

2008 Northern California Wildfires

Beginning June 20, 2008, lightning from a series of thunderstorms ignited hundreds of fires throughout Northern and Central California. By the time the last of the fires were finally contained in September, over 26 counties had been affected, with over a million acres burned. PM_{2.5} FRM monitors throughout the Northern and Central regions of California exceeded the PM_{2.5} 24-hour National Ambient Air Quality Standard (NAAQS) of 35 ug/m³.

Documentation for this natural event was prepared by ARB staff and posted on the ARB website at <http://www.arb.ca.gov/desig/excevents/2008wildfires.htm> for public review beginning July 20, 2009. An announcement of this posting was sent to all Air Districts as well as through the email listserv established for public interested in State designation activities. No comments were received.

The major Federal Wildland fires during this time period are shown in Table 1. The locations of these wildfires, as well as the affected PM_{2.5} monitors, are shown in the accompanying map in Figure 1. As can be noted, monitoring sites were affected by numerous fires, with variations in concentrations at the sites dependent on weather conditions and topography, as well as the relative strength and proximity of various fires to the monitoring sites on a given day.

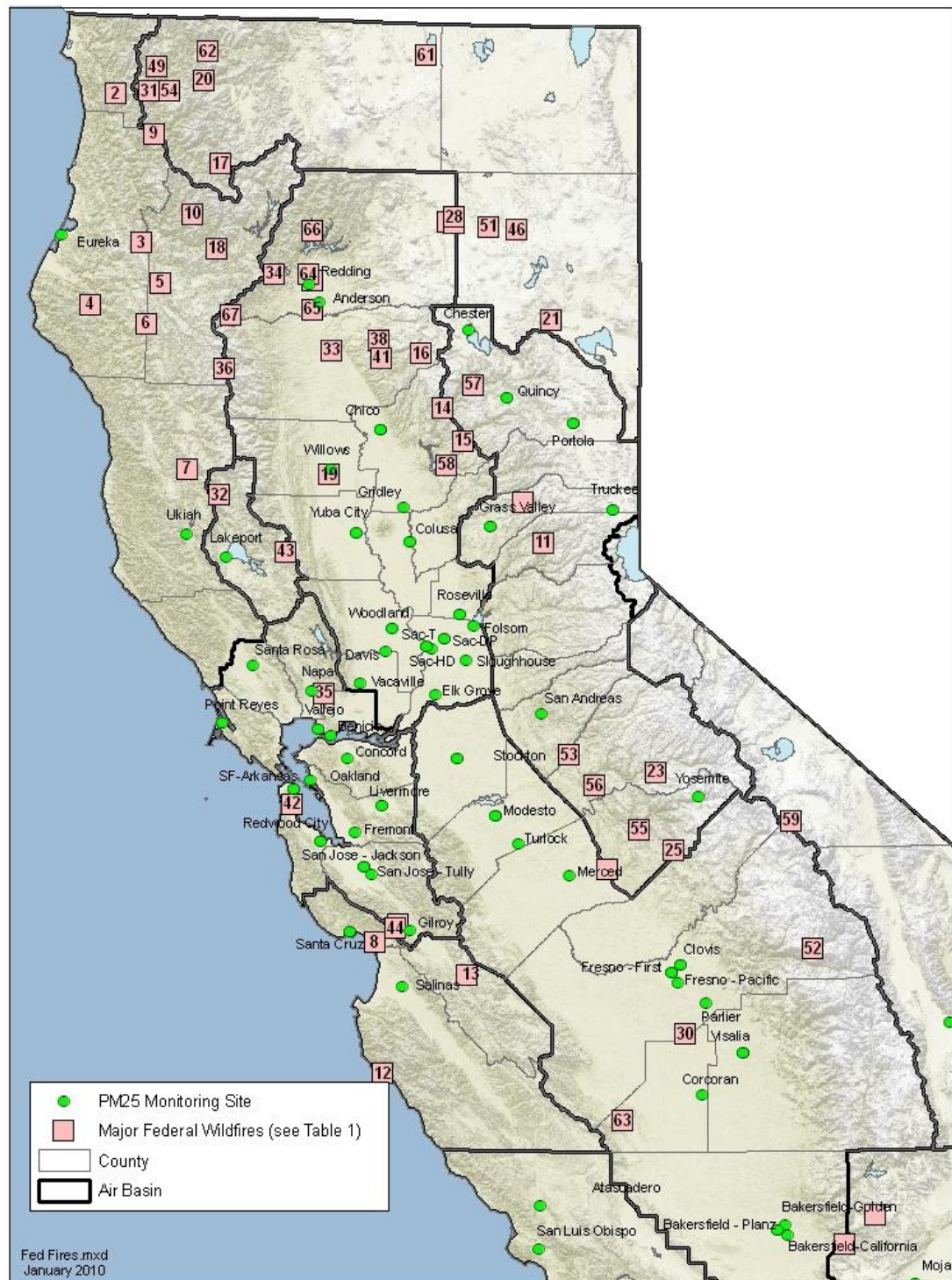
TABLE 1 - Federal Wildland Fire Incidents in Northern California – June 20 to September 7, 2008

