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Civilian Radioactive Waste Management System
Management and Operating Contractor

Meteorological Monitoring Program

Particulate Matter Ambient Air Quality Monitoring Report

January through December 1996

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Prepared for:

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EXECUTIVE SUMMARY

Environmental field studies in the Yucca Mountain site characterization activities have included monitoring ambient levels of particulate matter since April 1989. The monitoring and reporting work was performed by the Management and Operating Environmental Field Programs Division. The parameters monitored, methods used in the monitoring, and the sampling schedule complied with U.S. Environmental Protection Agency regulations and monitoring guidance. The inhalable particulate matter results have been reported to the State of Nevada since July 1991 to comply with State of Nevada air quality permit requirements. Three previous project reports presented the results obtained through 1995 (Environmental Field Programs Division 1992a; 1992b; 1996). This report presents the results obtained during 1996.

Results of this monitoring program continue to identify that particulate matter remains well below applicable ambient air quality standards. The maximum inhalable particulate matter result was 60 micrograms per standard cubic meter; this result is less than one-half of the applicable 24-hour National (and Nevada) Ambient Air Quality Standard of 150 micrograms per standard cubic meter. The annual inhalable particulate matter averages for the period were approximately one-fifth of the applicable annual standard of 50 micrograms per standard cubic meter. The 1996 results were similar to results from 1989 to 1995.

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TABLES

1. BACKGROUND AND METHODS

The *Scientific Investigation Implementation Package for Air Quality Monitoring* (Environmental Field Program's Division [EFPD] 1995) describes the regulatory rationale and technical aspects of the monitoring program. Total suspended particulate matter (TSP) and inhalable particulate matter (PM_{10}) monitoring began in 1989 at two sites. The monitoring was intended to determine background airborne particulate matter levels prior to the onset of major site disturbance activities associated with the site characterization program. Two more sites, with PM_{10} samplers, were added in late 1992 along the southern and western borders of the Nevada Test Site, where typical wind patterns could carry airborne particulate matter associated with site characterization activities beyond the Nevada Test Site (NTS).

1.1 REGULATORY RATIONALE

The level for the National and Nevada Primary and Secondary Ambient Air Quality Standards for particulate matter is 150 micrograms per standard cubic meter (µg/m^3) for a 24-hour average concentration (40 Code of Federal Regulations [CFR] 50.6). This standard is attained when the expected number of days is less than or equal to one (40 CFR 50, Appendix K). The standards include a maximum annual arithmetic average of 50 µg/m^3.

The State of Nevada air quality permit covering surface disturbance site characterization activities includes the requirement to report results of the PM_{10} monitoring, with corresponding meteorological data. The permit specifies that the monitoring and reporting are to be accomplished following the permit "Attachment A" guidance (Nevada 1994). The PM_{10} results have been reported to the State of Nevada for each calendar quarter period since July 1991 to comply with the permit requirements.

The National Ambient Air Quality Standards for particulate matter (40 CFR 50.6) were expressed as TSP until 1987, when the standard was changed to PM_{10}. In 1991, the State of Nevada changed its standards to follow the federal changes (Nevada 1995). TSP samplers measure airborne particulate matter up to approximately 50 micrometers aerodynamic diameter. PM_{10} samplers measure the inhalable particulate matter with an aerodynamic diameter less than or equal to 10 micrometers. Both TSP and PM_{10} are measured because of 1) the transition of the Nevada ambient air quality standards from TSP to PM_{10} in 1991 and 2) to provide a more complete particulate matter characterization for environmental study purposes.

1.2 NETWORK DESCRIPTION

Particulate matter monitoring has included both TSP and PM_{10} at Sites 1 and 5 since the program began in April 1989. PM_{10} monitoring began at Sites 6 and 9 late in 1992. The four site locations are identified in Table 1 and shown in Figure 1.

Table 1. Coordinates of the Particulate Monitoring Sites

Site	UTM Coordinates Zone 11 (meters)	Nevada System (feet)	Latitude-Longitude (deg° min' sec")	Elevation (msl)
Site 1 (NTS-60)	550,784E 4,077,374N	569,126E 761,795N	116°25'50"W 36°50'34"N	3750 ft 1143 m
Site 5 (Fortymile Wash)	554,385E 4,068,727N	580,843E 733,378N	116°23'26"W 36°45'52"N	3125 ft 953 m
Site 6 (WT-6)	549,388E 4,083,097N	564,612E 780,592N	116°26'45"W 36°53'40"N	4315 ft 1315 m
Site 9 (G-510)	553,418E 4,058,398N	577,554E 699,491N	116°24'08"W 36°40'17"N	2750 ft 838 m

The reasons for choosing these locations are as follows:

- Site 1 (NTS-60) is near the Exploratory Studies Facility in Midway Valley. The ambient particulate matter data from before and after the beginning of the major site disturbance activities provide a measure of air quality impacts of these activities. The collocated pairs of TSP and PM_{10} samplers are both at Site 1.

- Site 5 (Fortymile Wash) is along Fortymile Wash, about halfway between the major surface disturbance area in Midway Valley near Site 1 and the nearest populated area, Amargosa Valley.

