Appendix C

Summary of WRAP RMC BART Modeling for New Mexico

Summary of WRAP RMC BART Modeling for New Mexico

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More Information: http://pah.cert.ucr.edu/aqm/308/bart.shtml

This document summarizes the CALMET/CALPUFF BART modeling results performed by the WRAP RMC for New Mexico. The procedures used are outlined in the WRAP RMC BART Modeling Protocol that is available at:
http://pah.cert.ucr.edu/aqm/308/bart/WRAP_RMC_BART_Protocol_Aug15_2006.pdf

Information on the New Mexico potential BART-eligible sources can be found at:
http://pah.cert.ucr.edu/aqm/308/bart/calpuff/emissions/nm_emis.xls

The basic assumptions in the WRAP BART CALMET/CALPUFF modeling for New Mexico are as follows:

- Use of three years of modeling of 2001, 2002 and 2003
- Initially visibility impacts due to emissions of SO2, NOx and primary PM emissions were calculated (even for Section 309 States):
    - Unless States provided speciated PM emissions, all PM emissions were modeled as $PM_{2.5}$.
- Visibility was calculated using the Original IMPROVE equation and Annual Average Natural Conditions.

The tables on the visibility impacts for each source below contain the following information for each New Mexico BART source complex (Table 1) and each Class I area that is within at least 300 km of the source:

- The header contains information on the source number, name and emissions that were used in the analysis and other information.
- Each subsequent row has information on the visibility impacts at a Class I area, with the columns containing the following information for the indicated Class I area:
    1. The Class I area name;
    2. The distance (km) between the source and the closest receptor in the Class I area;
    3. The 98th percentile (8th highest) visibility impacts in 2001;
    4. The 98th percentile (8th highest) visibility impacts in 2002;
    5. The 98th percentile (8th highest) visibility impacts in 2003; and
    6. The average of the 98th percentile across 2001, 2002 and 2003.

Initial model was performed for 11 source complexes in New Mexico with visibility estimated from the sources' SO2, NOx and PM emissions (Table 1). Then for those source's whose 98th percentile visibility impacts at any Class I area due to their combined SO2, NOx and PM emissions exceeded the 0.5 dv significance threshold, the separate contribution to visibility at Class I areas was assessed for SO2 alone (SO4), NOx alone (NO3), PM alone (PMF) and combined NOx plus PM emissions (NO3+PMF). This is because New Mexico has already submitted a Section 309 SIP that addresses the SO2 emissions component of the regional haze rule at this time.

Of the 11 source complexes analyzed, only one source complex's visibility impacts at any Class I area due to combined SO2, NOx and PM emissions exceeded the 0.5 dv threshold (SRC02 PNM San Juan Boilers #1-4). Consequently just the PNM San Juan Boilers #1-4 SRC02 source complex was evaluated for the visibility impacts due to each emissions component separate, which is presented at the end of this document.

This summary document updates the CALPUFF BART modeling results to include the Carlsbad Cavern (CAVE) Class I area for those sources that lie within 300 km of the CAVE Class I area. However, the archive of CALPUFF output files only included the 2001 and 2003 calendar years as the 2002 data was on a corrupted disk drive. Thus for sources within 300 km of the CAVE Class I area, we also include the two-year (2001 and 2003) average 98th percentile visibility impacts.

Table 1. Summary of emissions used in the WRAP RMC New Mexico BART screening CALPUFF modeling.

