

## Appendix A

### Exceptional Events Data

As part of the data review and certification process, IDEM performs a thorough review of all data that exceed an ambient air quality standard. This review is conducted to insure the data are correct and not influenced by an exceptional event. Exceptional events are unusual or naturally occurring events that can affect air quality but are not reasonably controllable by state and local agencies. Data which are affected by these events are “flagged” meaning the high monitored values are not the norm and were influenced by an exceptional event.

IDEM has identified six exceptional events from wildfires and fireworks that occurred during the 2004-2006 monitoring period. After the removal of the exceptional events that occurred during the years 2004-2006 the 2004-2006 design value for the daily PM<sub>2.5</sub> NAAQS drops from 32 (31.7) µg/m<sup>3</sup> to 31 (31.0) µg/m<sup>3</sup> at New Albany and from 37 (36.6) µg/m<sup>3</sup> to 32 (31.7) µg/m<sup>3</sup> at Jeffersonville. After the removal of the exceptional events that occurred during the years 2004-2006 the 2005-2007 design value for the daily PM<sub>2.5</sub> NAAQS drops from 35 (34.6) µg/m<sup>3</sup> to 34 (33.9) µg/m<sup>3</sup> at New Albany and from 40 (39.8) µg/m<sup>3</sup> to 35 (35.1) µg/m<sup>3</sup> at Jeffersonville. The exceptional event data exclusions results in a 2005-2007 design value below the daily PM<sub>2.5</sub> NAAQS at the Jeffersonville monitor in Clark County.

The following table compares the data for Clark and Floyd Counties with and without the exceptional events. Also note that for the 24-hour PM 2.5 Standard when the exceptional events are taken out for Clark County the monitor is below the standard.

County	Site #	City	Site Name	24-hour PM 2.5 Standard (35 ug/m3)			Daily Site Design Value 05-07
				2005	2006	2007	
Clark	180190006	Jeffersonville	Pfau (Exceptional Events left in)	45.5	35.9	38.1	40
Clark	180190006	Jeffersonville	Pfau (Exceptional Events taken out for 04-06)	35.1	32.2	38.1	35
Floyd	180431004	New Albany	Green Valley Sch (Exceptional Events left in)	40.1	28.2	35.4	35
Floyd	180431004	New Albany	Green Valley Sch (Exceptional Events taken out for 04-06)	39.0	27.4	35.4	34
							<b>Nonattainment</b>

IDEM has identified one exceptional event from a wildfire that occurred during the 2007 monitoring period. After the removal of the exceptional events that occurred during the year 2007 the 2005-2007 design value for the daily PM<sub>2.5</sub> NAAQS drops from 36 (35.833) µg/m<sup>3</sup> to 35 (34.6) µg/m<sup>3</sup> at the Dubois Post Office monitor. The exceptional event data exclusions results in a 2005-2007 design value below the daily PM<sub>2.5</sub> NAAQS at the Post Office monitor in Dubois County.

The following table compares the data for the Post Office monitor in Dubois County with and without the exceptional events. Also note that for the 24-hour PM 2.5 Standard when the exceptional events are taken out for Post Office monitor in Dubois County the monitor is below the standard.

		<b>24-hour PM 2.5 Standard (35 ug/m3)</b>					
<b>County</b>	<b>Site #</b>	<b>City</b>	<b>Site Name</b>	<b>Daily 98th Percentile Values</b>			<b>Daily Site Design Value 05-07</b>
				<b>2005</b>	<b>2006</b>	<b>2007</b>	
Dubois	180372001	Jasper	Post Office (Exceptional Events left in)	41.2	31.6	34.7	(36) 35.833
Dubois	180372001	Jasper	Post Office (Exceptional Events taken out for 05-07)	41.2	31.6	31	35 (34.6)
						<b>Nonattainment</b>	

The following pages describe in detail the exceptional events associated with Indiana monitoring data for the years 2004-2007 and exceptional events associated with Kentucky 2007 monitoring data.

# Indiana Exceptional Events Flagging of PM<sub>2.5</sub> Data (2004 – 2006)

## Overview

As part of the data review and certification process, IDEM performs a thorough review of all data that exceed an ambient air quality standard. This review is conducted to insure the data are correct and not influenced by an exceptional event.

Exceptional events are unusual or naturally occurring events that can affect air quality but are not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the Clean Air Act is not appropriate. Data which are affected by these events are "flagged" so that the public and the EPA may be aware that these high monitored values are not the norm and were influenced by an exceptional 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. Federal regulations, 40 Code of Federal Regulations (CFR) Part 50.14 (b)(2) also allow states to exclude data from regulatory determinations on a case-by-case basis for monitoring stations whose exceedances or violations are caused by emissions from fireworks displays.

EPA uses ambient air quality data to determine if an area is in attainment of a National Ambient Air Quality Standard (NAAQS). If an area is designated as non-attainment, restrictions are placed on the area and control measures will have to be put in place to bring the area back into attainment. The regulatory and planning process established by the Clean Air Act is not appropriate for dealing with natural and exceptional events. For example, natural events cannot be controlled by humans nor is it appropriate to attempt to develop regulations to control exceptional events. Therefore it would be inappropriate to place restrictions on an area were the attainment status was biased by an exceptional event.

According to 40 CFR Part 50, the NAAQS for the annual average PM<sub>2.5</sub> level is 15.0 µg/m<sup>3</sup> and for the 24-hour maximum is 35.0 µg/m<sup>3</sup>. By flagging the following events, the combined three year annual average or design value drops from 14.6 µg/m<sup>3</sup> to 14.3 µg/m<sup>3</sup> at New Albany and from 16.2 µg/m<sup>3</sup> to 15.9 µg/m<sup>3</sup> at Jeffersonville. The design value for the daily NAAQS or the three year average of the 98th percentile 24-hour maximum values drops from 31.7 µg/m<sup>3</sup> to 31.0 µg/m<sup>3</sup> at New Albany and from 36.6 µg/m<sup>3</sup> to 31.7 µg/m<sup>3</sup> at Jeffersonville. Although the annual average changes do not affect attainment status at either location, the data exclusions result in an attainment designation of the 24-hour NAAQS at Jeffersonville.

The new federal exceptional events regulations, 40 CFR Part 50.14 (c) (3)(i), require all relevant flagged data be made available by the State for a 30-day public review and comment period. IDEM has identified the following six (6) events as having evidence to support flagging and are being posted for public comment:

Event Date	Cause	Jeffersonville 24-hour Value (µg/m <sup>3</sup> )	New Albany 24-hour Value (µg/m <sup>3</sup> )
08/04/2004	Northwest Wildfires	43.6	38.1
09/10/2005	Arkansas/Texas/Mississippi Wildfires	45.6	40.1
09/13/2005	Arkansas/Texas/Mississippi Wildfires	45.5	42.5
11/12/2005	Fort Knox Wildfire	21.4	33.2
07/04/2006	Fireworks	31.4	
07/19/2006	Kansas Wildfires	36.4	38.1

The following tables illustrate the elevated concentration levels for the exceptional events and how removing the flagged values impacts the design values for the New Albany and Jeffersonville areas.

**Table 1**

Multi-Year 98th Percentiles of 24-hour Averages\*

Date	New Albany 18-043-1004	Jeffersonville 18-019-0006
2004	26.7	28.4
2005	40.1	45.5
2006	28.2	35.9
Average (Daily design value)	<b>32</b>	<b>37</b>

**Table 2**

Multi-Year 98th Percentiles of 24-hour Averages Excluding Flagged Data

Date	New Albany 18-043-1004	Jeffersonville 18-019-0006
2004	26.4	27.9
2005	39.3	35.1
2006	27.4	32.2
Average (Daily design value)	<b>31</b>	<b>32</b>

\*NAAQS PM<sub>2.5</sub> 24-hour Average = 3 year average of 98th percentile of 24-hour concentrations must not exceed **35.0 µg/m<sup>3</sup>**

**Table 3**

Multi-Year Annual Averages\*\*

Date	New Albany 18-043-1004	Jeffersonville 18-019-0006
2004	13.7	15.1
2005	16.8	18.6
2006	13.3	15.0
Average (Annual design value)	<b>14.6</b>	<b>16.2</b>

**Table 4**

Multi-Year Annual Averages Excluding Flagged Data

Date	New Albany 18-043-1004	Jeffersonville 18-019-0006
2004	13.5	15.0
2005	16.3	18.0
2006	13.2	14.8
Average (Annual design value)	<b>14.3</b>	<b>16.0</b>

\*\*NAAQS PM<sub>2.5</sub> Annual Average = 3 year average of the annual mean of concentrations must not exceed **15.0 µg/m<sup>3</sup>**

Indiana Department of Environmental Management  
Office of Air Quality  
Indianapolis, IN

Subject: Exceptional Events Flagging for Wildfire Event

Parameter: PM<sub>2.5</sub>

Sites: Jeffersonville and New Albany

Dates: August 4, 2004

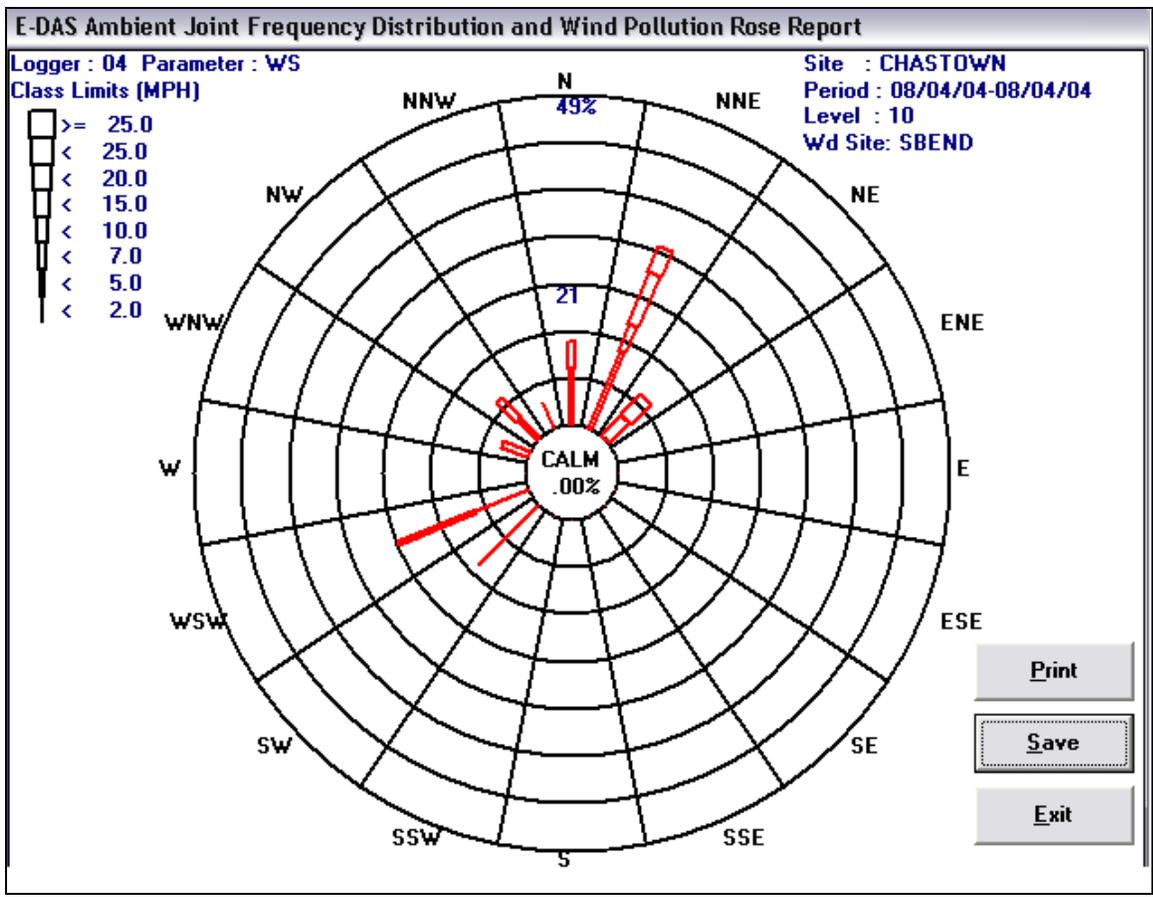
Reason: Smoke from wildfires occurring some distance from an area can affect the PM<sub>2.5</sub> levels measured at a particular site. In late July and early August 2004 wildfires occurred in the Northwest. From August 2 to August 4 the air quality in the Jeffersonville and New Albany areas was affected. PM<sub>2.5</sub> values were 43.6 ug/m<sup>3</sup> and 38.1 ug/m<sup>3</sup> respectively on August 4. Before and after this time period values ranged from 10 ug/m<sup>3</sup> to 22 ug/m<sup>3</sup>.

Data: Table 1 shows daily FRM averages prior to, during, and after the event. The Wind Rose indicates the local conditions on August 4 which correspond with the channeling and recirculation of the smoke plume as evidenced by the backward trajectory modeling from NOAA.

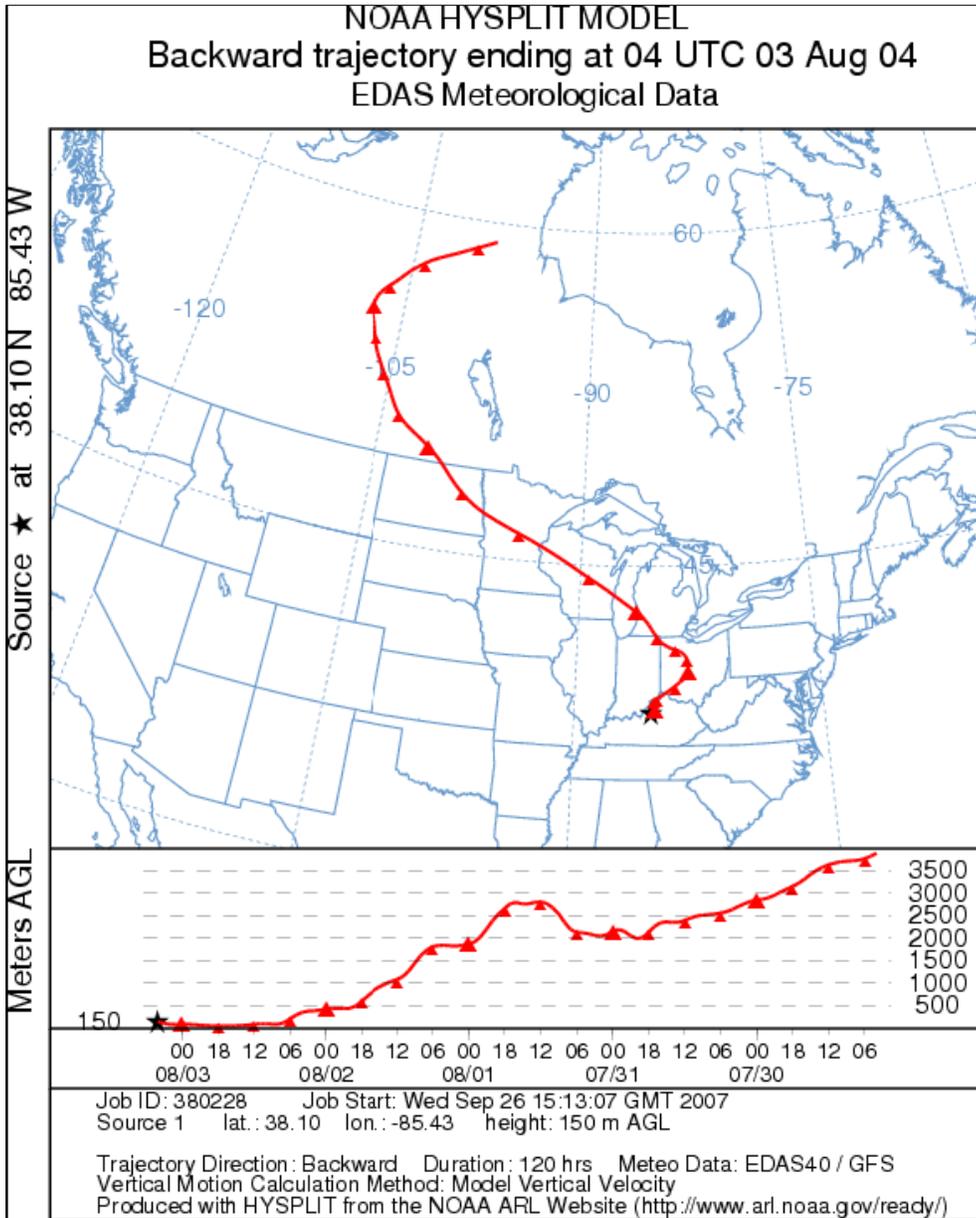
Maps: Maps from NOAA Satellite and Information Services show the Back trajectory model and smoke plume over the Jeffersonville/New Albany Area on August 2-4.

Table 1  
FRM PM<sub>2.5</sub> 24-hour Averages

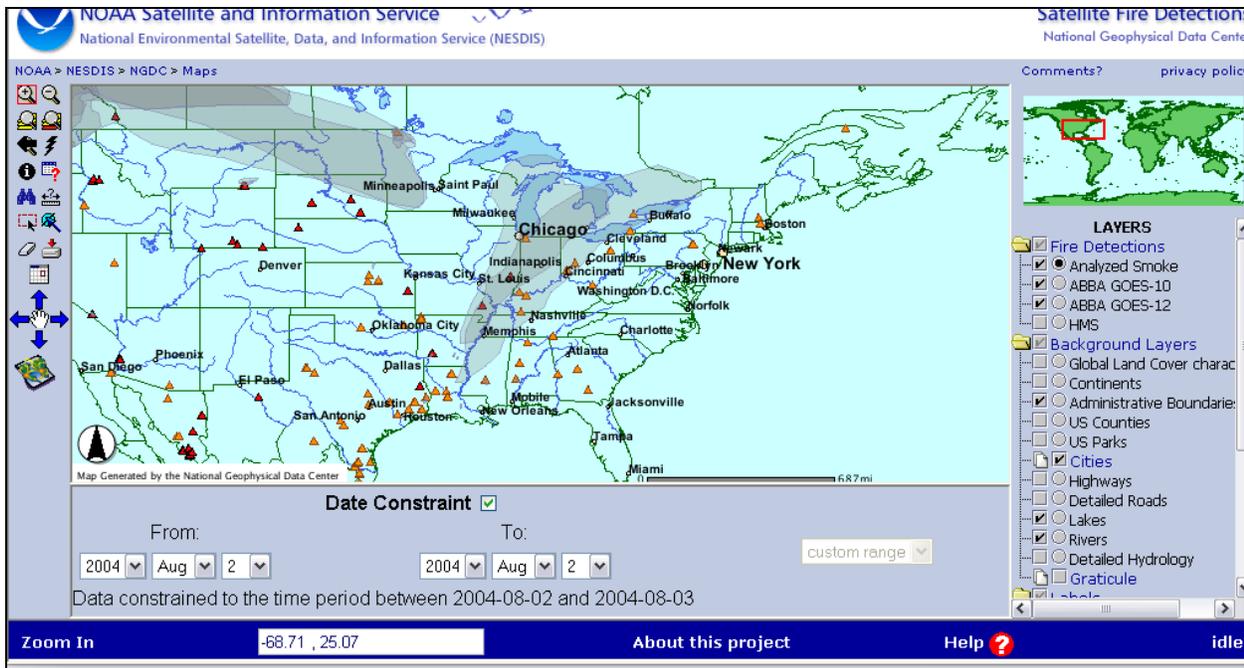
Date	New Albany 18-043-1004	Jeffersonville 18-019-0006
8/1/2004	18.2	22.0
<b>8/4/2004</b>	<b>38.1</b>	<b>43.6</b>
8/7/2004	10.6	13.0



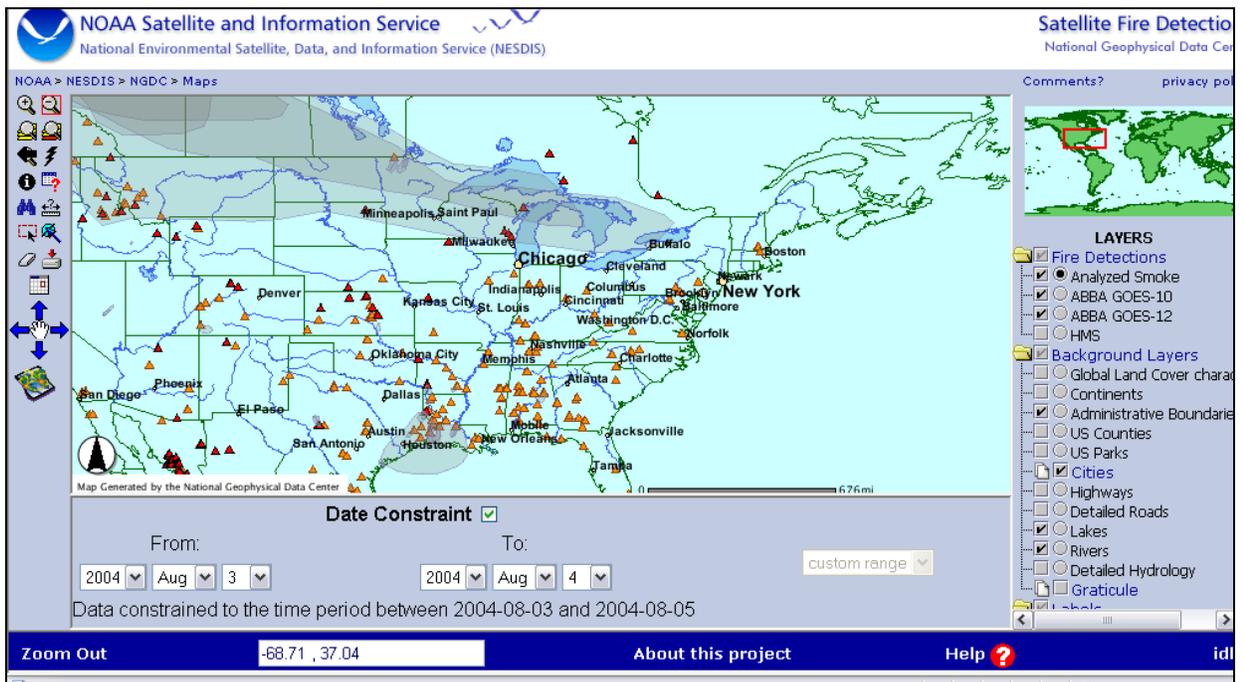
Wind rose from 08/04/04 shows the prevailing winds to be from the NNE, the primary direction of the smoke plume on that day.



Back Trajectory modeling for the five (5) days prior to the 08/04/04 event



NOAA smoke plume model for August 2, 2004 with impacts on Jeffersonville and New Albany.



NOAA smoke plume model for August 3-4, 2004\*

\*Map does not clearly indicate the plume due to sporadic rainfall that occurred during the day. However, continuous PM measurements from Louisville Metro Pollution Control District indicate the plume did not fully dissipate until 2200 on 8/4/04.

Indiana Department of Environmental Management  
Office of Air Quality  
Indianapolis, IN

Subject: Exceptional Events Flagging for Wildfire Event

Parameter: PM<sub>2.5</sub>

Sites: Jeffersonville and New Albany

Dates: September 10-13, 2005

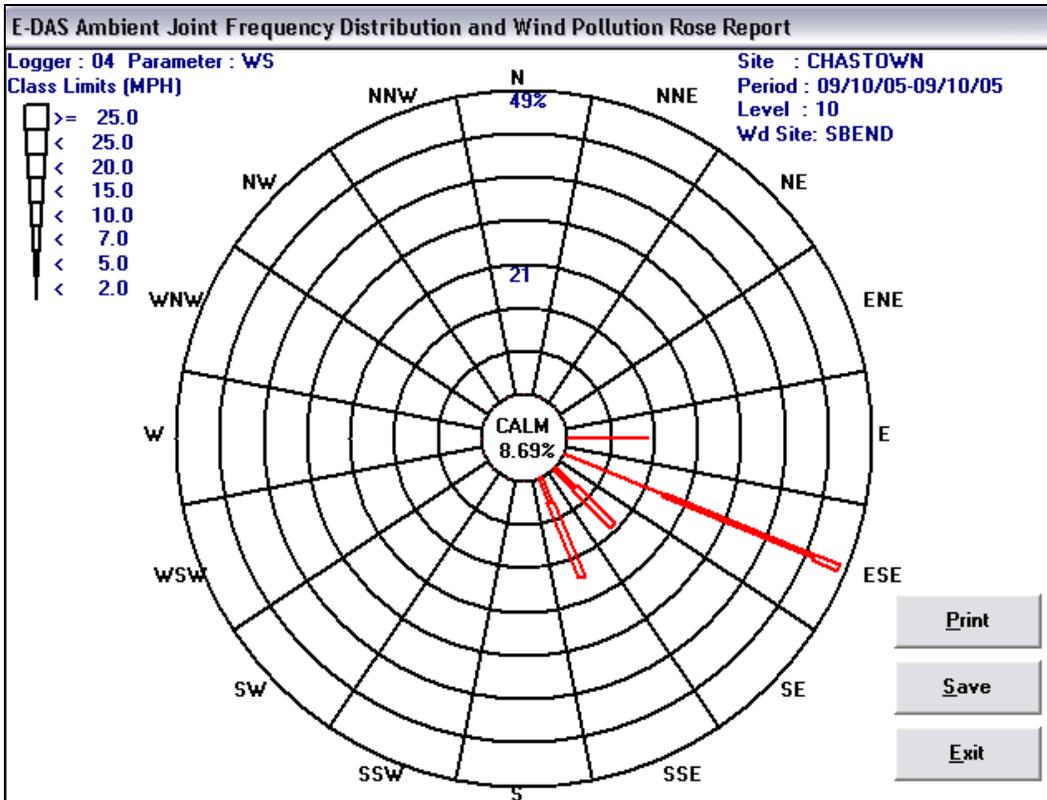
Reason: Smoke from wildfires in Arkansas, Mississippi and Texas impacted the Jeffersonville and New Albany sites on September 10 and 13, 2005. A front from the west and a front from the east caused by hurricane Ophelia effectively channeled smoke plumes into the area causing elevated levels of PM<sub>2.5</sub>.

Data: Table 1 shows daily FRM averages prior to, during, and after the event. PM<sub>2.5</sub> concentrations during the event ranged from 40 to 45 ug/m<sup>3</sup>. Values before and after were between 16 and 32 ug/m<sup>3</sup>. The Wind Roses show the complex meteorology that occurred during this time period. The trajectory models show the air mass moving in from the northwest until the 10<sup>th</sup> and then looping back from the south and southwest on the 11<sup>th</sup> -13<sup>th</sup>.

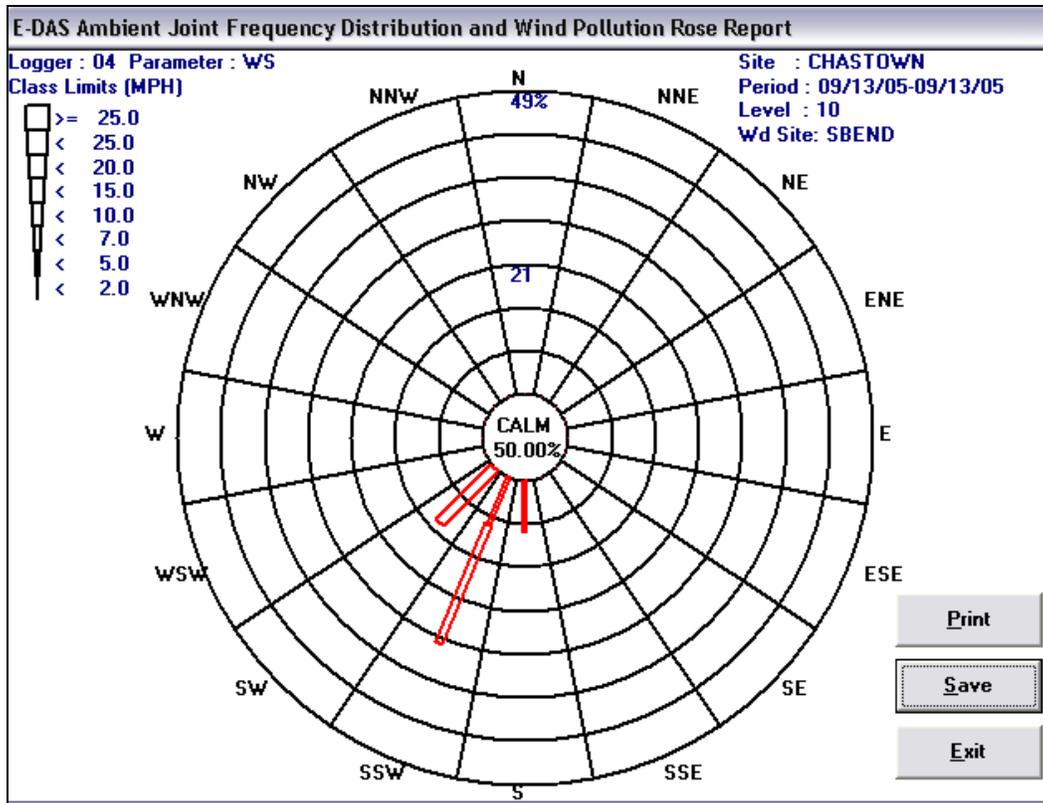
Maps: Images of maps from NOAA Satellite and Information Services show the smoke plume over the New Albany/Jeffersonville Metro Area as well as the channeling effects of the front from the west and hurricane Ophelia.

Table 1  
FRM PM<sub>2.5</sub> 24-hour Averages

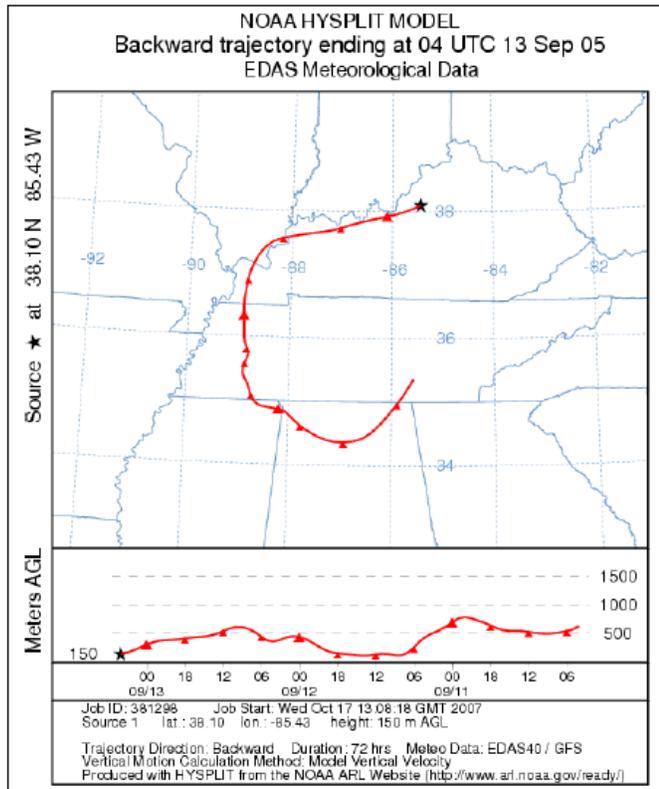
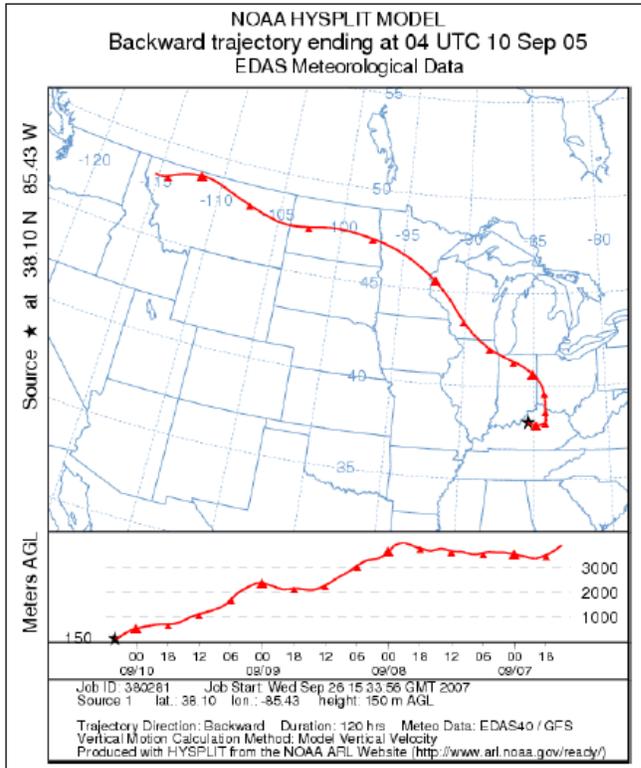
Date	New Albany 18-043-1004	New Albany (col) 18-043-1004	Jeffersonville 18-019-0006
09/07/05	28.3	29.4	32.1
<b>09/10/05</b>	<b>40.1</b>	no sample	<b>45.6</b>
<b>09/13/05</b>	<b>42.5</b>	<b>43.2</b>	<b>45.5</b>
09/16/05	16.7	no sample	16.7

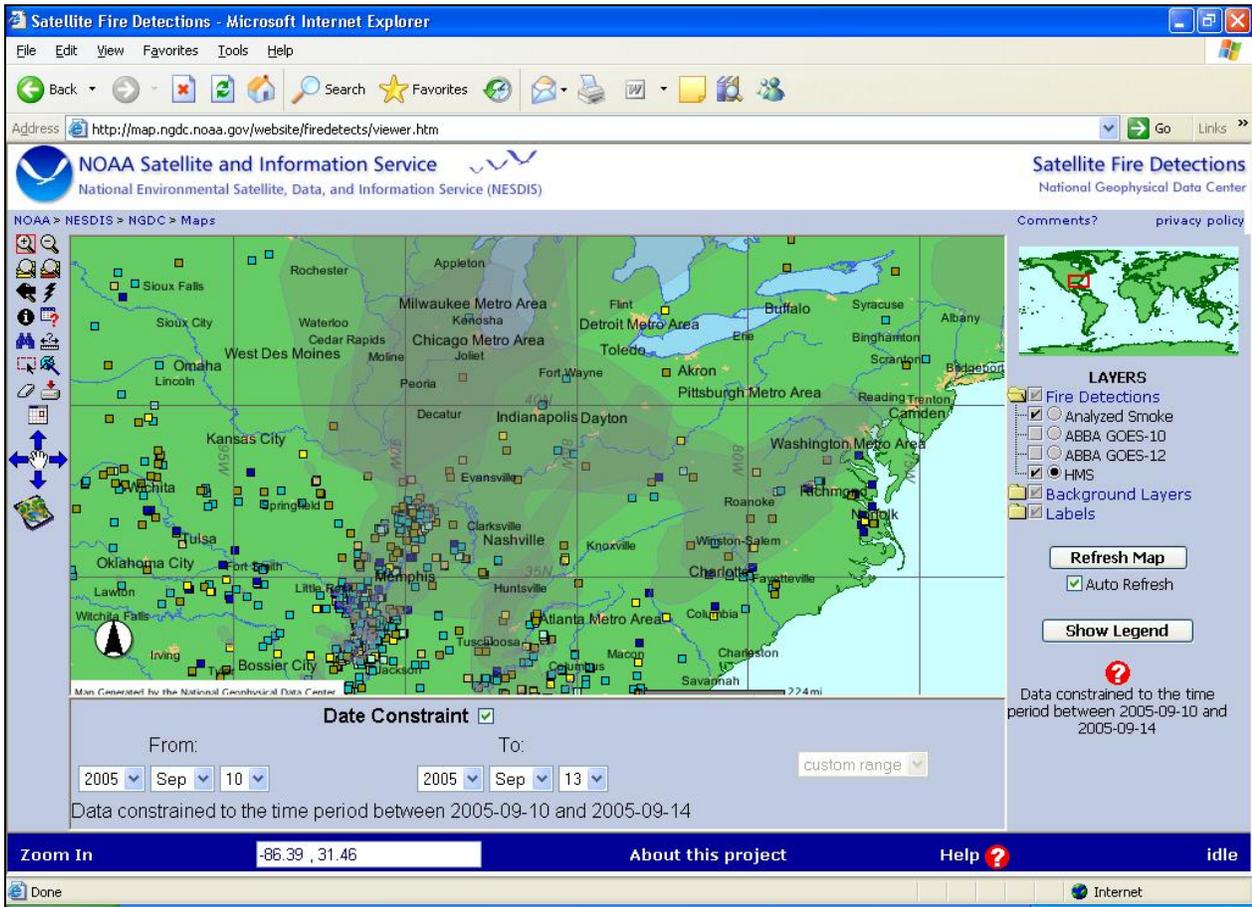


Wind rose from 09/10/05 shows the prevailing winds to be from the ESE, the primary direction of the smoke plume on that day (supported by trajectory model).

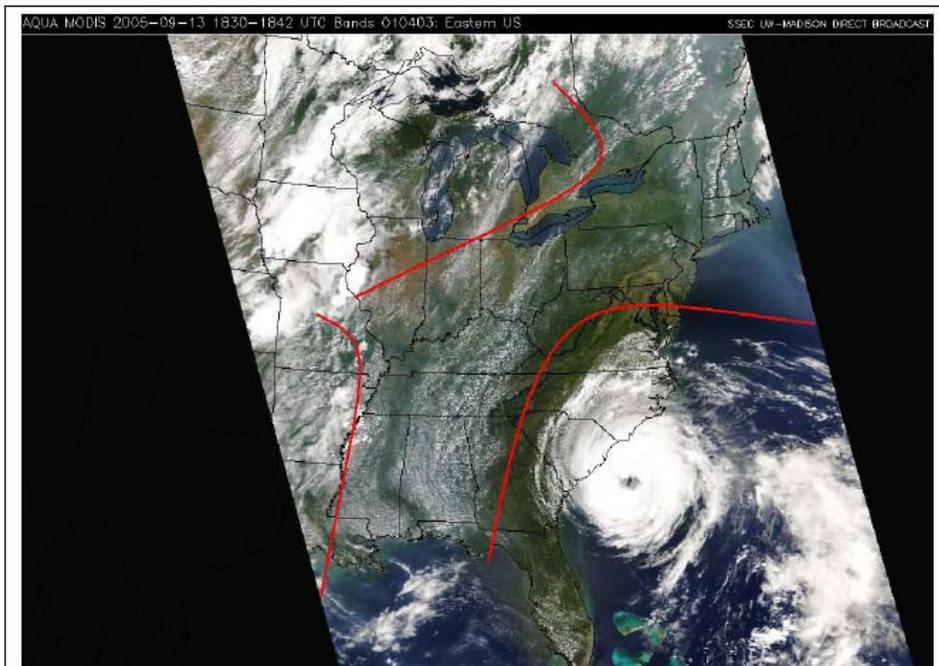


Wind rose from 09/13/05 shows the prevailing winds to be from the SSW, the primary direction of the smoke plume on that day (supported by trajectory model).





Smoke map from 10/10/05 – 10/13/05 clearly shows the smoke coverage over the Jeffersonville/New Albany area.



Satellite image from September 13, 2005 shows the channeling effects of the front from the west and hurricane Ophelia keeping the smoke plume over the Midwest.

Indiana Department of Environmental Management  
Office of Air Quality  
Indianapolis, IN

Subject: Exceptional Events Flagging for Fire Event

Parameter: PM<sub>2.5</sub>

Sites: Jeffersonville and New Albany

Dates: November 12, 2005

Reason: Smoke from a fire at the Fort Knox Military Reservation that was caused by tracer rounds that ignited a brush pile, causing a brush fire which impacted the Jeffersonville and New Albany areas. The fire was allowed to burn because unexploded ordinance in the area prevented fire crews from moving in. See the included Louisville Courier Journal Article dated November 13, 2005 for details.

Data: Table 1 shows daily FRM averages prior to, during, and after the event. There was a definite rise in values on November 12. Even though the values at the Jeffersonville site were lower than the New Albany values, the smoke plume map from the NOAA Satellite and Information Service is shown to also be impacting it as well. New Albany was near the center of the plume, while Jeffersonville was near the edge. The Wind Rose for this date indicates the predominance of south southwest wind, directly from Fort Knox.

Maps: Images of maps from NOAA Satellite and Information Services show the smoke plume over the New Albany/Jeffersonville Metro Area on November 11-12, 2005.

Table 1  
FRM PM<sub>2.5</sub> 24-hour Averages

Date	New Albany 18-043-1004	New Albany (col) 18-043-1004	Jeffersonville 18-019-0006
11/9/05	10.5	no sample	11.7
<b>11/12/05</b>	<b>33.2</b>	<b>34.4</b>	<b>21.4</b>
11/15/07	7.0	no sample	8.1

*Courier-Journal* newspaper article/weblink

Fort Knox fire sends smoke into Louisville

Sunday, November 13, 2005

Fort Knox fire sends smoke into Louisville

No buildings at post threatened

By Michael A. Lindenberger

mlindenberger@courier-journal.com

The Courier-Journal

A brush fire has been burning on Fort Knox's main firing range since Thursday evening, but officials said yesterday that the flames posed no threat to buildings or people on the post.

A haze caused by the fire that became visible in parts of Louisville, Southern Indiana and Hardin County yesterday prompted a handful of calls to area fire departments, officials in Elizabethtown and Louisville said.

Sgt. Tim Marsh of the Radcliff Fire Department said range fires happen several times a year and pose no threat to the surrounding property or residents.

Fort Knox spokeswoman Connie Shaffery said the fire began Thursday when tracer rounds ignited dry brush on the range, located south of the Salt River and west of the Rolling Fork.

Shaffery said the fire would be allowed to burn itself out since firefighters cannot reach the area because of unexploded ordnance in the range's four-mile-long impact zone. Shaffery said a range officer continued to monitor the fire and that if it appeared likely to spread beyond the area, firefighters on the 109,000-acre post would contain it.

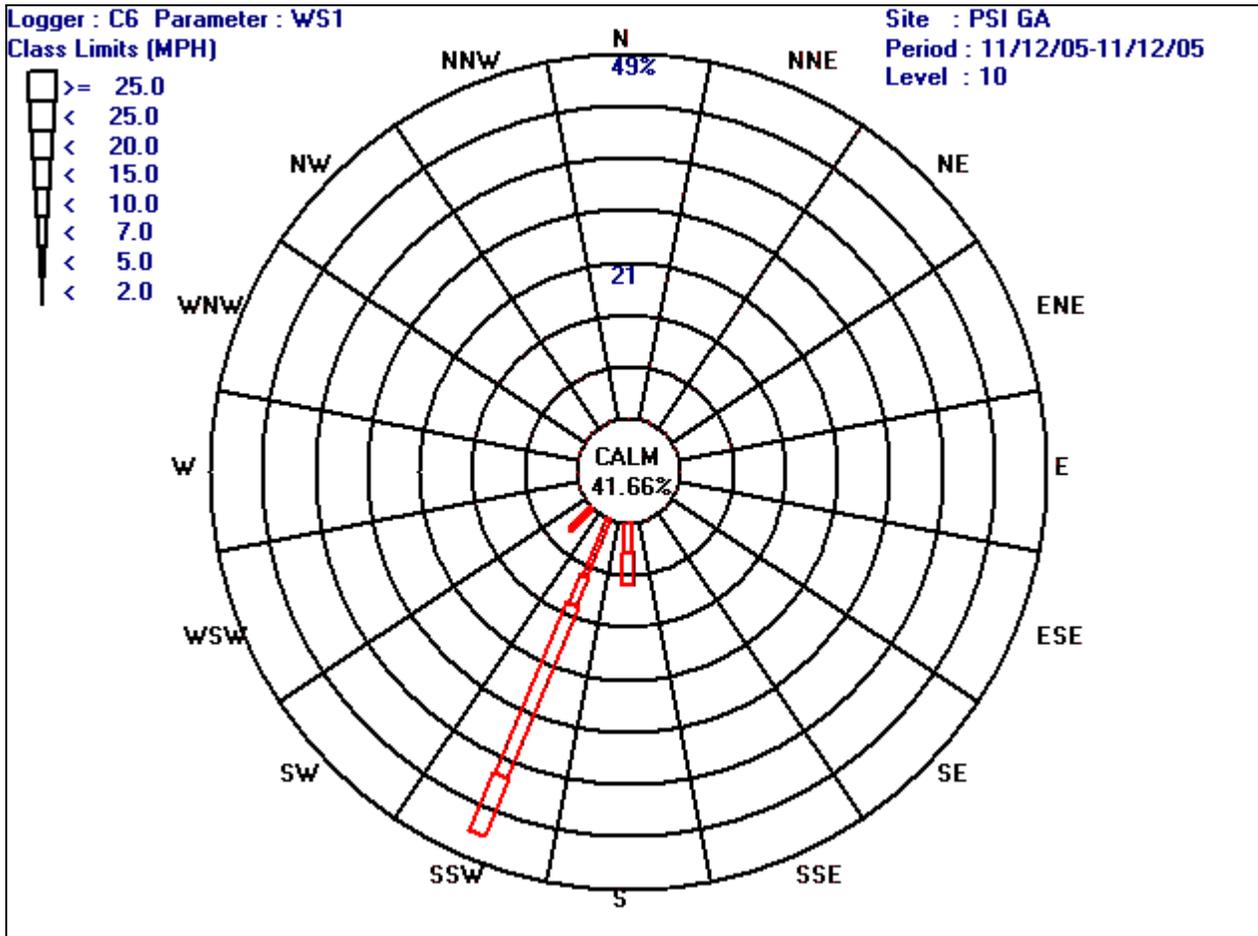
"It's supposed to rain this evening, and we expect that will put it out," she said.

Dispatcher Pat Riordan of Louisville Fire & Rescue said several residents had called to complain about the smoke.

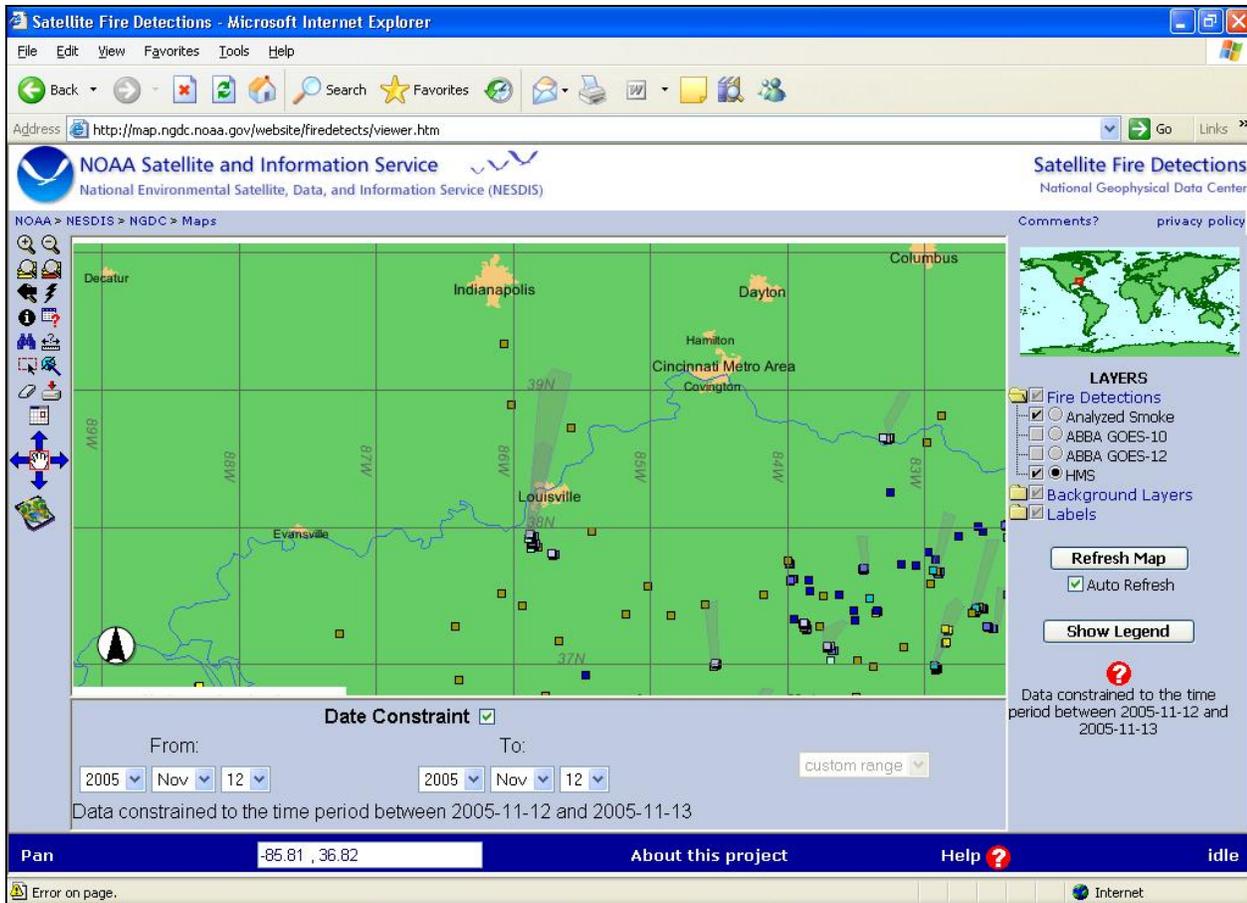
"It's not particularly worrisome," Riordan added. "But if you have respiratory problems, you'd likely find it to be irritating."

Riordan said winds blowing 9 to 15 mph out of the south carried smoke into the Louisville area.

Because of strong winds and low humidity, the National Weather Service issued a "red flag warning" for increased fire danger yesterday afternoon for Central and Western Kentucky and Southern Indiana. The warning expired at 7 last night.



Wind rose for November 12, 2005 clearly showing prevailing winds from the direction of the Fort Knox fire



Smoke map from November 12, 2005 showing the smoke plume coming from Fort Knox and impacting the New Albany/Jeffersonville areas

Indiana Department of Environmental Management  
Office of Air Quality  
Indianapolis, IN

Subject: Exceptional Events Flagging for Fireworks Event

Parameter: PM<sub>2.5</sub>

Site: Jeffersonville

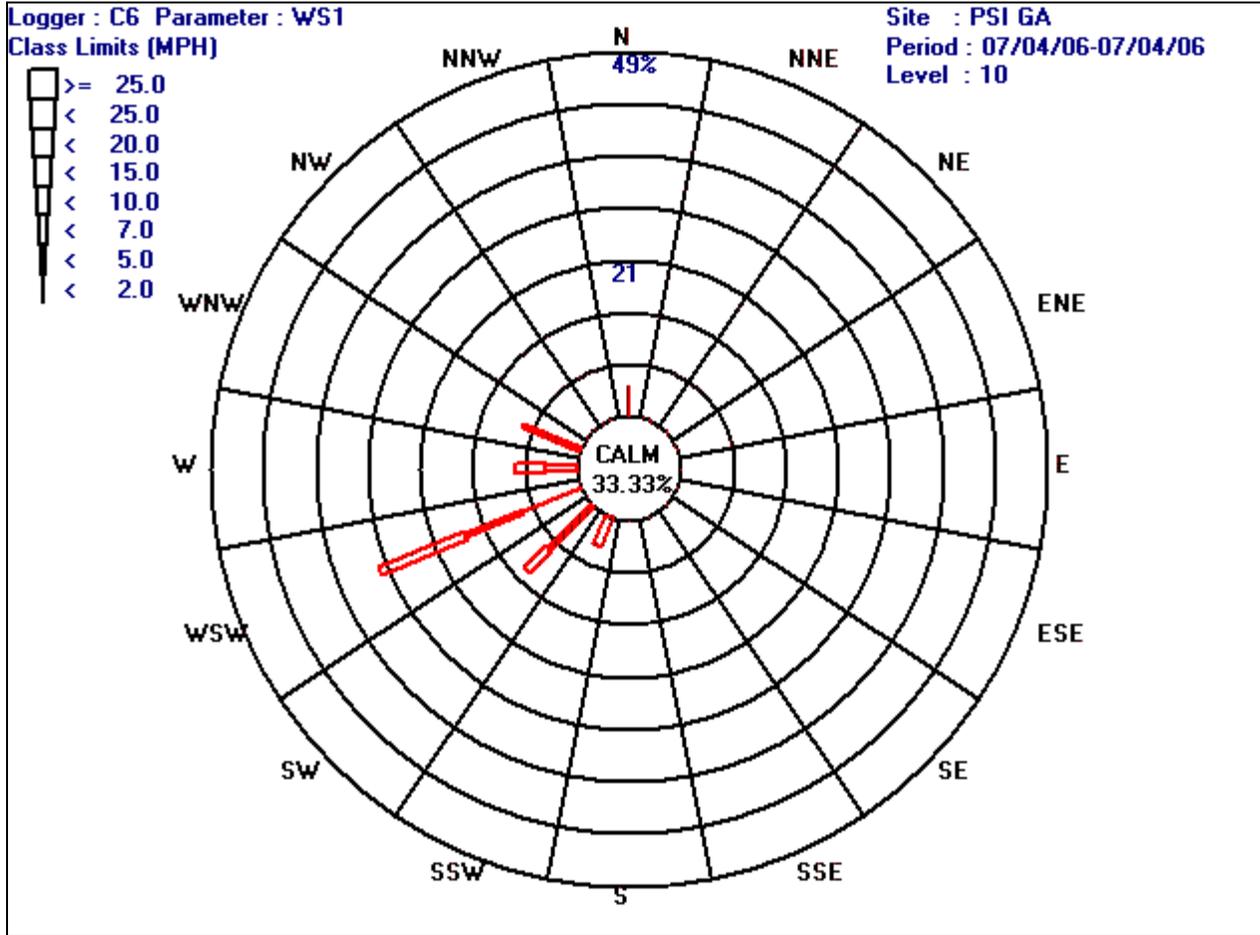
Dates: July 4, 2006

Reason: The Jeffersonville / Louisville Metro community like many large communities has a tradition of celebrating the Fourth of July with several activities throughout the day ending with huge fireworks displays that typically begin between 9-10 p.m. Unfortunately, this traditional celebration may have a short term impact on air quality especially if meteorological conditions are such that dispersion of the smoke plumes from these events are hindered. The short term effects typically last 2-4 hours and depending on the conditions and duration can substantially impact the particulate loading on PM<sub>2.5</sub> samples. Therefore in accordance with the Final Rule on Treatment of Data Influenced by Exceptional Events, IDEM has requested the data from Jeffersonville be flagged for this date.

Data: Table 1 shows daily FRM averages prior to, during, and after the event at both Jeffersonville and New Albany. The values track well between the two sites except on July 4. The Wind Rose shows the predominately calm and west southwest winds on this date. The Jeffersonville site was impacted by the Louisville fireworks display, while the New Albany site was not.

Table 1  
FRM PM<sub>2.5</sub> 24-hour Averages

Date	Jeffersonville 18-019-0006	New Albany 18-048-1004
06/28/06	19.4	17.0
07/01/06	28.2	27.2
<b>07/04/06</b>	<b>31.4</b>	<b>21.4</b>
07/07/06	12.6	No Data
07/10/06	28.5	25.1



Pollution rose from July 4, 2006 illustrates either calm or winds coming from the general direction of the larger fireworks displays in Louisville.

Indiana Department of Environmental Management  
Office of Air Quality  
Indianapolis, IN

Subject: Exceptional Events Flagging for Wildfires

Parameter: PM<sub>2.5</sub>

Sites: Jeffersonville and New Albany

Dates: July 19, 2006

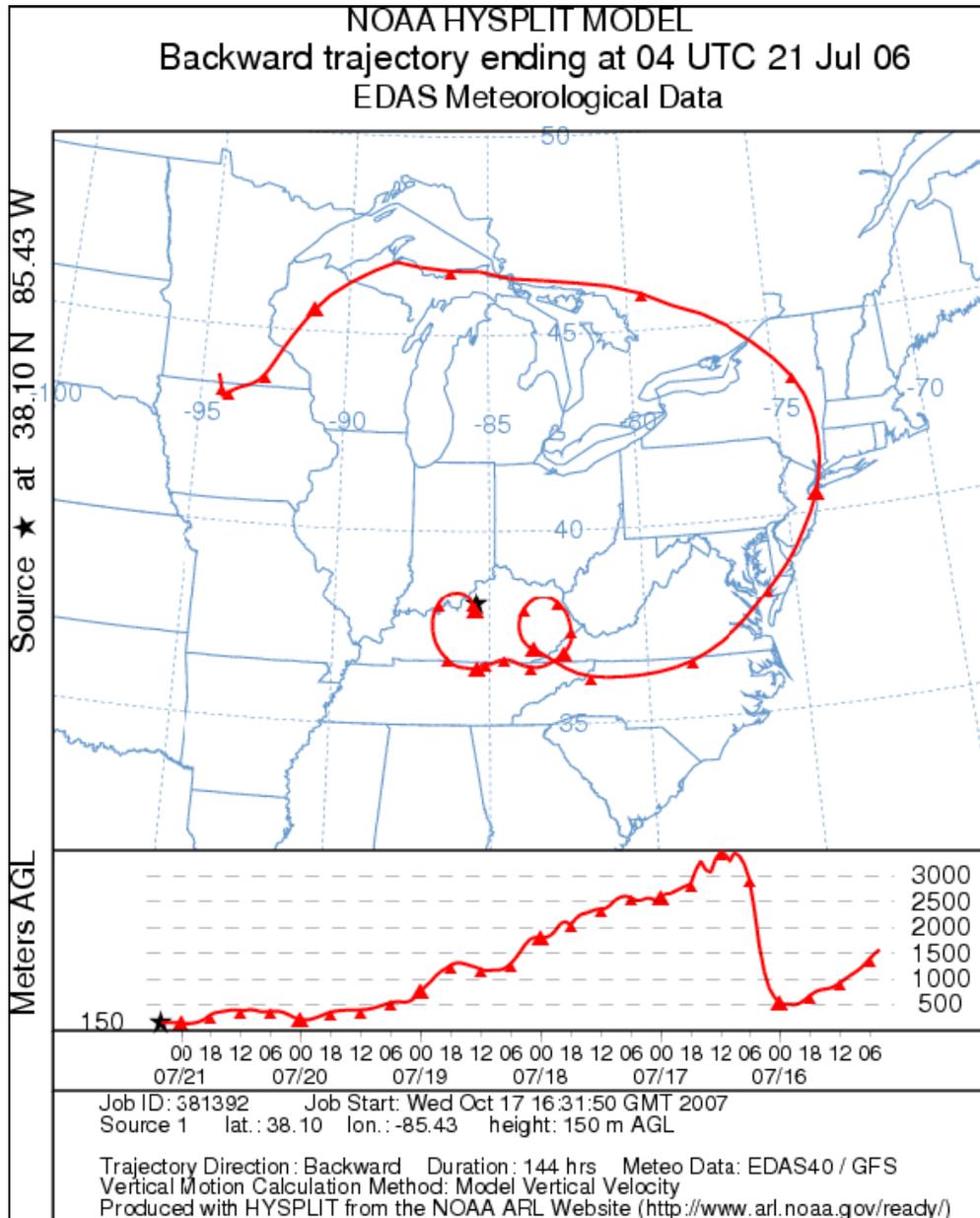
Reason: Smoke from numerous wildfires in Kansas, and surrounding states impacted the PM<sub>2.5</sub> values at the Jeffersonville and New Albany sites.

Data: Table 1 shows daily FRM averages prior to, during, and after the event. The values were 36 and 38 ug/m<sup>3</sup> on 7-19, while values before and after that date ranged from 10 to 16 ug/m<sup>3</sup>.

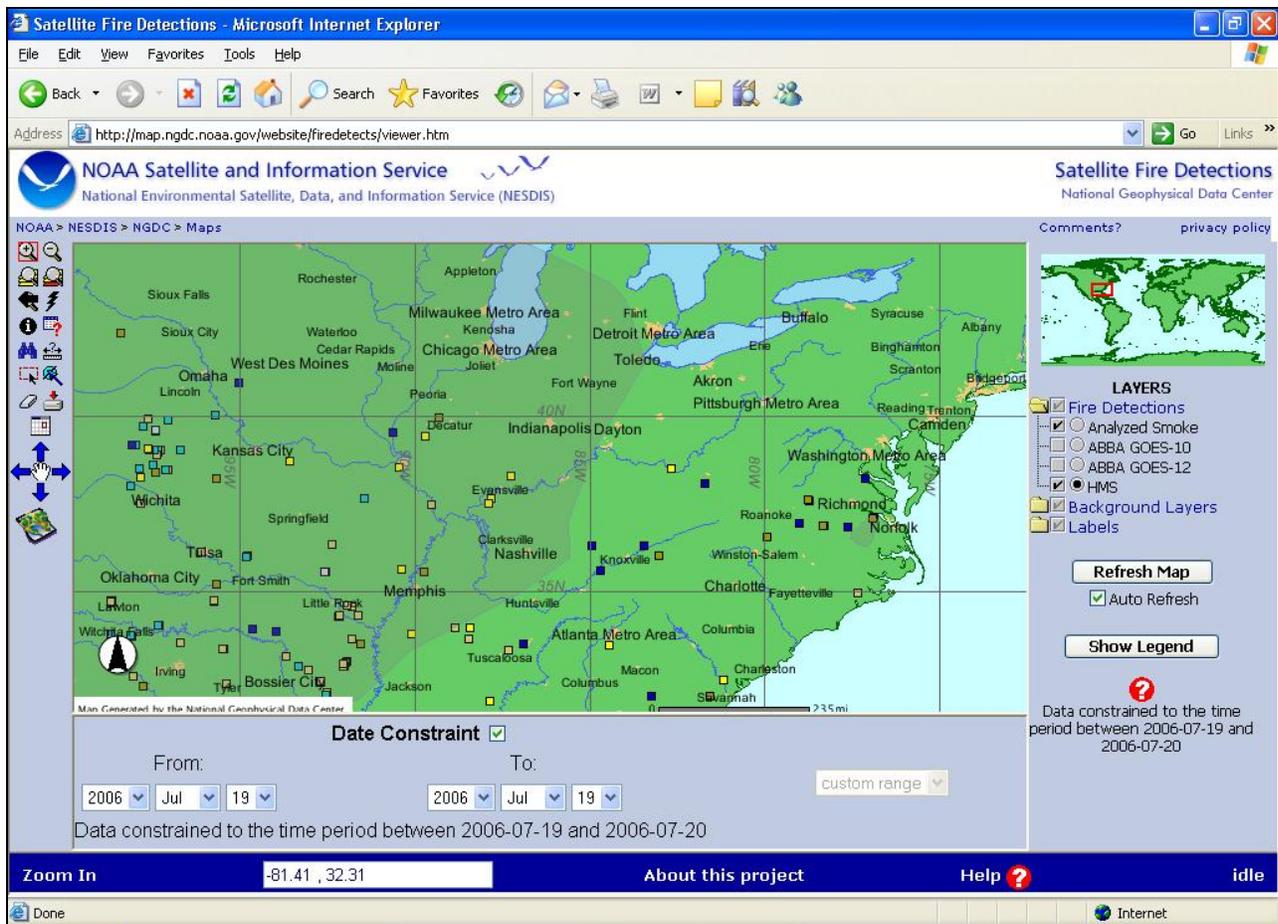
Maps: Images of maps from NOAA Satellite and Information Services show the smoke plume over the New Albany/Jeffersonville Metro Area on July 18-19, 2006.

Table 1  
FRM PM<sub>2.5</sub> 24-hour Averages

Date	New Albany 18-043-1004	New Albany (col) 18-043-1004	Jeffersonville 18-019-0006
07/16/06	12.8	13.6	16.7
<b>07/19/06</b>	<b>38.1</b>	<b>no sample</b>	<b>36.4</b>
07/22/06	9.7	10.6	9.7



Trajectory modeling shows the direction of the plume for 07/21/06 and the six days prior to the event.



Smoke map for July 19, 2006 clearly shows the Jeffersonville/New Albany area being impacted by the smoke plume.

# **Indiana Department of Environmental Management**

## **Exceptional Events Request**

### **for**

### **May 23 – June 2, 2007**

#### **Event**

During the period of May 23 – June 2, 2007, smoke from wildfires in northern Florida and southern Georgia impacted the State of Indiana by causing several exceedances of the 24-hour PM<sub>2.5</sub> NAAQS and significantly elevating PM<sub>2.5</sub> levels as a whole for the majority of the State. IDEM has compiled this comprehensive report to demonstrate that these elevated concentrations were due to an “exceptional event” and are requesting that the EPA concur with our decision to flag these values with an ‘E’ in AQS. Although the majority of the values to be flagged are not exceedances of the 24-hour PM<sub>2.5</sub> NAAQS, IDEM still requests for these values to be flagged as they will be used in design value calculations for the current 2005-2007 period as well as the next two periods; 2006-2008 and 2007-2009.

#### **Exceptional Events Criteria**

EPA defines an “exceptional event” as an unusual or naturally occurring event that can affect air quality but is not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the clean air act are not appropriate. IDEM will illustrate through the use of maps, meteorological data, speciation data, trajectory models and historical data that the smoke from wildfires in Florida and Georgia were the cause of the statewide elevated PM<sub>2.5</sub> values and should therefore be flagged as Indiana had no control over this event.

#### **Particulate Source**

The high PM<sub>2.5</sub> values originated from wildfires in northern Florida and southern Georgia. One of the largest fires was located in the Okefenokee National Wildlife Refuge and was known as the Bugaboo Scrub Fire. This fire started on May 5 and continued through June. During the period of the elevated PM<sub>2.5</sub> values in Indiana, the combined fires had burned over 500,000 acres making it one of the largest in modern history in the lower 48 states ([www.inciweb.org](http://www.inciweb.org)). Appendix 1 lists several news publications about the fire along with a map of the local area to illustrate the amount of acreage burned.

#### **Overall Impact**

The smoke from the fires began to influence PM<sub>2.5</sub> values in Indiana beginning May 22 as levels began to rise in southern and central Indiana. The impact becomes a statewide event on the May 23 and May 24. As weather conditions changed on the 25<sup>th</sup>, the northern part of the state is not affected by the fire again until May 29, but areas from Indianapolis to southern Indiana continue to be impacted. From May 29 through May 31, the entire state is again impacted by the smoke from the fires. The event ends for all of the state on the 31st, with the exception of southeast Indiana, which continues to be impacted on June 1 and June 2. The event is over on June 3.

#### **Data**

Table 1 lists the data for the time period from May 21 through June 5. The values which Indiana has determined as being impacted by the wildfires in Florida and Georgia are highlighted in yellow.

**Table 1 – PM<sub>2.5</sub> Data**

REGION	COUNTY NAME	NAME OF SITE	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5
Northwest Indiana	Lake	E. Chicago - Franklin Sch.	14.3			29.5			8.0			32.5			11.0			5.2
	Lake	Gary - IITRI	12.7			28.4			8.8			31.9			11.1			3.9
	Lake	Gary - Burr St.	19.0			31.2			9.4			36.8			12.0			4.7
	Lake	Griffith	13.6			27.6			IN			IN			10.2			5.0
	Lake	Gary - Madison St	14.2			27.6			IN			IN			10.7			5.4
	Lake	Gary - Ivanhoe Sch.	16.0			30.4			9.4			33.1			11.1			4.2
	Lake	Hammond - Purdue	14.2			30.1			IN			32.4			10.5			5.5
	Lake	Hammond - Clark HS	14.1			39.3			8.3			32.2			11.9			3.6
	LaPorte	Michigan City - Marsh Sch	11.3	16.6	31.7	27.9	9.1	12.5	10.1	12.6	36.7	31.5	30.2	18.4	10.7	9.2	6.9	3.0
	LaPorte	LaPorte - Lake St	11.8			27.0			8.8			31.0			11.6			2.9
	Porter	Dunes Nat'l Lakeshore	10.8			25.8			8.9			30.1			10.4			2.9
	Porter	Ogden Dunes	IN			27.9			9.3			31.5			11.4			3.5
North Central Indiana	Elkhart	Elkhart - Pierre Moran Sch.	11.4	16.6	32.8	30.9	11.0	17.0	15.5	16.0	34.7	32.8	31.3	22.0	IN	IN	IN	4.0
	St. Joseph	S. Bend - Nuner Sch.	11.8	18.8	33.9	31.7	10.6	18.3	13.7	15.3	37.1	34.0	32.0	IN	IN	IN	IN	4.3
	St. Joseph	S. Bend - Shields Dr.	IN			28.6			11.7			30.8			IN			3.8
	St. Joseph	S. Bend - LaSalle HS	11.1			28.7			10.2			31.3			IN			3.5
Northeast Indiana	Allen	Fort Wayne - Beacon St.	9.4	26.0	43.4	34.9	21.1	19.7	17.8	15.0	33.8	33.7	33.0	IN	IN	IN	IN	IN
	Allen	Fort Wayne - Taylor Univ.	8.8			31.0			16.9			33.1			IN			IN
Central Indiana	Delaware	Muncie - Central HS	IN	IN	36.0	31.4	30.7	24.7	22.4	21.3	35.1	33.4	30.2	24.6	19.4	23.5	7.2	5.2
	Henry	Mechanicsburg	14.6			30.7			21.5			32.4			IN			IN
	Howard	Kokomo	14.0			30.6			20.5			33.5			15.1			5.7
	Madison	Anderson - W. 5th St	16.2	19.5	36.4	29.4	30.2	27.8	24.5	22.8	38.0	32.9	32.6	28.5	19.1	19.7	6.8	4.6
	Marion	Indpls - Mann Rd.	16.3			30.7			23.0			31.0			18.7			7.4
	Marion	Indpls - West St.	24.4			31.6			25.1			33.2			21.1			7.7
	Marion	Indpls - English Ave.	19.4	23.1	37.9	33.1	35.8	31.3	26.6	28.7	37.9	34.1	34.6	29.4	23.0	19.4	7.0	7.5
	Marion	Indpls - Washington Park	19.1	22.5	38.5	31.9	34.9	29.3	24.5	26.3	37.6	34.1	32.0	26.5	20.2	19.2	7.7	6.3
	Marion	Indpls - E. 75th St.	16.3			30.5			25.2			32.4			18.9			5.8
	Marion	Indpls - W. 18th St.	17.7			IN			25.4			31.4			19.3			6.2
	Marion	Indpls - E. Michigan St.	18.4			30.2			25.3			32.9			21.6			6.3
West Central Indiana	Tippecanoe	Lafayette - Greenbush St.	15.6	18.3	34.7	27.8	21.9	24.6	19.8	19.4	36.8	32.7	30.0	23.2	15.7	13.3	5.9	6.6
	Vigo	Terre Haute - Lafayette Ave	16.0			28.8			21.5			29.2			18.0			6.9
	Vigo	Terre Haute - Devaney Sch.	14.9	20.1	32.6	27.7	30.4	25.4	21.2	23.2	39.6	29.6	30.5	20.3	16.8	13.6	5.5	6.6
Southwest Indiana	Dubois	Jasper - Sport	15.4			25.7			30.0			IN			22.8			11.2
	Dubois	Jasper - Golf	16.5			26.5			30.0			33.1			20.2			10.3
	Dubois	Jasper - Post Office	IN	21.9	28.4	25.0	25.9	41.5	30.5	34.2	39.5	31.8	IN	21.5	IN	IN	IN	IN
	Knox	Southwest Ag Center	18.2			28.4			29.5			29.1			20.3			7.8
	Spencer	Dale	17.0			25.5			30.5			31.2			23.8			10.6
	Vanderburgh	Evansville - Civic Center	15.0			IN			IN			26.5			IN			IN
	Vanderburgh	Evansville - Mill Rd.	IN			23.9			29.9			28.0			19.8			7.7
	Vanderburgh	Evansville - U of E	14.9			25.8			27.7			27.6			22.3			8.0
Southeast Indiana	Clark	Jeffersonville - Walnut St	24.3	25.5	IN	32.0	32.8	32.6	28.9	33.8	38.2	29.2	33.4	32.3	40.2	23.3	11.0	15.2
	Floyd	New Albany	18.0			29.7			25.4			28.4			35.1			9.7
Exceptional Events Data																		

## **Investigation of High PM<sub>2.5</sub> Values**

To determine the cause of the high PM<sub>2.5</sub> values during the period from May 23 through June 2, several analyses were performed. Knowing where the air mass with the high PM<sub>2.5</sub> concentrations had been prior to moving across Indiana and what influenced it along the way are key to determining if the values were locally produced or transported into Indiana. When all the individual analyses are put together and compared, the source of the high values reported in Indiana is from the wildfires in southern Georgia and northern Florida.

### Trajectory Modeling

Back trajectory modeling provides an indication of where a parcel of air had been at a given point in time. If the forward trajectory from a suspected source matches up with the back trajectory from that time period, there is a strong probability that the air mass from the suspected source did impact a site or area a day or several days after the fact. Back trajectories for the individual areas are included in the individual report. As forward trajectory models are the same for each report, they are listed in Appendix 2.

### Weather Maps

Individual weather maps for a given day provide a good indication of atmospheric conditions and the general air flow. The daily weather maps are included with each area report.

### Smoke Maps

Daily smoke maps from NOAA Satellite and Information Service show the spatial impact of smoke from major fires along with its intensity. The smoke maps are included in each report.

### Wind Roses

Daily wind roses provide the localized wind speed and wind directions for a particular area on a given day. The daily wind roses are included in each area report.

Using the wind roses with the trajectory models and the weather maps provide a picture of the meteorological conditions on that day.

### Carbon Data

Speciated data is available from seven (7) sites in Indiana. Six (6) of the sites operate on a 1/6 day sampling schedule, while the Indianapolis site collects data every third day. During this period, very high organic carbon values were recorded. The elemental carbon values did not increase and remained at average or below average concentrations. High organic carbon values, without an increase in elemental carbon, are a very good indicator of biomass combustion. The high organic carbon values were not only seen in Indiana, but followed a general pattern from southern Georgia, through the eastern Mississippi River Valley and across the Midwest and Ohio River Valley. Maps with the plotted organic carbon values during the May 18 through June 5 are in Appendix 3. The time progression of the maps shows the rise and fall of the organic carbon values over this time period.

## **Area Specific Analysis**

As weather patterns change through the time period, specific areas of Indiana were affected differently. The individual area requests being submitted are identified in Table 2, along with the specific counties and cities affected.

**Table 2 – Section Reports**

<b>Section #</b>	<b>Section Name</b>	<b>City (s)</b>	<b>County (s)</b>
1	Lake County	East Chicago Gary Griffith Hammond	Lake
2	Northwest	Michigan City LaPorte Dunes Lakeshore Ogden Dunes	LaPorte LaPorte Porter Porter
3	North	South Bend Elkhart	St. Joseph Elkhart
4	Northeast	Ft. Wayne	Allen
5	Central	Kokomo Lafayette	Howard Tippecanoe
6	East Central	Anderson Muncie Mechanic sburg	Madison Delaware Henry
7	Indianapolis	Indianapolis	Marion
8	West	Terre Haute	Vigo
9	Vincennes	Vincennes	Knox
10	Jasper	Jasper Dale	Dubois Spencer
11	Evansville	Evansville	Vanderburgh
12	Southeast	New Albany Jeffersonville	Clark

**Review and Comment**

Proposed Exceptional Events Requests are posted on the IDEM website for review and comment for thirty (30) days.

Comments can be emailed to

Steve Lengerich ([slengeri@idem.in.gov](mailto:slengeri@idem.in.gov))

or mailed to

Steve Lengerich  
100 North Senate Avenue  
MC 61-50-2 Shadeland  
Indianapolis, IN 46204-2251

or faxed to

317-308-3239

# 1 – Lake County Exceptional Events Detail

Parameter: PM<sub>2.5</sub>

Dates: May 24 & 30, 2007

Location: Gary / E. Chicago / Griffith / Hammond - Lake Co.

Event: Smoke from wildfires in northern Florida and southern Georgia impacted the Lake County region on May 24 and 30. The buildup of smoke moving through the area during this period resulted in an exceedance of the 24-hour PM<sub>2.5</sub> NAAQS on May 30 at Gary – Burr St. (18-089-0026) and several elevated readings throughout Lake County on both days.

Data: Different analyses of the data are used to demonstrate that the PM<sub>2.5</sub> concentrations measured on May 24 and 30 have been influenced by outside events. Table 1.1 shows daily PM<sub>2.5</sub> averages prior to, during, and after the event with the values flagged in **bold**. Data have been flagged with an exceptional event flag of 'E' in AQS, awaiting concurrence from EPA.

Tables 1.2 and 1.3 list summaries of the data collected at the Lake County sites since 2000. Summary data from 2007 and the annual and daily design values for 2005-2007 are calculated with all current data and with the flagged data removed.

There is only one change in the Daily Design Values at the sites with the flagged data removed. This occurred at Gary – Burr St. All currently operating sites will remain either slightly below or above the daily NAAQS. All sites which are compared to the annual NAAQS, had design values less than the NAAQS value prior to flagging. When the flagged data were excluded, the design values improve. These improved values may be the difference between nonattainment and attainment of the annual NAAQS when the design values are calculated for 2006-2008 and for 2007-2009.

**Table 1.1 - FRM Daily Values  
Exceptional Event Period**

Values in **BOLD** are flagged as exceptional events

Date	East Chicago 18-089-006	Gary - IITRI 18-089-0022	Gary - Burr St 18-089-0026	Griffith 18-089-0027	Gary Water 18-089-0028	Gary Ivanhoe 18-089-1003	Hammond Purdue 18-089-2004	Hammond Robertsdale 18-089-2010
5/18/07	14.6	12.6	13.6	9.4	12.5	13.9	9.6	11.9
5/19/07								
5/20/07								
5/21/07	14.3	12.7	19	13.6	14.2	16	14.2	14.1
5/22/07								
5/23/07								
<b>5/24/07</b>	<b>29.5</b>	<b>28.4</b>	<b>31.2</b>	<b>27.6</b>	<b>27.6</b>	<b>30.4</b>	<b>30.1</b>	<b>29.3</b>
5/25/07								
5/26/07								
5/27/07	8	8.8	9.4			9.4		8.3
5/28/07								
5/29/07								
<b>5/30/07</b>	<b>32.5</b>	<b>31.9</b>	<b>36.8</b>	<b>30.9</b>	<b>31.6</b>	<b>33.1</b>	<b>32.4</b>	<b>32.2</b>
5/31/07								
6/1/07								
6/2/07	11	11.1	12	10.2	10.7	11.1	10.5	11.9

**Table 1.2 - Historical Daily Values**

Year		Gary IITRI 18089022		Gary Water 180890028		Gary - Burr St. 18089026		Gary Ivanhoe 180891003	
		98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>
2000		43.6				33.8		33.1	
2001		48.7				42		37	
2002	2000- 2002	39.5	44			38.7	38	32.7	34
2003	2001- 2003	45.9	45			41.7	41	31	34
2004	2002- 2004	45.8	44			38.6	40	30.5	31
2005	2003- 2005	40.4	44	38.7	39	43.7	41	39	34
2006	2004- 2006	28.5	38	27.1	33	30.4	38	25.8	32
2007	2005- 2007	35.2	35	36.2	34	36.8	37	33.8	33
Values excluding flagged data									
2007	2005- 2007	35.2	35	36.2	34	35	36	33.8	33

<sup>1</sup> Daily Design Value = 3 year average of annual 98<sup>th</sup> %ile values.

**Table 1.2 (con't) - Historical Daily Values**

		E. Chicago 180890006		Griffith 180890027		Hammond - Purdue 180892004		Hammond - Robertsdale 180892010	
Year		98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>
2000		34.2		31.9		32.8		33.9	
2001		39.8		37.3		36		37.9	
2002	2000- 2002	37.4	37	31.6	34	33.9	34	36.2	36
2003	2001- 2003	33.1	37	35.6	35	32.3	34	37.6	37
2004	2002- 2004	33	35	30.1	32	31.9	33	28.4	34
2005	2003- 2005	39.9	35	37.1	34	37.6	34	40.9	36
2006	2004- 2006	29.4	34	25.8	31	26.2	32	27.9	32
2007	2005- 2007	37.2	36	34.1	32	34.9	33	35.2	35
Values excluding flagged data									
2007	2005- 2007	37.2	36	34.1	32	34.9	33	35.2	35

<sup>1</sup>Daily Design Value = 3 year average of annual 98<sup>th</sup> %ile values.

**Table 1.3 - Historical Annual Averages**

		Gary - IITRI 18089022		Gary Water 180890028		Gary - Burr St. 18089026		Gary Ivanhoe 180891003	
Year		Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>
2000		17.4				17.2		15.3	
2001		18				18.2		15	
2002	2000- 2002	16.4	17.3			17.7	17.7	15.2	15.2
2003	2001- 2003	16.6	17			17.4	17.7	14.1	14.8
2004	2002- 2004	16.1	16.4			16.5	17.2	12.9	14.1
2005	2003- 2005	18.3	17	16.6	16.6	18.7	17.5	15.7	14.3
2006	2004- 2006	13.6	16	13.3	15	14.7	16.7	12.6	13.7
2007	2005- 2007	15.1	15.6	14.6	14.8	16.1	16.5	14	14.1
Values excluding flagged data									
2007	2005- 2007	14.7	15.5	14.3	14.7	15.7	16.4	13.7	14

<sup>2</sup>Annual Design value = 3 year average of the annual averages.

**Table 1.3 (con't) - Historical Annual Averages**

		E. Chicago 180890006		Griffith 180890027		Hammond - Purdue 180892004		Hammond - Robertsdale 180892010	
Year		Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>
2000		15.8		14		15		14.3	
2001		16.1		15.2		15.4		15.5	
2002	2000- 2002	14.9	15.6	15.6	14.6	14.7	15	14.9	14.9
2003	2001- 2003	14.6	15.2	14.1	14.6	14.6	14.9	14.3	14.9
2004	2002- 2004	13.2	14.2	12.8	13.8	13.3	14.2	12.5	13.9
2005	2003- 2005	15.8	14.5	15.5	14.1	15.4	14.4	15.6	14.1
2006	2004- 2006	13.2	14	12.3	13.5	12.7	13.8	12.8	13.6
2007	2005- 2007	14.4	14.5	13.2	13.6	13.8	14	13.7	14
Values excluding flagged data									
2007	2005- 2007	14.1	14.4	12.6	13.4	13.5	13.8	13.3	13.9

<sup>2</sup>Annual Design value = 3 year average of the annual averages.

