PM_{10} State Implementation Plan Milestone Achievement Report

Clark County, Nevada

Department of Air Quality and Environmental Management

June 2007

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EXECUTIVE SUMMARY

This Milestone Achievement Report (MAR) was prepared in compliance with the "Addendum to the General Preamble for the Implementation of Title I of the Clean Air Act Amendments of 1990" (40 CFR Part 52). It documents Clark County's attainment of the 24-hour PM_{10} National Ambient Air Quality Standards (NAAQS) and continued attainment of the annual PM_{10} standard. Summary data sets are provided in the report, and complete data sets are provided in Appendix A. In addition to PM_{10} data and analysis, the MAR contains an evaluation of the Clark County PM_{10} monitoring network. The report documents that the monitoring network is representative of the PM_{10} nonattainment area, complies with EPA siting criteria, and is operated in accordance with U.S. Environmental Protection Agency (EPA) maintenance requirements.

The June 2001 *PM_{10} State Implementation Plan* (PM_{10} SIP) contained both regulatory and non-regulatory commitments. The regulatory commitments included evaluating the feasibility of enhancing provisions of Sections 90, 92, 93, and 94 of the Clark County Air Quality Regulations and adopting those provisions deemed feasible. The nonregulatory commitments included implementing local paving programs, meeting specified staffing levels for enforcement staff, improving specific emissions inventories, and conducting research. The PM_{10} SIP also contained a commitment to remodel the attainment demonstration if the emissions inventory changed significantly. The addition of 26,440 (net) acres to the U.S. Bureau of Land Management (BLM) land disposal boundary area, which also serves as the modeling domain, triggered this requirement. The MAR documents Clark County's fulfillment of these SIP commitments. The nonregulatory measures submitted as part of the SIP, and enhancements developed as part of the SIP commitments, have been fully implemented. In addition, Clark County implemented a number of regulatory program improvements beyond those committed to in the PM_{10} SIP. The county has also completed the air quality research it committed to in the SIP.

Emissions from updated source categories were calculated using newly developed source activity data, improved emissions factors developed from Clark County research, and other special study data. Windblown emission calculations were updated using refined emissions factors developed from a wind tunnel study and new vacant land surface characterizations developed from a research study that used satellite imagery and air photos. A complete inventory of privately owned unpaved roads developed as part of a special study is included. Data from the Clark County Department of Comprehensive Planning was used to update the construction activities inventory, another area of emphasis. Additional data came from the Regional Transportation Commission of Southern Nevada, the Clark County Department of Aviation, and the Clark County School District.

The MAR provides the results of Clark County's updated attainment demonstration model, with a description of model updates and improvements. The 2006 design value is 106 $\mu g/m^3$, compared to the model's prediction of 92.54 $\mu g/m^3$. Both values fall far below the PM_{10} NAAQS limit. The variance of 13.46 $\mu g/m^3$ is 12.7 percent of the measured value, well within the EPA's accepted performance goals of ±20 percent. This result confirms the accuracy of the proportional rollback model for the Clark County nonattainment area.

Clark County has developed a Natural Event Action Plan to coordinate enforcement and public education programs during high wind events. The program has proven very effective since its implementation in January 2004.

The MAR documents Clark County's ongoing research initiatives. These include paved road dust emissions studies, soil surface characterization studies using state-of-the-art imaging technology, and research on environmental standards for dust suppressant products. Key innovations include vehicle-mounted continuous measurement systems to measure dust emissions entrained from paved roads and satellite imagery to evaluate soil surface characteristics for large land areas. An accurate assessment of soil surface characteristics enabled Clark County to apply the correct emission factors for windblown dust developed from previous wind tunnel studies.

As a result of its successful implementation of the PM_{10} SIP and attainment of the annual and 24-hour PM_{10} NAAQS, Clark County is requesting a clean data finding and a finding of attainment for the Las Vegas Valley (Hydrographic Area-212) PM_{10} nonattainment area.

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ACRONYMS AND ABBREVIATIONS

Acronyms

ADT	Average Daily Trips
AQS	Air Quality System
BACM	Best Available Control Measures
BAM	Beta Attenuation Monitor
BCC	Clark County Board of County Commissioners
BLM	U.S. Bureau of Land Management
CAAA	Clean Air Act Amendments of 1990
CFR	Code of Federal Regulations
CMB	Chemical Mass Balance
DAQEM	Clark County Department of Air Quality and Environmental Management
DCP	Clark County Department of Comprehensive Planning
DRI	Desert Research Institute
EPA	U.S. Environmental Protection Agency
EQM	Environmental Quality Management, Inc.
FR	*Federal Register*
GIS	Geographic Information System
HA-212	Hydrographic Area 212 (Las Vegas Valley)
IPSM	Information Processing Systems MeteoStar
MAR	Milestone Achievement Report
MRI	Midwest Research Institute
NAAQS	National Ambient Air Quality Standards
NEAP	Natural Events Action Plan
PM	particulate matter
QA	quality assurance
RTC	Regional Transportation Commission of Southern Nevada
RTP	*Regional Transportation Plan FY 2006-2030*
SIP	State Implementation Plan
VMT	vehicle miles traveled

Abbreviations

µg	microgram
ft	foot
g	gram
in.	inch
km	kilometer
m	meter
mph	miles per hour
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This Milestone Achievement Report (MAR) describes Clark County's progress in implementing the June 2001 *PM_{10} State Implementation Plan for Clark County* (PM_{10} SIP). Section 110 of the 1990 Clean Air Act Amendments (CAAA) requires states that do not meet the National Ambient Air Quality Standards (NAAQS) to submit a SIP detailing programs to bring the nonattainment area into compliance. The U.S. Environmental Protection Agency (EPA) published final approval of the PM_{10} SIP in June 2004 (*Federal Register*, Volume 69, page 32273 (69 FR 32273)).

This final report on the implementation measures detailed in the PM_{10} SIP:

1. Summarizes a three-year window of air quality data that demonstrate NAAQS compliance.
2. Describes Clark County's achievement of SIP commitments.
3. Provides updated emissions inventories.
4. Documents the implementation of SIP control measures.
5. Models attainment of the PM_{10} NAAQS.
6. Summarizes the *Clark County Natural Events Action Plan* (NEAP).
7. Describes research conducted under programs implemented for the SIP.

1.2 BACKGROUND

1.2.1 Air Quality Responsibilities in Clark County

In 1978, the governor of Nevada designated the Clark County Board of County Commissioners (BCC) as the lead air quality planning organization for the Las Vegas Valley nonattainment area. In 1991, after implementation of the CAAA, the governor reaffirmed the BCC's lead role in air quality planning programs in a letter to EPA.

In June 2001, the governor designated the BCC as the air pollution control agency for Clark County. The BCC formally accepted the designation in July of that year and delegated air quality planning responsibilities to the newly formed Department of Air Quality Management, which in 2005 became the Department of Air Quality and Environmental Management (DAQEM).

In November 2006, DAQEM established a Particulate Matter Working Group composed of stakeholders from the public and private sectors to guide research activities. Staff coordinates closely with the working group to build consensus on research programs that characterize PM_{10} emissions in southern Nevada, and to identify and implement emission control programs.

1.2.2 Clark County Nonattainment Area

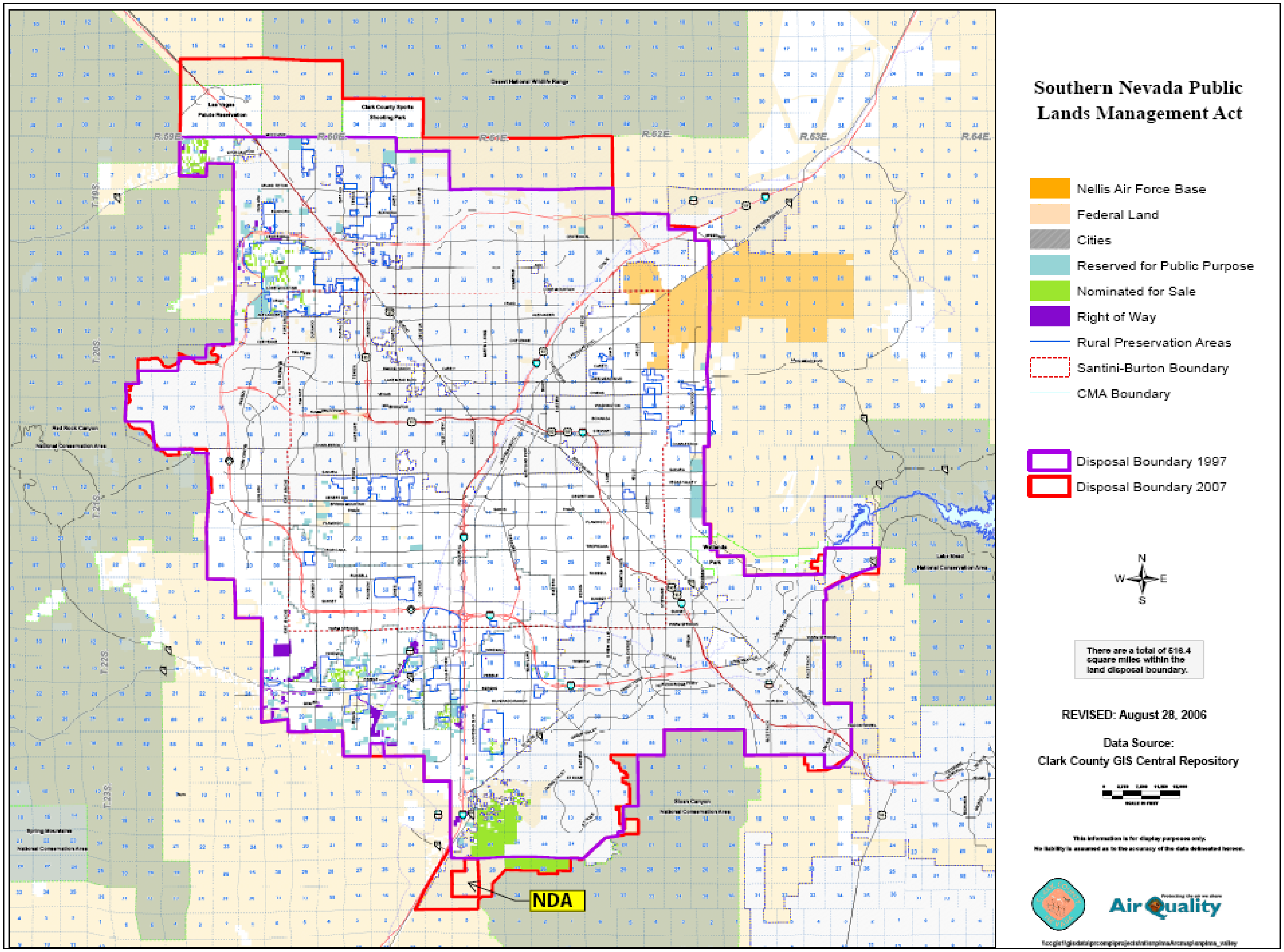
After passage of the CAAA, EPA designated all areas previously classified as "federal" PM_{10} nonattainment areas as "moderate" nonattainment areas, including the Las Vegas Valley. EPA required these moderate nonattainment areas to submit a SIP by November 1991 that would demonstrate attainment of the PM_{10} NAAQS by December 1994. Because of unprecedented growth, high wind events, and other factors, Clark County could not demonstrate attainment by the required date, and EPA reclassified the Las Vegas Valley as a "serious" nonattainment area in early 1993. In December 2000, the BCC requested that the state formally withdraw all previously submitted SIPs and addenda because none demonstrated attainment of the NAAQS.

After completing comprehensive research and work programs to address the problems identified in the 1997 PM_{10} SIP revision, Clark County submitted a new SIP to EPA in June 2001 that met federal requirements for serious PM_{10} nonattainment areas. This new SIP demonstrated that the adoption and implementation of Best Available Control Measures (BACM) and Best Available Control Technologies would result in attainment of the annual average PM_{10} NAAQS by 2001 and attainment of the 24-hour NAAQS by December 31, 2006. Although the CAAA required the SIP demonstrate attainment of the PM_{10} NAAQS no later than December 31, 2001, EPA granted Clark County a five-year extension for the 24-hour attainment date. Clark County supported its extension request with a Most Stringent Measure control analysis that showed the emission control programs proposed for the valley were at least as stringent, if not more so, than control programs implemented in other nonattainment areas.

Figure 1-1 depicts the Las Vegas Valley nonattainment area, which coincides with Hydrographic Area 212 (HA-212). This area is roughly 1,500 square miles, largely under federal control, and includes:

- City of Las Vegas
- City of North Las Vegas
- City of Henderson
- Unincorporated areas of Clark County
- Desert National Wildlife Refuge lands
- Toiyabe National Forest lands
- Red Rock Canyon National Conservation Area
- Nellis Air Force Base
- Lake Mead National Recreation Area lands
- U.S. Bureau of Land Management (BLM) lands.

The land inside the BLM disposal area will be sold for private use or granted for public use (e.g., parks and schools). Boulder City is located outside the nonattainment area.



Note: NDA = Nondisposable Area.

Figure 1-1. BLM Disposal Boundary Area Map.

1.3 STATE IMPLEMENTATION PLAN LAWS AND REGULATIONS

The CAAA assigns the primary responsibility for air pollution control to state governments. Each state must have a SIP that contains control measures and strategies developed through a public process, has been formally adopted by the state, and has been submitted to EPA by the governor or designee.

The BCC has delegated to DAQEM the responsibility for preparing SIPs for nonattainment areas within Clark County. After BCC approval, a SIP is forwarded to the Nevada Division of Environmental Protection. Once the state approves it, the governor sends the SIP to EPA for approval. On EPA approval, the SIP becomes federally enforceable. Each state must submit all SIP revisions to EPA for review and approval.

1.3.1 Determination of Attainment

Sections 179(c) and 188(b)(2) of the CAAA assign EPA the responsibility of determining, within six months of the attainment date, whether nonattainment areas have attained the PM_{10} NAAQS. EPA bases its determination on the area's air quality on the attainment date, which it ascertains by reviewing monitoring data from the area to determine its air quality status.

As specified in Appendix K of Title 40, Part 50 of the Code of Federal Regulations (40 CFR 50), attainment of the annual PM_{10} standard is achieved when the expected annual arithmetic mean PM_{10} concentration is equal to or less than 50 $\mu g/m^3$. Attainment of the 24-hour standard is determined by calculating the expected number of exceedances of the 150 $\mu g/m^3$ limit per year: the standard is attained when the expected number of exceedances is 1.0 or less. A total of three consecutive years of nonviolating air quality data is needed to show attainment of both PM_{10} standards. A complete year of air quality data comprises all four calendar quarters, with each quarter containing data from at least 75 percent of the scheduled sampling days.

1.3.2 Conformity

The CAAA and EPA regulations require that each SIP incorporate criteria and procedures for assessing the "conformity" of any transportation plan, program, or project with the required provisions of a state's SIP. Conformity ensures that federal actions do not cause or contribute to new violations, or adversely impact the SIP-established timeline for attainment and maintenance of the NAAQS. As the metropolitan planning organization for Clark County, the Regional Transportation Commission of Southern Nevada (RTC) is responsible for transportation conformity findings.

Section 176(c) of the CAAA prohibits federal actions that do not conform to SIPs. In November 1993, EPA promulgated two sets of regulations to implement Section 176(c):

- The *Transportation Conformity Regulations*, applicable to highways and mass transit, establish criteria and procedures for determining that transportation plans, programs, and projects conform to state SIPs.

- The *General Conformity Regulations*, applicable to everything else, ensure that other federal actions conform to requirements contained in state SIPs.

In August 2005, the BCC adopted the *Clark County Transportation Conformity Implementation Plan*. Appendix A of this plan details procedures for interagency consultation to ensure transportation conformity and establishes a Conformity Working Group to carry out the process in Clark County. Member agencies include local governments in Clark County, DAQEM, the Nevada Department of Transportation, and other state and federal agencies.

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2.0 MONITORING NETWORK & AIR QUALITY DATA

2.1 INTRODUCTION

This chapter describes Clark County's air quality monitoring network and summarizes PM_{10} air quality monitoring data for 2004 through 2006. It also demonstrates attainment of the 24-hour PM_{10} NAAQS by December 31, 2006, in accordance with the 2001 PM_{10} SIP, and continued attainment of the standard.

The "Addendum to the General Preamble for the Implementation of Title I of the Clean Air Act Amendments of 1990" (40 CFR 52), Section VIII.C.3, states:

> The State must demonstrate to EPA, within 90 days after the milestone achievement date, that the SIP measures are being implemented and the RFP/quantitative milestones have been met…The demonstration should also contain an evaluation of whether the PM_{10} NAAQS will be attained by the projected attainment date in the SIP, i.e., answer the question "Are the emission reductions to date sufficient to ensure timely attainment?"

2.2 DESCRIPTION OF THE MONITORING NETWORK

The monitoring network was designed using six basic monitoring objectives/ rationales and five measuring scales. Property availability, safety, security, accessibility, location, and staff resources were also considered.

Monitoring objectives are linked to the physical location of a site by matching the spatial scale represented by the sample of monitored air with the spatial scale most appropriate for the monitoring objective or rationale of the station. The spatial scale thus represents the physical dimensions of the air parcel nearest the monitor where pollutant concentrations are reasonably uniform (40 CFR 58, Appendix D). Combining the spatial measurement scale with the station monitoring objectives determines how and why monitoring sites are located in particular areas.

Site Monitoring Objectives/Rationales:

1. Determine highest concentrations expected to occur in the area covered by the network.
2. Determine representative concentrations in areas of high population density.
3. Determine impact on ambient pollution levels of significant sources or source categories.
4. Determine general background concentration levels.
5. Determine extent of regional pollutant transport from populated areas with regard to secondary standards (e.g., visibility impairment, effects on vegetation).
6. Determine population impacts in suburban and remote areas.

Spatial Measurement Scale:

Microscale:	0 to 100 m
Middle Scale:	100 to 500 m
Neighborhood:	500 m (0.5 km) to 4 km
Urban Scale:	4 to 50 km
Regional Scale:	10 to 100+ km

2.2.1 Monitoring Station Locations

In December 2006, DAQEM operated a network of 16 stations monitoring for PM_{10} within Clark County. Twelve were located in the Las Vegas Valley (HA-212); the other four were located in Jean, Boulder City, Apex, and Mesquite. Table 2-1 lists the 12 stations in the valley, along with their monitoring objectives and spatial scales.

Table 2-1. PM_{10} Monitoring Sites in HA-212

Site	Objective	Scale
City Center[1]	Source	Middle
Craig Road	Highest Concentration	Neighborhood
E. Sahara	Population Exposure	Neighborhood
Green Valley	Population Exposure	Middle
J. D. Smith	Population Exposure	Neighborhood
Joe Neal	Population Exposure	Neighborhood
Lone Mountain	Population Exposure	Neighborhood
Orr[2]	Population Exposure	Middle
Palo Verde	Population Exposure	Neighborhood
Paul Meyer	Population Exposure	Neighborhood
Pittman[3]	Population Exposure	Neighborhood
Southeast Valley[4]	Population Exposure	Neighborhood
Sunrise Acres[5]	Population Exposure	Neighborhood
Walter Johnson	Population Exposure	Neighborhood

[1]Closed in mid-2006.
[2]Relocated from E. Flamingo in fall 2002.
[3]Closed in February 2002 based on recommendations from EPA technical systems audit.
[4]Also referred to as "Henderson."
[5]Relocated from E. Charleston Blvd. (microscale site) in mid-2004.

All stations except the one at Craig Road measure population exposure to PM_{10}. The Craig Road site measures maximum PM_{10} concentration. The City Center and Pittman sites were closed and are shown only for reference. Two other monitoring sites were relocated: the East Flamingo Road site to Orr Middle School, and the East Charleston (microscale) site to Sunrise Acres.

2.2.2 Network Changes

The network has undergone changes since 2001, with some sites closing and new ones starting up. Table 2-2 summarizes network operations from 2001 through 2006, with an explanation for any change from 2001. A summary of the key changes follows.

Table 2-2. Summary of PM_{10} Monitoring Network Operations from 2001 through 2006

Site	Year						Comments
	01	02	03	04	05	06	
City Center	■	■	■	■	■	■	Site closed May 2006 due to siting issues and redundant data collected from nearby sites.
Craig Road	■	■	■	■	■	■	
East Sahara	■	■	■	■	■	■	
Flamingo	■	■					Site moved to the Orr location October 2002.
Green Valley	■	■	■	■	■	■	
Henderson	■	■	■	■	■	■	
J.D. Smith	■	■	■	■	■	■	Filter-based PM_{10} measurements terminated in 2003.
Joe Neal	■	■	■	■	■	■	
Lone Mountain	■	■	■	■	■	■	
Microscale (E. Charleston)	■	■	■	■			Site closed June 2004 due to expired lease agreement.
Orr School		■	■	■	■	■	Site started October 2002 to replace the nearby Flamingo location.
Paul Meyer	■	■	■	■	■	■	
Palo Verde	■	■	■	■	■	■	
Pittman	■	■					Closed February 2002 based on recommendations from EPA technical systems audit in August 2001.
Sunrise Acres				■	■	■	Monitoring started near the microscale location (E. Charleston) in April 2004.
Walter Johnson	■	■	■	■	■	■	

1. The City Center site was closed in mid-2006 because it no longer represented the area accurately, and the data collected were redundant with measurements from nearby stations.

2. The East Flamingo station was moved to nearby Orr Middle School because the property owners wanted to develop the site.

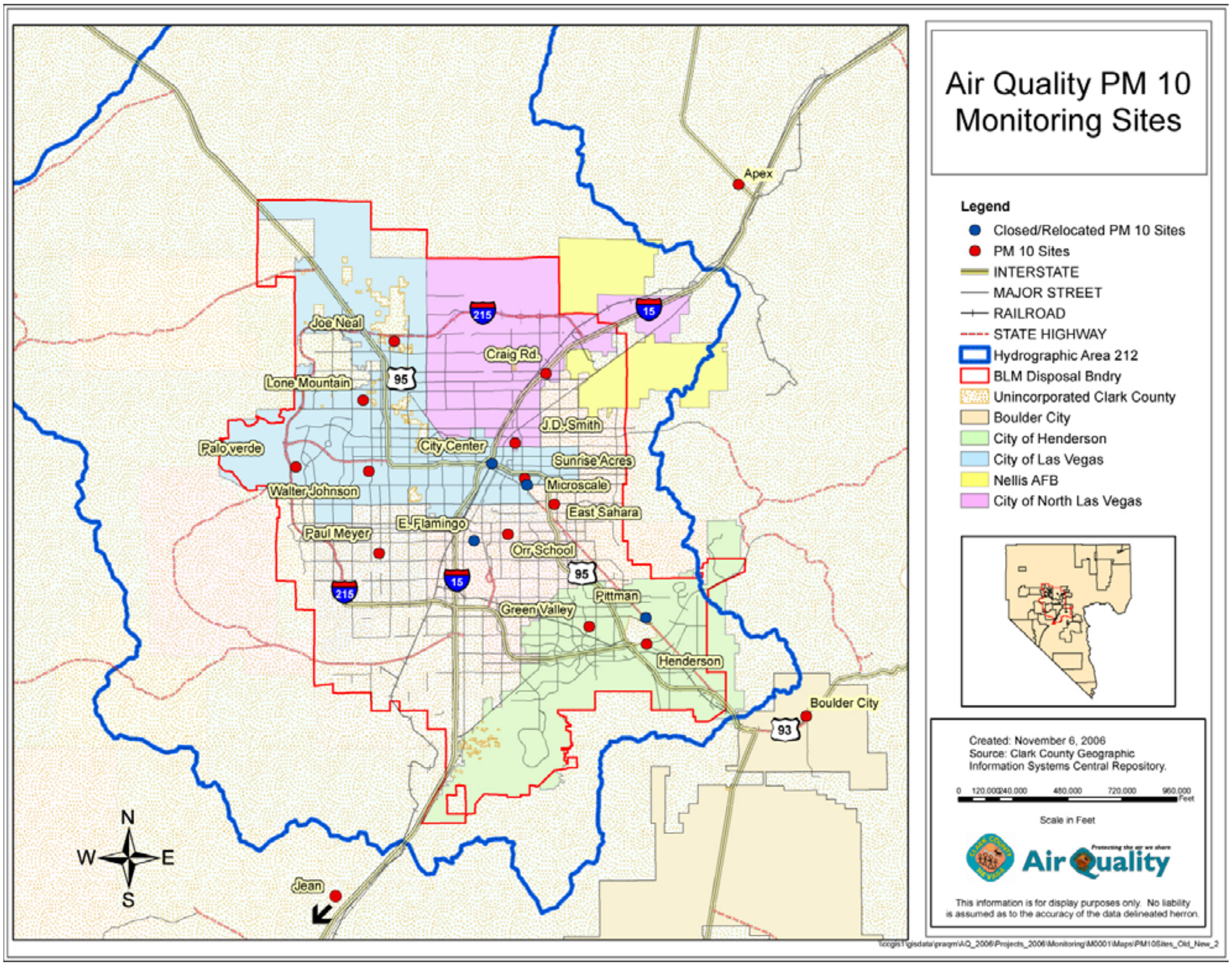
3. The East Charleston (microscale) site was closed in June 2004 because the City of Las Vegas decided to develop the property. DAQEM began monitoring PM_{10} at Sunrise Acres in April 2004 to compare the readings with those from the East Charleston site.

The readings agreed closely enough that DAQEM deemed the Sunrise Acres site representative of the area and closed the East Charleston site.

4. The Pittman site was closed and the property lease terminated because the data was much the same as that obtained from the Southeast Valley site (Henderson).

5. DAQEM terminated filter-based PM_{10} measurements at the J.D. Smith site in September 2004 after receiving EPA permission. The site now measures PM_{10} with a Beta Attenuation Monitor (BAM).

Figure 2-1 shows all 16 operating stations in the PM_{10} monitoring network, as well as permanently closed or relocated sites.



Note: The City Center and Pittman sites are now closed.

Figure 2-1. PM_{10} Monitoring Network in December 2006.

2.2.3 Equipment

The PM_{10} monitoring network uses two types of instruments: a size-selective inlet high-volume filter system and two beta particle attenuation systems. DAQEM stopped using the size-selective inlet high-volume filter system at the end of September 2004. Each site is equipped with an EPA-designated equivalent continuous-method PM_{10} BAM. In 2005, DAQEM upgraded from the Andersen Instrument FH621-N to the Thermo Electron Model FH62-C14. The new monitor, an improved BAM, uses carbon-14 as the beta source. The FH62I-N uses a krypton-85 source with a half-life of about 10 years, and many of the monitors were approaching that age; DAQEM therefore decided to upgrade to the FH62-C14. Both the FH621-N and the FH62-C14 have been designated as equivalent methods for monitoring PM_{10}.

2.3 AMBIENT AIR QUALITY DATA FOR HYDROGRAPHIC AREA 212

2.3.1 24-hour PM_{10} Average Concentrations, 2004 to 2006

The tables in Appendix A demonstrate that Clark County has met the PM_{10} 24-hour standard for the last three consecutive years (2004-2006). They present data for all PM_{10} monitoring sites in HA-212 operating from 2004 to 2006.

2.3.2 24-hour PM_{10} Exceedance Events

In 2004, Clark County had two exceedance events: on April 28 (177 $\mu g/m^3$) and May 11 (283 $\mu g/m^3$), both at Craig Road. The high readings were caused by high winds, and DAQEM submitted Natural Event Justification Packages to EPA for concurrence (Appendix B).

In 2006, Clark County had one exceedance: on September 15 (157 $\mu g/m^3$), again at Craig Road. This exceedance, which violated the standard by a small margin, was not caused by a high wind event as it is defined in the NEAP. The Craig Road site has periodically recorded high readings of PM_{10} concentrations. Clark County conducted a local land use survey to find potential emission sources near the site, but did not determine the source of the high PM_{10} concentrations. DAQEM will engage in more research in 2007 to determine the source(s).

According to EPA guidelines (40 CFR 50, Appendix K), Clark County has attained the 24-hour PM_{10} standard. The data show three days of exceedances from 2004 through 2006, two of which Clark County determined were caused by high wind events. EPA concurred and flagged the events in the Aerometric Information Retrieval System database. Even if EPA elected to include the two flagged exceedance days when determining attainment, Clark County would still attain the 24-hour PM_{10} NAAQS.

2.3.3 Annual PM_{10} Average Concentrations

Table 2-3 demonstrates that Clark County has continued to meet the annual PM_{10} standard, as forecast in the SIP. It lists all the monitoring sites in HA-212 that have been operating during the past three years and details the site data that demonstrate attainment of the annual PM_{10} NAAQS.

Table 2-3. PM_{10} Site Attainment of the Annual PM_{10} NAAQS in HA-212

Site	2004 Average ($\mu g/m^3$)	2005 Average ($\mu g/m^3$)	2006 Average ($\mu g/m^3$)	3-Yr Average ($\mu g/m^3$)
Green Valley	25.16	21.58	22.15	22.96
City Center[1]	35.07	31.84	NA	33.45
Craig Road	41.55	40.00	35.28	38.94
Henderson	30.71	29.24	26.08	28.68
J.D. Smith School	45.52	31.10	33.27	36.63
Microscale[2]	35.67	NA	NA	35.67
Joe Neal Elementary	29.97	28.86	28.18	29.00
Lone Mountain	20.49	19.80	20.51	20.27
East Sahara	31.49	32.76	32.69	32.31
Orr Middle School	28.78	30.17	28.55	28.83
Paul Meyer Park	24.14	23.91	25.97	24.67
Palo Verde High	15.35	15.03	16.41	15.60
Walter Johnson Jr. Middle School	18.24	19.20	19.69	19.04
Sunrise Acres	29.97	31.56	35.36	32.30

[1]Site closed in April 2006, so only 2004 and 2005 were averaged.
[2]A 3-year average could not be calculated because the site closed in June 2004.

2.3.4 Summary of Data Assessment and Finding of Attainment for the PM_{10} Annual and 24-Hour Standards

Table 2-4 lists data recovery rates for the monitoring sites within HA-212. The data illustrate that each monitoring site has had acceptable levels of data recovery for six consecutive years. The table shows that all monitoring sites were performing within EPA-acceptable levels during that time, so all data collected from these sites during the six-year period are valid.

Table 2-4. PM_{10} Data Recovery Rates for Each Monitoring Site

Station	2001	2002	2003	2004	2005	2006	Avg. Data Recovery
Pittman[1]	38%	95%	NA[2]	NA	NA	NA	66.5%
Green Valley	91%	94%	91%	92%	92%	93%	92%
City Center	91%	93%	92%	93%	93%	94%	93%
Craig Road	93%	95%	95%	92%	91%	93%	93%
Henderson	93%	94%	90%	92%	92%	94%	93%
J.D. Smith Middle School	93%	96%	89%	87%	87%	93%	91%
Microscale	93%	97%	89%	91%	NA	NA	92.5%
Joe Neal Elementary	NA	95%	93%	89%	91%	93%	92%
Lone Mountain	NA	95%	93%	92%	92%	93%	93%

Table 2-4. PM_{10} Data Recovery Rates for Each Monitoring Site (continued)

Station	2001	2002	2003	2004	2005	2006	Avg. Data Recovery
East Sahara	94%	95%	93%	92%	92%	90%	93%
Orr Middle School	NA	92%	93%	91%	92%	93%	92%
Paul Meyer Park	92%	94%	94%	89%	92%	93%	92%
Palo Verde High	93%	91%	93%	81%	93%	92%	91%
Walter Johnson Jr. High	94%	94%	93%	87%	93%	93%	92%
East Flamingo	92%	92%	NA	NA	NA	NA	92%
Sunrise Acres	NA	NA	NA	91%	91%	93%	92%

[1]Pittman experienced instrument malfunctions and power problems from January–June 2001, so there is no data for those months.
[2]NA = not applicable: station was off the network (closed permanently or not yet open).

2.4 EVALUATION OF THE PM_{10} MONITORING NETWORK

The PM_{10} monitoring network was a subject of intense comment during the SIP public review process. Appendices O, P and Q of the PM_{10} SIP contain the public's comments and DAQEM's formal responses. One recurrent concern was that the network did not accurately represent particulate concentrations in the nonattainment area; DAQEM's responses emphasized that the network was operated according to the requirements of 40 CFR 58. Section 2.4.1 describes DAQEM's approach to monitoring network reviews.

DAQEM also received public comments questioning the timing of a PM_{10} saturation study, a principal commitment in the SIP. The department's response emphasized that the study was not intended to review the adequacy of the network at the time of SIP development, but to evaluate the impact of population growth on future PM_{10} concentrations. Section 2.4.2 discusses this study, conducted in the spring of 2005.