		Unit #	Name	SO2 Rate (g/s)	NOx Rate (g/s)	PM25 Rate (g/s)
SRC01	NM01	350310008	Giant Refining, Ciniza Refinery, 4 B&W CO boiler	35.28	3.2634	2.142
SRC02	NM02	350450902	PNM, San Juan, Boiler #1	202.6836	198.2358	22.0248
SRC02	NM03	350450902	PNM, San Juan, Boiler #2	201.6378	306.8478	21.9114
SRC02	NM04	350450902	PNM, San Juan, Boiler #3	314.8362	307.9944	34.2216
SRC02	NM05	350450902	PNM, San Juan, Boiler #4	308.8638	302.1606	33.5790
SRC03	NM06	350450023	Giant Refining San Juan Ref Unit #1 FCCP ESP	11.2518	1.7388	0
SRC04	NM07	350150011	DEFS Artesia Gas Plant SRU only	41.9580	0.1134	0.0000
SRC05	NM08	350150002	Amoco Empire Abo SRU only	31.5000	0.0630	0.0000
SRC06	NM09	350150008	Marathon Indian Basin Gas Plant SRU only	35.532	1.0206	0.0378
SRC07	NM10	350250035	DEFS Linam Ranch Gas Plant SRU only	37.4094	0.1764	0
SRC08	NM11	350450247	Western Gas Res San Juan River Gas Plnt SRU	89.964	0.4032	0
SRC09	NM12	350250063	Dynegy Saunders SRU only	39.9042	0.1008	0
SRC10	NM13	350250054	SWPS Cunningham Station	0.1512	73.8108	0.7812
SRC10	NM14	350250034	SWPS Maddox Station	0.0882	41.769	0
SRC11	NM15	350130002	El Paso Rio Grande Generating Station	65.7594	50.8284	9.891

