Technical Support Document

CARBON MONOXIDE MODELING
FOR THE CLARK COUNTY MAINTENANCE PLAN

Prepared for

Clark County
Department of Air Quality and Environmental Management
500 S. Grand Central Parkway
PO Box 551776
Las Vegas, NV 89155-1776

Prepared by

Chris Emery
Gary Wilson
Stella Shepard
John Grant

ENVIRON International Corporation
773 San Marin Drive, Suite 2115
Novato, CA 94998

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1. INTRODUCTION

1.1 BACKGROUND

The Las Vegas Valley is a large desert basin at about 2000 feet elevation, surrounded by mountain ranges up to 11,900 feet, making it quite susceptible to air pollution problems. This area includes the City of Las Vegas, the City of North Las Vegas, and the City of Henderson. The remainder constitutes unincorporated areas of Clark County. Clark County has been the fastest growing area of the United States over the past 50 years, with a current population of nearly 2,000,000 (UNLV, 2008). During the winter months, cold air masses stagnate over the region, and nightly temperature inversions trap pollutants within the valley. The overnight buildup of pollutants has historically caused violations of the national carbon monoxide standard in a limited area surrounding the East Charleston (now Sunrise Acres) monitoring station. This monitoring site in the vicinity of converging major transportation corridors named the "Five Points," where three state highways intersect. Additionally, the site is located within a local depression where air pollution often collects.

The 1990 Clean Air Act Amendments (CAAA) established two National Ambient Air Quality Standards (NAAQS) for carbon monoxide (CO). The first sets a maximum allowable concentration of 35 parts per million (ppm) averaged over 1 hour, and the second sets a maximum concentration of 9 ppm[1] averaged over 8 hours. Areas that exceed one or both of the ambient standards more than two times in a two-year period are in violation and are thus classified as non-attainment areas for carbon monoxide.

Although the Las Vegas Valley has never exceeded the 1 hour CO NAAQS, it has previously exceeded the 8 hour standard at least once per year on a winter seasonal basis. The last exceedance of the 8-hour standard occurred in 1998 in the Five Points area and measured 10.3 ppm. There have been no CO exceedances since 1998. This downtrend is the direct result of the implementation of local CO control measures and the tighter federal motor vehicle emission standards.

1.1.1 CO Regulatory History

The number and severity of historical 8-hour CO violations caused the U.S. Environmental Protection Agency (EPA) to automatically designate the Valley as a "moderate" nonattainment area upon enactment of the 1990 CAAA on November 15, 1990. Moderate nonattainment areas were required to implement emission control measures as "expeditiously as practicable" in order to attain the CO NAAQS by December 31, 1995. Clark County implemented the set of controls required by the Clean Air Act for CO nonattainment areas, and made great strides towards attaining the 8-hour standard. However, due to phenomenal growth within the Las Vegas Valley, it fell short of meeting the NAAQS by the applicable attainment date. EPA then granted Clark County a one year extension to demonstrate compliance with the NAAQS. Still, the Las Vegas Valley was not successful in achieving compliance by December 31, 1996.

[1] Note that when rounding is taken into account, the CO concentration required to exceed the 8-hour standard is 9.5 ppm.

According to CAAA requirements, the EPA reclassified the Las Vegas Valley as a "serious" nonattainment area for carbon monoxide on October 2, 1997. A deadline of May 1999 (18 months from the notice publication date) was set for submission of a State Implementation Plan (SIP) that demonstrated attainment by December 31, 2000. The resulting 2000 CO State Implementation Plan (SIP) for Clark County contained local measures for attaining the standards, including wintertime gasoline specifications. In June 2005 the EPA found that the valley had attained the standards by the applicable attainment date.

Later, Clark County submitted a 2005 CO SIP Revision, which included revised and improved methodologies for estimating on-road mobile source emissions (the chief component of CO emissions in the valley), and extended future year estimates of CO concentrations out to 2030 to demonstrate maintenance of the standards and to establish conformity emission budgets for multiple future years. No changes in actual control regulations were incorporated into the 2005 CO SIP Revision.

1.1.2 Previous CO Modeling

Between 1996-2000, the Clark County Department of Comprehensive Planning developed computer models for valley-wide carbon monoxide to provide technical support for the control measures being evaluated for the 2000 CO SIP. This modeling was developed and conducted according to CAAA requirements and followed EPA modeling guidance specific to 8-hour CO SIP demonstrations. Modeling was conducted for three historical CO episodes in 1995-96 using a combination of numerical models, each focusing upon a specific scale and issue. The Urban Airshed Model (UAM) was used to simulate episodic urban-scale CO patterns on a grid with 1-km spacing over the entire developed portion of the Las Vegas Valley; the CAL3QHC intersection model was used to simulate micro-scale CO patterns at the "Five Points" intersections; and the EDMS airport model was used to simulate fine-scale emissions and CO concentration patterns at the three civil airports in the area, including McCarran International Airport, North Las Vegas, and Henderson.

At the time, CO emissions from on-road mobile sources (by far the largest contributor to the overall emission inventory for Las Vegas) were estimated using a combination of EPA's MOBILE5b emission factor model, the Direct Travel Impact Model (DTIM), and vehicle volume information provided by the Regional Transportation Commission (RTC) via their TRANPLAN transportation demand model (TDM). Ultimately the 2000 CO SIP was based on modeling results for the single best performing episode of the three: the night of December 8-9 (Sunday-Monday), 1996.

In 2005, the Clark County Department of Air Quality and Environmental Management updated their UAM CO modeling and conformity analysis using the latest tools, data resources, and methodologies available to estimate CO emissions. From the revised modeling results, Clark County submitted the 2005 CO SIP Revision. Continuing with the use of the previous UAM/CAL3QHC/EDMS modeling datasets developed for the December 8-9, 1996 episode, specific updates to the emission inventories were made, including modifications to on-road mobile, non-road mobile, civil airports, railroads and point sources. New spatial distributions were developed for area sources from updated land use projections. The future years modeled in this update included: 2006, 2010, 2015, 2020, and 2030.

The greatest effort in the 2005 CO modeling update focused on the on-road mobile source inventory estimates. MOBILE5b was replaced by the latest version of the model, MOBILE6.2.03. The TRANPLAN TDM link-level traffic volumes were replaced with improved and broader datasets generated using the GIS-based TransCAD TDM. DTIM was replaced by two new programs, one to process the link-based emissions and another to process start and intra-zonal emissions based on traffic analysis zones (TAZ). Additionally, NEVES-based non-road emission estimates were replaced with EPA's NONROAD2004 model, run with Clark County input data and activity profiles. Railroad estimates were improved based on a study conducted by Mactec (2003). Finally, improvements were incorporated for the CO emission inventories from the three civil airports. The latest version of EDMS was used, which introduced the AERMOD dispersion model and included emission factor inputs from MOBILE6.2.

1.2 MODELING FOR THE MAINTENANCE PLAN

Clark County is in the process of requesting a reclassification of its CO designation from non-attainment to attainment by EPA. As part of this re-designation request, the EPA has expressed a desire for the DAQEM to perform new modeling calculations using current population variables in the most recent TransCAD TDM for the Las Vegas Valley in its CO Maintenance Plan.

The modeling conducted in support of the CO Maintenance Plan followed the procedures developed for the 2005 CO SIP Revision. However, updated TransCAD TDM output was used, in parallel to the recent ozone SIP modeling, in addition to new wintertime fuel specifications. In addition, emissions from Nellis Air Force Base were updated according to the latest information from DAQEM. The following future years were simulated: 2008, 2010, and 2020. Note that the original 2006 future year modeled in the 2005 CO SIP Revision was replaced with the 2008 future year in this work.

The revised CO UAM modeling used RTC TransCAD runs that they performed in 2006 to define on-road mobile source activity and distributions, in a manner consistent with the ozone SIP modeling. Start and running exhaust emissions were calculated and distributed in time and space in the same manner as performed for the CO SIP revision with modifications as necessary to accommodate the different TAZ definitions in the updated TransCAD model. Although the current I/M program was maintained in all future years, a new fuel was specified for all years comprising a 13.5 RVP with the current 3.5% oxygenate, with no further fuel controls (no CBG, no TCM adjustments, and no alternative fuel programs for government fleets). EPA's MOBILE6.2 (Air Improvement Resource's version, which allows more detail in the database output to support the processing for this particular approach) was run for all years. Additionally, Sierra Research's modified version of MOBILE6.2, which improves the estimate of RVP effects on later model vehicles (Sierra Research, 2003), was used for all three future years to develop an alternative set of on-road mobile emissions. The NONROAD2005 model was used to calculate non-road emissions for the new gasoline specifications in all years; this model is also consistent with the version used in the ozone SIP.

Given that the original 2006 future year in the 2005 CO SIP Revision was replaced with the 2008 future year in this work, stationary CO emissions needed to be generated for 2008. Area emissions were interpolated from the existing 2006 and 2010 inventories and allocated in space using 2006 spatial surrogates. Civil airport and railroad emissions were similarly interpolated.

Since point source emissions are held constant for all years, they were used for 2008 without modification.

UAM was run for the 2008, 2010, and 2020 future years using the revised emission inventories. Following the methodology used in the 2005 CO SIP Revision, UAM was run in two ways: one in which all emissions were included in the model, and another in which emissions from the three civil airports were removed to minimize double-counting of airport impacts when UAM results are combined with EDMS results. Note that EDMS was not re-run in this project; EDMS model results from the 2005 SIP Revision were used without modification for 2010 and 2020. It is also important to note that traffic volumes on the major roadways within the McCarran airport property are included in both EDMS and TransCAD. As a result, the EDMS+UAM CO concentration results for McCarran reflect a double-counting of portions of the on-road mobile source emissions on that property, and so the CO concentrations reported for McCarran are conservative (i.e., high) estimates. EDMS receptor concentrations for 2008 were interpolated from 2006 and 2010. CAL3QHC was re-run in this project for the three "Five Points" intersections for all years using the updated traffic volumes and emission factors.

Section 2 of this report describes the development of the model-ready emission inventories. Section 3 describes the CO modeling using UAM and CAL3QHC, and reports the peak 8-hour results from UAM, UAM+CAL3QHC, and UAM+EDMS. Final on-road emission budgets are also reported in Section 3. Section 4 addresses the requirements of Clean Air Act Section 110(l) concerning changes to local control measures and their potential impacts on reasonable further progress and other pollutants.

2. EMISSION PROCESSING

2.1 OVERVIEW OF APPROACH

The estimation of CO emissions for the CO Maintenance Plan followed the procedures developed for the 2005 CO SIP Revision. However, updated TransCAD TDM output was used, in parallel to the recent ozone SIP modeling, in addition to new wintertime fuel specifications. The new wintertime fuel specifications affected MOBILE6 on-road emission factors and NONROAD emission estimates. In addition, emissions from Nellis Air Force Base were updated according to the latest information from DAQEM. The following future years were simulated: 2008, 2010, and 2020. Note that the original 2006 future year in the 2005 CO SIP Revision was replaced with the 2008 future year in this work.

The revised CO UAM modeling used RTC TransCAD runs that they performed in 2006 to define on-road mobile source activity and distributions, consistent with the ozone SIP modeling. Start and running exhaust emissions were calculated and distributed in time and space in the same manner as performed for the CO SIP revision with modifications as necessary to accommodate the different TAZ definitions in the updated TransCAD model. Although the current I/M program was maintained in all future years, a new fuel was specified for all years comprising a 13.5 RVP with the current 3.5% oxygenate, with no further fuel controls (no CBG, no TCM adjustments, and no alternative fuel programs for government fleets). EPA's MOBILE6.2 (Air Improvement Resource’s version, which allows more detail in the database output to support the processing for this particular approach) was run for all years. Additionally, Sierra Research's modified version of MOBILE6.2, which improves the estimate of RVP effects on later model vehicles (Sierra Research, 2003), was used for all three future years to develop an alternative set of on-road mobile emissions. The NONROAD2005 model was used to calculate non-road emissions for the new gasoline specifications in all years; this model is also consistent with the version used in the ozone SIP.

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2.2 ON-ROAD MOBILE SOURCES

DAQEM provided RTC’s TransCAD model output for each of the future years: 2006, 2008, 2010, and 2020. The TransCAD model output provided link-level volumes (number of vehicles) and trip origins and destinations for the following seven diurnal periods: midnight – 7 AM, 7 AM – 9 AM, 9 AM – 2 PM, 2 PM – 4 PM, 4 PM – 6 PM, 6 PM – 8 PM, 8 PM – midnight. When modeling Sunday, the period data were first summed together over all seven periods and then redistributed to hourly values using a weekend temporal distribution. When modeling

Monday, the period totals were maintained as output by TransCAD. They were further disaggregated into hourly values by applying the fraction of each hour within each period from the weekday distribution.

2.2.1 MOBILE6 Inputs

Future year MOBILE6 inputs were compiled according to the 2005 CO SIP Revision and fuel specifications selected by DAQEM (Table 2-1). For each future year, eight input files were created, for each of the four roadway types (freeway, arterial, local, and ramp) both for weekday and weekend. For Freeway and Arterial, the model was run for speeds between 5 and 65 mph for every 1 mph increment. The Local roadway type was set at 12.9 mph, and the Ramp roadway type was set to 34.6 mph by MOBILE6 itself.

No CNG fleets were assumed to be present in the future years. The current I/M program was maintained for all future years. Note that MOBILE6 I/M effectiveness was set to 100%; Clark County has developed a white paper to justify this value for Las Vegas (Clark County, 2005). For the VMT mix, values generated from a 2002 traffic study conducted by RTC in Las Vegas (Orth-Rodgers and Associates, 2003) were used, which yielded VMT for 5 vehicle types that were further broken down into 16 vehicle types based on MOBILE6 default VMT mix for 2002. Clark County does not have future year forecasts for vehicle VMT mix, seasonal/day-of-week adjustments, or hourly activity profiles, so the same settings were used for all future years.

Following the approach from the 2005 CO SIP Revision, a first set of MOBILE6 runs was conducted using the start distribution contained in the sdist.lv file (shown in Figure 2-1). These emission factors were applied to the whole domain except for a small region around Las Vegas Boulevard. A second set of MOBILE6 runs was conducted to better estimate the specific weekday start emission factors along the Las Vegas Boulevard (LVB), where the start activity is not centered within residential areas, but rather parking lots near casinos (and thus are not characteristic of typical commute activity profiles). A more representative start distribution was calculated as the fraction of TransCAD origin trips occurring over all TAZs along the boulevard from all periods available in the TransCAD output. Figure 2-2 shows the weekday start distributions for all future years along the Las Vegas Boulevard. Given the similarity of the future year start distributions, the composite start distribution was applied to all future years for the region around the Las Vegas Boulevard. Figure 2-3 compares the hourly MOBILE6 start emission factor profiles for Sunday (entire domain), Monday (LVB area), and Monday (remainder of the domain).

2.2.2 TransCAD Link Activity Adjustments

The TransCAD volume data is representative of an annual average weekday. The link-level activity was adjusted from annual average to December by a factor of 1.000. The activity data were scaled to Sunday estimates by weighting the Sunday day-of-week factor by the average weekday factor. The Sunday activity adjustment was 0.743. Activity was not adjusted for Monday.

Table 2-1. MOBILE6.2 input parameters for Las Vegas runs.

