PM2.5 Exceptional Event – Independence Day Fireworks

Event Date – July 4, 2010

Cottonwood Monitoring Station
Ogden Monitoring Station

Utah Department of
Environmental Quality

Table of Contents

Definition of Event and Introduction 2
Study Areas Community Event Locations 3
Affect Air Quality 3
Normal Historical Fluctuation 5
Ogden 6
Cottonwood 6
Causal Relationship 7
Meteorology 8
Hysplit Air Modeling 9
No Exceedance or Violation But For the Event 10
Mitigation 11
Utah Air Quality Public Notifications 11
Public Comment 11

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 the following evidence must be provided:

1. The event meets the definition of an exceptional event;
2. 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;
3. The event is associated with a measured concentration in excess of normal historical fluctuations, including background;
4. There would have been no exceedance or violation but for the event; and
5. The fireworks event was held on July 4, Independence Day, as part of a traditional or national culture event (40 CFR 50.14 (b)(2)).

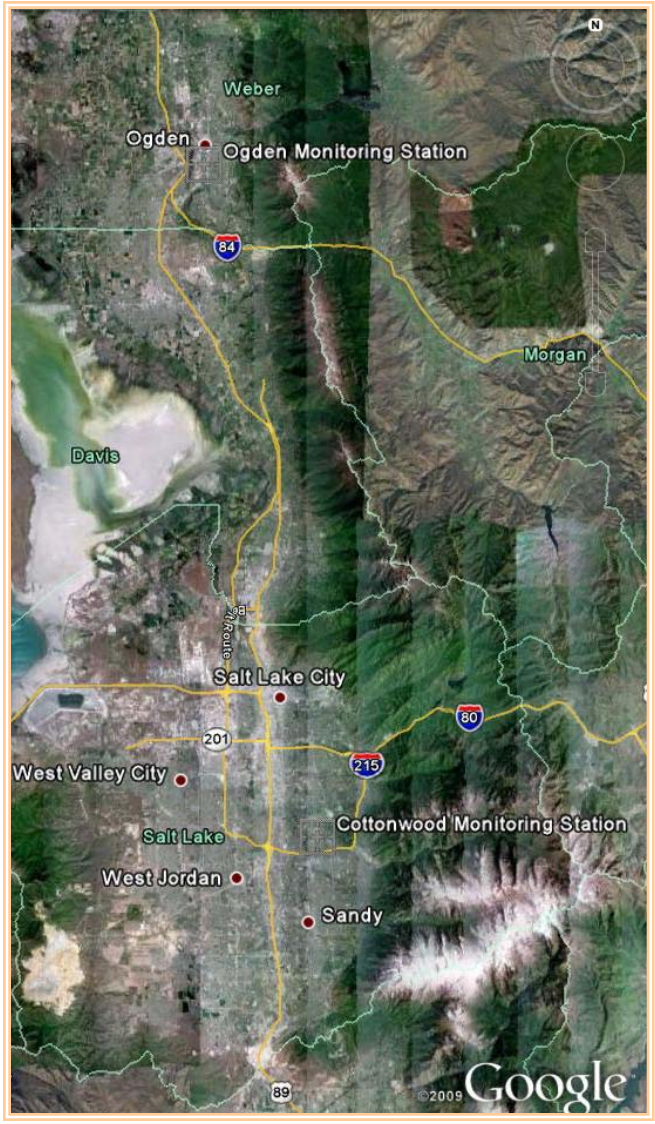
Exceedances of the 24-hr PM2.5 standard of 42.1 $\mu g/m^3$ occurred on July 4, 2010 at the Ogden monitoring station, located in Ogden, Utah and 35.9 $\mu g/m^3$ at the Cottonwood monitoring station located in Holladay, Utah. The Division of Air Quality (DAQ) investigated the events and has determined that the exceedances are associated with fireworks events sponsored by many communities celebrating the national 4th of July holiday. Utahns are exuberant in their celebration of Independence Day. Fireworks are a part of most community celebrations. DAQ was able to confirm 31 community fireworks events over the holiday weekend.

Study Areas

Ogden is located north of Salt Lake City in Weber County. The Ogden monitoring station is located adjacent to the Ogden Community Action Center and adjacent to a large grass field where legal and illegal fireworks are set-off (confirmed by Ogden Fire Department).

Nearby communities that are known to sponsor 4th of July fireworks events include Riverdale (at Riverdale Park), Clinton, Sunset (at 85 W. 1800 N), Clearfield (at Fisher Park) and Layton (Commons Park).

