Appendix F. Air Quality Analysis

Appendix F. Air Quality Analysis

This appendix documents the methods used to calculate emissions of carbon monoxide (CO), particulate matter less than ten microns in diameter (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), volatile organic compounds (VOCs), oxides of nitrogen (NO_X), and oxides of sulfur (SO_X) for existing conditions, the Proposed Action, and the No Action alternative. The emissions analysis was conducted to develop emissions inventories pursuant to the *National Environmental Policy Act of 1969*, and to determine whether emissions associated with construction and operation of a regional heliport and related facilities at the South of Sloan site (Heliport site) would exceed applicable *de minimis* thresholds as documented in the U.S. Environmental Protection Agency's (U.S. EPA's) general conformity regulations.

This appendix also documents the methods used to perform dispersion analyses for CO and PM_{10} for the Proposed Action and No Action alternative. Dispersion analyses were conducted to determine if localized pollutant concentrations would exceed the National Ambient Air Quality Standards (NAAQS) under the Proposed Action or No Action alternative.

F.1 Emissions Analysis

Total emissions associated with existing helicopter operations at McCarran International Airport (McCarran) were calculated for the existing condition (2004). Estimates of construction-related emissions were developed for the Proposed Action. Emissions estimates were also developed for the Proposed Action and No Action alternative for two future years (2011 and 2017). Sources of emissions are identified in **Table F-1** and are divided into two categories: heliport operational emissions and construction emissions, which are discussed in Sections F.1.1 and F.1.2, respectively.

Table F-1

Sources of Emissions

- Heliport operational emissions
  - Helicopter operations
  - Ground support equipment (GSE)
  - On-road motor vehicles used to transport helicopter air tour passengers (including entrained road dust)
  - Point sources (e.g., fuel tanks)
- Construction emissions
  - On-road construction equipment
  - Nonroad construction equipment
  - Land development
  - Wind erosion
  - Asphalt paving

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc., April 2008

F.1.1 Heliport Operational Emissions

Airport operational emissions were calculated using the Emissions and Dispersion Modeling System (EDMS) Version 4.3. EDMS is the U.S. EPA's preferred guideline model for air quality analyses at airports/heliports. EDMS is a combined emissions and dispersion model developed by the Federal Aviation Administration (FAA) in cooperation with the United States Air Force (USAF). The primary applications of the model are to generate an inventory of emissions caused by sources on and around an airport and to calculate pollutant concentrations in the surrounding environment. EDMS data tables include emission factors for civilian and military aircraft[1], ground support equipment, and motor vehicles.

The EDMS emissions inventory module incorporates U.S. EPA-approved methodologies for calculating aircraft emissions, on- and off-road vehicle emissions, and stationary source emissions. Pollutants currently included in EDMS for emissions inventories are CO, total hydrocarbons (THC), non methane hydrocarbons (NMHC), VOC, NO_X, SO_X, PM_{10}, and $PM_{2.5}$.

EDMS was used to estimate heliport-related emissions from the following sources:

- Helicopter operations
- GSE
- Ground access vehicles (associated with movements on roadways and in parking lots)
- Point sources

The methodologies and assumptions used to develop the emissions inventories are described in the sections that follow.

F.1.1.1 Helicopter Operations

Annual helicopter emissions are a function of the number of annual helicopter operations, the helicopter fleet mix (types of helicopters/engines used), the length of time helicopters spend in various modes (taxi/idle, takeoff, climbout, approach, and landing), and the emission rates of the engine. The EDMS 4.3 database contains a list of aircraft types (airframes) and engine types for use in air quality analyses.

<u>Helicopter LTO Cycles and Fleet Mix</u>

According to helicopter air tour operator interviews and surveys, two primary helicopter models are used for helicopter air tour operations: the Eurocopter AS350 and the Eurocopter EC130. EDMS 4.3 has a very limited database of civilian helicopters and the database does not include the AS350 or EC130 helicopters. The Bell 206, with a 250B17B engine, was selected to represent all helicopter air tour operations for this air quality analysis since it was determined to be the most representative civilian helicopter in the database.

To determine existing and projected pollutant emissions from helicopter operations, EDMS requires input data in terms of annual landing and takeoff (LTO) cycles. LTO cycles are one-half the number of total helicopter operations, because one helicopter operation represents one takeoff, landing, or touch-and-go. Helicopter LTO cycles at McCarran International Airport in 2004 were used to represent existing conditions in this environmental assessment and were based on actual helicopter operations data collected by AirScene.[2] Forecasts of annual LTO cycles in 2011 and 2017 were derived from the annual forecasts presented in Chapter III of this EA.

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1 As used in report, “aircraft” includes helicopters.

2 AirScene is a proprietary software package developed and licensed by Rannoch Corporation that provides data to the Department of Aviation regarding aircraft and helicopter operations at McCarran International Airport. The Department of Aviation has used the software package since July 2000.

Existing and forecast levels of helicopter LTO cycles under the Proposed Action and No Action alternative are presented in **Table F-2**. As shown in Table F-2, the number of Grand Canyon tour LTO cycles at the Heliport site under the Proposed Action is projected to be 29,500 in 2011 and 37,300 in 2017. It was assumed that the operators of Las Vegas Strip tours would not relocate to the proposed Heliport site from McCarran. Las Vegas Strip tours would continue to be accommodated at McCarran under the Proposed Action – 8,400 annual LTO cycles in 2011 and 9,100 annual LTO cycles in 2017. Under the Proposed Action there would be 9,800 Grand Canyon tour LTO cycles at McCarran in 2011 and 12,400 annual Grand Canyon tour LTO cycles in 2017. Under the Proposed Action it is anticipated that some helicopter LTO cycles, both Grand Canyon tours and Las Vegas Strip tours, would be accommodated at other locations in the region (11,100 annual LTO cycles in 2011 and 15,600 annual LTO cycles in 2017). These helicopter movements were not assessed or evaluated in this environmental assessment.

The number of Grand Canyon tour LTO cycles at McCarran under the No Action alternative is projected to be 29,500 in 2011 and 37,300 in 2017. Las Vegas Strip tours would continue to be accommodated at McCarran under the No Action alternative – 8,400 annual LTO cycles in 2011 and 9,100 annual LTO cycles in 2017. It is anticipated that some helicopter LTO cycles, both Grand Canyon tours and Las Vegas Strip tours, would be accommodated at other locations in the region under the No Action alternative (20,900 annual LTO cycles in 2011 and 28,000 annual LTO cycles in 2017).

Table F-2

Annual Helicopter Air Tour LTO Cycles – Proposed Action and No Action Alternative

	McCarran International Airport		Heliport Site 1/		Other Facility 2/		Total	
Year	Grand Canyon Tours	Las Vegas Strip Tours	Grand Canyon Tours	Las Vegas Strip Tours	Grand Canyon Tours	Las Vegas Strip Tours	Grand Canyon Tours	Las Vegas Strip Tours
Existing Conditions								
2004	33,190	11,501	-	-	-	-	33,190	11,501
Proposed Action								
2011	9,800	8,500	29,500	-	4,400	6,700	43,700	15,200
2017	12,400	9,100	37,300	-	5,500	10,100	55,200	19,200
No Action Alternative								
2011	29,500	8,500	-	-	14,200	6,700	43,700	15,200
2017	37,300	9,100	-	-	17,900	10,100	55,200	19,200

Notes:
LTO = Landing and takeoff. One LTO cycle equals two operations: a landing and a takeoff.
1/ It was assumed that Las Vegas Strip tours would not be accommodated at the proposed Heliport site.
2/ Not evaluated in the environmental assessment.

Sources: Ricondo & Associates, Inc., 2007, based on *Forecasts of Grand Canyon Helicopter Air Tour Operations and Passengers.* February 7, 2007 [I-12].
Prepared by: Ricondo & Associates, Inc., April 2008

Helicopter Time in Mode

The EDMS recognizes four modes that constitute a complete LTO cycle: takeoff, climbout, approach, and taxi. The helicopter time in mode is the time, in minutes, a helicopter spends in any one of these modes during an LTO cycle. The taxi mode consists of taxi time and queue time. The taxi and queue time is the time spent in hover taxi and queue between gates and Final Approach and Takeoff Areas (FATOs). Of the four modes, the taxi mode is the most variable, due to its airport/heliport specific nature, and accordingly the user may modify the time. The approach and climbout time varies depending on the aircraft performance and the mixing height. Mixing height is the vertical distance between the earth's surface and the height to which convectional movements within the atmosphere extend. The takeoff mode represents the time spent between the initiation of takeoff and 1,000 feet above ground level (AGL) and is dependent on aircraft performance.

The time in mode of aircraft in the EDMS database are based on either of two methodologies: the International Civil Aviation Organization (ICAO) and U.S. EPA default or performance data from methodology presented in the Society of Automotive Engineers (SAE) Aerospace Information Report (AIR) 1845. There is a lack of consistent performance data for helicopters. ICAO/EPA default times per LTO cycle for the Bell 206 helicopter were used in the air quality analysis, and are presented in **Table F-3**.

Table F-3

Times in Mode for the Bell 206 Helicopter

Mode	Time per LTO Cycle (minutes) 1/
Takeoff	2.17
Climbout	4.33
Approach	6.50
Taxi 2/	7.00

Notes:
1/ LTO = Landing and takeoff. One LTO cycle equals two operations: a landing and a takeoff.
2/ Taxi time includes taxi time and queue time.

Source: The Emissions and Dispersion Modeling System (EDMS) Version 4.3.
Prepared by: Ricondo & Associates, Inc., April 2008

Helicopter Engine Emissions Rates

EDMS Version 4.3 includes default emission indices (in grams/kilogram of fuel burned) for each aircraft engine in the database. Emission indices are available for CO, VOC, NO_X, and SO_X. **Table F-4** presents the default emission indices, by mode, for the Bell 206 with a 250B17B engine.

EDMS Version 4.3 is not capable of calculating PM_{10} emissions for helicopters. However, the U.S. EPA has developed some guidance for calculating aircraft PM_{10} emissions. The primary source of information on aircraft PM_{10} emissions is the U.S. EPA document, AP-42, *Compilation of Air Pollutant Emission Factors,* Volume II: *Mobile Sources.* AP-42 contains detailed information regarding fuel flow rates and pollutant emissions (CO, HC, NO_X, SO_X, and PM_{10}) for a variety of aircraft engines. However, AP-42 contains particulate emission factors for only nine types of commercial aircraft engines and eight types of military aircraft engines.

Particulate emission factors for the 250B17B engine are not available in AP-42. The only propeller/turboprop-driven aircraft engine for which particulate emission factors are available is the

TPE331-3 engine, manufactured by Allied Signal. This engine was used for calculating helicopter PM_{10} emissions. Particulate emission factors, by mode, for the TPE331-3 engine are presented in **Table F-5**.

Table F-4

Emission Indices by Mode for the Bell 206 Helicopter with a 250B17B Engine

	Emission Indices (g/Kg) per LTO Cycle [1/]			
Mode	Carbon Monoxide (CO)	Hydrocarbons (HC) [2/]	Oxides of Nitrogen (NO_X)	Oxides of Sulfur (SO_X)
Approach	47.20	5.20	2.20	0.54
Climbout	9.02	0.40	5.96	0.54
Takeoff	7.81	0.30	6.60	0.54
Taxi [3/]	97.00	20.00	1.00	0.54

Notes:
1/ LTO = Landing and takeoff. One LTO cycle equals two operations: a landing and a takeoff.
2/ EDMS calculates emissions of volatile organic compounds (VOC) by applying a conversion factor to hydrocarbons (HC).
3/ Taxi time includes taxi time and queue time.

Source: The Emissions and Dispersion Modeling System (EDMS), Version 4.3.
Prepared by: Ricondo & Associates, Inc., April 2008

Table F-5

Particulate (PM_{10}) Emission Factors by Mode for the TPE331-3 Engine

Mode	PM_{10} Emission Factors (Kg/hr) per LTO Cycle [1/]
Approach	0.27
Climbout	0.27
Takeoff	0.36
Taxi [2/]	0.14

Notes:
1/ LTO = Landing and takeoff. One LTO cycle equals two operations: a landing and a takeoff.
2/ Taxi time includes taxi time and queue time.

Source: U.S. EPA, AP-42, *Compilation of Air Pollutant Emission Factors,* Volume II: *Mobile Sources,* Fourth Edition. September 1985.
Prepared by: Ricondo & Associates, Inc., April 2008

The calculation of aircraft PM_{10} emissions requires three pieces of information: time in mode, number of engines on each aircraft, and the emission factors for each engine type. Time in mode estimates were based on default values contained in EDMS, as described earlier in this section. **Equation F-1** was used to calculate particulate emissions for the Bell 206 helicopter.

Although EDMS Version 4.3 does not estimate particulate emissions for helicopters, user-created helicopters/engines may be created that incorporate PM_{10} emission indices. This allows EDMS to integrate PM_{10} emissions into emission inventories and dispersion analyses. For the air quality analysis, a user-created helicopter was created based on the Bell 206 helicopter with a 250B17B engine. All aspects of the user-created helicopter, including times in mode and emission indices, were identical to the EDMS system aircraft, except PM_{10} emission indices were included.

To derive emission indices for PM_{10}, it was necessary to first calculate PM_{10} emissions, by mode, using Equation F-1. **Equation F-2** was then used to solve for PM_{10} emission indices, by mode.

These emission indices were incorporated into the user-defined helicopter/engine combination, allowing PM_{10} emissions to be incorporated into the model. For helicopters, $PM_{2.5}$ emissions are assumed to be equal to PM_{10} emissions. The resultant PM_{10} emission indices, by mode, for the user-created Bell 206 helicopter are presented in **Table F-6**.