M6 Input Parameter	Weekday Parameters	Weekend Parameters	Source
HOURLY TEMPERATURES	42.0 44.0 49.0 51.0 55.0 58.0 64.0 66.0 66.0 66.0 62.0 58.0 55.0 53.0 51.0 50.0 48.0 47.0 45.0 44.0 44.0 43.0 42.0 42.0	42.0 44.0 49.0 51.0 55.0 58.0 64.0 66.0 66.0 66.0 62.0 58.0 55.0 53.0 51.0 50.0 48.0 47.0 45.0 44.0 44.0 43.0 42.0 42.0	same temperatures used as in previous work
REGISTRATION DIST	LV_reg02.RDT	LV_reg02.RDT	provided by Clark County
VMT FRACTIONS BY VEHICLE TYPE	0.5042 0.0767 0.2552 0.0779 0.0358 0.0080 0.0002 0.0001 0.0003 0.0007 0.0003 0.0000 0.0000 0.0024 0.0011 0.0030 0.0008 0.0007 0.0002 0.0016 0.0025 0.0031 0.0113 0.0072 0.0008 0.0013 0.0019 0.0015	0.5042 0.0767 0.2552 0.0779 0.0358 0.0080 0.0002 0.0001 0.0003 0.0007 0.0003 0.0000 0.0000 0.0024 0.0011 0.0030 0.0008 0.0007 0.0002 0.0016 0.0025 0.0031 0.0113 0.0072 0.0008 0.0013 0.0019 0.0015	provided by Clark County
VMT BY HOUR	Hvmt_lv.wek	Hvmt_lv.wnd	provided by Clark County
START DIST	sdist.lv	sdist.lv	provided by Clark County
OXYGENATED FUELS	0.00 1.00 0.00 0.035 1	0.00 1.00 0.00 0.035 1	provided by Clark County
ANTI-TAMP PROG	83 81 50 22222 22222222 2 11 090. 22212112	83 81 50 22222 22222222 2 11 090. 22212112	provided by Clark County
> Exhaust I/M program #1			provided by Clark County
I/M PROGRAM	1 1983 2050 1 TRC 2500/IDLE	1 1983 2050 1 TRC 2500/IDLE	
I/M MODEL YEARS	1 1968 1995	1 1968 1995	
I/M VEHICLES	1 22222 22222222 2	1 22222 22222222 2	
I/M STRINGENCY	1 22	1 22	
I/M COMPLIANCE	1 90	1 90	
I/M WAIVER RATES	1 0.1 0.1	1 0.1 0.1	
I/M EFFECTIVENESS	1.00 1.00 1.00	1.00 1.00 1.00	
I/M GRACE PERIOD	1 2	1 2	
I/M CREDIT FILE	tech12.d	tech12.d	
> Exhaust I/M program #2			
I/M PROGRAM	2 1983 2050 1 TRC OBD I/M	2 1983 2050 1 TRC OBD I/M	
I/M MODEL YEARS	2 1996 2050	2 1996 2050	
I/M VEHICLES	2 22222 22222222 2	2 22222 22222222 2	
I/M STRINGENCY	2 22	2 22	
I/M COMPLIANCE	2 90	2 90	
I/M WAIVER RATES	2 0.1 0.1	2 0.1 0.1	
I/M GRACE PERIOD	2 2	2 2	
> Evap I/M program #3			
I/M PROGRAM	3 1983 2050 1 TRC EVAP OBD	3 1983 2050 1 TRC EVAP OBD	
I/M MODEL YEARS	3 1996 2050	3 1996 2050	
I/M VEHICLES	3 22222 11111111 1	3 22222 11111111 1	

M6 Input Parameter	Weekday Parameters	Weekend Parameters	Source
I/M COMPLIANCE	3 90	3 90	
I/M WAIVER RATES	3 0.1 0.1	3 0.1 0.1	
I/M GRACE PERIOD	3 2	3 2	
CALENDAR YEAR	2009, 2011, 2021	2009, 2011, 2021	
EVALUATION MONTH	1	1	
WE VEH US	no	yes	
FUEL RVP	13.5	13.5	provided by Clark County
FUEL PROGRAM	1	1	provided by Clark County
	Average Gasoline Fuel Sulfur Content = 30 ppm	Average Gasoline Fuel Sulfur Content = 30 ppm	
	Maximum Gasoline Fuel Sulfur Content = 80 ppm	Maximum Gasoline Fuel Sulfur Content = 80 ppm	
DIESEL SULFUR	15,15,15	15,15,15	provided by Clark County

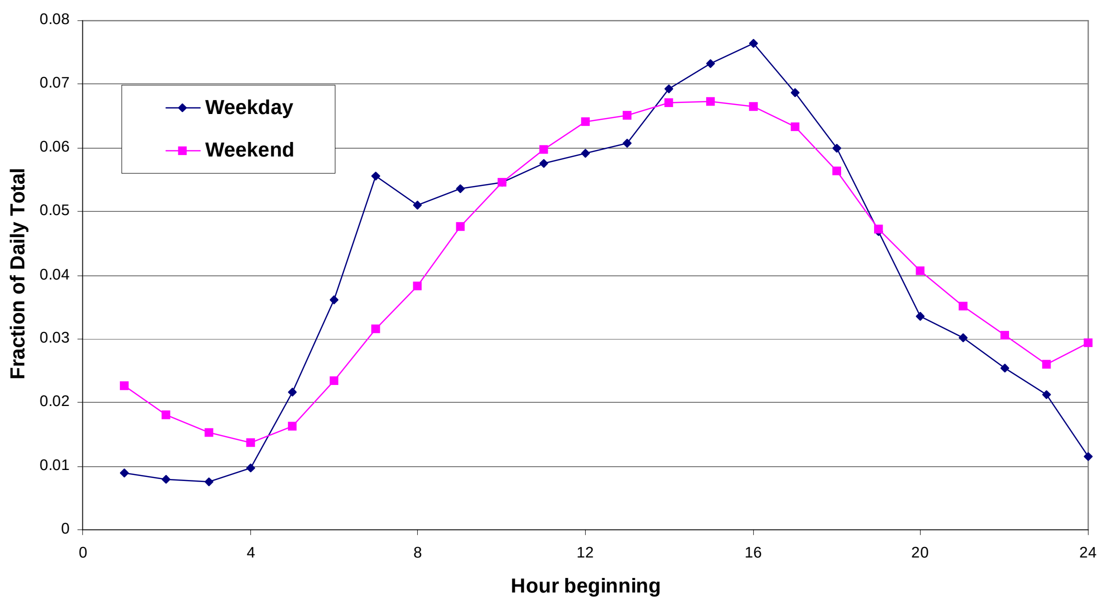


Figure 2-1. Hourly weekend and weekday start distributions (fraction) provided by Clark County, used to temporally allocate emissions derived from TransCAD.

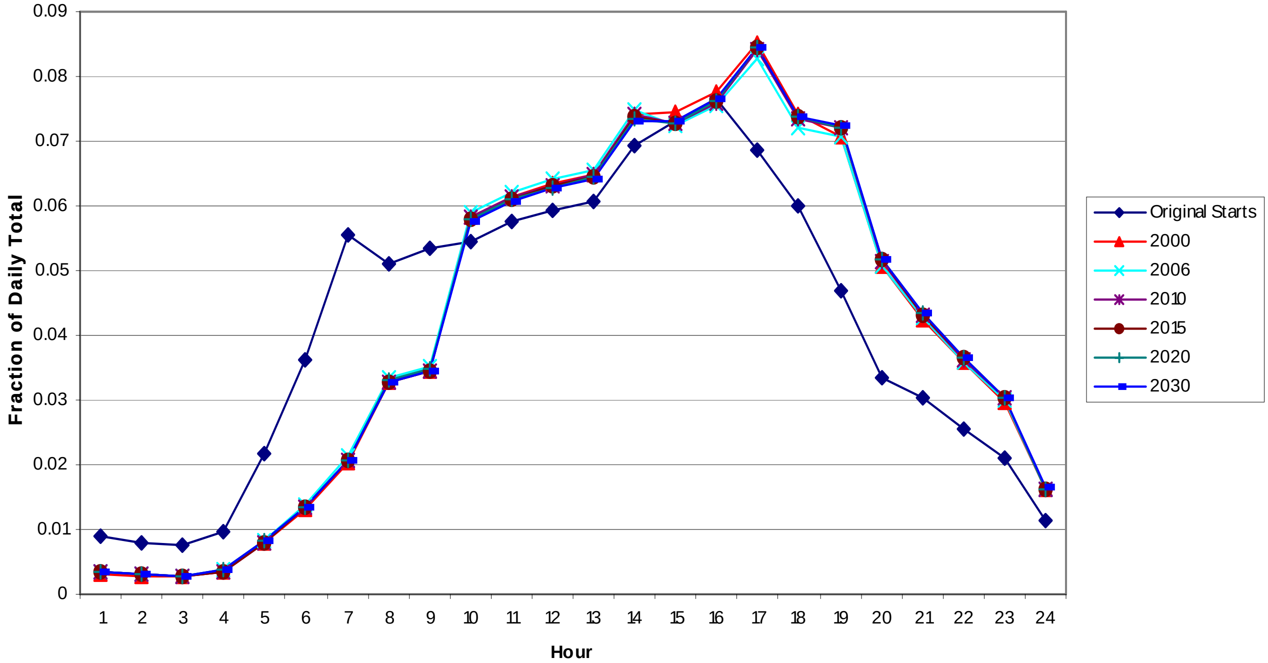


Figure 2-2. Fraction of original weekday start distribution (from Figure 2-1) and start distributions in all future years for the Las Vegas Boulevard area calculated from the TransCAD origin trips by TAZ (from the 2005 CO SIP Revision).

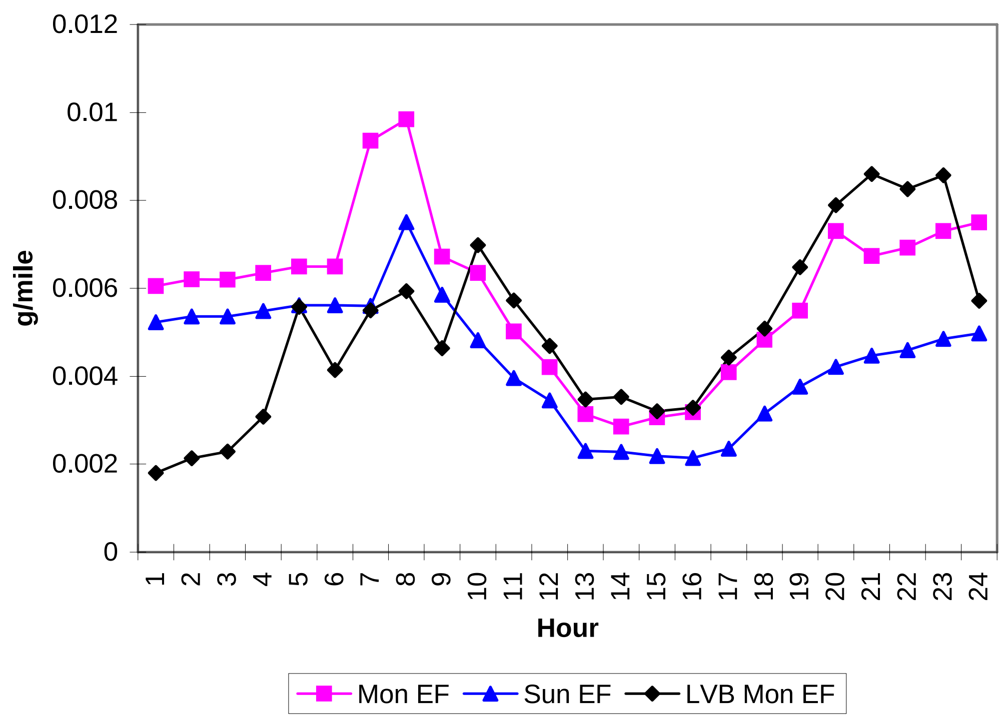


Figure 2-3. Hourly start emission factors from the MOBILE6 runs: "Sun EF" is the Sunday profile used for all start emissions; "Mon EF" is the Monday profile used for start emissions

outside of the LVB area; and "LVB Mon EF" is the Monday profile used for start emissions within the LVB area.

Prior to calculating the link-based emissions, the link volumes were first adjusted to observed traffic counts by facility type. Then, the adjusted link volumes were adjusted to bring the total volume into agreement with the VMT reported through the Highway Performance Monitoring System (HPMS). The overall HPMS adjustment was a single factor multiplied uniformly to the volumes to bring the total into agreement with HPMS. The HPMS adjustment factor used was 1.0628, based on the ozone SIP work.

Within each of the seven periods, the data were further disaggregated using the default weekday (Dec. 9) distribution for Monday. For Sunday, the data were summed to obtain the daily total before re-distributing into the hours using the default weekend (Dec. 8) distribution. The same VMT distributions that were used for the 2005 CO SIP Revision were used for the future years, as illustrated in Figure 2-4.

After the link data were temporally allocated to hourly values, the hourly speeds were adjusted using the following Bureau of Public Roads (BPR) curve, where the volume to capacity ratio was capped at 1.25:

$$S_a = \frac{S_{ff}}{1 + \left[A * \left(V / C \right)^B \right]}$$

where:

S_a = adjusted link speed (mph)

S_{ff} = reported link free flow speed (mph)

V = total link volume (vehicles OR vehicles per hour)

C = total link capacity (vehicles OR vehicles per hour)

For freeways, interstates, system ramps, and expressways,

A = 0.66 B = 7.2

For major arterials, minor arterials, collectors, ramps, and other,

A = 0.76 B = 5.9

The link-level emissions were adjusted upward by the factors shown in Table 2-2 to capture transit activity (values provided by DAQEM). Link-level emissions were not adjusted for TCMs.

Table 2-2. Adjustment factor to scale link-level emissions to account for mass transit and traffic control measures.

Year	Transit Adjustment Factor	TCM Adjustment Factor
2008	1.004438	1.000
2010	1.003913	1.000
2020	1.003192	1.000

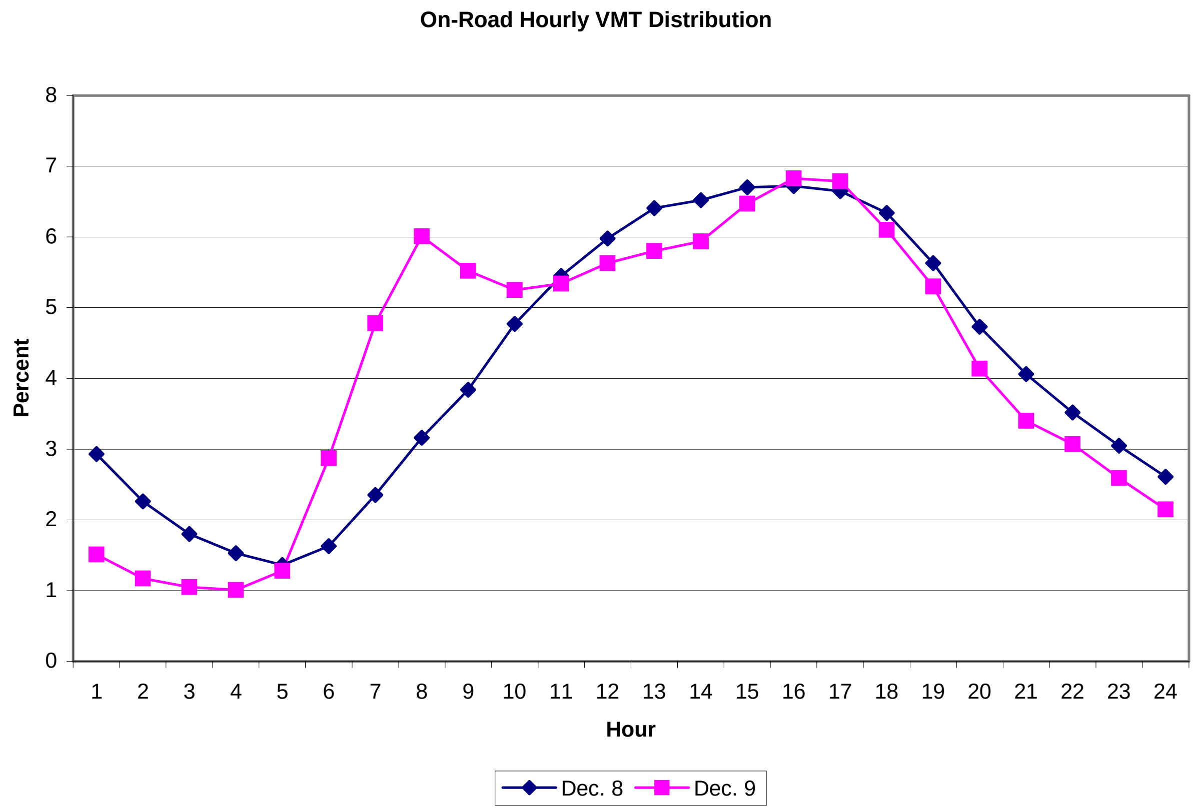


Figure 2-4. Weekday and Sunday hourly VMT distribution.

2.2.3 Link-Level Running Emissions

The TransCAD link level volumes were first adjusted by the count correction factor and the HPMS adjustment. Then, they were disaggregated to hourly volumes. The speed was adjusted using the hourly volume to capacity ratio in the BPR curve. The MOBILE6 emission factor for that hour and adjusted speed was multiplied by the hourly link volume to determine hourly emissions. The hourly emissions were further adjusted to December, day of week, transit activity, and TCM's in CNTLEM within the EPS3 processing. Tables 2-3 through 2-5 present tabulations of VMT by facility type for each future year, as directly reported by TransCAD, and after the adjustments described above.

2.2.4 Start Emissions

For Monday, the hourly VMT was estimated by disaggregating the period VMT to hourly VMT using the weekday VMT distribution show in Figure 2-4. The start emissions were calculated by multiplying the hourly VMT by the hourly MOBILE6 start emission factors. The hourly link start emissions were then totaled over the entire network and redistributed to TAZ, based on the

Table 2-3. 2008 VMT by facility type. Totals are shown as output by TransCAD, and after seasonal, day-of-week, and public transit adjustments.

Group Code	Facility Type	Modeled 2006 DVMT	Count Correction Factor	DVMT Corrected to Count	DVMT Corrected to HPMS	DVMT Adjusted to December	DVMT Adjusted for Transit	Sunday DVMT	Monday DVMT
0	External Connector	607,755	0.9102	553,178	587,918	587,918	590,527	438,762	590,527
1	System Ramp	341,326	1.4572	497,380	528,616	528,616	530,962	394,505	530,962
2	Minor Arterial	5,439,127	0.9774	5,316,203	5,650,060	5,650,060	5,675,135	4,216,625	5,675,135
3	Major Arterial	15,344,935	0.9468	14,528,584	15,440,979	15,440,979	15,509,507	11,523,563	15,509,507
4	Freeway on- or off-ramp	1,226,843	1.0633	1,304,503	1,386,425	1,386,425	1,392,578	1,034,686	1,392,578
5	Interstate	10,477,414	1.0043	10,522,467	11,183,278	11,183,278	11,232,909	8,346,052	11,232,909
6	Freeway	4,567,426	1.1169	5,101,358	5,421,723	5,421,723	5,445,785	4,046,218	5,445,785
7	Expressway	198,762	1.9272	383,054	407,110	407,110	408,916	303,825	408,916
8	Collector	3,310,084	1.1742	3,886,701	4,130,786	4,130,786	4,149,118	3,082,795	4,149,118
9	Centroid Connector	3,255,261	1.1742	3,822,327	4,062,369	4,062,369	4,080,398	3,031,736	4,080,398
10	Local	15,271	1.1742	17,931	19,057	19,057	19,141	14,222	19,141
11	HOV Lane	243,363	1.1169	271,812	288,882	288,882	290,164	215,592	290,164
	Intrazonal	106,738	1	106,738	113,442	113,442	113,945	84,661	113,945
Daily Total		**45,134,305**		**46,312,237**	**49,220,645**	**49,220,645**	**49,439,086**	**36,733,241**	**49,439,086**
Transit adjustment		1.004438							
HPMS adjustment		1.0628							
December adjustment		1.000							
Sunday adjustment		0.743							
Monday adjustment		1.000							

Table 2-4. 2010 VMT by facility type. Totals are shown as output by TransCAD, and after seasonal, day-of-week, and public transit adjustments.

