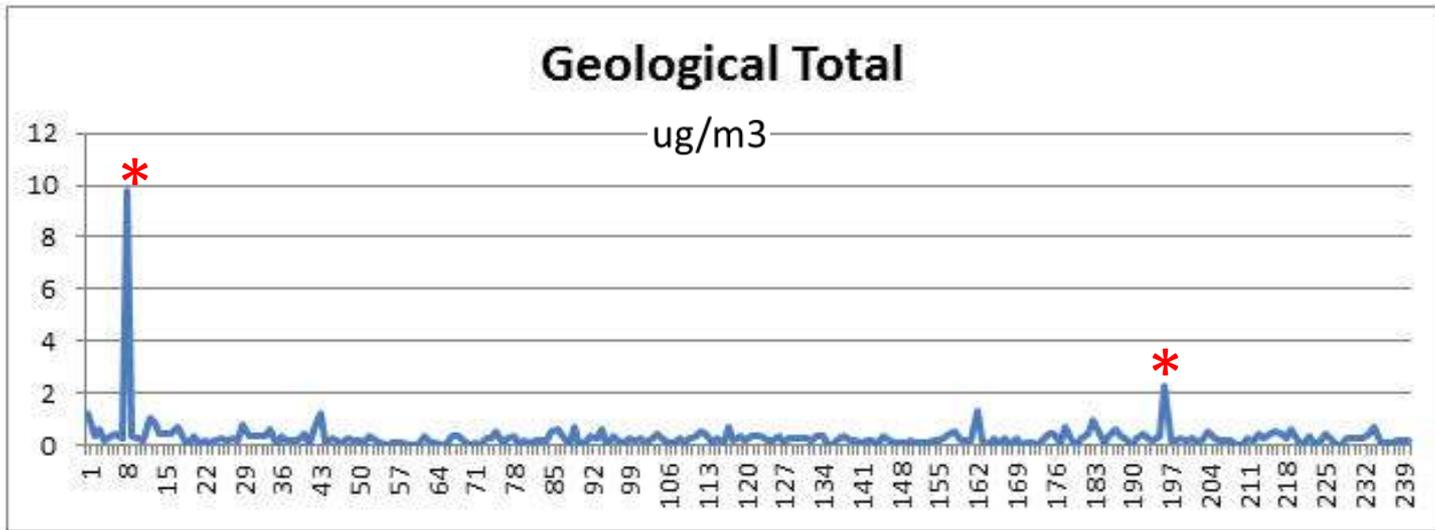
24-hr HYSPLIT Back- Trajectories Ending in Boise from 1600PST Nov 21 to 2300PST Nov 22, 2006

★TEXN2 Mesowest Site, NV Nov 21 - 23, 2006



Boise-Nampa Winter Geologic Component, 2006 - 2012

Normally averages 0.34 ug/m3. Highest 5 Geologic components are shown below.



Top 5 samples with highest geological material

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11/1/2006	8.65%	16.15%	7.51%	11.78%	0.00%	1.21
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* 2/14/2011	6.00%	24.08%	6.39%	6.39%	0.49%	2.30
11/4/2010	3.89%	16.65%	4.50%	17.56%	0.07%	1.31
11/8/2007	4.77%	18.32%	11.97%	9.88%	0.23%	1.24

* Associated with back trajectories over Black Rock Desert and high winds in NV

Chemical Analysis of Black Rock Playa (BRP) and other Nevada Soils

Table 2. Analyses of grab samples of miscellaneous "dirt" and mine tailings from selected locations in northwestern Nevada.

