Update on District's Regional Modeling Analyses

STMPR Advisory Group Meeting

March 14, 2007

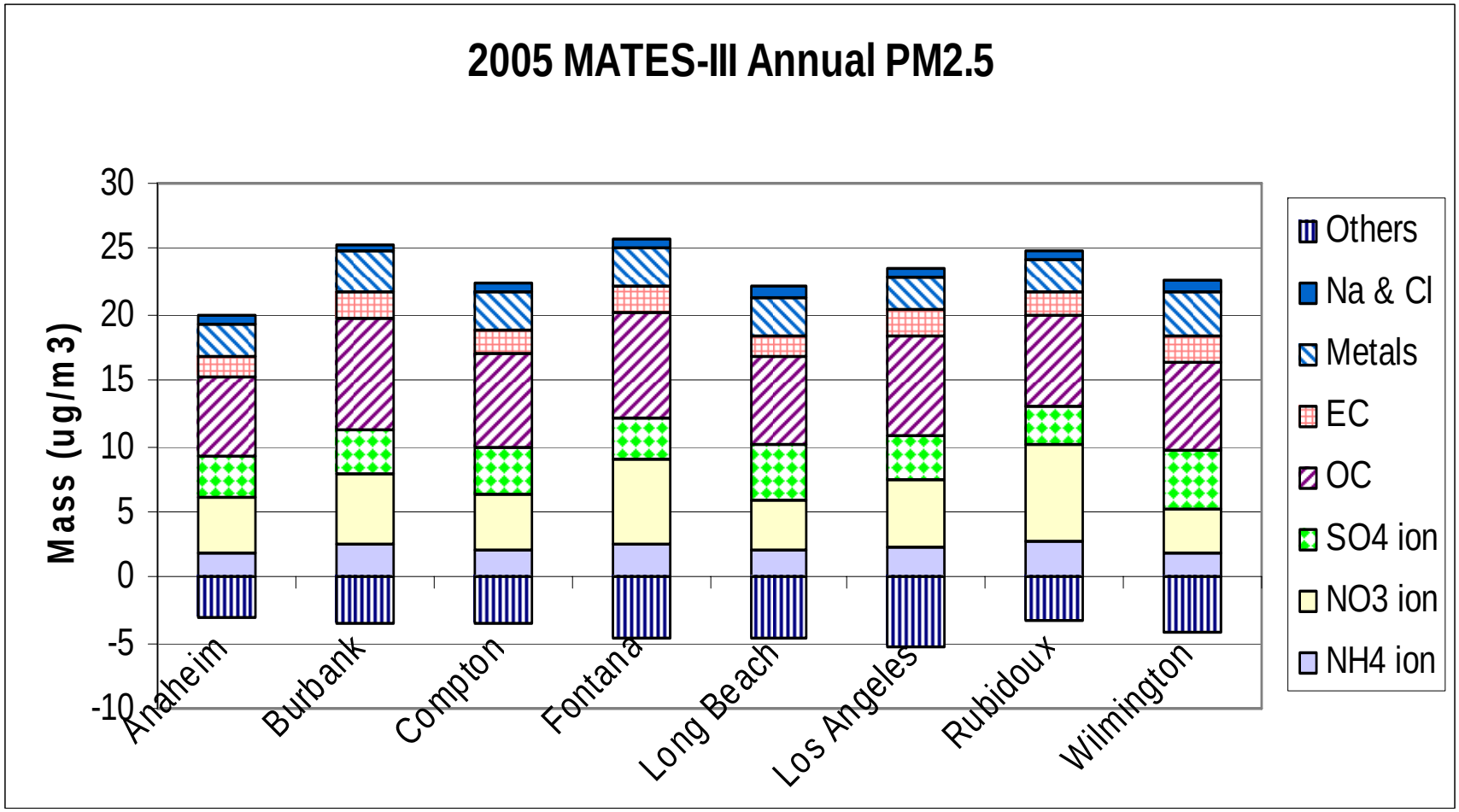
Final AQMP Modeling

- PM2.5
  - annual
  - 24 Hour
- PM10 24 Hour
- Visibility
- Ozone
  - 1-Hour 2010
  - 8-Hours 2017 & 2023
  - Downwind (other districts)

PM2.5

- Final MATES-III data 2005
- Sandwich Method to estimate organic carbon
- SMAT for annual average estimate
- Suite of estimates of maximum 24-Hour average concentrations
- Emissions reductions weighting: SOx, PM2.5, NOx, VOC
- Adjustments to Ammonia Inventory