Group Code	Facility Type	Modeled 2010 DVMT	Count Correction Factor	DVMT Corrected to Count	DVMT Corrected to HPMS	DVMT Adjusted to December	DVMT Adjusted for Transit	Sunday DVMT	Monday DVMT
0	External Connector	631,693	0.9102	574,967	611,075	611,075	613,466	455,805	613,466
1	System Ramp	356,340	1.4572	519,259	551,868	551,868	554,028	411,642	554,028
2	Minor Arterial	6,100,189	0.9774	5,962,325	6,336,759	6,336,759	6,361,555	4,726,635	6,361,555
3	Major Arterial	16,609,483	0.9468	15,725,859	16,713,443	16,713,443	16,778,842	12,466,680	16,778,842
4	Freeway on- or off-ramp	1,347,467	1.0633	1,432,762	1,522,739	1,522,739	1,528,697	1,135,822	1,528,697
5	Interstate	11,303,566	1.0043	11,352,171	12,065,087	12,065,087	12,112,298	8,999,437	12,112,298
6	Freeway	5,395,363	1.1169	6,026,081	6,404,519	6,404,519	6,429,580	4,777,178	6,429,580
7	Expressway	193,598	1.9272	373,103	396,534	396,534	398,085	295,777	398,085
8	Collector	3,498,212	1.1742	4,107,601	4,365,558	4,365,558	4,382,641	3,256,302	4,382,641
9	Centroid Connector	3,581,532	1.1742	4,205,435	4,469,537	4,469,537	4,487,026	3,333,860	4,487,026
10	Local	15,632	1.1742	18,355	19,507	19,507	19,584	14,551	19,584
11	HOV Lane	486,752	1.1169	543,654	577,795	577,795	580,056	430,982	580,056
	Intrazonal	121,457	1	121,457	129,084	129,084	129,589	96,285	129,589
Daily Total		**49,641,284**		**50,963,026**	**54,163,504**	**54,163,504**	**54,375,446**	**40,400,956**	**54,375,446**
Transit adjustment		1.003913							
HPMS adjustment		1.0628							
December adjustment		1.000							
Sunday adjustment		0.743							
Monday adjustment		1.000							

Table 2-5. 2020 VMT by facility type. Totals are shown as output by TransCAD, and after seasonal, day-of-week, and public transit adjustments.

Group Code	Facility Type	Modeled 2020 DVMT	Count Correction Factor	DVMT Corrected to Count	DVMT Corrected to HPMS	DVMT Adjusted to December	DVMT Adjusted for Transit	Sunday DVMT	Monday DVMT
0	External Connctor	789,029	0.9102	718,174	763,276	763,276	765,712	568,924	765,712
1	System Ramp	535,150	1.4572	779,821	828,794	828,794	831,439	617,759	831,439
2	Minor Arterial	8,695,678	0.9774	8,499,155	9,032,902	9,032,902	9,061,735	6,732,869	9,061,735
3	Major Arterial	19,167,364	0.9468	18,147,660	19,287,333	19,287,333	19,348,898	14,376,231	19,348,898
4	Freeway on- or off-ramp	1,707,664	1.0633	1,815,759	1,929,789	1,929,789	1,935,949	1,438,410	1,935,949
5	Interstate	15,636,220	1.0043	15,703,456	16,689,633	16,689,633	16,742,906	12,439,979	16,742,906
6	Freeway	7,464,694	1.1169	8,337,317	8,860,901	8,860,901	8,889,185	6,604,664	8,889,185
7	Expressway	7,652	1.9272	14,746	15,672	15,672	15,722	11,682	15,722
8	Collector	4,146,492	1.1742	4,868,811	5,174,573	5,174,573	5,191,090	3,856,980	5,191,090
9	Centroid Connector	4,693,489	1.1742	5,511,095	5,857,191	5,857,191	5,875,887	4,365,784	5,875,887
10	Local	15,818	1.1742	18,573	19,739	19,739	19,802	14,713	19,802
11	HOV Lane	1,160,461	1.1169	1,296,119	1,377,515	1,377,515	1,381,912	1,026,761	1,381,912
	Intrazonal	168,722	1	168,722	179,317	179,317	179,890	133,658	179,890
Daily Total		**64,188,433**		**65,879,409**	**70,016,635**	**70,016,635**	**70,240,128**	**52,188,415**	**70,240,128**
Transit adjustment		1.003192							
HPMS adjustment		1.0628							
December adjustment		1.000							
Sunday adjustment		0.743							
Monday adjustment		1.000							

fraction of period-specific trip origins for each TAZ over the total number of trip origins over all TAZs. For Sunday, the TransCAD data is not representative of a typical weekend profile, so the hourly VMT was estimated by first totaling all the period VMT to a daily value, then it was distributed to hourly values using the weekend profile in Figure 2-4. The Sunday start emissions were then calculated by multiplying the hourly VMT by the MOBILE6 hourly emission factors for all hours. The emissions were totaled over the entire network and then spatially distributed to each TAZ using a single ratio of the daily total TAZ trip origins to the daily total of all trip origins over the domain.

The future year start emissions were calculated twice; once using the MOBILE6 emission factors generated using the sdist.lv hourly start distribution (Figure 2-1), and once using the MOBILE6 emission factors generated using the modified start distribution discussed above to reflect the activity along the Las Vegas Boulevard (Figure 2-2).

Following the methodology in the 2005 CO SIP Revision, the hourly TAZ start emissions were spatially allocated to the grid cell containing the TAZ centroid and the 24 surrounding cells in a “wedding cake” fashion: the grid cell containing a TAZ centroid receives 25% of the start emissions from that TAZ, the surrounding 8 grid cells receive 60% of the start emissions (7.5% per cell), and the outside 16 grid cells receive 15% of the start emissions (0.9375% per cell).

2.2.5 Intrazonal Activity

The intrazonal VMT was calculated assuming a default length of 1 mile for each intrazonal trip (as is described in the 2004-2005 Regional Transportation Plan documentation [FY 2004-2025 RTP and FY 2004-2006 TIP, Chapter 5, page 5-16]).

2.2.6 Total On-Road Emissions

Table 2-6 lists the component and total on-road mobile source emissions for all future years using the AIR version of MOBILE6. For comparison, Table 2-7 lists the component and total on-road emissions using the Sierra-modified version of MOBILE6. Figures 2-5 through 2-7 present the future year spatial distribution of the total on-road mobile source emissions for December 9, 1996 using the AIR version of MOBILE6.

The combination of updated TransCAD traffic volumes and higher MOBILE6 emission factors due to fuel changes results in much higher on-road mobile emissions out to 2020 than reported in the 2005 CO SIP Revision. Figure 2-8 displays the 2020 on-road mobile sources from the 2005 CO SIP Revision (compare to Figure 2-7). Figure 2-9 shows the difference in mobile source emissions between Figures 2-8 and 2-7. Note that higher emission factors and higher traffic volumes in the Las Vegas Boulevard and McCarran airport areas result in the largest increases in those areas.

Table 2-6. Component and total on-road mobile source CO emissions (TPD) for all future years from the AIR version of MOBILE6.

	2008	2010	2020
Sunday 12/8/2005			
Links - Running	206.6	204.6	188.9
Starts	157.3	158.8	167.6
Intrazonals	0.7	0.8	0.8
Total	**364.6**	**364.2**	**357.3**
Monday 12/9/2005			
Links - Running	277.6	275.1	253.7
Starts	300.6	303.4	319.4
Intrazonals	1.1	1.2	1.3
Total	**579.3**	**579.7**	**574.4**

Table 2-7. Component and total on-road mobile source CO emissions (TPD) for all future years from the Sierra-modified version of MOBILE6.

	2008	2010	2020
Sunday 12/8/2005			
Links - Running	167.2	163.7	146.1
Starts	150.3	151.1	158.3
Intrazonals	0.6	0.7	0.7
Total	**318.1**	**315.5**	**305.1**
Monday 12/9/2005			
Links - Running	224.3	219.6	195.8
Starts	286.3	287.8	300.5
Intrazonals	1.0	1.0	1.1
Total	**511.6**	**508.4**	**497.4**

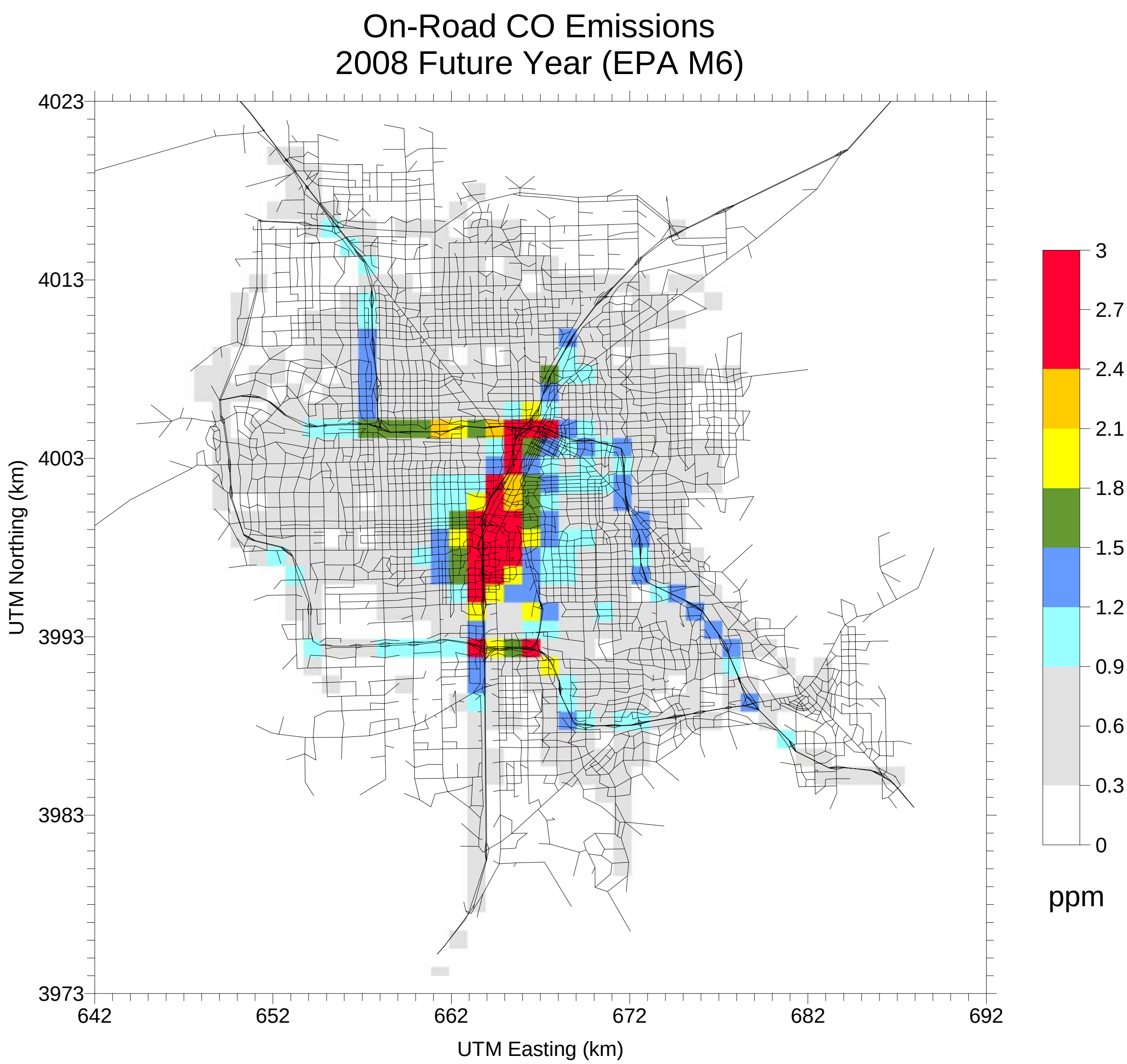


Figure 2-5. Spatial distribution of total on-road mobile source CO emissions on December 9 for the 2008 future year (using AIR version of MOBILE6).

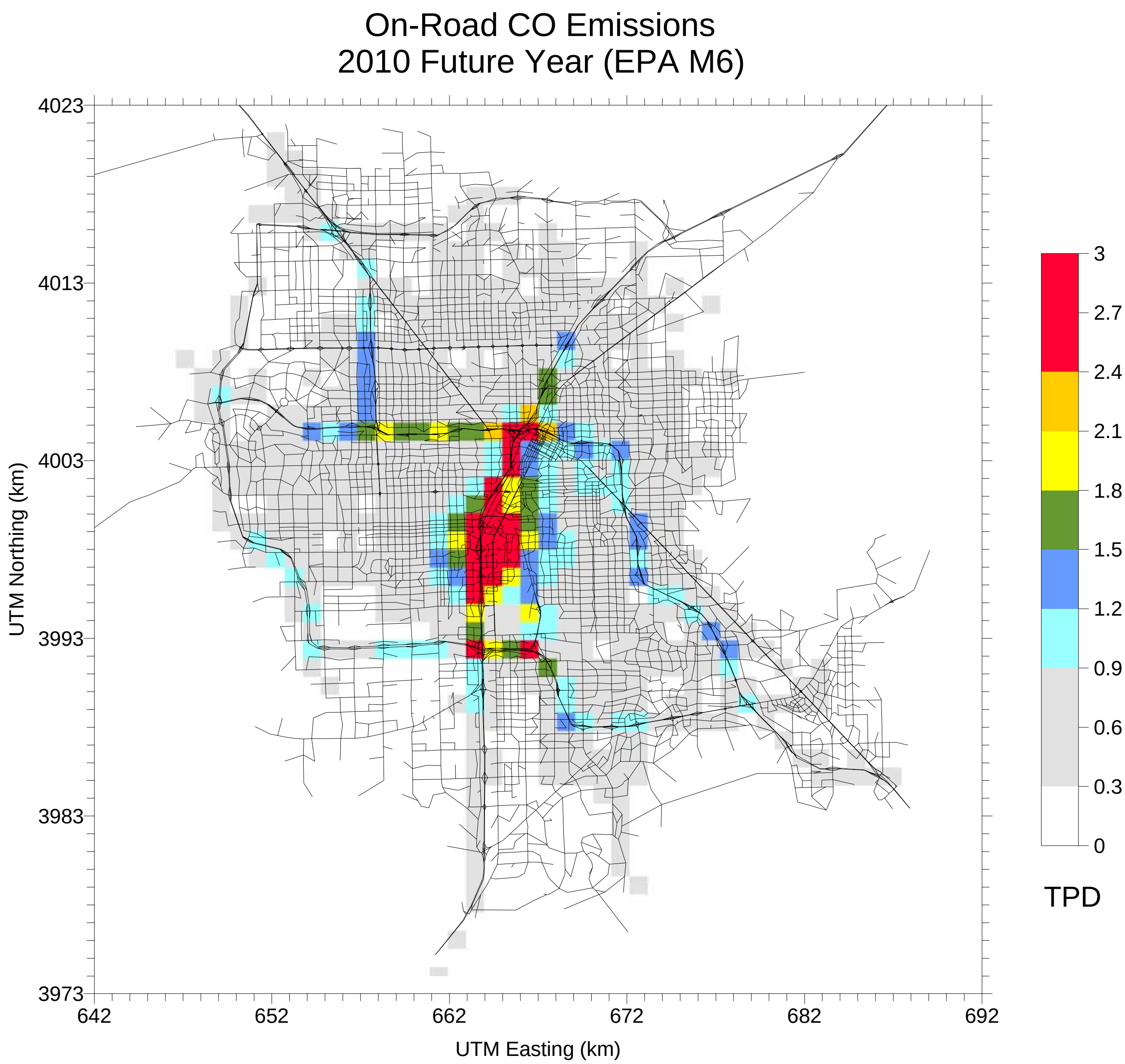


Figure 2-6. Spatial distribution of total on-road mobile source CO emissions on December 9 for the 2010 future year (using AIR version of MOBILE6).

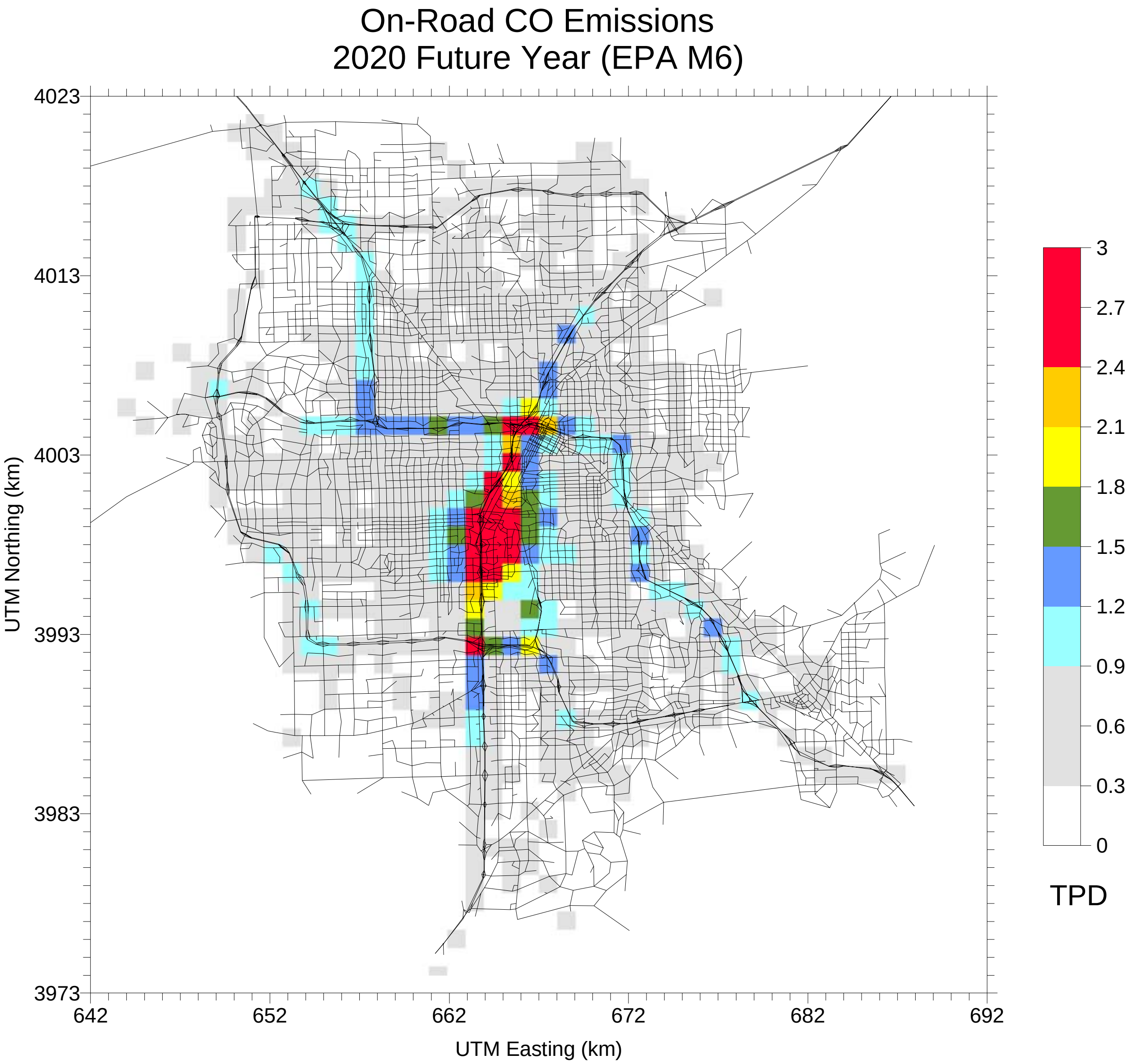


Figure 2-7. Spatial distribution of total on-road mobile source CO emissions on December 9 for the 2020 future year (using AIR version of MOBILE6).