**Particulate**

**Composition:** Speciation data are collected at the Gary – IITRI and Hammond - Purdue site on a one in six day sampling schedule. Data are available for May 24 and May 30. High organic carbon values were reported on those two dates; 9.35 ug/m<sup>3</sup> and 8.17 ug/m<sup>3</sup> at Gary and 9.86 ug/m<sup>3</sup> and 8.07 ug/m<sup>3</sup> at Hammond, respectively. These values were the highest values of the year at these two sites. The annual average for organic carbon is 3.45 ug/m<sup>3</sup> at Gary and 3.23 ug/m<sup>3</sup> at Hammond. The elemental carbon values were very near the annual average concentrations. The high organic carbon values, without an increase in elemental carbon, are a very good indicator of biomass combustion.

The maps in Appendix 3 indicate that the regional organic carbon values were elevated on the two available sample days. The time progression of the maps shows the rise and fall of the organic carbon values over this time period.

**Maps:**

Images of maps from NOAA Satellite and Information Services show the smoke plume originating from the northern Florida/southern Georgia region. Dispersion and movement of the smoke plume from these fires was generally to the west or northwest and then to the north. The daily satellite smoke photos show that the smoke plume from the fires extends into Lake County on May 24. The plume recedes farther to the south and east and

returns to influence the May 30 sample. The daily wind roses (obtained from the nearest meteorological site at Gary - IITRI, 18-089-0022) show information on prevailing wind direction, calm conditions and wind speed. NOAA weather maps are also used to show that an upper level trough greatly influences the direction of the plume in relation to the Lake County region.

Trajectory  
Modeling:

The NOAA HYSPLIT Models are used to show wind trajectories at different levels during this event. Backward modeling from the site (latitude: 41.60°; longitude: -87.34°) at elevations of 25m, 150m and 500m was conducted for a period of three (3) to four (4) days prior. The differing elevations were chosen to demonstrate the air mass's uniformity at ground-level where the samplers were located and aloft which avoids the ground-level limitations of the model. Forward modeling was conducted using the Bugaboo Scrub Fire as the starting point (latitude: 30.70°; longitude: -82.40°) at an elevation of 250 meters (appropriate height that is low enough to always be in the well-mixed zone and high enough to avoid the ground-level model limitation) and going three (3) to four (4) days. Overall, there is a very good correlation when comparing the forward and backward trajectories for a given date. May 24 and 30 show a very narrow channel of air flow between southeastern Georgia and Lake County. Forward trajectory modeling can be found in Appendix 2.

Conclusion:

EPA defines an “exceptional event” as an unusual or naturally occurring event that can affect air quality but is not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the clean air act is not appropriate. It has been illustrated through the use of maps, meteorological data, speciation data, trajectory models and historical data that the smoke from wildfires in Florida and Georgia impacted the Lake County region on the days of May 24 and 30, 2007 causing elevated levels of the PM<sub>2.5</sub> 24-hour standard and significantly increasing the annual average. According to 40 CFR Part 50.14 (b)(1), “EPA shall exclude data from use in determinations of exceedances and NAAQS violations where a State demonstrates to EPA’s satisfaction that an exceptional event caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section.” IDEM believes they have successfully illustrated the impact of this event on the sites in this region.

Therefore, IDEM requests that EPA concur with the ‘E’ flag on the data in AQS for the data in **bold** in Table 1.1.

## NOAA Satellite Smoke Maps, Weather Maps, and Wind Roses

The smoke map shows that the plume is remaining over the area. The prevailing wind direction has shifted to the south as the upper level trough moves further to the east and another trough develops over Ohio, keeping the plume over the Lake county region.

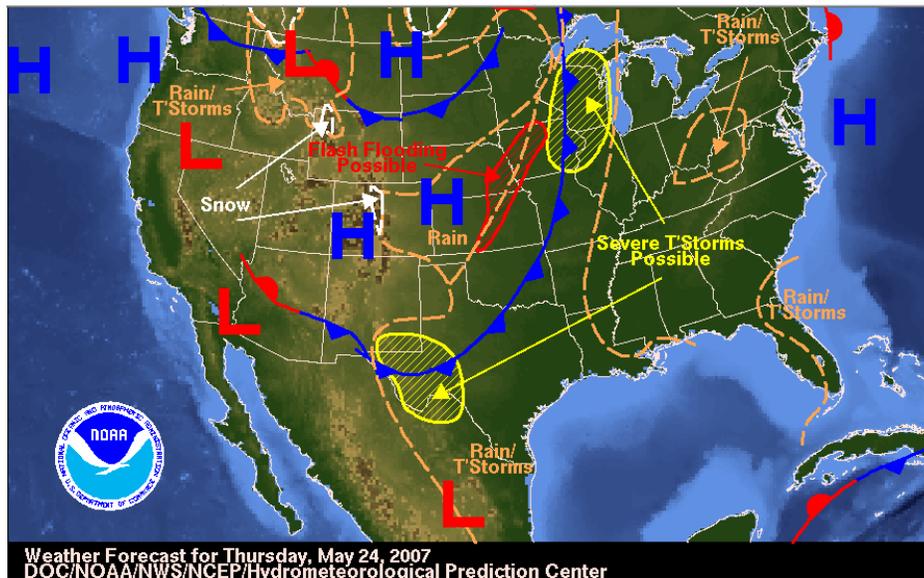
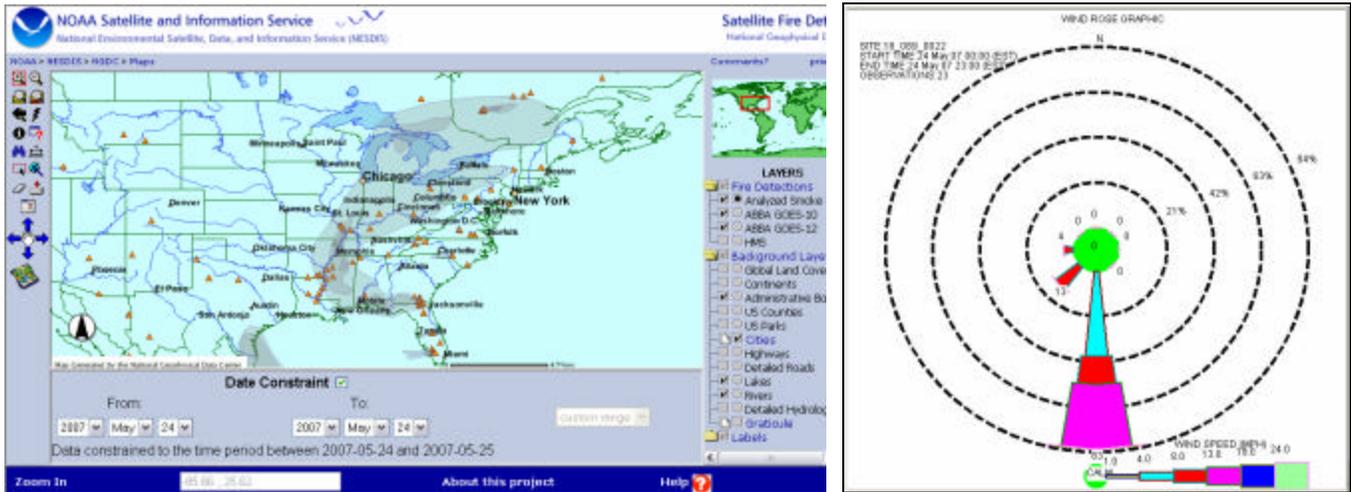


Figure 1.1 - May 24, 2007

The map shows the plume has moved back over the region as the upper level trough dips down over the area and the wind direction continues to be from the south.

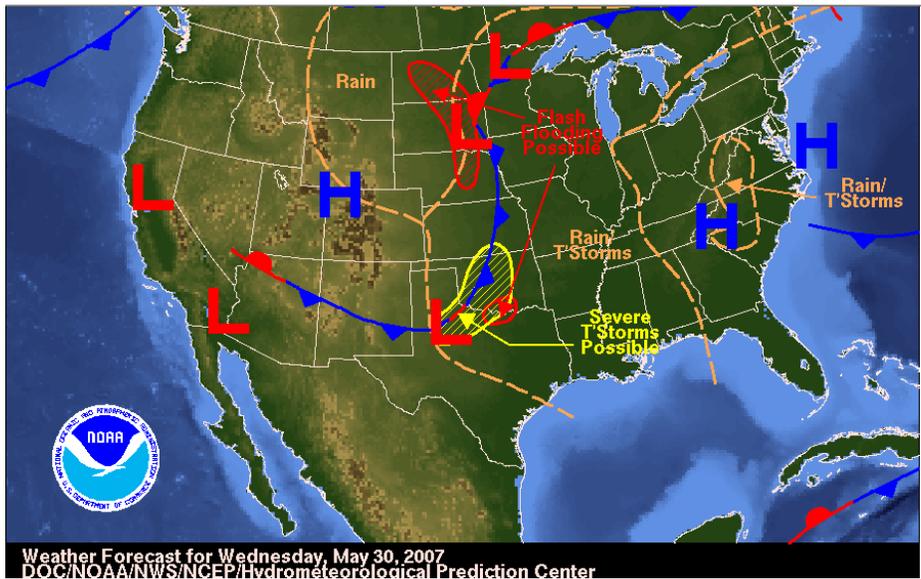
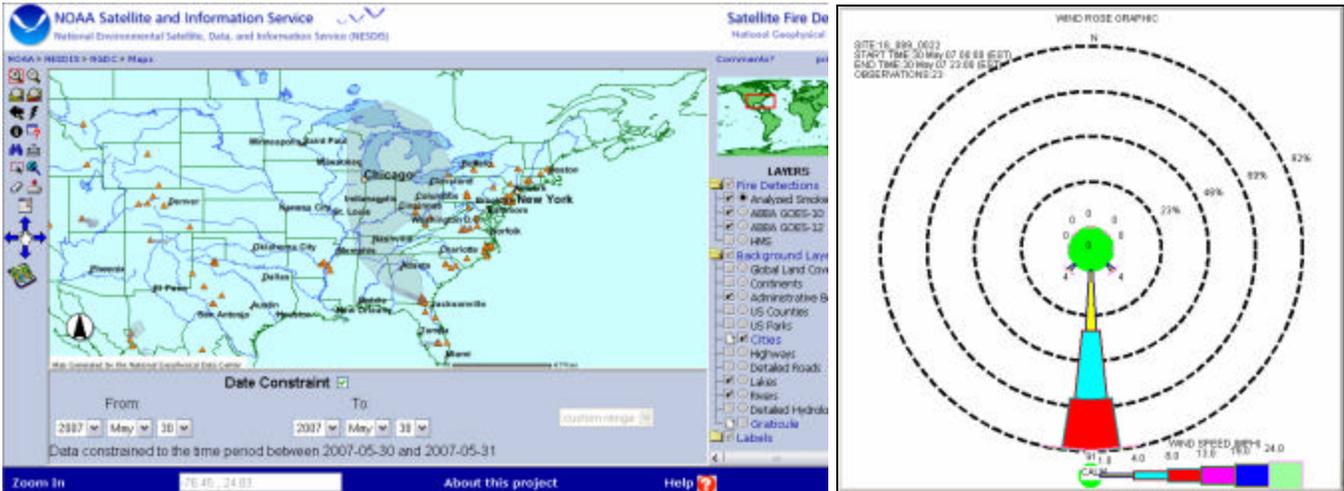
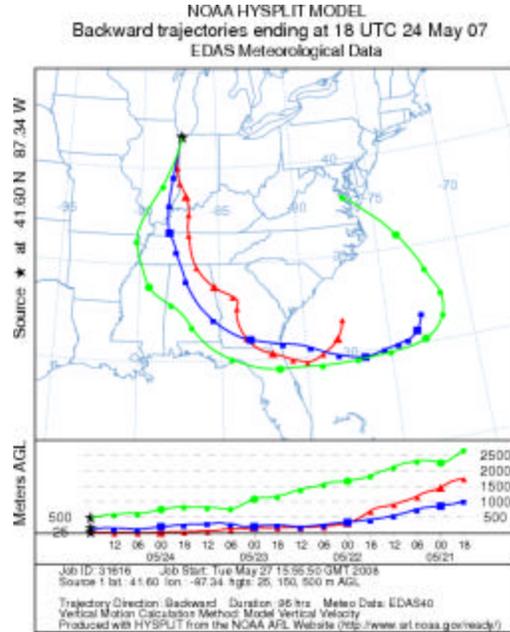


Figure 1.2 - May 30, 2007

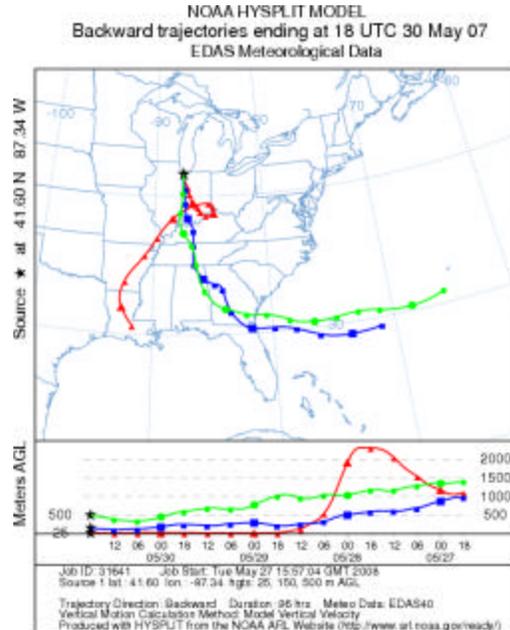
# Backward Trajectory Models

## NOAA ARL READY HYSPLIT Maps

Draxler, R.R. and Rolph, G.D., 2003. HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (<http://www.arl.noaa.gov/ready/hysplit4.html>). NOAA Air Resources Laboratory, Silver Spring, MD.



**Figure 1.3:** Backward trajectories originating from Gary on 5/24/07 at 12:00 PM CST showing consistency in the air mass passing over southern Georgia and northern Florida.



**Figure 1.4:** Backward trajectories originating from Gary on 5/30/07 at 12:00 PM CST showing continuation of the air mass passing over southern Georgia and northern Florida.

## 2 – Northwest Indiana Exceptional Events Detail

- Parameter: PM<sub>2.5</sub>
- Dates: May 23, 24, 29 - 31, 2007
- Location: Michigan City, LaPorte/ Dunes Lakeshore, Ogden Dunes - LaPorte / Porter Co.
- Event: Smoke from wildfires in northern Florida and southern Georgia impacted the Northwest Indiana region during the period of May 23 – 31. The buildup of smoke moving through the area during this period resulted in an exceedance of the 24-hour PM<sub>2.5</sub> NAAQS on May 29<sup>th</sup> at Michigan City (18-091-0005) and several elevated readings throughout the region.
- Data: Different analyses of the data are used to demonstrate that the PM<sub>2.5</sub> concentrations measured from May 23 – 31 are beyond the range of values typically found during that time period and that they have been influenced by outside events. Table 2.1 shows daily PM<sub>2.5</sub> averages prior to, during and after the event with the values flagged in **bold**. Data have been flagged with an exceptional event flag of 'E' in AQS, awaiting concurrence from EPA.
- Tables 2.2 and 2.3 list summaries of the data collected in LaPorte and Porter counties sites since 2000. Data from 2007 are calculated with all current data and with the flagged data removed. There is an improvement in the Michigan City and LaPorte daily design values (2005-2007) and an improvement in all of the annual averages at all sites when the flagged data are removed.

**Table 2.1 - FRM Daily Values  
Exceptional Event Period**

Values in **BOLD** are flagged as exceptional events

Date	Michigan City - Marsh 18-091-0011	LaPorte 18-091-0012	Dunes Nat'l Lakeshore 18-127-0020	Ogden Dunes 18-127-0024
5/17/07	3.7			
5/18/07	7.5	6.3	7.2	
5/19/07	9.5			
5/20/07	5.6			
5/21/07	11.3	11.8	10.8	
5/22/07	16.6			
<b>5/23/07</b>	<b>31.7</b>			
<b>5/24/07</b>	<b>27.9</b>	<b>27</b>	<b>25.8</b>	<b>27.9</b>
5/25/07	9.1			
5/26/07	12.5			
5/27/07	10.1	8.8	8.9	9.3
5/28/07	12.6			
<b>5/29/07</b>	<b>36.7</b>			
<b>5/30/07</b>	<b>31.5</b>	<b>31</b>	<b>30.1</b>	<b>31.5</b>
<b>5/31/07</b>	<b>30.2</b>			
6/1/07	18.4			
6/2/07	10.7	11.6	10.4	11.4

**Table 2.2 - Historical Daily Values**

Year		Michigan City 180910011		LaPorte 180910012		Dunes Lakeshore 181270020		Ogden Dunes 181270024	
		98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>
2000		28.5		29.7		27.3		32	
2001		33.7		36.1		35.2		34.8	
2002	2000- 2002	31.3	31	31.5	32	30.5	31	32.9	33
2003	2001- 2003	31.8	32	32.4	33	31.7	32	30.7	33
2004	2002- 2004	31.6	32	26.6	30	29.7	31	29.1	31
2005	2003- 2005	37.5	34	36.5	32	37.6	33	37.5	32
2006	2004- 2006	25.5	32	24.7	29	26.6	31	26.1	31
2007	2005- 2007	31.5	32	31	31	30.6	32	33.3	32
Values Excluding Flagged Data									
2007	2005- 2007	29.1	31	30.1	30	30.6	32	33.3	32

<sup>1</sup> Daily Design Value = 3 year average of annual 98<sup>th</sup> %ile values.

**Table 2.3 - Historical Annual Averages**

Year		Michigan City 180910011		LaPorte 180910012		Dunes Lakeshore 181270020		Ogden Dunes 181270024	
		Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>
2000		13.4		12.6		13.5		14.5	
2001		14.2		14.2		13.6		14.2	
2002	2000-2002	13.2	13.6	13.5	13.4	13.2	13.5	14.2	14.3
2003	2001-2003	12.8	13.4	13.2	13.6	13.2	13.4	12.9	13.8
2004	2002-2004	12.1	12.7	11.9	12.9	11.8	12.8	12.4	13.2
2005	2003-2005	13.6	12.8	14.1	13.1	14	13	14.6	13.3
2006	2004-2006	11.1	12.3	11.4	12.5	11	12.3	11.8	12.9
2007	2005-2007	12.4	12.4	12.1	12.5	13	12.7	13.8	13.4
Values excluding flagged data									
2007	2005-2007	12.1	12.3	11.8	12.4	12.7	12.6	13.5	13.3

<sup>2</sup>Annual Design value = 3 year average of the annual averages.

**Particulate**

**Composition:** Speciation data are collected at the Gary – IITRI and Hammond - Purdue sites in Lake County on a one in six day sampling schedule. Data are available for May 24 and May 30. High organic carbon values were reported on those two dates; 9.35 ug/m<sup>3</sup> and 8.17 ug/m<sup>3</sup> at Gary and 9.86 ug/m<sup>3</sup> and 8.07 ug/m<sup>3</sup> at Hammond, respectively. These values were the highest values of the year at these two sites. The annual average for organic carbon is 3.45 ug/m<sup>3</sup> at Gary and 3.23 ug/m<sup>3</sup> at Hammond. The elemental carbon values were very near the annual average concentrations. The high organic carbon values, without an increase in elemental carbon, are a very good indicator of biomass combustion.

The maps in Appendix 3 indicate that the regional organic carbon values were elevated on the two available sample days. The time progression of the maps shows the rise and fall of the organic carbon values over this time period.

**Maps:** Images of maps from NOAA Satellite and Information Services show the smoke plume originating from the northern Florida/southern Georgia region. Dispersion and movement of the smoke plume from these fires was generally to the west or northwest and then to the north. The daily satellite smoke photos show that the smoke plume from the fires extend statewide on May 23 and 24. The plume recedes back to the south and east until May 29. It continues to influence all sites statewide until May 31. The daily

wind roses (obtained from the nearest meteorological site at Gary - IITRI, 18-089-0022) show information on prevailing wind direction, calm conditions and wind speed. NOAA weather maps are also used to show that an upper level trough greatly influences the direction of the plume in relation to the Northwest Indiana region.

Trajectory  
Modeling:

The NOAA HYSPLIT Models are used to show wind trajectories at different levels during this event. Backward modeling from the site (latitude: 41.60°; longitude: -86.73°) at elevations of 25m, 150m and 500m was conducted for a period of three (3) to four (4) days prior. The differing elevations were chosen to demonstrate the air mass's uniformity at ground-level where the samplers were located and aloft which avoids the ground-level limitations of the model. Forward modeling was conducted using the Bugaboo Scrub Fire as the starting point (latitude: 30.70°; longitude: -82.40°) at an elevation of 250 meters (appropriate height that is low enough to always be in the well-mixed zone and high enough to avoid the ground-level model limitation) and going three (3) to four (4) days. Overall, there is a very good correlation when comparing the forward and backward trajectories for a given date. May 24 and 30 show a very narrow channel of air flow between southeastern Georgia and Northwest Indiana, with similar results on other days. The forward trajectory models are in Appendix 2.

Conclusion:

EPA defines an “exceptional event” as an unusual or naturally occurring event that can affect air quality but is not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the clean air act is not appropriate. Indiana has illustrated through the use of maps, meteorological data, speciation data, trajectory models and historical data that the smoke from wildfires in Florida and Georgia impacted the Northwest Indiana region on May 23, 24, 29 – 31, 2007 causing an exceedance of the PM<sub>2.5</sub> 24-hour standard and significantly increasing the annual average. According to 40 CFR Part 50.14 (b)(1), “EPA shall exclude data from use in determinations of exceedances and NAAQS violations where a State demonstrates to EPA’s satisfaction that an exceptional event caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section.” IDEM believes they have successfully illustrated the impact of this event on the sites in this region.

Therefore, IDEM requests that EPA concur with the ‘E’ flag on the data in AQS for the data in **bold** in Table 2.1.

## NOAA Satellite Smoke Maps, Weather Maps, and Wind Roses

The smoke map shows that the plume has reached the Northwest Indiana region and as shown in Table 2.1, PM<sub>2.5</sub> levels have started to increase. The corresponding wind rose and weather map further illustrate the direction of the plume by the location of the upper level trough (orange dashed line) and the S, SW prevailing winds.

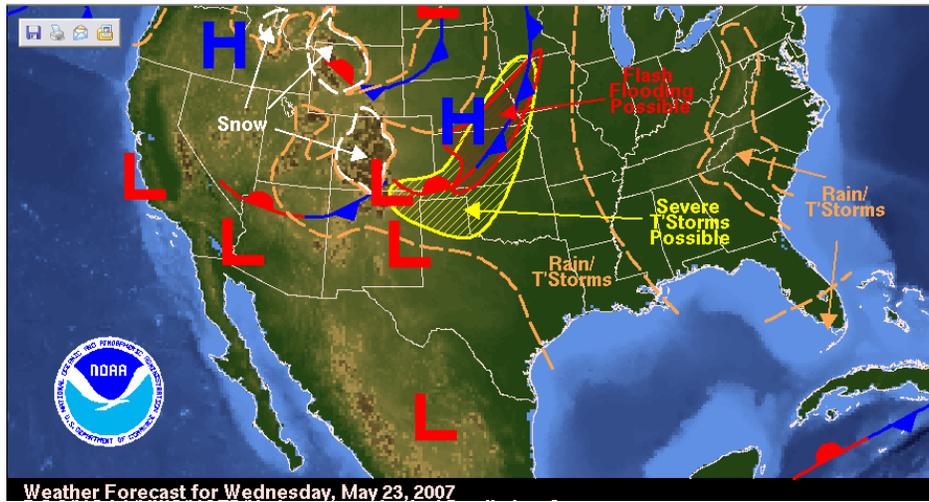
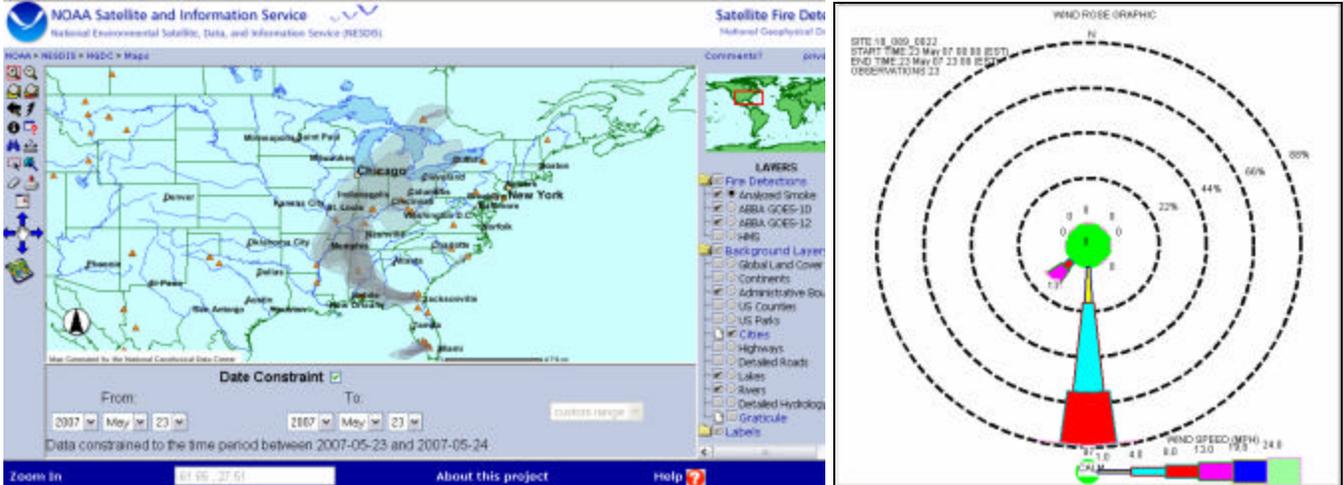


Figure 2.1 - May 23, 2007

The smoke map shows that the plume is remaining over the area. The prevailing wind direction continues to be directly from the south as the upper level trough moves further to the east and another trough develops over Ohio, keeping the plume over the northern Indiana region.

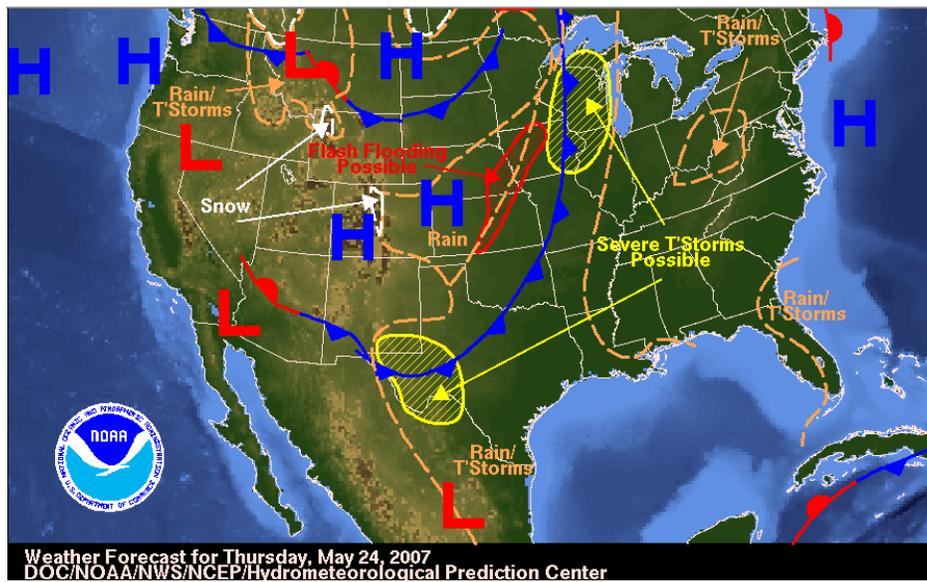
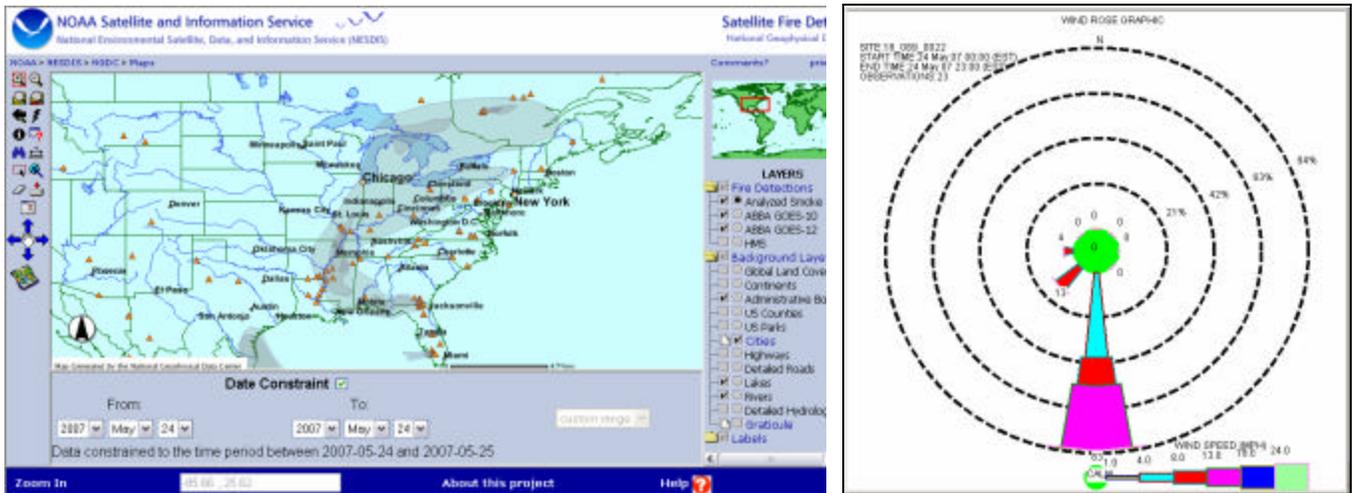


Figure 2.2 - May 24, 2007

Although the map illustrates the plume is not over the region, the prevailing SE wind direction, as shown by the wind rose, keep the high levels of PM<sub>2.5</sub> over the area.

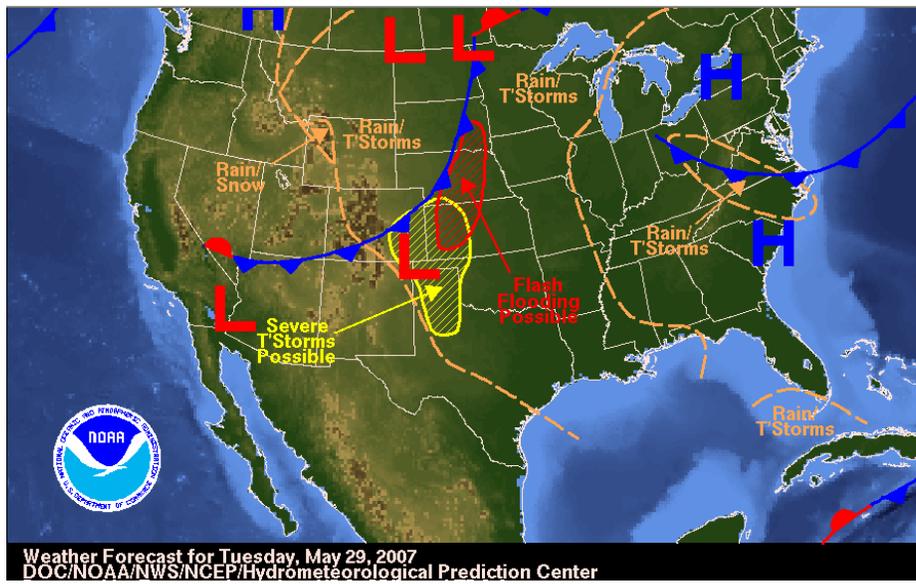
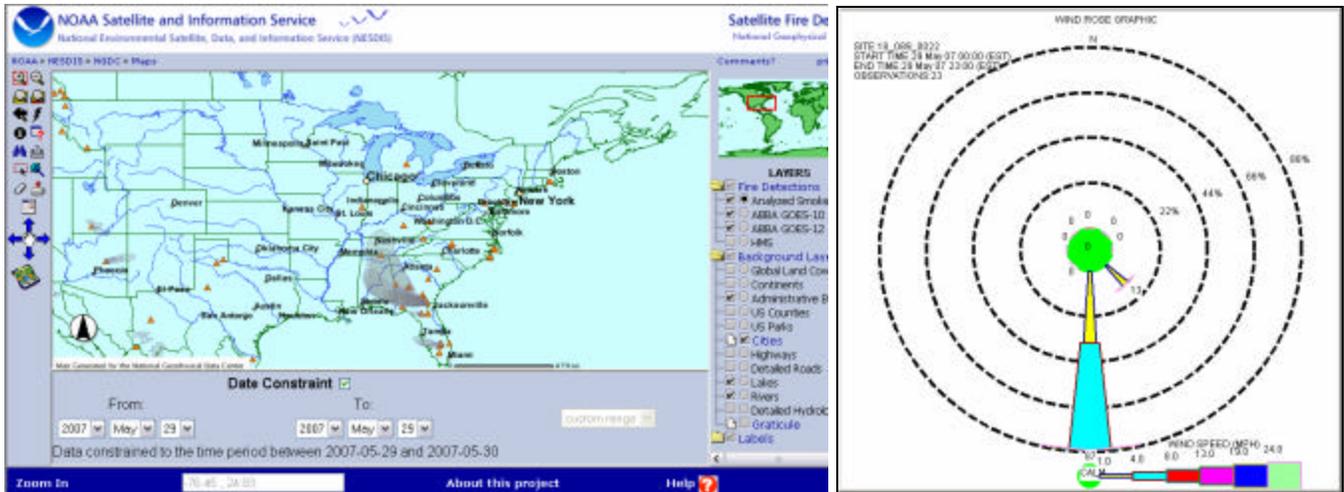


Figure 2.3 - May 29, 2007

The map shows the plume has moved back over the region as the upper level trough dips down over the area and the wind direction continues to be from the south.

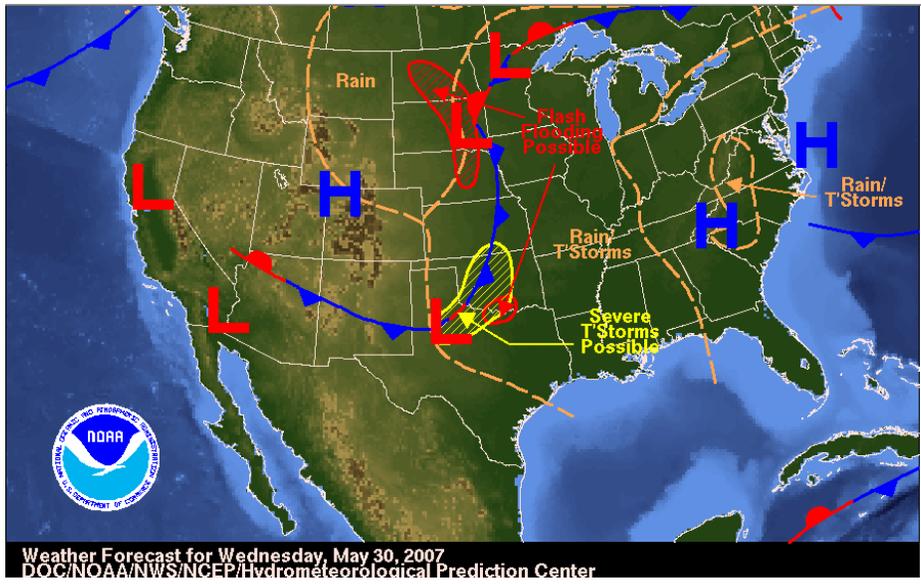
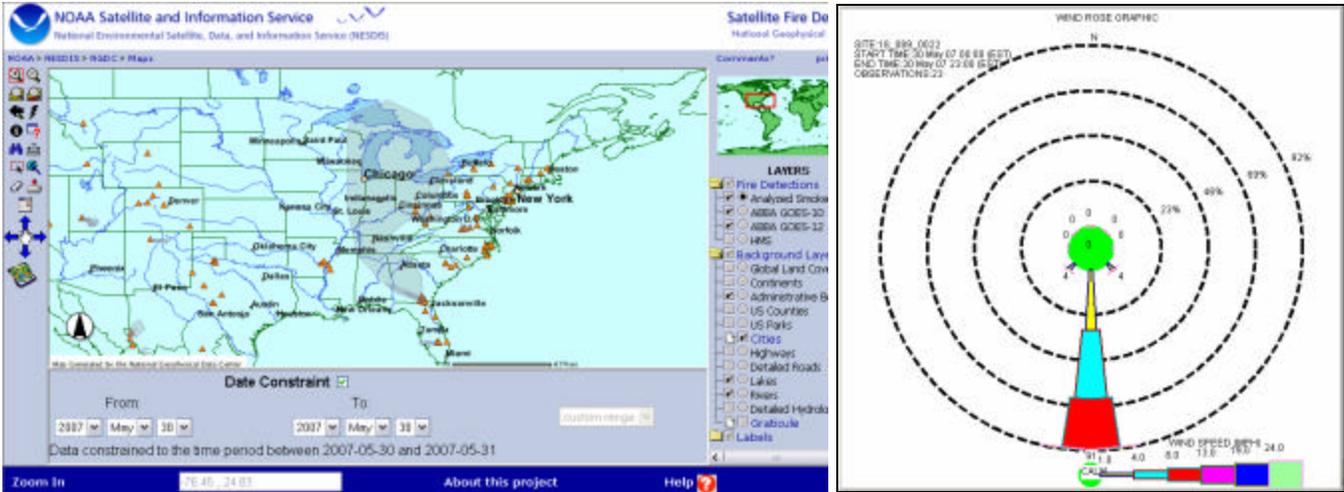


Figure 2.4 - May 30, 2007

The map shows the plume has dissipated as the upper level trough moves to the east. However, a stronger southerly wind direction keeps the high levels over the area.

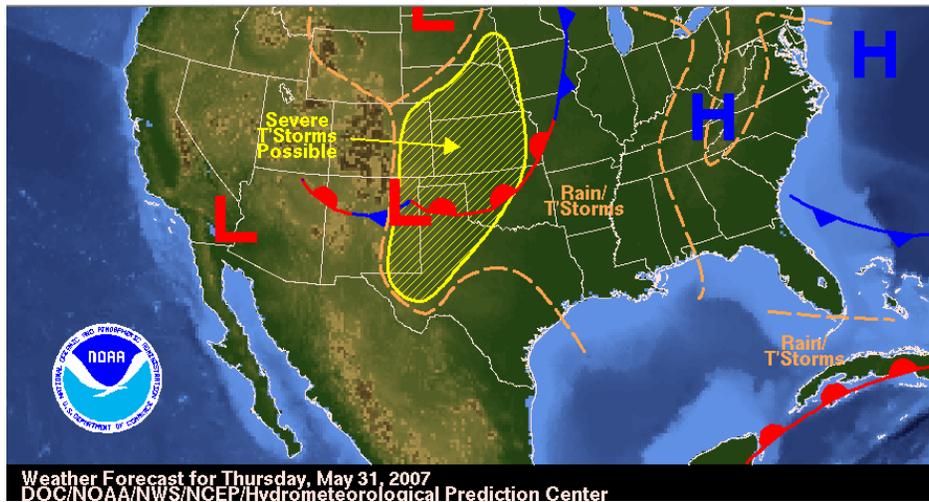
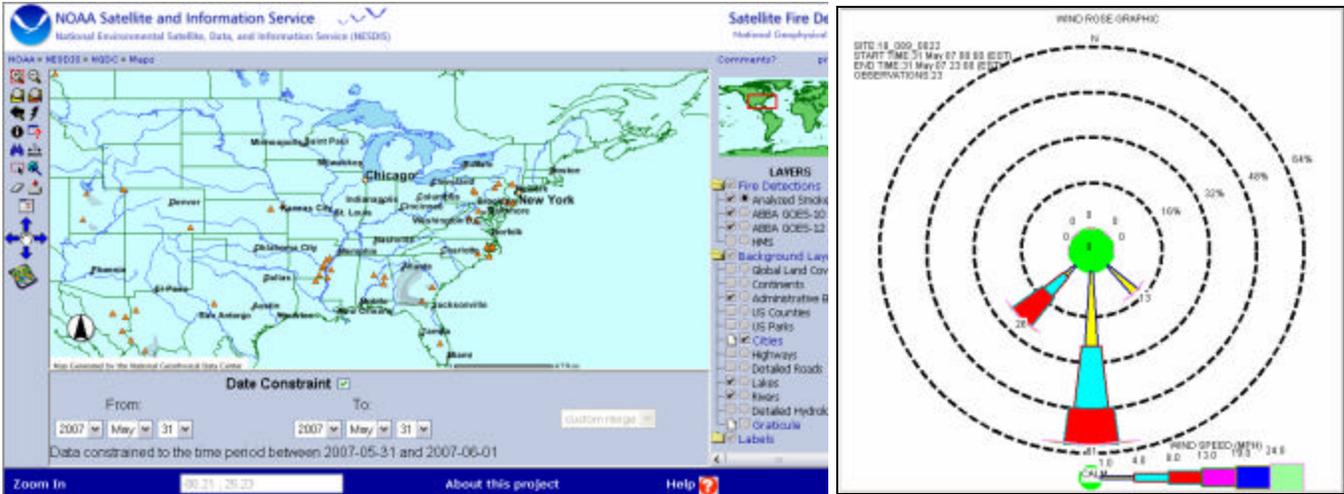


Figure 2.5 - May 31, 2007

## Backward Trajectory Models

### NOAA ARL READY HYSPLIT Maps

Draxler, R.R. and Rolph, G.D., 2003. HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (<http://www.arl.noaa.gov/ready/hysplit4.html>). NOAA Air Resources Laboratory, Silver Spring, MD.

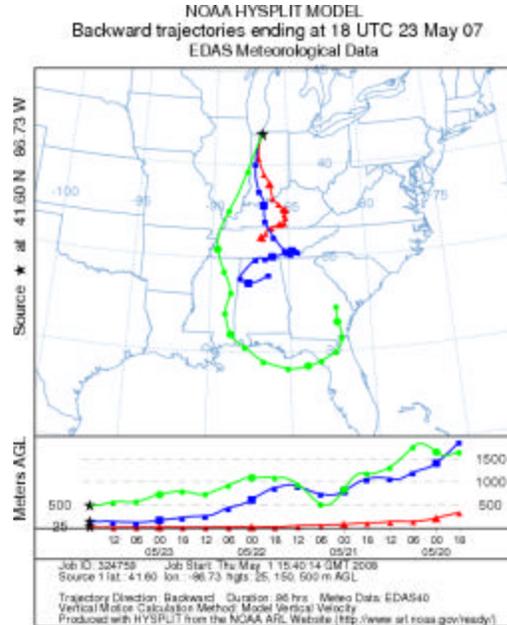


Figure 2.6: Backward trajectories originating from NW Indiana on 5/23/07 at 12:00 PM CST showing the higher level air mass passing over Florida and Georgia. Note: the lowest-level trajectory breaks down due to the model predicting a zero elevation air mass.

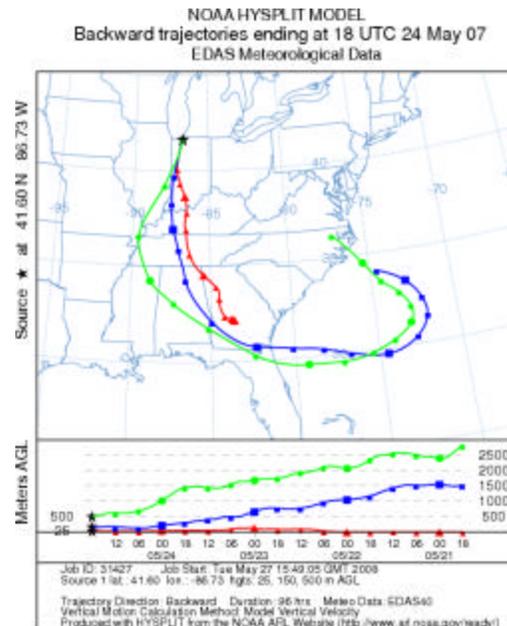


Figure 2.7: Backward trajectories originating from NW Indiana on 5/24/07 at 12:00 PM CST showing the air mass passing over southern Georgia and northern Florida.

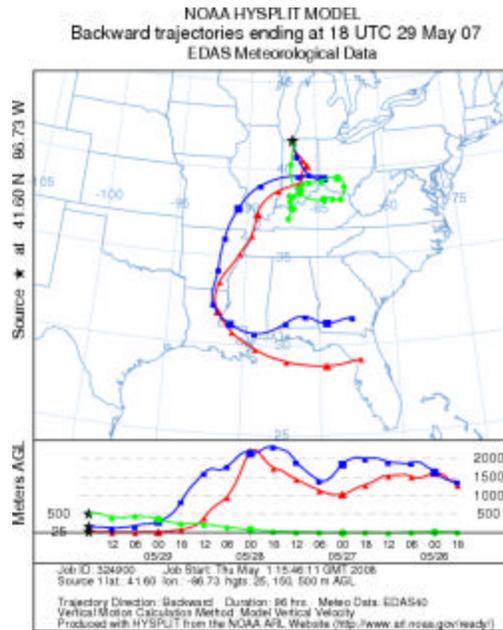


Figure 2.8: Backward trajectories originating from NW Indiana on 5/29/07 at 12:00 PM CST showing the air mass still passing over northern Florida.

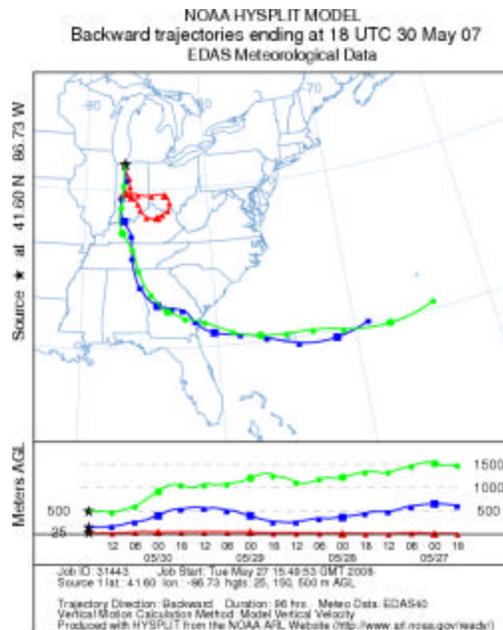


Figure 2.9: Backward trajectories originating from NW Indiana on 5/30/07 at 12:00 PM CST showing the air mass still passing over southern Georgia.

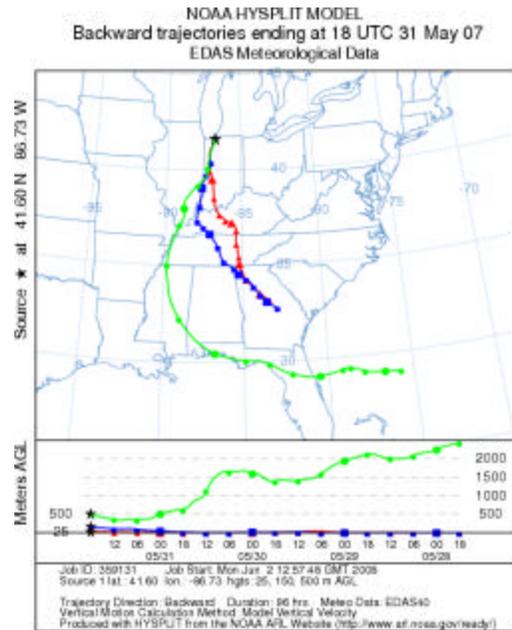


Figure 2.10: Backward trajectories originating from NW Indiana on 5/31/07 at 12:00 PM CST showing consistency in the air mass passing over northern Florida.

### 3 – Northern Indiana Exceptional Events Detail

Parameter: PM<sub>2.5</sub>

Dates: May 23, 24, 29-31, 2007

Location: South Bend / Elkhart – St. Joseph & Elkhart Co.

Event: Smoke from wildfires in northern Florida and southern Georgia impacted the South Bend region during the period of May 23 – 31. The gradual buildup of smoke moving through the area during this period resulted in an exceedance of the 24-hour PM<sub>2.5</sub> NAAQS on May 29<sup>th</sup> at South Bend Nuner (18-041-0014) and several elevated reading throughout the region.

Data: Different analyses of the data are used to demonstrate that the PM<sub>2.5</sub> concentrations measured from May 23 – 31 are beyond the range of values typically found during that time period and that they have been influenced by outside events. Table 3.1 shows daily PM<sub>2.5</sub> averages prior to, during, and after the event with the values flagged in **bold**. Data have been flagged with an exceptional event flag of ‘E’ in AQS, awaiting concurrence from EPA.

Tables 3.2 and 3.3 list summaries of the data collected at the South Bend / Elkhart sites since 2000. Summary data from 2007 and the annual and daily design values for 2005-2007 are calculated with all current data and with the flagged data removed. There is a significant improvement in the Elkhart 98<sup>th</sup> percentile design value (2005-2007) from 34 ug/m<sup>3</sup> to 33 ug/m<sup>3</sup> and an improvement in all of the annual averages when the flagged data is removed.

The values recorded during the May 24-31 time period are outside the normal values collected during the month of May. Prior to this time, the highest value reported at South Bend in May had been 27.5 ug/m<sup>3</sup> and the highest monthly average had been 14.2 ug/m<sup>3</sup>. With the high data collected in May 2007, the highest value was 37.1 ug/m<sup>3</sup> and the monthly average was 14.7 ug/m<sup>3</sup>. Removing the flagged data results in a maximum daily concentration of 18.8 ug/m<sup>3</sup> and an average concentration of 10.2 ug/m<sup>3</sup>. Prior to this time, the highest value reported at Elkhart in May had been 24.7 ug/m<sup>3</sup> and the highest monthly average was 15.5ug/m<sup>3</sup>. With the high data collected in May 2007, the highest value was 34.7 ug/m<sup>3</sup> and the monthly average was 14.5 ug/m<sup>3</sup>. Removing the flagged data results in a maximum daily concentration of 17.5 ug/m<sup>3</sup> and an average concentration of 10.3 ug/m<sup>3</sup>. These values are much more in line with historical data.

**Table 3.1 - FRM Daily Values  
Exceptional Event Period**

Values in **BOLD** are flagged as exceptional events

Date	S. Bend - Shields 18-141-0015	S. Bend - LaSalle 18-043-1004	S. Bend - Nuner 18-141-0014	Elkhart - P. Moran 18-039-0003
5/17/07			3.9	4.3
5/18/07		7.4	8.7	7.9
5/19/07			8.4	9.2
5/20/07			9.7	10.9
5/21/07		11.1	11.8	11.4
5/22/07			18.8	16.6
<b>5/23/07</b>			<b>33.9</b>	<b>32.8</b>
<b>5/24/07</b>	<b>28.6</b>	<b>28.7</b>	<b>31.7</b>	<b>30.9</b>
5/25/07			10.6	11
5/26/07			18.3	17
5/27/07	11.7	10.2	13.7	15.5
5/28/07			15.3	16
<b>5/29/07</b>			<b>37.1</b>	<b>34.7</b>
<b>5/30/07</b>	<b>30.8</b>	<b>31.3</b>	<b>34</b>	<b>32.8</b>
<b>5/31/07</b>			<b>32</b>	<b>31.3</b>
6/1/07				22
6/2/07				

**Table 3.2 - Historical Daily Values**

Year		South Bend CAAP 181410008 / 1005		South Bend Nuner 181410014		South Bend LaSalle 181412004		Elkhart P. Moran 180390003	
		98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>
2000		30.2		29.5		30.4		38.6	
2001		37.6		34.5		36.8		37.5	
2002	2000- 2002	32.8	34	31.7	32	31.3	33	35.2	37
2003	2001- 2003	34.8	35	35	34	33.3	34	36.7	36
2004	2002- 2004	27.4	32	26.7	31	25.1	30	31.4	34
2005	2003- 2005	37.3	33	40.2	34	35.8	31	40.8	36
2006	2004- 2006	24.7	30	26	31	24.1	28	25.5	33
2007	2005- 2007	30.8	31	33.8	33	31.3	30	34.6	34
2007	2005- 2007	30.2	31	31.9	33	30.5	30	33.2	33

<sup>1</sup>Daily Design Value = 3 year average of annual 98<sup>th</sup> %ile values.

**Table 3.3 - Historical Annual Averages**

		South Bend CAAP 181410008 / 1005		South Bend Nuner 181410014		South Bend LaSalle 181412004		Elkhart P. Moran 180390003	
Year		Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>
2000		14.1		13.8		13.8		15.7	
2001		14.7		14		14.5		15.7	
2002	2000- 2002	14.4	14.4	14.3	14	13.9	14.1	15	15.5
2003	2001- 2003	13.8	14.3	13.8	14	13.5	14	14.9	15.2
2004	2002- 2004	12.5	13.6	12.3	13.5	11.7	13	13.3	14.4
2005	2003- 2005	14.8	13.7	14.8	13.7	14.5	13.2	15.6	14.6
2006	2004- 2006	11.8	13	12.4	13.2	11.3	12.5	12.6	13.8
2007	2005- 2007	12.9	13.2	12.9	13.4	12.4	12.8	13.8	14
Values excluding flagged data									
2007	2005- 2007	12.5	13	12.6	13.3	12.1	12.6	13.5	13.9

<sup>2</sup>Annual Design value = 3 year average of the annual averages.

**Particulate Composition:** Speciation data are collected at the Elkhart Pierre Moran site on a one in six day sampling schedule. Data are available for May 24 and May 30. High organic carbon values were reported on those two dates; 7.5 ug/m<sup>3</sup> and 8.2 ug/m<sup>3</sup> respectively. These values were the fourth and the fifth highest values of the year. The annual average for organic carbon at this site is 4.0 ug/m<sup>3</sup>. There was no significant increase in the elemental carbon values; 0.65 ug/m<sup>3</sup> and 1.1 ug/m<sup>3</sup>, on these two dates, as compared to the annual average of 0.67 ug/m<sup>3</sup>. The high organic carbon values, without an increase in elemental carbon, are a very good indicator of biomass combustion. Appendix 3 illustrates the rise and fall of the regional organic carbon values.

**Maps:** Images of maps from NOAA Satellite and Information Services show the smoke plume originating from the northern Florida/southern Georgia region. Dispersion and movement of the smoke plume from these fires was generally to the west or northwest and then to the north. The daily satellite smoke photos show that the smoke plume from the fires extends statewide on May 23 and 24. The plume recedes farther to the south and east until May 29. It continues to influence all sites statewide until May 31. The daily wind roses (obtained from the meteorological site at South Bend – Shields Dr. (18-141-1005) show information on prevailing wind direction, calm conditions and wind speed. NOAA weather maps are also used to

show that an upper level trough greatly influences the direction of the plume in relation to the South Bend region.

Trajectory Modeling: The NOAA HYSPLIT Models are used to show wind trajectories at different levels during this event. Backward modeling from the site (latitude: 41.70°; longitude: -86.21°) at elevations of 25m, 150m and 500m was conducted for a period of three (3) to four (4) days prior. The differing elevations were chosen to demonstrate the air mass's uniformity at ground-level where the samplers were located and aloft which avoids the ground-level limitations of the model. Forward modeling was conducted using the Bugaboo Scrub Fire as the starting point (latitude: 30.70°; longitude: -82.40°) at an elevation of 250 meters (appropriate height that is low enough to always be in the well-mixed zone and high enough to avoid the ground-level model limitation) and going three (3) to four (4) days. Overall, there is a very good correlation when comparing the forward and backward trajectories for a given date. For example, May 24 shows a very narrow channel of air flow between southeastern Georgia and northern Indiana. Both the backward and forward trajectories confirm this. Forward trajectory modeling can be found in Appendix 2.

Conclusion: EPA defines an “exceptional event” as an unusual or naturally occurring event that can affect air quality but is not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the clean air act is not appropriate. Indiana has illustrated through the use of maps, meteorological data, speciation data, trajectory models and historical data that the smoke from wildfires in Florida and Georgia impacted the South Bend region on May 23, 24, 29 – 31, 2007 causing an exceedance of the PM<sub>2.5</sub> 24-hour standard and significantly increasing the annual average. According to 40 CFR Part 50.14 (b)(1), “EPA shall exclude data from use in determinations of exceedances and NAAQS violations where a State demonstrates to EPA’s satisfaction that an exceptional event caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section.” IDEM believes they have successfully illustrated the impact of this event on the sites in this region.

Therefore, IDEM requests that EPA concur with the ‘E’ flag on the data in AQS for the data in **bold** in Table 3.1.

## NOAA Satellite Smoke Maps, Weather Maps, and Wind Roses

The smoke map shows that the plume has reached the South Bend / Elkhart area and as shown in Table 1, PM<sub>2.5</sub> levels have started to increase. The corresponding wind rose and weather map further illustrate the direction of the plume by the location of the upper level trough (orange dashed line) and the S, SE prevailing winds.

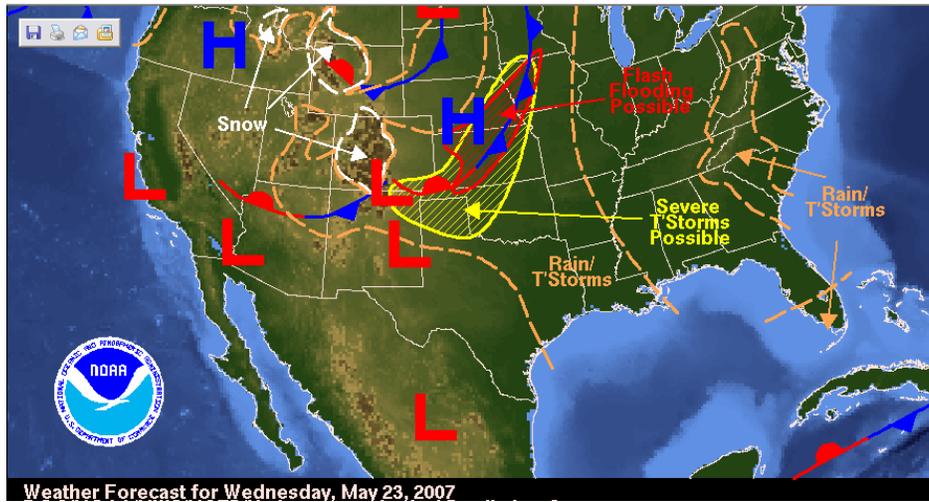
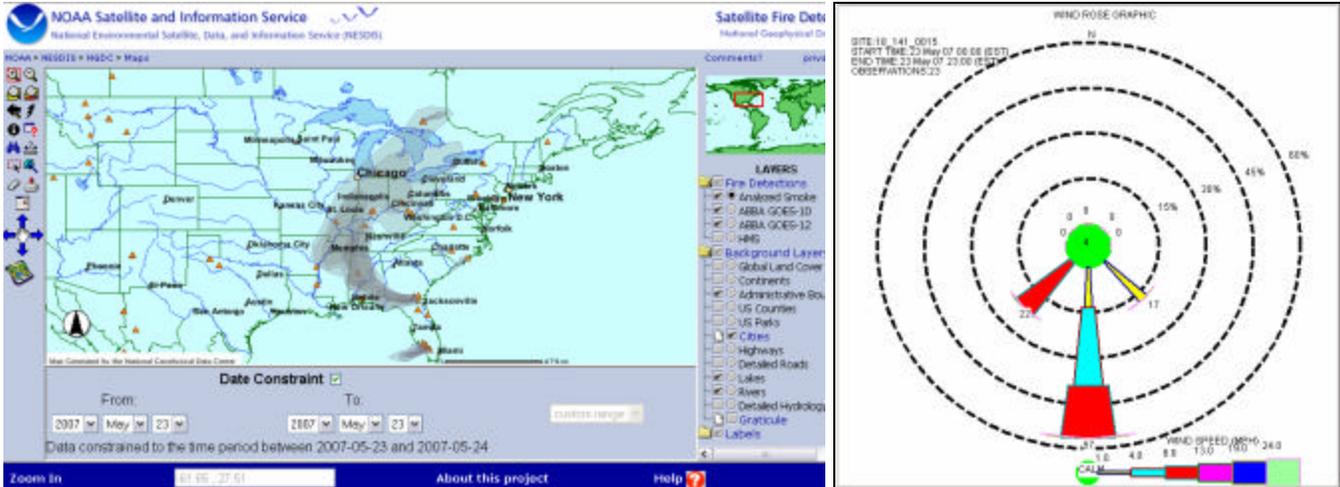


Figure 3.1 - May 23, 2007

The smoke map shows that the plume is remaining over the area. The prevailing wind direction continues to be directly from the south as the upper level trough moves further to the east and another trough develops over Ohio, keeping the plume over the northern Indiana region.

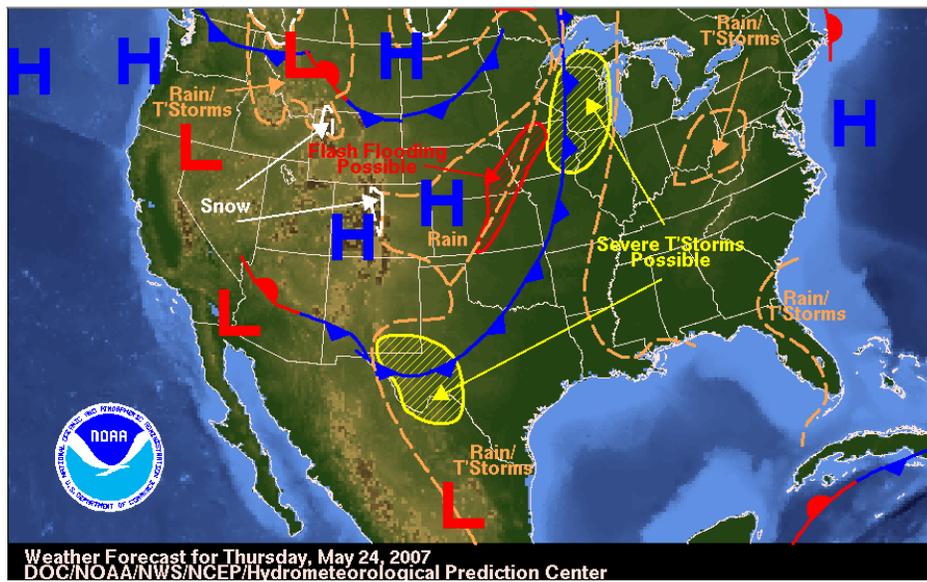
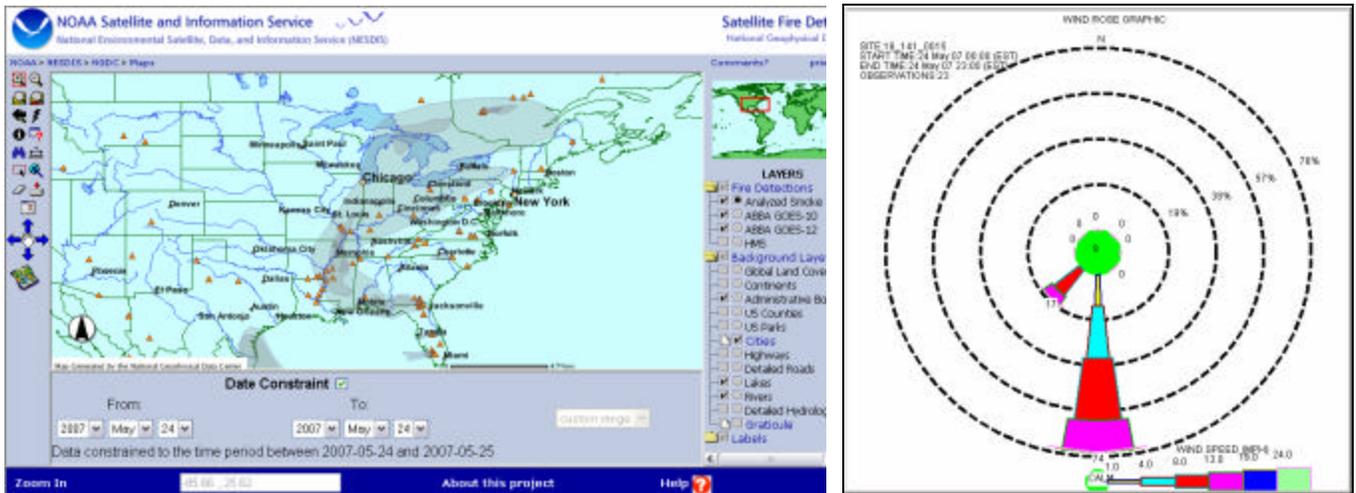


Figure 3.2 - May 24, 2007

Although the map illustrates the plume is not over the region, the prevailing SE wind direction, as shown by the wind rose, keep the high levels of PM<sub>2.5</sub> over the area.

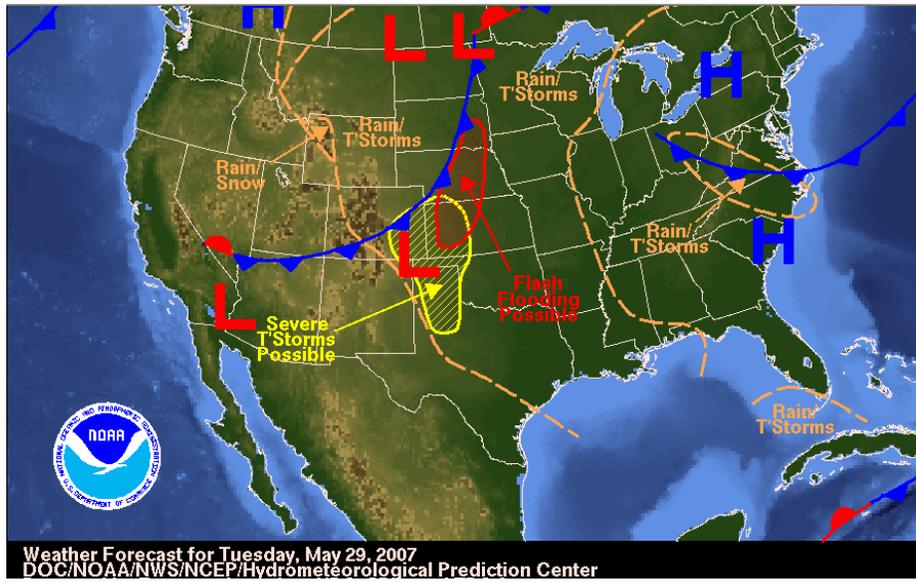
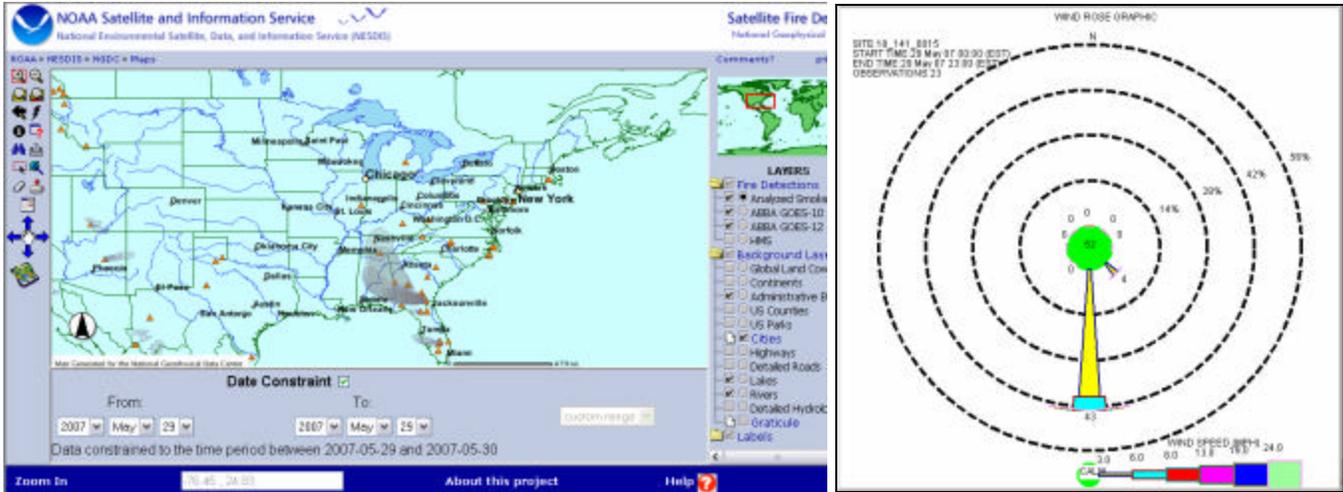


Figure 3.3 - May 29, 2007

The map shows the plume has moved back over the region as the upper level trough dips down over the area and the wind direction continues to be from the S, SW.

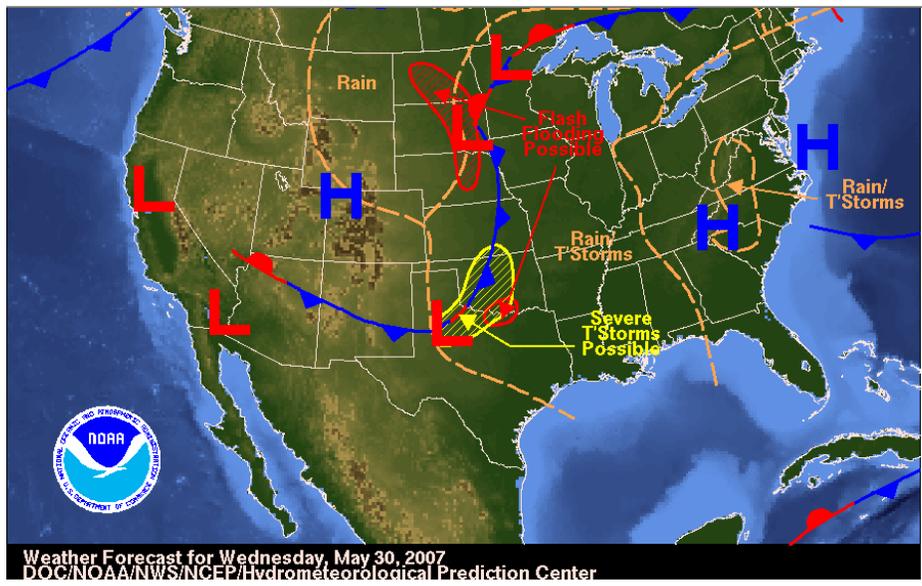
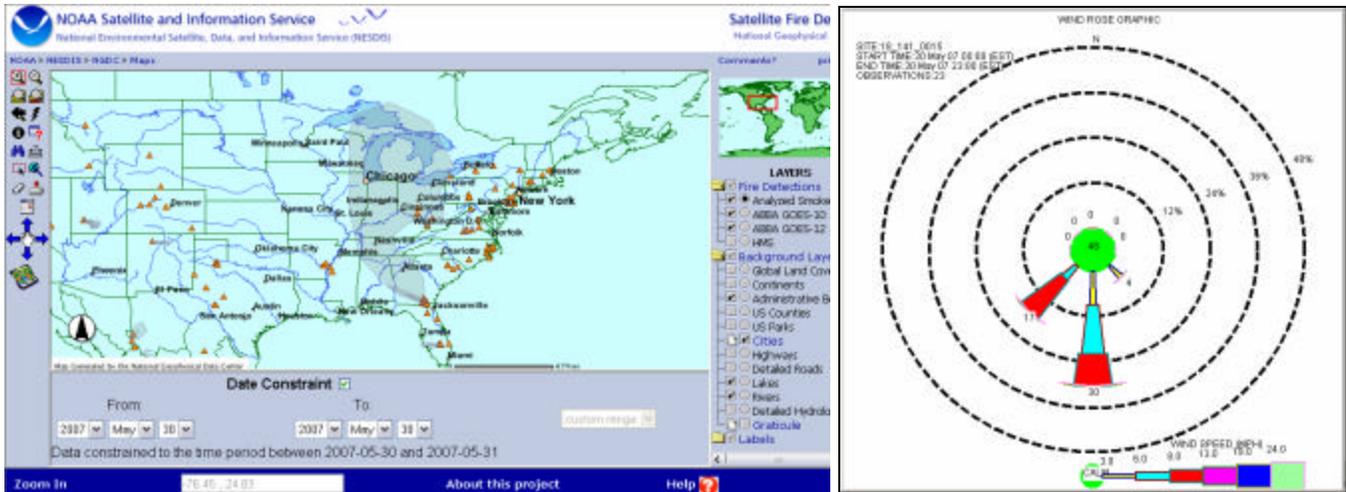


Figure 3.4 – May 30, 2007

The map shows the plume has dissipated as the upper level trough moves to the east. However, calm wind conditions and a southerly wind direction keep the high levels over the area.

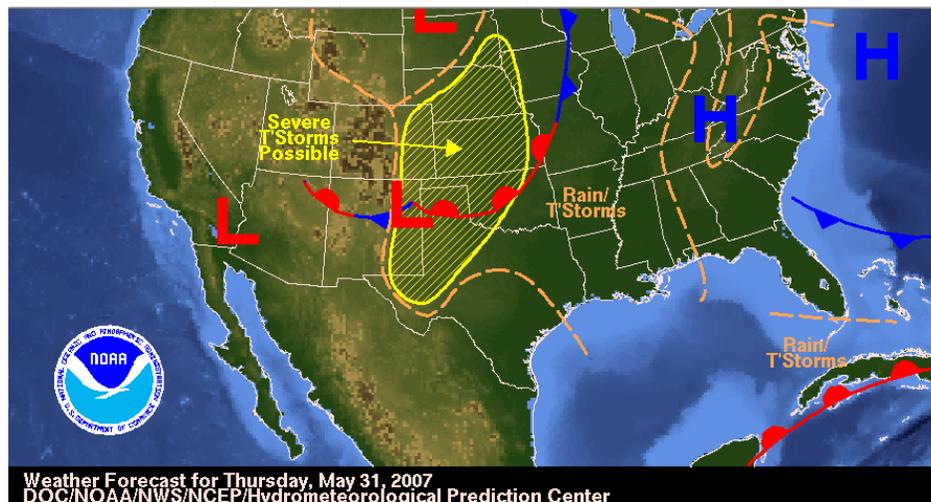
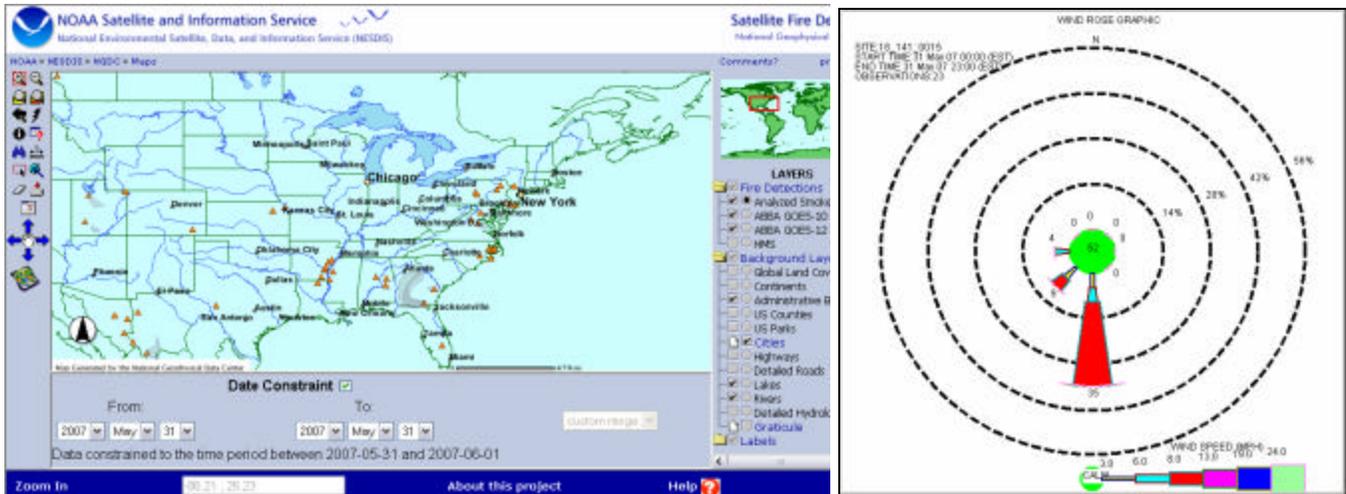
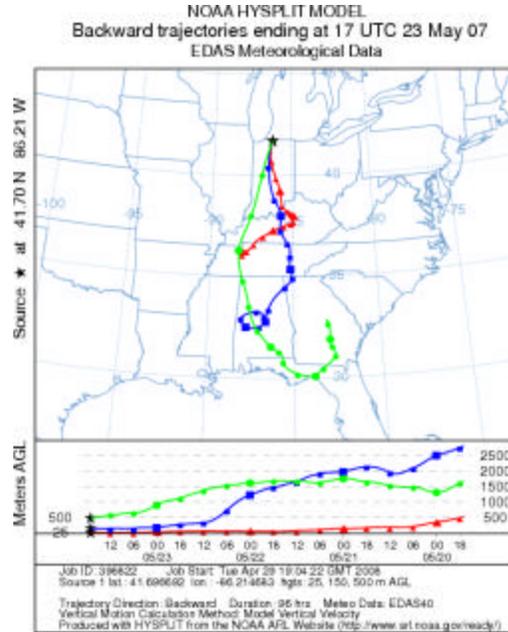


Figure 3.5 – May 31, 2007

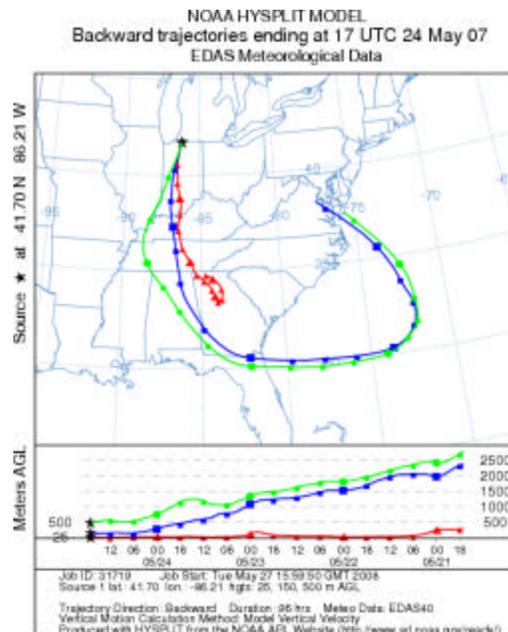
## Backward Trajectory Models

### NOAA ARL READY HYSPLIT Maps

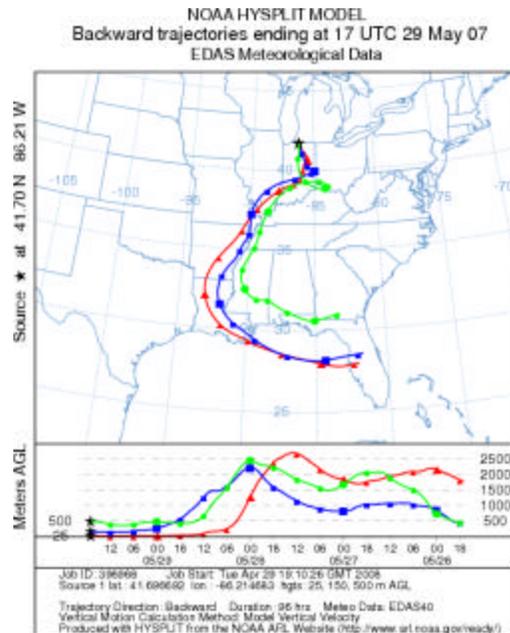
Draxler, R.R. and Rolph, G.D., 2003. HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (<http://www.arl.noaa.gov/ready/hysplit4.html>). NOAA Air Resources Laboratory, Silver Spring, MD.



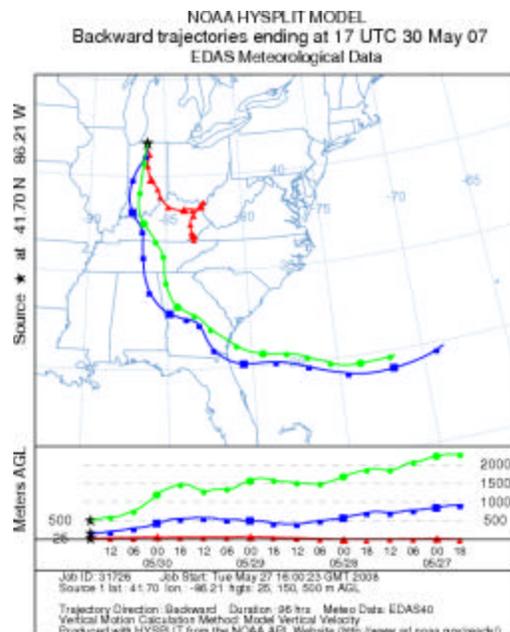
**Figure 3.6:** Backward trajectories originating from South Bend on 5/23/07 at 12:00 PM EST showing the air mass originating from southern Georgia.



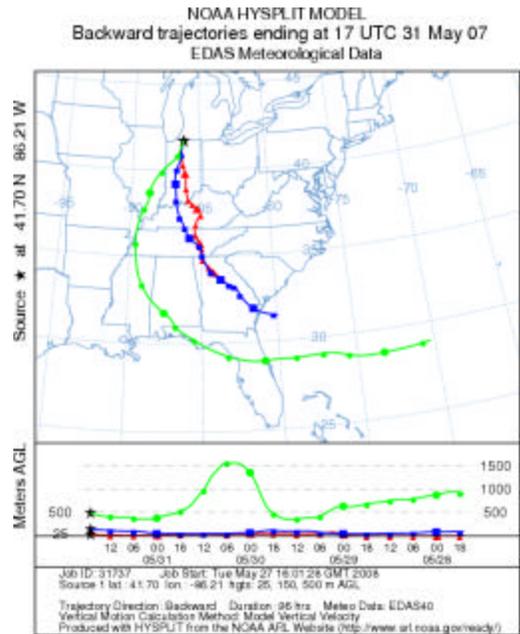
**Figure 3.7:** Backward trajectories originating from South Bend on 5/24/07 at 12:00 PM EST showing continuation of the air mass passing over southern Georgia and northern Florida.



**Figure 3.8:** Backward trajectories originating from South Bend on 5/29/07 at 12:00 PM EST showing consistency in the air mass passing over southern Georgia and northern Florida.



**Figure 3.9:** Backward trajectories originating from South Bend on 5/30/07 at 12:00 PM EST showing consistency in the air mass passing over southern Georgia and northern Florida.