Map Number	Incident Number	Incident Name	Latitude	Longitude	Size (acres)	Start Date	Controlled Date
1	CA-SRF-1057	Blue	41.5664	-123.8217	225	6/20/2008	
2	CA-SRF-1224	Blue 2	41.5664	-123.8217	9,728	6/20/2008	
3	CA-SRF-1123	Hell's Half	40.7511	-123.5956	15,146	6/20/2008	
4	CA-HUU-003384	Humboldt Complex	40.3994	-123.9494	1,325	6/20/2008	
5	CA-SHF-1041	LIME COMPLEX	40.5342	-123.4508	99,585	6/20/2008	
6	CA-SRF-1120	Mad Complex	40.3047	-123.5364	3,705	6/20/2008	
7	CA-MEU-004608	MEU Lightning Complex	39.5139	-123.2083	54,819	6/20/2008	11/4/2008
8	CA-CZU-005581	TRABING	36.9319	-121.8089	630	6/20/2008	6/24/2008
9	CA-SRF-1126	Ukonom-South Complex	41.3547	-123.5364	58,871	6/20/2008	
10	CA-SHF-001079	ALPS COMPLEX	40.9194	-123.2381	1,218	6/21/2008	
11	CA-TNF-1011	American River Complex	39.1439	-120.6725	20,541	6/21/2008	

Map Number	Incident Number	Incident Name	Latitude	Longitude	Size (acres)	Start Date	Controlled Date
12	CA-LPF-1649	Basin Complex	36.2103	-121.7394	162,818	6/21/2008	
13	CA-BEU-002390	BROWN	36.7622	-121.1750	3,870	6/21/2008	6/24/2008
14	CA-BTU-007660	BTU Lightning Complex	39.8797	-121.4000	64,995	6/21/2008	10/3/2008
15	CA-PNF-000539	Canyon Complex	39.7039	-121.2483	47,680	6/21/2008	10/1/2008
16	CA-LNF-2713	CUB Complex	40.1808	-121.5622	19,718	6/21/2008	
17	CA-KNF-002970	Gould	41.2003	-123.0464	229	6/21/2008	7/2/2008
18	CA-SHF-1057	Iron & Alps Complexes	40.7325	-123.0539	105,805	6/21/2008	
19	CA-MNF-000579	June ABCD Complex	39.5025	-122.2025	3,000	6/21/2008	
20	CA-KNF-3393	Klamath Theater	41.6600	-123.1850	192,038	6/21/2008	
21	CA-LNF-002729	LNF June Lightning Complex	40.3750	-120.6250	200	6/21/2008	7/3/2008
22	CA-MMU-008048	Mariposa Complex	37.3450	-120.2142	2,500	6/21/2008	6/24/2008
23	CA-STF-1063	North Mountain	37.8833	-119.8792	2,889	6/21/2008	
24	CA-MMU-008107	OLIVER	37.4511	-119.7533	2,789	6/21/2008	
25	CA-SNF-0715	OLIVER COMPLEX	37.4511	-119.7533	1,000	6/21/2008	
26	CA-LNF-002745	Peterson	40.9114	-121.3789	1,200	6/21/2008	
27	CA-LNF-002782	Peterson Complex	40.9000	-121.3333	7,842	6/21/2008	
28	CA-LMU-2725	Popcorn	40.9347	-121.3342	3,000	6/21/2008	
29	CA-SHU-004727	SHU LIGHTNING COMPLEX	40.5708	-122.3558	86,500	6/21/2008	
30	CA-SNF-718	SILVER COMPLEX	36.4392	-119.6772	1,161	6/21/2008	
31	CA-KNF-002975	Siskiyou / Blue 2 Complex	41.5894	-123.5800	82,186	6/21/2008	
32	CA-MNF-645	SODA COMPLEX	39.3750	-122.9756	8,632	6/21/2008	
33	CA-TGU-4245	TGU LIGHTNING COMPLEX	40.1872	-122.2069	22,907	6/21/2008	7/6/2008
34	CA-WNP-1095	Whiskeytown Complex	40.6000	-122.6333	6,420	6/21/2008	
35	CA-LNU-004790	WILD	38.3000	-122.2044	NR	6/21/2008	6/26/2008
36	CA-MNF-000663	Yolla Bolly Complex	40.0703	-122.9653	NR	6/21/2008	9/15/2008
37	CA-TNF-1015	Yuba River Complex	39.3664	-120.8206	4,254	6/21/2008	
38	CA-LNF-002776	Antelope	40.2519	-121.8664	600	6/22/2008	
39	CA-SCU-	HUMMINGBIRD	37.0353	-121.6553	794	6/22/2008	

