Request for EPA Concurrence as Exceptional Events for the February 15–16, 2011, High Wind PM_{10} Dust Event

Affecting High PM_{10} Concentrations at the Boise Fire Station, Ada County and Nampa Fire Station, Canyon County, Idaho

State of Idaho

Department of Environmental Quality

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Table of Contents

Acronyms, Abbreviations, and Symbols vii
Executive Summary ix
1 Conceptual Model 1
1.1 Overview 1
1.2 Source Area and Affected Region 1
1.3 Emissions Process 3
1.4 Contributing Weather Phenomena Synopsis 5
1.5 Path and Timeline from Source Area to Monitors 5
1.6 Concentration Patterns 6
2 Not Reasonably Controllable or Preventable (nRCP) 9
2.1 Source Areas Contributing to the Event 9
2.2 Source Area Wind Speeds 10
2.3 Basic Controls Analysis 10
3 In Excess of Historical Fluctuations (HF) 11
3.1 Time Series for the Previous Ten Years 11
3.2 Percentile of Concentrations 15
4 Clear Causal Relationship (CCR) 16
4.1 Occurrence and Geographic Extent of the Event 16
4.2 Description of Weather Conditions that Created the Event 22
4.3 Transport of Emissions Related to the Event in the Direction of the Monitor(s) Where Measurements Were Recorded 31
4.4 Spatial Relationship Between the Event, Sources, Transport of Emissions, and Recorded Concentrations. 34
4.5 Temporal Relationship Between the High Wind and Elevated PM Concentrations at the Monitor(s) in Question 34
4.6 Similarity of Chemical Composition of Measured Pollution with that Expected from Sources Identified as Upwind 34
4.7 Comparison of Event-Affected Days to Specific Nonevent Days—Comparison of Area Concentrations and Wind Speeds in the Days Preceding and Following the Event 40
4.8 Alternative Hypotheses 40
5 Affects Air Quality (AAQ) 42
6 Natural Event or Human Activity Unlikely to Recur at the Same Location (NE/HAURL) . 42
7 No Exceedance But For this Event (NEBF) 43
8 Mitigation 44
9 Procedural Requirements 45
10 References 46

Appendix A. EPA Completion Checklist 50
Appendix B. Supporting Meteorological Data 52
Appendix C. Hells Canyon IMPROVE Site $PM_{2.5}$ Speciation 63
Appendix D. St. Luke's Meridian NCORE Site Speciation Data for February 14, 2011 65
Appendix E. DEQ Air Quality Alerts and Public Education 67
Appendix F. News Articles 71

List of Tables

Table A. Monitored values Included in this request for concurrence. ix
Table B. Summary of DEQ demonstration in this report meeting Exceptional Event Rule elements. x
Table 1. Statistics of 24-hour PM_{10} concentrations recorded in Boise and Nampa, 2002–2011.. 11
Table 2. Percentile statistics with respect to annual and seasonal datasets, with and without high wind days, 2002–2011. 16
Table 3. Hourly PM_{10} concentrations greater than 100 µg/m^3 at the Nampa fire station for winter 2010 and 2011 only. Values related to this dust event are shown in bold (red circles in Figure 32). 38
Table 4. Comparison of February 14 St. Luke's monitoring site $PM_{2.5}$ composition with the annual average and winter season historical compositions, 2009–2011. 39
Table 5. Average, 95th and 99th percentile of PM_{10} concentrations (µg/m^3) in Boise and Nampa, 2002–2011, in comparison to recorded values during this event. Statistics are shown for all data (top) and winter season (bottom). 44
Table 6. DEQ compliance with procedural requirements of the exceptional events rule. 45
Table A-1. EPA completion checklist. 50
Table B-1. Identification of MESOWEST stations used in this report (Horel et al. 2002). 52
Table B-2. Source region weather station data from Mesowest (Horel et al. 2002). 53
Table B-3.Intermediate (Oregon) and affected area weather stations from MESOWEST (Horel et al. 2002). 55
Table B-4. Weather observations at Lovelock, Boise, and Winnemucca from Mesowest (Horel et al. 2002). 57
Table B-5. Daily precipitation in source region, January 1–February 15, 2011 (Horel et al. 2002). 62
Table D-1. St. Luke's NCORE site speciation for February 14, 2011—XRF elements. 65

List of Figures

Figure 1. Location of Black Rock Playa and Carson Sink Playa source areas, affected PM_{10} monitors at Boise and Nampa, and MESOWEST weather stations referenced in this report. 2
Figure 2. Schematic illustration of relationship between high dust potential and a near-surface capillary fringe zone on a wet playa versus a lower dust potential for a dry playa (Reynolds et al. 2007). 3

Figure 3. Playa dust storm example near Carson Sink Playa, March 28, 2012. 4
Figure 4. (a) Boise and Nampa PM_{10} concentrations, (b) southwest Idaho hourly $PM_{2.5}$ concentrations, and (c) wind conditions at the Boise airport from MESOWEST (Horel et al. 2002)..... 7
Figure 5. (a) Surface wind speed, (b) wind gusts, and (c) wind directions at source area sites (BLUN2, BUFN2, TR730, and KLOL) and intermediate distances (GSFO3 and JVCI1) between source area and affected area. Figure 1 provides locations, and Appendix B provides station information and tabular data obtained from MESOWEST (Horel et al. 2002)..... 8
Figure 6. Twenty-four hour $PM_{2.5}$ concentration pattern in southwest Idaho on February 12, 2011, (first bar) through February 17, 2011 (last bar). $PM_{2.5}$ is a surrogate for PM_{10}. 9
Figure 7. Historical PM_{10} fluctuations at Boise fire station no. 5, 2002–2011. Values over 120 µg/m^3 are identified by date along with the maximum 1-hour wind speed/gust speed for that day..... 12
Figure 8. Historical PM_{10} fluctuations at the Nampa fire station, 2002–2011. Values over 120 µg/m^3 are identified by date along with the maximum 1-hour wind speed/gust speed for that day..... 13
Figure 9. PM_{10} concentration (blue dots) and paired maximum daily 1-hour wind speed (=SKNT, red line) at the Boise fire station, sorted by decreasing wind speed with the highest wind speeds to the left..... 13
Figure 10. Daily mean PM_{10} concentration (blue dots) and paired 1-hour maximum wind speed (=SKNT, red line) at Nampa fire station sorted by decreasing wind speed with the highest wind speeds to the left..... 14
Figure 11. PM_{10} concentration distribution, 2002–2011, at the Boise fire station. 14
Figure 12. PM_{10} concentration distribution, 2002–2011, at the Nampa fire station..... 15
Figure 13. MODIS true color image from the Terra satellite, captured at ~1030 PST on February 14, 2011..... 18
Figure 14. MODIS Aqua image captured at ~1330 PST on February 14, 2011..... 19
Figure 15. MODIS true color image from the Terra satellite, captured at ~1030 PST on February 15, 2011..... 20
Figure 16. MODIS Aqua image captured at ~1330 PST on February 15, 2011..... 21
Figure 17. MODIS Aqua false color images (clouds and snow are blue-tinted; dust is white) showing turbulent dust cloud generation on Black Rock Playa (left) and Carson Sink Playa (right) as well as dust plumes leaving the playas toward the northeast ~1330 PST February 15, 2011..... 22
Figure 18. Twenty-four hour precipitation totals in the BRP and CSP source region in the 45 days prior to the event. 23
Figure 19. 1800Z (1100 MST) surface analysis February 15, 2011 (National Weather Service Hydrometeorological Prediction Center: http://www.hpc.ncep.noaa.gov/html/sfc_archive.shtml)..... 24
Figure 20. 2100Z (0200 MST) surface analysis February 15, 2011 (National Weather Service Hydrometeorological Prediction Center: http://www.hpc.ncep.noaa.gov/html/sfc_archive.shtml)..... 24
Figure 21. NCEP/NARR model reanalysis of midlevel winds (meters per second), February 14–15, 2011 (NOAA/ESRL Physical Science Division, Boulder Colorado: http://www.esrl.noaa.gov/psd/). 25

Figure 22. Sounding information for Reno, Nevada, at 18Z (1100 PST) February 15, 2011 (National Weather Service Upper-Air Observations Program-Global Climate Observing System. University of Wyoming Sounding: http://weather.uwyo.edu/upperair/sounding.html). 26
Figure 23. Friction velocity for 18Z (1200 MST) February 15, 2012, NARR NAM-ANL (National Climatic Data Center National Operational Model Archive and Distribution System, NWS-NCEP NAM, 12 km: http://nomads.ncdc.noaa.gov/data.php?name=access#hires_weather_datasets). 27
Figure 24. Sounding information for Boise, Idaho, at 12Z (0500 MST) February 16, 2011 (National Weather Service Upper-Air Observations Program-Global Climate Observing System. University of Wyoming Sounding: http://weather.uwyo.edu/upperair/sounding.html). 28
Figure 25. 1500Z (0800 MST) surface analysis February 16, 2011 (National Weather Service Hydrometeorological Prediction Center: http://www.hpc.ncep.noaa.gov/html/sfc_archive.shtml). 29
Figure 26. 1800Z (1100 MST) surface analysis February 16, 2011 (National Weather Service Hydrometeorological Prediction Center: http://www.hpc.ncep.noaa.gov/html/sfc_archive.shtml). 29
Figure 27. Surface winds 1500 MST on February 15, 2011, from MESOWEST (Horel et al. 2002). 30
Figure 28. HYSPLIT back-trajectories from the 0500–1000 MST PM_{10} peak at Boise-Nampa area on February 15, 2011 (NOAA Ready HYSPLIT model: http://ready.arl.noaa.gov/HYSPLIT_traj.php). 32
Figure 29. HYSPLIT back-trajectories from the 1600–2400 MST PM_{10} peak at Boise-Nampa area on February 15, 2011 (NOAA Ready HYSPLIT model: http://ready.arl.noaa.gov/HYSPLIT_traj.php). 33
Figure 30. HYSPLIT back-trajectories for the Boise-Nampa area PM10/PM2.5 impact period 2100–2300 MST, February 14, 2011 (NOAA Ready HYSPLIT model: http://ready.arl.noaa.gov/HYSPLIT_traj.php). 35
Figure 31. February 14, 2011, $PM_{2.5}$ composition (NCORE 2013) compared to Black Rock Playa surface soil composition (Gillett 1997). 36
Figure 32. $PM_{2.5}/PM_{10}$ ratio at the Nampa fire station sorted from low to high (red line, left axis) versus paired 1-hour PM_{10} concentration (blue dots). 38
Figure 33. Event-affected days along with nonevent days before and after the February 14–16, 2011, event. 40
Figure C-1. Hells Canyon speciation for February 2011, showing high coarse mass (top) and elevated soil component on February 14, 2011. 63
Figure C-2. Hells Canyon speciation for February 2011 showing higher Si, Fe, Al, and Ca on February 14, 2011. 64

Acronyms, Abbreviations, and Symbols

µg	microgram
µm	micrometer
AAQ	affects air quality
BRP	Black Rock Playa
Ca	calcium
CCR	clear causal relationship
CFR	Code of Federal Regulations
CSP	Carson Sink Playa
DEQ	Idaho Department of Environmental Quality
EER	Exceptional Events Rule
EPA	United States Environmental Protection Agency
FR	Federal Register
FS	fire station (Boise and Nampa)
HAUR	human activity unlikely to recur
HAURL	human activity unlikely to recur at a particular location
HF	historical fluctuations
HYSPLIT	Hybrid Single Particle Lagrangian Integrated Trajectory
IMPROVE	Interagency Monitoring of Protected Visual Environments
km	kilometer
m	meter
mb	millibar
mph	miles per hour
MODIS	Moderate Resolution Imaging Spectroradiometer
MST	mountain standard time
Na	sodium
NAAQS	National Ambient Air Quality Standard
NAM-ANL	North American Mesoscale Model-Analysis
NASA	National Aeronautics and Space Administration
NE	natural event
NEBF	no exceedance *but for*
NCEP	National Center for Environmental Prediction
NCORE	National Core air monitoring network
NOAA	National Oceanic and Atmospheric Administration
nRCP	not reasonably controllable or preventable
NWS	National Weather Service
PM_{10}	particulate matter 10 micrometers and smaller
$PM_{2.5}$	particulate matter 10 micrometers and smaller
PST	Pacific standard time
s	second
SIP	state implementation plan
TFV	threshold friction velocities

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Executive Summary

Northern Ada County is designated as a *maintenance area* for the National Ambient Air Quality Standard (NAAQS) for particulate matter 10 micrometers and smaller (PM_{10}), and the Idaho Department of Environmental Quality (DEQ) has just completed the second 10-year maintenance plan. While PM_{10} levels have declined to well below the 150 micrograms per cubic meter ($\mu g/m^3$) standard since the last violation in 1991, a white haze settled in the area on February 14–16, 2011, causing the PM_{10} standard to be exceeded on February 15 and 16, 2011, at the Boise fire station (Boise FS) and on February 15 at the Nampa fire station (Nampa FS).

To address exceptional events that are not reasonably controllable or preventable, the United States Environmental Protection Agency (EPA) promulgated the Exceptional Events Rule (EER) in 40 CFR 50 and 51 (72 FR 13560) on March 22, 2007. The EER allows for states to *flag* air quality data as *exceptional* and exclude those data from use in determining compliance with the NAAQS, if EPA concurs with the state's demonstration that it satisfies the rule requirements.

In accordance with the EER procedures, DEQ flagged two values at the Boise FS monitor and one at the Nampa FS monitor as indicated in Table A. DEQ demonstrates in this report, and requests EPA concurrence, that these three concentration values occurred as a result of natural conditions in another state, not reasonably controllable or preventable by the State of Idaho, fully meeting the criteria of the EER.

Table A. Monitored values Included in this request for 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	**PM_{10} Concentration Recorded, $\mu g/m^3$**	
2/15/2011	183	174
2/16/2011	156	a

Notes: Particulate matter 10 micrometers or smaller (PM_{10}); micrograms per cubic meter ($\mu g/m^3$)
a. Elevated PM_{10} concentrations of 55 and 68 $\mu g/m^3$ at the Boise and Nampa fire stations, respectively on February 14, 2011, and 108 $\mu g/m^3$ at the Nampa fire station on February 16, 2011, were also influenced by the same multiday high wind event, however, concurrence is not requested for any values below the standard (150 $\mu g/m^3$).

The EER requires that demonstrations to justify data exclusion *as exceptional events* shall provide evidence that the event (a) affects air quality (AAQ); (b) is not reasonably controllable or preventable (nRCP), (c) is a natural event or is an event caused by human activity that is unlikely to recur at a particular location (NE/HAURL); (d) that there is a clear causal relationship (CCR) between the identified source and measurement under consideration; (e) that the event is associated with measured concentrations in excess of normal historical fluctuations (HF), including background; and (f) that there would have been no exceedance or violation of the standard *but for* the event (NEBF). In addition, the state must document that prompt public notification procedures and measures to reduce public exposure were followed and that the public comment process was followed in reviewing the demonstration. DEQ's demonstration satisfying these elements is summarized in Table B, which identifies the report section

containing each element of the demonstration. In addition, EPA's detailed checklist for specific items recommended in the high wind strategy guidance (EPA 2013) is included in Appendix A.

Table B. Summary of DEQ demonstration in this report meeting Exceptional Event Rule elements.

Exceptional Event Rule (EER) Element	Section	Summary
Conceptual model (United States Environmental Protection Agency guidance, not an EER element)	1	The conceptual model describes the source, natural dry lake beds or *playas* in northwest Nevada, high wind conditions, emissions mechanisms leading to the event, and transport conditions and concentration patterns. Impact area wind conditions contributing to high particulate matter 10 micrometers or smaller (PM_{10}) levels remaining in place over portions of 2 days are also presented.
Not reasonably controllable or preventable (nRCP)	2	Pleistocene epoch 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 were exposed to winds over the wind speed threshold for natural areas and dust generation from them is *not reasonably controllable or preventable* (nRCP). In addition, there are no anthropogenic sources capable of contributing dust levels as high as those experienced during this event.
Exceeds historical fluctuations (HF)	3	The PM_{10} concentrations on February 15 and 16, 2011, are the highest 24-hour concentrations observed in over 10 years at the Boise fire station, and the February 15 concentration is the second highest observed at the Nampa fire station in the previous 10 years. A comparison to annual and seasonal data sets for the last 10 years is provided showing that normal *historical fluctuations* (HF) are well below these levels.
Clear causal relationship (CCR)	4	Evidence provided shows that the playas of northwest Nevada, notably BRP and CSP, are the source of dust impacting the Boise-Nampa area on February 15 and 16, 2011. Evidence includes wind data at the source area and at monitors; satellite images of dust blowing toward Boise-Nampa; back-trajectories linking BRP and CSP with the monitors in question; and chemical composition fingerprinting of the BRP soils that matches National Core (NCORE) air monitoring network air filters collected on February 14, 2011, the first day of the event. Alternative source hypotheses are discussed and shown to be incapable of creating levels this high.
Affects air quality (AAQ)	5	The *affects air quality* (AAQ) element is met by demonstrating PM_{10} in excess of *historical fluctuations* (HF) and a *clear causal relationship* (CCR) between source and monitored values.
Natural event or human activity unlikely to recur (NE/HAUR)	6	The *natural event/human activity unlikely to recur* (NE/HAUR) 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* (CCR) with the identified natural source area.
No exceedance *but for* event (NEBF)	7	Nonevent PM_{10} levels are typically well below the National Ambient Air Quality Standards. A quantitative *no exceedance but for* (NEBF) analysis for the last 10 years shows that PM_{10} levels are typically not more than 23 to 66 micrograms per cubic meter ($\mu g/m^3$) for Boise and 24 to 78 $\mu g/m^3$ for Nampa (annual average to 99th percentile). The three PM_{10} values under consideration all exceed the 99th percentile background level by more than 90 $\mu g/m^3$. No other unusually significant sources were present during the event period. Thus, there would be *no exceedance but for* (NEBF) the high wind event involving the BRP and CSP source areas.
Mitigation	8	DEQ provided prompt public advisories of the elevated levels and advice to reduce public health exposure on February 15 and 16, 2011.
EER procedures	9	DEQ met EER procedural requirements for flagging, demonstration, and public comment as summarized in this section.

1 Conceptual Model

1.1 Overview

On February 14 and 15, 2011, high afternoon winds swept 4,000 square kilometers (km^2) of the flat playa surface covering dry lake beds in northwest Nevada, including the Black Rock Playa (BRP), and nearby Carson Sink Playa (CSP), entraining a fine white dust and transporting it toward the Boise-Nampa area of southwest Idaho. It arrived in the evening of February 15 sending hourly particulate matter 10 micrometers or smaller (PM_{10}) concentrations over 500 micrograms per cubic meter ($\mu g/m^3$) around midnight. Light winds and a weak surface inversion allowed the fine white dust cloud to remain over the most of the valley until it mixed out the next morning, causing monitors to exceed the National Ambient Air Quality Standards (NAAQS) for PM_{10} on February 15 and 16 at the Boise fire station (Boise FS) PM_{10} monitoring site and on February 15 at the Nampa fire station (Nampa FS) monitoring site.

1.2 Source Area and Affected Region

The source areas for this event are the flat alkali playas or dry lakebeds, BRP and CSP, and other smaller playas located within the Black Rock Desert region of northwest Nevada. The playas of western Nevada are clearly capable of producing dust clouds that may affect the Boise-Nampa area. Steenburgh et al. (2012) found in a satellite study of episodic dust events impacting the Wasatch Front area of Utah, that for most of the dust events in the period 2001–2010, "emission sources are located primarily in low-elevation late Pleistocene-Holocene alluvial environments in southern and western Utah and southern and western Nevada." The BRP and CSP of western Nevada are approximately 350 miles from the Wasatch front, but only 200–300 miles from the Boise-Nampa area so dust emissions and transport from the BRP and CSP to the Boise-Nampa area are also likely to occur. The BRP is over 2,600 km^2 in area, one of the largest flat alkali playas on earth (Adams and Sada 2010). It is an arid region of lava beds and playa that lies within the footprint of late Pleistocene Lake Lahontan at a mean elevation of 4,000 feet (1,220 meters) above sea level. The CSP is approximately 1,300 km^2 so the total potentially erodible surface, including other smaller playas, is around 4,000 km^2 (the approximate size of Rhode Island).

The affected region around Boise and Nampa is located roughly 250 miles (400 km) northeast of the source region, however, elevated particulate levels during the period of February 14–16 reached from Idaho City, Idaho, to Hells Canyon on the Oregon-Idaho border and as far north as Garden Valley, Idaho (possibly even McCall, Idaho). Boise has a mean elevation of 2,700 feet (824 meters) above sea level. Figure 1 shows the geographic location of Boise FS and Nampa FS monitors, the weather stations referenced in this document, and the BRP and CSP source areas. Boise lies within the lower Snake River basin and the smaller Boise River valley and is subject to the channeling effect of both of these topographic features. Mean wind flow from either the northwest or southeast through the basin is typical when diurnal up/down valley wind flow patterns dominate with light synoptic winds. The Nampa FS lies approximately 18 miles west of the Boise FS at an elevation of about 2,500 feet (762 meters). It is also in the lower Snake River

basin, however, it lies outside the Boise River valley and experiences less of the stagnation and terrain-influenced lighter winds that can trap pollutants in the Boise River valley, as occurred on the morning of February 16.

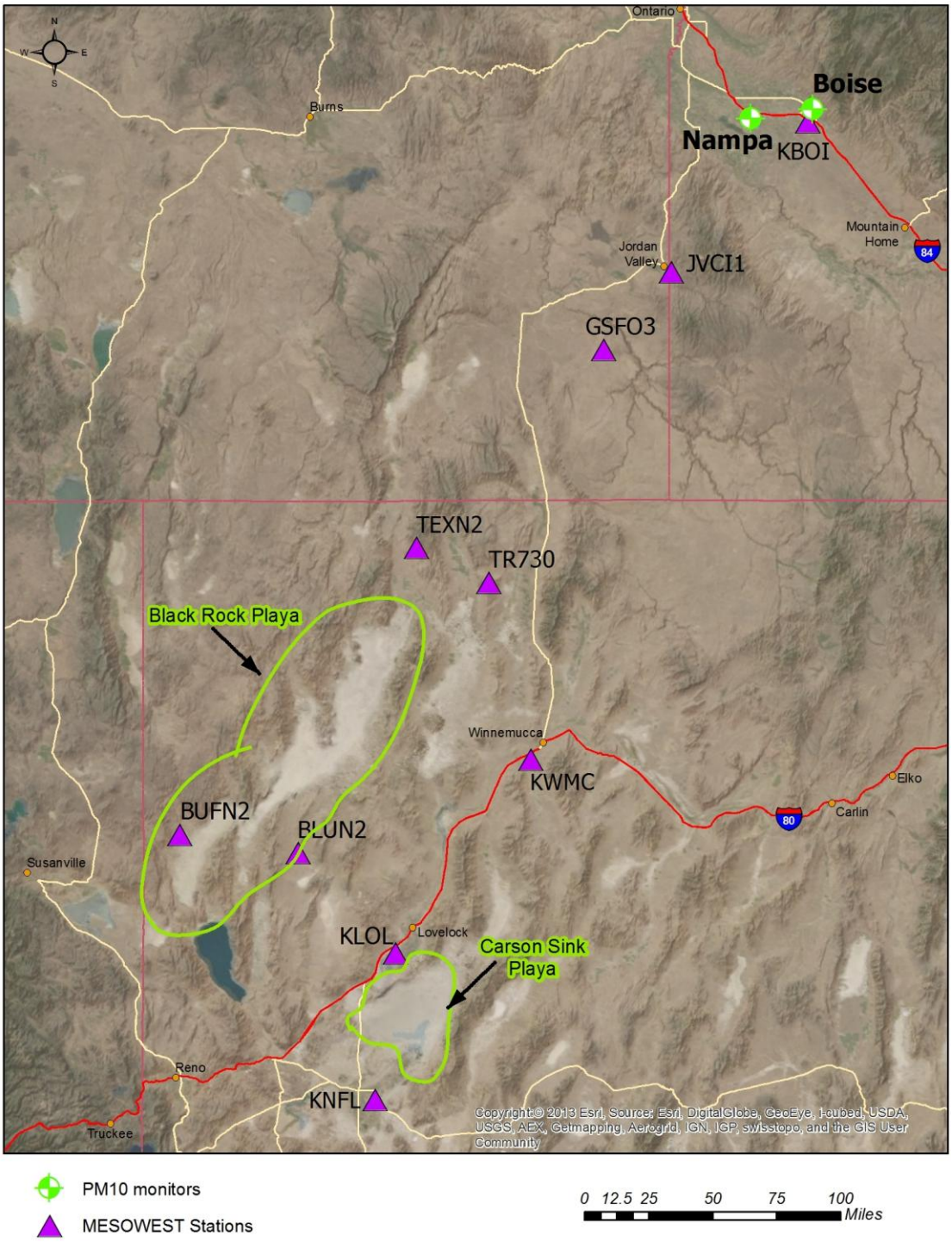


Figure 1. Location of Black Rock Playa and Carson Sink Playa source areas, affected PM_{10} monitors at Boise and Nampa, and MESOWEST weather stations referenced in this report.

1.3 Emissions Process

The BRP surface is composed of fine-grained clay and silt sediments mostly smaller than 3 micrometers (µm) in diameter and dominated by minerals containing silica, aluminum oxide, iron, magnesium, and soluble salts (or *evaporite* minerals). Evaporite minerals include calcite ($CaCO_3$), halite (NaCl), and gypsum ($CaSO_4 \cdot 7H_2O$), which exhibit shrink-swell properties when wetted and dried, thereby making the surface crust looser, less compacted, and more available for wind erosion and transport (Adams and Sada 2010; Tollerud and Fantle 2012; Lewis et al. 2011; and Reynolds et al. 2007, 2009). Reynolds et al. (2007) reports that evaporation of rainwater or shallow ground water evaporating through a capillary fringe zone produces *fluffy* erodible sediments when salt crystals such as calcite, halite and gypsum grow during evaporation. To confirm this process Tollerud and Fantle (2012) exposed BRP sediments to wetting and drying cycles by simulating rain in laboratory tests. They found that added quantities of the evaporite minerals disrupted the hard clay surface of the sediments through formation and expansion of calcite and halite crystals . Reynolds et al. (2007) provides a schematic (Figure 2) showing that the highest potential for dust emission from playas occurs not on *dry playas* but on *wet playas* when a very shallow capillary fringe exists near the surface due to a shallow water table or to a recent precipitation event. A *wet playa* is one with ephemeral hydrologic features, often even a small residual water body reflecting the presence of a shallow water table. BRP and CSP both have such features. Lewis et al. (2011) attributed one BRP dust storm they studied to antecedent precipitation 2 weeks prior to passage of a high wind front.

Once loose unconsolidated minerals and sediments are produced by evaporation of rain or shallow ground water, the *fluffy* or *puffy* surface materials with increased calcium and sodium concentrations are more vulnerable to wind erosion. Ginoux et al. (2012) and Argaman et al. (2006) both identify wind erosion thresholds above which dust may become entrained to be around 15 miles per hour (mph) (10 meters) for extremely flat surfaces, based on threshold surface friction velocity of 0.6 meters per second (m/s) over deserts. Thus for a playa, any 10 meter wind over about 15 mph is likely to begin generating dust. At wind speeds double or triple that threshold, significant dust production may be expected.

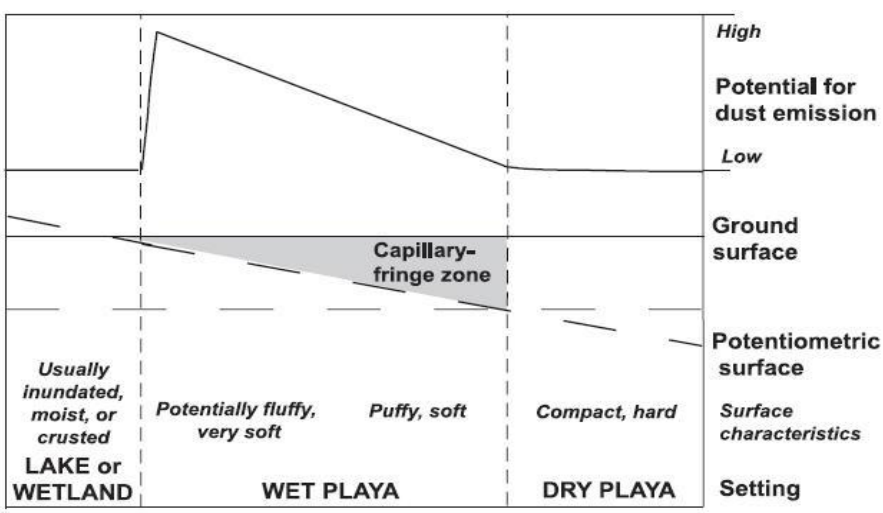


Figure 2. Schematic illustration of relationship between high dust potential and a near-surface capillary fringe zone on a wet playa versus a lower dust potential for a dry playa (Reynolds et al. 2007).

The effect of precipitation on the potential for dust from deserts and playas is complex, and it is important to distinguish the effect of antecedent precipitation in the weeks prior to a high wind event from antecedent precipitation in the months to years prior to high wind dust storms. The former, involving evaporite formation as described by Tollerud and Fantle (2012); Lewis et al. (2011); and Reynolds et al. (2007, 2009), relates to precipitation in the *weeks* prior to the dust storm on nonvegetated playas. The latter, involving reduced wind erosion due to increased vegetation growth promoted by precipitation *months* to *years* antecedent to the high wind conditions is also described in the literature (Urban et al. 2009; Holcombe et al. 1997; and Pelletier 2005). Both effects are well established, however, the surface mineral changes bringing calcium and sodium evaporite minerals to the surface as described by Tollerud and Fantle (2012), Lewis et al. (2011), and Reynolds et al. (2007, 2009) are believed to have contributed to the dust storm of February 14–16, 2011, on the largely unvegetated BRP and CSP. Nevertheless, back-trajectories, satellite images, and chemical composition all point to these playas as the source of the dust arriving in Boise-Nampa area on February 14–16, 2011, irrespective of mechanism.