Equation F-1

Aircraft Particulate (PM_{10}) Emissions Calculation Equation

$$PM_m = (NE_a)(TIM_m)(EF_m)$$

where:

PM_m = PM_{10} emissions from one aircraft type for mode *m* during one LTO cycle
NE_a = Number of engines on aircraft *a*
TIM_m = Time in mode in hours for specified mode *m* for a single engine
EF_m = Emission factor of the engine type in kg/hr for the specified mode *m*

Source: U.S. EPA, AP-42, Compilation of Air Pollutant Emission Factors, Volume II: Mobile Sources, Fourth Edition. September 1985.
Prepared by: Ricondo & Associates, Inc., April 2008

Equation F-2

Aircraft Particulate (PM_{10}) Emission Indices Calculation Equation

$$EI_m = PM_m / [(60/1000)(NE_a)(FF_m)(TIM_m)]$$

where:

EI_m = Emission index of the engine type in g/Kg of fuel burned for the specified mode *m*
PM_m = PM_{10} emissions from one aircraft type for mode *m* during one LTO cycle
60 = Number of seconds per minute
1000 = Number of grams per kilogram
NE_a = Number of engines on aircraft *a*
FF_m = Fuel flow rate of the engine type in Kg/sec for the specified mode *m*
TIM_m = Time in mode in hours for specified mode *m* for a single engine

Source: Derivative of Equation F-1, from U.S. EPA, AP-42, Compilation of Air Pollutant Emission Factors, Volume II: Mobile Sources, Fourth Edition. September 1985.
Prepared by: Ricondo & Associates, Inc., April 2008

Table F-6

Particulate (PM_{10}) Emission Indices by Mode for the User-Created Bell 206 Helicopter

Mode	PM_{10} Emission Indices (g/Kg) per LTO Cycle [1/]
Approach	6.80
Climbout	2.42
Takeoff	2.99
Taxi [2/]	4.91

Notes:
1/ LTO = Landing and takeoff. One LTO cycle equals two operations: a landing and a takeoff.
2/ Taxi time includes taxi time and queue time.

Source: Ricondo & Associates, Inc., 2005, based on Equations F-1 and F-2, and information contained in U.S. EPA, AP-42, *Compilation of Air Pollutant Emission Factors,* Volume II: *Mobile Sources,* Fourth Edition. September 1985.

Prepared by: Ricondo & Associates, Inc., April 2008

F.1.1.2 Ground Support Equipment

Ground support equipment includes a wide range of vehicles used to service aircraft. Examples of GSE include tugs that haul baggage carts, fuel trucks, catering trucks, and auxiliary power units (APUs) and ground power units (GPUs) that provide electrical power to aircraft when the engines are not running. The EDMS database includes default GSE assignments for each aircraft type. These default assignments are expressed in terms of total operating times by specific type of GSE per LTO cycle. For the air quality analysis, default GSE assignments and operating times were assumed for the Bell 206 helicopter, as presented in **Table F-7**.

Table F-7

EDMS Default Ground Support Equipment for the Bell 206 Helicopter

Ground Support Equipment Type	Fuel	Horsepower	Load Factor [1/]	Minutes per LTO Cycle [2/]
Fuel Truck	Diesel	175	25%	10
Ground Power Unit	Diesel	71	75%	40

Note:

1/ Load factor is defined as the average fraction of rated power (horsepower) used during operation of equipment.

2/ LTO = Landing and takeoff. One LTO cycle equals two operations: a landing and a takeoff.

Source: The Emissions and Dispersion Modeling System, Version 4.3.
Prepared by: Ricondo & Associates, Inc., April 2008

F.1.1.3 On-Road Motor Vehicles

Motor vehicle traffic (on airport/heliport roadways and in parking lots) can be a significant source of pollutant emissions at an airport/heliport. This section summarizes the methodology used to model on-road motor vehicle emissions. For purposes of the air quality analysis, only vehicles operating on heliport access roads and in heliport parking lots were modeled in EDMS.

To estimate emissions from on-road motor vehicles, EDMS requires the definition of roadway segments and parking lots, the total annual motor vehicle volumes utilizing the roadway segments and parking lots, and speed-specific emission factors.

Heliport Access Roadways and Parking Lots

The locations and lengths/sizes of heliport access roadways and parking lots at McCarran International Airport were derived by Ricondo & Associates, Inc., based on information provided by the Clark County Department of Aviation. Locations of access roadways and parking lots at the Heliport site were derived from the conceptual heliport layout drawing developed by HNTB Corporation.[3] These data were input into EDMS and speeds were assigned to each roadway segment and parking lot. An average speed of 25 miles per hour (mph) was assumed for all heliport access roads. Vehicles operating within heliport parking lots were assigned an average speed of 2.5 mph.

Annual motor vehicle volumes were calculated for the existing condition, Proposed Action, and No Action alternative using a ratio of annual vehicle trips to annual helicopter air tour LTO cycles. According to operator interviews and surveys, helicopter air tour operators currently operating at McCarran International Airport use a combination of vans and limousines to transport passengers

[3] HNTB Corporation. *Conceptual Heliport Layout Drawing*. July 2007.

from the customer base (the Las Vegas Strip) to their respective heliport facilities. Based on these interviews and surveys, an average fleet mix was derived and a ratio of 1.25 vehicle trips per LTO cycle was assumed. This ratio was used to calculate annual vehicle trips to/from McCarran International Airport.

Based on conversations with helicopter air tour operators, it was assumed that all operators would utilize passenger vans if operating to/from the Heliport site, resulting in a ratio of one vehicle trip per LTO cycle. This ratio was used to calculate annual vehicle trips to/from the Heliport site.

Using the applicable ratios of vehicle trips to helicopter LTO cycles, annual motor vehicle volumes were calculated for the existing condition (2004) and future years (2011 and 2017). **Table F-8** presents annual motor vehicle volumes for existing conditions, the Proposed Action, and the No Action alternative.

Table F-8

Heliport Access Roadway Motor Vehicle Volumes

	Annual Motor Vehicle Volumes [1/]		
	2004	2011	2017
Existing Conditions			
McCarran International Airport [2/]	55,865	-	-
Proposed Action			
Heliport Site	-	29,500	37,300
McCarran International Airport [2/]	-	22,875	26,875
Total	-	52,375	64,175
No Action Alternative			
McCarran International Airport [2/]	-	47,500	58,000

Notes:

1/ Stated annual motor vehicle volumes represent total vehicle trips, rather than roundtrips. The EDMS Version 4.3 calculates vehicle trips on roadways as roundtrips. Therefore, the total annual vehicle trips on a roadway segment was divided by 2 for entry into the EDMS.

2/ The calculation of annual motor vehicle volumes for McCarran International Airport includes vehicle trips associated with both Las Vegas Strip tours and Grand Canyon tours.

Source: Ricondo & Associates, Inc., 2007, based on helicopter air tour operator interviews and helicopter historical and forecast activity developed in association with the Clark County Department of Aviation.

Prepared by: Ricondo & Associates, Inc., April 2008

Heliport Enroute Roadways

As previously discussed, only vehicles operating on heliport access roads and in heliport parking lots were modeled in EDMS. Emissions associated with on-road motor vehicle trips to/from the Las Vegas Strip to/from McCarran International Airport and the Heliport site were calculated outside of EDMS and added to the emissions summary presented in Section F.1.1.5. Distances were measured between Caesars Palace, located at the intersection of South Las Vegas Boulevard and Flamingo Road (a point on the Strip representative of where most helicopter air tour vehicular traffic would originate), and the access roads serving existing helicopter operator locations at McCarran International Airport and the proposed operator locations at the Heliport site. An average speed of 35 miles per hour was assumed for these "enroute" trips between the Las Vegas Strip and the Heliport site since it is anticipated that the vehicles would make several stops along the route. Vehicle volumes presented in Table F-8 were multiplied by the corresponding distances between each heliport site and the Strip to derive total vehicle miles traveled (VMT). VMT for existing conditions, Proposed Action, and No Action alternative are presented in **Table F-9**. Total VMT was multiplied by an appropriate emission factor to estimate enroute motor vehicle emissions.

Table F-9

Heliport Enroute Roadway Vehicle Miles Traveled

	Annual Vehicle Miles Traveled [1/]		
	2004	2011	2017
Existing Conditions			
McCarran International Airport [2/]	109,831	-	-
Proposed Action			
Heliport Site	-	486,750	615,450
McCarran International Airport [2/]	-	44,972	54,836
Total	-	531,722	668,286
No Action Alternative			
McCarran International Airport [2/]	-	93,385	144,028

Notes:

1/ Annual vehicle miles traveled are calculated by multiplying total annual vehicle trips by the corresponding on-way distance between each heliport site and a designated location on the Las Vegas Strip.

2/ The calculation of annual motor vehicle volumes for McCarran International Airport includes vehicle trips associated with both Las Vegas Strip tours and Grand Canyon helicopter tours.

Sources: Ricondo & Associates, Inc., 2007, based on helicopter air tour operator interviews and helicopter historical and forecast activity developed in association with the Clark County Department of Aviation, and distance information measured using Geographic Information System software.

Prepared by: Ricondo & Associates, Inc., April 2008

On-Road Vehicle Emission Factors

The Clark County DAQEM provided emission factors for use in the air quality analysis, which were developed using the EPA's MOBILE6.2 model. Factors developed by the Clark County DAQEM are specific to Clark County and take into account local characteristics such as fuel mixture and vehicle fleet mix. However, due to the methodology by which the EDMS calculates emissions generated by vehicles in parking lots, default EDMS emission factors were used for on-road motor vehicle operations in heliport parking lots.

Table F-9 presents emission factors, expressed in grams per vehicle mile, for on-road motor vehicles operating on heliport access roadways and on roadways between the Strip and each heliport site. Emission factors for PM_{10} include fugitive dust. Fugitive dust from vehicles operating on roadway segments was calculated separately and added to total PM_{10} emissions in the emissions summaries presented in Section F.1.1.5.

Table F-9

On-Road Motor Vehicle Emission Factors

Year/Speed (miles per hour)	Emission Factors (grams per vehicle-mile) Carbon Monoxide (CO)	Volatile Organic Compounds (VOC)	Oxides of Nitrogen (NO_x)	Oxides of Sulfur (SO_x)	Particulate matter (PM_{10} 1/)	Fine particulate matter ($PM_{2.5}$)
2004						
2.5	34.607	15.146	2.606	0.0325	2.6666	0.0219
25	11.267	1.499	1.289	0.0326	2.6664	0.0217
35	11.504	1.302	1.202	0.0327	2.6660	0.0213
2011						
2.5	18.087	7.667	1.167	0.0082	2.3487	0.0146
25	5.634	0.805	0.576	0.0082	2.3487	0.0146
35	5.603	0.702	0.537	0.0083	2.3487	0.0145
2017						
2.5	13.869	4.645	0.625	0.0082	2.3466	0.0127
25	4.227	0.502	0.300	0.0082	2.3466	0.0127
35	4.144	0.433	0.278	0.0083	2.3466	0.0126

Note:
1/ Includes entrained road dust.

Source: Clark County Department of Air Quality and Environmental Management.
Prepared by: Ricondo & Associates, Inc., April 2008

F.1.1.4 Point Sources

It is anticipated that a fuel storage facility would be located at the Heliport site. Fuel tanks are sources of VOC emissions. Annual consumption of jet fuel at McCarran International Airport and the Heliport site was calculated based on information contained in the project definition manual prepared by HNTB Corporation.[4] **Table F-10** shows the annual helicopter air tour-related jet fuel consumption (in kiloliters) for the fuel storage facilities at McCarran International Airport and the Heliport site.

[4] HNTB Corporation. *Final: Project Definition, Development, and Operational Manual, Southern Nevada Regional Heliport*. December 5, 2006.

Table F-10

Existing and Forecast Jet Fuel Consumption

	Annual Fuel Consumption (kiloliters)		
	2004	2011	2017
Existing Conditions			
McCarran International Airport [1/]	38,958	-	-
Proposed Action			
Heliport Site	-	22,964	30,710
McCarran International Airport [1/]	-	13,177	15,482
Total	-	36,141	46,192
No Action Alternative			
McCarran International Airport [1/]	-	27,364	33,413

Note:

1/ The calculation of fuel consumption for McCarran International Airport includes activity associated with both Las Vegas Strip tours and Grand Canyon helicopter tours.

Source: Ricondo & Associates, Inc., 2007, based on HNTB Corporation, Final: Project Definition, Development, and Operational Manual, Southern Nevada Regional Heliport. December 5, 2006.

Prepared by: Ricondo & Associates, Inc., April 2008

F.1.1.5 Summary of Heliport Operational Emissions

Table F-11 presents the estimated annual emissions of CO, VOC, NO_X, SO_X, PM_{10}, and $PM_{2.5}$ generated by helicopter activity at McCarran International Airport under 2004 existing conditions. **Tables F-12** through **F-14** summarize the estimated annual heliport operational emissions of CO, VOC, NO_X, SO_X, PM_{10}, and $PM_{2.5}$ under the Proposed Action and No Action alternative, in 2011 and 2017.