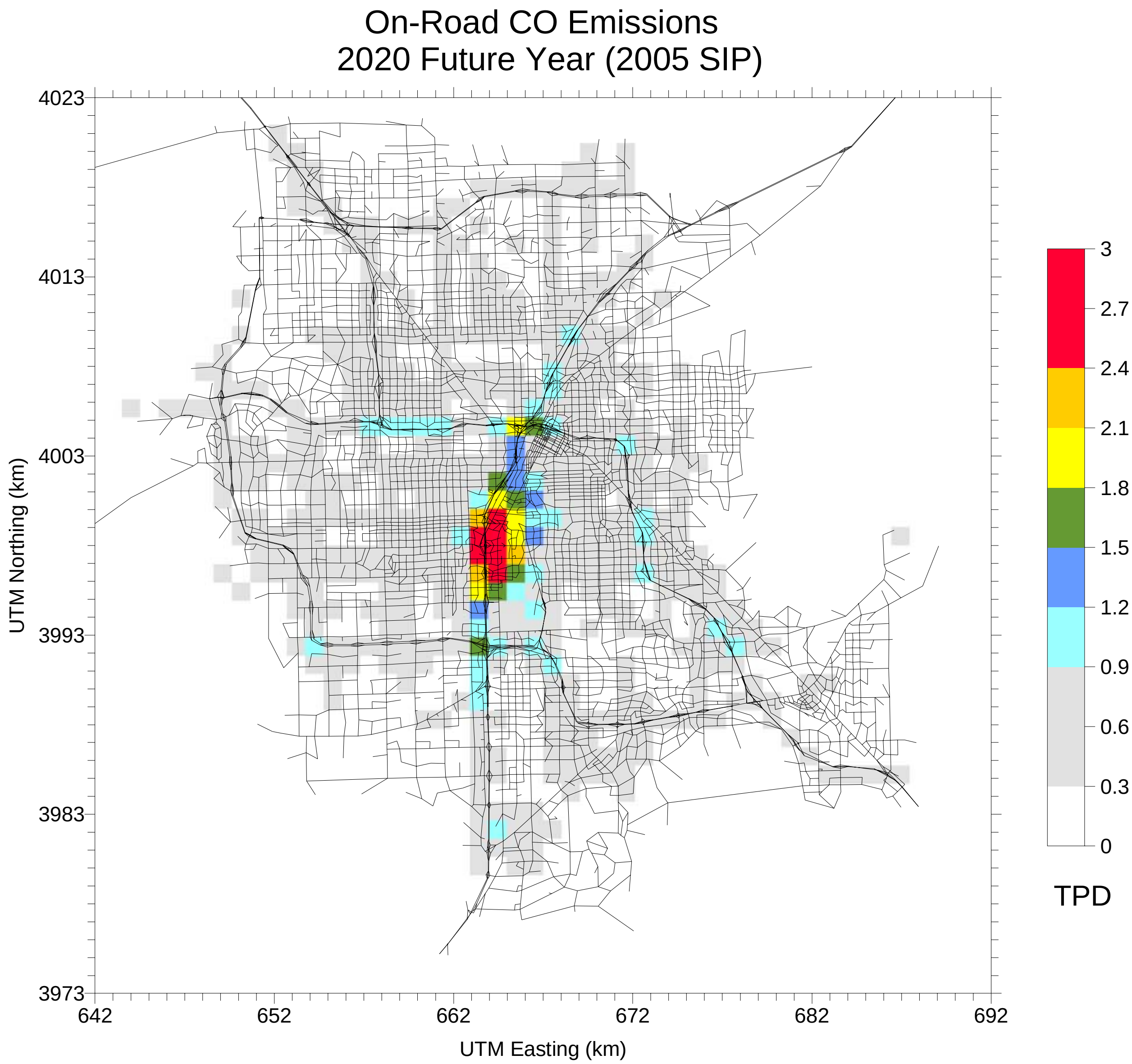


Figure 2-8. Spatial distribution of total on-road mobile source CO emissions on December 9 for the 2020 future year (taken from the 2005 CO SIP Revision).

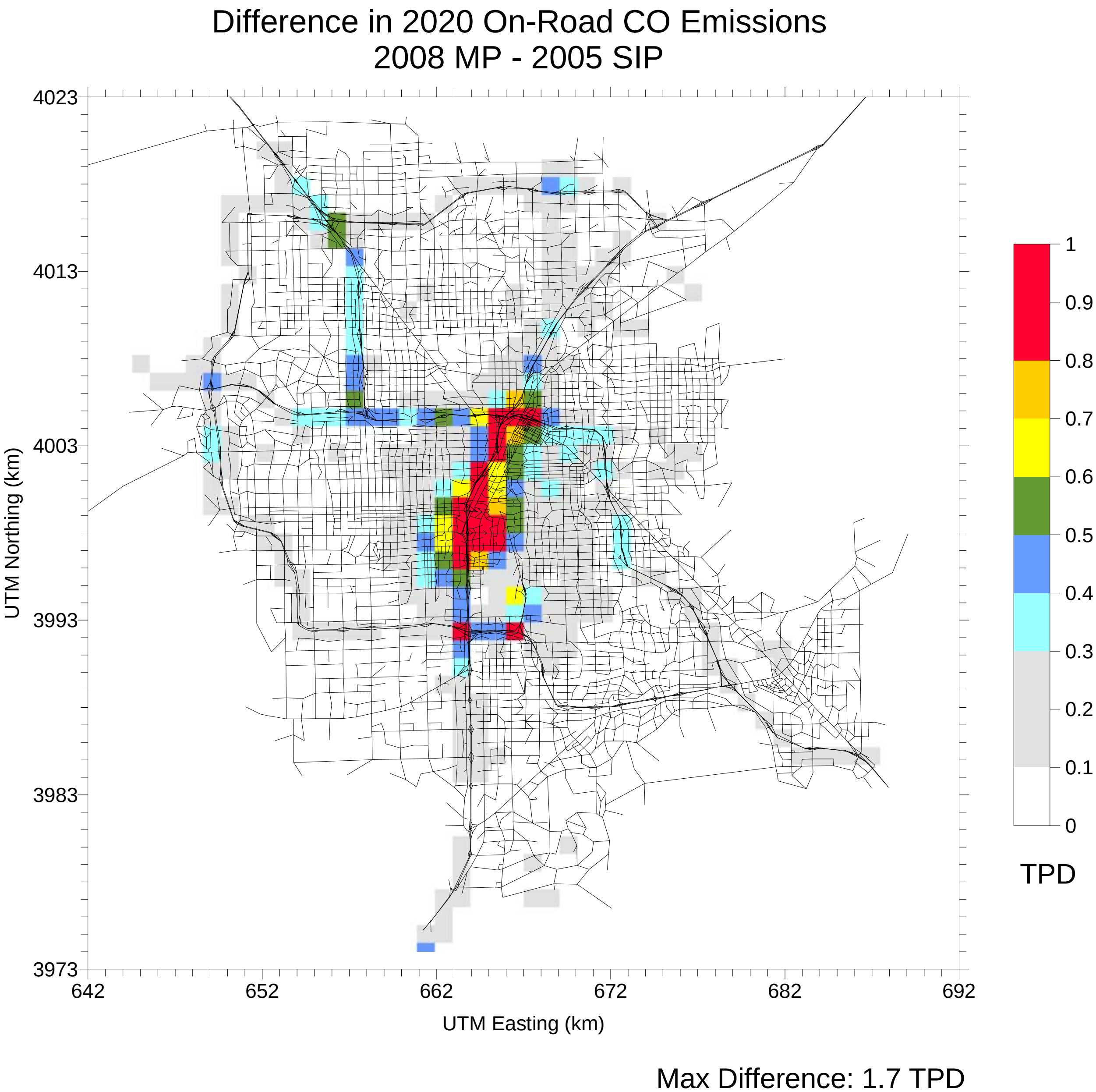


Figure 2-9. Difference in total on-road mobile source CO emissions on December 9 for the 2020 future year. The field shown in Figure 2-8 is subtracted from the field shown in Figure 2-7.

2.3 NON-ROAD EMISSION CATEGORIES

2.3.1 Airports

In 2003, Clark County and their contractor Ricondo and Associates developed a detailed emissions inventory at the three county civil airports (McCarran, North Las Vegas, and Henderson), and performed dispersion modeling using the Federal Aviation Administration's EDMS model (Ricondo, 2003, 2005). The latest version of EDMS was used, which introduced the AERMOD dispersion model. On-road mobile sources were estimated using Clark County runs of MOBILE6.2. EDMS was run for 2000, 2005, 2010, 2015 and 2020.

To properly account for the contributions of civil airports toward the valley-wide distribution of CO during the December 8-9 episode, the UAM emissions inventory included the EDMS airport emission estimates. Airport emissions for the 2010 and 2020 future years were taken from the 2005 CO SIP Revision, which in turn were based upon the work of Ricondo (2003, 2005). Emission estimates for 2008 were derived by linearly interpolating total airport emissions between 2006 and 2010.

The emission estimates for Nellis AFB were updated in the current modeling project based on data provided by DAQEM. Table 2-8 shows annual total CO emissions reported for Nellis. Emissions for this facility were allocated to each hour of the episode assuming a flat temporal profile (i.e., no monthly, daily, or hourly variations).

Table 2-8. Annual CO emissions reported for Nellis AFB (TPY).

Year	CO (TPY)
2008	1266.03
2010	1305.74
2020	1476.60

Following the 2005 CO SIP Update, airport emissions were placed evenly across the grid cells in which the airports reside.

2.3.2 Locomotives

The 2005 CO SIP Update included estimates of railroad emissions for 2001 based on the work of Mactec (2003). Switching and line-haul locomotive emissions were allocated to the grid according to the location of yards and railroad line segments, respectively. Projections for 2006, 2010, and 2020 were developed for the 2005 CO SIP Update. Estimates for 2008 were determined by interpolated between 2006 and 2010.

Railroad maintenance emissions were estimated in the 2005 CO SIP Update using EPA's NONROAD Model. In this project, railroad equipment emissions for 2010 and 2020 were taken from the previous SIP, and estimates for 2008 were similarly determined by interpolated between 2006 and 2010.

2.3.3 Other Non-Road Categories

Weekday and weekend emissions for Clark County were estimated using EPA's NONROAD Model (Core Model Version 2005a, February 2006) for the years 2008, 2010, and 2020. The period type was set to Winter Season, and emissions were reported as tons per day. Clark County was modeled as a "Southwest" region instead of the default "Central West" region. Table 2-9 summarizes the NONROAD Model input parameters for each future year. All inputs except for the gasoline specifications were taken from the 2005 CO SIP Update.

Table 2-9. Summary of inputs used for NONROAD modeling future years.

	2008		2010		2020	
	Weekday (tpd)	Weekend (tpd)	Weekday (tpd)	Weekend (tpd)	Weekday (tpd)	Weekend (tpd)
Period Type	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly
Summation Type	Typical Day	Typical Day	Typical Day	Typical Day	Typical Day	Typical Day
Year of Episode	2008	2008	2010	2010	2020	2020
Month of Year	Dec.	Dec.	Dec.	Dec.	Dec.	Dec.
Weekend or weekday	Weekday	Weekend	Weekday	Weekend	Weekday	Weekend
Fuel RVP for gas	13.5	13.5	13.5	13.5	13.5	13.5
Oxygen Weight %	3.50	3.50	3.50	3.50	3.50	3.50
Gas sulfur %	0.003	0.003	0.003	0.003	0.003	0.003
Diesel sulfur %	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
CNG/LPG sulfur %	0.003	0.003	0.003	0.003	0.003	0.003
Minimum temper. (F)	42	42	42	42	42	42
Maximum temper. (F)	66	66	66	66	66	66
Average temper. (F)	51.9	51.9	51.9	51.9	51.9	51.9
Altitude of region	low	low	low	low	low	low

Airport ground support equipment (GSE) was removed from the NONROAD emissions estimates because they were reported as part of the EDMS (civil airports) and Nellis AFB inventories. Recreational marine estimates were also removed since the major water areas in Clark County lie outside of the modeling domain. Railroad maintenance/equipment emissions were removed from the NONROAD estimates as emissions for this category were taken from the 2005 CO SIP Update.

Figure 2-10 shows the distribution used to temporally allocate non-road sources. Non-road emissions in 2010 and 2020 were allocated to the grid using surrogates developed specifically for those years from GIS-based landuse datasets as part of the 2005 CO SIP Update. Non-road emissions for 2008 were spatially allocated using the 2006 gridding surrogates from the 2005 CO SIP Update.

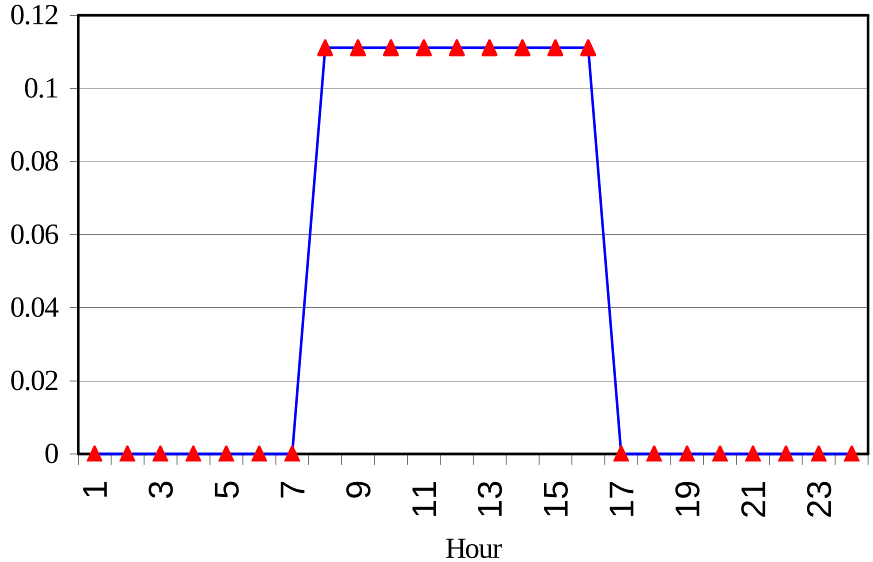


Figure 2-10. Hourly activity profile used to temporally allocate non-road emissions.

2.4 AREA SOURCES

The 2010 and 2020 area source estimates were taken from the 2005 CO SIP Update with no changes. Values were interpolated to 2008 from the 2006 and 2010 estimates. Since 2006 and 2010 area sources were spatially allocated using different gridding surrogates, special processing was required to perform the interpolation to 2008. First, the 2010 area source estimates were processed to the grid using 2006 spatial surrogates. Then 2008 area source estimates were calculated by interpolated between 2006 and 2010 on a cell-by-cell and hour-by-hour basis. Therefore, the 2008 area sources are represented on the grid by 2006 spatial surrogates, similarly to the non-road sources.

2.5 POINT SOURCES

The point source inventory from the 2000 CO SIP and 2005 SIP Update was used for this modeling. At that time, Clark County provided a point source emission inventory for future years that included updated stack parameters and emissions based on "Potential To Emit" (PTE) levels for seven specific facilities. The UAM future year inventories included PTE levels plus a 70 ton/year buffer for these sources. All future year modeling used the same future year point source data. Table 2-10 shows a breakdown by elevated and low-level point sources.

Table 2-10. Modeling CO point source emission estimates (TPD).

	Future Years
Elevated	15.53
Low Level	0.28
Total	**15.82**

2.6 SUMMARY OF TOTAL EMISSIONS

Table 2-11 presents a summary of total daily CO emissions by source category, including on-road emissions (based on the AIR version of MOBILE6), for all future years. Figures 2-11 through 2-13 show the spatial distribution of total CO emissions on December 9 for all future years.

Table 2-11. Summary of total daily CO emissions (TPD) in the UAM CO Maintenance Plan. On-road mobile emissions are taken from the AIR version of MOBILE6.

