Demonstration to Justify Data Exclusion of Data Influenced by Exceptional Events

Date of Event: October 21, 2005

Mecklenburg County LUESA Air Quality
700 North Tryon Street
Suite 205
Charlotte, NC 28202

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Date of Event:
October 21, 2005

1.0 Background

The following analysis provides evidence to document an exceptional event associated with $PM_{2.5}$ measurements that exceeded the 24 hour National Ambient Air Quality Standard (NAAQS = 35 $\mu g/m^3$). These concentrations were measured in the Mecklenburg County (MCAQ), North Carolina ambient air monitoring network.

A prescribed burn was conducted 4.52 miles NNW of the intersection of SC Highways 215 and 72 near Carlisle, SC in Union County, SC. The SC Forestry Commission CFS Number: N102005-11 placed the location of the burn at latitude 34.65 N and longitude -81.50 W. The location of the event is approximately 54 miles SW of the central business district of Charlotte, NC.

Emissions from the fire may have impacted measurements of $PM_{2.5}$ recorded at monitoring sites operating in the Mecklenburg County Air Monitoring network on October 21, 2005. High readings were recorded at two air quality monitoring sites. The data are listed below:

Site:	37-119-0010	37-119-0041
Sampler:	R-P 2025 Sequential	R-P 2025 Sequential
Interval:	24 hr	24 hr
October 21, 2005	40.5 μg/m3	37.1 μg/m3

This data has been flagged in AQS with a Q – Prescribed Burning (q) validity flag.

This demonstration is submitted for EPA concurrence or non-concurrence as indicated by 40 CFR Part 50 § 50.14- Treatment of Air Quality Monitoring Data Influenced by Exceptional Events.

2.0 Definition of an Exceptional Event

An exceptional event as defined by 40CFR Part 50 § 50.1 is “an event that affects air quality, is not reasonably controllable or preventable, is an event caused by human activity that is unlikely to recur at a particular location or a natural event, and is determined by the Administrator in accordance with 40 CFR 50.14 to be an exceptional event.”

3.0 Evidence Event Occurred

3.1 Location of Event

The event is documented by the South Carolina Forestry Commission CFS Information Report, CFS Number: N102005-11. The report was received at 11:04 am on October 20, 2005 and sent at 11:06 am on October 20, 2005. (Please see the attached report located in Appendix A.) The address for the event was latitude 34.65 N and longitude -81.50 W.

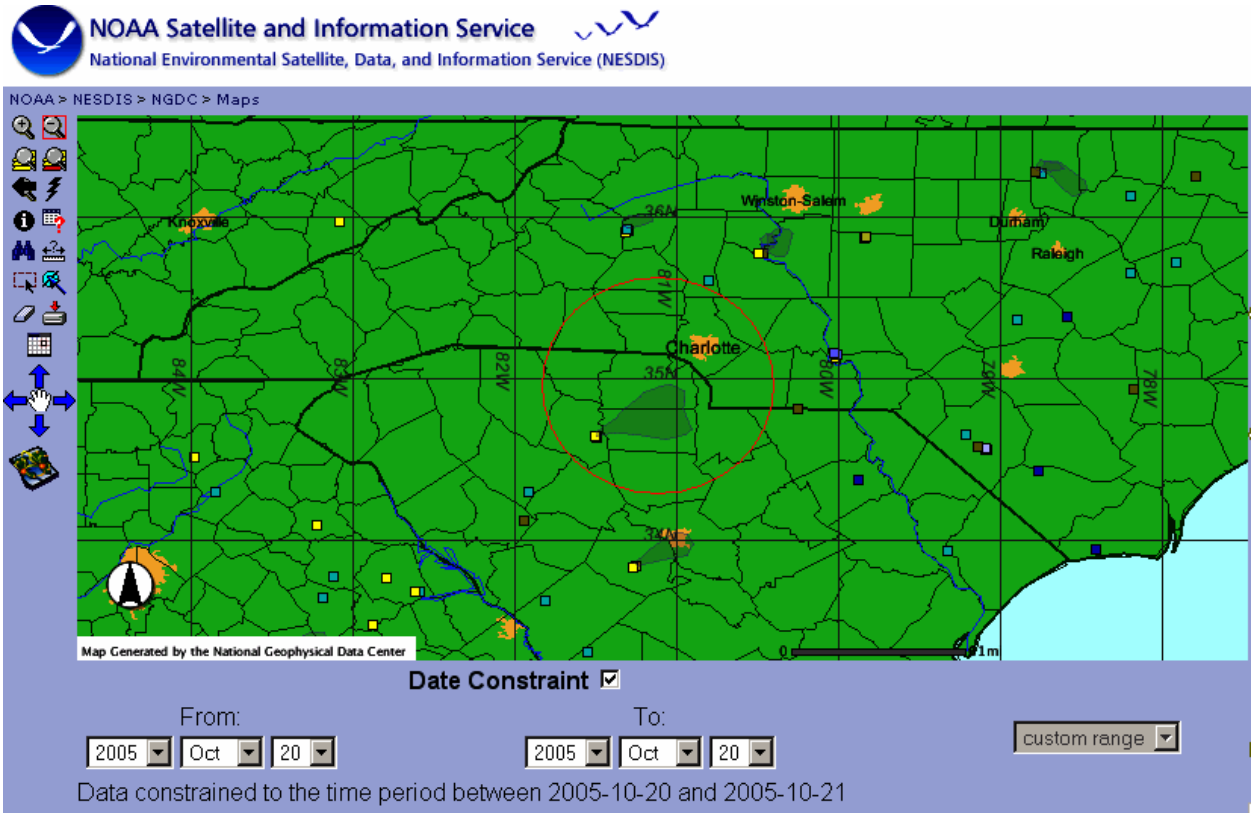

Figure1. NOAA Satellite and Information Service – October 20, 2005[1]

3.2 National Oceanic and Atmospheric Administration's National Environmental Satellite, Data, and Information Service (NESDIS)[4] Information

Listed below is the National Oceanic and Atmospheric Administration's National Environmental Satellite, Data, and Information Service (NESDIS) report from October 20, 2005. The report has been included to provide background information regarding conditions in the region. It does not discuss the event that is the subject of this analysis. The event, however; was documented by NESDIS from information derived from the analysis of satellite data (See Figure 1 above.) The location of the prescribed burning

as documented by the NESDIS analysis corresponds with the location cited on the SC Forestry Commission CFS Information report.

Thursday, October 20, 2005
DESCRIPTIVE TEXT NARRATIVE FOR SMOKE/DUST OBSERVED IN SATELLITE IMAGERY
THROUGH 0300Z October 21, 2005
"…Southeastern US/Middle and Lower Mississippi Valley/Southeastern Texas: Numerous fires with smoke were detected this afternoon and early evening across a very large swath stretching from southeastern Texas across the middle and lower Mississippi Valley to the Southeast. The fires with the largest and most dense smoke plumes were over western Georgia, central to southwestern Alabama, central to western Louisiana, and southeastern Texas. All smoke plumes in this region were moving in a NNE or NE direction. Even though a very concentrated area of agricultural burns was analyzed over the middle Mississippi Valley, only minimal amounts of smoke were detected. Cloudiness from an approaching weather system overspread the area late in the afternoon at the time when smoke generally can be observed the best using GOES-East Visible Imagery with the low sun angle…"

4.0 Composition and Size of Fires

4.1 South Carolina Forestry Commission Information:

The following information was documented in telephone discussions with Libby Martin, Dispatch Operations Coordinator for the South Carolina Forestry Commission. The discussions occurred on October 3rd and 4th, 2007.

The event documented as N102005-11 was conducted in accordance with the South Carolina Smoke Management Plan and was classified as a "Site Prep Burn". Conditions on the date of the burn were predicted as a "Smoke Management Category Day - 4". A total of 120 acres were burned. Fuel loading was 4 tons per acre. Material burned was not determined.

The following emission estimates were determined using the "Andreae and Merlet: Emissions from Biomass Burning" table (2001)[2]. Since the material burned is not known, values were estimated using combined and averaged emission factors for savanna and grassland / extratropical forest. Where ranges of emissions factors were given, the average value was used.

Area Burned	120 acres
Estimated Fuel Loading (SC)	4 tons per acre (0.9 kg/m^2)
PM2.5 Grassland / Savanna emission factor	5.4 g/kg
PM2.5 Extratropical Forest emission factor	13.0 g/kg
Average PM2.5 emission factor	9.2 g/kg
Material Consumed	437,400 kg
PM2.5 emitted	4024 kg (4.4 tons)

Table 1.

5.0 Meteorological Data

19-Oct-05											
TimeEDT	Temperatu	Dew PointF	Humidity	Sea Level I	Visibility	Wind Direc	Wind Spee	Gust Speed	Precipitatio	Events	Conditions
12:51 AM	61	55	81	29.96	10	Calm	Calm	-	N/A		Scattered Clouds
1:51 AM	60.1	54	80	29.96	10	Calm	Calm	-	N/A		Scattered Clouds
2:51 AM	55	52	89	29.97	10	Calm	Calm	-	N/A		Clear
3:51 AM	57	54	89	29.97	10	Calm	Calm	-	N/A		Clear
4:51 AM	55	53.1	93	29.97	10	Calm	Calm	-	N/A		Partly Cloudy
5:51 AM	55	53.1	93	29.99	10	WNW	3.5	-	N/A		Partly Cloudy
6:51 AM	54	52	93	29.99	10	Calm	Calm	-	N/A		Partly Cloudy
7:51 AM	53.6	53.6	100	30.02	7	West	3.5	-	N/A		Partly Cloudy
8:51 AM	62.1	57	84	30.02	9	Calm	Calm	-	N/A		Partly Cloudy
9:51 AM	64.9	55.9	73	30.03	10	NW	3.5	-	N/A		Partly Cloudy
10:51 AM	72	55.9	57	30.02	10	Calm	Calm	-	N/A		Clear
11:51 AM	75.9	59	56	30.01	10	Variable	3.5	-	N/A		Clear
12:51 PM	79	59	50	29.99	10	Variable	4.6	-	N/A		Clear
1:51 PM	81	57.9	45	29.95	10	SSW	8.1	-	N/A		Clear
2:51 PM	81	59	47	29.94	10	SSW	6.9	-	N/A		Clear
3:51 PM	82	57.9	44	29.92	10	South	6.9	-	N/A		Clear
4:51 PM	81	57	44	29.93	10	SW	4.6	-	N/A		Clear
5:51 PM	78.8	60.8	54	29.95	10	SSW	3.5	-	N/A		Clear
6:51 PM	71.1	61	70	29.94	10	Calm	Calm	-	N/A		Partly Cloudy
7:51 PM	63	60.1	90	29.95	10	Calm	Calm	-	N/A		Clear
8:51 PM	68	60.1	76	29.95	10	Calm	Calm	-	N/A		Clear
9:51 PM	66.9	60.1	79	29.96	10	Calm	Calm	-	N/A		Clear
10:51 PM	64.9	60.1	84	29.95	9	Calm	Calm	-	N/A		Partly Cloudy
11:51 PM	64.9	60.1	84	29.95	8	South	3.5	-	N/A		Partly Cloudy