2005 MATES-III



MATES-III 2005 Annual PM2.5 Species Concentrations (µg/m3)

Location	NH4	NO3	SO4	OC	EC	Metals	Na & Cl	OTR	MASS
Anaheim	1.90	4.09	3.30	6.03	1.43	2.54	0.73	-3.04	16.97
Burbank	2.43	5.49	3.38	8.44	2.09	2.94	0.55	-3.47	21.83
Compton	2.07	4.18	3.74	6.99	1.84	2.80	0.72	-3.60	18.73
Fontana	2.52	6.43	3.15	8.01	2.14	2.88	0.55	-4.53	21.14
Long Beach	2.11	3.87	4.17	6.71	1.52	2.98	0.85	-4.59	17.61
Los Angeles	2.27	5.09	3.43	7.58	1.95	2.55	0.59	-5.42	18.04
Rubidoux	2.73	7.31	3.05	6.88	1.69	2.52	0.61	-3.38	21.41
Wilmington	1.90	3.34	4.47	6.66	2.12	3.26	0.88	-4.15	18.47

MATES-III/Sandwich Apportioned 2005 Quarterly Design Values

Quarter	NH4	NO3	SO4	OC	EC	Water	Crustal/ Metals	Blank	Mass
				Fontana					
1	1.89	6.22	1.82	2.95	1.84	1.94	1.58	0.50	18.73
2	2.24	5.93	3.30	1.63	1.46	1.94	2.16	0.50	19.17
3	2.10	4.83	4.27	1.37	1.88	2.00	3.24	0.50	20.20
4	3.53	8.29	2.40	0.55	2.51	2.72	2.67	0.50	23.17
				Los Angeles					
1	1.78	6.25	2.44	2.54	1.98	2.55	1.69	0.50	19.73
2	1.58	4.07	3.74	0.73	1.32	2.16	2.22	0.50	16.33
3	2.95	4.52	5.11	0.98	1.45	2.47	2.22	0.50	20.20
4	3.17	7.06	2.92	0.52	3.25	2.59	2.23	0.50	22.23
				Rubidoux					
1	1.79	6.51	1.93	4.18	2.00	2.44	1.81	0.50	21.17
2	3.00	8.25	3.18	1.39	1.18	2.23	2.15	0.50	21.87
3	2.94	7.29	4.30	1.62	1.17	2.27	2.50	0.50	22.60
4	3.47	8.44	2.65	1.53	2.61	3.04	2.64	0.50	24.87

Annual Average Day Emissions Inventory (tons/day)

Year	VOC	NO_x	SO_x	Diesel	Geol	PM2.5
(a) Baseline						
2005	**740**	**1029**	**62**	**22**	**25**	**106**
2014	**528**	**654**	**43**	**12**	**27**	**102**
2020	**499**	**525**	**50**	**7**	**28**	**103**
(b) Controlled						
2014	**469**	**442**	**19**	**6**	**27**	**88**
2020	**398**	**287**	**20**	**3**	**28**	**87**

Ammonia Emissions Adjustments

- Incorporated rule projected reductions
- Small impacts in 2014, but important

Category	2003 AQMP (TPD)	Draft 2007 AQMP (TPD)
Soil	34.2	1.42
On-road Mobile	9.47	36.12
Live stock	60.37	25.67

Annual PM2.5 Model Performance Stress Tests

Stress Test Methodology	Simulated Impact
Boundary conditions only: no biogenic or anthropogenic emissions	Annual average concentration range 2-5 $\mu g/m^3$
Boundary conditions and biogenic emissions: no anthropogenic emissions	Annual average concentration range 2-5 $\mu g/m^3$
Boundary conditions and anthropogenic emissions: no biogenic emissions	Annual average concentration range 10-30 $\mu g/m^3$
No NOx emissions in LA and Orange Counties or offshore	Annual average concentration range 10-22 $\mu g/m^3$. Westside lower 10-19 $\mu g/m^3$ but indicates sea breeze dispersion and transport.
No NOx emissions in San Bernardino and Riverside Counties	Annual average concentration range 10-28 $\mu g/m^3$. East Basin 5 $\mu g/m^3$ lower but indicates sea breeze dispersion and transport.
Gross VOC emissions reductions 40, 60 & 80 %	Net 1-2 % reduction in PM2.5 concentration for 20% VOC emissions reduction.
Gross NOx emissions reductions 40, 60 & 80 %	Net 5-10 % reduction in PM2.5 concentration for 20% NOx emissions reduction.
Halving NO & NO2 concentrations in boundaries	Reduction of approximately about 1 $\mu g/m^3$
EPA Clean SO2 Boundary 10 ppb to WRAP 1 ppb	Reduction of approximately 5 $\mu g/m^3$