	2008	2010	2020
Sunday 12/8			
On-Road	364.6	364.2	357.3
Henderson Airport	1.5	1.6	2.6
McCarran Airport	30.9	33.2	43.2
North Las Vegas Airport	5.2	5.2	5.5
Nellis AFB	3.5	3.6	4.0
Area Sources	13.6	14.3	18.1
Non-Road	39.9	42.5	49.7
Point Sources	15.8	15.8	15.8
Railroad	0.2	0.2	0.3
Total	**475.1**	**480.6**	**496.5**
Monday 12/9			
On-Road	579.3	579.7	574.4
Henderson Airport	1.2	1.3	2.0
McCarran Airport	30.9	33.2	43.2
North Las Vegas Airport	4.1	4.1	4.3
Nellis AFB	3.5	3.6	4.0
Area Sources	13.9	14.7	18.6
Non-Road	57.7	60.8	71.2
Point Sources	15.8	15.8	15.8
Railroad	0.3	0.3	0.4
Total	**706.7**	**713.5**	**733.9**

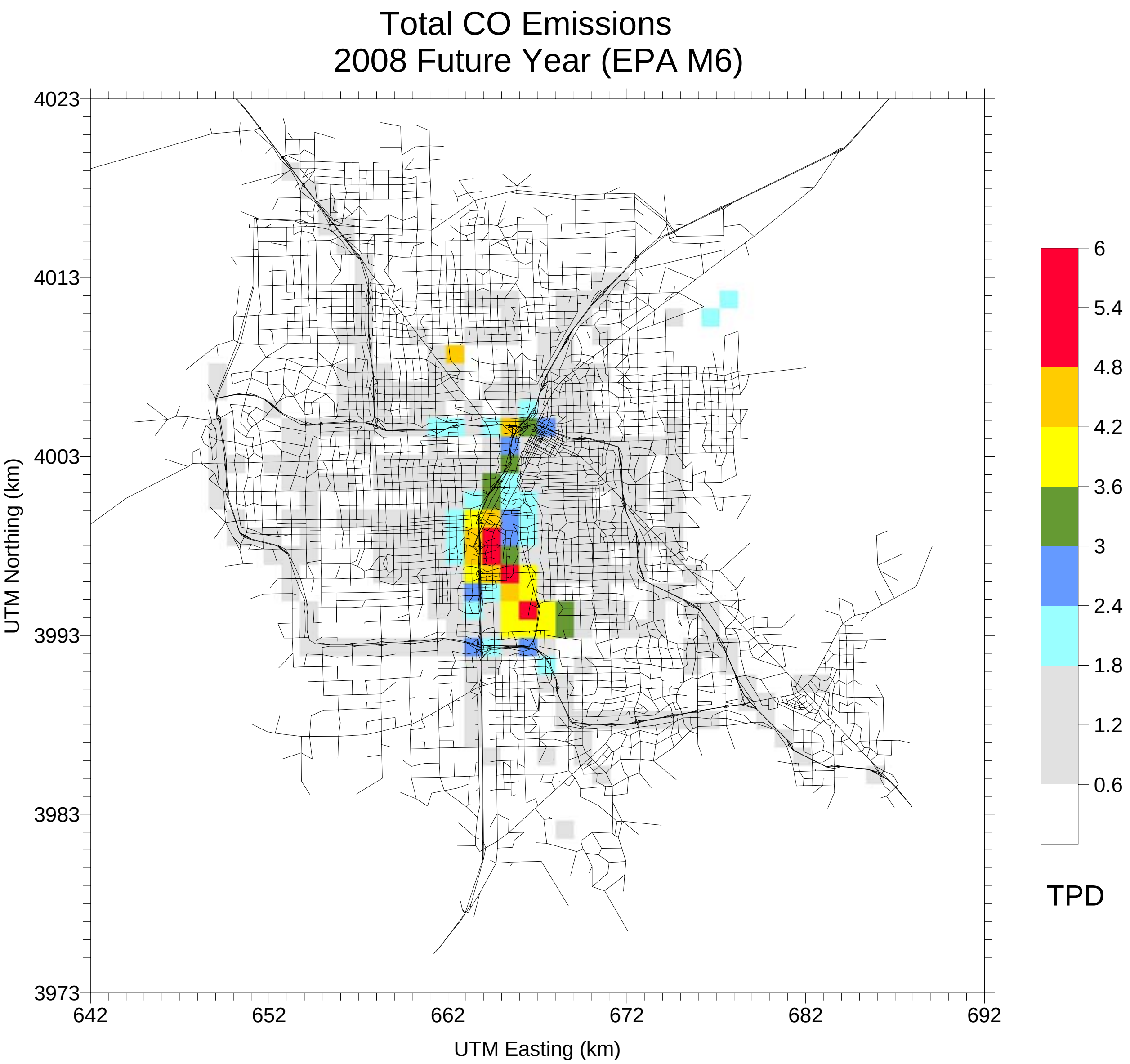


Figure 2-11. Spatial distribution of total surface gridded CO emissions on December 9 for the 2008 future year (using AIR version of MOBILE6).

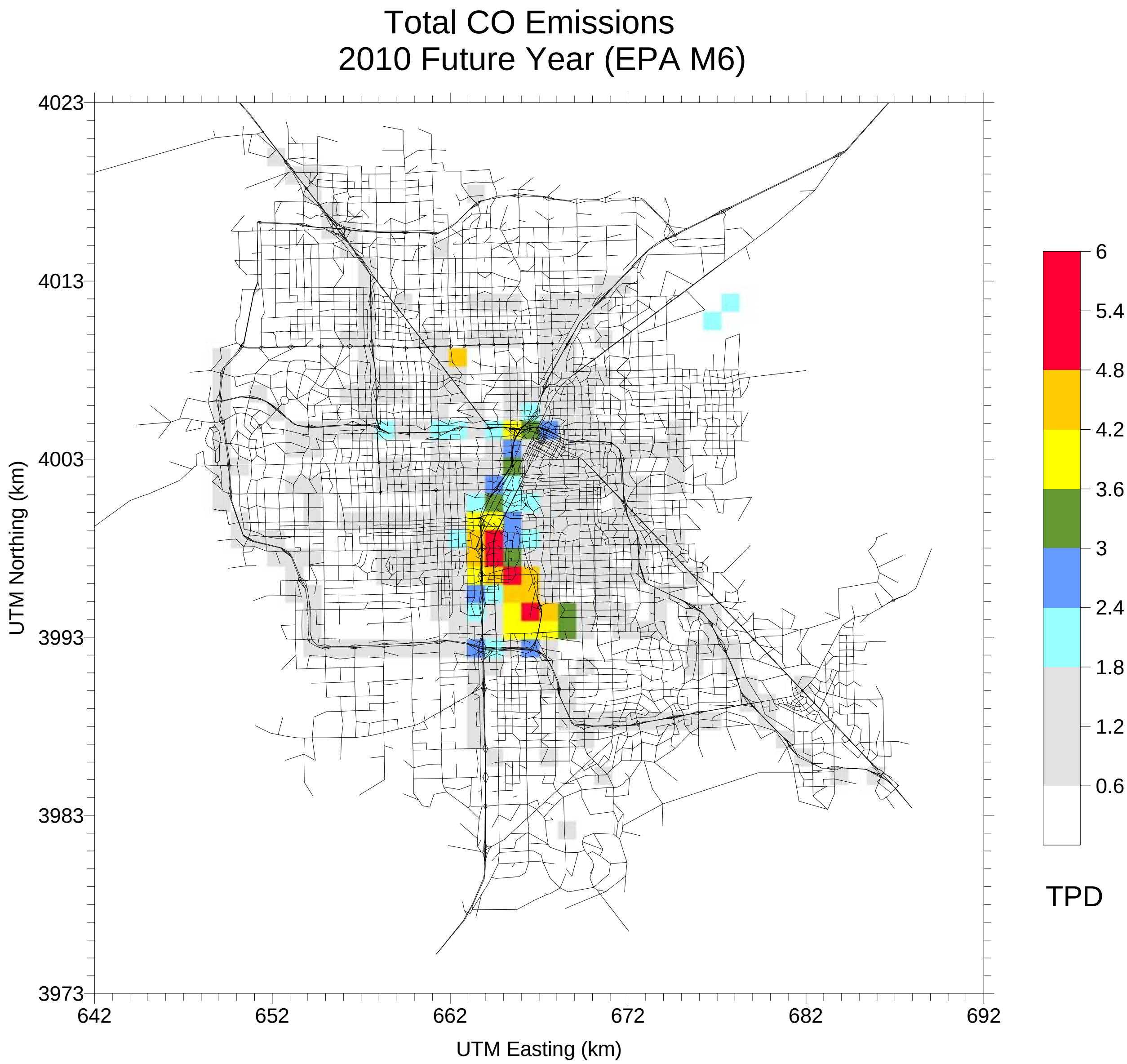


Figure 2-12. Spatial distribution of total surface gridded CO emissions on December 9 for the 2010 future year (using AIR version of MOBILE6).

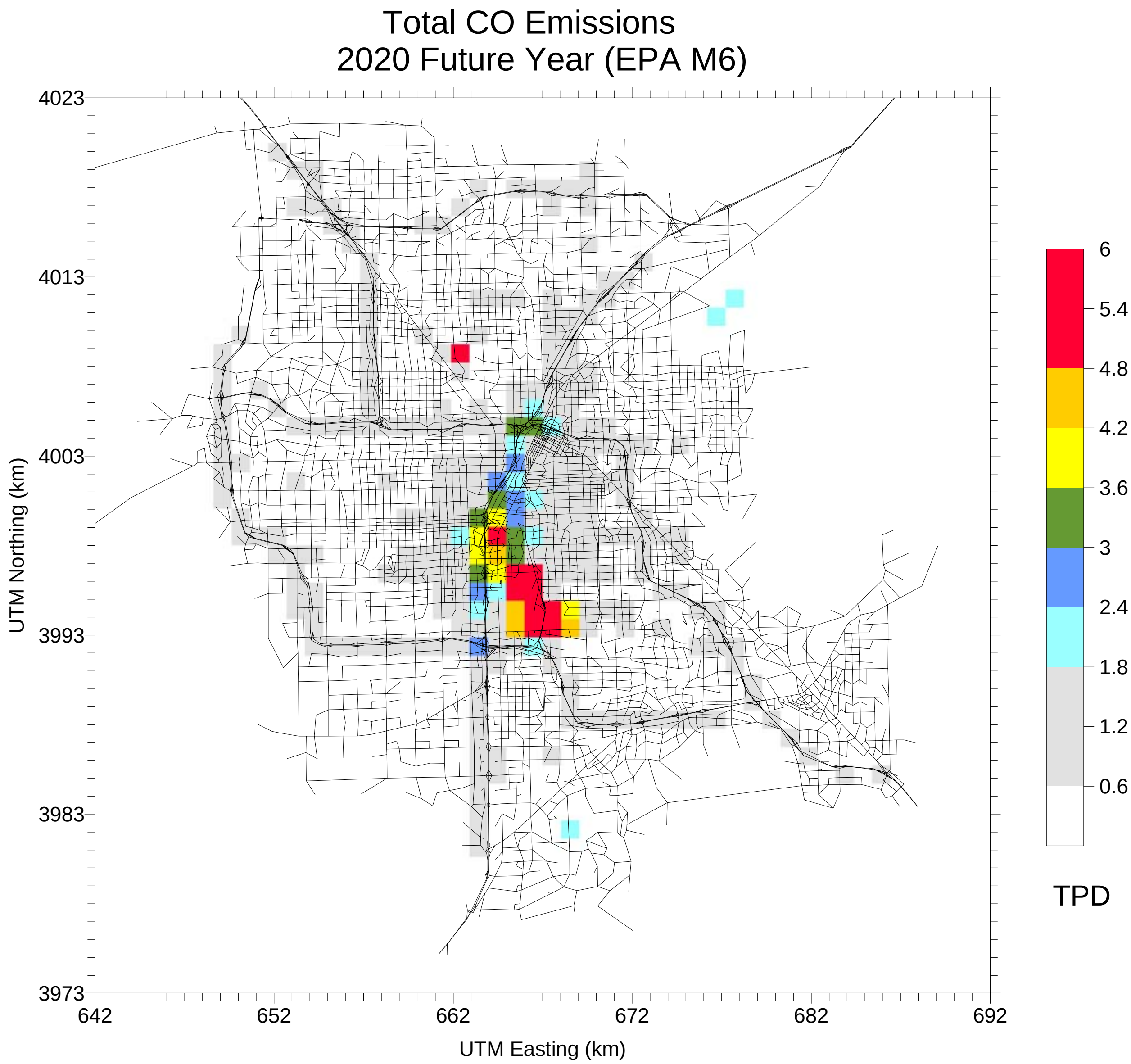


Figure 2-13. Spatial distribution of total surface gridded CO emissions on December 9 for the 2020 future year (using AIR version of MOBILE6).

3. MODELING RESULTS

3.1 OVERVIEW OF APPROACH

The UAM was provided with the updated future year CO emission inventories for 2008, 2010, and 2020 (as described in Section 2) and run for the December 8-9, 1996 historical CO event. All other environmental parameters were taken from the original modeling as documented in the 2000 CO SIP and the 2005 CO SIP Update. The UAM was used to determine peak 8-hour CO levels in the basin for each future year.

Modeling was performed to address UAM valley-wide CO distributions, intersection "hot spot" modeling with CAL3QHC, and EDMS micro-scale results reported by Ricondo (2003, 2005). With regard to the airports, it was necessary to run UAM twice using two different inventories per future year:

1. Valley-wide CO and micro-scale intersection modeling – including updated EDMS emissions in the UAM;
2. Micro-scale airport CO modeling – removing EDMS airport emissions from the UAM inventory in order to minimize double-counting.

EDMS results from the Ricondo (2003, 2005) analyses were combined with the revised UAM model predictions for the future years of 2008, 2010, and 2020 to estimate 8-hour CO concentrations for the duration of the episode on and around the airport properties. Note that the EDMS results previously reported for 2006 and 2010 (from the 2005 CO SIP Update) were interpolated to derive 2008 EDMS concentrations.

For hotspot intersection modeling, the CAL3QHC model was used to model three intersections: Charleston/Eastern, Charleston/Fremont and Eastern/Fremont, which are referred to collectively as the "Five Points" area. EPA (1992, 1995) guidance for screening level modeling of these three intersections was followed. The ambient temperature for each hour of the episode (needed to estimate emissions with the MOBILE6 model), and the wind direction and speed (needed for the CAL3QHC dispersion estimates) were taken from the original UAM/CAL3QHC modeling documented in the 2000 SIP. The same MOBILE6 inputs documented for the on-road emissions calculations in Section 2 were used to estimate emission factor inputs for CAL3QHC. Traffic volumes for all links associated with the three intersections were scaled according to the differences between the current TransCAD volumes and those used in the 2005 CO SIP Update. Since there were no 2008 volumes from the TransCAD results reported in the 2005 CO SIP Update, they were derived by scaling from 2006 (original TransCAD volumes) to 2008 (current TransCAD volumes). The CAL3QHC model output was added to the background UAM levels to estimate 8-hour CO concentrations for the duration of the episode.

Additional UAM simulations were run with scaled-up on-road CO emissions for each future year to develop on-road mobile emission budgets that demonstrate compliance with the 8-hour CO standard.

3.2 UAM SIMULATIONS

The UAM was used to simulate the emissions and transport of carbon monoxide throughout the Las Vegas Valley during the night of December 8-9, 1996 (Sunday-Monday). Specifically, the UAM was run from 1500 LST December 8 to 1100 LST December 9 to cover the most cold, stagnant and stable portion of the episode during which CO was observed to build up. The UAM was run using two sets of emission inputs, as described in Section 2:

1. On-road mobile sources estimated using the AIR version of MOBILE6;
2. On-road mobile sources estimated using the Sierra-modified version of MOBILE6.

Figures 3-1 through 3-3 display predicted 8-hour maximum CO concentrations in the modeling domain using the AIR version of MOBILE6 for the years 2008, 2010, and 2020, respectively. UAM predictions show that the 8-hour CO standard of 9 ppm will not be violated anywhere within the domain. Three distinct areas of CO maxima occur in the simulation: (1) near the “elbow” of U.S. 95 in northeast Las Vegas; (2) around the intersection of U.S. 95 and I-15; and (3) along the Las Vegas Boulevard “strip” near the intersection with Spring Mountain Road and extending to McCarran airport.

Similar patterns are seen when using emissions derived from the Sierra-modified version of MOBILE6, although the CO concentration patterns are lower overall in each year (Figures 3-4 through 3-6). The domain-peak 8-hour CO concentrations are tabulated below for each year and MOBILE6 run.

Table 3-1. Domain-peak 8-hour CO (ppm) from each UAM simulation.

	Peak 8-hour CO	
Year	**AIR MOBILE6**	**Sierra-modified MOBILE6**
2008	8.8	8.4
2010	8.5	8.1
2020	7.7	7.1

Note that the contribution of McCarran airport to local CO concentrations in that area steadily increases over this period. This is due to the projected growth in airport activities as reported by Ricondo (2003, 2005). In each successive year through 2020, however, the contribution from on-road mobile sources diminishes, while the peak moves from the U.S. 95 “elbow” in northeast Las Vegas to the northern boundary of McCarran airport along Tropicana Boulevard.