During a windy day unrelated to the February 2011 event in question, an Idaho Department of Environmental Quality (DEQ) staff person traveling along Interstate I-80 in Nevada observed and photographed large white dust clouds arising from the playa (Figure 3) in the CSP area near Lovelock, Nevada. The photograph in Figure 3 was taken on March 28, 2012, at approximately 1300–1400 Pacific standard time (PST) when the hourly winds averaged 22 mph and gusts reached 32 mph at two nearby meteorological stations. The white dust in this photograph suggested to DEQ that the *white haze* in Boise and Nampa on February 15–16, 2011, might be related to these dry lake beds. The photograph is included in this report to help the reader conceptualize these dust events and to provide direct, if anecdotal, evidence that such events may occur with winds at least as low as 22 mph.

Figure 3. Playa dust storm example near Carson Sink Playa, March 28, 2012.

1.4 Contributing Weather Phenomena Synopsis

A relatively snow-free playa surface with unseasonably mild conditions allowing for rainfall in the last 2-3 weeks of January 2011 resulted in ideal conditions for developing an extremely large (~4,000 km^2) erodible surface on the BRP, CSP, and other, smaller playa areas in the region. On February 14–16, 2011, a cold front moved through the northwestern Nevada area causing very high afternoon winds on each day from the southwest blowing toward the Boise-Nampa area of Idaho approximately 200–300 miles away. The dust cloud arrived first on February 14, 2011, then again on the morning of February 15, 2011, and finally the most dense cloud of white dust arrived on the evening of February 15, 2011, causing hourly PM_{10} concentrations to reach over 500 $\mu g/m^3$ by 2300 mountain standard time (MST). As the particulate concentrations began to climb, the local wind speeds at the Boise airport ranged from calm to 18 mph, well below the United States Environmental Protection Agency (EPA) suggested 25 mph threshold velocity for entraining dust from local sources such as natural desert, roadways, unvegetated lots, and agricultural fields (EPA 2013). The Boise airport winds remained relatively low overnight, allowing the dust cloud to remain in the area until morning. The dust was advected out of the valley around 0900 MST on February 16, 2011. To summarize, the weather phenomenon contributing to this event included (a) antecedent rain 2 to 5 weeks prior, producing a highly erodible surface, (b) a cold front with sustained high winds on February 14 and 15, entraining the dust from some of the 4,000 km^2 of playa, (c) transport winds carrying the dust from the playas to the Boise-Nampa area; and (d) light winds and a weak surface inversion, which allowed the dust cloud to remain in the area overnight, particularly at the Boise site where the surrounding foothills tend to somewhat mitigate the valley winds, in comparison to Nampa in the midvalley.

1.5 Path and Timeline from Source Area to Monitors

The time line of dust impacts in southwest Idaho are shown in Figure 4, which combines the (a) Boise-Nampa hourly PM_{10} concentrations, (b) southwest Idaho hourly $PM_{2.5}$ concentrations, and (c) Boise airport wind speeds and directions. Figure 5 shows the (a) surface wind speeds, (b) wind gusts, and (c) wind directions for selected stations in the source area (BLUN2, BUFN2, TR730, and KLOL) and in Oregon along the transport path from the playas to the Boise-Nampa area (GSFO3 and JVCI1). Detailed hourly data obtained from the MESOWEST service (Horel et al. 2002) are provided in Appendix B, along with station information, and their locations are shown in Figure 1. Three distinct periods of dust impacts occurred at the Boise FS and Nampa FS monitors, typically preceded 8 to 12 hours earlier by high surface winds in the BRP and CSP source areas. High surface winds exceeding 25 mph occurred in the source regions on February 14 and 15 from around 1200 to 1600 MST with another period of high winds from 0400 to 0800 MST on February 15. Wind speeds were well above the site-specific threshold wind speeds (15–22 mph) for the onset of wind erosion. The path of dust transport suggested by these wind observations is confirmed by the Hybrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) back-trajectories presented in section 4.3.

1.6 Concentration Patterns

Temporal Patterns—The rise in dust concentrations, indicated by the hourly PM_{10} at Boise and Nampa (Figure 4 (a)) and the $PM_{2.5}$ concentrations at five locations in the southwestern Idaho area (Figure 4 (b)) indicates that the dust arrived at the southern edge of the area first (Nampa FS and St. Luke's Meridian monitoring sites) then reached more northerly monitors later, beginning with Idaho City, followed by Garden Valley. Garden Valley $PM_{2.5}$ levels did not increase until 0200–0400 MST on February 16, suggesting that the dust plume may have passed over Idaho City to the east of Garden Valley, then reached Garden Valley from the east with the night time valley drainage flows of the South Fork Payette River. The $PM_{2.5}$ peaks at the McCall monitor suggest that dust may have reached McCall, however, the increase is small and cannot be positively attributed to the dust storm. These temporal patterns, with southern sites recording higher particulate levels before northern sites, suggest that the source is located to the south of the Boise-Nampa area.

Spatial Patterns—The spatial concentration pattern that occurred from February 12 to 17 is shown in Figure 6 representing 24-hour averaged $PM_{2.5}$ concentrations throughout the southwest Idaho area. $PM_{2.5}$ concentrations are shown because there are more $PM_{2.5}$ monitors than PM_{10} monitors so they are preferred for reflecting the spatial pattern of the dust. The map in Figure 6 shows that the Boise-Nampa area received the highest concentrations but that the spatial extent of the dust cloud was very broad, reaching the mountainous sites at Idaho City and Garden Valley. The Interagency Monitoring of Protected Visual Environments (IMPROVE) aerosol monitoring site at Hells Canyon on the Oregon-Idaho border (IMPROVE 2013; Hand 2011; and NRC 1993) also appears to have elevated $PM_{2.5}$ on February 14, with higher than normal geologic components compared to the other days in February 2011. IMPROVE speciation data for Hells Canyon are provided in Appendix C indicating higher $PM_{2.5}$, higher coarse mass (> 2.5 μm), and enrichment in the *soil* component as well as the geologic elements including silicon, iron, aluminum, magnesium, and calcium. This broad spatial pattern cannot be explained by typical local-scale anthropogenic dust sources such as road dust, construction, or local industrial facilities in Ada County, but it suggests a much larger regional-scale dust source originating some distance away and widely spread by variable wind directions.

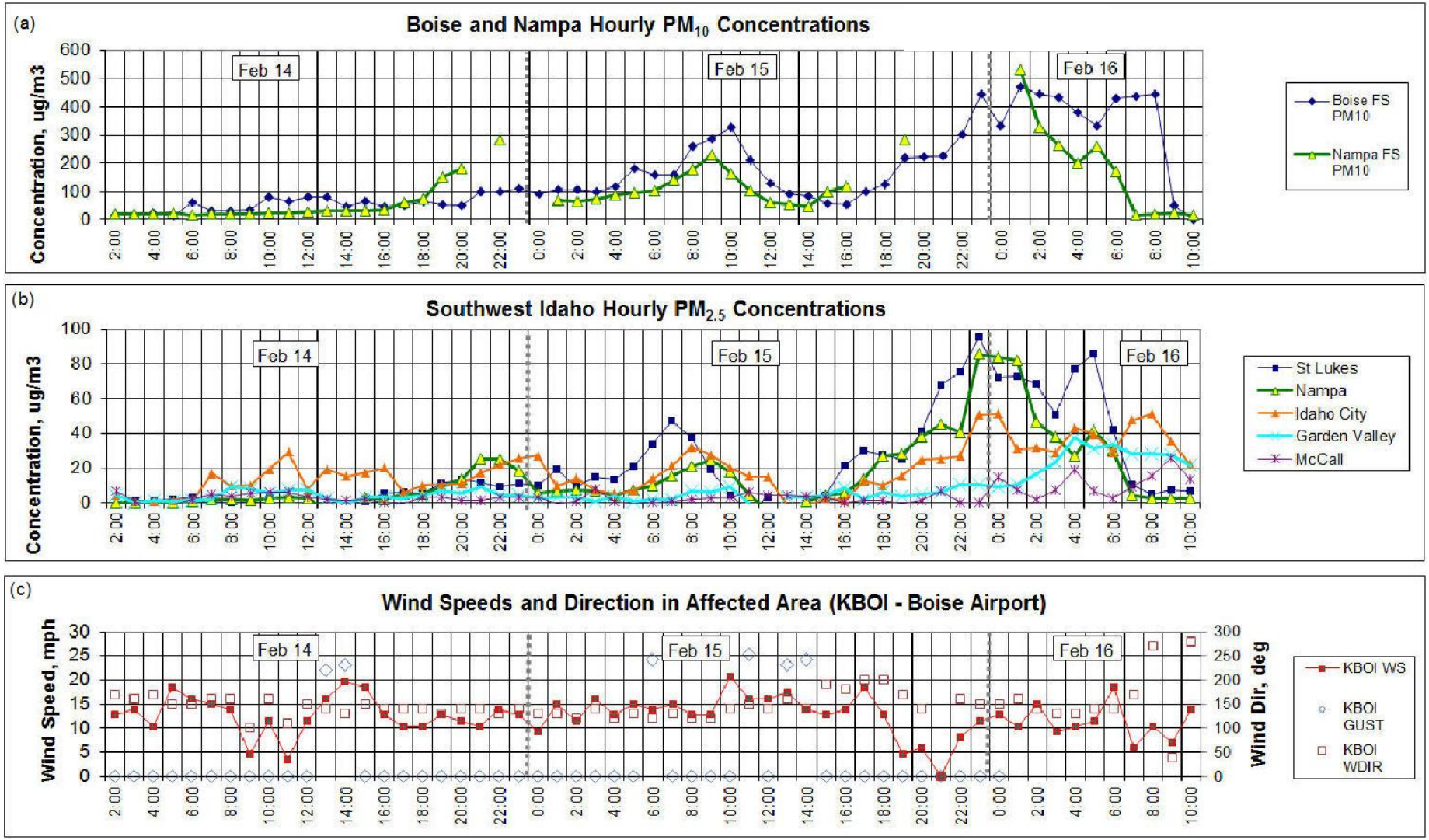


Figure 4. (a) Boise and Nampa PM_{10} concentrations, (b) southwest Idaho hourly $PM_{2.5}$ concentrations, and (c) wind conditions at the Boise airport from MESOWEST (Horel et al. 2002).

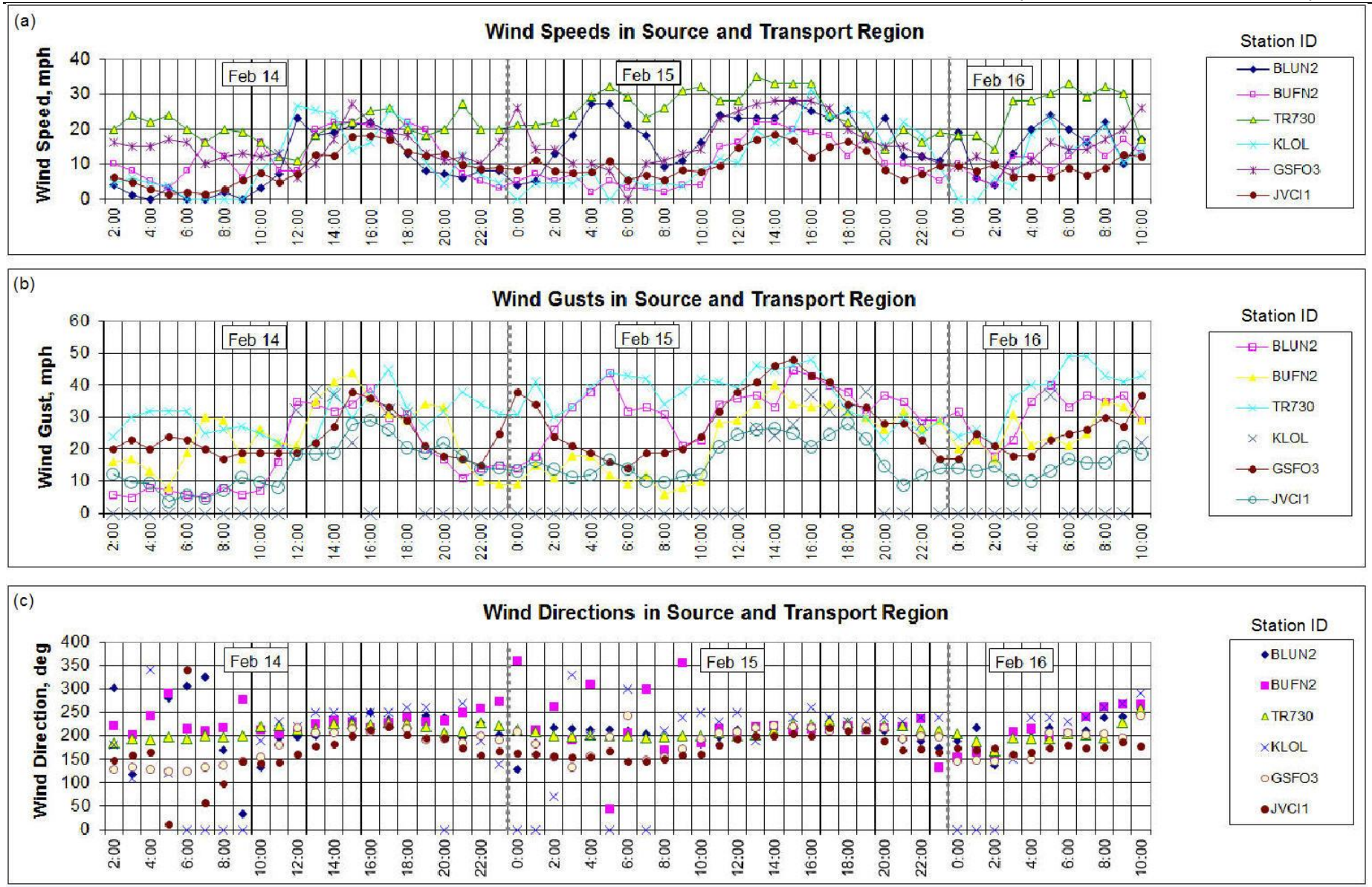
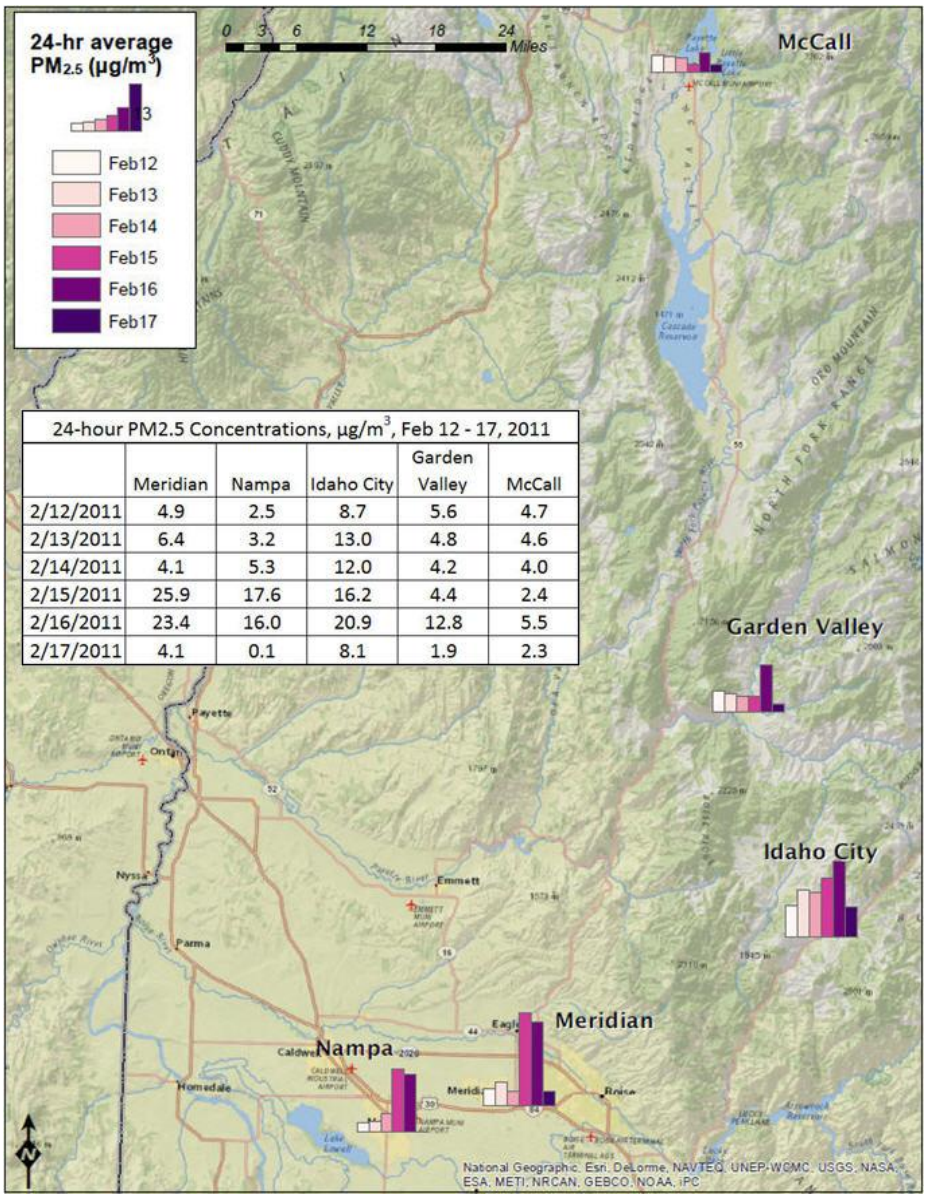


Figure 5. (a) Surface wind speed, (b) wind gusts, and (c) wind directions at source area sites (BLUN2, BUFN2, TR730, and KLOL) and intermediate distances (GSFO3 and JVCI1) between source area and affected area. Figure 1 provides locations, and Appendix B provides station information and tabular data obtained from MESOWEST (Horel et al. 2002).



24-hour PM2.5 Concentrations, µg/m^3, Feb 12 - 17, 2011

	Meridian	Nampa	Idaho City	Garden Valley	McCall
2/12/2011	4.9	2.5	8.7	5.6	4.7
2/13/2011	6.4	3.2	13.0	4.8	4.6
2/14/2011	4.1	5.3	12.0	4.2	4.0
2/15/2011	25.9	17.6	16.2	4.4	2.4
2/16/2011	23.4	16.0	20.9	12.8	5.5
2/17/2011	4.1	0.1	8.1	1.9	2.3

Figure 6. Twenty-four hour $PM_{2.5}$ concentration pattern in southwest Idaho on February 12, 2011, (first bar) through February 17, 2011 (last bar). $PM_{2.5}$ is a surrogate for PM_{10}.

2 Not Reasonably Controllable or Preventable (nRCP)

2.1 Source Areas Contributing to the Event

The BRP is approximately 2,600 km^2 in surface area and extends approximately 100 km in length, trending northeasterly such that winds approaching it from 220 degrees and eroding dust along its entire length are aligned to carry the dust directly toward the Boise-Nampa area. The BRP is a dry alkali lakebed remnant of the Pleistocene epoch Lake Lahontan that covered much of northwest Nevada approximately 15,000 years ago (Adams and Sada 2010). Numerous other playas in the area, including CSP, are also remnants of Lake Lahontan. They presumably have

similar mineral composition and are likely to also contribute to the dust reaching southwest Idaho, including during the February 15–16 event. Thus, it is clear that BRP, CSP, and other playas are natural, having originated before modern human habitation in the area. Section 2.3 shows that these playas are not significantly altered by modern human activities.

2.2 Source Area Wind Speeds

EPA will generally accept 25 mph as a high wind threshold as stated in the May 2013 interim guidance on high wind exceptional events (EPA 2013):

> The high wind threshold is the minimum threshold wind speed capable of overwhelming reasonable controls on anthropogenic sources (i.e., significant emissions from controlled sources) or causing emissions from natural undisturbed areas. The EPA recommends that air agencies establish area-specific high wind thresholds based on local or applicable conditions and information. If an agency is unable to develop an area-specific high wind threshold, the EPA will generally accept a threshold of a sustained wind of 25 mph for areas in the West provided the agencies submit evidence of this as the level at which they expect stable surfaces (i.e., controlled anthropogenic and undisturbed natural surfaces) to be overwhelmed.

However, for extremely flat surfaces with disturbed or loose fine surface soils, the literature suggests that steady winds over 15 mph may cause blowing dust (Ginoux et al. 2012; Argaman et al. 2006). This is consistent with the 22 mph wind speed that occurred when DEQ photographed a large turbulent dust storm on CSP. Together, the literature and DEQ observation establish an area-specific wind threshold range for entraining fine playa dust from 15 to 22 mph.

Wind speeds in Nevada on February 14–16, 2011, are shown in Figure 5 and provided in detail in Appendix B along with station identification and quality control information. All wind data were obtained from MESOWEST (Horel et al. 2002), which gathers data from meteorological networks throughout the west. Measured sustained winds at the southwest end of BRP (BLUN2), northeast of BRP (TR730), and at Lovelock, Nevada, in the vicinity of the CSP (KLOL) exceeded 28 mph on February 15 (Figure 5), reaching 35 mph at the TR730 station north of the BRP and 31 mph at Lovelock, near the CSP. These 1-hour sustained wind speeds are well above the 15 mph sustained wind threshold established in the literature for extremely flat surfaces such as playas, above the 22 mph site-specific level documented when DEQ photographed turbulent dust clouds on the CSP and above the EPA default windspeed (25 mph) for natural undisturbed areas in the west. Wind gust speeds exceeded 30 mph at all the source region sites and reached or exceeded 45 mph at two of them (KLOL and TR730).

2.3 Basic Controls Analysis

Human activities that occur on the BRP include recreational vehicle traffic, gypsum mining, and periodic large but temporary gatherings such as amateur rocketry launches. The largest event, the annual Burning Man performance art festival is held at a temporary *Black Rock City* on the last week of August of each year. The Burning Man festival disturbs only about 1% of the playa surface (BLM 2012). Together with all other human activities, up to 7% of the playa surface is estimated to be disturbed by humans each year. However, the BLM concludes in the 2012 Environmental Assessment for the Burning Man 2012–2016 Special Recreation Permit (BLM 2012) that the weathering processes that occur in the fall and winter following the Burning Man festival “promote the formation of a surface crust on the playa, which would decrease the ability

of the winds to move dust." If the human-disturbed playa surface contributed in any significant manner to dust from the BRP, the dust impacts would be expected to occur near the end of the summer during or shortly after the Burning Man festival when human disturbance peaks, rather than 6 months later in February. The winter season sees a minimum of human activity, due to harsh winter conditions, so the February 14–16 dust storm is not likely to be related to human activity. In addition, if human activity related to the Burning Man event was the primary cause of dust generation, the large turbulent dust clouds visible from space would be restricted to that location near the left-central portion of the BRP where *Black Rock City* is located and would not occur so broadly on the BRP and on the CSP, as seen in section 4.1, Figure 17. In conclusion, the dust storm of February 14–16, 2011 is a natural event with very little if any contribution from human activity.

Regardless of the conclusion that the February 14–16, 2011, dust storm is a natural event, it is also clear that even if human activity did contribute to a portion of the wind erosion on the playa during this event, making it in a small part not a natural event, such human activity would be beyond the State of Idaho's jurisdiction, and for the purposes of the EER demonstration and Idaho's responsibility, the event would still remain *not reasonably controllable or preventable* (nRCP).

3 In Excess of Historical Fluctuations (HF)

Analysis and observations showed that high winds may create dust storms and elevate PM_{10} concentrations in the Boise-Nampa area but not often. Table 1 shows the statistics of the PM_{10} concentration at the Boise FS and Nampa FS monitors during the 10-year period from 2002 through 2011 (EPA 2012). The mean annual 24-hour PM_{10} concentrations are 22.9 and 24.5 $\mu g/m^3$ at Boise and Nampa, respectively

Table 1. Statistics of 24-hour PM_{10} concentrations recorded in Boise and Nampa, 2002–2011.

Statistics	Boise	Nampa
Mean PM_{10} concentration ($\mu g/m^3$)	22.9	24.5
Median PM_{10} concentration ($\mu g/m^3$)	21.0	20.0
Mode PM_{10} concentration ($\mu g/m^3$)	14.0	15.0
Standard deviation ($\mu g/m^3$)	13.7	17.1
Count	3,325	2,852

Notes: Micrograms per cubic meter ($\mu g/m^3$)

3.1 Time Series for the Previous Ten Years

High wind events usually last a short time. Therefore, the impact on the 24-hour average PM_{10} concentrations is very limited most of the time. Figure 7 and Figure 8 show the 24-hour PM_{10} concentrations from 2002 through 2011 at Boise and Nampa. There were only two days in which the PM_{10} concentrations were higher than 120 $\mu g/m^3$ in Boise (February 15 and 16, 2011), and five days in Nampa (including February 15, 2011). Days in which the PM_{10} exceeded 120 $\mu g/m^3$ (an arbitrary break point for discussion only) are identified along with the maximum 1-hour wind

speed and 2-minute gust speed, recorded at the Boise airport for that day. These graphs indicate that local wind speeds over 30 mph and gusts over 40 mph are typically required in order for local dust sources to produce concentrations approaching the standard—speeds well above those recorded at Boise Air Terminal (KBOI) on February 15. Higher winds did occur on February 16, however, those winds did not generate the dust; they occurred after 0800 MST and served to blow the dust out of the valley, ending the high PM_{10} event.

Figure 9 and Figure 10 show the 24-hour PM_{10} concentrations at Boise and Nampa monitoring sites respectively, along with maximum daily 1-hour wind speeds, measured at the Boise airport, from 2002 through 2011. In these plots the wind speeds (red line) and paired 24-hour PM_{10} concentrations (blue dots) were sorted from highest to lowest wind speed to demonstrate that when the maximum 1-hour wind speed is below about 30 mph, the general pattern does not show any apparent correlation between maximum wind speeds and PM_{10} concentrations, and PM_{10} concentrations never exceed 120 µg/m^3 (an arbitrary dividing point between normal fluctuations and extreme events). If the traditional local dust sources were a problem in the Boise-Nampa area, many more of the PM_{10} concentrations in Figure 9 and Figure 10 would increase on the far left as the highest winds occur.

Figure 11 and Figure 12 show PM_{10} concentration distributions for Boise and Nampa, respectively. Both figures show that all the 24-hour average PM_{10} concentrations over 120 µg/m^3 are isolated from the main distribution range. These distributions indicate that the February 2011 exceedance days are exceptional with respect to the sample distribution over the previous 10 years.

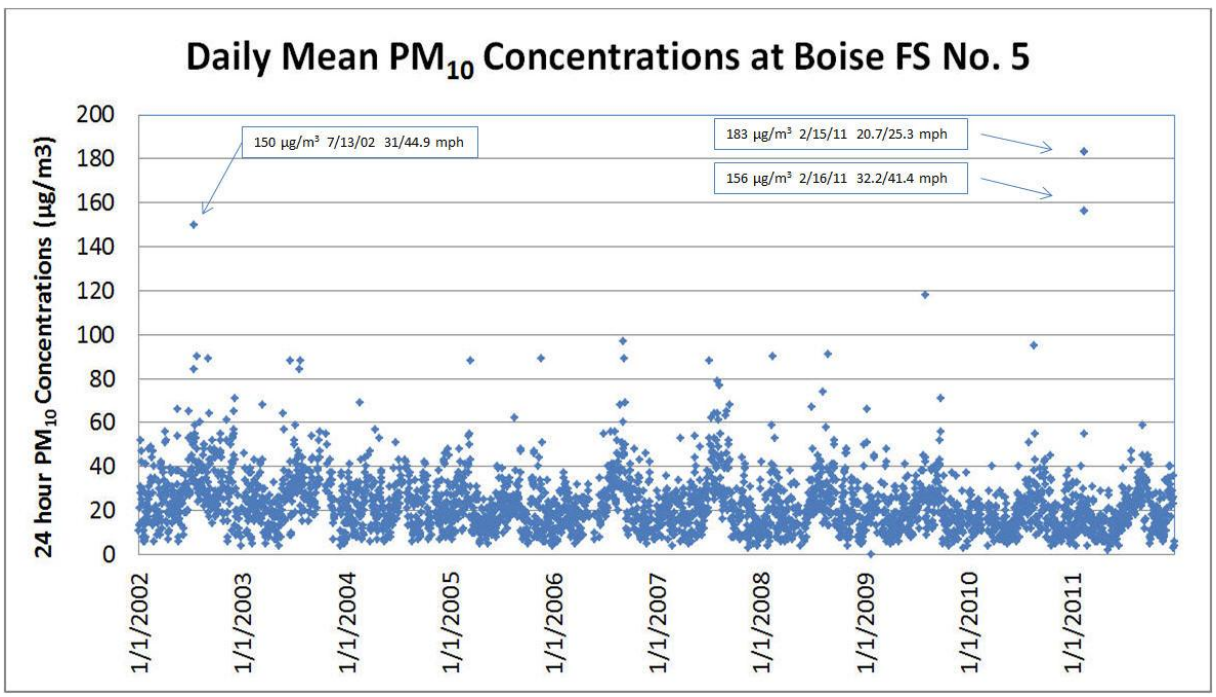


Figure 7. Historical PM_{10} fluctuations at Boise fire station no. 5, 2002–2011. Values over 120 µg/m^3 are identified by date along with the maximum 1-hour wind speed/gust speed for that day.