Map Number	Incident Number	Incident Name	Latitude	Longitude	Size (acres)	Start Date	Controlled Date
	3094						
40	CA-LNF-002777	Mill	40.1503	-121.8475	1,500	6/22/2008	
41	CA-LNF-002781	Mill Complex	40.1503	-121.8475	2,100	6/22/2008	
42	CA-CZU-005708	Quarry	37.6847	-122.4033	300	6/22/2008	6/29/2008
43	CA-LNU-004843	WALKER	39.0714	-122.4947	NR	6/22/2008	7/3/2008
44	CA-SCU-003091	WHITEHURST	37.0100	-121.6692	200	6/22/2008	
45	CA-BDF-6944	CAJON	34.2281	-117.4228	100	6/23/2008	
46	CA-LMU-2759	Corral	40.8681	-120.8825	12,434	6/23/2008	
47	CA-KRN-19301	BENA	35.2725	-118.6128	120	6/27/2008	6/27/2008
48	CA-SQF-001356	PIUTE	35.4308	-118.4011	37,026	6/28/2008	8/31/2008
49	CA-KNF-003204	No Mans	41.7219	-123.5325	200	6/30/2008	7/6/2008
50	CA-LPF-1778	Gap	34.4869	-119.7828	9,443	7/1/2008	
51	CA-LMU-002934	Dixie	40.8853	-121.0844	350	7/2/2008	7/4/2008
52	CA-KNP-0020	Tehipite	36.9047	-118.7986	11,596	7/19/2008	12/10/2008
53	CA-TCU-006881	FRENCH	37.9767	-120.4808	102	7/22/2008	7/26/2008
54	CA-KNF-003624	Panther	41.5919	-123.4308	72,344	7/22/2008	
55	CA-MMU-009779	Telegraph	37.5675	-119.9969	34,091	7/25/2008	
56	CA-TCU-7033	Serpentine	37.8089	-120.3014	162	7/26/2008	7/28/2008
57	CA-PNF-000784	RICH	40.0114	-121.1836	6,112	7/29/2008	12/1/2008
58	CA-BTU-9395	Craig	39.5667	-121.3669	2,001	8/3/2008	8/22/2008
59	CA-INF-000656	SHERWIN	37.6106	-118.9403	347	8/3/2008	
60	CA-LPF-002250	Santa Lucia Lightning Complex	34.9678	-120.1297	244	8/15/2008	9/2/2008
61	CA-BNP-0437	Jack	41.8267	-121.5594	6,900	8/17/2008	
62	CA-KNF-004096	Slinkard	41.8164	-123.1653	374	8/17/2008	
63	CA-FKU-009403	Avenal	35.9639	-120.1078	946	8/19/2008	8/20/2008
64	CA-SHU-006888	Lake	40.6031	-122.3819	110	8/26/2008	8/30/2008
65	CA-SHU-6922	Olinda	40.4122	-122.3450	186	8/27/2008	8/30/2008
66	CA-SHF-1949	ELMORE	40.8450	-122.3633	343	9/7/2008	
67	CA-SHF-1944	GULCH	40.3667	-122.9350	2,847	9/7/2008	