Table F-11

McCarran International Airport Helicopter Emissions Summary – 2004 Existing Conditions

	Pollutant Emissions (tons/year)					
Source	Carbon Monoxide (CO)	Volatile Organic Compound (VOC)	Oxides of Nitrogen (NO_X)	Oxides of Sulfur (SO_X)	Particulate matter (PM_{10})	Fine particulate matter ($PM_{2.5}$) [1/]
Aircraft	31.072	4.880	4.399	0.531	3.839	3.839
GSE	2.240	0.829	11.333	1.712	0.623	0.604
On-Road Vehicles [2/]	1.535	0.173	0.159	0.004	0.356	0.003
Parking Lots	0.854	0.180	0.049	0.000	0.000	0.000
Stationary Sources	0.000	0.007	0.000	0.000	0.000	0.000
Total	35.701	6.069	15.940	2.247	4.818	4.446

Notes:

Calculated emissions include emissions associated with both Grand Canyon and Strip helicopter air tour activity.

Columns may not add to totals shown because of rounding.

GSE = Ground support equipment

1/ $PM_{2.5}$ emissions for aircraft are assumed to be equal to PM_{10} emissions.

2/ PM_{10} emissions for on-road vehicles include entrained road dust.

Sources: Ricondo & Associates, Inc., 2007, based on output from the Emissions and Dispersion Modeling System, Version 4.3, and information obtained from the Clark County Department of Aviation and HNTB Corporation.

Prepared by: Ricondo & Associates, Inc., April 2008

Table F-12

2011 Operational Emissions Summary – Proposed Action

Site/Source	Pollutant Emissions (tons/year) Carbon Monoxide (CO)	Volatile Organic Compound (VOC)	Oxides of Nitrogen (NO_X)	Oxides of Sulfur (SO_X)	Particulate matter (PM_{10})	Fine particulate matter ($PM_{2.5}$) 1/
Heliport Site						
Aircraft	20.510	3.221	2.903	0.351	2.534	2.534
GSE	1.197	0.360	4.383	1.102	0.477	0.463
On-Road Vehicles 2/	3.113	0.386	0.291	0.004	1.311	0.008
Parking Lots	0.201	0.033	0.013	0.000	0.000	0.000
Stationary Sources	0.000	0.013	0.000	0.000	0.000	0.000
Total	25.020	4.014	7.591	1.457	4.323	3.005
McCarran International Airport 3/						
Aircraft	12.723	1.998	1.801	0.217	1.572	1.572
GSE	0.742	0.224	2.718	0.683	0.297	0.288
On-Road Vehicles 2/	0.306	0.038	0.028	0.000	0.130	0.001
Parking Lots	0.155	0.024	0.011	0.000	0.000	0.000
Stationary Sources	0.000	0.008	0.000	0.000	0.000	0.000
Total	13.926	2.293	4.559	0.901	1.998	1.861
Total Proposed Action (2011)	38.946	6.306	12.150	2.359	6.321	4.865

Notes:
Columns may not add to totals shown because of rounding.
GSE = Ground support equipment
1/ $PM_{2.5}$ emissions for aircraft are assumed to be equal to PM_{10} emissions.
2/ PM_{10} emissions for on-road vehicles include entrained road dust.
3/ Includes emissions associated with both Las Vegas Strip tours and Grand Canyon helicopter tours.

Source: Ricondo & Associates, Inc., 2007, based on output from the Emissions and Dispersion Modeling System, Version 4.3, and information obtained from the Clark County Department of Aviation and HNTB Corporation.
Prepared by: Ricondo & Associates, Inc., April 2008

Table F-13

2017 Operational Emissions Summary – Proposed Action

Site/Source	Carbon Monoxide (CO)	Volatile Organic Compound (VOC)	Oxides of Nitrogen (NO_X)	Oxides of Sulfur (SO_X)	Particulate matter (PM_{10})	Fine particulate matter ($PM_{2.5}$) [1/]
	Pollutant Emissions (tons/year)					
Heliport Site						
Aircraft	25.932	4.073	3.672	0.444	3.204	3.204
GSE	1.424	0.338	4.206	1.365	0.741	0.719
On-Road Vehicles [2/]	2.914	0.297	0.190	0.006	1.656	0.009
Parking Lots	0.203	0.028	0.009	0.000	0.000	0.000
Stationary Sources	0.000	0.018	0.000	0.000	0.000	0.000
Total	30.472	4.754	8.077	1.815	5.601	3.932
McCarran International Airport [3/]						
Aircraft	14.947	2.348	2.116	0.256	1.846	1.846
GSE	0.821	0.195	2.425	0.787	0.427	0.414
On-Road Vehicles [2/]	0.263	0.026	0.016	0.000	0.152	0.001
Parking Lots	0.147	0.022	0.008	0.000	0.000	0.000
Stationary Sources	0.000	0.009	0.000	0.000	0.000	0.000
Total	16.178	2.600	4.565	1.043	2.425	2.262
Total Proposed Action (2017)	46.651	7.354	12.642	2.858	8.026	6.193

Notes:
Columns may not add to totals shown because of rounding.
GSE = Ground support equipment
1/ $PM_{2.5}$ emissions for aircraft are assumed to be equal to PM_{10} emissions.
2/ PM_{10} emissions for on-road vehicles include entrained road dust.
3/ Includes emissions associated with both Las Vegas Strip tours and Grand Canyon helicopter tours.

Sources: Ricondo & Associates, Inc., 2007, based on output from the Emissions and Dispersion Modeling System, Version 4.3, and information obtained from the Clark County Department of Aviation and HNTB Corporation.
Prepared by: Ricondo & Associates, Inc., April 2008

Table F-14

2011 and 2017 Operational Emissions Summary (McCarran International Airport) – No Action Alternative

	Pollutant Emissions (tons/year)					
Year/Source	Carbon Monoxide (CO)	Volatile Organic Compound (VOC)	Oxides of Nitrogen (NO_X)	Oxides of Sulfur (SO_X)	Particulate matter (PM_{10})	Fine particulate matter ($PM_{2.5}$) 1/
2011						
Aircraft	26.419	4.149	3.741	0.452	3.264	3.264
GSE	1.541	0.464	5.646	1.420	0.615	0.596
On-Road Vehicles 2/	0.635	0.079	0.059	0.001	0.270	0.001
Parking Lots	0.324	0.054	0.022	0.000	0.000	0.000
Stationary Sources	0.000	0.015	0.000	0.000	0.000	0.000
Total	28.920	4.761	9.469	1.873	4.149	3.861
2017						
Aircraft	32.259	5.067	4.568	0.552	3.986	3.986
GSE	1.771	0.421	5.233	1.699	0.922	0.894
On-Road Vehicles 2/	0.576	0.058	0.038	0.001	0.329	0.002
Parking Lots	0.315	0.044	0.014	0.000	0.000	0.000
Stationary Sources	0.000	0.019	0.000	0.000	0.000	0.000
Total	34.922	5.610	9.853	2.252	5.236	4.882

Notes:
Calculated emissions include emissions associated with both Grand Canyon and Strip helicopter air tour activity.
Columns may not add to totals shown because of rounding.
GSE = Ground support equipment
1/ $PM_{2.5}$ emissions for aircraft are assumed to be equal to PM_{10} emissions.
2/ PM_{10} emissions for on-road vehicles include entrained road dust.

Sources: Ricondo & Associates, Inc., 2007, based on output from the Emissions and Dispersion Modeling System, Version 4.3, and information obtained from the Clark County Department of Aviation and HNTB Corporation.
Prepared by: Ricondo & Associates, Inc., April 2008

F.1.2 Construction Emissions

Pollutant emissions resulting from construction of the regional heliport at the Heliport site (the Proposed Action) were estimated from both on-road and nonroad sources, as well as from land development, wind erosion, and asphalt paving activities. Construction emissions were not estimated for the No Action alternative. Under the No Action alternative, it is assumed that helicopter air tour operators would utilize existing facilities at McCarran International Airport. If, under the No Action alternative, helicopter air tour operators were to relocate from McCarran, the construction of any related facilities may require separate environmental analyses beyond the scope of this environmental assessment.

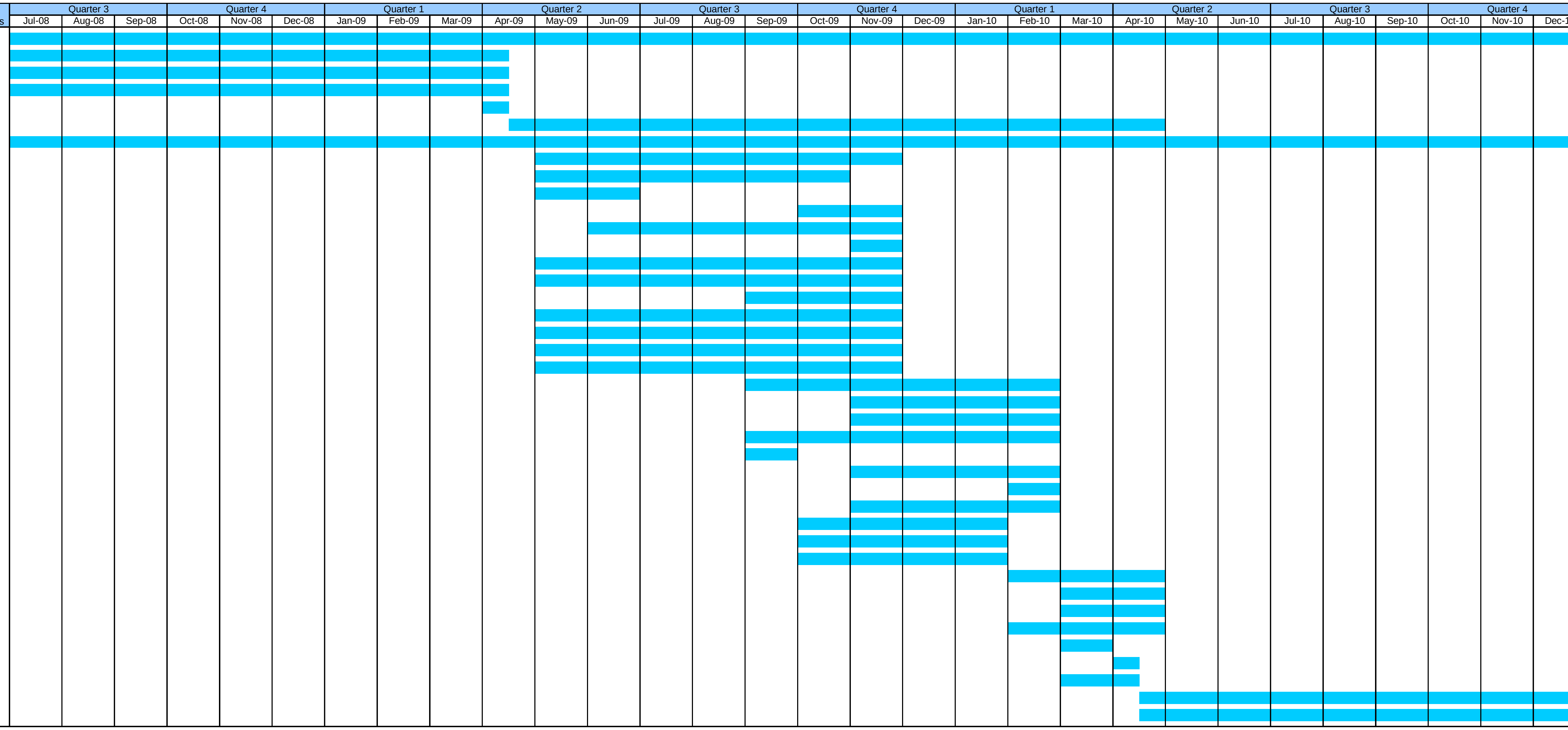
F.1.2.1 Construction Schedule

Construction emissions were calculated for the period planned for construction of the regional heliport at the Heliport site. The construction schedule used in the air quality analysis was derived from information obtained form The Louis Berger Group and the Clark County Department of Aviation (CCDOA). The construction schedule is presented on **Exhibit E-1**.