**Figure 3.10:** Backward trajectories originating from South Bend on 5/31/07 at 12:00 PM EST showing the air mass still passing over southern Georgia and Florida.

## 4 – Northeast Indiana Exceptional Events Detail

- Parameter: PM<sub>2.5</sub>
- Dates: May 23, 24, 29 – 31, 2007
- Location: Ft. Wayne – Allen Co.
- Event: Smoke from wildfires in northern Florida and southern Georgia impacted the Ft. Wayne region during the period of May 23 and 24 and May 29 - 31. The gradual buildup of smoke moving through the area during this period resulted in an exceedance of the 24-hour PM<sub>2.5</sub> NAAQS on May 23<sup>rd</sup> at Fort Wayne - Beacon St. (18-003-0004) and several elevated readings throughout the region.
- Data: Different analyses of the data are used to demonstrate that the PM<sub>2.5</sub> concentrations measured from May 23 – 31 are beyond the range of values typically found during that time period and that they have been influenced by outside events. Table 4.1 shows daily PM<sub>2.5</sub> averages prior to, during and after the event with the values flagged in **bold**. Data have been flagged with an exceptional event flag of 'E' in AQS, awaiting concurrence from EPA.

Tables 4.2 and 4.3 list summaries of the data collected at the Fort Wayne sites since 2000. Data from 2007 are calculated with all current data and with the flagged data removed. There is a significant improvement in the design values of both the 98<sup>th</sup> percentile daily value and the annual average.

The values recorded during the May 24-31 time period are outside the normal values collected during the month of May. Prior to this time, the highest value since 2000 reported in May had been 25.8 ug/m<sup>3</sup> and the highest monthly average had been 16 ug/m<sup>3</sup>. With the high data collected in May 2007, the highest value was 43.4 ug/m<sup>3</sup> and the monthly average was 16 ug/m<sup>3</sup>. Removing the flagged data results in a maximum daily concentration of 26 ug/m<sup>3</sup> and an average concentration of 10 ug/m<sup>3</sup>. These values are much more in line with historical data.

**Table 4.1 - FRM Daily Values  
Exceptional Event Period**

Values in **BOLD** are flagged as exceptional events

Date	Ft. Wayne – Beacon St. 18-003-0004	Ft. Wayne - Taylor 18-003-0014
5/17/07	3.7	
5/18/07	7.3	7.1
5/19/07	9.4	
5/20/07	12.5	
5/21/07	9.4	8.8
5/22/07	26	
<b>5/23/07</b>	<b>43.4</b>	
<b>5/24/07</b>	<b>34.9</b>	<b>31</b>
5/25/07	21.1	
5/26/07	19.7	
5/27/07	17.8	16.9
5/28/07	15	
<b>5/29/07</b>	<b>33.8</b>	
<b>5/30/07</b>	<b>33.7</b>	<b>33.1</b>
<b>5/31/07</b>	<b>33</b>	
6/1/07		
6/2/07		

**Table 4.2 - Historical Daily Values**

Year		Fort Wayne – Beacon St. 180030004		Fort Wayne Taylor 180030014	
		98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>
2000		34.5		34.9	
2001		32		32.5	
2002	2000- 2002	32.1	33	32.4	33
2003	2001- 2003	34.6	33	33.3	33
2004	2002- 2004	31	33	28.3	31
2005	2003- 2005	38.4	35	34.9	32
2006	2004- 2006	26.2	32	26.5	30
2007	2005- 2007	33.7	33	32	31
Values excluding flagged data					
2007	2005- 2007	31.4	32	28.1	30

<sup>1</sup> Daily Design Value = 3 year average of annual 98<sup>th</sup> %ile values.

**Table 4.3 - Historical Annual Averages**

Year		Fort Wayne – Beacon St 180030004		Fort Wayne Taylor 180030014	
		Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>
2000		15.7		14.3	
2001		14.3		14.2	
2002	2000-2002	14.6	14.8	14.3	14.2
2003	2001-2003	14.1	14.3	13.6	14
2004	2002-2004	12.5	13.7	12.4	13.4
2005	2003-2005	15.6	14.1	15.7	13.9
2006	2004-2006	11.9	13.4	11.8	13.3
2007	2005-2007	13.2	13.6	12.9	13.5
		Values excluding flagged data			
2007	2005-2007	12.8	13.5	12.5	13.3

<sup>2</sup>Annual Design value = 3 year average of the annual averages.

**Particulate**

**Composition:** Speciated data are not collected at Fort Wayne. The maps in Appendix 3 indicate that the regional organic carbon values were elevated on the two available sample days. The values were among the highest values recorded in 2007. The elemental carbon values on these dates remained at or below average values.

**Maps:** Images of maps from NOAA Satellite and Information Services show the smoke plume originating from the northern Florida/southern Georgia region. Dispersion and movement of the smoke plume from these fires was generally to the west or northwest and then to the north. The daily satellite smoke photos show that the smoke plume from the fires comes into southern Indiana on May 23 and continues to influence the atmosphere sporadically until June 2. The daily wind roses (obtained from the meteorological site at Mechanicsburg, 18-065-0003) show information on prevailing wind direction, calm conditions and wind speed. NOAA weather maps are also used to show that an upper level trough greatly influences the direction of the plume in relation to the Ft. Wayne region.

Trajectory  
Modeling:

The NOAA HYSPLIT Models are used to show wind trajectories at different levels during this event. Backward modeling from the site (latitude: 41.10°; longitude: -85.10°) at elevations of 25m, 150m and 500m was conducted for a period of three (3) to four (4) days prior. The differing elevations were chosen to demonstrate the air mass's uniformity at ground-level where the samplers were located and aloft which avoids the ground-level limitations of the model. Forward modeling was conducted using the Bugaboo Scrub Fire as the starting point (latitude: 30.70°; longitude: -82.40°) at an elevation of 250 meters (appropriate height that is low enough to always be in the well-mixed zone and high enough to avoid the ground-level model limitation) and going three (3) to four (4) days. Overall, there is a very good correlation when comparing the forward and backward trajectories for a given date. For example, May 24, 29, and 31 show a very narrow channel of air flow between southeastern Georgia and northeastern Indiana. Both the backward and forward trajectories confirm this. Forward trajectory modeling results are shown in Appendix 2.

Conclusion:

EPA defines an “exceptional event” as an unusual or naturally occurring event that can affect air quality but is not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the clean air act is not appropriate. Indiana has illustrated through the use of maps, meteorological data, speciation data, trajectory models and historical data that the smoke from wildfires in Florida and Georgia impacted the Ft. Wayne region on May 23, 24, 29-31, 2007 causing an exceedance of the PM<sub>2.5</sub> 24-hour standard and significantly increasing the annual average. According to 40 CFR Part 50.14 (b)(1), “EPA shall exclude data from use in determinations of exceedances and NAAQS violations where a State demonstrates to EPA’s satisfaction that an exceptional event caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section.” IDEM believes they have successfully illustrated the impact of this event on the sites in this region.

Therefore, IDEM requests that EPA concur with the ‘E’ flag on the data in AQS for the data in **bold** in Table 4.1.

## NOAA Satellite Smoke Maps, Weather Maps And Wind Roses

The smoke map shows that the plume has reached the Ft. Wayne area and as shown in Table 4.1,  $PM_{2.5}$  levels have started to increase. The corresponding wind rose and weather map further illustrate the direction of the plume by the location of the upper level trough (orange dashed line) and the S, SE prevailing winds.

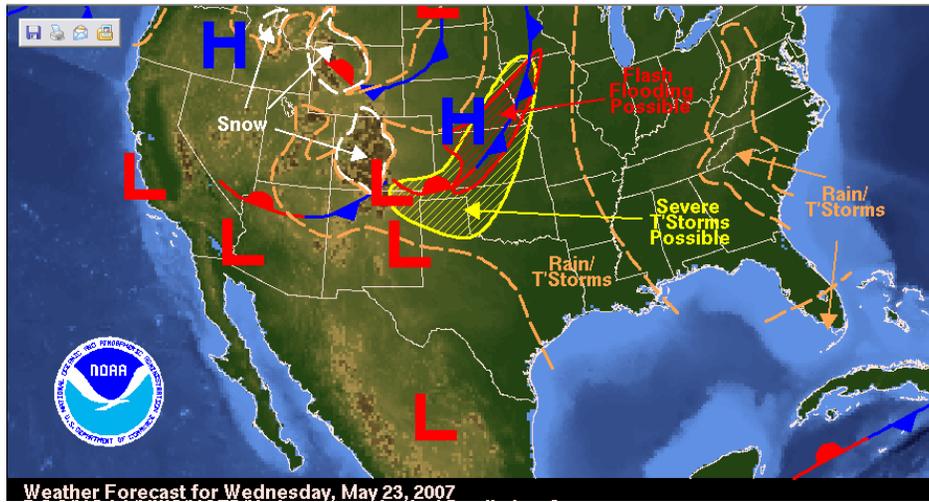
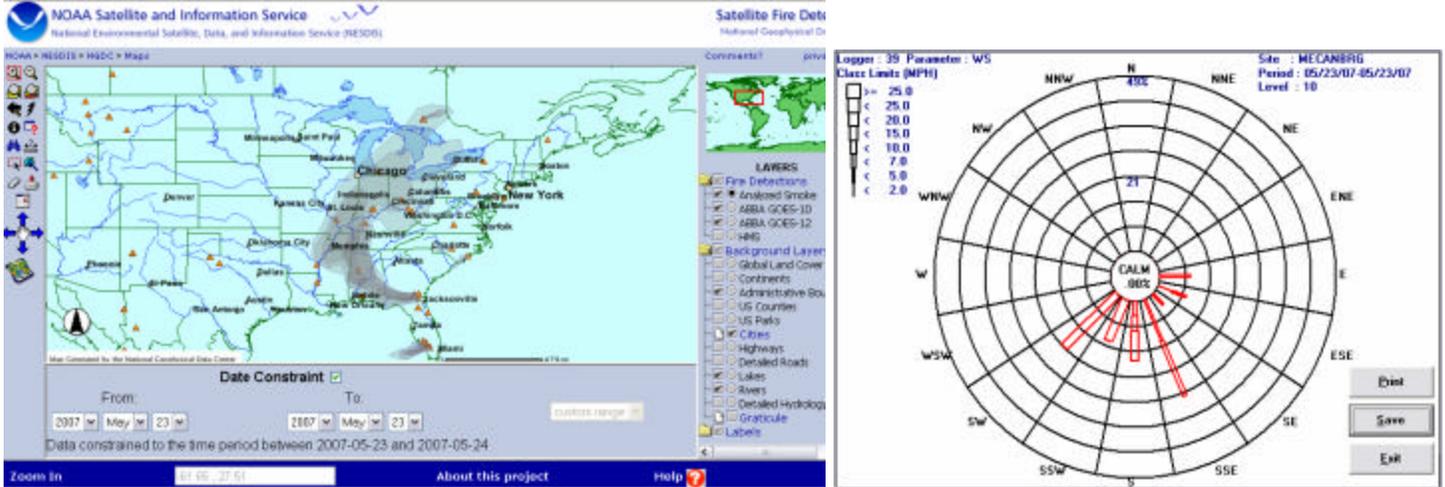


Figure 4.1 - May 23, 2007

The smoke map shows that the plume is remaining over the area. The prevailing wind direction has shifted to the SSW as the upper level trough moves further to the east and another trough develops over Ohio, keeping the plume over the NE Indiana region.

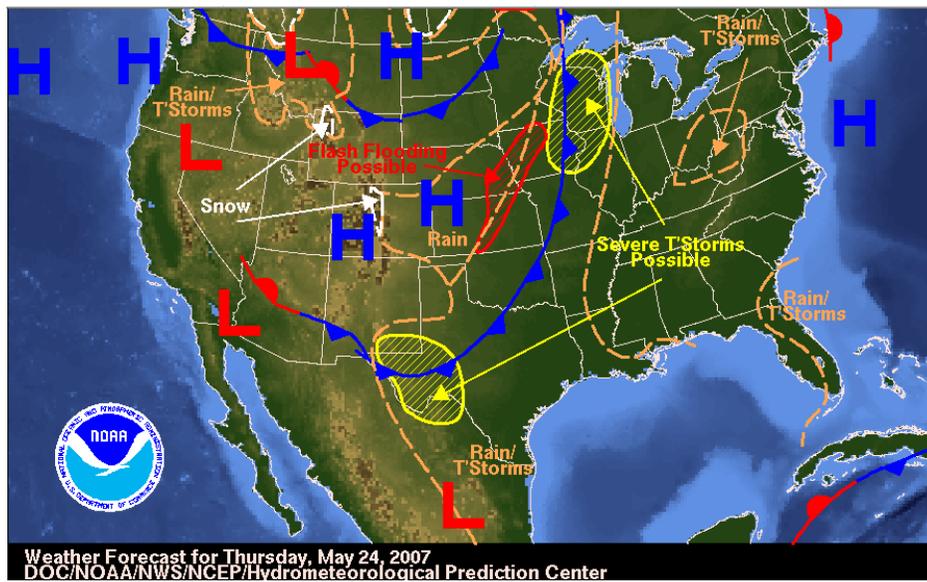
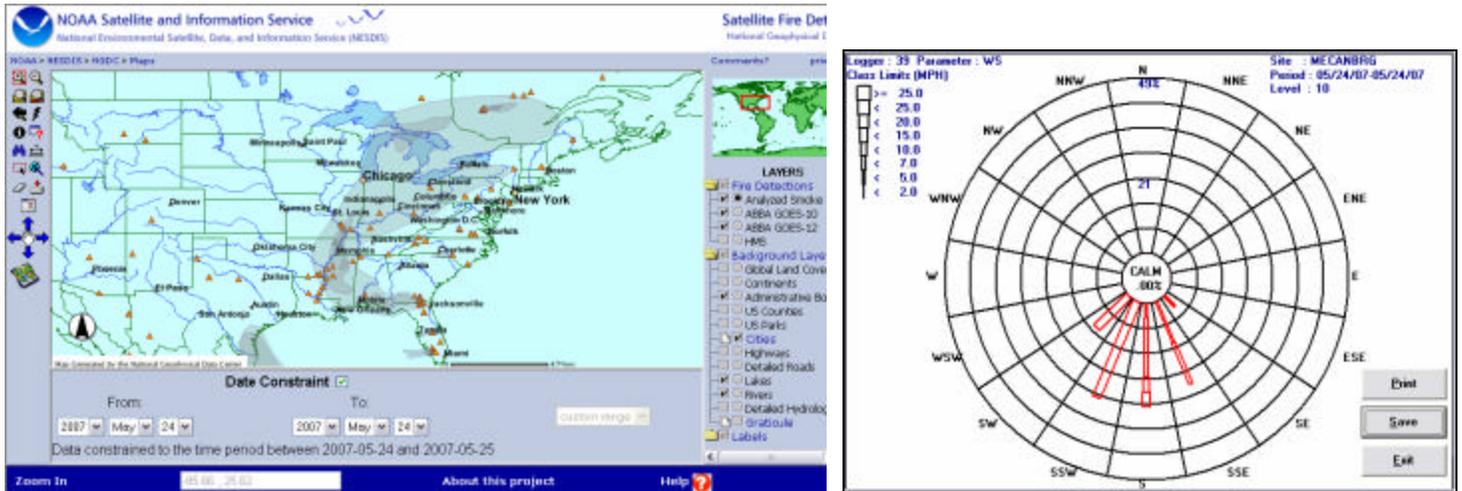


Figure 4.2 - May 24, 2007

Although the map illustrates the plume is not over the region, the prevailing SE wind direction, as shown by the wind rose, keep the high levels of PM<sub>2.5</sub> over the area.

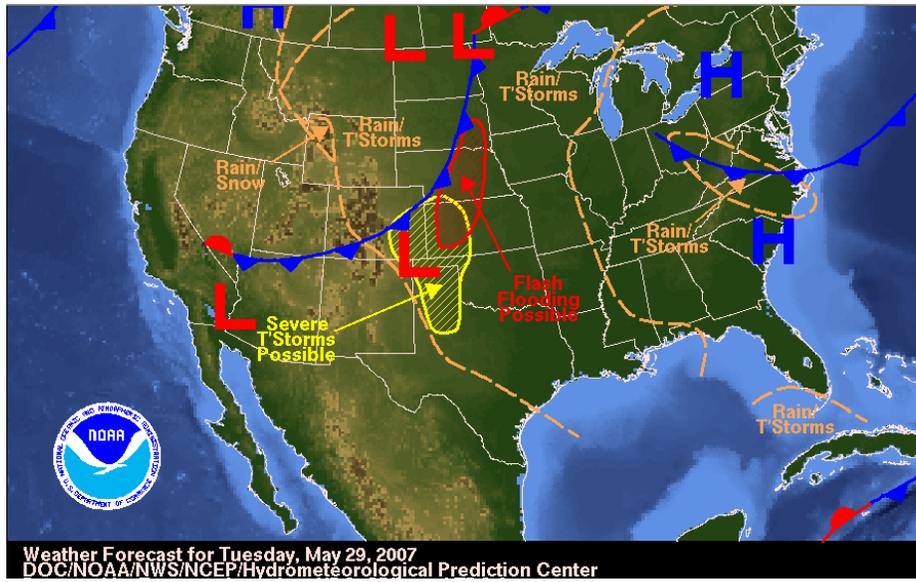
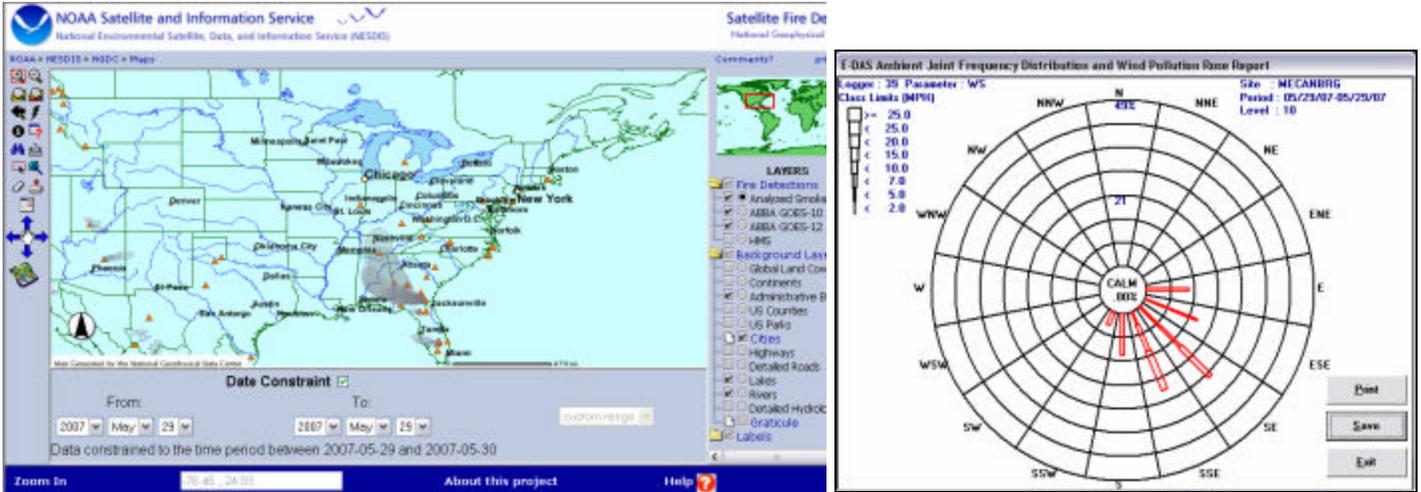


Figure 4.3 - May 29, 2007

The map shows the plume has moved back over the region as the upper level trough dips down over the area and the wind direction continues to be from the S, SE.

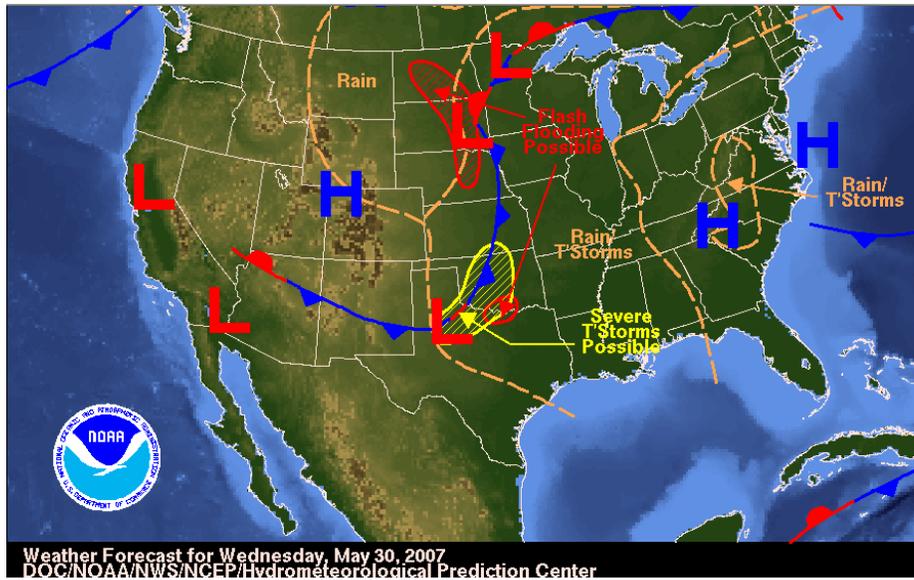
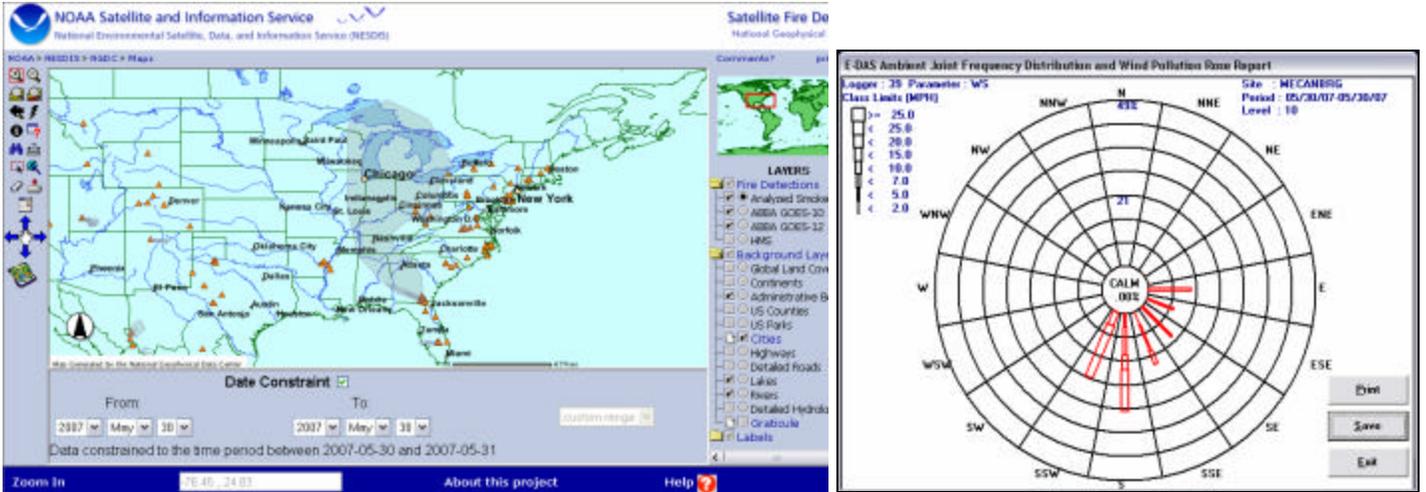


Figure 4.4 - May 30, 2007

The map shows the plume has dissipated as the upper level trough moves to the east, however, strong southerly winds continues to move high particulate levels into the area.

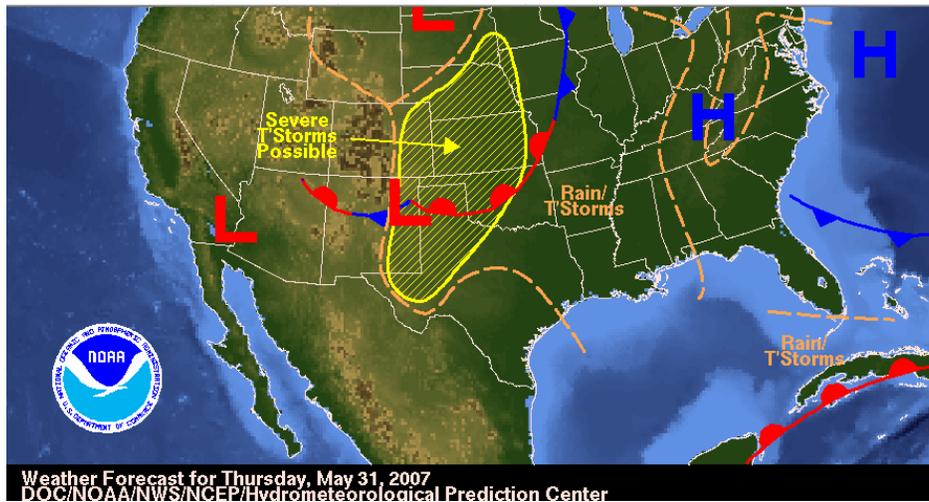
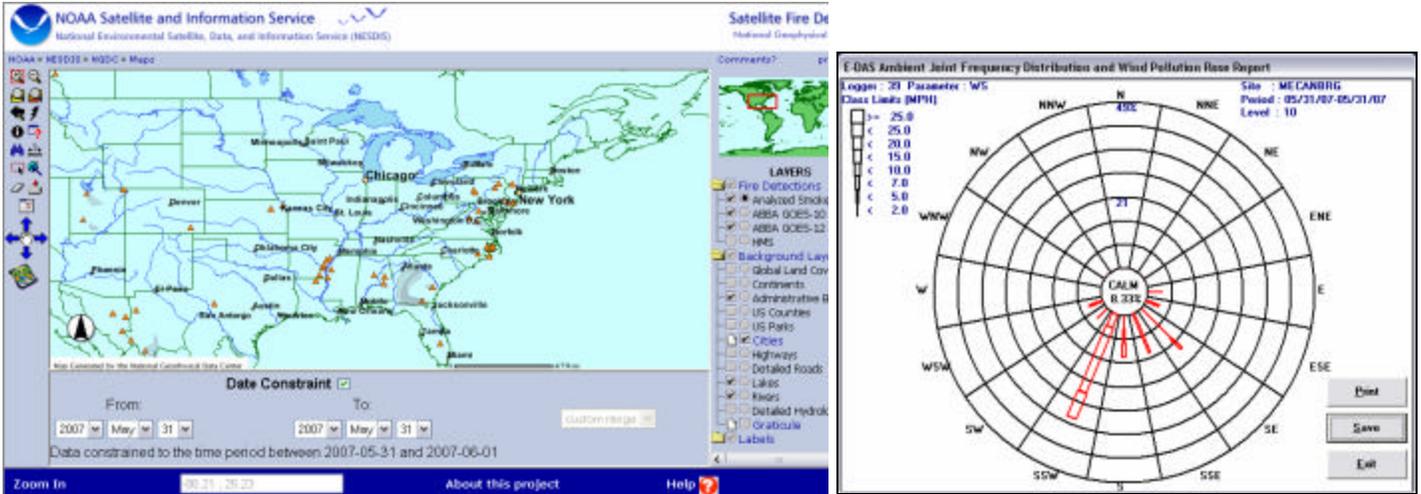
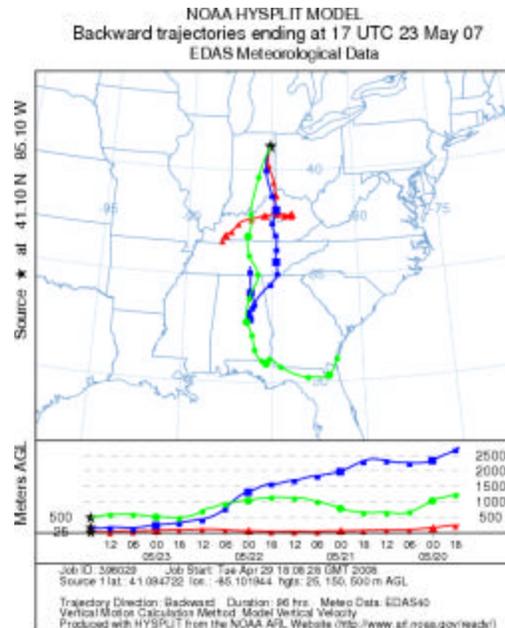


Figure 4.5 - May 31, 2007

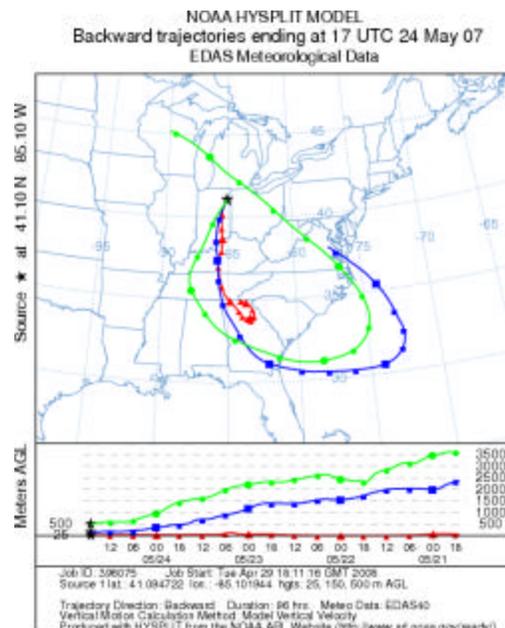
## Backward Trajectory Models

### NOAA ARL READY HYSPLIT Maps

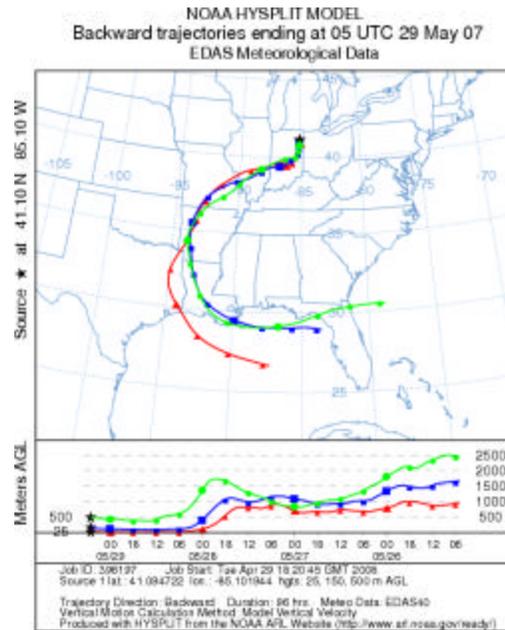
Draxler, R.R. and Rolph, G.D., 2003. HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (<http://www.arl.noaa.gov/ready/hysplit4.html>). NOAA Air Resources Laboratory, Silver Spring, MD.



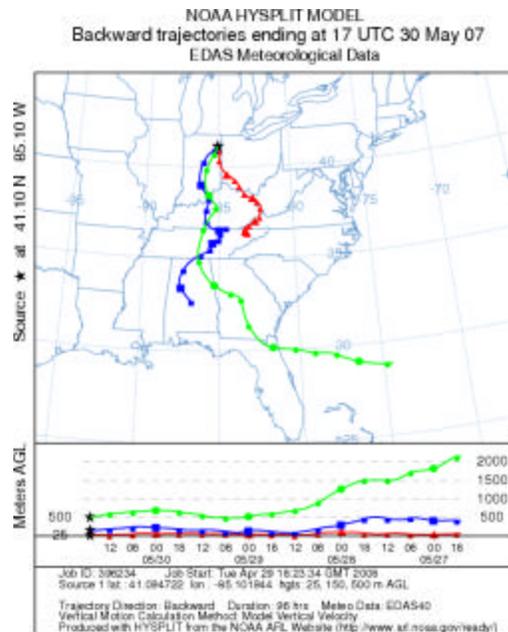
**Figure 4.6:** Backward trajectories originating from Fort Wayne on 5/23/07 at 12:00 PM EST showing the air mass passing over Georgia.



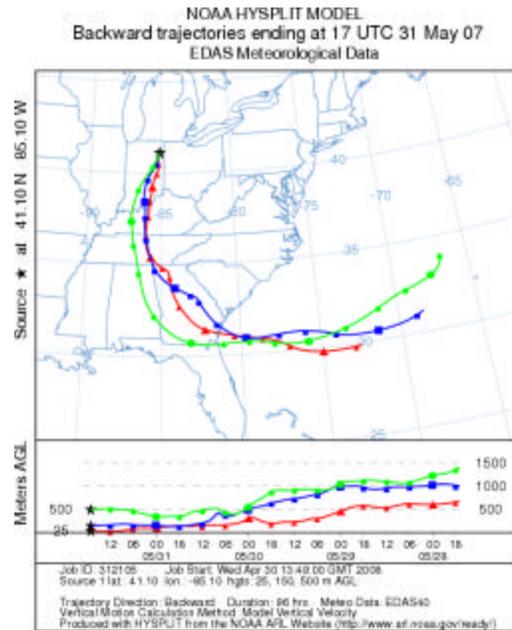
**Figure 4.7:** Backward trajectories originating from Fort Wayne on 5/24/07 at 12:00 PM EST showing the air mass passing over southern Georgia.



**Figure 4.8:** Backward trajectories originating from Fort Wayne on 5/29/07 at 12:00 AM EST showing the air mass still passing over southern Georgia.



**Figure 4.9:** Backward trajectories originating from Fort Wayne on 5/30/07 at 12:00 PM EST showing the air mass still arriving from southern Georgia.



**Figure 4.10:** Backward trajectories originating from Fort Wayne on 5/31/07 at 12:00 PM EST showing the air mass still arriving from southern Georgia.

## 5 – Central Indiana Exceptional Events Detail

Parameter: PM<sub>2.5</sub>

Dates: May 23, 24, 29-31, 2007

Location: Kokomo / Lafayette – Howard / Tippecanoe Co.

Event: Smoke from wildfires in northern Florida and southern Georgia impacted the Central Indiana region during the period of May 23 and 24 and May 29 - 31. The gradual buildup of smoke moving through the area during this period resulted in an exceedance of the 24-hour PM<sub>2.5</sub> NAAQS on May 29th at Lafayette (18-157-0008) and several elevated readings at both Lafayette and Kokomo (18-067-0003).

Data: Different analyses of the data are used to demonstrate that the PM<sub>2.5</sub> concentrations measured from May 23 – 31 were influenced by outside events. Table 5.1 shows daily PM<sub>2.5</sub> averages prior to, during and after the event with the values flagged in **bold**. Data have been flagged with an exceptional event flag of 'E' in AQS, awaiting concurrence from EPA.

Tables 5.2 and 5.3 list summaries of the data collected at the Kokomo and Lafayette sites since 2000. Data from 2007 are calculated with all current data and with the flagged data removed.

**Table 5.1 - FRM Daily Values  
Exceptional Event Period**

Values in **BOLD** are flagged as exceptional events

Date	Kokomo - Superior St 18-067-0003	Lafayette - Greenbush 18-157-0008
5/18/07	5.9	10.7
5/19/07		8.4
5/20/07		12.4
5/21/07	14	15.6
5/22/07		18.3
<b>5/23/07</b>		<b>34.7</b>
<b>5/24/07</b>	<b>30.6</b>	<b>27.8</b>
5/25/07		21.9
5/26/07		24.6
5/27/07	20.5	19.8
5/28/07		19.4
<b>5/29/07</b>		<b>36.8</b>
<b>5/30/07</b>	<b>33.5</b>	<b>32.7</b>
<b>5/31/07</b>		<b>30</b>
6/1/07		23.2
6/2/07	15.1	15.7

**Table 5.2 - Historical Daily Values**

Year		Kokomo 180670003		Lafayette 181570008	
		98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>
2000		34.3		34	
2001		38.1		35.5	
2002	2000- 2002	29.7	34	27.7	32
2003	2001- 2003	33.1	34	34.5	32
2004	2002- 2004	27.6	30	26.4	30
2005	2003- 2005	37.6	33	49.3	37
2006	2004- 2006	27.6	31	27	34
2007	2005- 2007	33.6	33	34.2	37
Values excluding flagged data					
2007	2005- 2007	33.6	33	32	36

<sup>1</sup>Daily Design Value = 3 year average of annual 98<sup>th</sup> %ile values.

**Table 5.3 - Historical Annual Averages**

Year		Kokomo 180670003		Lafayette 181570008	
		Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>
2000		15.6		15.6	
2001		15.0		14.9	
2002	2000- 2002	14.7	15.1	15.7	15.4
2003	2001- 2003	14.3	14.7	14	14
2004	2002- 2004	12.7	13.9	12.3	13.5
2005	2003- 2005	15.9	14.3	15.8	14.1
2006	2004- 2006	12.2	13.6	11.8	13.3
2007	2005- 2007	13.5	13.9	13.5	13.7
Values excluding flagged data					
2007	2005- 2007	13.1	13.8	13.1	13.6

<sup>2</sup>Annual Design value = 3 year average of the annual averages.

## Particulate

**Composition:** Speciated data are not collected at either Lafayette or Kokomo. The maps in Appendix 3 indicate that the regional organic carbon values were elevated on the two available sample days. The values were among the highest values recorded in 2007. The elemental carbon values on these dates remained at or below average values.

**Maps:** Images of maps from NOAA Satellite and Information Services show the smoke plume originating from the northern Florida/southern Georgia region. Dispersion and movement of the smoke plume from these fires was generally to the west or northwest and then to the north. The daily satellite smoke photos show that the smoke plume from the fires extending statewide on May 23 and 24. The plume recedes farther to the south and east until May 29. It continues to influence all sites statewide until May 31. The daily wind roses (obtained from the nearest meteorological site at Flora Municipal airport, 18-015-0002) show information on prevailing wind direction, calm conditions and wind speed. NOAA weather maps are also used to show that an upper level trough greatly influences the direction of the plume in relation to the Central Indiana region.

## Trajectory

**Modeling:** The NOAA HYSPLIT Models are used to show wind trajectories at different levels during this event. Backward modeling from the site (latitude: 40.43°; longitude: -86.85°) at elevations of 25m, 150m and 500m was conducted for a period of three (3) to four (4) days prior. The differing elevations were chosen to demonstrate the air mass's uniformity at ground-level where the samplers were located and aloft which avoids the ground-level limitations of the model. Forward modeling was conducted using the Bugaboo Scrub Fire as the starting point (latitude: 30.70°; longitude: -82.40°) at an elevation of 250 meters (appropriate height that is low enough to always be in the well-mixed zone and high enough to avoid the ground-level model limitation) and going three (3) to four (4) days. Overall, there is a very good correlation when comparing the forward and backward trajectories for a given date. For example, May 30 shows a very narrow channel of air flow between southeastern Georgia and central Indiana. Both the backward and forward trajectories confirm this. Forward trajectory modeling results are shown in Appendix 2.

**Conclusion:** EPA defines an "exceptional event" as an unusual or naturally occurring event that can affect air quality but is not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the clean air act is not appropriate. Indiana has illustrated through the use of maps, meteorological data, speciation data, trajectory models and historical data that the smoke from wildfires in Florida and Georgia impacted the Kokomo / Lafayette region on May 23, 24, 29, 30, and 31, 2007 causing elevated levels of the PM<sub>2.5</sub> 24-hour standard and significantly increasing the annual average. According to 40 CFR Part 50.14 (b)(1), "EPA shall exclude data from use in determinations of exceedances and NAAQS violations where a State

demonstrates to EPA's satisfaction that an exceptional event caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section." IDEM believes they have successfully illustrated the impact of this event on the sites in this region.

Therefore, IDEM requests that EPA concur with the 'E' flag on the data in AQS for the data in **bold** in Table 5.1.

## NOAA Satellite Smoke Maps, Weather Maps, and Wind Roses

The smoke map shows that the plume has reached the central Indiana region and as shown in Table 5.1,  $PM_{2.5}$  levels have started to increase. The corresponding wind rose and weather map further illustrate the direction of the plume by the location of the upper level trough (orange dashed line) and the S, SE prevailing winds.

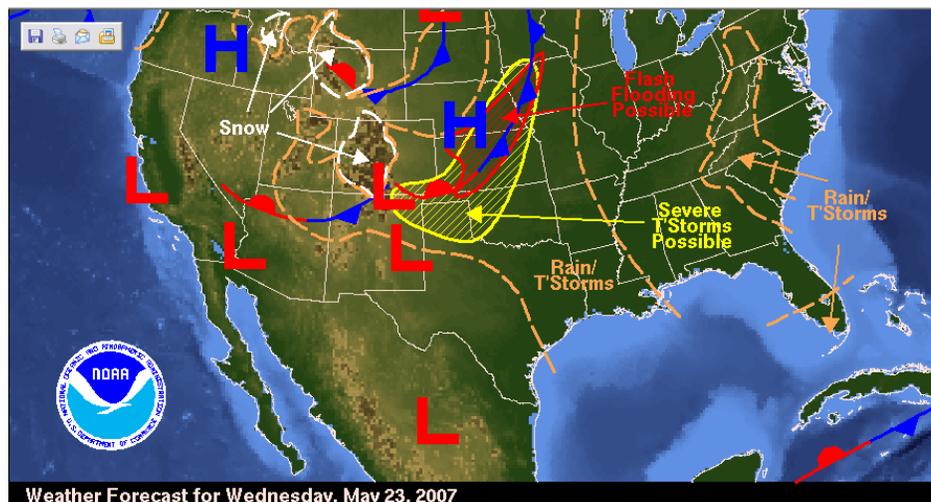
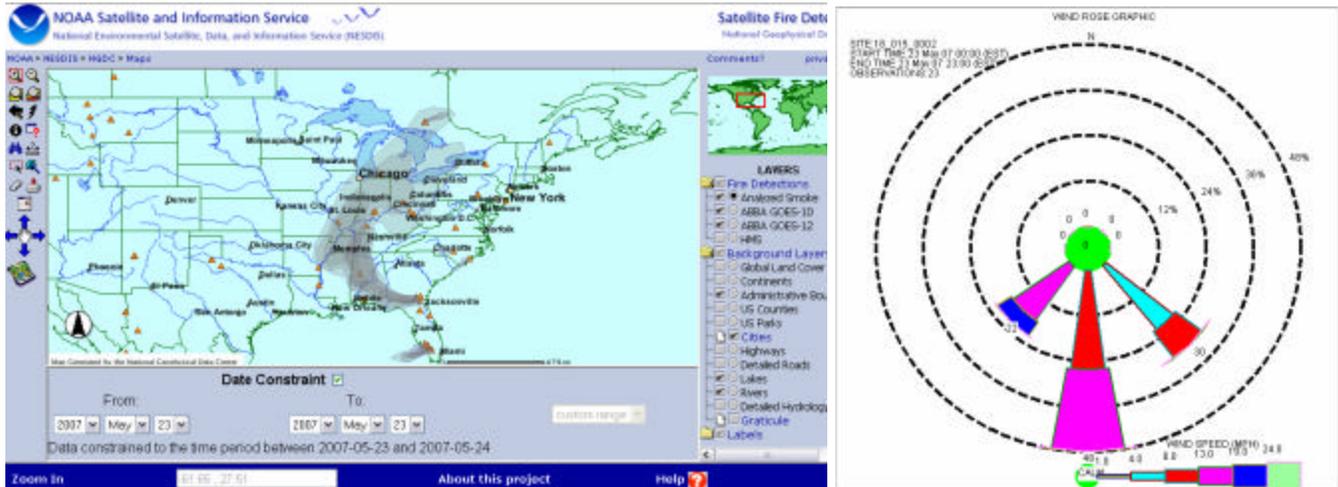


Figure 5.1 - May 23, 2007

The smoke map shows that the plume is remaining over the area. The prevailing wind direction has shifted to the SSW as the upper level trough moves further to the east and another trough develops over Ohio, keeping the plume over the central Indiana region.

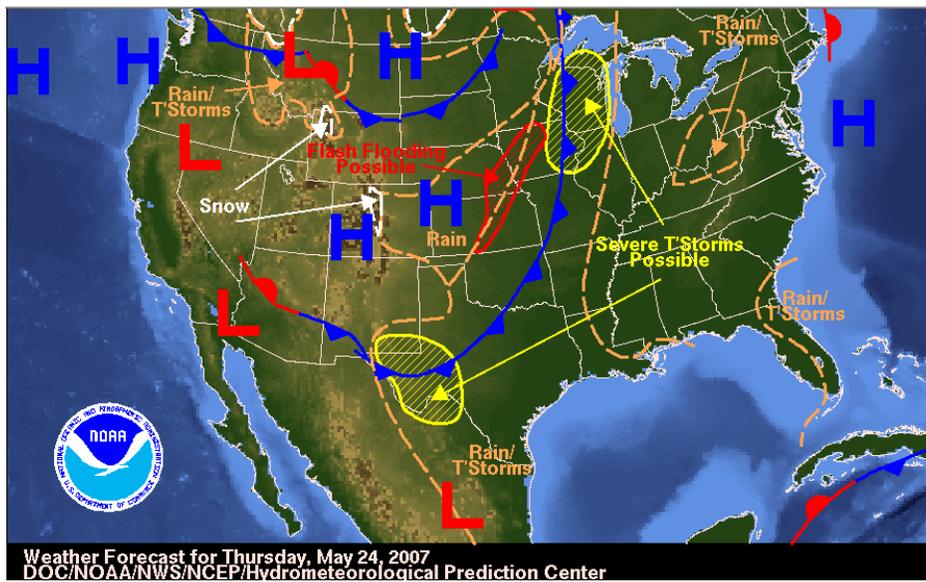
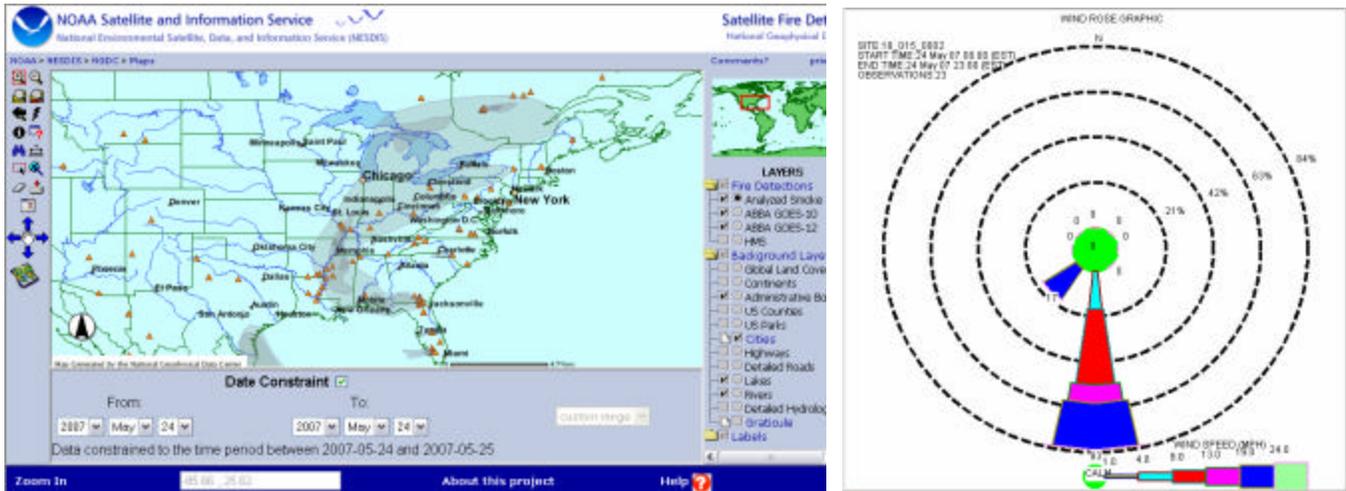


Figure 5.2 - May 24, 2007

Although the map illustrates the plume is not over the region, the prevailing SE wind direction, as shown by the wind rose, keep the high levels of PM<sub>2.5</sub> over the area.

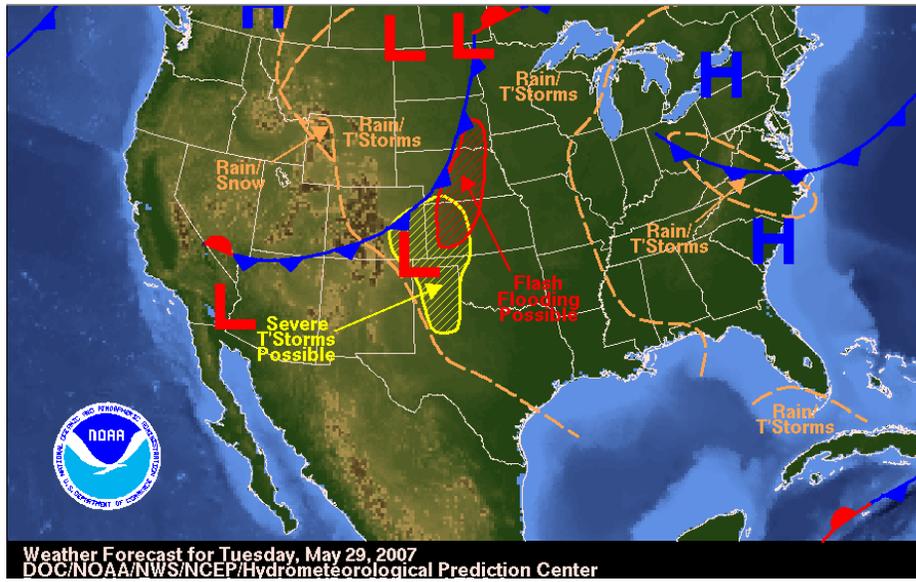
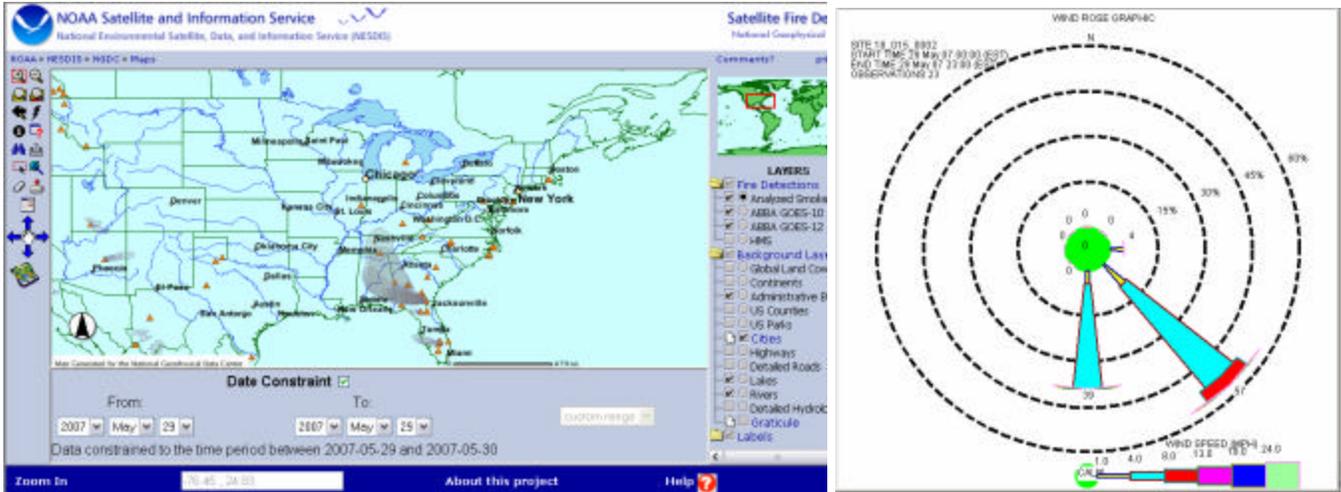


Figure 5.3 - May 29, 2007

The map shows the plume has moved back over the region as the upper level trough dips down over the area and the wind direction continues to be from the S, SE.

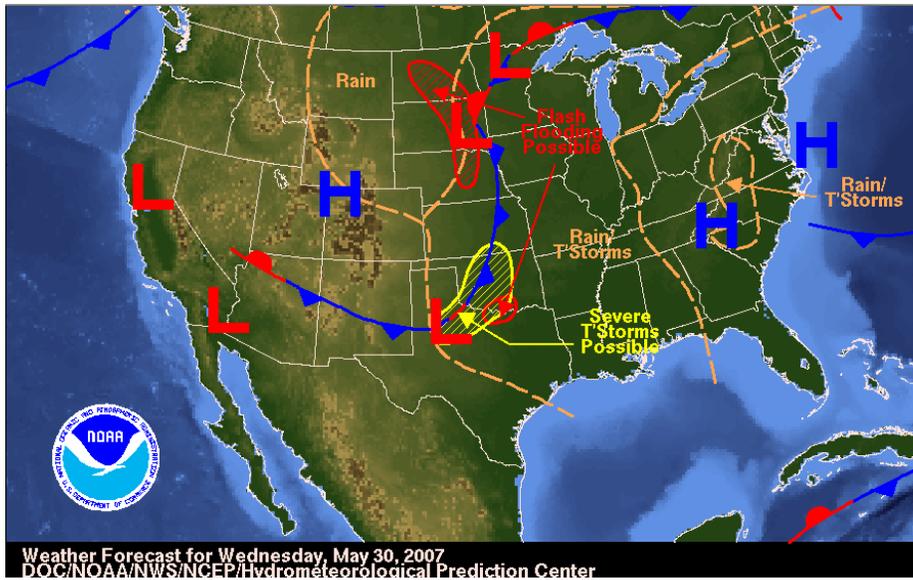
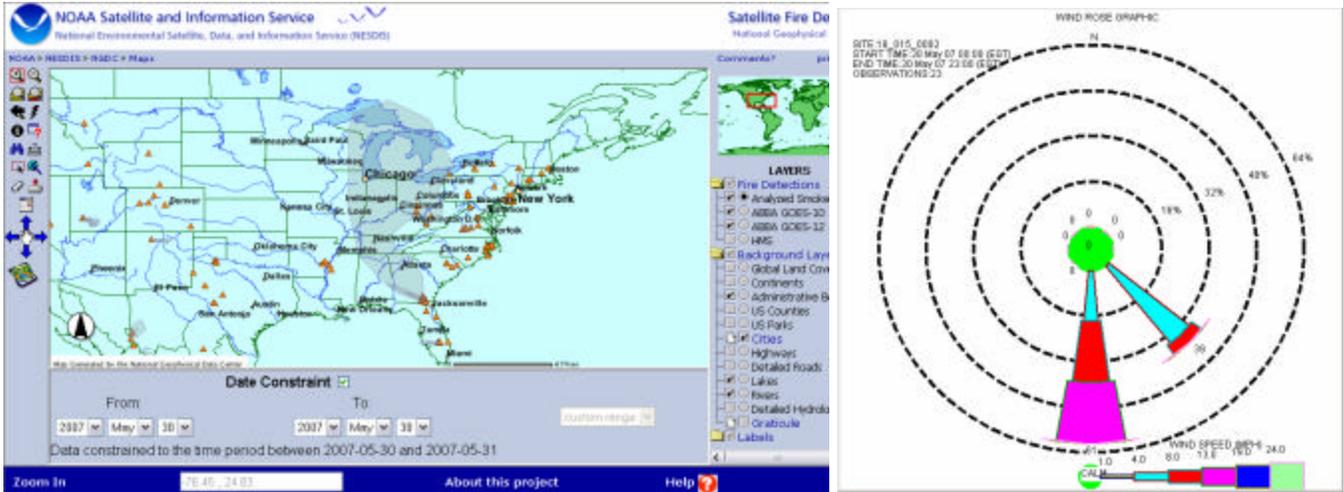


Figure 5.4 - May 30, 2007

The map shows the plume has dissipated as the upper level trough moves to the east, however, strong Southerly winds continues to move high particulate levels into the area.

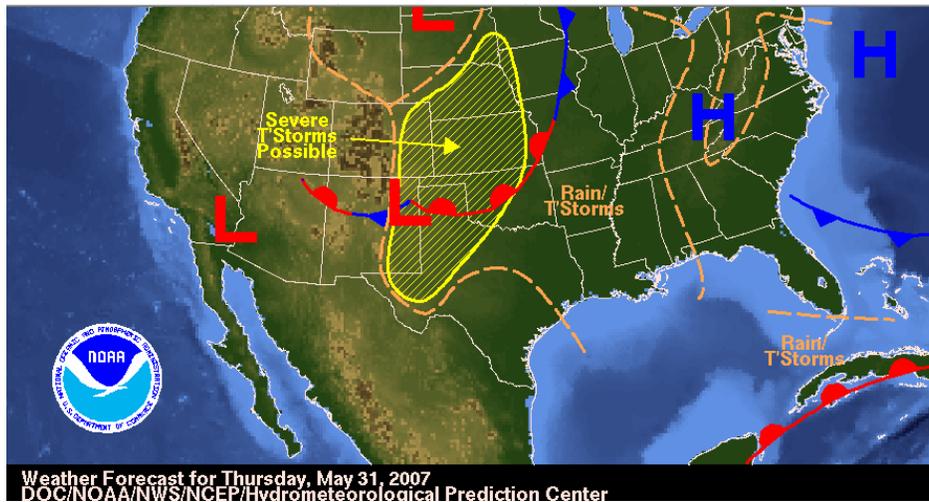
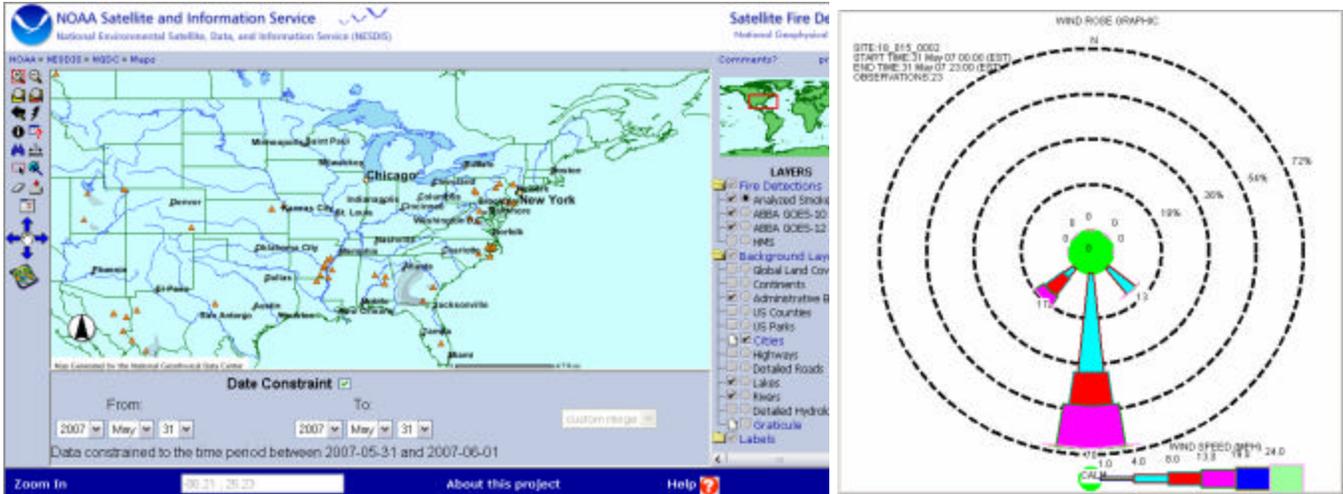
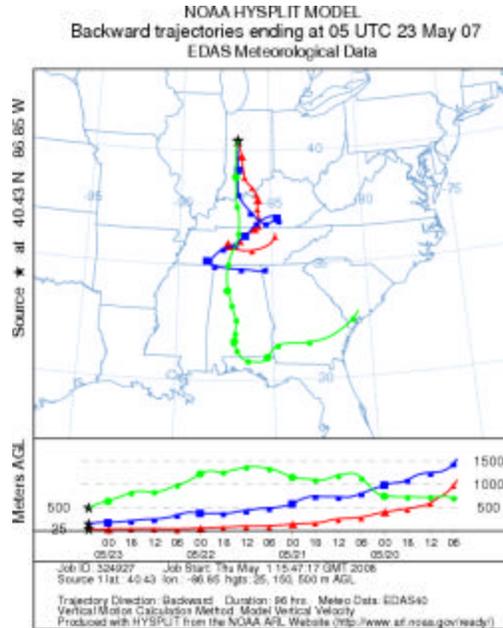


Figure 5.5 - May 31, 2007

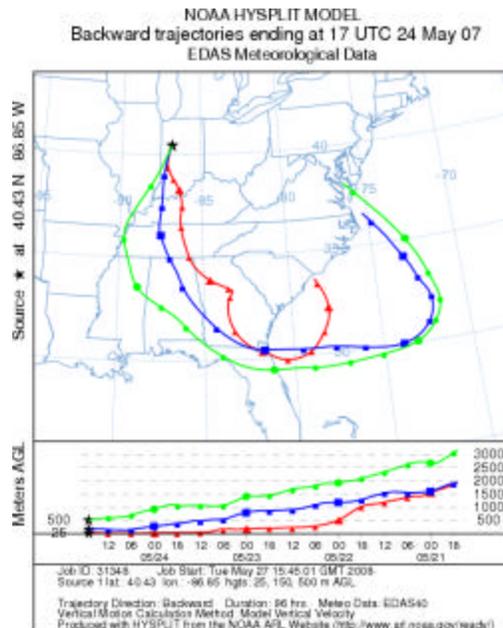
# Backward Trajectory Models

## NOAA ARL READY HYSPLIT Maps

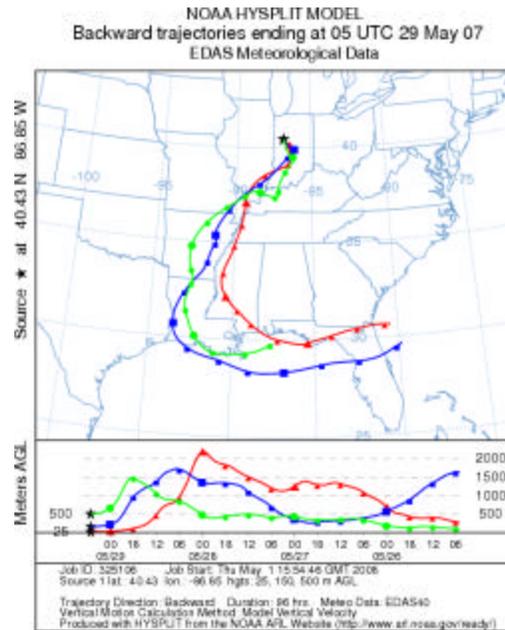
Draxler, R.R. and Rolph, G.D., 2003. HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (<http://www.arl.noaa.gov/ready/hysplit4.html>). NOAA Air Resources Laboratory, Silver Spring, MD.



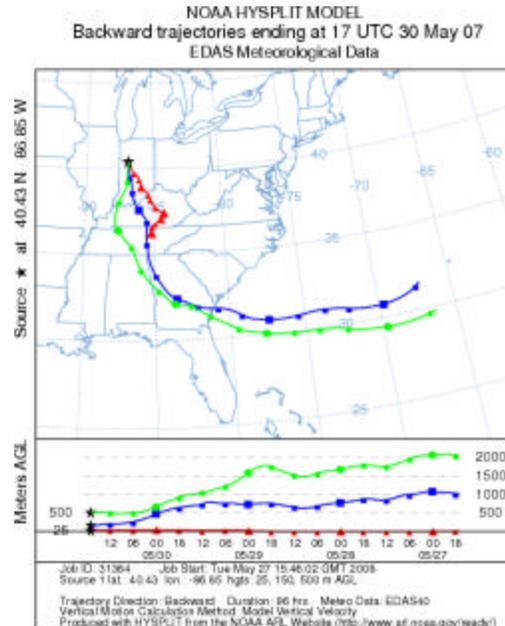
**Figure 5.6:** Backward trajectories originating from Lafayette on 5/23/07 at 12:00 AM EST showing the air mass originating over Georgia.



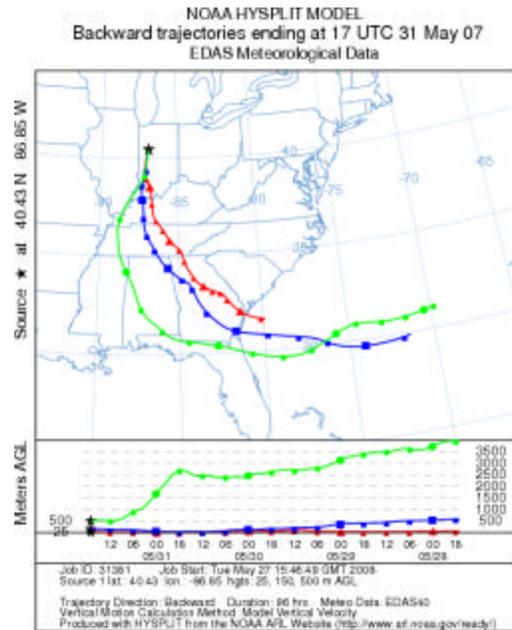
**Figure 5.7:** Backward trajectories originating from Lafayette on 5/24/07 at 12:00 PM EST showing the air mass passing over southern Georgia.



**Figure 5.8:** Backward trajectories originating from Lafayette on 5/29/07 at 12:00 AM EST showing the air mass still passing over southern Georgia.



**Figure 5.9:** Backward trajectories originating from Lafayette on 5/30/07 at 12:00 PM EST showing the air mass still passing over southern Georgia.



**Figure 5.10:** Backward trajectories originating from Lafayette on 5/31/07 at 12:00 PM EST showing the air mass still arriving from southern Georgia.

## 6 – East Central Indiana Exceptional Events Detail

- Parameter: PM<sub>2.5</sub>
- Dates: May 23-25, 29-31, 2007
- Location: Anderson / Muncie / Mechanicsburg – Madison / Delaware / Henry Co.
- Event: Smoke from wildfires in northern Florida and southern Georgia impacted the East Central Indiana region during the period of May 23-25 and 29 - 31, 2007. The gradual buildup of smoke moving through the area during this period resulted in an exceedance of the 24-hour PM<sub>2.5</sub> NAAQS on May 23<sup>rd</sup> at Anderson (18-095-0009) and May 23<sup>rd</sup> and 29<sup>th</sup> at Muncie (18-035-0006) in addition to several elevated readings throughout the region.
- Data: Different analyses of the data are used to demonstrate that the PM<sub>2.5</sub> concentrations measured from May 23 – 31 are beyond the range of values typically found during that time period and that they have been influenced by outside events. Table 6.1 shows daily PM<sub>2.5</sub> averages prior to, during and after the event with the values flagged in **bold**. Data have been flagged with an exceptional event flag of 'E' in AQS, awaiting concurrence from EPA.

Tables 6.2 and 6.3 list summaries of the data collected at all three sites since 2000. Data from 2007 are calculated with all current data and with the flagged data removed. There is a significant improvement in both the 98<sup>th</sup> percentile and annual average values at all three sites.

**Table 6.1 - FRM Daily Values  
Exceptional Event Period**

Values in **BOLD** are flagged as exceptional events

Date	Anderson - 5th St. 18-095-0009	Muncie Central 18-035-0006	Shenandoah HS/ Mechanicsburg 18-065-0003
5/17/07	4.3	3.7	
5/18/07	6.5	5.5	4.9
5/19/07	11	10	
5/20/07	14		
5/21/07	16.2		14.6
5/22/07	19.5		
<b>5/23/07</b>	<b>36.4</b>	<b>36</b>	
<b>5/24/07</b>	<b>29.4</b>	<b>31.4</b>	<b>30.7</b>
<b>5/25/07</b>	<b>30.2</b>	<b>30.7</b>	
5/26/07	24.8	24.7	
5/27/07	24.5	22.4	21.5
5/28/07	22.8	21.3	
<b>5/29/07</b>	<b>38</b>	<b>35.1</b>	
<b>5/30/07</b>	<b>32.9</b>	<b>33.4</b>	<b>32.4</b>
<b>5/31/07</b>	<b>32.6</b>	<b>30.2</b>	
6/1/07	28.5	24.6	
6/2/07	19.1	19.4	
6/3/07	19.7	23.5	

**Table 6.2 - Historical Daily Values**

Year		Anderson 180950009		Muncie 180350006		Mechanicsburg 180650003	
		98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>
2000		33.1		34.8			
2001		36.8		35.7		30.7	
2002	2000- 2002	34.2	35	30	34	29.7	27
2003	2001- 2003	35.5	36	36.5	34	31.4	31
2004	2002- 2004	28.2	33	27.2	31	26.9	29
2005	2003- 2005	38.3	34	37.3	34	37.3	32
2006	2004- 2006	28	32	27.4	31	27.2	30
2007	2005- 2007	34.3	34	32.9	33	32.4	32
Values excluding flagged data							
2007	2005- 2007	30.9	32	29.1	31	28.9	31

<sup>1</sup>Daily Design Value = 3 year average of annual 98<sup>th</sup> %ile values.

**Table 6.3 - Historical Annual Averages**

Year		Anderson 180950009		Muncie 180350006		Mechanicsburg 180650003	
		Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>
2000		15.5		16.2			
2001		14.6		14.5		13.6	
2002	2000- 2002	14.9	15	14.5	15.1	13.7	13.4
2003	2001- 2003	14.3	14.6	14	14.3	13.4	13.6
2004	2002- 2004	12.8	14	12.3	13.6	11.9	13
2005	2003- 2005	16.1	14.4	16.4	14.2	15.7	13.6
2006	2004- 2006	12.1	13.6	11.9	13.5	11.1	12.9
2007	2005- 2007	13.7	13.9	13.3	13.9	13.1	13.3
Values excluding flagged data							
2007	2005- 2007	13.4	13.8	12.9	13.7	12.8	13.2

<sup>2</sup>Annual Design value = 3 year average of the annual averages.

**Particulate**

**Composition:** Speciation data are collected at the Mechanicsburg site on a one in six day sampling schedule. Data are available for May 24 and May 30. High organic carbon values were reported on those two dates; 7.0 ug/m<sup>3</sup> and 7.2 ug/m<sup>3</sup> respectively. These values were the highest and the second highest values of the year. They were also more than twice the annual average of 3.06 ug/m<sup>3</sup> for organic carbon at this site. There was only a slight increase in the elemental carbon values; 0.5 ug/m<sup>3</sup> and 0.6 ug/m<sup>3</sup>, on the two dates, as compared to the annual average of 0.45 ug/m<sup>3</sup>. Appendix 3 details the rise and fall of the regional organic carbon values through mapping.

**Maps:** Images of maps from NOAA Satellite and Information Services show the smoke plume originating from the northern Florida/southern Georgia region. Dispersion and movement of the smoke plume from these fires was generally to the west or northwest and then to the north. The daily satellite smoke photos show that the smoke plume from the fires comes into southern Indiana on May 23 and continues to influence the atmosphere sporadically until June 2. Daily wind roses (obtained from the meteorological site at Shenandoah HS, 18-065-0003) show information on prevailing wind direction, calm conditions and wind speed. NOAA weather maps are also

used to show that an upper level trough greatly influences the direction of the plume in relation to the East Central Indiana region.

Trajectory  
Modeling:

The NOAA HYSPLIT Models are used to show wind trajectories at different levels during this event. Backward modeling from the site (latitude: 40.20°; longitude: -85.39°) at elevations of 25m, 150m and 500m was conducted for a period of three (3) to four (4) days prior. The differing elevations were chosen to demonstrate the air mass's uniformity at ground-level where the samplers were located and aloft which avoids the ground-level limitations of the model. Forward modeling was conducted using the Bugaboo Scrub Fire as the starting point (latitude: 30.70°; longitude: -82.40°) at an elevation of 250 meters (appropriate height that is low enough to always be in the well-mixed zone and high enough to avoid the ground-level model limitation) and going three (3) to four (4) days. Overall, there is a very good correlation when comparing the forward and backward trajectories for a given date. For example, May 25 and 31 show a very narrow channel of air flow between southeastern Georgia and East Central Indiana. Both the backward and forward trajectories confirm this. Forward trajectory modeling results are shown in Appendix 2.

Conclusion:

EPA defines an “exceptional event” as an unusual or naturally occurring event that can affect air quality but is not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the clean air act is not appropriate. It has been illustrated through the use of maps, meteorological data, speciation data, trajectory models and historical data that the smoke from wildfires in Florida and Georgia impacted the East Central Indiana region during the period of May 23–25, 29-31, 2007 causing exceedances of the PM<sub>2.5</sub> 24-hour standard and significantly increasing the annual average. According to 40 CFR Part 50.14 (b)(1), “EPA shall exclude data from use in determinations of exceedances and NAAQS violations where a State demonstrates to EPA’s satisfaction that an exceptional event caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section.” IDEM believes they have successfully illustrated the impact of this event on the sites in this region.

Therefore, IDEM requests that EPA concur with the ‘E’ flag on the data in AQS for the data in **bold** in Table 6.1.

## NOAA Satellite Smoke Maps, Weather Maps And Wind Roses

The smoke map shows that the plume has reached the east central Indiana region and as shown in Table 6.1, PM<sub>2.5</sub> levels have started to increase. The corresponding wind rose and weather map further illustrate the direction of the plume by the location of the upper level trough (orange dashed line) and the S, SE prevailing winds.

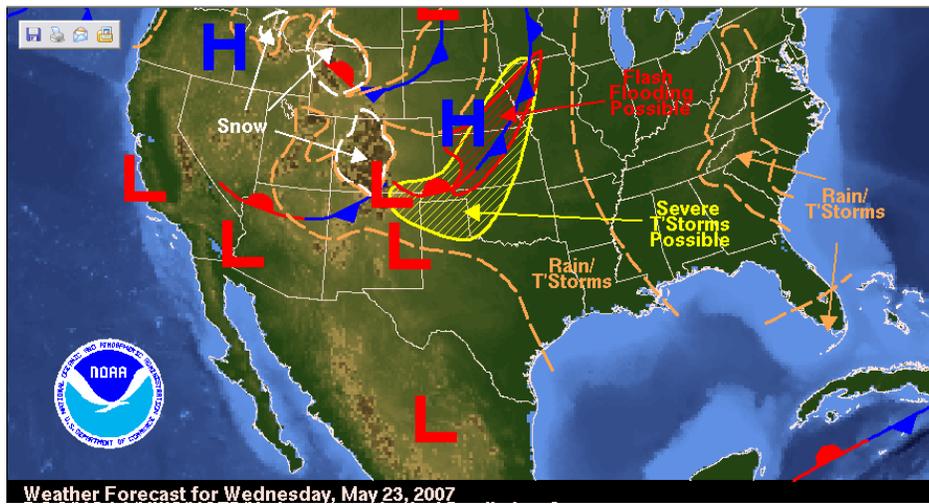
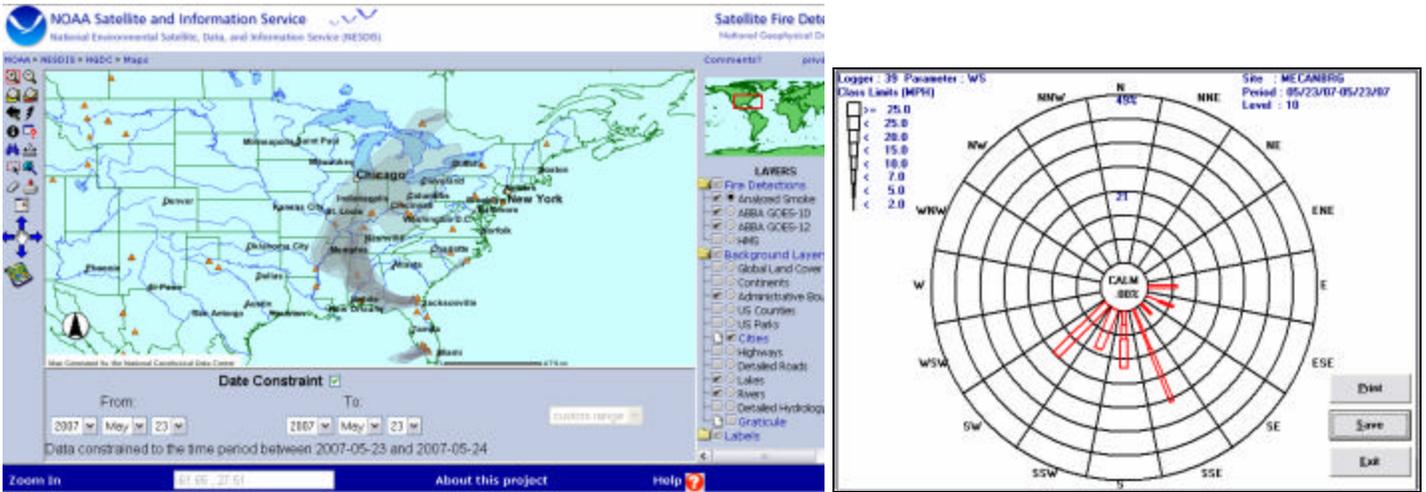


Figure 6.1 - May 23, 2007

The smoke map shows that the plume is remaining over the area. The prevailing wind direction has shifted to the SSW as the upper level trough moves further to the east and another trough develops over Ohio, keeping the plume over the central Indiana region.

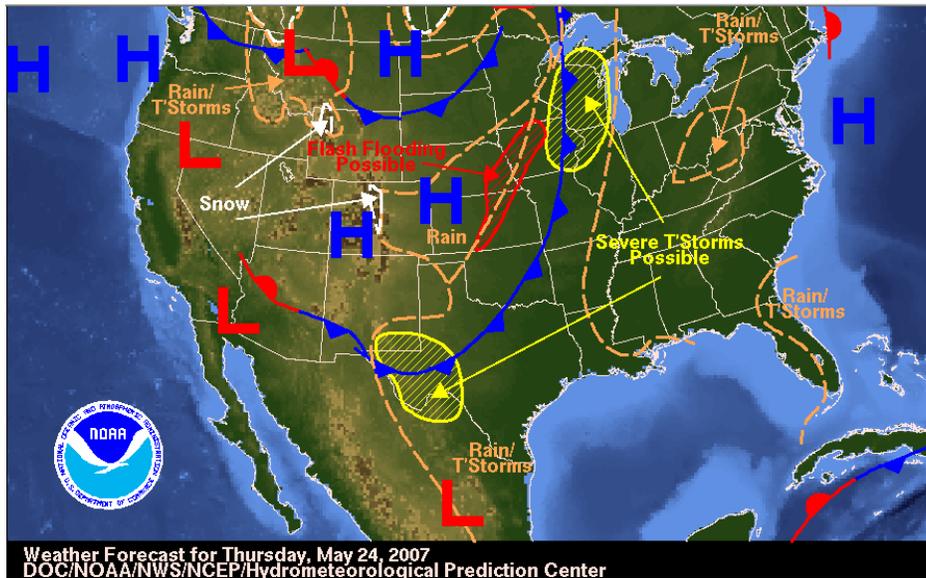
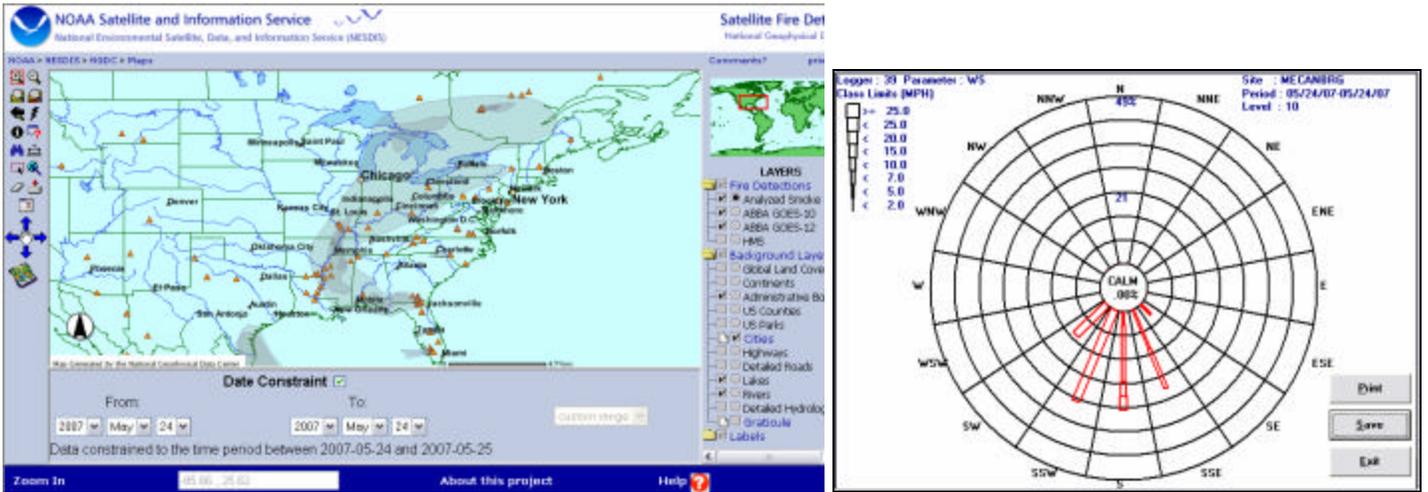


Figure 6.2 - May 24, 2007

The smoke map shows that the plume is remaining over the area. The prevailing wind direction continues to be from the SW as the upper level trough has now moved directly over the east central Indiana region.

