APPENDIX C

AIR QUALITY

AIR QUALITY ANALYSIS

The air quality analysis examined impacts from air emissions associated with the proposed action. As part of the analysis, emissions generated from construction, aircraft operation, aerospace ground equipment (AGE), motor vehicles, and other area (nonmobile) sources were examined for carbon monoxide (CO), nitrogen oxides (NO_X), sulfur dioxide (SO_X), volatile organic compounds (VOCs), and particulate matter (PM_{10}). Kern County Air Pollution Control District (APCD) is in serious nonattainment for ozone; Mojave Desert (AQMD) and Antelope Valley APCD are currently in severe nonattainment for ozone and moderate nonattainment for PM_{10} (See Table 3.5-4). The Feather River AQMD is a maintenance areas for ozone, and the air quality control region associated with Wright-Patterson AFB and is also a maintenance area for ozone. *De minimis* levels for the associated criteria pollutants are presented in Tables 3.5-2 and 3.5-3.

CONSTRUCTION EMISSIONS: Construction activities would generate both combustive emissions from heavy equipment use and fugitive dust from ground-disturbing activities. Fugitive dust would be generated during construction activities associated with building construction and modification. These emissions would be greatest during site clearing and grading activities. Particulate matter emissions from ground-disturbing activities were computed are a rate of 220 lbs per acre per month (EPA 1995a) with construction taking place 12 months per year.

Construction for the proposed action would disturb between 55,000 to 241,500 square feet (1.3 to 5.5 acres) between 2004 and 2008 (see Table 2.2-3). The model assumed that twice the square footage was disturbed, but that only 25 percent of the area would be exposed at any one time. These temporary emissions from construction would produce short-term elevated PM_{10} concentrations that would fall off rapidly with distance from the source.

Combustive emissions from equipment exhaust were estimated by developing a profile of typical daily construction equipment for the months of construction activities. The equipment included a mix of heavy trucks, light trucks, graders, loaders, and tractors. Analysis of the construction vehicles was performed using emissions information from AP-42 (EPA 1995b) assuming one suite of vehicles per 10 acres of construction.

AIRCRAFT OPERATIONS: Emissions were calculated for aircraft operations associated with the Global Hawk, including power setting, minutes at taxi/idle, takeoff, climbout, and approach, using information from the Tier II UAV test vehicles (USAF 1996). CO, NO_X, PM_{10} and SO_X (Table C-1) were obtained from Rolls-Royce (the manufacturer) for the Allison 3007 (personal communication, Vern Corea, July 2000). A daily average of 4.8 take-offs and landings were assumed based on the 624 annual sorties for 18 Global Hawk aircraft in 2012. Calculations were based on landings and takeoffs and flights up to 5,000 feet AGL (3,000 feet AGL at Edwards AFB). The total tons per year of CO, NO_X, SO_X, VOCs, and PM_{10} were proportioned in other years based on the beddown of two aircraft per year.

VEHICLE EMISSIONS: Vehicle emissions were obtained through the use of vehicle daily trip generation for the proposed action and the use of Emissions and Dispersions Modeling System (EDMS) methodology, and Mobile 5a program data. Mobile 5a is an U.S. EPA-approved, regulatory on-road mobile-source emissions model. The model calculates vehicle emissions factors using input data such as fuel usage and distance of travel for a mix of general vehicle types (i.e., light trucks, cars).

The commute of personnel living off base (average daily trip) was assumed to be between 15 and 50 miles round-trip. Vehicle emissions results also included privately owned vehicle miles traveled on base. For Edwards AFB, emissions were divided into separate air quality districts based on the location of the emitter (construction areas; locations of most commutors).

AEROSPACE GROUND EQUIPMENT: AGE is maintenance equipment associated with the particular aircraft. It includes heaters, compressors, coolers, lifts, and other miscellaneous equipment. A list of the AGE associated with the Global Hawk aircraft was obtained from specifications on the Cessna Citation, which uses a similar engine. Emissions in tons from AGE per year were calculated using the information for the Air Quality Assessment Model (USAF 1976)

OTHER AREA SOURCES: Other area (nonmobile) sources included facility space heating, residential space heating, and refueling emissions (including fuel evaporation and JP-8 refueling emissions). The Air Quality Assessment Model (USAF 1976) provided the information use in the analysis.