2014 PREDICTED PM2.5 WITH CARB MEASURES AND DISTRICT OVERLAY

Location	NH4	NO3	SO4	OC	EC	Metals/ Others	Water	Blank	PM2.5 Mass
Anaheim	1.2	2.7	1.9	1.7	1.1	1.9	1.2	0.5	12.3
Burbank	1.5	3.5	1.9	2.8	1.5	2.0	1.3	0.5	14.9
Compton	1.4	3.4	2.2	2.2	1.4	1.9	1.5	0.5	14.5
Fontana	1.5	3.7	2.0	1.4	1.7	2.5	1.4	0.5	14.7
Los Angeles	1.7	4.2	2.2	0.9	1.6	2.0	1.7	0.5	14.9
Long Beach	1.4	3.0	2.3	1.3	1.2	1.7	1.4	0.5	12.7
Rubidoux	1.6	4.1	1.9	1.8	1.5	2.1	1.4	0.5	15.0
Wilmington	1.1	2.4	2.2	1.3	1.4	1.6	1.2	0.5	11.8

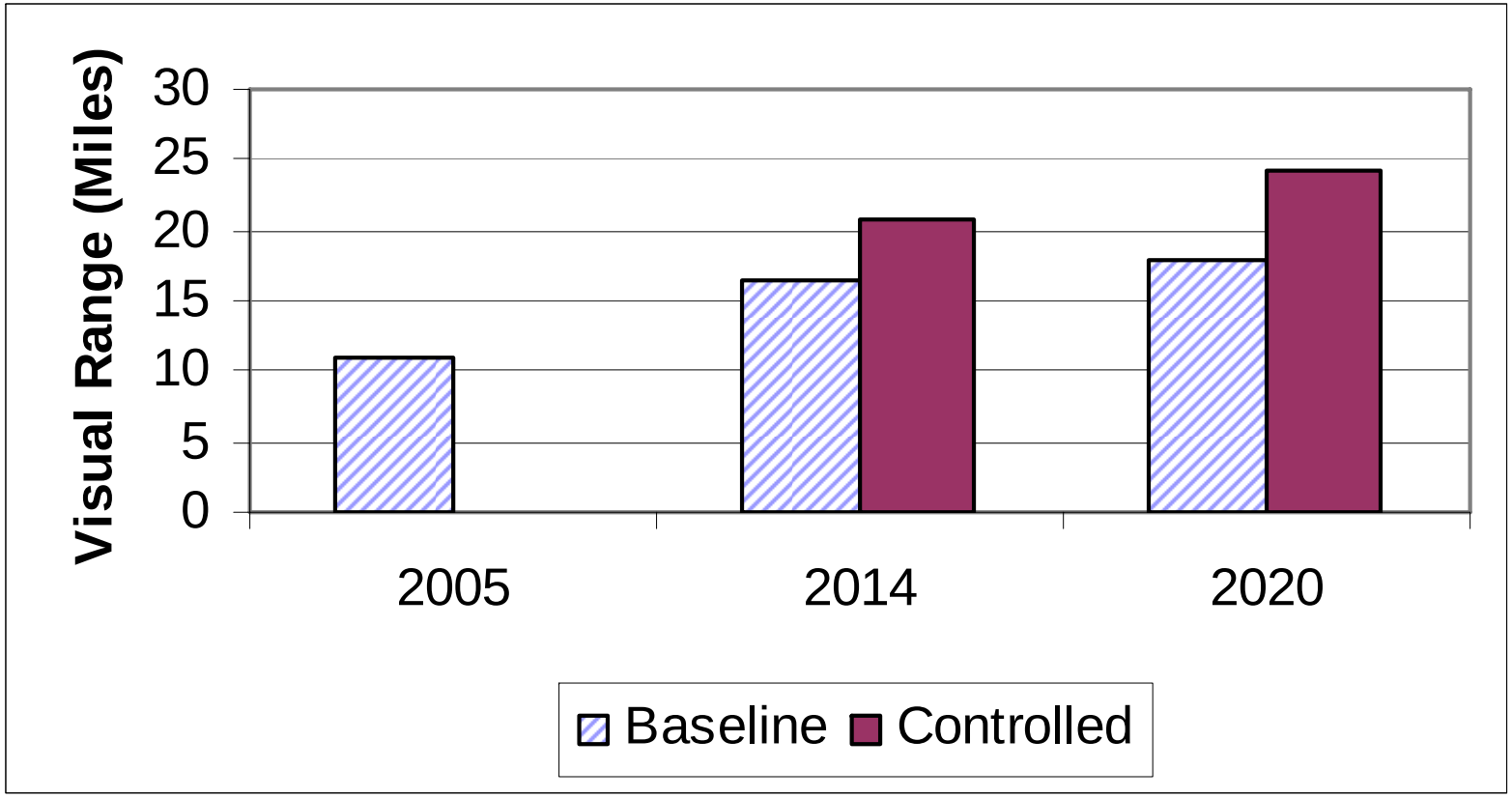
Summary of Methodologies to Calculate 2015 24-Hour Average Design Value (µg/m3)