- Site 6 (WT-6) is a remote location on the border between the NTS and Nellis Air Force Base Gunnery Range in Yucca Wash. This location is on a possible pathway of particulate matter through Midway Valley towards the community of Beatty, Nevada.

- Site 9 (Gate 510) is along the southern border of the NTS near the community of Amargosa Valley. Results from this site are the most significant indicator of actual "ambient" PM_{10} concentrations; that is, inhalable particulate matter levels at locations where the general public has unrestricted access.

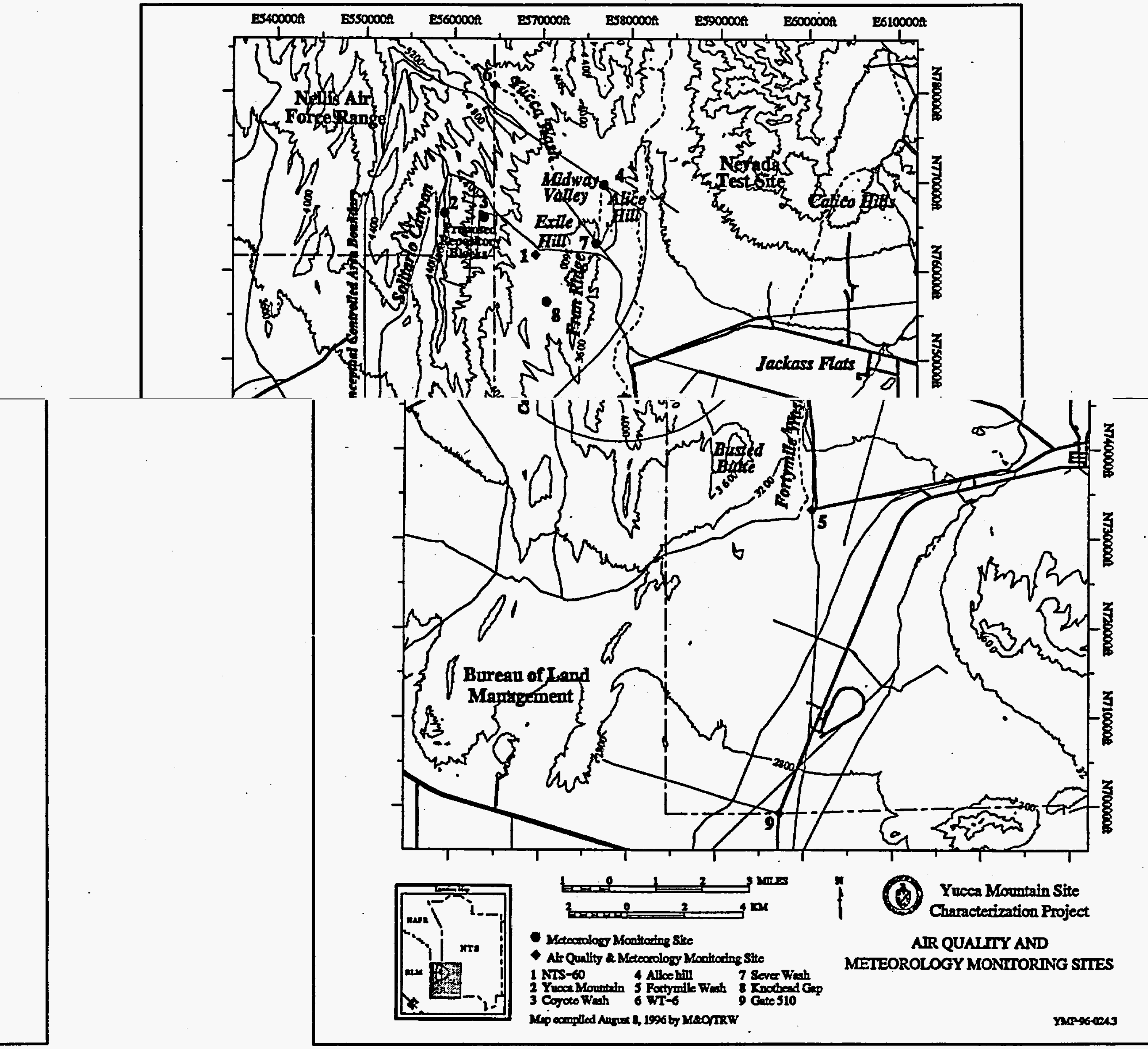


Figure 1. Site Map

1.3 PARTICULATE MATTER SAMPLING METHODS

The TSP and PM_{10} monitoring was performed using high-volume air samplers, following the sampling techniques prescribed in approved Nevada Work Instructions NWI-AQ-001; NWI-AQ-002; and NWI-AQ-016. The work instructions were based in part on 40 CFR 50, Appendix J, and the U.S. Environmental Protection Agency (EPA) monitoring guidance prescribed in the EPA Quality Assurance Handbook for Ambient Air Quality Monitoring, Volume II, sections 2.2, TSP and 2.11, PM_{10} (EPA 1990). The instructions followed project conventional quality assurance requirements. The routine monitoring, maintenance, and quality control procedures were designed so the sampling program would meet at least an 80 percent data recovery rate, to comply with Attachment A of the State of Nevada permit (Nevada 1994).

