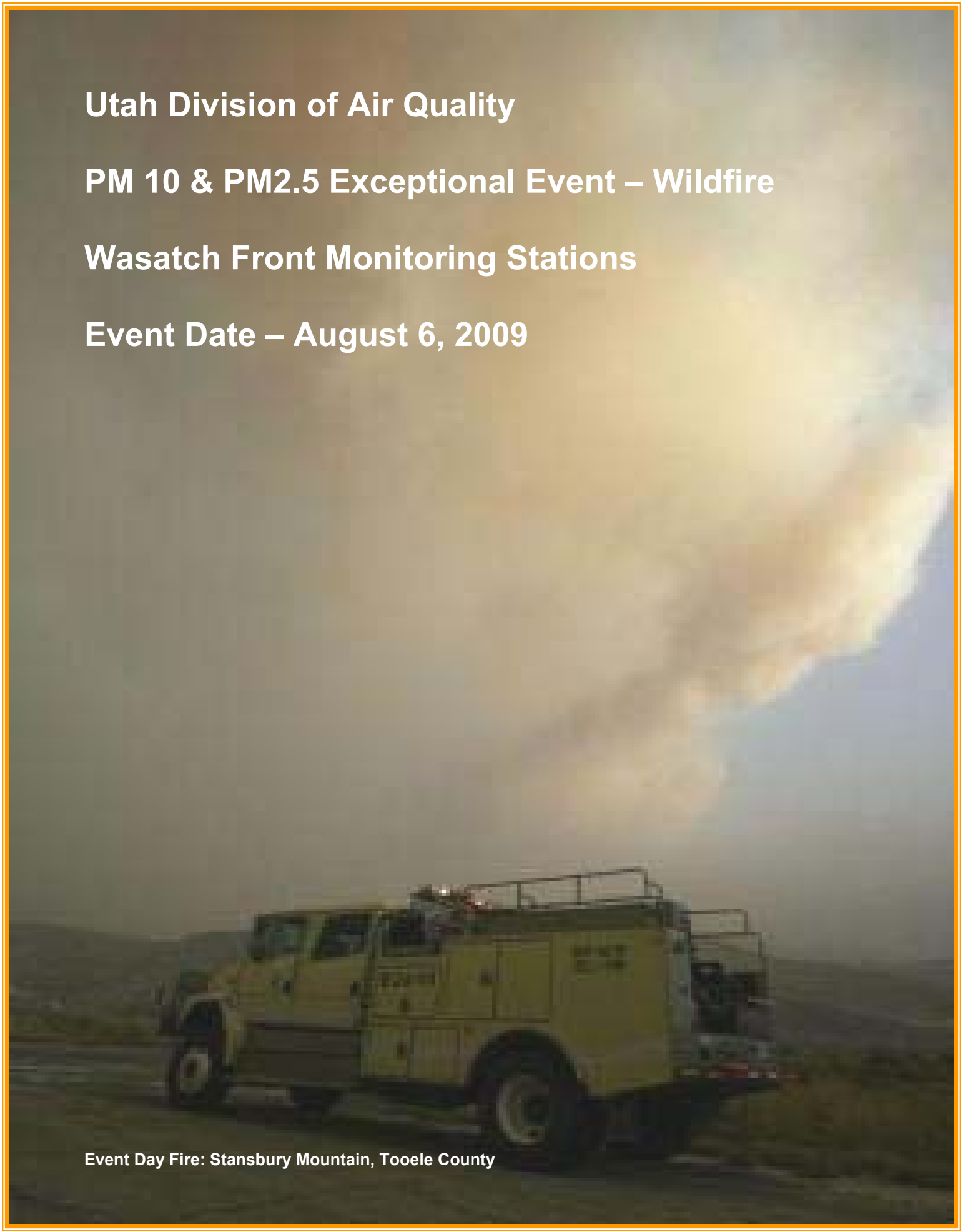
Utah Division of Air Quality

PM 10 & PM2.5 Exceptional Event – Wildfire

Wasatch Front Monitoring Stations

Event Date – August 6, 2009



Event Day Fire: Stansbury Mountain, Tooele County

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Definition of Event and Introduction

The Code of Federal Regulations (CFR) provides the definition and criteria for determining whether air quality data is impacted by an exceptional event. The 40 CFR 50.1 (j) definition states that "exceptional event means an event that affects air quality, is not reasonably controllable or preventable, is an event caused by human activity that is unlikely to recur at a particular location or a natural event, and is determined by the Administrator in accordance with 40 CFR 50.14 to be an exceptional event." The demonstration to justify data exclusion as outlined in 40 CFR 50.14 specifies that evidence must be provided that:

1. The event meets the definition of an exceptional event;
2. The event is associated with a measured concentration in excess of normal historical fluctuations, including background;
3. There is a clear causal relationship between the measurements under consideration and the event that is claimed to have affected air quality in the area;
4. There would have been no exceedance or violation but for the event; and
5. The demonstration must include a public comment process and documentation of such to the Environmental Protection Agency (EPA).

This report documents that the PM10 and PM2.5 event due to wildfire smoke meets the above criteria and provides analyses to demonstrate that:

I. The smoke from the wildfires was not reasonably controllable or preventable;

II. There is a clear-causal connection between smoke clouds emanating from the wildfires and the event at the Utah monitoring stations;

III. The measured concentrations were beyond normal historical levels; and

IV. The exceedances would not have occurred "but for" the smoke clouds.

Utah Wildfires

Lightning from passing thunderstorms across Utah ignited 24 fires. Crews on the fire line battled heavy winds and low visibility for much of the afternoon of August 6. High winds prevented the use of airplanes and helicopters to fight the fire. The cover photo was taken of firefighters keeping watch as a wildfire burns on the east side of Stansbury Mountain in Tooele County.

The following media coverage describes thunderstorms, high winds, and wildfires.

Salt Lake Tribune August 6, 2009

Heavy winds whipped at Steve Davis' face as he watched spot fires from the 22,400-acre Big Pole blaze jump from the Iosepa area into Timpie Valley on the northeast side of the Stansbury Mountains. The Unified Fire Authority firefighter was helping Thursday to fight the largest wildfire so far this season, a little more than 20 miles west of Tooele. "With the wind like this and the light fuel, it will run," he said.

About 200 fire personnel from the Bureau of Land Management, the Uintah Forest Service and Tooele County and city volunteers were at the scene of the blaze, along with 15 engines, said Brenyn Lohmoelder, spokeswoman for the BLM's Salt Lake City field office.

Several crews from Idaho arrived late Thursday night to help fight the fire. Further reinforcements are expected this morning.

Crews on the fire line battled heavy winds and low visibility for much of the afternoon. Those weather conditions also prevented any help from planes and helicopters, Lohmoelder said. The ground crews are trying to keep the flames from other ranches in the area, but will need reinforcements before they can try to contain the wildfire.

"We were doing some structure protection. We burned around a house [to protect it]," Davis said.

But the west desert fire, fed by 30 to 40 mph winds, burned through one ranch and was threatening others in the area. It is unclear if any structures in the area were destroyed, Lohmoelder said. Voluntary evacuations are in effect for residents of five or six ranches in the area.

The Big Pole fire, burning mostly on BLM and private land, is believed to have been ignited by lightning from a Wednesday evening thunder storm. The winds pushed it north, from the foothills northeast of the Skull Valley reservation, toward Interstate 80, before later turning the fire southeast. It is burning through sagebrush and cheat grass, and, with 30 to 40 mph gusts, it was moving at 50 to 60 mph earlier in the day, Lohmoelder said. There have been no injuries reported, she added.

When it was discovered at 7 a.m. Thursday, the Big Pole fire had consumed a mere 10 acres near the southern tip of the Stansbury Mountains. Fire officials now say it could take days to control the blaze. Smoke from the fire enveloped the Salt Lake Valley.

There are 24 fires in the state right now; seven of those, including the Big Pole, are in the BLM's west desert district, Lohmoelder said.

Among those fires are:
» A 150-acre fire in Settlement Canyon, south of Tooele.
» The White Rocks fire at Dugway Proving Ground.

According to the National Weather Service, there is a 50 percent chance of thunderstorms in the west desert area today. Lohmoelder said it should be cooler today. "We hope there's no wind," she said.

Meanwhile, thunderstorms and high winds caused a flurry of fires throughout the Salt Lake Valley, keeping firefighters scrambling to put out one blaze after another.

Lightning from passing thunderstorms sparked a brush fire in Bountiful, though it was contained. The 6-acre brush fire on U.S. Forest Service land in the north part of Bountiful was contained by 12:30 p.m., about six hours after it was reported. It was located above the Viewmont High School's "V" sign, said Forest Service spokeswoman Kathy Jo Pollock.

Fire near airport may burn for few days
Date: August 6, 2009

A fast-moving grass fire Thursday night closed Interstate 80 and a runway at Salt Lake City International Airport and destroyed a bathroom at a golf course.

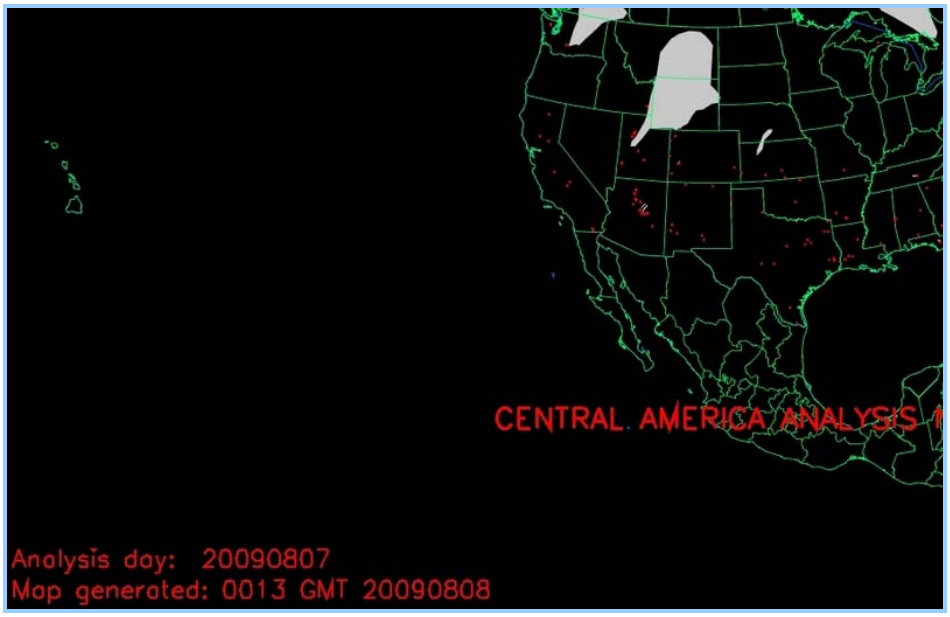
The interstate reopened after about two hours and the fire did not delay flights. High winds diverted three Southwest flights and forced them to go to Boise, said airport spokeswoman Barbara Gann.
Salt Lake City Fire Department spokesman Mark Bednarik hoped the fire would be contained by this morning, but said...

Author: Nate Carlisle The Salt Lake Tribune
Word Count: 212
Publication: Salt Lake Tribune, The (UT)
Article ID: 13011469

Dang, it was windy Thursday
Date: August 6, 2009

Fires flamed, billboards and power lines fell and dust flew Thursday in Utah. A cold front from Nevada blew 60 mph winds into northern Utah and 45 mph winds into southwest Utah and the Sevier Valley. The strong winds were to end by late Thursday. The National Weather Service said the winds today were to be only 10 to 20 mph for most of Utah. Temperatures were to drop into the 70s, with a high likelihood of thunderstorms and rain from Provo into northern Utah. Central Utah...

Author: Nate Carlisle The Salt Lake Tribune
Publication: Salt Lake Tribune, The (UT)
Article ID: 13010775



The NOAA fire and smoke map shows several fires in northern Utah and smoke from some of those fires.

Affect Air Quality

Figures 1 and 2 present the PM10 and PM2.5 24-hr values for the Utah monitoring network during August 4 to 8, 2009.