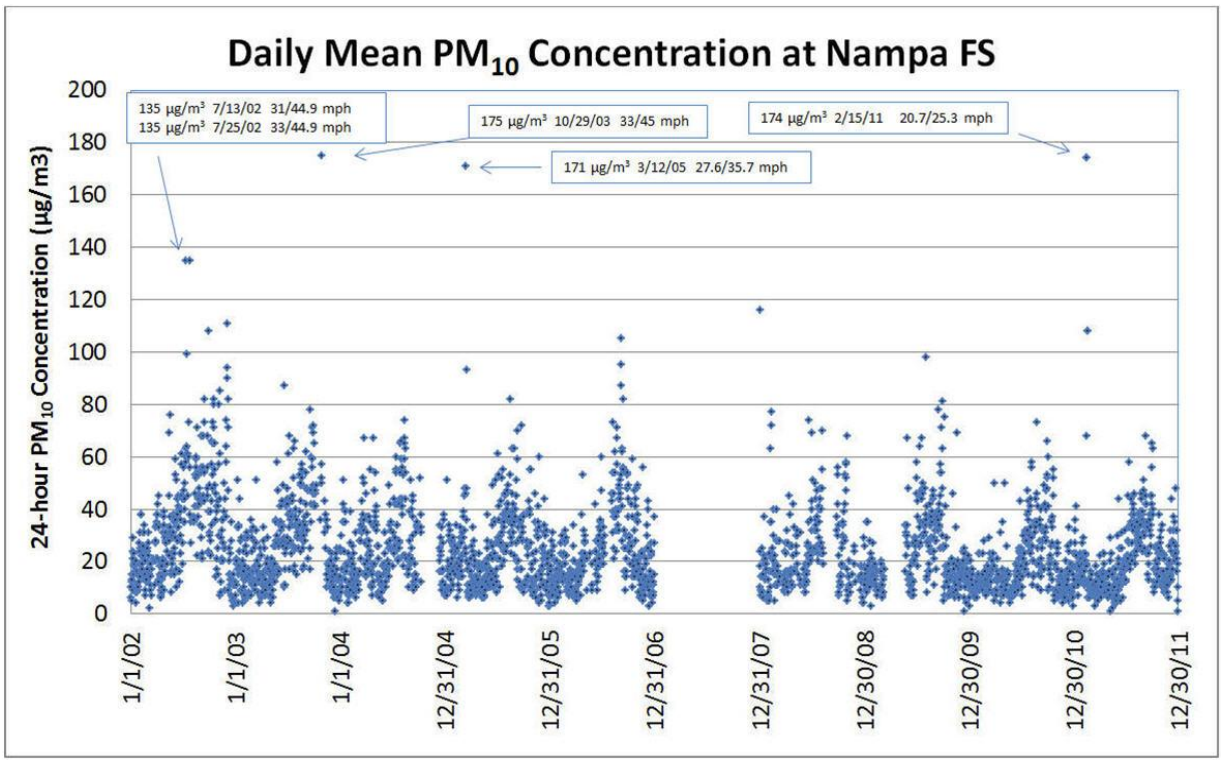


Figure 8. Historical PM_{10} fluctuations at the Nampa fire station, 2002–2011. Values over 120 µg/m^3 are identified by date along with the maximum 1-hour wind speed/gust speed for that day.

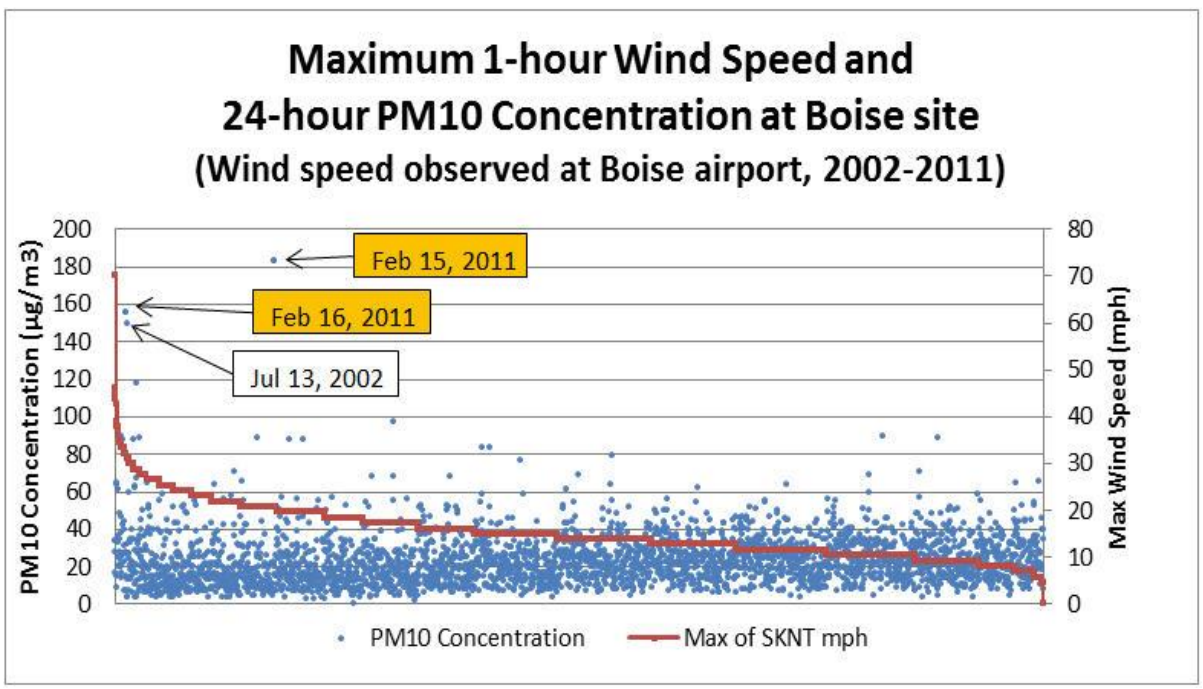


Figure 9. PM_{10} concentration (blue dots) and paired maximum daily 1-hour wind speed (=SKNT, red line) at the Boise fire station, sorted by decreasing wind speed with the highest wind speeds to the left. The orange boxes indicate the February 15 and 16, 2011, exceedances. The wind speeds were measured at the Boise airport. Note that the high wind on February 16 occurred *after* the event when a cold front blew the dust out.

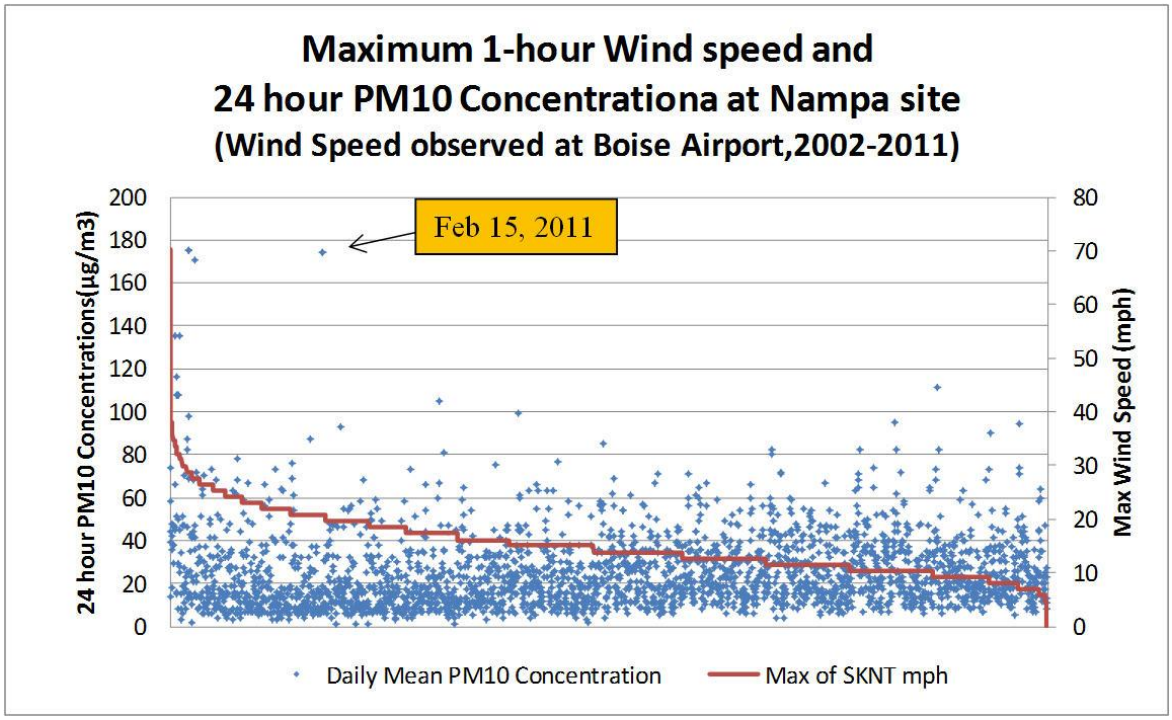


Figure 10. Daily mean PM_{10} concentration (blue dots) and paired 1-hour maximum wind speed (=SKNT, red line) at Nampa fire station sorted by decreasing wind speed with the highest wind speeds to the left. The orange box indicates the February 15, 2011, exceedance.

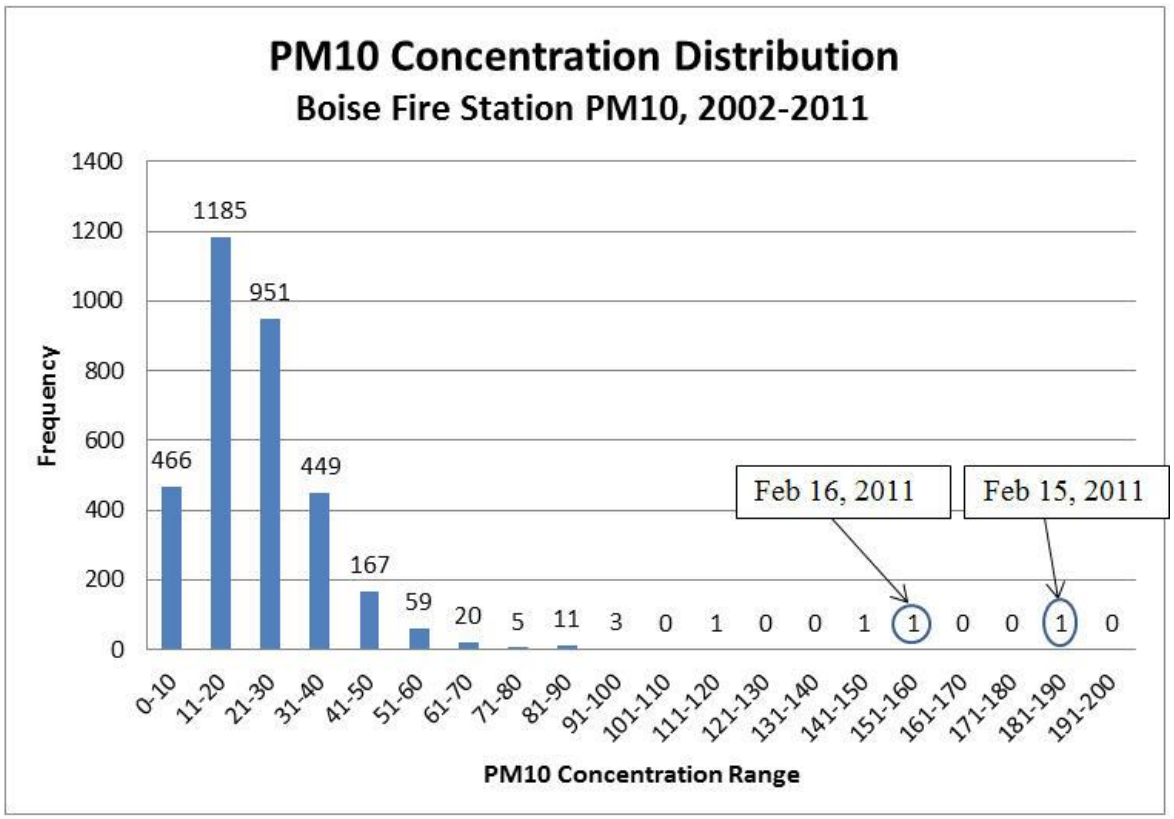


Figure 11. PM_{10} concentration distribution, 2002–2011, at the Boise fire station.

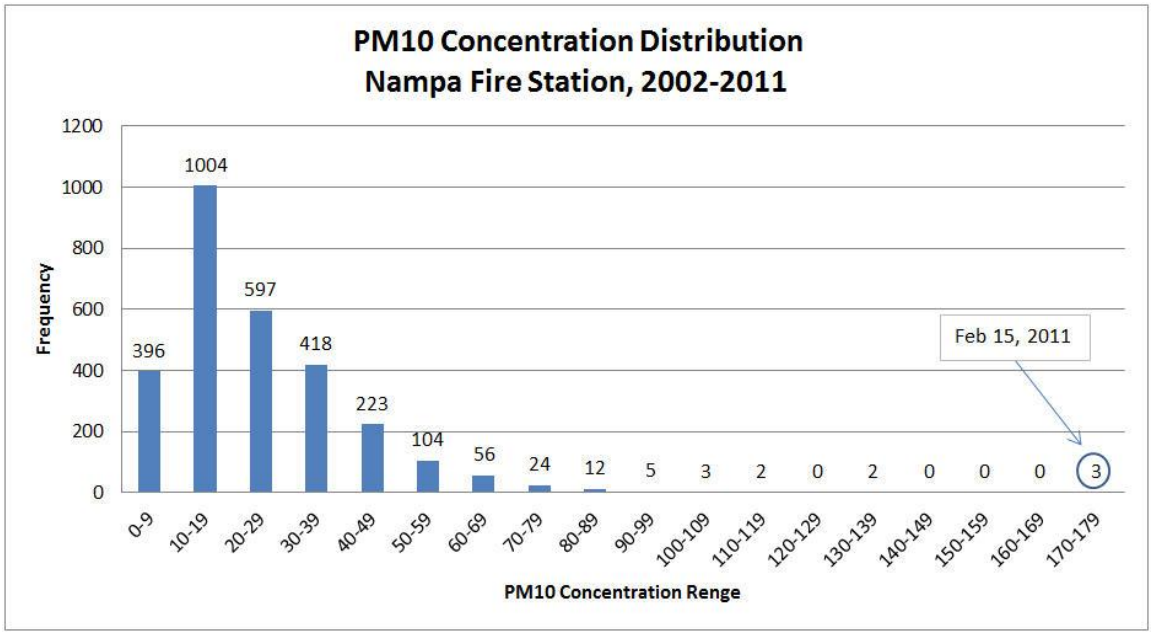


Figure 12. PM_{10} concentration distribution, 2002–2011, at the Nampa fire station.

3.2 Percentile of Concentrations

The exceptional concentrations on February 15 and 16, 2011, of 183 and 156 µg/m^3 respectively, are the highest and second highest values recorded at the Boise FS in the 10-year dataset from 2002 to 2011. The February 15, 2011, concentration of 174 µg/m^3 at the Nampa FS was the second highest in the 2002–2011 annual dataset, just 1 µg/m^3 lower than the highest value (175 µg/m^3) recorded on October 29, 2003. The percentile statistics for these values relative to the annual dataset for 2002–2011, and the 2002–2011 seasonal winter (December, January, and February) data set are summarized in Table 2. The percentiles with and without all high wind days are also shown. For the analysis summarized in Table 2, *high wind* days are defined as days with at least 1 hour in which the wind speed exceeded 25 mph, as recorded at the Boise airport's National Weather Service (NWS) station, KBOI. Finally, in the last column, the percentile ranking for each February exceedance is shown relative to the set of only the high wind days from 2002 through 2011 (days with maximum 1-hour wind speed > 25 mph). In comparison, the daily maximum 1-hour wind speed of 20.7 mph on February 15 at 1000 MST, was the 83rd percentile value for the 10-year period, with 610 of 3,647 days having a higher maximum hourly wind speed. This demonstrates the disconnect between this event and local winds.

It is clear from these statistics that the extreme PM_{10} concentrations observed February 15 and 16, 2011, are exceptionally high amongst any subset of Boise and Nampa data, largely independent of season or wind conditions in the Boise-Nampa area.

Table 2. Percentile statistics with respect to annual and seasonal datasets, with and without high wind days, 2002–2011.

Site	Date	PM_{10} ($\mu g/m^3$)	Percentile Relative to				
			Annual Data[a]	Annual Data without High Wind Days (> 25 mph)[b]	Winter Season Data[c]	Winter Data without High Wind Days (> 25 mph)[d]	All High Wind Days with Maximum 1-hour Wind Speed (> 25 mph)[e]
Number of Boise fire station observations			3,322	3,112	809	769	208
Boise fire station	2/15	183	99.970%	99.968%	99.88%	99.87%	99.52%
Boise fire station	2/16	156	99.940%	99.936%	99.75%	99.74%	99.52%
Number of Nampa fire station observations			2,820	2,647	757	724	173
Nampa fire station	2/15	174	99.18%	99.96%	99.87%	99.86%	98.84%

Notes: Particulate matter 10 micrometers or smaller (PM_{10}); micrograms per cubic meter ($\mu g/m^3$); miles per hour (mph)
a. Annual data including all observations, 2002–2011
b. Annual data excluding all days with the maximum hourly wind speed above 25 mph
c. Winter data including all observations in December, January, and February, 2002–2011
d. Winter data excluding all days with the maximum hourly wind speed above 25 mph
e. High wind days including the 2002–2011 annual dataset after removing all days with a maximum daily 1-hour wind speed less than 25 mph

4 Clear Causal Relationship (CCR)

4.1 Occurrence and Geographic Extent of the Event

Occurrence—The dust that settled on the Boise-Nampa area on February 15, 2011, arrived briefly from 0800 to 1000 MST, and then again in the evening when it was trapped until the cold front blew it out of the area around 0800 to 0900 MST the morning of February 16. Since the area was dark for most of that time, the haze was not widely noticed beyond the NWS *weather* observations indicating *haze* and not reported in the media other than to report the DEQ advisories (Appendix F). NWS entries identifying the *haze* are provided in Appendix B.

Geographic Extent—The geographic extent of the event can be seen in the $PM_{2.5}$ concentration pattern represented in Figure 6. The dust was composed of 82%–96% coarse particles (2.5–10 µm in size) and only 4%–18% in the *fine* mode, less than 2.5 µm in aerodynamic diameter. So $PM_{2.5}$ levels are not as extreme as PM_{10} levels, however DEQ operates mostly $PM_{2.5}$ monitors so $PM_{2.5}$ is used as a surrogate for PM_{10} to show the spatial concentration patterns. Figure 6 shows that the highest particulate concentrations occurred at Nampa and Meridian on February 15 and 16 but also reached the cities of Idaho City and Garden Valley in the mountains to the north of the Boise-Nampa area. Finally, the Hells Canyon IMPROVE site appears to also have been

impacted on February 14 (Appendix C), however, IMPROVE samples were not collected on February 15 or 16.

MODIS Satellite Evidence—MODIS (Moderate Resolution Imaging Spectroradiometer) satellite imagery of the source area (NOAA 2013) confirms that major dust plumes were generated over the BRP and CSP areas on February 14 and 15, 2011, and travelled in the direction of the Boise-Nampa area of southwest Idaho. The playa areas can be seen without significant dust generation on the morning of February 14, 2011 (Figure 13), which shows a MODIS true color image from the Terra satellite taken at approximately 1030 PST.

The increasing winds on February 14, 2011, began to generate significant dust clouds in the afternoon, as seen in the MODIS Aqua satellite image shown in Figure 14 taken around 1330 PST. Turbulent dust clouds can be seen on the BRP and CSP, and white haze is visible trailing toward the northeast. The dust eroded from the BRP and CSP on February 14 first arrived in the Boise-Nampa area on February 14 around 1800 to 1900 MST, peaking around 2200 MST as seen in the time series chart in Figure 4(a). Although the hourly PM_{10} concentration nearly reached 300 $\mu g/m^3$ on the evening of February 14, the 24-hour concentration was only 55 $\mu g/m^3$ at the Boise FS monitor and 68 $\mu g/m^3$ at the Nampa FS monitor, so the NAAQS was not threatened and exceptional event concurrence is not requested. Nevertheless, the dust impact on February 14 is important to note, because the only National Core (NCORE) air monitoring network $PM_{2.5}$ speciation samples collected during this 3-day wind episode, were collected on February 14. $PM_{2.5}$ reached 24-hour levels around 25 $\mu g/m^3$ on this day at Nampa and Idaho City, well above the levels typical for this time of year. The February 14 speciation is discussed in section 4.6.

On February 15, dust entrainment on the BRP and CSP started earlier in the day and can be seen in the ~1030 PST MODIS Terra image (Figure 15), already streaming to the northeast from the BRP and other smaller dry lakebeds and crossing the Nevada-Oregon border. By the time the afternoon MODIS Aqua image was taken (Figure 16), dust again streamed to the northeast, and turbulent *puffy* dust clouds are visible on both the BRP and CSP. To verify that the puffy clouds on the BRP and CSP are dust rather than water vapor condensation clouds, *false color* magnifications of the February 15 afternoon MODIS image are shown for the BRP (left side of Figure 17) and CSP (right side of Figure 17). *Puffy*, white-tan turbulent dust clouds can be seen on both playas, distinct from the blue-tinted moisture clouds in the area and are reminiscent of the dust clouds photographed by DEQ (Figure 3) near the CSP in March 2012.

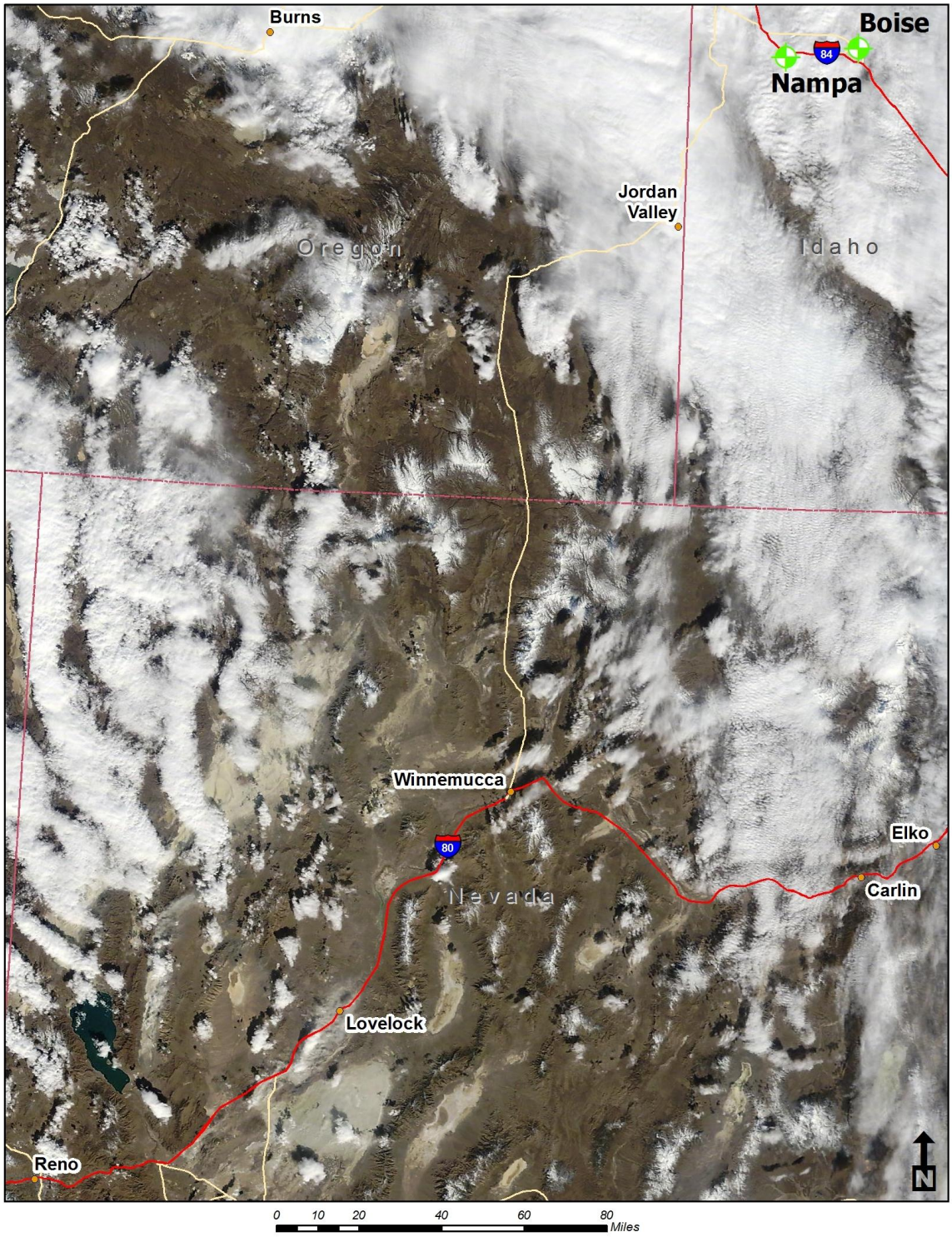


Figure 13. MODIS true color image from the Terra satellite, captured at ~1030 PST on February 14, 2011.

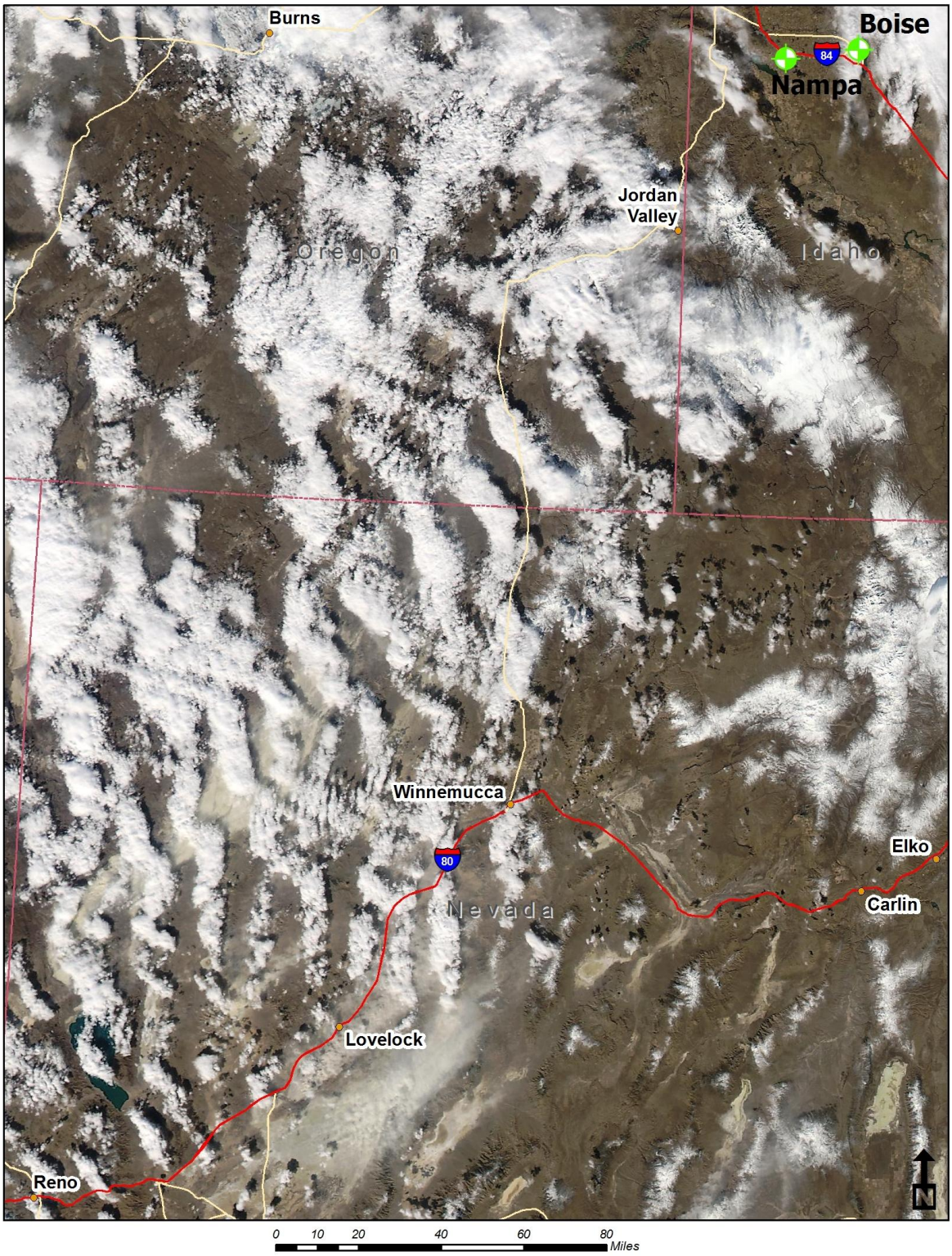


Figure 14. MODIS Aqua image captured at ~1330 PST on February 14, 2011.