Airflow through the high-volume air samplers is controlled by a fixed critical orifice, which minimizes airflow control problems. The sampler airflow is checked at least once each calendar quarter by EFPD technical staff, and again each quarter during an independent performance audit. All flow checks are performed using orifice calibrators, which are certified as traceable to National Institute of Standards and Technology flow testing devices.

The collocated pairs of PM_{10} (MS1 and MS2) and TSP (MS5 and MS6) samplers are both at Site 1. Data from these samplers provide a precision assessment of the monitoring data and complies with EPA quality assurance requirements (40 CFR 58 *Ambient Air Quality Surveillance*) and the Nevada monitoring guidelines (Nevada 1996).

The samplers operated for 24 hours every sixth day as prescribed by the EPA and State of Nevada schedule. The samplers at Sites 1, 5, and 9 were powered by standard electrical power and were operated from midnight-to-midnight on the scheduled sampling dates using a timer. The sampler at Site 6, powered by a propane-fueled electric generator, was manually started. Samplers stopped automatically at the end of a 24-hour period. Every attempt is made to adhere to the scheduled supplied by the State of Nevada Bureau of Air Quality that is referenced in Attachment A of the air quality permit. When equipment malfunctions or power failures occur on primary samplers, substitute runs are made, if this can be accomplished without interfering with the next schedule's sampling run.

Gravimetric analyses of the filters include equilibrating the filters to laboratory conditions for the pre-sampling and post-sampling filter weighing. The filter net weight gain is the particulate matter sampled. A calculation using this weight, the sampler airflow data, and the seasonal average site conditions produces average concentrations of particulate matter. Results are reported in micrograms per standard cubic meter ($\mu g/m^3$), calculated to a standard temperature and pressure (25 degrees Celsius and 760 millimeters of mercury, per 40 CFR 50, §50.3).

2. RESULTS

The primary purpose of air quality monitoring for regulatory compliance purposes is to compare monitoring program results to applicable standards. Results for 1996 were well below applicable ambient air quality standards (see section 2.1), indicating that inhalable particulate matter concentrations did not jeopardize the health and welfare of the general public. The strict interpretation of the ambient air quality standards does allow expected values (40 CFR 50, Appendix K) of PM_{10} concentration levels to exceed the 24-hour level once per year; hence, the second-highest value becomes the critical indicator of compliance with the standard. Some additional statistical interpretations of the results are presented to facilitate understanding. The particulate matter sampling results are included in Appendix A. Assessments of data quality based on EPA quality assurance requirements are also included in Section 3.

2.1 DATA RECOVERY

Regulatory monitoring stipulations (air quality permit Attachment A [Nevada 1994]) include a data recovery criterion that at least 80 percent of the total data possible shall be recovered. This criterio only applies to the PM_{10} data, though it was also used as the goal for TSP. The annual PM_{10} and TS data recovery rates for the four sites are presented in Table 2. The values are the number of reporte results divided by the number of scheduled sampling runs and are expressed as a percent. The tabl shows that the criterion was met for all samplers. All the data recovery rates exceeded 95 percen and the average data recovery rates for the primary samplers in this reporting period exceeded 9 percent.

Table 2. Data Recovery Rates

PM_{10}					TSP		
Site 1		Site 5	Site 9	Site 6	Site 1		Site 5
MS1	MS2	FM3	G510	WT6	MS5	MS6	FM4
100.0%	95.1%	98.4%	100.0%	98.4%	98.4%	100.0%	98.4%

2.2 REGULATORY COMPLIANCE

Results of the PM_{10} sampling, shown in Table 3, indicate that the monitoring area easily attained th particulate matter ambient air quality standards. The highest 24-hour sampling result was 60 µg/m which was less than half of the regulatory standard of 150 µg/m³. This result came from Site 1 o July 26, 1996; the conditions associated with this sampling date are discussed later in this repor The next highest results were 57 µg/m³ from Sites 5 and 9 on the same date.

Table 3. PM_{10} (µg/m^3) Highest, Second-Highest, and Annual Average 24-Hour Values

	MS1	FM3	G510	WT6
Highest	60	57	57	32
2nd-Highest	23	35	28	21
Average	10	10	10	9

The second-highest value is often the best measure of regulatory compliance, since the standard allows for one value each year that exceeds the standard level. The maximum second-highest value from all four sites during the period was 35 µg/m^3 at Site 5. This value is approximately one-fourth the standard level, further indicating the very low particulate matter levels in the area. The highest arithmetic mean value from the four primary PM_{10} samplers was 10 µg/m^3. This value is approximately one-fifth of the ambient air quality standard (50 µg/m^3).

