Wildfire Exceptional Event

PM2.5
July 11, 2007
Lindon

Photo from MODIS, July 10, 2007

Photos Furnished by: NASA

Purpose of Report

- UDAQ is flagging PM2.5 data for removal from regulatory consideration
  - This is the follow-up documentation for the event that was flagged and described in AQS

Regulatory Process

- Treatment of Data Influenced by Exceptional Events is covered in 40 CFR Parts 50 and 51.

- Guidance for the regulations can be found at 72 FR 55 March 22, 2007 13560-81.

Event Description

- Date: July 11, 2007
- Monitor: Lindon
- 24 hour Avg.: 42.1 $\mu g/m^3$
- AQS monitor #: 49-049-4001
- Monitor Location: UTM
  - Zone 12
  - Northing 4465406
  - Easting 430337

Event Description (Cont)

- The following slides will address each of the required elements of the exceptional events regulation regarding this data point.

- A weight of evidence will be provided that concludes this data should be removed from regulatory consideration.

Event Qualifies as an Exceptional Event

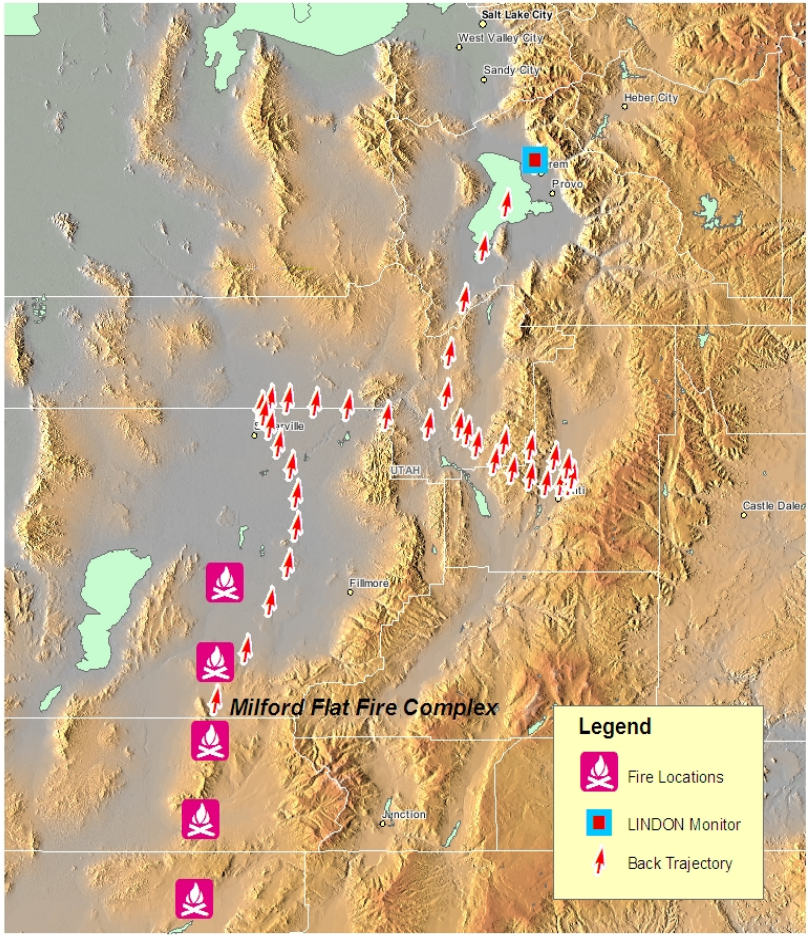
- Section IV E of the guidance (72 FR 55 March 22, 2007 13564-67) lists wildfires as a type of natural event.

- This event is a wildfire.