Figure 1 – PM10 24-hr Values

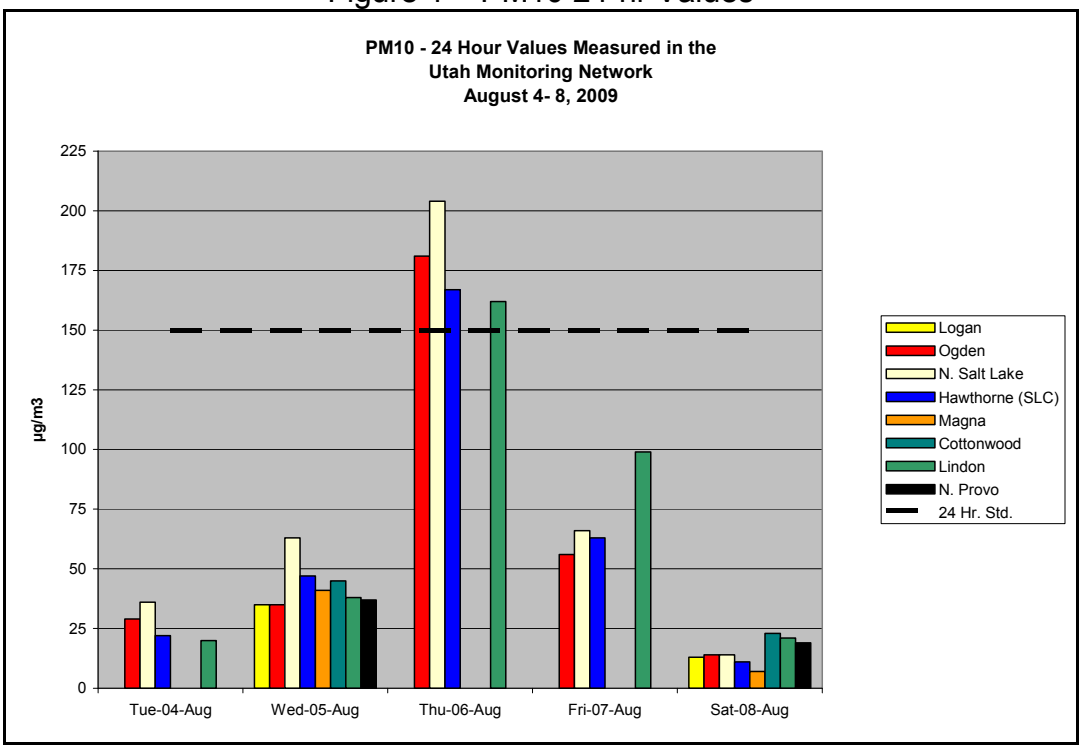


Figure 2 – PM2.5 24-hr Values

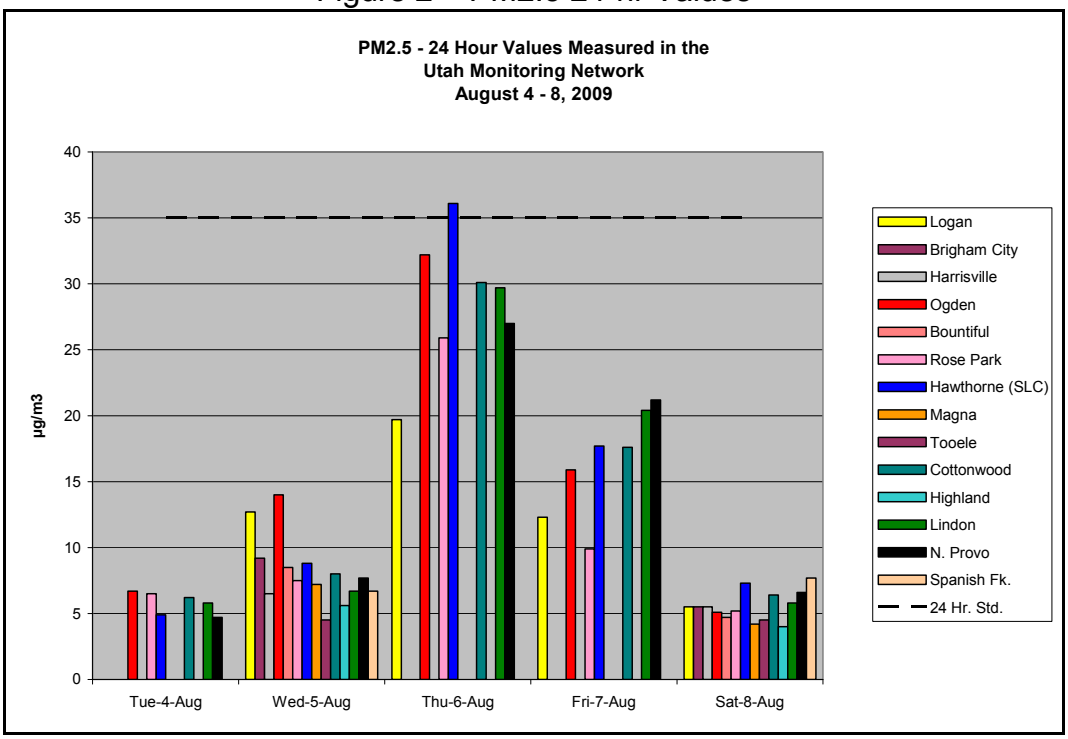


Table 1 provides the PM10 and PM2.5 National Ambient Air Quality Standards (NAAQS) exceedances for this event.

Table 1 – NAAQS Exceedances

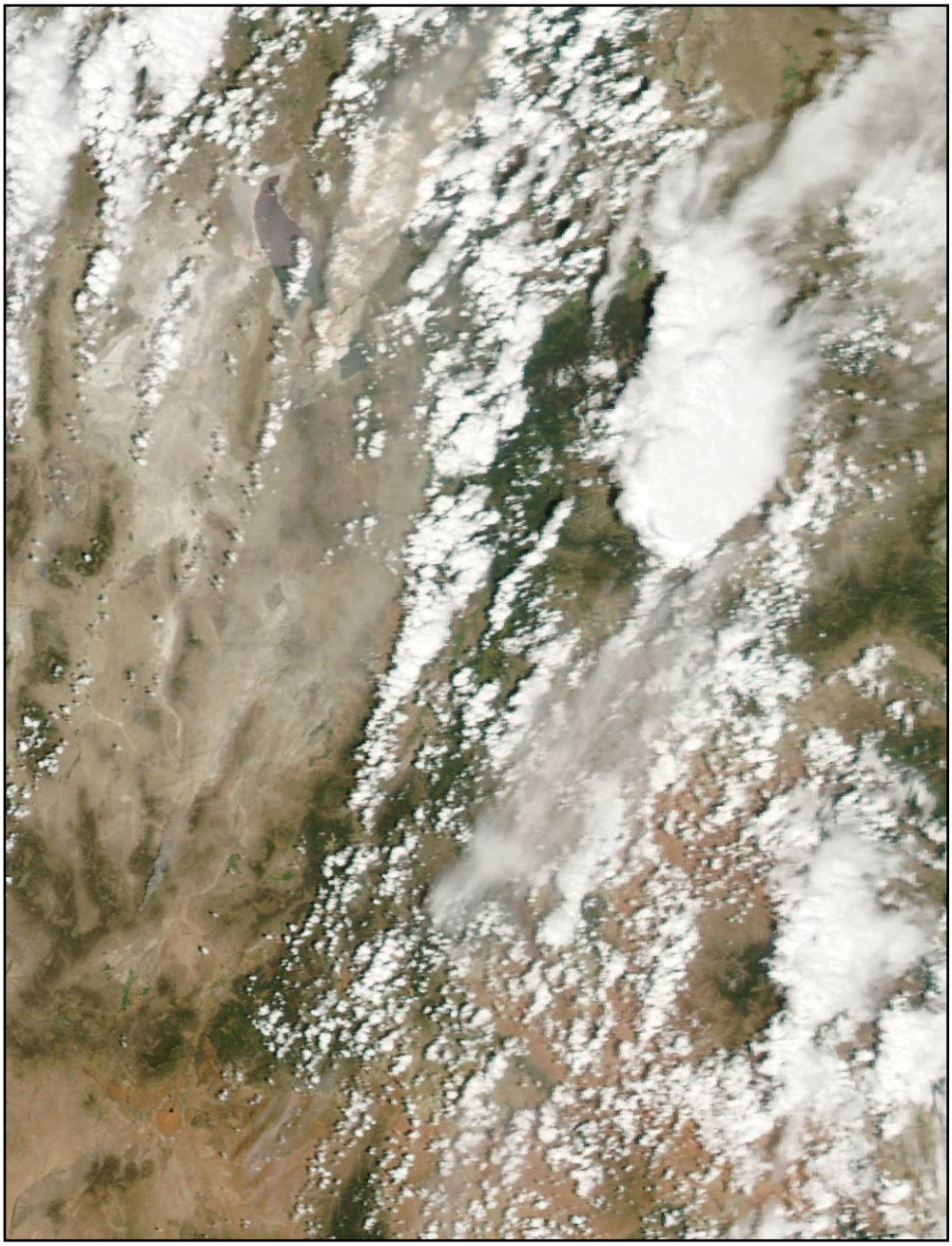
Monitoring Station	PM 10 µg/m^3	Standard µg/m^3	PM 2.5 µg/m^3	Standard µg/m^3
Hawthorne	167	150	36.2	35
Lindon	162	150		
North Salt Lake	204	150		
Ogden	181	150		

Not Reasonably Controllable or Preventable & Natural Event

The Exceptional Events Rule defines a wildfire as an unplanned, unwanted wildland fire "such as fires caused by lightning…" The Utah fires were caused by lightning and flamed by high winds; therefore, they qualify as wildfires under the Rule. The wildfires ignited by uncontrollable natural events, and were not reasonably controllable or preventable.

The visible satellite image shows multiple fire sources (red/pink), cone shaped plumes and smoke clouds covering Box Elder, Tooele, Utah, Salt Lake, Davis, Weber and Cache Counties.

Image 1 – Visible Satellite Image Showing Fires, Plumes and Smoke



Normal Historical Fluctuation

PM10

Normal historical fluctuation for PM10 was computed in a three-step process in order to assess whether an observed value is in excess.

First, all historical PM10 values from each monitoring station were aligned from least to greatest. The location of the effected value in relation to the rest of the historically values is expressed as a %ile.

Second, a box plot analysis was preformed on the historical data. The interquartile range (IQR) was calculated. This was then compared to the event value.

Third, a lognormal distribution analysis was preformed on the historical data. The geometric mean, geometric standard deviation, and the 1st, 2nd, and 3rd geomantic standard deviations above the geometric mean where calculated. These where then compared to the event value.

In addition, an analysis is included showing that winds speeds during this event are not the norm.

Ranking

Guidance found at 72 Federal Register 55 March 22, 2007, pages 13560-81, states that a lesser amount of documentation would likely be necessary for "extremely high" concentrations (e.g. > 95th%ile) than for concentrations that were closer to "typical levels" (e.g. < 75th%ile).

Lindon

The data ranking for the Lindon monitoring station data collected from 1993 through 2009 verifies that the PM10 concentration on August 6, 2009, is above the 99th%ile. Consequently, we can conclude that the event day concentration is outside the normal historical fluctuation.

Ogden

The data ranking for the Ogden monitoring station data collected from 2001 through 2009 verifies that the PM10 concentration on August 6, 2009, is above the 99th%ile. Consequently, we can conclude that the event day concentration is outside the normal historical fluctuation.

North Salt Lake

The data ranking for the North Salt Lake monitoring station data collected from 1993 through 2009 verifies that the PM10 concentration on August 6, 2009, is above the 99th%ile. Consequently, we can conclude that the event day concentration is outside the normal historical fluctuation.

Hawthorne

The data ranking for the Hawthorne monitoring station data collected from 1997 through 2009 verifies that the PM10 concentration on August 6, 2009, is above the 99th%ile. Consequently, we can conclude that the event day concentration is outside the normal historical fluctuation.

Interquartile Range

The IQR is a measure of statistical dispersion, and is a "robust statistic." Robust statistics seek to provide methods that emulate classical methods, but which are not unduly affected by outliers or other small departures from model assumptions. The IQR was calculated on a quarterly basis and on a yearly basis.

Lindon

The following is the IQR for Lindon data:

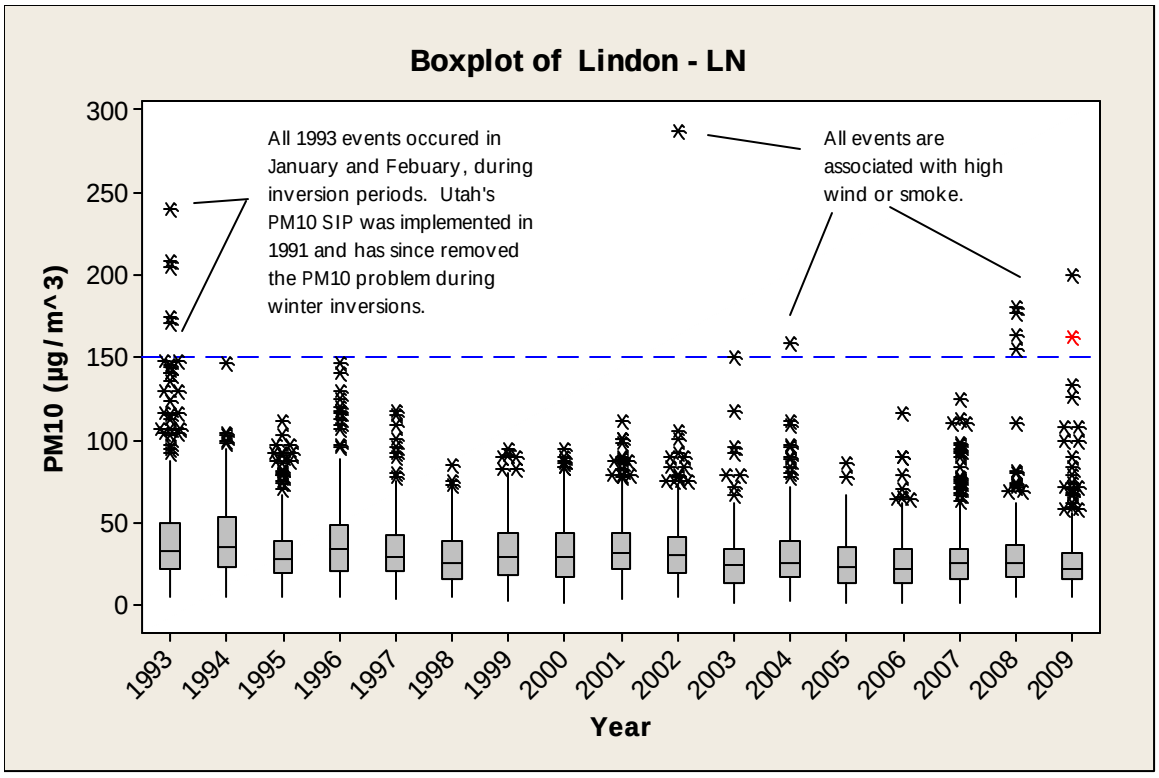
First Quartile (Q1): 17 µg/m^3
Median (Q2): 27 µg/m^3
Third Quartile (Q3): 40 µg/m^3
IQR: 23 µg/m^3

The IQR was calculated on a quarterly basis (shown in Table 2) along with the annual.