The Cottonwood monitoring station is located in the city of Holladay in Salt Lake County. The station is situated between a high school football and baseball field conducive to street level fireworks.



Affect Air Quality

Fireworks consist of 75% gunpowder (potassium nitrate,KNO_3), 15% carbon and 10% sulfur. The materials react with each other when heat is applied from a fuse. Metal compounds and other elements described in Table 1, are added to generate desired color and or pyrotechnic effects.

The Hawthorne station was scheduled for the routine PM2.5 speciation on the 4th and the data is shown in Table 1. While the Hawthorne station did not exceed the standard, it does provide an indication of air quality in the valley during the national holiday. The levels of potassium and sulfur, amongst other elements, are high and would be expected to be so because they represent the fundamental components of fireworks.

Table 1 – Fireworks Chemistry

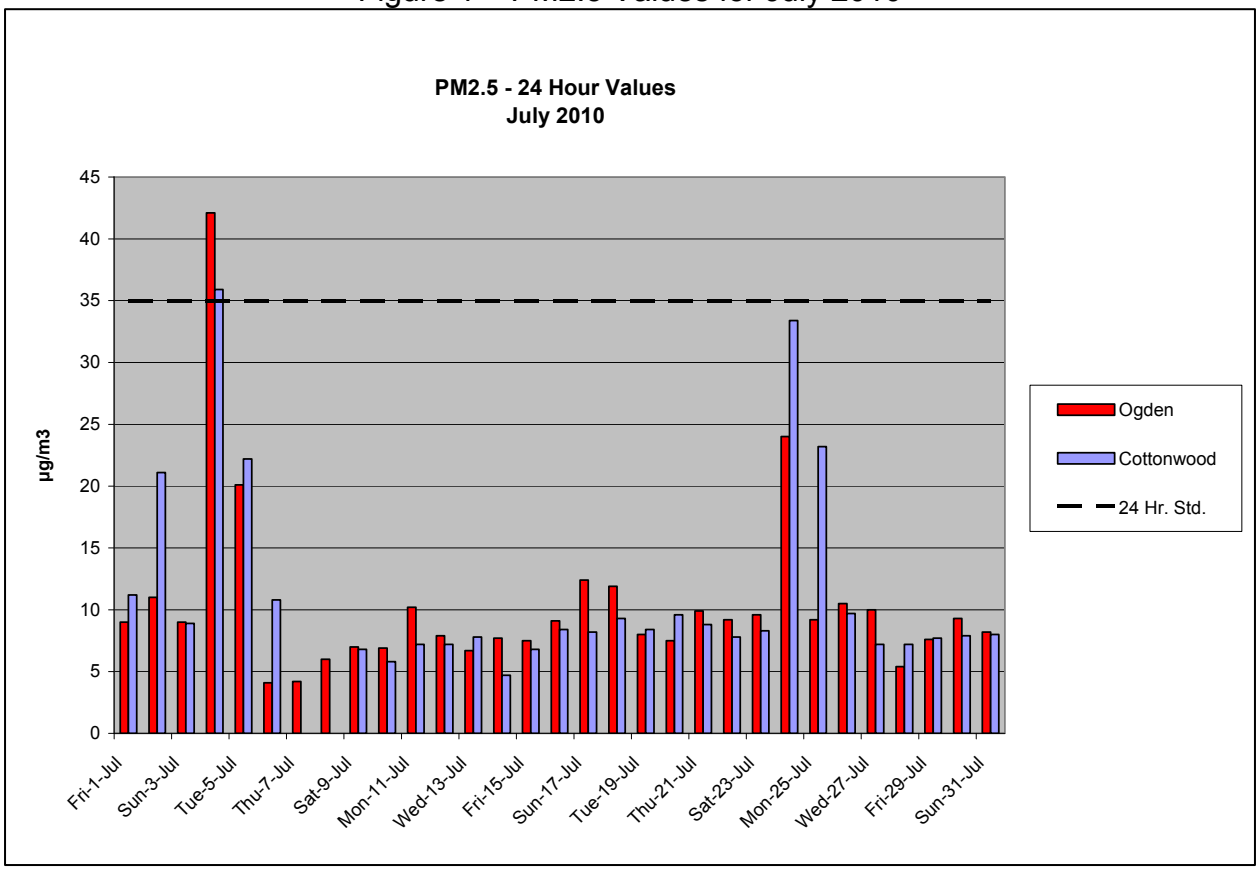
Hawthorne* PM2.5 July 1, 2010 (µg/m^3)	Hawthorne* PM2.5 July 4, 2010 (µg/m^3)	Element /Compound	Oxidizer	Colorant	Propellant or Fuel	Stabilizer	Smoke	Glitter Effect
0.07530	0.07300	Aluminum		√				
0.01740	0	Antimony						√
0.00151	**0.180**	Barium		√		√		
0.118	0.05190	Calcium		√				
Not Tested	Not Tested	Carbon			√			
0.01020	**0.426**	Chlorine	√					
0.00370	**0.07400**	Copper		√				
0.05810	0.03130	Iron		√				
Not Tested	Not Tested	Lithium		√				
0.01850	**0.300**	Magnesium		√				
0.195	**2.45**	Potassium	√					
0	0	Phosphorus			√			√
0.00711	**0.06830**	Sodium		√				
0.00162	**0.03860**	Strontium	√					
0.595	**0.931**	Sulfur			√			
0.00209	0.00128	Titanium		√				
0.00498	**0.01800**	Zinc					√	
Not Tested	Not Tested	Chlorates	√					
0.442	0.292	Nitrates	√					
Not Tested	Not Tested	Perchlorates	√					