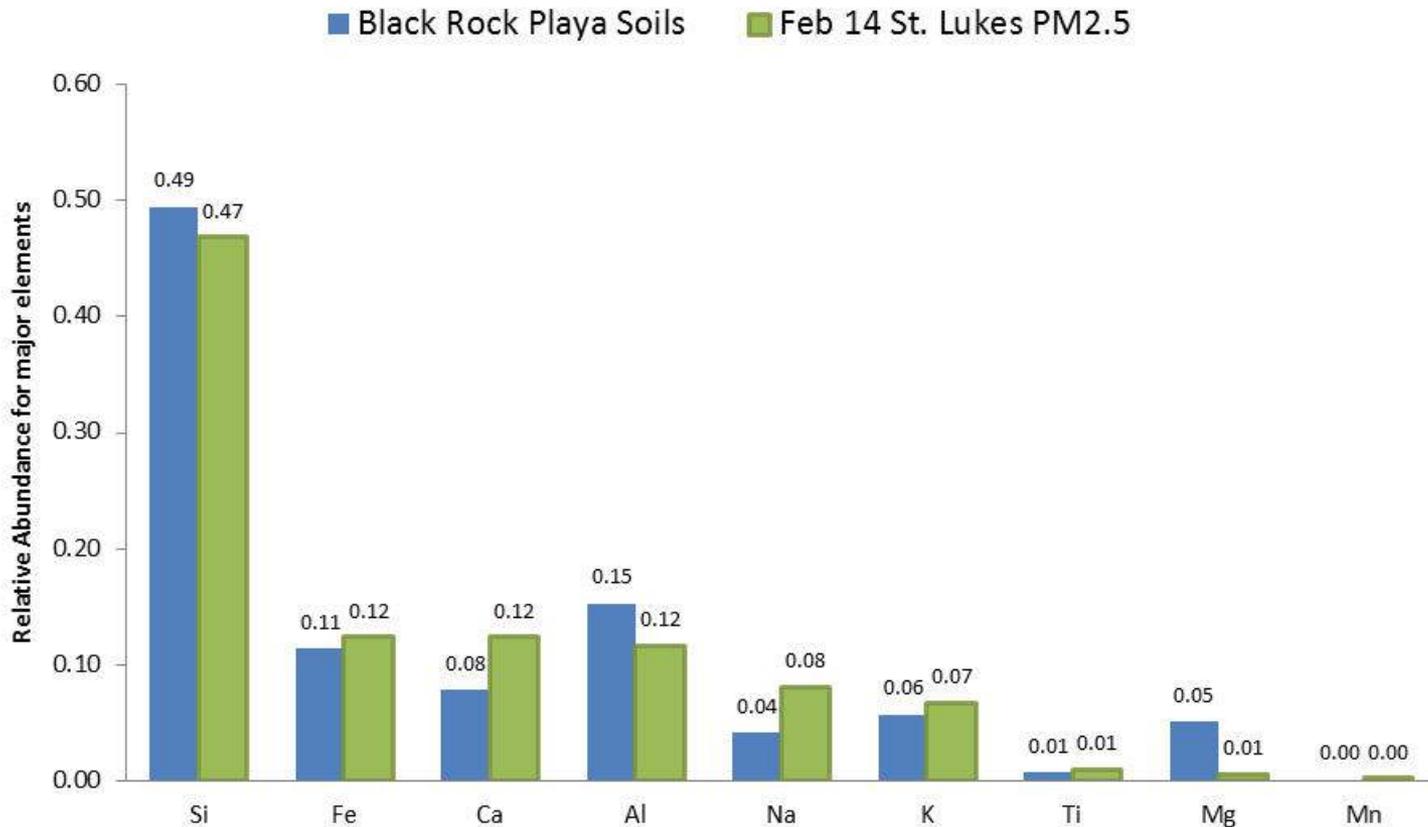
	BRP	OF	SP	TLD	YT	MT
<i>Major elements (oxide percentages by weight):</i>						
SiO ₂	43.1 %	66.0 %	52.5 %	57.5 %	64.2 %	67.6 %
TiO ₂	0.49	0.67	0.70	0.74	0.47	0.51
Al ₂ O ₃	11.8	15.0	16.3	17.5	14.6	13.2
Fe ₂ O ₃	5.32	3.86	6.98	6.03	4.79	3.18
MnO	0.08	0.12	0.14	0.14	0.00	0.00
MgO	3.46	1.02	3.13	2.32	0.96	0.61
CaO	4.51	2.12	2.33	4.31	1.31	0.33
Na ₂ O	2.29	2.55	2.01	3.14	2.71	1.30
K ₂ O	2.82	2.91	2.53	2.06	2.81	3.25
P ₂ O ₅	0.19	0.16	0.29	0.21	0.20	0.05
LOI	25.4	5.92	13.4	5.22	6.33	8.57
Total	99.52	100.31	100.23	99.18	98.40	98.64

CCR

St. Lukes NCORE Speciation Feb 14, 2011 vs BRP Soils

Of 6 NV soils, the Feb 14 NCORE correlates best with BRP

Relative Abundance of Major Mineral Elements



EER Technical Demonstration for High Wind Dust Events

- ✓ • Affects Air Quality
- ✓ • Not Reasonably Controllable or preventable
- ✓ • Caused by human activity unlikely to recur
- ✓ • Clear Causal Relationship
- ✓ • No Exceedance “But For”
- ✓ • Concentration in excess of Historical Fluctuations

Questions?