FIGURE 1 – Major Federal Wildfires and PM2.5 (FRM, FEM, and BAM) Monitoring Sites in California



The fires were scattered throughout Northern and Central California. Due to the number of fires, both large and small, the complex terrain and the locally-influenced, as well as regional, meteorological conditions, smoke impacts at the sites varied.

Portola, in Plumas County in the Mountain Counties Air Basin, is at an elevation of approximately 4,800 feet and is surrounded by hilly terrain. The monitoring site, in a small valley, is located on the roof of a building at an elevation of 4,895 feet.

The town of Quincy, approximately 27 miles west-northwest of Portola, is at an elevation of about 3,400 feet in hilly terrain. The monitoring site, in a small valley, is located on the roof of a building at an elevation of 3,422 feet.

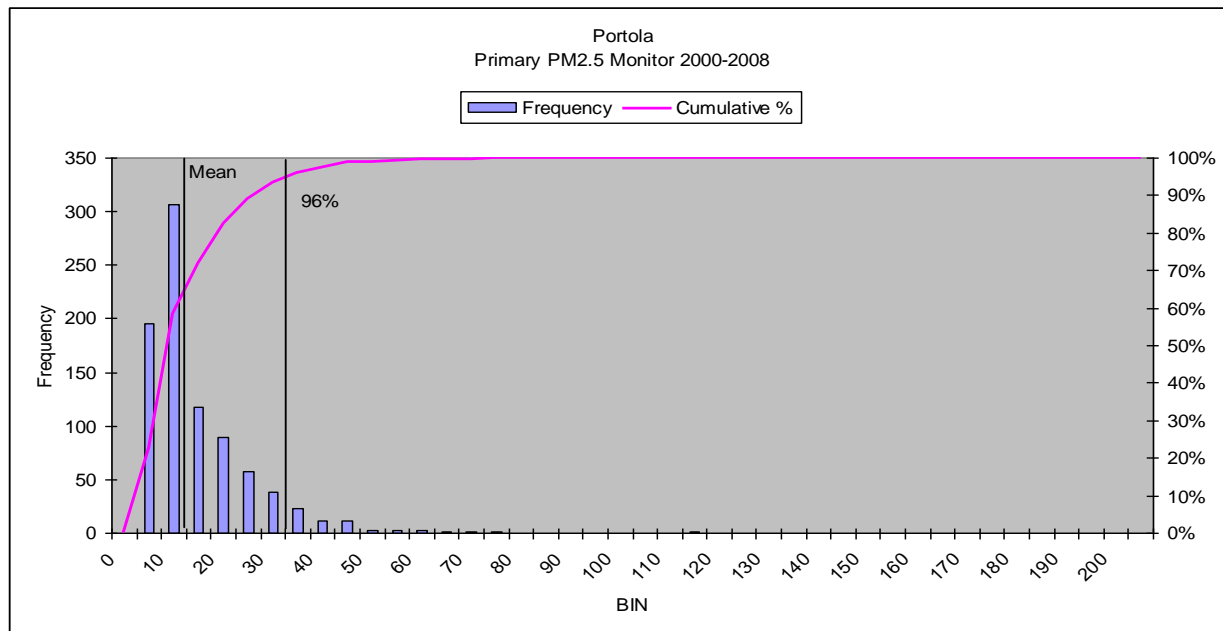
Redding, in northern Shasta County in the Sacramento Valley Air Basin, is almost 90 miles northwest of Quincy and 115 miles northwest of Portola. Located between the Cascades and the Trinity Alps, the town has an approximate elevation of 560 feet. The monitoring site, in fairly level terrain, is located atop a building at an elevation of 488 feet.