**Flagged Data.*
Primary fireworks components in red.
Increased concentration on event day bolded.

Normal Historical Fluctuation

Figure 1 presents the PM2.5 values for the two monitoring stations for July. Utah law permits fireworks from three days before to three days after the 4th of July and the 24th of July (Pioneer Day, a Utah holiday). Elevated values near/over the standard were due to firework events.

Figure 1 – PM2.5 Values for July 2010



Ogden

Table 2 presents the annual mean and maximum values for the 24-hr PM2.5 at the Ogden station from it's inception in 2001 until 2010. The annual mean ranges from 9.5 to 14.6 µg/m^3. The observed value for this event is 42.1 µg/m^3.

Table 2 – Ogden 24-hr PM2.5

Year	Observations	Annual Mean (µg/m^3)	Annual Max (µg/m^3)
2001	50	12.4	66.6
2002	119	14.6	108.3 (4th of July)
2003	118	9.9	38.3
2004	118	13.9	74.2
2005	115	10.5	42.4
2006	120	9.8	47.6
2007	121	11.7	76.8
2008	358	9.9	46.7
2009	343	10.2	56.4
2010	297	9.5	56.1

Cottonwood

Table 3 presents the annual mean and maximum values for the 24-hr PM2.5 at the Cottonwood station from 2007 until 2010. The annual mean had a limited range of 10.6 to 11 µg/m^3. The observed value for this event is 35.9 µg/m^3.