Table 10. 24-hour design value ($\mu\text{g}/\text{m}^3$) based on the highest observed PM_{10} 24 hour average concentrations from 2007 through 2009. The design value is the third-highest value during the 3 years and is indicated in bold.

Year	First	Second	Third	Fourth
2007	88	79	74	67
2008	91	90	74	67
2009	118	71	66	56

4.1.2 Recent Data

While too late to be included in the modeling, more recent data became available for 2010. The 2010 PM_{10} data from Boise Fire Station No. 5 have now been fully audited. The highest four PM_{10} values for 2010 are listed in Table 11.

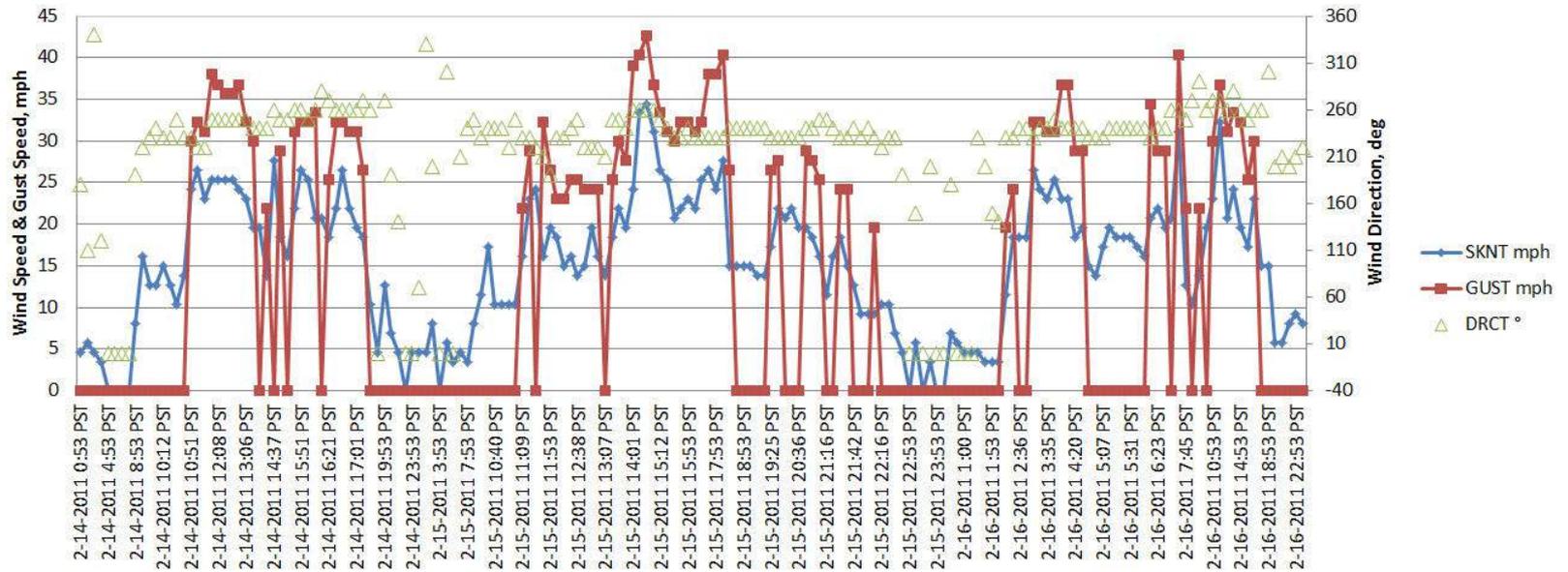
Table 11. The highest 24-hour average PM_{10} values and annual average in 2010 ($\mu\text{g}/\text{m}^3$).

Year	First	Second	Third	Fourth
2010	95	55	51	45

The highest value of $95 \mu\text{g}/\text{m}^3$ —recorded on August 21, 2010—was determined to qualify as an exceptional event due to winds over 30 mph and gusts over 40 mph. The annual average is lower than the maximum value of $23 \mu\text{g}/\text{m}^3$ in 2007–2009.