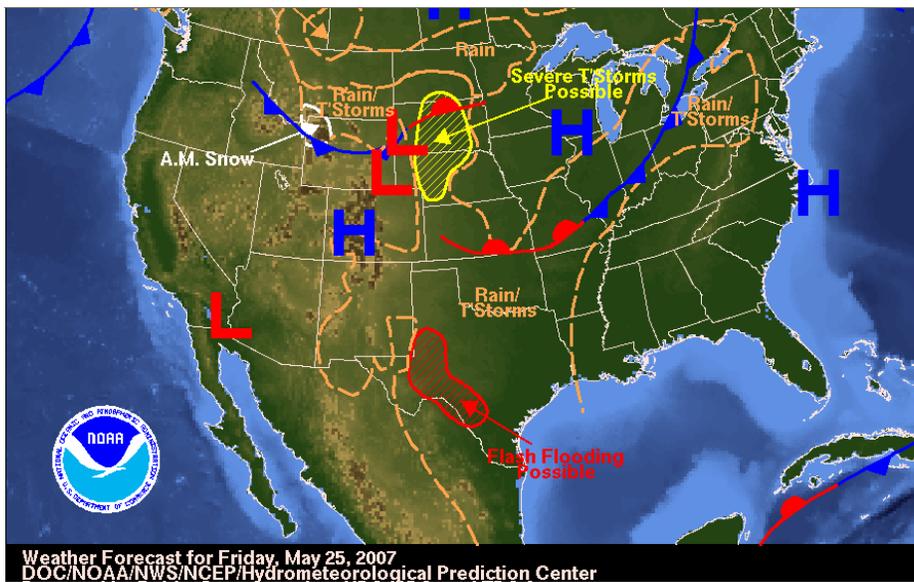
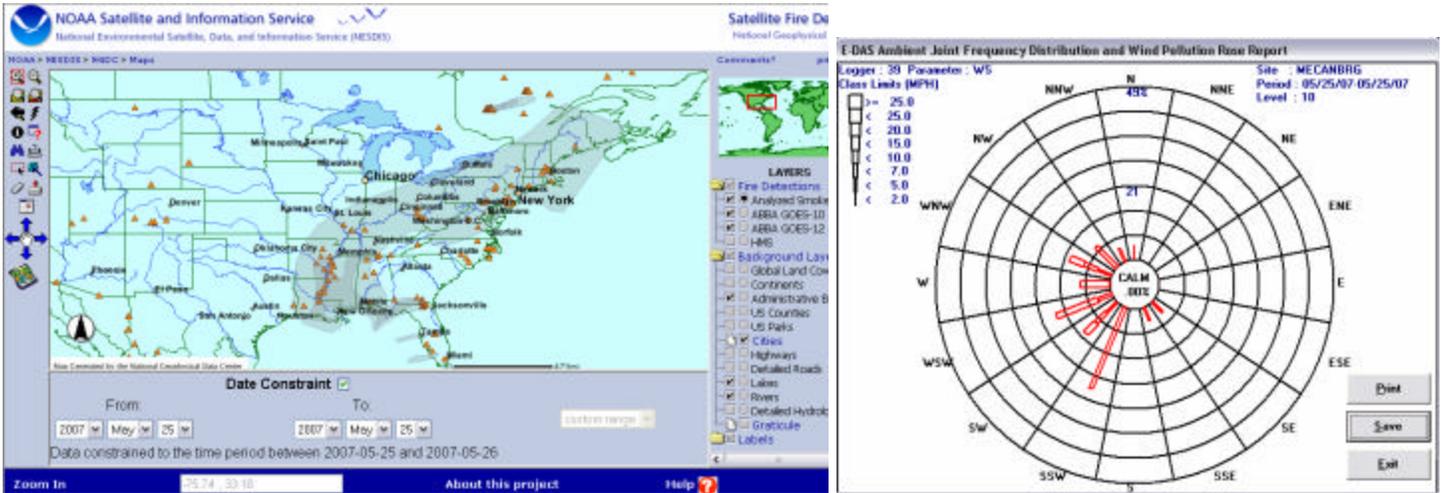


Figure 6.3 - May 25, 2007

Although the map illustrates the plume is not over the region, the prevailing SE wind direction, as shown by the wind rose, keep the high levels of PM<sub>2.5</sub> over the area.

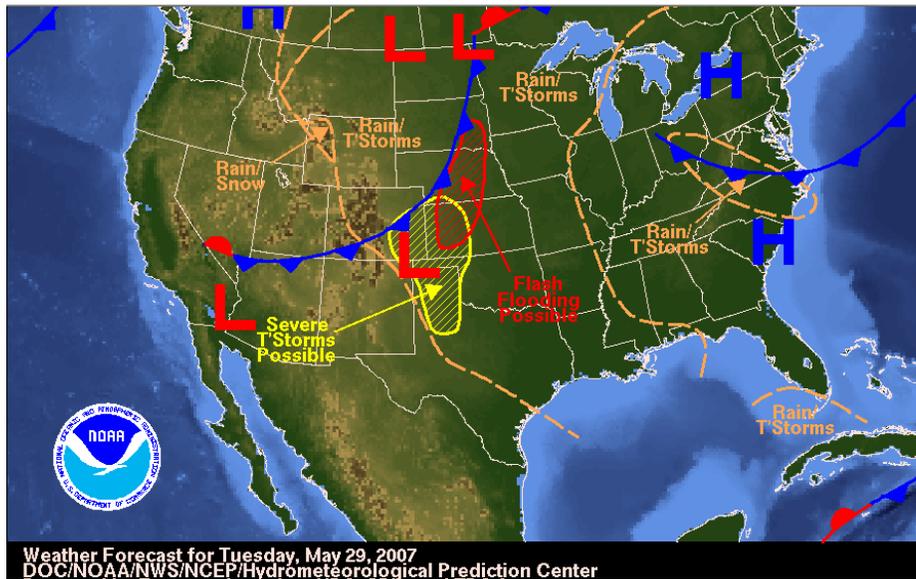
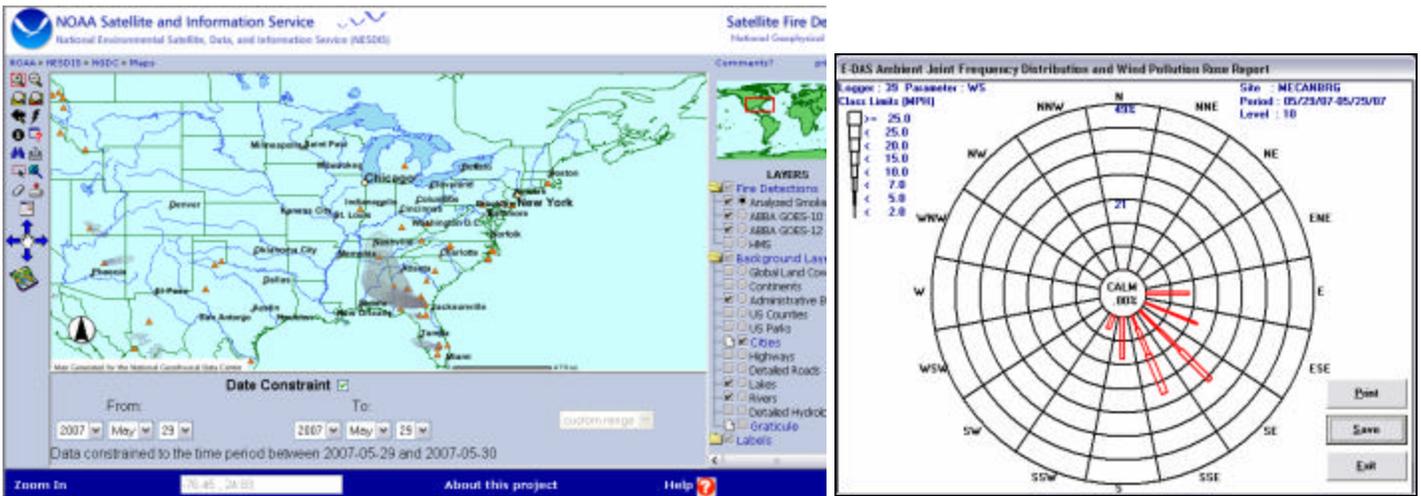


Figure 6.4 - May 29, 2007

The map shows the plume has moved back over the region as the upper level trough dips down over the area and the wind direction continues to be from the S, SE.

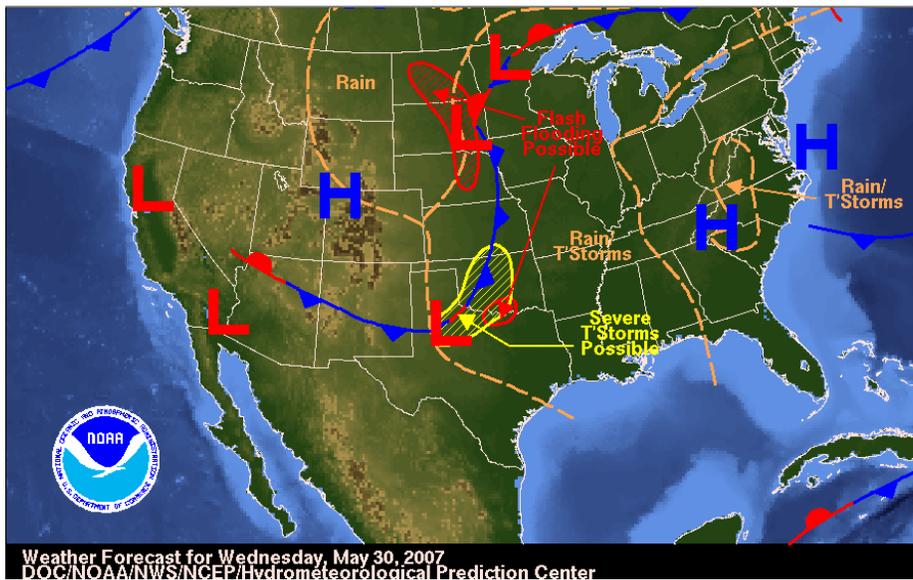
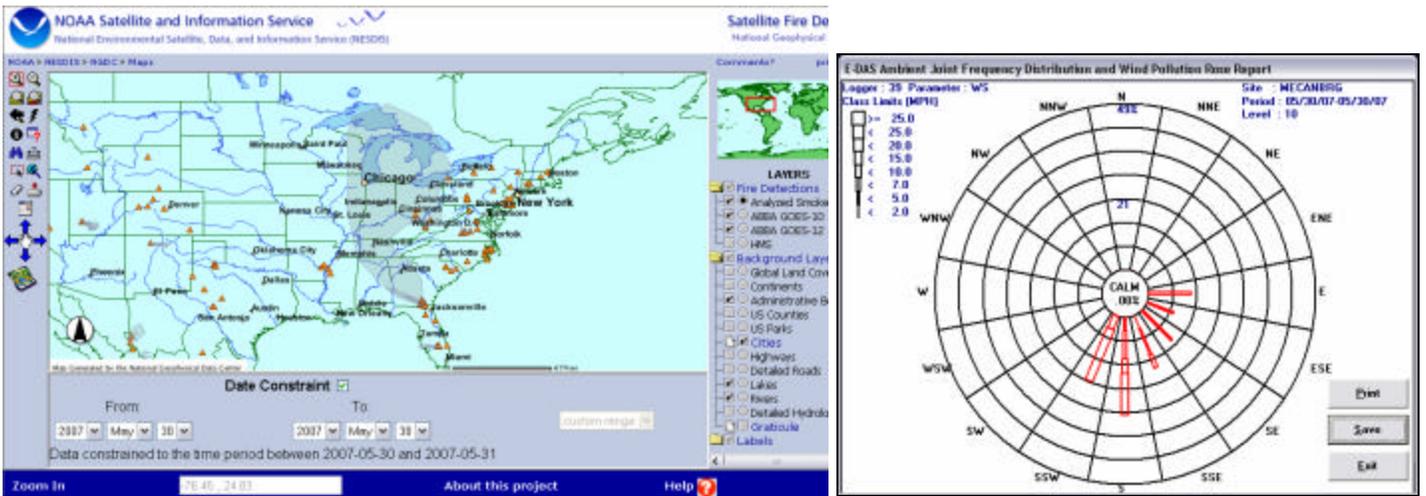


Figure 6.5 - May 30, 2007

The map shows the plume has dissipated as the upper level trough moves to the east, however, strong southerly winds continue to move high particulate levels into the area.

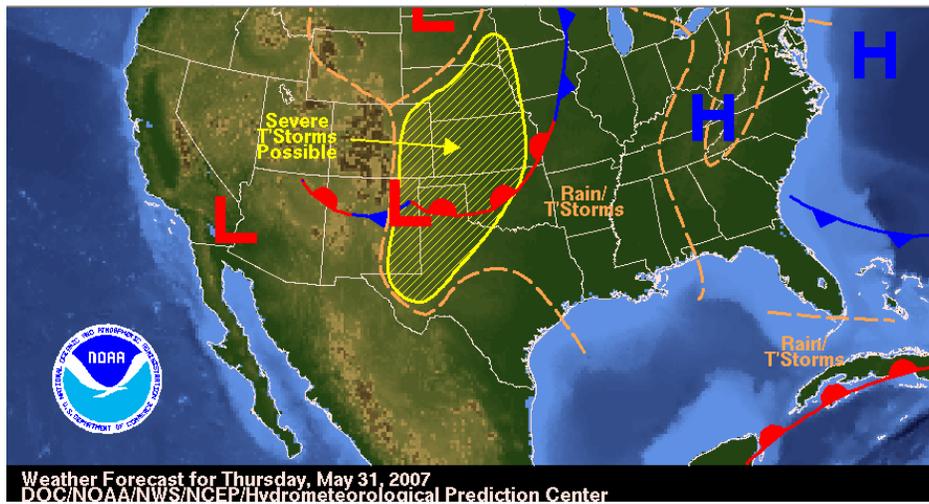
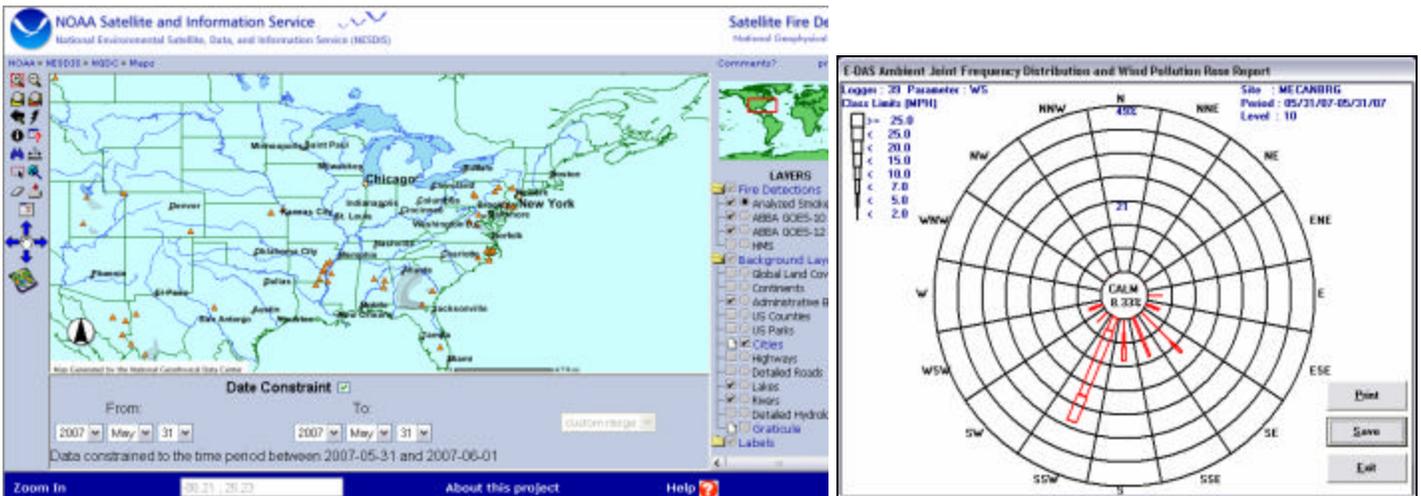
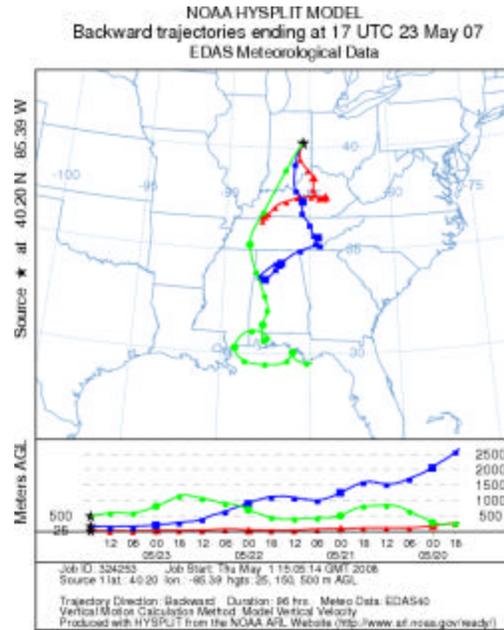


Figure 6.6 - May 31, 2007

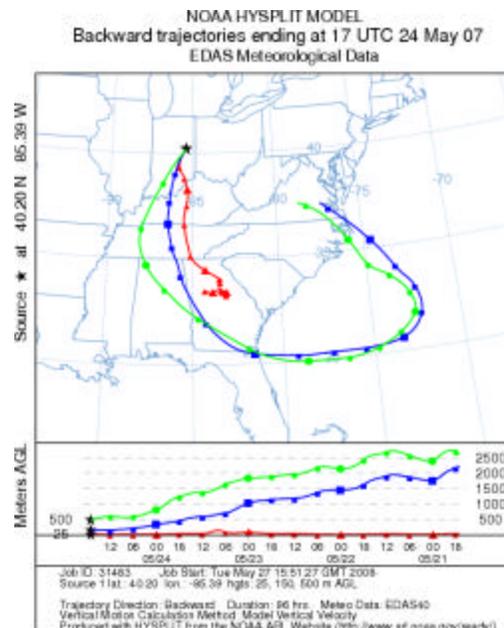
## Backward Trajectory Models

### NOAA ARL READY HYSPLIT Maps

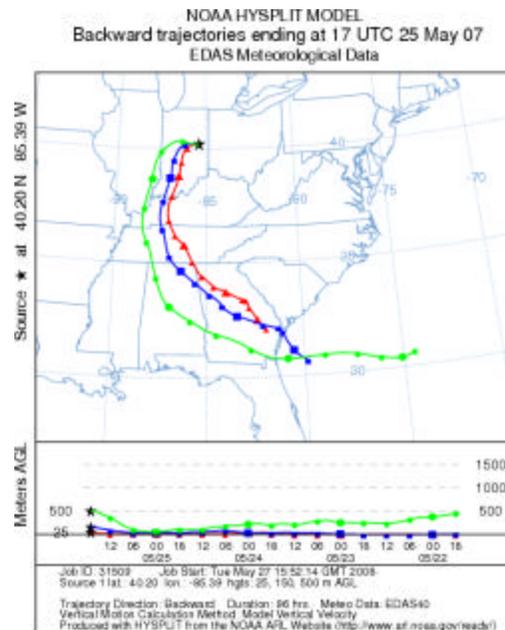
Draxler, R.R. and Rolph, G.D., 2003. HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (<http://www.arl.noaa.gov/ready/hysplit4.html>). NOAA Air Resources Laboratory, Silver Spring, MD.



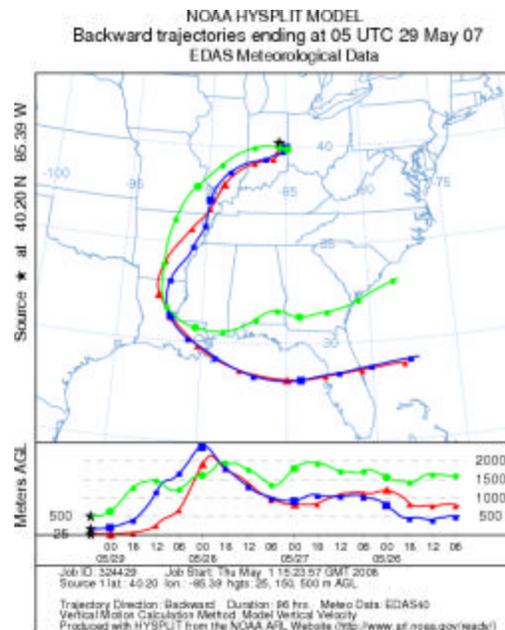
**Figure 6.7:** Backward trajectories originating from Muncie on 5/23/07 at 12:00 PM EST showing the air mass beginning to arrive from the South.



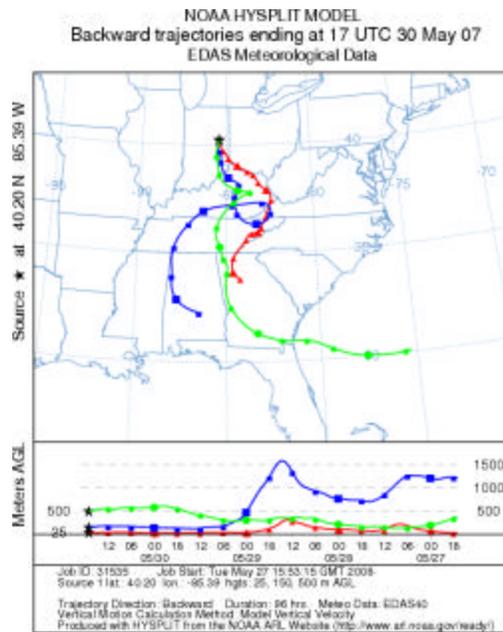
**Figure 6.8:** Backward trajectories originating from Muncie on 5/24/07 at 12:00 PM EST showing the air mass now passing over southern Georgia.



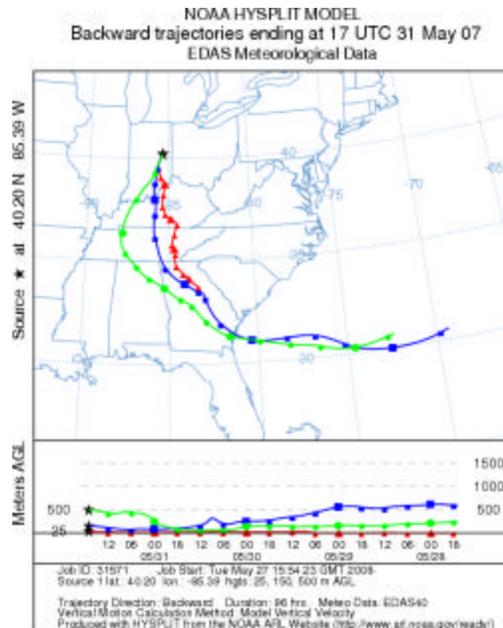
**Figure 6.9:** Backward trajectories originating from Muncie on 5/25/07 at 12:00 PM EST showing the air mass still passing over southern Georgia.



**Figure 6.10:** Backward trajectories originating from Muncie on 5/29/07 at 12:00 AM EST showing the air mass still passing over the Florida/Georgia region.



**Figure 6.11:** Backward trajectories originating from Muncie on 5/30/07 at 12:00 PM EST showing the air mass still arriving from Georgia.



**Figure 6.12:** Backward trajectories originating from Muncie on 5/31/07 at 12:00 PM EST showing the air mass still arriving from southern Georgia.

## 7 - Indianapolis

### Exceptional Events Detail

- Parameter: PM<sub>2.5</sub>
- Dates: May 23 – 31, 2007
- Location: Indianapolis – Marion Co.
- Event: Smoke from wildfires in northern Florida and southern Georgia impacted the Indianapolis region during the period of May 23 – 31. The gradual buildup of smoke moving through the area during this period resulted in exceedances of the 24-hour PM<sub>2.5</sub> NAAQS on May 23<sup>rd</sup> at English Ave. (18-097-0066) and Washington Park (18-097-0078), May 25<sup>th</sup> at English Ave, May 29<sup>th</sup> at both English Ave. and Washington Park and several elevated readings throughout the region.
- Data: Different analyses of the data are used to demonstrate that the PM<sub>2.5</sub> concentrations measured from May 23 – 31 have been influenced by outside events. Table 7.1 shows daily PM<sub>2.5</sub> averages prior to, during and after the event with the values flagged in **bold**. Data have been flagged with an exceptional event flag of 'E' in AQS, awaiting concurrence from EPA.

Tables 7.2 and 7.3 list summaries of the data collected at Indianapolis sites the since 2000. Data from 2007 are calculated with all current data and with the flagged data removed along with recalculated design values.

There are no changes in the Daily Design Values at the sites with the flagged data removed. All currently operating sites will remain above the daily NAAQS. Even though several sites continue to remain over the annual NAAQS after the flagged data are removed from the calculations, there is significant improvement of the 2007 annual averages. These improved values may be the difference between nonattainment and attainment of the annual NAAQS when the design values are calculated for 2006-2008 and for 2007-2009.

**Table 7.1 – FRM Daily Values**

## Exceptional Event Period

Values in **BOLD** are flagged as exceptional events

Date	Indpls - E. Michigan 18-097-0083	Indpls - E. 75th St. 18-097-0079	Indpls - W. 18th St. 18-097-0081	Indpls - Mann Rd. 18-097-0042	Indpls - S West St. 18-097-0043	Indpls - English Ave 18-097-0066	Indpls - Wash Park 18-097-0078
5/17/07						7.5	6.2
5/18/07	8.1	7.9	6.8	7	8.4	9.5	6.9
5/19/07						16.9	12.4
5/20/07						17.2	14
5/21/07	18.4	16.3	17.7	16.3	24.4	19.4	19.1
5/22/07						23.1	22.5
<b>5/23/07</b>						<b>37.9</b>	<b>38.5</b>
<b>5/24/07</b>	<b>30.2</b>	<b>30.5</b>	IN	<b>30.7</b>	<b>31.6</b>	<b>33.1</b>	<b>31.9</b>
<b>5/25/07</b>						<b>35.8</b>	<b>34.9</b>
<b>5/26/07</b>						<b>31.3</b>	<b>29.3</b>
<b>5/27/07</b>	<b>25.3</b>	<b>25.2</b>	<b>25.4</b>	<b>23</b>	<b>25.1</b>	<b>26.6</b>	<b>24.5</b>
<b>5/28/07</b>						<b>28.7</b>	<b>26.3</b>
<b>5/29/07</b>						<b>37.9</b>	<b>37.6</b>
<b>5/30/07</b>	<b>32.9</b>	<b>32.4</b>	<b>32.4</b>	<b>31</b>	<b>33.2</b>	<b>34.1</b>	<b>34.1</b>
<b>5/31/07</b>						<b>34.6</b>	<b>32</b>
6/1/07						29.4	26.5
6/2/07	21.6	18.9	19.3	18.7	21.1	23	20.2
6/3/07						19.4	19.2

**Table 7.2 - Historical Daily Values**

Year		Indianapolis - E Michigan 180970083		Indianapolis - E 75th St 180970079		Indianapolis - W 18th St 180970081		Indianapolis - Mann Rd 180970042	
		98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>
2000		35.7		35.1		36.3		33.5	
2001		39.5		35.9		38.5		31	
2002	2000-2002	36.7	37	33.3	35	26.8	34	39.6	35
2003	2001-2003	36.7	38	38	36	36.2	34	33.7	35
2004	2002-2004	31.3	35	28.7	33	31.9	32	29.3	34
2005	2003-2005	40.3	36	43.4	37	45.7	38	39.4	34
2006	2004-2006	33.5	35	30.7	34	34.8	37	31	33
2007	2005-2007	37.2	37	33.5	36	38.4	40	35.6	35
Values Excluding Flagged Data									
2007	2005-2007	37.2	37	33.5	36	38.4	40	35.6	35

<sup>1</sup>Daily Design Value = 3 year average of annual 98<sup>th</sup> %ile values.

**Table 7.2 (con't) - Historical Daily Values**

Year		Indianapolis - S West St 180970043		Indianapolis - English Ave 180970066		Indianapolis - Washington Park 180970078	
		98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>
2000		36.8		39.5		36.5	
2001		36.4		44.1		37.2	
2002	2000- 2002	36.5	37	44.8	43	35	36
2003	2001- 2003	37.9	37	39.4	43	39.3	37
2004	2002- 2004	31.7	35	31.1	38	31	35
2005	2003- 2005	43.9	38	44	38	42.5	38
2006	2004- 2006	37.5	38	36.2	37	31.7	35
2007	2005- 2007	38.3	40	38.8	40	38.8	38
Values Excluding Flagged Data							
2007	2005- 2007	38.3	40	38.8	40	38.8	38

<sup>1</sup>Daily Design Value = 3 year average of annual 98<sup>th</sup> %ile values.

**Table 7.3 - Historical Annual Averages**

Year		Indianapolis - E. Michigan St. 180970083		Indianapolis - E 75th St 180970079		Indianapolis - W 18th St 180970081		Indianapolis - Mann Rd 180970042	
		Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>
2000		17		16.4		16.8		15.2	
2001		17.1		16.2		17.1		14.8	
2002	2000- 2002	16.7	16.9	15.7	16.1	14.2	16.1	15.2	15.1
2003	2001- 2003	16.3	16.7	14.7	15.5	16.2	15.9	14.5	14.8
2004	2002- 2004	15	16	13.4	14.6	15	15.1	12.9	14.2
2005	2003- 2005	17.5	16.3	16.9	15	18.1	16.4	16.1	14.5
2006	2004- 2006	14.1	15.6	12.7	14.4	14.1	15.7	12.5	13.8
2007	2005- 2007	15.9	15.9	14.8	14.8	16.1	16.1	14.6	14.4
Values excluding flagged data									
2007	2005- 2007	15.6	15.7	14.3	14.7	15.8	16	14.2	14.3

<sup>2</sup>Annual Design value = 3 year average of the annual averages.

**Table 7.3 (con't) - Historical Annual Averages**

Year		Indianapolis - S West St 180970043		Indianapolis - English Ave 180970066		Indianapolis - Washington Park 180970078	
		Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>
2000		18.4		18.9		17.7	
2001		17.7		18.6		16.6	
2002	2000- 2002	17	17.7	18.3	18.6	16.6	17
2003	2001- 2003	17.2	17.3	17.5	18.1	15.4	16.2
2004	2002- 2004	15.7	16.6	16.7	17.5	14.3	15.4
2005	2003- 2005	19.1	17.3	19.3	17.8	16.4	15.4
2006	2004- 2006	15.5	16.8	15.2	17.1	14.1	15
2007	2005- 2007	17.3	17.3	17.3	17.3	15.8	15.4
Values excluding flagged data							
2007	2005- 2007	16.9	17.2	16.7	17.1	15.3	15.3

<sup>2</sup>Annual Design value = 3 year average of the annual averages.

**Particulate**

**Composition:** Speciation data are collected at the Indianapolis – Washington Park on a one in three day sampling schedule. Data are available for May 24, 27, and 30. High organic carbon values were reported on those three dates; 7.72 ug/m<sup>3</sup>, 7.81, and 8.54 ug/m<sup>3</sup> respectively. These values were the highest values reported in 2007. The annual average for organic carbon at this site was 3.4 ug/m<sup>3</sup>. The elemental carbon values during this period were from 1.0 ug/m<sup>3</sup> to 1.6 ug.m<sup>3</sup>. The high organic carbon values, without high elemental carbon, are a very good indicator of biomass combustion. Maps with the plotted organic carbon values during the May 18 through June 5 are in Appendix 3. The time progression of the maps shows the rise and fall of the organic carbon values over this time period.

**Maps:** Images of maps from NOAA Satellite and Information Services show the smoke plume originating from the northern Florida/southern Georgia region. Dispersion and movement of the smoke plume from these fires was generally to the west or northwest and then to the north. The daily satellite smoke photos show that the smoke plume from the fires extends statewide on May 23 and 24. The plume recedes farther to the south and east until May 29, but continues to influence the PM<sub>2.5</sub> readings in Indianapolis. It continues to influence all sites statewide until May 31. The daily wind roses obtained from the nearest meteorological site at Indianapolis - E. 16<sup>th</sup> St.,

18-097-0073) show information on prevailing wind direction, calm conditions and wind speed. NOAA weather maps are also used to show that an upper level trough greatly influences the direction of the plume in relation to the Indianapolis region.

Trajectory

Modeling:

The NOAA HYSPLIT Models are used to show wind trajectories at different levels during this event. Backward modeling from the site (latitude: 39.81°; longitude: -86.11°) at elevations of 25m, 150m and 500m was conducted for a period of three (3) to four (4) days prior. The differing elevations were chosen to demonstrate the air mass's uniformity at ground-level where the samplers were located and aloft which avoids the ground-level limitations of the model. Forward modeling was conducted using the Bugaboo Scrub Fire as the starting point (latitude: 30.70°; longitude: -82.40°) at an elevation of 250 meters (appropriate height that is low enough to always be in the well-mixed zone and high enough to avoid the ground-level model limitation) and going three (3) to four (4) days. Overall, there is a very good correlation when comparing the forward and backward trajectories for a given date. For example, May 24, 26, and 29 show a very narrow channel of air flow between southeastern Georgia and southwestern Indiana. Forward trajectory modeling can be found in Appendix 2.

Conclusion:

EPA defines an “exceptional event” as an unusual or naturally occurring event that can affect air quality but is not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the clean air act is not appropriate. It has been illustrated through the use of maps, meteorological data, speciation data, trajectory models and historical data that the smoke from wildfires in Florida and Georgia impacted the Indianapolis region during the period of May 23 – 31, 2007 causing exceedances of the PM<sub>2.5</sub> 24-hour standard, high daily sampled values, and significantly increasing the annual average. When removing the data from this time period, there is an improvement in the annual averages for 2007 and the annual design value for 2005-2007. According to 40 CFR Part 50.14 (b)(1), “EPA shall exclude data from use in determinations of exceedances and NAAQS violations where a State demonstrates to EPA’s satisfaction that an exceptional event caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section.” IDEM believes they have successfully illustrated the impact of this event on the sites in this region.

Therefore, IDEM requests that EPA concur with the ‘E’ flag on the data in AQS for the data in **bold** in Table 7.1.

## NOAA Satellite Smoke Maps, Weather Maps, and Wind Roses

The smoke map shows that the plume has reached the Indianapolis area and as shown in Table 7.1, PM<sub>2.5</sub> levels have started to increase. The corresponding wind rose and weather map further illustrate the direction of the plume by the location of the upper level trough (orange dashed line) and the S, SE prevailing winds.

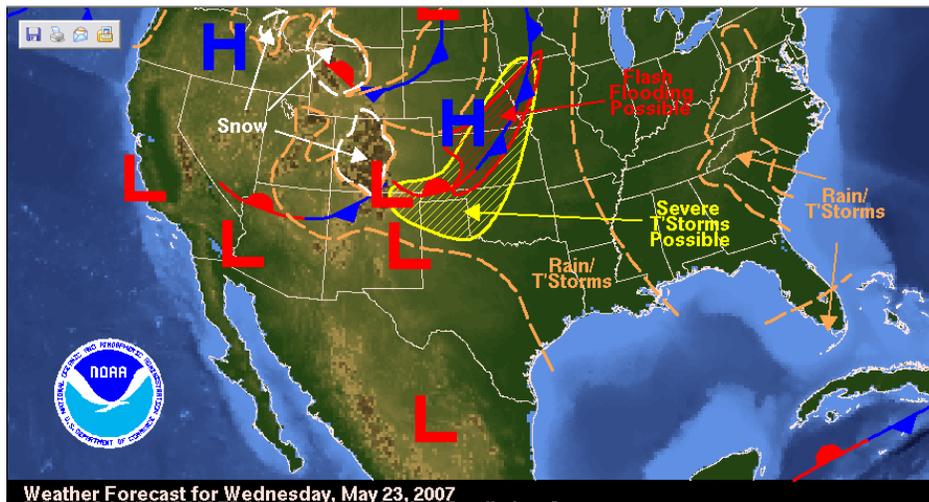
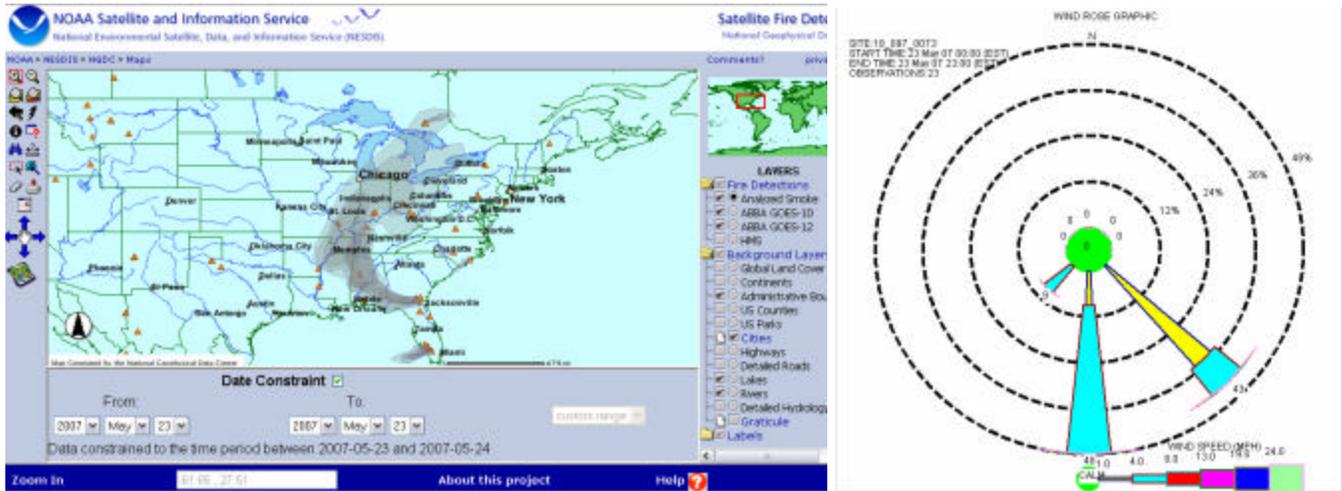


Figure 7.1 - May 23, 2007

The smoke map shows that the plume is remaining over the area. The prevailing wind direction has shifted to the SSW as the upper level trough moves further to the east and another trough develops over Ohio, keeping the plume over the SW Indiana region.

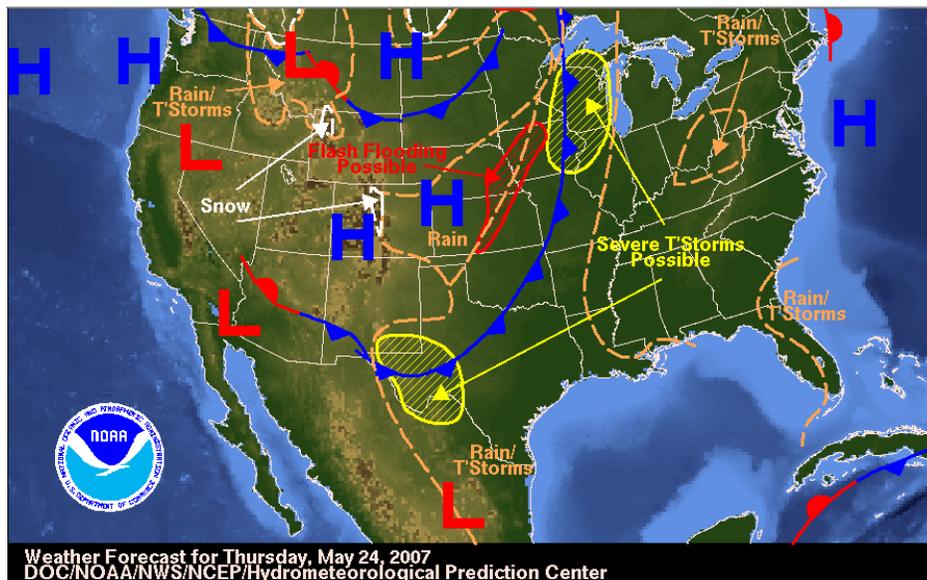
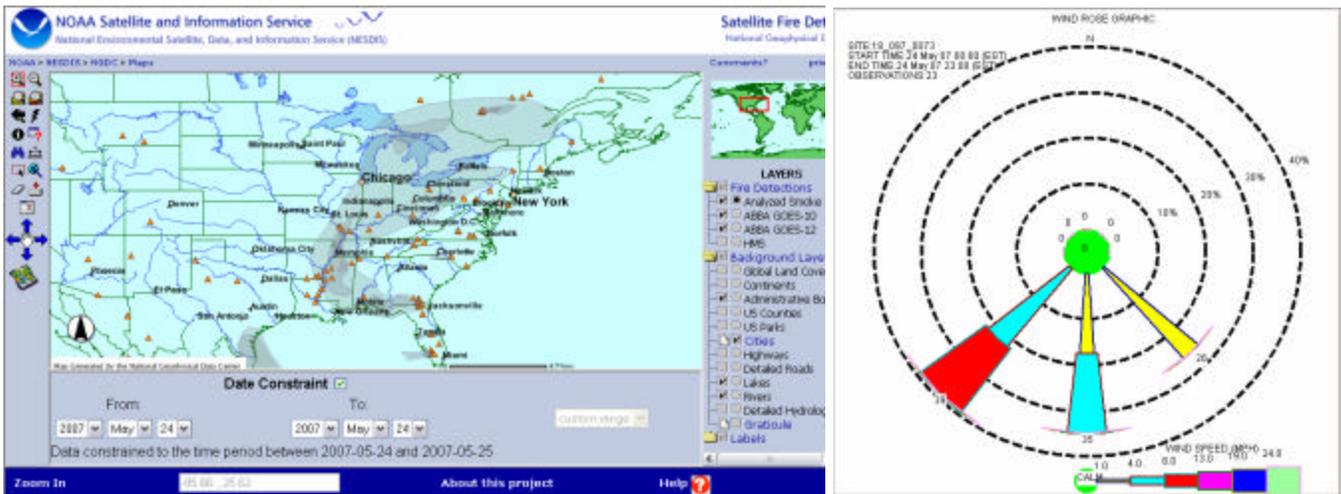


Figure 7.2 - May 24, 2007

The smoke map shows that the plume is remaining over the area. The prevailing wind direction continues to be from the SSW as the upper level trough has now moved directly over the Indianapolis area.

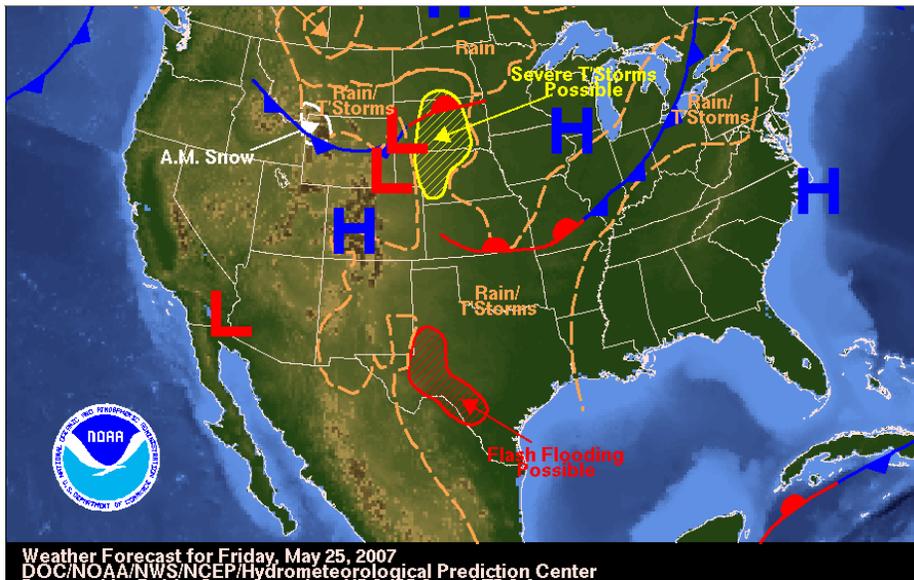
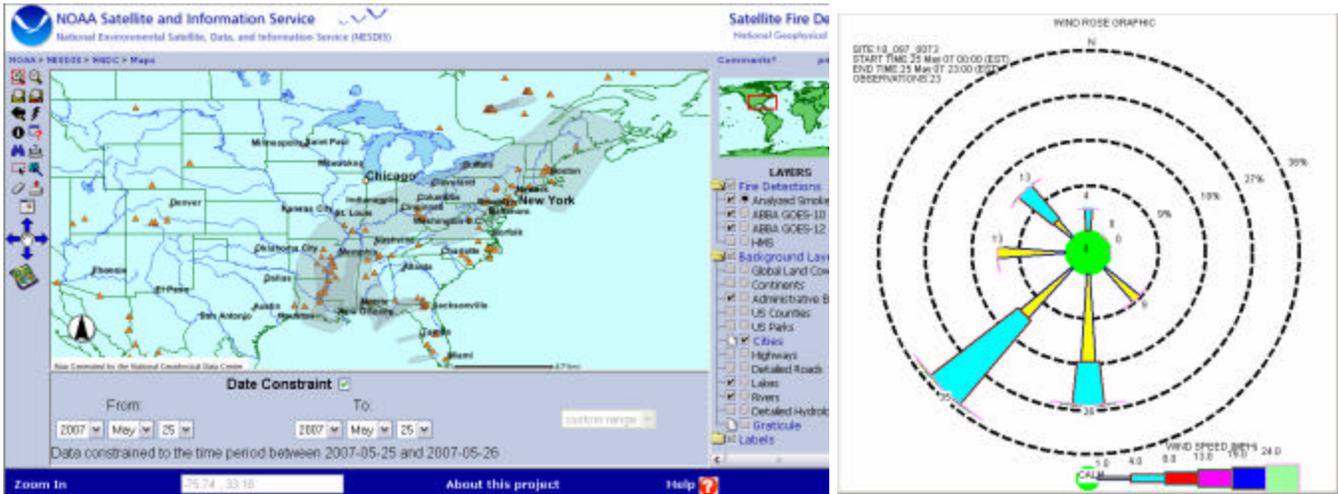


Figure 7.3 - May 25, 2007

The smoke map illustrates that the plume has essentially dissipated as the trough keeps the smoke pushed to the south. However, due to the extremely calm wind conditions the stagnant air mass continues to cause the PM<sub>2.5</sub> levels to rise past the 24-hour standard.

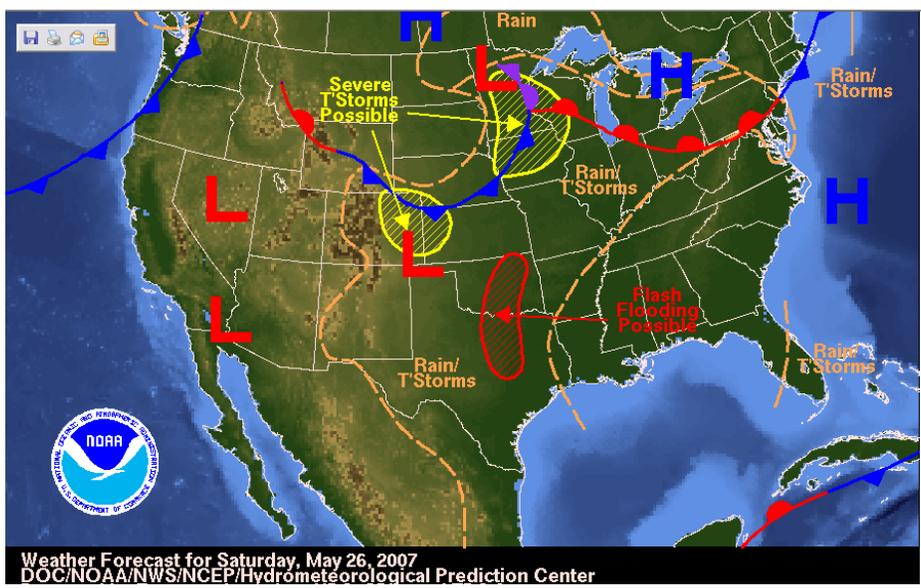
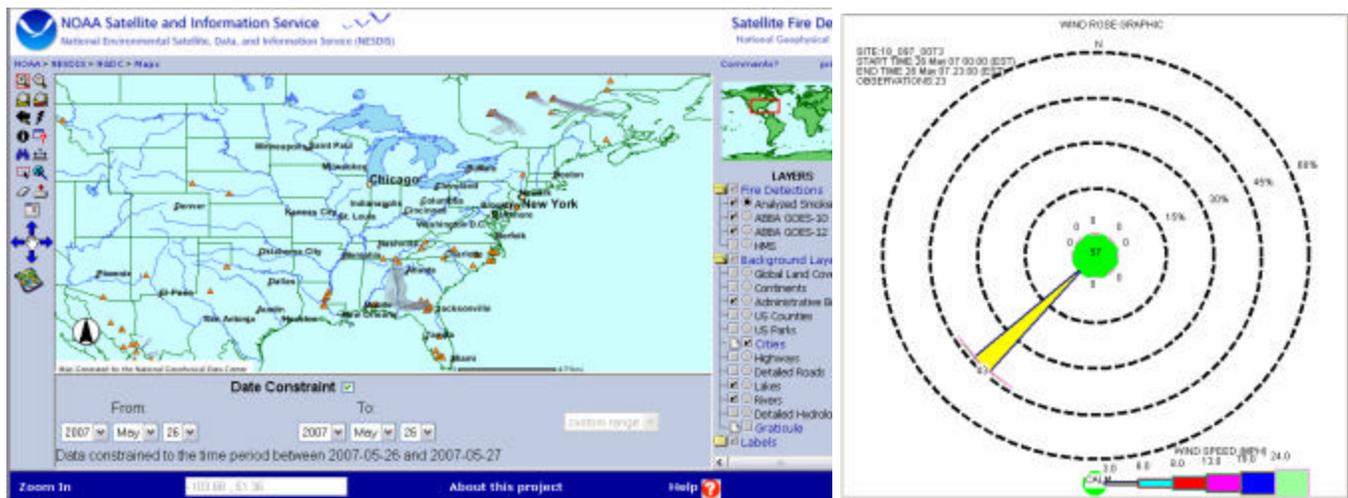


Figure 7.4 - May 26, 2007

The smoke map illustrates that the plume continues to stall as the trough continues to keep the smoke pushed to the south. However, due to the extremely calm wind conditions the stagnant air mass continues to cause the PM<sub>2.5</sub> levels to remain elevated.

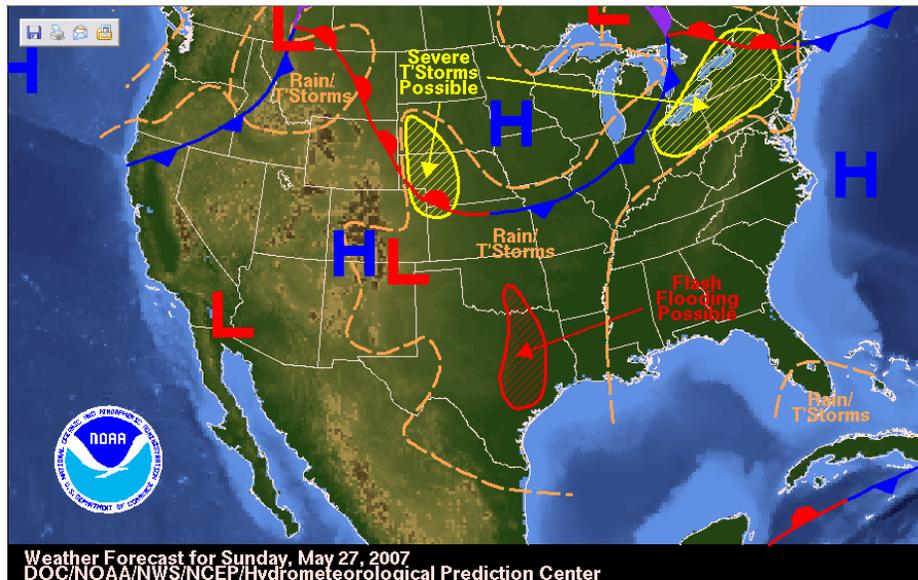
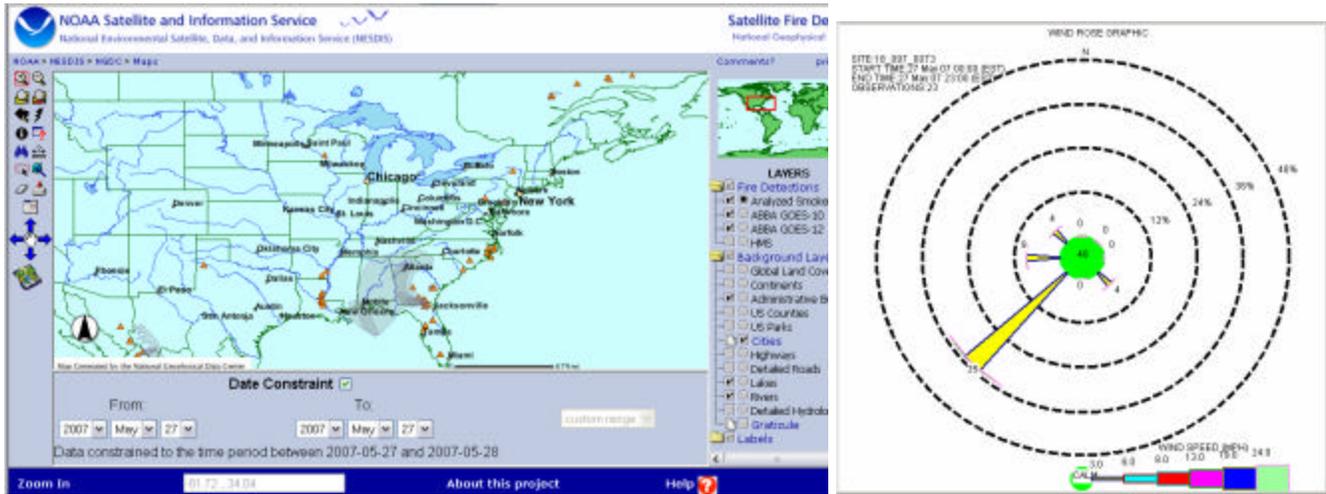


Figure 7.5 - May 27, 2007

The smoke map shows the plume has been pushed back into the region due to the upper level trough moving to the north and causing the plume to become more concentrated over the area.

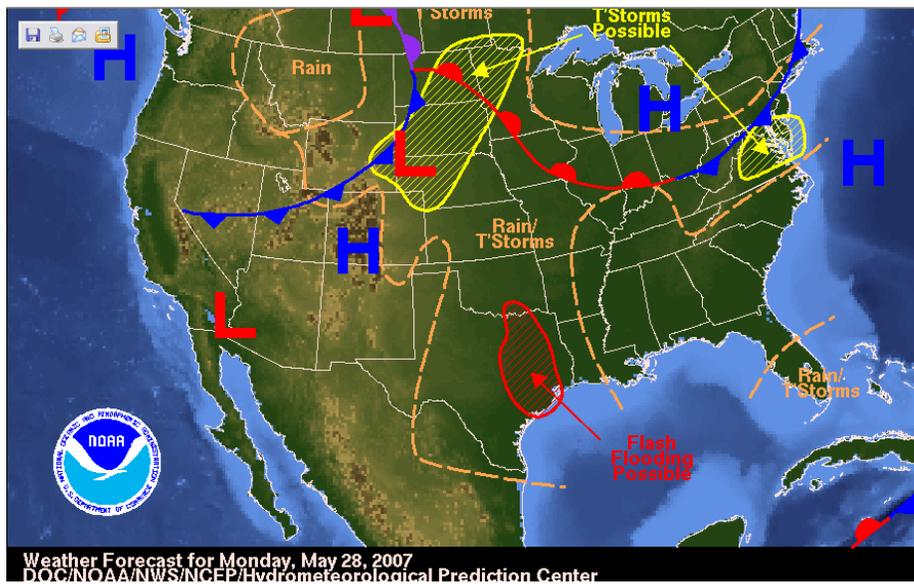
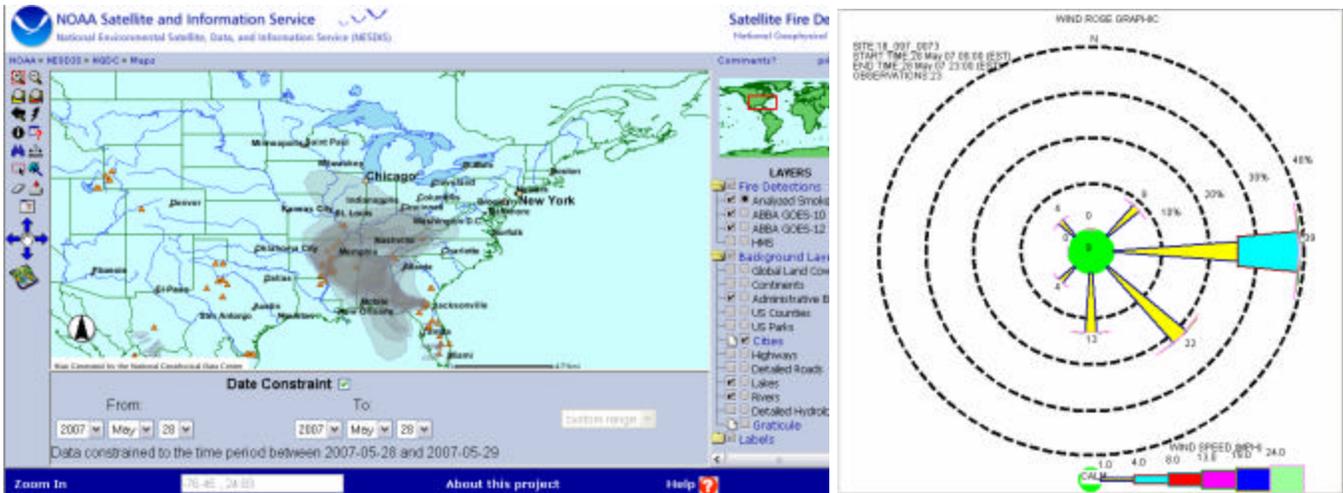


Figure 7.6 - May 28, 2007

Although the map illustrates the plume is not over the region, the extremely calm wind conditions, as shown by the wind rose, keep the high levels of PM<sub>2.5</sub> over the area.

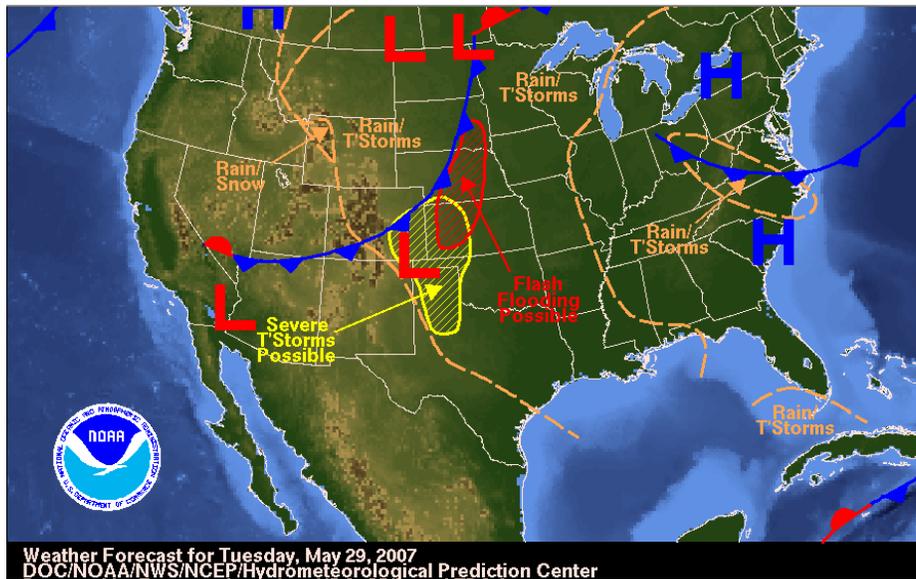
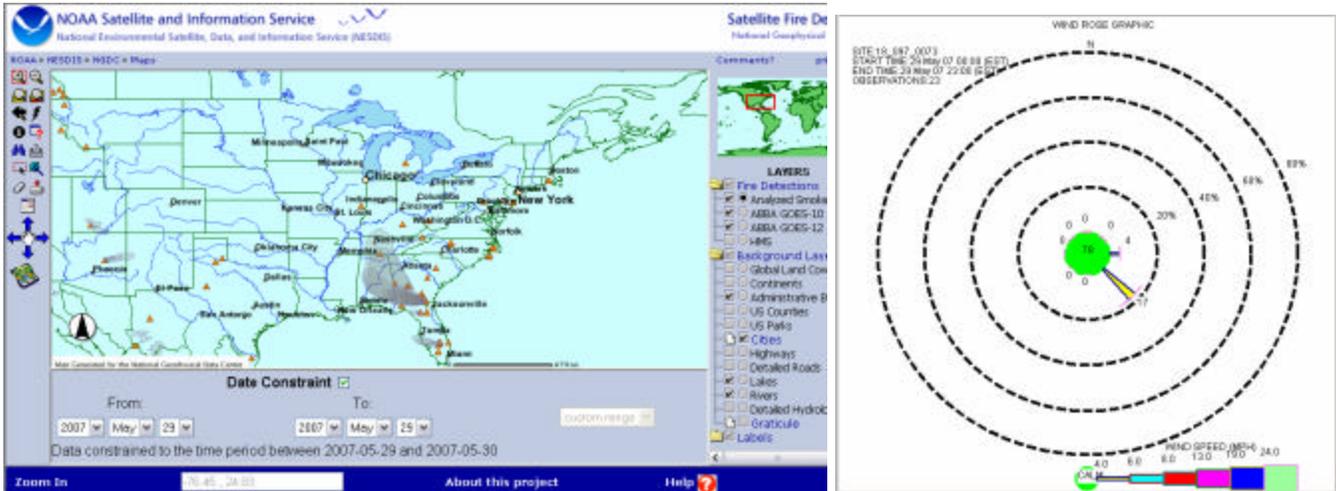


Figure 7.7 - May 29, 2007

The map shows the plume has moved back over the region as the upper level trough dips down over the area and the wind direction continues to be calm and from the SSE.

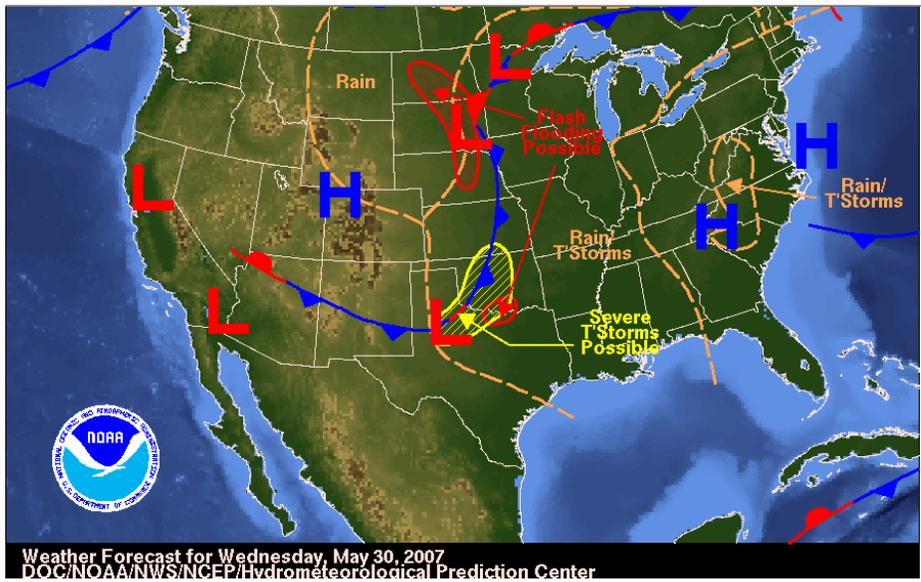
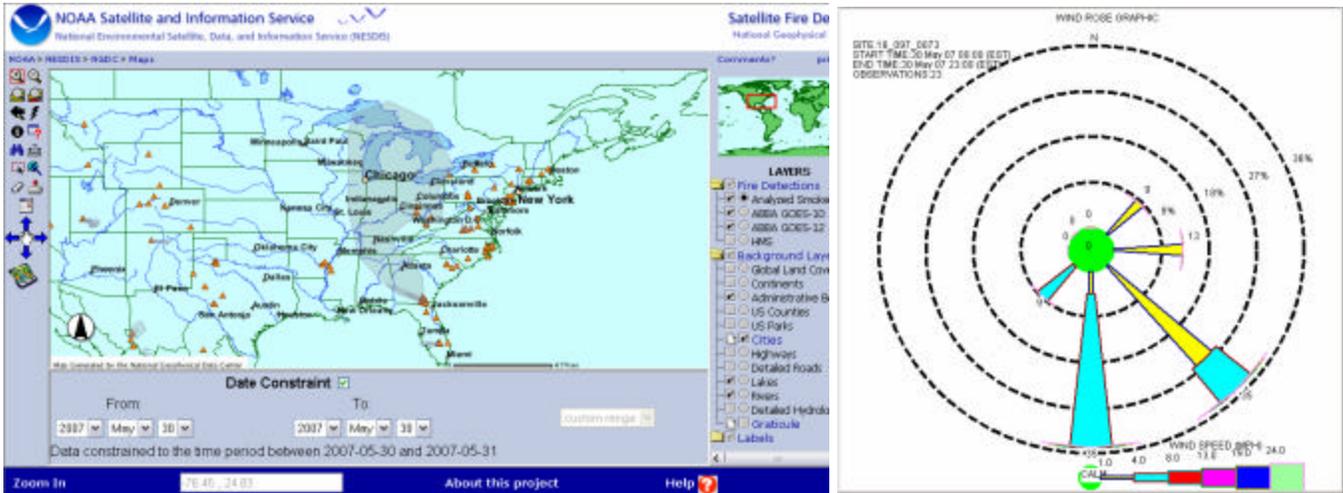


Figure 7.8 - May 30, 1997

The map shows the plume have dissipated, however, the PM2.5 levels remain elevated as the prevailing winds still remain from the S, SE.

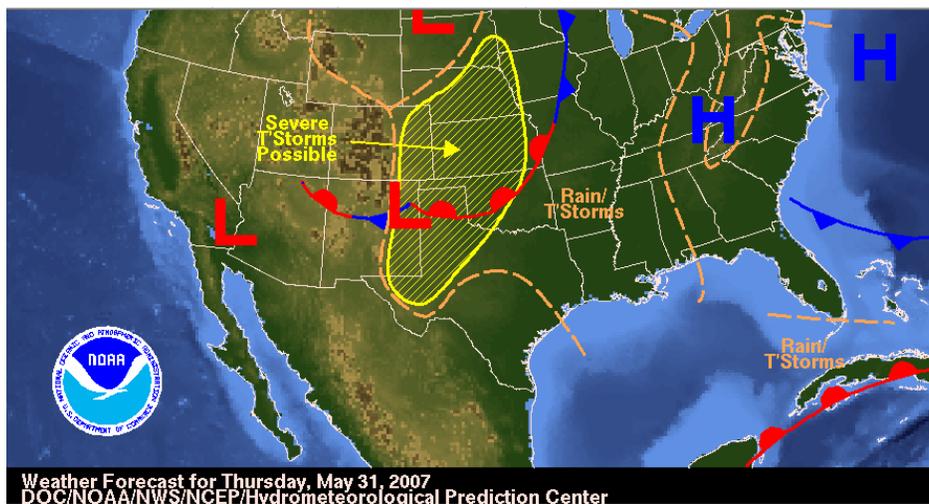
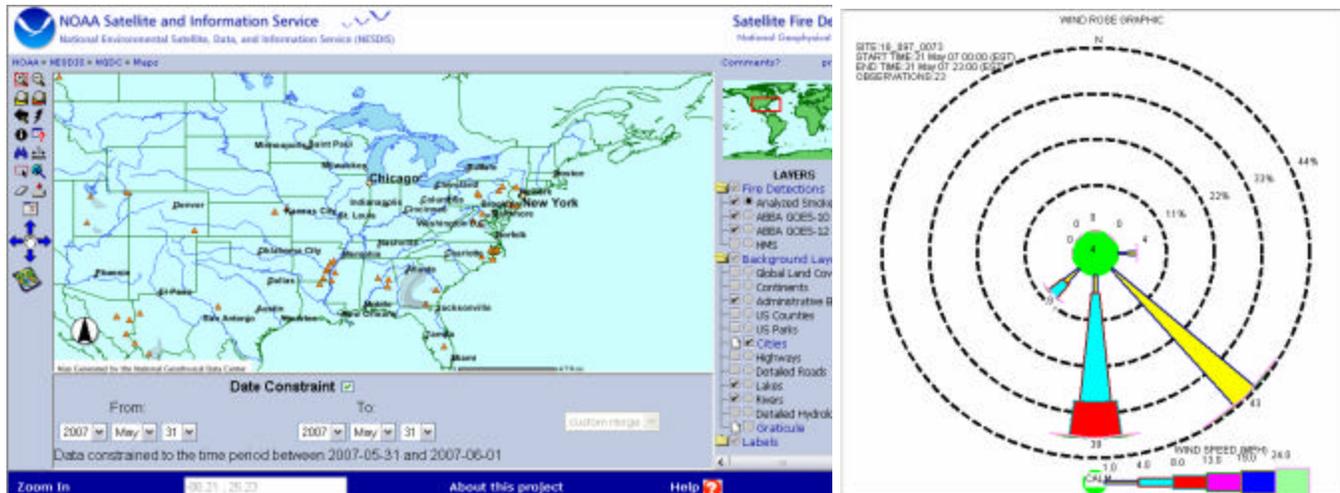
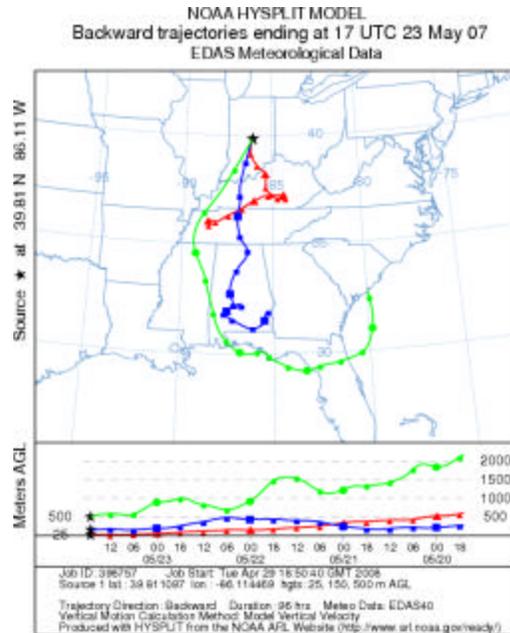


Figure 7.9 - May 31, 2007

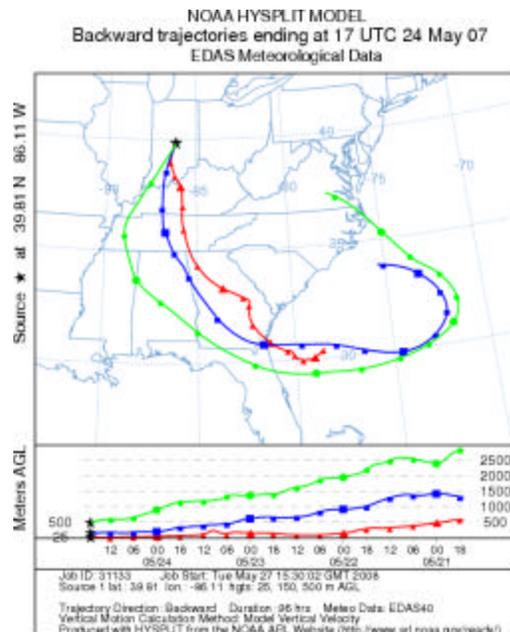
## Backward Trajectory Models

### NOAA ARL READY HYSPLIT Maps

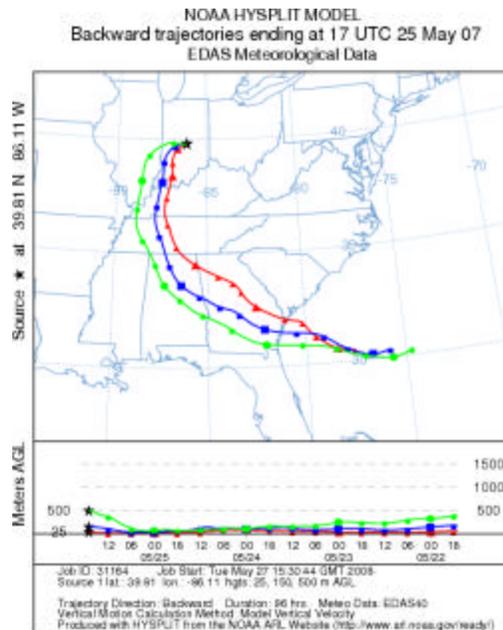
Draxler, R.R. and Rolph, G.D., 2003. HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (<http://www.arl.noaa.gov/ready/hysplit4.html>). NOAA Air Resources Laboratory, Silver Spring, MD.



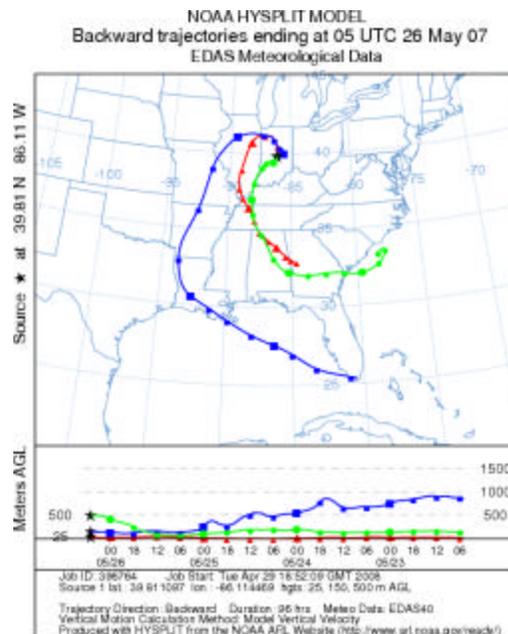
**Figure 7.10:** Backward trajectories originating from Indianapolis on 5/23/07 at 12:00 PM EST showing the air mass passing over northern Florida.



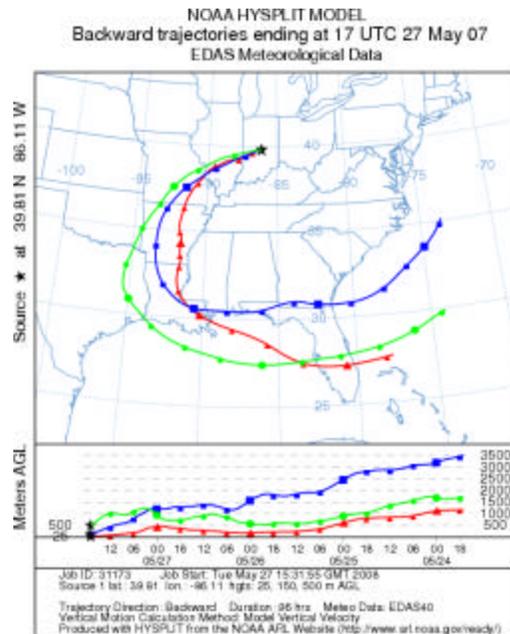
**Figure 7.11:** Backward trajectories originating from Indianapolis on 5/24/07 at 12:00 PM EST showing continuation of the air mass passing over southern Georgia and northern Florida.



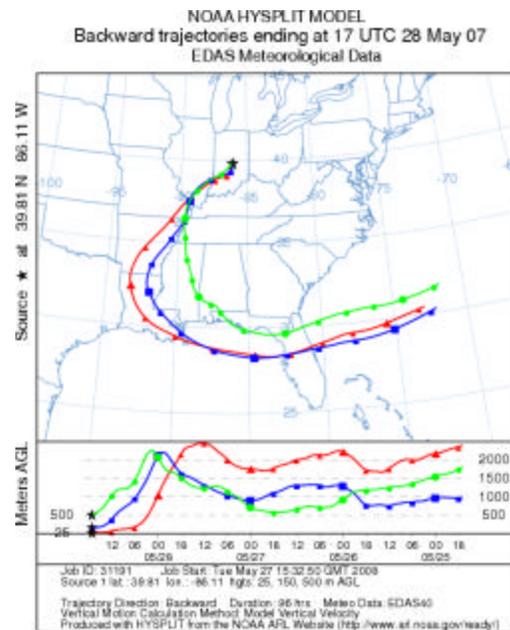
**Figure 7.12:** Backward trajectories originating from Indianapolis on 5/25/07 at 12:00 PM EST showing the air mass still passing over southern Georgia.



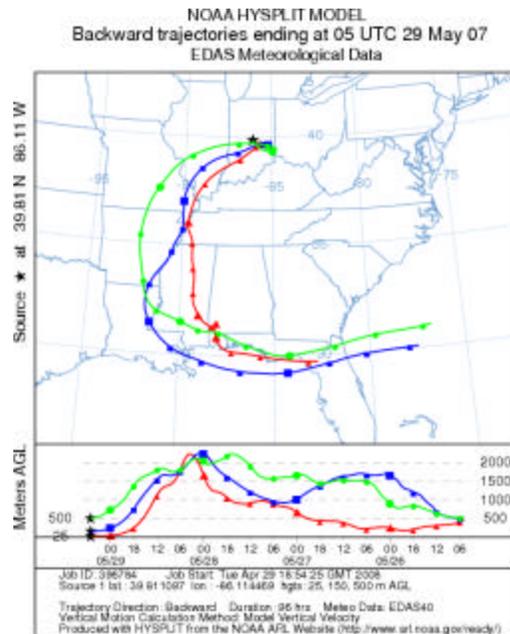
**Figure 7.13:** Backward trajectories originating from Indianapolis on 5/26/07 at 12:00 AM EST showing the air mass still passing over Georgia.



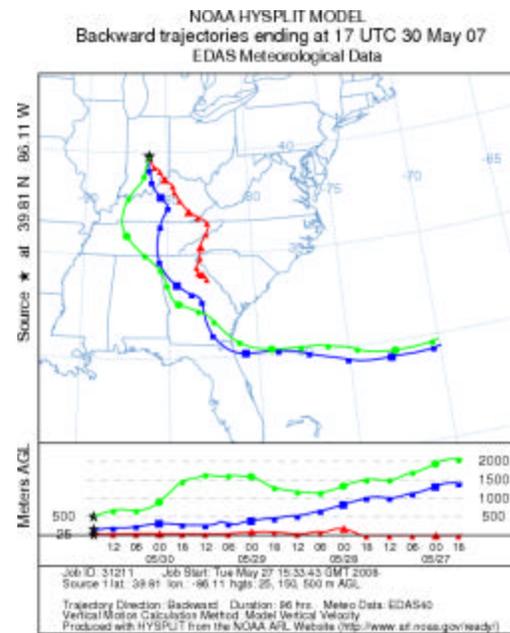
**Figure 7.14:** Backward trajectories originating from Indianapolis on 5/27/07 at 12:00 PM EST showing the air mass still passing over southern Georgia and Florida.



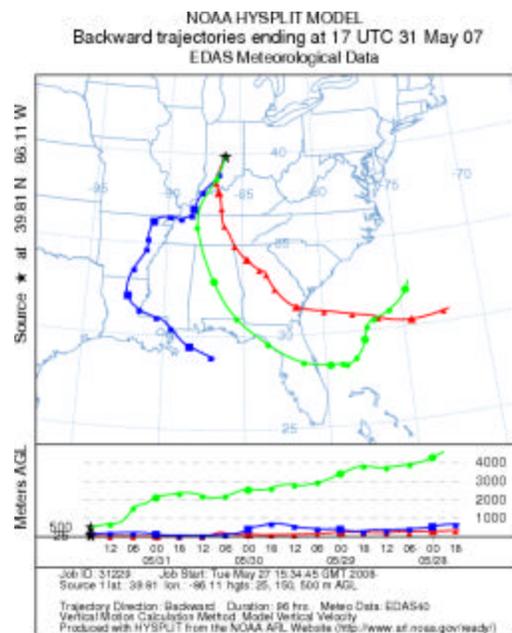
**Figure 7.15:** Backward trajectories originating from Indianapolis on 5/28/07 at 12:00 PM EST showing the air mass still passing over northern Florida.



**Figure 7.16:** Backward trajectories originating from Indianapolis on 5/29/07 at 12:00 AM EST showing the consistency of the air mass passing over northern Florida.



**Figure 7.17:** Backward trajectories originating from Indianapolis on 5/30/07 at 12:00 PM EST showing the air mass passing over Georgia.



**Figure 7.18:** Backward trajectories originating from Indianapolis on 5/31/07 at 12:00 PM EST showing the air mass still passing over Georgia and Florida.

## 8 – Western Indiana Exceptional Events Detail

Parameter: PM<sub>2.5</sub>

Dates: May 23 – 25 & 29 – 31, 2007

Location: Terre Haute – Vigo Co.

Event: Smoke from wildfires in northern Florida and southern Georgia impacted the Terre Haute region during the period of May 23 – 31. The gradual buildup of smoke moving through the area during this period resulted in an exceedance of the 24-hour PM<sub>2.5</sub> NAAQS on May 29<sup>th</sup> at Terre Haute Devaney and several elevated levels throughout the region.

Data: Different analyses of the data are used to demonstrate that the PM<sub>2.5</sub> concentrations measured from May 23 – 25 and May 29 - 31 have been influenced by outside events. Table 8.1 shows daily PM<sub>2.5</sub> averages prior to, during and after the event with the values flagged in **bold**. Data have been flagged with an exceptional event flag of 'E' in AQS, awaiting concurrence from EPA.

Tables 8.2 and 8.3 list summaries of the data collected at the Terre Haute sites since 2000. Data from 2007 are calculated with all current data and with the flagged data removed.

**Table 8.1 - FRM Daily Values  
Exceptional Event Period**

Values in **BOLD** are flagged as exceptional events

Date	Terre Haute – Lafayette Ave. 1816700181	Terre Haute Devaney 181670023
5/18/07	9.9	6.3
5/19/07		10.2
5/20/07		12.5
5/21/07	16	14.9
5/22/07		20.1
<b>5/23/07</b>		<b>32.6</b>
<b>5/24/07</b>	<b>28.8</b>	<b>27.7</b>
<b>5/25/07</b>		<b>30.4</b>
5/26/07		25.4
5/27/07	21.5	21.2
5/28/07		23.2
<b>5/29/07</b>		<b>39.6</b>
<b>5/30/07</b>	<b>29.2</b>	<b>29.6</b>
<b>5/31/07</b>		<b>30.5</b>
6/1/07		20.3
6/2/07	18	16.8

**Table 8.2 - Historical Daily Values**

		Terre Haute – Lafayette Ave. 1816700181		Terre Haute Devaney 181670023	
Year		98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>
2000		34.2		28.7	
2001		38.4		30.1	
2002	2000- 2002	40.2	38	38.1	32
2003	2001- 2003	35.3	38	35.4	35
2004	2002- 2004	26.9	34	30.4	35
2005	2003- 2005	43.1	35	42.5	36
2006	2004- 2006	31	34	29.1	34
2007	2005- 2007	31	35	32.2	35
Values excluding flagged data					
2007	2005- 2007	31	35	31.2	34

<sup>1</sup>Daily Design Value = 3 year average of annual 98<sup>th</sup> %ile values.

**Table 8.3 - Historical Annual Averages**

		Terre Haute –Lafayette Ave. 1816700181		Terre Haute Devaney 181670023	
Year		Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>
2000		15.7		13.8	
2001		15.2		13.4	
2002	2000- 2002	14.5	15.2	13.4	13.5
2003	2001- 2003	14.1	14.6	13.4	13.4
2004	2002- 2004	12.7	13.8	12.1	13
2005	2003- 2005	15.4	14.1	15.1	13.5
2006	2004- 2006	13	13.7	12.2	13.1
2007	2005- 2007	14.1	14.2	13.8	13.7
Values excluding flagged data					
2007	2005- 2007	13.8	14.1	13.4	13.6

<sup>2</sup>Annual Design value = 3 year average of the annual averages.