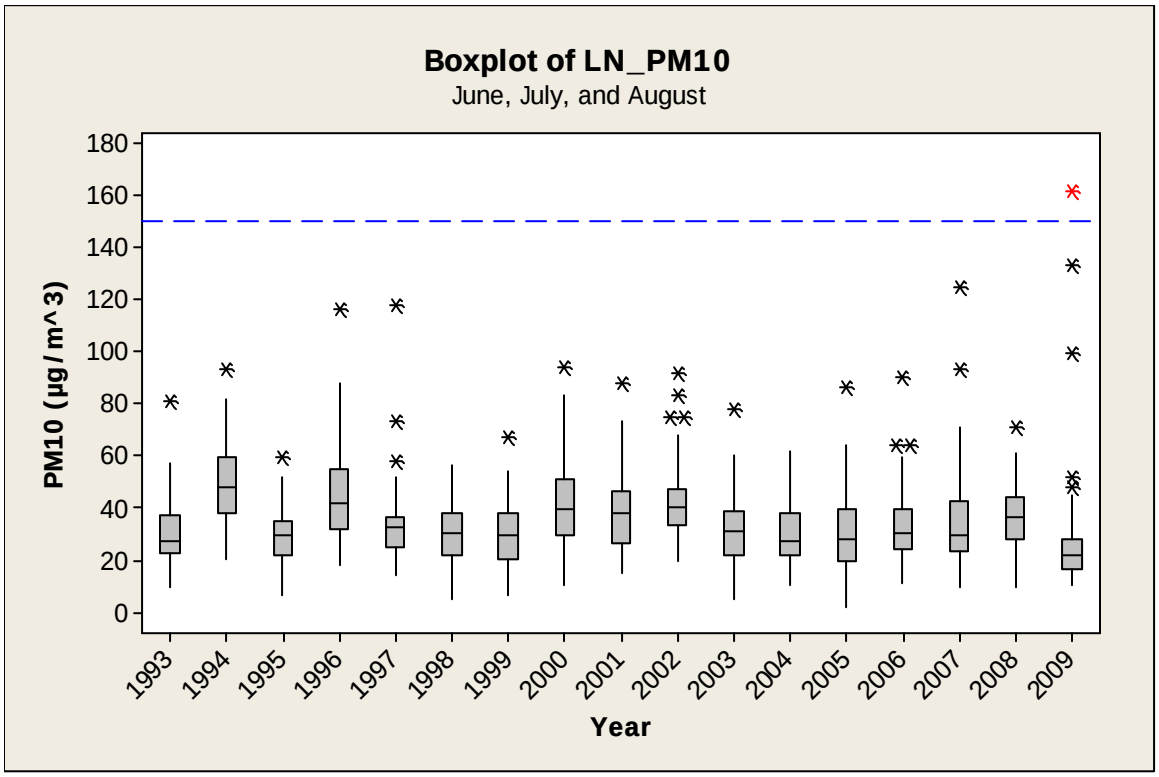
Table –2 Lindon Interquartile (µg/m^3)

Quarter	Sample Size (N)	Q1	Q2	Q3	IQR
1	1456	15	26	48	33
2	1511	14	22	32	18
3	1446	24	32	42	18
4	1389	17	26	38	21
All	5802	17	27	40	23

The boxplot presents the historical PM10 values, by year; the event value is marked in red. The blue dashed line represents the current PM10 standard.



Because this event occurred during the third quarter, it maybe more valuable to focus on other PM10 values during the same time of the year, June-August. The revised boxplot presents the historical PM10 values, by year, during the 3rd quarter (June-August) of each year. The event value is marked in red. The blue dashed line represents the current PM10 standard.



The only event that exceeds the current PM10 standard is associated with a high wind or wildfire event.

Analysis of the boxplot graphs permit us to conclude that the event concentration is outside of normal historical fluctuation.

Ogden
The following is the IQR for Ogden data:

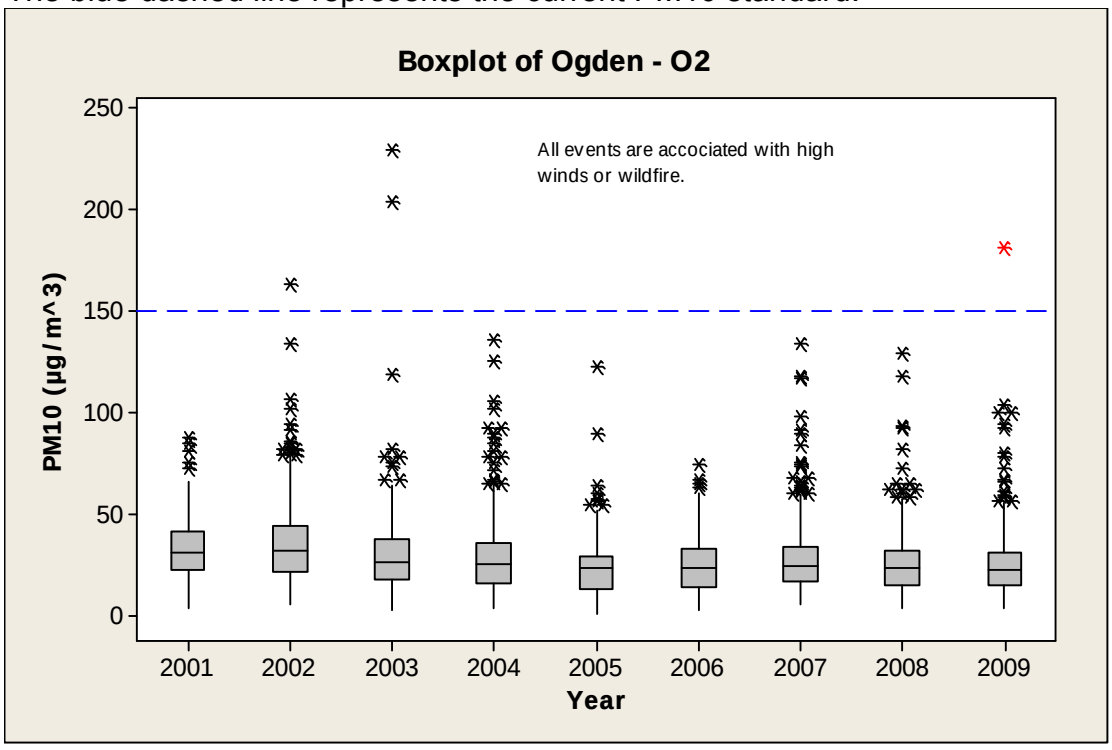
First Quartile (Q1): 17 µg/m^3
Median (Q2): 27 µg/m^3
Third Quartile (Q3): 40 µg/m^3
IQR: 23 µg/m^3

The IQR was calculated on a quarterly basis (shown in Table 3) along with the annual.

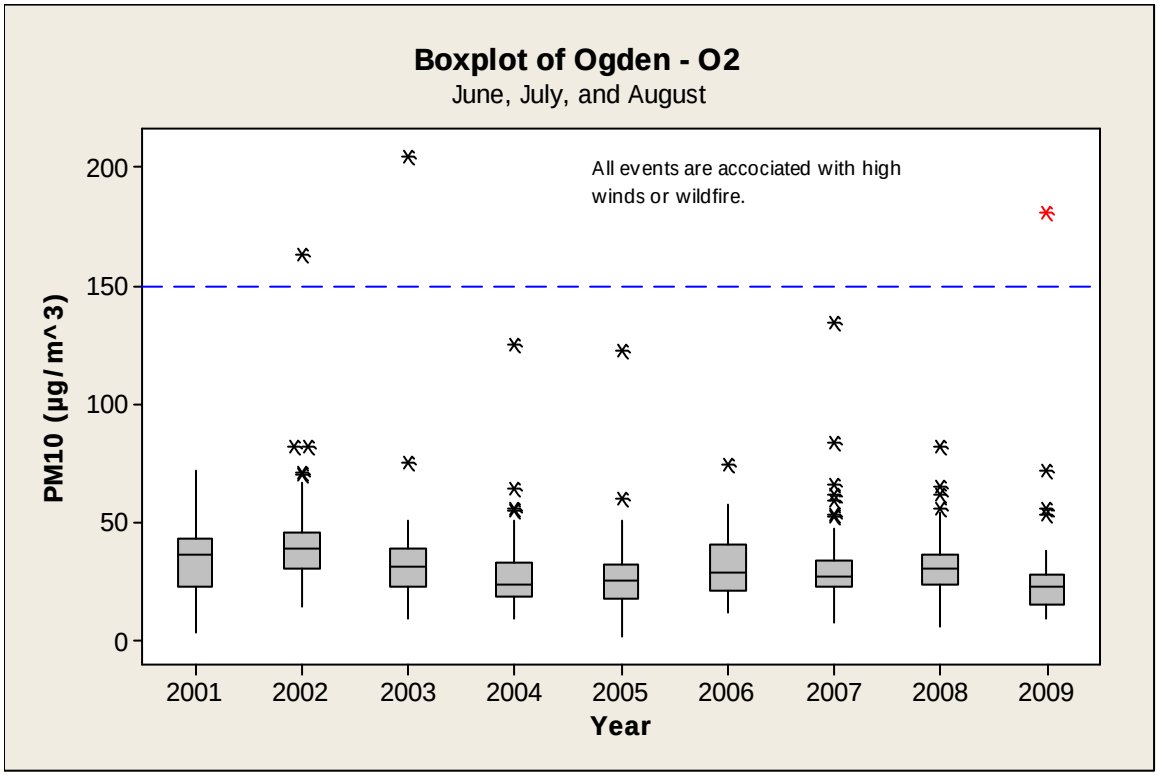
Table – 3 Ogden Interquartile (µg/m^3)

Quarter	Sample Size (N)	Q1	Q2	Q3	IQR
1	725	16	28	44	28
2	706	12	19	29	17
3	747	22	28	38	16
4	786	16	24	31	15
All	2964	16	25	35	19

The boxplot presents the historical PM10 values, by year; the event value is marked in red. The blue dashed line represents the current PM10 standard.



Because this event occurred during the third quarter, it maybe more valuable to focus on other PM10 values during the same time of the year, June-August. The revised boxplot presents the historical PM10 values, by year, during the 3rd quarter (June-August) of each year. The event value is marked in red. The blue dashed line represents the current PM10 standard.



The all events that exceed the current PM10 standard are associated with high wind or wildfire events.

Analysis of the boxplot graphs permit us to conclude that the event concentration is outside of normal historical fluctuation.

North Salt Lake
The following is the IQR for North Salt Lake data:

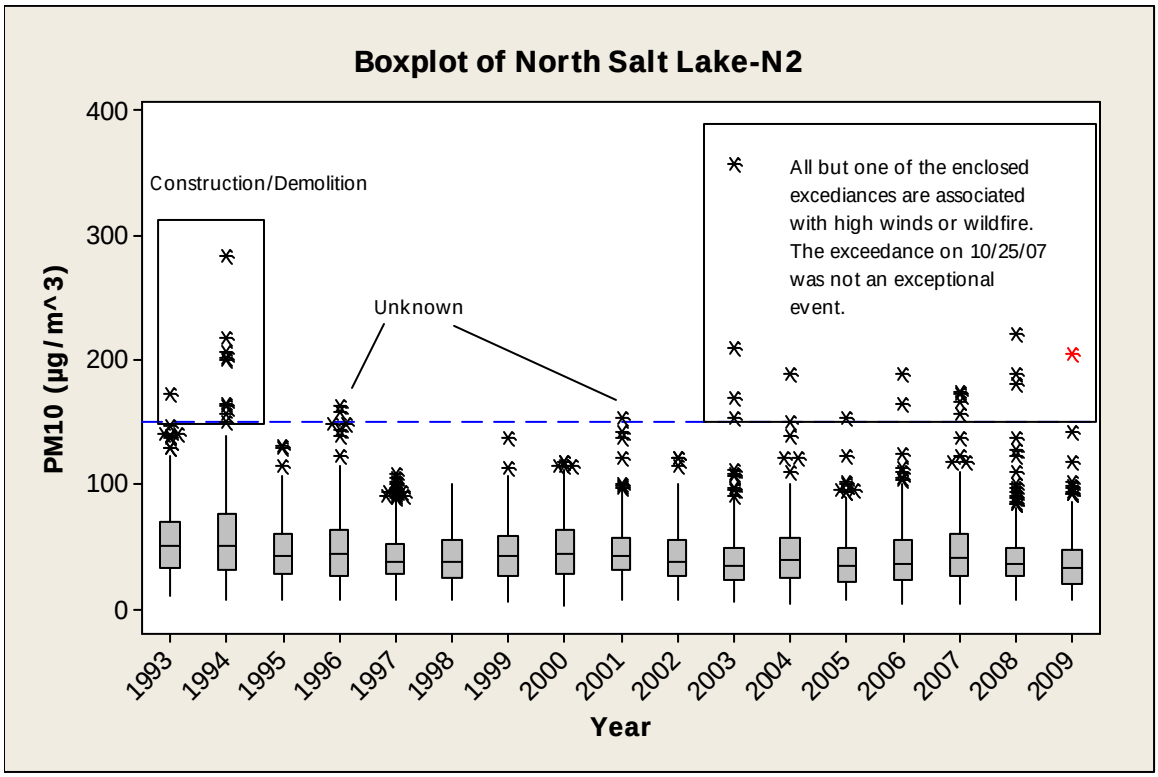
First Quartile (Q1): 25 µg/m^3
Median (Q2): 29 µg/m^3
Third Quartile (Q3): 56 µg/m^3
IQR: 31 µg/m^3

The IQR was calculated on a quarterly basis (shown in Table 4) along with the annual.