RESULTS

The results of the emission calculations for the years 2001 to 2008 for the area around each of the five bases are presented in the Tables C-2 through C-11. For each base the tables show the emissions for a specific pollutant (CO, NO_X, SO_X, VOCs, and PM_{10}) during 2012 using the following categories:

- Construction and Construction Equipment
- Aircraft Operations and Aerospace Ground Equipment
- Motor Vehicles
- Other Area Sources

Beale AFB is a maintenance area for ozone, Edwards AFB is an area with severe and serious nonattainment for ozone and a maintenance area for PM_{10}, and Wright-Patterson AFB is in a maintenance area for ozone. Based on the underlying assumption of 624 sorties in a fully operating program of 18 aircraft, the maximum annual emissions of VOCs, NO_x, and PM_{10} are well below the *de minimis* levels for the general conformity rule. The maximum amounts of criteria pollutants tend to occur during full build-out in 2012. The proposed action would add a maximum amount of VOCs and NO_x at Edwards AFB in 2012, but at 13 and 24 tons, respectively they are below the *de minimis* levels of 25 tons per year in districts in severe nonattainment for ozone. All criteria pollutants are below regional significance for their respective districts or regions.

Table C-1. Aircraft Emissions for the Global Hawk					
Mode	*Time in Mode[1] (minutes)*	*Emission Factor (kg/hr)[2]*			
		CO	*VOCs*	*NO_x*	*SO_x*
Take off	1.5	0.978	0.292	17.055	0.5443
Climbout	0.4	1.002	0.278	12.265	0.4549
Approach	2.6	1.474	0.272	2.172	0.1769
Idle	19.2	4.195	0.820	0.455	0.0758

Mode	*Annual Emissions (tons/year) at 3000 feet*			
	CO	*VOCs*	*NO_x*	*SO_x*
Take off	0.017	0.005	0.293	0.009
Climbout	0.005	0.001	0.056	0.002
Approach	0.044	0.008	0.065	0.005
Idle	0.923	0.180	0.100	0.017
Total	0.989	0.195	0.514	0.033

Mode	*Annual Emissions (tons/year) at 5000 feet*			
	CO	*VOCs*	*NO_x*	*SO_x*
Take off	0.017	0.005	0.293	0.009
Climbout	0.008	0.002	0.101	0.004
Approach	0.073	0.014	0.108	0.009
Idle	0.923	0.180	0.100	0.017
Total	1.021	0.201	0.602	0.039

[1] USAF 1996

[2] Personal Communication. V. Corea, Ryan Technologies, July 2000; Allison 3007c engine

Table C-2. Estimate of Additional Annual Emissions from Global Hawk at Beale AFB under Proposed Action (tons/year)

Calendar Year	*CO*	*NO_x*	*VOCs*	*SO_x*	*PM_{10}*
2001	6.7	0.8	0.9	0.0	0.0
2002	10.0	1.3	1.2	0.1	0.1
2003	31.8	4.4	4.1	0.2	0.2
2004	40.6	10.0	6.3	0.6	1.1
2005	56.5	12.2	8.7	0.8	1.2
2006	64.2	15.8	10.0	0.8	1.0
2007	79.9	17.9	12.6	0.9	1.1
2008	81.9	14.0	10.4	0.6	0.4
2009	76.3	14.6	9.2	0.6	0.5
2010	79.9	15.3	9.7	0.7	0.5
2011	83.3	15.8	10.2	0.7	0.5
2012	86.9	16.4	10.6	0.8	0.5
Maximum Annual Emissions	**86.9**	**17.9**	**12.6**	**0.9**	**1.2**

[1] Beale AFB is in a maintenance area for ozone. *De minimis* for VOCs or NO_x = 100 tons / year.

Table C-3. Beale AFB Emissions Summary Report for 2012

	CO	*NO_x*	*VOCs*	*SO_x*	*PM_{10}*
Mobile Sources					
POV/commuting	74.4	12.3	9.6	0.67	0.52
AGE/GSE	9.4	0.5	0.2	0.02	0.01
Aircraft flying operations	1.0	0.2	0.6	0.004	0.00
Aircraft ground operations	0.8	0.5	0.2	0.03	0.00
Total	**85.6**	**13.4**	**10.6**	**0.75**	**0.53**
Other Area Sources					
Facility Space Heating	1.3	3.0	0.0	---	0.01
Jet Fuel Evaporation			0.0		
Total	**1.3**	**3.0**	**.01**	**.00**	**.01**
Grand Total (tons/year)	**86.9**	**16.4**	**10.6**	**0.8**	**0.5**