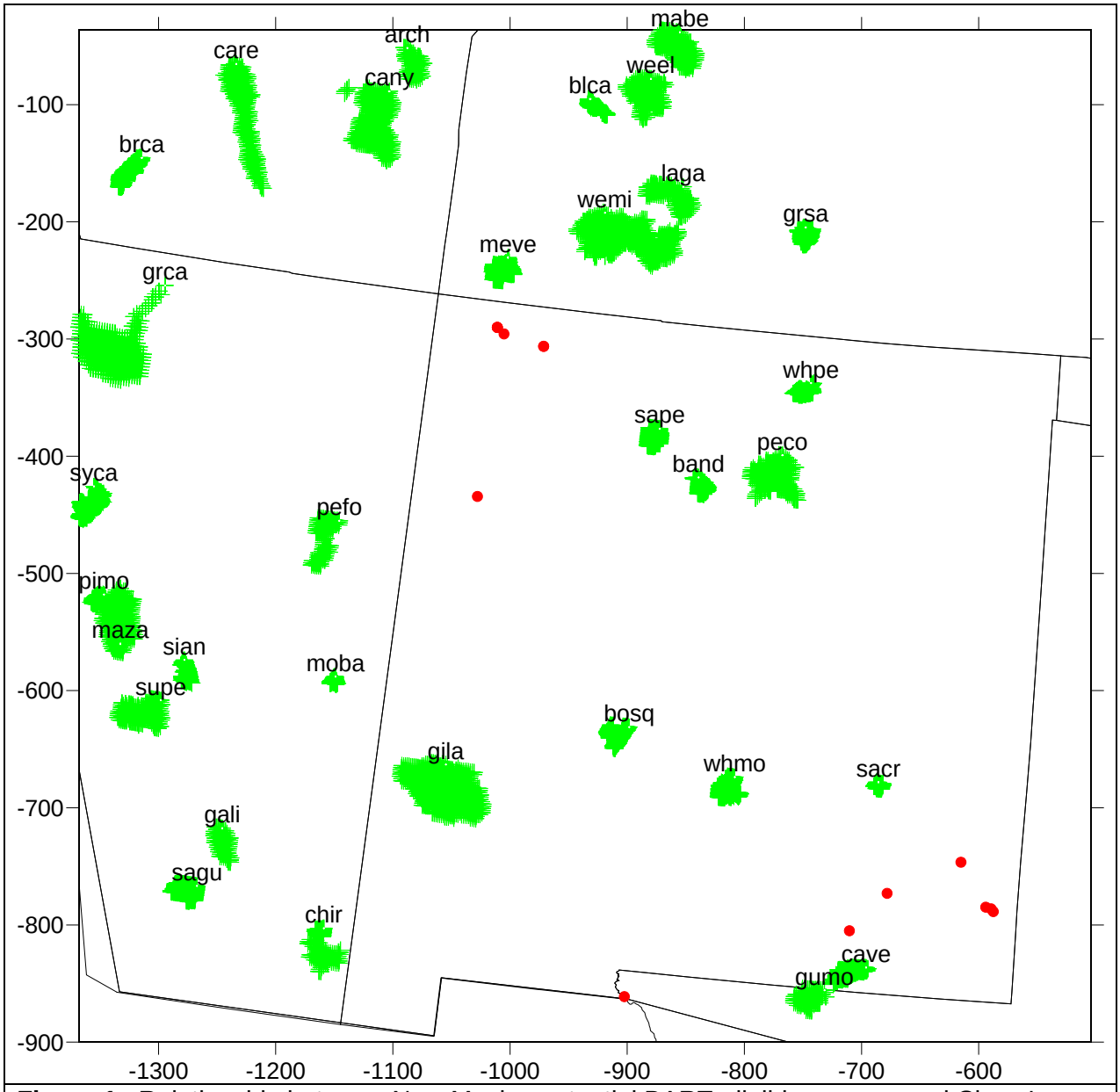

Figure 1. Relationship between New Mexico potential BART-eligible sources and Class I areas.

NM SRC01 Unit # 350310008, Giant Ciniza: SO2 = 1,226 TPY; NOx = 113 TPY; PM = 74 TPY
Annual Average Natural Conditions
Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance (km)	98th Percentile for Each Year 2001	2002	2003	98th 3 year AVG
Petrified Forest NP	119	0.07	0.11	0.08	0.09
San Pedro Parks Wilderness	151	0.06	0.05	0.06	0.05
Bandelier NM	184	0.05	0.04	0.05	0.05
Mesa Verde NP	185	0.05	0.04	0.05	0.05
Weminuche Wilderness	227	0.04	0.03	0.03	0.03
Pecos Wilderness	233	0.04	0.04	0.05	0.04
Wheeler Peak Wilderness	283	0.03	0.03	0.03	0.03
Sierra Ancha Wilderness	286	0.03	0.02	0.03	0.03
La Garita Wilderness	294	0.03	0.02	0.02	0.02
Canyonlands NP	296	0.05	0.04	0.06	0.05

NM SRC02 Unit # 350450902, PNM SJ #1-4: SO2 = 35,735 TPY; NOx = 38,763 TPY; PM = 3,884 TPY
Annual Average Natural Conditions
Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance (km)	98th Percentile for Each Year 2001	2002	2003	98th 3 year AVG
Mesa Verde NP	40	5.54	5.34	5.30	5.40
Weminuche Wilderness	98	2.24	2.99	2.41	2.55
San Pedro Parks Wilderness	155	3.80	4.07	4.14	4.01
La Garita Wilderness	169	1.63	1.82	1.77	1.74
Canyonlands NP	170	6.21	4.33	4.44	4.99
Black Canyon Gunnison NM	203	2.38	2.27	2.43	2.36
Bandelier NM	210	2.47	2.90	3.08	2.82
Petrified Forest NP	213	1.62	1.27	1.03	1.31
West Elk Wilderness	216	2.14	1.90	2.20	2.08
Arches NP	222	4.06	3.71	3.59	3.79
Capitol Reef NP	232	4.00	2.02	2.35	2.79
Pecos Wilderness	248	2.17	2.63	2.81	2.53
Wheeler Peak Wilderness	258	1.94	1.73	1.97	1.88
Great Sand Dunes NM	269	1.47	1.59	1.74	1.60
Maroon Bells-Snowmass WA	271	1.19	1.27	1.15	1.21
Grand Canyon NP	285	2.12	1.50	1.18	1.60