PM2.5 FRM data is available for the monitoring site at Portola from 2000 through 2008. Basic statistics for the monitor for this time period are shown in Table 2. The accompanying histogram illustrates the historically low levels of PM2.5 at this site, with 96% of all concentrations occurring at or below the 24-hour NAAQS; 12% of those concentrations above the NAAQS occurred during this natural event, which accounted for 100% of the June/July exceedances from 2000-2008.

TABLE 2 – Portola PM2.5 Concentration Statistics for Primary Monitor

	<i>All Data</i>	<i>June/July</i>		
	2000-2008	2000-2008	2000-2007	2008
Mean	12.61	8.05	6.03	23.38
Standard Error	0.36	0.98	0.23	7.44
Median	9	5.95	5	13.1
Mode	6	5	5	#N/A
Standard Deviation	10.70	11.87	2.59	30.68
Sample Variance	114.40	141.00	6.72	941.40
Kurtosis	12.45	48.97	2.96	3.81
Skewness	2.56	6.48	1.31	1.96
Range	112.5	112.5	16	112.5
Minimum	1	1	1	1
Maximum	113.5	113.5	17	113.5
Sum	10897.9	1175.5	778	397.5
Count	864	146	129	17
Largest(1)	113.5	113.5	17	113.5
Smallest(1)	1	1	1	1
Confidence Level(95.0%)	0.71	1.94	0.45	15.78

FIGURE 2 – Histogram of PM2.5 Concentrations from Portola Primary Monitor

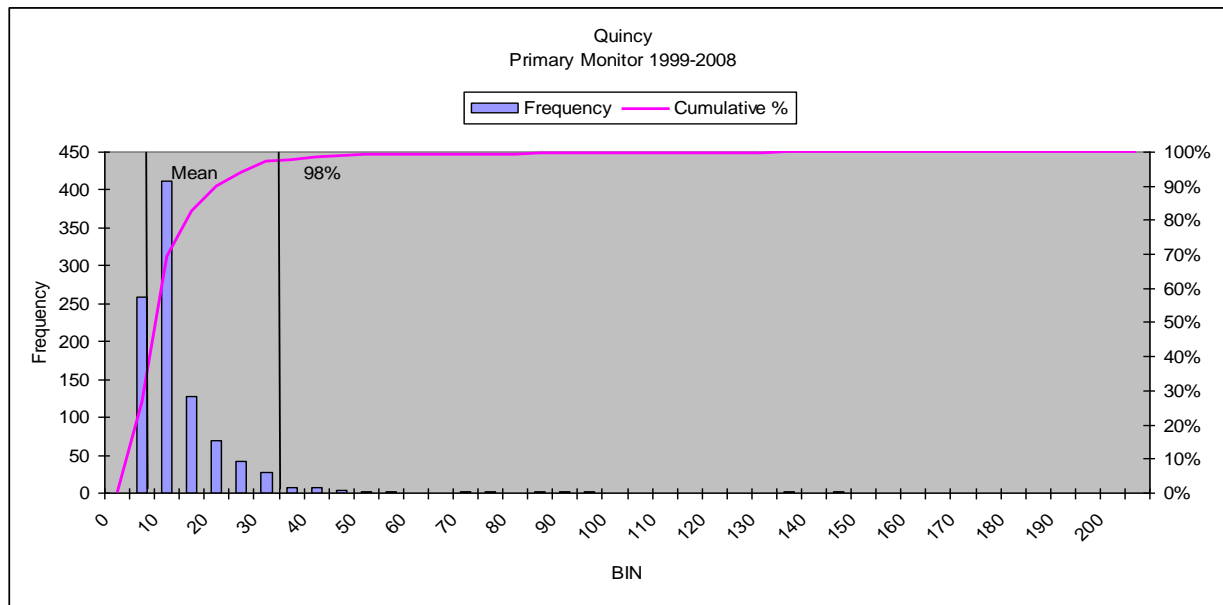


PM2.5 FRM data is available for the monitoring site at Quincy from 1999 through 2008. Basic statistics for the monitor for this time period are shown in Table 3. The accompanying histogram illustrates the historically low levels of PM2.5 at this site, with almost 98% of all concentrations occurring at or below the 24-hour NAAQS; 23% of those concentrations above the NAAQS occurred during this natural event, which accounted for 100% of the June/July exceedances from 1999-2008.