10/20/05											
TimeEDT	Temperatu	Dew Point	Humidity	Sea Level	Visibility	Wind Direction	Wind Spee	Gust Spee	Precipitatio	Events	Conditions
12:51 AM	63	60.1	90	29.95	7	SSE	3.5	-	N/A		Partly Cloudy
1:51 AM	63	60.1	90	29.95	7	Calm	Calm	-	N/A		Scattered Clouds
2:51 AM	62.1	60.1	93	29.95	7	Calm	Calm	-	N/A		Scattered Clouds
3:51 AM	61	59	93	29.94	6	Calm	Calm	-	N/A		Scattered Clouds
4:51 AM	59	57.9	96	29.94	5	Calm	Calm	-	N/A		Scattered Clouds
5:51 AM	57.9	57	97	29.95	4	Calm	Calm	-	N/A		Partly Cloudy
6:25 AM	57.2	57.2	100	29.97	4	Calm	Calm	-	N/A		Partly Cloudy
6:51 AM	57.9	57.9	100	29.96	4	NW	3.5	-	N/A		Partly Cloudy
7:51 AM	57.9	57	97	29.97	1.5	Calm	Calm	-	N/A	Fog	Patches of Fog
8:51 AM	63	62.1	97	29.98	4	Calm	Calm	-	N/A	Fog	Patches of Fog
9:51 AM	68	63	84	29.99	4	SSE	6.9	-	N/A		Haze
10:51 AM	73	63	71	29.98	8	Variable	3.5	-	N/A		Clear
11:51 AM	78.1	63	60	29.97	7	Variable	4.6	-	N/A		Clear
12:51 PM	81	62.1	52	29.95	9	South	5.8	-	N/A		Clear
1:51 PM	82	62.1	51	29.92	10	Variable	6.9	-	N/A		Clear
2:51 PM	82.4	60.8	48	29.93	10	SSW	9.2	-	N/A		Partly Cloudy
3:51 PM	82.9	60.1	46	29.9	10	Variable	6.9	-	N/A		Partly Cloudy
4:51 PM	82	60.1	47	29.9	10	SSW	4.6	-	N/A		Partly Cloudy
5:51 PM	78.1	61	56	29.89	10	South	4.6	-	N/A		Partly Cloudy
6:51 PM	75	61	62	29.9	10	SSW	4.6	-	N/A		Partly Cloudy
7:51 PM	73	60.1	64	29.91	10	South	4.6	-	N/A		Clear
8:51 PM	70	59	68	29.93	8	South	3.5	-	N/A		Clear
9:51 PM	70	60.1	71	29.94	8	South	5.8	-	N/A		Clear
10:51 PM	69.8	60.8	73	29.96	7	South	4.6	-	N/A		Clear
11:51 PM	68	59	73	29.93	7	South	4.6	-	N/A		Clear

10/21/05											
TimeEDT	Temperatu	Dew Point	Humidity	Sea Level	Visibility	Wind Direction	Wind Spee	Gust Spee	Precipitatio	Events	Conditions
12:51 AM	68	59	73	29.93	7	Variable	4.6	-	N/A		Clear
1:51 AM	64.9	57.9	78	29.92	6	South	3.5	-	N/A		Haze
2:51 AM	63	57.9	84	29.91	6	Calm	Calm	-	N/A		Haze
3:51 AM	62.1	57.9	86	29.9	5	Calm	Calm	-	N/A		Clear
4:51 AM	57.9	55.9	93	29.91	4	South	4.6	-	N/A		Clear
5:51 AM	59	57	93	29.92	4	SSE	3.5	-	N/A		Clear
6:51 AM	57	55	93	29.93	4	SSE	4.6	-	N/A		Clear
7:12 AM	57.2	55.4	94	29.95	2.5	SSE	3.5	-	N/A	Fog	Patches of Fog
7:19 AM	57.2	55.4	94	29.95	2.5	SSE	4.6	-	N/A	Fog	Patches of Fog
7:51 AM	59	57	93	29.94	3	Calm	Calm	-	N/A	Fog	Patches of Fog
8:51 AM	63	57.9	84	29.94	5	Calm	Calm	-	N/A		Haze
9:51 AM	68	60.1	76	29.94	6	Calm	Calm	-	N/A		Haze
10:51 AM	69.1	59	70	29.94	7	Calm	Calm	-	N/A		Scattered Clouds
11:51 AM	72	60.1	66	29.93	6	WNW	5.8	-	N/A		Haze
12:51 PM	75	60.1	60	29.91	7	West	5.8	-	N/A		Partly Cloudy
1:51 PM	77	61	58	29.87	8	West	4.6	-	N/A		Scattered Clouds
2:51 PM	79	61	54	29.83	10	South	9.2	-	N/A		Scattered Clouds
3:51 PM	80.1	59	48	29.82	10	Variable	4.6	-	N/A		Scattered Clouds
4:51 PM	80.1	60.1	50	29.81	10	Variable	4.6	-	N/A		Scattered Clouds
5:51 PM	75.9	62.1	62	29.81	10	Calm	Calm	-	N/A		Partly Cloudy
6:51 PM	72	63	73	29.82	6	Calm	Calm	-	N/A		Haze
7:51 PM	73	62.1	68	29.82	6	Variable	5.8	-	N/A		Haze
8:51 PM	70	62.1	76	29.8	5	Calm	Calm	-	N/A		Haze
9:51 PM	69.1	62.1	78	29.81	5	NW	4.6	-	N/A		Haze
10:51 PM	66.2	62.6	88	29.83	5	Calm	Calm	-	N/A		Scattered Clouds
11:51 PM	64.9	61	87	29.8	4	Calm	Calm	-	N/A		Mostly Cloudy

10/22/05											
TimeEDT	Temperatu	Dew PointF	Humidity	Sea Level I	Visibility	Wind Direc	Wind SpeedM	Gust Spee	Precipitatio	Events	Conditions
12:51 AM	63	61	93	29.77	4	NW	5.8	-	N/A		Clear
1:51 AM	61	60.1	97	29.76	4	NW	3.5	-	N/A		Clear
2:07 AM	60.8	60.8	100	29.78	4	WNW	3.5	-	N/A		Partly Cloudy
2:51 AM	60.1	59	96	29.74	4	WNW	5.8	-	N/A		Mostly Cloudy
3:36 AM	60.8	59	94	29.75	3	NW	4.6	-	N/A		Overcast
3:51 AM	59	57.9	96	29.72	3	NNW	4.6	-	N/A		Mostly Cloudy
4:51 AM	57.9	57	97	29.71	3	NW	4.6	-	N/A		Overcast
5:10 AM	59	57.2	94	29.73	2.5	NNW	3.5	-	N/A		Overcast
5:38 AM	60.8	59	94	29.73	2	NW	5.8	-	N/A		Overcast
5:51 AM	60.1	59	96	29.71	2	NNW	3.5	-	N/A		Overcast
6:06 AM	60.8	59	94	29.73	1.5	North	3.5	-	N/A		Overcast
6:51 AM	60.8	59	94	29.72	1.2	North	3.5	-	N/A		Overcast
7:20 AM	60.8	59	94	29.72	1	North	4.6	-	N/A		Overcast
7:44 AM	60.8	59	94	29.73	0.8	Calm	Calm	-	N/A		Overcast
7:51 AM	60.1	59	96	29.71	0.8	North	3.5	-	N/A		Overcast
8:06 AM	60.8	59	94	29.73	1	Calm	Calm	-	N/A		Overcast
8:51 AM	61	59	93	29.73	1.2	North	3.5	-	N/A		Overcast
9:51 AM	62.1	60.1	93	29.72	1.5	Calm	Calm	-	N/A		Overcast
10:09 AM	62.6	60.8	94	29.74	1.5	SSW	3.5	-	N/A		Overcast
10:16 AM	62.6	60.8	94	29.74	3	South	3.5	-	N/A		Overcast
10:51 AM	64.9	59	81	29.72	4	WSW	4.6	-	N/A		Haze
11:51 AM	66.9	57.9	73	29.72	5	WSW	5.8	-	N/A		Haze
12:14 PM	69.8	57.2	64	29.72	6	North	5.8	-	N/A		Haze
12:51 PM	71.1	57.9	63	29.69	7	NW	5.8	-	N/A		Scattered Clouds
1:51 PM	70	57	63	29.68	9	Variable	6.9	-	N/A		Mostly Cloudy
2:51 PM	73.4	53.6	50	29.68	10	WNW	9.2	-	N/A		Scattered Clouds
3:51 PM	72	54	53	29.67	10	NNW	9.2	-	N/A		Mostly Cloudy
4:51 PM	73	53.1	49	29.68	10	Variable	4.6	-	N/A		Scattered Clouds
5:51 PM	69.1	53.1	57	29.71	10	NNW	8.1	-	N/A		Partly Cloudy
6:51 PM	63	46	54	29.75	10	NW	9.2	-	N/A		Partly Cloudy
7:51 PM	61	42.1	50	29.78	10	NW	11.5	-	N/A		Partly Cloudy
8:51 PM	57.9	43	58	29.81	10	NW	9.2	-	N/A		Partly Cloudy
9:51 PM	57.2	41	55	29.83	10	NNW	12.7	-	N/A		Partly Cloudy
10:51 PM	55	39.9	57	29.82	10	NNW	11.5	-	N/A		Clear
11:51 PM	53.1	39.9	61	29.82	10	NNW	9.2	-	N/A		Clear

6.0 Ozone Data from Regional Sites

8 - Hour Averages, ppm									
			16-Oct	17-Oct	18-Oct	19-Oct	20-Oct	21-Oct	22-Oct
Site Name	**County**	**AIRS Code**	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
MonroeMS	Union	37-179-0003	0.047	0.036	0.049	0.058	0.062	0.048	0.047
Enochville	Rowan*	37-159-0022	0.049	0.046	0.055	0.065	0.062	0.054	0.037
Crouse	Lincoln	37-109-0004	0.047	0.046	0.051	0.071	0.070	0.044	0.036
Rockwell	Rowan*	37-159-0021	0.047	0.045	0.055	0.068	0.070	0.052	0.035
Arrowood	Meck. Co	37-119-1005	0.043	0.032	0.037	0.045	0.046	0.036	0.041
County Line (U)	Meck. Co	37-119-1009	0.047	0.041	0.048	0.053	0.053	0.037	0.041
Garinger	Meck. Co.	37-119-0041	0.045	0.036	0.040	0.056	0.052	0.041	0.040
York	York, SC	45-091-0006	0.046	0.043	0.05	0.061	0.064	0.046	0.042
1 - Hour Averages, ppm									
			16-Oct	17-Oct	18-Oct	19-Oct	20-Oct	21-Oct	22-Oct
Site Name	**County**	**AIRS Code**	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
MonroeMS	Union	37-179-0003	0.053	0.045	0.062	0.068	0.072	0.059	0.053
Enochville	Rowan*	37-159-0022	0.053	0.052	0.071	0.084	0.072	0.064	0.054
Crouse	Lincoln	37-109-0004	0.052	0.053	0.059	0.078	0.079	0.06	0.046
Rockwell	Rowan*	37-159-0021	0.052	0.05	0.07	0.079	0.078	0.063	0.049
Arrowood	Meck. Co	37-119-1005	0.054	0.042	0.056	0.062	0.058	0.052	0.048
County Line (U)	Meck. Co	37-119-1009	0.054	0.048	0.057	0.075	0.076	0.052	0.049
Garinger	Meck. Co.	37-119-0041	0.052	0.042	0.061	0.075	0.071	0.065	0.051
York	York, SC	45-091-0006	0.051	0.051	0.056	0.067	0.067	0.058	0.049

Table 2.