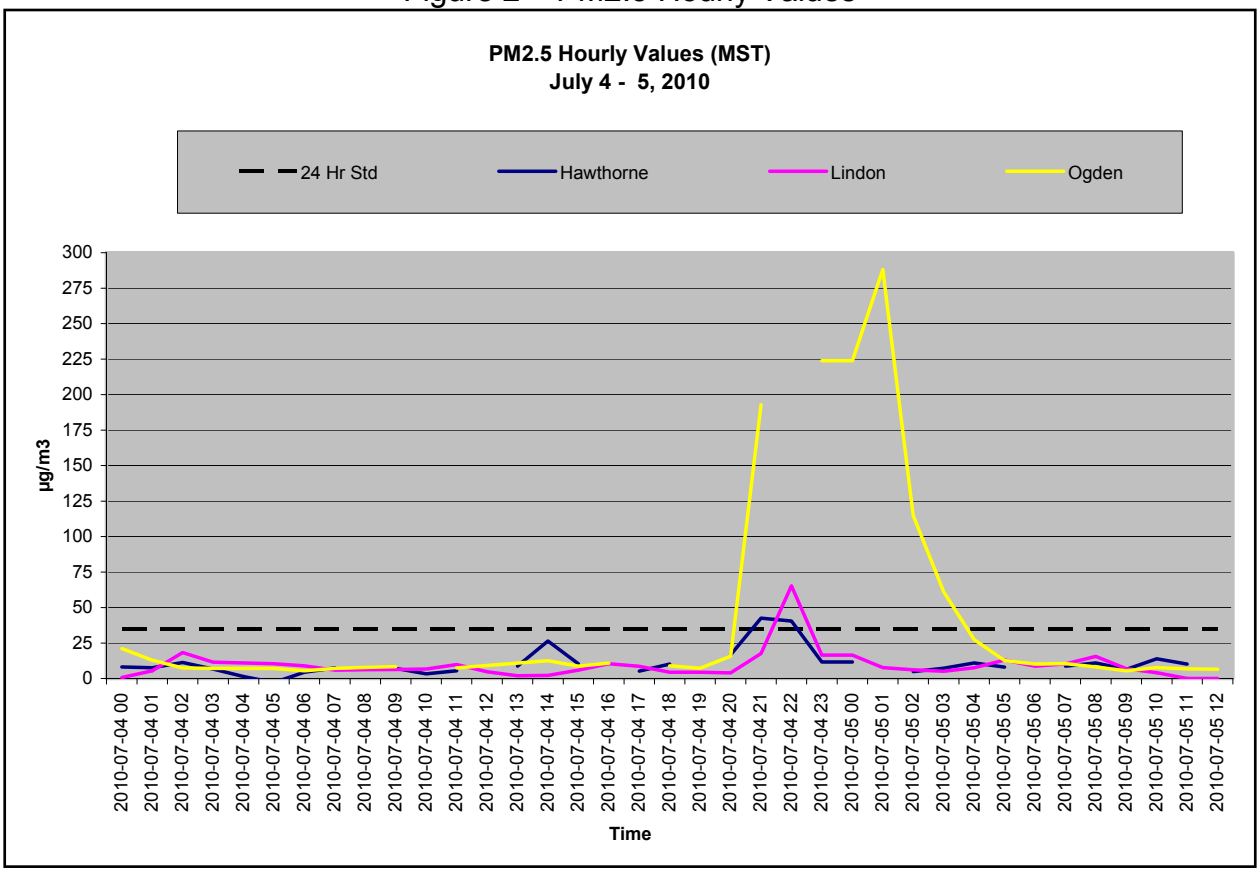
Table 3 – Cottonwood 24-hr PM2.5

Year	Observations	Annual Mean (µg/m^3)	Annual Max (µg/m^3)
2007	275	10.9	78.2
2008	405	11	54.6
2009	424	10.1	64.3
2010	283	10.6	73.5

Causal Relationship

Figure 2 shows the PM2.5 hourly values for select monitoring stations from July 4 to mid-day July 5, 2010 (missing values are due to system interruption). Fireworks traditionally take place between 9 and 10 p.m. PM2.5 levels increased dramatically between those hours, with some carry over into the next day due to the filter change at midnight.