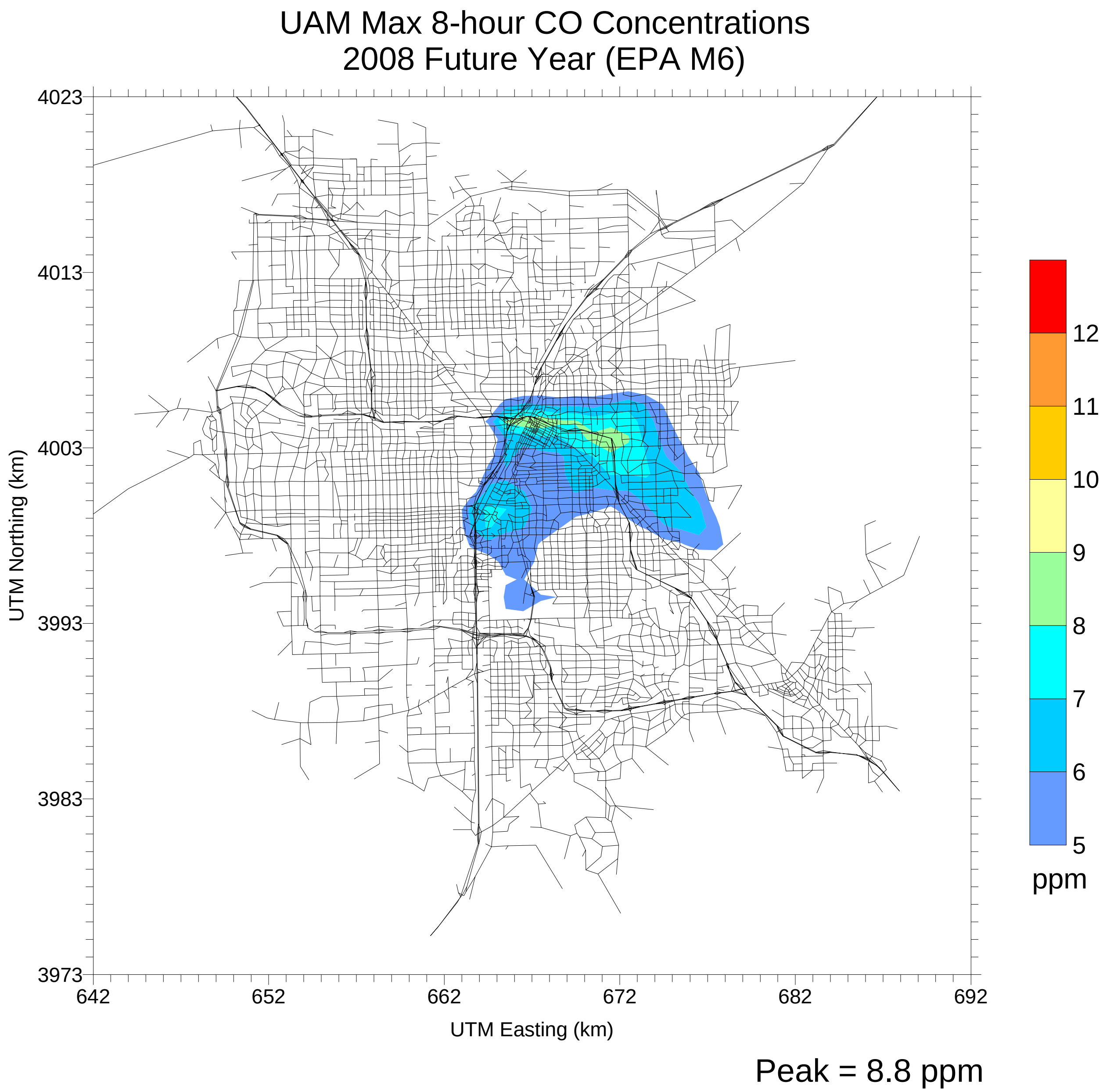
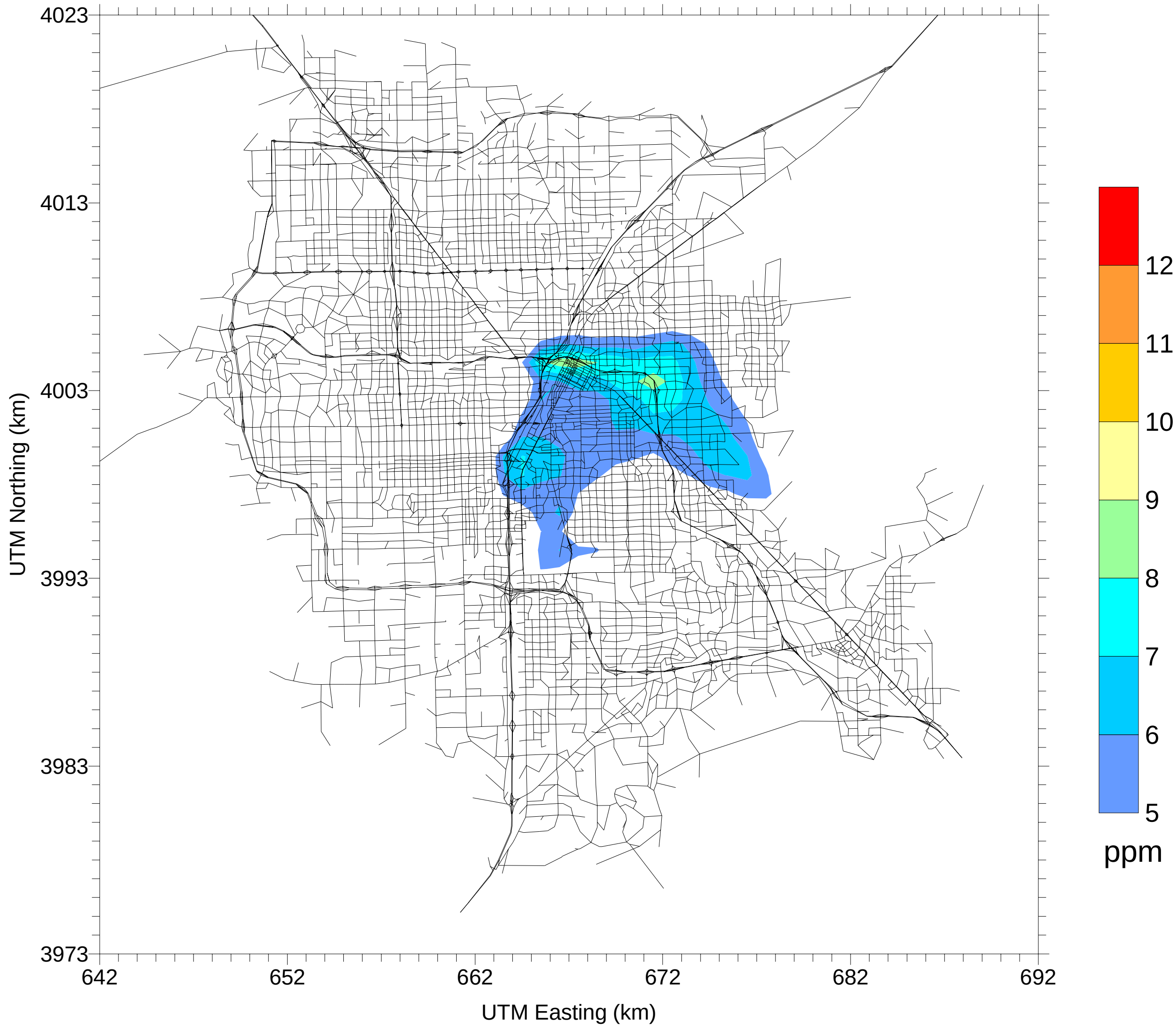


Figure 3-1. Spatial distribution of UAM predicted 8-hour maximum CO concentrations (ppm) for the December 8-9, 1996 episode using emission forecasts for 2008 (AIR version of MOBILE6).

UAM Max 8-hour CO Concentrations
2010 Future Year (EPA M6)



Peak = 8.5 ppm

Figure 3-2. Spatial distribution of UAM predicted 8-hour maximum CO concentrations (ppm) for the December 8-9, 1996 episode using emission forecasts for 2010 (AIR version of MOBILE6).

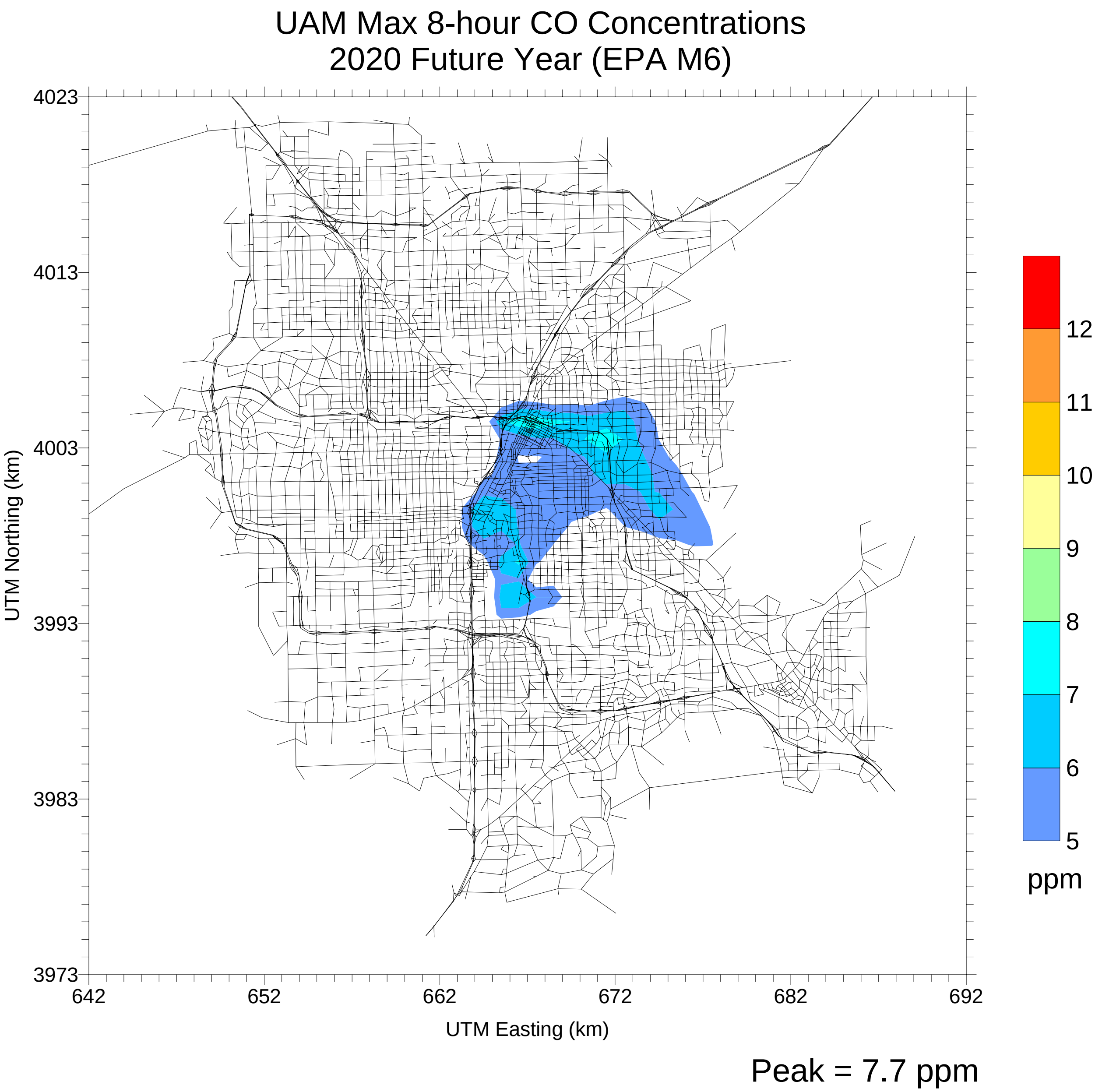


Figure 3-3. Spatial distribution of UAM predicted 8-hour maximum CO concentrations (ppm) for the December 8-9, 1996 episode using emission forecasts for 2020 (AIR version of MOBILE6).

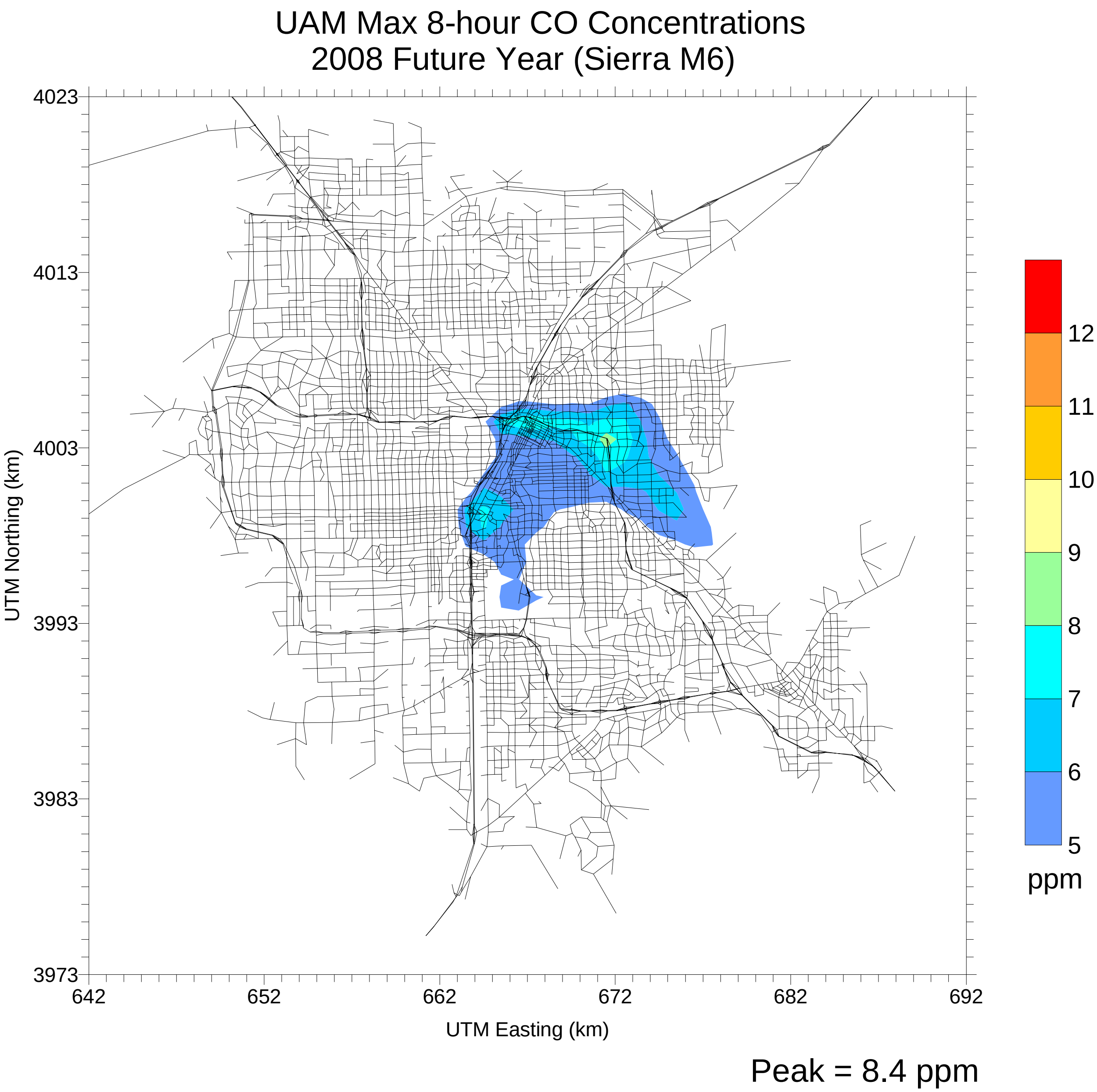


Figure 3-4. Spatial distribution of UAM predicted 8-hour maximum CO concentrations (ppm) for the December 8-9, 1996 episode using emission forecasts for 2008 (Sierra-modified version of MOBILE6).

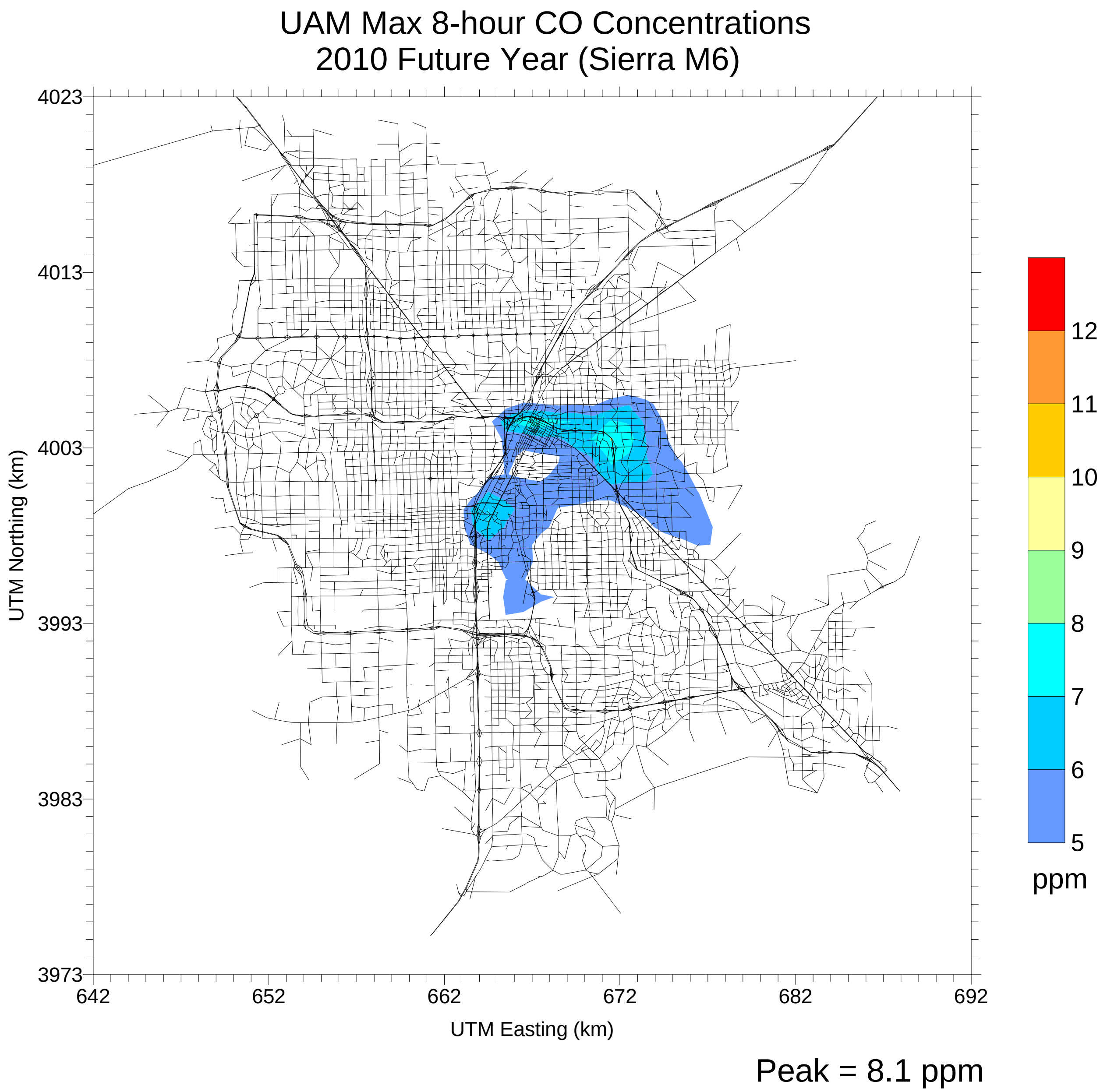


Figure 3-5. Spatial distribution of UAM predicted 8-hour maximum CO concentrations (ppm) for the December 8-9, 1996 episode using emission forecasts for 2010 (Sierra-modified version of MOBILE6).