Exhibit F-1

Construction Schedule

Task ID	Task Name	Work Days	No. Months
Task 1	**Project Coordination, Schedule, and Preparations**	**654.0**	**30**
Task 2	**Final Design**	**207.0**	**0.5**
Task 2.1	Engineering Plans and Specification	207.0	9.5
Task 2.2	Bid Phase	207.0	9.5
Task 3	**Geotechnical**	**11.0**	**0.5**
Task 4	**Survey**	**273.0**	**12.5**
Task 5	**Utility Extensions to Site (off-site)**	**654.0**	**30**
Task 6	**Utilities, Water (on-site)**	**152.0**	**7**
Task 6.1	Water Line	131.0	6
Task 6.2	Storage Tanks	43.0	2
Task 6.3	Fire Pump	43.0	2
Task 6.4	Pump Station	131.0	6
Task 6.5	Back up Generator	21.0	1
Task 7	**Utilities, Sanitary Sewer (on-site)**	**152.0**	**7**
Task 7.1	Sewer Line	**152.0**	7
Task 7.2	Septic Tank	65.0	3
Task 8	**Utilities, Telephone (on-site)**	**152.0**	**7**
Task 8.1	Telephone service	152.0	7
Task 9	**Utilities, Gas (on-site)**	**152.0**	**7**
Task 9.1	Gas service	152.0	7
Task 10	**Grading**	**129.0**	**6**
Task 10.2	Apron	85.0	4
Task 10.3	Taxiways	85.0	4
Task 10.4	TLOF/FATO Areas	129.0	6
Task 10.5	Buildings	22.0	1
Task 10.6	Access Roads	85.0	4
Task 10.7	Fuel Tank	20.0	1
Task 10.8	Parking	85.0	4
Task 10.9	Drainage Facalities	87.0	4
Task 11	**Drainage**	**87.0**	**4**
Task 11.1	Drainage Facalities	87.0	4
Task 12	**Paving or Treated**	**65.0**	**3**
Task 12.1	Apron	45.0	2
Task 12.2	Taxiways	45.0	2.0
Task 12.3	TLOF/FATO Areas	65.0	3
Task 12.4	Access Roads	23.0	1
Task 12.5	Fuel Tank	11.0	0.5
Task 12.6	Parking	34.0	1.5
Task 13	**Building**	**187.0**	**8.5**
Task 13.1	Terminal and Maintenance	187.0	8.5



Source: Ricondo & Associates, Inc., 2007, based on information obtained from The Louis Berger Group and the Clark County Department of Aviation.
Prepared by: Ricondo & Associates, Inc., April 2008

F.1.2.2 On-Road Construction Equipment

On-road source emissions were calculated using the methodologies outlined in the U.S. EPA's AP-42, *Compilation of Air Pollutant Emission Factors* Fourth Edition, Volume II: *Mobile Sources*. On-road construction emissions include emissions from off-site vehicle trips (i.e., employee vehicle trips to and from the job site, off-site hauling trips, and material delivery trips) and on-site vehicle trips (i.e., water trucks). Vehicle trips were derived based on information provided by The Louis Berger Group, the CCDOA, and from the conceptual heliport layout drawing developed by HNTB Corporation.[5]

On-Road/Off-Site Construction Equipment

The first step in calculating total on-road/off-site construction emissions was to determine total vehicle miles traveled (VMT) by each type of vehicle trip during each construction year. VMT is calculated by multiplying the total number of roundtrips made by the vehicle by the distance per roundtrip. VMT is then multiplied by an appropriate emission factor to calculate total emissions. The Clark County DAQEM provided emission factors for use in the air quality analysis, which were developed using the EPA's MOBILE6.2 model. Factors developed by the Clark County DAQEM are specific to Clark County and take into account local characteristics such as fuel mixture and vehicle fleet mix. An average speed of 45 miles per hour was assumed for all on-road/off-site construction equipment trips. **Table F-15** presents the MOBILE6.2 emission factors used to calculate emissions for on-road construction equipment.

Table F-15
On-Road/Off-Site Motor Vehicle Emission Factors

	Emission Factors (grams per vehicle-mile) [1/]						
Construction Year	Carbon Monoxide (CO)	Volatile Organic Compound (VOC)	Oxides of Nitrogen (NO_X)	Oxides of Sulfur (SO_X)	Particulate matter (PM_{10})	Entrained Road Dust (PM_{10})	Fine particulate matter ($PM_{2.5}$)
2008	7.794	0.836	0.785	0.0083	0.0311	2.320	0.0167
2009	7.202	0.769	0.704	0.0083	0.0301	2.320	0.0159
2010	6.643	0.701	0.625	0.0083	0.0292	2.320	0.0150

Note:
1/ Assuming an average speed of 45 miles per hour for on-road/off-site vehicle trips.

Source: Clark County Department of Air Quality and Environmental Management.
Prepared by: Ricondo & Associates, Inc., April 2008

Emissions were calculated for a variety of on-road/off-site vehicle trips/activities, as follows:

- It was assumed that employees would make one roundtrip per work day to/from the job site and that the total roundtrip distance traveled by each employee each day would be 40 miles.
- Grading operations at the Heliport site will require fill material to be hauled to the site to balance cut and fill requirements. In addition, excavation for the extension of underground utilities to the site would require excess fill material to be hauled away. It was assumed that net grading material resulting from utility excavation would not be used for fill material at the Heliport site. It was assumed that dump trucks with a capacity of 13 cubic yards (CY)

5 HNTB Corporation. *Conceptual Heliport Layout Drawing*. July 2007.

would perform all fill material delivery/hauling trips. The roundtrip distance to/from the site to/from the material pickup/drop off site was assumed to be 40 miles.

- Construction of the regional heliport facilities at the Heliport site would require truck trips for the delivery of construction materials. Total vehicle trips required for these deliveries were estimated by The Louis Berger Group and were assumed to be from local suppliers within 20 miles of the job site (roundtrip distance of 40 miles). Additional construction material deliveries would be required for the extensions of utilities to the site (i.e., deliveries of poles, cabling, and pipes). Total vehicle trips were estimated based on data provided by the CCDOA, with deliveries assumed to be from local suppliers within 20 miles of the job site (40 miles roundtrip).
- Since it is not anticipated that water utilities will be available at the Heliport site until the end of the construction period, water will need to be trucked on site to serve employees and various construction needs (i.e., dust control), as well as to provide adequate fire suppression capabilities during construction. The delivery of water to the site was assumed to be from local suppliers within 20 miles of the job site (40 miles roundtrip). It was assumed that 4,000-gallon tanker trucks would deliver water to the site.
- Asphalt will be required for the paving of taxiways, aprons, roadways, and parking lots at the proposed heliport site. Based on estimates provided by The Louis Berger Group, it was assumed that 2,700 truck trips would be required for the delivery of asphalt mix, obtained from a plant located in the Southwest Las Vegas Valley near Blue Diamond Road and Jones Boulevard (26 miles roundtrip to/from the job site).
- Concrete is assumed to be required for several surface applications at the proposed heliport site, including helicopter pads, takeoff and landing areas, and building foundations. It was assumed that concrete would delivered using transit mixers with a capacity of 10 CY from a supplier such as Nevada Ready Mix, located on Las Vegas Boulevard, approximately 10 miles from the Heliport site (roundtrip distance of 20 miles).

Total on-road construction emissions were calculated by multiplying the VMT for each activity by an emission factor (expressed in grams per vehicle mile) obtained from MOBILE6.2. A conversion factor was then applied to obtain total emissions for each pollutant in tons per year.

An additional source of PM_{10} emissions associated with on-road construction activity is entrained road dust. Entrained road dust was calculated by using an emission factor developed by the Clark County DAQEM for each construction year. This factor was multiplied by the VMT for each activity, resulting in a value of entrained road dust (PM_{10}) emissions in tons per year.

On-Road/On-Site Construction Equipment

In addition to the on-road vehicle trips previously discussed, on-site water trucks and bucket trucks were modeled using on-road emission factors. Water trucks would be required for dust control, while bucket trucks would be needed for above-ground utility work. Construction schedules developed in association with The Louis Berger Group and the CCDOA were used to derive monthly/annual hours for these vehicles.

To estimate emissions from on-road/on-site water trucks and bucket trucks, MOBILE6.2 emission factors were converted from grams per vehicle mile to pounds per hour and then multiplied by an estimate of total vehicle hours. An average speed of 5 miles per hour was assumed for all on-road/on-site construction equipment. Emission factors for on-road on-site construction vehicles, by construction year, are presented in **Table F-16**.

Table F-16

On-Road/On-Site Motor Vehicle Emission Factors

	Emission Factors (pounds per hour) [1/]						
Construction Year	Carbon Monoxide (CO)	Volatile Organic Compound (VOC)	Oxides of Nitrogen (NO_X)	Oxides of Sulfur (SO_X)	Particulate matter (PM_{10})	Entrained Road Dust (PM_{10})	Fine particulate matter ($PM_{2.5}$)
2008	0.150	0.042	0.016	0.0001	0.0003	0.026	0.0002
2009	0.139	0.038	0.014	0.0001	0.0003	0.026	0.0002
2010	0.130	0.034	0.012	0.0001	0.0003	0.026	0.0002

Note:
1/ Assuming an average speed of 5 miles per hour for on-road/on-site vehicle trips.

Source: Clark County Department of Air Quality and Environmental Management.
Prepared by: Ricondo & Associates, Inc., April 2008

Emissions estimates for on-road construction equipment for the Proposed Action are presented in **Table F-17**.

F.1.2.3 Nonroad Construction Equipment

Nonroad construction equipment includes bulldozers, loaders, sweepers, and other heavy-duty construction equipment that does not travel on roadways. Emission factors for nonroad vehicles equipped with gasoline-powered engines were derived from AP-42 Volume 1: *Stationary Point and Area Sources.* Emissions from diesel-powered engines are regulated under 40 CFR Part 89.112,[6] *Oxides of nitrogen, carbon monoxide, hydrocarbon, and particulate matter exhaust emission standards*. Emission factors associated with diesel engines vary by engine year and horsepower according to Tier 1, Tier 2, Tier 3, and Tier 4 emissions standards as presented in Table 1 of the U.S. EPA report NR-009c, *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling – Compression-Ignition.* These factors were used with data and methodologies described in the U.S. EPA *Nonroad Engine and Vehicle Emission Study–Report* to estimate diesel equipment emissions for each construction year.

Nonroad construction equipment emissions were calculated based on the type of fuel (gasoline or diesel), engine horsepower, equipment use in hours, load factor, and the average age of the equipment. The U.S. EPA recommends the technique shown in **Equation F-3** for calculating emissions from nonroad engine sources.

[6] U.S. Environmental Protection Agency. *Control of Emissions from New and In-Use Nonroad Compression-Ignition Engines, Oxides of nitrogen, carbon monoxide, hydrocarbon, and particulate matter exhaust emission standards.* 40 C.F.R. Part 89.112.

Table F-17

On-Road Construction Equipment Emissions – Proposed Action

Year/Source	Round-trips per Year	VMT	Hours per Year	CO	VOC	NO_X	SO_X	PM_{10}	$PM_{2.5}$	Entrained Road Dust
2008										
Employee Vehicles	2,640	105,600	n.a.	0.907	0.097	0.091	0.001	0.002	0.004	0.270
Grading material hauling/delivery	1,081	43,242	n.a.	0.372	0.040	0.037	0.000	0.001	0.001	0.111
Material deliveries	18	725	n.a.	0.006	0.001	0.001	0.000	0.000	0.000	0.002
Water trucks	n.a.	n.a.	1,122	0.084	0.024	0.009	0.000	0.000	0.000	n.a. [1/]
Bucket trucks	n.a.	n.a.	1,122	0.084	0.024	0.009	0.000	0.000	0.000	n.a. [1/]
Total				1.453	0.185	0.147	0.001	0.003	0.005	0.382
2009										
Employee Vehicles	10,187	407,480	n.a.	3.235	0.345	0.316	0.004	0.007	0.014	1.042
Grading material hauling/delivery	28,653	1,146,124	n.a.	9.099	0.972	0.889	0.010	0.020	0.038	2.931
Material deliveries	357	14,289	n.a.	0.113	0.012	0.011	0.000	0.000	0.000	0.037
Water deliveries	1,900	76,008	n.a.	0.603	0.064	0.059	0.001	0.001	0.003	0.194
Water trucks	n.a.	n.a.	3,706	0.258	0.070	0.026	0.000	0.001	0.000	n.a. [1/]
Bucket trucks	n.a.	n.a.	2,219	0.154	0.042	0.015	0.000	0.000	0.000	n.a. [1/]
Total				13.463	1.506	1.317	0.015	0.030	0.055	4.204
2010										
Employee Vehicles	10,329	413,140	n.a.	3.025	0.319	0.285	0.004	0.007	0.013	1.057
Grading material hauling/delivery	14,491	579,655	n.a.	4.245	0.448	0.399	0.005	0.010	0.019	1.482
Material deliveries	470	18,818	n.a.	0.138	0.015	0.013	0.000	0.000	0.001	0.048
Asphalt deliveries	2,700	70,200	n.a.	0.514	0.054	0.048	0.001	0.001	0.002	0.180
Concrete deliveries	18,146	362,914	n.a.	2.657	0.280	0.250	0.003	0.006	0.012	0.928
Water trucks	n.a.	n.a.	4,437	0.288	0.076	0.028	0.000	0.001	0.000	n.a. [1/]
Bucket trucks	n.a.	n.a.	2,219	0.144	0.038	0.014	0.000	0.000	0.000	n.a. [1/]
Total				11.011	1.231	1.037	0.014	0.025	0.047	3.695

Notes:
Columns may not add to totals shown because of rounding.
n.a. = not applicable
VMT = vehicle miles traveled
CO = carbon monoxide; VOC = volatile organic compounds; NO_x = oxides of nitrogen; SO_x = oxides of sulfur; PM_{10} = particulate matter; $PM_{2.5}$ = fine particulate matter.
1/ Entrained road dust emissions for on-site water trucks and bucket trucks are included in land development fugitive dust emissions (See Section F.1.2.4).

Source: Ricondo & Associates, Inc., 2007, based on information obtained from the Clark County Department of Aviation, HNTB Corporation, The Louis Berger Group, and the Clark County Department of Air Quality and Environmental Management.
Prepared by: Ricondo & Associates, Inc., April 2008

Equation F-3

Nonroad Construction Equipment Emissions Calculation Equation

$$M_i = (N)(HRS)(HP)(LF/100)(EF_i)$$

where:

M_i = mass of emissions of i^{th} pollutants during the inventory period;
N = source population (units);
HRS = annual hours of use;
HP = average rated horsepower;
LF = typical load factor;
EF_i = average emissions of i^{th} pollutant per unit of use (e.g., pounds per horsepower-hour).

Source: U.S. Environmental Protection Agency. *Nonroad Engine and Vehicle Emission Study—Report*. November 1991.

Emission factors associated with diesel engines vary by the year the engine was manufactured and by horsepower. The fleet age of the diesel equipment that would be used for the construction of a regional heliport was estimated to be an eight year spread – for the 2007 construction year, it was assumed that the oldest piece of equipment on-site was manufactured in 2000, whereas, for the 2008 construction year, it was assumed that the oldest piece of equipment on-site was manufactured in 2001. Through the use of the vehicle age spread, a weighted average of Tier 1, Tier 2, Tier 3, and Tier 4 emission standards was developed for each equipment type and horsepower range. This methodology is the most representative process for calculating pollutant emissions for nonroad construction equipment equipped with diesel engines.