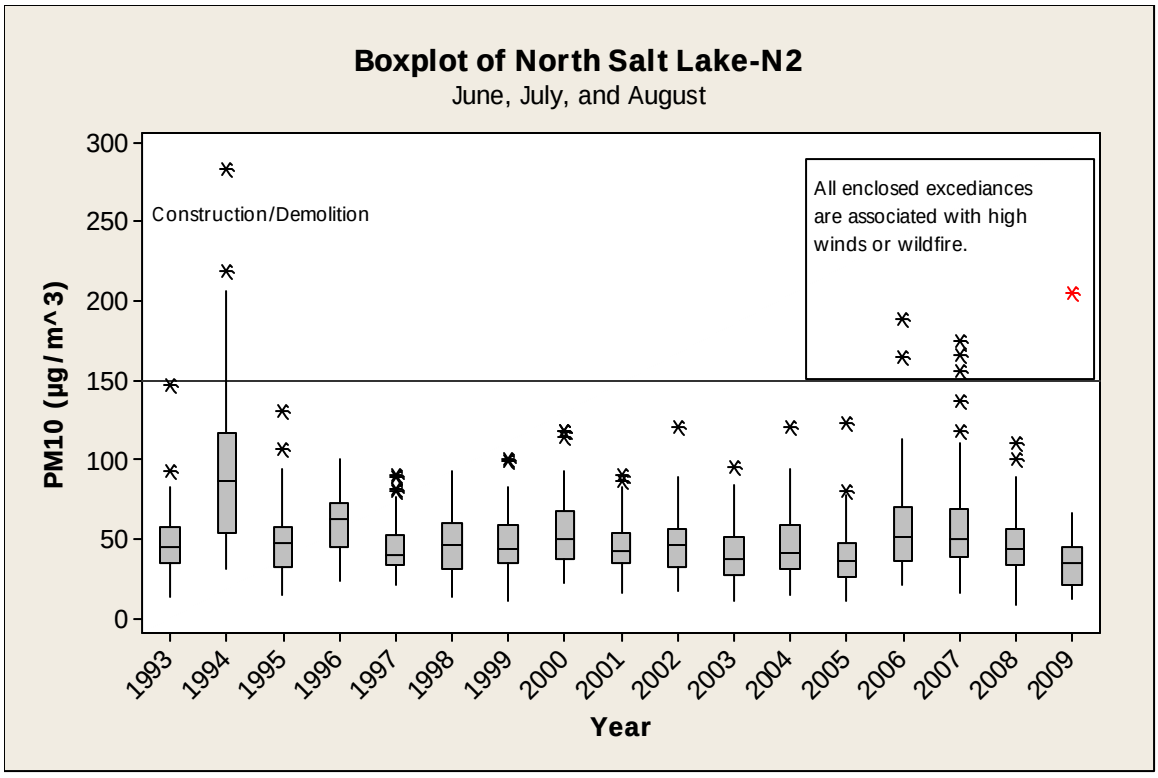
Table – 4 North Salt Lake Interquartile (µg/m^3)

Quarter	Sample Size (N)	Q1	Q2	Q3	IQR
1	1408	23	37	58	35
2	1533	20	32	47	27
3	1494	33	45	60	27
4	1453	26	41.	61	35
All	5888	25	39	56	31

The boxplot presents the historical PM10 values, by year; the event value is marked in red. The blue dashed line represents the current PM10 standard.



Because this event occurred during the third quarter, it maybe more valuable to focus on other PM10 values during the same time of the year, June-August. The revised boxplot presents the historical PM10 values, by year, during the 3rd quarter (June-August) of each year. The event value is marked in red. The blue dashed line represents the current PM10 standard.



The all events since 1995 that exceed the current PM10 standard are associated with high wind or wildfire events.

Analysis of the boxplot graphs permit us to conclude that the event concentration is outside of normal historical fluctuation.

Hawthorne
The following is the IQR for Hawthorne data:

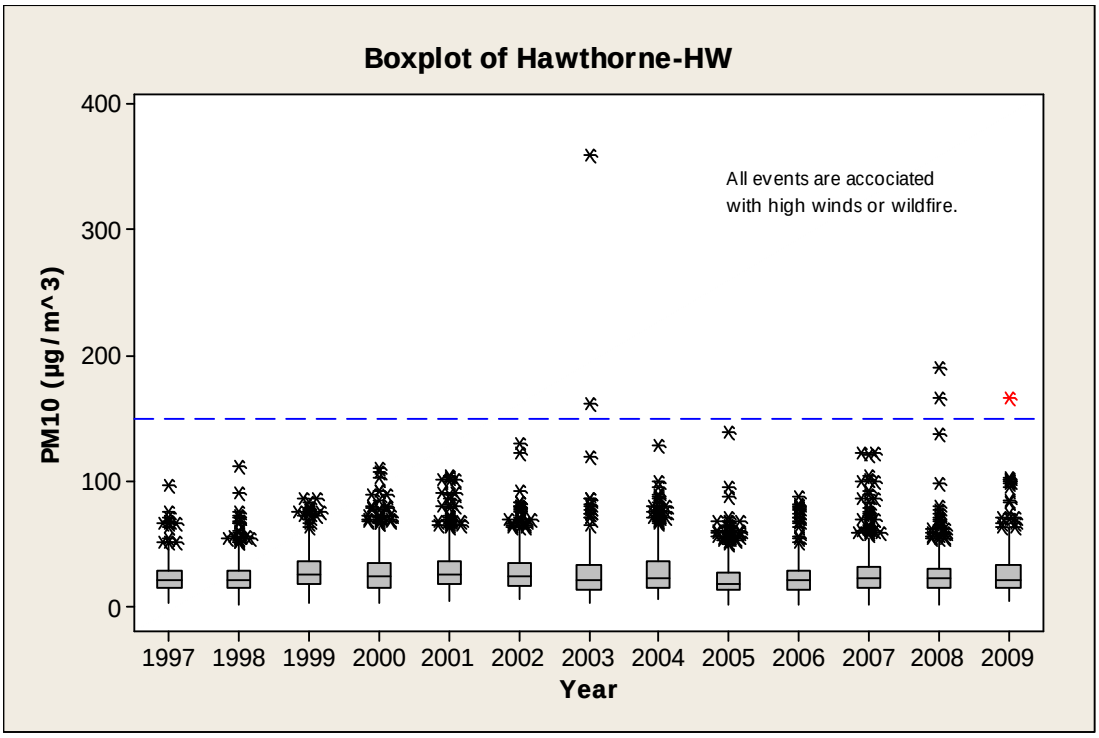
First Quartile (Q1): 16 µg/m^3
Median (Q2): 23 µg/m^3
Third Quartile (Q3): 32 µg/m^3
IQR: 16 µg/m^3

The IQR was calculated on a quarterly basis (shown in Table 5) along with the annual.

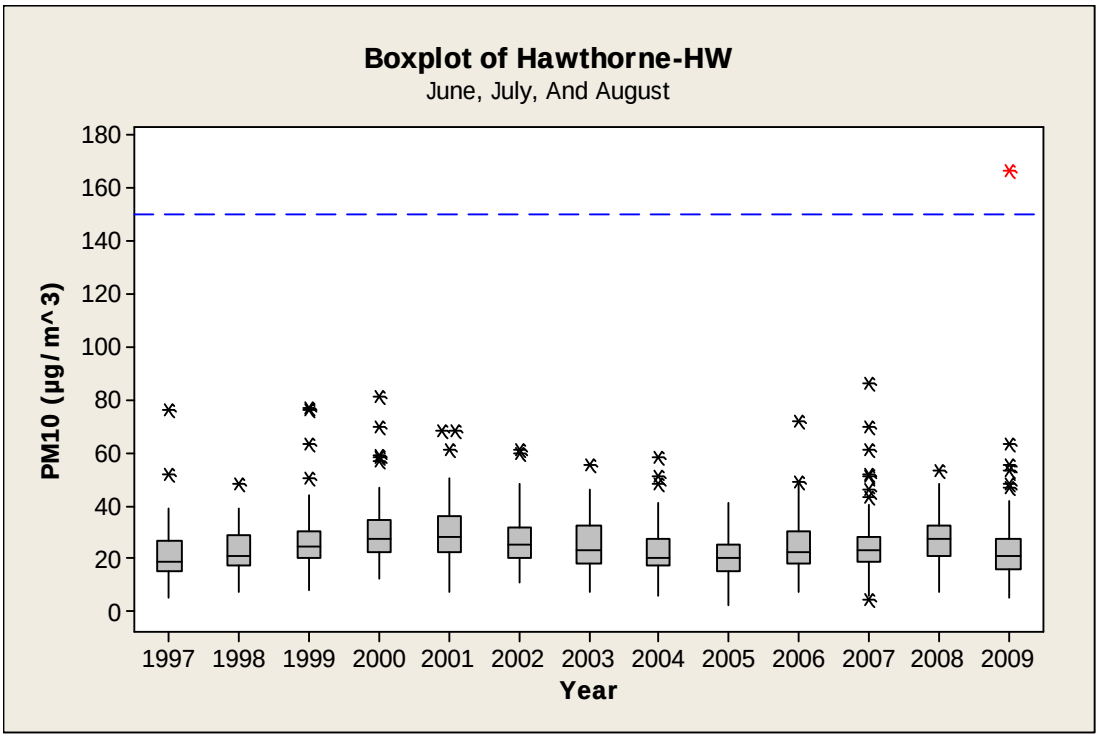
Table – 5 Hawthorne Interquartile (µg/m^3)

Quarter	Sample Size (N)	Q1	Q2	Q3	IQR
1	1041	17.5	29	51	33.5
2	1119	12	18	26	14
3	1122	18	23	30	12
4	1103	16	24	32	16
All	4385	16	23	32	16

The boxplot presents the historical PM10 values, by year; the event value is marked in red. The blue dashed line represents the current PM10 standard.



Because this event occurred during the third quarter, it maybe more valuable to focus on other PM10 values during the same time of the year, June-August. The revised boxplot presents the historical PM10 values, by year, during the 3rd quarter (June-August) of each year. The event value is marked in red. The blue dashed line represents the current PM10 standard.



The only event that exceeds the current PM10 standard is the August 6, 2009, wildfire event. Analysis of the boxplot graphs permit us to conclude that the event concentration is outside of normal historical fluctuation.

Lognormal Distribution

Lognormal distribution analysis was conducted to establish the normal historical fluctuations for each station (inclusive of exceptional event results). Lognormal distribution was selected because of its ability to accurately describe the distribution of measured concentrations of PM10. The geometric mean (μgeo) was calculated on a quarterly basis (shown in Table 2) and on an annual basis. The annual basis provides the greatest number of data points and is sufficiently similar to the spring quarterly value thus; the annual geometric mean is used to reflect the normal historical value.