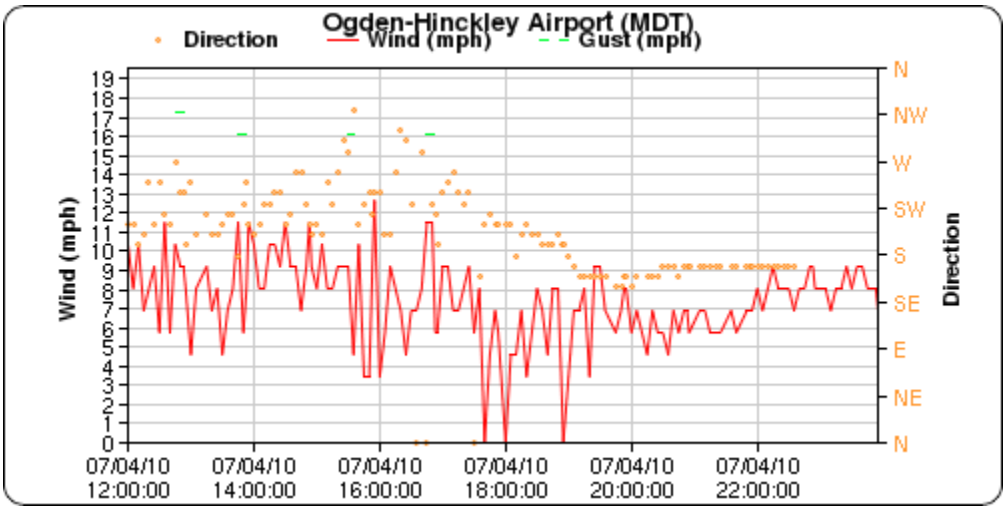
Figure 2 – PM2.5 Hourly Values

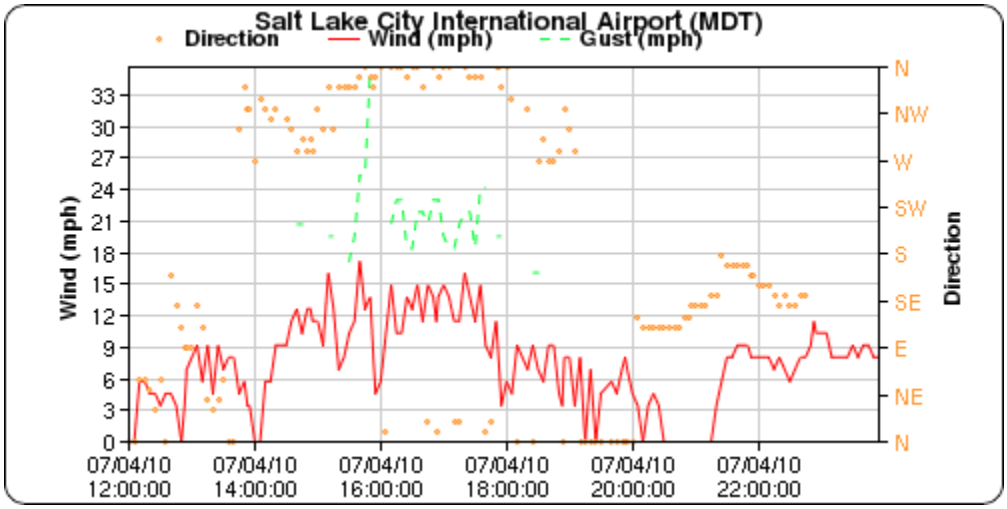


Meteorology

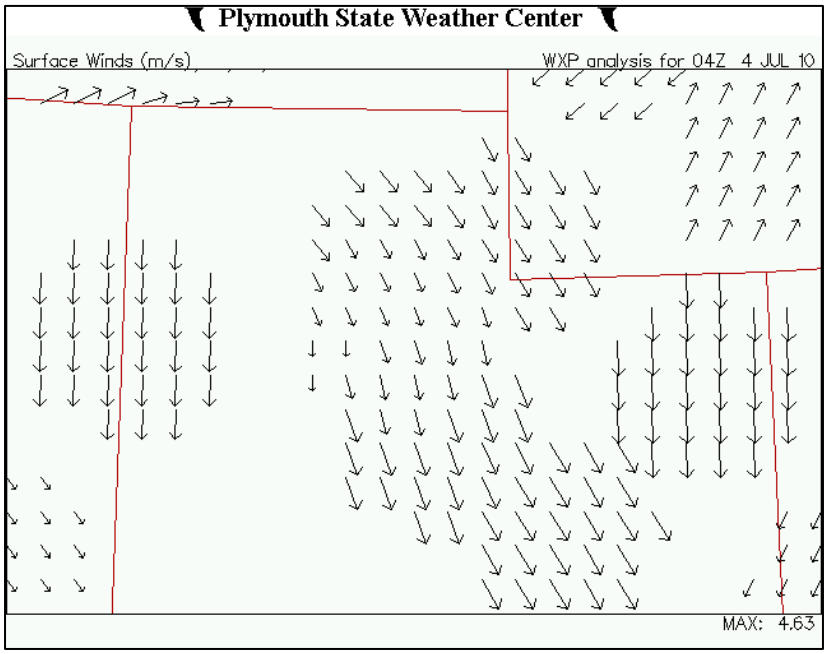
Meteorological data from the Ogden-Hinckley Airport shows late night southerly wind speeds ranging from 7-9 mph, indicating that fireworks events from Riverdale, Clinton, Sunset, and Clearfield would be expected to impact the air quality at the Ogden station, as well as fireworks immediately adjacent the station.

Wind conditions in the Salt Lake Valley (Salt Lake airport) were stagnant at the beginning of the fireworks display hours, then increased to around 8-9 mph. Stagnant conditions, combined with large numbers of fireworks displays, were likely contributors to the exceedance at the Cottonwood station.