Note: No Global Hawk construction in 2012

Table C-4. Estimate of Additional Annual Emissions from Global Hawk at Edwards AFB under Proposed Action (tons/year)

Calendar Year	*CO*	*NO_x*	*VOCs*	*SO_x*	*PM_{10}*
2001	7.7	1.5	1.1	0.1	0.1
2002	11.2	2.1	1.5	0.1	0.1
2003	36.1	7.3	5.1	0.3	0.3
2004	46.2	12.9	8.1	0.8	7.7
2005	60.6	13.5	8.6	0.5	0.4
2006	69.7	18.8	11.3	1.0	1.1
2007	84.2	19.1	12.0	0.8	0.6
2008	90.3	20.4	12.8	0.8	0.6
2009	83.7	21.5	11.2	0.9	0.7
2010	87.6	22.5	11.8	1.0	0.7
2011	91.1	23.6	12.4	1.0	0.7
2012	94.8	24.5	13.0	1.1	0.8
2012a[1]	62.8	16.3	8.3	0.7	0.5
2012b[2]	3.4	0.9	0.5	0.04	0.03
2012c[3]	28.6	7.4	4.2	0.3	0.3
Maximum Annual Emissions	**94.8**	**24.5**	**13.0**	**1.1**	**7.7**

1 Kern County APCD: *de minimis* $VOCs/NO_x = 50$ tons/year
2 Antelope Valley APCD: *de minimis* $VOCs/NO_x = 25$ tons/year
3 Mojave Desert AQMD: *de minimis* $VOCs/NO_x = 25$ tons/year; *de minimis* $PM_{10} = 100$ tons/year

Table C-5. Edwards AFB/Kern County APCD Emissions Summary Report for 2012

	CO	*NO_x*	*VOCs*	*SO_x*	*PM_{10}*
Mobile Sources					
POV	50.7	13.0	7.4	0.60	0.46
AGE/GSE	9.4	0.5	0.2	0.02	0.01
Aircraft flying operations	1.0	0.2	0.5	0.03	0.00
Aircraft ground operations	0.8	0.5	0.2	0.03	0.00
Total	**61.9**	**14.1**	**8.3**	**0.68**	**0.48**
Other Area Sources					
Facility Space Heating	0.9	2.2	0.0	---	0.0
Jet Fuel Evaporation			0.0		
Total	**0.9**	**2.2**	**0.0**	**0.0**	**0.0**
Grand Total (tons/year)	**62.8**	**16.3**	**8.3**	**0.7**	**0.5**

Note: No Global Hawk construction in 2012

Table C-6. Estimate of Additional Annual Emissions from Global Hawk at Ellsworth AFB under Proposed Action (tons/year)

Calendar Year	*CO*	*NO_x*	*VOCs*	*SO_x*	*PM_{10}*
2001	3.5	0.6	0.4	0.03	0.02
2002	5.5	0.8	0.6	0.04	0.02
2003	15.0	2.6	1.6	0.12	0.08
2004	18.0	3.1	2.0	0.14	0.10
2005	27.0	8.6	5.0	0.57	1.34
2006	29.1	7.9	3.1	0.22	0.16
2007	28.6	8.8	3.7	0.27	0.18
2008	38.9	9.6	4.2	0.31	0.20
2009	41.7	10.0	4.3	0.33	0.22
2010	43.3	10.4	4.5	0.35	0.23
2011	44.8	10.7	4.7	0.36	0.24
2012	46.4	11.0	4.9	0.38	0.25
Maximum Annual Emissions	**46.4**	**11.0**	**5.0**	**0.57**	**1.34**

Table C-7. Ellsworth AFB Emissions Summary Report for 2012

	CO	*NO_x*	*VOCs*	*SO_x*	*PM_{10}*
Mobile Sources					
POV/commuting	34.0	6.8	3.9	0.30	0.23
AGE/GSE	9.4	0.5	0.2	0.02	0.01
Aircraft flying ops	1.0	0.2	0.6	0.04	0.00
Aircraft ground ops	0.8	0.5	0.2	0.03	0.00
Total	**45.1**	**8.0**	**4.8**	**0.38**	**0.24**
Other Area Sources					
Facility Space Heating	1.3	3.1	0.0	---	0.01
Jet Fuel Evaporation			0.0		
Total	**1.3**	**3.1**	**0.1**	**0.0**	**0.01**
Grand Total (tons/year)	**46.4**	**11.0**	**4.9**	**0.38**	**0.25**