An exceedance was recorded on a relatively windy day on February 15, 2011, with a 24-hour value of $183 \mu\text{g}/\text{m}^3$. If this value were included in the calculation (2007–2011), the design value would be $91 \mu\text{g}/\text{m}^3$ (excluding the exceptional event in 2010). This value is only $1 \mu\text{g}/\text{m}^3$ higher than the design value based on 2007–2009 data and would not significantly change the predictions nor the conclusions of the analysis.

Wind Speed, Gust Speed and Direction, Lovelock NV



PM10 and PM2.5 Nampa Idaho Feb 10 - 20, 2011

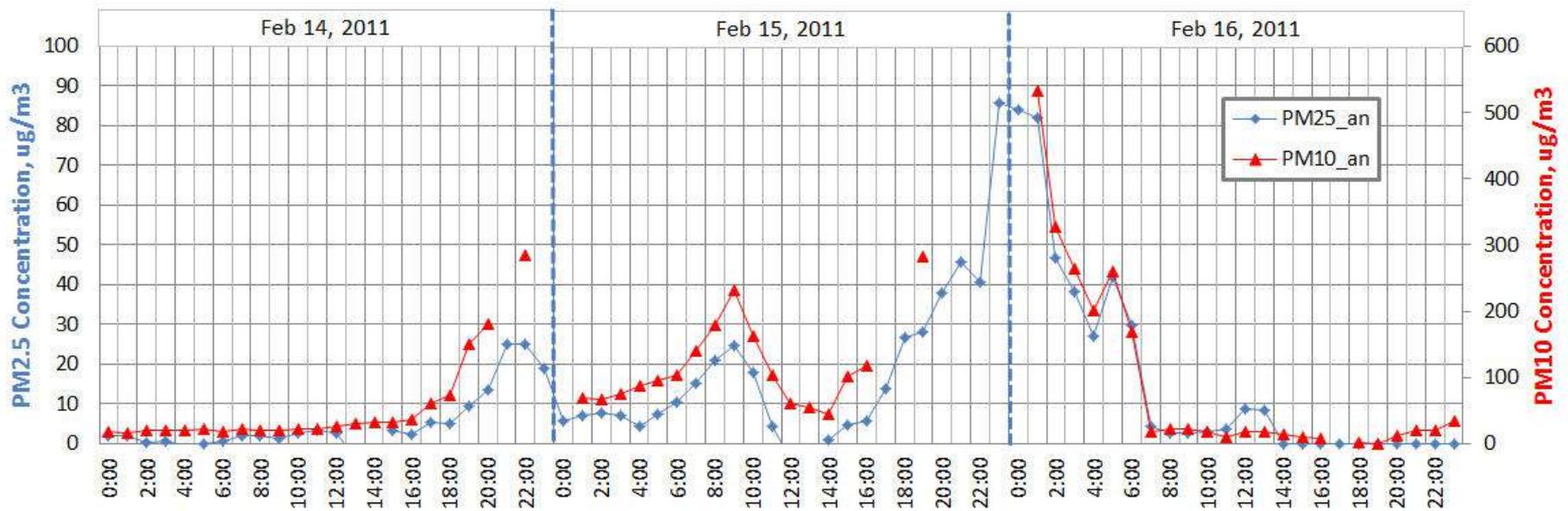


Table 24 presents the forecasted PM₁₀ levels using the estimated RRFs in Table 22. All future-year predicted levels are below NAAQS. The high-winter scenario provides the highest predictions.

Table 24. PM₁₀ attainment demonstration—PM₁₀ and composition for on-road emission conformity (µg/m³).