7.0 Trajectories and Mixing Heights

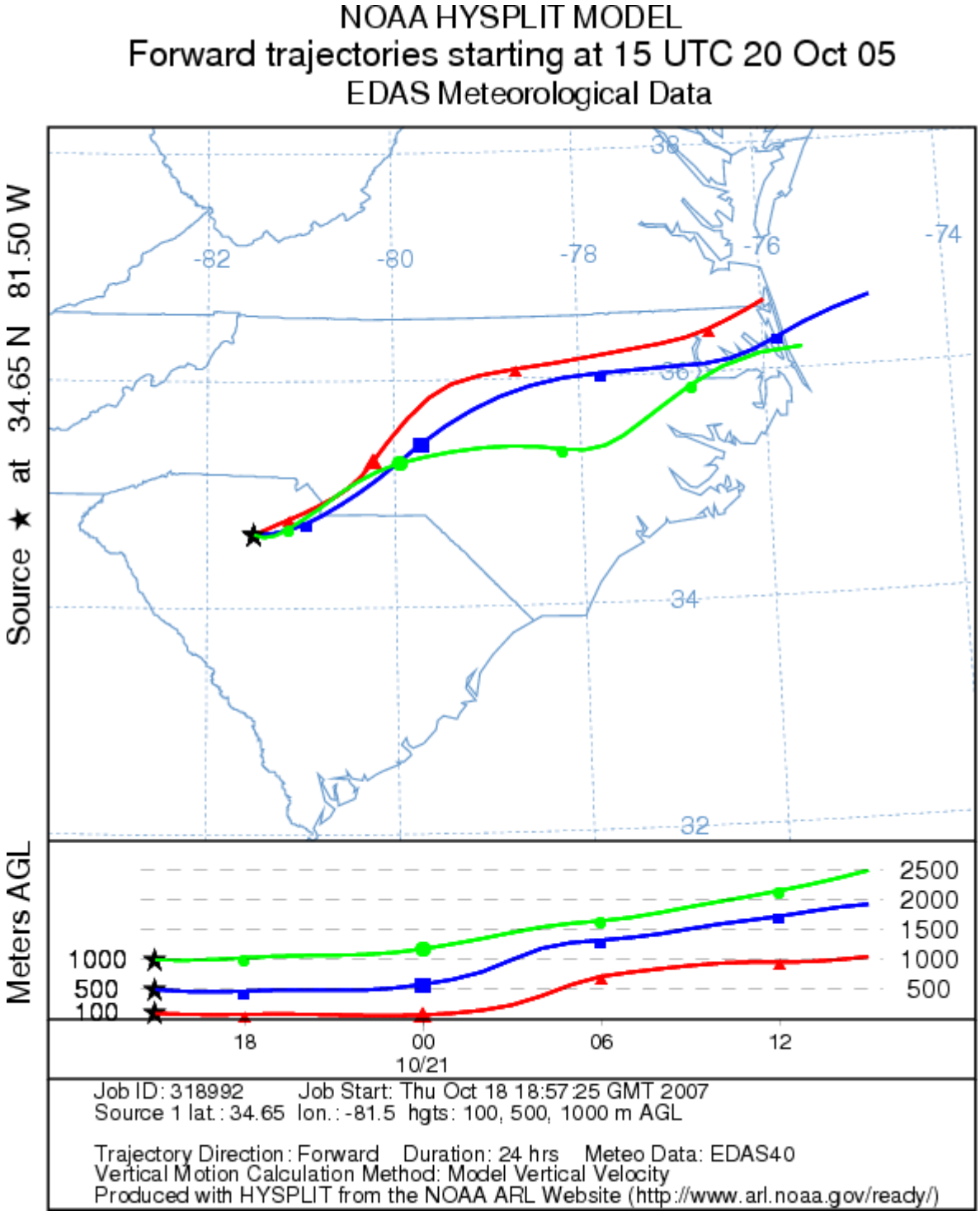

Figure 2.

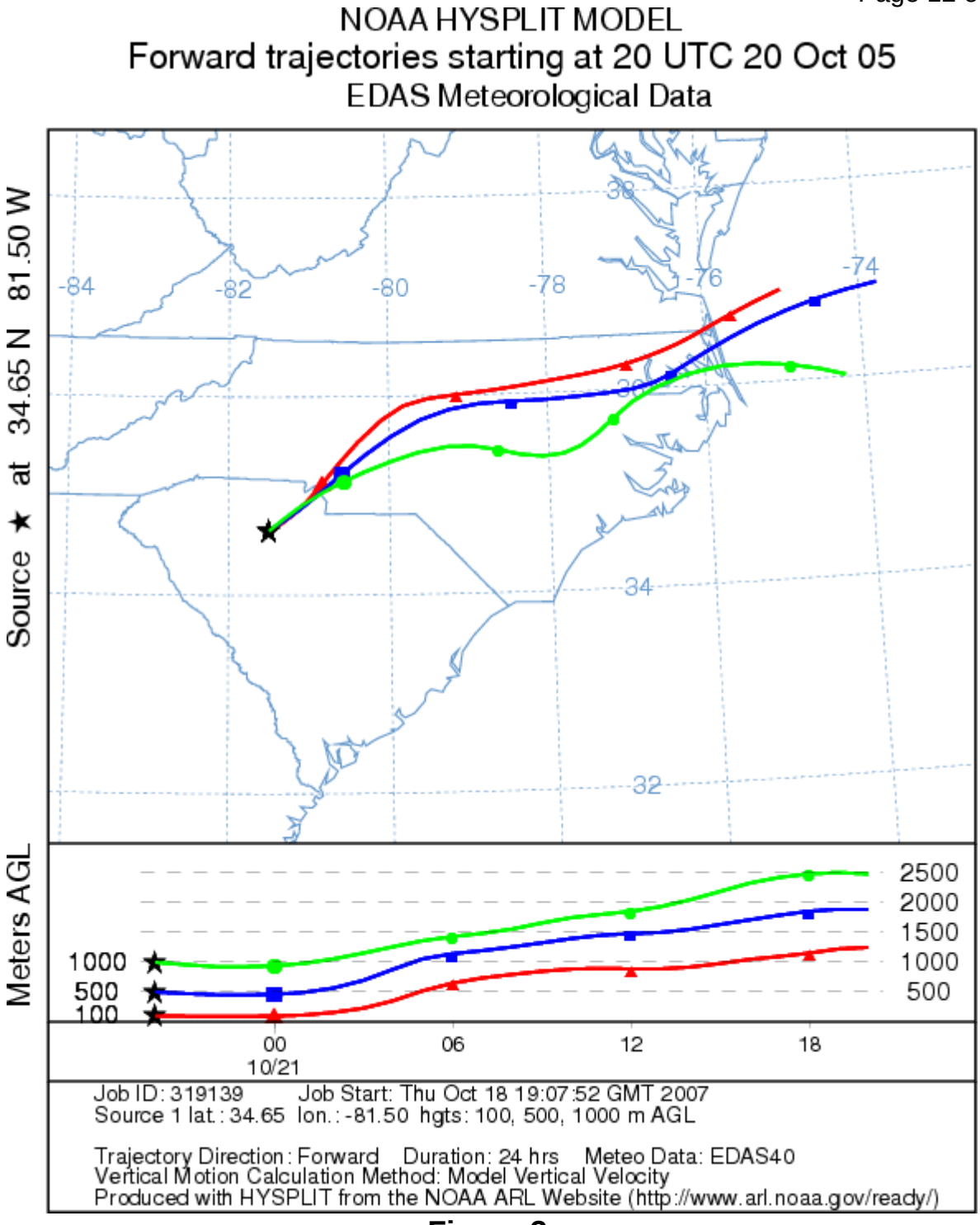
NOAA HYSPLIT MODEL
Forward trajectories starting at 20 UTC 20 Oct 05
EDAS Meteorological Data
Source ★ at 34.65 N 81.50 W
-84
-82
-80
-78
-76
-74
38
34
32
Meters AGL
2500
2000
1500
1000
500
1000
500
100
00
10/21
06
12
18
Job ID: 319139 Job Start: Thu Oct 18 19:07:52 GMT 2007
Source 1 lat.: 34.65 lon.: -81.50 hgts: 100, 500, 1000 m AGL
Trajectory Direction: Forward Duration: 24 hrs Meteo Data: EDAS40
Vertical Motion Calculation Method: Model Vertical Velocity
Produced with HYSPLIT from the NOAA ARL Website (http://www.arl.noaa.gov/ready/)

Figure 3.

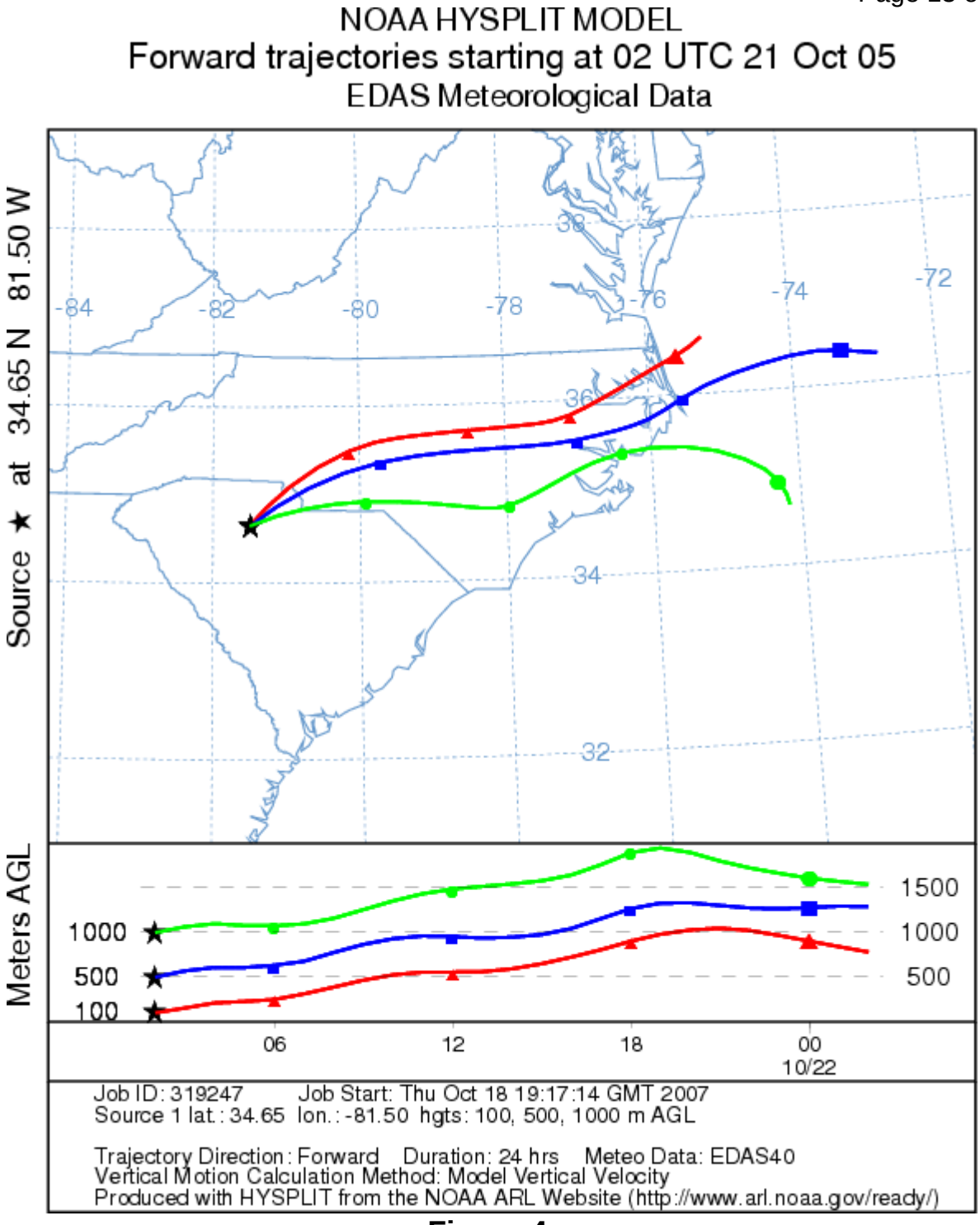
NOAA HYSPLIT MODEL
Forward trajectories starting at 02 UTC 21 Oct 05
EDAS Meteorological Data
Source ★ at 34.65 N 81.50 W
-84
-82
-80
-78
-76
-74
-72
38
36
34
32
Meters AGL
1000
500
100
1500
1000
500
06
12
18
00
10/22
Job ID: 319247 Job Start: Thu Oct 18 19:17:14 GMT 2007
Source 1 lat.: 34.65 lon.: -81.50 hgts: 100, 500, 1000 m AGL
Trajectory Direction: Forward Duration: 24 hrs Meteo Data: EDAS40
Vertical Motion Calculation Method: Model Vertical Velocity
Produced with HYSPLIT from the NOAA ARL Website (http://www.arl.noaa.gov/ready/)

Figure 4.