Lindon

Table 6 – Geometric Mean of PM10

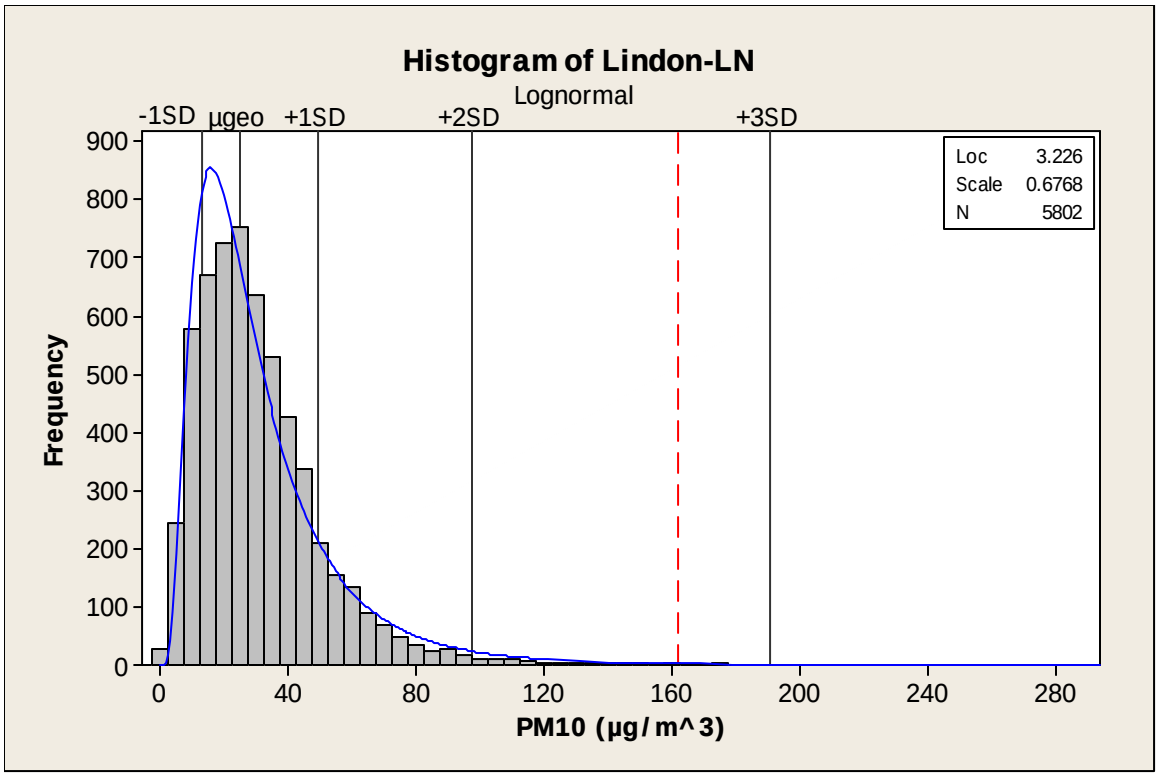
Location	Quarter	N Quarterly	μgeo (μg/m^3)	Annual ugeo (μg/m^3)
Lindon 01/01/1993 to 12/31/2009	1	1456	26.00	25.18
	2	1511	20.64	
	3	1446	31.03	
	4	1389	24.31	

The annual value is far below the August 6th event of 162 μg/m^3.

The following are the calculations for the geometric mean, geometric standard deviation, and the upper boundary of the 1st, 2nd, and 3rd standard deviations from the geometric mean.

Geometric Mean (μgeo): Exp(Loc)=25.18
Geometric Standard Deviation (σgeo): Exp(Scale)= 1.9676
+1 Standard Deviation (+1SD): Exp(Loc +Scale)= μgeo* σgeo= 49.54
+2 Standard Deviation (+2SD): Exp(Loc +2*Scale)= μgeo* (σgeo)^2= 97.48
+3 Standard Deviation (+3SD): Exp(Loc +3*Scale)= μgeo* (σgeo)^3= 191.79

The histogram presents the historical values and the event value with a red dashed line. The blue line is a fitted line overlay of a lognormal distribution.



Noting that the normal historical values fall within the lognormal distribution, it is reasonable to utilize plus or minus 2SD above the geometric mean as the bounds of normal PM10 values. The event value approaches 3SD. The event value is clearly outside the normal historical fluctuation.

Ogden

Table 6 – Geometric Mean of PM10

Location	Quarter	N Quarterly	µgeo (µg/m^3)	Annual ugeo (µg/m^3)
Ogden 01/01/2001 to 12/31/2009	1	725	25.66	23.13
	2	706	18.45	
	3	747	27.55	
	4	789	21.78	

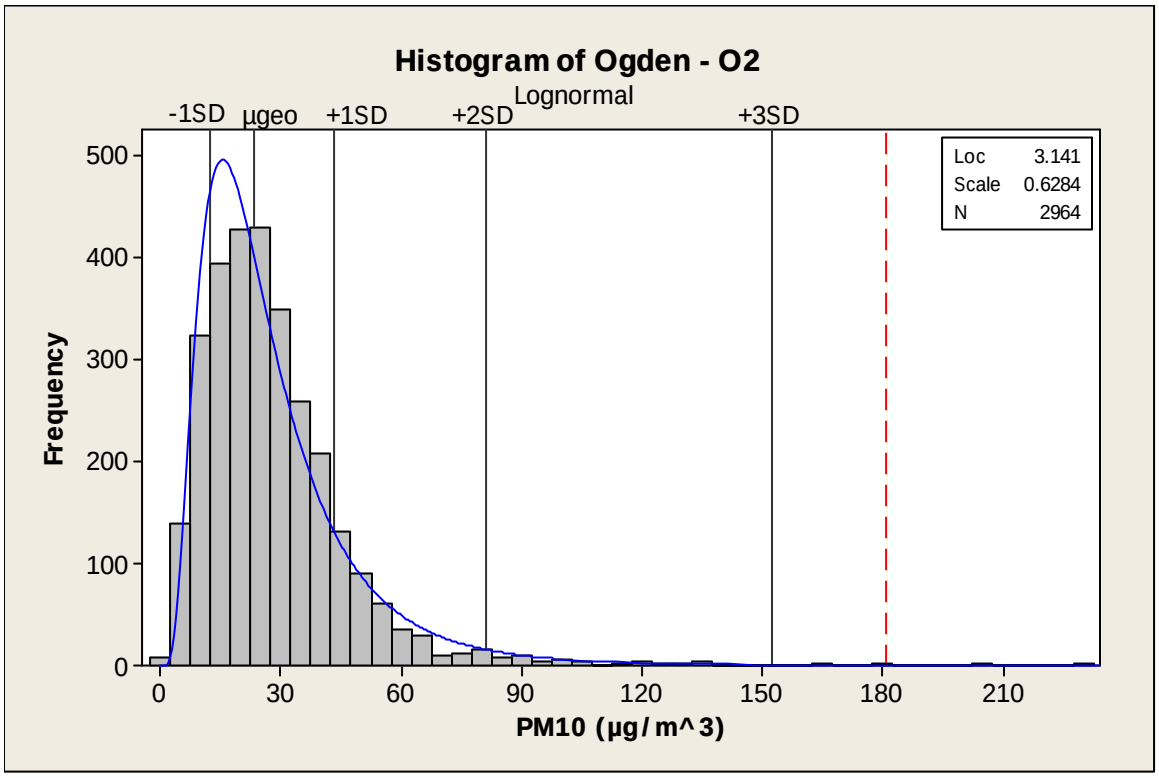
The annual value is far below the August 6th event of 181 ug/m^3.

The following are the calculations for the geometric mean, geometric standard deviation, and the upper boundary of the 1st, 2nd, and 3rd standard deviations from the geometric mean.

Geometric Mean (µgeo): Exp(Loc)=23.13
Geometric Standard Deviation (σgeo): Exp(Scale)= 1.8746
+1 Standard Deviation (+1SD): Exp(Loc +Scale)= µgeo* σgeo= 43.35

+2 Standard Deviation (+2SD): Exp(Loc +2*Scale)= µgeo* (σgeo)^2= 81.27
+3 Standard Deviation (+3SD): Exp(Loc +3*Scale)= µgeo* (σgeo)^3= 152.35

The histogram presents the historical values and the event value with a red dashed line. The blue line is a fitted line overlay of a lognormal distribution.



Noting that the normal historical values fall within the lognormal distribution, it is reasonable to utilize plus or minus 2SD above the geometric mean as the bounds of normal PM10 values. The event value exceeds 3SD. The event value is clearly outside the normal historical fluctuation.

North Salt Lake

Table 7 – Geometric Mean of PM10

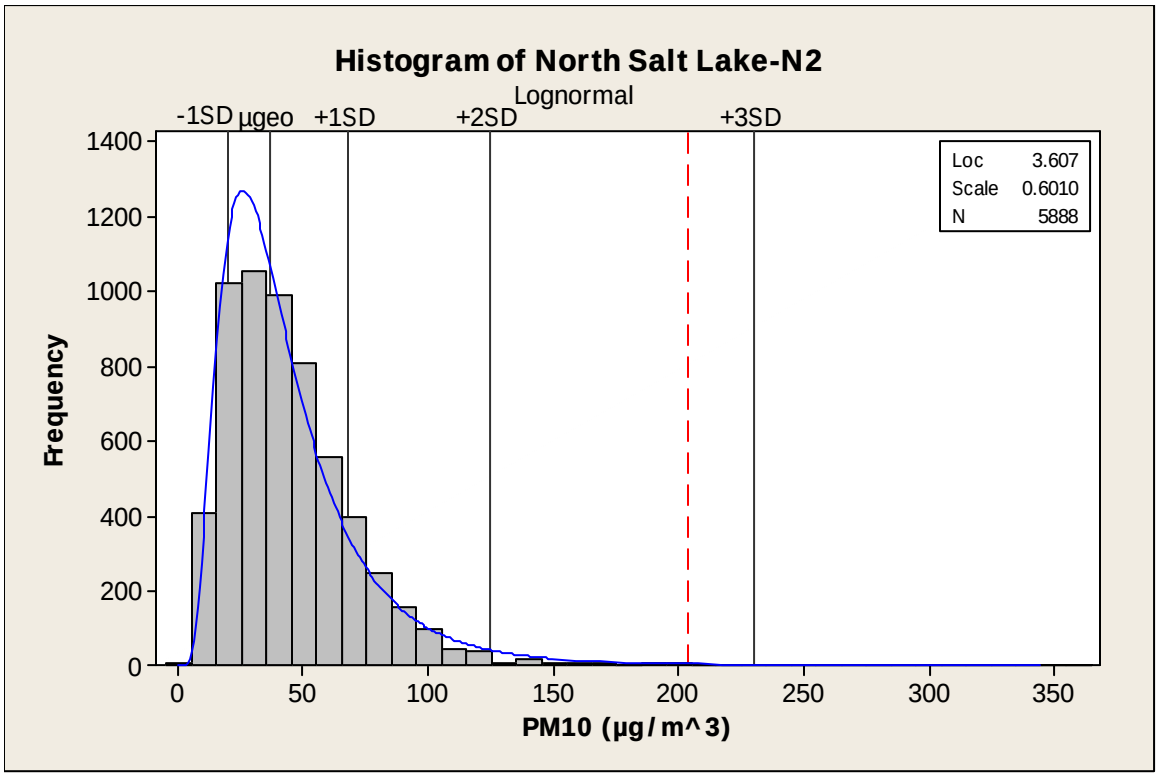
Location	Quarter	N Quarterly	µgeo (µg/m^3)	Annual ugeo (µg/m^3)
North Salt Lake 01/01/1993 to 12/31/2009	1	1408	35.48	36.86
	2	1533	30.51	
	3	1494	44.04	
	4	1453	38.82	

The annual value is far below the August 6th event of 204 µg/m^3.

The following are the calculations for the geometric mean, geometric standard deviation, and the upper boundary of the 1st, 2nd, and 3rd standard deviations from the geometric mean.

Geometric Mean (μgeo): Exp(Loc)=36.86
Geometric Standard Deviation (σgeo): Exp(Scale)= 1.8406
+1 Standard Deviation (+1SD): Exp(Loc +Scale)= μgeo* σgeo= 67.84
+2 Standard Deviation (+2SD): Exp(Loc +2*Scale)= μgeo* (σgeo)^2= 124.86
+3 Standard Deviation (+3SD): Exp(Loc +3*Scale)= μgeo* (σgeo)^3= 229.82

The histogram presents the historical values and the event value with a red dashed line. The blue line is a fitted line overlay of a lognormal distribution.



Noting that the normal historical values fall within the lognormal distribution, it is reasonable to utilize plus or minus 2SD above the geometric mean as the bounds of normal PM10 values. The event value approaches 3SD. The event value is clearly outside the normal historical fluctuation.

Hawthorne

Table 8 – Geometric Mean of PM10

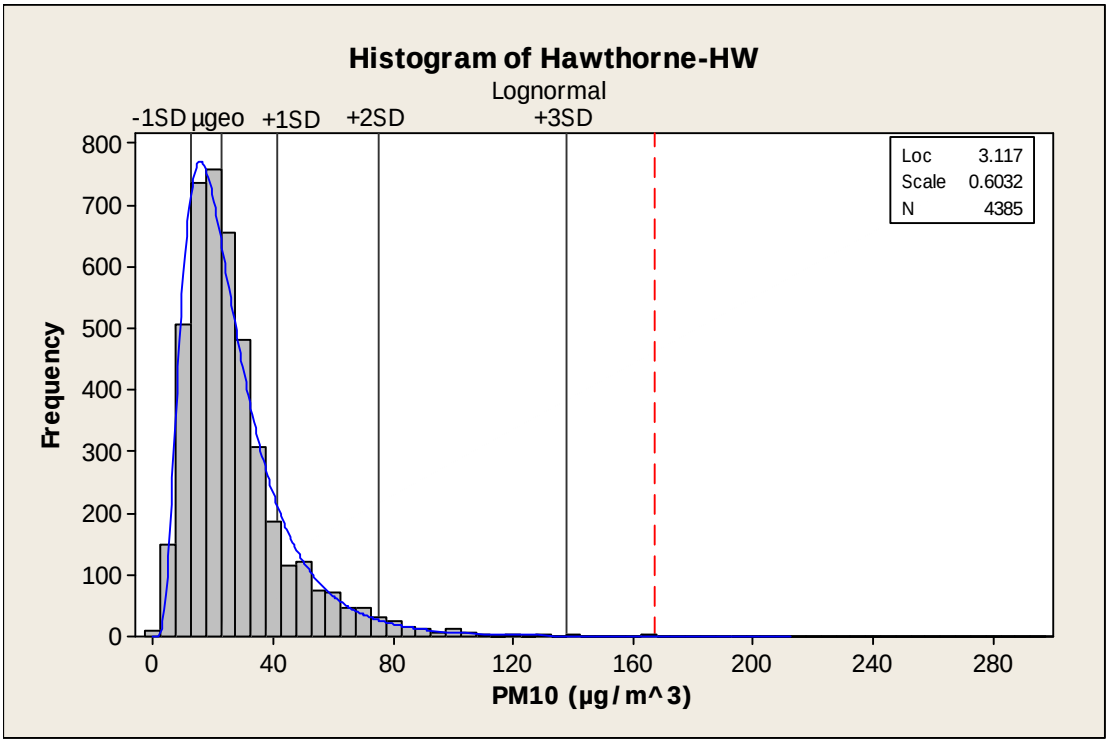
Location	Quarter	N Quarterly	µgeo (µg/m^3)	Annual ugeo (µg/m^3)
Hawthorne 01/01/1997 to 12/31/2009	1	1041	28.82	22.58
	2	1119	17.74	
	3	1122	22.76	
	4	1103	22.69	

The annual value is far below the August 6th event of 167 µg/m^3.