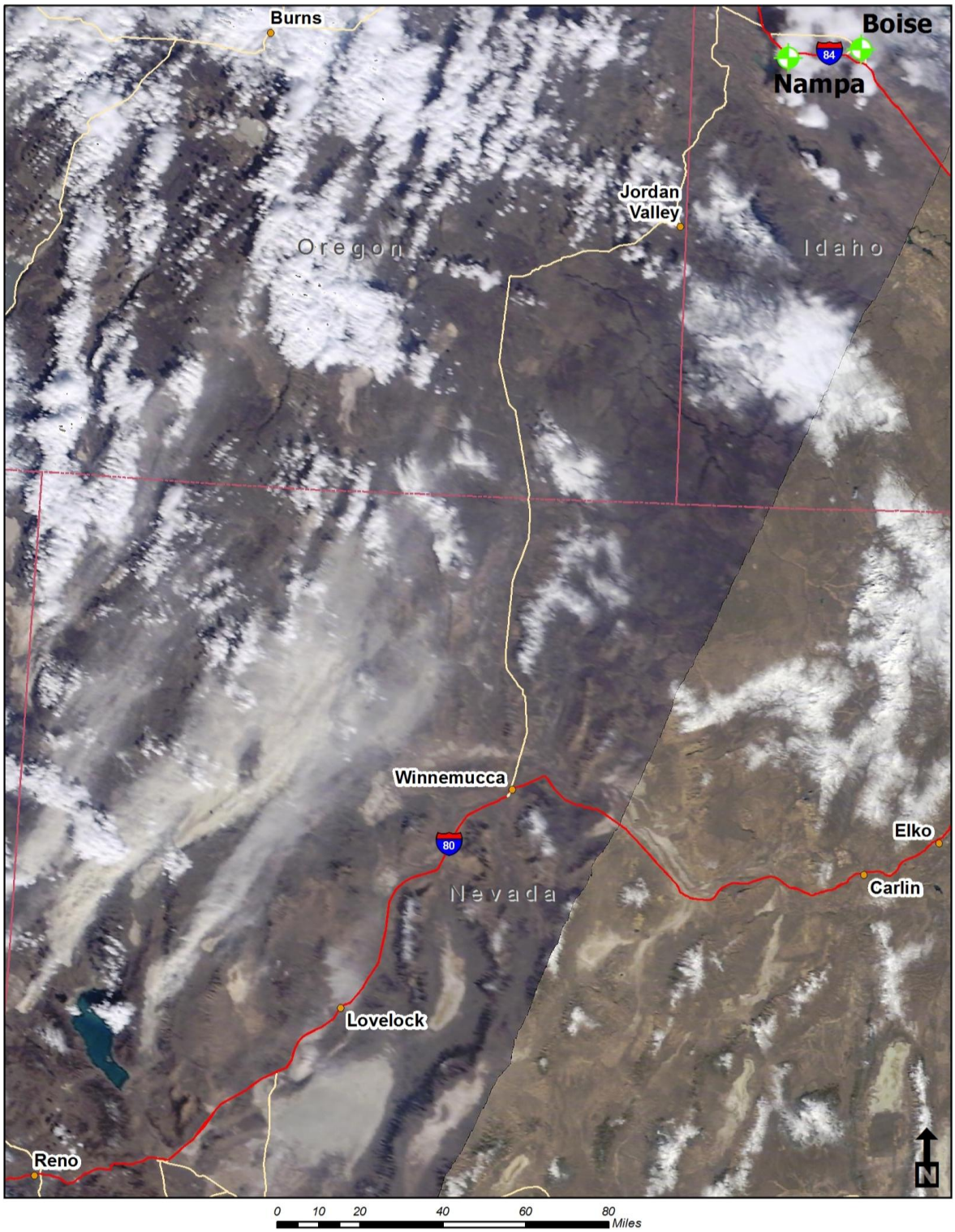


Figure 15. MODIS true color image from the Terra satellite, captured at ~1030 PST on February 15, 2011.

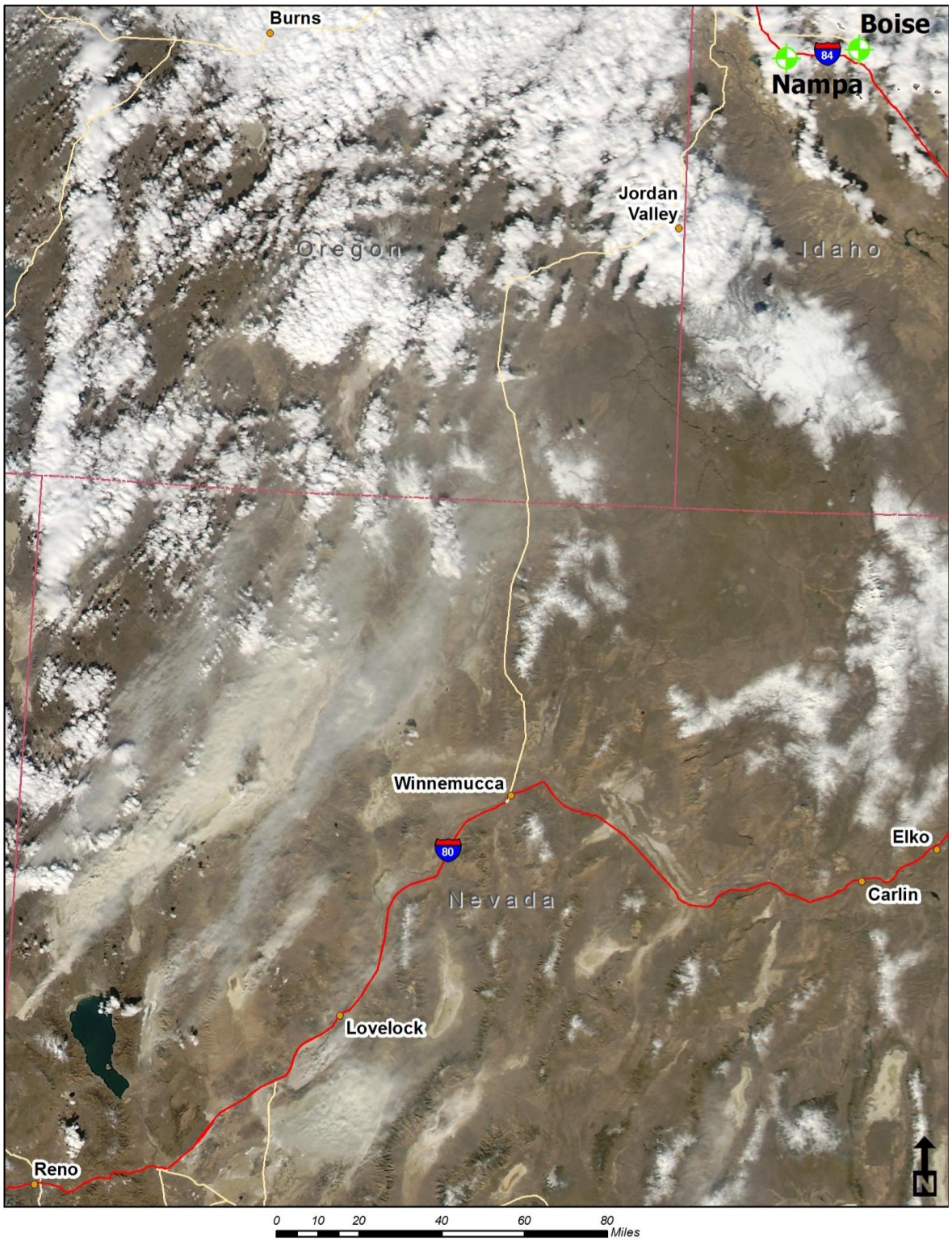


Figure 16. MODIS Aqua image captured at ~1330 PST on February 15, 2011.

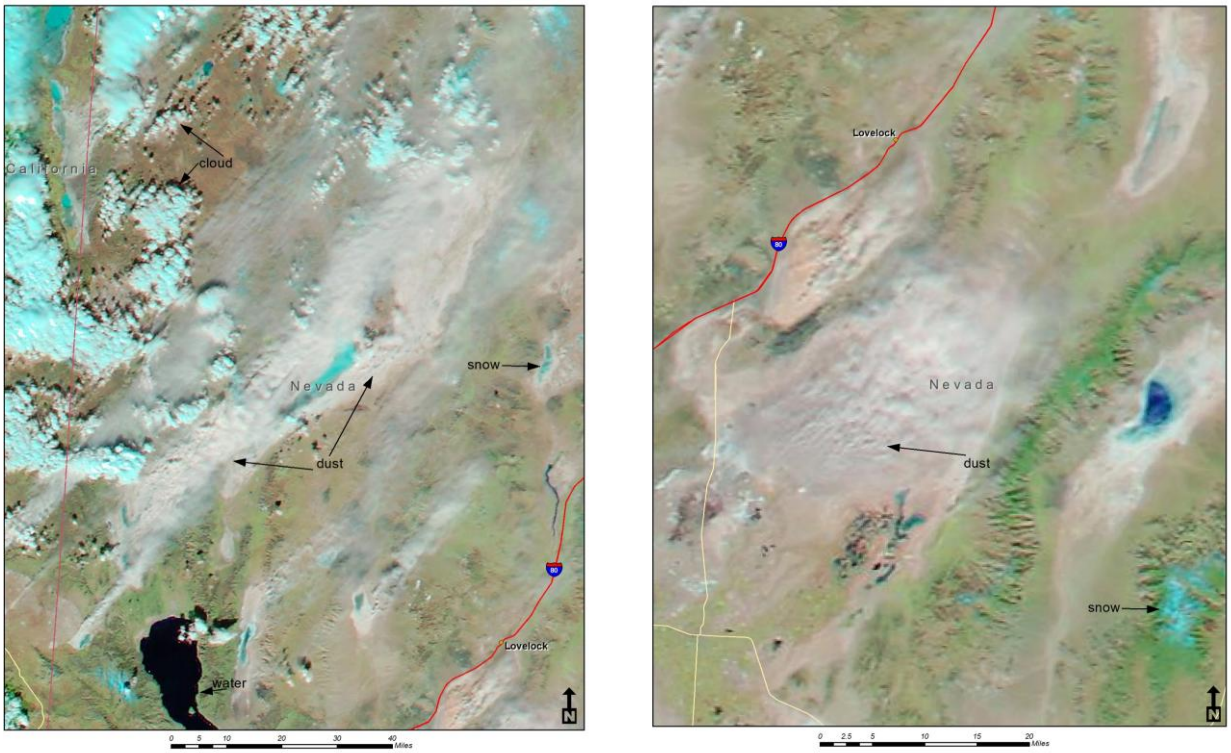


Figure 17. MODIS Aqua false color images (clouds and snow are blue-tinted; dust is white) showing turbulent dust cloud generation on Black Rock Playa (left) and Carson Sink Playa (right) as well as dust plumes leaving the playas toward the northeast ~1330 PST February 15, 2011.

4.2 Description of Weather Conditions that Created the Event

Antecedent Conditions—As described in section 1.3, precipitation in the weeks prior to a wind event produces loose, highly erodible evaporite minerals on the surface of certain alkali playas such a BRP and CSP. Once loose materials are present on the surface, wind gusts may initiate saltation of small particles. Daily precipitation data at sites in the BRP and CSP source region for the period from January 1 through February 15, 2011, are shown in Figure 18 and are provided in tabular form in Appendix B. Rain fell at Lovelock and Fallon, near the CSP and north of the BRP (TEXN2) on January 30, two weeks prior to the event, and relatively heavy rains fell at all sites around the BRP (BUFN2, BLUN2, TR730 and TEXN2) between January 12 and 16, 2011, four weeks prior to the event. The two weeks prior to the event were dry at all stations except for TEXN2, a higher elevation station north of the BRP, which received 0.07 inches on February 5, still leaving nine days for drying and surface evaporite formation. DEQ believes that these precipitation patterns are ideal for enhancing the near-surface water table or moisture layer in the weeks prior to the high wind dust event and for causing significant surface evaporite mineral formation.

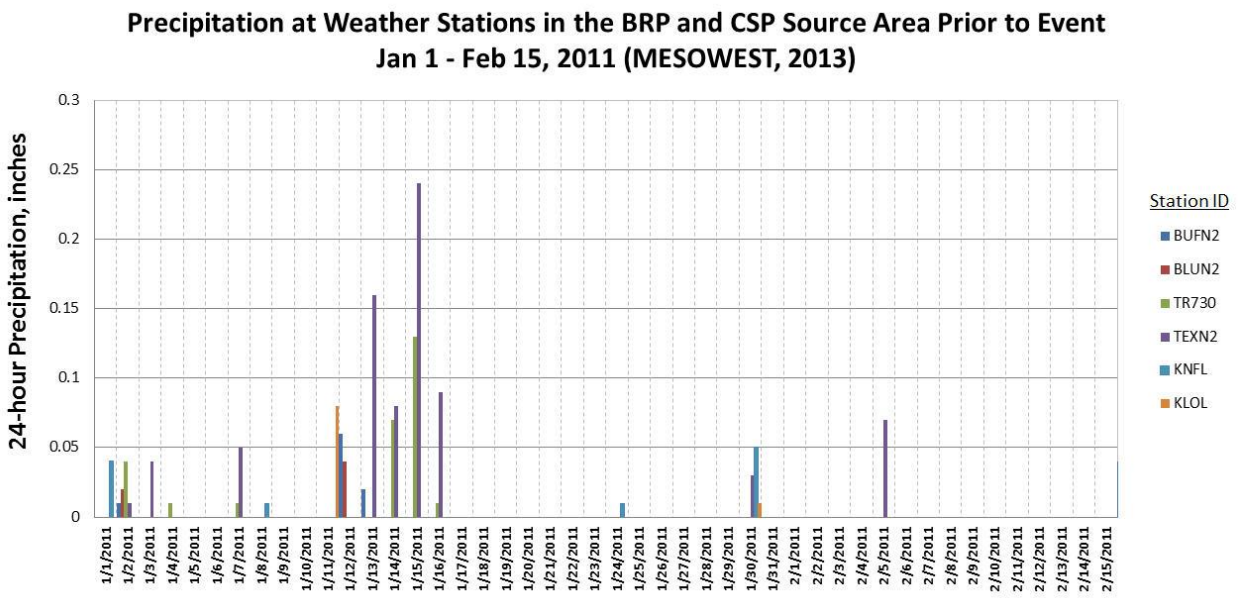


Figure 18. Twenty-four hour precipitation totals in the BRP and CSP source region in the 45 days prior to the event.

Event Conditions—Also important for dust episodes stemming from the BRP and CSP are the passage of cold fronts (or baroclinic troughs) and geostrophic adjustment (Steenburgh et al. 2012). A trough passed through around 1100 MST on February 15, 2011, and propagated eastward with the jet stream. This jet contributed to a rapid rate of pressure change as the atmosphere adjusted to geostrophic imbalance (Kaplan et al. 2010). It is possible to note the marked decrease in pressure of about 1 millibar per hour ($mb_{*}hr^{-1}$) at several stations in northern Nevada, such as Fallon and Elko, southern Idaho, and Ontario in eastern Oregon, associated with this passage when one compares Figure 19 and Figure 20.

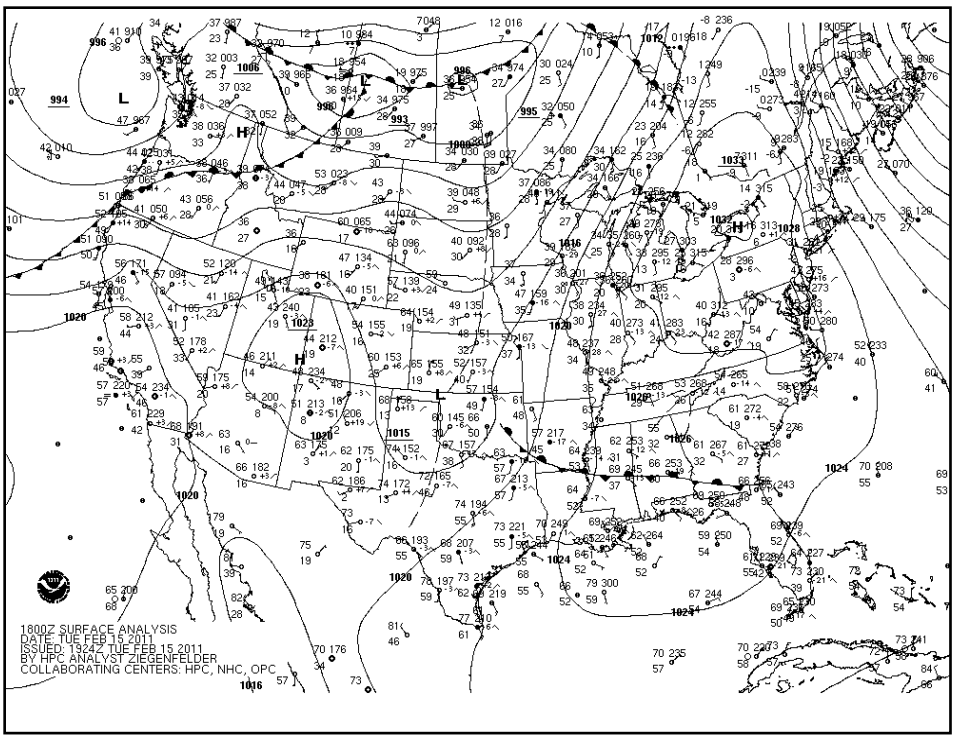


Figure 19. 1800Z (1100 MST) surface analysis February 15, 2011 (National Weather Service Hydrometeorological Prediction Center: *http://www.hpc.ncep.noaa.gov/html/sfc_archive.shtml*).

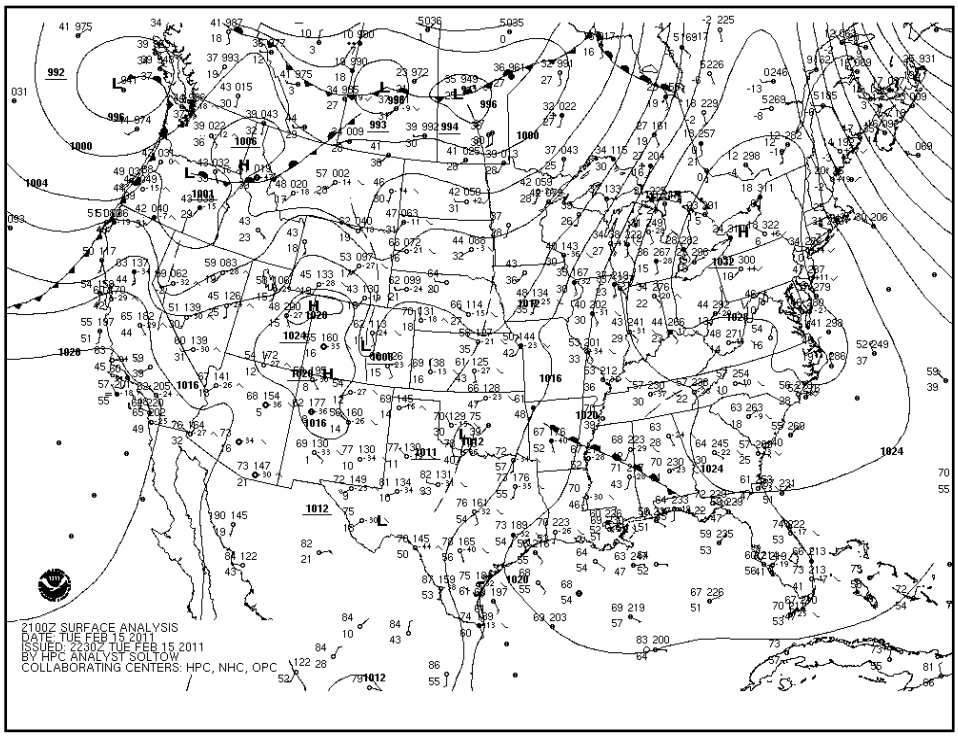


Figure 20. 2100Z (0200 MST) surface analysis February 15, 2011 (National Weather Service Hydrometeorological Prediction Center: *http://www.hpc.ncep.noaa.gov/html/sfc_archive.shtml*).

High wind speeds can be observed across eastern Oregon and northwest Nevada preceding and on the event day using National Center for Environmental Prediction (NCEP)/North American Regional Reanalysis (NARR) model data (Mesinger et al. 2006, accessed November 23, 2012 from *http://www.esrl.noaa.gov/psd/ data/gridded/data.narr.html*). The BRP lies along the edge of this boundary and experienced winds aloft of 25 m/s (56 mph) as shown in Figure 21.

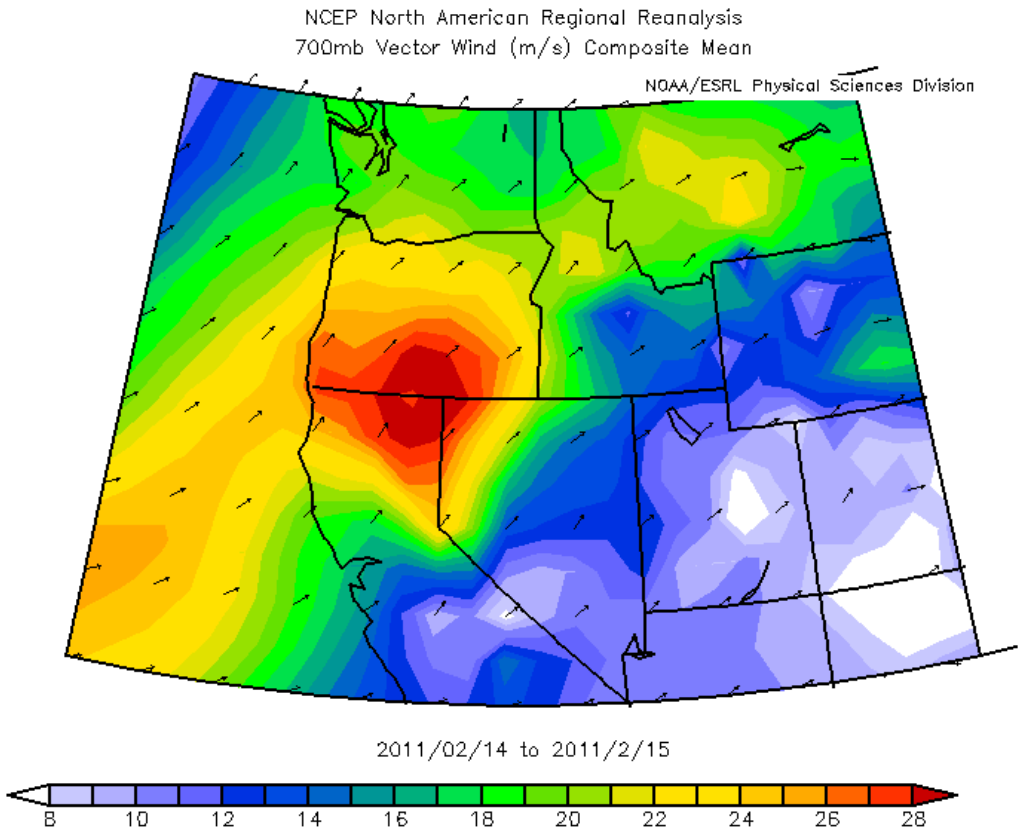


Figure 21. NCEP/NARR model reanalysis of midlevel winds (meters per second), February 14–15, 2011 (NOAA/ESRL Physical Science Division, Boulder Colorado: *http://www.esrl.noaa.gov/psd/*).

Steenburgh et al. (2012) noted that sustained winds of 10 m/s (22 mph) are strong enough to elevate dust, while Argaman et al. (2006) and Ginoux et al. (2012) suggest that 15 mph is an appropriate threshold velocity for wind erosion on flat surfaces with disturbed or loose material. After the morning inversion broke, the momentum associated with this midlevel flow would have mixed down to the surface and enhanced winds related to the baroclinic trough passage. Figure 22 shows the 1100 PST sounding information for Reno, Nevada. The figure indicates that not only had the inversion broken, but vertical mixing occurred as the temperature profile parallels the dry adiabat curve to around 690 millibar (mb). At this height, another inversion set in and prevented any further mixing.

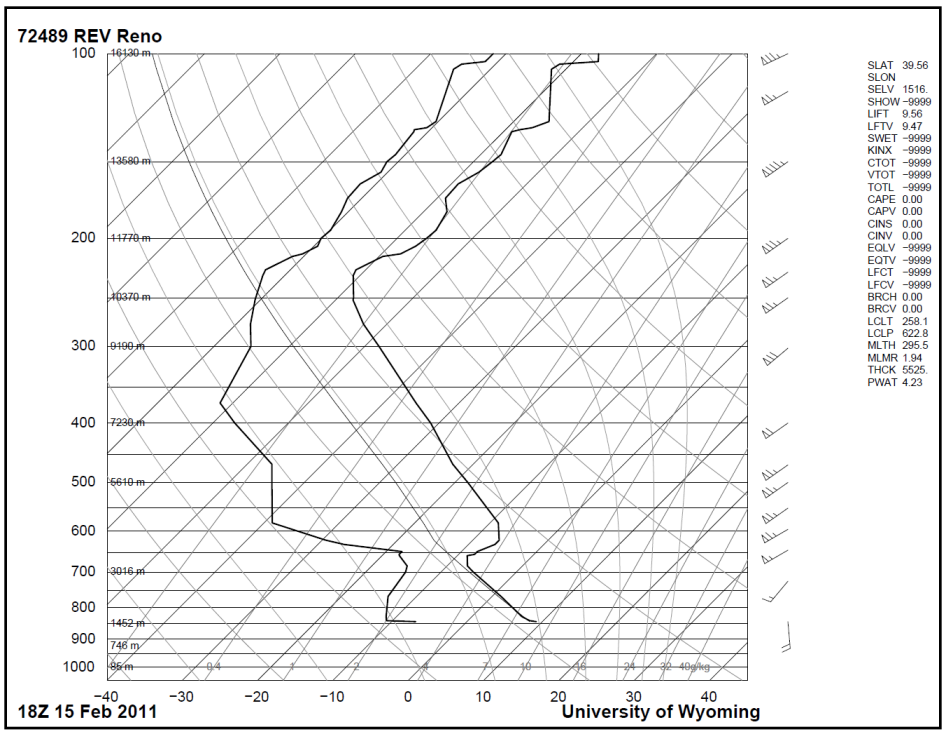


Figure 22. Sounding information for Reno, Nevada, at 18Z (1100 PST) February 15, 2011 (National Weather Service Upper-Air Observations Program-Global Climate Observing System. University of Wyoming Sounding: *http://weather.uwyo.edu/upperair/sounding.html)*.

Surface observations taken from stations across the desert and Great Basin on February 14 and 15, 2011, indicate sustained wind speeds greater than 10 m/s (22 mph) for multiple consecutive hours across both days. Coupled with this were sufficiently high threshold friction velocities (TFV). TFV values greater than 0.8 m/s are generally strong enough to erode both disturbed and undisturbed dust (Marticorena et al., 1997); however, Holcombe et al. (1997) noted that TVF values of 0.3–0.5 m/s are strong enough to lift disturbed particles, which are expected to be present on the playas. TFV is a measure for conditions necessary for blowing dust and is higher for undisturbed soils and lower for disturbed soils. Friction velocities have been calculated for 18Z February 15 (1100 MST) using the NAM12 model. As illustrated in Figure 23, the TFV exceeds 0.4 m/s and is between 0.8 and 1.2 m/s across the source region indicating that the minimum TFV required to lift dust are met and exceeded for both disturbed and undisturbed crust.

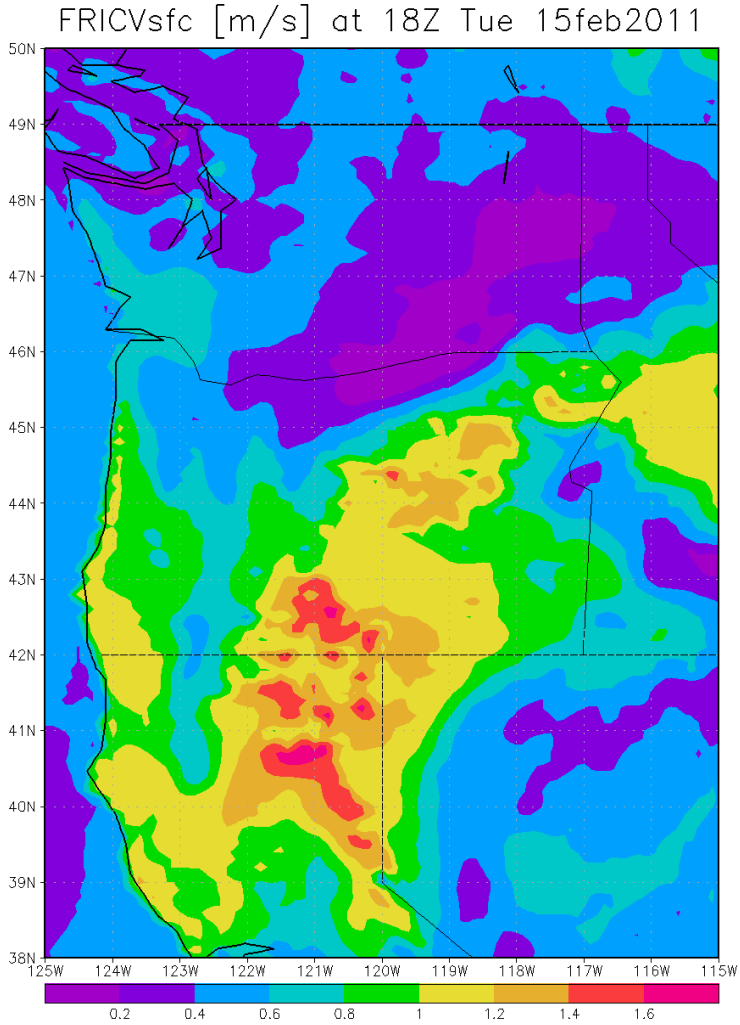


Figure 23. Friction velocity for 18Z (1200 MST) February 15, 2012, NARR NAM-ANL (National Climatic Data Center National Operational Model Archive and Distribution System, NWS-NCEP NAM, 12 km: *http://nomads.ncdc.noaa.gov/data.php?name=access#hires_weather_datasets*).