2.3 TSP RESULTS

Results of the TSP sampling (Table 4) show generally low levels of particulate matter in the area. The highest TSP result was 148 µg/m^3. The highest TSP results at Sites 1 and 5 were 147 µg/m^3 and 148 µg/m^3, respectively. Both occurred on July 26, 1996, the same date as the highest PM_{10} results at all sites. The second highest results at the Sites 1 and 5 were 126 µg/m^3 and 77 µg/m^3, respectively. Both of these results also occurred on the same date as the second highest PM_{10} results.

Table 4. TSP (µg/m^3) Highest, Second-Highest, and Annual Average 24-Hour Values

	MS5	FM4
Highest	147	148
2nd-Highest	77	126
Average	24	26

2.4 ADDITIONAL RESULTS

The results presented in Sections 2.1 and 2.2 follow a regulatory approach of only examining the two highest concentrations observed during the calendar year. Additional data analyses are reported in this section to describe particulate matter levels occurring in the study area more completely. These analyses include the ratio of PM_{10} to TSP, the 95th-percentile and median values, and distributions of the results by concentration levels.

The fraction of total suspended particulate matter in the inhalable size range (less than 10 micrometers nominal aerodynamic diameter), called the inhalable fraction, is described by the ratio of PM_{10} concentration to TSP concentration. This ratio was calculated from the simultaneous PM_{10} and TSP measurements at Site 1, using the MS1 (PM_{10}) and MS5 (TSP) samplers, and at Site 5, using the FM3 (PM_{10}) and FM4 (TSP) samplers. The averages of the ratios were 0.443 at Site 1 and 0.416 at Site 5.

The PM_{10} to TSP ratio data showed a large variation for PM_{10} concentrations less than 10 µg/m³, which included about one-half of the samples. To obtain better indicators of the inhalable fraction for PM_{10} concentrations larger than these small values, two other ratio averages were calculated: an average excluding samples with PM_{10} less than or equal to 4 µg/m³ and an average excluding samples with PM_{10} less than or equal to 9 µg/m³. The results of the three averages (all results, those greater than 4 µg/m³, and those greater 9 µg/m³) are shown in Table 5. The results for concentrations greater then 9 µg/m³, 0.494 for Site 1 and 0.445 for Site 5, are similar to those observed in other rural environments (Brook et al. 1997).

Table 5. Ratio of PM_{10} to TSP Results

Samplers	all pairs	>4 µg/m³	>9 µg/m³
MS1/MS5 (Site 1)	0.443	0.455	0.494
FM3/FM4 (Site 5)	0.416	0.425	0.445

The 24-hour ambient air quality standard for particulate matter is based on the two highest sampling results occurring during a calendar year. These sampling results have the potential to present misleading descriptions of both extreme and typical conditions. Two alternative statistical descriptions are the 95th percentile value, which measures the level that five percent of the values exceed, and the median, which is the middle value in a ranked list of values. When used with the mean, these alternative descriptions provide a more complete picture of the particulate matter

Table 6. 95th-Percentile, Median, and Mean Values ($\mu g/m^3$) for PM[redacted] and TSP

[redacted]

15 to <20	7	7	5	8	9	10
20 to <30	5	2	3	2	27	15
30 to <50	0	1	0	1	4	11
50 to <70	1	1	1	0	2	1
70 to <100	0	0	0	0	1	0
100 to <300	0	0	0	0	1	3

Additional investigation of the maximum values observed shows that some of the higher particulate matter concentrations were representative of the overall area, rather than being due to localized [redacted] indicating an area-wide occurrence of high-level suspended particulate matter concentrations. These elevated concentrations appear to be associated with numerous forest fires occurring in the adjacent western states (California, Oregon, Arizona, and Utah). Elevated concentrations were also observed at the sites on March 28, 1996. The technician noted on the filter weight log: "Strong winds with a lot of dust during run."