NM SRC02 Unit # 350450902, PNM SJ #1-4: PM Only (PM = 3,884 TPY)
Annual Average Natural Conditions
Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance (km)	98th Percentile for Each Year 2001	2002	2003	98th 3 year AVG
Mesa Verde NP	40	0.86	0.96	1.13	0.98
Weminuche Wilderness	98	0.15	0.24	0.25	0.21
San Pedro Parks Wilderness	155	0.25	0.28	0.22	0.25
La Garita Wilderness	169	0.06	0.08	0.09	0.08
Canyonlands NP	170	0.28	0.20	0.22	0.23
Black Canyon Gunnison NM	203	0.09	0.11	0.07	0.09
Bandelier NM	210	0.13	0.19	0.17	0.16
Petrified Forest NP	213	0.05	0.03	0.05	0.05
West Elk Wilderness	216	0.07	0.09	0.07	0.08
Arches NP	222	0.19	0.19	0.15	0.17
Capitol Reef NP	232	0.12	0.07	0.09	0.09
Pecos Wilderness	248	0.08	0.10	0.10	0.09
Wheeler Peak Wilderness	258	0.07	0.06	0.07	0.06
Great Sand Dunes NM	269	0.07	0.05	0.06	0.06
Maroon Bells-Snowmass WA	271	0.04	0.04	0.03	0.04
Grand Canyon NP	285	0.08	0.04	0.05	0.05

NM SRC02 Unit # 350450902, PNM SJ #1-4: NOx Only (NOx = 38,763 TPY)
Annual Average Natural Conditions
Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance (km)	98th Percentile for Each Year 2001	2002	2003	98th 3 year AVG
Mesa Verde NP	40	3.59	3.73	3.24	3.52
Weminuche Wilderness	98	1.66	2.15	1.71	1.84
San Pedro Parks Wilderness	155	2.70	2.74	2.89	2.78
La Garita Wilderness	169	1.09	1.30	1.22	1.20
Canyonlands NP	170	4.28	3.22	2.79	3.43
Black Canyon Gunnison NM	203	1.67	1.72	1.86	1.75
Bandelier NM	210	1.69	2.13	2.23	2.02
Petrified Forest NP	213	0.80	0.70	0.30	0.60
West Elk Wilderness	216	1.22	1.44	1.60	1.42
Arches NP	222	3.22	2.50	2.40	2.71
Capitol Reef NP	232	2.89	0.92	1.45	1.75
Pecos Wilderness	248	1.49	1.72	1.94	1.72
Wheeler Peak Wilderness	258	1.15	1.09	1.36	1.20
Great Sand Dunes NM	269	1.09	1.00	1.10	1.07
Maroon Bells-Snowmass WA	271	0.76	0.88	0.88	0.84
Grand Canyon NP	285	1.56	0.80	0.44	0.93

NM SRC02 Unit # 350450902, PNM SJ #1-4: SO2 Only (SO2 = 35,735 TPY)
Annual Average Natural Conditions
Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance (km)	98th Percentile for Each Year 2001	2002	2003	98th 3 year AVG
Mesa Verde NP	40	2.78	3.17	3.14	3.03
Weminuche Wilderness	98	1.28	1.23	0.89	1.13
San Pedro Parks Wilderness	155	1.77	2.13	1.72	1.87
La Garita Wilderness	169	0.81	0.89	0.70	0.80
Canyonlands NP	170	2.65	1.79	2.06	2.17
Black Canyon Gunnison NM	203	0.92	1.03	0.89	0.95
Bandelier NM	210	1.17	1.62	1.24	1.34
Petrified Forest NP	213	0.94	0.83	0.94	0.91
West Elk Wilderness	216	0.75	0.79	0.59	0.71
Arches NP	222	1.74	1.22	1.33	1.43
Capitol Reef NP	232	1.68	1.47	1.32	1.49
Pecos Wilderness	248	1.09	1.16	1.24	1.16
Wheeler Peak Wilderness	258	1.00	0.86	1.06	0.97
Great Sand Dunes NM	269	0.64	0.69	0.68	0.67
Maroon Bells-Snowmass WA	271	0.54	0.62	0.36	0.51
Grand Canyon NP	285	1.18	0.78	0.73	0.90