## Particulate

**Composition:** Speciated data are not collected at either Terre Haute site. The maps in Appendix 3 indicate that the regional organic carbon values were elevated on the two available sample days. The values were among the highest values recorded in 2007. The elemental carbon values on these dates remained at or below average values.

**Trajectory Modeling:** The NOAA HYSPLIT Models are used to show wind trajectories at different levels during this event. Backward modeling from the site (latitude: 39.49°; longitude: -87.40°) at elevations of 25m, 150m and 500m was conducted for a period of three (3) to four (4) days prior. The differing elevations were chosen to demonstrate the air mass's uniformity at ground-level where the samplers were located and aloft which avoids the ground-level limitations of the model. Forward modeling was conducted using the Bugaboo Scrub Fire as the starting point (latitude: 30.70°; longitude: -82.40°) at an elevation of 250 meters (appropriate height that is low enough to always be in the well-mixed zone and high enough to avoid the ground-level model limitation) and going three (3) to four (4) days. Overall, there is a very good correlation when comparing the forward and backward trajectories for a given date. For example, May 25, 29, and 30 show a very narrow channel of air flow between southeastern Georgia and western Indiana. Both the backward and forward trajectories confirm this although Forward trajectory modeling results are shown in Appendix 2.

**Maps:** Images of maps from NOAA Satellite and Information Services show the smoke plume originating from the northern Florida/southern Georgia region. Dispersion and movement of the smoke plume from these fires was generally to the west or northwest and then to the north. The daily satellite smoke photos show that the smoke plume from the fires comes into Indiana on May 23 and continues to influence the atmosphere until June 2. The daily wind roses generally track the direction of the smoke plume on that day at the local level. The daily wind roses generally track the direction of the smoke plume on that day at the local level. Meteorological data for the wind roses is from the West Union, Il monitoring site (170230001). NOAA weather maps are also used to show that an upper level trough greatly influences the direction of the plume in relation to the Western Indiana region.

**Conclusion:** EPA defines an “exceptional event” as an unusual or naturally occurring event that can affect air quality but is not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the clean air act is not appropriate. It has been illustrated through the use of maps, meteorological data, speciation data, trajectory models and historical data that the smoke from wildfires in Florida and Georgia impacted the Terre Haute region during the period of May 23 – 25 and May 29 - 31, 2007 causing exceedances of the PM<sub>2.5</sub> 24-hour standard and significantly increasing the annual average. According to 40 CFR Part 50.14 (b)(1), “EPA shall exclude data from use in determinations of exceedances and NAAQS violations where a State demonstrates to EPA’s satisfaction that an exceptional event

caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section.” IDEM believes they have successfully illustrated the impact of this event on the sites in this region.

Therefore, IDEM requests that EPA concur with the ‘E’ flag on the data in AQS for the data in **bold** in Table 8.1.

## NOAA Satellite Smoke Maps, Weather Maps, and Wind Roses

The smoke map shows that the plume has reached the Terre Haute area and as shown in Table 8.1, PM<sub>2.5</sub> levels have started to increase. The corresponding wind rose and weather map further illustrate the direction of the plume by the location of the upper level trough (orange dashed line) and the strong southerly prevailing winds.

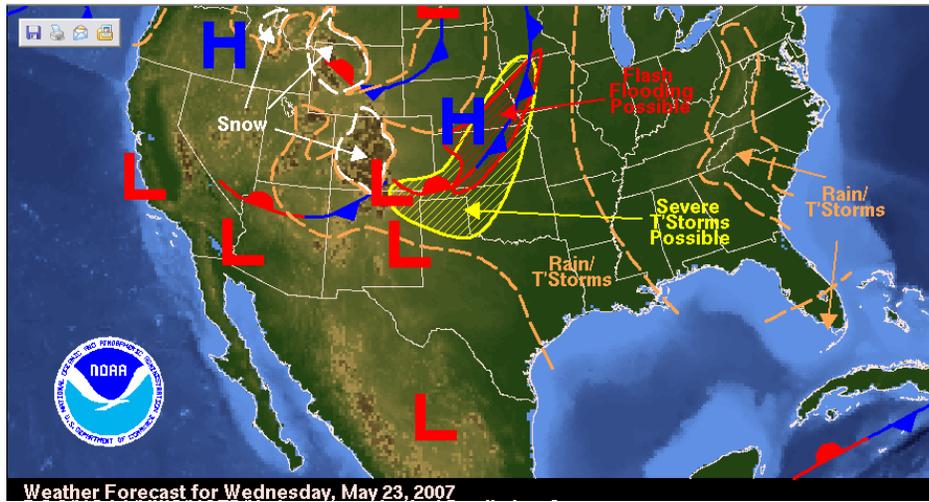
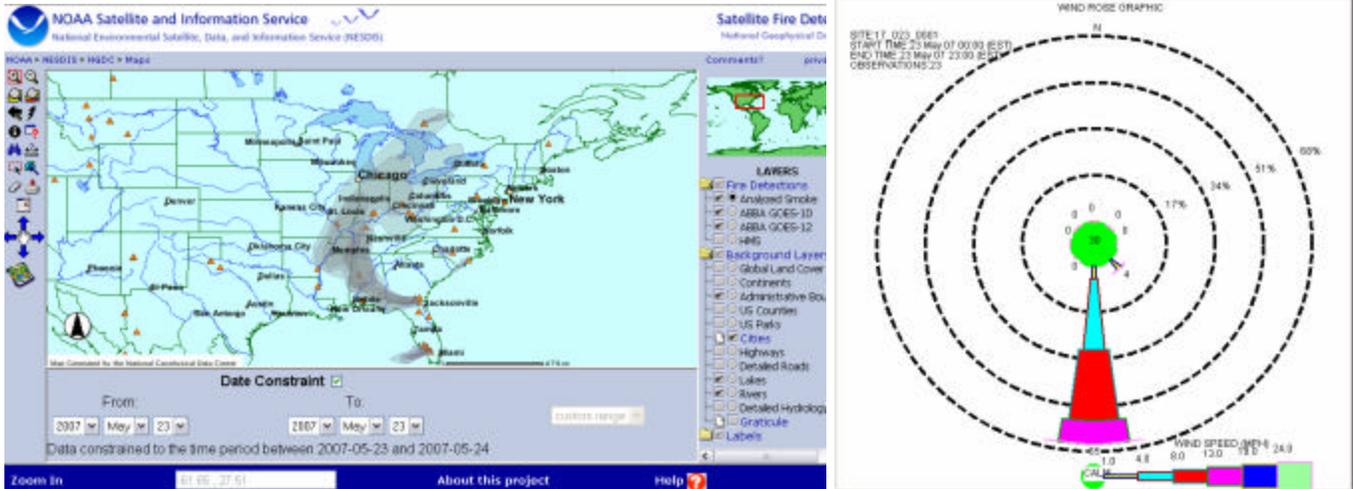


Figure 8.1 - May 23, 2007

The smoke map shows that the plume is remaining over the area. The prevailing wind direction remains from the south as the upper level trough moves further to the east and another trough develops over Ohio, keeping the plume over the western Indiana region.

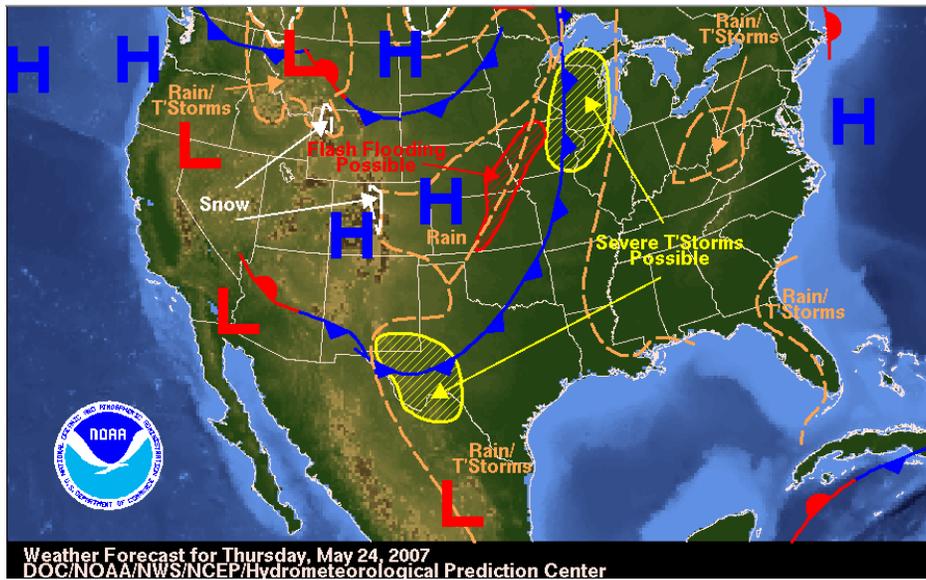
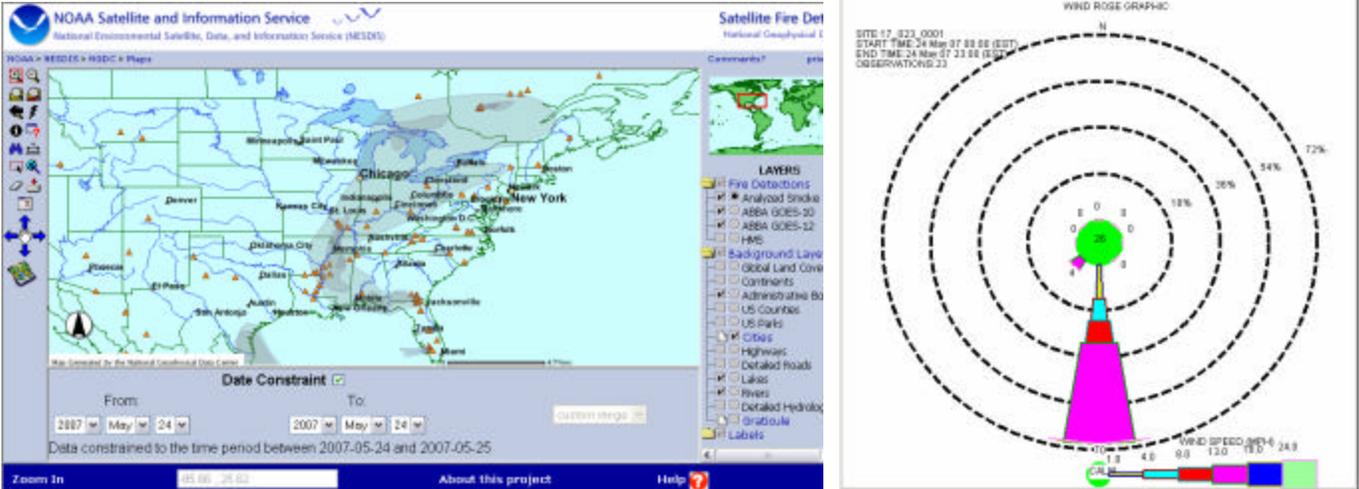


Figure 8.2 - May 24, 2007

The smoke map shows that the plume is remaining over the area. The prevailing winds are calm and from the SW as the upper level trough has now moved directly over the Terre Haute region.

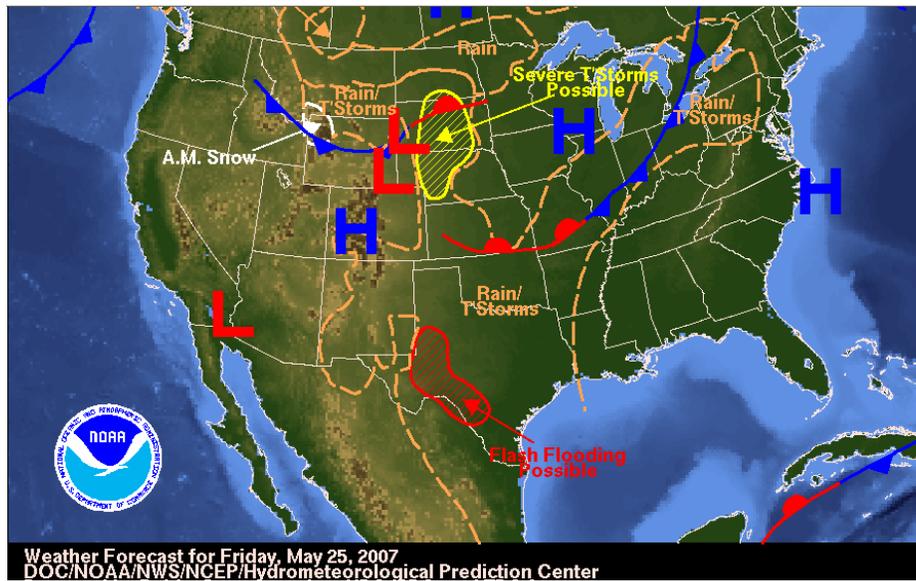
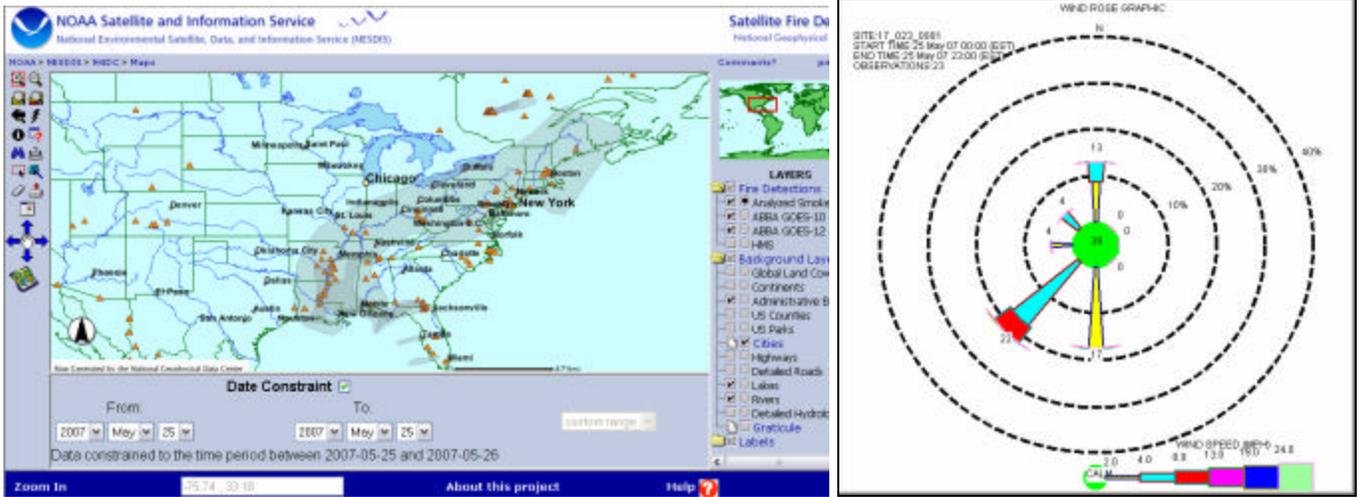


Figure 8.3 – May 25, 2007

Although the map illustrates the plume is not over the region, the prevailing calm wind conditions and southerly wind direction, as shown by the wind rose, keep the high levels of PM<sub>2.5</sub> over the area.

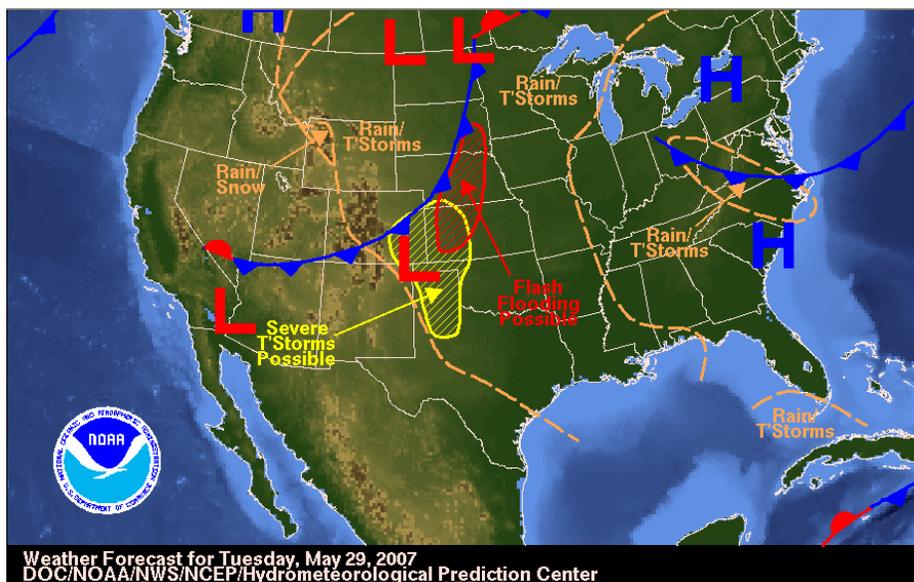
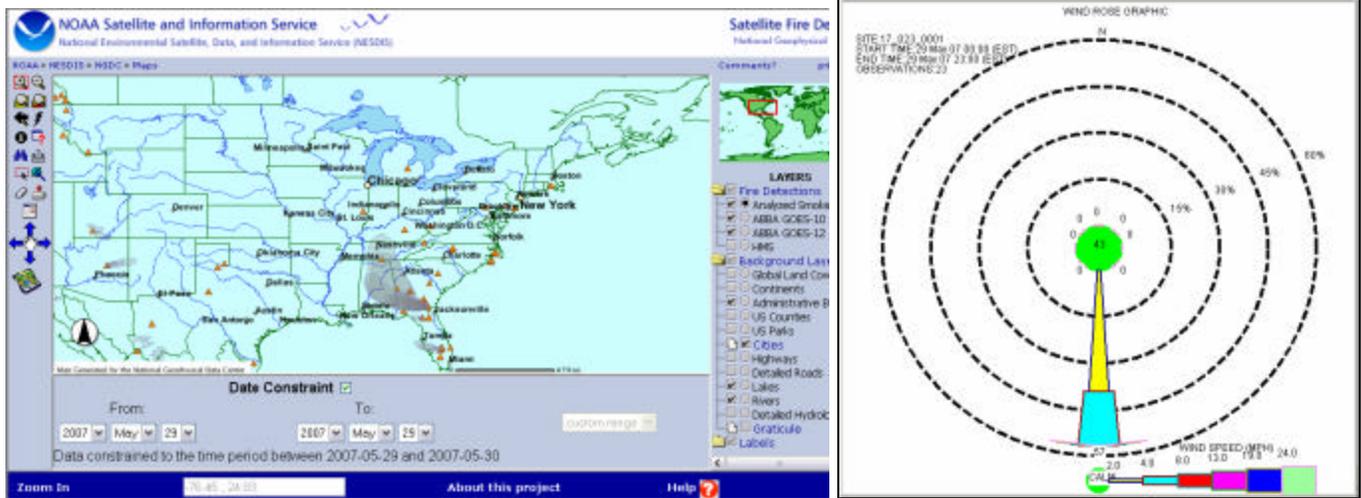


Figure 8.4 – May 29, 2007

The map shows the plume has moved back over the region as the upper level trough dips down over the area and the wind direction continues to be from the south.

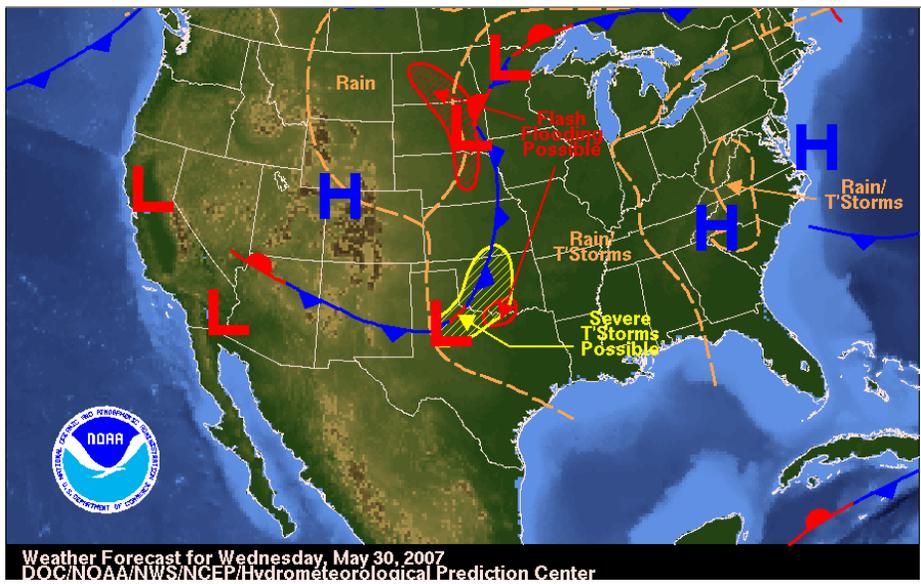
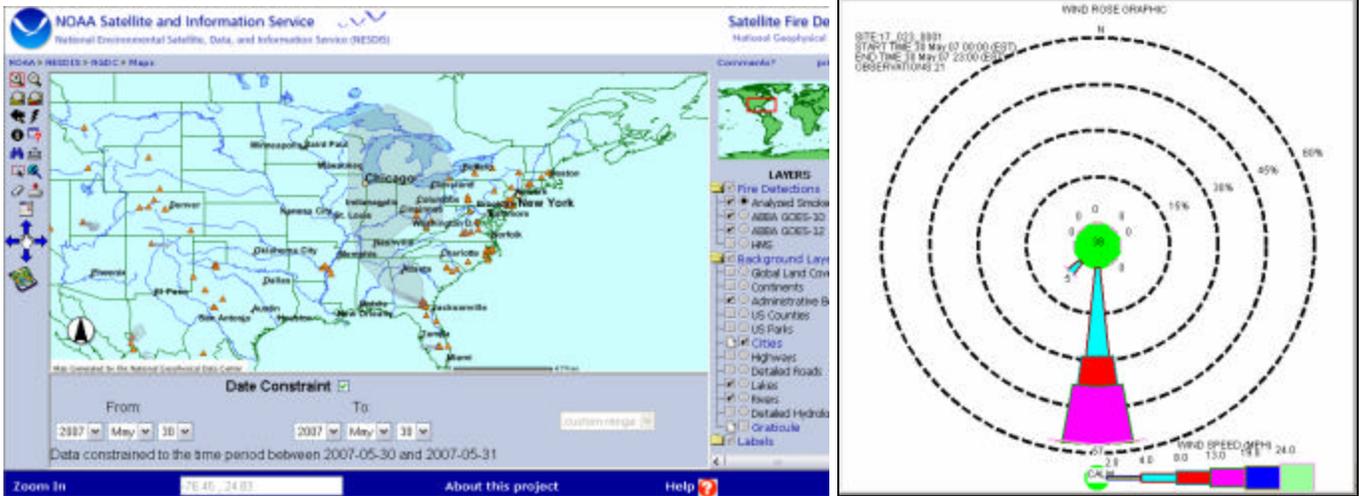


Figure 8.5 – May 30, 2007

The map shows the plume has dissipated as the upper level trough moves to the east. However, a strong southerly wind keeps the high levels over the area.

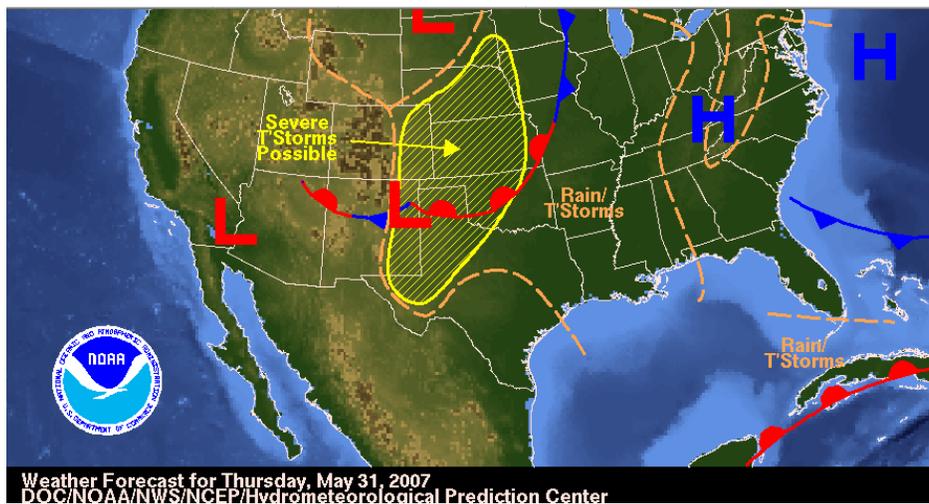
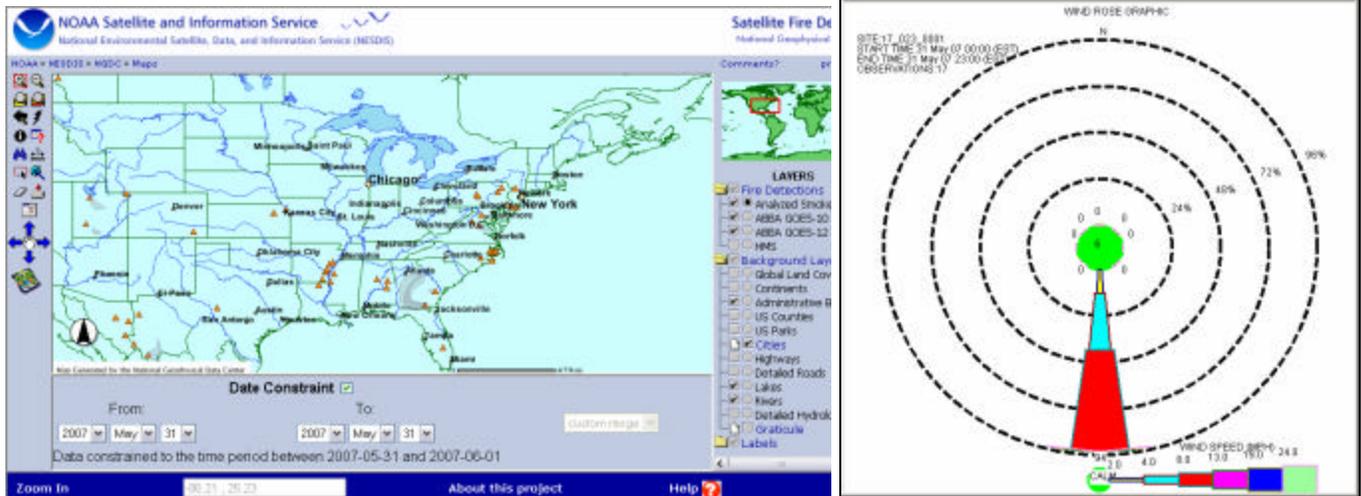
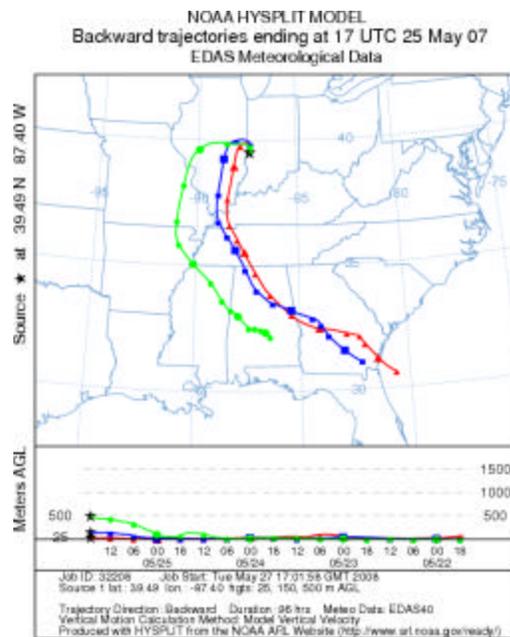
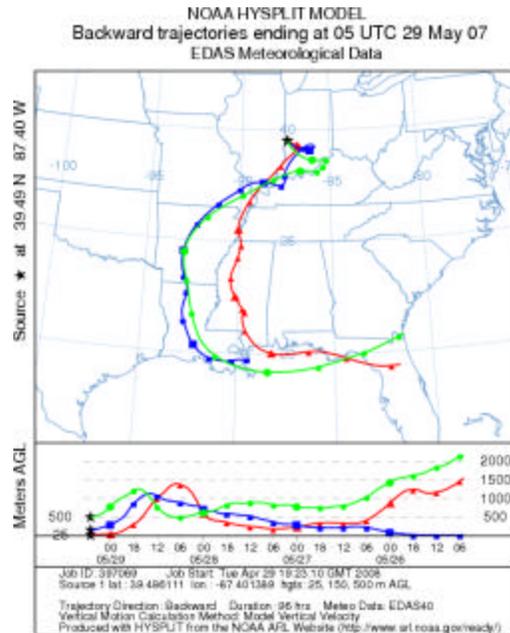


Figure 8.6 – May 31, 2007

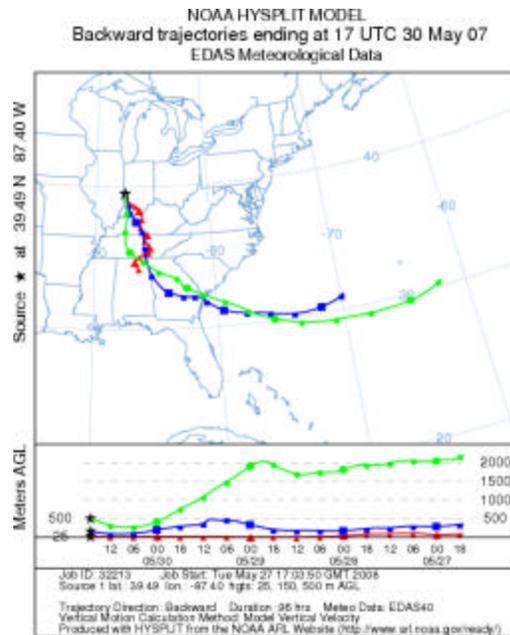




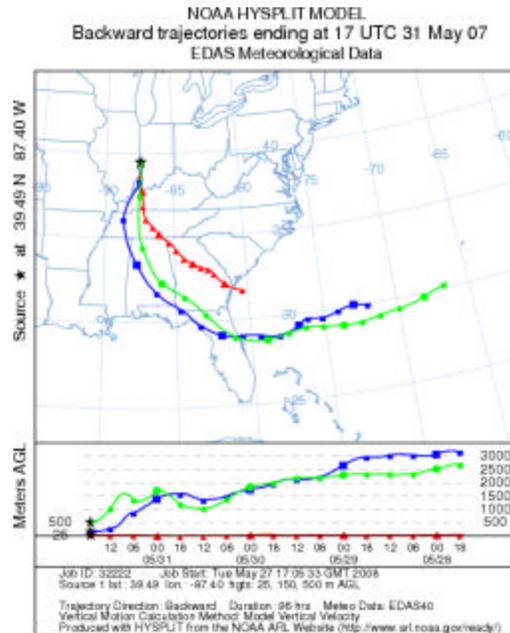
**Figure 8.9:** Backward trajectories originating from Terre Haute on 5/25/07 at 12:00 PM EST showing the air mass still passing over southern Georgia.



**Figure 8.10:** Backward trajectories originating from Terre Haute on 5/29/07 at 12:00 AM EST showing continuation of the air mass passing over northern Florida.



**Figure 8.11:** Backward trajectories originating from Terre Haute on 5/30/07 at 12:00 PM EST showing the air mass still passing over southern Georgia.



**Figure 8.12:** Backward trajectories originating from Terre Haute on 5/31/07 at 12:00 PM EST showing consistency in the air mass passing over southern Georgia and northern Florida.

## 9 – Vincennes

### Exceptional Events Detail

- Parameter: PM<sub>2.5</sub>
- Dates: May 24, 27, & 30, 2007
- Location: Vincennes – Knox Co.
- Event: Smoke from wildfires in northern Florida and southern Georgia impacted the Knox County region during the period of May 24 – 30. The gradual buildup of smoke moving through the area during this period resulted in elevated levels of PM<sub>2.5</sub> concentrations.
- Data: Different analyses of the data are used to demonstrate that the PM<sub>2.5</sub> concentrations measured on May 24, 27, and 30 are beyond the range of values typically found during that time period and that they have been influenced by outside events. Table 9.1 shows daily PM<sub>2.5</sub> averages prior to, during and after the event with the values flagged in **bold**. Data have been flagged with an exceptional event flag of ‘E’ in AQS, awaiting concurrence from EPA.

Tables 9.2 and 9.3 list summaries of the data collected at the SW Agricultural Center since 2000. Data from 2007 are calculated with all current data and with the flagged data removed. Although the design value of the 98<sup>th</sup> percentile (2005-2007) remains the same at 36 ug/m<sup>3</sup>, there is an improvement in the mean design value (2005-2007) from 14.2 ug/m<sup>3</sup> to 14.1 ug/m<sup>3</sup>.

The values recorded during the May 24-30 time period are outside the normal values collected during the month of May. Prior to this time, the highest value reported in May since 2000 had been 25.2 ug/m<sup>3</sup> and the highest monthly average had been 13.9 ug/m<sup>3</sup>. With the high data collected in May 2007, the highest value was 29.5 ug/m<sup>3</sup> and the monthly average was 19.5 ug/m<sup>3</sup>. Removing the flagged data results in a maximum daily concentration of 22.7 ug/m<sup>3</sup> and an average concentration of 15.4 ug/m<sup>3</sup>. These values are much more in line with historical data.

**Table 9.1 - FRM Daily Values  
Exceptional Event Period**

Values in **BOLD** are flagged as exceptional events

Date	SW Purdue Ag Center 180830004
5/18/07	6.6
5/19/07	
5/20/07	
5/21/07	18.2
5/22/07	
5/23/07	
<b>5/24/07</b>	<b>28.4</b>
5/25/07	
5/26/07	
<b>5/27/07</b>	<b>29.5</b>
5/28/07	
5/29/07	
<b>5/30/07</b>	<b>29.1</b>
5/31/07	
6/1/07	
6/2/07	20.3

**Table 9.2 - Historical Daily Values**

		SW Purdue Ag Center 180830004	
Year		98th %ile	Daily Design Value <sup>1</sup>
2000		34.5	
2001		33	
2002	2000- 2002	38.6	35
2003	2001- 2003	34.8	35
2004	2002- 2004	29.9	34
2005	2003- 2005	41.8	36
2006	2004- 2006	36.2	36
2007	2005- 2007	30.9	36
		Values excluding flagged data	
2007	2005- 2007	30.9	36

<sup>1</sup>Daily Design Value = 3 year average of annual 98<sup>th</sup> %ile values.

**Table 9.3 - Historical Annual Averages**

		SW Purdue Ag Center 180830004	
Year		Annual Ave.	Annual Design Value <sup>2</sup>
2000		13.9	
2001		13.4	
2002	2000-2002	14.2	13.8
2003	2001-2003	14	13.9
2004	2002-2004	12.6	13.6
2005	2003-2005	15.7	14.1
2006	2004-2006	13.2	13.8
2007	2005-2007	13.8	14.2
		Values excluding flagged data	
2007	2005-2007	13.3	14.1

<sup>2</sup>Annual Design value = 3 year average of the annual averages.

**Particulate**

**Composition:** Speciated data are not collected at Vincennes. The maps in Appendix 3 indicate that the regional organic carbon values were elevated on the two available sample days. The values were among the highest values recorded in 2007. The elemental carbon values on these dates remained at or below average values.

The time progression of the maps in Appendix 3 shows the rise and fall of the organic carbon values across the region over this time period.

**Maps:**

Images of maps from NOAA Satellite and Information Services show the smoke plume originating from the northern Florida/southern Georgia region. Dispersion and movement of the smoke plume from these fires was generally to the west or northwest and then to the north. The daily satellite smoke photos show that the smoke plume from the fires comes into southern Indiana on May 23 and continues to influence the atmosphere until June 2. The daily wind roses generally track the direction of the smoke plume on that day at the local level. NOAA weather maps are also used to show that an upper level trough greatly influences the direction of the plume in relation to the SW Indiana region.

Trajectory  
Modeling:

The NOAA HYSPLIT Models are used to show wind trajectories at different levels during this event. Backward modeling from the site (latitude: 38.74°; longitude: -87.48°) at elevations of 25m, 150m and 500m was conducted for a period of three (3) to four (4) days prior. The differing elevations were chosen to demonstrate the air mass's uniformity at ground-level where the samplers were located and aloft which avoids the ground-level limitations of the model. Forward modeling was conducted using the Bugaboo Scrub Fire as the starting point (latitude: 30.70°; longitude: -82.40°) at an elevation of 250 meters (appropriate height that is low enough to always be in the well-mixed zone and high enough to avoid the ground-level model limitation) and going three (3) to four (4) days. Overall, there is a very good correlation when comparing the forward and backward trajectories for a given date. May 24 and 30 both show a very narrow channel of air flow between southeastern Georgia and southwestern Indiana. Both the backward and forward trajectories confirm this. Forward trajectory modeling results are shown in Appendix 2.

Conclusion:

EPA defines an “exceptional event” as an unusual or naturally occurring event that can affect air quality but is not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the clean air act is not appropriate. Indiana has illustrated through the use of maps, meteorological data, speciation data, trajectory models and historical data that the smoke from wildfires in Florida and Georgia impacted the Knox County region during the period of May 24 – 30, 2007 causing elevated levels of the PM<sub>2.5</sub> 24-hour standard and increasing the annual average. According to 40 CFR Part 50.14 (b)(1), “EPA shall exclude data from use in determinations of exceedances and NAAQS violations where a State demonstrates to EPA’s satisfaction that an exceptional event caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section.” IDEM believes they have successfully illustrated the impact of this event on the sites in this region.

Therefore, IDEM requests that EPA concur with the ‘E’ flag on the data in AQS for the data in **bold** in Table 9.1.

## NOAA Satellite Smoke Maps, Weather Maps And Wind Roses

The smoke map shows that the plume has reached the Knox Co. area and as shown in Table 9.1, PM<sub>2.5</sub> levels have increased. The corresponding wind rose and weather map further illustrate the direction of the plume by the location of the upper level trough (orange dashed line) and the S, SW prevailing winds.

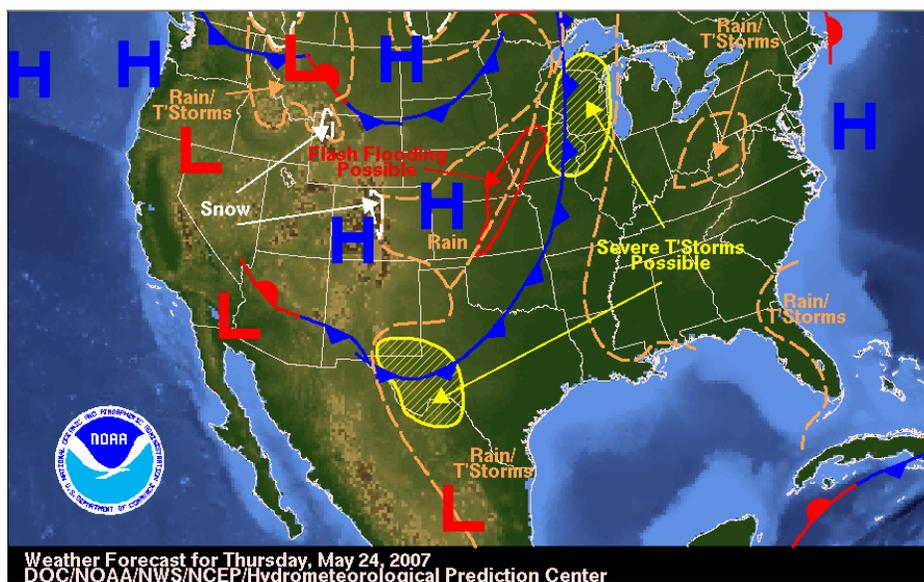
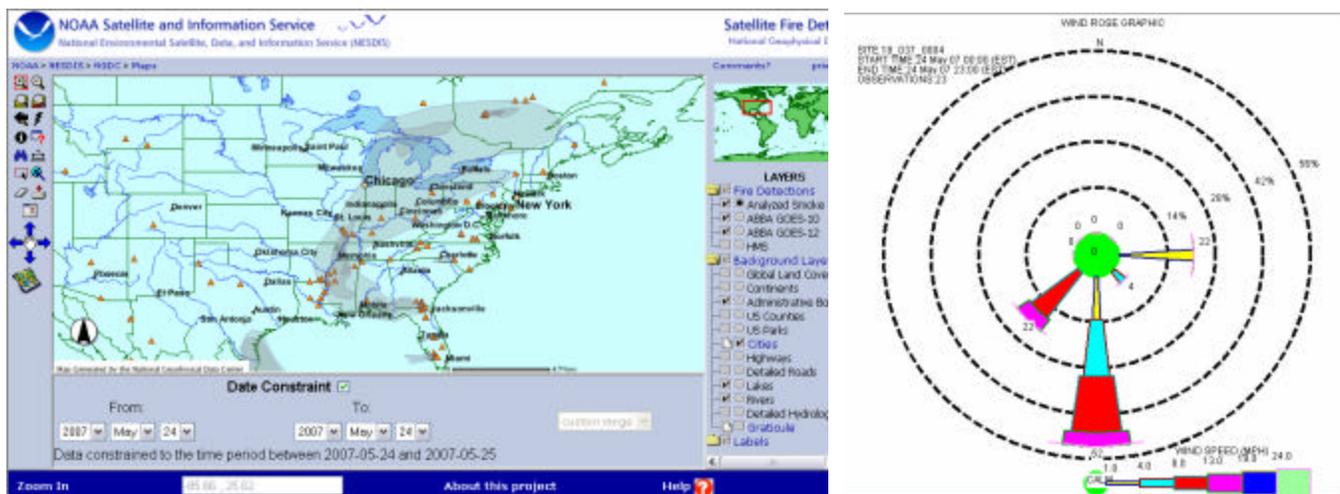


Figure 9.1 - May 24, 2007

The smoke map illustrates that the plume stalls as the trough keeps the smoke pushed to the south. However, due to the predominately calm wind conditions the stagnant air mass continues to cause the PM<sub>2.5</sub> levels to remain elevated.

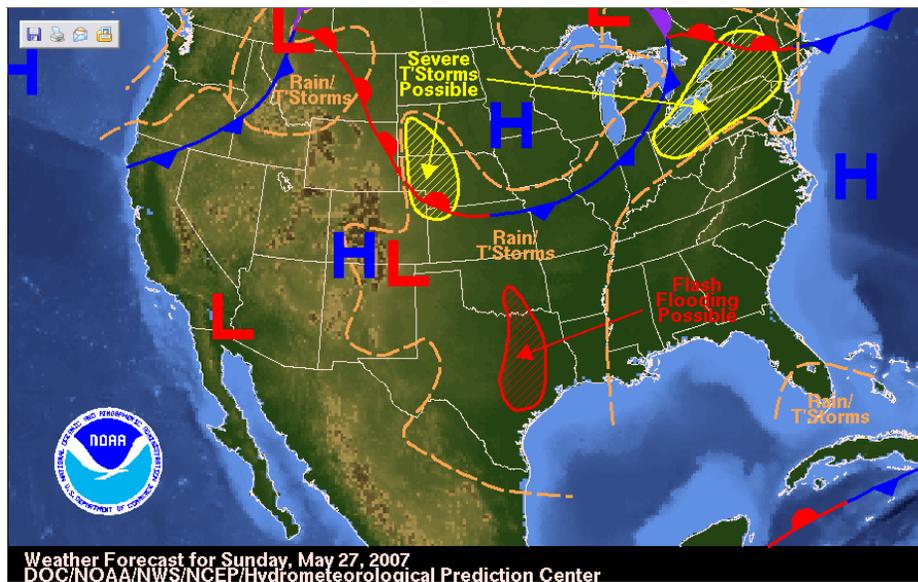
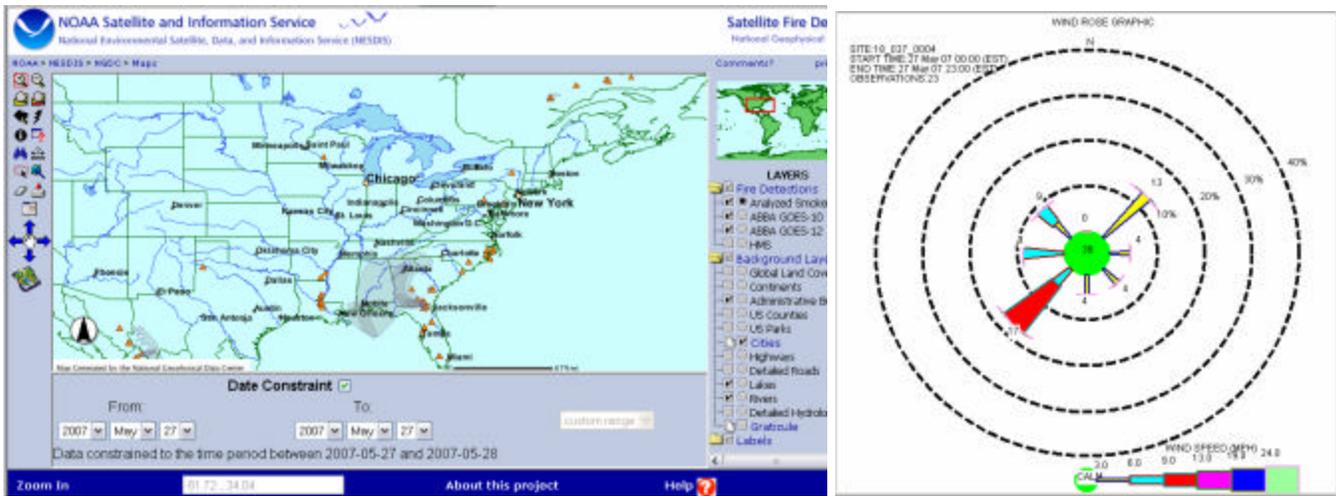


Figure 9.2 - May 27, 2007

The map shows the plume has moved back over the region as the upper level trough dips down over the area and the wind direction continues to be from the S, SE.

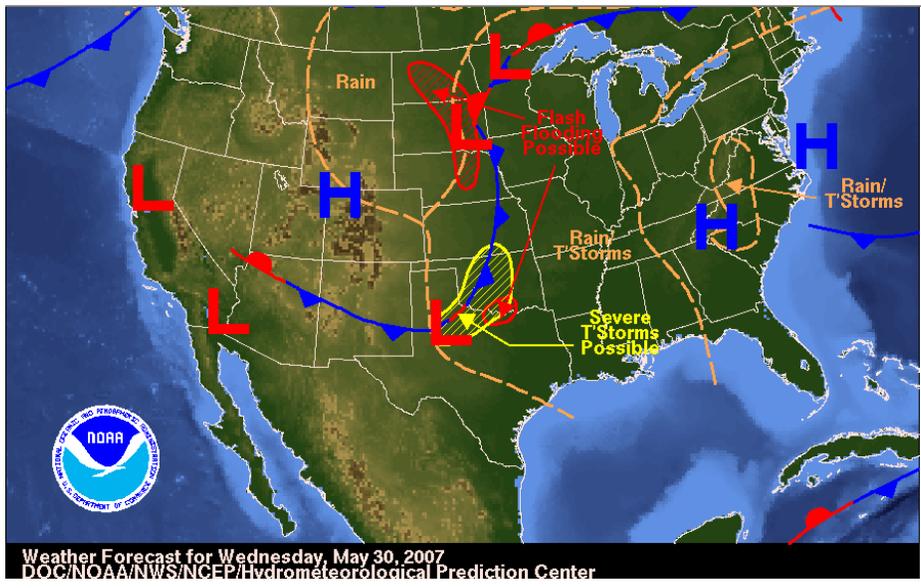
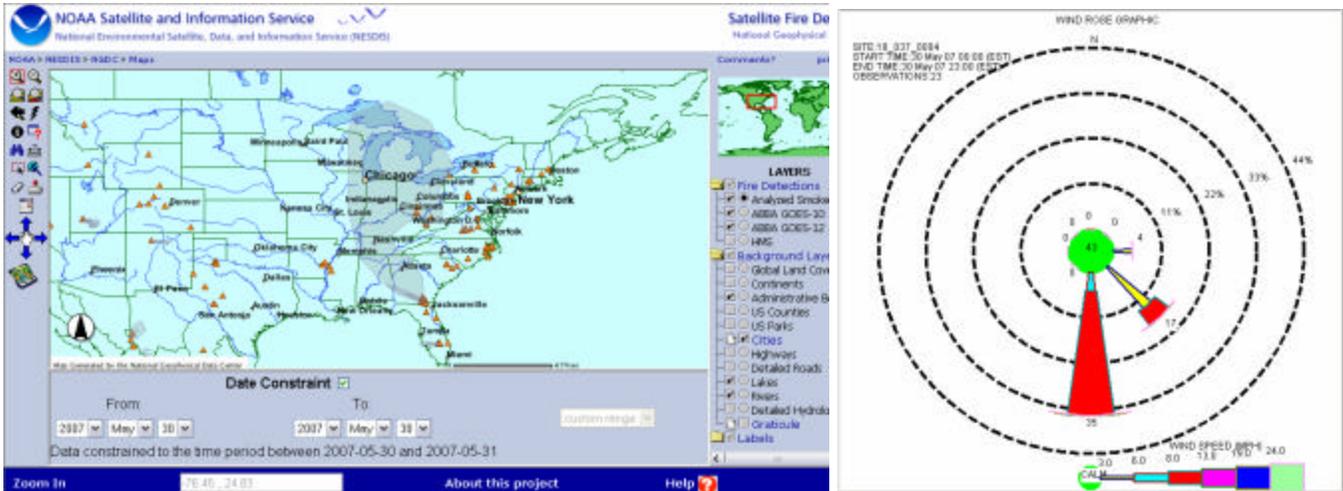
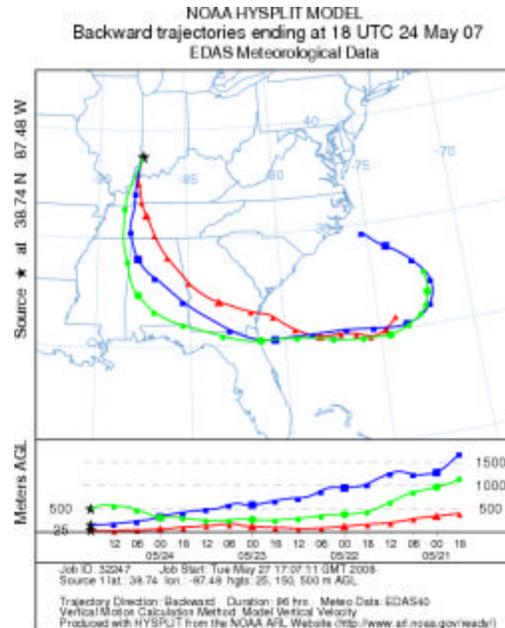


Figure 9.3 - May 30, 2007

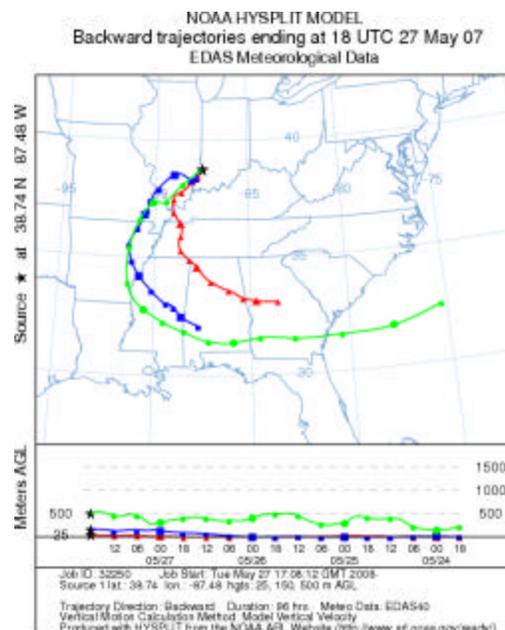
## Backward Trajectory Models

### NOAA ARL READY HYSPLIT Maps

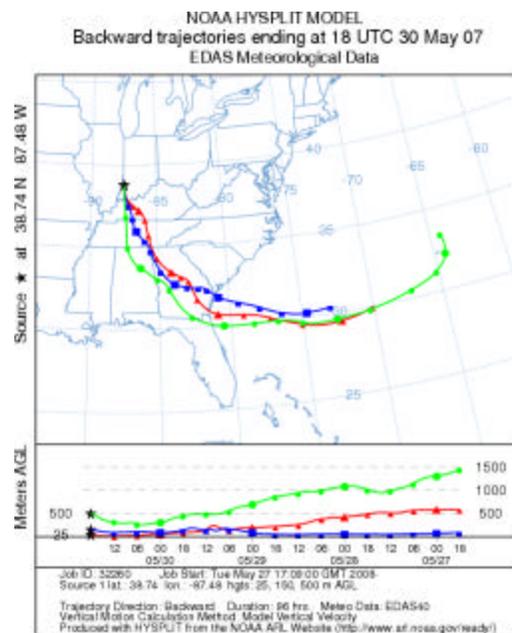
Draxler, R.R. and Rolph, G.D., 2003. HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via a NOAA ARL READY Website (<http://www.arl.noaa.gov/ready/hysplit4.html>). NOAA Air Resources Laboratory, Silver Spring, MD.



**Figure 9.4:** Backward trajectories originating from Vincennes on 5/24/07 at 12:00 PM CST showing the air mass passing over southern Georgia.



**Figure 9.5:** Backward trajectories originating from Vincennes on 5/27/07 at 12:00 PM CST showing the air mass still passing over southern Georgia.



**Figure 9.6:** Backward trajectories originating from Vincennes on 5/30/07 at 12:00 PM CST showing the air mass still passing over Georgia.

## **10 – Jasper Exceptional Events Detail**

Parameter: PM<sub>2.5</sub>

Dates: May 23 - 30, 2007

Location: Jasper / Dale – Dubois / Spencer Co.

Event: Smoke from wildfires in northern Florida and southern Georgia impacted the Southwest Indiana region during the period of May 23 – 30. The gradual buildup of smoke moving through the area during this period resulted in exceedances of the 24-hour PM<sub>2.5</sub> NAAQS on May 26 and May 29 at Jasper Post Office (180372001). Higher values were also recorded at the Post Office on the other dates during this time period and at the Jasper – Sport Complex Site (180270004) on May 24 and May 27, and at the Jasper – Golf Course Site (180370005) and Dale (181470009) on May 24, 27, and 30.

Data: Different analyses of the data are used to demonstrate that the PM<sub>2.5</sub> concentrations measured from May 23 - 30 are beyond the range of values typically found during that time period and that they have been influenced by outside events. Table 10.1 shows daily PM<sub>2.5</sub> averages prior to, during and after the event with the values flagged in **bold**. Data have been flagged with an exceptional event flag of ‘E’ in AQS, awaiting concurrence from EPA.

Tables 10.2 and 10.3 list summaries of the data collected at the Jasper Post Office since 2000. Data from 2007 are calculated with all current data and with the flagged data removed. There is an improvement in the status of the area as the Daily Design Value for the 2005-2007 time period goes from 36 (nonattainment) to 35 (attainment). As Jasper Sport and Jasper Golf have collected data for only two years, no historical trend data are available and no long term analysis is possible. The values from these two sites correlate very well with the Post Office site and all sites are within three (3) miles of each other. All sites are in the same air mass and any conclusions of data from the Post Office are the same as for the other two sites.

The PM<sub>2.5</sub> data from Dale show a decrease in the annual average and the annual design value, but no change in the daily design value.

The values recorded during the May 23 – 30 time period are outside the normal values collected during the month of May. Prior to this time, the highest value reported in May had been 26.7 ug/m<sup>3</sup> and the highest monthly average had been 15.49 ug/m<sup>3</sup>. With the high data collected in May 2007, the highest value was 41.5 ug/m<sup>3</sup> and the monthly average was 20.4 ug/m<sup>3</sup>. Removing the flagged data results in a maximum daily concentration of 26 ug/m<sup>3</sup> and an average concentration of 15.73 ug/m<sup>3</sup>. These values are much more in line with historical data. The May comparison data are in Table 10.4.

**Table 10.1 - FRM Daily Values  
Exceptional Event Period**

Values in **BOLD** are flagged as exceptional events

Date	Jasper Post Office 18-037-2001	Jasper Sport 18-037-0004	Jasper Golf 18-037-0005	Dale 18-037-0005
5/17	6.1			
5/18	6.4	6.5	6.2	7
5/19	11.2			
5/20	12.2			
5/21	No sample	15.4	16.5	17
5/22	21.9			
<b>5/23</b>	<b>28.4</b>			
<b>5/24</b>	<b>25.0</b>	<b>25.7</b>	<b>26.5</b>	<b>25.5</b>
<b>5/25</b>	<b>25.9</b>			
<b>5/26</b>	<b>41.5</b>			
<b>5/27</b>	<b>30.5</b>	<b>30</b>	<b>30</b>	<b>30.5</b>
<b>5/28</b>	<b>34.2</b>			
<b>5/29</b>	<b>39.5</b>			
<b>5/30</b>	<b>31.8</b>	No Sample	<b>33.1</b>	<b>31.2</b>
5/31	No Sample			
6/1	21.5			
6/2	No Sample	22.8	20.2	23.8

**Table 10.2 – Historical Daily Values**

Year		Jasper - Post Office 18-037-2001		Dale 18-147-0005	
		98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>
2000		40		43.4	
2001		39		28.2	
2002	2000- 2002	36.3	28	27.8	33
2003	2001- 2003	39.5	38	34.6	30
2004	2002- 2004	20	35	25.2	29
2005	2003- 2005	41.2	37	39.7	33
2006	2004- 2006	31.6	34	27.7	31
2007	2005- 2007	34.7	36	31.4	33
Values excluding flagged data					
2007	2005- 2007	31	35	31.4	33

<sup>1</sup>Daily Design Value = 3 year average of annual 98<sup>th</sup> %ile values.

**Table 10.3 - Historical Annual Averages**

Year		Jasper - Post Office 18-037-2001		Dale 18-147-0005	
		Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>
2000		17.16		16.32	
2001		16.54		14.52	
2002	2000- 2002	16.34	16.7	14.06	15
2003	2001- 2003	15.72	16.2	14.63	14.4
2004	2002- 2004	14.42	15.5	12.17	13.6
2005	2003- 2005	16.92	15.7	16.76	14.5
2006	2004- 2006	13.54	15	12.78	13.9
2007	2005- 2007	14.39	14.9	14.13	14.6
Values excluding flagged data					
2007	2005- 2007	13.95	14.8	13.74	14.4

<sup>2</sup>Annual Design value = 3 year average of the annual averages.

**Table 10.4 – Examination of Daily Maximums and Averages for May Monitored Values for 2000-2007 (Jasper Post Office)**

Year	Maximum Values	Monthly Averages
2000	22.2	15.49
2001	26.7	14.76
2002	No Data	No Data
2003	15.9	11.14
2004	22.1	13.37
2005	22.1	14.08
2006	21.5	9.94
2007	41.5	20.4
Values with flagged data removed		
2007	26	15.73

**Particulate**

**Composition:** Speciation data are collected at the Jasper Post Office site on a one in six day sampling schedule. Data are available for May 24 and May 30. High organic carbon values were reported on those two dates; 6.9 ug/m<sup>3</sup> and 10.7 ug/m<sup>3</sup> respectively. These values were the highest and the fourth highest values of the year. The annual average for organic carbon at this site is 3.95 ug/m<sup>3</sup>. There was no increase in the elemental carbon values; 0.5 ug/m<sup>3</sup> and 0.3 ug/m<sup>3</sup>, on the two dates, as compared to the annual average of 0.55 ug/m<sup>3</sup>. The time progression of the maps in Appendix 3 shows the rise and fall of the organic carbon values across the region over this time period.

**Maps:** Images of maps from NOAA Satellite and Information Services show the smoke plume originating from the northern Florida/southern Georgia region. Dispersion and movement of the smoke plume from these fires was generally to the west or northwest and then to the north. The daily satellite smoke photos show that the smoke plume from the fires comes into southern Indiana on May 23 and continues to influence the atmosphere until May 30. The daily wind roses (obtained from the nearest meteorological site at Jasper Sport, 18-037-0004) show information on prevailing wind direction, calm conditions and wind speed NOAA weather maps are also used to show that an upper level trough greatly influences the direction of the plume in relation to the SW Indiana region.

**Trajectory Modeling:** The NOAA HYSPLIT Models are used to show wind trajectories at different levels during this event. Backward modeling from the site (latitude: 38.39°; longitude:-86.93°) at elevations of 25m, 150m and 500m was conducted for a period of three (3) to four (4) days prior. The differing elevations were chosen to demonstrate the air mass's uniformity at ground-level where the samplers were located and aloft which avoids the ground-level limitations of the model. Forward modeling was conducted using the Bugaboo Scrub Fire as the starting point (latitude: 30.70°; longitude: -82.40°) at an elevation of 250 meters (appropriate height that is low enough

to always be in the well-mixed zone and high enough to avoid the ground-level model limitation) and going three (3) to four (4) days. These models are in Appendix 2. Overall, there is a very good correlation when comparing the forward and backward trajectories for a given date. For example, May 24, 26, and 29 show a very narrow channel of air flow between southeastern Georgia and southwestern Indiana. Both the backward and forward trajectories confirm this. In addition, other days during the event in question show similar results although those trajectories are not shown here.

**Conclusion:** EPA defines an “exceptional event” as an unusual or naturally occurring event that can affect air quality but is not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the clean air act is not appropriate. The various analyses show that the high PM<sub>2.5</sub> concentrations observed at the Jasper and Dale sites from May 23, 2007 through May 30, 2007 are coming from the wildfires in southern Georgia and northern Florida. Indiana had no control over this event. According to 40 CFR Part 50.14 (b)(1), “EPA shall exclude data from use in determinations of exceedances and NAAQS violations where a State demonstrates to EPA’s satisfaction that an exceptional event caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section.” IDEM believes they have successfully illustrated the impact of this event on the sites in this region.

Therefore, IDEM requests that EPA concur with the ‘E’ flag on the data in AQS for the data in **bold** in Table 10.1.

## Daily Smoke Maps and Weather Conditions

The smoke map shows that the plume has reached the Jasper area and as shown in Table 10.1,  $PM_{2.5}$  levels have started to increase. The corresponding wind rose and weather map further illustrate the direction of the plume by the location of the upper level trough (orange dashed line) and the S, SE prevailing winds.

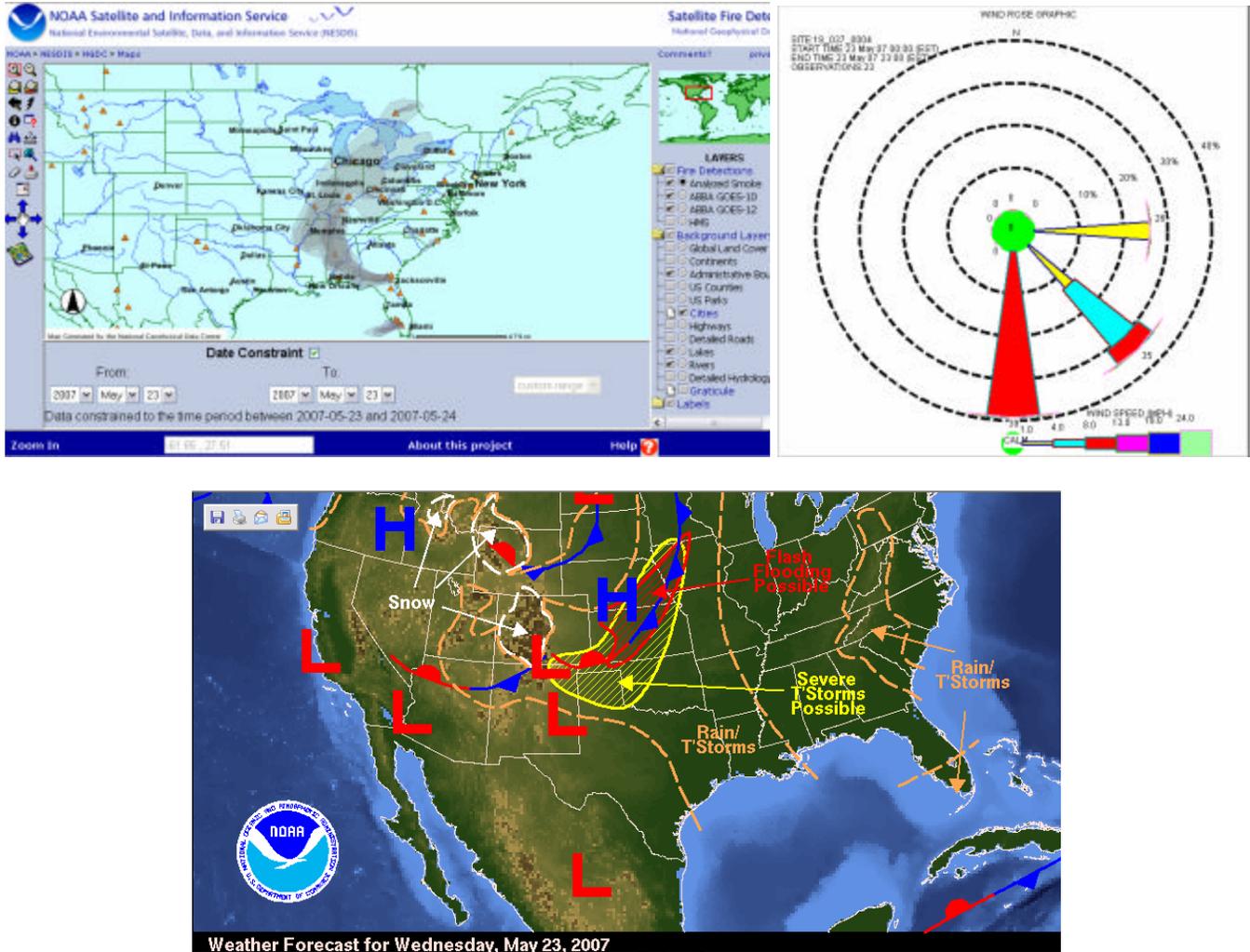


Figure 10.1 - May 23, 2007

The smoke map shows that the plume is remaining over the area. The prevailing wind direction has shifted to the SSW as the upper level trough moves further to the east and another trough develops over Ohio, keeping the plume over the SW Indiana region.

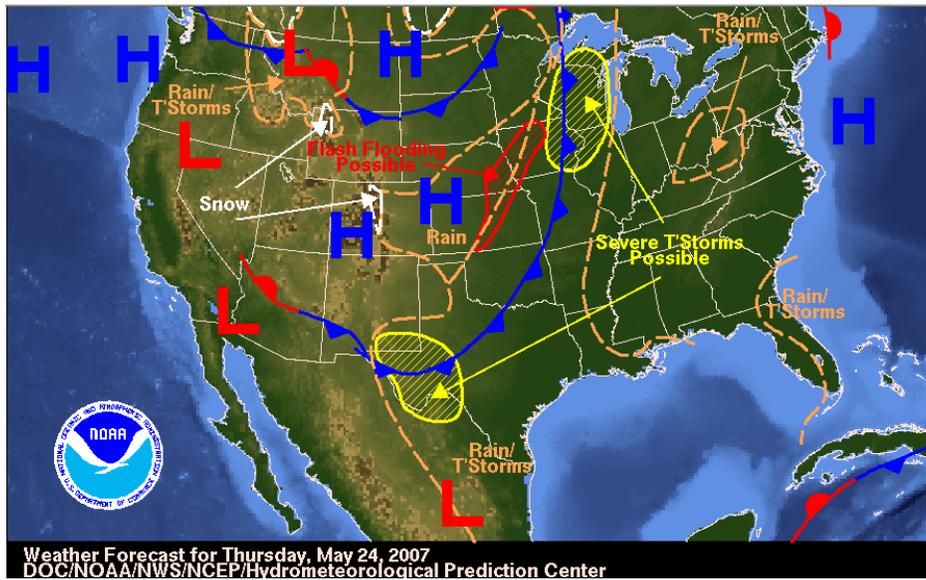
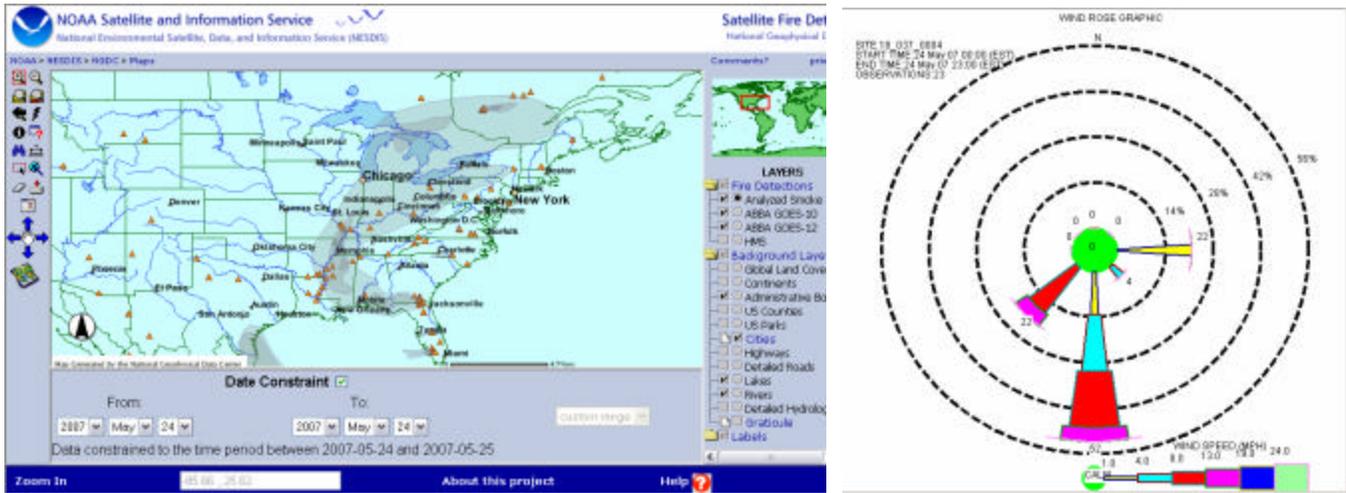


Figure 10.2 - May 24, 2007

The smoke map shows that the plume is remaining over the area. The prevailing wind direction continues to be from the south as the upper level trough has now moved directly over the SW Indiana region.

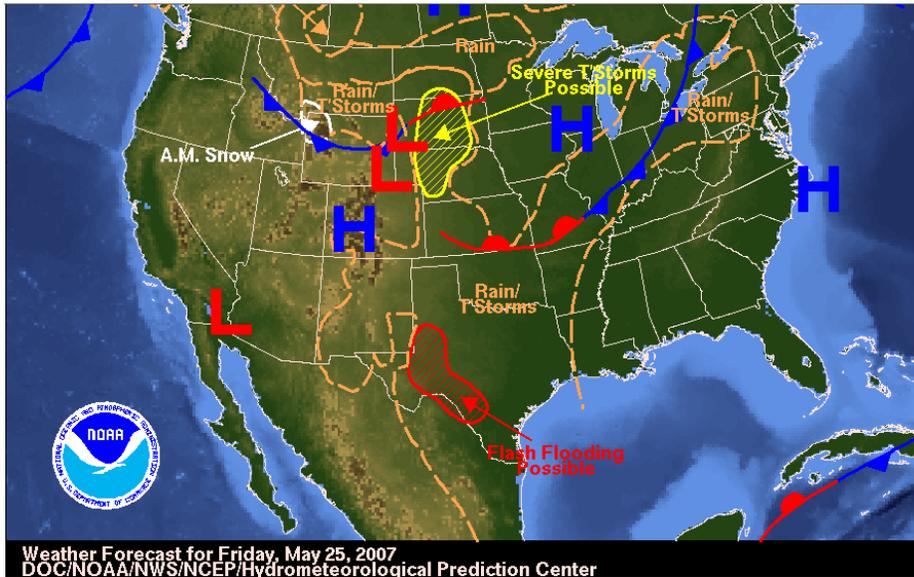
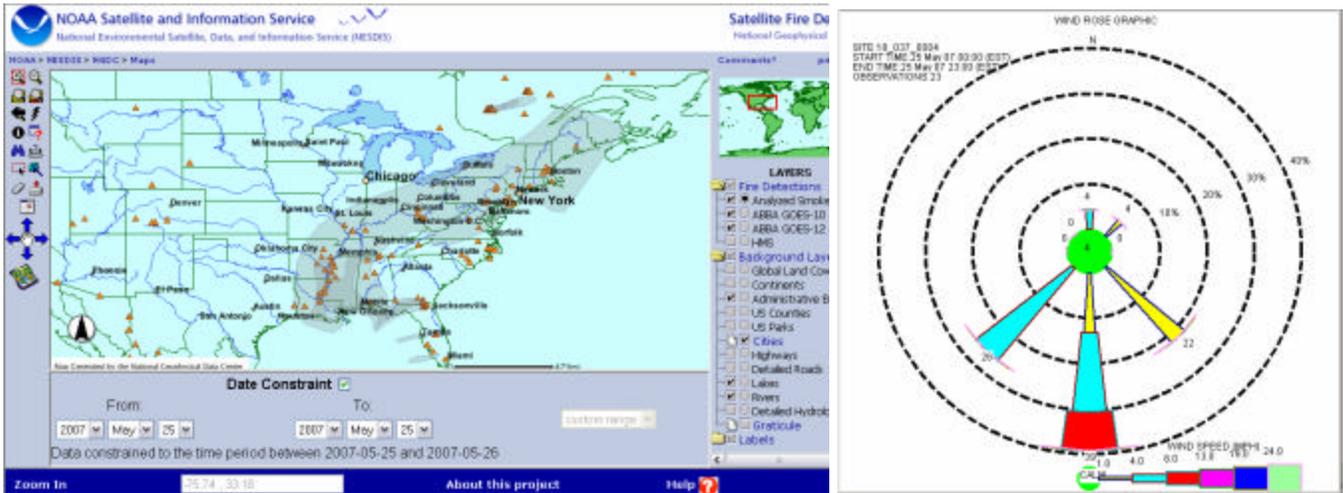


Figure 10.3 - May 25, 2007

The smoke map illustrates that the plume has essentially dissipated as the trough keeps the smoke pushed to the south. However, due to the prevailing calm wind conditions the stagnant air mass continues to cause the PM<sub>2.5</sub> levels to rise past the 24-hour standard.

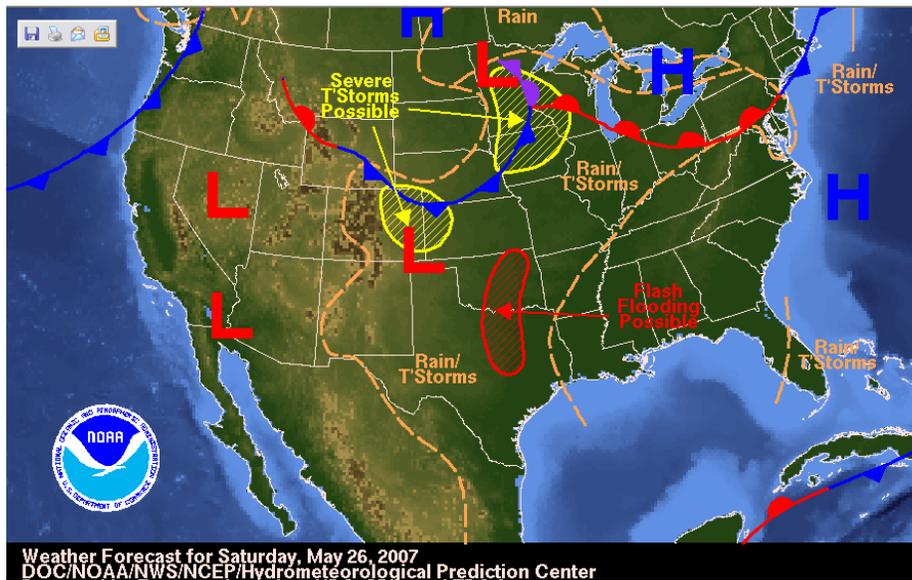
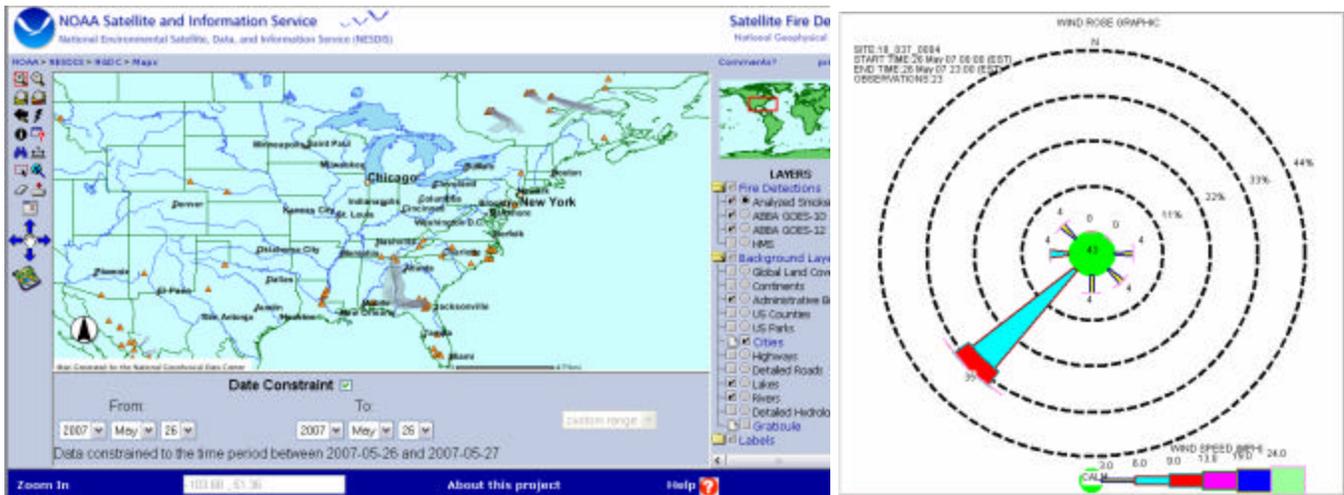


Figure 10.4 - May 26, 2007

The smoke map illustrates that the plume continues to stall as the trough continues to keep the smoke pushed to the south. However, due to the predominately calm wind conditions the stagnant air mass continues to cause the PM<sub>2.5</sub> levels to remain elevated.

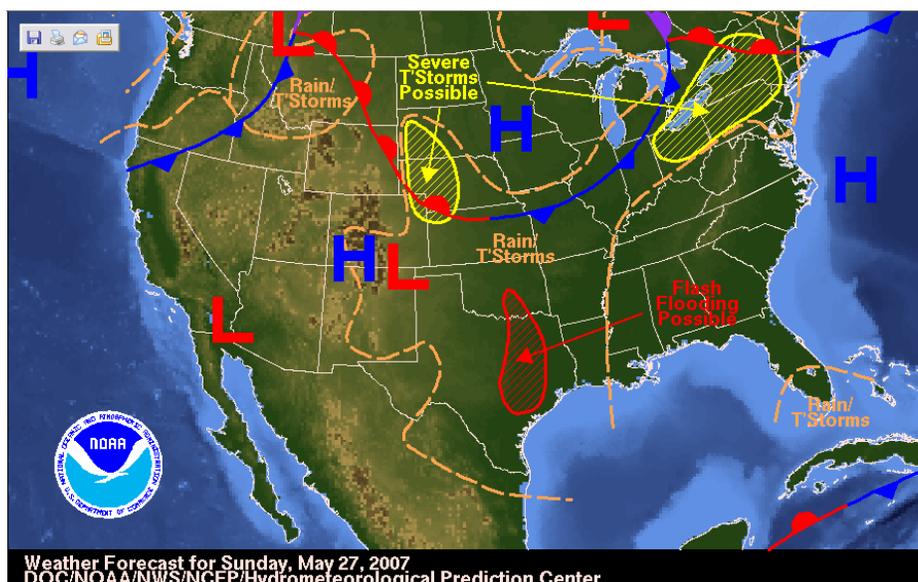
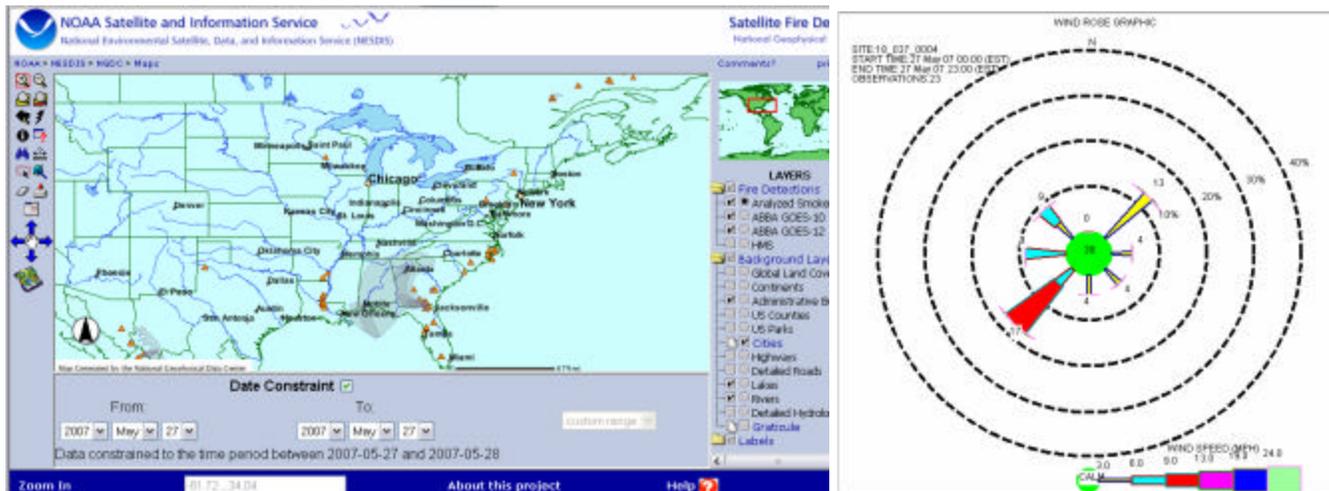


Figure 10.5 - May 27, 2007

The smoke map shows the plume has been pushed back into the region due to the upper level trough moving to the north and causing the plume to become more concentrated over the area.