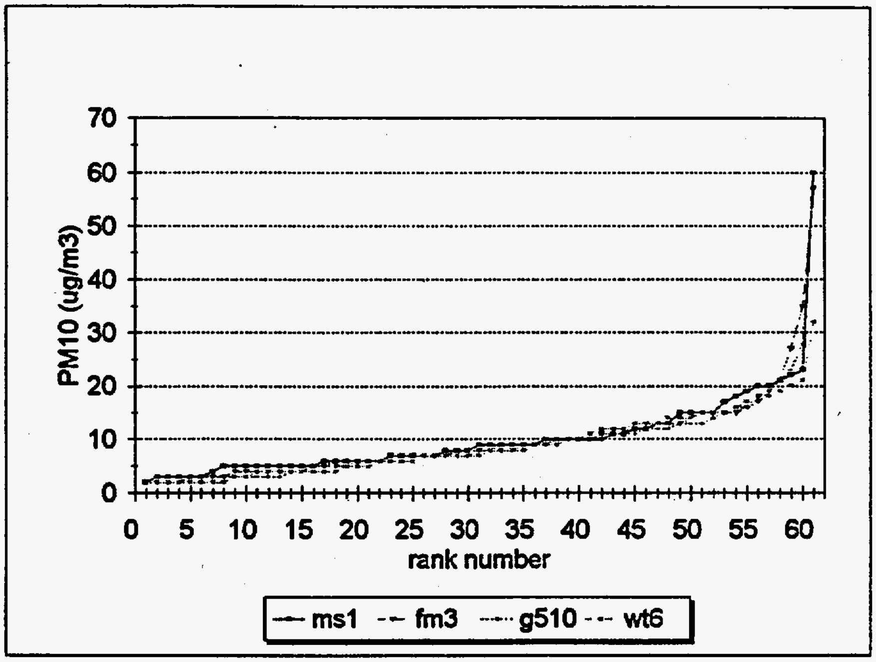


Figure 2. Ranked Occurrences of the PM_{10} Values for 1996

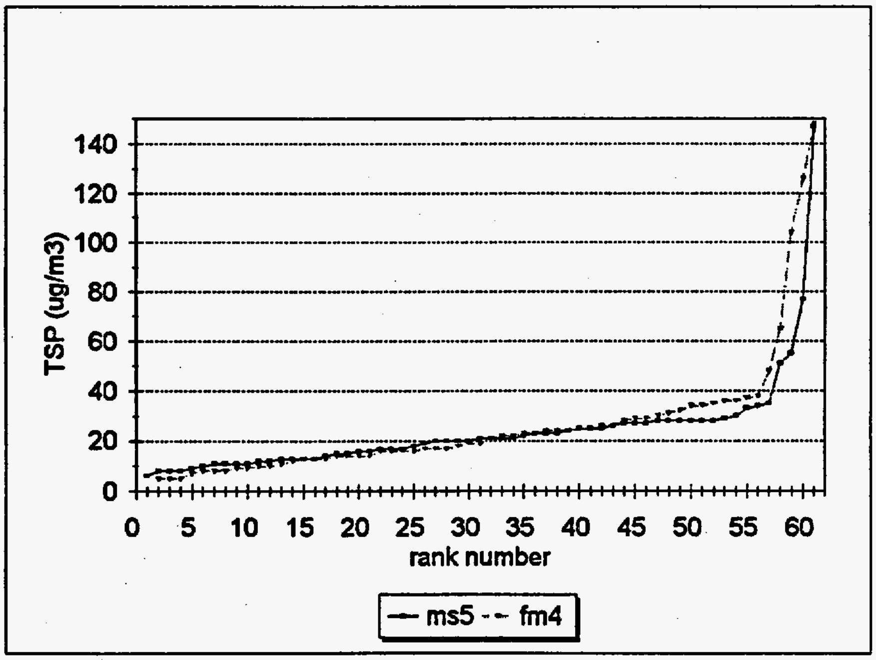


Figure 3. Ranked Occurrences of the TSP Values for 1996

Table 8. Dates (Month/Day) of Highest and Second-Highest Particulate Matter Occurrences

	PM_{10}		TSP		PM_{10}	TSP	PM_{10}	
	MS1	MS2	MS5	MS6	FM3	FM4	G510	WT6
Highest	7/26	3/28	7/26	7/26	7/26	7/26	7/26	7/26
Second Highest	3/28	5/15	3/28	3/28	3/28	3/28	3/22	5/15

2.5 SUMMARY AND PARTICULATE MATTER TRENDS

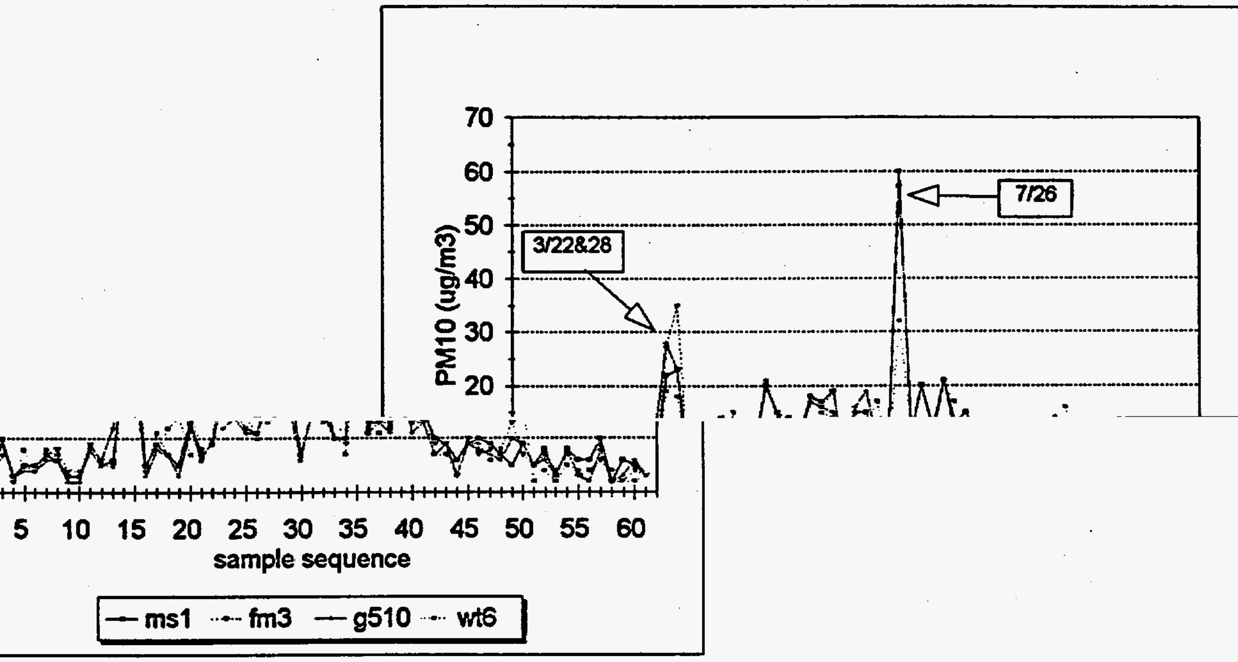
Analyses of the particulate matter data lead to two primary conclusions about observed concentration levels and chronological trends. These two main points follow, with discussion text to support the primary conclusions.