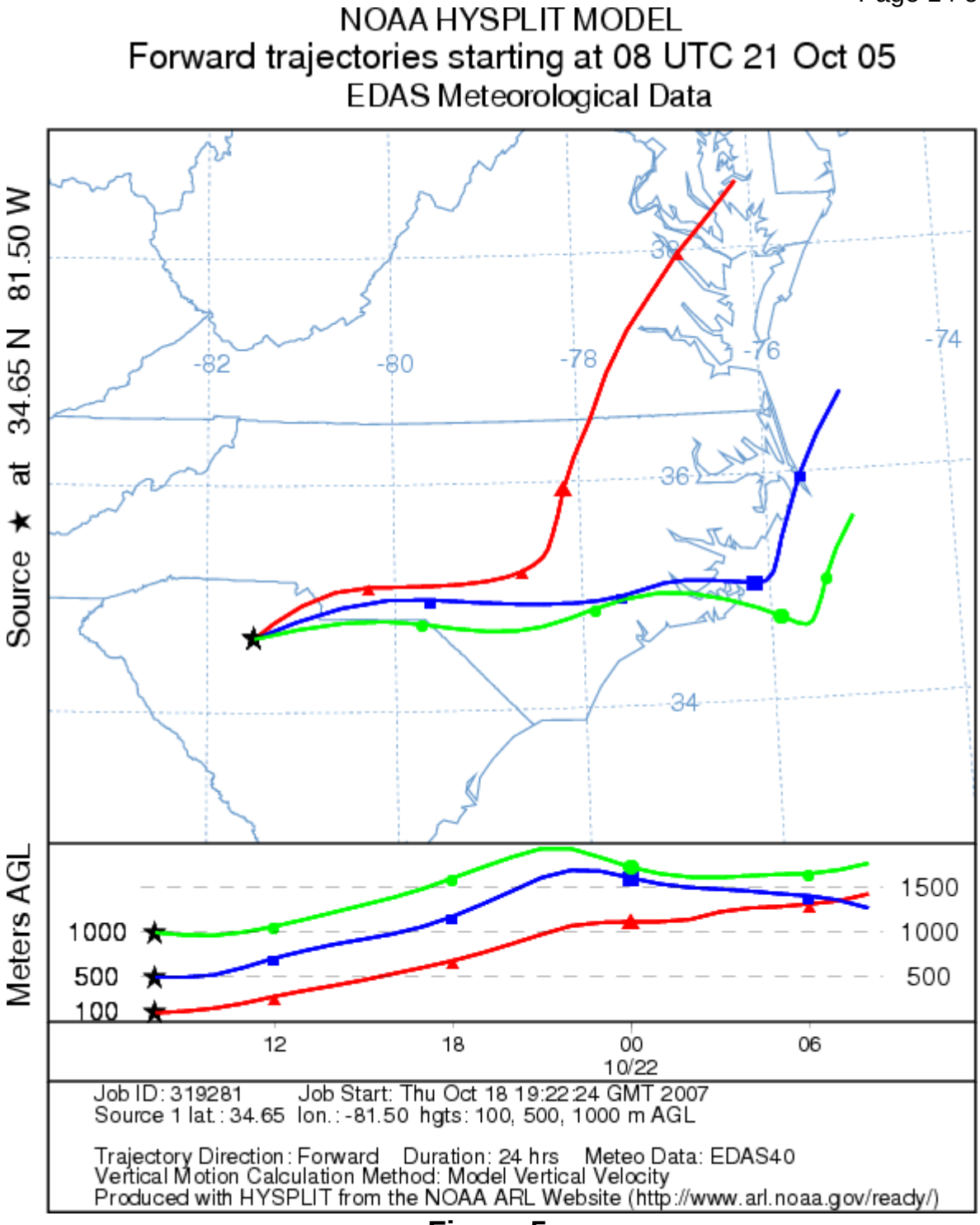
NOAA HYSPLIT MODEL
Forward trajectories starting at 08 UTC 21 Oct 05
EDAS Meteorological Data
Source ★ at 34.65 N 81.50 W
-82
-80
-78
-76
-74
36
34
Meters AGL
1000
500
100
1500
1000
500
12
18
00
10/22
06
Job ID: 319281 Job Start: Thu Oct 18 19:22:24 GMT 2007
Source 1 lat.: 34.65 lon.: -81.50 hgts: 100, 500, 1000 m AGL
Trajectory Direction: Forward Duration: 24 hrs Meteo Data: EDAS40
Vertical Motion Calculation Method: Model Vertical Velocity
Produced with HYSPLIT from the NOAA ARL Website (http://www.arl.noaa.gov/ready/)

Figure 5.

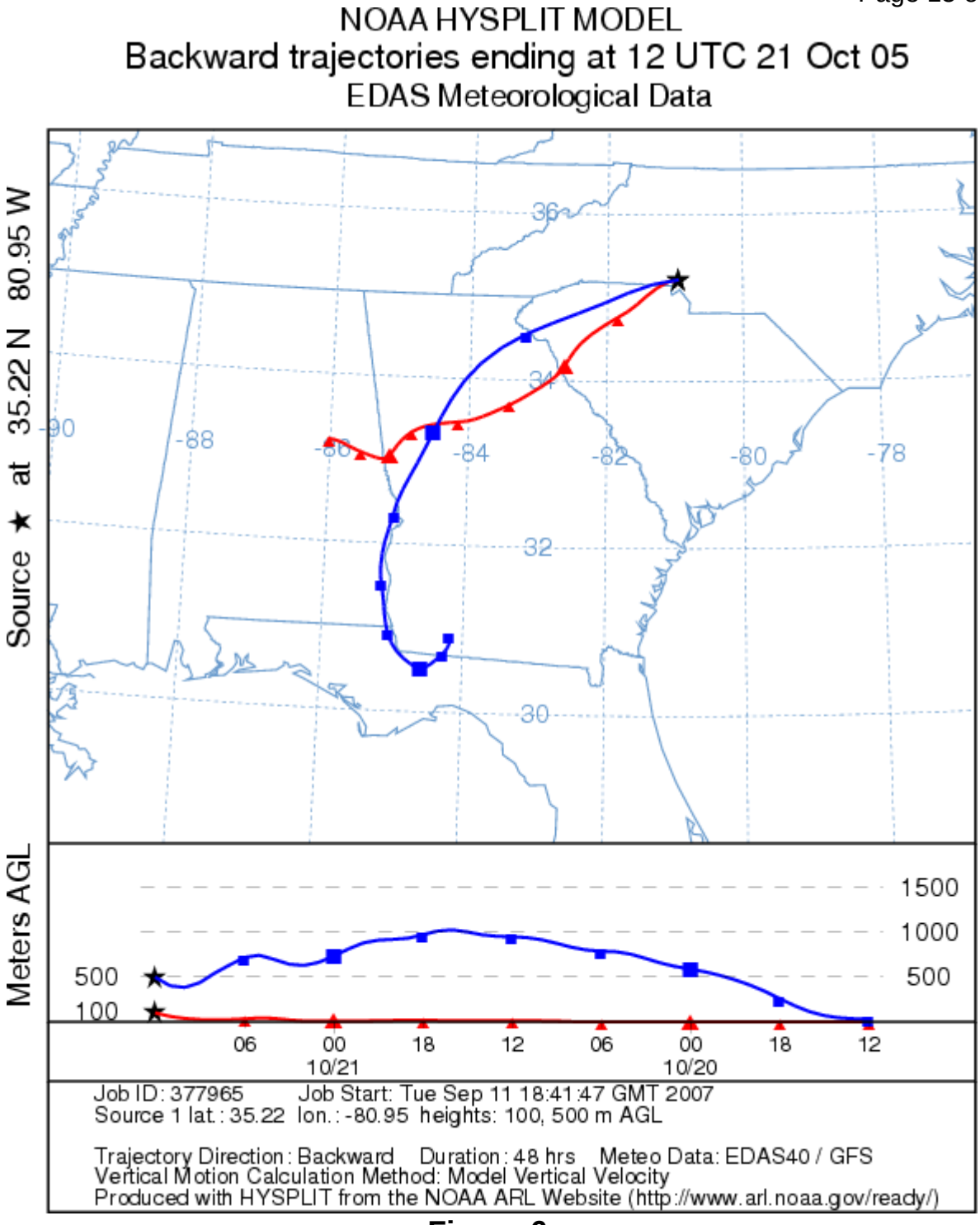
NOAA HYSPLIT MODEL
Backward trajectories ending at 12 UTC 21 Oct 05
EDAS Meteorological Data
Source ★ at 35.22 N 80.95 W
36
34
32
30
-90
-88
-86
-84
-82
-80
-78
Meters AGL
1500
1000
500
500
100
06
00
18
12
06
00
18
12
10/21
10/20
Job ID: 377965 Job Start: Tue Sep 11 18:41:47 GMT 2007
Source 1 lat.: 35.22 lon.: -80.95 heights: 100, 500 m AGL
Trajectory Direction: Backward Duration: 48 hrs Meteo Data: EDAS40 / GFS
Vertical Motion Calculation Method: Model Vertical Velocity
Produced with HYSPLIT from the NOAA ARL Website (http://www.arl.noaa.gov/ready/)

Figure 6.

The table below documents the mixing height in Greensboro, NC on October 21, 2005. Direct upper air measurements are not made in Charlotte, NC. Charlotte is approximately 90 miles SW of Greensboro, NC. The afternoon mixing height reported from Greensboro, NC on October 21, 2005 was 2089 meters.

DAILY MIXING HEIGHTS AND AVERAGE WIND SPEEDS

U/A DATA STA. NO 13723 GREENSBORO, NC

SFC DATA STA. NO 72314 CHARLOTTE, NC

			MORNING				AFTERNOON		
YEAR	MO	DAY	T	MXG HGT	WIND LYR	WIND SFC	T	MXG HGT	WIND LYR	WIND SFC
2005	10	01	1	936	1.5	2.5	1	1671		1.3
2005	10	02	1	354	1.7	1.4	1	1556		2.8
2005	10	03	1	209	3.9	1.5	1	1163		3.4
2005	10	04	1	584	5.9	2.3	1	1565		4.1
2005	10	05	2	564	6.5	3.2	1	1543		4.8
2005	10	06	2	1179	11.5	3.7	2	164		5.7
2005	10	07	2	899	10.7	3.0	2	572		2.8
2005	10	08	2	777	2.7	2.2	1	671		4.0
2005	10	09	1	682	5.1	3.1	1	718		3.4
2005	10	10	2	668	3.4	3.1	2	461		4.1
2005	10	11	2	666	4.1	2.8	2	503		3.7
2005	10	12	1	805	5.4	3.2	1	767		3.6
2005	10	13	1	824	8.8	2.0	1	1080		3.7
2005	10	14	1	144	2.0	2.0	1	1223		3.3
2005	10	15	1	57	.4	.4	1	1281		2.4
2005	10	16	1	261	1.9	2.6	1	1355		2.2
2005	10	17	1	409	2.7	1.4	1	1139		2.5
2005	10	18	1	47	.2	.2	1	1321		1.1
2005	10	19	1	54	.4	.4	1	1767		2.8
2005	10	20	1	60	.2	.2	1	1315		3.0
2005	10	21	1	443	3.4	.8	1	2089		2.6
2005	10	22	1	609	4.8	1.8	1	868		3.2
2005	10	23	1	36	.9	.9	1	802		1.3
2005	10	24	1	128	1.0	1.0	1	128	6.3	6.3
2005	10	25	1	612	11.8	1.2	1	1616		3.8
2005	10	26	1	125	1.3	1.3	1	1429		3.2
2005	10	27	1	103	1.3	1.3	1	1530		1.9
2005	10	28	1	314	4.2	3.0	1	2016		3.6
2005	10	29	1	52	2.3	2.3	1	1882		1.7
2005	10	30	1	29	1.8	1.8	1	1281		1.3
2005	10	31	1	33	.0	.0	1	1077		2.7

MIXING HEIGHT IN METERS
WIND SPEED IN METERS/SEC
TYPE 1 = NO PRECIPITATION
TYPE 2 = PRECIPITATION
TYPE 3 = SELECTED TEMPERATURE LESS THAN RAOB TEMP
TYPE 4 = MISSING

Table 3.

8.0 Selected $PM_{2.5}$ Speciation Data

The event occurred between the scheduled Speciation Trends Network (STN) sample days. No STN data was collected for the event date.