Location	Annual RRF to Design	Quarterly Top 25 Percentile RRF to Quarterly Design	Quarterly RRF from Annual to Quarterly Design	Quarterly Top 25 Percentile RRF to Quarterly Top-3 Ratio to Design	Peak Day RRF to Peak Day	Annual RRF to Peak Day	Maximum of Methods
Anaheim	35.7	42.8	41.8	38.5	34.6	34.1	42.8
Burbank	40.5	47.7	46.7	44.1	43.8	39.4	47.7
Compton	39.5	56.6	46.3	54.3	37.5	40.9	56.6
Fontana	40.0	45.0	46.7	41.2	36.8	33.0	46.7
Long Beach	32.4	41.9	39.1	37.3	31.2	33.3	41.9
Los Angeles	46.1	55.1	50.7	47.8	50.3	46.4	55.1
Rubidoux	42.8	46.9	49.3	47.1	38.6	37.4	49.3
Wilmington	30.3	39.5	36.1	35.8	30.3	28.8	39.5

PM10: 2003-2005 Design and 2015 Controlled

	Average Maximum				Average 2nd Maximum				24-Hour Average PM2.5 RRF	2015 Estimated Average Maximum (μg/m³)	2015 Estimated Average 2nd Maximum (μg/m³)
Location	Mass (μg/m³)	PM2.5 /PM10 Ratio	Est. 2.5 Mass (μg/m³)	Est. Coarse Mass (μg/m³)	Mass (μg/m³)	PM2.5/ PM10 Ratio	Est. 2.5 Mass (μg/m³)	Est. Coarse Mass (μg/m³)			
Azusa	93	0.51	47.6	45.4	79	0.54	42.3	36.7	0.75	81	68
Burbank	82	0.51	42.0	40.0	73	0.69	50.2	22.8	0.79	73	62
Long Beach	96	0.73	69.8	26.2	63	0.78	48.9	14.1	0.73	77	50
Los Angeles	74	0.75	55.7	18.3	69	0.80	54.9	14.1	0.76	61	56
Santa Clarita	60	0.56	33.6	26.4	54	0.54	29.2	24.8	0.75	52	47
Hawthorne	53	0.56	29.7	23.3	61	0.54	32.9	28.1	0.75	46	53
Anaheim	78	0.50	38.8	39.2	67	0.49	33.1	33.9	0.74	68	58
Mission Viejo	51	0.69	35.4	15.6	44	0.33	14.7	29.3	0.74	42	40
Rubidoux	141	0.60	84.4	56.6	129	0.42	54.3	74.7	0.66	112	111
Perris	102	0.56	57.1	44.9	88	0.54	47.5	40.5	0.75	88	76
Banning Airport	79	0.56	44.2	34.8	55	0.54	29.7	25.3	0.75	68	48
Crestline	49	0.56	27.4	21.6	47	0.54	25.4	21.6	0.75	42	41
Fontana	105	0.29	30.6	74.4	96	0.36	34.2	61.8	0.73	97	87
San Bernardino	96	0.58	55.5	40.5	85	0.44	37.8	47.2	0.75	82	76
Redlands	80	0.56	44.8	35.2	70	0.54	37.8	32.2	0.75	69	61
Ontario	90	0.44	40.0	50.0	77	0.65	50.1	26.9	0.75	80	64

Annual Average Daytime Visibility Projections at Rubidoux in Miles



Ozone

Evaluated:

- 2009 1-Hour & 8 Hours
- 2012 8-Hours
- 2017 8-Hours
- 2020 8-Hours
- 2023 8-Hours

Lambert Conformal Grid – all simulations

2002, 2023 Base Year and 2023 Future Year Controlled Emissions Scenarios (TPD)