Presented with the following information, it is possible to relate observed meteorological conditions and atmospheric measurements to such a conceptual model. Observations taken from MESOWEST stations at KBOI (Boise, ID), KLOL (Lovelock, NV), and KWMC (Winnemucca, NV), provided in Appendix B, all indicate poor visibility and haze throughout the period of February 15–16, 2011. Weather conditions in Boise during the event promoted the containment and accumulation of particulate in the valley as a result of weak surface winds overnight and a weak surface inversion, as indicated in the February 16, 2011, morning (12Z) sounding shown in Figure 24 taken at Boise, Idaho.

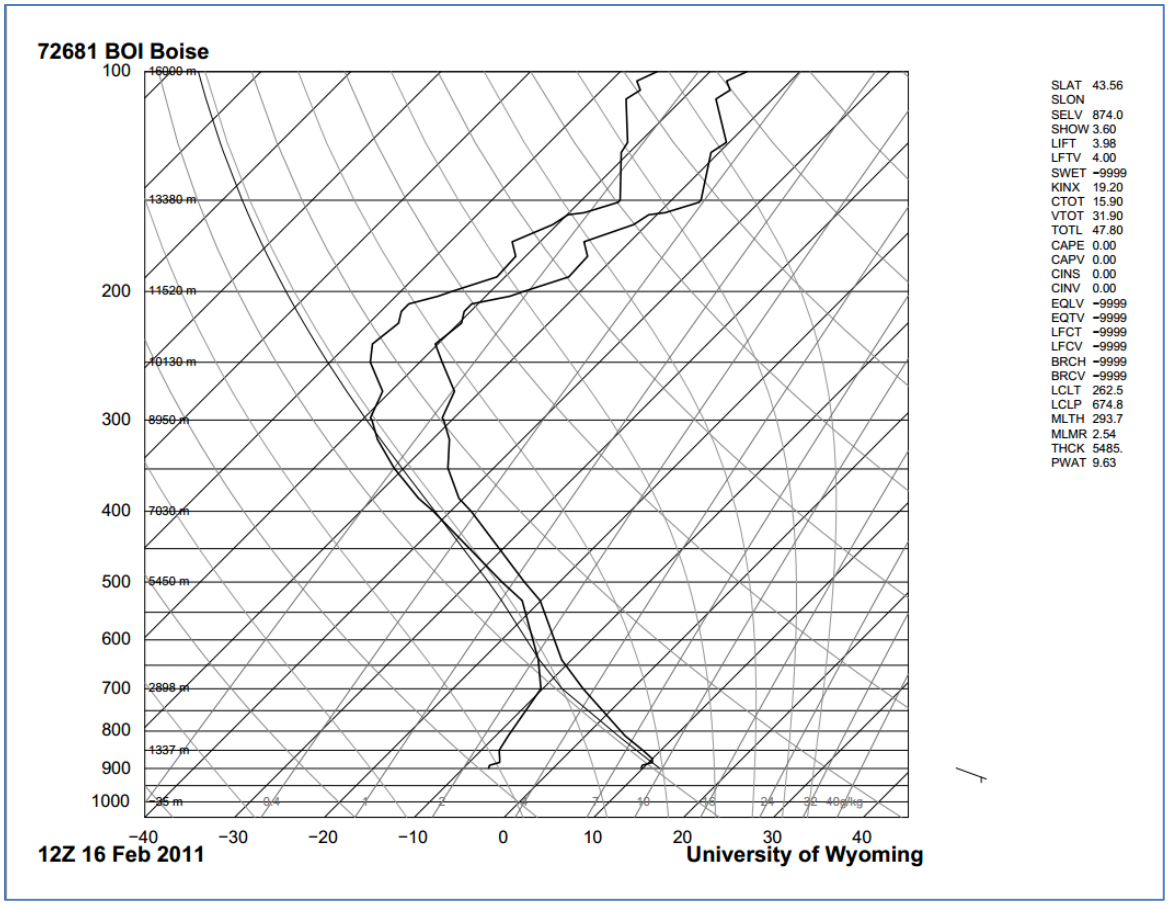


Figure 24. Sounding information for Boise, Idaho, at 12Z (0500 MST) February 16, 2011 (National Weather Service Upper-Air Observations Program-Global Climate Observing System. University of Wyoming Sounding: *http://weather.uwyo.edu/upperair/sounding.html*).

Winds the evening of February 15, 2011, ranged from calm to 18 mph over the time period of 1900 to 0700 MST the morning of February 16, with observations of haze from 2200 to 0800 MST. At 0900 MST a cold front associated with the trough axis responsible for the event passed through the area quickly removing any residual airborne dust. After that, conditions were reported as mostly clear as winds shifted from the southeast to the northwest, surface temperatures dropped from 48 ^{o}F to 33 ^{o}F, and snow began to fall. Figure 25 indicates the position of the cold front to be slightly west of Boise, Idaho, at 15Z on February 16, 2011 (0800 MST), and Figure 26 indicates the position of the cold front to be east of Boise, Idaho, at 1800Z on February 16, 2011 (1100 MST).

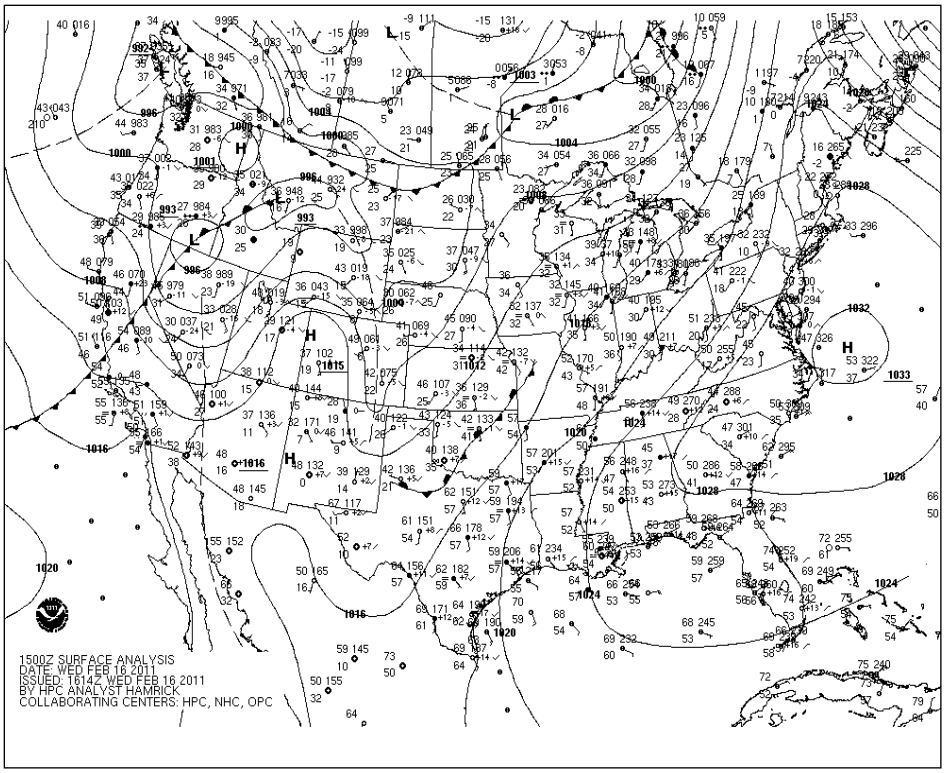


Figure 25. 1500Z (0800 MST) surface analysis February 16, 2011 (National Weather Service Hydrometeorological Prediction Center: *http://www.hpc.ncep.noaa.gov/html/sfc_archive.shtml*).

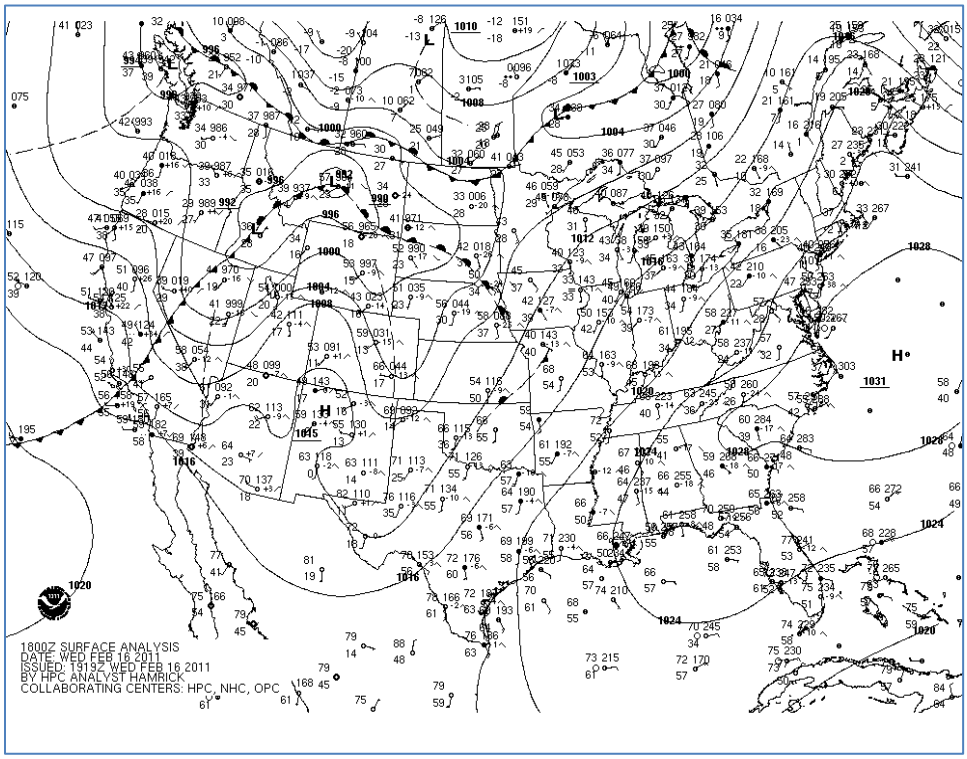


Figure 26. 1800Z (1100 MST) surface analysis February 16, 2011 (National Weather Service Hydrometeorological Prediction Center: *http://www.hpc.ncep.noaa.gov/html/sfc_archive.shtml*).

The observed surface winds during the afternoon of February 15, 2011 (1500 MST) are shown for the NWS and United States Department of Agriculture Forest Service/Bureau of Land Management remote automatic weather (RAWS) stations reporting to the MESOWEST service (Horel et al. 2002) in Figure 27. Winds in the source region around the playas are generally in the 20 to 28 mph range, and gusts reach up to 46 mph. Surface wind speeds between the BRP and CSP area and Boise and Nampa monitors remain elevated but then decrease to around 13 mph only after reaching the Snake River and Boise River valleys.

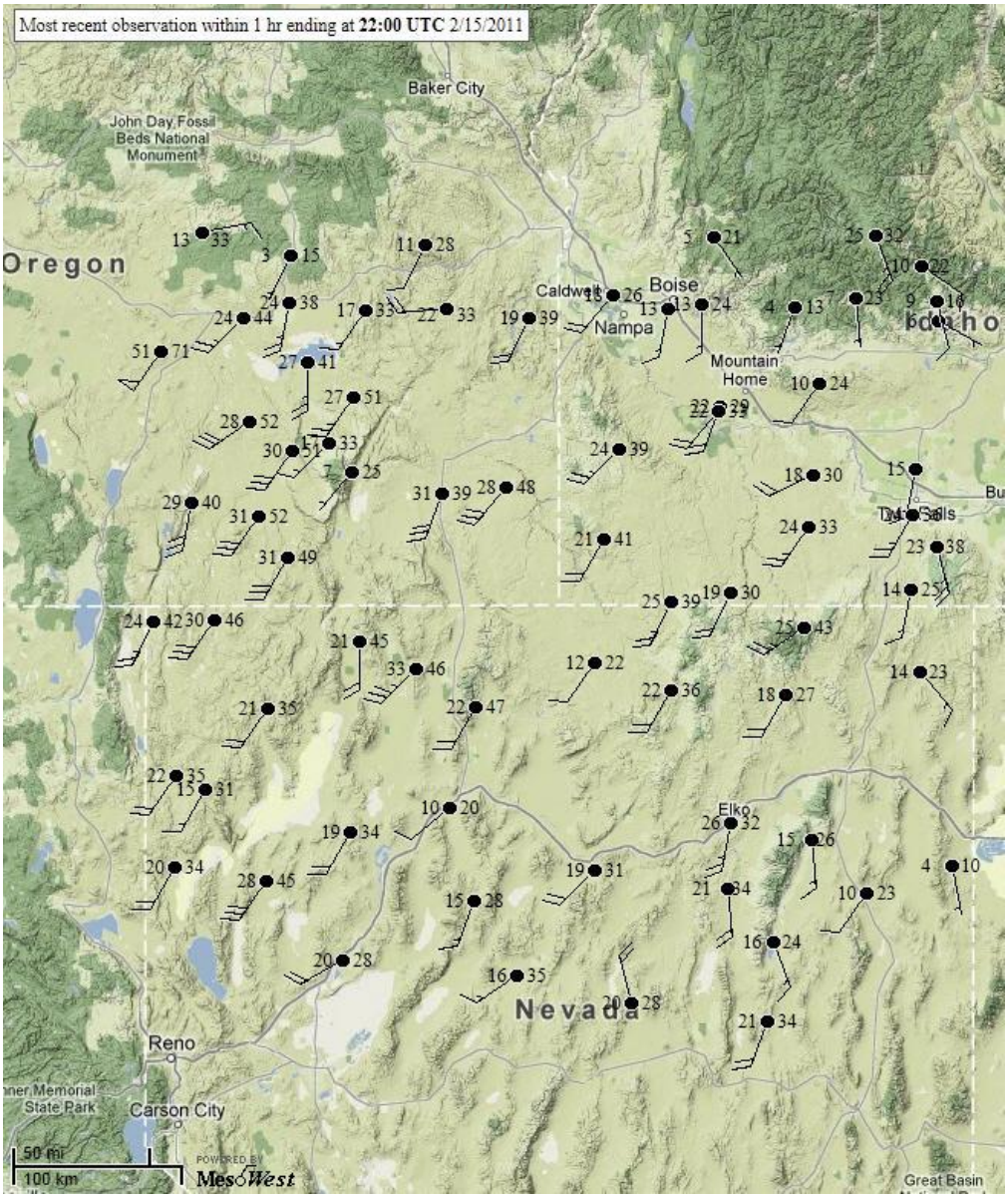


Figure 27. Surface winds 1500 MST on February 15, 2011, from MESOWEST (Horel et al. 2002). Wind barbs point in the direction toward which the wind is blowing. Number on left of dot indicates hourly sustained wind speed, and number on right indicates the maximum 2-minute wind gust for that hour, both in miles per hour.

4.3 Transport of Emissions Related to the Event in the Direction of the Monitor(s) Where Measurements Were Recorded

The transport of emissions from the source area to the monitors where the particulate measurements were recorded are shown graphically using back-trajectory plots, which begin at the monitors at the time that the PM_{10} levels are rising through the time that they either peak or pass. The back-trajectories are an established methodology that utilizes archived model meteorological fields, including a wind speed and wind direction vector for every hour and every 12 km distance and links them backward in time, delineating the path that the air mass has taken in the previous 24 hours prior to its arrival at the monitor. Using this approach, whenever the suspected source area or areas occur along one or more of the back-trajectory lines, this is evidence linking the source area to the monitored peak concentrations, a key element demonstrating the causal relationship.

Back-trajectories were computed using the National Oceanic and Atmospheric Administration's (NOAA's) Ready HYSPLIT modeling tool (Draxler and Rolph 2003). The archived NAM 12km meteorological model was used to compute 24-hour long back-trajectories with modeled vertical motion, and starting elevations at 0, 500, and 1,000 meters aboveground level, ending at the Boise FS monitor (which is also reasonably representative of the Nampa FS monitor).

For the February 15–16, 2011, dust episode, two periods of time occurred in which the dust from the playas of northwest Nevada arrived in the Boise-Nampa area. The back-trajectories are designed to show the origin of the winds reaching Boise at these times. These two impact periods are visible in the PM_{10} time series plot in Figure 4:

- **0500 to 1000 MST February 15**—This was a smaller impact, with 1-hour PM_{10} concentrations in the 200 to 330 µg/m^3 range, but it did contribute significantly to the recorded 24-hour PM_{10} concentration. The back-trajectories for this period, shown in Figure 28, indicate that the 500 meter and 1,000 meter trajectories pass near the BRP, closely paralleling the visible blowing dust trending toward Boise.
- **1600 to 2400 MST February 15**—This is the major impact period when dust from Nevada reached hourly concentrations around 500 µg/m^3, then remained trapped in the valley overnight until the dust was advected out of the valley around 0900 to 1000 MST on February 16. As a result, the high PM_{10} concentrations persisted for nearly 10 hours, exceeding the standard on both February 15 and 16 at the Boise FS monitor and on February 15 at the Nampa FS monitor. The back-trajectories for the period of rising PM_{10} concentrations on the evening of February 15, 2011, between 1600 and 2400 MST are shown in Figure 29. For the air mass arriving in Boise during this period, it appears that the surface level air may have passed over the CSP, while the 500 meter and 1,000 meter air passed directly over the BRP. Thus, it appears that either or both playas may have contributed.

In summary, the back-trajectories for the dust impact periods on February 15 and 16, 2011, corroborate the blowing dust visible in the MODIS satellite images for the same time frame and are consistent with the measured surface wind directions shown in Figure 27.

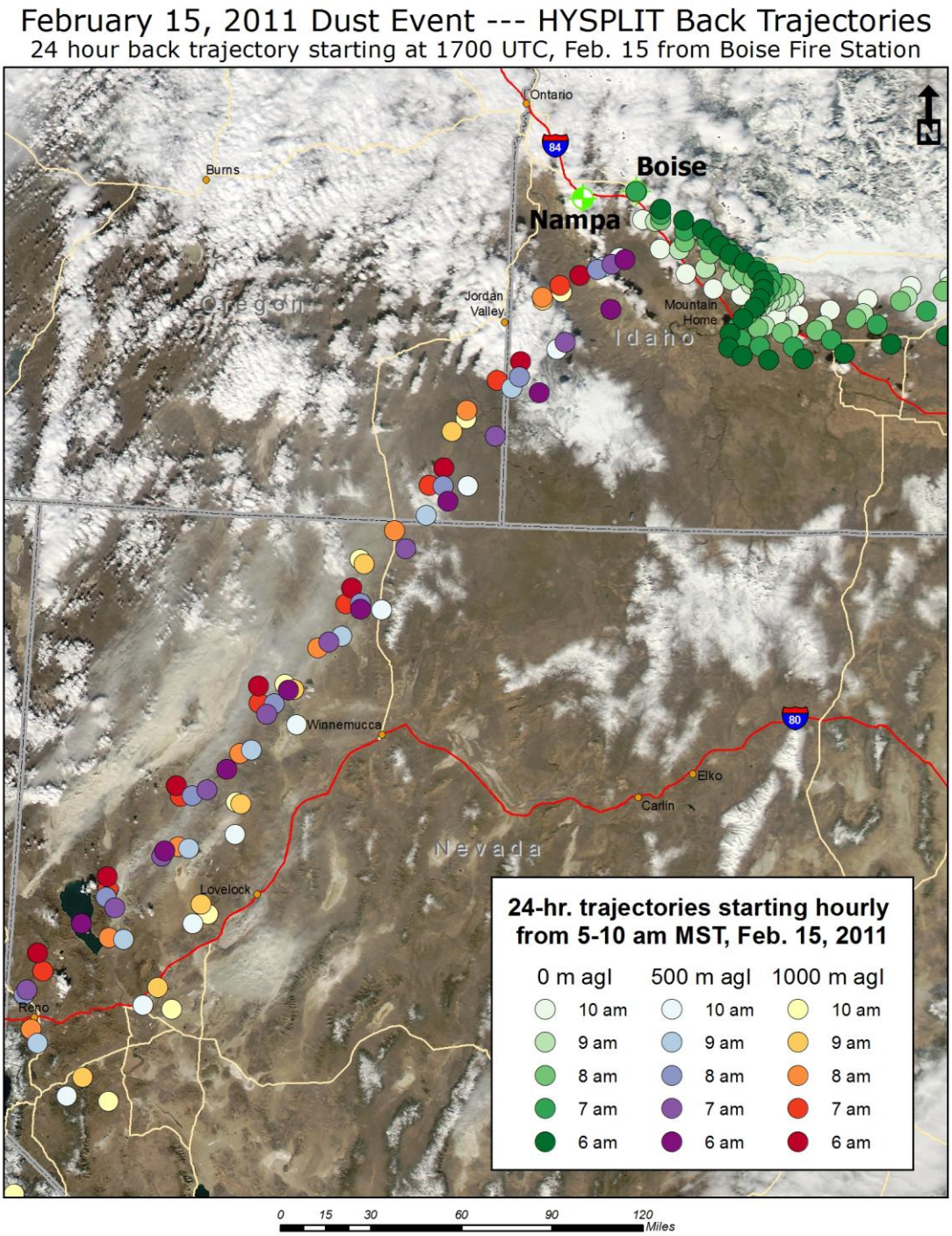


Figure 28. HYSPLIT back-trajectories from the 0500–1000 MST PM_{10} peak at Boise-Nampa area on February 15, 2011 (NOAA Ready HYSPLIT model: *http://ready.arl.noaa.gov/HYSPLIT_traj.php*).

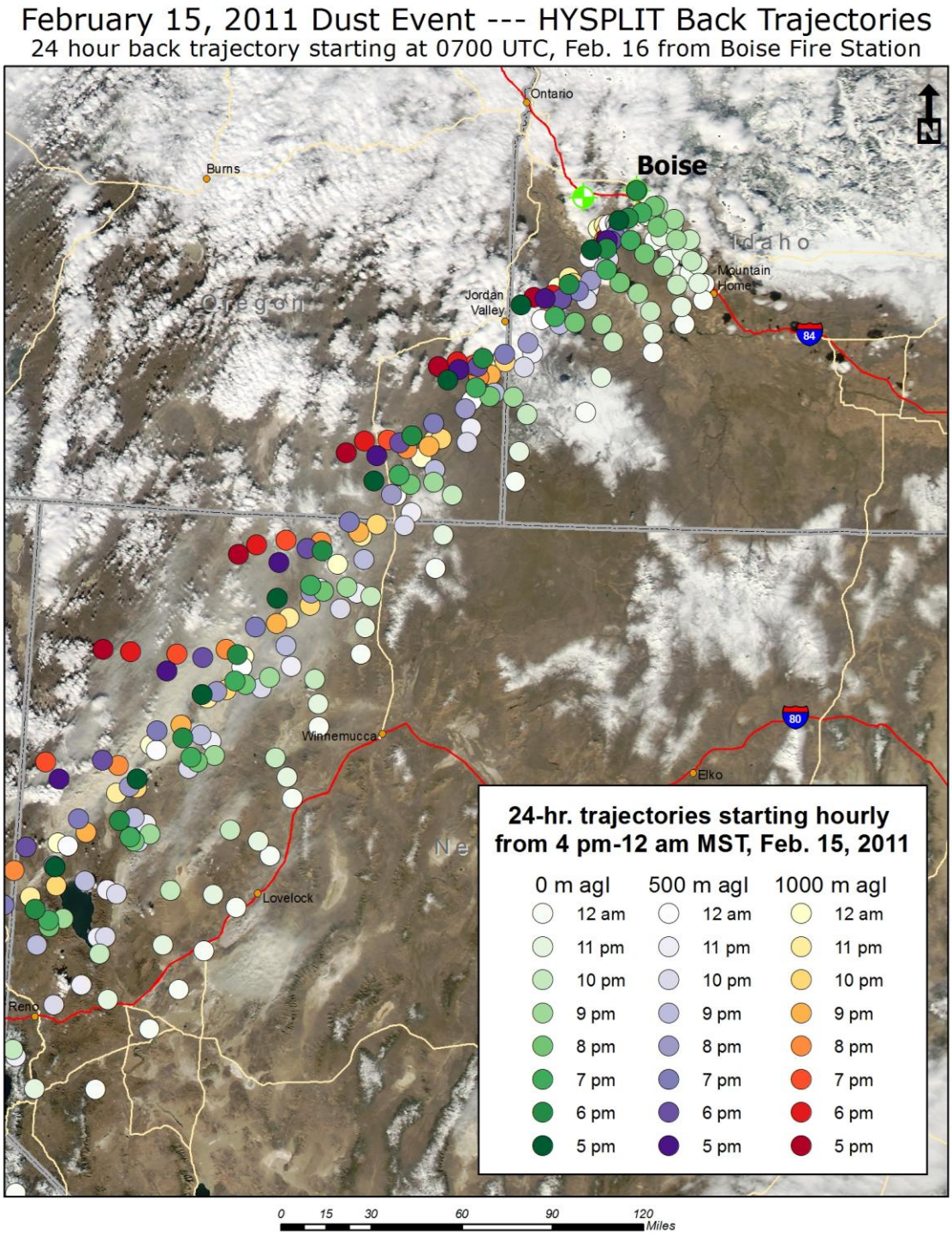


Figure 29. HYSPLIT back-trajectories from the 1600–2400 MST PM_{10} peak at Boise-Nampa area on February 15, 2011 (NOAA Ready HYSPLIT model: *http://ready.arl.noaa.gov/HYSPLIT_traj.php*).

4.4 Spatial Relationship Between the Event, Sources, Transport of Emissions, and Recorded Concentrations.

The spatial relationship between the wind erosion event at the BRP and CSP source areas, and the transport winds are depicted in Figure 28 and Figure 29 where back-trajectories lead directly from the impacted area of the Boise-Nampa monitors to the source areas. These modeled back-trajectories are confirmed by the recorded surface observations throughout the source and transport region, depicted graphically in Figure 27, as well as the MODIS satellite images in Figure 14 through Figure 16, which show dust blowing from the BRP and CSP source areas directly toward the Boise-Nampa area along the same 210 to 230 degrees bearing (from true north).

4.5 Temporal Relationship Between the High Wind and Elevated PM Concentrations at the Monitor(s) in Question

Time series charts combining source area winds and wind directions, and Boise-Nampa area hourly PM_{10} monitor data and winds are shown in Figure 4 and Figure 5. These time series charts show high afternoon winds in the source areas in Nevada blowing dust toward the Boise-Nampa area on the afternoon of February 14 and throughout most of the day on February 15, 2011. The dust, indicated by PM_{10} concentrations at Boise FS and Nampa FS monitors, peaked on February 14 at 1900–2200 MST, and again on February 15 at 0500–1000 MST and 1600–2400 MST, where it appeared to be trapped by reduced wind speeds until the increasing winds associated with the cold front blew it out of the valley the following morning.

4.6 Similarity of Chemical Composition of Measured Pollution with that Expected from Sources Identified as Upwind

Chemical Similarity—The PM_{10} monitors indicated unusually high concentrations peaking at 1900–2200 MST on February 14, 2011. Although the NAAQS was not threatened, the PM_{10} impacts are of interest on February 14 because that is the only day of the multiday high wind episode in Nevada for which a speciation sample was collected at the NCORE speciation site located at St. Luke’s Medical Center, Meridian, Idaho, sampling location, situated between the Boise FS and Nampa FS. The St. Luke’s speciation filters are routinely submitted to an EPA laboratory for extensive chemical analysis, thus providing a chemical composition for the dust. The PM_{10} at the Boise and Nampa FS monitoring sites and the $PM_{2.5}$ at the St. Luke’s monitoring site all reached unusually high levels on the evening of February 14, suggesting dust impacts. DEQ investigated the potential sources to see if the same source mechanisms and transport conditions occurred on February 14 as DEQ documented on February 15 and 16.

First, winds in the source areas of northwest Nevada were obtained, verifying winds around 25 mph with gusts exceeding 40 mph occurred for the entire afternoon from 1200 through 1800 MST, with additional high wind periods around 2100 and 2300 MST (Figure 5). Next, MODIS satellite images were obtained showing that while visible dust was not blowing during the ~1030 PST MODIS Terra satellite pass (Figure 13), visible dust blowing off the BRP toward the Boise-Nampa area was visible in the afternoon during the MODIS Aqua satellite pass at ~1330 PST (Figure 14).

Finally, HYSPLIT back-trajectories were simulated, as described earlier, starting at Boise FS during the peak PM_{10} hours, 1900–2300 MST, on February 14. As shown in Figure 30, surface level back-trajectories appear to pass over the CSP area where MODIS satellite images show vigorous *puffy* dust clouds indicative of turbulent wind erosion. The 500 meter and 1,000 meter trajectories pass very near the western edge of the BRP suggesting that while CSP is a very likely source, BRP is potentially also a contributing source area on February 14.