9.0 Continuous and FRM $PM_{2.5}$ Monitoring Data

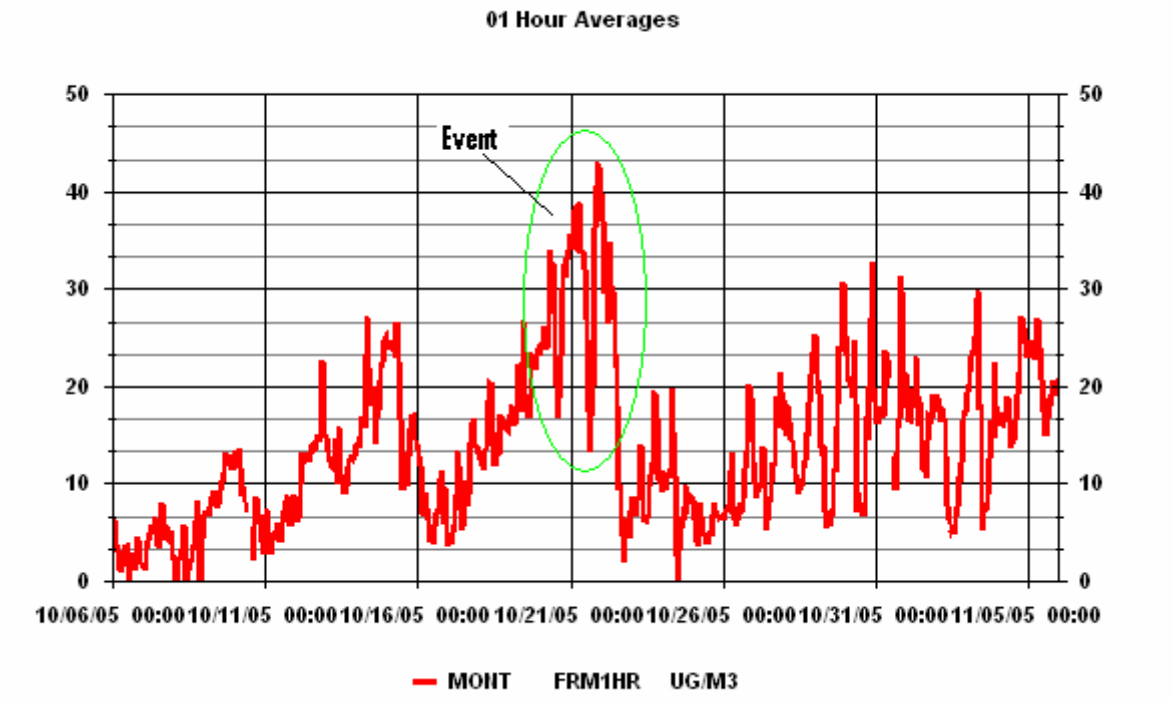

Figure 7. TEOM Data

Data displayed in the chart above was recorded at site 37-119-0042. The measurements were made using an R&P TEOM continuous PM2.5 instrument operating at 50ºC.

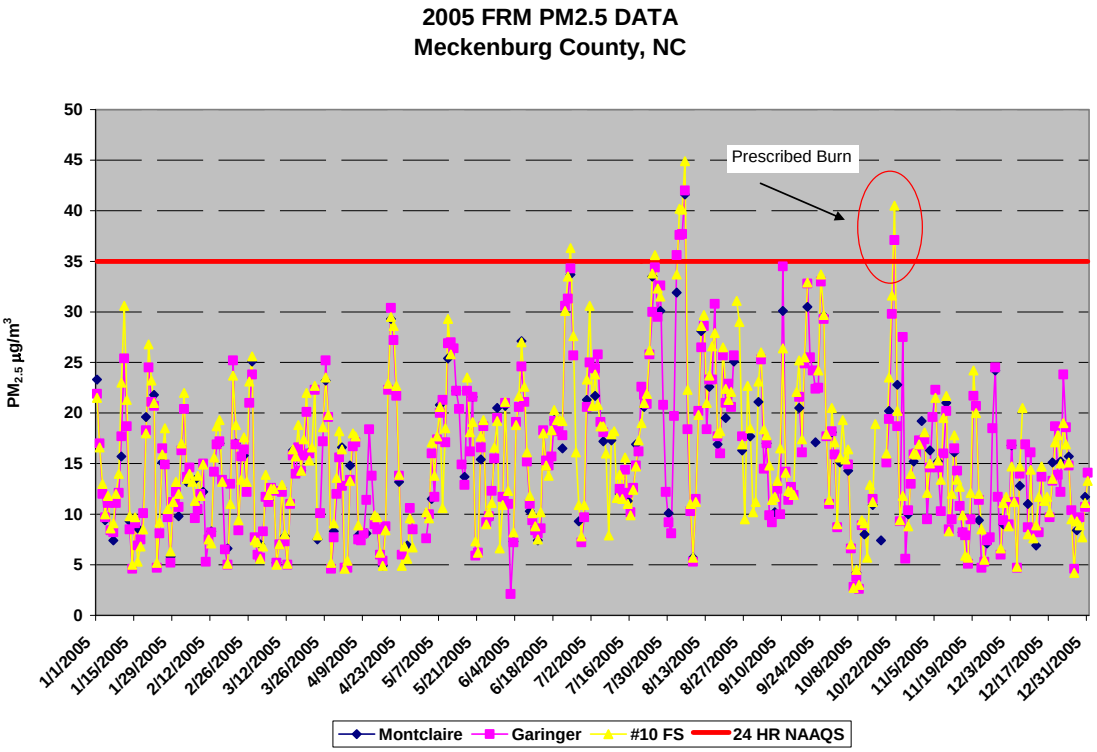

Figure 8. 2005 FRM $PM_{2.5}$ Data for Mecklenburg County

Data displayed in the chart above was recorded at sites 37-119-0041, 37-119-0042, and 37-119-0010.

10.0 Comparison to Typical Data

Below is the box and whisker plot for PM2.5 data measured at all sites operating in Mecklenburg County during the fall months from 2003 to 2005:

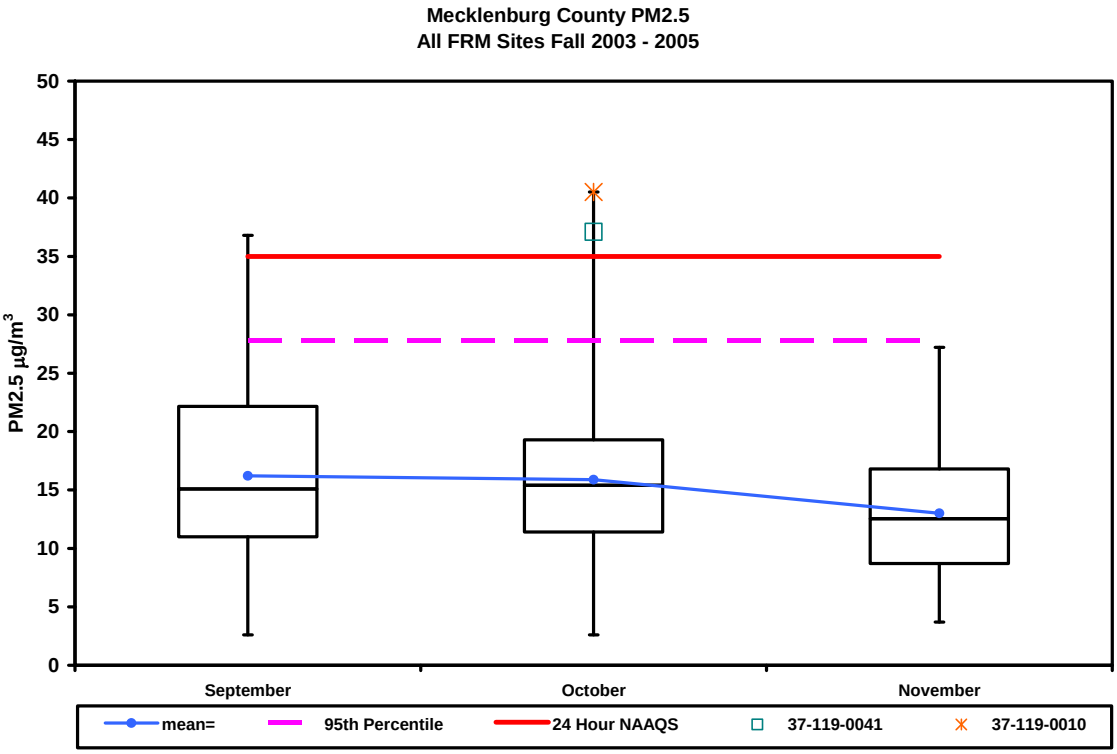

Figure 9.

Since the data being analyzed was measured on October 21st, the fall months were chosen for the analysis rather than the 4th calendar quarter.

The data from October 21, 2005 is plotted for both 37-119-0041 (teal box) and 37-119-0010 (orange ×). The values are 37.1 µg/m^3 and 40.5 µg/m^3, respectively. The 95th percentile for the fall season is 27.8 µg/m^3. The 24-hour NAAQS is 35 µg/m^3. Measured values at each site are 9.3µg/m^3 and 12.7µg/m^3 greater; respectively, than the seasonal 95th percentile for all sites in Mecklenburg County.

	September	October	November
n	203	197	194
# Values > 95th %	17	13	0
# Values > NAAQS	2	3	0

Table 4.

During the 3 year fall period listed above, 35 of 594 measurements are greater than the 95th percentile and 4% of the measurements (5/594) are greater than the NAAQS.

The seasonal evidence indicates data for the date of concern (October 21, 2005) is greater than the 95th percentile at each site of concern (37-119-0041, 37-119-0010). The data is also well above the 75th percentile:

	37-119-0041	37-119-0010
Data for October 21, 2006	37.1 μg/m^3	40.5 μg/m^3
95th Percentile (Seasonal, all sites)	27.8 μg/m^3	
75th Percentile (Seasonal, all sites)	19.0 μg/m^3	

Table 5.

For comparison, the annual data for all sites operating during the period 2003 – 2005 is displayed below:

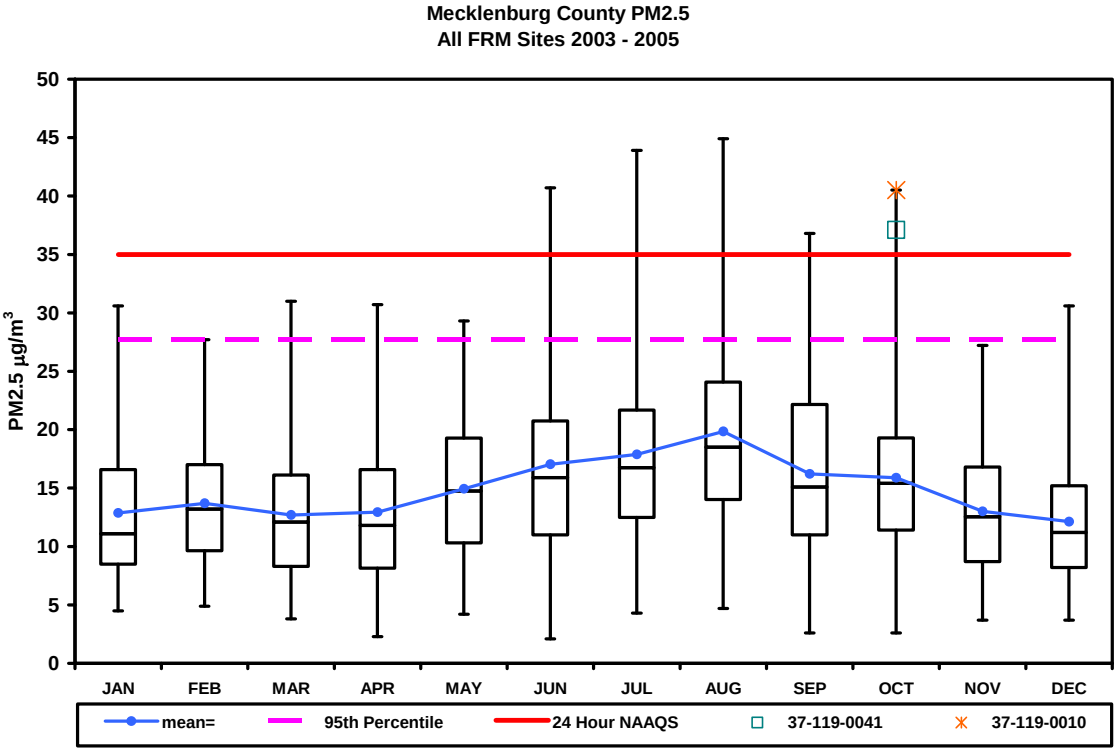

Figure 10.