The data used to estimate emissions from nonroad construction equipment for each construction year (2008, 2009, and 2010), as well as total emissions by equipment type and construction year, are presented in **Table F-18**.

Table F-18 (1 of 2)

Nonroad Construction Equipment Emissions – Proposed Action

Year and Equipment Type	Fuel Type	Load Factor 3/	Brake Horsepower	Total Hours	Emission Factors (pounds per horsepower-hour) 1/ CO	VOC	NO_x	SO_x	PM_{10}	Conversion Factor 4/	Pollutant Emissions (tons per year) 2/ CO	VOC	NO_x	SO_x	PM_{10}	$PM_{2.5}$ 5/
2008																
Crane	Diesel	43%	200	1,122	0.0016	0.0006	0.0084	0.0003	0.0004	0.0005	0.080	0.028	0.408	0.013	0.018	0.018
Dump Truck	Diesel	38%	260	1,122	0.0016	0.0006	0.0084	0.0003	0.0004	0.0005	0.091	0.032	0.468	0.014	0.021	0.021
Hydraulic Excavator	Diesel	59%	222	1,122	0.0016	0.0006	0.0084	0.0003	0.0004	0.0005	0.121	0.042	0.621	0.019	0.027	0.027
Soil Compactor	Diesel	55%	150	1,122	0.0019	0.0007	0.0090	0.0003	0.0005	0.0005	0.088	0.031	0.417	0.012	0.022	0.022
Wheel Loader	Diesel	38%	220	1,122	0.0016	0.0006	0.0084	0.0003	0.0004	0.0005	0.077	0.027	0.396	0.012	0.017	0.017
Total 5/											0.458	0.160	2.310	0.070	0.105	0.105
2009																
Backhoe Loader	Diesel	38%	124	1,488	0.0019	0.0006	0.0081	0.0003	0.0005	0.0005	0.067	0.022	0.285	0.009	0.016	0.016
Crane	Diesel	43%	200	3,706	0.0016	0.0005	0.0076	0.0003	0.0003	0.0005	0.263	0.086	1.211	0.041	0.055	0.055
Dump Truck	Diesel	38%	260	3,706	0.0016	0.0005	0.0076	0.0003	0.0003	0.0005	0.302	0.099	1.392	0.048	0.063	0.063
Generator	Diesel	74%	749	1,488	0.0029	0.0004	0.0073	0.0003	0.0003	0.0005	1.206	0.152	3.000	0.107	0.128	0.128
Hydraulic Excavator	Diesel	59%	222	3,511	0.0016	0.0005	0.0076	0.0003	0.0003	0.0005	0.379	0.125	1.747	0.060	0.079	0.079
Motor Grader	Diesel	54%	215	748	0.0016	0.0005	0.0076	0.0003	0.0003	0.0005	0.072	0.024	0.330	0.011	0.015	0.015
Soil Compactor	Diesel	55%	150	3,706	0.0019	0.0006	0.0081	0.0003	0.0005	0.0005	0.292	0.095	1.245	0.040	0.070	0.070
Wheel Loader	Diesel	38%	220	3,706	0.0016	0.0005	0.0076	0.0003	0.0003	0.0005	0.255	0.084	1.177	0.040	0.053	0.053
Wheel Tractor - Scraper	Diesel	60%	450	748	0.0019	0.0004	0.0075	0.0003	0.0003	0.0005	0.188	0.037	0.761	0.026	0.031	0.031
Total 6/											3.023	0.723	11.149	0.383	0.510	0.510

Notes:
CO = carbon monoxide; VOC = volatile organic compounds; NO_X = oxides of nitrogen; SO_X = oxides of sulfur; PM_{10} = particulate matter; $PM_{2.5}$ = fine particulate matter.
1/ Emission factors were derived from Tier 1 and Tier 2 standards and an eight-year spread for construction equipment was used to create a weighted average emission factor.
2/ Vehicle emissions are calculated by multiplying the annual hours, load factor, horsepower, emission factor, usage factor, and conversion factor to create a value of tons per year for each piece of equipment.
3/ Load factor is defined as the average fraction of rated power (horsepower) used in a duty cycle. The load factor information was derived from Table 2-05 "Inventory A and B Typical Operating Load Factor Estimates" of the *Nonroad Engine and Vehicle Emission Study-Report*, November 1991. The load factors used for diesel vehicles were derived from Inventory B.
4/ The conversion factor is the number of pounds per ton – 1 ton/ 2,000 pounds = 0.0005.
5/ For nonroad construction equipment, $PM_{2.5}$ emissions are assumed to be equal to PM_{10} emissions.
6/ Columns may not add to totals shown because of rounding.

Sources: Ricondo & Associates, Inc., 2007, based on the document listed above and information provided by The Louis Berger Group, HNTB Corporation, and the Clark County Department of Aviation.
Prepared by: Ricondo & Associates, Inc., April 2008

Table F-18 (2 of 2)

Nonroad Construction Equipment Emissions – Proposed Action

Year and Equipment Type	Fuel Type	Load Factor [3/]	Brake Horsepower	Total Hours	Emission Factors (pounds per horsepower-hour) [1/] CO	VOC	NO_x	SO_x	PM_{10}	Conversion Factor [4/]	Pollutant Emissions (tons per year) [2/] CO	VOC	NO_x	SO_x	PM_{10}	$PM_{2.5}$ [5/]
2010																
Asphalt Paver	Diesel	56%	200	553	0.0016	0.0005	0.0068	0.0001	0.0003	0.0005	0.051	0.016	0.209	0.004	0.010	0.010
Backhoe Loader	Diesel	38%	124	1,658	0.0019	0.0006	0.0073	0.0001	0.0004	0.0005	0.075	0.022	0.284	0.005	0.017	0.017
Concrete Paver - Bidwell	Diesel	56%	460	553	0.0019	0.0004	0.0070	0.0001	0.0003	0.0005	0.132	0.026	0.500	0.009	0.022	0.022
Concrete Pump Truck	Diesel	62%	430	553	0.0019	0.0004	0.0070	0.0001	0.0003	0.0005	0.137	0.027	0.518	0.009	0.023	0.023
Concrete Saw	Diesel	78%	20	553	0.0048	0.0010	0.0098	0.0001	0.0006	0.0005	0.021	0.004	0.042	0.001	0.003	0.003
Crane	Diesel	43%	200	4,250	0.0016	0.0005	0.0068	0.0001	0.0003	0.0005	0.301	0.093	1.234	0.022	0.058	0.058
Dual Drum Vibrator	Diesel	55%	145	553	0.0019	0.0006	0.0073	0.0001	0.0004	0.0005	0.042	0.013	0.160	0.003	0.010	0.010
Dump Truck	Diesel	38%	260	3,876	0.0016	0.0005	0.0068	0.0001	0.0003	0.0005	0.316	0.097	1.293	0.023	0.060	0.060
Generator	Diesel	74%	749	2,219	0.0029	0.0004	0.0068	0.0001	0.0003	0.0005	1.799	0.226	4.203	0.075	0.194	0.194
Hydraulic Excavator	Diesel	59%	222	3,145	0.0016	0.0005	0.0068	0.0001	0.0003	0.0005	0.339	0.105	1.391	0.025	0.065	0.065
Motor Grader	Diesel	54%	215	349	0.0016	0.0005	0.0068	0.0001	0.0003	0.0005	0.033	0.010	0.137	0.002	0.006	0.006
Pneumatic Tire Compactor	Diesel	55%	99	553	0.0052	0.0007	0.0092	0.0001	0.0006	0.0005	0.078	0.011	0.138	0.002	0.008	0.008
Soil Compactor	Diesel	55%	150	3,689	0.0019	0.0006	0.0073	0.0001	0.0004	0.0005	0.291	0.088	1.107	0.019	0.067	0.067
Wheel Loader	Diesel	38%	220	3,876	0.0016	0.0005	0.0068	0.0001	0.0003	0.0005	0.267	0.082	1.094	0.020	0.051	0.051
Wheel Tractor - Scraper	Diesel	60%	450	349	0.0019	0.0004	0.0070	0.0001	0.0003	0.0005	0.087	0.017	0.331	0.006	0.015	0.015
Total [6/]											3.970	0.837	12.641	0.224	0.610	0.610

Notes:

CO = carbon monoxide; VOC = volatile organic compounds; NO_x = oxides of nitrogen; SO_x = oxides of sulfur; PM_{10} = particulate matter; $PM_{2.5}$ = fine particulate matter.

1/ Emission factors were derived from Tier 1 and Tier 2 standards and an eight-year spread for construction equipment was used to create a weighted average emission factor.

2/ Vehicle emissions are calculated by multiplying the annual hours, load factor, horsepower, emission factor, usage factor, and conversion factor to create a value of tons per year for each piece of equipment.

3/ Load factor is defined as the average fraction of rated power (horsepower) used in a duty cycle. The load factor information was derived from Table 2-05 "Inventory A and B Typical Operating Load Factor Estimates" of the *Nonroad Engine and Vehicle Emission Study-Report*, November 1991. The load factors used for diesel vehicles were derived from Inventory B.

4/ The conversion factor is the number of pounds per ton – 1 ton/ 2,000 pounds = 0.0005.

5/ For nonroad construction equipment, $PM_{2.5}$ emissions are assumed to be equal to PM_{10} emissions.

6/ Columns may not add to totals shown because of rounding.

Sources: Ricondo & Associates, Inc., 2007, based on the document listed above and information provided by The Louis Berger Group, HNTB Corporation, and the Clark County Department of Aviation.

Prepared by: Ricondo & Associates, Inc., April 2008

F.1.2.4 Land Development

Fugitive dust from land development includes particulate emissions from activities such as grading, trenching, crushing, screening, and back filling. Particulate emissions from land development activities are calculated by multiplying the estimated number of acres disturbed per year by the total months per year the land is disturbed, an emission factor (measured in tons/acre/month), and a control efficiency.

Estimates of development areas at the Heliport site were derived from the conceptual heliport layout drawing developed by HNTB Corporation. Development areas include helicopter parking pads, fuel tanks, takeoff and landing areas, buildings, paved aprons, taxiways, access roadways, parking lots, and on-site utilities. The number of acres affected during each construction year was calculated based on the percentage of construction activity scheduled to take place each year. Land development emissions were also calculated for the areas of the utility extensions requiring earth moving activities. An emission factor of 0.42 tons/acre/month was obtained from the Clark County PM_{10} State Implementation Plan (PM_{10} SIP), prepared in June 2001. It is assumed that the disturbed areas would be watered, thus partially mitigating the amount of fugitive dust generated by construction activities. A control efficiency of 50 percent was assumed to account for adequate watering.

Table F-19 presents the data used to calculate PM_{10} emissions from land development activities, as well as the total PM_{10} emissions from land development activities for the proposed action, by construction year.

Table F-19

Particulate Emissions from Land Development – Proposed Action

Project Component	Total Area (acres)	Disturbed Area (acres)			Total Months Disturbed			Emission Factor [1/]	Mitigation [2/]	PM_{10} Emissions (tons/year)		
		2008	2009	2010	2008	2009	2010			2008	2009	2010
Site Infrastructure [3/]	34.75	0.00	15.62	19.13	0	4	9	0.42	50%	0.00	13.12	36.16
On-Site Utilities	23.07	0.00	23.07	0.00	0	7	0	0.42	50%	0.00	33.92	0.00
Utility Extensions [4/]	24.32	20.87	1.72	1.72	6	12	12	0.42	50%	26.30	4.34	4.34
Total	82.14	20.87	40.42	20.85						26.30	51.38	40.50

Notes:
Columns may not add to total shown because of rounding.
PM_{10} = particulate matter.

1/ The emission factor for land development activities is measured in tons/acre/month, and was obtained from the Clark County PM_{10} State Implementation Plan (June 2001).
2/ Adequate watering is assumed to reduce particulate emissions by 50 percent.
3/ Site infrastructure includes helicopter parking pads, fuel tanks, takeoff and landing areas, buildings, apron areas, taxiways, access roadways, and parking lots.
4/ Land development area for the utility extensions is assumed to only apply to those areas subject to excavation/earth moving activities.

Sources: Ricondo & Associates, Inc., 2007, based on information provided by HNTB Corporation and the Clark County Department of Aviation.
Prepared by: Ricondo & Associates, Inc., April 2008

F.1.2.5 Wind Erosion

Dirt piles, areas of bare soils, and newly paved portions of a construction site can be sources of windblown PM_{10}. Emission factors for wind erosion were derived from Section 11.9 “Western Surface Coal Mining” of AP-42. Coal mining emission factors were used in the analysis where AP-42 dust factors were lacking, consistent with standard industry practices.

PM_{10} emissions caused by wind erosion were calculated using the methodologies outlined in Section 13.2.3 “Heavy Construction Operations” of AP-42. Wind erosion emissions are calculated by determining the acreage affected by land development activities (see Section E.1.2.4) and multiplying the acreage amount by the appropriate emission factor and control efficiency factor. The methodology used to calculate wind erosion emissions is presented in **Equation F-4**.

Equation F-4

Wind Erosion Emissions Calculation Equation

$$M_i = (A)(YR)(1-CE)(EF_i)$$

where:

M_i = mass of emissions of i^{th} pollutants during inventory period;
A = area of land affected (acres);
YR = percentage of year that operations are occurring;
CE = control efficiency of mitigation measures taken (watering, covering, etc.);
EF_i = average emissions of i^{th} pollutant per unit of use (tons per acre per year).