2.4.1 Monitoring Network Evaluation

DAQEM reviews the entire monitoring network annually, scrutinizing site conditions that can change over time and may affect data quality. The review also examines items relevant to data use and interpretation, such as quality assurance (QA) and site location. As required by 40 CFR 58.20(d), DAQEM submits an annual monitoring network review report to EPA. The report addresses the following objectives, set forth in EPA guidelines:

1. Monitoring methodology.
2. Network design.
3. Probe and path siting criteria.
4. Quality assurance requirement.

5. Periodic systems audits and national performance audits.

6. Corrective action(s).

As detailed in DAQEM's most recent report to EPA (DAQEM 2006), the method used to perform the network review was based on "SLAMS/NAMS/PAMS Network Review Guidance" (EPA 1998). Specifically, DAQEM completed the following tasks:

1. Inspected each station for pathway and probe siting criteria, using the inspection forms in the guidance document.

2. Reviewed Air Quality System (AQS) reports.

3. Reviewed topographical reports.

4. Reviewed historical trends measured by the monitoring network.

The EPA guidance document recommends using several resources that were not available, including quality assurance project plans, graphics maps, emission density maps, and emission trends reports. DAQEM is currently developing these items, and they will be available for future reviews.

2.4.2 Monitoring Network Saturation Study

Section 4.8.2.2 of the PM_{10} SIP committed to conducting a saturation study that would begin in 2004 and be completed in 2006. The overall goals were to:

1. Determine particulate matter concentrations in geographic locations that may not be well represented by the monitoring network as it is because of growth in the Las Vegas Valley.

2. Determine inter-area and intra-area transport during high wind events.

3. Determine the neighborhood impacts of major sources in the region.

The results of this study were used to:

1. Evaluate the representativeness of the National Air Monitoring Station, State and Local Air Monitoring Station, and Special Purpose Location station monitoring networks in the Las Vegas Valley.

2. Assess the appropriateness of the existing network.

3. Recommend possible changes for monitoring station locations.

4. Provide additional recommendations for expanding the network to better cover the impacts from changing population and work centers in the valley.

2.4.2.1 Study Tasks

The PM_{10} saturation study was divided into six specific tasks: analyze existing data, plan an appropriate saturation network, determine the most appropriate instruments to conduct the study, conduct the study, process the data collected, and report the results. Key elements included:

1. **Analysis of Existing Data.** The study analyzed the most recent four years of data (2000–2003) to find the regions experiencing the greatest number of 24-hour exceedances and related meteorological conditions. This determined the area the saturation monitoring network needed to cover.

2. **Planning of Appropriate Saturation Network.** The study focused on evaluating prospective samplers that could monitor PM_{10} concentrations continuously instead of only logging 24-hour averages, as filter-based methods do. The method selected could not be an EPA-designated equivalent method because of siting, power, and cost constraints. EPA recognizes the use of non-designated equivalent methods as an acceptable method for saturation monitoring, so the study reviewed optical sampling methods that allowed continuous PM_{10} measurement. These included the DustTrak sampler developed by the Bourns College of Engineering–Center for Environmental Research & Technology at the University of California, Riverside.

3. **Conduct of Study.** Twelve sites were chosen using criteria that addressed the study's goals (see Section 2.4.2). The program deployed instrumentation from April through early July 2005. A comprehensive quality assurance program documented data quality and provided a link to measurements from PM_{10} monitoring sites in Clark County.

4. **Data Processing and Validation.** Data were corrected for zero offsets and measured flow rates. The resulting database underwent an audit to verify the appropriateness of corrections and the validity of the values obtained.

5. **Data Analysis**. Results from the saturation and monitoring networks were evaluated against the study objectives. The study assessed how well current monitor sites represent PM_{10} concentrations throughout the valley, along with their appropriateness for monitoring transport and local impacts from major source areas.

2.4.2.2 Saturation Sampling Network

Figure 2-2 identifies the number of exceedances at each monitoring site between 2000 and 2003. The exceedance numbers are overlaid on a particulate emissions potential map, where red areas indicate regions with a high potential for emitting fugitive dust. The soil in these areas has a high silt content, so it resuspends more easily during strong winds or other sources of soil movement. The general pattern in Figure 2-2 shows more exceedances in regions with a high potential for fugitive dust emissions, although the actual level of emissions will depend on soil disturbances and mitigation measures taken.

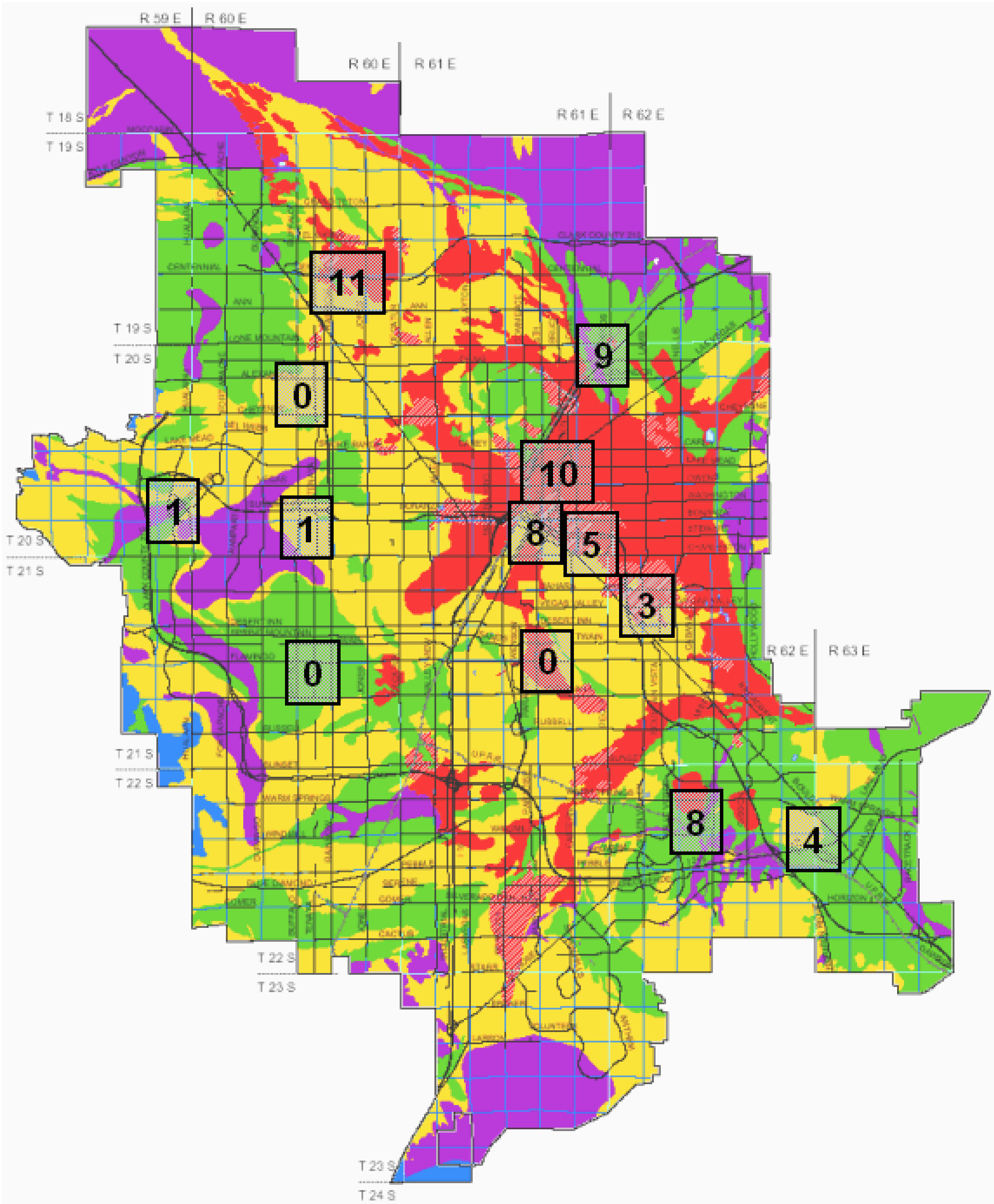


Figure 2-2. Exceedances at DAQEM Monitoring Sites from 2000-2003.

Figure 2-3 depicts the proposed locations of saturation network sites on the same map in Figure 2-2. These locations were chosen to fill gaps between existing monitors, take measurements in regions that may have elevated PM_{10} levels, and document PM_{10} transport throughout the study area. The site numbers in Figure 2-3 correspond to those in Table 2-5, which lists the proposed sites and their locations.

The following reasons guided site selection:

1. Sites in the south to southwest region would help identify upwind PM_{10} concentrations during wind events with a more southerly flow; analyzing existing data determined this was a key wind direction.

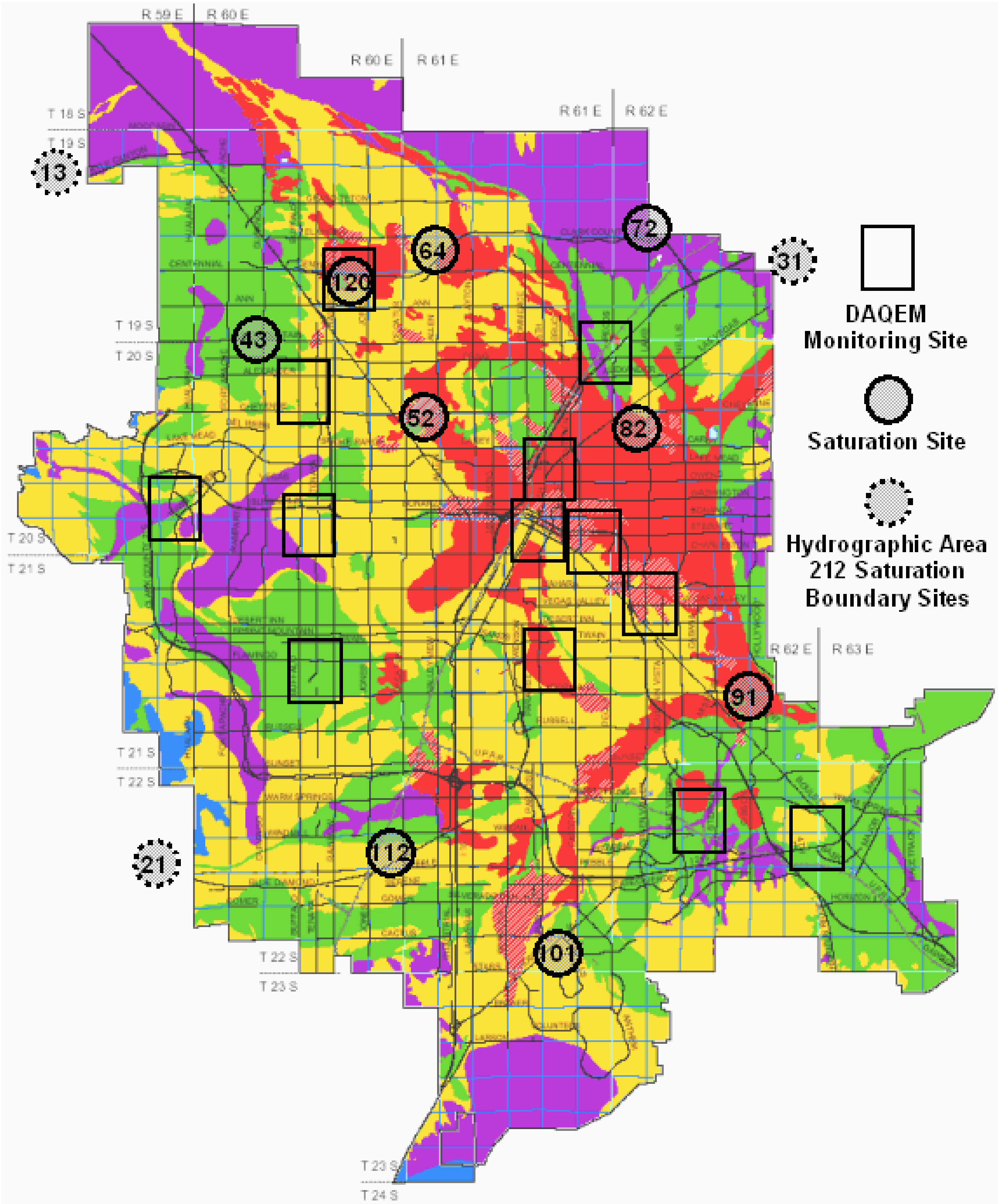
2. Selected sites to the southeast and east would follow soil types that may be high emission sources, and are further away from urban areas.

3. Selected sites in the northeast to north quadrants would fill suspected monitoring gaps in potential high-emission areas with new housing and commercial developments.

4. To the northwest are potential gaps in established neighborhoods that, depending on activities, could be impacted by increased fugitive dust emissions. This included the selection of the Mountain Crest site near a possible large source.

5. Sites placed near the BLM disposal area could answer questions about transport and PM_{10} concentrations in remote areas.

To the extent possible, selected sites will follow EPA siting criteria for exposure and sample height to ensure data represent an area accurately.



Note: The site numbers in this figure correspond to the numbers in Table 2-5.

Figure 2-3. Monitoring and Saturation Network Sites.

Table 2-5. Summary of Site Locations

Site Designation	Location	Purpose
13 -- Kyle Canyon Lat: 36.3105 Lon: -115.3957 Alt: 1129 m	Private residence	Boundary of BLM disposal area, NW
21 -- Blue Diamond Lat: 36.0259 Lon: 115.3174 Alt: 897	Private residence	Boundary of BLM disposal area, SW
31 – Speedway Lat: 36.2759 Lon: -115.0032 Alt: 607 m	Las Vegas Speedway	Boundary of BLM disposal area, NE
43 – Mountain Crest Lat: 36.2478 Lon: 115.2835 Alt: 738	Mountain Crest Park	Downwind of quarry during drainage flow and west to southwest wind events
52 – North Las Vegas Airport Lat: 36.2170 Lon: -115.1942 Alt: 669 m	North side of North Las Vegas Airport	Near northwest area
64 – Aliante Lat: 36.2793 Lon: -115.1885 Alt: 688 m	Aliante Deer Springs Park	Recently built area
72 – Lamb Lat: 36.2918 Lon: -115.0828 Alt: 648 m	Near I-215 and Lamb	Remote location north of newly built / potential growth area
82 – Alto Lat: 36.2097 Lon: -115.0861 Alt: 557 m	Private residence near Alto Rd. and Lamb Blvd.	Established area near Nellis AFB
91 – Wetlands Lat: 36.1014 Lon: -115.0230 Alt: 496 m	Wetlands Park Visitor Center	Southeast side
101 – Henderson AP Storage Lat: 35.9918 Lon: 115.1346 Alt: 710	Storage facility north of Henderson Airport	South side
112 – Star Nursery Lat: 36.0312 Lon: -115.2165 Alt: 737 m	Star Nursery at Mohawk and Blue Diamond Highway	South side, west of I-15
120 -- Joe Neal Lat: 36.2706 Lon: -115.2382 Alt: 709 m	DAQEM site	QA purposes

2.4.2.3 Saturation Study Quality Assurance

The PM_{10} saturation study created a data set of known quality that could be used to assess PM_{10} concentrations throughout HA-212, including the Las Vegas Valley. The study's QA program incorporated the following elements:

1. Comprehensive checkout and acceptance tests of all measurement equipment to configure systems consistently and ensure that operations met QA objectives.

2. Auditing of study components, including evaluations of equipment, sampler performance, network siting and operation, data processing and validation, and monitor performance.

3. Implementation of a quality control program that included site inspections, routine zero and flow checks of samplers, application of appropriate K factors to data, and any needed corrections to sampler flow rates.

4. Operation of a saturation sampler in parallel with the site monitor at the Joe Neal station during saturation data collection.

5. Quality assessment of the data collected by the saturation network to confirm achievement of measurement goals.

2.4.2.4 Observations from the Monitoring Network

There were no exceedances of the 24-hour PM_{10} NAAQS during the saturation study (from mid-April through June). Figure 2-4 presents the 24-hour average data collected by the DAQEM monitoring network in a time series format. All the sites that collected data on a specific day are grouped in a narrow bar format, with the bar height representing the PM_{10} value. Days are delineated by gaps between data groupings. The plot highlights days with the highest values in the network as measured by more than three sites, identifying periods when exceedances were widespread. The figure also identifies the periods in late June and early July when widespread wildfires affected particulate matter (PM) levels in the valley.

Figure 2-5 shows the 24-hour average wind speed at five key sites: Jean, Paul Meyer, Joe Neal, Craig Road, and Green Valley. All measured winds at 10 m except Jean, which measured at 30 m. The sites were spaced reasonably across the DAQEM network, with good spatial coverage of the Las Vegas Valley. The wind speed and PM_{10} records clearly show that high PM_{10} values occurred during days with high wind speeds. These days formed the periods of interest for evaluating the saturation network data.

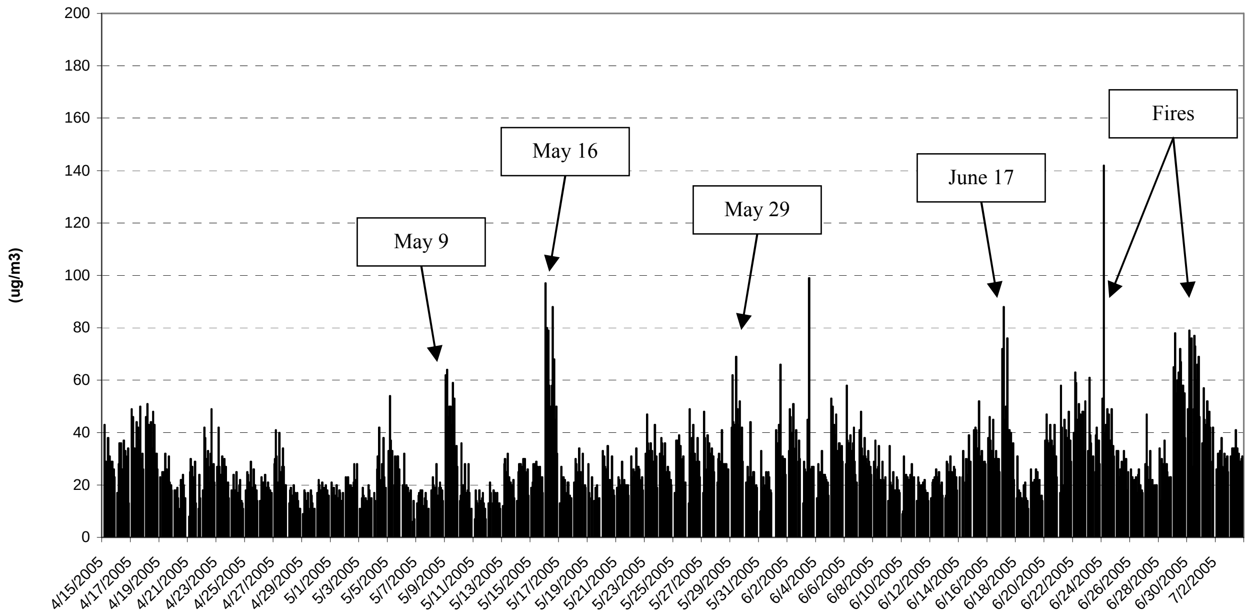


Figure 2-4. 24-Hour Average PM_{10} Data Collected by the DAQEM Monitoring Network.

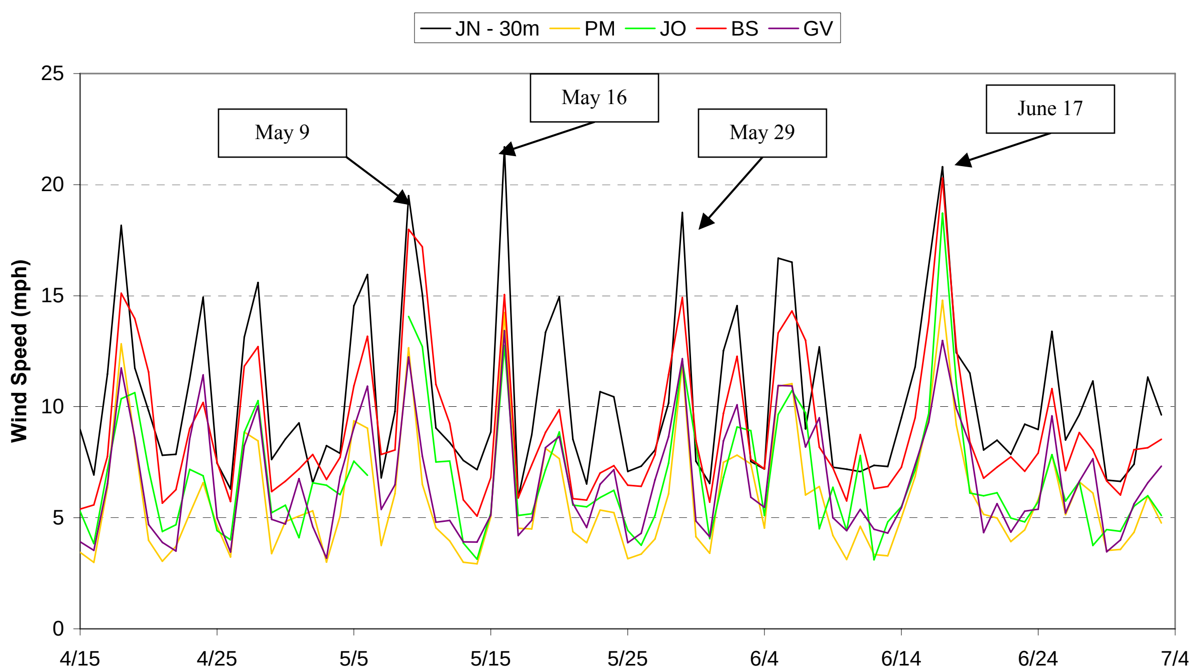


Figure 2-5. 24-Hour Average Wind Speed Record at Five DAQEM Sites.

2.4.2.5 Observations from the Saturation Network

In Figure 2-6, which shows the PM_{10} data collected by the saturation network, the peaks caused by high wind speeds are lower than those in the BAM data (Figure 2-4). The optical method used by the DustTrak sampler is less sensitive to windblown particulates than to smoke-related particulates; therefore, PM readings from the DustTrak are higher than PM readings from the BAM monitors during wildfire events. During the monitoring period, the 24-hour average value only rose above 150 μg/m^3 during wildfire events. The highest observed 24-hour value during wind-driven events was 81 μg/m^3.

The K factor has been applied to all the saturation data to obtain more of a "dust mix." This factor would reduce concentrations of the combustion-related PM observed during the wildfires by at least 30 percent from the values in Figure 2-6. Therefore, calibrating the DustTrak samplers for combustion particulates instead of geologic particulates would reduce the PM_{10} concentrations from wildfires below the PM_{10} NAAQS.

One advantage of the saturation network was an increased time resolution for data. The BAM network provides hourly average data, but shorter durations mean noisier values during periods of high particulate loading and less confidence in the averages. Final validation of the BAM data used averages calculated from total loading during the day, rather than an average of individual hourly values. The DustTrak optical method provides reliable short-term data, so its hourly values can be used to track the progress of PM events.

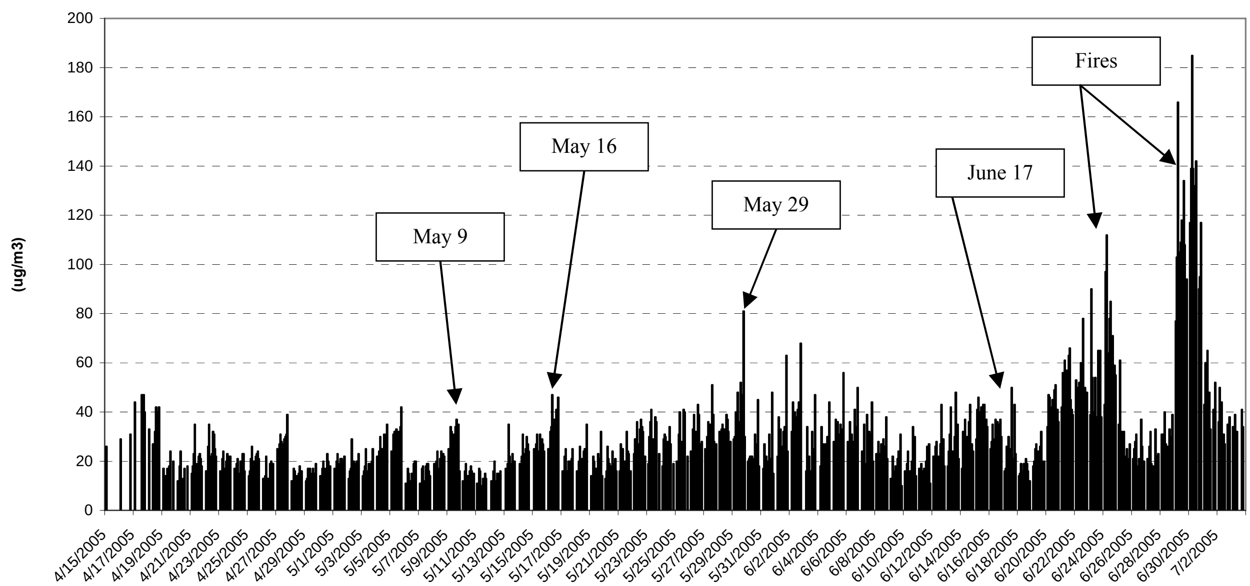


Figure 2-6. 24-Hour Average PM_{10} Data Collected by the Saturation Network.

DAQEM selected the four days with the highest PM_{10} concentrations during high wind events for further evaluation. Figures 2-7 through 2-10 show saturation network PM_{10} concentrations and associated composite wind speed data from four stations. The stations—Green Valley, Paul Meyer, Joe Neal, and Craig Road—provide a reasonable cross section of observed wind speeds throughout the saturation study domain. Data observations included:

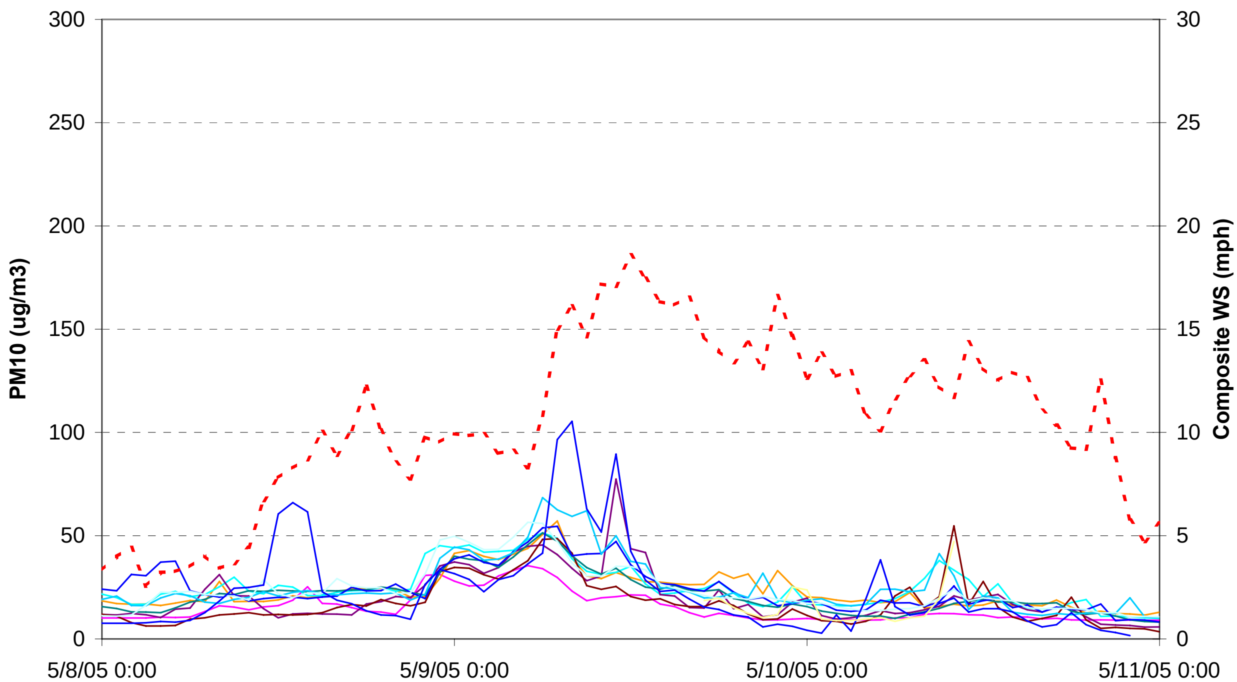
1. An hourly average wind speed threshold of about 15 mph was needed for a wind-driven PM_{10} event to start.

2. The May 9 and May 29 high wind speed events showed an initial peak in PM_{10} concentrations during the first several hours. Although the event lasted longer, the reservoir of available PM was probably depleted during the initial peak. Substantial rains in the previous months stabilized the soils enough to prevent a longer event.

3. The May 16 high wind speed event was shorter, with the PM peak closely following the wind speed peak. Again, the PM peak trailed off before the wind speed decreased.

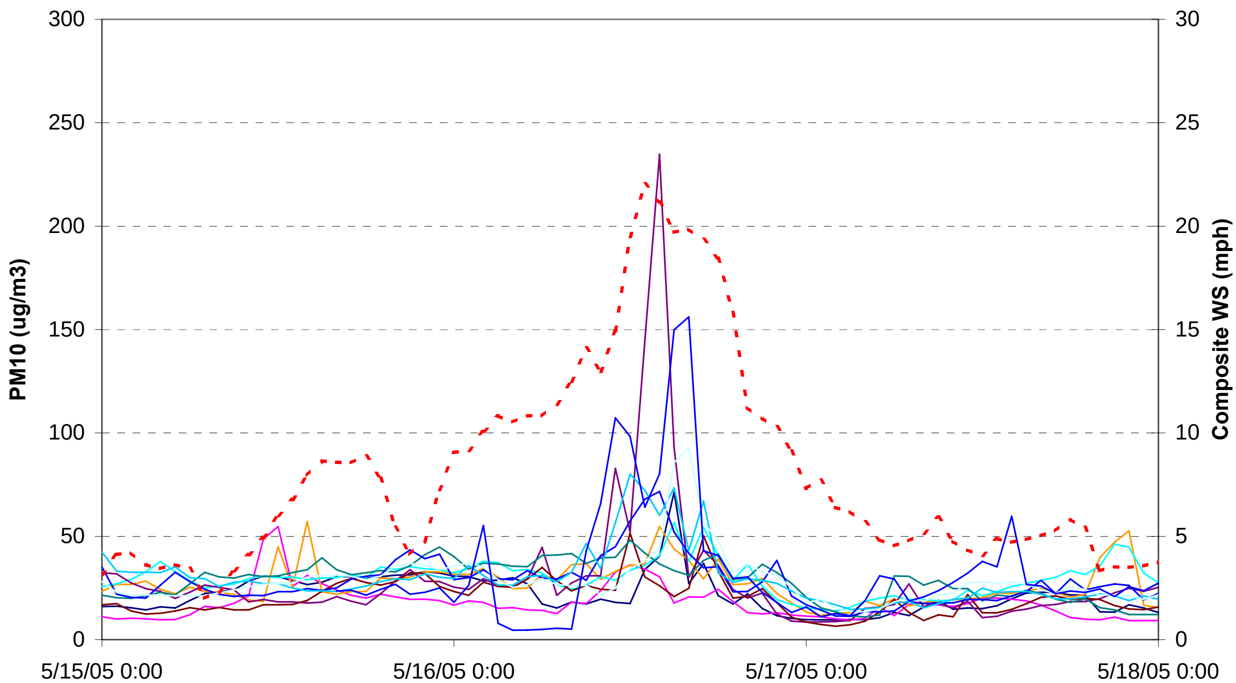
4. The June 17 high wind speed event had a double peak, but PM concentrations again decreased while the wind speed was still high. As noted before, the PM reservoir probably diminished quickly because winter rainfall had stabilized much of the surface.

5. Overall, the regions selected for PM_{10} saturation measurements did not show appreciable increases or concentrated "hot spots." Monitors only observed local short-term "hits," which were likely caused by a local short-term source.



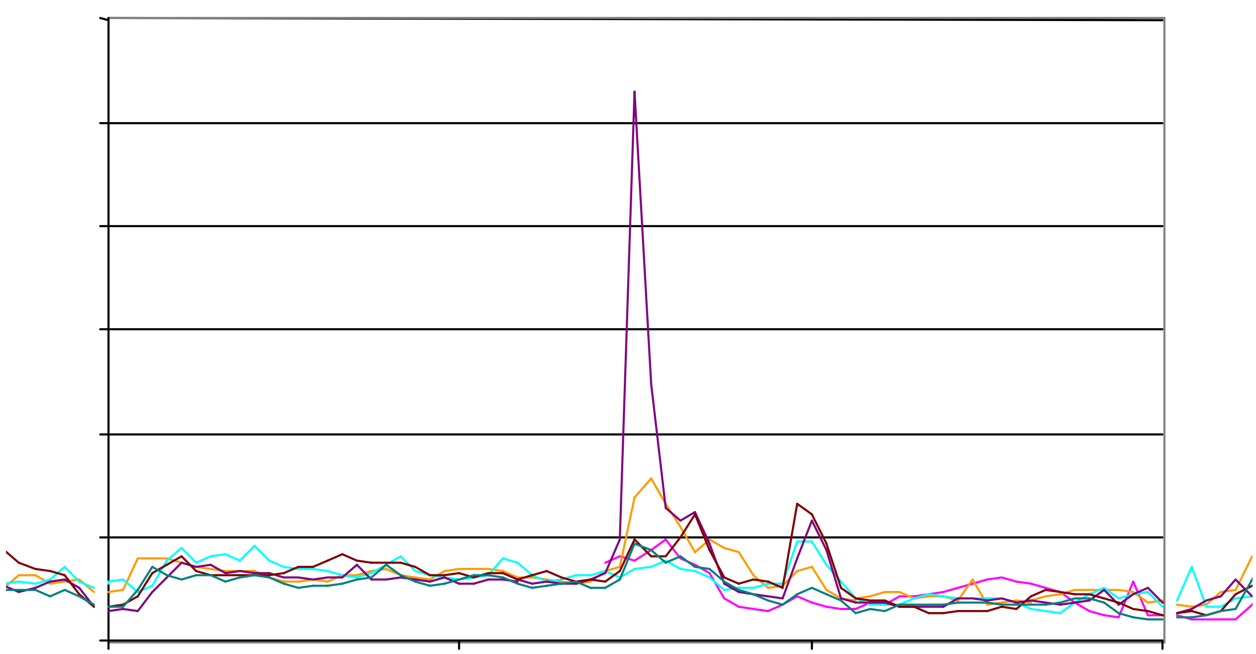
Note: The dashed line shows composite wind speed.