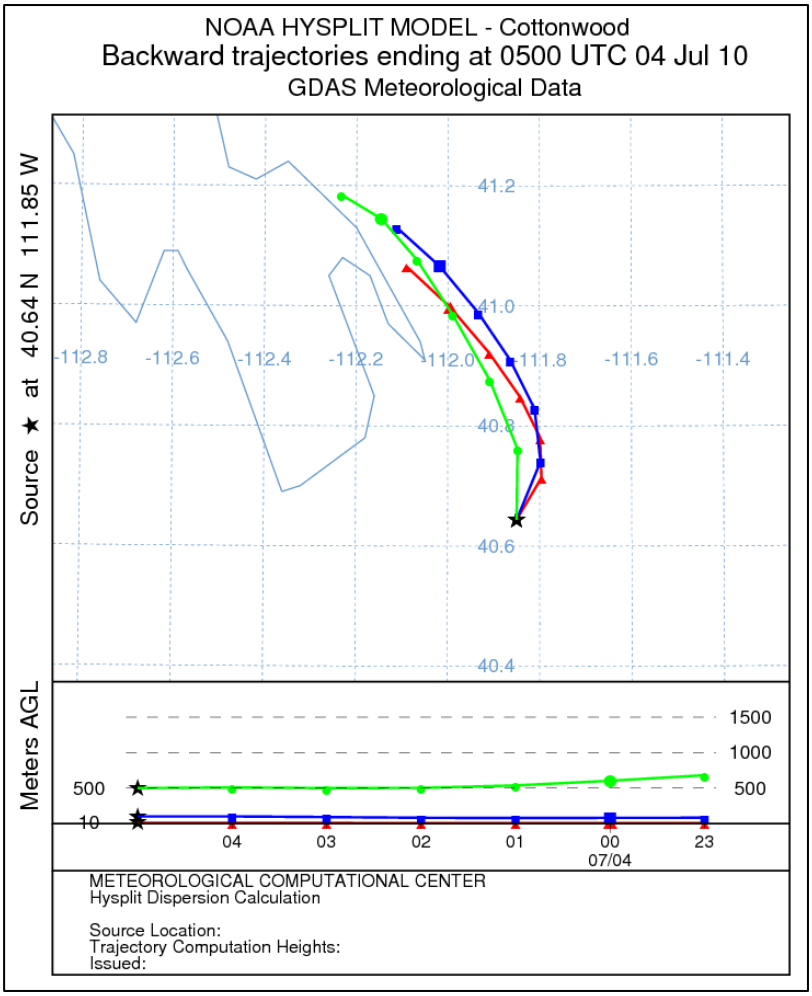
Wind vector mapping for the Cottonwood station at the height of fireworks events shows air movement from the valley towards the station.



Hysplit Air Modeling

Hysplit is a particle tracking model created by the National Oceanic and Atmospheric Administration. The model can be used to back track air movement so that we can determine how the PM2.5 standard exceedance occurred at the. Cottonwood monitoring station.

Six hour back trajectories starting at 11 p.m. local time were modeled at 10, 50 and 100 meters from the ground. The star indicates the location of the Cottonwood station and each hour is designated by a symbol on each trajectory. There was little variation between 10 and 50 meters. Overall, the modeling shows that the Cottonwood monitoring station was influenced by Salt Lake Valley air during the hours when fireworks are set off and would linger within the atmosphere in the valley.