Source: U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Section 13.2.3 “Heavy Construction Operations”. January 1995.

PM_{10} emissions associated with wind erosion were calculated: (1) for the period of time when the area of disturbance would have exposed soil and (2) for the period of time after the area of disturbance was paved and construction was still ongoing. Wind blown PM_{10} emissions were estimated separately for prepaving/postpaving because of the different control efficiencies that are possible before and after an area has been paved. The control efficiencies used in this analysis were based on professional judgment and experience.

For purposes of the wind erosion analysis, it was assumed that adequate watering would occur before paving – approximately three to four applications of water per day – to reduce PM_{10} emissions caused by wind erosion. It was also assumed that a maximum speed limit of 25 miles per hour would be instituted on the construction site to reduce wind erosion emissions. This is consistent with the assumption that on-site construction equipment would travel at an average speed of 5 miles per hour. According to the methodology outlined in Table 13.2.3-1 “Recommended Emission Factors for Construction Operations” in Section 13.2.3 of AP-42, the combination of these two control methods creates a total control efficiency of 63 percent. It was assumed that infrequent cleanup (approximately once per week) of the paved ground would occur at the construction site after paving, reducing dust emissions by 85 percent.

Table F-20 provides a summary of PM_{10} emissions associated with wind erosion for the proposed action.

Table F-20

Particulate Emissions from Wind Erosion – Proposed Action

Year	Land Development Source	Total Area Affected (acres) 1/	TSP Emission Factor (tons per acre per month) 2/,3/	PM_{10} Fraction 4/	Percentage of Year of Wind Erosion	Control Efficiency 5/	Total PM_{10} Emissions (tons/year)
2008	Wind Erosion before Paving	20.87	0.38	50%	100.00%	63%	1.47
2008	Wind Erosion during Paving	0.00	0.38	50%	0.00%	63%	0.00
2008	Wind Erosion after Paving	0.00	0.38	50%	0.00%	63%	0.00
						Total (2008)	1.47
2009	Wind Erosion before Paving	40.42	0.38	50%	55.20%	63%	1.57
2009	Wind Erosion during Paving	0.00	0.38	50%	0.00	63%	0.00
2009	Wind Erosion after Paving	0.00	0.38	50%	0.00	63%	0.00
						Total (2009)	1.57
2010	Wind Erosion before Paving	20.85	0.38	50%	15.90%	85%	0.23
2010	Wind Erosion during Paving	57.83	0.38	50%	25.00%	85%	1.02
2010	Wind Erosion after Paving	57.83	0.38	50%	66.67%	85%	1.10
						Total (2010)	2.35

Notes:

PM_{10} = particulate matter

TSP = total suspended particulates

1/ Acres and schedule information were provided by The Louis Berger Group.

2/ The emission factor for earth moving is based on information in the *PM_{10} State Implementation Plan* for the Las Vegas Valley.

3/ Emission factors for wind erosion are found in the report *Compilation of Air Pollutant Emission Factors* AP-42, Fifth Edition, Volume I: *Stationary Point and Area Sources,* Section 11.9 “Western Surface Coal Mining”, Table 11.9-4 October 1998. Emission factors for wind erosion are expressed in tons/acre/year. The factor is appropriate assuming that pulverized coal and unconsolidated earth have the same potential for becoming airborne (i.e., the same degree of “dustiness”).

4/ TSP was converted to PM_{10} using a fraction of 0.5, based on *Compilation of Air Pollutant Emission Factors* AP-42, Fifth Edition, Volume I, and professional judgment.

5/ The control efficiencies were calculated assuming that the area of disturbance would be watered three to four times a day and that the maximum allowable speed on the site would be 25 miles per hour. After the paving operations are completed, it was assumed that the paved area would be swept once a week.

Source: Ricondo & Associates, Inc., 2007, based on information provided by HNTB Corporation and the Clark County Department of Aviation, and the sources noted above.

Prepared by: Ricondo & Associates, Inc., April 2008

F.1.2.6 Asphalt Paving

Asphalt surfaces and pavements are composed of compacted aggregate and an asphalt binder. Aggregate materials are produced from rock quarries as manufactured stone or are obtained from natural gravel or soil deposits. Asphalt binders take the form of asphalt cement (the residue of the distillation of crude oils), and liquefied asphalts. Asphalt cement, which is semi-solid, must be heated prior to mixing with aggregate.

Asphalt paving operations can be a source of VOC emissions. VOC emissions are created by the evaporation of the petroleum distillate solvent, or diluent, used to liquefy asphalt cement. Asphalt paving emissions associated with the construction of the Heliport were calculated using the methodologies presented in Section 4.5 "Asphalt Paving Operations" of AP-42, Fifth Edition, Volume I. The formula used to calculate VOC emissions caused by asphalt paving operations is presented in **Equation F-5**.

Equation F-5

Asphalt Paving Emissions Calculation Equation

$$M_i = (A)(AR)(VD)(EF)(D)$$

where:

M_i = mass of emissions of i^{th} pollutants during inventory period;
A = area of land affected (square meters);
AR = application rate of liquefied asphalt over area (liters per square meter);
VD = percent, by volume, of diluent in liquefied asphalt (percentage);
EF = percent of diluent (mass) that evaporates and becomes VOC (percentage);
D = density of solvent used (pounds per liter).

Source: U.S. Environmental Protection Agency. *Compilation of Air Pollutant Emission Factors* AP-42, Fifth Edition, Volume I: *Stationary Point and Area Sources*, Section 4.5 "Asphalt Paving Operations". January 1995.

The following assumptions were used to estimate VOC emissions associated with asphalt paving operations.

- The paving area for applicable components of the Heliport site was derived from the conceptual heliport layout drawing developed by HNTB Corporation.
- Asphalt would be batched offsite and trucked to the construction site.
- The asphalt would be put down in one lift (layer) for each applicable activity, unless otherwise stated. The asphalt paving process, therefore, includes a prime coat and one tack coat (one tack coat for each lift).
- Asphalt paving operations were assumed to include liquefied asphalts as the asphalt binder. Liquefied asphalts include cutback asphalts, assumed to be used for prime coat paving operations, and emulsified asphalts, assumed to be used for tack coat paving operations. The cutback asphalt was assumed to contain kerosene as the diluent, a common construction industry practice.
- The application rate for the prime coat would be 1.3583 liters of cutback asphalt per square meter of paving.
- The application rate for the tack coat would be 0.4528 liter of emulsified asphalts per square meter of paving.

- The cutback asphalt used would be medium cure. The percent by volume of diluent in the cutback asphalt would be 35 percent.
- All asphalt paving is assumed to occur in 2010 at the Heliport site.

The emission calculations were performed separately for the tack coat and the prime coat because each would have a different application rate and percent by volume of diluent. **Table F-21** presents a summary of VOC emissions associated with asphalt paving activities.

Table F-21

Asphalt Paving Emissions – Proposed Action

Year	Paved Area (m^2) 1/	Solvent Density (lb/L) 2/	Application Rate (L/m^2) 3/	Percent VOC Emitted 4/	Conversion Factor (ton/lb)	Total VOC Emissions (tons)
Aprons (Tack Coat)	43,123	1.8	0.38	3%	1/2000	0.53
Aprons (Prime Coat)	43,123	1.8	0.38	20%	1/2000	10.54
Taxiways (Tack Coat)	32,546	1.8	0.38	3%	1/2000	0.40
Taxiways (Prime Coat)	32,546	1.8	0.38	20%	1/2000	7.96
Access Roads (Tack Coat)	27,748	1.8	0.38	3%	1/2000	0.34
Access Roads (Prime Coat)	27,748	1.8	0.38	20%	1/2000	6.78
Parking Lots (Tack Coat)	20,810	1.8	0.38	3%	1/2000	0.25
Parking Lots (Prime Coat)	20,810	1.8	0.38	20%	1/2000	5.09
Total (2010)						31.89

Notes:
m = meter.
L = liter.
lb = pound.
VOC = volatile organic compounds.

1/ The areas to be paved were derived from the conceptual heliport layout drawing developed by HNTB Corporation.

2/ Solvent density is for kerosene. It is standard industry practice to use kerosene to liquify asphalt cement.

3/ Application rates are consistent with standard industry practice.

4/ The percent VOC emitted for the tack coat is consistent with the use of emulsified asphalt. The percent VOC emitted for the prime coat is based on data found in Table 4.5-1 of *Compilation of Air Pollutant Emission Factors* AP-42, Fifth Edition, Volume I: *Stationary Point and Area Sources*, Section 4.5 “Asphalt Paving Operations”, July 1979 (reformatted January 1995). The value is based on medium cure cutback and 35 percent, by volume, of diluent in cutback for the prime coat.

Source: Ricondo & Associates, Inc., 2007, using the sources noted above.
Prepared by: Ricondo & Associates, Inc., April 2008

F.1.2.7 Summary of Heliport Construction Emissions

A summary of total construction-related emissions by construction year for the proposed action is presented in **Table F-22**.

Table F-22

Construction Emissions Summary – Proposed Action

Year/Source	Pollutant Emissions (tons/year) Carbon Monoxide (CO)	Volatile Organic Compound (VOC)	Oxides of Nitrogen (NO_X)	Oxides of Sulfur (SO_X)	Particulate matter (PM_{10})	Fine particulate matter ($PM_{2.5}$)
2008						
On-Road/Off-Site Equipment [1/]	1.285	0.138	0.129	0.001	0.388	0.382
On-Road/On-Site Equipment	0.168	0.047	0.017	0.000	0.000	0.000
Nonroad Equipment [2/]	0.458	0.160	2.310	0.070	0.105	0.105
Land Development	--	--	--	--	26.298	--
Wind Erosion	--	--	--	--	1.467	--
Asphalt Paving	--	0.000	--	--	--	--
Total	1.911	0.345	2.457	0.072	28.258	0.488
2009						
On-Road/Off-Site Equipment [1/]	13.051	1.393	1.276	0.015	4.259	4.204
On-Road/On-Site Equipment	0.412	0.113	0.041	0.000	0.001	0.001
Nonroad Equipment [2/]	3.023	0.723	11.149	0.383	0.510	0.510
Land Development	--	--	--	--	51.378	--
Wind Erosion	--	--	--	--	1.568	--
Asphalt Paving	--	0.000	--	--	--	--
Total	16.486	2.229	12.466	0.398	57.716	4.715
2010						
On-Road/Off-Site Equipment [1/]	10.579	1.116	0.995	0.013	3.741	3.695
On-Road/On-Site Equipment	0.432	0.114	0.041	0.000	0.001	0.001
Nonroad Equipment [2/]	3.970	0.837	12.641	0.224	0.610	0.610
Land Development	--	--	--	--	40.500	--
Wind Erosion	--	--	--	--	2.348	--
Asphalt Paving	--	31.891	--	--	--	--
Total	14.981	33.958	13.678	0.237	47.200	4.305

Notes:
Columns may not add to totals shown because of rounding.

1/ PM_{10} emissions for on-road/off-site vehicles include entrained road dust. $PM_{2.5}$ emissions were calculated using emission factors presented in Table F-15.

2/ $PM_{2.5}$ emissions for nonroad construction equipment are assumed to be equal to PM_{10} emissions.

Sources: Ricondo & Associates, Inc., 2007, based on information obtained from The Louis Berger Group, the Clark County Department of Aviation, and HNTB Corporation.

Prepared by: Ricondo & Associates, Inc., April 2008

F.1.3 Summary of Emissions

Table F-23 presents a summary of total emissions for existing conditions, the Proposed Action, and the No Action alternative. Heliport construction emissions occur in 2008, 2009, and 2010, while heliport operational emissions occur in 2011 and 2017.

Table F-23
Summary of Emissions

Year/Source	Pollutant Emissions (tons/year): Carbon Monoxide (CO)	Volatile Organic Compound (VOC)	Oxides of Nitrogen (NO_X)	Oxides of Sulfur (SO_X)	Particulate matter (PM_{10})	Fine particulate matter ($PM_{2.5}$)
Existing Conditions						
Operational Emissions						
2004	35.701	6.069	15.940	2.247	4.818	4.446
Proposed Action						
Construction Emissions						
2008	1.911	0.345	2.457	0.072	28.258	0.488
2009	16.486	2.229	12.466	0.398	57.716	4.715
2010	14.981	33.958	13.678	0.237	47.200	4.305
Operational Emissions						
2011	38.946	6.306	12.150	2.359	6.321	4.865
2017	46.651	7.354	12.642	2.858	8.026	6.193
No Action Alternative						
Construction Emissions						
2008	--	--	--	--	--	--
2009	--	--	--	--	--	--
2010	--	--	--	--	--	--
Operational Emissions						
2011	28.920	4.761	9.469	1.873	4.149	3.861
2017	34.922	5.610	9.853	2.252	5.236	4.882

Note:
Columns may not add to totals shown because of rounding.

Sources: Ricondo & Associates, Inc., 2007, based on output from the Emissions and Dispersion Modeling System, Version 4.3, and information obtained from The Louis Berger Group, the Clark County Department of Aviation, and HNTB Corporation.
Prepared by: Ricondo & Associates, Inc., April 2008

F.2 Dispersion Analysis

In addition to an operational emissions analysis, EDMS was used to conduct CO and PM_{10} dispersion analyses for the Proposed Action and No Action alternative. Dispersion modeling was conducted for the Proposed Action and the No Action alternative in response to scoping comments received from the U.S. EPA requesting an assessment of the potential for the Proposed Action to cause or contribute to exceedances of the CO and PM_{10}[7,8] National Ambient Air Quality Standards (NAAQS).

