

PM2.5 Exceptional Event – Independence Day Fireworks



Event Date – July 4, 2011

Ogden Monitoring Station



Utah Department of
Environmental Quality

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Definition of Event

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)).

Introduction

Exceedance of the 24-hr PM_{2.5} standard of 43.8 µg/m³ occurred on July 4, 2011 at the Ogden monitoring station, located in Ogden, Utah. The Division of Air Quality (DAQ) investigated the event and has determined that the exceedance is associated with fireworks events celebrating the national 4th of July holiday. Utahns are exuberant in their celebration of Independence Day. Fireworks are a part of most community celebrations.

Significant changes to Utah law occurred in 2011. Utahans are now permitted to purchase and use fireworks from June 26 to July 26. A new type of aerial firework, commonly called “cake” is now lawful. Aerial devices look like miniature professional display that can travel as high as 150 feet.

Event Location

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

Affect Air Quality

Fireworks consist of 75% gunpowder (potassium nitrate, KNO₃), 15% carbon and 10% sulfur. The materials react with each other when heat is applied from a fuse. Metal

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compounds and other elements described in Table 1, are added to generate desired color and or pyrotechnic effects. Additional elements and or concentrations of these elements are directly dependent on the selection of desired color and effect; thus, individual fireworks events will have a specific tracer element.

The Ogden PM2.5 filter speciation data for the July 4, 2011 is shown in Table 1 (Appendix 1 contains raw data). Primary fireworks components are in red. 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

Ogden PM2.5 July 4, 2011 (µg/m ³)	Element /Compound	Oxidizer	Colorant	Propellant or Fuel	Stabilizer	Smoke	Glitter Effect
1.1050	Aluminum		√				
0.0294	Antimony						√
0.9167	Barium		√		√		
0.2876	Calcium		√				
Not Tested	Carbon			√			
2.720	Chlorine	√					
0.2706	Copper		√				
0.1145	Iron		√				
Not Tested	Lithium		√				
1.6350	Magnesium		√				
13.000	Potassium	√					
0	Phosphorus			√			√
0.138	Sodium		√				
0.2007	Strontium	√					
4.1880	Sulfur			√			
0.1715	Titanium		√				
0.0637	Zinc					√	
Not Tested	Chlorates	√					
0.5283	Nitrates	√					
Not Tested	Perchlorates	√					

Normal Historical Fluctuation

Figure 1 presents the PM2.5 values for the Ogden monitoring station for July 2011. Elevated values near/over the standard are associated with the use of fireworks before, during and after the 4th of July, Independence Day and the 24th of July, Pioneer Day.