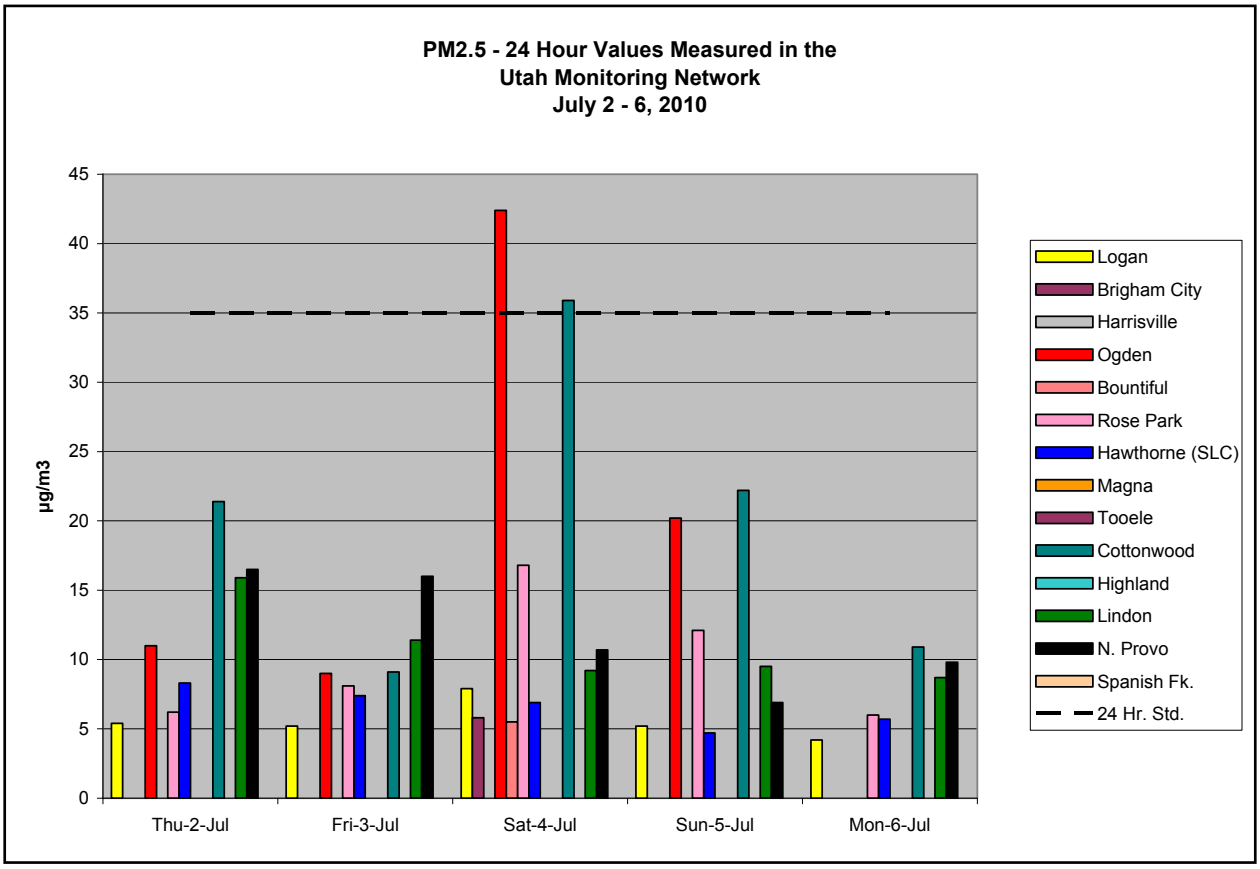


Modeling for Ogden was not performed because there is a known history of localized fireworks that influences the monitoring station.

No Exceedance or Violation But For the Event

Figure 3 shows the PM2.5 24-hr values for the Utah monitoring network from July 2 to July 6, 2010. Exceedances occurred during the national holiday. Utah fireworks law permits street level fireworks lighting from July 1-7, accounting for the higher than normal levels observed before and after the 4th of July.

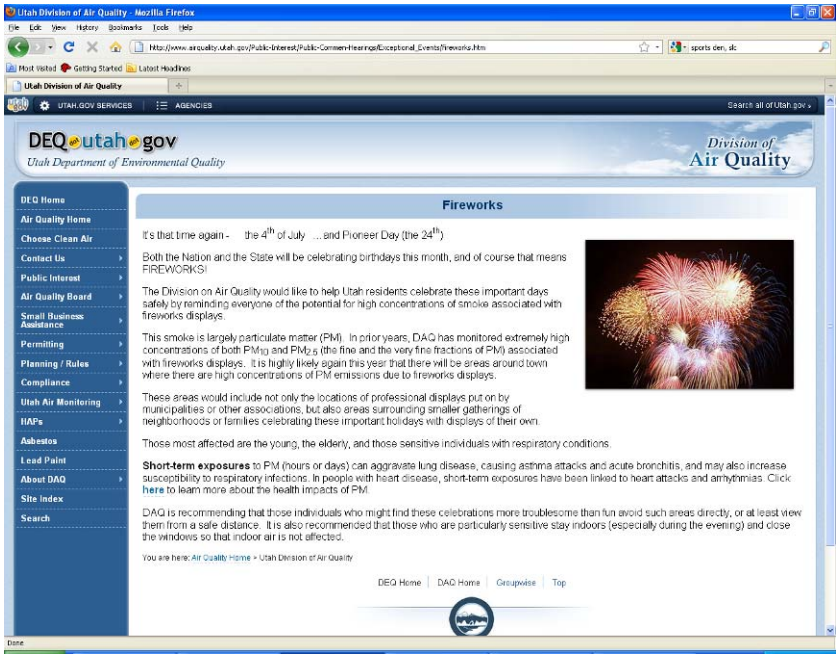
Figure 3 - PM2.5 24-hr Values for Utah Monitoring Network



Mitigation

Utah Air Quality Public Notifications

The DAQ web page shows the air quality forecast for today and the next two days, as well as providing information on fireworks events, explaining the type of air quality impact from fireworks and warning sensitive populations to stay indoors.



Public Comment

The notice of public comment availability was posted in the Utah Bulletin and on the DAQ web site. The public comment period was held from 10/17/11 to 11/17/11. The public comments and copy of the Utah Bulletin publication follow.

Comment #1
Date: 10/20/2011 10:26 P.M.
Subject: Air Pollution Exemption
As a resident of Ogden, I am stating my objections to the exemption requested for air pollution due to fireworks. I believe that public health is more important than the dubious enjoyment of fireworks by some residents. The combination of air pollution, noise pollution, and emotional and physical distress to humans and animals in the area is unconscionable.