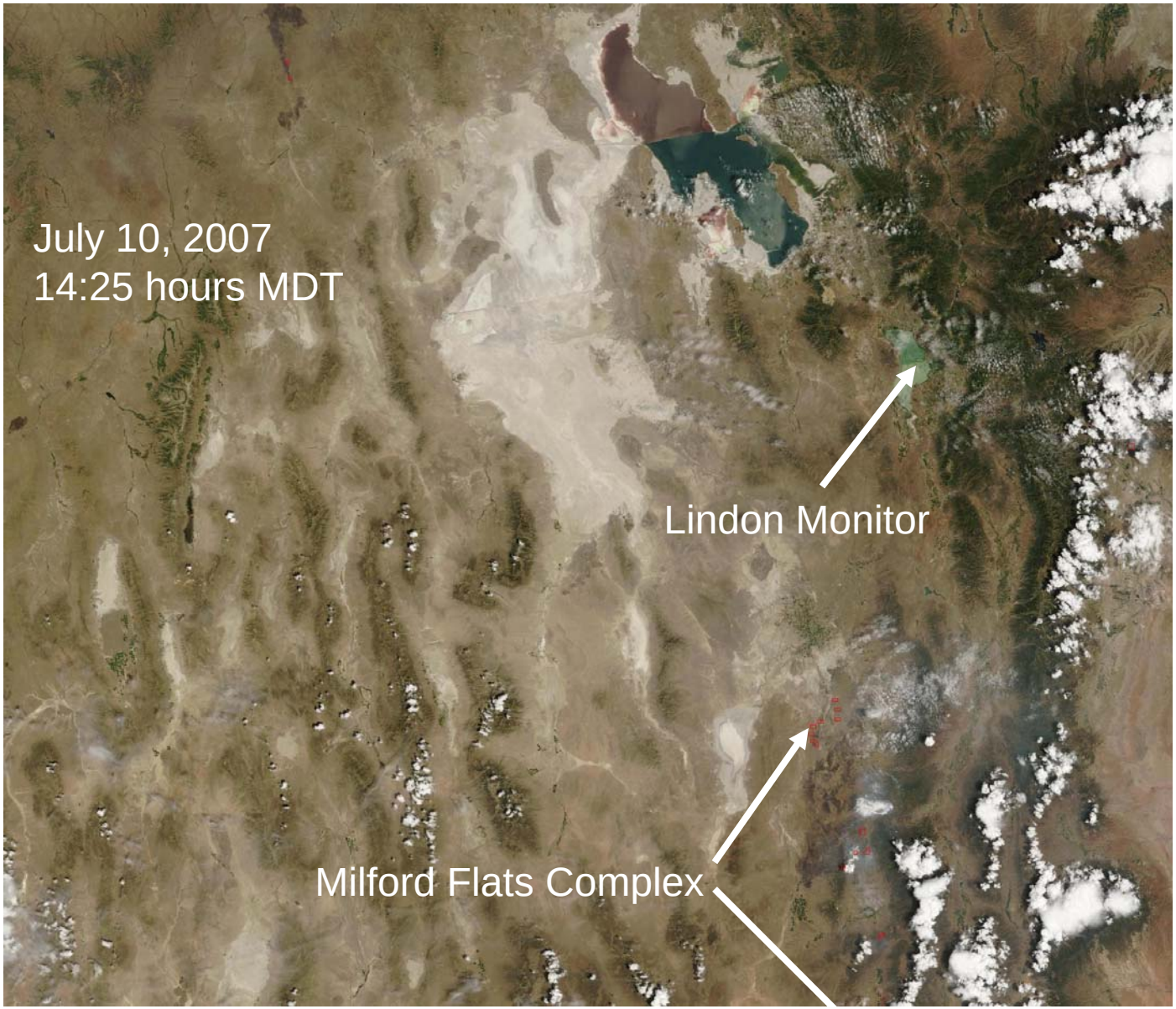
Clear and Causal Relationship

- There were several fire complexes burning on this day that were up wind of the monitor.
- These complexes are also shown on the satellite image on the next slide.
- The back trajectory analysis uses the Hysplit model, EDAS 40 km data, and charted with GIS mapping.
  - The air mass arrived at the Lindon Monitor at 12:00 Hours MDT on July 11, 2007.
  - Each arrow represents 1 hour of elapsed travel time.

36 Hour Back Trajectory of the Air Mass
Lindon Monitor
July 11, 2007



Clear and Causal Relationship (Cont)



Clear and Causal Relationship (Cont)

- The date of the satellite image in the previous slide is July 10, 2007 (the day before the event) and illustrates available atmospheric smoke for transport.