Figure 1 – PM2.5 Values for July

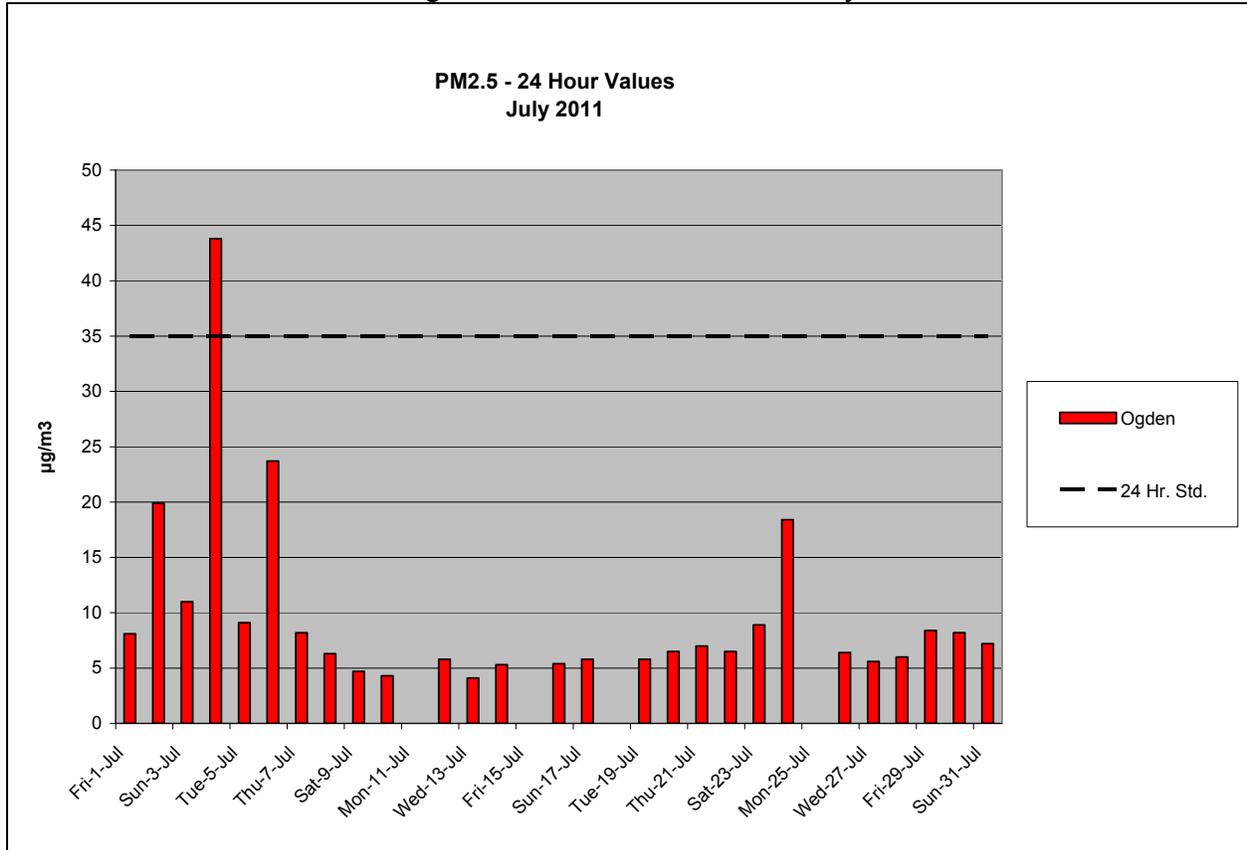


Table 2 presents the annual mean and maximum values for the 24-hr PM2.5 at the Ogden station from its inception in 2001 to 2010. The annual mean ranges from 9.2 to 14.6 µg/m³. The observed value for this event is 43.8 µg/m³.