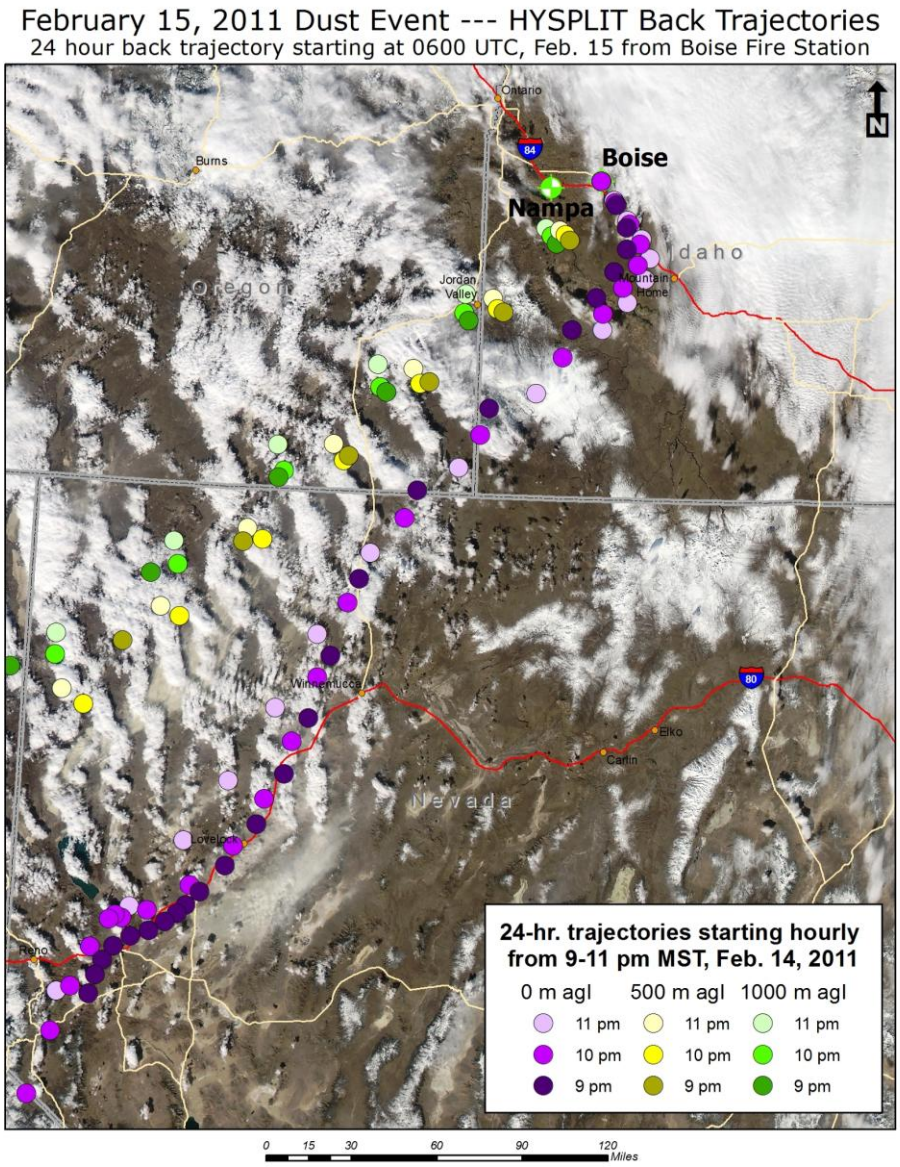


Figure 30. HYSPLIT back-trajectories for the Boise-Nampa area PM10/PM2.5 impact period 2100–2300 MST, February 14, 2011 (NOAA Ready HYSPLIT model: http://ready.arl.noaa.gov/HYSPLIT_traj.php).

Based on the additional wind speed data, satellite images, and back-trajectories presented for February 14, DEQ concluded that the same source areas and transport conditions brought elevated PM_{10} and $PM_{2.5}$ to the Boise-Nampa area on February 14 as was demonstrated for the

higher impacts observed on February 15–16, 2011, and therefore the chemical composition of the February 14 sample is a fingerprint of the same dust that caused the NAAQS violations on February 15–16, 2011.

NCORE speciation data for February 14, 2011, is provided in Appendix D and is compared in Figure 31 to a literature composition for the BRP surface soils analysis (Gillett 1997). The February 14 St. Luke's $PM_{2.5}$ fingerprint matches the BRP surface soils composition very well (Figure 31) but is slightly enriched in calcium (Ca) and sodium (Na). These are indicators of the water soluble evaporite minerals identified by Tollerud and Fantle (2012), and their enrichment in the February 14 NCORE samples supports the conceptual model mechanism involving wind erosion of calcium enriched evaporite minerals (along with clays and silts) made more erodible by antecedent precipitation in the weeks prior to the event.

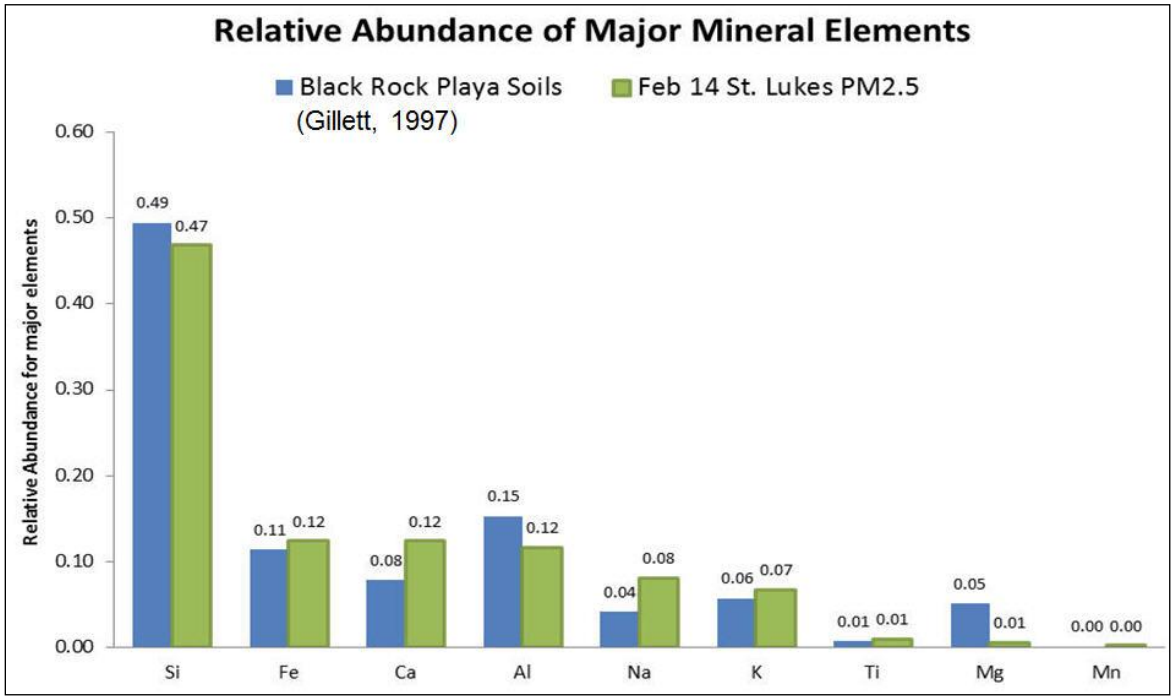


Figure 31. February 14, 2011, $PM_{2.5}$ composition (NCORE 2013) compared to Black Rock Playa surface soil composition (Gillett 1997).

It should be noted, as anecdotal *weight-of-evidence*, that the February 14, 2011, NCORE speciation represents the second highest *geologic* composition observed at the St. Luke's NCORE site. An examination of the highest geologic component in the 2006–2011 database, which was recorded on November 22, 2006, indicates a remarkably similar composition to the February 14 sample, in that the calcium content was unusually high. DEQ examined winds in Nevada on November 22, 2006, developed back-trajectories, and concluded that the dust reaching the Boise-Nampa area on that day, while not approaching the PM_{10} standard in magnitude, also originated in the playa region of northwest Nevada under high wind conditions. DEQ concludes that high geologic component, enriched in calcium is a signature of the playa dust from the BRP, CSP, and other playas in northwest Nevada.

Size Similarity—In addition to the chemical similarity between the dust reaching the Boise-Nampa area on February 14, 2011, and BRP surface sediments, the size distribution provides additional information about the nature of potential sources. Wind-blown dust is known to be mostly larger than 2.5 µm in size, while most other sources of atmospheric particulate air pollution generate particles smaller than 2.5 µm. Smoke particles from combustion sources, including fires, residential wood combustion, gas and diesel vehicle exhaust, and industrial combustion sources are typically smaller than 1 µm in size. Secondary organic aerosols formed by condensation of gaseous organic compounds such as terpenes or polyaromatic hydrocarbons are also less than 2.5 µm in size. Finally, secondary inorganic aerosol species including ammonium nitrate and ammonium sulfate, formed when nitrogen oxides and sulfur oxides oxidize in the atmosphere and combine with ammonia are less than 2.5 µm. Careful examination of $PM_{2.5}$ and PM_{10} hourly concentrations in Figure 4 indicates that the PM_{10} dust that arrived on February 15 was composed of approximately 4% to 18% $PM_{2.5}$ (the remainder, 82% to 96% was in the *coarse* particle fraction, 2.5 to 10 µm in size).

Analysis of historical $PM_{2.5}/PM_{10}$ ratios data suggests that the event of February 14–16, 2011, was a dust event. Figure 32 shows the $PM_{2.5}/PM_{10}$ ratio measured at the Nampa FS monitoring site in winter months over the previous 2 years (red line) sorted by increasing the $PM_{2.5}/PM_{10}$ ratio, along with the paired 1-hour PM_{10} concentration (blue squares). The data show that for the all samples with PM_{10} hourly concentrations higher than 100 µg/m^3, the $PM_{2.5}/PM_{10}$ ratio is lower than ~0.2 (or 20%), indicating that the main component is coarse particulates, the character of dust particles, while the majority of winter hours have more than 20% $PM_{2.5}$ indicating that they consist largely of smoke and secondary aerosol species typical of a winter speciation. Table 3 shows that 18 of the 25 highest hourly PM_{10} concentrations (greater than 100 µg/m^3) in the winter 2010 and 2011 dataset at the Nampa FS (circled red in Figure 32) were measured during the February 14–16 event. The other seven hourly PM_{10} concentrations above 100 µg/m^3 occurred on days when the Boise airport winds were in the 22–25 mph range with gusts from 32 to 39 mph, all higher than the winds recorded during the February 15 event. These nonevent hourly observations reflect local dust transported a much shorter distance, allowing less of the larger particles to settle out, therefore having a more *coars*e composition and a lower $PM_{2.5}/PM_{10}$ ratio. The 24-hour averages that included the other hourly values never exceeded 48 µg/m^3 at the Nampa FS or 21 µg/m^3 at the Boise FS, more typical of windy winter days where local sources dominate. In conclusion, the size information demonstrates that there is very little contribution from sources of fine particulate ($PM_{2.5}$) during the event, such as car exhaust, burning, industrial combustion, and secondary aerosol formation but a somewhat greater $PM_{2.5}/PM_{10}$ ratio than expected during high wind dust storms originating from local sources.

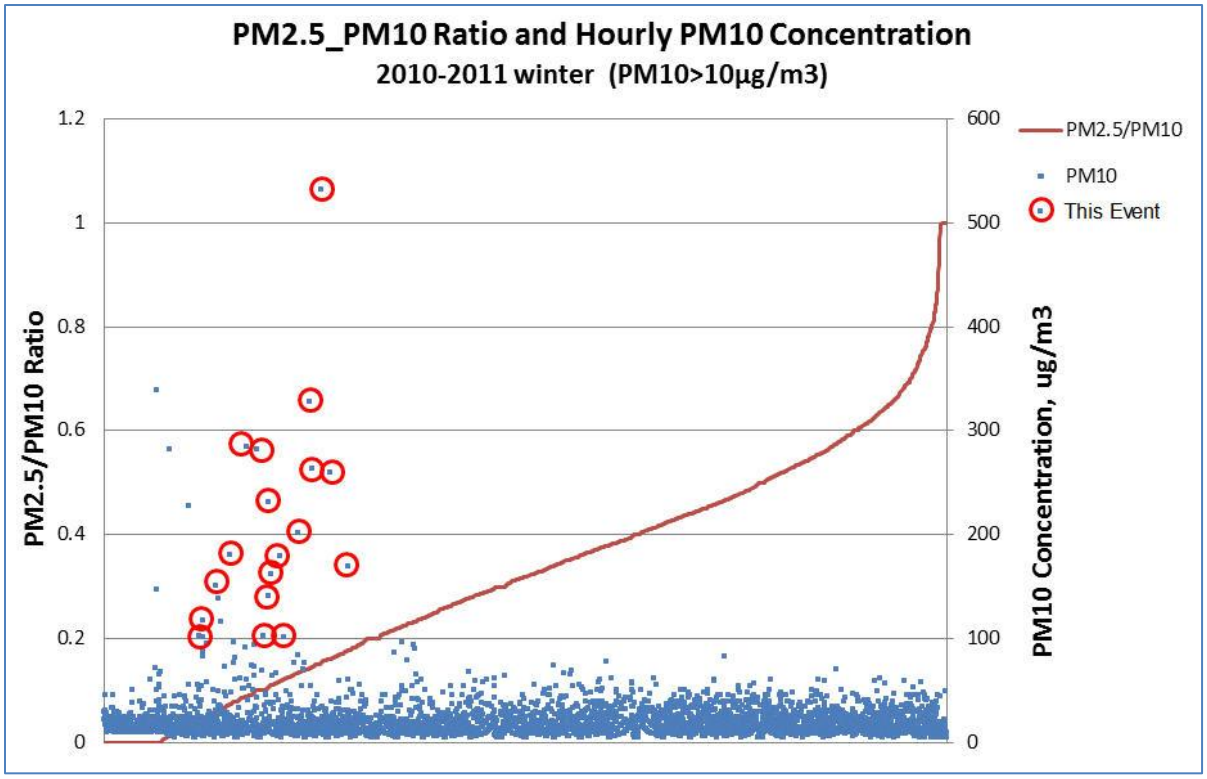


Figure 32. PM $_{2.5}$/PM_{10} ratio at the Nampa fire station sorted from low to high (red line, left axis) versus paired 1-hour PM_{10} concentration (blue dots).Hourly values above 100 µg/m^3 that occurred during the February 14–16 event are circled in red

Table 3. Hourly PM_{10} concentrations greater than 100 µg/m^3 at the Nampa fire station for winter 2010 and 2011 only. Values related to this dust event are shown in bold (red circles in Figure 32).

Date	Hourly PM_{10} (µg/m^3)	Date	Hourly PM_{10} (µg/m^3)	Date	Hourly PM_{10} (µg/m^3)
1/19/2011	101	**2/15/2011**	**141**	**2/16/2011**	**260**
2/14/2011	**285**	**2/15/2011**	**117**	**2/16/2011**	**202**
2/14/2011	**181**	**2/15/2011**	**103**	**2/16/2011**	**169**
2/14/2011	**151**	**2/15/2011**	**103**	11/1/2011	139
2/15/2011	**282**	**2/15/2011**	**101**	11/3/2011	116
2/15/2011	**231**	**2/16/2011**	**532**	12/2/2011	339
2/15/2011	**179**	**2/16/2011**	**328**	12/2/2011	147
2/15/2011	**162**	**2/16/2011**	**264**	12/21/2011	282
—	—	—	—	12/21/2011	228

Notes: Particulate matter 10 micrometers or smaller (PM_{10}); micrograms per cubic meter (µg/m^3).

Difference in Composition from Typical Boise-Nampa Aerosol—The NCORE speciation sample captured on February 14 includes approximately 5 hours of elevated dust impacts attributed to the BRP and CSP wind erosion source, while the remainder of the day exhibits somewhat normal PM_{10} and $PM_{2.5}$ concentrations, based on the time series chart presented in

Figure 4. DEQ transformed the NCORE speciation into the routine classifications of fine particulate matter (< 2.5 µm): elemental carbon (EC), organic carbon (OC), ammonium sulfate ($(NH_4)_2SO_4$), ammonium nitrate (NH_4NO_3), and geologic (GEO) as shown in Table 4. The fine particulate matter in western cities is usually classified into these five categories and their sum should approximate the total $PM_{2.5}$ mass.

In addition to the February 14 composition, Table 4 shows that the average composition of the Boise-Nampa airshed averaged over 2009–2011, which is typically dominated by organic matter and ammonium nitrate, a secondary aerosol pollutant formed from photochemical reactions of nitrogen oxides to form nitrates and combine with ammonia. The winter speciation is similar to the annual speciation, with the exception that the ammonium nitrate is much higher and the geologic component is generally lower. On February 14, the ammonium nitrate and organic matter were lower than usual, and the geologic portion of the $PM_{2.5}$ was much higher, comprising 37.7% of the mass, 10 times higher than the normal geologic composition in winter (3.7%). Most of the geologic particulate mass probably arrived mostly during 5 hours on the evening of February 14 when the PM_{10} peaked, while the remainder of the hours on that day apparently contributed organic matter and smaller amounts of other species reflective of near normal wintertime speciation.

Table 4. Comparison of February 14 St. Luke's monitoring site $PM_{2.5}$ composition with the annual average and winter season historical compositions, 2009–2011.

February 14, 2011, 24-hour Speciation Sample						
Species	OM	EC	$(NH_4)_2SO_4$	NH_4NO_3	GEO	$PM_{2.5}$
Concentration (µg/m^3)	1.4	0.2	0.3	0.3	2.3	6.1
%	22.7%	4.0%	5.2%	5.7%	37.7%	
3-year Annual Average Speciation, 2009–2011						
Species	OM	EC	$(NH_4)_2SO_4$	NH_4NO_3	GEO	$PM_{2.5}$
Concentration (µg/m^3)	2.8	0.4	0.7	1.4	0.7	7.1
%	41.2%	5.4%	10.1%	20.7%	10.5%	—
3-year Winter Average Speciation, 2009–2011						
Species	OM	EC	$(NH_4)_2SO_4$	NH_4NO_3	GEO	$PM_{2.5}$
Concentration (µg/m^3)	3.8	0.5	1.1	3.4	0.3	9.4
%	41.3%	5.3%	12.3%	36.3%	3.7%	—

Notes: Organic carbon (OC); elemental carbon (EC); ammonium sulfate ($(NH_4)_2SO_4$); ammonium nitrate (NH_4NO_3); geologic (GEO); particulate matter 2.5 micrometers or smaller ($PM_{2.5}$); micrograms per cubic meter (µg/m^3)

4.7 Comparison of Event-Affected Days to Specific Nonevent Days—Comparison of Area Concentrations and Wind Speeds in the Days Preceding and Following the Event

The high winds over the playas of northwestern Nevada lasted from about noon on February 14 through the afternoon on February 15, 2011, and affected the Boise-Nampa area PM_{10} concentrations on February 14, 15, and 16. The elevated PM_{10} concentrations on these three days at the Boise FS and Nampa FS monitors are compared to the nonevent days before and after the event in Figure 33. This figure shows that the normal winter season PM_{10} concentrations are typically around 10–30 µg/m^3 even when the local winds are higher than those experienced on February 14 and 15 when the dust was transported to the area. The high wind speed on February 16 is not associated with the dust event that persisted through the early morning hours but occurred later on that day when the cold front moved through the valley after about 0800 MST effectively blowing the dust out of the valley. Finally, it appears obvious from Figure 33 that the elevated PM_{10} concentrations on February 14 and 16 were also part of the same multiday wind event that peaked on February 15 although they are not included in this exception request.

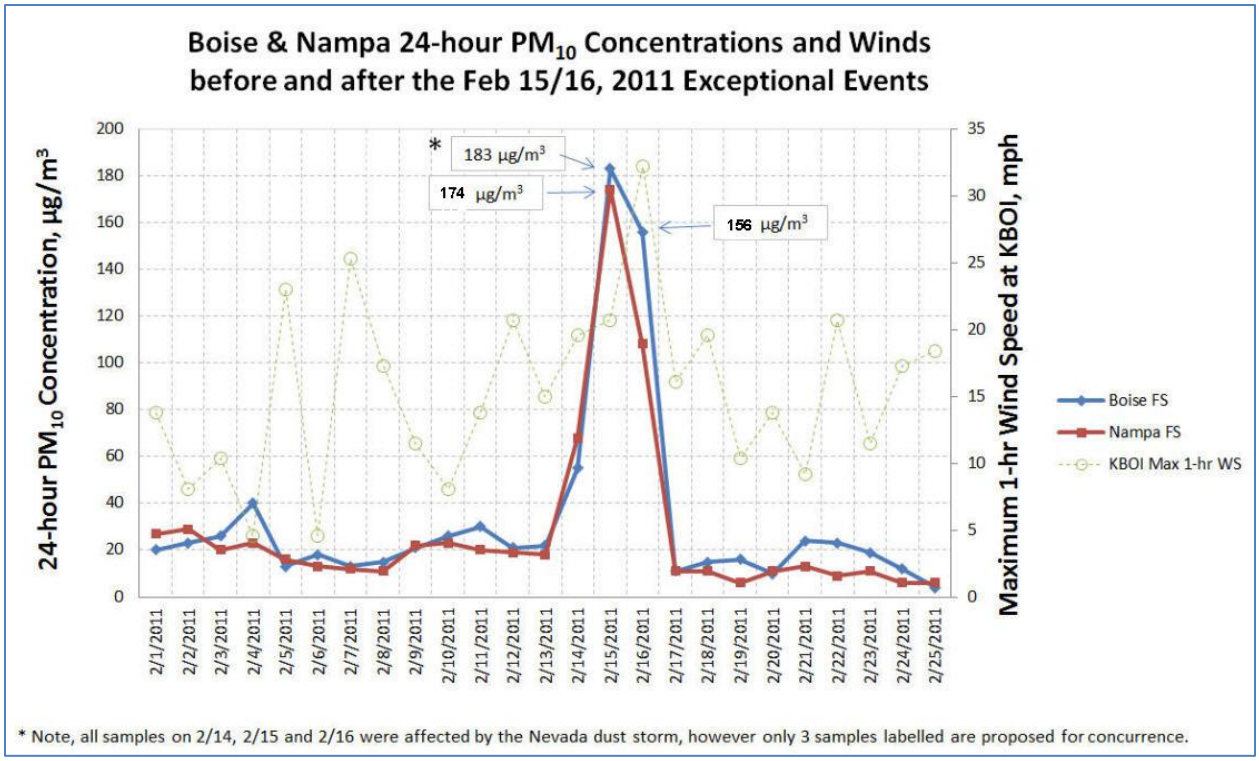


Figure 33. Event-affected days along with nonevent days before and after the February 14–16, 2011, event.

4.8 Alternative Hypotheses

The analysis presented in this report demonstrates that the elevated PM_{10} particulate matter impacting the Boise and Nampa FS monitors is composed of over 82% of coarse particulate (larger than 2.5 µm and smaller than 10 µm), predominately geologic in composition with some enrichment in evaporite mineral constituents calcium and sodium. Very little elemental carbon,

ammonium sulfate, and ammonium nitrate particulate is present as is common in many wintertime western urban airsheds, including the Boise-Nampa airshed (section 4.6). It is therefore clear that the normal urban sources such as residential wood combustion, vehicle exhaust, industrial combustion, and outdoor burning are not contributors to any significant extent, but rather, the source is geologic in nature. In addition, the lack of significant elemental carbon, along with the timing in the winter season indicate that neither wildfires nor agricultural fires contributed to the PM_{10} levels during this event.

Potential geologic particulate sources include road dust, construction dust, industrial emissions, agricultural dust, and wind erosion from nonagricultural lands, either those surrounding the Boise-Nampa area, or regional sources located outside the Treasure Valley of Idaho. All these potential sources are inherently included in the statistics for the previous 10 years provided in Section 3, "In Excess of Historical Fluctuations" and Section 7, "No Exceedance But For This Event," and therefore are already excluded as probable sources since, historically, they rarely produced concentrations as high as those recorded on February 15 and 16. Nevertheless, DEQ considered each of these sources as a potential source category for coarse geologic dust and discusses each below.

- **Road Dust**—Road dust emissions vary with the quantity of fine particles or *silt* on the roadway and the amount of vehicle traffic. The quantity of silt varies with season and is typically higher in the winter due to antiskid road sanding operations. However, road sanding agreements and cleanup documented in the *Northern Ada County PM_{10} State Implementation Plan* (SIP) (DEQ 2004) provide reasonable control of silt loadings resulting from winter antiskid treatment. In addition, the period from January 1 through February 15, 2011, just prior to this event, had the second lowest snowfall of any January 1–February 15 period in the previous 10 years, so road-sanding-related silt on the road should have been lower than most of the years included in the PM_{10} statistics described in section 3.1.
- **Construction Dust**—No major new construction projects were in progress in the vicinity of either the Boise FS or Nampa FS monitors in February 2011. February is also generally too early in the spring for any significant new construction elsewhere in the valley. Finally, it is unlikely that a location-specific source category such as construction would affect both sites similarly, not to mention the Idaho City and Garden Valley sites in the mountains to the north.
- **Industrial Emissions**—Idaho's New Source Review Permitting Program limits industrial emissions. Air quality permits for 13 significant sources of dust were revised to limit allowable PM_{10} emissions in the 2004 Northern Ada County PM_{10} SIP (DEQ 2004). Thus, a decline in allowed industrial particulate emissions has occurred over the last 10 years, and no sudden increase in industrial emissions appears to have occurred that is large enough to reach the dust levels observed during this event.
- **Agricultural Activity**—Agricultural areas surround the city of Nampa and are not too far from the city of Boise and are a potential source of fugitive dust from tilling and harvesting or from wind erosion from bare fields that have been recently disturbed. Harvesting in the Treasure Valley occurs in the fall with the last harvest date for any major Idaho crop ending by November 10, while the earliest planting date for any major Idaho crop is March 21 (USDA 2010). Thus, soil-disturbing agricultural activities are at a minimum level in the winter, and 3 months of wintertime weather should serve to

minimize the freshly disturbed surface amenable to wind erosion. Finally, wind speeds at the Boise airport did not exceed 21 mph on February 15, so significant wind erosion from agricultural land is not likely to have contributed noticeably to the PM_{10} concentrations during this event.

- **Nonagricultural Lands**—The winds in the Boise area during this event did not exceed 21 mph, with gusts no greater than 25 mph, much lower than other wind storms over the last 10 years that never produced PM_{10} concentrations approaching the standard, so it is very unlikely that natural, nonagricultural lands such as desert and rangeland in Idaho contributed significantly to the dust events of February 14–16, 2011.

Alternative source categories such as those described above are generally already characterized in the normal PM_{10} historical fluctuations (section 3) over the past 10 years, and no significant variation in any of these source categories is known that could cause an extreme PM_{10} episode of the magnitude and geographic extent observed February 14–16, 2011.

5 Affects Air Quality (AAQ)

The EER requires agencies to document that the identified source of an exceptional event truly affected air quality at the location of the monitor in question. However, EPA's interim high wind guidance (EPA 2013) indicates that if *historical fluctuations* (HF) and a *clear causal relationship* (CCR) have been adequately demonstrated, then the *affects air quality* (AAQ) element will have been met.

The PM_{10} concentrations reached at the Boise FS on February 15 and 16, 2011, exceed any reached in the previous 10 years, far exceeding all normal historical fluctuations (section 3). Similarly, the February 15 PM_{10} concentration at the Nampa FS monitor exceeded all but one value in the previous 10 years demonstrating both sites exceeded normal historical fluctuations. In addition, a clear causal relationship has been demonstrated through back-trajectories, satellite images, and composition, linking dry lake beds in Nevada to these events (section 4). Therefore the high wind events originating at the BRP and/or CSP in Nevada clearly affected air quality at the Boise FS and Nampa FS monitoring sites on February 15 and 16, and DEQ has satisfied the affects air quality criterion.

6 Natural Event or Human Activity Unlikely to Recur at the Same Location (NE/HAURL)

The EER requires agencies to document that the identified source of an exceptional event is either a *natural event* (NE) or a *human activity unlikely to recur at the same location* (HAURL) and affects the monitors in question again. However, EPA's interim high wind guidance (EPA 2013) indicates that if an agency has adequately demonstrated that the source is a natural event or, if not natural, is not reasonably controllable or preventable and that there is a clear causal relationship between the identified source and the affected monitor, then the natural event/human activity unlikely to recur at the same location criterion is also satisfied.

DEQ demonstrated in section 4 that there is a clear causal relationship between the BRP and CSP source areas in Nevada and the extremely high PM_{10} levels at the Boise FS and Nampa FS monitors on February 15 and 16, 2011. DEQ showed in section 2 that these Pleistocene-era dry lakebeds are not only natural sources, with a natural dust generation mechanism minimally influenced by human activity, but also that even if human activity was considered significant enough to term the playa emissions in some small part not *natural*, Idaho has no control over any human activity occurring on federal lands in another state, and therefore from an Idaho perspective, the source would remain not reasonably controllable or preventable.

7 No Exceedance *But For* this Event (NEBF)

The EER 40 CFR 50.14(b)(1) directs EPA to exclude data only where an agency demonstrates an *exceptional event* caused a concentration in excess of a NAAQS. It must be shown that the concentrations at the monitor would have been below the standard if the event had not occurred (i.e., *but for* the event).

EPA guidance (EPA 2013) suggests that if nonevent pollution levels are typically significantly below the NAAQS during the season of the event, then a qualitative no exceedance *but for* (NEBF) may be adequate. The very low 95th and 99th percentile values in Table 5 demonstrate that this is the case. The discussion of particle size in section 4.6 demonstrating that fire and secondary aerosol cannot be responsible, and the discussion of alternative local dust sources in section 4.8 demonstrate qualitatively that no other local sources could cause PM_{10} concentrations as high as those recorded during this event. A quantitative no exceedance but for analysis is provided below in addition to the qualitative discussion.

Quantitative No Exceedance *But For* Analysis—The clear causal relationship with the Nevada playas has already been established in section 4. Table 5 shows the PM_{10} concentrations at the Boise FS and Nampa FS monitoring sites representing the average, 95th and 99th percentile concentration values for historical annual and winter season monitoring data, 2002–2011. While the most probable upper end of the range of concentrations expected at Boise FS and Nampa FS monitors may be represented by the average and 95th percentile values (EPA 2013), DEQ will assume that the normal background fluctuations could have been as high as the 99th percentile historical value, to be conservative.