Dispersion modeling using EDMS is significantly more complex in scope and in data input requirements than emissions inventory modeling. Users must (1) specify coordinates for sources of emissions, (2) assign helicopters to FATOs, taxiways, and gate areas, (3) develop appropriate operational profiles for mobile sources, (4) develop weather variables for individual hours, and (5) define other source-specific parameters for each emissions source included in the dispersion analysis. The user is also required to define individual receptors or grids of receptors for pollutant concentration estimation. In preparing for the dispersion analyses, heliport operations and physical planning data were assembled and documented.

The methodology followed, and key assumptions used for the dispersion modeling aspect of the study are described in the sections that follow.

F.2.1 Coordinates for Sources of CO and PM_{10} Pollution

For McCarran International Airport, coordinates for major point (e.g., fuel storage facilities), area (e.g., parking lots, and aircraft gates), and line (e.g., roads, taxiways and takeoff and landing areas) sources of CO and PM_{10} emissions were derived from drawings of existing helicopter air tour facilities. For the Heliport site, coordinates were derived from the conceptual heliport layout drawing developed by HNTB Corporation.[9] The drawings provide configurations, lengths, and coordinates of takeoff and landing areas and taxiways, helicopter gate/apron areas, and other heliport facilities that are sources of CO and PM_{10} emissions. These coordinates were input into the EDMS.

F.2.2 Helicopter FATO, Taxiway, and Gate Assignments

The EDMS dispersion module requires FATO, taxiway, and gate assignments for each active helicopter in the study. These assignments directly affect emissions concentrations and therefore are a crucial component of EDMS dispersion modeling.

Helicopter FATOs were modeled in EDMS and assigned an identifier based on the general direction of flight to and from the FATO. FATO use percentages were developed for each heliport site alternative by ASRC Aerospace Corporation. FATO use percentages for helicopter arrivals and departures were normalized and applied to helicopter LTO cycles for the dispersion analysis.

A system of taxiways connecting gate/apron areas to FATOs were modeled in EDMS. For McCarran International Airport, existing taxiways were used as necessary. Helicopters were assigned to taxiways based on the gate/FATO combination from/to which they were departing/arriving.

For operations at McCarran International Airport, LTO cycles were assigned to gate areas based on the distribution of existing helicopter operations. Helicopter LTO cycles at the Heliport site were

7 As described in Section 3.8.2 in Volume 1 of this EA, the nonattainment areas for CO and PM_{10} roughly coincide with Hydrographic Basin 212, which encompasses the Las Vegas region. Hydrographic Basin 212 is designated as nonattainment for the 8-hour CO NAAQS and the 24-hour PM_{10} NAAQS.

8 Because ozone is a regional pollutant and ambient concentrations can only be predicted using regional photochemical models that account for all sources of precursors, ozone was not evaluated in the EA dispersion modeling analysis.

9 HNTB Corporation. *Conceptual Heliport Layout Drawing*. July 2007.

distributed among gate areas according to the anticipated number of helicopter pad positions required for each air tour helicopter operator based on information obtained from the project definition manual prepared by HNTB Corporation.[10]

F.2.3 Helicopter Operational Profiles

Atmospheric dispersion of pollutants in EDMS is calculated for one hour periods. Because sources of CO and PM_{10} emissions at airports/heliports vary in their activity or strength depending on the hour of the day, EDMS allows users to develop operational profiles to simulate variations in heliport-related traffic volumes that occur over the course of an entire year (8,760 hours). These operational profiles can be used to define hourly, daily, and monthly peaking characteristics for aircraft and ground access vehicles.

Operational profiles were defined for helicopters, ground access vehicles, and ground support equipment on the basis of available data. Adequate data for developing operational profiles for Strip tour helicopter activity was not available. Good data regarding the peaking characteristics of Grand Canyon helicopter air tour activity was available. Data used to develop helicopter operational profiles included: (1) monthly Grand Canyon helicopter air tour operations summaries reported by AirScene for 2004; and (2) hourly Grand Canyon helicopter air tour operations summaries for 2004 as documented in the *Clark County Department of Aviation Helicopter Noise Monitoring Report*.[11] **Table F-23** and **Table F-24** present the monthly and hourly operational profiles used in the dispersion analysis, respectively. These operational profiles were applied to helicopter and associated ground support equipment operations, motor vehicle trips on heliport access roadways and parking lots, and to fuel storage facility point sources. It should be noted that although operational profiles were generated based only on Grand Canyon helicopter air tour activity (the best data available), those profiles were applied to both Strip and Grand Canyon helicopter air tour activity for modeling purposes.

[10] HNTB Corporation. *Final: Project Definition, Development, and Operational Manual, Southern Nevada Regional Heliport*. December 5, 2006.

[11] Brown-Buntin Associates, Inc. *Clark County Department of Aviation Helicopter Noise Monitoring Report.* September 2004.

Table F-23

Grand Canyon Helicopter Air Tour Monthly Operational Profile

Month	Grand Canyon Helicopter Air Tour Operations (2004)	Percent of Year	Percent of Maximum
January	4,318	6.72%	66.63%
February	4,100	6.38%	63.26%
March	5,706	8.88%	88.04%
April	6,265	9.75%	96.67%
May	4,957	7.71%	76.49%
June	5,320	8.28%	82.09%
July	5,583	8.69%	86.14%
August	5,359	8.34%	82.69%
September	6,244	9.71%	96.34%
October	6,481	10.08%	100.00%
November	5,768	8.97%	89.00%
December	4,182	6.51%	64.53%

Source: AirScene activity data provided by the Clark County Department of Aviation.
Prepared by: Ricondo & Associates, Inc., April 2008

Table F-24

Grand Canyon Helicopter Air Tour Hourly Operational Profile

Hour	Grand Canyon Helicopter Air Tour Departures	Grand Canyon Helicopter Air Tour Arrivals	Total Grand Canyon Helicopter Air Tour Operations	Percent of Day	Percent of Maximum
1:00	0	0	0	0.00%	0.00%
2:00	0	0	0	0.00%	0.00%
3:00	0	0	0	0.00%	0.00%
4:00	0	0	0	0.00%	0.00%
5:00	0	0	0	0.00%	0.00%
6:00	3	0	3	1.58%	13.64%
7:00	11	0	11	5.79%	50.00%
8:00	6	5	11	5.79%	50.00%
9:00	10	8	18	9.47%	81.82%
10:00	11	5	16	8.42%	72.73%
11:00	1	9	10	5.26%	45.45%
12:00	12	10	22	11.58%	100.00%
13:00	5	4	9	4.74%	40.91%
14:00	9	10	19	10.00%	86.36%
15:00	6	7	13	6.84%	59.09%
16:00	6	8	14	7.37%	63.64%
17:00	10	8	18	9.47%	81.82%
18:00	6	4	10	5.26%	45.45%
19:00	0	7	7	3.68%	31.82%
20:00	0	9	9	4.74%	40.91%
21:00	0	0	0	0.00%	0.00%
22:00	0	0	0	0.00%	0.00%
23:00	0	0	0	0.00%	0.00%
0:00	0	0	0	0.00%	0.00%

Notes:
Hourly profile data was developed based on activity data from July 30, 2004 to August 12, 2004.
The departures, arrivals, and operations data presented in the table was used only to develop the hourly profile, not as a source of historical operations data for use in the air quality analysis.

Source: Ricondo & Associates, Inc. and Clark County Department of Aviation, based on data obtained from Brown-Buntin Associates, Inc. Clark County Department of Aviation Helicopter Noise Monitoring Report. September 2004.
Prepared by: Ricondo & Associates, Inc., April 2008

F.2.4 Meteorological Data

Meteorological data required for dispersion modeling includes surface data and upper air data. Surface data from the McCarran International Airport weather station was obtained in the format specified by the Support Center for Regulatory Atmospheric Modeling (SCRAM). Upper air data from the Mercury Desert Rock weather station was obtained in the TD-6201 format. Hourly meteorological data, including winds and temperature, were available for five years: 1988, 1989, 1990, 1991 and 1992. Localized surface and upper air data were not available for the Heliport site. Therefore, the surface data from the McCarran International Airport weather station and upper air data from the Mercury Desert Rock weather station were used in the dispersion analysis for the Heliport site.

F.2.5 Dispersion Receptors

A 10x10 grid of receptors, spaced 1,000 feet apart, was established in EDMS for each potential heliport site to display the predicted CO and PM_{10} concentrations. For each site, the receptor grid was centered over the Heliport site and over the general area where helicopter operations are based on the west side of McCarran International Airport. The receptor grids were also positioned to ensure that some receptors were located in areas where people could congregate, such as curbs, parking lots, and the aircraft aprons. **Exhibit F-2** and **Exhibit F-3** depict the location of the receptor grid with respect to the Heliport site and the west side of McCarran, respectively.

F.2.6 Dispersion Screening Analysis

A screening analysis was performed to select the meteorological year resulting in the greatest average 8-hour average concentration of CO and the greatest average 24-hour and annual average of PM_{10}. Each year of meteorological data was run in EDMS with the 2004 existing conditions McCarran International Airport scenario for the two pollutants. **Table F-25** presents the results of the screening analysis.

Table F-25

Dispersion Screening Analysis

Pollutant/Averaging Period	Concentration by Year				
	1988	1989	1990	1991	1992
CO 8-Hour Average (ppm)	0.000589787	0.000545936	0.000656323	0.000774880	0.000759387
PM_{10} 24-Hour Average ($\mu g/m^3$)	0.054837011	0.050931848	0.061189776	0.070666862	0.069847182

Notes:
CO = carbon monoxide; PM_{10} = particulate matter.
$\mu g/m^3$ = Micrograms per cubic meter.
ppm = Parts per million.

Source: Ricondo & Associates, Inc., 2007, based on output from the Emissions and Dispersion Modeling System, Version 4.3.
Prepared by: Ricondo & Associates, Inc., April 2008

As shown, the 1991 meteorological year yielded the highest 8-hour average concentrations of CO, as well as the highest 24-hour and annual average concentrations of PM_{10}, and was therefore selected as the meteorological analysis year for the dispersion analyses conducted in EDMS. An additional screening was conducted to determine the "worst case" year for Proposed Action and No Action alternative in terms of helicopter operations and emissions. The analysis year of 2017 yielded the greatest number of helicopter operations for each heliport site alternative.

Exhibit F-2

Air Quality Dispersion Receptors – Proposed Heliport Site

Exhibit F-2 depicts sites/receptors near the proposed heliport site where the Emissions and Dispersion Modeling System (EDMS) was used to estimate pollutant concentrations. The receptor grid is superimposed on an aerial photograph with the boundary of the proposed Heliport site highlighted with a red hatch.

Exhibit F-3

Air Quality Dispersion Receptors – McCarran International Airport

Exhibit F-3 depicts sites/receptors near the McCarran International Airport where the Emissions and Dispersion Modeling System (EDMS) was used to estimate pollutant concentrations. The receptor grid is superimposed on an aerial photograph..

As a result of the screening analysis, dispersion modeling was conducted for CO (8-hour average) and PM_{10} (24-hour average) using 1991 meteorological data for the following cases:

- Proposed Action: Heliport site (2017)
- No Action alternative: McCarran International Airport (2017)

Although both the Proposed Action and No Action alternative assume that helicopter air tour operations would be performed at multiple locations, dispersion modeling was conducted only for the facility expected to accommodate the highest level of helicopter operations, according to the demand forecasts.

F.2.7 Dispersion Modeling Results

Table F-26 and **Table F-27** present, by receptor, the estimated 8-hour average CO concentrations and 24-hour average PM_{10} concentrations for each of the modeled cases described in Section F.2.6, respectively. The rank-ordered 8-hour average CO concentrations are expressed in parts per million (ppm). The rank-ordered 24-hour PM_{10} concentrations are expressed in micrograms per cubic meter ($\mu g/m^3$).