The following are the calculations for the geometric mean, geometric standard deviation, and the upper boundary of the 1st, 2nd, and 3rd standard deviations from the geometric mean.

Geometric Mean (µgeo): Exp(Loc)=22.58
Geometric Standard Deviation (σgeo): Exp(Scale)= 1.8280
+1 Standard Deviation (+1SD): Exp(Loc +Scale)= µgeo* σgeo= 41.27
+2 Standard Deviation (+2SD): Exp(Loc +2*Scale)= µgeo* (σgeo)^2= 75.44
+3 Standard Deviation (+3SD): Exp(Loc +3*Scale)= µgeo* (σgeo)^3= 137.91

The histogram presents the historical values and the event value with a red dashed line. The blue line is a fitted line overlay of a lognormal distribution.



Noting that the normal historical values fall within the lognormal distribution, it is reasonable to utilize plus or minus 2SD above the geometric mean as the bounds of normal PM10 values. The event value exceeds 3SD. The event value is clearly outside the normal historical fluctuation.

PM2.5

Normal historical fluctuation for PM2.5 was computed in a three-step process in order to assess whether an observed value is in excess.

First, all historical PM2.5 values from each monitoring station were aligned from least to greatest. The location of the effected value in relation to the rest of the historically values is expressed as a %ile.

Second, a box plot analysis was preformed on the historical data. The interquartile range (IQR) was calculated. This was then compared to the event value.

Third, a lognormal distribution analysis was preformed on the historical data. The geometric mean, geometric standard deviation, and the 1st, 2nd, and 3rd geomantic standard deviations above the geometric mean where calculated. These where then compared to the event value.

In addition, an analysis is included showing that winds speeds during this event are not the norm.

Ranking

Guidance found at 72 Federal Register 55 March 22, 2007, pages 13560-81, states that a lesser amount of documentation would likely be necessary for "extremely high" concentrations (e.g. > 95th%ile) than for concentrations that were closer to "typical levels" (e.g. < 75th%ile).

The data ranking for the Hawthorne monitoring station data collected from 1999 through 2009 verifies that the PM2.5 concentration on August 6, 2009, is above the 95th%ile. Consequently, we can conclude that the event day concentration is outside the normal historical fluctuation.

Interquartile Range

The IQR is a measure of statistical dispersion, and is a "robust statistic." Robust statistics seek to provide methods that emulate classical methods, but which are not unduly affected by outliers or other small departures from model assumptions. The IQR was calculated on a quarterly basis and on a yearly basis.

The following is the IQR for all Hawthorne data:

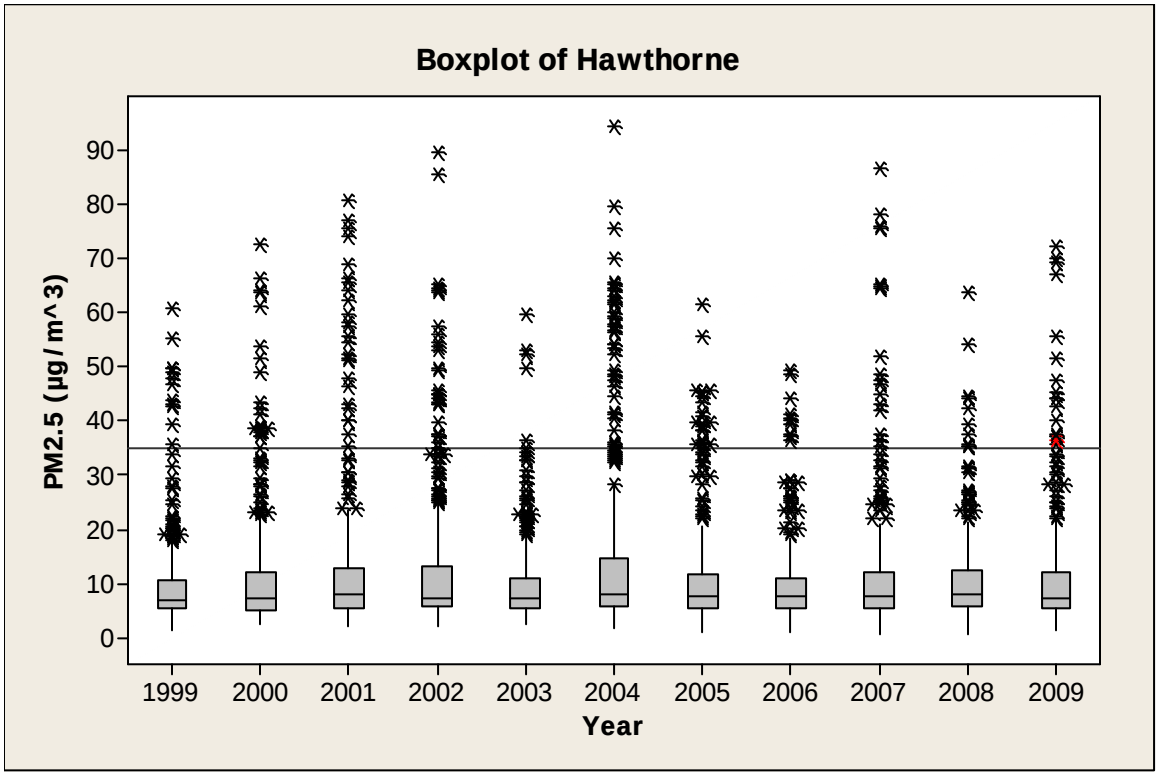
First Quartile (Q1): 5.4 µg/m^3
Median (Q2): 7.5 µg/m^3
Third Quartile (Q3): 11.6 µg/m^3
IQR: 6.2 µg/m^3

The IQR was calculated on a quarterly basis (shown in Table 9) along with the annual.

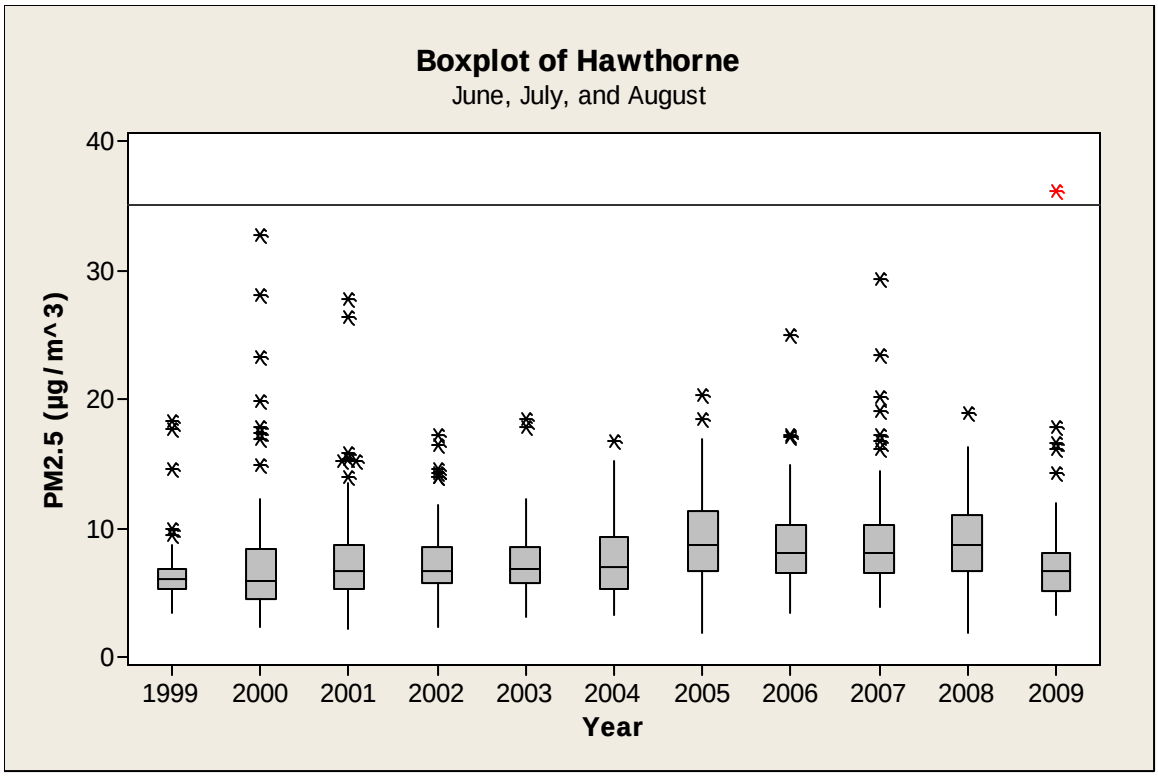
Table – 9 Hawthorne Interquartile (µg/m^3)

Quarter	Sample Size (N)	Q1	Q2	Q3	IQR
1	963	7.8	14	27.9	20.1
2	971	4.4	5.7	7.6	3.2
3	946	5.6	7.2	9.4	3.8
4	937	5.85	7.8	11.3	5.45
All	3817	5.4	7.5	11.6	6.2

The boxplot presents the historical PM2.5 values, by year; the event value is marked in red. The blue dashed line represents the current PM2.5 standard.



Because this event occurred during the third quarter, it maybe more valuable to focus on other PM2.5 values during the same time of the year, June-August. The revised boxplot presents the historical PM2.5 values, by year, during the 3rd quarter (June-August) of each year. The event value is marked in red. The blue dashed line represents the current PM2.5 standard.



The only event exceeds the current PM2.5 standard is the wildfire event.

Analysis of the boxplot graphs permit us to conclude that the event concentration is outside of normal historical fluctuation.

Lognormal Distribution

Lognormal distribution analysis was conducted to establish the normal historical fluctuations for the Lindon station (inclusive of exceptional event results). Lognormal distribution was selected because of its ability to accurately describe the distribution of measured concentrations of PM2.5. The geometric mean (µgeo) was calculated on a quarterly basis (shown in Table 10) and on an annual basis. The annual basis provides the greatest number of data points and is sufficiently similar to the spring quarterly value thus; the annual geometric mean is used to reflect the normal historical value.

Table 10 – Geometric Mean of PM10

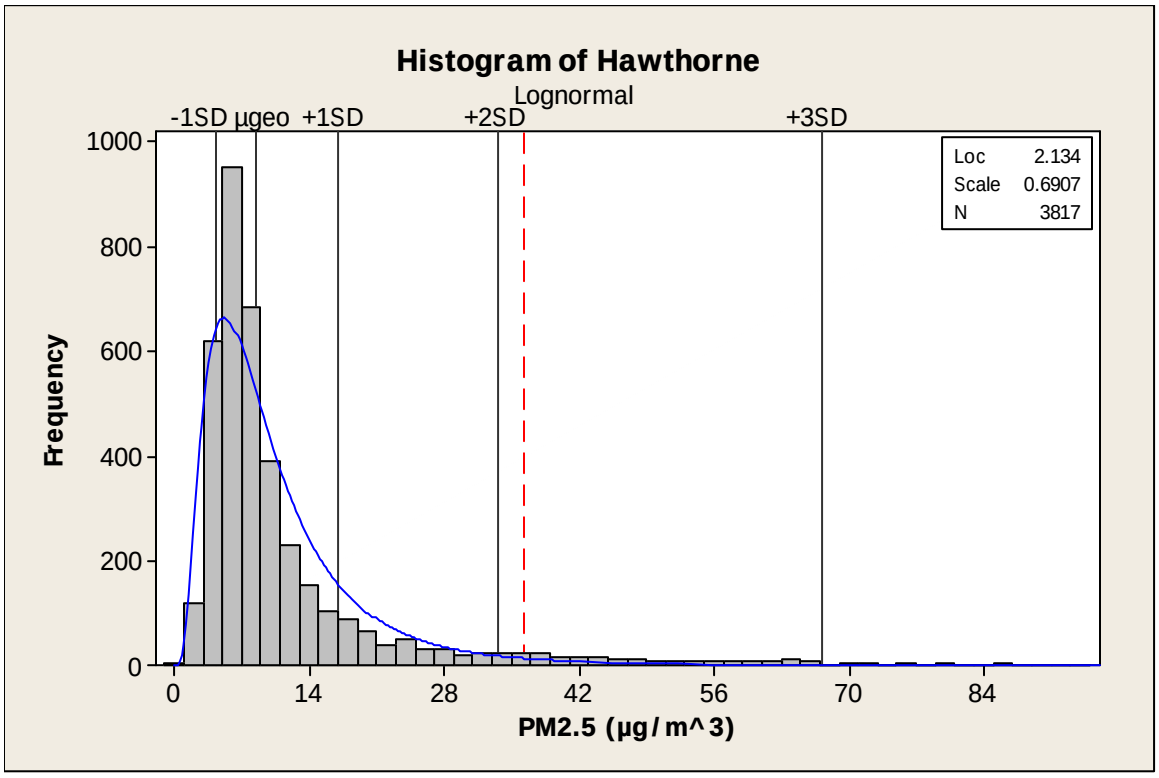
Location	Quarter	N Quarterly	µgeo ($\mu g/m^3$)	Annual ugeo ($\mu g/m^3$)
Hawthorne 01/01/1999 to 12/31/2010	1	963	14.34	8.45
	2	971	5.88	
	3	946	7.28	
	4	937	8.28	

The annual value is far below the August 6th event of 36.2 $\mu g/m^3$.