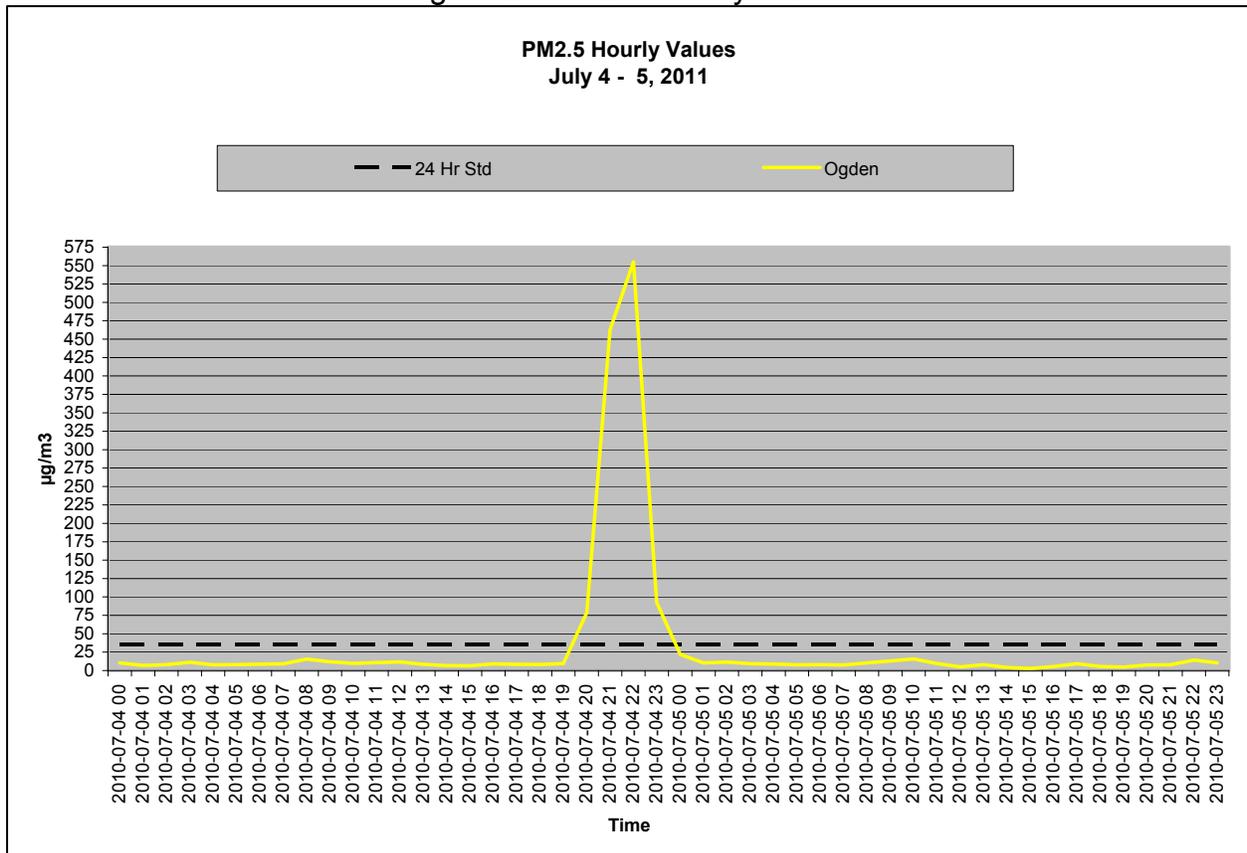
Table 2 – Ogden 24-hr PM2.5

Year	Observations	Annual Mean ($\mu\text{g}/\text{m}^3$)	Annual Max ($\mu\text{g}/\text{m}^3$)
2001	50	12.4	66.6
2002	119	14.6	108.3 (4 th 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	341	9.2	56.1

Causal Relationship

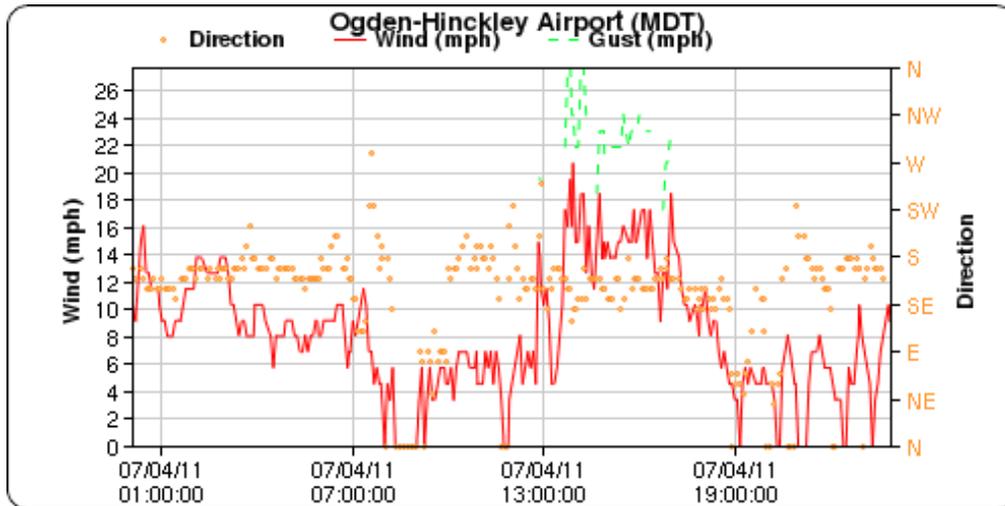
Figure 2 shows the PM_{2.5} hourly values from July 4 through July 5, 2011. Fireworks take place between 9 and 10 p.m. PM_{2.5} levels increased dramatically between those hours, with some carry over into the next day due to the filter change at midnight.