During the 3 year period listed above 121 of 2396 measurements are greater than the 95th percentile (27.7 μg/m^3) and 1% of the measurements (30/2396) are greater than the NAAQS (35 μg/m^3).

Based on the qualifications of 40 CFR Part 50 § 50.14 (Federal Register / Vol. 72, No. 55 / Thursday, March 22, 2007 / Rules and Regulations Page-13569, and taking into consideration the evidence of the occurrence of the event, the event may be associated with an unusual measured concentration beyond typical fluctuations including background.

11.0 "But For" Analysis

The prescribed burn near Carlisle, SC is estimated (assuming 100% consumption) to have consumed 437,400 kilograms (482 tons) of fuel materials. Using a derived emission factor (Andreae and Merlet, 2001: 9.2 grams per kilogram)[2] yields estimated total $PM_{2.5}$ emissions of 4024 kilograms (4.4 tons) on October 20, 2005.

The South Carolina Forestry Commission CFS Information Report (Appendix A) documents the burn. The National Environmental Satellite, Data, and Information Service (NESDIS) documents the existence of the smoke plume.

Modeled forward trajectories (Figures 3 – 5.) from the event location indicate trajectories that intersect the monitoring area in Mecklenburg County, NC. The modeled trajectories indicate the potential for smoke to be transported to the monitoring locations where it may have impacted measurements made at breathing height (2 m).

The $PM_{2.5}$ concentrations (FRM) measured at the monitoring sites in Mecklenburg County were 40.5 $\mu g/m^3$ and 37.1 $\mu g/m^3$ on October 21, 2005.

Given:

1. Estimated $PM_{2.5}$ emissions from the described event were in excess of 4024 kilograms (4.4 tons) on October 20, 2005 (date prior to the exceedance date).

2. The 75^{th} and 95^{th} percentile of fall $PM_{2.5}$ data for all sites operating in the MCAQ network from 2003 – 2005 was 19.0 $\mu g/m^3$ and 27.8 $\mu g/m^3$, respectively. Measured values were greater than the 95^{th} percentile.

3. Modeled forward trajectories from the location of the described event intersect with the area where $PM_{2.5}$ was measured. The event location was approximately 54 miles from the sampling locations.

4. A multi-variable regression of seasonal (September to November) data from 2003 to 2005 was performed using meteorological data obtained from Charlotte-Douglas International Airport. Daily wind speed, wind direction, temperature, dew point, precipitation, and previous day precipitation data were plotted versus the FRM $PM_{2.5}$ data for each site.

   The estimated 99% upper-bound of a normal approximation (using estimation of missing observations by covariance) for the data for October 21, 2005 were 32.4 $\mu g/m^3$ ($r^2 = 0.35$) and 33.4 $\mu g/m^3$ ($r^2 = 0.41$) at each site respectively, versus the measured values of 37.1$\mu g/m^3$ and 40.5 $\mu g/m^3$.

Based on the 2003 – 2005 seasonal estimations of missing observations by covariance, less than 1% of measured values would be expected to be greater than 32.4 $\mu g/m^3$ at 37-119-0041 and 33.4 $\mu g/m^3$ at 37-119-0010 on October 21, 2005.

But for the contribution of $PM_{2.5}$ from this event, the $PM_{2.5}$ NAAQS may not have been exceeded on October 21, 2005 at sites 37-119-0010 and 37-119-0041.

References

1. Hazard Mapping System (HMS). Image from HMS, July 1, 2006. NOAA Satellite and Information Service, National Environmental Satellite, Data, and Information Service (NESDIS), Satellite Fire Detection – National Geophysical Data Center, http://map.ngdc.noaa.gov/website/firedetects/viewer.htm .

2. Andreae, M. O. and P. Merlet, “Emission of Trace Gases and Aerosols from Biomass Burning”, Global Biochemical Cycles, Vol. 15, No. 4, Pages 955-966, December 2001.

3. U.S. Air Quality, The Smog Blog, Http://alg.umbc.edu/usaq/archives/2006_07.html , July 2006.

Appendix A

SC FORESTRY COMMISSION

CFS INFORMATION REPORT

CFS Number: N102005-11
Date: 10/03/2007
Page: 1 of: 1

CFS Number: N102005-11
Call Taker: PDMNT34
Inc Code: SP
Date Rcvd: 10/20/2005 11:04:51 AM
Day: THRUSDAY
In Progress: 4
Sent: 10/20/2005 11:06:20 AM
Completed: 10/21/2005 12:00:50 AM
Inc Address: @ 34 39 00.00 @ 81 30 00.00 UNION
Complainant: KENNY DORN
Phone:
Comp Addr: SECONDARY RD 86
Res Phone: 8649410102
How Rcvd: B
Weapon: Y
Alarm:

DR Number:

DR Number: 6NB00673
Agency: BURN NOTIFICATIONS

Zones:

Zone: EAST-4 SECTOR
Zone: LE-4 ZONE
Zone: PIEDMONT EAST UNIT
Zone: PIEDMONT REGION
Zone: SC FORESTRY COMMISSION
Zone: SC FORESTRY COMMISSION - LE
Zone: SPARTANBURG ZONE
Zone: STATEWIDE LAW ENFORCEMENT
Zone: UNION
Zone: UNION WEATHER ZONE
Zone: WHITMIRE WEATHER STATION

Comments:

10/20/2005 11:06:24 AM PDMNT34 DR NUMBER 06NB00673 ASSIGNED FOR AGENCY BURN NOTIFICATIONS

Appendix B
South Carolina Smoke Management Guidelines (See next Page)

Smoke Management Guidelines

for
Vegetative Debris Burning
for
Forestry, Agriculture, and Wildlife Purposes in the State of South Carolina

SCFC 7th Printing
Revised 8/06

Smoke Management Guidelines

for Vegetative Debris Burning Operations
State of South Carolina

Table of Contents

Published by
the South Carolina Forestry Commission

Objective

The South Carolina Smoke Management Guidelines provide for minimizing the impact of smoke from vegetative debris burning operations for forestry, agriculture, and wildlife purposes.

To do this, the Guidelines define smoke sensitive areas, amounts of vegetative debris that may be burned, and atmospheric conditions suitable for burning this debris.

Administration

The South Carolina Forestry Commission is responsible for administering the Smoke Management Guidelines. In so doing the Commission will consult and coordinate activities with the National Weather Service and the South Carolina Department of Health and Environmental Control (DHEC).

The Forestry Commission is also responsible for training, education, complaint investigation, and evaluation related to the smoke management program. This is in accordance with the *Memorandum of Understanding* between DHEC and the Forestry Commission (p.14), and Air Pollution Regulation 62.2 (p.15).

Daily compliance with the smoke management guidelines will be coordinated by the appropriate SC Forestry Commission Dispatch Center. Dispatchers will be thoroughly familiar with the **Smoke Management Guidelines** and the **Operating Plan for Fire Weather Service in South Carolina**, and will keep informed of the category day and the respective mixing heights and transport winds. Dispatchers will maintain a record of smoke management notifications and smoke complaints.

The **prescribed fire manager** is ultimately responsible for compliance with the Guidelines. This individual should follow a logical plan, identify any smoke sensitive areas, and evaluate downwind conditions prior to and during burning operations. If it is determined that visibility in a smoke sensitive area is already seriously reduced, or would likely become so with additional burning, prescribed fires should be postponed, and fires already in progress should be terminated. Upon termination, residual smoke should be eliminated as soon as possible.

Prescribed Fire Planning

A written prescribed fire plan, prepared by a knowledgeable person, is recommended for each forest, wildlife, and agricultural area to be burned (except for crop stubble and grass fields). The plan can be simple or complex, depending on the area, but each burn unit should be similar in topography, fuels, and the burn objective. The written plan should include the following:

Location and sketch map or photo
Purpose and objective
Description of stand, fuels, and topography
Optimum weather and fuel conditions
Smoke management information
Preparation required
Public contacts needed
Firing technique
Patrol, mop up, and escaped fire procedures
Special precautions
Evaluation information

A prepared form with space for all the above information serves as a good checklist. A sample plan appears on pp.17-18. Other formats may be acceptable.

The prescribed fire plan should be on site during the burn and adhered to by personnel conducting the burn. It is important that the persons preparing the plan and conducting the burn consider the location of all potential smoke sensitive areas in order to eliminate any adverse effects from the smoke. In addition to evaluating smoke sensitive areas within a sixty degree arc downwind from the burn, consider possible wind direction shifts and down-drainage smoke drift in all directions. In the absence of significant wind, residual smoke usually flows to low areas and may create hazardous conditions during night and early morning hours, especially when combined with fog.

Use caution when igniting a large area in a very short time. Smoke columns may penetrate the mixing height ceiling, travel downwind, and descend a considerable distance from the burn. It is especially important under these circumstances to monitor smoke columns downwind to determine potential impact of the smoke.

Smoke Management Forecast

The SC Forestry Commission receives a fire weather forecast from the National Weather Service every day of the year. It includes smoke management information and is usually available by 7:00 A.M. EST. An updated forecast is usually available at approximately 3:00 P.M. EST.

Fire managers can obtain forecast information by calling a Forestry Commission Dispatch Center (1-800-777-3473). The forecast includes: transport wind direction and speed, mixing height, ventilation rate, category day, surface inversion time, nighttime dispersion, and the next day's dispersion outlook. The fire weather forecast is also available on the internet (www.state.sc.us/forest).

The category day issued will remain in effect until a new forecast is received the following day unless it must be changed due to a revised forecast. If the category day is changed due to a revised forecast, all current prescribed fires must be brought into compliance as soon as possible.

The predicted category day, issued in the afternoon updated forecast, is for planning purposes only.

The following table shows the relationship between ventilation rate and category day.

Afternoon Ventilation Rate*	Smoke Management Category Day
0 — 17,249	1
17,250 — 34,499	2
34,500 — 51,749	3
51,750 — 68,999	4
69,000 or greater	5

* Ventilation rate equals transport wind speed multiplied by mixing height

Transport wind speed is measured in mph, and mixing height is measured in feet.

Exercise caution with high transport wind and low mixing height or low transport wind and high mixing height which can cause smoke dispersion problems.

Air Stagnation Advisory and Ozone Alert

Occasionally, during periods of relatively stagnant air, the National Weather Service, at the request of the South Carolina Department of Health and Environmental Control, will issue an Air Stagnation Advisory (ASA). An ASA is a report or warning stating that an Air Pollution Episode exists. There are four levels of an Air Pollution Episode: forecast; watch; alert; and emergency.

When an Air Pollution Episode exists, at the watch, alert, or emergency level, the smoke management category day will be 1. ***When an Ozone Alert is orange or higher, the category day will be 1.*** Ozone season is May 1 through September 30.

ASAs will be issued directly to the public by the Weather Service through television, commercial radio, N.O.A.A. weather radio and newspapers. They will also be relayed by the Forestry Commission's communication network to all SCFC offices. Managers of fires in progress will be notified as soon as possible by Forestry Commission personnel.

Notification Procedure

The fire manager must comply with Title 48, Chapter 35, of the 1976 Code of Laws as amended ("Notification/ Precautions Law"), and all other applicable regulations. Using information from the smoke management forecast and the Guidelines, it is the fire manager's responsibility to calculate available fuel tonnage and/or acreage that may be burned under forecasted conditions before notifying the SC Forestry Commission. Notifications will be accepted only on the day of the burn.

On the day of the burn the fire manager should report the following information to the Forestry Commission Dispatch Center:

Time of burn (planned)
County and location (latitude and longitude if possible)
Type of burn
Tonnage and/or acreage to be burned
Identity of and distance to nearest downwind smoke sensitive area
Person in charge of burn and how he/she can be contacted

If the tonnage for a single burn causes the tonnage for a given 16,000 acres (25 square miles) to exceed permissable limits, the Forestry Commission will advise the fire manager that the plan should be altered (either by delaying the burn, or by reducing the acreage to be burned). Burning is allowed up to the tonnage acceptable under the Guidelines. If a prescribed fire manager decides not to complete a burn or reduces the number of acres to be burned, he/she should then advise the Dispatch Center. This may make it possible for someone else in the vicinity to ignite additional fuels that day.