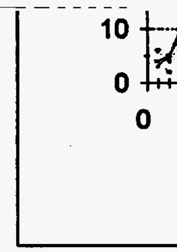
- Particulate matter levels in the primary site characterization area were for the most part, well below the applicable standards. Results from the summer months tend to be slightly higher than those during the remainder of the year. The highest levels observed at all sites were values well above the remainder of the data, indicating the presence of unusual circumstances causing those results. Approximately one-half of the TSP is in the PM_{10} size range.

- Comparison to previous years shows similar particulate matter concentration levels, generally with slight differences in the highest levels observed from year to year. There were only slight differences between the annual groupings of results, with no significant chronological trend seen. Thus, there does not seem to be any detectable increase in particulate matter levels with the onset of increased site disturbance activities.

From a regulatory perspective, the highest and second-highest 24-hour PM_{10} concentrations and the annual average PM_{10} values represent the best measure of particulate matter levels. The results presented in Section 2.2 show that the maximum indicators are well below the applicable ambient air quality standards. Figures 4 and 5 show chronological plots of the PM_{10} and TSP values for 1996. Typically, the particulate matter values were higher during the summer than during the winter. Plots of all operating sampler data show the similarity in the annual trends. The plots also show that the annual maximum values are typically well above the remainder of the monitoring results.

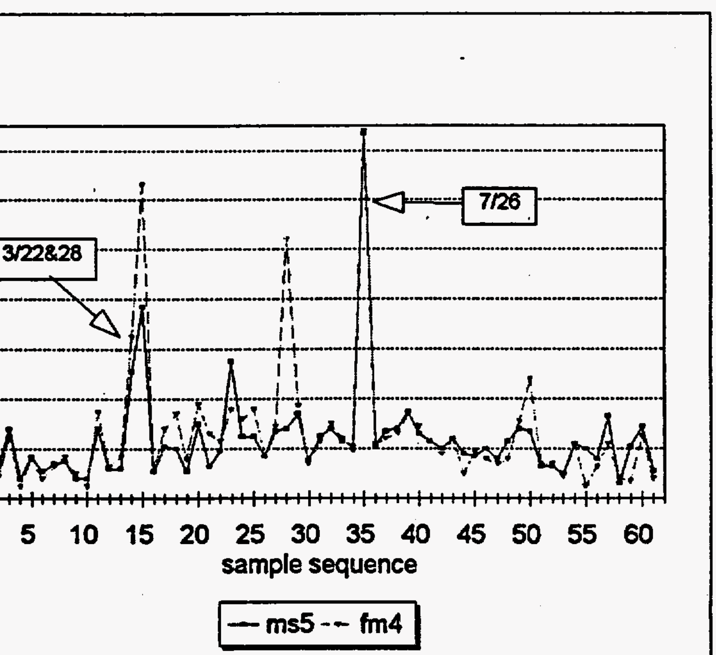
The highest 24-hour values and the annual averages for the primary samplers for the 1989 through 1995 reporting period are presented in Table 9. As with the 1996 results, results from previous years indicate few occurrences of higher concentrations, with typically low values contributing to low

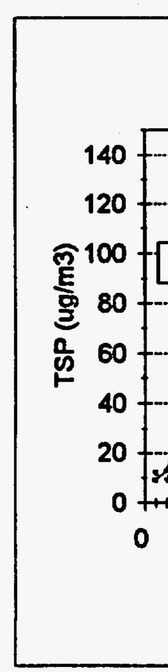




Chronological Plots of the PM_{10} Values for 1996

Figure 4.





Chronological Plots of the TSP Values for 1996

Figure 5.