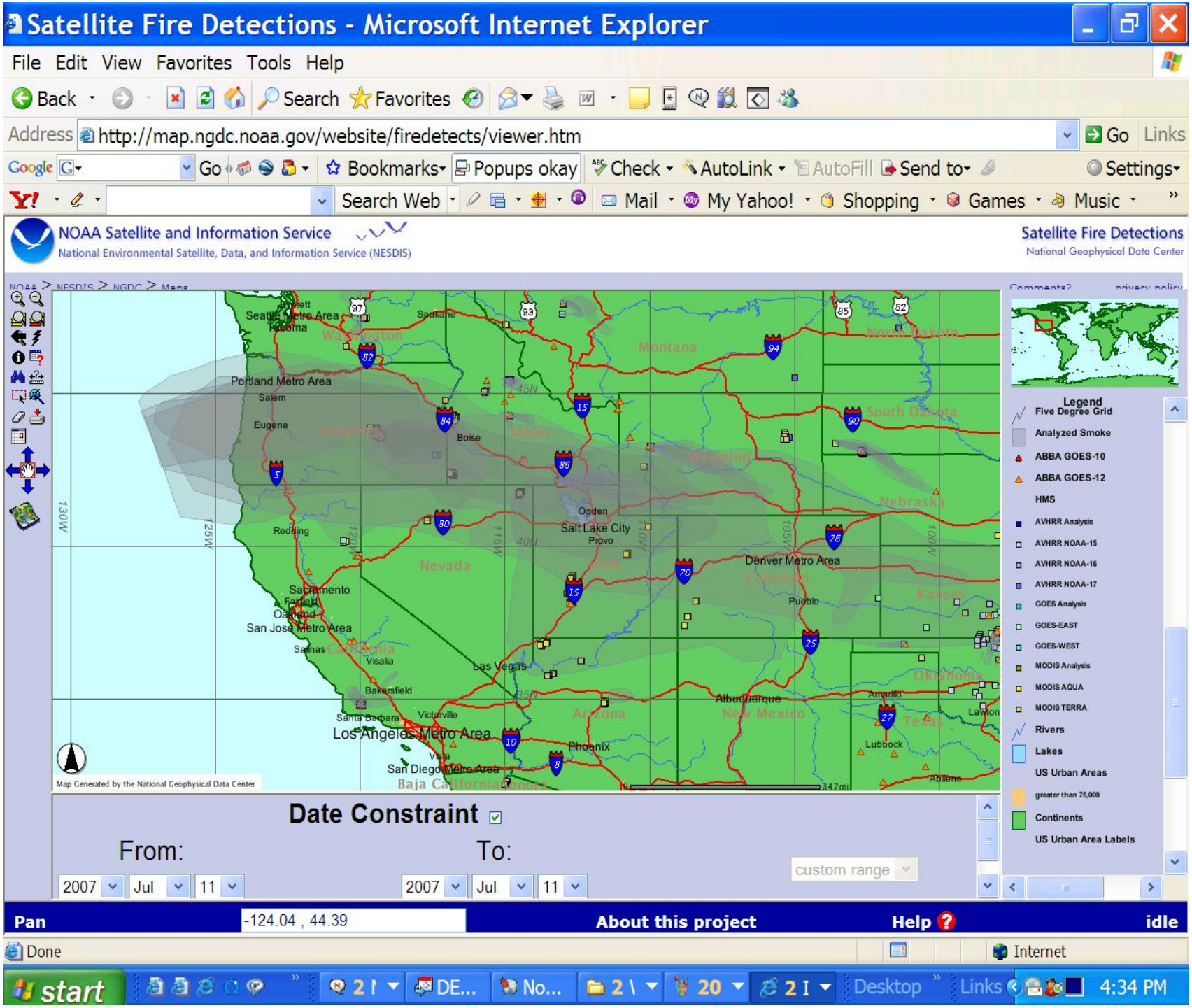
- The timing of the satellite image is coincident with the first half of the back trajectory analysis.

Clear and Causal Relationship (Cont)

- The image in the next slide shows regional impact from these wildfires.