General Burning Limitations

Category 1:

No burning allowed, except for crop stubble and grass fields (p. 9).

Category 2:

Daytime burning only, between 9:00 A.M. and 4:00 P.M. EST, (10:00 A.M. and 5:00 P.M. DST). The fire should be appreciably burned out by the end of this time frame, with smoke production substantially ended.

Distance to closest downwind smoke sensitive area	Maximum tons of fuel that may be burned per day per 16,000 acres (25 sq. miles)
0 — less than 1000 feet	0
1000 feet — less than 5 miles	360
5 miles — less than 10 miles	720
10 miles or more	1440

CAUTION: In addition to downwind smoke sensitive areas, always consider down-drainage smoke drift. Residual smoke flows to and settles in low areas during the night and early morning, creating hazardous conditions on roads, especially when combined with fog.

Category 3:

If forecasted nighttime dispersion is poor or very poor, only daytime burning will be permitted between 9:00 A.M. and 5:00 P.M., (10:00 A.M. and 6:00 P.M. DST). The fire should be appreciably burned out by the end of this time frame, with smoke production substantially ended. If forecasted nighttime dispersion is fair to excellent, then daytime burning (all hours) and nighttime burning are permissible. If nighttime burning is allowed, ignition prior to receiving the new category day the following morning will be allowed based on the current category day. All burns (including those ignited earlier that morning) must comply with the new category day when issued.

Distance to closest downwind smoke sensitive area	Maximum tons of fuel that may be burned per day per 16,000 acres (25 sq. miles)
0 — less than 1000 feet	0
1000 feet — less than 5 miles	1800
5 miles — less than 10 miles	3600
10 miles or more	no limit

CAUTION: In addition to downwind smoke sensitive areas, always consider down-drainage smoke drift. Residual smoke flows to and settles in low areas during the night and early morning, creating hazardous conditions on roads, especially when combined with fog.

Category 4:

Daytime burning (all hours). Nighttime burning permissible with forecasted fair to excellent nighttime dispersion. When nighttime burning is permissible, ignition prior to receiving the new category day the following morning will be based on the current category day. All burns (including those ignited earlier that morning) must comply with the new category day when issued.

When forecasted dispersion is poor or very poor, the fire should be appreciably burned out by sunset, with smoke production substantially ended by the time of the forecasted inversion.

Distance to closest downwind smoke sensitive area	Maximum tons of fuel that may be burned per day per 16,000 acres (25 sq. miles)
0 — less than 1000 feet	0
1000 feet — less than 5 miles	2880
5 miles — less than 10 miles	5760
10 miles or more	no limit

CAUTION: In addition to downwind smoke sensitive areas, always consider down-drainage smoke drift. Residual smoke flows to and settles in low areas during the night and early morning, creating hazardous conditions on roads, especially when combined with fog.

Category 5:

Daytime burning (all hours). Nighttime burning permissible with forecasted fair to excellent nighttime dispersion. When nighttime burning is permissible, ignition prior to receiving the new category day the following morning will be based on the current category day. All burns (including those ignited earlier that morning) must comply with the new category day when issued.

When forecasted dispersion is poor or very poor, the fire should be appreciably burned out by sunset, with smoke production substantially ended by the time of the forecasted inversion.

Distance to closest downwind smoke sensitive area	Maximum tons of fuel that may be burned per day per 16,000 acres (25 sq. miles)
0 — less than 1000 feet	0
1000 feet — less than 5 miles	3600
5 miles — less than 10 miles	7200
10 miles or more	no limit

CAUTION: In addition to downwind smoke sensitive areas, always consider down-drainage smoke drift. Residual smoke flows to and settles in low areas during the night and early morning, creating hazardous conditions on roads, especially when combined with fog.

Crop Stubble and Grass Fields

This fuel type includes debris left following the harvest of crops such as corn, soybeans, and small grains. Also included are coastal Bermuda and other open field grasses where there is an absence of pine needles, leaves, pine cones, stumps, tree limbs, and other fuels that produce residual smoke. MARSH GRASSES AND RICE FIELDS ARE NOT INCLUDED IN THIS FUEL TYPE.

Because crop stubble and pasture grass fires burn quickly and produce very little residual smoke, fuel loading is not a critical factor. Most attention should be directed to smoke sensitive areas close to the fire. Smoke blowing directly over a road can reduce visibility and cause hazardous conditions. Always consider what is downwind from your fire before igniting it. Don't burn if the wind will blow your smoke on a road or other smoke sensitive area.

Category 1:

Burning is allowed between 9:00 A.M. EST and sunset. A maximum of 50 acres may be ignited at any one time. If you are burning the maximum of 50 acres, smoke from the fire must have dissipated before adjacent fuels are ignited. The burn location must be at least 1000 feet from any downwind smoke sensitive area.

Categories 2-5:

Burning is allowed between 9:00 A.M. EST and sunset. A maximum of 200 acres may be ignited at any one time. If you are burning the maximum of 200 acres, smoke from any previous fires must have dissipated before adjacent fuels are ignited. The burn location must be at least 1000 feet from any downwind smoke sensitive area.

Piled Debris Burning

for Forestry, Wildlife, and Agricultural purposes

This fuel type normally follows a land clearing or timber cutting operation where vegetative materials are piled.

Burning piled debris produces long-term residual smoke and releases large amounts of particulate matter into the air. Special consideration should be given to nighttime dispersion, wind shifts, downwind/down-drainage smoke drift, and residual smoke production during subsequent times of poor dispersion. Piled debris fires should be appreciably burned out and smoke production substantially ended before any forecasted time of inversion or poor dispersion.

Except for small amounts from less than two acres, piled debris must not be ignited on any day when the forecasted nighttime dispersion is poor or very poor.

CAUTION: In addition to downwind smoke sensitive areas, always consider down-drainage smoke drift. Residual smoke flows to and settles in low areas during the night and early morning, creating hazardous conditions on roads, especially when combined with fog.

Category 1:

No burning allowed.

Categories 2-5:

No igniting allowed when forecasted nighttime dispersion is poor or very poor, except for small amounts from less than two acres. Other limitations apply as set forth in the chapter **General Burning Limitations,** Categories 2 through 5, pp.7-8.

NOTE: SC Forestry Commission employees are not permitted to conduct, or provide standby service for, the burning of piled debris.

Ditchbank/Hedgerow

Burning ditchbanks/hedgerows is normally associated with agricultural operations and therefore falls under the Smoke Management Guidelines. To determine fuel loading, select the fuel type (in the Guidelines) that best represents the fuel to be burned in the ditchbank/hedgerow, and use tons/acre for that type.Then estimate acres to be burned.

Typical Total Fuel Loadings

In most, if not all, prescribed fire situations, available tons of fuel will be less than total tons. Due to soil moisture and other factors, all of the fuel on a given area will not be consumed by the fire.

> **Example:** It rained heavily 4 days before a burn is to be conducted in a 20-year-old pine plantation. The pine plantation has a total fuel loading in the medium (8 total tons per acre) range. In this case, if approximately one half of the total fuel will still be wet from the rain, the available fuel will be 4 tons per acre. This is the tonnage that should be used when calculating the tonnage limit that can be burned on a given Category Day.

The following are typical South Carolina fuel types. The total fuel loading ranges are based on results of actual sample measurements.

Pine Litter—overstory composed of loblolly, shortleaf, slash, or longleaf pine. Amount of litter will vary with the age of the stand, degree of crown closure, species and age of rough.

Loading Range	Total Tons/Acre
Low	3
Medium	8
High	14

Hardwood Litter—overstory usually composed of oak–hickory with a mixture of other hardwoods. Amount of litter will vary with the age of the stand, degree of crown closure, species, and age of rough.

Loading Range	Total Tons/Acre
Low	3
Medium	5
High	7

Pine/Hardwood Litter—overstory composed of both pines and hardwoods. Amount of litter will vary with age of the stand, degree of crown closure, species and age of rough.

Loading Range	Total Tons/Acre
Low	3
Medium	6
High	8

Wiregrass—usually associated with a longleaf pine–scrub oak overstory. Some forested areas that are fairly “open” will have a mixture of wiregrass and broomstraw.

Loading Range	Total Tons/Acre
Low	2
Medium	3
High	5

Grass/Brush—first fuel type to appear on site-prepared, burned, or cutover areas. Grass is the major fuel component. Tree/brush species present include pine, gum, maple, oak, wax-myrtle, and sumac.

Loading Range	Total Tons/Acre
Low	2
Medium	4
High	8

Palmetto/Gallberry—occurs mostly along the coast. Overstory is usually pine. Gallberry and palmetto form a brush-type understory. Pine litter is a significant component of this fuel type.

Loading Range	Total Tons/Acre
Low	5
Medium	10
High	15

Marsh Grass—coarse grass, 2–6 feet tall, associated with open wetlands.

Loading Range	Total Tons/Acre
Low	4
Medium	10
High	15

Bay—characterized by heavy brush on a site with considerable organic soil. Primary species are various bays, maple, gum, wax-myrtle, and pond pine. Some species present have waxy leaves with a high oil content.

Loading Range	Total Tons/Acre
Low	10
Medium	15
High	20

Slash in Place—normally follows a clearcut or heavy thinning operation where the debris is not piled. Limbing gate piles should be excluded because of residual smoke production.

Loading Range	Total Tons/Acre
Low	8
Medium	12
High	16

Piled Debris—normally follows a land clearing or timber cutting operation where vegetative materials are piled. Due to heavy fuel loading, fuel arrangement, and large fuel size, inefficient burning produces great amounts of smoke and particulate matter for long time periods.

Loading Range	Total Tons/Acre
Low	10
Medium	15
High	20+

Glossary

Available Fuel—An estimate of the tons of fuel per acre that will actually be consumed by a fire at a given time and place. It is influenced by soil moisture and other factors.

Backing Fire—A fire spreading against the wind.

Category Day—A scale from 1 to 5 based on ventilation rates. For smoke dispersal, 1 is poor and 5 is excellent.

Dispersion—The removal (by whatever means) of pollutants from the atmosphere over a given area.

Dissipated—Scattered, disappeared, vanished.

Down-drainage—In the absence of significant surface winds, especially during night and early morning hours, residual smoke will settle and drift to lower elevations. This drift usually follows drainage patterns, even where elevation change is slight.

Downwind—Wind directions are expressed as flowing *from* one of sixteen cardinal points of compass (N, NNE, NE, ENE,…). If, for example, wind is from the west, then downwind from fire is to the east.

Fuel Loading—An estimate of the entire accumulation of vegetative matter on a given area, expressed in tons per acre.

Head Fire—A fire spreading with the wind.

Ignite—To set on fire.

Inversion—An increase of temperature with height in the atmosphere whereby vertical air movement is inhibited.

Mass Ignition—Igniting large areas in a very short time.

Micrometer—One millionth of a meter (also micron).

Mixing Height—The upper limit of a mixing layer of unstable air within which vigorous up and down movement of the atmosphere occurs. It is measured from the ground surface and is expressed in feet.

Notification—Informing the SC Forestry Commission of intent to burn outdoors and providing all requested information.

Particulate Matter—Any liquid or solid particles. “Total Suspended Particulates” (TSP), as used in air quality, are those particles suspended in or falling through the atmosphere. They generally range in size from 0.1 to 100 micrometers.

Prescribed Fire—Controlled application of fire to vegetative fuels (in either their natural or modified state, under planned weather and fuel moisture conditions, confining the fire to a predetermined area) to accomplish certain objectives including silviculture, wildlife habitat management, grazing, and fire hazard reduction.

Residual Smoke—Smoke produced after the initial fire has passed through the fuel.

Smoke Sensitive Area (SSA)—Any area downwind or down-drainage where smoke may be dangerous or offensive (i.e. roads, towns, chicken farms, etc.)

Stable Layer of Air—A layer of air having a temperature change (lapse rate) less than that of dry adiabatic air (approximately 5.5°F per 1,000 feet), thereby retarding either upward or downward mixing of smoke.

Sunset—Official time as published; from the Bureau of Standards.

Three Year Rough—A woodland understory that has a three-year buildup of litter and vegetation.

Transport Wind Speed and Direction—The average speed of the wind (mph) moving through the mixing layer, and the direction *from* which the wind is coming. When used in conjunction with the observed or forecasted surface wind, it is a smoke drift indicator.