Year	Scenario	VOC	NOx	CO
2002	Baseline	1030	1090	5525
2017	Baseline	509	581	2368
2017	Controlled	444	380	2283
2023	Baseline	496	515	2058
2023	Controlled without Long- Term Measures	402	317	2058
2023	Controlled with Long-Term Measures	420	114	1966

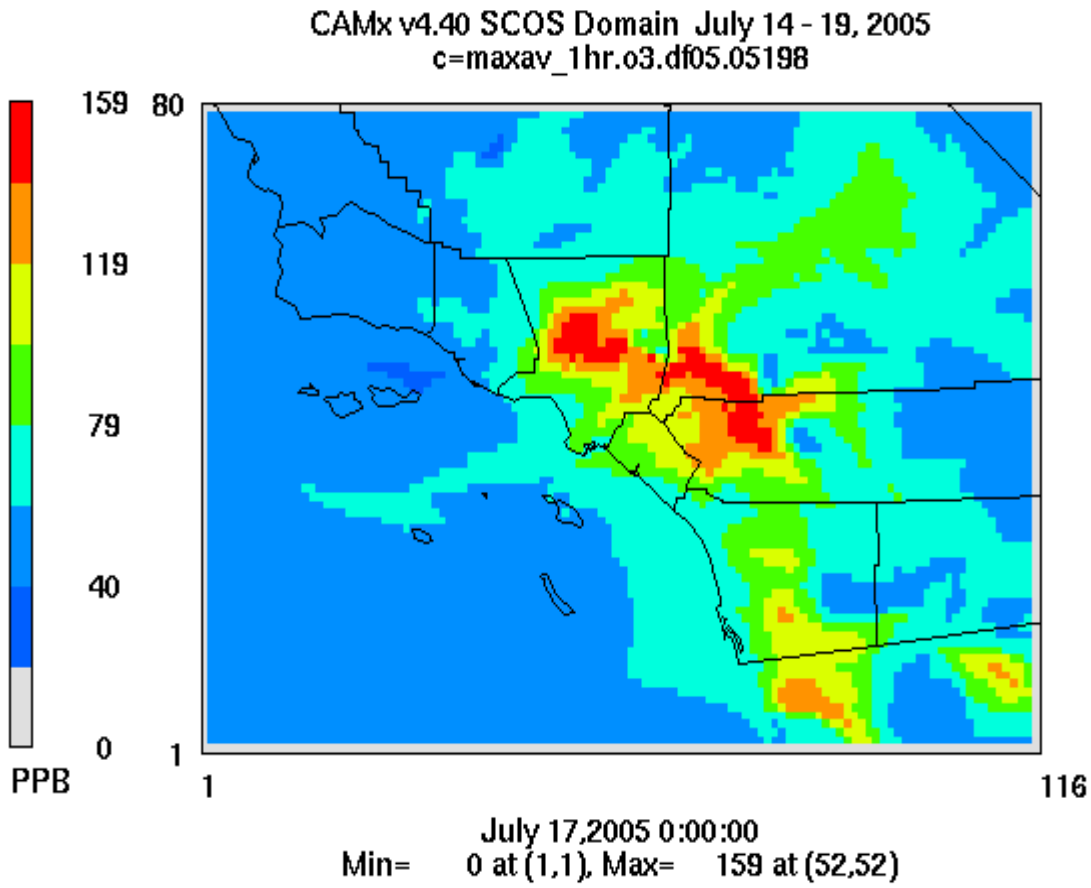
Ozone Meteorological Episodes

Date	Stagnation Severity Rank	Percentile	8-Hour Maximum Ozone (ppb)	Episode Average 8-Hour Maximum Ozone (ppb)	Annual 4th Highest Observed 8-Hour Maximum Ozone /Station (ppb)
8/4/1997	570	93	110	124	127 San Bernardino
8/5/1997	198	98	124		
8/6/1997	203	97	130		
8/7/1997	515	95	130		
8/7/2004	331	96	127	125	116 Crestline
8/8/2004	144	98	122		
5/21/2005	389	95	112	129	125 Crestline
5/22/2005	50	99	145		
7/15/2005	265	96	143	132	
7/16/2005	22	99	141		
7/17/2005	15	99	141		
7/18/2005	73	99	127		
7/19/2005	567	93	110		
8/4/2005	270	97	108	113	
8/5/2005	399	95	110		
8/6/2005	288	96	119		
8/7/2005	341	96	114		
8/27/2005	160	98	130	126	
8/28/2005	138	98	121		