Note: No Global Hawk construction in 2012

Table C-8. Estimate of Additional Annual Emissions from Global Hawk at Tinker AFB under Proposed Action (tons/year)					
Calendar Year	*CO*	*NO_x*	*VOCs*	*SO_x*	*PM_{10}*
2001	3.5	0.5	0.4	0.0	0.0
2002	5.6	0.7	0.6	0.0	0.0
2003	15.5	2.2	2.0	0.1	0.1
2004	22.6	8.5	6.2	0.5	2.6
2005	29.8	9.6	7.2	0.6	2.7
2006	36.6	17.7	10.9	1.0	3.3
2007	40.0	12.8	7.3	0.7	0.8
2008	41.9	11.6	5.0	0.3	0.2
2009	40.3	11.9	4.5	0.3	0.2
2010	41.8	12.2	4.7	0.3	0.2
2011	43.2	12.5	4.9	0.4	0.2
2012	44.6	12.7	5.1	0.4	0.3
Maximum Annual Emissions	**44.6**	**17.7**	**10.9**	**1.0**	**3.3**

Table C-9. Tinker AFB Emissions Summary Report for 2012					
	CO	*NO_x*	*VOCs*	*SO_x*	*PM_{10}*
Mobile Sources					
POV/commuting	30.9	5.5	4.1	0.30	0.23
AGE/GSE	9.4	0.5	0.2	0.02	0.01
Aircraft flying ops	1.0	0.2	0.6	0.04	0.00
Aircraft ground ops	0.8	0.5	0.2	0.03	0.00
Total	**42.0**	**6.6**	**5.1**	**0.38**	**0.24**
Other Area Sources					
Facility Space Heating	2.6	6.1	0.0	---	0.01
Jet Fuel Evaporation			0.0		
Total	**2.6**	**6.1**	**0.1**	**0.00**	**0.01**
Grand Total (tons/year)	**44.6**	**12.7**	**5.1**	**0.38**	**0.25**

Note: No Global Hawk construction in 2012

Table C-10. Estimate of Additional Annual Emissions from Global Hawk at Wright-Patterson AFB under Proposed Action (tons/year)[1]

Calendar Year	*CO*	*NO_x*	*VOCs*	*SO_x*	*PM_{10}*
2001	3.7	0.5	0.4	0.0	0.3
2002	5.8	0.8	0.6	0.0	0.3
2003	15.9	2.3	1.7	0.1	0.3
2004	20.9	6.4	3.7	0.5	0.7
2005	27.3	5.3	3.0	.02	0.1
2006	32.4	9.7	5.3	0.6	0.8
2007	39.7	12.9	6.0	0.7	0.8
2008	41.9	9.5	4.5	0.3	0.5
2009	43.0	9.9	4.5	0.3	0.5
2010	44.7	10.2	4.7	0.4	0.5
2011	46.3	10.5	4.9	0.4	0.5
2012	48.0	10.8	5.1	0.4	0.5
Maximum Annual Emissions	**48.0**	**12.9**	**6.0**	**0.7**	**0.8**

[1] Maintenance area for ozone. *De minimis* for VOCs/NO_x = 100 tons/year

Table C-11. Wright-Patterson AFB Emissions Summary Report for 2012

	CO	*NO_x*	*VOCs*	*SO_x*	*PM_{10}*
Mobile Sources					
POV/commuting	35.3	6.0	4.1	0.31	0.2
AGE/GSE	9.4	0.5	0.2	0.02	0.0
Aircraft flying ops	1.0	0.2	0.6	0.04	0.0
Aircraft ground ops	0.8	0.5	0.2	0.03	0.0
Total	**46.4**	**7.1**	**5.1**	**0.39**	**0.3**
Other Area Sources					
Facility Space Heating	1.6	3.6	0.02	---	0.0
Jet Fuel Evaporation			0.03		
Total	**1.6**	**3.6**	**0.05**	**0.0**	**0.0**
Grand Total (tons/year)	**48.0**	**10.8**	**5.1**	**0.4**	**0.5**

Note: No Global Hawk construction in 2012

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