Vegetative Debris—The natural covering of tree leaves and needles, grasses, vines, twigs, and limbs normally involved in a fire.

Ventilation Rate—A rate indicating the capability of the lower atmosphere to diffuse and disperse smoke. It is determined by multiplying the mixing height times the transport wind speed.

Memorandum of Understanding

between the
South Carolina Department of Health and Environmental Control
Bureau of Air Quality
and the
South Carolina Forestry Commission

The agreement is made and entered into the first day of July, 1985, by and between the S.C. Department of Health and Environmental Control, Air Quality (hereinafter referred to as DHEC) and the S.C. Forestry Commission (hereinafter referred to as the Commission).

Whereas DHEC and the Commission, because of mutual concerns relating to vegetative debris burning related to forestry, wildlife, and agriculture, desire to enter into an agreement for the purpose of accomplishing mutual objectives and for cooperation in protecting lives, quality of life and property of the citizens of South Carolina.

Now, therefore, in consideration of the mutual benefits to each party hereto, the parties agree as follows:

1. The Commission assumes the responsibility to coordinate a smoke management program involving vegetative debris burning related to forestry, wildlife, and agriculture.

2. The Commission assumes the responsibility for complaints and investigations of vegetative debris burning related to forestry, wildlife, and agriculture. Noted air quality regulatory violations will be referred to DHEC.

3. The Commission takes an active role in training for, coordinating, and encouraging the use of The Smoke Management Guidelines within the forestry, wildlife, and agricultural communities.

4. The Commission will enforce Precautions Law and require that parties obtain authorization as prescribed by law.

5. The Commission will continue to keep Burning Authorization and Smoke Management records.

6. DHEC shall retain the duty and authority to implement and enforce Air Pollution Regulation 62.2. Under this authority and by this agreement, DHEC relegates the administration of forestry, wildlife, and agricultural burning and resulting emissions to the Commission.

7. DHEC shall promptly notify the Commission of any circumstances, such as an Air Pollution Episode, which would require special action regarding open burning.

8. DHEC shall have the authority to propose and adopt amendments to Air Pollution Control Regulation 62.2; however DHEC shall consult and work with the Commission in identifying provisions of the existing regulations which require amendments and in developing new regulations concerning emissions from open burning.

South Carolina

Department of Health and Environmental Control

Regulation 61-62.2 - Prohibition of Open Burning

Open burning is prohibited except as provided below:

SECTION I - Exceptions

A. Open burning of leaves, tree branches or yard trimmings originating on the premises of private residences and burned on those premises.

B. Open burning in connection with the preparation of food for immediate consumption.

C. Campfires and fires used solely for recreational purposes, ceremonial occasions, or human warmth. Fires set for the purpose of human warmth must use only clean wood products (woody vegetation, leaves, or wood which is not coated with stain, paint, glue or other coating material, and not treated lumber).

D. Fires purposely set in accordance with *Smoke Management Guidelines for Vegetative Debris Burning Operations in South Carolina*, administered by the South Carolina Forestry Commission and acceptable to the Department to include the following:

1. Prescribed burning of forest lands for specific management practices; and

2. Fires purposely set for agricultural control of diseases, weeds, pests, and for other specific agricultural purposes.

3. Open burning of trees, brush, grass and other vegetable matter for game management purposes.

E. Open burning in areas other than predominantly residential for the purpose of land clearing or right-of-way maintenance. This will be exempt only if the following minimum conditions are followed:

1. The location of the burning must be a sufficient distance but not less than 1000 feet, from public roadways and all residential, commercial, and industrial sites not a part of the contiguous property on which the burning is conducted.

2. Winds during the time of the burning must be away from any area in which the ambient air may be significantly affected by smoke from the burning if that area contains a public roadway or a residential, commercial, or industrial site.

3. The material to be burned must have been generated onsite and not moved to the site from another location;

4. The amount of dirt on the material being burned must be minimized;

5. No heavy oils, asphaltic materials, items containing natural or synthetic rubber, or any materials other than plant growth may be burned;

6. The initial burning must be started only between the hours of 9:00 a.m. and 3:00 p.m.; no combustible material may be added to the fire between 3:00 p.m. of one day and 9:00 a.m. the following day;

7. No more than two piles 30' x 30' or equivalent may be burned within a six-acre area at one time; and

8. In the case of land clearing, all salvageable timber and pulpwood must be removed.

F. Fires set for the purposes of training fire-fighting personnel and conducted at permanent fire-fighter training facilities. Prior Department approval is required in order to obtain the exemption as a permanently established training site. Fires set for the purpose of fire-fighter training at non-permanent locations must receive Department approval prior to the initiation of any burning activity. Materials used for fire-fighter training cannot contain asbestos, heavy oils, asphaltic material, plastic or rubber without express written consent from the Department.

G. Open burning on the property where it occurs of residential construction waste from building and construction operations will be exempt only if the following conditions are met:

1. The material being burned is residential construction waste associated with the building and construction of one and two family dwellings only;

2. The location of the burning is at least five hundred (500) feet from any occupied structure other than a dwelling or structure located on the property on which the burning is conducted;

3. Heavy oils, treated wood products, asphaltic materials, items containing natural or synthetic rubber, or any other trade wastes which produce smoke in excess of forty (40) percent opacity are not burned;

4. The burning does not occur during the ozone season (April 1 through October 30); and

5. The burning is conducted only between the hours of 9:00 a.m. and 3:00 p.m.;

H. Open burning, in remote or specified areas:

1. For non-recurring unusual circumstances.

2. For experimental burning for purposes of data gathering and research.

However, prior approval for these types of burning (in subparagraph H above) must be obtained from the Department.

SECTION II - General

A. A written report or warning to a person of a violation at one site shall be considered adequate notice of the Regulation and subsequent observed violations at the same or different site will result in appropriate legal action.

B. Open burning may be conducted in certain situations if no undesirable levels are or will be created. The authority to conduct open burning under this Regulation does not exempt or excuse the person responsible for the burning from the consequences of or the damages or injuries resulting from the burning and does not exempt or excuse anyone from complying with other applicable laws and with ordinances, regulations, and orders of governmental entities having jurisdiction, even though the burning is otherwise conducted in compliance with this Regulation.

C. The Department reserves the right to impose other or different restrictions and exemptions on open burning in addition to those enumerated above, whenever in the judgment of the Department such is necessary to realize the purpose of this Regulation.

R. 61-62.2 History – South Carolina State Register:
Vol. 9, Issue No. 5, (Doc. No. 457), May 24, 1985.
Vol. 28, Issue No. 6, (Doc. No. 2872), June 25, 2004.

Prescribed Fire Plan

South Carolina Forestry Commission

County_____ Lat. & Long._____ Photo #_____ Acres_____

Owner & Address_____

Phone #_____ Agent & Phone#_____

Burn Purpose & Objectives _____

_____

Stand Description: overstory_____

understory_____

Fuels Description _____

_____ Fuel Model #_____

Soil Type_____ Topography_____

Wind Direction_____ Wind Speed (20 ft.)_____ Rel. Hum._____ Temp._____

1 hr. Fuel Moist._____ 10 Hr. Fuel Moist._____ Drought Index _____

Months_____ Flame Length Mid-Flame Wind Speed _____

Avail. Tons/Acre _____ Total Avail. Tons _____ Trans. Wind Dir. _____

Smoke Sens. Areas_____ Distance_____ Min. Category Day_____

Advance Preparation _____

Firing Technique _____

Personnel & Equip. _____

Patrol, Mopup, Escaped Fire Procedures_____

_____

_____

Special Precautions_____

_____

Adjacent Owners & RFD to inform _____

Prepared by: _____ Approved by:_____

Date:_____ Date:_____

Prescribed Fire Plan

_____Tract

Pre-Burn Checklist: Weather Update_____Notify Dispatch_____Inform Others_____

Smoke Signs_____ Smoke Management Compliance_____Escaped Fire Plan_____

Plan & Map Review _____Safety Brief_____Firebreak Inspect _____Test Fire_____

Conducted by:_____ Date:_____

Evaluation: Wind Dir._____Wind Speed (20 ft.)_____RH ___Temp._____Cat.Day_____

%Fuel Burned _____%Crown Scorch_____%Stem Kill _____Fire Escape?_____

Smoke Dispersal_____Drought Index_____Objectives Met?_____

Problems, Plan Variances, Remarks _____

_____

_____

Conducted by:_____Date:_____

TITLE 48, CHAPTER 34
SOUTH CAROLINA PRESCRIBED FIRE ACT

48-34-20. Definitions.

As used in this chapter:

1. 'Prescribed fire' means a controlled fire applied to forest, brush, or grassland vegetative fuels under specified environmental conditions and precautions which cause the fire to be confined to a predetermined area and allow accomplishment of the planned land management objectives. It also is known as 'controlled burn'.

2. 'Certified prescribed fire manager' means an individual who successfully completes a certification program approved by the State Commission of Forestry.

3. 'Prescribed fire plan' means a written prescription for starting and controlling a prescribed fire.

48-34-30. Forestry Commission responsibility.

The State Commission of Forestry shall promulgate regulations for the use of prescribed fire and for the certification of prescribed fire managers.

48-34-40. Requirements for prescribed fire qualified under this chapter.

Prescribed fires conducted pursuant to this chapter:

1. must have a prescribed fire plan prepared before authorization to burn is given by the State Commission of Forestry, and the plan must be on site and followed during the burn;

2. must have at least one certified prescribed fire manager present and supervising the burn from ignition until it is declared safe according to certification guidelines;

3. are considered in the public interest and do not constitute a public nuisance when conducted pursuant to state air pollution statutes, smoke management guidelines, and regulations applicable to the use of prescribed fire;

4. are considered a property right of the property owner.

48-34-50. Liability protection unless negligence proven.

No property owner or lessee or his agent or employee conducting a prescribed fire pursuant to this chapter is liable for damage, injury, or loss caused by fire, resulting smoke, or other consequences of the prescribed fire unless negligence is proven.

48-34-60. Other prescribed fires not prohibited.

Notwithstanding the requirements of this chapter, a person may conduct a prescribed fire without a certified prescribed fire manager present.

CHAPTER 2.
FOREST MANAGEMENT PROTECTION ACT

SECTION 50-2-10. Short title.

This act may be cited as the “South Carolina Forest Management Protection Act”.

SECTION 50-2-20. Purpose of Forest Management Protection Act.

The purpose of this act is to encourage and protect landowners’ ability to maintain their land for forest use and to conduct forest management activities.

SECTION 50-2-30. Definitions.

(A) A forestry operation is an area where forest management activities are conducted for the production of timber resources for wood products or providing wildlife habitat, outdoor recreation, or other environmental values. A forestry operation inherently includes lengthy periods between forest management activities and shall be deemed continuously operating so long as the operation supports an actual or developing forest.
(B) Forest management activities include, but are not limited to, timber harvest, site preparation, controlled burning, tree planting, applications of fertilizers, herbicides, and pesticides, weed control, animal damage control, fire control, insect and disease control, forest road construction, and any other generally accepted forestry practices.

SECTION 50-2-40. Application of Forest Management Protection Act.

This act shall apply only to forest management activities on forestry operations that are eligible for timberland use value assessment for property tax purposes.

SECTION 50-2-50. Forestry operation as nuisance; established date of operation; local ordinance making forestry operation nuisance null and void.

(A) No established forestry operation is or may become a nuisance, private or public, if the forestry operation adheres to best management practices as promulgated by the South Carolina Forestry Commission. This section does not apply whenever a nuisance results from the negligent, improper, or illegal operation of a forestry operation.
(B) For the purposes of this chapter, the established date of operation is the date on which the forestry operation commenced operation. If the operation is expanded subsequently or new technology adopted, the established date of operation for each change is not a separately and independently established date of operation and the commencement of the expanded operation does not divest the forestry operation of a previously established date of operation.
(C) An ordinance of a county or municipality that makes a forestry operation following best management practices as promulgated by the South Carolina Forestry Commission a nuisance or providing for abatement as a nuisance in derogation of this chapter is null and void. The provisions of this section do not apply whenever a nuisance results from the negligent, illegal, or improper operation of a forestry operation.