Table 9. Results from Previous Years

		PM_{10} (µg/m³)		TSP (µg/m³)	
Year	Statistic	MS1	FM3	MS5	FM4
1989	Highest 24-Hour Average	42	40	90	94
	Annual Average	12	12	26	27
1990	Highest 24-Hour Average	62	48	150	106
	Annual Average	12	10	24	22
1991	Highest 24-Hour Average	33	46	62	103
	Annual Average	10	11	22	25
1992	Highest 24-Hour Average	30	49	73	130
	Annual Average	12	12	27	30
1993	Highest 24-Hour Average	30	21	86	56
	Annual Average	10	9	25	20
1994	Highest 24-Hour Average	39	42	99	98
	Annual Average	10	9	22	19
1995	Highest 24-Hour Average	21	67	56	310
	Annual Average	10	10	23	27

3. QUALITY ASSURANCE ASSESSMENT

Three quantitative quality assurance assessments are reported in this section: precision, accuracy, and the sampling integrity. The assessments of precision and accuracy comply with the EPA requirements applicable to Prevention of Significant Deterioration programs (40 CFR, Part 58, Appendix B). The results from slightly different assessment methods currently required by the State of Nevada for PM_{10} monitoring programs are also reported. The technique used to assess sample integrity is included in the EPA Quality Assurance Handbook (EPA 1990). These assessments began in 1993. Data recovery is considered an element of quality assurance. These results were presented in Section 2.1.

3.1 PRECISION

The precision of the particulate matter monitoring program was assessed using the results of simultaneous measurements using collocated samplers. Precision is a measure of the consistency in application of the sampler operations and laboratory analyses. The collocated samplers are located at Site 1 (NTS-60); the PM_{10} samplers are MS1 and MS2, and the TSP samplers are MS5 and MS6. The State of Nevada monitoring guidance (Nevada 1994) requires the average of the difference in concentrations for values less than 80 $\mu g/m^3$. The EPA Prevention of Significant Deterioration technique (40 CFR 58) is based on the percent difference (%-diff) of the paired sample results (X and Y) from the two samplers compared to the average of the paired values.

$$\%\text{-diff} = 100\% \bullet (X - Y) / [(X + Y) / 2]$$

A separate calculation of the precision results was made for samples with concentrations at least 4 $\mu g/m^3$ to reduce the unrealistically high percent-difference values calculated from the difference of two very small numbers. The upper and lower 95-percent confidence intervals are calculated based on the mean (M) and the standard deviation (SD) of the percent differences using the following equation:

$$95\% \text{ interval} = M \pm [1.96 \bullet SD / (2)^{1/2}]$$

The annual precision results are shown in Table 10. The differences based on the State of Nevada method are 0.2 $\mu g/m^3$ for PM_{10} and -1.1 $\mu g/m^3$ for TSP. The upper and lower 95 percent interval values were 17.2 percent and -13.0 percent for PM_{10}, and +6.8 percent and -19.5 percent for TSP. The modified calculation for the PM_{10} results (only using values at least 4 $\mu g/m^3$) eliminated approximately one-fourth of the differences. The modified 95 percent interval results are 13.5 percent and -9.8 percent. The EPA does not have guidance on acceptable data precision. These results are seen as acceptable for the purposes of demonstrating regulatory compliance and general environmental characterization.

Table 10. Annual PM_{10} and TSP Precision Assessment Results

	Concentration (µg/m³)	Upper 95%	Lower 95%
PM_{10}, All Concentrations	0.2	17.2%	-13.0%
PM_{10}, Concentrations >4µg/m³	0.2	13.5%	-9.8%
TSP, All Concentrations	-1.1	6.8%	-19.5%

3.2 ACCURACY

The accuracy of the particulate matter monitoring program was assessed using the performance results from independent performance audit measures of sampler airflow rates. The auditor measured the typical operating airflow rate and used a calibrated orifice to determine the actual [redacted] within ±10 percent of the design flow rate (1.13 m³/min) are considered acceptable (EPA 1990). These performance audits were performed once during each calendar quarter. The results of the audits of both the PM_{10} and TSP samples are shown in Table 11. These results reasonably indicate that the samplers were operating within acceptable tolerances. If necessary, investigations would be promptly initiated to explain results that exceeded the flow rate limit given above. Corrective actions would be taken when necessary.

Table 11. Summary of Performance Audits for Samplers

	Sampler & Orifice			Sampler & Design (1.13 m³/min)		
	max	min	avg	max	min	avg
PM_{10}	4.0%	-0.9%	1.3%	0.5%	-4.1%	1.8%
TSP	3.7%	0.2%	1.7%	1.2%	-3.0%	0.7%

3.3 SAMPLING INTEGRITY

The sampling integrity of the particulate matter monitoring program was assessed using the results of gravimetric analyses of blank filters. These filters were treated as samples except that they were removed from the sampler immediately after installation, without the sampler being run. Such samples are called "blanks" in some analytical operations. Since 1993, blank filter samples have been created once each month by using different samplers. The EPA guidance allows a ±5 µg/m³ equivalent concentration in this assessment. The eleven sampling integrity results ranged between 0 and 2 µg/m³, with an average of 0.8 µg/m³, and are acceptable according to the EPA guidelines. These results further demonstrate and ensure the quality of field data.

4. REFERENCES

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4.2 STANDARD, REGULATIONS, AND CODES

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40 CFR 58 1996. *Ambient Air Quality Surveillance.* Washington, D.C.: U.S. Government Printing Office.

Nevada Administrative Code Chapter 445B: Air Pollution 1995.

4.3 PROCEDURES

NWI-AQ-001 (Nevada Work Instruction AQ-001) 1995a. *Routine Operations and Maintenance for Ambient Particulate Matter Sampling.* Las Vegas, Nevada.