Boundary profile concentrations (ppb) for the SCOS modeling domain

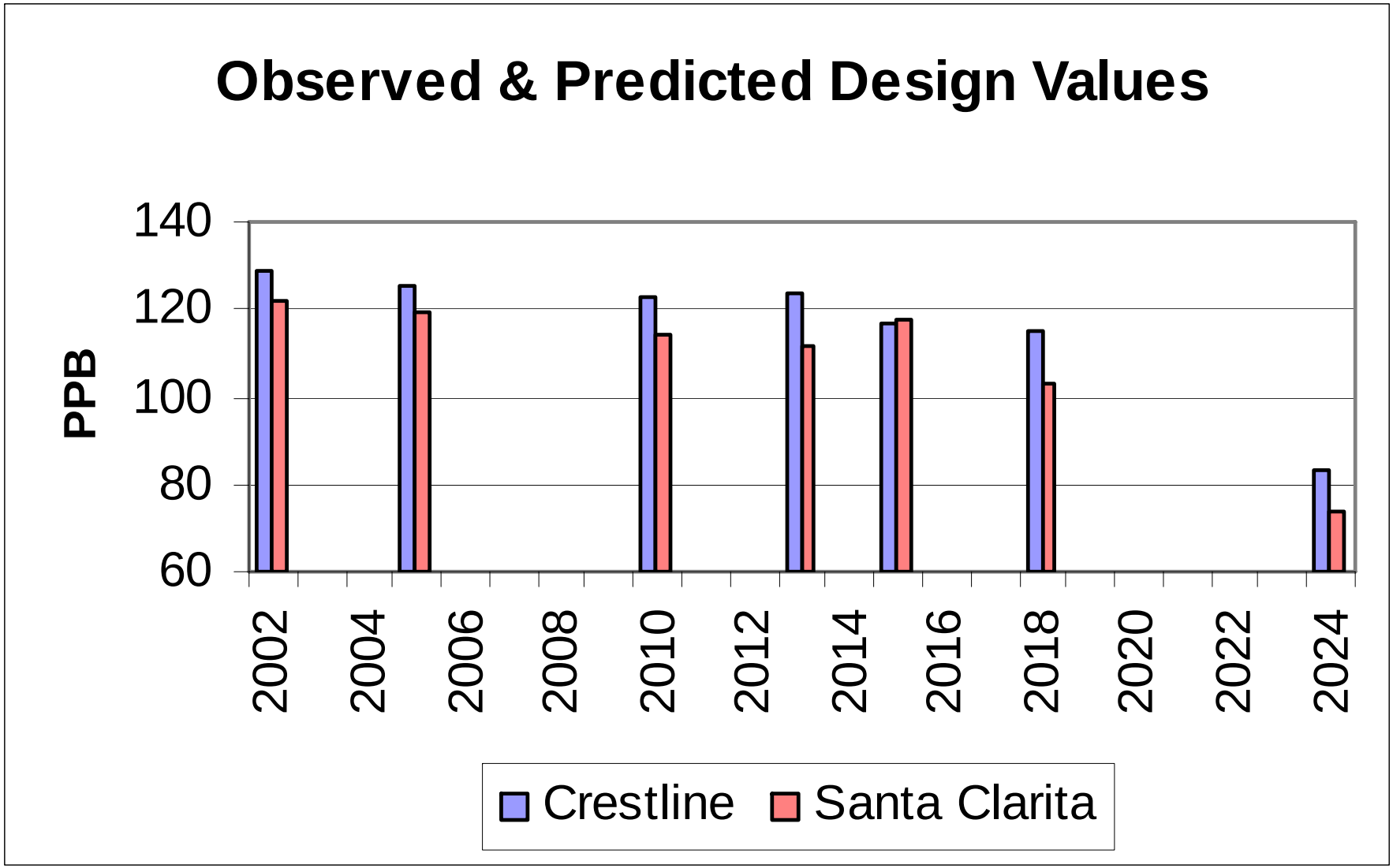
SAPRC99 Species	(ppb)	SAPRC99 Species	(ppb)
HCHO	0.930	ARO1	0.210
CCHO	0.530	ARO2	0.070
RCHO	0.250	OLE1	0.180
ISOP	0.020	OLE2	e-13
MEOH	0.100		
ETOH	0.050	O3	40.0
ETHE	0.180	CO	200.
ALK1	2.500		
ALK2	2.300	NO	0.100
ALK3	0.930	NO2 (surf)	2.000
ALK4	e-13	NO2 (aloft)	0.100
ALK5	e-13		