NM SRC02 Unit # 350450902, PNM SJ #1-4: PM plus NOx (NOx = 38,763 TPY; PM = 3,884 TPY)
Annual Average Natural Conditions
Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance (km)	98th Percentile for Each Year 2001	2002	2003	98th 3 year AVG
Mesa Verde NP	40	4.27	4.06	3.46	3.93
Weminuche Wilderness	98	1.74	2.28	1.76	1.93
San Pedro Parks Wilderness	155	2.85	2.87	3.07	2.93
La Garita Wilderness	169	1.15	1.36	1.30	1.27
Canyonlands NP	170	4.39	3.33	2.91	3.54
Black Canyon Gunnison NM	203	1.73	1.84	1.90	1.82
Bandelier NM	210	1.77	2.29	2.31	2.12
Petrified Forest NP	213	0.83	0.72	0.31	0.62
West Elk Wilderness	216	1.26	1.50	1.64	1.47
Arches NP	222	3.30	2.65	2.50	2.82
Capitol Reef NP	232	3.06	0.95	1.50	1.83
Pecos Wilderness	248	1.55	1.77	2.04	1.79
Wheeler Peak Wilderness	258	1.20	1.12	1.40	1.24
Great Sand Dunes NM	269	1.14	1.05	1.15	1.11
Maroon Bells-Snowmass WA	271	0.78	0.91	0.91	0.87
Grand Canyon NP	285	1.60	0.82	0.45	0.96

NM SRC03 Unit # 350450023, Giant Ref Unit #1: SO2 = 391 TPY; NOx = 60 TPY; PM = 0 TPY
Annual Average Natural Conditions
Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance (km)	98th Percentile for Each Year 2001	2002	2003	98th 3 year AVG
Mesa Verde NP	66	0.05	0.06	0.06	0.06
Weminuche Wilderness	87	0.02	0.02	0.02	0.02
San Pedro Parks Wilderness	113	0.03	0.04	0.03	0.03
La Garita Wilderness	155	0.01	0.01	0.01	0.01
Bandelier NM	169	0.02	0.02	0.02	0.02
Black Canyon Gunnison NM	204	0.01	0.01	0.01	0.01
Canyonlands NP	206	0.03	0.03	0.02	0.03
Pecos Wilderness	206	0.02	0.02	0.02	0.02
West Elk Wilderness	211	0.01	0.01	0.01	0.01
Wheeler Peak Wilderness	216	0.02	0.01	0.01	0.02
Petrified Forest NP	229	0.01	0.01	0.01	0.01
Great Sand Dunes NM	236	0.01	0.01	0.02	0.01
Arches NP	251	0.02	0.02	0.02	0.02
Maroon Bells-Snowmass WA	265	0.01	0.01	0.01	0.01
Capitol Reef NP	274	0.04	0.02	0.02	0.02

NM SRC04 Unit # 350150011, Artesia SRU: SO2 = 1,458 TPY; NOx = 4 TPY; PM = 0 TPY
Annual Average Natural Conditions
Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance (km)	98th Percentile for Each Year 2001	2002	3 year AVG	98th 3 year AVG	98th 2 year AVG
Carlsbad Cavern	65	0.11	NA	0.06	NA	0.09
Salt Creek	91	0.11	0.16	0.12	0.13	0.12
Guadalupe Mountains NP	98	0.07	0.06	0.04	0.05	0.06

NM SRC05 Unit # 350150002, Amoco SRU: SO2 = 1,095 TPY; NOx = 2 TPY; PM = 0TPY
Annual Average Natural Conditions
Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance (km)	98th Percentile for Each Year 2001	2002	2003	98th 3 year AVG	98th 2 year AVG
Carlsbad Cavern	66	0.08	NA	0.05	NA	0.07
Salt Creek	89	0.09	0.12	0.09	0.10	0.09
Guadalupe Mountains NP	98	0.05	0.03	0.03	0.04	0.04