Figure 2-7. Elevated PM_{10} Concentrations During the High Wind Speed Event on May 9, 2005.



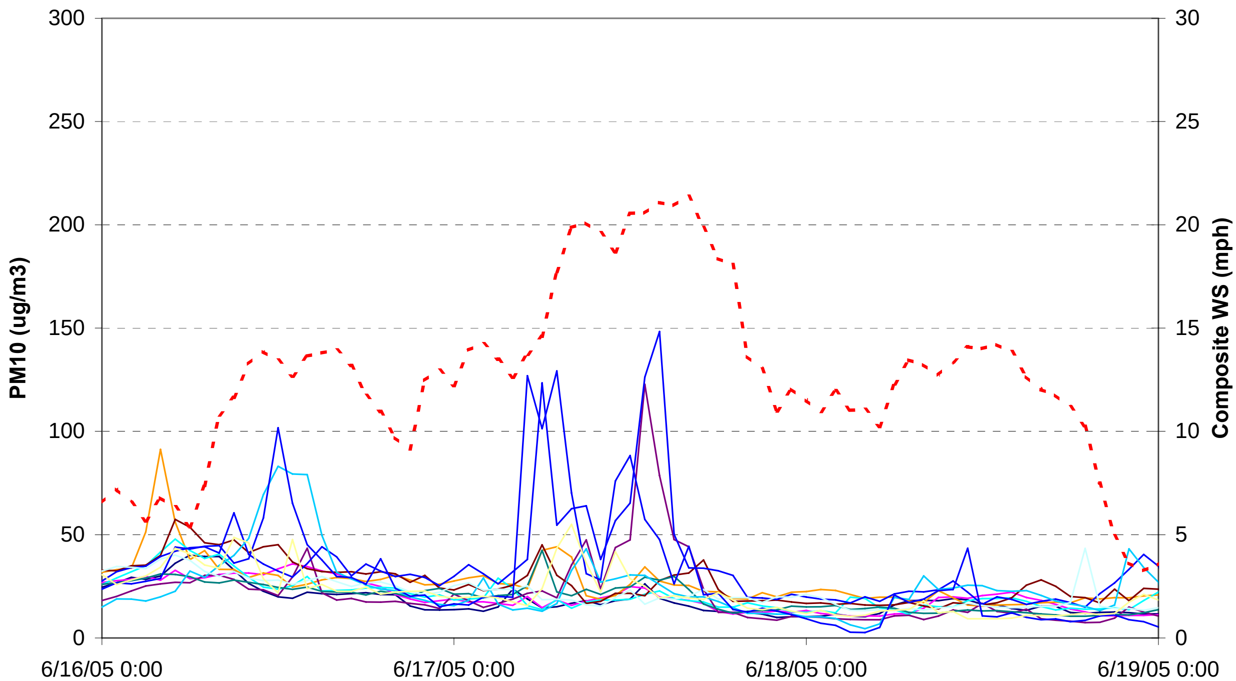
Note: The dashed line shows composite wind speed.

Figure 2-8. Elevated PM_{10} Concentrations During the High Wind Speed Event on May 16, 2005.



Note: The dashed line shows composite wind speed.

Figure 2-9. Elevated PM_{10} Concentrations During the High Wind Speed Event on May 29, 2005.



Note: The dashed line shows composite wind speed.

Figure 2-10. Elevated PM_{10} Concentrations During the High Wind Speed Event on June 17, 2005.

2.4.2.6 Study Results

The saturation study had three main goals:

1. Determine PM concentrations in geographic locations that may not be well represented by the current monitoring network due to recent growth in the Las Vegas Valley.
2. Determine inter-area and intra-area transport during high wind speed events.
3. Determine the neighborhood impacts of major sources in the region.

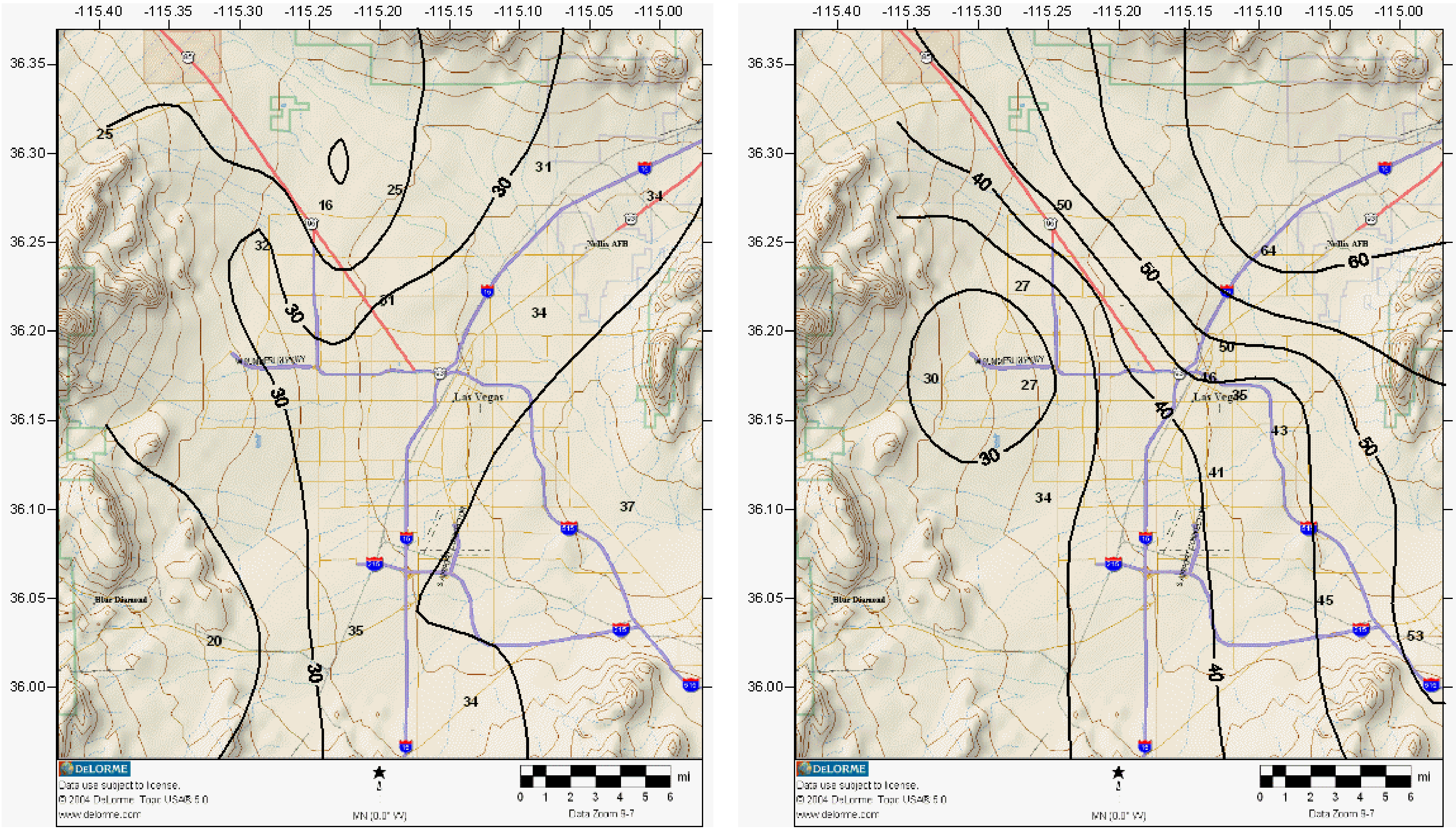
Sections 2.4.2.6.1 through 2.4.2.6.3 summarize the study results.

2.4.2.6.1 Adequacy of PM_{10} Monitoring Network

Figures 2-11 through 2-14 present the 24-hour concentration isopleths for the four identified high wind days. These were not exceedance days, but high wind events that in prior years might have produced exceedances. The left panel shows the distribution as measured by the saturation network; the right panel shows the distribution as measured by the monitoring network. Key observations include:

1. The 24-hour average PM_{10} levels observed even on high PM days were relatively low, and the resulting concentration patterns were not well defined. The patterns may have been better defined during prior dry years, with the same high wind speeds and more disturbed desert surface.

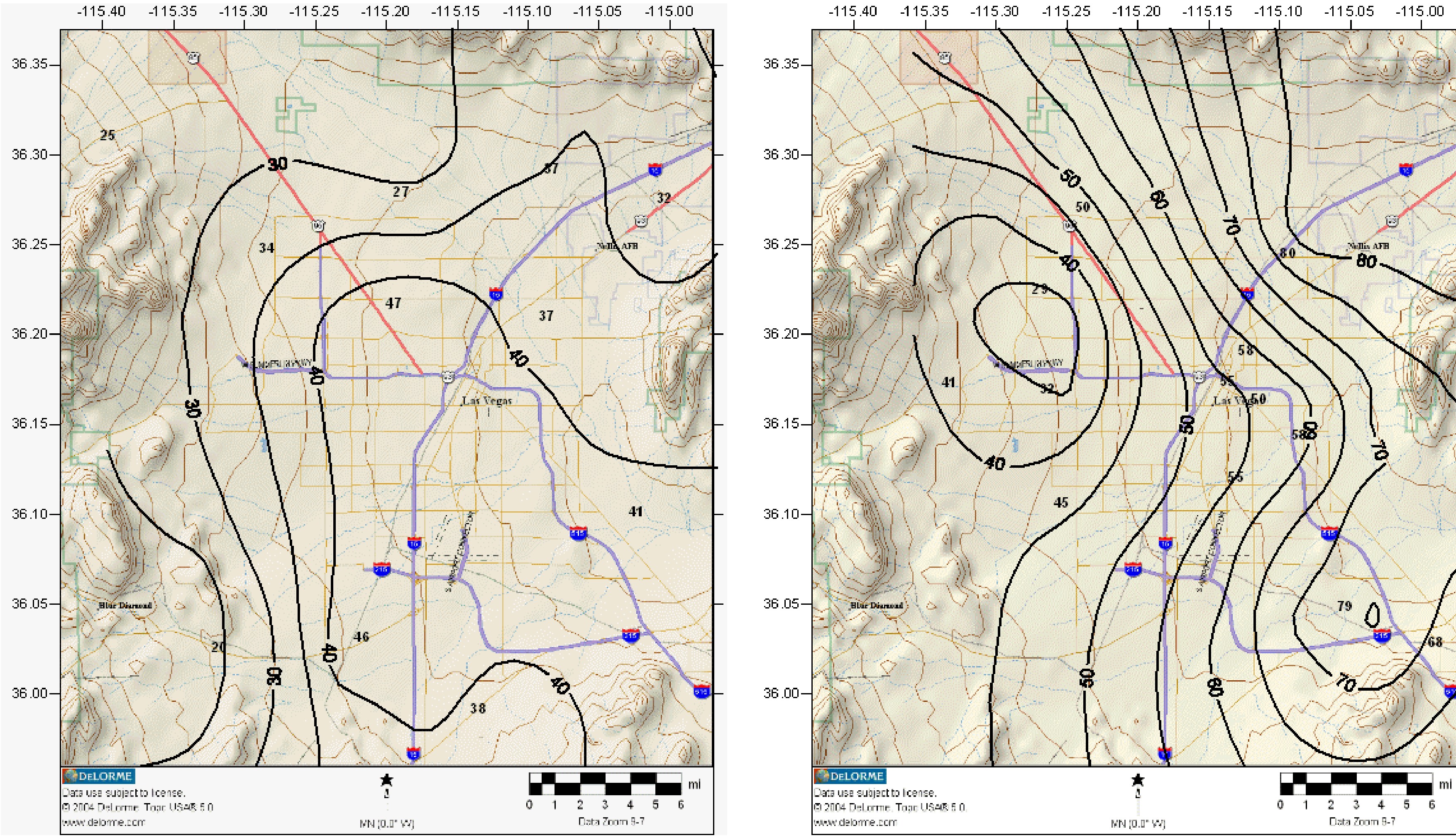
2. The monitoring network reflected the patterns identified in the historical analysis, with the highest concentrations in northeast areas. However, it lacks a measurement station in the valley region where southwesterly winds flow in, around the location of the Star Nursery site in the saturation network. This area showed high PM_{10} concentrations during high wind speed events that the monitoring network did not show, e.g., an apparent PM_{10} plume during the May 29 and June 17 events. The Jean station is too far southwest to represent the southern valley boundary adequately, and would be upwind of a potentially significant natural source at Jean Dry Lake during southerly wind events. Significant current and potential future growth in this region underscores the need for a monitoring site.



24-hour Particulate Levels–
Saturation Network

24-hour Particulate Levels–
Monitoring Network

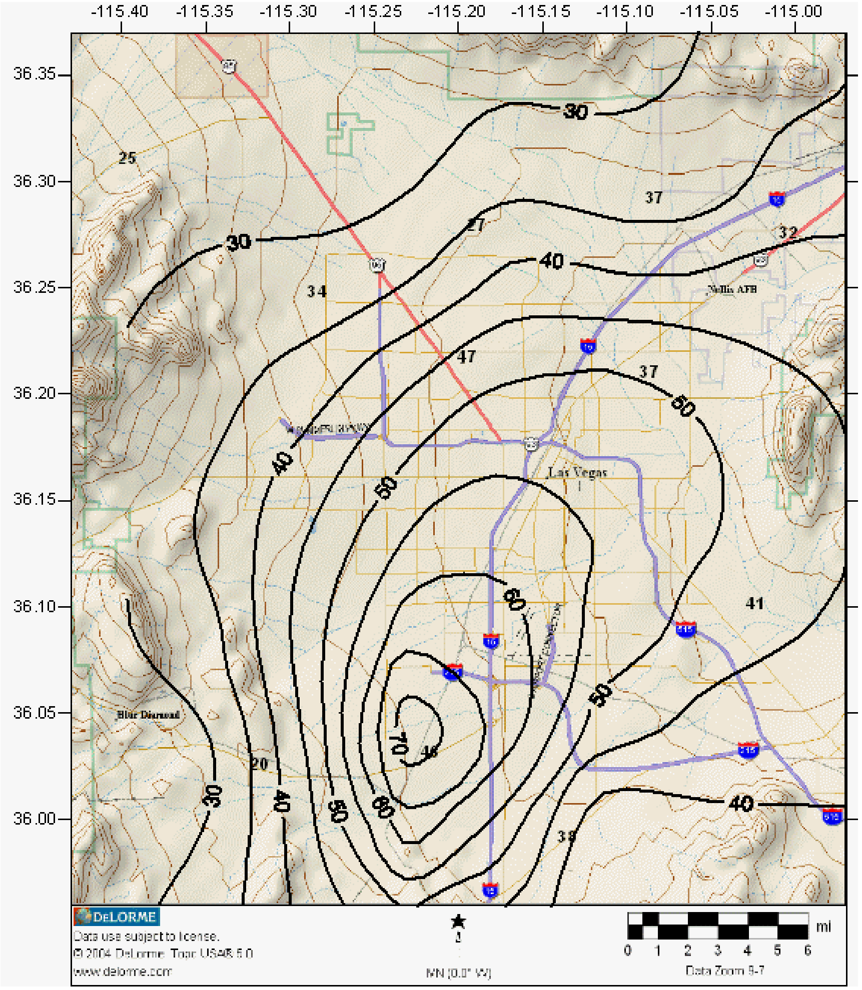
Figure 2-11. Concentration Profiles from the Saturation and Monitoring Networks for May 9, 2005.



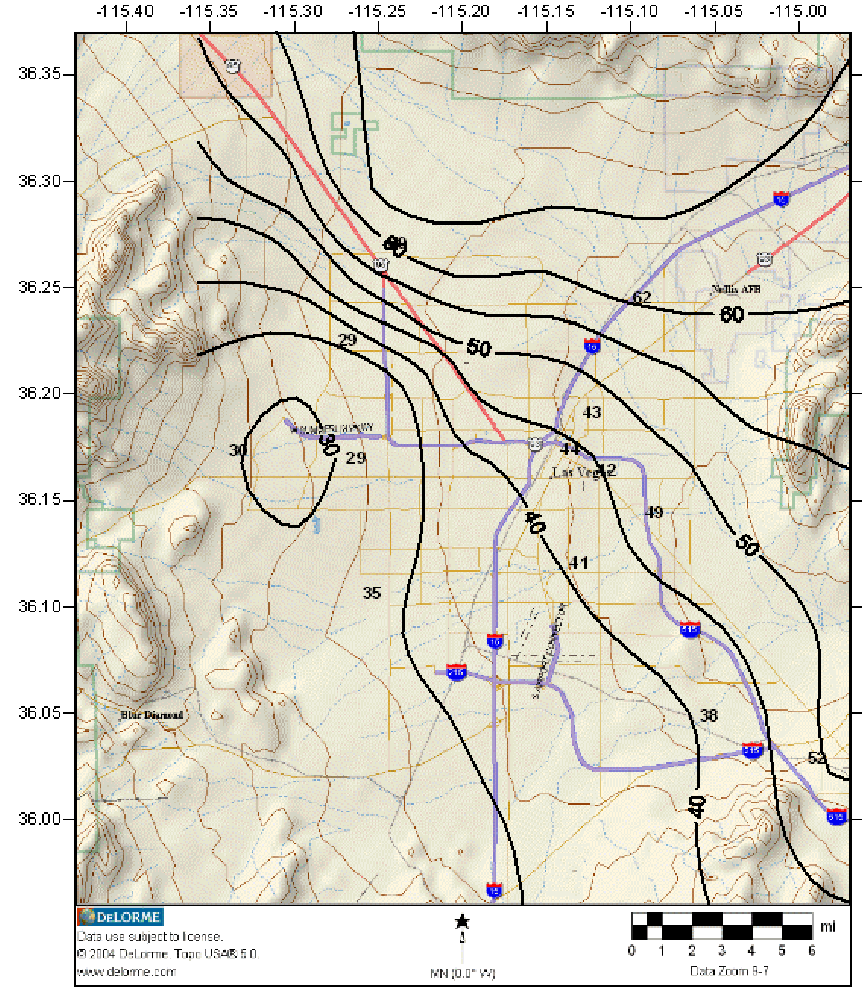
24-hour Particulate Levels–
Saturation Network

24-hour Particulate Levels–
Monitoring Network

Figure 2-12. Concentration Profiles from the Saturation and Monitoring Networks for May 16, 2005.

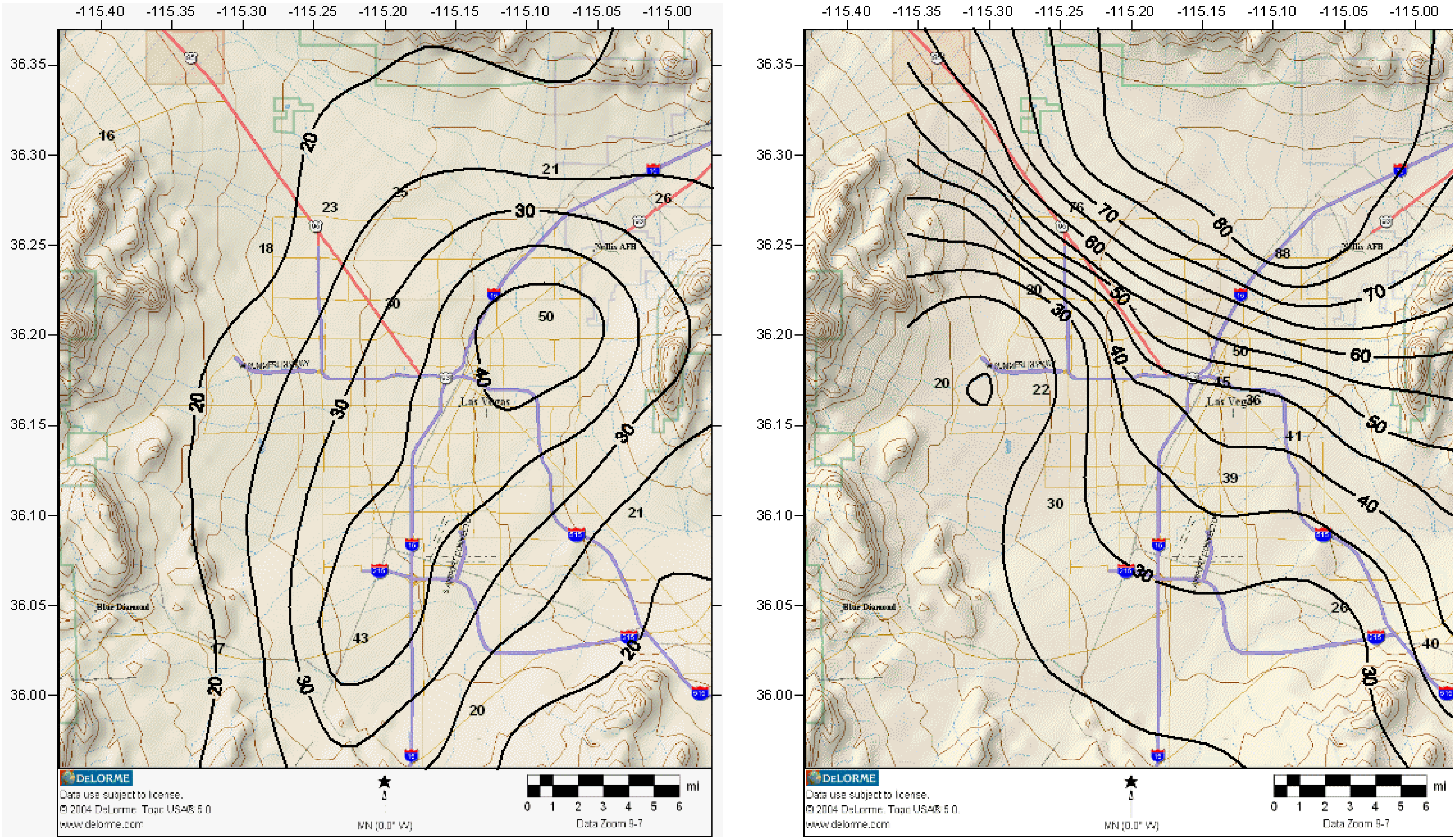


24-hour Particulate Levels–
Saturation Network



24-hour Particulate Levels–
Monitoring Network

Figure 2-13. Concentration Profiles from the Saturation and Monitoring Networks for May 29, 2005.



24-hour Particulate Levels–
Saturation Network

24-hour Particulate Levels–
Monitoring Network

Figure 2-14. Concentration Profiles from the Saturation and Monitoring Networks for June 17, 2005.

2.4.2.6.2 Particulate Matter Transport During High Wind Speed Events

The four high wind speed events identified during the study did not produce concentrations that exceeded the 24-hour average PM_{10} standard, but the patterns that developed reflected transport through and out of the study domain. The concentrations on June 17, in particular, showed a southwest to northeast axis (Figure 2-14). Figure 2-15 combines the data from the saturation and monitoring networks in a composite distribution. The plot is skewed somewhat by the Craig Road site, which may be influenced by a local source, but the overall pattern reflects PM_{10} transport through the valley.

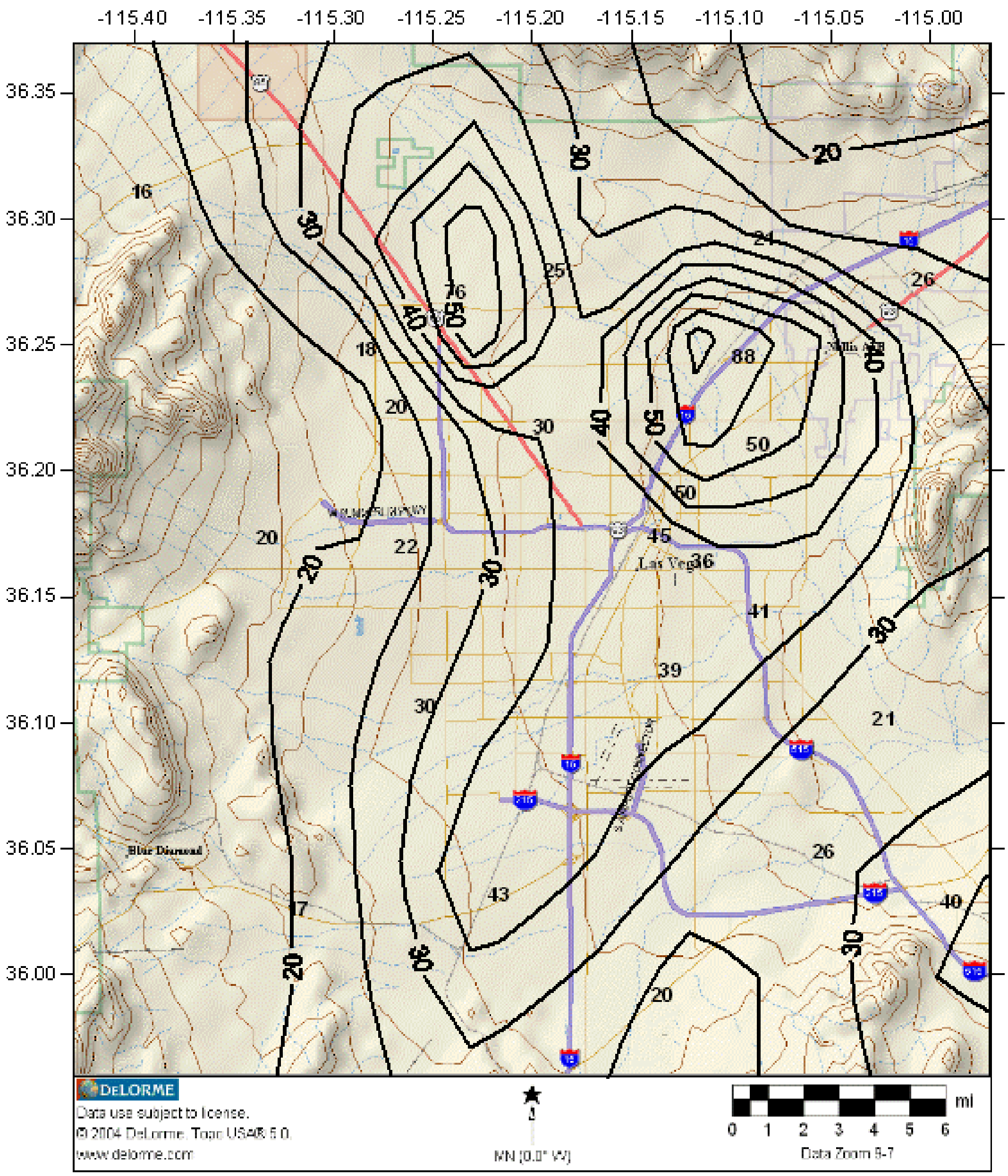


Figure 2-15. Combined Concentration Profile from June 17, 2005.

While some transport occurred during the high wind speed events, the available reservoir of PM_{10} governed concentration magnitude. Rains during the 2004-2005 season stabilized the desert surface throughout the Las Vegas Valley and in regions upwind. If the surface is undisturbed, this area will remain stable and emissions during high wind events will be reduced. The hourly values of PM_{10} from the saturation network show that initial concentrations were high early in the wind events; however, they dropped significantly once the loose surface material had been entrained, even as high wind speeds continued (Figures 2-8 through 2-11).

Technicians observed dust plumes on several occasions when servicing the PM_{10} monitoring network. Wind gusts would transport dust from large sources and lakebeds (e.g., Jean Lake) to the Las Vegas Valley, contributing to urban haze in the valley. The dust stayed airborne as long as wind speeds remained high. As expected, higher concentrations, such as those at the Star Nursery saturation site, were observed closer to sources.

2.4.2.6.3 Neighborhood Impacts of Major Sources

The study's third goal was to identify the neighborhood impacts of major sources. Several network sites, including one at Mountain Crest, were selected specifically to find out whether potential sources had a significant impact on nearby regions. The Mountain Crest site was downwind of an active quarry on the west side of the Las Vegas Valley during the night and early morning, when drainage flows are most active. A monitor at the site could determine whether areas downslope of the quarry had higher PM_{10} levels entrained in the drainage flow; this material would most likely have been released by handling operations at the quarry.

To find out whether the quarry influenced PM_{10} levels, the data were averaged by hour so the diurnal average concentration could be evaluated. Figure 2-16 presents the PM_{10} average concentration distribution by hour for the Mountain Crest site. The figure shows a clear increase in PM_{10} concentrations during the nighttime and early morning hours. The multiple peaks in the daily distribution were unique to this site, with peaks near midnight, 6:00 a.m., and midday. The midday peak was seen at most other sites and is typical of the diurnal cycle observed throughout the saturation network. Figure 2-17 shows the diurnal cycle at two other sites in the network—Blue Diamond and the Wetlands—where drainage flow was not influenced by a local source. Just how the observed pattern relates to the quarry's operating schedule is unknown, but the schedule may influence the peaks observed during late night and early morning. Although the quarry showed a definite impact on PM_{10} levels, it was not enough to generate an exceedance.

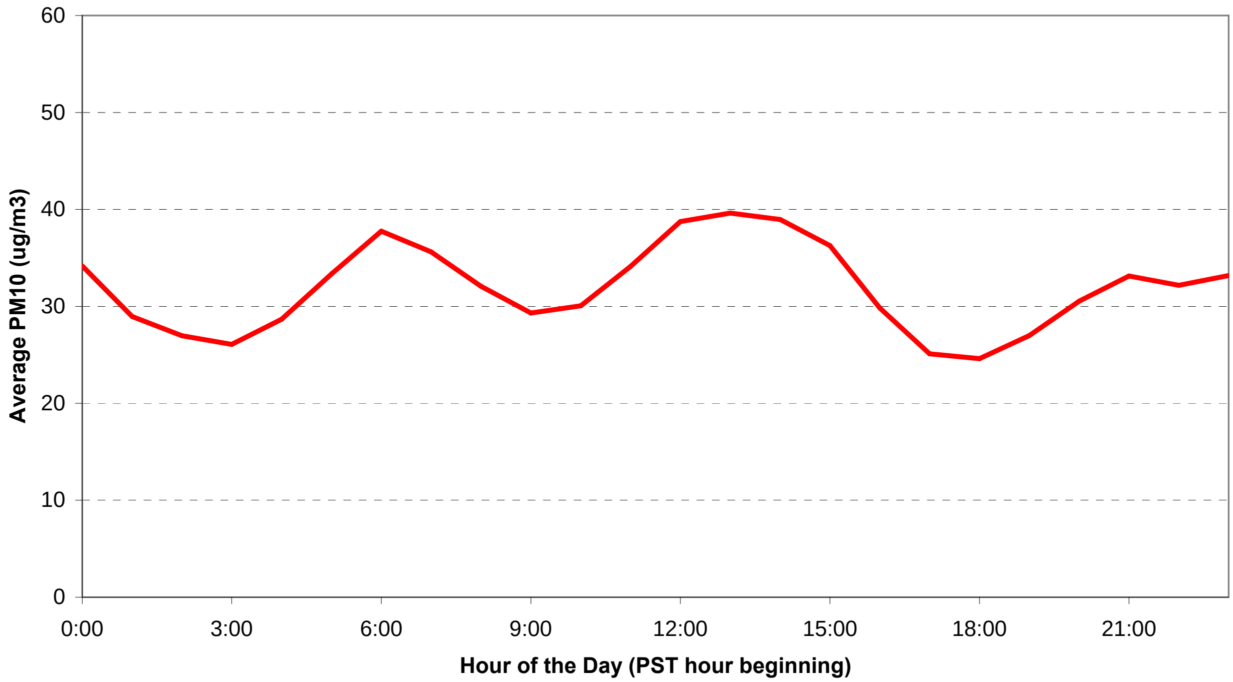


Figure 2-16. Average Concentration Distribution at Mountain Crest Site by Hour of Day.