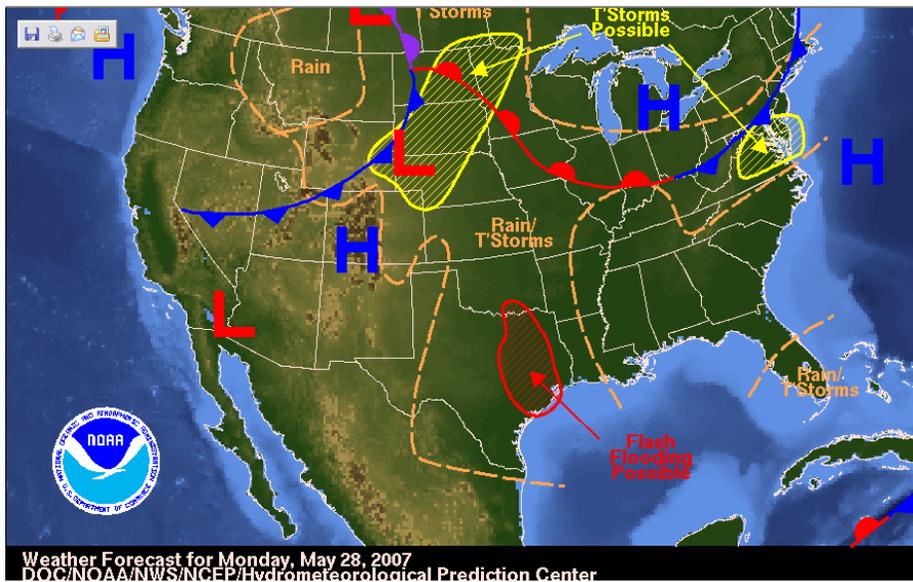
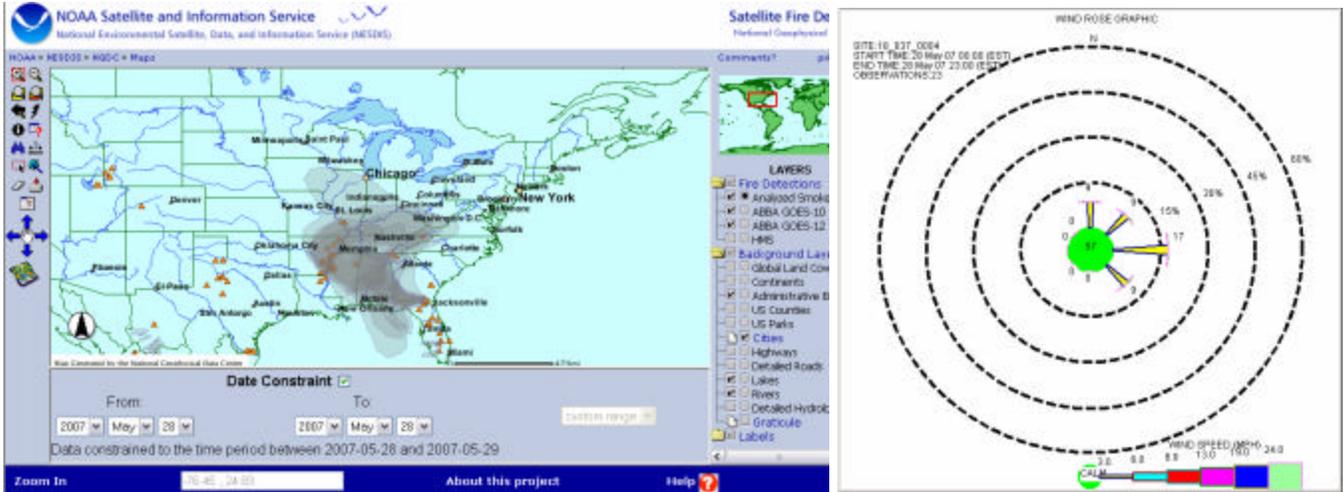


Figure 10.6 - May 28, 2007

Although the map illustrates the plume is not over the region, the prevailing SE wind direction, as shown by the wind rose, keep the high levels of PM<sub>2.5</sub> over the area.

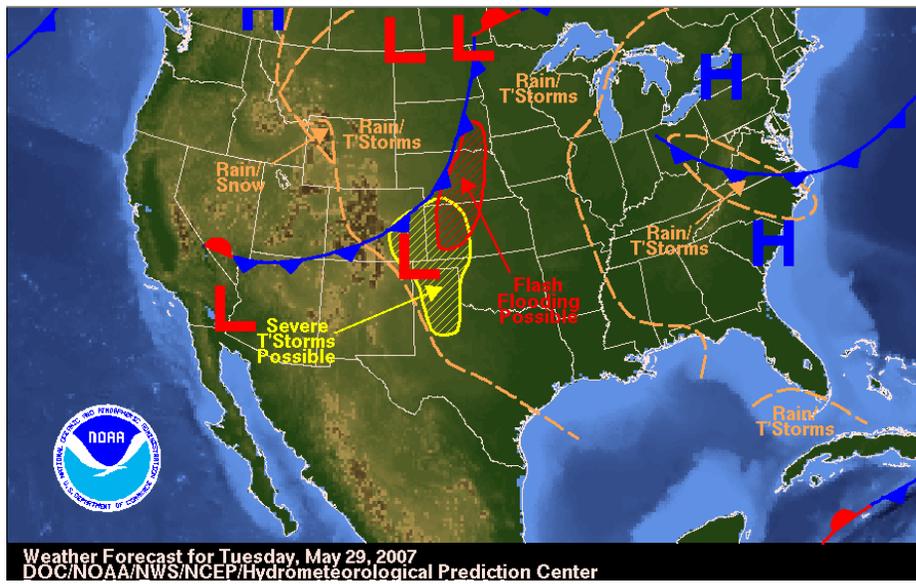
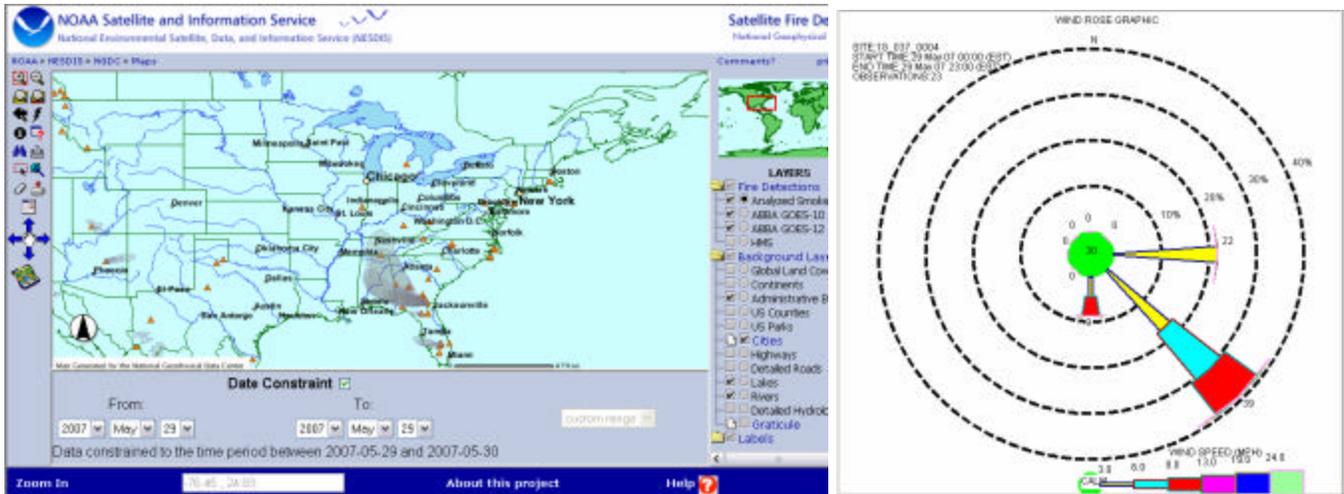


Figure 10.7 - May 29, 2007

The map shows the plume has moved back over the region as the upper level trough dips down over the area and the wind direction continues to be from the S, SE.

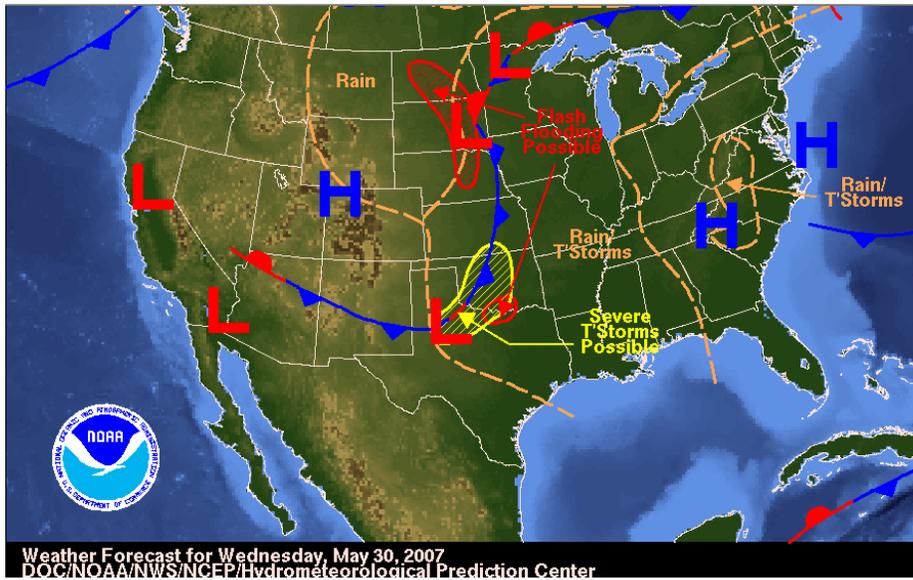
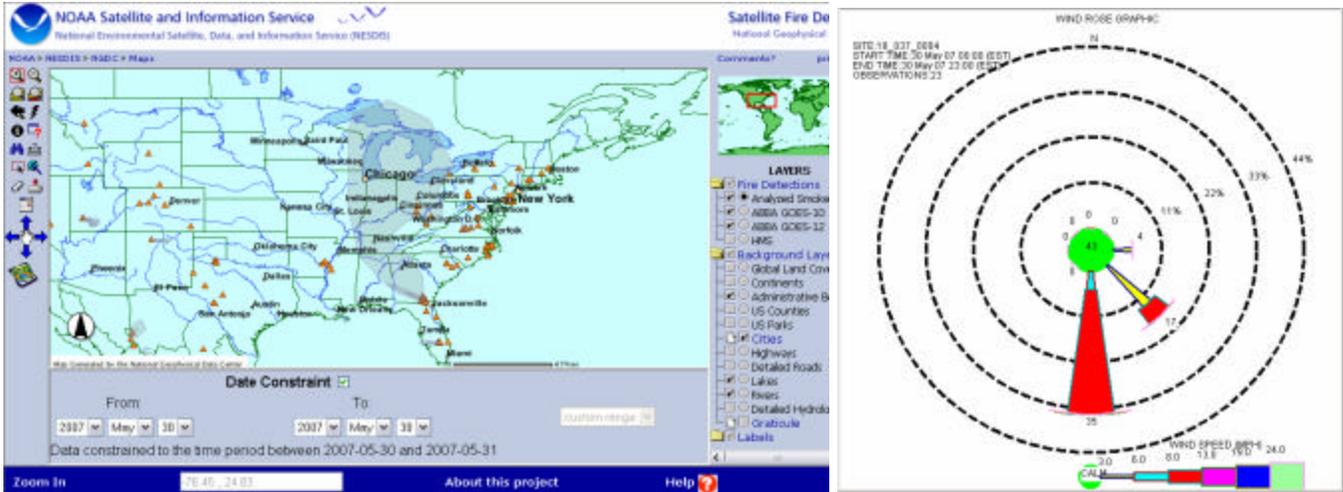


Figure 10.8 - May 30, 2007

The map shows the plume has dissipated as the upper level trough and increased wind speed have pushed the remaining smoke toward the east and out of the region.

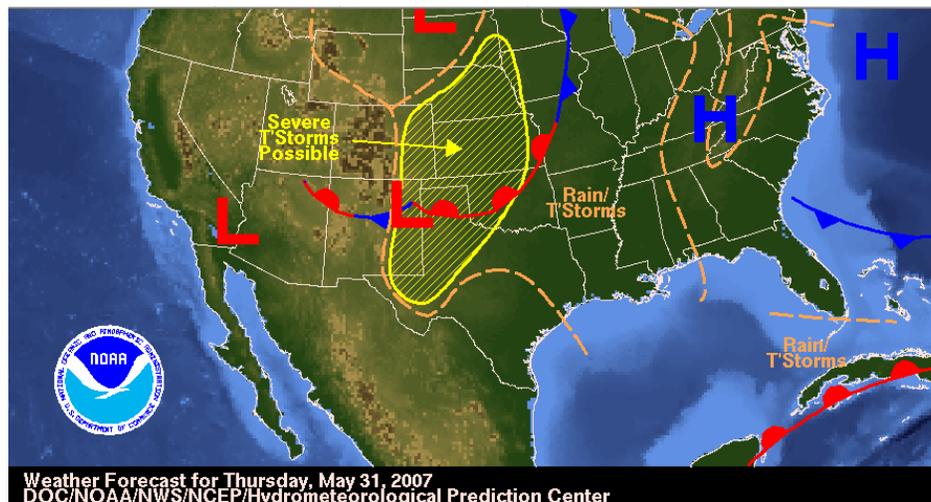
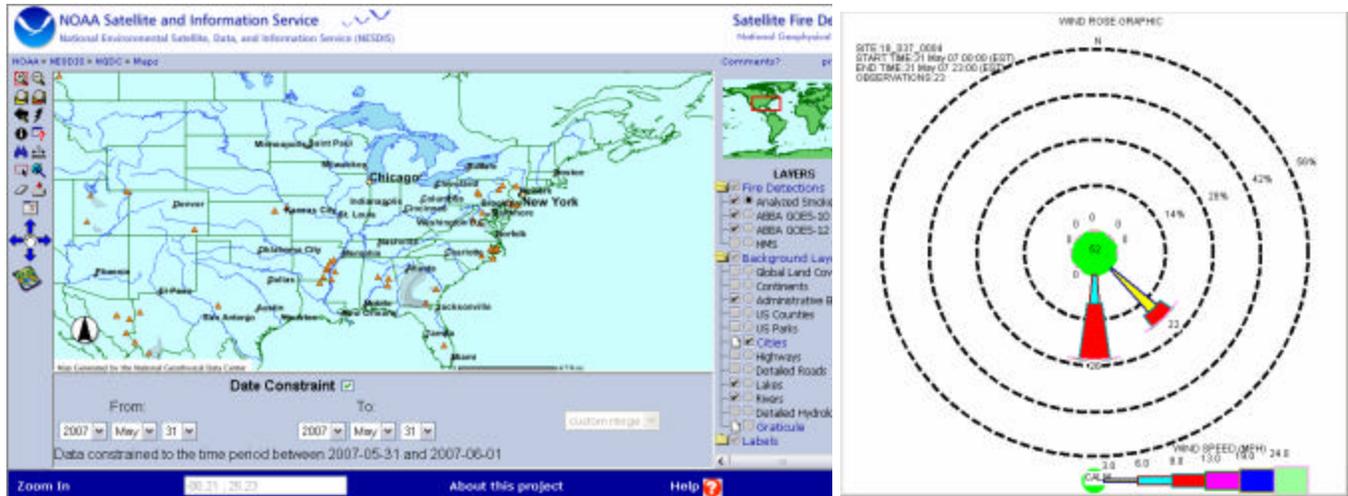
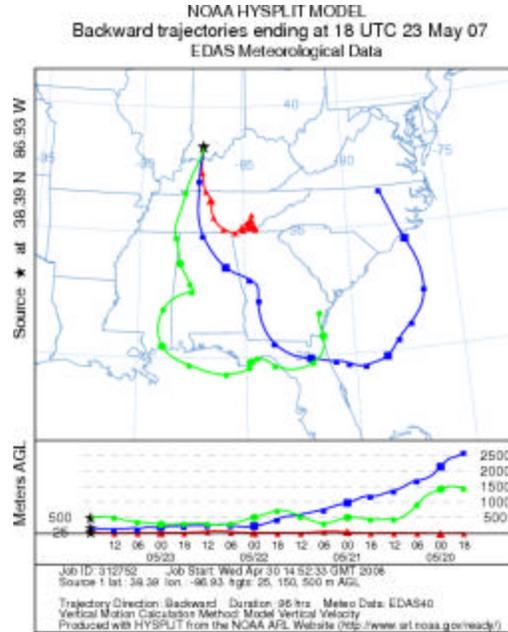


Figure 10.9 - May 31, 2007

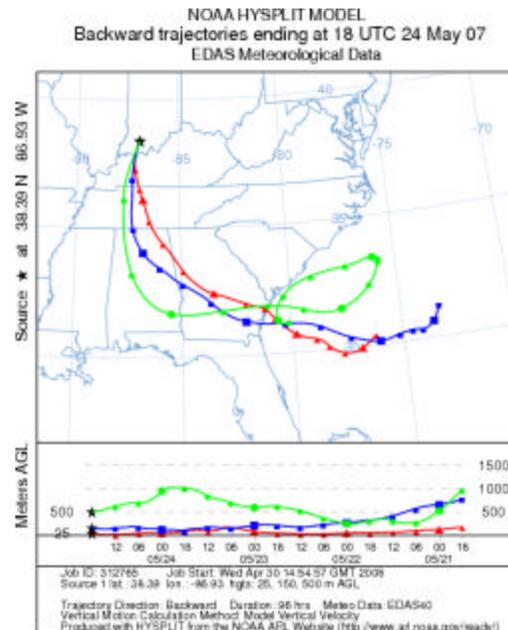
## Backward Trajectory Models

### NOAA ARL READY HYSPLIT Maps

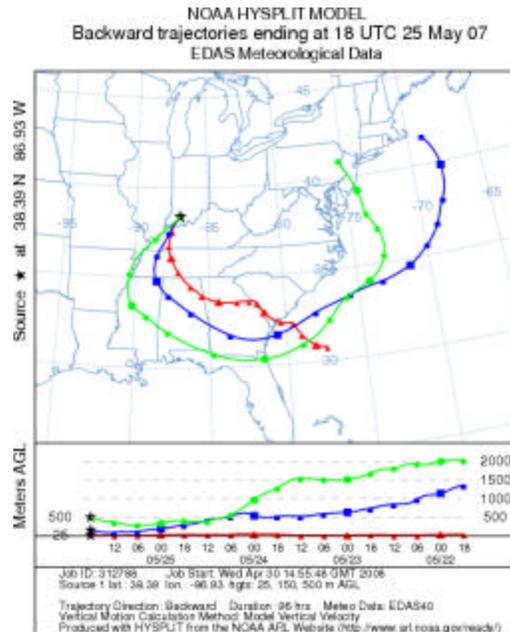
Draxler, R.R. and Rolph, G.D., 2003. HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (<http://www.arl.noaa.gov/ready/hysplit4.html>). NOAA Air Resources Laboratory, Silver Spring, MD.



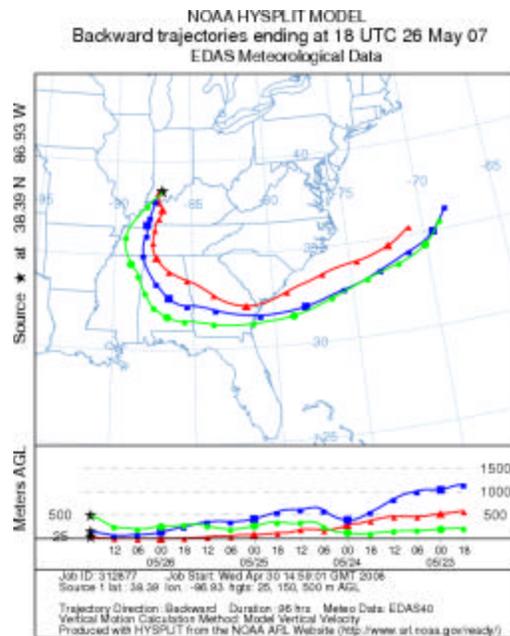
**Figure 10.10:** Backward trajectories originating from Jasper on 5/23/07 at 12:00 PM CST showing consistency in the air mass passing over northern Florida.



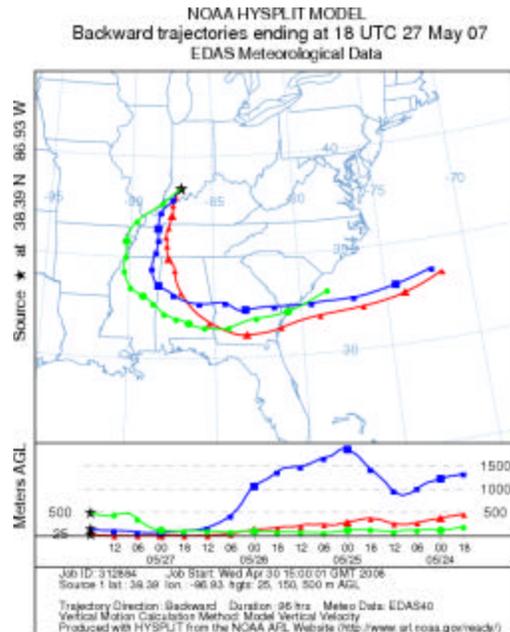
**Figure 10.11:** Backward trajectories originating from Jasper on 5/24/07 at 12:00 PM CST showing continuation of the air mass passing over southern Georgia.



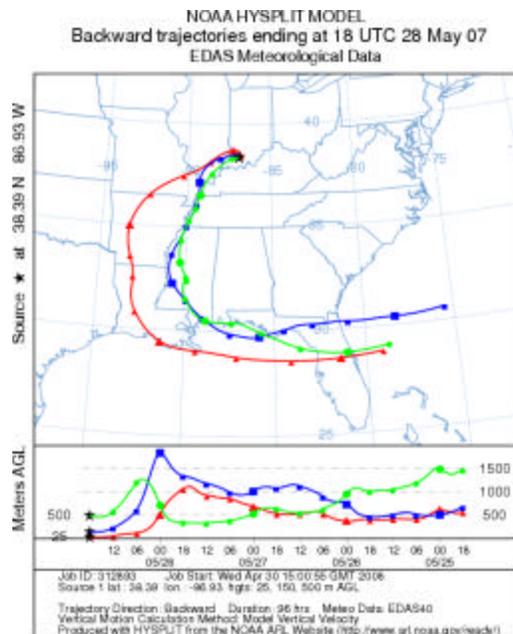
**Figure 10.12:** Backward trajectories originating from Jasper on 5/25/07 at 12:00 PM CST showing the air mass still passing over southern Georgia.



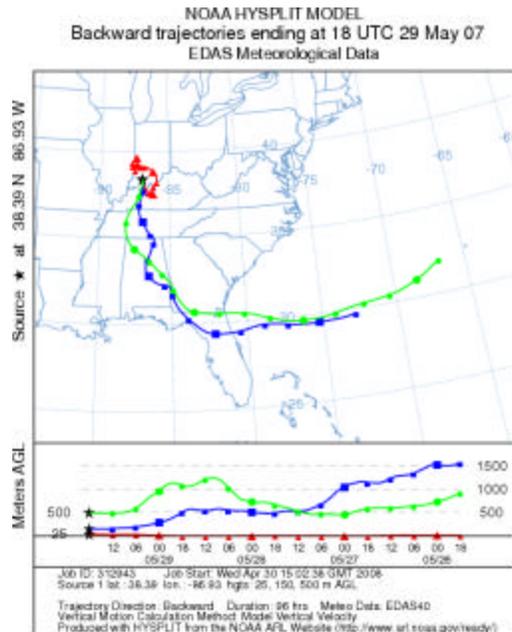
**Figure 10.13:** Backward trajectories originating from Jasper on 5/26/07 at 12:00 PM CST showing the air mass still passing over southern Georgia.



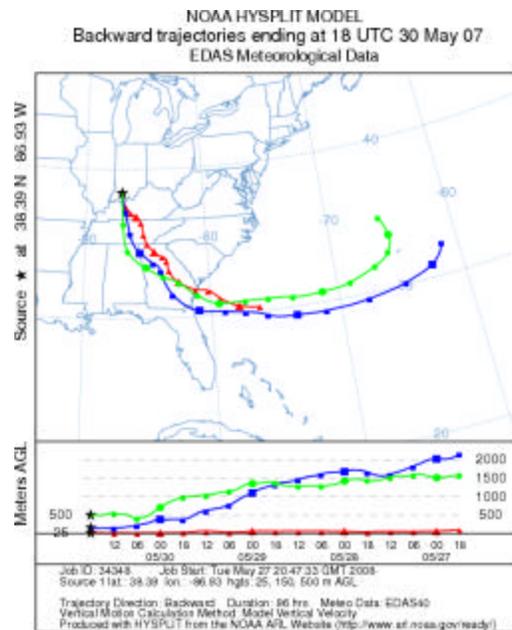
**Figure 10.14:** Backward trajectories originating from Jasper on 5/27/07 at 12:00 PM CST still showing consistency in the air mass passing over southern Georgia.



**Figure 10.15:** Backward trajectories originating from Jasper on 5/28/07 at 12:00 PM CST showing the air mass passing over northern Florida.



**Figure 10.16:** Backward trajectories originating from Jasper on 5/29/07 at 12:00 PM CST showing the air mass passing over northern Florida and southern Georgia. Note: the lowest-level trajectory breaks down due to the model predicting a zero elevation air mass.



**Figure 10.17:** Backward trajectories originating from Jasper on 5/30/07 at 12:00 PM CST showing the air mass still passing over Georgia.

## 11 – Evansville, Indiana Exceptional Events Detail

- Parameter: PM<sub>2.5</sub>
- Dates: May 24 – 30, 2007
- Location: Evansville – Vanderburgh Co.
- Event: Smoke from wildfires in northern Florida and southern Georgia impacted the Evansville region during the period of May 24 – 30. The gradual buildup of smoke moving through the area during this period resulted in elevated levels of the 24-hour PM<sub>2.5</sub>.
- Data: Different analyses of the data are used to demonstrate that the PM<sub>2.5</sub> concentrations measured from May 24 – 30 are beyond the range of values typically found during that time period and that they have been influenced by outside events. Table 11.1 shows daily PM<sub>2.5</sub> averages prior to, during and after the event with the values flagged in **bold**. Data have been flagged with an exceptional event flag of ‘E’ in AQS, awaiting concurrence from EPA.

Tables 11.2 and 11.3 list summaries of the data collected at the three Evansville sites since 2000. Data from 2007 are calculated with all current data and with the flagged data removed. There was a significant improvement in the design values for the annual averages when removing the flagged values.

The values recorded during the May 24-30 time period are higher than the normal values collected during the month of May. Prior to this time, the highest value reported in May since 2000 had been 25 ug/m<sup>3</sup> and the highest monthly average had been 14.95 ug/m<sup>3</sup>. With the high data collected in May 2007, the highest value was 29.9 ug/m<sup>3</sup> and the highest monthly average was 22.06 ug/m<sup>3</sup>. Removing the flagged data results in a maximum daily concentration of 24.2 ug/m<sup>3</sup> and a highest monthly average concentration of 18.94 ug/m<sup>3</sup>. These values are much more in line with historical data.

**Table 11.1 - FRM Daily Values  
Exceptional Event Period**

Values in **BOLD** are flagged as exceptional events

Date	Evan - Civic Center 18-163-0006	Evan - Mill Rd 18-163-0012	Evan - U of E 18-163-0016
5/17/07			
5/18/07	7.8		8.8
5/19/07			
5/20/07			
5/21/07	15		14.9
5/22/07			
5/23/07			
<b>5/24/07</b>	<b>26.2</b>	<b>23.9</b>	<b>25.8</b>
5/25/07			
5/26/07			
<b>5/27/07</b>		<b>29.9</b>	<b>27.7</b>
5/28/07			
5/29/07			
<b>5/30/07</b>	<b>26.5</b>	<b>28</b>	<b>27.6</b>
5/31/07			
6/1/07			
6/2/07		19.8	22.3
6/3/07			

**Table 11.2 - Historical Daily Values**

Year		Ev - Civic Cntr. 181630006		Ev - Mill Rd 181630012		Ev - U of E 181630016	
		98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>
2000		37.3		34.3		33.5	
2001		36.4		34.2		37.9	
2002	2000-2002	46.7	40	44.9	38	46.2	39
2003	2001-2003	34.5	39	34.1	38	35.9	40
2004	2002-2004	28.3	37	27.6	36	28.3	37
2005	2003-2005	42.5	35	41.5	34	37	34
2006	2004-2006	30.5	34	27.9	32	29.5	32
2007	2005-2007	33.6	36	29.9	33	31.5	33
Values excluding flagged data							
2007	2005-2007	33.6	36	29.1	33	31.5	33

<sup>1</sup>Daily Design Value = 3 year average of annual 98<sup>th</sup> %ile values.

**Table 11.3 - Historical Annual Averages**

Year		Ev - Civic Cntr. 181630006		Ev - Mill Rd 181630012		Ev - U of E 181630016	
		Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>
2000		16.2		16.2		15.7	
2001		15.5		15.2		16.2	
2002	2000-2002	15.4	15.7	15.3	15.5	15.2	15.7
2003	2001-2003	14.9	15.2	15.3	15.2	15.1	15.5
2004	2002-2004	13.2	14.5	13.5	14.7	13.7	14.7
2005	2003-2005	16.5	14.9	16.3	15	16.7	15.1
2006	2004-2006	13.7	14.5	14.1	14.6	14.2	14.8
2007	2005-2007	13.9	14.7	14.2	14.9	14.2	15
Values excluding flagged data							
2007	2005-2007	13.7	14.6	13.9	14.7	13.9	14.9

<sup>2</sup>Annual Design value = 3 year average of the annual averages.

**Table 11.4 – Examination of Daily Maximums and Averages for May Monitored Values for 2000 – 2007 (Evansville – Mill Rd)**

Year	Maximum Values	Monthly Averages
2000	21.2	14.74
2001	22.4	13.38
2002	18.4	14.48
2003	15.3	10.84
2004	18.9	13.12
2005	25	14.95
2006	21.2	10.56
2007	29.9	22.06
Values with flagged data removed		
2007	24.2	18.94

**Particulate**

Composition: Speciation data are collected at the Evansville – Mill Rd. site (181630012) on a one in six day sampling schedule. Data are available for May 24 and May 30. High organic carbon values were reported on those two dates; 8.03 ug/m<sup>3</sup> and 7.40 ug/m<sup>3</sup> respectively. These values were the highest and the fourth highest values of the year. The 2007 annual average for organic carbon at this site is 3.45 ug/m<sup>3</sup>. There was no increase in the elemental carbon values; 0.68 ug/m<sup>3</sup> and 0.84 ug/m<sup>3</sup>, on the two dates, as compared to the annual average of

0.63ug/m<sup>3</sup>. The high organic carbon values, without an increase in elemental carbon, are a very good indicator of biomass combustion.

Maps with the plotted organic carbon values during the May 18 through June 5 are in Appendix 3. The time progression of the maps shows the rise and fall of the organic carbon values over this time period.

Maps: Images of maps from NOAA Satellite and Information Services show the smoke plume originating from the northern Florida/southern Georgia region. Dispersion and movement of the smoke plume from these fires was generally to the west or northwest and then to the north. The daily satellite smoke photos show that the smoke plume from the fires comes into southern Indiana on May 23 and continues to influence the atmosphere until June 2. The daily wind roses generally track the direction of the smoke plume on that day at the local level. The daily wind roses show information on prevailing wind direction, calm conditions and wind speed. (Note: Met data are from industrial site 181730002. Data were input into the State database to obtain the wind rose processed under the St Philips site name.) NOAA weather maps are also used to show that an upper level trough greatly influences the direction of the plume in relation to the SW Indiana region.

Trajectory Modeling: The NOAA HYSPLIT Models are used to show wind trajectories at different levels during this event. Backward modeling from the site (latitude: 38.02°; longitude: -87.57°) at elevations of 25m, 150m and 500m was conducted for a period of three (3) to four (4) days prior. The differing elevations were chosen to demonstrate the air mass's uniformity at ground-level where the samplers were located and aloft which avoids the ground-level limitations of the model. Forward modeling was conducted using the Bugaboo Scrub Fire as the starting point (latitude: 30.70°; longitude: -82.40°) at an elevation of 250 meters (appropriate height that is low enough to always be in the well-mixed zone and high enough to avoid the ground-level model limitation) and going three (3) to four (4) days. Overall, there is a very good correlation when comparing the forward and backward trajectories for a given date. May 24, 27, and 30 show a very narrow channel of air flow between southeastern Georgia and southwestern Indiana. Both the backward and forward trajectories confirm this. Forward trajectory modeling results are shown in Appendix 2.

Conclusion: EPA defines an "exceptional event" as an unusual or naturally occurring event that can affect air quality but is not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the clean air act is not appropriate. Indiana has illustrated through the use of maps, meteorological data, speciation data, trajectory models and historical data that the smoke from wildfires in Florida and Georgia impacted the Evansville region during the period of May 24 – 30, 2007 causing elevated levels of the PM<sub>2.5</sub> 24-hour standard and significantly increasing the annual average. According to 40 CFR Part 50.14 (b)(1), "EPA shall exclude data from use in

determinations of exceedances and NAAQS violations where a State demonstrates to EPA's satisfaction that an exceptional event caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section." IDEM believes they have successfully illustrated the impact of this event on the sites in this region.

Therefore, IDEM requests that EPA concur with the 'E' flag on the data in AQS for the data in **bold** in Table 11.1.

## NOAA Satellite Smoke Maps, Weather Maps, and Wind Roses

The smoke map shows that the plume has reached the Evansville area and as shown in Table 11.1,  $PM_{2.5}$  levels have started to increase. The corresponding wind rose and weather map further illustrate the direction of the plume by the location of the upper level trough (orange dashed line) and the S, SE prevailing winds.

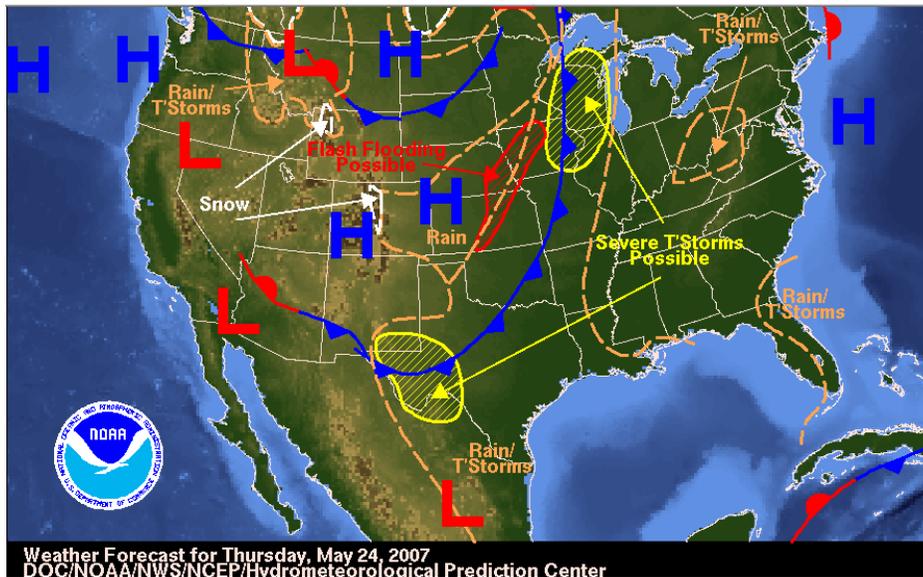
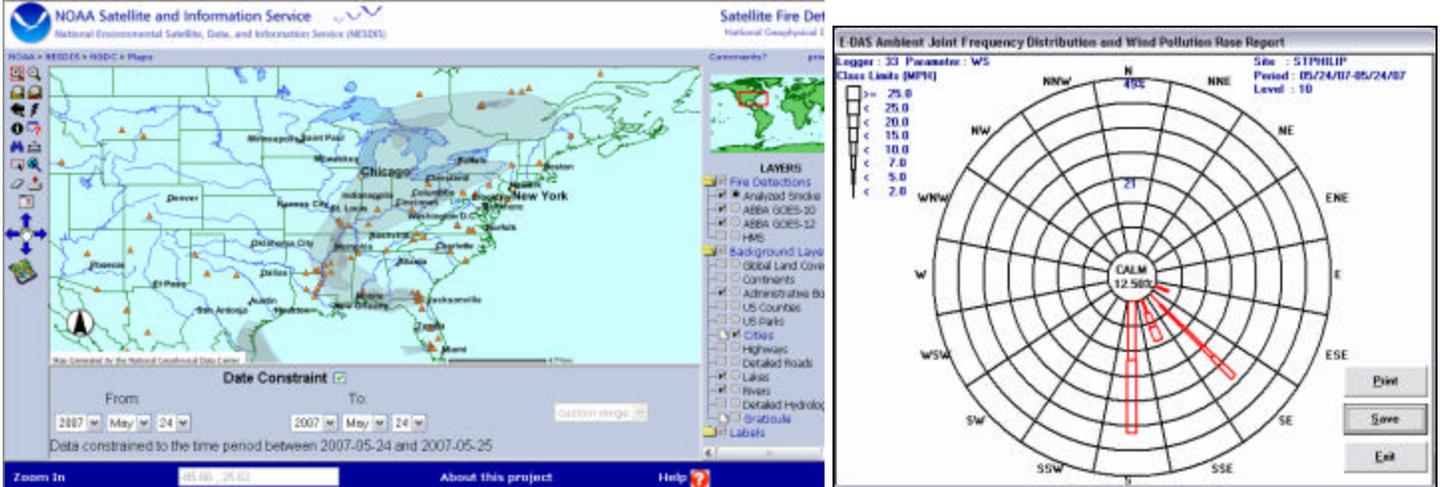


Figure 11.1 - May 24, 2007

The smoke map illustrates that the plume stalls as the trough keeps the smoke pushed to the south. However, due to the predominately calm wind conditions the stagnant air mass continues to cause the PM<sub>2.5</sub> levels to remain elevated.

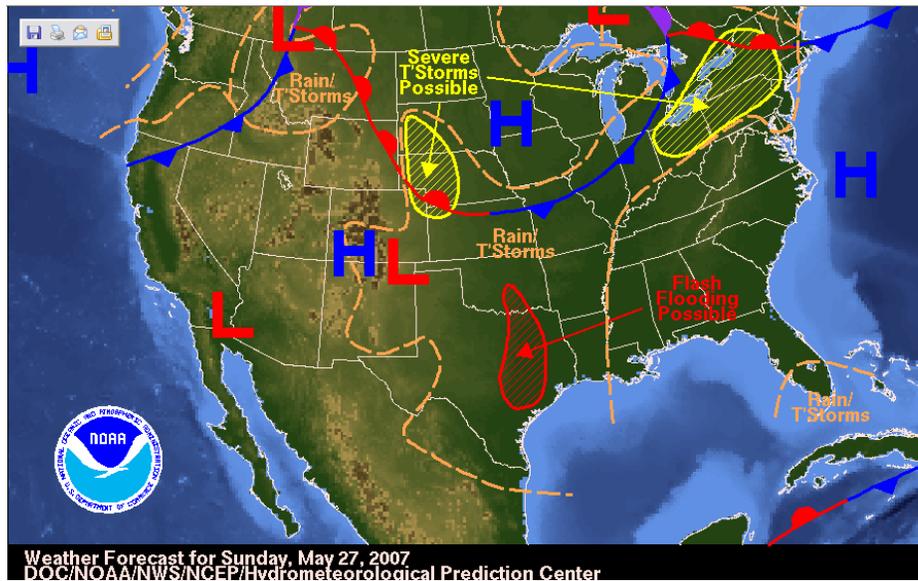
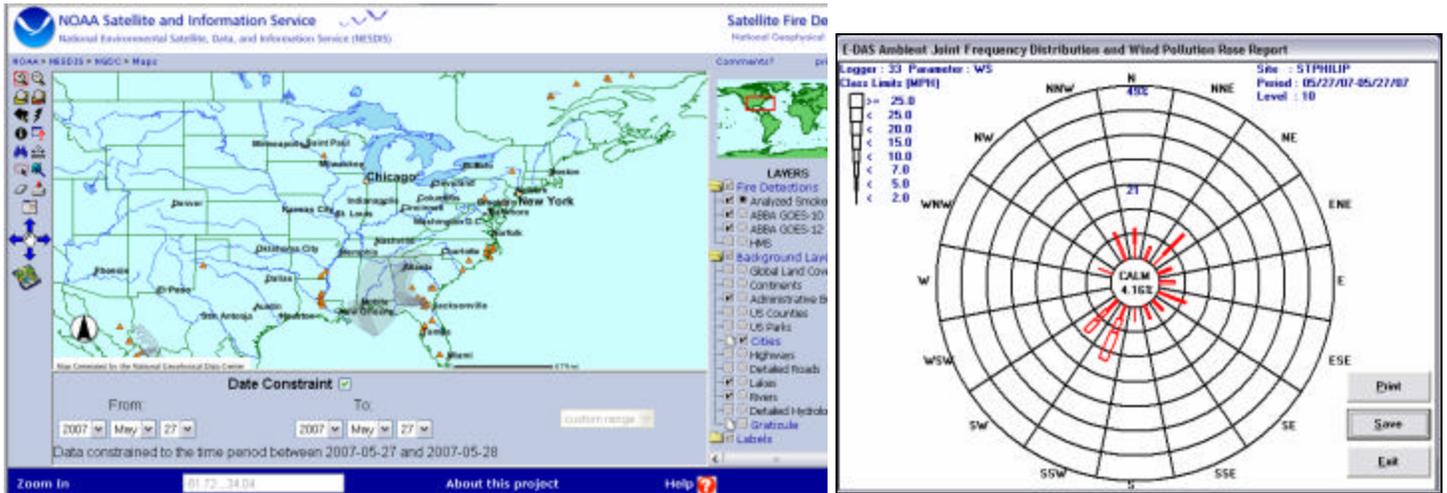


Figure 11.2 - May 27, 2007

The map shows the plume has moved back over the region as the upper level trough dips down over the area and the wind direction continues to be from the S, SE.

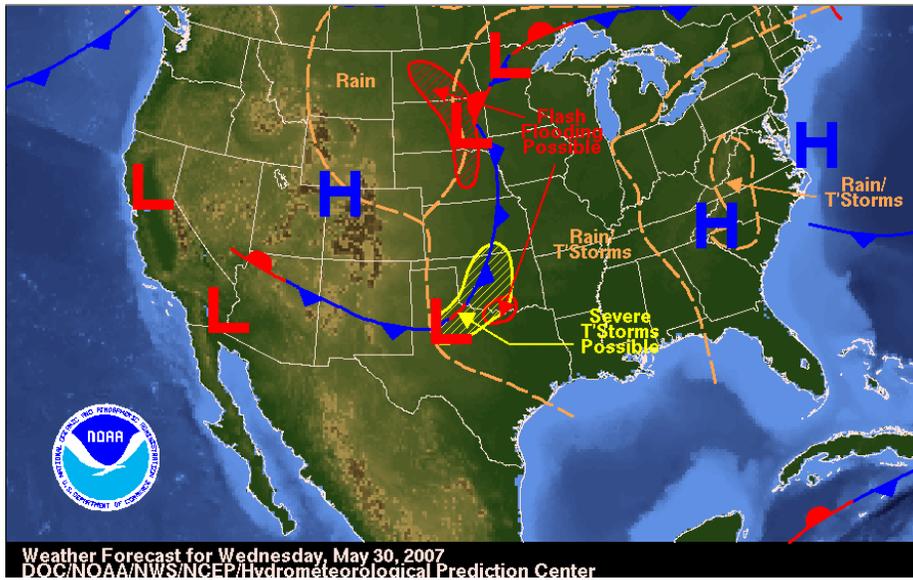
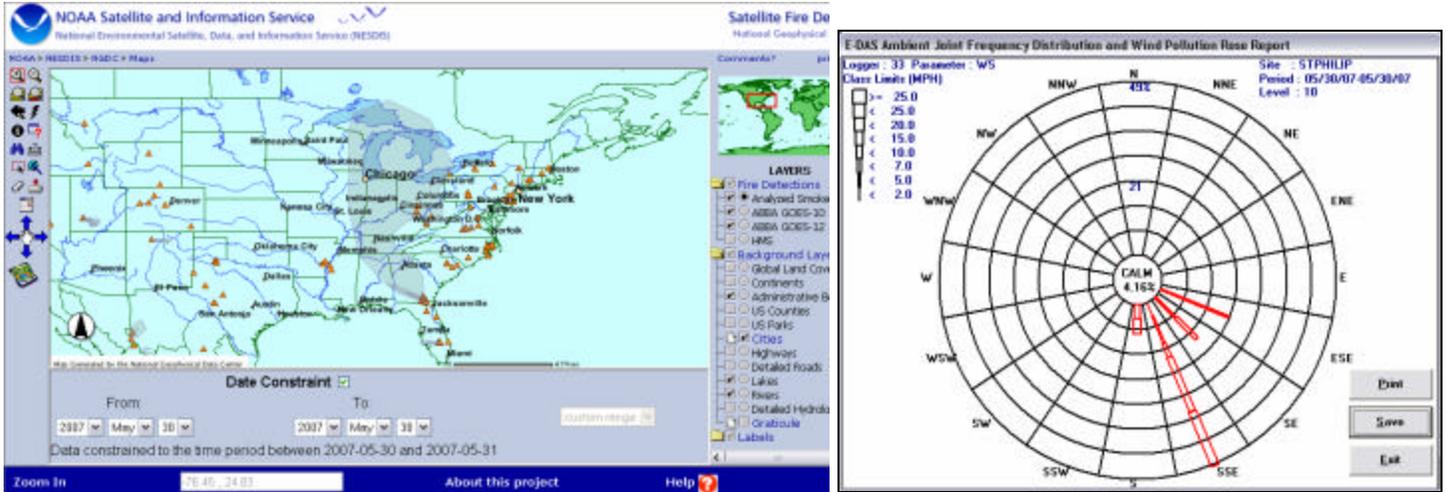
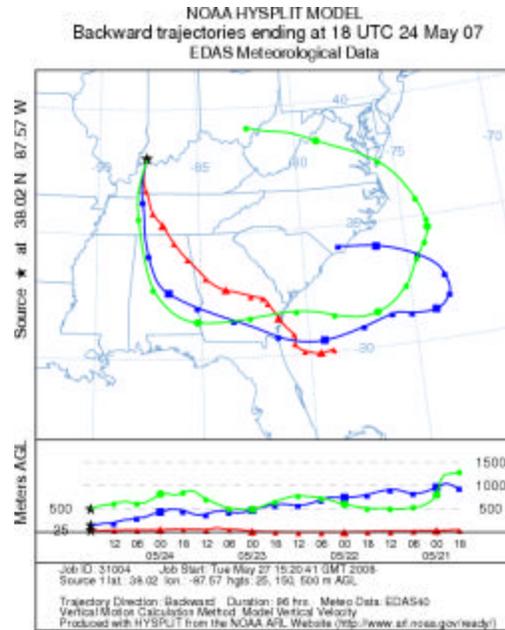


Figure 11.3 - May 30, 2007

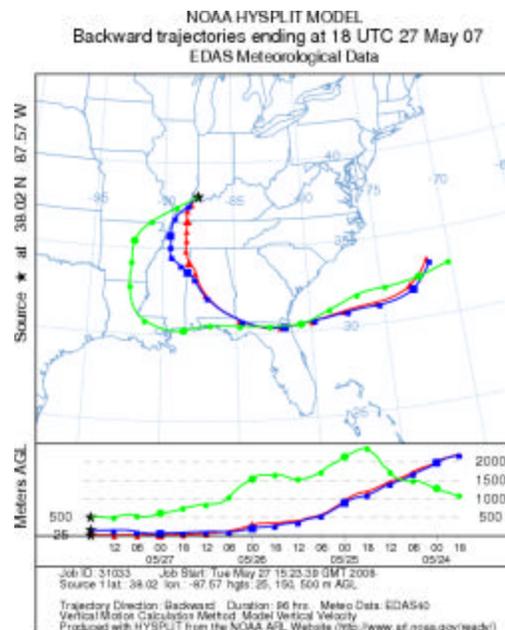
## Back Trajectory Models

### NOAA ARL READY HYSPLIT Maps

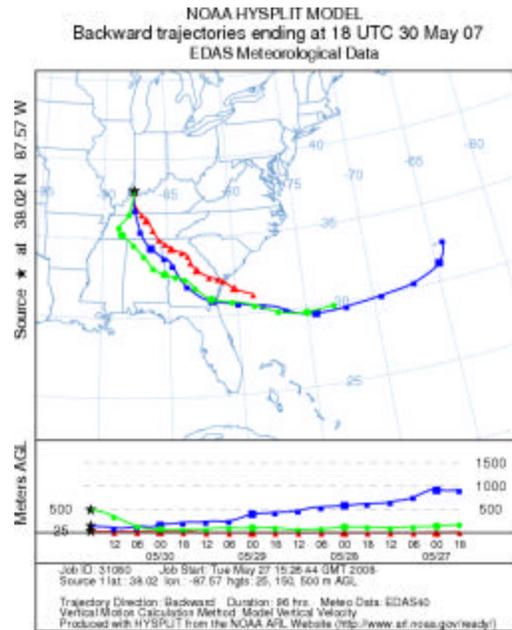
Draxler, R.R. and Rolph, G.D., 2003. HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (<http://www.arl.noaa.gov/ready/hysplit4.html>). NOAA Air Resources Laboratory, Silver Spring, MD.



**Figure 11.4:** Backward trajectories originating from Evansville on 5/24/07 at 12:00 PM CST showing the air mass passing over southern Georgia.



**Figure 11.5:** Backward trajectories originating from Evansville on 5/27/07 at 12:00 PM CST showing the air mass still arriving from over southern Georgia.



**Figure 11.6:** Backward trajectories originating from Evansville on 5/30/07 at 12:00 PM CST showing the air mass still passing over southern Georgia.

## 12 – Southeast Indiana Exceptional Events Detail

- Parameter: PM<sub>2.5</sub>
- Dates: May 24 – June 2, 2007
- Location: Jeffersonville / New Albany – Clark / Floyd Co.
- Event: Smoke from wildfires in northern Florida and southern Georgia impacted the Jeffersonville / New Albany region during the period of May 24 – June 2. The gradual buildup of smoke moving through the area during this period resulted in exceedances of the 24-hour PM<sub>2.5</sub> NAAQS on May 29<sup>th</sup> at Jeffersonville (18-019-0006) and June 2<sup>nd</sup> at both Jeffersonville and New Albany (18-043-1004). Elevated values were reported on all other days, as well.
- Data: Different analyses of the data are used to demonstrate that the PM<sub>2.5</sub> concentrations measured from May 24 – June 2 are beyond the range of values typically found during that time period and that they have been influenced by outside events. Table 12.1 shows daily PM<sub>2.5</sub> averages prior to, during and after the event with the values flagged in **bold**. Data have been flagged with an exceptional event flag of 'E' in AQS, awaiting concurrence from EPA.

Tables 12.2 and 12.3 list summaries of the data collected at the two sites since 2000. Data from 2007 are calculated with all current data and with the flagged data removed. There is an improvement in the status of the area as the Daily Design Value for the Jeffersonville 2005-2007 time period goes from 40 to 39.

The values recorded during the May 24 – June 2 time period are outside the normal values collected during the month of May. Prior to this time, the highest value reported in May at New Albany had been 26.5 ug/m<sup>3</sup> and the highest May average had been 15.96 ug/m<sup>3</sup>. With the high data collected in May 2007, the highest value was 29.7 ug/m<sup>3</sup> (35.4 on June 2) and the monthly average was 20.52 ug/m<sup>3</sup>. Removing the flagged data results in a maximum daily concentration of 28.8 ug/m<sup>3</sup> and an average concentration of 17.39 ug/m<sup>3</sup>.

The highest value reported in May at Jeffersonville since 2000 had been 30.7 ug/m<sup>3</sup> and the highest monthly average was 17.24 ug/m<sup>3</sup>. With the high data collected in May 2007, the highest value was 38.2 ug/m<sup>3</sup> (40.2 on June 2) and the monthly average was 21.9 ug/m<sup>3</sup>. Removing the flagged data results in a daily maximum of 30.7 ug/m<sup>3</sup> and an average concentration of 18.06 ug/m<sup>3</sup>.

At both sites, these values are much more in line with historical data. The summary data from the past months of May are in Table 12.4.

**Table 12.1 - FRM Daily Values Exceptional Event Period**

Values in **BOLD** are flagged as exceptional events

Date	Jeffersonville 18-019-0006	New Albany 18-043-1004
5/17/07	8.5	
5/18/07	7.5	4.5
5/19/07	15.7	
5/20/07	18	
5/21/07	24.3	18
5/22/07	25.5	
5/23/07	IN	
<b>5/24/07</b>	<b>32</b>	<b>29.7</b>
<b>5/25/07</b>	<b>32.8</b>	
<b>5/26/07</b>	<b>32.6</b>	
<b>5/27/07</b>	<b>28.9</b>	<b>25.4</b>
<b>5/28/07</b>	<b>33.8</b>	
<b>5/29/07</b>	<b>38.2</b>	
<b>5/30/07</b>	<b>29.2</b>	<b>28.4</b>
<b>5/31/07</b>	<b>33.4</b>	
<b>6/1/07</b>	<b>32.3</b>	
<b>6/2/07</b>	<b>40.2</b>	<b>35.1</b>
6/3/07	23.3	

**Table 12.2 - Historical Daily Values**

Year		Jeffersonville 181090005 & 6		New Albany 180431004	
		98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>
2000		41.3		36.5	
2001		41.7		38.2	
2002	2000- 2002	46.1	43	40.8	39
2003	2001- 2003	40.4	40	33.9	38
2004	2002- 2004	28.4	34	26.7	34
2005	2003- 2005	45.5	38	40.1	34
2006	2004- 2006	35.9	37	28.2	32
2007	2005- 2007	38.1	40	35.4	35
		Values excluding flagged data			
2007	2005- 2007	37	39	35.4	35

<sup>1</sup>Daily Design Value = 3 year average of annual 98<sup>th</sup> %ile values.

**Table 12.3 - Historical Annual Averages**

Year		Jeffersonville 181090005 & 6		New Albany 180431004	
		Annual Ave.	Annual Design Value <sup>2</sup>	Annual Ave.	Annual Design Value <sup>2</sup>
2000		18.6		16.3	
2001		16.9		15.7	
2002	2000- 2002	16	17.2	14.6	15.5
2003	2001- 2003	16.9	19.1	14.4	14.9
2004	2002- 2004	15.1	17.1	13.7	14.2
2005	2003- 2005	18.5	17.6	16.8	15
2006	2004- 2006	15	16.2	13.3	14.6
2007	2005- 2007	16.5	16.7	14.7	14.9
		Values excluding flagged data			
2007	2005- 2007	16	16.5	14.1	14.8

<sup>2</sup>Annual Design value = 3 year average of the annual averages.

**Table 12.4 – Examination of Daily Maximums and Averages for May Monitored Values for 2000-2007**

Year	Maximum Values		Monthly Averages	
	Jeffersonville	New Albany	Jeffersonville	New Albany
2000	25.7	21.2	17.24	15.96
2001	30.1	25.3	16.32	15.71
2002	21.2	21.2	14.78	14.05
2003	18.7	16.1	11.52	10.76
2004	22	21.9	14.1	13.27
2005	25.3	24.9	16.07	14.59
2006	22.5	26.5	11.6	10.39
2007	38.2	29.7	21.94	20.52
Values with flagged data removed				
2007	30.7	28.8	18.06	17.39

## Particulate

Composition: Speciation data are collected at the Southwick (21-111-0043) monitoring site in Louisville on a one in six day sampling schedule. Data are available for May 24 and May 30. High organic carbon values were reported on those two dates; 7.28 ug/m<sup>3</sup> and 7.92 ug/m<sup>3</sup> respectively. These values are in line with the high organic carbon values reported, in the 7 to 11 ug/m<sup>3</sup>, across the Midwest on these days. The high organic carbon values, without an increase in elemental carbon, are a very good indicator of biomass combustion.

The maps in Appendix 3 shows the rise and fall of the organic carbon values across the region over this time period.

Maps: Images of maps from NOAA Satellite and Information Services show the smoke plume originating from the northern Florida/southern Georgia region. Dispersion and movement of the smoke plume from these fires was generally to the west or northwest and then to the north. The daily satellite smoke photos show that the smoke plume from the fires comes into southern Indiana on May 23 and continues to influence the atmosphere until June 2. . The daily wind roses show information on prevailing wind direction, calm conditions and wind speed. (Note: Met data are from industrial site 180430004. Data were input into the State database to obtain the wind rose processed under the Charlestown site name.) NOAA weather maps are also used to show that an upper level trough greatly influences the direction of the plume in relation to the Jeffersonville / New Albany area.

## Trajectory

Modeling: The NOAA HYSPLIT Models are used to show wind trajectories at different levels during this event. Backward modeling from the Jeffersonville site (latitude: 38.28°; longitude: -85.74°) at elevations of 25m, 150m and 500m was conducted for a period of three (3) to four (4) days prior. The differing elevations were chosen to demonstrate the air mass's uniformity at ground-level where the samplers were located and aloft which avoids the ground-level limitations of the model. Forward modeling, Appendix 2, was conducted using the Bugaboo Scrub Fire as the starting point (latitude: 30.70°; longitude: -82.40°) at an elevation of 250 meters (appropriate height that is low enough to always be in the well-mixed zone and high enough to avoid the ground-level model limitation) and going three (3) to four (4) days. Overall, there is a very good correlation when comparing the forward and backward trajectories for a given date. For example, May 26 and 30 show a very narrow channel of air flow between southeastern Georgia and southeastern Indiana. Both the backward and forward trajectories confirm this. Forward trajectory modeling can be found in Appendix 2.

Conclusion: EPA defines an “exceptional event” as an unusual or naturally occurring event that can affect air quality but is not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the clean air act is not appropriate. Indiana has illustrated through the use of maps, meteorological data, speciation data, trajectory models and historical data that the smoke

from wildfires in Florida and Georgia impacted the Jeffersonville / New Albany region during the period of May 24 – June 2, 2007 causing exceedances of the PM<sub>2.5</sub> 24-hour standard and significantly increasing the annual average. When removing the data from this time period, the Daily Design Values at Jeffersonville for the 2005-2007 period drop from 40 to 39 ug/m<sup>3</sup>. According to 40 CFR Part 50.14 (b)(1), “EPA shall exclude data from use in determinations of exceedances and NAAQS violations where a State demonstrates to EPA’s satisfaction that an exceptional event caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section.” IDEM believes they have successfully illustrated the impact of this event on the sites in this region.

Therefore, IDEM requests that EPA concur with the ‘E’ flag on the data in AQS for the data in **bold** in Table 1.

## NOAA Satellite Smoke Maps, Weather Maps, and Wind Roses

The smoke map shows that the plume has reached the Jeffersonville / New Albany area and as shown in Table 12.1, PM<sub>2.5</sub> levels have started to increase. The corresponding wind rose and weather map further illustrate the direction of the plume by the location of the upper level trough (orange dashed line) and the S, SSW prevailing winds.

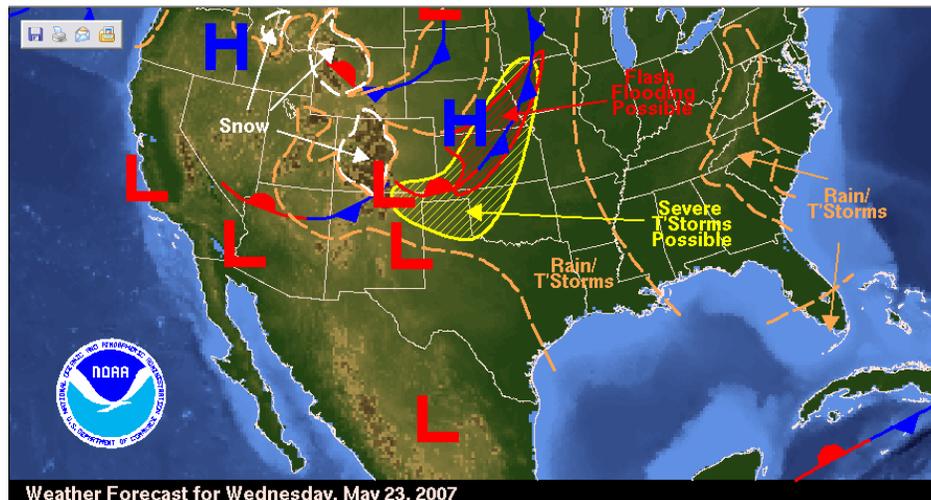
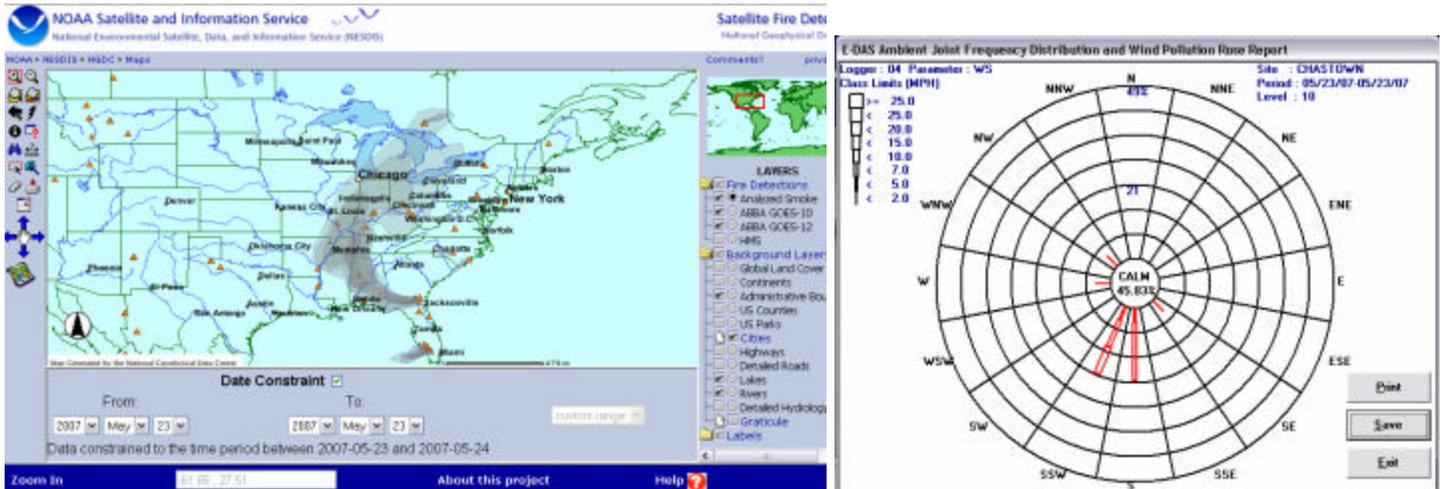


Figure 12.1 - May 23, 2007

The smoke map shows that the plume is remaining over the area. The prevailing wind direction has shifted to the SSW as the upper level trough moves further to the east and another trough develops over Ohio, keeping the plume over the SE Indiana region.

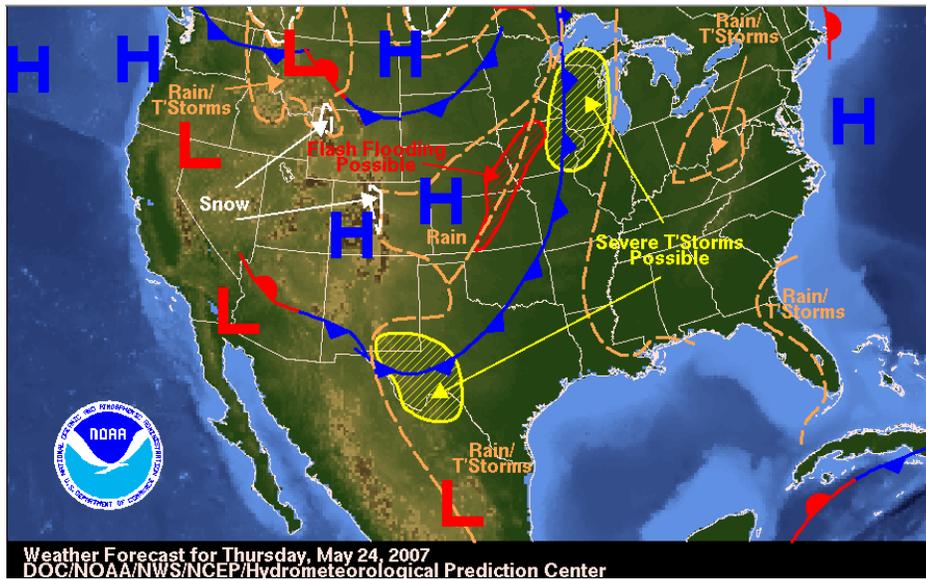
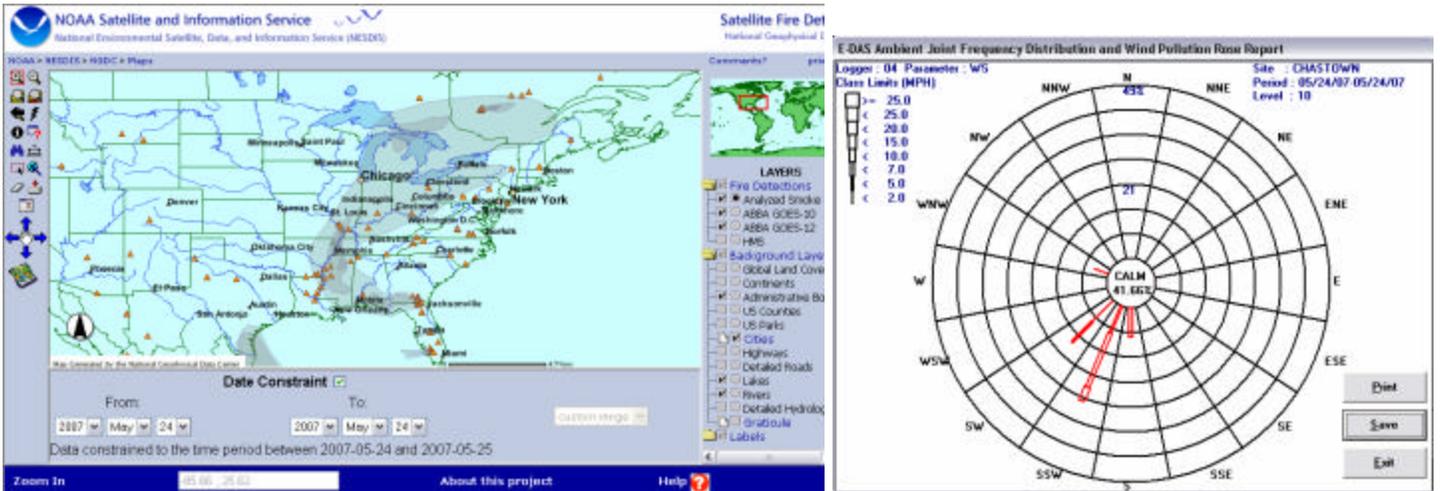


Figure 12.2 - May 24, 2007

The smoke map shows that the plume is remaining over the area. The prevailing wind direction continues to be from the south as the upper level trough has now moved directly over the SE Indiana region.

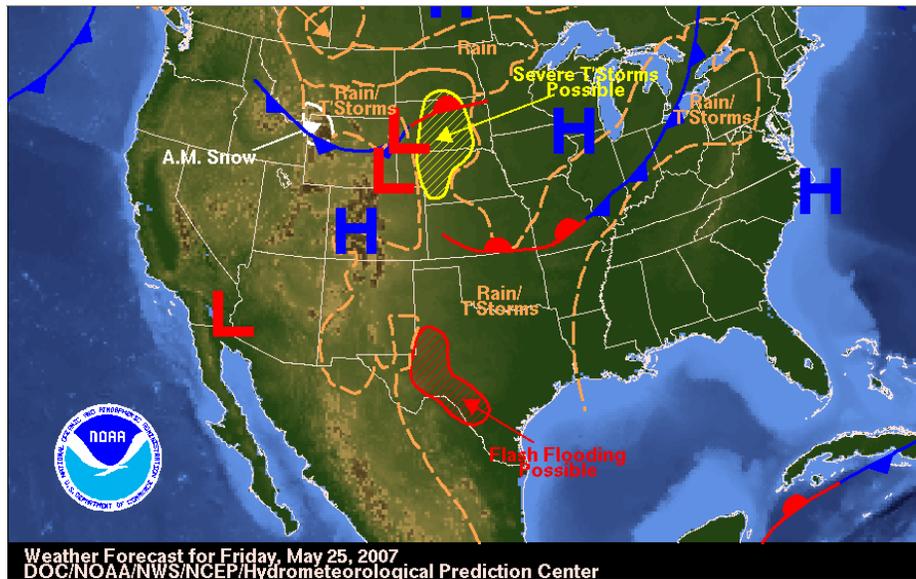
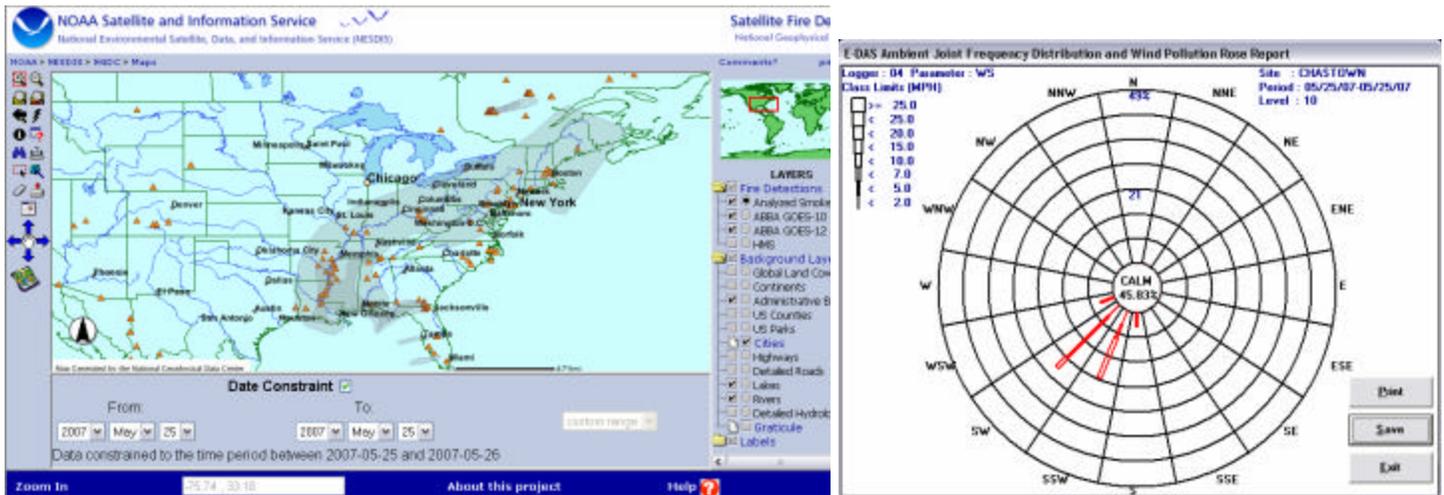


Figure 12.3 - May 25, 2007

The smoke map illustrates that the plume has essentially dissipated as the trough keeps the smoke pushed to the south. However, due to the prevailing calm wind conditions the stagnant air mass continues to cause the PM<sub>2.5</sub> levels to rise past the 24-hour standard.

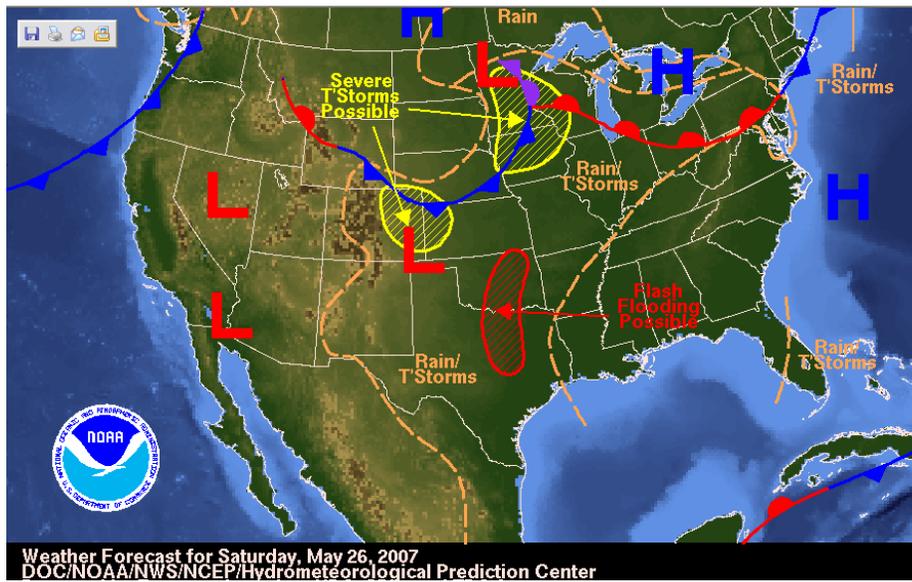
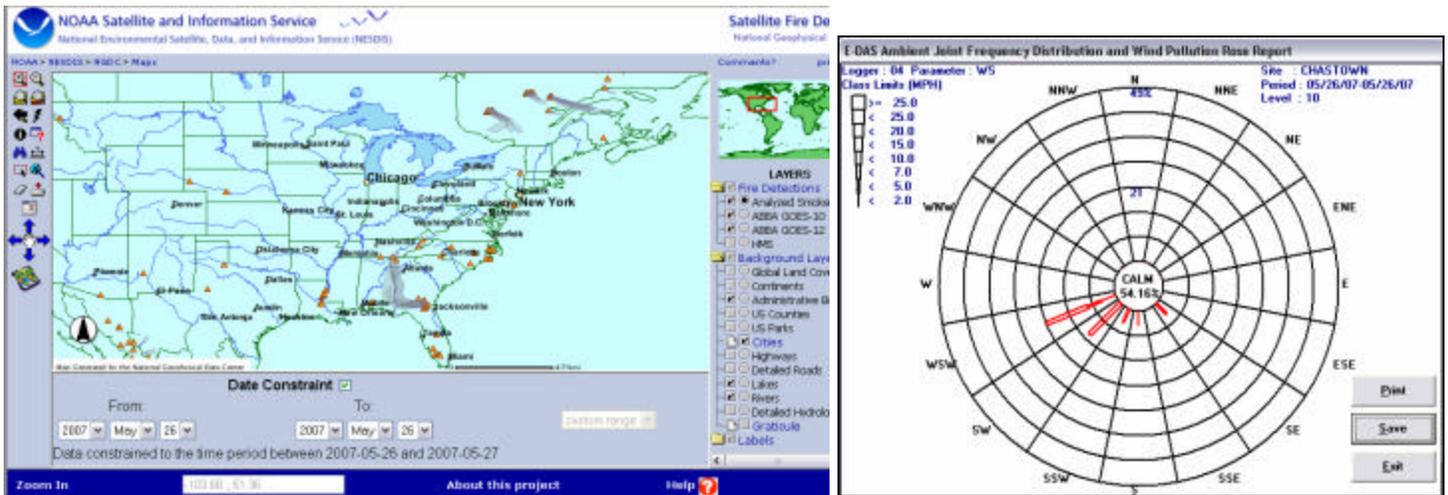


Figure 12.4 - May 26, 2007

The smoke map illustrates that the plume continues to stall as the trough continues to keep the smoke pushed to the south. However, due to the predominately calm wind conditions the stagnant air mass continues to cause the PM<sub>2.5</sub> levels to remain elevated.

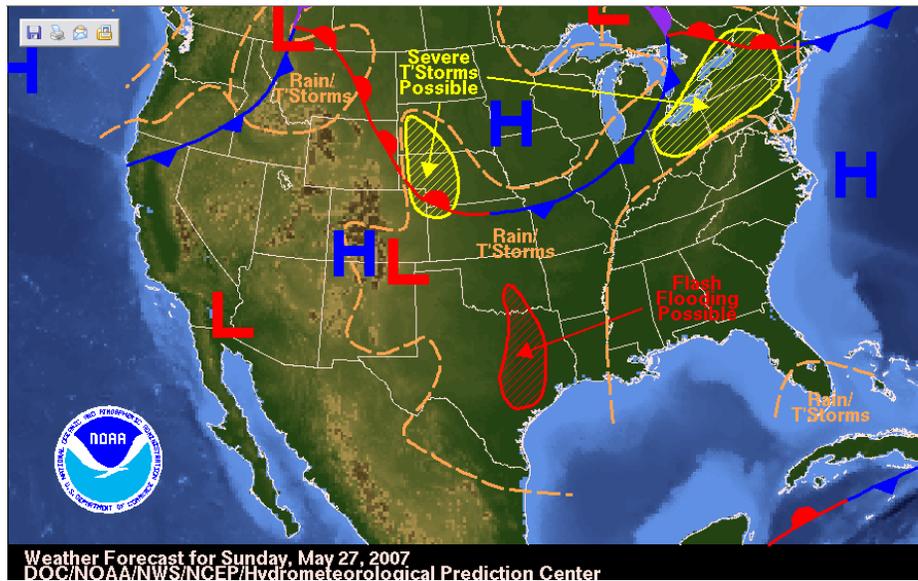
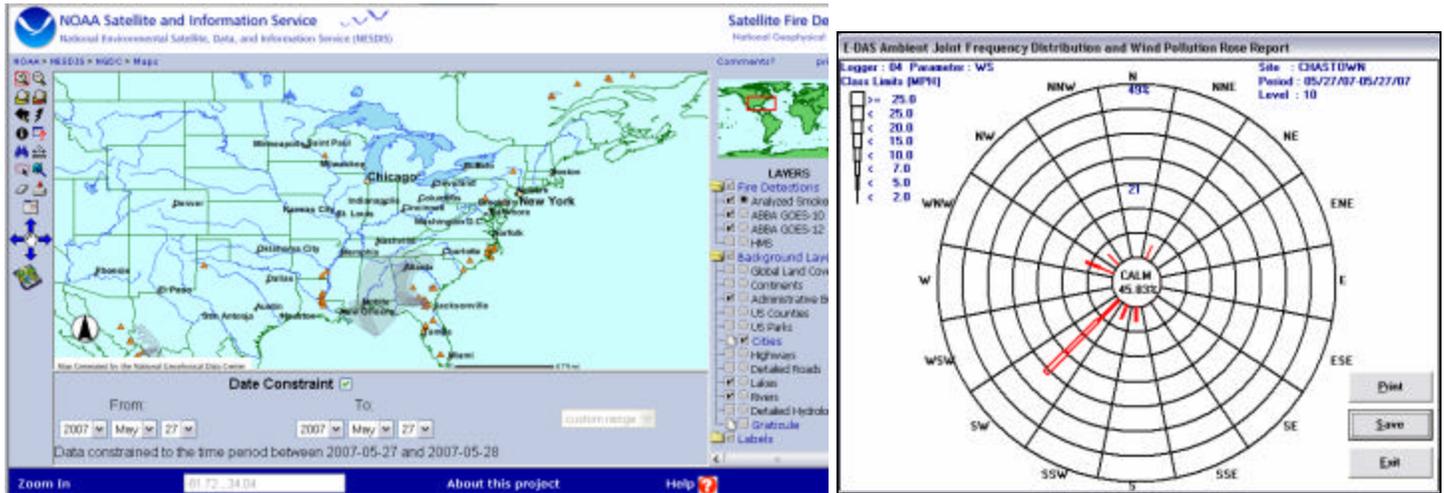


Figure 12.5 - May 27, 2007

The smoke map shows the plume has been pushed back into the region due to the upper level trough moving to the north and causing the plume to become more concentrated over the area.

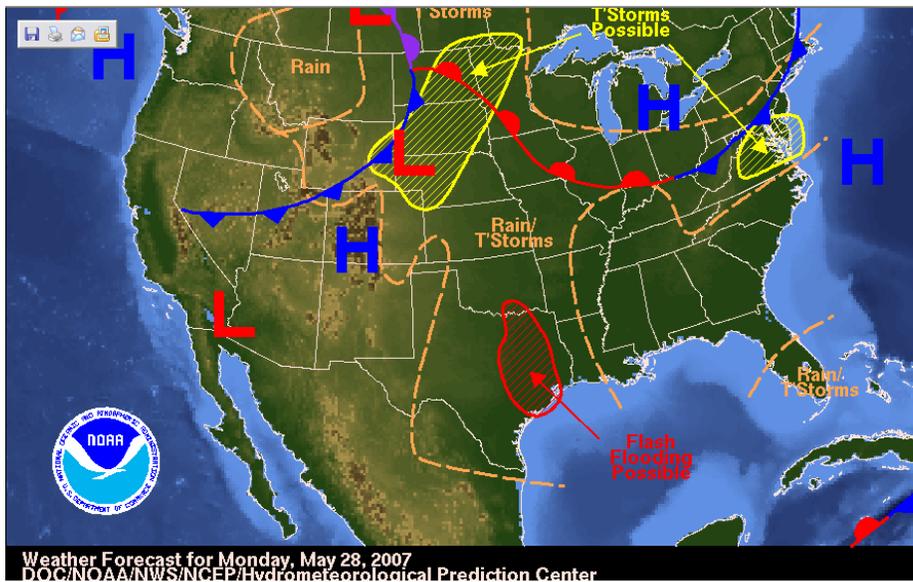
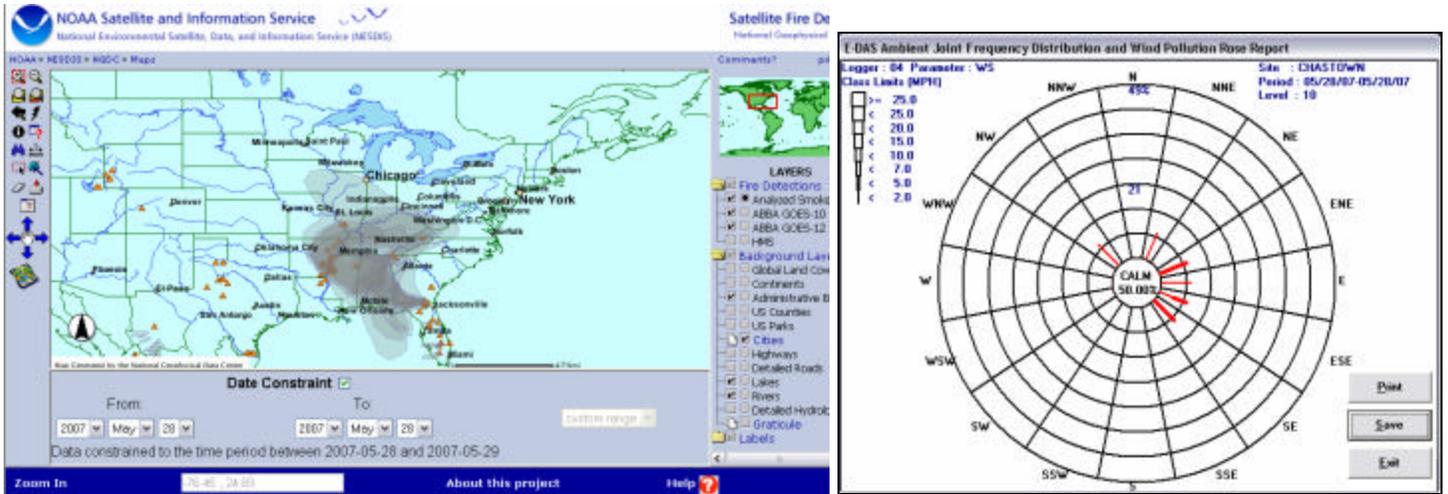


Figure 12.6 - May 28, 2007

Although the map illustrates the plume is not over the region, the prevailing SE wind direction, as shown by the wind rose, keep the high levels of PM<sub>2.5</sub> over the area.