NM SRC06 Unit # 350150008, Marathon SRU: SO2 = 1,234 TPY; NOx = 39 TPY; PM = 1 TPY
Annual Average Natural Conditions
Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance (km)	98th Percentile for Each Year 2001	2002	3 year AVG	98th 3 year AVG	98th 2 year AVG
Carlsbad Cavern	34	0.20	NA	0.14	NA	0.17
Salt Creek	55	0.10	0.06	0.05	0.07	0.08
Guadalupe Mountains NP	123	0.08	0.10	0.09	0.09	0.09

NM SRC07 Unit # 350250035, Linam SRU: SO2 = 1,300 TPY; NOx = 6 TPY PM = 0 TPY
Annual Average Natural Conditions
Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance (km)	98th Percentile for Each Year 2001	2002	2003	98th 3 year AVG	98th 2 year AVG
Carlsbad Cavern	119	0.05	NA	0.04	NA	0.04
Salt Creek	141	0.07	0.09	0.07	0.08	0.07
Guadalupe Mountains NP	158	0.03	0.04	0.02	0.03	0.03

NM SRC08 Unit # 350450247, River Gas SRU: SO2 = 3,127 TPY; NOx = 14 TPY; PM = 0 TPY
Annual Average Natural Conditions
Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance (km)	98th Percentile for Each Year 2001	2002	2003	98th 3 year AVG
Mesa Verde NP	45	0.31	0.34	0.33	0.33
Weminuche Wilderness	98	0.15	0.13	0.10	0.13
San Pedro Parks Wilderness	147	0.17	0.26	0.17	0.20
La Garita Wilderness	169	0.07	0.08	0.07	0.07
Canyonlands NP	178	0.28	0.22	0.22	0.24
Bandelier NM	202	0.12	0.17	0.12	0.14
Black Canyon Gunnison NM	205	0.08	0.09	0.07	0.08
Petrified Forest NP	212	0.09	0.08	0.08	0.08
West Elk Wilderness	218	0.07	0.07	0.05	0.06
Arches NP	229	0.19	0.14	0.15	0.16
Capitol Reef NP	240	0.26	0.14	0.15	0.19
Pecos Wilderness	240	0.11	0.13	0.12	0.12
Wheeler Peak Wilderness	251	0.09	0.08	0.09	0.08
Great Sand Dunes NM	265	0.05	0.06	0.08	0.07
Maroon Bells-Snowmass WA	272	0.05	0.05	0.03	0.05
Grand Canyon NP	292	0.11	0.08	0.06	0.08

NM SRC09 Unit # 350250063, Dynegy Saunders SRU: SO2 = 1,387 TPY; NOx = 4 TPY; PM = 0 TPY
Annual Average Natural Conditions
Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance (km)	98th Percentile for Each Year 2001	2002	2003	98th 3 year AVG	98th 2 year AVG
Salt Creek	92	0.10	0.11	0.11	0.11	0.11
Carlsbad Cavern	121	0.05	NA	0.03	NA	0.04
Guadalupe Mountains NP	159	0.04	0.03	0.02	0.03	0.03

NM SRC10 Unit # 350250034, SWPS Cunningham: SO2 = 5 TPY; NOx = 2,566 TPY; PM = 27 TPY
Annual Average Natural Conditions
Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance (km)	98th Percentile for Each Year 2001	2002	2003	98th 3 year AVG	98th 2 year AVG
Carlsbad Cavern	114	0.25	NA	0.10	NA	0.17
Salt Creek	134	0.32	0.26	0.23	0.27	0.28
Guadalupe Mountains NP	154	0.16	0.14	0.06	0.12	0.11

NM SRC11 Unit # 350130002, El Paso Rio Grande: SO2 = 2,286 TPY; NOx = 1,767 TPY; PM = 344 TPY
Annual Average Natural Conditions
Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance (km)	98th Percentile for Each Year 2001	2002	2003	98th 3 year AVG	98th 2 year AVG
Guadalupe Mountains NP	144	0.19	0.16	0.15	0.17	0.17
Carlsbad Cavern	208	0.13	NA	0.13	NA	0.13
Chiricahua NM	245	0.10	0.10	0.11	0.10	0.11
Salt Creek	278	0.10	0.07	0.09	0.08	0.10