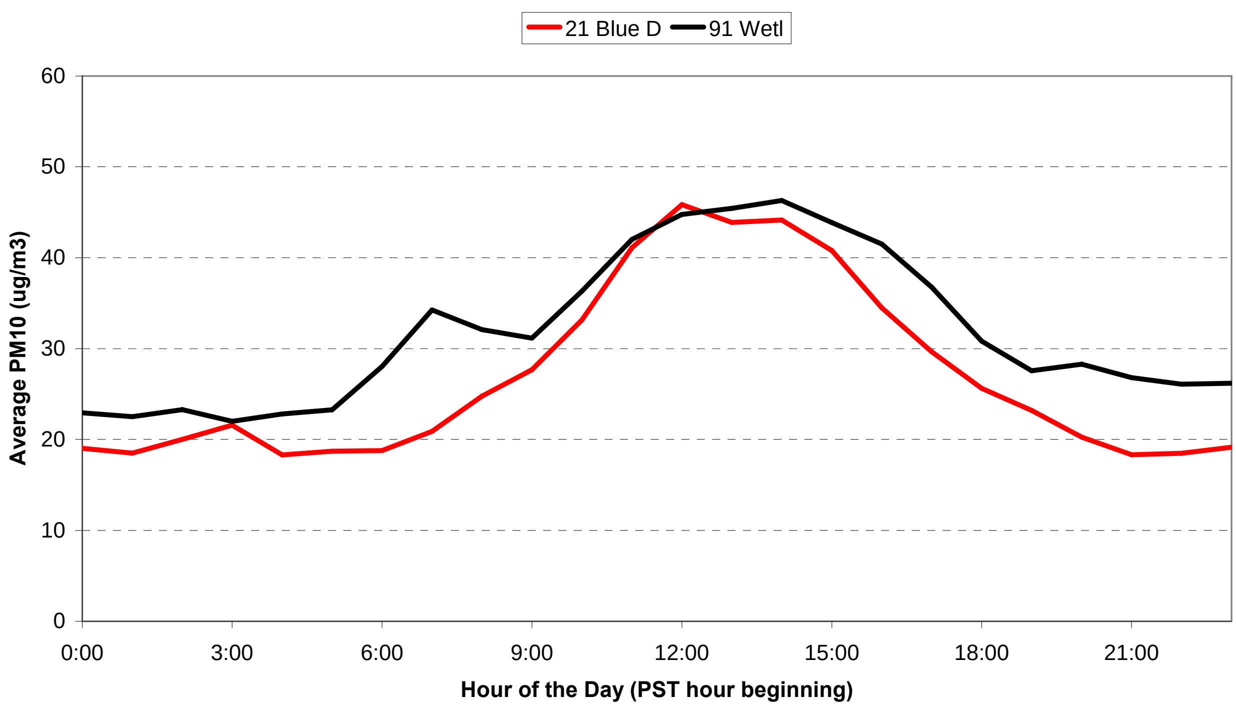


Figure 2-17. Typical Average Concentration Distribution at Two Sites not Influenced by Drainage Flow from a Neighboring Source.

The measured data showed that the site monitor could detect sources adjacent to the Mountain Crest site during periods of drainage flow. However, understanding the magnitude of the quarry's PM_{10} contribution would require knowledge of the type of material released during operations, upwind monitoring to determine true background levels, and potential monitoring during the drainage flow with both an optical and a mass method to establish the response (K) factor for the DustTrak. Furthermore, quantifying the contribution of a potential source to an exceedance event would require taking measurements during the event. No high concentration days occurred during the study, and the data suggest only that the quarry influences concentrations downwind; the impact could not be adequately quantified with the data available.

Like the Mountain Crest site, the Speedway site had a quarry nearby. Staff at the monitoring site occasionally saw haze from the quarry region drifting toward the Las Vegas Speedway. This would happen during morning drainage flow patterns from the northeast, when particulate matter released from material handling operations would become airborne and available for transport. Figure 2-18 shows the PM_{10} distribution from the Speedway site. As with the Mountain Crest site, the impacts could be seen but did not appear to be high enough to generate an exceedance. Just how the observed pattern relates to the quarry's operating schedule, and the response of the quarry material in the DustTrak (K factor), is unknown; but the peak at about 6:00 a.m. was apparent, and similar to the one observed at the Mountain Crest site.

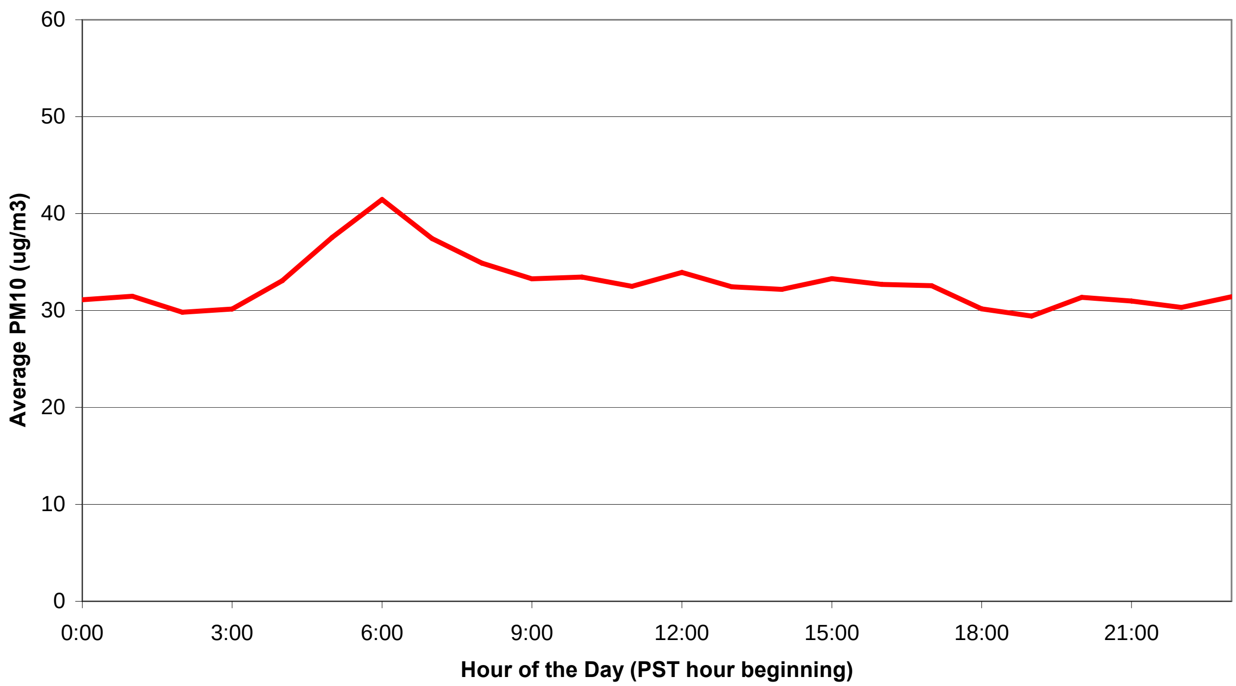


Figure 2-18. Average Concentration Distribution at Speedway Site by Hour of Day.

As stated previously, the dry lakebeds upwind of the Las Vegas Valley provide a major source of particulate matter that could be transported into the study domain during high wind speed events. While no exceedances occurred during the study period, plumes were observed from lakebeds that could be a source for an exceedance. Although these sources had been stabilized by winter rains, only recently drying enough to be a potential source of particulate matter, this issue should be explored further. The extent to which the surface is physically disturbed is unknown, but the observation of plumes during high wind speed events is enough reason to explore measures to minimize these areas as reservoirs of fugitive particulate matter.

The issue of physical soil surface disturbance is closely related to the issue of mitigation of disturbed soil. At numerous times during the saturation study, staff saw concerted efforts to apply water as a dust control measure. This is directly related to the DAQEM dust permitting process. Disturbed soil provides the greatest potential for fugitive dust emissions, and the measures observed had a significant effect on their reduction. In fact, the absence of exceedances during the study period was probably due, at least in part, to increased enforcement of dust mitigation measures.

2.4.2.7 Key Findings and Recommendations

The three main goals of the saturation study were to (1) determine PM concentrations in area that might not be well represented in the monitoring network, (2) determine inter- and intra-area transport during high wind speed events, and (3) determine the neighborhood impacts of major sources in the region. The following sections describe the study's results and recommendations.

2.4.2.7.1 Representativeness of the Network

The saturation sampler results showed one location that would benefit from additional routine PM_{10} measurements: the Star Nursery site. Potential plumes from Jean Lake and other source areas in high wind speed events could arrive between the existing stations at Green Valley and Lone Mountain; a station at the Star Nursery site would identify these sources, which might otherwise be missed at this entry point into the valley. Significant current and potential future growth in this region further underscores the need to establish a monitoring site.

The sites on the west side at Paul Meyer, Palo Verde, and Walter Johnson have all experienced relatively few exceedances. Maintaining these sites for historical continuity may be worthwhile; however, other locations may better represent potential exceedance regions, such as the south end of the valley or areas where significant development is anticipated. While the Lone Mountain site on the west side has seen few exceedances, a trend in recent years towards higher values makes the $PM_{2.5}$ levels at this location worth observing. Maintaining the PM_{10} measurements in addition to the $PM_{2.5}$ measurements will help in understanding this trend.

2.4.2.7.2 Inter-Area and Intra-Area Transport During High Wind Speed Events

Analysis of historical data shows that the key periods for exceedances occur during southwest wind flow, with strong pressure gradients produced in synoptic-scale prefrontal conditions. The events typically last one or two days.

Northwest winds generally follow synoptic-scale fronts that produce PM events. Wind speeds stay high, but PM_{10} concentrations diminish; even with relatively dry fronts, PM concentrations do not remain elevated. The southwest winds may deplete the reservoir of available particulate matter and leave less material for the northerly winds to entrain. Alternatively, source areas to the northwest may have a lower emissions potential. Hourly observations from the saturation network showed that entrainment of particulate matter required winds averaging about 15 mph.

2.4.2.7.3 Neighborhood Impacts of Major Sources

On the basis of the measured data near two potential major sources, a quarry near the Mountain Crest site and quarry operations near the Speedway site, the influence of material handling at the sites could be seen in the collected data during the periods of stable drainage flow. Apparently this contribution was not due to high wind speed entrainment, but to the transport of particulate matter that had become airborne due to material handling. While the influence could be detected, the concentrations were not large enough to create an exceedance of the PM_{10} standard. To quantify the contribution of the sources to the ambient PM_{10} concentrations would require further measurements upwind of the sources to determine the true background, and measurements made during representative times to assess the contribution.

2.4.2.7.4 General Findings

In addition to the primary findings described in Sections 2.4.2.7.1–2.4.2.7.3, some general items were discovered during the study:

1. Higher than normal rainfall has reduced the number of exceedances in the last several years: 2003, 2004, and 2005 were among the 10 wettest years on record. Conversely, 2002—the sixth driest year on record—had a relatively high number of exceedances. Precipitation plays a major role in stabilizing the desert surface, as the absence of exceedances in recent years clearly shows. A wet surface will form and maintain a reasonable crust until disturbed.

2. A stable desert surface minimizes the entrainment of particulate matter during high winds. When the desert surface is disturbed, more particulate matter is available and entrainment during high winds increases. The requirements for soil stabilization as part of the DAQEM earth disturbance permit process greatly reduce the particulate matter available for entrainment. During the study, field crews reported that dust mitigation measures taken at active construction sites (mostly watering the soil surface) had a noticeable impact on the generation of visible fugitive dust.

3. The optical sampling method for PM_{10} works fairly well, but has some response differences from EPA-designated equivalent methods (e.g., BAM). Crustal material PM10 required a multiplier of approximately 1.7 to correct the indicated readings of the selected DustTrak samplers to the BAM. Particulate matter with more of a combustion fraction required a factor of about 1.2. Significant differences were observed in the measurement of smoke from wildfires: the DustTraks were far more sensitive to this form of particulate matter, with the saturation network reporting significantly higher concentrations than the monitoring (BAM) network.

4. The harsh desert environment takes a toll on the DustTrak samplers. Pumps and dampening chambers were known weak spots, but overall operations were successful and field sampling produced reasonable results.

2.5 2005 MONITORING NETWORK REVIEW REPORT

The 2005 monitoring network review found deficiencies in four areas: spacing from trees, spacing to roadways, traffic flow, and AQS scale and objective (DAQEM 2006). DAQEM is correcting these issues, but the process will take time, given the complexities of redeploying a monitoring site and complying with new EPA regulations. Additionally, site reevaluation will now be a continual process to meet the goal of producing quality data. Table 2-6 summarizes the review results by site.

Table 2-6. Summary of Deficiencies Found During the 2005 Site Review

Site	Trees	Roadway	Traffic Flow	AQS Scale & Objective
City Center [1]		X	X	X
Craig Road				X
Green Valley	X	X		X
JD Smith				X
Joe Neal		X		
Lone Mountain				X
Orr		X		X
Palo Verde				X
Paul Meyer				X
Walter Johnson				X

[1]Site now closed.

The corrective action plan to address these network deficiencies consists of the following actions.

1. Spacing from Trees

DAQEM will evaluate monitor spacing from trees and attempt to comply with 40 CFR 58, Appendix E. This regulation states that the sampler should be placed at least 20 m from the drip line, and must be 10 m from the drip line when the tree(s) acts as an obstruction. If spacing from trees continues to have an impact on sampling at the site, DAQEM will evaluate the following options:

- Modify the site so the tree is no longer an issue.
- Work with the owners of the tree to alter or remove the obstacle.
- Relocate the site.
- Shut down operations at the site.

2. Spacing to Roadways

DAQEM will evaluate spacing to roadways and attempt to comply with 40 CFR 58, Appendix E, as charted in Figure 2-19. In this figure, “Category (a) sites” are sites impacted by a source or sources, and are typically microscale or middle scale. “Category (b) sites” are typically residential and neighborhood scale. If roadway distance continues to have an impact on sampling at the site, DAQEM will evaluate the following options:

- Relocate the site.
- Shut down operations at the site.

3. Traffic Flow

DAQEM will evaluate traffic flow near monitoring stations and attempt to comply with 40 CFR 58, Appendix E, as charted in Figure 2-19. However, traffic patterns will likely worsen, in which case DAQEM will evaluate the following options:

- Relocate the site.
- Shut down operations at the site.

4. Inaccurate AQS Entries

DAQEM will correct current and make appropriate future entries to the AQS database relative to the scale of representation, monitoring objectives, and the overall monitoring network in Clark County.

Table 2-7 shows the schedule for implementation of the corrective action plan.

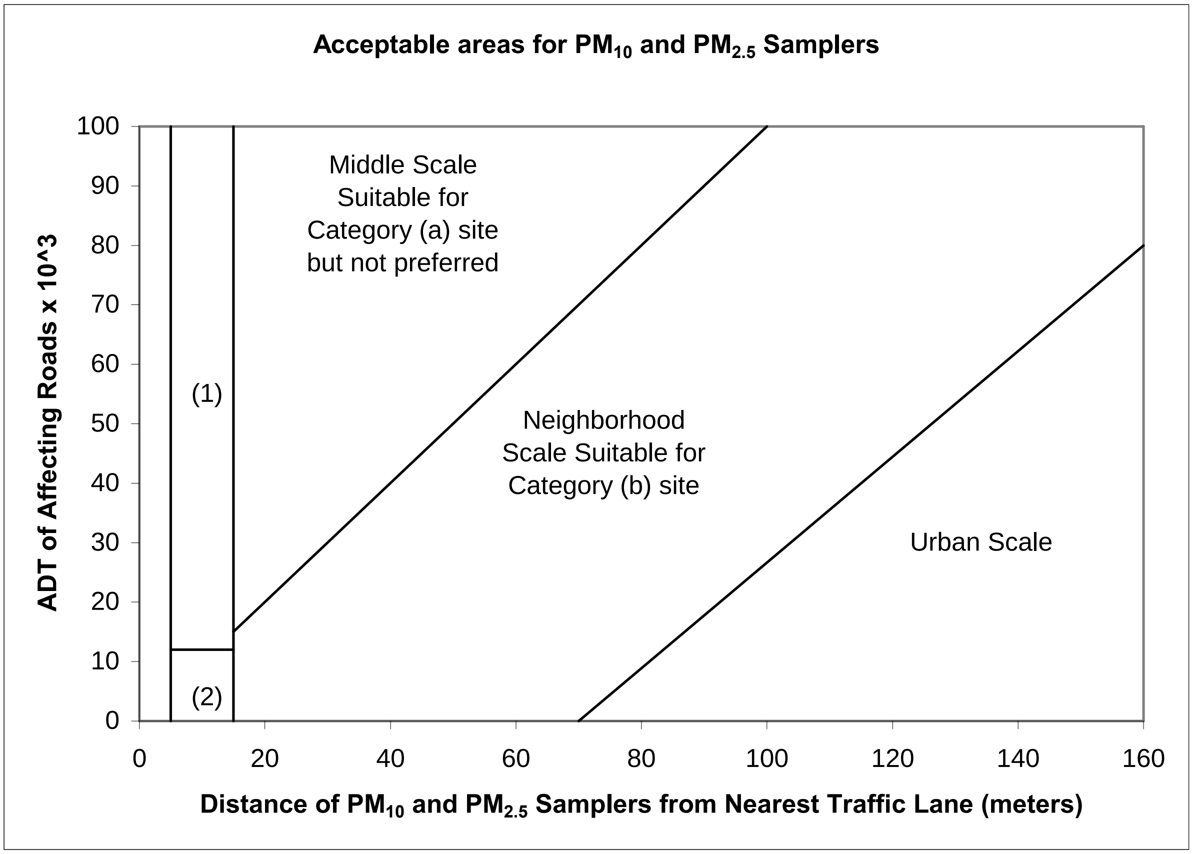


Figure Notes:
(1) Preferred area for Category (a) site microscale if monitor is 2-7 m high; middle scale otherwise.
(2) Not Category (a) sites.

Figure 2-19. Roadway Siting Criteria for PM_{10} Samplers.

Table 2-7. Implementation Schedule for Corrective Action

Deficiency	Site	Corrective Action	Implementation Schedule
Spacing to trees	Green Valley	Assess site, perform modifications	Spring 2006
Spacing to roadways	City Center Green Valley Joe Neal Orr	Relocate/close site Consult EPA Consult EPA Consult EPA	2006 2006 2006 2006
Traffic flow	City Center	Relocate/Close Site	2006
Inaccurate AQS entries	City Center Craig Rd. Green Valley J. D. Smith Lone Mountain Orr Palo Verde Paul Meyer Walter Johnson	Update AQS	Completed

2.6 MONITORING NETWORK AUDITS

The entire DAQEM monitoring network, including the PM_{10} monitoring network, underwent a detailed technical systems audit from EPA in August 2001. The audit report presented numerous findings and recommendations, but the overall findings were:

1. DAQEM supervisory, operational, and quality-related roles were not well defined, which led to misunderstandings of roles and responsibilities.

2. Insufficient effort was made to establish or follow formal procedures based on EPA monitoring guidance, or to document the quality control work performed.

3. There was a failure to reevaluate network siting in light of changing demographics and increased emission sources.

4. DAQEM should consider outfitting its monitoring sites with a more reliable data logging system.

DAQEM developed a corrective action plan that responded to every EPA comment: it provided the EPA recommendation(s), proposed DAQEM corrective action(s), further discussion of the problem, and a timetable for implementing changes. Most EPA comments applied to the monitoring network in general, but several concerned PM_{10} measurements specifically:

- The PM_{10} filters were not being weighed and conditioned in a controlled environment. Filter-based measurements of PM_{10} were discontinued in September 2004 under an agreement with EPA.

- Calibration and audit technicians were using the same foil weight to check the PM_{10} BAMs. EPA recommended the audit group maintain its own independent foil weight, which it now does.

- Flow devices were being verified periodically against a standard, but the results were not being documented. Procedures for verifying and documenting flow standards have been implemented.

All problems noted in the EPA audit have been corrected or are subject to ongoing review (e.g., the annual network review) except replacement of the data acquisition system. Replacing this system would improve data recovery for all criteria pollutants, including PM_{10}. The new data acquisition system, the Information Processing Systems MeteoStar (IPSM) Leading Environmental Analysis and Display System Environment Management System, collects, integrates, and processes meteorological air and water pollution data in near real-time. DAQEM is converting to this new system on the following installation schedule:

1. IPSM stations installed as of 12/31/06:

- Joe Neal
- J.D. Smith

- Lone Mountain
- Palo Verde
- Walter Johnson
- Paul Meyer
- Craig Road
- City Center

2. IPSM stations installed as of 2/12/07:

- Apex
- Green Valley
- Winterwood

3. IPSM stations anticipated for completion by 6/1/07:

- Boulder City
- East Sahara
- Henderson
- Jean
- Orr
- MGM Grand
- Mesquite
- Sunrise Acres

All new monitoring systems use Zeno Data Loggers for data storage, archival, and backup, including the database and the DAQEM Web page. The systems use a version V620 wireless card and regular phone lines to transmit data.

2.7 FUTURE NETWORK ADEQUACY

DAQEM concurs with the independent consultant's recommendation to locate a monitoring site in the southwest Las Vegas Valley. The selection of a site between the existing Green Valley and Lone Mountain locations would enable air quality monitoring in an area that will be under development for a number of years. A monitor in this location could also quantify transport into the valley from the southwest during high wind events. Following project approval, the specific location will be determined based on the availability of suitable land sites, funding, security concerns, and other necessary site criteria, in accordance with EPA guidance.

Sites on the west side of the valley, such as Paul Meyer, Palo Verde, and Walter Johnson, have recorded few exceedances of the PM_{10} standard; however, the value of maintaining these sites for more than historical continuity is justified. These sites monitor ozone, and in some cases $PM_{2.5}$, in addition to PM_{10}. The Lone Mountain site has seen relatively few exceedances, but maintaining PM_{10} measurements there in addition to tracking $PM_{2.5}$ levels will help in analyzing recent trends at the site. DAQEM will continue to evaluate and adjust locations and to monitor pollutants, based on annual network analysis and EPA recommendations.

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3.0 STATE IMPLEMENTATION PLAN COMMITMENTS

3.1 INTRODUCTION

The PM_{10} SIP contained commitments for Clark County to:

1. Evaluate implementing more stringent control measures.
2. Complete research projects related to emissions inventories and control measures.
3. Reevaluate emissions inventories for specified source categories.
4. Remodel attainment if specified source category emission inventories changed significantly.

This chapter describes the specific commitments, their current status, and future actions to maintain and implement them.

3.2 COMMITMENTS

The control measures and compliance program Clark County implemented through its PM_{10} SIP are among the most stringent in the nation. Figure 3-1 demonstrates how effectively they reduced fugitive dust emissions and improved air quality in the Las Vegas Valley, as measured by air quality monitoring data.

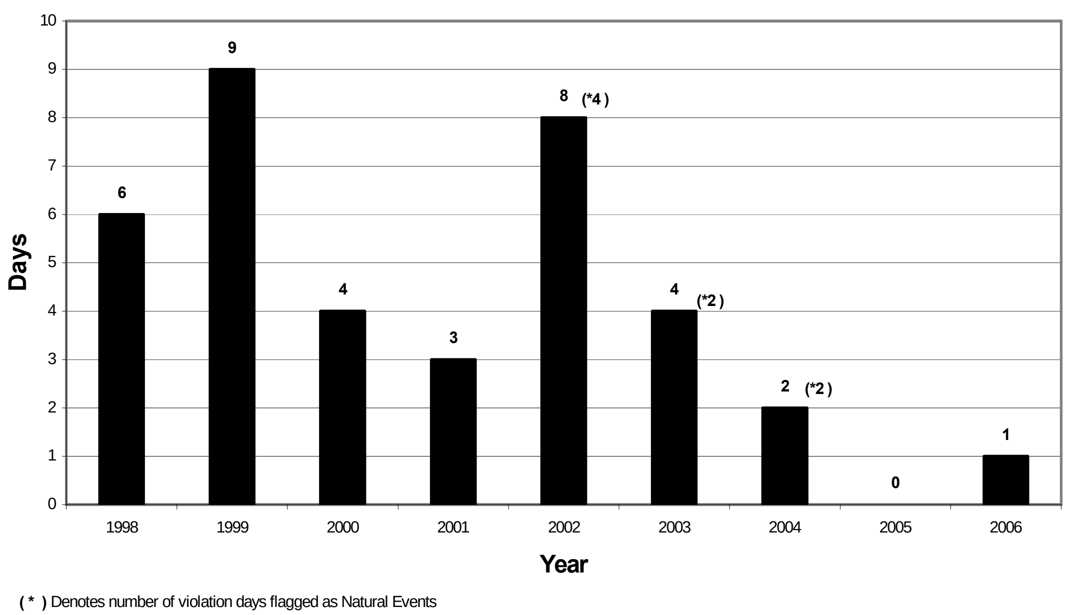

Figure 3-1. Number of 24-Hour PM_{10} NAAQS Violation Days.

Table 3-1 details the commitments Clark County made in the SIP and their status through December 31, 2006. Implementing the combination of SIP control measures and these commitments allowed Clark County to attain the 24-hour NAAQS by the mandated date of December 31, 2006. Clark County continues to comply with the annual NAAQS it first attained in December 2001.

Table 3-1. PM_{10} SIP Commitments

Commitments from SIP Chapter 4	Time Frame	Status	Action Plans
4.8.1: Commitment for additional staffing levels and enhanced enforcement efforts.	12/31/2001	Completed by 09/2002. Clark County's enforcement staff levels exceed the numbers committed to in the SIP.	Maintain current compliance program and enforcement staffing levels.
4.8.2.1: Participation in funding dust suppressant multimedia studies.	End of 2003	Completed. Partially funded UNLV study of water quality impacts from surfaces treated with dust suppressants and soil stabilizers. Participated in EPA "Expert Panel " symposium. After 2003, provided supplemental funding and staff support for EPA dust suppressant study.	Continue participating in dust suppressant multimedia studies as opportunities arise.
4.8.2.2: Commitment to conduct PM_{10} saturation study.	2003-2006	Completed 10/2006. Contracted with T&B Systems to conduct study; Appendix C contains final report.	Implement recommendations in Section 2.4.
4.8.2.3: Commitment to develop an improved inventory of unpaved roads.	1st qtr 2002 for public roads; 03/2003 for private roads	Improved inventory for public roads completed 06/2003.	Not applicable.
	Inventory completed 12/2006	Contracted with EQM & MRI to develop improved private unpaved road inventory. Inventory completed 12/2006.	Not applicable.
4.8.2.4: Commitment to develop an improved disturbed vacant land inventory.	6/2003	Contracted with EQM & MRI to develop improved disturbed vacant land inventory. Inventory completed 12/2006.	Not applicable.
4.8.2.4: Commitment to develop an improved construction inventory.	12/2002	Contracted with UNLV to develop improved construction activity inventory. Inventory completed 12/2006.	Not applicable.
4.8.2.5: Commitment to develop improved emission factors for native desert and disturbed areas.	2003-2005	Contracted with UNLV to develop improved emissions factors for native desert and disturbed areas. Completed field measurements in 2004 and final report 06/2006.	Not applicable.
4.8.2.6: Commitment to track silt loading on paved roads.	4th qtr 2001 to 06/2006	Completed quarterly sampling. This report contains a summary of study findings in Section 3.2.8.	Convert to alternative evaluation method upon EPA approval.
4.8.2.7: Commitment to establish test methods for Section 94 of the county Air Quality Regulations.	12/1/2001; time frame revised by SIP amendment: 3/31/2003	Completed 3/18/2003.	Not applicable.
4.8.2.8: Commitment to update emission inventories.	2003	This report contains a review of the control measure and describes the implementation assumptions used in the inventory projects throughout Section 4.	Not applicable.

Table 3-1. PM_{10} SIP Commitments (continued)

Commitments from SIP Chapter 4	Time Frame	Status	Action Plans
4.8.2.9: Commitment to revise air quality regulations.	8/1/2001; time frame revised by 11/19/2005 SIP amendment: 3/31/2003	Completed 3/18/2003.	Not applicable.
4.8.3.1: Commitment to pave unpaved roads.	6/1/2003	Completed 6/1/2003.	Not applicable.
4.8.3.2: Commitment to stabilize shoulders for paved roads.	12/31/2003-12/31/2006	Stabilization work is ongoing by public works agencies.	Completed shoulder stabilization at the end of 2006.
4.8.4: Commitment to encourage adoption of dust suppressant product specifications.	Ongoing until standards are developed	EPA and state agencies cannot develop and adopt dust suppressant product specs until research is completed. Working with EPA to obtain funds for additional research.	Continue working with EPA and states to find funding sources for additional field studies.

Note: EQM = Environmental Quality Management, Inc.; MRI = Midwest Research Institute; T&B Systems = Technical & Business Systems, Inc.; UNLV = University of Nevada, Las Vegas.

The following sections provide updated information on each commitment listed in Table 3-1.

3.2.1 Enforcement Staff

DAQEM filled the forecasted positions by December 2001, and continues to recruit qualified staff as openings occur to fulfill all commitments regarding increased staffing. DAQEM has 38 compliance officers assigned to such enforcement functions as stationary source inspection and enforcement; asbestos inspection and enforcement; gasoline pump inspection and enforcement; violations processing; and fugitive dust inspection and enforcement. Fugitive dust compliance includes enforcement of Sections 90, 91, 92, 93, and 94 of the Clark County Air Quality Regulations (AQRs), along with other applicable codes and regulations.

DAQEM has 24 field compliance officers who spend at least 90 percent of their time on fugitive dust inspection and enforcement activities. This does not include compliance officers assigned to the violations processing group, although the majority of violations that group processes are for fugitive dust violations.

Tables 3-2 and 3-3 list the number of construction site inspections, vacant land inspections, corrective action orders issued, violations issued, and dust control permits issued for 2005 and 2006, respectively. They also show the total acreage under dust control permits and the amount collected in combined penalties for each year.

Table 3-2. 2005 Compliance Actions

2005 (Complete Calendar Year)	
Type of Inspection or Procedure	**Inspections, Procedures, or Fines**
Construction site inspections	8,688
Vacant land inspections	798
Corrective action orders	2,864
Notices of violation	405
Combined penalties for the year 2005	$1,246,897.00
Dust control permits issued	4,562
Total acreage under dust control permits	42,509

Table 3-3. 2006 Compliance Actions

2006 (Complete Calendar Year)	
Type of Inspection or Procedure	**Inspections, Procedures, or Fines**
Construction site inspections	13,749
Vacant land inspections	2,639
Corrective action orders	3,666
Notices of violation	459
Combined penalties for the year 2006	$1,084,628.00
Dust control permits issued	4,586
Total acreage under dust control permits	43,426

The Compliance Division conducts extensive training for the building industry, including a 4-hour dust control class and a 3-day dust control monitor class. The program has trained 22,024 participants since it started in September 1997. DAQEM also provides technical assistance to public works agencies, land management agencies, and property owners as requested.

3.2.2 Dust Suppressant Studies

DAQEM contributed $35,000 to a $120,000 study to evaluate water runoff from dust suppressants that the University of Nevada, Las Vegas (UNLV) completed in September 2002. Results suggested the need to conduct additional fieldwork. DAQEM also helped UNLV and the EPA Office of Research and Development develop an expert panel symposium, held in May 2002, to discuss environmental issues related to dust suppressants and make recommendations on use.

In 2006 DAQEM contributed $8,000 to a project led by the EPA Region 9 office that tested dust suppressants for water quality impacts. DAQEM made additional in-kind contributions in the form of project staff support. In November 2006, staff made a presentation to the Federal Highway Administration Coordinated Federal Lands Highway Technology Implementation Program Panel, hosted by UNLV, on the topic of unpaved road stabilization products.

3.2.3 PM_{10} Saturation Study

Technical and Business Systems, Inc. conducted this study under a contract with DAQEM. T&B Systems completed the fieldwork in 2005, but DAQEM delayed publication of the final report until 2006 to coordinate data analysis with the results of a concurrent ozone field study. Section 2.4 describes the study and its recommendations, and Appendix C contains the final study report.

3.2.4 Inventory of Unpaved Roads

Public agencies in Clark County updated an inventory of unpaved public roads in the first quarter of 2002. DAQEM then contracted with Environmental Quality Management (EQM) and the Midwest Research Institute (MRI) to develop an inventory of private unpaved roads using Geographical Information System (GIS) data, satellite imagery, ground surveys, and traffic counts. The contractors completed the fieldwork in 2005 and finalized the study report in December 2006 (Appendix D, Section 1). The emissions inventories in Section 4 and the attainment demonstration modeling in Section 6 use information developed as part of this study.

3.2.5 Inventory of Disturbed Vacant Lands

DAQEM also contracted with EQM and MRI to update the vacant lands inventory for HA-212. The consultants conducted extensive analysis using satellite imagery, ground truthing, and soil data to develop the inventory. The study used two pilot study areas with different underlying soil characteristics, developing spectral signatures of each surface condition before creating images of the overall study area. This is a state-of-the-art approach to developing emission inventories of open areas and disturbed vacant land.

This inventory was developed in conjunction with the private unpaved road inventory to avoid duplication of effort and reduce costs. The EQM-MRI team completed the field study in 2005 and submitted the final report in December 2006 (Appendix D, Section 1). The emissions inventories in Section 4 and the attainment demonstration modeling in Section 6 use information from this study.

3.2.6 Inventory of Construction Activities

DAQEM contracted with UNLV to update and refine an inventory of construction activity in Clark County. This study required obtaining data on construction activities from public agencies, organizing the data by category and location, and producing a detailed inventory for use in future SIPs. Data sources included:

- Clark County Development Services, Public Works, Aviation, and Parks and Recreation departments.
- Clark County School District.
- Nevada Department of Transportation.
- City of Henderson.
- City of Las Vegas.
- City of North Las Vegas.