The statistics shown in Table 5 indicate that the normal year-round concentrations at the Boise FS, *but for* the BRP and CSP playa dust on February 15 and 16, 2011, would have been at or below the range 23–45 $\mu g/m^3$ and 99% of the time it would have been 66 $\mu g/m^3$ or less. The Boise FS concentrations on February 15 and 16 were 183 $\mu g/m^3$ and 156 $\mu g/m^3$, respectively, so it is clear that the playa dust contributed at least 117 $\mu g/m^3$ on February 15 (183 − 66 = 117) and 90 $\mu g/m^3$ on February 16 (156 − 66 = 90). Thus, the event contributed more than half the PM_{10} on these two days, and it is clear that the NAAQS (150 $\mu g/m^3$) would not have been exceeded *but for* the regional transport event from the playas as described in this document.

At the Nampa FS, the normal concentrations, *but for* the BRP and CSP playa dust would have been in the range 24–56 $\mu g/m^3$, and 99% of the time, it would have been less than 78 $\mu g/m^3$ based on the annual values in Table 5. Again, it is clear, that at the Nampa FS, over half the PM_{10} concentration of 174 $\mu g/m^3$ measured on February 15 resulted from the regional playa dust event

and that at least 96 µg/m^3 (174 − 78 = 96) or 55% of the February 15 concentration may be attributed to the playa dust. Therefore, the NAAQS would not have been exceeded on that day *but for* the regional transport event from the playas.

The seasonal statistics shown in the bottom of Table 5 are very similar to the annual percentiles, indicating again no significant seasonal variation and no substantial difference in the *but for* demonstration.

Table 5. Average, 95th and 99th percentile of PM_{10} concentrations (µg/m^3) in Boise and Nampa, 2002–2011, in comparison to recorded values during this event. Statistics are shown for all data (top) and winter season (bottom).

Site	Annual Average	Annual 95th Percentile	Annual 99th Percentile	Recorded Values	
				Feb. 15	Feb. 16
Boise	23	45	66	183	156
Nampa	24	56	78	174	
Site	**Seasonal Average**	**Seasonal 95th Percentile**	**Seasonal 99th Percentile**	**Recorded Values**	
				Feb. 15	**Feb. 16**
Boise	20	41	65	183	156
Nampa	19	40	80	174	—

8 Mitigation

The mitigation provisions of the EER (40 CFR 51.930) require that (EPA 2013):

> (a) A State requesting to exclude air quality data due to exceptional events must take appropriate and reasonable actions to protect public health from exceedances or violations of the national ambient air quality standards. At a minimum, the State must:
>
> (1) Provide for prompt public notification whenever air quality concentrations exceed or are expected to exceed an applicable ambient air quality standard;
> (2) Provide for public education concerning actions that individuals may take to reduce exposures to unhealthy levels of air quality during and following an exceptional event; and
> (3) Provide for the implementation of appropriate measures to protect public health from exceedances or violations of ambient air quality standards caused by exceptional events.

The dust event of February 15 and 16, 2011, arrived mostly in the evening, without the warning signs that usually accompany high winds such as thunderstorms or very windy conditions. Nevertheless, DEQ's Boise Regional Office issued air quality alerts at 1023 MST on February 15 and again at 0909 MST on February 16, alerting the public to the high particulate levels and providing public advisory information concerning actions that individuals may take to reduce exposures to unhealthy levels of particulate dust in the air. Given the sudden nature of the event, and the prompt dispersal of the dust on the morning of February 16, there was no time nor need for additional advisories or educational material. DEQ's public advisory messages and associated public health educational material are provided in Appendix E. News stories based on DEQ advisories that also contributed to informing the public are provided in Appendix F.

In conclusion, the DEQ public notification process successfully alerted the public during this event and in view of the very low frequency of occurrence in the prior 10 years, DEQ believes

that additional public notification measures are not necessary and source mitigation is not feasible.

9 Procedural Requirements

The EER establishes specific procedural requirements that an air agency must follow to request data exclusion (EPA 2013). Those requirements and DEQ's actions to meet them are summarized in Table 6.

Table 6. DEQ compliance with procedural requirements of the exceptional events rule.

Exceptional Event Rule Procedural Requirements	DEQ Action/Intended Action
A State shall notify EPA of its intent to exclude one or more measured exceedances of an applicable ambient air quality standard as being due to an exceptional event by placing a flag in the appropriate field for the data record of concern which has been submitted to the AQS database... 40 CFR 50.14(c)(2)(i)	DEQ placed flags on the three samples described in this report in prior to July 2012.
The placement of the flags and the submittal of an initial event description must be done *not later than July 1st of the calendar year following the year in which the flagged measurement occurred.* 40 CFR 50.14(c)(2)(iii)	DEQ placed flags on the three samples described in this report in prior to July 2012.
A State that has flagged data as being due to an exceptional event and is requesting exclusion of the affected measurement data shall, after notice and opportunity for public comment, submit a demonstration to justify data exclusion to EPA not later than the lesser of, 3 years following the end of the calendar quarter in which the flagged concentration was recorded or, 12 months prior to the date that a regulatory decision must be made by EPA. A State must submit the public comments it received along with its demonstration to EPA. 40 CFR (50.14(c)(3)(i))	DEQ is submitting this package for public comment and intends to subsequently submit it to EPA by December 2013, less than 3 years following the first quarter of 2011, when the event occurred.
With the submission of the demonstration, the air agency *must document that the public comment process was followed*. 40 CFR (50.14(c)(3)(iv))	DEQ is presenting this demonstration for public comment in July 2013.

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Appendix A. EPA Completion Checklist

Completeness Checklist for High Wind Dust Exceptional Events Demonstration:
Site Name/AQS ID: Boise FS 16-001-0009 POC3 and Nampa FS: 10-027-0002 POC2
Pollutant: PM10
Date(s): Boise FS: February 15 and 16, 2011. Nampa FS: February 15, 2011

Table A-1. EPA completion checklist.

Procedural Criteria			EPA Use
Did an exceedance of the NAAQS occur?		Yes	
Were data flagged by July 1st of following year (or by another appropriate deadline associated with a new or revised NAAQS)?		Yes	
Was there a 30-day public comment period? Is documentation for the comment period included?		Aug 2013 Will be	
If public comments were received, are the public comments and responses included?		Will be	
Was the package submitted within 3 years of the end of the quarter in which the event occurred and 12 months prior to the date that any regulatory decision must be made by the EPA (or by another appropriate deadline associated with a new or revised NAAQS)?		Will be	
Evidence	**Information Included**	**Page(s)**	
Conceptual Model		p. 1-8	
-description of weather phenomena resulting in high wind	Yes	p. 5 p. 23-30	
-description of what sources were likely entrained by the high wind	Yes	p. 1, 3, 4	
-explanation of the path by which the dust reached the monitor(s)	Yes	p. 5, 31-34	
-map showing relevant monitors, topography, other relevant geographic features	Yes	p. 2	
-description of how the event day differs from non-event days	Yes	p. 38-40	
-description of concentration and wind patterns for the exceeding monitor(s) and surrounding area	Yes	p. 5 - 8	
Wind Statistics			
-max sustained wind (Hourly avg)	35 mph in Nevada	p. 7, 8 & App. B	
- max sustained wind (1-5 min avg)	48 mph in Nevada	p. 7, 8 & App. B	
-max gust (1 min avg)	49 mph in Nevada	p. 7, 8 & App. B	
-wind trajectories included?	Yes	p. 32 - 33	

-other:	Modeled Friction Velocities	p. 26, 27	
nRCP			
-Area-specific high wind threshold (default = 25mph)	15 - 22 mph for flat playas	p. 3, 4	
-sources contributing to event identified, including anthropogenic vs. natural?	Yes - Natural	p. 1, 10, 11	
-controls identified for anthropogenic sources? (note: level of control analysis depends on wind speed)	Not applicable – no anthropogenic sources	N/A	
-are natural sources not reasonably controllable?	Yes	p. 10, 11	
-was a High Wind Action Plan included?	No – Not applicable	N/A	
HF			
-were time-series analyses for concentration and wind data included?	Yes	p. 7, 8	
-annual comparison to historical data (wind and concentrations)	> 99%ile for all 3 concentration values. 83%tile for Boise wind	p. 15, 16	
-seasonal comparison to historical data (wind and concentrations)	> 99%ile for all 3 concentration values. Local wind no relevant	p. 15, 16	
CCR (=> AAQ & / Natural Event)			
-were spatial analyses included, establishing a spatial relationship between the event, sources, transport of emissions, and recorded concentrations?	Yes: a)Satellite Images and b)Hysplit Back-trajectories	a)Fig 6, b)p. 31-33	
-were temporal analyses included, establishing a temporal relationship between the high wind and elevated PM concentrations at the monitor?	Yes	p. 5-8 p. 31	
-comparison of event-affected day(s) to specific non-event days?	Yes	p. 38, 39, 40	
-was the dust shown to be from the sources discussed in the nRCP section?	Yes	Sec 4 CCR p. 16-41	
-were alternative hypotheses discussed?	Yes	p. 40-42	
-was a causal (not just correlational) relationship established?	Yes	Sec 4 CCR p. 16-41	
NEBF			
-was a “but for” analysis included?	Yes	p. 43-44	

Appendix B. Supporting Meteorological Data

Table B-1. Identification of MESOWEST stations used in this report (Horel et al. 2002).

Station ID	Station Name	Mesonet ID	Latitude	Longitude	Elevation, ft
BUFN2	BUFFALO CREEK	RAWS	40.5806	-119.7888	3940
BLUN2	BLUEWING MOUNTAIN	RAWS	40.5015	-119.1216	4570
TR730	DOUBLE H	RAWS	41.6525	-118.0442	6380
JVCI1	JORDAN VALLEY CWMA	SCAN	42.9500	-117.0100	4508
GSFO3	GRASSY MOUNTAIN	RAWS	42.6261	-117.3951	4560
TEXN2	TEXAS SPRINGS	RAWS	41.8009	-118.4514	5760
KBOI	BOISE AIR TERMINAL	NWS/FAA	43.5670	-116.2405	2822
KLOL	LOVELOCK, DERBY FIELD AIRPT	NWS/FAA	40.0684	-118.5702	3901
KNFL	FALLON, NAVAL AIR STATION	NWS/FAA	39.43222	-118.686	3934
KWMC	WINNEMUCCA MUNICIPAL AIRPT	NWS/FAA	40.9019	-117.8072	4301

All meteorological data were obtained from MESOWEST at *http://mesowest.utah.edu/*

This study was made possible in part due to the data made available by the governmental agencies, commercial firms, and educational institutions participating in MesoWest.

Data quality control information for individual networks and additional overall quality control checks implemented by MESOWEST is identified below.

Quality control for NWS/FAA stations:

Federal Meteorological Handbook No. 1 - Surface Weather Observations and Reports September 2005: *http://www.ofcm.gov/fmh-1/fmh1.htm*

Quality control for USDA RAWS stations:
http://raws.fam.nwcg.gov/nfdrs/WeatherStationStandards.pdf

SCAN, Soil Climate Analysis Network, Natural Resources Conservation Service, USDA:
http://www.wcc.nrcs.usda.gov/scan/

MESOWEST Quality Control: *http://mesowest.utah.edu/html/help/qc.html*

Table B-2. Source region weather station data from Mesowest (Horel et al. 2002).

Date/ Time, MST	BLUN2 WS mph	BLUN2 GUST mph	BLUN2 DRCT °	BUFN2 WS mph	BUFN2 GUST mph	BUFN2 DRCT °	TR730 WS mph	TR730 GUST mph	TR730 DRCT °	KLOL WS mph	KLOL GUST mph	KLOL DRCT °
2/14 02:00	4	6	302	10	16	221	20	24	185	4.6		180
2/14 03:00	1	5	118	8	17	202	24	30	193	5.8		110
2/14 04:00	0	8	244	5	13	244	22	32	191	4.6		340
2/14 05:00	3	7	281	3	8	290	24	32	197	3.5		120
2/14 06:00	0	6	305	8	19	215	20	32	194	0		
2/14 07:00	0	5	325	16	30	211	16	25	200	0		
2/14 08:00	2	8	170	12	29	217	20	26	197	0		
2/14 09:00	0	6	33	6	17	277	19	27	201	0		
2/14 10:00	3	7	132	16	26	213	16	25	220	8.1		190
2/14 11:00	7	16	195	8	22	204	12	22	221	12.7		230
2/14 12:00	23	35	197	8	21	210	11	18	214	26.5	32.2	220
2/14 13:00	18	34	200	20	35	225	18	23	215	25.3	38	250
2/14 14:00	19	32	222	22	41	232	21	38	227	24.2	36.8	250
2/14 15:00	21	34	233	22	44	230	22	30	226	13.8	21.9	240
2/14 16:00	22	39	250	21	36	218	25	37	224	16.1		250
2/14 17:00	19	30	234	18	31	229	26	45	229	25.3	32.2	250
2/14 18:00	13	31	238	22	29	238	20	33	225	21.9	31.1	260
2/14 19:00	8	20	243	20	34	230	18	27	219	10.4		260
2/14 20:00	7	17	239	12	33	232	20	32	207	4.6		
2/14 21:00	6	11	195	7	17	249	27	38	208	12.7		270
2/14 22:00	8	14	229	5	10	259	20	34	229	6.9		190
2/14 23:00	8	15	203	3	9	273	20	31	221	4.6		140
2/14 24:00	4	14	128	5	9	359	21	31	213	0		
2/15 01:00	5	18	184	7	15	213	21	41	209	4.6		
2/15 02:00	13	26	217	5	11	263	22	30	199	4.6		70
2/15 03:00	18	33	216	7	18	191	24	33	197	4.6		330
2/15 04:00	27	38	214	2	18	310	29	39	203	8.1		200
2/15 05:00	27	44	212	5	12	45	32	44	201	0		
2/15 06:00	21	32	211	3	9	206	29	43	200	5.8		300
2/15 07:00	18	33	205	3	12	300	23	42	195	3.5		
2/15 08:00	9	31	164	2	6	169	26	34	197	4.6		210
2/15 09:00	11	21	172	4	8	355	31	38	201	3.5		240
2/15 10:00	16	23	183	4	10	184	32	42	200	8.1		250
2/15 11:00	24	34	198	15	28	216	28	41	206	11.5		230
2/15 12:00	23	36	212	16	29	199	28	39	200	10.4		250
2/15 13:00	23	37	199	22	34	220	35	46	203	19.6	26.5	190
2/15 14:00	23	33	204	22	40	222	33	45	211	16.1	24.2	220
2/15 15:00	28	45	216	20	34	212	33	46	225	19.6	27.6	240
2/15 16:00	25	43	210	19	33	215	33	48	223	31.1	36.8	260
2/15 17:00	23	40	214	18	34	215	24	40	233	23	32.2	240
2/15 18:00	25	38	218	12	32	222	22	32	228	25.3	32.2	230
2/15 19:00	17	31	213	18	30	213	18	30	220	24.2	38	230
2/15 20:00	23	37	211	10	26	217	14	23	222	15		240
2/15 21:00	12	35	191	10	32	220	20	30	221	21.9		230
2/15 22:00	12	29	189	8	26	236	16	25	213	18.4	27.6	240
2/15 23:00	11	29	175	5	29	133	19	29	211	9.2		240
2/15 24:00	19	32	189	10	20	155	18	24	205	0		
2/16 01:00	6	23	217	6	23	165	18	26	188	0		
2/16 02:00	4	18	137	4	17	156	14	21	168	5.8		
2/16 03:00	13	23	204	12	31	208	28	36	196	3.5		150
2/16 04:00	20	35	211	12	21	216	28	40	194	18.4		240

Date/ Time, MST	BLUN2 WS mph	BLUN2 GUST mph	BLUN2 DRCT °	BUFN2 WS mph	BUFN2 GUST mph	BUFN2 DRCT °	TR730 WS mph	TR730 GUST mph	TR730 DRCT °	KLOL WS mph	KLOL GUST mph	KLOL DRCT °
2/16 05:00	24	40	218	8	24	201	30	40	194	23	36.8	240
2/16 06:00	20	33	207	12	21	204	33	49	205	13.8		230
2/16 07:00	16	37	210	17	25	241	29	49	203	16.1		240
2/16 08:00	22	35	240	12	35	263	32	43	196	20.7		260
2/16 09:00	10	37	242	17	33	268	30	41	229	10.4		270
2/16 10:00	17	29	259	13	29	266	17	43	256	13.8	21.9	290
2/16 11:00										19.6		260
2/16 12:00	21	36	238	7	22	240	12	21	223	23	29.9	270
2/16 13:00	18	32	228	15	23	235	21	27	227	32.2	36.8	270
2/16 14:00	16	27	233	14	23	235	28	37	227	20.7	31.1	260
2/16 15:00	14	26	217	13	32	239	29	39	228	24.2	33.4	280
2/16 16:00	19	28	229	16	28	240	21	43	257	19.6	32.2	260
2/16 17:00	15	30	217	15	26	232	26	37	226	17.3	25.3	250
2/16 18:00	13	29	216	7	29	48	15	30	251	23	29.9	260
2/16 19:00	15	29	212	7	17	170				15		260
2/16 20:00	13	27	212	10	17	203	23	42	222	15		300
2/16 21:00	11	22	210	1	12	192	19	31	214	5.8		200
2/16 22:00	10	21	216	8	14	193	22	34	222	5.8		210
2/16 23:00	2	12	235	2	10	237	27	37	226	8.1		200
2/16 24:00	0	5	160	3	6	352	23	38	226	9.2		210
2/16 01:00	3	11	151	3	5	23	14	26	224	8.1		220

Table B-3.Intermediate (Oregon) and affected area weather stations from MESOWEST (Horel et al. 2002).

Date/ Hour MST	GSFO3 WS mph	GSFO3 GUST mph	GSFO3 DRCT °	JVCI1 WS mph	JVCI1 GUST mph	JVCI1 DRCT °	KBOI WS mph	KBOI GUST mph	KBOI DRCT °
2/14 02:00	16	20	128	6.3	12.3	148	12.7		170
2/14 03:00	15	23	133	4.9	9.7	158	13.8		160
2/14 04:00	15	20	129	2.7	9.2	166	10.4		170
2/14 05:00	17	24	124	1.4	3.8	11	18.4		150
2/14 06:00	16	23	124	2	5.5	341	16.1		150
2/14 07:00	10	20	134	1.4	4.7	58	15		160
2/14 08:00	12	17	137	2.8	7	99	13.8		160
2/14 09:00	13	19	147	5.4	11.3	147	4.6		100
2/14 10:00	12	19	154	7.3	9.6	142	11.5		160
2/14 11:00	13	19	180	4.9	8.1	144	3.5		110
2/14 12:00	6	19	218	7	18.6	162	11.5		150
2/14 13:00	10	22	207	12.7	18.4	178	16.1	21.9	140
2/14 14:00	17	27	206	12.4	18.8	183	19.6	23	130
2/14 15:00	27	38	215	17.7	27.7	201	18.4		150
2/14 16:00	22	36	209	18.2	28.9	213	12.7		140
2/14 17:00	19	33	219	16.9	26.2	220	10.4		140
2/14 18:00	18	29	216	13.6	20.4	203	10.4		140
2/14 19:00	13	21	191	12.2	19	195	12.7		130
2/14 20:00	11	18	193	13	22.1	195	11.5		140
2/14 21:00	12	17	185	9.7	17.9	175	10.4		140
2/14 22:00	10	15	199	8.5	13.7	159	13.8		130
2/14 23:00	16	25	192	8.7	14	168	12.7		140
2/14 24:00	26	38	208	8.4	13	163	9.2		130
2/15 01:00	14	34	183	11.2	16.2	161	15		130
2/15 02:00	14	24	154	8.1	13.8	156	11.5		120
2/15 03:00	10	21	134	7.5	11.4	154	16.1		140
2/15 04:00	10	19	157	7.7	11.8	155	12.7		120
2/15 05:00	8	16	198	10.9	16.6	167	15		130
2/15 06:00	0	14	243	5.5	13.7	147	13.8	24.2	120
2/15 07:00	10	19	149	6.9	10	147	15		130
2/15 08:00	11	19	154	5.5	9.7	150	12.7		120
2/15 09:00	13	20	171	8.2	11.5	160	12.7		120
2/15 10:00	14	24	193	7.6	12.2	162	20.7		140
2/15 11:00	23	32	207	9.4	20.8	181	16.1	25.3	150
2/15 12:00	25	38	209	14.6	24.6	193	16.1		140
2/15 13:00	27	41	217	17.1	26.2	199	17.3	23	160
2/15 14:00	28	46	222	18.3	26.5	199	13.8	24.2	140
2/15 15:00	28	48	220	16.8	25	204	12.7		190
2/15 16:00	28	43	217	11.6	20.8	201	13.8		180
2/15 17:00	26	41	210	14.8	24.5	218	18.4		200
2/15 18:00	20	34	219	16.3	27.9	211	12.7		200
2/15 19:00	17	33	219	13.8	23.4	214	4.6		170
2/15 20:00	15	28	218	8.3	14.7	189	5.8		140
2/15 21:00	15	28	193	5.5	8.8	170	0		
2/15 22:00	12	23	201	7.1	11.9	171	8.1		160
2/15 23:00	10	17	198	9.5	14.2	166	11.5		150
2/15 24:00	9	17	147	9.5	14	173	12.7		150
2/16 0100	12	25	149	8	13	169	10.4		160
2/16 0200	10	21	147	9.7	14.8	174	15.0		140
2/16 0300	8	18	156	6.2	10.2	161	9.2		130

Date/ Hour MST	GSFO3 WS mph	GSFO3 GUST mph	GSFO3 DRCT °	JVCI1 WS mph	JVCI1 GUST mph	JVCI1 DRCT °	KBOI WS mph	KBOI GUST mph	KBOI DRCT °
2/16 04:00	11	18	151	6.2	9.9	166	10.4		130
2/16 05:00	16	23	206	6.2	13	174	11.5		140
2/16 06:00	14	25	206	8.7	17	181	18.4		140
2/16 07:00	14	26	202	6.7	15.7	173	5.8		170
2/16 08:00	17	30	204	8.9	15.7	176	10.4		270
2/16 09:00	20	27	196	12.5	20.9	188	6.9		40
2/16 10:00	26	37	243	11.9	18.5	179	13.8		280
2/16 11:00				13.3	30.7	205	15.6	23	295
2/16 12:00				7.7	18	321	9.0		303
2/16 13:00	6	14	181	3.5	7.8	250	2.6		355
2/16 14:00	13	21	235	3.3	6.6	163	3.5		200
2/16 15:00	19	27	238	3.1	9	179	4.6		100
2/16 16:00	25	46	258	10.8	22	213	6.9		120
2/16 17:00	17	37	278	15.5	29.1	282	14.7	32.2	258
2/16 18:00	18	29	273	9.1	17.2	282	8.1		70
2/16 19:00	8	26	277	7.3	12.1	286	3.5		90
2/16 20:00	4	12	267	3.4	10.2	316	5.8		120
2/16 21:00	3	11	175	1.6	3.8	82	8.1		60
2/16 22:00	16	24	181	2.8	6.7	147	5.8		110
2/16 23:00	18	28	251	5.7	17.9	153	5.8		120
2/16 24:00	3	20	229	8.6	25.9	175	4.6		170

Table B-4. Weather observations at Lovelock, Boise, and Winnemucca from Mesowest (Horel et al. 2002).

Lovelock Nevada, KLOL		Boise, ID KBOI		Winnemucca, NV KWMC	
Date/Time of Obs	Weather Obs	Date/Time of Obs	Weather Obs	Date/Time of Obs	Weather Obs
2-14-2011 0:53 PST	clear	2-14-2011 0:53 MST	clear	2-14-2011 0:56 PST	clear
2-14-2011 1:53 PST	clear	2-14-2011 1:53 MST	clear	2-14-2011 1:56 PST	clear
2-14-2011 2:53 PST	clear	2-14-2011 2:53 MST	clear	2-14-2011 2:56 PST	clear
2-14-2011 3:53 PST	clear	2-14-2011 3:53 MST	clear	2-14-2011 3:56 PST	clear
2-14-2011 4:53 PST	clear	2-14-2011 4:53 MST	clear	2-14-2011 4:56 PST	clear
2-14-2011 5:53 PST	clear	2-14-2011 5:53 MST	clear	2-14-2011 5:56 PST	clear
2-14-2011 6:53 PST	clear	2-14-2011 6:53 MST	clear	2-14-2011 6:56 PST	clear
2-14-2011 7:53 PST	clear	2-14-2011 7:53 MST	clear	2-14-2011 7:56 PST	clear
2-14-2011 8:53 PST	mostly clear	2-14-2011 8:53 MST	clear	2-14-2011 8:56 PST	clear
2-14-2011 9:53 PST	haze	2-14-2011 9:53 MST	clear	2-14-2011 9:56 PST	overcast
2-14-2011 9:55 PST	haze	2-14-2011 10:53 MST	clear	2-14-2011 10:56 PST	partly cloudy
2-14-2011 10:03 PST	haze	2-14-2011 11:53 MST	clear	2-14-2011 11:56 PST	clear
2-14-2011 10:12 PST	haze	2-14-2011 12:53 MST	clear	2-14-2011 12:56 PST	partly cloudy
2-14-2011 10:24 PST	haze	2-14-2011 13:53 MST	clear	2-14-2011 13:32 PST	haze
2-14-2011 10:28 PST	haze	2-14-2011 14:53 MST	mostly clear	2-14-2011 13:41 PST	haze
2-14-2011 10:39 PST	haze	2-14-2011 15:53 MST	mostly cloudy	2-14-2011 13:50 PST	haze
2-14-2011 10:51 PST	haze	2-14-2011 16:53 MST	mostly cloudy	2-14-2011 13:56 PST	partly cloudy
2-14-2011 10:53 PST	haze	2-14-2011 17:53 MST	overcast	2-14-2011 14:56 PST	haze
2-14-2011 11:24 PST	lt rain	2-14-2011 18:53 MST	overcast	2-14-2011 15:45 PST	partly cloudy
2-14-2011 11:53 PST	lt rain	2-14-2011 19:53 MST	overcast	2-14-2011 15:56 PST	clear
2-14-2011 12:08 PST	lt rain	2-14-2011 20:53 MST	clear	2-14-2011 16:56 PST	haze
2-14-2011 12:26 PST	lt rain	2-14-2011 21:53 MST	mostly clear	2-14-2011 17:13 PST	haze
2-14-2011 12:33 PST	lt rain	2-14-2011 22:53 MST	mostly cloudy	2-14-2011 17:56 PST	partly cloudy
2-14-2011 12:53 PST	haze	2-14-2011 23:53 MST	clear	2-14-2011 18:56 PST	clear
2-14-2011 13:06 PST	haze	2-15-2011 0:53 MST	clear	2-14-2011 19:56 PST	clear
2-14-2011 13:13 PST	haze	2-15-2011 1:53 MST	clear	2-14-2011 20:56 PST	clear
2-14-2011 13:31 PST	haze	2-15-2011 2:53 MST	clear	2-14-2011 21:56 PST	clear
2-14-2011 13:53 PST	haze	2-15-2011 3:53 MST	clear	2-14-2011 22:56 PST	clear
2-14-2011 14:37 PST	haze	2-15-2011 4:53 MST	clear	2-14-2011 23:56 PST	clear
2-14-2011 14:49 PST	haze	2-15-2011 5:53 MST	clear	2-15-2011 0:56 PST	clear
2-14-2011 14:53 PST	haze	2-15-2011 6:53 MST	clear	2-15-2011 1:56 PST	clear
2-14-2011 15:29 PST	haze	2-15-2011 7:53 MST	haze	2-15-2011 2:56 PST	clear
2-14-2011 15:51 PST	haze	2-15-2011 8:53 MST	haze	2-15-2011 3:56 PST	clear
2-14-2011 15:53 PST	haze	2-15-2011 9:53 MST	haze	2-15-2011 4:56 PST	clear
2-14-2011 16:00 PST	haze	2-15-2011 10:53 MST	clear	2-15-2011 5:56 PST	clear
2-14-2011 16:13 PST	haze	2-15-2011 11:53 MST	clear	2-15-2011 6:56 PST	clear
2-14-2011 16:21 PST	haze	2-15-2011 12:53 MST	clear	2-15-2011 7:56 PST	clear
2-14-2011 16:43 PST	haze	2-15-2011 13:53 MST	partly cloudy	2-15-2011 8:56 PST	clear
2-14-2011 16:45 PST	haze	2-15-2011 14:53 MST	mostly clear	2-15-2011 9:56 PST	clear
2-14-2011 16:53 PST	haze	2-15-2011 15:53 MST	clear	2-15-2011 10:56 PST	clear
2-14-2011 17:01 PST	haze	2-15-2011 16:53 MST	mostly clear	2-15-2011 11:56 PST	clear
2-14-2011 17:03 PST	haze	2-15-2011 17:53 MST	mostly clear	2-15-2011 12:56 PST	clear
2-14-2011 17:53 PST	clear	2-15-2011 18:53 MST	mostly cloudy	2-15-2011 13:56 PST	clear
2-14-2011 18:53 PST	clear	2-15-2011 19:53 MST	clear	2-15-2011 14:56 PST	haze
2-14-2011 19:53 PST	clear	2-15-2011 20:53 MST	clear	2-15-2011 15:56 PST	clear
2-14-2011 20:53 PST	haze	2-15-2011 21:53 MST	haze	2-15-2011 16:32 PST	Haze