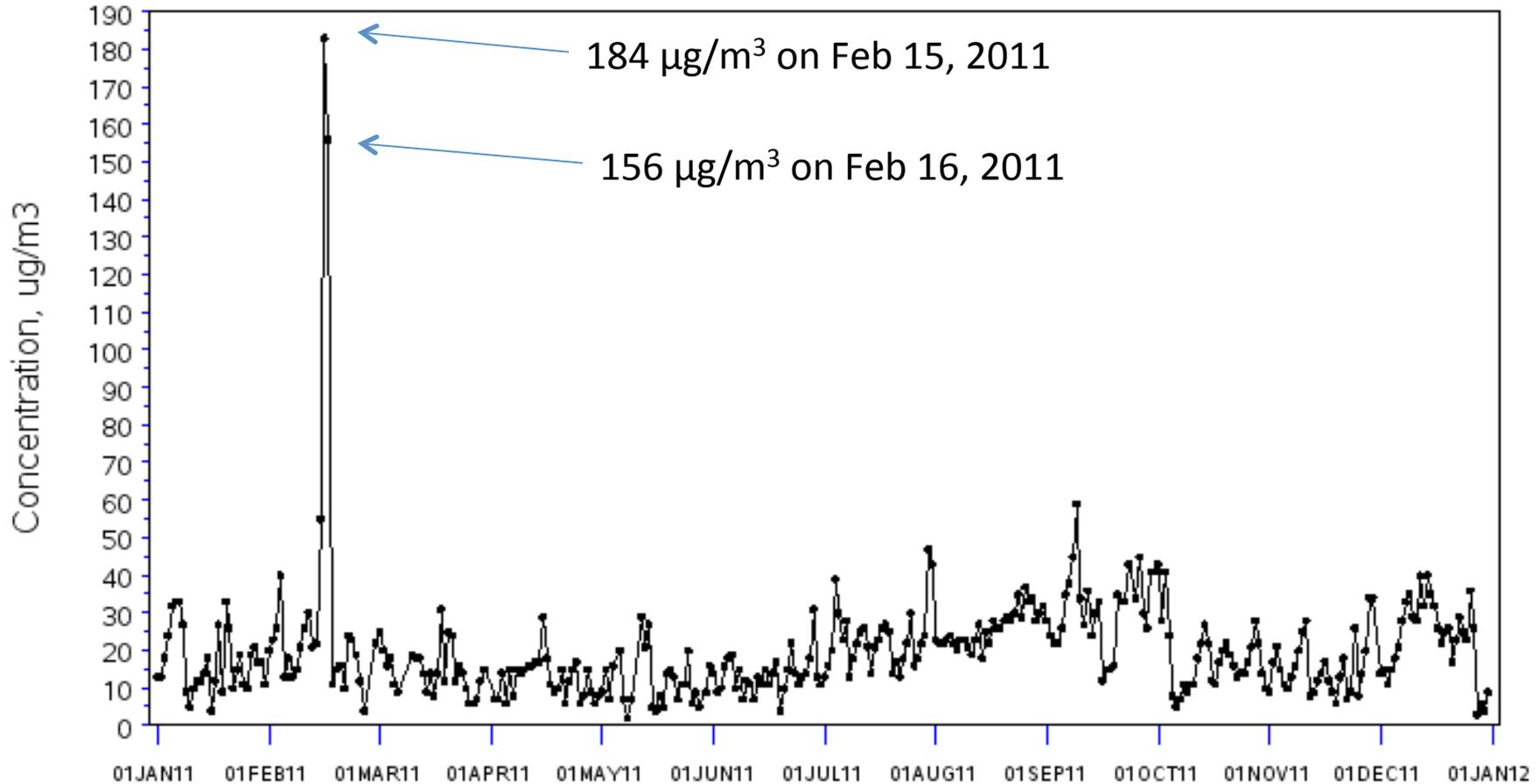
Year	Sulfate Mass	Nitrate Mass	Total Carbon	Crustal Mass	Unknown Artifact	PM ₁₀
Annual						
2008–2015	1.1	1.2	4.2	17.7	0.4	24.6
2015–2023	1.1	1.2	5.0	21.1	0.5	28.3
2023–2050	1.1	1.3	5.1	24.7	0.5	32.6
Nonwinter Season High Crustal Day						
2008–2015	3.2	0.0	9.8	82.3	1.0	96.3
2015–2023	3.2	0.0	11.7	92.6	1.2	108.7
2023–2050	3.2	0.0	12.1	110.0	1.4	126.7
Nonwinter Season High Carbon Day						
2008–2015	2.8	1.5	34.2	58.2	1.2	97.9
2015–2023	2.8	1.5	41.7	65.1	1.5	112.6
2023–2050	2.8	1.6	43.1	76.8	1.7	126.0
Winter Season Stagnation Day						
2008–2015	7.0	37.7	21.3	29.6	1.4	97.1
2015–2023	7.0	37.7	25.9	38.2	1.7	110.4
2023–2050	7.0	42.9	26.6	48.3	1.9	126.6
Winter Season High-winter Day						
2008–2015	4.7	20.5	38.0	34.3	1.9	99.5
2015–2023	4.7	20.5	46.0	45.3	2.6	119.1
2023–2050	4.7	23.3	47.3	57.9	2.9	136.1