Efforts to mine these sources have not met expectations, forcing greater reliance on the dust control permit database. Although UNLV completed the research work in 2006, DAQEM elected not to use the reported data due to conflicts in the development of data categories, overlapping categories for source data, and discrepancies in the data. DAQEM is working with UNLV to resolve these issues.

In collaboration with the Clark County Department of Comprehensive Planning (DCP), DAQEM developed the base data and additional information needed to complete the construction activity emissions inventory. See Appendix F for the tables used to develop the source category inventory and details of the inventory process.

3.2.7 Emission Factors for Native Desert and Disturbed Areas

DAQEM contracted with UNLV to develop improved emission factors for native desert and disturbed areas. The study identified soil classes and employed regulatory soil stability criteria for soil crusting, friction threshold velocity, and rock cover to characterize sampled soils. UNLV and DAQEM coordinated this study with the EQM-MRI disturbed vacant land study to ensure consistency of methods and portability of data.

UNLV used a wind tunnel to determine the emissions factor for each soil type and condition. To maximize data collection for each site, UNLV first operated the wind tunnel on undisturbed locations in each test area. It then disturbed the site mechanically and conducted a second set of wind tunnel tests. Findings and emissions factors from this study validated previous work in the PM_{10} SIP, and are used in the emissions inventories in Section 4 of this report. Appendix E contains the final study report.

3.2.8 Silt Loading on Paved Roads

Dames & Moore collected and analyzed paved road dust samples on 22 paved roads in the Las Vegas metropolitan area from September 23 through October 1, 1999, and in February 2000 (Dames & Moore 2000). The criteria to select roads for silt sampling included traffic counts, road classification, current construction activity, visible track-out, and paved curbs and shoulders. Road classifications were based on traffic counts and number of lanes, as listed below (Venkatram and Fitz 1998):

- Freeways: Four or more lanes carrying 150,000 or more cars per day.
- Arterial: Four or more lanes carrying 10,000–150,000 cars per day[1].
- Collector: Two lanes carrying 500 to 10,000 cars per day.
- Local: Two lanes carrying fewer than 500 cars per day.

[1]The designation of a major or minor arterial uses traffic volume as the determining factor. According to the Dames & Moore report, few roads in the Las Vegas Valley other than freeways average more than 70,000 vehicles a day. The range for arterials used 10,000-70,000 cars per day. The RTC designates roadways with 10,000-20,000 vehicles per day as minor arterials, and roadways with 20,001-150,000 as major arterials.

The Dames & Moore report also assessed the effects of gravel shoulders on the silt loadings of paved travel lanes, providing baseline data for estimates of PM_{10} emissions from entrained paved road dust that were incorporated into the PM_{10} SIP.

Another SIP commitment was:

> Clark County Comprehensive Planning will conduct additional measurements of silt loadings on paved roads in order to update the paved road emission inventory and evaluate the effectiveness of control measures for reducing silt loading on paved roads. Silt loading measurements will begin in the fourth quarter of 2001 and continued quarterly through June 2006.

In accordance with this commitment, the DCP collected paved road dust samples from six roadways for the first sampling period, December 19-20, 2001. After the BCC consolidated air quality planning responsibilities, DAQEM carried out paved road dust sampling and analysis from the first quarter of 2002 through the fourth quarter of 2006. Table 3-4 shows the sampling dates for each quarter.

Table 3-4. Paved Road Silt Sampling

Sampling Qtr	Year	Sampling Dates	Comments
1st	2002	3/31/02 – 4/03/02	
2nd	2002	6/26/02 – 7/02/02	
3rd	2002	10/15/02 – 10/24/02	
4th	2002	12/23/02 – 12/30/02	
1st	2003	3/26/03 – 4/04/03	
2nd	2003	5/28/03 – 6/05/03	
3rd	2003	6/20/03 – 7/03/03	
4th	2003	12/08/03 – 12/17/03	
1st	2004	2/01/04 – 3/31/04	
2nd	2004	5/28/04 – 6/30/04	
3rd	2004	7/01/04 – 7/03/04	Samples collected in conjunction with paved road dust field study.
4th	2004	10/31/04 – 12/31/04	Samples collected in conjunction with site survey for AP-42 sampling in preparation for paved road dust field study.
1st	2005	1/01/05 - 3/15/05	Samples collected in conjunction with paved road dust field study.
2nd	2005	4/01/05 – 6/30/05	
3rd	2005	7/01/05 – 8/30/05	
4th	2005	11/02/05 – 11/08/05	Samples collected in conjunction with paved road dust field study.
1st	2006	3/14/06 – 5/30/06	
2nd	2006	6/15/06 – 8/31/06	
3rd	2006	9/11/06 – 9/16/06	Samples collected in conjunction with paved road dust field study.
4th	2006	10/01/06 – 11/28/06	Additional paved road silt analysis to support quality assurance/ quality control concerns on AP-42 sampling during a mobile sampling arrays & empirical study.

Quarterly measurements clearly demonstrate that silt-loading values for paved roads with unpaved shoulders are higher than silt-loading values for fully improved roadways, and that track-out of mud or dirt from construction sites and other sources (e.g., unpaved parking areas) elevates silt-loading values on paved roads.

Although EPA required quarterly sampling to monitor PM levels, its usefulness in improving PM_{10} emissions estimates or tracking control measure effectiveness was limited for several reasons:

1. The collection method is labor intensive, time-consuming, and expensive, and it produces few data points.

2. The limited data and the nature of fugitive dust emissions make it hard to establish baseline data for improving emission inventories or evaluating control measures. Many variables, including meteorology, adjacent land use, and traffic, affect silt loading on paved roads. The mix changes from location to location, and can vary at the same location over a short time (e.g., hours).

3. Silt loading measurement requires closing one lane of traffic for a few hours while samples are collected from strips across the lane. Road congestion is already an issue in the Las Vegas Valley, as is safety in roadway work zones ("Officials Battle Safety Woes in Work Zones," *Las Vegas Sun*, April 5, 2002).

4. A comprehensive analysis of silt loading values from 1999 to 2006 did not show a statistically significant decline in silt loadings on paved roads. Clark County attained the PM_{10} NAAQS in spite of this trend; new track-out controls implemented in early 2003 resulted in visibly cleaner roadways. Such discrepancies between silt loading data trends and real world conditions led the county to pursue better methods for estimating and measuring paved road emissions (Langston et al. 2006).

To address these and other issues, DAQEM contracted with the University of Nevada's Desert Research Institute (DRI) and the University of California, Riverside's Center for Environmental Research & Technology to develop improved sampling technologies. In these alternative systems, vehicle-mounted sensors collect sampling data as vans drive down the road. This method reduces the costs, subjectivity, and labor involved in paved road silt sampling, and allows DAQEM to monitor more of the county's paved roadway network. Vehicle-mounted systems can also take measurements more quickly, sample freeways, sample streets without closing lanes, and obtain enough data to make scientifically defensible claims about source emissions and control measure effectiveness. DAQEM presented its research results on these alternative technologies at EPA's 16th Annual International Emissions Inventory Conference and is finalizing the peer review of the study report.

3.2.9 Test Methods for Section 94 of the Air Quality Regulations

Clark County collaborated with Maricopa County (Arizona) and EPA Region 9 to develop improved opacity test methods for construction activities. Clark County prepared a protocol for test method development, and the three agencies conducted field studies on April 8-9, 2002, and December 26-27, 2002. Maricopa County tabulated the data sheets from the December field study. After reviewing the field data and video, Clark County developed a simpler intermittent visible emissions test method based on the unpaved road emissions visible emissions test method. After consulting with EPA and conducting public meetings and a public hearing, Clark County incorporated the revised method into Section 94, received BCC approval of the revised section in March 2003, and submitted it to NDEP on March 24, 2003, for incorporation into the state SIP and transmittal to EPA.

3.2.10 Emission Inventories Update

DAQEM reviewed the control measure implementation assumptions used to develop the emissions inventory projections for the 2003 and 2006 milestone years in the PM_{10} SIP. Backed by a strong enforcement program, Clark County implemented all the control measures in the PM_{10} SIP, in several instances exceeding SIP commitments. In addition, Clark County and other local entities fully implemented a contingency measure to pave all roads with Average Daily Trips (ADT) of 100 vehicles or more. These efforts validate the projections in the 2003 and 2006 emission inventories. Using improvements to the source-specific inventories in Section 4, DAQEM will begin preparing a new base year inventory for the PM_{10} maintenance plan in 2007.

3.2.11 Revision of Air Quality Regulations

Section 4.8.2.9 of the PM_{10} SIP committed to evaluating the feasibility of revising Sections 90, 92, 93, and 94 of the AQRs. Clark County evaluated all the revisions and found them feasible; the specific language was refined during the workshop process. The BCC adopted revisions to Sections 90, 92, and 93 on December 17, 2002, and included additional revisions to strengthen the regulations beyond SIP commitments. The BCC adopted further changes to Section 93 on March 4, 2003. The BCC adopted revisions to Section 94 on March 18, 2003, again including further revisions to strengthen its effectiveness. EPA approved these regulations effective December 29, 2006 (71 FR 63250). The following sections provide an overview of these revisions.

3.2.11.1 Section 90 (Open Areas and Vacant Lots): Dust Mitigation Plans

Section 90 was amended on December 17, 2002 to require that owners and/or operators having a cumulative open area of 10,000 acres or greater submit a dust mitigation plan for these areas to DAQEM. This revision was a SIP commitment. The two agencies subject to this requirement, the BLM and the U.S. Forest Service, submitted dust mitigation plans to DAQEM. The BLM is now developing an Environmental Impact Statement, which it will use to update its dust mitigation plan. Nellis Air Force Base was previously subject to this requirement, but in 2003 the U.S. Air Force nullified it by placing the entire Nellis facility under a DAQEM permit.

In addition to incorporating the dust mitigation plan requirement, DAQEM inserted amendments to clarify the regulation and strengthen its enforceability.

3.2.11.2 Section 92 (Unpaved Parking Lots): Rule Applicability to Permanent Material, Equipment, and Vehicle Storage Yards

On December 17, 2002, the BCC approved revised language that clarified and expanded the scope of Section 92. Permanent material handling and storage yards, and vehicle and equipment storage yards, became subject to the regulation. These revisions were not included in the SIP commitments, but DAQEM identified them as advantageous to improve rule enforceability and penetration.

3.2.11.3 Section 92 (Unpaved Parking Lots): Restrictions on New Unpaved Parking Lots

The December 17, 2002 revisions prohibited construction of new unpaved parking lots, with limited exceptions:

- Certain rural facilities outside the valley where paving would conflict with their rural nature.
- Limited areas used for storing and handling landscaping aggregate and similar bulk materials, which can damage asphalt. The owner/operator must use alternative control measures approved by the control officer and pave all access, parking, and other loading areas used by on-road vehicles.
- Parking areas used chiefly to store non-rubber-tired vehicles or equipment, if the owner/operator employs alternative control measures approved by the control officer.

These revisions were SIP commitments.

3.2.11.4 Section 92 (Unpaved Parking Lots): Prohibition of Dust Over Property Line

On December 17, 2002, the BCC incorporated Section 92.2.1.4 into the regulation. This provision prohibits dust from an unpaved parking lot from crossing over a property line where BACM have not been applied. This revision was a SIP commitment.

3.2.11.5 Section 93 (Fugitive Dust from Paved Roads): New Shoulder Requirement

On December 17, 2002, the BCC incorporated Section 93.2.1.2 into the regulation. This provision requires construction of eight feet of stabilized shoulder adjacent to the paved travel lane on roads carrying 3,000 or more vehicles per day. This revision was a SIP commitment.

3.2.11.6 Section 93 (Fugitive Dust From Paved Roads): Revised Shoulder Requirement

On March 4, 2003, the BCC deleted Section 93.2.1.4 from the regulation. This removed an exemption to the requirement for paved shoulders or curbing at intersections, which is particularly beneficial, and for auxiliary entry and exit lanes. The BCC added a more stringent standard for stabilization of road shoulders with gravel. Neither revision was included in the SIP commitments, but DAQEM identified both as advantageous to improve control measure effectiveness.

3.2.11.7 Section 93 (Fugitive Dust from Paved Roads): Dry Rotary Brushes and Blower Devices

On December 17, 2002, the BCC incorporated Section 93.2.3 into the regulation. This provision prohibits the use of dry rotary brushes and blower devices without enough wetting to control visible emissions, and expressly prohibits using them without water. This revision was a SIP commitment.

3.2.11.8 Section 93 (Fugitive Dust from Paved Roads): Crack Seal Equipment Requirements

On December 17, 2002, the BCC incorporated Section 93.2.4 into the regulation. This provision requires that owner/operators buy vacuum-type equipment when they purchase new crack seal equipment. This revision was a SIP commitment.

3.2.11.9 Section 94 (Construction Activities): Major Restructuring

Section 94 mandates a site-specific, soil-specific, activity-specific approach to controlling dust from construction activities. After more than two years of enforcing the regulation, DAQEM identified a number of areas for improvement; therefore, it completely restructured and revised the rule in consultation with the EPA Region 9 office. Revisions included adopting a new *Construction Activities Dust Control Handbook* that contains a number of enhanced Best Management Practices (BMP). The BCC adopted the revisions to Section 94 on March 18, 2003. These were not included in the PM_{10} SIP commitments, but DAQEM identified them as advantageous to improve the effectiveness and enforceability of the regulation.

3.2.11.10 Section 94 (Construction Activities): Plume Length Limited to 100 Feet, Dust Plume Crossing Property Line

This new section prohibits generating a dust plume longer than 100 feet or allowing a dust plume to cross a property line where BACM have not been fully applied. This revision was a SIP commitment.

3.2.11.11 Section 94 (Construction Activities): Dry Rotary Brushes and Blower Devices

This new section prohibits the use of dry rotary brushes and blower devices without enough wetting to control visible emissions, and expressly prohibits using them without water. This revision was a SIP commitment.

3.2.11.12 Section 94 (Construction Activities): Soils Test

This new section requires submitting an actual soils test to calculate the on-site Particulate Emissions Potential (PEP) of soils for any project of 50 acres or more. At least one soils test is required for each soil group at the site. Previously, applicants for projects of any size could use a DAQEM reference map to determine the site-specific PEP and applicable BMP for each project activity. This revision was not included in the SIP commitments, but DAQEM identified it as advantageous to improve control measure effectiveness.

3.2.11.13 Section 94 (Construction Activities): Enhanced Track-out Control Requirements

The regulation requires immediate cleanup when track-out extends more than 50 ft from the point of origin or accumulates to a depth of greater than 0.25 inch. This revision was not included in the SIP commitments, but DAQEM identified it as advantageous to improve control measure effectiveness.

3.2.11.14 Section 94 (Construction Activities): Dust Class Requirements

The regulation expands the requirements for mandatory dust class attendance to include construction site supervisors and foremen. This revision was not included in the SIP commitments, but DAQEM identified it as advantageous to improve control measure effectiveness.

3.2.11.15 Section 94 (Construction Activities): Dust Control Monitor Requirements

This regulation expanded the requirements for an on-site dust control monitor on any project of 50 acres or more. Under the new requirements, the monitor must be on site whenever construction activities take place. This revision was not included in the SIP commitments, but DAQEM identified it as advantageous to improve control measure effectiveness.

3.2.11.16 Section 94 (Construction Activities): *Construction Activities Dust Control Handbook*

The new handbook more clearly identifies which BMPs are mandatory for each type of construction activity. Revisions to existing BMP include a prohibition on explosive blasting of soil and rock when the National Weather Service forecasts wind gusts above 25 mph and installation of a perimeter wind fence on project sites of 5 acres or less. The handbook adds a new BMP for saw cutting and a requirement prohibiting the use of soil curb ramps, which improves track-out control and cleanup. These revisions were not included in the SIP commitments, but DAQEM identified them advantageous desirable to improve control measure effectiveness.

3.2.12 Paving of Unpaved Roads

By the end of June 2003, Clark County and other local governments had paved all unpaved roads in the PM_{10} nonattainment area with an ADT of 150 or more. By March 2004, the local governments had paved all unpaved roads with an ADT of 100 or more. This fully implements the road paving contingency measure set forth in Section 4.6.3 of the PM_{10} SIP.

3.2.12.1 City of Henderson

In February 2002, the city of Henderson reported that it had paved all unpaved roads with an ADT of 150 or more. By the end of 2006, it had paved all unpaved roads within the city limits.

3.2.12.2 City of Las Vegas

The City of Las Vegas met the June 30, 2003, deadline for paving all unpaved roads with an ADT of 150 or more. At the end of 2006, the city met the SIP commitment to pave all unpaved roads within its jurisdiction.

3.2.12.3 City of North Las Vegas

The City of North Las Vegas met the June 30, 2003, deadline for paving all unpaved roads with an ADT of 150 or more. In addition, the city has now paved all unpaved roads with an ADT of 100 or more.

3.2.12.4 Clark County

Clark County met the June 30, 2003, deadline for paving all unpaved roads with an ADT of 150 or more. In addition, the county has now paved all unpaved roads with an ADT of 100 or more.

An extranet website established in 2001 helped coordinate paving activities among municipalities in Clark County and displayed the progress of road paving activities. The site was deactivated in 2003, in accordance with Section 4.8.3.1 of the PM_{10} SIP, after all unpaved roads with an ADT of 150 or more had been paved.

3.2.13 Commitment to Stabilize Shoulders of Paved Roads

Local agencies drew up plans to stabilize road shoulders, and by the end of 2003 had met a commitment to stabilize 33 miles of the initial inventory of unstable paved road shoulders. By the end of 2006, the RTC had documented the paving of all unpaved shoulders.

3.2.14 Commitment to Encourage Adoption of Dust Suppressant Product Specifications

Clark County continues to participate in the Dust Suppressant Working Group, which identified the evaluation of surfactants as a priority for additional field studies. These studies are necessary to further evaluate product effectiveness across a range of soil conditions and potential water quality impacts. Clark County would then facilitate the adoption of product specifications by appropriate regulatory agencies. These studies may also foster development of enhanced BMP for construction activities and new BMP for water conservation. The next step is for the EPA Office of Research and Development to release the final expert panel report.

3.3 SUMMARY

DAQEM is responsible for air quality planning and regulatory programs in the Clark County nonattainment area. Clark County attained the PM_{10} annual standard at the end of 2001 and implemented further actions to achieve attainment of the 24-hour PM_{10} standard in 2006. Ongoing programs to upgrade and enforce SIP control measures and to meet SIP commitments will continue to improve air quality in the Las Vegas Valley.

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4.0 2006 EMISSION INVENTORIES

4.1 INTRODUCTION

Particulate air pollution in the Clark County nonattainment area is largely comprised of wind-blown dust, re-entrained road dust, and construction activity emissions. There are three main sources of ambient PM_{10} in the area:

- **Area Sources:** Fugitive emissions from construction activities, disturbed vacant land, vehicle exhaust, paved road dust, unpaved road dust, and similar sources.
- **Stationary Sources:** Aggregate processing facilities, residential wood burning, natural gas-burning electric power plants, and commercial charbroiling kitchens.
- **Natural or Background Emissions:** Emissions from physical and climatological conditions that exist in the absence of humans. Fugitive dust is emitted directly from native desert areas in arid environments like the Las Vegas Valley.

PM_{10} particles are classified as primary, condensable, or secondary. *Primary* particles are emitted directly from a stack or open source. These particles are larger and heavier (i.e., coarse particles between 10 and 2.5 microns in aerodynamic diameter), except for the primary particulates emitted from burning fuels. *Condensable* particles are formed by condensation, and *secondary* particles are produced through atmospheric chemical reactions with other pollutants.

The emission inventories include only primary PM_{10}, because Chemical Mass Balance (CMB) receptor modeling (Chow et al. 1999) showed that secondary and condensable particles contribute insignificant amounts to ambient PM_{10} concentrations. Average secondary particulate concentrations were therefore added to the background as an irreducible part of the total PM_{10} concentration.

Ambient PM_{10} concentrations in the nonattainment area usually peak during high winds, since they are generated primarily by windblown particles from disturbed soil surfaces. Particles in the valley become airborne for three reasons:

- The lack of vegetation typical of an arid desert climate.
- The fine texture of valley soil types.
- Soil-disturbing activities taking place throughout the valley.

Strong wind gusts are most common between April and September, although high wind speeds can result from thunderstorm activity in the region or a significant pressure difference between marine and continental air masses at any time of the year. Soil particles dominate PM_{10} measurements during high wind events, and monitoring stations near large areas of disturbed soil usually record the highest concentrations.

Approximately two-thirds of the PM emissions in the 1998 annual nonattainment emissions inventory came from wind erosion of vacant land. Dust from paved and unpaved roads composed nearly 20 percent of the inventory, and construction activities and related wind erosion totaled about 10 percent.

4.2 NONATTAINMENT AREA INVENTORIES

The PM_{10} SIP provided base year annual and 24-hour emission inventories for the design year (1998) and design day (12/21/98), which were determined using EPA guidelines (EPA 1987). Appendix A of the SIP describes the methodology used, and Appendix B describes the inventory calculations in detail. The inventories were developed using meteorological data collected at McCarran International Airport; Chapter 2 of the SIP contains the applicable wind roses.

DAQEM developed the 24-hour nonattainment area inventory from the annual inventory using the average anticipated activities for December 21, 1998. The annual emissions inventory was divided by 365 to estimate the 24-hour emissions. Wind data for the design day came from McCarran and were used for sources whose emissions depend on wind speed.

Vacant land emissions dominated the 24-hour inventory. More than two-thirds of all emissions were from vacant land fugitive dust. Dust from paved and unpaved roads accounted for about ten percent of the inventory, and construction activities accounted for approximately four percent. The wind speed for the design day was less than the threshold velocity of 25 mph needed to generate emissions from the native desert, so the 24-hour inventory does not include areas in that classification.

4.3 ATTAINMENT DEMONSTRATION AREA

The Clark County nonattainment area (HA-212) is roughly 960,000 acres. More than half of it is under federal control:

- Bureau of Reclamation = 9,689 acres.
- Desert National Wildlife Refuge = 226,728 acres.
- Lake Mead National Recreational Area = 1,148 acres.
- Nellis Air Force Base and Ranges = 25,124 acres.
- Red Rock Canyon National Conservation Area = 195,780 acres.
- Toiyabe National Forest = 60,073 acres.

Although EPA requires an emissions inventory for the entire nonattainment area, it will accept an attainment demonstration for a smaller area if there are compelling reasons to do so. EPA granted Clark County permission to model attainment using the area within the 1997 BLM land disposal boundary (Figure 4-1), which identifies federal land available for purchase, trade, or lease by public or private interests. In 2003, this area was 327,047.5 acres.

Clark County used the BLM disposal area to model attainment for the following reasons:

- All lands outside the boundary that are controlled by the federal government will remain in a native state.
- The boundary can only be changed by an act of Congress. (Congress revised the boundary in 2003, adding a net 26,440 acres.)
- More than 99 percent of the population in the nonattainment area lives in the BLM disposal area. It includes all populated areas and the areas where growth is anticipated.
- All measured violations of the NAAQS have occurred within the BLM disposal area.
- The BLM disposal area contains nearly all the anthropogenic sources in the nonattainment area.

4.4 EMISSION INVENTORY DEVELOPMENT

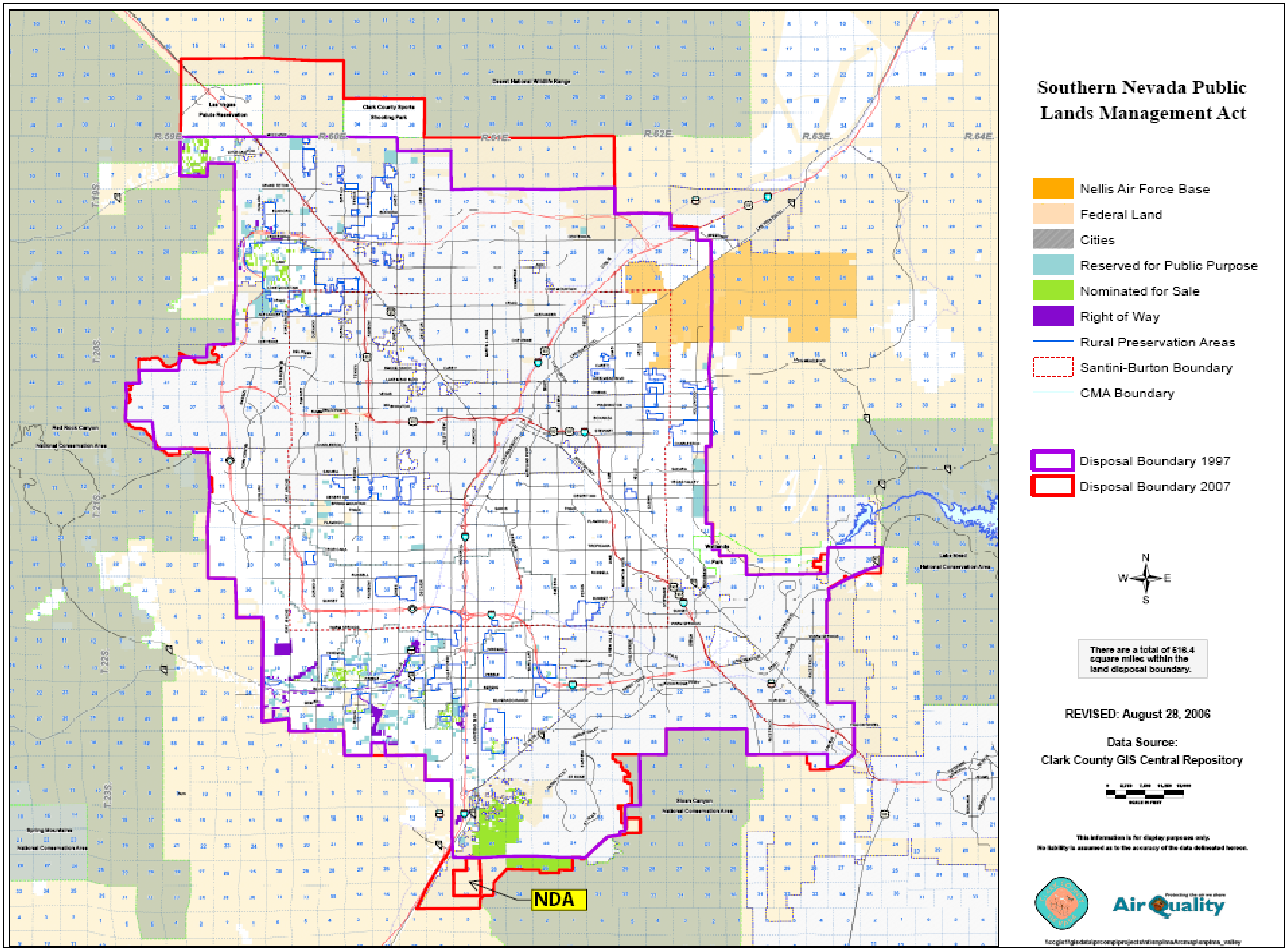
Clark County committed to improving emission factors and updating emission inventories in the PM_{10} SIP. This section describes the methodologies used in developing new emissions inventories for vacant lands, a major contributor to PM_{10} in the valley.

4.4.1 2003 Bureau of Land Management Disposal Area Expansion

Changes in the size of the BLM disposal area affect the total emissions inventories for key source categories, notably open areas and vacant lands. Congress added 26,442 acres of native desert to the BLM disposal area in 2003, making new emission inventories for vacant lands necessary. Figure 4-1 depicts the 1997 boundary (purple line) and the current 2003 boundary (orange line).

4.4.2 Vacant Land Inventory Development

In 2004, Clark County hired EQM to develop an inventory of the 2003 BLM disposal area (Appendix D, Section 1). This study improved the inventory of native desert, disturbed stabilized, and disturbed unstable vacant land. DAQEM also worked with the DCP to develop an inventory of developed and undeveloped land areas using parcel records from the Clark County Assessor's Office for July 2006. Tables 4-1 and 4-2 present these two inventories.



Note: NDA = Nondisposable Area.

Figure 4-1. BLM Disposal Area Boundaries.

Table 4-1. EQM Land Use Emission Inventory Categories

Land Use Category[1]	BLM (sq mi)	BLM (acres)	Area %
Native desert land (includes wash/drainage)	164.94	105,565.70	32.3%
Nondisposable land within BLM disposal boundary	1.24	795.00	
Disturbed stable vacant land	36.61	23,436.28	7.3%
Disturbed unstable vacant land	17.74	11,359.75	3.5%
Developed land (urban, concrete, vegetative)	291.41	18,6503.20	56.9%
Tribal land native desert		2,477.00	
Tribal urban developed		1315.00	
Cumulative Areas	***511.94***	***327,659.93***	***100.0%***

[1]Classifications developed in 2005.

Table 4-2. DCP Land Use Emission Inventory Categories

Land Use Category	BLM (sq mi)	BLM (acres)	Area %
Native desert land (includes wash/drainage)	135.73	86,867.55	26.6%
Disturbed stable vacant land	30.13	19,285.04	5.9%
Disturbed unstable vacant land	14.60	9,343.95	2.9%
Developed land (urban, concrete, vegetative)	330.55	211,551.00	64.7%
Cumulative Areas	***511.01***	***327,047.54***	***100.1%***

The slightly different cumulative area for the BLM disposal area in Table 4-1 is attributable to the different methodologies used, and is within accepted rounding conventions. The difference in acreage between Tables 4-1 and 4-2 results from EQM using 2005 imagery instead of 2006 DCP data, and from the different methodologies (satellite imagery versus GIS parcel data) used to develop the respective acreage figures.

The parcel data used by DCP tracks the developed or undeveloped status of a parcel, but provides no information on its surface condition. The EQM study concentrated on undeveloped land because developed land is an insignificant contributor to fugitive dust emissions. EQM used state-of-the-art remote sensing imagery analysis to classify the surfaces of undeveloped land in HA-212 and the 2003 BLM disposal area (Appendix D, 5-4). The new method used three classifications to characterize windblown emissions from undeveloped land: native desert, disturbed stable, and disturbed unstable. These are equivalent to the native desert, stable, and unstable categories in the PM_{10} SIP.

EQM's approach involved developing multi-band spectral signatures for each land surface classification. Two separate signatures were needed to account for all native desert areas: one for native desert vegetation areas, and a second for native desert areas dominated by desert washes, drainage, and desert paving. The same emission factor applied to both types of areas. EQM included wash and drainage areas in the native desert acreage totals for the emission inventory computations in Section 4.4.

Another category in the EQM study, barren/shadow, comprised areas in shadow during image development. Non-erodible mountainous areas on the periphery of HA-212 accounted primarily for this signature, but the study found some of these signatures within the disposal area. Although tall buildings were the main component of the signatures within HA-212, some of the shadowed areas included undeveloped land that could contribute to fugitive dust emissions.

To determine what percentage of the barren/shadow surface category within the disposal area came from developed urban areas and what percentage came from undeveloped native desert, DAQEM combined digital photographs with the GIS classification overlay from the EQM study. Staff concluded that 99 percent of the barren/shadow surface consisted of non-erodible developed urban areas and 1 percent was erodible native desert.

DAQEM estimates that the emission rates for the non-erodible barren/shadow areas, including mountain areas and developed land, range from very low to nonexistent. To keep its emissions estimate conservative, DAQEM applied the emission factor for native desert areas to the nonurban, undeveloped barren/shadow classification areas within HA-212.

EQM developed additional spectral signatures for urban, concrete, and urban vegetation areas that it used to eliminate developed urban areas from the assessment of open area and vacant land. It eliminated native desert on tribal lands because the tribal land categories were not counted in the DCP inventories. EQM subtracted another 795 acres of nondisposable land at the southern tip of the BLM disposal area from its inventories because they are not part of the disposal area and were not counted in the DCP inventories (Figure 4-1). Table 4-3 lists the undeveloped vacant land classifications in the EQM inventory and the area percentage of each.

Table 4-3. Undeveloped Vacant Land Classifications

Classification	Area %
Native desert land (includes wash/drainage)	75.2%
Disturbed stable vacant land	16.7%
Disturbed unstable vacant land	8.1%
Cumulative Area	***100.0%***

4.5 EMISSIONS INVENTORY UPDATES

In the PM_{10} SIP, the county committed to rerunning the attainment demonstration model if any of the following source categories changed significantly:

- Native desert fugitive dust
- Disturbed vacant lands/unpaved parking lots
- Stabilized vacant lands
- Construction activity fugitive dust
- Paved road dust (includes construction track-out)
- Unpaved road dust
- Highway construction projects
- Highway construction projects–wind erosion
- Vehicle sulfate PM

- Vehicle tire wear
- Vehicle exhaust

The following sections describe updates to the emission inventories for these source categories.

4.5.1 Native Desert Fugitive Dust

Native desert and disturbed areas account for a major part of the PM_{10} generated during high wind conditions. DAQEM estimated native desert emissions inventories using the figures for undeveloped land from the DCP inventory (Table 4-2) and the estimated percentage of native desert from the EQM inventory (Table 4-1). The calculations used the meteorology data from the design day (12/21/98).

4.5.1.1 Emission Factors for Native Desert and Disturbed Open Land Areas

Appendix C of the PM_{10} SIP documents the wind tunnel tests and baseline studies from which UNLV developed the original emission factors for native desert. In 2003, DAQEM committed to additional studies to refine these emission factors. Appendix E contains the final report on these studies, entitled "Refined Emission Factors for Native Desert and Disturbed Open Land Areas."