The following are the calculations for the geometric mean, geometric standard deviation, and the upper boundary of the 1st, 2nd, and 3rd standard deviations from the geometric mean.

Geometric Mean (μgeo): Exp(Loc)=8.45
Geometric Standard Deviation (σgeo): Exp(Scale)= 1.9951
+1 Standard Deviation (+1SD): Exp(Loc +Scale)= μgeo* σgeo= 16.86
+2 Standard Deviation (+2SD): Exp(Loc +2*Scale)= μgeo* (σgeo)^2= 33.63
+3 Standard Deviation (+3SD): Exp(Loc +3*Scale)= μgeo* (σgeo)^3= 67.09

The histogram presents the historical values and the event value with a red dashed line. The blue line is a fitted line overlay of a lognormal distribution.



Noting that the normal historical values fall within the lognormal distribution, it is reasonable to utilize plus or minus 2SD above the geometric mean as the bounds of normal PM2.5 values. The event value exceeds 3SD. The event value is clearly outside the normal historical fluctuation.

Clear Causal Relationship

Impacted Area

Fire areas and wafting smoke are easier to identify under false coloring of the satellite. The pink and orange spots are fire locations, the largest of which is the Stansbury fire in Tooele County. Smaller fires can be seen in the southern and southwestern portions of the state, along with large regions of smoke.

Image 2 – False Color Imagery

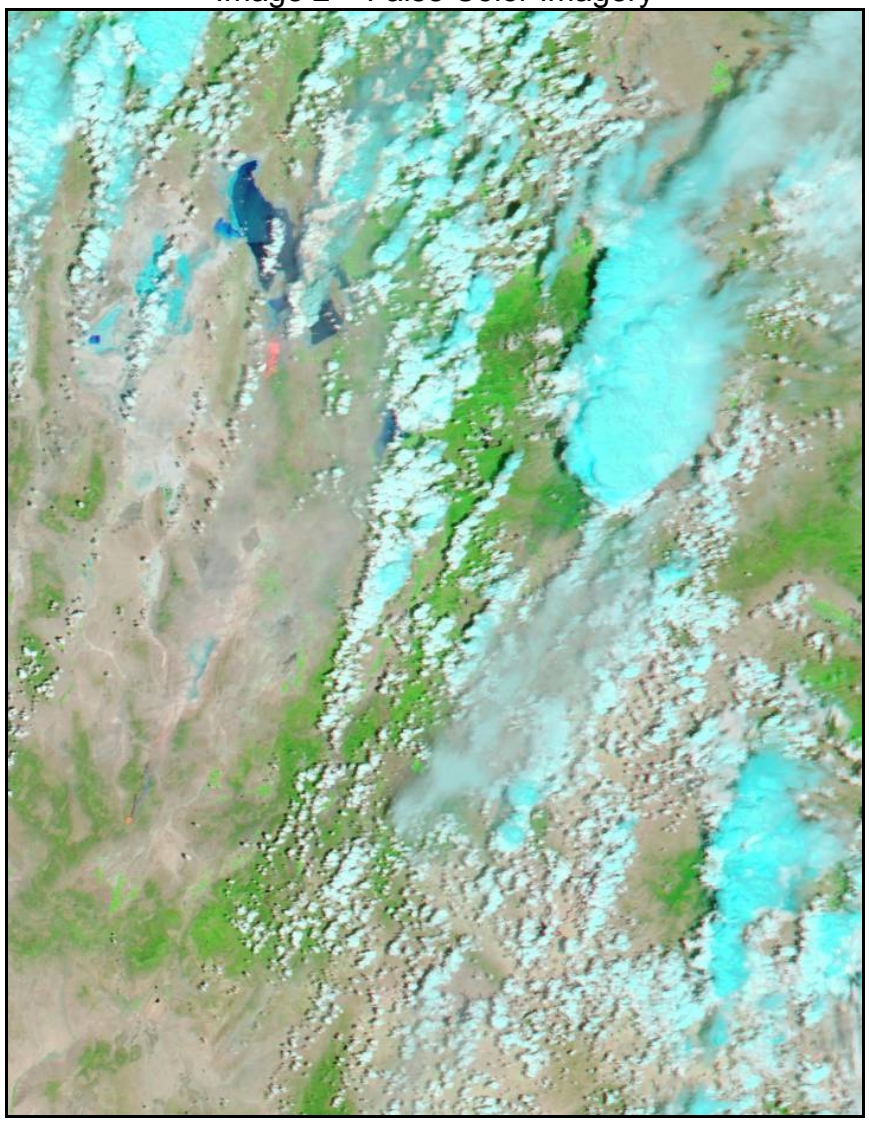
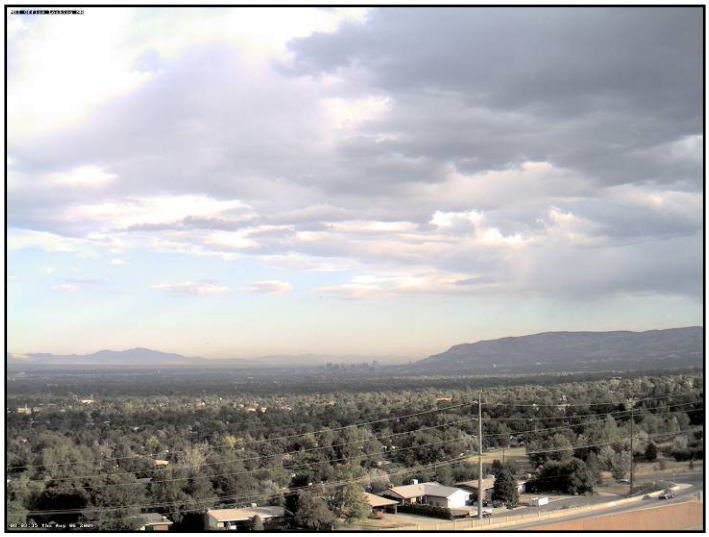


Photo Documentation of Smoke in the Salt Lake Valley
August 6, 2009

8 a.m. A haze is visible in the horizon.



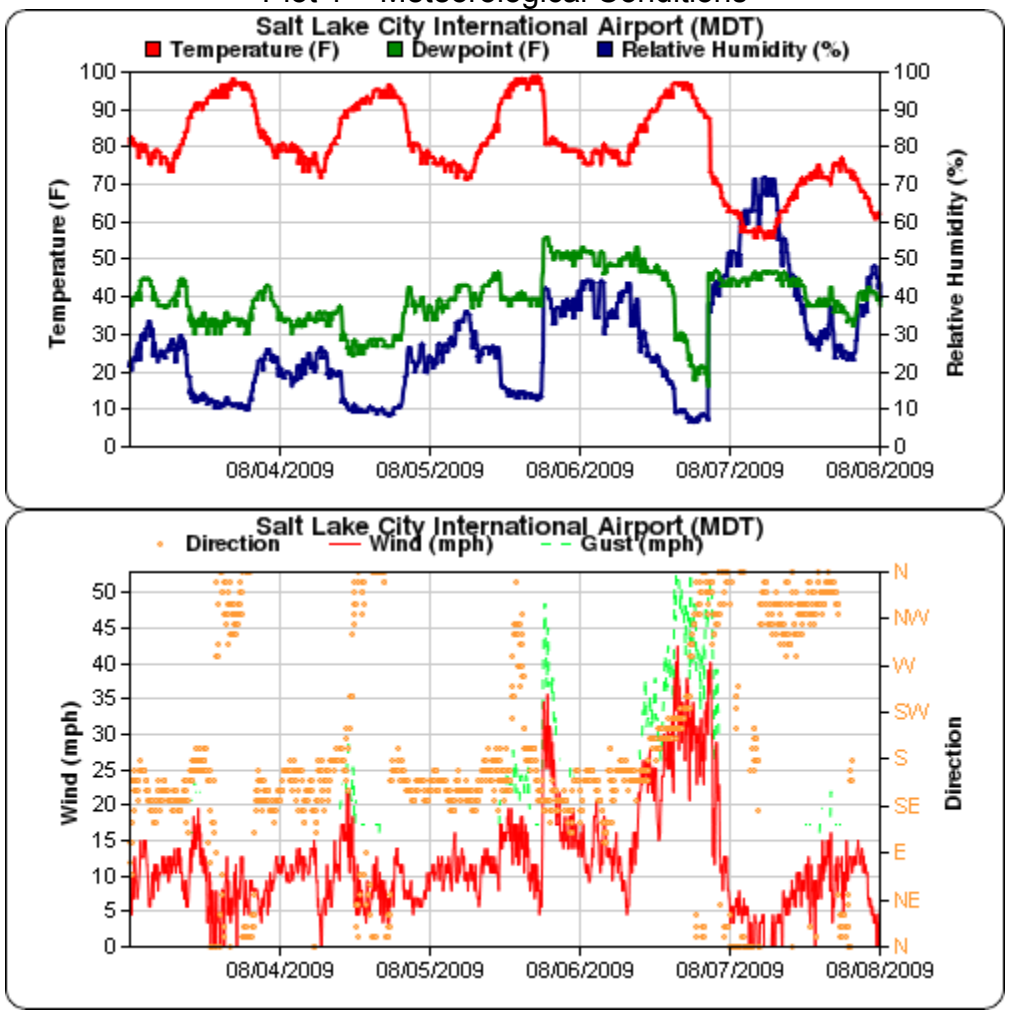
Late afternoon.

Just before sunset and hours before the peak PM concentrations.

Meteorology and Wind Effect

Hot dry conditions with high winds in northern Utah before, during and after the event were prime wildfire conditions.

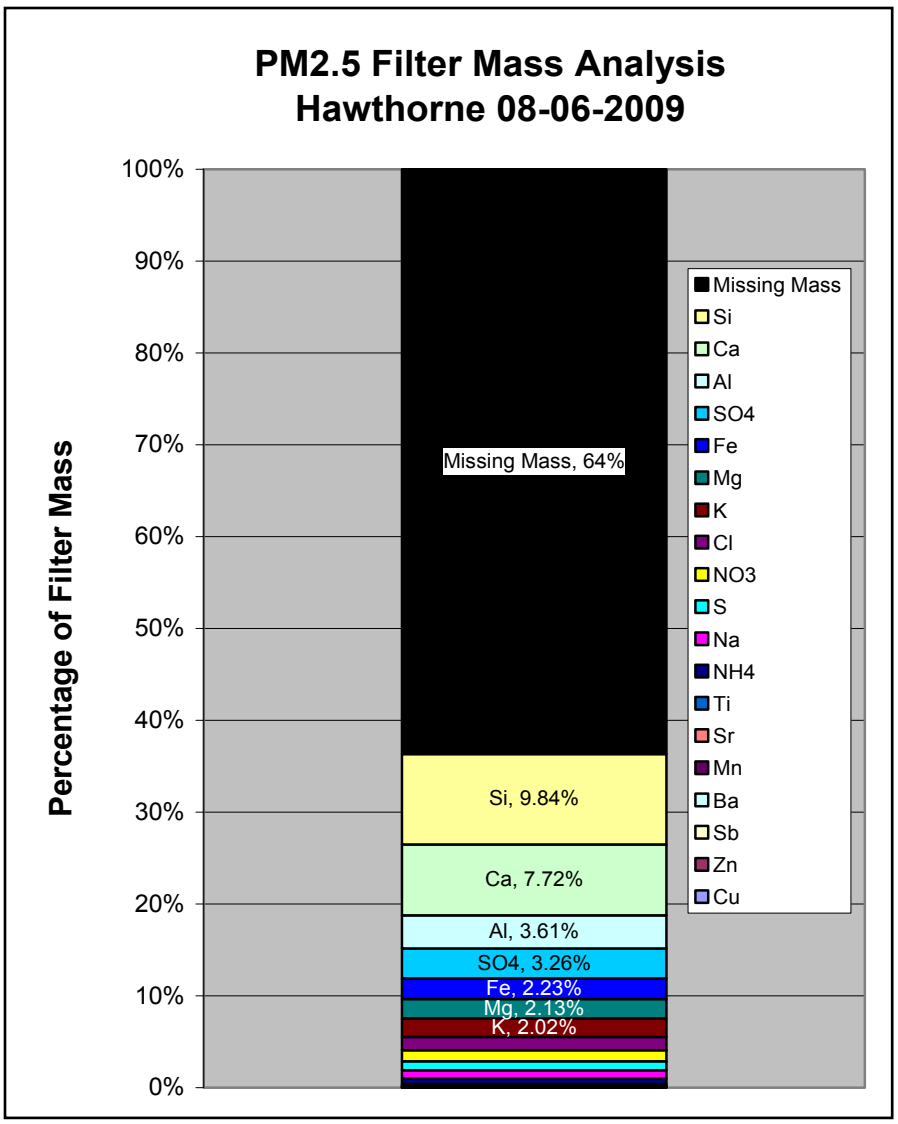
Plot 1 – Meteorological Conditions



Speciation

Clear and causal relationship evidence may be evaluated from the Hawthorne filter analysis, which is dominated by 63% missing mass (Appendix 1 contains speciation data). The mass is not distinguishable from the Teflon filter on which it was collected. Most of this mass is organic carbon due to the smoke from the fires.