Conclusion

- The unusually high PM₁₀ values at Boise Fire Station on February 15 and 16 clearly resulted from an exceptional high-wind dust storm originating at the Black Rock Desert Playa of Nevada.
- Including those 2 days, the 2007–2011 DV is 91 µg/m³. This is 1 µg/m³ above the current DV used.
- Excluding those 2 days, the 2009–2011 DV is 71 µg/m³.

Daily Mean PM10 Concentrations from 01/01/11 to 12/31/11

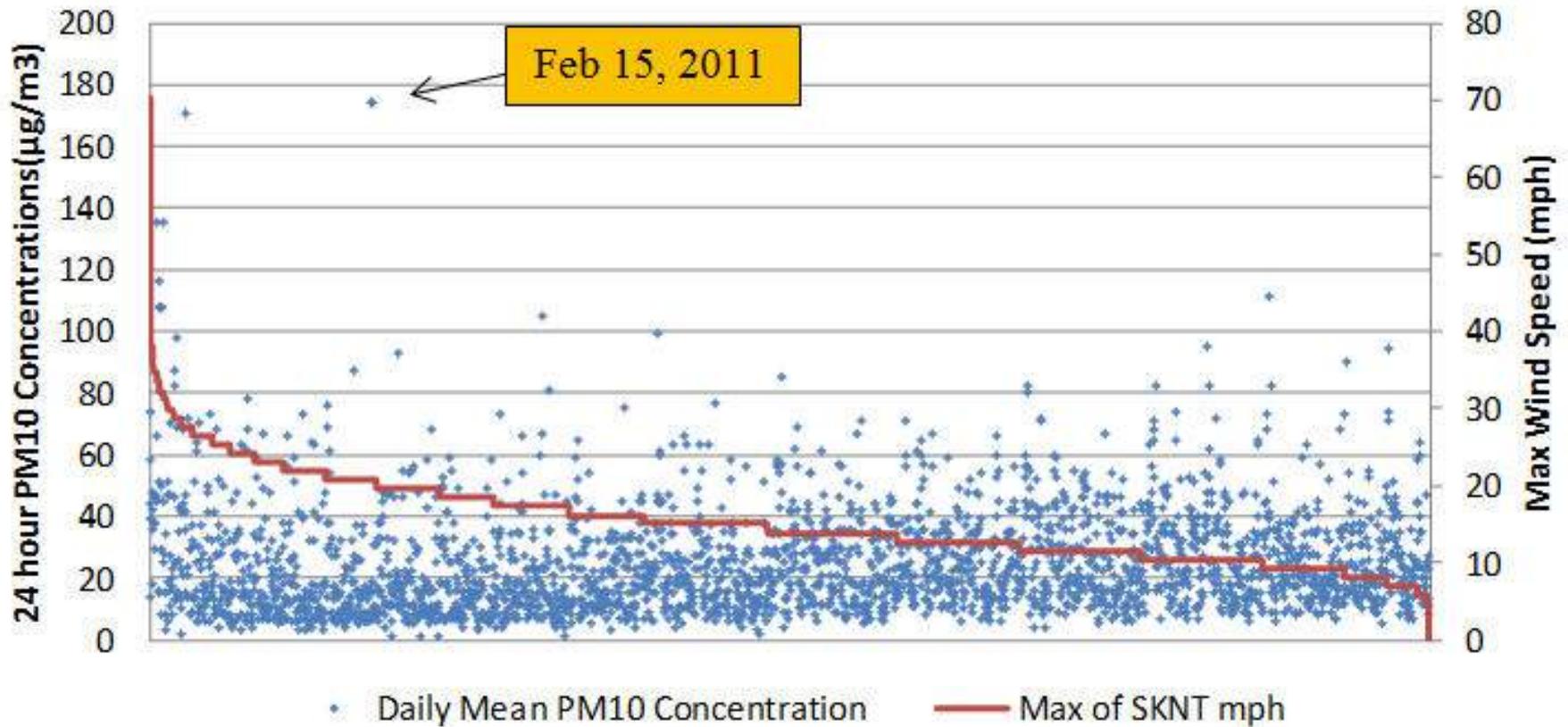
Parameter: PM10 Total 0-10um STP
CBSA: Boise City-Nampa, ID
County: Ada
State: Idaho
AQS Site ID: 16-001-0009, poc 3