Site selection for the refined emission factors study was based on the U.S. National Resources Conservation Service's major Wind Erodibility Group classifications. Seven of the eight classifications were available for testing and analysis in the BLM disposal area and the Southern Nevada Public Lands Management Act area (Figures 4-2 and 4-3). Out of 53 sites selected for visits, UNLV found 32 that could be physically sampled by the wind tunnel crew (Figure 4-4).

Data from UNLV wind tunnel tests showed that soil surface condition had more influence on the windblown particulate emission rate than soil classification or wind erodibility group. Characterizing undeveloped vacant land as native desert, stable, or unstable simplified application of the correct emissions factor and provided the basis for using appropriate emissions factors. The 2004 refined emission factors study validated this approach.

DAQEM was not able to fulfill a SIP commitment to refine native desert emission factors because a wind tunnel large enough to accommodate native desert plants and other surface features was not available when necessary.

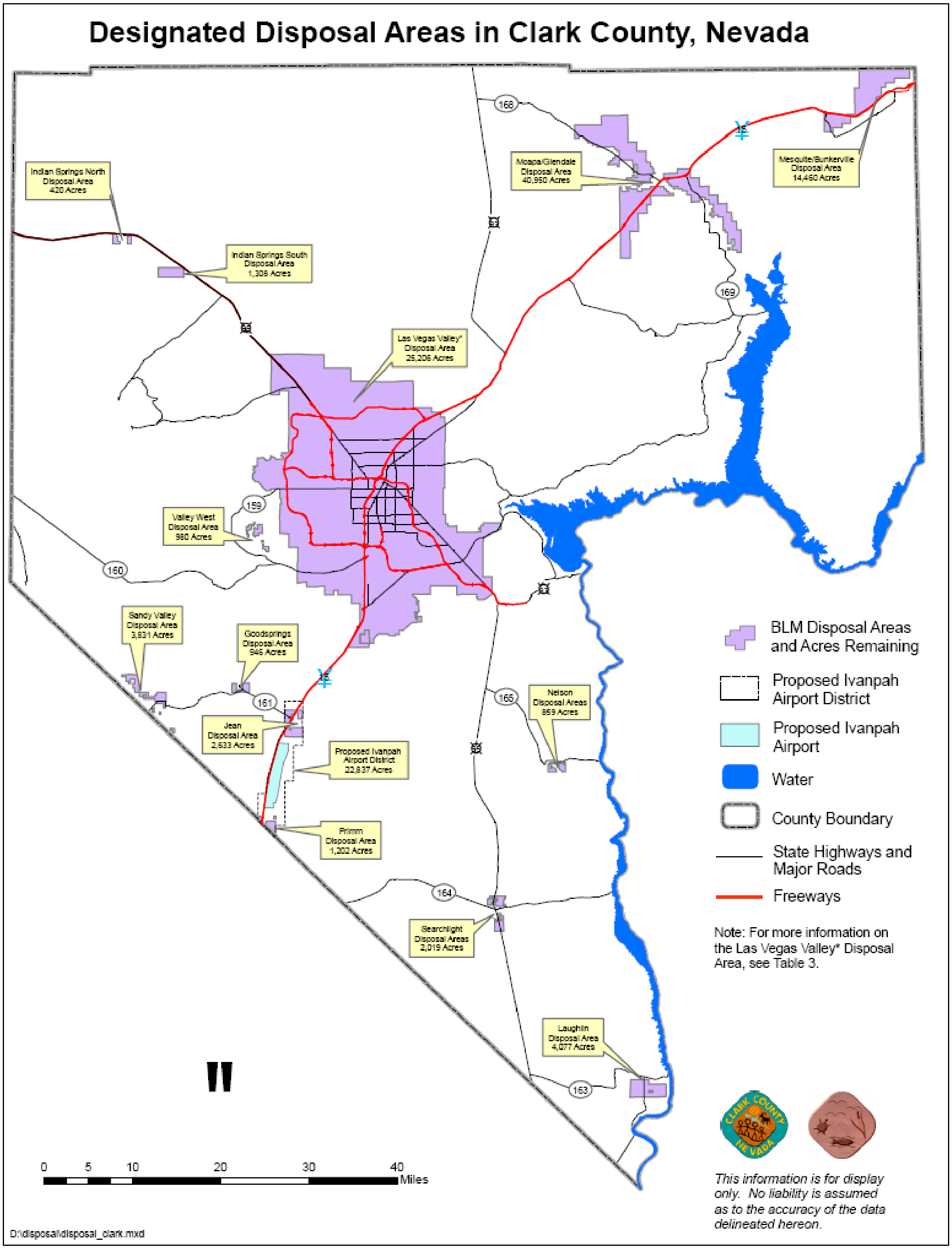


Figure 4-2. 2003 BLM Disposal Area.

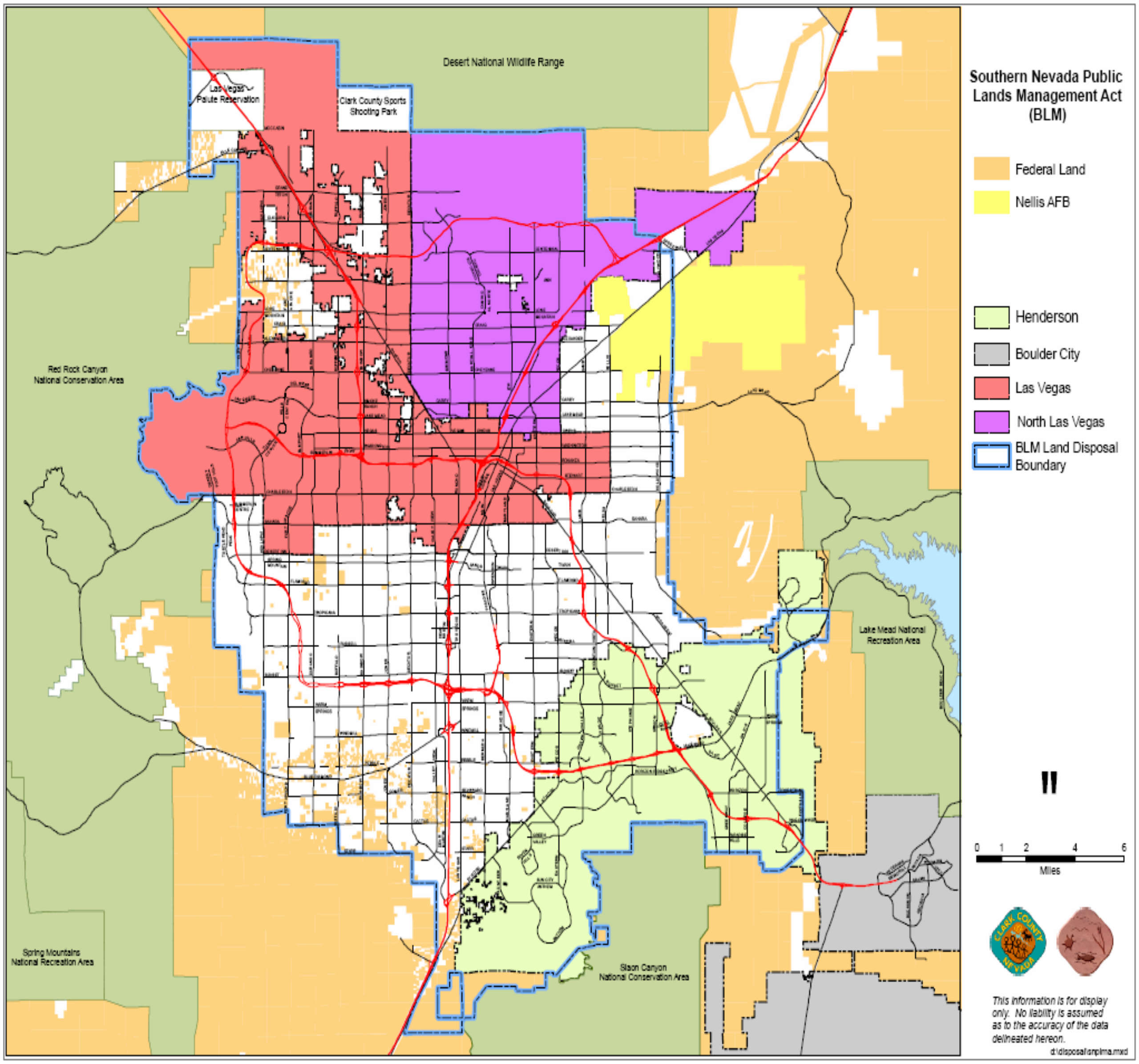
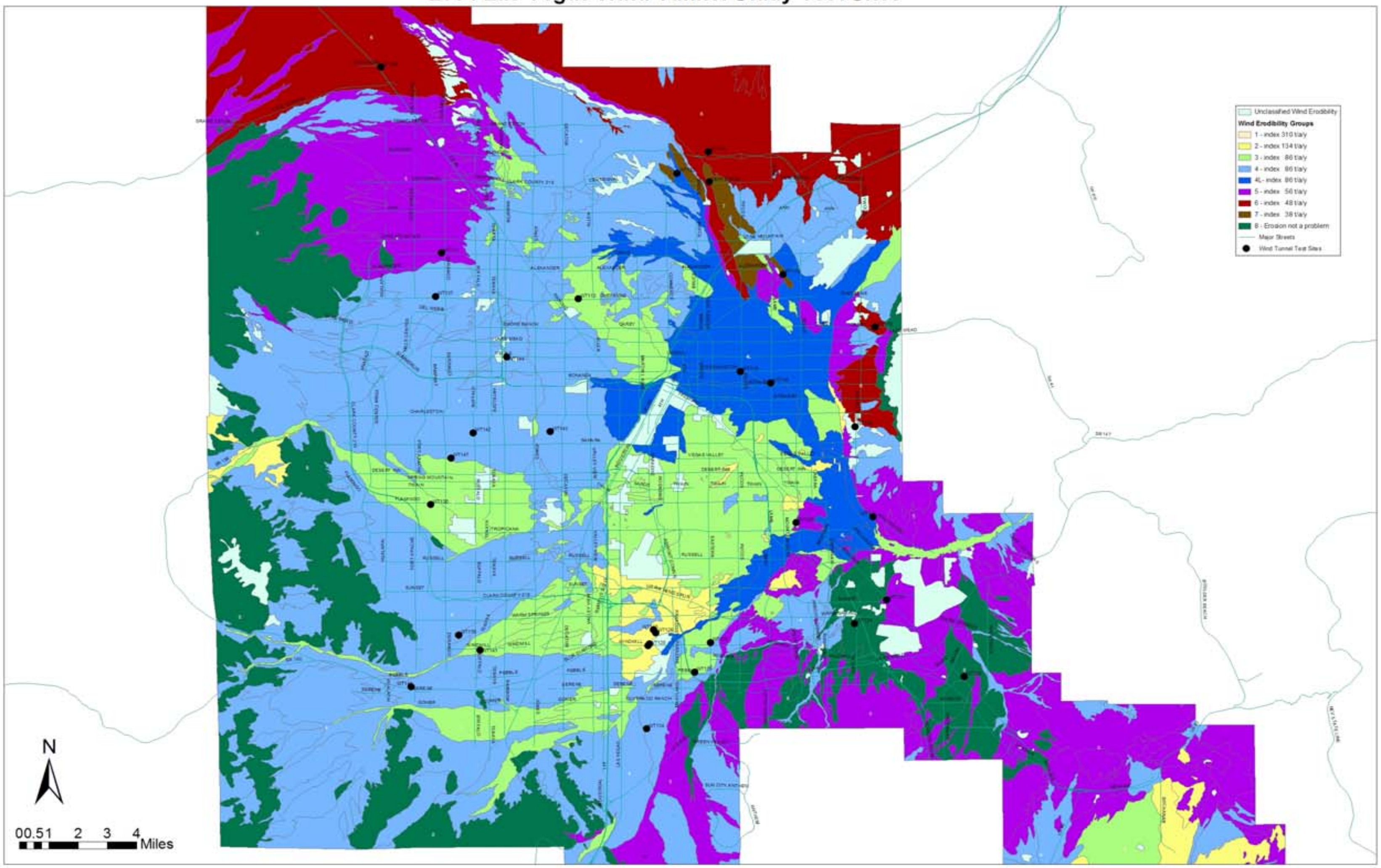


Figure 4-3. Southern Nevada Public Lands Management Act Area.

2004 Las Vegas Wind Tunnel Study Test Sites



Wind Erodibility Group Index: pale blue=0 (unclassified); light yellow=1; yellow=2; light green=3; light blue=4; dark blue=4L; purple=5; red=6; brown=7; dark green=8 (erosion not a problem).

Figure 4-4. 2004-2005 Wind Tunnel Test Sites.

Table 4-4 shows the emissions factors for native desert. Study data showed that fugitive dust emissions from undisturbed native desert increase considerably when average wind speeds exceed 25 mph, so the wind threshold for native desert parcels was set at 25 mph. Since average hourly wind speeds did not reach that threshold on the design day, emissions for this category were set to zero. Study findings indicated that emission factors for the undisturbed native desert category were unchanged from the 1995 factors used in the 2001 PM_{10} SIP.

Table 4-4. Native Desert Emission Factors

Wind Speed (mph)	No. Days in Range	Sustained Winds Emission Factor (ton/acre/hour)	Spike Emission Factor (ton/acre)	Emission Factor for Unstable Land (ton/acre)
15 – 19.9	144	N/A	N/A	N/A
20 – 24.9	91	N/A	N/A	N/A
25 – 29.9	31	0.00257	0.000361	0.0909
30 – 34.9	9	0.00316	0.000468	0.0327
35 – 39.9	1	0.00299	0.000815	0.00381
Total				**0.127**

Note: Composite emission factor = 0.127 tons/acre for the annual standard and 0.000348 tons/acre for the 24-hour standard.

In 2006, UNLV used wind tunnel tests to determine the emissions factor for each soil type and surface condition in the Las Vegas Valley (James et al. 2006). To maximize data collection, UNLV first conducted tests on undisturbed locations in each test area, then mechanically disturbed the site and conducted a second set of tests. The findings and emissions factors in UNLV's 2006 study validated the emissions factors in the PM_{10} SIP.

4.5.1.2 Disturbed (Unstable) Vacant Lands/Unpaved Parking Lots

DAQEM estimated disturbed (unstable) vacant lands and unpaved parking lot emissions inventories using the figures for undeveloped land from the DCP inventory (Table 4-2) and the estimated percentage of disturbed unstable land from the EQM inventory (Table 4-1). The emissions factors from the 2004 refined emissions factor study were applied to the DCP inventory to calculate emissions from disturbed vacant lands. The calculations used the meteorology data from the design day.

The erosion rates of unstable land documented in the refined emissions factor study were generally lower than the 1995 erosion rates in the lower wind speed bands (0.26 ratio at 15-20 mph, 0.89 ratio at 20-25 mph), although smaller data sets may render the 1995 data less reliable. The more reliable 2004 erosion rates were generally 3.86 times higher in the 25-40 mph wind bands, with ratios ranging from 3.44 to 4.00.

There are four likely reasons for the higher average unstable ratios in the 2004 study:

1. **Unstable sites were "fresh" and had not had time to recrust or be partially depleted.** The 2004 study classified field sites as stable or unstable based on the ball drop test, vegetation coverage, and percentage of non-erodible rock cover. Using these objective methods, 31 of the 32 measured sites were classified as stable. Unstable sites were then

created intentionally by disturbing stable soil surfaces with a metal rake and measuring the erosion rate before the surface could restabilize. Erosion rates of fresh unstable sites (worst-case scenario) could then be compared to rates of the same sites in stable condition. In the 1995 study, soil surfaces were not intentionally destabilized; unstable sites were measured when found during field surveys. The age of the surfaces in the 1995 study was unknown, and some of the sites may have been partially depleted of fine erodible material or partially restabilized. The field notes are not detailed enough to interpret the degree of instability. The 1995 study originally classified sites as disturbed or undisturbed, using visual inspection of the physical sites. Site photos were reexamined in 1999-2000 to reclassify sites as “stable” or “unstable.”

2. **There were more unstable sites.** The 2004 study examined 32 deliberately created unstable sites; the 1995 study examined 29 found unstable sites.

3. **More measurements were taken at each site.** In the 1995 study, only one set of three to four velocity runs was performed at each unstable site. In the 2004 study, three runs of four velocity steps each were performed in several different locations at each site. Thus each of 32 sites in the 2004 study had 12 velocity increments (three sets of four), compared to 29 sites in the 1995 study with one set of three or four velocity increments. The low number of unstable wind erosion data points in the 1995 study necessitated a change in field methods to create a larger set of data points. In the 2004 study, the wind tunnel was moved three times at each study site. Because of this change, the wind tunnel team obtained erosion data from the soil surface at each wind speed. The change in methodology resulted in less depletion of the soil surface during sampling than in the 1995 study. In 1995, the wind tunnel was run in place for 10 minutes at increasing wind speeds.

4. **There was less PM_{10} depletion during each run.** The 2004 field study employed four shorter periods (four minutes) of steady-state erosion at a set of progressively increasing velocities. The 1995 study ran the tunnel for 10 minutes at one wind speed. The average erosion rate for the 2004 study was calculated on a surface that had been depleted of erodible particles for a much shorter period than in the 1995 study. The 2004 study used four progressive-step increases in erosion velocity during each wind tunnel run; each step lasted four minutes, for a total run length of 16 minutes.

The combination of intentional destabilization at more sites and more measurements per site resulted in a much larger data set for unstable sites in the 2004 study than in the 1995 study. The 1995 data set is thinly populated in some wind speed bands because there were only three runs per site at a smaller number of found unstable sites. Erosion rates may also be higher in the 2004 study because the sites were freshly destabilized, as opposed to sites in the 1995 study that may have been partially depleted or recrusted (Appendix E).

The wind speed data used to calculate emissions from disturbed (unstable) vacant land were measured at McCarran International Airport on the design day. The meteorological data collected by the National Weather Service were broken down by duration and hourly average wind speed within the ranges used in the wind tunnel tests (Table 4-5).

Table 4-5. Average Hourly Wind Speed Classifications for December 21, 1998

Wind Speed Category (mph)	Number of Hours Average Hourly Winds Occurred
15 – 19.9	9
20 – 24.9	3

Table 4-6 presents the emission factor and resulting vacant land emissions for the 1998 demonstration, and Table 4-7 presents the same data for the 2006 demonstration. Emissions from vacant lands are caused by high winds and soil-disturbing activities, such as vehicle movement and weed abatement. Because quantifying emissions from vehicles and weed abatement is difficult, and because a relatively small portion is attributable to vacant lots, these emissions are not quantified in the SIP or MAR inventories.

Table 4-6. 24-Hour Disturbed (Unstable) Vacant Land Emissions Factors for 1998

Wind Speed Category (mph)	# of Hours in Range	# of Days in Range	Sustained Winds Emission Factor (ton/acre/hour)	Spike Emission Factor (ton/acre)	24-hour Emission Factor of Unstable Land (ton/acre)
15 – 19.9	9	0	N/A	N/A	N/A
20 – 24.9	3	1	0.00521	0.000816	0.0164
25 – 29.9	0	0	0.00640	0.00194	0.00194
30 – 34.9	0	0	0.00462	0.00141	0.00141
Total					**0.0198**

Table 4-7. 24-Hour Disturbed (Unstable) Vacant Land Emissions Factors for 2006

Wind Speed Category (mph)	# of Hours in Range	# of Days in Range	Emission Factor (ton/acre/hour)	24-hour Emission Factor of Unstable Land (ton/acre)
15 – 19.9	9	0	N/A	N/A
20 – 24.9	3	1	0.0047	0.0141
25 – 29.9	0	0	0.0220	N/A
30 – 34.9	0	0	0.0172	N/A
Total				**0.0141**

Table 4-8 shows that UNLV measured no unstable soil emissions in the 10-15 mph range during the 1995 study. Table 4-9 presents data UNLV obtained during the 2004 study using the new method, which was sensitive enough to measure an emissions rate of 0.0018 ton per acre-hour in the 10-15 mph range. However, the principal investigator believes this emission rate is short-lived (Dr. David James, telephone conversation, March 29, 2007).

Table 4-8. All Unstable Wind Erodibility Groups from 1995 Study

Wind Band (mph)	Geo Mean Flux (ton/acre/hr)	Sample Size
10-15	N/A	N/A
15-20	0.0049	3

Table 4-8. All Unstable Wind Erodibility Groups from 1995 Study (continued)

Wind Band (mph)	Geo Mean Flux (ton/acre/hr)	Sample Size
20-25	0.0052	4
25-30	0.0064	12
30-35	0.0046	13
35-40	0.0070	19
40-45	0.0113	9
45-50	0.0071	7
50-55	0.0037	1
Total Data Points		**68**
Average 15 – 40 mph	***0.0056***	

Table 4-9. All Unstable Wind Erodibility Groups from 2004 Study

Wind Band (mph)	Geo Mean Flux (ton/acre/hr)	Sample Size
10-15	0.0018	63
15-20	0.0013	102
20-25	0.0047	103
25-30	0.0220	12
30-35	0.0172	96
35-40	0.0281	30
40-45	0.0313	46
45-50	0.0317	5
50-55	N/A	
Total Data Points		**457**
Average 15 – 40 mph	***0.0147***	

The 2004 study did not evaluate the duration of low wind speed emissions, but DAQEM has excluded them from the emissions inventory based on observed emission decay rates.

4.5.1.3 Disturbed Stable Vacant Lands

DAQEM estimated disturbed stable vacant lands using the figures for undeveloped land from the DCP inventory (Table 4-2), the estimated percentage of disturbed stable vacant land from the EQM inventory (Table 4-1), meteorological data from the design day, and the refined UNLV emissions factors.

The 2004 stable PM_{10} emission factors are generally higher than the 1995 stable PM_{10} emissions factors used in the PM_{10} SIP. Wind speed emission thresholds were similar to those in the 1995 UNLV study. However, the stable erosion rates in the 2004 study averaged 2.5 times higher than the stable erosion rates in the 1995 study, with a range of 0.82 to 4.14. Probable causes include changes in the procedure for applying wind stress, use of freshly raked unstable surfaces instead of aged unstable surfaces, larger data sets, and differences in sampling methods (Section 4.5.1.2).

For stabilized vacant lands, it is assumed that the particle reservoir is small and emissions only occur during the first hour of the average hourly wind velocities in each category. The reservoir is assumed to recharge within 24 hours. Therefore, for a 24-hour period, once hourly average wind speeds are recorded in a category, emissions are assumed to occur for only one hour. Average hourly wind speeds were measured in two categories for the design day: 15–19.9 mph and 20–24.9 mph (Table 4-5). Tables 4-10 and 4-11 show the stabilized vacant land emission factors.

Table 4-10. 24-Hour Disturbed Stable Vacant Land Emission Factors for 1998

Wind Speed Category (mph)	# of Days in Range	Sustained Winds Emission Factor (ton/acre/hour)	Emission Factor of Stabilized Land (ton/acre)
15 – 19.9	1	0.00042	0.00042
20 – 24.9	1	0.00034	0.00034
Total	**1**		**0.00076**

Table 4-11. 24-Hour Disturbed Stable Vacant Land Emission Factors for 2006

Wind Speed Category (mph)	# of Days in Range	Emission Factor (ton/acre/hour)	Emission Factor of Stabilized Land (ton/acre)
15 – 19.9	1	0.0016	0.0016
20 – 24.9[1]	1	0.0031	0.0031
Total	**1**		**0.0031***

[1]Includes emissions from the lower wind speed band. The 2004 refined emission factors study provided cumulative emissions factors (see Appendix E).

Table 4-12 shows that UNLV measured no stable soil emissions in the 10-15 mph wind speed range during the 1995 study. Table 4-13 presents data UNLV obtained during the 2004 study using the new method, which was sensitive enough to measure an emission rate of 0.0017 ton per acre-hour. As with the unstable source category, DAQEM did not use the 10-15 mph wind speed emission factor due to observed emission decay rates.

Table 4-12. All Stable Wind Erodible Groups from 1995 Study

Wind Band (mph)	Geo Mean Flux (ton/acre/hour)	Sample Size
10-15	N/A	N/A
15-20	0.0019	1
20-25	0.0014	4
25-30	0.0026	11
30-35	0.0032	23
35-40	0.0030	28
40-45	0.0059	34
45-50	0.0076	30
50-55	0.0110	22
55-60	0.0169	12
60-65	0.0166	4
Total Data Points		**169**
Average, 15-40 mph	***0.0024***	

Table 4-13. All Stable Wind Erodible Groups from 2004 Study

Wind Band (mph)	Geo Mean Flux (ton/acre/hour)	Sample Size
10-15	0.0017	77
15-20	0.0016	91
20-25	0.0031	97
25-30	0.0104	11
30-35	0.0080	102
35-40	0.0124	33
40-45	0.0112	41
45-50	0.0128	2
50-55	N/A	N/A
55-60	N/A	N/A
60-65	N/A	N/A
Total Data Points		**454**
Average, 15-40 mph	***0.0071***	

4.5.1.4 Construction Activities

Table 4-14 shows the current population and acres of developed land for the BLM disposal area.

Table 4-14. Clark County Population and Total Developed Acres in the BLM Disposal Area

Year	Population	Change in Population	Total Developed Acres	Acres Constructed Per Year	Density Ratio (Pop. vs. Total Developed Acres)
1998	1,195,376	—	131,426	—	9.10
1999	1,266,680	71,304	137,501	6,074	9.21
2000	1,366,916	100,236	143,930	6,430	9.50
2001	1,445,791	78,875	147,134	3,204	9.83
2002	1,522,117	76,326	162,878	15,744	9.35
2003	1,583,172	61,055	171,173	8,294	9.25
2004	1,685,197	102,025	187,878	16,705	8.97
2005	1,752,240	67,043	193,426	5,548	9.06
2006	1,847,495	95,255	202,561	9,136	9.12

Source: DCP.

Table 4-15 divides construction activities into 10 categories. DAQEM used the best available data for each category, compiled from several sources in the county. The table describes the rationale for using each of these sources.

Table 4-15. Construction Category Sources and Rationale

Construction Type	Source (Clark Co.)	Rationale
Airport	Department of Aviation	Tracks all new construction and redevelopment at all Clark County airports. No other entity in the county tracks total construction for this category.
Commercial	DCP	Only entity that tracks total construction for this category.
Flood Detention	DCP	Only entity that tracks total construction for this category.
Highway	RTC	Responsible for all highway construction and redevelopment in Clark County. Its records represent the best available construction data for this category.
Public Parks	DCP	Only entity that tracks total construction for this category.
Schools	Clark County School District	Responsible for all new construction and redevelopment on all school property. Their records represent the best available construction data for this category.
Public Works	DCP	Only entity that tracks total construction for this category.
Residential Homes	DCP	Only entity that tracks total construction for this category.
Underground Utilities	DCP	Only entity that tracks total construction for this category.
Miscellaneous	DCP	Only entity that tracks total construction for this category.

There is a difference between these 2006 construction emissions tables and the 1998 base year inventory tables used in the PM_{10} SIP: the category "Schools" in the 2006 tables replaces the category "Public Bridges" in the 1998 inventory. Public bridges were placed into the "Highway Construction" category and a separate category was created for schools because school construction has increased so much in the last 10 years, due to continued record population growth (Table 4-14), that it became necessary to separate out emissions from this type of construction.

Tables 4-16 and 4-17 show the acres constructed in 1998 and 2006, the emission rates, overall control efficiency, and the percentage of sites implementing controls. Since 1998, Clark County has implemented extensive control measures for construction activities. The overall control reduction in each construction category is 68 percent.

Table 4-16. Construction Activity Emissions for 1998

Construction Type	Number of Acres Under Active Construction in 1998	Percentage of Sites Implementing Controls	Overall Control Efficiency	Months Under Active Construction	PM_{10} Emission Rate (tons/acre/month)	PM_{10} Emissions for 1998 (tons/year)
Airport	84.4	80%	40%	12	0.42	255.2
Commercial	3,226.8	50%	25%	3	0.265	1,924.0
Flood Detention	174.3	70%	35%	12	0.42	571.0
Highway	788.4	80%	40%	12	0.42	2,384.1
Public Parks	190.7	80%	40%	6	0.265	181.9
Public Bridges	574.8	70%	35%	12	0.265	1,188.1
Public Works	1,132.8	70%	35%	3	0.42	927.8

Table 4-16. Construction Activity Emissions for 1998 (continued)

Construction Type	Number of Acres Under Active Construction in 1998	Percentage of Sites Implementing Controls	Overall Control Efficiency	Months Under Active Construction	PM_{10} Emission Rate (tons/acre/month)	PM_{10} Emissions for 1998 (tons/year)
Residential Homes	10,555.3	50%	25%	6	0.265	12,587.2
Underground Utilities	736.8	20%	10%	1	0.42	278.5
Miscellaneous	1,984.7	80%	40%	6	0.265	1,893.4
Total	**19,449**					**22,191.2**

Table 4-17. Construction Activity Emissions for 2006

Construction Type	Number of Acres Under Active Construction in 2006	Overall Control Reduction (%)	Months Under Active Construction	PM_{10} Emission Rate (tons/acre/month)	PM_{10} Emissions for 2006 (tons/year)	PM_{10} Emissions for 2006 (tons/day)
Airport	166	68	12	0.42	267.72	0.733
Commercial	420	68	3	0.265	106.85	0.292
Flood Detention	147	68	12	0.42	237.08	0.649
Highway	305	68	12	0.42	491.90	1.347
Public Parks	0	68	6	0.265	0	0
Schools	549	68	6	0.265	279.33	0.765
Public Works	240	68	3	0.42	96.77	0.265
Residential Homes	10,601	68	6	0.265	5,393.79	14.777
Underground Utilities	0	68	1	0.42	0	0
Miscellaneous	1,160	68	6	0.265	590.21	1.617
Total	**13,588**				**7,463.65**	**20.445**

The "acres constructed per year" category in Table 4-14 differs from the "number of acres under active construction" category in Table 4-17. Table 4-14 lists the number of acres added to the built environment and subtracted from native desert land available in the BLM disposal area. Table 4-17 lists the total construction acres for each year, including redeveloped land in the built environment. All construction emission inventories are based on the number of acres under active construction because that number includes all construction activity in the BLM disposal area, not just new construction.

4.5.1.5 Windblown Construction Dust

The UNLV wind tunnel study updated emission rates for disturbed stable and disturbed unstable land (Appendix E). Table 4-18 shows the new emission rates. DAQEM used these updated rates to calculate 24-hour PM_{10} wind erosion emissions for construction activities (Table 4-19).

Table 4-18. 24-Hour Wind Erosion from Construction Sites in 1998

Construction Type	Uncontrolled Acres	Stabilized Acres	Disturbed Unstable Land Emission Rate (ton/acre/day)	Disturbed Stable Land Emission Rate (ton/acre/day)	24-hour PM_{10} Emissions (tons/day)
Airport	50.6	33.8	0.0198	0.00076	1.03
Commercial	2,420.1	806.7	0.0198	0.00076	48.5
Flood Detention	113.3	61.0	0.0198	0.00076	2.29
Highway	473.0	315.4	0.0198	0.00076	9.61
Public Parks	114.4	76.3	0.0198	0.00076	2.32
Public Bridges	373.6	201.2	0.0198	0.00076	7.55
Public Works	736.3	396.5	0.0198	0.00076	14.29
Residential Homes	7,916.5	2,638.8	0.0198	0.00076	159.00
Underground Utilities	663.1	73.7	0.0198	0.00076	13.2
Miscellaneous	1,190.8	793.9	0.0198	0.00076	24.2
Total	**14,051.9**	**5,397.2**			**282.00**

Table 4-19. 24-Hour Wind Erosion from Construction Sites in 2006

Construction Type	Uncontrolled Acres	Stabilized Acres	Disturbed Unstable Land Emission Rate (ton/acre/day)	Disturbed Stable Land Emission Rate (ton/acre/day)	24-hour PM_{10} Emissions (tons/day)
Airport	107.9	58.1	0.0141	0.0031	1.7
Commercial	273	147	0.0141	0.0031	4.31
Flood Detention	95.55	51.45	0.0141	0.0031	1.51
Highway	198.25	106.75	0.0141	0.0031	3.13[1]
Public Parks	0	0	0.0141	0.0031	0
Schools	356.85	192.15	0.0141	0.0031	5.63
Public Works	156	84	0.0141	0.0031	2.46
Residential Homes	6,890.65	3,710.35	0.0141	0.0031	108.66
Underground Utilities	0	0	0.0141	0.0031	0
Miscellaneous	754	406	0.0141	0.0031	11.89
Total	**8,832.2**	**4,755.8**			**139.29**

Note: Apply the 65% & 35% ratio to unstable & stable acres.
[1]3.13 tons per day in the category "Highway Construction" is included in the category "On-Road Mobile Source Emissions."

4.5.1.6 Mobile Source Emission Inventories

The following emission inventory categories were based on the vehicle miles traveled (VMT) numbers developed by the RTC using the TransCAD model:

- Paved road dust
- Vehicle sulfate PM
- Vehicle tire wear
- Vehicle brake wear
- Vehicle exhaust

Unpaved road dust was calculated using ADT estimates and the lane miles provided by the EQM study.