TABLE 3– Quincy PM2.5 Concentration Statistics for Primary Monitor

	<i>All Data</i>	<i>June/July</i>		
	1999-2008	1999-2008	1999-2007	2008
Mean	10.54	9.23	6.48	41.64
Standard Error	0.35	1.24	0.23	13.24
Median	7	6	6	16
Mode	6	5	5	16
Standard Deviation	10.88	16.65	3.01	49.54
Sample Variance	118.44	277.21	9.08	2454.08
Kurtosis	49.05	43.21	18.23	0.03
Skewness	5.57	6.35	3.34	1.16
Range	141.2	141.2	25	139.5
Minimum	1	1	1	2.7
Maximum	142.2	142.2	26	142.2
Sum	10171.5	1651.9	1069	582.9
Count	965	179	165	14
Largest(1)	142.2	142.2	26	142.2
Smallest(1)	1	1	1	2.7
Confidence Level(95.0%)	0.69	2.46	0.46	28.60

FIGURE 3 – Histogram of PM2.5 Concentrations from Quincy Primary Monitor

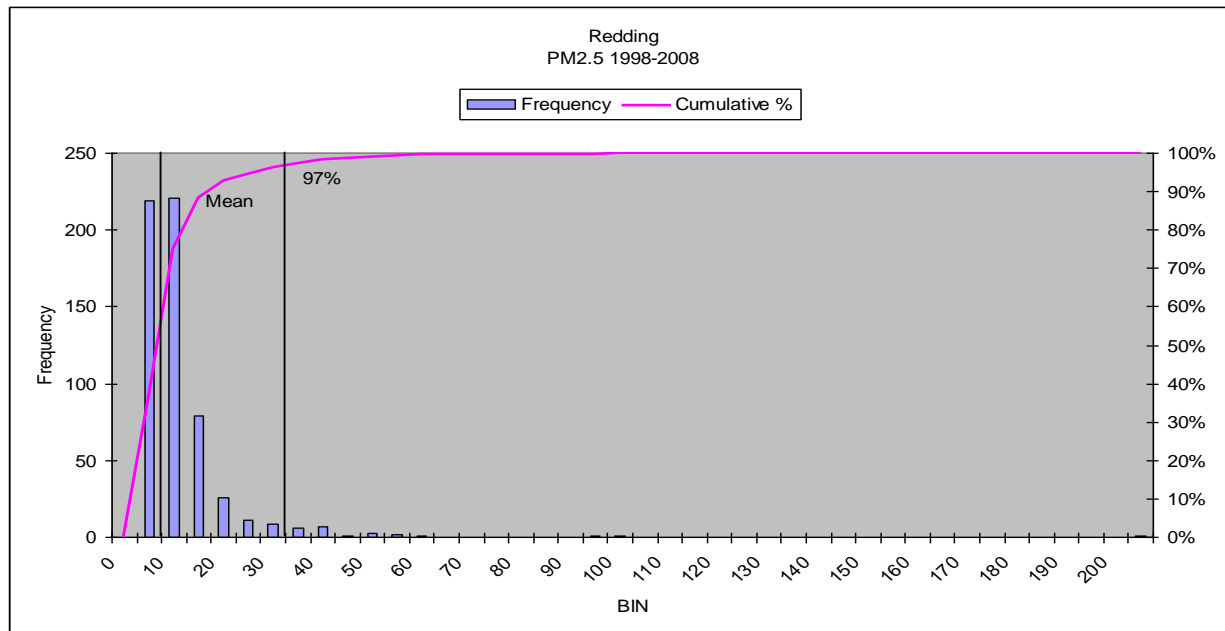


PM2.5 FRM data is available for the monitoring site at Redding from 1998 through 2008. Basic statistics for the monitor for this time period are shown in Table 4. The accompanying histogram illustrates the historically low levels of PM2.5 at this site, with 97% of all concentrations occurring at or below the 24-hour NAAQS; 29% of those concentrations above the NAAQS occurred during this natural event, which accounted for 100% of the June/July exceedances from 1999-2008.