Comment #2
Date: 11/13/2011 9:26 P.M.
Subject: Fireworks-related pollution spikes
It is our opinion that there should be no exceptional event status for fireworks because 1) they occur every year in the same places at the same time of year, and 2) they cannot be called a natural event. Every 4th of July and Pioneer Day, we have a choice. Under the current state and local laws, fireworks are permitted during these holidays, and many people exercise their freedom of choice to light fireworks as a celebration. In

doing so, however, these people adversely affect the air quality such that those with respiratory illnesses are practically confined to their homes. In other words, one person's recreation negatively affects the health of people nearby. As a civil society, we all have a responsibility to protect the health of our fellow citizens. We also have laws that encourage this behavior. For example:

 Smoking is no allowed inside public buildings in order to protect non-smokers from second-hand smoke.

 Drunk driving is not allowed in order to protect the safety of other motorists, passengers, and pedestrians.

 Target shooting or hunting must be conducted away from public roads in order to protect passers by. Therefore, we find it completely inconsistent that it is allowable for one person to discharge fireworks, thereby creating significant particulate air pollution that negatively affects the health of young and old. Furthermore, the decision to discharge fireworks also creates an unnecessary risk of fire and property damage. Given that fireworks are traditional on the 4th of July and Pioneer Day, we propose that municipalities should continue to host fireworks displays conducted by licensed professionals. In order to reduce the health hazards, we also propose that Utah bans the sale and personal use of fireworks. We think that this action represents a compromise between what is allowed by EPA and what we should do to protect the health of the community.

Thank you.

SPECIAL NOTICES

Environmental Quality
Air Quality

Notice of Public Comment Period for Fireworks Exceptional Events -Event Date: July 4,2010

Federal regulations (40 Code of Federal Regulations (CFR) Part 50) allow states to exclude air quality data that exceed or violate a National Ambient Air Quality Standard (NAAQS) if it can demonstrate that an "exceptional event" has caused the exceedance or violation. Exceptional events are unusual or naturally occurring events that can affect air quality but are not reasonably controllable or preventable using techniques implemented to attain and maintain the NMOS. Exceptional events are events for which the normal planning and regulatory process established by the Clean Air Act are not appropriate.

Exceptional events may be caused by human activity that is unlikely to recur at a particular location, or may be due to a natural event. EPA defines a "natural event" as an event in which human activity plays little-or no direct causal role to the event in question. For example, a natural event could include such things as high winds, wild fires, and seismic/volcanic activity. In addition, the EPA will allow states to exclude data from regulatory determinations on a case-by-case basis for monitoring stations that measure values that exceed or violate the NMOS due to emissions from fireworks displays from cultural events. These events can be flagged as being affected by exceptional or natural events and then justified.

Federal regulations (40 CFR Part 50.14(c)(3)(i) require that all relevant fl<;l.gged data, the reasons for the data being. flagged, and a demonstration that the flagged data are caused by exceptional events be, made available by the State for 30 days of public review and comment. These comments will be considered in the final demonstration of the event that is submitted to EPA, The following monitored values have been attributed to exceptional events:

1. July 4, 2010, Ogden Monitor Station,' 42.1 IJg/m3 PM2,5 (Due to Firework Display Emissions)
2. July 4, 2010, Cottonwood Monitor Station, 35.9 *jJg/m*^{3} PM2.5 (Due to Firework Display Emissions)

The documentation to support removing this data from use in regulatory determinations will be available by October 15, 2011 for public review and comment. It can be viewed at the following website: www.airquality.utah.gov\Public-Interest\Public-Commen-Hearings\ExceptionaLEvents\Exceptional_Events.htm or at the DEO Building located at 150 North 1950 West in Salt Lake City.

In compliance with the American with Disabilities Act, individuals with special needs (including auxiliary communicative aidsand services} should contact Brooke Baker, Office of Human Resources at 801-536-4412 (TOO 536-4414).

The comment period will close at 5:00 p.m. on November 17, 2011. Comments postmarked on or before that date will be accepted. Comments may be submitted by electronic mail to Jkarmazyn@utah.gov or may be mailed to:

Joel Karmazyn Utah Division of Air
Quality PO Box 144820
195N1950W Salt Lake City, UT
84114-4820

Environmental Quality
Air Quality

Notice of Public Comment Period, Fireworks Exceptional Events -Event Date: July 4,2011

Federal regulations (40 Code of Federal Regulations (CFR) Part 50) allow states to exclude air quality data that exceed or violate a National Ambient Air Ouality Standard (NMOS) if it can demonstrate that an "exceptional event" has caused the exceedance or violation. Exceptional events are unusual or naturally occurring events that can affect air quality but are not reasonably controllable or preventable using techniques implemented to attain and maintain the NMOS. Exceptional events are events for which the normal planning and regulatory process established by the Clean Air Act are not appropriate.