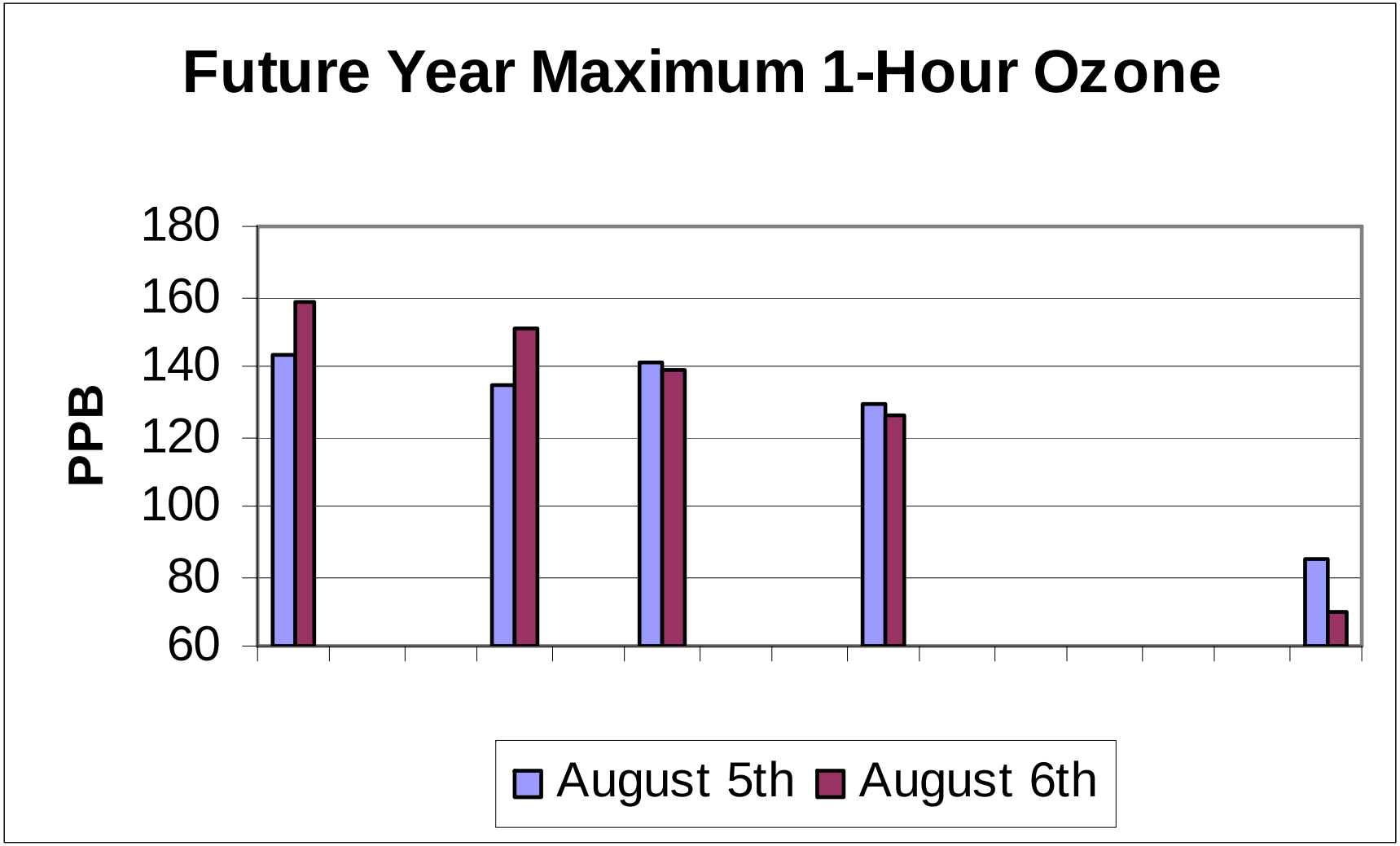
CAMx Simulated Maximum 1-Hour Average Ozone, July 17, 2005