Table 4-20 summarizes the calculations of total PM_{10} mobile source emissions for 2006. Each source in the table represents the contributions to mobile source emissions in the Las Vegas Valley. All data comes from the *Regional Transportation Plan FY 2006-2030* (RTP) (RTC 2006) except the "Highway Construction Projects–Wind Erosion" calculation, which is based on the new emission factor from the 2004 refined emissions factor study (Appendix E).

Table 4-20. Total PM_{10} Mobile Source Emissions for 2006

Source Category	Tons per Day (TPD)
Paved road dust (includes construction and unpaved shoulder track-out)	83.53
Private unpaved roads	9.34
Highway construction projects activities	1.34
Highway construction projects - wind erosion	3.13
Vehicular sulfate PM	0.022
Vehicle tire wear	0.369
Vehicle brake wear	0.549
Vehicle exhaust	0.527
PM_{10} mobile source emissions	**98.81**

4.5.1.6.1 Unpaved Shoulder Dust

PM_{10} emissions from unpaved or unstabilized road shoulders are caused by road silt tracked onto the paved road from the unpaved shoulder and then entrained by passing vehicles. Paving and maintaining paved shoulders costs less than continual long-term stabilization of unpaved shoulders, although Section 93 of the AQRs allowed the latter for existing roads.

RTC member agencies decided to reduce and eventually eliminate roads with unpaved shoulders due to the long-term cost effectiveness of this approach. The RTP indicates that paving and road improvement programs, including projects funded through the Congestion Mitigation and Air Quality program, have eliminated most unpaved road shoulders and estimated that only 25 percent of the original unpaved road shoulders inventory remains. The unpaved shoulder dust is combined with paved road dust in the MAR's 2006 emissions inventory.

4.5.1.6.2 Paved Roads

Paved road dust is the largest contributor to mobile source emissions in the Las Vegas Valley. Soil from disturbed vacant lands and construction sites is deposited onto the road network and then entrained by passing vehicles. The RTC took current Annual Average Weekday VMT, the most recent silt loading data, and the current mean average fleet vehicle weights for Clark County to calculate paved road emissions in 2006 (Table 4-20) using the EPA-approved paved road emissions equation.

4.5.1.6.3 Unpaved Roads – Public

A revision to Section 91 of the AQRs prohibited new unpaved roads in public thoroughfares. DAQEM reviewed the best available geographical information, data, and mapping sources to determine that, based on lane width and road development standards from the Institute of Transportation Engineers, no public unpaved roads existed in the BLM disposal area by 2006. A review of paving programs and annual reports for 2006 showed that all RTC member agencies met or exceeded the paving requirements in Appendix D, Section 2 of the PM_{10} SIP. In developing the RTP, the RTC determined that all unpaved roads in the public road network had been eliminated.

4.5.1.6.4 Unpaved Roads – Private

Under a contract with DAQEM, EQM used a combination of satellite imagery, digital photos, and GIS overlays to locate privately owned unpaved roads in the BLM disposal area. Table 4-21 lists the 38 sites originally chosen for ADT traffic counts. However, EQM encountered a variety of issues that prevented some sites from being used; Table 4-22 lists the actual sites where traffic counts were obtained and their suitability for the study. Figure 4-5 depicts the 157 miles of private unpaved roads on which traffic counts were taken. No private unpaved roads in the study area exceeded 93 ADT; the overall average was 36.4.

Table 4-21. Unpaved Roads Selected For Traffic Counts

Site No.	Starting Point Location	Ending Point Location
1	W. Sunset Rd. & S. Tenaya Way	Sundown Glen Ave. & S. Tenaya Way
2	W. Patrick Ln. & Buffalo Dr.	W. Patrick Ln. & west of Maccan St.
3	W. Russell Rd & Buffalo Dr.	North of W. Sunset Rd & Buffalo Dr.
4	Boulder Opal Ave. & S. Fort Apache Rd.	W. Warm Springs Rd. & S. Fort Apache Rd.
5	W. Wigwam Ave. & S. Durango Dr.	W. Wigwam Ave. & S. Riley St.
6	W. Wigwam Ave. & S. Riley St.	W. Ford Ave. & S. Riley St.
7	W. Torino Ave. & west of Fortney Rd.	W. Torino Ave. & Kulka
8	Blue Diamond Rd. & S. Hualapai Way	Serene Ave. & S. Hualapai Way
9	Serene Ave. & S. Hualapai Way	Serene Ave. & Orduno St.

Table 4-21. Unpaved Roads Selected For Traffic Counts (continued)

Site No.	Starting Point Location	Ending Point Location
10	Gary Ave. & S. Decatur Blvd.	Gary Ave. & Edmond St.
11[1]	North of St. Rose Pkwy & Bermuda	Liberty Heights & Bermuda Rd.
12	Chartan Ave. & Gillespie St.	Starr Ave. & Gillespie St.
13	Wigwam Ave. & Hinson St.	Wigwam Ave. & west of Procyon Ave.
14	Stewart Ave. & Lois Feliz St.	Stewart Ave. & Probst Way
15[1]	Cartier Ave. & Lincoln Rd.	Cartier Ave. & Desert Edge St.
16	Brooks Ave. & Revere St.	North of Wilson Ave. & Revere St.
17	N. Decatur Blvd. at the northeast corner of the power station	N. Decatur Blvd. & south of the water tower section
18	N. Decatur Blvd. & north of the water tower section	N. Decatur Blvd. & a short distance north towards the mine
19	Gilbert Ln. & Bradley Rd.	Gilbert Ln. & Jones Blvd.
20	Maggie Ave. & Mustang St.	Iron Mountain Rd. & Mustang St.
21	Iron Mountain Rd. & N. Torrey Pines Dr.	Iron Mountain Rd. & Jones Blvd.
22	Horse Dr. & Mustang St.	Horse Dr. & Gareheim St.
23	Donald Nelson Ave. & Balsam St.	Farm Rd. & Balsam
24	Deer Springs Way & Rio Vista St.	Rome Blvd. & Rio Vista St.
25	W. Azure Dr. & Starlight Dr.	W. Tropical Parkway & Starlight Dr.
26	W. Tropical Parkway & Moonlight Dr.	South of W. Azure Dr. & Moonlight Dr.
27	Corbett St. & N. Bronco St.	Corbett St. & Jones Blvd.
28	South of W. Washburn Rd. & N. Bronco St.	West of La Madre Way & N. Bronco St.
29	Deer Springs Way & Alpine Ridge Way	Deer Springs Way & Bath Dr.
30	Deer Springs Way & Egan Crest Dr.	Tate & Egan Crest Dr.
31	Gilcrease Ave. & N. Tee Pee Ln.	Grand Teton Dr. & N. Tee Pee Ln.
32	Regena Ave. & Grand Montecito	Regena Ave. & east of N. Juliano Rd.
33[1]	W. Tropical Parkway & west of N. Durango Dr.	W. Tropical Parkway & N. Bonita Vista St.
34	Corbett St. & west of N. El Capitan Way	Corbett St. & E. of Campbell Rd.
35	Corbett St. & N. Kevin Way	South of W. Tropical Parkway & N. Kevin Way
36	Fort Apache Rd. & Azure Dr.	Dapple Gray & Azure Dr.
37	Rantool St. & Log Cabin Way	Nickelson St. & Log Cabin Way
38	Trails End Way & power transfer station	Trails End Way & Frontage Rd.

[1]Denotes unpaved roads that were paved after the inventory was conducted but before December 31, 2006.

Table 4-22. Average Daily Traffic Counts

Site No.	Traffic Count Data								ADT
	Sun	Mon	Tue	Wed	Thur	Fri	Sat	Counter	
1	6	13	22					EQ01	13.7
2	9	27	23					J1	19.7
3	21	60	54					J2	45.0
4	Construction area — road extremely active with earthmoving equipment — did not use.								
5&6	12	32	28					J3	24.0
7	23	24	26					EQ02	24.3
8	50	140	89					J5	93.0
9a	34	32	29					J4	31.7
9b	34	36	28					EQ03	32.7
10	27	28	79					J7	44.7
11	203	493	511					J8	402.3[1]
12	Did not use.								
13	40	43	53					J6	45.3
14					96	105	80	J8	93.7
15a					249	172	208	J7	209.7[1]
15b					189	153	177	EQ03	173.0[1]
16	Dirt berm added — access to unpaved road blocked.								
17					58	84	137	EQ02	93.0
18					16	12	28	J6	18.7
19					33	33	30	J5	32.0
20					17	18	26	EQ01	20.3
21					4	4	7	J4	5.0
22					45	43	43	J3	43.7
23					13	20	12	J2	15.0
24					89	73	53	J1	71.7
25					11	15	5	J3	10.3
26					70	45	61	J2	58.7
27					6	7	10	J1	7.7
28	Old pavement — broken up — did not use.								
29	Did not use.								
30	Dead-end street — did not use.								
31					68	61	19	J6	49.3
32a					10	12	1	J4	7.7
32b					10	9	2	EQ01	7.0
33					642	693	463	J5	599.3[1]
34					11	11	12	EQ02	11.3
35	Did not use.								

Table 4-22. Average Daily Traffic Counts (continued)

Site No.	Traffic Count Data								ADT
	Sun	Mon	Tue	Wed	Thur	Fri	Sat	Counter	
36a					91	76	50	J1	72.3
36b					84	74	56	EQ01	71.3
37					35	33	23	J7	30.3
38					3	3	0	J8	2.0
ADT excluding sites 11, 15a, 15b, and 33 (ADT>150)									**36.4**
ADT including sites 11, 15a, 15b, and 33 (ADT>150)									**73.2**

[1]Denotes unpaved roads that were paved after the inventory was conducted but before December 31, 2006.

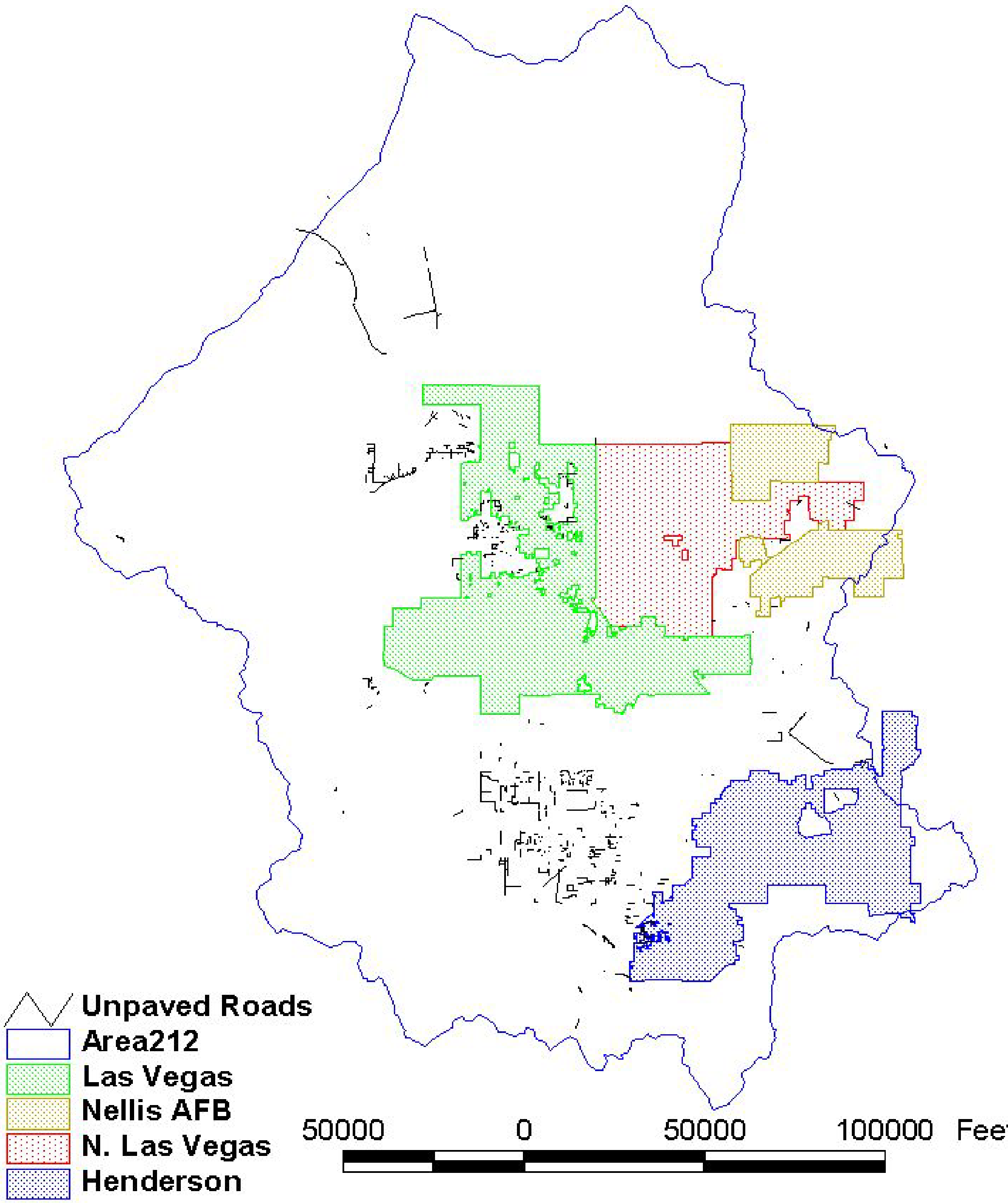


Figure 4-5. Overview of 157 Miles of Private Unpaved Roads.

4.5.1.7 On-road Mobile Sources

On-road mobile source emissions include vehicle sulfate PM, vehicle tire wear and brake wear, and vehicle exhaust of carbon particulates. The PM_{10} SIP emission rates for on-road mobile sources do not vary by roadway facility type—exterior connector, freeway ramp, minor arterial, major arterial, ramp, intrazonal trip, transit. Therefore, DAQEM used a single rate of 0.0334 g per VMT. This emission factor was developed using the MOBILE6.2 model and federal automotive exhaust standards. Table 4-23 shows total PM_{10} vehicle emissions for the Las Vegas Valley in 2006 based on the annual average weekday VMT and the vehicle emissions factor.

Table 4-23. PM_{10} Vehicle Emissions

Category Type	2006
Annual average weekday VMT	39,856,006
Vehicle emissions factor (g/VMT)	0.0334
PM_{10} vehicle emissions (kg/day)	1,331
Total PM_{10} Vehicle Emissions (tons/day)	**1.47**

4.5.1.7.1 Highway Construction and Windblown Construction Dust

The PM_{10} SIP developed emission rates for two categories of roadway construction: “highway construction projects” and “highway construction projects–wind erosion.” The following calculations were used to estimate PM_{10} emissions from highway construction.

Highway Construction Projects Emission Calculations:

1. Calculate the average length of a project by dividing the lane miles for 2006 by the total number of projects.
2. Estimate the number of projects under construction during 2006. (The assumptions were that one-third of the projects are under active construction at any one time and the average project is four months in duration, yielding 3 four-month project periods.)
3. Convert the lane miles of project to acres: 5,280 ft/mi x 12 ft (average lane width) = 63,360 ft^2 in one lane mile. 63,360 ft^2 divided by 43,560 ft^2 (ft^2/acre) = 1.45 acres per lane mile. 1.45 x project lane mile average x number of projects = number of acres under construction.
4. Apply SIP emission factor: 0.42 tons/month = 840 pounds/acre/month.
5. Apply control measure reduction factor to total acres under construction:
   Product - (product x 0.68).
6. Divide by 30.5 (avg days/month) to convert to average day emissions.

Highway Construction Projects–Wind Erosion Emission Calculations:

1. Obtain calculation of area (in acres) for analysis period from Step 1 above.
2. Apply PM_{10} wind erosion rates per day to acres calculation.
3. Stable land emissions factor = 35% of acres x 0.0031 tons.
4. Unstable land emissions factor = 65% of acres x 0.0141 tons.
5. Determine total daily wind erosion by adding products from Step 2.
6. Apply control measure reduction percentage from the SIP: 71%.

Table 4-24 shows the results of these calculations for the "Highway Construction Projects" category; Table 4-25 shows the results for the "Highway Construction Projects–Wind Erosion" category. Acreages were calculated for 2003 through 2005 from projects identified in the RTC's Transportation Improvement Program. The average of these three years was taken as a basis for 2006 highway projects.

Table 4-24. PM_{10} Emissions from Highway Construction

Highway Construction Source	2006
Number of projects in 2006	38
Average length (lane-miles)	7969.30
Lane-miles	209.72
Estimated acreage	305
Emissions factors (tons/acre/month)	0.42
PM_{10} vehicle emissions (tons/day)	4.20
Control measure reduction (%)	68%
Net PM_{10} Emissions (tons/day)	**1.34**

Table 4-25. PM_{10} Emissions from Highway Construction–Wind Erosion

Highway Construction Wind Erosion	2006
Estimated acreage	305
Erosion rate (tons/acre/day) – 35% of site (stable)	0.0031
Erosion rate (tons/acre/day) – 65% of site (unstable)	0.0141
PM_{10} emissions (tons/day)	4.01
Control measure reduction (%)	71%
Net PM_{10} Emissions (tons/day)	**3.13**

In developing the emission inventories for 2006, DAQEM estimated 19.3 tons per day of PM_{10} from uncontrolled disturbed vacant land. When control measures for this source category were factored into the overall calculations, total PM_{10} emissions fell to 5.4 tons per day. These estimates were based on the 1997 land inventory of the BLM disposal area.

4.5.1.8 Non-road Mobile Sources

The emissions inventory for non-road mobile sources was produced using output from the NONROAD model, PM_{10} SIP projections for Nellis Air Force Base, and data from the Clark County Department of Aviation. All the individual source categories remained de minimis. Table 4-26 summarizes the non-road emissions data; see Appendix H for the complete inventory.

Table 4-26. Non-road Emissions Inventory

Non-road Mobile Source	PM_{10} (TPD)
Airport support equipment	0.036
Commercial equipment	0.19
Construction & mining equipment	2.4
Lawn & garden equipment	0.75
Railroad equipment	0.0016
Recreational equipment	0.136
Aircraft emissions from McCarran International, Henderson Executive, and North Las Vegas municipal airports	0.29
Nellis Air Force Base	0.09

4.6 SUMMARY

Table 4-27 summarizes the 24-hour PM_{10} emissions for the BLM disposal area. It shows uncontrolled emissions, overall control reductions, and controlled emissions in 2006 for each source category.

Table 4-27. 24-Hour PM_{10} Emissions Summary Table for BLM Disposal Area in 2006

SOURCES	PM_{10} Uncontrolled Emissions (TPD)	Overall Control Reduction (%)	PM_{10} Controlled Emissions (TPD)
Stationary Point Sources			
Sand & gravel operations	1.72	0	1.72
Utilities – natural gas	0.55	0	0.55
Asphalt concrete manufacture	0.47	0	0.47
Industrial processes	0.22	0	0.22
Other sources	0.34	0	0.34
Subtotal	***3.29***	—	***3.29***
Stationary Area Sources			
Small point sources	0.50	0	0.5
Residential firewood	1.12	0	1.12
Residential natural gas	0.25	0	0.25
Commercial natural gas	0.09	0	0.09
Industrial natural gas	0.04	0	0.04

Table 4-27. 24-Hour PM_{10} Emissions Summary Table for BLM Disposal Area in 2006 (continued)

SOURCES	PM_{10} Uncontrolled Emissions (TPD)	Overall Control Reduction (%)	PM_{10} Controlled Emissions (TPD)
Natural gas purchased at the source & carried by Southwest Gas Co.	0.58	0	0.58
Structural/vehicle fires & wildfires	0.07	0	0.07
Charbroiling/meat cooking	2.84	0	2.84
Disturbed vacant lands/unpaved parking lots	131.75	72	36.89
Native desert fugitive dust	0	N/A	0.00
Disturbed stable vacant land dust	59.78	0	59.78
Construction activity fugitive dust	12.78	68	4.09
Windblown construction dust	136.16	71	39.49
Subtotal	***345.96***	—	***145.74***
On-road Mobile Sources			
Paved road dust (includes construction, unpaved shoulder track-out)	83.53	0	59.31
Private unpaved road dust	9.34	65	3.27
Highway construction projects	1.34	68	0.43
Highway construction projects–wind erosion	3.13	71	0.91
Vehicle sulfate PM	0.022	0	0.02
Vehicle tire wear	0.369	0	0.37
Vehicle brake wear	0.549	0	0.55
Vehicle exhaust	0.527	0	0.53
Subtotal	***98.81***	—	***65.38***
Non-road Mobile Sources			
Airport support equipment	0.036	0	0.036
Commercial equipment	0.19	0	0.19
Construction & mining equipment	2.4	0	2.4
Lawn & garden equipment	0.75	0	0.75
Railroad equipment	0.0016	0	0.0016
Recreational equipment	0.136	0	0.136
Aircraft emissions from McCarran International, Henderson Executive, and North Las Vegas municipal airports	0.29	0	0.29
Nellis Air Force Base	0.09	0	0.09
Subtotal	***3.9***	—	***3.9***
GRAND TOTAL	**451.95**		**218.30**

Clark County committed to reviewing emissions factors or activity levels and calculating controlled emissions for the source categories listed in the PM_{10} SIP. It used projected emissions from the SIP for source categories with emissions factors or activity levels that were not revised:

- Stationary sources
- Small point sources
- Residential firewood
- Residential natural gas
- Commercial natural gas
- Industrial natural gas
- Natural gas purchased at the source and carried by Southwest Gas Company
- Structural/vehicle fires & wildfires
- Charbroiling & meat cooking
- Nellis Air Force Base

Emissions from the following source categories were recalculated using newly developed data:

- Disturbed vacant lands/unpaved parking lots
- Native desert fugitive dust
- Disturbed stable vacant land dust
- Construction activity fugitive dust
- Windblown construction dust
- Airport support equipment
- Commercial equipment
- Construction & mining equipment
- Lawn & garden equipment
- Railroad equipment
- Recreational equipment
- Aircraft emissions from McCarran International, Henderson Executive, and North Las Vegas municipal airports
- Paved road dust (including track-out from construction & unpaved road shoulders)
- Dust from private unpaved roads
- Highway construction projects
- Highway construction projects–wind erosion
- Vehicle sulfate PM
- Vehicle tire wear
- Vehicle brake wear
- Vehicle exhaust

Emissions from disturbed vacant lands/unpaved parking lots were calculated using new emission factors developed by UNLV, new soil stability classification data developed by EQM, and new undeveloped land acreage values calculated by DCP. Overall control reductions came from the SIP. Disturbed stable vacant land was calculated using new emission factors developed by UNLV, new soil stability classification data developed by EQM, and new undeveloped land acreage values calculated by DCP.

The construction activity values used to calculate windblown construction dust came from land use data provided by DCP. Disturbed stable and disturbed unstable emission factors from UNLV's 2004 refined emissions factors study (Appendix E) were used to compute these construction activity emissions.

Calculations of paved road dust emissions were based on information from the RTC, as were calculations of highway construction project and highway construction project–wind erosion emissions. Unpaved road dust emissions were calculated using EQM's inventory of private unpaved roads, and the emissions factors for disturbed stable and disturbed unstable soils were calculated using data from the 2004 UNLV study. Vehicle emissions were generated from the EPA-approved MOBILE6.2 model. MOBILE6.2 does not generate uncontrolled emissions or emissions reduction percentages, because the controls are included in the model.

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5.0 CONTROL MEASURES IMPLEMENTED

5.1 INTRODUCTION

Control measures for the Clark County nonattainment area comprise the regulatory programs and nonregulatory control measures delineated in the 2001 PM_{10} SIP. Regulatory programs include the AQRs for identified sources of fugitive dust; nonregulatory control measures include keeping compliance staffing levels up and using dedicated funds from the Congestion Mitigation and Air Quality program to pave unpaved roads. The county also adopted regulatory program enhancements beyond the commitments in the SIP.

Ambient PM_{10} in Clark County is predominantly comprised of airborne geologic particulate matter from multiple sources. The county's regulatory and nonregulatory programs therefore focus on source categories that emit geologic particulate matter. Other emission sources, such as combustion sources, were deemed de minimis under applicable EPA guidelines.

5.2 STRINGENCY AND EFFECTIVENESS

EPA classified Clark County as a serious nonattainment area, so the county had to employ BACM for all significant source categories. As part of the SIP, Clark County completed a comprehensive BACM analysis that showed all control measures met the BACM threshold.

BACM is defined as the "maximum degree of emission reduction feasible for a significant source category" (59 FR 42010). It is determined on a case-by-case basis, taking into account technical feasibility; energy, environmental, and economic impacts; and other costs. The process also takes into account the most common emission sources in a community, when emissions occur, what measures can be taken to reduce them, and the cost of such measures relative to their effectiveness.

Table 5-1 divides the significant sources that contribute to 24-hour PM_{10} exceedances into five source categories: disturbed vacant lands, unpaved parking lots, construction activities, paved road dust, and unpaved road dust. BACM for each significant source were identified and implemented to ensure attainment of the PM_{10} standards as quickly as practicable. Sources determined to be insignificant were not considered.

Table 5-1. Significant and Insignificant Source Categories

Source Category	Annual		24-Hour	
	Significant	Insignificant	Significant	Insignificant
Stationary Point Sources				
Sand & gravel operations		X		X
Utilities–natural gas		X		X
Asphalt concrete manufacture		X		X
Industrial processes		X		X
Other stationary point sources		X		X

Table 5-1. Significant and Insignificant Source Categories (continued)

Source Category	Annual		24-Hour	
	Significant	Insignificant	Significant	Insignificant
Stationary Area Sources				
Small point sources		X		X
Residential firewood		X		X
Residential natural gas		X		X
Commercial natural gas		X		X
Industrial natural gas		X		X
Natural gas purchased at the source & carried by Southwest Gas Co.		X		X
Structural/vehicle & wildfires		X		X
Charbroiling & meat cooking		X		X
Disturbed vacant land/unpaved parking lots	X		X	
Construction activity fugitive dust	X		X	
Windblown construction dust	X		X	
Racetrack wind erosion		X	X	
Racetrack vehicles		X	X	
Non-road Mobile Sources				
Airport support equipment		X		X
Commercial equipment		X		X
Construction & mining equipment		X		X
Lawn & garden equipment		X		X
Railroad equipment		X		X
Recreational equipment		X		X
McCarran International Airport		X		X
Henderson Executive Airport		X		X
North Las Vegas Airport		X		X
Nellis Air Force Base		X		X
On-road Mobile Sources				
Paved road dust (includes construction track-out)	X		X	
Unpaved road dust	X		X	
Highway construction projects	X		X	
Highway construction projects–wind erosion	X		X	
Vehicle sulfate PM		X		X
Vehicle tire wear		X		X
Vehicle brake wear		X		X
Vehicle exhaust		X		X

Because of rapid and extensive population growth, Clark County requested and EPA granted a five-year extension of the CAAA deadline for attainment (from 2001 to 2006). Section 188(e) of the CAAA mandates the implementation of Most Stringent Measures (MSM) to extend an attainment deadline. Since there is no guidance on implementing Section 188(e), Clark County prepared the following operating definition for its PM_{10} SIP after reviewing technical support documentation for the Maricopa County SIP: "The maximum degree of emission reduction that has been required or achieved from a source or source category in other SIPs or in practice in other states and can feasibly be implemented in the area."

Because BACM is defined as the best level of control for an area, it may also meet the requirements for MSM. Clark County evaluated each BACM included in the PM_{10} SIP to ensure it met the requirements for MSM and achieved the maximum feasible emissions reductions. EPA interprets the nonattainment provisions of the CAAA as requiring more stringent control measures wherever feasible to offset longer time frames for attainment. To reduce the time frame for attainment, Clark County evaluated the effects of applying BACM level controls to de minimis (insignificant) sources and determined that additional controls on them would not accelerate the attainment date.

As part of the MSM analysis in Chapter 6 of the SIP, Clark County compared its control measures with the measures implemented for significant PM_{10} sources in five other serious nonattainment areas: Maricopa County in Arizona and the South Coast Air Quality Management District, San Joaquin Valley Unified Air Pollution Control District, Mojave Desert Air Quality Management District, and Imperial County Air Pollution Control District, all in California.

The control measures in these areas were the most stringent found for the same or similar significant sources requiring control in the Las Vegas Valley. DAQEM carefully scrutinized Maricopa Rules 310 and 310.1 (amended 2/16/00); South Coast Rule 403 (amended 12/11/98); and the BACM/MSM analysis in EPA's technical support document for the Maricopa County PM_{10} plan.

5.2.1 Commitments to Enhance Control Measures

Section 3 documents Clark County's fulfillment of its commitments in the PM_{10} SIP, along with specific actions taken to strengthen the county's AQR and enforcement programs. These include:

- Adding enforcement staff and developing new programs.
- Establishing more stringent visible emissions test methods.
- Adding requirements to the AQRs to improve control measure effectiveness.

5.2.2 Non-State Implementation Plan Requirements for Enhanced Control Measure Effectiveness

DAQEM conducted workshops with members of the public and regulated industry to determine what areas of the regulatory program were working well and what areas could be improved. As a result, Clark County had adopted program enhancements beyond those committed to in the SIP by the end of March 2003. The following sections outline these improvements.

5.2.2.1 Section 94 Soil Test Requirements

Section 94 did not originally require soils tests for construction sites, and allowed use of the PEP map in lieu of site-specific tests. Approved dust plans did not always require the proper BMP to achieve BACM-level emissions control, nor could proactive BACM-level control be achieved through corrective action orders issued in the field. To prevent these situations, Clark County amended Section 94 to require on-site soils testing for construction sites of 50 acres or more. The county also contracted with a geotechnical consultant to prepare improved PEP maps using a much larger body of soil test data. Although the improved maps made the soil test requirements redundant, the increased emphasis on identifying the correct site-specific PEP for each dust control permit has proven highly successful.

5.2.2.2 Track-out Controls

The measure to control track-out—dirt tracked onto paved roads from construction sites—did not meet initial expectations. Section 94 now requires immediate cleanup of track-out extending more than 50 ft or accumulating to a depth of 0.25 in. or more. *Construction Activities Dust Control Handbook* revisions preclude certain practices, such as dirt curb ramps, that contributed to the problem.

5.2.2.3 Dust Control Monitors

Section 94 did not originally require the presence of qualified dust control monitors during construction activities. Monitors were required for sites of 50 acres or more, but the regulation did not specify when they had to be available or present. The revised requirement specifically states that a qualified, authorized dust control monitor must be available when construction activities occur at a site. Construction site operators have become much more effective at self-policing under this revision.

5.2.2.4 Improved Clarity and Readability

Section 94 was rewritten to improve its readability and clarity, which improved the regulated community's understanding of it significantly. The regulation now serves as a benchmark for other air regulatory agencies and industry trade groups.

5.2.2.5 New *Construction Activities Dust Control Handbook*

This document, which replaced the 2001 "Best Management Practices Handbook," clarifies which BMP are mandatory for each construction activity. Soil PEP and BMP are more tightly integrated (see Section 5.2.2.1). New BMP include a prohibition on explosive blasting when forecasted winds are 25 mph or higher, and a requirement for wind barriers on sites of 5 acres or less. A new BMP for saw cutting is also included. A new BMP prohibiting dirt curb ramps, although resisted by industry and public works agencies, has been highly effective.

5.2.3 Natural Events Action Plan for High Wind Conditions

Section 7 describes the NEAP developed for high wind events. The NEAP employs SIP control measures, public notifications, and enforcement measures to control anthropogenic sources of dust as stringently as possible during a high wind event. The program also applies to permitted stationary point sources. The Clark County NEAP program is very successful, and other air quality agencies have modeled their programs after it.

5.3 SUMMARY

This section described how Clark County's control measures have met or exceeded the BACM and MSM requirements mandated by the CAAA. Many of the county's control measures have gone beyond legal mandates and SIP commitments. Because of this community effort, Clark County has attained the PM_{10} standard in the windy, arid Mojave Desert. Clark County's SIP control measures and regulatory programs are widely recognized as models for control of coarse-fraction PM_{10} emissions.

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6.0 MODELING

The PM_{10} SIP modeled attainment of the annual PM_{10} standard at the end of 2001, and the 2004 "Rate of Further Progress Report" documented attainment of the standard.

6.1 MODEL SELECTION

Clark County used rollback modeling to demonstrate attainment of the 24-hour and annual average NAAQS in the PM_{10} SIP. Although this is not one of EPA's preferred methods for attainment demonstration, more sophisticated models—dispersion modeling, source/receptor models (CMB), and advanced regional models (Urban Airshed)—do not offer significant improvements in demonstrating attainment under the arid conditions that prevail in the Las Vegas Valley. In a 1995 DRI study, CMB receptor modeling showed that fugitive dust accounted for 80-90 percent of the PM_{10} contribution in Clark County. In this case, standard receptor modeling does not give enough information to base an attainment demonstration on. CMB receptor modeling depends on relative chemistry to distinguish one source from another, so it cannot differentiate between soil entrained from construction activities and soil entrained from vehicles or wind erosion.