NWI-AQ-002 1995b. *Calibrations and Performance Audits of Particulate Matter Samplers.* Las Vegas, Nevada.

NWI-AQ-016 1995c. *Air Quality Monitoring: Gaseous and Particulate Data Processing Instructions.* Las Vegas, Nevada.

APPENDIX A

PARTICULATE MATTER DATA

APPENDIX A
PARTICULATE MATTER DATA

Table A-1 Data Listing

	PM_{10} (µg/m³)					TSP (µg/m³)		
DATES	MS1	MS2	FM3	G510-7	WT6-8	MS5	MS6	FM4
01/04/96	4	5	6	3	4	9	10	12
01/10/96	5	5	4	5	2	13	13	9
01/16/96	10	10	7	9	7	28	28	25
01/22/96	3	2	2	3	2	8	8	5
01/28/96	5	5	5	4	8	17	17	16
02/03/96	5	5	4	4	4	11	11	8
02/09/96	7	7	7	6	8	14	14	13
02/15/96	6	7	8	6	7	15	14	17
02/21/96	3	4	R	2	4	8	7	10
02/22/96	NA	NA	4	NA	NA	NA	NA	NA
02/27/96	3	3	3	2	4	8	7	5
03/04/96	8	10	9	9	8	28	26	35
03/10/96	5	6	6	6	5	12	12	13
03/16/96	6	6	5	12	5	12	12	17
03/22/96	22	21	27	28	19	51	48	65
03/28/96	23	22	35	23	18	77	72	126
04/03/96	5	5	4	3	4	11	8	11
04/09/96	9	10	11	8	8	21	21	28
04/15/96	7	8	7	7	12	20	18	34
04/21/96	5	5	5	3	14	11	10	16
04/27/96	13	14	15	12	7	30	27	38
05/03/96	7	7	8	6	6	13	12	26
05/09/96	9	10	10	10	10	19	19	23
05/15/96	20	22	M	R	21	55	52	36
05/17/96	NA	NA	NA	12	NA	NA	NA	NA
05/21/96	15	15	15	14	15	25	24	32

Table A-1. Data Listing (Continued)

	PM_{10} (µg/m³)					TSP (µg/m³)		
DATES	MS1	MS2	FM3	G510-7	WT6-8	MS5	MS6	FM4
05/27/96	12	12	14	11	12	25	25	36
06/02/96	11	11	11	11	10	17	15	17
06/08/96	18	17	18	17	13	27	27	29
06/14/96	17	17	16	16	15	28	26	104
06/20/96	19	19	19	15	14	34	33	37
06/26/96	7	7	7	6	6	15	15	14
07/02/96	15	17	15	16	15	25	24	23
07/08/96	15	16	15	19	13	28	26	30
07/14/96	10	10	10	10	17	23	22	24
07/20/96	10	10	9	10	7	21	22	19
07/26/96	60	M	57	57	32	147	146	148
08/01/96	11	11	11	13	12	21	20	22
08/07/96	R	14	13	13	11	27	25	24
08/10/96	20	20	NA	NA	NA	NA	NA	NA
08/13/96	12	12	13	11	13	28	27	26
08/19/96	21	22	21	21	20	35	34	34
08/25/96	13	14	13	11	17	26	26	29
08/31/96	15	14	13	13	M	23	22	M
09/06/96	10	M	9	7	7	20	17	18
09/12/96	9	10	9	9	7	24	23	24
09/18/96	6	6	3	3	3	18	17	10
09/24/96	9	10	10	9	9	17	18	19
09/30/96	10	10	7	8	9	20	20	16
10/06/96	9	7	8	7	6	16	14	14
10/12/96	7	7	8	6	6	R	14	16
10/16/96	NA	NA	NA	NA	NA	23	22	NA
10/18/96	R	11	13	10	14	28	26	31
10/22/96	5	5	NA	NA	NA	NA	NA	NA
10/24/96	9	8	7	9	16	27	25	48
10/30/96	5	M	5	5	2	13	13	14
11/05/96	8	8	7	6	4	13	12	14

Table A-1. Data Listing (Continued)

	PM$_{10}$ (µg/m^3)					TSP (µg/m^3)		
DATES	MS1	MS2	FM3	G510-7	WT6-8	MS5	MS6	FM4
11/11/96	3	4	4	3	2	10	8	9
11/17/96	8	8	7	8	5	22	21	21
11/23/96	R	R	3	3	4	R	R	5
11/26/96	6	6	NA	NA	NA	20	20	NA
11/29/96	6	6	4	2	2	16	16	13
12/05/96	10	10	6	8	9	33	31	22
12/11/96	2	2	2	2	4	6	4	8
12/17/96	6	5	2	3	2	21	17	7
12/23/96	5	5	4	6	2	29	27	25
12/29/96	3	3	3	3	3	11	7	8

Notes:

M—Missed sampling run with no make-up run.

R—Scheduled sampling run that was missed due to equipment problems but was made up and is shown in the following sampling date.

NA—Results that are not applicable. It appears for samplers that did not require make-up runs.