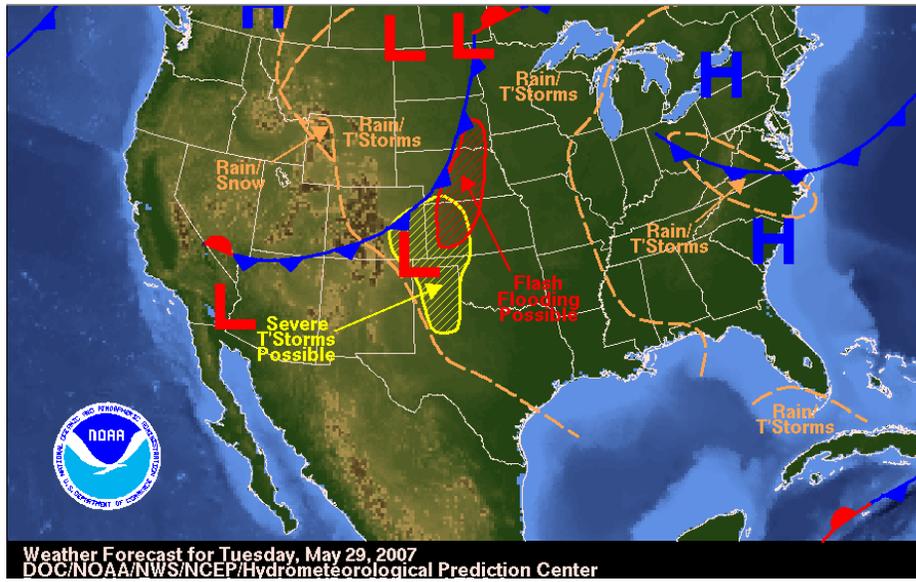
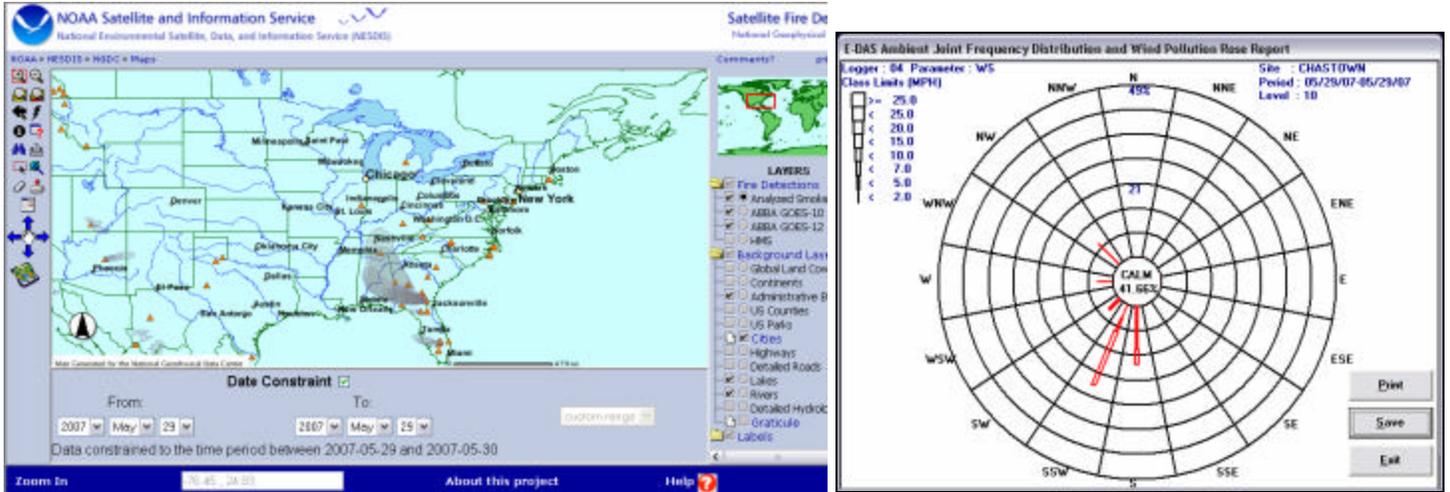


Figure 12.7 - May 29, 2007

The map shows the plume has moved back over the region as the upper level trough dips down over the area and the wind direction continues to be from the S, SW.

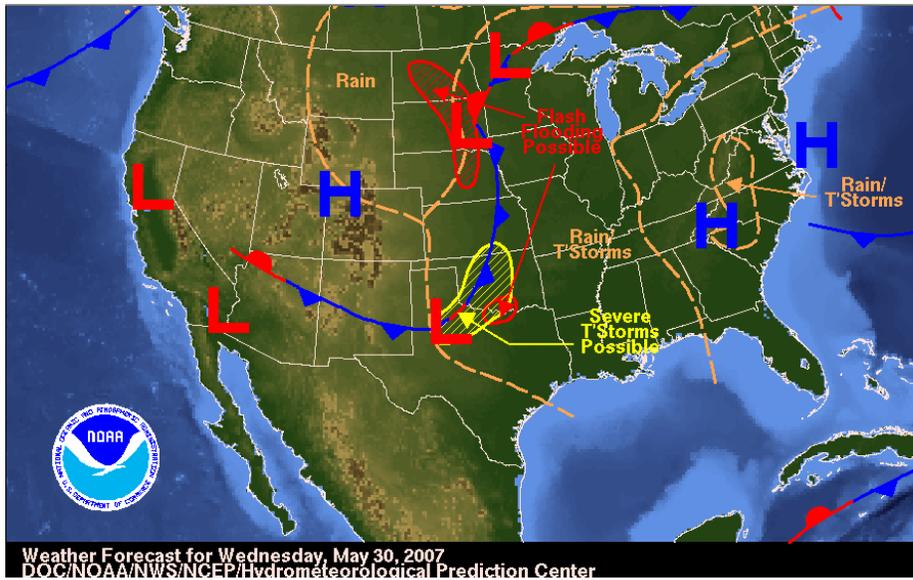
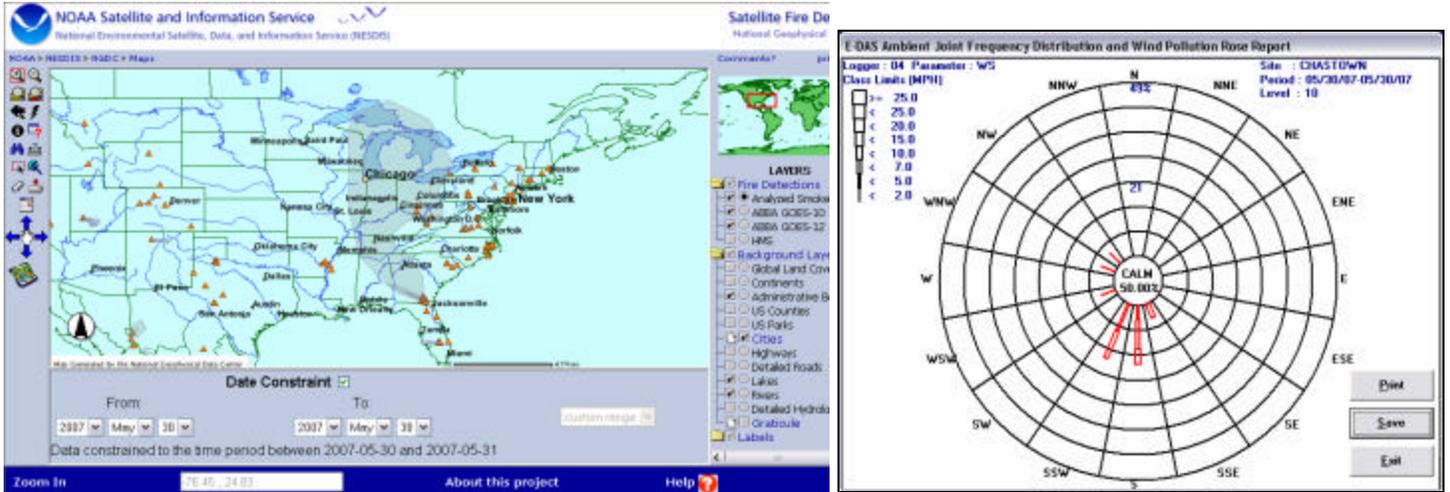


Figure 12.8 - May 30, 2007

The map shows the plume has dissipated as the upper level trough and increased wind speed have pushed the remaining smoke toward the east and out of the region. However, due to the prevailing calm wind conditions, high levels of particulate remain.

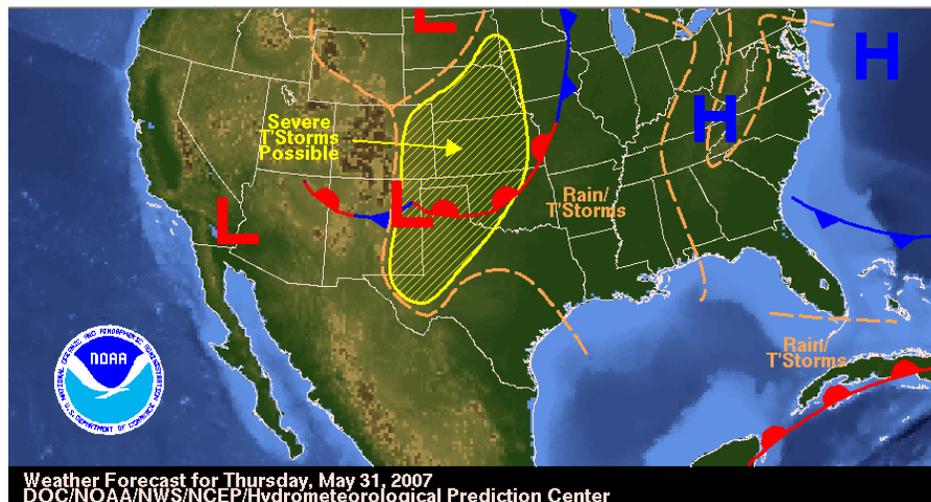
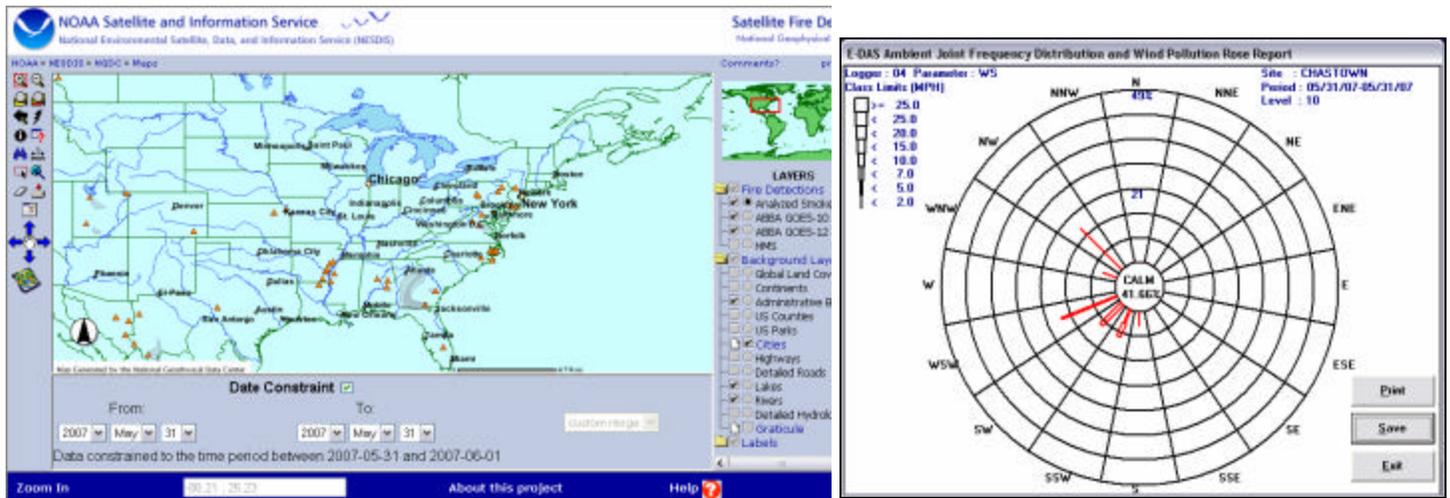


Figure 12.9 - May 31, 2007

The smoke map shows the plume has been pushed out of the region but due to the calm weather conditions, high levels of particulate remain.

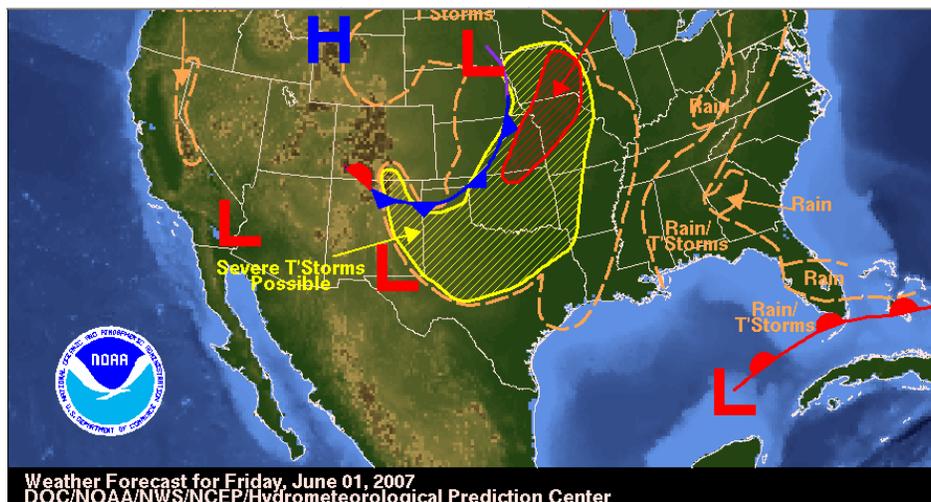
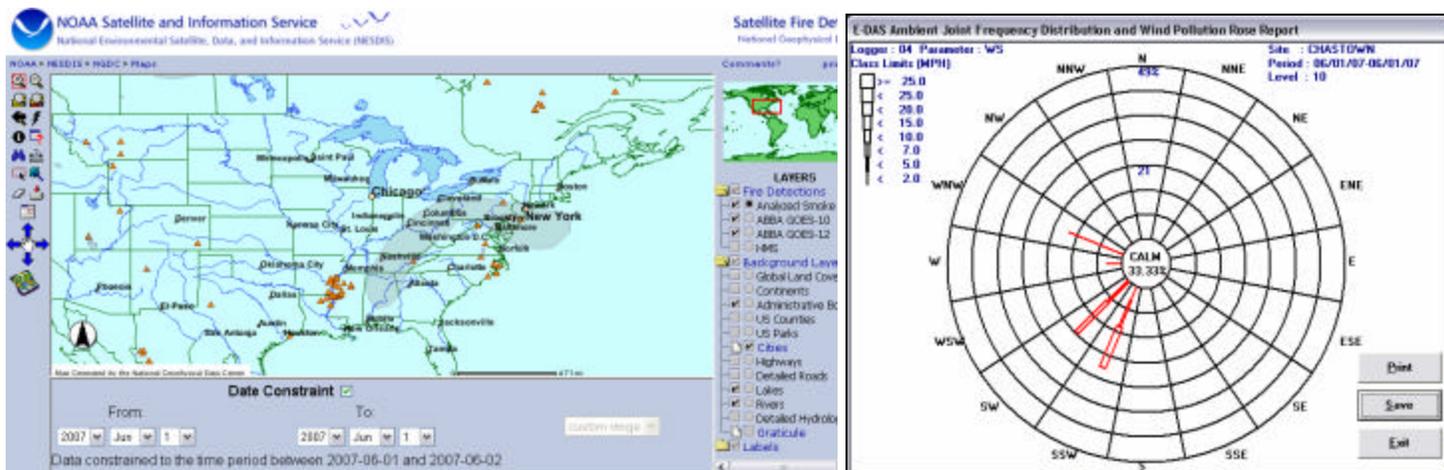


Figure 12.10 - June 1, 2007

The smoke map shows the plume has dissipated over the region but due to the calm weather conditions and a local fire, high levels of particulate remain.

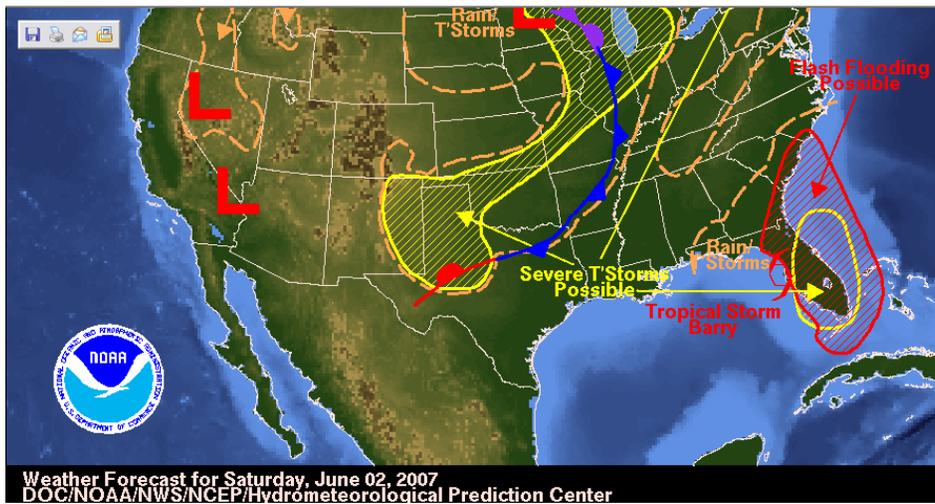
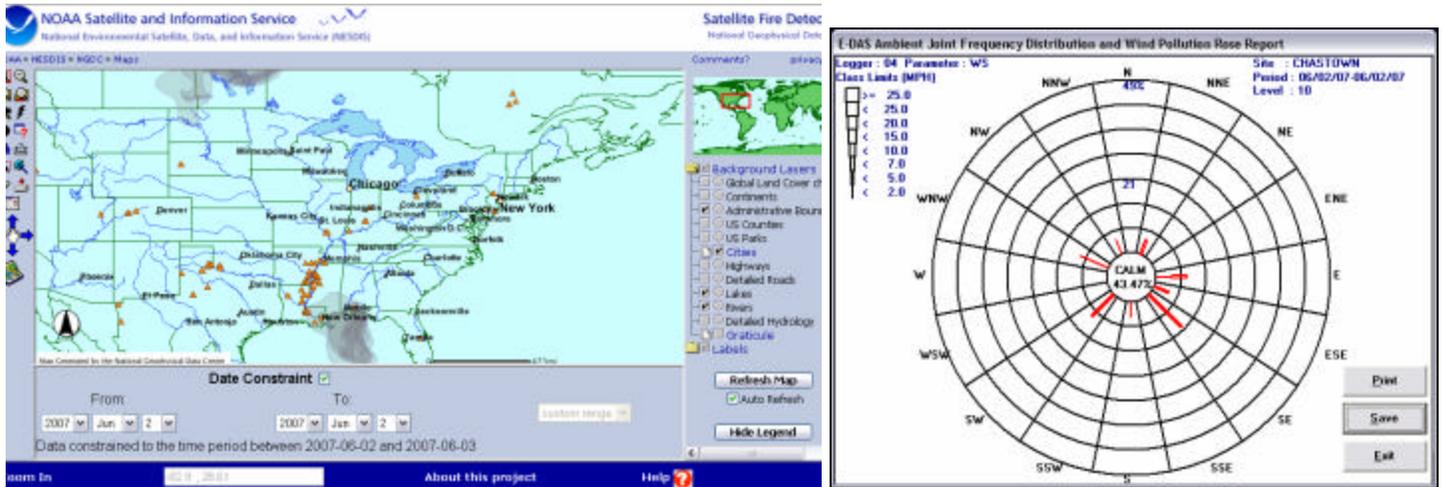
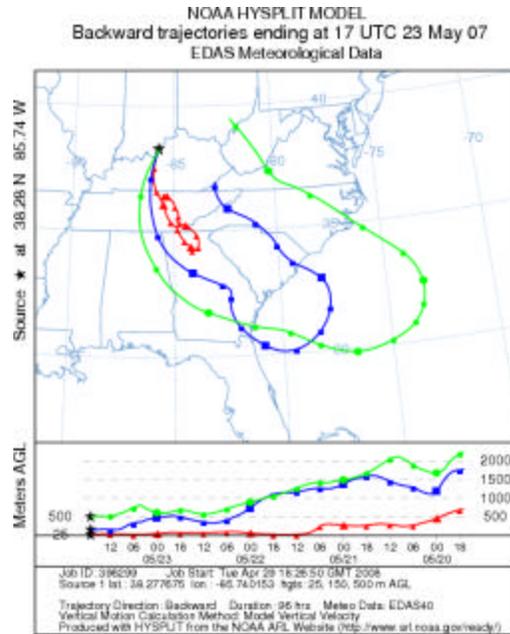


Figure 12.11 - June 2, 2007

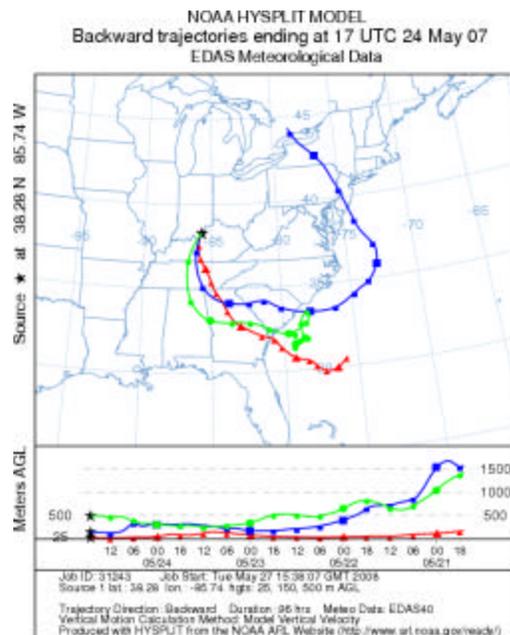
## Back Trajectory Modeling

### NOAA ARL READY HYSPLIT Maps

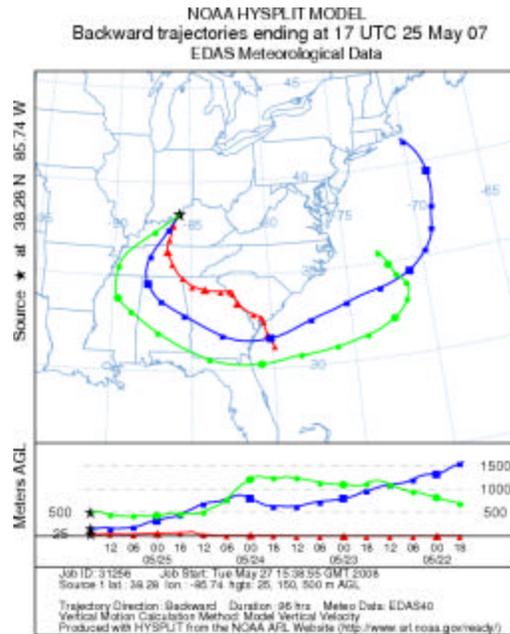
Draxler, R.R. and Rolph, G.D., 2003. HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (<http://www.arl.noaa.gov/ready/hysplit4.html>). NOAA Air Resources Laboratory, Silver Spring, MD.



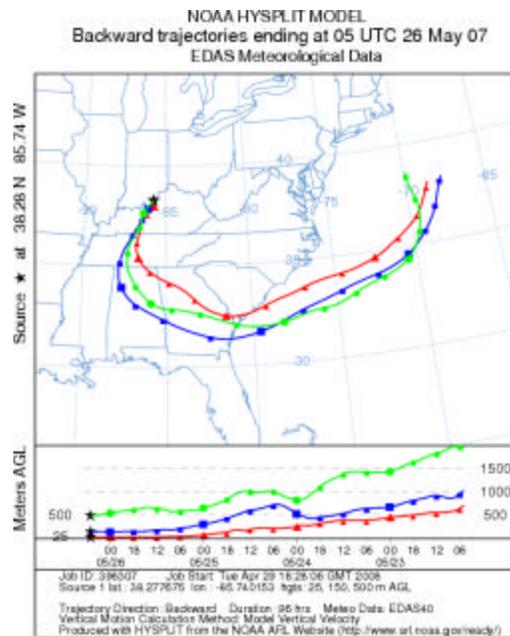
**Figure 12.12:** Backward trajectories originating from Jeffersonville on 5/23/07 at 12:00 PM EST showing the air mass passing over southern Georgia.



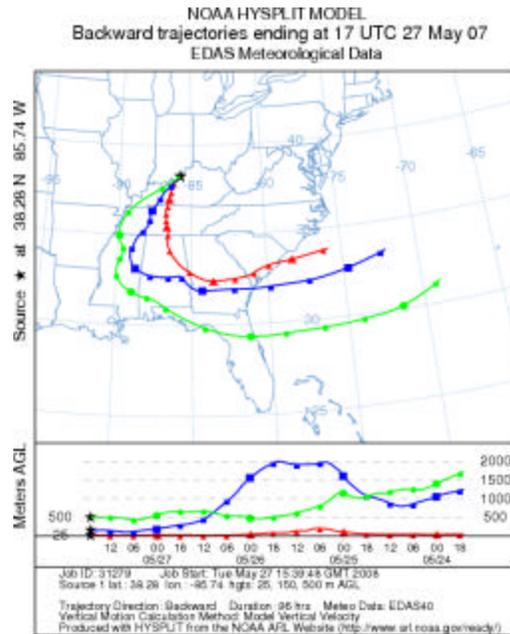
**Figure 12.13:** Backward trajectories originating from Jeffersonville on 5/24/07 at 12:00 PM EST showing continuation of the air mass passing over Georgia.



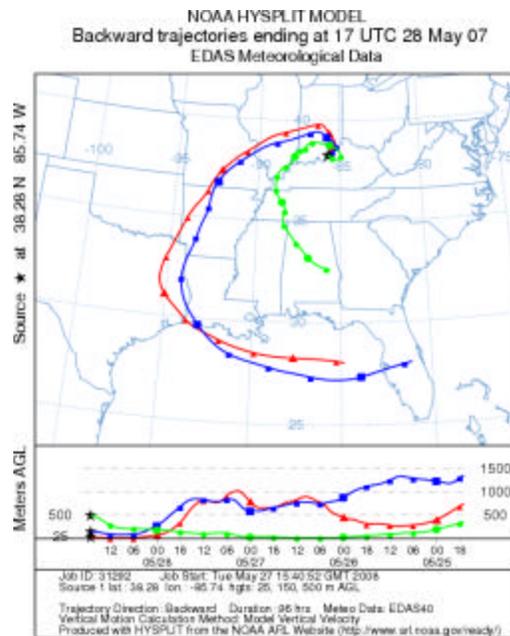
**Figure 12.14:** Backward trajectories originating from Jeffersonville on 5/25/07 at 12:00 PM EST showing the air mass still passing over southern Georgia and northern Florida.



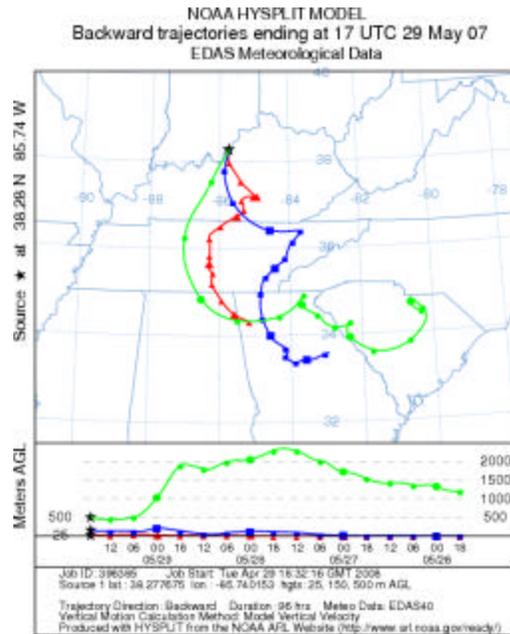
**Figure 12.15:** Backward trajectories originating from Jeffersonville on 5/26/07 at 12:00 AM EST showing continuation of the air mass passing over Georgia.



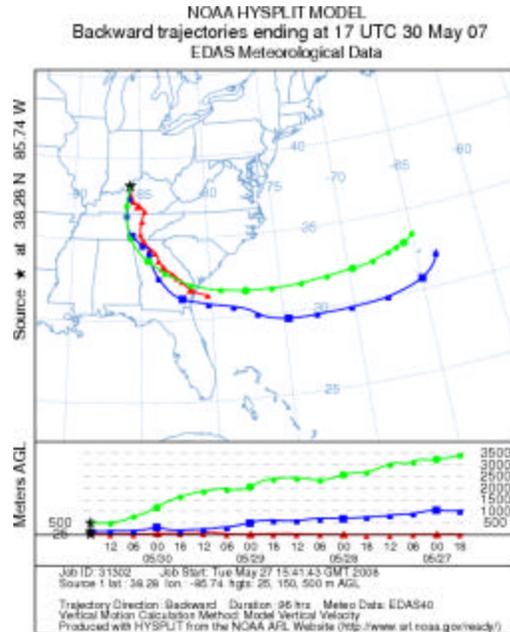
**Figure 12.16:** Backward trajectories originating from Jeffersonville on 5/27/07 at 12:00 PM EST showing continuation of the air mass passing over southern Georgia and northern Florida.



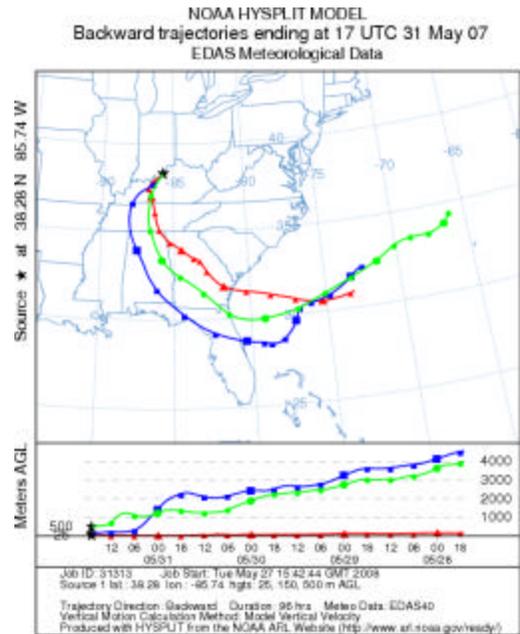
**Figure 12.17:** Backward trajectories originating from Jeffersonville on 5/28/07 at 12:00 PM EST showing continuation of the air mass passing over central Florida.



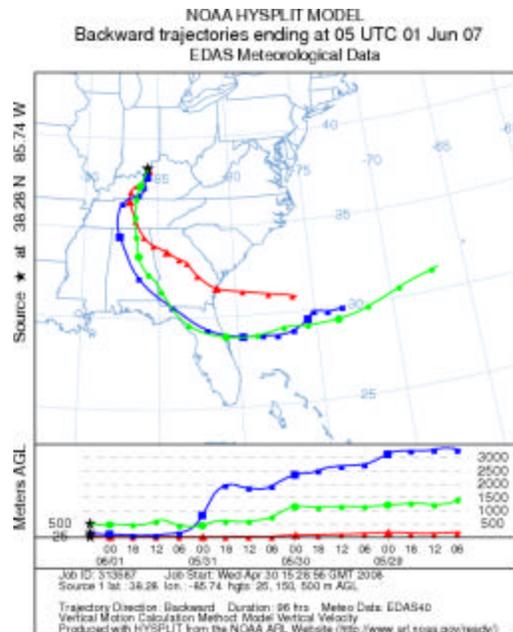
**Figure 12.18:** Backward trajectories originating from Jeffersonville on 5/29/07 at 12:00 PM EST showing the air mass continuing to originate from Georgia.



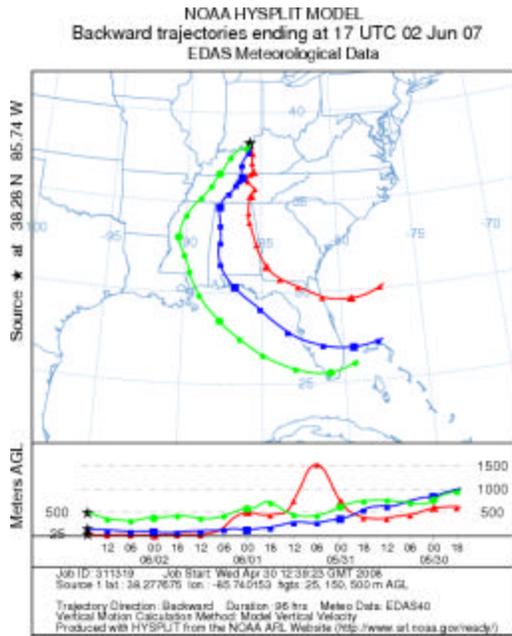
**Figure 12.19:** Backward trajectories originating from Jeffersonville on 5/30/07 at 12:00 PM EST showing consistency in the air mass passing over southern Georgia and northern Florida.



**Figure 12.20:** Backward trajectories originating from Jeffersonville on 5/31/07 at 12:00 PM EST showing consistency in the air mass passing over southern Georgia and northern Florida.



**Figure 12.21:** Backward trajectories originating from Jeffersonville on 06/01/07 at 12:00 AM EST showing the air mass still passing over southern Georgia and northern Florida.

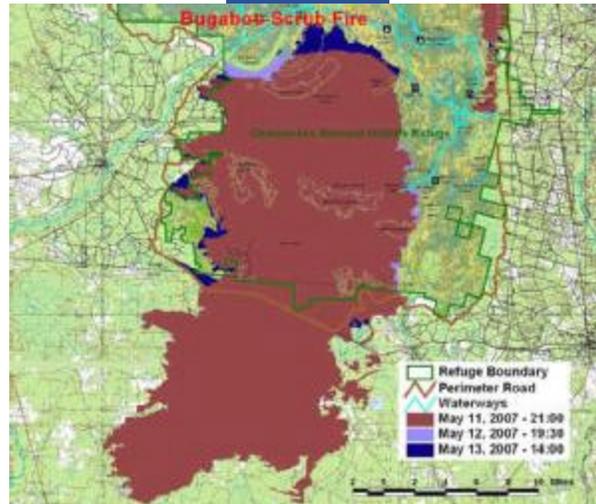


**Figure 12.22:** Backward trajectories originating from Jeffersonville on 6/02/07 at 12:00 PM EST showing continuation of the air mass passing over Florida.

# Appendix 1 Fire Information

Figure 1

[+ Enlarge](#)



Large Map of 233,718-acre Bugaboo Scrub Fire on May 13

Figure A1.1 – Bugaboo Scrub Fire

Article from AP for New4Jax.com

## Bugaboo Scrub Fire Dubbed Largest In Florida History

### *Firefighter: We're Here For Long Haul*

UPDATED: 10:42 am EDT May 17, 2007

**LAKE CITY, Fla.** -- After getting a firsthand look at the fire damage from the Bugaboo Scrub Fire, Florida's Lt. Gov. Jeff Kottkamp spoke with the residents of Columbia County, calling the 180-square-mile blaze that burned out of the Okefenokee Swamp last week the largest in Florida history.

"One of the purposes for me to be here along with other representatives is to make sure that we have provided every single resource we can," Kottkamp said at Wednesday's briefing.

As of Wednesday morning, 419 state and federal forestry personnel plus more than 200 local firefighters on structure-protection teams were working to contain the blaze. Six aircraft, 23 bulldozers and 37 fire engines were committed to fighting the blaze that has consumed 370 square miles of dry woodlands in three counties.

Firefighters were able to take advantage of light winds to fortify containment lines to protect 725 evacuated homes, making progress and holding a raging wildfire in check in north Florida.

Although most of the fire is a few miles north of Interstate 10, flames are creeping toward U.S. Route 441, where most of the evacuations were.

Officials said keeping the fire east of the highway is crucial because if the fire spreads another one or two miles to the west, at least 1,500 more homes would have to be evacuated, including those northwest Columbia County and Hamilton County.

While the smoke had lifted enough to open interstates 10 and 75 to traffic, drivers were warned periodic closures were possible. U.S. 441 remained closed from I-10 north to Homerville, Ga.

Firefighters have been able keep the blaze away from widely scattered rural homes -- the nearest it has gotten to the highway is about a mile.

The Red Cross shelter at Columbia County High School remained open Wednesday.

Ashsah Dees, 34, and her 9-year-old daughter, Meagan, were among those evacuated.

"I live in the middle of the Osceola National Forest. It could come at my house from any direction," she said. "You bet I'm worried."

Dees said she was able to go home for a few minutes and saw a tanker truck sitting in her front yard, which made her feel better.

Florida Division of Forestry spokesman Jim Harrell said calm winds allowed firefighters to work Wednesday on strengthening their containment lines to prevent the fire from spreading to nearby homes.

More good news announced at Wednesday afternoon's information briefing was that the 119,500-acre wildfire was 65 percent contained.

However, Harrell said the weather would likely worsen next weekend, with strong winds and high temperatures that could allow the blaze to spread.

The fire commander said it would take a significant amount of rainfall before the fire would be completely out.

On Tuesday, 50-foot flames exploded through a stand of trees as a helicopter made three water drops to help cool the raging inferno.

Firefighters, however, said they are making good progress on containing the massive fire that spread into Florida and raged through the Osceola National Forest, heading west, north of Lake City.

"We're just throwing everything that we have at it," said Forestry's Russell Hubright said. "We've got air tankers flying, we've got helicopters flying, we've got dozers plowing, we've got hand crews working. We're doing everything we can, all the strategies we can to tame this beast."

The flames jumped containment lines three times on Monday as brisk winds, low humidity and high temperatures made work difficult for an army of local, state and federal firefighters. But on each occasion, firefighters were able to quickly extinguish the blazes.

There were no reports Wednesday of fires jumping fire lines and the fire.

"The advance of the fire is slowing. We've been very, very successful at holding these lines," incident Cmdr. Joe Ferguso said. "But we're not going to let our guard down."

Firefighters call it the Bugaboo Scrub Fire for the island in the Okefenokee Swamp where it started with a lightning strike 10 days ago.

One fire crew drove 2,200 to Florida from California to help fight the blaze.

"Firefighting is my No. 1 passion in life. It's what I want to do. There's no better way to spend my 21st birthday than being out here on the fire," said California firefighter Cory Wilford.

Sixteen-hour shifts have firefighters fighting fatigued but still valiantly battling the blaze.

"One of the guys on the line asked me this morning, 'How much more can a person take?' You just kind of wonder, but the guys just keep on going -- they have to do it. The men and women fighting this fire just have a dedication to it, and they're going to stay here until it's out," said Hubright.

"We're in here for the long haul. I have 12 more days before I get to go home," said Baker City, Ore., firefighter Jeff Trevor.

Columbia County schools were open on Wednesday.

Lake City has declared a water shortage, asking homes and businesses not to irrigate and to suspend nonessential uses of water to ensure there's enough water for firefighting efforts.

## After One Month, Fires Still Threaten South Georgia

Four weeks ago, a power line falling in dry brush south of Waycross started a fire that forced hundreds from their homes, destroyed more than a dozen homes, kept Ware County schools closed for more than a week and continues to burn out of control -- mostly in the National Wildlife Refuge and surrounding stands of timber.

This blaze, called Sweat Farm-Big Turnaround Fire, has burned 138,500 acres in Ware and Northern Charlton counties since April 16. While it was called the largest fire in since record keeping began in 1957, the Bugaboo Scrub Fire is the bigger focus of firefighting. In eight days, it has spread over 250,852 acres on both sides of the state line. The only mandatory evacuation remaining in south Georgia was changed to precautionary Monday night, meaning people in Reeves Landing and Moniac could return home but need to be prepared to leave again with 12- to 24-hour notice if conditions change.

"Everybody's being told not to let their guard down, don't unpack," said Laura Polant, a fire information officer in Fargo. "Residents are still being told to be prepared to leave, because the call can come at any time."

Deep in the Okefenokee National Wildlife Refuge a crew of fire fighters set brush ablaze Tuesday to help stem the growth of the largest wildfire in the Georgia's history.

The controlled burn -- called a "burnout" -- was along a road in the refuge about two miles from the main blaze.

"This is one of the biggest tools that we have to put the biggest fires out," said Craig Daugherty, a firefighter from New Mexico. "It robs the main fire of fuel."

Firefighters walk along the brush holding torches that drip fire. The brush is so dry that flames quickly shoot 20 to 30 feet in the air, sending hot embers and thick black smoke into the sky.

In Georgia, portions of state roads 94 and 177 remain closed, although state Road 177 south of U.S. Highway 1 has reopened. U.S. 441 is closed at the Florida border.

The Wildlife Refuge and Georgia's Steven C. Foster State Park inside it remained closed, but Okefenokee Swamp Park has reopened.

The airport in Folkston, Davis Field, remains closed.

Haze from the fires has traveled as far south as the Miami area, about 340 miles away.

## Other Florida Fires

The Florida Department of Forestry reported 237 active fires burning 164,226 acres on Monday morning.

While the Bugaboo Scrub fire was by far the largest in the state, smaller fires that threatened northeast Florida were largely contained.

The 15,000-acre fire that kept people out of their homes and roads closed in **Bradford County** much of last week was 80 percent contained, Florida officials said on Monday morning.

The last evacuation orders in Bradford County were lifted over the weekend.

One home and two outbuildings were destroyed as the fire was burning out of control on Tuesday.

Starke, Fla., got only .10-inch of rain on Sunday, while parts of Gainesville received up to 4 inches.

Two fires that burned over 9,000 acres in **Flagler County** last week were 65 and 70 percent contained, with officials saying Monday that firefighters were overseeing containment and mopping up hot spots at fires near Deland and near the Flagler-Volusia border. ([FlaglerEmergency.com](http://FlaglerEmergency.com))

# Giant Wildfires Merge Into One

Provided By: [The Associated Press](#)  
Last Modified: 5/23/2007 4:22:42 PM

UNDATED (AP) -- Shifting winds have moved the smoky haze caused by the wildfires burning in southeast Georgia away from the metro Atlanta area.

Officials said two large forest fires that started in southeast Georgia have merged in the Okefenokee Swamp -- creating one tremendous wildfire.

Fire has blackened more than 473,000 acres of forest and swampland in drought-stricken Georgia and north Florida. Commercial timber losses are estimated at well over \$30 million.

One fire -- known as the Sweat Farm Road Fire -- started April 16 when a tree fell onto a power line near Waycross. The second blaze -- called the Bugaboo Fire -- started by lightning in the Okefenokee on May 5 and rapidly spread into Florida.

Tuesday, a task force monitoring the blazes for the two states said the fires in Georgia have burned more than 350,000 acres, and nearly 123,000 acres in Florida.

For the second time in a week, southeast winds brought smoke from the fires near the Georgia-Florida line into north Georgia Tuesday.

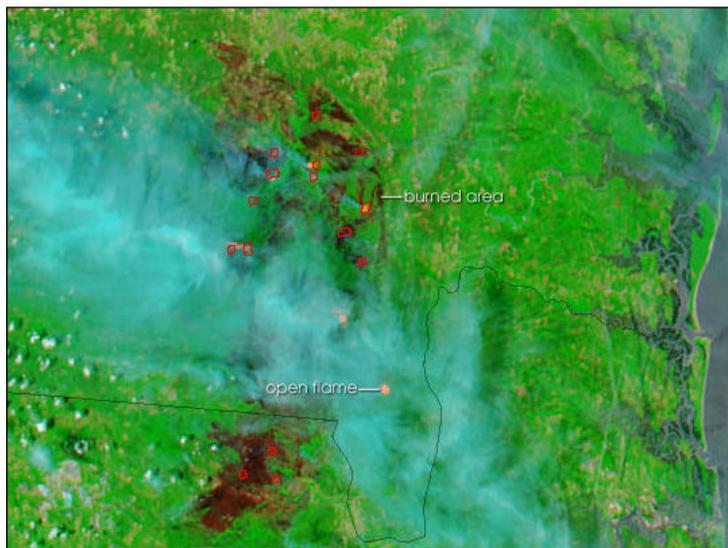
Forecasters said wind swinging to the east later in the day should bring fresher air from the Atlantic and the Carolinas, and that a front moving through the area today also should bring some relief.

(Copyright 2007 by The Associated Press. All Rights Reserved.)

[Natural Hazards](#) >> [Fires](#) >> Fires in Georgia and Florida



natural color (visible light)



false color (visible, shortwave, and near-infrared light)

[Click here to view high-resolution version \(1.2MB\)](#)  
Image Acquired: May 30, 2007

## Fires in Georgia and Florida

Scattered clouds over Florida and Georgia during the last week of May 2007 made it difficult for NASA satellites to

capture images of the sprawling Bugaboo and Big Turnaround Complex Fires. The Bugaboo Fire had been burning on either side of the state line in the Okefenokee Swamp since the first week of May. The Big Turnaround Complex southeast of Waycross, Georgia, had been burning since mid-April.

This pair of partly cloudy images was captured by the Moderate Resolution Imaging Spectroradiometer ([MODIS](#)) on NASA's [Aqua](#) satellite on May 30, 2007. The top image is a photo-like version of the area, while the bottom image is an infrared-enhanced version that highlights the burned areas. Places where MODIS detected actively burning fire are outlined in red. In this type of false-color image, bright pink (glowing) areas often indicate open flame. (The absence of a "hotspot" outline around some of these glowing areas is probably because clouds or smoke interfered with the automatic fire-detection process.) The exact boundary between the fires is not clear; in essence there is a mammoth fire burning in a broken line more than 50 miles long. A swath of clouds, partially mingled with smoke, cuts through the scene.

Southern Georgia and Florida are experiencing extreme drought. In the normally swampy terrain that is common in this part of the country, dead vegetation accumulates without completely decaying because it is frequently submerged in water. When these layers of dead vegetation, or peat, dry out, they are extremely flammable. Fire officials have said that these fires could burn for months; heavy rains over an extended period of time will likely be needed to totally extinguish them.

The large image provided above is the infrared-enhanced version at a spatial resolution (level of detail) of 250 meters per pixel. The MODIS Rapid Response Team provide twice-daily images of this area in both natural and false color in additional resolutions via a [clickable map](#).



#### Where in the World

**Image Posted**  
May 31, 2007

**Satellite & Sensor**  
Aqua - MODIS

#### Other Images for this Event

Posted: [May 21, 2007](#)  
Posted: [May 17, 2007](#)  
Posted: [May 09, 2007](#)  
Posted: [May 08, 2007](#)  
Posted: [May 03, 2007](#)  
Posted: [Apr 30, 2007](#)

#### Fires Latest Events

[Fires in Victoria, Australia](#)  
[Fires in Mexico and Guatemala](#)  
[Burn Scar near Fort Carson, Colorado](#)  
[Fires Spread Smoke over Buenos Aires](#)  
[Fires in the Southern Plains](#)  
[Fires in Southern Russia](#)

NASA image courtesy the [MODIS Rapid Response Team](#),  
Goddard Space Flight Center .

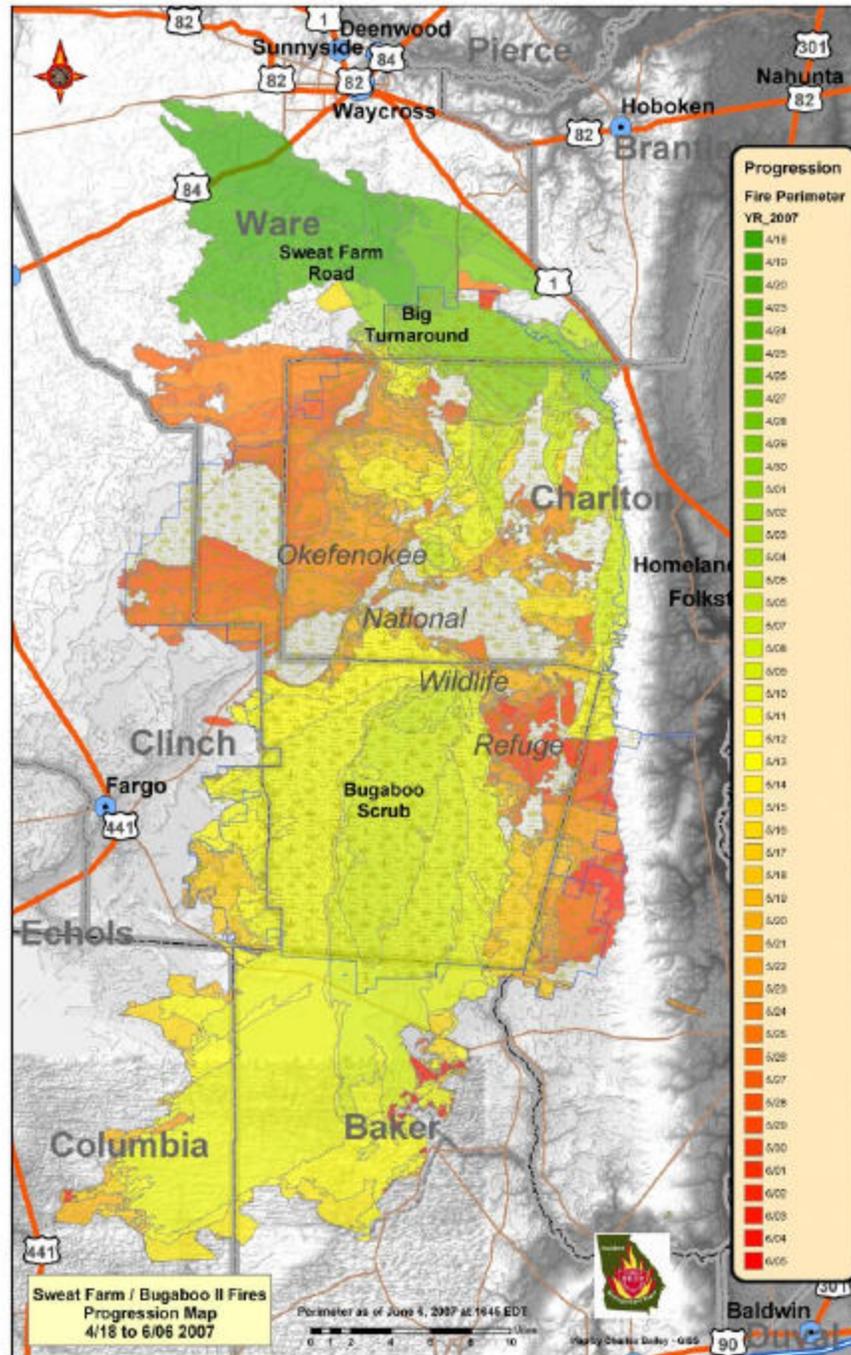


Figure A1.2: Fire progression map of combined swamp fires in Georgia and Florida from April to June 2007.

## Appendix 2: Forward Trajectories

Draxler, R.R. and Rolph, G.D., 2003. HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (<http://www.arl.noaa.gov/ready/hysplit4.html>). NOAA Air Resources Laboratory, Silver Spring, MD.



Figure A2.1: A forward trajectory originating from Georgia near the Bugaboo fire on 5/19/07 at 12:00 PM EST showing the air mass passing by Indiana through the night of 5/22/07 to 5/23/07.

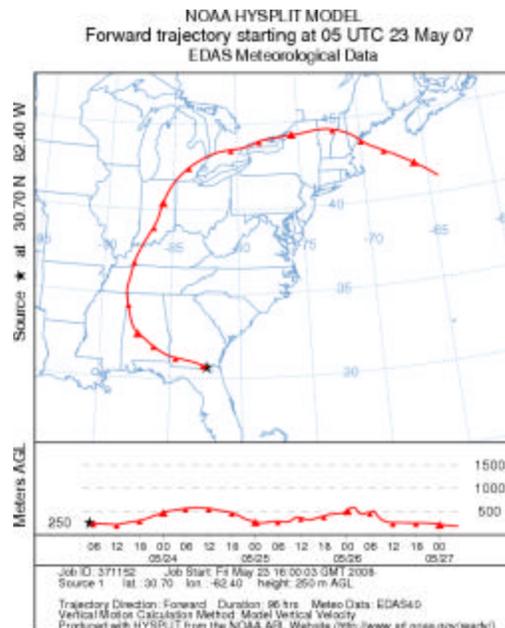


Figure A2.2: A forward trajectory originating from Georgia near the Bugaboo fire on 5/23/07 at 12:00 AM EST showing the air mass passing Indiana during the day of 5/24/07.

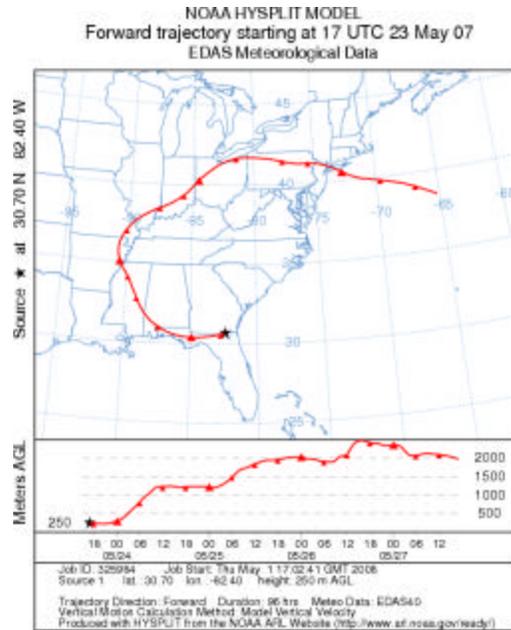


Figure A2.3: A forward trajectory originating from Georgia near the Bugaboo fire on 5/23/07 at 12:00 PM EST showing the air mass passing over Indiana during the day of 5/25/07.

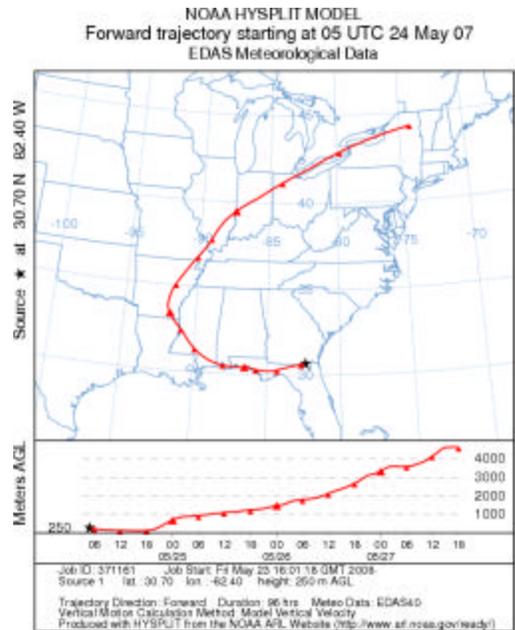


Figure A2.4: A forward trajectory originating from Georgia near the Bugaboo fire on 5/24/07 at 12:00 AM EST showing the air mass passing over Indiana during the day of 5/26/07.

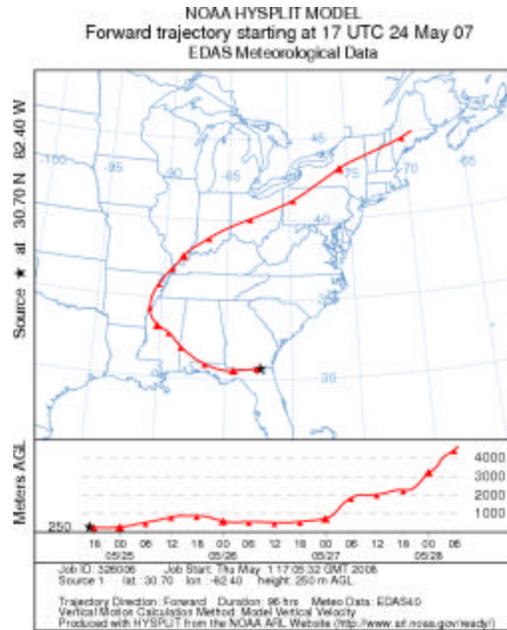


Figure A2.5: A forward trajectory originating from Georgia near the Bugaboo fire on 5/24/07 at 12:00 PM EST showing the air mass passing southern Indiana during the morning of 5/27/07.

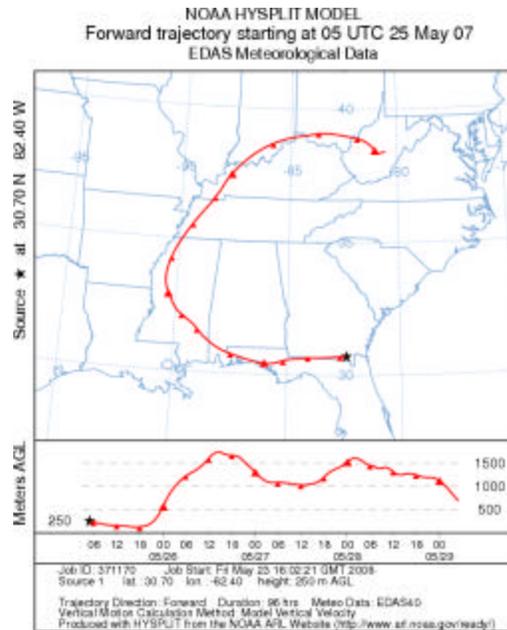


Figure A2.6: A forward trajectory originating from Georgia near the Bugaboo fire on 5/25/07 at 12:00 AM EST showing the air mass passing southern Indiana during the night of 5/27/07 to 5/28/07.



Figure A2.7: A forward trajectory originating from Georgia near the Bugaboo fire on 5/27/07 at 12:00 AM EST showing the air mass passing over southern Indiana during the day on 5/29/07.

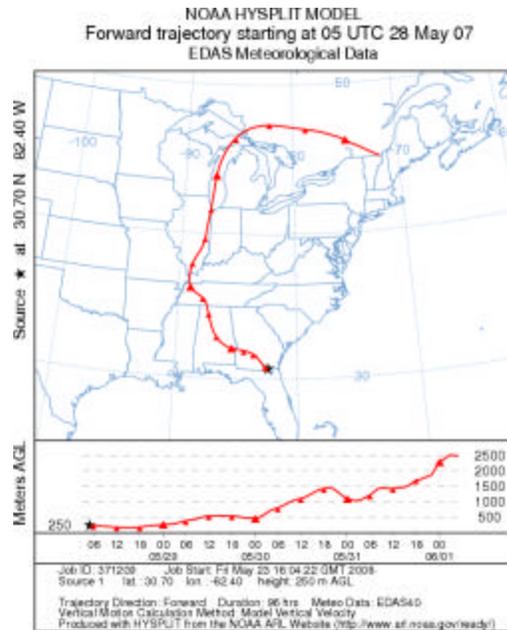


Figure A2.8: A forward trajectory originating from Georgia near the Bugaboo fire on 5/28/07 at 12:00 AM EST showing the air mass passing near Indiana during the day on 5/30/07.

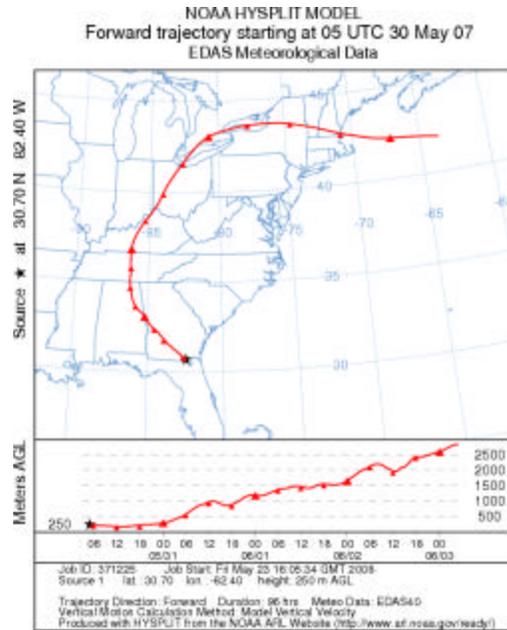


Figure A2.9: A forward trajectory originating from Georgia near the Bugaboo fire on 5/30/07 at 12:00 AM EST showing the air mass passing near southeastern Indiana during the night of 5/31/07 to 6/1/07.



Figure A2.10: A forward trajectory originating from Georgia near the Bugaboo fire on 5/30/07 at 3:00 PM EST showing the air mass passing near southeastern Indiana during the night of 6/1/07 to 6/2/07.

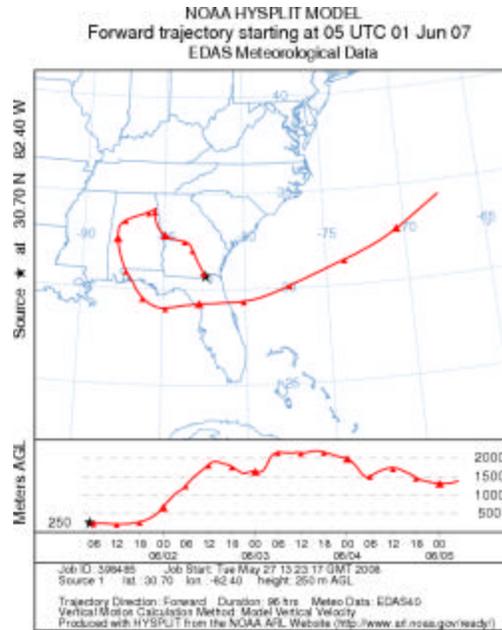


Figure A2.11: A forward trajectory originating from Georgia near the Bugaboo fire on 6/1/07 at 12:00 AM EST showing the air mass shifting out of the Midwest in early June.

### About HYSPLIT (from: <http://www.arl.noaa.gov/ready/hysplit4.html>)

The HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) model is the newest version of a complete system for computing simple air parcel trajectories to complex dispersion and deposition simulations. As a result of a joint effort between NOAA and Australia's Bureau of Meteorology, the model has recently been upgraded. New features include improved advection algorithms, updated stability and dispersion equations, a new graphical user interface, and the option to include modules for chemical transformations. Without the additional dispersion modules, Hysplit computes the advection of a single pollutant particle, or simply its trajectory.

The dispersion of a pollutant is calculated by assuming either puff or particle dispersion. In the puff model, puffs expand until they exceed the size of the meteorological grid cell (either horizontally or vertically) and then split into several new puffs, each with its share of the pollutant mass. In the particle model, a fixed number of initial particles are advected about the model domain by the mean wind field and a turbulent component. The model's default configuration assumes a puff distribution in the horizontal and particle dispersion in the vertical direction. In this way, the greater accuracy of the vertical dispersion parameterization of the particle model is combined with the advantage of having an ever expanding number of particles represent the pollutant distribution.

### Appendix 3: Organic Carbon Maps

Figures A3.1 through A3.6 show the regional organic carbon (OC) response to the predominant weather pattern throughout the eastern U.S. in relation to the scrub fires. The regional scale pattern shows the increases in the organic carbon measurements from before the event in question with the average readings on May 18<sup>th</sup>. Increases in the readings correlating to the southerly air flow from May 24<sup>th</sup> to May 30<sup>th</sup> are indicative of the impact of the smoke plume. The readings then return to more baseline measurements on June 5<sup>th</sup> after the weather pattern shifts.

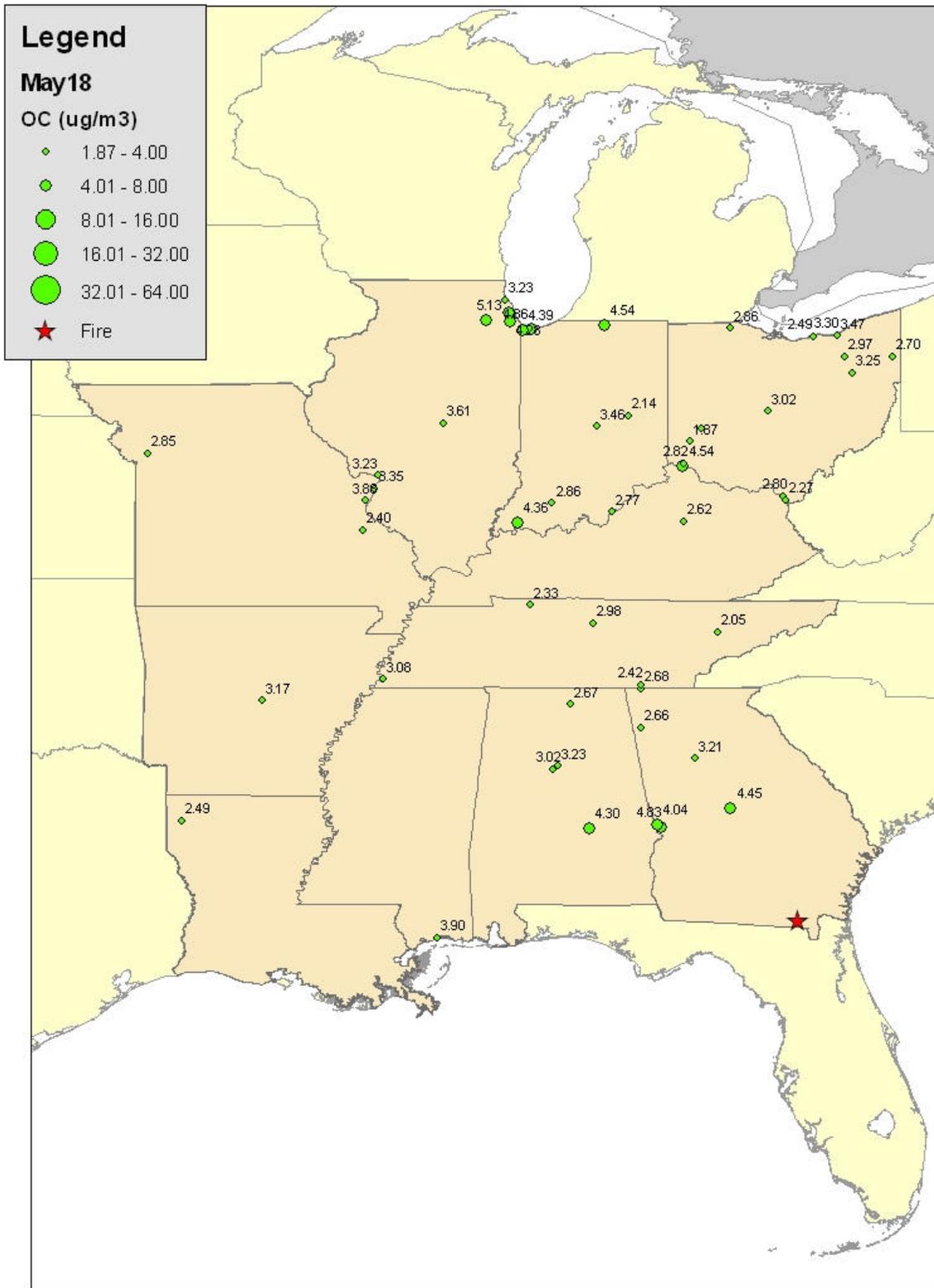


Figure A3.1: May 18<sup>th</sup>: The regional OC readings are closer to baseline data for each area.

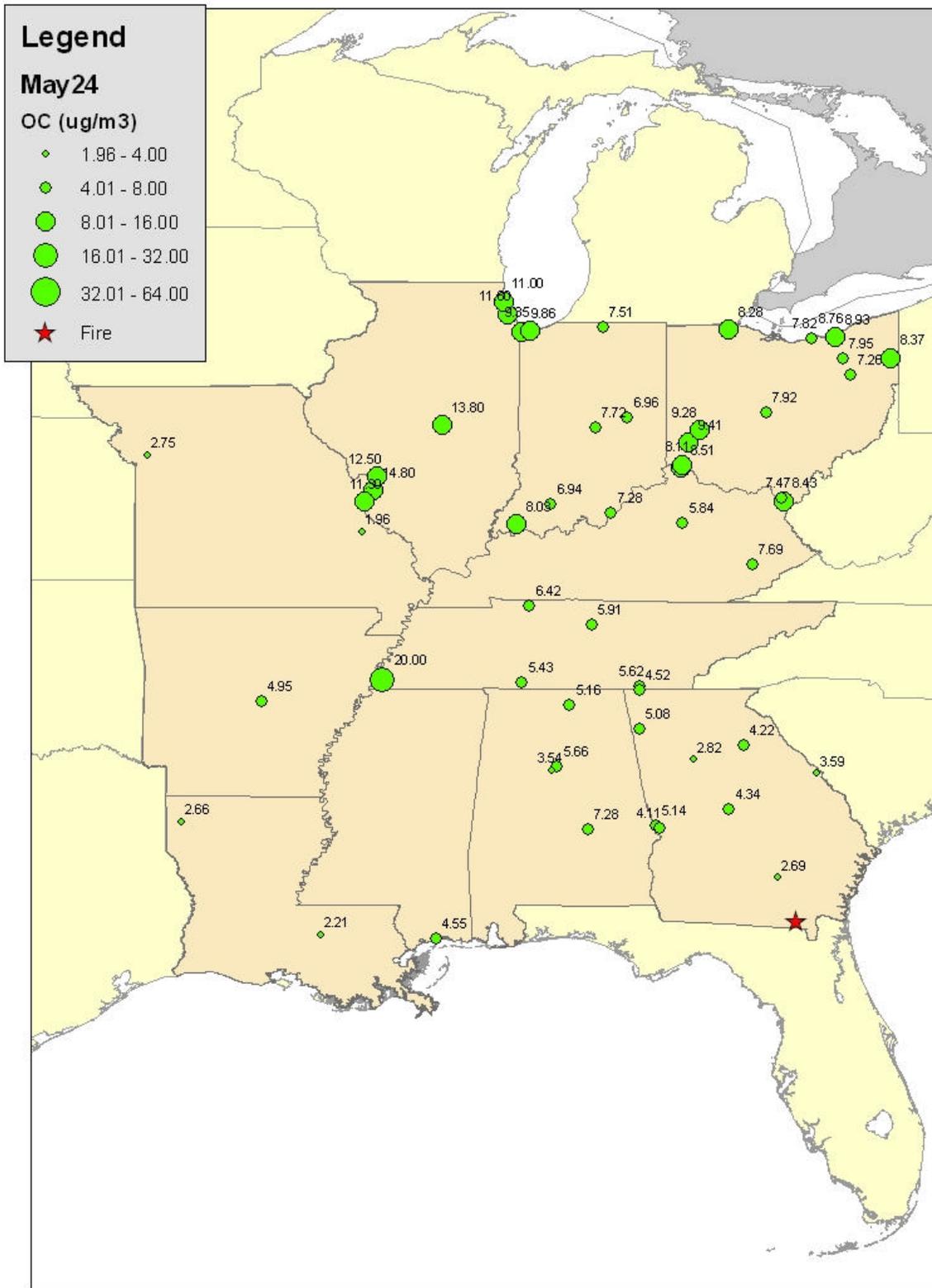


Figure A3.2: May 24<sup>th</sup>: The readings jump mostly west of the fire event as the weather pattern shows a clockwise air flow to the west and then north.

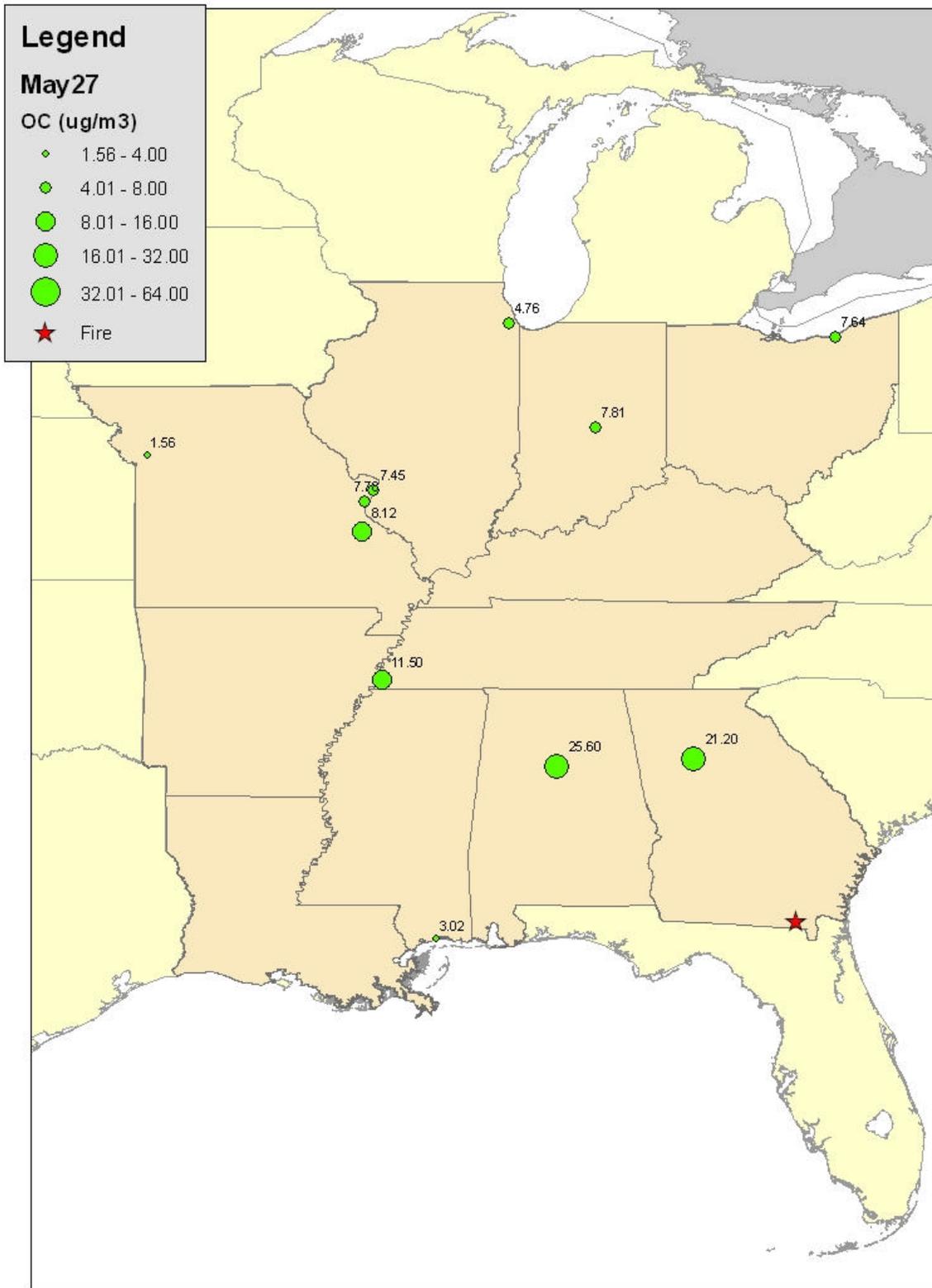


Figure A3.3: May 27<sup>th</sup>: The few 1-in-3 day OC readings show increases across the entire region.



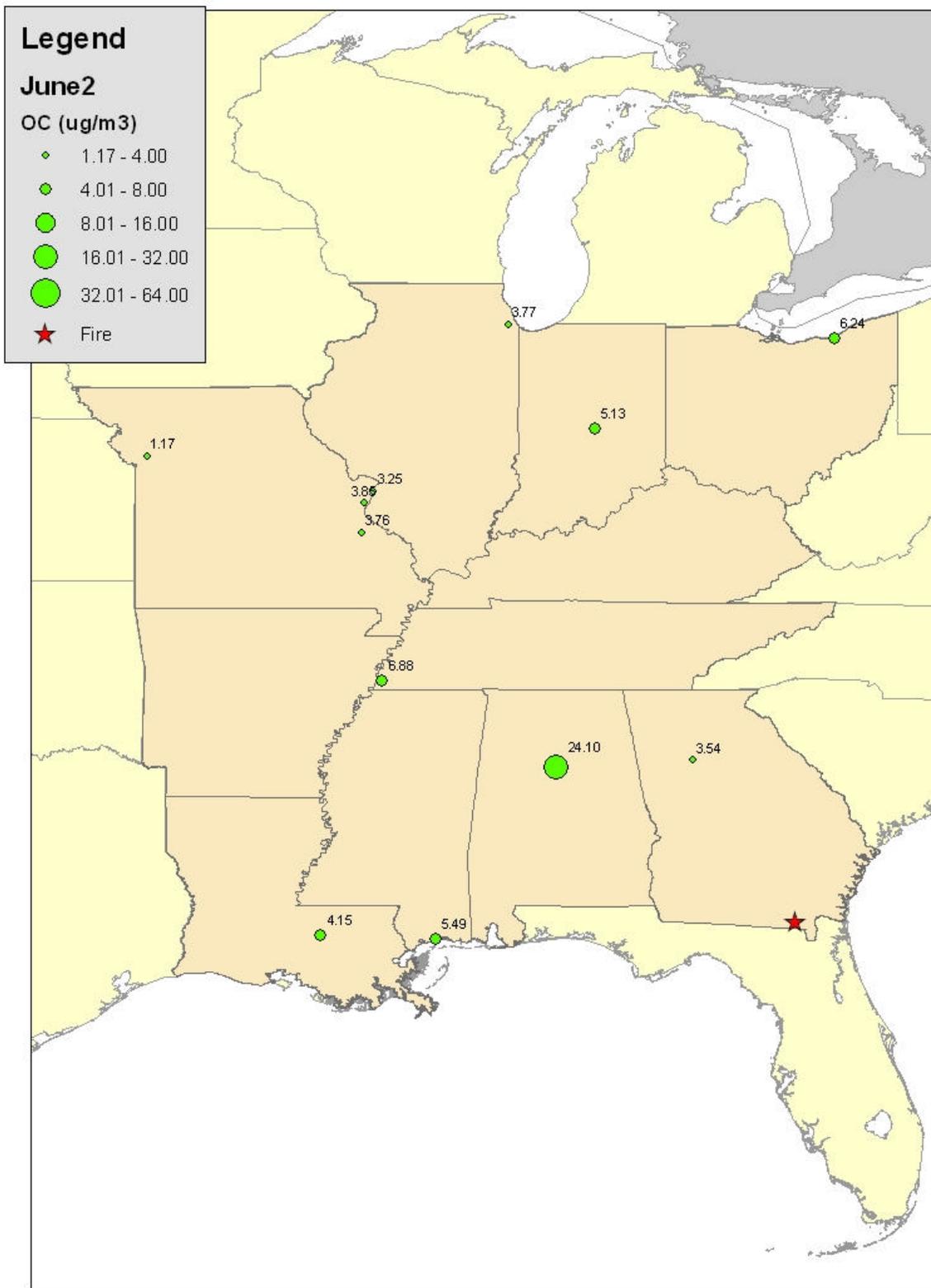


Figure A3.5: June 2<sup>nd</sup>: The few 1-in-3 day OC readings show a general decrease in OC across most of the sites.

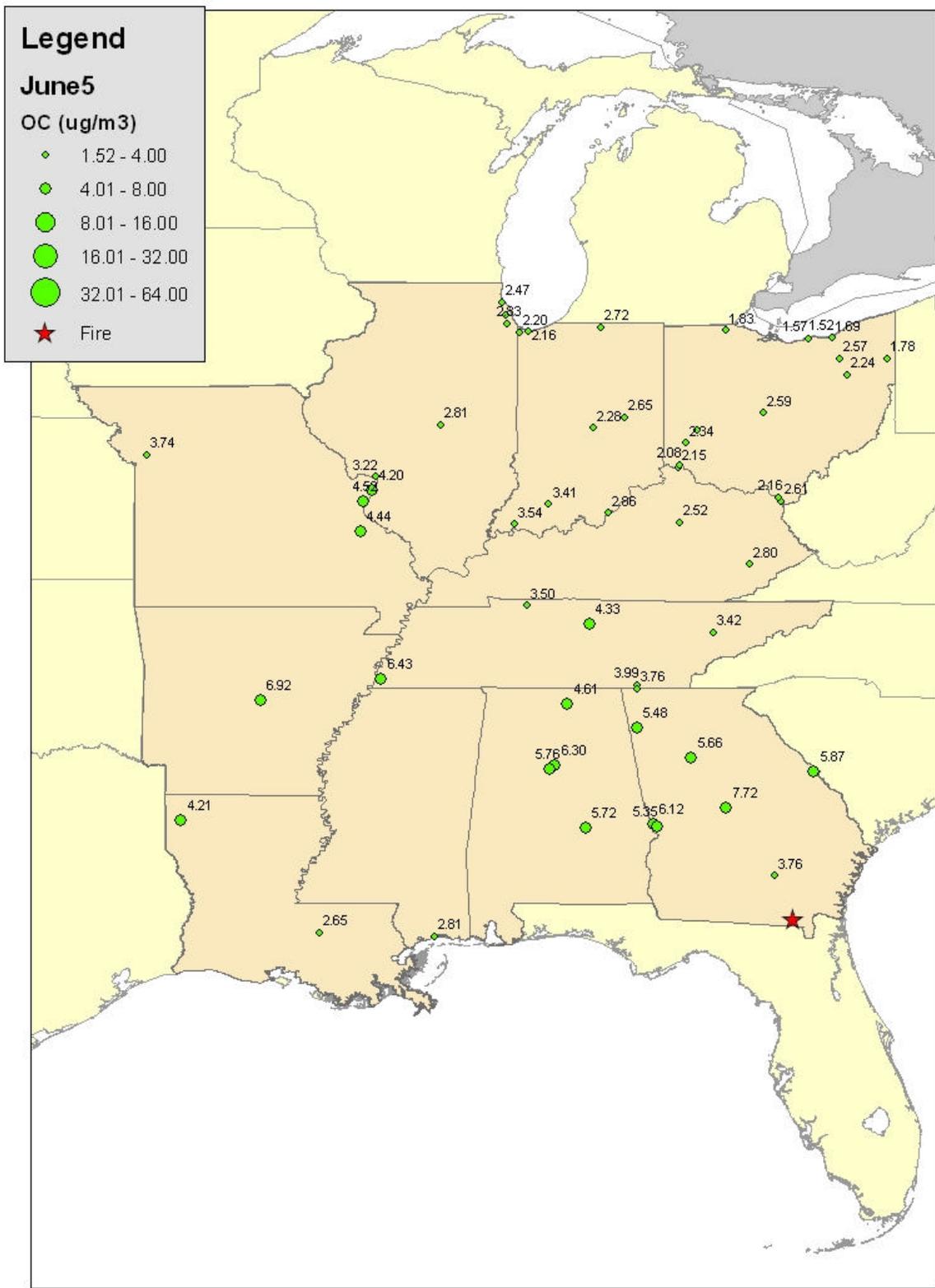


Figure A3.6: June 5<sup>th</sup>: The OC readings at all sites have returned to more baseline levels (as seen on May 18<sup>th</sup>) as the regional weather pattern again shifts.