- The image is a super position of smoke plumes from all the western wildfires burning on July 11, 2007. This is based on satellite images compiled by NOAA.

- The slide illustrates the impact from smoke plumes on the majority of the state.


Satellite Fire Detections - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://map.ngdc.noaa.gov/website/firedetects/viewer.htm
Go Links
Google Go Bookmarks Popups okay Check AutoLink AutoFill Send to Settings
Search Web Mail My Yahoo! Shopping Games Music
NOAA Satellite and Information Service
National Environmental Satellite, Data, and Information Service (NESDIS)
Satellite Fire Detections
National Geophysical Data Center
Seattle Metro Area
Spokane
Portland Metro Area
Salem
Eugene
Boise
Ogden
Salt Lake City
Provo
Redding
Sacramento
San Jose Metro Area
Las Vegas
Bakersfield
Santa Barbara
Los Angeles Metro Area
Phoenix
Denver Metro Area
Pueblo
Albuquerque
Amarillo
Lubbock
Montana
South Dakota
Nebraska
Nevada
Kansas
Oklahoma
Texas
Arizona
New Mexico
Map Generated by the National Geophysical Data Center
Legend
Five Degree Grid
Analyzed Smoke
ABBA GOES-10
ABBA GOES-12
HMS
AVHRR Analysis
AVHRR NOAA-15
AVHRR NOAA-16
AVHRR NOAA-17
GOES Analysis
GOES-EAST
GOES-WEST
MODIS Analysis
MODIS AQUA
MODIS TERRA
Rivers
Lakes
US Urban Areas
greater than 75,000
Continents
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About this project
Help
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start
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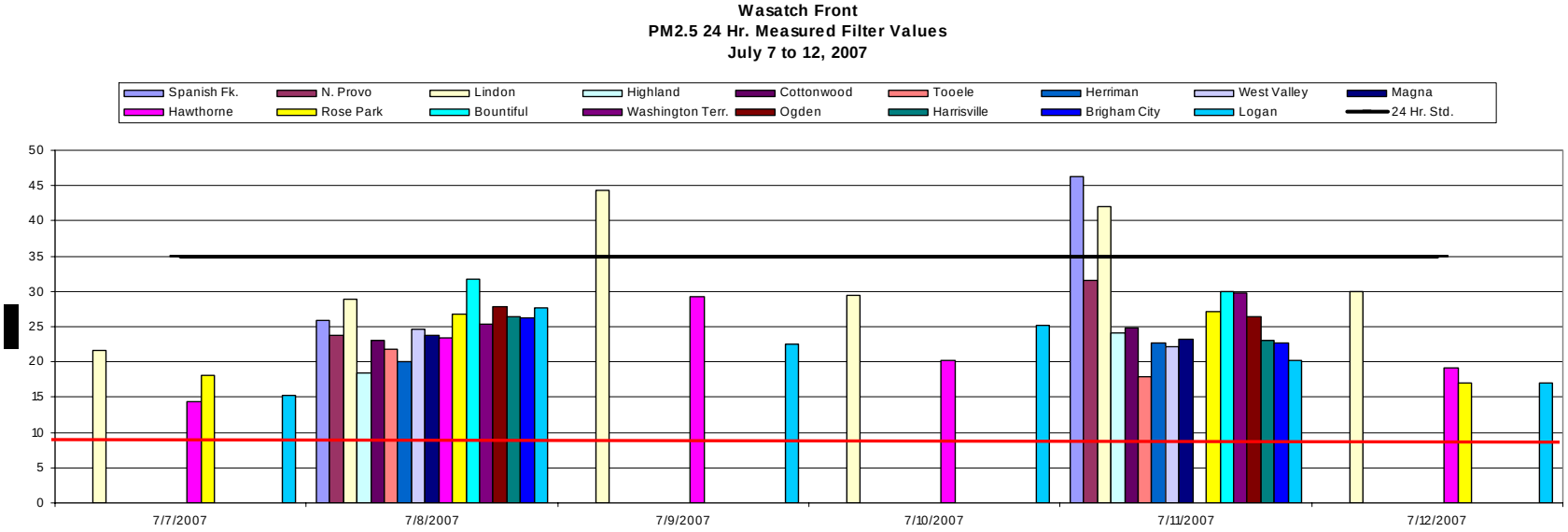
Clear and Causal Relationship (Cont)



- This chart shows data collected from the entire network area, and shows that all the values were elevated on several days surrounding the event.