Source: U.S. EPA AirData <<http://www.epa.gov/airdata>>
Generated: October 11, 2012

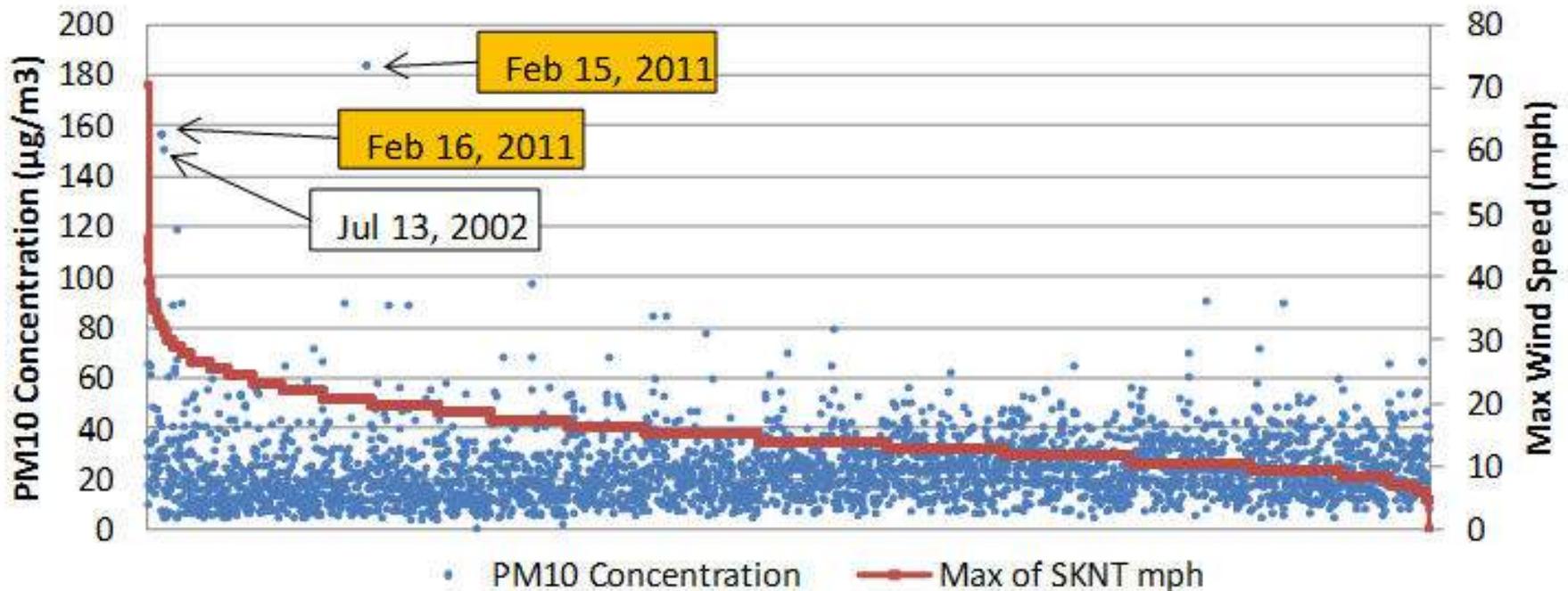
Exceeds Historical Fluctuations

Maximum 1-hour Wind speed and
24 hour PM10 Concentrationa at Nampa site
(Wind Speed observed at Boise Airport,2002-2011)



Exceeds Historical Fluctuations

**Maximum 1-hour Wind Speed and
24-hour PM10 Concentration at Boise site
(Wind speed observed at Boise airport, 2002-2011)**



PM_{2.5}/PM₁₀ Ratio ~ 10 – 18%

PM_{2.5}_PM₁₀ Ratio and Hourly PM₁₀ Concentration
2010-2011 winter (PM₁₀>10µg/m³)