The effectiveness of dispersion modeling is problematic because of the uncertainties in PM_{10} emission factors and activity levels. It is possible that applying a dispersion model to a microscale area might have given a better idea of relative source contributions than a proportional rollback model based only on the emission inventory; however, dispersion models would have required substantially more resources and time, along with the development of meteorological inputs. The uncertainties from emission factors and activity levels offset the potential for more information on source contributions, and the extra resources required for dispersion modeling made it impractical for the PM_{10} SIP.

Therefore, Clark County used the proportional rollback model with microscale inventories for the SIP attainment demonstration. Sources within a relatively short distance (1-2 km) were assumed to contribute the most to the ambient concentration measured at a monitor. The inventories for the proportional rollback model covered sources in an area with a 2-km radius that centered on a monitoring station.

In 2006, Clark County contracted with UNLV to streamline the proportional rollback model. The SIP model consisted of nine separate spreadsheets and required transferring emissions from one spreadsheet to another to complete the final calculations. This process introduced human error, was difficult to follow, and required a considerable amount of time. The model had a limited ability to perform scenario tests, and every parameter change required saving an additional set of files. This section provides an overview of the new model and its development; Appendix H describes the model in detail.

6.2 PROPORTIONAL ROLLBACK MODEL

The proportional rollback model assumes a linear relationship between PM_{10} emissions and their contribution to measured ambient PM_{10} levels: i.e., if 25 percent of an area's emissions come from wind erosion of vacant land, the model assumes that 25 percent of the ambient concentration measured by a monitor in the area—minus the background, which remains constant—came from wind-entrained soil. For example, construction activity emissions of 20 tons were calculated on the day a monitor in the area recorded an ambient concentration of 120 $\mu g/m^3$. The total inventory for the area was 100 tons, so construction activities represented 20 percent. Using the proportional rollback model approach, the relative contribution of construction activities to the ambient measured concentration was 24 $\mu g/m^3$ (20 percent). If control measures reduce construction activity emissions by 50 percent, the proportional rollback model assumes the relative contribution from those activities will also be reduced by 50 percent (e.g., to 12 $\mu g/m^3$). The ambient concentration would be reduced by the same amount, to 108 $\mu g/m^3$. The basic steps for the rollback model are:

1. Determine representative monitoring station(s) and design value.
2. Define background as the lowest PM_{10} value recorded at an upwind monitoring location on the same day or during the same time period.
3. Prepare a microscale inventory of the sources emitting PM_{10} in the time period the monitor measured.
4. Calculate the percentage for each source based on the entire inventory.
5. Calculate the relative contribution from each source to the concentration measured during the time period.
6. Estimate the anticipated increase or decrease in emissions from each source.
7. Apply the same percentage of increase or decrease from each source to the relative contribution calculated for the same source.
8. Calculate the anticipated ambient concentration after emissions change.

6.3 SYSTEM DYNAMICS ROLLBACK MODEL

DAQEM needed a modeling tool that was easier to communicate to others and allowed for input value updates. It selected a system dynamics representation as an alternative, with the goal of providing a more flexible modeling tool. The system dynamics model was not intended to change the mathematical process by which emissions were calculated but to improve the usability of the original model, which reflects the rollback methodology previously approved by EPA. A system dynamics model evaluates the consequences of policy changes in a system. It represents cause-and-effect relationships in the real world through mathematical equations.

System dynamics models help examine the way a system changes over time, and focus on trends rather than specific data points. Various software packages can simulate these models; DAQEM used Vensim® PLE Plus, version 5.4 (2003), from Ventana Systems. The software checks that all equations are dimensionally consistent and adhere to the laws of conservation of matter. Different scenarios can easily be simulated and saved. Lastly, the software can easily update parameter values and add new structural aspects to the model as systems become better understood or quantified. To validate the model, its output was compared to the spreadsheet values from the proportional rollback model. Appendix H contains the complete description and documentation of the systems dynamic model used for this report.

6.4 MODELING RESULTS FROM THE 2001 STATE IMPLEMENTATION PLAN

6.4.1 Attainment Emissions Inventories and Percentage Reductions

The PM_{10} SIP projected 2006 emissions inventories and used them to model ambient air concentrations. Table 6-1 contains the valley-wide emissions inventories and microscale inventories from the SIP.

Table 6-1. 24-Hour PM_{10} Attainment Levels by Location

Location	Design Day Emission Inventory (tons)	Reduction to Meet 24-Hour NAAQS (tons)	Reduction from Man-made Sources to Meet 24-Hour NAAQS (tons)	24-Hour Attainment Levels to Meet NAAQS (tons)
Valley-wide	719.78	335.42	348.37	371.41
Craig Road	15.65	6.40	7.18	8.47
East Flamingo	11.94	2.46	3.09	8.85
Green Valley	33.58	15.65	16.82	16.76
J.D. Smith	27.57	8.60	10.86	16.71
Pittman	19.62	7.30	8.71	10.91

Table 6-2, also from the SIP, shows the reduction percentages necessary at each location to attain the 24-hour NAAQS (150 $\mu g/m^3$). The total required reduction was 131 $\mu g/m^3$ (46.6 percent).

Table 6-2. 24-Hour Attainment Percent and Concentration Reductions

Location	Design Value ($\mu g/m^3$)	Percent Reduction for Attainment	Concentration Reduction for Attainment ($\mu g/m^3$)	Percent Reduction From Man-made Sources
Valley-wide	281	46.6	131	48.4
Craig Road	254	40.9	104	45.9
East Flamingo	189	20.6	39	25.9
Green Valley	281	46.6	131	50.1
J.D. Smith	218	31.2	68	39.4
Pittman	239	37.2	89	44.4

6.4.2 24-hour Background Concentration

Background concentrations are assumed to be consistent from year to year, and not subject to control strategies. They mostly come from natural PM_{10} sources that cannot be controlled, such as windblown dust from native desert parcels outside the BLM disposal area.

To determine the 24-hour background concentration, DAQEM selected the lowest concentration in the monitoring network on the design day. Once the lowest concentration had been determined, the wind roses for the design day (PM_{10} SIP, Appendix D) were reviewed to ensure the measurement had been made upwind. The 24-hour background concentration was calculated to be 10.5 $\mu g/m^3$.

6.4.3 24-Hour Design Value and Concentration

Design values are used to determine the level of control needed to demonstrate attainment of the PM_{10} NAAQS for a particular site or receptor. DAQEM determined the 24-hour valley-wide design value in accordance with the procedures in 40 CFR 50, Appendix K, and the *PM_{10} SIP Development Guideline* (EPA 1987). It selected the design value of 281 $\mu g/m^3$ because it was the highest value out of all the third-highest PM_{10} concentrations measured at the five microscale monitoring sites used in the PM_{10} SIP, and it was the sixth highest value overall in the monitoring network. DAQEM calculated the design concentration for the rollback model by subtracting the background concentration value from the design value, for a final design concentration value of 270.5 $\mu g/m^3$ (281 $\mu g/m^3$ - 10.5 $\mu g/m^3$ = 270.5 $\mu g/m^3$).

6.4.4 Attainment Modeling Results

The PM_{10} SIP modeled the 2006 projected emissions inventory to demonstrate attainment, but used the wrong inventory in its calculations. The demonstration of attainment of the annual PM_{10} standard in 2001 correctly used the design day emissions inventory to do the proportional rollback. However, the demonstration of attainment of the 24-hour PM_{10} standard in 2006 incorrectly used the uncontrolled projected 2006 emissions inventory instead of the design day inventory. Background PM_{10} was thus included in the 24-hour attainment demonstration calculations, and the SIP overestimated the attainment emissions inventory (see Table 5-10 in the PM_{10} SIP and Table 6-1 in the MAR). Table 6-3 shows the projected 2006 emissions inventory from the PM_{10} SIP.

Table 6-3. Projected 2006 24-Hour BLM Disposal Area Controlled PM_{10} Emissions and Design Concentration Contributions—PM_{10} SIP

Sources	PM_{10} (TPD)	Controlled PM_{10} (TPD)	Percent Reduction	Impact on Design Concentration ($\mu g/m^3$)
Stationary Point Sources				
Sand & gravel operations	1.72	1.72	0.00	1.18
Utilities–natural gas	0.55	0.55	0.00	0.37
Asphalt concrete manufacture	0.47	0.47	0.00	0.32
Industrial processes	0.22	0.22	0.00	0.15
Other sources	0.34	0.34	0.00	0.23
Subtotal	***3.29***	***3.29***	***0.00***	***2.25***
Stationary Area Sources				
Small point sources	0.50	0.50	0.00	0.35
Residential firewood	1.12	1.12	0.00	0.77
Residential natural gas	0.25	0.25	0.00	0.17

Table 6-3. Projected 2006 24-Hour BLM Disposal Area Controlled PM_{10} Emissions and Design Concentration Contributions—PM_{10} SIP (continued)

Sources	PM_{10} (TPD)	Controlled PM_{10} (TPD)	Percent Reduction	Impact on Design Concentration ($\mu g/m^3$)
Commercial natural gas	0.09	0.09	0.00	0.06
Industrial natural gas	0.04	0.04	0.00	0.03
Natural gas purchased at the source & carried by Southwest Gas Co.	0.58	0.58	0.00	0.39
Structural/vehicle fires & wildfires	0.07	0.07	0.00	0.04
Charbroiling/meat cooking	2.84	2.84	0.00	1.94
Disturbed vacant lands/unpaved parking lots	19.30	5.40	-72.00	3.70
Native desert fugitive dust	0.00	0.00	0.00	0.00
Stabilized vacant lands dust	1.09	1.09	0.00	0.75
Construction activity fugitive dust	40.70	13.02	-68.00	8.93
Windblown construction dust	90.34	27.20	-69.89	18.64
Subtotal	***156.91***	***52.00***	***-66.73***	***35.77***
Non-road Mobile Sources				
Airport support equipment	0.14	0.14	0.00	0.10
Commercial equipment	0.00	0.00	0.00	0.00
Construction & mining equipment	1.36	1.36	0.00	0.94
Lawn & garden equipment	0.05	0.05	0.00	0.03
Railroad equipment	0.05	0.05	0.00	0.04
Recreational equipment	0.00	0.00	0.00	0.00
McCarran International Airport	0.57	0.57	0.00	0.39
Henderson Executive Airport	0.02	0.02	0.00	0.01
North Las Vegas Airport	0.07	0.07	0.00	0.05
Nellis Air Force Base	0.09	0.09	0.00	0.06
Subtotal	***2.36***	***2.36***	***0.00***	***1.62***
On-road Mobile Sources				
Paved road dust (includes construction track-out)	161.70	114.86	-28.97	78.71
Unpaved road dust	55.11	19.50	-64.61	13.36
Highway construction projects	4.90	1.57	-68.00	1.07
Highway construction projects–wind erosion	7.20	2.22	-69.17	1.52
Vehicle sulfate PM	1.52	1.52	0.00	1.04
Vehicle tire wear	0.32	0.32	0.00	0.22
Vehicle brake wear	0.51	0.51	0.00	0.35
Vehicle exhaust	0.91	0.91	0.00	0.62
Subtotal	***232.16***	***141.40***	***-39.09***	***96.90***
Background				**10.5**
TOTAL	**394.72**	**199.25**	**-49.52**	**147.04**

6.5 MODELING RESULTS FROM THE 2006 MILESTONE ACHIEVEMENT REPORT

6.5.1 2006 24-Hour Controlled PM_{10} Emissions and Attainment Concentration Contributions in the Bureau of Land Management Disposal Area

The attainment modeling for this MAR used the 2006 emissions inventory in Section 4. The model rolls back the ambient concentration using the design day (12/21/98) ambient concentration and emissions inventory. Table 6-4 shows the results.

Table 6-4. 2006 24-Hour Controlled PM_{10} Emissions and Attainment Concentration Contributions in the BLM Disposal Area—MAR

Source	Uncontrolled PM_{10} (TPD)	Controlled PM_{10} (TPD)	Percent Reduction	Design Concentration Impact (μg/m^3)
Stationary Point Sources				
Sand & gravel operations	1.72	1.72	0.00%	0.65
Utilities–natural gas	0.55	0.55	0.00%	0.20
Asphalt concrete manufacture	0.47	0.47	0.00%	0.18
Industrial processes	0.22	0.22	0.00%	0.08
Other sources	0.34	0.34	0.00%	0.13
Subtotal	***3.29***	***3.29***	***0.00%***	***1.24***
Stationary Area Sources				
Small point sources	0.5	0.50	0.00%	0.19
Residential firewood	1.12	1.12	0.00%	0.42
Residential natural gas	0.25	0.25	0.00%	0.09
Commercial natural gas	0.09	0.09	0.00%	0.03
Industrial natural gas	0.04	0.04	0.00%	0.02
Natural gas purchased at the source & carried by Southwest Gas Co.	0.58	0.58	0.00%	0.22
Structural/vehicle fires & wildfires	0.07	0.07	0.00%	0.03
Charbroiling/meat cooking	2.84	2.84	0.00%	1.07
Soil microbial activity/biological sources	0.00	0.00	0.00%	0.00
Disturbed vacant lands/unpaved parking lots	131.75	36.89	72.00%	13.86
Native desert fugitive dust	0	0.00	0.00%	0.00
Stabilized vacant lands dust	59.78	59.78	0.00%	22.47
Construction activity fugitive dust	12.78	4.09	68.00%	1.54
Windblown construction dust	136.16	39.49	71.00%	14.84
Subtotal	***345.96***	***145.74***	***57.87%***	***54.77***
Non-road Mobile Sources				
Airport support equipment	0.036	0.04	0.00%	0.01
Commercial equipment	0.19	0.19	0.00%	0.07
Construction & mining equipment	2.4	2.40	0.00%	0.90
Lawn & garden equipment	0.75	0.75	0.00%	0.28
Railroad equipment	0.0016	0.00	0.00%	0.00

Table 6-4. 2006 24-Hour Controlled PM_{10} Emissions and Attainment Concentration Contributions in the BLM Disposal Area—MAR (continued)

Source	Uncontrolled PM_{10} (TPD)	Controlled PM_{10} (TPD)	Percent Reduction	Design Concentration Impact ($\mu g/m^3$)
Recreational equipment	0.136	0.14	0.00%	0.05
Aircraft emission all airports	0.29	0.29	0.00%	0.11
Nellis Air Force Base	0.09	0.09	0.00%	0.03
Subtotal	***3.89***	***3.89***	***0.00%***	***1.46***
On-road Mobile Sources				
Paved road dust (includes construction track-out)	83.53	59.31	29.00%	22.29
Unpaved road dust	9.34	3.27	65.00%	1.23
Highway construction projects activities	1.34	0.43	68.00%	0.16
Highway construction projects–wind erosion	3.13	0.91	71.00%	0.34
Vehicle sulfate PM	0.022	0.02	0.00%	0.01
Vehicle tire wear	0.369	0.37	0.00%	0.14
Vehicle brake wear	0.549	0.55	0.00%	0.21
Vehicle exhaust	0.527	0.53	0.00%	0.20
Subtotal	***98.81***	***65.38***	***33.83%***	***24.57***
TOTAL	**451.95**	**218.30**	**51.70%**	**82.04**
Background				**10.5**
Ambient PM_{10} ($\mu g/m^3$)				**92.54**

The rollback model uses the same background concentration (10.5 $\mu g/m^3$) and predicts an ambient concentration of 92.54 $\mu g/m^3$ for a controlled inventory of 218.3 tons per day.

6.5.2 Model Performance

To measure the ability of the proportional rollback model to predict ambient levels of PM_{10}, actual ambient 2006 concentrations must be compared to predicted 2006 concentrations using a system design value. EPA (1987) guidelines require using the sixth-highest monitored value in a consecutive three-year period to determine the systemwide ambient concentration (i.e., design value). Clark County's sixth-highest value in 2006 occurred at the Walter Johnson monitoring station on May 22. The value was 106 $\mu g/m^3$, compared to the model's predicted value of 92.54 $\mu g/m^3$. The variance of 13.46 $\mu g/m^3$ is 12.7 percent of the measured value, well within EPA's accepted performance goals of ±20 percent. This result confirms the accuracy of the proportional rollback model for the Clark County nonattainment area.

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7.0 NATURAL EVENTS ACTION PLAN

7.1 INTRODUCTION

EPA's Natural Events Policy describes its approach to protecting public health in areas where uncontrollable natural events, such as high winds, may cause violations of the PM_{10} NAAQS. The following principles guided the development of this policy:

- Protection of public health is the highest priority of federal, state, and local air pollution control agencies.
- The public must be informed whenever the air quality in the area is unhealthy.
- All valid ambient air quality data should be submitted to EPA.
- State and local agencies must take appropriate, reasonable measures to safeguard the public health regardless of the source of PM_{10} emissions.
- Emission controls should apply to sources that contribute to exceedances of the PM_{10} NAAQS when those controls will result in fewer exceedances.

Clark County and participating stakeholders followed these guiding principles in developing the county's NEAP. Protection of the public health is the highest priority of this document, and its foundation.

The NEAP contains detailed information about the programs and actions Clark County has implemented to minimize public exposure to potentially high levels of PM_{10} caused by wind. Its primary components are:

- High wind event notification system ("Wind Event Action Plan").
- Education and outreach programs.
- Enforcement program to reduce emissions.
- Submittal to EPA of required documentation and a system for justifying exceedances during high wind events.

7.2 SUCCESSES

Clark County submitted the NEAP to EPA on April 18, 2005. On 13 qualifying days that year, DAQEM notified the media, the school district, the health district, and medical facilities countywide of potential high wind events. It also sent out faxes to 1,400 stationary permitted sources and active dust permittees warning of high wind events and requesting they take additional measures to stabilize their sites. Because of the program's success, no high wind events caused PM_{10} exceedances in the Clark County NEAP coverage area during 2005.

On 14 qualifying days in 2006, DAQEM released media advisories and sent faxes to stationary permitted sources and active dust permittees. Again in 2006, no validated natural events resulted in PM_{10} exceedances in the Clark County NEAP coverage area.

Validated natural events occur when winds are strong enough to overwhelm native desert areas, resulting in PM_{10} exceedances. The NEAP justification package to EPA includes meteorological data, hourly PM_{10} mass data compared to wind data, precipitation data, maps and air photos, photos showing visible emissions, and documentation that BACM were implemented for anthropogenic sources. In the past four years, Clark County has had eight validated natural events (Table 7-1). Despite numerous qualifying events during the past two years, there were no exceedance events in 2005 and 2006 that required NEAP justification packages (Table 7-2).

Table 7-1. Natural Events Action Plan Days (2002–2004)

Date	Event
March 1, 2002	High wind
March 13, 2002	High wind
April 15, 2002	High wind
April 17, 2002	High wind
October 29, 2003	High wind
October 30, 2003	High wind
April 28, 2004	High wind
May 11, 2004	High wind

Source: Clark County NEAP.

Table 7-2. Natural Event Action Plan Impacts (2004–2006)

Month	2004		2005		2006	
	No. Days Wind Threshold Met[1]	No. Days Exceedance Measured	No. Days Wind Threshold Met[1]	No. Days Exceedance Measured	No. Days Wind Threshold Met[1]	No. Days Exceedance Measured
Jan	0	0	0	0	0	0
Feb	0	0	0	0	1	0
Mar	0	0	3	0	1	0
Apr	2	1	2	0	2	0
May	5	1	3	0	1	0
Jun	3	0	3	0	1	0
Jul	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sep	3	0	2	0	3	1[3]
Oct	2	0	0	0	2	0
Nov	3	0	0	0	2	0
Dec	1	0	0	0	1	0
TOTAL	**19**	**2**[2] *[2]*	**13**	**0**	**14**	**1**[3]

[1]Threshold wind velocity = sustained winds of 25 mph or more and gusts of 40+ mph. Advisory system is activated when winds are 20-30 mph and/or gusts are near 40 mph.
[2]Italicized number in brackets = number of justification packages that were submitted to EPA and received concurrence.
[3]Exceedance did not meet the threshold to be classified as a high wind event.

7.3 COMMUNITY OUTREACH

DAQEM has issued air quality alerts during the high wind season since March 2003. Other activities include expanding public education efforts—for example, training local weather news media in air quality reporting. DAQEM also meets with city, county, and local environmental and health professionals to devise improved ways to reach and educate the community on the impacts of blowing dust. The department issues press releases as needed and provides a Speakers Bureau, real-time website information, and public service announcements. DAQEM will also continue to build partnerships with local businesses.

7.3.1 School and Youth Outreach

DAQEM established a school and youth outreach program during 2004 that includes classroom and youth group presentations, teacher training, and air quality information packets. The packets include a section on high wind events and steps to avoid exposure to fugitive dust.

7.3.2 Annual Community Events

DAQEM participates actively in community events (Tables 7-3 through 7-6) to raise public awareness of efforts to reduce blowing dust and its impacts. At these events, DAQEM sets up a booth display staffed by air quality professionals to distribute materials, including the NEAP brochure, and answer any questions the public may have.

7.3.3 Industrial Education and Outreach

DAQEM provides dust classes to local contractors and other major PM_{10} sources to familiarize them with the county's AQRs, effective ways to reduce PM_{10} emissions, and air pollution health effects. Each participant receives a dust card and Certificate of Completion after finishing the course. DAQEM conducted 96 dust control classes in 2004, 89 classes in 2005, and 93 classes in 2006. Since the program's start in 1997, more than 22,000 people have attended these classes.

7.4 PUBLIC EDUCATION EFFORTS

Since 2003, DAQEM has participated in many outreach events designed to educate the public on protecting air quality. These events stress avoiding behaviors that disturb native desert and open areas, leading to unhealthy dust levels during wind events.

Actions taken to develop the education program include:

- Distribution of an informational health-related brochure to the public at large, and to sensitive populations in particular (e.g., children, the elderly, the chronically ill). DAQEM began handing out "*Dust Storms and Your Health: What Everyone Should Know*" in April 2003. The brochure is available in both English and Spanish.

- Distribution of *"Protecting the Air We Share"* at public outreach and community events began in March 2003. This brochure provides information on the six criteria pollutants, defines particulate matter, and discusses air quality tips.

Table 7-3. 2003 Outreach Events

Event	Date
TIMET Open Forum	3/6
ECO-Jam 2003 (formerly Earth Day)	4/19
Henderson 50th Anniv. Parade	4/26
RTC Bike Party in the Park	5/31
Clark Co. Health Fair	6/10
Clark Co. Red, White & Boom at Desert Breeze Park	7/4
RTC Clean Air Month	7/1–31
Belz Mall Back-to-School Fair	7/26
Western Planning Experience Conference	8/6-8
NLV Annual Back-to-School Health/Ed. Fair	8/23
Silverado High Student Mixer	9/18
Day with the Experts	10/11
LV Century Bicycle Ride/RTC Bikefest	10/18
RTC Horizon Awards	12/10

Table 7-4. 2004 Outreach Events

Event	Date
Desert Demo Gardens Breakfast (Conservation District of So. NV)	3/13
RTC Carpool Madness Month	3/1–21
Clark County Fair	4/8–11
Summerlin EarthFaire (formerly Earth Day)	4/17
So. NV Homebuilders Fair	4/20
Clark Co. Health & Wellness Fair	6/8–9
NLV 6th Annual Back-to-School Health/Ed. Fair	8/14
RTC Rally in Boulder City	8/25
Farm Festival	9/21–23
Day with the Experts	10/16
LV Century Bicycle Ride/RTC Bikefest	10/16
Safety Week Fair at Sam's Club	10/23
RTC Try Transit Week	10/24–30
Fremont St./Neonopolis – RTC	10/27
Trails Day in Boulder City	10/29
Grand Opening of Acacia Demo Gardens	11/20
RTC Horizon Awards	12/8

Table 7-5. 2005 Outreach Events

Event	Date
Growth Task Force Open House	1/22
So. NV Homebuilders Show	3/1
Desert Demo Gardens Breakfast (Conservation District of So. NV)	3/19
Venetian Health Fair	4/6
Clark County Fair	4/7–10
UNLV Earth Day	4/22
Summerlin EarthFaire (formerly Earth Day)	4/23
Henderson Springsational Heritage Parade	4/23
Boy Scout Jamboree	4/23
Spring Mountain Ranch State Park Earth Fair	4/24
Komen Race for the Cure	5/7
Moapa Days	5/7
Silverton Hotel Health Fair	5/12
Henderson Wheels on Water St.	5/21
Clark Co. Health & Wellness Fair	5/25-26
Heritage Corridor Family Hike	5/28
NLV 6th Annual Back-to-School Health/Ed. fair	8/13
RTC/Boulder City Club Ride Rally	8/25
Christmas Jubilee	9/17
Farm Festival	9/20–22
Day with the Experts at Acacia Gardens	9/24
World of Women Expo	10/8
Sam's Club Health Fair	10/15
Day with the Experts at Desert Demo Gardens	10/15
Trails Day in Henderson	10/22
Community College of So. NV Environmental Fair	11/2
Griffith Elementary Community Fair	11/5
RTC Horizon Awards	12/7

Table 7-6. 2006 Outreach Events

Event	Date
Preview Las Vegas (Chamber of Commerce)	2/2
Women's' Fair (Infinity)	2/11
So. NV Homebuilders Show	2/28
Spring Celebration at the Gardens	3/18
Community College of So. NV Gardening Show/Sale	3/25
Clark Co. Health & Wellness Fair	3/30–31
Spring Mountain Ranch State Park Earth Fair	4/1
Clark County Fair	4/5–9
St. Rose Environmental Fair	4/19
UNLV Earth Fair	4/21
Summerlin EarthFaire (formerly Earth Day)	4/22
Henderson Springsational Heritage Parade	4/22
Boy Scout Jamboree	5/6
Komen Race for the Cure	5/6
Air & Waste Mgmt. Association Symposium	5/24–25
Summer of Fun	5/27
Chamber of Commerce Business Expo	6/7
4th Annual Girls Day Out	6/24
Beauty Health Fitness Expo	6/24-25
Meet Your Community Day	8/15
NLV 8th Annual Back-to-School Health/Ed. Fair	8/19
RTC/Boulder City Club Ride Rally	8/24
End of Summer Bash at the Cannery Hotel	9/2
HSBC Environmental Day	9/7
Ice Cream Sunday	9/10
Chilean Independence Day	9/17
Las Vegas Mixer	9/19
Summerlin Ice Cream Festival	9/23
Henderson National Trails Day	10/14
Day with the Experts at Acacia Gardens	10/14
Farm Festival	10/17–19
Goshen Community Family Affair	10/21

8.0 RESEARCH PROGRAMS AND INNOVATIONS

8.1 INTRODUCTION

Section 3 discusses research projects carried out by DAQEM between 2001 and 2006 to fulfill PM_{10} SIP commitments. This section describes ongoing, innovative PM_{10} projects, such as original research on vehicle-based methods for measuring paved road emissions; use of satellite imagery to develop open area/undeveloped land inventories and classify them by soil stability; and collaboration with other agencies and industry groups in developing standards for dust suppressants.

8.2 ONGOING PROJECTS

8.2.1 Paved Road Dust Emissions

Innovations from this work include development of baseline data sets and data analysis justifying the use of vehicle-mounted continuous measurement mobile sampling systems to measure paved road dust emissions. DAQEM recently completed the Phase IV empirical assessment of these systems and presented its findings at the EPA's 16th Annual International Emissions Inventory Conference. Following the conference, DAQEM and EPA initiated a peer review of the study report. DAQEM will continue to work with other agencies in developing mobile technologies to improve the characterization of paved road dust emissions estimates. It will also collaborate with interested air quality agencies, metropolitan planning agencies, transportation departments, and other organizations, including the Western Regional Air Partnership and the National Association of Clean Air Agencies, to develop the information these organizations need to approve alternative-technology systems for measuring and inventorying entrained road dust.

8.2.2 Soil Surface Characterization

After EQM completed the soil surface characterization study on open areas and vacant land in HA-212, Clark County entered into a second contract to characterize soil surfaces in other priority areas using the same satellite imagery methodology. The additional characterizations will provide a better understanding of transport emissions during high wind events and aid in site-specific planning.

8.2.3 Dust Suppressant Products

Clark County continues to work with other agencies and industry groups to develop standards for dust suppressants. DAQEM provided staff support for EPA's Regional Applied Research Effort dust suppressant study through the end of 2006. The Western Transportation Institute recently invited DAQEM to participate in a dust stabilization and suppression summit planned for late 2007, and DAQEM has tentatively agreed to participate.

8.3 RESEARCH INNOVATIONS

DAQEM was an early evaluator of vehicle-mounted systems for measuring paved road dust emissions. Clark County is the only entity that has evaluated the two leading systems in conjunction with AP-42 silt sampling. The Phase IV study took the evaluation further by sampling a test track using three vehicle-mounted continuous measurement systems, AP-42 sampling methods, and external tower measurement methods, then comparing the results. DAQEM conducted all sampling under controlled conditions with no external traffic, controlled vehicle speeds, and controlled silt loadings on the road surface. Ancillary measurements included depletion rates (using fluorescent dye sampling) and silt loading (using the Portable In Situ Wind Erosion Lab system developed by DRI). Data from this study will help document the validity of measurements from vehicle-mounted continuous measurement mobile sampling systems.

DAQEM's initial approach to evaluating windblown dust emissions from open areas and vacant lands, though innovative, lacked sufficient field sampling. The SIP committed DAQEM to researching alternative approaches for characterizing the surfaces of open areas and vacant lands. After extensive research and consultation, DAQEM developed a research project that used satellite imagery to develop reliable soil surface characterizations in the PM_{10} nonattainment area (see Appendix D for details). This innovative approach for characterizing soil surface stability may provide other agencies with a more accurate means of characterizing windblown emissions potential from similarly diverse land surfaces.

8.4 SUMMARY

The dry desert climate and rapid population growth contributed to high PM_{10} concentrations in Clark County for more than a decade, and made reducing these concentrations a challenge. In response, DAQEM developed a number of innovative approaches for accurately estimating and controlling particulate emissions. Developing these new approaches required scientific research beyond what is normally done by local air regulatory agencies, but the innovations in Section 8.3 have made Clark County a national leader in the measurement and control of PM_{10} emissions and enabled it to consistently attain the PM_{10} NAAQS.

9.0 REQUEST FOR CLEAN DATA FINDING / FINDING OF ATTAINMENT FOR THE 24-HOUR PM_{10} STANDARD

9.1 INTRODUCTION

Clark County requests an attainment/clean data finding for the 24-hour PM_{10} NAAQS.

Title I, Part D, Subpart 4, Section 189(b)(C)(2) of the CAAA states:

> Not later than 90 days after the date on which a milestone applicable to the area occurs, each State in which all or part of such area is located shall submit to the Administrator a demonstration that all measures in the plan approved under this section have been implemented and that the milestone has been met. A demonstration under this subsection shall be submitted in such form and manner, and shall contain such information and analysis, as the Administrator shall require. The Administrator shall determine whether or not a State's demonstration under this subsection is adequate within 90 days after the Administrator's receipt of a demonstration, which contains the information and analysis required by the Administrator.

This section contains supporting documentation that the attainment/finding request is justified and CAAA requirements for granting an clean data/attainment finding have been met.

9.2 COMPLIANCE WITH REQUIREMENTS AND COMMITMENTS

This report confirms that the PM_{10} SIP for the Las Vegas Valley complies with all requirements in sections 172 and 189 of the CAAA relating to "serious" PM_{10} nonattainment areas. Section 5 documents the adoption and implementation of control measures designed to attain the PM_{10} NAAQS by the milestone achievement date of December 31, 2006. These constitute the BACM and Reasonably Available Control Measures for all significant sources of PM_{10}.

Sections 2, 3, 4, and 6 (and corresponding appendices) present technical support documentation, documentation of SIP commitment completion, emissions inventories, , and attainment demonstration modeling, in accordance with EPA regulations, guidelines, and policies. Section 6 contains a modeled demonstration of attainment, showing attainment of the 24-hour PM_{10} standard at the end of 2006.

A review of the ambient air quality data for the last three consecutive years (2004-2006) shows that Clark County has attained the 24-hour PM_{10} standard and continues to meet the annual PM_{10} standard. Section 2 offers a detailed analysis of this data.

Since PM_{10} in the Las Vegas Valley is dominated by geologic materials, the SIP focused on controlling dust from four significant sources: disturbed open areas, construction activities, paved roads, and unpaved roads. Sections 90, 91, 92, 93, and 94 of the AQRs fully implemented controls on these sources.

The emission reductions from the revised AQRs enabled Clark County to attain the annual PM_{10} standard by the extended CAAA deadline. As modeled in Chapter 5 of the SIP and documented in Section 6 of this report, Clark County attained the 24-hour PM_{10} standard by the milestone achievement date of December 31, 2006.

9.2.1 24-Hour Concentrations in 2006 and the Attainment Demonstration

Section 2 presents the 24-hour PM_{10} concentrations in the BLM disposal area for the 2006 attainment year. The proportional rollback modeling described in Section 6 demonstrates that 24-hour concentrations in the BLM disposal area are below the 24-hour PM_{10} NAAQS of 150 $\mu g/m^3$.

9.3 SUMMARY

The documentation in this report supports a clean data/attainment finding from the EPA. Clark County has met all its SIP commitments and implemented the most stringent PM_{10} control program in the nation. The ambient air quality data collected from 2004 to 2006 demonstrates the county's attainment of both the annual and the 24-hour PM_{10} NAAQS; therefore, Clark County requests that EPA issue a clean data/attainment finding.

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