- A more typical value (8.8 µg/m^3) for this season, including normal historical fluctuations is indicated by the red line (see slide 17 through 19 for more information).

Clear and Causal Relationship (Cont)

Additional evidence comes from the filter analysis (see next slide).

- This sample is dominated by missing mass
- It is not distinguishable from the Teflon filter on which it was collected
- Most of this mass is carbon, due to the smoke from the fires
- A more typical filter would contain some missing mass (carbon), but not nearly as much
- Speciated data from Lindon suggests that missing mass on a typical day in this season would be roughly 5.9 $\mu g/m^3$
  - Estimated as: [(Elemental Carbon) + 1.4 X (Organic Carbon)]

Clear and Causal Relationship (Cont)

Concentration in Excess of Normal Fluctuations

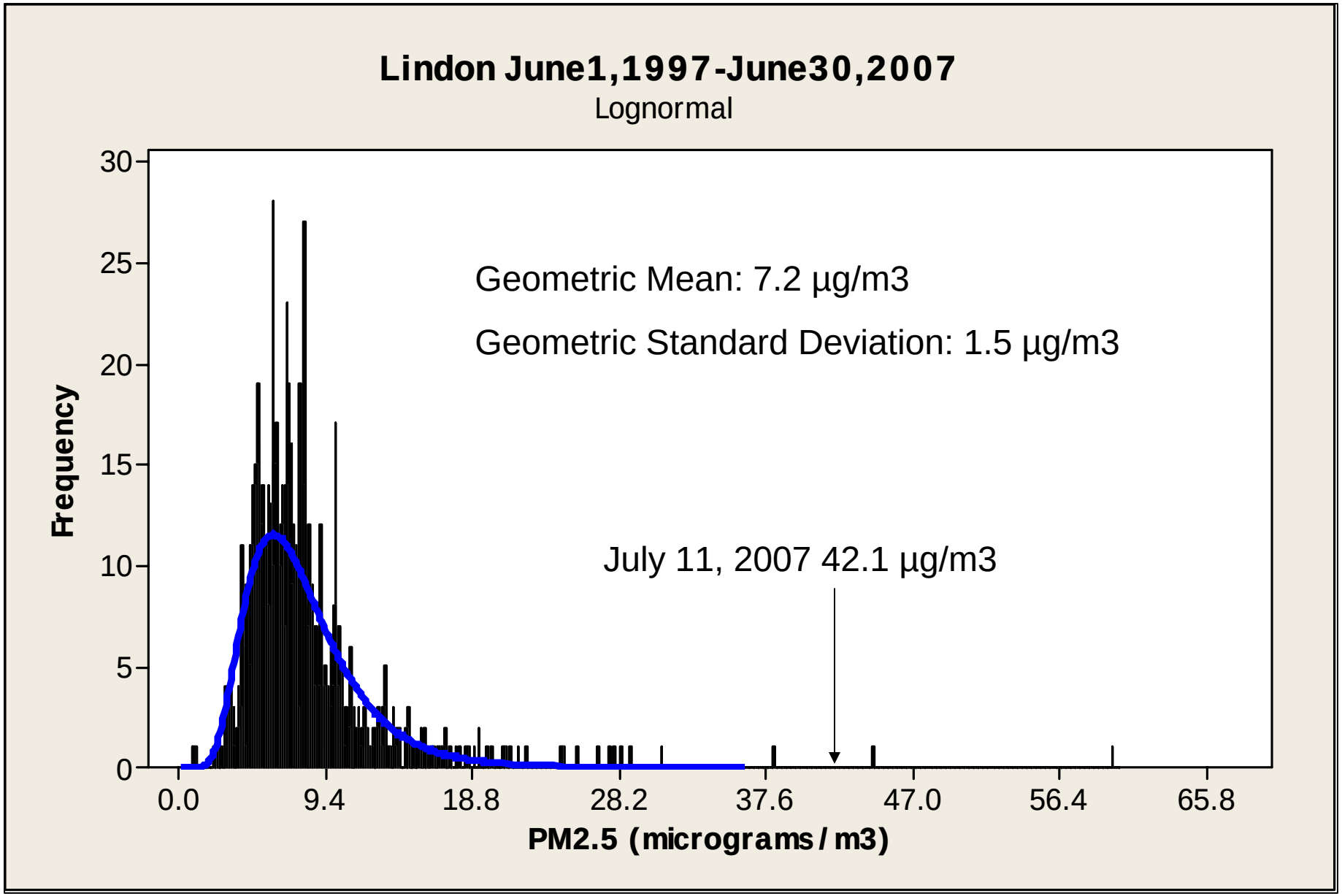
Statistics from this event reveal the following:

- The geometric mean value could be used to describe a background concentration
- The geometric mean was calculated to be 7.2 µg/m^3.
  - Ten-years of historical data was used for the calculation.
  - All data points from June 1 through August 31 for the years 1998 through June 30, 2007 were included.
    - This is statistically characteristic of the summer air quality season.
- Normal historical fluctuation might be described as one geometric standard deviation above or below the geometric mean. The upper bound of this fluctuation for the Lindon monitoring site would then be 8.7 µg/m^3.

Concentration in Excess of Normal Fluctuations (Cont)

The measured concentration associated with this event is shown in the graph on the next slide.

- Clearly the measured concentration exceeds 8.7 $\mu g/m^3$
- From June 1998 through June of 2007, only 5 days have been above the 24-hour NAAQS, these days were influenced by either fireworks or forest fires. Summertime exceedances of the 24-hour NAAQS are therefore not seen in the normal variation of the Lindon data.
- In fact, it falls above the 99th percentile of all summertime values measured at this site.
- Guidance found at 72 FR 55 March 22, 2007 13560-81, says 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 June1,1997-June30,2007
Lognormal
Geometric Mean: 7.2 µg/m3
Geometric Standard Deviation: 1.5 µg/m3
July 11, 2007 42.1 µg/m3
Frequency
30
25
20
15
10
5
0
0.0
9.4
18.8
28.2
37.6
47.0
56.4
65.8
PM2.5 (micrograms/m3)

No Exceedance or Violation “but for” the Event

- For the time period surrounding this event one might have expected a background concentration (geometric mean) of 7.2 $\mu g/m^3$.
  - Calculation of the geometric mean was already described in slide 15.

- This is well below the current 24-hour PM2.5 NAAQS standard.

No Exceedance or Violation “but for” the Event (Cont)

- Measured concentration associated with the event was 42.1 $\mu g/m^3$.
- The difference between the measured concentration and the expected background is 34.9 $\mu g/m^3$.
- This difference could be considered the amount of impact from the event.

No Exceedance or Violation “but for” the Event (Cont)

- However, to account for typical fluctuations we must subtract a representative amount.
  - Again, this might be described by one geometric standard deviation above the mean.
  - In this case one geometric standard deviation equates to 1.5 $\mu g/m^3$.
- Hence, the amount of concentration that would be attributable to the event using this approach is **33.4 $\mu g/m^3$**.