Figure 2 – PM_{2.5} Hourly Values



Meteorology

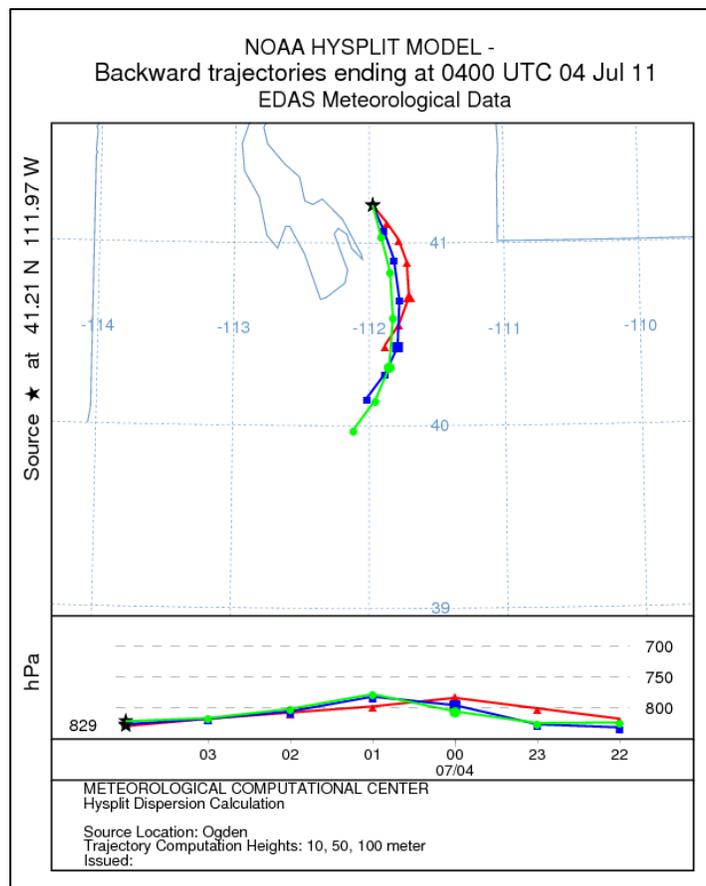
Meteorological data from the Ogden-Hinckley Airport shows late night southerly wind speeds ranging from 0-10 mph, indicating that fireworks events from the nearby cities of Riverdale, Clinton, Sunset, and Clearfield could have impact the air quality at the Ogden station and fireworks immediately adjacent 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 Ogden monitoring station.

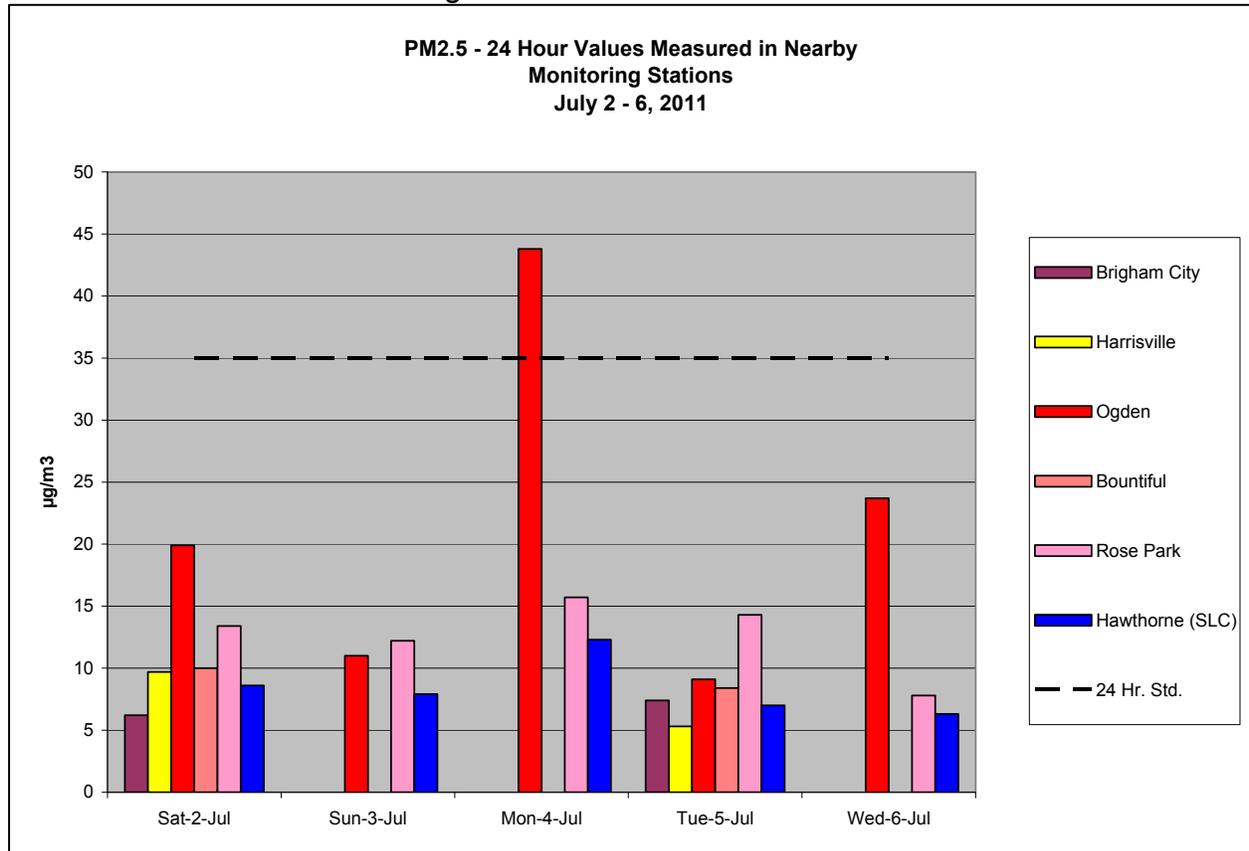
Six hour back trajectory starting at 10 p.m. local time was modeled at 10 (red), 50 (blue) and 100 (green) meters from the ground. The star indicates the location of the Ogden station. Back trajectory shows that the monitoring station could have been influenced by Salt Lake Valley air during the hours when fireworks are set off and would linger within the atmosphere in the valley.