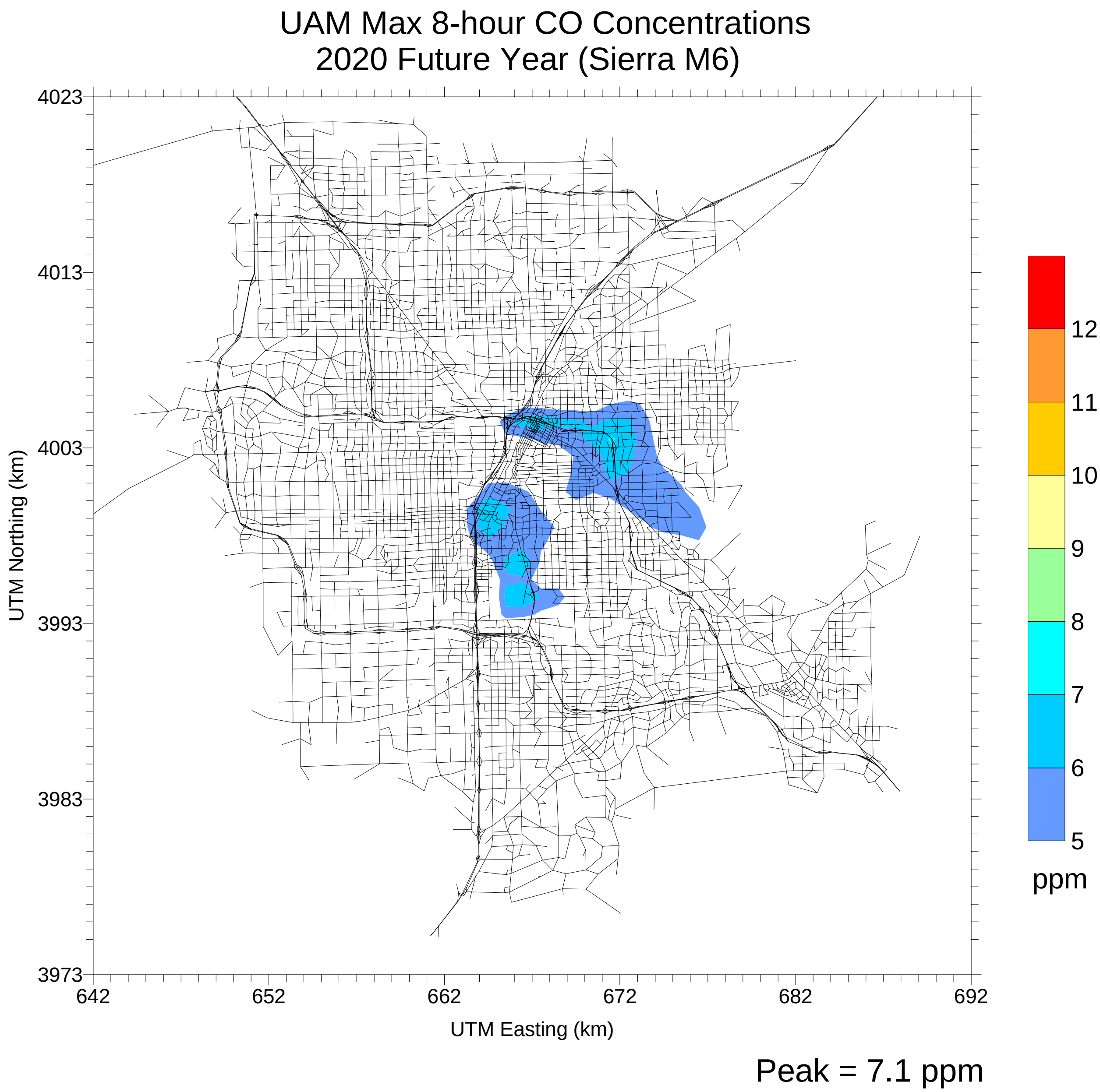


Figure 3-6. Spatial distribution of UAM predicted 8-hour maximum CO concentrations (ppm) for the December 8-9, 1996 episode using emission forecasts for 2020 (Sierra-modified version of MOBILE6).

3.3 MICROSCALE MODELING

Future year UAM simulation results were used to provide estimates of background ambient CO levels for micro-scale modeling performed for the “Five Points” hot spot intersection and for the three civil airports in the modeling domain (McCarran, Henderson Executive, and North Las Vegas). UAM concentrations from the appropriate grid cells were simply added to the concentrations predicted at each micro-scale receptor to obtain a total (background + micro-scale) CO concentration. Note that the UAM simulations reported here utilized on-road mobile emissions generated from the AIR version of MOBILE6 only. Procedures for running CAL3QHC and combining with UAM predictions followed the same methodology as described in the 2000 CO SIP and 2005 CO SIP Revision. Results are presented in the following sub-sections.

3.3.1 CAL3QHC Intersection Modeling

The CAL3QHC model was used to model three intersections: Charleston/Eastern, Charleston/Fremont and Eastern/Fremont, which are referred to collectively as the “Five Points” area. The ambient temperature for each hour of the episode (needed to estimate emissions with the MOBILE6 model), and the wind direction and speed (needed for the CAL3QHC dispersion estimates) were taken from the original modeling documented in the 2000 SIP. The AIR version of MOBILE6 was used to provide emission factor inputs for idle and 30 MPH for each hour and each year. Traffic volumes for all links associated with the three intersections were scaled according to the differences between the current TransCAD volumes and those used in the 2005 CO SIP Update. For 2010 and 2020, scaling factors were developed according to the differences between the current and 2005 SIP TransCAD volumes averaged over the four UAM grid cells that contain the Five Points intersections. Since there were no 2008 volumes from the 2005 SIP TransCAD, scaling factors were derived to scale from 2006 to 2008 according to the difference between the current 2008 and original 2006 TransCAD volumes. The scaling factors are listed below for each year:

Year	CAL3QHC Volume Scaling
2008	1.28
2010	1.19
2020	1.26

The CAL3QHC model output was added to the background UAM levels to estimate 8-hour CO concentrations for the duration of the episode. Table 3-2 presents the individual peak 8-hour average CO concentrations predicted by UAM, CAL3QHC, and their combination, in each of the future years and for each of the three intersections in the “Five Points” area. Note that the peak 8-hour periods among the UAM, CAL3QHC, and UAM+CAL3QHC results occur at different times. All values are well below the 9 ppm standard.

Table 3-2. Peak 8-hour average CO concentrations (ppm) predicted by UAM, CAL3QHC, and UAM+CAL3QHC for each future year and for each of the Five Points intersections. Note that peaks reported for each of the models and their combined effect occur over different 8-hour periods.

Year	UAM	Eastern/Charleston		Eastern/Fremont		Fremont/Charleston	
		CAL3QHC	CAL3QCH+UAM	CAL3QHC	CAL3QHC+UAM	CAL3QHC	CAL3QHC+UAM
2008	6.6	2.1	8.1	1.8	7.7	1.0	7.0
2010	6.4	1.9	7.7	1.7	7.4	1.0	6.7
2020	5.8	1.5	6.9	1.4	6.7	0.8	6.0

3.3.2 EDMS Airport Modeling

The UAM was run for all future years with exactly the same inputs as described in Section 3.2; however, airport emissions for the three civil airports in the domain were removed from the UAM inventory to minimize double counting to the extent possible. It is important to note that traffic volumes on the major roadways within the McCarran airport property are included in both EDMS and TransCAD. As a result, the EDMS+UAM CO concentration results for McCarran reflect a double-counting of portions of the on-road mobile source emissions on that property, and so the CO concentrations reported for McCarran are conservative (i.e., high) estimates.

As part of the 2005 CO SIP Revision, Clark County provided EDMS simulation results for 2005, 2010, 2015 and 2020, based on the work of Ricondo (2003, 2005). The EDMS results reported for 2006 and 2010 were interpolated to derive 2008 EDMS receptor concentrations. EDMS concentrations were combined with the UAM model predictions for 2008, 2010, and 2020 to estimate 8-hour CO concentrations for the duration of the episode on and around the airport properties. Note that the receptor grid for North Las Vegas airport was reduced to the immediate area surrounding the airport, and thus results shown in Table 3-3 are lower than reported in the 2005 CO SIP Revision.

In each of these years, several receptors at McCarran airport reported total 8-hour CO concentrations (sum of EDMS and UAM components) above the 8-hour CO standard of 9 ppm. Note, however, that all receptors above the 9 ppm standard in all future years evaluated occurred within areas that are not publicly accessible, as defined by Ricondo (2005). Disregarding any receptors in publicly restricted areas removes all exceedance estimates. Table 3-3 presents the peak total 8-hour CO concentration at all three airports for each future year evaluated. Values for McCarran are taken from the peak publicly accessible receptor. All peak CO concentrations are below the 9 ppm standard in all years.

Table 3-3. Peak total UAM + EDMS 8-hour CO concentrations (ppm) at all three airports and for all future years evaluated. Values shown for McCarran airport occur at the peak publicly accessible receptor.

Airport	2008	2010	2020
McCarran	7.8	7.7	8.9
Henderson Executive	1.3	1.4	3.0
North Las Vegas	3.5	3.4	2.9

3.4 ESTIMATING ON-ROAD EMISSION BUDGETS

The UAM was used to refine the estimation of future year on-road mobile CO emission budgets for the central, most urbanized portion of the modeling domain. The definition of the central urban sub-domain is given in Table 3-4 and shown in Figure 3-7. On-road mobile source emissions calculated from the AIR version of MOBILE6 were scaled up over the entire domain to the point at which the peak 8-hour CO concentration reached 8.9 ppm in each of the future years. Additionally, the on-road mobile source emissions outside the central urban sub-domain

Table 3-4. Grid definition of the central urban sub-domain.

	Column	Row	UTM East	UTM North
Low-left	11	19	652.000	3991.000
Upper-Right	36	45	678.000	4018.000

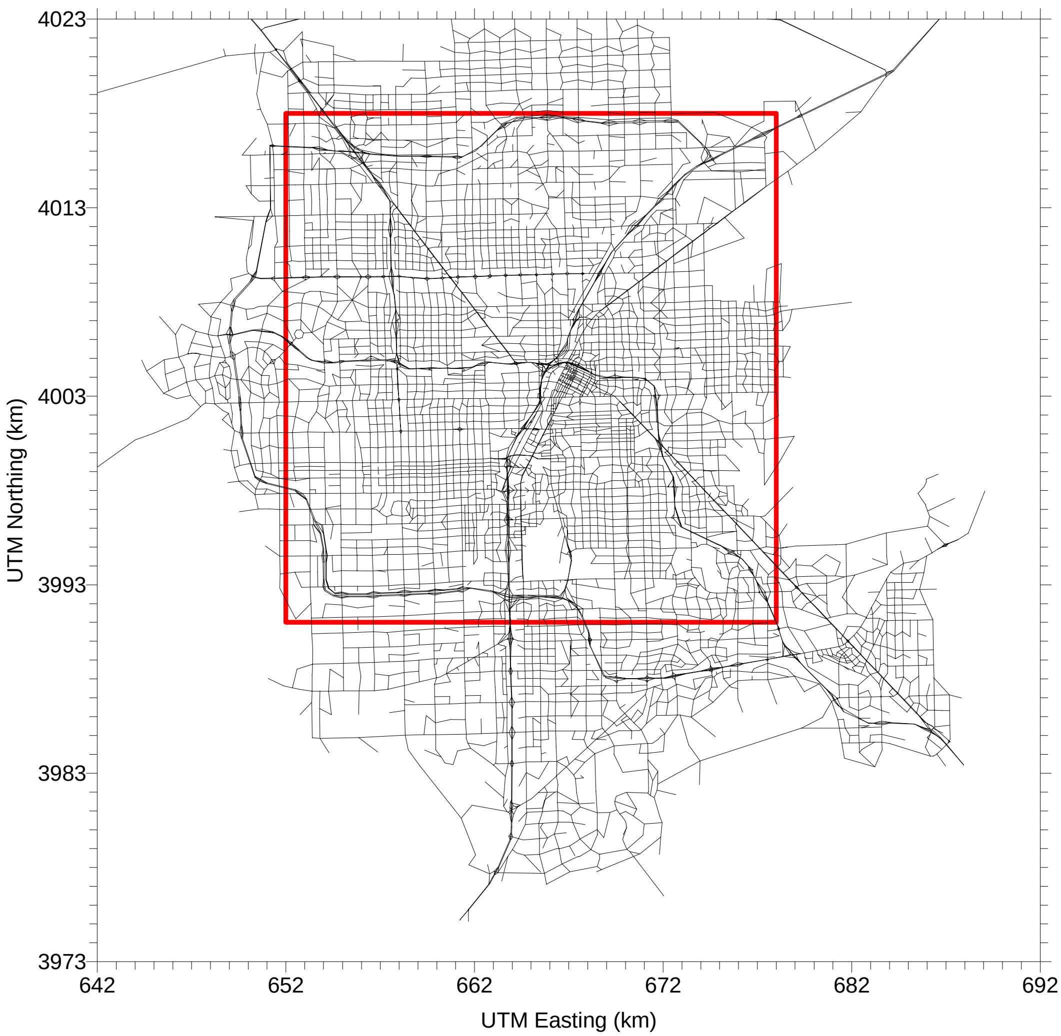


Figure 3-7. Location of the central urban sub-domain used in the UAM sensitivity tests (heavy red line).

were increased by an additional 60% in each year to reach a maximum peak 8-hour CO concentration of just under 9.0 ppm in either the peak UAM grid cell, the peak UAM+ CAL3QHC receptor, or the peak UAM+EDMS receptor. UAM results from this analysis are presented in Table 3-5. Plots of UAM daily maximum CO concentrations for each future year are shown in Figures 3-8 through 3-10.

Table 3-5. Weekday domain-wide on-road emission increase, net on-road emission increase that includes an additional 60% increase outside the central urban sub-domain, resulting UAM predicted peak CO, and resulting total and sub-domain on-road emission budgets (December 9) for each future year.

Year	Domain-Wide On-Road Emissions Increase	Net On-Road Emissions Increase	Peak 8-hr CO (ppm)	Total Domain On-Road Emissions (TPD)	Sub-Domain On-Road Emissions (TPD)
2008	0.5%	13%	8.87	658	457
2010	4.0%	18%	8.88	686	464
2020	5.0%	23%	8.12	704	435

Future year CAL3QHC intersection results were similarly scaled up by the domain-wide on-road emission increases shown in the second column of Table 3-5. Table 3-6 presents the individual peak 8-hour average CO concentrations predicted by UAM, CAL3QHC, and their combination, in each of the future years and for each of the three intersections in the "Five Points" area. Note that the peak 8-hour periods among the UAM, CAL3QHC, and UAM+CAL3QHC results occur at different times. All values remain well below the 9 ppm standard.

Table 3-7 presents the peak total UAM + EDMS 8-hour CO concentration from each UAM run listed in Table 3-5 (without airports included). Note that EDMS results were not scaled up as on-road motor vehicle emissions consist of a fraction of the total EDMS inventory, and much of the on-road emissions on airport property are already double counted as described earlier. Values for McCarran are taken from the peak publicly accessible receptor. All peak CO concentrations are below the 9 ppm standard in all years.

Table 3-6. Peak 8-hour average CO concentrations (ppm) predicted by UAM, CAL3QHC, and UAM+CAL3QHC for each future year, and for each of the Five Points intersections. UAM and CAL3QHC results are taken from the on-road sensitivity scaling tests. Note that peaks reported for each of the models and their combined effect occur over different 8-hour periods.

Year	UAM	Eastern/Charleston		Eastern/Fremont		Fremont/Charleston	
		CAL3QHC	CAL3QCH+UAM	CAL3QHC	CAL3QHC+UAM	CAL3QHC	CAL3QHC+UAM
2008	6.7	2.1	8.2	1.8	7.8	1.0	7.0
2010	6.7	2.0	8.0	1.8	7.7	1.0	7.0
2020	6.1	1.6	7.2	1.4	7.0	0.8	6.3

Table 3-7. Peak total UAM + EDMS 8-hour CO concentrations (ppm) at all three airports and for all future years evaluated. Values shown for McCarran airport occur at the peak publicly accessible receptor. UAM results are taken from the on-road sensitivity scaling tests.