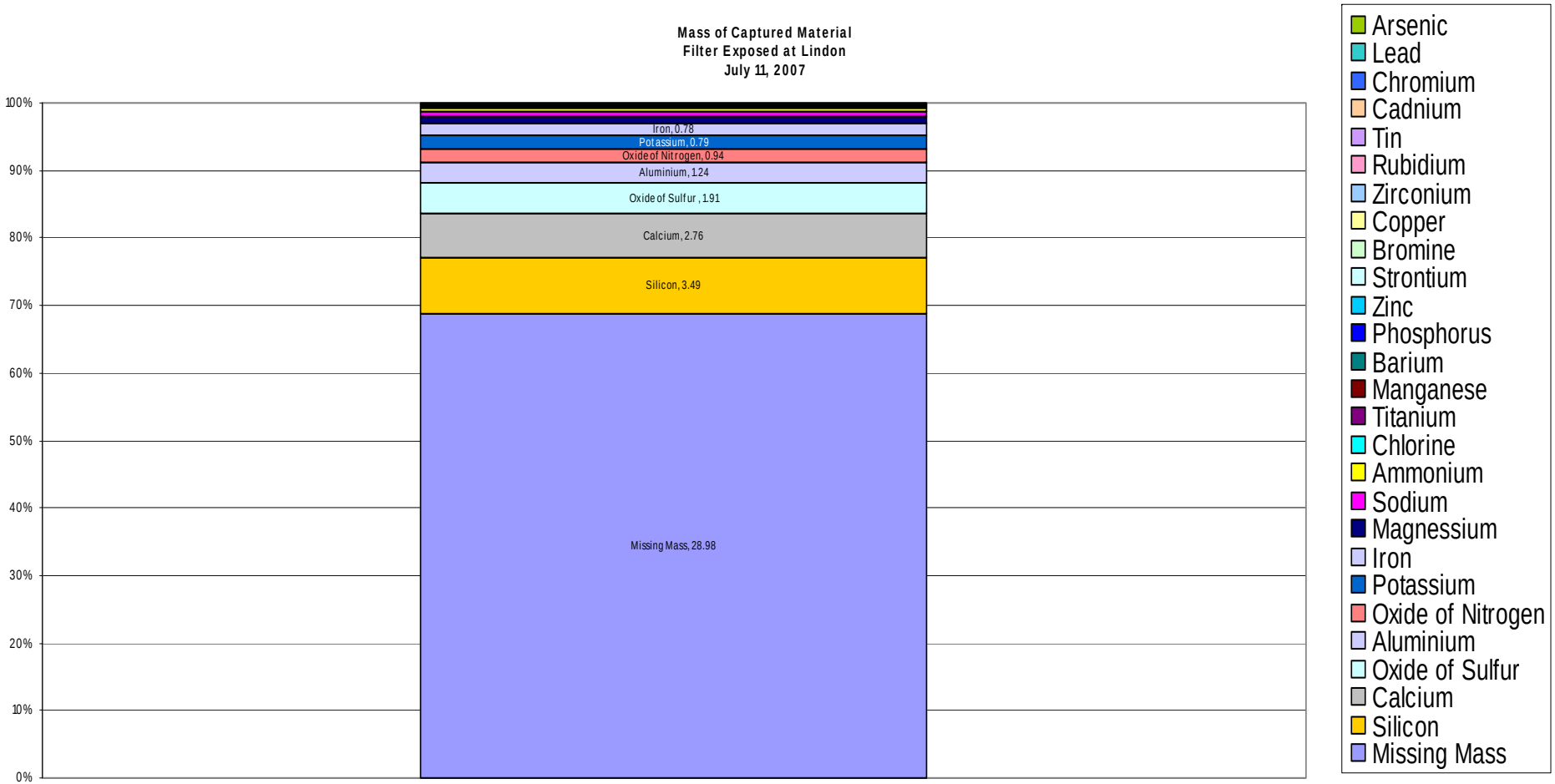
No Exceedance or Violation “but for” the Event (Cont)

- Analysis of filter chemistry reveals that 29.0 µg/m^3 is associated with the missing mass.

- As explained on slide 13 the majority of the missing mass is likely attributable to smoke from wildfire.

- Assuming a typical filter would contain roughly 5.9 µg/m^3 carbon compounds one could still attribute **23.1 µg/m^3** of this missing mass to the wildfire event.

No Exceedance or Violation “but for” the Event (Cont)