**Indiana Department of Environmental Management**  
**Exceptional Events Request**  
**for**  
**July 4, 2007**

Parameter: PM<sub>2.5</sub>

Locations: Elkhart – Pierre Moran Jr. High School  
South Bend – Nuner School  
Fort Wayne – Beacon St.

Date: July 4, 2007

Source: Most communities have a tradition of celebrating the Fourth of July with several activities throughout the day ending with huge fireworks displays in the evening. Unfortunately, this traditional celebration may have a short term impact on air quality especially if meteorological conditions are such that dispersion of the smoke plumes from these events are hindered. The short term effects typically last 2 - 6 hours and depending on the meteorological conditions and duration, can substantially impact the particulate loading of PM<sub>2.5</sub> samples. In the State of Indiana, three sites in different communities experienced significantly high PM<sub>2.5</sub> 24-hour concentrations on this date.

Exceptional  
Events

Criteria: EPA defines an “exceptional event” as an unusual or naturally occurring event that can affect air quality but is not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the clean air act are not appropriate. Emissions from fireworks are treated in the same manner as an “exceptional event”. The following discussion illustrates that the three sites in question were influenced by local fireworks and the data should be excluded. Indiana has flagged the data with the ‘IH’ flag in AQS, and is awaiting concurrence from EPA.

Data: Different analyses of the data are used to demonstrate that the PM<sub>2.5</sub> concentrations measured on July 4, 2007 were influenced by local fireworks displays. Table 1 shows daily PM<sub>2.5</sub> averages prior to, during and after the event with the values flagged in **bold**.

Tables 2 and 3 list summaries of the data collected at all three sites since 2000. Data from 2007 are calculated with all current data and with the flagged data removed. There is a significant improvement in both the 98<sup>th</sup> percentile and annual average design values at Elkhart (18-039-0003) and an improvement in the annual averages for all three sites. Please note that the calculated values for the removed data do not include other values flagged as exceptional events that are awaiting concurrence from EPA.

**Table 1 - FRM Daily Values  
Exceptional Event Period**

Values in **BOLD** are flagged as exceptional events

Date	Elkhart – P. Moran 18-039-0003	South Bend - Nuner 18-141-0014	Ft. Wayne – Beacon 18-003-0004
7/2/07	-	6.4	7.2
7/3/07	-	16.6	11.9
<b>7/4/07</b>	<b>70.6</b>	<b>39</b>	<b>34.3</b>
7/5/07	23	21.1	11
7/6/07	12.8	11.9	9.6

**Table 2 - Historical Daily Values**

Year		Elkhart – P. Moran 18-039-0003		South Bend - Nuner 18-141-0014		Ft. Wayne – Beacon 18-003-0004	
		98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>	98th %ile	Daily Design Value <sup>1</sup>
2000		38.6		29.5		34.5	
2001		37.5		34.5		32	
2002	2000-2002	35.2	37	31.7	32	32.1	33
2003	2001-2003	36.7	36	35	34	34.6	33
2004	2002-2004	31.4	34	26.7	31	31	33
2005	2003-2005	40.8	36	40.2	34	38.4	35
2006	2004-2006	25.5	33	26	31	26.2	32
2007	2005-2007	34.6	34	33.8	33	33.7	33
<b>Values excluding flagged data</b>							
2007	2005-2007	33.2	33	33.8	33	33	33

<sup>1</sup>Daily Design Value = 3 year average of annual 98<sup>th</sup> %ile values.

**Table 3 - Historical Annual Averages**

Year		Elkhart – P. Moran 18-039-0003		South Bend - Nuner 18-141-0014		Ft. Wayne – Beacon 18-003-0004	
		Annual Ave.	Annual Design Value <sup>1</sup>	Annual Ave.	Annual Design Value <sup>1</sup>	Annual Ave.	Annual Design Value <sup>1</sup>
2000		15.7		13.8		15.7	
2001		15.7		14		14.3	
2002	2000-2002	15	15.5	14.3	14	14.6	14.8
2003	2001-2003	14.9	15.2	13.8	14	14.1	14.3
2004	2002-2004	13.3	14.4	12.3	13.5	12.5	13.7
2005	2003-2005	15.6	14.6	14.8	13.7	15.6	14.1
2006	2004-2006	12.6	13.8	12.4	13.2	11.9	13.4
2007	2005-2007	13.8	14	12.9	13.4	13.2	13.6
<b>Values excluding flagged data</b>							
2007	2005-2007	13.5	13.9	12.8	13.4	13.1	13.6

<sup>2</sup>Annual Design value = 3 year average of the annual averages.

Event

Discussion: Hourly Data

Hourly concentrations of PM<sub>2.5</sub> are available from the Fort Wayne – Beacon St. site. The data show high hourly concentrations influencing the PM<sub>2.5</sub> sample being collected. The day was mostly influenced from the evening hours when measured concentrations were around 150 ug/m<sup>3</sup> when the city’s fireworks display took place. The influence of individuals’ fireworks can be seen beginning on the evening of July 3 and throughout the day of July 4. The influence tapers off early on the morning of July 5. Table 4 lists the hourly data collected at the site on July 3 – 5.

**Table 4 – Fort Wayne Hourly Data**

Start Hour (EST)	Day		
	7/3	7/4	7/5
00	7.8	35.5	38.1
01	7.3	32.4	10
02	9.4	30.2	9
03	9.8	29.5	10.2
04	9.8	31.2	11.5
05	10.2	31.4	11.1
06	11	32.2	8.1
07	13.4	32	10.7
08	15.9	33	12.7
09	13.8	32.3	9.5
10	9.8	24.2	8.7
11	10.7	19.2	15.4
12	9.9	19.9	7.5
13	10	21	7.1
14	10.5	24.8	16
15	10.5	24	12.9
16	12.8	22.5	11
17	14.8	20.8	8
18	15.3	20.8	9.3
19	14.7	21.3	9.9
20	18.3	36.3	8.7
21	32	78.2	10.5
22	41.5	145.1	9.3
23	42.9	151	12.1

Similarly high values hourly values were recorded at the South Bend - Shields Dr. site. Even though Shields Drive is approximately three (3) miles north of the South Bend - Nuner site, hourly data reported there shows the same rise of PM<sub>2.5</sub> values on the evening of July 3, the values peaking on the evening/night of July 4, and high values continuing through July 5. Table 5 lists the data during this period.

**Table 5 – South Bend Hourly Data**

Start Hour (EST)	Day		
	7/3	7/4	7/5
00	7.1	26.2	247.7
01	15.8	21.1	221.9
02	11.4	25.4	136.4
03	12.8	28.9	43.2
04	17.7	25.7	40.0
05	10.4	15.9	30.4
06	16.6	4.5	25.1
07	10.8	33.7	32.4
08	11.4	35.7	46.6
09	12.0	31.6	60.7
10	11.9	27.4	56.7
11	13.3	14.6	29.3
12	13.5	13.9	18.1
13	14.1	21.3	18.3
14	26.1	10.5	16.2
15	17.6	12.9	14.7
16	19.8	13.4	16.2
17	17.7	12.5	14.4
18	16.3	15.6	13.0
19	15.0	11.5	12.7
20	19.9	10.0	13.9
21	20.4	25.5	18.3
22	33.4	162.3	28.8
23	27.1	371.0	19.8

No hourly data are available from Elkhart.

Meteorological Conditions

The wind rose in Figure 1 displays the wind speed and direction data from South Bend – Shields Dr. during the evening of July 4. The wind rose is indicative of conditions which occurred across northern Indiana at this time. The wind rose illustrates the calm wind conditions that were occurring during the time period of the large fireworks displays. Because there was very little wind during this time period, particulate matter in the air was not able to be dispersed or carried away from the cities quickly, therefore resulting in high values of PM<sub>2.5</sub> being recorded.



Review and  
Comment:

Proposed Exceptional Events Requests are posted on the IDEM website for review and comment for thirty (30) days.

Comments can be emailed to

Steve Lengerich ([slengeri@idem.in.gov](mailto:slengeri@idem.in.gov))

or mailed to

Steve Lengerich  
100 North Senate Avenue  
MC 61-50-2 Shadeland  
Indianapolis, IN 46204-2251

or faxed to

317-308-3239

## **Kentucky Exceptional Events in 2007 Affecting Air Quality Measurements**

*Tuesday January 8, 2008*

The Louisville Metro Air Pollution Control District routinely reviews any air quality monitoring data showing an exceedance of an ambient air quality standard set by the U.S. Environmental Protection Agency.

The EPA considers an exceptional event to have occurred if the air quality is affected by a natural event or human activity that is unlikely to recur at a particular location and is not reasonably controllable or preventable.

Examples of exceptional events include structural and wildland fires and fireworks displays. The District “flags” data so that the public and the EPA may be aware that these “flagged” high monitored values are not the norm and were influenced by an exceptional event.

The District then prepares a report on the event for review by the public and the EPA.

The District is providing this notice that it has prepared exceptional event reports for three events in 2007 and is providing a 30-day opportunity for the public to review and comment on these reports.

Here are links to relevant documents. Each link opens in a new window.

- [A fact sheet on exceptional events](#)
- [Information about the June 2, 2007 event](#)
- [Information about the August 2-4, 2007 event](#)
- [Information about the September 6, 2007 event](#)

Questions or comments should be directed to Mr. Larry Garrison, Environmental Supervisor, Ambient Monitoring Unit, Louisville Metro Air Pollution Control District, 850 Barret Ave., Louisville, KY 40204, Telephone (502) 574-7278.

## **Treatment of Data Influenced by Exceptional Events Flagging of PM<sub>2.5</sub> data collected in 2007**

The Louisville Metro Air Pollution Control District operates an ambient air monitoring network that measures the levels of certain air pollutants in the Metro area. The data collected by this network are used to:

- 1) Determine compliance with the National Ambient Air Quality Standards.
- 2) Determine the effectiveness of the Air Pollution Control District's programs.
- 3) Provide data for scientific research.
- 4) Provide air quality information to the public and alert the public if air quality levels approach unhealthy levels.

To insure the data collected is complete and accurate the data is subjected to quality assurance checks that include a review of the data and a final certification process. Part of the review and certification process is to identify exceptional events that may have influenced data and to flag data that was influenced by an exceptional event. During the review of the 2007 data collected by the fine particulate (PM<sub>2.5</sub>) sampling network the Louisville Metro Air Pollution Control District identified 3 events for which there were sufficient evidence to warrant flagging of data. As required by the Federal EPA these reviews are being posted for public comment. They are:

- |                      |                              |
|----------------------|------------------------------|
| 1) June 2, 2007      | Data influenced by Wildfires |
| 2) August 2-4, 2007  | Data influenced by Wildfires |
| 3) September 6, 2007 | Data influenced by Wildfires |

### ***What are fine particulates (PM<sub>2.5</sub>)?***

Fine particulates such as those found in smoke and haze, are 2.5 micrometers in diameter and smaller. These particles can be directly emitted from sources such as forest fires, or they can form when gases emitted from power plants, industries and automobiles react in the air.

### ***What is an exceptional event?***

For ambient air quality measurements an exceptional event is defined as an event that:

- 1) Effects air quality.
- 2) Is not reasonably controllable or preventable.
- 3) Is caused by human activity that is unlikely to recur at a particular location or is a natural event.

### ***What are some examples?***

- 1) Chemical Spills and Industrial Accidents
- 2) Structural Fires
- 3) Exceedances due to Transported Pollution
- 4) Terrorist Attack
- 5) Fireworks Displays
- 6) Natural Disasters and Associated Clean-Up Activities

- 7) Volcanic and Seismic Activities
- 8) High Wind Events
- 9) Wildland Fires
- 10) Prescribed Fires
- 11) Stratospheric Ozone Intrusions

***What is flagging of data?***

Ambient air quality data collected by the air monitors operated by the Louisville Metro Air Pollution District are submitted to EPA's Air Quality System which is a database that contains data from all air monitoring programs in the United States. After the data is submitted into the database, the data may be flagged by adding a code to the end of the data.

***Why is the data flagged?***

Typically exceptional events will cause ambient readings to be much higher than normal or expected for the area. The flags let EPA and other users of the data know that the values reported are not the norm and they were influenced by an exceptional event.

***How does this affect the use of the data?***

Flagging of the data helps scientists analyze the data and can help them better understand how exceptional events affect ambient air quality.

EPA also uses ambient air quality data to determine if an area is in attainment for a National Ambient Air Quality Standard. If an area is designated as nonattainment, restrictions are placed on the area and control measures will have to be put in place to bring the area back into attainment. The regulatory and planning process established by the Clean Air Act is not appropriate for dealing with natural and exceptional events. For example, natural events cannot be controlled by humans nor is it appropriate to attempt to develop regulations to control exceptional events. Therefore it would be inappropriate to place restrictions on an area were the attainment status was influenced by an exceptional event. If the data is flagged, EPA will review the documentation that contains the reason for the flag and if they agree with the documentation they will add an additional flag and the flagged data will not be used for regulatory purposes.

***How does this apply to me?***

By better understanding the data, scientists can make better decisions as to where the air pollution is coming from and what controls will have the best results in an area.

One of the primary uses of ambient air quality data is to notify the public as to the levels of pollutant to which they are exposed. The Air Pollution Control District does this in a number of ways such as the Air Quality Index which is a call in number at (502) 574-3319, by the District's website at <http://services.louisvilleky.gov/MetroAirNet/AQI.aspx>, by providing the information to local news agencies, by posting the data on EPA and National Weather Service websites, and by use of the TRIMARC signs. Flagged data is not excluded from the process, so measured pollutant levels regardless of its source will still be reported to the public. In addition, lowering of the daily standard from  $65\mu\text{g}/\text{m}^3$  to  $35\mu\text{g}/\text{m}^3$  will lower the level for which Air Quality Alerts are issued.

Louisville Metro Air Pollution Control District  
850 Barret Avenue  
Louisville, KY 40204

Subject: Exceptional Events Flagging

Parameter:  $PM_{2.5}$

Date: June 2, 2007

Event: Smoke from wildfires in southern Georgia impacted the Louisville Metro area during the period of May 22<sup>nd</sup> through June 4<sup>th</sup> 2007. The gradual buildup of smoke resulted in exceedances of the 24-hour  $PM_{2.5}$  standard on June 2<sup>nd</sup>. All  $PM_{2.5}$  samples collected on this date have been flagged with an exceptional event flag of “E” in AQS.

Data: Analyses of the data are used to demonstrate that the  $PM_{2.5}$  concentrations measured on June 2<sup>nd</sup> are beyond the range of values typically measured during this time period. Table 1 shows daily  $PM_{2.5}$  values prior to, during, and after the event. Table 2 contains the multi-year 95<sup>th</sup> percentiles which statistically provide an estimate of expected maximum values for the Louisville Metro area. Table 3 contains the 95<sup>th</sup> percentile values for each year if the data flagged due to exceptional events are excluded from the calculations. Table 4 shows historical daily maximums and averages for the June 2<sup>nd</sup> sample date as well as the historical averages for the month of June. Table 5 is a comparison of the maximum annual and 98<sup>th</sup> percentile values using all the data and then excluding the data that has been flagged. Annual background concentrations for the Louisville Metro area are estimated to be in the  $12.1 \mu\text{g}/\text{m}^3$  range and are based on multi-year annual averages from background rural sites located at Mammoth Cave in Kentucky, Grayson Lake in Kentucky, and the Henry County transport site located in Southern Indiana.

A continuous  $PM_{2.5}$  sampler and meteorological sensors located at the Southwick Community Center site provide data used to generate pollution and wind roses. The pollution roses are used to show the  $PM_{2.5}$  concentrations in relation to meteorological conditions. The wind roses provide information on prevailing wind direction in relation to wind speed.

The NOAA HYSPLIT model is used to show upper and lower wind trajectories for the time period.

Maps: Images of maps from NOAA Satellite and Information Services show the smoke plume originating in southern Georgia and the dispersion of the plume over a wide area in the Southeast. The dispersion of the plume,

timelines, and meteorological conditions correspond to increases in daily concentrations measured by the PM<sub>2.5</sub> samplers operated by the Louisville Metro Air Pollution Control District.

AQA: An air quality alert was not issued for this time period. Forecasts were for PM<sub>2.5</sub> levels to be in the moderate range. Using the existing Air Quality Index cut-points the AQI for PM<sub>2.5</sub> for June 2<sup>nd</sup> was 96.

Table 1  
FRM PM<sub>2.5</sub> 24-hour Averages  
Values in **BOLD** Have been flagged in AQS

Date	21-111-0048 Barret	21-111-0043 Southwick	21-111-0043 Southwick Collocated	21-111-0051 Watson	21-111-0044 Wyandotte
5-20-07	No sample	13.5	14.0	No sample	14.8
5-21-07	18.0	17.7	18.0	No sample	16.5
5-22-07	No sample	20.9	20.8	No sample	19.7
5-23-07	No sample	27.9	27.8	No sample	26.3
5-24-07	25.7	26.8	27.1	24.0	26.5
5-25-07	No sample	23.3	23.7	No sample	25.4
5-26-07	No sample	25.4	25.8	No sample	26.4
5-27-07	26.2	25.9	26.1	No sample	26.1
5-28-07	No sample	32.3	32.3	No sample	31.4
5-29-07	No sample	33.8	33.7	No sample	32.4
5-30-07	23.8	27.3	No sample	No sample	23.1
5-31-07	No sample	30.0	No sample	No sample	26.7
6-1-07	No sample	28.6	No sample	No sample	29.1
6-2-07	<b>37.2</b>	<b>34.2</b>	<b>33.8</b>	<b>36.3</b>	<b>36.8</b>
6-3-07	No sample	19.9	19.4	No sample	21.8
6-4-07	No sample	8.8	8.7	No sample	8.5

Table 2  
Multi-Year 95<sup>th</sup> Percentiles

Year	21-111-0048 Barret	21-111-0043 Southwick	21-111-0051 Watson	21-111-0044 Wyandotte
2004	27.4	27.0	24.2	26.6
2005	35.2	36.4	30.0	32.1
2006	33.4	29.4	28.4	30.8
2007*	31.9	31.1	36.3	30.9
Average	32.0	31.0	30.0	30.1

\* 2007 data through October

Table 3  
Multi-Year 95<sup>th</sup> Percentiles Excluding Flagged Data

Year	21-111-0048 Barret	21-111-0043 Southwick	21-111-0051 Watson	21-111-0044 Wyandotte
2004	26.1	26.7	24.2	25.4
2005	32.2	32.1	29.2	31.2
2006	26.4	28.2	26.2	28.5
2007*	29.1	28.8	32.0	28.2
Average	28.5	29.0	27.9	28.3

\* 2007 data through October

Table 4  
Multi-year Daily Maximums and Averages

Year	Maximum Values Reported for June 2	Average Values Reported for June 2	Monthly Averages for June
2004	8.9	8.7	15.9
2005	8.3	7.5	19.9
2006	13.3	12.9	18.1
2007	<b>37.2</b>	<b>35.6</b>	<b>19.6</b>

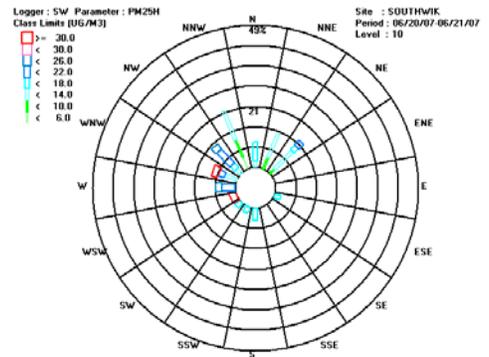
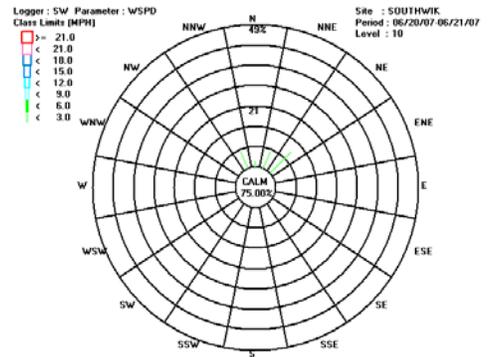
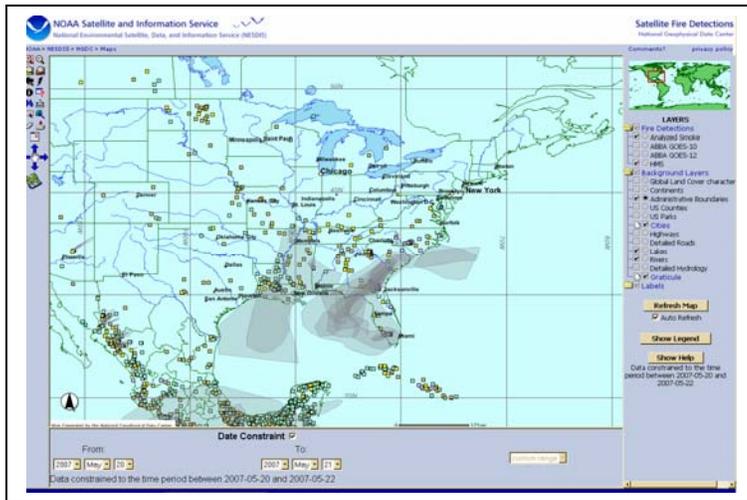
Table 5  
Comparison of Maximum Annual Averages and 98<sup>th</sup> Percentiles  
With and Without Flagged Data

Year	Annual Averages Using All Data	98 <sup>th</sup> Percentiles Using All Data	Annual Averages Excluding Flagged Data	98 <sup>th</sup> Percentiles Excluding Flagged Data
2004	14.5	31	14.3	29
2005	16.8	43	16.3	37
2006	15.2	37	14.8	31
2007*	15.3	51	14.4	32

\* 2007 data through October

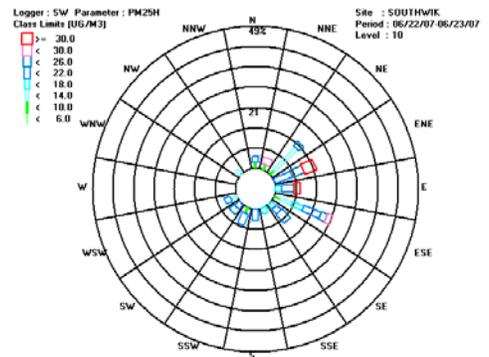
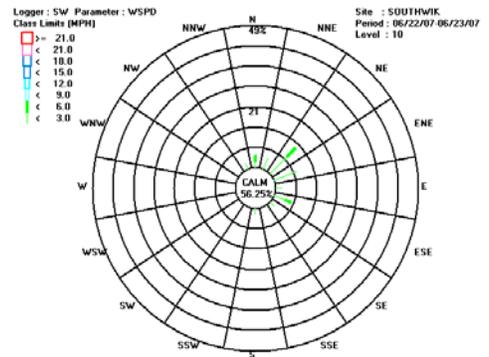
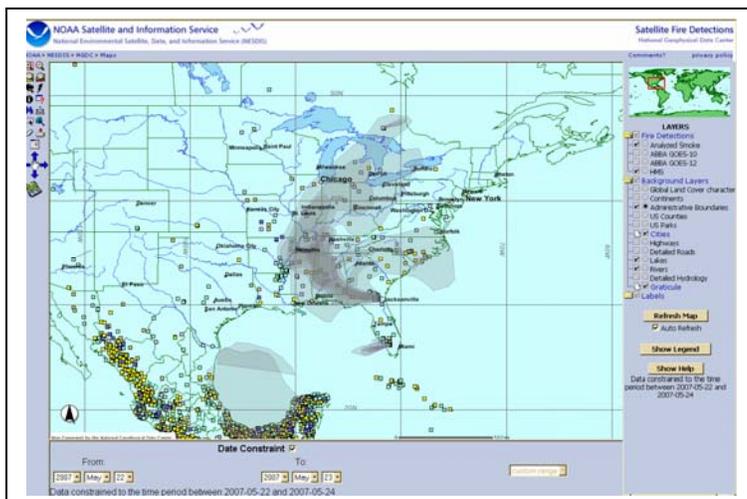
May 20-21, 2007

The map is used to show the fires originating in Georgia. The wind rose shows the prevailing wind direction is from the NE. Data from Table 1 shows daily averages in the mid teens demonstrating that the smoke plume has not yet reached the Louisville area.



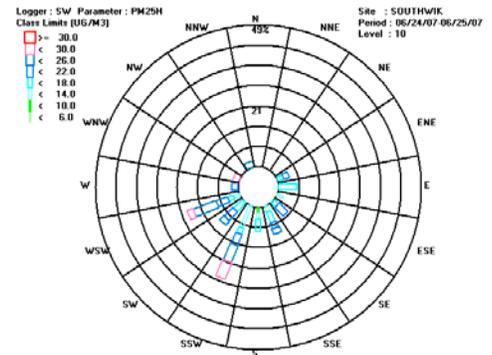
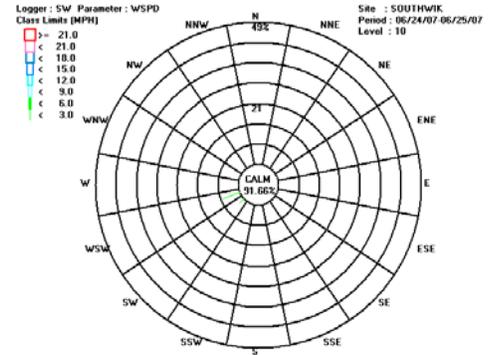
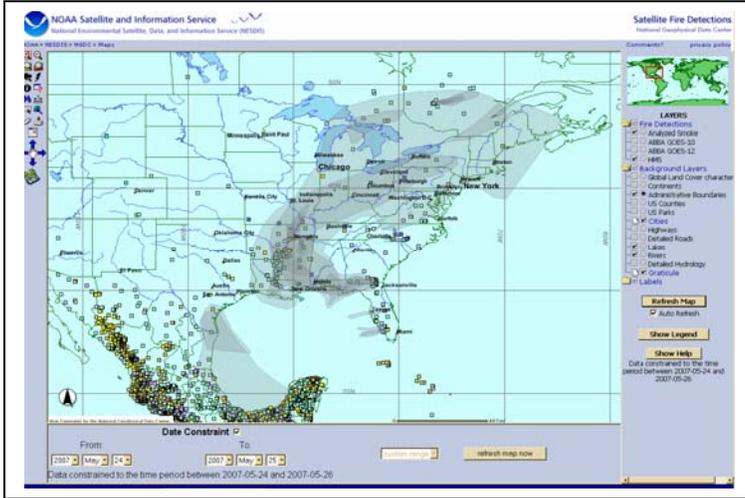
May 22-23, 2007

This map shows the plume has now reached the Louisville area and is looping back from the NE-ENE. As shown in Table 1  $\text{PM}_{2.5}$  levels have started to increase.



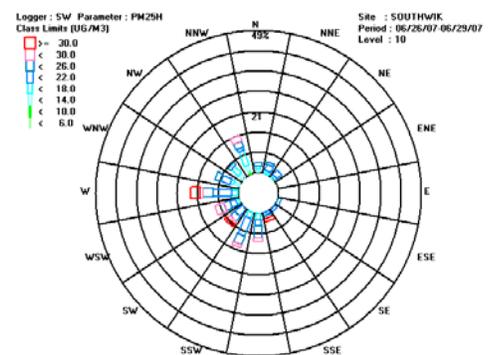
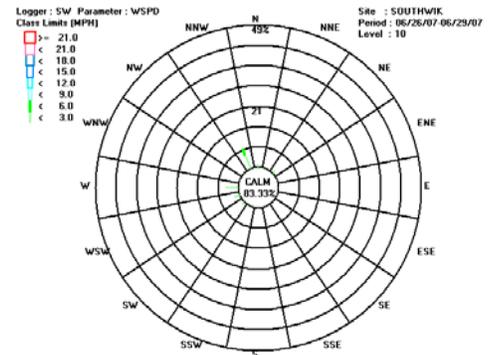
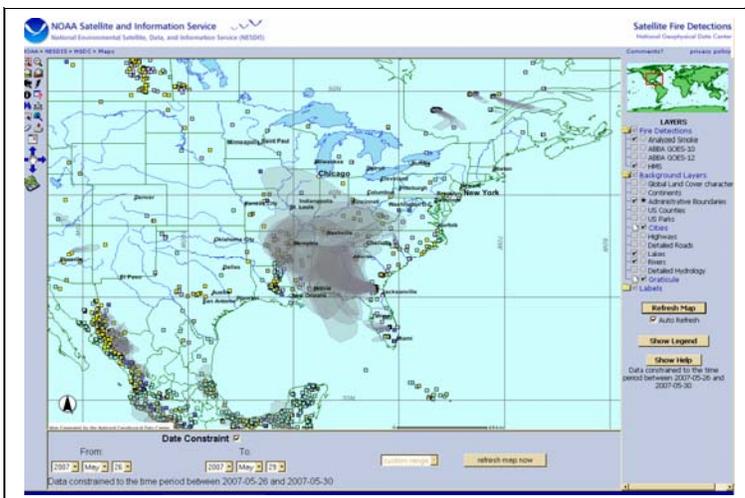
May 24-25, 2007

This map shows the plume over the area. The prevailing wind direction has shifted from the WSW-SSW and an increase in calm conditions is resulting in a stagnant air mass causing PM<sub>2.5</sub> concentrations to continue to increase.



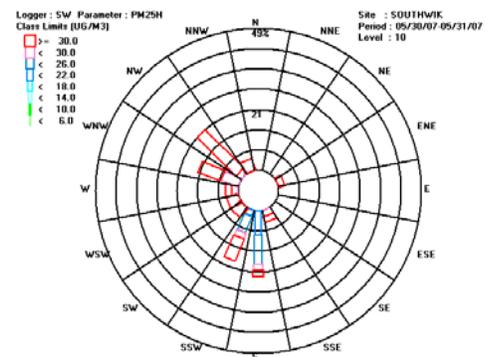
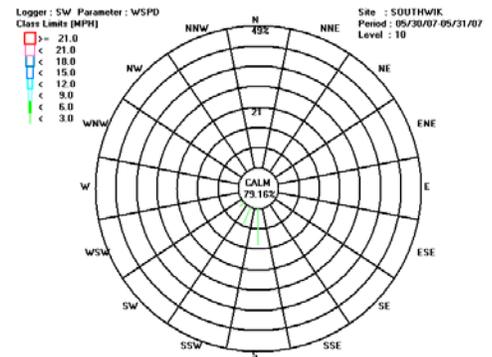
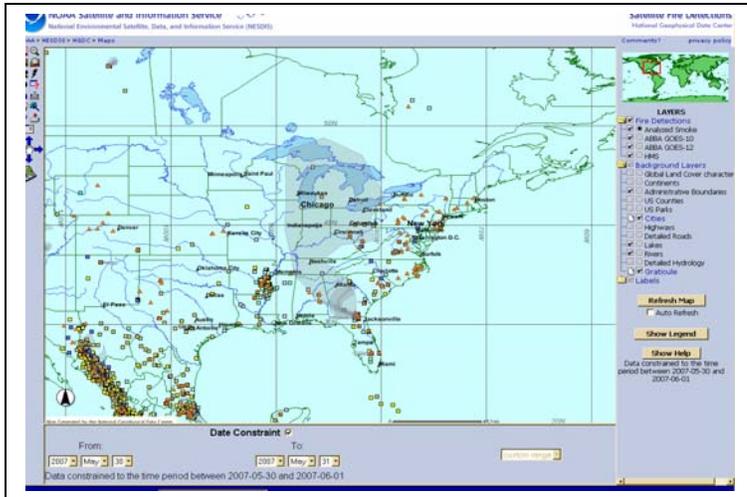
May 26-29, 2007

The map shows the plume has essentially stalled as further demonstrated by the calm conditions shown by the wind rose. PM<sub>2.5</sub> levels continue to remain high and approach the 24-hour standard.



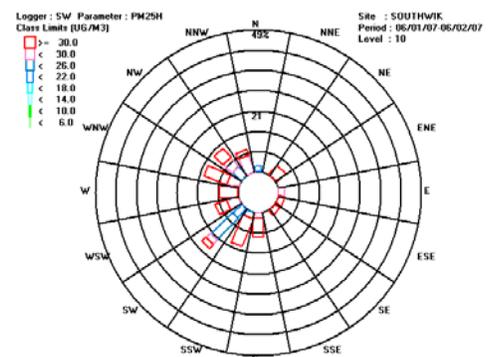
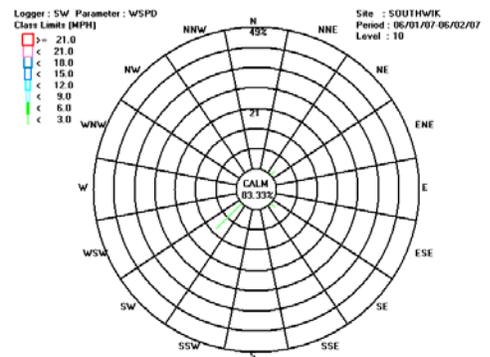
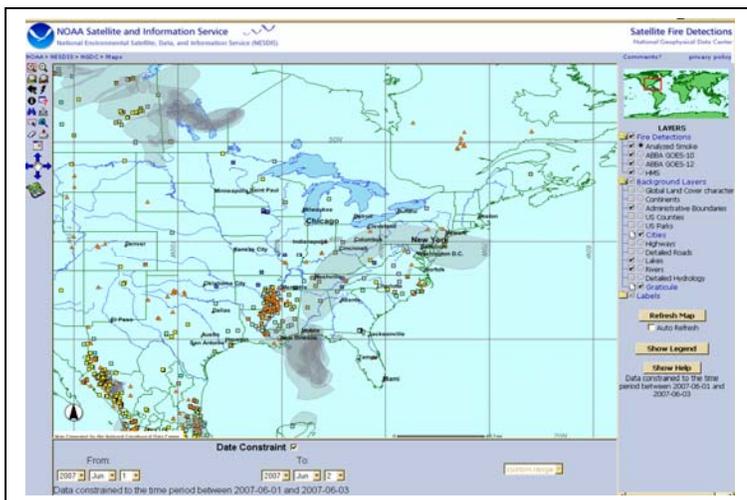
May 30-31, 2007

Although the map shows the plume has started to disperse, the samplers continue to measure elevated concentrations of  $PM_{2.5}$  as the prevailing wind direction changes from the South.



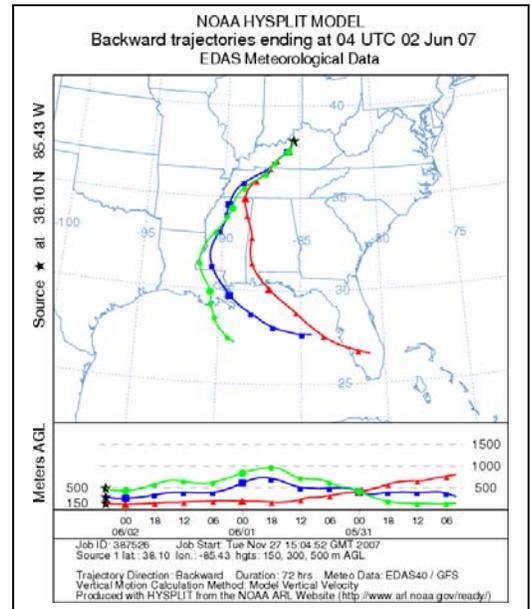
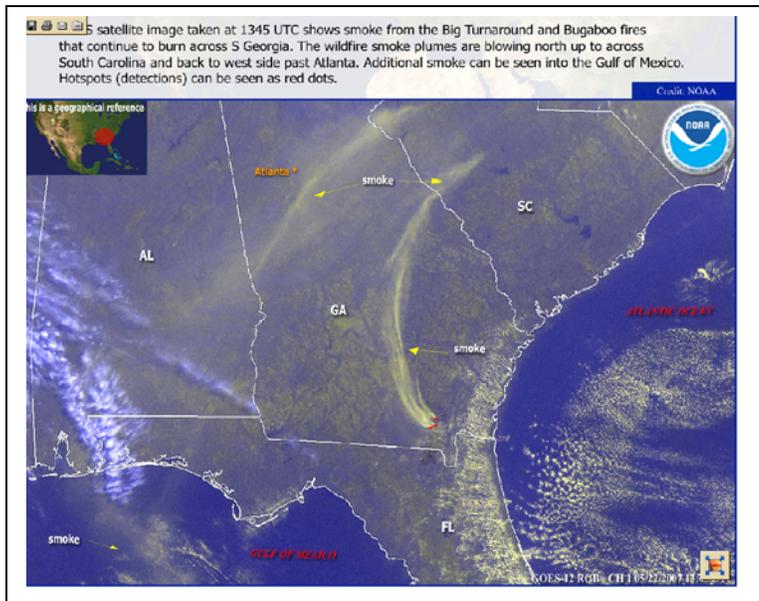
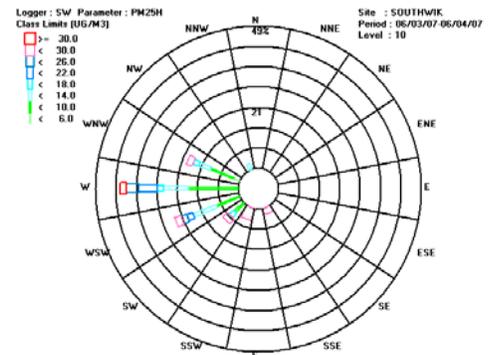
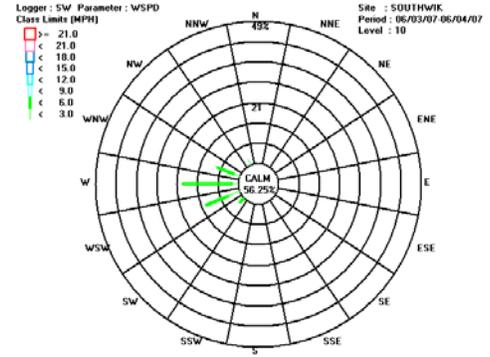
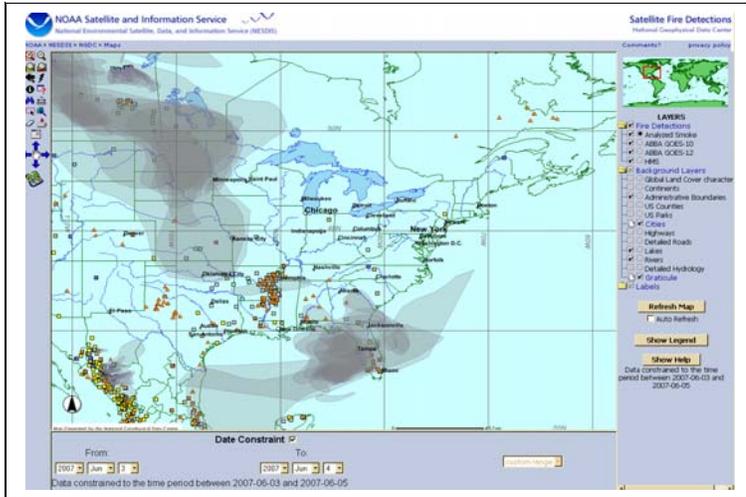
June 1-2, 2007

The map continues to show the plume over the Louisville Metro area. Calm conditions result in a continued increase in  $PM_{2.5}$  concentrations with exceedances of the 24-hour standard recorded on the 2<sup>nd</sup>.



June 3-4, 2007

The map shows the plume has moved out of the Louisville Metro area as the winds have shifted from the West. Table 1 indicates corresponding decreases in measured PM<sub>2.5</sub> levels.



May 31-June 2, 2007

The NOAA HYSPLIT Model is used to show the trajectory of the wind during the event. The model clearly shows the trajectory of the upper and lower winds during the event were from the south and from the vicinity of the wildland fires.

Louisville Metro Air Pollution Control District  
850 Barret Avenue  
Louisville, KY 40204

Subject: Exceptional Events Flagging

Parameter: PM<sub>2.5</sub>

Dates: August 2-4, 2007

Event: Smoke from wildfires in Canada, Idaho, and Montana impacted the Louisville Metro area during the period of July 29<sup>th</sup> through August 8<sup>th</sup>. The gradual buildup of smoke resulted in exceedances of the 24-hour PM<sub>2.5</sub> standard on August 2<sup>nd</sup>-4<sup>th</sup>. All FRM PM<sub>2.5</sub> samples collected on these dates have been flagged with an exceptional event flag of “E” in AQS.

Data: Analyses of the data are used to demonstrate that PM<sub>2.5</sub> concentrations measured during the event are beyond the range of values typically measured during this time period. Table 1 shows daily PM<sub>2.5</sub> values prior to, during, and after the event. Table 2 contains the multi-year 95<sup>th</sup> percentiles which statistically provide an estimate of expected maximum values for the Louisville Metro Area. Table 3 contains the 95<sup>th</sup> percentile values for each year if data flagged due to exceptional events are excluded from the calculations. Table 4 shows historical daily maximums and averages for dates when the exceedances occurred as well as the historical averages for the month of August. Table 5 is a comparison of the maximum annual averages and 98<sup>th</sup> percentile values using all the data and then excluding the data that has been flagged. Annual background concentrations for the Louisville Metro area are estimated to be in the 12.1 µg/m<sup>3</sup> range and are based on multi-year annual averages from background rural sites located at Mammoth Cave in Kentucky, Grayson Lake in Kentucky and the Henry County transport site located in Southern Indiana.

A continuous PM<sub>2.5</sub> sampler and meteorological sensors located at the Southwick Community Center site provide data used to generate pollution and wind roses. Pollution roses are used to show the PM<sub>2.5</sub> concentrations in relation to meteorological conditions. The wind roses provide information on prevailing wind direction, calm conditions, and wind speed.

The NOAA HYSPLIT model is used to show upper and lower wind trajectories for the time period.

Maps: Images of maps from NOAA Satellite and Information Services show smoke plumes developing in Canada and from fires in Idaho and Montana. The dispersion of the plume, timelines, and meteorological conditions correspond to increases in daily concentrations measured by the PM<sub>2.5</sub> samplers operated by the Louisville Metro Air Pollution Control District.

AQA: Air Quality alerts were issued for the period of August 2<sup>nd</sup> -5<sup>th</sup> when predicted levels reached the Unhealthy for Sensitive Groups Range

Table 1  
FRM PM<sub>2.5</sub> 24-hour Averages  
Values in **BOLD** have been flagged in AQS

Date	21-111-0048 Barret	21-111-0043 Southwick	21-111-0043 Southwick Collocated	21-111-0051 Watson	21-111-0044 Wyandotte
7/28/07	No sample	20.6	20.4	No sample	20.6
7/29/07	25.0	23.8	24.0	25.8	24.5
7/30/07	No sample	25.0	25.0	No sample	25.5
7/31/07	No sample	22.2	22.2	No sample	22.4
8/1/07	31.3	No sample	31.1	No sample	31.6
8/2/07	No sample	<b>47.4</b>	<b>47.2</b>	No sample	<b>44.5</b>
8/3/07	No sample	<b>40.4</b>	No sample	No sample	<b>40.3</b>
8/4/07	<b>42.9</b>	<b>43.0</b>	No sample	<b>51.3</b>	<b>42.8</b>
8/5/07	No sample	23.4	No sample	No sample	23.7
8/6/07	No sample	28.8	No sample	No sample	27.0
8/7/07	22.0	21.1	No sample	No sample	19.7
8/8/07	No sample	20.1	20.1	No sample	21.0

Table 2  
Multi-Year 95<sup>th</sup> Percentiles

Year	21-111-0048 Barret	21-111-0043 Southwick	21-111-0051 Watson	21-111-0044 Wyandotte
2004	27.4	27.0	24.2	26.6
2005	35.2	36.4	30.0	32.1
2006	33.4	29.4	28.4	30.8
2007*	31.9	31.1	36.3	30.9
Average	32.0	31.0	30.0	30.1

\* 2007 data through October

Table 3  
Multi-Year 95<sup>th</sup> Percentiles Excluding Flagged Data

Year	21-111-0048 Barret	21-111-0043 Southwick	21-111-0051 Watson	21-111-0044 Wyandotte
2004	26.1	26.7	24.2	25.4
2005	32.2	32.1	29.2	31.2
2006	26.4	28.2	26.2	28.5
2007*	29.1	28.8	32.0	28.2
Average	28.5	29.0	27.9	28.3

\*2007 data through October

Table 4  
Historical Maximums and Averages  
For Sample Dates with Flagged Data

Year	Maximum Values Reported for August 2	Average Values Reported for August 2	Maximum Values Reported for August 3	Average Values Reported for August 3	Maximum Values Reported for August 4	Average Values Reported for August 4	Monthly Averages for August
2004	26.6	26.0	43.0*	42.3*	45.8*	43.9*	18.4**
2005	24.1	21.9	23.5	23.4	36.6	34.7	20.4
2006	18.8	17.0	32.9	27.5	16.0	14.5	22.6**
2007	<b>47.4</b>	<b>46.4</b>	<b>40.4</b>	<b>40.4</b>	<b>51.3</b>	<b>45.0</b>	<b>22.2</b>

\*2004 data was flagged for exceptional events on these dates.

\*\*Monthly averages include data flagged for exceptional events.

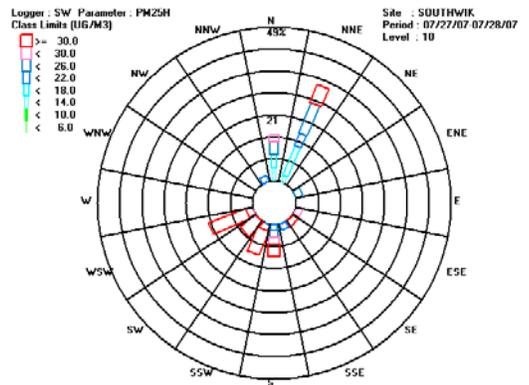
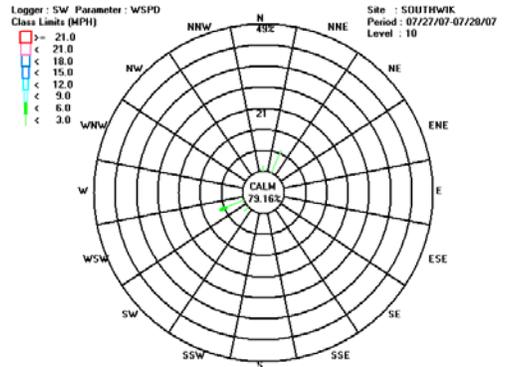
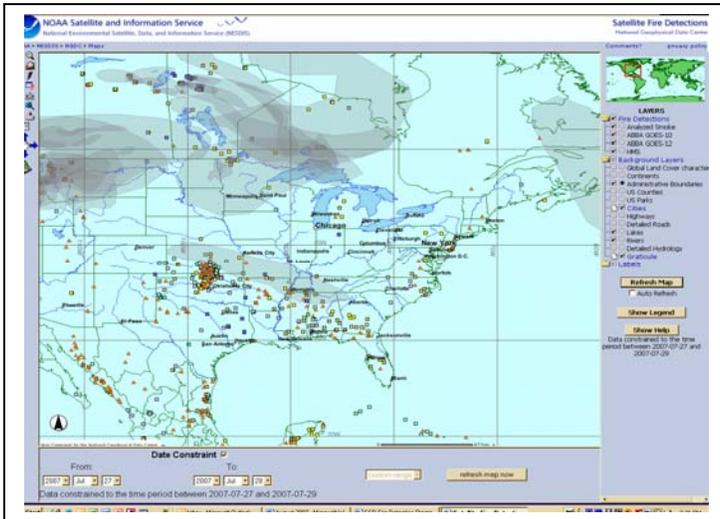
Table 5  
Comparison of Maximum Annual Averages and 98<sup>th</sup> Percentiles  
With and Without Flagged Data

Year	Annual Averages Using All Data	98 <sup>th</sup> Percentiles Using All Data	Annual Averages Excluding Flagged Data	98 <sup>th</sup> Percentiles Excluding Flagged Data
2004	14.5	31	14.3	29
2005	16.8	43	16.3	37
2006	15.2	37	14.8	31
2007*	15.3	51	14.4	32

\* 2007 data through October

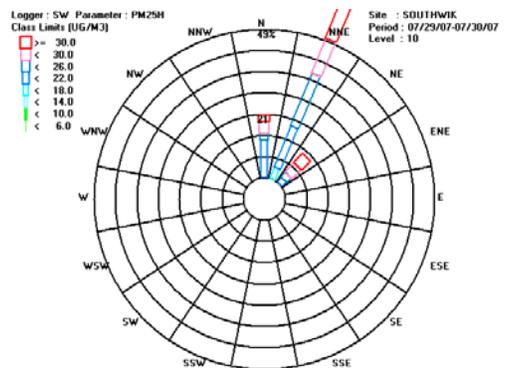
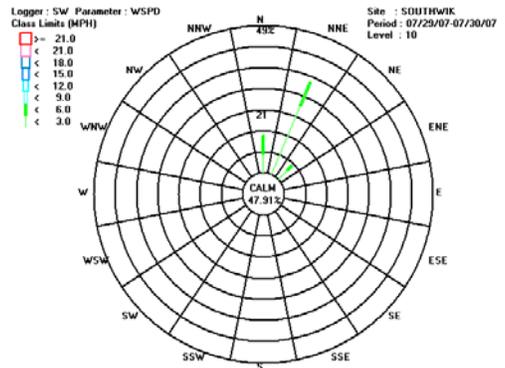
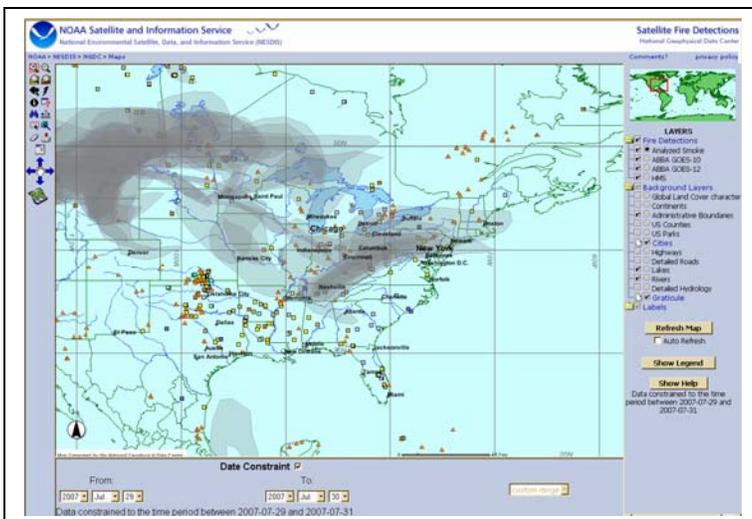
July 27-28, 2007

The map shows the smoke plume from Canadian wildfires developing north of the Louisville Metro area. Also note the plume developing in the northwest from wildfires in Idaho and Montana.



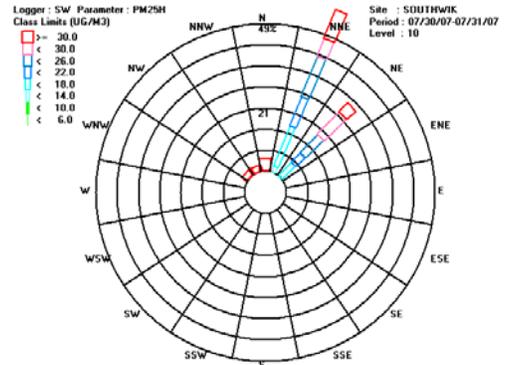
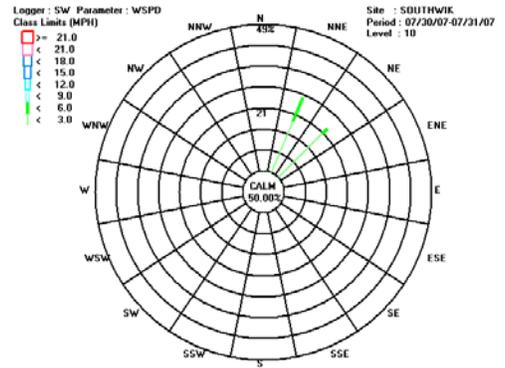
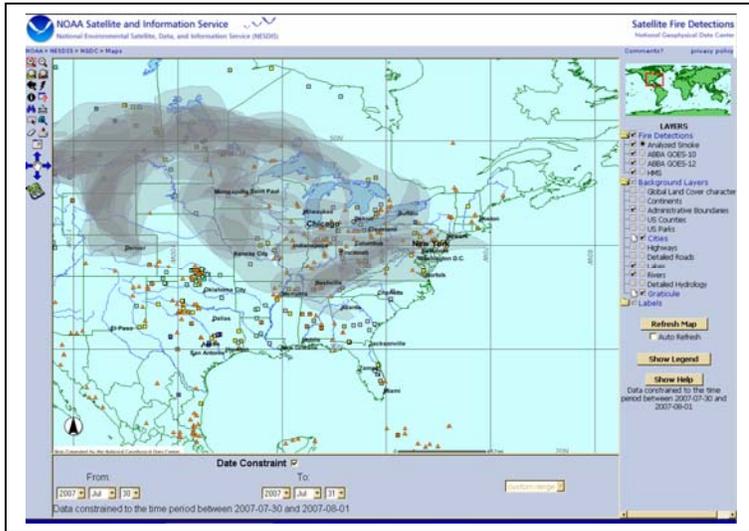
July 29-30, 2007

The smoke plume from the Canadian fires has reached the Louisville Metro Area. PM<sub>2.5</sub> concentrations begin to increase. Note that the density of the smoke plume from the Idaho and Montana fires appears to have increased.



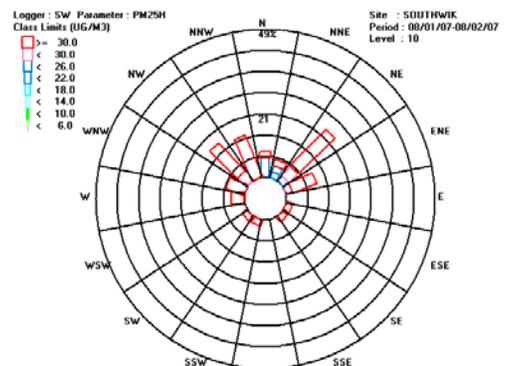
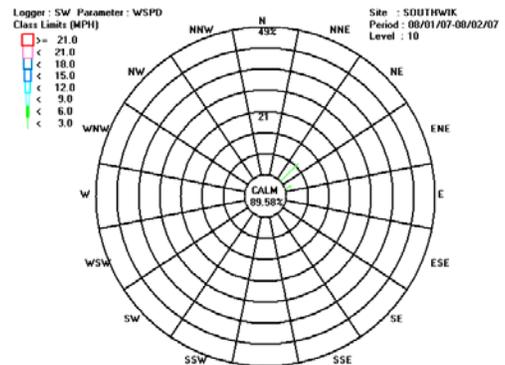
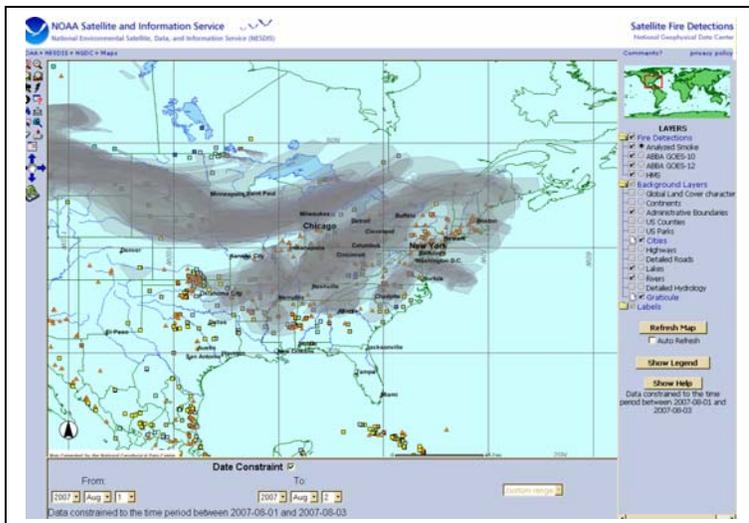
July 30-31, 2007

The smoke plume continues to move into the area. The wind and pollution roses verify that the significant contributions of PM<sub>2.5</sub> concentrations are from the NNE which corresponds to the trajectory of the smoke plume.



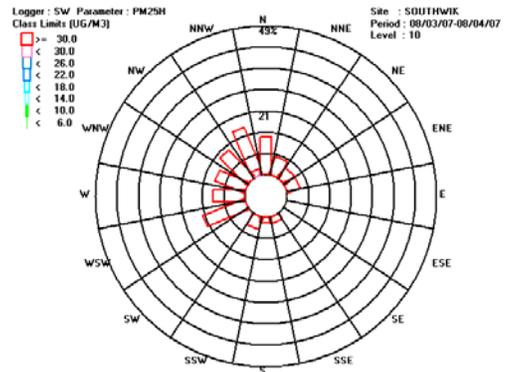
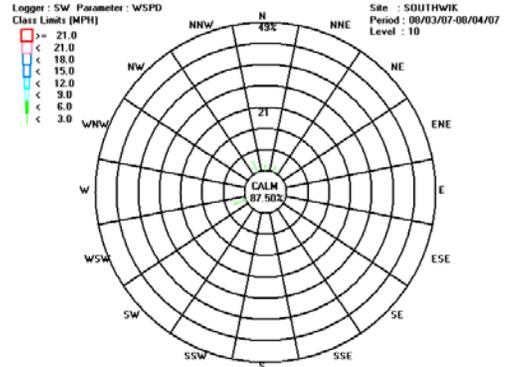
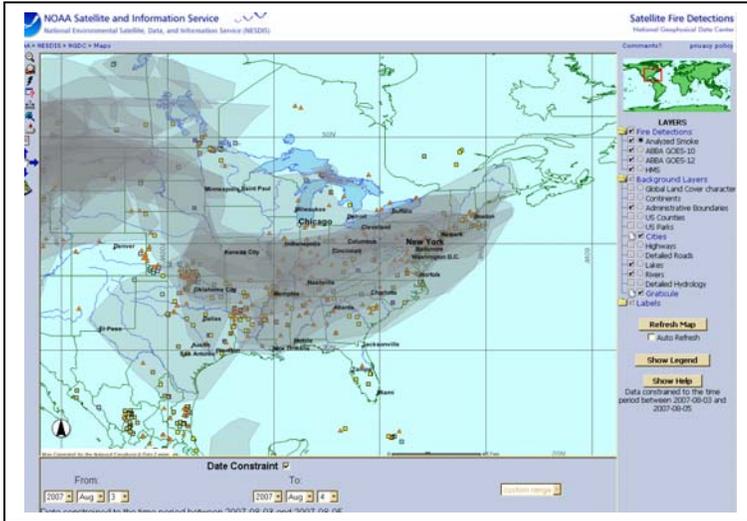
August 1-2, 2007

The map shows a dense smoke plume over most of the eastern portion of the United States. Calm conditions contribute to a significant increase in PM<sub>2.5</sub> concentrations with exceedances of the 24-hour standard measured on the 2<sup>nd</sup>.



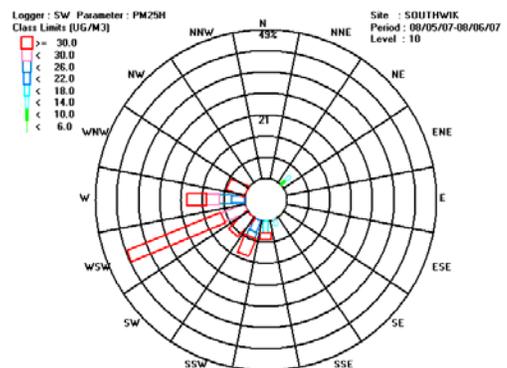
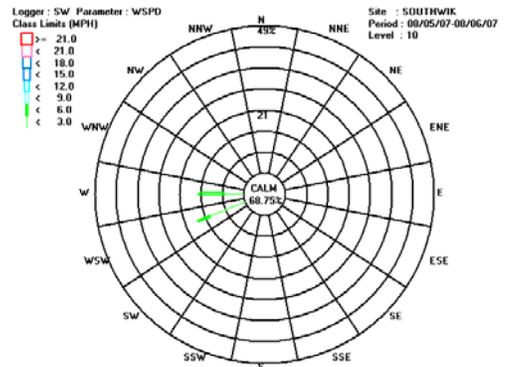
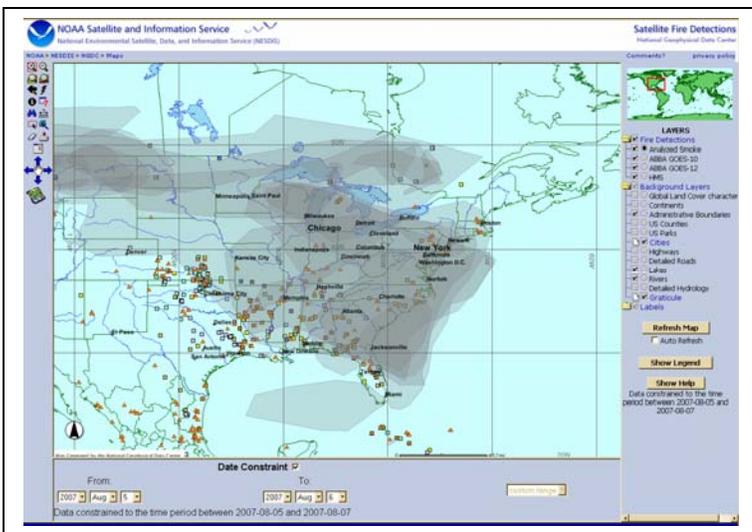
August 3-4, 2007

The map shows the plume continues to cover the eastern portion of the United States. Exceedances of the 24-hour standard are measured on the 3<sup>rd</sup> and 4<sup>th</sup>.



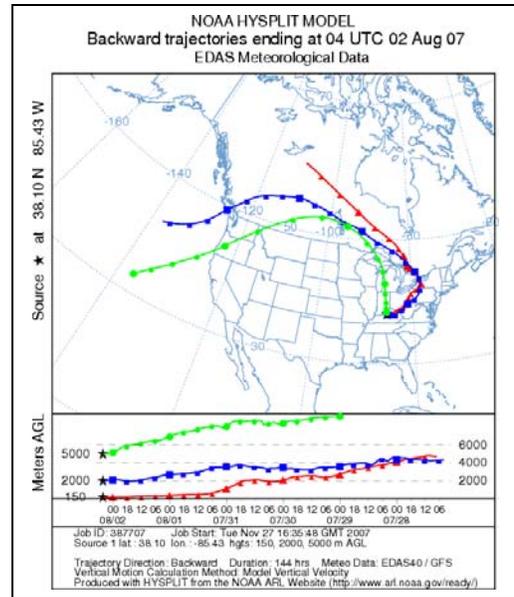
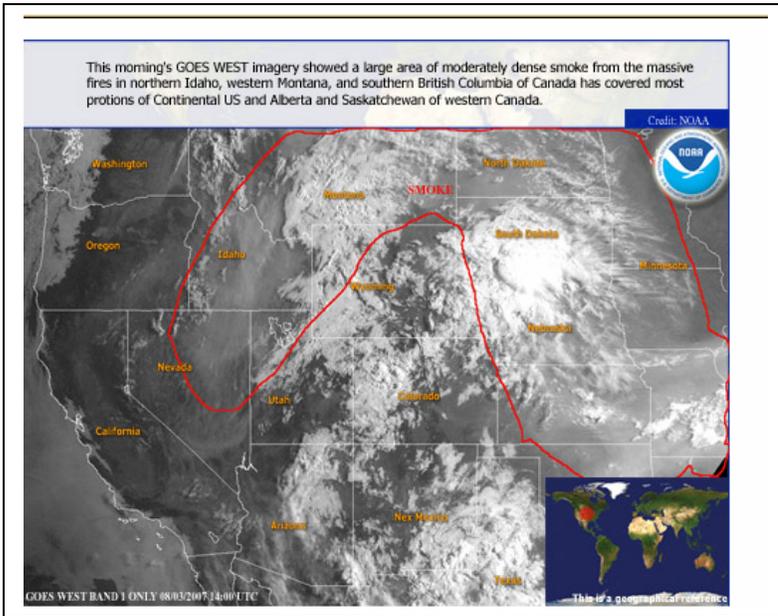
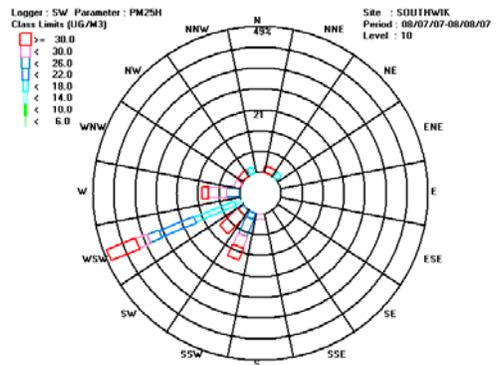
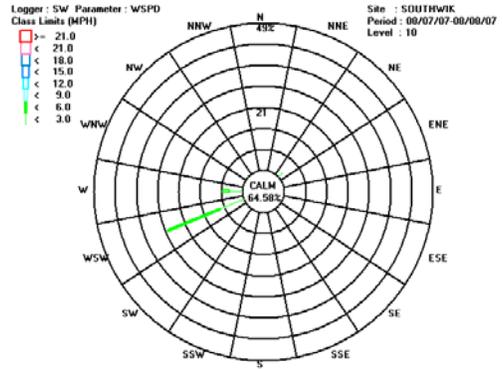
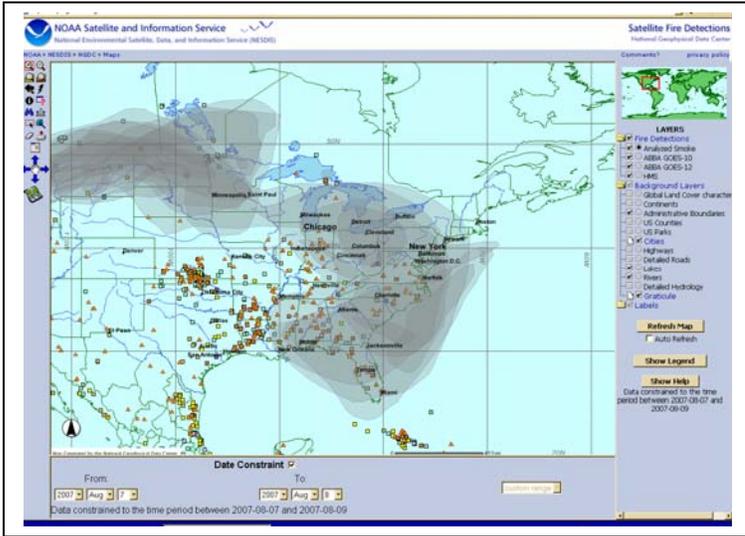
August 5-6, 2007

The smoke plume begins to disperse and move out of the area. The wind rose shows that the wind direction has shifted from the WSW. The pollution rose now indicates that the primary contributions to PM<sub>2.5</sub> concentrations are from sources in the west away from the initial trajectory of the smoke plume. A significant drop in PM<sub>2.5</sub> concentrations is observed.



August 7-8, 2007

The map shows the plume continuing to move northeast which corresponds to the data provided by the wind and pollution roses. Measured PM<sub>2.5</sub> concentrations are now at levels comparable to historical monthly averages.



July 28-August 2, 2007

The NOAA HYSPLIT Model is used to show the trajectory of the wind during the event. The model indicates that lower level winds originated in the vicinity of the Canadian wildfires while the upper level winds originated in the vicinity of the Idaho and Montana fires.

Louisville Metro Air Pollution Control District  
850 Barret Avenue  
Louisville, KY 40204

Subject: Exceptional Events Flagging

Parameter: PM<sub>2.5</sub>

Date: September 6, 2007

Event: Smoke from Wildfires in Idaho and Montana as well as smoke from fires in Kansas, Oklahoma, and Missouri impacted the Louisville Metro area on September 3<sup>rd</sup> - 6<sup>th</sup> causing exceedances of the 24-hour standard on the 6<sup>th</sup>. All FRM PM<sub>2.5</sub> samples collected on this date have been flagged with an exceptional event flag of "E" in AQS.

Data: Analyses of the data are used to demonstrate that the PM<sub>2.5</sub> concentrations measured on September 6<sup>th</sup> are beyond the range of values typically measured during the time period. Table 1 shows daily PM<sub>2.5</sub> averages prior to, during, and after the event. Table 2 contains the multi-year 95<sup>th</sup> percentiles which statistically provide an estimate of expected maximum values for the Louisville Metro Area. Table 3 contains the 95<sup>th</sup> percentile values for each year if data flagged due to exceptional events are excluded from the calculations. Table 4 shows historical maximums and averages for the September 6<sup>th</sup> sampling date as well as the historical averages for the month of September. Table 5 is a comparison of the maximum annual and 98<sup>th</sup> percentile values using all the data and then excluding the data that has been flagged. Background concentrations for the Louisville Metro area are estimated to be in the 12.1 µg/m<sup>3</sup> range and are based on multi-year annual averages from background rural sites located at Mammoth Cave in Kentucky, Grayson Lake in Kentucky, and the Henry County transport site located in Southern Indiana.

A continuous PM<sub>2.5</sub> sampler and meteorological sensors located at the Southwick Community Center site provide data used to generate pollution and wind roses. Pollution roses are used to show the PM<sub>2.5</sub> concentrations in relation to meteorological conditions. The wind roses provide information on prevailing wind direction, calm conditions, and wind speed.

The NOAA HYSPLIT model is used to show upper and lower wind trajectories for the time period.

Maps: Images of maps from NOAA Satellite and Information Services show the smoke plumes originating in Idaho and Montana as well as in Kansas,

Missouri and Oklahoma. The smoke plumes eventually impact most of the eastern portion of the United States.

AQA: Air Quality Alerts were issued for September 3-5 with forecast values in the Unhealthy for Sensitive for Groups range. A predicted change in weather patterns resulted in a forecast for moderate conditions on the 6<sup>th</sup>. However, the predicted change in weather patterns did not occur until the next day resulting in the AQI for PM<sub>2.5</sub> reaching 115 on the 6<sup>th</sup>.

Table 1  
FRM PM<sub>2.5</sub> 24-hour Averages  
Values in **BOLD** have been flagged in AQS

Date	21-111-0048 Barret	21-111-0043 Southwick	21-111-0043 Southwick Collocated	21-111-0051 Watson	21-111-0044 Wyandotte
9/1/07	No sample	11.1	11.6	No sample	10.8
9/2/07	No sample	24.6	25.2	No sample	25.2
9/3/07	31.9	31.3	31.4	30.7	33.7
9/4/07	No sample	28.2	No sample	No sample	27.4
9/5/07	No sample	31.1	No sample	No sample	30.4
9/6/07	<b>40.4</b>	<b>41.4</b>	No sample	No sample	<b>41.6</b>
9/7/07	No sample	18.0	No sample	No sample	17.4
9/8/07	No sample	14.8	No sample	No sample	15.8

Table 2  
Multi-Year 95<sup>th</sup> Percentiles

Date	21-111-0048 Barret	21-111-0043 Southwick	21-111-0051 Watson	21-111-0044 Wyandotte
2004	27.4	27.0	24.2	26.6
2005	35.2	36.4	30.0	32.1
2006	33.4	29.4	28.4	30.8
2007*	31.9	31.1	36.3	30.9
Average	32.0	31.0	30.0	30.1

\* 2007 data through October

Table 3  
Multi-Year 95<sup>th</sup> Percentiles Excluding Flagged Data

Date	21-111-0048 Barret	21-111-0043 Southwick	21-111-0051 Watson	21-111-0044 Wyandotte
2004	26.1	26.7	24.2	25.4
2005	32.2	32.1	29.2	31.2
2006	26.4	28.2	26.2	28.5
2007*	29.1	28.8	32.0	28.2
Average	28.5	29.0	27.9	28.3

\* 2007 data through October

Table 4  
Multi-Year Daily Maximums and Averages

Year	Maximum Values Reported for September 6	Average Values Reported for September 6	Monthly Averages for September
2004	21.9	19.2	17.6
2005	29.6	28.9	23.9*
2006	11.8	11.5	13.6
2007	<b>41.6</b>	<b>41.1</b>	<b>16.7</b>

\* The monthly average for 2005 includes September data flagged for exceptional events.

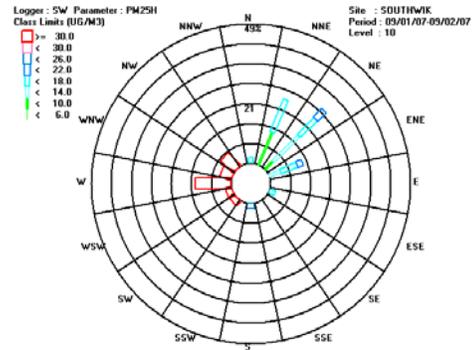
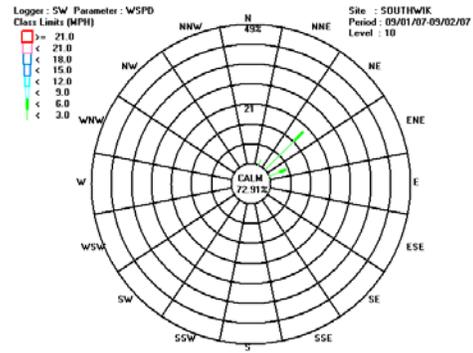
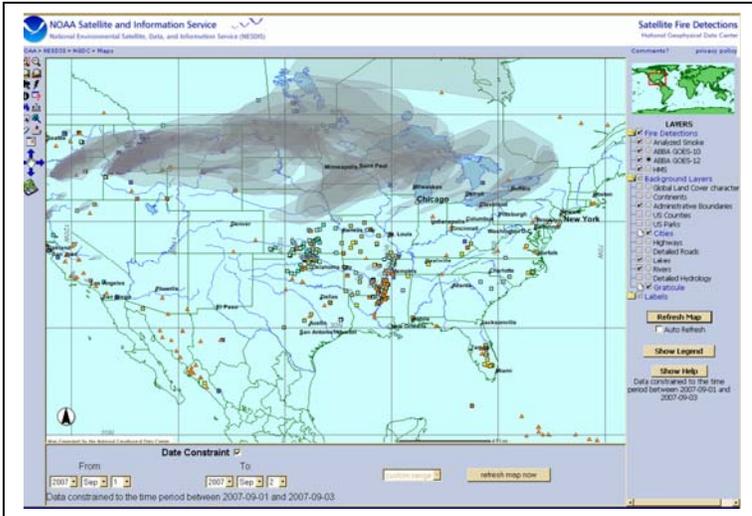
Table 5  
Comparison of Maximum Annual Averages and 98<sup>th</sup> Percentiles  
With and Without Flagged Data

Year	Annual Averages Using All Data	98 <sup>th</sup> Percentile Using All Data	Annual Averages Excluding Flagged Data	98 <sup>th</sup> Percentile Excluding Flagged Data
2004	14.5	31	14.3	29
2005	16.8	43	16.3	37
2006	15.2	37	14.8	31
2007*	15.3	51	14.4	32

\* 2007 data through October

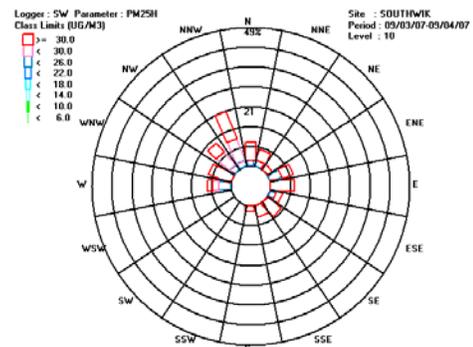
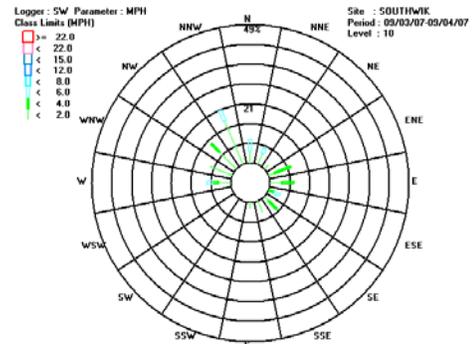
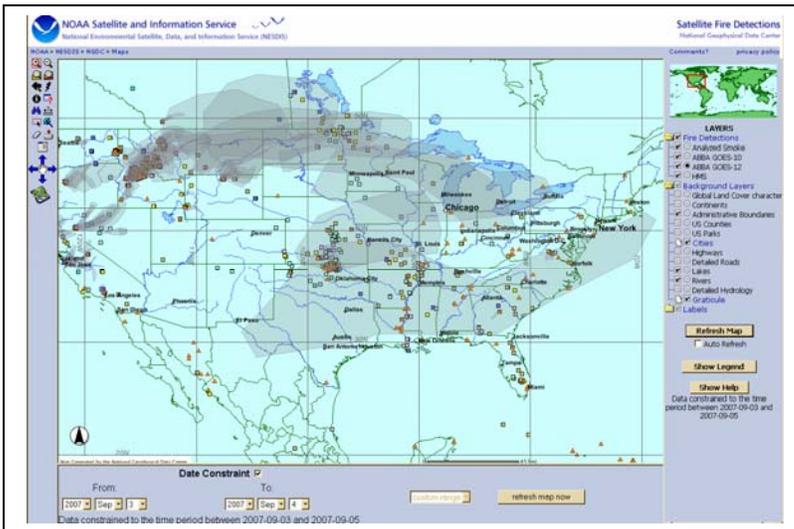
September 1-2, 2007

The map shows the smoke plume from the northwest fires to be north of the area. However the pollution rose indicate the increase in PM<sub>2.5</sub> concentrations is from the west which suggests impact from the fires in Oklahoma, Kansas and Missouri.



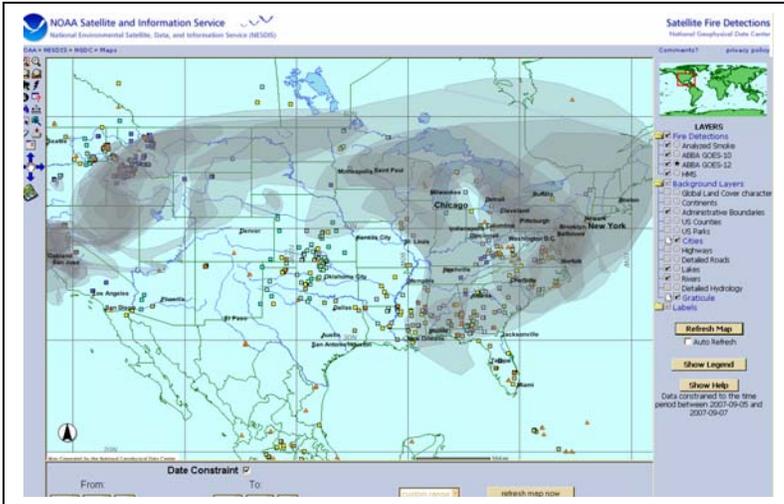
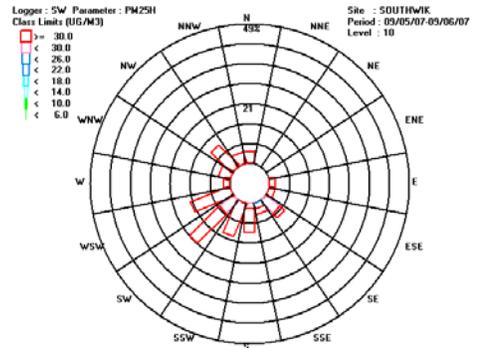
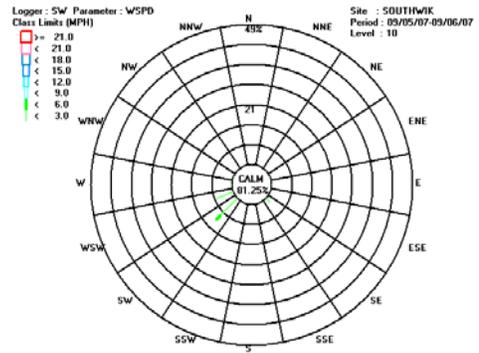
September 3-4, 2007

The maps show smoke plumes converging from multiple fires. The change in wind direction and the pollution rose suggests the impact from the northwest fires to be of more significance.



September 5-6, 2007

The map shows the smoke plume looping from the north to the southwest. Data from the wind rose and pollution rose correspond to this looping effect as well as the data from the NOAA HYSPLIT model which clearly demonstrates the looping effect.



September 7-8, 2007

As the fires are contained and the wind directions change more from the southwest the plume moves out of the area. Table 1 shows a significant drop in PM<sub>2.5</sub> levels which correspond to levels more typically observed during this time period.