No Exceedance or Violation But For the Event

Figure 3 shows the PM_{2.5} 24-hr values for monitoring stations near Ogden from July 2 to July 6, 2011. The exceedance occurred during the national holiday. Higher than normal levels are noted before and after the 4th and may be attributed to the newly legal cake fireworks.

Figure 3 - PM_{2.5} 24-hr Values

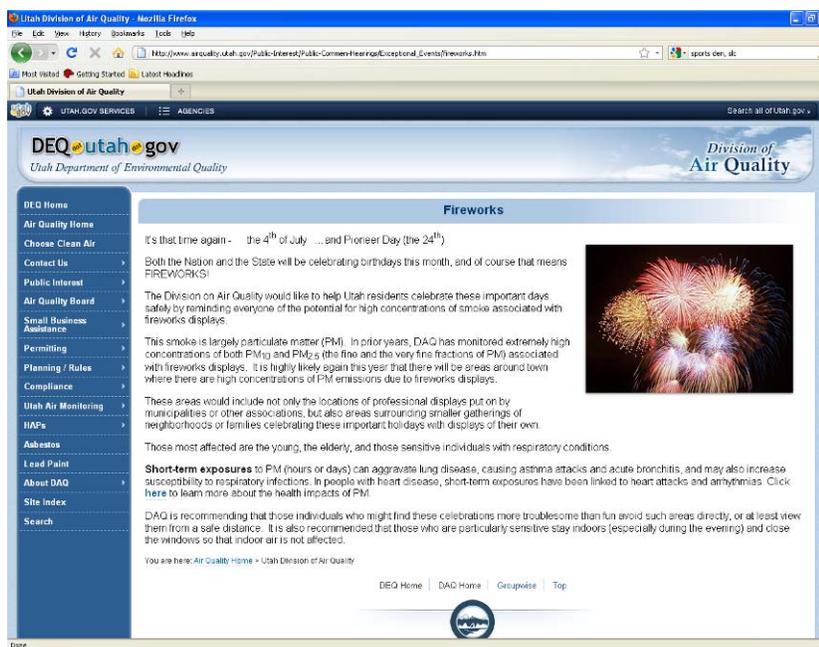


Mitigation

Utah Air Quality Public Notifications

The DAQ web page shows the air quality forecast for that day 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.

The Utah Fire Prevention Board established safety requirements for the newly lawful sale of cake in Utah. Salespersons are required to provide safety information to buyers. All sales must include “person to person” contact before permitting the purchase of cake to assure customers understand proper use of cake fireworks.



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 9/15/2011 to 10/17/2011. The public comments and copy of the Utah Bulletin publication follow.

Comment #1

Date: 9/17/2011 9:41 AM

Subject: Fireworks on the 4th of July 2011

The new laws regarding fireworks have effected more than just Ogden. I live in West Jordan and had difficulties breathing the entire month. I would like to have the new laws revoked that extended the period of fire works to the entire month, and changed the type/amount of fireworks that can be used. Both my wife and I are older, I am 71 and she is 67. We both suffer from poor health and were adversely affected by both the type of fireworks, and the length of time that they were allowed to be used. We were trapped in our home, and unable to use our swamp cooler due to the high concentration of smoke and particulates. It was a choice between sweltering in the heat without AC, or breathing the "crap" that was surrounding our house.