TABLE 4 – Redding PM2.5 Concentration Statistics for Primary Monitor

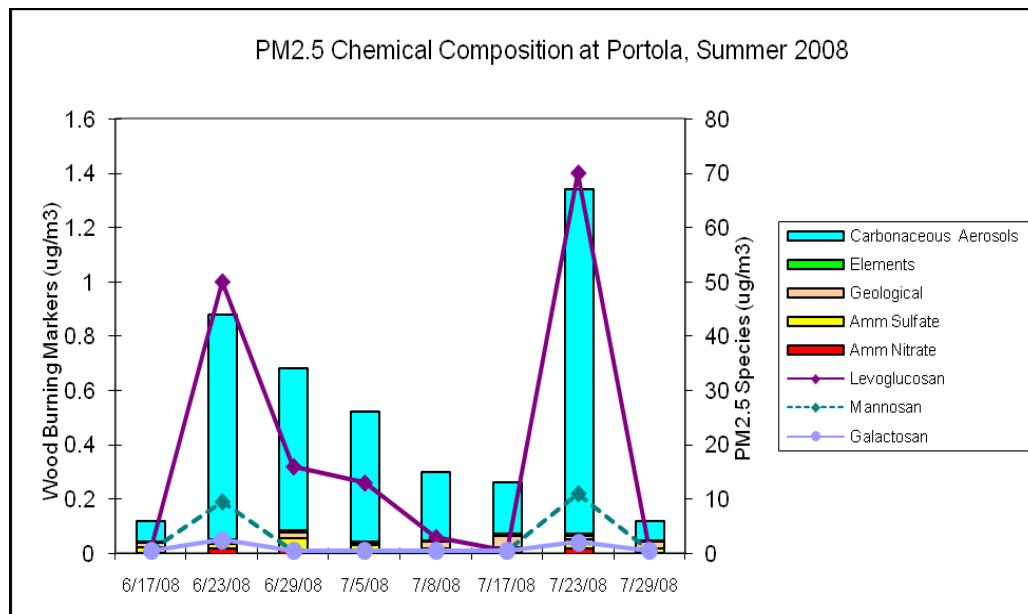
	<i>All Data</i>	<i>June/July</i>		
	1998-2008	1999-2008	1999-2007	2008
Mean	9.46	11.09	5.98	54.59
Standard Error	0.51	2.52	0.34	19.61
Median	7	6	6	37.2
Mode	6	6	6	2.3
Standard Deviation	12.33	24.54	3.15	62.02
Sample Variance	152.02	602.08	9.93	3846.29
Kurtosis	105.82	40.17	5.83	2.72
Skewness	8.21	5.92	1.57	1.59
Range	199.2	199.2	20	197.9
Minimum	1	1	1	2.3
Maximum	200.2	200.2	21	200.2
Sum	5562.1	1053.9	508	545.9
Count	588	95	85	10
Largest(1)	200.2	200.2	21	200.2
Smallest(1)	1	1	1	2.3
Confidence Level(95.0%)	1.00	5.00	0.68	44.37

FIGURE 4 – Histogram of PM2.5 Concentrations from Redding Primary Monitor



Speciation data is only available for the Portola monitor during this period. This data was collected every six days. Carbon data is not available, but was estimated by subtracting all other estimated components (ammonium nitrate, ammonium sulfate, geological, and elemental) from the PM2.5 mass measured by the speciation sampler. Figure 5 shows the low levels of carbonaceous aerosols as well as the wood burning markers of levoglucosan, galactosan, and mannosan, on June 17, prior to the thunderstorms that spawned the wildfire. These low concentrations were not seen again until the end of July, after most of the fires had been contained.

FIGURE 5 – Wood Burning Markers (Levoglucosan, Galactosan, Mannosan) at Portola During the Summer 2008 Wildfires



Wood Burning marker speciation at the Portola monitoring site has been collected since 2007. The summer average (June, July, August) of 2007 and 2008, excluding those days affected by the wildfires, was at the level of detection. Figure 6 shows that concentrations of the wood burning markers during the wildfires were extremely elevated.

FIGURE 6 - Wood Burning Markers (Levoglucosan, Galactosan, Mannosan) at Portola During the Summer 2008 Wildfires Compared to Summer Averages