Figure 4 – Filter Mass Analysis



Potassium is released in fires as potassium chloride and potassium sulfate and is used as an indicator of biomass burning. Potassium and sulfate data for the Hawthorne station collected as part of the PM2.5 Speciation Trends Network can be used to compared pre and post event day conditions (Table 11 and Appendix 1). Potassium was absent before and after the event day and contributed 2.02% of the filter mass, as shown in Figure 4. Sulfate was also elevated during the event day, contributing 3.26% of the filter mass.

Table 11 – Fire Tracer Data (in ug/m^3)

	Pre-event Day August 5	Event Day August 6	Post-event Day August 8
Potassium	0	0.7303	0
Sulfate	0.7747	1.180	0.2866

No Exceedance or Violation But For the Event

1. The following table shows the expect background concentrations (geometric mean) for the time period surrounding this event, event values and differences associated with this event;

Monitoring Station	**PM 10 geometric means ($\mu g/m^3$)**	**PM10 Event Values ($\mu g/m^3$)**	**Difference**	**PM2.5 geometric mean ($\mu g/m^3$)**	**PM2.5 Event Value ($\mu g/m^3$)**	**Difference**
Ogden	23.13	181	157.87			
North salt Lake	36.86	204	167.14			
Hawthorne	22.58	167	144.42	8.45	36.2	27.8
Lindon	25.18	162	156.82			

2. Filter chemistry analysis of the Hawthorne filter reveals that 547 µg or 64% is associated with missing mass likely attributed to smoke from the wildfires.

3. Tracer analysis supports contribution from the fire.

4. A survey of complaint and inspection records shows that there were no complaints the day of the event. There were no reports of anthropogenic events at the time that would cause PM exceedances of this magnitude.

Mitigation

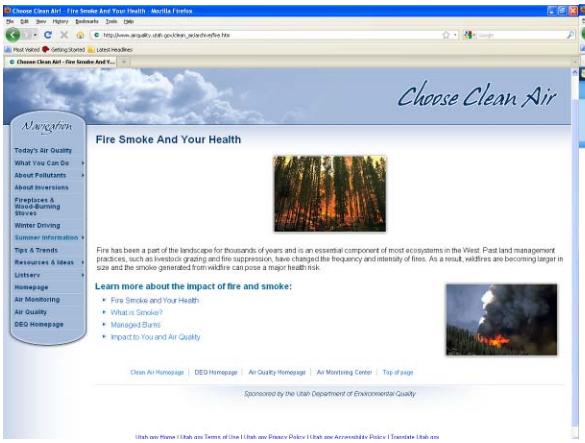
1. Utah rule R302-202 prohibits open burning and burning of waste materials.

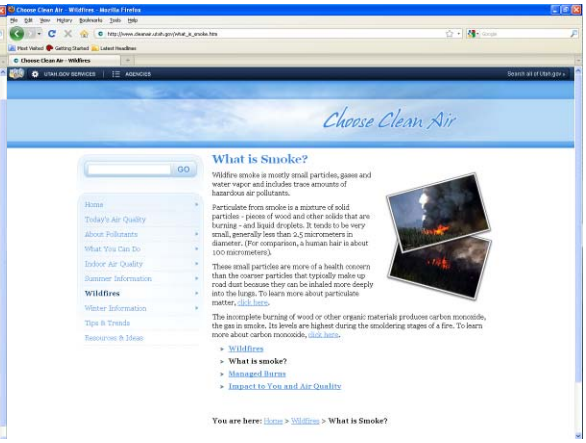
2. Utah rule R307-204 Emission Standards: Smoke Management helps minimize smoke from other sources during an event. The rule and plan states that new prescribed fires and new wildland fire use events would not be approved if there was a potential to exceed the NAAQS. The rule also requires all land managers to submit an annual non-burning alternative to fire report to the executive director. This report lists areas that were treated in the previous year by alternative methods and describes the methodology.

3. Wildland fire management in Utah is coordinated by the Utah Oversight Committee pursuant to the Master Cooperative Wildland Fire Management agreement reached between the State of Utah Division of Forestry, state lands agencies (Bureau of Land Management, Bureau of Indian Affairs, National Park Service etc.) and the Intermountain Region of the Forest Service.

4. A news release during the episode advised citizens of the potential health impacts of smoke from wildfires. Extensive news coverage existed during the event.

5. A series of web sites about emissions from wildfire were posted on the DEQ web site during the event. They covered the health impacts of PM and actions a person could take to minimize exposure to PM.

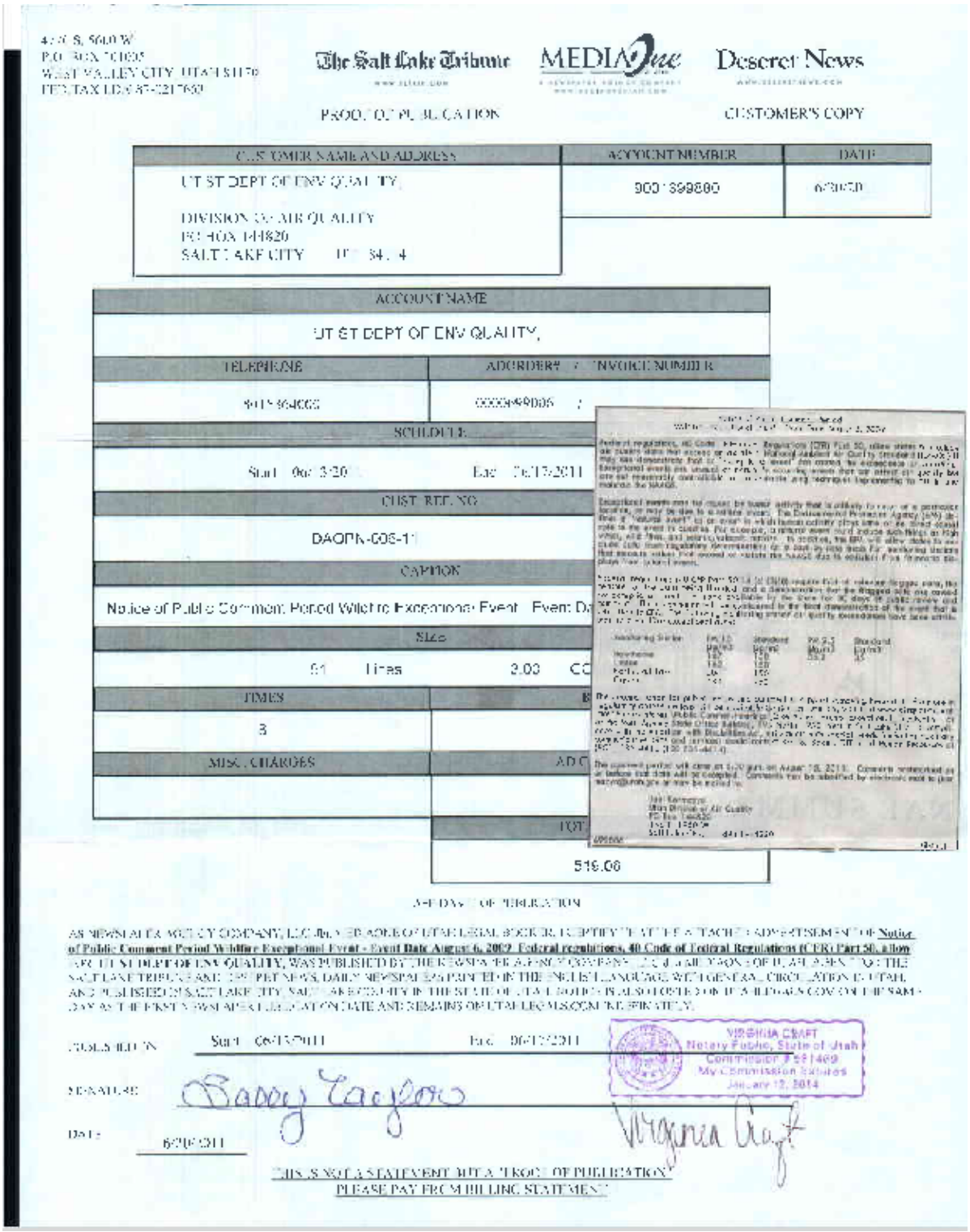




6. The Bureau of Land Management has placed a ban on motorized access for 27,000 acres west of the Stansbury Mountains for at least two years to let the land recover from the fire.

Public Comment

The documentation was available for public comment from June 15 to July 15, 2011 in all major Salt Lake valley publications.



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UT ST DEPT OF ENV QUALITY,	
TELEPHONE	ADORDER# / INVOICE NUMBER
8015366000	0000649086 /
SCHEDULE	
Start 06/15/2011	End 06/15/2011
CUST. REF. NO.	
DAQPN-605-11	
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Appendix 1

Speciation Data

Missing Mass, Figure 4 Data

Lab ID	Client ID	Site	Sample Date	Part. Size
09-X2045	9518158	Hawthorne (HW)	8/6/2009	PM2.5

Deposit Area	Net Mass	Net Unc.	Volume	Volume Unc.	Units
11.3	869	10	24	2.4	ug/m3

Na	Na Unc.	Mg	Mg Unc.	Al	Al Unc.	Si	Si Unc.	P	P Unc.	S	S Unc.
0.0000	0.0295	0.7698	0.0982	1.3060	0.1555	3.5620	0.4039	0.0004	0.0023	0.3559	0.0406

Cl	Cl Unc.	K	K Unc.	Ca	Ca Unc.	Ti	Ti Unc.	V	V Unc.	Cr	Cr Unc.
0.4391	0.0497	0.7303	0.0821	2.7960	0.3134	0.0758	0.0085	0.0021	0.0006	0.0016	0.0005

Mn	Mn Unc.	Fe	Fe Unc.	Co	Co Unc.	Ni	Ni Unc.	Cu	Cu Unc.	Zn	Zn Unc.
0.0138	0.0016	0.8075	0.0903	0.0000	0.0010	0.0000	0.0005	0.0086	0.0014	0.0096	0.0012

Ga	Ga Unc.	Ge	Ge Unc.	As	As Unc.	Se	Se Unc.	Br	Br Unc.	Rb	Rb Unc
0.0000	0.0005	0.0003	0.0004	0.0009	0.0006	0.0005	0.0003	0.0042	0.0006	0.0024	0.0004

Sr	Sr Unc.	Y	Y Unc.	Zr	Zr Unc.	Mo	Mo Unc.	Pd	Pd Unc.	Ag	Ag Unc.
0.0164	0.0019	0.0004	0.0005	0.0028	0.0007	0.0030	0.0009	0.0006	0.0022	0.0011	0.0023

Cd	Cd Unc.	In	In Unc.	Sn	Sn Unc.	Sb	Sb Unc.	Ba	Ba Unc.	La	La Unc.
0.0000	0.0024	0.0012	0.0027	0.0000	0.0032	0.0120	0.0042	0.0126	0.0034	0.0000	0.0027

Hg	Hg Unc.	Pb	Pb Unc.	Br	Br Unc.	Cl	Cl Unc.	NO3	NO3 Unc.	SO4	SO4 Unc.
0.0001	0.0008	0.0031	0.0010	0.0000	0.0210	0.5220	0.0580	0.4370	0.0490	1.1800	0.1320

Na	Na Unc.	NH4	NH4 Unc.	K	K Unc.
0.3210	0.0360	0.2160	0.0240	0.2940	0.0330

PM2.5 Speciation, Trends Network – Table 11 Data

Station:	Date:	Total Mass:	Ammonium:	Potassium:	Sodium:
Hawthorne	8/5/2009	8.06	0.26623514	0	0.042138
Hawthorne	8/8/2009	8.47	0.10018937	0	0.022644
Hawthorne	8/11/2009	0.00	0	0	0

Station:	Date:	Nitrate:	Sulfate:	EC:	OC:	OC (mass):	Tot. C (comb).
Hawthorne	8/5/2009	0.215612	0.774765	0.750228	1.697749	2.376849	3.12707727
Hawthorne	8/8/2009	0.163408	0.2866	0.193529	1.651416	2.311983	2.505511468
Hawthorne	8/11/2009	0	0	0	0.170981	0.239373	0.239373366