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Comment #2

Date: 9/17/2011 9:35 PM

Subject: Fireworks and air pollution

Please follow the EPA guidelines. Utah is becoming more dangerous with its open fireworks for a full month - and many other times of the year. I am listening to them right now going off at WSU. Sure, they are pretty, but breathing is more important. Children and the elderly are the most vulnerable.

Comment #3

Date: 9/18/2011 4:25 PM

Subject: Ogden Fireworks Exceptional Event comments

I am opposed to fireworks being included as an exceptional event. Fireworks are not natural events, and if there are going to be air quality issues associated with them, then those who use them should be fined, or they shouldn't be used at all. I'm not unpatriotic, but I prefer to breathe.

Comment #4

Date: 9/18/2011 12:59 PM

Subject: fireworks are not exceptional events

Hello,

I am a Utahn who believes Utah should be fined for causing pollution by using fireworks. Fireworks are in no way a necessity and their pollution is completely preventable. Let them pay the fine and if they don't like it, they can find another way to celebrate the holidays next year. We all need to sacrifice some luxury for the sake of the environment. Regards,

Comment #5

Date: 9/20/11 10:30 AM

I must weigh in on this subject. I cannot understand why the Division of Air Quality wants the EPA to count holiday spikes as an "exception". Pollution is pollution. Fireworks are constantly going off all over the Salt Lake Valley, not just on celebrated events. Fireworks are almost classified as an entitlement in this state. To me, fireworks are an annoyance costing the state more than they bring in. Enough of my commentary. Your job is to keep the air clean....do your job. Thanks much.

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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 flagged 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 $\mu\text{g}/\text{m}^3$ PM_{2.5} (Due to Firework Display Emissions)
2. July 4, 2010, Cottonwood Monitor Station, 35.9 $\mu\text{g}/\text{m}^3$ PM_{2.5} (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-Comment-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 aids and 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

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SPECIAL NOTICES

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July 4, 2011, Ogden Monitor Station, 43.8 µg/m³ PM_{2.5} (Due to Firework Display Emissions)

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Joel Karmazyn
Utah Division of Air Quality
PO Box 144820
195 N 1950 W
Salt Lake City, UT 84114-4820

**Health
Health Care Financing, Coverage and Reimbursement Policy
Notice for October 2011 Medicaid Rate Changes**

Effective October 1, 2011, Utah Medicaid will adjust its rates consistent with approved methodologies. Rate adjustments include new codes priced consistent with approved Medicaid methodologies as well as potential adjustments to existing codes. Nursing home rate changes to case mix components consistent with adopted payment methodology. All rate changes are posted to the web and can be viewed at: <http://health.utah.gov/medicaid/stplan/bcrp.htm>

**Tax Commission
Property Tax**

Corrections to the Amendment on Section R884-24P-57, DAR No. 35152, in the September 1, 2011, Bulletin

The Tax Commission filed an amendment on Section R884-24P-57, Levies Pursuant to Utah Code Ann. Sections 59-2-918.5, 59-2-924, 59-2-1328, and 59-2-1330, under DAR No. 35152 in the September 1, 2011, issue of the Bulletin (2011-17, pg. 75). After publication, the Tax Commission discovered that the information given for the rule analysis was incorrect. The following information for the "purpose of the amendment", the "summary of changes" and the "cost information" is the correct information.

APPENDIX 1
FILTER SPECIATION DATA

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Client: U005 - State of Utah DEQ

Report Number: 11-330

Lab ID: 11-X1490

Client ID: 1535243

Site: Ogden (02)