Lovelock Nevada, KLOL		Boise, ID KBOI		Winnemucca, NV KWMC	
Date/Time of Obs	**Weather Obs**	**Date/Time of Obs**	**Weather Obs**	**Date/Time of Obs**	**Weather Obs**
2-14-2011 21:53 PST	clear	2-15-2011 22:53 MST	clear	2-15-2011 16:41 PST	haze
2-14-2011 22:53 PST	clear	2-15-2011 23:53 MST	haze	2-15-2011 16:51 PST	haze
2-14-2011 23:53 PST	clear	2-16-2011 0:53 MST	haze	2-15-2011 16:56 PST	haze
2-15-2011 0:53 PST	clear	2-16-2011 1:53 MST	haze	2-15-2011 17:03 PST	haze
2-15-2011 1:53 PST	clear	2-16-2011 2:53 MST	haze	2-15-2011 17:15 PST	haze
2-15-2011 2:53 PST	clear	2-16-2011 3:53 MST	haze	2-15-2011 17:56 PST	haze
2-15-2011 3:53 PST	clear	2-16-2011 4:53 MST	haze	2-15-2011 18:15 PST	haze
2-15-2011 4:53 PST	clear	2-16-2011 5:53 MST	haze	2-15-2011 18:45 PST	haze
2-15-2011 5:53 PST	clear	2-16-2011 6:53 MST	haze	2-15-2011 18:56 PST	haze
2-15-2011 6:53 PST	clear	2-16-2011 7:53 MST	haze	2-15-2011 19:56 PST	clear
2-15-2011 7:53 PST	clear	2-16-2011 8:53 MST	mostly clear	2-15-2011 20:19 PST	haze
2-15-2011 8:53 PST	clear	2-16-2011 9:53 MST	clear	2-15-2011 20:34 PST	haze
2-15-2011 9:53 PST	clear	2-16-2011 10:42 MST	overcast	2-15-2011 20:56 PST	haze
2-15-2011 10:31 PST	haze	2-16-2011 10:53 MST	overcast	2-15-2011 21:56 PST	haze
2-15-2011 10:40 PST	haze	2-16-2011 11:16 MST	lt snow; fog	2-15-2011 22:56 PST	haze
2-15-2011 10:44 PST	mostly cloudy	2-16-2011 11:18 MST	lt snow; fog	2-15-2011 23:56 PST	clear
2-15-2011 10:46 PST	haze	2-16-2011 11:26 MST	lt snow; fog	2-16-2011 0:56 PST	mostly clear
2-15-2011 10:53 PST	haze	2-16-2011 11:40 MST	lt snow; fog	2-16-2011 1:56 PST	mostly clear
2-15-2011 11:09 PST	haze	2-16-2011 11:48 MST	lt snow; fog	2-16-2011 2:56 PST	mostly cloudy
2-15-2011 11:22 PST	haze	2-16-2011 11:53 MST	lt snow; fog	2-16-2011 3:56 PST	mostly cloudy
2-15-2011 11:31 PST	haze	2-16-2011 12:06 MST	lt snow; fog	2-16-2011 4:56 PST	overcast
2-15-2011 11:44 PST	haze	2-16-2011 12:14 MST	lt snow; fog	2-16-2011 5:56 PST	overcast
2-15-2011 11:53 PST	clear	2-16-2011 12:51 MST	mostly cloudy	2-16-2011 6:56 PST	lt rain
2-15-2011 12:12 PST	haze	2-16-2011 12:53 MST	partly cloudy	2-16-2011 7:58 PST	mod rain
2-15-2011 12:19 PST	haze	2-16-2011 13:53 MST	clear	2-16-2011 8:01 PST	lt snow; fog
2-15-2011 12:33 PST	haze	2-16-2011 14:53 MST	partly cloudy	2-16-2011 8:10 PST	mod snow; fog
2-15-2011 12:38 PST	haze	2-16-2011 15:53 MST	partly cloudy	2-16-2011 8:31 PST	lt snow; fog
2-15-2011 12:51 PST	haze	2-16-2011 16:03 MST	thunder	2-16-2011 8:36 PST	lt snow; fog
2-15-2011 12:53 PST	haze	2-16-2011 16:12 MST	lt snow shwr; squalls	2-16-2011 8:41 PST	lt snow; fog
2-15-2011 12:57 PST	haze	2-16-2011 16:20 MST	mod snow; fog	2-16-2011 8:56 PST	lt snow
2-15-2011 13:07 PST	partly cloudy	2-16-2011 16:25 MST	mostly cloudy	2-16-2011 9:56 PST	overcast
2-15-2011 13:24 PST	haze	2-16-2011 16:30 MST	mostly cloudy	2-16-2011 10:13 PST	lt snow; fog
2-15-2011 13:39 PST	haze	2-16-2011 16:31 MST	mostly cloudy	2-16-2011 10:23 PST	lt snow; fog
2-15-2011 13:53 PST	haze	2-16-2011 16:34 MST	mostly cloudy	2-16-2011 10:30 PST	lt snow; fog
2-15-2011 14:01 PST	haze	2-16-2011 16:40 MST	partly cloudy	2-16-2011 10:39 PST	lt snow; fog
2-15-2011 14:10 PST	haze	2-16-2011 16:42 MST	mostly cloudy	2-16-2011 10:47 PST	lt snow; fog
2-15-2011 14:41 PST	lt rain	2-16-2011 16:49 MST	mostly cloudy	2-16-2011 10:53 PST	lt snow; fog
2-15-2011 14:53 PST	lt rain	2-16-2011 16:53 MST	mostly cloudy	2-16-2011 10:56 PST	lt snow; fog
2-15-2011 15:12 PST	haze	2-16-2011 17:53 MST	clear	2-16-2011 11:02 PST	lt snow
2-15-2011 15:14 PST	haze	2-16-2011 18:53 MST	clear	2-16-2011 11:10 PST	lt snow
2-15-2011 15:33 PST	haze	2-16-2011 19:53 MST	clear	2-16-2011 11:29 PST	mostly cloudy
2-15-2011 15:42 PST	haze	2-16-2011 20:53 MST	clear	2-16-2011 11:56 PST	mostly clear
2-15-2011 15:53 PST	haze	2-16-2011 21:53 MST	clear	2-16-2011 12:56 PST	clear
2-15-2011 16:06 PST	haze	2-16-2011 22:53 MST	mostly cloudy	2-16-2011 13:56 PST	mostly clear

Lovelock Nevada, KLOL		Boise, ID KBOI		Winnemucca, NV KWMC	
Date/Time of Obs	**Weather Obs**	**Date/Time of Obs**	**Weather Obs**	**Date/Time of Obs**	**Weather Obs**
2-15-2011 16:53 PST	haze	2-16-2011 23:53 MST	overcast	2-16-2011 14:56 PST	mostly cloudy
2-15-2011 17:51 PST	haze			2-16-2011 15:56 PST	clear
2-15-2011 17:53 PST	haze			2-16-2011 16:56 PST	clear
2-15-2011 18:09 PST	haze			2-16-2011 17:56 PST	clear
2-15-2011 18:36 PST	haze			2-16-2011 18:56 PST	mostly clear
2-15-2011 18:40 PST	haze			2-16-2011 19:56 PST	partly cloudy
2-15-2011 18:53 PST	haze			2-16-2011 20:56 PST	clear
2-15-2011 19:03 PST	haze			2-16-2011 21:56 PST	clear
2-15-2011 19:06 PST	haze			2-16-2011 22:56 PST	partly cloudy
2-15-2011 19:16 PST	haze			2-16-2011 23:56 PST	overcast

Lovelock Nevada, KLOL (cont)	
Date & Time of Observation	**Weather Obs**
2-15-2011 19:25 PST	haze
2-15-2011 19:42 PST	haze
2-15-2011 19:50 PST	haze
2-15-2011 19:53 PST	haze
2-15-2011 20:36 PST	haze
2-15-2011 20:46 PST	haze
2-15-2011 20:53 PST	haze
2-15-2011 21:02 PST	haze
2-15-2011 21:16 PST	haze
2-15-2011 21:22 PST	haze
2-15-2011 21:29 PST	haze
2-15-2011 21:36 PST	haze
2-15-2011 21:42 PST	haze
2-15-2011 21:53 PST	haze
2-15-2011 21:58 PST	haze
2-15-2011 22:10 PST	haze
2-15-2011 22:16 PST	haze
2-15-2011 22:23 PST	haze
2-15-2011 22:32 PST	haze
2-15-2011 22:47 PST	haze
2-15-2011 22:53 PST	haze
2-15-2011 23:20 PST	haze
2-15-2011 23:36 PST	haze
2-15-2011 23:49 PST	haze
2-15-2011 23:53 PST	haze
2-16-2011 0:10 PST	haze
2-16-2011 0:43 PST	haze
2-16-2011 0:53 PST	haze
2-16-2011 1:00 PST	haze
2-16-2011 1:05 PST	haze
2-16-2011 1:36 PST	haze
2-16-2011 1:43 PST	haze

Lovelock Nevada, KLOL		Boise, ID KBOI		Winnemucca, NV KWMC	
Date/Time of Obs	Weather Obs	Date/Time of Obs	Weather Obs	Date/Time of Obs	Weather Obs

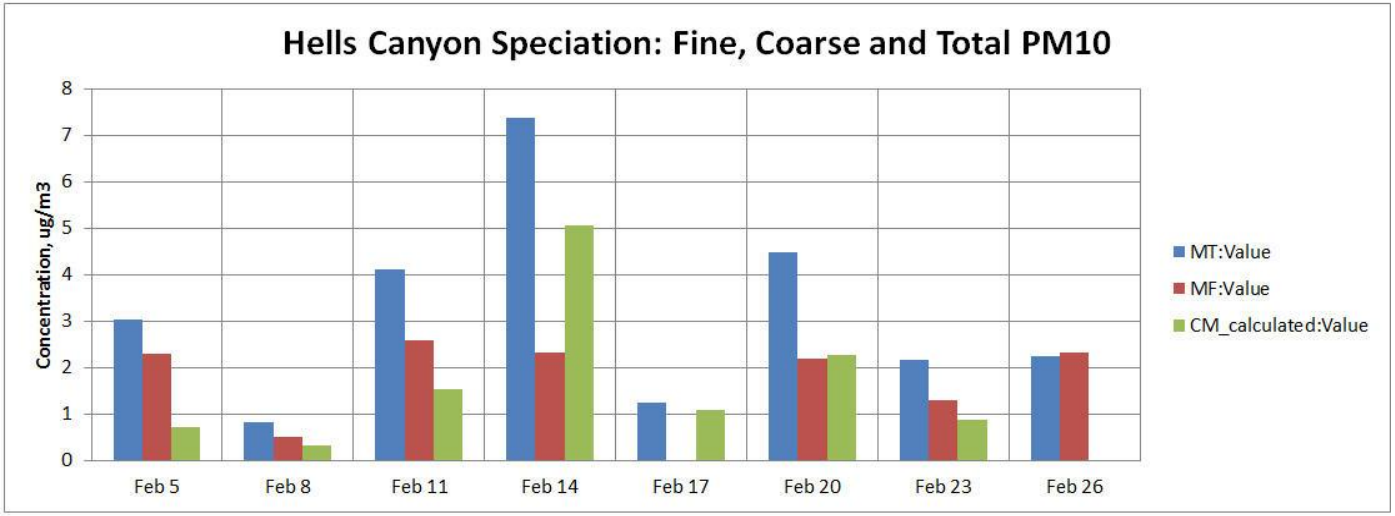
Lovelock Nevada, KLOL (cont)	
Date & Time of Observation	**Weather Obs**
2-16-2011 1:53 PST	haze
2-16-2011 2:14 PST	haze
2-16-2011 2:22 PST	haze
2-16-2011 2:31 PST	haze
2-16-2011 2:36 PST	haze
2-16-2011 2:53 PST	haze
2-16-2011 3:22 PST	haze
2-16-2011 3:28 PST	haze
2-16-2011 3:35 PST	haze
2-16-2011 3:37 PST	haze
2-16-2011 3:48 PST	haze
2-16-2011 3:49 PST	haze
2-16-2011 4:20 PST	haze
2-16-2011 4:23 PST	haze
2-16-2011 4:51 PST	haze
2-16-2011 4:53 PST	haze
2-16-2011 5:07 PST	haze
2-16-2011 5:14 PST	haze
2-16-2011 5:25 PST	haze
2-16-2011 5:29 PST	haze
2-16-2011 5:31 PST	haze
2-16-2011 5:38 PST	mostly cloudy
2-16-2011 5:53 PST	overcast
2-16-2011 6:16 PST	haze
2-16-2011 6:23 PST	haze
2-16-2011 6:30 PST	haze
2-16-2011 6:53 PST	overcast
2-16-2011 7:20 PST	mod rain; fog
2-16-2011 7:45 PST	partly cloudy
2-16-2011 7:53 PST	mostly clear
2-16-2011 8:53 PST	clear
2-16-2011 9:53 PST	clear
2-16-2011 10:53 PST	clear
2-16-2011 11:53 PST	mostly clear
2-16-2011 12:53 PST	clear
2-16-2011 13:53 PST	clear
2-16-2011 14:53 PST	mostly clear
2-16-2011 15:53 PST	mostly clear
2-16-2011 16:53 PST	clear
2-16-2011 17:53 PST	partly cloudy
2-16-2011 18:53 PST	clear
2-16-2011 19:53 PST	clear

Lovelock Nevada, KLOL		Boise, ID KBOI		Winnemucca, NV KWMC	
Date/Time of Obs	**Weather Obs**	**Date/Time of Obs**	**Weather Obs**	**Date/Time of Obs**	**Weather Obs**
2-16-2011 20:53 PST	clear				
2-16-2011 21:53 PST	clear				

Table B-5. Daily precipitation in source region, January 1–February 15, 2011 (Horel et al. 2002).

Date	BUFN2	BLUN2	TR730	TEXN2	KNFL	KLOL
1/1/2011	0	0	0	0	0.04	0
1/2/2011	0.01	0.02	0.04	0.01	0	0
1/3/2011	0	0	0	0.04	0	0
1/4/2011	0	0	0.01	0	0	0
1/5/2011	0	0	0	0	0	0
1/6/2011	0	0	0	0	0	0
1/7/2011	0	0	0.01	0.05	0	0
1/8/2011	0	0	0	0	0.01	0
1/9/2011	0	0	0	0	0	0
1/10/2011	0	0	0	0	0	0
1/11/2011	0	0	0	0	0	0.08
1/12/2011	0.06	0.04	0	0	0	0
1/13/2011	0.02	0	0	0.16	0	0
1/14/2011	0	0	0.07	0.08	0	0
1/15/2011	0	0	0.13	0.24	0	0
1/16/2011	0	0	0.01	0.09	0	0
1/17/2011	0	0	0	0	0	0
1/18/2011	0	0	0	0	0	0
1/19/2011	0	0	0	0	0	0
1/20/2011	0	0	0	0	0	0
1/21/2011	0	0	0	0	0	0
1/22/2011	0	0	0	0	0	0
1/23/2011	0	0	0	0	0	0
1/24/2011	0	0	0	0	0.01	0
1/25/2011	0	0	0	0	0	0
1/26/2011	0	0	0	0	0	0
1/27/2011	0	0	0	0	0	0
1/28/2011	0	0	0	0	0	0
1/29/2011	0	0	0	0	0	0
1/30/2011	0	0	0	0.03	0.05	0.01
1/31/2011	0	0	0	0	0	0
2/1/2011	0	0	0	0	0	0
2/2/2011	0	0	0	0	0	0
2/3/2011	0	0	0	0	0	0
2/4/2011	0	0	0	0	0	0
2/5/2011	0	0	0	0.07	0	0
2/6/2011	0	0	0	0	0	0
2/7/2011	0	0	0	0	0	0
2/8/2011	0	0	0	0	0	0
2/9/2011	0	0	0	0	0	0
2/10/2011	0	0	0	0	0	0
2/11/2011	0	0	0	0	0	0
2/12/2011	0	0	0	0	0	0
2/13/2011	0	0	0	0	0	0
2/14/2011	0	0	0	0	0	0
2/15/2011	0	0	0	0	0	0

Appendix C. Hells Canyon IMPROVE Site $PM_{2.5}$ Speciation



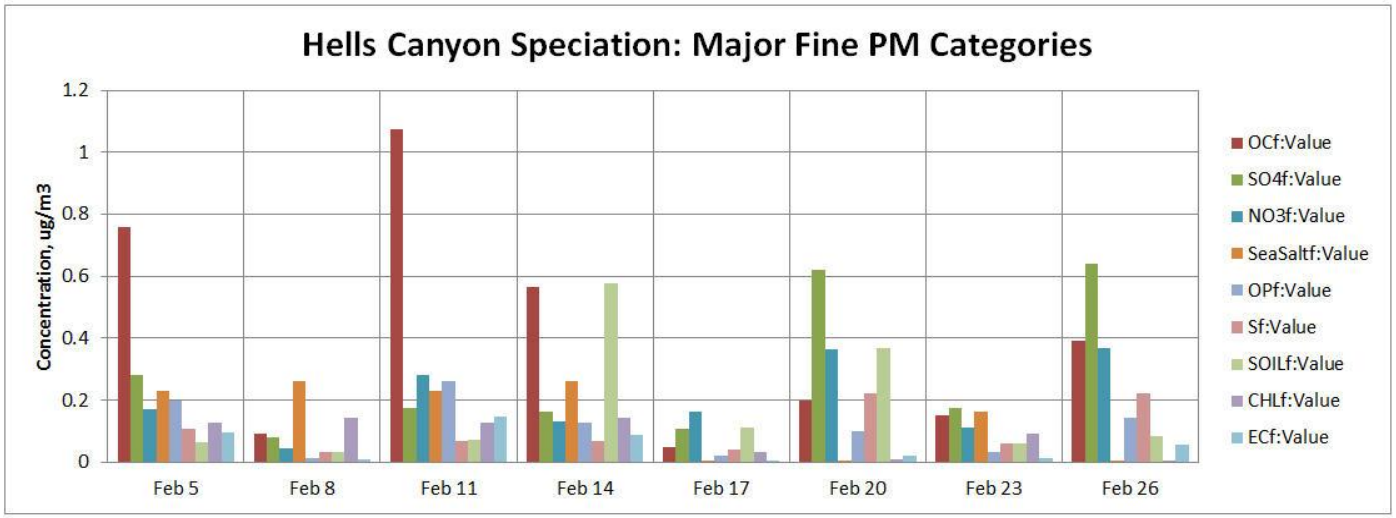


Figure C-1. Hells Canyon speciation for February 2011, showing high coarse mass (top) and elevated soil component on February 14, 2011. In top panel, MT = total mass, MF = fine mass, CM = coarse mass. In bottom panel, OCf = fine organic carbon, SO4f = fine sulfate, NO3f = fine nitrate, Opf = fine pyrolysis carbon, Sf = fine sulfur, soilf = fine soil/geologic mass, CHLf = fine chloride, and ECf = fine elemental carbon (IMPROVE 2013).

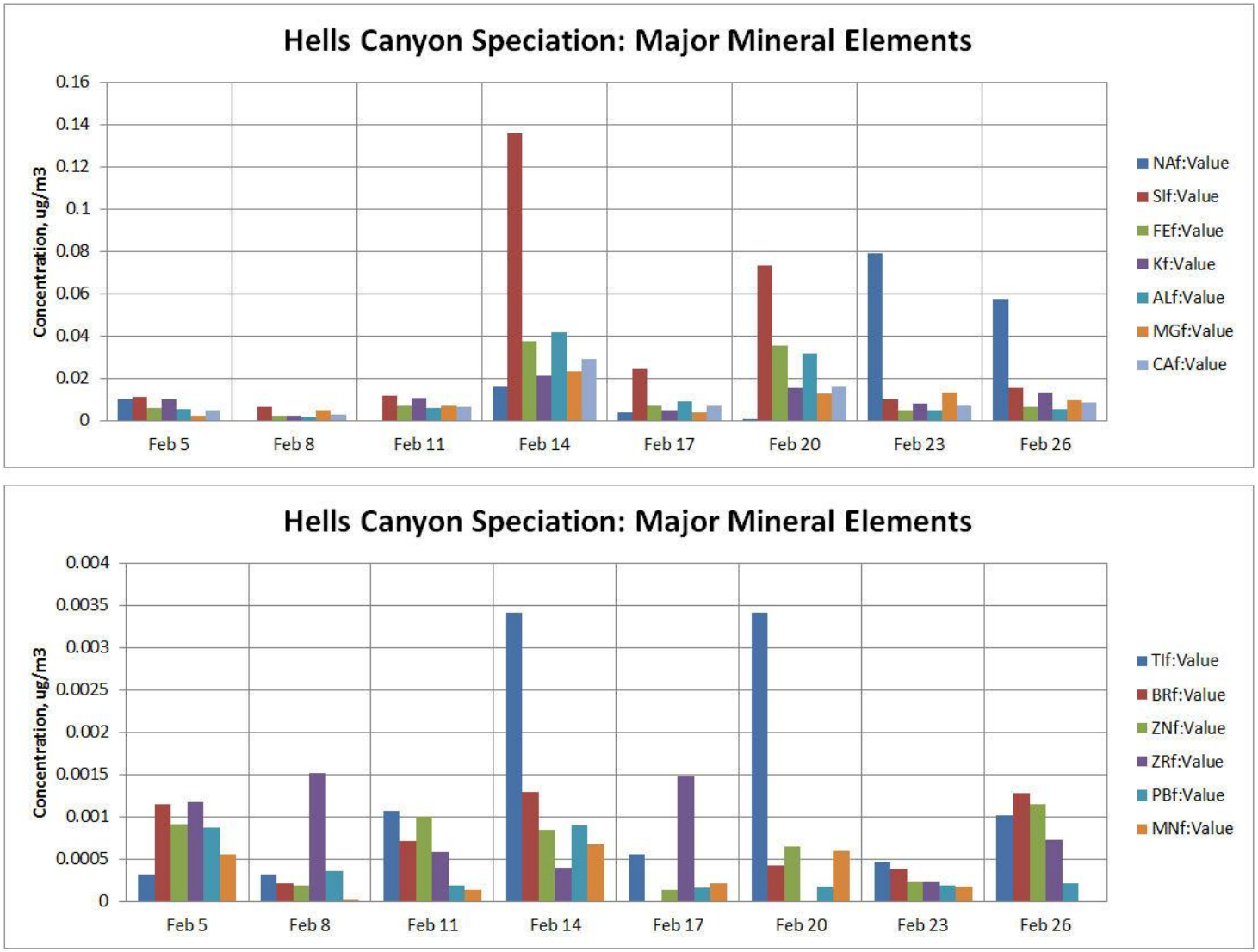


Figure C-2. Hells Canyon speciation for February 2011 showing higher Si, Fe, Al, and Ca on February 14, 2011. In top panel, NAf = fine sodium, SIf = fine silicon, Fef = fine iron, Kf = fine potassium, Alf = fine aluminum, MGf = fine magnesium, CAf = fine calcium. In bottom panel, Tif = fine titanium, BRf = fine bromine, ZNf = fine zinc, ZRf = fine zirconiuim, PBf = fine lead, and MNf = fine manganese. Fine aerosol is < 2.5 µm (IMPROVE 2013).

Appendix D. St. Luke's Meridian NCORE Site Speciation Data for February 14, 2011

Table D-1. St. Luke's NCORE site speciation for February 14, 2011—XRF elements.

Parameter Code	Parameter	Sample Value, ug/m3	Alternate Method Detectable Limit	Uncertainty	Note
88102	Antimony	0	0.042	0.014	
88103	Arsenic	0	0.0017	0.00064	
88104	Aluminum	0.138	0.013	0.016	
88107	Barium	0	0.01	0.0039	
88109	Bromine	0.0023	0.0018	0.0011	
88110	Cadmium	0	0.019	0.0062	
88111	Calcium	0.147	0.0047	0.011	
88112	Chromium	0	0.0022	0.00072	
88113	Cobalt	0.00081	0.0011	0.00071	
88114	Copper	0.00023	0.0013	0.0017	
88115	Chlorine	0.0409	0.005	0.0037	
88117	Cerium	0	0.0068	0.003	
88118	Cesium	0	0.034	0.011	
88126	Iron	0.147	0.0014	0.011	
88128	Lead	0	0.0049	0.0016	
88131	Indium	0	0.022	0.0073	
88132	Manganese	0.00306	0.0018	0.0008	
88136	Nickel	0.00001	0.0011	0.00045	
88140	Magnesium	0.00671	0.011	0.0044	
88152	Phosphorus	0	0.01	0.0041	
88154	Selenium	0	0.002	0.00068	
88160	Tin	0	0.032	0.011	
88161	Titanium	0.0113	0.0043	0.0026	
88164	Vanadium	0	0.003	0.0013	
88165	Silicon	0.554	0.011	0.046	
88166	Silver	0	0.015	0.0049	
88167	Zinc	0	0.0035	0.0012	
88168	Strontium	0	0.0023	0.00076	
88169	Sulfur	0.105	0.0073	0.0082	a
88176	Rubidium	0	0.0018	0.00059	
88180	Potassium	0.0803	0.0039	0.006	
88184	Sodium	0.0961	0.04	0.014	
88185	Zirconium	0	0.0045	0.0069	
88301	Ammonium	0.147	0.017	0.01	
88302	Sodium	0.0351	0.03	0.064	

Parameter Code	Parameter	Sample Value, ug/m3	Alternate Method Detectable Limit	Uncertainty	Note
88303	Potassium	0	0.014	0.001	
88306	Nitrate	0.27	0.0072	0.021	
88403	Sulfate	0.232	0.01	0.019	b
88502	Particulate matter 2.5u	6.1	0.77	0.41	
88355	OC IMPROVE TOT	0.989			c
88357	EC IMPROVE TOT	0.244			d
88370	OC IMPROVE TOR	0.975			e
88374	O1 IMPROVE	0.0241			
88375	O2 IMPROVE	0.204			
88376	O3 IMPROVE	0.368			
88377	O4 IMPROVE	0.218			
88378	OP IMPROVE TOR	0.161			f
88380	EC IMPROVE TOR	0.258			g
88383	E1 IMPROVE	0.373			
88384	E2 IMPROVE	0.0458			
88385	E3 IMPROVE	0			
88388	OP IMPROVE TOT	0.175			h

Notes:

a Qualifier-1 = 5

b Qualifier-1 = 5

c OC = Organic Carbon, TOT = by total optical TRANSMITTANCE

d EC = Elemental Carbon, TOT = by total optical TRANSMITTANCE

e OC = Organic Carbon, TOR = by total optical REFLECTANCE

f OP = Pyrolysis Carbon, TOR = by total optical REFLECTANCE

g EC = Elemental Carbon, TOR = by total optical REFLECTANCE

h OP = Pyrolysis Carbon, TOR = by total TRANSMITTANCE

Appendix E. DEQ Air Quality Alerts and Public Education

Air quality alert and public education sheet for yellow alerts sent out February 15, 2011, 10:23 a.m. MST by DEQ's Boise Regional Office.

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 been 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.**

David Luft
Airshed Coordinator
Idaho Department of Environmental Quality
Boise Regional Office
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(208) 373-0201
david.luft@deq.idaho.gov

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Air Quality Alert Condition for today

Yellow

- 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

Idaho Department of Environmental Quality

Air quality alert and public education sheet for orange alerts sent out February 16, 2011, 9:09 a.m. MST by DEQ's Boise Regional Office.

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 been 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.**

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Orange

Air Quality Index (AQI) 101-150

Air quality alert notifications are issued daily when warranted. For air quality information call 373-0313 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/arindex.cfm

Appendix F. News Articles

Idaho Statesman, The (Boise, ID)
February 16, 2011
Section: Local, as provided by the The McClatchy Company

Wind-blown dust leads to orange air quality alert in Treasure Valley, but snow expected to improve air quality

Author: ***Boise - Idaho Statesman***

Article Text:

The Idaho Department of Environmental Quality issued an orange alert for Wednesday due to poor air quality. The cause is particulates from dust that has blown in from the desert, said David Luft, airshed coordinator for the Boise regional office.

An orange alert means that members of sensitive groups should limit time outdoors. Indoor wood burning is restricted in Ada County when the AQI is 74 or higher. Within unincorporated Ada and Canyon counties, only EPA-certified woodstoves are allowed when AQI is above 74.

"This is pretty high for us," Luft said of the air quality index of 110, the low end of the orange level.

Luft said dry conditions combined with sustained winds of 10 to 20 miles per hour from the southeast for two days impacted air quality.

Luft expected that precipitation overnight Tuesday would prevent the need for an alert, but that did not materialize and the air quality got worse. The cold front moving through the area Wednesday should clear the air, Luft said.

Snow was falling throughout the Boise metro area Wednesday morning. The Valley will get a half inch to 1 inch of snow today, according to meteorologist Megan Thimmesch. She said Boise hit a high temperature for the day of 46, and temperatures will fall through the rest of the day.

It was about 34 degrees at noon, and the overnight low is expected to be about 30 degrees. There's a 25 percent chance of precipitation Thursday, and that's likely to be snow. The high Thursday will be about 41.

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Record Number: 201102161456KNRIDDERIDSTATES_6f947997a02ef64f079c76f03f11475a

NBC - 7 KTVB (Boise, ID)
February 16, 2011
Section: Local News

Treasure Valley air quality improves, in moderate range

Article Text:

BOISE -- The Idaho Department of Environmental Quality reports that air quality in the Treasure Valley has improved and is now in the moderate or yellow range.

As of 2 p.m. Mountain Time, DEQ's website puts the Air Quality Index at 65.

Idaho's Chief Meteorologist Rick Lantz credits the precipitation we received earlier in the day for the improved air quality. He says there was a lot of dust in the air before the storm moved through.

High winds overnight were responsible for an orange air quality alert in the Treasure Valley. The AQI hit 110.

An orange air quality alert means the air quality is unhealthy for sensitive groups, meaning people with respiratory or heart disease, the elderly, and children.

While the alert is in effect, outdoor burning is prohibited.

Even though the air quality is back in the moderate range, usually sensitive people are encouraged to reduce their outdoor activities.

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