Airport	2008	2010	2020
McCarran	7.88	7.77	8.98
Henderson Executive	1.38	1.50	3.38
North Las Vegas	3.53	3.51	3.10

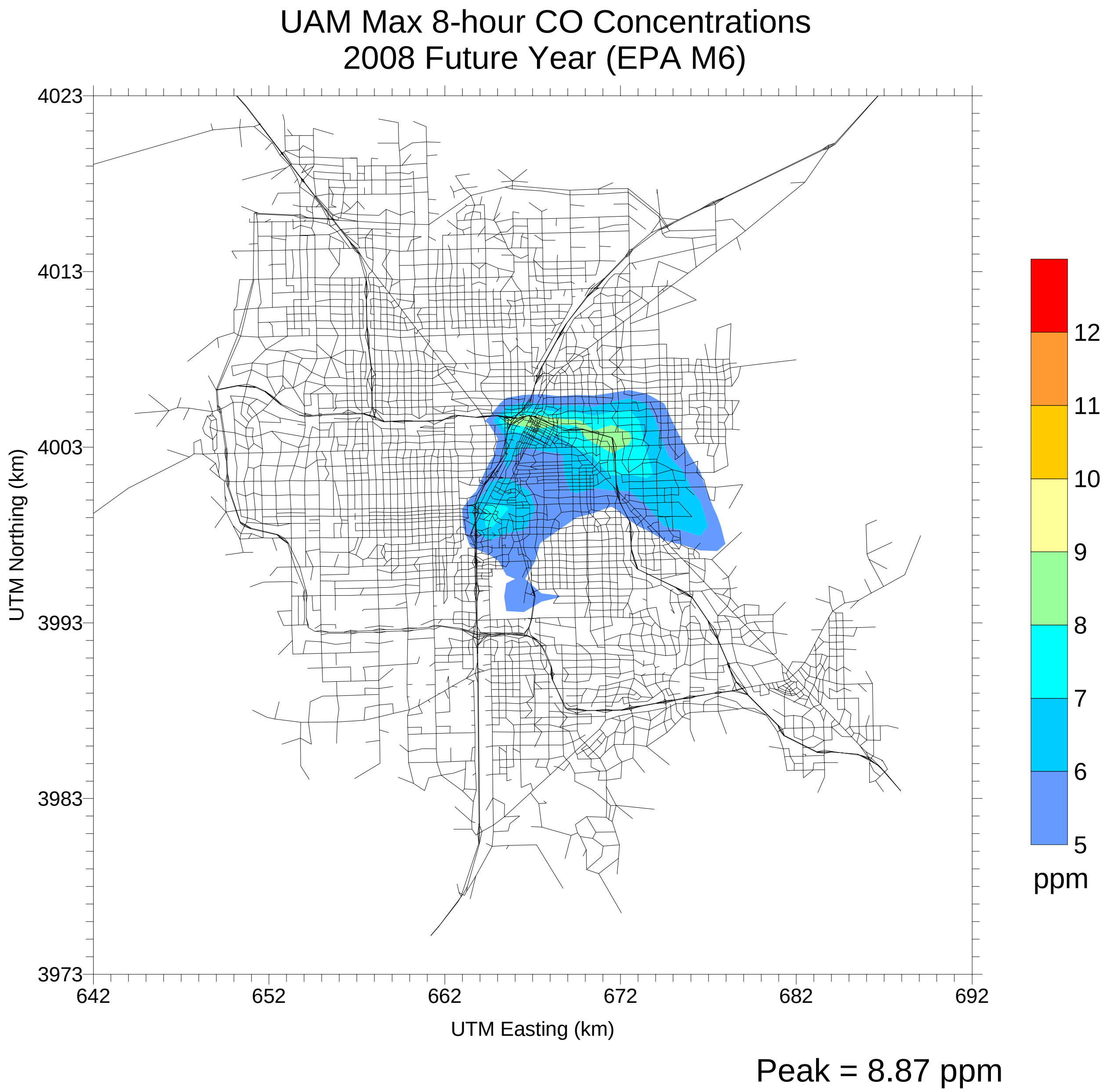


Figure 3-8. Spatial distribution of UAM predicted 8-hour maximum CO concentrations (ppm) for the December 8-9, 1996 episode using emission forecasts for 2008 with increased on-road mobile source emissions to reach peak CO just under 9.0 ppm (AIR version of MOBILE6).

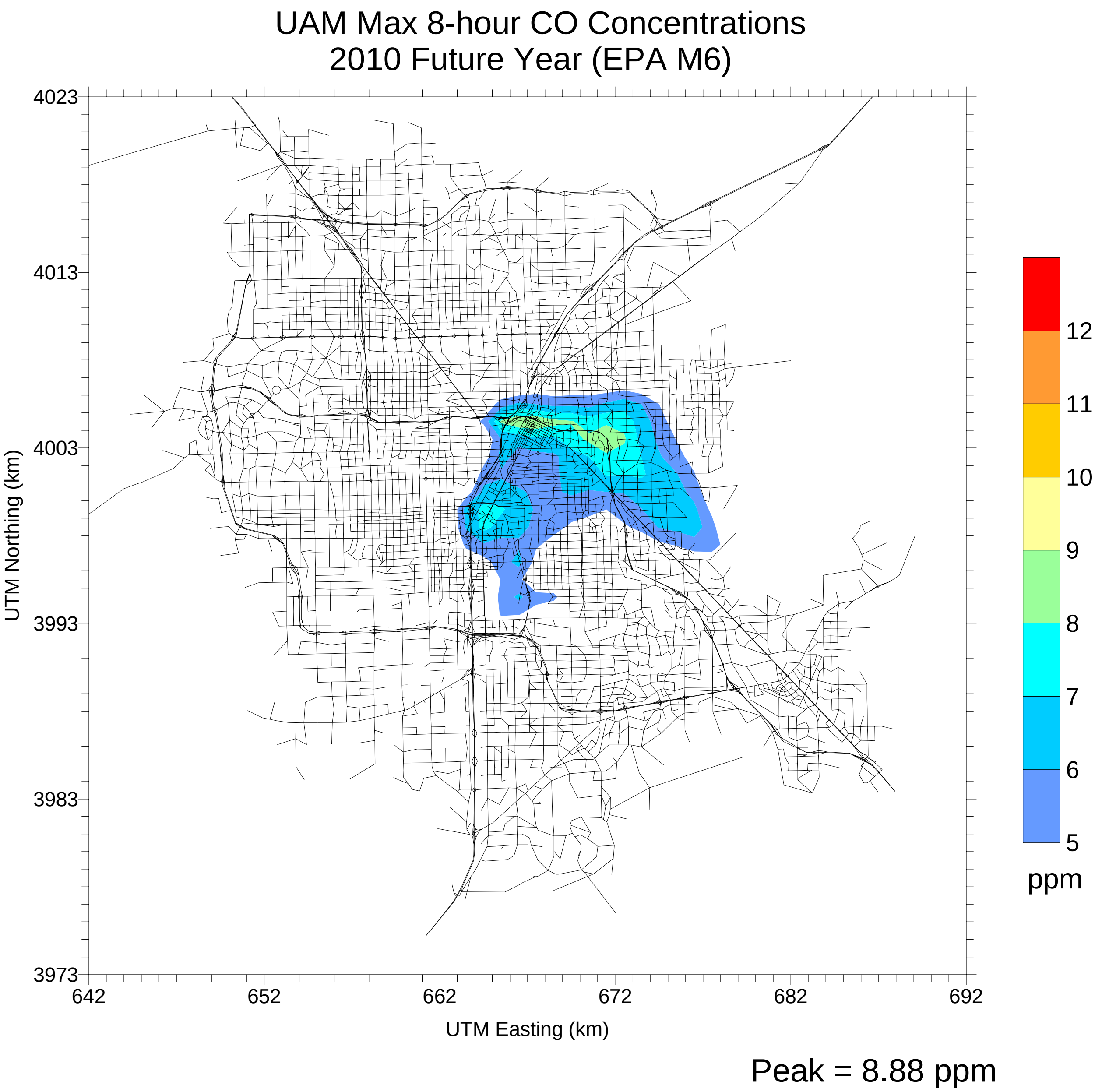


Figure 3-9. Spatial distribution of UAM predicted 8-hour maximum CO concentrations (ppm) for the December 8-9, 1996 episode using emission forecasts for 2010 with increased on-road mobile source emissions to reach peak CO just under 9.0 ppm (AIR version of MOBILE6).

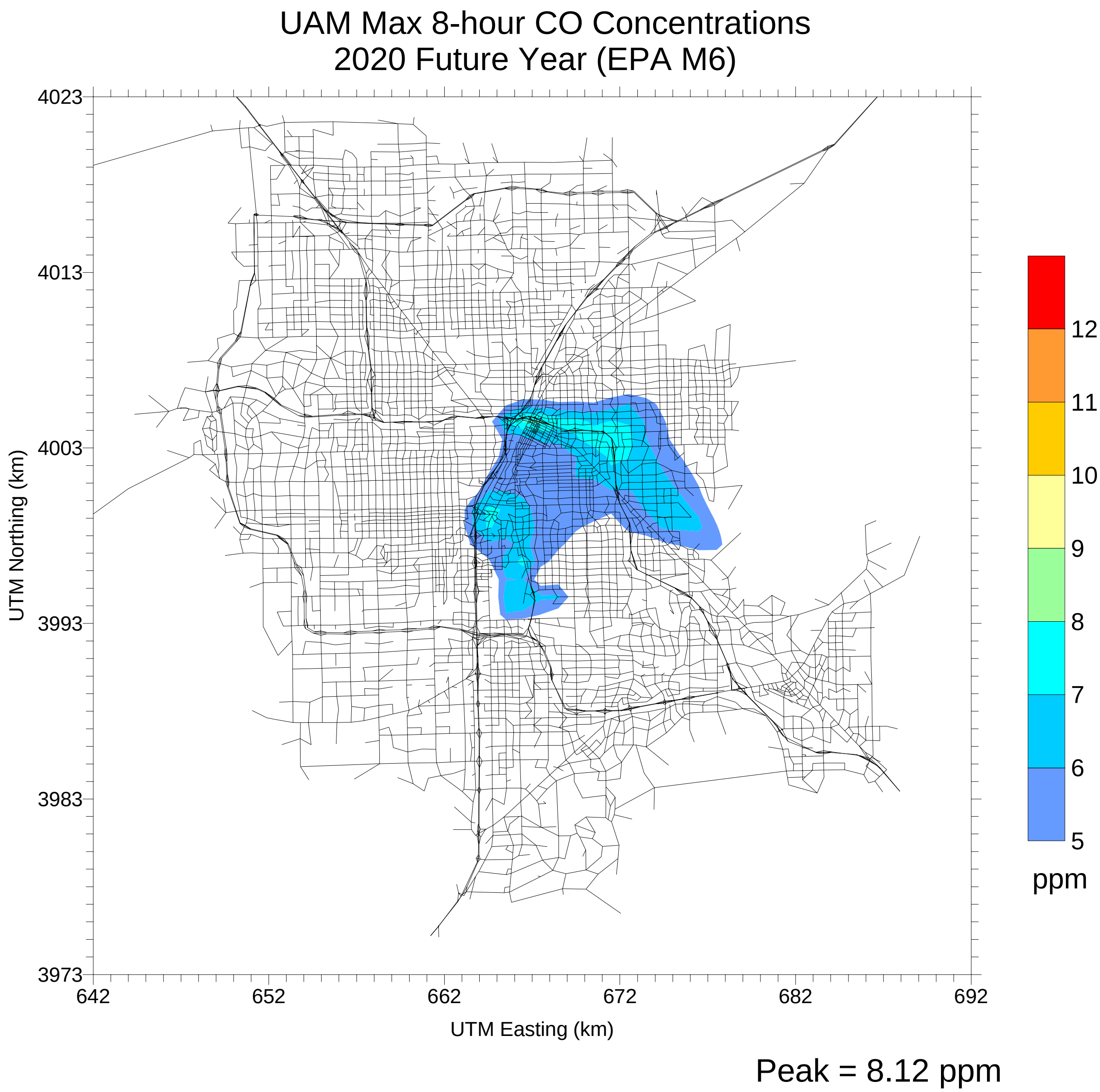


Figure 3-10. Spatial distribution of UAM predicted 8-hour maximum CO concentrations (ppm) for the December 8-9, 1996 episode using emission forecasts for 2020 with increased on-road mobile source emissions to reach peak CO just under 9.0 ppm (AIR version of MOBILE6).

4. SECTION 110(l) REQUIREMENTS

Before the EPA can redesignate the Las Vegas Valley nonattainment area to attainment – based on the proposed changes contained in this plan – the provisions of CAAA Section 110(a)(2) and Section 110(l) must be satisfied. Section 110(a)(2) addresses the general requirements for SIPs. Section 110(l) requires that any SIP revision not interfere with requirements for attainment or reasonable further progress regarding other criteria pollutants, or with any other CAAA requirements. The requirements of Section 110(l) are addressed here.

The maintenance plan proposes to relax one federally enforceable control measure – the reduced RVP gasoline program – and removes three other control measures: the CBG wintertime program, TCM/TDM, and the Alternative Fuels Program. However, the TCM/TDM and the Alternative Fuels Program will be retained in the plan as contingency measures. The following analysis demonstrates that the control measure changes proposed in this CO maintenance plan will not interfere with Clark County's progress towards attaining the 8-hour ozone NAAQS, or with continued attainment of the PM10 NAAQS. Nevada is currently designated as attainment/ unclassifiable for PM2.5 under Section 107(d) of the CAAA; therefore, no analysis is required on PM2.5 NAAQS impacts.

4.1 OZONE

4.1.1 Reduced RVP Gasoline and CBG Wintertime Programs

Relaxation of the RVP for wintertime fuels and elimination of the CBG wintertime program are not expected to interfere with attainment of the 8-hour ozone standard because both are wintertime programs. Elevated levels of ozone normally occur during the summertime because heat and sunlight are needed to produce the chemical reactions between nitrogen oxides (NOx) and volatile organic compounds (VOC) that form ground-level ozone.

4.1.2 TCM/TDM

CAAA Section 187(b)(2) requires areas classified as serious nonattainment to adopt TCMs as provided in Section 182(d)(1). The RTC adopted Resolutions No. 177 and No. 186 (2000 CO SIP, Appendix D), which indicated support and established the guidelines for administering a voluntary employer-based commuter incentive program (VMEP), also known as CAT MATCH.

In 1997, EPA released a policy document that set forth guidance and interpretation on the enforceability of VMEPs (Memo from R. Wilson dtd. 10/24/97). It said that state and local agencies "are not responsible, necessarily, for implementing a program dependent on voluntary actions" (2000 CO SIP, Appendix A). Furthermore, policy directs that the total amount of emission reductions from voluntary measures shall not exceed 3 percent of the statutory requirements of the CAAA with respect to any SIP submittal.

DAQEM is evaluating the benefits of VMEPs in conjunction with the development of an ozone SIP; discontinuation of CO SIP credits from the TCM/TDM is not expected to interfere.

4.1.3. Alternative Fuels Program for Government Fleets

The state of Nevada developed the Alternative Fuels Program as a result of the Energy Policy Act of 1992, which required federal, state, and fuel provider fleets to acquire alternative fuel vehicles. The law establishing this program is set forth in NRS Chapter 486a, which authorizes the State Environmental Commission to promulgate implementing regulations. Those regulations are set forth in NAC Chapter 486a.

DAQEM is evaluating the benefits of the Alternative Fuel Program in conjunction with the development of an ozone SIP; discontinuation of CO SIP credits from the program is not expected to interfere.

4.2 PARTICULATE MATTER

Relaxation of the RVP requirement for wintertime fuels, elimination of the CBG wintertime program, and discontinuation of CO SIP credits from the TCM/TDM and the Alternative Fuels Program are not expected to interfere with continued attainment of the 24-hour PM10 standard because DAQEM has demonstrated that motor vehicle exhaust is an insignificant source of PM10 in the Las Vegas Valley (PM10 State Implementation Plan for Clark County, 2001; Milestone Achievement Report for Clark County, 2007).

DAQEM's determination of source significance was based primarily on the J.D. Smith annual inventory and the 24-hour micro-inventories at five representative sites, supplemented by reviews of the 1998 valley-wide annual emission inventory and Chemical Mass Balance modeling. The emission inventories/projections in the Milestone Achievement Report for Clark County (2007) show that motor vehicle exhaust makes an insignificant contribution to PM10 concentrations.

Table 4-1 shows total PM10 mobile source emissions for the Las Vegas Valley in 2006. The contribution of vehicle exhaust to total PM10 mobile source emissions is less than 1 percent.

Table 4-1. Total PM_{10} Mobile Source Emissions for 2006.

On-Road Mobile 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	0.02
Vehicle tire wear	0.37
Vehicle brake wear	0.55
Vehicle exhaust	0.53
Total PM_{10} mobile source emissions	**98.81**

Source: PM_{10} Milestone Achievement Report for Clark County, June 2007.

Table 4-2 shows that mobile source emission programs, such as reduced RVP, CBG, TCM/TDM, and alternative fuel fleets, have a negligible effect in reducing 24-hour PM10 concentrations in the Las Vegas Valley.

Table 4-2. 2006 24-Hour Controlled PM_{10} Emissions.

On-Road Mobile Source Category	Uncontrolled PM_{10} (tpd)	Controlled PM_{10} (tpd)	Percent Reduction
Paved road dust (includes construction track-out)	83.53	59.31	29.00
Unpaved road dust	9.34	3.27	65.00
Highway construction projects activities	1.34	0.43	68.00
Highway construction projects–wind erosion	3.13	0.91	71.00
Vehicle sulfate PM	0.02	0.02	0.00
Vehicle tire wear	0.37	0.37	0.00
Vehicle brake wear	0.55	0.55	0.00
Vehicle exhaust	0.53	0.53	0.00
Total	**98.81**	**65.38**	**33.83%**

Source: PM_{10} Milestone Achievement Report for Clark County, June 2007.

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