Table F-26

Dispersion Modeling Results – Proposed Action

8-Hour Average CO Concentrations (ppm)

Rank	Receptor	Concentration	Rank	Receptor	Concentration
1	56	0.0035024889	51	23	0.0001365402
2	46	0.0032431622	52	70	0.0001240160
3	57	0.0028242338	53	99	0.0001215180
4	45	0.0022330809	54	30	0.0001194064
5	47	0.0011216645	55	97	0.0001192840
6	55	0.0009783230	56	17	0.0001164446
7	67	0.0007621296	57	63	0.0001158645
8	66	0.0006397255	58	74	0.0001140261
9	58	0.0006134246	59	32	0.0001099644
10	36	0.0005837297	60	19	0.0001078787
11	35	0.0005647310	61	5	0.0001078384
12	48	0.0005109561	62	41	0.0001065571
13	44	0.0004777050	63	14	0.0001059493
14	37	0.0004291269	64	51	0.0001058165
15	54	0.0004010189	65	18	0.0001057305
16	59	0.0003704659	66	6	0.0001056525
17	77	0.0003578419	67	13	0.0001033953
18	68	0.0003214709	68	85	0.0001012637
19	38	0.0003170481	69	20	0.0000981968
20	65	0.0003051526	70	100	0.0000978067
21	34	0.0002994842	71	96	0.0000910053
22	78	0.0002826437	72	31	0.0000909761
23	49	0.0002763375	73	90	0.0000906807
24	26	0.0002618014	74	62	0.0000898733
25	76	0.0002593420	75	84	0.0000857286
26	43	0.0002455057	76	12	0.0000843897
27	25	0.0002433798	77	80	0.0000830495
28	53	0.0002254417	78	7	0.0000795377
29	39	0.0002232795	79	4	0.0000768253
30	60	0.0002167957	80	22	0.0000744768
31	88	0.0002002043	81	10	0.0000734170
32	27	0.0001978347	82	73	0.0000733993
33	87	0.0001972348	83	61	0.0000732870
34	24	0.0001865604	84	95	0.0000698469
35	28	0.0001793964	85	2	0.0000696886
36	50	0.0001742335	86	9	0.0000683120
37	64	0.0001732033	87	8	0.0000678760
38	75	0.0001694992	88	3	0.0000649925
39	69	0.0001686550	89	83	0.0000631694
40	40	0.0001637813	90	1	0.0000595009
41	16	0.0001566356	91	94	0.0000592365
42	29	0.0001557147	92	21	0.0000572395
43	42	0.0001547911	93	93	0.0000543834
44	89	0.0001512484	94	72	0.0000533311
45	15	0.0001496496	95	11	0.0000476608
46	79	0.0001488588	96	71	0.0000468346
47	33	0.0001479709	97	82	0.0000414796
48	52	0.0001468830	98	92	0.0000397120
49	98	0.0001419257	99	81	0.0000306258
50	86	0.0001405423	100	91	0.0000275988

24-Hour Average PM_{10} Concentrations ($\mu g/m^3$)

Rank	Receptor	Concentration	Rank	Receptor	Concentration
1	56	1.0080840274	51	30	0.0269751781
2	57	0.9302135068	52	97	0.0266797260
3	45	0.8735126575	53	41	0.0264832055
4	46	0.4020816438	54	32	0.0259972603
5	55	0.2279631233	55	17	0.0256882192
6	47	0.1901936712	56	99	0.0253481644
7	67	0.1581661644	57	79	0.0248942192
8	66	0.1501795068	58	52	0.0247001370
9	35	0.1408474521	59	14	0.0238327671
10	58	0.1400321096	60	18	0.0237718356
11	36	0.1151450411	61	5	0.0237210137
12	44	0.1138609589	62	19	0.0222392603
13	48	0.1067966027	63	13	0.0220176164
14	37	0.0864666301	64	85	0.0218876986
15	34	0.0836611781	65	12	0.0218436164
16	77	0.0770475068	66	6	0.0217203288
17	54	0.0739929315	67	63	0.0207984384
18	65	0.0639091507	68	74	0.0205170685
19	59	0.0632127123	69	20	0.0204241370
20	38	0.0626517808	70	31	0.0201640000
21	68	0.0624172329	71	22	0.0185138904
22	49	0.0615311233	72	96	0.0181943288
23	76	0.0591228767	73	4	0.0177929315
24	25	0.0570216438	74	100	0.0172837808
25	43	0.0565009315	75	51	0.0171778630
26	78	0.0559813699	76	7	0.0170022192
27	26	0.0508935616	77	80	0.0156948219
28	39	0.0480091507	78	84	0.0154944384
29	27	0.0447010685	79	10	0.0154759178
30	87	0.0438641096	80	9	0.0153816438
31	88	0.0424252877	81	8	0.0152883288
32	50	0.0419406849	82	2	0.0152847671
33	24	0.0414171233	83	1	0.0150475890
34	60	0.0395635342	84	3	0.0150247397
35	53	0.0382073699	85	95	0.0149794247
36	42	0.0373033151	86	90	0.0148955342
37	33	0.0369003836	87	62	0.0142294795
38	28	0.0368024110	88	73	0.0140779726
39	23	0.0363064110	89	21	0.0138304110
40	69	0.0361732603	90	11	0.0120271233
41	64	0.0359270959	91	94	0.0118057260
42	15	0.0342667123	92	83	0.0115451507
43	40	0.0342098082	93	61	0.0108319726
44	75	0.0341717534	94	72	0.0105269041
45	29	0.0322927945	95	93	0.0094969315
46	16	0.0312483562	96	71	0.0089980822
47	98	0.0305813699	97	82	0.0072425753
48	86	0.0296745479	98	92	0.0070875068
49	70	0.0286489315	99	81	0.0055012877
50	89	0.0279756986	100	91	0.0047584932

Notes:
$\mu g/m^3$ = micrograms per cubic meter; ppm = parts per million.
CO = carbon monoxide; PM_{10} = particulate matter.

Source: Ricondo & Associates, Inc., 2007, based on output from the Emissions and Dispersion Modeling System, Version 4.3.
Prepared by: Ricondo & Associates, Inc., April 2008

Table F-27

Dispersion Modeling Results – No Action Alternative: McCarran International Airport

8-Hour Average CO Concentrations (ppm)						24-Hour Average PM_{10} Concentrations ($\mu g/m^3$)					
Rank	Receptor	Concentration	Rank	Receptor	Concentration	Rank	Receptor	Concentration	Rank	Receptor	Concentration
1	68	0.0086812716	51	31	0.0003107860	1	69	1.4369211507	51	36	0.0372452329
2	56	0.0044138443	52	84	0.0003098458	2	68	0.6565751781	52	84	0.0365111233
3	67	0.0039686608	53	37	0.0002940113	3	79	0.3848869589	53	95	0.0339098356
4	69	0.0036680283	54	73	0.0002732459	4	56	0.3339565753	54	73	0.0322836712
5	55	0.0026541477	55	38	0.0002647478	5	55	0.3149257534	55	22	0.0316474521
6	79	0.0024303479	56	41	0.0002633810	6	67	0.3061137808	56	37	0.0313076712
7	66	0.0020505230	57	62	0.0002600899	7	70	0.2487517808	57	51	0.0312163288
8	57	0.0020388434	58	39	0.0002446099	8	32	0.2109192055	58	62	0.0310010137
9	78	0.0020272458	59	94	0.0002395123	9	66	0.1848384658	59	39	0.0300980000
10	77	0.0015443656	60	83	0.0002128451	10	80	0.1810612055	60	38	0.0296907397
11	43	0.0014939552	61	51	0.0002088294	11	78	0.1688092877	61	94	0.0268927945
12	44	0.0014598929	62	26	0.0001951326	12	57	0.1633347397	62	83	0.0261708767
13	45	0.0012943153	63	40	0.0001932535	13	89	0.1580553151	63	23	0.0252544110
14	70	0.0012259772	64	72	0.0001896909	14	90	0.1381939726	64	25	0.0246800000
15	32	0.0012066014	65	23	0.0001842251	15	77	0.1323336712	65	61	0.0245683836
16	89	0.0011594546	66	25	0.0001831873	16	43	0.1295563562	66	24	0.0237902192
17	88	0.0011446210	67	27	0.0001789021	17	44	0.1265288219	67	40	0.0222824658
18	58	0.0011192717	68	22	0.0001759555	18	45	0.1261326849	68	72	0.0218371507
19	76	0.0010611835	69	24	0.0001754067	19	88	0.1120538082	69	26	0.0217386575
20	54	0.0010522965	70	28	0.0001744874	20	42	0.1116491781	70	28	0.0209100548
21	65	0.0010060193	71	61	0.0001691590	21	65	0.1094929315	71	21	0.0206284932
22	87	0.0008881620	72	93	0.0001661090	22	58	0.1048223562	72	27	0.0191635068
23	59	0.0007766381	73	82	0.0001550919	23	76	0.1017224110	73	82	0.0190833151
24	46	0.0007494031	74	29	0.0001474183	24	59	0.1011175342	74	93	0.0183533699
25	99	0.0007457946	75	30	0.0001405763	25	54	0.0978212877	75	29	0.0183473973
26	80	0.0007430281	76	71	0.0001373530	26	99	0.0943056164	76	71	0.0178581370
27	42	0.0007353245	77	21	0.0001290870	27	100	0.0860148767	77	14	0.0163594521
28	98	0.0007302821	78	16	0.0001250300	28	46	0.0844848767	78	30	0.0156747123
29	90	0.0007083976	79	92	0.0001246453	29	87	0.0800969315	79	81	0.0153181918
30	53	0.0006774295	80	17	0.0001191327	30	53	0.0755559726	80	92	0.0149938904
31	86	0.0006584177	81	15	0.0001153671	31	98	0.0720887123	81	19	0.0145369041
32	75	0.0006393302	82	81	0.0001152072	32	60	0.0687716438	82	17	0.0140425479
33	64	0.0006141521	83	18	0.0001123927	33	75	0.0677646027	83	18	0.0133012055
34	97	0.0006065193	84	19	0.0001055304	34	33	0.0670868767	84	16	0.0132482192
35	47	0.0006043525	85	14	0.0001047385	35	64	0.0659167123	85	91	0.0132322466
36	100	0.0006021600	86	13	0.0000974293	36	47	0.0643159452	86	13	0.0128093699
37	60	0.0005433254	87	12	0.0000960666	37	86	0.0614416986	87	12	0.0125946849
38	33	0.0005157796	88	20	0.0000953994	38	31	0.0614004384	88	15	0.0123096164
39	48	0.0004932745	89	91	0.0000947014	39	97	0.0608295616	89	11	0.0121295890
40	96	0.0004782769	90	6	0.0000933547	40	52	0.0502998356	90	20	0.0120340548
41	85	0.0004336547	91	7	0.0000851088	41	48	0.0496239178	91	5	0.0101903836
42	63	0.0004041312	92	5	0.0000822870	42	49	0.0492909315	92	6	0.0099795342
43	74	0.0004034361	93	8	0.0000796437	43	63	0.0465136712	93	7	0.0099522740
44	49	0.0003985934	94	11	0.0000789779	44	96	0.0458644932	94	8	0.0097578904
45	52	0.0003866919	95	9	0.0000749628	45	74	0.0454470411	95	3	0.0095204658
46	34	0.0003803007	96	4	0.0000718380	46	85	0.0454005205	96	9	0.0094030959
47	35	0.0003339862	97	10	0.0000709333	47	34	0.0436026301	97	4	0.0084607671
48	95	0.0003329346	98	3	0.0000636692	48	41	0.0422443562	98	10	0.0083495616
49	36	0.0003323351	99	2	0.0000618014	49	35	0.0392795068	99	1	0.0078775616
50	50	0.0003244818	100	1	0.0000596112	50	50	0.0380642192	100	2	0.0075914795

Notes:
$\mu g/m^3$ = micrograms per cubic meter; ppm = parts per million.
CO = carbon monoxide; PM_{10} = particulate matter.

Source: Ricondo & Associates, Inc., 2007, based on output from the Emissions and Dispersion Modeling System, Version 4.3.
Prepared by: Ricondo & Associates, Inc., April 2008

F.3 Emissions beneath Overflight Area

EDMS does not estimate emissions or concentrations of emissions along potential helicopter flight corridors. To estimate the potential effects of helicopter emissions along these corridors, total helicopter flight time in hours was calculated for each heliport flight corridor scenario for the Proposed Action and No Action alternative. It can be inferred from the analysis that helicopter flight corridors that would accommodate more total helicopter flight hours per year would experience higher levels of helicopter emissions and pollutant concentrations. **Equation F-6** was used to calculate total helicopter flight hours per year for each flight corridor option associated with the Proposed Action and the No Action alternative.

Equation F-6

Helicopter Flight Time Calculation Equation

$$HFT_i = [(T_i)(OPS_i)]/60$$
$$T_i = [(DD_i*60)/SD]+[(DC_i*60)/SC]$$
$$OPS_{ti} = (OPS_a)(AP_i) + (OPS_d)(DP_i)$$

where:

HFT_i = helicopter flight time (hours) on corridor *i*
T_i = time (minutes) required to fly to/from rendevous point on corridor *i*
OPS_{ti} = total operations (arrivals and departures) on corridor *i*
OPS_a = total annual arrivals
OPS_d = total annual departures
AP_i = percentage of arrivals on corridor *i*
DP_i = percentage of departures on corridor *i*
DD_i = one-way distance (nautical miles) in climb/descent on corridor *i*
DC_i = one-way distance (nautical miles) in cruise on corridor *i*
SD = average climb/descent speed (nautical miles per hour)
SC = average cruise speed (nautical miles per hour)

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc., April 2008

Potential flight corridor distances were calculated from data provided by the CCDOA. Information regarding helicopter climb/descent and cruise speed was obtained from interviews with helicopter air tour operators. Arrival and departure percentages on each potential helicopter flight corridor were obtained from ASRC Aerospace Corporation. **Table F-28** shows the total estimated helicopter flight time in hours for each flight corridor scenario associated with the Heliport site in 2011 and 2017.

Table F-28

Annual Helicopter Flight Times

	Helicopter Flight Hours per Year			
	2011		2017	
Alternatives and Optional Flight Corridors [1/]	Helicopter Flight Hours	Difference between Proposed Action and No Action [2/]	Helicopter Flight Hours	Difference between Proposed Action and No Action [2/]
Proposed Action				
Option A	28,087	14.5 %	35,519	18.6 %
Option B	27,842	13.5 %	35,210	17.5 %
Option C	29,997	22.3 %	37,933	26.6 %
No Action Alternative	24,534	n.a.	29,957	n.a.

Notes:

1/ Proposed Action options differ based on the primary flight corridor that is anticipated to be used to and from the Heliport site, in conjunction with existing flight corridors to and from McCarran International Airport.

2/ The difference in helicopter flight hours were calculated by subtracting the No Action alternative from each of the Proposed Action options.

Source: Ricondo & Associates, Inc., based on information provided by ASRC Aerospace Corporation, the Clark County Department of Aviation, and interviews with helicopter air tour operators.

Prepared by: Ricondo & Associates, Inc., April 2008