2024 Projected Basin 8-Hour Ozone Design Values

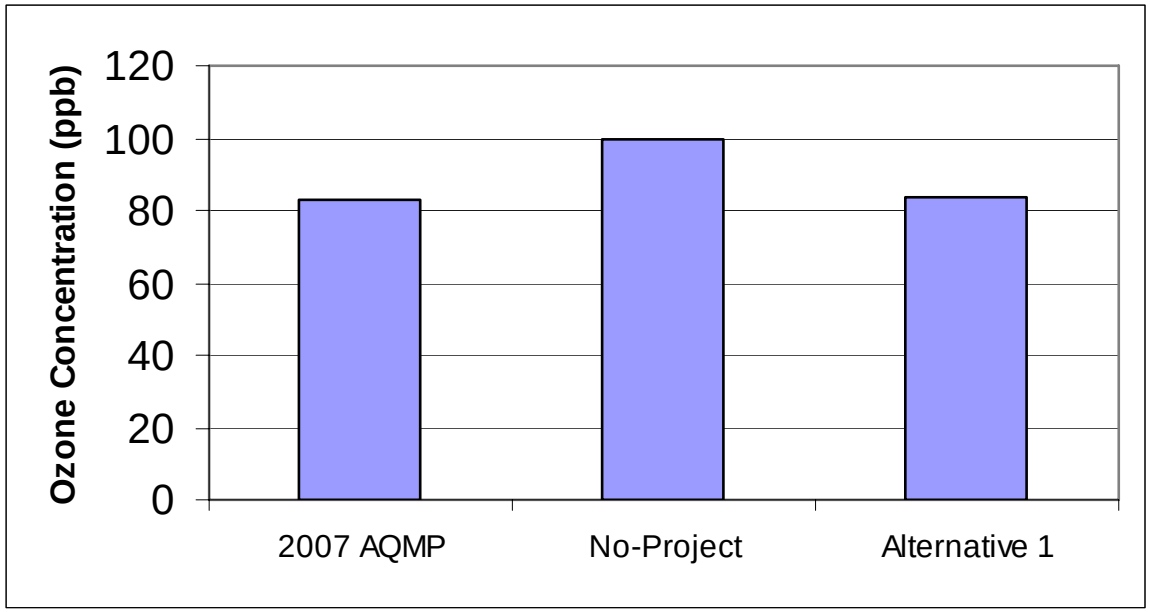
Site	2002 Weighted Design (PPB)	2002 Baseline Simulation (PPB)	2023 Controlled Average (PPB)	No. Valid Days	RRF	2024 Controlled Design (PPB)
Azusa	101.0	108.1	66.3	< 5	0.661	69
Banning Airport	115.0	119.0	69.4	11	0.588	68
Burbank	92.0	103.8	77.0	< 5	0.661	63
Crestline	128.7	123.0	78.5	8	0.644	83
Elsinore	107.0	110.5	63.3	9	0.575	62
Fontana	117.7	108.1	73.6	11	0.685	81
Glendora	112.0	106.6	73.8	5	0.706	79
Indio Jackson	95.0	93.0	54.5	< 5	0.661	56
Pasadena	96.0	99.0	73.4	< 5	0.661	73
Perris	112.0	107.3	75.4	< 5	0.661	79
Palm Springs	105.7	106.8	59.1	9	0.556	59
Pomona	96.0	101.7	77.9	8	0.779	75
Redlands	125.0	116.5	75.2	13	0.649	81
Reseda	104.0	105.3	66.2	7	0.632	66
Rubidoux	111.0	111.4	76.0	12	0.688	76
Santa Clarita	122.0	109.8	66.4	10	0.610	74


Observed & Predicted Design Values
PPB
140
120
100
80
60
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
Crestline
Santa Clarita


Future Year Maximum 1-Hour Ozone
PPB
180
160
140
120
100
80
60
August 5th
August 6th

CEQA Simulations

Ozone-2023			
	VOC	NOX	CO
Baseline	496	506	2142
Plan	420	117	2049
Alt-1	200	160	1965
Alt-2	100	250	1965
No-Project	283	373	2100



2107 Projected Coachella Valley 8-Hour Ozone Design Values

Site	2002 Weighted Design (PPB)	2002 Baseline Simulation (PPB)	2017 Controlled Average (PPB)	No. Valid Days	RRF	2018 Controlled Design (PPB)
Palm Springs	105.7	99.9	75.9	9	0.767	81.1
Indio Jackson	95.0	84.0	66.2	5	0.791	75.2

Future Actions

- Projects:
  - mid summer ozonesondes
  - aircraft sampling along over water boundaries
  - Improved surrogates (GIS based)
  - Evaluate WRF as a tool
  - Evaluate CB5 and new aerosol modules
- Peer reviewer recommendations

Future Actions (continued)

- Essential to have a weekend transportation model
- Continue to use PAMS to reconcile inventory
- Improved sub-county mobile emissions profiles
- Grade consideration for selected critical traffic links
- 2008-09 field program for speciated PM2.5
- 2010+ NOAA field program