Sample Date: 7/ 4/11

Mass: 1053. +- 10. pg

Volume: 24.00 +- 2.400 m₃

Deposit Area: 11. 3 cm₂

Size Fraction: PM2.5

Suspended

Particulates: 43.88 +- 4.41 pg/m₃

Analyte pg/filter percent pg/m₃

XRF

Na 0.0000 ± 2.202 0.0000 ± 0.2092 0.0000 ± 0.0918

Mg 39.24 ± 3.809 3.727 ± 0.3635 1. 635 ± 0.2279

Al 26.52 ± 2.224 2.519 ± 0.2125 1.105 ± 0.1442

Si 5.752 ± 0.5017 0.5462 ± 0.0479 0.2397 ± 0.0318

P 0.0000 ± 0.1107 0.0000 ± 0.0105 0.0000 ± 0.0046

S 100.5 ± 5.212 9.544 ± 0.5032 4.188 ± 0.4717

Cl 59.72 ± 3.110 5.671 ± 0.3002 2.488 ± 0.2806

K 280.9 ± 14.38 26.68 ± 1. 389 11. 70 ± 1. 315

Ca 6.903 ± 0.4317 0.6556 ± 0.0415 0.2876 ± 0.0339

Ti 4.115 ± 0.3356 0.3908 ± 0.0321 0.1715 ± 0.0221

V 0.7119 ± 0.1017 0.0676 ± 0.0097 0.0297 ± 0.0052

Cr 0.0000 ± 0.0260 0.0000 ± 0.0025 0.0000 ± 0.0011

Mn 0.2915 ± 0.0271 0.0277 ± 0.0026 0.0121 ± 0.0017

Fe 2.748 ± 0.1412 0.2610 ± 0.0136 0.1145 ± 0.0129

Co 0.0000 ± 0.0102 0.0000 ± 0.0010 0.0000 ± 0.0004

Ni 0.0000 ± 0.0068 0.0000 ± 0.0006 0.0000 ± 0.0003

Cu 6.495 ± 0.3277 0.6168 ± 0.0317 0.2706 ± 0.0303

Zn 1. 528 ± 0.0791 0.1451 ± 0.0076 0.0637 ± 0.0072

Ga 0.0147 ± 0.0079 0.0014 ± 0.0008 0.0006 ± 0.0003

Ge 0.0000 ± 0.0068 0.0000 ± 0.0006 0.0000 ± 0.0003

As 0.0565 ± 0.0136 0.0054 ± 0.0013 0.0024 ± 0.0006

Se 0.0068 ± 0.0056 0.0006 ± 0.0005 0.0003 ± 0.0002

Br 0.0949 ± 0.0079 0.0090 ± 0.0008 0.0040 ± 0.0005

Rb 0.0486 ± 0.0068 0.0046 ± 0.0006 0.0020 ± 0.0003

Sr 4.817 ± 0.2418 0.4575 ± 0.0234 0.2007 ± 0.0225

Y 0.0000 ± 0.0090 0.0000 ± 0.0009 0.0000 ± 0.0004

Zr 0.0090 ± 0.0124 0.0009 ± 0.0012 0.0004 ± 0.0005

Mo 0.0158 ± 0.0147 0.0015 ± 0.0014 0.0007 ± 0.0006

Pd 0.0780 ± 0.0373 0.0074 ± 0.0035 0.0032 ± 0.0016

Ag 0.0768 ± 0.0373 0.0073 ± 0.0035 0.0032 ± 0.0016

Cd 0.1322 ± 0.0373 0.0126 ± 0.0035 0.0055 ± 0.0016

In 0.0689 ± 0.0407 0.0065 ± 0.0039 0.0029 ± 0.0017

Sn 0.1356 ± 0.0508 0.0129 ± 0.0048 0.0056 ± 0.0022

Sb 0.7062 ± 0.0701 0.0671 ± 0.0067 0.0294 ± 0.0041

Ba 22.00 ± 1. 210 2.089 ± 0.1166 0.9167 ± 0.1046

La 0.0000 ± 0.3085 0.0000 ± 0.0293 0.0000 ± 0.0129

Hg 0.0068 ± 0.0136 0.0006 ± 0.0013 0.0003 ± 0.0006

Pb 0.3627 ± 0.0260 0.0344 ± 0.0025 0.0151 ± 0.0019

IC

Cl 65.30 ± 3.265 6.201 ± 0.0613 2.721 ± 0.3042

Br 0.0000 ± 0.5000 0.0000 ± 0.0067 0.0000 ± 0.0208

N03 12.68 ± 0.6340 1. 204 ± 0.0137 0.5283 ± 0.0591

S04 241. 6 ± 12.08 22.94 ± 0.2204 10.07 ± 1.125

Na 3.300 ± 0.1650 0.3134 ± 0.0049 0.1375 ± 0.0154

NH4 5.340 ± 0.2670 0.5071 ± 0.0069 0.2225 ± 0.0249

K 312.2 ± 15.61 29.65 ± 0.2841 13.01 ± 1. 454