No Exceedance or Violation “but for” the Event Summary

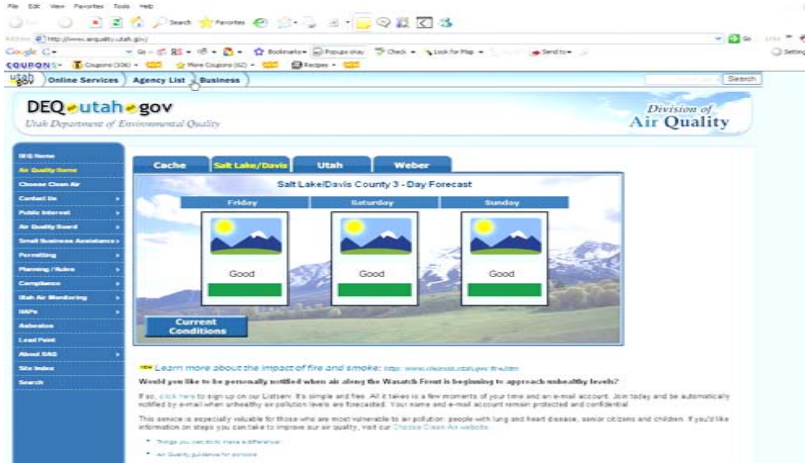
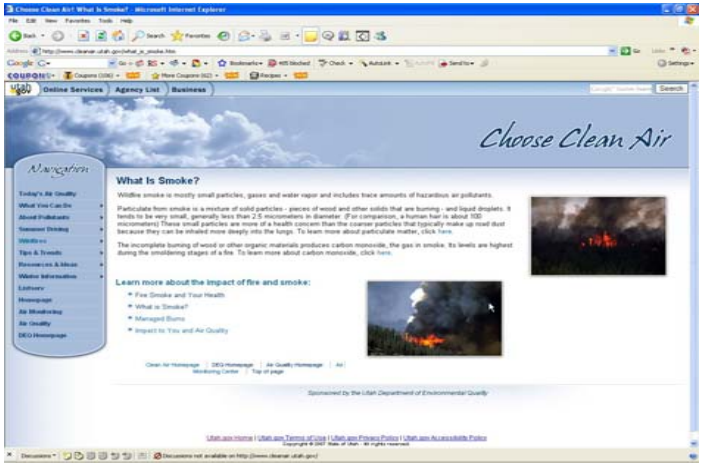
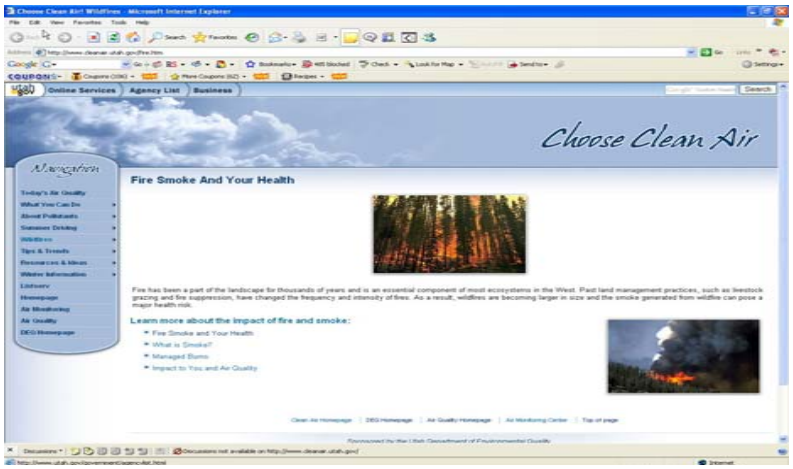
- Using the statistical approach discussed in slides 15-20 the concentration attributable to the event is **33.4 µg/m^3**.

- Using the filter analysis approach discussed in slides 21-22 the concentration attributable to the event is **23.1 µg/m^3**.

- Both numerical approaches suggest that a sufficient concentration was attributed to the wildfire event and that the measured concentration would not have exceeded the PM2.5 24-hour NAAQS but for the impact of emissions from the wildfire complexes!

Mitigation of Event

State Action included:

- A Smoke management rule and plan that helps minimize smoke from other sources during the event.
  - The rule and plan state that new prescribed fires and new wildland fire use events would not be approved if there was a potential to exceed the NAAQS.
- A news release during the episode that advised citizens of the potential health impacts of smoke from wildfires.
  - Staff also participated in interviews with news media (both print and TV).
- A series of websites (see next slide) about emissions from wildfire were posted on the web during the event.
- Specifically they covered the following items:
  - The health impacts of PM
  - The actions a person could take to minimize exposure to PM.

Mitigation of Event (Cont)